

Appendix D5
Restore Seabirds to Baja California Pacific Islands

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Restore Seabirds to Baja California Pacific Islands

The Natural Resource Trustees for the Montrose case (Trustees) have evaluated a variety of seabird restoration actions for the Baja California Pacific islands in Mexico. These islands support a wide range of seabirds that nest in or use the Southern California Bight (SCB). Restoration efforts would target a suite of seabird species, including the Cassin's auklet, Brandt's cormorant, double-crested cormorant, California brown pelican, ashy storm-petrel, and Xantus's murrelet. To streamline the evaluation of these actions, the general background and regulatory framework is provided below. Detailed project descriptions are then provided for the following islands: (1) Guadalupe Island, (2) Coronado and Todos Santos Islands, (3) San Jeronimo and San Martín Islands, and (4) San Benito, Natividad, Asunción, and San Roque Islands. The actions discussed in this appendix do not cover all of the potential seabird restoration actions for the Baja California Pacific islands; therefore, the Trustees will consider additional actions in the future for implementation under this Restoration Plan, as appropriate.

D5.1 GENERAL BACKGROUND

The Baja California Pacific islands are located in the northwestern portion of Mexico, off of the Pacific coast of Baja California (Figure D5-1). Of the 12 islands or island groups (18 total islands) in this region, nine present unique opportunities for seabird restoration. Three of these islands or island groups (Coronado, Todos Santos, and San Martín) are oceanographically considered part of the SCB. The remaining six islands (San Jeronimo, San Benito, Guadalupe, Natividad, Asunción, and San Roque) are located south of the SCB but are still part of the California Current System. This system, which extends from southern British Columbia to Baja California, is one of the most highly productive eastern boundary currents in the world.

The Baja California Pacific islands support a diverse group of breeding seabirds and are known for their overall high levels of biological diversity and endemism. As shown in Table D5-1, 17 species and 8 subspecies of seabirds breed on the Baja California Pacific islands. Ten of these species also breed on the California Channel Islands (Wolf 2002). Of these 10 shared species, 5 have special-status listings in the United States as endangered, threatened, or species of special concern.

Most of the seabird colonies in Mexico and California form part of a larger metapopulation of seabirds that breed, forage, and disperse into and through the SCB and surrounding marine environment. Breeding seabirds in this region have been documented moving between islands, and crossing the U.S./Mexico border to use islands in the Mexican portion of the SCB and other islands further south and into the Gulf of California. This is best illustrated by the California brown pelican metapopulation, which is divided into four populations: the Southern California Bight, the Baja California Coastal, the Gulf of California, and the Mexican Mainland populations (Gress and Anderson 1983). The SCB population includes colonies both on the Channel Islands and the northwestern Baja California Pacific islands of Coronado, Todos Santos, and San Martín. California brown pelicans within the SCB population have demonstrated interchange of birds, use of same prey resources, and population shifts in response to prey availability (Anderson and Gress 1983). California brown pelicans also demonstrate regular multidirectional movement across the border, with birds from the Gulf of California and Baja California moving into the SCB and Salton Sea regions (Anderson and Gress 1983).

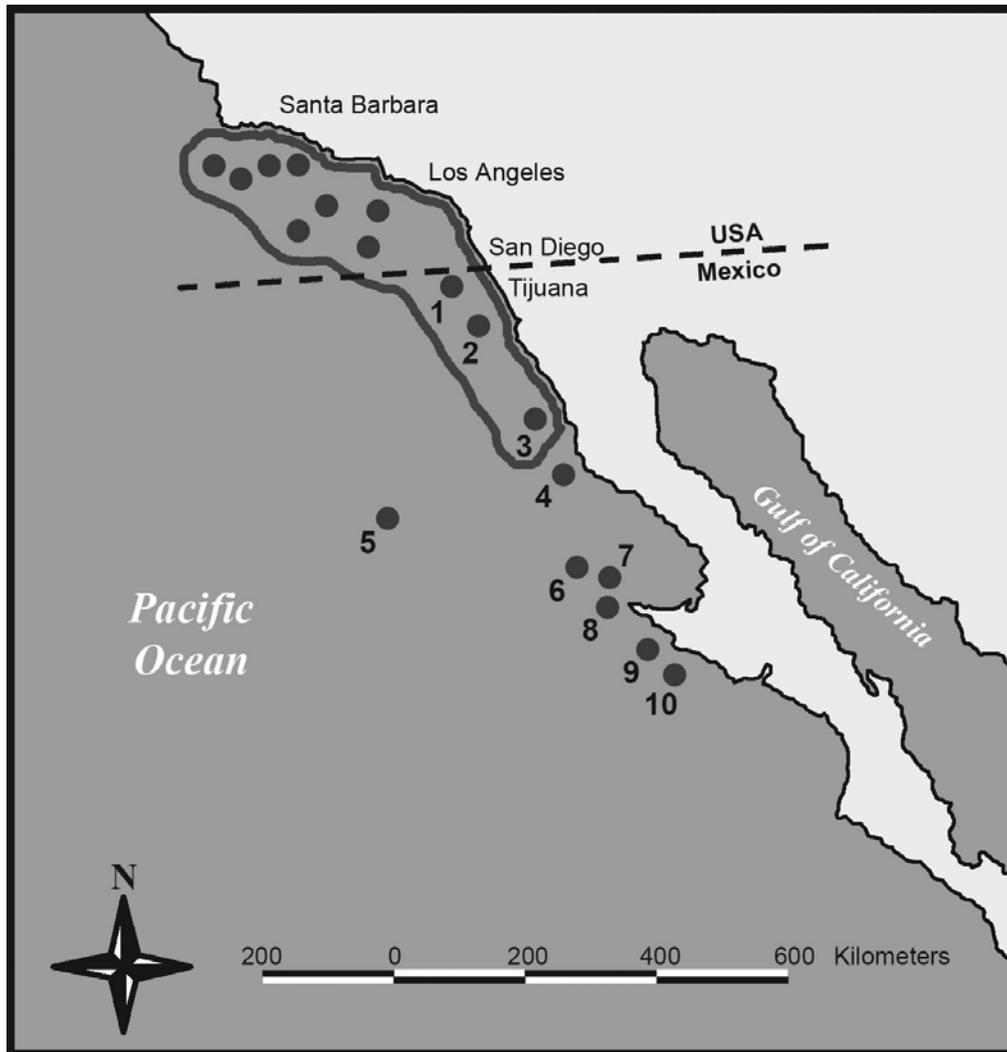


Figure D5-1. Baja California Pacific islands.

Identification of islands: (1) Coronado (2) Todos Santos (3) San Martín (4) San Jeronimo (5) Guadalupe (6) San Benito (7) Cedros (8) Natividad (9) San Roque (10) Asunción. The solid line indicates islands located within the Southern California Bight.

