

## **NOAA Research and Monitoring Plan in support of the Virginia Key Coastal and Marine Habitat Restoration project**

The Virginia Key Coastal and Marine Habitat Restoration project is focused on several projects on and around Virginia Key, FL the following components describe a prototype coastal marine sampling program that would encompass the entire perimeter of Virginia Key, with special attention paid to key subregions of interest. The program, to be led by scientists from AOML's Physical Oceanography Division (PhOD), will consist of the full suite of physical oceanographic techniques (shipboard surveys, water samples, moored instrumentation, and satellite-tracked surface drifters) as well as information on ocean temperature and ocean color from remote sensing satellite imagery. In addition, scientists propose to monitor a number of important water quality parameters including microbiological indicators. Lastly, colleagues from SEFSC propose to monitor certain biological parameters related to zooplankton and juvenile fish trophodynamics and ichthyofaunal assemblages.

The results of this study will provide the first comprehensive interdisciplinary ecological and oceanographic depiction of the region, and will allow us to assess, in detail, the pre-, during, and post-Marine Habitat Restoration condition in the Virginia Key coastal waters. A brief synopsis of the four project components is given below.

### **1. Physical Oceanography and Remote Sensing - Characterizing the coastal and oceanic environment of Virginia Key, FL before, during, and after Habitat Restoration**

We propose to conduct monthly 1-day surveys aboard our small research catamaran to collect current, temperature, salinity, fluorometry and transmissometry data continuously along the cruise track shown in Figure 1 using shipboard-mounted instrumentation and a flow-through seawater system. The monthly cruises will also provide a platform for the net tow and fish survey techniques as required by the other project components. Trajectory data from satellite-tracked surface drifters will also be collected to assess tidal excursions and transport.

State-of-the-art satellite remote sensing technology and image processing techniques, in conjunction with ground-truth information from the monthly cruises and moored instrumentation, will provide a large-scale analysis of the regional temperature, ocean color, and turbidity variability. These aerial efforts will characterize and monitor the evolution of the coastal line, beaches, mangrove, vegetation, sea grass, sediments and other natural environment elements associated with the island, to provide a pre-, during, and post-Restoration detailed assessment.

### **2. Ocean Chemistry and Ecosystem Trophodynamics - Assessing the Ecological Response to Restoration of Virginia Key, FL**

Ecological measurements will be conducted to assess the ecology of the nearshore region. The emphasis will be to ensure that the nearshore region maintains or improves its current oligotrophic condition and suitable habitat for juvenile fish. These data will quantify changes between pre-restoration, during restoration, and post-restoration. A

coastal ecosystem with increased mangrove and seagrass habitat will ideally support increased upper trophic level productivity. Zooplankton will be collected monthly at both mangrove and seagrass sites to determine how the zooplankton community changes in response to restoration. Juvenile fish will be assessed using otter trawls over the seagrass beds and seine nets with visual surveys along the shoreline and at mangrove sites.

### **3. Molecular Microbial Water Quality Monitoring and Assessment of Mangrove Wetlands, Beach, and Coastal Environment of Historic Virginia Key, FL**

In support of the Virginia Key Coastal and Marine Habitat Restoration Project, the AOML Microbiology Lab will conduct microbial water quality assessment and microbial source tracking for the detection and characterization of fecal indicator bacteria, alternate indicators, and selected pathogens in both the mangrove and salt marsh wetlands area of Virginia Key Park, and the surrounding coastal environment. Interior wetlands and beach assessment will be conducted on a weekly basis for the period of the project, while coastal sampling will be conducted as part of the larger AOML monthly shipboard water quality monitoring program for this project.

With this microbial monitoring and assessment before, during, and after the habitat restoration activities, the efficacy and the impacts both on surrounding coastal ecosystem and local public health can be investigated. This work will be leveraged with our other ongoing collaborative research efforts on Virginia Key, including beach epidemiological studies, and long-term beach and water quality studies at Hobie Cat Beach.

### **4. Baseline Observations, Monitoring, and Assessment of Nearshore Ichthyofauna Assemblages surrounding Virginia Key, FL**

The SEFSC Early Life History (ELH) Laboratory will provide nearshore monitoring of the status and/or changes in the ichthyofauna around the coastal perimeter of Virginia Key, FL, in support of the Virginia Key Coastal and Marine Habitat Restoration project. Detailed ichthyological baseline surveys will be conducted to allow for comparisons over time of the pre-, during, and post habitat restoration changes along the shoreline of Virginia Key. The proposed SEFSC/ELH work will have two components: establishing a baseline chemical signature for otolith chemistry (lead, mercury, cadmium, barium, and aluminum); and monitoring ichthyofauna assemblages.

Microchemistry of otoliths, or calcium carbonate ear bones in fish, is a proven method for determining environmental conditions at early stage habitats of juvenile fishes. Trace elements and stable isotopes obtained from the otoliths of teleost fish have been well documented as useful tools for providing a wealth of information on changes occurring in the environment. Otoliths serve as permanent records of ambient water conditions as a result of particles becoming affixed once deposited onto the otolith when fishes drink water.

Sampling will commence at four stations, covering the entire perimeter of Virginia Key, with particular focus on sea grass bottom type. Juvenile fishes, which settle in these sea grasses, will be sampled once monthly through hook and line fishing.

