

Warren J. Baker Endowment

for Excellence in Project-Based Learning

Robert D. Koob Endowment *for Student Success*

CAL POLY

FINAL REPORT

*Final reports will be published on the Cal Poly Digital Commons website
(<http://digitalcommons.calpoly.edu>).*

I. Project Title

Investigating the Mechanism by which Southern Sea Otters (*Enhydra lutris nereis*) Facilitate the Invasion of an Exotic Fouling Bryozoan

II. Project Completion Date

June 15, 2017

III. Student(s), Department(s), and Major(s)

(1) Maggie Jenkins, Biology, M.S. Biology

IV. Faculty Advisor and Department

Lisa Needles, Biology

Dean Wendt, Biology

V. Cooperating Industry, Agency, Non-Profit, or University Organization(s)

VI. Executive Summary

I made progress on satisfying the objectives I set out to accomplish for my thesis project. Since spring of 2016, I designed and built predatory exclusion cages, deployed cages at the North T-Pier, and trapped crabs and maintained them at the Cal Poly pier. Additionally, I led over 30 scientific dives and collected sea otter foraging data weekly. I still need to run the foraging data through the Sea Otter Foraging Analysis (SOFA) program developed by Dr. Tim Tinker. However, based on my observations, clams comprise a majority of the sea otter diet in Morro Bay, but crabs still seem to be a major prey item. The caging supplies for the predatory cage exclusion experiment were more costly than expected, so I was not able to purchase cameras for documenting sea otter presence at the study site. However, I have been recording personal observations of sea otters foraging at the study site while diving and while collecting foraging data. We will be starting sea otter distribution surveys in July 2017 to help quantify the foraging pressure at the study site. We will be counting the number of sea otters present at the study site and recording their behavior.

I designed 9.5 in x 13 ft predatory exclusion cages with openings for 6 settlement plates per cage and removable doors for cleaning (Figure 1). The cage design and deployment took longer than anticipated; cages were deployed on 6 pilings at the North T Pier in May 2017. I began collecting data on crab abundances on the pier pilings at the North T-pier in Morro Bay and on the percent cover of fouling organisms on the settlement plates in June 2017. I will continue to collect crab

abundance data and monitor the percent cover of *Watersipora* through December 2017 to satisfy my objective of quantifying the changes in *Watersipora* abundance in response to varying crab densities.

I successfully disseminated my research to the general public and plan to present at the Western Society of Naturalists conference in November 2017. I was invited to present my research to the Santa Lucia chapter of the Sierra Club and gave a talk detailing the life history and current research surrounding the southern sea otter. I also created an interactive display, including live *Watersipora* and a mock pier piling photo booth (figure 2) for the Cal Poly Pier Open House. I mentored 12 undergraduate students throughout the course of this project, teaching them sea otter foraging data collection techniques, crab identification and husbandry, and data management. As data collection continues, I will collaborate with undergraduate biologists and scientific divers.

