

Draft Report

October 5, 2007

Zach Coffman and Jesse Irwin
Farallon National Wildlife Refuge
Wildlife Refuge Specialist
U. S. Fish and Wildlife Service
510-792-4275x33
zachary_coffman@fws.gov

BOARDWALK BURROW STUDY, FARALLON NATIONAL WILDLIFE REFUGE

2007 Monitoring Results and Project Summary

Introduction:

248 meters of dilapidated boardwalk were replaced on Southeast Farallon Island (SEFI) in September, 2000 with recycled plastic lumber. The boardwalks are designed to allow researchers to transverse the island and greatly reduce the incidents of crushed burrows. Researchers noticed Cassin's auklets (*Ptychoramphus aleuticus*) often dig burrows next to objects such as rocks or manmade debris as illustrated in figures 1 and 2. The new boardwalks were constructed with auklet trough design contain gaps roughly equivalent to the width of a Cassin's auklet (CAAU) body. This design basically skips every fourth plank leaving space for auklets to crawl underneath and excavate burrows.

Each pair of Cassin's auklets excavates and maintains their own burrow. Newly formed pairs claim abandoned burrows, dig their own burrow, or use one of the over 400 artificial nest boxes provided by PRBO Conservation Science, who monitor seabird populations on SEFI through a cooperative agreement with the U. S. Fish and Wildlife Service. Auklets readily use the nest boxes which facilitates population and productivity monitoring. Rhinoceros auklets, tufted puffins, pigeon guillemots, ashy storm-petrels, and Leach's storm-petrel are additional birds on the island that nest in burrows and crevices. Only Cassin's and rhinoceros auklets use burrows in areas affected by the boardwalks. There are no burrowing mammals on the island to provide additional burrows.

Methods:

The 248 meters of boardwalks are comprised of 18 sections of various lengths (see figure 3). Three of the 18 boardwalks are used for rhinoceros auklet mist netting and intentionally were not built with the auklet trough design to prevent losing fish diet samples down the cracks. Several of the shortest boardwalks were combined for the purposes of this study to form 15 study units, with numbers 7, 9, & 11 being the mist net boardwalks. Objectives of the study are 1) document colonization of newly created habitat; 2) survey burrow utilization by auklets; and 3) compare density of auklet burrows in the “influence zone” of the boardwalk (underneath or within 12” of either side) with burrow density in natural habitat (PRBO’s monitored Cassin’s index plots, figure 4). The Zone of Influence is illustrated in figure 5.

In June of 2003 every 10th board was sequentially labeled with an aluminum tag that allows us to identify each boardwalk and each burrow along the boardwalk. This was an improvement over the “sharpie pen” method of labeling boards, which quickly became illegible. All boardwalks were labeled as one long sequence. Each board was identified by its position in the sequence and each burrow was identified by the board that it was closest to. For example a burrow located at the 95th board in the sequence would be burrow 9.5 (remember every 10th board is marked). Boardwalks were mapped using GPS and each section of boardwalk was checked for burrows in the boardwalk zone of influence.

In each season from 2001-2007 a burrow census was conducted in the boardwalk zone of influence. GPS points were taken for all burrows along the boardwalk in 2003 and 2006. Location of the burrow is also indicated by the burrow number. A low-light burrow camera was used to check burrows for occupancy by nesting auklets. This camera has a 6’ long flexible shaft allowing the camera head to maneuver through the burrow. A hole longer than 12 inches and a diameter of 10cm or greater is considered a potential burrow.

Occupancy checks in 2002 and 2003 were conducted using a random subset of burrows in the boardwalk zone of influence. The resulting small number of positive determinations in the 2002 and 2003 surveys prompted for 2004, a complete survey of all the burrows instead of a subset of burrows. All observed burrows have subsequently been checked using the small diameter camera head low-light camera in June 2004-2007.

Results

52 burrows were identified at the end of the breeding season in August 2001. A check in February 2002 found the number of burrows increased only to 53. By the beginning of the breeding season (March 2002) 65 burrows were identified. In July 2002, 31 burrows were randomly selected and 7 (22%) were occupied.

