

FY20 and FY21 National Wildlife Refuge System Large Invasive Species Project Proposal

Name of Project: Farallon Islands National Wildlife Refuge Invasive House Mouse Eradication Project

Date Submitted: June 1, 2018

Species Targeted for Eradication: House Mouse (*Mus musculus*)

This project aims for complete and long-term eradication of the non-native, invasive house mouse at the Farallon Islands National Wildlife Refuge (FINWR) to eliminate their impacts on the Farallon ecosystem, and to initiate strict biosecurity protocols that reduces the opportunity for further rodent invasions. The house mouse is only known to occur on the South Farallon Islands, the largest and only inhabited islands of the Farallon Islands group. The remoteness of these islands, 15 miles from the nearest mainland, prevents the chance for natural recolonization. House mice have been eradicated from over 60 islands worldwide; success rates have been >70% since 1970 and >90% since 2005 (Samaniego 2016, DIISE 2017). Careful planning and following established best practices (USFWS 2013a, Broome et al. 2017) provide for a high likelihood of eradication success. To ensure long-term success, existing biosecurity protocols will be followed and strengthened utilizing Refuge base funds for implementation.

Refuge/Wetland Management District

The proposed project will occur on the South Farallon Islands, FINWR, part of the San Francisco Bay National Wildlife Refuge Complex (SFBNWR), California. The islands are located 30 miles offshore of San Francisco and 15 miles from the nearest mainland at Point Reyes. The much smaller, uninhabited Middle and North Farallon islands which are 2.5 and 7 miles from the South Farallones, respectively, are not known to harbor mice based on their small size and lack of appropriate habitat. Only 120 acres in size, the South Farallon Islands are comprised of Southeast Farallon Island, West End Island, and seven smaller islets. All but Southeast Farallon, the only inhabited island, are part of the Farallon Wilderness. The islands are part of the UNESCO Golden Gate Biosphere Reserve because of the international significance of their natural resources. FINWR is closed to the public and access is limited to small numbers of Refuge staff, researchers, volunteers, and contractors. Access is either by a Refuge boat kept on the island or, less often, by helicopter. All access and visitors are under the control of Refuge staff, ensuring that biosecurity protocols are followed and minimizing the risks of new invasions. All work done utilizing funds for this project will be for eradicating house mice from the South Farallon Islands.

Project Contact Information/Qualifications

The Project Leader for the SFBNWR is Anne Morkill, 510-792-0222 x123; the Manager of the FINWR is Gerry McChesney, 510-792-0222 x222, gerry_mcchesney@fws.gov

This project would be implemented by USFWS in partnership with USDA-APHIS, DOI Restoration Support Unit, Point Blue Conservation Science, and other agencies and NGOs. Implementation will be conducted by a contractor/cooperator with a successful track record of conducting other similar eradication projects.

USFWS is represented by staff at the San Francisco Bay NWRC, Planning, Bay-Delta Fish and Wildlife Office, Refuges Inventory & Monitoring, and Office of Migratory Birds. Several USFWS Refuge staff members have been involved in invasives control and eradication projects, including the large Invasive *Spartina* Project in San Francisco Bay. At least two staff are certified pesticide applicators. Vast staff knowledge and expertise have been gained in the extensive planning process for this project.

The DOI Restoration Support Unit staff have expertise in ecotoxicology and have assisted with various large-scale ecosystem restoration projects nationwide, including planning, implementation, and environmental monitoring.

Point Blue Conservation Science advances conservation of birds, other wildlife, and ecosystems through science, partnerships, and outreach. They have assisted the USFWS with stewardship and wildlife monitoring on FINWR for nearly 50 years. The project will utilize their expertise with pre- and post-eradication ecosystem monitoring, logistics, and communications.

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) are members of the USFWS's Island Restoration MOU group. USDA-APHIS Wildlife Services has collaborated with the USFWS in previous rodent eradications, has independently conducted rodent control and eradications, has assisted with rodenticide registration and labeling issues, and has conducted monitoring of ecosystem and non-target effects during eradication operations.

Statement of Need

The South Farallon Islands host the largest seabird breeding colony in the lower 48 United States, with nearly 400,000 birds of 13 species, including globally significant populations of several species. Nearly 50% of the world population of $\leq 10,000$ ashly storm-petrel (*Oceanodroma homochroa*; USFWS Species of Conservation Concern, IUCN red-listed) breeds there. The islands also host the endemic Farallon arboreal salamander (*Aneides lugubris farallonensis*), endemic Farallon camel cricket (*Farallonophilus cavernicolus*), a unique plant community dominated by the seabird island endemic maritime goldfield (*Lasthenia maritima*), and designated wilderness. The Farallon Islands ecosystem evolved in the absence of terrestrial mammals. Introductions of invasive mammals by early inhabitants in the 19th and early 20th centuries led to ecological damage. With the removal of introduced rabbits (*Oryctolagus cuniculus*) and domestic cats (*Felis catus*) in the early 1970s, house mice are the only remaining introduced mammals on the Farallones. At their annual peak, densities of house mice on the South Farallones have been measured at over 490 per acre, among the highest densities recorded on any island (USFWS 2013b). This has resulted in impacts to the islands' native seabirds, salamanders, insects and plants. Thus, eradication of house mice was identified in the FINWR Comprehensive Conservation Plan (CCP; 2009).

