

Hardbottom Communities of Biscayne National Park

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The floral and faunal communities within the aquatic areas of Biscayne National Park display a zonation pattern that is said by some (Meeder, John F., Alvord, Jennifer, Byrne, Michael, Ross, Michael S., and Renshaw, Amy 97; Kohout, F. A. and Kolipinski, M. C. 67) to correlate with groundwater discharge into the Bay. The spatial pattern of benthic communities in the Park is described as shoal grass (*Halodule wrightii*) and bare mud bottom-dominant within 200 m of the coastline and turtle grass (*Thalassia testudinum*) dominant 600 m from shore. The large area between these seagrass-dominant zones is dominated by green algae, calcareous green algae, sponges, soft corals (octocorals) and some small hard corals (84). These organisms persist in areas where the substrate is exposed or slightly-covered (< 6 inches of sediment) bedrock, limestone, or fossil reef formation which gives the name "hardbottom community" to this type of habitat.

Substrate

Biscayne National Park is underlain by the Key Largo limestone foundation. This limestone base in the center portion of the Park (between the western shore and the barrier islands) is covered by a build-up (accretion) of coquina mollusks, sand, and shell marl (Duane, D. B., Field, M. E., Meisburger, E. P., and Williams, J.). Colonies of tube-building polychaete worms and other invertebrate and macroalgal species present in these habitats contribute to the complexity of the limestone base.

Flora

Macroalgae (e.g. *Laurencia* spp., *Batophora oerstedii*, and *Halimeda* spp.) are able to exploit hardbottom areas better than vascular plants because they do not have root systems. Roots are used to help a plant hold itself to the substrate and to gather nutrients from the sediment. In order to accomplish this function, the roots must be able to penetrate into the substrate. This is obviously difficult in a hardbottom substrate so vascular or rooted plants such as seagrasses are essentially excluded from these areas. Algae, on the other hand, can attach themselves directly to the rocky substrate or to a coral skeleton.

Fauna

Hardbottom substrates provide habitat for many animals including sponges, fishes, lobsters, crabs, and other invertebrates, many of which are commercially harvested. Anthropogenic activities (e.g. pesticide run-off, dredge and fill, bulkheading, sewage and industrial pollution) in and around Biscayne National Park affect the environmental characteristics of the water in which they live and therefore affect the health and abundance of the animals the Bay.

Though it contributes to primary productivity, the nearshore hardbottom habitat within Biscayne National Park fulfills an equally important ecological role. As this community is located between the eastern reef tract and the western estuarine environment, it is believed to serve as settlement habitat for immigrating invertebrate larvae and/or as intermediate nursery habitat for juvenile vertebrates emigrating out of the estuary inlets (Lindeman, K. C. and Snyder, D. B. 98; Lindeman 1997). Without such a settlement habitat available, larval invertebrates would have no space to attach and grow and would remain floating in the water column to either be eaten or washed out into the ocean where they would be lost from the ecosystem of the Park. Juvenile fishes that are spawned in the inland and estuarine zones use the complex hardbottom habitat as a place to find food resources as well as camouflage cover (inside sponges or soft corals) to protect them from predators. Without such a habitat available, fish and invertebrate abundances in the Park would be negatively affected.

Many sponge species are found in assemblages on nearshore hardbottom substrates along with soft corals. They prefer areas with constant salinity, low sedimentation, shallow and coarse sediments, and sparse vegetation cover (Schmahl 1987). The highest densities of sponges in Biscayne National Park are found along a transect running from north to south down the center of the Bay where the environmental conditions outlined above are relatively consistent.

Sponges are filter feeders so they need to have a great portion of their skeleton exposed to the water column so they can gain access to nutrients as they flow by in the water. As such, they are not typically found within dense seagrass beds because one of the ecological functions of seagrasses is to "baffle" or reduce water velocity. There are sponges which associate with seagrasses (e.g. Chicken Liver sponge) but they attach themselves to the seagrass blades themselves, rather than the substrate, in order to be exposed to flowing water and thus their food source. Sponges also can attach directly to the bedrock substrate so they can inhabit this type of habitat.

Sponges are ecologically very important within their ecosystem as they filter the equivalent of several times their volume of water every day which affects water quality in their environment (DiResta, Daniel, Curry, Richard W., and Lockwood, Brian R. 199?). They also increase biodiversity by providing habitat for plants and other animals (Butler, Mark J. IV, Hunt, John H., Herrnkind, William F., Childress, Michael, Bertelsen, Rodney, Sharp, William, Mathews, Thomas, Field, Jennifer M., and Marshall, Harold G. 95). The commercial sponges of Biscayne National Park came under increased harvest pressure in the late 1980's as sponge fishing increased in popularity in this area in conjunction with the immigration of traditional sponge fishermen to South Florida from Cuba. Knowing that any changes in the sponge community would result in a change in the benthic community composition of Biscayne Bay with unknown trickle-down effects to adjacent habitats (author unknown 95?), the Florida Marine Fisheries Commission banned commercial sponging in Biscayne National Park in 1991 (DiResta, Daniel, Curry, Richard W., and Lockwood, Brian R. 199?). Currently, though over-harvesting is not a threat to sponge abundance, sponges are still vulnerable to other anthropogenic

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stressors such as increased turbidity and changes in timing and quantity of freshwater flow.

Soft corals such as sea fans, sea plumes, and sea whips are non reef-building (ahermitypic) corals. They require specific environmental conditions including water temperature, water movement, salinity, clarity, and attachment space, each of which is satisfied within the hardbottom community structure within Biscayne National Park.

