

HABITAT AND FAUNA OF DEEP-WATER CORAL REEFS OFF THE SOUTHEASTERN USA

**A Report to the South Atlantic Fishery Management Council
Addendum to 2004 Report
2005-2006 Update- East Florida Reefs**

by
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ABSTRACT

In 2004 a Summary Report (Reed 2004) was compiled by the PI at the request of the South Atlantic Fishery Management Council (SAFMC) to provide a preliminary, general summary on the status of current knowledge concerning deep-water (> 200 m) reefs off the southeastern U.S. from Florida to North Carolina. The purpose was to prioritize areas of deep-water, live-bottom habitats for: 1) potential designation as Habitat Areas of Particular Concern (HAPC) or Marine Protected Areas (MPA) by the SAFMC, and 2) high-resolution habitat maps and habitat characterization studies.

The following report is an update to the 2004 Report that provides new data collected from eight expeditions using submersible or ROV off eastern Florida during 2005 and 2006. Based on the 2004 Report and the data from this report that was presented by the PI to the Coral and Habitat Advisory Panels (SAFMC meeting, June 2006), the SAFMC has proposed six new deep-water reef HAPCs off southeastern US. The resource potential of the deep-water habitats in this region is unknown in terms of fisheries and novel compounds yet to be discovered from associated fauna that may be developed as pharmaceutical drugs. Activities involving bottom trawling, pipelines, or oil/gas production could negatively impact these reefs.

JUSTIFICATION

The South Atlantic Fishery Management Council (R. Pugliese) requested that this update to the 2004 Report on the state of knowledge of deep sea coral ecosystems (DSCE) off Florida be available in time for the Coral and Habitat Advisory Panels meeting of the SAFMC, June 9, 2006. The Council needs immediate scientific data and maps as it considers designation of new Habitat Areas of Particular Concern (HAPC) to protect DSCE areas. Such protection may be needed to prevent long-term (perhaps permanent) damage, such as has occurred on shallower *Oculina* reefs off Florida and *Lophelia* banks in the northeastern Atlantic, both destroyed in part by trawling. After trawlers were banned from the *Oculina* HAPC, there is justified concern that trawlers may move to deeper habitats in search of valuable commercial fisheries, such as royal red shrimp or benthic finfish. The resource potential of the deep-water habitats in this region is unknown in terms of fisheries and novel compounds yet to be discovered from associated fauna that may be developed as pharmaceutical drugs. Although these habitats are not currently designated as MPAs or HAPCs, they are incredibly diverse and irreplaceable resources. Activities involving bottom trawling, pipelines, or oil/gas production could negatively impact these reefs.

OBJECTIVES

Objectives of this report and accompanying DVD are the following:

- 1) Compile a list of research cruises that explored the deep-water reefs off eastern Florida from 2005 to 2006.
- 2) Compile list of submersible dives, including dive number, date, location, GPS coordinates, depth, and habitat type for each dive (DVD- Excel file).

- 3) Provide Powerpoint presentation of this report, including insitu digital still images and video of newly discovered bottom habitat, that was presented to the Coral and Habitat Advisory Panels meeting of the SAFMC, June 9, 2006 (DVD- ppt file).
- 4) Provide Cruise Report from the following expedition: Florida's Deep-Water Oases: Exploration of Deep Reef Ecosystems, May 31- June 9, 2006 (DVD- ppt file). This expedition provided for the first time an assessment of the biodiversity and relative abundance of the benthic, fish and zooplankton communities; geological features; physical processes; and biochemical compounds of interest for drug discovery within a deep-water reef ecosystem.

INTRODUCTION

Deep-Sea Coral Reefs (from Reed, 2004)

Deep-water reefs are sometimes defined as bioherms, coral banks, or lithoherms (Teichert, 1958; Stetson et al., 1962; Neumann et al., 1977; Wilson, 1979; Reed, 1980; Freiwald et al. 1997; Fosså et al. 2000; Paull et al., 2000). Some deep-water reefs consist of caps of living coral on mounds of unconsolidated mud and coral debris, such as some *Oculina* and *Lophelia* coral reefs (Reed 2002a,b; Reed et al. 2005, 2006), whereas deep-water lithoherms are defined as high-relief, lithified carbonate limestone mounds rather than unconsolidated mud mounds (Neumann et al., 1977). Rogers (1999) has suggested that deep-water coral bioherms fall within the definition of a coral reef based on their physical and biological characteristics. Various types of deep-water, high-relief bioherms are common off the southeastern United States, along the base of the Florida-Hatteras Slope, on the Blake Plateau, in the Straits of Florida, and eastern Gulf of Mexico (Reed et al., 2005, 2006). Only a small percentage of deep-water reefs have had their benthic and fish resources characterized.