During fall bird migration, when the house mouse population peaks, mice provide a temporary, artificial food source for migratory burrowing owls (*Athene cunicularia*) that stop at the islands. Each year, at least 2-10 owls are known to remain through the winter, encouraged to stay by the abundant mouse food source. However, when the mouse population crashes in winter, the owls switch to preying on rare ashly storm-petrels which are then beginning courtship activities (USFWS 2013b, Chandler et al. 2016, Mills 2016). Chandler et al. (2016) showed that mice and storm-petrels make up 70% and 28% of owl diet by biomass, respectively, with mainly mice taken in September-January and mainly storm-petrels taken in February-May. Nur et al. (2013) found owl numbers have increased since 2007, with increased predation on storm-petrels and associated change in storm-population trend from increasing to a 7.2% annual decline. Modelling efforts showed that reductions of owl predation by just 50% can be expected to increase storm-petrel annual survival by 2.6-4.9% and increase annual population growth rates by 2.3-3.9%; with a 71.5% reduction in owl numbers, storm-petrel population growth rates increase by 3.1-5.3% (Nur et al. 2013). These benefits can be achieved by eradicating the owl's preferred food source, house mice. With no mice on the islands, most, if not all, burrowing owls that stop at the islands would continue on their fall migration. Leach's storm-petrels (*O. leucorhoa*), which breed at the FINWR in lesser numbers, are also expected to benefit in a similar fashion (USFWS 2013b).

As opportunistic omnivores, house mice consume a variety of foods including invertebrates, plants and seeds, eggs, other vertebrates, and carrion (Rowe et al. 1989, Cole et al. 2000, Angel et al. 2009, St. Clair 2011). In particular, when mice are at peak abundance in fall, they consume large quantities of native invertebrates including the Farallon camel cricket, altering the makeup of the Farallon invertebrate fauna and competing with native insectivores such as the arboreal salamander. Mice also consume large numbers of seeds and other plant parts of native vegetation, reducing native vegetation cover in favor of hardier, introduced plants such as New Zealand spinach (*Tetragonia tetragonoides*), narrowleaf plantain (*Plantago coronopus*), and several species of European grasses that have become dominant on large parts of the islands. Mice negatively impact the natural character of the Farallon Wilderness (USFWS 2013b). Mouse eradication would help restore the natural ecosystem by removing these impacts. For example, when rabbits and cats were removed in the early 1970s, rhinoceros auklets (*Cerorhinca monocerata*), a seabird, re-colonized the islands (Ainley and Lewis 1974).

Eliminating mouse impacts on the Farallon ecosystem also will increase ecosystem resiliency to impacts of climate change; expected impacts on the FINWR include increasing air temperatures, more frequent and prolonged droughts, more frequent El Niño events, increased intensity of upwelling, and a more variable ocean environment (Snyder et al. 2003, Kao et al. 2009; Sydeman et al. 2013, 2014; Diffenbaugh et al. 2015). Some of these factors are already being observed on the FINWR (Kelsey et al. 2015; Schmidt et al. 2014, 2015). The rapidly changing environment will put additional stressors on the Farallon ecosystem and could even alter the annual population cycle of house mice. For example, on Midway Atoll, a recent change in rainfall patterns apparently resulted in a change in the introduced house mouse population cycle there. Mice then began preying on adult Laysan (*Phoebastria immutabilis*) and black-footed (*P. nigripes*) albatrosses and their young (USFWS 2018). If mouse population cycles changed on FINWR, mice could begin preying extensively on the island's breeding seabirds or their eggs, increasing their impacts.

Project Goals and Objectives

The primary management goals of the FINWR CCP (USFWS 2009) are to protect and restore populations of breeding seabirds, other native wildlife, and native plants. One objective to achieve this is the eradication of invasive house mice from the Refuge. The goal of this project is to eradicate house mice from the Refuge in order to eliminate their impacts on native seabirds, salamanders, invertebrates, plants, and wilderness character, utilizing strategies outlined in USFWS (2013b):

Objective 1: In less than 8 weeks, completely eradicate mice from the entire 120 acres of South Farallon Islands utilizing Best Management Practices and Integrated Pest Management (IPM).

Objective 2: Minimize impacts (mortality and disturbance) from implementation to all non-target species, including western gulls (*Larus occidentalis*), migrant raptors, and salamanders from eradication related effects.

Objective 3: Conduct pre- and post-eradication monitoring to document elimination of mice, adverse effects to non-target resources, and to measure ecosystem responses from mouse eradication. Monitoring for mice will extend for at least 2 years after the operation. Ecosystem response monitoring will extend for several years.

Objective 4: Maintain rigorous biosecurity to prevent reintroductions and monitoring for mice and rats in perpetuity to ensure that if there is a reintroduction, immediate response actions are taken to eliminate them.

Eradication Methodology

This project will be conducted following FWS policy and the principles of IPM. Eradication of invasive species from islands is based on certain core principles (Cromarty et al. 2002):

1. Every target species individual must be put at risk with the proposed technique(s);
2. The technique(s) must eliminate them faster than they can breed; and
3. Immigration must be zero or introductions detected and managed to result in no increase from zero.

