Seagrass Monitoring Project

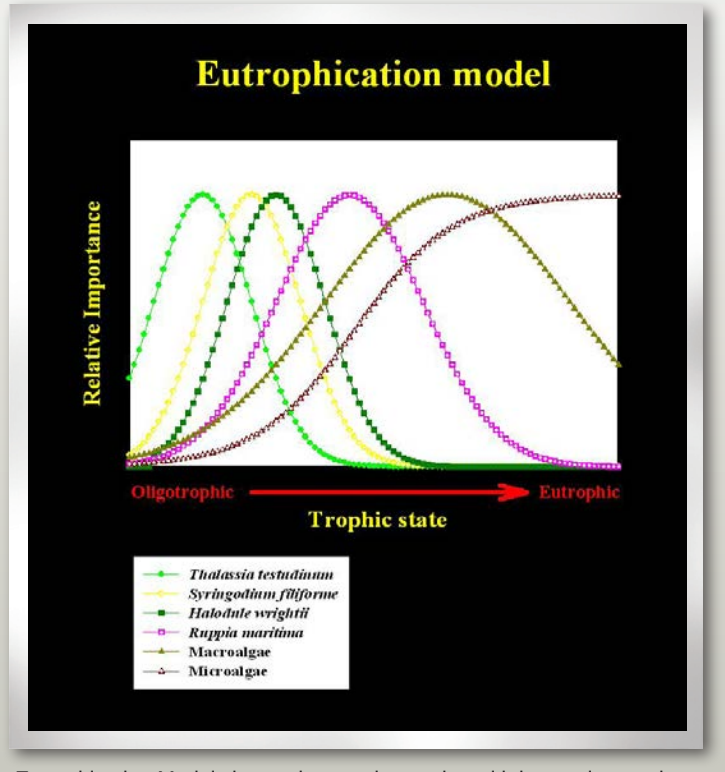
Florida Keys National Marine Sanctuary

Seagrass Is a Vital Link in the Ecosystem

Seagrass meadows cover much of the seafloor in the Florida Keys National Marine Sanctuary and are a vital link in the coral reef ecosystem of the Keys. They serve as nursery and feeding grounds for manatees, sea turtles, bottle-nose dolphins, snook, pink shrimp and a variety of reef fish and invertebrates. Any significant loss of this productive habitat could result in negative impacts on the ecosystem, including reduced invertebrate and fish populations at the coral reef.

Scientists use a square quadrat to record species and their abundance.
Photo: Florida International University

Since 1995, scientists from Florida International University have been studying seagrass in the Florida Keys as part of the Water Quality Protection Program for the Florida Keys National Marine Sanctuary. A major goal of the seagrass monitoring project is to track changes in grassbeds over time. Scientists are particularly interested in detecting changes in seagrass cover caused by nutrient enrichment, or eutrophication, in nearshore waters. Using a variety of sampling methods and data analyses, the project produces numerical indicators that reflect environmental conditions in the field and can be used by resource managers to detect trends in seagrass meadows before there has been any significant loss of this vital habitat.



Eutrophication Model shows changes in species with increasing nutrients.
Image: Florida International University

Seagrass Species Are Sensitive to Nutrients

To detect potential changes in seagrass communities, project scientists developed a conceptual computer model that uses field data to determine whether nutrients, specifically phosphorus and nitrogen, are having negative effects on the sanctuary's seagrass beds. This "eutrophication" model is based on the concept that higher nutrient conditions favor faster-growing plants over those that grow more slowly. If nutrient enrichment is occurring in sanctuary waters, faster-growing plants will replace slower-growing ones over time. Such changes can be tracked using visual surveys to record the abundance of seagrass and other plant species at fixed sampling sites throughout the sanctuary.

The model shows that as more nutrients become available, predictable changes will occur in the most common, or dominant, plant species. Turtle grass (*Thalassia testudinum*) is the dominant species in much of the sanctuary. Highly productive turtle grass meadows are found in Florida Bay and on the ocean side. This slow-growing species thrives in low-nutrient conditions.

http://sanctuaries.noaa.gov

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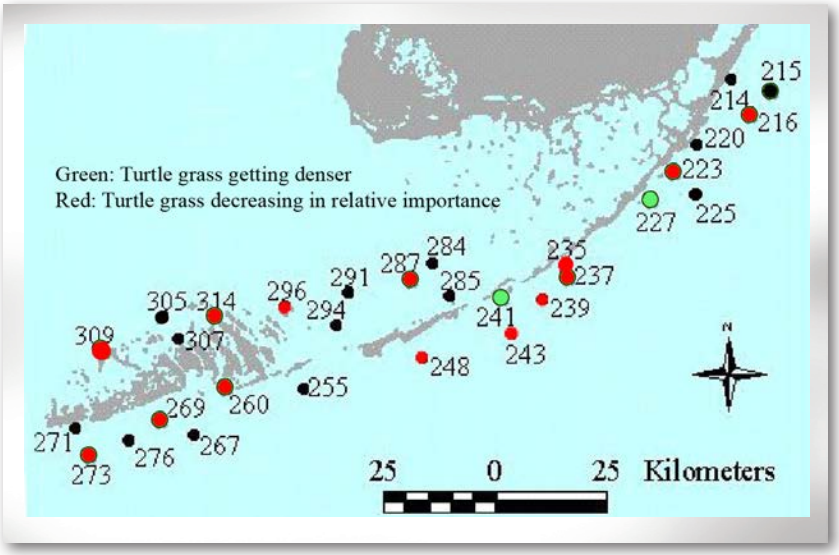
Turtle Grass Disappears Under High Nutrient Conditions