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Macroalgae:

Batophora oerstedii
Gracilaria cylindrica, *G. verrucosa*
Laurencia intricata
Lomentaria baileyana
Anadyomene stellata
Chondria cnicophylla
Cladophora fuliginosa
Dictyosphaeria cavernosa
Laurencia poitei
Siphonocladus rigidus
Valonia macrophysa

Invertebrates:

Sheepswool sponge (*Hippospongia lachne*)*
Yellow sponge (*Spongia barbara*)*
Glove sponge (*Spongia graminea*)*
Grass sponge (*Spongia tubulifera*)*
Loggerhead sponge (*Speciospongia vesperia*)
Stinker sponge (*Ircinia* spp.)
corals
Florida Spiny Lobster (*Panulirus argus*)
Crab

*commercial sponges

Fishes:

Grouper
Spotted seatrout (*Cynoscion nebulosus*)
Gray Snapper (*Lutjanus griseus*)
Remora

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Reference List

author unknown. 1995? untitled: Commercial sponge data in Biscayne National Park.

This document consists of commercial sponge data for four sites in Biscayne National Park: Pelican Bank, Billy's Point, Black Ledge, and Black Point. The data consists of plot maps and species present at each site.

Butler, M.J.I., J.H. Hunt, W.F. Herrnkind, M. Childress, R. Bertelsen, W. Sharp, T. Mathews, J.M. Field, and H.G. Marshall 1995. Cascading disturbances in Florida Bay USA: cyanobacteria blooms, sponge mortality and implications for juvenile spiny lobster *Panmularis argus*. Marine Ecology Progress Series 129: 119-125. **Science files BISC**

DiResta, Daniel, Curry, Richard W., and Lockwood, Brian R. 199? A study of population density, habitat characteristics, and size- frequency distribution of commercial sponges in Biscayne National Park, Florida.

The purpose of this study was to determine how the distribution of commercial sponges has changed in Biscayne National Park since a survey done in 1978. To achieve this goal, the investigators examined the abundance, habitat characteristics, habitat distribution, and size-frequency distribution of the commercial sponges in the park. Graphs, diagrams, maps, and tables present the data.

Duane, D. B., Field, M. E., Meisburger, E. P., and Williams, J. Inner continental shelf program: Shallow structure, geomorphology, and sediments. In Second National Coastal and Shallow Water Research Conference. **Science files BISC**

This entry deals with the ongoing "survey [of] subbottom structure and sediments of portions of the U.S. inner continental shelf." "...the investigations are conducted by utilization of high resolution seismic reflection profiling and vibratory coring." "In addition to detailed studies of geomorphology and sediments and calculation of sand resources in south Florida, the ICONS Program has ... resulted in determination of Holocene-Pleistocene of the Cape Kennedy nearshore area, delineation of buried stream channels at Chesapeake Bay mouth, mapping of Atlantic Florida deep regional structure..."

Jaap, Walter C. 1984. The ecology of the south Florida coral reefs: a community profile. Metairie, LA.

This report discusses aspects of the Florida reef tract including reefs in Biscayne National Park and Dry Tortugas National Park. Topics include characterization of the reefs and their environment, coral reef community types, coral reef benthos, plankton, reef fish, coral reef ecology, and management. It also includes graphs, tables, and drawings.

Kohout, F.A. and M.C. Kolipinski 1967. Biological zonation related to groundwater discharge along the shore of Biscayne Bay, Miami, Florida. Estuaries 488-499.

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The purpose of this report is to describe the hydrological factors that cause zonation of flora and fauna at a site along the western shore of Biscayne Bay. The report discusses the Biscayne aquifer, the zone of diffusion through the aquifer, the discharge of fresh groundwater, salinity, bottom type, and biological zonation. Graphs, tables, and drawings present the data.

Lindeman, K. C. 1997. Development of grunts and snappers of southeast Florida: cross-shelf distributions and effects of beach management alternatives. PhD Dissertation - PhD. dissertation. University of Miami. Miami, FL.

The economically important fish families Haemulidae and Lutjanidae (grunts and snappers) are valuable model systems for the comparative examination of development and habitat use. Over 20 species were used to assess: (a) variations in early life history attributes within and among basal percoid families, and (b) effects of ten beach management alternatives in southeast Florida. For the Biscayne Bay region, combining habitats and cross-shelf strata identified over 150 available habitats.

Lindeman, K.C. and D.B. Snyder 1998. Nearshore hardbottom fishes of southeast Florida and effects of habitat burial caused by dredging. Fisheries Bulletin 97: 508-525. **Science Files BISC: Biscayne Bay: Fisheries**

Meeder, John F., Alvord, Jennifer, Byrne, Michael, Ross, Michael S., and Renshaw, Amy. 1997. Distribution of benthic nearshore communities and their relationship to groundwater nutrient loading. **Science files BISC: Biscayne Bay: Water Quality**

*This report documents benthic community distribution between Military Canal and Mowry Canal in Biscayne National Park. Site biomass and productivity of *Thalassia testudinum*, *Halodule wrightii*, and *Penicillus capitatus* were measured, along with salinity and nutrient data for both surface and groundwater, discharge levels, and nutrient loading. Management recommendations are given. Graphs and tables present the data.*

Schmahl, George P. 1987. Aspects of the ecology of sponges (Porifera) associated with coral reefs of Biscayne National Park, Upper Florida Keys. PhD Dissertation - University of Georgia. Athens, GA.

This study documents the occurrence and distribution of sponge species on Biscayne National Park coral reefs. It also examines the variability of the sponge assemblages with depth and location. Influences of other environmental variables upon species distribution are postulated. Four shelf-edge reefs were studied, Triumph, Long, Ajax, and Pacific reefs, and eight patch reefs, Dome, Dome control, Star, Star control, Schooner, Schooner control, Elkhorn, and Elkhorn control.