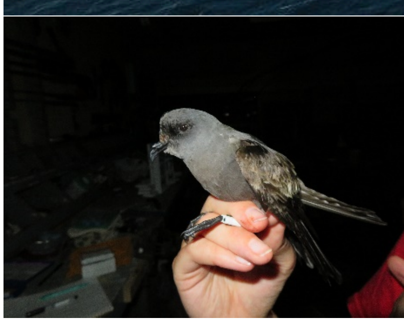
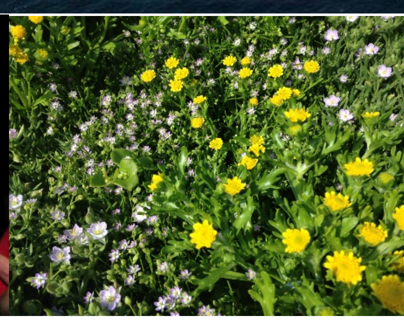
Coastal Consistency Determination
Farallon Islands National Wildlife Refuge:
South Farallon Islands Invasive House Mouse Eradication Project





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Farallon Islands National Wildlife Refuge:
South Farallon Islands Invasive House Mouse Eradication Project

U.S. Department of the Interior
Fish and Wildlife Service

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Table of Contents

List of Figures

List of Tables

List of Appendices

1 Introduction

This Coastal Consistency Determination is submitted to the California Coastal Commission (Commission) in support of the *South Farallon Islands Invasive House Mouse Eradication Project: Final Environmental Impact Statement* (FEIS; USFWS 2019; hereafter, referred to as the Project). The U.S. Fish and Wildlife Service (Service), the federal lead agency for the Project, seeks the Commission's concurrence that the Project is consistent to the maximum extent practicable with the enforceable policies of the California Coastal Management Program.

The Service is proposing to eradicate introduced, invasive house mice (*Mus musculus*) from the South Farallon Islands (or South Farallones) within the Farallon Islands National Wildlife Refuge, California (Figure 1). The purpose of this Project is to eliminate the pervasive, negative impacts of invasive house mice on the native ecosystem of the South Farallon Islands.

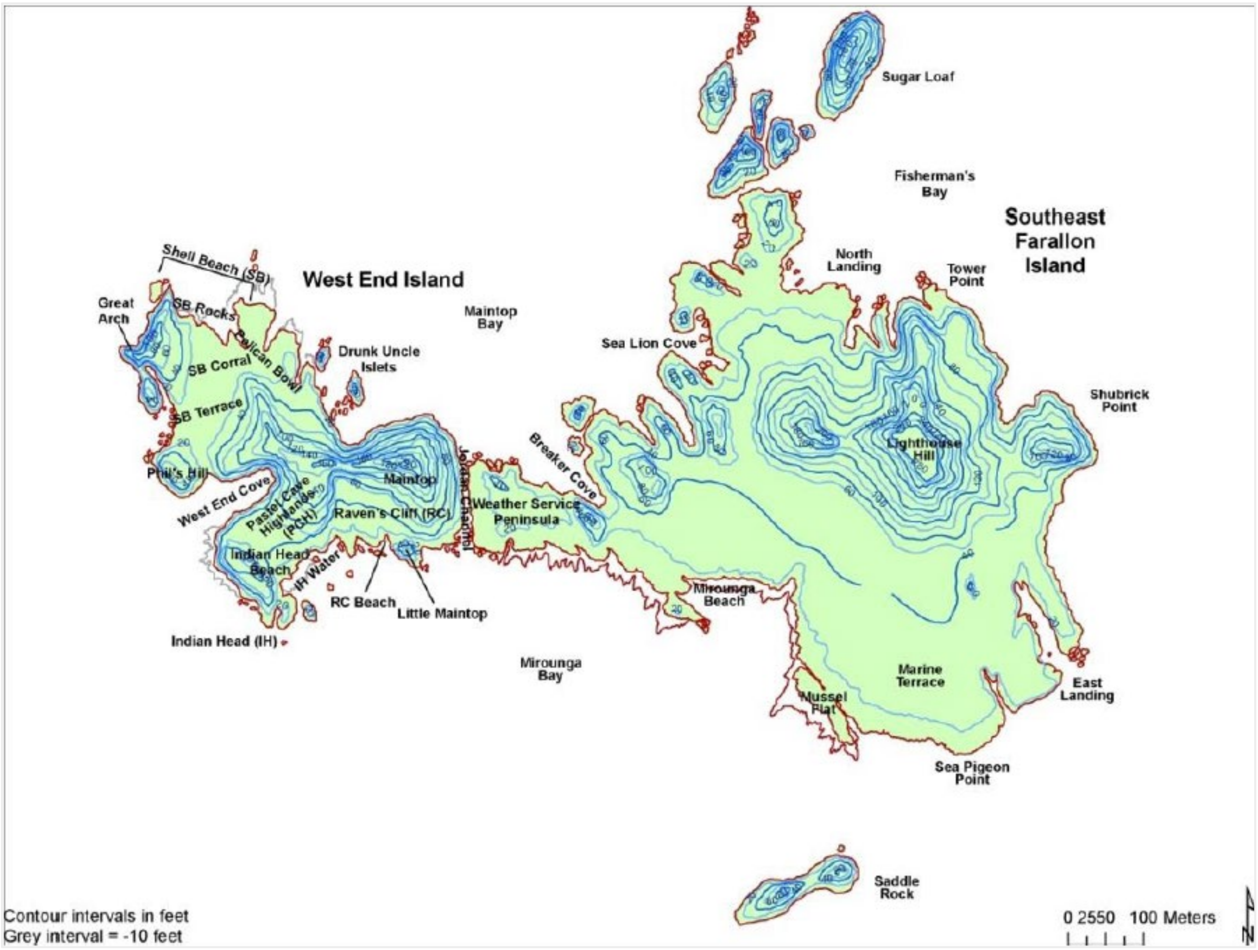

Figure 1. Topographical map of the South Farallon Islands.

House mice are extremely abundant on the islands. A study reported a density estimate of 1,297 per ha (504 per acre), which is possibly the highest reported house mouse density estimate for any island in the world (FEIS, Section 2.8.2). This density estimate equates to a population of nearly 60,500 mice on these small islands. House mice are well known to cause population level impacts to a large variety of taxa, including birds as large as albatrosses, reptiles, amphibians, insects, and plants. As described in Section 1.2.2 of the FEIS, mice significantly impact the Farallon ecosystem both directly and indirectly (Figure 2).

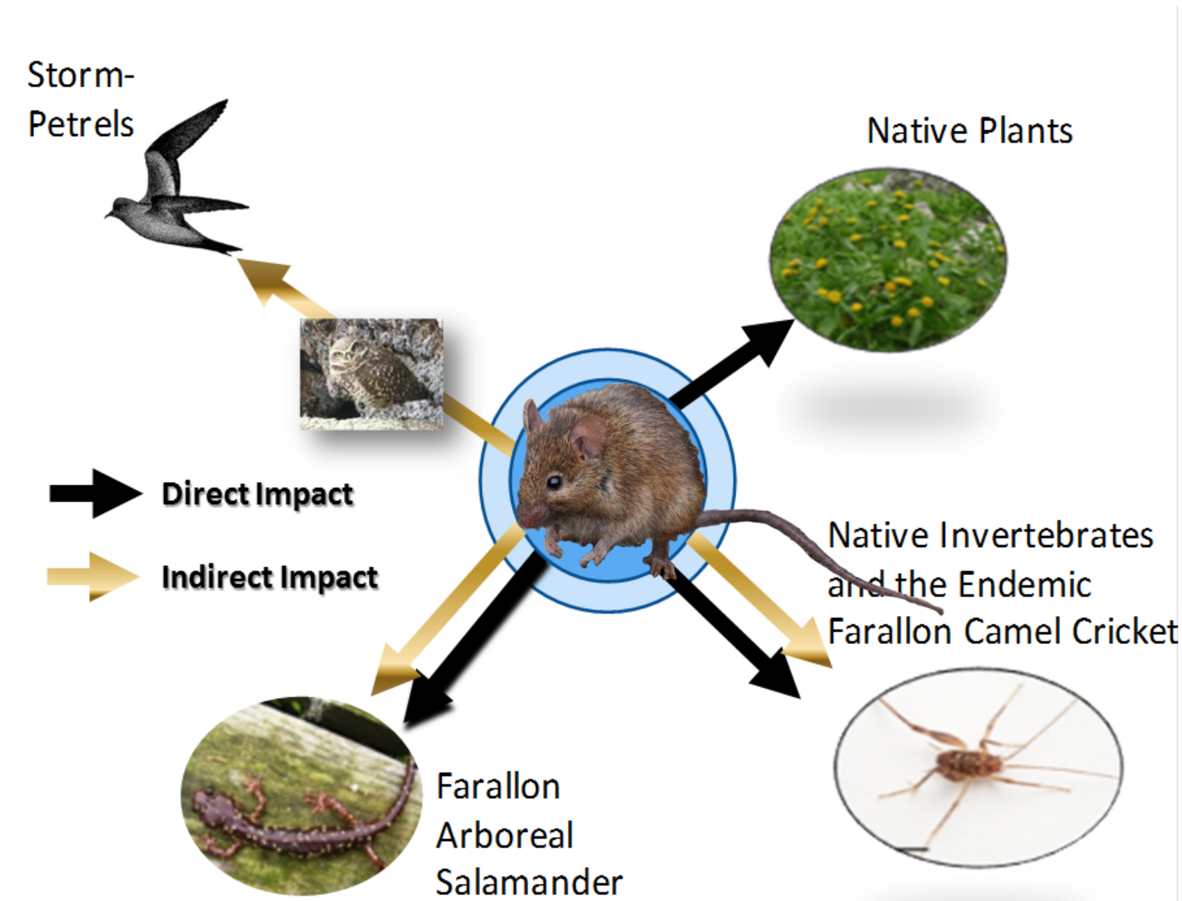

Figure 2. Food web of invasive house mice on the South Farallon Islands, showing native species impacted either directly or indirectly by mice.

Directly, mice feed on native insects, plants, seabirds, and most likely the endemic Farallon arboreal salamander (*Aneides lugubris farallonensis*), and compete for food with the native salamander, lowering their population size. Indirectly, mice unnaturally sustain a wintering population of migrant burrowing owls (*Athene cunicularia*). These owls arrive on the islands during their fall migration, when the mouse population is at its annual peak. Multiple owls are encouraged by the abundance of mice as a primary prey resource to remain on the islands through the winter instead of continuing on their migration, as most migrant landbirds that stop at the islands do. When the mouse population crashes and mice are no longer available as owl prey, the owls switch to preying primarily on the rare ashy storm-petrel (*Oceanodroma homochroa*), and, most likely, the similar Leach's storm-petrel (*O. leucorhoa*), until the owls depart in spring. The owls also prey extensively on the rare, endemic Farallon camel cricket (*Farallonophilus cavernicolus*) and other native insects, another indirect impact of the mice. Mice also impact the natural character of the Farallon Wilderness. Together, these direct and indirect impacts significantly alter the natural balance of the Farallon ecosystem.

The eradication of house mice is one critical step in the restoration of the internationally unique and important ecosystem of the South Farallon Islands. The removal of the mice, the last remaining invasive mammal on the islands, would result in long-term, significant ecosystem benefits. Expected benefits include population increases of native species including ashy and Leach's storm-petrels, Farallon camel cricket and other terrestrial invertebrates, Farallon arboreal salamander, and maritime goldfield and other native plants. The removal of the mice, a severe environmental stressor, also will help buffer the Farallon ecosystem from other human impacts including climate change and catastrophic oil spills.

In the preferred alternative, the Service proposes to eradicate the invasive house mice using the rodent bait product Brodifacoum-25D Conservation (Bell Laboratories, Inc.), with aerial broadcast as the primary method of application. This method is considered best practice for the eradication of mice and other rodent species from islands. The use of baits containing the rodenticide brodifacoum or similar rodenticides has been used successfully in hundreds of rodent eradications worldwide, including 64 house mouse eradications. While the operation will have adverse impacts to native fish and wildlife, these will be limited to small numbers of individuals with no significant population-level impacts expected. A mitigation plan based on other successful rodent eradication projects has been developed to help ensure minimal impacts to non-target resources. An accompanying monitoring plan will document Project outcomes and guide adaptive management to best assure eradication success and minimal non-target impacts. Bait spill and non-target contingency plans will guide responses in the event of an unexpected occurrence that could jeopardize Project success.

The Project is consistent with and will be conducted under the authority of the National Wildlife Refuge System Administration Act of 1966, amended by the National Wildlife Refuge System Improvement Act of 1997 and codified at 16 U.S.C. §§ 668dd-668ee; Presidential Executive Order 13112 on Invasive Species, February 3, 1999, as amended December 5, 2016, and Service policy for implementing the Executive Order (601 FW 3); and the Wilderness Act of 1964 (16 U.S.C. §§ 1131-1136) along with the Service's Wilderness Stewardship Policy (610 FW 1-2, 2008).

This Project came before the Commission at its July 10, 2019 hearing during which the Commission requested the Service to provide additional information about the Project. In order to address the Commission's requests, the Service withdrew its request for concurrence at the July 2019 hearing and agreed to submit a new Consistency Determination at a date to be determined. Following ongoing consultations with Commission staff, the Service has prepared this new Consistency Determination which incorporates information requested by the Commission. In particular, this Consistency Determination includes the following:

- A set of Project implementation plans that will govern Project operations if the Project is approved in the Record of Decision: *Draft Operational Plan*; *Draft Mitigation and Monitoring Plan*; *Draft Bait Spill Contingency Plan*; and *Draft Non-target Contingency Plan*. These draft plans are included as appendices and summarized in the sections below. The Service accelerated the preparation of these plans at the Commission's request and is providing them in draft form for Commission review;
- Further clarification of why this Project in consistent to the maximum extent practicable with the California Coastal Management Program;
- A summary of the process used in selecting the preferred alternative for this Project, including additional discussion of non-toxic methods that were considered and greater detail about why they were rejected;
- Additional information on the background, operational details, and impacts to the environment;
- Additional information on previous mammal eradication efforts on the South Farallon Islands; and
- A Response to Comments raised by Commissioners and the public from our previous Consistency Determination and hearing in July 2019 (see Appendix 1).

2 Project Area

The Farallon Islands National Wildlife Refuge (Refuge) is managed by the Service as a unit of the National Wildlife Refuge System and administered as part of the San Francisco Bay National Wildlife Refuge Complex. The Refuge encompasses 211 acres, with about 120 acres on the South Farallon Islands. The Refuge is located approximately 27 miles west of San Francisco off the California coast. The Farallon Islands National Wildlife Refuge was established in 1909 through Executive Order 1043 "… as a preserve and breeding ground for native birds," and originally included North and Middle Farallon Islands and Noonday Rock. The South Farallon Islands were added to the Refuge in 1969. In 1974, Congress designated all the emergent land except the island of Southeast Farallon as wilderness under the Wilderness Act of 1964. The Service has cooperative agreements with Point Blue Conservation Science and the U.S. Coast Guard to assist with Refuge stewardship and wildlife monitoring. The waters around the islands below the mean high tide line are part of the Greater Farallones National Marine Sanctuary.

3 Authority

This Consistency Determination is submitted in compliance with the federal Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, and the National Oceanic and Atmospheric Administration's (NOAA) federal Consistency Regulations in 15 C.F.R. Part 930. The Project is a federal agency activity as defined in 15 C.F.R. § 930.31(a). Because the South Farallon Islands are federally-owned lands under the jurisdiction of the Service, this Project will take place on lands outside the California coastal zone (See, 16 U.S.C. § 1453(1)). The Commission's review of this Project's consistency with the Coastal Management Program is therefore focused on spillover effects from the Project in the Coastal Zone.

4 Determination

As explained more fully below in Section 10, the Service has evaluated the relevant enforceable policies of the California Coastal Management Program (CCMP) and has determined the Project will be undertaken in a manner that is consistent to the maximum extent practicable with the CCMP. The Final Environmental Impact Statement (FEIS) for the Project provides the basis for this finding.

The South Farallon Islands host the largest seabird breeding colony in the lower 48 United States and constitute an environmentally sensitive habitat area (ESHA) within the meaning of CCMP Section 30240. The continued presence of introduced, invasive house mice on the South Farallon Islands is resulting in continuous adverse impacts to ESHA on those islands. As detailed in the FEIS, mice significantly degrade habitat for sensitive and endemic species and cause havoc on the islands' natural ecosystem dynamics. Mouse impacts affect the relationship between land and marine resources and compromise the Service's ability to achieve the National Wildlife Refuge System mission and Refuge purposes to protect and restore populations of native birds and other species. Further, because the Farallon Islands provide breeding and resting habitat for a large proportion of the region's seabird and pinniped (seals, sea lions, fur seals) populations, factors impacting the island ecosystem also impact the entire Gulf of the Farallones ecosystem and beyond.

As described below in Section 9, the benefits that would accrue to ESHA from the Project are significant and long-lasting. Native species and habitats that would experience these benefits include the ashy storm-petrel, a Service Bird of Conservation Concern and a California Bird Species of Special Concern, the endemic Farallon camel cricket, the endemic Farallon arboreal salamander, and the islands' unique native plant community. The eradication of mice is expected to arrest or reverse impacts affecting the ashy storm-petrel population and potentially result in a population-level increase for this species. The endemic cricket and salamander would also experience population level benefits from the Project. In contrast, adverse impacts to non-target species will be short-term and less than significant. No adverse population level impacts are expected for any non-target species.

The use of Brodifacoum-25D Conservation for this Project is consistent with the recently enacted California Ecosystem Protection Act of 2020 which establishes limits on the use of rodenticides for general purposes but endorses the use of rodenticides such as brodifacoum in island eradication projects in order to restore healthy ecosystem dynamics (FAC Section 12978.7(4)). Because the Project would remove an invasive species that is causing continuous adverse impacts to ESHA on the Refuge and hindering restoration, the Project is consistent to the maximum extent practicable with Section 30240 and furthers the goals of the California Ecosystem Protection Act of 2020.

The Project is also consistent with the relevant policies in Article 4 of the CCMP. The aerial application of rodent bait on the South Farallon Islands has been designed to avoid bait from entering and harming the marine environment. As disclosed in the FEIS, the use of measures such as bait deflectors and trickle buckets has been shown to effectively reduce the extent of bait drift into the marine environment (FEIS Section 2.10.7.7). Even if bait were to accidentally drift into the marine environment, it would be very unlikely to contribute to detectable levels of brodifacoum in the marine environment. The physical and chemical properties of the bait, its low water solubility, and the strong chemical affinity of brodifacoum to the bait matrix significantly reduce the chance of brodifacoum contaminating water resources around the islands (FEIS Section 4.4.1.3). Moreover, all of the fish species with essential fish habitat in the Project area are either planktivores or predators of invertebrates or other fish. For these reasons, the FEIS concludes that it is highly unlikely that marine fish species in the Project area would consume bait or experience other adverse effects (FEIS Section 4.5.6.1.4).

In addition to avoiding any long-term, significant negative impacts to coastal waters or the biological productivity of marine species, the Project would result in long-term and significant beneficial impacts for marine species such as the ashy and Leach's (*O. leucorhoa*) storm-petrels. This outcome would further the goals of the CCMP Section 30230 with regard to restoring species of special biological significance. For these reasons, the Project is consistent to the maximum extent practicable with the provisions of Sections 30230 and 30231 of the CCMP in that it will maintain healthy populations of marine species and the productivity and quality of coastal waters.

The Project would result in minimal, short-term, adverse impacts on recreational boating and shark diving (for 2-4 days during bait deployment), but it could also bring about long-term beneficial impacts to wildlife viewing opportunities. Because there would be no long-term changes in water-oriented recreation or recreational boating opportunities, the Project is maximally consistent with the recreation policies in Article 3 of the Coastal Act.

Sections 30210 and 30214 of the Coastal Act recognize that public access can be restricted in order to protect public safety, preserve fragile natural resource areas, and in areas where topographic conditions are incompatible with public use. Each of these conditions exists on the Farallon Islands. Moreover, this Project would occur on a federally-owned and managed national wildlife refuge which is outside the state's coastal zone. For these reasons, the Project is consistent to the maximum extent practicable with the Coastal Act's public access policies.

5 The Problem of Invasive Species on Islands

The South Farallon Islands are one of thousands of islands worldwide impacted by invasive species. An understanding of the problem of invasive species on islands is important in the context of this Project.

Problems with invasive species on islands was summarized in Section 1.2.1 of the FEIS. It is widely accepted that the natural world is facing a very high rate of species extinction (Raup 1988), that most recent extinctions can be directly attributed to human activity (Diamond 1989), and that for ethical, cultural, aesthetic, and economic reasons, the current rate of extinction is cause for considerable concern (Ehrlich 1988, Ledec and Goodland 1988). One of the major worldwide causes of anthropogenic extinctions is the introduction of species. The introduction of species into new environments is responsible for over 50 percent of all of the recorded animal extinctions since 1600 for which a cause could be attributed (Clavero and Garcia-Berthou 2005, Bellard et al. 2016).

Island ecosystems are key areas for biodiversity conservation worldwide. While islands make up only about three percent of the earth's surface, they are home to 15-20 percent of all plant, reptile, and bird species (Whittaker 1998, Holmes et al. 2015). However, small population sizes and limited habitat availability make species that live on islands susceptible to extinction, and their adaptation to isolated environments makes them particularly vulnerable to introduced species (Diamond 1985, 1989, Olson 1989). Studies show the majority of species extinctions worldwide have been island species. Tershy et al. (2015) reported that 61 percent of all extinct species, and 37 percent of all critically endangered species, were from islands. The World Conservation Monitoring Centre (1992) reported that of 245 animal species extinctions since 1500, 75 percent were species endemic to islands. Of species extinctions caused by invasive species, 86 percent were island endemics (Bellard et al. 2016). Introduced species were at least partially responsible for a minimum of 54 percent of 170 island species extinctions for which the cause of extinction was known (Ricketts et al. 2005).

6 Previous Mammal Eradication Efforts on the South Farallon Islands

The Farallones' isolated nature, varied and extensive habitats, and adjacent productive marine environment makes them an ideal breeding and resting location for wildlife. Unfortunately, the Farallon Islands have experienced extensive human impacts since the early 19th century (see Section 1.2.1 in FEIS). Since assuming stewardship of the South Farallon Islands in 1969, the Service has worked with its partners to protect and restore the islands' habitats and native species. For example, feral European rabbits (*Oryctolagus cuniculus*) and domestic cats (*Felis catus*), which were introduced to the islands by prior inhabitants, caused extensive damage to native flora and fauna. In early efforts to begin Farallon restoration efforts, the Service eradicated these non-native mammals through trapping and shooting in the early 1970s (see Section 3.1 in the FEIS). These actions, along with better protections of the islands, have created conditions allowing extirpated seabird species, like the rhinoceros auklet (*Cerorhinca monocerata*), to recolonize the islands and many other seabird populations to increase dramatically. Since the early 1970s, rhinoceros auklets have increased to over 3,000 breeding birds (McChesney et al. 2013). Tufted puffins (*Fratercula cirrhata*) have increased from about 70 breeding birds to about 400, while common murres (*Uria aalge*) have increased from about 50,000 breeding birds to over 250,000 (Johns and Warzybok 2019). However, other sensitive species on the Refuge remain at reduced population levels or are declining, and remain vulnerable to the impacts of invasive mice.

7 Project Development

7.1 Project Goals and Objectives

The proposal to eradicate invasive house mice on the South Farallon Islands is an outgrowth of the 2009 *Comprehensive Conservation Plan* (CCP) for the Farallon Islands National Wildlife Refuge, which set forth the following goals and objectives:

- Protect, inventory, monitor, and restore to historic[1] levels breeding populations of 12 seabird species, five marine mammal species, and other native wildlife.
- Reduce or eliminate invasive wildlife species that threaten the viability of seabird and marine mammal species.
- Restore degraded habitat and reduce the prevalence of invasive vegetation in order to re-establish historic abundance and distribution of native plant species by reducing consumption of native species and reducing the spread of invasive plants by house mice.
- Comply with Objective 1.1 of the Refuge's 2009 Comprehensive Conservation Plan (CCP), which established a goal of reducing the impacts of invasive wildlife on the island ecosystem.

When the Service initiated the National Environmental Policy Act (NEPA) planning process for the Project in 2011, it identified the following specific goals for eradicating invasive house mice from the South Farallon Islands in the Project's EIS:

- To increase the population sizes of ashy (Service Bird of Conservation Concern and California Bird Species of Special Concern) and Leach's storm-petrels;
- To increase the abundance and recruitment of native vegetation;
- To increase the productivity and abundance of endemic Farallon arboreal salamanders;
- To increase the productivity and abundance of endemic Farallon camel crickets and other native invertebrates;
- To improve the natural wilderness character of the Farallon Islands;
- To restore native ecosystem functions altered by invasive house mice; and
- To improve species and ecosystem adaptability and resilience in light of projected future climate change.

The objectives for eradicating invasive house mice from the South Farallon Islands include:

- The complete removal of invasive house mice from the South Farallon Islands using the best available methods;
- Meet the Refuge's management and policy guidelines;
- Minimize and mitigate any negative impact to the native species, other natural resources, and cultural resources of the islands as well as the surrounding environment;
- Ensure human safety is preserved;
- Ensure that long-term benefits of mouse removal outweigh any short-term negative effects from project implementation; and
- Prevent the future reinvasion of house mice through the implementation of a biosecurity plan.

7.2 Summary of Project NEPA Process and Process for Identifying Preferred Alternative

At our Coastal Commission hearing in 2019, members of the public and Commissioners questioned why we are not proposing to use a non-toxic alternative, in particular the use of a

[1] Historic levels refer to before human-caused declines that began in the early 19th century, based on early scientific investigations and assessments of historical populations.

contraceptive product. Commissioners also requested more information on the Service's alternative selection process and how the Service chose its Preferred Alternative in the FEIS (Alternative B). Below, we describe these processes, describe non-toxic alternatives considered but dismissed from further analysis, provide new information on methods identified as theoretical (i.e., contraceptives and genetic engineering) in the FEIS, and describe why alternatives based on use of a contraceptive product or genetic engineering remain infeasible for this Project.

7.2.1 Alternative Selection Process

The range of alternatives that was presented in the Project's Draft EIS was preceded by a rigorous alternative selection process. In response to the Commission's request for additional information, the following information regarding the alternative screening and selection process is provided.

The initial step in this process was to identify the range of alternatives for full evaluation in the EIS. As described in Section 2.2 and Appendix C of the FEIS (also provided as Appendix 2 here), to accomplish this the Service utilized a Structured Decision Making (SDM) approach. In total, 49 different potential mouse removal methods were assessed including mechanical, theoretical, biological, and chemical methods applied using three different delivery techniques. The methods analyzed were first assessed to determine if they met the Minimum Operational Criteria, which required that each method:

1. Be consistent with select management and policy guidelines required of all proposed projects within the National Wildlife Refuge System, including:
    a. Purpose and goals of the Farallon Islands National Wildlife Refuge;
    b. Farallon Comprehensive Conservation Plan;
    c. U.S. Department of the Interior Policy on Introduced/Invasive Species;
    d. Wilderness Act Minimum Requirements;
    e. Endangered Species Act take prohibitions;
    f. Migratory Bird Treaty Act;
    g. Marine Mammal Protection Act;
2. Be feasible to implement; and
3. Meet human safety and logistical guidelines.

A second parallel analysis, conducted simultaneously with the Minimum Operational Criteria analysis, scored and ranked each potential method for likely environmental impacts to the islands' resources and operational considerations associated with implementing the method at the Farallon Islands. The scoring and ranking of methods were done within a series of matrices to provide a quantitative comparative analysis of potential alternatives. This approach was intended to allow decision-makers to readily compare the potential environmental impacts and operational consideration of each method on island resources in a quantifiable manner. Each method was analyzed for its potential impact to island resources (biological, physical, and social), its availability for use, and its potential for successfully eradicating mice from the South Farallon Islands. Thirty-five resources in total were scored and analyzed for each method.

The 49 potential methods for mouse eradication assessed were grouped into the following categories:

- Non-rodenticide methods – Live trapping, snap-trapping, and non-native predator introduction;
- Theoretical methods – Immuno-contraception, disease, and genetic engineering; and
- Rodenticide methods – Fifteen different rodenticide products were evaluated for each of three different primary delivery methods (aerial, hand, and bait station).

In addition to these methods, mouse control (instead of complete eradication) and burrowing owl translocation were assessed in the EIS as potential means of reducing mouse impacts on the Farallon ecosystem.

Below is a summary of the non-toxic alternatives evaluated in the Alternative Selection Process and why they were not chosen as action alternatives.

7.2.2 Non-Rodenticide Methods

Live Trapping: This would involve the setting and checking of live-traps across all parts of the South Farallon Islands, and removing all captured mice from the traps. The captured mice would likely be euthanized humanely on site and incinerated for human and environmental health reasons. This technique would involve accessing on foot all portions of all islands and conducting daily trapping efforts repeatedly for months or, more likely, years. If traps were placed every 10 meters (based on the small home ranges of 0.6 acres or less for house mice [Pickard 1984]), approximately 5,000 traps would be necessary to cover the islands (49 ha). Traps would need to be checked, re-baited, reset, and mice removed daily. If each person checked and baited up to 100 traps per day, at least 50 personnel on foot would be required to check the 5,000 traps daily. Given the steep and rugged terrain of much of the Farallon Islands, actual time or personnel needed would be significantly greater especially when mice are at cyclic high numbers. Because many areas on the islands are not safely accessible on foot, this method involves substantial safety risks to personnel. It also involves substantial impacts to non-target resources and ESHA from destruction of habitat from frequent trampling, frequent and long-term disturbance to marine mammal haul-outs and breeding areas, and frequent and long-term disturbance to seabird breeding areas. The latter two would likely result in large-scale loss of the annual productivity of many Farallon species, including abandonment of certain areas. This method is most frequently used as a non-lethal research tool and has no record of success in an island rodent eradication.

Snap Trapping: This method would likely involve much of the same personnel effort as the live-trapping technique above, although the mice would already be dead when captured so would not need to be euthanized. Over 5,000 traps would be required with traps placed at 10 m spacing. Traps may need to be checked daily for weeks, or, more likely, years. If each person checked, removed, re-baited, and reset 100 traps per day, 50 personnel on foot would be required to check the 5,000 traps daily. Given the steep and rugged terrain of much of the Farallon Islands, actual time or personnel needed would be significantly greater especially when mice are at cyclic high numbers. Because many areas are not safely accessible on foot, this method involves substantial safety risks to personnel. It also involves substantial impacts to non-target island resources and ESHA from destruction of habitat from frequent trampling, frequent and long-term disturbance to marine mammal haul-outs and breeding areas, and frequent and long-term disturbance to seabird breeding areas. The latter two would likely result in large-scale loss of the annual productivity of many Farallon species, including abandonment of certain areas. This method is most used for rodent control on a very local level and has no record of success in an island rodent eradication.

Non-native Predator introduction: This technique would involve the introduction of an unknown number of non-native predators (such as cats or snakes) that are known to prey on rodents in the hope that they would prey on and kill every mouse on the islands. This method may provide some means of partial control of mouse numbers on the Farallones. But its use has never been documented in an eradication setting and it is highly unlikely to fully eradicate mice from the islands. Also, there is a high risk of major impacts to native wildlife on the islands from introduced predators, as well as a high risk of such an introduced predator becoming naturalized on the islands. There are many examples around the world of catastrophic, unintended consequences resulting from the introduction of predators either intentionally or accidentally.

7.2.3 Theoretical Methods (not yet developed or ready for field testing)

Immuno-contraception: This technique utilizes a form of mammalian birth control delivered aerially in a food pellet that would theoretically inhibit conception and reproduction of mice. At the time of the writing of the FEIS, research was being conducted into control efforts for rats using this technology, but no registered product existed in the U.S. for any rodent in a deliverable or permitted format for control or eradication. Since mice live up to 18 months or more before they die naturally of old age, any contraceptive product likely would have to be delivered to every mouse on the island for at least two years to have a chance at eradication of all the mice. Bait would likely need to be continually delivered periodically for many months or years.

Since publication of the FEIS, the contraceptive product ContraPest® (manufactured by SenesTech, Inc., Flagstaff, Arizona) has been approved by the EPA for the control of Norway (*Rattus norvegicus*) and black (or, roof; *R. rattus*) rats (EPA Reg. No. 91601-1). ContraPest is a liquid contraceptive bait that limits the fertility of both female and male rats by depleting ovarian follicle development and spermatogenesis, respectively. Laboratory studies found that ingestion of ContraPest results in inducing infertility of Norway and black rats within 15 days of the start of daily ingestion and that infertility can last for 2 to 6 months (Siers et al. 2017, Witmer et al. 2017; also see https://senestech.com/contrapest/). The main benefits of ContraPest are that bioaccumulation is negligible and toxicity appears to be low to negligible.

While ContraPest holds promise for rat control, it remains infeasible for the South Farallon Islands house mouse eradication project for several reasons, mainly:

- ContraPest is only for rat population control, not eradication, as infertility is reversed over time;
- It has only been tested and approved for control of Norway and black rats, and not house mice;
- Field efficacy has not yet been experimentally tested;

- Non-target impacts, such as the potential for contraceptive effects on other exposed wildlife, have not been experimentally tested;
- The product is delivered in a liquid bait within a bait station. In the FEIS Section 2.7.3, the use of bait stations as a primary method of bait delivery was dismissed from further analysis because many areas are not accessible, risks to human health and safety to deploy and maintain bait stations would be unacceptably high, and the ecological damage that would occur from the frequent visits to service the many thousands of bait stations that would be necessary, rendering the technique infeasible. House mice have small home ranges, typically 0.6 acres or less (Pickard 1984). Even if all parts of the South Farallon Islands were accessible, which they are not, to expose every mouse (a requirement for successful eradication), bait stations would need to be deployed 2 m (6.5 ft) to 4 m (13 ft) apart over the entire 120 acres of the islands. This would require more than 61,000 bait stations that would need regular servicing, an untenable task.

To use ContraPest or another similar contraceptive bait (if one were available) on the Farallones, even if just for rodent control, would require frequently accessing all areas of the islands to service bait stations, including seabird and marine mammal breeding areas, likely for years or in perpetuity, to have any lasting impacts on the target population. The impacts of these disturbances would be extremely high, likely catastrophic, far outweighing the short-term benefits achieved. For example, several of the breeding seabird species of the islands, such as Brandt's (*Phalacrocorax penicillatus*), Pelagic (*P. pelagicus*), and Double-crested (*P. auritus*) cormorants, common murre, and tufted puffin, are very sensitive to human disturbance and readily abandon nests when approached. Other species, including Cassin's (*Ptychoramphus aleuticus*) and rhinoceros auklets, nest in soil burrows that are easily destroyed if stepped on. Avoiding destruction of auklet burrows while deploying and maintaining such large numbers of bait stations would be nearly impossible. Disturbance to these species during the breeding season would result in catastrophic breeding failures, and after a period of years of maintaining bait stations, would result in large population declines of these species. Pinniped rookeries would also have to be disturbed on a regular basis, with results similar to those for seabirds. In addition, the frequent trampling of habitats would damage plants, dislodge rocks that provide storm-petrel and salamander habitat, and increase erosion.

More recently, the Service has become aware that the non-profit organization FYXX Foundation is working to develop and register a contraceptive product for mice, with the goal that it would be delivered in a solid bait pellet form (Mayer, L. and Ohmart, T., pers. comm.). While this product, if successfully approved by the EPA, holds future promise as a non-toxic mouse *control* product, it would not be a feasible alternative for mouse *eradication* on islands of the size and topographic complexity as the South Farallon Islands for many of the same reasons described for ContraPest (above). The effects of this product on non-target species would also have to be studied before it could be used in an ecosystem as sensitive as that of the Farallones. If this product is successfully developed and approved for use, it would still need to be made available to the entire mouse population for a prolonged period of time, requiring multiple bait applications to even begin to reduce the population. As indicated by a FYXX Foundation representative, this effort would need to be conducted multiple times per year, likely indefinitely, and would only control, not eradicate the mouse population (T. Ohmart, pers. comm.). Thus, this product would not meet Project objectives. Moreover, the need for repeated and costly aerial applications throughout the year would cause long-term, significant adverse disturbance impacts to the islands' wildlife populations.

Disease: Like immuno-contraception, the technique of introducing a fatal disease that would kill only mice has been researched for decades, but no product or process is currently available to field test for eradication. Theoretically, if developed in the future, this technique might involve aerially introducing infected mice or food dosed with some infectious agent that could kill mice. A number of exposure attempts would likely be necessary during different portions of the island and throughout the year, possibly over years.

Genetic Engineering: Another theoretical technique, that if developed would likely involve multiple releases on the islands of genetically modified house mice that might eventually lead to the eradication of mice by producing a sex-bias (daughterless method) so severe that mouse reproduction might eventually cease. Some lab and small field trial work on mosquitoes suggests that this might be a possibility for mouse control in the future.

Since publication of the FEIS, new information on efforts to develop genetically engineered mice has come to our attention. Genetic engineering of mice using CRISPR gene drive technology is being explored with house mice as a method to skew the sex ratio of offspring so that it approaches 100% single-sex. Such a method could theoretically be used for eradication without the inherent toxic risks of rodenticides. However, research is still in its infancy, this method is not currently feasible for either control or eradication, and thus is still considered theoretical. There is no known timeline for when such a method might be available for use, or even if it can be developed successfully. In addition, many other challenges would need to be overcome including ethics and social license of using genetically engineering mice (Campbell et al. 2019, Serr et al. 2020). At this time, the U.S. National Academy of Sciences' position is that there is insufficient evidence "…to support the release of gene-drive modified organisms into the environment" (NASEM 2016). The Service would likely follow the Academy's recommendations.

7.2.4 Alternatives Carried Forward for Full Analysis in EIS

Based upon the existing site conditions, purpose and need for action, constraints, and feedback received during the public scoping process, three alternatives were identified for full evaluation in the Draft EIS: The No Action alternative (Alternative A) and two action alternatives, Alternative B (*Eradicate invasive house mice from the South Farallon Islands by aerial broadcast of the rodent bait Brodifacoum-25D Conservation as the primary method of bait delivery*) and Alternative C (*Eradicate invasive house mice from the South Farallon Islands by aerial broadcast of the rodent bait Diphacinone-50 Conservation as the primary method of bait delivery).* The Draft EIS did not identify a preferred alternative.

The two action alternatives were developed by resource specialists within the Service, experts in island rodent eradications, experts on the Farallon Islands' resources, and input from other regulatory agencies with relevant expertise. In addition, the action alternatives reflect feedback received from agencies and the general public during scoping. Background information used during the development of action alternatives is provided in FEIS Section 2.8. The alternatives are outlined in FEIS Sections 2.9 – 2.13, including the No Action Alternative. Because both action alternatives rely on the aerial application of rodenticide bait, the many features common to these alternatives were grouped into Section 2.10 of the FEIS.

The Service published a Draft EIS (DEIS) for public review on August 16, 2013 followed by a Revised DEIS on October 25, 2013. A public meeting was held on August 29, 2013, and public comments were received through December 9, 2013. A total of 553 public correspondences were received on both the DEIS and RDEIS. For more information on the public review process and response to comments, see Appendix P of the FEIS.

7.2.5 Choice of Preferred Alternative for FEIS

Following the end of the public review period, the Service prepared the FEIS. The FEIS incorporated changes made in response to public comments and new information. Of note, the Service incorporated lessons learned from past eradication projects into the FEIS and the results of a study on potential impacts of rodenticide exposure to salamanders. The FEIS identified Alternative B, *Eradicate invasive house mice from the South Farallon Islands by aerial broadcast of the rodent bait Brodifacoum-25D Conservation as the primary method of bait delivery,* as the preferred alternative.

The Service identified Alternative B as the preferred alternative because of its much greater potential to successfully eradicate house mice from the South Farallon Islands and its lower, short-term adverse impacts to wilderness, as compared to Alternative C. As described in Sections 2.5 and 2.6 of the FEIS, brodifacoum bait products have been shown to be very effective on mice, including in just a single feeding, have been used in nearly every successful mouse eradication, and are considered part of best practices for mouse eradication. In addition, the Service consulted with collaborating agencies including the U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (USDA/APHIS/WS), U.S. Environmental Protection Agency (EPA), Greater Farallones National Marine Sanctuary, and California Department of Fish and Wildlife prior to identifying the preferred alternative for this Project.

A major component of the Service's choice of the Preferred Alternative is brodifacoum's proven effectiveness at eradicating house mice from islands. Following the first successful whole-island rodent eradications in the 1970s, techniques have been modified to better guarantee eradication success while minimizing non-target impacts. Current island rodent eradication tracking shows that over 722 successful island rodent eradications (9 species on 578 islands) have been conducted worldwide, including 64 for house mice (DIISE 2021). Best practices for eradicating house mice from islands call for aerial broadcast of brodifacoum bait (Broome et al. 2017, 2019). All but one successful house mouse eradication used brodifacoum or another closely related second-generation anticoagulant (Table 1; DIISE 2021). The other used the 1st generation anticoagulant warfarin. As described in Section 2.5 of the FEIS, success rates have improved over time, particularly within the last two decades. Current numbers show that since 2005, 33 of the 35 (94%) house mouse eradications undertaken have been confirmed as successful (DIISE 2021). We are unaware of any successful whole-island house mouse eradications that did not use a rodenticide. Although success cannot be guaranteed, the success rates now being achieved in other mouse eradication projects show that a well-planned and executed project would provide a high chance of success at the South Farallon Islands.

Table 1. Summary of house mouse eradication attempts utilizing rodenticides with documented results and methods (DIISE 2021).[1, 2]

Toxicant used		Eradication attempts	Successful	Failed
1st Generation anticoagulant rodenticides	Diphacinone	1	0	1
	Pindone	1	0	1
	Warfarin	1	1	0
2nd Generation anticoagulant rodenticides	Brodifacoum	72	52	20
	Bromadiolone	4	4	0
	Flocoumafen	3	2	1
	Flocoumafen and brodifacoum	1	1	0
Mixed 1st and 2nd generation anticoagulant rodenticides	Brodifacoum and Diphacinone	1	1	0
	Pindone and Brodifacoum	3	3	0
	Brodifacoum and Coumatetralyl	1	0	1
Acute rodenticides	Sodium monofluoroacetate (1080)	1	0	1
TOTAL		89	64	25

[1] Only eradication attempts with known methods and known results were included in this table.
[2] Updated from Table 2.2 in the Final Environmental Impact Statement (USFWS 2019).

Although it is less toxic than brodifacoum and thus has less risk to non-target species, diphacinone (the rodenticide proposed in Alternative C) requires multiple feedings over multiple days to be effective, is less effective on mice (than rats), would require more bait applications and have a longer operational period, and has never been used in a successful, full-island mouse eradication. For these reasons, we consider Alternative C to have a high risk of eradication failure in addition to causing substantially more disturbance to the Farallon ecosystem, and thus we did not identify Alternative C as the preferred alternative. See Sections 2.5, 2.6, 2.11, and 2.12 for more information on these subjects.

The history and success of past rodent eradication efforts (summarized in FEIS Section 2.5) played a major role in the Service's selection of its preferred alternative for the Farallon Project. While no mouse eradications have yet been attempted in the U.S., five successful rat eradications have been conducted including Anacapa Island (California), Hawadax Island (formerly known as Rat Island, Alaska), Midway Atoll (Pacific Islands), Palmyra Atoll (Pacific Islands), and Desecheo Island (Puerto Rico) (Howald et al. 2009, Buckalew et al. 2011, Wegman et al. 2012, Will et al. 2019, DIISE 2021). Another, Lehua Island (Hawaii), awaits confirmation of success. All confirmed successful eradications used brodifacoum, while Lehua used diphacinone. The most similar to the South Farallon Islands project was the highly successful black rat eradication at Anacapa Island, in the California Channel Islands (Howald et al. 2009, Newton et al. 2016). Methods to be used at the Farallones will be very similar to Anacapa, although Anacapa was even more logistically challenging, with larger area, extensive high cliffs, many sea caves, and the presence of a native rodent species, the deer mouse (*Peromyscus maniculatus*).

Although the Farallones project poses some logistical challenges, mouse and other rodent eradications have been conducted on islands much larger and more logistically complex than the Farallones. For example, house mice were eradicated from 4,972 acre, 1,200 foot high Antipodes Island, New Zealand, in a project that took just under a month in 2016 (Horn et al. 2017). Mice were known to be impacting various aspects of the Antipodes ecosystem. The brodifacoum bait Pestoff 20R™ (essentially the New Zealand version of Brodifacoum-25) was used to successfully eradicate the mice. Three species of landbirds (two parakeets and a pipit) were found to suffer some mortality from brodifacoum consumption, but none showed population-level impacts and within two years all were found in numbers similar to or greater than pre-eradication levels. Populations of several native insect species were noted to increase rapidly following the eradication, a further indication of rapid benefits of the project (Horn et al. 2017).

Targeting multiple species in one eradication project is even more challenging, yet has been achieved on some very large, highly complex islands. For example, in 2009 the successful eradication of house mouse, three species of rats, and four other invasive species was conducted simultaneously on two adjacent, large islands, Rangitoto (2,311 ha; 5,710 acres) and Motupapu (1,509 ha; 3,729 acres) (Griffiths et al. 2015). These inhabited islands are located just 5.5 miles from the center New Zealand's largest city of Auckland, and are comprised of a complex variety of topography and habitats, including steep cliffs, plateaus, marshes, forests, and pastoral farmland. Mice and rats were eradicated successfully using the brodifacoum bait Pestoff 20R™ (Griffiths et al. 2015).

Another even more complex house mouse and brown rat (*Rattus norvegicus*) eradication project was conducted on the Subantarctic island of South Georgia (Martin and Richardson 2017). This very remote and very large island is 43 miles long and 1,350 square miles in size. Large glaciers provided barriers to rodent movement, allowing the eradication project to be conducted in phases over five years. Both mice and rats, which occurred is separate areas, were successfully eradicated using Brodifacoum-25 bait. Seven of 30 breeding species of birds suffered some level of mortality, all of which were either scavengers or plant feeders. All populations appeared to recover within 5 years, with some at greater numbers than prior to the eradication. The endemic South Georgia pipit (*Anthus antarcticus*) quickly recolonized newly rodent-free habitats. None of the island's birds which forage exclusively at sea (e.g., penguins, albatrosses, and storm-petrels) were negatively affected by the project (Martin and Richardson 2017).

8 Project Description

8.1 Overview

Following best practices for house mouse eradications from islands, the Project involves the aerial application of Brodifacoum-25D Conservation rodent bait as the primary application method to all mouse territories on the South Farallon Islands in order to eliminate the pervasive adverse effects of invasive house mice on the islands. The implementation of the Project is expected to take about 7 weeks, including 2 weeks for pre-eradication activities and 5 weeks for operational activities. During the operational period, bait would be applied in two separate applications (each taking one to two days), 10 to 21 days apart. The aerial broadcast of rodent bait would occur using a helicopter equipped with a specialized bait spreading bucket. Aerial application of rodenticide is recognized internationally as the most effective technique in rodent, including house mouse, eradication. All bait application would follow EPA-approved labeling requirements for this product.

The Project would occur during the fall (between October and December), most likely in November or December, which is typically the optimal time to minimize non-target impacts. At that time of year, bird nesting is over and most breeding birds have departed from the islands, except for a small number of remaining ashy storm-petrel chicks that would still be visited and fed by parents in the early part of the operation (most fledge and depart by mid-November). This species is not expected to be impacted by operations because they nest in underground crevices and only feed on marine prey far from the islands. No marine mammal pupping occurs in fall, and remaining sea lion and fur seal pups born in summer are highly mobile and spending large periods of time in the ocean.

Throughout the operational period, Service staff will be actively engaged in mitigation and monitoring activities to ensure that impacts remain within the parameters described in the FEIS. In all cases, the FEIS found that there would be no long-term significant adverse impacts on any resources (see Section 9. Environmental Consequences, below; FEIS Section 4.5.6.1). Monitoring will also continue after the operational period. All aspects of the Project, including its extensive mitigation and monitoring programs, are described below.

8.2 Operational Specifications

A summary of operational specifications is provided below and in Table 2. Additional details of the Project (FEIS Alternative B) are described in Sections 2.10 and 2.11 of the FEIS and in the *Draft Operational Plan* (see Operational Plan, below).

8.2.1 Application Area

Rodent bait would be applied to all areas above Mean High Water Spring (MHWS) on the South Farallon Islands, which includes Southeast Farallon Island, West End (or, Maintop) Island, and the smaller associated offshore islets including Saddle Rock, Sugarloaf, Chocolate Chip, Arch Rock, Finger Rock, Aulon Islet, and Sea Lion Islet (Figure 1). The MHWS mark would be the boundary of the operational area such that areas beyond this point would not be targeted for baiting. Areas of the island above MHWS but excluded from aerial bait application are still considered within the operational area but would be treated via hand broadcast and/or bait stations. The operational area is estimated to total approximately 120 acres (about 49 ha) of planar surface area. About 70 acres is on the largest island, Southeast Farallon, while the remainder is on the other islands and islets. Mice are known to occur at least on Southeast Farallon and West End islands. The other, nearly inaccessible islets have not been surveyed but are assumed to harbor mice at least periodically. Channels between islands are narrow and well within mouse swimming capability (at least several hundred meters; Broome et al. 2019), and some channels can be traversed during minus tides. Thus, all areas above MHWS must be treated to expose every mouse and prevent risk of eradication failure.

8.2.2 Bait Type and Properties

Brodifacoum-25D Conservation (Bell Laboratories, Inc.), the specific bait product proposed for the Project, is registered with the EPA (EPA Reg. No. 56228-37) with the registration held by USDA/APHIS/WS. As described on the EPA product label (provided in Appendix C), Brodifacoum-25D is registered for conservation use only and "may be used only to control or eradicate Norway rats (*Rattus norvegicus*), roof rats (*Rattus rattus*), Polynesian rats (*Rattus exulans*), house mice (*Mus musculus*), or other types of invasive rodents on islands for conservation purposes, or on grounded vessels or vessels in peril of grounding."

Brodifacoum-25D Conservation is a compressed cereal grain pellet that weighs approximately 0.35 oz (1 g). The pellet contains 25 ppm or 0.0025 percent brodifacoum, a second-generation anticoagulant of the coumarin class. Pellets are dyed green to make them less attractive to birds and reptiles (Pank 1976, Tershy et al. 1992, Tershy and Breese 1994). All other ingredients in the bait pellets are non-germinating grains (either sterile or crushed) and other non-toxic additives.

Brodifacoum, like other anticoagulant toxicants, acts by interfering with the synthesis of vitamin K-dependent clotting factors. This increases the clotting time of blood and leads to death from hemorrhaging. Brodifacoum is absorbed through the gastrointestinal tract. It can also be absorbed through the skin. Brodifacoum is not readily metabolized and the major route of excretion of the unbound compound is through the feces. A proportion of any ingested dose of brodifacoum is bound in the liver, kidney, or pancreas where it remains in a stable form for some time and is only very slowly excreted.

The precise chemical name for brodifacoum is 3-(3-(4'-Bromo-(1,1'-biphenyl)-4-yl)-1,2,3,4-tetrahydro-1-napthalenyl)-4-hydroxycoumarin. The empirical formula for brodifacoum is $C_{31}H_{23}BrO_3$ and its molecular weight is 523.4. It has a very low solubility in water (less than 10 ppm or mg/L at 20ºC and pH 7) and is stable at room temperature.

For additional discussion of this product, see Section 2.6 of the FEIS.

8.2.3 Bait Application

Bait application will be undertaken in accordance with the Federal Insecticide Fungicide Rodenticide Act of 1972 (FIFRA) and EPA-approved pesticide label instructions, which define the legally allowable use and restrictions of the specific pesticide. The FEIS (Section 2.10) indicated that a supplemental label would likely be requested from EPA for the Project. Consultations among the Service, USDA-APHIS/WS and EPA since the release of the FEIS have indicated that issuance of a supplemental label is appropriate to account for the amount of bait required to sufficiently cover steep (non-planar surface area) slopes and cliffs, to back-bait portions of the islands where initial baiting is interrupted (e.g., due to deteriorated weather conditions) and then resumed at a later date, and to aerially or hand-broadcast bait near dwellings (instead of using bait stations). In addition, USDA/APHIS/WS staff also advised the Service to consider requesting that the supplemental label authorize the second bait application to use up to the same amount of bait as the first application (see Bait Application Rate, below).

The Service will work with USDA-APHIS.WS to request a supplemental label after an operational team has been selected and has provided input on bait handling and application protocols in the *Draft Operational Plan*. Conditions of the supplemental label will be incorporated into the Operational Plan prior to its finalization. Acquisition of supplemental labels for rodent eradication projects is common practice to address project-specific needs. The Service does not intend or expect any major changes to the Project, environmental risk, or mitigation measures as a result of a supplemental label. All bait application activities would be conducted under the supervision of a certified pesticide applicator holding a Qualified Applicator Certificate from the State of California.

The timing of the bait broadcast operation would occur sometime in the October-December timeframe, with November being the most likely month. Timing of bait application is a key attribute of the Project to both maximize the likelihoods of success at both eradicating the target species and minimizing non-target impacts. This timeframe is based on three factors: the annual reproductive and population cycle for house mice; typical weather patterns; and seasonal attendance patterns for native wildlife. As explained in Section 2.10.4 and Table 2.4 of the FEIS, this time period represents the point when mouse reproduction has mostly ceased, and November and December represent the period in which no seabirds other than ashy storm-petrels (who are nocturnal and nest underground) are breeding. October and November also are outside the pinniped breeding season. Finally, this time window maximizes the ability to time bait application with a subsequent seasonal rain event (see FEIS Section 3.2.3 for monthly rainfall totals), which would degrade bait and reduce risks to non-target species. The timing has been kept flexible to allow for assessment of mouse population status, unusual weather events and wildlife behavior, and is also discussed in the Mitigation section, below.

8.2.4 Bait Application Rate

Bait would be applied at a rate that would ensure that all individual mice have access to sufficient bait to ingest a lethal dose. The FEIS indicated that bait would be applied at about 18 kg/ha (16 lb/acre) for the first application and about 9 kg/ha (8 lb/acre) for the second application, totaling about 1,323 kg (2,880 lbs) of bait. Because of the very low concentration of rodenticide contained in each bait pellet, the total amount of toxicant distributed would be only about 33 g (1.2 oz) (Table 2). Any bait not initially consumed by mice would likely remain attractive to mice for a few to several weeks, although bait pellets are designed to degrade after sufficient rain or exposure to any other water source including maritime moisture from fog and humidity. In the absence of a major rain event, unconsumed bait is expected to remain available and palatable for about five weeks following the last bait application.

As described in Bait application (above), a supplemental label will be sought for Project. Based on a more recent recommendation from USDA/APHIS/WS, a greater bait application rate of up to 16 lb/acre (instead of 8 lb/acre) will be requested for the second application. This additional label authorization would only be employed if monitoring were to find that bait disappearance rates from the first application are greater than expected, such as from higher mouse uptake rates or degradation from rainfall, and that a higher application rate was necessary to best assure eradication success. If the full amount of bait is used for the second application, it would equate to an estimated total of 1,764 kg (3,840 lbs) of bait pellets for the entire Project. Again, because of the very low concentration of rodenticide contained in each pellet, the total amount of toxicant distributed would be 44 g (1.6 oz) for the Project. This would be an increase of 33% above that which was disclosed in the FEIS. This increase would not change any of the expected impacts or operational procedures that were described in the FEIS or in this Consistency Determination because of the small amount of toxicant involved and the mitigation measures to protect non-target resources that will employed.

Table 2. Summary of operational specifications.

Action Attribute	Preferred Alternative Parameters (Alt B)
Toxicant type/Product	Brodifacoum-25D Conservation (Bell Labs)
Primary bait delivery method (~90%)	Aerial Broadcast
Supplementary bait delivery methods (~10%)	Hand Broadcast, Bait Station
Timing: start of application	Fall
Number of aerial applications	2
Anticipated time between applications	10-21 days
Minimum length of exposure required to ensure eradication	4 days following each application
Anticipated bait pellet application rates	24 lb/acre (16 lb/acre + 8 lb/acre)[1] 27 kg/ha (18 kg/ha + 9 kg/ha)[1]
Anticipated total amount of rodent bait that would be applied	2,880 lb (1,323 kg)[2,3]
Concentration of rodenticide within rodent bait	0.0025%
Anticipated total amount of rodenticide to be applied	1.2 oz (33 g)[4,5]
Anticipated hours of flight time required for aerial bait application actions	About 11 hours (~5.5 hours x 2)
Total helicopter time over island for bait application	About 6 hours (~3 hours per application)
Bait application duration	Up to 21 days (2 drops 10-21 days apart)
Projected bait availability and palatability to gulls	Up to 5 weeks after the second application
Anticipated hours of flight time required for gull hazing	Up to 70 hours (2 hours daily for up to 8 weeks)
Actions to minimize risk to non-target species	Timing of operation, gull hazing, raptor capture, carcass removal, use of bait stations
Actions to minimize bait drift	Baiting of areas above MHWS only, flying only in wind speeds of less than 30kts, use of deflector and dribble buckets.

[1] Bait application rates and amounts are based on anticipated rates, which were published in the Final Environmental Impact Statement. However, based on a recent recommendation from the USDA/APHIS/WS/NWRS, the Service intends to apply for a supplemental label allowing for an application rate of up 16 lb/acre (9 kg/ha) in the second application. If approved, this application rate would only be used if deemed necessary based on results of the first application. This application rate for the second application would result in a total application rate of 32 lb/acre (36 kg/ha).

[2] The FEIS incorrectly reported an anticipated total of 2,917 lbs of bait.

[3] If bait is applied at 16 lb/acre (9 kg/ha) for the second application, anticipated total amount of bait pellets applied would be 3,840 lbs (1,764 kg).
[4] The FEIS incorrectly reported an anticipated total of 1.6 oz. of rodenticide.
[5] If bait is applied at 16 lb/acre (9 kg/ha) for the second application, anticipated total amount of rodenticide applied would be 1.6 oz. (44 g).

8.2.5 Aerial Bait Application

Aerial bait broadcast would be conducted in strict accordance with the EPA-approved bait label. The bait spreading bucket would be composed of a bait storage compartment (the hopper), a remotely triggered adjustable gate to regulate bait flow out of the storage compartment, and a motor-driven broadcast device (the spinner). The bait spreading bucket would be used in three different configurations (Figure 3). The standard configuration would be used to apply bait to most of the operational area. With the spinner on, this configuration would be used to broadcast bait over a predetermined swath width. With a bait deflector installed and/or a skirt attached, the bucket would be used to provide a directional (~180° rather than 360°) broadcast of bait out to a predetermined distance. This configuration would be used to apply bait along the island's coastline and around areas excluded from aerial bait application. The final configuration would be with the spinner removed and a deflection cone added. With this set up, the bait bucket would trickle bait at a low rate on a precise point or along linear or small features.

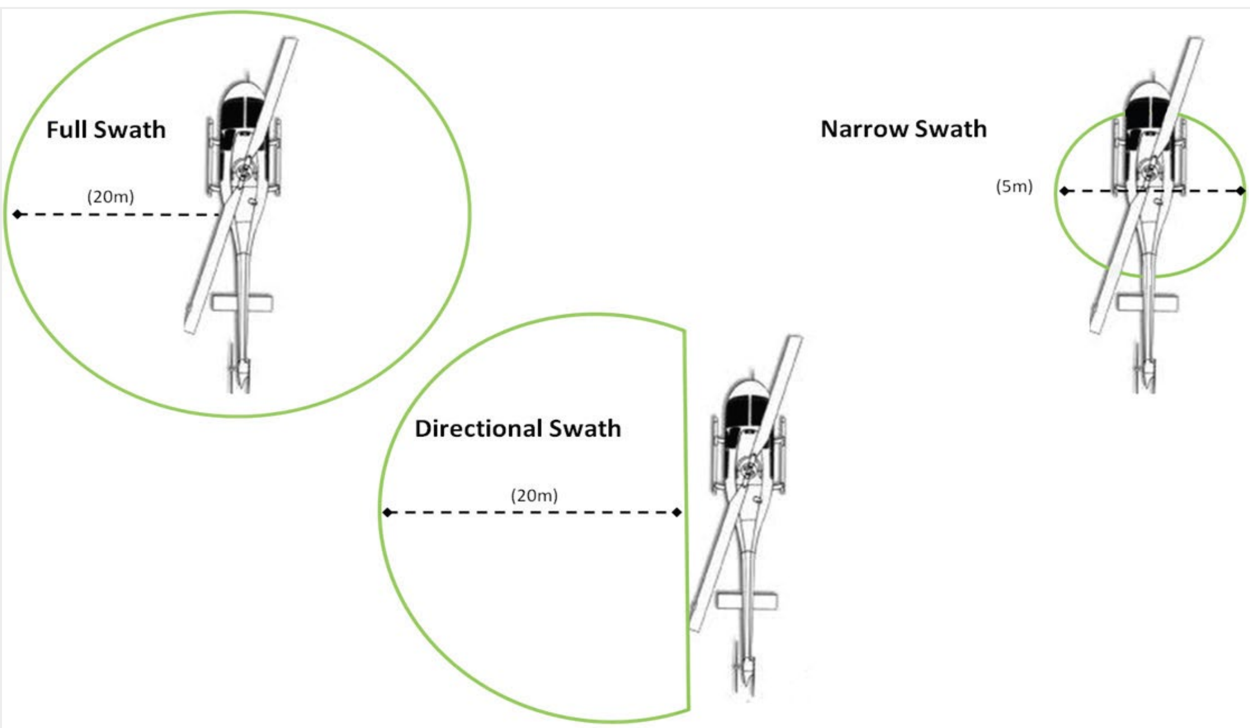

Figure 3. Aerial bait applications types (note: example swath widths shown are not specific to this project).

Prior to bait application, the bait spreading buckets would be calibrated at a separate test site, using a non-toxic bait product to ensure consistent and accurate bait application. Exact swath widths, flight speed, and rate of bait flow to be used during the operation would be determined through this trial.

Aerial broadcast would comprise a series of low-altitude flights by helicopter to most parts of the South Farallon Islands except for areas excluded from aerial application (Figure 4). The baiting regimen would follow common practices based on successful rodent eradications completed in the U.S. and abroad (e.g., Broome et al. 2017, 2019). Each flight swath would overlap the previous by approximately 50 percent to ensure no gaps in bait coverage. During each application, most parts of the South Farallones would be subject to multiple helicopter passes. Following common practice, to compensate for topography, slopes over 45 degrees may be flown additional times to ensure bait application rates across the island are consistent.

Bait pellets would be applied according to a flight plan that would account for:

- The need to apply bait as evenly as possible to prevent gaps in coverage or excessive overlap;
- Island topography;
- The need to minimize bait drift into the marine environment;
- The need to avoid bait broadcast in other exclusion zones such as areas of human habitation (unless a supplemental label is obtained to do so); and
- Weather conditions.

It is estimated that bait could be applied by helicopter at a rate of approximately 660 lb/hr (300 kg/hr). Up to eight hours of flight time would be required to complete the two applications required, or up to four hours for each application. Additional hours of flight time and helicopter costs would be involved in transporting the helicopter, personnel and equipment.

As described in the *Draft Mitigation and Monitoring Plan* (see Monitoring, below), bait application rates would be monitored throughout the operation by calculating the area covered versus the quantity of bait used and other methods, such as the hula-hoop method, to estimate densities of bait pellets in various areas of the islands. More in depth analysis of application rates across the island would be undertaken periodically during the operation using GIS software. If necessary, adjustments in bait flow rates, helicopter speed, and flight lines would be made as needed to achieve the target bait application rate while remaining within label limits set by the EPA.

