

**Literature Review:**  
SEAGRASS AND MANGROVE HABITATS AS REEF FISH NURSERY  
HABITATS AND CUMULATIVE IMPACTS FROM COASTAL  
CONSTRUCTION IN FLORIDA, USA  
(CONTRACT ORDER #: GA133F06SE5828)

**FINAL**

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## INTRODUCTION:

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act set forth a new mandate for the National Marine Fisheries Service (NMFS), regional fishery management councils, and other Federal agencies to identify and protect important marine and anadromous fish habitat, such as mangroves, seagrasses, coral reefs, hard bottom reefs, and wetlands. The purpose of this project is to complete a literature review of references, including university theses and dissertations, scientific studies, reports, books, and gray literature, regarding the role of seagrasses and mangroves in coral reef ecology and reef fish productivity; and the impacts of coastal construction to reef fish nursery habitats, fish stocks, and the implications of these impacts for the fisheries of Florida, USA. Coastal construction includes beach nourishment, dredging, dock and marina construction, shoreline hardening, and the construction of other structures that result in the elimination or degradation of mangrove and seagrass habitats. This project supports local efforts to implement coastal construction best management practices and to provide information on cumulative impacts on coral reef fish nursery habitats in Florida, USA.

References were compiled in the form of an annotated bibliography containing the complete citation of the work, a summarized abstract, the reference location, and keywords. The reference search included visiting offices, libraries, and computer/internet search engines of federal agencies, specifically NMFS, and U.S. Geological Survey's and NOAA's CoRIS Website; from local agencies, specifically the Florida Department of Environmental Protection and the Palm Beach County Department of Environmental Resources Management; from universities, specifically Florida Atlantic University, Boca Raton, Florida, Florida International University, Miami, Florida, Nova-Southeastern University, Ft. Lauderdale, Florida, and the Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida; and internet searches database searches and other gray literature. The literature review also provides a location of where the reference can be obtained, as well as keywords.

The references for the literature review were organized into seven different sections:

- I. MANGROVES: ROLE/ STATUS/ TRENDS/ IMPACTS/ RESTORATION
- II. SEAGRASS: ROLE/ STATUS/ TRENDS/ IMPACTS/ RESTORATION
- III. COASTAL HABITATS: VALUE/ POLLUTION/ RESTORATION/ RESOURCE MANAGEMENT
- IV. CORAL REEF DIVERSITY & FISH PRODUCTIVITY: ROLE/ STATUS/ IMPACTS/ MITIGATION
- V. BEACH NOURISHMENT: STATUS/ IMPACTS/ MANAGEMENT
- VI. FISHERIES & MARINE NURSERIES GENERAL: IMPACTS/ MANAGEMENT
- VII. REFERENCES OF SPECIFIC STUDIES OUTSIDE OF FLORIDA

All reference searches were focused on Florida within the past 10 years. Any other specific studies performed in other countries that are related and emphasize the importance of the topics of interest were placed in the section entitled: VII. REFERENCES OF SPECIFIC STUDIES OUTSIDE OF FLORIDA. References from past literature reviews developed for the NMFS were to be used as a complement to this report and are accessible on the CoRIS website. Therefore, repetitions should be minimal.

This project builds on ongoing efforts of the National Oceanic and Atmospheric Administration (NOAA) / National Marine Fisheries Service in the state of Florida, USA, to strengthen existing management of reef resources. This work addresses specific management needs identified by the NMFS.

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## I. MANGROVES:

### ROLE/ STATUS/ TRENDS/ IMPACTS/ RESTORATION:

**Barr, J. G., T. L. O'Halloran, J. D. Fuentes, T. A. Frankovich, J. C. Zieman, and D. L. Childers. 2004. New flux tower facility tracks CO<sub>2</sub> in the Florida coastal Everglades: Mangrove forest provides significant carbon sink. The Network Newsletter. 17(1). Spring 2004. Florida Coastal Everglades LTER.**

Abstract: Mangrove ecosystems represent a potentially significant carbon sink because of year-round physiologically active foliage, as well as carbon exchanges at the estuary interface and continuous accretion of sediments. During June 2003, a 30-m tall triangular tower was erected in a riverine mangrove forest to rise as a platform to set up flux measurement systems. The study site, located along the Shark River in the western region of the Florida Everglades, includes red (*Rhizophora mangle*), black (*Avicennia germinans*), and white (*Languncularia lacemosa*) mangroves. Continuous field measurements from an eddy covariance system provided the net exchange of carbon dioxide across the forest-atmosphere interface every half hour. The carbon dioxide fluxes to the mangrove forest showed strong diurnal variations and unusually high values, with maximum daytime fluxes reaching 30 micro-moles (CO<sub>2</sub>) m<sup>-2</sup>(ground area) s<sup>-1</sup>. Photosynthetically active irradiance and temperature mainly transform the diurnal patterns of carbon dioxide fluxes. This supports the hypothesis that mangrove forests constitute an important carbon sink.

Reference Location: Internet Search: The Network News: LTER Network Newsletter

[http://intranet.lternet.edu/archives/documents/Newsletters/NetworkNews/spring04/spring04\\_pg05.htm](http://intranet.lternet.edu/archives/documents/Newsletters/NetworkNews/spring04/spring04_pg05.htm)

Keyword(s): Coastal Everglades, Florida, Carbon Sink, Biosphere

**Brooks. R. A., and S. S. Bell. 2005. A multivariate study of mangrove morphology (*Rhizophora mangle*) using both above and below-water plant architecture. Estuarine and Shelf Coast Science. 65(3): 440-448.**

Abstract: This descriptive study of the architecture of the red mangrove, *Rhizophora mangle* L., habitat of Tampa Bay, Florida, was conducted to observe if plant architecture could be used to discriminate overwash from fringing forest types. Seven above-water features, including tree height and leaf area, and ten below-water features, including root density and root complexity, were measured in eight mangrove stands. A multivariate technique was used to test the ability of different models comprising above-water, below-water, or whole tree architecture to classify forest type. Based on habitat architecture, the results of this study do not support a sharp distinction between overwash and fringing mangrove forests in Tampa Bay, but rather indicate that the two are architecturally undistinguishable. Within this northern portion of the geographic range of red mangroves, a more appropriate classification system based on architecture may be one in which overwash and fringing forest types are combined into a single, "tide dominated" category.

Reference Location: Wimberly Library, Florida Atlantic University: Internet Database Search: Current Contents Connect, Boca Raton, Florida, USA

Keyword(s): Mangrove, Fringing Mangrove, Habitat Classification, Prop Root, Morphology, *Rhizophora mangle*, Plant Architecture, Tampa Bay, Florida,

**Burton, M. L., K. J. Brennan, R. C. Munoz, and R. O. Parker, Jr. 2005. Preliminary evidence of increased spawning aggregations of mutton snapper (*Lutjanus analis*) at Riley's Hump two years after establishment of Tortugas South Ecological Reserve. Fishery Bulletin. 103(2): 404-410.**

Abstract: This study describes the re-formation of a spawning aggregation of mutton snapper (*Lutjanus analis*). A review of four consecutive years of survey data indicates that the aggregation may be increasing in size. Juveniles and subadults are found in a variety of habitats such as vegetated sand bottoms, bays, and mangrove estuaries. Adults are found offshore on coral reefs and other complex hardbottom habitat. Mutton snapper are highly prized by Florida fishermen for their size and fighting ability, and the majority of landings occur from Cape Canaveral to the Florida Keys, including the Dry Tortugas.

Reference Location: Internet Search: ASFA: Aquatic Pollution and Environmental Quality, Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Resource Conservation, Fishery Surveys, *Lutjanus analis*, Reproductive Behaviour, Organism Aggregations, Fishery Management, Spawning Migrations, Coral Reefs, Marine Parks, Fishery Resources, Riley's Hump, Tortugas South Ecological Reserve, Florida, Brazil

**Davis, S. M., D. L. Childers, J. J. Lorenz, H. R. Wanless, and T. E. Hopkins. 2005. A conceptual model of ecological interactions in the mangrove estuaries of the Florida Everglades. *Wetlands*. 25(4): 832-842.**

Abstract: Because of their location at the lower end of the Everglades drainage basin, Everglades mangrove estuaries have been affected by upstream water management practices that have altered the freshwater heads and flows and that affect salinity gradients. Two major external drivers of this system are water management activities and global climate change. Causal relationships between stressors and attributes include coastal transgression, hydroperiods, salinity gradients, and the "white zone" freshwater/estuarine interface. Regardless of the spatio-temporal timing of this transgression, a salinity gradient supportive of ecologically functional Everglades mangrove estuaries will be required to maintain the integrity of the South Florida ecosystem.

Reference Location: Internet Search: ASFA: Aquatic Pollution and Environmental Quality, Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Estuaries, Mangrove Ecosystems, Salinity, Rainfall, Ecological Distribution, Sea Level Changes, Brackish Water Environment, El Niño Phenomena, Environmental Restoration

**Davis III, S. E., and D. L. Childers. 2006. Importance of water source in controlling leaf leaching losses in a dwarf red mangrove (*Rhizophora mangle* L.) wetland. *Estuarine, Coastal and Shelf Science*. (In Press)**

Abstract: The southern Everglades mangrove ecosystem in Florida is characterized by extensive dwarf red mangrove forests. In this study, a leaf leaching experiment was conducted to understand the influence that water source and its water quality have on the early decay of leaves, early exchange of total organic carbon, and total phosphorous between leaves and the water column. Results showed the importance of water sources in controlling leaf leaching losses in this mangrove system in the Everglades and Florida Bay.

Reference Location: Internet Search: Science Direct, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Hydraulic Residence Time, Organic Carbon, Phosphorous, Limiting Factor, Salinity, Everglades, Florida

**Dennis, G. D., and K. J. Sulak. 2001. Mangrove prop-root habitat as essential fish habitat in northeastern Florida Bay. Florida Integrated Science Center. Tech. Rep. USGS Gainesville, Florida.**

Abstract: Proposed restoration of freshwater flow in South Florida has the potential to change fish distribution and abundance, especially forage fishes that cannot migrate from changing environmental conditions. The red mangrove habitat has been proposed as a nursery area for several fish species. This study was performed to determine the spatial and temporal distribution of piscivorous fishes and their forage fish base in northeastern Florida Bay and to identify the indicator taxa that would reflect changing salinity conditions. Results showed that as fringe increases, abundance increases, and as water depth increases, abundance increases. Inshore areas have poor habitat quality, shallow depths, and narrow fringe, which is not optimal for fish species abundance in these areas.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Red Mangrove, Prop-Root, Habitat, Essential Fish Habitat, Northeastern Florida, Florida Bay

**Ellis, W. L. 2003. Mangrove canopy damage: Implications for litter processing and fish utilizations of the intertidal zone. Ph.D. Dissertation, University of South Florida, Florida, USA.**

Abstract: Mangrove systems are widely recognized as important habitat for juvenile fish and crustaceans, yet there is little consensus focused on the exact features which contribute their "nursery" function. This dissertation explored the role of mangrove canopies in influencing the intertidal distribution of fishes. From 1996-2002, a series of experiments designed to examine the relative influence of shade, structure, and mangrove litter on the distribution of fishes was conducted in the intertidal zone of a mangrove embayment in Tampa Bay, Florida. While the presence of mangrove root structure was not found to be a significant factor, fish were strongly associated with shading and litter. This relationship was not constant over all water depths. Fish associated more closely with shaded plots at greater water depths, while litter covered plots were abandoned with greater depth. From 1998-2000, a study of the impact of an anthropogenic source of canopy damage, horticultural mangrove trimming, was conducted at twelve sites in Rookery Bay, Florida. The results indicate that while mangrove trimming reduces litter fall rates, there was no subsequent change in fish density, biomass, or species composition that could be linked to the canopy damage. These results suggest that given the shallow water depths, canopy damage is unlikely to cause great changes in the utilization of these intertidal habitats by fishes.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Litter, Fish, Juvenile Fish, Mangroves, Canopy, Intertidal Zone, Tampa Bay, Rookery Bay, Florida

**Faunce, C. H. 2005. Reef fish utilization of mangrove shoreline habitats within southeastern Florida. Ph.D. Dissertation, University of Miami, Coral Gables, Florida, USA.**

Abstract: This dissertation focuses on reef fish utilization of mangrove shorelines in the region of Biscayne and northeastern Florida Bays, Florida, U.S.A. Fishes were sampled using an underwater visual belt transect (30 x 2m) method, supplemented by the measurement a suite of biotic and abiotic habitat variables. The predominant reef fishes utilizing the mangrove shorelines examined were: *Lutjanus griseus*, *L. apodus*, *Haemulon sciurus*, *H. parra*, and *Sphyraena barracuda*. Habitat utilization was quantified in terms of their seasonal frequency, concentration, density, and relative abundance among shorelines. Results suggested that density patterns were driven primarily by patterns in frequency of occurrence and not concentration. With the exception of *Sphyraena barracuda*, the species examined exhibited selection among mangrove shorelines, where utilization was significantly greater than expected along the Florida Keys, and significantly less than expected along the Florida mainland. These patterns suggest reef fish utilization of

mangrove shorelines was a function of habitat isolation and distance from oceanic sources, rather than habitat quantity. Indications from this study show that isolated mangrove shorelines may act as a sink for larger-bodied individuals. Annual production estimates fall between those previously observed for transient fishes, and are the first of their kind for a reef fish inhabiting mangrove shoreline habitats.

Reference Location: Rechter Library, The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, Florida, USA

Keyword(s): Reef Fishes, Florida Keys, *Lutjanus griseus*, *L. apodus*, *Haemulon sciurus*, *H. parra*, *Sphyraena barracuda*, Utilization, Mangrove Shorelines, Essential Fish Habitat, Annual Production

**Faunce, C. H., and J. E. Serafy. 2006. Mangroves as fish habitat: 50 years of field studies. Marine Ecology Progress Series. 318: 1-18.**

Abstract: To provide the first comprehensive list of empirical field studies for comparative and reference purposes, this review assembled and quantified aspects of 111 mangrove-fish surveys published between 1955 and 2005. Differences in location, purpose, methodology, data gathered, and analyses performed among studies have resulted in a fragmented literature. The present focus has been to identify assemblage-level patterns of fish use, with very few studies providing species-specific estimates of abundance, growth, mortality, and secondary production.

Reference Location: The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, Florida

Keyword(s): Fishes, Essential Fish Habitat, Mangroves, Nursery, Review

**Florida Department of Environmental Protection. 2006. Facts about mangroves. State of Florida. Tallahassee, FL.**

Abstract: This page on Florida's Department of Environmental Protection website details the value and importance of preservation of mangrove species throughout the state of Florida. It includes information on the three species founding Florida: Red, Black, and White mangroves. This information is necessary in implementing the Mangrove Trimming and Preservation Act to protect mangroves through the state of Florida.

Reference Location: Internet Search: Florida Department of Environmental Protection

[http://www.dep.state.fl.us/water/wetlands/mangroves/mangrove\\_facts.htm](http://www.dep.state.fl.us/water/wetlands/mangroves/mangrove_facts.htm)

Keyword(s): Mangroves, Red, Black, White, Climate, Salt Water, Tidal Fluctuation, Soil Type, Mangrove Functions and Values, Mangrove Trimming and Preservation Act, Florida

**Green, D., J. Trexler, J. Lorenz, C. McIvor, and T. Philippi. 2006. Spatial patterns of fish communities along two estuarine gradients in southern Florida. Hydrobiologia. 569(1): 387-399.**

Abstract: This article documented spatial and temporal patterns in fish community structure and standing crops along salinity and nutrient gradients in two subtropical drainages of Everglades National Park, Florida, USA. The hypothesis was concluded that the more nutrient enriched system would support higher standing crops of fishes in its mangrove zone. There were 50 species of fish collected from January 2000 to April 2004 at six sampling sites crossing fresh to brackish salinities in both the Shark and Taylor River drainages. There was an observed lower standing crops and density of fishes in the more nutrient rich tidal mangrove forest of the Shark River than in the less nutrient rich mangrove habitats bordering the Taylor River. Tidal mangrove habitats in the Shark River were dominated by salt-tolerant fish and displayed lower species richness than mangrove communities in the Taylor River, which included more freshwater taxa and yielded relatively higher richness. It was proposed that this difference in small-scale topographic relief

limits movement of fishes from upstream marshes into the fringing mangrove forest in the Shark River system, but not the Taylor River system. Understanding the influence of habitat structure, including connectivity, on aquatic communities is important to anticipate effects of construction and operational alternatives associated with restoration of the Everglades ecosystem.

Reference Location: IngentaConnect, Search Engine, The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Richter Library, Virginia Key, Florida, USA

[http://www.ingentaconnect.com/search/article?title=Nurseries+AND+Florida+AND+Seagrass+OR+Mangroves&title\\_type=tka&year\\_from=1998&year\\_to=2007&database=1&pageSize=20&index=14](http://www.ingentaconnect.com/search/article?title=Nurseries+AND+Florida+AND+Seagrass+OR+Mangroves&title_type=tka&year_from=1998&year_to=2007&database=1&pageSize=20&index=14)

Keyword(s): Community Structure, Freshwater Marshes, Habitat Connectance, Landscape Ecology, Mangroves, Nutrient Gradients, Salinity Gradients, Southern Florida

**Hoff, R. Z., ed., P. Hensel, E. C. Proffitt, P. Delgado, G. Shigenaka, R. Yender, and A. Mearns. 2002. Oil spills in mangroves: Planning & response considerations. NOAA Fisheries. Office of Response and Restoration. 51 pp.**

Abstract: Mangroves cover an approximate area of 240,000 square kilometers of sheltered coastlines in the tropics and subtropics. Four of the most common ecotypes are fringe, riverine, basin, and scrub forests. Mangroves are restricted to the intertidal zone and have a great capacity to recover from major natural disaster. They maintain water quality by trapping sediments and taking up excess nutrients from the water. This pamphlet details mangrove ecology, oil toxicity, response to oil spills in mangrove habitats, recovery and restoration, and case studies, including figures and tables involving mangrove distribution, various species of mangroves throughout the U.S. and Gulf Coast, and oil spill impacts.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Oil Spills, Mangroves, Response, Restoration, Planning

**Keickbusch, D. K. 2001. Trophic linkages of primary producers and consumers in fringing mangroves of tropical lagoons. M.Sc. Thesis, Florida Atlantic University, Boca Raton, Florida, USA.**

Abstract: Stable carbon and nitrogen isotope ratios were analyzed to investigate the trophic linkages between primary producers and consumers in fringing mangrove ecosystems of The Bahamas and Biscayne Bay, Florida. The isotope ratios, in combination with stomach content analysis, were used to trace the flow of organic matter from the primary organic sources, such as mangroves, seagrass, and macroalgae, to primary consumers and ultimately the gray snapper, *Lutjanus griseus*. It was found that the mean carbon value of the primary consumers was closely related to the mean values of the macroalgae and the seagrass. Results suggest the ultimate source of carbon for the primary and secondary consumers, located at the study sites, is algal and seagrass material, individually or possibly a mixture, and that mangroves are not the sole source of carbon in these systems.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Ecology, Oceanography, Primary Producers, Seagrass, Macroalgae, Primary Consumers, Gray Snapper, *Lutjanus griseus*, Trophic Linkages, Fringing Mangroves, Florida



**Kieckbusch, D. K., M. S. Koch, J. E. Serafy, and W. T. Anderson. 2004. Trophic linkages among primary producers and consumers in fringing mangroves and subtropical lagoons. *Bulletin of Marine Science*. 74(2): 271-285.**

Abstract: Fringe mangroves associated with islands of the subtropical Atlantic/Caribbean region create extensive subtidal mangrove epibont communities. This study examined the trophic linkages among primary producers such as mangroves, seagrass, and algae, and consumers using stable carbon and nitrogen isotopes in fringe mangroves of the Bahamas and Biscayne Bay, Florida. From the results, mangroves do not appear to be the major source of carbon to consumers in fringe mangroves of subtropical lagoons. Instead, fringe island-associated mangroves constitute refuge for invertebrates and young reef fishes, and create substrate for a diversity of primary producers and consumers, thereby playing an important indirect role to the food web of these systems.

Reference Location: Internet Search: ASFA: Aquatic Sciences and Fisheries Abstracts, University of Miami, Florida, USA (Membership Needed To View)  
Keyword(s): Mangroves, Consumers, Seagrasses, Carbon, Trophic Structure, Food Webs, Refuges, Species Diversity, Florida, Bahamas, Caribbean Region

**Koenig, C. C., F. C. Coleman, A. Eklund, J. Schull, and J. Ueland. In review. Mangroves as essential nursery habitat for goliath grouper (*Epinephelus itajara*): Juvenile grouper habitat. *Bull. Mar. Sci.***

Abstract: This study evaluated the use of mangroves as essential nursery habitats for the Goliath grouper, *Epinephelus itajara*, by estimating absolute abundance, density, survival, age structure, home range, mangrove habitat association, habitat quality, and recruitment to the adult population. Densities of mangrove-lined rivers and mangrove islands were assessed, including the Ten Thousand Islands and Everglades National Park, which comprises Florida Bay, Florida, USA. In the Ten Thousand Islands juvenile densities in mangrove islands were higher and less variable than those in rivers. Juveniles showed high site reliability in mangrove habitat for 5 to 6 years, then emigrated from mangroves at about 1.0 m total length. Very low densities examined in Florida Bay are most likely related to other water quality variables in this human-altered system. The offshore abundance of adults was largely explained by the abundance of mangrove, but not seagrass habitat. Thus, protection and/ or restoration measures must be taken as this high-quality mangrove habitat appears essential to the recovery and sustainability of Goliath grouper populations.

Reference Location: National Marine Fisheries Service, West Palm Office, Florida

Keyword(s): Goliath Grouper, *Epinephelus itajara*, Mangroves, Telemetry, Nursery Habitat, Protected Species, Density, Serranidae, Ten Thousand Islands, Florida Bay

**Krauss, K. W. 2004. Growth, photosynthetic, and water use characteristic of South Florida mangrove vegetation in response to varying hydroperiod. Ph.D. Dissertation, University of Louisiana at Lafayette, Louisiana, USA.**

Abstract: Hydrology, salinity, nutrition, biotic factors, and physical disturbance all influence structure in coastal forested wetlands. Hydrologic rehabilitation in South Florida may affect all of these parameters in mangrove communities. Through a series of greenhouse and field experiments, the study isolated the effects of particular hydrologic metrics, especially flood duration and frequency, on mangrove vegetation. Growth increased proportional to flood duration for *Laguncularia racemosa*. Growth potential tended to improve as nutrient and salinity were held constant in the greenhouse experiment with *Avicennia germinans* and *Rhizophora mangle*. Growth patterns were related to soil total phosphorous concentrations, which were linked strongly to flood duration, and were suggestive of a growth benefit from water-borne phosphorous subsidies. Mangroves appeared to be resilient to a range of hydroperiods as long as changes are imposed

incrementally to avoid reductions in growth, leaf gas exchange, and whole-tree transpiration that may eventually lead to mortality.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Water Use, Hydroperiod, Photosynthesis, Growth, *Laguncularia racemosa*, *Avicennia germinans*, *Rhizophora mangle*, Mangroves, Vegetation, Florida

**Lewis III, R. E. 2006. Mangrove forest ecology: Management and restoration presentation. Parts I-IV. Lewis Environmental Services, Inc. Coastal Resources Group, Inc. February 20-23, 2006. Salt Springs, Florida.**

Abstract: Most mangrove restoration is not ecological restoration, but silviculture, since ecological restoration focuses on restoring the entire ecosystem and all species within the ecosystem, while silviculture specifies one species for wood production. Most mangrove restoration projects fail completely, or rarely achieve their stated restoration goals. The question is: why does this happen and what tools can help to avoid the common mistakes? This presentation in Microsoft power-point format, details information on mangrove forest ecology, management, and restoration methods used in the past and today.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Mangrove Forest Ecology, Impacts, Stressors, Management, Restoration, Presentation

**Milbrandt, E., and M. Tinsley. 2006. The role of saltwort (*Batis maritima* L.) in regeneration of degraded mangrove forests. *Hydrobiologia*. 568(1): 369-377.**

Abstract: Saltwort (*Batis maritima* L.) is common in the fringe mangrove forests of southwest Florida. This article focuses on its role in regeneration of degraded mangrove communities. In the study, a greater number of mangrove seedlings were observed in existing *B. maritima* patches compared to surrounding mudflats. A planting experiment was designed to determine whether *B. maritima* was responsible for the observed pattern. Black mangrove (*Avicennia germinans* L.) seedlings, raised in a nursery, were planted in previously established *B. maritima* patches and on mudflats with and without nursery-raised *B. maritima*. There was significantly lower mortality of *A. germinans* seedlings when planted in existing *B. maritima* patches (69%), compared to seedlings planted on the mudflats (93%), demonstrating that existing *B. maritima* improved *A. germinans* seedling survival. Nursery-raised *B. maritima* had lower mortality on open mudflats (28%), suggesting that it can tolerate conditions, which make it an early colonizer of newly available habitats. Future restoration methods to improve seedling success in anticipating the response of mangroves to sea-level rise include a slight increase in elevation provided by the dense root network of established *B. maritima*.

Reference Location: IngentaConnect, Search Engine, The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Richter Library, Virginia Key, Florida, USA

[http://www.ingentaconnect.com/search/article?title=Nurseries+AND+Florida+AND+Seagrass+OR+Mangroves&title\\_type=tka&year\\_from=1998&year\\_to=2007&database=1&pageSize=20&index=9](http://www.ingentaconnect.com/search/article?title=Nurseries+AND+Florida+AND+Seagrass+OR+Mangroves&title_type=tka&year_from=1998&year_to=2007&database=1&pageSize=20&index=9)

Keyword(s): *Avicennia germinans*(L.), Sediment Condition, Sea-Level Rise, Colonization, Succession, Restoration, Saltwort, *Batis maritima* L., Regeneration, Degradation, Mangrove Forests, Southwest Florida

**Oehm, N. J. 1998. The effects of nutrient limitation and salinity on soil carbon mineralization rates in a carbonate-based mangrove ecosystem. M.Sc. Thesis, Florida International University, Miami, Florida, USA.**

Abstract: This study examines the effects of nutrient limitation on soil carbon mineralization along a salinity gradient in the mangroves of Everglades National Park. Seasonal changes in water salinity reflect temporal variability in both water and nutrient sources. This study examines the effects of temporal variability on carbon mineralization and tests the hypotheses that mineralization rates are nutrient limited and that they are higher during the rainy season and alongside the creek, which was found to be valid. Soil carbon mineralization was measured on five quarterly sampling intervals as carbon dioxide, methane, and acid volatile sulfide production. Nutrient amendments further revealed that total carbon flux in those soils was phosphorous limited.

Reference Location: Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Effects, Nutrient Limitation, Salinity, Carbon, Mineralization Rates, Mangrove Ecosystem, Florida

**Proffitt, C. E., and S. E. Travis. 2005. Albino mutation rates in red mangroves (*Rhizophora mangle* L.) as a bioassay of contamination history in Tampa Bay, Florida. *Wetlands*. 25(2): 326-334.**

Abstract: This study assessed the sensitivity of a viviparous estuarine tree species, *Rhizophora mangle*, to historic sublethal mutagenic stress across a fine spatial scale by comparing frequency of trees producing albino propagules in historically contaminated and uncontaminated forests in Tampa Bay, Florida. Two sites that were contaminated by oil failed to show elevated FHT. The sensitivity of this bioassay for the effects of mutagens will facilitate future monitoring of contamination events and comparisons of bay-wide recovery in future decades. Development of a database of FHT values for a range of subtropical and tropical estuaries is underway that will provide a baseline against which to compare mutational consequences of global change.

