Mapping the Oculina Bank Deep Coral Marine Protected Areas with Ne Undersea Technologies

Situation and Need

The Oculina Bank Habitat Area of Particular Concern (OHAPC) and the Oculina Experimental Closed Area (OECA) are marine protected areas (MPAs) designed to conserve deep coral habitat and fisheries in 70-110 meters of water off the east coast of Florida (Figure 1). Over the past thousand or more years, the ivory tree coral, Oculina varicosa, has built up coral mounds or bioherms, on limestone bedrock at the shelf edge; 100 km of these pinnacles, mounds, and ridges (5-35 m above bottom) from Fort Pierce to Cape Canaveral is the area covered by the Oculina Habitat Area of Particular Concern (OHAPC) (Figure 1). The mounds are overlain with living or dead coral, coral rubble, sand, or mud (Figure 2). Biodiversity of intact living Oculina colonies (thickets or heads) is similar to shallow tropical coral reefs and much greater than unconsolidated substrate (rubble, sand, shell, mud). Healthy, intact Oculina habitat also supports dense and diverse populations of fishes. Bank mounds are known breeding grounds for commercially exploited populations of gag and scamp grouper, nursery grounds for juvenile snowy grouper and speckled hind, and feeding grounds for many reef and pelagic fish species. Unfortunately, rock shrimp trawling and scallop dredging over the past three decades has destroyed most of the intact coral mounds on the Bank.

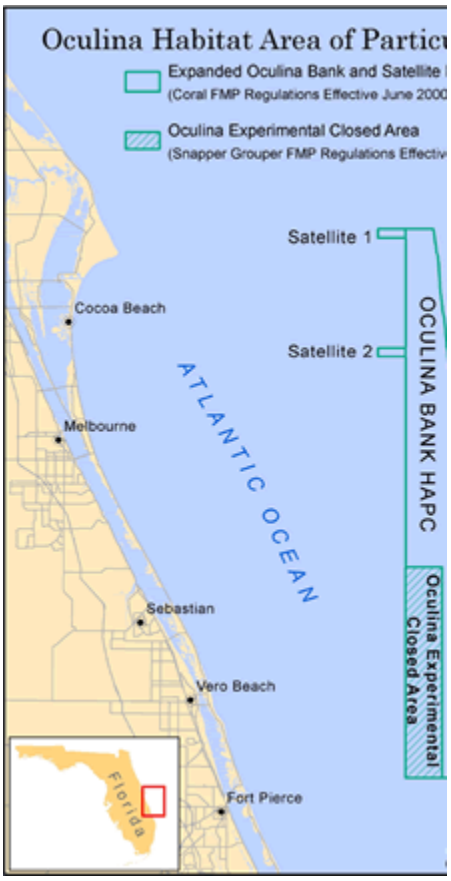

Figure 1: Oculina Bank off east coast of F of water from Fort Pierce to Cape Canave OECA noted. West boundary of OECA is 8 East boundary of OHAPC is 100 fm isobat boundary of OHAPC is 28-30N and south 30N.

Fisheries in federal waters off Florida are managed by the South Atlantic Fishery Management Council (SAFMC). The Magnuson-Stevens Act mandates the Council to identify essential fish habitat (EFH) and adverse impacts on EFH from fishing and non-fishing activities, in all their Fishery Management Areas of Particular Concern (HAPC) are EFH especially critical for fish reproduction and growth to maturity HAPC was the first coral HAPC in federal waters (first established in 1984 and expanded in 2000). The Ocu Experimental Closed Area (OECA, southern portion of OHAPC, Figure 1) was closed to harvest or possessi

snapper/grouper species in 1994, and was the first reef-fish Marine Protected Area in federal waters in the Amendment 13A to the Snapper/Grouper Fishery Management Plan requires review of the OECA boundari review of the research, outreach and law enforcement efforts supporting the OECA by 2014. Accurate map priority as identified in the draft OECA assessment, research and monitoring plan (download PDF).