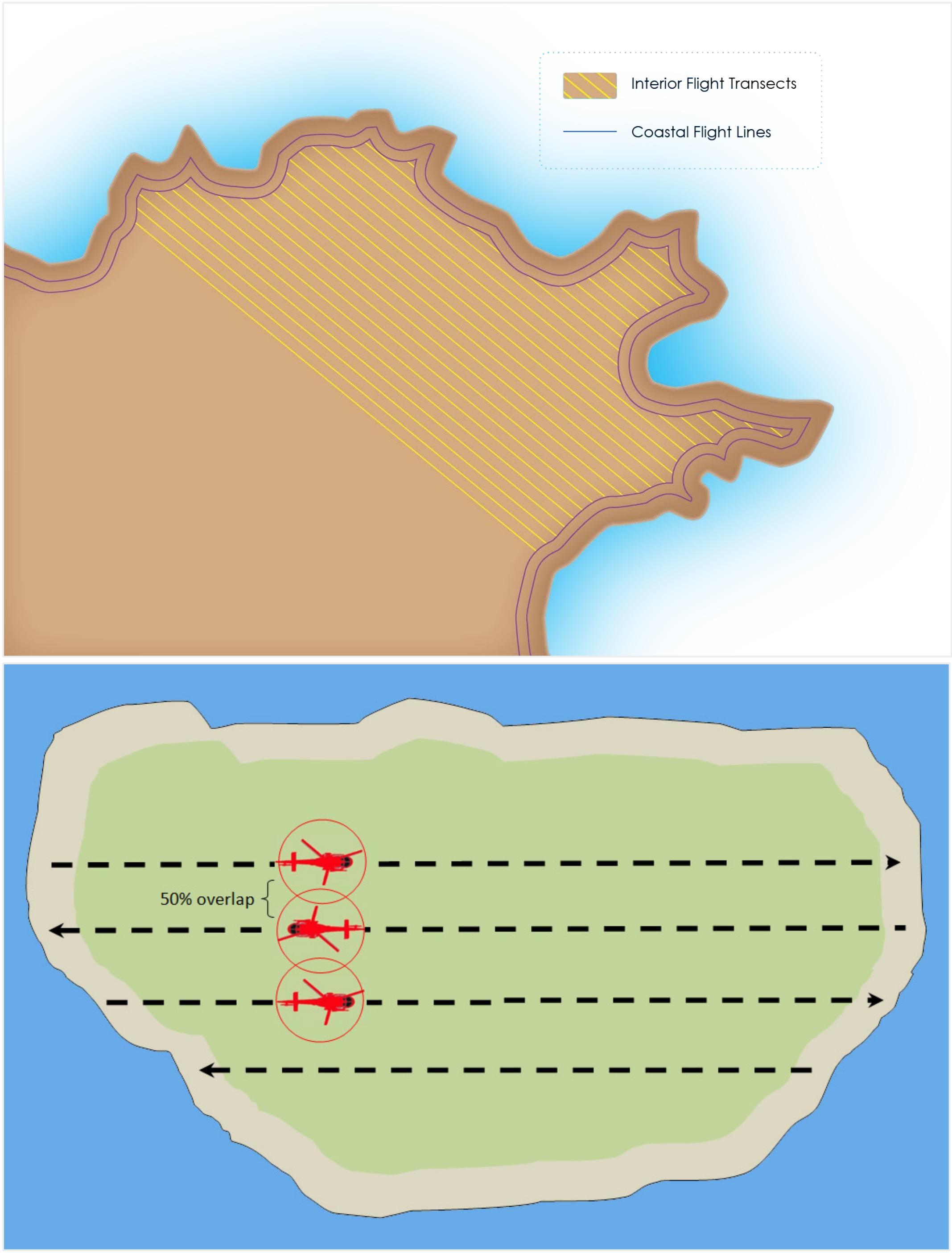

Figure 4. Schematic of example aerial baiting tracklines. (Top): Shorelines would be flown separately from interior transects; (Bottom): Flight lines would be flown to distribute bait with 50% overlap between transects to assure bait is distributed into every potential mouse territory.

8.2.6 Other Baiting

Some areas would be excluded from aerial bait application, including shoreline areas where the risk of bait drift into sensitive intertidal habitats is considered high. Other areas that may be excluded from aerial bait application include high use gull roosts and around the two island residences, although a supplemental label may allow aerial or hand baiting around the residences (see Bait Application, above). In areas excluded from aerial bait application, hand baiting, bait stations, or a combination of these techniques would be used. Precise details will be formalized in the Final Operational Plan (see below), which will include an assessment of potential exclusion areas following further on-site assessments and consultations with stakeholders.

It is expected that up to 12 acres (5 ha) of the islands may require hand-baiting to fill gaps in aerial baiting such as within caves, around areas of human habitation, or certain steep cliffs. Personnel would hand broadcast bait across all land areas excluded from aerial bait application (i.e. using the bait spreading bucket) except for those areas being treated with bait stations, such as the inside of buildings that are in use. In areas to be hand baited, project staff would distribute rodent bait by hand at the same application rate as it is applied aerially. It is estimated that selected land areas could be hand-baited by crews on foot at a rate of approximately three acres/person/day (1.25 ha/person/day). This estimate of productivity includes assessing GIS maps of bait spread, as well as carrying and broadcasting bait to these areas. Hand baiting would be conducted on foot, from a boat, or from a helicopter. All personnel participating in supplemental hand broadcasts will be trained in systematic bait application at the target application rates.

8.3 Operational Plan

The Operational Plan guides staff through the preparation and implementation of the eradication Project to ensure the Project is carried out in a manner consistent with the FEIS. The document is a prescriptive plan detailing the tools, steps, strategies, logistics, staffing, safety, mitigation measures, and timeframe necessary to achieve the highest probability of Project success. In response to the Commission's request, a *Draft Operational Plan* has been prepared and is included in Appendix 3. If the Service's Record of Decision chooses the Preferred Alternative (Alternative B) identified in the FEIS, this draft plan will be updated to incorporate input from the implementation team (not yet selected) and from consultations with USDA/APHIS/WS, EPA (especially with regard to a supplemental label), other relevant regulatory agencies, and other experts. The plan would be finalized prior to Project implementation. If requested, we would also welcome review by Commission staff of the draft final plan to confirm that the Project has not changed since Commission approval.

8.4 Mitigation Measures

In order to protect human health and safety and minimize risks to non-target species that would be present during Project operations, Section 2.10 of the FEIS includes a comprehensive suite of mitigation measures to avoid or reduce adverse impacts. Through the use of these mitigation measures and careful Project design, the FEIS concludes that no long-term, significant adverse environmental effects would occur from the Project. Of particular importance is that the operation would take place when most breeding and migratory birds are not on the islands and when marine mammals are not breeding.

Mitigation measures for the Project are summarized below. Additional details are in Section 10, Article 4: Marine Environment (below) and in the *Draft Mitigation and Monitoring Plan* (Appendix 4), which was prepared at the Commission's request. If the Service's Record of Decision chooses the Preferred Alternative (Alternative B) identified in the FEIS, the Draft Mitigation and Monitoring Plan will be updated to incorporate input from the implementation team (not yet selected) and from consultations with USDA/APHIS/WS, EPA, other relevant regulatory agencies, and other experts. The plan would be finalized prior to project implementation. If requested, we would also welcome review by Commission staff on the draft final plan to confirm that the Project has not changed since Commission approval.

8.4.1 Project Timing

The Service has identified an operational window for the Project of October– December, with November being the most likely month for bait application. This window is based on two main factors: the annual reproductive and population cycle for house mice, and seasonal attendance patterns for native wildlife. As explained in Section 2.10.4 of the FEIS and shown in Table 3, this window represents the time when annual mouse reproduction subsides, and November and December represent the period in which no seabirds other than the season's last few remaining ashy storm-petrels (which are nocturnal, nest underground and are at minimal risk of rodenticide exposure) are breeding. October through mid-December also are outside the pinniped breeding season, so breeding activities would not be disturbed. An additional benefit is that this period, the start of the local rainy season, increases the likelihood of a fairly near-term rain event following bait application; rain will degrade bait, reducing risks of exposure to non-target species. Together, these favorable conditions will help reduce risks to non-target species to less than significant levels.

Table 3. Overall project timing considerations.

Issue or Constraint	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Mouse numbers increasing		X	X	X	X	X	X					
Increased likelihood of mouse breeding	X	X	X	X	X	X	X					
Seabirds breeding	X	X	X	X	X	X	X[1]	X[1]			X	X
More than 5,000 Gulls present (avg)	X	X	X	X	X	X			X	X	X	X
Pinnipeds breeding	X	X	X	X	X	X			X	X	X	X
Average rainfall >2"							X	X	X	X	X	X
Proposed Timing for Implementation								X				

[1]In October and November the only seabird species still breeding on the Farallon Islands is the ashy storm-petrel. Because ashy storm-petrels nest underground in small rock crevices and are nocturnal, they would be nearly unaffected by proposed eradication activities.

8.4.2 Bait Application

Additional information on bait application is provided in Operational Specifications section (above) and in Appendix 3.

A suite of proven mitigation measures would be employed to minimize the risk of incidental bait drift into intertidal and nearshore waters, thus greatly reducing the risk to aquatic resources. These would include:

1. The coastal boundary for the bait application operation, Mean High Water Spring (MHWS), would be flown by helicopter and mapped prior to bait being applied.
2. The flight path flown by the helicopter would be monitored using an onboard, high-precision GPS and a navigation bar to guide bait application.
3. Rodent bait aerially broadcast along the island's coastline would be applied using a bait spreading bucket configured with a deflector providing a 180 degree swath pattern (Figure 3). This enables the pilot to fly along the shore and more accurately direct bait inshore of the MHWS.
4. A trickle bucket with a narrow (<33 ft, <10 m) swath would be used to complete linear features and sections of coastline considered too challenging for deflector and full swath bucket configurations.
5. To reduce potential for bait drift outside target areas, bait application would not be conducted in wind speeds exceeding 30 knots, the maximum permitted by the label (provided in Appendix C). A Project-specific maximum wind speed will be defined in the Final Operational Plan.
6. Bait stations or hand baiting would be used in more highly sensitive shoreline areas, such as adjacent to important tide pool habitats or easily accessible areas where pre-application monitoring shows persistent concentrations of roosting gulls.
7. Contingency plans to respond to 1) a bait spill on the island or in the marine environment (Appendix 5) and 2) potential non-target impacts (Appendix 6) from operations identify triggers and potential responses to address possible serious but unexpected events (see Contingency Planning, below).

Note: The use of bait deflectors and trickle buckets has been shown to be effective at reducing the extent of bait drift into the marine environment during aerial broadcasts. An analysis of bait drift, completed on Palmyra Atoll in the tropical Pacific by Pitt et al. (2012), found bait at densities of up to 14 percent of the targeted application rate 7 m from shore and the authors considered that bait may have drifted past this point. Pitt et al. (2012) noted that a number of factors including a malfunction of the bait deflector, a dense forest canopy hanging over the coastline, an irregular coastline, and strong winds could have exacerbated the extent of the bait drift observed at Palmyra Atoll. Corrective action to permanently fix the deflector was made on Palmyra. The shoreline and terrain of Palmyra Atoll are entirely different than the Farallones. There is no vegetation overhanging the shoreline at the Farallones; thus, pilot visibility would not be an issue as it was at Palmyra Atoll. The Farallones also do not have an interior lagoon like at Palmyra and other atolls, which increase the shoreline area and risk of bait drift. Moreover, lessons learned from the Palmyra project and other projects have been incorporated into operational planning for the Farallones Project. To further minimize the possibility of bait drift into the marine environment at the Farallones, the coastal boundary for the operation at the Mean High Water Spring (MHWS) mark will be flown and mapped prior to bait being applied. In addition, Project-specific operating limits for wind speed and helicopter flight speed will be incorporated into the Project's final Operational Plan after receiving input from the hired pilot and other operational team leaders.

The following additional adaptive management measures will be considered prior to finalizing the Operational Plan. These measures would only be employed if they would further reduce the likelihood of non-target impacts (which are already less than significant) without jeopardizing the success of the eradication:

- Reducing the swath width of all bait spreading bucket configurations to provide for more precise placement of bait;
- Reducing helicopter flight speed to ensure more precise placement of bait;
- Utilizing traps in caves or within structures as a secondary mouse removal method.

Traps would be used in areas that are unlikely to have mouse territories in addition to having minimal exposure to the elements, such as caves, to reduce likelihood of exposure to Farallon camel crickets. If employed, the exact trap protocol would be outlined in the Operational Plan and will comply with all permitted activities.

8.4.3 Gull Hazing

Gulls, including the resident western gull (*Larus occidentalis*) and several species of migrant gulls including the California (*Larus californicus*), herring (*L. argentatus*), and glaucous-winged (*L. glaucescens*) gulls, are considered to be among the species most at risk from exposure to the toxicant. While gull numbers on the Farallones are near annual minimums during the Project's operational window, several thousand individuals could visit the islands at some point during the planned operational period (also see Sections 3.4.2 and 4.5.6.2.1 of the FEIS for more information on seasonality and species present). During the operational period, gulls visit the islands almost exclusively for roosting, with most activity in the late afternoon through early morning. Attendance is most frequent at several roost sites, especially around the periphery of the islands, including intertidal zones that will not be baited.

As described in Section 2.10.7.1 of the FEIS, because gulls are at relatively high risk of exposure to toxicant, a multi-faceted gull hazing program would be implemented to minimize the numbers of gulls landing on the islands and, thus, from being exposed to toxicant. The primary goal of hazing is to minimize rodenticide exposure to gulls. A secondary goal is to reduce bait removal by gulls and thereby maximize bait availability to mice. The gull hazing program would begin prior to the application of rodent bait and continue until exposure risk is determined to be negligible, estimated to be about five weeks from the first bait application. Hazing is expected to keep western gull mortality well below a threshold that would have a population level impact (Nur et al. 2021). (See the Monitoring section below for more information on this topic.) As indicated in the *Draft Non-Target Contingency Plan* (Appendix 6), the Project would only proceed if hazing was demonstrated to be successful prior to bait application.

A hazing trial undertaken in 2012 on the South Farallon Islands successfully deployed a range of hazing techniques and demonstrated the ability to keep all but a few western gulls off the islands for an extended period (see Appendix 4 of the FEIS). The hazing trial also prevented gulls from landing in areas where non-toxic rodent bait was made available. One key factor in this high hazing success is that, unlike many other less successful gull hazing studies, gulls visiting the islands in fall do so just for roosting, not feeding. Many other hazing programs are conducted at landfills and other food sources, making hazing more challenging. Results from the Farallon trial provide a high degree of confidence that a well planned and executed hazing operation would keep gull mortality to an acceptable level during a mouse eradication. In addition, impacts to other island natural resources from hazing activities, such as other bird species and marine mammals, were well below levels of concern; pinniped use of the islands was not affected. Hazing of laughing gulls (*Leucophaeus atricilla*) was also conducted successfully during a mouse eradication on Allen Cay, Bahamas in 2012 (Alifano 2012).

Effective hazing methods from the 2012 hazing trial and other projects are the cornerstones of the Project's hazing program. To implement the program, a team of hazing personnel would deploy a range of proven hazing techniques including pen-light lasers, spotlights, pyrotechnics, biosonics, predator calls, air cannons, effigies, and kites to haze gulls off the islands. The use of trained falcons and bird-hazing dogs are also possible but would only be deployed if deemed necessary. However, the availability of these resources would be confirmed prior to Project implementation so that they could be deployed quickly if needed. A small, relatively quiet helicopter may be used to transport personnel to otherwise inaccessible areas, monitor gull presence and haze gulls in conjunction with other techniques. The reciprocating engine Robinson R22 helicopter used in the gull hazing trial was found to be effective without causing substantial disturbance to pinnipeds. To minimize the potential for gulls habituating to hazing techniques, the hazing program would be adaptively managed based on real-time monitoring of efficacy. Based on the trials completed, hazing activities would be concentrated along the islands' coastline and hazing tools would be used sporadically and only where needed. Consequently, only small areas of the South Farallon Islands should be affected at any one time. Based on the information and analysis in the FEIS, the gull hazing program will reduce impacts on all gull species to a less than significant level.

The gull hazing plan described in the FEIS was previously approved by the Service's Office of Migratory Birds. Recently, the Department of the Interior announced that the Service would undertake a new rulemaking process regarding the scope of the Migratory Bird Treaty Act. The Service will consult with the Office of Migratory Birds prior to implementing the Project to determine whether a permit will be needed and whether any additional protocols should be added to the *Mitigation and Monitoring Plan* and *Non-Target Contingency Plan* to further protect migratory birds.

Although the analysis in the FEIS and the results of the gull hazing trial indicate that the hazing program will be successful in reducing impacts to gulls below the level of significance, the *Draft Non-target Contingency Plan* (see Contingency Planning, below) includes triggers and potential responses to address the possibility of lower than expected hazing success or greater than expected disturbance to pinnipeds from hazing activities. Among the potential response actions included in the *Draft Non-target Contingency Plan* is the option of stopping the Project in order to ensure that gull mortality does not exceed the levels anticipated in the FEIS.

8.4.4 Carcass Removal

Carcasses of mice or other species exposed to rodenticide pose a threat to potential scavengers such as gulls or owls. Thus, carcass removal will be implemented to reduce this threat, following the best management practices established in USFWS (2013). Prior to Project implementation, personnel will take reasonable efforts to remove or mark all carcasses of species considered to be at moderate to high risk of rodenticide effects if exposed. The intent of such an effort is to allow for operations personnel to discern between mortality of non-target wildlife before and after eradication operations. Within one week of rodenticide bait being first applied, systematic searches of all accessible areas would be initiated to remove dead mice and any other carcasses suspected of potentially containing anticoagulant residues. These surveys would be continued until the primary exposure risk period has ended, estimated to be about five weeks from the last bait application. Carcasses also would be removed from monitored mainland beaches (see below).

Collection of non-target species carcasses will be continued until it is determined that the risk of rodenticide exposure has declined to a negligible stage. All discovered carcasses found during the operational window would be carefully identified, recorded, labeled, and stored for further analysis if found in suitable condition.

8.4.5 Manually Reducing Bait Availability

Removing or moving rodent bait so that it is inaccessible to gulls may be conducted to reduce their risk of exposure and the length of time that gull hazing is required in areas where bait is likely to persist for a longer period of time, such as on rocky substrates. Although this measure would be limited to accessible locations, it will be considered as an adaptive management strategy as a means of reducing risk to non-target species. Unless monitoring data shows the risk of remaining bait to non-target species is determined to be unacceptably high, moving or removing rodent bait would be initiated no sooner than 10 days after the final application of bait to ensure that all house mice have sufficient access to bait.

8.4.6 Raptor Capture, Captive Management, and Release

To minimize risk to individual birds, raptors present on the island will be captured just prior to and during the implementation period. These efforts would continue as long as the risk of exposure remains high (i.e., bait or carcasses remain available and palatable). The predominant raptors visiting the Farallones in fall, burrowing owls and peregrine falcons, would be the primary targets of capture operations. Based on available data, between two and 12 burrowing owls are typically found in accessible areas during the fall period, although actual numbers are likely greater. Between eight and 30 peregrine falcons are expected to visit the islands during the implementation period, although many of these will only visit briefly. Probably no more than single individuals of a few other raptor species would be expected to occur during operations.

Migrant species including burrowing owls would be transported off the island and released into suitable habitat on the mainland. Species with high likelihood of returning to the islands if released, such as peregrine falcons, would be transported to a captive facility off-island until it is determined safe to return them to the wild. Methods involving capture and translocation or temporary captivity will be done in accordance with the terms of a Special Purpose Miscellaneous Permit issued by the Service's Regional Migratory Bird Permit Office.

Capture techniques have been utilized effectively for island rodent eradications elsewhere. For example, on Anacapa Island, Howald et al. (2009) reported approximately 68% of the known raptors (37 birds, including eight peregrine falcons *Falco peregrinus*, nine red-tailed hawks *Buteo jamaicensis*, four barn owls *Tyto alba* and six burrowing owls) were captured prior to rodenticide applications. Most were released on the mainland but peregrine falcons were held and released back onto Anacapa three weeks after rodenticide applications. Some raptors not captured, including a burrowing owl, survived the rodenticide applications. On Palmyra Atoll, 13 of about 80 (16% of known birds present) bristle-thighed curlews (*Numenius tahitiensis*) and one Pacific golden plover (*Pluvialis fulva*) were live-captured prior to rodenticide applications; all survived captive holding and were released after the risk of exposure ceased. On Pinzon Island in the Galapagos Archipelago, 60 captured Galápagos hawks (*Buteo galapagoensis*) were held successfully in captivity and released 12-14 days after the last bait application on a rat eradication project. When it was found that hawks continued to receive secondary exposure to rodenticide, 10 hawks were recaptured and held successfully for three more years. Within three months of release, hawks were breeding (Rueda et al 2019).

8.4.7 Salamander Capture, Captive Management, and Release

Although the toxicant risk to endemic arboreal salamanders is anticipated to be low, out of an abundance of caution, the Service will capture approximately 40 individual salamanders and hold them in captivity until risk has declined to a point to be considered negligible (see FEIS Section 4.5.6.1.3). In addition, the Draft *Non-Target Contingency Plan* (see Contingency Planning, below) includes triggers and potential response actions to address unanticipated effects on salamanders including capturing additional salamanders or increasing hold times to ensure that impacts to salamanders remain less-than-significant and do not affect the population.

8.4.8 Reducing Disturbance

Ground, air and hazing operations would cause short-term, less than significant disturbance impacts to wildlife, such as flushing in the case of bird species. Timing the eradication in the fall is ideal since the operation would be implemented outside of the breeding season for seabirds and pinnipeds, thereby minimizing the consequences of disturbance to wildlife. Most bird species present on the islands during that period would number in the tens or less. Only a relatively small number of bird species are expected to visit the islands in substantial numbers during the operational period including the western gull, California Gull, Cassin's auklet (*Ptychoramphus aleuticus*), common murre (*Uria aalge*), brown pelican (*Pelecanus occidentalis*), Brandt's cormorant (*Phalacrocorax penicillatus*), and possibly the glaucous-winged gull (see FEIS Section 4.5.6.1).

A few thousand pinnipeds would be present on any given day during the operational window. Specific procedures to minimize disturbance impacts to pinnipeds will be determined through consultation with the National Oceanic and Atmospheric Administration (NOAA) Fisheries and the Greater Farallones National Marine Sanctuary and included in an Incidental Harassment Authorization from NOAA Fisheries. Based on initial, informal consultations with these agencies, pinnipeds may be carefully flushed from the islands prior to aerial bait application to protect animals from falling bait and to prevent stampeding which could cause injuries. Gull hazing operations would minimize, to the extent practicable, hazing activities that monitoring (see below) shows causes more pinniped disturbance. In addition, the *Draft Non-target Contingency Plan* (see Contingency Planning, below) includes triggers and potential response actions to address unanticipated impacts to pinnipeds. Potential responses include ceasing hazing activities that cause undue disturbance, adjusting helicopter operations, and ceasing bait applications.

8.4.9 Treating non-target wildlife exposed to brodifacoum

Attempts will be made to capture birds or other wildlife that appear to be poisoned by brodifacoum exposure. Vitamin K1 is the only known antidote to reverse coagulopathy caused by brodifacoum and other anticoagulants (https://www.petpoisonhelpline.com/poison/long-acting-anticoagulants-mouse-and-rat-poison/). A certified veterinarian or wildlife rehabilitation professional will be part of the operational team for immediate administering of Vitamin K1 antidote and initial care for affected wildlife. After initial treatment on the island, wildlife patients would be transferred to a mainland facility for longer-term care. For birds found on the mainland that appear to be poisoned by brodifacoum, information will be provided for beached bird monitoring personnel and members of the public on what they should do.

8.5 Monitoring

As described in Section 2.10.10 of the FEIS, the Service will undertake an extensive monitoring program to track and document operational, mitigation, and ecosystem restoration objectives before, during and after the proposed mouse eradication project. Additional details about the Project's comprehensive monitoring program are described the *Draft Mitigation and Monitoring Plan* (Appendix 4) which has been prepared at the Commission's request. If the Service's Record of Decision chooses the Preferred Alternative (Alternative B), this draft plan will be updated to incorporate input from the implementation team (not yet selected) and from consultations with USDA/APHIS/WS, EPA (especially with regard to a supplemental label), other relevant regulatory agencies, and other experts. The plan would be finalized prior to project implementation. If requested, we would also welcome review by Commission staff on the draft final plan to confirm that the Project has not changed since Commission approval.

Monitoring would be conducted in accordance with guidance on mitigation monitoring from the Council for Environmental Quality protocols associated with recent successful rodent eradication monitoring plans, such as those for Palmyra Atoll (Pitt et al. 2015), Desecheo Island (Shiels et al. 2017), and Lehua Island (Siers 2018, Siers et al. 2018); and best management practices recommended by the Service following the Rat Island rat eradication project (USFWS 2013).

8.5.1 Operational Monitoring

Operational monitoring, meaning monitoring related to the Project's goal of eradicating all mice, would encompass tracking a range of parameters necessary to ensure the complete eradication of all house mice from the South Farallon Islands. These efforts include checking bait quality, ensuring the application rate is appropriate, ensuring that there is sufficient bait coverage to expose every mouse on the Farallones, ensuring that bait is available for a sufficient amount of time, and monitoring bait breakdown over time. Information gained from operational monitoring would be used to adaptively manage latter stages of implementation within the constraints of the Project, such as the interval between bait applications.

The *Draft Mitigation and Monitoring Plan* also addresses monitoring measures to determine the presence or absence of mice. These measures would begin following bait application and continue for about two breeding seasons or up to two years after the operation. If mice are not detected during that time, the eradication will be considered a success. A range of rodent detection devices such as traps, tracking tunnels and chew blocks would be deployed to detect any surviving mice. If small numbers of mice are detected, response measures may be implemented following instructions provided on the product label (provided in Appendix C). Bait broadcast under these circumstances would be localized, and focused on areas where mice continue to be found). These measures would only be employed to target a small number of mice that, if not removed, could jeopardize the success of the eradication. How long to continue baiting if mouse detections continued would be determined based on the estimated numbers present, estimates of probability of success, and potential non-target impacts from continued baiting. Such measures were used at Palmyra Atoll and Lehua Island after small numbers of rats were detected soon after all individuals were expected to have been removed. Localized, targeted baiting resulted in a successful outcome at Palmyra (Island Conservation, unpubl. data). At Lehua, no rats have been observed since December 2018, although a declaration of eradication success has not yet been made (Island Conservation, unpubl. data).

8.5.2 Monitoring of Non-Target Species, Soil, and Water

Mitigation monitoring including island-wide surveys of certain wildlife species would be undertaken prior to, during, and immediately after the mouse eradication operation to determine the presence, location, and abundance of potential non-target species (such as gulls requiring hazing and other migratory bird species requiring capture and translocation) and gauge the effectiveness of mitigation techniques to reduce impacts to natural resources. Principles of adaptive management would be applied to subsequent mitigation activities and information gained from monitoring would guide how best to minimize risk to non-target species. During and immediately after the eradication, regular surveys and searches would be conducted for poisoned or incapacitated birds (such as gulls, raptors, and other bird species). Birds or other sickened wildlife that can be captured will be treated to reverse anticoagulation (see Mitigation section, above).

Regular assessments of marine mammal haul-outs would also be completed during implementation to gauge the level of disturbance from operational activity. Marine mammals would be monitored to gauge responses to helicopter operations, bait station installation and maintenance, and other Project tasks to ensure compliance with the Marine Mammal Incidental Harassment Authorization (issued under the Marine Mammal Protection Act).

In addition to on-island carcass searches, the *Draft Mitigation and Monitoring Plan* calls for regular, standardized surveys of mainland Gulf of the Farallones beaches to search for dead birds that could have been exposed to rodenticide. Surveys would be conducted following standardized protocols of the Greater Farallones National Marine Sanctuary's Beach Watch program and would include collection of carcasses. Recorded mortality during the implementation period would be compared to long-term baseline values to determine if numbers of beached birds were significantly above average. If island and/or mainland monitoring indicates unanticipated mortality of any non-target species (including gulls) that could result in significant impacts following the first bait application, a management decision on whether to proceed with subsequent bait applications would be made (see *Non-target Contingency Plan*, below).

The *Draft Mitigation and Monitoring Plan* provides for the collection and processing of abiotic samples (soil and water) and biota, analysis of rodenticide residues, and monitoring of bait drift into the marine environment. These efforts will be conducted separately by a contractor or cooperator with demonstrated expertise and following consultation with collaborating and permitting agencies and others with appropriate expertise. The *Draft Mitigation and Monitoring Plan* will assist in tracking the environmental fate of rodenticide, characterizing the extent and period of exposure to non-target biota, determining when it is safe to release captured and held native wildlife (e.g., Farallon arboreal salamanders) back onto the islands, and evaluating the overall non-target impacts from the Project. Sampling would include both the terrestrial (e.g., soil, birds, salamanders, and invertebrates) and surrounding marine environment (water, intertidal and subtidal invertebrates and fish).

A report(s) summarizing the results on non-target monitoring will be made available to the public.

8.5.3 Monitoring of Ecosystem Restoration Objectives

The eradication of house mice is expected to significantly benefit the populations of many native species on the South Farallones, including ashy and Leach's storm-petrels, endemic Farallon arboreal salamanders, Farallon camel crickets, other island invertebrates, and native plants.

The *Draft Mitigation and Monitoring Plan* describes the types of ecosystem monitoring that would occur to track the long-term effects of the Project. Monitoring to establish baseline conditions has already begun as part of the biological monitoring that has been an integral part of managing the South Farallon Islands for nearly 50 years. As described in Section 2.10.10.4 of the FEIS, current monitoring efforts include ongoing daily, weekly, monthly and seasonal studies and counts of marine mammals, breeding seabirds, migrant birds, plants, bats, migrant butterflies and dragonflies, arboreal salamanders, and Farallon camel crickets. In addition, the Greater Farallones National Marine Sanctuary conducts periodic monitoring of intertidal algae and invertebrates (Roletto et al. 2014). As indicated in the *Draft Monitoring and Mitigation Plan*, monitoring to document the effects of the Project will continue for at least two years after the eradication of mice. The Service and its partners will make these data available and report periodically on the Project's outcomes with respect to ecosystem restoration objectives.

8.6 Incorporation of Lessons Learned from Other Projects

In planning the South Farallon Islands house mouse eradication Project, we have the benefit of information from hundreds of prior rodent eradication projects, including dozens of mouse eradication projects. As described in Sections 1.5 and 2.6.5 of the FEIS, lessons learned from these projects, both those that contributed to project success and those that arose from project failures, have been considered during Project planning. In developing the EIS, the Service reviewed and incorporated lessons learned from prior eradication projects to the maximum extent practicable and will continue to incorporate these and additional lessons learned that become available until the cessation of implementation activities.

In the FEIS, the Service highlighted lessons learned in three different chapters. Chapter 1 describes the Service's approach to addressing lessons learned from past projects, the overall lessons learned that were accounted for in this Project and outlined the Best Management Practices (BMPs) for rodent eradication projects developed by the Service (USFWS 2013). Chapter 2 incorporates lessons learned from projects that failed to eradicate the target species, a summary of the BMPs developed by the New Zealand Department of Conservation (DOC) for aerial mouse eradications, as well as the specific mitigation measures that have been incorporated into this FEIS to address potential impacts. Finally, Chapter 4 incorporates lessons learned from eradication projects where non-target impacts were greater than expected, as well as how the mitigation measures and contingency planning incorporated into this FEIS would minimize the negative impacts to those species most at risk from eradication operations.

8.7 Contingency Planning

To be prepared for the possibility of unexpected occurrences during Project implementation that could jeopardize Project success or that could cause unexpected impacts, the Preferred Alternative requires the developed contingency plans prior to Project implementation. In response to a request from the Commission, the Service accelerated the development of these plans. A *Draft Bait Spill Contingency Plan* and *Draft Non-target Contingency Plan* are presented in Appendixes 5 and 6. These draft plans outline the triggers, potential responses, and notification process should a serious and unexpected event occur during Project implementation. Specific protocols from these plans are discussed in many of the previous sections of this Consistency Determination.

If the Service's Record of Decision chooses the Preferred Alternative (Alternative B), the draft contingency plans will be updated to incorporate input from the implementation team (not yet selected) and from consultations with USDA/APHIS/WS, EPA, other relevant regulatory agencies, and other experts. The plans would be finalized prior to Project implementation. If requested, we would also welcome review by Commission staff on the draft final plans to confirm that the Project has not changed since Commission approval.

9 Environmental Consequences

9.1 Summary

The impacts to biological, physical, and cultural resources from the eradication of invasive mice from the Farallon Islands were evaluated in Chapter 4 of the FEIS. Resources were evaluated in relation to significance thresholds which reflect the severity or long-term impact to a resource from the implementation of any alternative proposed for eradicating invasive house mice on the Farallon Islands National Wildlife Refuge (FEIS Section 4.2.3).[2] In the case of biological resources, species were grouped by type, feeding habits, behavior, and exposure pathways to determine both negative and positive impacts expected from the successful eradication of invasive house mice from the Farallon Islands. Section 4.5.6.1 of the FEIS provides a detailed analysis of the toxicological and disturbance risks to biological resources from the Project (Alternative B in the FEIS) and the associated mitigation measures that would be implemented to reduce or avoid impacts. For species with sufficient information (birds and pinnipeds), estimates of the numbers of individuals that may visit the islands through the entire operational period were provided. Table 4.4 of the FEIS (attached hereto as Table 4) presents the impact conclusions for biological resources in summary form and Table 5 highlights differences in outcomes between no action (mice permitted to remain) and the preferred action alternative (mice removed) to species expected to benefit from mouse eradication.

The FEIS concludes that although there would be adverse impacts (including mortality) to certain non-target species such as gulls, there would be no long-term significant adverse impacts to any resources, in part because there would be no adverse population-level effects to any non-target species. These less-than-significant impacts are the result of careful Project design and a comprehensive suite of mitigation measures (e.g., gull hazing, capture and release protocols). The FEIS's conclusions regarding impacts to western gulls, the species most at risk from non-target effects due to their prevalence on the island and feeding habits, are supported by a detailed discussion in Section 4.5.4.4 of the results of the gull population viability analysis and the gull risk assessment studies conducted for the EIS.

The FEIS also concludes that several sensitive species would experience long-term, population-level benefits from the Project. These species include two seabird species, the ashy and Leach's storm-petrels, the endemic Farallon arboreal salamanders, the endemic Farallon camel cricket, other native terrestrial invertebrates, and native plants including the endemic maritime goldfield, Sticky sand-spurrey (*Spergularia macrotheca*), salt marsh sand spurrey (*S. salina*), and miner's lettuce (*Claytonia perfoliata*) (Table 4). These benefits are described in Sections 1.3 and 4.5.6.1 of the FEIS and summarized here. The discussion below also summarizes potential risks of the Project to non-target species, focusing on species of most concern.

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[2] For significance thresholds:

- Long-term is considered to be five or more years, unless otherwise indicated.
- Significance determinations reflect the expected impact from the alternative being assessed.
- Impacts may be beneficial or adverse.
- Significance levels are classified as negligible, not significant, or significant:
    - **Negligible** – no measurable impacts are anticipated.
    - **Not Significant** – short-term impacts are anticipated, but no long-term impacts are anticipated.
    - **Significant** – long-term impacts are anticipated.

Table 4. Impacts of Alternative B on biological resources.

Species	Significance determination	Duration of ToxicantRisk[1]	Toxicant Sensitivity[2]	Toxicant exposure risk level[3]	Overall Toxicant Risk (Sensitivity+ Exposure)[4]	Disturbance Sensitivity[5]	Duration of Disturbance risk[6]	Scale of Negative Impact[7]	
								toxicant	disturbance
Raptors[8,9]	Not Significant	Long	High	High	High	Low/Med	Short/Med	Individ.	Individ.
Burrowing Owl[9]	Not Significant	Long	High	High	High	Low/ High	Short/ Medium	Individ.	Individ.
Western Gull	Not Significant	Long	High	High	High	High	Medium	Regional	Regional
Other Gulls[10]	Not Significant	Long	High	High	High	High	Medium	Individ.	Individ.
Ashy and Leach's Storm-petrel	Significant positive effect	Short	High	Low	Low	Low	Short	Regional	Regional
Cassin's Auklet	Not Significant	Short	High	Low	Low	Low	Short	Regional	Regional
Common Murre	Not Significant	Short	High	Low	Low	Medium	Medium	Regional	Regional
Brown Pelican and Cormorants	Not Significant	Short	High	Low	Low	High	Medium	Regional	Regional
Cackling Goose, Green-Winged Teal	Not Significant	Long	High	High	High	Medium	Medium	Individ.	Individ.
Brant	Not Significant	Long	High	High	Medium	Low	Medium	Individ.	Individ.
Rocky Intertidal Shorebirds[11]	Not Significant	Medium	High	Low	Medium	Medium	Medium	Individ.	Individ.
Black Oystercatcher	Not Significant	Medium	High	Low	Medium	High	Medium	Individ.	Individ.
Other Shorebirds[12]	Not Significant	Medium	High	Medium	High	Medium	Medium	Individ.	Individ.
Passerine Omnivores[13]	Not Significant	Long	High	Medium	Medium	Medium	Medium	Individ.	Individ.
Passerine Insectivores[14]	Not Significant	Long	High	Medium	Medium	Medium	Medium	Individ.	Individ.
Passerine Granivores[15]	Not Significant	Long	High	High	High	Medium	Medium	Individ.	Individ.
Anna's Hummingbird	Not Significant	Long	High	Medium	Medium	Medium	Medium	Individ.	Individ.

Northern Elephant Seal	Not Significant	Medium	High	Low	Low	High	Medium	Regional	Regional
Harbor Seal	Not Significant	Medium	High	Low	Low	High	Medium	Regional	Regional
Other Pinnipeds[16]	Not Significant	Medium	High	Low	Low	High	Medium	Regional	Regional
Marine Fish	Not Significant	Short	High	High	Medium	Low	Short	Individ.	Individ.
Salamanders	Significant positive effect	Long	Low	Medium	Medium	Low	Short	World	World
Terrestrial Invertebrates	Significant positive effect	Long	Medium	Low	Medium	Low	Short	Regional	Regional
Other Intertidal Invertebrates	Negligible	Medium	Low	Low	Low	Negligible	Negligible	Individ.	Individ.
Black Abalone	Not Significant	Short	Medium	Low	Low	Negligible	Negligible	Individ.	Individ.
Other Intertidal Gastropods	Not Significant	Short	Medium	Low	Low	Negligible	Negligible	Individ.	Individ.
Camel Cricket	Significant positive effect	Long	Medium	Low	Low	Low	Short	World	World
Vegetation	Significant positive effect	None	None	None	None	Low	Medium	None	Individ.

[1] None: No duration of risk; Short: potential exposure risk for up to 30 days; Medium: potential exposure risk for 31-90 days; Long: potential exposure risk for more than 90 days.
[2] None: No toxicological sensitivity; Low: Minor toxicological sensitivity; Medium: Moderate toxicological sensitivity; High: High toxicological sensitivity.
[3] None: No exposure pathway; Low: Possible exposure pathway; Medium: One exposure pathway; High: Multiple exposure pathways.
[4] None: Negligible risk from toxicant; Low: Low risk from toxicant; Medium: Medium risk from toxicant; High: High risk from toxicant.
[5] None: Negligible sensitivity to disturbance; Low: Low sensitivity to disturbance; Medium: Moderate sensitivity to disturbance; High: High sensitivity to disturbance. For cells containing two values separated by a slash (e.g., Low/High), the upper value is for to non-captured birds lower value is for captured birds.
[6] Short: Potential disturbance risk for 1 – 30 days; Medium: Potential disturbance risk for 30 – 90 days; Long: Potential disturbance risk for more than 90 days.
[7] Individual (Individ.): Few individuals potentially affected; Island population (Island): Many individuals may be affected with potential impacts to the island population; regional population (Regional): Many individuals may be affected with potential impacts to the regional population; Species/Subspecies: Many individuals may be affected with potential impacts to the species or subspecies.
[8] Northern harrier, sharp-shinned hawk, , American kestrel, merlin, peregrine falcon, long-eared owl, short-eared owl, barn owl, .
[9] For Disturbance Sensitivity and Duration of Disturbance Risk, two outcomes are listed: First – individuals remaining on island / Second – individuals captured and held in captivity.
[10] Ring-billed gull, California gull, glaucous-winged gull, mew gull, herring gull, Heermann's gull, Thayer's gull.
[11] Wandering tattler, willet, least sandpiper, black turnstone, ruddy turnstone, surfbird.
[12] Whimbrel, black-bellied plover, Wilson's snipe, killdeer.
[13] Hermit thrush, American robin, varied thrush, cedar waxwing, European starling, American pipit, mountain bluebird.
[14] Yellow-rumped warbler, palm warbler, golden-crowned kinglet, ruby-crowned kinglet, Northern flicker, black phoebe, Say's phoebe, brown creeper, rock wren, Nashville warbler, Townsend's warbler.
[15] Horned lark, fox sparrow, savannah sparrow, white-throated sparrow, white-crowned sparrow, golden-crowned sparrow, dark-eyed junco, red-winged blackbird, western meadowlark, Brewer's blackbird, purple finch, pine siskin, lesser goldfinch, horned lark, Lapland longspur, house finch.

[16] Stellar sea lions, California sea lions, northern fur seal, Steller sea lion.

Table 5. Comparison between the No Action (Alternative A) and Preferred Alternatives (Alternative B) of benefits and adverse (or potentially adverse) impacts to natural resources most likely to benefit from house mouse eradication at the South Farallon Islands.

Species	No Action Alternative Adverse Impacts	Preferred Alternative Benefits	Preferred Alternative Potential Adverse Impacts
Ashy storm-petrel (California Bird Species of Special Concern, USFWS Bird of Conservation Concern, IUCN Endangered)	Indirect impacts of mice continue, estimated 63% decline over 20 years	Little or no indirect impacts of mice, 2% population increase over 20 years	None expected. Few present during operational period and this species feeds only on marine prey at sea.
Leach's storm-petrel	Indirect impacts of mice continue, population adversely impacted	Little or no indirect impacts of mice, population stabilizes or increases	None expected. Species will not be present during operational period.
Farallon arboreal salamander (Endemic Species)	Mouse predation and competition for food, population adversely impacted	No mouse predation, no competition for food, population increases	Some risk from rodenticide exposure, mainly from feeding on exposed invertebrates, but expected to be limited to small numbers of individuals. Precautionary capture/hold program reduces risk of unexpected adverse impacts.
Farallon camel cricket (Endemic Species)	Direct and indirect mouse impacts from predation; population adversely impacted	No direct mouse predation impacts, little or indirect predation impacts, population increases	Little risk from rodenticide exposure because insects aren't affected by anticoagulants
Other insects and spiders	Direct and indirect mouse impacts from predation; population adversely impacted	No direct mouse predation impacts, little or indirect predation impacts, population increases	Little risk from rodenticide exposure because insects aren't affected by anticoagulants
Native plants (endemic maritime goldfield, spurreys, miner's lettuce)	Mouse predation on plants and seeds; populations adversely impacted	No mouse predation on plants and seeds, populations increase	None

9.2 Sensitive Species

9.2.1 Ashy and Leach's storm-petrels

By eradicating invasive house mice from the islands, beneficial, long-term population level effects are anticipated for the ashy and Leach's storm-petrels because these species are preyed upon by the unnatural abundance of burrowing owls on the islands supported by the mouse population. The ashy storm-petrel is one of the rarest seabirds in the North Pacific and listed as a Service Bird of Conservation Concern, a California Bird Species of Special Concern, and endangered (or, red listed) by the International Union for the Conservation of Nature (IUCN). The Service's Regional Seabird Conservation Plan for the Pacific Region identified the ashy storm-petrel as "highly imperiled" (USFWS 2005). The ashy storm-petrel is endemic to the region, with a limited breeding range that extends from Mendocino County, California, to northern Baja California, Mexico (Carter et al. 2008).The most important breeding colony in the world, comprising of about 50% of the total population, of this species occurs on the South Farallon Islands. To help ashy storm-petrels recover from human impacts including habitat loss, DDE contamination, and Farallon house mouse impacts, eradication of house mice from the Farallon Islands was identified as a priority in the California Bird Species of Special Concern species assessment (Carter et al. 2008), the Service's Regional Seabird Conservation Plan (USFWS 2005), the Farallon National Wildlife Refuge Comprehensive Conservation Plan (USFWS 2009), and the Ashy Storm-Petrel Conservation Action Plan (Parker 2016).

In a detailed study, Chandler et al. (2016) found that mice and storm-petrels made up 98 percent of Farallon burrowing owl diet by weight, with mostly mice in the fall and early winter and mostly storm-petrels in the late winter and spring. In another study, Bradley et al. (2011) estimated that between 2003 and 2011, a minimum of 90-108 storm-petrels were depredated by burrowing owls per year. However, this is likely a gross underestimate of actual numbers of storm-petrels killed because it only included carcasses actually found and parts of the island regularly accessed, which only amounts to perhaps 30% of the island area. Actual numbers are likely much higher.

In yet another study that was updated since publication of the FEIS, Nur et al. (2019) examined the impacts of mice (and owls) on the Farallon ashy storm-petrel population. They found that owl predation (an indirect impact of mice) caused a reduction in annual adult survival of ashy storm-petrels. During periods with high numbers of wintering owls and high owl predation rates, the ashy storm-petrel population declines. By modelling future population trajectories based on differing levels of owl predation, the authors showed that by reducing owl predation by just 50%, the Farallon ashy storm-petrel population will benefit. For example, with no reduction in owl numbers, ashy storm-petrels are expected to decline 63% in 20 years. With just a 50% reduction in owl numbers, the expected decline is reduced to 26%, while a reduction in owl numbers by 80% would result in a 2% increase in storm-petrel numbers over 20 years (Figure 5). While there is some uncertainty in these models, they clearly demonstrate the benefits of reducing, or eliminating, owl predation on the ashy storm-petrel population. For more information on this topic, see FEIS Section 1.3.1.

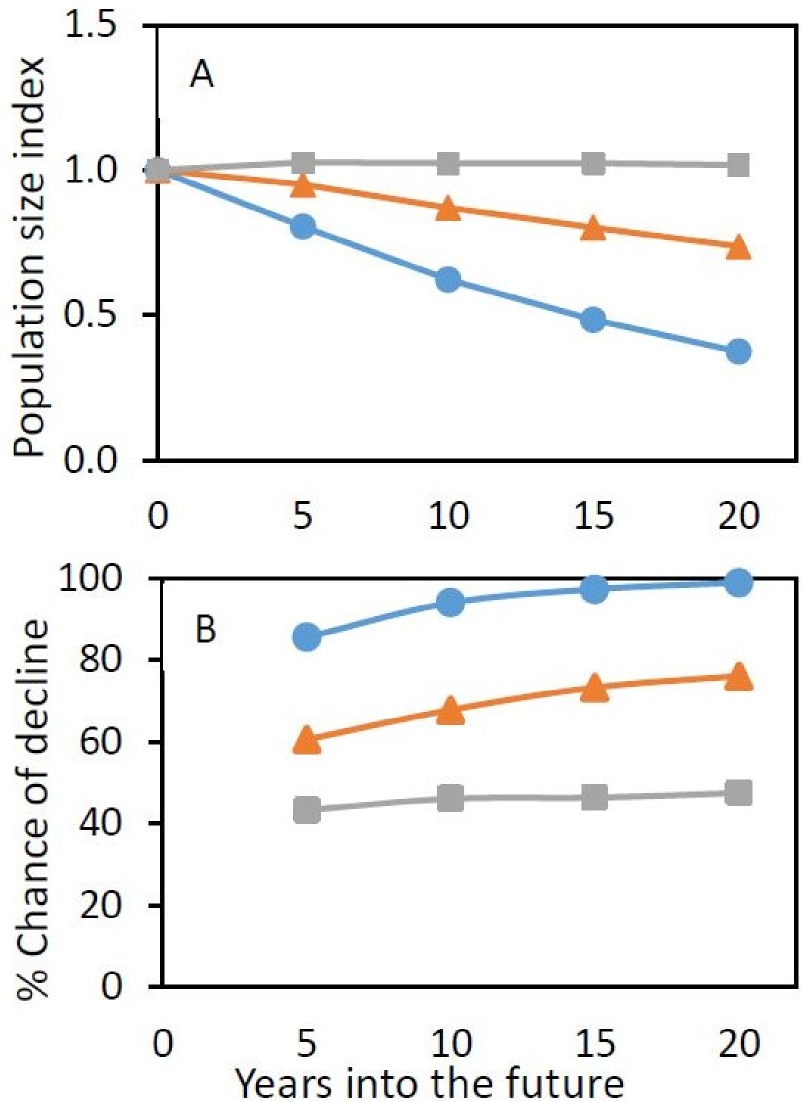

Figure 5. Ashy storm-petrel population projections and probability of decline at the South Farallon Islands. (A) Farallon ashy storm-petrel population projections under the three levels of reduction in burrowing owl abundance: 0% (blue circles), 50% (orange triangles), and 80% reduction (gray squares). Median results are shown (10,000 simulations each). Depicted are relative population sizes for a 20-yr period; the population size index has been set to 1.0 for Year 0. Year 0 corresponds to the first breeding season following burrowing owl reduction. (B) Probability of population decline for the Farallon ashy storm-petrel population under three levels of reduction in burrowing owl abundance: 0% (blue circles), 50% (orange triangles), and 80% (gray squares). Depicted is the probability of a net decline, shown as percent, at the end of 5, 10, 15, and 20 yr. (From Nur et al. 2019).

The Leach's storm-petrel is a relatively widespread species in both the North Pacific and North Atlantic Oceans. The colony on the South Farallon Islands was estimated at about 1,400 breeding birds in the early 1970s (Ainley and Lewis 1974). Like the ashy storm-petrel, these secretive, nocturnal, crevice-nesting seabirds are difficult to study, and no detailed population assessments have been conducted in recent years. However, regular mist-net capture surveys for storm-petrels have shown that captures of Leach's storm-petrels have declined dramatically since the mid-1970s, to the point where very few birds are captured each year (Point Blue Conservation Science, unpublished data). This strongly suggests a major decline in the Farallon Leach's storm-petrel population, with numbers now perhaps in the tens to hundreds of breeding birds. Because of their similar size and habits, threats to Farallon-breeding Leach's storm-petrels are likely very similar to those of the ashy storm-petrel. Thus, it is assumed that the relative impacts of mice on ashy storm-petrels is similar to that of the Leach's storm-petrels, but because of the Leach's storm-petrel scarcity, direct documentation of those impacts is lacking.

9.2.2 Western Gull

As summarized in FEIS Section 4.5.4.4.1, the Farallones host a large breeding colony of Western Gulls. During the fall period when this Project would be conducted, gull numbers on the islands vary day-to-day between about 1,800 to 14,000 individuals. During this time of year, most gull attendance is between late afternoon and early morning, and in intertidal roosts. Because they are opportunistic omnivores, gulls will be prone to foraging both on rodenticide bait and carcasses of mice and other species that have consumed bait. With a high sensitivity to rodenticides, this makes gulls the most at risk species to non-target impacts of the Project (Table 4).

A population viability analysis conducted for the FEIS and summarized in Section 4.5.4.4.1.3, estimated that up to 1,700 western gulls could be removed in a single event from the Farallon population without a long-term (defined as 20 years) population impact. That estimate was more recently revised to 1,050 western gulls (Nur et al. 2019). To keep gull numbers below the level where the population would sustain population-level impacts, an aggressive mitigation plan involving hazing gulls to keep them away from the islands and from rodenticide exposure has been developed (see the Mitigation section, below). These mitigation measures are expected to keep gull mortality well below the level that would incur a significant population level impact. Because gulls frequently move between the islands and mainland, the plan also includes measures to minimize the risk of exposed gulls bringing toxicant to the mainland. Based on these mitigation measures, the FEIS determined that no significant impacts to western gulls and other gull species would occur from the Project (Section 4.5.6.1.1.7)

9.2.3 Other Seabirds

As described in the Introduction, above, the South Farallon Islands host a colony of nearly 350,000 breeding seabirds of 12 species (including one shorebird, the black oystercatcher *Haematopus bachmani*). House mice are well known to prey on seabird eggs, chicks, and adults. Section 1.2.1.3 and FEIS Section 1.2.2.1 provide several examples of the impacts of invasive house mice on breeding seabirds. For example, on Gough Island in the southern Atlantic Ocean, introduced house mice prey on chicks of the rare Tristan albatross (*Diomedea dabbenena*), Atlantic petrel (*Pterodroma incerta*), and probably several other petrel species (Cuthbert and Hilton 2004, Wanless et al. 2007, Cuthbert et al. 2013). High chick predation by mice is contributing to very low breeding success for the albatross and Atlantic petrel, raising the possibility of extinction of these species (Cuthbert and Hilton 2004, Wanless et al. 2007, Cuthbert et al. 2013). As a result, a mouse eradication project is planned for Gough Island (R. Hall, pers. comm.). On Midway Atoll in the subtropical North Pacific, invasive house mice only recently began a disturbing behavior of attacking and killing the chicks of Laysan (*Phoebastria immutabilis*) and black-footed (P. *nigripes*) albatrosses, leading to mouse control efforts to protect the albatrosses (USFWS 2018; B. Flint, USFWS, pers. comm.).

Studies have detected seabirds in the diets of Farallon house mice, mostly during the summer breeding season (Jones and Golightly 2006, Polito et al. 2021). Little evidence of direct impacts from mice on Farallon seabirds has been obtained from several decades of monitoring, however, there is concern that if a shift in the seasonal mouse population cycle (such as by climate change) was to result in higher abundances of mice during the spring-summer seabird breeding season, mice would begin preying more extensively on seabirds.

Potential negative impacts to breeding seabirds from the Project are low for a number of reasons. Operations will be conducted outside the breeding season and populations on the island will be at annual lows. Because most of the Farallon seabirds (except gulls) feed only on marine prey at sea, their risk of toxicant exposure to birds that will be present is low (Table 4). Thus, aside from some disturbance from operations, none of the other seabird species are expected to suffer any adverse impacts from the Project (FEIS Section 4.5.6.1.1.7).

9.2.4 Shorebirds and Landbirds

The South Farallon Islands are well known for the large diversity of migratory bird species that have been recorded there (FEIS Section 3.4.2). Besides the breeding seabirds, most birds that occur on the Farallones arrive as migrants, remaining for only a short duration before continuing on their migration. A shorebird, the black oystercatcher, is resident with a population of about 20 breeding pairs. Small populations of a few other species of migratory rocky intertidal shorebirds remain to overwinter, such as the black turnstone (*Arenaria melanocephala*), willet (*Tringa semipalmata*), and whimbrels (*Numenius phaeopus*). Because these shorebirds feed primarily on invertebrates in intertidal habitats, their overall risk from the Project is low (Table 4).

Of the many species and individuals of landbirds that stop at the islands during migration, only a small number remain for extended periods or overwinter. Granivorous species that feed on seeds and other vegetative matter, such as sparrows and finches, will be expected to consume bait and thus will be at high risk of toxicant exposure. Insectivorous species, such as flycatchers and warblers, are at risk of secondary poisoning by feeding on insects that fed on bait. Raptors (hawks, falcons, and owls), also are at higher risk of secondary toxicant exposure by feeding on poisoned mice, birds or insects that had consumed bait. Most raptors that stop at the islands only do so briefly. But numbers of burrowing owls, encouraged by the large population of mouse prey, remain through the winter (for more detail, see Introduction and Ashy and Leach's storm-petrels sections, above). Several peregrine falcons also winter at the islands, feeding largely on seabirds.

Because populations of these species on the islands are so low, adverse impacts from rodenticide exposure would be to small numbers of individuals, and no population-level impacts are expected. However, because of their greater exposure risk, the Project mitigation plan includes capture of raptors present on the islands just prior to and during the operational period to minimize the risk of harm to these species (see Mitigation, below).

9.2.5 Farallon Arboreal Salamander

The Farallon arboreal salamander is an endemic subspecies found only on the South Farallon Islands. As summarized in FEIS Section 1.2.2.2, available information on mouse diet shows that mice both prey on salamanders and compete with salamanders for the same insect prey. Preliminary analyses from a study using stable isotopes to assess diets shows considerable overlap in mouse and salamander diets, particularly in the fall when mice are most abundant and other food sources become more limited (Polito et al. 2021). Given the omnivorous diet of the mice, it is also suspected that mice prey on the salamanders or their eggs. Stable isotopes analyses of mouse diet suggest that salamanders may constitute a fairly large proportion (as much as 22 percent in the fall) of mouse diet, although similarities in isotopic signatures confounded separating insects from salamanders in these analyses (Polito et al. 2021). Regardless, the endemic salamander is expected to experience a long-term and significant beneficial population increase because of removal of mouse predation and reduced competition for food.

As a potential non-target species of the eradication operation, salamanders were determined to be at low risk of toxicant sensitivity and medium risk to toxicant exposure (Table 4). Because their circulatory systems are different than mammals and birds, salamanders and other amphibians are not believed to be highly sensitive to anticoagulant rodenticides (FEIS Section 4.5.4.3.2). A lab exposure study commissioned by the Service for the Project supported this assessment (FEIS Section 2.8.12). Even though salamanders are at low risk from the Project, the FEIS proposes to capture and hold up to 40 salamanders until risk of toxicant exposure is negligible (Section 4.5.6.1.3). While some non-captured individual salamanders will likely be exposed to toxicant during Project operations from consuming insects that have fed on rodenticide bait, impacts to a small numbers of individuals will not result in any population level effects. Additional discussion of mitigation measures is provided in the Mitigation section of Section 8. Project Description, above.

9.2.6 Farallon Camel Cricket and Other Invertebrates

Significant beneficial, long-term population level effects are also anticipated for the endemic Farallon camel cricket and other invertebrate species. (Section 4.5.6.1.5) The cricket occurs only on the South Farallon Islands, mainly in a small number of caves. As also summarized in FEIS Section 1.2.2.3, invertebrates comprise a large proportion of Farallon mouse diet. Jones and Golightly (2006) reported that invertebrates are prevalent in mouse diet throughout the year. Many were unidentifiable to species, but those that could be identified included arachnids, Coleopteran beetles, and Coleopteran beetle larvae. Another study of Farallon mouse diet using stable isotopes also found that insects are important in mouse diet, with a possible peak in the fall when mice are most abundant (Polito et al. 2021). An attempt at identifying individual insect species, such as Farallon camel crickets, using stable isotopes was unsuccessful (Polito et al. 2021). However, given the high prevalence of insects in mouse diet, it can be assumed that mice that occur in camel cricket habitat (e.g., caves) likely feed extensively on the crickets.

In an indirect impact of house mice, burrowing owls also prey on large numbers of insects, mainly beetles (Coleoptera) and Farallon camel crickets. In a study of Farallon burrowing owl diet, Chandler et al. (2016) reported that Farallon camel crickets and beetles comprised 28.1 percent and 32.3 percent of items found. Thus, the rare crickets are preyed upon by both the mice and by burrowing owls, which are present on the islands in unnaturally high numbers because of the mice. The combined mouse and owl predation is likely suppressing numbers of the rare cricket and other invertebrates. Reductions in invertebrate populations may have other ecosystem impacts since many invertebrates are important pollinators of plants, help to decompose dead plant and animal matter, and provide food sources for migratory birds stopping to refuel at the islands. By removing both direct and indirect impacts of house mice, populations of Farallon camel crickets and other native insects are expected to increase.

On other islands worldwide, invasive rodents, including mice, are known to have dramatic, negative impacts on island native invertebrates (Rowe-Rowe et al. 1989, Cole et al. 2000, Angel et al. 2009, St. Clair 2011). Impacts to invertebrate populations from invasive rodents have led to extinctions but population suppression is more common (Angel et al. 2009, St. Clair 2011). Negative impacts to large arthropods, especially Coleoptera (beetles) and Orthoptera (crickets, grasshoppers, weta, and locusts), by rodents have been reported the most (reviewed in St. Clair 2011). On Marion Island, house mice affect populations of a number of endemic invertebrates, especially the Marion flightless moth (*Pringleophaga marioni*), the single most important decomposer on the island (Angel et al. 2009). Mice are also believed to be responsible for the extirpations of several invertebrate species on the Antipodes Islands, and species of flightless Lepidoptera (moths and butterflies) are impacted by mice on the Antipodes and Gough islands (Angel et al. 2009). Shortly after mice were eradicated from Antipodes Island, a greater abundance of moths and the endemic fly (*Xenocalliphora antipodea*) were noted, indicating rapid recovery of native insects there (Horn et al. 2017). Following mouse eradication from Mana Island, New Zealand, the endemic giant cricket (*Deinacrida rugosa*) population increased, suggesting its population was suppressed by mice (Newman 1994). An experimental removal of mice at Maungatautari, New Zealand, suggested that mice suppressed abundance and size of beetles, spiders, earthworms, and weta (Watts et al. 2017, in Broome et al. 2019). Direct impacts on arthropods in turn have the potential to cause other impacts within an ecosystem, as arthropods are often crucial in the pollination and recruitment strategies used by plants, the decomposition of dead plant and animal matter, and as a food source for other native species (Seastedt and Crossley 1984, Angel et al. 2009, St. Clair 2011).

Because of their open circulatory systems, insects and other invertebrates are not sensitive to anticoagulant rodenticides (FEIS Section 4.5.4.3.4) and thus are at low to negligible risk from the Project. However, because of their endemic status, mitigation measures to protect Farallon camel crickets from exposure have been developed and are summarized in the Mitigation section, below.

9.2.7 Native Plants

Native plants, including the endemic maritime goldfield, are expected to significantly benefit from removal of mouse predation on plants and seeds by increasing in population size, density and distribution. As also described in FEIS Section 1.2.2.4, plants and plant seeds make of a large component of Farallon mouse diet. Jones and Golightly (2006) reported that at least 70% of mouse stomachs contained plant material. Species identified included both native (*Lasthenia maritima*, *Spergularia* spp., and *Claytonia perfoliata*) and non-native (*Hordeum murinum*, *Urtica urens*, *Coronopus didymus, Sonchus* spp., and *Stellaria media*) species. The native *L. maritima* and *C. perfoliata* and non-native *H. murinum* were the most numerous plants identified. More recent mouse diet analyses using stable isotopes (Polito and Bradley 2014; M. Polito, unpublished data) confirm that plants form a large proportion of mouse diet, especially in spring. The large numbers of native seeds consumed by mice likely reduces native plant abundance and may also give more hardy invasive plants (mostly perennials and aggressive European grasses) a competitive edge. Indirectly, mice may impact native plants by reducing populations of important pollinators.

Elsewhere, mouse impacts on island plants has not been well studied, but it is known that mice feed on a variety of native plants and seeds. At sub-Antarctic Marion Island, mouse predation on the seeds and young shoots of the native sedge *Uncinia compacta* has led to the near extirpation of that species. Similar impacts may be occurring to the herbaceous *Acaena magellanica*. At Marion Island, the importance of plant material in mouse diet increased over three decades, possibly because of decreased alternate prey (e.g., invertebrates; reviewed in Angel et al. 2009).

Plants are not affected by rodenticides and thus are at negligible risk from the Project (FEIS Section 4.5.6.1.6).

9.3 Marine Mammals

The South Farallon Islands host rookeries of five species of pinnipeds, including the California sea lion (*Zalophus californianus*), Steller sea lion (*Eumatopius jubatus*), northern fur seal (*Callorhinus ursinus*), northern elephant seal (*Mirounga angustirostris*), and Pacific harbor seal (*Phoca vitulina*) (see FEIS Section 3.5.4. for more information). The bait product proposed for use in the Project contains a very low dose of Brodifacoum-25D. Risk from toxicant exposure to large mammals like pinnipeds is therefore very low because it is highly unlikely that any individual pinnipeds would consume enough toxicant to experience adverse effects. For example, a 660 lb (300 kg) animal may need to consume approximately 5,000 pellets, or 11 lbs (5 kg; assuming 1 g per pellet at 25 ppm) of Brodifacoum-25D bait in order to reach a lethal dose, assuming the animal has a sensitivity similar to the Norway rat (FEIS Section 4.5.4.3.1). Because pinnipeds are so large (hundreds to thousands of pounds) and they feed exclusively at sea on marine fish and invertebrates, no individuals would be expected to be impacted from rodenticide exposure (Table 4; FEIS Section 4.5.6.1.2.1).

Most species of pinnipeds are sensitive to human disturbances, especially on land. Typical reactions of close approach by humans, boats, or helicopters, or from loud noises, include raising the head in alarm, moving a short distance away from the threat, or flushing into the water. Pinnipeds hauling out on the islands will be impacted by disturbances caused by Project operations, including helicopter and hand bait application, gull hazing, and monitoring activities. An Incidental Harassment Authorization under the Marine Mammal Protection Act will be obtained from NOAA Fisheries prior to Project implementation. Mitigation measures will be employed to minimize disturbance impacts to pinnipeds (see Section 8. Project Description, above). Based on these measures, the Service determined that impacts to pinniped populations from the Project will be not significant (Table 4; FEIS Section 4.5.6.1.2.1).

Several species of cetaceans (whales, dolphins and porpoises) visit the waters off the Farallon Islands. Because of their large size (hundreds of pounds to many tons) and negligible risk of exposure to rodenticide from the Project, analysis of impacts to these species was not warranted under NEPA. (FEIS Section 4.3.2).

9.4 Marine Fish and Invertebrates

A summary of the intertidal and nearshore fish and invertebrate community around the South Farallon Islands was provided in FEIS Section 3.4.4.

Studies on impacts to fish from rodenticides have had varying results (summarized in FEIS Section 4.5.4.3.3). Most studies that found exposure to fish from toxicants used in rodent eradication projects were conducted for tropical atoll environments where bait application rates were much higher than planned for the Farallon Project. Tropical atoll eradication projects also involve complex shoreline habitats, such as large trees overhanging waters (Palmyra Atoll) and narrow strips of land bisecting lagoons (Wake Atoll) that resulted in greater than expected bait drift into marine environments. Although some dead or exposed fish were found in those projects, no population-level impacts occurred and brodifacoum residues declined to negligible or non-detectable levels within a few years (Siers et al. 2016, Wegmann et al. 2019). In projects more similar to the Farallones, such as Anacapa Island, California, no evidence of rodenticide exposure to marine fish or invertebrates was found (Howald et al. 2009).

The FEIS discloses that the Project's overall toxicant risk level to marine fish is considered medium and would occur only to a small number of individuals. As a result, there would be no significant population-level impacts to fish. (Table 4; FEIS Section 4.5.6.2.4). Nor would Essential Fish Habitat (EFH) around the islands be affected. A consultation with NOAA Fisheries on ESH (April 9, 2019) determined impacts from the Project to be negligible. Impacts of the Project to another species that visits and feeds in waters surrounding the islands, the white shark (*Carcharodon carcharias*), did not warrant analysis because of their very large size and negligible risk of exposure to rodenticide (FEIS Section 4.3.2).