With over 500 successful island rodent eradications worldwide (DIISE 2017), including several in the U.S., a wealth of knowledge is available for project design. Following the general principles and established best practices for rodent eradication, the goal is to ensure toxic bait is available for every rodent to consume a lethal dose (Howald et al. 2007, Broome et al. 2017). For FINWR, the recommended preferred alternative is the aerial broadcast of bait containing 25 ppm brodifacoum (Brodifacoum-25D; supplemented by hand broadcast and bait stations for certain areas) with a robust mitigation plan to protect non-target resources. Pre-eradication trials using non-toxic bait determined that application of bait at established label rates with minor adjustments should be sufficient to expose the entire mouse population. Monitoring of bait uptake and possibly of radio-collared mice will help determine rates of mouse exposure to toxicant. Timing of the proposed eradication in November-December 2020 has been optimized based on mouse population cycles and minimizing risk to non-target species. During this period, mice are in decline and not reproducing; birds are not nesting and bird numbers are near annual minimums.

The eradication would be conducted by USFWS in cooperation with a qualified contractor or cooperator with demonstrated ability to conduct a house mouse eradication project on the Farallon Islands. Prior to implementation, precise methods will be described in a detailed Operational Plan. The eradication will be accompanied by an intensive effort to mitigate and monitor potential impacts to non-target resources including fish, wildlife, soil and water.

Post-eradication Monitoring

Monitoring would be conducted in accordance with established best management practices (USFWS 2013a) and adapted from protocols from other eradication projects (Pitt et al. 2015, Newton et al. 2016, Broome et al. 2017) and existing protocols for Farallon wildlife and plants (Point Blue, unpubl. data). Our post-eradication monitoring plan will be designed to determine: 1) whether the eradication was successful; 2) both short- and long-term ecosystem response from mouse eradication; and 3) effectiveness of biosecurity protocols to prevent future introductions of mice and other non-native species. Monitoring for mice will incorporate the principles of Early Detection and Rapid Response (EDRR) and IPM and will be conducted by USFWS and partner staff with USFWS funds. Project monitoring to document eradication success and potential reinvasion will begin immediately after the eradication operation is complete. Our strategy will be to detect any surviving mice using traps, tracking tunnels, chew blocks, cameras, owl pellets, and other methods as appropriate. Detection of any mice would be followed by a planned rapid response. The typical timeline to declare rodent eradication success is two consecutive years of monitoring without a mouse detection.

With an abundance of existing ecosystem monitoring data for the FINWR, this project offers the ability to detect both short and long-term changes associated with a first-ever house mouse eradication from a temperate U.S. island. Studies already underway include examining potential changes to seabird population sizes and reproductive success, burrowing owl populations and predation on storm-petrels, ash storm-petrel survivorship, cricket abundance, abundance and survivorship of arboreal salamanders, and

changes to plant community composition. Ecosystem monitoring studies would be conducted by USFWS, Point Blue, and other partners.

Data collection and storage will follow the data management lifecycle (<https://www2.usgs.gov/datamanagement/why-dm/lifecycleoverview.php>). Prior to project implementation, a Data Management Plan (<https://www2.usgs.gov/datamanagement/plan/dmplans.php>) will be developed in collaboration with the eradication contractor and other cooperators. Data will be collected using GPS and paper forms, data will be entered into a data entry system, and data will be copied to refuge servers. Analyses will include assessments of mouse presence/absence, changes in populations of key species, and adherence to biosecurity protocols. A report will summarize the first two years of post-eradication monitoring. Metadata, final datasets and reports will be preserved and shared through ServCat (ecos.fws.gov/ServCat).

Anticipated Outcomes

Because pre-mouse conditions on the FINWR are unknown, precise ecosystem responses are uncertain. However, like other rodent eradication projects (Olivera et al. 2010, Newton et al. 2016), anticipated outcomes of house mouse eradication include restoration of native species, habitats, ecosystem integrity, and natural wilderness character. Possibly the most immediate response will be an expected decline (or complete loss) in numbers of burrowing owls wintering on the islands, the associated decline in owl predation on ashy storm-petrels, and resulting increase in the storm-petrel population (Nur et al. 2013; see Statement of Need, above). Also expected are population increases in both crickets and salamanders. Along with ongoing invasive plant control efforts, elimination of mouse predation on native plants and seeds is expected to increase these plants' abilities to compete with invasives and restore the natural plant community on the island. Natural character of the Farallon Wilderness will be restored. Removing the mice also will help buffer the island ecosystem from the impacts of climate change by removing the stressor of mouse impacts.

Project Basis/Likelihood of Success

Rats and mice have been eradicated from over 500 islands worldwide. Keitt et al. (2011) reported that of 796 rodent eradication attempts worldwide, 82 targeted house mice and 61% were successful. Success rates have improved dramatically over time; of 31 attempted mouse eradications since 2005, 93.3% were successful. House mice have now been removed from islands as large as South Georgia (1350 m²), Macquarie Island (31,810 acres), and the interconnected islands of Rangitoto and Motutapu (9,523 acres), all much larger than the South Farallon Islands (120 acres). This increase in success is a result of refinement of techniques, modified from earlier methods for rat eradication, and has resulted in the establishment of best practices for mouse eradication (MacKay et al. 2007, Broome et al. 2017).

