

UC Agriculture & Natural Resources

Proceedings of the Vertebrate Pest Conference

Title

Anacapa Rat Eradication 10 Years Later

Permalink

<https://escholarship.org/uc/item/9rj9j5jn>

Journal

Proceedings of the Vertebrate Pest Conference, 26(26)

ISSN

0507-6773

Authors

Gasser, Erv
Badzik, Bruce

Publication Date

2014

DOI

10.5070/V426110330

Anacapa Rat Eradication 10 Years Later

Erv Gasser

National Park Service, Pacific West Regional Office, Seattle, Washington

Bruce Badzik

National Park Service, Golden Gate National Recreation Area, San Francisco, California

ABSTRACT: Black rats have been on Anacapa Island for close to 100 years and pose a threat to the biodiversity of the island. Removing non-native rats from an island is a powerful conservation tool. There have been numerous attempts to eradicate rats from Anacapa: 2001/2002 marked the first successful eradication of invasive rodents from an entire island where an endemic rodent was present, and the first aerial application of rodenticides in North America.

KEY WORDS: aerial broadcast, Anacapa Island, black rat, brodifacoum, endangered species, non-target, *Rattus rattus*, rodent control, rodenticides, trapping

Proc. 26th Vertebr. Pest Conf. (R. M. Timm and J. M. O'Brien, Eds.)
Published at Univ. of Calif., Davis. 2014. Pp. 98-100.

INTRODUCTION

Invasive mammals are major drivers of extinction and changes in ecosystems. This is very apparent on islands, where more than half of all vertebrate extinctions have occurred (Aguirre-Munoz et al. 2008). Rats (*Rattus* spp.) have been introduced to approximately 80% of the world's islands and are associated with the decline or extinction of invertebrates, vertebrates, and insular plants (Townes et al. 2006). In response to these negative impacts, new control techniques have been developed in New Zealand over the last 30 years using rodenticide baits (Townes and Broome 2003). Improved biodiversity following rat eradications has been well documented (Townes et al. 2006, Donlan and Heneman 2007). As these techniques are being refined, conservationists are attempting eradications on larger and more biologically diverse islands. As they do this, they face the challenges of mitigating for potential non-target species that are susceptible to rodenticides.

Here, we report on the successful eradication of black rats (*R. rattus*) 10 years ago from Anacapa Island, a unit of the Channel Island National Park (Park) located in Southern California. This project was the first invasive rodent eradication from an entire island where an endemic rodent was present. The rodent eradication was consistent with the Channel Islands General Management Plan (NPS 1985) to restore altered ecosystems.

METHODS

Study Area

Anacapa Island consists of three islets: East, Middle, and West. Black rats were introduced to the island some time before 1939. It is unknown exactly how they arrived, but it is believed they were introduced in supplies transported to the island or possibly from a shipwreck (Collins 1979). Evidence showed that the rats were having a negative impact on the Scripps's murrelet (*Synthliboramphus scrippsi*), as well as on terrestrial and intertidal marine invertebrates (Erickson and Halvorson 1990, Jones et al. 2005, Whitworth et al. 2005). The rats had also been observed predated the native mice on Anacapa (Gellerman 2007).

Despite Anacapa's small size, a number of challenges presented themselves to those working on the rat eradication on the island, including 1) protected breeding sea birds [e.g., California brown pelicans (*Pelecanus occidentalis californicus*)], which limited access to parts of the island, 2) extremely steep cliffs with rugged topography, and 3) presence of native species, such as the endemic deer mouse and predatory birds susceptible to rodenticides. Due to these challenges, Island Conservation and Ecology Group and Park staff developed an overall mitigation strategy and specific techniques to limit potential environmental impacts while ensuring that sufficient amounts of bait would be delivered to all areas to eradicate the rats. As in other countries where aerial rodenticide applications occurred, adherence to laws such as the Clean Water Act and the National Environmental Policy Act was not required. The mitigation strategy included scheduling the rodenticide application to occur in the months of November and December when no breeding birds were present on the island, and trapping and relocating any predatory birds found on the island to a site that is sufficiently remote from the island to lower the possibility of the bird(s) returning. As an added mitigation measure, the rodenticide application was staggered over 2 years to protect a variety of species. To protect mice (*Peromyscus* spp.), approximately 1,000 individuals were live-trapped prior to treatment and held in captivity for 6 months before being returned to the island, at which point all traces of rodenticide had degraded in the environment. Additionally, custom bait was created so that the amount of rodenticide active ingredient was cut in half to reduce risk to native mice; this was feasible, as rats need less brodifacoum to succumb than do mice.