Reference Location: Internet Search: ASFA: Aquatic Pollution and Environmental Quality, Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Bioassays, Mutations, Recruitment, Baseline Studies, Albinism, Mangroves, Water Pollution Effects, Estuaries, Urbanization, Contamination, Oil Pollution, Tampa Bay, Florida

**Sanchez, B. G. 2005. Belowground productivity of mangrove forests in Southwest Florida. Ph.D. Dissertation, Louisiana State University and Agricultural & Mechanical College, Louisiana, USA.**

Abstract: This dissertation focused on methods for analyzing mangrove roots, root responses to phosphorous and flooding, and variation in root production between forest types. Techniques to separate live and dead roots such as colorimetric, fluorescence, buoyancy, and visual assessment were compared. Root and litter production, and hydro-edaphic conditions were determined seasonally for one year at eight sites, such as fringe, basin, and scrub forest types in Southwest Florida. Root production increased with low nutrient availability and high flooding, and decreased with high salinity and nutrient availability. Nutrient enrichment increased the specific root length and surface area at the basin-monospecific forest, and decreased the specific surface area at the scrub forest. Greenhouse experiments were conducted to study root dynamics of *Rhizophora mangle* and *Avicennia germinans* seedlings in response to phosphorous availability and flooding regime. Mangrove species differed in their tolerance of flooding, and their plasticity to nutrients availability. This study contributes to a better understanding of how mangrove ecosystems function.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Belowground Productivity, Dynamics, *Rhizophora mangle*, Mangrove, Forests, Florida

**Serafy, J., ed. 2006. First International Symposium on Mangroves as Fish Habitat. Miami, Florida. April 19-21, 2006.**

Abstract: The goal of this symposium is to provide a forum for the exchange of ideas, approaches, methods, and data on the linkages between mangrove forests and the fishes and fisheries associated with them. International experts were invited to lead discussion on the contribution of a given mangrove habitat to the diversity, productivity, and stability of broader fish communities and their exploited components. Suggested themes include the following: historical, economic, and regional perspectives on mangroves as fish habitat; tools and techniques for quantifying fish use and/or fish movement among the prop roots; ecological field investigations on the structure, function, and/or dynamics of mangrove-fish assemblages; mangrove wetland restoration and fish assessment/monitoring; and the conservation and management of mangroves and associated fisheries resources.

Reference Location: Internet Search: International Coral Reef Initiative:

[http://www.icriforum.org/event\\_detail.cfm?CID=217](http://www.icriforum.org/event_detail.cfm?CID=217)

Keyword(s): Mangroves, Fisheries, Habitat, Essential Fish Habitat, Populations, First International Symposium

**Tihansky, A. B. 2006. USGS and integrated science at first international symposium on mangroves as fish habitat. Sound Waves: USGS Monthly Newsletter. June 2006.**

Abstract: The U.S. Geological Survey cosponsored and participated in the First International Symposium on Mangroves as Fish Habitat in Miami, Florida from April 19-21, 2006. The Symposium was organized by Joseph Serafy and Shauna Slingsby of NOAA, Rafael Araujo of the University of Miami, and Doreen DiCarlo of the Florida Center for Environmental Studies. Objectives were to characterize the present state of knowledge, identifying critical information gaps; to gauge the current understanding of fish utilization of mangrove habitats and their importance in the systems that they occupy; and to publish submitted papers on this topic in a special issue of the Bulletin of Marine Science. Symposia that integrate across scientific disciplines ensure that science programs have increased value to natural resource managers and the general public.

Reference Location: Internet Search: USGS Sound Waves Newsletter:

<http://soundwaves.usgs.gov/2006/06/meetings.html>

Keyword(s): Mangroves, Fish Habitat, Essential Fish Habitat, United States Geological Survey. Symposium

**Ueland, J. S. 2005. Ecological modeling and human dimensions of mangrove change in Florida. Ph.D. Dissertation, The Florida State University, Florida USA.**

Abstract: This dissertation examines recent, past, present, and potential future spatial distribution of mangrove habitat in Florida. A combination of remote-sensing of 14 southern counties in Florida, mail and web-based surveys, interviews, and spatial-temporal modeling are all employed. An examination of citizens, regulators, and mangrove enforcement professionals was taken. Lastly, a cellular automata-Markov model was employed to examine a potential future scenario of mangrove distribution in Florida. This scenario was derived by examining past trends in mangrove change and projected changes in basic environmental and human-driven factors. The end result provides a projected loss of mangrove cover in the state over the next half century.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Mangroves, Ecological Modeling, Human Dimensions, *Rhizophora mangle*, *Avicennia germinans*, *Laguncularia racemosa*, Mangroves, Habitat, Spatial Distribution, Florida

## II. SEAGRASS:

### ROLE/ STATUS/ TRENDS/ IMPACTS/ RESTORATION:

**Applied Technology & Management, Inc. 2005. Seagrass monitoring in Lake Worth Lagoon: Final cumulative report for 2000-2004. Prepared for: Palm Beach County: Department of Environmental Resources Management. West Palm Beach, Florida. Tech. Rep. 135 pp.**

Abstract: Seagrass communities are highly productive habitats that are important components of marine and estuarine ecosystems. Since Palm Beach County has been increasingly urbanized, the residential, commercial, and industrial development that has occurred within the drainage basins that discharge into Lake Worth Lagoon have resulted in the degradation of water quality and the loss of productive seagrass communities. With implementations to improve water quality and the expansion of seagrass beds, in the year 2000, Palm Beach County initiated a long-term seagrass monitoring project. Several fixed transects have been established at strategic locations throughout the 21-mile long lagoon where the positive effects of water quality improvement projects are likely to result in increases in the spatial distribution, density, and vitality of seagrasses. Seagrasses were monitored at nine transects annually, and this report presents and summarizes the results that have been observed in the years 2000-2004.

Reference Location: Internet Search: Department of Environmental Resources Management: Palm Beach County, Florida; Lake Worth Lagoon

[http://www.co.palmbeach.fl.us/erm/enhancement/Images/PDF\\_Document/s/Final%20Report.pdf](http://www.co.palmbeach.fl.us/erm/enhancement/Images/PDF_Document/s/Final%20Report.pdf)

Keyword(s): Seagrass Transect Monitoring Report, Spatial Distribution, Density, Lake Worth Lagoon, West Palm Beach, Florida

**Biber, P. D. 2002. The effects of environmental stressors on the dynamics of three functional groups of algae in *Thalassia testudinum* habitats of Biscayne, Florida: A modeling approach. Ph.D. Dissertation, University of Miami, Miami, Florida, USA.**

Abstract: The effects of stressors related to canal discharges on near-shore, shallow-water tropical macroalgae occurring in *Thalassia testudinum* ecosystems were investigated. Three functional groups of macroalgae, drift algae, rhizophotic algae, and seagrass epiphytes, contribute to seagrass system structure and function. The physiological responses by the macroalgae to environmental variables including lighting, salinity, nutrients, and hydrodynamic regime were investigated. Temperature was found to drive seasonal changes in abundance, whereas salinity and nutrients were important determinants of the spatial distribution of the three groups within Biscayne Bay's study area. A simulation model of algal productivity was developed to improve a pre-existing primary production model for seagrass systems. Predicted simulation results agreed closely with the observed field data for both drift and rhizophotic algae, but less so for the epiphytes. In canal-influenced portions of the Bay, rhizophotic algae had reduced biomass because of low salinity stress, drift algae bloomed under favorable temperature conditions because of the nitrogen loadings, and filamentous epiphytes were favored over calcareous forms.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library,

Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): *Thalassia testudinum*, Environmental Stressors, Population Dynamics, Modeling Approach, Algae, Habitats, Biscayne, Florida

**Clinton, J. D., R. C. Phillips, and G. Morrison. 2004. Seagrass communities of the Gulf Coast of Florida: Status and ecology. Tampa Bay Estuary Program. Tampa Bay, Florida. 80 p.**

Abstract: The high level of production and biodiversity of seagrass communities has led to the view that they are the marine equivalent of tropical rainforests. Seagrasses are receiving focused attention from environmental managers, who require integrated science to aid in developing seagrass-protection programs. This document provides an up-to-date synthesis of research on the ecology, biology, and management of these complex and diverse communities for the Gulf Coast of Florida.

Reference Location: Internet Search: USGS Website:

[http://gulfscei.er.usgs.gov/gom\\_ims/pdf/pubs\\_fl.pdf](http://gulfscei.er.usgs.gov/gom_ims/pdf/pubs_fl.pdf)

Keyword(s): Seagrass, Communities, Ecology, Biology, Management, Gulf Coast, Florida

**Cunniff, K. M. Phenology, sexual reproduction, and the factors affecting sexual reproduction of the marine angiosperm, *Thalassia testudinum*, in the Florida Keys National Marine Sanctuary. 2006. M.Sc. Thesis, Florida International University, Miami, Florida, USA.**

Abstract: This study investigated phenology and the factors affecting sexual reproduction of *Thalassia testudinum* in the Florida Keys National Marine Sanctuary. Flowering was assessed at 30 permanent monitoring sites via direct observation and age reconstruction techniques of seagrass cores in 2002. Relative nitrogen availability was most important in influencing flowering and was negatively correlated with flowering. Higher flowering occurred with low N availability and lower flowering occurred with high N availability.

Reference Location: Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Phenology, Sexual Reproduction, Marine Angiosperm, Seagrass, *Thalassia testudinum*, Florida Keys National Marine Sanctuary

**Davis, B. C. 1998. Determining interspecific interactions between the dominant macrophytes of tropical, Atlantic seagrass meadows. M.Sc. Thesis, Florida International University, Miami, Florida, USA.**

Abstract: Interactions between abundant rhizophytic macroalgae and coexisting tropical seagrasses have not been directly examined. This study first tested for negative correlations between species densities over large and small spatial scales. Next the study tested for a competitive interaction by manipulating the relative densities of the locally dominant seagrass and a representative macroalgae. Due to significant growth responses to density manipulations, it is demonstrated that these species are likely competing for some limiting resource, possibly nitrogen. This study contributes to a better understanding of processes that dictate community composition in these systems.

Reference Location: Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Interspecific Interactions, Seagrass, Atlantic, Florida, Macrophytes

**Ferdie, M. 2002. Nutrient limitation of benthic primary production in the upper Florida Keys. M.Sc. Thesis, Florida International University, Miami, Florida, USA.**

Abstract: Spatial patterns in seagrass stoichiometry from the Florida Keys suggest that benthic community responses to eutrophication may significantly differ from nearshore habitats to the offshore reef tract. A 14-month in-situ nitrogen and phosphorous fertilization experiment was carried out to assess the consequences of coastal nutrient enrichment in the upper Florida Keys. The responses of benthic communities to nitrogen and phosphorous enrichment varied much between nearshore and offshore habitats. Offshore seagrass beds were strongly limited by nitrogen but not to phosphorous. Nearshore sites were affected by simultaneous nitrogen and phosphorous addition, where significant increases were found for seagrass abundance and growth, macroalgae abundance, epiphyte loads, and sediment macroalgae. This investigation emphasized the importance of nutrient supply in determining benthic community structure and composition in the upper Florida Keys.

Reference Location: Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Nutrient Limitation, Benthic Primary Productivity, Upper Florida Keys, Spatial Patterns, Seagrass, Stoichiometry, Eutrophication

**Ferdie, M., and J. W. Fourqurean. 2004. Responses of seagrass communities to fertilization along a gradient of relative availability of nitrogen and phosphorous in a carbonate environment. *Limnology and Oceanography*. 49(6): 2082-2094.**

Abstract: Patterns of relative nutrient availability in south Florida suggest spatial differences regarding the importance of nitrogen and phosphorous to benthic primary producers. A 14-month in situ fertilization experiment was conducted to test limitation predictions at six sites. Offshore seagrass beds were strongly limited by nitrogen, and nearshore beds were affected by nitrogen and phosphorous. Nutrient addition at offshore sites increased the length and aboveground standing crop of two seagrass species, *Thalassia testinidum* and *Syringodium filiforme*, and growth rates of *T. testinidum*. The observed species-specific responses to nutrient enrichment underscore the need to monitor all primary producers when addressing questions of nutrient limitation and eutrophication in seagrass communities.

Reference Location: Internet Search: ASFA: Aquatic Sciences and Fisheries Abstracts, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Phosphorous, Nitrogen, Nutrients, Fertilization, Nutrient Enrichment, Spatial Variations, Eutrophication, Environmental Impact, Seagrasses, South Florida

**Florida Fish & Wildlife Conservation Commission. 2001. The underwater world of Florida's seagrasses. Pamphlet. St. Petersburg, Florida.**

Abstract: This pamphlet provides an educational foundation of the importance and role of seagrass habitats of Florida and other subtropical and tropical environments worldwide. It discusses the habitat function, as well as environmental sensitivity to natural and anthropogenic stressors at the present-day. Recommendations are included for restoration measures to provide sustainable habitats for the wide scale of fish and invertebrate species diversity.

Reference Location: Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Seagrasses, Habitat Composition, Species Diversity, Habitat Functions, Restoration, Environmental Protection, Management, Florida

**Fonseca, M. S. 1999. Essential fish habitat project: Deepwater seagrass beds of the West Florida shelf; An overlooked essential fish habitat. Progress Report. NOAA Technical Memorandum.**

Abstract: This document is a progress report discussing the importance of deepwater seagrass beds as essential fish habitat on the West Florida shelf. Focus of discussion is on the value, present state of conditions in western Florida, and restoration and conservation methods to protect essential fish habitats for coastal and marine resources.

Reference Location: Internet Search: NOAA NCCOS Website: Publications & Products

<http://shrimp.ccfhrb.noaa.gov/~mfonseca/efhrept.pdf> (If not accessible try: <http://www8.nos.noaa.gov/nccos/pubinfo.aspx?id=1030>)

Keyword(s): Essential Fish Habitat, Deepwater Seagrass Beds, West Florida, Shelf, Progress Report

**Fonseca, M. S., W. J. Kenworthy, and G. W. Thayer. 1998. Guidelines for the conservation and restoration of seagrasses in the United States and adjacent waters. NOAA's Coastal Ocean Program Decision Analysis Series No. 12. NOAA Coastal Ocean Office, Silver Spring, MD. 222 pp.**

Abstract: Seagrass ecosystems are protected under the federal "no-net-loss" policy for wetlands and form one of the most productive plant communities on the planet, performing important ecological functions. These habitats have been recognized as a valuable resource critical to the health and function of coastal waters. This report identifies the values of seagrass ecosystems, the present state, and restoration methods to attain replacement of the lost seagrass species with an area of bottom coverage that compensates for interim lost resource services and a comparable shoot density. More information needs to be available for managers in order to mitigate loss.

Reference Location: Internet Search: NOAA's Coastal Ocean Program:

<http://www.alaskacoast.state.ak.us/Science/documents/Eelgrass/Eelgrass.pdf>

Keyword(s): Guidelines, Conservation, Seagrass Ecosystems, Wetlands, Resources, Mitigation, Restoration, Replacement, Coastal Waters, United States, Adjacent Waters

**Fonseca, M. S., W. J. Kenworthy, B. E. Julius, S. Shutler, and S. Fluke. 2002. Seagrasses. Pages 149-170 in Davy, A. J., and M. R. Perrow (eds.) Handbook of Ecological Restoration: Chapter 7. Cambridge University Press, Cambridge.**

Abstract: This chapter in the Handbook of Ecological Significance identifies seagrasses as essential fish habitat. Seagrass communities are described as valuable and critical habitat for many fish species and biological processes. Disturbances from anthropogenic impacts are discussed, along with survival from recovery methods, and transplanting protocols for restoration measures in the future.

Reference Location: Internet Search: NOAA NCCOS Website:

<http://www8.nos.noaa.gov/nccos/pubinfo.aspx?id=807>

Keyword(s): Seagrasses, Restoration, Resource Services, Habitat Equivalency Analysis, Site Selection, Transplanting, Protocols, Survival, Growth, Disturbance, Habitat Characterization



**Fourqurean, J. W., A. Willsie, C. D. Rose, and L. M. Rutten. 2001. Spatial and temporal pattern in seagrass community composition and productivity in south Florida. *Marine Biology*. 138: 341-354.**

Abstract: This article documents the distribution and abundance of seagrasses, as well as the intra-annual temporal patterns in the abundance of seagrasses and the productivity of the nearshore dominant seagrass, *Thalassia testudinum*, in the south Florida region. The productivity of this species was both temporally and spatially variable. The efficacy of rapid visual surveys was assessed for estimating abundance of seagrasses in south Florida by comparing results to measure of leaf biomass for *T. testudinum* and *Syringodium filiforme*. Rapid visual surveys proved useful for quantifying seagrass abundance, and the data presented in this paper serve as a benchmark against which future change in the system can be quantified.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Spatial, Temporal, Patterns, Seagrass Communities, Composition, Productivity, South Florida

**Gulf of Mexico Program. 2004. Seagrass habitat in the northern Gulf of Mexico: Degradation, conservation, and restoration of a valuable resource. Tech. Rep. EPA, USGS. 855-R-04-001.**

Abstract: The Gulf of Mexico Program's Habitat Team set a goal in 1999 to restore, enhance, or protect 20,000 acres of important coastal and marine habitats in the U.S. areas of the Gulf by 2009. Part of their objectives was to create an updates Seagrass Status and Trends Report. The purpose of this report is to provide scientists, managers, and citizens with valuable baseline information on the status of seagrasses in coastal waters of the Gulf of Mexico, and to increase awareness that the seagrasses of the Gulf are of global significance. The Habitat Team's Seagrass Committee provided the latest seagrass maps, seagrass status and trends, causes of change and current monitoring, restoration, and enhancement activities important to their area.

Reference Location: Internet Search: USGS Website:

[http://gulfsce.er.usgs.gov/gom\\_ims/pdf/pubs\\_gom.pdf](http://gulfsce.er.usgs.gov/gom_ims/pdf/pubs_gom.pdf)

Keyword(s): Seagrass, Status, Trends, Monitoring, Restoration, Coastal, Marine, Habitats, Gulf of Mexico, Florida

**Hale, J. A., T. K. Frazer, D. A. Tomasko, and M. O. Hall. 2004. Changes in the distribution of seagrass species along Florida's Central Gulf Coast: Iverson and Bittaker Revisited. *Estuaries*. 27(1): 36-43.**

Abstract: A broad-scale survey of seagrass species composition and distribution along Florida's central Gulf Coast was conducted in the summer of 2000 to address growing concerns over the potential effects of increased nutrient loading from adjacent coastal rivers. There were 188 stations revisited from what Iverson and Bittaker (1986) originally surveyed. *Thalassia testudinum*, *Syringodium filiforme*, and *Halodule wrightii*, were observed in these areas. There were several localized areas of seagrass loss that were frequently associated with the mouths of coastal rivers. These results suggest that increased nutrient loading to coastal rivers that discharge into the Big Bend area may be affecting seagrasses by increasing phytoplankton abundance in the water column, thus changing water quality characteristics of the region.

Reference Location: Internet Search: ASFA: Aquatic Sciences and Fisheries Abstracts, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Population Structure, Species Composition, Biogeography, Seagrasses, Coastal Environments, Eutrophication, Environmental Impact, River Discharge, Nutrients, Phytoplankton, *Thalassia testudinum*, *Syringodium filiforme*, *Halodule wrightii*, Florida

**Kenworthy, J., W. Judson, M. S. Fonseca, P. E. Whitfield, and K. Hammerstrom. 2000. Experimental manipulation and analysis of recovery dynamics in physically disturbed tropical seagrass communities of North America: Implications for restoration and management. *Biologia Marina Mediterranea*. 7: 385-388.**

Abstract: This report documents a study on the experimental manipulation and analysis of recovery dynamics in disturbed tropical seagrass communities of North America. Results from this study identify habitat loss and impacts to these ecosystems. This report concludes with suggestions and possible effective methods for the replacement of seagrass communities and restoration and management for future conservation goals.

Reference Location: Internet Search: NOAA NCCOS Website: Publications & Products

<http://www8.nos.noaa.gov/nccos/pubinfo.aspx?id=1067>

Keyword(s): Resource, Land Use, CCFHR, Estuaries, Fish Ecology, Seagrass Communities, Habitat Restoration

**Kenworthy, J., W. Judson, M. S. Fonesca, P. E. Whitfield, and K. K. Hammerstrom. 2002. Analysis of seagrass recovery in experimental excavations and propeller-scar disturbances in the Florida Keys National Marine Sanctuary. *Journal of Coastal Research*. 37: 75-85.**

Abstract: This report involves a study to analyze seagrass recovery and rates from disturbance due to propeller damage in the Florida Keys National Marine Sanctuary. Three species observed included *Thalassia testudinum*, *Syringodium filiforme*, and *Halodule wrightii*. Results show great impact due to human disturbance and the need for more effective long-term recovery of these three predominant species for future restoration and management of the Florida Keys National Marine Sanctuary.

Reference Location: Internet Search: NOAA NCCOS Website: Publications & Products

<http://www8.nos.noaa.gov/nccos/pubinfo.aspx?id=1240>

Keyword(s): Land Use, Resource Use, Tropical, Seagrasses, Recovery, Rates, Disturbance, Propeller Scars, *Thalassia testudinum*, *Syringodium filiforme*, *Halodule wrightii*, Florida Keys Marine Sanctuary, Injury, Restoration, Models

**Lapointe, B. E., P. J. Barile, and W. R. Matzie. 2004. Anthropogenic nutrient enrichment of seagrass and coral reef communities in the Lower Florida Keys: Discrimination of local versus regional nitrogen sources. *Journal of Experimental Marine Biology and Ecology*. 308(1): 23-58.**

Abstract: Land-based nutrient pollution represents a significant human threat to coral reefs globally. This study examined this phenomena in shallow seagrass and coral reef communities between the Content Keys and Looe Key in the Lower Florida Keys by quantifying the role of physical forcing and water management on mainland South Florida to nutrient enrichment and blooms of phytoplankton, macroalgae, and seagrass epiphyte. Phase I and II studies were assessed and results suggest that regional-scale agricultural runoff from the mainland Everglades watersheds as well as local sewage discharges from the Florida Keys are both significant nitrogen sources supporting eutrophication and algal blooms in seagrass and coral reef communities in the Lower Florida Keys.

Reference Location: Internet Search: ASFA: Aquatic Sciences and Fisheries Abstracts, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Sewage, Seagrasses, Coral Reefs, Nitrogen, Agricultural Runoff, Nutrients, Eutrophication, Water Quality, Algal Blooms, Anthropogenic Factors, Florida Keys

**Macia, S. M. 2000. The role of sea the urchin *Lytechinus variegatus* in the community ecology of seagrass beds. Ph.D. Dissertation, University of Miami, Miami, Florida, USA.**

Abstract: The abundance of sea urchins, *Lytechinus variegatus*, was manipulated in the field through the use of cages. Experimentally increased sea urchin density caused a decline in these parameters, but only in the winter. During the summer, increased sea urchin grazing did not affect the seagrass *Thalassia testudinum*. Sea urchins were introduced to a second site in central Biscayne Bay that did not previously support sea urchin populations. Grazing did not affect seagrass biomass, and shoot density was affected only in the fall, not spring. In the summer of 1997, this sea urchin species did overgraze parts of a *Syringodium filiforme* bed in Florida Bay. The effects of this grazing event were monitored for two years after passage of the front. Grazing activities caused decreases in sediment depth and percent composition of fine grains, and an increase in sediment organic content. Deposition of sea urchin feces was at least partly responsible for the observed increase in organic matter of the sediment. Laboratory experiments demonstrated that sea urchin feces can also fertilize seagrass, but only at sea urchin population densities where negative effects from grazing would outweigh the fertilization effect.

Reference Location: Internet Search: ProQuest, Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Sea Urchin, *Lytechinus variegatus*, Community Ecology, Seagrass, *Thalassia testudinum*, *Syringodium filiforme*

**Meyer, D. L., M. S. Fonseca, P. L. Murphey, R. H. Mc Michael, M. M. Byerly, M. W. La Croix, P. E. Whitfield, and G. W. Thayer. 1998. Effects of live-bait shrimp trawling on seagrass beds and fish bycatch in Tampa Bay, Florida. Fishery Bulletin. 97: 193-199.**

Abstract: Night collections are conducted over seagrass beds, *Thalassia testudinum*, with roller beam trawls to capture live shrimp, primarily pink shrimp, *Penaeus duorarum*. This fishery has become controversial in Tampa Bay, Florida. Due to the specific type of seagrass, it is not likely to be uprooted by roller trawls, but the roller on the trawl has been noted to break off and collect old seagrass leaves. The study objectives were to determine the effects of a roller beam trawl on turtlegrass biomass and morphometrics during intensive, short-term trawling to examine the mortality of the bycatch of finfish following capture by trawl. The research group was unable to detect significant trawl impacts on shoot density, structure, or biomass of turtlegrass by intensive, short-term trawling. However, they did not test for effects of repetitive trawling over turtlegrass beds over a longer period of time. Trawling may cause elevated localized turbidity, which could chronically reduce the potential for seagrass to perform photosynthesis.

Reference Location: Internet Search: NOAA NCCOS Website: Publications & Products

<http://fishbull.noaa.gov/18meyerf.pdf>

Keyword(s): Resources, Land Use, CCFHR, Shrimp Fisheries, *Penaeus duorarum*, Gear Selectivity, Trawling, Bait Fishing, Estuaries, Fish Ecology, Habitat Restoration, Seagrass Beds, *Thalassia testudinum*, Tampa Bay, Florida

**Orth, R. J., T. J. B. Carruthers, W. C. Dennison, C. M. Duarte, J. W. Fourqurean, K. L. Heick Jr., A. R. Hughes, G. A. Kendrick, W. J. Kenworthy, S. Oloarnik, F. T. Short, M. Waycott, and S. L. Williams. 2006. A global crisis for seagrass ecosystems. *BioScience*. 56(12): 987-996.**

Abstract: This article highlights the role, importance, and present-day impacts on seagrasses across the world, due to coastal human population pressures. Primary focus is on key ecological services including organic carbon production and export, nutrient cycling, sediment stabilization, enhanced biodiversity, trophic transfers to adjacent habitats, and serve as “coastal canaries” with regards to large-scale losses and coastal ecosystem health detriment resulting from anthropogenic stressors. These losses of seagrass habitat have led to increased awareness of the need for seagrass protection, monitoring, management, and restoration. There continues to be a need to connect public awareness with seagrass science to increase global conservation methods, including a reduction of watershed nutrient and sediment inputs and educational programs concerning seagrass ecosystem value.

Reference Location: [www.biosciencemag.org](http://www.biosciencemag.org).

Keyword(s): Seagrass, Decline, Sentinels, Ecological Services, Monitoring

**Rose, C. D. 2004. The role of disturbance and resource availability in structuring plant communities. Ph.D. Dissertation, Florida International University, Miami, Florida, USA.**

Abstract: Disturbances alter competitive hierarchies by reducing populations and altering resource regimes. The interaction between disturbance and resource availability may strongly influence the structure of plant communities, as observed in the re-colonization of seagrass beds in outer Florida Bay that were impacted by sea urchin overgrazing. This dissertation presented the resource-disturbance hypothesis as a graphical model to make predictions of CI as a function of both disturbance intensity and availability of a limiting resource. Predictions of this model were tested in two experiments within a seagrass community in south Florida, in which transplants of *Halodule wrightii* were placed into near-monocultures of *Syringodium filiforme* in full-factorial array. Results suggest that the resource-disturbance hypothesis may be used as a next step in developing an understanding in the structure of plant communities. The focus of this model is on the outcome of CI, which may be an indicator of changes in species diversity. Future studies are needed to confirm the results of this study and validate the usefulness of this model in other systems.

