Annual Report

Period Covered by the Report: April 1, 2001- March 31, 2002
Date of Report: April 1, 2002
Title: Fisheries-induced changes in the structure and function of shallow water 'nursery habitats': an experimental assessment
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Institution: Dauphin Island Sea Lab
Research Category: Estuarine Studies
Project Period: Year 3 of 3

Objectives:

Nutrient enrichment and overfishing are two of the most common man-induced perturbations of coastal systems. Eutrophication can produce many undesirable effects in coastal systems including: 1) a decline in submerged aquatic vegetation (SAV) through increased light attenuation and algal overgrowth, and 2) reduction in primary and secondary production (including commercially important finfish and shellfish that rely on SAV as a "nursery" ground) in near-coastal waters. Losses of top predators in SAV dominated systems in both freshwater and marine ecosystems could indirectly lead to the disappearance of SAV, similar to the decline seen associated with eutrophication. Overfishing can reduce large predators, allowing for an increase in smaller predators. Increasing smaller predators can lead to a decrease in mesograzers, which in turn may cause an increase in epiphytes. Shading by increased epiphytes may ultimately cause a loss in seagrass biomass. Consideration of the degree of top-down susceptibility to cascading trophic effects for both freshwater and marine ecosystems is necessary to understand the consequences of overfishing. Important differences in ecosystem responses are to be expected among riverine, estuarine, marine and freshwater ponds and lakes since cumulative effects are likely to be more profound in small, "closed" systems and less important in large, "open" systems. It has also been suggested that marine communities, with many omnivorous taxa and high levels of food-web redundancy may be less susceptible than simpler fresh water communities. This "top-down" alternative to the "bottom-up" nutrient enrichment hypothesis may explain reductions in SAV biomass in heavily fished areas, but to date remains inadequately tested. We sought to remedy this by carrying out field experiments over a multi- year period. Specific objectives for this project are to: 1) develop a mechanistic understanding of the indirect effects resulting from overharvesting large predators in two different but common types of SAV-dominated aquatic ecosystems, 2) evaluate the degree to which "openness" influences the susceptibility to top/down effects, and 3) evaluate the degree to which "omnivory" influences the susceptibility to top/down effects.

Progress Summary/ Accomplishments:

We completed the final year of our three-year study that examined how the degree of openness and the degree of omnivory affected our study systems susceptibility to trophic cascades caused by overfishing. We studied two systems; 1) a freshwater /oligohaline environment in the Mobile Bay Delta and 2) a mesohaline environment at

Big Lagoon in the Perdido Bay system. Preliminary results from both of our study systems provided little evidence supporting the proposed trophic cascade. Having increased the density of small predators within our enclosures to simulate the effects of overfishing, we expected a decrease in mesograzer abundance, however; we detected no significant changes or consistent trends in mesograzer abundance. Nor did we see any significant changes or consistent trends in epiphyte abundance or seagrass biomass within our enclosures. Therefore, the degree of openness and the degree of omnivory did not seem to play a significant role in systems, such as ours, which contain complex food webs and many alternative prey items. These results suggest that systems with reticulate food webs might not be susceptible to trophic cascades caused by overfishing.

Publications/ Presentations:

N/A

Future Activities:

Gut content analysis will be conducted on fish recovered from the enclosures to determine the composition of prey items. Following data analysis and synthesis, the projects final report will be written and submitted, along with the raw data and metadata.

Supplemental Keywords:

Top down control, trophic cascades, submerged aquatic vegetation (SAV), Gulf Coast, estuary

Relevant Web Sites:

http://www.southalabama.edu/aces/
http://mas.usouthal.edu/Faculty/heck/index.html
http://mas.usouthal.edu/Faculty/valentine/index.html
http://www.disl.org/~faculty/kheck.html
http://www.disl.org/~faculty/jvalentine.html
http://www.auburn.edu/~devridr/index.html

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