Small numbers of individual marine invertebrates may be exposed to rodenticide residues because of incidental bait drift into the marine environment. Because most invertebrates are not sensitive to anticoagulant rodenticides (FEIS Section 4.5.4.3.4), impacts are expected to be negligible (Table 4; FEIS Section 4.5.6.1.5). The South Farallon Islands are listed as critical habitat for the endangered black abalone (*Haliotis cracherodii*), an intertidal gastropod. Only a few individual black abalone were found in the islands' intertidal zone either incidentally or during intertidal monitoring surveys conducted in the 1990s, and a focused survey in 2015 did not locate any (Roletto et al. 2015). Nor have any been found in more recent intertidal monitoring surveys (Roletto 2018, 2020) or incidentally from island staff. Most evidence indicates risk to gastropods, including abalone, is low (FEIS Section 4.5.4.3.4, Parent et al.

2019). However, because some terrestrial gastropods have been found to consume and test positive for rodenticide residues, toxicant exposure risk to this species and other marine gastropods is considered medium but no significant impacts are expected (Table 4) because of their insensitivity to the bait product, and additionally in the case of black abalone, their apparent absence from the Project area. The FEIS's impact assessment for black abalone was confirmed through the Section 7 Endangered Species Act consultation with NOAA Fisheries (April 9, 2019), which determined that impacts to black abalone and black abalone critical habitat from this Project will be negligible.

10 Consistency with Provisions of the California Coastal Act

10.1 Article 2: Public Access

Due to the fragility of the Farallon Islands' natural resources and very difficult access conditions, public recreation has been determined to be not compatible with the establishing purposes of the Refuge as a preserve for breeding birds. This determination was made in the 2009 Comprehensive Conservation Plan for the Refuge in accordance with the National Wildlife Refuge Administration Act of 1968, as amended by the National Wildlife Refuge System Improvement Act of 1997, 16 U.S.C. 668dd-668ee. Therefore, the Refuge is closed to public access. Limited facilities on Southeast Farallon Island (SEFI) support refuge operations and maintenance, and a research field station that supports the protection and stewardship of the islands' resources. Embarking onto SEFI is extremely challenging due to the lack of public docking facilities, harsh weather conditions and equipment reliability. Furthermore, nearly every part of the island is utilized for nesting or roosting by seabirds or pupping and hauling out by marine mammals. There are no public accommodations or recreational facilities on any of the islands.

Refuge wildlife and resources are best viewed and experienced by the public from charter boat tours that circumnavigate the islands. Because the Refuge is closed to public access, the proposed action imposes no new access restrictions. Sections 30210 and 30214 of the Coastal Act recognize that public access can be restricted in order to protect public safety, preserve fragile natural resource areas and in areas where topographic conditions are incompatible with public use. Each of these conditions exists on the Farallon Islands. Moreover, this Project would occur on a federally-owned and managed national wildlife refuge which is outside the state's coastal zone. For these reasons, the Project is consistent to the maximum extent practicable with the Coastal Act's public access policies.

10.2 Article 3: Recreation

As explained above, the Refuge is closed to the public and no recreational facilities are provided on the islands. Therefore there would be no change in on-island recreational opportunities as a result of the Project.

The waters surrounding the South Farallones are not included within the Refuge's boundary and are not managed by the Service. The surrounding waters are managed by the State of California and the Greater Farallones National Marine Sanctuary. In May of 2010, the State of California established the Southeast Farallon Island State Marine Reserve (SMR) surrounding the South Farallon Islands. The 5.34 square mile "no take" SMR prohibits the take of all living marine resources (California Dept. of Fish and Game 2011). The State also established the Southeast Farallon Island State Marine Conservation Area (SMCA). This 12.95 sq. mi. area adjacent to and offshore of the SMR prohibits the take of all living marine resources except the recreational take of salmon by trolling (California Dept. of Fish and Game 2011). The Project would not result in any changes to recreational fishing opportunities.

Several wildlife-viewing boats conduct natural history tours throughout the year or seasonally (weather permitting) to the waters surrounding the islands. These tours focus on whales, seabirds, pinnipeds, and sharks. Because of frequent rough sea conditions, visiting boats to the waters surrounding the Refuge are few during the November-December period. The wildlife-viewing opportunities associated with the Farallones extend to the nearby mainland coast, as well as to some of the seabird species that breed on the Farallones and forage near the mainland.

In addition to guided tours, private pleasure boats occasionally visit the waters surrounding the South Farallones. However, due to the often-unsettled nature of the weather and seas, general recreational boating is infrequent and much less common near the islands than within or just offshore of the more protected waters of the San Francisco Bay.

As a safety precaution, the Service likely will request that the California Department of Fish & Wildlife implement a vessel closure in the area immediately surrounding the South Farallon Islands (within approximately 0.5 miles) during the days of aerial bait application. This closure is expected to range from two to four days, depending on weather and other operational factors. These closures would be a minor short-term inconvenience to the few recreational boaters that visit these waters during the late fall.

In recent years from one to five permitted recreational shark cage diving ventures operate within 0.5 miles of the islands on many days (weather permitting) from late September until late November. Shark diving permits are issued by the Greater Farallones National Marine Sanctuary. Project-related boating closures around the island could result in two to four lost shark diving days (See Section 3.5.4 of the FEIS). However, since shark diving boats are not present every day, the number of days they would be impacted would likely be less.

Flocks of roosting seabirds and shorebirds, particularly gulls, would likely be flushed during helicopter operations and hazing operations and the flocks would be visible to any recreational boaters offshore. Also, pinnipeds flushed during helicopter operations and hazing operations may also be visible to boaters offshore.

The expected recovery of the South Farallones ecosystem after mouse eradication would likely not be perceptible to recreational boaters near the islands, although sightings of ashy storm-petrels seen by pelagic birdwatchers farther from the islands may increase over time and enhance their wildlife viewing experience.

The Project would have no impact on on-shore recreational opportunities. There would be minimal, short term, adverse impacts on recreational boating and shark diving and potentially long term, beneficial impacts to wildlife viewing opportunities. Because there would be no long-term changes in water-oriented recreation or recreational boating opportunities, the Project is maximally consistent with the recreation policies in Article3 of the Coastal Act.

10.3 Article 4: Marine Environment

The aerial application of bait on the South Farallon Islands has been designed to avoid bait from entering the marine environment. As described in the FEIS and the *Draft Operational Plan*, the following protocols would guide aerial bait application:

- The coastal boundary for the operation, Mean High Water Spring (MHWS), would be flown and mapped prior to bait being applied;
- Bait application by helicopter would be guided by an onboard computer utilizing GIS software;
- Rodent bait aerially broadcast along the coast would be applied using a bait spreading bucket configured with a deflector providing a 120-degree swath pattern;
- A trickle bucket with a narrow (<33 ft, <10 m) swath would be used to complete linear features and sections of coastline considered too challenging for deflector and full swath bucket configurations; and
- Bait application would not be conducted in wind speeds exceeding 30 knots, consistent with the EPA-approved bait label for the product.

Consideration of the following additional measures would also be made for more environmentally sensitive shoreline areas (such as important tide pools) considered to be more at risk of impacts from bait drift into the marine environment:

- Reducing the swath width of all bait spreading bucket configurations to provide for more precise placement of bait.
- Reducing helicopter flight speed to ensure more precise placement of bait.

These areas would be identified in consultations with the Greater Farallones National Marine Sanctuary and through pre-eradication site surveys conducted by the implementation team, and included in the Final Operational and Mitigation plans. These measures would be employed if they would further reduce the potential for non-target impacts (which are already less than significant) without jeopardizing the likelihood of eradication success.

The Service would also acquire and comply with all necessary permits or authorizations from the GFNMS, U.S. EPA, and the Regional Water Quality Control Board related to aerial baiting operations.

As disclosed in the FEIS, the use of measures such as bait deflectors and trickle buckets has been shown to effectively reduce the extent of bait drift into the marine environment (FEIS Section 2.10.7.7). Even if bait were to accidentally drift into the marine environment, it would be very unlikely to contribute to detectable levels of brodifacoum in the marine environment. The physical and chemical properties of the bait, its low water solubility, and the strong chemical affinity of brodifacoum to the bait matrix significantly reduce the chance of brodifacoum contaminating water resources around the islands (see FEIS Section 4.4.1.3). In the water, bait pellets would be expected to sink to the bottom and disintegrate within a few hours in the turbulent wave action. The small amount of toxicant would then be expected to bind to the sea bottom. This has been confirmed by environmental testing following other rodent eradications. These studies failed to detect more than trace amounts of brodifacoum in any water samples taken after bait application (Buckelew et al. 2005, Buckelew et al. 2008, Howald et al. 2009, Pitt et al. 2015). Other studies have suggested similar findings, where little to no nearshore contamination of ocean biota, suggestive of water contamination, was detected following analysis of post-application samples, including at Anacapa Island, California following the rat eradication project there. (Howald et al. 2009).

In addition, the Service has developed a *Draft Bait Spill Contingency Plan* (Appendix 5). The Plan describes response actions that would be undertaken to protect the marine environment in the event of an accidental bait spill.

As with water resources, the Project would also not result in significant adverse impacts to any marine species. While the Project would occur within designated critical habitat for the endangered black abalone, an intertidal and nearshore subtidal marine gastropod, an extensive survey conducted at the South Farallon Islands in 2015 found no black abalone (Roletto et al. 2015), and none have been reported since then in intertidal monitoring visits (Roletto 2018, 2020) or incidentally by island staff. Even if black abalone were present at the islands, risk of exposure and impacts of brodifacoum would be very low because they only occupy habitats below the MHWS and because of the low toxicity of brodifacoum to invertebrates. Nor would the Project cause any changes to black abalone critical habitat. For these reasons, the Project is not likely to adversely affect black abalone or black abalone critical habitat. The Service engaged in consultation with the National Marine Fisheries Service (NMFS) under the Endangered Species Act for this species. NMFS concurred with this assessment on April 9, 2019.

Coastal waters near the islands but outside the Southeast Farallon SMR and Southeast Farallon SMCA are important recreational and commercial fishing grounds for species such as Chinook salmon (*Oncorhynchus tshawytscha*), albacore tuna (*Thunnus alalunga*), Dungeness crab (*Metacarcinus magister*), cabezon (*Scorpaenichthys marmoratus*), lingcod (*Ophiodon elongatus*), California halibut (*Paralichthys californicus*), and several species of rockfish (genus *Sebastes*). As discussed above, only very small quantities of rodenticide are expected to incidentally drift into the marine environment. Therefore, the risk of exposure to brodifacoum by any fishery species is very low and the risk of impacts to fishery species from exposure to brodifacoum is medium to low and limited to small numbers of individuals over a short period of time.

The Project is located adjacent to designated Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Management and Conservation Act for Finfish, Market Squid, Krill (*Thysanoessa spinifera*), Krill (*Euphausia pacifica*), Other Krill Species, Pacific Coastal Pelagic Species, Pacific Highly Migratory Species, West Coast Salmon, and Groundfish under the jurisdiction of the Pacific Fishery Management Council. As described above, even if bait does drift into the marine environment in the vicinity of the South Farallones, it is unlikely to result in detectable levels of brodifacoum in the water column.

All of the fish species with EFH in the Project area are either planktivores or predators of invertebrates or other fish. In addition, ocean conditions around the islands would cause bait pellets to quickly breakdown. For these reasons, the FEIS concludes that it is highly unlikely that marine fish species in the Project area would consume bait. (FEIS Section 4.5.6.1.4)

It is also unlikely that the Project would result in a reduction in food for EFH species. For this to occur, prey would have to consume brodifacoum bait in such quantity as to impact their populations. Based on available literature, including data from previously completed rodent eradication projects on islands where brodifacoum was used, exposure to this toxicant by marine invertebrates and fish has been minimal and highly limited in spatial extent. It is anticipated that only small numbers of nearshore fish will be exposed to bait pellets (which will degrade rapidly), and even fewer numbers of fish are anticipated to experience acute effects.

Based on the rodent bait exposure, toxicity, and persistence information presented above and more fully analyzed in the FEIS, the Project is not likely to adversely affect elements of EFH near the South Farallon Islands. The Service has completed EFH consultation with NMFS. On April 9, 2019, NMFS concurred with this assessment.

Shark diving trips could be disrupted on two to four days during Project implementation. The economic impacts to shark diving operations are expected to be minimal and every effort would be made to keep diving operators informed during the operation to minimize economic impacts.

Juxtaposed with these less-than-significant adverse impacts are the long-term, significant, beneficial impacts that would occur to the ashy storm petrel, a marine bird which is a Service Bird of Conservation Concern, a California Bird Species of Special Concern, and red-listed (endangered) by the International Union for the Conservation of Nature (IUCN). The FEIS discloses that the Project would likely arrest or reverse the long-term population decline being experienced by this species and potentially result in a population-level increase (see Environmental Consequences section, above, and FEIS Section 1.3.1).

As summarized above, the Project would not result in any long term, significant negative impacts to coastal waters or the biological productivity of marine species. Instead, it would result in long-term and significant beneficial impacts for ashy and Leach's storm-petrels and potentially aid in the restoration of the rare ashy storm-petrel. This outcome would help avoid the need for the species to be listed as threatened or endangered under the Endangered Species Act, mitigate potential impacts to this species from climate change, and further the goals of the CCMP Section 30230 with regard to restoring species of special biological significance. For these reasons, the Project is consistent to the maximum extent practicable with the provisions of Sections 30230 and 30231 of the CCMP in that it will maintain healthy populations of marine species and the productivity and quality of coastal waters. The mitigation measures described above to minimize potential bait drift into the marine environment, coupled with the *Bait Spill Contingency Plan*, protect against the spillage of hazardous substances into the marine environment and demonstrate the Project's consistency with CCMP Section 30232.

The Project does not propose any changes to recreational or commercial fishing facilities, nor does it involve any dredging or alteration of waterways or shoreline areas. As a result, the policies in Sections 30233, 30234, 30235 and 30236 of the Coastal Act are not applicable.

10.4 Article 5: Land Resources

10.4.1 Consistency with Section 30240 – Environmentally Sensitive Habitat Areas

The South Farallon Islands are by any measure an environmentally sensitive habitat area (ESHA) within the meaning of CCMP Section 30240 and Section 30107.5 of the Public Resources Code. Section 30240 specifically calls upon the Commission to support the protection environmentally sensitive habitat areas from uses that significantly disrupt habitat values. Only uses dependent on environmentally sensitive habitat areas should be allowed.

Recently, the California legislature recognized the importance of preserving healthy ecosystem dynamics on islands when it endorsed the use of rodenticides such as brodifacoum in island eradication projects. The California Ecosystem Protection Act of 2020 specifically authorizes, "[T]he use of any second generation anticoagulant rodenticides for the eradication of nonnative invasive species inhabiting or found to be present on offshore islands in a manner that is consistent with all otherwise applicable federal and state laws and regulations." (FAC Section 12978.7(4)).

The continued presence of introduced, invasive house mice on the South Farallon Islands is resulting in adverse impacts to the Refuge's ESHA. As detailed in the FEIS Sections 1.2.2.1 - 1.2.2.4 and the Environmental Consequences (above), mice significantly degrade habitat for sensitive and endemic species and cause havoc on islands' natural ecosystem dynamics. Mice subsidize a transient burrowing owl population that in turn preys upon ashy and Leach's storm-petrels as well as endemic Farallon camel crickets. They also compete for prey with and likely prey upon the endemic arboreal salamander. Mice directly consume native invertebrates such as insects and spiders, and likely prey upon endemic Farallon camel crickets, as well as rare native plants.

The complete elimination of mice (as opposed to population control) is the only way to remove the direct and indirect adverse impacts of this incompatible use on the islands' ESHA values. As described in Alternative Selection Process in Section 7.B., above, control of mice on the South Farallon Islands is infeasible for many logistical, safety, and wildlife and habitat disturbance reasons. Even if control measures were feasible, this technique would have to be employed on a permanent basis, in perpetuity, to have a lasting effect. This untenable situation would not satisfy the goals of restoring the Farallon ecosystem.

The benefits that would accrue to sensitive native species are significant and long-lasting. The ashy storm-petrel is a Service Bird of Conservation Concern; about half the world population of this species breeds on the South Farallones. The islands also provide habitat for the Leach's storm-petrel. As described in Section 9. Environmental Consequences (above), fall migrant owls are attracted to stay on the islands through the winter by an abundant mouse supply. After the mouse population crashes in winter, the owls switch to feeding on the storm-petrels. If allowed to continue, this hyper-predation is projected to reduce the ashy storm petrel population by 63% over 20 years. (Nur et al. 2019). In the absence of mice, it is expected that the fall migrant owls will move on to mainland wintering areas, thereby dramatically reducing or eliminating their predation on these species. With just a 50% reduction in owl numbers, the expected decline in the petrel population is reduced to 26%, while a reduction in owl numbers by 80% would result in a 2% increase in storm-petrel numbers over 20 years (Figure 5). The eradication of mice would therefore arrest the long-term population decline affecting the ashy storm petrel population and potentially result in a population-level increase for this sensitive species (FEIS Section 1.3.1).

The rare and endemic Farallon arboreal salamander and Farallon camel cricket are found nowhere else. Mice compete for invertebrate prey with the salamanders and possibly feed directly on salamanders. Burrowing owls, and most likely mice (as inferred by diet studies showing extensive feeding on insects) also extensively prey on camel crickets. The populations of both of these endemic species would experience significant, long-term beneficial impacts from the eradication of mice (see Environmental Consequences, above, and FEIS Sections 4.5.6.1.3. and 4.5.6.1.5).

Native plants of the Farallones are expected to benefit from the eradication of mice. Vegetation is not known to be negatively impacted by rodenticides. Due to the very low solubility of brodifacoum in water, plant uptake of brodifacoum is unlikely to occur (Weldon et al. 2011). Post-application monitoring for the Anacapa Island rat eradication tested negative for brodifacoum residue in all plant samples (Howald et al. 2009). The maritime goldfield (*Lasthenia maritima)* is an annual plant endemic to seabird nesting islands along the coasts of California and Oregon; its largest population is on the South Farallones where it forms the basis of a unique plant community. Mice feed on plant seeds and other plant parts, including the goldfield. Mouse predation is likely suppressing native plant populations in favor of more hardy introduced perennial plants (FEIS Section 4.5.6.1.6).

The Project also plays an important role in protecting ESHA from the disruptive and ongoing effects of climate change, oil spills, and other human-caused stressors. It is believed that the continued presence of house mice on the Farallones would compromise the effectiveness of future ecosystem restoration efforts and exacerbate larger-scale (e.g., regional, global) ecosystem impacts. Mice present an obstacle to the Service facilitating ecological adaptation in the face of accelerated global climate change (FEIS Section 2.9). As summarized in FEIS Section 4.8.3, climate change is accelerating rapidly, and is considered one of the primary threats to the north central California coast (Largier et al. 2010). The effects of climate change are being seen in both the larger landscape and at the Farallon Islands. At the islands, maximum annual air temperatures have significantly increased by over 4ºC since the early 1970s, and average annual daytime air temperate has increased by almost 1ºC during this period. This warming trend could lead to more favorable year-round conditions for the mice on the islands, which currently experience a significant reduction in population size during colder months.

Climate change is expected to have several far-reaching consequences for the California Current System, stemming from alterations in water-column stability, timing and intensity of upwelling favorable winds, and the sources and chemical properties of water that is advected horizontally and vertically into the system (Doney et al. 2012). A warming ocean is projected to reduce nutrient inputs and primary productivity as the thermocline deepens and stratification intensifies.

Changes in timing of the spring phytoplankton and zooplankton blooms is resulting in observed asynchronies between prey availability and food demand for marine predators, which can have particularly strong consequences for consumers such as seabirds (Sydeman et al. 2009). Other observed or expected climate change impacts on the Farallon ecosystem include increasing sea level rise, increased extreme weather events, increasing ocean acidification, northward range shifts of many species, and shifts in prey availability for seabirds and other marine wildlife (FEIS Section 4.8.3).

Climate change impacts appear to be increasing the frequency and magnitude of die-offs of seabirds and marine mammals. Since 2009, die-offs of unprecedented scale between the Gulf of the Farallones and Alaska have impacted Brandt's cormorants, Cassin's auklets, and common murres (Ainley et al. 2018, Jones et al. 2018, Piatt et al. 2020). All resulted from unusually warm ocean conditions and the resulting disappearance of prey resources. The unprecedented extreme marine heat wave (aka "The Blob") that encompassed much of the Northeast Pacific in 2014-2016, leading to ecosystem collapse, resulted in the massive die-offs of Cassin's auklets and common murres, along with reproductive failure throughout much of the murre's range (Jones et al. 2018, Piatt et al. 2020). Marine heat waves are expected to become more frequent and could result in major ecosystem changes. If changing ocean conditions, sea level rise that will reduce habitat availability (FEIS Section 4.8.3), or other anthropogenic impacts such as a major oil spill(s), were to cause die-offs or reductions in reproductive success for Farallon storm-petrels, impacts to the population could be significant and long-lasting. Removing the impacts of house mice on the storm-petrel would help buffer the population against these or other potential climate change impacts.

The house mouse eradication project will also help buffer other aspects of the Farallon ecosystem from climate change, such as impacts to plants, invertebrates, and salamanders that might be caused by changes in air temperatures, seasonal rainfall, or extreme weather events. More directly, changing weather patterns could result in changes in the pattern of the mouse annual population cycle, potentially resulting in greater ecosystem impacts. For example, a recent change in mouse behavior has resulted in house mice attacking and killing albatross chicks at Midway Atoll. Given the high density of Farallon mice at their peak abundances, shifts in their seasonal cycle that lead to increased abundance during the seabird breeding season (when mouse abundance is currently low) could result in much greater direct mouse predation on seabirds, their eggs or chicks (FEIS Section 2.9).

For the salamander, removal of mouse impacts could buffer the species from impacts of climate change and from chytrid fungus, which has severely depleted many amphibian populations worldwide. Fortunately, this deadly fungal pathogen has not yet been detected in Farallon salamanders (FEIS Section 3.4.3.1).

The FEIS acknowledges that the Project will adversely impact non-target species native to the islands; however, in each case, the impacts will be short-term, less-than-significant, and will not affect population levels (see Table 4). The species at greatest risk for adverse impacts or concern, whether from toxicant exposure or disturbance, were described in Section 9. Environmental Consequences. In particular, large numbers of western gulls and several other species of gulls are at risk of toxicant exposure. For other species, including other birds and salamanders, only small numbers of individuals are expected to be exposed and adversely affected by toxicant. Because most invertebrates are not affected by anticoagulant rodenticides, adverse impacts are not expected. Plants are not affected by rodenticides.

The Service has developed a comprehensive suite of mitigation measures to ensure that impacts to non-target species remain below significant levels. These include: an intensive gull hazing plan designed to safely deter gulls from landing on the islands or remaining long enough to discover and ingest toxic bait or mice; capture and captive holding of a sample of 40 salamanders as a precautionary measure; and capture, captive holding or translocation of birds of prey that might consume mice or other species that have been exposed to toxicant. These mitigation measures are described in the Mitigation section (above), in Section 2.10.7 of the FEIS, and in the *Draft Mitigation and Monitoring Plan* (Appendix 4).

Risks to mainland resources from the Project are expected to be negligible. Most likely the greatest risk of exposure to mainland resources from the Project would result from an intoxicated gull dying or washing up dead on a mainland beach, feeding area (such as a waste facility) or gull roost site. A variety of mammals and birds scavenge on fresh gull carcasses (Ford et al. 2006), the most likely route of exposure to mainland resources. However, because mitigation measures (see Mitigation Measures in Section 8. Project Description, above) will minimize the number of gulls and other non-target resources exposed to brodifacoum, we expect few intoxicated gulls to reach mainland shores. This expectation is supported by results from previous rodent eradication projects, including the rat eradication project on Anacapa Island, California in 2000-2001. Non-target impacts from the Anacapa Island rat eradication project included on-island mortality of raptors, gulls and passerine birds; no impacts to mainland resources were reported (Howald et al. 2009; K. Faulkner, pers. comm.), although we are unaware of any systematic surveys conducted. As part of the mitigation and monitoring program, beached bird surveys to record and remove potentially intoxicated gulls or other bird species (see Mitigation Measures and Monitoring in Section 8. Project Description, above, and Appendix 4) will help further reduce scavenging risk to mainland resources.

The benefit of this conservation action is significant from a national perspective because of the importance of the South Farallon Islands' ESHA for breeding seabirds and endemic species. The islands hold the largest seabird breeding colony in the lower 48 United States, including the world's largest colony of the rare ashy storm-petrel. If allowed to continue, the direct and indirect impacts of mice threaten to reduce their population by 63% over 20 years. Study results demonstrate that removal of these impacts will arrest and possibly even reverse the ongoing decline in the storm-petrel population, thereby helping avoid the need to list this, and possibly other rare species such as the Farallon arboreal salamander and Farallon camel cricket, under the Endangered Species Act. Mouse removal would further the goals of the California Ecosystem Protection Act of 2020 and help satisfy the Service's goal of reducing impacts of invasive species in the United States. Additionally, the eradication of house mice at the South Farallon Islands supports the Service's priority to facilitate ecological adaptation in the face of accelerated global climate change by removing a non-climate change stressor from the environmentally sensitive Farallones ecosystem. Mouse removal will also benefit wilderness character since mice significantly impact the natural character of the federally designated Farallon Wilderness Area. For these reasons, the Project is consistent to the maximum extent practicable with the

Commissions' policies on environmentally sensitive habitats in Section 30240.

10.4.2 Consistency with Section 30243 – Soil Productivity

Monitoring data from projects that have used brodifacoum indicate either no detectable soil contamination or insignificant levels of contamination. Brodifacoum has a published half-life of 157 days under laboratory conditions in sandy clay loam soil (USEPA 1998). On the Farallones, brodifacoum would be expected to terminate in the soils followed by breakdown by molds, fungus and microbial degradation to base components of carbon dioxide and water. Radio-labeled brodifacoum was found to be effectively immobile (i.e. not leached) in four soil types (World Health Organization 1995). Craddock (2003) reported that where soil residues were found below disintegrating Pestoff® 20R pellets at Tawharanui Regional Park, Auckland, they were low (near the limit of detection of 0.02mg/kg) and after 110 days no residues could be detected. Results from soil monitoring for brodifacoum residues six to nine months after bait application on Red Mercury Island, Coppermine Island (Morgan and Wright 1996) and Lady Alice Island (Ogilvie et al. 1997) were all negative. Similarly, on Anacapa Island trace levels were detected in just one of 48 samples collected approximately six months post bait application in 2003 (Howald et al. 2009). The one positive sample contained 1.2 µg/g of brodifacoum. After 153 days the highest residue concentration measured from soil extracted from underneath Pestoff 20R baits used on Hauturu Island in 2004 was 0.07 µg/g (Weldon et al. 2011). Soil samples taken 28 days following aerial application of 10mm Pestoff 20R baits containing 20 ppm brodifacoum to the Ipipiri Islands in the Bay of Islands, New Zealand in June 2009 contained an average brodifacoum concentration of 0.0016 µg/g (Walker 2010).

Soil samples were collected from the Bay of Islands 58 days post baiting and contained brodifacoum residues of approximately 0.002 µg/g. These samples were taken 8 inches below each sampled bait pellet on the pasture (Weldon et al. 2011). In simulated rainfall trials, Booth et al. (1999) did not detect brodifacoum in the soil underneath any bait. Alifano et al. (2012) found trace amounts of brodifacoum (greater than 1 µg/g) in topsoil analysis on Palmyra Atoll during monitoring efforts conducted 50 days after bait application. In a separate study on Palmyra Atoll, soil samples collected approximately two months following rodenticide bait application (three applications at an average rate of 75.5 kg/ha) contained brodifacoum concentrations ranging from 0.03 µg/g (the method limit of detection) to 0.056 µg/g (Pitt et al. 2015).

The results of these studies indicate that the Project will have no long term effect on soil productivity, and that the Project is therefore consistent to the maximum extent practicable with CCMP Section 30243.

The South Farallones are not suitable for agriculture or timber production. The Project does not involve any digging or soil-disrupting activities nor does it propose to alter any cultural resources. Therefore, the policies in Sections 30241, 30242, 30243 (timberlands) and 30244 of the Coastal Act are not applicable.

10.5 Articles 6 and 7: Development and Industrial Development

The Refuge is minimally developed. Existing development includes a fully automated lighthouse, two residences for itinerant Refuge personnel and research staff, maintenance buildings, a water catchment and delivery system and other minimal infrastructure to support ongoing scientific research, monitoring and Refuge stewardship activities

The Project does not involve any new development or redevelopment on the Refuge. Therefore the policies in Articles 6 and 7 of the CCMP are not applicable to the Project.

11 Further Consultation with Coastal Commission Staff and Project Reporting

Assuming that the Commission finds the Project to be consistent to the maximum extent practicable with the enforceable policies of the CCMP, the Service is willing to agree to the following consultation and reporting measures.

The Service will notify the Executive Director of the Record of Decision when it becomes available. If the Record of Decision selects the preferred alternative, the Service is committed to the following notification process and process for review of revised implementation plans (i.e., *Operational Plan*, *Mitigation and Monitoring Plan*, *Bait Spill Contingency Plan*, and *Non-target Contingency Plan*) and reporting:

1. Notify the Executive Director when the implementation teams have been selected;
2. Notify the Executive Director when a target implementation period has been selected and any changes to that period;
3. Notify the Executive Director of any significant modifications made to the Project subsequent to the Commission's concurrence with this Consistency Determination;
4. No later than two months prior to the start of Project operations, submit to the Executive Director draft final versions of all implementation plans (e.g., *Operational Plan*, *Mitigation and Monitoring Plan*, *Bait Spill Contingency Plan*, and *Non-target Contingency Plan*) for review of consistency with the Draft Plans provided in this Consistency Determination;
5. Notify the Executive Director when all environmental compliance permits and consultations have been obtained or finalized;
6. Notify the Executive Director of implementation progress, including the start and end of the operational phase, when bait applications have been completed, and any significant events; and
7. Provide the Executive Director a preliminary post-Project report and a final Project report once conclusions are made regarding the Project goals and objectives.

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Appendix 1. Response to substantive comments from the July 10, 2019 hearing

In response to a request from California Coastal Commission staff, the Service has prepared responses to a variety of comments and questions raised by Commissioners and members of the public at our first hearing on the Farallon Islands house mouse eradication project, held on July 10, 2019. More information on these topics can be found in the Service's Consistency Determination (hereafter referred to as the CD).

Project Need and Urgency

- Since the mice have been there since the 19th century, why is there an urgency to conduct this project now?

Only in recent decades has a safe, effective method--the targeted, short-term use of rodenticide--proven successful for complete eradication of rodents from islands. Successful rodent eradications have now been conducted on over 700 islands worldwide, including 64 for house mice and the highly successful rat eradication at Anacapa Island in the Channel Islands National Park.

The Service has identified the eradication of invasive house mice from the South Farallon Islands as a priority after a thorough, inclusive and lengthy public planning process. As discussed in the Consistency Determination in detail, successfully eradicating mice on the Farallon Islands will preserve this globally important ecological treasure and its ESHA values, increase the populations of endemic species, facilitate the Service's ability to protect native species in the face of accelerated climate change, and help avoid the possible listing of the Ashy storm petrel under the Endangered Species Act.

- If the Ashy storm-petrel isn't listed as endangered, why the need for the project?

As described in the CD, the purpose of the house mouse eradication project on the South Farallon Islands is to eliminate their negative impacts on the entire Farallon ecosystem, not just their effects on the ashy storm-petrel population. Other specific project goals include increasing the productivity and abundance of native species such as the Leach's storm-petrel, the endemic Farallon arboreal salamander, the endemic Farallon camel cricket, and the endemic maritime goldfield. Only through the eradication of mice can long-term, population level benefits accrue to these native species.

The project would also help avoid a future listing of the ashy storm petrel under the Endangered Species Act. The ashy storm-petrel is one of the rarest seabirds in the North Pacific, with a range restricted to California and northern Baja California, Mexico, and their most important breeding colony is at the South Farallon Islands. The species is already listed as a U.S. Fish and Wildlife Service Bird of Conservation Concern, a California Bird Species of Special Concern, and Endangered by the International Union for Conservation of Nature (IUCN). The presence of mice on the islands leads to hyper-predation on ashy (and Leach's) storm-petrels. If allowed to continue, this hyper-predation is projected to reduce the ashy storm-petrel population by 63% over 20 years (Nur et al. 2019). Delaying eradication of the mice from the Farallones therefore risks having the species decline to the point where other protections and recovery will be necessary, such as through Endangered Species Act listing. The Service's goal is to protect species before their populations are in critical jeopardy. As explained in the CD, the eradication of mice will allow the Service to dramatically reduce and possibly reverse this precipitous downward trend in the Farallone's ashy storm petrel population.

<u>Likelihood of Success</u>

- Can you really eradicate 100% of the mice?

As described in Section 7.2.5 of the CD, whole island eradications of rodents have been conducted successfully on over 700 islands worldwide, including 64 successful house mouse eradications. Fifty-two of the recorded successful mouse eradications were achieved using broadcast of the second-generation anticoagulant rodenticide Brodifacoum, utilizing methods like those proposed for the South Farallon Islands. Many of these eradications were on islands much larger and more logistically complex than the Farallones. Examples such as Antipodes (New Zealand; 4,972 acres), South Georgia (South Atlantic; 1,350 square miles), and Macquarie (Tasmania; 31,900 acres) islands have demonstrated the capabilities of today's rodent eradication professionals. Lessons learned from over 700 rodent eradications around the world have allowed the island restoration community to derive principles of eradication and best practices that have improved the rate of success to 94% for mouse eradications since 2005. The Service has incorporated these lessons learned and best practices to best assure a successful Farallon mouse eradication.

- How do you know that if you get rid of the mice, the burrowing owls will leave in winter?

The ecology of burrowing owls visiting the Farallon Islands has been well studied and data shows their diet relies on house mice from the time the owls arrive at the islands in the fall until the mouse population crashes in the winter, then relies on storm-petrels after that until the owls depart the island in the spring for their breeding grounds. Without the presence of the mice, few prey would be available for migrant owls that stop at the islands to rest. Therefore, like most other visiting landbirds, the owls would be expected to continue on their migration to find more suitable mainland habitats.

- How do you know the burrowing owls won't start eating ashy storm-petrels if the mice are eradicated?

Burrowing owls arrive at the Farallon Islands during their fall migration. At that time, ashy storm-petrels are near the end of their breeding season when birds are departing the islands to go to sea. The storm-petrels that are still nesting spend most of their time at sea and little time on the islands, secretively visiting for only brief periods to feed their chicks which are hidden away in underground rocky crevices. This behavior makes the storm-petrels very hard to find and capture. The situation is very different in winter and spring when burrowing owls feed on the storm-petrels. At that time of year, the storm-petrels are returning to the islands and performing courtship activities, when they spend a lot of time flying around the island and sitting on the ground. Their behavior at this time of the year makes them much more vulnerable to owl predation.

Project Risks

- Isn't it risky to use rodenticide in such an environmentally sensitive habitat?

Rodenticides have been utilized in 652 successful rodent eradication (DIISE 2021) projects on islands to safeguard native ecosystems from the negative impacts caused by invasive rodents. Islands are sensitive habitats that despite their small size harbor a disproportionately high amount of biodiversity. Small population sizes and limited habitat availability make species that live on islands susceptible to extinction, and their adaptation to isolated environments makes them particularly vulnerable to introduced species (Diamond 1985, 1989; Olson 1989). As discussed in the CD, hyper-predation caused by mice is projected to reduce the refuge's ashy storm petrel population by 63% over 20 years. Mice also suppress the populations of the endemic Farallon arboreal salamander and the Farallon camel cricket. The continued presence of mice on the South Farallon Islands therefore presents a risk to the long-term health of the islands' ecosystem and the rare and endemic species it supports.

The Service recognizes that the use of rodenticides for eradication on islands does carry inherent risks to non-target species. These risks have been fully assessed in the FEIS and a comprehensive set of mitigation measures has been developed to minimize potential environmental harm. The Service has also prepared contingency plans to respond to unanticipated events. By following best practices, mitigation measures, and lessons learned from other eradication projects, the Service has the ability to implement this project safely and effectively.

- Doesn't the proximity of the islands to the mainland make it risky?

There is little to no potential risk to mainland resources from the proposed Project. The bait would be intentionally applied only over the landmass of the islands, and mitigation strategies would minimize incidental drift of bait into the surrounding marine environment. Any bait entering the water would break down quickly in the high energy marine environment. That, together with the fact that most fish and invertebrates in waters around the islands would not be expected to consume bait pellets, mean that only small numbers of individuals in the waters immediately surrounding the islands would be exposed to toxicant. Because brodifacoum has very low solubility in water (less than 10 ppm or mg/L at 20ºC and pH 7), the risk to water quality is negligible.

Other eradication projects using rodenticides have been conducted on islands within a similar or closer distance to mainland shores than the South Farallon Islands project. Examples include Anacapa Island, 11 miles off the coast of southern California, and Rangitoto and Motupapu islands, inhabited islands located just 5.5 miles from the center of New Zealand's largest city of Aukland (see Section 7 of the CD). We are unaware of any reported impacts to mainland resources from those projects.

The FEIS for the Project discloses that small numbers of western gulls and other species of gulls that may be exposed to brodifacoum could fly to the mainland where they could be consumed by mainland scavengers, which would then be exposed to toxicant. Based on results from past projects, this scenario is highly unlikely, or would be limited to a very small number of individuals.

To minimize adverse impacts, the Project's *Draft Mitigation and Monitoring Plan* calls for regular, standardized surveys of mainland Gulf of the Farallones beaches to search for dead birds that could have been exposed to rodenticide. Surveys would be conducted following standardized protocols of the Greater Farallones National Marine Sanctuary's Beach Watch program and would include collection of carcasses. Recorded mortality during the implementation period would be compared to long-term baseline values to determine if numbers of beached birds were significantly above average. If island and/or mainland monitoring indicates unanticipated mortality of any non-target species (including gulls) that could result in significant impacts following the first bait application, a management decision on whether to proceed with subsequent bait applications would be made. The Mitigation and Monitoring Program also requires public notifications about the Project and steps for the pubic to take if they encounter dead birds on mainland beaches.

Alternative Solutions

- Can't you just trap and remove the small number of burrowing owls?

Removing burrowing owls would not address the purpose of the mouse eradication project on the South Farallon Islands, which is to eliminate all negative impacts from the mice on the Farallon ecosystem. The house mouse eradication is expected to have multiple, significant long-term benefits, including increasing the productivity and abundance of the endemic Farallon arboreal salamander, the endemic Farallon camel cricket and other invertebrates, increasing the abundance and recruitment of native vegetation, improving wilderness character, and restoring ecosystem processes altered by non-native mice. Moreover, the cost and logistics of a perpetual burrowing owl control effort make it an unrealistic option.

- What about contraception/fertility control? Wasn't a contraceptive product approved by the US EPA?

Recently, the contraceptive product ContraPest® (manufactured by SenesTech, Inc., Flagstaff, Arizona) has been approved by the EPA for the control of Norway (*Rattus norvegicus*) and black (or, roof; *Rattus rattus*) rats (EPA Reg. No. 91601-1). ContraPest is a liquid contraceptive bait that limits the fertility of both female and male rats by depleting ovarian follicle development and spermatogenesis, respectively. Laboratory studies found that ingestion of ContraPest results in inducing infertility of Norway and black rats within 15 days of the start of daily ingestion and that infertility can last for 2 to 6 months (Siers et al. 2017, Witmer et al. 2017; also see https://senestech.com/contrapest/). The main benefits of ContraPest are that bioaccumulation is negligible and toxicity appears to be low to negligible.

While ContraPest holds promise for rodent population control, it remains infeasible for the South Farallon Islands house mouse eradication project for several reasons, mainly:

- ContraPest is only for rat population control, not eradication, as infertility is reversed over time;
- It has only been tested and approved for control of Norway and black rats (not house mice;
- Field efficacy has not yet been experimentally tested; and
- Non-target impacts, such as the potential for contraceptive effects on other exposed wildlife, have not been experimentally tested.

Distribution of the bait is also a major issue. The product is delivered in a liquid bait within a bait station. In the FEIS, the use of bait stations as a primary method of bait delivery was dismissed from further analysis because many areas are not accessible, placement and maintenance of bait stations in many areas poses risks to human health and safety, and the ecological damage that would occur from the frequent visits to service the tens of thousands of bait stations that would be necessary. Achieving meaningful and lasting impacts on the mouse population using ContraPest on the Farallons, would require frequently accessing all areas of the islands multiple times a year and for many years or in perpetuity, including seabird and marine mammal breeding areas. This level of disturbance to sensitive areas would be high, possibly catastrophic, far outweighing the short-term benefits achieved.

- Can't you use traps and/or bait stations for the mice, instead of rodenticide?

To achieve whole island eradication of rodents, all individuals of the target population must be put at risk by the eradication strategy. To utilize traps or bait stations to achieve eradication would mean that devices must be placed in every potential mouse territory. Both traps and bait stations must be placed manually, anchored to the ground, baited, checked regularly, and removed upon project completion. On the Farallons, this is not a feasible alternative for several reasons: 1) many areas of the South Farallon Islands are inaccessible on foot or pose a significant safety risk to personnel; 2) mice have small territories and traps/bait stations would need to be placed in a 2m x 4m grid which would amount to 61,000 devices; 3) the human presence and disturbance associated with such an effort would likely cause large-scale, unacceptable impacts to nesting seabirds and their habitats, breeding and resting marine mammals, native vegetation and other sensitive species, and wilderness character.

- Why not use diphacinone, a less toxic rodenticide than brodifacoum?

A major component of the Service's choice of the Preferred Alternative is the proven effectiveness at eradicating house mice from islands by brodifacoum-based baits like Brodifacoum-25D Conservation. The use of brodifacoum is considered part of best practices for successful mouse eradication from islands by wildlife biologists and land managers around the world. Of the 64 recorded whole-island mouse eradications, all but one utilized brodifacoum or a similar rodenticide, while none utilized diphacinone as the primary toxicant. The success rates now being achieved in mouse eradication projects (94%) show that a well-planned and executed project would provide a high chance of success at the South Farallon Islands.

Although it is less toxic than brodifacoum and thus poses less risk to non-target species, diphacinone requires multiple feedings over multiple days to be effective, is less effective on mice (than rats), would require more bait applications and have a longer operational period, and has never been used in a successful, full-island mouse eradication. Based on this information, the Service determined that there was a high risk of eradication failure using diphacinone, and using it would not achieve the goals of the Project.

- What other methods were considered and rejected, and why?

To help identify action alternatives for full analysis in the Project's EIS, the Service examined 49 different methods in a thorough and transparent process. Among the methods assessed were: a sustained population control program; the use of bait stations; hand broadcasting of bait; trapping of mice; introduction of disease targeting the mice; introduction of a biological control agent such as snakes or cats; fertility control; and burrowing owl relocation. From this rigorous review process, two action alternatives were selected for full analysis in the EIS: Aerial Broadcast of Brodifacoum-25D Conservation and Aerial Broadcast of Diphacinone-50 Conservation. The remaining alternatives were dismissed from further analysis because of their infeasibility, unavailability (e.g., theoretical), inherent human safety risks, or because they otherwise could not satisfy the goals of the project. See the CD and Appendix B for more information on this topic.

Brodifacoum Impacts

-What are risks to public health from the Project?

Brodifacoum is classified as an extremely hazardous compound (Class 1a) by the World Health Organization (WHO 2020). However, risk of human exposure to brodifacoum as a result of the Project is negligible because of a lack of exposure routes. The most likely pathway of exposure to humans would be from low level secondary exposure resulting from ingestion of contaminated seafood. The chance of this occurring is highly unlikely for several reasons:

1) As described in Sections 9 and 10 of the CD, most fish species around the Farallones are either predators or planktivores that are unlikely to consume any of the small numbers of bait pellets that will incidentally drift into the marine environment. Scavenging species such as crabs are also unlikely to be affected by brodifacoum because benthic habitats around the islands are of poor quality for crabs and because any incidental bait pellets will disintegrate quickly in the rough ocean waters. Exposure of fishery species would therefore be limited to a few individuals in the nearshore waters immediately surrounding the islands;
2) Fishing is prohibited in the Southeast Farallon Island State Marine Reserve and limited to take of salmon by trolling in the Southeast Farallon Island Marine Conservation Area;
3) In the unlikely event that any human were to consume a contaminated fishery species, risk of harm is low because:
    a. Risk of exposure to humans is expected to be for a short period of duration. Studies of marine fish and invertebrates conducted a few years after other rodent eradications did not find quantifiable evidence of rodenticide persisting in marine fish and invertebrate tissues (Siers et al. 2015, Wegmann et al. 2019);
    b. Brodifacoum generally does not persist in invertebrate (e.g., Dungeness crab) tissues and rarely accumulates in marine fish (Howald et al. 2009; Masuda et al. 2015);
    c. any rodenticide that is consumed by and accumulates in marine biota should accumulate in the liver or digestive tract and not edible tissues, such as muscle (Weldon et al. 2011); and

d. Very large portions of seafood (hundreds of pounds) contaminated with low (ppb) concentrations of brodifacoum would need to be consumed by a human to elicit adverse health effects (WHO 1996).

-Hasn't brodifacoum poisoned the food chain on the mainland?

Use of brodifacoum and other anticoagulant rodenticides over extended periods of time has been a genuine concern on the California mainland because of chronic impacts to non-target species such as mountain lions. The Farallones project, by contrast, proposes a controlled, very short-term use of brodifacoum that will not result in long-term adverse impacts to the Farallon ecosystem or contribute to the long-term problems experienced on the mainland.

- Didn't California ban the use of brodifacoum, even for wildlife management?

No.

The California Ecosystem Protection Act of 2020 specifically authorizes the use of second-generation anticoagulant rodenticides (SGARs) in limited circumstances, one of which includes the eradication of invasive species from islands. Of critical importance with respect to the Commission's consideration of this Project, the California legislature made the following finding in Section 1(a)(9) of the Act:

"The use of pesticides and rodenticides to reduce or eliminate nonnative invasive species inhabiting or found to be present on offshore islands is critically important for the environmental and ecosystem health of these islands, and for allowing federally and state-listed endangered and threatened species, including species presumed extinct or on the verge of extinction, to recover and propagate back to population levels that existed before the presence of these nonnative invasive species and for avoiding federal or state listing of native and endemic species due to their displacement by nonnative invasive species."

Full text of California Ecosystem Protection Act can be found at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200AB1788).

Impacts to Non-target Species

- Doesn't the USFWS' Environmental Impact Statement say 1,700 gulls will be killed in this operation?

That is incorrect. Section 4.5.4.4.1 of the FEIS provides an impact assessment for western gulls, including estimates of the numbers of gulls that would be at risk to rodenticide exposure and the number that could be removed from the Farallon population before having a population level impact. From that risk assessment, it was determined that up to about 1,700 western gulls could be removed from the Farallon population without having a long-term impact (defined as 20 years) on the population. The CD reported on additional modeling efforts that revised the number of western gulls that could be removed without having a long-term impact to about 1,050 birds. While it is important to be aware of these numbers, the Project is not expected to have anywhere near this amount of gull mortality due to thorough mitigation and monitoring planning.

One of the primary goals of the Project is to minimize non-target impacts. Mitigation measures for gulls are designed to keep mortality of western gulls well below a level that result in a significant population level impact, including conducting the operation during the time of year when western gull numbers on the islands will be near their annual minimum, and a comprehensive gull hazing program designed to deter gulls from landing on or remaining on the islands long enough to be exposed to the bait or exposed mice.

- Can you really keep notoriously persistent gulls away with hazing?

A hazing trial undertaken in 2012 on the South Farallon Islands successfully deployed a range of hazing techniques and demonstrated the ability to keep all but a few western gulls off the islands for an extended period of time (see Appendix E of the FEIS and Mitigation in Section 8 of the CD). The hazing trial also prevented gulls from landing in areas where non-toxic rodent bait was available. One key factor in this high hazing success is that, unlike with many other less successful gull hazing studies, gulls visiting the islands in fall do so just for roosting, not feeding. Many other hazing programs are conducted at landfills and other food sources, making hazing more challenging. Results from the Farallon hazing trial provide a high degree of confidence that a well planned and executed hazing operation would keep gull mortality to an acceptable level during a mouse eradication. Hazing of laughing gulls (*Leucophaeus atricilla*) was also conducted successfully during a mouse eradication on Allen Cay, Bahamas in 2012 (Alifano 2012).

- Won't gull hazing disturb other nesting birds and marine mammals on the islands?

Some incidental disturbance of other birds and pinnipeds will occur as a result of gull hazing. Disturbance of marine mammals will be conducted under an Incidental Harassment Authorization issued by NOAA Fisheries. As described in Appendix E of the FEIS, during the hazing trial undertaken in 2012 on the South Farallon Islands, impacts to other bird species and marine mammals from hazing activities were well below levels of concern. Pinniped use of the islands was not affected. Since the Project would occur outside the breeding season for seabirds and pinnipeds, breeding would not be affected.

- Won't raptors migrating through the Golden Gate National Recreational Area eat the poisoned mice?

The likelihood that the Farallon mouse eradication would attract raptors to the islands is negligible for several reasons, including:

1) The distance between Hawk Hill and the South Farallon Islands is about 29 miles. Despite this relatively close distance for raptors to fly, long-term monitoring has shown that very few migrant raptors (except for burrowing owls and peregrine falcons) occur at the Farallon Islands. In recent years, less than 10 individuals per year of species besides the burrowing owl and peregrine falcon have been recorded on the Farallones during the month of November, and none of these species are known as scavengers;
2) Previous studies described in the FEIS have shown that the majority of rodents killed in eradication projects die underground and thus are not available to surface predators;
3) While raptors are known for their keen vision, it is not keen enough to spot a dead rodent at distances like those between the islands and the mainland; and
4) Most birds have a poor sense of smell and would not be attracted by the smell of dead mice. While scavenging Turkey Vultures are common along the central California coast and have a more refined sense of smell, they very rarely have flown across the ocean waters to the islands, and it is highly unlikely that they could detect the odors of rodent or other carcasses over the distances required.

For raptors that would be present during the eradication project, the Project mitigation plan includes the capture of raptors present on the islands to either translocate them away from the island or hold them in captivity until the risk of rodenticide exposure is considered to be safe to release them.

- *What's the threat of rodenticide to invertebrates and other species on the islands, including vegetation?*

Some invertebrates such as beetles and crickets likely will feed on the rodent bait, exposing them to the toxicant. However, because of their open circulatory systems, evidence indicates that most invertebrates are not affected by anticoagulant rodenticides, including brodifacoum. Instead of negative impacts, several studies have shown increases in invertebrate populations following rodent eradications. At the Farallones, eradication of mice is expected to result in increasing populations of Farallon camel crickets and other invertebrate populations.

Due to the very low solubility of brodifacoum in water, plant uptake of the rodenticide is unlikely to occur and no impacts to plants are expected. For example, post-application monitoring for the Anacapa Island rat eradication found no brodifacoum residue in plant samples (Howald et al. 2009). Instead, native plants are expected to benefit from the eradication by eliminating plant and seed consumption by mice.

Information on potential impacts to non-target species from rodenticide exposure can be found in Chapter 4 of the FEIS and Sections 9 and 10 of the CD.

<u>Impacts on the Marine Environment</u>

- Won't bait get in the surrounding waters, threatening fish and marine mammals?

The aerial application of bait on the South Farallon Islands has been designed to minimize bait entering the marine environment. However, the Service acknowledges that a small amount of incidental bait drift into the marine environment will occur. Any bait entering the water would break down quickly in the high energy marine environment. That, together with the fact that most fish and invertebrates in waters around the islands would not be expected to consume bait pellets, mean that only small numbers of individuals in the waters immediately surrounding the islands would be exposed to toxicant. Because brodifacoum is mostly insoluble in water, the risk to water quality is negligible. The risk to marine mammals is also negligible since they only feed at sea on fish and invertebrate prey, and would not be expected to consume the bait pellets. Even if they did, the very low concentration of toxicant in the bait pellets, together with the very large size of marine mammals (hundreds of pounds to many tons), mean that hundreds if not thousands of pellets (depending on the size of the animal) would need to be consumed to have any adverse impact, an inconceivable scenario.

For more information on this topic, see Chapter 4 of the FEIS and Sections 9 and 10 of the CD.

- Aren't black abalone (gastropods related to snails) vulnerable? Didn't eradication in the Seychelles cause extinction of snails there?

Most evidence has shown that invertebrates are not adversely affected by anticoagulant rodenticides. While the toxicity and impact of brodifacoum on terrestrial mollusks is debated, there is limited evidence that snails (terrestrial gastropods) can be negatively affected. The report of a snail extinction in the Seychelles (Gerlach 2005) involved a study that found one individual on the island prior to a rat eradication in 1999 and no individuals in 2002 after the eradication. The link of snail extinction to the rat eradication in this study is tenuous but has led to increased awareness and caution when making assumptions about risk to mollusks. Other evidence presented by Parent et al. (2019) more strongly indicates that the risk to snails and other terrestrial mollusks to brodifacoum toxicity is low based on four experimental studies reviewed and their own study.

While the Farallon Project would occur within designated critical habitat for the endangered black abalone (*Haliotis cracherodii*), an endangered intertidal and nearshore subtidal marine gastropod, an extensive survey conducted at the South Farallon Islands in 2015 found no black abalone (Roletto et al. 2015) and none have been detected since then. Even if black abalone were present at the islands, risk of exposure to brodifacoum would be very low because they only occupy habitats below the Mean High Water Spring (MHWS), the lowest extent of baiting on the islands. Nor would the Project cause any changes to black abalone critical habitat. For these reasons, the Project is not likely to adversely affect black abalone or black abalone critical habitat. The Service engaged in consultation with the National Marine Fisheries Service (NMFS) under the Endangered Species Act for this species. NMFS concurred that the Project would not adversely affect this species or its critical habitat.

For more information on these topics, see Chapter 4 of the FEIS and Sections 9 and 10 of the CD.

- Is there a potential threat to Dungeness crab or salmon?

Because of 1) the planned mitigation measures to minimize incidental bait drift into the marine environment, 2) the speed at which the bait pellets will break down in the high energy marine environment surrounding the islands, 3) the fact that salmon are predators, not scavengers, and 4) the low solubility of brodifacoum in water, the risk of toxicant exposure to Dungeness crabs, salmon and other fishery species is low to negligible. In case of an unexpected bait spill in the marine environment, a *Draft Bait Spill Contingency Plan* has been prepared to respond to and minimize impacts to non-target resources.

For more information on these topics, see Chapter 4 of the FEIS and Sections 9 and 10 of the CD.

Impacts to Terrestrial Environment

- If the half-life of the bait in the soil is 120 days, will you continue hazing gulls all that time?

Brodifacoum is recognized to have a half-life of 120 days. The cereal-based pellet containing brodifacoum breaks down much more rapidly - on the order of days to weeks on land, and even more quickly following significant rainfall. The Service estimates that rodent bait will remain available and palatable to wildlife for about 5 weeks following the last bait application, based on typical Farallon weather patterns. Once the bait breaks down it is no longer a threat to gulls and other non-target wildlife. After the bait pellet breaks down, the brodifacoum within the bait will bind to the soil, where it becomes essentially unavailable biologically, until it completely degrades.

Past Eradications

- Weren't bald eagles killed in the Rat Island, Alaska eradication?

Yes, both bald eagles and glaucous-winged gulls suffered mortality following the rodent eradication on Hawadax (formerly called Rat) Island in 2008. A total of 41 eagle carcasses were discovered about one year following the rodenticide operation on the island; snow cover likely played a role in preserving brodifacoum laden carcasses and/or bait that became available to gulls and eagles in the following spring. The total population of bald eagles in Alaska is estimated at 30,000 birds. In 2019, a post- eradication monitoring expedition to Hawadax Island (Zilliacus and Croll 2020) found higher numbers of both bald eagle nests (10 nests in 2019 vs. 6-8 pre-eradication), and glaucous-winged gull nests (19 nests in 2019 vs. 5 pre-eradication) than recorded pre-eradication, showing that short-term negative impacts of the eradication were transient. Furthermore, important responses over a decade post-eradication include significant increases for several terrestrial (gray-crowned rosy finch, Song Sparrow, Pacific Wren, and Snow Bunting) and marine bird species (black oystercatcher, glaucous-winged gull, tufted puffin). Nests of three bird species (song sparrow, tufted puffin, rock sandpiper) not previously recorded as breeding on Hawadax were also observed. Finally, the Hawadax intertidal community switched from a grazing invertebrate-dominated system pre-eradication to an algal-dominated system in 2019, a recovery from the indirect impacts of rats on that community (Kurle et al. 2021). Thus, these studies have demonstrated that adversely impacted non-target species have already recovered from the Hawadax Island eradication, and that the ecosystem as a whole has already started its recovery from the long-term impacts of rats.

- Wasn't there a 942-day fishing ban in the aftermath of the Wake Island operation in the Pacific?

Based on information the Service was able to gather, a **lagoon** fish consumption ban was established on Wake Atoll in 2002 in response to contaminants in the water, unrelated to any eradication effort. This ban was still in effect ten years later during a rat eradication operation in 2012. Six months following the eradication operation, ecotoxicology analysis detected brodifacoum in five (one Papio and four Blacktailed snapper) out of 48 fish samples collected in the lagoon (summarized in Siers et al. 2016). Based on information the Service was able to gather, the U.S. Air Force utilized a precautionary approach based on the expected half-life of brodifacoum and the lack of clear guidelines on safe levels of brodifacoum for human consumption and potential cumulative effects from human consumption. It resulted resulted in the recommendation of a 942 days consumption ban after the last application of brodifacoum baits on the island. It is noteworthy that the fishing ban was restricted to lagoon fish and there was no detection of brodifacoum in fish samples from the open ocean. In 2015, three years after the eradication, sampling found two out of 69 fish to have detectable but below quantifiable levels of brodifacoum in liver tissues (which are usually not consumed by humans). Both fish were Blacktail snappers from an intermittently land-locked pond in an area of the island that had been heavily baited (Siers et al. 2016).

Conditions at Wake Atoll are very different from the South Farallon Islands. With interior atoll lagoons which dramatically increase shoreline baiting area, risk of bait drift into the marine environment is greater than at temperate islands like the Farallones. Also, lagoons lack the high energy wave environment of the Farallones, so baits likely break down more slowly and remain available for fish consumption longer. For these reasons, it is highly unlikely that a situation like that at Wake Atoll would occur in the Farallon mouse eradication project.

Furthermore, as described above in response to the question about potential impacts to human health from the Farallon Project, human health risks are negligible from the Project. Very large quantities of seafood (hundreds of pounds) contaminated with low (ppb) concentrations of brodifacoum would need to be consumed by a human to elicit adverse health effects (WHO 1996).

- Weren't there reported fish kills during the Lehua, Hawaii eradication?

In a rat eradication project on Lehua Island, Hawaii in 2017, a total of 45 dead mullet-like fish were collected from a tide pool after the third application of the rodent bait DITRAC-50 (Diphacinone), in response to a social media post. All fish were collected for analysis and found to be degraded to the point where they could not be identified. The only sample that tested positive for Diphacinone could not be ruled out as a potential contamination from contact with pellets in the water (vs. consumption). Despite passive and active carcass searches, no other fish were found dead following the Lehua operation, except for two fish caught and released by the monitoring team and later found dead near the site of release. Of the 29 fish collected for diphacinone residue analysis two weeks after the last bait application, only two (a blacktail snapper and a bluestripe snapper) had detectable diphacinone residues in liver, only (Siers et al. 2018).

Die-offs of fish in tidepools in the Lehua and nearby Niihau islands are not uncommon, and a definitive origin and cause of death for the mullet-like fish could not be determined (P. Chee, personal communication).

Operational & Contingency Plans

- What's the threshold of non-target take that would trigger early removal of bait?

Various thresholds for non-target impacts, or potential non-target impacts, and lists of potential response actions were established in the *Draft Non-target Contingency Plan* which is provided as Appendix G to the CD.

- Would you use more bait later if 100% of the mice are not eradicated?

As described in Section 8 (Operational Monitoring) of the CD, following instructions on the Brodifacoum-25D Conservation bait label, additional, localized treatments may be implemented if small numbers of mice were detected after the period at which mouse activity would no longer be expected. Bait broadcast under these circumstances would be localized, and focused on areas where mice continue to be found. These measures would only be employed to target a small number of mice that, if not removed, could jeopardize the success of the eradication. How long to continue baiting if mouse detections continued would be determined based on the estimated numbers present, estimates of probability of success, and potential non-target impacts from continued baiting.

- Why are you recommending temporary closure of shark-diving during the operation?

As per Consistency Determination section 10, Article 3: as a safety precaution, the Service likely will request that the California Department of Fish & Wildlife implement a vessel closure in the area immediately surrounding the South Farallon Islands (within approximately 0.5 miles) during the days of aerial bait application. This closure is expected to range from two to four days, depending on weather and other operational factors. These closures are recommended in an abundance of caution and mostly in recognition of the complexity of the aerial operations and a desire not to have any potential interference from vessels that are not part of the Project. They would be a minor short-term inconvenience to the few recreational boaters that visit these waters during the late fall.

- Will there be third-party review of the Operational Plan, as EPA recommended?

A *Draft Operational Plan* has been developed and is included as Appendix D to the CD for review by the Commission. If the Service's Record of Decision chooses the Preferred Alternative (Alternative B) identified in the FEIS, this Draft Plan will be updated to incorporate input from the implementation team and from consultations with the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA/APHIS), U.S. Environmental Protection Agency (EPA), and other relevant regulatory agencies. The Draft Plan will be finalized prior to Project implementation.

<u>Follow-up and Monitoring</u>

- What if dead or dying gulls appear on local beaches?

Public notifications made prior to and during Project implementation will provide instructions for members of the public should they find sick or dead gulls or other birds on mainland beaches or elsewhere in and near the San Francisco Bay Area. In addition, the Project's *Draft Mitigation and Monitoring Plan* calls for regular, standardized surveys of mainland Gulf of the Farallones beaches to search for dead birds that could have been exposed to rodenticide. Surveys would be conducted following standardized protocols of the Greater Farallones National Marine Sanctuary's Beach Watch program and would include collection of carcasses. Recorded mortality during the implementation period would be compared to long-term baseline values to determine if numbers of beached birds were significantly above average. If island and/or mainland monitoring indicates unanticipated mortality of any non-target species (including gulls) that could result in significant impacts following the first bait application, a management decision on whether to proceed with subsequent bait applications would be made in accordance with protocols adopted in the *Non-target Contingency Plan.* (Appendix G to the CD) Depending on conditions, contingency responses may include additional monitoring of mainland areas and collection or capture of affected birds, modifying gull hazing methods, delaying the second bait application, manual removal of bait pellets, or cancelation of the second bait application.

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APPENDIX 2

Alternatives Selection Process Report

For the Farallon House Mouse Eradication DEIS

U.S. Department of the Interior
Fish and Wildlife Service

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Executive Summary

This report summarizes the process used to select action alternatives to be developed and analyzed in a draft Environmental Impact Statement (EIS) to eradicate invasive house mice from the South Farallon Islands, which are part of the Farallon National Wildlife Refuge, California. Home to more than 300,000 breeding seabirds, the Farallon National Wildlife Refuge supports the largest seabird colony in the contiguous United States, as well as important populations of marine mammals, the endemic Farallon arboreal salamander (*Aneides lugubris farallonensis*),the endemic Farallon camel cricket (*Farallonophilus cavernicolas*), and a unique plant community. House mice were inadvertently introduced to these islands in the nineteenth century by early human occupants.

Invasive house mice are directly and indirectly negatively impacting the native biological resources of the South Farallon Islands. Of particular concern is the rare ashy storm-petrel (*Oceanodroma homochroa*). This small and rare seabird species is nearly endemic to coastal California, with about half of the world population breeding on the Farallones (Carter et al. 2008). One of the major factors affecting the Farallon ashy storm-petrel population is high predation rates from wintering burrowing owls (*Athene cunicularia*; Nur et al. 2012). These owls arrive on the island as fall migrants who remain and persist into the winter on a diet primarily of invasive house mice. The cyclic house mouse population peaks in the fall when owls arrive, with densities as high as 1,200 mice per hectare, one of the highest recorded rodent densities on any island. After the mouse population crashes in early winter, the owls switch to alternative prey to survive, killing hundreds of storm-petrels each year. Based largely on impacts of invasive rodents on other islands, it is believed that invasive house mice are impacting other parts of the Farallones' native ecosystem, including the endemic salamander, invertebrates including the endemic cricket, and plant communities. The U.S. Fish and Wildlife Service (Service) has identified mouse eradication as a critical step toward reducing the impacts of mice and restoring the island's ecosystem (USFWS 2009).

In 2011, the Service began the process of preparing an Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act to assess the most appropriate action alternatives for eradicating invasive house mice from the South Farallon Islands. To decide which action alternatives to include in the Draft EIS, the Service utilized a Structured Decision Making (SDM) approach known as the Alternatives Selection Process. This report documents the findings of that process and describes the decision-making structure and resources that the Service relied upon to assess and compare potential alternatives. The methods analyzed were gleaned from public and agency comments received during an extended public scoping period, as well as from a thorough review of past mouse and similar and more numerous rat eradication efforts world-wide.

In total, forty-nine mouse removal methods were assessed including mechanical, theoretical, and chemical methods with three different delivery techniques. The methods analyzed were first assessed to determine if they met the Minimum Operational Criteria, which required that each method:

a) Be consistent with select Service management and policy guidelines;

b) Be feasible to implement; and

c) Meet human safety and logistical guidelines.

