

**SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL
CORAL REEF CONSERVATION
PROPOSAL NARRATIVE
FY 2014 – FY 2016**

The following activities will provide essential tools for the conservation and management of the South Atlantic coral resources under the SAFMC’s Coral, Coral Reef and Live/Hard bottom Habitat Fishery Management Plan (Coral FMP). The proposed work conforms to the “Coral Reef National Action Strategy” and the “National Action Plan to Conserve Coral Reefs.” The proposed work is consistent with ongoing and proposed NOAA mapping, monitoring, and management initiatives and state and territorial coral reef conservation.

A. INTRODUCTION

The South Atlantic Fishery Management Council (SAFMC) is mandated to conserve and manage fishery resources and protect essential fish habitat including coral, coral reefs and live/hardbottom habitat. This is accomplished through two avenues, as specified by the Magnuson-Stevens Act. The first is through regulation of fisheries to protect coral habitat from the direct or indirect impacts of fishing. The second is through collaborating on essential fish habitat consultations with NOAA Fisheries’ Southeast Regional Office Habitat Conservation Division on non-fishing projects or policies that may impact essential coral habitat.

With implementation of the Coral FMP and subsequent amendments, the SAFMC has protected these resources in the South Atlantic region by establishing an optimum yield of zero and prohibiting all harvest or possession of coral, seafans, coral reefs, and live rock which serve as essential fish habitat to many other managed species under the SAFMC’s jurisdiction. In addition, Coral Habitat Areas of Particular Concern (CHAPCs), (the Oculina Bank and five deepwater coral areas), have been designated in the South Atlantic. Within these areas, the use of damaging fishing gear, including trawl gear, traps, dredges, and bottom longlines is prohibited. Anchoring and the use of grapples by all fishing vessels are prohibited within these areas. Recently, the SAFMC has approved management measures through Coral Amendment 8 expanding several of the CHAPCs based on research observations of deepwater coral resources outside of and adjacent to several of the CHAPC boundaries in the South Atlantic. In addition, regulations to limit take of allowable octocorals and a permitting system for live rock aquaculture have been in place since 1995. The SAFMC has established 8 deepwater Marine Protected Areas (MPAs) through Amendment 14 to the Snapper Grouper FMP to protect areas of known importance to deepwater snapper grouper species. Within the MPAs, bottom fishing for snapper grouper species is prohibited. Currently, the SAFMC is developing Snapper Grouper Regulatory Amendment 17, which considers alternatives for MPAs (including re-orientation of existing MPAs and options for new MPAs) that would help diminish bycatch of speckled hind and warsaw grouper.

Gear prohibitions are also in place in the South Atlantic region to protect habitat, including coral: bottom longlines in the exclusive economic zone (EEZ) inside of 50 fathoms or anywhere south

of St. Lucie Inlet, Florida; fish traps, bottom tending (roller-rig) trawls on live bottom habitat, and entanglement gear.

Also established through Snapper Grouper Amendment 13A is the Oculina Experimental Closed Area (OECA) where the harvest or possession of all species in the snapper grouper complex is prohibited in order to provide continued protection for deepwater snapper grouper species. The SAFMC is working with the OECA Evaluation Team to develop determinations based on fulfillment of law enforcement, research and monitoring, and outreach objectives on whether or not it is necessary to change the size and configuration of the OECA as well as gear restrictions currently in place.

Projects included in this proposal will directly address management needs for the SAFMC's managed areas. Multibeam mapping, habitat characterization and monitoring of reef fish populations within the OECA and the deepwater MPAs are essential. For the OECA, this data and information is essential as the SAFMC re-initiates discussion of the effectiveness of the regulations in this area. The Southeast Fisheries Science Center has been conducting Remotely Operated Vehicle (ROV) surveys in the MPAs to characterize the habitat and assess reef fish usage since before the closures became effective in 2009. It is critical that this work continue for a number of years in order to obtain enough data to assess the effectiveness of MPAs, as well as OECA, as a management tool.

In addition to providing more information to effectively manage closed areas, the activities included in this proposal will support the SAFMC's management efforts with additional information pertaining to corals, coral reefs and live/hardbottom habitat. Further, the projects will provide tools to enhance the SAFMC's ability to effectively conserve and manage coral and dependent fishery resources in the region and minimize the impact of fishing and non-fishing activities on these essential habitats.

B. PROGRAMMATIC ACTIVITIES, STATEMENT OF WORK

A South Atlantic Fishery Management Council (SAFMC) Fishery Biologist will continue to be funded to provide technical support for the SAFMC's coral conservation and management activities. This individual will continue to provide enhanced coordination with State and Federal partners in the region.

The position will continue to represent a coral/habitat fisheries scientist for the SAFMC under the supervision of the Deputy Executive Director. The scope of work for this programmatic position will be consistent throughout each funded year.

The SAFMC fishery biologist will continue to assist in the formulation and development and technical review/revision of the coral, habitat and other associated sections of fishery management plans (FMPs), amendments and related documents.

