**FARALLON NATIONAL WILDLIFE REFUGE**

**Preliminary**

**Structural Rodent Exclusion Assessment**

October 2010

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National Park Service Golden Gate National Recreation Area

On October 13, 2010 at the request of Gerry McChesney from U.S. Fish and Wildlife Service, manager of the Farallon National Wildlife Refuge and Daniel Grout of Island Conservation a preliminary inspection was conducted of the structures on Southeast Farallon Island to assess the feasibility of rodent proofing the structures to exclude non-native house mice found on the Farallon Islands.

The US Fish and Wildlife Service are working to eradicate the non native house mouse (*Mus musculus*) from the South Farallon islands, including all of the structures found on the islands.

In 1855 the US Lighthouse Service first established the lighthouse on Southeast Farallon Island, since that time multiple structures have been build and/ rehabilitated and demolished either partially or completely by a variety of agencies such as US Weather Bureau, US Lighthouse Service, US Navy, US Fish and Wildlife Service. It is important to consider all the changes that may occurred in structures such as the light house keeper’s homes first built in the 1870’s, a time before indoor plumbing and electricity existed and later structures that have been rehabilitated for present day use.

To fully appreciate the depth of some of the recommendations found in this report it is beneficial to have a basic understanding of the biology of the house mouse.

**House Mouse Biology**

The house mouse (*Mus musculus*) is one of the most troublesome and economically important rodents in the United States. House mice thrive under a variety of conditions, the can be found in and around homes, restaurants, commercial structures, agricultural fields and open fields and natural sites such as the Farallon Islands. In addition to eating and contaminating billions of dollars of food each year, house mice cause considerable damage to structures and property including many electrical fires from their gnawing of house wiring.

House mice for the most part are nocturnal mammals, although at some locations considerable daytime activity may be seen. Seeing mice during daylight hours does not necessarily mean that a high population exists, although this is usually true for rats.

House mice have poor eyesight, relying on their hearing and their exceptional sense of smell, taste and touch. Their sense of smell is highly developed, allowing them to detect down to 250 parts per billion. They are considered color – blind: therefore, for safety reasons rodenticides can be dyed distinctive colors without causing avoidance by the house mouse. Although their ability to perceive objects is limited to 1 to 2 feet, they can see movement up to 45 feet away.

The house mouse my burrow in to the ground in natural areas or around structures when other shelter is not readily available. Nesting may occur in the ground or in any sheltered location. Nests are normally constructed of shredded fibrous materials, such as paper, burlap, cardboard, cotton, or other similar items, and generally have the appearance of a “ball” of material loosely woven together. They are usually 4 to 6 inches in diameter. The House mouse typically does not go more than 30 feet from its nest; however, in natural areas of the Farallon Islands that distance may not hold true.

House mice have litters of 5 or 6 young, which are born 19 to 21 days after mating. Mice are born hairless with their eyes closed. They grow extremely fast and after 14 days they are completely covered with hair and their eyes and ears are open. After three weeks they begin to make short excursions from the nest and eat solid food. Weaning soon follows, and mice are sexually mature at 6 to 10 weeks of age. The life span of a mouse is usually nine to 12 months.

Mice may breed year-round, but when living outdoors, they typically breed mostly in the spring and fall. A female house mouse may have from 5 to 10 litters a year. Mouse populations can grow rapidly under good conditions, however breeding and survival of young decline markedly when population densities become high.

House mice have superb physical abilities. They are capable of climbing any rough vertical surface, balancing along horizontal wires or cables and jumping vertically on to a flat surface 12 inches above the floor. Mice can also reach speeds of 4 to 6 mph and bound across 3 foot gaps. They are tough enough to survive a 9 foot vertical drop. Mice can squeeze through openings slightly larger than ¼ inch in diameter.

Although house mice prefer cereal grains, they will eat almost anything. An adult typically consumes only 1/10 of an ounce of food per day by nibbling bits of food during its travels throughout the day. Mice also cache food as supply permits.

**Light House Keeper’s Quarters**

The two Lighthouse keeper’s quarters are basically in good shape. The crawl space and attic still need to be inspected on both buildings, which should be a high priority project, as these are typical sites to find large populations of rodents. In general, from the information presently at hand, both houses need only minor work, except perhaps for removing the debris in the crawl space of the Coast Guard House.



Removal of debris from under the structure is important as there is a potential for multiple mouse nests to be located in the piles and rodent activity would not be visible without crawling under the entire structure every time to inspect for rodent activity.

The most difficult task, will be patching holes on the cement foundation on both structures to fill in gaps the mice can use as entry points.



The rest of the work on both buildings typically consists of replacing vent screens and filling gaps around cables and pipes.

