



Effects of Erosion on the Distribution of Subtidal Communities of Elkhorn Slough, CA.

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Introduction

Since the loss of sediment input from the Salinas River in 1908 (Schwartz 2002) and the removal of a dune barrier that separated the slough from Moss Landing Harbor, (Van Dyke & Wasson 2005) Elkhorn Slough has shifted from a depositional system to one that is primarily erosional; its new configuration leaves it at the head of the Monterey Canyon subject to strong tidal flows. With this change in flow environment there has been a change in subtidal communities. In this experiment I tested if there was a difference in frequency of occurrence of biological (shells, *Zostera marina*, and *macroalgae*) and exposed clay features in areas of differential amounts of erosion and areas of no net change and areas that have been the site of deposition.

Methods

Multibeam bathymetric data of Elkhorn Slough collected in 2001 and 2005 were subtracted using ArcMap to show the distribution of change in bathymetry. The degrees of change (erosional and depositional) were broken into 4 categories (Fig 1). The study site included the area closest to the mouth, which was most dynamic and the most tidally influenced section of the slough. An underwater video camera was used to estimate biological cover as well as distribution of clay features (Fig 2). Images were collected in summer 08, fall 08, and winter 09, but because of difficulty and uncertainty of sampling the exact location twice, different random locations were sampled each season.

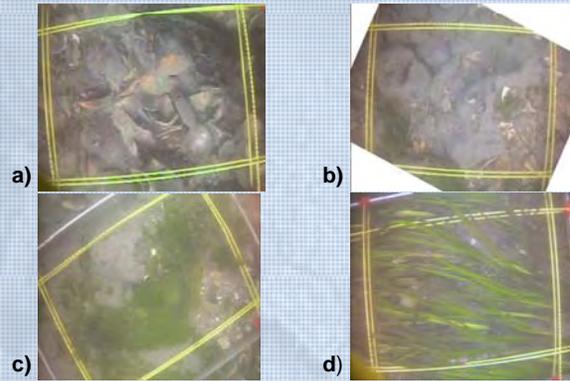


Figure 2. Examples of Biological cover and exposed clay. a) Red alga *Chondracanthus exasperatus* and shell b) Clay like feature and green alga *Ulva lactuca* c) *U. lactuca* and clay feature d) seagrass *Zostera marina*

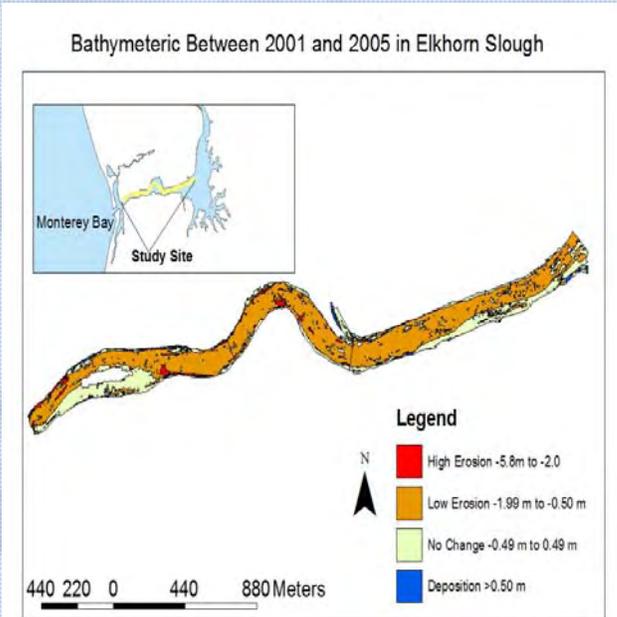


Figure 1. Map of bathymetric depth change in Elkhorn Slough, CA over 4 year period; high erosion (depth increase 2.0 to 5.8 m), low erosion (depth increase 0.50 to 1.99 m), no change (depth increase 0.49 to decrease of 0.50 m), and deposition (decrease of depth greater than 0.50 m). Study site only included area from mouth of slough to Parsons' slough. Data Courtesy of Seafloor Mapping Lab of California State University, Monterey Bay.

Results

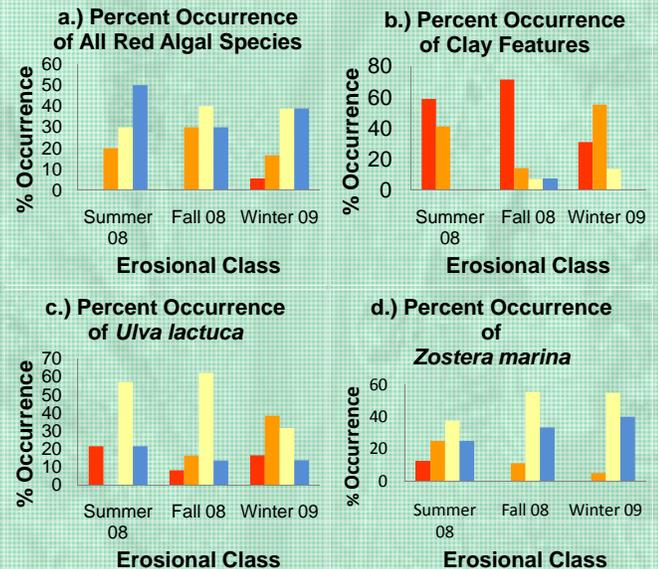


Figure 3. Frequency of occurrence of biotic cover and clay features in erosional classes. Critical Chi-squared (3)(0.05) = 7.815. Significant differences were: a.) Red algal species $X^2= 11.40$ for Summer 08. b.) Clay $X^2= 14.38$ for Summer 08; $X^2= 39.63$ for Fall 08; $X^2= 18.49$ Winter 09 c.) *U. lactuca* $X^2= 8.52$ for Summer 08; $X^2= 7.59$ for Fall 08. d.) *Z. marina* $X^2= 15.95$ Winter 09.

Discussion and Conclusions

Red algal species and seagrass showed significant difference among erosional classes during Winter 09 (Fig 3); *Ulva lactuca* also showed significant differences in Summer 08 (Fig 3). Because red algae, seagrass, and *U. lactuca* were not significantly different in each season, the data suggest that the response of these species to erosion is seasonally variable. One pattern which is interesting is that of seagrass, which maybe able to expand into areas of high and low erosion in the summer when currents are weaker, but as currents get stronger in fall and even stronger in winter, seagrass may only be able to persist in areas of no change and deposition where currents would be expected to be much slower. Clay like features were they only variable that showed significant differences between erosional classes for all seasons. This suggest that the presence of clay is a response to erosion, which is consistent with previous predictions. (Schwartz 1983, Israel & Watt 2005). The biological consequences of increase exposure of clay with erosion have yet to be determined.

Future Work

Sediment collected in Summer 08 will be analyzed to determine if associations between grain size, clay exposure, erosional classes and biological cover exist. If associations are observed, it will give insight into which biological features will change as a function of changing grain size with increased future erosion. (Sanders 1958, Teske & Woolridge 2003, Koch 2001).

References

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