The fishery biologist will continue to be the SAFMC lead on the Interagency Planning Team (IPT) tasked with developing a Comprehensive Ecosystem-Based Amendment to amend Council FMPs as needed under the SAFMC's ecosystem-based management approach. The fishery

biologist will continue to develop Amendments to the Coral Fishery Management Plan as management measures are warranted in the South Atlantic. The fishery biologist will continue to work as the staff contact with the Council's Coral AP, and also the Shrimp and Deepwater Shrimp APs on management issues associated with the coral, coral reefs and live/hardbottom habitat.

The fishery biologist will plan and coordinate meetings of the SAFMC's Coral, Shrimp and Deepwater Shrimp APs as needed, and AP reports will be developed following each meeting (held annually or semiannually as necessary).

The fishery biologist will compile and analyze biological or other technical data related to the SAFMC's management of coral and coral reef resources as needed.

The fishery biologist is responsible for assisting in the acquisition, compilation and review of technical resource data needed to meet the SAFMC's mandates relative to essential fish habitat (EFH) and HAPCs as they relate to coral. The fishery biologist will coordinate with SAFMC advisors and other partners in the region to propose new EFH and HAPC designations, as needed, and will assist in developing research, enforcement and outreach recommendations for existing HAPCs.

The fishery biologist will continue coordination with the Habitat Conservation Division of the NMFS to review proposed activities and comment on non-fishing projects that have the potential to impact EFH and EFH-HAPCs encompassing coral resources. The fishery biologist will continue to be instrumental in development of comment letters on proposed non-fishing activities that have potential impacts within affected Coral HAPCs.

The fishery biologist will continue to collaborate with NOAA's Deep Sea Coral Research and Technology Program to ensure program awareness of SAFMC management actions. The fishery biologist will provide management updates and disseminate information (presentations, meetings, workshops) etc. as needed.

The fishery biologist will assist in coordination and development of the re-evaluation plan for the Oculina Experimental Closed Area (OECA) as identified in Snapper Grouper Amendment 13A. Based upon guidelines identified in Amendment 13A, a re-evaluation of the effectiveness of the management measures in place in the OECA is due to the Council in 2014. The goals identified for this evaluation include an assessment of monitoring, research, outreach and enforcement projects and initiatives associated with the OECA. The fishery biologist will coordinate development of an OECA Evaluation Team via in-person meetings and/or webinars to provide recommendations to the SAFMC on the effectiveness of management measures in place within this area.

During FY 2014, the fishery biologist will plan, develop and prepare proposals to request programmatic funding in support of the SAFMC's coral and habitat related activities. The fishery biologist will prepare requests for proposals (RFP) for coral-related projects and evaluate proposals in response to contract bids, providing recommendations for funding.

The fishery biologist will serve as the Coral Contract Officer coordinating and monitoring SAFMC contracts with governmental agencies, universities, fishermen and others. The fishery biologist will oversee contracts established through this award, keep track of progress reports and prepare semi-annual reports for submission to the Coral Reef Conservation Program. Providing quarterly updates on Project #1 (Oculina Experimental Closed Area and South Atlantic MPAs) during SAFMC meetings will also ensure that Council members are informed of the progress and accomplishments of the project included under the CRCP Cooperative Agreement grant. The fishery biologist will provide a yearly report to CRCP outlining the status of the project included under the CRCP Cooperative Agreement grant, including milestones accomplished and next steps project personnel will be working towards during the upcoming FY. The fishery biologist is involved in all aspects of the field work reporting and development of quarterly and final report submissions to SAFMC. Project field research biologists communicate regularly with the SAFMC fishery biologist.

The fishery biologist will be a part of the Interagency Planning Team (IPT) developing Snapper Grouper Regulatory Amendment 17. Council staff coordinate IPT calls with the Southeast Regional Office staff, work with the SAFMC's Scientific and Statistical Committee and Advisory Panels to facilitate input in development of the amendment.

The fishery biologist will be responsive to the CRCP needs as they arise and participate in activities when appropriate, particularly when South Atlantic regional representation and input is warranted.

Proposed duration of study is anticipated for FY 2014-2016: October 1, 2014 – September 30, 2017 (dependent on when the funds are received by the SAFMC).

The SAFMC understands that out year funds are based on 1) the Coral Reef Conservation Program appropriations staying relatively the same or increasing and 2) our performance of implementing the prior year's activities.

C. PROJECTS

Project #1: South Atlantic Oculina Experimental Closed Area and Deep-Water Marine Protected Areas: Characterization of Benthic Habitat and Fauna NOAA CRG 2014-16

Linkages:

This project is in direct support of Fishery Management Council activities associated with the characterization of protected deep-water coral ecosystems and the efficacy testing of existing protected areas. It addresses the following objectives identified in the 2005 Oculina Experimental Closed Area Evaluation Plan: 1. Identify OECA fish population demographics, 2. Characterize major fishery species within the OECA compared to reference sites, 3. Complete high definition bathymetric mapping within the OECA, and 4. Complete habitat characterization within the OECA. The project also addresses the following CRCP National Goals and Objectives: 1. Obtain ecological information for coral reef fishes and spawning aggregations: Activities may include: a) Studies that identify, map and characterize fisheries habitat (including

essential fish habitat, habitat areas of particular concern, and spawning aggregation sites) in U.S. coral reef ecosystems, and assess the condition of the habitat; b) Studies associated with coral reef areas that are currently, permanently, or seasonally closed to fishing, or that may merit inclusion in an expanded network of no-take ecological reserves; and c) Multi-beam or sidescan sonar mapping and ground truthing, habitat characterization, and monitoring of such areas, including deeper coral reefs, bands and beds.

