The Biscayne Learning Center

Infrastructure for Education and Research on Coral Reef Ecosystems

Coral reefs are among the most biodiverse and productive ecosystems on the planet. They provide a variety of important services including shoreline protection, tourism, fisheries, trade, and aesthetic and cultural value. Although historically treated as such, coral reefs are not isolated entities. They are typically flanked by deep pelagic environments and a mosaic of shallow-water habitats, including patch reefs, seagrass beds and mangroves. Collectively, these habitats comprise ***Coral Reef Ecosystems***.

We seek funds to build the infrastructure for sustainable education and research activities from one of seven houses perched on pilings just inside the northeastern eastern boundary of Biscayne National Park and Biscayne Bay. **The Biscayne Learning Center** sits over about two meters of water on the edge of a complex system of relatively deep passes called "the Safety Valve". Over the tidal cycle, oceanic and bay waters flow in and out of these passes and with them, a wide diversity of marine organisms. For the most part these organisms are destined for seagrass, hardbottom and coral reef habitats to complete their life cycles.

The **Biscayne Learning Center** is an ideal platform for studying, monitoring, and teaching about ecological connectivity in subtropical ecosystems. Components of our education and research initiative are: (1) a program for intensive immersion courses on Coral Reef Ecosystem Connectivity for high school and undergraduate students; (2) the Coral Reef Nursery Program; and (3) the Shark Program. Descriptions of each of these programs follow.

Coral Reef Connectivity Classroom: An Intensive Immersion Course

The Biscayne Subtropical Learning Center will be the base for students habitat connectivity in a coral reef ecosystem. In a 5-day course, they will follow the life cycle of coral reef fishes, which entails: (1) spawning and egg fertilization at the reef's outer periphery; (2) egg hatching and larvae development in the pelagic, blue waters of the Florida Straits/Gulf Stream; (3) late larvae navigation inshore to settle in shallow seagrass beds, where they metamorphose into early juveniles; (4) movement of subadults into the dense structure of mangrove prop-root habitats; and (5) migration offshore to the reef tract as they approach sexual maturity to reproduce, and begin the cycle again.

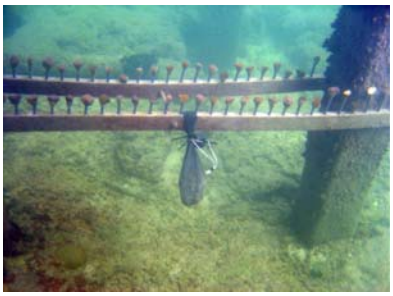
Students will first be introduced to each of the habitats and concepts above, and then will immediately experience each habitat via boating trips, collecting, and guided snorkeling trips (waters are typically less than 4 m deep). The core learning device, however, will be for participants to engage in habitat-specific research activities that reinforce the concept that coral reef ecosystems include, and rely on, a sequence of healthy inter-connected habitats and oceanographic processes, which, in turn depend on wise conservation and management of human activity and coastal watersheds.

During the five-day immersion course, the following objectives and standards for University of Miami, Miami-Dade County Public Schools, State of Florida, and National Science Education will be addressed:

- Compare and contrast South Florida's coral reefs and adjacent seagrass and mangrove communities;
- Develop and test hypotheses, design appropriate sampling schemes, implement data collection and analyze and report data;
- Identify and relate the types and quantities of flora and invertebrate and vertebrate fauna to the habitats in which they are found;
- Present scientific findings orally as a slide show for class critique as well as in written report form for grading.

The **Biscayne Learning Center** offers unmatched stability and quiet (a factor that limits at-sea encounters with many large marine organisms) and learning opportunities from which to conduct marine science education; it is also a place of extraordinary natural beauty. With the appropriate infrastructure, the Center will serve to enrich minds of the future stewards of our natural heritage.

Biscayne Learning Center: Coral Nursery Program



Biscayne National Park's coral nursery program operates under a permit issued by the National Park Service and has the purpose of retaining a large number of coral colonies (7 inches or less) that would be available for coral reef restoration or enhancement throughout the Park and, if asked, the Florida Keys. The Park coral nurseries program started in the spring of 1993 and has rescued corals from various reported and unreported grounding throughout the park. We do not purposely collect coral of any kind to populate the nursery. We rescue only those coral that have been damaged or dislodged by some of physical or hydraulic impact.

There are currently over 400 colonies in culture in our nurseries and we would like to increase that number to 3000 and the distribution of species in the nursery reflect that found on the natural reef. However, there are no colonies of *Acropora cervicornis* or *A. palmata,* the two main reef building coral in the park. Like other coral grounding programs throughout the Keys and the Caribbean, larger corals are stabilized by reattachment at the site. The smaller fragments, those that are generally thought to be too small (generally less than 4 inches) to survive the rigors of the natural reef system are rescued and stabilized in a triage facility on the mainland (currently the University of Miami Experimental Hatchery). After a short period of stabilization, they are reshaped (cut into roughly one-inch rectangular fragments) and mounted on growth stakes and, again, allowed to stabilize for another month or two. During this stage of our protocol, the mounted coral fragments are uniquely identified by placing a passive inductive transponder (PIT) tag that produces a unique 15-digit number in the mounting stake. After the second stabilization period they are relocated in one of four coral field nurseries in the park for final grow out. Throughout the whole process (collection to placement in the field nurseries), we have less than a 5% mortality.

A subset of the coral colonies will occasionally be sampled by staff at the U of Miami Experimental Hatchery to provide a legitimate source of coral colonies to be cultivated and further subdivided, under highly controlled conditions, and made available to the coral based research community in the United States.

The nursery activities at the park have a significant management implication for Biscayne National Park, the neighboring Florida Keys National Marine Sanctuary, and the John Pennekamp Coral Reef State Park as the nurseries provide a nondestructive source of a spectrum of coral species common to and from the Florida Key coral Reef ecosystem. Further through the development of a large stand of cultured corals and the extraction of a small portion of the development of experimental coral colonies eliminating the need to collect wild colonies for the study of diseases and other factors that affect the health and survival of coral through out Florida and the world.

Biscayne Learning Center: Shark Program

Program Goal:

The South Florida Student Shark Program (SFSSP) is a collaborative, multi-disciplinary research and education program. Graduate, undergraduate as well as high school students are trained in marine science field sampling techniques, as well as research protocol, data synthesis and reporting. The SFSSP supports student career development in a variety of natural science disciplines, focusing on the study and conservation of coastal Floridian shark species through service learning, education and research.

Research Objectives:

Research will be conducted from the **Biscayne Learning Center** and specific research objectives include: (1) determining the relative abundances, growth rates, and sex ratios of coastal shark species; (2) determining the presence and concentrations of mercury toxicity in coastal sharks; (3) delineating areas important for shark congregation, foraging, migration, and parturition as well as areas where sharks are susceptible to fishing exploitation.

Activities:

Using the **Biscayne Learning Center** as a base, students will conduct field trips via boat in Biscayne National Park to study sharks. Students will have the opportunity to catch sharks using different gears and sample them. All sharks will be identified, measured, sexed, tissue sampled, tagged and then released. Associated laboratory work as well as lectures on various topics in shark biology will take place on the **Biscayne Learning Center.**