



Salt Marsh Harvest Mice (*Reithrodontomys raviventris*) Distribution & Population Trends Along Eastern Shore of San Francisco Bay

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Abstract

The Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*) is a state and federally listed endangered species endemic to the salt marshes of the San Francisco Bay Area. As a result of anthropogenic activities, greater than 80% of the tidal marsh habitat in the region has been lost. The East Bay Regional Park District (EBRPD) and the California Department of Fish and Wildlife (CDFW) manages more than 40 miles of shoreline which includes viable Salt Marsh Harvest Mouse (SMHM) habitat. Using standard (SMHM) field protocols and genetic sampling techniques the Hayward Regional Shoreline (EBRPD) and Eden Landing Ecological Reserve (CDFW)(ELER or Eden Landing) were surveyed between the years of 2012 and 2020. Average Capture Efficiency values ($\frac{\text{\#SMHM}}{\text{\#traps} \times \text{\#nights}} \times 100$) approximated 2.8 for the EBRPD site and 8.34 for ELER site. Genetic analyses identified a close relationship between SMHM at Eden Landing and Hayward shoreline, with unique but relatively low diversity compared to sites in Suisun and San Pablo Bays. Because this species' remaining habitat is particularly vulnerable to the effects of climate change, sea level rise, and extreme storm and flood events, continued monitoring is necessary to document their distribution and population trends in order to provide critical information for adaptive management of estuarine wetland species that will influence the future development and restoration.

Study Areas

Hayward Regional Shoreline (EBRPD) contains an assortment of salt, fresh and brackish water marshes totaling more than 1,713 acres of Bayshore in Hayward, California (37°37'.30.19"N, Lat., 122°8'19.76"W Long.). Eden Landing Ecological Reserve (CDFW) is approximately 6,400 acres of restored salt ponds, diked wetlands, and upland transition that are managed for resident and migratory waterbirds and tidal marsh habitats and species. Eden Landing Ecological Reserve is adjacent to Hayward and Union City, California (37°37'.54.11"N, Lat., 122°06'07.18"W Long.).

Methods

Using standard (SMHM) field protocols and genetic sampling techniques the Hayward Regional Shoreline (EBRPD) and Eden Landing Ecological Reserve (CDFW) were surveyed between the years of 2012 and 2020 (Figure 1). Live traps were baited with birdseed and ground walnut; opened at dusk and checked at dawn. Each animal was identified to specie, sexed, marked and released. Capture Efficiency was calculated by dividing the number of SMHM by the number of trap nights ($\frac{\text{traps} \times \text{\#nights}}{100}$) (Figure 2&3). We identified harvest mice to species using mitochondrial DNA sequences. We also used the DNA sequences to assess the relationship of SMHM from Hayward and Eden to one another and to animals from Suisun and San Pablo Bays.