A second parallel analysis scored and ranked each potential method for likely environmental impacts to the islands resources and operational considerations associated with implementing the method at the Farallon Islands. The scoring and ranking of methods was done within a series of matrices to provide a quantitative comparative analysis of potential alternatives. This approach was intended to allow decision makers to compare the potential environmental impacts and operational consideration of each method on island resources in a quantifiable manner. Each method was analyzed for its potential impact to island resources (biological, physical, and social), its availability for use, and its potential for successfully eradicating mice from the South Farallon Islands. Thirty-five attributes in total were scored and analyzed for each method.

Based on the information reviewed, assessed, and scored the Service selected two action alternatives to be developed and analyzed in the draft EIS:

1) Aerial broadcast of the rodenticide brodifacoum as the primary technique; and

2) Aerial broadcast of the rodenticide diphacinone as the primary technique.

These two methods met all of the Minimum Operational Criteria and ranked among the top ten methods within the matrix analysis. The two alternatives include the only products legally available and registered for island rodent eradication use in the United States: Diphacinone 50–Conservation and Brodifacoum 25-Conservation. The assessments and conclusions reached in this report were thoroughly researched, discussed and reviewed by a wide range of experts, and are based on the best scientific information currently available.

Table of Contents

1 Introduction

1.1 Description of the Problem

The Farallon Islands, or Farallones, within the Farallon National Wildlife Refuge (Refuge), are home to more than 300,000 breeding seabirds, with over 200,000 of them on the South Farallon Islands. These islands support the largest seabird breeding colony in the contiguous United States. Located offshore of the central California coast within the productive California Current Upwelling System, this unique ecosystem supports important populations of a variety of other species as well. There are five species of breeding pinnipeds including the threatened Steller sea lion (*Eumatopias jubata*), the endemic Farallon arboreal salamander (*Aneides lugubris farallonensis*), several species of terrestrial invertebrates including the endemic Farallon camel cricket (*Farallonophilus cavernicolus*), nesting Peregrine Falcons (*Falco peregrinus*), over 400 species of migrant birds, and a diverse intertidal plant and invertebrate community. The unique terrestrial plant community is dominated by the native, annual, maritime goldfield (*Lasthenia maritima*), a species endemic to seabird nesting islands along the California and Oregon coasts.

The Refuge was established by President Theodore Roosevelt in 1909 under Executive Order 1043 as a preserve and breeding ground for marine birds. In 1969 the Refuge was expanded to include the South Farallon Islands, the largest islands of the Farallon group. Because of their size and diversity of habitats, these islands historically held the largest and most diverse populations of wildlife and plants. However, the South Farallones have been impacted dramatically by human use since the early 19th century (White 1995). Since its inclusion in the Farallon National Wildlife Refuge, the U.S. Fish and Wildlife Service (Service), along with its partners PRBO Conservation Science and others, have been working to protect and restore the islands' habitats and native wildlife and plant communities.

House mice (*Mus musculus)* were inadvertently introduced to the South Farallon Islands in the 19th century by early human visitors. Typical of island ecosystems worldwide where this or similar species have been introduced, house mice have both direct and indirect negative impacts on the native biological resources of the South Farallones. Following an annual cycle of abundance, the Farallon mouse population peaks in the fall months when densities have been measured at over 1,200 mice per hectare (3,000 per acre), one of the highest densities ever recorded for the species (MacKay 2011). As part of the efforts to restore the native ecosystems of the islands, in the mid-2000s the Service began investigating the possibility of eradicating the invasive house mice) from the South Farallon Islands. In 2009, the Service published the Farallon National Wildlife Refuge Final Comprehensive Conservation Plan and Environmental Assessment (CCP; USFWS 2009), which provided guidelines and goals for managing the islands over the next 15 years. The CCP described eradication of invasive house mice as one of those goals.

After several years of research, field trials, and planning the Service decided in early 2011 to prepare an Environmental Impact Statement (EIS) in compliance with the National Environmental Policy Act (NEPA) of 1969 as a means of analyzing the potential impacts to the affected environment from the chosen range of alternatives. In order to move forward with the eradication of mice from the Farallon Islands, the Service must consider the environmental impacts of the actions proposed in compliance with NEPA. Specifically, federal agencies must consider the environmental impacts of a reasonable range of alternatives for implementing an action, and make the public aware of the environmental impacts of each of the action alternatives presented.

The Service released a public Notice of Intent (NOI) to prepare the EIS and initiated a Public Scoping period in April 2011. After reviewing comments from both the general public and other agencies, the Service concluded that a broad range of alternatives needed to be considered and initially assessed in a thorough and transparent manner to assist the Service in deciding which action alternatives to fully analyze in the draft EIS. A variety of mechanical and chemical methods have been used or potentially could be used for mouse removal. Our goal was to assess those methods for their potential to eradicate mice from the islands as well as their potential impacts on the affected environment. This report and decision tool documents the process that the Service and its partners used to analyze and review potential mouse removal methods for inclusion in the Draft EIS as action alternatives.

1.2 Objectives

1. Identify a reasonable range of alternatives that meet the Purpose and Need for action based on input from project scoping (and in conformance with 40 CFR 1502.14 & 43 CFR 46.415).

2. Explore and assess each alternative to be considered according to a set of established *Minimum Operational Criteria, Environmental Concerns, and Operational Considerations*.

   a. Rigorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated (§1502.14(a)).

   b. Use the NEPA process to identify and assess the reasonable alternatives to proposed actions that will avoid or minimize the adverse effects of these actions on the quality of the human environment (§1502(e)).

   c. The range of alternatives discussed in Environmental Impact Statements shall encompass those to be considered by the ultimate agency decision-maker (§1505.1(e), §1502.2(e)).

3. Systematically accept or dismiss alternatives from further consideration for development in the Draft EIS based on whether they meet the *Minimum Operational Criteria* for success.

4. Objectively assess the applicability of non-target species mitigation measures to remaining alternatives to inform which alternatives will be developed as Action Alternatives in the Draft EIS for the Farallon Mouse Eradication project.

5. Fully document the Alternatives Selection Process and the rationale used to select alternatives based on the *Minimum Operational Criteria, Environmental Concerns,* and *Operational Considerations.*

2 Methods

The Alternatives Selection Process is a quantitative decision tool that utilizes available data and the expertise of eradication and island resource specialists to systematically and objectively analyze and compare potential action alternatives to include in the Draft EIS. The methods analyzed within this tool were included if they had the potential to meet the Service's management goal of protecting and restoring the ecosystem of the Farallones, particularly seabirds and other native biological resources, by eradicating non-native house mice and eliminating their negative impacts on the island ecosystem. In addition, potential alternatives were considered based on comments received during the NEPA scoping process, as well as potential alternatives that have had some history of use in rodent eradication or control operations throughout the world.

In total, 49 methods were analyzed: 6 non-rodenticide methods including trapping and immunocontraception, as well as 15 rodenticides with up to three different application methods. While a combination of methods is probable for any of the proposed action alternatives, this preliminary analysis only assessed the primary methods that would be used if implemented. In an effort to minimize the amount of uncertainty within the model, the analyses did not assess the myriad of possible combinations of methods available. Furthermore, this model is not intended to provide a full scale impacts analysis of all 49 methods; rather it is intended to allow decision makers to compare the potential impacts of each method to island resources, identify trade-offs between methods, and determine which methods have the greatest potential to effectively eradicate mice from the Farallon Islands. A full impacts analysis will be conducted for all action alternatives included in the EIS.

Every method was first filtered to establish a subset of potential alternatives that would meet the Minimum Operational Criteria. The Minimum Operational Criteria Checklist is a coarse filter that provided a framework for eliminating methods that were either unsafe for personnel, logistically or technically infeasible (timing and availability), or contrasted with the Service's guidelines for management of the Refuge. Additionally, each method was then scored for its potential impact to island resources (biological, physical and social), its availability for use and its potential for successfully eradicating mice from the Farallon Islands. The scores allowed for easy comparison of the potential alternatives to better understand the relationship between various operational considerations and environmental concerns.

2.1 Model Approach

The process of selecting a reasonable range of methods to fully analyze as action alternatives in an EIS typically does not require a comparative analysis of methods; however, the Service felt that the best way to address the comments and concerns of stakeholders, permitting agencies, and

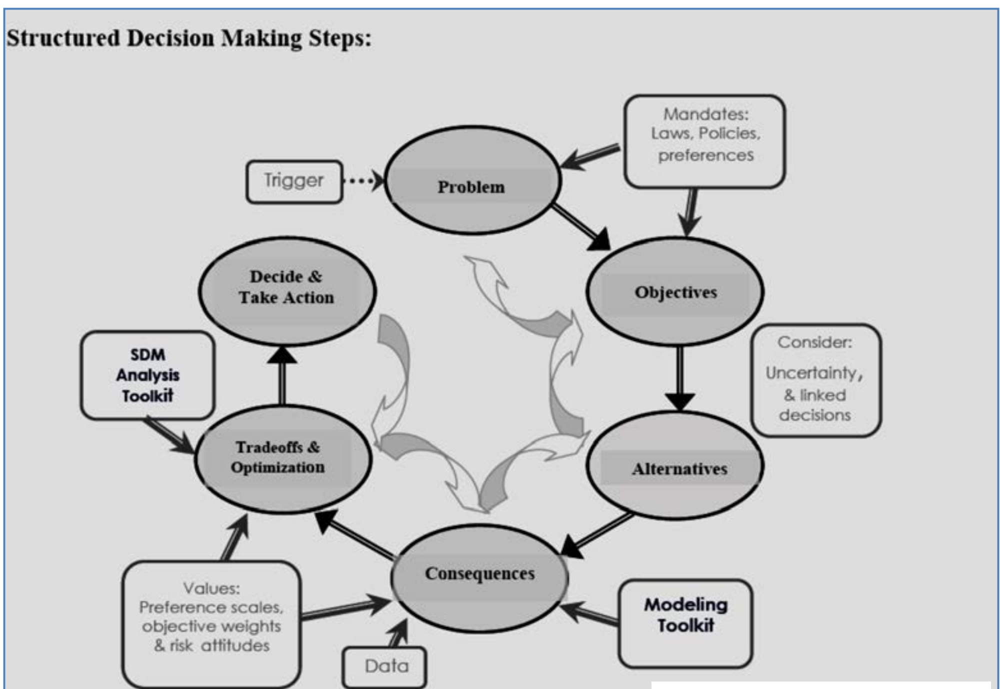

Figure 1: FWS 2008 Fact Sheet

the public was through the development of a comprehensive, multi-attribute, uncertainty model that analyzed a wide array of potential alternatives in a transparent and impartial manner (Figure 1).

The Service employed a modified Structured Decision Making (SDM) approach, which is a general term describing an organized problem oriented approach to decision making that is focused on achieving a specific goal. Structured Decision Making is rooted in decision theory and risk analysis that integrates science and policy explicitly (FWS 2008). Additionally, the Service has regularly utilized this tool over the last 20 years for endangered species management, developing Comprehensive Conservation Plans and Habitat Management Plans, as well as numerous other applications. The steps to SDM begin with: 1) defining the problem; 2) identifying management objectives; 3) identifying alternatives to choose from; 4) identifying the consequences of different alternatives; 5) identifying tradeoffs between multiple objectives; 6) explicitly identifying the uncertainties within the model; 7) identifying the risk tolerance (the level of acceptable risk) of the decision makers; and finally 8) making an informed decision (FWS 2008).

SDM provides a framework for decision makers to balance the biological or environmental goals of a project with societal objectives such as social justice, economic benefits, or health and safety. Moreover, SDM is designed to allow risk managers to make decisions in the presence of substantial biological uncertainty by adopting the Precautionary Principle. The Precautionary Principle states that “lack of full scientific certainty should not be used as a reason for postponing cost-effective measures to prevent environmental degradation” (1992 UN Rio Declaration – Agenda 21). Precautionary approaches to natural resources management are intended to highlight the gap between scientifically supported data with the need for decision makers to present defensible rationale for their choices (Gregory and Long 2009). Tools like SDM allow decision makers to assess and aggregate multiple objectives in an effort to identify tradeoffs between objectives and impacts to resources. Aggregation and integration of several factors across multiple metrics is the preferred method of analysis despite the debate around the strengths and limitations of this technique between scientists and decision makers (Bell et al. 2001 and Ohlson et al. 2005).

Selecting action alternatives for mouse eradication on the Farallon Islands is an ideal scenario for utilizing SDM and multi-attribute analysis. This is due to the fact that decisions about the management of invasive species encompass attributes that are typically addressed by multi-attribute decision analysis given that the outcomes of management activities are uncertain, there are multiple, conflicting objectives, and there are many stakeholders with differing and often opposing viewpoints (Maguire 2004). Furthermore, SDM decision analysis can provide insights into important elements of the project to remove mice from the Farallones that are typically neglected in ecological analyses due to a lack of available data. SDM explicitly provides a quantitative and conceptual framework around the problem in an effort to help decision makers use scientific data and frame the problem in a manner that will aid in the decision making process. The overall intent of this type of modeling is to document the key exposure pathways and the resources that are sensitive to change, not to provide an impacts analysis for each method assessed.

The Alternatives Selection Model was built to identify the range of alternatives that will be included in the draft EIS by utilizing a combined matrix method (consequence table) and expert modeling approach. Matrix modeling and expert judgment are often used in concert to evaluate the potential impacts of a given method that clearly projects the expected outcomes (Ohlson 2005). The knowledge and experience of experts can typically be valuable at documenting the most important system vulnerabilities, as well as to project the outcomes of an action in the face of uncertainty (See Appendix B for Expert Bios). The value of utilizing a matrix method of analysis is that it efficiently summarizes the trade-offs that may exist across strategies or across objectives, prioritizes methods, and allows decision makers to select methods based on the personal values and risk tolerances of the given decision maker (Ohlson 2005).

In order to assess the multitude of possible methods available for mouse eradication, we developed a course filter (Minimum Operational Criteria) that would identify the methods that met human safety standards, are logistically feasible to implement, and comply with the Service's refuge and resource management guidelines. In addition, we then scored each method through a set of matrices (Environmental Concerns Matrix, Operational Considerations Matrix, and Combined Matrix) for its potential impacts to island resources and its potential for successfully eradicating mice from the Farallones. Together, the Minimum Operational Criteria and the set of matrices identified the methods of eradication that are most likely to meet the Services objective of eradicating mice from the Farallones, while minimizing impacts to the islands' and nearby ocean's resources.

The following is the list of products that were developed to evaluate and rank the potential alternatives in a manner that identified tradeoffs, managed uncertainties, and were transparent and easy to understand (See Appendix A for Products 1-6 and accompanying CD for Products 7-12).

List of Products Developed for the Alternatives Selection Model:

1. **List of Minimum Operational Criteria**
2. **List of Operational Tools and Methods**
3. **List of Important Operational Considerations, Environmental Concerns, and Potential Mitigation Measures** to evaluate in Matrices
4. **An Analysis of Mouse Control vs. Eradication**
5. **Comparison of Mouse and Rat Ecology**
6. **Conceptual Model of the Alternative Selection Process** scores methods for:
7. **Minimum Operational Criteria Checklist** assesses each method as a course filter
8. **Matrices evaluating the Methods for Environmental Concerns**
    a. *Biological Resources Worksheet* (Short Term Negative Impacts)
    b. *Overall Environmental Concerns Matrix*
9. **Operational Considerations Matrix** scores methods
10. **Combined Matrix** that combines scores from the *Overall Environmental Concerns Matrix* and the *Operational Considerations Matrix*
11. **Mitigation Matrix** that includes a subset of potential alternatives that meet the Minimum Operational Criteria and are evaluated for mitigation potential
12. **Potential Alternatives List** with a described outcome from the Alternatives Selection Process

2.2 Potential Alternatives

Forty-nine potential alternatives were analyzed within the alternatives selection decision tool. The following is a brief description of how each potential alternative is likely to be implemented if chosen for full analysis in the Draft EIS.

2.2.1 Non-Rodenticide Methods

Live Trapping –This would involve the setting and checking of live-traps across all parts of the South Farallon Islands, and removing all captured mice from the traps. The captured mice would likely be euthanized humanely on site and incinerated for human and environmental health reasons. This technique would involve accessing on foot all portions of all islands and conducting daily trapping efforts repeatedly for months or, more likely, years. If traps were placed every 10 meters, approximately 5,000 traps would be necessary to cover the islands (49 ha). Traps would need to be checked, re-baited, reset, and mice removed daily. If each person checked and baited up to 100 traps per day, at least 50 personnel on foot would be required to check the 5,000 traps daily. Given the steep and rugged terrain of much of the Farallon Islands, actual time or personnel needed would be significantly greater especially when mice are at cyclic high numbers. Some areas are not safely accessible on foot. Most likely potential impacts to non-target resources from the application method include destruction of habitat from frequent trampling, frequent and long-term disturbance to marine mammal haul-outs and breeding areas, and frequent and long-term disturbance to seabird breeding areas. The latter two would likely result in large-scale loss of the annual productivity of many Farallon species, including abandonment of certain areas. This method is most frequently used as a non-lethal research tool and has no record of success in an island rodent eradication.

Snap Trapping –This method would likely involve much of the same personnel effort as the live-trapping technique above, although the mice would already be dead when captured so would not need to be euthanized. Over 5,000 traps would be required with traps placed at 10 m spacing. Traps may need to be checked daily for weeks, or, more likely, years. If each person checked, removed, re-baited, and reset 100 traps per day, 50 personnel on foot would be required to check the 5,000 traps daily. Given the steep and rugged terrain of much of the Farallon Islands, actual time or personnel needed would be significantly greater especially when mice are at cyclic high numbers. Some areas are not safely accessible on foot. Most likely potential impacts to non-target island resources from the application method include destruction of habitat from frequent trampling, frequent and long-term disturbance to marine mammal haul-outs and breeding areas, and frequent and long-term disturbance to seabird breeding areas. The latter two would likely result in large-scale loss of the annual productivity of many Farallon species, including abandonment of certain areas. This method is most used for rodent control on a very local level and has no record of success in an island rodent eradication.

Non-native Predator introduction – This technique would involve the introduction of an unknown number of non-native predators (such as cats or snakes) that are known to prey on rodents in the hope that they would prey on and kill every mouse on the islands. This method may provide some means of partial control of mouse numbers on the Farallones. But its use has never been documented in an eradication setting and it is highly unlikely to fully eradicate mice from the islands. Also, there is a high risk of major impacts to native wildlife on the islands from introduced predators, as well as a high risk of such an introduced predator becoming naturalized on the islands.

2.2.2 Theoretical Methods (not yet developed or ready for field testing)

Immunocontraception – This technique utilizes a form of mammalian birth control delivered aerially in a food pellet that would theoretically inhibit conception and reproduction of mice. While research is being conducted into control efforts for rats using this technology, no registered product exists in the U.S. for any rodent in a deliverable or permitted format, and none of the methods currently being tested are expected to be available or registered for mouse eradication on islands, or any other purposes, in the near future. Since mice live up to 18 months or more before they die naturally of old age, this product likely would have to be delivered to every mouse on the island for at least two years to have a chance at eradication of all the mice. Bait would likely need to be continually delivered periodically for many months or years.

Disease -Like immunocontraception, the technique of introducing a fatal disease that would kill only mice has been researched for decades, but no product or process is currently available to field test for eradication. Theoretically, if developed in the future, this technique might involve aerially introducing infected mice or food dosed with some infectious agent that could kill mice. A number of exposure attempts would likely be necessary during different portions of the island and throughout the year, possibly over years.

Genetic Engineering –Another theoretical technique, that if developed would likely involve multiple releases on the islands of genetically modified house mice that might cause the eradication of mice by producing a sex-bias (daughterless method) so severe that mouse reproduction might eventually cease. Some lab and small field trial work on mosquitoes suggests that this might be a possibility for mouse control in the future, but this technique is at least 5-10 years away, if ever, from being ready for any practical field use for eradication.

2.2.3 Rodenticide Methods

A variety of chemicals have been developed to kill rodents. These chemical rodenticides are typically delivered in an ingestible form such as a bait pellet made up largely of grain materials. Table 1 summarizes the recognized classifications and subclassifications of rodenticides and the products assessed. The different classes vary in their physical means of inducing mortality, time to induce mortality, effectiveness at causing mortality, and effects on non-target species, soil and water. Most have been developed and used as rodent control agents, mainly for rats (*Rattus* spp.). A small number have been used for island rat or mouse eradications. Two products have been most widely and successfully used for rodent eradications: brodifacoum and diphacinone. These same two are the only products registered in the U.S. for island eradication purposes. Others may be legal or illegal for use for other purposes.

Table 1. List of rodenticides assessed in this report, including classification and description.

Classification	Sub classification	Description	Products assessed
Nontoxic		A highly soluble and biodegradable cellulose maize product that blocks the digestive system of rodents, without impacting other mammals or birds. It causes rodent death by dehydration, blood thickening, and circulatory collapse. It requires multiple feedings for 4-7 days, of at least 10-15 grams per mouse, and can only be applied through a bait station operation. This technique has never been trialed or used in an eradication setting.	Eradibait
Acute		A rodenticide that acts rapidly and causes death shortly after ingestion.	Zinc phosphide, Bromethalin, 1080 (Sodium fluoroacetate), Strychnine
Subacute		A rodenticide that causes death between 24 and 48 hours after ingestion.	Cholecalciferol
Chronic	1st generation anticoagulant	A rodenticide that prevents coagulation (clotting) of the blood and requires multiple doses to induce mortality. It takes at least 48 to 72 hours for the anticoagulant effect to develop.	Diphacinone, Warfarin, Chlorophacinone, Pindone, Coumatetralyl
	2nd generation anticoagulant	A rodenticide that prevents coagulation (clotting) of the blood and may require just a single dose to induce mortality. It takes at least 48 to 72 hours for the anticoagulant effect to develop.	Brodifacoum, Bromadiolone, Difethialone, Flocoumafen

- *Available Broadcast Methods:*

Aerial Broadcast: This approach involves the use of a sophisticated helicopter delivery system that utilizes a custom designed and calibrated agricultural hopper with Digital GPS mapping electronics. The hopper allows practitioners to spread bait at designated rates over the entire island in a systematic way. Aerial broadcast is effective at quickly spreading bait over large areas, including areas not accessible on foot. One treatment can be accomplished on the Farallones in a few hours. Two treatments separated by a week or two are usually conducted when using second generation anticoagulants, acute toxicants, and subacute toxicants. Three or more treatments may be necessary if using first generation anticoagulants since they require multiple feeds to cause a lethal response to target individuals, more bait is needed to successfully eradicate every mouse, and mice need to be exposed to the toxicant for 2 to 3 weeks at minimum. For this method, it was assumed that implementation would be conducted during the fall months when impacts to Farallon breeding birds and marine mammals would be minimized. Thus, the most likely potential impacts to non-target resources from the application method include short-term disturbance to marine mammal haul-outs and seabird roosting areas, and mortality of non-target species from both primary and secondary consumption of rodenticide.

Hand Broadcast: This method would require broadcasting bait by hand over the entirety of the islands on foot. Bait would be spread using over 5,000 designated baiting points spaced 10 m apart.). Given the steep and rugged terrain of much of the Farallon Islands, in order to complete one treatment on 50 ha, 50-100 people might be needed to allow for the marking of each bait point and to execute the simultaneous baiting of all 5,000 points on all islands in one to two days. Some areas are not safely accessible on foot and thus could not be baited. Two applications would be required for second generation anticoagulants, acute toxicants, and subacute toxicants, whereas 3 or more applications may be required for first generation anticoagulants. For this method, it was assumed that implementation would be conducted during the fall months when impacts to Farallon breeding birds and marine mammals would be minimized. Thus, the most likely potential impacts to non-target resources from the application method include potential destruction of habitat from trampling, short-term disturbance to marine mammal haul-outs and seabird roost sites, and mortality of non-target species from both primary and secondary consumption of rodenticide.

<u>Bait Station:</u> Bait stations are box-like enclosures with small entryways designed to be attractive to rodents, but difficult to navigate for other species such as birds. Bait station methods involve securing bait stations in a manner that will enable them to hold and deliver rodenticides or other bait delivered products, including disease and immunocontraception, to every mouse on the island. Bait station operations are typically left in place for several months, and up to two years to ensure 100% delivery to all mice. Approximately 5,000 bait stations would be required and secured at 10 m spacing to cover the entire island, and would need to be checked every other day for several weeks, then potentially less frequently for several months and for as long as two years or more. A crew of approximately 10 -15 people would be needed for at least 20 days on island to construct, transport and install (secure) the 5,000 bait stations, assuming a rate of up to 50 bait stations installed per person per day. Approximately 100 people would be needed to fill all 5,000 bait stations the first day, as one person can fill one bait station every 10 minutes (= 6/hour x 8 hours = 48-50/day/person). Given the steep and rugged terrain of much of the Farallon Islands, approximately 50-100 people likely would be required to check and refill each of the 5,000 stations every other day for several weeks or months; and 15-20 people would be needed to check and refill the stations once per week for several months or years.   Some areas are not safely accessible on foot and thus could not be baited. Most likely potential impacts to non-target resources from the application method include destruction of habitat from frequent trampling, frequent and long-term disturbance to marine mammal haul-outs and breeding areas, frequent and long-term disturbance to seabird breeding areas, and mortality of non-target species mainly from secondary consumption of rodenticide. The latter two would likely result in large-scale loss of the annual productivity of many Farallon species, including abandonment of certain areas.

2.3 Steps to Developing the Alternative Selection Model

The steps taken to develop the Alternatives Selection Model are illustrated below and are meant to describe the process used to produce all of the matrices and Minimum Operational Criteria for the model, as well as identify trade-offs and assess the risk tolerance of the Service and its partners.

- **Develop a matrix that can be used to determine if a potential alternative meets the Minimum Operational Criteria**
    - **A.** Evaluate each method to determine if it meets all of the Minimum Operational Criteria
    - **B.** Provide a justification for dismissing an alternative that does not meet the Minimum Operational Criteria

- **Describe the difference between control and eradication operations**

- **Describe the differences between mouse and rat ecology**
    - **A.** Information about rats (*Rattus* spp.) and rat eradications that can be used to inform the planning of a mouse eradication, and how mice are different from rats.

- **Develop a conceptual model illustrating the Alternatives Selection Process**
    - **A.** The conceptual model should provide a visual representation of the modeling process.

- **Develop matrices (Biological Resources Worksheet and Overall Environmental Concerns) that evaluate the potential alternatives for Environmental Concerns**
    - **A.** Identify all major environmental concerns for use within the matrix.
    - **B.** Develop matrices for short-term negative impacts to individuals of each species or group of species.
    - **C.** Determine how each environmental concern will be evaluated and scored within the matrix,
    - **D.** Score and total each method for environmental concerns.

- **Develop a matrix that evaluates the alternatives for Operational Considerations**
    - **A.** Identify all of the operational issues for use within the matrix.
    - **B.** Score and total each method for operational considerations.

- **Develop a combined matrix that includes the potential alternatives that meet the Minimum Operational Criteria**
    - **A.** Combine scores from the Overall Environmental Concerns Matrix and the Operational Consideration Matrix to determine the overall score for each method.
    - **B.** Rank the scores in order from smallest to largest to identify the methods that are likely to have the greatest likelihood of successfully eradicating mice from the islands combined with the least impact on island resources .

- **Develop a mitigation matrix that includes the potential alternatives that meet the Minimum Operational Criteria**
    - **A.** Determine the amount of relief (score) each mitigation measure will have on the overall impact to the Environmental Concerns and Operational Considerations.
    - **B.** Combine scores from the Operational Considerations Matrix and Mitigated Environmental Concerns to determine the Total Mitigated Score of the alternative.

- **Develop a ranked list of potential alternatives that meet the Minimum Operational Criteria and determine which of the potential alternatives will be dismissed or considered and evaluated fully within the EIS**
    - **A.** FWS and its partners will determine which alternatives from the list will be developed in the EIS based on the results of the model, the identified trade-offs, and their tolerance for risk.

2.4 Scoring

Each method was scored for a suite of potential impacts and operational considerations using a range from zero to three. The lower the score the less impactful the method was projected to be to island resources, or the more likely the method was expected to satisfy the operational considerations. The scoring was a relative comparison of the methods evaluated in this analysis and was not intended to be used for comparison with other methodologies not assessed herein. This approach allowed us to compare the potential impacts and operational capacity of each alternative in light of uncertainties associated with these methods and their potential to successfully eradicate mice from the Farallon Islands in a manner that imparts the minimum impact to non-target species. The scoring system that was used for each matrix is explained in greater detail within the following discussion. Where data gaps were present, scores were determined by utilizing known information for similar methods. For example, a rodenticide was scored similarly to related rodenticides if information was lacking on its impact to island resources.

2.4.1 Environmental Concerns Matrix (Products 8a and 8b)

The Environmental Concerns Matrix was split into the Biological Resources Worksheet, which compared the impacts of the potential alternatives on biological resources, and the Overall Environmental Concerns Matrix, which includes impacts to all of the affected environment's resources including physical, social, and biological.

Biological Resources Worksheet *(Product 8a)*

The Biological Resources Worksheet analyzes the likely expected short-term impacts to one individual for each of the biological resources on the Farallon Islands for Toxicant hazard (T), Disturbance risk (D), and Habitat alteration risk (H). A score of zero indicates that the impact to the resource is expected to be negligible. A score of one indicates that the impact to the resource is expected to be relatively low. A score of two indicates that the impact to the resource is expected to be relatively moderate, and a score of three indicates that the impact to the resource is expected to be relatively high. Scores were not meant to be absolute impact assessments, but to be categorical scores relative to the other methods assessed. Scores were added together for all of the biological resources to obtain a total score. The total score was then incorporated into the Overall Environmental Concerns matrix to obtain the overall score for the environmental concerns for each potential alternative. Table 2 illustrates the scoring methodology for biological resources. Toxicant hazard refers to potential for an individual to be exposed to lethal doses of toxicant (for potential alternatives using rodenticides). This takes into account both a species susceptibility to toxicant effects, as well as its potential to consume the toxicant. Disturbance risk refers to the individual's potential to be impacted by implementation activities. Examples of disturbance impacts include animals moving from breeding, resting or foraging areas, being trampled, or abandoning breeding sites. Habitat alteration risks refers to an individual's susceptibility to likely habitat changes resulting from implementation activities, such as trampling of vegetation, dislodging rocks, or placement of materials such as traps or bait stations. In the case of introduced plants, extensive ground-based operations will likely lead to spread of invasive plant seeds, which attach to personnel shoes and clothing; this is another type of habitat alteration.

Table 2 – Scoring Methodology for Biological Resources

	Toxicant Hazard (Exposure + Toxicity)	Disturbance Risk	Habitat Alteration Risk (Long-term)
0	A score of zero indicates no toxicant hazard. The species is either not susceptible to toxicant effects or will not be exposed to the toxicant (e.g., no toxicant hazard).	A score of zero indicates that the species is at a negligible risk from disturbance impacts (e,g., no expected impact due to disturbance).	A score of zero indicates that the species is at a negligible risk from habitat alteration (e.g. no expected impact to habitat)
1	A score of one indicates that the species is at a low risk or toxicant hazard. These individuals may be affected by high doses of toxicant but do not have a clear exposure pathway and thus are unlikely to consume lethal doses of toxicant.	A score of one indicates that the species is at a low risk from disturbance impacts and will likely recover very quickly after implementation has ceased.	A score of one indicates that the species is at a low risk from habitat alteration and any impacts to habitat will likely be short-term (e.g. minor short-term impacts to habitat)
2	A score of two indicates that the species is at a moderate level of risk, has at least one exposure pathway, and is moderately susceptible to the toxicant (e.g., consumption of toxicant is possible and could result in mortality).	A score of two indicates that the species is at a moderate risk from disturbance and is likely to experience some impact from disturbance.	A score of two indicates that the species is at a moderate risk from habitat alteration and could be negatively impacted for the short-term (e.g. Impacts to habitat that could impact the individual for the breeding season)
3	A score of three indicates that the species has more than one exposure pathway, is susceptible to toxicant effects, and is highly likely to either consume bait directly or other species that consumed bait (e.g., consumption of toxicant is highly likely and will likely cause mortality).	A score of three indicates that the individual is highly likely to be exposed to disturbance impacts such as lost productivity, long-term or permanent departure from the islands, injury or death.	A score of three indicates that the species is highly likely to be impacted by habitat alteration (e.g. restoration of the habitat or several years of recovery will likely be needed)

Overall Environmental Concerns Matrix *(Product 8b)*

The Overall Environmental Concerns Matrix provides scores for the impacts of each potential alternative to physical and social resources combined with the total score from the Biological Resources Worksheet. The physical and social resources are scored from zero to three; zero is negligible impact, one is low impact, two is moderate impact, and three is high impact. For the most part, all of the physical and social resources were similarly scored for all of the potential alternatives since none are likely to have significant impacts to any of these resources. Table 3 illustrates the scoring for the physical and social resources.

Table 3. Scoring methodology for physical and Social resources.

	Disturbance Impact or Length of Exposure to Physical and Social Resources
0	A score of zero indicates that the resource is likely to experience negligible disturbance impacts or the length of exposure is likely to be negligible (e.g.. persistence in soil is for a few days or expected impacts to social resources are negligible).
1	A score of one indicates that the resource is likely to experience minor disturbance impacts or the length of exposure is likely to be minimal (e.g., persistence in soil is for a few weeks or expected impacts to social resources are low)
2	A score of two indicates that the resource is likely to experience moderate disturbance impacts or the length of exposure is likely to be for a moderate period (e.g. persistence in soil is for a few months or expected impacts to social resources are moderate).
3	A score of three indicates that the resource is likely to experience high levels of disturbance impacts or the length of exposure is likely to be for a long period (e.g. persistence in soil is for more than 6 months or expected impacts to social resources are high)

2.4.2 Operational Considerations Matrix (Product 9)

The Operational Considerations Matrix analyzes the potential for each method to be used to successfully eradicate all mice from the Farallon Islands. This matrix looks at the efficacy of the method at eradicating mice, its legal availability, physical availability, safety to humans, logistics, research needs, and the time needed to obtain registration with the EPA and make island eradication ready prior to implementation. Each operational consideration is scored from zero to three, where zero represents the least risk and three has the most risk. However, since each operational consideration is different, they have individual scoring methods. Table 4 displays the scoring method for each operational consideration.

Table 4. Scoring methodology for Operational Considerations.

Value	Efficacy	Legal Availability	Physical Availability	Time to trial for Registration & Island use	Personnel Safety	Logistical Feasibility	Research Needs
3	Ineffective at eradicating mice	Illegal to use in the U.S.	No known source to obtain for eradication	5 or more years to trial for registration and island use	High risk to personnel from operations	Unfeasible due to access, timing, other logistics	Exorbitant research required for eradication
2	Low likelihood of eradicating mice	Not legally available in the U.S.	Needs a redesign to be used for eradication purposes	3 to 5 years to trial for registration and island use	Moderate risk to personnel from operations	Low feasibility due to access, timing, other logistics	Extensive research required for eradication
1	Moderate likelihood of eradicating mice	Legal for other purposes in the U.S. but not eradication	Could be manufactured but is not readily available	1 to 3 years to trial for registration and island use	Low risk to personnel from operations	Moderate feasibility due to access, timing, other logistics	Some research required for eradication
0	High likelihood of eradicating mice	Legal to use for eradication purposes	Sold commercially for eradication purposes	0 to 1 year to trial for registration and island use	Negligible risk to personnel from operations	High feasibility due to access, timing, other logistics	Little research required for eradication

3 Results

3.1 Minimum Operational Criteria Checklist

The Minimum Operational Criteria checklist is a coarse filter that requires all methods to meet a set of standards for further consideration as potential action alternatives in the Draft EIS. Each potential action alternative is required to be consistent with selected Farallon National Wildlife Refuge management guidelines, be feasible to implement, and meet all safety and logistic requirements. Methods that do not satisfy all the Minimum Operational Criteria were removed from further consideration and will be included in the EIS in the section: Alternatives Considered and Dismissed. Even though many potential methods did not meet the minimum operational criteria, all 49 methods were scored and ranked in the parallel assessment method, as described in Section 3.2.

The seven methods that passed through the Minimum Operational Criteria filter are shown in Table 5. All of these include the aerial application of rodenticide products that are currently registered with the EPA for some purpose in the U.S. Two are registered for island eradication use for non-native rodents, and five are registered for some type of control use but not for island eradication and conservation purposes (Table 5). Potential action alternatives that would utilize mechanical means as the primary method of operation, including the use of snap traps or live traps, did not meet the Minimum Operational Criteria because they did not meet Service's safety and logistical guidelines since they require the use of extensive ground measures over the entire island, which is considered to be highly unsafe for personnel due to steep and unstable terrain, logistically unfeasible because of the inaccessibility of many areas, and highly impactful to island resources from the repeated disturbance to individuals and habitats. Similarly, all of the rodenticide methods that primarily would utilize ground operations (hand baiting or bait stations) were eliminated for the same human safety, logistical feasibility and unacceptable habitat and disturbance impacts. Furthermore, none of these techniques have ever been used successfully to eradicate mice on large islands.

Most rodenticide methods did not meet Minimum Operational Criteria because they are not currently registered for use in the United States, making the method infeasible to implement in the near future. This is primarily due to the large amount of time associated with developing a bait product, product manufacturing, conducting lab and field trials for registration with the U.S. Environmental Protection Agency (EPA), as well as conducting field trials in an eradication setting. In addition, there is a high degree of uncertainty of the efficacy of the unregistered potential. Many are either less effective on mice, and/or would likely have equal impacts on non-target species as the available registered methods (Howald, 2011 unpublished report). Thus, years of research and development may or may not show these currently unregistered products to be either effective or safe for mouse eradication.

Table 5. Minimum Operational Criteria for eradicating invasive house mice from the South Farallon Islands, including the seven potential methods that passed all criteria.

Minimum Operational Criteria				
Operational Category	**Consistent with Farallon Refuge Management Guidelines**	**Feasible to implement (available & registered, or able to register and trial on an island within 2 years)**	**Meets safety and logistical guidelines**	**Meets all Minimum Operational Criteria**
Aerial Cholecalciferol (subacute)	yes	yes	yes	yes
Aerial Warfarin (1st generation)	yes	yes	yes	yes
Aerial Diphacionone (1st generation)	yes	yes	yes	yes
Aerial Chlorophacinone (1st generation)	yes	yes	yes	yes
Aerial Brodifacoum (2nd generation)	yes	yes	yes	yes
Aerial Bromadiolone (2nd generation)	yes	yes	yes	yes
Aerial Difethialone (2nd generation)	yes	yes	yes	yes

3.2 Scoring Potential Alternatives

In general, potential alternatives that required aerial application scored lower for disturbance and habitat alteration risk because they required minimal ground operations, some ground-based methods (e.g., hand baiting) received moderate scores for disturbance and habitat alteration risk because they only required ground operations for a short period of time, and methods with extensive ground operations (e.g., bait stations and live trapping) received high scores for disturbance and habitat alteration because they required extensive and repeated ground operations for an extended period of time. The latter group would entail frequent disturbances to seabird and pinniped breeding and resting areas, likely resulting in major impacts including extended abandonment of large areas, abandonment of nests or pups, crushing of seabird nesting burrows, dislodging of rocks, injury to pinnipeds from trampling and flushing, damage to plant communities from trampling, among others.

Potential alternatives that utilized acute, sub-acute, and second generation anticoagulant rodenticides scored higher than first generation anticoagulants for toxicant risk because of their higher toxicities, while methods that did not include toxicants received negligible (0) scores for toxicant hazard. The score for toxicant hazard was based on three factors: exposure potential, toxicity to the resource, and the type of rodenticide. Therefore, a toxicant may be highly toxic to an individual but receive a low score for toxicant hazard if the individual is not likely to be present at the time of implementation or there is no foreseeable pathway of exposure to lethal doses (e.g., seabirds that primarily eat pelagic fish will be at a negligible toxicant risk since they are unlikely to come in contact with the toxicant through primary or secondary exposure pathways). Toxicant risk to invertebrates and plants is low to moderate because rodenticides are not known to be toxic to these resources. Marine mammals scored low fortoxicant risk because they are highly unlikely to consume rodenticide in the large quantities required to have toxic effects. Birds, such as gulls, scored high for toxicant risk because of their likelihood of consuming lethal doses of toxic bait pellets, as well as the possibility of consuming dead mice or other organisms killed by rodenticide ingestion. Certain raptors, such as Peregrine Falcons and Burrowing Owls, scored high for toxicant risk because of their risk of secondary exposure by feeding on either birds that had been exposed to rodenticide (falcon or owl) or mice exposed to rodenticide (owl).

Generally, methods that are not currently legally available (registered for island conservation purposes in the United States) scored higher than those that are currently registered due to the research needs, physical availability of the method, and the time needed to trial and register a product for island use. Potential alternatives with a limited or nonexistent history of successful rodent eradication received higher scores for operational efficacy risk than methods with a history of successful eradication use. Methods that required intensive ground-based activity scored higher than those that could be applied aerially (for reasons described above) and methods that have the potential to eradicate mice but are not available scored higher than those currently available for use at this time.

3.3 Ranked List of All Potential Alternatives

The Combined Matrix (Product 10) incorporates the scores from the Overall Environmental Concerns Matrix (Product 8b) and the Operational Considerations Matrix (Product 9) to provide a ranked list of alternatives.

The ranked methods were then compared to the results of the Minimum Operational Criteria. Eight of the top eleven ranking methods are aerial rodenticide methods (Table 6). Seven of these rodenticide methods successfully passed the Minimum Operational Criteria (Table 5) and were considered for inclusion in the draft EIS as potential action alternatives. Aerial broadcast of pindone did not meet all of the Minimum Operational Criteria due to the length of time needed to trial and register for island use.

Immunocontraception, disease, and genetic engineering methods all ranked relatively high, as they are non-toxic methods that could potentially be effective at eradicating mice in the future. However, at this time they are all still in the theoretical design and planning stage (Dr. Cheryl Dyer of Synestech and Dr. David Threadgill of North Carolina State University pers. comm.), and consequently are not available to be considered as viable action alternatives.

The hand broadcast, bait station, and trapping methods had the highest scores (most impactful) primarily because they did not meet the safety and logistical requirements, but also because all of these methods require repeated foot traffic over the entire island for many months/years, which would have unacceptable long-term negative impacts to important seabird breeding areas and pinniped haul outs on the islands.

Table 6. Top ranked potential action alternatives based on total combined scores of the Environmental Concerns and Operational Concerns matrices.

Possible Action Alternatives	Total Environmental Concerns (8a + 8b)	Total Operational Considerations (9)	Total Combined Score (10)
Immunocontraception *	9	16	25
Aerial Warfarin	17	8	25
Disease *	9	19	28
Aerial Diphacinone	21	6	27
Genetic Engineering*	12	17	29
Aerial Cholecalciferol	23	8	31
Aerial Chlorophacinone	23	9	32
Aerial Brodifacoum	32	3	35
Aerial Bromadiolone	30	6	36
Aerial pindone*	24	13	37
Aerial Difethialone	33	6	39

* Alternatives eliminated from full consideration because they did not meet the Minimum Operational Criteria listed in Product 1.

3.4 Mitigation Matrix

The Mitigation Matrix (Product 11) was designed to compare methods that met the minimum operational criteria under both mitigated and unmitigated operations. A suite of mitigation measures that may be included in the design of action alternatives for the draft EIS were applied and valued for the potential alternatives that met the Minimum Operational Criteria. Mitigation measures that were included in this portion of the analysis involve techniques that could be employed to reduce the potential impacts of rodenticides and disturbance to non-target resources, depending on the method used. Several of these techniques have been used successfully in previous rodent eradications. Mitigation measures to reduce risk of toxicant exposure from rodenticide methods included: 1) gull hazing to reduce their risk of consuming toxic bait; 2) carcass removal of all dead animals found to reduce the risk of secondary toxicant exposure to predators and scavengers ; 3) raptor capture and hold to eliminate the risk of those individuals to secondary exposure to toxicant by preying on organisms that were otherwise exposed to toxicant; 4) capture and hold of suitable numbers of endemic arboreal salamanders and Farallon camel crickets in the unlikely case that reintroduction is necessary to protect against population level impacts to those species; 5) using a bait deflector on the coastline; and 6) tarping the water catchment pad to protect the island drinking water supply. Mitigation measures to reduce risk of wildlife disturbance included, for aerial broadcast methods, controlled helicopter flights to partially habituate and slowly and safely flush marine mammals during baiting operations. The mitigation measures in this analysis represent the type of mitigation measures that could be incorporated into operational plans for the action alternatives developed in the draft EIS; however, it is too early in the planning process to determine precisely which measures will ultimately be used during project implementation. Additional mitigation measures not used in this preliminary analysis may also be considered and eventually employed.

Furthermore, the implementation of some mitigation measures such as bird hazing may reduce the toxicant impacts to some species (e.g., gulls) that may also result in temporary disturbance impacts to other species (e.g., marine mammals). As a result, the overall scores for the mitigated methods are, in general, about the same as for the unmitigated methods, but these scores are not weighted for relative importance. These factors will need to be considered thoroughly as part of the decision making process on a preferred alternative.

Table 7 provides a comparison of mitigated and unmitigated scores for the seven potential alternatives. In addition, the table provides mitigated and unmitigated scores for the seven alternatives without any consideration of potential disturbance impacts to illustrate the differences both with and without mitigation for toxicant risk to non-target resources. Basically, with mitigation, the toxicant risk can be reduced to low or negligible levels for most non-target resources on the islands. Additionally, the table identifies the key trade-off between potential gull mortality due to toxicant exposure and increased disturbance to both birds and marine mammals with extensive mitigation (i.e., gull hazing).

Table 7. Comparison of the mitigated and unmitigated scores for all 7 potential alternatives that met the minimum operational criteria and ranked in the top ten. Scores with and without disturbance impacts were included to better illustrate how mitigation measure will likely decrease the lethal exposure of rodenticides to non-target species.

Alternative	Total Unmitigated Score[1]	Total Mitigated Score[2]	Total Unmitigated Score without Disturbance[3]	Total Mitigated Score without Disturbance[4]
Aerial Warfarin	25	33	15	13
Aerial Diphacinone	27	33	17	11
Aerial Chlorophacinone	31	37	21	15
Aerial Cholecalciferol	31	37	23	17
Aerial Brodifacoum	35	48	27	16
Aerial Bromadialone	39	41	31	19
Aerial Difethialone	39	42	31	20

[1]Total Combined Score from Table 6 and Matrix 10.
[2] Total Combined Score from Table 6 adjusted when mitigation measures for rodenticide toxicant risk and disturbance are incorporated (Matrix 10).
[3] Total Combined Score from Table 6 adjusted when potential impacts to non-target resources from disturbance are not considered (Matrix 10).
[4] Total Combined Score from Table 6 adjusted when potential impacts from disturbance are not considered but mitigation measures to reduce toxicant risk to non-target resources are included (Matrix 10).

4 Conclusions

The Alternatives Selection Process utilized a Structured Decision Making (SDM) approach to analyze and evaluate 49 potential alternatives for inclusion in the proposed Farallon Islands mouse eradication Draft EIS. SDM is widely used by the Service to evaluate alternatives, identify priority areas for conservation, and to develop programmatic planning documents. The Alternatives Selection Process evaluated each method for its potential impacts to island resources, as well as its ability to fulfill all of the operational requirements for invasive house mouse eradication on the Farallon Islands.

4.1 Potential Action Alternatives

Of the 49 potential alternatives that were initially assessed in the model, a total of seven met the Minimum Operational Criteria and were analyzed further under a scenario incorporating measures to mitigate, or reduce, potential impacts to non-target resources. All seven potential action alternatives incorporated an aerial application of rodenticide as the primary mouse removal method.

The seven potential action alternatives included:

- One sub-acute toxicant: cholecalciferol;
- Three 1st generation anticoagulants: chlorophacinone, warfarin, and diphacinone
- Three 2nd generation anticoagulants: brodifacoum, bromadiolone, and difethialone.

Of the seven rodenticides meeting the Minimum Operational Criteria, only two have products that are currently registered with the EPA for conservation use and thus are legally available for rodent eradication on islands in the United States: diphacinone (D50 Conservation) and brodifacoum (25D Conservation and 25W Conservation).

Of the 47 successful mouse eradications world-wide, 98% (all but one) used brodifacoum or a closely related second generation anticoagulant. The application of rodent bait containing brodifacoum is the only method with a demonstrated history of success for eradicating mice from islands worldwide. However, it does pose a greater risk than subacute or 1st generation anticoagulants to non-target species such as birds. However, diphacinone, which is less toxic to birds, has never been successfully used for a mouse eradication, although it has been used successfully for rat eradications

The other five rodenticides that met the Minimum Operational Criteria are not registered for island eradication use and have properties generally similar to one of the two available rodenticides. None of the five unregistered compounds have been proven more effective at eradicating mice than one of the two available, registered products. Furthermore, no new products are currently in development or are likely to be available and trialed in an island eradication setting within the time-frame preferred for this project. Also, several of the unselected compounds (including warfarin, chlorophacinone, and bromadiolone) have a history of resistance, while cholecalciferol has a history of bait shyness and resistance. Difethialone is a compound that has a very long half life in soil (635 days).

Table 8 illustrates the outcome of each of the seven potential action alternatives and a summary of the primary justifications for their dismissal from further consideration in the draft EIS as action alternatives. The results of the minimum operational criteria and the ranked analyses identified two possible eradication methods as available and appropriate for consideration as action Alternatives in the EIS: aerial diphacinone and aerial brodifacoum.

Table 8. Potential action alternatives for development in a draft EIS for house mouse eradication from the South Farallon Islands, based on results of this study.

Potential DEIS Action Alternatives Meeting the Minimum Operational Criteria		
Alternative	**Suggested Outcome**	**Justification for dismissal or inclusion as an Action Alternative**
Aerial Diphacinone	**Action Alternative in EIS**	**Registered for conservation on islands, has history of use for rodent control and eradication; however, has a history of bait shyness[1]**
Aerial Brodifacoum	**Action Alternative in EIS**	**Registered for conservation on islands, has history of success for mouse control and eradication**
Aerial Warfarin	Dismissed	Not registered for conservation on islands, impacts likely similar to Diphacinone, history of resistance[2]
Aerial Cholecalciferol	Dismissed	Not registered for conservation on islands, history of resistance* and bait shyness[1]
Aerial Chlorophacinone	Dismissed	Not registered for conservation on islands, impacts likely similar to Diphacinone
Aerial Bromadiolone	Dismissed	Not registered for conservation on islands, impacts likely similar to Brodifacoum, history of resistance[2]
Aerial Difethialone	Dismissed	Not registered for conservation on islands, impacts likely similar to Brodifacoum, long soil half life

[1] Bait shyness is a taste aversion, often associated with ills feelings, to a toxicant that typically results in individuals who will avoid consuming enough bait to meet the toxic threshold.
[2] Bait resistance is a genetic mutation that prevents the individual from experiencing the toxic effects of the toxicant.

Additional unregistered and untested theoretical techniques for mouse removal were identified as having some potential to eradicate mice from islands in the future, but these techniques are likely several from being tested and successfully employed in an island eradication setting, if at all. Because of the pressing need to remove the destructive invasive mice from the Farallones and the high uncertainty of currently unregistered products to become available for successful implementation makes these products extremely difficult and undesirable to develop as action alternatives for mouse eradication from the Farallon Islands. Thus, it is recommended that the Service develop the two currently registered products for island rodent eradications, diphacinone and brodicafoum, using the safest and most effective method of aerial broadcast, as action alternatives in the draft EIS for mouse eradication at the South Farallon Islands.

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6 Appendices

6.1 Appendix A: Model Products

- ### Product 1 - Minimum Operational Criteria for Action Alternatives

  A. Must be Consistent with the Farallon National Wildlife Refuge Management Guidelines

  I. *Mission of the National Wildlife Refuge System*
  II. *Mission of the Farallon National Wildlife Refuge*
  III. *Farallon Comprehensive Conservation Plan*
  IV. *U.S. Department of Interior Policy on Introduced/Invasive Species*
  V. *Wilderness Act Minimum Requirements*
  VI. *Endangered Species Act Take Requirements*
  VII. *Migratory Bird Treaty Act*

  B. Implementation of the Alternative is Feasible to Implement

  I. *Product is available and registered for conservation eradication or could affordably be developed and registered for conservation eradication within 2 years (including research, trialing, manufacturing, registering, planning, and implementing)*

  C. Alternative Meets with Personnel Safety and Logistical Guidelines

  I. *Is the alternative safe and unlikely to put personnel at undo physical risk and can it be implemented without accessing large, relatively inaccessible portions of the island by foot?*

- ### Product 2 – Operational Tools and Methods

  - *Tools include*:
    - Live Trapping
    - Snap Trapping
    - Disease
    - Genetic Engineering
    - Immunocontraception
    - Non-native Predator introduction
    - Rodenticides:
      - Tools
        - Non-toxic
          - Eradibait
        - Acute
          - Zinc phosphide
          - Bromethalin
          - 1080 (Sodium Fluoroacetate)
          - Strychnine
        - Subacute
          - Cholecalciferol
        - First Generation Anticoagulant
          - Warfarin
          - Chlorophacinone

        - Diphacinone
        - Pindone
        - Coumatetralyl
    - Second Generation Anticoagulant
        - Brodifacoum
        - Bromadiolone
        - Difethialone
        - Flocoumafen
    - Aerial broadcast
    - Bait Stations
    - Hand Broadcast

- **Product 3 – Environmental Concerns, Operational Considerations, and Potential Mitigation Measures**

Environmental Resources of Concern

Physical Resources

- Water, including drinking water supply and the surrounding ocean. No freshwater resources besides captured drinking water exist on the islands.
- Soil
- Wilderness

Issues to Consider

- Risk of water contamination – solubility and persistence
- Risks to wilderness character
- Risk of soil contamination or compaction

Biological Resources

- Seabirds: western gulls, ashy storm-petrels, Leach's storm-petrels, other cavity nesters (pigeon guillemont and tufted puffin), other surface nesters (double-crested cormorant, Brandt's cormorant, pelagic cormorant, and common murre), burrow nesters (Cassin's auklet and rhinoceros auklet), and other gulls (California gull, glaucous-winged gull, herring gull, thayer's gull, Heermann's gull, etc.)
- Shorebirds - black oystercatchers (resident breeder), black turnstone, wandering tattler, whimbrel, and several other occasional or rare visitants.
- Raptors: burrowing owl, peregrine falcon, other raptors (American kestrel, red-tailed hawk, common raven, and several other rare or occasional transient species)
- Passerines: All (migrants) except breeding common ravens which was included with raptors
- Marine mammals: Steller sea lion, northern elephant seal, all others (California sea lion, northern fur seal, and harbor seal)
- Farallon arboreal salamanders
- Invertebrates –

- Terrestrial: All, including Farallon camel cricket, kelp fly, beetles (Lepidoptera) , spiders, etc.
- Marine: All, including mussles *(Mytilus californianus*), &), limpets (such as *Lottia scabra* and *L. giganita*)*,* barnacles (such as *Chthamalus dalli*/*Balanus glandula* and *Tetraclita rubescens*), colony anemone *(Anthopleura* elegantissima), etc.

- Vegetation –
  - Native: All. The most common species include maritime goldfield (or “Farallon weed”, *Lasthenia maritima*”); sticky sandspurry *(Spergularia macrotheca*); and miner's lettuce (*Claytonia perfoliata*).
  - Introduced Vegetation: All. The most common species include New Zealand spinach (*Tetragonia tetragonoides*), ripgut brome (*Bromus diandrus*)*;* foxtail barley (*Hordeum murinum leporinum),* cheeseweed (*Malva parviflora*) and buckhorn plantain (*Plantago coronopus*).

- Nearshore fish: All
- Human health and safety

Issues to Consider

- T = Toxicant hazard (toxicity + exposure = toxicant risk)
- D = Risks from disturbances (e.g. trampling vegetation, disturbance to breeding activities, disturbance to rest sites, etc.)
- H = Risks from habitat alteration/destruction (e.g., long-term habitat alteration)

Social/Historical Resources

- Historical resources: buildings and artifacts
- Fisheries and tourism: recreational and commercial

Issues to Consider

- Impacts to recreation
- Impacts to historical features
- Impacts to commercial fisheries

Scoring Resources

- All resources were scored 0 to 3 for potential impacts ; biological resources were evaluated for toxicant risk, disturbance risk, and risk of habitat alteration.
  - 0 = Negligible or Not Applicable
  - 1 = Low
  - 2 = Medium
  - 3 = High

Operational Considerations

1. Efficacy
2. Legal availability of technique
3. Physical availability of technique
4. Time to register and trial for conservation on islands

5. Personnel safety
6. Logistical feasibility
7. Research needs

The following table is a breakdown of the valuation system for each operational consideration.

Value	Efficacy	Legal Availability	Physical Availability	Time to Register & Trial for Island Use	Personnel Safety	Logistical Feasibility	Research Needs
3	Ineffective	Illegal	No Known Source	5+ years	High Risk	Unfeasible	Exorbitant
2	Low	Not Legally Available	Needs a Redesign	3-5 years	Moderate Risk	Low	Extensive
1	Moderate	Legal for Other Purposes	Could be Manufactured	1-3 years	Low Risk	Moderate	Some Required
0	High	Legal	Sold Commercially	0-1 year	Negligible Risk	High	Little Required

Potential Mitigation Measures

<u>To Reduce Toxicant Hazard</u>

1. Carcass removal
2. Gull hazing – intended to reduce gull take to a minimal level
3. Raptor capture/hold/relocation
4. Captive holding of salamanders
5. Captive holding of camel crickets
6. Tarp drinking water catchment pad
7. Bait deflector

<u>To Reduce Disturbance Risk</u>

1. On the ground measures to reducing wildlife disturbance (e.g. crouching, walking slowly, etc.)
2. Helicopter controlled surveillance flight and slow approach to decrease disturbance to pinnipeds

• Product 4 – Comparing Rodent Control versus Eradication Operations

The net conservation gain achieved by rodent control (i.e. reducing and maintaining rodent populations at low levels) on an island is temporary, generally more expensive and less beneficial that the permanent restorative benefits of complete eradication. Sustained rodent control is immensely challenging on islands such as the Farallones where topography, climate, and disturbances to sensitive native wildlife make access difficult and in some areas impossible. The long-term risks to non-target wildlife from control operations are generally greater than the risks posed by island eradications because of the ongoing nature of a control operation. Eradications occur over a short timeframe and, if conducted properly and successfully, are single actions resulting in only short-term negative impacts.

On the Farallones, a hugely greater number of personnel hours would be needed on an annual basis in perpetuity to sustain a mouse control operation. Activities associated with a control program would result in repeated disturbances to sensitive breeding seabirds and marine mammals. If rodenticides were used as the control method, control operations would place non-target wildlife at an almost constant risk of exposure to toxicants. Should rodent control operations be interrupted or ineffective, mice are able to quickly reproduce and rapidly re-populate the island reaching former population sizes relatively quickly. An ongoing control effort, even if possible, would increase personnel safety risk, be more impactful to native species, would be less cost-effective, and would not result in permanent island-wide conservation and restoration benefits to the species of native animals and plants that exist on the Refuge.

Table 4.1 illustrates why eradication, and not control, is being considered for Farallon ecosystem restoration, a comparison of the differences between eradication and control operations is provided in the table below.

Table 4.1. Comparison of island eradication and mainland control operations for rodents.

Comparison of Island Eradication and Mainland Control Operations		
	Eradication on Islands	**Control on Mainland**
Location	Rodent eradications are primarily attempted on isolated islands where an invasive species is impacting the native species of plants, animals, and the island's natural ecological processes, and where rodents cannot recolonize the area from adjacent habitats.	Rodent control efforts are primarily attempted on the mainland in urban, residential or agricultural areas where rodents impact people or commercial endeavors.
Goal	Restoration of the island ecosystem by complete removal of the target species from an island. 100% removal of all individuals is required, as failure to remove every individual from an island will result in surviving individuals repopulating the island.	Reduction of the rodent population in a confined management area (agricultural zone or near residential areas/buildings). Generally, an eradication is impossible because rodents can easily recolonize from adjacent habitats..
Successful Methods	On all but the very smallest islets, the only invasive rodent eradication technique that has been successful on islands has involved distributing a lethal dose of rodenticide to every individual rodent on the island.	A variety of toxic, non-toxic, mechanical (traps) and biological (predator) methods are available for controlling rodents in mainland areas. It is not necessary for control operations to remove every single rodent.
History of Success	Rodent eradications have been successfully conducted on over 338 islands world-wide with many more	Many methods are used for controlling rodent numbers on the mainland with variable rates of

	awaiting confirmations. Successful eradications typically result in the recovery of native biota. Success rates have increased in recent years as techniques are refined. Success depends on a variety of factors including rodent species, techniques employed, and seasonal timing.	success including toxic and non-toxic techniques.
Length of Operation	Eradications are typically one-time operations that usually take only a few days or weeks to conduct.	Depending on the nature of the infestation, control efforts must be continued for long periods or revisited periodically in perpetuity.
Extent of Positive Impact	The positive impacts to island ecosystems include measurable, dramatic, and often immediate benefits to the many native species, while other species take years to be restored.	The positive impacts are limited in extent, degree, and duration. Measurable benefits to mainland areas are generally small in size and temporary as immigration and repopulation can result in a return to former rodent population levels within months.
Extent of Negative Impact	While eradications have been known to have non-target effects, these unintentional impacts are usually one-time, short-term, and generally lack population-level impacts. A majority of impacts are avoided, minimized or mitigated. Most have a limited extent and are confined to a relatively closed island ecosystem.	Negative effects of chronic rodent control efforts have resulted in direct and indirect impacts to non-target species. Because of the open ecological system on the mainland, a toxicant can be distributed widely through a variety of pathways by a wider range of scavengers and predators. Repeated toxicant exposure in urban and agricultural settings extends the period of time in which toxicant impacts can occur. Most non-target species populations that are negatively impacted continue to repeatedly accumulate toxins for a period of many years, often with fatal results.
Risk of Failed Operation	Because of the generally high one-time cost and logistical complexity of conducting whole-island rodent eradications, there is a reduced likelihood of funding and organizing follow up attempts. The ecological benefits to sensitive island species and resources will not be realized and certain species may face extirpation or extinction as a result.	Rodent controls efforts are never completely successful because individuals repopulate the area from adjacent habitats. Because of their relative low short-term cost and low logistical complexity, unsuccessful rodent control efforts can be manipulated with additional techniques to increase success. Rodent control is typically on a local and relatively small scale and impacts of failure are similarly low level and localized. While short-term impacts to human health and economic endeavors may continue, long-term

		impacts are less likely. In the long-term, managing frequent infestations can incur large economic costs.
Extent of Regulatory Oversight	In the U.S., island eradications are permitted after extensive planning and a review of impacts are assessed under NEPA, in addition to the federal, state, and local permits that are required.	For some compounds, pesticide applicator licenses and permits are not required for purchase and use. Often their use is allowed without the need for a NEPA analysis. There is little oversight regarding application rates and methods of delivery for rodent control products used in the commercial and residential sectors. However, the use/misuse of toxicants for residential and commercial use is wide in extent and has resulted in the removal of several rodenticides from retail sale.

- ## Product 5 – Assessment of Mouse vs. Rat Ecology

Eradications of introduced rodent species have been successfully conducted on about 482 islands since 1971 (MacKay 2007). Success rates can vary depending on the species targeted, the methods attempted, as well as the geographic and ecological factors of each island (Howald 2007, MacKay 2011, Clapperton 2006, Parkes et al. 2011). The large majority, 89%, of rodent eradications have targeted one or more species of rat (*Rattus* spp.). In conjunction, most methods that have been developed for island rodent eradication have been focused on rats. In the relatively small number of attempts made (81 attempts), success rates for mouse eradications have historically been lower on average (35% success) than rat eradications partly because managers generally treated mice in the same way as rats. While there are some similarities between house mice and rats, there are several differences between them in behavior and physiology that are important to consider when designing island eradication projects. In some recent mouse eradications, managers have taken into consideration these differences, with resulting success.

Understanding how each introduced rodent species interacts with their environment allows conservation managers to direct resources and conduct rodent removal operations more effectively. While many of the aspects of a rodent eradication are the same regardless of the rodent species targeted, understanding the unique behavior and biology of the target species allows for greater likelihood of eradication success and minimization of impacts to non-target species. Eradication methods that might be effective for some rat species may not be as effective for house mice due to differences between mice and rats in their foraging ecology, home range, density, and physiology (Clapperton 2006).

The following discussion summarizes the relevant differences in foraging ecology, home range, density, and physiology between rats and mice to help inform the planning process for the removal of introduced house mice from the South Farallon Islands.

<u>Foraging Ecology</u>

All rodent species are opportunistic omnivores, readily consuming seeds, plants, invertebrates, and bird eggs and chicks (IUCN 2011, MacKay 2011). Mice tend to consume more invertebrates than rats (Shiels 2010). Mice are considered to be light and more intermittent feeders than rats (Crowcroft & Jeffers 1961), as rats are known to cache and store food more regularly. Rats need to consume approximately 1.5 oz (43 grams) of food per day (about 20% of their body weight), while house mice on average only need to consume approximately 0.1 ounces (3-4 grams) of food per day (about 13% of their body weight). Thus it can require more careful planning to ensure that each mouse ingests the required lethal dose of bait.

Home Range Size and Population Density

Home range size is a factor that can potentially affect the efficacy of eradication techniques for rats and mice. Rats generally have much larger home ranges than house mice. Average home range size for most rats is typically greater than one hectare and can be as large as 11 hectares (Shiels 2010). House mouse home ranges, however, are typically 0.25 hectares or less (Pickard 1984). Small home range size for mice accentuates the need for ensuring comprehensive bait coverage when targeting a mouse population to ensure that every individual mouse gets access to the required dose of bait or access to a removal device, with no gaps in coverage.

