

Coastal Watershed Development, Erosion, Marine Habitat Loss and Kelp Forest Decline in Santa Monica Bay

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Abstract - The purpose of this project was to test the hypothesis that the dramatic decline in the kelp forests of Santa Monica Bay (SMB), California, can be attributed in part to sediment deposition and the resultant loss of nearshore rocky habitat. Extensive development and erosion within the coastal watersheds of this region have long been suspected of impacting the marine habitats of SMB. Our general approach has been to use Geographic Information Systems (GIS) to compare kelp surveys from 1912, 1989 and 1999 to identify where the most significant losses have occurred in SMB, and then to map the current distribution of rocky habitat using acoustic remote sensing (multibeam bathymetry, Sidescan sonar and sub-bottom profiling) and video substrate verification. Our goal has been to determine whether or not there is still rocky habitat suitable for kelp recruitment in areas where kelp is no longer found.

Introduction

Coastal erosion within the nearshore marine environment

Santa Monica Bay kelp bed distribution and abundance have dramatically decreased within the last 100 years. Extensive development and erosion within the coastal watersheds of this region have long been suspected of impacting the marine habitats of the Santa Monica Bay.

The Purpose of this project is to test the hypotheses that the decline in the kelp forests of Santa Monica Bay can be attributed in part to sediment deposition and the resultant loss of nearshore rocky habitat.

Study Area

This Project focuses on the Santa Monica Bay region of California, due to its highly developed coastline and the significant loss in kelp forest within the bay.

There are two study areas: The first is from Pt. Dume to Topanga Canyon, and the second is from Flat Rock Pt. To Pt. Fermin on the Palos Verdes Peninsula. Both study areas total approximately thirty miles of coastline (Figure 1).



Figure 1: Study area along with the local watersheds.

Note: Picture obtained from the Santa Monica Bay Restoration Project Web Page - www.smbay.org

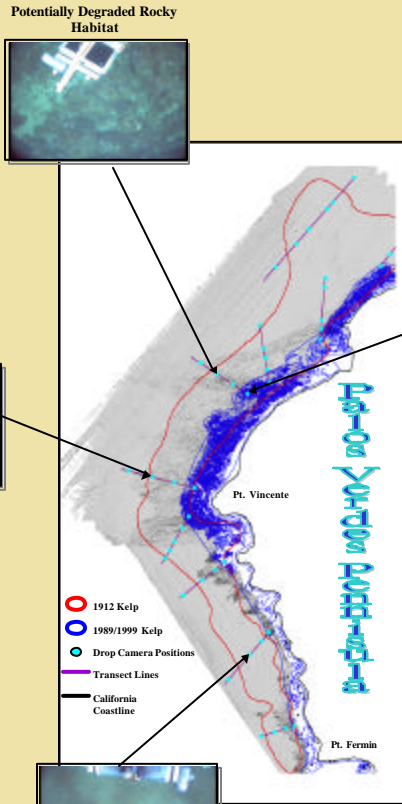


Figure 2: Shaded-relief multibeam bathymetry image showing distribution of rocky habitat. Also displayed are 1912, 1989, and 1999 kelp coverage polygons, along with transect lines and drop camera GIS points.

General Questions and Hypotheses

Has there been a loss or degradation of rocky substrate in areas of Santa Monica Bay formally occupied by kelp?

H₀: Rocky habitat is still present in areas of kelp forest decline.

H₁: Rocky habitat is "dusted" with sediment (degraded) in these areas of kelp loss.

H₂: Rocky habitat has been completely buried in these areas of kelp loss.

Methods

Geographic Information Systems was used to compare kelp surveys from 1912, 1989, and 1999 to identify where the most significant losses of kelp have occurred in the Santa Monica Bay (Figure 2). These data were then compared to maps of the current distribution of rocky habitat, made using acoustic remote sensing (multibeam bathymetry, Sidescan sonar and sub-bottom profiling) and video substrate verification (Figure 2).

The sub-bottom profiler will allow us to identify if there is rocky habitat underneath overlying sediment to measure the depths of the overlying sediment (Figure 3). Ground truthing was conducted using a drop camera attached to a sediment grab to verify the acoustic interpretations (Figure 2). These results combined with grain size analyses will be used to create a detailed, high-resolution habitat map of the nearshore (0-30m) area of Santa Monica Bay.

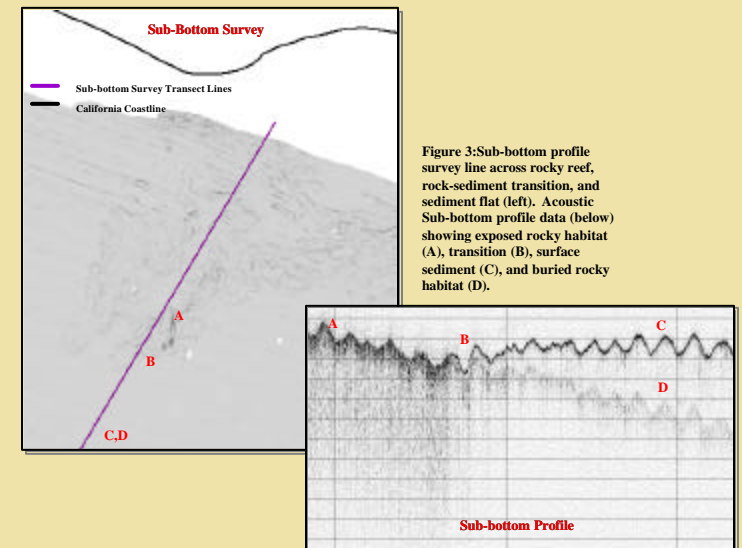


Figure 3: Sub-bottom profile survey line across rocky reef, rock-sediment transition, and sediment flat (left). Acoustic Sub-bottom profile data (below) showing exposed rocky habitat (A), transition (B), surface sediment (C), and buried rocky habitat (D).

Conclusions

This project is still ongoing and will be completed in the spring of 2002. Once complete these data will assist other researchers and agencies in assessing the impacts of sediment runoff from eroded watersheds into these coastal habitats, along with human and environmental factors and possibly using this data to form a restoration and monitoring program for the coastal watersheds within the Santa Monica area.

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