One area of concern is the voids where the original chimneys or other utilities have been boxed in. It is suggested that a Video Borescope / Wireless Inspection camera be obtained (See attachment A for more information on this device) to look into the voids to find out the condition of the chimneys and look for the presence of mice.

In the Coast Guard House, upstairs (Eastern bedroom), there is a closet that has a unique floor element that is located in an area with a very strong odor of rodent urine. This is another site where the boroscope would be of great value for inspecting this void with very little impact to the fabric of the building (about ½ hole is all that would be required for this device to access this area).



It would be beneficial if the original building plans for these structures could be obtained to see if there are any voids between the walls, or if the ceilings were dropped when the present day lighting and plumbing systems were installed.

There is what appears to be an old cistern at the back of the Coast Guard house that has lost it structural integrity. This area should be inspected thoroughly for rodent activity and if none found, the cistern should be filled in with sand or some sort of secure cover put in place to keep rain water and rodents from entering.

A more detailed inspection of these buildings should be carried out to look at specific issues, such as condition of door sweeps on all exterior doors and specific locations of entry points in the structure that need rodent exclusion. A mouse log should be placed in each structure so occupants can record any rodent activity that they observe (i.e. date and time, saw rodent or found rodent droppings) as this will help determine how successful the rodent exclusion work has been. Occupants should be reminded that exterior doors should be kept closed at all times to prevent rodent entry, this is especially critical in the months leading up to the rodent eradication.

With the fact that USFWS has an employee with experience in doing wood destroying organism inspections, thought should be given to performing an inspection on the two houses as this may provide an additional reason to support fumigating the structures.

Normally, structural fumigation with a product such as Vikane™ is rarely recommended for house mice, as their burrows and nests are so small there is a potential for the gas to not adequately penetrate in to these areas. It should also be noted that is common to experience roof damage when fumigating structures with shingle roofs, and there are safety issues to be concerned with tenting two story structures in windy areas. One should also not forget the potential for odor issues from the dead rodents. On the other side, fumigation will address any ectoparisite issues from the dead house mice.

**The North Landing Structure**

There is only minor rodent exclusion work needed on this structure. There is a large gap at the top of the roll up door that needs to be screened, along with installing a latch or door knob so the entry door can be properly secured in addition to caulking around the piece of plywood covering a large opening on the eastern side of the building next to the entry way.

Due to the extensive clutter in the building, it was difficult to conduct a quick assessment on mouse activity in this building, however some droppings were observed, but it was not known how fresh the fecal material was.

There is a clay pipe that runs south of the structure that has a gap in the top of the pipe that should be sealed in some manner (either replace pipe or place a strip of metal over the top to prevent rodent entry).

**The Power House**

There are numerous holes in the exterior walls, some with pipes, and some without. These will all need to be address to ensure all holes ¼ inch or larger are sealed. There is also the need to place screens over the air vents on the back wall.

Doors to this structure are apparently left open during the day to allow more ventilation of this facility. Consideration should be given to installing an “a mouse proof fence” (a strip of aluminum or sheet metal 2 ½ to 3 feet high) at the door ways to keep mice from entering the structure. It would also be beneficial to remove weeds and clutter on the exterior back wall, as this will take away mouse habitat and relieve potential population increases in this area.

It would be beneficial to reduce the clutter in the building to reduce mouse habitat, make it easier to monitor and trap for rodents.

**The Carpenter Shop**

Both doors to this structure have large gaps at the bottom of the door that need to be addressed, either door sweeps and door knobs (or something to cover holes) should be installed or new doors. There are multiple holes in the walls, with pipes running though them that need to be sealed.

The one task that will require a skilled worker is the area under the window on the eastern side of the building in which the mortar had previously failed, and a poor attempt was made to repair the problem, thus resulting in small cracks and holes in which mice can nest and gain entry into the structure.

It would also be beneficial to reduce the clutter in this structure to facilitate easier monitoring for rodents.

**The Pump House**

There are multiple gaps around the pipes entering this structure that need to be sealed up. This can be easily done by using a product such as Stuff-it (See attachment B).

**Water Storage Tank**

The below ground tank has several sites where the vent screening needs to be replaced. There also are pipes penetrating the structure in several spots that have gaps over ¼ inches in size that need to be sealed up.

**Fuel Storage Shed**

There are openings between the top of the wall and the ceiling that need to be screened in along with a few small gaps around the structure that need to be addressed.

**Next Steps**

The Light house and the workroom adjacent to the tower along with all the wooden water tanks still needs to be inspection, this is in addition to the crawl spaces and attics of the Light house keeper’s homes.