In August 2003, 104 burrows were counted. 25 were selected for sampling (chosen by selecting every 4th burrow). Of the 25 only 18 burrows could be positively identified as either occupied or empty. The remaining seven burrows were too narrow for the camera head. 12 of the 18 (67%) were occupied. Sampling conducted in 2002 and 2003 was hindered by the 2.5" diameter of the camera head. A camera head with a 1" diameter was purchased to aid surveys in 2004 and beyond.

In June of 2004 138 burrows were identified along the boardwalk. All of the burrows were sampled with the new camera; of these, 88 of the burrows were occupied by Cassin's auklets, one had a rhinoceros auklet in it; 43 were unoccupied and I could not determine the occupancy in 6 burrows. Of the 132 burrows for which occupancy was determined, 89 (67.4%) had birds in them. This is comparable to the occupancy rate in PRBO index plots (natural habitat) where 60-65% is normal.

The burrows were surveyed again in June 2005. The number of burrows was reduced dramatically as only 60 burrows could be located. The winter rains filled in burrows and few birds were around through the winter and early spring to excavate and maintain burrows. Overall, the Cassin's had a very poor reproductive year on SEFI, including the boardwalk burrows. Of the 60 burrows located, 1 burrow had a Cassin's chick, 1 burrow had an adult Cassin's, 1 burrow had a Cassin's egg, 5 burrows had Rhinoceros auklet adults, and I could not make a positive determination in 9 burrows.

2006 started off on a good note then saw high abandonment during the warm, rainy March. 101 burrows were located during the survey, up 68% from 2005. 50 burrows were empty, 34 burrows contained eggs (many appeared abandoned), 1 burrow contained a CAAU chick and adult, 9 contained adult CAAU, 5 were occupied by adult

RHAU (same as 2005) and occupancy could not be determined in 2 burrows. Occupancy is 49.5% in 2006 if eggs are considered; however with the high abandonment rate occupancy may have been closer to 15.2% if eggs are not considered.

For 2007 there were 99 burrows located representing a nominal 2% reduction from the 101 observed burrows of 2006. Of these 99 burrows 65 were empty, 17 contained CAAU chicks (though 3 were dead), 4 burrows contained eggs, 8 contained adult CAAU'S (of which 7 had a unknown chick/egg with them), 5 were occupied by adult RHAU'S with an unknown (chick/egg) with them, 2 were occupied by RHAU chicks and occupancy could not be determined in 7 burrows.

In comparing the occupancy rates for the CAAU'S between 2007 and 2006 there were 34.3% of burrows (regardless of species) occupied for 2007, which is 16.2% lower than 2006. Of the burrows that were occupied 13.2% more contained chicks, 29.6% fewer had eggs, 1.8% less contained adults, 3% more had dead chicks in them and 5.1% more were unknown. A similar increase is observed in the RHAU where 2% more chicks were present and 5% more unknown (chick or egg) were observed.

Discussion

Weather conditions for 2007 were similar to the 2006 breeding season. Though the productivity for CAAU is well below the long term average in 2006, it appears to be a slightly better showing than 2005. The boardwalk burrow counts and occupancy rates are consistent with the results of PRBO's of long term CAAU studies.

The boardwalks were constructed in three of the PRBO index plots. For comparison, each index plot is 100m², while the boardwalks occupy a maximum of about 11m² within the plots (11% of the plot area). Index plots S4, S5, and S7 have boardwalks. Though the boardwalks occupy only 11% of the area in a plot, 36.4 to 44.4% of the burrows in those plots were found in the boardwalk zone of influence (figure 6, results through 2005). The high percentage of burrows under boardwalks compared to the area occupied by the boardwalks support our assumption that boardwalks can provide good nesting habitat.