Project Summary:

The Oculina Experimental Closed Area (OECA) was established in 1994 and closed the area to all bottom fishing in order to evaluate the effectiveness of the reserve for management and conservation of snapper grouper populations. The OECA is located within the Oculina Bank Habitat Area of Particular Concern (HAPC) which was established in 1984 when the significance and value of *Oculina varicosa* to important fishery species was recognized by the SAFMC. As part of the OECA Evaluation Plan, a re-evaluation of the area is set to be completed in 2014.

In 2009, the SAFMC established eight MPAs ranging from North Carolina to the Florida Keys. The proposed study is a continuation of a monitoring program of five of these MPAs which began five years prior to the closures. The MPAs were implemented to protect five species of grouper and two species of tilefish, all of which are long-lived, late-maturing species. These life history characteristics suggest it will take several years to detect population-level changes in abundance of these target species. Thus far, four years of pre-closure and four years of post-closure data have been collected (surveys in 2005 and 2011 were not conducted due to weather and funding issues respectively). Funding of the proposed study would extend the surveys to a point at which the first year classes born in the absence of fishing pressure would begin to reach maturity. An unfished population is valuable for determining the natural density of these species in the MPAs. This survey is the most comprehensive, long term and geographically dispersed of any in these MPAs, and as such the SAFMC has placed high emphasis on the survey to provide the most detailed information on these areas.

This project proposes to continue annual monitoring of five of the eight deepwater MPAs to examine closure effectiveness by conducting remotely operated vehicle (ROV) dives inside and adjacent to the protected areas. Additionally, the project proposes to complete multibeam mapping and also continue habitat characterization and monitoring of reef fish populations through ROV dives inside the OECA. Digital video and still images collected with the ROV will result in a full, detailed analysis of fish assemblages, macro-benthos, and habitat inside the OECA and inside the MPAs as well as in neighboring areas that are open to fishing. For each year of this study, the abundance and distribution of economically important reef fish species and macro-benthos will be determined inside the OECA as well as in and around the MPAs in the U.S. South Atlantic. Percent cover of habitat types will be calculated, and habitat and fishery data will be correlated. Multibeam mapping has also become a priority over the past couple of years and has proven crucial for locating target habitats to examine with the ROV.

Partners:

PIs for this project are from NOAA/NMFS/SEFSC and HBOI/FAU. The ROV and pilots are from the University of North Carolina at Wilmington's Underwater Vehicles Program

(UNCW/UVP), and multibeam mapping expertise has come primarily from NOAA's National Ocean Service - National Centers for Coastal Ocean Science (NOS/NCCOS).

Expected outcomes and performance evaluation:

During each year of the project, semi-annual progress reports will be submitted to the SAFMC as well as a final report including a detailed analysis of fish assemblages, macro-benthos, and habitat of each year's ROV dives as well as processed multibeam mapping data from the OECA and MPAs. Results from this OECA and MPA monitoring survey will be used by the SAFMC to evaluate efficacy of these protected areas as well as aid in decisions made on future sites. Project P.I.'s will also be available for presentation(s) during SAFMC meetings to ensure project information dissemination occurs during appropriate SAFMC Committee agenda discussions.

Task Description and Methodology:

The SAFMC has a mandate through Amendment 13A to the Snapper-Grouper Fishery Management Plan to provide a re-evaluation of the OECA in order to determine if the regulations have been successful and to determine if changes are needed in size, configuration, and gear restrictions for the area. A portion of the Oculina Bank known as the Oculina Habitat Area of Particular Concern (HAPC) first received protection in 1984 when the significance and value of *Oculina varicosa* to important fishery species was recognized by the SAFMC. The OECA was then established in 1994 in response to rapidly diminishing grouper populations (**Figure 2**). This closed the area to all bottom fishing in order to evaluate the effectiveness of the reserve for management and conservation of snapper grouper populations. Previous ROV dives have been completed in the OECA in 2003, 2005, and most recently in 2011 which will be used to compare past and present fish and macro-benthos populations from dives in 2015-2017. Additionally, *Oculina varicosa* mounds recently discovered by PIs David and Reed in 2011 lie in the area between the North Florida MPA and the Oculina Bank HAPC which will be incorporated into this project if time allows.