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Table D5-1
Characteristics of Birds That Breed on the Baja California Pacific Islands

Breeding Seabirds on Baja California Pacific Islands	Breeding on Channel Islands?	Disperse/ Forage in SCB?	Status in Mexico	Status in United States	International Union for Conservation of Nature and Natural Resources (IUCN) Status
Leach's storm-petrel	Yes	Yes	FE, FT ¹		
Ashy storm-petrel	Yes	Yes	FT	SSC	LR/nt
Black storm-petrel	Yes	Yes	FT	SSC	
California brown pelican	Yes	Yes		FE, SE	
Double-crested cormorant	Yes	Yes		SSC	
Brandt's cormorant	Yes	Yes			
Pelagic cormorant	Yes	Yes			
Western gull	Yes	Yes			
Xantus's murrelet	Yes	Yes	FE	ST	VU
Cassin's auklet	Yes	Yes	FT	SSC	
Laysan albatross	No	Yes	FT		
Black-vented shearwater	No	Yes	FE		
Least storm-petrel	No	Yes	FT		
Magnificent frigatebird	No	Yes			
Heermann's gull	No	Yes	SP		LR/nt
Least tern	No	Yes	FE	FE, SE	
Craveri's murrelet	No	Yes	FT		

¹ Three subspecies are listed: *O.l. chapmani* (FT), *O.l. socorroensis* (FE), *O.l. cheimomnestes* (FT)

FE = Federal Endangered, FT = Federal Threatened, LR/nt = Lower Risk/near threatened, SE = CA State Endangered, SP = Special Protection, SSC = Species of Special Concern, ST = CA State Threatened, VU = Vulnerable

Metapopulations serve to create more stable and viable populations because each individual colony buffers the others against extinction (Petersen and Frederiksen 2000). This is especially important when populations undergo large perturbations such the DDT-induced reproductive failures of pelicans and cormorants in this region. As the SCB population of brown pelicans recovered from DDT-induced population declines, the Baja California Coastal population and most likely the Gulf of California population supplied pelicans that helped to restore the SCB population. San Martín Island in Mexico is likely one such source for pelicans in the U.S. portion of the SCB (Anderson and Gress 1983).

In addition to movement of breeding birds and natal dispersal between colonies on either side of the U.S./Mexico border, a large number of birds breeding in Mexico annually disperse during the non-breeding season into the U.S. portion of the SCB. Dispersal also occurs in the reverse direction, with birds from the U.S. going south to roost on islands in Mexico. During the fall and winter, populations of Brandt's cormorants, double-crested cormorants, and California brown pelicans increase dramatically, surpassing the total number of breeders in the U.S. alone

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(Thelander 1994). Other species that breed along the Pacific coast of Baja California or in the Gulf of California but not in the U.S. portion of the SCB are also observed in large numbers during the non-breeding season, indicating that they disperse into U.S. waters for foraging. These species include the Craveri's murrelet (Deweese and Anderson 1976), black-vented shearwater (Keitt et al. 2000), Heermann's gull (Islam 2002), elegant tern (Burness et al. 1999), the southern subspecies of Xantus's murrelet (Drost and Lewis 1995), least storm-petrel, and black storm-petrel (Ainley and Everett 2001). Thus, large portions of these species' populations are exposed to threats within the U.S. and along the northwest coast of Baja California during the non-breeding season.

Because seabird populations overlap international boundaries, protection and restoration of seabird colonies in Mexico directly benefits seabirds nesting on the Channel Islands and foraging in the SCB. Robust seabird colonies in Mexico are also important to ensure the survival of shared species should catastrophic events (e.g., oil spills) lead to a severe decline in seabird numbers on the Channel Islands.

D5.1.1 Jurisdictional and Legal Framework in Mexico

The Baja California Pacific islands are owned by the Mexican government, and access to them is controlled by the Secretariat of Gobernación (Gobernación). Because these islands support globally important populations of marine birds, Mexico's federal government recognizes the Baja California Pacific islands as critical habitat (Ezcurra, pers. comm., 2004). Several seabirds that breed on the Baja California Pacific islands are listed as endangered or threatened under the Norma Oficial Mexicana 059 (the Mexican equivalent of the U.S. Endangered Species Act). The federal designation of seabirds such as Xantus's murrelet, Cassin's auklet, and the ashy storm-petrel further facilitates protection of nesting habitat on these islands (Ezcurra, pers. comm., 2004).

Several Mexican laws are applicable to the conservation of natural resources on the islands, including the General Wildlife Law of 2000 and the General Law of Ecological Balance and Environmental Protection (LGEEPA) of 1988. The General Wildlife Law is implemented primarily by the Secretary of the Environment and Natural Resources (SEMARNAT) Wildlife Directorate General and provides general authority for conservation of migratory species and species restoration, as well as more detailed regulation of wildlife management and use. The LGEEPA focuses on the preservation and restoration of ecological balance and addresses the issues of Natural Protected Areas, jurisdiction, ecological zoning, and enforcement.

Within the Mexican government, several entities are responsible for management and enforcement on the islands. Gobernación is responsible for access to the Baja California islands. Visitors to the islands must obtain permits from the Gobernación prior to landing on the islands. Regulatory enforcement on the islands is the responsibility of the Federal Environment Protection Agency (PROFEPA). Created in 1992 and operating under the SEMARNAT umbrella, PROFEPA is responsible for enforcing Mexican environmental law such as the LGEEPA. The Mexican Navy has responsibility for the waters surrounding the islands and has agreements with the Secretariats (including SEMARNAT, Gobernación, and the National Fisheries and Aquaculture Commission) to enforce their regulations.

D5.1.2 Natural Protected Areas

The National System of Natural Protected Areas was created in 1983 and is one of Mexico's fundamental biodiversity conservation policy tools. This status is meant to protect the most diverse and ecologically important areas of Mexico. The Natural Protected Areas are “areas within the national territory, where the original environmental conditions haven't been significantly altered by human activity or areas that require protection and restoration...” (LGEEPA, Article 3). There are six different categories of Natural Protected Areas in Mexico: (1) Biosphere Reserves, (2) National Parks, (3) Natural Monuments, (4) Areas for the Protection of Natural Resources, (5) Areas for the Protection of Wildlife, and (6) Natural Sanctuaries. The National Commission of Natural Protected Areas (CONANP) is a decentralized organization of SEMARNAT and is charged with management of Natural Protected Areas. PROFEPA is responsible for enforcing rules on Natural Protected Areas through inspection and surveillance.

D5.1.3 Status of Baja California Pacific Islands

The current status of the Baja California Pacific islands varies among the different islands. Because of their unique ecology and biodiversity, the islands are designated a Marine Priority Area for Conservation by the Mexican National Commission for Knowledge and Use of Biodiversity.

The islands under consideration in this proposal fall under three categories: (1) Biosphere Reserve, (2) Natural Protected Area, and (3) proposed Biosphere Reserve. Natividad Island, San Roque Island, and Asunción Island were incorporated into the Vizcaíno Biosphere Reserve in 1988. Guadalupe Island first received special status in 1928 (Munoz et al. 2003) and was designated a Biosphere Reserve on April 25, 2005, as recorded in the Diario Oficial (Mexican Federal Register).

Efforts between local groups and the Mexican government are currently under way to establish the remaining Baja California Pacific islands (including Cedros, San Jeronimo, San Martín, Todos Santos, San Benito and Coronado) as a protected area. A technical study was completed by Grupo de Ecología y Conservación de Islas in support of the designation. In July 2003, the Mexican Congress called upon Gobernación and SEMARNAT to determine the legal and environmental status of the islands (Congress of the Union 2004). On June 3, 2005, SEMARNAT published in the Mexican Federal Register a public notification of their intent to decree a new Biosphere Reserve for 19 islands off the Pacific Coast of Baja California and Baja California Sur and the marine waters around them, as recorded in the Diario Oficial. The designation of these islands as a protected area would create a legal infrastructure for enforcing regulations and developing management plans.

D5.1.4 Recent Conservation Efforts

For the past 10 years, significant efforts have been made to conserve island ecosystems in northwest Mexico. A successful collaboration between local universities, Mexican and U.S. non-profit conservation organizations, local fishing cooperatives, and Mexican governmental agencies has resulted in the removal of introduced species from 24 islands in the region, 12 of which are in the Baja California Pacific islands (Keitt, pers. comm., 2004). Of 19 recorded animal extinctions on islands in northwest Mexico, 18 can be attributed in whole or part to

introduced mammals (Donlan et al. 2000). With the recent efforts, 35 exotic mammal species have been removed from islands in the region (IC 2004b). With the removal of these introduced species, suitable habitat is once again available to seabirds for nesting and roosting. The success of this regional conservation effort has provided unique opportunities to enhance recovery of seabird populations on the Baja California Pacific islands.

