

Jumping the gun: island fox recovery efforts at Channel Islands National Park

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Channel Islands National Park is currently implementing aggressive, expensive long-term recovery actions for the island fox (*Urocyon littoralis*), a species that is not currently listed as endangered or threatened under the federal Endangered Species Act. Even so, the imminent threat of extinction for three subspecies of island foxes mandates that the National Park Service (NPS) manage this functionally endangered species with the resolve and the resources usually reserved for listed species, but without access to any funding source for long-term, large-scale natural resource projects.

The island fox is the smallest canid in North America. Adults weigh approximately 2.0 kg and are a third smaller than their mainland progenitor, the gray fox (*Urocyon cinereoargenteus*). The island fox is one of the most geographically restricted canid species, being found only on the six largest of California's eight Channel Islands. Both genetic and morphological differences among the island populations support the differentiation of the species into six separate subspecies, one on each island where the fox occurs. Within the park, island foxes occur on San Miguel Island (3,865 ha), Santa Rosa Island (21,600 ha), and Santa Cruz Island (24,314 ha).

Decline of island foxes on the northern Channel Islands

Island foxes have typically existed at small population sizes of 100 to 1,000 individuals. Total population for the species in 1994 was approximately 6,000 adults (Roemer et al. 1994). Current population size is less than half that, and island foxes have declined by over 90% on four of six islands (Figure 21.1; Coonan et al. 1998; Roemer 1999; Timm et al. 2000; Coonan 2001). Only 17 island foxes remain on San Miguel Island, and all but one are in captivity. Likewise, there are 21 foxes in captivity on Santa Rosa Island, and only one left in the wild.

On Santa Catalina Island, which is not in the park, island foxes declined by over 90% on the eastern portion of the island due to an outbreak of canine distemper virus, probably vectored to island foxes by domestic dogs (Timm et al. 2000). On the northern Channel Islands, predation by golden eagles (*Aquila chrysaetos*) is likely responsible for the massive population decline. The evidence for the importance of eagle predation comes from two studies that bracket the period of decline. In 1994-1995, Roemer (1999) found signs of eagle predation at 19 of 21 island fox carcasses on the western end of Santa Cruz Island, and during that time period the study population declined from 35 foxes to zero.

NPS conducted a radio-telemetry study on San Miguel Island in 1998-1999 to directly determine mortality factors for island foxes. Within four months of the study's inception, six of eight radio-collared foxes had died, and four of those deaths were attributed to eagle predation (Coonan et al., in prep.). Cumulative survivorship over the year-long study was approximately 10%.

Golden eagles have not historically bred or wintered on the northern Channel Islands. Golden eagles were first sighted on the islands in the mid-1980s and the first nesting record was in 1999 (Roemer 1999). Their increased presence is due to the

existence of a substantial non-native prey base, feral pigs, and the recovery of mainland golden eagle populations following decades of persecution. Also, bald eagles (*Haliaeetus leucocephalus*) historically bred on the Channel Islands but have been missing since the 1950s due to persecution and the effects of organochlorine pesticides (Kiff 1980). Breeding bald eagles are highly territorial and may have prevented golden eagles from establishing breeding territories.

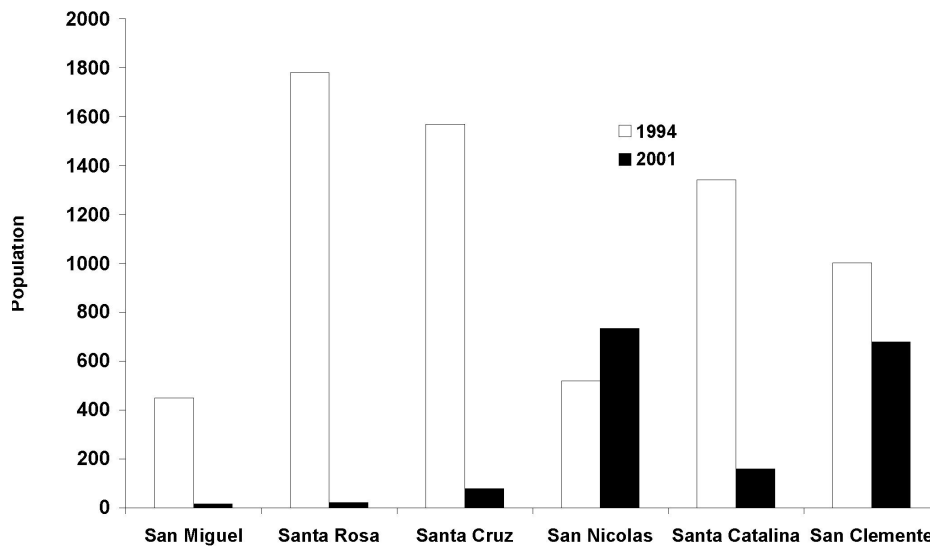


Figure 21.1. Island fox population estimates on each island where they occur, 1994 and 2001. Data are from Roemer et al. (1994) and Coonan (2001).