Densities of introduced rats on islands are typically much lower than densities of invasive mice. Rat densities on Pacific islands are typically in the 5-10 individuals per hectare range, while most reported house mouse densities fall into the 10-50 individuals per hectare range (Pearson 1963, MacKay 2011). Densities of more than 800 mice per hectare have been reported during periodic population eruptions (Pearson 1963). Estimated densities on islands can be an order of magnitude higher for mice than for rats. In a mark-recapture study on Southeast Farallon Island in 2010, mouse densities were calculated to be approximately 1,200 individuals per hectare (95% CI 799-1792). This density estimate is among the highest ever reported for this or any other rodent species (Grout, in prep). Mouse populations typically show cyclical changes in population density (Ruscoe and Murphy, 2005), especially in the northern latitudes when food or weather are variable (MacKay 2011). Mouse removal operations must be designed and timed to consider these cyclical population fluctuations.

Physiology

Adult house mice generally range from 0.5oz to 0.9oz (15g to 25g), while introduced rats species can be 80 times more massive (King 2005). House mice, however, are not simply small rats, as their physiology is much different, with higher metabolic rates, higher reproductive rates, and differences in behavior. House mice have a very high reproductive potential, which is a large part of their success as an invasive species. Female mice can breed for the first time at 3-6 weeks of age and can produce litters of 6-8 young every 4 weeks after that (Berry 1981). Such reproductive capabilities can lead to massive eruptions and subsequent population crashes for mice. In one study, 20 mice placed in an outdoor enclosure with abundant food and water became a population of 2,000 in only 8 months (Corrigan 2001).

Mice and rats also react to toxicants much differently. Resistance by mice to first generation toxicants such as warfarin and diphacinone has been recorded, and mice are known to have different levels of susceptibility to many toxicants. The LD_{50} (poison dose required to kill 50% of tested individuals) for 1^{st}

generation anticoagulants like Diphacinone is 1.75 mg/kg for the Norway rat while the same test determined that the LD_{50} for a laboratory mouse is over four times higher, 7.05 mg/kg (Erickson and Urban 2004). Another study lists the LD_{50} for diphacinone as much as 350 times higher for mice than for rats (O'Connor and Booth 2001). It seems apparent that the physiology of mice and rats are sufficiently different that it would be inadvisable to assume that a method or toxin that has proven effective for eradicating rats would necessarily be as effective for eradicating mice.

Mouse Eradication Success Rates

Many more island eradication operations have been undertaken for rats (>400) than for mice (81). Prior to 2007, reported operational failure rates were higher for mice (19-32%) than for rats (about 5-10%), but some of the mouse operations either only targeted (or primarily targeted) rats. Additionally, many of the mouse eradication attempts did not take into account the unique behavior and ecology of mice (Howald et al. 2007, MacKay 2007). Much has been learned from both the early mouse removal successes and failures, and since 2007 ten of the eleven (91%) mouse eradications attempted have been confirmed as successful. Mice have now been removed from islands as large as Rangitoto (2,311 ha) and Motutapu (3,854 ha) in New Zealand.

Of the 41 successful mouse eradications, all but one used brodifacoum, a second generation anticoagulant, or another closely related toxicant. Bait stations were used as the primary method in 30 of 60 mouse eradication attempts on 48 islands. Hand broadcasting was used in two attempts, and aerial broadcast was used in 25 attempts. A total of 29 mouse eradication attempts have been completed on islands where another pest mammal species was present, and 13 of these operations failed. Early mouse eradication failures may have been complicated by the presence of other species, and the eradication design may not have accounted for the presence of mice. Several operations that used bait stations used a spacing design appropriate for rats but not for the small home range sizes of mice.

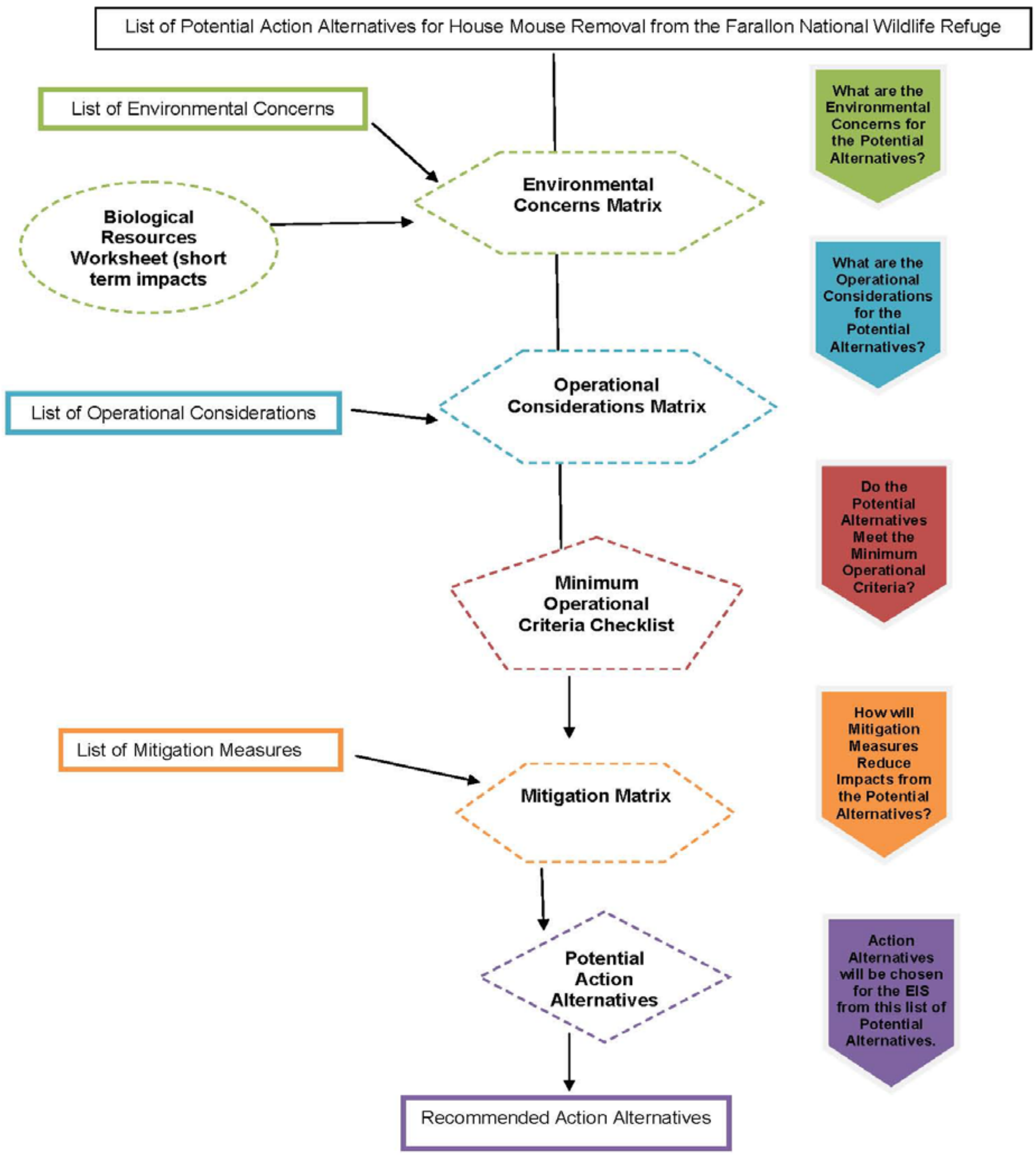
When mice are the only target species on the island, the eradication success rate is now over 90%. Table 5.1 summarizes the results of the attempted mouse eradications and corresponding success rates.

Table 5.1. Summary of house mouse (*Mus musculus*) eradication attempts with documented results and methods *(Keitt et al. 2011, Mackay et al. 2011).*

Toxicant used		Eradication attempts	Successful	Failed
1st Generation anticoagulant rodenticides	Diphacinone	1*	0	1
	Pindone	1	0	1
	Warfarin	1	1	0
2nd Generation anticoagulant rodenticides	Brodifacoum	50	35	15
	Bromadiolone	5	5	0
	Flocoumafen	3	2	1
	Flocoumafen and brodifacoum	1	1	0
Mixed 1st and 2nd generation anticoagulant rodenticides	Pindone and brodifacoum	3	3	0
Acute rodenticides	Sodium monofluoroacetate (1080)	1	0	1

*At Buck Island in .U. Virgin Islands a successful rat eradication failed to eradicate house mice, although it is unclear if mice were eradication targets or not (Witmer 2007).

- **Product 6 – Conceptual Model of the Alternatives Selection Process**



6.2 Appendix B: Contributors

US Fish and Wildlife Service

- Gerry McChesney, Manager, Farallon National Wildlife Refuge: Gerry has a B.A. in Biology (focus, Marine Sciences) from the University of California, Santa Cruz and an M.S. in Biological Sciences (Conservation Biology) from Sacramento State University. He began his career as a seabird biologist in 1986 as an intern for Point Reyes Bird Observatory on Southeast Farallon Island. Gerry returned to Southeast Farallon in summer 1987 to conduct a study on population status and diet of ashy and Leach's storm-petrels. He completed his M.S. thesis work examining the breeding ecology of Brandt's Cormorants (*Phalacrocorax penicillatus*) on San Nicolas Island, California. Gerry now has over 25 years of experience studying seabirds in the California marine ecosystem. After working as a wildlife biologist at Humboldt State University for nearly 14 years, Gerry began managing a seabird restoration program at the Service's San Francisco Bay National Wildlife Refuge Complex in 2002 and since 2008 has also been the manager of the Farallon National Wildlife Refuge.

- Carolyn Marn, Fish and Wildlife Biologist: Carolyn has a Ph.D. in Wildlife Science from Oregon State University and an M.S. in Wildlife Management from Auburn University. She has over 20 years of experience with the U.S. Geological Survey and the U.S. Fish & Wildlife Service addressing the effects of environmental contaminants on wildlife. She has been working as a senior staff biologist with the Service's Natural Resource Damage Assessment and Restoration Branch in Sacramento since 2005.

PRBO Conservation Science

- Russ Bradley, Farallon Program Manager: Russ earned a B.S. in Biological Sciences and an M.S. in Wildlife Ecology from Simon Fraser University in British Columbia, Canada. He brings almost 15 years of conservation research experience from work in British Columbia, California, Hawaii, Nova Scotia, and the Pacific. Russ completed his Masters work on the breeding ecology of Marbled Murrelets, a threatened seabird breeding in old growth forests, on one of the largest conservation projects in Canada. Since 2002, he has worked on the Farallon Islands as a biologist for PRBO Conservation Science, and has managed their Farallon research program since 2005. He has spent over 1400 nights on the Farallon Islands and has extensive expertise and unique knowledge of their islands and their wildlife populations through scientific research and monitoring. Russ has authored over 20 scientific publications, and presented research findings at dozens of scientific conferences, management councils, and public meetings.

Island Conservation

- Gabrielle Feldman, Environmental Compliance Specialist: Gabrielle earned a BS in Zoology and an MS in Environmental Science and Regional Planning from Washington State University. She earned a Ph.D. in Natural Resources with an emphasis in Environmental Policy Analysis and Decision Science from the University of Idaho. Gabrielle has worked on a myriad of environmental planning projects in the United States and on the Black Sea with a focus on biodiversity conservation and sustainable development.

Gabrielle brings over fifteen years of experience analyzing and writing state, national, and international environmental impact analyses, developing decision making tools for land managers, and building consensus between stakeholders. Gabrielle currently serves as the Environmental Compliance Specialist at Island Conservation. Under her guidance, Gabrielle has lead the compliance processes for the Palmyra Atoll rat eradication, the Desecheo Island rat eradication, and is currently leading the compliance process for the Farallon Islands mouse eradication. In addition, Gabrielle has developed several decision tools (including the Alternatives Selection Model) designed to provide a framework for decision making that is comprehensive, transparent, and impartial.

- <u>Dan Grout, Project Manager</u>: Dan earned a B.S. with Honors in Wildlife Ecology from the University of Wisconsin-Madison. He has 30 years of endangered species conservation experience with a wide range of international, federal, state, university and private institutions throughout California, Hawaii, Mexico, Micronesia and the Pacific. Dan has worked as a Senior Wildlife Ecologist for California State Parks, the U.S. Fish & Wildlife Service, as a private consultant and as adjunct faculty with CSU-Monterey Bay and CalPoly University. Dan served as USFWS liaison to the Department of Defense and the CNMI in the Western Pacific and has coordinated with many international agencies and nonprofit organizations from many different countries overseas. His field research expertise focuses largely on endangered birds and small mammals, but he has over 25 years of experience conducting environmental impact assessments on a wide variety of wildlife species. Dan has written peer-reviewed articles and has presented his research on ecosystem restoration at dozens of scientific conferences and conservation community gatherings. His expertise is in designing and implementing endangered species research, recovery and management programs for endangered bird and mammals species, including invasive species control and removal operations on islands. He has been assisting the USFWS and PRBO in the planning efforts for the Farallon Island Restoration Project since August 2010, and his professional goal is to facilitate practical collaborative conservation and recovery actions for imperiled species based on sound science.
- <u>Brad Keitt, Director of Conservation</u>: Brad received an MS in Marine Sciences from the University of California, Santa Cruz and is a Switzer Foundation Conservation Fellow. His thesis work focused on the conservation and ecology of the Baja California endemic Black-vented Shearwater. He has conducted research on all of the Baja Pacific Islands, as well as islands in Alaska, Hawaii, California, Oregon, the tropical Pacific, and the Caribbean. Brad has published over 40 scientific articles on seabirds and the conservation of islands and has extensive involvement around policy issues related to the protection of island biodiversity and island ecosystems in the US and Mexico. Brad helped to create the Guadalupe Island Biosphere Reserve, leading to the protection of nearly a half million hectares of marine environment and the 26,000 hectares of terrestrial habitat on Guadalupe Island. Brad helped secure almost $4million US to implement much needed management actions on the “Islas del Pacifico” of Baja California, and he also petitioned to declare these islands an official protected area – an action that will protect 11 islands and almost 180,000 hectares of the surrounding marine environment. Brad currently serves as the Director of Conservation at Island Conservation where he oversees the implementation of island restoration projects. In his more than15 years with Island Conservation Brad

has participated in the planning and implementation of over 70 eradications of invasive vertebrates from islands.

- Richard Griffiths, Project Director: Richard Griffiths gained his MS in Ecology at Lincoln University in 1996. Between 1998 and 2011, he worked for the New Zealand Department of Conservation where he led species recovery and island restoration programs. Richard also served as a member of the Department's Island Eradication Advisory Group over a five year period. Some of his successes include the successful eradication of mice from Mokoia Island in 2000, Pacific rats from Little Barrier Island, the world's largest Pacific rat eradication, in 2004 and the removal of eight invasive mammals in one operation from Rangitoto and Motutapu in the Hauraki Gulf in 2009. With stoats, cats, hedgehogs, rabbits, mice and three species of rats spread across an area of 3854 ha, the latter project was the most challenging and complex island pest eradication the Department of Conservation had ever attempted and as a consequence the Department received the 2010 Parks Forum Environmental Award. Richard has a strong interest in the conservation of threatened species and led the stitchbird (*Notiomystis cincta*) recovery program between 2000 and 2007. During this period additional populations of the species were established including on the mainland after an absence of over 120 years. Richard now works for Island Conservation based in Santa Cruz, California where he manages a team of project managers and island restoration specialists whose focus is preventing extinctions on islands through the removal of invasive vertebrates. Two recent accomplishments by his team include working with USFWS to successfully implement the removal of rats from Palmyra and Desecheo National Wildlife Refuges.

- Gregg Howald, North American Regional Director: Gregg received an MS from the University of British Columbia's Department of Animal Science. He is one of the world's foremost experts in island restoration – he has participated in the restoration of 20 islands from the sub-Arctic to the deep tropics. Gregg has consulted on rodent removal and research programs in Hawai`i, Micronesia, Alaska, British Columbia, the California Channel Islands, and Mexico. Gregg works closely with multiple government agencies across North America in his capacity as the North America Regional Director. Gregg's technical expertise in ecotoxicology has been applied in multiple projects in which the use of rodenticides have been used for rodent eradication - both during the development of bait products and shepherding specific rodenticides through rigorous field trials for the regulatory process. He has applied his technical expertise in environmental compliance and project management. He published peer-reviewed articles, and has given over 50 presentations to the scientific and conservation communities regarding rodent eradications on islands. Gregg's wide range of skills, excellent diplomatic sense, and tri-national contact network make him a heavily-utilized resource in nearly all of IC's projects worldwide.

APPENDIX 3

INVASIVE HOUSE MOUSE ERADICATION PROJECT

DRAFT Operational Plan

FARALLON ISLANDS NATIONAL WILDLIFE REFUGE

IMAGES COURTESY OF U.S. FISH AND WILDLIFE SERVICE

Prepared by:
SeaJay Environmental LLC, Oakland, California

for the
U.S. Fish and Wildlife Service, Farallon Islands National Wildlife Refuge

March 2021

Contents

Executive Summary

This *Draft Operational Plan* (Draft Plan) for the South Farallon Islands Invasive House Mouse Eradication Project (Project) lays out the operational steps needed to ensure successful implementation and completion of the Project. The South Farallon Islands are managed by the U.S. Fish and Wildlife Service (Service) as the Farallon Islands National Wildlife Refuge (Refuge). The Service is the lead agency and federal sponsor for this Project.

The South Farallon Islands host the largest seabird breeding colony in the lower 48 States and are home to the world's largest colony of the rare ashy storm-petrel (*Oceanodroma homochroa*). The ashy storm-petrel is listed as endangered on the International Union for the Conservation of Nature (IUCN) Red List, a Bird of Conservation Concern by the Service, and a Bird Species of Special Concern by the State of California. As described in the *South Farallon Islands Invasive House Mouse Eradication Project, Final Environmental Impact Statement* (FEIS; USFWS 2019), eradication of invasive house mice (*Mus musculus*) would result in significant benefits to the Farallon ecosystem including reduced predation pressure on impacted native species that would assist population recovery of several species including protected seabirds such as the ashy storm-petrel, the Leach’s storm-petrel (*O. leucorhoa*), as well as two rare endemic species, the Farallon arboreal salamander (*Aneides lugubris farallonensis*) and the Farallon camel cricket (*Farallonophilus cavernicolus*). Additionally, mice are feeding on native plants and seeds including the maritime goldfield (*Lasthenia maritima),* which is endemic to seabird nesting islands along the California and Oregon coasts. The eradication of invasive mice will likely increase germination and survival rates of plants like the maritime goldfield, helping to improve the conditions of the native Farallon plant community.

If the Service’s Record of Decision chooses the Preferred Alternative (Alternative B) identified in the FEIS, this Draft Plan will be updated to incorporate input from the implementation team and from consultations with the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA/APHIS), U.S. Environmental Protection Agency (EPA), and other relevant regulatory agencies. The Draft Plan will be finalized prior to Project implementation.

The Project proposes to distribute, primarily by aerial means, a second-generation rodenticide named Brodifacoum-25D Conservation (hereafter referred to as Brodifacoum-25D). Brodifacoum-25D is a Restricted Use Pesticide currently registered by USDA-APHIS, with the EPA under Registration Number 56228-37. Brodifacoum-25D is approved for rodent control and eradication for conservation uses on islands and abandoned vessels. Brodifacoum-25D contains 0.0025% weight concentration (or 25 parts per million [ppm]) of the active ingredient brodifacoum (Chemical Abstract Service Number 56073-10-0). Brodifacoum-25D is a green-colored, grain-based, pelleted bait formulation. Pellets are 3/8-inch in diameter and approximately one to three grams (g) each in weight and can be formulated with or without an incorporated bittering agent.

Staging of equipment and baiting operations will either be based at the existing helicopter landing pad on Southeast Farallon Island or at a helicopter facility on the nearby California mainland. The staging location will be identified in the Final Plan. Two separate bait applications, spaced 10-21 days apart, will occur sometime between October and December (ideally during the month of November). Application dates within the Project window will be based on mouse reproductive state, weather conditions, and bait availability (which will affect the second bait application timing). The goal is for the bait to be consistently available to every mouse for at least four days after each application.

To ensure ready and sufficient access to bait by all mice, the first application is expected to be distributed at approximately 16 pounds of bait pellets per acre (lb/ac; 18 kilograms per hectare [kg/ha]). This amount is based on a two-dimensional surface of the island, which will be adjusted to more accurately reflect the actual topography. In some areas, aerially broadcast bait swaths and hand broadcast areas will likely overlap. This most typically would occur in the overlap between the bait swath following the coastline and the interior swaths or anywhere else where swath lines intersect. It could also occur along adjacent borders of baiting swaths, along the tops of ridgelines, and from back baiting. Adaptive management will guide the Service to assess the areas that may need higher rates of bait, such as steep cliffs, to ensure adequate bait coverage to expose every mouse to rodent bait. Any such changes made to reflect site-specific needs will remain within the parameters of the supplemental label (refer to Section 5.1 for more information on the supplemental label). The second application is expected to be distributed at 8 lb/ac (9 kg/ha) of bait, but a supplemental label may be requested to increase the application rate to up to 16 lb/ac if deemed necessary by results of the first bait application.

The exact application rate will be based on an accurate accounting of the Operational Area, which will be determined from a three-dimensional mapping of the South Farallon Islands and include all areas above the mean high water spring (MHWS). The total acreage in the Operational Area is the value that will be used to determine the actual application rate in accordance with the EPA-approved "bait label."[1], which can be found in Appendix A. All bait application activities will be conducted under the supervision of a Certified Pesticide Applicator holding a Qualified Applicator License from the State of California Department of Pesticide Regulation (DPR). The Certified Pesticide Applicator is responsible for the legal and safe operation of the pesticide activities. The helicopter pilot will also be certified by DRP as a Pest Control Aircraft Pilot.

[1] A bait label dictates how a pesticide product may be purchased, stored, and applied, including where and when to use it, which pest(s) to use it on, how much to apply, and which types of application equipment are appropriate. See, U.S. EPA Label Review Manual, at 3-12. Available at: https://www.epa.gov/sites/production/files/2018-04/documents/chap-03-mar-2018_1.pdf.

1 INTRODUCTION

1.1 Project Purpose

The purpose of the invasive house mouse (*Mus musculus*) eradication project (Project) is to meet the management goal of the U.S. Fish and Wildlife Service (Service or USFWS) of eradicating house mice from the Farallon Islands National Wildlife Refuge (Refuge) in order to eliminate their negative impacts on the native ecosystem of the South Farallon Islands. The Service is the federal lead agency for the Project and has prepared a Final Environmental Impact Statement (FEIS) for the Project in accordance with the National Environmental Policy Act. Additional details about the range of alternatives considered in the FEIS and the public comment process can be found in the *South Farallon Islands Invasive House Mouse Eradication Project: Final Environmental Impact Statement* (USFWS 2019).

Prior to its protection as a Refuge, habitat manipulation and degradation occurred over the centuries including numerous plant and animal introductions, invasions, and subsequent eradications. Successful eradication of invasive mice will result in improved conditions for native species such as the ashy-storm petrel (*Oceanodroma homochroa*), which is listed as endangered on the International Union for the Conservation of Nature (IUCN) Red List, a Bird of Conservation Concern by the U.S. Fish and Wildlife Service (Service), and a Bird Species of Special Concern by the State of California. Other native species that will benefit from the Project include the endemic Farallon arboreal salamander (*Aneides lugubris farallonensis*), the Farallon camel cricket (*Farallonophilus cavernicolus*), and the near endemic maritime goldfield (*Lasthenia maritima*). The Service has determined that invasive mice must be eradicated (i.e., 100% of individuals must be removed) to restore the ecological functioning of the South Farallon Islands.

This *Draft Operational Plan* (Draft Plan) provides an outline of the operational procedures that will be used to assure a successful and safe eradication Project. Background information about the project is also provided for the benefit of operational team members. The Draft Plan is informed by the FEIS for the Project, along with additional research; experts in the field of island conservation, ecotoxicology, and island biogeography; and biologists who have been studying the plant and animal life on the South Farallon Islands for decades. It is also based on lessons learned and knowledge gained from more than 1,200 rodent eradication attempts on islands around the world, with over 700 successful eradications. These have included 89 that targeted house mice resulting in 64 that were successful. All but one of the successful mouse eradications used brodifacoum or another closely related second-generation anticoagulant. Best practices from these efforts have been incorporated into this plan and will continue to be refined as the Project undergoes the permitting, planning, and implementation phases.

This Draft Plan is also complimentary to and consistent with the other Project implementation plans including the *Draft Mitigation and Monitoring Plan*, the *Draft Non-Target Species Contingency Plan*, and the *Draft Bait Spill Contingency Plan*. This *Draft Operational Plan* will be further refined prior to Project implementation based on: 1) the Record of Decision for the FEIS; ; 2) input from an experienced contractor or cooperator enlisted to lead Project implementation with oversight from the Service; 3) input from the U.S. Department of Agriculture's *Animal and Plant Health Inspection Service* (USDA-*APHIS*) and the U.S. Environmental Protection Agency (EPA), including incorporation of an expected supplemental rodenticide bait label (Appendix A); and 4) input from other regulatory agencies with relevant expertise. Contractors and cooperators with applicable expertise, along with applicable permitting agencies, will be engaged to assist the Service with refining and carrying out these plans, including development of more detailed protocols. Some parts of this Draft Plan may be placed in separate, stand-alone plans or protocols if doing so will enhance operational compliance efforts. Red text in this current Draft Plan is used to indicate placeholders for information that will be addressed in the Final Plan. Table 1 provides a summary of the operational aspects of the Project.

TABLE 1. OPERATIONAL SUMMARY.

Location	South Farallon Islands: 120 acres, part of the Farallon Islands National Wildlife Refuge, 30 miles from the Golden Gate Bridge of San Francisco Bay; 37°42'North latitude and 123°00'West longitude
Target species	House mouse (*Mus musculus*)
Benefit species	Ashy (*Oceanodroma homochroa)* and Leach's (*O. leucorhoa*) storm-petrels, Farallon arboreal salamander (*Aneides lugubris farallonensis)*, Farallon camel cricket (*Farallonophilus cavernicolus)*, maritime goldfield (*Lasthenia maritima)*, and others
Island description	Southeast Farallon Island (SEFI) is an oceanic island with a 357-foot peak called Lighthouse (or, Tower) Hill. SEFI is surrounded by several smaller islets to the northwest, Saddle (or, Seal) Rock about 800 feet to the south, and West End (or, Maintop) Island to the west.
Climate characteristics	Cool temperate oceanic
Tentative start & end date	November 1, 2023 through December 15, 2023
Methods	Two aerial broadcast applications, 10-21 days apart, using an estimated 2,917 pounds (1,323 kilograms) of Brodifacoum-25D Conservation, a pelleted cereal bait. Additional application methods will include hand-baiting and bait stations of certain sensitive or hard-to-reach (by helicopter) areas, including in and around dwellings. Traps may be used in caves where exposure to endemic crickets and degradation of bait is a concern.
Conservation outcomes	Complete and permanent eradication of the house mouse resulting in increases in native storm-petrel, salamander, cricket, other invertebrate, and plant populations along with enhancements of natural wilderness character and natural ecological functions.

1.2 Goals

Project goals for 100% removal of invasive house mice from the South Farallon Islands will result in:

1. Increase in the populations of ashy and Leach's storm-petrels;
2. Restoration of native ecosystem functions altered by invasive house mice;
3. Increase in the abundance and recruitment of native vegetation;
4. Increase in the productivity and abundance of endemic Farallon arboreal salamanders;
5. Increase in the productivity and abundance of endemic Farallon camel crickets and other native invertebrates;
6. Improvements to the natural wilderness character of the Farallon islands; and
7. Improvements to species and ecosystem adaptability and resilience in light of projected future climate change.

1.3 Project Objectives and Outcomes

The objectives that the mouse eradication effort is aiming to achieve, and the outcomes that are expected from a successful Project, are shown in Table 2.

TABLE 2. PROJECT OBJECTIVES AND OUTCOMES.

Objectives	Outcomes
Remove all invasive house mice from the South Farallon Islands using the best available methods	House mice are eradicated from the South Farallon Islands following a carefully planned and executed operation that is consistent with the FEIS.
Meet the Refuge's management and policy guidelines	Project implementation through to completion is consistent with the: • Mission of the Farallon Islands National Wildlife Refuge • Farallon Comprehensive Conservation Plan • U.S. Department of the Interior Policy on Introduced/Invasive Species • Wilderness Act minimum requirements • Endangered Species Act jeopardy requirements • Migratory Bird Treaty Act • Marine Mammal Protection Act
Ensure that long-term benefits of mouse removal outweigh any short-term negative effects to ecological processes from Project implementation	Enhancement of natural ecological processes (ecosystem functions), including nutrient cycling,
	Improved wilderness character of the islands.
	Enhanced ecosystem resilience considering ongoing and projected climate change.
	Improved chances of success for future biosecurity measures to prevent the arrival of other invasive vertebrate species.

Minimize and mitigate any negative impacts to the native species and other natural and cultural resources of the islands	Burrowing owls and other raptors (except peregrine falcons) present immediately prior to and during the bait application period will be captured, translocated, and released to appropriate habitat on mainland.
	Peregrine falcons present immediately prior to and during the bait application period will be captured, held in captivity at an appropriate location, and released when deemed safe.
	As a precautionary measure, 40 Farallon arboreal salamanders will be captured, held in captivity, then released to the site of capture when deemed safe.
	A gull hazing program will minimize potential impacts to gulls.
	Operations will be conducted to minimize disturbance to marine mammals.
	Baiting techniques minimize bait drift into the marine environment with negligible impacts to water quality, marine species, and Essential Fish Habitat.
	Comprehensive monitoring studies (as described in the separate *Draft Mitigation and Monitoring Plan*) conducted to ensure and document operations are conducted in accordance with the FEIS, the bait label, other permits and consultations, and to provide information to adaptively manage the Project to best ensure success.
Ensure human safety is preserved during Project implementation	No injuries, near misses, or negative health impacts occur to Project personnel.
	Project activities are fully compliant with permit and consent conditions.
Prevent future reinvasion of house mice	Future rodent incursions on the islands are prevented or rapidly detected through the implementation of a biosecurity plan.

1.4 Adaptive Management Process

An adaptive management approach will be used because it promotes flexible decision making that can be adjusted in the face of uncertainties as outcomes from actions of the eradication operations become better understood. For example, adaptive management will be used to assess areas that may need higher rates of bait, such as steep cliffs, to ensure adequate bait coverage to expose every mouse to rodent bait. Likewise, the hazing program will be adaptively managed based on real-time monitoring of efficacy that will be used to minimize the potential for gulls habituating to hazing techniques while preventing the gulls from feeding on bait to extent practicable. Adaptive management will also be used to minimize marine mammal disturbance, and raptor and salamander captures and release. Other Project management measures may be needed based on information provided by Project monitoring efforts.

2 PROJECT SITE AND OPERATIONAL LOGISTICS

2.1 Geophysical Description

The Farallon Islands are remnants of ancient marine terraces composed primarily of granitic rock. These oceanic islands are characterized by moderate temperatures, wet winters, and dry summers. The South Farallon Islands have a planar land area of approximately 120 acres ([ac]; 49 hectares [ha]) and consist of two main islands that are separated by a narrow channel (Figure 1). The largest is Southeast Farallon Island with its prominent 357-foot ([ft]; 109-meter [m]) peak called Lighthouse (or, Tower) Hill. The next largest island is West End (or, Maintop) Island, which is dominated by the steep-sided, 223-ft (68-m) peak called Maintop. Several offshore islets immediately surround the main islands. Saddle (or, Seal) Rock to the south and smaller islets to the north are relatively small, barren, and difficult to access. On Southeast Farallon Island, a broad, flat Marine Terrace predominates the south side where the majority of infrastructure occurs (Figure 1). Most of the remainder of the island is dominated by the rocky, steep-sided slopes and cliffs of Lighthouse Hill. Most shorelines of the islands are steep and rocky, with limited accessibility in most conditions. A few narrow, steep-sided coves are present on Southeast Farallon and West End islands. The few “beaches” that occur are very small; most are no longer sandy and are either cobble or bedrock.

2.2 Access and Features

Southeast Farallon Island is the only island in the group that supports infrastructure, several of which have been maintained or renovated for Refuge management purposes. The Refuge is closed to the public to protect the sensitive resources of the islands. Service cooperator Point Blue Conservation Science (Point Blue) maintains a permanent field station on the island with rotating groups of biologists and volunteers. Point Blue assists the Service with Refuge stewardship and biological monitoring while also conducting research studies. Other human activities include periodic visits by Service staff, volunteers and contractors, the U.S. Coast Guard, and occasional visiting researchers by permit.

Southeast Farallon Island is typically reached by boat from the San Francisco Bay area and safe transport is dependent on appropriate sea conditions. The main boat landing location (East Landing; Figure 1) is on the southeast end of Southeast Farallon Island, which has a mechanized derrick to lift a small shuttle boat with personnel and supplies in and out of the water. Occasionally, bulky supplies are lifted directly from the back deck of another vessel capable of maneuvering under the crane. A path from this landing leads directly to island infrastructure including a water catchment pad and cistern, powerhouse, and two houses used as bunkhouses and offices (Figure 2).

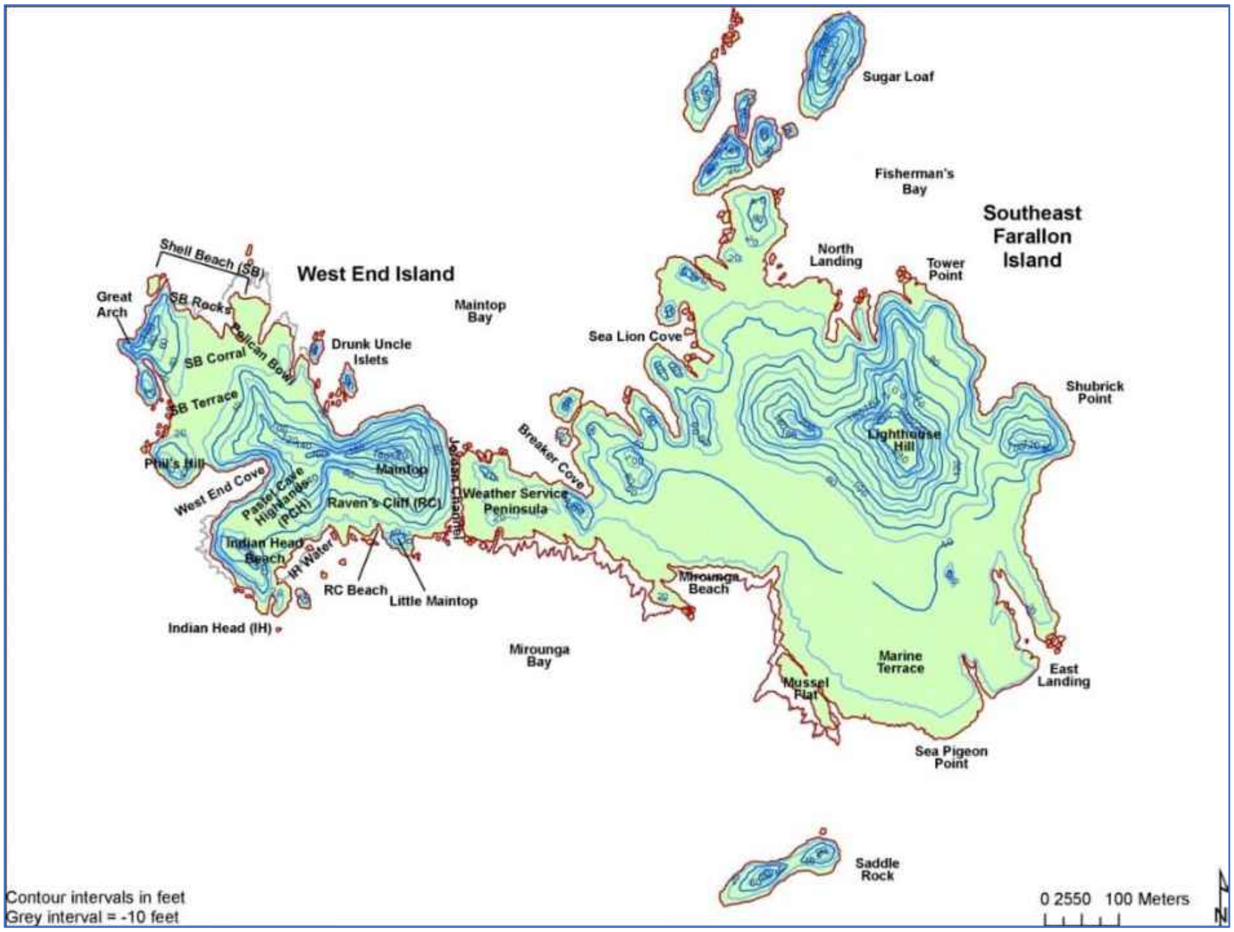


FIGURE 1. MAP OF THE SOUTH FARALLON ISLANDS SHOWING MANY OF THE COMMON PLACE NAMES AND TOPOGRAPHY.

The powerhouse contains a photovoltaic system that produces most of the electricity used for island operations, along with diesel generators for derrick and water pumping operations. A historic rail cart system is used to transport supplies from the landing to the houses and the powerhouse. There is an alternate boat landing site on the north side of the island (North Landing; Figure 1) that has a hand-cranked crane that is only used to lower an inflatable boat into the water. Wheelbarrows are the primary means for transporting cargo to and from this landing. The island can also be accessed by helicopter during the period from September 1 to March 15, which is outside of the dominant bird breeding months. The helicopter landing pad is located on gently sloped terrain of the Marine Terrace (Figure 2).

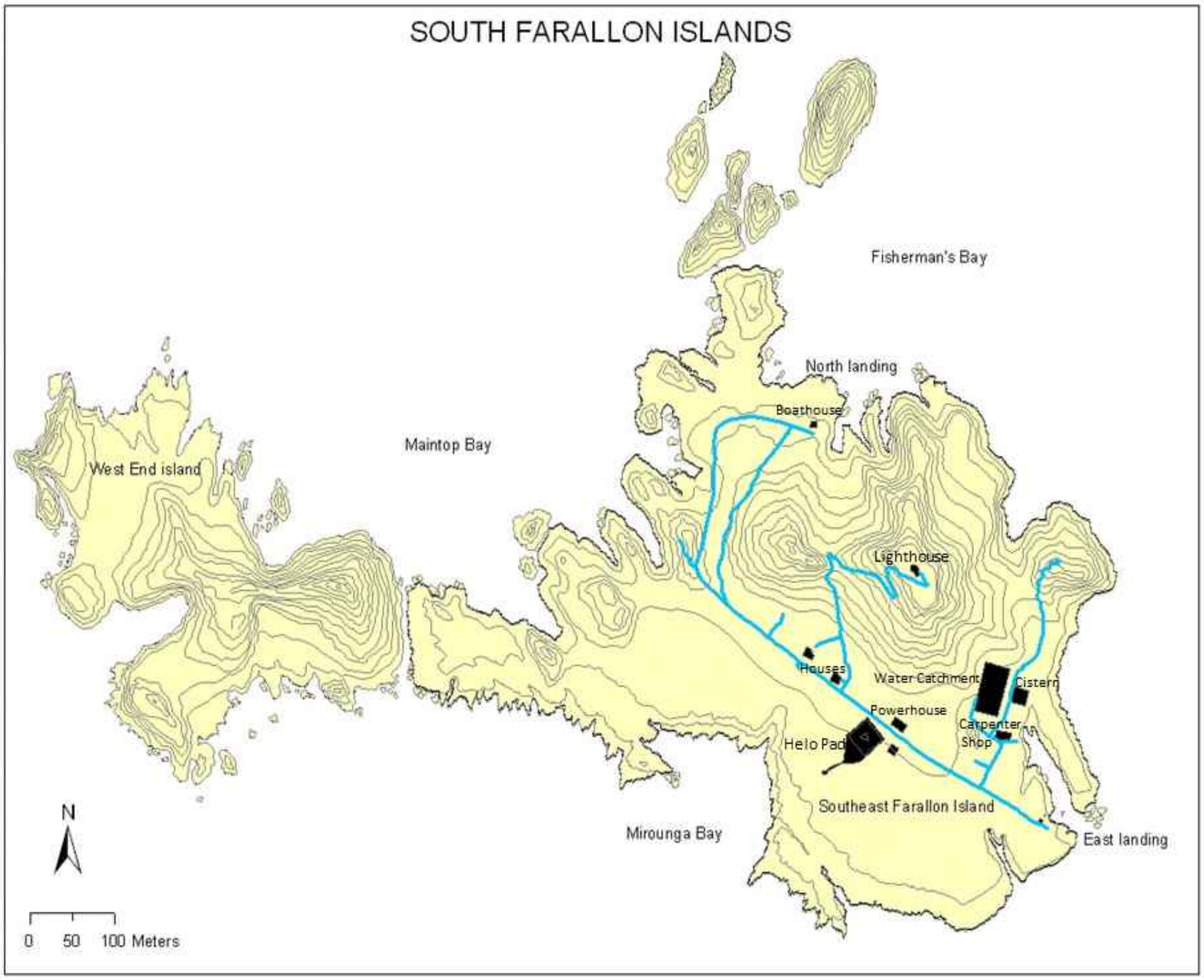


FIGURE 2. CURRENT INFRASTRUCTURE ON SOUTHEAST FARALLON ISLANDS. BLUE LINES ARE TRAILS.

2.3 Operational Area

The Operational Area of the Project on the South Farallon Islands nominally encompasses 120 ac (49 ha), which includes Southeast Farallon Island, West End Island, and the smaller associated offshore islets including Saddle Rock, Sugarloaf, Chocolate Chip, Arch Rock, Finger Rock, Aulon Islet, and Sea Lion Islet (Figure 1). A more precise accounting of the Operational Area will need to be determined from three-dimensional mapping that will be conducted prior to finalizing this Draft Plan and in consultation with USDA-APHIS and EPA on a supplemental label. Rodent bait will be applied above mean high water spring (MHWS) and will primarily consist of aerial broadcast applications.

Additional deployment in certain areas will be conducted by hand broadcast, bait stations, and possibly traps (see Section 5.7 for more information). Safety of personnel will be a primary consideration during Project activities, especially because of the challenging physical environment with many steep and rocky areas that are hard to access. This will also be a factor to consider when the quality of the bait is being monitored because there needs to be complete and consistent ground coverage of bait, particularly in areas where mice dwell. No bait will be applied below MHWS although a small amount of incidental bait drift below MHWS will almost certainly occur. Procedures to avoid and minimize bait drift are addressed in Section 5.6.

2.4 Logistics

The helicopter that will be used to broadcast rodent bait will be staged from Southeast Farallon Island or at a nearby mainland location. Both methods have been used safely and successfully in other rodent eradication projects. Each method has inherent risks and choosing which method will depend on a variety of factors including transportation sources available at the time of implementation. A final decision on the bait transport method will be made in consultation with the implementation team and with input from the Greater Farallones National Marine Sanctuary (GFNMS). Whichever method is chosen, appropriate safety precautions will be employed to minimize the risk of a bait spill or other incident.

Staging the aerial bait broadcasts from Southeast Farallon Island likely would be the safest and most efficacious method of completing the operation. This would require that bait (and possibly other supplies) first be transported in bulk to the island. This approach is possible with a large helicopter if the transport method (i.e., slingload or carried inside the aircraft) is determined to be safe. Another method would involve first transporting bait to the island via a ship or barge. Bait would then be brought ashore either by the Refuge shuttle boat, or, if necessary, by airlifting bait onto the island by helicopter. Although this type of activity is performed safely in various settings, lifting loads from an unstable platform does incur certain risks that will need to be minimized.

Staging from the mainland will be considered in developing the final plan and will be chosen if it is considered to be safer than transporting bait in bulk to the island. However, given the fairly long distance (about 30 miles) to potential mainland staging sites, the greater amount of time commuting back and forth over marine waters during the baiting operation may add more risk of a bait spill and extend the length of time it takes to complete baiting. This latter issue could, in turn, reduce operational flexibility and Project success, such as by limiting time of day for baiting or amount of time needed to complete the baiting before unexpected weather changes could force a premature cessation of aircraft flights.

Under any of these possible scenarios, staff will fill the bait spreading bucket, refuel the helicopter as necessary, and conduct other necessary preparations. Refer to Sections 2.5 for details about the team's roles and responsibilities. The staging area will be stocked with fuel and other supplies and equipment to support the helicopter operations for the entire bait application process. Regardless of staging area used, the bait loading process (as described in Section 5.5) will remain the same. Final logistical plans will be addressed in a revised *Final Operational Plan* document.

2.5 Operational Team

The Project will be managed by an Operational Team that will be led by the Refuge Manager, who will also serve as the Incident Commander in the unlikely event there is an accident resulting in a unpermitted release of material or other emergency response situation. The roles listed for each position in Table 3 are their major responsibilities; other responsibilities may be assigned to any of the positions by the Refuge Manager (Operations Commander), as needed.

TABLE 3. SUMMARY OF ROLES AND RESPONSIBILITIES FOR INCIDENT OPERATIONS.

Team Function	Position	Role
Project Command Team	Operations Commander	Manages whole operation; all teams report to the Operations Commander for ultimate decisions
	Assistant Operations Commander	If needed, an Assistant Operations Commander will be designated to provide back up support to the Operations Commander
	Communications Officer	Manages coordination of public information to partners, media, and the public
	Eradication Advisor	Ensures technical efficacy and provides advice to the Baiting Operation Chief
	Independent Observer	Documents operation deviations, decision-making processes and procedures
	Air Operations Chief	Responsible for aerial operations and integrating helicopter operations with bait loading and data recovery from TracMap or other GPS guidance tracking software
Operations Team	Operations Team Lead Advisor	Ensures the operation's legal compliance in coordination with the Command Team's Eradication Advisor and provides advice to the Baiting Operation Chief
	Bait Operations Chief	Manages bait application efficacy, including bait loading, and supervises the Bait Loaders
	Bait Loaders (4)	Assists in the bait loading operations
	Data Specialist	Records, summarizes, and reports on the GPS-based data
	Pilot-in-Charge (also known as the Pest Control Aircraft Pilot)	Implements helicopter operations and aerially broadcasts bait
	Helicopter Mechanic	Maintains helicopter and assists Pilot-in-Charge
	Safety Officer	Identifies, assesses, and anticipates hazardous and unsafe situations

Team Function	Position	Role
Planning Team	Certified Pesticide Applicator	Assumes responsibility for the bait once the bait shipment is received from the manufacturer, and supervises all bait applications under the product label or supplemental label
	Biosecurity Officer	Implements Biosecurity Protocol
	Bait Availability Monitoring Officer	Manages efficacy of monitoring operations, supervises monitoring crew, implements safety protocols to the field team and collects, analyzes, and reports data
	Bait Availability Monitoring Crew (2)	Assists the Bait Availability Monitoring Officer and implements monitoring
Environmental Team	Environmental Monitoring Officer	Manages the environmental hazing and monitoring operations, supervises monitoring crew, implements safety protocols to the field team and collects, analyzes, and reports data
	Environmental Hazing and Monitoring Crew (8)	Implements required environmental monitoring and hazing operations

3 DESCRIPTION OF TARGET AND NON-TARGET SPECIES

3.1 Target Species

The targeted species is the invasive house mouse (*Mus musculus*), which is believed to have been introduced to the South Farallon Islands in the early to mid-19th century. The mice weigh approximately 0.5 - 0.7 oz (14 – 20 g). House mice are omnivorous and eat a variety of seeds, fungi, insects, reptiles, and other small animals, as well as bird eggs, chicks, and adults. House mice also consume native invertebrates including the Farallon camel cricket, which alters the makeup of the invertebrate fauna. Mice consume large numbers of seeds and other plant parts of native vegetation, reducing native vegetation cover in favor of hardier, invasive plants. They also provide an unnatural and temporary food source for migratory burrowing owls, which then switch to preying on ashy storm-petrels as the mouse population decreases during the winter. In addition, the owls prey extensively on Farallon camel crickets. These impacts on storm-petrels and crickets are indirect effects of the mice on the South Farallon Islands ecosystem.

Mice typically reside in burrows or crevices, rarely traveling outside of a 65-square-foot (ft^2; 6-m^2) area surrounding their burrows. They are prolific breeders with females commonly producing six to eight litters a year, each with four to seven young, which mature within three weeks and are reproductively active soon after. The population of invasive house mice on the South Farallon Islands is highly cyclical, growing steadily and rapidly throughout the summer and early fall with a peak in October, followed by a crash throughout the winter as winter rains, cooler temperatures, and declining food resources lead to large scale mortality. The population is at its lowest numbers in spring, typically in April. At their annual peak, they can number more than 490 per acre – among the highest densities recorded on any island in the world.

3.2 Non-Target Species

The biological resources of the South Farallon Islands are described in Section 3.4 of the FEIS. An assessment of impacts to biological resources from the Project are described in Section 4.5.6.1 of the FEIS. The islands provide habitat for the largest seabird breeding colony in the contiguous United States, important haul-out and breeding sites for five species of pinnipeds (both seals and sea lions), and they are surrounded by protected waters that support a productive marine ecosystem.

The islands are inhabited by a high number and large diversity of birds including breeding and non-breeding seabirds, waterfowl, birds of prey, shorebirds, and landbirds. Some birds are resident, while many are migratory. The FEIS examined potential impacts to many of the bird species, but the ones described in this Draft Plan are those that were found to be at greater risk of exposure (determined to be for only short-term) to the rodenticide bait. Only the western gull (*Larus occidentalis*) was found to be potentially at risk of population impacts if large numbers of the gulls were to be exposed to toxic levels of rodenticide. The impacts to other bird species that were assessed in the FEIS (refer to Table 4.4 in the FEIS for a summary) were determined to be insignificant due to the birds' ecology and the timing of proposed operations (such as not feeding on bait pellets or not being present during the late fall timing of the operations). The bird species that have been included in this Draft Plan (i.e., western gulls and raptors) are the ones considered to be most likely at short-term risk as a result of the Project, thus requiring additional protective measures during the implementation phase.

The islands also host large numbers of pinnipeds of five species. The FEIS concluded that pinnipeds would be at risk of disturbance-related impacts during operational activities. Pinnipeds are particularly sensitive to nearby human activities and will be potentially exposed to short-term disturbance from ground, air, and gull hazing operations.

Two endemic terrestrial species, the Farallon arboreal salamander and Farallon camel cricket, are both considered to be at low risk of impacts from the Project, but mitigation measures will be employed as extra precaution to guard against population level impacts.

The intertidal zone holds a diversity of marine invertebrates, and the waters off the islands contain valuable commercial and recreational fishery species. Although risks to marine resources are low, measures to minimize incidental bait drift and accidental bait spills into the marine environment will be utilized.

Information on additional protective measures for the resources described above are detailed in the separate *Draft Mitigation and Monitoring Plan* document.

3.2.1 Western Gull

Western gulls are vulnerable to consuming rodent bait because they are omnivorous scavengers. In the absence of any hazing activities, between 2,000 and 6,000 birds could be on the island on any given day in mid-November when the mouse eradication effort will be undertaken. Most of this roosting occurs along the island's periphery (referred to as "intertidal roosts"; Figure 3). Western gull numbers and frequency of attendance increase through December and January with up to 14,000 possible by early January. Non-breeding gulls of other species are also common in the intertidal roosts in late fall and winter, but they are not nearly as numerous as the western gulls on most days. During fall and winter, gull attendance is highest in late evening and early morning hours; most gulls disperse from the island to feeding areas during the day.

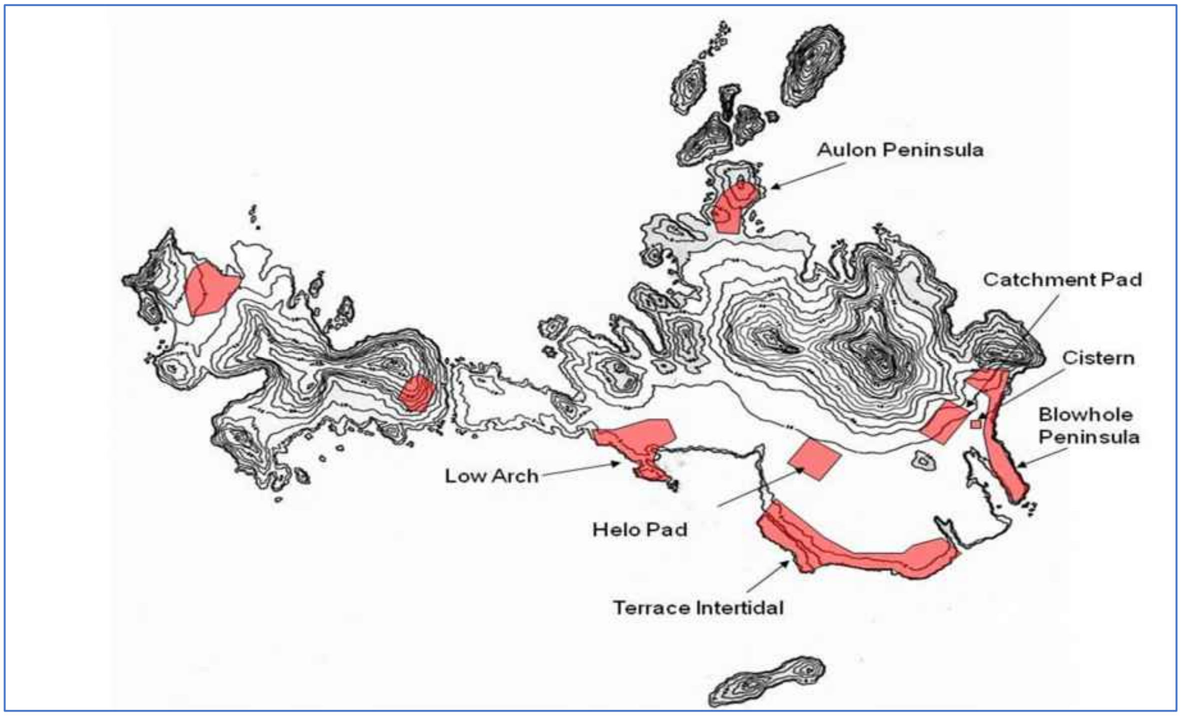


FIGURE 3. COMMONLY USED WESTERN GULL ROOSTING SITES ON THE SOUTH FARALLON ISLANDS.

3.2.2 Raptors

Low numbers of raptors (generally less than 12 per species) visit the islands in September and October during the fall migration period (FEIS at 168-172). Only a few raptor species regularly winter on the islands including the peregrine falcon and burrowing owl. Single bald eagles were observed in December 2011 and in March and September 2016. The only golden eagle record for the islands was a single bird in October 1971. Prior to implementation of the Project, consultation with the Service's Migratory Bird Permit Office will be conducted to determine if a Bald and Golden Eagle Protection Act permit will be needed.

Burrowing owls typically arrive in September to November during the fall southbound migration. While most visiting owls only stop briefly on the islands, generally one to 12 individuals, but sometimes more, will remain and overwinter each year. The burrowing owl population on the South Farallon Islands is supported mainly by a diet of the invasive house mice in the fall, then as the mouse population drops, the owls switch to feed on storm-petrels in the late winter and spring. Burrowing owls may consume one to two storm-petrels per day. Owls generally depart the islands by early May. It is likely that during the mouse eradication Project, these burrowing owls will be at risk of exposure to rodenticide if they consume mice or other prey that have ingested rodenticide.

3.2.3 Other Terrestrial Wildlife

The islands host unique populations of other animals including the endemic Farallon arboreal salamander, the endemic Farallon camel cricket, and many other native insects and other invertebrates.

The Farallon camel cricket is found primarily in caves around the islands. Invertebrates such as the camel cricket are not considered to be at risk from ingesting bait because of their different circulatory systems that make them generally unsusceptible to anticoagulant pesticides. Cricket abundance is expected to increase on the islands once house mice are removed because mice consume large numbers of native invertebrates. Burrowing owls also feed extensively on camel crickets, beetles, and other invertebrates. This consumption by mice and owls is likely suppressing camel cricket and other invertebrate numbers. This can have cascading detrimental ecosystem effects since many insects are important pollinators, decomposers of animal and plant matter, and an integral source of food for many migratory birds.

The Farallon arboreal salamander is not considered threatened but this subspecies is found only on the South Farallon Islands. The salamanders are primarily insectivorous. While salamanders are at risk of exposure to rodenticide, mainly by consuming invertebrates that have consumed bait (i.e., secondary exposure), studies indicate that salamanders are not at high risk from rodenticides because of their different circulatory systems than other vertebrates. Salamanders primarily inhabit crevices and burrows during the day and venture out on humid nights to forage. During the wet season, salamanders can be found spending the day on the surface under rocks, logs, or other cover. Arboreal salamanders are most active when the surrounding environment is moist but are not dependent on water for any part of their lifecycle and are more tolerant of dry conditions than most salamander species. The average age of maturity for the Farallon arboreal salamander is approximately three years with a relatively high rate of adult survival, which is estimated to range from eight to eleven years. They breed and lay eggs during the summer, with young appearing in the fall.

3.2.4 Marine Mammals

California sea lions (*Zalophus californianus*) are the most abundant pinniped on the islands with peak numbers during the mid- to late fall months. Steller sea lions (*Eumetopias jubatus*) are much less numerous with peak numbers occurring during the breeding season. Pupping for both of these sea lion species occurs mainly in June. Northern elephant seals (*Mirounga angustirostris*) and harbor seals (*Phoca vitulina*) are the least numerous species throughout most of the year. A few harbor seals pup on the islands (mostly in April). A few small rookeries of Northern elephant seals occur on Southeast Farallon and West End islands; adult males being first to arrive for breeding in mid-December, with pupping occurring from late December to early February. Northern fur seals (*Callorhinus ursinus*) occur almost exclusively on a small portion of West End Island known as Indian Head Beach. This rookery has been increasing rapidly in recent years. Most pups are born in mid-June to July. Most of the rookery departs the islands by early to mid-November although small numbers are present through the winter.

3.2.5 Other Marine Species

White sharks feed in waters around the islands during the fall months. There are also numerous bony fish including at least 16 species of rockfish (genus Sebastes), lingcod (*Ophiodon elongatus*), wolf eel (*Anarrhichthys ocellatus*), California halibut (*Paralichthys californicus*), big skate (*Raja binoculata*), Pacific sanddab (*Citharichthys sordidus*), cabezon and other sculpins (*Cottidae*), Chinook salmon (*Oncorhynchus tshawytscha*), northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), and other species. Dungeness crab (*Cancer magister*) is found around the islands and is an important fishery in the

Gulf of the Farallones. Red abalone (*Haliotis rufescens*) is known to occur in the subtidal zone. Small numbers (less than 10) of endangered black abalone (*Haliotis cracherodii*) have been known to occur in the intertidal zone around the islands and a few individuals may be present although a survey in 2015 failed to find any.

It is expected that a small amount of rodent bait will incidentally drift into the marine environment during aerial deployment operations. The relatively few bait pellets that do reach the water will break down rapidly in the high wave action environment surrounding the islands. In addition, due to its extremely low solubility, it is not expected that enough brodifacoum will dissolve to create a hazard to nontarget aquatic organisms. However, procedures to avoid and minimize bait drift will be taken and are addressed further below in Section 5.6. Monitoring of the marine environment also will be conducted; details are provided in the *Draft Mitigation and Monitoring Plan*.

4 SPECIES PROTECTION

In order to minimize risk to non-target wildlife, the Project will be implemented in the fall months, which are outside of the breeding season for seabirds (except for ashy storm-petrels, as noted below) and pinnipeds (refer to FEIS Section 2.10.4). However, it is expected that a range of tens to thousands of birds and a few thousand pinnipeds will be present on any given day during the operational window. (Anticipated numbers of each avian species are provided in Section 4.5.6.1.1 of the FEIS.) Small numbers of late-nesting ashy storm-petrels will still be raising chicks, which should all be fledged by the end of November. Since storm-petrels nest underground in rock crevices, are nocturnal, and feed only on marine fish and invertebrates, their risk of harm from eradication operations is low.

A variety of methods will be used to maintain species protection efforts on the islands and minimize detrimental effects from the mouse eradication Project. These are briefly described below and are described in more detail in the separate *Draft Mitigation and Monitoring Plan*.

4.1 Pre-deployment Wildlife Monitoring

Existing annual surveys of breeding populations, seabird productivity, storm-petrel population and survivorship trends, and other long-term monitoring studies, will occur prior to and after the mouse eradication Project to document impacts on seabird species.

Resident and migrant bird populations will also be surveyed using standardized protocols for long-term monitoring studies. Standardized area searches will occur daily from mid-August to early December to assess species and approximate numbers of birds present. This will include surveying daily for all non-breeding birds, and the banding and color banding of landbird species to assess stopover duration. Area searches will be conducted twice daily up to mid-November and then reduced to once daily in mid-November due to shorter days and decreasing numbers of birds, which is typical during this late fall migration period.

Before the start of the Project, a daily recording of all dead birds will be conducted along with a standardized storm-petrel “wing walk” survey every five days. Within five days prior to the first bait drop, carcass surveys for all birds will be conducted throughout the safely accessible areas of the islands to provide baseline numbers. As many carcasses as feasible will be collected for potential baseline residue analyses and to ensure they are not counted again after bait application has started. Carcasses that cannot be collected will be wing-clipped for future identification and recorded.

Other wildlife monitoring will include ongoing weekly pinniped counts, quarterly cricket surveys, twice monthly salamander surveys (starting in October or November), daily cetacean surveys, and daily white shark attack surveys.

4.2 Reducing Disturbances During Project Implementation

Prior to the start of the Project, personnel will be trained on strategies and techniques that will be used to minimize wildlife disturbances. These techniques will be implemented during eradication operations and during all monitoring activities. Field safety briefings and training requirements will include the following for all Service staff, contractors, cooperators, and others involved in the Project:

- Participating in briefings, which will include maps detailing sensitive wildlife areas such as pinniped haul-outs, cricket caves, and tidepools.
- Participating in trainings on how to avoid disturbance to wildlife, especially pinnipeds, and avoid trampling and other impacts to sensitive habitats such as seabird nesting burrows and crevices.
- Requiring slow movements in sensitive wildlife areas to minimize disturbances to marine mammals.
- Traveling carefully by foot to avoid sensitive areas, when possible, to reduce unnecessary impacts to native vegetation, burrows, crevices, and intertidal areas.
- Conducting avian hazing operations with the goal of minimizing disturbances to marine mammals and other non-target wildlife.
- Documenting pinniped disturbance effects, as required under the Marine Mammal Protection Act, and using disturbance data to adaptively manage bait application and gull hazing operations to optimize Project success while minimizing pinniped disturbance.

4.3 Raptor Capture, Captive Management, and Release

Attempts will be made to capture all raptors found on the island prior to and during bait application activities. Capture efforts will continue to occur for as long as the risk of exposure is considered to remain substantial (i.e., bait pellets or carcasses of exposed wildlife remain available and palatable). Methods involving capture and translocation or temporary captivity will be carried out in accordance with the terms of a Special Purpose Miscellaneous Permit issued by the Service's Regional Migratory Bird Permit Office.

If peregrine falcons are captured, they will be held off-island in a captive facility until it is determined safe to release them, given the high likelihood that some individuals may return to the Farallon Islands.

Other species including burrowing owls that are considered at low risk of returning to the islands will be transported off the island and released into suitable habitat on federal lands on the mainland.

4.4 Captive Management of Salamanders

Although the risk to salamanders from the Project is considered to be low, a sample of the total salamander population will be collected prior to bait application and held on the island in terrariums until the risk of exposure is deemed negligible or monitoring of wild salamanders shows that the operation has had no effect on the population. Captive holding of salamanders will follow established protocols. Approximately 40 individual salamanders will be collected and housed in captivity to retain sufficient genetic diversity in the population should an unexpected, large mortality event occur. If possible, individual salamanders will not be collected from under existing research "coverboards" so that this long-term monitoring area can be used to examine potential impacts from the eradication operation and to not impact long-term population studies (refer to the *Draft Mitigation and Monitoring Plan* for more information). As these animals have small home ranges, salamanders will be returned to their same location of capture.

4.5 Gull Hazing and Monitoring

To prevent gulls from feeding on bait, they will be subject to an intensive hazing program beginning prior to the first bait application and continuing until the availability of palatable bait pellets has declined to a level where the risk of gull exposure is negligible. The hazing will also be conducted at night, as needed. Assuming similar rainfall patterns as in the past, Brodifacoum-25D bait is expected to remain available and palatable to western gulls for a period of up to five weeks following the second bait application. The purpose of gull hazing is to prevent gull exposure to rodenticide by preventing gulls from landing on or roosting on the islands long enough to discover and consume bait pellets or carcasses of exposed mice or other wildlife.

Gull hazing will begin at least five days before rodent bait application begins and continue until gull exposure risk has declined to a negligible status. Monitoring of bait and mouse carcass availability will be used as the primary approach to determine when to cease hazing.

Goals:

1. To reduce rodenticide exposure to and mortality of gulls and other non-target wildlife; and
2. To maximize the amount of bait available to mice since consumption by gulls will reduce bait availability.

Objectives:

- Document the numbers of gulls and locations present each day;
- Document response of gulls to various hazing techniques both passive and active;
- Accurately assess changes in gull numbers from baseline surveys to determine hazing effectiveness and whether gull numbers present pose a risk of significant impacts to gulls; and
- Document impacts of hazing activities on non-target species, particularly marine mammals.