Manatee grass *(Syrinogodium filiformes*) and shoal grass (*Halodule wrightii)* are faster-growing seagrass species that prefer higher nutrient conditions. As nutrients increase or become more vailable, turtle grass will gradually disappear and be replaced by manatee and/or shoal grass. With even more nutrient enrichment, the faster-growing seagrass species will disappear altogether and be replaced by seaweed and other macroalgae. Finally, with very high levels of nutrients, macroalgae will be replaced by microalgae—microscopic plants living in the water column that can have undesirable effects on water clarity and quality when experiencing rapid population explosions, or blooms.



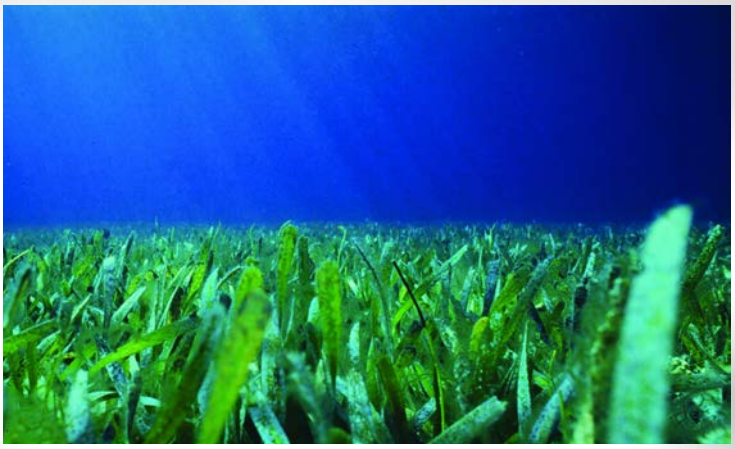
Sites shown in red and green exhibited changes that point to increasing nutrients.
Image: Florida International University

Significant changes in the dominant plants brought about by nutrient enrichment can have profound impacts on the seagrass-based food web. Species shifts away from seagrass and toward more macroalgae or microalgae leads to changes in the kinds and availability of invertebrates, fish, birds and other animals in that food web. In time, the species like shrimp, crabs and certain fish will disappear and be replaced by a new food web made of organisms that thrive in the new nutrient-rich environment.

Indicators Detect Higher Nutrient Availability in Sanctuary Waters

Seagrass scientists have recorded thousands of observations of species composition in the field and fed these data into the eutrophication model. So far, they have not found any significant overall loss of seagrass coverage in the sanctuary, but significant changes have occurred in the composition of species in plant communities. In 19 of the 30 monitoring sites, the dominant species had shifted from turtle grass to another species, suggesting higher availability of nutrients. In most of these sites, turtle grass decreased, but sites with increases in turtle grass density were seen as well. Both trends indicate that nutrients are increasing in that location. As nutrient levels rise, an increase in turtle grass density occurs first, and then with more nutrients this dense grass dies and is replaced with faster-growing species.

Scientists have also developed the Species Composition Index (SCI), a measure of the relative abundance of turtle grass based on one year's sampling results. If the SCI shows that the abundance of turtle grass compared to other species is declining, then nutrients are increasing and nutrient-loving plants are being favored. This one-year SCI value can be compared to the baseline SCI value, which was calculated using data collected over a 10-year period between 1995 and 2005. In 2006, the annual SCI was slightly higher than the 10-year baseline, suggesting lower nutrient availability. In 2007 and 2008, the annual SCI was slightly lower, indicating high nutrients and declining water quality. It should be noted, though, that none of the values were statistically significant from the baseline SCI.



Healthy turtle grass beds thrive in clear, low-nutrient waters.
Photo: Florida Keys National Marine Sanctuary

Good Water Quality Is Essential to Grassbeds

Good water quality is an essential ingredient for healthy seagrass meadows and the marine ecosystem as a whole. The seagrass monitoring program and other research efforts in the Water Quality Protection Program will continue to track the status of seagrass meadows, coral reefs and water quality in the Florida Keys National Marine Sanctuary. For reports, graphs and more information about seagrass monitoring, visit http://www.fiu.edu/~seagrass. For more information on preventing degradation of nearshore waters, visit http://floridakeys.noaa.gov/wqpp/welcome.html.

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