Island fox recovery actions

Faced with the imminent extinction of three island fox subspecies, NPS convened an ad hoc recovery team in 1999 to assess the status on the northern Channel Islands and to recommend emergency recovery actions. The team, comprising experts in canid conservation, endangered species management, and raptor research and management, concluded that island foxes were rapidly declining toward extinction on the northern Channel Islands, and that golden eagle predation had been confirmed as the primary mortality factor. The team recommended that island foxes be brought into captivity on San Miguel and Santa Rosa Islands to protect them, and to form the basis for a captive-breeding program that would ultimately return island fox populations to viable levels. The team recommended that golden eagles be removed from the northern Channel Islands until the root causes of their presence were rectified; that is, until feral pigs were eliminated from Santa Cruz Island.

Channel Islands National Park began emergency recovery actions in 1999, with the objectives being to remove the primary mortality factor now affecting island foxes (golden eagle predation), and to recover island fox populations to viable levels through captive breeding. Eagle relocation commenced in the summer of 1999 when raptor biologists from the Santa Cruz Predatory Bird Research Group, working un-

der a cooperative agreement with the park, began removing golden eagles from the northern islands by trapping the birds and releasing them in northern California (Figure 21.2). Bow-net traps were set around dead (feral pig) or live (rabbit) bait, and were tripped remotely when eagles alighted on the prey. Between November 1999 and March 2001, 14 eagles were removed from Santa Cruz Island. Several of these were members of pairs that began defending territories in the spring of 2000 but had not nested, most likely due to low numbers of piglets. Satellite telemetry shows that none of the relocated eagles have attempted to return to the islands; most have not attempted to cross the Sierra Nevada. At least seven eagles remained on the island as of spring 2001. Six of these comprised three breeding pairs, either at the incubation or hatchling stages by April 2001. Removal efforts were slated to resume in May 2001, but the island will continue to attract golden eagles until feral pigs are removed.



Figure 21.2. Golden eagle captured from Santa Cruz Island for relocation to northeastern California.

In 1999, NPS established an island fox captive-breeding facility on San Miguel Island, and added one on Santa Rosa in 2000 (Coonan and Rutz 2001). The program is being conducted under the guidance of a captive-breeding working group of the island fox recovery team. Fourteen foxes were brought into captivity on San Miguel in 1999 (Figure 21.3), and only one is known to exist in the wild. Of those 14, only four were males, and they were paired with females for the 1999-2000 breeding season. Only one of those pairs produced a litter (of two pups). Three litters were born on Santa Rosa in spring 2000, to females that had conceived in the wild. There are currently 21 foxes in captivity on Santa Rosa, and only one is known to exist in the wild.



Figure 21.3. Island fox pup, Santa Rosa Island captive-breeding facility, May 2001.

Physical establishment of the captive-breeding facilities was logistically challenging, due to the difficulties inherent in transporting materials and labor to the islands. On San Miguel Island, materials were taken by barge to the island and then lifted by helicopter onto the island. Pen construction was primarily by volunteer crews. Despite the difficulties in establishing and maintaining island captive facilities, the alternative of breeding on the mainland is not currently feasible or acceptable. First, there is very little small-canid space available in North American zoos. Second, island foxes are extremely vulnerable to canid diseases and parasites, and any foxes bred on the mainland would potentially vector pathogens to wild populations.

The captive pens (Figure 21.4) are constructed of 6x10-ft chain-link fence panels, about 45 sq m in extent, roofed to prevent foxes from climbing out and to protect them from aerial predators. Each pen has several den boxes and other structures to provide foxes with locations for parturition and privacy.

Island foxes have never been bred in captivity before. Husbandry methods have not been established, and little is known of their reproductive biology. The park, therefore, consulted with numerous canid experts prior to designing pens and developing a standard diet. The park is also cooperating with canid pathologists and reproductive specialists to establish baseline conditions for the species.