Reference Location: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Disturbance, Ecology, Oceanography, Resource Availability, Plant Communities, Seagrass, *Halodule wrightii*, *Syringodium filiforme*, Florida

**Sanderson, P. A. 2006. Effects of nutrient enrichment on the animal assemblages of *Halodule wrightii* seagrass beds in Big Lagoon, Perdido Key, Florida. M.Sc. Thesis, Mississippi State University, Mississippi, USA.**

Abstract: As nutrient levels arise in coastal waters, epiphytic algal biomass increases, contributing to declines in the health and aerial extent of seagrass beds. It is important to determine where primary consumers have the capacity to neutralize the positive effects of nutrient enrichment on epiphytic algal growth through grazer population growth and in creases in grazing pressure. This study analyzed differences in abundance and species richness in control, and low and high nutrient-enriched plots from May through July 2003 of all animals within *Halodule wrightii* beds in Big Lagoon, Perdido Key, Florida. Grazer species were found in higher abundance in high enrichment plots, and there were significant correlations between animal abundance. Richness data and epiphyte pigment concentrations. Evidence suggests that as animals depart from their natural life cycles, community structure changes under nutrient enrichment. This raises the

question of whether primary consumers are capable of compensating for increased algal biomass under nutrient enrichment.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Mathematical Programming, Spatial Modeling, Marine Reserve, Coral Reef, Fishes, Florida

Keyword(s): Ecology, Oceanography, Nutrient Enrichment, Animal Assemblages, *Halodule wrightii*, Seagrass Beds, Big Lagoon, Perdido Key, Florida

**Shafer, D. J., and J. Lundin. 1999. Design and construction of docks to minimize seagrass impacts. WRP Technical Notes Collection TN-WRP-VN-RS-3.1. U.S. Army Engineer Research and Development Center. Vicksburg, MS. June 1999. 6 pp.**

Abstract: Seagrasses are widely recognized as one of the most productive and valuable habitats in the shallow marine environment. The amount of light is one of the most important factors affecting the survival, growth, and depth distribution of seagrasses. This technical note provides recommendation for the design and construction of dock and terminal platform structures to minimize impacts to seagrasses, and describes the two experimental platforms in St. Andrew Bay, Florida.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Construction, Docks, Impacts, Seagrass Beds

**Singh, A. G. 2003. Epiphyte productivity and community structure in conjuncture with HPLC pigment analysis. M.Sc. Thesis, Florida Atlantic University, Boca Raton, Florida, USA.**

Abstract: Seagrass meadows in Florida Bay have significantly declined due to synergistic stresses. The microalgal communities present on the leaves of *Thalassia testinidum* were studied in the Snake Bight and Whipspray Basin areas of Florida Bay. This study explored recurrent plankton blooms within the microalgal epiphytic communities. Epiphytometers were used to provide time zero point which is impossible in natural samples. These samples were analyzed using HPLC/PDA which provided measurements of standing crop and community structure. The monitoring of productivity, standing crop and community structure should allow insight into positive and negative effects of water supply changes.

Reference Location: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Environmental Science, Epiphyte Productivity, Community Structure, Seagrass, *Thalassia testinidum*, Snake Bight, Whipspray Basin, Florida Bay

**Tomasko, D. A., C. A. Corbett, H. S. Greening, and G. E. Raulerson. 2005. Spatial and temporal variation in seagrass coverage in Southwest Florida: Assessing the relative effects of anthropogenic nutrient load reductions and rainfall in four contiguous estuaries. Marine Pollution Bulletin. 50(8): 797-805.**

Abstract: The estuaries of Tampa Bay, Sarasota Bay, Lemon Bay, and Upper Charlotte Harbor are contiguous water bodies located within the subtropical environment of Southwest Florida. Based on an examination of rainfall data, there is no evidence for spatial differences or monotonic trends in annual rainfall. Seagrass coverage has remained relatively constant since the mid 1980s in

Lemon Bay and Charlotte Harbor. Domestic wastewater treatment facilities are minor sources of nitrogen to Lemon Bay, and water clarity in Charlotte Harbor varies mostly as a function of dissolved organic matter and non-chlorophyll associated turbidity, not phytoplankton levels. Even in estuaries that share boundaries varied responses to anthropogenic changes and natural phenomena were observed in water quality and associated seagrass content. Future resource management strategies must take into account system-specific factors.

Reference Location: Internet Search: ASFA: Aquatic Sciences and Fisheries Abstracts, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Water Transparency, Restoration, Plant Populations, Tampa Bay, Sarasota Bay, Lemon Bay, Upper Charlotte Harbor, Southwest Florida

**Valentine, J. F. 2003. Seagrass herbivory: New evidence of dynamical interactions between seagrasses and their consumers. Gulf of Mexico Science. 21(1): 122-123.**

Abstract: Emerging evidence suggests that marine herbivores consume substantial quantities of seagrass in many coastal areas. The apparent contradiction between high estimates of consumption, and the persistence of extensive seagrass meadows, indicates that many dynamic, unstudied interactions exist between these plants and their consumers, and that our current understanding of seagrass herbivory is overly simplified. New findings include the evidence that herbivores can trigger shifts in seagrass species composition, growth rates, and possibly reproduction. Also, it is seen that some seagrasses produce chemical defenses that may deter repeated attacks by grazers. Using the marine reserves of the Florida Keys, it was found that while the presence of piscivorous fishes can reduce the density of smaller seagrass herbivores, they have little impact on overall grazing rates. This new evidence greatly suggests that there have been underestimations of the importance of seagrass herbivory in many coastal ecosystems.

Reference Location: Internet Search: ASFA: Aquatic Sciences and Fisheries Abstracts, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Seagrass, Herbivores, Secondary Production, Interspecific Relationships, Trophic Relationships, Defense Mechanisms, Community Composition, Harvesting

**Wetlands Restoration Program. 1999. Design and construction of docks to minimize seagrass impacts. June, 1999. Wetlands Restoration Program Technical Note: VN-RS-3.1.**

Abstract: Cumulative impacts and fragmentation of seagrass beds may be significant along highly developed shorelines. With seagrass populations in decline, coastal resource managers are interested in the development of consistent, defensible guidelines to reduce additional dock-associated impacts to an already stressed resource from existing coastal development. This report provides recommendations for the design and construction of dock and terminal platform structures to minimize impacts to seagrasses.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Seagrass, Dock Construction, Wetlands Restoration Program

### III. COASTAL HABITATS:

#### VALUE/ POLLUTION/ RESTORATION/ RESOURCE MANAGEMENT:

**Alvarez-Fraga, L. 2003. Effects of increased urban and agricultural land use on the anthropogenic loading to Southwest Florida estuaries. M.Sc. Thesis, Florida International University, Miami, Florida, USA.**

Abstract: South Florida has been subject to considerable changes during the last 100 years. This study provides a detailed survey of the presence, concentration levels and spatial distribution of organic and inorganic contaminants in sediment samples collected within the coastal environments of Southwest Florida. It evaluates the potential contributions and effects of the urban and agricultural development to the pollution of the estuarine sediments, as well as providing information on chronology of contamination at impacted sites. Copper was found to be the most critical contaminant among trace metals. The evaluation for the chronology of contamination showed a significant increase with time of every contaminant analyzed. Fluorescence spectroscopy proved to be a good method for fast screening PAHs.

Reference Location: Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Effects, Urban Runoff, Agricultural Land Use, Anthropogenic Loading, Southwest Florida, Estuaries

**Browder, J., P. Ortner, C. Buckingham, S. Blair, S. Markley, D. Smith, D. Rudnick, and D. Deis. 2004. South Biscayne Bay: Re-establish and maintain seasonal salinity gradients from freshwater to coastal wetlands with continuous estuarine conditions nearshore along the western shore of Biscayne Bay between Shoal Point and Turkey Point. SE Working Group. NOAA, USCOE, MDDERM, ENP, SFWMD, EPJV. In Press.**

Abstract: Prior to the construction of the South Dade Conveyance System, estuarine conditions in lower Biscayne Bay were maintained by the flow of fresh water through a series of creeks, as identified by historic photographs, satellite imagery and soil analyses. Historic oyster beds are presently inactive due to habitat changes associated with the loss of freshwater discharge into wetlands through creek systems. Estuarine fishes and shellfish have declined in abundance due to the loss of estuarine habitat along the southwestern edge. This report identifies the western shore of Biscayne Bay between Shoal Point and Turkey Point as areas of interest and assessment for evaluation of present-day conditions. Sufficient salinity data are required to accurately generate average salinity within the 0-500-m zone.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Seasonal Salinity Gradients, Freshwater, Coastal, Wetlands, Estuaries, Western Shore, Biscayne Bay, Shoal Point, Turkey Point, Florida

**Carter, K., N. J. Gassman, G. Riley, and C. Wilbur. 2000. Ambient nutrient concentrations in south Florida urban canals. Pages 7-10 in Higgins, R. W., ed. AWRA's annual water resources conference proceedings: Water quantity and quality issues in coastal urban areas. American Water Resources Association. Middleburg, Virginia. TPS-00-3, 400.**

Abstract: The Broward County Department of Planning and Environmental Protection in Ft. Lauderdale, Florida, has monitored water quality in an urban sector of the watershed for 28 years. This study investigates the nutrient characteristics of 7 freshwater canals that typify the South

Florida watershed. Three nutrient groups are proposed from the county based on relative total nitrogen and total phosphorous content and compared with corresponding specific conductance readings. Nutrient fate within the canal and discharge points will be discussed.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Nitrogen, Phosphorous, Urban Watersheds, South Florida

**Chasar, L. C. 2002. Implications of environmental change for energy flow through natural systems: Wetlands and coastal zones. Ph.D. Dissertation, The Florida State University, Florida, USA.**

Abstract: Freshwater wetlands and coastal zones are complex ecosystems threatened by direct human disturbances, such as encroachment and poor wastewater management, and by indirect human disturbances, such as climate change. This research evaluates a northern peatland and a subtropical estuary using natural abundance isotopes to trace origin, transport, and transformation of energy through these systems. This information is used in establishing current levels of functioning. Comparing to past status, and constructing models of potential responses to continually changing environmental conditions. Coastal ecosystems are often characterized by the predominant source of organic carbon driving the system. Florida Bay has been highly impacted by the development and management of south Florida in the last century, and changing conditions in the bay show that the system is shifting from dependence on benthic production from seagrass detritus, to water-column production, as with phytoplankton. Long-term fish preservation experiments indicate that this multiple stable isotope approach is feasible for museum specimens that have been fixed in ethanol or formalin. This allows for evaluation of trophic dynamics of current and historic populations relative to environmental conditions, such as temperature, salinity, turbidity, and seagrass distribution.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Environmental Change, Energy Flow, Wetlands, Coastal Zones, Carbon Cycling, Biogeochemistry, Environmental Science

**Craig, M., D. Stites, K. Snyder, P. Fiske, M. and Hill. 2002. Coastal highway and marine turtles: Who comes first in Flagler County, FL? Pages 9-14 in ed. Lesnik, J. R. Coastal water resources. AWRA 2002 Spring Specialty Conference Proceedings. American Water Resources Association. Middleburg, Virginia. TPS-02-1.**

Abstract: A section of Atlantic Ocean beach along the City of Flagler Beach FL was heavily eroded during Hurricane Floyd of 1999. The FDOT repaired the section with a granite boulder revetment to ensure stability of the road. The FDEP was concerned with violations of state statutes. The beaches in the area are monitored for sea turtle nesting activity, and questions were posed to the degree of impact after the storm. New data led Florida Fish and Wildlife Conservation Commission to inform FDEP that the repair may have resulted in a "taking" of marine turtles via interference with essential breeding habitat and behavior. This issue is discussed within this article.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Coastal Erosion, Revetment, Nesting, Marine Turtles, Beaches, Flagler County, Florida



**Department of Commerce, National Oceanic and Atmospheric Administration.  
1998. Benthic habitats of the Florida Keys. NOAA's Ocean Service, National Centers for Coastal Ocean Science (NCCOS), Silver Spring, MD.**

Abstract: The benthic habitats of the Florida Keys were mapped from a series of 450 aerial photographs. Ecologists outlined the boundaries of specific habitat types by interpreting color patterns on the photographs. Benthic habitats were classified into four major categories-corals, seagrasses, hardbottom, and bare substrate-and 24 subcategories, such as sparse seagrass and patch reef. Habitat boundaries were georeferenced and digitized to create computer maps. These digital data were then incorporated into a geographic information system for direct electronic mapping.

Reference Location: Internet Search: NOAA CoRIS Website:

[http://coris.noaa.gov/metadata/records/faq/florida\\_keys\\_benthic\\_habitat\\_1992.html#what.1](http://coris.noaa.gov/metadata/records/faq/florida_keys_benthic_habitat_1992.html#what.1)

Keyword(s): Benthic Habitats, Florida Keys, Corals, Seagrasses, Hardbottom, Bare Substrate, Patch Reef, Geographic Information System

**Department of Commerce, National Oceanic and Atmospheric Administration.  
2004. Goal 6: Reduce impacts of fishing and other extractive uses. National Coral Reef Action Strategy. NOAA's Ocean Service, National Centers for Coastal Ocean Science (NCCOS), Silver Spring, MD. pp. 47- 53.**

Abstract: Coral reefs and associated habitats provide important commercial, recreational, and subsistence fishery resources in the U.S. and around the world, and represent a critical source of food for many developing countries. Potential threats of fishing include: direct over-exploitation of fish, invertebrates, algae for food and the aquarium trade; physical impacts to reef environments associated with fishing techniques and fishing gear; impacts that occur over a wide range of trophic levels as a result of the removal of a species or a group of species; and by-catch of non-target species. This report focuses on reducing adverse impacts of fishing and other extractive uses in order to reduce key threats to coral reef ecosystems.

Reference Location: Internet Search: NOAA CoRIS Website:

[http://www.coris.noaa.gov/activities/actionstrategy/04\\_goal\\_06.pdf](http://www.coris.noaa.gov/activities/actionstrategy/04_goal_06.pdf)

Keyword(s): Coral Reef Action Strategy, Fisheries, Exploitation, Impacts, By-catch, Coral Reef Ecosystems

**Department of Environmental Resources Management: Palm Beach County. 2003.  
Lake Worth Lagoon monitoring project: Final report. DEP Agreement No. WAP028.**

Abstract: The purposes of the water quality monitoring program are the identification of trends in water quality and existing water quality status, and the assessment of the effectiveness of the Stormwater Management Programs. A major objective of the Lake Worth Lagoon Management Plan is to restore, preserve, and create seagrass beds, oyster bars, and other submerged benthic habitat. Also, fixed transects were provided to determine whether seagrass beds in the lagoon are stable, improving, or declining and by how much. This report also includes a summary of the in-kind projects used as match, recommendations for future monitoring and management, and a summary of all financial activity under the references agreement.

Reference Location: Internet Search: Department of Environmental Resources Management: Palm Beach County, Florida; Lake Worth Lagoon

[http://www.co.palm-beach.fl.us/erm/enhancement/Images/PDF\\_Documents/LWL\\_Report.pdf](http://www.co.palm-beach.fl.us/erm/enhancement/Images/PDF_Documents/LWL_Report.pdf)

Keyword(s): Lake Worth Lagoon Monitoring Program, Seagrass Beds, Management Program, Palm Beach County, Florida

**Department of Environmental Resources Management: Palm Beach County. 2005. Lake Worth Lagoon Status Report. State of Florida. Tech. Rep. 3 pp.**

Abstract: This report briefly underlines main themes on the status of Lake Worth Lagoon, Florida. It discusses the Lake Worth Lagoon Partnership Grant Program, Lake Worth Lagoon Public Outreach, Tyler's Islands Resource Survey, C-51 Sediment Transport Project, Dredge Hole Evaluation, Abandoned Vessel Recovery, Manatee Protection Plan, In Water Sea Turtle Monitoring, and Reef Management. This update serves as a guide for what future surveys need to be performed and the present condition of Lake Worth Lagoon in order to construct effective management and restoration efforts for the future.

Reference Location: Internet Search: Department of Environmental Resources Management: Palm Beach County, Florida; Lake Worth Lagoon  
[http://www.co.palmbeach.fl.us/erm/enhancement/Images/PDF\\_Documents/Quarterly%20Update.pdf](http://www.co.palmbeach.fl.us/erm/enhancement/Images/PDF_Documents/Quarterly%20Update.pdf)

Keyword(s): Sediment, Lake Worth Lagoon, Status, Environmental Resource Management, Grants, Habitat, Native Plants, Fish, Wildlife, West Palm Beach, Florida

**Dillon, K. S. 2003. The use of stable and radioactive isotopes in tracing nutrient sources and sinks in two urbanized coastal environments of Florida: The Florida Keys and Sarasota Bay. Ph.D. Dissertation, The Florida State University, Florida, USA.**

Abstract: Two artificial tracer experiments were conducted in a groundwater system surrounding a high-volume wastewater disposal well in the Florida Keys. The limestone matrix underlying the study zone appeared to act as a phosphate buffer once exposed to phosphate-rich water. In Sarasota Bay, stable nitrogen isotopes were employed to examine the two largest sources of nitrogen to the Bay: wet atmospheric deposition and stormwater runoff. Seagrass and attached benthic macroalgae were used as proxies for water column analyses. Mass balance calculations support previous estimates of the percentage of nitrogen loadings to Sarasota Bay from stormwater, wet deposition, and wastewater, although better estimates of the wastewater and groundwater nitrogen compositions still need to be obtained for future analyses.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): De-nitrification, Nutrient Sources, Groundwater, Urbanized Coastal Environments, Florida

**Finkl, C. W., R. H. Chaliar, and S. L. Krupa. 2005. Vulnerability of coastal environments to land use and abuse: The example of southeast Florida. International Journal of Environmental Studies. 62(5): 535-554.**

Abstract: The Atlantic coastal zone of subtropical southeast Florida supports nearly 7 million inhabitants. Population densities approaching 2500 persons per square km and dredge and fill operations to create urban land in western marshes has degraded coastal environments bringing environmental sustainability into question. Efforts to maintain environmental integrity included massive beach re-nourishment projects along developed coasts subject to critical erosion. Marine algal blooms, degraded coastal water quality and the deterioration of coral reefs indicate environmental problems more serious than beach erosion. Recognition of a potential ecocatastrophe provoked the Everglades Restoration Project, which is the largest single environmental recovery effort in the world. The cleanup of terrestrial systems is essential to sustainability of marine ecosystems now jeopardized by nutrient loading.

Reference Location: Wimberly Library, Florida Atlantic University: Internet

Database Search: CSA, Boca Raton, Florida, USA

Keyword(s): Environmental Engineering, Erosion, Sustainable Development, Environmental Degradation, Coastal Zone, Nutrient Loading, Coral Reefs, Sustainable Development, Florida

**Gunderson, L. H. 2001. Managing surprising ecosystems in southern Florida. *Ecological Economics*. 37(3): 371-378.**

Abstract: Southern Florida ecosystems have had changes in dominant plant species in freshwater marshes of the Everglades and massive die-offs of seagrass in Florida Bay. Both examples indicate a loss of ecological resilience and subsequent shifts in controlling processes or stability domains. Two predicates for adaptive management are sufficient resilience in the ecosystem components of a resource system and flexibility in the social system. Ecological resilience provides a buffer to the failure of management actions, while social flexibility is needed if ecosystem resilience is exceeded.

Reference Location: Internet Search: Science Direct, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Resilience, Adaptive Management, Everglades, Florida Bay

**Kentula, M. E., and G. W. Thayer. 2005. Coastal restoration: Where have we been, where are we now, and where should we be going? Coastal Education and Research Foundation, West Palm Beach, FL.**

Abstract: This book offers an historical understanding of coastal habitat conditions and restoration in the past, present-day challenges concerning coastal erosion and disturbance due to natural and anthropogenic factors, and future goals to restore coastal habitats. Habitats of focus include estuaries, wetlands, salt marsh ecosystems, mangrove communities, seagrass beds, and habitat linkages among these. Hydrology models, nutrient biogeochemistry, and community dynamics are discussed, along with a need to have compensatory restoration methods for effective coastal zone management.

Reference Location: Internet Search: World Cat/Libraries Website

<http://www.worldcatlibraries.org/oclc/58794845?tab=holdings>

Keyword(s): Coastal Ecology, Marine Ecology, Restoration Ecology, Environmental Monitoring, United States

**Lewis, M. A., D. E. Weber, R. S. Stanley, and J. C. Moore. 2001. Dredging impact on an urbanized Florida bayou: Effects on benthos and algal-periphyton. *Environmental Pollution*. 115(2): 161-171.**

Abstract: Environmental effects of dredging events have been reported for shallow, residential estuaries. The objective of this study was to determine the impact of hydraulic dredging on an urbanized estuary. Physicochemical quality, benthic community composition, whole sediment toxicity, periphytic algal community composition, and trace metal tissue quality were determined prior to and after dredging. Dredging significantly reduced benthic diversity and density. Results demonstrated that the environmental impact of small-scale dredging events in urbanized near-coastal areas are likely to be localized and of short-term environmental consequence. Important considerations for future assessment include identified biota, response parameters, and chemical analyses.

Reference Location: Internet Search: Science Direct, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Dredging, Benthos, Periphyton, Florida, Bayou-Estuary

**Leitz, A. C., and E. A. Debiak. 2005. Development of rating curve estimators for suspended-sediment concentration and transport in the C-51 Canal based on surrogate technology, Palm Beach County, Florida, 2004-05. Palm Beach County Department of Environmental Resources Management. Tech. Rep. U.S. Dept. Int., U.S. Geol. Survey.**

Abstract: The Lake Worth Lagoon watershed natural resources and aquatic biota have been adversely affected by anthropogenic activities since the 19<sup>th</sup> century. A major concern is the large deposition of muck sediment that has had a deleterious effect on seagrass growth. The major cause is due to stormwater laden with fluvial sediment, discharging through out the S-155 control structure on the West Palm Beach Canal, C-51. Rating curve estimators were developed based on the relationship between suspended sediment and different explanatory variables, including turbidity and discharge. Cross-sectional water-quality surveys were made at three verticals in the stream cross section during various seasonal and hydrologic conditions to assess water-quality homogeneity in the stream. Results indicated a range of concentration differences. Quality-assurance samples were collected as part of this study and included equipment blanks, field blanks, and duplicate samples. Relative percent difference between duplicate samples collected at the probe and cross section were within Florida DEP standards. According to the results attained from the study, the logarithm of both turbidity and discharge as explanatory variables is the best estimator for computing suspended-sediment concentrations and loads at the stream cross section.

Reference Location: Internet Search: Department of Environmental Resources Management: Palm Beach County, Florida; Lake Worth Lagoon  
[http://www.co.palmbeach.fl.us/erm/enhancement/Images/PDF Documents/Sediment Transport Study.pdf](http://www.co.palmbeach.fl.us/erm/enhancement/Images/PDF_Documents/Sediment_Transport_Study.pdf)

Keyword(s): Water-quality Survey, Hydrology, Sediment Transport, Turbidity, Discharge, West Palm Beach C-51 Canal, Lake Worth Lagoon, Florida

**Lipp, E. K., S. A. Farrah, and J. B. Rose. 2001. Assessment and impact of microbial fecal pollution and human enteric pathogens in a coastal community. *Marine Pollution Bulletin*. 42(4): 286-293.**

Abstract: The objective of this study was to assess watersheds impacted by high densities of onsite sewage disposal systems for evidence of fecal contamination and evaluate the occurrence of human pathogens in coastal waters off west Florida. Eleven stations were sampled for microbial indicators of fecal pollution and human enteric pathogens from May-September 1996. Results suggest that stations of highest pollution risk were located within areas of high onsite sewage disposal systems densities. The high prevalence of enteroviruses throughout the study area suggests a chronic pollution problem and potential risk to recreational swimmers in and around Sarasota Bay.

Reference Location: Internet Search: Science Direct, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Pathogens, Fecal Pollution, Florida, Estuary, Enteric Virus, Indicator Bacteria

**Loftus, W. F., R. M. Kobza, D. Padilla, and J. C. Trexler. 2003. Fish community colonization pattern in the Rocky Glades wetlands of Southern Florida. USGS. Greater Everglades Ecosystem Restoration Conference.**

Abstract: The Rocky Glades is a wetland ecosystem degraded by drainage and land conversion. In 2000, there was a pilot study that was performed to test the use of drift fence/funnel traps to study fish dispersal, composition, and succession. Larger-bodied species and non-native fishes appeared to immigrate later. This article describes how the data will be used in restoration of this region and future research questions and requirements to achieve this goal.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Fish Communities, Colonization Patterns, Restoration, Rocky Glades, Wetlands, Southern Florida

**Maie, N., J. N. Boyer, C. Yang, R. Jaffé. 2006. Spatial, geomorphological, and seasonal variability of CDOM in estuaries of the Florida coastal Everglades. *Hydrobiologia*. 569(1): 135-150.**

Abstract: This paper demonstrates the usefulness of fluorescence techniques for long-term monitoring and assessment of the dynamics of chromophoric dissolved organic matter in highly compartmentalized estuarine regions with non-point water sources. Water samples were collected monthly from a total of 73 sampling stations in the Florida Everglades estuaries during 2001 and 2002. Spatial and seasonal variability characteristics in this assessment were investigated for geomorphologically distinct sub-regions within Florida Bay. The source of dynamics of CDOM in these subtropical estuaries were found to be complex and influenced by many factors including hydrology, geomorphology, vegetation cover, land use, and biogeochemical processes.

Fluorescence parameters for surface waters can add valuable information on CDOM dynamics to long-term water quality studies which can not be obtained from quantitative determinations alone. Reference Location: Internet Search: EBSCO Research Databases: Environmental and Natural Sciences

Keyword(s): Carbon Compounds, Estuaries, Fluorescence, Swamps, Seawater, Everglades, Coastal Ecology, Florida

**McAloon, C., R. C. Garza, J. Silvestre, M. Watts, A. Wildman, M. Kay, J. Mahoney, J. McGinley, J. Smart, P. Welsh, P. Bogenschutz, E. Rogers, and T. Nicolini. 2005. The coastal storms program: Improved prediction of coastal winds, waves, and flooding. *Solutions to Coastal Disasters 2005*. Charleston, South Carolina. pp. 227-376.**

Abstract: The Coastal Storms Program is an interdisciplinary NOAA project developed to assist coastal communities in preparing for and mitigating the impacts of coastal storms. The first phase of this program was on the St. John's River region of northeast Florida. Hazards of greatest interest for this region include tropical storms, flooding, and ecological impacts. The primary concerns in the second area in the Columbia River region of the Pacific Northwest, are storms, flooding and erosion, and fish habitat impacts. The primary focus of this paper is on the efforts in the northeast Florida region, which is nearing completion.

Reference Location: Wimberly Library, Florida Atlantic University: Internet Database Search: CSA, Boca Raton, Florida, USA

Keyword(s): Coastal Environment, Foods, Wind, Storm Surges, Rivers, Erosion, Coastal Storms Program, Florida

**Mumford, P. L. 1999. The effects of environmental stress and primary productivity on food chain length in Florida Bay. M.Sc. Thesis, Florida International University, Miami, Florida, USA.**

Abstract: The objective of this investigation was to determine if stress or seagrass primary productivity played an important role in structuring epibenthic food chain length found within Florida Bay. Nitrogen stable isotopes were used as an indicator of food chain length across sites. No significant differences in food chain length were found across stress levels, productivity levels, or across productivity levels within each basin. However, there are significantly longer food chain lengths found within the high stress basins once Whipray Bain was excluded. As management policies are changed, affecting Florida Bay, baselines need to be established to understand what effect these actions will have on seagrass communities.