D5.1.5 Risks and/or Uncertainties

The Trustees recognize that there is a certain level of uncertainty in funding actions outside of the U.S. Factors such as government support, enforcement, and accountability are of greater concern when implementing actions outside of U.S. jurisdiction. Given the limited staffing and funding in the Mexican resource agencies, there is less certainty of the long-term benefit of an action in Mexico than one in the U.S. As such, the Trustees may consider additional mechanisms or tools to enhance the viability and success of restoration actions in Mexico. Such tools may include: (1) funding a U.S. organization that can be held accountable in U.S. jurisdiction, (2) withholding full payment until project completion, (3) partnering with other conservation programs that successfully implement restoration actions in Mexico (e.g., U.S. Fish and Wildlife Service [USFWS] Sonoran Joint Venture), and (4) seeking matching payments or in-kind contributions.

D5.2 RESTORE SEABIRDS ON GUADALUPE ISLAND

D5.2.1 Goals and Nexus to Injury

The goal of this action is to eradicate feral cats and restore seabird populations on Guadalupe Island, Mexico. This action would target a suite of seabirds including Cassin's auklet, Brandt's cormorant, Xantus's murrelet (subspecies *S. h. hypoleucus*), and the western gull.

Eggshell thinning and/or elevated levels of DDT have been documented in the eggs of Cassin's auklets, Brandt's cormorants, Xantus's murrelets, and western gulls in the SCB (Kiff 1994, Fry 1994). Section 5.1.1 provides a detailed description of the seabird nexus to the injuries of the Montrose case.

D5.2.2 Background

Guadalupe Island measures 255 square kilometers (km²) (98 square miles [mi²]) with three satellite islands of <1 km² in size. This island group is located 386 kilometers (km) (240 miles) south of San Diego and 370 km (230 miles) off the coast of Baja California. Although outside of the SCB, Guadalupe Island is biogeographically affiliated with coastal Southern California, and is part of the critically endangered California coastal sage and chaparral ecoregion. Human presence on the island includes a small fishing community and a Mexican Navy station.

Guadalupe Island is a Biosphere Reserve managed by the Mexican government. World-renowned for its high level of biodiversity, Guadalupe Island supports 34 endemic plants (including two endemic genera), 2 endemic subspecies of seabirds, 10 endemic land birds, 11 endemic land snails, and at least 18 endemic insects. Birdlife International recognizes Guadalupe

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Island as one of two regionally important Endemic Bird Areas in the California Floristic Province Hotspot (Stattersfield et al. 1998).

The overwhelming threat to the degradation of the ecosystem of Guadalupe Island is the presence of introduced goats and cats. Goats introduced in the 1850s have completely transformed the island through habitat degradation and loss from erosion and trampling. The top of the island, once covered with an endemic Guadalupe Island pine forest, is now sparsely vegetated with only about 200 adult trees. In 2002, a team of international experts from Australia, New Zealand, Mexico, United States, and Ecuador visited Guadalupe Island to develop a plan for goat and cat eradication. This plan has the full support of the Mexican National Institute of Ecology, the Mexican National Commission of Natural Protected Areas, the Mexican Navy, and the local fishing community. Efforts to eradicate the goats began in 2004 with funding from the Mexican government and private donors.

Feral cats are a significant threat to seabird populations on Guadalupe Island. Introduced prior to 1880, cats are responsible for the likely extinction of the endemic Guadalupe storm-petrel and the likely extirpation of many other seabird populations from the main island of Guadalupe, including Xantus's murrelet, the black-vented shearwater, Cassin's auklet, and Leach's storm-petrel (Keitt et al. in press). These species now occur only on small offshore islets of Guadalupe Island (Jehl and Everett 1985). In addition, cats have caused the extinction of five endemic species or subspecies of landbirds on Guadalupe Island, and currently threaten the survival of one of the three Laysan albatross colonies found outside of Hawaii. Cats are known to kill large numbers of seabirds and are particularly effective at taking smaller species such as shearwaters, alcids, and storm-petrels (Keitt et al. 2002, Van Aarde 1978).

As a result of habitat degradation by goats and predation by cats, the main island of Guadalupe has likely experienced one extinction (Guadalupe storm-petrel) and possibly five extirpations of seabirds (Table D5-2). Currently the offshore islets support eight taxa of seabirds, including Brandt's cormorant, Laysan albatross, western gull, Xantus's murrelet, black-vented shearwater, Cassin's auklet, and two endemic subspecies of Leach's storm-petrel (Table D5-2). Of these eight taxa (or seven species), recent surveys have only confirmed Brandt's cormorant and Laysan albatross nesting on the main island of Guadalupe; however, it is possible small breeding populations of murrelets, shearwaters, auklets, and petrels are present in areas restricted or inaccessible to cats (Keitt et al. in press).

D5.2.3 Project Description and Methods

The goal of this action is to eradicate feral cats to restore seabird colonies on Guadalupe Island. A 4-year restoration action is proposed to achieve this goal. Proven techniques used worldwide in recent cat removal programs would be employed on this action. In general, the most successful methods used in feral cat eradication efforts have been trapping and hunting (Wood et al. 2002, Nogales et al. 2004). An important component of this action would be to ensure that cats are not reintroduced to the island after the removal. A prevention program would be developed as part of the overall management plan for Guadalupe Island.

Important seabird colonies and plant populations that still occur on small offshore islets of Guadalupe would likely serve as source populations that may naturally recolonize the main island of Guadalupe once cats and goats are removed. Additional restoration activities could be

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undertaken to facilitate the recovery of seabird populations back onto the main island, such as social attraction, artificial nests and burrows, habitat enhancement, and light shielding. Although the Trustees may contribute to these additional restoration efforts in the future, the focus of the proposed action is the eradication of feral cats.

Table D5-2
Historical and Current Status of Seabird Species on Guadalupe Island

	Historically Present		Currently Present	
	Main Island	Offshore Islets	Main Island	Offshore Islets
Guadalupe storm-petrel	Yes	No	No ¹	No
Xantus's murrelet	Yes	Yes	Unknown ²	Yes
Black-vented shearwater	Yes	Yes	Unknown ²	Yes
Cassin's auklet	Unknown ⁵	Yes	Unknown ²	Yes
Leach's storm-petrel ssp.	Yes	Yes	Unknown ²	Yes
Leach's storm-petrel ssp.	Yes	Yes	Unknown ²	Yes
Laysan albatross	Yes ⁶	Yes	Yes ³	Unknown
Brandt's cormorant	Yes	Yes	Yes ⁴	Yes
Western gull	Yes	Yes	Yes	Yes

¹Cats likely caused extinction.

²Unknown, but reduced from historical numbers and likely at risk of local extirpation from main island due to cats.

³Cats are currently threatening the survival of colony.

⁴Confirmed nesting on main island.

⁵Cassin's auklets never recorded on main island, but suitable habitat is available.

⁶Laysan albatross colonized naturally in 1980.

D5.2.4 Environmental Benefits and Impacts

Biological

Benefits

Eradication of cats from Guadalupe Island would have both immediate and permanent conservation benefits for seabirds. In 2003, cats were removed locally around the Laysan albatross colony on Guadalupe Island to protect it from heavy predation pressure. Mortality from cats decreased from more than 30 birds found dead in the previous 60 days to zero birds over the next 60 days (Keitt et al. in press). Although no specific monitoring was done on these species, this local removal is also believed to have spared prospecting storm-petrels, Xantus's murrelets, and black-vented shearwaters from predation in the area. The immediate benefit of cat removal was also documented on Natividad Island where more than 1,000 black-vented shearwaters were found dead each month at the colony when cats were present (Keitt et al. 2002). Once cats were eradicated, fewer than 100 shearwaters were found dead each month as a result of sustainable, natural mortality (Keitt and Tershy 2003).