Rodenticide Application

Bait was broadcast by helicopter in December 2001 and November 2002 on East, and Middle/West Anacapa, respectively. The helicopter was equipped with an onboard GPS unit to ensure the bait was properly distributed. Areas around shorelines and caves were baited by hand, using boats for access. Aerial distribution of rodenticide on Anacapa Island required compliance

with a variety of environmental laws; development of an Environmental Impact Statement; and acquisition of a 3-year quarantine exemption registration for aerial broadcast of a bait containing brodifacoum. Additionally, a specially-designed deflector shield was used on the hopper carried by the helicopter, in order to reduce the risk of rodenticide being introduced into the ocean while treating the cliff sides.

Bell Labs (Madison, WI) provided the National Park Service (NPS) specially-formulated bait labeled as "CI 25." The NPS was the registered label holder of record. The bait consisted of green, non-waxed, compressed grain pellets containing 25 ppm brodifacoum. The application rate for aerial and hand application was 15 kg/ha. It was applied in two stages: in 2001, East Anacapa was treated, and then in 2002 Middle and West Anacapa were treated. Both laboratory and field trials demonstrated the bait was palatable and lethal to rats (Howald et al. 2005). The bait was applied during the dry season (November - December) when the island rat population was likely to be food stressed and thus likely to consume bait (Erickson and Halvorson 1990), and when many of the predatory birds were absent from the island.

One hundred rats were live-trapped at various sites throughout the island using Tomahawk traps baited with peanut butter. The rats were anesthetized with isoflurane (IsoFlo); weighed, sexed, and aged; fitted with radio-collars (AVM Instruments, Livermore, CA) programmed with a unique radio frequency; and then released. Tracking was conducted nightly to determine a rat's approximate position and whether the rat was active. Prior to the rodenticide application, burrow locations were mapped by tracking radio signals during daylight hours when the rodents were not active. This action later facilitated locating rats that died below ground.

Live trapping, wax chew blocks, and radio telemetry were used to assess eradication efficacy. Live trapping was conducted in targeted areas before and after rodenticide applications. Tomahawk live traps (Tomahawk Live Trap LLC, Hazelhurst, WI) baited with peanut butter were placed every 15-25 m along transect lines across the islets in accessible areas. Flavored non-toxic wax chew blocks (experimental use, produced by Island Conservation and Ecology Group) were also used, before and after application; in some cases they were used in conjunction with the live traps, and other times they were used alone.

RESULTS

Of the 34 radio-collared rats known to be active just prior to the rodenticide application, all stopped moving between 0 and 14 days post-application. Of the rats 18 rats whose fate was followed (8 in 2001, 10 in 2002), 71% died underground. However, observations led us to believe that a higher number of rats may have died underground, as a number of the signals from the radio-collared rodents were lost. This observation was based on the fact that there were, at minimum, daily searches for dead rodents with few rodents found above ground. Following rodenticide application, in 21,382 trap-nights and 17,283 chew block-nights, no sign of rodent activity was found.

Surveys have shown that Scripps's murrelet populations went from a pre-eradication level of approximately

10 nests to >20 nests in 2010. Predation by all sources dropped 60% during the first year after the second stage of the application in 2003 (Whitworth et al. 2012). Cassin's auklet (*Ptychoramphus aleuticus*), which was never observed nesting on Anacapa before the rat eradication, was reported to have 2 active nests in 2003, and in 2010 the number had increased to 11 (Whitworth et al. 2012). The ashy storm-petrel (*Oceanodroma homochroa*), which was never known to inhabit the island, was observed with a nest in 2011.

DISCUSSION

The black rats that had inhabited Anacapa for over 100 years have been successfully eradicated. This was confirmed by data derived from live trapping and monitoring of chew blocks placed on the island. The successful mitigation plan for the Anacapa deer mouse (*P. maniculatus anacapae*) was based on prior research that recommended that a captive population of at least 1,000 mice caught throughout the entire island was needed to successfully maintain a genetically diverse deer mouse population (Pergams et al. 2000). Maintaining captive deer mice, as well as staggering the rodenticide application over 2 years, guaranteed two viable deer mouse populations existed at all times. Deer mouse populations were impacted during the application but returned to pre-application levels after reintroduction of captive mice.

