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NOAA Deep-Sea Coral Research and Technology Program

Priority Scoping Workshop Report for the DSCRTP Southeast Research Initiative 2016-2019

Workshop date: November 18-20, 2015
NOAA Fisheries Southeast Regional Office
St. Petersburg, Florida

By

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Introduction

The National Oceanic and Atmospheric Administration (NOAA) Deep-Sea Coral Research and Technology Program (DSCRTP) was launched in 2009, following the reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). The goal is to provide scientific information needed to conserve and manage deep-sea coral ecosystems in the United States (NOAA 2008; Hourigan 2009). The Program is guided by the NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems, which aims to (1) produce sound science to support NOAA's role in managing fishing impacts and to address threats to deep-sea coral ecosystems, (2) support conservation of deep-sea ecosystems in National Marine Sanctuaries, and (3) integrate the expertise and resources available across NOAA (NOAA 2010a). The Program works in consultation with regional fishery management councils and in partnership with other federal agencies and academic partners to support focused, three-year research initiatives in priority regions, through analysis of existing information about deep-sea coral ecosystems, studies of the distribution and intensity of fishing activities that impact deep-sea corals in federal waters, and investigations of coral and sponge bycatch in fisheries (NOAA 2010a). Since its inception, the DSCRTP has funded targeted research initiatives in the South Atlantic (2009-2011) (Figure 1), the West Coast (2010-2012), Alaska (2012-2014), the Northeast (2013-2015), and the Pacific Islands (2015-2017).

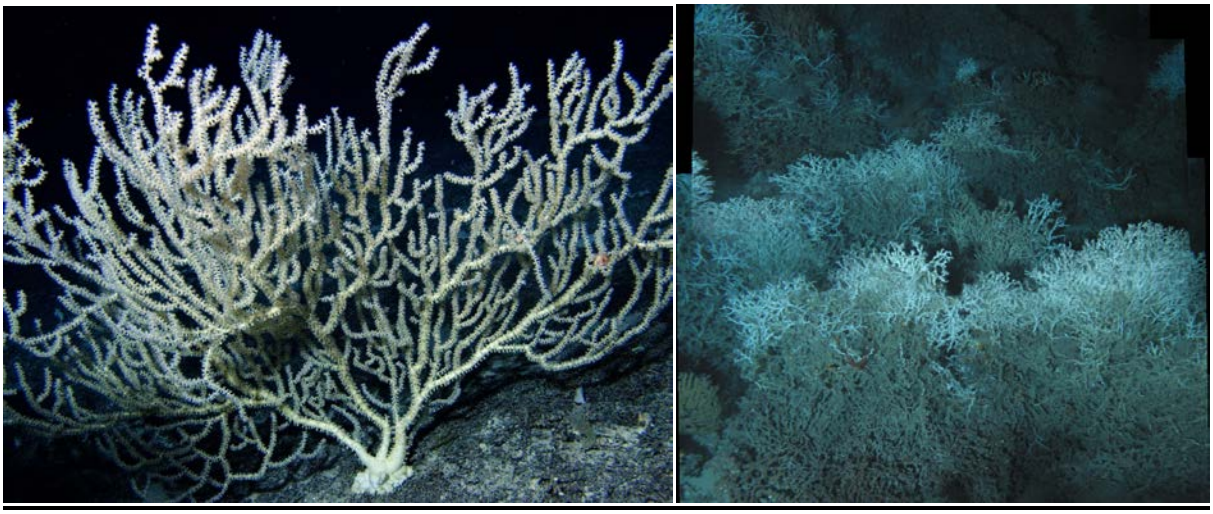

Figure 1. Bamboo coral (left) and *Lophelia pertusa* coral (right) observed on the first DSCRTP South Atlantic Regional Initiative in 2009.

Beginning in 2016, the DSCRTP will initiate a new four-year research initiative in the Southeast U.S. Atlantic Region, an area including U.S. federal waters of the South Atlantic, the Caribbean Sea and the Gulf of Mexico (Figure 2), corresponding to the jurisdictions of the three regional fishery management councils. For clarification, South Atlantic is the collective term used to include federal waters off the east coast of the United States from Cape Hatteras, N.C. through the Florida Keys. As a first step towards launching this new Southeast Regional Research Initiative, the DSCRTP and the Southeast Fisheries Science Center conducted a Priority Scoping Workshop in November 2015. This workshop brought together expertise from NOAA, fishery management councils, the Bureau of Ocean and Energy Management (BOEM), the U.S.

Geological Survey, academic institutions, and others (Appendix B) to discuss and prioritize deep-sea coral and sponge ecosystem research in the Southeast Region. This report details the process and outcomes of this workshop, which will provide background to the science implementation team and guide the development of a science plan for the upcoming DSCRTP Southeast Regional Research Initiative in 2016-2019.