The SAFMC implemented eight Type II MPAs between Cape Hatteras, NC and the Florida Keys to protect seven species of the deepwater snapper-grouper complex in February 2009 (**Figure 1**). The closures, however, will provide ecosystem-level benefits to the entire complex as well as protect the shelf-edge reef habitat these species utilize. The targeted species consist of five species of grouper: snowy grouper (*Hyporthodus niveatus*), yellowedge grouper (*H. flavolimbatus*), warsaw grouper (*H. nigritus*), speckled hind (*Epinephelus drummondhayi*), and misty grouper (*H. mystacinus*); and two species of tilefish: golden tilefish (*Lopholatilus chamaeleonticeps*) and blueline tilefish (*Caulolatilus microps*). These species are considered to be at risk due to currently low stock densities and/or life history characteristics which make them vulnerable to fishing mortality. Based on the most recent stock assessments, one of these are considered to be overfished, snowy grouper, and two are undergoing overfishing, warsaw grouper and speckled hind (SEDAR 04, 2004). Yellowedge grouper and tilefish (SEDAR 25, 2011) are not considered overfished, and the status of misty grouper is unknown at this time. A stock assessment for blueline tilefish was recently completed and indicated they are overfished and undergoing overfishing (SEDAR 32, 2013). An updated stock assessment for snowy grouper is currently on-going. Life history characteristics of several of the targeted species make them more vulnerable to overfishing. Many are protogynous hermaphrodites with highly female-skewed sex ratios, even in unfished populations. Aggregate spawning with strong

interannual site fidelity is also common, offering knowledgeable fishermen the possibility to harvest large numbers of reproductively active fish in a short period of time. Dominant males aggressively defend these spawning aggregation sites and are more easily caught than during non-spawning periods, leading to further skewing of the sex ratios and localized reproductive failure (Gilmore and Jones, 1992; Coleman et al., 1996). Bottom-tending fishing gear has been shown to have deleterious effects upon reefs and is now prohibited in the MPAs.

These sites are the first MPAs designated by the Council to protect spawning grounds of reef fish. As such, decisions to create future area closures will be based upon the efficacy of these areas and the lessons learned during their implementation. Additionally, the MPAs contain extensive areas infested with the invasive lionfish (*Pterois volitans/miles*), whose population continues to rapidly expand (Whitfield et al, 2007). Future monitoring will assist in evaluating the ecosystem effects of this invasion. Area closures constitute a politically charged issue that is unlikely to retain support without evidence indicating increases in the target species. Knowledge gained and information disseminated by projects such as this one will educate the public and inform managers about the usefulness of closed areas as a management tool. This project will also benefit coral reef ecosystems directly by improving our understanding of the impact of fishing activities on both vertebrate and invertebrate species.

The proposed monitoring program for the MPAs will ensure the Council remains well informed of changes within reef fish populations and coral habitats associated with these MPAs. NOAA Fisheries conducted pre-closure examinations of five of these potential MPA sites in April-May 2004, June 2006, August 2007, and July 2008. Post-closure data were collected in November 2009, May 2010, July 2012, and July 2013. This situation afforded the opportunity to obviate the criticisms of comparing MPAs with concurrent surveys of analogous, adjacent open-to-fishing areas by examining the future MPA sites for four years prior to the closures. Since monitoring began in 2004, this project has produced population density estimates of targeted reef fish species within the boundaries of five of the eight MPAs and adjacent control areas, before and after closure. Three of the MPA sites have not been included in this survey thus far, one artificial reef site off Charleston, SC and two natural bottom sites off southern Florida. The artificial reef site was excluded because the project focused on fish-habitat relationships in natural areas and because no structures were placed on the bottom until 2013. The south Florida sites were excluded for logistical reasons related to their remoteness from the remaining five natural habitat sites in the South Atlantic Bight. The artificial reef site off Charleston, SC will have structure on it by the time funding for this proposal would begin, so it will be included in the ROV surveys to examine reef fish and invertebrate colonization. Time series data provided by this project allows detection of trends in reef fish populations in these MPAs and may afford the opportunity to forecast outcomes of new closures across the U.S. South Atlantic specifically and in other shelf-edge reef areas in general. Annually updated population evaluations provide enhanced management opportunities as well as updated information products and new publications. These closures are very recent in comparison to the life cycles of the fish they are designed to protect; therefore it is imperative to continue annual examinations of these areas as population changes may take several years to detect. Also, examination of previously collected data reveals annual fluctuations in population structures of the targeted species which would not have been detected with biannual (or longer) surveys.

This project also examines mesophotic and deep coral habitat linkages due to the location of the MPAs on the outer edge of the continental shelf. During the most recent cruise (July 2013), *Oculina varicosa* (typically considered a mesophotic coral) was discovered to be common off North Carolina at depths of 90-119 meters and what appears in the video to be *Lophelia pertusa* (typically known as a deep-water coral) was observed in depths of 110-134 meters, also off North Carolina. Photos of the “*Lophelia*” were sent to several deep-water coral researchers post cruise that unanimously agreed with the *Lophelia* identification, but could not confirm without a sample in hand. Therefore, it appears the depth ranges of the two coral species could possibly overlap. The ROV we propose to utilize is equipped with a five function manipulator which will allow collection of reference samples, and thus positive identification of noteworthy sessile organisms.