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It is anticipated that seabirds would naturally recolonize historical habitat on the main island of Guadalupe from the nearby islets within several years of cat eradication. On Marion Island, the common diving petrel (*Pelecanoides urinatrix*) recolonized the island after cats were successfully eradicated (Hanel and Chown 1998). Because of its size and the amount of suitable nesting habitat, Guadalupe Island has significant potential for seabird recovery. Seabirds such as the Cassin's auklet, Brandt's cormorant, Xantus's murrelet, western gull, black-vented shearwater, and Leach's storm-petrel would significantly benefit from the action in terms of increased available nesting habitat and improved reproductive success as a result of reduced predation from cats.

In addition to seabirds, this action would also have collateral benefits to the island ecosystem. Endemic landbirds, such as the critically endangered Guadalupe junco (*Junco insularis*), would benefit from cat removal (Mendoza et al. in press).

Impacts

There is the potential for limited short-term soil disturbance and compaction from the proposed human activity associated with hunting and trapping. Guadalupe Island does not support other large native mammals that could be impacted by the action.

Physical

Benefits

This action would not result in benefits to the physical environment.

Impacts

This action would not result in impacts to the physical environment.

Human Use

Benefits

The eradication of feral cats and goats from Guadalupe Island is the first step in the restoration of this unique island ecosystem. Ecological restoration of the island would provide aesthetic and recreational benefits to inhabitants and visitors.

The proposed cat removal action would not result in benefits to cultural resources, transportation, or health and safety issues.

Impacts

Island users, including the Mexican military and the local fishing cooperative, have strict policies against the importation of any live animal or potential weedy plant to the island. Since Guadalupe Island is a Biosphere Reserve, these policies would be enforced in perpetuity. Therefore, the eradication program and subsequent prevention program would not impact human uses on the island.

This action would not result in impacts to cultural or socioeconomic resources, recreation, aesthetics, transportation, or health and safety.

D5.2.5 Likelihood of Success/Feasibility

Although difficult, feral cat eradication has been successfully carried out on at least 48 islands worldwide (Nogales et al. 2004). In northwest Mexico, cats have been successfully eradicated from 15 islands (Wood et al. 2002). The experience, knowledge, and lessons learned from these previous efforts would be applied to this action. Guadalupe Island is within the size range of other islands that had successful cat eradications; therefore, the feasibility and likelihood of success is high.

The proposed cat removal action is a critical step in the ecological restoration of Guadalupe Island. Several Mexican agencies would oversee management and enforcement on Guadalupe Island (see Section D5.1.1), and would be responsible for ensuring that the long-term success of this action is not compromised by the introduction of exotic species. In light of Guadalupe Island's protected status, and the local, national, and international effort being directed to the restoration of the island, the cat removal action would result in long-term benefits to seabird populations and the overall island ecosystem.

D5.2.6 Performance Criteria and Monitoring

The benefits of cat eradication may be evaluated by recolonization and recovery of seabird colonies onto the main island of Guadalupe, increased breeding success, and reduced predation. Protocols for seabird monitoring are well established and standardized. Efforts to document baseline seabird populations would be undertaken before project implementation to evaluate the benefits from the action.

D5.2.7 Evaluation

The Trustees have evaluated this action against all screening and evaluation criteria developed to select restoration actions and have concluded that this action is consistent with these selection factors. The Trustees determined that this type and scale of action would effectively provide long-term benefits to priority seabirds, including the Cassin's auklet, western gull, Xantus's murrelet, and Brandt's cormorant. All of these species also breed in the Channel Islands and are part of a larger metapopulation of seabirds that breed, forage, and disperse into and throughout the SCB and surrounding marine environment. In addition, this action would provide long-term benefits to the unique ecosystem on Guadalupe Island.

D5.2.8 Budget

Table D5-3 shows the estimated budget for a 4-year restoration action on Guadalupe Island.

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Table D5-3
Estimated Budget for 4-Year Guadalupe
Island Restoration Project

Personnel	\$767,000
Travel	\$18,000
Equipment	\$67,000
Communications	\$10,000
Operating Supplies	\$35,000
Research/Monitoring	\$194,000
Overhead	\$45,000
Total	\$1,136,000

D5.3 RESTORE SEABIRDS ON CORONADO AND TODOS SANTOS ISLANDS

D5.3.1 Goals and Nexus to Injury

The goal of this action is to restore seabird populations on the Coronado and Todos Santos Islands. These islands are oceanographically considered part of the SCB. Restoration efforts would target a suite of seabirds including the Cassin's auklet, Brandt's cormorant, double-crested cormorant, California brown pelican, ashy storm-petrel, and Xantus's murrelet.

Eggshell thinning and/or elevated levels of DDT have been documented in the eggs of the Cassin's auklet, Brandt's cormorant, double-crested cormorant, California brown pelican, ashy storm-petrel, and Xantus's murrelet in the SCB (Kiff 1994, Fry 1994). Section 5.1.1 provides a detailed description of the seabird nexus to the injuries of the Montrose case.

D5.3.2 Background

Coronado Islands

The Coronado Islands consist of four islands that lie 11 km (7 miles) offshore of the Mexican mainland near Tijuana, Baja California Norte. These islands total 2.5 km² (1 mi²) in area. The largest two islands are the North and South Island; the Middle Island is smaller, and Middle Rock is smaller still. The topography of the islands is steep and rugged and supports several vegetation communities including maritime succulent scrub and coastal sage scrub.

Human presence is limited on the Coronado Islands. With the exception of a Mexican Navy garrison and the lighthouse on South Island, these islands do not support human habitation. The Coronado Islands are owned and managed by the Mexican government (see Section D5.1.1).

Historically, the Coronado Islands supported significant colonies of Cassin's auklets, Xantus's murrelets, and brown pelicans (Grinnell and Daggett 1903, Howell 1910). During the 1930s, the California brown pelican colony reached its maximum size, with approximately 5,000 birds nesting on the North Island, 100 on the Middle Island, and several nests on the South Island (Jehl 1973). As with other brown pelican colonies in the SCB, the Coronado colony experienced

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DDT-related reproductive failure in the late 1960s and early 1970s (Jehl 1973, Risebrough 1972). Of the 375 California brown pelican nests on the Coronado Islands in 1969, no young fledged (Jehl 1973).

In addition to negative effects from DDT contamination, seabird populations on the Coronado Islands also declined due to the presence of introduced animals (cats, goats, burros) and human disturbance. The mean productivity of California brown pelicans dropped precipitously in the 1980s when increased fishing around the islands caused a high level of nest abandonment (Anderson 1988). Brown pelicans are particularly sensitive to human disturbance and have been documented crushing or knocking eggs and small nestlings from the nest when they flush in panic (Schreiber and Risebrough 1972, Kushlan and Frohring 1985). Eggs and small nestlings left unattended are then susceptible to predators and hyperthermia (Anderson and Keith 1980).

It is currently estimated that approximately 4,000 breeding seabirds of 10 species nest on the Coronado Islands, including Brandt's cormorants, double-crested cormorants, California brown pelicans, western gulls, Cassin's auklets, black storm-petrels, and Xantus's murrelets (Wolf 2002). Although recent surveys have shown signs of seabird recovery, seabird colonies remain significantly lower than historical levels. For example, a survey in 2002 documented 643 pairs of brown pelicans on North Coronado Island, and no pairs nesting on the other islands (Palacios et al. 2003). These islands also currently support one of the world's largest threatened Xantus's murrelet colonies, and support the southernmost breeding colony of the rare ashy storm-petrel. Cassin's auklets and Leach's storm-petrels have yet to recolonize North Coronado Island after their extirpation due to cat predation (Donlan et al. 2000).

In recent years, efforts have been taken to protect and conserve the flora and fauna of the Coronado Islands. In addition to important seabird colonies, the Coronado Islands support one endemic species of small mammal, four endemic species of reptiles, and two subspecies of endemic land birds. Efforts to remove introduced species from the Coronado Islands included the eradication of feral cats from North Island in 1995 and 1996, the removal of one cat from South Island in 2004, and the removal of goats and burros from South Island in 2004. The American Trader Trustee Council contributed funding to these removal efforts. With the eradication of these introduced species, suitable habitat is once again available to seabirds for nesting and roosting.