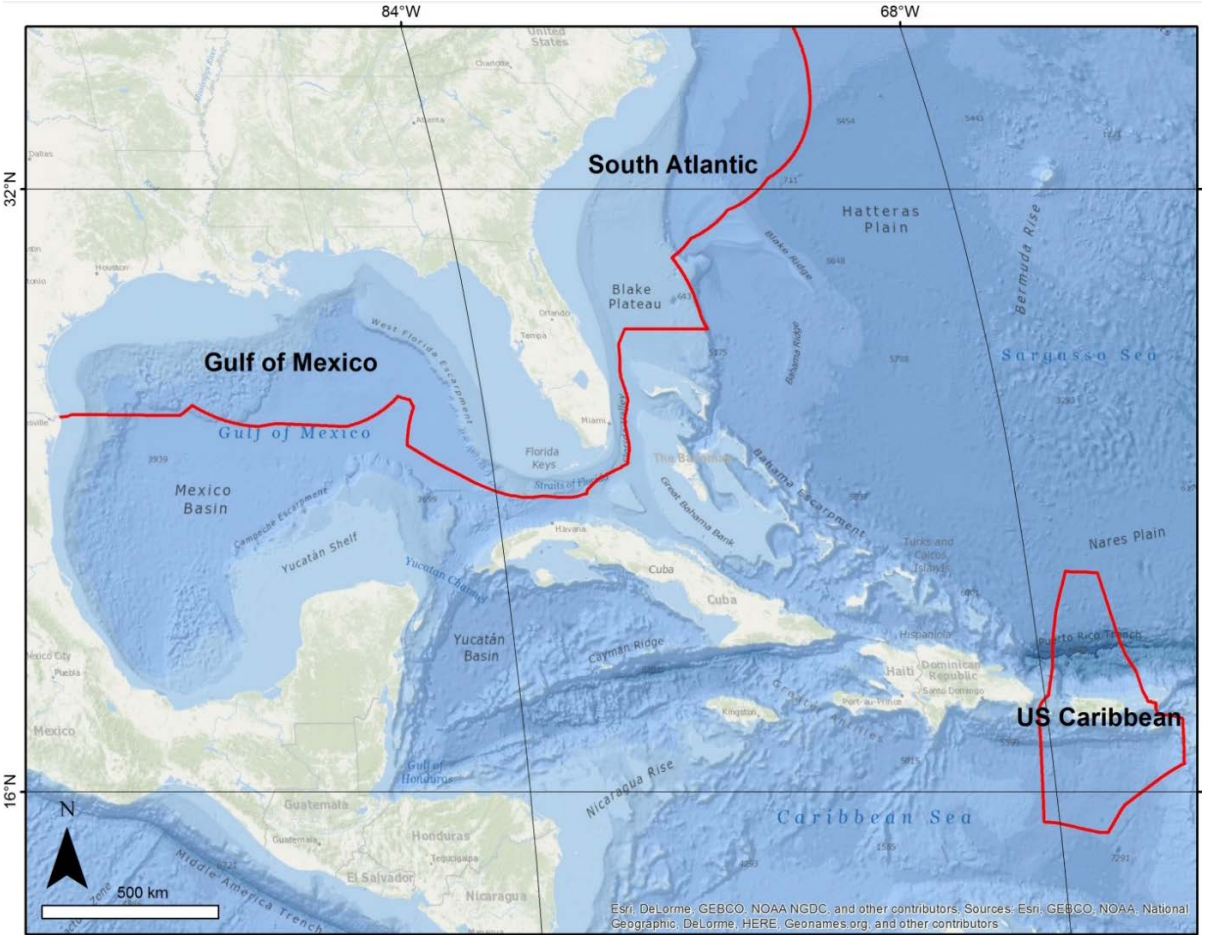

Figure 2. There are three geographic areas in which the DSCRTP Southeast Research Initiative will operate in 2016-2019. These are illustrated in red by the perimeter of the U.S. Exclusive Economic Zone. Separate maps for these three geographic areas are presented in Figures 3-5.

Strategic Plan for Deep-Sea Coral and Sponge Ecosystems

Concurrent with the development of the DSCRTP, NOAA published the Strategic Plan for Deep-Sea Coral and Sponge Ecosystems (NOAA 2010a), herein called the Strategic Plan, to guide NOAA activities, including this emerging program. The Strategic Plan identified goals, objectives and approaches to guide NOAA's research, management and international cooperation activities. In addition, the Strategic Plan covered three main objectives: (1) exploration and research; (2) conservation and management; and (3) international cooperation (NOAA 2010a). The overall goal of the Strategic Plan was to improve the understanding, conservation and management of deep-sea coral and sponge ecosystems. One purpose of the Strategic Plan was to coordinate all of NOAA's activities on deep-sea coral and sponge research and conservation beyond the efforts of the DSCRTP.

Workshop Goals and Objectives

Goal:

- Generate recommendations for science priorities for a four-year (2016-2019) DSCRTP initiative in the Southeast United States that will meet resource management needs.

Objectives:

- Review and understand past and current deep-sea coral and sponge ecosystem science in the Southeast United States (also called the Western North Atlantic Ocean).
- Review and understand the management needs for deep-sea coral and sponge ecosystems both nationally and in the Southeast United States.
- Identify and prioritize exploration and research needs for each region (U.S. Caribbean, South Atlantic and Gulf of Mexico) and by objectives stated in the NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems
- Review and discuss data management requirements for DSCRTP
- Discuss regional and thematic priorities
- Discuss next steps for developing a science implementation plan
- Produce, update and refine interactive maps and calendars, as well as inventories of opportunities, vessels, platforms and tools

The workshop was hosted by the NOAA National Marine Fisheries Service (NMFS) Southeast Regional Office (SERO) in St. Petersburg, Florida. A steering committee composed of eight representatives from three NOAA line offices (NMFS, National Ocean Service (NOS), and Oceanic and Atmospheric Research (OAR), planned and executed the workshop (Appendix B). The workshop was held on November 18-20, 2015 and consisted of a series of introductory presentations, interactive group discussions and breakout sessions. It is important to point out, that while deep-sea corals are typically defined as azooxanthellate corals found at depths below 50 m (Cairns 2007), discussions at the workshop focused mostly on coral ecosystems found below 200 m depths. The workshop agenda is presented in Appendix A, and participants of the workshop are listed in Appendix B.

