

AT THE DRAWING BOARD: PLANNING A MOUSE ERADICATION ON THE FARALLON NATIONAL WILDLIFE REFUGE

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I. OBJECTIVES

- 1) Share preliminary ideas on mouse eradication project
- 2) Discuss why we want to get rid of mice
- 3) Talk about ideas for next steps and information needs we have to generate feedback

I. INTRODUCTION/BACKGROUND

A. ISLAND SETTING & REFUGE RESOURCES

The Farallon NWR was established in 1909 by President Teddy Roosevelt. It is a group of islands, with a land area totaling 211 acres, located approximately 28 miles west of San Francisco. The islands are steep granite outcrops, uplifted from the ocean floor. Only the largest one, the 120-acre South Farallon Island, is accessible and inhabited by people and house mice. The Farallon NWR is part of the San Francisco Bay NWR Complex. Headquarters are located in Fremont, CA, in south San Francisco Bay.

SEFI houses a small field station comprised of a half dozen vintage buildings inherited from former tenants: 2 former lighthouse keeper's quarters built in 1876 (listed on the register of historic places) serve as residence/ offices. Several other buildings left over from US Coast Guard (USCG) or other military days house other support facilities (i.e. power generation, workshop, equipment storage, a lighthouse).

Biologists from the Point Reyes Bird Observatory live on the island year long under a cooperative agreement with the USFWS. Their primary duties are to collect biological data, operate and maintain facilities, and prevent trespass and other human disturbance. Four to eight people live on the island at any one time.

The Farallon NWR comprises the largest seabird breeding colony south of Alaska. It supports 12 nesting seabird species including the world's largest breeding colonies of ashby storm-petrel, Brandt's cormorant, and western gull. Other species that nest on the refuge include tufted puffins, common murrelets, pigeon guillemots, and two species of auklets. The islands support 30% of California's breeding seabirds. Six marine mammals, including elephant seals, California sea lion, and the endangered Steller's sea lion, breed or haul-out on the islands. The waters surrounding the Farallon NWR are one of the best places in the world to study white sharks, attracted to the area by the abundant seals, a primary food source.

The current managers are nursing wildlife populations back from a long history of human occupation, use, and abuse. Wildlife populations were heavily exploited in the 19th and

early 20th centuries for meat, hides, and eggs. In the early 1800s sealers from Russia and the eastern US hunted marine mammals. The Gold Rush era brought eggers to the islands, who harvested staggering numbers of seabird eggs for customers in San Francisco. Some species completely disappeared from the island or were reduced by orders of magnitude. Wildlife populations are gradually recovering and increasing in number.

A. RODENT SPECIES ON ISLAND

The only rodent species on South Farallon Is. is the introduced House Mouse (*Mus musculus*). There are no native rodents on any of the islands.

Mouse introduction dates back to at least 100 + years ago. Although no documented records have yet been found, the rich oral history of the islands seems to point to an introduction sometime in the 1840s, and associated with the Russian occupation. Probably arrived via Ft. Ross. In fact, we suspect that the house mouse on the island is the Russian sub-species because of their characteristic white bellies (which led a one time to a false rumor of them being a native *Peromyscus spp.*)

I. RESOURCES AT RISK

A. ASHY STORM-PETREL

The Farallon NWR supports the world's largest breeding population of ashy-storm petrels, 50% or more of the total population. We are concerned about a long-term and alarming decline on SEFI. Long-term monitoring of breeding populations and reproductive success has collected a 27-year data set. Mark/recapture data have been partially analyzed and show a 42% decline in breeding population size between 1972 and 1992 (Sydeman et al. 1998). The total breeding population size of ashy storm-petrels on SEFI was estimated to be 2,661 in 1992.

The 2.87% annual decrease roughly equals the number of ASSP wings (as a % of population size) found per year along trails. So we feel that predation of adults is the main cause of the long-term decline that we are witnessing.

The ASSP was listed by the USFWS as a Category 2 species under the ESA in Nov 99. However, the USFWS discontinued all Category 2 designations in 1996. The ASSP is currently a "species of concern," with no status under the ESA. Prompted by the potential listing, PRBO (Sydeman & Nur) recently completed a population viability analysis of ASSP. The analysis concluded that the population is not in imminent danger of extinction, but should be considered threatened.