The captive foxes' diet comprises high-quality dry dog food supplemented with hard-boiled eggs, vegetables and fruits, and dead coturnix quail and live deer mice (*Peromyscus maniculatus*). Foxes are given semiannual veterinary examinations. Several on-island field surgeries have been conducted to treat ailments, and have necessitated building a separate fox quarantine facility on Santa Rosa Island. In the spring of 2001, an adult female in the Santa Rosa facility died of cancer despite two field surgeries. With the known population of the San Miguel and Santa Rosa sub-

species numbering 17 and 22 foxes, respectively, this underscores the importance of each individual in the captive-breeding facilities, and the high level of care required to ensure the ultimate success of the program.



Figure 21.4. Island fox captive-breeding facility, Santa Rosa Island.

As if it were listed

Although there is a low probability that the island fox will be federally listed, the park has nevertheless decided to approach management of the species as if it were listed as endangered. The severity of the recent decline and the profound continuing threats to the species warrant an endangered species-type approach. Were the park not to treat the species with the attention and resources normally reserved for listed species, the potential extinction of three subspecies would contravene all NPS policies regarding conservation of natural resources in general and wildlife and rare species in particular (NPS 2001).

Several aspects of the island fox management program are typical of programs for listed species. First, the primary management measures, golden eagle removal and captive breeding of island foxes, are aggressive, difficult to implement, and largely unprecedented. The scope of recovery actions range from short-term actions, such as eagle removal, to longer-term actions, such as captive breeding of island foxes and eradication of feral pigs from Santa Cruz Island. The cost of recovery is significant; island fox recovery is estimated to take at least 10 years to complete (Coonan 2001), and costs to NPS are estimated at about \$5 million. This does not include the costs of pig eradication, which will require \$6-8 million.

The park has modeled its approach to island fox management on the U.S. Fish and Wildlife Service (USFWS) model, which includes establishment of a recovery team and development of a recovery plan. The park recognized early on that effecting the recovery of island foxes exceeds NPS capabilities, and requires a broad base of expertise. For example, with captive breeding the park is embarking on a long-term program for which the agency has little proficiency. Thus the island fox recov-

ery team originally convened by the park in 1999 will continue to meet on an annual basis to evaluate the recovery program and provide technical guidance.

The park developed a USFWS-style recovery plan that will serve as a road map to recovery (Coonan 2001). The plan is in the format of a typical USFWS recovery plan, which includes description of the species, the current status and trends, threats to the species, recovery goals and criteria, recovery actions, implementation schedule, and cost estimates. The plan also contains two sections (guidelines for management and need for the action) that are more typical of NPS plans. These were added because although their contents are assumed for USFWS recovery plans, they are critical elements of NPS plans and are needed to establish the necessity for the action and its basis in policy, legislation, and regulation.

The island fox recovery plan contains specific, measurable recovery criteria that are similar to delisting or downlisting criteria used by USFWS. Team members suggested that such criteria be developed using demographic modeling, to ensure that recovery criteria are attainable and have a basis in reality. Accordingly, the demographic modeling program VORTEX was used with island fox population data from San Miguel, Santa Cruz, and San Clemente Islands to determine values of demographic parameters such as adult and juvenile survivorship and female fecundity that would produce stable or increasing populations (Roemer et al. 2000). Modeling was then used to evaluate initial island fox population sizes that would result in robust populations that persist over time, both with and without catastrophic mortality factors such as canine disease and eagle predation. Finally, modeling was used to determine the scope of a captive-breeding program that would return wild populations to targeted levels within a reasonable time.

Obstacles to recovery

The non-listed status of the island fox, coupled with lack of long-term funding sources, present severe problems for recovery efforts. The decade-long recovery program outlined in the plan is largely unfunded, because there is no NPS funding source available for long-term, large-scale resource management actions. Moreover, project proposals for non-listed species do not rank as highly in existing NPS funding programs as those involving listed species. However, if the island fox were listed, it would be eligible for USFWS funding under the federal Endangered Species Act. Moreover, it would have much higher name recognition among the public, which would facilitate outside fundraising. Few people have heard of the island fox, much less realize that it is imperiled.

Listing would also bring the full weight of the Endangered Species Act to bear on the recovery program. If the species were listed, development of a recovery plan would occur under USFWS authority and expertise, but attempting to duplicate the USFWS recovery process within NPS is difficult. Park management is currently uncomfortable with the concept of an ad hoc recovery team, and has suggested that its use violates the Federal Advisory Committee Act. However, threats to biodiversity in the National Park System are unlikely to be abated any time soon, and NPS may find itself increasingly in the unenviable position of viewing non-listed species as functionally endangered. Ecological crises will continue to occur more rapidly than bureaucratic wheels can turn. NPS thus needs to become more comfortable with management actions borne of necessity, or else develop effective Servicewide tools and funding mechanisms to deal with rapid ecological crises.

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