4.5.1 Passive Hazing

Passive (i.e., non-manned and stationary) hazing will be conducted to prevent gulls from landing on the islands while bait and carcasses remain available. Passive hazing methods may include stationary kites, effigies, biosonics, mylar and propane cannons. A final determination on the optimal device (or combination of devices) to be used will occur prior to Project implementation. When near a pinniped haul-out, passive hazing techniques will prioritize those least likely to disturb pinnipeds. Techniques that are more likely to result in pinniped disturbance will be used only if other techniques are not successful.

At least 5 days before the application of bait, a series of passive hazing devices will be deployed at predetermined locations around Southeast Farallon and West End islands. All passive hazing devices will be mapped using global positioning system (GPS) coordinates and monitored once every two hours during daylight hours (for personnel safety) throughout their deployment. It will be possible to check on many of these devices from distant vantage points, such as Lighthouse Hill or Maintop, while others may require visiting the site due to obstructed views or poor visibility conditions. Hazing team members participating in island surveys will be required to approach carefully or to observe from a safe distance so as not to unintentionally influence the effectiveness of the passive hazing device.

4.5.2 Active Hazing

Depending on the findings of the additional passive hazing trials, active hazing will be conducted of any gull roosts on the islands that are not responsive to passive hazing techniques or where passive hazing techniques cannot be conducted (e.g., inaccessible areas). Active hazing includes human presence, moving kites or effigies, biosonics, lasers, pyrotechnics, helicopter passes, and potentially other methods. When near a pinniped haul-out, active hazing techniques will prioritize those least likely to disturb pinnipeds. Techniques that are more likely to result in pinniped disturbance will be used only if other techniques are not successful.

Each hazing team will "police" their designated Hazing Sector to look for roosting gulls and conduct any hazing actions necessary to keep gulls off their sector for the duration of the operational period. In addition, hazing team members may be deployed at any time to a specified area at the direction of the Environmental Monitoring Officer (refer to the Project Team in Table 3). This is most likely to occur if gulls are persistently roosting in a particular spot or if another hazing team requires assistance.

4.5.3 Hazing Monitoring

Whenever any passive or active hazing is to occur, the hazing monitor will record the following information in the Wildlife Response notebook for their Hazing Sector.

1. **Date** - Record the date the hazing occurred.
2. **Time** – Record the time (24-hour format) of specific hazing activity.
3. **Treatment Area** – Record the specific location where the hazing treatment occurred.
4. **Hazing Treatment –** Record the specific type of hazing treatment employed (i.e., moving kite, helicopter or pyrotechnics).
5. **Initial Gull Count –** Record how many gulls were present before hazing is initiated.
6. **Gull Response –** Record the approximate percent of gulls from the initial count that exhibit each of the three categories of response: none, alert or flush (i.e., 25% no response, 50% alert, 25% flush).
7. **Flight Response –** For birds that flushed, record the approximate percent of gulls which departed the island, moved to another area, or circled and returned to the same area (i.e., in response to the hazing, 30% of the birds that flushed departed the island, 70% moved to another area and 0% returned).
8. **Marine mammal responses –** Record the numbers of marine mammals disturbed because of hazing operations, including species, age category, and behavioral responses (moved, flushed).
9. **Notes** – Record any other pertinent information including other species' responses or other gull roosts affected.

5 BAIT APPLICATION PROCEDURES

5.1 Supplemental Label

A supplemental label for Brodifacoum-25D will likely be pursued to address Project specific needs for increasing the likelihood of success while still protecting non-target resources. Potential reasons to seek a supplemental bait label include the need to increase bait application rates in specific areas such as steep cliffs or areas of unusually high bait uptake to ensure adequate bait coverage; conduct aerial baiting over dwellings to minimize gaps in baiting; back-bait certain areas because of rapid bait degradation or disappearance; or to conduct targeted follow-up baiting in case small numbers of rodents are still detected after the initial bait applications. Prior to Project implementation, the Service will consult with the USDA-APHIS (bait registrant) and EPA to identify any Project-specific needs that would be included on a supplemental label. If a supplemental label is deemed appropriate, the label registrant, USDA-APHIS, would apply to EPA for the supplemental label. In this case, the supplemental label would describe the specific bait application activities approved for the Project. Any operational adjustments resulting from a supplemental label will be incorporated into the *Final Operational Plan*.

5.2 Timing

As indicated in FEIS Section 2.10.4, the Project would occur in the fall, which coincides with the annual decline in the mouse population and their breeding activity. Studies indicate that the annual mouse population decline begins in November when breeding mostly ceases. Numbers continue to decline through the winter with annual low numbers in spring. This population decline also corresponds with a decrease in food supply, which means the mice would be more inclined to eat the bait.

Another factor informing the choice of a fall Project window is the potential risk of disturbance and rodenticide exposure to non-target species. Most breeding seabird species are at annual minimum population numbers in the fall months following the breeding season, although several species begin to return sporadically starting in late fall (mid- to late November) and through the winter. Although fall is the time when the greatest numbers and diversity of migrant birds arrive, most have departed by early November. Also, there is no pinniped pupping in the fall months although some sea lion and fur seal pups born during the summer will still be present. Elephant seal pupping season begins in late December.

Implementing the Project in the fall rather than the winter is also preferable from a weather perspective because a dry period long enough to complete the bait application is more likely during the fall. Precipitation can impact bait condition and availability as well as increase the potential for bait pellets being washed into the ocean. However, receiving a significant rain event soon after bait has been deployment and is no longer needed on the ground, is a desired situation in order to break down remaining bait pellets so they are no longer available and palatable to non-target wildlife. As a result, the actual timing of the Project will be informed by a close evaluation of weather conditions, both for safety of personnel during helicopter operations and to ensure optimal bait application conditions. Weather and gull hazing efficacy are the primary drivers for determining the ultimate implementation schedule. The most optimal timing would be to conduct the first drop in early November and the second drop about 10 to 21 days later.

5.3 Aerial Application Procedures

Figure 4 shows a draft of the helicopter baiting strategy and flight lines. This strategy will be finalized following review by the implementation team, USDA-APHIS, and EPA. The strategy will also incorporate terms of the supplemental label if one is obtained. The pre-selected flight paths will be followed and monitored during bait application using an onboard GPS with a Geographic Information System (GIS) software program such as TracMap, which allows for a navigation bar to guide the bait application, helping to avoid gaps and unanticipated overlaps. Figure 4 also shows sample track lines. All areas treated with bait will be above the MHWS mark, which is the highest level of the tides that have been calculated from predictions over a 19-year period. The MHWS mark of the South Farallon Islands will be indicated on the flight maps by GPS points.

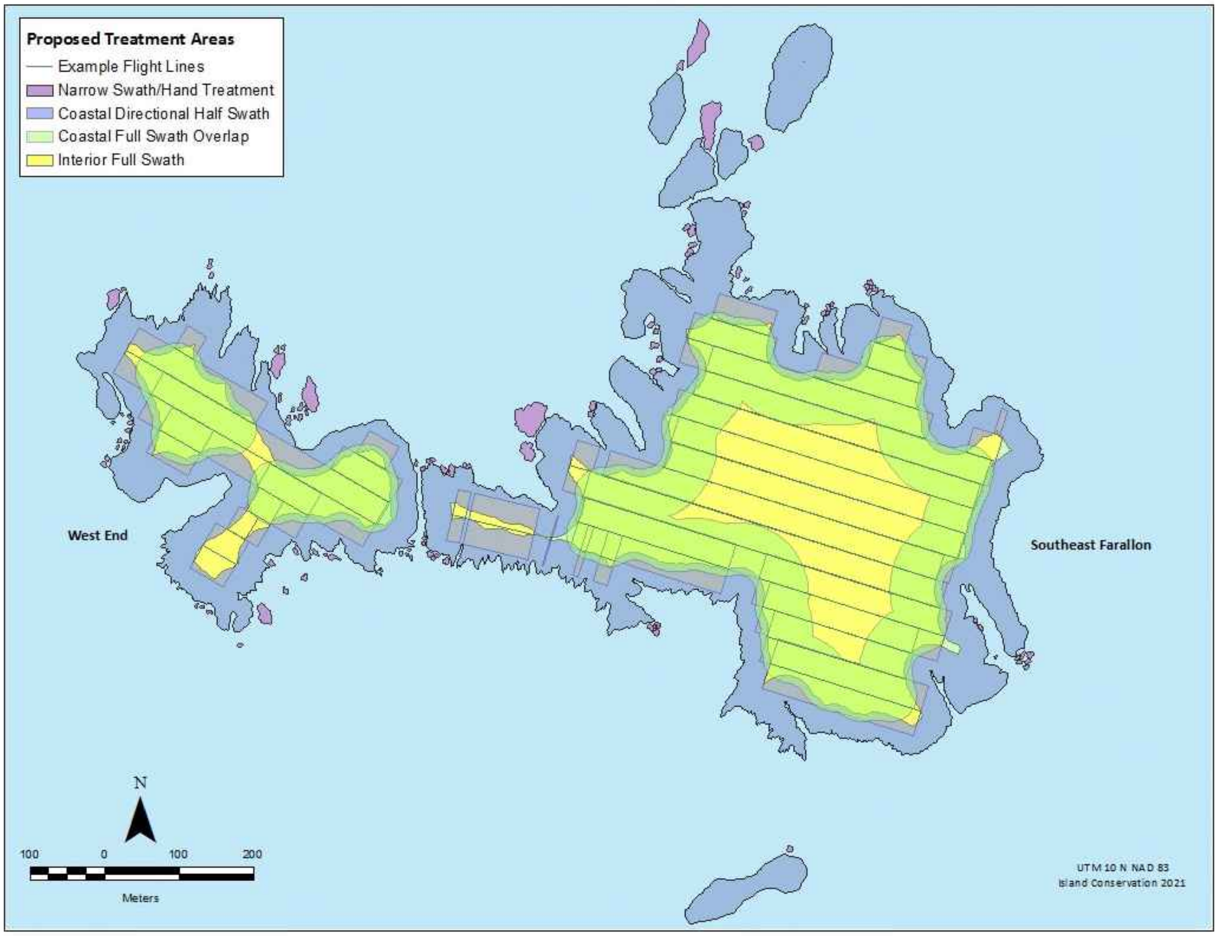


FIGURE 4. SCHEMATIC EXAMPLE OF AERIAL BAITING TRACKLINES.

Shorelines would be flown separately from interior transects. Flightlines would be flown to distribute bait with 50% overlap between transects or swaths to assure bait is distributed into every potential mouse territory. See Figure 5 for swath descriptions.

The bait will be deployed from a specialized bait spreading bucket slung beneath the helicopter. The bait spreading bucket consists of a bait storage compartment (the “hopper”), a remotely triggered adjustable gate to regulate bait flow out of the storage compartment, and a motor-driven broadcast device (the “spinner”).

Three different bucket configurations will allow for four different effective swath widths (Figure 5). The swath width will be based on the width of the target baiting area and probabilities of risk of bait entering the ocean. The different bucket configurations can be employed to apply bait at the effective swath width, or the estimated horizontal distance of bait spread from the bucket. The most effective swath widths will be confirmed during calibration trials prior to Project implementation.

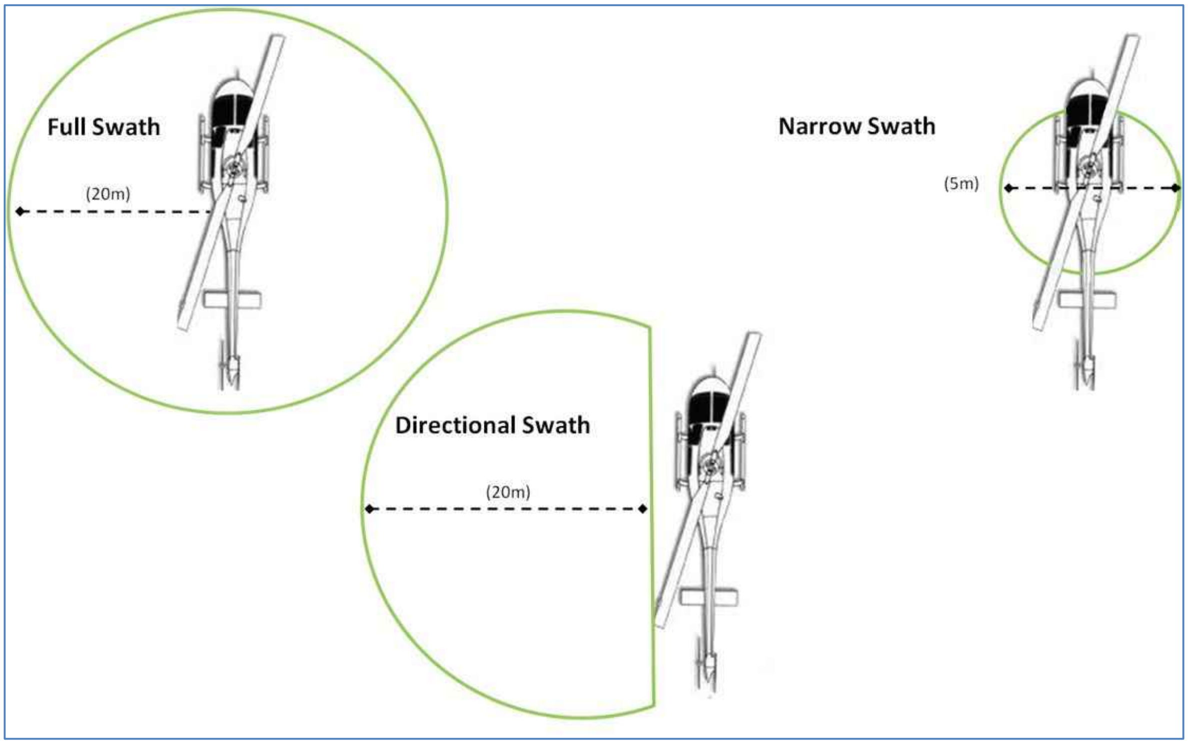


FIGURE 5. AERIAL BAIT APPLICATION TYPES (SWATH WIDTHS ARE NOT SPECIFIC TO THIS PROJECT).

Swath definitions:

- *Interior full swath* – bait broadcast from both sides of the bucket with 50% overlap of interior flight lines.
- *Coastal full swath overlap* – bait broadcast from both sides of the buckets inset from the coastal perimeter run.
- *Coastal directional swath* – spinner equipped with an internal deflector to only allow bait to be broadcast from one side of the bucket, which is used along the coast or where a full swath is too wide for the land area being treated.
- *Narrow swath* – spinner removed, and a spreading cone put in so that bait falls straight down, which is used to treat very narrow areas.

5.4 Aerial Broadcast Application Rates

Throughout the operation, the aerial broadcast application rate will be monitored by calculating the area covered versus the quantity of bait used. More in-depth analysis of application rates across the island will be undertaken periodically during the operation using GIS or other techniques such as the "hula hoop" method to estimate bait densities by counting the number of bait pellets within the hoop. Rodent bait will be applied at a rate that ensures all individual mice have access to sufficient bait to ingest a lethal dose.

Two discrete aerial broadcast applications of Brodifacoum-25D will be undertaken approximately 10 to 21 days apart. For the first application, bait-bucket calibrations and air speeds will be matched to give a nominal rate of bait-sowing of X lb/ac. Based on bait-buckets providing an effective swath width of X ft, the parallel flight lines will be spaced to give an X-ft (50%) overlap in bait-sowing swaths. This will result in an effective application rate of 16 lb/ac.

The second application will be completed at the nominal sowing rate of X lb/ac but with an X ft (25%) overlap in swaths to provide an effective application rate of 8 lb/ac.[2] Flight lines for the second application will also, if possible, be flown at approximately 90 degrees to the flight lines used for the first drop. This is intended to reduce the risk of gaps in bait spread. If this is not possible, then the second drop lines will be run at whatever different angle to the first is practical.

During each application of bait, the islands' coastlines will be flown a second time using a combination of parallel flight lines and line of sight to ensure adequate bait coverage. The flights along the coastline will use a XX-ft (50%) overlap to guard against gaps occurring at the end of the parallel flight lines. In addition, the bucket will have a bait deflector installed and a skirt attached, which provides a directional (120° rather than 360°) broadcast of bait out to a predetermined distance (refer to Figure 5).

Bait will be applied by helicopter at a rate of approximately 660 lb/hour. Adjustments in bait flow rates, helicopter speed, and flight lines will be made, as needed, to achieve the bait application rate while remaining within maximum broadcast application rates set by the Brodifacoum-25D label or the supplemental label.

It is estimated that up to three hours of flight time is required to complete each of the two bait applications, assuming helicopter operations are staged at the island. Additional time will be needed for helicopter transport, reloading, and other flight-related logistics as well as time for contingencies. The helicopter may also be used to transport equipment and personnel to and from the island, to monitor gulls in otherwise inaccessible areas, to gently move pinnipeds away from bait application areas (prior to baiting), and/or to support gull hazing operations.

5.5 Bait Loading Operations

The bait loading site will consist of one bait bucket loading platform. Full bait pods (i.e., secure storage containers such as tripled-walled corrugated boxes made by Ox Box) will be transported from the storage area to the bait loading site and set-up in a strategic layout prior to the aerial baiting operation. The bait will be stored in a cool, dry place that is inaccessible to unauthorized people, children, and pets. It will be stored in its original container and away from other chemicals. Efficacy of the product may be reduced under high moisture conditions. The bait pods will be set up in a way that allows the team to efficiently carry bait bags to the bait loading platform in between bait spreader bucket re-loads.

5.5.1 Bait Loading Team

The Bait Loading Team will consist of:

- Air Operations Chief (site controller)
- Bait Operations Chief
- Bait loader 1
- Bait loader 2
- Bait loader 3
- Bait loader 4

[2] A supplemental label may be requested to apply bait at up to 16 lb/ac if necessary, for the second bait application.

Other Project staff will be involved as and when required at the loading site. Bait loading will be done manually with a team of five personnel with the Air Operations Chief present to oversee operations. Only four bait loaders will be on the bait loading platform at a given time. The Air Operations Chief will oversee the bait loading operation from a strategic position allowing observation of the loading operations while being in sight of the pilot. The bait spreader bucket will be filled with bait directly from pre-opened containers. A secure loading platform will be created with full or empty pods for emptying bags into the bucket, which will be referred to as the bucket loading platform. The bucket loading platform may be moved as pods are emptied. Up to sixteen pre-opened bait containers (XXX lb per load) will be arranged on the top of the loading platform in readiness for the next bucket. It will be up to the Pilot-in-Charge to communicate the desired bucket load weight to the Air Operations Chief who will then direct the team to have only the required number of containers of bait on the platform.

5.5.2 Bucket Loading Sequence:

- Staff will open bait pods and place full containers of bait onto the top of the loading platform, making sure that all lids are secured shut after removing containers.
- The containers will be arranged in two rows and pre-opened in readiness.
- The Pilot-in-Charge will communicate to the Air Operations Chief when inbound to the bait loading site for a bucket load.
- The Air Operations Chief will be present in a location that allows observation of the loading team and line of sight with the Pilot-in-Charge.
- The Air Operations Chief will confirm with the Pilot-in-Charge that the loading site is ready for the helicopter's arrival, that the bait and loading team are in place, and that there are no additional risks (pod lids open, etc.).
- Two Bait Loaders will be positioned on top of the loading platform ready to put bait into the bucket while the other two will be on the ground in front of the platform ready to position the bucket and receive empty bait containers.
- When the bucket arrives, the two Bait Loaders on the ground will grab the bucket by the frame and guide it next to the loading platform.
- The Bait Operations Chief will check the bucket each time it comes back to ensure there is approximately 22 lb of bait remaining in the bottom that will be used to assess whether there might have been gaps in coverage. The Bait Operations Chief will relay this information to the Air Operations Chief.
- Once the bucket is next to the loading platform, the two Bait Loaders standing by on top of the loading platform will lift and empty each bait container into the bucket.
- The second set of Bait Loaders on the ground will grab and secure the empty containers from the loaders as they become available.
- The first set of Bait Loaders on top of the loading platform will maintain positive contact with the container and not let it go until the bait loader on the ground has securely grabbed the container.
- The Bait Loaders will hold containers against their chest, ensuring that one arm is always holding onto the containers as they reach to grab another, until the helicopter departs the bait loading site, at which point they will deposit the containers into an agreed upon and secured empty bait pod.

- Once all containers have been emptied into the bucket the two Bait Loaders on the platform will ensure the bucket lifts off the platform smoothly by holding the frame and guiding it away from the loading platform.
- Between bucket loads, the Bait Loading Team will manage the opening of the next bait pod, prepping the site for the next load, as well as maintain the security and storage of empty bait containers and any other debris.
- The Bait Operations Chief must ensure that staff stay on task and are prepared to receive and load the bucket at any given moment.
- The Bait Operations Chief must confirm to the Air Operations Chief that the team is ready before the Pilot-in-Charge is given approval to land for a refill.
- Remaining time will be spent either resting or carrying out duties such as bucket maintenance and GIS management.
- Team members will be rotated as needed to reduce the risk of heat exhaustion, injury, etc.
- The Pilot-in-Charge will communicate with the Air Operations Chief to indicate how much bait is needed in each individual load, taking into consideration the site to be baited. The bucket is to return to the loading platform with some bait remaining in the bottom to demonstrate that no gaps were produced through running out of bait. If the bait bucket returns empty the Air Operations Chief will relay information to the Eradication Advisor and notify the Pilot-in-Charge that the previous line needs to be rebaited.

5.5.3 Managing Debris at the Loading Site

A key aspect of safety on the loading sites is securing the empty bait containers. These can cause extensive damage if drawn up into the rotors after being caught in the rotor wash. Empty containers will be secured by two designated loading team members then placed in a bait pod designated for this purpose and far enough from the loading site to not be affected by rotor wash. Emptied bait pods and pods that are filled with empty bait containers will be moved as needed during refuels. The Air Operations Chief will ensure that the pace of loading is conducted so that the loading site remains clear of debris.

5.6 Preventing Incidental Bait Drift into the Marine Environment

To minimize incidental bait drift into the marine environment, bait will be applied above the MHWS mark at the coastline with a directional (deflector) swath bucket fitted to the helicopter. The bucket will not have a deflector for interior areas. As described above, bait applied at the MHWS mark and interior zones will overlap to reduce the risk of bait gaps and areas of lower-than-target bait density. The timing of the bait drops will be targeted to coincide with dry weather to prevent bait pellets from degrading too quickly or being washed into the water. Wind speeds will also be a factor to ensure that the helicopter can maintain a fixed GPS flight path that remains above the MHWS line.

5.7 Non-aerial Application of Bait in Special Treatment Areas

Certain areas such as caves, sensitive shorelines and structures will require hand-baiting, bait stations or trapping to address gaps from aerial baiting. The non-aerial applications of bait or deployment of traps will occur between October and December depending on weather and other conditions; ideally this will be conducted in November. All such areas will be identified prior to Project implementation through a comprehensive inventory conducted by the implementation team and through consultations with USDA-

APHIS, EPA, GFNMS, and other relevant agencies. For hand-baiting operations, bait will be broadcast in the target area at the applicable rate. Caves deemed too sensitive for unprotected bait will utilize bait stations or kill traps. All treated caves and burrows will be inspected daily.

Bait stations will also be used both inside and outside of all structures. The bait stations will be placed in a grid pattern around and inside the two occupied houses and the four out-buildings. Bait stations outside of these structures will be secured to the ground with anchors, placed into the soil or drilled into rock or a wooden board, as appropriate. Bait stations will be initially filled with up to 1.0 oz (28.4 g) of bait. The amount of bait will be checked and replenished at least once every seven days for the duration that the bait stations are deployed. In areas where bait stations are deployed, they would be spaced in a grid pattern at least 10-13 ft (3-4 m) apart to ensure that bait is available to all mice. Bait stations will be placed in a manner that will prevent them from accidentally entering the marine environment. Aerial broadcast may be done around each of the houses and out-buildings if the supplemental label allows this because inhabitants will be only Service employees and contractors who will be knowledgeable of the Project and relevant safety precautions. It is anticipated that all bait stations, will be removed no later than X months after the last evidence of mouse consumption of the bait. All buildings associated with human habitation or use will also be cleaned of bait residue following treatment.

The water catchment pad will be covered with a tarpaulin prior to application to prevent bait from entering the water catchment system. The tarp will remain in place until the aerial bait application component of the operation is complete. Within XX hours after bait application, any bait that incidentally lands on the tarp will be swept up and properly disposed of. Water from the cistern will also be tested for the presence of rodenticide after Project implementation.

5.8 Bait Availability Monitoring

The amount of bait in the environment will be monitored to ensure that enough bait is available to achieve eradication success and that bait has been applied in accordance with the EPA-approved label. The rate of bait uptake will be monitored daily for X nights following each bait drop. Detailed monitoring protocols can be found in the *Draft Monitoring and Mitigation Plan*.

6 PERSONNEL HEALTH AND SAFETY

6.1 Personal Protective Equipment

All personnel will be assigned their own protective clothing and equipment when handling or transporting bait or when responding to a spill incident. Personnel working on the Project will always be required to wear high-visibility vests and designated personal protective equipment (PPE) while at the bait loading site. The use restrictions and safety precautions associated with Brodifacoum-25D are available in Appendix A and the Safety Data Sheet is in Appendix B. All treated areas will be posted with warning signs appropriate to the eradication control Project. The following PPE-required lists are based on the current EPA-approved bait label (Label ID 56228-37-Nov-07-2019; Appendix A). These lists will be updated if there is any change based on the supplemental label.

<u>Applicators and other handlers must wear:</u>

- Long-sleeved shirt and long pants
- Barrier laminate gloves

- Shoes plus socks

For aerial application, in addition to the above PPE, loaders must wear:

- Protective eyewear or face shield
- A minimum of a NIOSH-approved particulate filtering facepiece respirator with any N, R, or P filter; OR a NIOSH-approved elastomeric particulate respirator with any N, R, or P filter; OR a NIOSH-approved powered air purifying respirator with HE filters.

Any person who retrieves carcasses or unused bait following application of this product must wear:

- Barrier laminate gloves

6.2 Passive and Active Hazing Team Operations

Field staff will primarily work in two person teams. Each team will consist of a designated Wildlife Hazer and a Wildlife Monitor. There will be a total of 4 teams, each responsible for “policing” their assigned hazing sector and enacting various hazing methods when necessary. To accurately assess all wildlife responses to the various hazing methods, good communication will be maintained between each Wildlife Hazer and their assigned Wildlife Monitor as well as between the different hazing teams and the Environmental Coordinator. This will ensure the safety of all island personnel as well as make sure that all necessary data are recorded. The Wildlife Hazer and Wildlife Monitor may not always be together and there may be times when multiple monitors will be required for a single hazing event. Therefore, personnel will always carry handheld radios and use them as the primary form of communication.

6.3 Weather Considerations

Before dawn on each planned operation day, the Pilot-in-Charge will consult local weather conditions and forecasts to assess whether they are suitable for the bait drops. If conditions are deemed suitable, the team will proceed with preparation and positioning for baiting. The Refuge Manager (who also serves as the Incident Commander) will be advised if there are any conditions that are unsuitable. Poor weather conditions may require baiting operations to be halted, changed, or delayed. Bait drops will be delayed (or discontinued if flying has already commenced) if the weather is unsuitable, and/or the Pilot-in-Charge determines it is no longer possible to continue flying in a safe manner. The Pilot-in-Charge has final authority for determining safe flying conditions. At minimum, aerial applications will be terminated when the following conditions are present:

- Sustained winds exceed 35 mph (30 knots), as required by the label. Note: A lower wind threshold for initiating bait application will be determined in consultation with the implementation team.
- When visibility is reduced to 1 mile or less due to fog.
- When heavy rain (more than one inch in a 12-hour period) is forecast within the next 12 hours. (Note: This time period will likely be extended for up to several days because heavy rain will degrade bait.)

Heavy rain will physically degrade bait quickly. It is important that mice have access to the bait before any significant degradation occurs through moisture absorption (and subsequent mold growth) as this may affect bait palatability and potentially also the quantity of accessible bait.

7 HELICOPTER OPERATIONS

It will be essential that all aviation operations are planned with the utmost consideration given to safety and operational efficiency. The Refuge will follow U.S. Fish and Wildlife Service Policy FW4: Aviation Operations and Maintenance (https://www.fws.gov/policy/330fw4.html) to ensure that the eradication operations are accomplished safely and efficiently. The policy includes the application of specific requirements for pre-flight planning risk management and analysis. In particular, the team's Safety Officer will ensure that a safety briefing is conducted prior to the start of each operation day and that all potential risks are assessed and briefed. Any safety concerns identified by a team member will be brought to the Safety Officer's attention and either communicated immediately to the team (if deemed a critical risk) or discussed at the next operational briefing.

7.1 Helicopter Communications Plan

To be developed.

7.2 Authorization to Commence Aerial Operations

Prior to initiating the aerial baiting operation, an operation checklist will be completed by the Air Operations Chief and reviewed by the Eradication Advisor and the Bait Operations Chief. The checklist shall include, but not be limited to:

- Helicopter and associated equipment have been tested and are ready
- The bait bucket has been calibrated
- Pilot-in-Charge has been briefed
- The Pilot-in-Charge has assessed all conditions for the flight
- Safety equipment and procedures are in place and the team has been briefed
- A trial run of the loading procedure has been completed

Following approval by the Operations Commander, the authorization to commence aerial baiting operations will be given to the Pilot-in-Charge. The Eradication Advisor will be responsible for providing details of flight activities for the day, while the decision to fly on any given day will be made by the Operations Commander. Ultimately, the final decision to proceed with an approved flight will be made by the helicopter Pilot-in-Charge depending on a number of go/no-go conditions not least of which will be suitability of the weather.

8 DEMOBILIZATION

8.1 Disposal of Unused Bait

Unused bait will be properly disposed of at an approved waste disposal facility in accordance with local, state, and federal hazardous waste requirements.

8.2 Removal of Supplies, Equipment, and Infrastructure

To be developed.

9 REFERENCES

U.S. Fish and Wildlife Service. 2019. Farallon Islands National Wildlife Refuge: South Farallon Islands Invasive House Mouse Eradication Project: Final Environmental Impact Statement. U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Fremont, California.

APPENDIX A – Current bait label for Brodifacoum-25D Conservation

RESTRICTED USE PESTICIDE

DUE TO HAZARDS TO NON-TARGET SPECIES

For retail sale only to employees of federal agencies responsible for wildlife management to be used only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

BRODIFACOUM-25D CONSERVATION

A pelleted rodenticide for control or eradication of invasive rodents in dry climates on islands or vessels for conservation purposes.

ACTIVE INGREDIENT:
Brodifacoum (CAS No. 56073-10-0): 0.0025%
OTHER INGREDIENTS:..99.9975%

TOTAL:..100.0000%

ACCEPTED
11/12/2019
Under the Federal Insecticide, Fungicide and Rodenticide Act as amended, for the pesticide registered under EPA Reg. No. 56228-37

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID

IF SWALLOWED:
- Call a physician or poison control center immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

IF ON SKIN OR CLOTHING:
- Take off contaminated clothing.
- Rinse skin immediately with plenty of soap and water for 15-20 minutes.
- Call a poison control center or doctor immediately for further treatment advice.

IF INHALED:
- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance; then give artificial respiration, preferably mouth-to-mouth, if possible.
- Call a poison control center or doctor immediately for further treatment advice.

IF IN EYES:
- Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor immediately for treatment advice.

Have the product container or label with you when calling a poison control center or doctor or going for treatment. If you need immediate medical attention, call the Poison Control Center at 1-800-222-1222, a doctor, or 877-854-2494. For non-emergency information concerning this product, call the National Pesticide Information Center at 1-800-858-7378.

NOTE TO PHYSICIAN: If swallowed, this material may reduce the clotting ability of the blood and cause bleeding. If ingested, administer Vitamin K_1, intramuscularly or orally, as indicated in bishydroxycoumarin overdose. Repeat as necessary based on monitoring of prothrombin times.

TREATMENT FOR PET POISONING: If pet eats the bait, call a veterinarian at once.
NOTE TO VETERINARIAN: For animals ingesting bait and/or showing poisoning signs (bleeding or elevated prothrombin times), administer Vitamin K_1.

Manufactured for:
United States Department of Agriculture
Animal and Plant Health Inspection Service
4700 River Road, Unit 149
Riverdale, MD 20737
EPA Est. 12455-WI-1

Net Contents: ___________________

Batch Code: ___________________

PRECAUTIONARY STATEMENTS

CAUTION

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Harmful if swallowed. Causes moderate eye irritation. Avoid contact with eyes, skin, or clothing. Keep away from humans, domestic animals, and pets.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Applicators and other handlers must wear:
- Long-sleeved shirt and long pants
- Barrier laminate gloves
- Shoes plus socks

For aerial application, in addition to the above PPE, loaders must wear:
- Protective eyewear or face shield
- A minimum of a NIOSH-approved particulate filtering facepiece respirator with any N, R, or P filter; OR a NIOSH-approved elastomeric particulate respirator with any N, R, or P filter; OR a NIOSH-approved powered air purifying respirator with HE filters.

Any person who retrieves carcasses or unused bait following application of this product must wear:
- Barrier laminate gloves

USER SAFETY REQUIREMENTS

Follow the manufacturer's instructions for cleaning/maintaining PPE. If no such instructions are provided for washables, use detergent and hot water. Keep and wash PPE separately from other laundry. Remove PPE immediately after handling this product. Wash the outside of barrier laminate gloves before removing. As soon as possible, wash hands thoroughly after applying the bait and before eating, drinking, chewing gum, using tobacco, or using the toilet, and change into clean clothing.

ENVIRONMENTAL HAZARDS

This product is extremely toxic to birds, mammals, and aquatic organisms. Predatory and scavenging mammals and birds might be poisoned if they feed upon animals that have eaten bait. Runoff may be hazardous to aquatic organisms in water adjacent to treated areas. **DO NOT** contaminate water when disposing of equipment wash water or rinsate.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

READ THIS LABEL: Read the entire label. This product must be used strictly in accordance with this label's precautionary statements and use directions, as well as with all applicable State and Federal laws and regulations.

USE RESTRICTIONS

- **IMPORTANT: DO NOT** expose children, pets, or other non-target animals to rodenticides. Take all appropriate steps to limit exposure to and impacts on nontarget species, especially those for which special conservation efforts are planned or ongoing. To help prevent accidental exposures:
  - Keep children out of areas where this product is used or deny them access to bait by use of tamper resistant bait stations.
  - Store this product in a location out of reach of children, pets, livestock, and nontarget wildlife.
  - Apply bait only as specified on this label and in strict accordance with the **USE RESTRICTIONS** and **APPLICATION DIRECTIONS**.
  - Dispose of the product container and any unused, spoiled, or unconsumed bait as specified under **STORAGE AND DISPOSAL**.
- This product may be used only to control or eradicate Norway rats (*Rattus norvegicus*), roof rats (*Rattus rattus*), Polynesian rats (*Rattus exulans*), house mice (*Mus musculus*), or other types of invasive rodents on islands for conservation purposes, or on grounded vessels or vessels in peril of grounding.
- This product is to be used for the protection of State or Federally-listed Threatened or Endangered Species or other species determined to require special protection.
- **DO NOT** apply this product to food or feed.
- **DO NOT** reuse implements used for applying bait for food or feed use.
- Treated areas with public access must be posted with warning signs appropriate to the current rodent control or eradication operation.
- Broadcast applications are prohibited on vessels or in areas of human habitation.
- The pilot in command has final authority for determining safe flying conditions. Do not make aerial broadcast applications in sustained winds exceeding 35 mph (30 knots).

DIRECTIONS FOR USE, continued

APPLICATION DIRECTIONS

HAND BAITING APPLICATIONS:

Applicators may use the hand baiting methods at use sites for rats and mice as specified in Table 1.

Table 1.

Method	Use sites	Application rate	Additional baiting instructions
Tamper-resistant bait stations	• All use sites allowed on this label. • For canopy baiting: Follow the instructions below, as applicable, for **Bait bolas (sachets)** used for canopy baiting.	Rats: • 4.0-16.0 ounces (113.4-453.6 grams) per station or tray. • Space stations or trays at intervals of approximately 16-82 feet (5-25 meters) in a grid over the area. • Check and replenish stations or trays at least once every 7 days. Mice: • 0.25-1.0 ounces (7.1-28.4 grams) per station or tray. • Space stations or trays at intervals of approximately 10-65 feet (3-20 meters) in a grid over the area. • Up to 3.0 ounces (85.1 grams) per station or tray may be needed at locations with high mouse activity. • Check and replenish stations or trays at least once every 7 days.	• Where a continuous source of infestation is present, permanent bait stations may be established and bait replenished as needed.
Burrow baiting	• Uninhabited non-crop areas	Rats: • 3.0-4.0 ounces (85.1-113.4 grams) per active burrow entrance. • Flag treated burrows and inspect them frequently, daily if possible. • Reapply bait if the bait has been removed. Mice: • 0.25 ounces (7.1 grams) per active burrow entrance. • Flag treated burrows and inspect them frequently, daily if possible. • Reapply if the bait has been removed.	• Place bait within burrows in piles or within small bags made of rodent accessible material. • Holes should be made in plastic bags to allow the bait odor to escape. Plastic bags may be left unperforated if applied in areas where occasional immersion in water may occur. • Place bait far enough into burrow so that it can barely be seen. Do not plug burrows.
Bait bolas (sachets)	• Uninhabited grounded vessels or vessels in peril of grounding that are difficult or unsafe for applicators to enter. • Canopy of trees and shrubs in non-crop areas where sufficient food and cover are available to harbor populations of rodents in canopies of trees and shrubs.	Rats: • 4.0-16.0 ounces (113.4-453.6 grams) per small bag made of rodent accessible material. • Space bolas at intervals of approximately 16-82 feet (5-25 meters) in a grid over the area. • Check at least every 7-14 days and reapply if the bait has been removed. Mice: • 0.25-1.0 ounces (7.1-28.4 grams) per small bag made of rodent accessible material. • Space bolas at intervals of approximately 10-65 feet (3-20 meters) in a grid over the area. • Up to 3.0 ounces (85.1 grams) per bag may be needed at locations with high mouse activity. • Check at least every 7-14 days and reapply if the bait has been removed. Canopy baiting: • 4.0-16.0 ounces (113.4-453.6 grams) per small bag made of rodent accessible material. • Place bolas in the canopy at intervals of ≤160 feet (≤49 meters). • If possible, check at least every 7-14 days and reapply if the bait has been removed.	• Bait bolas should be knotted or otherwise sealed to avoid spillage. • Holes should be made in plastic bags to allow the bait odor to escape. Plastic bags may be left unperforated if applied in areas where occasional immersion in water may occur. • Throw or drop bolas into areas that are unsafe for applicators to enter. • Place bolas in the canopy of trees or shrubs by hand or use long poles (or other devices). Bolas may be fitted with line or string to ensure canopy entanglement.

DIRECTIONS FOR USE, continued

APPLICATION DIRECTIONS, continued

BROADCAST APPLICATIONS:

Broadcast applications are prohibited on vessels or in areas of human habitation. Set the application rate according to the extent of the infestation and apparent population density. For eradication operations, treat entire land masses.

Broadcast bait using aircraft, ground-based mechanical equipment, or by gloved hand at a rate no greater than 16 lbs of bait per acre (18 kg bait/hectare) per application. Make a second broadcast application, typically 5 to 7 days after the first application, depending on local weather conditions, at a rate no higher than 8 lbs of bait per acre (9 kg bait/hectare). In situations where weather or logistics only allow one bait application, a single application may be made at a rate no higher than 16 lbs bait per acre (18 kg bait/hectare).

Assess baited areas for signs of residual rodent activity after the last broadcast application (typically 7 to 10 days post-treatment).

If rodent activity persists, conduct hand baiting applications as specified in Table 1 in areas where rodents remain active. If the terrain does not permit use of hand baiting methods, continue with broadcast baiting, limiting such treatments to areas where active signs of rodents are seen. Maintain treatments for as long as rodent activity is evident in the area and rodents appear to be accepting bait.

POSTTREATMENT CLEAN-UP

For all methods of baiting, monitor the baited area periodically for carcasses during and after the operation, if possible. Using gloves, collect and dispose of any carcasses in accordance with federal, state, and local regulations. Carcasses do not need to be collected in areas where non-target animals have naturally high mortality rates and collecting and disposing of carcasses is impractical (e.g., some bird breeding areas).

Using gloves, collect and dispose of bait stations and trays at the end of control or eradication operations as specified under **STORAGE AND DISPOSAL**. Bait stations and bolas applied in grounded vessels, vessels in peril of grounding, canopies, abandoned structures or infrastructure, or landscape features that are unsafe for applicators to access, do not have to be retrieved.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

PESTICIDE STORAGE: Store only in original closed container in a cool, dry place inaccessible to unauthorized people, children, and pets. Store separately from fertilizer and away from products with strong odors that may contaminate the bait and reduce acceptability. Spillage should be carefully swept up and collected for disposal.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of at an approved waste disposal facility.

CONTAINER HANDLING: ***Nonrefillable container.*** Do not reuse or refill this container.

Plastic Containers: Triple rinse (or equivalent) promptly after use. Offer for recycling, if available. Otherwise, puncture and dispose of empty container in a sanitary landfill or by incineration if allowed by state and local authorities.

Paper Containers: Dispose of empty container at an approved waste disposal facility or by incineration if allowed by state and local authorities.

NOTICE: Buyer assumes all risks of use, storage, or handling of the material not in strict accordance with directions given herewith. The efficacy of the product may be reduced under high moisture conditions.

APPENDIX B – Safety Data Sheet for Brodifacoum-25D Conservation

BRODIFACOUM 25D CONSERVATION PELLETS

SAFETY DATA SHEET	ACCORDING TO REGULATION: OSHA Hazard Communication Standard 29 CFR 1910.1200	DATE OF ISSUE: October 2015	PREPARED BY: CAR

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: BRODIFAOUM 25D CONSERVATION PELLETS
EPA Registration Number: 56228-37
Relevant identified uses of the substance or mixture and uses advised against
Relevant identified uses: Anticoagulant Rodenticide - Ready to use
Uses advised against: Use only for the purpose described above

MANUFACTURER/SUPPLIER:
Bell Laboratories, Inc.
3699 Kinsman Blvd.
Madison, WI 53704, USA
Email: sds@belllabs.com
Phone: 608-241-0202
Medical or Vet Emergency: 877-854-2494 or 952-852-4636
Spill or Transportation Emergency: 800-424-9300 (CHEMTREC)

2. HAZARD IDENTIFICATION

Classification according to Regulation OSHA 1910.1200(d): Not classified

See Section 15 for information on FIFRA applicable safety, health, and environmental classifications.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS No.	% By weight
Brodifacoum [3-[3-(4'-Bromo-[1,1'-biphenyl]-4-yl)-1,2,3,4-tetrahydro-1-naphthalenyl]-4-hydroxy-2H-1-benzopyran-2-one]	56073-10-0	0.0025%
Inert and Non-Hazardous Ingredients	Proprietary	99.9975%

4. FIRST AID MEASURES

Description of first aid measures
Ingestion: Call physician or emergency number immediately. Have person sip a glass of water if able to swallow. Do not induce vomiting unless instructed by physician.
Inhalation: Not applicable**.**
Eye contact: Hold eye open and rinse slowly with water for 15 – 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. If irritation develops, obtain medical assistance.
Skin contact: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. If irritation develops, obtain medical assistance.
Most important symptoms and effects, both acute and delayed
Ingestion of excessive quantities may cause nausea, vomiting, loss of appetite, extreme thirst, lethargy, diarrhea, bleeding.
Advice to physician: If ingested, administer Vitamin K_1 intramuscularly or orally as indicated for bishydroxycoumarin overdoses. Repeat as necessary as based upon monitoring of prothrombin times.
Advice to Veterinarian: For animals ingesting bait and/or showing poisoning signs (bleeding or elevated prothrombin times), give Vitamin K_1. If needed, check prothrombin times every 3 days until values return to normal (up to 30 days). In severe cases, blood transfusions may be needed.

5. FIRE-FIGHTING MEASURES

Extinguishing media
Suitable Extinguishing Media: water, foam or inert gas.
Unsuitable Extinguishing Media: None known.
Special hazards arising from the mixture: High temperature decomposition or burning in air can result in the formation of toxic gases, which may include carbon monoxide and traces of bromine and hydrogen bromide.
Advice for firefighters: Wear protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Gloves should be worn when handling the bait. Collect spillage without creating dust.
Environmental precautions: Do not allow bait to enter drains or water courses. Where there is contamination of streams, rivers or lakes contact the appropriate environment agency.
Methods and materials for containment and cleaning up
For Containment: Sweep up spilled material immediately. Place in properly labeled container for disposal or re-use.
For Cleaning Up: Wash contaminated surfaces with detergent. Dispose of all wastes in accordance with all local, regional and national regulations.
Reference to other sections: Refer to Sections 7, 8 & 13 for further details of personal precautions, personal protective equipment and disposal considerations.

7. HANDLING AND STORAGE

Precautions for safe handling: Do not handle the product near food, animal foodstuffs or drinking water. As soon as possible, wash hands thoroughly after applying bait and before eating, drinking, chewing gum, using tobacco, or using the toilet.
Conditions for safe storage, including any incompatibilities: Store only in original container in a cool, dry place, inaccessible to pets and wildlife. Do not contaminate water, food or feed by storage or disposal. Keep containers closed and away from other chemicals.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Established Limits

Component	OSHA	ACGIH	Other Limits
Brodifacoum	Not Established	Not Established	Not Established

Appropriate Engineering Controls: Not required
Occupational exposure limits: Not established
Personal Protective Equipment:
Respiratory protection: Not required
Eye protection: Not required
Skin protection: Shoes plus socks, and waterproof gloves.
Hygiene recommendations: Wash thoroughly with soap and water after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance/Color:	Blue-green granular pellet
Odor:	Sweet grain-like
Odor Threshold:	Not applicable, odor not associated with a hazardous material.
pH:	Not applicable, Brodifacoum 25D Conservation Pellets are not dispersible with water.
Melting point:	Not applicable to rodenticide bait
Boiling point:	Not applicable to rodenticide bait
Flash point:	Not applicable, Brodifacoum 25D Conservation Pellets do not contain components classified as flammable.
Evaporation rate:	Not applicable, Brodifacoum 25D Conservation Pellets are solid.
Upper/lower flammability or explosive limits:	Not applicable, Brodifacoum 25D Conservation Pellets do not contain components classified as flammable or explosive.
Vapor Pressure:	Not applicable to rodenticide bait
Vapor Density:	NA: Brodifacoum 25D Conservation Pellets are solid
Relative Density:	1.33 g/mL @ 20°C
Solubility (water):	Not water soluble
Solubility (solvents):	Not applicable to rodenticide bait
Partition coefficient: n-octanol/water:	Not applicable to rodenticide bait
Auto-ignition temperature:	Not applicable, Brodifacoum 25D Conservation Pellets do not contain components classified as flammable.
Decomposition temperature:	Not applicable to rodenticide bait
Viscosity:	Not applicable, Brodifacoum 25D Conservation Pellets are not a liquid.

10. STABILITY AND REACTIVITY

Reactivity: Stable when stored in original container in a cool, dry location.
Chemical stability: Stable when stored in original container in a cool, dry location.
Possibility of hazardous reactions: Refer to Hazardous decomposition products
Conditions to avoid: Avoid extreme temperatures (below 0°C or above 40°C).
Incompatible materials: Avoid strongly alkaline materials.
Hazardous decomposition products: High temperature decomposition or burning in air can result in the formation of toxic gases, which may include carbon monoxide and traces of bromine and hydrogen bromide.

11. TOXICOLOGICAL INFORMATION

Information on toxicological effects
Acute Toxicity
LD50, oral (ingestion): >5001 mg/kg (rats) (Brodifacoum rat LD50 oral: 0.490 mg/kg bw).
LD50, dermal (skin contact): > 5001 mg/kg (rats) (Brodifacoum rabbit LD50 dermal: 4.185 mg/kg bw).
LC50, inhalation: Brodifacoum 25D Conservation Pellets are a granular pellet and therefore exposure by inhalation is not relevant.
Skin corrosion/irritation: Not irritating to skin.
Serious eye damage/Irritation: Not irritating to eyes.
Respiratory or skin sensitization: Dermal sensitization: Not a Sensitizer (Guinea pig maximization test).
Germ cell mutagenicity: Brodifacoum 25D Conservation Pellets contain no components known to have a mutagenetic effect.
Carcinogenicity: Brodifacoum 25D Conservation Pellets contain no components known to have a carcinogenetic effect**.**

Components	**NTP**	**IARC**	**OSHA**
Brodifacoum	Not listed	Not listed	Not listed

Reproductive Toxicity: Brodifacoum 25D Conservation Pellets: No data
Aspiration Hazard: Not applicable. Brodifacoum 25D Conservation Pellets are a granular pellet.
Target Organ Effects: Reduced blood clotting ability.

12. ECOLOGICAL INFORMATION

Ecotoxicity Effects: This product is extremely toxic to fish, birds and other wildlife. Dogs and predatory and scavenging mammals and birds might be poisoned if they feed upon animals that have eaten this bait. Do not apply this product directly to water or to areas where surface water is present or to intertidal areas below the mean high water mark. Runoff also may be hazardous to aquatic organisms in water adjacent to treated areas. Do not contaminate water when disposing of equipment wash water or rinsate.
Persistence and degradability: Brodifacoum 25D Conservation Pellets are inherently biodegradable.
Bioaccumulative potential: Not determined for Brodifacoum 25D Conservation Pellets. Brodifacoum water solubility is extremely low (< 0.1mg/l).
Mobility in Soil: Not determined for Brodifacoum 25D Conservation Pellets. Mobility of brodifacoum in soil is considered to be limited.
Other adverse effects: None.

13. DISPOSAL CONSIDERATIONS

Do not contaminate water, food or feed by storage or disposal.
Pesticide Storage: Store only in original container in a cool, dry place inaccessible to children and pets. Keep containers closed and away from other chemicals.
Pesticide Disposal: Wastes resulting from the use of this product may be placed in trash or delivered to an approved waste disposal facility.
Container Handling: Non-refillable container. Do not reuse or refill this container. [Plastic:] Offer for recycling or reconditioning; or puncture and dispose of in a sanitary landfill; or by incineration. In most states, burning is not allowed. [Paper:] Dispose of empty container by placing in trash, at an approved waste disposal facility or by incineration. In most states, burning is not allowed.

14. TRANSPORT INFORMATION

UN number: Not regulated
UN proper shipping name: Not regulated
Transport hazard class(es): Not regulated
Packing group : Not regulated
Environmental Hazards
DOT Road/Rail: Not considered hazardous for transportation via road/rail.
DOT Maritime: Not considered hazardous for transportation by vessel.
DOT Air: Not considered hazardous for transportation by air.
Freight Classification: LTL Class 60
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code: Not applicable
Special precautions for user: None

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture:
FIFRA: This pesticide product is not regulated by the United States Environmental Protection Agency. The pesticide label includes other important information, including directions for use.
Signal Word: WARNING, RESTRICTED
Precautionary Statements: Contains the anticoagulant Brodifacoum which may cause bleeding if ingested. Harmful if swallowed or absorbed through the skin. Keep away from children, domestic animals and pets. Do not get in eyes, on skin or on clothing.
Potential Health Effects:
Eye Contact: May cause irritation
Skin Contact: Non-irritating to the skin
Ingestion: Harmful if swallowed

TSCA: All components are listed on the TSCA Inventory or are not subject to TSCA requirements
CERCLA/SARA 313: Not listed
CERCLA/SARA 302: Not listed

16. OTHER INFORMATION

For additional information, please contact the manufacturer noted in Section 1.

NFPA	Health: 1 (caution)	Flammability: 0 (will not burn)	Reactivity: 0 (stable)	Specific Hazard: None
HMIS	Health: 2 (moderate)	Flammability: 0 (minimal)	Reactivity: 0 (minimal)	Protective Equipment: B

Disclaimer: The information provided in this Safety Data Sheet has been obtained from sources believed to be reliable. Bell Laboratories, Inc. provides no warranties; either expressed or implied, and assumes no responsibility for the accuracy or completeness of the data contained herein. This information is offered for your consideration and investigation. The user is responsible to ensure that they have all current data, including the approved product label, relevant to their particular use.

APPENDIX 4

INVASIVE HOUSE MOUSE ERADICATION PROJECT

DRAFT Mitigation and Monitoring Plan

FARALLON ISLANDS NATIONAL WILDLIFE REFUGE

Photos Courtesy of Island Conservation

Prepared by:
SeaJay Environmental LLC, Oakland, California

for the
U.S. Fish and Wildlife Service, Farallon Islands National Wildlife Refuge

March 2021

Contents

Overview

As part of the South Farallon Islands House Mouse Eradication Project (Project), mitigation and monitoring activities will be carried out before, during, and after each bait application. The goal of mitigation is to avoid and minimize impacts to non-target species and, where possible, eliminate risks to non-target species populations while ensuring the highest likelihood of Project success. The goal of monitoring is to provide data and information to managers to determine whether the observed non-target outcomes are in line with expected outcomes as identified in the *South Farallon Islands Invasive House Mice Eradication Project: Final Environmental Impact Statement* (FEIS; U.S. Fish and Wildlife Service [USFWS or Service] 2019), as well as to provide information needed to make potential adaptive management decisions during project implementation that will best ensure Project success.

This *Draft Mitigation and Monitoring Plan* (Draft Plan) is complimentary to, and consistent with, other implementation plans developed for the Project including the *Draft Operational Plan*, the *Draft Non-Target Species Contingency Plan*, and the *Draft Bait Spill Contingency Plan*. If the Service's Record of Decision chooses the Preferred Alternative (Alternative B) identified in the FEIS, this Draft Plan will be updated to incorporate input from the implementation team and from consultations with the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS), U.S. Environmental Protection Agency (EPA), other relevant regulatory agencies, and other experts. The Draft Plan will be finalized prior to Project implementation and will include detailed protocols developed by the implementation team. Throughout this Draft Plan, text in red font indicates a placeholder for information to be completed in the Final Plan following input from the selected operational team and any other appropriate agencies or experts.

The purposes of this Draft Plan are to:

1. Outline mitigation actions to be implemented to avoid, minimize, and where possible, eliminate risks to non-target species.
2. Outline monitoring procedures to inform mitigation management including incidental bait drift into the marine environment, non-target wildlife, and brodifacoum residues in different environmental components.
3. Outline monitoring protocols to inform management efficacy including bait application rates, bait availability, and mouse uptake of bait.
4. Outline monitoring procedures to determine success of the Project on the eradication of the target species.

Mitigation and monitoring will be carried out by teams stationed on the island for an estimated period of six weeks starting one week prior to baiting and remaining until bait has disappeared or degraded to a point where it is considered a negligible risk to non-target fish and wildlife. Many team members will remain constant throughout the operation for consistency and continuity. Some activities will commence before the start of the eradication Project, as further described below.

An adaptive management approach will be applied throughout the Project, utilizing data from monitoring to make informed decisions. Activities will also be combined as much as possible to maximize efficiency. This proposed mitigation and monitoring program is based on the use of Brodifacoum-25D Conservation (Brodifacoum-25D) as the rodent bait product. Details of the bait product are provided in the FEIS and the current EPA-approved bait label can be found in the *Draft Operational Plan*.

Operational Monitoring

Operational monitoring will encompass tracking a range of parameters necessary to maximize the likelihood of project success, which is defined as the complete eradication of house mice from the South Farallon Islands while minimizing impacts to non-target resources. This Draft Plan was developed following examples from past rodent eradication projects in the U.S. (e.g., Buckelew 2009, 2011; Howald et al. 2010; Pitt et al. 2015; Shiels et al. 2017) and modified for specificity at the South Farallon Islands. These monitoring efforts include real-time information gained from operational monitoring that will be used to improve the effectiveness of mitigation measures during project implementation.

Data and information collected will be used in an adaptive management approach, which is a systematic method for improving resource management by learning from management outcomes. These principals are based on the U.S. Department of the Interior's Technical Guide by Williams, Szaro, and Shapiro (2009). The approach, as shown in Figure 1, reduces uncertainty inherent in natural systems by transforming the management decision-making into an experimental context that improves management actions.

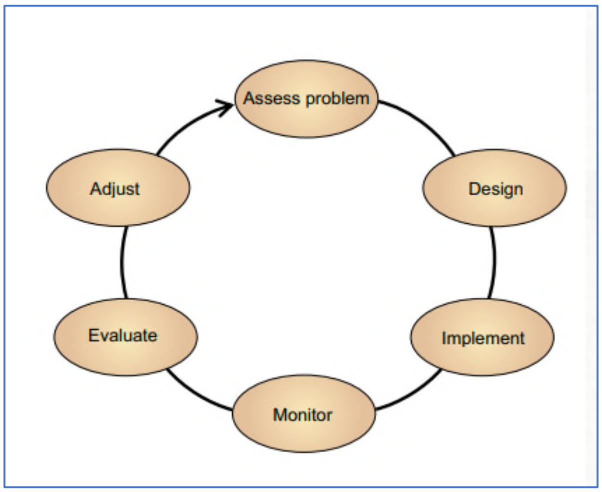


Figure 1. Diagram of the Adaptive Management Process.

For example, adaptive management for the Project will include operational decisions such as: at what time within the operational window should bait application be undertaken; which of the proposed baiting methods should be used to address gaps in bait application, if they occur; and when will mitigation actions begin and conclude? If unanticipated mortality in any non-target species is recorded following the first bait application, a management decision on whether to proceed with subsequent applications will also be made. This will be based on past risk analyses and will also encompass observations made during the operation. If operational monitoring uncovers an unforeseen event that has the potential to cause impacts beyond those disclosed in the FEIS, the response actions that will be followed can be found in the *Draft Non-Target Species Contingency Plan*. Refer to section 2.10.2 of the FEIS for further details on this adaptive management approach.

The Service will undertake operational monitoring to determine the presence or absence of mice and the outcome of the eradication operation. This will occur for approximately two years after bait application. A range of rodent detection devices such as traps, tracking tunnels, and cameras may be used to detect potentially surviving mice.

Monitoring beyond the direct footprint of the South Farallon Islands will be supported by the Greater Farallon Islands National Marine Sanctuary (GFNMS) Beach Watch program (https://farallones.noaa.gov/science/beachwatch.html) to detect potential project-related bird mortality on nearby mainland beaches. This is part of a long-term monitoring program between the

GFNMS and the Greater Farallones Association in which shoreline surveys are conducted every two weeks at 59 beaches. The survey locations stretch from Manchester Beach in Mendocino County south to Point Año Nuevo in San Mateo County, including two beaches east of the Golden Gate Bridge. From these standardized surveys for live and dead wildlife and human activities, Beach Watch develops deposition and activity rates, resulting in status and trends for birds along the sanctuary shoreline, i.e., annual, seasonal, and monthly rates (number per kilometer surveyed).

To support monitoring for the Project, Beach Watch will provide data from standardized monitoring including comparisons of numbers of target live and dead birds recorded during the Project period to baseline deposition and sightings rates. In addition, Beach Watch will conduct more frequent monitoring at a pre-selected sampling of two to ten beaches with historically high deposition rates of dead gulls and beaches with known high concentrations of live gulls. Selected beaches for increased monitoring likely will be between Otonoe Beach in Sonoma County and Half Moon Bay State Beaches in San Mateo County. Increased monitoring may range from daily to weekly.

Part I. Mitigation and Monitoring of Non-target Species

Mitigation actions that will be taken to avoid or minimize adverse impacts to non-target bird species to less than significant levels (as defined in the FEIS) include hazing of several species of gulls (mainly western gulls (*Larus occidentalis*) and the capture and translocation of migratory birds of prey (raptors). Impacts to pinnipeds (seals and sea lions), the Farallon arboreal salamander (*Aneides lugubris farallonensis*), and the Farallon camel cricket (*Farallonophilus cavernicolus*) will also be minimized to less than significant levels through the use of mitigation measures.

Monitoring activities include surveys that will be undertaken prior to, during, and after the Project to determine the presence, location, condition, and abundance of non-target species.

1.1 Western Gull Mitigation

The primary mitigation measure that will be used to protect gulls will be hazing. If necessary and practical, hazing also could be employed to deter other at-risk species from foraging in baited areas such as black oystercatcher (*Haematopus bachmani*). This involves disturbing the birds, so they depart and stay away from the area. Hazing will be conducted not only to reduce the risk of non-target mortality, but also to minimize pellet consumption by gulls (and possibly other non-target bird species) that could increase the risk of eradication failure. Gull hazing for these actions will continue as long as the risk of exposure remains elevated (i.e., bait remains available and palatable as defined in the Bait Degradation Trial Report in Appendix D of the FEIS).

There are two main categories of gull hazing: passive and active. Passive hazing is non-manned and stationary, and includes the use of devices such as kites, stationary effigies, biosonics, Mylar, and Zon Cannons. Active hazing includes human presence, moving kites or effigies, helicopter passes, lasers, and pyrotechnics. Extensive hazing trials were conducted on the South Farallon Islands in 2011 and 2012 (USFWS 2019). The 2012 trial successfully demonstrated the ability to keep the majority of western gulls off the islands for an extended period of time, including preventing gulls from landing in areas where non-toxic rodent bait was available. The results provide a high degree of confidence that a well-planned and executed hazing operation would keep gull mortality below levels that would result in a population-level impact.

For gull hazing mitigation, a team of hazing personnel will deploy a range of hazing techniques directed at birds that would likely include lasers, spotlights, pyrotechnics, biosonics, predator calls, air cannons, effigies, and kites to haze gulls off the islands. The use of trained falcons and bird-hazing dogs are also being considered but would only be deployed if deemed necessary. These active techniques would only be used as necessary and directed at individuals or groups of birds either on or approaching the islands. These same techniques could be used to deter species such as black oystercatchers from feeding in baited areas, if monitoring discovers the birds are doing this.

A small helicopter may be used to transport hazing personnel to otherwise inaccessible areas, monitor gull presence, and haze gulls in conjunction with other techniques. Refer to Figure 2 for the locations of major gull roosting sites on the islands. To respond to the potential for gulls habituating to certain hazing techniques, the hazing program will be adaptively managed based on real-time monitoring of its efficacy. Based on the trials completed, many hazing activities will be concentrated near the islands' shoreline. Other methods, such as lasers and pyrotechnics, will be initiated from more interior areas. Hazing tools will be used as sparingly as possible and only where needed to reduce disturbance impacts to non-target species, such as pinnipeds. Consequently, only small areas of the South Farallon Islands should be affected at any one time.

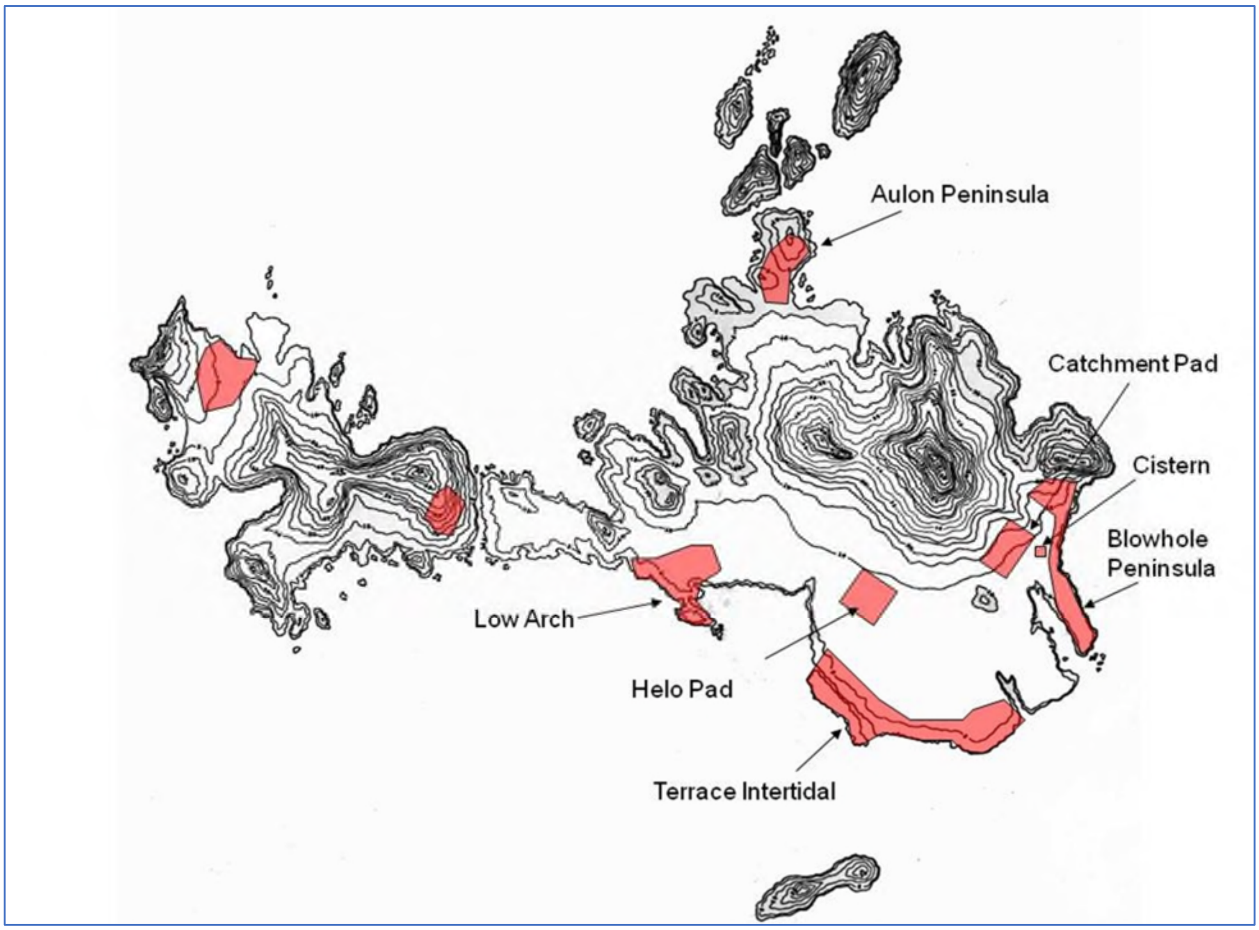


Figure 2. Western Gull Roosting Sites on South Farallon Islands.