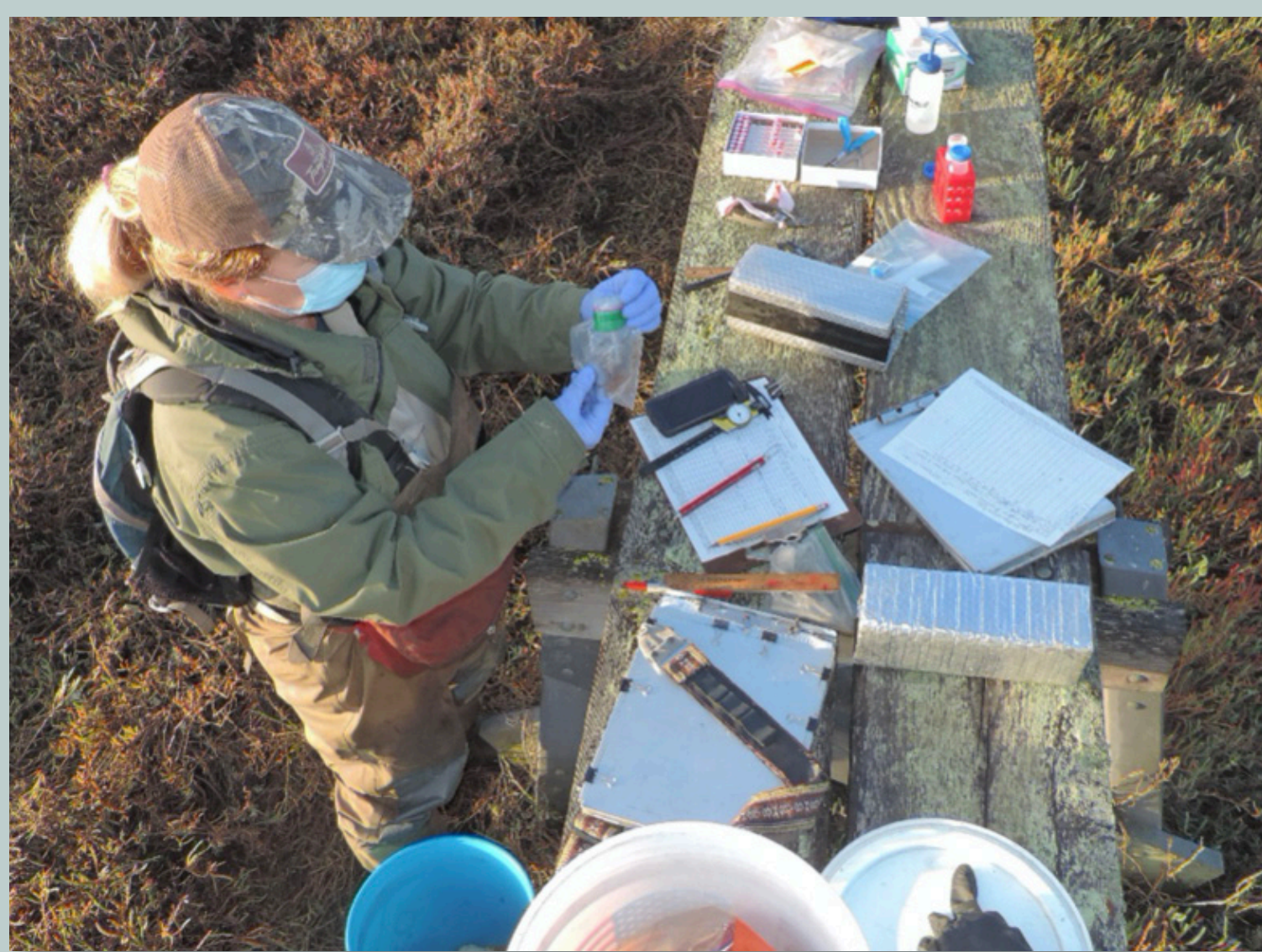


Figure 1. Using field protocols and genetic sampling techniques the Salt Marsh Harvest Mouse Working Group is examining existing SMHM populations to develop an San Francisco Bay Estuary approach to surveying and locating population hotspots and those that are most at risk or resilient.

