

## **FIVE-YEAR REVIEW**

### **Point Arena Mountain Beaver (*Aplodontia rufa nigra*)**

#### **GENERAL INFORMATION:**

**Species:** *Aplodontia rufa nigra*

**Date listed:** 12/12/1991

**FR citation(s):** 56 FR 64716

**Classification:** Endangered

#### **BACKGROUND:**

**Most recent status review:** Point Arena mountain beaver Five-year Review: 75 FR 28636 (05/21/2010).

**Initiation of Point Arena mountain beaver five-year review:** 83 FR 28251. Initiation of Five-Year Status Reviews of 50 Species in California, Nevada, and the Klamath Basin of Oregon (06/18/2018)

#### **ASSESSMENT:**

This Five-year review was conducted by the U.S. Fish and Wildlife Service's Arcata Field Office (AFWO). The entire occupied distribution and historical range of the Point Arena mountain beaver (PAMB) occurs within the jurisdictional area of the AFWO. Data for this review were solicited from interested parties through a Federal Register notice announcing this review on June 18, 2018. Additionally, we conducted a literature search and a review of information in our files, including information provided by private biological and forestry consultants. We also contacted species experts from private consulting firms; the U.S. Department of Agriculture, Forest Service–Pacific Southwest Research Station; and Humboldt State University. Additionally, the AFWO conducted PAMB occupancy surveys at several historical burrow systems and searched for new PAMB occurrences on accessible public and private lands from June 2016 through May 2019.

We did not receive any information from the public in response to our Federal Register Notice announcing this Five-year Review. However, new information included new occurrence records and nine peer-reviewed publications.

#### Notable Updates:

##### **1. Occurrence data:**

Since 2010, there has been an addition of 255 individual location detections noted in the AFWO records from the previously noted occurrences of 262 records. Approximately 40 percent of the 255 new occurrence records were from public lands and 60 percent from private lands. The majority (206 of 255) of new occurrence records postdated the 2010 Five-year review, but the remaining 49 records predated the 2010 Five-year review and were

recently (2016–2019) extracted from older maps and reports. A systematic PAMB occupancy survey of suitable habitat within the historical range of the PAMB was conducted in 2013 (Zielinski et al. 2015; see below) with PAMB burrow entrances detected at 33 of 127 (26%) 25-hectare sample units. Additionally, since 2016, the AFWO opportunistically confirmed PAMB occupancy within 10 of the 14 “geographical groupings” (2010 Five-year Review; Figure 2).

## 2. Annotated bibliography of relevant literature published since the 2010 Five-year review:

**Hunter, J.E., M.J. Mazurek, N.C. Nieto, and J.F. Foley. 2010.** Some ectoparasites and pathogens of the Point Arena mountain beaver (*Aplodontia rufa nigra*). Northwestern Naturalist. 91:225–229.

**Summary:** Captured 36 PAMB from June 2004 to January 2005 and examined them for ectoparasites. Representative specimens found from each apparent taxon of ectoparasites were submitted to taxonomists for identification. Three species of mites from two families were detected on 12 (33.3%) of the 36 PAMB examined. Fifteen (41.7%) PAMB were found to host the Ixodes tick, *Ixodes angustus*. The Histrichopsyllid flea, *Histrichopsylla schefferi*, was detected on seven PAMB (19.4%). This flea species, the world’s largest, is considered to be specific to mountain beavers and is considered rare. Usually, there is only one flea per host animal. Single specimens of each of three different taxa of small fleas were collected from three different individual PAMB. However, these fleas may be accidentals that originated from PAMB predators or other mammals that share PAMB burrow systems; that is, PAMB were likely not the host species for these small fleas. All eight ectoparasite species (i.e., three mites, one tick, and four fleas) mentioned above represent first records for the PAMB. The only pathogen identified from PAMB was *Leptospira interrogans*. This pathogen is a bacterial species containing over 200 pathogenic serovars, which are infectious agents that cause the zoonotic disease leptospirosis.

**Piaggio, A.J., B.A. Coghlan, A.E. Miscampbell, W.M. Arjo, D.B. Ransome, and C.E. Ritland. 2013.** Molecular phylogeny of an ancient rodent family (Aplodontiidae). Journal of Mammalogy. 94(3):529–543.