Although island size should not impact project success, other factors that could impact success include: not getting bait in every mouse territory, non-target uptake of bait, mouse reproduction during project implementation, and bait palatability. Bait uptake trials conducted with non-toxic bait concluded that bait applied at the current registered label rate should be adequate for exposing all mice to toxicant. GPS technology has greatly improved bait delivery to better assure that bait is delivered to every mouse territory. A hazing plan for gulls, which could consume bait, has been successfully trialed and is expected to minimize non-target uptake of bait. Studies showed that the planned implementation period in November-December is at the end of the mouse reproductive cycle and thus reproduction should not prevent project success. Other measures of success will be based on minimization of non-target impacts, including native

birds (especially gulls and raptors), salamanders, soil, and the marine environment. Mitigation measures using established methods have been developed to minimize toxicant exposure to non-target resources.

NEPA and Section 7 Status

A draft EIS was released for public comment in the fall of 2013 (USFWS 2013b). USFWS is currently working with an environmental consultant and other partners addressing public comments received and revising the EIS. Consistent with DOI requirements (SO 3355), a Final EIS and Record of Decision will be completed by April 2019. One species has been identified for Section 7 consultation, the endangered black abalone (*Haliotis cracherodii*), although recent surveys failed to locate any around FINWR. USFWS has begun consultation proceedings with the National Marine Fisheries Service for this species, with completion expected by April 2019. Other permits and approvals, including Migratory Birds, PUP, Marine Mammal Protection Act, and National Marine Sanctuaries, will be completed by April 2020.

Biosecurity and Reinvasion

Preventing reinvasion is critical to the success of the Farallon house mouse eradication project. The risk of introductions is already reduced by the Refuge being closed to the public, the considerable distance to the mainland (15 miles), infrequent and controlled transport trips to the islands, difficult landing conditions that help prevent unauthorized landings, and low numbers of people and supplies coming ashore. No mammal invasions are known to have occurred since USFWS assumed management of FINWR in 1969. The draft FINWR Biosecurity Plan (2013; to be revised and finalized with the mouse eradication Final EIS) contains protocols for minimizing reinvasion risk and EDRR. Measures to reduce the likelihood of future introductions of rodents and other non-native species have been implemented for several years, including the control of vessels and aircraft delivering personnel and supplies to the islands, use of rodent-proof containers, inspections of suspect cargo, and containerizing and off-island transport of all garbage. Following mouse eradication, additional measures are planned including the rodent-free certifications for vessels and aircraft delivering personnel and supplies, development of quarantine facilities, inspections of all cargo destined for the islands, and implementation of a EDRR protocol in order to detect any rodents that may come ashore and to eliminate them promptly. The biosecurity program would be funded and implemented by USFWS using USFWS base funds.

Boats – Most personnel and supply deliveries arrive about every two weeks by vessels <50 ft long. Transport vessels then moor 0.25 mi off the island, where personnel and cargo are transferred to a 17-ft shuttle boat that is kept on island. Improperly packed cargo is re-packed and cleared before going ashore. Prior to the mouse eradication project, strengthened protocols will be implemented requiring boats to obtain rodent-free certifications. Cargo will be quarantined and inspected prior to boat loading and upon arrival.

The waters surrounded the islands are visited occasionally by tour boats and both recreational and commercial fishermen. A closure surrounding the islands prohibits approaches closer than 300 ft. A marine protected area surrounding the islands that prohibits fishing also limits the numbers of boats coming near the islands. Shipwrecks are now rare, although one small sailboat wrecked on the FINWR in 2012. In case of shipwrecks, the EDRR Protocol from the revised FINWR Biosecurity Plan would be used to prevent reinvasion of mice and other invasive species.

Helicopters – A small number (≤ 15 /year) of helicopter trips deliver personnel and supplies to the island in the fall and winter months. Most (>75%) are U.S. Coast Guard helicopters. Pilots are instructed to inspect and clean their helicopters of any living things prior to boarding. Suspect cargo is inspected upon landing.

Prior to the mouse eradication project, strengthened protocols will be implemented requiring helicopters to obtain rodent-free certifications. Cargo will be quarantined and inspected prior to loading and upon arrival.

Early Detection and Rapid Response – All visitors to FINWR are given instructions on preventing invasive species introductions to the islands, including the packing of gear and clothing worn. Island personnel are constantly vigilant for signs of new invasions. Immediately following the mouse eradication operation, the rodent EDRR Protocol will be implemented so that any potential incursion can be thwarted quickly. This may include combinations of snap and cage traps, camera traps, chew blocks, tracking plates, and bait stations deployed and monitored regularly at strategic locations such as landings, dwellings and other infrastructure.

