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Further case-studies from around the globe

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Re-introduction of bobcats to Cumberland Island, Georgia, USA: status and lessons learned after 25 years

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Introduction

The bobcat (*Lynx rufus*) is a medium-sized spotted cat (4 - 18 kg), widely distributed in North America. Bobcats are legally harvestable in most of their range, and are currently classified as Least Concern by IUCN and listed in Appendix II of CITES, due to similarity of appearance with other spotted cat species. Bobcats in the coastal plain region of Georgia, USA, occur at densities of 0.4 - 0.6 per km^2. The most common prey of bobcats across most of their range are cottontail rabbit species (*Sylvilagus sp*). Cumberland Island is the largest of Georgia's Atlantic coastal barrier islands. Since 1972, approximately 80% of the island has been administered by the National Park Service as Cumberland Island National Seashore (CINS). The island has a subtropical climate and contains approximately 85 km^2 of upland habitat. It is accessible only by boat or small plane. Thirty-two bobcats were released on CINS during 1988 - 1989.

Goals

- Goal 1: Restore an extirpated native species to CINS.
- Goal 2: Reduce abundance of

Bobcat on Cumberland Island © F. Whitehead

herbivores (primarily white-tailed deer (*Odocoileus virginiana*), and feral hogs (*Sus scrofa*) on CINS.
- Goal 3: Increase regeneration of native vegetation (including live oaks (*Quercus virginiana*) on CINS.
- Goal 4:Test the validity of the Scent Station Index method for monitoring trends in carnivore populations.

Success Indicators

- Indicator 1: Survival of released adult bobcats on CINS.
- Indicator 2: Successful reproduction of bobcats on CINS.
- Indicator 3: Recruitment of island-born bobcats into the adult bobcat population.
- Indicator 4: Persistence of a bobcat population on Cumberland Island over time.

Project Summary

Feasibility: The 1983 Resources Management Plan for CINS identified re-introduction of extirpated species as a management objective. Bobcats are widely distributed in North America, and adapt readily to a variety of habitats and ecological conditions. Cumberland Island is located within the native range of bobcats, and they existed on the island historically until they were extirpated around 1907. Prior to the re-introduction, CINS had abundant populations of potential prey species, including white-tailed deer, feral hogs, marsh rabbits (*Sylvilagus palustris*), gray squirrels (*Sciurus carolinensis*), cotton rats (*Sigmodon hispidus*), and cotton mice (*Peromyscus gossypinus*).

An Environmental Assessment (required under the National Environmental Policy Act) was prepared prior to project implementation. Some commenters were opposed to the re-introduction of bobcats on the grounds that i) it was not desirable to control populations of herbivores or ii) it would be better to use human harvest to control herbivore populations rather than to re-establish a native carnivore. The Park Service issued a Finding of No Significant Impact, and the project was approved.

Release of a bobcat into the wild

Implementation: Adult bobcats (>1 year old) were captured using hunting dogs, leghold traps and cage traps from the coastal plain region of mainland Georgia. Captured animals were retained in a holding

Cumberland Island and Atlantic Ocean

facility on the mainland for <1 month. During this period, they were anesthetized, fitted with a very high frequency (VHF) radio-collar, and vaccinated for feline panleukopenia, rhinotracheitis, and calicivirus. Bobcats were released on CINS in groups of 4 - 6 at 1 - month intervals during October - December of 1988 and 1989. This controlled increase in population size allowed evaluation of the accuracy of the scent-station index. A total of 32 bobcats were released. All releases of bobcats were “hard releases” in which bobcats were transported to the release site and freed. One bobcat died at the holding facility when it slipped its jaw under the radio-collar. One bobcat released along the interdune meadow habitat ran into the Atlantic Ocean and swam away, and apparently drowned.

Post-release monitoring: Four graduate students and several technicians from the University of Georgia conducted three years of monitoring during and following the bobcat releases (1988 - 1991). Location and survival of all bobcats was monitored via ground and aerial radio-telemetry. Bobcats on the island were trapped using cage traps to replace radio-collars and to capture juvenile bobcats born on the island. Bobcat dens were located through intensive telemetry monitoring of females during the denning season. Food habits of bobcats were related to prey abundance by collecting bobcat scats and conducting line-transect surveys for large and medium-sized mammals and trapping webs for small mammals.

During 1997 - 1999, two graduate students from the University of Georgia conducted additional bobcat studies on Cumberland Island. A study based on a human dimensions survey of public opinion of the bobcat re-introduction found the level of knowledge about bobcats among visitors was low. Another study addressed bobcat food habits, surveys of white-tailed deer abundance, and live oak regeneration counts (Nelms, 1999). Deer harvest data from 1980 through 1997 was analyzed to compare deer condition and population structure before and following the bobcat releases.

Annual survival of the bobcats released on the island was 93% during 1988 - 1991. In the spring of 1989 at least 10 kittens were born in four bobcat litters. Three island-born bobcats were captured and radio-collared as adults in 1990. Marsh rabbits, deer, and cotton rats were major prey items during 1988 - 1991.