Reference Location:

Keyword(s): Effects, Environmental Stress, Primary Productivity, Food Chain Length, Epibenthic Food Chain, Seagrass, Florida Bay

**Phillips, M. R., and A. L. Jones. 2006. Erosion and tourism infrastructure in the coastal zone: Problems, consequences, and management. *Tourism Management*. 27(3): 517-524.**

Abstract: The importance of coastal zones to the tourism industry and the need to protect such resources is not only vital to the economy of our nations, but it presents a growing issue for many regions. Beaches have become synonymous with tourism and current predictions of climate change and sea-level rise. From an assessment of the effects of erosion, including evaluation of impacts on coastal destinations and tourism development, the consequences for global tourism are projected in this report. An analysis of the hard and soft engineering responses demonstrated that coastal protection measures should be linked to physical processes while management strategies included a case study proposal for beach nourishment in response to the erosion of a tourist beach. Coastal Zone Management efforts are recommended to continue in order to analyze projected impacts.

Reference Location: Internet Search: Science Direct, University of Miami, Florida, USA (Membership Need to View)

Keyword(s): Destination, Beach Nourishment, Dive Tourism, Coastal Zone Management

**Renken, R. A., J. Dixon, J. A. Koehmstedt, S. Ishman, A. C. Lietz, R. L. Marella, P. Telis, J. Rodgers, and S. Memberg. 2005. Impact of anthropogenic development on coastal ground-water hydrology in southeastern Florida, 1900-2000. *Tech. Rep. U. S. Geological Survey Circular: Greater Everglades Priority Ecosystems Science Program*. Reston, Va., U.S. 77 p.**

Abstract: Much of the present-day urban-agricultural corridor of southeastern Florida lies within an area that is no more than 15 feet above NGVD 1929 and formerly characterized by freshwater marsh, upland, and saline coastal wetland ecosystems. Miami-Dade, Broward, and Palm Beach Counties have experienced explosive population growth, increasing from less than 4,000 inhabitants in 1900 to more than 5 million in 2000. The construction of a complex canal drainage system and large well fields has substantially altered the surface- and ground-water hydrologic systems. The drainage system constructed between 1910 and 1928 mostly failed to transport flood flows, however, and exacerbated periods of low rainfall and drought by overdraining the superficial aquifer system. Following completion of the 1930s Hoover Dike levee system that was designed to reduce Lake Okeechobee flood flows, the Central and Southern Florida Flood Control Project initiated the restructure of the existing conveyance system in 1948 through canal expansion, construction of protective levees and control structures, and greater management of ground-water levels in the superficial aquifer system. Core sample paleontologic observations of salinity and the distribution of seagrass in Biscayne Bay and Florida Bay suggest that the coastal marine ecosystem system during the 20th century has been impacted considerably by anthropogenic activities. Land use and water-management practices have increased nutrient loads and other pollutants and increased bay turbidity. Prior to 1900, the Biscayne Bay ecosystem was characterized by much lower marine salinities, including the extreme southern part of the bay, which contained waters that were nearly fresh. Changes in land use and water-management practices over the long term have had a profound effect on the ground-water hydrology of southeastern Florida and are found in this report.

Reference Location: Internet Search: USGS Publications Warehouse  
<http://pubs.er.usgs.gov/usgspubs/cir/cir1275>

Keyword(s): Anthropogenic Factors, Urban Agriculture Runoff, Ground-water,

**Restore America's Estuaries, and National Oceanic and Atmospheric Administration. 2002. A national strategy to restore coastal and estuarine habitat. April 2002.**

Abstract: Estuaries provide critical habitat for many species of fish, shellfish, and seagrasses. They serve as a nursery and spawning grounds for a number of endangered and threatened species. Coastal habitats, from watersheds to open oceans, nourish one another, their biology and chemistry linked such that the very component that restores one protects another. This report focuses on the ecology, role, importance, and impacts that estuaries and other coastal ecosystems are experiencing presently. Preservation and restoration methods to further maintain healthy coastal ecosystems continues to be a national strategy needed to pursue.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Coastal Habitats, Estuarine Habitats, Restoration, Ecology, Management, United States

**Rutten, L. M. 2002. An assessment of nearshore benthic communities of the Florida Keys. M.Sc. Thesis, Florida International University, Miami, Florida, USA.**

Abstract: This study attempts to distinguish between influences of natural and environmental factors and anthropogenic factors on spatial and temporal variations in nearshore environments to understand the causes of degradation to coastal marine ecosystems in the Florida Keys. Spatial variations in water depth, substrate type, and sediment depth, were significant and variations in the composition of nearshore benthic communities may be used to detect nutrient loading impacts. Nearshore benthic macrophytes demonstrated slight temporal variations that differed between study areas, but these variations were also unrelated to land use, as the spatial variations.

Reference Location: Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Nearshore, Benthic Communities, Coastal Marine Ecosystems, Florida Keys

**Schropp, S. J. 2000. Sediment quality in Florida's intracoastal waterway. Page 60 in Higgins, R. W., ed. AWRA's annual water resources conference proceedings: Water quantity and quality issues in coastal urban areas. American Water Resources Association. Middleburg, Virginia. TPS-00-3, 400.**

Abstract: An integrated approach to providing flood control for urbanizing areas was used to model watershed and channel hydrologic and hydraulic processes dynamically in the Big Cypress Basin in Southwest Florida. Channel design and improvements were performed and the modified channel was incorporated into the regional unsteady model to determine the effectiveness of final design based on dynamic flow simulations. The modeling approach was found to be a valuable tool in achieving the desired levels of flood control without adverse impacts to the wetlands.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Hydrology, Hydraulic, Modeling, Canal Design, Conveyance

**Sole, M. 2002. Guidelines for design elevations seaward of the coastal construction control line. The Florida Department of Environmental Protection: Office of Beaches and Coastal Systems. Tech. Rep. 89 pp.**

Abstract: The Florida Department of Environmental Protection, Office of Beaches and Coastal Systems established the design of elevations for the lowest structural member of habitable structures located Seaward of the Coastal Construction Control Line. This report outlines the process that was developed between 1981 and 2001 for the establishment of these structures, entailing disciplines of coastal modeling, hurricane dynamics, wave dynamics, and statistics, and described is the general methodology as well as a summary of the scientific basis for the models used in this study. This report also explains the efforts made by the Office of Beaches and Coastal Systems to accurately identify the specific locations where structures are anticipated to be constructed or altered.

Reference Location: Internet Search: Florida Department of Environmental Protection website: Technical Reports

<http://bcs.dep.state.fl.us/100ystrm/guide/cert-rpt.pdf>

Keyword(s): Coastal Construction, Control Line, Beaches, Coastal Protection, Environmental Protection

**Swarzenski, P. W., J. F. Bratton, J. Crusius. 2004. Submarine ground-water discharge and its role in coastal processes and ecosystems. Open File Report: 2004-1226. Tech. Rep. USDO, USGS.**

Abstract: Submarine ground-water discharge has been a phenomena that strongly influences coastal water and geochemical budgets and drive ecosystem change. This technical report provides recent techniques and methods that measure and identify ground-water discharge and effects to coastal processes and ecosystems. These tools can be used to study submarine ground-water that can contribute to coastal management and restoration for the future.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Submarine Ground-water, Discharge, Coastal Processes, Ecosystems

**Taylor, R. B., W. F. McFertridge, and D. K. Roach. 2000. Dredged material management planning for the intracoastal waterway in Florida. Pages 51-54 in Higgins, R. W., ed. AWRA's annual water resources conference proceedings: Water quantity and quality issues in coastal urban areas. American Water Resources Association. Middleburg, Virginia. TPS-00-3, 400.**

Abstract: Increased environmental awareness and regulation during the 1970s made securing dredges material placement areas increasingly difficult and expensive, specifically with Florida's high growth and increasingly urbanized coastal corridor. To address the situation, Florida Inland Navigation District embarked on a 15-year planning program to ensure the waterway's continues viability. This article discussed the concepts involved and management areas in investigation for future control and regulation.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Dredged Material, Management Planning, Navigation, Inland Waterways, Environmental Protection



**Thayer, G. W., T. A. McTigue, R. J. Bellmer, F. M. Burrows, D. H. Merkey, A. D. Nickens, S. J. Lozno, P. F. Gayaldo, P. J. Polmateer, and P. T. Pinit. 2003. Science-based restoration monitoring of coastal habitats: Volume 1: A framework for monitoring plans under the Estuaries and Clean Waters Act of 2000 (Public Law 160-457). Technical Report. U. S. Department of Commerce. NOAA, National Ocean Service, National Centers for Coastal Ocean Science, Center for Sponsored Coastal Ocean Research. October 2003.**

Abstract: This technical report reviewed the background of restoration, coastal habitat restoration, restoration monitoring, and the role of estuaries, among others. Coastal habitats under investigation included the water column, rocky bottom, coral reefs, oyster reefs, softbottom, soft shoreline, submerged aquatic vegetation, marshes, mangrove swamps, deep water swamps, and riverine forests. Human dimensions of coastal restoration, cost estimates for monitoring, and future techniques are included to be reviewed to enhance sustainability of coastal habitats throughout the United States.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Monitoring Plans, Estuaries, Clean Waters Act, Socioeconomics, Restoration, Management, Coastal Habitats

**Thayer, G. W., T. A. McTigue, R. J. Salz, D. H. Merkey, F. M. Burrows, and P. F. Gayaldo. 2005. Science-based restoration monitoring of coastal habitats: Volume 2: Tools for monitoring coastal habitats. Technical Report. U. S. Department of Commerce. NOAA, National Ocean Service, National Centers for Coastal Ocean Science, Center for Sponsored Coastal Ocean Research. April 2005.**

Abstract: Despite their many benefits and values, coastal habitats have been systematically modified, degraded, and destroyed throughout the United States and its territories starting with European colonization in the 1600's. The monitoring of restoration projects is necessary to further the science, and to increase the efficiency of future restoration efforts. This technical report discusses restoration monitoring techniques of the water column, coral reefs, oyster reefs, kelp and macroalgae, rocky habitats, softbottom habitats, hardbottom habitats, mangroves, and coastal marshes, among others. Human dimensions of coastal restoration, cost estimates for monitoring, and future techniques are included to be reviewed to enhance sustainability of coastal habitats throughout the United States.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Tools, Monitoring, Ocean Research, Coastal Habitats, Mangroves, Seagrass Beds, Coral Reefs, Wetlands, Restoration

**United States Department of the Interior, United States Fish and Wildlife Service. 1994. The impact of federal programs on wetlands: The Everglades, coastal Louisiana, Galveston Bay, Puerto Rico, California's central valley, western riparian areas, southeastern and western Alaska, the Delmarva Peninsula, North Carolina, northeastern New Jersey, Michigan, and Nebraska.**

Abstract: This is the second of two reports to Congress on the impact of Federal programs on wetlands. It focuses on 17 additional study areas selected because they reflect the broad array of problems facing wetlands nationwide. The area of concern for this review is on Puerto Rico's mangroves and coastal wetlands and the impacts due to land-based pollution. The four chapters in Part I describe the Federal programs affecting wetlands: agriculture; water development and

management; infrastructure, local development, and housing; and resource use, extraction, and development. Parts II through V are organized regionally and examine the 17 study areas.

Reference Location: Internet Search: Mayagüez Electronic Library Database:

ASFA: Aquatic Sciences and Fisheries Abstracts (Membership Needed to View)

Keyword(s): Puerto Rico, Coastal Development, Wetlands, Government Finance, Research Priorities, Water Management, Resource Management, Environmental Impact

**United States Geological Survey. 2003. Measuring and mapping the topography of the Florida Everglades for ecosystem restoration. Tech. Rep. USGS Fact Sheet: 021-03.**

Abstract: The South Florida ecosystem encompasses an area of around 28,000 square kilometers and one main issue facing the Greater Everglades is the availability and distribution of clean, fresh water. Hydrologic and ecological models provide predictive capabilities for evaluating management options for parks, refuges, and land acquisition and to understand the impacts of land management practices in surrounding areas. This fact sheet provides all recent information regarding ecosystem restoration methods and techniques to sustain and protect water quality standards in the area.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Measuring, Mapping, Topography, Florida Everglades, Ecosystem Restoration, Hydrological Models, Elevation Data

**VanArman, J., G. A. Graves, and D. Fike. 2005. Loxahatchee watershed conceptual ecological model. Wetlands. 25(4):: 926-942.**

Abstract: Historically, the Loxahatchee River watershed included an area of more than 560 km<sup>2</sup>. The drainage basin was comprised of pine flatwoods, hardwood swamps, marshes, and wet prairies. Development in the watershed, stabilization of the inlet, and dredging of the estuary and river have resulted in saltwater intrusion in the river, destruction of riverine cypress forest along the river, and upstream mitigation of seagrasses and mangroves. A conceptual ecological model was developed for this system to characterize wetland, riverine, and estuarine components of this complex and diverse system. This is way to understand linkages between ecological stressors and attributes in this river system. These relationships lead to development of a set of working hypotheses that explain how observed shifts in the distribution of riverine floodplain plant communities, oysters, seagrasses and other key species are related to increases in salinity in the river and estuary that have occurred to changing land use, climate change, and water management practices.

Reference Location: Wimberly Library, Florida Atlantic University: Internet Database Search: CSA, Boca Raton, Florida, USA

Keyword(s): Loxahatchee River, Watershed, Climatic Changes, Water Management, River Discharge, Mangroves, Florida

**Xu, Yunping. 2005. Origin, transport and fate of organic matter in Florida Bay: A biomarker record of historical environmental changes. Ph.D. Dissertation, Florida International University, Miami, Florida, USA.**

Abstract: The Everglades are undergoing the largest wetland restoration project with the aim of returning the system to hydrological conditions in place prior to anthropogenic modifications. This dissertation employed molecular marker distributions and carbon stable isotopic signatures in sediment samples to assess historical environmental changes in Florida Bay over the last 4000 years. Two biomarkers for mangroves and two seagrass proxies revealed a sedimentary environmental shift from freshwater marshes to mangrove swamps and then to seagrass dominated

marine ecosystems. The highlight of this work is the development of HBIs as paleo-proxies. This study provides evidence that some C<sub>25</sub> HBIs can be applied as biomarkers for certain diatom inputs in paleoenvironmental studies. The sources of C<sub>20</sub> and C<sub>30</sub> HBIs and their potential applicability as paleo-proxies were also investigated and their sources assessed based on their organic matter distributions.

Reference Location: ProQuest Database: Alvin Sherman Library,  
Research, and Information Technology Center, Nova Southeastern University,  
Florida, USA

Keyword(s): Organic Matter, Florida Bay, Biomarker, Environmental Changes

#### IV. CORAL REEF DIVERSITY & FISH PRODUCTIVITY: ROLE/ STATUS/ IMPACTS/ MITIGATION:

**Andrews, K., L. Nall, C. Jeffrey, and S. Pittman. 2005. Chapter 7: The state of coral reef ecosystems of Florida. Pages 150-192 in Waddell, J. E., ed. The state of coral reef ecosystems of the United States and Pacific freely associated states: 2005. NOAA Technical Memorandum NOS NCCOS 11. NOAA/NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. Silver Spring, MD.**

Abstract: Three types of coral reef habitats found in Florida are hardbottom, patch reefs, and bank reefs. Species diversity and richness of stony corals are highest in patch reef habitats. Coral reefs in Florida face a number of different stressors, including coral bleaching, diseases, water pollution, physical impacts (groundings, dredging activities, and beach nourishment), tropical storms, and winter cold fronts. Other stressors include national security activities and trade in coral species. Coastal development and runoff, tourism and recreation and fishing impacts are discussed in this report, with results of adverse effects on the biological communities surrounding the state of Florida. Methods to continue monitoring biological communities and species of concern will be a growing management technique needed to tracking the status and sustainability of these habitats for future restoration purposes.

Reference Location: National Marine Fisheries Service, Caribbean Field Office,  
Puerto Rico

Keyword(s): Habitat, Monitoring, Status, Coral Reef Ecosystems, Florida, United States

**Ault, J. S., S. G. Smith, and J. A. Bohnsack. 2005. Evaluation of average length as an estimator of exploitation status for the Florida coral-reef fish community. ICES Journal of Marine Science. 62(3): 417-423.**

Abstract: Simulation and empirical analyses were conducted to evaluate the utility and robustness of average length of animals in the exploited population as an estimator of fishing mortality, as an indicator of exploitation status for Florida coral-reef fish. Results showed that the Lbar estimator of fishing mortality was relatively insensitive to trends in recruitment, and demonstrated favourable properties for detecting statistical differences between sustainable and non-sustainable rates of exploitation. A majority of snapper-grouper species are currently fished unsustainably in the Florida Keys, though overfishing appears most severe for long-lived, slow-growing fish.

Reference Location: Internet Search: Science Direct, University of Miami,  
Florida, USA (Membership Needed To View)

Keyword(s): Average Size, Coral-reef Fish, Exploitation, Florida Keys

**Ault, J. S., S. G. Smith, J. A. Bohnsack, J. Luo, D. E. Harper, and D. B. McClellan. 2006. Building sustainable fisheries in Florida's coral reef ecosystem: Positive signs in the Dry Tortugas. *Bulletin of Marine Science*. 78(3): 633-654.**

Abstract: This article focuses on the development of sustainable fisheries in the coral reef ecosystem of Dry Tortugas, Florida. The 267 fishes in the area are stable and the reef-fish biodiversity is high. This proves that no-take marine reserves can help develop sustainable fisheries and at the same time, it can protect the coral reef ecosystem of Florida Keys.

Reference Location: Internet Search: EBSCO Research Databases: Environmental and Natural Sciences

Keyword(s): Fisheries, Coral Reef Ecology, Marine Biodiversity Conservation, Dry Tortugas, Florida

**Banks, K., C. Beaver, J. Bohnsack, R. E. Dodge, D. Gilliam, W. Jaap, B. Keller, V. R. Leeworthy, T. Mathews, R. Ruiz-Carus, D. Savanty, and R. Spieler, J. Ault, G. Delgado, F. Ferro, C. R. Fretwell, B. Goodwin, D. Harper, J. Hunt, M. Miller, C. Pattengil-Semmens, B. Sharp, S. Smith, J. Wheaton, and D. Williams. 2005. The state of coral reef ecosystems of Florida. Florida DEP, NOAA Center for Coastal Monitoring and Assessment: Biogeography Team, Broward County EPD. 151 pp.**

Abstract: Three types of coral reef habitats found in the Florida Keys are hardbottom, patch reefs, and bank reefs. This report provides a detailed inventory and analysis on the status and condition of coral reef ecosystems of the state of Florida, USA. The Florida Reef Tract has coral reef characteristics similar to many areas in the Bahamas and the Caribbean Basin. The undeveloped coastal fringe includes extensive mangrove forests and exposed rock and sediments. Elevated rock formations support coral reef development and the sediments support the most extensive seagrass beds in the world. Conclusions include suggestions for future management and restoration methods with the use of artificial reefs and other techniques to sustain the livelihood of coral reef systems in Florida.

Reference Location: Internet Search: CCMA/NOAA:

[http://ccma.nos.noaa.gov/ecosystems/coralreef/coral\\_report\\_2005/FL\\_Ch7\\_C.pdf](http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/FL_Ch7_C.pdf)

Keyword(s): Status, Coral Reef Ecosystems, Hardbottom, Patch, Bank, Florida

**Barber, T. R. 2001. The evolution of artificial reefs: Reef Balls: An advanced technique to mimic natural reef systems using designed artificial reefs. Reef Ball Project Planning. *Scientific Report*. 21 pp.**

Abstract: Reef Balls are state of the art designed artificial reefs used primarily to restore ailing reefs or to create new reefs for ecological enhancement, fishing scuba diving, beach erosion protection, and many other specific end use goals. Variable to be adjusted to meet natural conditions include stability, void spacing, hole sizing, hole complexity, surface texture, surface chemical composition, bottom features, subsidence variables, overall weight, size of units in both height and width, interconnection of holes, layout or spacing on the sea floor, and density of units and proportioning of sizing ratios. This technique will be used to enhance, restore, and maintain the diversity and livelihood of life in the coral reef communities today.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Reef Ball, Artificial Reefs, Designed Reefs, Reef Restoration, Mitigation, Beach Erosion, Scuba, Fishing

**Barnes, P. W., and J. P. Thomas. 2005. Benthic habitats and the effects of fishing. American Fisheries Society Symposium 41: Proceedings of symposium in effects of fishing activities on benthic habitats: Linking geology, biology, socioeconomics, and management. Tampa, Florida. November 12-14, 2005. 869 pp.**

Abstract: This volume focuses on the effects of fishing activities on benthic habitats and the related science and knowledge needed to understand and quantify those effects, as well as to suggest new ways to address them for sustainable fisheries and healthy, diverse ecosystems. This volume includes research papers and a panel discussion that represent a solid cross section of research and analysis related to the physical, biological, socioeconomic, and management aspects of fishing. The goals of the symposium were to help ensure sustainable fisheries and healthy, diverse ecosystems.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Benthic Habitats, Effects, Fishing, Geology, Biology, Socioeconomics, Management, Sustainable Fisheries, United States

**Bik, M. 2004. [Coral-List] Coral spawning Culebra Island, Puerto Rico, Florida Keys, and Bank, USA. Letter to: A. Szmant, M. Vermeij, and E. Hernández. Dept. Marine Biogeochemistry & Toxicology, Royal Netherlands Institute for Sea Research (NIOZ). August 20, 2004.**

Abstract: This is a letter to address coral mass spawning in Culebra Island, Puerto Rico, the Florida Keys, and Bank, USA. There are suggestions for future monitoring of spawning to start earlier, as predictions for future spawning events may be different than past years. Past data and future predictions show mid-August to early September for coral mass spawning periods.

Reference Location: Internet Search: NOAA Fisheries/Coral-List Website: <http://coral.aoml.noaa.gov/pipermail/coral-list/2004-August/001239.html>

Keyword(s): Coral-List, Coral Mass Spawning, Predictions, Culebra Island, Puerto Rico, Florida Keys, Bank, USA

**Bohnsack, J. A. 1989. Are high densities of fishes at artificial reefs the result of habitat limitation or behavioral preference? Bull. Mar. Sci. 44(2): 631-645.**

Abstract: Rapid colonization, high fish densities, and high catch rates at artificial reefs have been used as evidence for habitat-limitation and increased production of reef fishes. An alternative hypothesis is that artificial reefs attract fishes due to behavioral preferences but do not increase reef fish production or abundance. Reviewed literature in this report reveals that except in one case evidence for increased production is mostly anecdotal and inadequate. Attraction and/or production by a particular artificial reef is predicted to depend on species and individual ages, sizes, and reef location. Important factors would include natural reef availability, mechanisms of natural population limitation, fishery exploitation pressure, life history dependency on reefs, and species-specific and age-specific behavioral characteristics. Artificial reefs are unlikely to benefit heavily exploited or overfished populations without other management actions.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): High Densities, Fishes, Artificial Reefs, Habitat Limitation, Behavioral Preference

**Borneman, E. H. 2003. The coral health and disease consortium: New information on coral disease. Reefkeeping: An Online Magazine for the Marine Aquarist.**

Abstract: This article focuses on current issues from the Coral Disease and Health Consortium that was created in response to the Coral Reef's Task Force National Action Plan. Coral disease is discussed in the Caribbean, including areas in Florida and Puerto Rico. Coral histology and the scope and management of coral disease is investigated along with detailed photographs.

Reference Location: Internet Search: Reefkeeping Website :

[www.reefkeeping.com/issues/2002-03/eb/index.php](http://www.reefkeeping.com/issues/2002-03/eb/index.php)

Keyword(s): Coral Health, Coral Disease, Banding, Dark Spot Disease, Patchy Necrosis, Florida, Puerto Rico

**Bruckner, A. 2004. Summary of professional exchanges on Coral Genomics. NOAA Fisheries: Coral Reef Information System. CoRIS.**

Abstract: Provides a summary of a discussion started by a small group of research partners, who asked the coral reef community to provide letters of support for a proposed project to sequence the genome of the reef-building lobe coral, *Porites lobata*. This summary also provides photographs and information on *Montastraea faveolata* and *Acropora palmata*, among other species inhabiting the Gulf of Mexico, Florida Keys, and throughout the Caribbean. The sequencing of a coral genome would provide a foundation for coral scientific research, as well as provide a basis for technology development that would promote coral reef resource management.

Reference Location: Internet Search: NOAA Fisheries: CoRIS:

[www.coris.noaa.gov/.../sup\\_digest.html](http://www.coris.noaa.gov/.../sup_digest.html)

Keyword(s): Coral Genomics, Coral Reef Resource Management, *Porites lobata*

**Burton, M. L. 2002. Age, growth and mortality of mutton snapper, *Lutjanus analis*, from the east coast of Florida, with a brief discussion of management implications. Fisheries Research. 59(1-2): 31-41.**

Abstract: Mutton snapper, *Lutjanus analis*, were sampled from recreational headboat and commercial vessels along the east coast of Florida, 1992-2000. The species was aged up to 29 years, and the largest fish measured 880 mm TL (total length). Growth was not significantly different between sexes, and they were fully recruited to the headboat fishery by age 4, the commercial fishery by age 6, and the private recreational fishery by age 3. The problems are evident in managing a species that forms spawning aggregations and using spawning stock ratios alone to assess a stock.

Reference Location: Internet Search: Science Direct, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): *Lutjanus analis*, Mutton Snapper, Age and Growth, Mortality

**Causey, B., J. Delaney, E. Diaz, D. Dodge, J. Garcia, J. Higgins, B. Keller, R. Kelty, W. Jaap, C. Matos, G. Schmahl, C. Rogers, M. Miller and D. Turgeon. 2002. Status of coral reefs in the U.S. Caribbean and Gulf of Mexico: Florida, Texas, Puerto Rico, US Virgin Islands, Navassa. Pages 251-276 in C.R. Wilkinson, ed. Status of coral reefs of the world: 2002. Australian Institute of Marine Science, Townsville. Queensland, Australia.**

Abstract: The marked increase in government funding from 2000-2002 for the U.S. Caribbean has resulted in vastly improved regional mapping, monitoring, and management of coral reef ecosystems in Florida, Texas, Puerto Rico, the U.S. Virgin Islands, and Navassa. The improvements in monitoring and management have led to more accurate statistics of the status of coral reefs. Maps of benthic habitats of the Florida Keys National Marine Sanctuary (FKNMS)

were completed in 1998. The NOAA National Coral Reef Monitoring Program has been expanded from US\$0.6 to 0.9 million and now supports monitoring of water quality, reef fish populations, and the habitat in Florida as well as in Puerto Rico and the U.S. Virgin Islands. A comprehensive monitoring program in the FKNMS was expanded, and shows that fishes in no-take reserves are larger and more abundant than in fished reference areas. Databases have been improved to allow easier data entry from the field and many are now available on-line. Monitoring data are published in peer-reviewed literature and in the first National Report on the Status and Health of U.S. Coral Reef Ecosystems. Monitoring and assessment of the status of the coral reefs in these areas are necessary methods to restore and stabilize these ecosystems.