Relationship to Planning Documents

The eradication of house mice from FINWR aligns with the goals and objectives of several USFWS and other regional plans. The FINWR CCP (USFWS 2009) provided that the Service should, within five years of the completion of the CCP, develop a plan to reduce the impacts of non-native species on the islands' ecosystem. To implement this objective, the Service developed the Draft EIS which proposed to eradicate house mice and prevent future human introductions of mice (USFWS 2013b). The Regional Seabird Conservation Plan, Pacific Region (USFWS 2005), listed eradication of house mice from FINWR as a top priority to benefit seabirds. The Ashy Storm-Petrel Conservation Plan (Parker 2016) listed eradication of house mice from the FINWR as a top priority to benefit the species. The Luckenbach (2006) and Cosco Busan (2012) oil spill restoration plans identified eradication of house mice from FINWR to benefit ash storm-petrels.

Partnerships and Benefits

Core Project Partners include the USFWS, Point Blue Conservation Science, DOI Restoration Support Unit, and USDA-APHIS Wildlife Services. These partners will benefit the proposed project by providing their specific skills and experience. USFWS staff will provide project leadership and oversight, infrastructure and logistical support, intimate knowledge of the FINWR and its resources, and staff and resources for post-eradication monitoring and biosecurity implementation. Planning, IPM, and Migratory Birds staff will help ascertain that all environmental compliance is obtained prior to implementation. Visitor's Services staff will bring their skills in communication and education for effective public relations about the project.

Point Blue Conservation Science will bring their 50 years of experience studying the FINWR ecosystem and logistical expertise to assist with project planning, implementation, pre- and post-eradication monitoring, communications, public education, and fundraising to the project. DOI Restoration Support Unit will assist with environmental monitoring study design and implementation, and fundraising. They have already provided \$169,000 to support NEPA planning. Staff have expertise in ecotoxicology and have assisted with various large-scale ecosystem restoration projects nationwide, including planning, implementation, and environmental monitoring. USDA-APHIS-Wildlife Services will bring their expertise with rodenticide registration, assistance with operational planning, and environmental monitoring.

Other project partners have included the DOI Office of the Solicitor which has provided extensive NEPA review and advice. Island Conservation, which has extensive experience with rodent eradications on islands, assisted with planning. The NOAA-Greater Farallones National Marine Sanctuary will assist with monitoring of marine resources. The National Fish and Wildlife Foundation (NFWF) provided significant funding support for the planning phase of the project (\$334,500). Other collaborating agencies include

NOAA Restoration Center, California Department of Fish and Wildlife, and the U.S. Environmental Protection Agency.

Long-Term Sustainability

The long-term sustainability of this project will depend on the success of biosecurity efforts to protect the islands from future invasions of mice and other invasive species. FINWR is currently revising its Biosecurity Plan (expected completion April 2019), based on other FWS, NPS and other island models, to reduce the likelihood of future species introductions, to rapidly detect introductions should they occur, and to respond quickly to eliminate any potential threats. The updated plan will both broaden and strengthen measures already in place that have prevented introduced vertebrate invasions since the USFWS assumed management of the South Farallon Islands in 1969. Periodic reviews of the Biosecurity Plan will be conducted and updates made as necessary. If any future incursions should occur, an immediate review of the cause, efficacy of detection and response, and measures needed to prevent another incursion would be conducted. Implementation and enforcement of the biosecurity plan will be a primary duty of Refuge staff with dedicated Refuge funds.

Climate change is not expected to reduce the success of biosecurity or the benefits from mouse eradication. Instead, this project is expected to provide resiliency to the impacts of climate change by reducing impacts of mice on the FINWR ecosystem. Forecasts of increasing air temperatures, changing rainfall patterns, and changing upwelling patterns (Snyder et al. 2003, Kao et al. 2009; Sydeman et al. 2013, 2014; Diffenbaugh et al. 2015) will put additional stressors on Farallon wildlife and plants. Long-term data are showing that some of these factors are already happening at the Farallones. Potential impacts of climate change on ash storm-petrels are uncertain, but could result in reduced breeding success. Removal of owl predation, an indirect result of mice, is expected to result in a minimum 3.1% increase in annual population growth rate and would reduce the effects of climate change as a stressor. Increasing severe droughts, a byproduct of climate change (Diffenbaugh et al. 2015), could hinder germination of native plants in favor of more hardy, invasive species. Removal of mouse predation on native plant seeds may help these species compete for space (Angel et al. 2009).

Budget and Timeline for Activities

Detailed budget is provided in Table 1. All funding will be obligated during the first year of the project. Funds are being requested for FY20, which would allow the eradication to occur along the targeted timeline of November-December 2020. Funds to complete the planning phase have come from a variety of sources, including USFWS (in-kind), NFWF, Island Conservation, Point Blue Conservation Science (in-kind), and the DOI Restoration Support Unit. Not including the funds that have already been invested in eradication planning, the total estimated cost of eradicating mice from the South Farallon Islands is \$1,752,000. However, the proposal funding request is for \$1,000,000. Likely funders for the small remaining balance include USFWS (in-kind support), the Luckenbach Oil Spill Trustee Council, NFWF, Point Blue, and private donors.