**Summary:** Mitochondrial and nuclear genes were sequenced to infer molecular phylogenies of *Aplodontia rufa*. One of the goals of this study was to use molecular data to test the current taxonomic hypothesis of seven subspecies of *A. rufa* based on morphology. Another goal was to incorporate geographic information to elucidate distributions of major clades. Results support the previously held subspecies designations based on morphological taxonomy, with one main exception: within *A. rufa*, the subspecies *A. rufa rainieri* and *A. rufa rufa* north of the Columbia River represent a single lineage and should revert to the name *A. rufa olympica*. Although this work revised geographic boundaries for some groups (*A. r. rufa*, *A. r. olympica*, and *A. r. pacifica*), the conservation status and management of only *A. r. olympica* (previously two subspecies) in

Canada may be affected. Findings support the continued conservation efforts for the isolated and endangered lineages present in coastal California, including the PAMB. Five individual genetic clades of *A. rufa* (Coastal [including the PAMB], Californica, Olympica, Pacifica, and Rufa) were identified.

**Pilgrim, K.L., W.J. Zielinski, F.V. Schlexer, and M.K. Schwartz. 2012.** Developing a reliable method for determining sex of a primitive rodent, the Point Arena mountain beaver (*Aplodontia rufa nigra*). Conservation Genetics Resources. DOI: 10.1007/s12686-012-9686-6.

**Summary:** Efforts to recover the PAMB have been limited by the lack of knowledge on their demography, particularly sex and age-specific vital rates. Recent studies have employed non-invasive genetic sampling to conduct capture-mark-recaptures to estimate abundance, survival and recruitment. This paper reports the development of a method using restriction fragment length polymorphisms to determine sex from tissues, bone and non-invasively collected hair samples for the PAMB.

**Scherbinski, J.J. 2018.** The influence of microclimate and local adaptation for a climate-sensitive species (*Aplodontia rufa*). Arcata, CA: Humboldt State University. 59 p. M.S. Thesis.

**Summary:** Examined the climatic niche of mountain beavers at four scales: range-wide; by clade; PAMB rangewide; and PAMB microclimates to test whether PAMB exhibit different climatic requirements than other subspecies of mountain beaver.

Modeled the distribution of mountain beaver range-wide and the distributions of the five individual genetic clades identified by Piaggio et al. 2013 (Coastal [including the PAMB], Californica, Olympica, Pacifica, and Rufa). To examine the microclimate use of PAMB, developed fine-scale climate surfaces using temperatures recorded from data loggers and topographic variables calculated from LiDAR data. These layers were incorporated with PAMB occurrence data to model distribution. Finally, examined pairwise differences in microhabitat use between burrows and available space.

At all scales, high temperatures were a limiting factor in distribution. Despite a low level of niche overlap at broad scales, mountain beavers appear to display some level of niche conservatism. The PAMB does seem to exist in a warmer climate than other mountain beavers; however, they apparently persist by selecting the coolest places within that range. This suggests that niche overlap between the Coastal clade and all other clades may be higher than what is detected at the coarser scale. Further research is needed to understand the mechanisms limiting this distribution, but it may be that mountain beavers in marginal habitat are more adaptable to changes in climate.

**Zielinski, W.J., and M.J. Mazurek. 2016.** Reproductive characteristics of the Point Arena mountain beaver (*Aplodontia rufa nigra*). Northwest Science. 90(2):136–145.

**Summary:** Knowledge of the PAMB breeding season and other reproductive characteristics is necessary so that ground-disturbing activities near burrow systems can be scheduled to avoid the breeding season.

Examined the reproductive status of 38 individuals, captured 150 times, from June 2004–July 2005 (excluding 01 February–01 May when prohibited from trapping). Used changes in vaginal cytology to monitor estrus and evaluated male breeding readiness by determining whether testes were scrotal. The earliest onset of estrus occurred on 02 December and it was detected until the trapping prohibition period began on 01 February. The first males had scrotal testes somewhat earlier, in late November, and most males were still in this condition when trapping prohibition began (i.e., 01 February). These data suggest an earlier onset of the breeding season than described for other subspecies of mountain beaver. All females and a majority of males (70%) examined in December and January had evidence of reproductive condition. No evidence of pregnancy was observed during the study period, but based on allometric equations developed elsewhere, and applied to the weights of juveniles we captured, parturition (i.e., birth of young) was estimated to occur in early- to mid-April.