Prior to the workshop, the steering committee provided background documents and summary materials to participants. Each of the three fishery management councils in the Southeast Region was asked to prepare a summary describing their most critical research and management needs for deep-sea coral and sponge ecosystems (Appendix C). Maps of bathymetry, deep-sea coral locations, as well as existing and proposed protected areas (National Marine Sanctuaries, marine protected areas, habitat of particular concern, deep-water coral habitat of particular concern) in the Southeast Region were provided to workshop participants in order to guide discussions at the workshop.

The steering committee also compiled information on relevant research activities planned for the 2016-2019 timeframe, and an inventory of opportunities, vessels and tools that could be used as part of the DSCRTP Southeast Research Initiative.

The workshop focused on the first of three research objectives of the NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems (NOAA 2010a): exploration and research. This area of work has five priorities including to: (1) locate and characterize deep-sea coral and sponge ecosystems; (2) understand the biology and ecology of deep-sea corals and sponges; (3) understand the biodiversity and ecology of deep-sea coral and sponge ecosystems; (4) understand the extent and degree of impact to deep-sea coral and sponge ecosystems caused by fishing and other human activities; and (5) understand past oceanic conditions and predict the impacts of climate change using deep-sea corals. The workshop included a series of introductory presentations that summarized the goals of the DSCRTP, as well as the state of knowledge of deep-sea resources in each of the three geographic areas of the Southeast Region, followed by breakout sessions during which participants prioritized future research activities in the region.

Overview Presentation: DSCRTP & Strategic Plan

Dr. Tom Hourigan, Chief Scientist for NOAA's DSCRTP, provided background and context for the DSCRTP including its genesis, history, strategic framework, and activities. A summary of this information is captured in the introduction section above. The presentation explained that the program conducts 3-4[1] year regional field initiatives, with high emphasis on management relevance, as well as leveraging partnerships. In 2016-2019, the DSCRTP will initiate a new research initiative in the Southeast Region and will provide support to fund field expeditions and small research projects in the region. DSCRTP funding for these research activities is ~$400K for 2016, and is expected to range between ~$750-800K annually in 2017-2019. Given the large geographic area, limited funding, high costs and logistic needs of deep-sea fieldwork in the Southeast Region, the DSCRTP Southeast Research Initiative will not be able to address all research priorities in even one region.

The South Atlantic was home to the first regional field initiative of the DSCRTP (2009-2011), so the presentation covered the outcomes of this previous effort and the lessons learned. As the program rotates to the Southeast U.S. in 2016, program activities will cover a much broader geographic area that includes the Gulf of Mexico and the U.S. Caribbean, as well as the South Atlantic (Figure 2).

Dr. Hourigan described some of the activities and outcomes of field research initiatives in other U.S. regions, including the Pacific Islands, the Pacific Coast, Alaska and the Northeast Region. Some time was spent describing data and product delivery expectations, which include cruise reports, site characterization reports, contributions to the National Database of Deep-Sea Coral and Sponges (https://deepseacoraldata.noaa.gov/), and metadata records consistent with the Federal Government's requirements under the Public Access to Research Results (PARR) initiative (Hourigan et al. 2015).

[1] In the past the DSCRTP has funded 3-year research initiatives in the South Atlantic, the West Coast, Alaska, the Northeast, and the Pacific Islands. Given the large area of the Southeast Region, the DSCRTP will fund a 4-year research initiative in this region in 2016-2019.

Introductory Presentation: Visual Aids and Synoptic Figures

The workshop steering committee developed a series of visual aids and synoptic figures to help assimilate and present information during the workshop, including (1) an interactive map, (2) an interactive calendar, and (3) a list of opportunities, vessels, platforms and tools. This session introduced these visual aids, so they could be populated throughout the workshop.

The interactive map provided an opportunity to assimilate and share georeferenced shape files on a GIS platform, integrating data layers of bathymetry, distribution and abundance of key deep-sea organisms, habitat types, oceanography and other information onto a shared folder in Google Drive (https://drive.google.com/drive/folders/0B5ZgSRpmhgQNcUtKN2x3NjVlbWc). These online resources for geo-referenced spatial information on the distribution of fisheries, deep-sea corals, and protected areas in the area of operations for DSCRTP were identified by the team:

- South Atlantic Fishery Management Council Digital Dashboard
http://ocean.floridamarine.org/safmc_dashboard/

- NOAA Gulf of Mexico Digital Atlas
http://www.ncddc.noaa.gov/website/DataAtlas/atlas.htm

- Gulf of Mexico Fishery Management Council Portal
http://portal.gulfcouncil.org/

- Multibeam data, maps, and GIS layers from National Centers for Coastal Ocean Science
https://products.coastalscience.noaa.gov/collections/benthic/e49s_atlantic/default.aspx

The interactive calendar summarized activities and events planned for 2015-2019 for each of the three geographic areas in the Southeast Region (Appendix F). Highlights are shown in Table 1. The list of opportunities, vessels, platforms and tools allowed workshop participants to visualize different research tools that could be used to accomplish the goals of the four-year DSCRTP Southeast Research Initiative (Appendix G).

Table 1. A calendar of events showing synergistic activities and prospects for collaboration.