Granivorous birds and raptors, like the native deer mouse, suffered impacts during the eradication; however, captive holding and translocation reduced the severity of the impact to raptors. Unfortunately, the experimental design and surveys were not rigorous enough to adequately monitor the impacts to granivorous birds. In future applications, captive holding or other mitigation measures may be needed to protect these birds.

The benefits of the eradication were quickly realized by island nesting seabirds, as a concurrent study documented the recovery of nesting Scripps's murrelet on Anacapa Island following rat eradication. The average hatching success increased from 42% to 80% (Whitworth et al. 2005). No apparent impact on marine animals was observed during the application.

The successful eradication of the black rats on Anacapa Island demonstrates that it is possible to eradicate the invasive rodents when mitigation measures are in place to safely protect native species that are susceptible to impacts from rodenticides. However, granivorous birds and raptors may need additional measures to protect them from impacts of rodenticides in some scenarios.

LITERATURE CITED

Aguirre-Munoz, A., D. A. Croll, C. J. Douglas, R. W. Henry, M. A. Hermossillo, G. R. Howald, B. S. Keitt, L. Luna-Mendoza, M. Rodríguez-Malagón, L. M. Salas-Flores, A. Samaniego-Herrera, J. A. Sanchez-Pacheco, J. Sheppard, B. R. Tershy, J. Toro-Benito, S. Wolf, and B. Wood. 2008. High-impact conservation action: Invasive mammal eradication from the islands of western Mexico. *Ambio* 27:101-107.

- Collins, P. W. 1979. Vertebrate zoology: The biology of introduced black rats on Anacapa and San Miguel Islands. Pp. 14.1-14.9 in: D. M. Power (Ed.), Natural Resources Study of the Channel Islands National Monument, California. Santa Barbara Natural History Museum, Santa Barbara, CA.
- Donlan, C. J., and B. Heneman. 2007. Maximizing return on investments for island restoration with a focus on seabird conservation. A report prepared for the Commonwealth Ocean Policy Program, Advanced Conservation Strategies, Santa Cruz, CA.
- Erickson, W. A., and W. L. Halvorson. 1990. Ecology and control of the black rat (*Rattus rattus*) in Channel Islands National Park. Cooperative Park Studies Unit, Technical Report No. 38, University of California.
- Gellerman, H. 2007. Conservation of the Anacapa deer mouse: Impact and recovery from an eradication. M.S. thesis, California Polytechnic State University, San Luis Obispo, CA.
- Howald, G. H., K. R. Faulkner, B. R. Tershy, B. S. Keitt, H. Gellerman, E. M. Creel, M. Grinnell, S.T. Ortega, and D. A. Croll. 2005. Eradication of black rat from Anacapa Island: Biological and social considerations. Pp. 299-312 in: D. K. Garcelon and C. A. Schwemm (Eds.), Proceedings of the Sixth California Islands Symposium. Instit. for Wildlife Studies, Arcata, CA.
- Jones, H. R., R. W. Henry, G. R. Howald, B. R. Tershy, and D. A. Croll. 2005. Predation of artificial Xantus's murrelet (*Synthliboramphus hypoleucus scrippsii*) nests before and after black rat (*Rattus rattus*) eradication. Environ. Conserv. 32:320-325.
- NPS (National Park Service). 1985. Channel Islands National Park, California: General Management Plan. National Park Service, U.S. Dept. of the Interior.
- Pergams, O. R. W., R. C. Lacy, and M. V. Ashley. 2000. Conservation and management of Anacapa deer mice. Conserv. Biol. 14:819-832.
- Towns, D. R., and K. G. Broome. 2003. From small Maria to massive Campbell: Forty years of rat eradications from New Zealand islands. NZ J. Zool. 30:377-398.
- Towns, D. R., I. A. E. Atkinson, and C. H. Daugherty. 2006. Have the harmful effects of introduced rats on islands been exaggerated? Biol. Invas. 8:863-398.
- Whitworth, D. L., H. R. Carter, R. J. Young, J. K. Koepke, F. Gress, and S. Fangman. 2005. Initial recovery of Xantus's murrelets following rat eradication on Anacapa Island, California. Marine Ornithol. 33:131-137.
- Whitworth, D. L., H. R. Carter, and F. Gress. 2012. Responses by breeding Xantus's murrelets eight years after eradication of black rats from Anacapa island, California. Unpubl. Rept., Calif. Instit. of Envir. Studies, Davis, CA. 79 pp.