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Rodent Management in Death Valley National Park

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ABSTRACT: Death Valley National Park located 120 miles from any town, has a historic rodent problem. Native mice and commensal rodents are damaging historic structures and putting visitors and park employees at risk of contracting diseases from the rodents' presence. The majority of structures found in Death Valley are on the National Historic Register, meaning that repairs and/or improvements to the buildings are highly regulated, and some changes to the historic structure may not be permitted. This study looks at the feasibility of controlling rodents with minimal impacts to buildings and to the native wildlife found in the Park that is protected under National Park Service policy. A variety of tactics were employed to manage the rodent problem, including surveying and identifying the problems species and sites; rodent trapping; limited rodenticide use; and rodent proofing when possible. When all tactics were employed and Park staff became committed in their efforts to help solve the issue, a substantial drop in rodent populations was observed and maintained over the course of the year-long study.

KEY WORDS: Death Valley National Park, deer mice, historic structures, native species, Norway rat, *Peromyscus* spp., *Rattus norvegicus*, rodent control, rodenticides, snap traps

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INTRODUCTION

The National Park Service mission statement states the Service will preserve unimpaired the natural and cultural values and resources of the National Park System for the enjoyment, education, and inspiration for this and future generations. This statement directs the service to remove non-native species, and to restore and protect ecosystems along with preserving historic cultural resources found within the Park's boundaries.

Like many other tourist attractions, Death Valley National Park in California has its share of rodent problems. However, unlike most locations with rodent issues, Death Valley has some unusual challenges when it comes to removing these pests. Death Valley is recorded as the hottest spot on earth (Samenow 2012). Norway rats (*Rattus norvegicus*) and the house mouse (*Mus musculus*), both invasive species, are found throughout the Park inside and outside of structures. They are of concern to the Park Service as rats eat and contaminate food stuffs and animal feed. They also damage containers and packaging materials in which foods and feed are stored. Norway rats and house mice cause problems by gnawing on electrical wires and wooden structures such as doors, ledges, corners, and wall material, and they tear up insulation in walls and ceilings for nesting, which in historic structures is not acceptable.

Norway rats can undermine building foundations and slabs with their burrowing activities and can gnaw on all types of materials, including soft metals such as copper and lead, as well as plastic and wood. If roof rats are living in the attic of a residence, they can cause considerable damage with their gnawing and nest-building activities (Timm et al. 2011). They also damage historic and cultural landscape plantings.

With the hantavirus incident in Yosemite in 2012 (CDC 2012), the National Park Service has also placed an emphasis on removing the native deer mouse

(*Peromyscus maniculatus*) from inside structures in that visitors and staff use. Deer mice are also a concern because of their small size, as they can gain entry into many buildings and often enter vacated homes, cabins, and other structures where they build nests and store food. Deer mice damage upholstered furniture, mattresses, clothing, paper, or other materials they find suitable for constructing their nests (Quinn et al. 2012), and thus are a threat to historic furnishings found in the buildings along with causing destruction of Park and employee property. Death Valley National Park is home to 16 species of native rodents; 5 of those species are *Peromyscus* (NPS 2015), a mouse that is an important part of the native ecosystem, helping control populations of a variety of insects, and are an important food source for larger wildlife. Conducting rodent management activities in an area with these native species being present complicate the work being done, as native species they are protected under National Park Service regulations, and losing any of these mice by artificial means can impact wildlife that are dependent on these animals as a food source.

In a large number of structures and historic landscapes, commensal rodents were causing a variety of damage: house mice were gnawing on electrical wiring, and on water lines for air conditioning units in several structures; Norway rats were damaging historic artifacts by chewing and urinating on them. Both deer mice and house mice were contaminating human food supplies. With a limited amount of resources, the Park and a pest control contractor surveyed a number of buildings and came up with a list of 77 structures in need of prompt attention to address rodent issues.

STUDY SITE

Death Valley National Park, 3 million acres of wilderness along the California-Nevada border, is a land

of extremes – from Badwater Basin, the lowest point in North America at 282 ft below sea level, to the 11,000-ft snow-capped Panamint Mountains. The summertime temperatures routinely exceed 120°F in the Furnace Creek area of the park, at an elevation of 196 feet below sea level.

Death Valley poses several challenges to such a project. There are 16 species of native rodents found within the Park, and over 80% of the Park's structures are historic structures (NPS 2011); any changes to these buildings would require compliance with Section 106 of the National Historic Preservation Act (2009). There was an additional challenge due to the remoteness of the Park; the only pest control contractor who was qualified to do the work was located in Bishop, California, 120 miles away.

METHODS

Several control methods were considered, including live trapping and glue boards. Both techniques were rejected, due to management policies against relocating non-native species, and the fact that glue boards would not be effective in temperatures above 120°F. Live trapping of mice was also rejected due to the fact that mice have the reproductive potential to increase quickly, and the number of live traps needed to keep up with their reproduction potential was unmanageable.

To mitigate for the native species found in Death Valley, the Park and contractor put together a pre-baiting assessment program to identify what specific rodents were present at each building before moving into a full-fledged baiting program. The contractor worked with Park staff to confirm each species present. The plan consisted of placing 70 Protecta LP[®] rat-size bait stations with non-toxic DEETEX blocks[®] (Bell Laboratories, Madison, WI). Over the next several weeks, they checked bait stations frequently to pinpoint the main areas of infestation. They assessed the number of hits to bait stations in different areas and documented the results. The results were confirmed by measuring bite marks and identifying rodent tracks in the area around the bait stations.

Before placing Bell Labs Terad₃[®], a cholecalciferol-based rodenticide the target area, the pest control contractor held a training session for Park staff to educate them about the baiting methods that would be used, along with additional measures Park staff needed to employ to help manage the problem (i.e., increase in sanitation, rodent proofing, etc.).

Seventy bait stations were routinely monitored and when bait was no longer being consumed, the bait stations were moved to new areas. The bait stations were monitored daily for activity; if a week passed with no activity, the station was removed. If there was excessive activity in the area, an additional bait station was added. When the bait stations were removed, in buildings where Park staff could monitor them daily, they were replaced with Havahart[®] X-Small 2-door live traps (Woodstream Corp., Lititz, PA). In buildings that had no Park staff assigned, wooden Victor[®] (Woodstream Corp.) snap traps were placed (mouse- or rat-sized, depending on the rodents previously identified at the site).

RESULTS

Using visual inspection techniques (i.e., looking for rodent droppings and damage) and reports of visual sightings from building occupants, it was found that in structures that followed up with rodent proofing, new trash cans, and an increase in sanitation, rodent population numbers dropped 80% or more in 9 months' time. Rodent population increase/decrease was measured by findings from live and snap-trap placement and by visual monitoring, where inspectors and building occupants filled out monitoring reports whenever rodents or rodent droppings were observed. In buildings where no follow up work (e.g., rodent proofing and sanitation improvements) was done, the house mouse, Norway rat, and deer mouse populations returned to their previous (before baiting) size within 6 months.

DISCUSSION

Even with the numerous challenges of a large deer mouse and diverse native rodent population, an isolated area, and lack of sufficient funds and staffing to adequately address the problem, an effective rodent management program can occur as long as all parties participate, and follow-up measures, including rodent proofing, sanitation improvements, habitat management to remove rodent nesting sites, and monitoring programs, are implemented.

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