Todos Santos Islands

The Todos Santos Islands consist of two islands located approximately 90 km (60 mi) south of the U.S./Mexico border. These islands total 1.2 km² (0.5 mi²) in size. Vegetation on the Todos Santos Islands consists of coastal sage scrub. The Todos Santos Islands are owned and managed by the Mexican government. Human presence on Todos Santos North is maintained by the Mexican Navy (two radio personnel) and the Secretary of Transportation (one lighthouse keeper). Todos Santos South, the larger of the two islands, has a small facility formerly used by an abalone aquaculture company and recently purchased by a tuna aquaculture company. An illegal fishing camp was recently removed from the island, and the area was cleaned up by a coalition, including the Grupo de Ecología y Conservación de Islas, Mexican Navy, and the National University in Ensenada.

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Historically, the Todos Santos Islands supported important colonies of seabirds, including the California brown pelican and double-crested cormorant (Howell 1912). However, seabird colonies and island vegetation have been heavily impacted by introduced cats and rabbits, regular human use and development, and occasional human-caused wildfires. By 1920, the brown pelican colony had disappeared, largely due to human disturbance (Jehl 1973, Jehl 1984).

An estimated 3,500 breeding seabirds of six species currently nest on the Todos Santos Islands, including double-crested cormorants, Brandt's cormorants, pelagic cormorants, western gulls, Cassin's auklets, and Xantus's murrelets (Wolf 2002). Todos Santos North is the southernmost known breeding colony of pelagic cormorants (Palacios and Mellink 2000). Xantus's murrelets and Cassin's auklets were extirpated from Todos Santos South likely due to cat predation and have not yet recolonized this island (Donlan et al. 2000). To date, California brown pelicans have not recolonized either island for breeding, likely because of ongoing human disturbance. However, surveys in 2002 documented 108 nesting attempts by double-crested cormorants and 336 active Brandt's cormorant nests on Todos Santos South (Palacios et al. 2003). Because brown pelicans and cormorants often nest in mixed colonies, the presence of these nesting cormorants demonstrates the potential for Todos Santos to be recolonized by brown pelicans (Palacios et al. 2003).

Recent eradication efforts have been undertaken to restore the Todos Santos island ecosystem. Cats and rabbits were eradicated in 1998, and burros were removed in 2004. During the burro removal, illegal camps were cleaned up and more than two tons of garbage was removed from Todos Santos North. With the removal of these introduced animals, suitable habitat is once again available to seabirds for nesting and roosting.

D5.3.3 Project Descriptions and Methods

With the recent removal of introduced species from these islands, opportunities exist to enhance the recovery of these seabird colonies within the SCB. Due to their proximity, and to maximize restoration efforts on these islands, a combined 5-year restoration action is proposed for the Coronado and Todos Santos Islands. On the Coronado Islands, restoration actions will include using social attraction techniques (including decoys and vocalizations), improving nesting opportunities with artificial nests, and reducing human disturbance. Standard social attraction techniques that have been used successfully elsewhere would be employed on these islands. Target species for restoration on the Coronado Islands include the Brandt's cormorant, double-crested cormorant, California brown pelican, western gull, Cassin's auklet, ashy storm-petrel, black storm-petrel, and Xantus's murrelet. An example restoration activity would be to facilitate the recolonization of Cassin's auklets to North Coronado Island through the use of playback systems and artificial nests.

On the Todos Santos Islands, restoration actions would include social attraction techniques (e.g., decoys and vocalizations), improving nesting opportunities with artificial nests, shielding lights, and reducing human disturbance. For example, efforts to restore California brown pelican breeding would focus on reducing human disturbance around historical colonies. Target species on Todos Santos Islands include Brandt's cormorant, double-crested cormorant, pelagic cormorant, California brown pelican, western gull, Cassin's auklet, and Xantus's murrelet.

Although the Trustees are focusing on the above-mentioned restoration activities, consideration would be given to additional restoration opportunities that may arise in the future on these islands.

D5.3.4 Environmental Benefits and Impacts

Biological

Benefits

This action involves multiple restoration activities that will likely provide long-term benefits to target seabird populations. Social attraction efforts will facilitate the recolonization of seabirds on these islands after the removal of introduced species, and will encourage seabirds to use suitable and historically occupied habitats. Once seabirds are attracted to the island, the presence of nest boxes will further encourage the seabirds to nest in suitable habitat. The use of nest boxes will also allow biologists to effectively monitor the success of the restoration efforts and minimize disturbance to nesting seabirds. Although social attraction may only be used for a limited time, the recolonization and recovery of historically occupied colonies will provide long-term benefits to seabird populations in the SCB, as the re-established presence of a colony of birds will likely serve as an ongoing natural attractant in perpetuity.

A reduction in human disturbance around the colonies will significantly benefit roosting and breeding seabirds, particularly those that are sensitive to disturbance, such as California brown pelicans and cormorants. On islands in the Gulf of California, brown pelican subcolonies disturbed by humans produced 0.0 to 0.6 fledglings per nest compared with 1.2 to 1.5 fledglings per nest in undisturbed colonies (Anderson and Keith 1980). A reduction in human disturbance can have dramatic impacts on seabird populations, as illustrated on the Farallon Islands, off the coast of Northern California. At least six species of marine birds had experienced severe population declines on these islands due to human disturbance. Subsequent protection from disturbance resulted in almost complete recovery of all populations (Anderson and Keith 1980).

The increase in seabird populations on the Coronado and Todos Santos Islands will also likely benefit resident peregrine falcon pairs that prey on seabirds such as petrels and auklets. Because peregrine falcon pairs prey on a variety of seabird species (Huey in Kiff 1980, Nelson and Myres in Kiff 1980), increases in seabird populations may help buffer the impacts of predation.

Impacts

The proposed activities have the potential for limited short-term impacts. These impacts could include soil disturbance in the areas where nest boxes are used or short-term disturbance to seabirds during monitoring efforts. However, the proposed activities would not result in significant impacts to biological resources.

Physical

Benefits

This action will not result in benefits to the physical environment.

Impacts

This action will not result in impacts to the physical environment.

Human Use

Benefits

The waters around the Baja California Pacific islands offer many recreational and economic opportunities. Healthy and complete ecosystems support fishing communities around these islands (Anderson and Keith 1980). Seabird colonies are a valuable part of island ecosystems and provide economic benefits in the form of tourism.

Impacts

This action proposes to limit human disturbance in the vicinity of seabird colonies. This action would likely impact people that either inhabit or illegally camp on the islands. However, this impact is not anticipated to be significant due to the minimal number of people that inhabit the islands.

The action will not result in impacts to cultural resources, transportation, or health and safety.

D5.3.5 Likelihood of Success/Feasibility

Social attraction efforts, including the use of playback systems and decoys, have been successfully used for a variety of seabirds, including terns (Kress 1983), Atlantic puffins (Kress and Nettleship 1988), Laysan albatross (Podolsky 1990), dark-rumped petrels (Podolsky and Kress 1992) and Leach's storm-petrels (Podolsky and Kress 1989). The use of artificial nests has also proven to be successful for seabirds such as the ashy storm-petrel, Leach's storm-petrel, Cassin's auklet, and the pigeon guillemot. Experts in the field of social attraction will be consulted during project planning and implementation to ensure that playback systems, decoys, and artificial nests are designed in a manner that maximizes the success of the action.