Results

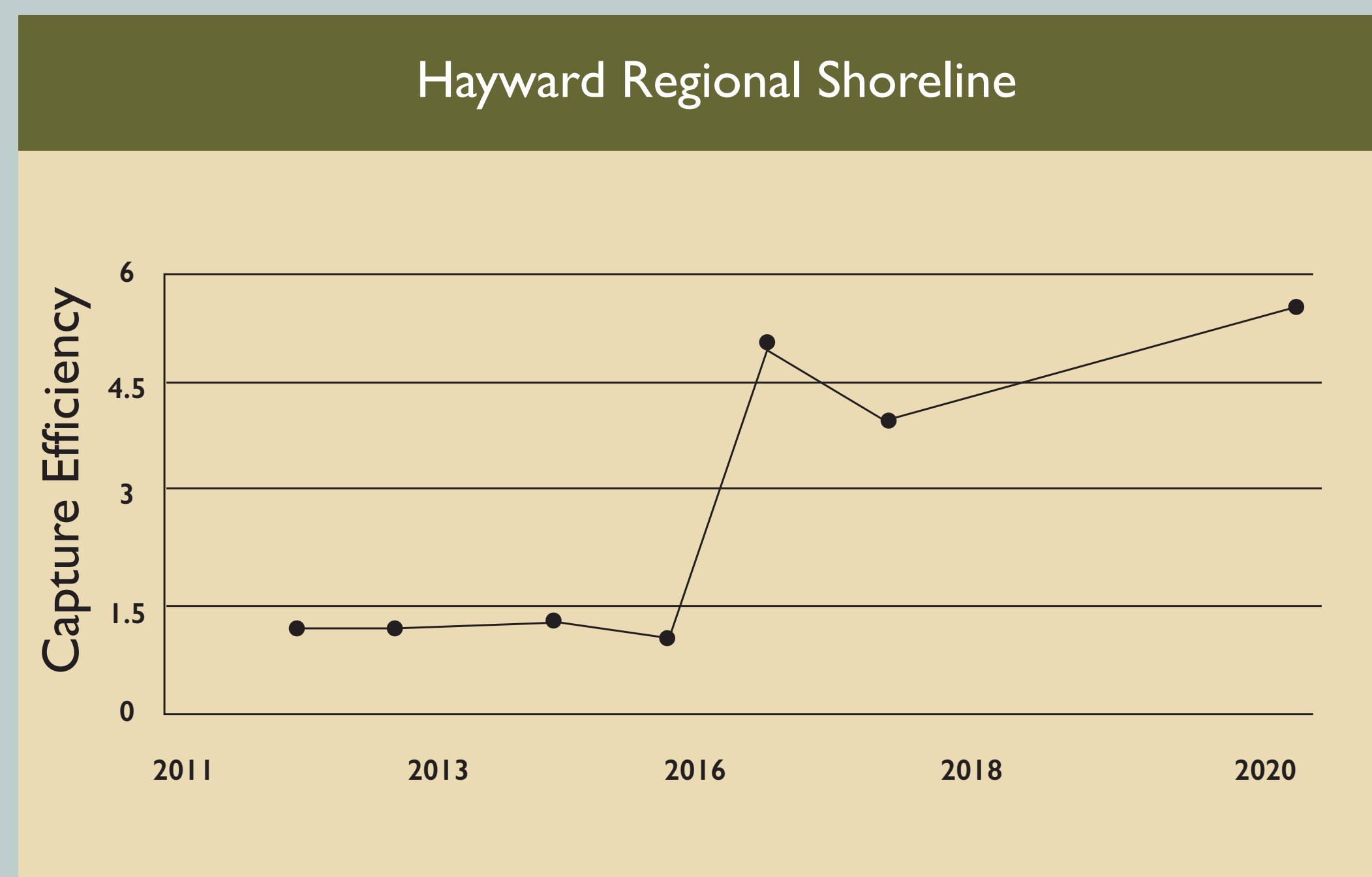


Figure 2. SMHM Capture Efficiency at the Hayward Regional Shoreline (EBRPD) between the years of 2012 to 2020 (Capture Efficiency average 2.8).

