

Appendix D1
Restore Seabirds to San Miguel Island

D1.1 GOALS AND NEXUS TO INJURY

This action aims to restore seabird nesting habitat on San Miguel Island in the Channel Islands National Park by eradicating the introduced black rat (*Rattus rattus*). Target species for restoration include burrow/crevice nesting seabirds such as the ashy storm-petrel, Cassin's auklet, and Xantus's murrelet, as well as other seabirds such as the western gull, Brandt's cormorant, the pelagic cormorant, and the pigeon guillemot.

Eggshell thinning and/or elevated levels of DDTs were documented in eggs of ashy storm-petrels, Cassin's auklets, western gulls, Brandt's cormorants, pelagic cormorants, pigeon guillemots, and Xantus's murrelets in the Southern California Bight (SCB) (Kiff 1994, Fry 1994). Section 5.1.1 provides a detailed description of the seabird nexus to the injuries of the Montrose case.

D1.2 BACKGROUND

Island ecosystems are critical for the conservation of biodiversity. They represent about 3 percent of the world's surface, but support approximately 15 to 20 percent of all birds, reptiles, and plants (Whittaker 1998). Of the 484 extinctions that have been recorded since 1600, at least 75 percent have been island endemics (World Conservation Monitoring Centre 1992). Non-native species were implicated in the majority of these extinctions (Atkinson 1985). Introduced rats alone are responsible for about 40 to 60 percent of all bird and reptile extinctions from islands (Howald et al. 2003). Rats have been introduced onto more than 80 percent of islands worldwide, causing ecosystem-wide effects on the distribution and abundance of native flora and fauna (Atkinson 1985), including in the Channel Islands National Park (Collins 1979, Erickson 1990, Erickson and Halvorson 1990).

Seabird life history characteristics make them particularly vulnerable to increased predation from introduced predators such as rats. For example, adult Xantus's murrelets sporadically leave their eggs unattended during the incubation period while they forage at sea. The unattended eggs are then vulnerable to predation by rats. Most seabirds are long lived and have high adult survivorship (Russell 1999). Even small reductions in adult survivorship can cause drastic reductions in annual population growth and colony persistence (Keitt et al. 2002). Rats affect multiple life history stages of seabirds and have been known to significantly reduce or eliminate seabird colonies in ecologically short periods of time (Kaiser et al. 1997, Atkinson 1985).

Introduced rats have an ecosystem-wide impact on the California Channel Islands. As documented on nearby Anacapa Island, introduced rats are known to feed and prey on many floral and faunal organisms, including terrestrial and intertidal invertebrates, reptiles and amphibians, land birds, and a wide variety of plant material (Erickson 1990). In addition, black rats likely contributed to the 20-year extirpation of the Anacapa deer mouse (*Peromyscus maniculatus anacapae*) from East Anacapa Island (Collins et al. 1979, Drost, pers. comm., 2000). In 2001 and 2002, the American Trader Trustee Council successfully implemented the Anacapa Island Restoration Project, eradicating black rats in an effort to restore seabird populations on the island. Given the similar goals and biological setting between the two projects, the Anacapa Island Restoration Project will serve as a successful model for the proposed effort on San Miguel Island.

D1.2.1 San Miguel Island and the Introduction of Rats

San Miguel Island is the westernmost island of the Channel Islands National Park and is managed by the National Park Service (NPS). This island totals 37 square kilometers (km²) (14 square miles) in size and is about 13 km (8 miles) long and 6 km (4 miles) wide. The island is primarily a plateau of about 150 meters (500 feet) in elevation with two 244-meter (800-foot) rounded hills. San Miguel Island is dominated by grassland, which covers most of the deeper, stabilized soils on the island terrace (Hochberg et al. 1979). San Miguel Island has a primitive campground, miles of hiking trails, and several large beaches.