**Zielinski, W.J., J.E. Hunter, R. Hamlin, K.M. Slauson, and M.J. Mazurek. 2010.** Habitat characteristics at den sites of the Point Arena mountain beaver (*Aplodontia rufa nigra*). Northwest Science. 84(2):119–130.

**Summary:** Located dens of 23 individuals via radio telemetry in Manchester State Park, Mendocino County, California. Measured vegetation and topographic variables directly above the dens and at two available sites within the same burrow system. Alternative resource selection functions, based on multivariate expressions of important ecological characteristics, were developed to model features associated with dens.

The best model contained three variables: MEANDENS (mean vegetation density), PAMBTOP4 (cover of the four plant species most frequently used), and COSASPECT (cosine aspect).

PAMBTOP4 was negatively associated with dens, indicating that dens were not chosen for their proximity to important plant species. Topography plays an important role in that western and northern aspects were favored and SLOPE was included in the second-highest ranked model. Cross validation indicated moderate stability for the top model suggesting that potentially important predictors that were excluded from the analysis (e.g., soil characteristics, social context) may be influential.

Demonstrated that dense vegetation and aspect/slope considerations are more important predictors of PAMB den selection than proximity to cover of important plant species. Results apply only to PAMB populations in coastal shrub communities; den selection may be different farther inland, in forests.

**Zielinski, W.J., F.V. Schlexer, T.L. George, K.L. Pilgrim, and M.K. Schwartz. 2013a.**

Estimating abundance and survival in the endangered Point Arena mountain beaver using noninvasive genetic methods. *Northwest Science*. 87(2):126–139.

**Summary:** Developed noninvasive survey methods, using hair snares to sample DNA and to estimate abundance and survival at two sites, Kinney Beach and Alder Creek, within Manchester State Park. Extracted DNA and genotyped 371 hair samples resulting in the identification of a total of 54 individuals during annual sampling from 2006–2009. Estimated population numbers were small, ranging from 9–18 individuals at Kinney Beach and 14–18 individuals at Alder Creek. Neither location demonstrated a trend in abundance over the 4-year sample period. There was weak support for higher apparent survival probabilities at Alder Creek (0.75) than Kinney Beach (0.59) and no support for time or site effects on recruitment. Recruitment ranged from 0.25 to 0.46 and was highest during the same interval (2007–2008) at both locations. The time series of estimates from 2006–2009 does not suggest that abundance at either study site is declining; while reassuring, concern still remains due to low total numbers at this, one of the few protected sites for this endangered subspecies.

**Zielinski, W.J., F.V. Schlexer, S.A. Parks, K.L. Pilgrim, and M.K. Schwartz. 2013b.** Small geographic range but not panmictic: how forests structure the endangered Point Arena mountain beaver (*Aplodontia rufa nigra*). *Conservation Genetics*. 14:369–383.

**Summary:** Examined the landscape genetic structure of the PAMB throughout its 85-km<sup>2</sup> range. Based on its small range, predicted widespread gene flow and a relatively weak role for landscape variation in defining genetic structure. Used skin, bone, tissue and noninvasively collected hair samples to describe genetic substructure and model gene flow. Examined spatial partitioning of multilocus DNA genotypes and mitochondrial DNA (MtDNA) haplotypes.

Identified three groups from microsatellite data, all of which had low estimates of effective population size consistent with significant tests for historical bottlenecks. Used least-cost-path analysis with the microsatellites to examine how vegetation type affects gene flow in a landscape genetics framework. Gene flow was best predicted by a model with “Forest” as the most permeable, followed by “Riparian.” Agricultural lands demonstrated the highest resistance.

MtDNA data revealed only two haplotypes: one was represented in all 57 individuals that occurred north of the east–west flowing Garcia River. South of the river, however, both haplotypes occurred, often at the same site suggesting that the river may have affected historical patterns of genetic divergence.

**Zielinski, W.J., F.V. Schlexer, J.P. Dunk, M.J. Lau, and J.J. Graham. 2015.** A range-wide occupancy estimate and habitat model for the endangered Point Arena mountain beaver (*Aplodontia rufa nigra*). *Journal of Mammalogy*. 96(2):380–393.