Reference Location: Internet Search: CSA Illumina Website:

<http://mdl.csa.com/partners/viewrecord.php?requester=gs&collection=ENV&recid=5633461&q=+Causey%2C+B.+2002&uid=788814236&setcookie=yes>

Keyword(s): Coral Reefs, Percent Coral Cover, Acropora, Mona Island, Resource management, Bleaching, Environmental monitoring, Data collections, Ecosystem management, Information services, ASW, Mexico Gulf; ASW, Caribbean Sea, ASW, USA, Florida, ASW, USA, Texas, Puerto Rico

**Dahlgren, C. P., and D. B. Eggleston. 2000. Ecological processes underlying ontogenetic habitat shifts in coral reef fish. *Ecology*. 81(8): 2227-2240.**

Abstract: Distribution of mobile animals may reflect decisions on how to balance conflicting demands associated with foraging and avoiding predators. In this study, field caging and tethering experiments quantified habitat-specific growth rates and mortality risk, respectively, for three different sizes of a coral reef fish, Nassau grouper, *Epinephelus striatus*, during its juvenile tenure in off-reef nursery habitats. Results suggested that small fish face a trade-off between living in a relatively safe algal habitat and achieving high growth rates in post-algal habitats. Habitat use by juvenile Nassau grouper was consistent with the hypothesis. These results highlight how behavioral responses to ecological processes, such as changing predation risk with body size, determine distribution pattern of mobile animals.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Bahamas, Caging Experiments, *Epinephelus striatus*, Growth Rate, Habitat, Macroalgae, Nassau Grouper, Ontogenetic, Optimization Models, Predation Risk, Refuge

**Dandelski, J. R. 2001. Impacts of commercial fishing on key habitats within Biscayne National Park. M.Sc. Internship: Partial Fulfillment Requirements: Thesis, University of Miami, Coral Gables, Florida, USA.**

Abstract: Live bait shrimp, *Penaeus spp.*, spiny lobster, *Panulirus argus*, blue crab, *Callinectes sapidus*, and stone crab, *Menippe mercenaria*, were studied for impacts on the benthic communities located within Biscayne National Park, Florida. Elements of the study included a questionnaire given to boat captains in each of the fisheries; identification of the spatial coverage for each fishery; analyses of the benthic microhabitat for each fishery; and use of experimental designs to quantify damage to benthic flora and fauna due to trawling and trap placement. The conclusions from the results of this study are in the process to be determined for analyses and are not detailed in this report.

Reference Location: Rechter Library, The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, Florida, USA

Keyword(s): Impacts, Bait Shrimp, Spiny Lobster, Blue Crab, Stone Crab, Commercial Fishing, Key Habitats, Spatial Coverage, Trap Placement, Trawling, Biscayne National Park, Florida

**Drew, C. A. 2006. Spatial ecology of reef fish in backreef and coral reef habitats. Ph.D. Dissertation, North Carolina State University, North Carolina, USA.**

Abstract: This dissertation contributes to the development of marine spatial ecology by addressing the effects of local habitat patch characteristics, regional landscape structure, and hydrodynamics upon dispersal and recruitment of marine populations at multiple spatial scales. Focus was on the important shallow ecosystems that often serve as nursery habitat for many fish and crustacean species, and where habitat and hydrodynamics are likely to play important roles in organism dispersal and survival. Research discussed includes three related studies: a computer simulation model of passive and active dispersal strategies evaluated how organism dispersal behavior and landscape structure interacted to influence dispersal and recruitment success; a regression analysis tested the efficacy of both traditional and marine-specific landscape characteristics at multiple scales as predictors of juvenile fish population and community patterns at local scales in Florida Keys mangroves; and a retrospective analysis of island-wide, Caribbean habitat and fish population databases tested the degree to which adult reef fish population abundance and community structure correlate with nursery habitat variables. This research indicated that the spatial ecology of marine populations varies across spatial scales and among species. The behavioral strategies of dispersing individuals, as well as the patch- and landscape-scale characteristics of the habitat encountered by dispersing individuals, influence individuals' recruitment success and assemblage composition over larger scales. Even reef fish species in the same family or behavioral guild have been observed to respond to distinct landscape and patch scale habitat features.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Reef Fish, Backreef, Coral Reef, Mangroves, Recruitment, Assemblage Composition, Spatial Ecology, Habitat, Patch Characteristics, Florida

**Eaken, D. 2002. Coral spawning: Romance under a starlit sky. Coral reefs and hard grounds: Introduction to coral and more. Florida Fish and Wildlife Conservation Commission. Fish and Wildlife Research Institute.**

Abstract: This website article details the phenomena of coral mass synchronized spawning events, what to expect when observing spawning, and the process of coral mass spawning. It includes links to a one-hour movie of coral spawning and an article displaying which nights corals are likely to spawn in 2002. Most of this information has to do with Florida areas, although the general spawning information has widespread significance throughout the Caribbean.

Reference Location: Internet Search: Florida Fish and Wildlife Conservation Commission/Fish and Wildlife Research Institute:

[http://research.myfwc.com/features/view\\_article.asp?id=14821#may](http://research.myfwc.com/features/view_article.asp?id=14821#may)

Keyword(s): Coral Spawning, Synchronized Spawning Events, Fish and Wildlife Research Institute

**Eggleston, D. B., C. P. Dahlgren, and E. G. Johnson. 2004. Fish density, diversity, and size-structure within multiple back reef habitats of Key West National Wildlife Refuge. Bulletin of Marine Science. 75(2): 175-204.**

Abstract: Seagrass meadows, mangrove prop-roots, and channels bisecting mangrove islands serve as important nursery areas for numerous fishes. This study provides an initial step towards identification of the nursery role of specific habitats within multiple back reef habitats by quantifying fish density, diversity, and size-structure, and was part of a larger study that used aerial photographs, ground-truthing, and GIS software to map nursery habitats in the Key West National Wildlife Refuge. Visual surveys assessed fish density, diversity, and size-structure in the Lakes and Marquesas regions over a 3-month period across seagrass, channels, mangroves,



hardbottoms, patch reefs, and offshore reeds. From results it was found that there was no relationship between fish density and diversity, or seagrass shoot density and blade height. Inclusion of seagrass, mangrove, and channel habitats in future studies of reef fish growth, survival, and emigration should produce a more complete picture of their nursery role in tropical back reef environments.

Reference Location: Internet Search: ASFA: Aquatic Sciences and Fisheries Abstracts, University of Miami, Florida, USA (Membership Needed To View)  
Keyword(s): Microhabitats, Seagrass, Species Diversity, Growth, Ecological Distribution, Habitat Selection, Mangroves, Ontogeny, Survival, Back Reef Habitats, Florida Keys

**Eilperin, J. 2004. Limits of ocean preservation being tested. Washington Post. Oct. 18. 2004. 3 pp.**

Abstract: This article investigates many marine national sanctuaries throughout the U.S., including Biscayne National Park. Recent snorkeling observations showed changes in coral color intensities, size differences in fish populations, and other impacts due to overfishing. Groups such as the Ocean Conservancy and the National Parks Conservation Association have called for creating no-take reserves in Biscayne, which is part of the Florida Keys under the Park Service rather than the sanctuary program. They cite a 2002 academic study of Biscayne that called the waters “seriously overfished,” adding that without more active management, “collapse of many important fisheries resources appears imminent.” Today, exploited species are thriving in restrictive Keys reserves such as Eastern and Western Sambo, which have been closed to fishing and other activities since 1997. Education and more active involvement for management strategies need to take effect soon.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Ocean Preservation, Limits, Fish Stocks, Coral Reefs, Habitats

**Ferro, F., L. K. B. Jordan, and R. E. Spieler. 2005. The marine fishes of Broward County, Florida: Final report of 1998-2002 survey results. Tech. Rep. NOAA. NFMW-SEFSC-532. 73 pp.**

Abstract: This final report is an inventory of fishes associated with three hardbottom reef tracts that are separated by sand and run parallel to the coast in sequentially deeper water offshore Broward County, Florida. Fish abundance, species richness, sizes, and general habitat characteristics were recorded. Sites were sampled along transects at quarter nautical mile intervals along 18 nautical miles. A total of 86,463 fishes belonging to 208 species and 52 families were censused from 667 sites over four years from 1998 to 2002. Differences were found within reef tracts based on edge or crest sites and position along reefs north or south of Port Everglades and Hillsboro Inlet. The reason for these differences might be linked to topographic variables.

Reference Location: Internet Search: SEFC/NOAA:

<http://www.sefsc.noaa.gov/PDFdocs/TM532-BrowardFishes2005.pdf>

Keyword(s): Fisheries, Inventory, Offshore, Coastline, Species Richness, Abundance, Biomass, Broward County, Florida

**Figueira, W. F. Metapopulation dynamics of coral reef fish: Understanding habitat, demography, and connectivity in source-sink systems. Ph.D. Dissertation, Duke University, USA.**

Abstract: Ignoring the effects of habitat can be detrimental to fisheries management efforts such as the establishment of no-take reserves. This dissertation did the following: evaluated the appropriateness of using source-sink dynamics to describe coral reef fish systems and suggested alternative conceptual and mathematical framework to study these dynamics; quantified the levels of habitat-specific variation in demographic rates for the bicolor damselfish, *Stegastes partitus*, in

the Florida Keys; evaluated the relative importance of patch spatial position versus demographics in determining hatch quality; and simulated a coral reef fish metapopulation in the Florida Keys to understand temporal and spatial variability in system connectivity and source-sink structure. It was found that demographics can play a more important role than spatial position in determining patch quality. Simulations of fish metapopulation dynamics in the Florida Keys affirmed these results and demonstrated the value of these techniques for understanding source-sink structure that results from taking both spatial and demographic considerations into account.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Metapopulation, Coral Reef Fish, Habitat, Source-sink, Ecology, Florida Keys

**Fioavanti, G. P. 2003. The role of habitat architecture in regulating communities of reef fishes and spatial subsidies in marine reserves of the Upper Florida Keys. M.Sc. Thesis, University of South Alabama, Alabama, USA.**

Abstract: Marine reserve establishment often leads to increases in higher order consumers. This thesis hypothesized that variation in habitat architecture can explain why marine reserves are not uniformly effective. Within the Upper Florida Keys National Marine Sanctuary, point-counts were used to assess reef fishes in replicated “no-take” zones and on a fished reef. The chain method and video were used to characterize habitat architecture. Available shelter best explained the variation in the fish communities, and landscape geometry influenced fish diversity and the density of snappers. The factors of time, distance from reef edge, and protection status all influenced cross-habitat energy exchange. These results indicated that available shelter, and to a lesser extent landscape geometry, confounded the ability to detect recovery of higher order consumers within marine reserves. Therefore, further consideration needs to be given to habitat architecture when studying higher order consumers within marine reserves.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Ecology, Oceanography, Environmental Science, Aquaculture, Fish Production, Role, Communities, Reef Fishes, Snappers, Seagrass, Spatial Subsidies, Marine Reserves, Upper Florida Keys

**García-Sais, J. R., C. Lilyestrom, R. Appeldoorn, A. Bruckner, and E. Williams. 2004. Puerto Rico. Page 435 in R. Kelty, ed. Status of coral reefs in the U.S. Caribbean and Gulf Of Mexico: Florida, Flower Garden Banks, Puerto Rico, U.S. Virgin Islands, Navassa. Pages 431-450 in C. Wilkinson, ed. Status of coral reefs of the world: 2004. Global Coral Reef Monitoring Network. Australian Institute of Marine Science, Townsville. Queensland, Australia.**

Abstract: The mapping, monitoring, and management of coral reefs in Florida, the Flower Garden Banks National Marine Sanctuary (FGBNMS) of the northwestern Gulf of Mexico, Puerto Rico, the U.S. Virgin Islands, and Navassa have all been enhanced due to increased awareness and funding from the U.S. Government. Quantitative baseline surveys and monitoring is demonstrating trends in reef community health and structure in other sensitive coastal areas. The monitoring of water quality, reef diversity, growth, and populations of benthic organisms continues to provide patterns of environmental and anthropogenic impacts. It is necessary to strengthen cross-boundary and cross-jurisdictional agreements to facilitate ecosystem-based management and information and technology transfer.

Reference Location: Internet Search: Coral Reef Report:

<http://www.aims.gov.au/pages/research/coral-bleaching/scr2004/pdf/scr2004v2-all.pdf>

Keyword(s): Coral Cover, Quantitative Baseline Survey, Coral Diversity, Mapping, Monitoring, Management, Puerto Rico

**García-Sais, J. R., R. Appeldoorn, A. Bruckner, C. Caldow, J. D. Christensen, C. Lilyestrom, M. E. Monaco, J. Sabater, E. Williams, and E. Diaz. 2005. The state of coral reef ecosystems of Puerto Rico. Pages 91-134 in J. E. Wadell, ed. The state of coral reef ecosystems of the United States and Pacific freely associated states: 2005. NOAA Technical Memorandum NOS NCCOS 11. NOAA/NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. Silver Spring, MD.**

Abstract: This study was performed to evaluate the state of coral reefs in present-day Puerto Rico. Topics discussed included the following: environmental and anthropogenic stressors, coral reef ecosystem data gathering activities and resource conditions, water quality, benthic habitats, associated biological communities, current conservation management activities, and overall conclusions and recommendations for future conservation methods.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Coral Reef, Status, Puerto Rico

**Gorham, J. C., and W. S. Alevizon. 1989. Habitat complexity and abundance of juvenile fishes residing on small scale artificial reefs. Bull. Mar. Sci. 44(2): 662-665.**

Abstract: To evaluate increasing abundances of juvenile fishes on man-made reefs, ten polypropylene-rope "streamers" were installed on each of the 12 PVC and concrete block reefs located in Looe Key National Marine Sanctuary in the Florida Keys. There were 12 identical reefs used as controls. Numbers of juvenile fishes were significantly higher on the streamer reefs than on the plain reefs. Such devices appear to be an effective means of increasing juvenile fish abundance on man-made reefs.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Habitat Complexity, Abundance, Juvenile Fishes, Small Scale Artificial Coral Reefs

**Johns, G. M., V. R. Leeworthy, F. W. Bell, and M. A. Bonn. 2002. Economic value of reefs in southeast Florida. Pages 3-8 in ed. Lesnik, J. R. Coastal Water Resources. AWRA 2002 Spring Specialty Conference Proceedings. American Water Resources Association. Middleburg, Virginia. TPS-02-1.**

Abstract: This study employed extensive survey research to determine the economic contribution and use of values of artificial and natural reefs in Palm Beach, Broward, Miami-Dade and Monroe counties over a one-year period from June 2000-May 2001. Reef-related expenditures generated from \$139 million and \$1.0 billion in income and supported from 6,300 and 36,000 full and part-time jobs per county. The results will provide public official with information important to managing the reef system.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Natural Reefs, Artificial Reefs, Reef Uses, Economic Value, Coral Reefs, Southeast Florida

**Kemp, S. J. 2004. Ecology of life history variation in the sailfin molly (*Poecilia latipinna*) in impounded mangrove marsh of the Indian River Lagoon, Florida. Ph.D. Dissertation, University of Pennsylvania, Pennsylvania, USA.**

Abstract: Effects of environmental change can be very complex and multi-faceted, and as a result, the greatest challenge facing ecologists today is the prediction of the effects of these changes on populations of organisms. This dissertation is a study of the effects of an ecosystem-wide alteration of habitat on the life history of populations of a resident organism. Sailfin molly (*Poecilia latipinna*) populations residing in mangrove habitats affected by impoundment provide an ideal opportunity to study the ecological aspects of environmental change. Research centered on three likely effects impoundment may have on the growth, survival, and reproduction of sailfin mollies in the impounded mangrove habitat to produce these life history patterns: changes in physical conditions, fish species assemblages, and changes in diet. Impoundment was significantly related to the three factors but the relationship between variation in the factors and life history pattern was not immediately apparent.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): *Poecilia latipinna*, Impounded, Mangrove, Indian River Lagoon, Florida

**King, M. 1995. Fisheries biology, assessment, and management. Fishing News Books. 312 pp.**

Abstract: Fish stocks in many countries are presently exploited. This book provides knowledge of how to assess and effectively manage fisheries to ensure that fish remain a renewable resource and continue to provide employment and food. It details fisheries resource species from invertebrates to migratory fish species, population dynamics, fisheries yield, and monitoring, as well as reviewing modern catch methods.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Fish Stocks, Fisheries Biology, Assessment, Management, Ecology

**Knight, J. L. 2005. Coral reef restoration: Scientific frameworks for rehabilitation. TFI Learning. University of Miami, Miami, Florida. October 18-19, 2005.**

Abstract: This conference handbook and guide details on several key ideas of coral reef rehabilitation: the role of the Florida Keys National Marine Sanctuary; assessing the concept of coral reef restoration; understanding the problem and implications, function and recovery; reef restoration case histories in south Florida an assessment of small boat grounding damage to shallow corals of the Florida Keys; combining applied ecology with a coral reef restoration program; critical issues in the management of reef ecosystems; determining the extent to which restoration is needed; and assessment of legal protection of coral reefs. It also focused on monitoring activities and the role of adaptive management practices to see where we are and where we need to go for future growth and sustainability in coral reef ecosystems.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Groundings, Impacts, Assessment, Restoration, Coral Reefs, Shallow Coral Reefs, Case Studies, South Florida

**Lindbergo, W. J., T. K. Frazer, K. M. Portier, F. Vose, J. Loftin, D. J. Murie, D. M. Mason, B. Nagy, and M. K. Hart. 2006. Density-dependent habitat selection and performance by a large mobile reef fish. *Ecological Applications*. 16(2): 731-746.**

Abstract: The article discusses the study that tests the components of density-dependent habitat selection using an experimental reef system in the Gulf of Mexico. The authors selected gag, a fish, as their study species because of its economic and ecological importance, its dominance in the study region and its life history characteristics, behavior and ecology. The results of the study indicate that this density-dependent habitat selection for shelter and individual growth dynamics were therefore interdependent ecological processes that help to explain how patchy reef habitat sustains gag production.

Reference Location: Internet Search: EBSCO Research Databases: Environmental and Natural Sciences

Keyword(s): Animal Ecology, Aquatic Ecology, Essential Fish Habitat, Habitat Selection, Resource Partitioning, Coral Reefs, Density-Dependence, Reef Fish, Gag Fish

**Lindeman, K. C., G. A. Diaz, J. E. Serafy, and J. S. Ault. 1998. A spatial framework for assessing cross-shelf habitat use among newly settled grunts and snappers. Pages 385-416 in *Florida Sea Grant. Proceedings of the 50<sup>th</sup> Gulf and Caribbean Fisheries Institute*.**

Abstract: The differential use of nursery habitats by grunts and snappers across a complex coastal seascape was examined using a cross-shelf habitat framework. The framework identified 10 cross-shelf strata, most encompassing over 15 natural bottom types for the shelf area of Biscayne Bay, Florida. The hypothesis that utilization of cross-shelf habitats by grunts and snappers was uniform was not supported by 30 years of prior literature or museum materials, and new field surveys of Biscayne Bay area. Habitat utilization patterns ranged from opportunistic to highly specialized. The framework used facilitated nursery area identification on several spatial scales and may provide a template for identifying habitats essential for fish production.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Habitat Use, Grunts, *Haemulidae*, Snappers, *Lutjanidae*

**Lindeman, K. C., R. Pugliese, G. T. Waugh, and J. S. Ault. 2000. Developmental patterns within a multispecies reef fishery: Management applications for essential fish habitats and protected areas. *Bulletin of Marine Science*. 66(3): 929-956.**

Abstract: This study identified key pelagic and demersal developmental patterns among 73 species of snapper-grouper complex of the South Atlantic Fishery Management Council. There were 22 potential spawning aggregation sites identified by commercial fishermen. Larval durations for grunts, snappers, and groupers are within residence times of some gyres. Sites that consistently support spawning aggregations for multiple species require management both as EFH-habitat and as potential no-take protected areas. An annual closure to protect both fish stocks and remaining habitat integrity is concluded.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Multispecies, Reef Fishery, Essential Fish Habitat, Protected Area, Pelagic, Demersal, Development, Snapper-Grouper Complex, Dry Tortugas, Key

West, Florida

**Luthy, S. A. 2004. Billfish larvae of the Straits of Florida. Ph.D. Dissertation. University of Miami, Coral Gables, Florida, USA.**

Abstract: This dissertation examined the role of the Straits of Florida as spawning and nursery habitat for billfishes (families Istiophoridae and Xiphiidae) by providing a means of accurately identifying larval istiophorids; developing an age-length relationship for the larvae of the most abundant billfish in this area-sailfish; and describing the spatial and temporal distribution of billfish larvae by species and age, with first approximations of potential origination points. Sailfish larvae were present May through September, blue marlin were collected from June to September, white marlin occurred in May and June, and swordfish were found in February, March, May, June, and August through October. The results of this study show the importance of the Straits of Florida as billfish reproduction habitat, and provide a bases for further characterization of billfish spawning and nursery grounds.

Reference Location: Rechter Library, The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, Florida, USA

Keyword(s): Billfish, Larvae, Straits of Florida, Spatial, Temporal, Distribution, Spawning Grounds, Nursery Habitat, Sailfish, Blue Marlin, White Marline, Swordfish, Age-Length Relationships, Reproduction

**Makowski, C., L. Fisher, and C. J. Kruempel. 2006. Green turtle (*Chelonia mydas* L.) population estimate for the nearshore reefs of Broward County: A summary after three years of pre-construction monitoring. *Shore & Beach*. 74(2): 26-28.**

Abstract: There has been an ongoing struggle to protect the endangered green turtles along the shores of Southeast Florida. As juveniles recruit to coastal waters, they undergo a dietary shift from omnivory to herbivory, and aggregate to patches of benthic macroalgae or seagrasses along the nearshore reefs of South Florida. An archive of in-water records was used to see if effects from beach re-nourishment activities cause either temporary fluctuations or long-term variation in the population dynamic. Results from three-annual pre-construction surveys produced an average of 48 turtles sighted along the 31.6 km of county shoreline. Employing the "Shark Fishing" monitoring protocol will create a comprehensive account of nearshore juvenile sea turtle populations possibly impacted by beach construction.

Reference Location: Internet Search: ASFA: Aquatic Sciences and Fisheries Abstracts, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Aquatic Reptiles, Environmental Monitoring, Rare Species, Seagrass, Recruitment, Population Dynamics, Beach nourishment, Nesting, Juveniles, Reproductive Behavior, Southeast Florida

**Matos, C. A., J. R. García, and E. Díaz. 2002. Condition of Puerto Rico's coral reef ecosystems. Pages 48-49 in *The state of coral reef ecosystems of the United States and Pacific freely associated states: 2002*. National Oceanic and Atmospheric Administration. ID: 1800. 265 pp.**

Abstract: Puerto Rico's coral reefs near La Parguera, Desecheo Island, and Vieques Island have been degraded by a host of human and natural impacts. This report details on the present-day conditions of coral reef ecosystems of Puerto Rico. Throughout the area, Staghorn and Elkhorn coral populations have declined over the last 25 years from hurricane damage, white-band disease, and corallivorous mollusks. Also, overfishing has been evident with signs of species decline as well. Illegally discharged wastes are a definite periodic problem for near-shore water quality. A major rum processing plant regularly exceeds permit limits for oxygen demand and solids in its stormwater runoff flowing into San Juan Bay. Also, this company has been cited by the U.S.

Environmental Protection Agency for discharging rum effluent directly into the Bayamón River Channel. Having the highest abundance and percent cover of living coral, these reefs need to be protected to prevent future destruction.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Condition, Coral Reef Ecosystems, Puerto Rico

**Meester, G. A. 2000. A mathematical programming and simulation-based approach to determining critical factors in the design of effective marine reserve plans for coral reef fishes. Ph.D. Dissertation, University of Miami, Coral Gables, Florida, USA.**

Abstract: The use of marine reserves to help sustain fisheries is a present-day trend in fishery management worldwide. A temporally and spatially explicit population simulation model was developed to explore the effects of spatial variation in fishing effort and population distributions. Spatial estimates of population density and length distributions are determined for snapper, grouper, and grunt fish species to use as input to the model. Four experiments were designed using these alternate plans to explore the impacts of numbers, sizes, and population content of marine reserve configurations for providing sustainable reef fisheries in the Florida Keys National Marine Sanctuary. Results show that well-designed marine reserves can be used for species exhibiting a wide range of movement strategies to increase their spawning stock, abundance, and egg production, while minimizing yield losses to the fishery.

Reference Location: Rechter Library, The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Florida, USA

Keyword(s): Mathematical Programming, Simulation, Marine Reserves, Sustainable Fisheries, Snapper, Grouper, Grunt, Population Size, Population Distributions, Density, Temporal, Spatial, Florida Keys National Marine Sanctuary

**Morinière, E. C., B. J. A. Pollux, I. Nagelkerken, and G. van der Velde. 2002. Post-settlement life cycle migration patterns and habitat preference of coral reef fish that use seagrass and mangrove habitats as nurseries. *Estuarine, Coastal and Shelf Science*. 55: 309-321.**

Abstract: Mangroves and seagrass beds have received considerable attention as nurseries for reef fish, but comparisons have often been made with different methodologies. Relative importance to different habitats to specific size-age classes of reef fish species remains unclear. This study surveyed 35 transects in 11 sites of mangroves, seagrass beds, and coral reef in front of a marine bay on the island of Curaçao (Netherlands Antilles). The density and size-frequency of nine reef fish species was determined during a five-month period using a single methodology. All species were “nursery species” in terms of their high densities of juveniles in mangroves or seagrass beds. Stepwise migrations in opposite directions, combined with different preference for either mangroves or seagrass beds among species, shows that reef fish using in-bay habitats during post-settlement life stages may do so by choice and not merely because of stochastic dispersal of their larvae, and underline the necessity of these habitats to Caribbean coral reef systems.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Life Cycle Migration Patterns, Habitat Preference, Coral Reef Fish, Seagrasses, Mangrove Swamps, Nursery Grounds

**Moyer, R. P., B. Riegl, R. E. Dodge, and B. Walker. 2002. Acoustic detection of different types of reef benthos in Broward County Florida (USA). National Coral Reef Institute, Nova Southeastern University Oceanographic Center, Florida.**

Abstract: Benthic assemblages of typical Caribbean reef fauna variably cover three ridges that parallel Broward County, Florida. Acoustic remote sensing is a useful tool for mapping the spatial arrangement of these benthic assemblages and describing change in their arrangements over time. Benthic fauna with distinct growth forms can be detected and differentiated acoustically due to the unique acoustic roughness associated with each growth form. An acoustic bottom classification survey was conducted over all three reef ridges. Data were compared to produce a final benthic habitat classification for the area of survey. It was concluded that acoustic remote-sensing methods can be used to differentiate various benthic assemblages, as long as enough differences exist in the growth-form characteristics of the dominant species to have unique acoustic roughness.

Reference Location: Internet Search: Quester Tangent: Marine:

<http://www.nova.edu/ocean/ncri/projects/acousticdetection/index.html>

Keyword(s): Acoustic Detection, Coral Reefs, Reef Fauna, Benthic Assemblages, Broward County, Florida

**National Oceanic and Atmospheric Administration: Undersea Research Center. 2002. Oculina Banks Habitat Area of Particular Concern Geographic Information System 2002. University of North Carolina, Wilmington, N.C.**

Abstract: Oculina Geographic Information System provides a comprehensive, interactive data source for the Oculina Banks Habitat Area off the east coast of Florida in 70 to 120 meters of water depth. Data presented in this system include multi-beam bathymetry, single-beam bathymetry, maps of habitat types, fish and habitat cover, and dive narratives. This system is in cooperation with NOAA Ocean Service, NOAA Ocean Exploration Program, U.S. Geological Survey- Coastal and Marine Geology Program, Harbor Branch Oceanographic Institution, and Florida State University.

Reference Location: Internet Search: NOAA CoRIS Website:

<http://www.unew.edu/oculine>

Keyword(s): Fisheries, Habitat Cover, Multi-beam Bathymetry, Single-beam Bathymetry, Geographic Information System, Oculina Banks, Florida

**National Oceanic and Atmospheric Administration. 2005. The state of coral reef ecosystems of the United States and Pacific freely associated states: 2005. NCCOS. Center for Coastal Monitoring and Assessment. 535 pp.**

Abstract: CCMA's Biogeography Team compiled a report characterizing the condition of shallow water ecosystems in the United States and Pacific Freely Associated States. This work is based primarily on qualitative information from the contributing authors. It involves data collection and integrated reporting to protect and conserve coral reefs, their associated habitats, and the organisms that depend on them.