It is unclear when rats were introduced to San Miguel Island. In the late 1980s, a small rat population appeared to have been restricted to the west side of the island along the coast from Harris Point to Tyler Bight (Erickson and Halvorson 1990). Collins (1979) documented rats using seabird nesting burrows for denning. Rats have also been documented on beaches and on the upper terraces of the island (Erickson and Halvorson 1990, Collins 1979). In March and July of 2004, a survey on San Miguel Island documented that rats are distributed along shorelines and within canyons on the island, but a more comprehensive survey is needed to determine the full extent of rat distribution on the island (IC 2004a). The many dry arroyos and erosion drainages provide key habitat and travel corridors for rats on the island, allowing rats to penetrate deep inland and across the island (Howald, pers. comm., 2004).

D1.2.2 Seabirds

San Miguel Island and its associated islets, Prince Island and Castle Rock, support regionally important and diverse seabird colonies, including one-third of the breeding seabirds in the Channel Islands (Wolf 2002). This area hosts at least 11 species of breeding seabirds, including significant populations of Brandt's cormorants, ashy storm-petrels, and Cassin's auklets. Other breeding species include Leach's storm-petrel, double-crested cormorant, pelagic cormorant, western gull, pigeon guillemot, and rhinoceros auklet. San Miguel Island and its associated islets represent the southern range on the west coast of North America for rhinoceros auklets, tufted puffins, and common murrelets. Similarly, this area is the northern end of the range for Xantus's murrelets and possibly black storm-petrels. Tufted puffins were recently observed on Prince Island (McChesney et al. 1995), and common murrelets were also observed in breeding plumage on Prince Island in 2004 (Whitworth, pers. comm., 2004).

Prince Island and Castle Rock are located 0.8 km (0.5 miles) and 1.2 km (0.75 miles) from San Miguel Island, respectively. There are currently no rats on either of these islets. The presence of rats on San Miguel Island presents a risk to the seabird colonies on Prince Island and Castle Rock, given their close proximity. It is possible that rats could disperse to these adjacent islets (e.g., via vegetation rafts or boats) and threaten these important seabird colonies.

D1.2.3 Marine Mammals

San Miguel Island is the only known place in the world where three different species of pinnipeds breed and the only area where five species are found. Breeding species include the California sea lion (*Zalophus californianus*), northern fur seal (*Callorhinus ursinus*), and northern elephant seal (*Mirounga angustirostris*). Harbor seals (*Phoca vitulina*) and Guadalupe fur seals (*Arctocephalus townsendi*) are also known to visit San Miguel Island.

D1.2.4 Endemic Species

The following endemic species on San Miguel Island are important considerations in the planning of this action: Channel Island song sparrow (*Melospiza melodia graminea*), San Miguel Island deer mouse (*Peromyscus maniculatus*), and San Miguel Island fox (*Urocyon littoralis littoralis*).

The Channel Island song sparrow is a resident sparrow endemic to the Channel Islands. This subspecies is considered to include the now-extirpated populations on San Clemente and Santa Barbara Islands (Patten 2001), and the formerly classified San Miguel song sparrow (*M.m. micronyx*).

The island fox (*Urocyon littoralis*) is a very small canid that inhabits six of the largest Channel Islands. The diminutive island fox is the largest native carnivore on the Channel Islands. Recent morphological and genetic studies support the division of the *U. littoralis* complex into six subspecies that are each limited in range to a single island, including San Miguel Island (USFWS 2004). The three most important food items in the diet of the San Miguel Island fox (*U.l. littoralis*) are deer mice, sea-fig (*Carpobrotus chilensis*), and insects (Collins and Laughrin 1979). Mice may be especially important prey during the breeding season because they are large, energy-rich food items that adult foxes can bring back to their growing pups (Garcelon et al. 1999).