By 1997, marsh rabbits and deer occurred less frequently in scats relative to 1988 - 1991, and all other species occurred more frequently. Analysis of deer harvest data from 1980 - 1997 found that eviscerated body mass of deer increased after bobcats were released on CINS by an average of 5.0 - 7.6 kg for males and 2.0 - 4.9 kg for females. Deer abundance declined >50% after the re-introduction of bobcats. The number of live oak seedlings increased an average of 153.5 seedlings per 16 m^2 plot between 1990 and 1997. These changes suggest bobcats caused a trophic cascade effect through deer predation releasing oak regeneration (Diefenbach *et al.*, 2009). Visitor and deer hunter attitudes towards bobcats were basically neutral in 1997.

A project to collect and genetically analyze bobcat scats was initiated in December 2011. Nine bobcats were uniquely identified, which is likely an incomplete count of the island population. Predictions at the time of re-introduction, based on a population viability analysis, were that the population would stabilize at approximately 10 - 12 individuals (Diefenbach, 1992). Among these nine individuals, the average number of alleles observed at 12 microsatellite loci was 3.8 and the overall heterozygosity for the population was 0.519. We did not observe evidence of inbreeding and the population displayed a slight heterozygote excess (F= -0.183). Compared to genotypes obtained from six of the bobcat founders, there was a significant difference in allele frequencies (P = 0.005) between the modern and founding populations, suggesting genetic drift has occurred.

Major difficulties faced

- Environmental Assessment (EA) and Public Opinion: The initial justification of the re-introduction for the EA, to control herbivores, was a mistake (Warren *et al.*, 1990). Public support for a re-introduction for its own sake was underestimated.
- Lack of funding and agency ability to continue monitoring efforts: Intensive monitoring occurred during the first three years post-release. However, once the contract for the re-introduction and initial post-release monitoring was completed, the National Park Service did not have the resources or management priority to continue follow-up efforts. The additional research undertaken in 1997 and again in 2011 was initiated through the efforts of the principal investigators. This effect was probably compounded by staff turnover at CINS, and loss of agency knowledge about the details of the project.
- Lack of long-term storage for genetic (blood and tissue) samples: Blood samples were obtained from all of the bobcats prior to release. However, there was a fire at the facility containing blood samples at the University of Georgia, and additional samples shipped to another researcher at a different university were inadvertently destroyed.

Major lessons learned

- We believe that slow releases, whereby animals are held in captivity at the release site and allowed to leave captivity following a holding period, might have prevented the disorientation of the one bobcat that swam into the Atlantic Ocean and presumably drowned.

Captured bobcat born on island

- The use of locally adapted, wild-captured adults likely contributed to the successful survival and reproduction of the bobcats after their release. It is probably best to use experienced adults in re-introduction efforts whenever possible, and if not possible, to provide as much experience as possible to captive-bred animals prior to any release effort.
- Post-release monitoring that includes consideration of trophic-level characteristics and effects can potentially provide greater insight into project success (or failure). Despite the stated objective of controlling herbivore populations, the relatively dramatic reduction in white-tailed deer abundance was somewhat of a surprise and re-establishment of understory vegetation, including live oak seedlings, exceeded expectations.
- Had we conducted public scoping or human dimensions surveys prior to preparing the Environmental Assessment, we could have identified the diversity of public opinions that surrounded the proposed bobcat restoration. Furthermore, a proactive role with the media could have minimized misconceptions about the project and resulting controversy, and personal contacts with influential people in the local community could have allowed us to identify opposition to the project prior to formally releasing the EA. A project involving a more controversial species that potentially represents a greater threat to human safety or property (such as large carnivores) would be wise to invest considerable effort in the human dimensions aspect of the project.
- Sometime between 1999 and 2011, coyotes either were introduced or successfully immigrated onto Cumberland Island. By 2011, a year-round breeding population of coyotes existed on the island. The recent establishment of coyotes on CINS may have undesirable effects on the bobcat population or of the native prey species, and may trigger additional trophic-level effects. The establishment of the coyotes does highlight the fact that all ecosystems change over time and it may not be possible to anticipate all possible future scenarios.

Success of project

Highly Successful	Successful	Partially Successful	Failure
√			

Reason(s) for success/failure:

- The re-introduction was conducted in a protected natural area with suitable habitat, where bobcat harvest is not allowed.
- The re-introduction was conducted within the animal's native range, and with wild-caught adults.
- The re-introduction was part of management objectives for the natural area and had management support.
- Bobcats, in general, rarely conflict with perceived human interests.
- Genetic analysis of bobcat scat from the present population found moderate levels of genetic variation. This analysis suggests a shift in allele frequencies from the founding bobcats to the current population, suggesting genetic drift has occurred. Although several potentially related individuals were identified, there does not appear to be significant inbreeding occurring in the population. This bodes well for the long-term persistence of bobcats on the island.

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