Reference Location: Internet Search: NOAA/ CCMA: Ecosystems: Coral Reefs:

[http://ccma.nos.noaa.gov/ecosystems/coralreef/coral\\_report\\_2005/](http://ccma.nos.noaa.gov/ecosystems/coralreef/coral_report_2005/)

Keyword(s): State of Coral Reefs, CCMA, Biogeography Team, NOAA



**Nye, L. B. 2000. Bioindicators of stress in fish in Biscayne Bay: Stress protein 70 and melanomacrophage aggregates. Ph.D. Dissertation, University of Miami, Coral Gables, Florida, USA.**

Abstract: Major sources of contamination to Biscayne Bay include non-point source pollution that is funneled to the Bay via Miami River and other canals. The objectives of this study were to review bioindicators in Biscayne Bay and to examine the utility of two bioindicators, stress protein 70 in the liver and gill of gray snapper, *Lutjanus griseus*, and melanomacrophage aggregates in the spleens of gray snapper and pinfish, *Lagodon rhomboides*. These results indicate that stress protein 70 would not be useful as evidence fish are negatively impacted at contaminated sites or to document exposure in Biscayne Bay. Melanomacrophage aggregates results showed more quantities, therefore providing a more useful bioindicator for documenting exposure to contamination in Biscayne Bay.

Reference Location: Rechter Library, The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, Florida, USA

Keyword(s): Bioindicators, Stress, Fish, Biscayne Bay, Florida, Stress Protein 70, Melanomacrophage Aggregates

**Orhun, M. R. 2001. Empirical and quantitative analysis of marine fish larvae dynamics. Ph.D. Dissertation, University of Miami, Coral Gables, Florida, USA.**

Abstract: This dissertation investigated growth variability of marine larval fish cohorts, role of size-selective predation upon them, and their population dynamic response. Larval fish dynamics were investigated by using an approach that included the formulation of a general analytical model of fish predation on cohorts, development of an individual-based simulation model of predation by fish predators on cohorts of two species of coral reef fish, butter hamlet *Hypoplectrus unicolor*, and lane snapper, *Lutjanus synгарis*, from hatching to 19 days after hatch, and a multi-cohort comparison of empirical growth patterns. Size distributions of hamlets exposed to the smaller predator were affected at higher predation rates and size-selective predation lead to greater presence of larger size classes and removal of the smallest size classes when compared to control simulations. This study revealed the widely hypothesized transition in larval cohort biomass from negative to positive growth rates where growth exceeded mortality at some time in the larval period. This provides a new tool to larval fish dynamics research to test hypotheses on the effects of larval and predator variables on cohort biomass and recruitment potential. Environmental conditions may have significant implications in nature for cohort recruitment and sustainable fisheries production.

Reference Location: Rechter Library, The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, Florida, USA

Keyword(s): Butter Hamlet *Hypoplectrus unicolor*, Lane Snapper, *Lutjanus synгарis*, Population Dynamics, Coral Reef Fish, Larval Fish Cohorts, Recruitment, Growth Rates

**Paddack, M. J. 2005. Herbivorous coral reef fishes in a changing ecosystem. Ph.D. Dissertation, University of Miami, Coral Gables, Florida, USA.**

Abstract: Using a top-down trophodynamic approach, the impact of herbivorous fishes on the benthic algal community was examined in two studies: one designed to measure guild-wide grazing intensity; the other designed to provide information in grazing variability of a dominant herbivorous reef fish. The first study was conducted on inshore and offshore reefs in the upper Florida Keys where fishing pressure on herbivorous fishes is absent but coral cover has declined in the past two decades. Algal production rates were similar between both reefs, but spatial variation in the biomass and feeding rates resulted in a high proportion of algal production consumed on offshore reefs and a low proportion consumed on inshore patch reefs. In the second study, density

size structure, biomass, and grazing rates of a dominant herbivorous coral reef fish, the stoplight parrotfish (*Sparisoma viride*), were compared among reefs in the upper Florida Keys, Bonire, and the Bahamas. Algal consumption rates were strongly driven by fish biomass. The results of both studies indicate that herbivorous fishes are capable of consuming a majority of the algal production on low coral cover reefs and thus limiting the spread of macroalgae, but that the feeding rates of herbivorous fishes may be shaped by local reef conditions. The second research tactic was to examine the population dynamics of the parrotfish *S. viride* to determine how these dynamics are influenced by reef community structure and location. An age-based analysis was conducted on fish collected from inshore and offshore reefs in the upper Florida Keys in order to investigate causes of observed differential spatial patterns in size structure and density. The results of this dissertation demonstrate that herbivorous fishes can exert a strong control on benthic algal biomass and distribution, and that benthic community structure and reef location can in turn influence fish population dynamics including recruitment, growth, and mortality rates.

Reference Location: Rechter Library, The Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, Florida, USA

Keyword(s): Coral Reef Ecosystems, Coral Reef Fishes, Recovery, Herbivorous Fishes, Coral Cover, Inshore Reefs, Offshore Reefs

**Paddack, M. J., R. K. Cowen, S. and Sponaugle. 2006. Grazing pressure of herbivorous coral reef fishes on low coral-cover reefs. Coral Reefs. 25(3): 461-472.**

Abstract: The impact of grazing by herbivorous fishes on low coral-cover reefs was assessed by measuring rates of benthic algal production and consumption on inshore and offshore reefs in the upper Florida Keys. Algal production rates, determined in situ with caged and un-caged experimental plates, were low and similar among reef types. Algal consumption rates were estimated in two different models, a detailed model incorporating fish bite rates and algal yield-per-bite for one species extrapolated to a guild-wide value, and a general regression relating fish biomass to algal consumption. Algal consumption differed among reef types. Spatial coherence of benthic community structure and temporal stability of algal turf over 3 years suggests that grazing intensity is currently sufficient to limit further spread of macroalgal cover on these low coral-cover reefs, but not to exclude it from the system.

Reference Location: Internet Search: EBSO Host Research Databases: Environmental and Natural Sciences

Keyword(s): Coral Reefs, Herbivores, Algal Consumption, Algal Production, Acanthuridae, Pomacentridae, Scaridae, Surgeonfishes, Florida Keys

**Precht, W. F., and R. E. Dodge. 2001. Coral reef restoration in the next millenium. pp. 57- 58.**

Abstract: Extreme disturbances of coral reefs around the world include hurricanes, coral bleaching, diseases of corals and sea urchins, overfishing, destructive fishing, nutrient loading , sedimentation, hyper- and hypothermic stress, various forms of pollution, harvesting of reef invertebrates, coral mining, trampling by tourists and divers, and the destruction caused by ship anchors and groundings. Reef ecosystems will irreversibly decline at the current rate of destruction. Most coral reef restoration programs have been focused on the physical damage caused by humans. Attempts to search for available technology, along with implications for management and policy are being assessed in order to examine the response of both corals and reefs to disturbances and about the process of reef recovery.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Coral Reef Restoration, Coral Reef Stresses

**Quinn, T. P., D. Fahy, R. E. Dodge, and R. E. Spieler. 2005. Mitigation of a SE Florida USA coral reef damaged by the grounding of a nuclear submarine: Results of a hypotheses-based restoration study. American Society of Limnology and Oceanography. ASLO Summer Meeting: A pilgrimage through global aquatic sciences. Santiago de Compostela, Spain.**

Abstract: This study organized 160 small ReefBalls into 40, 4-module quads. Each ReefBall had one of the four treatments: iron, limestone, coral transplants, or plain concrete. To examine the effects of fish assemblages on coral settlement and growth, quads were divided into four treatments: empty, small, mixed, and large. *Montastrea cavernosa* and *Meandrina meandrites* were used for transplantation. 100% of the *M. cavernosa* maintained or increased their tissue surface area, while 72.5% of the *M. meandrites* transplants showed varying degrees of tissue mortality.

Reference Location: Internet Search: Applied Research Ecosystem-level Research to Reverse Coral Reef Degradation: ASLO:

<http://www.sgmeet.com/aslo/santiago2005/sessionschedule.asp?SessionID=SS07>

Keyword(s): Mitigation, Coral Reef, Damage, Grounding, Nuclear Submarine, Restoration, Southeast Florida

**Riegl, B., R. P. Moyer, B. Walter, and R. E. Dodge. 2002. Broward County, Florida Coral Reef Habitat Mapping. National Coral Reef Institute. Nova Southeastern University Oceanographic Center, Florida.**

Abstract: This poster illustrates the coral reef habitat mapping effort completed by National Coral Reef Institute as of February 2002 in Broward County, Florida. Habitats were mapped using a combination of bathymetry data and Questar Tangent acoustic habitat mapping survey equipment and software. Initial surveys were conducted as part of a continuous effort to monitor beach renourishment activities. This new technology is a valuable resource for quantifying and analyzing marine habitats.

Reference Location: Internet Search: NCRI:

[http://www.nova.edu/ocean/ncri/projects/habitat\\_mapping/index.html](http://www.nova.edu/ocean/ncri/projects/habitat_mapping/index.html)

Keyword(s): Coral Reef, Acoustic Habitat Mapping, Bathymetry, Beach Renourishment Activities, Broward County, Florida

**Robbins, R. J. 2005. Impacts of salinity fluctuations on the productivity of coastal mangrove fish populations. Ph.D. Dissertation, University of Miami, Coral Gables, Florida, USA.**

Abstract: An empirical study examined the influence of salinity fluctuations on the key population demographic characteristic such as survivorship, growth, and reproduction, of two types of mangrove fish populations: livebearers, Poeciliidae, and killifish, Cyprinodontidae. Poeciliidae species demonstrated significant mortality following large, instantaneous salinity increases, while large instantaneous salinity decreases had no significant effect on mortality rate. Instantaneous salinity changes had no significant effect on the Cyprinodontidae species mortality rates. Salinity specific effects on growth and reproductive parameters, derived from the analytical experiments, were then incorporated into the basic components of the existing Across Trophic Levels System Simulator everglades restoration model for fish functional groups in freshwater marshes. Model simulations showed that salinity can affect population productivity in these species.

Reference Location: Rechter Library, The Rosenstiel School of Marine and Atmospheric Science. University of Miami, Florida, USA

Keyword(s): Impacts, Salinity Fluctuations, Population Productivity, Mangrove Fish Populations, Survivorship, Growth, Reproduction, Poeciliidae,

Cyprinodontidae

**Sherman, R. L., D. S. Gilliam, and R. E. Spieler. 1999. A preliminary examination of depth associated spatial variation in fish assemblages on small artificial reefs. *Journal of Applied Ichthyology*. 15(3): 116-121.**

Abstract: Small concrete artificial reef modules were placed at two sites, eight modules per site. The sites were in 7 m and 21 m of water off the coast of southeast Florida, USA. The reefs were censused monthly for fish over a 19-month period. Species, number of fish, and estimated total length of each individual were recorded by divers using SCUBA. A total of 88 species were recorded in the study, with significantly greater diversity on the deep reefs. There was also significantly more biomass, and more large fish on the reefs at 21 m than at 7 m. There were more small fish at the shallow site. These results highlight the potential differences in artificial reef and ambient environment interactions within a localized area.

Reference Location: Internet Search: Blackwell Synergy:

<http://www.blackwell-synergy.com/links/doi/10.1046/j.1439-0426.1999.00120.x>

Keyword(s): Depth, Spatial Variation, Fish Assemblages, Small Artificial Reefs, Southeast Florida

**Spieler, R. E. 2001. Artificial reef research in Broward County 1993-2000: A summary report. Broward County Department of Planning and Environmental Protection, Florida. 17 pp.**

Abstract: The goal of the studies in this report was to examine the functional attributes of artificial reefs as they relate to physical and biological characteristics of the Broward County marine environment. These characteristics include the following: species and community recruitment dynamics, attractants, volume, profile, complexity, void space, deployment depth, larval abundance, and seasonality. The project was undertaken with the purpose of determining the optimal design criteria for artificial reefs to enhance recreational fishing and other marine resources of Broward County. It was concluded that Broward County artificial reef research program has been a step in the right direction for understanding how to manage resources. Agencies and the general public need to be more educated with regards to applied research.

Reference Location: Internet Search: IngentaConnect:

<http://www.co.broward.fl.us/environment/dni01209.pdf>

Keyword(s): Community Recruitment Dynamics, Artificial Reefs, Attractants, Larval Abundance, Deployment Depth, Seasonality, Florida

**Spieler, R. E., D. S. Gilliam, and R. L. Sherman. 2001. Artificial substrate and coral reef restoration: What do we need to know to know what we need. *Bulletin of Marine Science*. 69(2): 1013-1030.**

Abstract: This review examines the functions of artificial substrate in restoration and some of the physical and environmental factors affecting these functions. Physical factors include composition, surface texture, color, chemistry, shelter, shading, size, and configuration. Environmental factors include temperature, light, sedimentation, surrounding biota, hydrodynamics, depth, settlement attractants, and stability. It was concluded that until additional research is performed, the use of artificial substrate in coral reef restoration will stay as a "best guess" attempt.

Reference Location: Internet Search: IngentaConnect:

<http://www.ingentaconnect.com/content/umrsmas/bullmar/2001/00000069/00000002/art00059>

Keyword(s): Artificial Substrate, Coral Reef Restoration, Damaged Environment, Hydrodynamics, Shelter, Shading, Size, Temperature, Light, Sedimentation, Composition, Surface Texture

**Talge, H. 1992. Impact of recreational divers on Scleractinian corals at Looe Key, Florida. Pages 1077-1082 in Proceedings of the 7<sup>th</sup> International Symposium, Guam. 2.**

Abstract: Recreational diver impacts on scleractinian corals were evaluated by quantifying diver interactions and by experimentally “touching” corals. Twelve coral species were subjected to four types of impacts for ten weeks. No corals died. Histological studies revealed no change in morphology, composition of tissue or cells, nor in reproductive cycles. Comparisons of frequency and area of coral tissue touched to the amount of live coral cover in high use areas indicate that 4-6% of the corals are touched each week by divers, which does pose adverse impact on sustainability of coral reef communities.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Scleractinian Corals, Impacts, Recreational Divers, Looe Key, Florida

**United States Environmental Protection Agency. 1998. Coral reef guidance. Memorandum for the Field. 4 pp.**

Abstract: There is a critical need to ensure that Federal agencies are implementing their authorities to protect coral reef ecosystems. Within the Clean Water Act Section 404, there is a permit program to regulate the discharge of dredged or fill material into U.S. waters. Marine Protection, Research and Sanctuaries Act, the Rivers and Harbors Act, and the Coastal Zone Management Act, and the U.S. Army Corps of Engineers enable federal projects to protect and preserve coral reef ecosystems throughout the United States, including Puerto Rico and the United States Virgin Islands.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Discharge, Dredged/Fill Material, U.S. Waters, Coastal Zone Management

**Walker, B., B. Henderson, and R. E. Spieler. 2002. Fish assemblages associated with artificial reefs of concrete aggregates or quarry stone offshore Miami Beach, Florida USA. Aquatic Living Resources. 15: 95-105.**

Abstract: This study compared the fishes associated with 12 co-located reefs constructed of limestone quarry boulders, concrete-gravel aggregate, or concrete-tire aggregate in 7 m of water, 200 m offshore Miami Beach, Florida, USA. All 12 reefs were deployed 100 m apart the same day in two lines of six. Every two months from October 1998 to February 2001, SCUBA divers recorded fish species, abundance, and length, as well as spiny lobster, *Panulirus argus*, abundance. There were 146 species of fishes recorded during the study. The abundance of species richness of fish on each treatment exhibited a significant seasonal variation with summer months having the greatest numbers and the winters the lowest. There was no significant difference in total fish or spiny lobster abundance or fish biomass amongst the three reef types. Comparison of pre-deployment fish counts from the reef sites and neighboring hard bottom and jetty with counts from the same sites two years post-deployment indicate the artificial reefs increased both fish abundance and richness in the local area.

Reference Location: Internet Search: EDP Sciences:

<http://www.edpsciences.org/articles/alr/pdf/2002/02/alr2095.pdf>

Keyword(s): Artificial Reef, Fish, *Panularis argus*

**Yoshioka, B., T. Adams, B. Reick, and C. Bohn. 2004. Final report: Investigations of mitigation for coral reef impacts in the U. S. Atlantic: South Florida and the Caribbean. Southeast Regional Office: U.S. Fish and Wildlife Service, South Florida Ecological Services. September 2004. 78 pp.**

Abstract: U. S. Fish and Wildlife Service completed a file review study of mitigation for federally funded or permitted projects from 1985 to the present that impact coral reefs in the South Atlantic and Caribbean, in response to Resolution 4 from the 8<sup>th</sup> Coral Reef Task Force meeting held on October 2-3, 2002, in San Juan, Puerto Rico. The Corps, EPA, NOAA Fisheries, State of Florida, Commonwealth of Puerto Rico, US Virgin Islands, and Palm Beach County provided information from their databases for review and/or comments to the draft report submitted in February, 2004 at the Task Force meeting in Washington, D.C. Agency comments and Service responses are included. The geographic area of the review included the southeastern Atlantic seaboard of Florida, from Indian River County south to the Dry Tortugas, and the U.S. Caribbean. Coral reef habitat is defined as actively accreting coral reef and coral colonized hard-bottom. Over 2,000 Corps' Regulatory Division permits and Planning Division civil works project files were screened, resulting in 28 projects from the Caribbean and 26 from Florida (16 completed and 10 pending) with adequate information for a more detailed review. Impacts from these completed and currently proposed projects total 264 acres: 47 in the Caribbean and 217 in Florida. Compensatory mitigation acreage for Florida projects consists mostly of the placement of artificial or natural substrate and is expected to total 113 acres: 43 acres for completed and, to date, 70 acres for pending projects. Completed projects involving filling and dredging for beach nourishment and port development have caused the most impacts to coral reefs habitats in South Florida since 1985. The anticipated impacts for pending projects are also expected to result from dredging, fill, and sedimentation for port development and beach nourishment. The expected aspects planned for the 10 pending projects in South Florida exceeded the known impacts from the 16 completed projects, with mitigation requirements still being evaluated. The number of projects and the acreage of impacts decreased over time in the Caribbean, and some of the decrease can be attributed to increased attention to avoidance and minimization. Recommendations include the establishment of a technical advisory team and/or interagency teams to provide consistent evaluations of project impacts, analysis of more effective coral reef mitigation techniques, and the development of appropriate protocols for mitigation unavoidable impacts, monitoring project construction, and complying with mitigation conditions.

Reference Location: U.S. Fish & Wildlife Service, Caribbean Field Office, Puerto Rico

Keyword(s): Mitigation, Coral Reef Impacts, Project Assessments, U. S. Atlantic, South Florida, Caribbean,

**V. BEACH NOURISHMENT:  
STATUS/ IMPACTS/ MANAGEMENT:**

**Benedet, L., C. W. Finkl, T. Campbell, and A. Klein. 2004. Predicting the effect of beach nourishment and cross-shore sediment variation on beach morphodynamic assessment. Coastal Engineering. 51(8-9): 839-861.**

Abstract: This article identifies criteria and boundary conditions that characterize beaches in terms of morphodynamic states that produce discrete beach types. Long-term wave statistics, small-scale aerial photography, cross-shore beach profiles, and beach sediment data from Florida's Atlantic and Gulf coasts were used as a basis for linking beach morphology with coastal processes. Results indicated that the parameter of the new model used is strongly influenced by cross-shore selective sorting of bimodal sediments, temporal changes in beach grain size, seasonal wave patterns, and inputs of new sediments to the littoral system.

Reference Location: Internet Search: Science Direct, University of Miami,

Florida, USA (Membership Needed To View)

Keyword(s): Beach Nourishment, Beach Morphodynamics, Cross-shore Sediment Variation, Florida

**Davis, R. A. Jr., P. Wang, and B. R. Silverman. 2000. Comparison of the performance of three adjacent and differently constructed beach nourishment projects on the gulf peninsula of Florida. *Journal of Coastal Research*. 16(2): 396-407.**

Abstract: The beach-profiling monitor and assessment of Indian Rocks Beach, Indian Shores, and Reddington Beach was studied on the gulf peninsula of Florida. More frequent beach and nearshore profile surveys were conducted in order to determine short-term of 1 year and long term of 4 to 8 years rates of shoreline and beach-nearshore volume changes. The shoreline and beach-nearshore volume change patterns at the three nourishment projects were different due to the different degrees of influence from the above factors, however, construction style was found to be an essential contributor. The much less costly dragline and conveyor-belt transfer technique used in the construction of Indian Shores project does not prove to be most effective for long-term performance.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Beach Nourishment, Beach Erosion, Nearshore Sediment Transport, Shoreline Change, Beach Profile, Hurricane Impact, Florida Gulf Coast

**Elko, N. A., and P. Wang. 2007. Immediate profile and planform evolution of a beach nourishment project with hurricane influences. *Coastal Engineering*. 54(1): 49-66.**

Abstract: In this study, weekly beach profiles, shoreline surveys, and nearshore wave measurements were conducted before, during, and immediately after construction of the 110-m long Upham Beach nourishment project on the low-energy, west coast of Florida. The shoreline orientation was changed abruptly due to a diffusion spit formation. A vector sum model for determining the orientation of a potential diffusion spit was developed. Results included the fact that the profile equilibration occurred rapidly due to the passage of three hurricanes soon after nourishment was complete. Hurricane Frances, Ivan, and Jeanne passed this area. This study indicated that profile equilibration can be an event-driven process, which contradicts the concept of longer-term gradual profile equilibration. Both profile and planform adjustment can occur rapidly given the appropriate site conditions and energy levels.

Reference Location: Internet Search: Science Direct, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Nearshore Sediment Transport, Cross-shore, Long-shore, Profile Equilibration, Shore Protection, Design

**Leadon, M., T. Watters, G. Watry, and E. Foster. 2001. Statewide coastal monitoring program: I. Regional data collection and processing plan. Department of Environmental Protection: Office of Beach and Coastal Systems. Tech. Rep. 77 pp.**

Abstract: The Office of Beaches and Coastal Systems organized a data collection program for beach and offshore profile survey data and aerial photography on a county-by-county basis for the state of Florida. This report details scheduling and planning of this data collection program as well as standard procedures and specifications for data collection and processing. It incorporates wave and weather data collection and analysis to allow for the correlation of coastal geomorphic change to wave and wind forcing. The purpose of this plan is to define and compile data requirements and technical and contract standards for data acquisition and processing. It provides a strategy for

systematic, statewide physical monitoring of Florida beaches and coastal systems for beach management and regulatory purposes. The plan also acknowledges a strategy for post-storm data collection and processing in order to perform analyses to assess storm erosion and impacts to coastal areas.

Reference Location: Internet Search: Florida Department of Environmental Protection: Regional Monitoring Publications

<http://www.dep.state.fl.us/beaches/publications/pdf/monplan.pdf>

Keyword(s): Coastal Monitoring Program, Beaches, Coastal Systems, Erosion, Coastal Impacts, Florida

**Leadon, M., E. Gates, and T. Watters. 2004. Monitoring standards for beach erosion control projects. Bureau of Beaches and Coastal Systems; Division of Water Resource Management: Department of Environmental Protection. State of Florida. Tech. Rep. 43 pp.**

Abstract: This technical report was written to provide consistent monitoring guidelines in the State of Florida and outlines the minimum data collection effort necessary to accomplish the Bureau of Beaches and Coastal Systems program goals. Data collected for specific projects is used to document and evaluate project performance, to perform beach management planning, and to assist in conducting regulatory reviews related to the coastal construction control lines and joint coastal permitting. It is also used in the review and documentation of hurricane and other storm impacts to Florida's beaches and coastal systems.

Reference Location: Internet Search: Florida Department of Environmental Protection: Project Monitoring Standards

<http://www.dep.state.fl.us/beaches/publications/pdf/standard.pdf>

Keyword(s): Monitoring Standards, Beach Erosion Control, Physical Monitoring, Florida

**Lindeman, K. C., and D. B. Snyder. 1999. Nearshore hardbottom fishes of southeast Florida and effects of habitat burial caused by dredging. Fish. Bull. 97: 508-525.**

Abstract: Fish assemblages of nearshore hardbottom habitats of southeast Florida were quantified at three sites from April 1994 to June 1996. Random 2x15m transects were visually censused within two replicate areas at each site. The hardbottom at one site was buried by a dredge project to widen a beach one year into the study. A total of 394 transects were sampled and grunts were the most diverse family, followed by the wrasses and parrotfishes. The most abundant were sailor's choice, silver porgy, and cocoa damselfish. Outside of lagoons, nearshore hardbottom areas are the primary natural structures in shallow waters of mainland Florida's east coast and were estimated to have nursery value for 34 species of fishes. Due to their early ontogenetic stage, many of these species may not be adapted for high mobility in response to habitat burial. Dredging effects may be amplified by burial prior to and during spring and summer periods of peak larval recruitment.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Nearshore Hardbottom Fishes, Southeast Florida, Habitat Burial, Dredging



**Lindeman, K., and 69 Scientists Signatories. 2000. 70 Ph.D. scientists urge higher environmental standards in beach dredge and fill projects. Submitted to: J. R. Miller, ACE, Jacksonville District. 2 p.**

Abstract: There may be significant cumulative impacts on coastal habitat quality and fisheries production for the existing paradigm for beach managing systems of the southeast United States and the massive dredge and fill projects, otherwise known as renourishments. Over 100 acres of nearshore reefs are now proposed for burial by four beach dredging projects in east Florida. This reference cites comments concerning the biological importance, as well as subsequent potential impacts of large and frequent dredge and fill operations across the east Florida shelf. It states that the potential cumulative effects of repeated dredge excavations and habitat burials have never been detailed in environmental impact statements. Based on available information, the administrative paradigm that repetitive, large-scale dredging and filling of coastal habitats of has no long-term environmental impacts is potentially false. This letter suggests that risk-adverse and ecosystem-based management approaches adopted by some federal and state agencies be functionally employed by the U.S. Army Corps of Engineers in its assessments of environmental effects and cumulative impacts.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Environmental Standards, East Florida, Beach Renourishments, Dredge and Fill Projects, Cumulative Biological Impacts

**Lindeman, K. C., and D. B. Snyder. 1999. Nearshore hardbottom fishes of southeast Florida and effects of habitat burial caused by dredging. Fishery Bulletin. 97(3): 508-525.**

Abstract: Between April 1994 and June 1996, fish assemblages of nearshore hardbottom habitats were quantified. Random transects of 2 x 15m were visually censused within two replicate areas at each site. At one site, the hardbottom was buried by a dredge project to widen a beach one year into the study. A total of 395 transects were sampled, observing 86 taxa from 36 families. Grunts (*Haemulidae*) were the most diverse family, followed by wrasses (*Labridae*) and parrotfishes (*Scaridae*). The most abundant species were sailors choice (*Haemulon parra*), silver porgy (*Diplodus argenteus*), and cocoa damselfish (*Stegastes variabilis*). Newly settled, early juvenile, and juvenile life stages represented over 80% of the individuals at all sites. After one year, burial of approximately five ha of hardbottom habitat at one site lowered the numbers of individuals and species by over 30x and 10x, respectively. Due to their ontogenetic stage, many of these species might not be adapted for high mobility from habitat burial. Dredging effects could possibly be greater by burial before and during spring and summer periods of peak larval recruitment.