The San Miguel, Santa Rosa, Santa Cruz, and Santa Catalina Island foxes have experienced precipitous declines in the last eight years (Coonan et al. 1998, Coonan et al. 2000, Roemer 1999, Roemer et al. 2001, Timm et al. 2000). Annual population monitoring documented a substantial decline in island fox populations on San Miguel Island between 1994 and 1999 (Coonan et al. 1998; Coonan et al. in press). During this time period, island fox populations dropped from an estimated 450 adults in 1994 (Coonan et al. 1998) to 15 foxes in 1999 (T. Coonan, unpublished data, as cited in USFWS 2004) as a result of predation by golden eagles (*Aquila chrysaetos*). Deer mouse densities rose sharply after the population crash of the island fox since the fox is the primary predator in the San Miguel Island ecosystem. The USFWS listed the San Miguel Island fox as an endangered species on March 5, 2004 (USFWS 2004).

In 1999, the NPS captured 14 (4 males and 10 females) of the 15 remaining foxes from San Miguel Island to protect the subspecies from further losses from predation by golden eagles and to initiate a captive propagation program. In 2003, the one remaining wild island fox was brought into captivity. In October 2001, NPS moved half of the captive foxes into a second breeding facility on the island to minimize the risk of a catastrophic event (e.g., wildfire or disease). The San Miguel Island fox captive population increased from 14 to 50 foxes after five years of captive breeding, and 10 of those foxes were released to the wild on San Miguel Island in fall 2004 (Coonan, pers. comm., 2005). Full recovery of the San Miguel subspecies may require annual releases of 10 to 20 foxes for as long as a decade (Coonan 2003).

In 2005, the NPS captive breeding program designed to restore the endangered island fox to the Northern Channel Islands produced a record 38 pups (NPS 2005). On San Miguel Island, 10 pups were born into captivity, bringing the total number of foxes in captivity to 49. A total of 4 new pups were recorded in the wild on San Miguel Island in 2005, thus increasing the total estimated number of foxes in the wild to 14 (NPS 2005).

D1.2.5 Project Goals

The goals of this action are to eradicate the introduced black rat, increase seabird populations, and prevent future rodent introductions. Due to the scale and complexity of the action, the NPS, with the assistance of the Natural Resource Trustees for the Montrose case (Trustees), will prepare a subsequent Environmental Impact Statement (EIS) or Environmental Assessment (EA) that will undergo public review and comment. This subsequent document will detail the specific methodologies of the action, the expected benefits and impacts, and the mitigation measures to reduce potential impacts. A general outline of the action is summarized below.

D1.3 PROJECT DESCRIPTION AND METHODS

D1.3.1 Approach

The use of rodenticides is critical to the successful eradication of rats from islands. Rats have been successfully removed from over 250 islands worldwide, the vast majority of which have been by the use of rodenticides (IC 2004b, Veitch and Bell 1990, Buckle and Fenn 1992, Taylor 1993). Nine rodenticides are registered for use in the United States. The anticoagulants (such as brodifacoum, warfarin, and diphacinone) are the only rodenticides that have resulted in complete eradication on islands. One or more of the anticoagulant rodenticides will be proposed for use on San Miguel Island. The U.S. Environmental Protection Agency (EPA) will be consulted to obtain registration of a rodenticide for rat eradication on San Miguel Island. Factors that will determine the rodenticide of choice include (1) previous successful use in island restoration projects, (2) demonstrated ability to eradicate the rat population, and (3) potential adverse effects on the San Miguel Island environment. Brodifacoum has been demonstrated to provide the greatest efficacy against the target species and has been used in the vast majority of successful island restoration projects, including the Anacapa Island Restoration Project.

Successful eradication requires the delivery of bait into every potential rat territory on the island, either by using bait stations deployed on a grid and/or by aerial broadcast from a helicopter, or, in some cases, broadcast by hand, or a combination of these techniques. Trapping rats has proven to be ineffective except on very small islands (e.g., Moors 1985b). San Miguel Island is within the size range of successful rat eradications that used bait stations or aerial broadcast. The specific methodology to be used on San Miguel Island will be determined by a combination of topography and size, previous successful uses, and a host of other biological constraints and considerations.

D1.3.2 Timing

The removal of the rats will be timed according to a set of biological conditions maximizing the probability of eradicating rats and minimizing the potential impact to the San Miguel Island environment (see below). Typically, eradication is more likely to be successful if bait is delivered during the dry season, when there is a food shortage and the rat population is in decline. The entire island will likely have to be treated at one time to prevent reinvasion of treated portions of the island.