Florida DSCE

Deep sea coral ecosystems (DSCE) in U.S. EEZ waters exist along the eastern and southwest Florida shelf slope (in addition to the *Oculina* Marine Protected Area and deep shelf-edge reefs with hermatypic coral). These include a variety of high-relief, hard-bottom, live-bottom habitats at numerous sites along the base of the Florida-Hatteras Slope off northeastern and central eastern Florida, the Straits of Florida, the Miami Terrace and Pourtales Terrace off southeastern Florida, and the southwestern Florida shelf slope. The predominate coral on these reefs are the azooxanthellate, colonial scleractinian corals, *Lophelia pertusa*, *Madrepora oculata*, and *Enallopsammia profunda*; various species of hydrocorals of the family Stylasteridae, and species of the bamboo octocoral of the family Isididae. Various types of high-relief, live-bottom habitat have been discovered in the area: *Lophelia* mud mounds, lithoherms, sinkholes, ancient Miocene escarpments and karst topographic features (Reed 2002b; Reed et al., 2004a,b, 2005, 2006). These all provide hard-bottom substrate and habitat for sessile macrofauna including deep-water corals, octocorals (gorgonians), black coral, and sponges, which in turn provide habitat and living space for a relatively unknown but biologically rich and diverse community of associated fish, crustaceans, mollusks, echinoderms, polychaete and sipunculan worms, and other macrofauna, many of which are undoubtedly undescribed species.

Recent research expeditions by Principal Investigator (PI), J. Reed, Harbor Branch Oceanographic Institution (HBOI), using HOVs (human occupied vehicle) and ROVs (remotely

operated vehicle) along with previous research by the PI in the 1990s and 1980s, have compiled new information on the status, distribution, habitat, and biodiversity of some of these relatively unknown and newly discovered deep reef ecosystems. In 2004, during a State of Florida funded mission with the *Johnson-Sea-Link (JSL)* Submersible, the PI discovered nearly 300 potential targets during echosounder transects that may be newly discovered deep-water reefs off the east coast of Florida, some of which are up to 168 m (550 feet) in height at depths of 732 m (2400 feet) (Reed and Wright, 2004; Reed et al., 2004b, 2005, 2006). Expeditions in 2002 and 2003 for biomedical research by the PI and funded by the National Oceanic and Atmospheric Administration's Office of Ocean Exploration (NOAA OE) enabled preliminary exploration of additional deep-water reef sites in the western Atlantic (Blake Plateau) and eastern Gulf of Mexico on southwest Florida shelf slope (Reed, 2003, 2004; Reed and Pomponi, 2002b; Reed et al., 2002, 2003, 2004d, 2006). These were the first HOV and ROV dives ever to document the habitat and benthic biodiversity of some of these relatively unknown deep-water reefs.

This report provides new information based on eight expeditions on deep-water reefs off eastern Florida and Straits of Florida using submersible or ROV during 2005 and 2006.

RESULTS

Cruise Summaries

The following summarizes all expeditions that explored deep-water reefs off eastern Florida during 2005 and 2006.

- 1) Title: Florida's Deep-Water Oases: Exploration of Deep Reef Ecosystems
Institution: Harbor Branch Oceanographic Institution (HBOI), Division of Biomedical Marine Research (DBMR)
Principal Investigators: John Reed, Amy Wright (HBOI)
Ship/Submersible: R/V *Seward Johnson*, *Johnson-Sea-Link I* submersible
Dates: April 4-15, 2005
Location: Bahamas- Bimini, Cay Sal; Florida- Miami Terrace
Number of submersible dives: 18
New reef sites discovered: 2 new reef sites ground truthed w/ sub

- 2) Title: Center of Excellence for Biotechnology and Marine Biomedical Research- Exploration of Deep Reef Ecosystems
Institutions: Harbor Branch Oceanographic Institution (HBOI), Division of Biomedical Marine Research (DBMR); Florida Atlantic University, Center of Excellence for Biotechnology and Marine Biomedical Research
Principal Investigators: John Reed, Amy Wright, Shirley Pomponi (HBOI); Russ Kerr, Frank Mari (FAU)
Ship/Submersible: R/V *Seward Johnson*, *Johnson-Sea-Link I* submersible
Dates: August 2-16, 2005
Location: Miami Terrace, Straits of Florida
Number of submersible dives: 27
New reef sites discovered: 9 new reef sites ground truthed w/ sub