Reference Location: Internet Search: Fishery Bulletin:

<http://fishbull.noaa.gov/09lindem.pdf>

Keyword(s): Fish Assemblages, Nearshore Hardbottom, Habitat Burial, Dredging, Southeast Florida

**National Research Council. 1995. Beach Nourishment and Protection. Committee on Beach Nourishment and Protection. 334 pp.**

Abstract: This volume examines the economic and social role of beaches, the history of beach nourishment projects, and management strategies for shore protection; discusses the role of the U.S. Army Corps of Engineers and other federal agencies; explores the state of the art in project design and prediction of outcomes; addresses what is known about environmental impacts of beach nourishment; and identifies the outcomes to be targeted for continued monitoring by project officials. This volume provides a sound technical basis for decision-making, with

recommendations regarding the utility of beach nourishment, the responsibility for cost, design methodology, and other issues.

Reference Location: Internet Search: National Academy Press:

[http://www.nap.edu/catalog.php?record\\_id=4984#description](http://www.nap.edu/catalog.php?record_id=4984#description)

Keyword(s): Beach Nourishment, Protection, Coastal Communities, Erosion, Management, Environmental Impacts

**Nelson, W. G. 1989. Beach nourishment and hard bottom habitats: The case for caution. Florida Institute of Technology. Melbourne, Florida. pp. 109-116.**

Abstract: A qualitative biological inventory of the nearshore rock outcrops near Sebastian Inlet, Florida was carried out and collected a total of 325 taxa from this hard bottom community. A comparison of summer versus winter samples indicated relatively small differences in the number of animal species, but large differences in the number of algae species present. In conclusion, the nearshore rock outcrop system was found to be extremely biologically diverse and the abundant organisms found appear to be important for nearshore fishes. Suggestions point to a very cautious approach to nourishment projects which may encroach on rock outcrop areas.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Beach Nourishment, Hard Bottom Habitats, Biological Composition, Ecology, Sebastian Inlet, South Florida

**Peterson, C. H., and M. J. Bishop. 2005. Assessing the environmental impacts of beach nourishment. Bioscience. 55(10): 887-896.**

Abstract: Dredge-and-fill programs are employed to protect coastal development from shoreline erosion, with respect to rising sea levels due to global warming. Such "beach nourishment" can bury shallow reefs and degrade other beach habitats. A review of 46 beach monitoring studies shows that only 11% of the studies controlled for both natural spatial and temporal variation in their analyses; 56% reached conclusions that were not adequately supported; and 49% failed to meet publication standards for citation and synthesis of related work. Reform of agency practices is needed as the risk of cumulative impacts grows.

Reference Location: Internet Search: BioOne Online Journals:

<http://www.bioone.org/perlserv/?request=get-document&doi=10.1641%2F0006-3568%282005%29055%5B0887%3AATEIOB%5D2.0.CO%3B2>

Keyword(s): Beach Nourishment, Biological Impacts, Monitoring, Public Trust, Sampling Design

## VI. FISHERIES & MARINE NURSERIES GENERAL: IMPACTS/ MANAGEMENT:

**Aquatic Living Resources. 2005. Benthic fisheries ecology in a changing environment: Unraveling process to achieve prediction. Aquatic Living Resources. 18(3): 310-311.**

Abstract: Fishery managers are faced with demands of resource users, politicians, and scientists when considering strategies for resource management. The necessary empirical data to appropriately parameterize models with vital rates representative of an altered environment are often lacking. Better approximated approaches are needed to understand the dynamics between environmental conditions, fishery impacts, and multi-species interactions. Spatially-explicit, individual-based simulation modeling potentially permits this kind of integration, but it has seen limited use in marine resource management, especially with respect to benthic resources. This article explores the impacts of nursery habitat deterioration, coastal freshwater management, and

fishery activities on Caribbean spiny lobster populations and sponge community structure in the Florida Keys, Florida (USA). Although not applicable for all resource management situations, the instances provide examples of the potential use of spatially-explicit, individual-based modeling and targeted empirical science in predicting resource conditions in a dynamic environment.

Reference Location: Internet Search: EBSCO Host Research Databases: Environment and Natural Sciences: University of Puerto Rico, Mayagüez, Puerto Rico

Keyword(s): Sustainability, Marine Fisheries, Fishery Management, Fishery Impacts, Coastal Zones, Population Dynamics

**Baron, R. M., L. K. B. Jordan, and R. E. Spieler. 2004. Characterization of the marine fish assemblage associated with the nearshore hardbottom of Broward County, Florida USA. *Estuarine, Coastal and Shelf Science*. 60(3): 431-443.**

Abstract: Some shallow nearshore hardbottom areas of southeast Florida have been reported to function as important juvenile fish habitat. Most of this area has been impacted by one or more local beach renourishments. This study characterized nearshore fish communities and compared the fish assemblages adjacent to renourished beach with those of adjacent never-renourished beaches along a 30-m stretch of coastline, mainly in Broward County, using three visual census methods. The assemblage structure was similar for the point-counts and transect-counts. However, greater abundance and greater species richness values were the dominant component of the inshore fish community. After the grunts being the most dominant, wrasses were next dominant, and damselfish were occurring as well. It is clear from the study that the nearshore hardbottom is an important juvenile fish habitat, especially for grunts. However, the nearshore bottom does not appear to be obligate habitat for these fishes as fishes associated with this area are not unique to the nearshore hardbottom either in species or ontogenetic stage.

Reference Location: Internet Search: ASFA: Aquatic Sciences and Fisheries Abstracts, Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Marine Fish, Commercial Species, Coastal Erosion, Fish Oceanography, Species Diversity, Beach Nourishment, Broward County, Florida

**Canter, L., and S. Atkinson. 2002. Environmental impact assessment and marine fisheries management. *Environmental Impact Training*. Presented for: National Marine Fisheries Service. St. Petersburg, Florida.**

Abstract: This reference contains information from a course on environmental impact assessment and marine fisheries management. The course included discussions on NEPA regulations, national standards for fishery conservation and management, workshops on planning an impact study, information on Turtle Excluder Devices, cumulative effects assessment, and explanations of impacts for future techniques in systematic assessment and analysis.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Environmental Impact Assessment, Marine Fisheries Management, Environmental Quality, NEPA Regulations

**Dahlgren, C.P., G. T. Kellison, A. J. Adams, B. M. Gillanders, M. S. Kendall, C. A. Layman, J. A. Ley, I. Nagelkerken, and J. E. Serafy. 2006. Marine nurseries and effective juvenile habitats: Concepts and applications. *Marine Ecology Progress Series*. 312: 291-295.**

Abstract: Recent attention has been focused on juvenile fish and invertebrate habitat use, particularly defining and identifying marine nurseries. The most significant advancement in this area has been the development of a standardized framework for assessing the relative importance

of juvenile habitats and classifying the most productive as nurseries. Within this framework, a marine nursery is defined as a juvenile habitat for a particular species that contributes a greater than average number of individuals to the adult population on a per-unit-area basis, as compared to other habitats used by juveniles. While the nursery definition provides a powerful approach to identifying habitats for conservation and restoration efforts, it can omit habitats that have a small per-unit-area contribution to adult populations, but may be essential for sustaining adult populations. This article builds on the nursery concept by developing a framework for evaluating juvenile habitats based on their overall contribution to adult populations, and introduce the concept of Effective Juvenile Habitat, EJH, to refer to habitats that make a greater than average overall contribution to adult populations.

Reference Location: Internet Search: ASFA: Aquatic Pollution and Environmental Quality, Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Conservation, Habitat Utilization, Nursery Grounds, Habitat Improvement, Habitat Selection, Nature Conservation, Juveniles

**Diaz, G. A. 2001. Population dynamics and assessment of pink shrimp (*Farfantepenaeus duorarum*) in subtropical nursery grounds. Ph.D. Dissertation, University of Miami, Miami, Florida, USA.**

Abstract: The population dynamics of the juvenile and sub-adult stages of pink shrimp are poorly understood. A system science approach was implemented to study the population dynamics and habitat utilization of the immature life stages of the pink shrimp, *Farfantepenaeus duorarum*, in Biscayne Bay, Florida. Estimates of population abundance were obtained by designing stratified random sampling and using fisher-independent surveys. A quantitative assessment of habitat utilization indicated that shallow seagrass beds on the western portion of the Bay are of critical importance since they are the preferred habitat for recruiting post-larvae. Observed differences between the population dynamics model and the population estimated indicated important aspects of pink shrimp biology and ecology, that can be introduced to improve estimation procedures. The impacts of the live-bait fishery on the standing stock appeared to be minimal. Although, the potential impacts of the food-shrimp fishery should not be underestimated and a great monitoring and assessment program should be developed to determine their effects on stock sustainability.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): *Farfantepenaeus duorarum*, Population Dynamics, Pink Shrimp, Subtropical, Nursery

**Eby, L. A., L. B. Crowder, C. M. McClellan, C. H. Peterson, and M. J. Powers. 2005. Habitat degradation from intermittent hypoxia: Impacts on demersal fishes. Marine Ecology Progress Series. 291: 249-262.**

Abstract: As eutrophication of estuaries and coastal oceans increases worldwide, the resulting expansion of hypoxic zones represents an increasingly frequent form of habitat degradation. Although impacts of prolonged hypoxia on benthic invertebrate species are well-documented, there is little understanding of how those effects subsequently influence the motile upper trophic levels in estuarine ecosystems. Quantitative nekton surveys in the Neuse River Estuary in June and August 1999 using Atlantic croaker, demonstrated that hypoxia decreased habitat quality for juvenile demersal fish through three pathways: it restricted the fishes in estuaries to shallow, oxygenated areas; this contraction of suitable habitat crowded the fish into smaller areas and may have resulted in density-dependent reduction of growth rates; and most importantly, mortality of sessile infauna in deeper areas exposed to hypoxia decreased prey densities about 8-fold. Through this evidence, intermittent hypoxia can result in ecological crunches or bottlenecks. Incorporation of these indirect effects of hypoxia on juvenile growth rates into a population model demonstrated

the potential for significant reductions in population growth rate. Therefore, sublethal effects of hypoxia-driven habitat degradation may impact fisheries production not only through reduced size at age, but also through reduced abundance of demersal fish populations.

Reference Location: Wimberly Library, Florida Atlantic University: Internet Database Search: CSA, Boca Raton, Florida, USA

Keyword(s): Atlantic Croaker, Hypoxia, Growth Rate, Population Density, Ecosystem Disturbance. Habitat, Coastal Waters, Estuaries, Eutrophication

**Florida Center for Community Design & Research. 2002. Florida's ocean horizon: Fisheries management. Friends of Florida. 4 pp.**

Abstract: Florida's most commercially important marine species are shrimp, mullet, blue crab, scallops, menhaden, grouper, oysters, king and Spanish mackerel, spiny lobster, swordfish, and red snapper. Recreationally important species include trout, king mackerel, Spanish mackerel, amberjack, red drum, dolphin, grouper, and snapper. Fishery management in Florida is difficult, as it is subject to numerous conflicts between fisheries as well as with other ocean resource interests or uses. This article discusses topics concerning management tools addressing commercial and recreational fisheries, artificial reefs, management tools addressing artificial reefs, aquaculture, and management tools addressing aquaculture.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Fisheries Management, Florida, Commercial Fishing Industry

**Frias-Torres, S. 2006. Habitat use of juvenile goliath grouper *Epinephelus itajara* in the Florida Keys, USA. Endangered Species Research. 1: 1-6.**

Abstract: This study reports the distribution, abundance, and habitat use of juvenile goliath grouper *Epinephelus itajara* along fringing red mangrove *Rhizophora mangle* shorelines of the Florida Keys, USA. The objective of this study was to evaluate the importance of underwater mangrove habitat structure and complexity in determining distribution of juvenile goliath grouper in the Florida Keys. Visual underwater surveys recorded juvenile presence, abundance, and size. Juveniles aggregated in sites with high structural complexity, soft sediment, and eroded shorelines. Well-developed fringing red mangrove shorelines were the preferred juvenile goliath grouper habitat.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Mangroves, Nursery, *Epinephelus itajara*, Essential Fish Habitat, Visual Census, Florida Keys

**Gratwicke, B., C. Petrovic, and M. R. Speight. 2006. Fish distribution and ontogenic habitat preferences in non-estuarine lagoons and adjacent reefs.**

**Environmental Biology of Fishes. Springer Netherlands. 76(2-4): 191-210.**

Abstract: Fish distribution was surveyed in three lagoons and adjacent reefs in the British Virgin Islands. There were 28,000 fish from 40 families and 118 species recorded in the survey. Canonical correspondence indicated that rock, sand, fleshy algae, gorgonians, mangroves and live hard coral were the most important habitat types influencing fish assemblage composition. About 47% of fishes occurring at more than 10 stations displayed evidence of ontogenetic partitioning between reefs and lagoons but post-settlement ontogenetic life history strategies were quite varied depending on the species. Even with all the variation, there were species that exhibited bay-reef partitioning and used the lagoons as juveniles then moved onto reefs as adults and not vice versa. This supports the hypothesis that bays are important nursery areas for reef-dwelling fishes.

Reference Location: SpringerLink- Journal Article:

<http://www.springerlink.com/content/h761qh5382601x11/>

Keyword(s): GIS, Length-frequency Analysis, Caribbean, Mangrove, Seagrass, Fish Distribution, Ontogenetic Habitat Preference, Non-estuarine Lagoons, Coral Reefs

**Hogarth, W. T., R. Lent, and R. J. Brock. 2004. Area-based management and sustainable fisheries under the purview of the National Marine Fisheries Service. American Fisheries Society Symposium. 42: 3-4.**

Abstract: NOAA Fisheries is entrusted with the management of the living marine resources of the United States. Realizing that single-species management does not adequately address issues such as trophic-level interactions, essential fish habitat, bycatch and discards, and abiotic forcing, NOAA Fisheries has implemented area-based management to deal with these uncertainties, and councils have done ecosystem-based management. The Oculina Banks Habitat Area of Particular Concern off the Atlantic coast of Florida is one of the oldest protected areas administered by NOAA and prohibits bottom trawling and other activities in order to protect the rare ivory tree coral *Oculina varicosa*. Improvements such as this will be realized in rebuilt fish stocks and sustainable fisheries for the future.

Reference Location: Internet Search: ASFA: Aquatic Pollution and Environmental Quality, Green Library, Florida International University, Miami, Florida, USA

Keyword(s): Fishery Management, Nature Conservation, Rare Species, Exclusive Economic Zone, Environmental Management, Fishery Regulations, Fishing Gear, Fishing Mortality, Marine Parks, Bottom Trawling, Environmental Protection

**Lindeman, K. C., D. DeMaria. 2005. Juveniles of the Caribbean's largest coral reef snapper do not use reefs. Coral Reefs. In Press.**

Abstract: *Lutjanus cyanopterus*, the cubrera snapper, is widely distributed and is the largest snapper in the Caribbean. This article focuses on characterizing habitat usage and the distribution of juvenile species of snapper and associations with regards to estuarine habitats as nurseries. Conservation methods to protect shelter and feeding resources are encouraged, especially at the early life stages of this species.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Juvenile Fish, Caribbean, Snapper, Coral Reefs, Habitat, Distribution, Estuarine Habitats

**Loftus, W. F. 2000. Inventory of fishes of Everglades National Park. Florida Scientist. 63(1): 27-47.**

Abstract: This report summarizes the ichthyologic and fisheries investigations that have provided information on the composition and distribution of the marine, brackish, and freshwater fish faunas. There were a total of 290 species of fishes that have been recorded from the park. The table includes abundance and habitat use information for each species.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Inventory, Marine, Brackish, Freshwater, Fish, Fauna, Composition, Distribution, Everglades National Park, Florida

**Lorenz, J. J., and J. E. Serafy. 2006. Subtropical wetland fish assemblages and changing salinity regimes: Implication for everglades restoration.**

**Hydrobiologia. 569(1): 401-422.**

Abstract: This study monitored the demersal fishes seasonally at six sites over an 8-year time period. During monitoring, extremely high rainfall conditions occurred over a 3.5-year period leading to salinity regimes that can be viewed as “windows” to the area’s natural past and future restored states. This article: examines the changes in fish communities over the 8-year study period and relates them to measured changes in salinity; makes comparisons among marine, brackish and freshwater demersal fish communities in terms of species composition, density, and biomass; and discusses several implications of our findings in light of the intended and unintended water management changes that are planned or underway as part of Everglades restoration. Results suggest the reduction in freshwater flow to Florida Bay over the last several decades has reduced demersal fish populations, and thus prey availability for apex consumers in the coastal wetlands compared to the pre-drainage inferred standard.

Reference Location: Internet Search: EBSCO Host Research Databases:  
Environment and Natural Science

Keyword(s): Fisheries, Fish Community Dynamics, Estuaries, Red Mangrove, Salinity, Everglades, Florida

**Neville, A. 2004. Oceans in Peril. Environmental Protection: Management and Problem Solving For Environmental Professionals. 15(8): 3 pp.**

Abstract: The dumping of pollutants, habitat degradation, the introduction of invasive species, and overfishing are all affecting the health of the world’s oceans, including Puerto Rico.

Recommendations for preservation methods include reducing water pollution particularly from non-point sources, strengthening the link between coastal and watershed management, setting up a coordinated management regime for federal waters, and improving fisheries management where the role of science is magnified, and the assessment of fisheries is separated from allocation decisions. The creation of a National Ocean Council would be necessary within the office of the President of the United States of America.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

<http://www.stevenspublishing.com/Stevens/EPPub.nsf/frame?open&redirect=http://www.stevenspublishing.com/stevens/epPub.nsf/d3d5b4f938b22b6e8625670c006dbc58/3edb4abdd930f39186256f090053566b?OpenDocument>

Keyword(s): Oceans, Environmental Protection, Management

**Practical Fishkeeping. 2006. Goliath grouper study reveals habitat use. May 12, 2006.**

Abstract: An underwater study on the mangrove habitats of the Florida Keys has revealed the habitat preferences of the Goliath grouper. This magazine article includes information on the studies findings and relevant species characteristics with regards to shelter preferences and feeding resources.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

<http://www.practicalfishkeeping.co.uk/pfk/pages/item.php?news=931>

Keyword(s): Goliath Grouper, Endangered Species Research, Mangrove Habitats, Florida Keys

**Reilinger, D. M. 1999. Impacts of fishing gear on habitat in tropical seas: Gulf of Mexico, South Atlantic, and Caribbean. ReefKeeper International. September 1999. 17 pp.**

Abstract: Impacts of fishing gear on habitat is discussed in this report. It details on the significance of essential fish habitat, fishing gear, including traps, net fishing, trawls, bottom longlines, and miscellaneous gear, including recreational hook and line uses throughout the Gulf of Mexico, South Atlantic, and Caribbean. This document summarizes the basic uses of these fishing gears, what is known about adverse impacts to essential fish habitats in tropical seas, identified research needs, action already in place to protect fragile habitats, and potential actions that could minimize or eliminate habitat damage by these fishing gears.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Fishing Gear, Habitat, Impacts, Tropical Seas, Gulf of Mexico, South Atlantic, Caribbean

**Rydene, D. A. 2003. Spotted seatrout (*Cynoscion nebulosus*): Factors affecting juvenile distribution, microhabitat selection, and trophic interactions in the Banana River Lagoon and Mosquito Lagoon, Florida. Ph.D. Dissertation, Florida Institute of Technology, Florida, USA.**

Abstract: Adult spawning, juvenile recruitment, growth, microhabitat selection, and diet of spotted seatrout (*Cynoscion nebulosus*) from Florida's Banana River Lagoon (BRL) and Mosquito Lagoon (ML) were studied. Spawning occurred during April-September, when temperatures exceeded 24°C. Juvenile recruitment to seagrass beds peaked in August and September. Juvenile densities and biomass were higher in ML, but growth rates were higher in BRL. BRL juveniles exhibited clumped distribution, but a dispersed distribution in ML. Smaller juvenile classes of seatrout had lower gut fullness. Diurnal and nocturnal feeding were recorded, and gut fullness was greater for nocturnal feeding. The smallest juveniles consumed calanoid copepods and hippolytid shrimp, shifting to hippolytid shrimp and fish with ontogeny. The proportion of fish in the diet increased with growth. Gobies were the most common fish prey. BRL juveniles shifted way from copepods sooner than ML juveniles, and ate a greater portion of fish. These differences can help with fishery management and sustainability.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Spotted Seatrout, *Cynoscion nebulosus*, Juvenile Distribution, Juvenile Recruitment, Seagrass, Microhabitat Selection, Trophic Interaction, Banana River Lagoon, Mosquito Lagoon, Florida

**Schofield, P. J. 2003. Factors affecting the distribution and densities of two gobies (*Microgobius gulosus* and *Gobiosoma robustum*) in a lagoonal estuarine system (Florida Bay, United States). Ph.D. Dissertation, The University of Southern Mississippi, Mississippi, USA.**

Abstract: *Microgobius gulosus* and *Gobiosoma robustum* are the clown and code Goby, respectively, have varying densities across the regions of Florida Bay. *G. robustum* is found at great abundance in the seagrass beds of the western and southern portion of the bay, where a strong Gulf of Mexico influence maintains salinities at a relative constant level. *M. gulosus* is most common in the northeastern section of the bay that is influenced by freshwater inflow and is characterized by low salinities. From the study, both species had similar abilities to withstand acute differences and shifts in salinities, and both exhibited greater growth rates at low salinities. Although competition modifies habitat selection in syntopy, it does not affect their growth or predation rates. Restriction



of water movements, and abundances of prey species may directly affect the larval ecology and physiology of these fish species, which would lead to insight into patterns structuring their abundances.

Reference Location: Internet Search: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): *Microgobius gulosus*, *Gobiosoma robustum*, Gobies, Lagoonal, Estuarine, Distribution, Densities, Florida Bay

**Seitz, J., and G. R. Poulakis. 2006. Anthropogenic effects on the smalltooth sawfish (*Pristis pectinata*) in the United States. *Marine Pollution Bulletin*. 52(11): 1533-1540.**

Abstract: Bycatch mortality in net fisheries was a major reason for the decline of the endangered smalltooth sawfish, *Pristis pectinata*, in the United States. These fisheries have been reduced or eliminated in some states such as Florida, where most smalltooth sawfish are currently found in the U.S. The objective of this study was to determine whether other factors are affecting this species. The procedure included obtaining non-net fishery entanglement, injury, and mortality data by soliciting information from anyone who may have encountered the species. This species was damaged by marine pollution and injured by humans. The impacts of marine pollution and injuries directly caused by humans on this endangered species can be prevented by incorporating fisher education into the conservation and management processes.

Reference Location: Internet Search: Science Direct, University of Miami, Florida, USA (Membership Needed To View)

Keyword(s): Anthropogenic Effects, Bycatch, Endangered Species, Florida, Marine Debris, Monofilament, *Pristis pectinata*

**Simpfendorfer, C. A. 2006. Movement and habitat use of smalltooth sawfish. Center for Shark Research: Mote Marine Laboratory. Tech. Rep. 1070. NOAA. Sarasota, FL.**

Abstract: The purpose of this study was to investigate the habitat use, site fidelity, movements and abundance of the smalltooth sawfish population in Florida. This research used a variety of techniques, including field surveys using longlines and gillnet, acoustic tracking and monitoring, satellite telemetry and the collection of data on encounters with sawfish by the public.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Smalltooth Sawfish, *Pristis pectinata*, Population Decline, Habitat Loss, Genetic Diversity, Movement, Florida

**Voorhees, D. V., and E. S. Pritchard, ed. 2003. Fisheries of the United States, 2002. Current Fisheries Statistics No. 2002. U. S. Department of Commerce, NOAA Fisheries, National Marine Fisheries Service. 118 pp.**

Abstract: This preliminary report on commercial and recreational fisheries of the United States with landings from the U.S. territorial seas, the U.S. Exclusive Economic Zone, and on the high seas. It includes reviews on fishery products, U.S. imports, exports, and supply, as well as inspection details, the Magnuson-Stevenson Fishery Conservation and Management Act, and general information supporting the National Marine Fisheries Service statistics.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Fisheries, United States, Landings, Supply

**Whitcraft, S. R., B. Richards, J. Lamkin, T. Carlson, J. Vucelick, and G. Williams. 2004. Developing shallow-water acoustic telemetry methods for juvenile snapper habitat studies in the Florida Keys National Marine Sanctuary. Cooperative Institute for Marine and Atmospheric Studies, Miami, Florida. NOAA.**

Abstract: This is a pilot study that supports increasing an understanding of life history habitat protection of mangrove habitats for juvenile snapper species. It involves the use of micro-acoustic tagging technology to identify specific movement patterns of juvenile gray snapper species between specific and similar habitats throughout Florida Bay. Results from the study indicate that this tagging method may provide a useful tool in understanding foraging movements, home ranges, and habitat use patterns of juvenile fishes both within obstruction-rich, shallow habitats, as well as marine protected areas. Quantifying and mapping these movements may provide helpful information for effective networks of marine protected areas.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Shallow-water Acoustic Telemetry, Juvenile Snapper, Habitat, Florida Keys National Marine Sanctuary

## VII. REFERENCES OF SPECIFIC STUDIES OUTSIDE OF FLORIDA:

### MANGROVES:

#### ROLE/ STATUS/ TRENDS/ IMPACTS/ RESTORATION:

**Acosta, C. A., and M. J. Butler. 1997. Role of mangrove habitat as a nursery for juvenile spiny lobster, *Panulirus argus*, in Belize. *Marine and Freshwater Research*. 48(8): 721-727.**

Abstract: The use of mangrove prop roots and associated coralline habitats by Caribbean spiny lobsters was investigated near two types of mangrove islands in Belize. Spiny lobsters sheltered among mangrove prop roots, in undercut peat banks and under corals near islands, and they ranged in size from newly recruited juveniles to subadults. Lobsters preferred to shelter under large stony corals, but their use of mangrove prop roots and undercut peat banks increased when the density of corals was low. As a consequence of high immigration rates, population sizes were highest near shallow islands. Predation on newly settled juveniles was greater in seagrass and coral crevices than in mangrove prop roots, whereas the survival of larger juveniles was higher in mangroves and coral patch reefs than in seagrass. These results suggest that mangrove habitats may function as a nursery for juvenile spiny lobsters but that the use of this habitat depends on shelter characteristics and the isolation of islands.

Reference Location: Wimberly Library, Florida Atlantic University: Internet Database Search: Current Contents Connect, Boca Raton, Florida, USA

Keyword(s): Mangrove Prop Roots, Adolescent Banana Prawns, Off-shore Area, Fish Communities, Florida, Estuary, *Panulirus argus*

**Cayman Net News. 2005. Mangroves save lives in Asia; Could protect Cayman. 769: 11. January 12, 2005.**

Abstract: Environmentalists are providing proof for the need of mangrove protection from the

December Asian Tsunami that these buffer zones of vegetation can save lives wherever they occur, including the Caribbean. This news article provides information on the importance, characteristics, and function of mangrove ecosystems throughout the world. Management, restoration, and protection measures need to be set and supported for all life cycles.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Asia, Cayman, Tsunamis, Storms, Protective Habitat, Mangroves

**Ellison, A. M. 1996. Anthropogenic disturbance of Caribbean mangrove ecosystems: Past impacts, present trends, and future predictions. *Biotropica*. 28(4a): 549-565.**

Abstract: This report reviews historical, current, and projected future impacts of four classes of anthropogenic disturbance: extraction, pollution, reclamation, and changing climate on Caribbean mangrove ecosystems. These disturbances occur at increasing spatial and temporal scales. Petroleum is the primary pollutant of Caribbean mangrove ecosystems, and results in tree defoliation, stand death, and loss of associated sessile and mobile animal species. Chemical, industrial, and urban wastes are associated with increased heavy metal content of seedlings, stand die-back, reduced system-wide species richness, and higher incidence of shellfish poisoning. Growth enhancements of mangroves resulting from increasing atmospheric carbon dioxide probably will not compensate for negative effects of rises in regional sea level.