D1.3.3 Mitigation Measures

This action will be designed and implemented in a manner that avoids, minimizes, and mitigates impacts to the natural environment on San Miguel Island. Measures to avoid and mitigate any impacts from the action will be developed during the planning phases and will be addressed in the subsequent EIS or EA. The successful mitigation program used on Anacapa Island will be considered during the development of a mitigation program for San Miguel Island. The following mitigation measures are examples that may be incorporated into the program design:

- Birds
 - Color and size bait appropriately to minimize direct consumption by seed-eating birds.
 - Use bait that will break down rapidly in the San Miguel Island maritime climate.
 - If possible, avoid bait application during bird breeding season and peak of land bird migration.
 - Design field transects in a manner that minimizes disturbance to seabird roosting habitat.
 - Avoid working for extended periods of time in vicinity of seabird roosts.
 - Reduce non-target poisoning of predatory birds with use of techniques such as live capture, holding, and/or translocation.
 - Protect Channel Island song sparrows by captive holding subset of the population of birds and releasing them once threat of exposure is removed.
- Marine Mammals
 - Avoid bait application during marine mammal pupping seasons.
 - Design field transects in a manner that minimizes disturbance to marine mammal haul outs.
 - Avoid working for extended periods of time in vicinity of rookeries and haul outs.
 - Work cautiously and slowly around animals using techniques that minimize disturbance.
- San Miguel Island Deer Mouse
 - Design a comprehensive protection plan for the deer mouse that incorporates successful techniques used in the Anacapa Island Restoration Project. Strategies to reduce impacts will likely include captive holding, as well as breeding mice in facilities on San Miguel Island for later release onto the island. Because the deer mouse is an important food source for the island fox, it will be necessary to protect more mice than would be necessary to strictly protect the species.
- San Miguel Island Fox
 - The presence of the endangered island fox presents a unique challenge since there is no precedent for rat eradication from an island with an endemic carnivore such as the island fox. An initial planning step will be to assemble a team of experts, including ecologists, veterinarians, NPS managers, behaviorists, toxicologists, and rodent control technicians, to address the feasibility of the project in light of the potential impacts of the project on the island fox. During this initial step, a comprehensive avoidance, minimization, and

mitigation program will be developed to reduce the potential impacts to the island fox to acceptable levels.

D1.4 ENVIRONMENTAL BENEFITS AND IMPACTS

D1.4.1 Biological

Benefits

The eradication of rats from San Miguel Island will benefit a variety of seabirds by increasing the amount of available seabird nesting habitat and decreasing predation on eggs, chicks, and adults. A reduction in predation will lead to increased population size and breeding success of seabirds on San Miguel Island. Small crevice-nesting seabirds, such as the ashy storm-petrel, Cassin's auklet, and Xantus's murrelet, will likely benefit from the elimination of a predator that is known to take eggs, chicks, and adults. Ecological monitoring on Anacapa Island after bait application has demonstrated an increase in the number of breeding Xantus's murrelets, and these birds were found in new habitat areas from which rats had previously excluded them (Howald et al. 2005). Within four months following bait application, two Cassin's auklet nests were found with chicks on Anacapa Island. This observation represented the first recorded nesting of this species on the island (Howald et al. 2005).

Although small burrow-nesting seabirds are particularly vulnerable to rat predation, larger seabirds have also been predated by rats. Studies have shown rats to be a source of predation to larger seabird eggs and chicks, including herring gulls and northern fulmars (Zonfrillo 2000), as well as Laysan albatrosses (Moors and Atkinson 1984). Therefore, larger seabirds on San Miguel Island (e.g., western gulls) are also likely to experience increased reproductive success from the elimination of rats on the island. Although the presence of the island fox limits the utility of much of San Miguel Island for seabirds, there are steep areas of suitable seabird habitat on the island that are accessible to rats but not to foxes. These areas in particular will benefit from rat eradication.