<table>
<tr><th></th><th colspan="2">2016</th><th colspan="2">2017</th><th colspan="2">2018</th><th colspan="2">2019</th></tr>
<tr><th></th><th>Winter</th><th>Spring</th><th>Winter</th><th>Spring</th><th>Winter</th><th>Spring</th><th>Winter</th><th>Spring</th></tr>
<tr><td rowspan="2">Southeast Atlantic</td><td></td><td>PISCES</td><td colspan="2">NCCOS Habitat Maps</td><td colspan="4">BOEM Coral Atlas</td></tr>
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<tr><td rowspan="3">Gulf of Mexico</td><td colspan="3"></td><td>Nancy Foster</td><td colspan="4"></td></tr>
<tr><td colspan="3">BOEM Coral Atlas</td><td colspan="2">RESTORE projects</td><td colspan="2"></td></tr>
<tr><td></td><td>RV Manta</td><td colspan="3">Sanctuary Expansion Plan</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Caribbean US</td><td colspan="2">NCCOS Habitat Maps</td><td></td><td>TBD</td><td colspan="2"></td><td colspan="2"></td></tr>
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Regional Presentation: South Atlantic

Chip Collier, South Atlantic Fishery Management Council (SAFMC), presented the priority needs for the South Atlantic, deriving content from the 2008 Deepwater Coral Research and Monitoring Needs for the South Atlantic Region Status Review (SAFMC 2008; Appendix C).

In 2009-2011, the South Atlantic was the subject of the DSCRTP's first regional science initiative (Figure 1), and the SAFMC has since protected extensive deep-sea coral resources in the region via several designations, including expansions of previously existing deep-water coral habitat areas of particular concern (CHAPC), a network of shelf-edge MPAs, and developments in related coral and fishery management plans (Figure 2). The SAFMC shared their knowledge of the history of deep-sea coral protection and management, and outlined a vision for a constructive working relationship with royal red, rock shrimp and golden crab fishers.

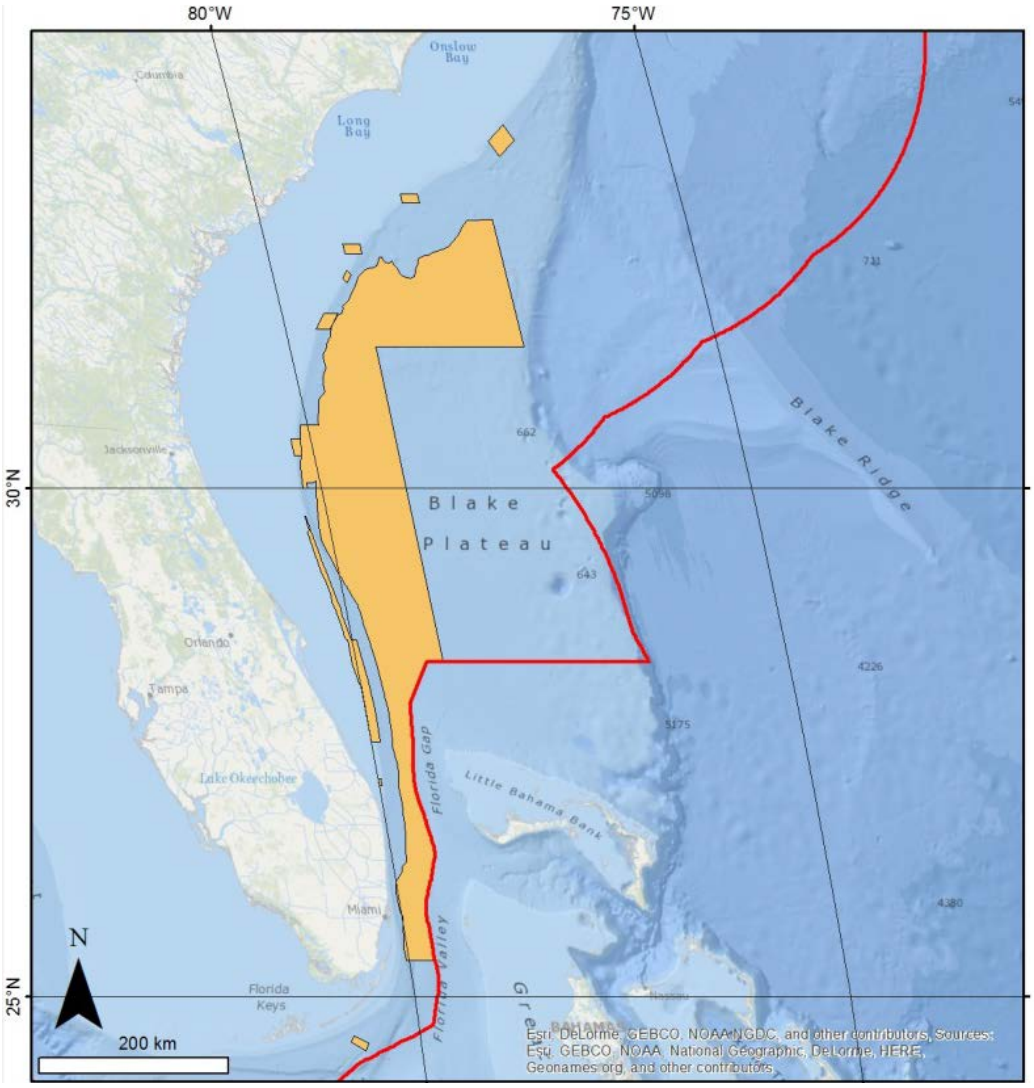

Figure 3. The Exclusive Economic Zone of the South Atlantic geographic area within the Southeast Region. Areas where deep-sea ecosystems are protected from bottom-disturbing fishing by MPAs or HAPCs are shown in orange.