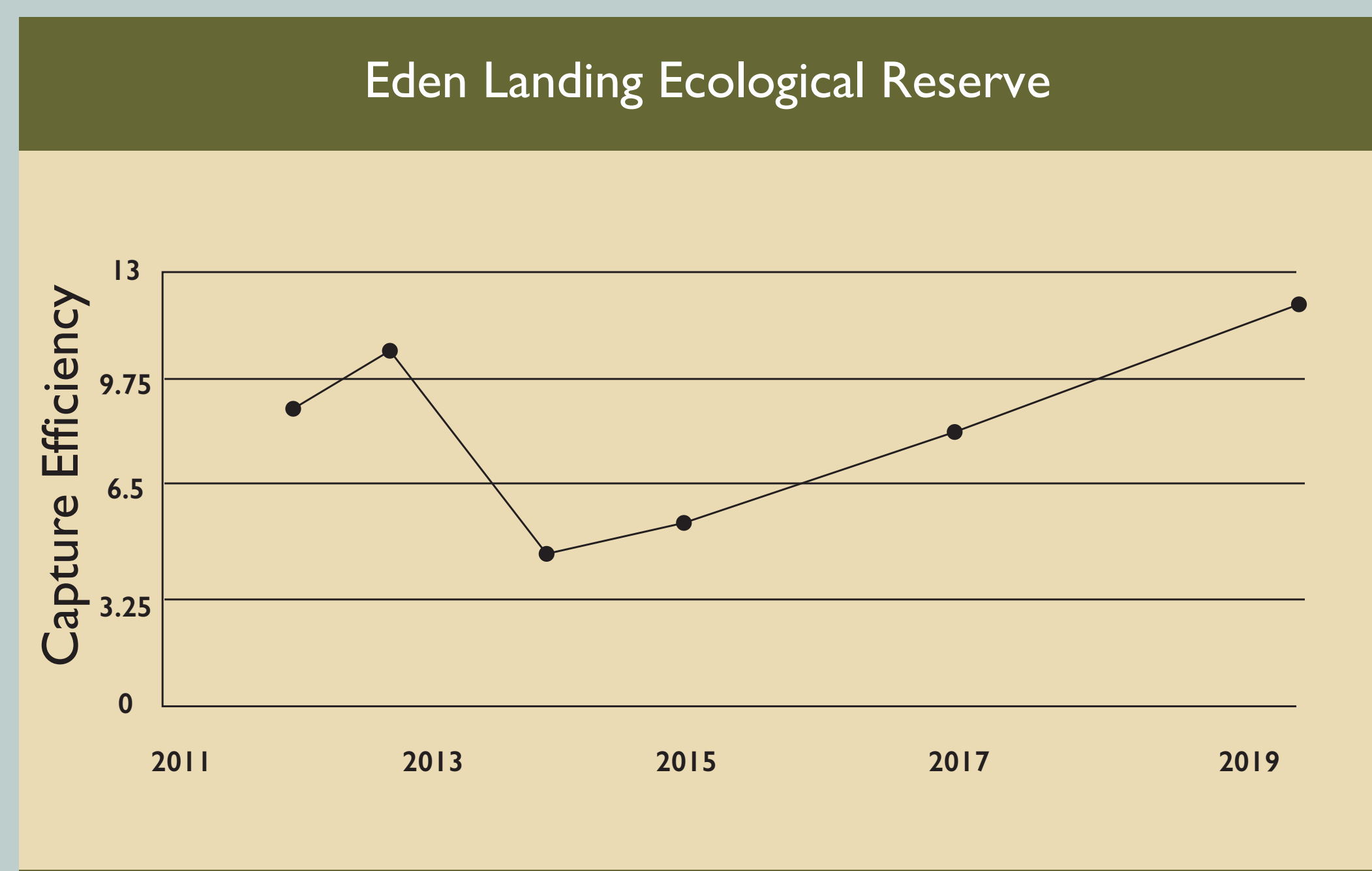


Figure 3: SMHM Capture Efficiencies for the Eden Landing Ecological Reserve. Only years 2017 and 2019 were surveyed in the same location. Years 2016 and 2018 were not surveyed.