Prince Island and Castle Rock are located within less than 1 mile of San Miguel Island; therefore, the eradication of rats on San Miguel Island will remove a threat to the regionally significant seabird populations that nest on these islets. Eliminating this risk of rat introduction to these islets is an important benefit of the project.

In addition to benefiting seabirds, eradicating rats from San Miguel Island will likely have ecosystem-wide benefits. Based on the results of post-application monitoring efforts from Anacapa Island, positive changes have already been measured in the Anacapa Island deer mouse, side-blotched lizard, and vegetation. Monitoring results on Anacapa Island demonstrated a two-fold increase in the survival of juvenile side-blotched lizards after rat removal (Comendant and Sinervo 2002). As was observed on Anacapa Island, land birds, lizards, and other species will likely benefit from the action on San Miguel Island. Because peregrine falcons consume seabirds on the Channel Islands, they are also expected to benefit from an increase in their prey base.

In summary, rat eradication on San Miguel Island should result in: (1) increases in small crevice-nesting seabird populations (such as alcids and storm-petrels); (2) decreased predation on ground-nesting seabirds such as western gulls; (3) protection of the important seabird colonies on

Prince Island and Castle Rock from rat invasion; (4) decreased predation of some terrestrial and marine intertidal invertebrates; and (5) broad ecological benefits to the San Miguel Island ecosystem.

Impacts

To successfully eliminate rats from San Miguel Island, a highly efficacious rodenticide must be used to ensure complete eradication. Because there are no rat-specific toxicants, the use of a rodenticide to eradicate rats will pose a risk of poisoning non-target species on San Miguel Island. Non-target species are defined as those species that are unintentionally exposed to the rodenticide. Although non-target poisoning is likely, the probability of poisoning depends on the toxicity of and the organism's exposure to the rodenticide.

Non-target poisoning is generally categorized as primary or secondary poisoning. Primary poisoning occurs when a non-target species consumes the bait directly. The species most at risk for primary poisoning on San Miguel Island are the deer mouse (Erickson and Halvorson 1990), song sparrow and other granivorous birds, and the island fox. Any individual that feeds on a primarily poisoned organism is at risk of secondary poisoning (e.g., a bird that feeds on a poisoned rodent). Species most at risk for secondary poisoning include predatory birds and the island fox.

Record and Marsh (1988) and Taylor (1993) identified elements involved in determining whether a rodenticide poses a poisoning hazard to non-target species: (1) chemical and toxicological properties of the rodenticide; (2) composition of the bait and how it is applied; (3) behavior of non-target species at risk; (4) behavior of the target species both when intoxicated and at death; and (5) local environmental factors. Each of these variables will be analyzed and presented in the EIS or EA developed by NPS. Studies will be conducted to evaluate the potential risk of poisoning non-target species and to develop appropriate mitigation measures. This action will proceed only if the risks to non-target species, in particular the endangered island fox and endemic deer mouse, can be minimized to an acceptable level.

The recent successful rat eradication on Anacapa Island can be used to predict some of the potential impacts from the proposed action. Subsequent planning will determine whether the mitigation measures used on Anacapa Island will be appropriate for use on San Miguel Island. The presence of the endangered island fox, however, is a unique feature of the San Miguel Island project that will require a complete analysis of the feasibility of the project, the potential impacts of the project on the island fox, and the development of a comprehensive mitigation program for the island fox.

Birds

During the Anacapa Island Restoration Project, a total of 94 individual birds are known to have died from the use of brodifacoum, but the impact had a negligible effect at a population level (Howald et al. 2005). The presence of the endemic song sparrow on San Miguel Island will require additional effort to minimize and mitigate exposure risk, such as the captive holding of a representative population. Although there will likely be short-term impacts, the elimination of the non-native rats should directly benefit the sparrow population as a whole in the long term. On

Anacapa Island, land birds such as the song sparrow, house finch, and Bewick's wren were breeding within six months after the bait drop (Howald et al. 2005).