The goals of the SAFMC pertaining to deep-sea coral ecosystems are to: (1) refine and designate new deep-water CHAPCs, and (2) increase our understanding of the ecological role and function of deep-sea coral ecosystems in order to guide future management efforts in the South Atlantic (SAFMC 2008; Appendix C). These goals are addressed in two phases: (1) map and describe known and expected deep-sea coral ecosystems in the South Atlantic region, and (2) determine the ecological role of deep-sea coral ecosystems, including the role of deep-water coral habitat as essential fish habitat (EFH). The SAFMC intends to expand the understanding of structure-forming species' biology and ecology.

John Reed from Harbor Branch Oceanographic Institute-Florida Atlantic University described the history of deep-coral mapping, research and monitoring in the South Atlantic. Essential partnerships in this work included the Harbor Branch Oceanographic Institute-Florida Atlantic University, NOAA's Ocean Exploration and Research Program (OER), NOAA's DSCRTP, NOAA's Coral Reef Conservation Program (CRCP), the SAFMC, the NMFS Southeast Fisheries Science Center, the University of North Carolina at Wilmington, and many other academic partners. Selective mapping of benthic habitats has been completed, as well as initial habitat characterization and habitat modeling work (Partyka et al. 2007; Reed et al. 2013).

Future work will continue to characterize deep-sea coral and sponge habitats, monitor status and trends of known coral areas and HAPCs, and identify threats such as oil and gas exploration, bottom-tending fishing activities, and climate change. John Reed suggested several locations in need of additional surveys, including Stetson Bank, the Miami Terrace, the Portales Terrace, the Agassiz Valley, and the Southern Straits of Florida. Comparative work with the Northern Bahamas Bank and Cuba would also be beneficial, but may be outside the scope of the DSCRTP Southeast Research Initiative. Furthermore, it was noted that oil and gas exploration may occur in the area in the future, and thereby impact deep-sea coral ecosystems. It was also noted that the invasive Indo-Pacific lionfish has colonized the deep reefs and its impact is poorly understood, but likely significant.

Regional Presentation: U.S. Caribbean

Dr. Graciela Garcia-Moliner from the Caribbean Fishery Management Council (CFMC) presented the status of knowledge on and priorities for deep-sea corals in the U.S. Caribbean, with reference to the CFMC's five-year research priorities plan. The plan is currently under development by the CFMC Scientific and Statistical Committee (Appendix C). Most of what is known about this geographic area is captured in the Inventory and Atlas of Corals and Coral Reefs for the U.S. Caribbean (Garcia Sais 2005). While maps are available for shallow-water habitats (< 30 m), there are significant gaps in knowledge of both mesophotic (30-150 m) and deeper habitats in the U.S. Caribbean, though significant advances have been made in surveying mesophotic environments in recent years.

According to this presentation, one of the largest potential anthropogenic impacts in the region is the lucrative deep-water snapper fishery, which operates in the ~70-270 m depth range (Boardman & Weiler 1979). There are also submarine cables crossing the region and some potential for oil and gas exploration. In recent years, the CFMC has supported investments in

mapping areas that could be considered EFH under the Magnuson-Stevens Act, focusing on important spawning areas of reef fish such as snappers and groupers.