As discussed earlier, a concerted effort is under way to conserve and protect the Baja California Pacific islands. Part of that effort is the designation of the Baja California Pacific islands, including the Coronado and Todos Santos Islands, as a Biosphere Reserve. The restoration activities are both feasible and compatible with these ongoing efforts. In light of the successful efforts to remove introduced species from these islands in the last decade, the support from the Mexican government, the designation of these islands as a Marine Priority Area for Conservation, and the current momentum to designate these islands as a Biosphere Reserve, it is likely that restoration activities undertaken on these islands will be successful and will result in long-term benefits to seabird populations in the SCB.

Restore Seabirds to Baja California Pacific Islands

D5.3.6 Performance Criteria and Monitoring

The benefits of these restoration activities to seabirds can be evaluated by increases in colony size, recolonization of seabirds into historically occupied habitats, and reduced disturbance to seabird colonies. Protocols for seabird monitoring are well established and standardized. Efforts to document baseline seabird populations and levels of human disturbance will be undertaken before project implementation to evaluate the benefits from the action.

D5.3.7 Evaluation

The Trustees have evaluated this action against all screening and evaluation criteria developed to select restoration actions and have concluded that this action is consistent with these selection factors. This action has a strong nexus to the Montrose case and is located in the SCB. Recent eradication efforts on these islands provide a unique opportunity to facilitate seabird recolonization and recovery. The Trustees determined that this type and scale of action will likely provide long-term benefits to ashy storm-petrels, Cassin's auklets, Xantus's murrelets, Brandt's cormorants, double-crested cormorants, and California brown pelicans.

D5.3.8 Additional Considerations

The Trustees are aware of plans by ChevronTexaco to build a liquefied natural gas receiving facility just east of South Coronado Island. The proposed terminal would receive tankers loaded with liquefied natural gas several times a week and process up to 1.4 million cubic feet of the fuel daily. ChevronTexaco has recently received a permit from Mexico's environmental ministry and is in the process of securing the remaining permits. It is unknown at this time if this project will be permitted and constructed. Because of the potential impacts to seabirds from the proposed terminal (from the effects of lighting, disturbance, and spills), the Trustees would carefully evaluate the potential ramifications of this liquefied natural gas project on the feasibility and long-term success of this proposed restoration action. Should the Trustees decide that the proposed liquefied natural gas terminal would compromise the success of this restoration action, the Trustees would reconsider this action and may allocate funds to other seabird restoration efforts.

D5.3.9 Budget

Table D5-4 shows the estimated budget for a 5-year restoration action on the Coronado and Todos Santos Islands.

Table D5-4
Estimated Budget for 5-Year Coronado and Todos Santos Islands
Restoration Action

Personnel	\$587,000
Travel	\$64,000
Equipment	\$92,000
Communications	\$7,000

Restore Seabirds to Baja California Pacific Islands

Table D5-4
Estimated Budget for 5-Year Coronado and Todos Santos Islands
Restoration Action

Operating Supplies	\$84,000
Overhead	\$208,000
Total	\$1,042,000

D5.4 RESTORE SEABIRDS ON SAN MARTÍN AND SAN JERONIMO ISLANDS

D5.4.1 Goals and Nexus to Injury

The goal of this action is to restore seabirds on San Martín and San Jeronimo Islands, Mexico. San Martín Island is oceanographically considered part of the SCB, whereas San Jeronimo Island is just south of this boundary. Restoration efforts would target a suite of seabirds, including the Cassin's auklet, Brandt's cormorant, double-crested cormorant, California brown pelican, western gull, and Xantus's murrelet.

Eggshell thinning and/or elevated levels of DDT have been documented in the eggs of Cassin's auklets, Brandt's cormorants, double-crested cormorants, California brown pelicans, western gulls, and Xantus's murrelets in the SCB (Kiff 1994, Fry 1994). Section 5.1.1 provides a detailed description of the seabird nexus to the injuries of the Montrose case.

D5.4.2 Background

San Martín Island

San Martín Island is 3.2 km² (1.2 mi²) in size and is located 5 km (3.1 miles) offshore from San Quintin, Mexico (see Figure D5-1). This rugged volcanic island is dominated by cliffs except on the northeast side, which has a small sandy beach and tidal lagoon. Vegetation on the island consists of dense Californian coastal scrub vegetation. In addition to six species of breeding seabirds, San Martín Island also supports three endemic reptiles and one endemic mammal. A permanent fishing camp exists on the island as well as two automated navigational lights that receive at least biannual maintenance by personnel of the Secretary of Communications and Transportation.

San Martín Island historically supported a large mixed colony of California brown pelicans, double-crested cormorants, and Brandt's cormorants from at least 1913 until the late 1960s (Palacios and Mellink 2000). This colony was the largest historic double-crested cormorant colony in North America, estimated at close to 350,000 nests (Gress et al. 1973, Wright 1913). Although this number is thought to be an overestimate (Carter et al. 1995), San Martín Island clearly supported an important breeding colony for the double-crested cormorant. In 1969 and 1971, approximately 5,000 double-crested cormorants were documented in the colony. During the 1970s, human disturbance was thought to be the principal factor in the decline of these colonies (Anderson and Keith 1980, Jehl 1973), which were also heavily impacted by introduced

cats, fisherman, and egg harvesters (Everett and Anderson 1991). Consequently, it was believed that this colony was essentially abandoned in 1987 and 1988 (Everett and Anderson 1991).

In recent years, efforts have been taken to protect and conserve San Martín Island, including the removal of feral cats in 1999 and 2000. A survey in 1999 documented the reoccupation of this regionally important colony, including 600 occupied double-crested cormorant and 30+ brown pelican nests (Palacios and Mellink 2000). Additional nesting seabirds on San Martín Island include Brandt's cormorants, western gulls, Cassin's auklets, and Xantus's murrelets (Wolf 2002). With the removal of feral cats and the recent reoccupation of the cormorant/pelican colony, opportunity exists to facilitate the recovery of this important colony as well as other seabird colonies on the island.

San Jeronimo Island

San Jeronimo Island is 0.7 km² (0.3 mi²) in size and is located south of San Martín Island (Figure D5-1). A permanent fishing camp exists on the island with up to 40 residents on the island during peak fishing seasons. A lighthouse keeper is permanently stationed on the island to maintain the lighthouse.

San Jeronimo Island historically supported large colonies of Brandt's cormorants and Cassin's auklets (Everett and Anderson 1991). The Brandt's cormorant colony was displaced and large sections of the Cassin's auklet colony were destroyed during an unauthorized guano mining operation in 1999 (Wolf 2002). Since that time, all guano mining operations have been stopped on the island (Keitt, pers. comm., 2004).

Efforts to remove introduced animals have also been undertaken on this island. Feral cats were eradicated in 2000. Seabirds currently nesting on San Jeronimo Island include the double-crested cormorant, western gull, Xantus's murrelet, and Cassin's auklet (Wolf 2002). The Cassin's auklet colony is currently the largest colony on the island. After the unauthorized guano mining operation, Brandt's cormorants did not re-nest in 2002, and it is unknown if they have reoccupied this colony since then.

D5.4.3 Project Descriptions and Methods

To maximize restoration efforts on these islands, a combined five-year action is proposed on San Martín and San Jeronimo Islands. The goal of this action is to enhance the recovery of seabird colonies following the removal of introduced species. Activities on San Martín Island would focus on restoring the California brown pelican, double-crested cormorant, and Brandt's cormorant colonies by reducing human disturbance through signage, public education, and redesign of the trail system on the island to avoid the colonies.

Efforts on San Jeronimo Island would focus on restoring the extirpated Brandt's cormorant colony through social attraction efforts (e.g., decoys) and reducing human disturbance. Additional restoration actions for Cassin's auklets and Xantus's murrelets would include shielding light sources, constructing a boardwalk to stop the destruction of burrows by fisherman walking through the colony, and controlling waste on the island.

Although the Trustees are focusing on the above-mentioned restoration activities, additional restoration opportunities would be considered for implementation under this restoration plan, as appropriate.