ASSP frequent breeding colonies year-round, but most intensely from Feb-Oct. They nest in rock crevices, and also use man-made features on SEFI, such as rock walls and buildings. Eggs are small, averaging 29.6 mm in length and 22.9 mm in breadth. Majority of eggs laid between mid-Apr and mid-July. They have a relatively long chick-rearing

stage; chicks fledge at an average of 84 days. So breeding period is relatively long: April through mid-Oct.

A. CASSIN'S AUKLET

Cassin's auklet were at one time the most numerous breeding seabird on the Farallons. In early 1970s their breeding population was estimated at over 100,000. The SEFI Cassin's auklet nesting population nesting has declined 70% over the past 20 years, according to PRBO/FWS monitoring studies. Current populations of CAAU on SEFI are estimated at less than 20,000.

Probable causes are predation of adults and long-term changes in food supply (krill and fish species, some of which use SF Bay. Entire, regurgitated auklet bodies are frequently found during the breeding season outside of their burrows, and are probably victims of gull predation. We are beginning to suspect that dis-articulated wing remains are victims of owl predation.

CAAU are burrow and crevice nesters. On SEFI courtship begins in Jan and nest building begins in late Jan or early Feb.. Egg laying from early Mar to late Apr. Eggs are 46.0 mm x 33.6 mm. Most young are fledged by end of Aug.

A. NATIVE ECOSYSTEM RESTORATION

Non-native mice conflict with one of the Refuge's objectives of restoring native species and eliminating exotics. The majority of plant species (in terms of diversity) are non-natives. The primary mouse food is a species of (introduced) *Chenopodium*. Anecdotal information suggests that house mice have become more numerous since the 1970s when non-native rabbits were eradicated. Rabbits likely competed with mice for *Chenopodium*, likely suppressed populations. There are doubtlessly other plant/rodent interactions that are as yet undiscovered.

A. FACILITIES

Mice damage field station facilities and equipment. They chew up paper products, insulation, wiring, etc. Their chewing, droppings, and urine have damaged equipment and caused shorts in electrical equipment. They are therefore considered a safety hazard. Whether they are vectors of Hantavirus has not been investigated, thus their human health risk is uncertain.

I. BIOLOGICAL/ECOLOGICAL INTERACTIONS

A. DIRECT VS. INDIRECT EFFECTS

There has been at least one documented occurrence of mouse predation on a (monitored) ASSP nest in July 1997. The extent of mouse predation on ASSP eggs needs to be further investigated. Our current thinking is that house mice are more indirectly responsible for

observed declines of burrow/crevice nesting nocturnal seabirds, through their effect on predatory, mouse eating birds. We used to think that Western Gulls were the smoking gun in ASSP/CAAU declines. Are beginning to think that predatory owls play more of a role. To understand this hypothesis takes an understanding of mouse cycles on the Farallons.

A. MOUSE CYCLES/RELATIONSHIP TO MIGRATORY AVIAN PREDATORS

House mice populations are rarely seen in the spring/early summer. Populations begin to grow (as evidenced by frequency of sightings in outside burrows and infestations in house) in July/August, probably in response to seeding *Chenopodium*. Populations peak in October and November. Mouse populations crash in December or with the first big rains (that flood out burrows).

Burrowing owls arrive in October when mouse populations are at their peak. Most are hatching year birds, who have not yet established winter residency periods. A few individuals each year (up to 4-8) usually remain on the island and over-winter. We hypothesize that the availability of mice causes them to be winter residents, as non-mouse eating birds migrate off the island after a few days or less.

Mouse population crashes in Dec-Feb. BUOW shift their diet to ASSP and CAAU

Preliminary investigation indicates that predatory birds (BUOW, BAOW, KEST, RLHA) that eat mice frequently over-winter. Non-mouse eaters (RTHA, SSHA, COHA, NOHA) do not overwinter.