Preliminary Conclusions and Recommendations:

- Construction of boardwalks on SEFI can be considered a successful habitat restoration and enhancement project. It protected habitat and the auklet trough design facilitated nesting by auklets within the first year.
- By year 3, burrow density and occupancy of the boardwalk burrows by nesting auklets equaled or exceeded natural nesting sites.
- Monitoring should continue for burrow density in the boardwalk “zone of influence” for at least 3 more years (2007-2009) since island-wide reproduction was poor in 2005 and 2006. The boardwalk was just becoming colonized and methods being perfected in 2001-2002. It would help to have additional data to observe confirmed results.
- All burrows should be checked for occupancy in June of 2008.
- Continue to compare burrow density between boardwalk’s zone of influence area and PRBO index plots.
- Consider installing more boardwalks, particularly near Rabbit Hill and the Catacombs. There is a RHAN mist located in this area that is heavily used. In addition the area is also highly populated with burrows.
- Additional boardwalks could be considered where main trail forks below the Corm Blind. This is an area where many burrows already exist but soil is prone to collapsing. Other areas on the Marine Terrace may also benefit from additional boardwalks.

Acknowledgements:

The boardwalks were constructed by the Telephone Pioneers with funding support from the Apex-Houston Trustee Council, Farallon Islands Foundation, San Francisco Bay Wildlife Society and UC Berkeley Seismology Lab. The Apex-Houston Trustee Council has provided continued funding for monitoring. Funding provided by the USFWS Coastal Program/ San Francisco Bay Program provided for the purchase of a burrow camera head that greatly improved our ability to survey auklet burrows.

Table 1. Comparison of burrow use rate and number of burrows observed under an artificial boardwalk on the Farallon Islands National Wildlife Refuge for Cassin's Auklet's and Rhinoceros Auklets

Number of Burrows Observed and Occupancy Within

	Number of Observed Burrows	empty	Cassin's Auklet					Rhinoceros Auklet		
			egg	chick	adult	unknown	Dead	adult	chick	unknown
Number of total observed burrows in 2007	99	65	4	14	8	7	3	5	2	5
Percent of total observed burrows in 2007		65.66%	4.04%	14.14%	8.08%	7.07%	3.03%	5.05%	2.02%	5.05%
Number of total observed burrows in 2006	101	50	34	1	10	2	0	5	0	0
Percent of total observed burrows in 2006		49.50%	33.66%	0.99%	9.90%	1.98%	0.00%	4.95%	0.00%	0.00%
Difference between 2006/2007		16.15%	-29.62%	13.15%	-1.82%	5.09%	3.03%	0.10%	NA	NA

Figure 1. Burrow entrance next to a partially buried rock.



Figure 2. Burrow entrance next to manmade objects.



Figure 3. Boardwalk and burrow locations 2006.

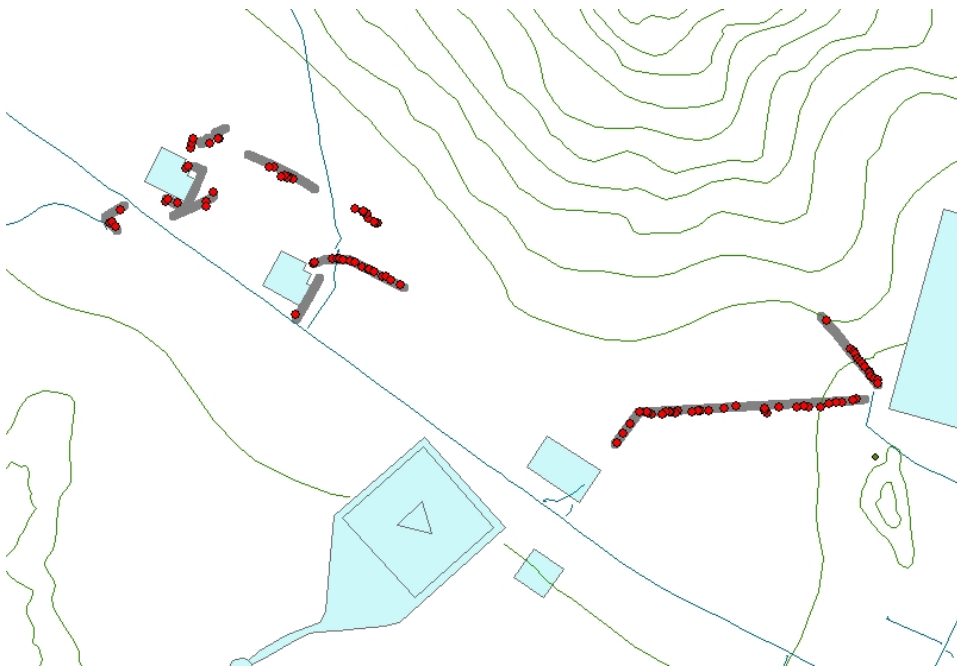


Figure 4. PRBO index plot locations.