The NEPA process is in the final phase and will be completed by April 2019. All environmental compliance permits are expected to be in-hand by April 2020. Funding allocations and operational planning for the eradication would be conducted between 2019 and fall 2020. Baiting would occur in November-December 2020, with non-target mitigation and monitoring continuing 4-6 weeks following baiting or until non-target risk is considered to be negligible. Eradication success monitoring will continue for two years. Ecosystem response monitoring is expected to last several years.

Table 1. Detailed project budget.

Task	Cost	Comment
Biosecurity supplies, on-site preparation	\$5,000	
Traps, bait stations and assoc supplies	\$25,000	
Bait	\$30,000	
Boat transport	\$25,000	
Helicopter transport	\$50,000	
Helicopter support	\$65,000	Baiting, non-target mitigation
Eradication contractor staff salaries, benefits, overhead	\$500,000	Includes preparation of Operational Plan, logistical planning, project implementation, report writing
Eradication contractor travel to California/Per Diem	\$45,000	
Field Per diem	\$15,000	
Equipment	\$50,000	
Non-target species mitigation	\$300,000	Gull hazing, raptor capture and hold, salamander capture/hold
Toxicological monitoring	\$200,000	
On-island pre- and post-eradication monitoring	\$50,000	
Coastal non-target wildlife monitoring	\$100,000	Beachcast wildlife surveys
Permit acquisition (contractor)	\$25,000	MBTA, MMPA, Marine Sanctuaries, etc.
Communications, outreach (contractor)	\$10,000	
Subtotal	\$1,495,000	
Contingency (20%)	\$299,000	
Project Total	\$1,794,000	
Matching funds:		
Luckenbach Oil Spill Restoration Plan	\$173,833	
Other (NFWF, PointBlue, private donations)	\$620,167	
Total Request	\$1,000,000	

Comment [PM1]: Is it possible delineate which tasks would be completed by a contractor/cooperator vs by FWS staff.

Comment [PM2]: Contract, agreement, FWS employees, or combination?

Comment [GJM3]: Keep? Delete?

Comment [GJM4]: Keep? Delete?

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Figures



Figure 1. Pile of Ashy Storm-Petrel wings from birds depredated by a burrowing owl at Southeast Farallon Island. Burrowing owls are artificially attracted to the South Farallon Islands by an abundance of invasive house mice. When the house mouse population crashes, owls switch to feeding on the rare storm-petrels, killing hundreds per year and causing population level impacts.



Figure 2. Adult Ashy Storm-Petrel. Nearly half of the world population of this species breeds at the South Farallon Islands. Their population is expected to benefit as a result of house mouse eradication from the South Farallon Islands.