Reference Location: Internet Search: Biotropica:

<http://links.jstor.org/sici?sici=0006-3606%28199612%2928%3A4%3C549%3AADOCME%3E2.0.CO%3B2-7&size=LARGE>

Keyword(s): Mangrove Ecosystems, Anthropogenic Disturbances, Petroleum, Spatial, Temporal, Tree Defoliation, Stand Death, Sessile, Mobile, Caribbean

**Huxham, M., E. Kimani, and J. Augley. 2004. Mangrove fish: A comparison of community structure between forested and cleared habitats. *Estuarine Coastal and Shelf Science*. 60(4): 637-647.**

Abstract: The fish communities of mangrove and cleared sites were investigated in Gazi Bay, Kenya. Five forested sites were compared with paired sites that had been cleared of mangroves by human activity. The most abundant species in mangrove plots was *Atherina afra*, while the most abundant species in cleared sites was *Gerres oyena*. There was large variation in catch rates between dates and sites, with one forested site recording no catches at all. These results do not support the predator refuge hypothesis that predicts higher abundance of juvenile fish inside mangroves. The low abundance of fish recorded in the mangrove sites may have been due to site-specific factors determining fish abundance within mangrove forests, to the sampling techniques used or to relatively high turbidities at these sites.

Reference Location: Wimberly Library, Florida Atlantic University: Internet Database Search: Current Contents Connect, Boca Raton, Florida, USA

Keyword(s): Mangrove, Fish, Nursery, Clearing, Seagrass Beds, Species Composition, Reef Fishes, Florida, Australia, East Africa

**Lewis III, R. R. 2005. Ecological engineering for successful management and restoration of mangrove forests. *Ecological Engineering*. 24: 403-418.**

Abstract: This report documents the importance of assessing the existing hydrology of natural mangrove ecosystems, and applies this knowledge to protect existing mangroves, and to achieve successful and cost-effective ecological restoration methods. More frequent flooding causes stress and death of these ecosystems. Prevention of this damage requires application of the understanding of mangrove hydrology, which is discussed in depth throughout this report.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Mangrove Forests, Restoration, Ecological Restoration, Ecological Engineering

## SEAGRASS:

### ROLE/ STATUS/ TRENDS/ IMPACTS/ RESTORATION:

**Goecker, M. E. 2003. The effects of nitrogen content in turtle grass, *Thalassia testinudum*, on food selection by the bucktooth parrotfish, *Sparisoma radians*. M.Sc. Thesis, University of South Alabama, Alabama, USA.**

Abstract: To clarify whether nitrogen content of plants affects herbivore choice, field and laboratory experiments were conducted in this study using *Thalassia testinudum*, the dominant seagrass in the Caribbean, and the bucktooth parrotfish, *Sparisoma radians*, a common browser and inhabitant of this species of seagrass. Field experiments showed the parrotfish consuming 60% more and in the laboratory, they only consumed 20% more. Results show that olfaction and gustation are also likely mechanisms underlying preference. Selective feeding on high nitrogen plants could influence the outcome of competitive interactions among seagrasses, leading to broad-scale changes in the composition of seagrass meadows.

Reference Location: ProQuest Database: Alvin Sherman Library, Research, and Information Technology Center, Nova Southeastern University, Florida, USA

Keyword(s): Ecology, Aquaculture, Fish Production, Nitrogen Content, Food Selection, Turtle Grass, Seagrass, *Thalassia testinudum*, Bucktooth Parrotfish, *Sparisoma radians*

**Roberson, L. 2006. Effects of water quality on seagrass community productivity and biodiversity. University of Puerto Rico-Seagrant Program. Marine Outreach Program/ Water Quality. February 3, 2006.**

Abstract: Seagrass beds provide habitat and food for endangered species and mobile or benthic invertebrates, damp waves and currents, and filter nutrients and suspended sediments. Light availability is the key to the overall health and success of sea grass communities. Eutrophication, sedimentation, over fishing, and habitat destruction all contribute to anthropogenic stressors on these communities, along with coastal development. This article includes the description of a project performed by Loretta Roberson from the Department of Biology at University of Puerto Rico. Plans to quantify both physical and biological characteristics of sea grass habitats are discussed. The proposed work will be performed in partnership with government agencies and will establish a baseline data set that can be extended into a long term data set.

Reference Location: Internet Search: Internet Search: Puerto Rico Sea Grant College Program, Publications

<http://seagrant.uprm.edu/index.php>

Keyword(s): Water Quality, Seagrass, Biodiversity, Outreach Program

## CORAL REEF DIVERSITY & FISH PRODUCTIVITY:

### ROLE/ STATUS/ IMPACTS/ MITIGATION:

**Adams, A. J. 2001. The importance of lagoon habitats of bank-barrier reefs as nurseries for coral reef fishes. Ph.D. Dissertation, University of Massachusetts, Boston, MA. U.S.A.**

Abstract: This dissertation focused on the importance of lagoon habitats of bank-barrier reefs as nurseries for coral reef fishes. Fishes were visually censused along transects on back-reefs and adjacent lagoons of bank-barrier reefs at six sites on St. Croix, U. S. Virgin Islands. Fishes were recorded by size class on 5 lagoon types: patch reef, rubble, seagrass, algal plain, and sand. Densities of six taxa and of all species combined were examined to determine spatial and temporal patterns of habitat use. Analyses indicated little influence of oceanographic processes in distributions of small fishes among sites relative to benthic processes. A pilot study to determine the feasibility of tagging juvenile *Acanthurus* spp in lagoon nurseries and tracking these fish over time to determine the proportion of adults on reefs that use lagoon nurseries indicated that tagging procedures were appropriate but predation rates were indeterminable due to artifacts associated with tethering. For species using lagoons as nurseries, benthic processes must be paramount when formulating marine conservation and resource management strategies.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Bank-Barrier Reefs, Nurseries, Coral Reef Fishes, Lagoon Habitats

**Adams, A. J., R. K. Wolfe, G. T. Kellison, and B. C. Victor. 2006. Patterns of juvenile habitat use and seasonality of settlement by Permit, *Trachinotus falcatus*. *Environmental Biology of Fishes*. 75(2): 209-217.**

Abstract: Permit, *Trachinotus falcatus*, are economically and ecologically important throughout their range of the Caribbean, subtropical and tropical western Atlantic, and Gulf of Mexico. For the juvenile life stage, nursery habitats and size and age at settlement have not yet been defined. Although six distinct habitat types (medium energy and low energy windward beaches, leeward beaches, and windward, leeward, and lagoon interior mangrove shorelines) were sampled to determine spatial patterns of habitat use by early juvenile permit at Turneffe Atoll, Belize, Central America, and the Florida Keys, USA, 99% of juvenile permit were found along medium energy windward beaches, indicating their role as nursery habitat for this species. A sub-sample of juvenile permit from Florida was examined to estimate spawning date and age at settlement from otoliths. Results from this study lay the foundation for future research on larval supply, population connectivity, and juvenile ecology, and will aid in the ongoing formulation of a conservation plan toward a sustainable fishery for permit.

Reference Location: Internet Search: EBSCO Research Databases: Environmental and Natural Sciences

Keyword(s): Aquatic Ecology, Habitat, Ontogeny, Permit Fish, Tropical Fish, Fish Ecology, Spatial, Temporal, Juvenile Fish

**Baums, I. B., M. E. Hellberg, and M. W. Miller. 2002. Preliminary data on genotypic diversity of *Acropora palmata* (Scleractinia: Acroporidae). Presentation: International Society for Reef Studies 2002 meeting. Cambridge, United Kingdom.**

Abstract: Knowledge of *Acropora* population structure is essential for assessing its degree of threat and deciding on appropriate conservation measures. This study was to set a precedent for Caribbean coral reef ecosystems reported observations. Polymarkers were developed and tested. Gametes were used in the development process to prevent contamination caused by zooxanthellate symbiots that are present in adult tissues. Two adjacent reefs, Horseshoe Reef and Little Grecian Reef, showed very little clonal variation. The markers developed have the potential to reveal the genotypic diversity of a major reef building coral species suspected of high clonal population structures. Preliminary results indicate wide ranges of genotypic diversities both locally and throughout the Caribbean. For *Acropora palmata* populations, larval exchange may be limited between certain reefs. Thus, after the number of samples analyzed increased it would indicate these populations would have to be managed on a local scale.

Reference Location: United States Fish and Wildlife Service, Caribbean Field

Office, Puerto Rico

Keyword(s): *Acropora palmata*, Scleractinia, Genotypic Diversity, Genetic Status, Coral Populations, Caribbean

**Dorenbosch, M., M. G. G. Grol, I. Nagelkerken, and G. van der Velde. 2005.**

**Distribution of coral reef fishes along a coral reef-seagrass gradient: edge effects and habitat segregation. *Marine Ecology Progress Series*. 299: 277-288.**

Abstract: To determine whether coral reef fishes on the coral reef are interlinked with or segregated from fishes on adjacent seagrass beds, a 60-m coral reef-seagrass gradient was studied on the island of Zanzibar in the western Indian Ocean. There were 4 habitat zones studied: (1) a coral patch reef, (2) seagrass beds bordering the coral reef, (3) seagrass beds at a 30-m distance from the coral reef edge, and (4) seagrass beds at a 60-m distance from the coral reef edge. From the densities of juveniles and adults in the 4 zones, the 48 species that were observed were classified into reef-associated species, seagrass-associated species, nursery species, generalists and rare species. The results of the study showed that this seagrass-coral reef landscape shows habitat segregation between species and life stages and shows an edge effect, possibly due to competition mechanisms between species or life stages.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Coral Reef Fish, Seagrass Beds, Habitat Connectivity, Species Interaction, Migrations, Edge Effect

**Hoff, R. Z., ed. G. Shigenaka, R. Yender, A. Mearns, and C. L. Hunter. 2002. Oil spills in coral reefs: Planning and response considerations. NOAA Fisheries. Office of Response and Restoration. 72 pp.**

Abstract: Environmental impacts on coral from anthropogenic and natural causes are increasing at rapid rates. Coral reef ecology, global impacts, toxicity, response to oil spills in coral reef habitats, reef restoration, and case studies entail this pamphlet. This guide is intended to serve as helpful information for resource agency personnel, state and federal agencies, as well as educate the general public and interested parties for future restoration methods that can prove successful in coral reef ecosystem growth and sustainability.

Reference Location: National Marine Fisheries Service, Caribbean Field Office, Puerto Rico

Keyword(s): Oil Spills, Coral Reefs, Response, Restoration, Planning

**Lindeman, K. C., P. A. Kramer, and J. S. Ault. 2001. Comparative approaches to reef monitoring and assessment: An overview. *Bulletin of Marine Science*. 69(2): 335-338.**

Abstract: This article entails a session on six papers discussing comparative approaches to coral reef monitoring and assessment. Three studies monitored or assessed reef conditions based on field studies, two evaluated anthropogenic impacts to corals using other methods, and one on variations in growth parameters among morphotypes. These studies illustrated two common differences among many assessment methods: (1) the spatial and temporal scales of the study, and (2) the availability of consistent habitat classification tools. Studies were focused in the Atlantic and Gulf of Mexico, Caribbean Yucatán, Red Sea, South Africa, Arabian Gulf, and the Bahamas.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Comparative Approaches, Reef Monitoring, Assessment, Coral

**Nagelkerken, I., G. van der Velde, and E. Cocheret de la Morinière. 2001. Fish feeding guilds along a gradient of bay biotopes and coral reef depth. *Aquatic Ecology*. 35: 73-86.**

Abstract: The study of fish feeding guild structure is a useful method to compare fish communities of complex marine ecosystems. Guild structure was determined in four coral reef depth zones; the fringing reef at depths of 2, 5, 10, and 15 m, as well as in seven shallow-water biotopes within a single bay; notches in fossil reef rock, mangroves, fossil reef boulders, seagrass beds, and algal beds at a depth of 2 m, algal beds at a depth of 5 m, and the channel. The study was done in an inland bay on the Caribbean island of Curaçao, using a visual census technique. Total fish densities within the different feeding guilds varied greatly between the biotopes, and were generally higher in the reef biotopes and on the boulders than in the remaining bay biotopes. The greatest dissimilarity in guild structures in terms of fish densities was that between the algal beds and all other biotopes, followed by that between the reef depth zones and other bay biotopes, such as notches, mangroves, seagrass beds, and the channel. Cluster analyses were used and revealed that the coral reef was dominated by omnivores and zooplanktivores, while the bay was dominated by zoobenthivores and herbivores. Differences in guild structure between the bay and the adjacent reef indicate differences in food availability.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Bay Isotopes, Coral Reef Fish, Curaçao, Guild Structure, Mangroves, Reef Zones, Seagrass Beds

**Ogden, J. C., I. Nagelkekern, and C. C. McIvor. 2005. Ecosystem interactions in the tropical coastal seascape: Life and death of coral reefs. 2<sup>nd</sup> Ed. C. Birkeland (ed.). 20 pp.**

Abstract: Mangroves and seagrass beds are considered important juvenile habitats for a variety of fish and invertebrate species that spend their adult life on coral reefs or off-shore habitats. This function is apparent in the Caribbean and Australia, but on some islands in the Indo-Pacific the value of these habitats has been questioned. This report discusses foraging movements and migrations, edge effects, dependencies on off-reef habitats, fluxes of nutrients and organic material in the seascape with regards to linking mangroves with seagrass beds and coral reefs, and the future of coral reef management and conservation.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Biological Interactions, Nursery, Ecosystem Interactions, Coral Reefs, Fish

**Riegl, B. M., S. J. Purkis, R. E. Dodge, B. Vargas-Angel, and M. S. Shiji. 2005. The NCRI monitoring network: Multidimensional and multidisciplinary reef assessment on a worldwide scale. *American Society of Limnology and Oceanography*. Santiago da Compostois, Spain. 12 pp.**

Abstract: This report covers research performed, using a CTD to get temperature, conductivity, and depth simultaneously, report whale activity and observations, and assess reef conditions and status, among other disciplines around the Bahamas and Caribbean to the Gulf Stream. It also includes a global scale of research to assess coral reef restoration and findings.

Reference Location: Internet Search: National Coral Reef Institute Publications:

[http://www.nova.edu/ocean/currents/currents\\_sum05.pdf](http://www.nova.edu/ocean/currents/currents_sum05.pdf)

Keyword(s): NCRI Monitoring Network, Reef Assessment, Multidimensional, Multidisciplinary

## FISHERIES & MARINE NURSERIES GENERAL: IMPACTS/ MANAGEMENT:

**Appeldoorn, R., and K. C. Lindeman. 2003. A Caribbean-wide survey of marine reserves: Spatial coverage and attributed of effectiveness. *Gulf and Caribbean Research*. 14(2): 139-154.**

Abstract: This study focused on compiling information on reserves from 21 countries to create a framework for supporting the most effective spatial scale of networks of reserves, and to assist policy makers in creating reserves that promote efficient management and science-based features. From data compiled, it was found that, since 1961, there have been over 50 reserves established in the Caribbean, and most reserves are less than 1,200 ha. Less than 20% of the reserves were fully compliant, but half did offer potentially significant levels of production.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Marine Reserves, Spatial Distribution, Habitats, Caribbean, Population Density, Ontogeny

**Cocheret de la Morinière, B. J. A. Pollux, I. Nagelerken, and G. van der Velde. 2003. Diet shifts of Caribbean grunts (*Haemulidae*) and snappers (*Lutjanidae*) and the relation with nursery-to-coral reef migrations. *Estuarine, Coastal and Shelf Science*. 57: 1079-1089.**

Abstract: The spatial size distribution of two grunt species, *Haemulon sciurus* and *Haemulon flavolineatum*, and two snapper species, *Lutjanus apodus* and *Ocyurus chrysurus*, have indicated the separation of juveniles in nursery habitats from the adults on the coral reef, which implies life cycle migrations from nursery habitats to the coral reef. If diet shifts are related to such migrations, then the diets of these fish must change before or around the fish size at which migrations occur. Regression analysis between fish size and dietary importance of small crustaceans showed a negative relationship in all four species. Although other factors may theoretically initiate or promote the migration patterns, the results of this study indicate that ontogenetic dietary changes may crucially influence the nursery-to-coral reef migrations of these reef fish species.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Nursery Habitats, Nursery-to-Reef Migrations, Diet Shifts

**Dahlgren, C. P., G. T. Kellison, A. J. Adams, B. M. Gillanders, M. S. Kendall, C. A. Layman, J. A. Ley, I. Nagelkerken, and J. E. Serafy. 2005. Marine nurseries and effective juvenile habitats: Concepts and applications. *Marine Ecology Progress Series*. In Press.**

Abstract: The need to define and identify marine nurseries is discussed in this article. This study builds on the nursery concept by developing a framework for evaluating juvenile habitats based on their overall contribution to adult populations, and introduce the concept of Effective Juvenile Habitat to refer to habitats that make a greater than average overall contribution to adult populations.

Reference Location: NMFS CD Copy: First International Symposium on



Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Habitat, Juvenile, Nursery, Nearshore

**Dorenbosch, M., M. C. van Riel, I. Nagelkerken, and G. van der Velde. 2004. The relationship of reef fish densities to the proximity of mangrove and seagrass nurseries. *Estuarine, Coastal and Shelf Science*. 60: 37-48.**

Abstract: Visual census surveys were used to study the distribution of coral reef fishes that are associated with seagrass beds and mangroves in their juvenile phase, on various coral reef sites along the coast of the Caribbean island of Curaçao (Netherlands Antilles). The hypothesis tested was that various reef fish species occur in higher densities on coral reefs adjacent to nursery habitats than on reefs located at some distance to these habitats. Of 17 coral reef fish species that are known to use bays with seagrass beds and mangroves as nurseries, 15 were observed in quadrats on the reef. Four nursery species, *Haemulon sciurus*, *Lutjanus apodus*, *Ocyurus chrysurus* and *Scarus coeruleus*, occurred in significantly higher densities on coral reefs adjacent to bays with seagrass beds and mangroves. *Lutjanus analis*, *Lutjanus mahogoni*, and *Sphyrna barracuda* also had their highest densities on reefs adjacent to the bays but the numbers were not always that significant. It is suggested that these seven species depend strictly on the presence of bays with seagrass beds and mangroves as nurseries. It is also suggested that the other species that are known to use the bays as nurseries are not dependent on these bay habitats for nurseries and switch off to reef habitats adjacent to the bays to use them as nurseries as well.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Nursery Grounds, Mangrove Swamps, Seagrasses, Coral Reef Fishes, Migration, Juveniles

**Dorenbosch, M., M. C. Verweij, I. Nagelkerken, N. Jiddawi, and G. van der Velde. 2004. Homing and daytime tidal movements of juvenile snappers (*Lutjanidae*) between shallow-water nursery habitats in Zanzibar, western Indian Ocean. *Environmental Biology of Fishes*. 70: 203-209.**

Abstract: Daily tidal movements of tagged juvenile *Lutjanus fulviflanma* and *Lutjanus ehrenbergii* were studied between two adjacent habitats, a subtidal channel and shallow tidal notches in the fossil reef terrace, in a shallow marine bay on Zanzibar Island, Tanzania, Africa. Of the re-sighted individuals, 48% showed clear movement between the two habitats, orientated in a perpendicular direction to the tidal currents. It is suggested that a significant part of this population of juvenile snappers may move from a low-tide resting habitat to a high-tide habitat during the daytime, perhaps to avoid predation by larger predators that may enter the channel at high-tide.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Coral Reef Fishes, Migration, Site Fidelity, Seagrass Beds, Tidal Channels, Marine Bay

**Dorenbosch, M., M. G. G. Grol, I. Nagelkerken, and G. van der Velde. 2005. Different surrounding landscapes may result in different fish assemblages in East African seagrass beds. *Hydrobiologia*. 00: 1-16.**

Abstract: To study the effects of surrounding habitats on the composition, diversity, and densities of coral reef fish species on seagrass beds, underwater visual census surveys were carried out in two seagrass habitat types at various locations along the coast of Zanzibar, Tanzania, in the western Indian Ocean. Fish assemblages of seagrass beds in a marine embayment with large areas of mangroves situated 9 km away from coral reefs were compared with those of seagrass beds

situated on the continental shelf adjacent to coral reefs. Results showed no differences in total fish density, total species richness or total juvenile fish density and species richness were observed between the two seagrass habitat types. At species level, nine species showed significantly higher densities in bay seagrasses, while eight other species showed significantly higher densities in reef grasses. Another four species were exclusively observed in bay seagrasses. Since seagrass complexity could not be related to these differences, it is suggested that the arrangement of seagrass beds in the surrounding landscape has a possible effect on the occurrence of various reef-associated species on seagrass beds. Fish migration from or to seagrass beds and recruitment and settlement patterns of larvae possibly explain these observations.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Coral Reef Fishes, Seagrass Beds, Mangroves, Nursery, Connectivity, Migration, Zanzibar, Tanzania, East Africa

**Dorenbosch, M., M. G. G. Grol, I. Nagelkerken, and G. van der Velde. 2005. Seagrass beds and mangroves as potential nurseries for the threatened Indo-Pacific humphead wrasse, *Cheilinus undulatus* and Caribbean rainbow parrotfish, *Scarus guacamaia*. *Biological Conservation*. 129: 277-282.**

Abstract: This study investigated the importance of seagrass beds and mangroves as a juvenile habitat as opposed to other shallow water habitat types on four islands in the western Indian Ocean for threatened Indo-Pacific humphead wrasse, *Cheilinus undulatus* and Caribbean rainbow parrotfish, *Scarus guacamaia*. *Cheilinus undulatus* juveniles were predominantly found on seagrass beds while adults were limited to the coral reef. The presence of seagrass beds resulted in significantly higher densities of the species on coral reefs in front of these habitats. This indicates the importance of seagrass beds as a juvenile habitat. Adult *S. guacamaia* occurred on all coral reefs along the sheltered coast of the island containing mangroves, but no relationship with distance to mangroves was observed. This could indicate the importance of mangroves for the occurrence of adults of this species on the scale of an entire island.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Coral Reef Fishes, Nursery, Seagrass Beds, Mangroves, Conservation

**Nagelkerken, I., and G. van der Velde. 2003. Connectivity between coastal habitats of two oceanic Caribbean islands as inferred from ontogenetic shifts by coral reef fishes. *Gulf and Caribbean Research*. 14(2): 43-59.**

Abstract: In this study, density and size of reef fish were determined using a single sampling technique in four non-estuarine bay habitats and four reef zones in Curaçao and Bonaire, Netherlands Antilles. The data indicate that of the complete reef fish community at least 21 species show ontogenetic cross-shelf shifts in habitat utilization, especially in mangroves and seagrass beds, channel, and shallow reefs. Fish species utilized 1-3 different nursery habitats simultaneously, but habitat utilization clearly differed between species. The strong connectivity between several coastal habitats during the ontogeny of various commercially important reef species is evidence for the inclusion of bay habitats within boundaries of fishery reserves or marine protected areas.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Connectivity, Mangroves, Seagrass Beds, Coral Reef Fishes, Nursery Habitats, Juvenile Fish, Ontogenetic Shifts, Caribbean, Bonaire, Curaçao, Netherlands Antilles

**Nagelkerken, I., and G. van der Velde. 2004. A comparison of fish communities of subtidal seagrass beds and sandy seabeds in 13 marine embayments of a Caribbean island, based on species, families, size distribution and functional groups. Journal of Sea Research. 52: 127-147.**

Abstract: The objective of this study was to determine whether the seagrass and sandy seabed habitats of various embayments are characterized by typical fish assemblages which differ in terms of taxa, size classes, and functional groups. This was linked to the hypothesis that differences in fish assemblages between habitats in different embayments are larger at taxonomic levels than at the level of functional groups. A second objective was to determine the most useful discriminating features between the two habitat types. The hypothesis was rejected, since differences in fish assemblages from different seagrass and sandy seabed sites did not increase from functional group composition, irrespective of differences in environmental and biotic variables between the embayments in which these habitats were situated. The two habitat types could be characterized with regards to fish family, ecological species group, feeding time, and size distribution.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Fish, Seagrass beds, Coral Reefs, Inland Lagoons, Nursery Grounds, Community Structure, Curaçao

**Nagelkerken, I., G. van der Velde. 2004. Relative importance of interlinked mangroves and seagrass beds as feeding habitats for juvenile reef fish on a Caribbean island. Marine Ecology Progress Series 274: 153-159.**

Abstract: In this study, the degree to which mangroves and seagrass beds are used as feeding grounds for 4 nocturnally active fish species was tested on Curaçao, Netherlands Antilles. Stable isotope analysis was used as a technique to distinguish between feeding on mangroves and seagrass beds. Results from the test indicate that 2 different subpopulations probably exist for the 4 species studied: a population of fishes sheltering in mangroves during the daytime and feeding mainly in the mangroves and next in the mangroves at night, and a population of fishes of the same species sheltering in adjacent seagrass beds in the daytime and feeding mainly in seagrass beds at night.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Coral Reef fish, Mangroves, Seagrass Beds, Stable Isotopes, Feeding Habitats, Interlinkages

**Nagelkerken, I., K. Vermonden, O. C. C. Moraes, A. O. Debrot, and W. P. Nagelkerken. 2005. Changes in coral reef communities and an associated reef fish species, *Cephalopholis cruentata* (Lacépède), after 30 years on Curaçao (Netherlands Antilles). Hydrobiologia. 549: 145-154.**

Abstract: This study quantifies the cover of hard coral species, soft corals, sponges, hard substratum and soft substratum, and density of a commercially important reef fish species, the graysby *Cephalopholis cruentata*, along a depth-gradient of 3-36 m on the coral reefs of Curaçao. The objective was to determine the multi-decade change in benthic coral reef cover and structural complexity, and their effect on densities of an associated reef fish species. Total coral cover

represented a relative decline of 58%. Cover of main reef builder coral species (*Agarcicia* spp., *Siderastrea siderea*, *Montastrea annularis*) decreased more than that of other species, and resulted in a significant decrease in reef complexity. *C. cruentata* showed a clear shift in density distribution from shallow water in 1973 into deep water in 2003. It can be concluded that the reefs in this area have degraded in the last decades, but that this had no major effect on the population size of one commercially important coral-associated fish species.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Coral Reef Degradation, Coral Reef Communities, Coral Reef Complexity, Serranidae, Fish Population Structure, Caribbean

**Verweij, M. C., I. Nagelerken, S. L. J. Wartenbergh, I. R. Pen, and G. van der Velde. 2006. Caribbean mangroves and seagrass beds as daytime feeding habitats for juvenile French grunts, *Haemulon flavolineatum*. Marine Biology. In Press. Accepted March 2006.**

Abstract: In this study, there are three hypothesized strategies: (1) fishes feed in mangroves or seagrass beds throughout the day and feed predominantly in seagrass beds during the night; (2) fishes start feeding in mangroves or seagrass beds during the day just prior to nocturnal feeding in seagrass beds; (3) after nocturnal feeding in seagrass beds, fishes complete feeding in mangroves or seagrass beds during the morning. The effect of habitat type, fish size, social mode, and time of day on resting and feeding behaviour, were studied on large juvenile and sub-adult *Haemulon flavolineatum* in mangroves and seagrass beds during the day. The study shows that both mangroves and seagrass beds provide daytime feeding habitats for some life-stages of *H. flavolineatum*, which is generally considered a nocturnal feeder.

Reference Location: NMFS CD Copy: First International Symposium on Mangroves as Fish Habitat. Miami, Florida.

Keyword(s): Caribbean, Seagrass Beds, Mangroves, Habitats, Juvenile Fish, French Grunts, Daytime Feeding Habitats