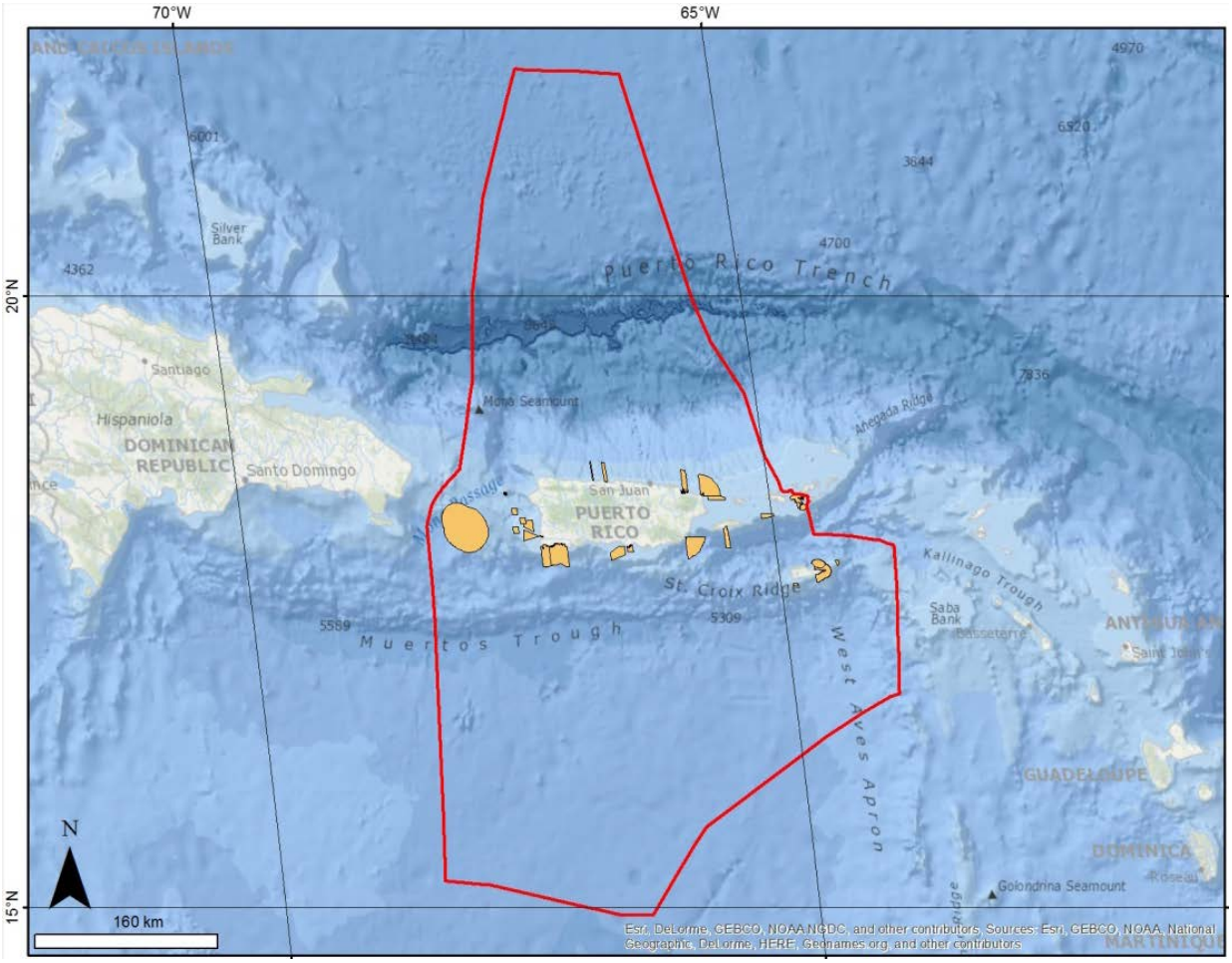

Figure 4. The Exclusive Economic Zone of the U.S. Caribbean geographic area within the Southeast Region. This area includes the waters around Puerto Rico and the U.S. Virgin Islands. Areas where deep-sea ecosystems are protected by MPAs are shown in orange.

The northern shelf of Puerto Rico has a very sharp drop off or shelf break (Figure 4). Areas of CFMC interest for deep-sea coral habitats are the submerged ridge systems to the west (Mona Passage, Bajo de Sico) and southeast (Bajo Investigador, Bajo Grappler and Bajo Whitting) of the island. The submerged seamounts off the south coast of Puerto Rico are of interest, since they support deep-water snapper fisheries. St. Croix and areas of the Marine Conservation District Hind Bank, Grammanik Bank, and Virgin Island Passage are also of interest. Characterizing habitat features, as well as their interactions with fisheries species is of primary interest to the CFMC. Understanding the life history and ecology of deep-water fisheries species is also critically important.

Through partnership with OER, and the U.S. Geological Survey (USGS), recent expeditions aboard the *E/V Nautilus* and the NOAA Ship *Okeanos Explorer* in 2014-2015 have expanded knowledge of deep reef communities in the U.S. Caribbean. Other partnerships include the

University of Puerto Rico, the University of the Virgin Islands, the University of North Carolina at Wilmington, NOAA's National Centers for Coastal and Ocean Science (NCCOS), and the NOAA Southeast Fisheries Science Center.

The CFMC has a fairly complete inventory of research expeditions that surveyed deep-sea coral habitats in U.S. Caribbean waters, but much of this information is not easily accessible or publicly available. There is a tremendous opportunity to compile and analyze previously collected data in the U.S. Caribbean, and utilize this information to make predictive maps of deep-sea corals in order to guide future explorations of this geographic area.

Regional Presentation: Gulf of Mexico

Dr. John Froeschke from the Gulf of Mexico Fishery Management Council (GMFMC) provided an overview of GMFMC research priorities, with an emphasis of potential intersections with the interests of the DSCRTP (Appendix C). Research priorities included developing ecosystem-based management recommendations and supporting integrated ecosystem assessments (IEAs), as well as developing ecosystem models to project future fish productivity based on habitat, climate change, and human dimensions.