1.2 Western Gull Monitoring

Gulls will be monitored both on the South Farallon Islands and on certain beaches of the coastal mainland within and adjacent to the Gulf of the Farallones. The goals of monitoring are to ensure that as many gulls as safely possible leave the islands and remain off the islands during the Project until bait is no longer available and palatable, and to assess how many gulls are potentially exposed to bait based on monitoring various outcomes.

In addition to on-the-ground survey teams, trail cameras (i.e., motion-triggered infrared cameras) placed at frequently used gull roosting sites (Figure 2) are another method that could be used to assess exposure to bait on gulls and other non-target animals. Trail cameras allow for continuous monitoring of animal interactions with bait without having to be physically present for such observations.

Information that will be obtained from gull monitoring includes:

1. The number of gulls present on the islands each day from one week prior to the start of bait application until bait is no longer available and palatable.
2. Numbers of gulls present prior to the start of an active hazing activity and numbers remaining following the conclusion of of that hazing activity.
3. The number of gulls observed feeding on bait.
4. The number of sickened or dead gulls found on the island.
5. The number of sickened or dead gulls found on monitored mainland beaches with comparisons to long-term baseline values.

A summary of the monitoring activities is listed below. Monitoring will be conducted from Project initiation until it is determined that bait is no longer available and palatable.

- *Abundance and distribution of gulls*: Surveys will be conducted multiple times per day [*To Be Determined*], following the protocol used in the gull hazing trials and to include any observations of gulls consuming bait.
- *Hazing effectiveness*: In accordance with the gull hazing protocol, tallies will be made of the number of gulls in a location before a hazing method is used and the number of gulls present after the hazing method is used. The results will be used to assess the effectiveness of the various techniques and inform adaptive management of hazing operations to maximize success at all stages of the operation.
- *Island carcass surveys*: Surveys will be conducted to locate and collect carcasses found. Surveys will be conducted daily of regularly accessible portions of Southeast Farallon Island, while less accessible areas of Southeast Farallon and West End islands will be conducted weekly or more often, if possible or deemed more necessary (see Section 2.6 for additional details).
- *Mainland beached bird monitoring*: As part of the Beach Watch program, standardized surveys of live and dead birds as well as other wildlife will be conducted at mainland beaches within the Gulf of the Farallones and adjacent areas (see above for a brief description of the program). In addition, more frequent surveys ranging from daily to weekly will be conducted at a sample of two to ten pre-selected beaches with historically high deposition rates for gulls and high concentrations of live gulls. This will provide improved detection of gulls potentially exposed to rodenticide. Numbers of live and dead birds will be compared to historical baseline rates for the

same time period. Data collected from Beach Watch surveys will include counting and identifying to species or nearest taxon all live birds on mainland beaches and assessing them for behavioral or physical signs of poisoning.

- All dead birds will be counted and counted and identified to species or the nearest taxon.
- To the extent practicable, fresh carcasses of dead birds from the following list will be collected during all surveys conducted during the Project and saved for possible necropsies and residue sampling:
    - Black oystercatcher
    - Black turnstone (*Arenaria melanocephala*)
    - Common murre (*Uria aalge*)
    - Cassin's auklet (*Ptychoramphus aleuticus*)
    - Western gull
    - California gull (*Larus californicus*)
    - Herring gull (*L. argentatus*)
    - Glaucous-winged gull (*L. glaucescens*)
    - Iceland (Thayer's) gull (*L. glaucoides thayeri*)
    - Brandt's cormorant (*Phalacrocorax penicillatus*)
    - Pelagic cormorant (*P. pelagicus*)
    - Peregrine falcon (*Falco peregrinus*)
    - Burrowing owl (*Athene cunicularia*)

- In addition to Beach Watch surveys, a hotline will be established for the public to report observations of dead or sickened gulls in other mainland areas. Personnel will be dispatched to those areas to investigate and collect or capture dead or sickened birds suspected of rodenticide poisoning for possible residue sampling and to remove them from being scavenged.
- *Rehabilitation of injured wildlife:* The Service will partner with a wildlife rehabilitation facility or veterinarian to provide care for captured live birds and the administration of Vitamin K, which can reverse the toxic effects of anticoagulant poisoning.

1.3 Raptor Mitigation

The primary method to mitigate potential adverse effects to raptors will be to capture – prior to deployment of bait – as many raptors present on the islands, as possible, with a particular focus on burrowing owls and peregrine falcons. Capture and translocation or temporary captivity will be done in accordance with the terms of a *Migratory Bird Special Purpose – Miscellaneous* permit issued by the Service's Regional Migratory Bird Program. Raptor mitigation efforts will continue until the risk of exposure has declined to a negligible level (i.e., bait and/or carcasses are no longer available or palatable to non-target species).

A contractor or cooperator with demonstrated professional experience will be employed to lead raptor capture efforts and develop specific protocols for both capture and post-capture care and release. Owls will be captured with a variety of methods including mist nets and traps. Peregrine falcons and other raptors will be captured using traps or other acceptable techniques that will be determined in consultation with a professional raptor trapper. Captured raptors that are deemed unlikely to return to the islands (e.g., nearly all species except for peregrine falcons) will be released in appropriate habitats on approved federal lands. For example, the Warm Springs Unit of the Don Edwards San Francisco Bay National Wildlife Refuge has suitable burrowing owl habitat that hosts both resident and wintering populations of owls. This would be one likely release site for owls and possibly other raptor species. Other potential release sites will be identified in the final *Mitigation and Monitoring Draft Plan* after further consultations with the Service's Regional Migratory Bird Program and federal land managers. Species more likely to return after release, such as peregrine falcons, will be held in captivity until it is deemed safe to return them to the wild. Location of the captive holding facility(ies) will be determined when a contractor or cooperator has been acquired.

If any raptors captured and released on the mainland are found to return to the islands while bait exposure risks are still present, attempts will be made to re-capture those individuals after which they will be held in captivity until it is deemed safe to release them.

1.4 Raptor Monitoring

Raptor monitoring on the South Farallon Islands will follow standard protocols that are already conducted for daily bird surveys and (separate) burrowing owl surveys on the islands (Pyle and Henderson 1993, Warzybok and Tietz 2019). Briefly, trained personnel will search for raptors during standard, twice-daily area searches on Southeast Farallon Island. In addition, all incidental observations of raptors seen during the day will be recorded. These observations will be combined with incidental observations of raptors to determine total numbers of individuals for each species present each day. In addition, a daily survey will be conducted of known burrowing owl roosts in easily accessible portions of Southeast Farallon Island to estimate total numbers present and locations of individuals. Monitoring data will help target raptors for capture and to watch for possible returns of raptors already captured and translocated to the mainland.

Raptors will also be searched for and collected during carcass surveys (see Section 2.6). Carcasses will be saved for possible necropsies and residue sampling (see Section 2.5).

1.5 Farallon Arboreal Salamander Mitigation

The main mitigation method will involve capture of approximately 40 individual Farallon arboreal salamanders in the days or weeks prior to the first bait application to ensure their population is protected from an unexpected impact. The salamanders will be released to their original capture locations after the completion of the bait eradication Project and when it is deemed that the potential for impacts from rodenticide exposure has declined to a negligible level. This determination will be made based on results of monitoring from salamanders still in the wild, bait degradation, and possibly other environmental factors identified by the monitoring team.

Searches for salamanders will be conducted on various portions of Southeast Farallon Island and, if feasible, on West End Island. Locations of active study coverboards (small plywood boards used to create artificial habitat) will be excluded to the extent possible because these sites are used for monitoring purposes (Figure 3). Captures will be conducted mainly at night when salamanders are active at the surface. Salamanders will be captured from a variety of locations as a precautionary measure and to best assure a genetically diverse sample. Each individual capture location will be marked with a global positioning system (GPS) device.

Standard capture protocols for prevention of disease transmission will be followed. Care of captured salamanders will be done by appropriately trained personnel following standard protocols that will be provided in the Final Plan. Captured salamanders will be housed on-island in terrariums and fed a diet of crickets and/or other invertebrates. Daily health assessments of the captive salamanders will be conducted.

1.6 Farallon Arboreal Salamander Monitoring

After each bait application, salamanders remaining in the wild will be monitored both at standard coverboard sites on Southeast Farallon Island (Figure 3) and by conducting surveys at night when salamanders are most active. Night surveys may be particularly important if conditions are dry because salamanders are not typically present under coverboards during the day in dry conditions. To make these data more useful, the Service will obtain baseline data from night surveys before Project implementation to compare abundances from the after-Project implementation.

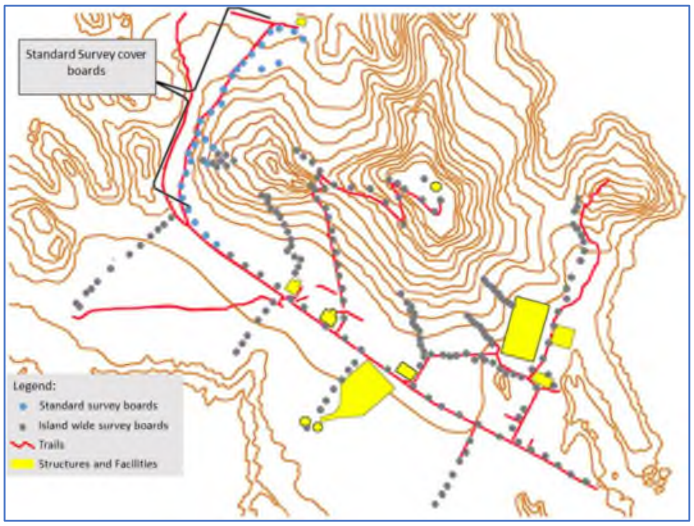


Figure 3. Location of Salamander Monitoring Coverboards on Southeast Farallon Island. Blue Circles Are Standard Survey Boards. Gray Circles Are Island-Wide Survey Boards That Are Not Currently Being Monitored (from Warzybok and Tietz 2019).

Coverboard surveys will be conducted every five days to detect the number of salamanders that are present. Surveys will follow the standard protocol that has been in use on the islands since 2007 (Warzybok and Tietz 2019) except that surveys will be conducted every five days instead of twice monthly. Numbers of salamanders under each coverboard will be counted and identified according to relative size and age: tiny (juvenile); small (immature); and large (adult). Each individual will also be photographed for possible tracking of recognizable individuals later because individuals may be identifiable by their spot patterns. In addition to coverboard surveys, nocturnal surveys to count salamanders in high use areas (e.g., north side of the island) will be conducted every five days. Survey areas and the specific protocol will be developed in more detail prior to Project implementation with input from salamander experts.

For both coverboard and nocturnal surveys, salamanders will be examined for the presence of bleeding or skin lesions that indicate possible exposure impacts from the bait. Any dead or moribund salamanders found will be collected for possible residue analyses. This information will be used to help determine: 1) potential impacts to salamanders from rodenticide exposure; 2) when it is safe to return captive-held salamanders to the wild; and 3) if the *Non-target Species Contingency Draft Plan* for salamanders needs to be activated.

1.7 Pinniped Mitigation

As disclosed in the FEIS, impacts to pinnipeds from the Project will be less than significant and there will be no long-term adverse effects to these species; however, short term disturbances to individual pinnipeds will occur during the Project. The Service will obtain an Incidental Harassment Authorization

(IHA) under the Marine Mammal Protection Act (MMPA) from the National Oceanic and Atmospheric Administration's Fisheries (NOAA Fisheries). Details of mitigation measures to be employed will be addressed during the IHA review in consultation with NOAA Fisheries and the GFNMS. Baiting operations will be conducted in a manner that minimizes potential for stampeding or other factors that could lead to pinniped injuries. Refer to the following Figures 4 through 8 for commonly used pinniped haul-out areas on the islands.

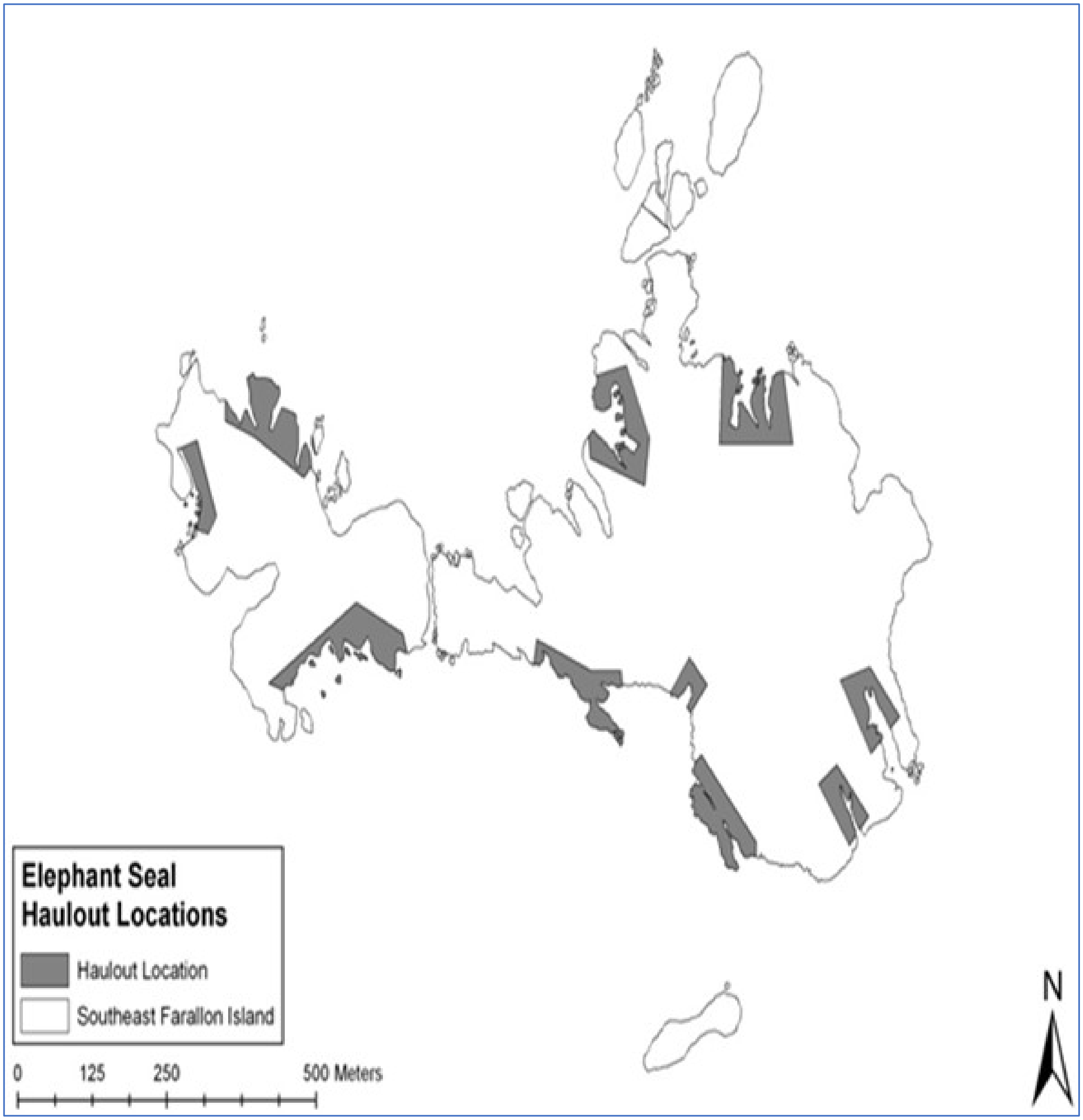


Figure 4. Elephant Seal Haul-Out Locations

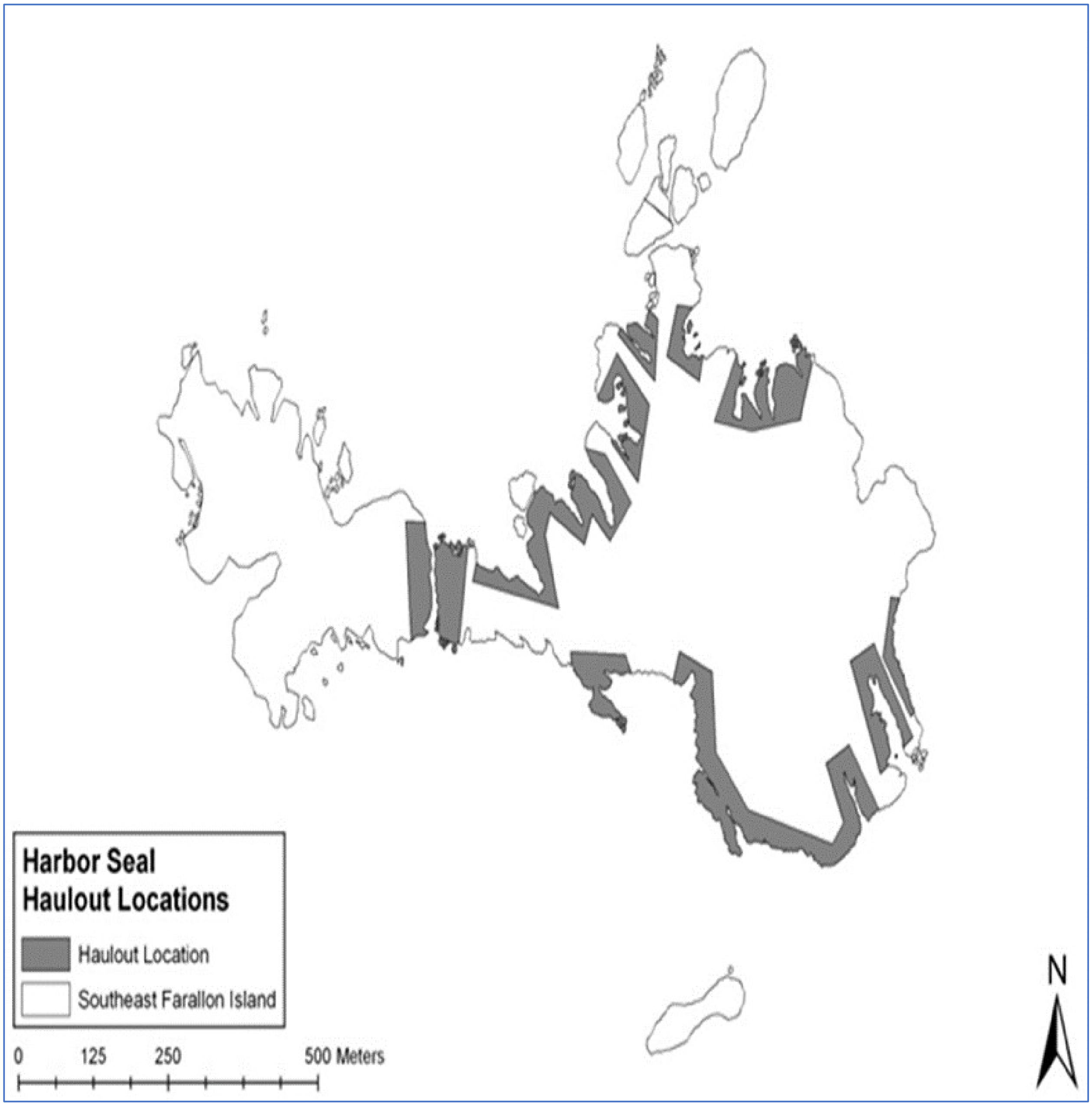


Figure 5. Harbor Seal Haul-Out Locations.

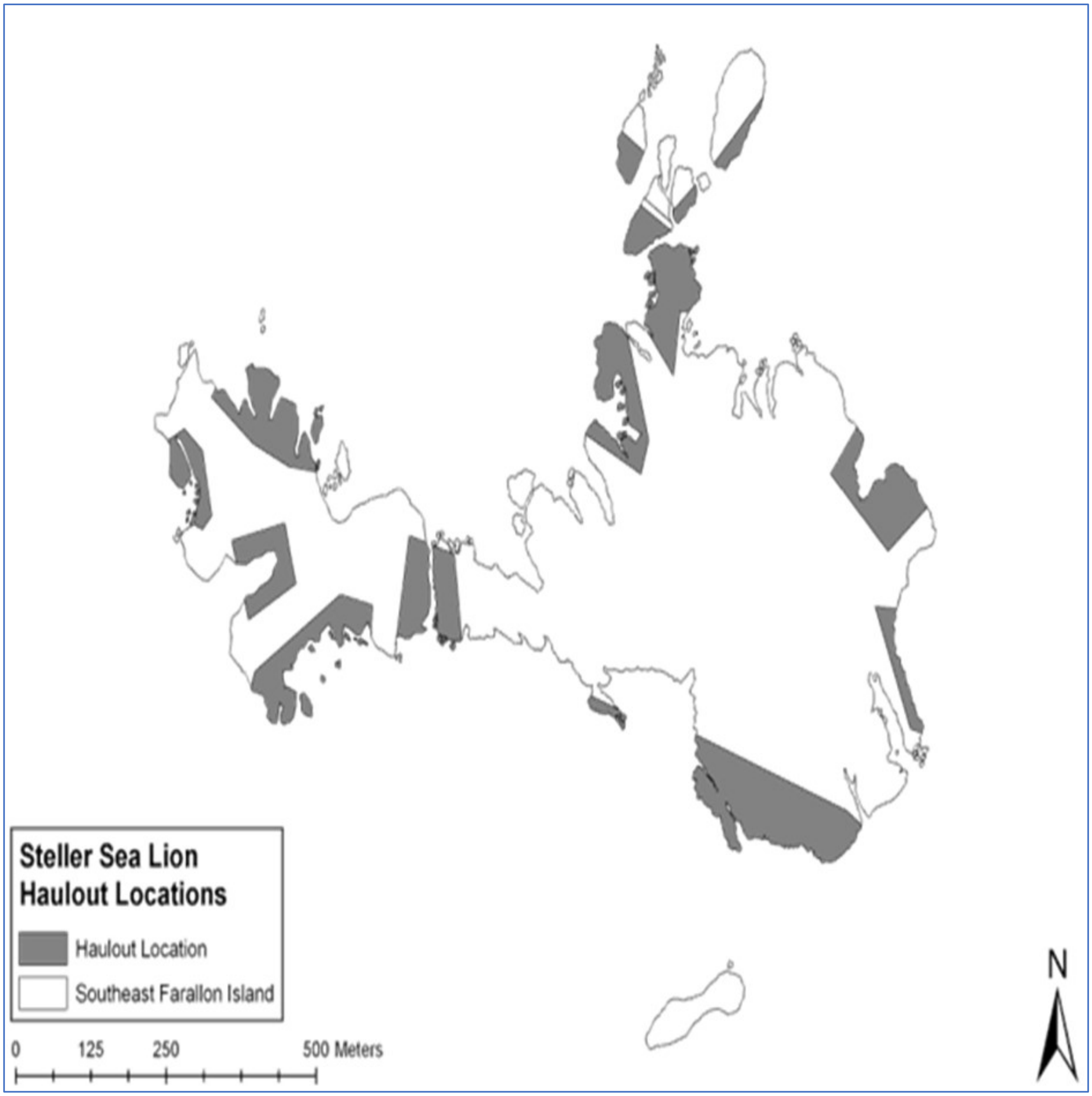


Figure 6. Steller Sea Lion Haul-Out Locations.

Figure 7. California Sea-Lion Haul-Out Locations.

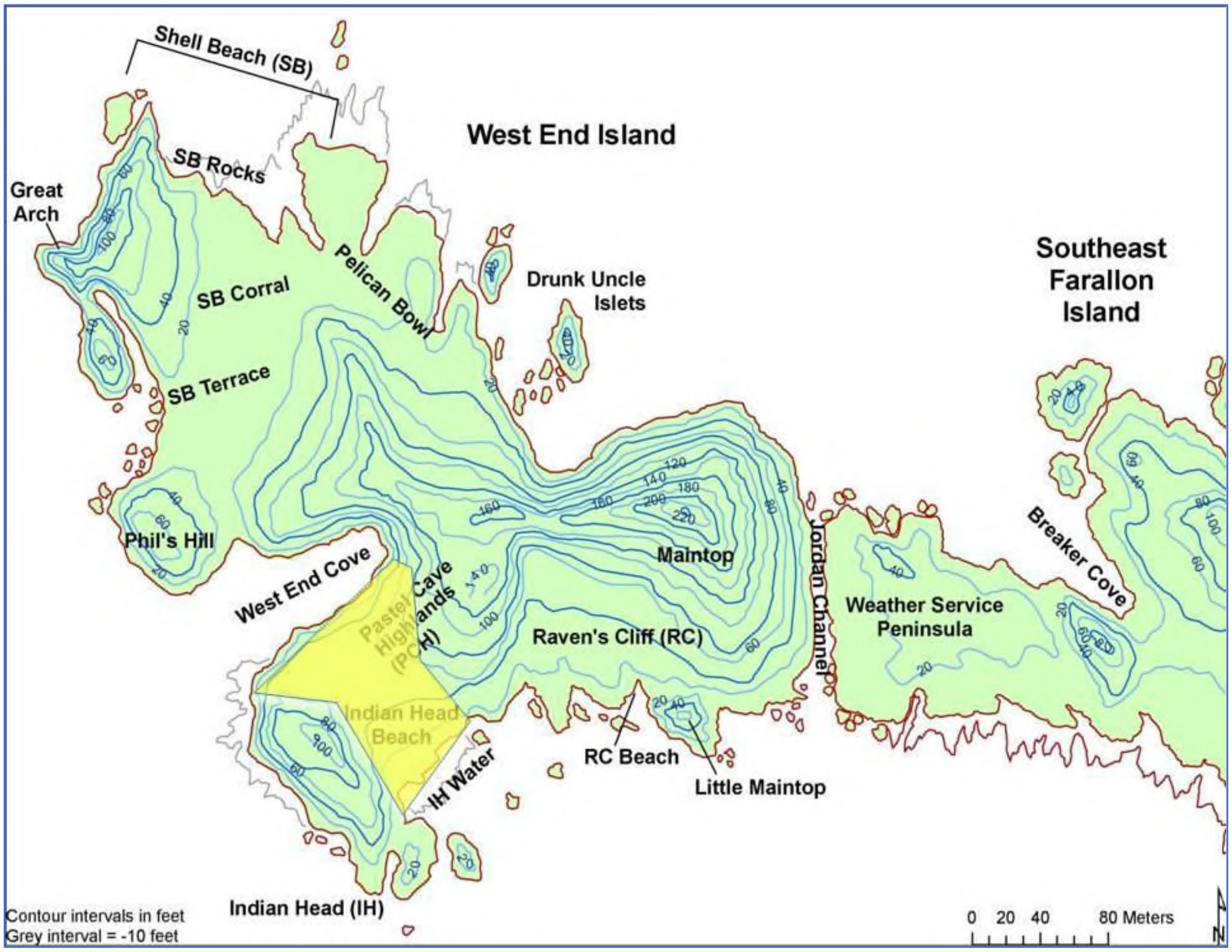


Figure 8. Northern Fur Seal Haul-Out and Breeding Area (Yellow Polygon).

One mitigation method avoid or minimize pinniped impacts may include using a helicopter just prior to deploying the bait to slowly and carefully move animals away from (or out of) areas to be baited. In areas that will be hand baited by personnel on foot, the team will be instructed to move slowly and methodically toward the area where pinnipeds are located to allow them time to move away or into the water without stampeding. To reduce disturbances to pinnipeds during gull hazing activities, human entry into pinniped haul-out areas and the use of pyrotechnics, helicopters, or other methods found to cause pinniped disturbance, will be minimized to the extent practicable.

1.8 Pinniped Monitoring

Standardized weekly counts (see Duncan 2020) conducted prior to, during, and after the Project period, will be used to examine whether pinniped numbers declined because of the bait eradication Project. This will be assessed by examining potential changes in numbers during the Project period and comparing them to past years. Table 1 is an example of pinniped numbers that may be present during the Project period with monthly average counts from 2019.

Table 1. Monthly Average Pinniped Counts on South Farallon Islands: October – December 2019 (Point Blue Conservation Science, unpublished data)

Species	October	November	December	Notes
California sea lions (*Zalophus californianus)*	4100	3521	2907	---
Steller sea lions (*Eumetopias jubatus*)	60 – 80	65	56	---
Northern elephant seal (*Mirounga angustirostris*)	200-300	193	197*	*Declined to 14 by end of December
Harbor seal (*Phoca vitulina*)	25-55	36	36	High fluctuations day to day
Northern fur seals (*Callorhinus ursinus*)	820	609, steady	66**	**150 early; less than 40 by mid-month

Pinniped behavior will also be monitored to gauge responses to helicopter operations, bait station installation and maintenance, and other Project tasks, to ensure compliance with the MMPA IHA. All pinnipeds disturbed during Project operations will be recorded to species following instructions provided in the IHA. Any disturbances caused by hazing operations will be recorded to examine if a hazing method is causing high levels of disturbances, which will be used to inform adaptive management efforts that may be implemented to further reduce pinniped disturbances during the Project.

1.9 Farallon Camel Cricket Mitigation

Figure 9. Caves and coves inspected during the November 2010 trial

The Farallon camel cricket is endemic to the South Farallon Islands. They are found mostly in caves and large rock crevices (Figure 9). Standardized surveys for camel crickets were initiated in 2012 to obtain baseline data before any potential mouse eradication. Comprehensive surveys of major cave sites have revealed that crickets reach their annual peak in the fall when there are high numbers of juveniles. The population then declines throughout the winter and spring to reach its lowest abundance in mid-summer.

One large cave on Shubrick Point, called Cricket Cave, has been determined at peak fall abundance to have approximately ten times the abundance of the next most numerous sites and likely supports a major component of the population of this species (USFWS 2019). In trials conducted on the South Farallon Islands in 2010, camel crickets were found to ingest a non-toxic form of rodent bait (refer to Appendix A in USFWS 2019); however, because of their different circulatory systems than vertebrates, existing information has shown that brodifacoum exposure does not cause mortality to insects and most other invertebrates. As a precautionary measure because of their endemic status, larger caves may be treated either with bait stations, traps, or another method to minimize potential risk to endemic crickets. Decisions about cave treatments will be made with input from the operational team. Details of the cave treatments will be described in the *Final Operational Plan*.

1.10 Farallon Camel Cricket Monitoring

As a part of regular monitoring on the islands, crickets are surveyed three times per year in January, July, and October at six caves (Cricket Cave, Rabbit Cave, Spooky Cave, Corm Blind Cave, Gap Cave, and North Landing Cave). Two other caves (Cricket Cave and Spooky Cave), which are not accessible during the seabird breeding season, are surveyed in January and October only (see Warzybok and Tietz 2019). Because of daily count variability, counts are conducted on three consecutive nights and data collected include the age (i.e., nymph, juvenile, adult) and sex of individual crickets.

During the operational period, cricket caves will be surveyed within five days after each aerial bait application for any indication of impacts from rodenticide exposure. In addition to standard counts, searches will be done for dead or moribund crickets. Indications of impacts would include the discovery of dead or moribund crickets or major declines in cricket numbers since the October survey.

Part 2. Mitigation and Monitoring of Bait and Brodifacoum Residue

2.1 Bait Drift Mitigation

To minimize bait drift into the marine environment, the following mitigation measures will be employed:

- The coastal boundary for the operation at the Mean High Water Spring (MHWS) mark will be flown and mapped prior to bait being applied.
- Helicopter flightlines for spreading bait will be confined to areas above the MHWS mark.
- Bait application by helicopter will be guided by GPS.
- Rodent bait that is aerially broadcast along the shoreline will be applied using a bait spreading bucket configured with a deflector providing a 120-degree swath pattern.
- A trickle bucket with a narrow (i.e., less than 33 feet [less than 10 meters]) swath will be used to complete linear features and sections of coastline considered too challenging for deflector and full swath bucket configurations.
- Bait application will not be conducted when wind speeds exceed 30 knots.

2.2 Bait Drift Monitoring

Monitoring for bait application rates and bait availability (see Section 2.3, below) will include study plots in intertidal habitats as well as observations of bait that may have drifted below the MHWS mark. This information will provide insight on the amount of bait drift that may occur, help identify any potential concerns, and address issues with the bait broadcast that could result in greater than acceptable levels of incidental bait drift. In addition, sampling for brodifacoum residue within tissues of both intertidal and subtidal fish and invertebrates (described more fully below in Section 2.5) will provide other information on bait drift and potential impacts to non-target species.

2.3 Bait Availability Monitoring

Key components of bait availability monitoring include:

1. Ensuring the application rate is appropriate
2. Ensuring there is sufficient bait coverage to expose every mouse on the Farallon Islands
3. Ensuring that bait is available to the mice for long enough time
4. Monitoring bait breakdown over time

Trained personnel will conduct on-the-ground monitoring of bait pellets to ensure that all mice are exposed to bait. Specifically, bait must be present in every potential mouse territory in sufficient quantity and duration to ensure that all mice have access to a lethal dose. This will be accomplished by establishing bait availability plots to evaluate the on-the-ground bait application rate (i.e., pellet density), and to calculate daily bait consumption by mice. The data collected will inform the bait application strategy and may lead to adaptive management responses to ensure adequate bait quantities or to adjust the bait application methods.

Bait availability monitoring will take place as soon as possible following each bait drop. Based on lessons learned from other similar island operations, it is best to begin monitoring the plots less than 40 minutes, or as soon as possible, from the time pellets are released. Bait density will be measured in selected (non-random) plots. Measuring bait application rates on the ground has been determined to be the most helpful means of providing ‘real time’ data to inform the operations team during the applications. This will allow for adjustments to be made, if needed, to help ensure that the target bait applications are met in all habitat types.

Monitoring protocols will include the use of a 1-meter square (m^2) circular hoops and then counting the number of bait pellets within the hoop. This will be used to estimate bait density on the ground following each application and to collect additional bait availability data across different treatment zones. This design will allow the analysis of slope, altitude, and habitat as potential factors influencing bait availability.

Bait will be measured in habitats where mouse activity is most likely. The bait availability plots will be distributed along transects, when possible, to facilitate logistics. Each plot will have an individual code and will be monitored every 24 hours in a consistent order. At each plot, pellets will be collected, counted, weighed collectively, and collectively assessed for bait degradation on the Craddock (2004) scale before being placed back within the same plot. The Craddock bait degradation scale incorporates details of wet, moldy, damaged, or intact bait; however, if the conditions are dry, it may be more appropriate to use the following general descriptions: 1 = fresh pellets, 2 = cracking, 3 = fracturing/flaking, 4 = pile of dust and >50% volume bait loss, and 5 = unorganized pile of dust and >75% volume bait loss.

All bait availability monitoring will commence the day of the first bait application and continue daily for X days depending on the results. By evaluating bait availability on the day of the bait drop, the on-the-ground bait application rate can be confirmed, and the values can be used as the basis upon which to start estimating daily bait consumption. All observers will be trained on the practical definition of ‘pellet’ to ensure systematic monitoring.

Observers will also visually evaluate if the general bait density matches the density measured inside the plots. This is a subjective process, but it will allow the team to validate the extrapolation to larger areas.

2.4 Target Species Monitoring

Efficacy

Efficacy of the bait applications on the target species, the invasive house mouse, will be evaluated with pre- and post-bait application monitoring protocols using multiple indicators. In the short term, efficacy of the baiting will be evaluated with radio collared mice monitored pre/post baiting until mortality (or not) is confirmed. In the longer term, mice will be monitored using direct and indirect detection tools. All tools used will have been tested on the target population on the South Farallon Islands before the operation. Monitoring will be conducted every X weeks for an expected period of two years.

Pre-operation

One week prior to the first bait application, up to X mice will be fitted with radio-collars. At least X live traps will be set and baited in high quality mouse habitat. Ideally, a balanced sex ratio and a range of age classes and breeding status will be targeted. However, animals in reproductive condition and juveniles will be preferentially collared because there is limited data on bait acceptance by these groups. Individuals will be fitted with radio-collars and released at their capture sites. Capture success rates will be calculated from the live traps and will be used to assess population status prior to the eradication Project. Additionally, body condition, morphometrics, and phenology data will be collected from captured mice.

Radio-collared mice will be monitored for one to two days prior to the first bait application to ensure they are alive and to identify burrow locations. Motion trigger cameras will be placed at the entrances of identified burrows to document bait acceptance and social interactions as well as survival (i.e., lack of activity) during the Project.

During operation

Radio telemetry monitoring will begin within five days before the first bait application and will continue until all collared mice are confirmed dead. All mice will be monitored every other day around sunset to check for movement. Once an individual is suspected to be dead, the site will be marked with GPS, and a recovery operation will be carried out as soon as possible.

Recovery may involve digging/moving rocks. Staff will be informed of the protocols. If dead mice are found within areas that must not be disturbed (archaeological or other protected sites), then the monitoring team will attempt to recover the radio collared individual only if it does not compromise the site.

Body condition, morphometric, and phenology data will be recorded for all recovered radio collared mice. Additionally, fresh carcasses of collared mice will be collected to assign cause of death and for toxicology analysis.

Strategically placed trail cameras may also be used to detect and document bait uptake by mice.

Post-operation

Passive detection devices that have been proven successful on the South Farallon Islands will be deployed. This includes chew blocks, wax tags, and tracking tunnels. Number to be determined (X) of these devices will be distributed as widely as possible across the islands.

2.5 Brodifacoum Residue Monitoring

Environmental (i.e., water, soil, and non-target fish and wildlife) monitoring will be led by a contractor or cooperator following specific protocols developed for the South Farallon Islands. The Residue Monitoring Plan will assist in tracking the environmental fate of rodenticide in the environment, characterizing the extent and period of exposure to non-target biota, and informing when it is safe to release or allow captured and held native wildlife (e.g., Farallon arboreal salamanders, peregrine falcons) back into the wild.

Necropsies and tissue samples from collected dead birds will be evaluated to assess brodifacoum exposure and relative risk within the South Farallon Islands avian community, including seabirds, shorebirds, raptors, and landbirds.

Residue monitoring for other species or species groups will require collections of live organisms but may also include any collected dead or moribund individuals suspected of brodifacoum exposure. Additional residue monitoring will likely be conducted on the following species or species groups, to be confirmed following consultation with other experts and applicable regulatory agencies:

- Farallon arboreal salamanders
- Farallon camel crickets
- Other indicator terrestrial invertebrates, such as beetles (Family: Coleoptera) and Corm flies (*Fucellia thinobi*a)
- Indicator intertidal invertebrates, such as mussels (*Mytilus californianus*) and limpets (*Lottia* spp.)
- Indicator subtidal invertebrates, including Dungeness crabs (*Cancer magister*)
- Indicator intertidal and subtidal fish, including groundfish (rockfish *Sebastes* spp., lingcod (*Ophiodon elongatus*), chinook salmon (*Oncorhynchus tshawytscha*), Pacific halibut (*Hippoglossus stenolepis*) or other flatfish, sculpins (*Leptocottus* spp., *Oligocottus* spp., *Artedius* spp.), and others

Because brodifacoum generally does not persist in invertebrate tissues, its presence would be indicative of recent exposure of brodifacoum cycling in non-target invertebrates, potentially signaling an exposure pathway of concern to predators.

Soil and Water

Soil and water monitoring will begin about 10 to 12 days prior to the first rodenticide application and continue for eleven weeks, divided into five time periods. Personnel will not handle bait on days during which soil and water samples are collected. Samples of rodenticide bait used in the operation will also be analyzed to determine actual brodifacoum concentrations.

Water samples will be collected across the South Farallon Islands at multiple intertidal, subtidal, and shallow freshwater sites [locations to be determined], as well as the water cistern. Samples will be collected in 1.0-liter glass bottles that will be chemically cleaned by the manufacturer and double bagged. Each bottle will be labeled immediately before use. For collection, the bottles will be held just below the water surface until full, then sealed and returned to their original storage bag. Water samples will be kept cold (refrigerated) and shipped [to a selected laboratory] for brodifacoum analysis.

Brodifacoum concentrations in the soil, sampled over time, will indicate its potential environmental fate and transport in the ecosystem. Soil samples will be collected from X areas throughout the South Farallon Islands at 1-, 3-, 6-, and 12-months following rodenticide applications. Approximately 2 to 4 inches (5 to 10 centimeters) of soil will be collected directly underneath a bait pellet (or from an area marked where a pellet had resided, for the later time periods).

Tissue Sampling

The tissue sampling effort will be focused on common species that are representative of different compartments of the islands' food web. Biological samples will be frozen and stored after collection. Brodifacoum residues in animal tissues will be analyzed using a liquid chromatography-tandem mass spectrometry (LC-MS/MS) method or other analytical method appropriate for the tissue matrix of interest. All brodifacoum residue data for tissue samples collected from control and exposure areas will be reported, including data for samples where brodifacoum concentrations are below the Detection Limit.

Birds will be collected during carcass surveys and incidentally. Other species listed above (salamanders, crickets, beetles, fish, etc.) will have to be collected live unless found dead.

2.6 Carcass Surveys and Removal

Pre-operation carcass surveys

The monitoring team will perform a full island search for carcasses prior to the first bait drop. This will be done by dividing the island into subareas with workers walking as much of the accessible area as possible while looking for carcasses. Staff will use a GPS device to track coverage within designated zones. The goal will be to get good coverage of the whole island rather than detailed coverage of a small portion of the island during the survey. Carcasses will be examined to determine likely cause of death. A sample of fresh carcasses will be collected for possible necropsy and toxicology analysis. Carcasses found but not collected will be "marked" by clipping at least one wing, following standard, current protocols on the islands.

Post-application carcass surveys

Purposes of the post-bait application surveys and collections include:

- Enumeration by species of numbers of dead individuals that may have died from brodifacoum exposure.
- Collection for potential necropsies and/or residue sampling.
- Prevention of access to and consumption of the carcasses by scavengers and mice.
- Informing adaptive management measures and potential need for non-target contingency actions (see *Draft Non-target Species Contingency Plan*) that could be applied to the second bait application or later, as necessary.

Mice that have consumed bait and die in accessible locations pose a hazard to non-target scavengers for the length of time that carcasses remain palatable, perhaps as long as five weeks. (This will be ascertained based on residue monitoring.) Carcass collection will occur when feasible and safe for operations staff.

Within one week following each bait drop, all safely accessible areas of the islands will be searched for mice, birds, and other animal carcasses. Birds and other small animal carcasses will be recorded and individuals with evidence of brodifacoum exposure will be collected. The locations of any new marine mammals or other large animal carcasses will be recorded. Carcasses will also be recorded and collected opportunistically during routine wildlife surveys and other daily activities on the islands for X weeks after commencement of the second aerial application of bait. These searches will include areas of known gull and shorebird roosting areas. Collected, fresh carcasses will be further preserved for potential residue analyses.

2.7 Cultural Resources

All known sites with important cultural resources will be clearly identified in a manner that will be recognizable to all field personnel. Personnel will be briefed on the locations and identification of archaeological and historical resources that are present on the islands and methods to avoid or minimize impacts to those resources. Field personnel will be prohibited from disturbing any sites of historical or cultural importance. Due to the presence of historic buildings and other features on Southeast Farallon Island, the Service will initiate consultation with the Service’s cultural resources staff and the State Historic Preservation Office (SHPO) to ensure that planned activities will be compatible with protection of cultural resources. Personnel will not dig into the ground or alter the physical environment except at discrete locations for the installation of bait stations and associated necessary equipment (USFWS 2019).

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APPENDIX 5

INVASIVE HOUSE MOUSE ERADICATION PROJECT

DRAFT Bait Spill Contingency Plan

FARALLON ISLANDS NATIONAL WILDLIFE REFUGE

IMAGES COURTESY OF U.S. FISH AND WILDLIFE SERVICE

Prepared by:
SeaJay Environmental LLC, Oakland, California

for the
U.S. Fish and Wildlife Service, Farallon Islands National Wildlife Refuge

March 2021

Contents

Introduction

This *Draft Bait Spill Contingency Plan* (Draft Plan) has been prepared to support the Proposed Action in the *South Farallon Islands Invasive House Mice Eradication Project: Final Environmental Impact Statement* (FEIS; USFWS 2019). The Proposed Action (or Project) would eradicate house mice on the Farallon Islands National Wildlife Refuge (Refuge), primarily through the aerial application of Brodifacoum-25D Conservation (Brodifacoum-25D) on the South Farallon Islands. The FEIS fully analyzed potential risks to the environment from the use of Brodifacoum-25D and based on the design of the Project and its mitigation measures, concluded that there would be no long-term, significant adverse impacts on the environment from the use of this bait product. However, because the risk of a bait spill cannot be completely eliminated, the FEIS called for the preparation of a Bait Spill Contingency Plan (FEIS Section 2.10.11), specifying that it will include information on: 1) natural resources at risk; 2) response strategy; 3) precautions that will be taken to minimize risk of a marine or terrestrial bait spill; 4) the response activities, including discovery and control, assessment, notification procedures, and disposal of spilled material; 5) necessary response resources and appropriate preparedness activities; 6) description of the Incident Command System (ICS) structure, ICS contacts, and other relevant information necessary to help respond to an unforeseen spill; and 7) appropriate response activities in designated wilderness areas.

This Draft Plan identifies measures that will be taken to respond to an unintentional bait spill that occurs outdoors into a marine or terrestrial natural environment (also referred to as a “release,” which includes any spilling, leaking, emptying, discharging, escaping, dumping, or disposing into the environment, unless permitted or authorized by a regulatory agency). This plan is complementary to the *Draft Operational Plan*, which is the primary document that summarizes the resources at risk and details the measures that will be taken to prevent accidental bait drift. This draft is also complementary to the *Draft Mitigation and Monitoring Plan,* which contains additional information on monitoring that will be done if there is a bait spill incident. Red text is used to indicate placeholders for information that will be addressed in the Final Plan.

This document is in draft form. If the Service’s Record of Decision selects the FEIS Preferred Alternative (Alternative B) for implementation, this Draft Plan will be revised to incorporate input of the implementation team and comments from appropriate federal and state agency reviews, including confirmation of the notification list and the ICS team. The Draft Plan will be finalized prior to Project implementation.

Objectives

The primary objectives of this plan are to:

- Define bait spills;
- Ensure the safety of personnel and the public;
- Describe measures to control the source of a bait spill;
- Describe measures to contain and recover spilled bait material; and
- Describe the process to inform partners and agencies with jurisdiction.

Brodifacoum-25D is a solid, pelletized, grain-based, rodenticide bait formulation. Each bait pellet weighs about 1 to 3 grams (.035 to .106 ounces) and contains 0.0025% weight concentration (or 25 parts per million [ppm]) of the active ingredient, brodifacoum.

The most potentially likely, but small probability, spill scenario into the environment is when bait containers are being transported from one location to another. Another low risk, but potential situation is if the bait-spreading bucket accidentally releases a partial or full load of bait while the helicopter is in flight or if the helicopter flies beyond its established flight path and bait is released over the water. An even lower probability scenario is a helicopter accident while transporting bait. In the unlikely event that one of these scenarios occurs, this plan describes the contingencies that will be used to respond to the spill and minimize any adverse consequences to people or the environment.

Definitions

Minor Bait Spill

A minor bait spill is one in which there is a small accidental release (e.g., greater than 2 pounds [lb; 1 kilogram (kg)] and less than 11 lb [5 kg]) of Brodifacoum-25D product into the environment outside of the intended application area.

Major Bait Spill

A major bait spill is defined as a discharge of Brodifacoum-25D in quantities greater than 11 lb (5 kg) in a non-treated, localized area, on water or on land except for man-made land surfaces that can be easily cleaned up and do not threaten aquatic resources.

Regulatory Context

Executive Order 12088, "Federal Compliance with Pollution Control Standards" (as amended), requires federal agencies to comply with applicable pollution control standards and to work cooperatively with federal, state, and local agencies to prevent, control, and abate environmental pollution. Included among the applicable statutes that federal agencies must comply with in Executive Order 12088 is the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; 7 U.S.C. § 136 *et seq*.). Under FIFRA, pesticides sold and distributed in the United States are registered with the U.S. Environmental Protection Agency (EPA) and once approved, must be used in accordance with an EPA-approved label. A pesticide label (called the "bait label") sets the conditions, directions, and precautions that define when, where, and how a pesticide may be used. In the case of the Proposed Action, it is expected that a "supplemental label" will be obtained from EPA prior to Project implementation. A supplemental label would allow Project-specific application allowances for the use of Brodifacoum-25D on the South Farallon Islands.

Other federal regulations under the Comprehensive Environmental Response, Compensations, and Liability Act (CERCLA), and the Emergency Planning and Community Right-to-Know Act (EPCRA) require responsible parties to report hazardous material releases if certain criteria are met. However, Brodifacoum-25D does not meet these criteria. For example, CERCLA requires that all releases of marine pollutants categorized as "environmentally hazardous substance, solid, not otherwise specified" listed in Appendix B of 49 CFR Part 172.101 when they exceed the "reportable quantities" in 49 CFR Part 172.101, be reported by the responsible party to the National Response Center. Although the active ingredient, brodifacoum, is listed as a severe marine pollutant under 49 CFR Part 172.101 Appendix B, the bait product that will be used, Brodifacoum-25D, does not meet the definition of a marine pollutant because it is packaged in a concentration that does not equal or exceed one percent (1%) by weight in the mixture (49 CFR Part 171.8). The concentration of brodifacoum within Brodifacoum-25D bait is 0.0025% weight concentration (or 25 ppm). In the absence of a reportable quantity, for the purposes of this Draft Plan, the Service will voluntarily report to the regulatory agencies any "major" spill to regulatory authorities as well as any spill (regardless of size) that creates significant risk to human health and/or the environment, including non-target wildlife and pets.

The California Department of Pesticide Regulation (DPR) has authority to directly regulate any private entity who conducts pest control activities on federal facilities. Application of the bait for this Project will be conducted under the supervision of a certified applicator who holds a Qualified Applicator Certificate from the State of California. An Aircraft Pilot Certificate is also required for those who operate the helicopter to deploy the bait. Additionally, DPR can impose penalties on private entities for violations of state pesticide laws.

The U.S. Fish and Wildlife Service's Integrated Pest Management (IPM) policy (569 FW 1; https://www.fws.gov/policy/569fw1.html) addresses training standards and other requirements for the use of pesticides on refuge lands. IPM is a science-based, decision making process that incorporates management goals, consensus building, pest biology, monitoring, environmental factors, and selection of the best available technology to achieve desired outcomes while minimizing effects to non-target species and the environment and preventing unacceptable levels of pest damage. As required by the EPA, Section 1.10.B of the policy reiterates the requirement that any person who purchases, uses, or supervises the use of Restricted Use Pesticides, to be a Certified Pesticide Applicator under Section 4 of FIFRA or under the direct supervision of a Certified Pesticide Applicator.

Notifications are required to be made to the State of California if there is any "significant release or threatened release of a hazardous material." The state definition of a significant release includes a solid hazardous material of 500 lb (227 kg) or greater (California Health and Safety Code §25507) or if the spill exceeds a federally listed reportable quantity. If such a spill were to occur, both the California Office of Emergency Services (Cal OES) and the California Unified Program Agency (CUPA) or 911 will be notified. In San Francisco, the CUPA is the Department of Public Health and it has deemed that the 911 call meets this notification requirement. Notifying Cal OES and 911, therefore, constitutes compliance with both the federal requirements of 42 USC § 11004, regarding verbal notification to the applicable state agencies, and with the California Code of Regulations at Title 19 Section 2631.

With the exception of Southeast Farallon Island, all of the South Farallon Islands are part of the Farallon Wilderness (designated in 1974) as designated under the Wilderness Act of 1964 (Public Law 88–577). The Wilderness Act prohibits human activities that would impact the natural, solitude, undeveloped, and untrammeled characters of wilderness except those permitted under an approved Minimum Requirements Decision Guide. In those cases, the minimum tools required to complete the task must be used. Response to a bait spill in the Farallon Wilderness would be conducted under the approved MRDG for this Project (refer to Appendix G of the FEIS). Unless approved in a separate MRDG, no mechanized equipment would be used for cleanup of spilled bait in wilderness.

The waters surrounding the Farallon Islands are also part of the Greater Farallones National Marine Sanctuary (GFNMS) and the Farallon Islands Area of Special Biological Significance (ASBS), which is a State of California Water Quality Protection Area designated by the State Water Resources Control

Board (SWRCB) for the maintenance of natural water quality. There are prohibitions on discharges into the sanctuary under 15 CFR § 922.92, and of "waste" discharges of any origin into the ASBS under the California Ocean Plan (2019). Both the GFNMS and the SWRCB will be notified by the Refuge Manager if there is any accidental release of bait into the waters of the GFNMS or ASBS, respectively.

Resources at Risk

Resources at risk to a bait spill are the same as those identified in the FEIS as at risk of rodenticide exposure and toxicity. For a spill on the island, the species of greatest concern to bait ingestion and toxicity effects are birds that would be likely to consume bait, especially gulls and granivorous landbirds. For a marine spill, bait is expected to break down rapidly (within minutes to a few hours), limiting risk of ingestion of bait pellets. Risk is further reduced by the fact that most marine species near the islands are either planktivores or predators, and the grain-based pellets are not a typical food item. However, some individual fish and invertebrates, particularly scavengers such as crabs, could be expected to ingest bait pellets if presented with the opportunity. If sufficient toxicant was mobilized in the water column, filter feeders such as mussels and limpets could potentially ingest detectable levels of toxicant.

Pre-Planning Procedures

Prior to Project implementation, the Refuge Manager or his/her designee will provide a courtesy notification to emergency response agencies and other state agency personnel informing them of the schedule for rodenticide bait transport to/from the South Farallon Islands and the anticipated aerial bait application dates. As part of this Project, the Refuge will hire a spill response contractor [NAME TO BE INSERTED HERE WHEN KNOWN] to be on site with a response vessel during bait transport and application in case of the need to respond to a marine bait spill. A full spill kit:/, including personal protective equipment (PPE), and trained personnel will be on board.

If bait is stored or handled at a mainland facility prior to its transport to the islands, the Refuge will share information with state and local emergency response agency personnel such as where it is housed, the facility site layout plan, access routes to the facility, and the location of storm drains or nearby water conveyances. Any contact with state and federal agencies or other entities will be documented and the response procedures agreed upon between the Refuge and the local fire department or the designated CUPA.

If requested, the Incident Commander and all essential operations personnel could participate in a spill scenario drill that includes planning activities with field personnel, response agencies, and other relevant parties. This could include reviewing the contents of this spill plan during planning meetings with federal, state, and other appropriate authorities, to allow additional opportunity to provide input.

Within 30 days prior to handling and use of bait, all phone numbers in the notification list (Appendix A) will be called to ensure that they remain correct. The plan will also be reviewed prior to the implementation of bait deployment activities to ensure that all information remains current and complete. This drill to check the notification list as well as any changes made to the plan will be noted in Appendix B.

Responsibilities

Fish and Wildlife Service Project staff, along with the mouse eradication operations team, have the primary responsibility for coordinating the initial response to a bait spill. The Refuge Manager will be designated as the Incident Commander if a bait spill occurs (refer to Appendix C). The Incident Command System provides a structure that is known by all local, state, and federal authorities on how to organize assets to respond to an incident and the processes that will be used to manage the response through its successive stages. All response assets are organized into five functional areas: Command, Operations, Planning, Logistics, and Administration/Finance. If the incident can be mitigated by resources present at the site, only the Command structure will be stood up. This means that the Refuge will implement its ICS Team with the Refuge Manager acting as the Incident Commander if a spill (or any significant incident) occurs during the Project. The Incident Commander has the central coordinating role in any emergency, has the authority to commit the necessary resources to respond to an incident, and will request assistance from local, state, and federal support personnel, contractors, or other responders, as appropriate. If the Refuge Manager is not available, or if the spill response operational period is longer than eight hours (or beyond what can be managed in a single workday), then an Acting Incident Commander will be designated by the Refuge Manager. Depending on the scale of the spill, additional positions in the ICS Team will be filled in, as needed. Identification of each ICS contact will be specified in the *Final Bait Spill Contingency Plan*.

Safety Data Sheet / Bait Label

Appendix D contains a copy of the current bait label. If a supplemental label is received that is specific to Project conditions, then the label in Appendix D will be updated in the Final Plan. The Safety Data Sheet (SDS) for Brodifacoum-25D Conservation is provided in Appendixes E. Refuge personnel and contractors will be provided a copy of the label and SDS and will be trained on the safe handling and use of the Brodifacoum-25D. All training will be conducted to accurately reflect the current label requirements and SDS.

Precautions to Minimize Risk of Spill or Release

The probability of a bait spill occurring can be effectively reduced by an education program that trains all Project personnel and contractors in:

- Pesticide spill prevention, control, and cleanup procedures.
- Methods for proper handling and storage of pesticides.
- Knowledge of the safety precautions around the use of this bait (Brodifacoum-25D).

Additional spill prevention practices include:

- Properly securing pesticide containers while in the storage areas or when transporting.
- Inspecting storage areas for leaking or damaged containers on a regular basis and prior to transport.
- Providing and properly maintaining spill kits at all storage and bait loading areas.

All operations personnel will be informed about appropriate response activities in the event of either a minor or major bait spill. All personnel will be familiar with the geography of the South Farallon Islands, the location of spill response equipment, response strategies, the Incident Command Structure, the need for prompt reporting of any incident, and the procedures described in this Draft Plan. All personnel involved with spill response efforts will have 40-hour training in hazardous waste operations and emergency response (also referred to as HAZWOPER), as required by the Occupational Safety and Health Administration (OSHA) in 29 CFR 1910.120. All personnel will be assigned their own PPE and will be trained in proper PPE use during a spill.

Given that this is a one-time bait eradication Project, training of personnel will also be job- and site-specific. Project personnel will be trained in all elements of this Draft Plan and in the *Draft Operational Plan* no fewer than 30 days prior to the initiation of Project activities. If there are personnel changes, new employees or contractors will also be trained to this same level prior to their involvement on the Project.

All personnel and contractors will be required to read these plans and to document their understanding of the bait spill procedures by dating and signing the enclosed training form (Appendix F). Hard copies of the Draft Plan will be readily accessible at the storage and loading facilities/locations, and on Southeast Farallon Island during Project implementation and the post-Project monitoring period. Revised copies will be furnished if changes are made to the document.

➔ **ANYONE WORKING ON THE MOUSE ERADICATION PROJECT WILL BE PROVIDED A HARD COPY OF THIS PLAN AND WILL ACKNOWLEDGE THEIR UNDERSTANDING OF THESE REQUIREMENTS**

Spill Discovery – Safety and Containment

In the event of a bait spill, the first priority is to ensure the safety of all personnel and anyone who may be potentially at-risk. This will be followed by containment (if possible), and then response actions. The mitigation phase that would occur after a spill has been controlled is addressed in the *Draft Mitigation and Monitoring Plan*.

This Draft Plan breaks the actions to be performed during a spill into different phases. This section describes the actions when a spill is first discovered to ensure safety protocols are followed and then the procedures that will be used to contain the spill and to prevent further spillage. Control efforts related to a terrestrial spill versus a marine spill are different and are addressed separately in the following sections.

➔ **PRIOR TO COMING INTO CONTACT WITH CONTAMINATED MATERIAL, ALWAYS SURVEY THE SCENE FOR HAZARDS AND DON APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT**

Before any action is taken, personnel will evaluate the scene to ensure it is safe to enter. The following basic safety procedures are expected to be accomplished as rapidly as possible.

Basic Safety Protocol

1. The Incident Commander will be informed as soon as possible of any concern related to personnel safety or the environment.
2. Site personnel who might be called upon to respond to a spill or to injured personnel will first conduct a quick assessment of potentially dangerous conditions at the site to determine whether it is safe for the responders to proceed.

3. If personnel are harmed or in danger, the responder will assess the situation, call 911 (if appropriate), quickly don necessary protective equipment (as specified in Section 6 of the SDS), and remove the injured to a safe location upwind from the spill.
4. Contaminated clothing will be removed from the victim and/or responder and the affected areas of the body will be washed with soap and water in an appropriate decontamination area.
5. First aid will be administered as required by the symptoms/signs and bait label instructions, which include flushing contaminated eyes with clean water for 15 to 20 minutes.
6. Medical assistance will be obtained for injured or contaminated persons. Anyone who is injured or incapacitated should not be left alone. Someone will be instructed to stay with the injured or contaminated person until proper medical assistance is provided or a physician has been informed of the incident.

Control of a Spill

Appropriate PPE will always be worn when handling bait, including during Project operations, Project monitoring, and spill response activities. If a spill occurs, the area will also be secured, to the extent feasible, to prevent access by unauthorized personnel who could potentially increase the spread of contamination or create additional safety concerns.

If it is safe to do so and the person at the spill site has been properly trained, then that person may take appropriate action(s) to control a spill such as plugging a leaking container or by covering spilled material with plastic tarpaulin to prevent bait from blowing away. Spilled bait will be prevented from entering storm drains, wells, water systems, ditches, and navigable waterways to the maximum extent possible. The control of a spill could include preventing further spillage by transferring unspilled bait to another container or garbage bag. All spilled material or contaminated soil or water will be placed into labeled receptacles and disposed of in accordance with state and federal hazardous waste requirements.

- ➔ ***MATERIAL USED TO CONTAIN AND CLEAN UP A SPILL, INCLUDING PPE, SHOVELS, BUCKETS, ETC., WILL BE TRIPLE RINSED BEFORE DISPOSAL OR RE-USE***

Terrestrial Spill Response Strategies

Depending on the severity of the incident, response activities may necessitate the assistance of outside contractors or other responders. Only qualified and trained personnel will undertake cleanup operations.

Response Actions to a Minor Terrestrial Spill on the South Farallon Islands or Mainland

If there is a minor bait spill that occurs at either a California mainland facility or on land at the South Farallon Islands, then the following procedures will be followed. Procedures for responding to a major spill on land are described in the next section (below).

1. Notify the Incident Commander immediately.
2. All personnel must wear appropriate PPE and have appropriate training.
3. Material will be immediately covered such that any powder, dust, or granular material will not become airborne and to make sure that bait is inaccessible to potential non-target species. This can be done by placing a tarpaulin over the spilled material and weighing down the ends, especially the end facing into the wind.

4. Begin cleanup operations by systematically rolling up the tarp while simultaneously sweeping up spilled bait using a broom and shovel or dustpan. Smaller amounts of bait pellets may need to be removed by hand using appropriate PPE. While sweeping, avoid brisk movements to keep the dry pesticide or other contaminated material from becoming airborne.
5. Place all spilled material in an appropriate container for disposal or re-use.
6. Properly secure the container and include a hazardous waste label that identifies the contents as Brodifacoum 25D-Conservation, its toxicity, the Refuge's contact address, contact person and phone number, and the date that waste material was placed into the container. HAZARDOUS MATERIAL should be clearly marked on the container.

Response Actions to a Major Terrestrial Spill on the South Farallon Islands or Mainland

In the event of a major terrestrial bait spill, the Incident Commander (Refuge Manager or designee), Refuge personnel, and other Project personnel will fully implement the procedures of this Draft Plan. Full implementation of the Draft Plan includes conducting agency notifications (Appendix A), standing up the Incident Response Team (Appendix C), and executing the spill recovery procedures described herein. For a major terrestrial spill, soil residue monitoring may be conducted to assess potential soil contamination and rodenticide degradation. Monitoring data may also be needed to determine if there is a need for soil remediation.

In the event of a major terrestrial spill, the listed steps below will be immediately implemented. Trained personnel wearing appropriate PPE and following safety precautions will secure and monitor the spill site at all times until it has been effectively contained and cleaned up. The contaminated area will be isolated, preferably by roping it off, if feasible. Anyone who is not authorized to directly respond to the spill will remain at least 30 feet away and upwind. All personnel will avoid coming into contact with any drift (dust) that may be released.

1. Notify the Incident Commander immediately (who will make further notifications, as necessary).
2. Take all necessary human safety precautions and minimize the number of personnel in the area.
3. Determine if any personnel are injured and take appropriate steps to assist individual(s) if it can be done safely (refer to Injured Persons Action Plan: on-island (South Farallon Islands) and Injured Persons Action Plan: off-island in the Operational Plan).
4. If necessary, stop helicopter operations until the spill is cleaned up.
5. Consult with the pilot regarding the location of the spill and include global positioning system (GPS) coordinates, if available.
6. Evaluate the scene and make sure the area is safe for authorized people to enter to help control additional releases.
7. Retrieve industrial strength garbage bags, shovels, and other material (as needed) that are listed in the Terrestrial Bait Spill Kit.
8. Assigned personnel or the response contractor wearing appropriate PPE and trained in cleanup procedures, will arrive at the spill area and start the cleanup. Contaminated residues will be placed in properly labeled leakproof containers.
7. Once spilled bait is cleaned up, bait will be assessed for quality and usability. If it is determined that bait is no longer useable, then the receptacles containing spilled bait will be secured and include a label that identifies the contents as Brodifacoum 25D-Conservation, its toxicity, the Refuge's contact address, contact person and phone number, and the date that waste material

was placed into the container. The spilled bait will then be disposed of in accordance with all federal, state, and local requirements.