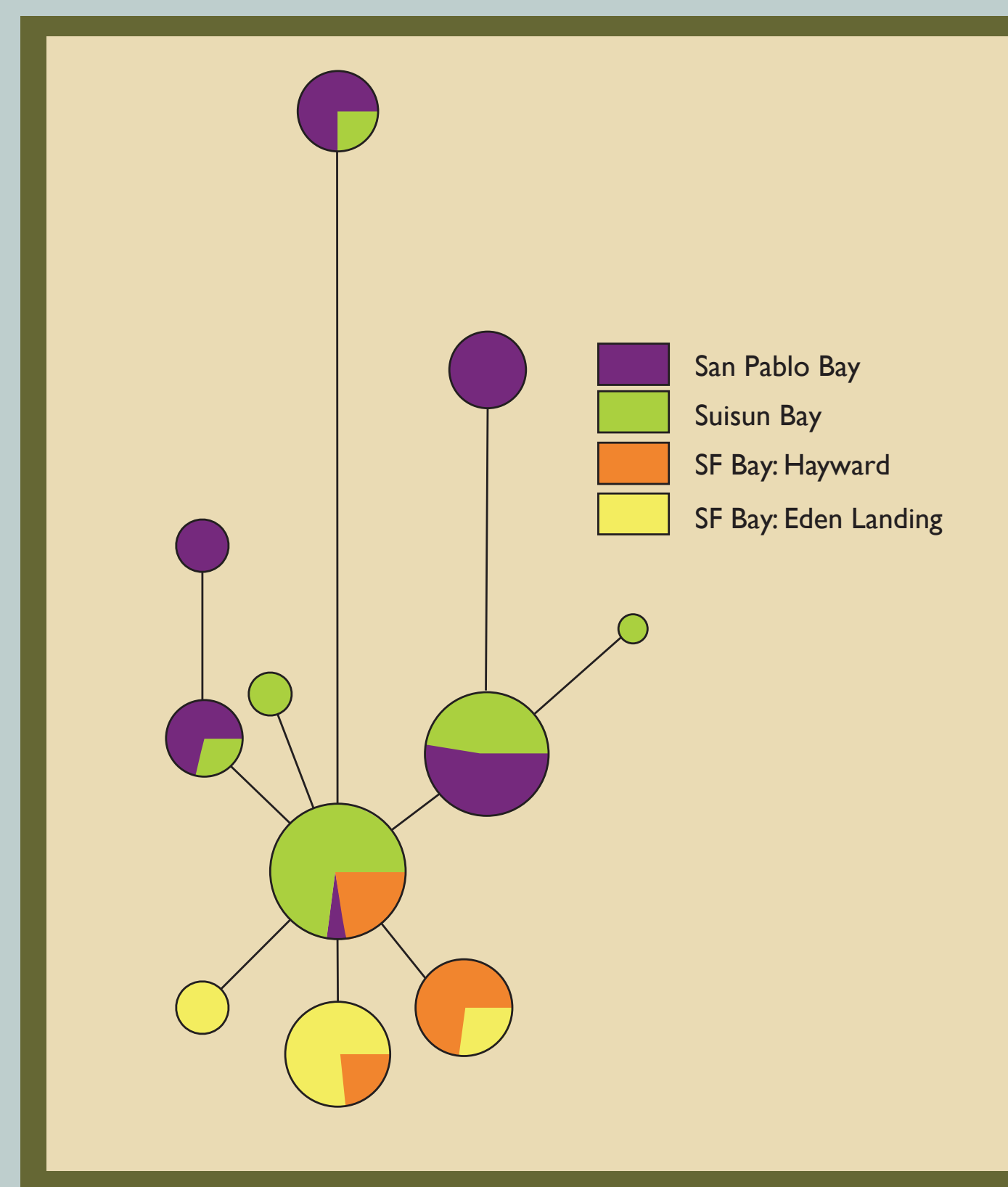


Figure 4. Haplotype network of salt marsh harvest mouse mtDNA. Based 96 mice (16 individuals from two locations each in San Pablo, Suisun, and San Francisco Bays) analyzed at 403 base pairs of cytochrome b. Circle sizes are proportional to the number of individuals represented and the distance between haplotypes is proportional to their genetic distance.



Figure 5. Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*) on eastern shore of the San Francisco Bay, California (Photographed by Daniel I. Riensche)

Discussion

We recovered DNA sequences from 16 SMHM at Hayward and compared to a similar number of individuals from Eden Landing and 2 sites each from San Pablo and Suisun Bays. The SMHM at Eden Landing and Hayward each shared two of their three haplotypes that were not found in any northern populations (Figure 4), thus indicating a close genetic relationship between southern sites. The two San Francisco Bay sites generally had lower nucleotide diversity than the mice from other locations. Together these findings confirm the unique, but less diverse, genetic nature of the southern SMHM subspecies.

Partnering Logos