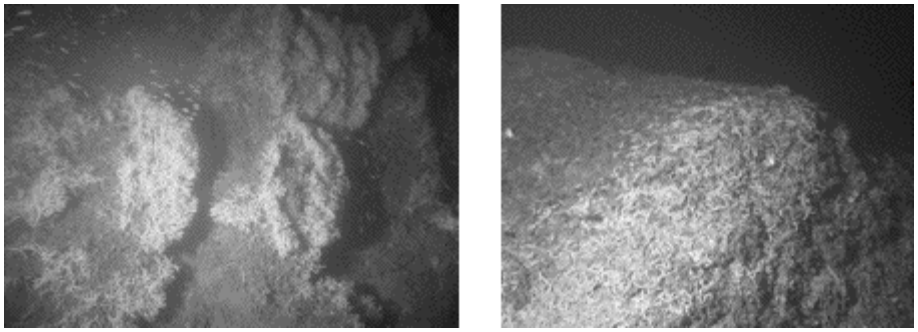

Figure 2: Left — Healthy Oculina bank at 80 m depth photographe submersible in 1984; Right — Fo healthy Oculina mound covered i rubble in 2001.

2006 AUV Survey Objectives

The OHAPC is rugged and deep (beyond normal scuba diving depths) and swept by the Gulf Stream west wall and its associated dynamics. Habitat mapping and reef fish assessment is ineffective using standard trawls and towed sonar equipment. Habitat maps include biotic (e.g., sessile epifauna) and abiotic (e.g., sand, rock, wreck) structure. Acoustic sonar mapping using multi-beam sonar systems (MBS) provides high resolution bathymetry (depth) and bottom hardness (backscatter or reflectance). However, as water deepens, resolution goes down due to signal attenuation or lower frequency of the sonar required to see the bottom. Even at best resolutions, acoustic data must be ground-truthed, visually or using bottom samples, in order to assess biota; flat rock bottom is less interesting to fish than a "live-bottom" covered in corals, hydroids, sponges or macro-algae. The only way to get higher resolution (greater than 1-2 m) below 100 m depth is to put the sonar closer to the bottom. As towed systems are less accurately positioned and controlled with respect to beam angles (pitch, heave, yaw), especially in high currents, the best solution is to put the MBS on an Autonomous Underwater Vehicle (AUV).

In 2002 and 2005, ship-board MBS surveys covered the majority of Oculina habitat in the OHAPC (Figure 3). In 2003 and 2005, ROV dives throughout the OHAPC (at sites inside and outside) provided video and still images in various habitat types. Results will be integrated in a Geographic Information System. As a result of the limitations of ship-board mapping, both the 2002 and 2005 surveys were cut off above 100 m depth, or roughly longitude 79-57.5W in the OECA (Figure 3). The 2006 survey will accomplish the following major objectives using the NURP Eagle Ray AUV as MBS platform (Figure 4):

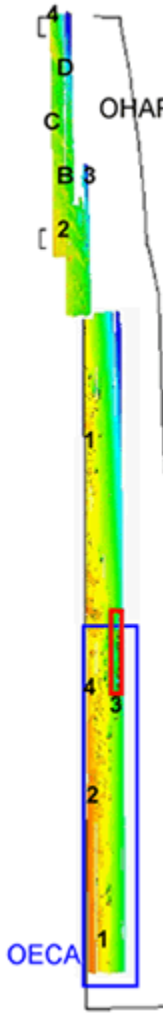

Figure 3: OHAPC, OECA, pr survey geotifs, and 2005 RO cruise will survey reef balls

- Provide open ocean testing of the new NURP AUV, within depths that can be covered by the NURC ROV in case of system failure; **unsurveyed portions of the**
- Image coral restoration modules in support of 2007 proposal to NURC for 2007 by Brooke et al.; and
- Complete mapping inside the OECA, from 79-56.0W to 79-57.5W, and from 27-33N to 27-53N.
- Ground-truth new acoustic survey using ROV video imagery.