D5.4.4 Environmental Benefits and Impacts

Biological

Benefits

The action combines restoration activities that would provide long-term benefits to priority seabird populations, in particular Brandt's cormorants, double-crested cormorants, California brown pelicans, and Cassin's auklets. Social attraction efforts would facilitate the recolonization of seabirds on these islands after the removal of introduced species. These types of efforts would encourage seabirds to use suitable and historically occupied habitats. Although social attraction may only be used for a limited time, the recolonization and recovery of historically occupied colonies would provide long-term benefits to seabird populations in the SCB since the re-established presence of a colony of birds would likely serve as an ongoing natural attractant in perpetuity.

A reduction in human disturbance around colonies would benefit roosting and breeding seabirds. Nesting seabirds that are sensitive to disturbance, such as California brown pelicans and cormorants, would in particular benefit from a reduction in human disturbance. Protection of the seabird colonies from human disturbance would likely result in increased reproductive success. Construction of a boardwalk on San Jeronimo Island would greatly reduce the number of Cassin's auklet burrows that are crushed by fisherman walking through the colony.

Impacts

The proposed activities have the potential for limited short-term impacts. These impacts could include soil disturbance in the areas where social attractants are used or short-term disturbance during monitoring efforts.

Physical

Benefits

This action would not result in benefits to the physical environment.

Impacts

This action would not result in impacts to the physical environment.

Human Use

Benefits

The waters around the Baja California Pacific islands offer many recreational and economic opportunities. Healthy and complete ecosystems support fishing communities around these islands (Anderson and Keith 1980). Seabird colonies are a valuable part of island ecosystems and provide economic benefits in the form of tourism.

This action would not result in benefits to cultural resources, transportation, or health and safety.

Impacts

This action proposes to limit human disturbance in the vicinity of seabird colonies. This action would likely impact fisherman on the islands; however, alternative trails would be provided. This impact is not anticipated to be significant due to the minimal number of people that inhabit the islands.

This action would not result in impacts to cultural resources, transportation, or health and safety.

D5.4.5 Likelihood of Success/Feasibility

Social attraction efforts, including the use of playback systems and decoys, have been successfully used for a variety of seabirds (see Section D5.3.5). Experts in the field of social attraction would be consulted during project planning and implementation to ensure that decoys are designed to maximize the success of the action. Activities to reduce human disturbance (e.g., redesign of trails, posting signs, and shielding lights) are feasible and would provide long-term benefits as long as measures are complied with and enforced.

As discussed earlier, a concerted effort is under way to conserve and protect the Baja California Pacific islands. Part of that effort is the designation of the Baja California Pacific islands as a Biosphere Reserve, including San Jeronimo and San Martín Islands. The proposed restoration activities are both feasible and compatible with these ongoing efforts. In light of the successful efforts to remove introduced species from these islands, the designation of these islands as a Marine Priority Area for Conservation, and the current momentum to designate these islands as a Biosphere Reserve, it is likely that restoration activities undertaken on these islands would be successful and would result in long-term benefits to seabird populations in the SCB.

D5.4.6 Performance Criteria and Monitoring

The benefits of these restoration activities to seabirds may be evaluated by increases in colony size, recolonization of seabirds into previously occupied habitats, and reduced disturbance to seabird colonies. Protocols for seabird monitoring are well established and standardized. Efforts to document baseline seabird populations and levels of human disturbance would be undertaken before project implementation to evaluate the benefits from the action.

D5.4.7 Evaluation

The Trustees have evaluated this action against all screening and evaluation criteria developed to select restoration actions and have concluded that this action is consistent with these selection factors. The Trustees determined that this type and scale of action would provide benefits to priority seabirds, including the Brandt’s cormorant, double-crested cormorant, Cassin’s auklet, Xantus’s murrelet, and California brown pelican.

D5.4.8 Budget

Table D5-5 shows the estimated budget for a 5-year restoration action on San Jeronimo and San Martín Island.

Table D5-5
Estimated Budget for 5-Year San Jeronimo and San Martín Islands Restoration Project

Personnel	\$411,000
Travel	\$70,000
Equipment	\$76,000
Communications	\$4,500
Operating Supplies	\$40,000
Overhead	\$150,000
Total	\$751,500

D5.5 RESTORE SEABIRDS ON SAN BENITO, NATIVIDAD, ASUNCIÓN, AND SAN ROQUE ISLANDS

D5.5.1 Goals and Nexus to Injury

The goal of these actions is to restore seabird colonies on the central Baja California Peninsula Islands. The San Benito, Natividad, Asunción, and San Roque Islands are clustered around central Baja California (see Figure D5-1). Restoration efforts would target a suite of seabirds including the Cassin’s auklet, Brandt’s cormorant, double-crested cormorant, California brown pelican, and Xantus’s murrelet.

Eggshell thinning and/or elevated levels of DDT were documented in eggs of the Cassin’s auklet, Brandt’s cormorant, double-crested cormorant, California brown pelican, and Xantus’s murrelet in the SCB (Kiff 1994, Fry 1994). Section 5.1.1 provides a detailed description of seabird nexus.

D5.5.2 Background

San Benito Islands

The San Benito Islands consist of three islands (East, Middle, and West) with a combined area of approximately 2.5 km² (1 mi²). The islands are located 65 km (40 miles) west of the mainland

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Restore Seabirds to Baja California Pacific Islands

(Figure D5-1). Permanent fishing camps exist on West Benito Island. The San Benito Islands are owned by the Mexican government.

The San Benito Islands support the largest and most diverse seabird colony in the California Islands (which includes the Channel Islands and Baja California Pacific islands). The islands host approximately 2 million breeding seabirds of 12 species, including three species of storm-petrel, brown pelican, western gull, double-crested cormorant, Brandt's cormorant, Xantus's murrelet (*S.h. hypoleucus*), and Cassin's auklet (*P.a. australe*) (Wolf 2002). In addition, these islands harbor at least three endemic plants (one of which is restricted only to West San Benito), three endemic landbirds, and one endemic lizard.

Recent eradication efforts have been undertaken to restore the island ecosystem. In 1998, feral goats and rabbits were removed from the three islands. Donkeys were removed in 2004. The presence of these introduced animals had degraded seabird nesting habitat on the islands, particularly on West Benito Island.

Natividad Island

Natividad Island is 7.2 km² (3 mi²) in size and is located 7 km (2.7 miles) off of Punta Eugenia (see Figure D5-1). There is a town of 400 permanent residents on the south end of the island, and most inhabitants are members of a fishing cooperative. Natividad Island is owned and managed by the Mexican government and was incorporated into the Vizcaíno Biosphere Reserve in 1988.

Limited information is available on historical seabird population numbers on Natividad Island. It is estimated that Natividad Island supports approximately 160,000 breeding seabirds of five species, including the California brown pelican, double-crested cormorant, Brandt's cormorant, western gull, and black-vented shearwater (Wolf 2002). This island supports the second-largest seabird breeding population on the California Islands (after the San Benito Islands), in large part because it supports over 95 percent of the world's black-vented shearwaters (Keitt et al. 2000). It is presumed that Xantus's murrelets historically bred on Natividad Island but were extirpated by cat predation (Drost and Lewis 1995, Keitt 2000). Cassin's auklets were also extirpated by cat predation.

Recent eradication efforts have removed feral cats, goats, domestic pigs, rabbits, and sheep from the island. Cat eradication was initiated in 1998 in response to the large number (more than 1,000) of dead shearwaters found in the colony each month (Keitt et al. 2002). Despite the removal of cats, Cassin's auklets have not yet recolonized Natividad Island (Keitt 2000).

Asunción Island and San Roque Island

Asunción Island (0.9 km² [0.4 mi²]) and San Roque Island (4 km² [0.2 mi²]) are located inside Asunción Bay (see Figure D5-1). There are no permanent settlements on these islands, though people regularly visit from the nearby town on the mainland. Asunción and San Roque Islands are owned and managed by the Mexican government and were incorporated into the Vizcaíno Biosphere Reserve in 1988.