At their March 2012 meeting, the SAFMC refined the Comprehensive Ecosystem-Based Amendment 3 (CE-BA 3), and included actions to consider expansion or designation of coral Habitat Areas of Particular Concern (HAPCs) and MPAs for speckled hind and warsaw grouper. A MPA Expert Working Group was subsequently formed to provide scientific input on using MPAs to end overfishing for these two species of grouper. PI Harter is a member of this group and presented results from previous cruises, particularly 2012, to the other Working Group members as this survey is one of only a few that is examining the deep-water MPAs and surrounding areas. Two meetings have been held thus far, one in May 2012 and the other in February 2013. At the conclusion of these meetings, a total of 29 areas were proposed by the Working Group along the U.S. South Atlantic shelf-edge ranging from North Carolina to the Florida Keys as possible areas to close to protect speckled hind and warsaw grouper. These included both new MPAs and well as re-orienting the existing MPAs. High emphasis was placed on and will continue to be placed on this survey as this process proceeds.

Project Objectives:

1. Complete multibeam mapping of the OECA.
2. Perform a re-evaluation of the OECA by conducting ROV dives inside the protected area to complete a species and habitat characterization of the area.
3. Continue annual monitoring of five of the eight deepwater MPAs to examine closure effectiveness by conducting remotely operated vehicle (ROV) dives inside and outside the protected areas.
4. Continue multibeam mapping inside and in the areas surrounding the MPAs. Maps produced have been and will continue to be crucial for locating areas to dive on with the ROV. They also provide an estimate of what percentage of the MPAs contain habitat suitable for the target species.
5. Begin monitoring of reef fishes and invertebrate colonization of artificial structures in the Charleston MPA.

Task Description and Methodology:

The following tasks will be completed each year of the project;

1. Determine the abundance and distribution of economically important reef fish species and macro-benthos inside the OECA and in and around the MPAs in the U.S. South Atlantic;

2. Evaluate the habitat of the areas with respect to species composition and abundance as well as geomorphology; and
3. Correlate fishery and habitat data to detect trends in fish and invertebrate populations as the protected areas mature.

The methodology is straightforward: conduct fishery independent, non-destructive surveys and evaluate trends in fishery abundance and distribution as well as habitat correlations over time. Proposed research for the deepwater MPAs and OECA will follow the protocol established during the self-funded pilot study for the MPAs in FY 04, the Coral Reef Conservation Program (CRCP) funded surveys in FY 06-10, and the CRCP Fishery Management Council Coral Reef Conservation Cooperative Agreement funded surveys in FY 11-13 projects. During the cruises, nighttime operations will consist of multibeam mapping and transiting between study areas and daytime operations will consist of ROV dives. During the course of this study, a couple of significant additions have been made to the field work in order to maximize the scientific value of the survey. P.I. Reed began collaborating on this project in 2010 to provide a detailed habitat and macro-benthos analysis and multibeam mapping was added when we started getting regular ship time on the NOAA R/V *Pisces*.

A stratified random design in its purest form is not possible at this point because we do not have complete maps of the deepwater MPAs from which the areas can be stratified by habitat type. However, with each year more areas are mapped allowing an increase in the ability to stratify and randomly select sites within the strata. Therefore, site selection for the deepwater MPAs is a combination of random selection within previously mapped strata, purposeful selection based upon near real-time mapping conducted the night before each dive, and return visits to previously surveyed sites to produce repeated measures in a time series. During the site selection process, contacts will be made with project personnel from the Marine Resources Monitoring Assessment and Prediction Program (MARMAP; PI is Marcel Riechart) and the SEFSC's Southeast Fishery-Independent Survey (SEFIS, PIs are Todd Kellison and Nate Bachelor). MARMAP and SEFIS are two additional monitoring programs that sample in or near the MPAs. Discussions will be used to learn where each program is sampling so that overlap does not occur and that we may all be efficient with limited resources. Site selection for the OECA will be based primarily on existing multibeam data of the area. Ship time for this project has been allotted on the NOAA Ship *Pisces* for the past three years and we anticipate this to continue in the future. Data collected from the *Pisces* mapping system will consist of both bathymetry from the ME70 multibeam system and fisheries data from the EK60 split-beam system. Data will be processed as it is collected using both CARIS and Fledermaus and then put into ArcGIS so survey sites can be selected for the next day's dives. The *Pisces* is the first vessel used for this project with multibeam mapping capabilities and has greatly improved the success of our cruises. In 2012, 145 km² was mapped and 218 mi² was mapped in 2013. These maps have been and will continue to be crucial for selecting hardbottom areas to dive on with the ROV. They also allow the percentage of each MPA and the OECA containing suitable habitat for the target species to be calculated.

An ROV will be used for habitat delineation, percent coverage estimates, fish identification and abundances, estimating fish size, determining the location of spawning aggregation sites, and the collection of biological samples. Transects for the ROV are generally 1.5-3.0 km in length and

topography and currents are factored into dive planning. Sites with similar habitat types will be examined both inside the MPAs and areas adjacent to the closed areas for comparison purposes. Every effort is made to survey all five MPAs in each year.