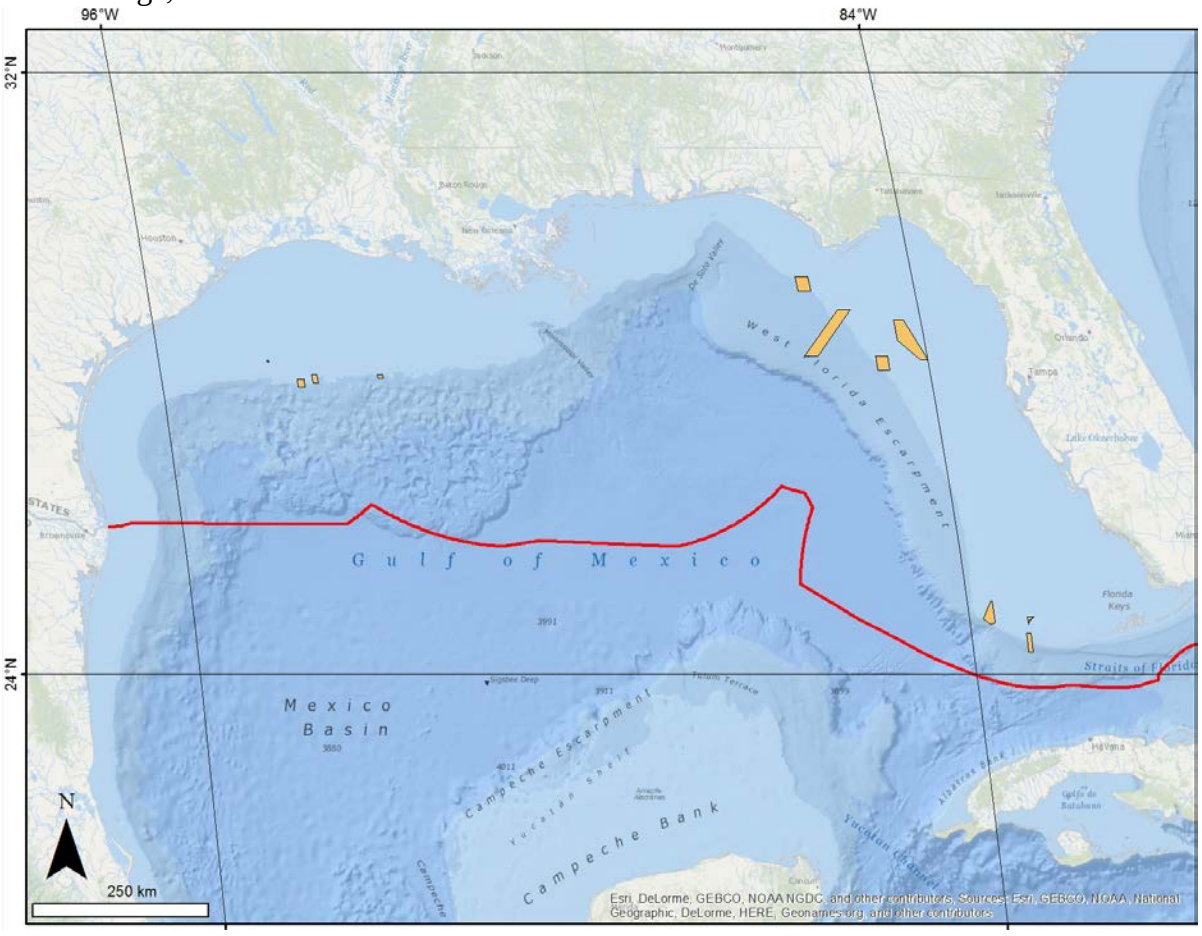

Figure 5. The Exclusive Economic Zone of the Gulf of Mexico geographic area within the Southeast Region. Areas where deep-sea ecosystems are protected by either MPAs, HAPC or National Marine Sanctuaries are shown in orange.

Dr. Erik Cordes from Temple University presented an overview on the state of knowledge on deep-sea coral and sponge communities in the Gulf of Mexico, highlighting some of the most recent peer-reviewed publications. The presentation covered mapping and habitat characterization for important locations within the Gulf of Mexico, such as the West Florida Shelf (including Pulley Ridge), the Northern Gulf of Mexico, the Western Gulf of Mexico off Texas, and Viosca Knolls. Dr. Cordes emphasized that the Gulf of Mexico is a highly modified ecosystem subject to a myriad of anthropogenic impacts including shipping, oil and gas exploitation, fishing, hypoxia, pollution, artificial structures and other impacts. The presentation also highlighted emerging research on the impacts of climate change and ocean acidification, and emphasized the need to monitor the aragonite saturation state over time, as well as document associated impacts to deep-sea resources. Other previous research on deep-sea corals in the Gulf of Mexico was also presented including studies on population connectivity (particularly of the coral genus *Lophelia*), community structure, species richness, diversity, growth and survival.

There was some discussion of expanding predictive modeling capabilities by using seismic reflectivity data (seismic anomalies) in order to refine existing habitat suitability models (e.g., Georgian et al. 2014). Other spatial models that focus on the potential impacts from a small golden crab fishery (comprised mainly of fishers from the South Atlantic) were also discussed. These fishers often do not use vessel monitoring systems (VMS) when fishing in Gulf of Mexico, so quantifying fishing intensity and impact is difficult, but needs to be addressed. Interest in deep-sea communities in the Gulf has increased since the Deepwater Horizon oil spill in 2010. The spill catalyzed a tremendous amount of research to characterize deep-sea coral and sponge communities in the Northern Gulf, and monitor their health and survival after the spill. The DSCRTP can leverage this effort and fill important knowledge gaps.

Since the time of the workshop, the Flower Garden Banks National Marine Sanctuary (FGBNMS) released a draft environmental impact statement on June 10, 2016. This draft environmental impact statement presents five alternatives for the boundaries of the FGBNMS, including a preferred alternative recommending the addition of fifteen deep-sea banks to the Sanctuary, which would increase the size of the protected area from 145.58 km^2 to 992.44 km^2. The DSCRTP Southeast Research Initiative could help provide valuable support to evaluate the various boundary alternatives for the FGBNMS.

Breakout Session 1: Priority Geographies

The objective of the first breakout session was to identify areas of particular interest within each of the three major geographic areas in the Southeast U.S. (Gulf of Mexico, U.S. Caribbean, and South Atlantic; Figures 2-5). Participants were divided into three groups and were asked to rotate among three stations, each of which focused on a different geographic area.