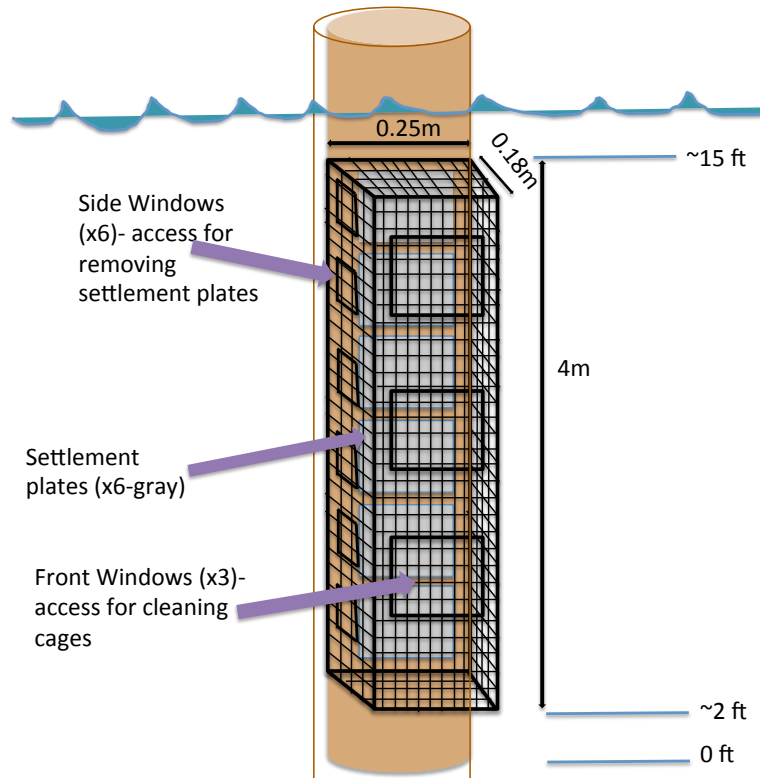


Figure 1. Design for predatory exclusion cages. Cages were deployed 5-7 ft below the surface at high tide and 2 ft above the ocean floor. Six settlement plates (gray) were deployed within each cage.



Figure 2. Mock pier pilings designed for photo booth at the Cal Poly Pier Open House.

VII. Major Accomplishments

- (1) Designed and constructed predatory exclusion cages and deployed my experimental set-up at the North T Pier in Morro Bay
- (2) Disseminated research to the general public at two outreach events- the Cal Poly Pier Open House and a Sierra Club event
- (3) Mentored 12 undergraduate students in the biological sciences department

VIII. Expenditure of Funds

I spent a total of \$2,464.5 on research and outreach supplies, and travel to the sea otter workshop hosted by the Seattle Aquarium. A majority of the research funds (\$2187.8) were spent on PVC for the settlement plates (\$621) and caging materials for building the predatory exclusion cages (\$573). The remaining research funds were spent on miscellaneous items such as painting supplies for applying antifouling coating, crab caging supplies and bait for maintaining the stock of crabs at the Cal Poly Pier, and zip ties and tools for deploying the cages. A total of \$235.78 was spent on attending the Seattle Aquarium Sea Otter Workshop where I had a chance to meet with leaders in the field and discuss sea otter foraging data collection techniques. The remaining budget (\$40.92) was used to purchase supplies for constructing the mock pier pilings, which were created for an interactive display at the Cal Poly Pier Open House. Thank you for supporting my research and outreach endeavor.

item	cost	store
hand trowel for removing cages in Morro Bay	9.22	Home Depot
AA\$ Rechargeable batteries for GPS unit	10.75	Home Depot
Anchovie Bait for feeding crabs	10.01	Patriot sportfishing
gas for fieldwork	211.19	Conserv Fuel
1/2" PVC pipe for building cages	22.55	Home Depot
crab caging supplies	58.35	Ace Hardware
crab caging supplies	12.93	Dollar Tree
outreach supplies	40.92	Michael's
painting supplies for applying anitfouling coating	10.05	Ace Hardware
painting supplies for applying anitfouling coating	67.01	Home Depot
caging supplies	95.52	Ace Hardware
zip ties	129.21	Home Depot
required regulator service	29.26	Depth Perceptions
seattle aquarium conference	235.78	Seattle Aquarium
bungee cords	36.14	Home Depot
pvc sheet for settlement plates	621	McMaster Carr
wire mesh caging material	430	Amazon
large cable ties-4ft	128.2	McMaster Carr
large cable ties-6ft	135.69	McMaster Carr
plastic mesh for cages	25	McMaster Carr
underwater paper	46	Amazon
rite-in-rain-paper	28.95	Amazon
bands for crab claws and tool for application	36.95	Amazon
stopwatch for foraging data collection	33.79	Amazon

TOTAL 2464.5

IX. Impact on Student Learning

I learned how to overcome obstacles associated with implementing an experiment. Through deploying the cages, I learned that everything is harder under the water and the more preparation that can be done on land, the better. Scientific diving for my research has taught me to allow more time than you may anticipate, have a back-up plan, and be flexible. I have applied my creative thinking and learned that, with innovation, almost anything can be fixed with a zip tie. I also improved my time management skills, and gained experience in managing undergraduate student research assistants.