A. RESULTS OF PRELIMINARY PELLETT ANALYSIS

In spring of 2000 we began to collect and examine the contents of owl pellets. Current year as well as prior year pellets were collected from known roost sites (usually crevices or caves), so the numbers below represent more than a single-season's predation pressure. Of a total of 133 dissected pellets, their contents were as follows:

BURROWING OWL:

58% ASSP remains
36% mice
12% beetle parts
10% CAAU
8% unknown birds sp.

BARN OWL:

43% CAAU remains
42% mice
15% unknown bird sp.
6% beetle parts
2% ASSP

LONG-EARED OWL:
100% had mice

In addition, we have two records of BUOW roost sites with up to 20 ASSP wings
1 documented record of BUOW killing a CAAU (no observations of BUOW killing ASSP)

I. DESIGNING THE PROJECT

A. CONCEPTUALIZED IN 1999

FWS and its partners PRBO began thinking about mouse eradication in 1999. Over the past 9 months, we have had two meetings to discuss the possibility. These meetings included rodent eradication expert Dick Veitch, and others with interest/ expertise in eradication: Mark Razon, Bill Everett, Gregg Howald, as well as two primary partners involved w/ managing the FNWR: USFWS & PRBO

To discuss the need for eradication and feasibility
To discuss mouse impacts, potential non-target effects
To outline steps and a process needed to accomplish a mouse eradication project
To discuss treatment options, identify data collection needs
To identify potential funding sources and stakeholders

A. SITE and ENVIRONMENTAL CONSIDERATIONS

- West End is a Wilderness Area
- Farallon Islands are within the Golden Gate Biosphere Reserve
- Waters surrounding the Farallon NWR are within the Gulf of the Farallons National Marine Sanctuary
- The Farallon Islands and surrounding waters are in the state managed Farallon Islands Ecological Reserve
- Steep, rocky, inaccessible terrain make aerial application our only option
- Need evaluation of effects on non-target species: 1 salamander species, gulls, fish

A. DATA COLLECTION EFFORTS IN 2000

Began general predation study this year to better document species involved in ASSP predation, their behavior, and other factors involved in predation

Time lapse video equip. and night vision camera to observe predation
Collection and analysis of owl pellets.

A. FUNDING

Proposal for mouse eradication submitted as a potential restoration project for Cape

Mohican Oil Spill funds (\$140,000)

* Phase 1 (Year 1): Pilot study to look at annual cycle of mice, determine growth pattern of food plants, understand other ecological factors.

* Phase 2 (Years 2-3): Prepare control plan, obtain permits, complete environmental documentation

* Phase 3 (Year 4): Implementation

USFWS San Francisco Coastal Ecosystem Project funded equipment for preliminary predation study (\$4,500)

I. NEXT STEPS

A. FURTHER DOCUMENTATION OF PROBLEM (Phase 1)

1. Analyze fall migration and over-winter records of non-mouse predatory birds vs. mouse predators in order to test hypothesis that greater % of mouse eaters over-winter.
2. Investigate direct effects of mouse predation on ASSP eggs/chicks via
 - time-lapse video camera
 - surrogate nest studies w/ quail eggs
 - smoke track plates.
3. Better document mouse population cycles on island & important food sources
4. Continue collection/analysis of owl pellets by season
5. Test potential non-target effects: salamanders, gulls, fish

B. \$\$\$\$\$\$\$\$\$\$

Develop more realistic budget

Seek funding sources

C. IMPLEMENT PHASE II

I. CONCLUSIONS

Eradicating house mice from SEFI would have positive effects on declining breeding seabird populations on SEFI: (ASSP and CAAU).

It would also result in benefits to migratory predatory bird species, primarily BUOW which is a California State Listed Species of Special Concern. A fairly large percentage of the BUOW population on SEFI dies in late winter or spring when their food supply crashes. If mice were eliminated, BUOW and other mouse predators would move on in

their migration.

Eliminating mice would also save facilities maintenance costs because mouse damage requires costly repairs .

Further investigations and analysis are needed to document the indirect and direct effects of House Mice on SEFI. Funding sources for this analysis, as well as planning and implementing the eradication are needed.

I. ACKNOWLEDGEMENTS