Birds that consume live rodents or carcasses will be at risk for secondary poisoning. The Anacapa Island Restoration Project demonstrated that the majority of monitored rats died underground after consuming the rodenticide and were therefore unavailable as food to avian scavengers after approximately one week (Howald et al. 2005). This is consistent with other field studies that evaluated the fate of anticoagulant-poisoned rodents (Taylor and Thomas 1993, Fenn et al. 1987). Nonetheless, western gulls, common ravens, and birds of prey will still be at risk for secondary exposure. Several measures implemented successfully on Anacapa Island, such as coloring the bait and timing the project outside the breeding season, will minimize potential impacts. Impacts to predatory birds will also be minimized by capturing and holding those birds until the period of risk is over. Monitoring results from the Anacapa Island Restoration Project confirm that insectivorous birds are not likely to experience extensive secondary poisoning by preying on invertebrates that ingested bait or tertiary poisoning by preying on invertebrates that fed on poisoned rat or mouse carcasses.

Roosting seabirds may be temporarily disturbed during either an aerial or bait station operation. However, the operation will be timed to coincide with seasonal minimums in the number of seabirds and land birds. Monitoring from the Anacapa Island Restoration Project demonstrated that seabirds were only temporarily disturbed by the operation.

Deer Mouse

The presence of the endemic deer mouse poses a biological challenge to the eradication of rats from San Miguel Island. Because rodenticides are designed to kill rodents, the bait will be attractive and poisonous to mice as well as rats. It is anticipated that any deer mouse that is not in captivity will be killed by the operation. However, deer mice are prolific breeders and can undergo considerable annual population fluctuation. Any reductions in the deer mouse population caused by rat eradication measures would probably not have a significant long-term effect on the population as long as an effective population size remains (Howald, pers. comm., 2004). Therefore, a strategy that removes the potential for rodenticide exposure to all mice will be necessary for the long-term protection of this endemic population.

The Anacapa Island Restoration Project clearly demonstrated that rats can be removed from an island with an endemic rodent. With the implementation of the mitigation measures and excellent environmental conditions for release and breeding, mouse densities on Middle Anacapa Island approximately 6.5 months after release were comparable to densities measured prior to the rat eradication (Howald et al. 2005). Application of established methods used on Anacapa Island (e.g., captive holding/breeding techniques) should effectively mitigate temporary impacts on the native mouse population of San Miguel Island.

Island Fox

There is no precedent for the eradication of rats from an island with an endemic carnivore such as the island fox. Any form of anticoagulant bait application on the island will present a secondary exposure risk to foxes through the consumption of any dead rodents that may be available. Because of the high likelihood of exposure to foxes, an effective mitigation strategy

must be implemented to ensure that direct exposure is avoided. Such a strategy will involve captive holding of foxes for a period of time. Foxes may also be impacted by the temporary reduction in available mice following bait application. Strategies to minimize and mitigate potential short-term and long-term impacts to the foxes (e.g., captive holding) will be developed during the preparation of additional environmental documentation. Also, future consultation with the U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act will ensure that the proposed action does not jeopardize the survival and recovery of the San Miguel Island fox.

Marine Mammals

Marine mammals hauled out on beaches may be temporarily disturbed during either an aerial or bait station operation. The operation will minimize disturbance to marine mammals using the minimization measures outlined earlier. However, minor disturbances to marine mammals from the helicopter activity and hand bait application are anticipated.

Erosion

Project implementation and monitoring may result in minor soil erosion and compaction. However, the benefits of the eradication (including stopping weed seed dispersal by rats) will offset any potential impacts from soil erosion. Careful planning and ongoing monitoring will minimize any negative impacts due to soil erosion and compaction. Procedures for staff will be implemented to minimize risks of weed seed dispersal.