Microchemistry will be conducted on the otoliths of samples and levels of heavy metals analyzed.

Nearshore ichthyofaunal surveys will be conducted via seining at four sites around Virginia Key – Hobie Beach, south of Rickenbacker Causeway, just off the main beach along the western shore, along the eastern shore, and on the backside of the Key just off the sewage treatment plant. The first site will serve as a “control” site associated with restoration activities, thus, data from both biological and physical parameters can be analyzed in conjunction with environmental conditions of the restoration project.

Each site will be continually monitored using three replicated seine samples every other month, before, during, and after major restoration activities. Each sample will be analyzed for 1) species abundances, 2) diversity of species, 3) size and age-classes, 4) changes over time, pre- and post-restoration, and 5) differences between sites with an emphasis on comparisons between the control site at Rickenbacker Causeway and the Virginia Key sites.

### **Economic Stimulation Benefits of the Project**

This project will help stimulate the economy by the employment of new personnel through the University of Miami Cooperative Institute of Marine and Atmospheric Studies (CIMAS), by supporting several undergraduate and graduate students, by educating and training volunteers, students, and participants in restoration-associated coastal marine survey sampling techniques, and through the purchase of project supplies and equipment.

### **Cost Sharing**

Considerable cost sharing for this project has been achieved by the contribution of all Federal salary costs including Principal Investigator (PI) salaries.

### **Budget (detailed breakdown available upon request)**

<b>Project Component</b>	<b>Salaries</b>	<b>Equipment/etc.</b>	<b>Total</b>
<b>1. PhOD</b>	129K	326K	455K
<b>2. OCD</b>	138K	101K	239K
<b>3. Microbiology</b>	80K	40K	120K
<b>4. SEFSC</b>	50K	14K	64K
<b>OVERALL TOTAL</b>	405K	481K	878K

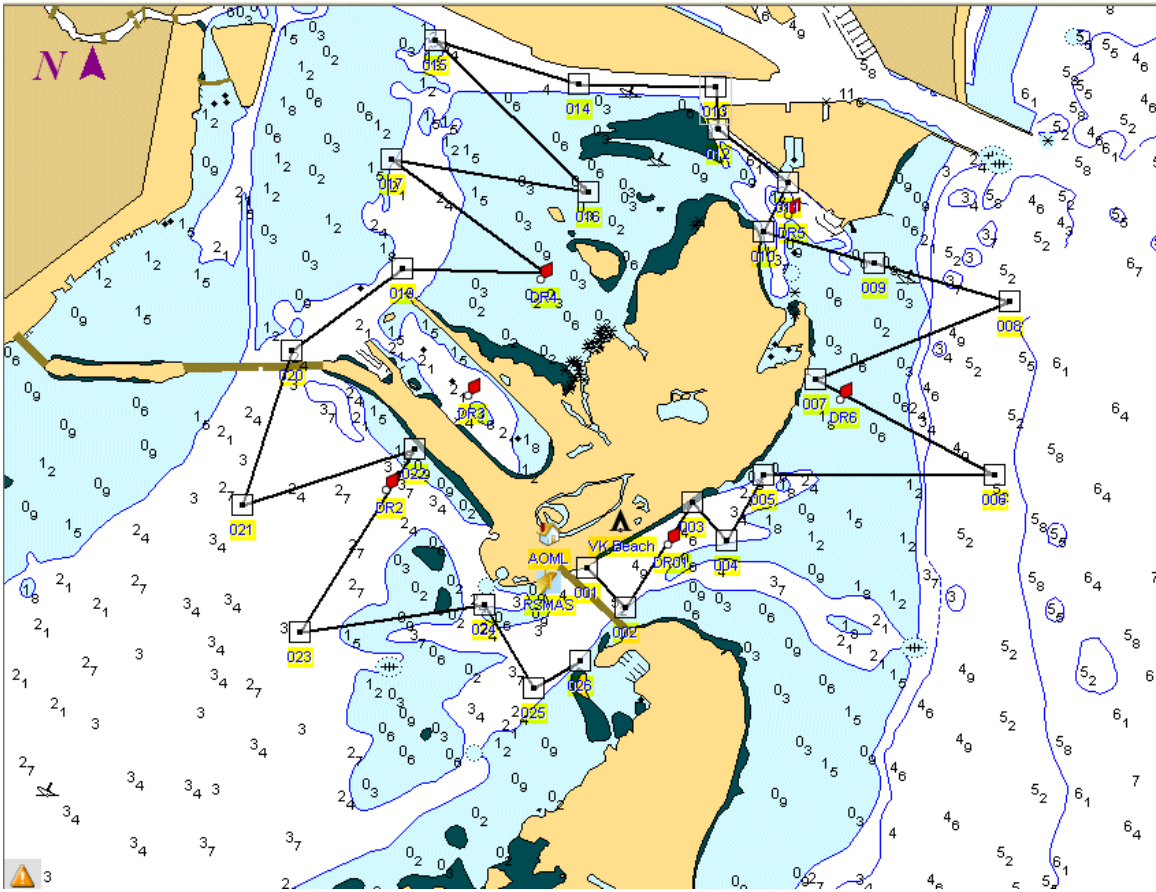


Figure 1. Virginia Key NOAA AOML/SEFSC shipboard sampling plan and nominal mooring locations.