8. Complete the documentation and reporting requirements (see below in the Notification Procedures section).

Terrestrial Bait Spill Response Kit

1. 1 storage bin (to contain all the spill kit supplies) that is labelled as to the listed contents
2. 1 laminated copy of the bait label for PPE and disposal references (include English and Spanish)
3. 1 box barrier laminate gloves in sizes that accommodate all personnel
4. 4 pairs (2 large, 2 extra-large) of chemically resistant overalls with hoods such as Tyvek
5. 4 pairs protective boot covers
6. 1 box of particle size dust masks
7. 4 pairs of safety goggles
8. 4-inch-wide painter's masking tape
9. 1 box labels
10. 2 permanent ink marking pens
11. 2 tarpaulins (20 feet by 20 feet)
12. 1 box industrial strength garbage bags (at least 50-gallon capacity) and nylon zip ties
13. 4 plastic buckets (5 gallons)
14. 3 brooms
15. 3 dustpans
16. 3 shovels

The contents of the Terrestrial Spill Kit(s) will be verified and documented as meeting the requirements whenever bait containers are in storage or the Project is underway. Each kit will be verified by ensuring that the lid is intact and that a visual marker (such as tape or a zip tie) has not been compromised, which would indicate that the container has been opened and the supplies need to be re-checked. If material in the spill kit has been used or the kit appears to have been opened, then the contents will be fully verified, replenished (if necessary), and the process documented. If personnel need to use material from the spill kit for any purpose, they will report the reasons for this use to the Refuge Manager, otherwise it could be assumed that a spill incident has occurred.

Marine Spill Response Strategies

Because of the sensitive nature of the offshore waters surrounding the South Farallon Islands, the procedures of this Draft Plan will be implemented for any major or minor spill to marine waters. This includes conducting agency notifications (Appendix A), standing up the Incident Response Team (Appendix C), and executing the spill recovery procedures described herein based on the severity of the incident. All minor and major bait spills will be cleaned up to the extent possible as required by the Brodifacoum-25D label and documented. For all marine spills, notification will be made to the Incident Commander (Refuge Manager or designee), the GFNMS, and to the California State Water Resources Control Board. Response activities may necessitate the assistance of outside contractors or other responders. Only qualified and trained personnel will undertake cleanup operations. This includes contractors on the spill response vessel, which will also have a full spill kit on board to respond to a marine bait spill. If the spill involves a helicopter incident, safety of the pilot is paramount and additional requirements will need to be followed with the Federal Aviation Administration and other response agencies, as necessary.

Response Actions to a Minor or Major Spill Into the Marine Environment

1. Notify the Incident Commander immediately.
2. The Incident Commander will make the proper notifications as soon as the Incident Commander becomes aware of the release.
3. The Spill Response Contractor, [NAME TO BE INSERTED HERE WHEN KNOWN], aboard the spill response vessel will use the spill kit nets to scoop up floating bait as quickly as possible.
4. All material recovered will be placed inside garbage bags or other appropriate receptacle and secured with a label that identifies the contents as Brodifacoum 25D-Conservation, its toxicity, the Refuge's contact address, contact person and phone number, and the date that waste material was placed into the container. All material recovered will be quantified and then properly disposed of in accordance with local, state, and federal regulations.
5. Complete the documentation and reporting requirements (see below under Notification Procedures).

Marine Bait Spill Response Kit

1. 1 storage bin (to contain the spill kit supplies) that is labelled as to the listed contents
2. 1 laminated copy of the bait label for PPE and disposal references (include English and Spanish, if necessary)
3. 1 box barrier laminate gloves (to accommodate all hand sizes)
4. 4 pairs (2 large and 2 extra-large) of chemically resistant overalls with hoods such as Tyvek
5. 4 pairs protective boot covers
6. 1 box of particle size dust masks (quantity 100)
7. 4 pairs safety goggles
8. 4-inch-wide painter's masking tape
9. 1 box industrial strength garbage bags (at least 50-gallon capacity) and nylon zip ties
10. 1 box labels (at least 4 inches by 6 inches)
11. 2 permanent ink marking pens
12. 2 tarpaulins (20 feet by 20 feet)
13. 3 medium hand nets of X handle length and X mesh size
14. 1 garbage bin or 4 plastic buckets (5-gallon capacity)

The contents of the Marine Spill Kit(s) will be verified and documented as meeting the requirements whenever bait containers are in storage or the Project is underway. Each kit will be verified by ensuring that the lid is intact and that a visual marker (such as tape or a zip tie) has not been compromised, which would indicate that the container has been opened and the supplies need to be re-checked. If material in the spill kit has been used or the kit appears to have been opened, then the contents will be fully verified, replenished (if necessary), and the process documented. If personnel need to use material from the spill kit, for any purpose, they will report the reasons for this use to the Incident Commander, otherwise it could be assumed that a spill incident has occurred.

Notification Procedures

All spills regardless of size, including any incident that has the potential to result in a release ("near miss"), will be immediately reported to the Incident Commander (Refuge Manager) whose contact information is listed in Appendix A. Phone numbers for reporting a discharge to federal, state, and local authorities are also provided in Appendix A. The Incident Commander, as the primary Qualified Individual (QI), may make agency notifications directly, or may assign this task to other personnel. Only the designated QI(s) will make notifications to the applicable agencies.

The primary or designated QI is responsible for ensuring that a major spill of Brodifacoum-25D product to water is reported as soon as it is known to the National Response Center. Likewise, the primary or designated QI will report any minor or major spill into navigable waterways, as soon as it is known, to Cal OES. Other agencies, such as the GFNMS, SWRCB, and the California Department of Fish and Wildlife, will also receive a courtesy notification within 24 hours for either a minor and major marine bait spill or any terrestrial spill that threatens marine or other resources including people or pets.

The Incident Commander is the person responsible for disseminating information to, and coordinating with, the appropriate response agencies as well as with all available Project staff. Project personnel who are on site at the time of an incident will likely be the ones most able to collect pertinent information about the spill that the Incident Commander will need to comply with the notification requirements. The following is information that needs to be collected (if known) and provided to the Incident Commander as soon as possible:

1. Any personnel injuries and if emergency medical assistance is required
2. Date, time, and location of the release (GPS coordinates, if available)
3. The cause or contributing factors of the release
4. Whether the release is under control
5. Approximate amount of bait that was released
6. Any actions taken thus far
7. Equipment available and where located
8. Weather conditions at the time of the release and the weather forecast
9. Name, address, and phone number of the person making the notification
10. Whether there is a continuing danger to life at the scene

A telephone report (followed by a written report) is required to the National Response Center (NRC) if one or more of the following occurs during the course of transportation in commerce (including loading, unloading, and temporary storage) as a direct result of use of the bait material:

1. A person is killed
2. A person receives an injury requiring admittance to a hospital
3. The public is evacuated for one hour or more
4. A major transportation artery or facility is closed or shut down for one hour or more
5. The operational flight pattern or routine of an aircraft is altered
6. If a situation exists of such a nature (e.g., a continuing danger to life exists at the scene of the incident) that, in the judgment of the person in possession of the hazardous material, it should be reported to the NRC even though it may not meet certain the reporting criteria

Terrestrial and marine bait spill response kits will be available at each operational location including on Southeast Farallon Island. A bait spill response kit will be provided to the bait transporting company if they do not already have an appropriate one.

Communication

Personnel involved in any spill response operation will use readily available two-way communication equipment (cell phones, two-way radios) to coordinate their activities. The Don Edwards San Francisco Bay National Wildlife Refuge (1 Marshlands Rd, Fremont, CA 94555) will serve as the Incident Command Center during an incident. All equipment needed for the Command Center will be identified as available for use in the event of a major bait spill. This may include a variety of fixed and mobile communication equipment (telephones, faxes, cell phones, computers with internet access, printers) to ensure continuous communication with responders, authorities, and other interested parties.

Island communications equipment includes:

- Portable hand-held radios. This includes two-way radios for communication among island staff and marine radios for communication with response vessels, aircraft, and the U.S. Coast Guard.
- Cell phones. The Project's Operations Manager and at least some of the field personnel will have an operational cell phone. However, due to the remote location of the islands, most cell phones only work inside buildings with Wi-Fi telecommunications. Depending on cell service quality, the Final Plan will detail how key personnel, including the Operations Manager and on-scene coordinator, can be reached 7 days a week, 24 hours a day during response activities.
- Other telecommunications. Southeast Farallon Island is equipped with a radio antenna-based telecommunications system that provides phone, high-speed internet, and marine radio service, along with a satellite phone for use when other telecommunications are not functional.
- Additional equipment. Additional equipment will be obtained if more equipment is necessary, such as computers and printers for accessing appropriate online ICS forms and other incident response activities.

The ICS Team will maintain close communication with the Incident Commander and will communicate the status of the response operations. The Incident Commander will share relevant information with involved parties, including local, state, and federal authorities. Any information released to the media will first be authorized by the Incident Commander or the designated Public Affairs Officer.

Disposal of Spilled Material

Disposal of all contaminated material will be conducted in accordance with all local, state, and federal requirements.

Termination

The Incident Commander, through consultation with agency response personnel, will ensure that cleanup has been completed to the greatest extent practicable and that the contaminated area has been mitigated according to applicable regulations and approval from regulatory agencies.

Post-Accident Analysis and Reporting Requirements

Any spill, or any incident that had the potential to cause a spill (e.g., near miss), will be analyzed to assess further training needs and/or the need for updated procedures to this Draft Plan. The following steps will be taken as part of this analysis:

1. Review circumstances that led to the spill or near spill and take all necessary precautions to prevent a recurrence.
2. Evaluate the effectiveness of the response activities and adjust response procedures and personnel training, as necessary.
3. Carry out personnel and contractor debriefings, as necessary, to emphasize prevention measures or to communicate changes in operations or response procedures.
4. Submit any required follow-up reports to appropriate regulatory agencies.

References

U.S. Fish and Wildlife Service. 2019. Farallon Islands National Wildlife Refuge: South Farallon Islands Invasive House Mouse Eradication Project: Final Environmental Impact Statement. U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Fremont, California.

APPENDIX A – AGENCY NOTIFICATIONS

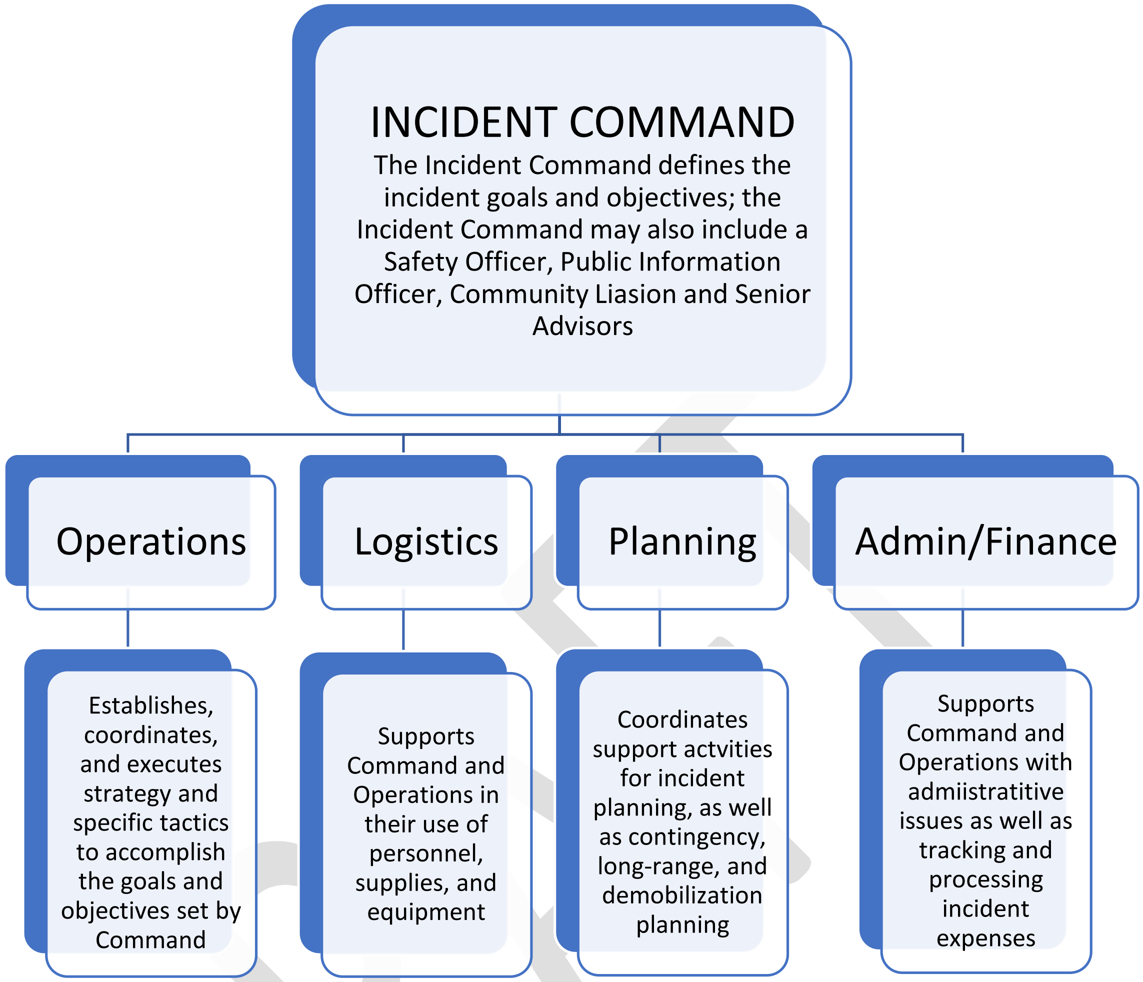
Time and Date When Completed	Notifications (as necessary, per *Draft Bait Spill Contingency Plan*)
	911, if needed
	Incident Commander – Farallon Islands National Wildlife Refuge Manager **(510) 792-0222 extension 222 (office)** **(510) 435-9151 (cell – 24/7)**
	California Office of Emergency Services (CAL OES) **(800) 852-7550**
	National Response Center (in case of a significant/reportable quantity spill) **(800) 424-8802**
	[INSERT NAME], Contracted Spill Response and Cleanup Company (XXX) XXX-XXXX
	U.S. Coast Guard District 11 (415) 556-2103
	County Unified Program Agency (CUPA) / San Francisco Department of Public Health (415) 252-3900
	California Department of Fish and Wildlife (DFW), Office of Spill Prevention and Response (800) 852-7550
	San Francisco Bay Regional Water Quality Control Board (510) 622-2300
	U.S. Fish and Wildlife Service Regional Compliance Coordinator (XXX) XXX-XXXX Farallon Islands Refuge Spill Prevention Coordinator, if applicable (XXX) XXX-XXXX
	Greater Farallones National Marine Sanctuary (415) 561-6622
	U.S. EPA Region 9 (415) 947-8713
	U.S. Department of Agriculture, APHIS, Wildlife Services (XXX) XXX-XXXX
	Local Hospital (XXX-XXX-XXXX) or Poison Control (800-222-1222), if necessary

APPENDIX B – SUMMARY OF PLAN REVISIONS

Description of Changes After Each Plan Review

Section	Page	Description	Person Making Change

APPENDIX C – INCIDENT COMMAND SYSTEM


INCIDENT COMMAND
The Incident Command defines the incident goals and objectives; the Incident Command may also include a Safety Officer, Public Information Officer, Community Liasion and Senior Advisors
Operations
Logistics
Planning
Admin/Finance
Establishes, coordinates, and executes strategy and specific tactics to accomplish the goals and objectives set by Command
Supports Command and Operations in their use of personnel, supplies, and equipment
Coordinates support actvities for incident planning, as well as contingency, long-range, and demobilization planning
Supports Command and Operations with admiistratitive issues as well as tracking and processing incident expenses

APPENDIX D – EPA-APPROVED BRODIFACOUM 25-D CONSERVATION BAIT LABEL

RESTRICTED USE PESTICIDE

DUE TO HAZARDS TO NON-TARGET SPECIES

For retail sale only to employees of federal agencies responsible for wildlife management to be used only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator's certification.

BRODIFACOUM-25D CONSERVATION

A pelleted rodenticide for control or eradication of invasive rodents in dry climates on islands or vessels for conservation purposes.

ACTIVE INGREDIENT:
Brodifacoum (CAS No. 56073-10-0): 0.0025%
OTHER INGREDIENTS:...99.9975%

TOTAL:...100.0000%

ACCEPTED
11/12/2019
Under the Federal Insecticide, Fungicide and Rodenticide Act as amended, for the pesticide registered under EPA Reg. No. 56228-37

KEEP OUT OF REACH OF CHILDREN

CAUTION

FIRST AID

IF SWALLOWED:
- Call a physician or poison control center immediately for treatment advice.
- Have person sip a glass of water if able to swallow.
- Do not induce vomiting unless told to by a poison control center or doctor.
- Do not give anything by mouth to an unconscious person.

IF ON SKIN OR CLOTHING:
- Take off contaminated clothing.
- Rinse skin immediately with plenty of soap and water for 15-20 minutes.
- Call a poison control center or doctor immediately for further treatment advice.

IF INHALED:
- Move person to fresh air.
- If person is not breathing, call 911 or an ambulance; then give artificial respiration, preferably mouth-to-mouth, if possible.
- Call a poison control center or doctor immediately for further treatment advice.

IF IN EYES:
- Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye.
- Call a poison control center or doctor immediately for treatment advice.

Have the product container or label with you when calling a poison control center or doctor or going for treatment. If you need immediate medical attention, call the Poison Control Center at 1-800-222-1222, a doctor, or 877-854-2494. For non-emergency information concerning this product, call the National Pesticide Information Center at 1-800-858-7378.

NOTE TO PHYSICIAN: If swallowed, this material may reduce the clotting ability of the blood and cause bleeding. If ingested, administer Vitamin K_1, intramuscularly or orally, as indicated in bishydroxycoumarin overdose. Repeat as necessary based on monitoring of prothrombin times.

TREATMENT FOR PET POISONING: If pet eats the bait, call a veterinarian at once.
NOTE TO VETERINARIAN: For animals ingesting bait and/or showing poisoning signs (bleeding or elevated prothrombin times), administer Vitamin K_1.

Manufactured for:
United States Department of Agriculture
Animal and Plant Health Inspection Service
4700 River Road, Unit 149
Riverdale, MD 20737
EPA Est. 12455-WI-1

Net Contents: ___________________

Batch Code: ___________________

PRECAUTIONARY STATEMENTS

CAUTION

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

Harmful if swallowed. Causes moderate eye irritation. Avoid contact with eyes, skin, or clothing. Keep away from humans, domestic animals, and pets.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Applicators and other handlers must wear:
- Long-sleeved shirt and long pants
- Barrier laminate gloves
- Shoes plus socks

For aerial application, in addition to the above PPE, loaders must wear:
- Protective eyewear or face shield
- A minimum of a NIOSH-approved particulate filtering facepiece respirator with any N, R, or P filter; OR a NIOSH-approved elastomeric particulate respirator with any N, R, or P filter; OR a NIOSH-approved powered air purifying respirator with HE filters.

Any person who retrieves carcasses or unused bait following application of this product must wear:
- Barrier laminate gloves

USER SAFETY REQUIREMENTS

Follow the manufacturer's instructions for cleaning/maintaining PPE. If no such instructions are provided for washables, use detergent and hot water. Keep and wash PPE separately from other laundry. Remove PPE immediately after handling this product. Wash the outside of barrier laminate gloves before removing. As soon as possible, wash hands thoroughly after applying the bait and before eating, drinking, chewing gum, using tobacco, or using the toilet, and change into clean clothing.

ENVIRONMENTAL HAZARDS

This product is extremely toxic to birds, mammals, and aquatic organisms. Predatory and scavenging mammals and birds might be poisoned if they feed upon animals that have eaten bait. Runoff may be hazardous to aquatic organisms in water adjacent to treated areas. **DO NOT** contaminate water when disposing of equipment wash water or rinsate.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

READ THIS LABEL: Read the entire label. This product must be used strictly in accordance with this label's precautionary statements and use directions, as well as with all applicable State and Federal laws and regulations.

USE RESTRICTIONS

- **IMPORTANT: DO NOT** expose children, pets, or other non-target animals to rodenticides. Take all appropriate steps to limit exposure to and impacts on nontarget species, especially those for which special conservation efforts are planned or ongoing. To help prevent accidental exposures:
  - Keep children out of areas where this product is used or deny them access to bait by use of tamper resistant bait stations.
  - Store this product in a location out of reach of children, pets, livestock, and nontarget wildlife.
  - Apply bait only as specified on this label and in strict accordance with the **USE RESTRICTIONS** and **APPLICATION DIRECTIONS**.
  - Dispose of the product container and any unused, spoiled, or unconsumed bait as specified under **STORAGE AND DISPOSAL**.
- This product may be used only to control or eradicate Norway rats (*Rattus norvegicus*), roof rats (*Rattus rattus*), Polynesian rats (*Rattus exulans*), house mice (*Mus musculus*), or other types of invasive rodents on islands for conservation purposes, or on grounded vessels or vessels in peril of grounding.
- This product is to be used for the protection of State or Federally-listed Threatened or Endangered Species or other species determined to require special protection.
- **DO NOT** apply this product to food or feed.
- **DO NOT** reuse implements used for applying bait for food or feed use.
- Treated areas with public access must be posted with warning signs appropriate to the current rodent control or eradication operation.
- Broadcast applications are prohibited on vessels or in areas of human habitation.
- The pilot in command has final authority for determining safe flying conditions. Do not make aerial broadcast applications in sustained winds exceeding 35 mph (30 knots).

APPLICATION DIRECTIONS

HAND BAITING APPLICATIONS:
Applicators may use the hand baiting methods at use sites for rats and mice as specified in Table 1.

Table 1.

Method	Use sites	Application rate	Additional baiting instructions
Tamper-resistant bait stations	• All use sites allowed on this label. • For canopy baiting: Follow the instructions below, as applicable, for **Bait bolas (sachets)** used for canopy baiting.	Rats: • 4.0-16.0 ounces (113.4-453.6 grams) per station or tray. • Space stations or trays at intervals of approximately 16-82 feet (5-25 meters) in a grid over the area. • Check and replenish stations or trays at least once every 7 days. Mice: • 0.25-1.0 ounces (7.1-28.4 grams) per station or tray. • Space stations or trays at intervals of approximately 10-65 feet (3-20 meters) in a grid over the area. • Up to 3.0 ounces (85.1 grams) per station or tray may be needed at locations with high mouse activity. • Check and replenish stations or trays at least once every 7 days.	• Where a continuous source of infestation is present, permanent bait stations may be established and bait replenished as needed.
Burrow baiting	• Uninhabited non-crop areas	Rats: • 3.0-4.0 ounces (85.1-113.4 grams) per active burrow entrance. • Flag treated burrows and inspect them frequently, daily if possible. • Reapply bait if the bait has been removed. Mice: • 0.25 ounces (7.1 grams) per active burrow entrance. • Flag treated burrows and inspect them frequently, daily if possible. • Reapply if the bait has been removed.	• Place bait within burrows in piles or within small bags made of rodent accessible material. • Holes should be made in plastic bags to allow the bait odor to escape. Plastic bags may be left unperforated if applied in areas where occasional immersion in water may occur. • Place bait far enough into burrow so that it can barely be seen. Do not plug burrows.
Bait bolas (sachets)	• Uninhabited grounded vessels or vessels in peril of grounding that are difficult or unsafe for applicators to enter. • Canopy of trees and shrubs in non-crop areas where sufficient food and cover are available to harbor populations of rodents in canopies of trees and shrubs.	Rats: • 4.0-16.0 ounces (113.4-453.6 grams) per small bag made of rodent accessible material. • Space bolas at intervals of approximately 16-82 feet (5-25 meters) in a grid over the area. • Check at least every 7-14 days and reapply if the bait has been removed. Mice: • 0.25-1.0 ounces (7.1-28.4 grams) per small bag made of rodent accessible material. • Space bolas at intervals of approximately 10-65 feet (3-20 meters) in a grid over the area. • Up to 3.0 ounces (85.1 grams) per bag may be needed at locations with high mouse activity. • Check at least every 7-14 days and reapply if the bait has been removed. Canopy baiting: • 4.0-16.0 ounces (113.4-453.6 grams) per small bag made of rodent accessible material. • Place bolas in the canopy at intervals of ≤160 feet (≤49 meters). • If possible, check at least every 7-14 days and reapply if the bait has been removed.	• Bait bolas should be knotted or otherwise sealed to avoid spillage. • Holes should be made in plastic bags to allow the bait odor to escape. Plastic bags may be left unperforated if applied in areas where occasional immersion in water may occur. • Throw or drop bolas into areas that are unsafe for applicators to enter. • Place bolas in the canopy of trees or shrubs by hand or use long poles (or other devices). Bolas may be fitted with line or string to ensure canopy entanglement.

DIRECTIONS FOR USE, continued

APPLICATION DIRECTIONS, continued

BROADCAST APPLICATIONS:

Broadcast applications are prohibited on vessels or in areas of human habitation. Set the application rate according to the extent of the infestation and apparent population density. For eradication operations, treat entire land masses.

Broadcast bait using aircraft, ground-based mechanical equipment, or by gloved hand at a rate no greater than 16 lbs of bait per acre (18 kg bait/hectare) per application. Make a second broadcast application, typically 5 to 7 days after the first application, depending on local weather conditions, at a rate no higher than 8 lbs of bait per acre (9 kg bait/hectare). In situations where weather or logistics only allow one bait application, a single application may be made at a rate no higher than 16 lbs bait per acre (18 kg bait/hectare).

Assess baited areas for signs of residual rodent activity after the last broadcast application (typically 7 to 10 days post-treatment).

If rodent activity persists, conduct hand baiting applications as specified in Table 1 in areas where rodents remain active. If the terrain does not permit use of hand baiting methods, continue with broadcast baiting, limiting such treatments to areas where active signs of rodents are seen. Maintain treatments for as long as rodent activity is evident in the area and rodents appear to be accepting bait.

POSTTREATMENT CLEAN-UP

For all methods of baiting, monitor the baited area periodically for carcasses during and after the operation, if possible. Using gloves, collect and dispose of any carcasses in accordance with federal, state, and local regulations. Carcasses do not need to be collected in areas where non-target animals have naturally high mortality rates and collecting and disposing of carcasses is impractical (e.g., some bird breeding areas).

Using gloves, collect and dispose of bait stations and trays at the end of control or eradication operations as specified under **STORAGE AND DISPOSAL**. Bait stations and bolas applied in grounded vessels, vessels in peril of grounding, canopies, abandoned structures or infrastructure, or landscape features that are unsafe for applicators to access, do not have to be retrieved.

STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

PESTICIDE STORAGE: Store only in original closed container in a cool, dry place inaccessible to unauthorized people, children, and pets. Store separately from fertilizer and away from products with strong odors that may contaminate the bait and reduce acceptability. Spillage should be carefully swept up and collected for disposal.

PESTICIDE DISPOSAL: Wastes resulting from the use of this product may be disposed of at an approved waste disposal facility.

CONTAINER HANDLING: ***Nonrefillable container.*** Do not reuse or refill this container.

Plastic Containers: Triple rinse (or equivalent) promptly after use. Offer for recycling, if available. Otherwise, puncture and dispose of empty container in a sanitary landfill or by incineration if allowed by state and local authorities.

Paper Containers: Dispose of empty container at an approved waste disposal facility or by incineration if allowed by state and local authorities.

NOTICE: Buyer assumes all risks of use, storage, or handling of the material not in strict accordance with directions given herewith. The efficacy of the product may be reduced under high moisture conditions.

APPENDIX E – BRODIFACOUM 25-D CONSERVATION SAFETY DATA SHEET

BRODIFACOUM 25D CONSERVATION PELLETS

SAFETY DATA SHEET	ACCORDING TO REGULATION: OSHA Hazard Communication Standard 29 CFR 1910.1200	DATE OF ISSUE: October 2015	PREPARED BY: CAR

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier: BRODIFAOUM 25D CONSERVATION PELLETS
EPA Registration Number: 56228-37
Relevant identified uses of the substance or mixture and uses advised against
Relevant identified uses: Anticoagulant Rodenticide - Ready to use
Uses advised against: Use only for the purpose described above

MANUFACTURER/SUPPLIER:
Bell Laboratories, Inc.
3699 Kinsman Blvd.
Madison, WI 53704, USA
Email: sds@belllabs.com
Phone: 608-241-0202
Medical or Vet Emergency: 877-854-2494 or 952-852-4636
Spill or Transportation Emergency: 800-424-9300 (CHEMTREC)

2. HAZARD IDENTIFICATION

Classification according to Regulation OSHA 1910.1200(d): Not classified

See Section 15 for information on FIFRA applicable safety, health, and environmental classifications.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS No.	% By weight
Brodifacoum [3-[3-(4'-Bromo-[1,1'-biphenyl]-4-yl)-1,2,3,4-tetrahydro-1-naphthalenyl]-4-hydroxy-2H-1-benzopyran-2-one]	56073-10-0	0.0025%
Inert and Non-Hazardous Ingredients	Proprietary	99.9975%

4. FIRST AID MEASURES

Description of first aid measures
Ingestion: Call physician or emergency number immediately. Have person sip a glass of water if able to swallow. Do not induce vomiting unless instructed by physician.
Inhalation: Not applicable.
Eye contact: Hold eye open and rinse slowly with water for 15 – 20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. If irritation develops, obtain medical assistance.
Skin contact: Take off contaminated clothing. Rinse skin immediately with plenty of water for 15-20 minutes. If irritation develops, obtain medical assistance.
Most important symptoms and effects, both acute and delayed
Ingestion of excessive quantities may cause nausea, vomiting, loss of appetite, extreme thirst, lethargy, diarrhea, bleeding.
Advice to physician: If ingested, administer Vitamin K_1 intramuscularly or orally as indicated for bishydroxycoumarin overdoses. Repeat as necessary as based upon monitoring of prothrombin times.
Advice to Veterinarian: For animals ingesting bait and/or showing poisoning signs (bleeding or elevated prothrombin times), give Vitamin K_1. If needed, check prothrombin times every 3 days until values return to normal (up to 30 days). In severe cases, blood transfusions may be needed.

5. FIRE-FIGHTING MEASURES

Extinguishing media
Suitable Extinguishing Media: water, foam or inert gas.
Unsuitable Extinguishing Media: None known.
Special hazards arising from the mixture: High temperature decomposition or burning in air can result in the formation of toxic gases, which may include carbon monoxide and traces of bromine and hydrogen bromide.
Advice for firefighters: Wear protective clothing and self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures: Gloves should be worn when handling the bait. Collect spillage without creating dust.
Environmental precautions: Do not allow bait to enter drains or water courses. Where there is contamination of streams, rivers or lakes contact the appropriate environment agency.
Methods and materials for containment and cleaning up
For Containment: Sweep up spilled material immediately. Place in properly labeled container for disposal or re-use.
For Cleaning Up: Wash contaminated surfaces with detergent. Dispose of all wastes in accordance with all local, regional and national regulations.
Reference to other sections: Refer to Sections 7, 8 & 13 for further details of personal precautions, personal protective equipment and disposal considerations.

7. HANDLING AND STORAGE

Precautions for safe handling: Do not handle the product near food, animal foodstuffs or drinking water. As soon as possible, wash hands thoroughly after applying bait and before eating, drinking, chewing gum, using tobacco, or using the toilet.
Conditions for safe storage, including any incompatibilities: Store only in original container in a cool, dry place, inaccessible to pets and wildlife. Do not contaminate water, food or feed by storage or disposal. Keep containers closed and away from other chemicals.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Established Limits

Component	OSHA	ACGIH	Other Limits
Brodifacoum	Not Established	Not Established	Not Established

Appropriate Engineering Controls: Not required
Occupational exposure limits: Not established
Personal Protective Equipment:
Respiratory protection: Not required
Eye protection: Not required
Skin protection: Shoes plus socks, and waterproof gloves.
Hygiene recommendations: Wash thoroughly with soap and water after handling.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance/Color:	Blue-green granular pellet
Odor:	Sweet grain-like
Odor Threshold:	Not applicable, odor not associated with a hazardous material.
pH:	Not applicable, Brodifacoum 25D Conservation Pellets are not dispersible with water.
Melting point:	Not applicable to rodenticide bait
Boiling point:	Not applicable to rodenticide bait
Flash point:	Not applicable, Brodifacoum 25D Conservation Pellets do not contain components classified as flammable.
Evaporation rate:	Not applicable, Brodifacoum 25D Conservation Pellets are solid.
Upper/lower flammability or explosive limits:	Not applicable, Brodifacoum 25D Conservation Pellets do not contain components classified as flammable or explosive.
Vapor Pressure:	Not applicable to rodenticide bait
Vapor Density:	NA: Brodifacoum 25D Conservation Pellets are solid
Relative Density:	1.33 g/mL @ 20°C
Solubility (water):	Not water soluble
Solubility (solvents):	Not applicable to rodenticide bait
Partition coefficient: n-octanol/water:	Not applicable to rodenticide bait
Auto-ignition temperature:	Not applicable, Brodifacoum 25D Conservation Pellets do not contain components classified as flammable.
Decomposition temperature:	Not applicable to rodenticide bait
Viscosity:	Not applicable, Brodifacoum 25D Conservation Pellets are not a liquid.

10. STABILITY AND REACTIVITY

Reactivity: Stable when stored in original container in a cool, dry location.
Chemical stability: Stable when stored in original container in a cool, dry location.
Possibility of hazardous reactions: Refer to Hazardous decomposition products
Conditions to avoid: Avoid extreme temperatures (below 0°C or above 40°C).
Incompatible materials: Avoid strongly alkaline materials.
Hazardous decomposition products: High temperature decomposition or burning in air can result in the formation of toxic gases, which may include carbon monoxide and traces of bromine and hydrogen bromide.

11. TOXICOLOGICAL INFORMATION

Information on toxicological effects
Acute Toxicity
LD50, oral (ingestion): >5001 mg/kg (rats) (Brodifacoum rat LD50 oral: 0.490 mg/kg bw).
LD50, dermal (skin contact): > 5001 mg/kg (rats) (Brodifacoum rabbit LD50 dermal: 4.185 mg/kg bw).
LC50, inhalation: Brodifacoum 25D Conservation Pellets are a granular pellet and therefore exposure by inhalation is not relevant.
Skin corrosion/irritation: Not irritating to skin.
Serious eye damage/Irritation: Not irritating to eyes.
Respiratory or skin sensitization: Dermal sensitization: Not a Sensitizer (Guinea pig maximization test).
Germ cell mutagenicity: Brodifacoum 25D Conservation Pellets contain no components known to have a mutagenetic effect.
Carcinogenicity: Brodifacoum 25D Conservation Pellets contain no components known to have a carcinogenetic effect.

Components	NTP	IARC	OSHA
Brodifacoum	Not listed	Not listed	Not listed

Reproductive Toxicity: Brodifacoum 25D Conservation Pellets: No data
Aspiration Hazard: Not applicable. Brodifacoum 25D Conservation Pellets are a granular pellet.
Target Organ Effects: Reduced blood clotting ability.

12. ECOLOGICAL INFORMATION

Ecotoxicity Effects: This product is extremely toxic to fish, birds and other wildlife. Dogs and predatory and scavenging mammals and birds might be poisoned if they feed upon animals that have eaten this bait. Do not apply this product directly to water or to areas where surface water is present or to intertidal areas below the mean high water mark. Runoff also may be hazardous to aquatic organisms in water adjacent to treated areas. Do not contaminate water when disposing of equipment wash water or rinsate.
Persistence and degradability: Brodifacoum 25D Conservation Pellets are inherently biodegradable.
Bioaccumulative potential: Not determined for Brodifacoum 25D Conservation Pellets. Brodifacoum water solubility is extremely low (< 0.1mg/l).
Mobility in Soil: Not determined for Brodifacoum 25D Conservation Pellets. Mobility of brodifacoum in soil is considered to be limited.
Other adverse effects: None.

13. DISPOSAL CONSIDERATIONS

Do not contaminate water, food or feed by storage or disposal.
Pesticide Storage: Store only in original container in a cool, dry place inaccessible to children and pets. Keep containers closed and away from other chemicals.
Pesticide Disposal: Wastes resulting from the use of this product may be placed in trash or delivered to an approved waste disposal facility.
Container Handling: Non-refillable container. Do not reuse or refill this container. [Plastic:] Offer for recycling or reconditioning; or puncture and dispose of in a sanitary landfill; or by incineration. In most states, burning is not allowed. [Paper:] Dispose of empty container by placing in trash, at an approved waste disposal facility or by incineration. In most states, burning is not allowed.

14. TRANSPORT INFORMATION

UN number: Not regulated
UN proper shipping name: Not regulated
Transport hazard class(es): Not regulated
Packing group : Not regulated
Environmental Hazards
DOT Road/Rail: Not considered hazardous for transportation via road/rail.
DOT Maritime: Not considered hazardous for transportation by vessel.
DOT Air: Not considered hazardous for transportation by air.
Freight Classification: LTL Class 60
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code: Not applicable
Special precautions for user: None

15. REGULATORY INFORMATION

Safety, health and environmental regulations/legislation specific for the substance or mixture:
FIFRA: This pesticide product is not regulated by the United States Environmental Protection Agency. The pesticide label includes other important information, including directions for use.
Signal Word: WARNING, RESTRICTED
Precautionary Statements: Contains the anticoagulant Brodifacoum which may cause bleeding if ingested. Harmful if swallowed or absorbed through the skin. Keep away from children, domestic animals and pets. Do not get in eyes, on skin or on clothing.
Potential Health Effects:
Eye Contact: May cause irritation
Skin Contact: Non-irritating to the skin
Ingestion: Harmful if swallowed

TSCA: All components are listed on the TSCA Inventory or are not subject to TSCA requirements
CERCLA/SARA 313: Not listed
CERCLA/SARA 302: Not listed

16. OTHER INFORMATION

For additional information, please contact the manufacturer noted in Section 1.

NFPA	Health: 1 (caution)	Flammability: 0 (will not burn)	Reactivity: 0 (stable)	Specific Hazard: None
HMIS	Health: 2 (moderate)	Flammability: 0 (minimal)	Reactivity: 0 (minimal)	Protective Equipment: B

Disclaimer: The information provided in this Safety Data Sheet has been obtained from sources believed to be reliable. Bell Laboratories, Inc. provides no warranties; either expressed or implied, and assumes no responsibility for the accuracy or completeness of the data contained herein. This information is offered for your consideration and investigation. The user is responsible to ensure that they have all current data, including the approved product label, relevant to their particular use.

APPENDIX F – DOCUMENTATION OF TRAINING

Date of Training	Name of Trainee	Signature

APPENDIX 6

INVASIVE HOUSE MOUSE ERADICATION PROJECT

DRAFT Non-target Species Contingency Plan

FARALLON ISLANDS NATIONAL WILDLIFE REFUGE

Photo (left) Courtesy of Island Conservation; photo (right) USFWS digital library

Prepared by:
SeaJay Environmental LLC, Oakland, California

for the
U.S. Fish and Wildlife Service, Farallon Islands National Wildlife Refuge

March 2021

Contents

1. INTRODUCTION

This *Draft Non-target Species Contingency Plan* (Draft Plan) is one of four plans associated with the project to eradicate invasive, introduced house mouse (*Mus musculus*) from the South Farallon Islands, part of the Farallon Islands National Wildlife Refuge (Refuge), California. The U.S. Fish and Wildlife Service (USFWS or Service) is the lead agency and federal sponsor for this project. This Draft Plan outlines the steps that will be taken to respond to unforeseen events or circumstances that have a high likelihood of resulting in significant negative impacts to non-target species from either exposure to rodenticide or disturbances resulting from the Project's activities.

The use of rodenticide baits for the eradication of invasive rodents is an established conservation tool with documented benefits to native island ecosystems. However, there are inherent risks to the use of toxicants at island scale to non-target species, as disclosed in the *South Farallon Islands Invasive House Mouse Eradication Project: Final Environmental Impact Statement* (FEIS; USFWS 2019). While mortalities will occur to some non-target species, the FEIS concluded that there would be no long-term, significant adverse impacts on the environment from the use of the bait product, Brodifacoum-25D Conservation (Brodifacoum-25D).

This Draft Plan is complimentary to and consistent with other implementation plans being developed for the project including the *Draft Operational Plan*, the *Draft Mitigation and Monitoring Plan*, and the *Draft Bait Spill Contingency Plan*. This is a working document intended to be further refined prior to project implementation based on: 1) the Record of Decision that is expected to be issued on the FEIS that had selected Alternative B (aerial broadcast of Brodifacoum-25D) as its preferred alternative; 2) input from experienced contractors, cooperators and other experts enlisted to assist the Service with project implementation; 3) input from the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (USDA-APHIS) and the U.S. Environmental Protection Agency (EPA), including incorporation of an expected supplemental rodenticide label; and 4) input from other applicable regulatory agencies and experts.

This and the other draft plans provide an outline for the more formal plans that will be updated and finalized if the Service proceeds with the Project. Contractors and cooperators with applicable expertise, along with applicable permitting agencies, will be engaged to assist the Service with refining and carrying out these plans, including development of detailed protocols. It is possible that some portions of this Draft Plan will require substantial revisions after receiving additional input and review. In addition, some parts of the plan may be placed in separate, stand-alone documents. Red text in this current Draft Plan is used to indicate placeholders for information that will be addressed in the Final Plan.

2. PURPOSE AND SCOPE

The purpose of this Draft Plan is to describe contingency actions that would be implemented if the proposed measures described in the *Draft Mitigation and Monitoring Plan* to avoid, minimize, and mitigate impacts to terrestrial and marine species are not effective to the expected extent based on the available data. The Service has developed this draft plan to address unexpected worst-case scenarios, which have a low likelihood of occurring during the eradication project based on the available data. These events are described here so that response processes are agreed upon by all applicable parties before the operations begin. This document will provide guidance for rapid and coordinated responses to these potential, and unanticipated, scenarios. The accidental bait spill scenario is described in detail in the *Draft Bait Spill Contingency Plan* and is not described further here.

This document addresses risks associated with an *extreme, unforeseen event*, such as unexpectedly high impacts from exposure to rodenticide to certain at-risk species or greater than expected (or permitted) levels of pinniped disturbance. The purposes of this Draft Plan are to:

1. Outline the triggers that will be used to identify potential extreme and unforeseen events.
2. Identify response procedures that could be used to avoid, minimize, or mitigate further risks to non-target fish and wildlife.
3. Identify chain of command, notification processes, and key personnel who will respond to incidents involving an extreme and unforeseen event.

The activities described in this plan are complementary to, and are a subcomponent of, the *Draft Mitigation and Monitoring Plan*, which remains the primary document that will be used to avoid, minimize, or mitigate potential risks to wildlife during the project.

Five scenarios are the focus of this Draft Plan:

- Potential failures or deficiencies of the gull hazing program, which is intended to reduce toxicant risks to western gulls (*Larus occidentalis*) to a less than significant level;
- Discovery of greater than expected impacts to Farallon arboreal salamanders (*Aneides lugubris farallonensis)*;
- Possible exceedance of permitted marine mammal takes as a result of bait application or gull hazing activities;
- Discovery of exposure to rodenticide to commercial or recreational fishery species; and
- Discovery during Project implementation of the unanticipated presence of a species listed under the Endangered Species Act that is not otherwise covered by Section 7 consultation.

3. PROJECT CONTEXT

The South Farallon Islands' isolated nature, varied and extensive habitats, and adjacent productive marine environment make them an ideal breeding and resting location for wildlife, especially seabirds and pinnipeds. This Refuge comprises the largest breeding seabird colony in the lower 48 states and supports the world's largest breeding populations of the ashy storm-petrel (*Oceanodroma homochroa*), Brandt's cormorant (*Phalacrocorax penicillatus*), and western gull. In addition, the islands are an important haul-out and breeding site for five species of pinnipeds: California sea lion (*Zalophus californianus*), northern elephant seal (*Mirounga angustirostris*), harbor seal (*Phoca vitulina*), northern fur seal (*Callorhinus ursinus*), and Steller sea lion (*Eumetopias jubatus*). The islands support endemic species including the Farallon camel cricket (*Farallonophilus cavernicolus*) and Farallon arboreal salamander.

The waters surrounding the islands are within the Greater Farallones National Marine Sanctuary. These waters are used by commercial and recreational fishing operators. While fishing is prohibited or limited within the state marine reserve and state marine conservation area immediately surrounding the islands, fishing is allowed outside of these areas based on current California fishing regulations. The most important fisheries that occur near the South Farallon Islands are Dungeness crab (*Metacarcinus magister*), groundfish such as several species of rockfish (*Sebastes* spp.) and lingcod (*Ophiodon elongatus*), and salmon (mainly chinook salmon, *Oncorhynchus tshawytscha*). Further details about the ecosystem and natural resources on the islands are described in the FEIS (USFWS 2019).

4. DESCRIPTION OF BRODIFACOUM-25D CONSERVATION

The eradication project involves the application of Brodifacoum-25D rodent bait, a second-generation anticoagulant rodenticide that is registered with EPA (Regulatory Number 56228-37) specifically for conservation purposes. A single bait pellet of Brodifacoum-25D consists of compressed cereal grain that weighs approximately 0.35 ounces (oz; 1 gram [g]). Each pellet contains 25 parts per million (ppm) or 0.0025% weight concentration of brodifacoum. Pellets are dyed green to make them less attractive to birds and reptiles. It is estimated that about 2,917 pounds (lb; 1,323 kilograms [kg]) of bait pellets containing a total of 1.16 oz (33 g) of brodifacoum will be applied on the South Farallon Islands during the Project, across all applications.

The low water solubility, relative immobility in soil, and strong chemical affinity of brodifacoum to the grain matrix of the bait pellet is an effective inhibitor preventing the rodenticide from contaminating aquatic environments. In other words, brodifacoum itself binds to the grain in the pellet rather than being washed out by rain or seawater. In seawater, the pellet breaks down within a matter of hours, at which point the bioavailability, or the ability of an animal to absorb the rodenticide, is low. As described in the FEIS, the potential for water contamination from bait application and any subsequent consumption and absorption by marine biota is expected to be negligible, and thus not a significant risk factor. The Service's application of Brodifacoum-25D will comply with all requirements of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), 7 U.S.C. Section 136 *et. seq*., and the EPA-approved bait label for this product.

5. SUMMARY OF EFFECTS ON NON-TARGET SPECIES

The FEIS analyzed all reasonably foreseeable, adverse impacts of the Project, including those to non-target species. The FEIS concluded in each case that impacts would be less than significant. Early in the planning process, the Service identified western gulls as the greatest non-target resource concern because of their potential exposure to rodenticide and mortality. A hazing trial conducted in 2012 demonstrated the ability to keep all but a few western gulls off the South Farallon Islands and to prevent gulls from landing in areas where non-toxic rodent bait pellets were distributed. That hazing trial informed the development of a comprehensive gull hazing plan that has been adopted as an operational element of the Project. Implementation of the hazing plan will reduce impacts to this species to less than significant levels

The Project will also incorporate measures to prevent significant adverse impacts to other non-target species. Even though the endemic Farallon arboreal salamander faces a low risk of rodenticide impacts, approximately 40 individuals will be captured and held in a safe facility until the risk of toxicant exposure is negligible.

Mitigation measures incorporated into the Project will limit bait drift into the marine environment and reduce impacts to the marine environment and fishery species to negligible levels. Moreover, rapid bait breakdown in the high surge environment surrounding the islands will further limit availability of rodenticide bait to and exposure of potential non-target marine species.

Despite operational measures employed to minimize impacts to non-target species, it must be recognized that certain measures may not provide the mitigation expected. Thus, the implementation of precautionary measures through an adaptive management process, and response procedures, as described in this and the other project plans, will help ensure minimal impacts to non-target species of fish and wildlife in and near the South Farallon Islands, a critical component for a successful operation.

6. PERSONNEL TRAINING FOR NON-TARGET CONTINGENCIES

All Service personnel and associated entities involved in the project will be trained on the final version of this Draft Plan. Response personnel will be on-call and prepared to respond to any incident described in the Final Plan.

Prior to commencement of rodent eradication operations, the Refuge Manager (who will function as the Incident Commander in any incident) and all essential personnel will receive training on the Incident Command System and will participate in scenario planning activities with field personnel, response agencies, and other potentially relevant parties. Refer to the *Draft Bait Spill Contingency Plan* for additional details about the Incident Command System.

Hard copies of the Final Plan will be available on the island, at the headquarters of the San Francisco Bay National Wildlife Refuge Complex, and other appropriate locations. There will also be a licensed pesticide applicator holding a Qualified Applicator License from the State of California Department of Pesticide Regulation that will be contracted for the project who has practical knowledge of the brodifacoum label and its use; safety requirements such as first aid, personal protective equipment, and emergency response; the laws and regulations associated with this rodenticide; and other responsibilities. The contents of this Draft Plan will be reviewed during consultations with federal, state, and other appropriate authorities. Changes may be made, as appropriate, during these consultations.

7. TRIGGERS AND RESPONSES

This section discusses unexpected but possible scenarios and events that, if triggered by results of project monitoring efforts or other means, would require immediate review and potential response. The section is organized by species or species groups. It first provides information about the risk, then lists the trigger events followed by the potential response actions. Response actions are listed in order, to be considered as different phases, as described in the lists below.

Depending on the scenario, notifications to the EPA, USDA-APHIS, Greater Farallones National Marine Sanctuary (GFNMS), California Department of Fish and Wildlife (CDFW), National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries), the State of California Water Resources Control Board, and the California Coastal Commission will occur immediately upon discovery of any of these trigger incidents involving non-target species. A list of agencies and stakeholders who will be provided notice is in Appendix A [TO BE DEVELOPED IN THE FINAL PLAN]. Responses will be coordinated between Service personnel and applicable agencies.

7.1 Western Gull Triggers and Responses

Western gulls, along with several other species of gulls, will be present at the South Farallon Islands prior to initiation of the mouse eradication project. In an effort to minimize potential exposure and gull mortality, a gull hazing program will be conducted prior to, during, and after bait application to discourage gull presence. The effectiveness of the hazing program is discussed in the FEIS, and specific hazing processes are described in the *Draft Mitigation and Monitoring Plan*. Once gulls have been hazed off the islands, the majority are expected to remain on or near the mainland, thereby eliminating their exposure to rodent bait. However, any individual gulls that remain or return to the islands could be at risk of lethal exposure to rodenticide if they were to consume bait pellets, poisoned mice, or other organisms exposed to rodenticide.

Based on a recent analysis, mortality of more than 1,050 western gulls would have to occur in order to affect the regional population level after 20 years (Nur et al. 2021). The threshold numbers used in this plan, therefore, ensure that project managers take proactive measures to ensure that there are no long-term population level effects on western gulls.

Monitoring of stranded or dead seabirds and other wildlife on beaches within the region for the duration of this project will be conducted by the Greater Farallones National Marine Sanctuary's Beach Watch program. Baseline values from past years of gulls found dead or moribund on program beaches will be used to look for a possible increase in beachcast gulls during the operational period. If gull deaths exceed the baseline by XX% [value to be determined after appropriate review of baseline data], then that will be a trigger requiring review and potential response, as described below.

The trigger scenarios below address contingency efforts if there is a failure of, or deficiencies in, the hazing program that results in higher-than-expected rates of gull retention and/or rodenticide exposure on the South Farallon Islands, which if not corrected, could potentially lead to higher levels of gull mortality than projected in the FEIS. For all triggers, the first response will always be to notify the Refuge Manager and hold an Operations Team meeting to discuss the possible cause(s) and the appropriate action(s). If it is determined that other responses are necessary, other appropriate entities will be notified and consulted. The Operations Team will need to consider all factors affecting the situation before deciding what actions to take.

Gull Scenario 1: Hazing is not sufficiently effective prior to the first bait application

Trigger:

- On any given day within three days of the first bait application, more than 200 gulls are present on the South Farallon Islands above the mean high spring water (MHSW) line for more than three hours after attempted hazing is started.

Potential Responses:

a. Monitor for 24 hours and then determine either that (1) the situation has resolved and no further action is required or (2) that one of the other listed actions needs to be taken.
b. Increase hazing effort or modify methods (e.g., increase human presence, use more pyrotechnics, deploy more effigies).

c. Delay aerial bait broadcast until sufficient hazing success is achieved.
d. If sufficient hazing success cannot be achieved, cancel bait broadcast.

Gull Scenario 2: Hazing is not sufficiently effective following the first bait application

Triggers:

- More than 300 gulls return to and are present on the islands for more than 3 hours within 24 hours after bait application.
- More than 50 gulls are observed in baited areas with evidence of likely exposure (e.g., foraging on bait).
- More than 20 sickened or dead gulls showing physical signs of rodenticide poisoning (e.g., bleeding from the mouth, nares, or cloaca; blood in droppings) are discovered on the islands and/or mainland.

Potential Responses:

a. Monitor for 24 hours and then determine either that (1) the situation has resolved and no further action is required or (2) that one of the other listed actions needs to be taken.
b. Modify hazing methods (i.e. use more pyrotechnics, deploy more effigies, and increase human presence).
c. Delay second aerial bait broadcast until sufficient hazing success is achieved.
d. Reduce bait availability by manually removing pellets in difficult to haze areas. Consider replacing with bait stations.
e. Manually remove pellets from all accessible areas.
f. Cancel second bait drop if Scenario 2 occurs and none of the above measures are adequate.

Gull Scenario 3: Hazing is insufficiently effective after the second bait application and exposure is still a high risk

Triggers:

- More than 300 gulls return to and are present on the island for more than 3 hours within 24 hours after bait application.
- More than 50 gulls are observed in baited areas with evidence of potential exposure (e.g., foraging on bait).
- More than 20 sickened or dead gulls showing physical signs of rodenticide poisoning are discovered on the islands.

Potential Responses:

a. Monitor for 24 hours and then determine either that (1) the situation has resolved and no further action is required or (2) that one of the other listed actions needs to be taken.
b. Increase hazing efforts (i.e. use more pyrotechnics, deploy more effigies, and increase human presence,).
c. Reduce bait availability by manually removing pellets in difficult to haze areas. Consider replacing with bait stations.
d. Manually remove pellets across all accessible areas

Gull Scenario 4: Sick, dying, or dead gulls that are suspected of rodenticide exposure are detected on mainland beaches by Beach Watch

Trigger:

- Greater than 20% of dead or dying gulls above the baseline (as reported by the Beach Watch Program), are found within a five-day period from any one or any combination of monitored beaches between Salmon Creek and Point Año Nuevo and within San Francisco Bay.

Potential Responses:

a. Modify hazing methods (i.e. use more pyrotechnics, deploy more effigies, and increase human presence).
b. If the second bait application has not yet occurred, delay second aerial bait broadcast until sufficient hazing success is achieved.
c. Reduce bait availability by manually removing pellets in difficult to haze areas.
d. Manually remove pellets across all accessible areas.
e. If the second bait application has not yet occurred, cancel second bait drop if none of the above measures are adequate.

Gull Scenario 5: Sick, dying, or dead gulls that are suspected of being poisoned are detected in mainland tourist areas

Trigger:

- Sickened or dead gulls suspected of rodenticide poisoning are reported in Bay Area tourist areas.

Potential Responses:

In addition to potential responses listed for Gull Scenario 4, the following potential responses would be considered:

a. Trained staff will be dispatched to collect the dead birds and conduct a survey of the area for additional birds, which will also be collected if possible. Birds will be stored for possible necropsy and tissue residue sampling.

b. Captured live birds will be taken to a local wildlife rehabilitation facility for administration of Vitamin K, care, and rehabilitation.
c. Surveys of other high public use areas will be conducted for the presence of dead or dying gulls.
d. The Service will issue a press release that dead or dying gulls have been observed at certain mainland areas, which will include information for the public about what to do if a dead or dying gull is found, including notification process and keeping pets away from any dead or injured wildlife.

7.2. Pinniped Triggers and Response

Large numbers of pinnipeds (seals and sea lions) will be present around and on the South Farallon Islands during the planned mouse eradication activities. The primary risks to pinnipeds from the eradication project are disturbances (or, harassments) during the application of rodenticide and gull hazing activities. During gull hazing trials in 2012, the impact of hazing activities on pinniped disturbance and pinniped abundance was shown to be relatively minor.

Prior to Project implementation, the Service will obtain an Incidental Harassment Authorization (IHA) under the Marine Mammal Protection Act (MMPA). The MMPA allows NOAA Fisheries to issue an IHA in cases where it finds that the taking (i.e., disturbance) of marine mammals will have a negligible effect on affected species of marine mammals. An IHA prescribes permissible methods of take and other measures to affect the least practicable adverse impacts on the affected species. It also includes requirements pertaining to monitoring and reporting. (See, MMPA Section 101(a)(5)(A) and 50 CFR 216.102) Therefore, adherence to the requirements of the IHA will limit pinniped disturbance to below what would cause significant impacts. A trigger scenario that is trending toward the potential to exceed permitted thresholds would necessitate immediate notification to NOAA Fisheries as the IHA will require, as well as secession and closer assessment of the activity that is causing the impact.

Pinniped Scenario 1: Gull hazing activities seem likely to result in greater pinniped harassment than the Incidental Harassment Authorization allows

Triggers:

- Based on numbers of animals disturbed to date, exceedance of disturbance limits for one or more of the five pinniped species appears likely if current trends continue.
- Stampeding behavior is observed that could lead to pinniped injuries.
- Disturbance results in a Level A harassment (i.e., injury or death of an individual).

Potential Responses:

a. Notify and consult with NOAA Fisheries. Discuss the possibility of increasing the IHA limit if deemed safe for the affected species' population.
b. Modify gull hazing methods (e.g. use fewer pyrotechnics, helicopter hazing, etc.) based on which method(s) is resulting in high levels of pinniped disturbance.
c. Reduce hazing or human presence in areas that are more sensitive to pinniped disturbance or in areas with highest numbers of pinnipeds

d. Eliminate gull hazing and human presence/actions near major pinniped haul-outs areas.
    a. Last resort action or if a pinniped mortality is observed: cease all hazing activity. If consultations or plan changes are feasible to correct the situation, then gull hazing activities may be resumed.

Pinniped Scenario 2: Baiting activities may result in pinniped harassment exceeding numbers permissible under the Incidental Harassment Authorization

Triggers:

- Pinniped disturbance limits for one or more of the five species may be exceeded.
- Disturbance results in a Level A harassment.

Potential Responses:

a. Notify and consult with NOAA Fisheries. Discuss the possibility of increasing the IHA limit if deemed safe for the affected species' population.
b. Increase altitude of the helicopter for aerial applications.
c. Restrict helicopter activity to areas without high concentrations of pinnipeds and hand bait those areas.
d. Last resort action or if any pinniped mortality is observed: cease all bait application activity. If consultations or plan changes are feasible to correct the situation, then bait application activities may be resumed.

7.3 Farallon Arboreal Salamander Triggers and Responses

The Farallon arboreal salamander is an endemic subspecies to the South Farallon Islands, meaning it is native and exists in no other place. The primary risk to salamanders from this project is anticipated to be from secondary exposure to rodenticide via invertebrate prey that may feed on rodenticide bait. Salamanders are considered to be at low risk of impacts from rodenticide exposure. However, given the salamander's endemic status, the Service plans to capture about 40 individuals prior to project implementation as a precautionary measure to prevent potential extirpation. These salamanders will be held and cared for in terrariums. Salamanders will be released back to the areas of their capture when the risk of exposure has declined to a negligible level. (See *Draft Mitigation and Monitoring Plan* for additional details.)

During the implementation phase of the project, monitoring of wild salamanders will be conducted to look for signs of rodenticide exposure and impacts to the salamander population.

Salamander Scenario 1: Higher than expected salamander mortality is detected after bait application

Trigger:

- If the number of salamanders detected on surveys after the first bait application is less than XX% of what was detected prior to the bait application(s).

- Greater than 50% of detected salamanders display indications of rodenticide exposure, such as bleeding, skin lesions, appearing lethargic, or death.

Responses:

a. Do not alter project activities. Continue to monitor the situation.
b. Capture as many remaining salamanders as possible that can be held safely in captivity and place them in temporary holding areas.
c. Administer Vitamin K to affected salamanders, which might reverse coagulopathy caused by exposure to the rodenticide.
d. Release a portion of the salamanders held in captivity after risks are determined to be low. Continue surveys to determine fate of released salamanders. If feasible, radio transmitters may be attached to some released salamanders to determine initial survival.
e. The remaining salamanders held in captivity will be released if at least 50% of monitored salamanders show no evidence of rodenticide impacts for at least 30 days post-release.

7.4 Fishery Resources Triggers and Responses

The FEIS (USFWS 2019) indicates that potential impacts to marine species from incidental bait drift of rodenticide into the marine environment are very low. However, in the unlikely case that exposure to fishery resources is discovered following bait application, contingency planning is needed to prepare for such an event. Because any exposure to fishery resources likely would not be discovered until residue analyses on collected samples are performed, it would be unlikely that such a discovery would be made in time to alter bait applications. Instead, contingency planning is focused on potential responses for notifying fishery managers, commercial and recreational fishermen, and the general public. Contingency planning for a bait spill, which could also impact fishery resources, is covered in the *Draft Bait Spill Contingency Plan*.

Fishery Resources Scenario 1: Residue monitoring results show accumulation of rodenticide in a fishery species

Trigger:

- Residue monitoring results show accumulation of rodenticide in a fishery species above background concentrations.

Potential Responses:

a. Immediately notify fishery regulators, including the California Department of Fish and Wildlife-Marine Region and NOAA Fisheries, as well as Greater Farallones National Sanctuary, USDA-APHIS, and EPA. Discuss potential actions including fishery and public notification.
b. Conduct additional collections for residue sampling in consultation with fishery regulators and other applicable agencies.

7.5 Triggers and Responses to Address Unanticipated Appearance of a Threatened or Endangered Species

Only one threatened or endangered (T&E) species was identified in the FEIS as potentially at risk from mouse eradication activities, the black abalone (*Haliotus cracherodii*). In accordance with the Endangered Species Act, the Service conducted a Section 7 consultation process for black abalone with NOAA Fisheries. [INSERT SENTENCE BRIEFLY DESCRIBING KEY RESULT OF CONSULTATION.] The contingency measures in this section have been developed in the unlikely event that another T&E species is discovered on or near the islands and is at risk of impact from project operations.

Threatened and Endangered Species Scenario 1: A live T&E species is discovered on the South Farallon Islands during project operations

Trigger:

- An unanticipated T&E species is discovered on or around the South Farallon Islands during project operations.

Potential Responses:

a. Take immediate measures to protect the individual(s) from project-related impacts (e.g., harassment, exposure to rodenticide).
b. Cease operations if the individual(s) cannot be protected from harm.
c. Immediately notify and consult with the appropriate regulatory agency (USFWS Ecological Services or NOAA Fisheries) depending on the species. Results of consultations will determine next steps.

Threatened and Endangered Species Scenario 2: A dead T&E species is discovered on or in the waters surrounding the South Farallon Islands during project operations

Trigger:

- A dead T&E species is discovered on or in the waters immediately surrounding the South Farallon Islands during project operations.

Potential Responses:

a. Immediately notify and consult with the appropriate regulatory agency (USFWS Ecological Services or NOAA Fisheries) depending on the species.
b. Results of consultations will determine next steps.

8. REFERENCES

Nur, N., R. W. Bradley, D. E. Lee, P. Warzybok, and J. Jahncke. 2021. Projecting long-term impacts of a mortality event on vertebrates: incorporating stochasticity in population assessment. Ecosphere 12(1):e03293. 10.1002/ecs2.3293

U.S. Fish and Wildlife Service. 2019. Farallon Islands National Wildlife Refuge: South Farallon Islands Invasive House Mouse Eradication Project: Final Environmental Impact Statement. U.S. Fish and Wildlife Service, San Francisco Bay National Wildlife Refuge Complex, Fremont, California.

APPENDIX A – AGENCY AND STAKEHOLDER CONTACT INFORMATION

(REFER TO THE BAIT SPILL CONTINGENCY PLAN FOR REQUIRED NOTIFICATIONS)

Federal Agencies			
Agency / Organization	**Phone**	**Circumstances**	**When to Notify**
USFWS Bay-Delta Fish and Wildlife Office	(916) 930.5631	An ESA species under their jurisdiction is found during project implementation	Immediately
USFWS Pacific Southwest Regional Office	(916) 414.6473	All contingency triggers	As soon as an incident is known
USFWS Pacific Southwest Regional Office – Migratory Birds	(916) 414-6727	All migratory bird issues	Immediately
U.S. Department of Agriculture - APHIS	(XXX) XXX-XXX	All contingency triggers	Immediately
EPA Region 9	(415) 947-8713	All contingency triggers	Immediately
Greater Farallones National Marine Sanctuary	(415) 561-6622	All contingency triggers related to Sanctuary resources	Immediately
NOAA Fisheries	(XXX) XXX-XXX	Marine mammal issues	Immediately
NOAA Fisheries	(XXX) XXX-XXX	Contingency triggers related to fisheries	Immediately
State Agencies			
Agency / Organization	**Phone**	**Circumstances**	**When to Notify**
California Department of Fish & Wildlife – Marine Region	(XXX) XXX-XXX	Contingency triggers related to fish and wildlife	Immediately
San Francisco Bay Regional Water Quality Control Board	(510) 622-2300	Contingency triggers related to water resources	Immediately

Local Agencies			
Agency / Organization	**Phone**	**Circumstances**	**When to Notify**