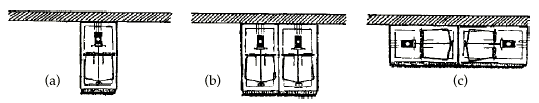
If resources are available, work should begin immediately to inspect the attics and crawl spaces of the lighthouse keeper’s quarters. If the attics are insulated, it may be worth trying to borrow or rent a Thermal Imaging Infrared camera (see Attachment C) to look for possible entry points. This camera will also pick up termite and wood rot, so it can help pinpoint repair needs and places where there is an easy potential for rodents to gain access to areas by gnawing through the wood work.

Rodent proofing the residential structures at this particular point in time will be advantageous as the fall season normally finds rodents in search of warm dry places to build nests, which usually results in new nesting sites inside the structure along with an increase in damage to the structure and contents. Preventing rodent access now will also reduce the amount of interior rodent control work later. Highest priority should be given to these structures as they have the highest food and water sources along with preferred habitat to the house mouse. It should also be remembered, that these are also the largest structures on the island and have the most potential to cause issues in the eradication project if rodent removal from the homes is not addressed properly.

If there is difficulty in determining how the mice are gaining access to rooms, one might want to consider the use of a trail camera set to operate at night after the occupants have gone to sleep or bring in a UV light to track urine stains. Or a simpler method is the use of baby powder or flour to track foot prints.

It would be the refuge’s benefit to have all island staff trained in the proper placement and setting of mice traps and rodent proofing. The US Environmental Protection Agency in 1982 stated that most rodent control programs failed due to not enough traps placed and poor trap placement. If all staff training is not practical, then all staff should be provided at least with this diagram and information from UC Pest Notes. (House Mouse Pest Notes are available at

<http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7483.html#MANAGEMENT> )



**Attachment A**

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| http://www.forestry-suppliers.com/images/vendor_logos/149800.gif   |  | | --- | | [http://www.forestry-suppliers.com/Images/Medium/8588_22501_v3.jpg](http://www.forestry-suppliers.com/product_pages/View_Catalog_Page.asp?mi=8588&title=Extech+Video+Borescope/Wireless+Inspection+Camera) | | **Extech® Video Borescope/Wireless Inspection Camera**  This inspection tool captures video with date/time stamp using a mini waterproof camera. The 39" flexible gooseneck’s camera features two bright LED lamps with a dimmer to illuminate the viewed object. Video can be played back on the 3.5" color TFT LCD wireless monitor or on any monitor with a video input jack. The detachable LCD monitor can be used for viewing at a remote location up to 32 feet away. Video and images can also be transferred to your PC using the included microSD card or USB cable and viewed using Windows® Multimedia Player. Comes complete with 4 AA batteries, microSD memory card with SD adapter, USB cable, extension tools (mirror, hook, magnet), video interconnect cable, AC adapter, magnetic base stand, and storage case. Camera – Pixels: 712 x 486. Transmission Range: 32' (10m) unobstructed view. Viewing Direction: Viewing angle 50°. Viewing Distance: 5.9" to 9.8". Shaft Diameter: 0.66". Working Length: 39". Dimensions: 7.3" x 5.7" x 1.6". Weight: 18.7 oz. Monitor – LCD Screen Type: 3.5" TFT. Pixels: 320 x 240. Frame Rate: 10, 15, 20, 25, 30 FPS. Video Resolution: 960 x 240 (avi format). Image Resolution: 640 x 480 (jpeg format). Dimensions: 3.9" x 2.7" x 1". Operating/Charge Time: 1.5 hours/3 hours. Weight: 4.9 oz. |
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Video Boroscopes / Wireless inspection cameras are available from Forestry Suppliers

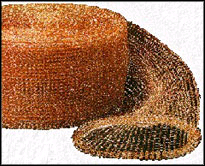
<http://www.forestry-suppliers.com/>

[www.**gsaadvantage**.gov/](http://www.gsaadvantage.gov/)

Home Depot, and some auto parts stores, they run from $250-$350 for basic models.

**Attachment B**

Stuf-It is a copper mesh product that comes in rolls (from 20 feet to 100 feet), that is great for a variety of rodent proofing needs.



It is available from a variety of pest control product supplies such at Target- Specialty Products in San Jose (408) 293-6032, Wildlife Control Supplies 860-844-0101 (They have the cheapest price)

<http://www.wildlifecontrolsupplies.com/>

This product can also be purchased from a variety of pest control supply places on the web

[www.**Do**My**OwnPestControl**.com](http://www.DoMyOwnPestControl.com)

<http://www.pestcontrolsupplies.com/Stuffit.htm>

**Attachment C**

Thermal imaging infrared camera (including sales and rental) information is available at

<http://www.flir.com/US/>

The best camera for this application is one for building diagnosis. One may be able to borrow a thermal imaging camera from local fire department, Coast Guard, or law enforcement groups.