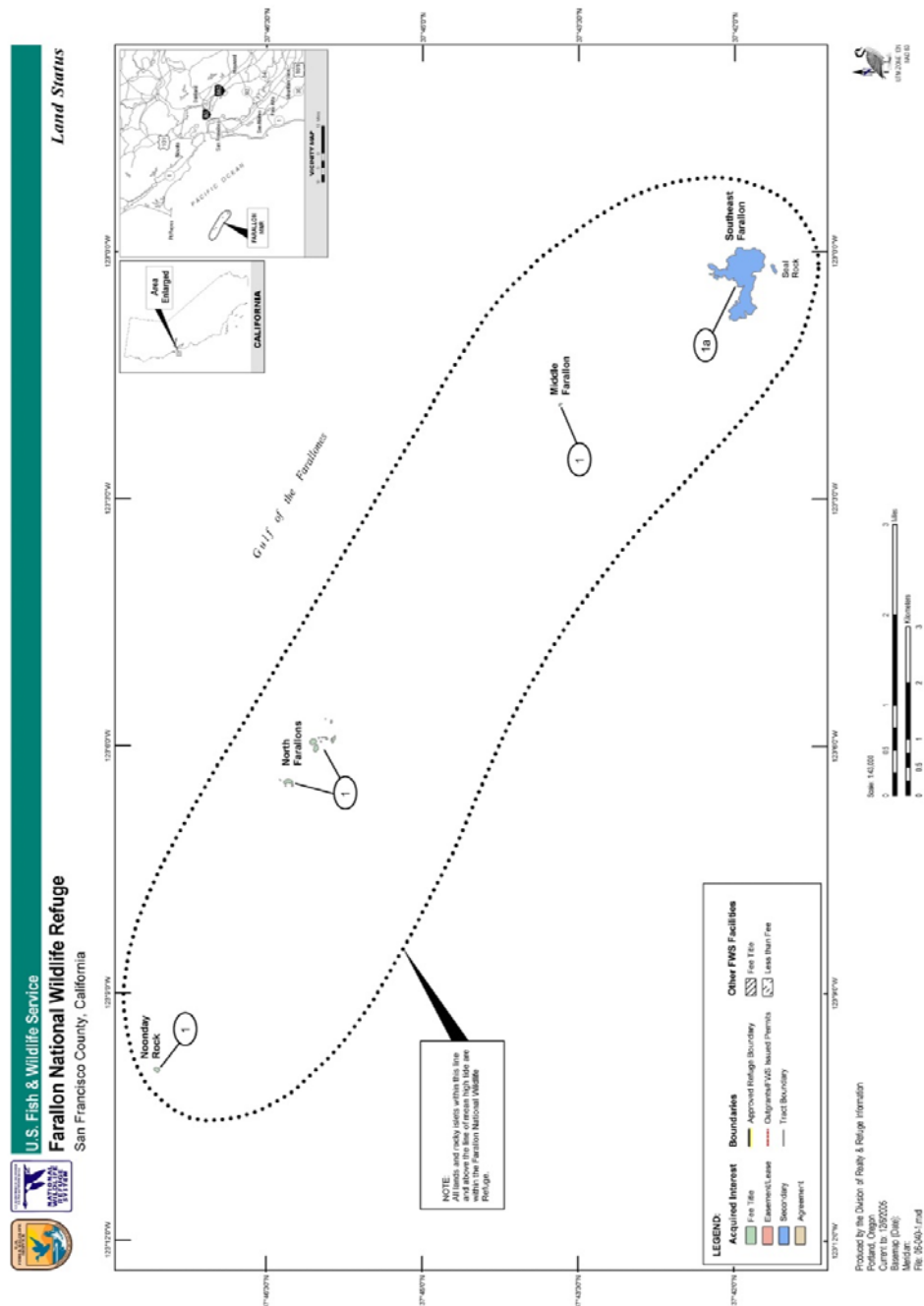


Figure 3. Map of the Farallon Islands National Wildlife Refuge. The invasive house mouse eradication project would be conducted only on the South Farallon Islands (Southeast Farallon and adjacent islands and islets), 30 miles west of San Francisco. Mice do not occur on the other islands.



Figure 4. The South Farallon Islands, California, viewed from the southeast.

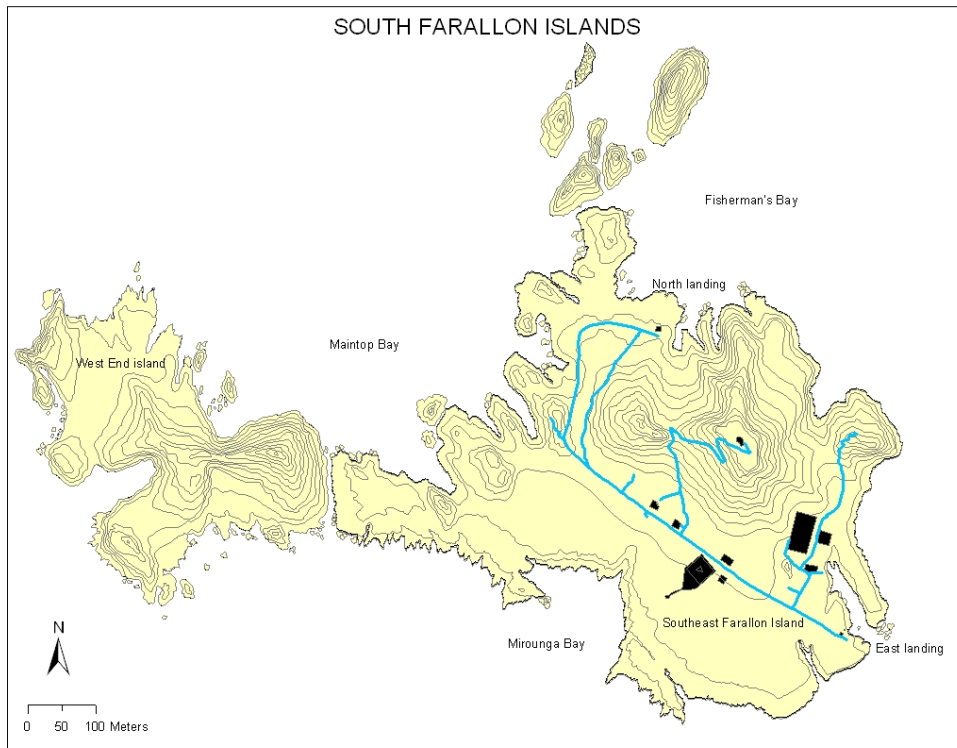


Figure 5. Topographic map of the South Farallon Islands, California. Black polygons represent buildings and other infrastructure; blue lines represent trails.

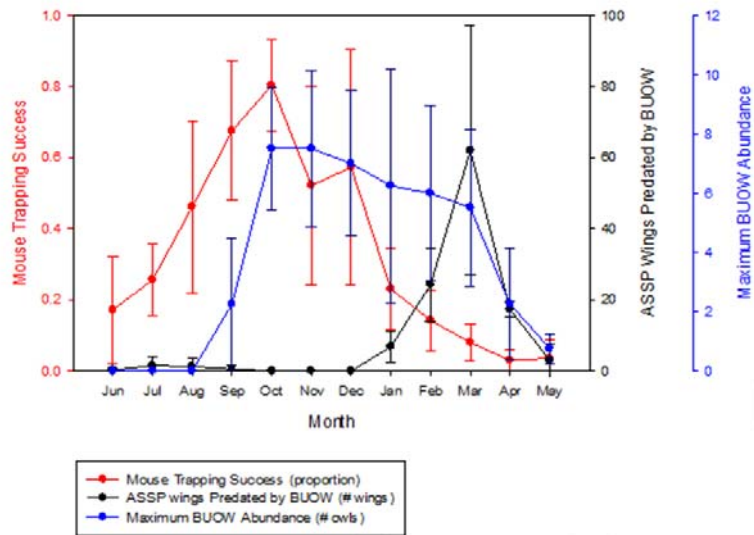


Figure 6. Seasonal cycle of house mouse abundance (2001-2004, 2011-2012), ash storm-petrel predation (ASSP) and burrowing owl (BUOW) abundance on Southeast Farallon Island. Monthly values with standard deviations are shown. [From USFWS (2013b)].