The ROV we will contract for the proposed work is the Sub-Atlantic MOHAWK owned and operated by the University of North Carolina at Wilmington (UNCW) Undersea Vehicle Program. This is a new vehicle with significant improvements over the vehicle previously used for this project. Upgrades include fiber optic cable, high definition video, significantly higher resolution digital still camera, more paired lasers for scaling measurements, and a five function manipulator and suction system for sample collection. If funding becomes available through the FGNMS, HBOI CIOERT will build a collection skid with various buckets for sample collections. The new vehicle also has the ability to go to 1000 meters, even though it is limited to 350 meters in its current configuration. High currents in the area require the use of a downweight (~145 kg) to keep the ROV umbilical cable near the bottom throughout the dives as we want the ROV to operate within two meters of the seafloor to make fish and invertebrate identifications possible. This downweight is tethered to the ROV umbilical and the ROV operates on a 30 meter leash which provides sufficient freedom of movement to investigate habitat features within visual range of the transect line. The downweight configuration allows the ROV to drift just above the bottom at a controlled over-the-ground speed of approximately 1.4 km/hr (range 0.9 to 2.8 km/hr). The geographic position of the ROV ($\pm 3\text{m}$) is constantly recorded throughout each dive with a tracking system linked to the ship's DGPS system.

Hydrographic data will also be acquired at all survey sites. A Seabird SBE-19+ CTD will be deployed at the beginning and end of each day and will collect a suite of environmental variables (temperature, depth, conductivity, dissolved oxygen, and transmissivity). In addition, a smaller Seabird SBE-39 will be mounted on the ROV and will measure temperature and depth throughout each dive.

Post cruise, video footage will be used to evaluate fish species presence and abundance within each habitat type inside and outside the MPAs as well as inside the OECA. ROV dives are typically 1.5-2.5 hours in length. Each dive will be divided into transects delineated by commonality of habitat type and/or time. All fish within a 5 meter radius of the transect line on the video tapes will be identified to the lowest discernible taxonomic level and counted (5 meters was determined as the maximum distance that fish could reasonably be identified). Highly mobile fish such as amberjack (*Seriola* sp.) will be conservatively counted as the maximum number seen at any one time in the field of view to prevent overestimating their abundances, since they have a tendency to circle the ROV. For habitat and benthic biota analysis, a digital still camera mounted on the ROV will be tilted perpendicular to the seafloor and an image taken every two minutes. These images will be used to determine percent cover of all habitat types and sessile benthic biota using Coral Point Count with Excel extensions (CPCE) for each dive. The habitat types and biota will be compared inside and outside of the MPAs. Average abundances of fish species inside versus outside each MPA will be compared for the seven target species as well as the more common species in the snapper-grouper complex and lionfish. The fish populations will also be compared by habitat type for the MPAs and OECA.

The SAFMC has also asked for data on size and age structure and sex ratios for the major fishery species within the OECA. This would require collecting specimens with traps, but because this gear type would be destructive to the *Oculina* coral and other macro-benthos, only visual surveys with the ROV will be conducted. The new ROV that will be contracted for this work, however, has more paired lasers allowing for better measuring capabilities. Size measurements of all major fishery species from inside the OECA will then be compared to fish caught in the area surrounding the OECA by the SEFIS trapping project led by Nate Bachelor and Todd Kellison (NMFS Beaufort Lab) to estimate size and age structure and sex ratios.

Specific activities to be accomplished each year from FY-14 through FY-16 will be a research cruise, data analysis, and submission of reports and data to the SAFMC. The reports to the SAFMC will include information on the presence/absence of all reef fish inside and outside each MPA and inside the OECA, percentage of all habitat types observed inside and outside the MPAs and inside the OECA, a comparison of the abundance of all target and other economically important species inside and outside each MPA and inside the OECA by habitat type, a benthic invertebrate species list with percent cover of sessile biota including sponges and corals, and electronic copies of all multibeam map data. Cruise dates will be targeted for early-summer, to match the majority of the previous effort, remove variability induced by seasonal changes in fish movements, and avoid hurricanes. An average of 14 days of ship time will be requested. Analysis of videotaped and photographic data is time consumptive and will take approximately four to six months to accomplish. Preparation of a final report to the SAFMC will require an additional month. The ROV we will use, operated by UNCW/UVP, has proven to be quite effective for this work and is very cost effective compared to other systems.

Preliminary Conclusions from Previous Years:

A presentation was given to the SAFMC in December 2013 reporting what has been accomplished with this project thus far. Changes in abundance of species from the snapper-grouper complex were examined and compared using a BACI design (inside MPA/before closure, outside MPA/before closure, inside MPA/after closure, outside MPA/after closure). Results varied by species and by MPA, but overall, there are a few general conclusions that have been made.

1. Snowy grouper and speckled hind may show an increase in density inside some of the MPAs.
2. Red porgy, vermilion snapper, and tomtate densities appear to have increased inside most of the MPAs.
3. Gag grouper densities appear to have increased in all MPAs with the exception of Georgia.

Note that these conclusions are based solely on comparisons of densities. Formal statistical analyses have not been completed yet. If funded, a total of 8 years of post-closure data will have been collected. Since the target species are long-lived, it will take some time before changes due to protection are detected, however, we are hoping that 8 years is long enough and that changes will start to be detected. At this point, a formal statistical analysis will be conducted to look for significant changes as a result of protection from fishing.

