



The ecology of organisms on the “lost reefs” of the Monterey Bay National Marine Sanctuary



Lauren Parker^{1,2}, James Lindholm¹, Scott Hamilton², Andrew DeVogelaere³

1 – Institute for Applied Marine Ecology at California State University, Monterey Bay, 2 – Moss Landing Marine Laboratories, 3 – Monterey Bay National Marine Sanctuary

Introduction

- Marine protected areas (MPAs) are used to conserve, manage, and protect ecologically and economically important marine resources¹.
- The design, implementation, and management of MPAs depends on reliable species/habitat associations and their use in estimating species composition².
- The majority of subtidal sampling to characterize marine resources in the MBNMS (Figure 1) is conducted using SCUBA in waters shallower than 20 meters and a variety of image-based platforms in waters deeper than 40 meters.
- While effective, these sampling techniques have left an area between 20 and 40 meters depth, termed the “lost reefs,” unexplored.

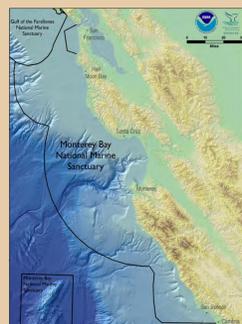


Figure 1. The Monterey Bay National Marine Sanctuary (MBNMS)

Goals

The goals of this project are to:

1. **Assess abundance, density, and species composition** along 30 meter transects at sites in Carmel Bay, California.
2. **Determine accurate size estimates and precise geo-referencing** of individual organisms along each transect.
3. **Create habitat suitability models** for economically important species in the MBNMS.
4. **Provide data and analyses** for use in updating the Sanctuary's Site Characterization, Condition Report, and Sanctuary Management Plan.

Methods

- Primary diving operations will be shore-based (with periodic boat dives) and will be conducted within no-decompression limits.
- Diver-held stereo video cameras will be coupled with traditional underwater visual census techniques to sample fishes and selected invertebrates.
- All stereo-video footage will be analyzed using *Eventmeasure* (Figure 3) digital imagery processing software and cross-referenced using visual census surveys along the same transect.
- Fish species will be identified in *Eventmeasure* and this data will be used to define depth zones and movement patterns for economically important fished species.
- Size data collected from *Eventmeasure* will be converted to biomass using commonly accepted length-weight ratios that are specific to each species of fish³.
- High resolution topographic maps will be used in conjunction with survey data to produce habitat suitability models which can then be extrapolated to similar habitats up and down the coast.

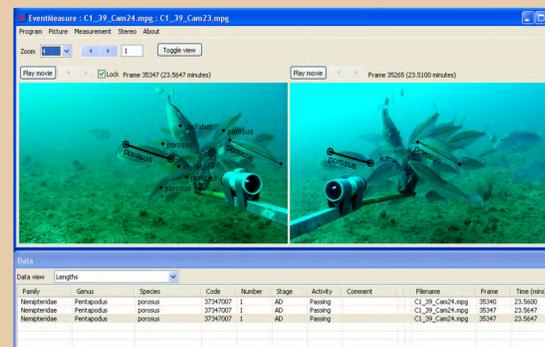


Figure 3. Screen shot of *Eventmeasure* stereo-video analysis.

H2: Observed habitat distributions for key groundfish species can be used as predictor models for all rocky reef habitats coast-wide

Hypothesis 2: Many rockfish are known to associate with certain types of substrate, namely rocky reef habitats with varying degrees of relief.

Models developed from this research can be used to define species specific habitats on rocky reefs, particularly in the depth zone of 20 to 40 meters, which is vastly understudied due to survey constraints.

Figure 4 (Below). An Olive/Yellowtail rockfish on transect, and (below) selected deep water fishes observed to-date.

Figure 5 (Right). Diver holding a stereo-video camera.



Significance

This project will:

1. **Address the paucity of data** in the records of marine resources of the MBNMS and **contribute to the Sanctuary's Site Characterization, Condition Report, and New Sanctuary Management Plan.**
2. **Monitor species interactions** between shallow water and deep water community assemblages in an area that acts as a **transition zone.**
3. **Provide researchers and managers with quantifiable data** that can be used to assess the value and management of the MBNMS.
4. **Create habitat suitability models** that can be used across **various spatial scales** to identify species composition and abundance, particularly in areas outside of the depth constraints of traditional survey methods.

Hypotheses

H1: “Lost reef” depth zone will act as a transition zone between shallow water and deep water species.

Hypothesis 1: Surveys will reveal that the depth zone between 20 and 40 meters acts as a transition zone occupied by both shallow water and deep water rockfish.

Rockfish occupy virtually every depth zone in temperate reefs, however different species tend to be found in different depth zones. This study will aid in the definition of rockfish depth distributions and help to define the connection between shallow water and deep water species assemblages.

References

- 1- Caselle, J.E. et al. Recovery trajectories of kelp forest animals are rapid yet spatially variable across a network of temperate marine protected areas. *Sci. Rep.* 5, 14102; doi: 10.1038/srep14102 (2015).; 2 – Young M. A. et al. Multivariate bathymetry-derived generalized linear model accurately predicts rockfish distribution on Cordell Bank, California, USA. *Marine Ecology Progress Series* 415 (2010): 247-261. 3 - Froese, R. and D. Pauly. Editors. 2017. FishBase. World Wide Web electronic publication. www.fishbase.org, (10/2017).

Acknowledgements

This publication was made possible by the National Oceanic and Atmospheric Administration, Office of Education Educational Partnership Program award (NA16SEC4810009). Its contents are solely the responsibility of the award recipient and do not necessarily represent the official views of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author and do not necessarily reflect the view of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration.

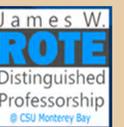
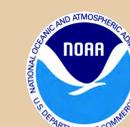
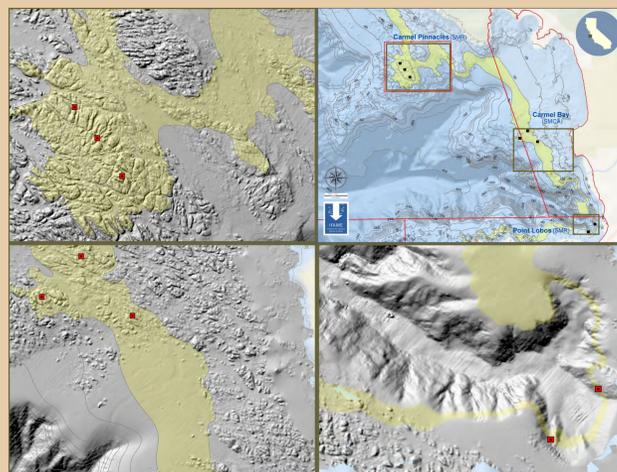


Figure 2. (Top Right) All proposed “lost reef” survey sites. (Bottom Right) Survey sites in Carmel Bay, California. (Top Left and Bottom Left) Proposed expansion to survey “lost reefs” at the Carmel Pinnacles and in the Carmel Bay State Marine Conservation Area.



Contact: laparker@csumb.edu
Institute for Applied Marine Ecology California State University, Monterey Bay