- 3) Title: Florida's Deep-Water Oases: Exploration of Deep Reef Ecosystems
Institutions: Harbor Branch Oceanographic Institution (HBOI), Division of Biomedical Marine Research (DBMR); Oregon Institute of Marine Biology, NOVA Southeastern University, Smithsonian Institution, NOAA Office of Ocean Exploration (funding agency)
Principal Investigators: Sandra Brooke (OIMB), John Reed (HBOI), Charles Messing (NOVA)
Ship/Submersible: R/V *Seward Johnson*, *Johnson-Sea-Link I* submersible
Dates: Nov. 7-20, 2005
Location: Florida *Lophelia* Reefs, Miami and Pourtales Terrace
Number of submersible dives: 14
New reef sites discovered: 8 new reef sites ground truthed w/ sub; 31 new potential targets from echosounder

- 4) Title: Seafarer Proposed Natural Gas Pipeline Route Deep-Water Survey
Institutions: Harbor Branch Oceanographic Institution (HBOI), ENSR Corp.
Principal Investigator: John Reed (HBOI)
Ship/Submersible: R/V *Seward Johnson*, *Johnson-Sea-Link I* submersible
Dates: February 28- March 7, 2006
Location: Florida *Lophelia* Reefs, Straits of Florida
Number of submersible dives: 9
New reef sites discovered: 1 new reef site ground truthed w/ sub; 18 nm ground truthed w/ sub

- 5) Title: Calypso Proposed Natural Gas Deep-Water Port Site Survey
Institutions: NOVA Southeastern University, Harbor Branch Oceanographic Institution (HBOI), Florida Fish and Wildlife Research Institute, Naval Surface Warfare Center, Suez Inc.
Principal Investigator: Charles Messing (NOVA), John Reed (HBOI), Sandra Brooke (FWRI)
Ship/Submersible: R/V *Walton Smith*, TONGS ROV
Dates: April 15-18, 2006
Location: Miami Terrace, Straits of Florida
Number of ROV dives: 15 transect legs
New reef sites discovered: 24² nm ground truthed w/ ROV; 36 reef/hard bottom sites recorded

- 6) Title: Calypso Proposed Natural Gas Pipeline Route Deep-Water Survey
Institutions: NOVA Southeastern University, Harbor Branch Oceanographic Institution (HBOI), Naval Surface Warfare Center, Suez Inc.
Principal Investigator: Charles Messing (NOVA), John Reed (HBOI)
Ship/Submersible: R/V *Walton Smith*, TONGS ROV
Dates: May 11-15, 2006
Location: Miami Terrace, Straits of Florida

Number of ROV dives: 15 transect legs

New reef sites discovered: 50 nm ground truthed w/ ROV; 51 reef/hard bottom sites recorded

- 7) Title: Florida's Deep-Water Oases: Exploration of Deep Reef Ecosystems
Institution: Harbor Branch Oceanographic Institution (HBOI), Division of Biomedical Marine Research (DBMR); University of Miami, RSMAS
Principal Investigators: John Reed, Shirley Pomponi, Amy Wright (HBOI); Mark Grasmueck, Gregor Eberli (UM)
Ship/Submersible: R/V *Seward Johnson*, *Johnson-Sea-Link II* submersible
Dates: May 22-30, 2006
Location: Bahamas- Bimini, Lucaya; Florida- Miami Terrace
Number of submersible dives: 12
New reef sites discovered: 9 new reef sites ground truthed w/ sub; four 2x2 nm high def multibeam maps groundtruthed
- 8) Title: Florida's Deep-Water Oases: Exploration of Deep Reef Ecosystems
Institution: Harbor Branch Oceanographic Institution (HBOI), Division of Biomedical Marine Research (DBMR); University of Miami, RSMAS; Florida Fish and Wildlife Research Institute; NOVA Southeastern University; University of Florida
Principal Investigators: John Reed, Tracey Sutton, Tammy Frank, Marsh Youngbluth (HBOI); Charles Messing (NOVA); Chuck Jacoby (UF); Robert Ginsburg, Chris Langdon (UM); Tina Udouj (FWRI)
Ship/Submersible: R/V *Seward Johnson*, *Johnson-Sea-Link II* submersible
Dates: May 31- June 9, 2006
Location: Miami Terrace, Straits of Florida
Number of submersible dives: 16
New reef sites discovered: 2 reef sites ground truthed w/ sub. Detailed ecological assessment of the biodiversity and relative abundance of the benthic, fish and zooplankton communities; geological features; physical processes within this ecosystem; and biochemical compounds of interest for drug discovery.

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