**Summary:** Determined PAMB range-wide distribution, predicted the environmental features that best describe their occurrence, and established a foundation for monitoring their distribution. Randomly sampled the occurrence of PAMB from the portion of their geographic range that was accessible (public lands plus private lands where permission was granted). Surveyed 127, 25-hectare sample units for their distinctive burrows and estimated the probability of detecting burrows, if they were present, at > 90% per visit. Using this information, estimated occupancy across the accessible portion of the range to be 26.2%. Range-wide estimates of occupancy, combined with strategically selected locations where abundance and survival can be estimated noninvasively, may comprise a realistic monitoring program for this taxon. Also used the detection and nondetection locations to develop a habitat suitability model by relating these locations to remotely sensed predictors. Evaluated 53 *a priori* candidate habitat suitability models and the best-fitting model included gentle slopes, low terrain roughness indices, and the high density of rivers and streams. Selecting the probability value that best separated the sample units into suitable and unsuitable habitat, they estimated a total of 70.5 kilometers<sup>2</sup> of suitable habitat, or approximately 40.4% of the original geographic range. New detections significantly expanded the known geographic range, moderating concerns about habitat loss, including that predicted by climate change. A substantial number of suitable areas were predicted to occur outside the current range. The identification of high suitability areas allows management agencies to prioritize areas for PAMB conservation planning, evaluate human impacts on habitat, and evaluate how a changing climate may affect distribution.

### **Conclusion:**

After reviewing the best available scientific information, we conclude that the Point Arena mountain beaver (*Aplodontia rufa nigra*) remains an endangered species. The evaluation of threats affecting the species under the factors in 4(a)(1) of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) and analysis of the status of the species in our 2010 Five-Year Status Review (75 FR 28636) remains an accurate reflection of the species current status.

Although the 255 “new” occurrence records nearly doubled the number reported in the 2010 5-year review, they all occurred within the known occupied distribution of the PAMB. That is, no new PAMB populations were discovered since the 2010 Five-year review. The systematic surveys conducted in 2013 by Zielinski et al. (2015; citation above) provided a baseline for quantitatively monitoring PAMB distribution within accessible portions of the historical range. Zielinski et al. (2015; citation above) recommended that the PAMB surveys at the 127 sample units previously surveyed should be repeated to estimate trends in occupancy over time.

PAMB populations on public lands (primarily Bureau of Land Management and California State Parks) continue to be protected from habitat loss and alteration and occupied areas are actively avoided. Occupied habitat on private lands is also largely avoided, but is at the greatest risk of being altered by conversion for residential development, agricultural use, or timber production. PAMB still exist in small, functionally isolated populations throughout their range. Increasing population abundance and distribution for this species will likely necessitate the continued protection or even restoration of habitat connecting currently occupied habitat patches. Increasing PAMB abundance and distribution may be especially important considering that

future climate change will likely increase ambient temperature and reduce rainfall, further reducing the distribution of the PAMB due to its preference for living in cool, moist areas.

#### **RECOMMENDATIONS FOR FUTURE ACTIONS:**

1. Estimate range-wide PAMB occupancy using methods described in Zielinski et al. (2015; citation above) on all public lands and accessible (i.e., where access is granted) private lands. Repeat occupancy surveys every five years to monitor trends in PAMB distribution.
2. Identify unprotected suitable habitat on private lands that appear to connect suitable habitat patches on adjacent protected public lands. Seek funding to place target parcels into conservation easements or to purchase outright. Improving habitat connectivity north to south across the Garcia River watershed and east to west on the north and south sides of the Garcia River watershed should be a priority; based on Zielinski et al. (2013b; citation above) suggestion that the Garcia River may reduce gene flow between PAMB populations.
3. Delineate suitable habitat patches on public lands in GIS and monitor for changes over time due to climate change. Monitor occupied patches for changes in occupancy over time.
4. Work with the Mendocino County Planning and Building Department to collaborate on county regulations on vegetation removal and ground-disturbing activities within suitable PAMB habitat as part of the Coastal Development Permit approval process.
5. Develop a roadside mowing plan for the California Department of Transportation (Caltrans) to protect PAMB burrow systems along their right-of-way (ROW) within the occupied distribution of the PAMB. The plan would establish maximum mowing widths and minimum vegetation height within occupied portions of the ROW. Similar mowing restrictions have been deployed in limited portions of the Caltrans ROW within the PAMB occupied distribution with good results, but a systematic approach to all road segment ROWs is needed.

#### **Lead Field Supervisor, Fish and Wildlife Service**

Approve Jennifer A. Novak for Date 8/21/2019  
Deputy Field Supervisor