Summary

The eradication of rats worldwide has documented ecosystem-wide benefits. In some cases, there have been short-term negative impacts; however, the impacts have been of short duration, and recoveries of some species to higher population levels and/or greater productivity than pre-eradication conditions have been documented (e.g., Towns 1991). In most cases, wildlife managers have determined that long-term benefits to island ecosystems with the removal of introduced rats greatly outweigh the short-term impacts to non-target species. All of the potential benefits and impacts of this action will be fully evaluated during the planning phase. Should the subsequent analysis show that this action is infeasible or that potential impacts are unacceptable, this action would not be implemented.

D1.4.2 Physical

Benefits

There are no known benefits to geology/earth resources, water resources, oceanographic and coastal processes, air quality, or noise receptors.

Impacts

There are no known impacts to geology/earth resources, water resources, air quality, and noise receptors. Specific measures will be developed and implemented to ensure that bait does not

enter the marine environment. On Anacapa Island, a small amount of bait entered the water indirectly from bouncing off of cliffs. Divers documented that the pellets began to degrade 1.5 hours after the bait drop and became scattered crumbs at 5 hours after the bait drop (Howald et al. 2005). No fish or other animals were observed feeding on the bait. No brodifacoum residues were detected in any of the fish or invertebrate samples that were collected. In addition, no brodifacoum residues were detected in water samples taken from the marine environment at either 24 or 48 hours after the application (Howald et al. 2005). Unlike Anacapa Island, San Miguel Island does not have steep cliffs; therefore, there are very few areas where bait would bounce off of cliffs and into the water.

D1.4.3 Human Use

Benefits

This action will have no known benefits to cultural, socioeconomic, aesthetic, or transportation resources.

Because rats pose health and safety hazards (e.g., Pratt et al. 1977) and can cause destruction to supplies and equipment, the eradication of rats will benefit visitors and NPS personnel on San Miguel Island. Although there have been no known rodent-vectored diseases transmitted to island staff or residents in the recent past, there is potential in any rodent population for the transmission of disease to humans. Health and safety standards will be improved at NPS facilities on the island, and a potential source of disease will be eliminated. The removal of black rats from San Miguel Island will be expected to have long-term health, safety, aesthetic, and recreational benefits and will remove a destructive nuisance to human habitation and use of the island.

Impacts

This action will have no known impacts to cultural, aesthetic, or transportation resources. Cultural resources will be avoided on the island during the operation.

To minimize potential exposure to visitors, San Miguel Island will be closed for several days. Recreational activities such as camping and hiking will not be permitted during that timeframe. However, due to its distance from the mainland and the annual visitation rate of less than 200 campers each year, the closure of the island will not have a significant impact on recreational and visitor activities.

With the exception of possible skin irritation caused by contact with bait by project workers, negative impacts of the rodenticide on humans is not expected. Project workers will follow proper safety procedures to avoid contact with the bait.

D1.5 LIKELIHOOD OF SUCCESS/FEASIBILITY

The eradication of rats from offshore islands has been successfully demonstrated worldwide. As of 2002, rats have been removed from more than 250 islands (IC 2004b). San Miguel is within the size range of successful eradications using bait stations or aerial broadcast. The recent successful removal of rats from Anacapa Island demonstrates that such a project can successfully

overcome the complex regulatory and biological challenges facing these types of restoration projects in the United States. Although the presence of the endangered San Miguel Island fox is a significant factor not present on Anacapa Island, the experience, knowledge, and lessons learned from the Anacapa Island Restoration Project will be applied to this action. All of the potential benefits and impacts of this action will be fully evaluated during the planning phase through additional environmental documentation. Should the subsequent analysis show that the action is infeasible or that potential impacts are unacceptable, this action would not be implemented.

A key factor to the success of the action is the development and implementation of a plan to prevent the reintroduction of rats to San Miguel Island. The effort and conservation gains made from the eradication could be negated with the reintroduction of rodents or other non-native species. Invasive species, including vertebrates, invertebrates, weeds, and pathogens can all be transported to the island inadvertently and have detrimental impacts on breeding seabirds. The rodent reintroduction prevention plan will be one component of a comprehensive program designed to prevent many non-native species from being introduced onto the island. This program will build upon the rodent reintroduction prevention plan that is being implemented on Anacapa Island by the NPS. The plan will address rat spill¹ kits, quarantine, monitoring, and response actions.