Technologies

An Autonomous Undersea Vehicle (AUV) and remotely operated vehicle (ROV) will be deployed from the M or its sister ship Freedom Star, owned by NASA and operated by the United Space Alliance out Cape Cana ships are ideally suited for these operations due to their proximity to the survey area, and technical suppo (e.g., expert crew, dynamic positioning, ability to deploy AUV and ROV). NURC's Phantom SII (Figure 4), depth, color video camera and digital still camera; tethered to ship by umbilical; USA ships are particularly Positioning is ideal) and proven for difficult operations on the Bank); major tasks will be to serve as rescu AUV if required, and to ground-truth acoustic survey done by AUV. NURC's Eagle Ray AUV (Figure 4), 220 5 meters long, 920 kg in air; major payload is a 300 kHz multi-beam echosounder which produces a high- than 1m pixel) bathymetric and backscatter (seafloor reflectance) map. We will overcome the resolution li deep water, ship-board MBES surveys by putting the system closer to the bottom on the Eagle Ray AUV.

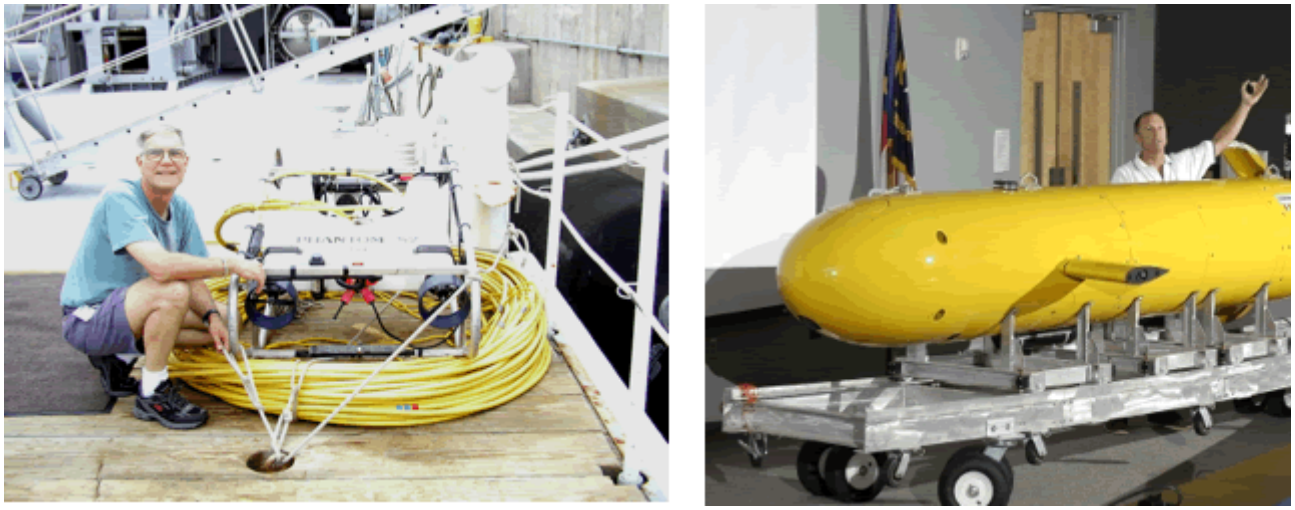

Figure 4: Major equipment to be used on 2006 cruise: Left — Phantom SII ROV on deck of Liberty Star; Right — Eagle Ra with multibeam echosounder.

Expected Outcomes

Expected benefits of this project include:

- Implementation of new cutting-edge technology for high-resolution habitat mapping off southeast U.S.;
- Improvement and/or maintenance of the health and sustainability of fish habitats in the South Atlantic
- Improved cooperation among academia, the SAFMC, industry, NOAA and NASA in the description of sei threatened coastal ocean resources and environments, as recommended by regional fishery and ecosys management plans.

Deliverables for the proposed activity, including but not limited to all GIS layers, map products, photograp
will be disseminated to a wide audience through the Council's Habitat and Ecosystem Homepage, which in
and Ecosystem Internet Mapping System