Cassin's Auklet Index Plots

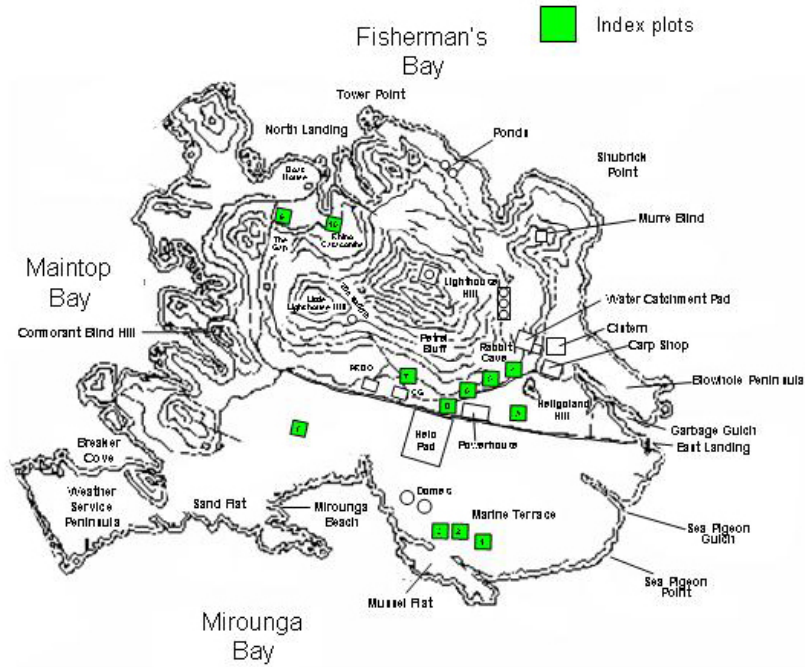


Figure 5. Burrow density of boardwalk area compared to natural index plots 2005.

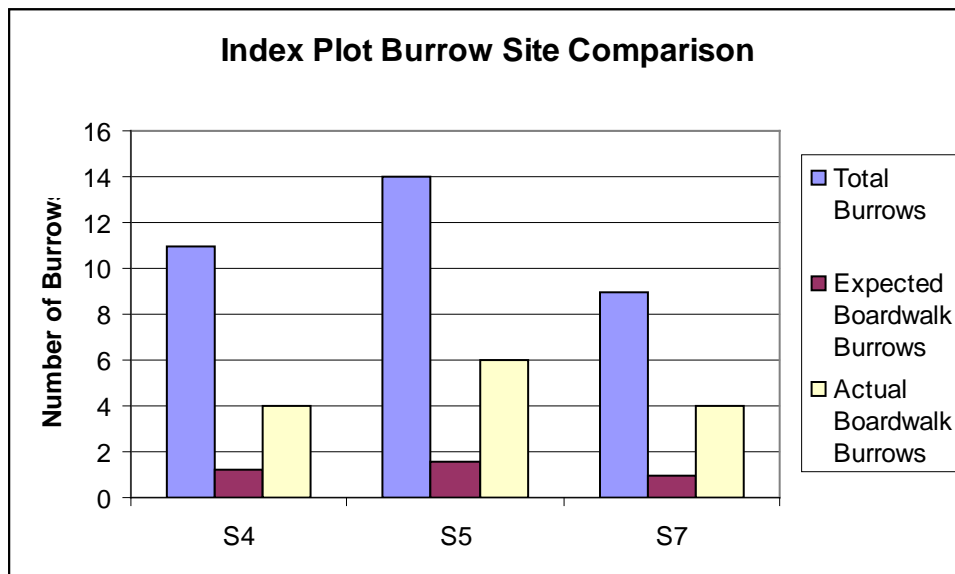


Figure 6. Boardwalk Zone of Influence.