With the use of techniques employed in successful eradication programs elsewhere and implementation of a comprehensive prevention plan, the probability of successful eradication of rats on San Miguel Island is high.

D1.6 PERFORMANCE CRITERIA AND MONITORING

The success of restoration activities on San Miguel Island will be measured by the complete removal of the rats from the island and subsequent increases in seabird populations. A long-term monitoring plan, to be developed and detailed in the subsequent EIS or EA, will expand on the following proposed research and monitoring actions:

- Collect baseline data on rat and mouse distribution patterns, relative abundance, and habitat use.
- Use a combination of trapping and ecological indicators to evaluate the presence/absence of rats using pre-eradication survey data to compare to post eradication data.
- Conduct mouse/seabird/land bird/fox monitoring before and after the bait application to quantify impact and recovery of these populations.
- Test unarmed bait consumption by non-target animals.
- Monitor the island fox captive breeding program following standard guidelines.
- Monitor populations of native fauna and flora before, during, and after bait application to document potential benefits and impacts.
- Develop long-term monitoring to detect any introductions as early as possible, and build the capacity to respond to and eliminate any introduction of non-native rodents or other species.

¹ A rat spill is the accidental importation of rats to a rat-free island.

The benefits of rat removal to seabirds that breed and roost on the island may be evaluated by increase in population number, increase in habitat availability, and reduced predation. Measuring statistically meaningful population increases in any seabird species on San Miguel Island may take years or even decades. However, increased habitat availability and reduced predation were demonstrated as soon as five months after the eradication of rats on Anacapa Island. In the absence of rats, sea cave nest monitoring of Xantus’s murrelets demonstrated high nesting effort and hatching success, no nest depredation, and signs of an expansion of their nesting range on Anacapa Island (Whitworth et al. 2003).

Protocols for seabird monitoring in the Channel Islands were developed in the 1980s. Consequently, the methods for seabird monitoring in the Channel Islands are well established and standardized. The NPS periodically monitors seabirds on Prince Island (primarily Cassin’s auklets), and historical information is available. However, currently no seabird monitoring occurs on San Miguel Island or Castle Rock, and minimal historical information exists. To evaluate the benefits of the action, baseline surveys of seabird populations will be conducted before project implementation.

D1.7 EVALUATION

The Trustees have evaluated this action against all screening and evaluation criteria developed to select restoration actions and concluded that this action is consistent with these selection factors. The Trustees determined that this type and scale of action will provide long-term benefits to seabird populations, including small crevice-nesting seabirds such as the ashy storm-petrel, Cassin’s auklet, and Xantus’s murrelet as well as ground-nesting seabirds such as the western gull. This action will likely also have benefits to peregrine falcon populations in the Northern Channel Islands and will likely provide long-term benefits to the ecosystem on San Miguel Island.

Multiple government agencies and experts will be involved in the development, evaluation, and implementation of the rat eradication program. Consultation with these agencies is required before implementation of the rat eradication program. The USFWS will be consulted regarding potential effects to endangered species under Section 7 of the Endangered Species Act. Based on the Anacapa Island Restoration Project, this action will also seek a Migratory Bird Take Permit from the USFWS to address potential impacts to migratory birds. The EPA will be consulted to obtain registration of a rodenticide for rat eradication on San Miguel Island. In addition, a subsequent EIS or EA will be prepared for public review prior to project implementation.

D1.8 BUDGET

Project management (development, implementation, and monitoring).....	\$1,065,000
Project environmental compliance/project management (NPS)	\$330,000
Eradication	\$513,000
Mitigation (deer mice, birds)	\$300,000
Mitigation (fox).....	TBD
Supplies.....	\$75,000
Equipment.....	\$65,000

Appendix D1
Restore Seabirds to San Miguel Island

Transportation.....	\$75,000
Public outreach.....	\$30,000
Estimated Total.....	\$2,453,000