These islands once supported large nesting colonies of seabirds including the Xantus's murrelet, Cassin's auklet (subspecies *P. a. australe*), and Brandt's cormorant (Everett and Anderson 1991, Drost and Lewis 1995, Wilbur 1987). Asunción and San Roque Islands were once the

southernmost breeding colonies of Cassin's auklet (Kaeding 1905). However, predation by cats extirpated the large populations of Cassin's auklets on these islands by 1992 (McChesney and Tershy 1998). Xantus's murrelets were likely extirpated by cats much earlier. Human disturbance has caused abandonment of the double-crested cormorant and Brandt's cormorant colonies on San Roque Island and the brown pelican colony on Asunción Island on repeated occasions. Ongoing human disturbance has kept the populations of these species well below their historical numbers.

Within the last 10 years, efforts have been made to restore the ecosystem on these islands. In 1994, feral cats and rats were removed and human visitation was ended through education and signage. These actions resulted in secure roosting habitat for thousands of brown pelicans and cormorants. In 1996, playback devices were used to encourage the return of the Cassin's auklet and Leach's storm-petrel (*O. leucorhoa*). In 2001, Brandt's cormorants (more than 2,000 nests) and California brown pelicans (approximately 10 nests) had begun breeding again on San Roque Island (Keitt, pers. comm., 2004). However, in 2002, after a long lapse in education efforts, local fishermen began visiting the island again on a regular basis and virtually all of the cormorants and brown pelicans abandoned their breeding efforts. Currently on San Roque Island, double-crested cormorants, elegant terns, royal terns, Xantus's murrelets, and Cassin's auklets have yet to recolonize the island. On Asunción Island, brown pelicans, elegant terns, and Xantus's murrelets have yet to recolonize. In 2004, Cassin's auklets were documented using artificial burrows on the island; however, it is unknown whether breeding occurred (Keitt, pers. comm., 2004).

D5.5.3 Project Descriptions and Methods

San Benito Islands

A 5-year restoration action is proposed on the San Benito Islands that would focus on rehabilitation of degraded habitat to increase the number of breeding seabirds. Efforts would concentrate on West San Benito Island, which supports considerably lower densities of seabirds than the Middle or East Islands. Target species for restoration include Cassin's auklets, Xantus's murrelets, and Leach's storm-petrels. Restoration efforts would include removal of exotic plant species and restoration of native plant communities disturbed by human activities and burros. Efforts would also focus on reducing human disturbance through signage, shielding lights around the fishing village, and managing waste on the island.

Natividad Island

A 5-year restoration action is proposed on Natividad Island that would focus on establishing Xantus's murrelets and restoring a historic Cassin's auklet colony by using playback systems and artificial nests. The goal of the action would be to attract birds from nearby colonies on the San Benito Islands. In addition, habitat protection and enhancement would be targeted for double-crested cormorants, Brandt's cormorants, California brown pelicans, and black-vented shearwaters. A reduction in human disturbance would be accomplished through signage, light shielding, public education, and road closures.

San Roque and Asunción Islands

To maximize restoration efforts on these islands, a 5-year joint project is proposed on San Roque Island and Asunción Islands, due to their proximity. The goal of this restoration action would be to facilitate the recolonization and recovery of seabird populations on these islands. Activities would include social attraction (both decoys and playback systems), use of artificial burrows, and actions taken to reduce human disturbance. Seabirds would be attracted from large source colonies on the nearby San Benito Islands and the Gulf of California. Target species for these efforts include Brandt's cormorants, California brown pelicans, Heermann's gulls, elegant terns, Cassin's auklets, storm-petrels, and Xantus's murrelets.

D5.5.4 Environmental Benefits and Impacts

Biological

Benefits

The action combines restoration activities that would provide long-term benefits to target seabirds. Social attraction efforts would facilitate the recolonization of islands after the removal of introduced species. These types of efforts would encourage seabirds into suitable and historically occupied habitats. Once attracted to the island, the presence of nest boxes would further encourage nesting in suitable habitat. The use of nest boxes would also allow biologists to effectively monitor the success of the restoration efforts. Although social attraction may only be used for a short time, the recolonization of a historically occupied colony would provide long-term benefits to seabird populations since the re-established presence of a colony of birds would likely serve as an ongoing natural attractant in perpetuity.

A reduction in human disturbance around colonies would benefit roosting and breeding seabirds. Nesting seabirds that are sensitive to disturbance, such as brown pelicans and cormorants, would in particular benefit from a reduction in human disturbance. Protection of the seabird colonies from human disturbance would likely result in recolonization of the islands and increased reproductive success. A reduction in human disturbance would also protect existing colonies, such as the world's largest black-vented shearwater colony on Natividad Island.

Peregrine falcons would also likely benefit from this action. Because peregrine falcons prey on smaller seabirds, increased seabird populations on these islands would benefit this species.

Impacts

There is the potential for limited short-term impact from the proposed activities. Such impacts could include soil disturbance in the areas where nest boxes are used or short-term disturbance during monitoring efforts.

Physical

Benefits

The proposed actions would not result in benefits to the physical environment.

Impacts

The proposed actions would not result in impacts to the physical environment.

Human Use

Benefits

The waters around the Baja California Pacific islands offer many recreational and economic opportunities. Healthy and complete ecosystems support fishing communities around these islands (Anderson and Keith 1980). Seabird colonies are a valuable part of island ecosystems and provide economic benefits in the form of tourism.

The proposed actions would not result in benefits to cultural resources, transportation, or health and safety.

Impacts

This action proposes to limit human disturbance in the vicinity of seabird colonies. This action would likely impact people that either inhabit or illegally camp on the islands. However, this impact is not anticipated to be significant due to the minimal number of people that inhabit the islands.

The proposed actions would not result in impacts to cultural resources, transportation, or health and safety.

D5.5.5 Likelihood of Success/Feasibility

Social attraction efforts, including the use of playback systems and decoys, have been successfully used for a variety of seabirds, including terns, puffins, albatross, and petrels. The use of artificial nests has also proven to be successful for seabirds such as the ash storm-petrel, Leach's storm-petrel, Cassin's auklet, and pigeon guillemot. Experts in the field of social attraction would be consulted during project planning and implementation to ensure that playback systems, decoys, and artificial nests are designed in a manner that maximizes success of the action.

Long-term success of these actions would also be dependent on whether these islands remain free from introduced species. The education of island users about the impact of introduced species is critical to the success of these restoration actions.

Appendix D5
Restore Seabirds to Baja California Pacific Islands

D5.5.6 Performance Criteria and Monitoring

The benefits of these restoration activities to seabirds may be evaluated by increases in colony size, recolonization of seabirds into previously occupied habitats, and reduced disturbance to seabird colonies. Protocols for seabird monitoring are well established and standardized. Efforts to document baseline seabird populations and levels of human disturbance would be undertaken prior to project implementation to evaluate the benefits from the action.

D5.5.7 Evaluation

The Trustees have evaluated this action against all screening and evaluation criteria developed to select restoration actions and have concluded that this action is consistent with these selection factors.

D5.5.8 Estimated Budget

Table D5-6 shows the estimated budget for a 5-year restoration action on San Benito, Natividad, Asunción, and San Roque Islands.

Table D5-6
Estimated Budget for 5-Year Restoration Project on San Benito, Natividad, Asunción, and San Roque Islands

	San Benitos	Natividad	Asunción/San Roque
Personnel	\$382,000	\$382,000	\$636,000
Travel	\$76,000	\$70,000	\$129,000
Equipment	\$49,000	\$63,000	\$134,000
Communications	\$8,000	\$2,000	\$6,000
Operating Supplies	\$42,000	\$53,000	\$68,000
Overhead	\$139,000	\$142,000	\$244,000
Total	\$696,000	\$712,000	\$1,217,000