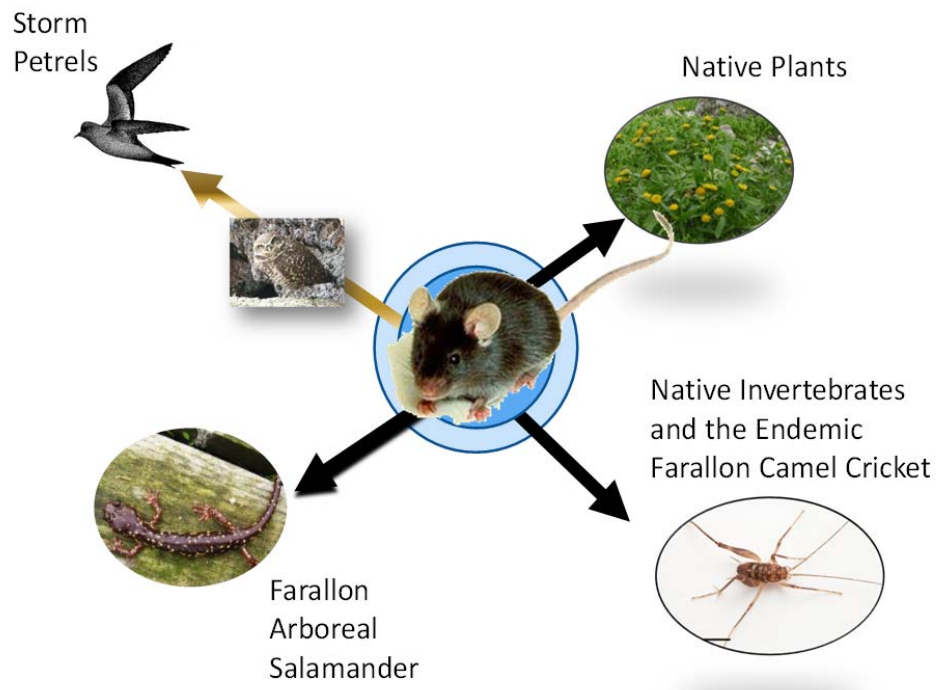


Figure 7. Food web of invasive house mice on the South Farallon Islands.

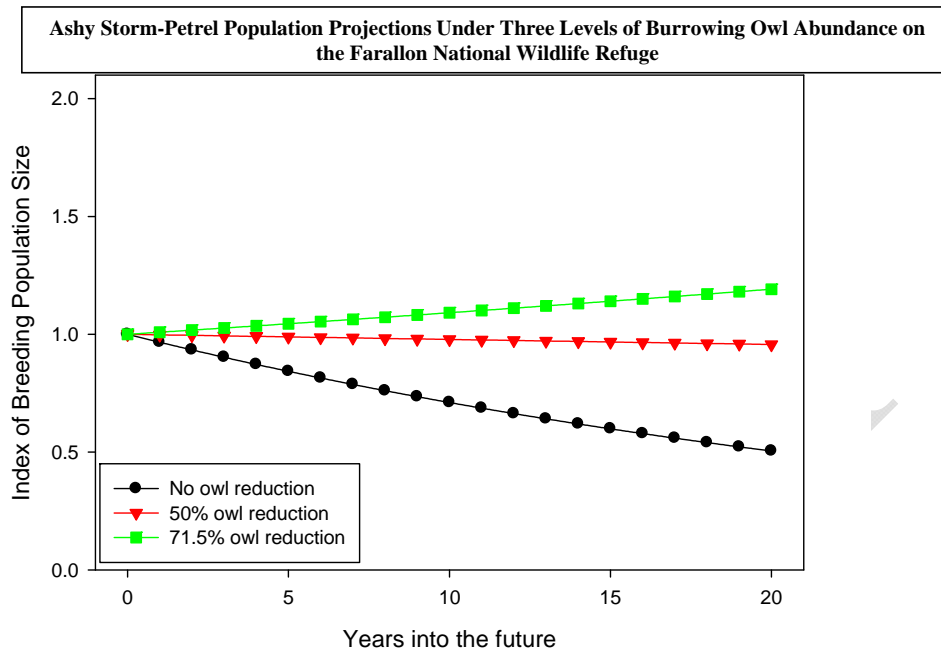


Figure 8. Farallon ashy storm-petrel population projections under three levels of reduction in burrowing owl winter abundance: Zero percent reduction, 50 percent reduction, and 71.5 percent reduction. Depicted are relative ashy storm-petrel breeding population sizes for a 20-year period with year Zero set to 1.0. Year Zero corresponds to most recent conditions and it is during this year that burrowing owl reduction is initiated. [From Nur et al. 2013 and USFWS 2013b].