Outcomes and Products:

For each year that the proposed project is funded, semi-annual progress reports will be submitted to the SAFMC as well as a final report including a full detailed analysis of fish assemblages, macro-benthos, and habitat of each year's ROV dives along with multibeam map data which will be distributed to the SAFMC and NOAA National Geophysical Data Center (NGDC). Results from the MPA and OECA monitoring survey will be used by the Council to evaluate efficacy of these areas as well as aid in decisions made on future ones. Because our time series of data on the MPAs will surpass a decade during the proposed funding period, data provided by this project should allow forecasting of trends in reef fish populations in these MPAs specifically and along the U.S. South Atlantic in general. We will continue to coordinate activities with other researchers working in the area (e.g., SEFIS and MARMAP) and conduct public outreach through a variety of venues including the NOAA Teacher-at-Sea Program. NOAA's Teacher-at-Sea Program will continue to supply an educator selected through a nationally-screened program. The Teacher-at-Sea Program requires the development of curricula for subsequent employment in the classroom and at-sea blogging of daily cruise activities. Council staff will provide field research updates as well as Teacher-at-Sea blog reports on the SAFMC web site. Further, results from the project fieldwork will be incorporated into SAFMC outreach materials and incorporated into the strategic planning document for the snapper grouper fishery. Currently, SAFMC port meetings are being held as a part of the visioning process for the snapper grouper fishery. The visioning process will culminate in a strategic plan for the snapper grouper fishery. These data dissemination efforts provide information gathered during this long term monitoring program to managers not directly associated with the U.S. South Atlantic, which may be useful in creating effective MPAs elsewhere.

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Figures

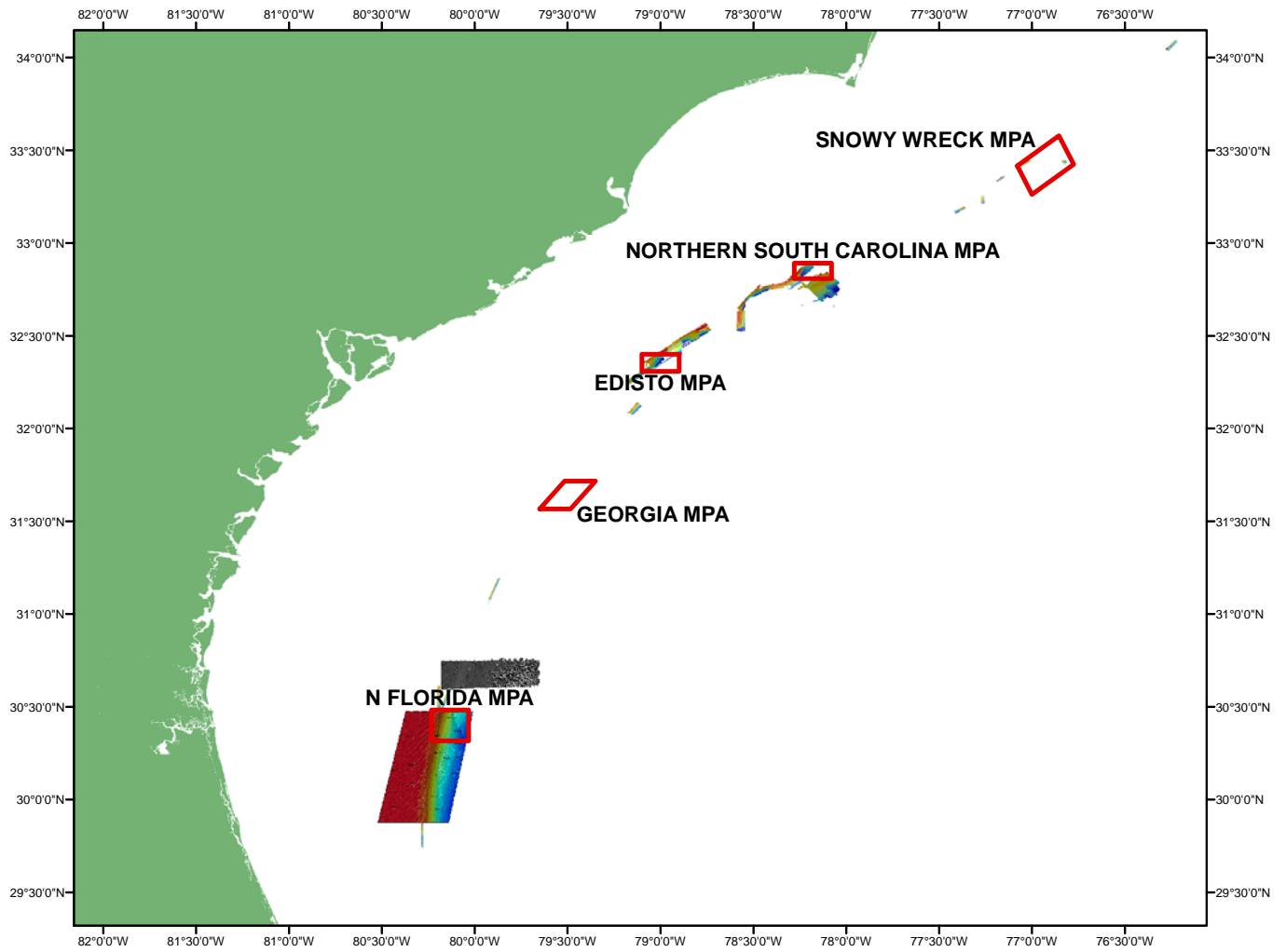


Figure 1. Map showing the deepwater shelf-edge MPAs (red polygons) and multibeam mapping accumulated over the past couple of years.

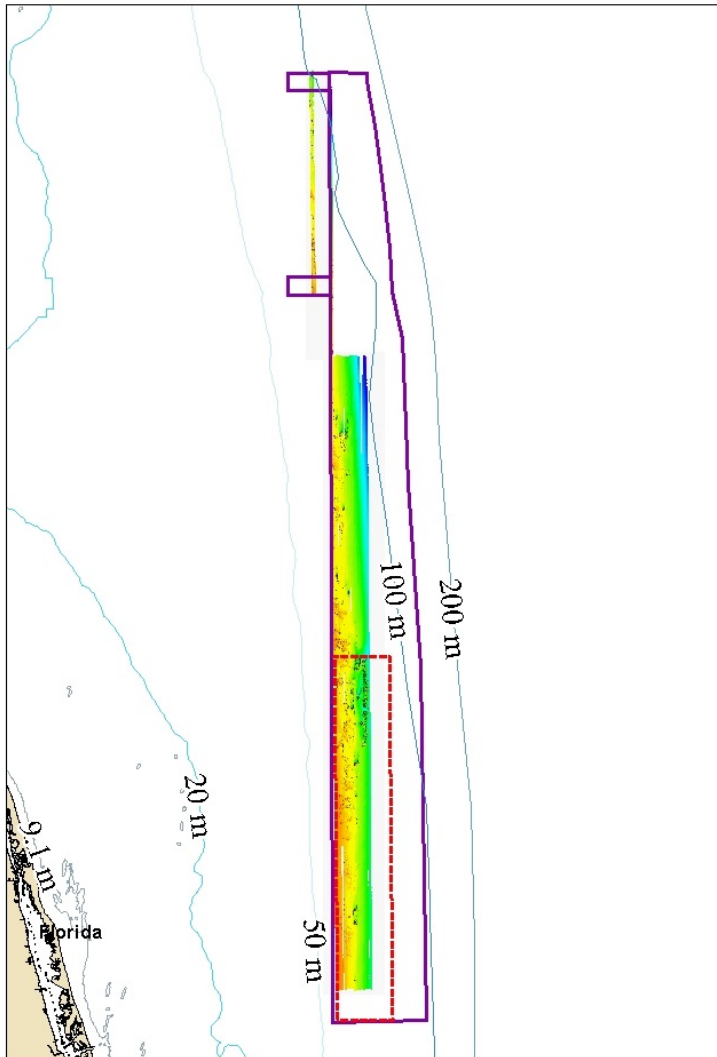


Figure 2. Map displaying the Oculina Bank Habitat Area of Particular Concern (HAPC), including the Oculina Experimental Closed Area (OECA), and the multibeam mapping that has been completed there. The entire HAPC is outlined in purple while the OECA is outlined in red.

Project #1 Schedule:

It will require approximately six months from the time data are collected to complete analysis of ROV dive video and digital still photos and an additional month to prepare the report for SAFMC.

Year 1

Collect ROV and multibeam data:	July 2015
Analyze and process data:	February 2016
Prepare Final Report for SAFMC:	March 2016

Year 2

Collect ROV and multibeam data:	July 2016
Analyze and process data:	February 2017
Prepare Final Report for SAFMC:	March 2017

Year 3

Collect ROV and multibeam data:	July 2017
Analyze and process data:	February 2018
Prepare Final Report for SAFMC:	March 2018

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PIs Harter and David have been examining mesophotic and deepwater ecosystems for over ten years and have been working together since 2004 on the U.S. South Atlantic MPAs. Harter is a member of the SAFMC's MPA Expert Working Group and David was the lead PI for NOAA's Deep Sea Coral Research and Technology Program for the Southeast. PI Reed has been studying deep coral ecosystems for 37 years and was integral in the implementation of the Oculina Bank HAPC and examination of the deepwater CHAPCs implemented by the SAFMC in 2009. He joined this project in 2010, enhancing it to include macro-benthos and a more detailed habitat analysis. Harter and David will be responsible for conducting fish analysis of the MPAs and OECA while Reed will be responsible for conducting the habitat characterization and sessile benthic invertebrate analysis. Collaborators with NOS Charleston and the College of Charleston will collect and process multibeam mapping data and fisheries acoustic data. Harter will be in charge of all cruise planning and will write the semi-annual reports and all three PIs will contribute to the final report.