At each station, participants identified specific locations within the geographic area that should be prioritized for future research activities. After participants rotated through all three of the stations, they were asked to return to the station with the geography they were most familiar with and explain why specific sites were important. Priority research locations identified during this exercise are given below, and the complete list along with the reasons why these locations should be prioritized for future research is presented in Appendix D.

The most common justifications for specific sites to be prioritized for future research activities were that sites were located in:

- areas inside existing or proposed protected areas (MPAs, HAPCs or National Marine Sanctuaries) and therefore have management implications,
- unexplored areas (especially in areas with potentially-damaging fishing activities),
- areas that have been surveyed in the past and could thus provide time-series data,
- suitable deep-sea coral habitat as determined by predictive habitat suitability models, and
- areas that are important for population connectivity studies.

South Atlantic (in no particular order)

- High probability sites identified in regional habitat suitability models (e.g., Kinlan et al. 2013)
- Florida Straits
    - Miami Terrace
    - Pourtales Terrace
    - Agassiz Valley Canyons
    - Comparative sides on the Cuban and Bahamian sides of the Straits
- Coral HAPCs (particularly the western edges of allowable fishing areas)
- Stetson Bank
- Keller, Palmico, and Hatteras Canyons off North Carolina
- Savannah Bank (glacial scours)
- Charleston Bump
- Blake Ridge and Escarpment

U.S. Caribbean (in no particular order)

- Topographic features between West Puerto Rico and Dominican Republic (Pichanco/Bajo Placeras, Desecheo/Los Rabos)
- Area Northeast of El Seco, Puerto Rico
- Puerto Rico Trench
- Area north of Puerto Rico Trench
- Puerto Rico shelf edge drop-off
- St. Croix shelf edge drop-off
- St. Croix southeast region, South of Lang Bank

Gulf of Mexico (in no particular order)

- All proposed deep-water Coral HAPCs
- South Texas Banks and upper Texas shelf
- Northwestern Gulf of Mexico
- West Florida shelf and slope
- Sigsbee Escarpment
- DeSoto Canyon
- Viosca Knoll 826 (long-term study site for *Lophelia pertusa*)
- Pulley Ridge
- High-intensity fishing areas throughout geographic area
- Campeche Bank (Mexico)

Breakout Session 2: Priority Research Questions

The objective of the second breakout session was to identify priority research questions for each exploration and research objective under the NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems (NOAA 2010a). The Strategic Plan sets out five research and explorations objectives, which were designated as research themes during this session. Due to time limitations at the workshop, the 2nd and 3rd research and exploration objectives of the Strategic Plan were merged, resulting in four research themes:

1. Locate and characterize deep-sea coral and sponge ecosystems.
2. Understand the biology, ecology and biodiversity of deep-sea corals and sponges.
3. Understand the extent and degree of impact to deep-sea coral and sponge ecosystems caused by fishing and other human activities.
4. Understand past oceanic conditions and predict the impacts of climate change using deep-sea corals.

For this breakout session, participants self-selected three of the four themes that were most in-line with their expertise and interests. Participants were asked to brainstorm priority research questions for each theme, and indicate if the research question they identified was specific to a certain location or applicable to the entire Southeast Region. Once participants rotated through all three of their self-selected priority research themes, the results were discussed in plenary. Following this plenary discussion, the research questions were arranged by the geographic area to which they applied to (Gulf of Mexico, U.S. Caribbean, South Atlantic, or entire Southeast Region). The participants were then given five votes for each geographic area (for a total of 20 votes per participant) and asked to vote for the research questions that they felt were most important to address. Research questions for each geographic area were then ranked based on the number of votes they received, with the top third considered high priority, the bottom third considered low priority and the rest considered medium priority. High priority research questions identified during this exercise for each of the geographic areas are given below, and the complete list including medium and low priorities is presented in Appendix E.

South Atlantic

Research Question	***Theme***
What drives community structure differences between sites (e.g. Miami Terrace vs. Portales, fish and benthic organisms, Straits of Florida vs. Carolina, East and West sides of Straits of Florida, *Lophelia* vs. *Enaplopsamnia*-dominated areas)?	2
How are populations connected and what factors shape the genetic connectivity of deep-sea coral ecosystems in the South Atlantic (e.g. stepping stones, dispersal barriers)?	1
How do communities differ inside and outside of protected areas (e.g. MPAs, HAPCs)?	3
How do upwelling regimes and variability in other ocean conditions impact communities?	4
What topographic features are associated with deep-sea coral communities (e.g. bumps, on the Carolina-Florida margin, within CHAPC)?	1
What interactions (past, present and future) occur between fishing gear (e.g. golden crab, royal red shrimp etc.) and deep-sea coral and sponge ecosystems?	3
How accurate are model predictions of deep-sea coral habitat or species distributions, particularly for structure-forming taxa?	1

U.S. Caribbean

Research Question	*Theme*
What is the extent of deep-sea coral communities in sites with high rugosity (particularly at El Pinchincho, east of Vieques, the shelf edge, southeast of St. Croix, Barca del Guineo, #143, and Mona Passage)?	1
Which species of deep-sea corals and sponges are present? Need to resolve taxonomy, more sampling and include molecular analyses.	2
Do deep-sea coral and sponge ecosystems exist in areas that are heavily fished for deep-water snapper fish? Can we partner with fishers to better understand deep-sea coral and sponge ecosystems?	3
Where are deep-sea coral and sponge ecosystems located? What existing datasets can be incorporated into models in order to predict the distribution of deep-sea coral and sponge ecosystems?	1
What are the most significant anthropogenic impacts to deep-sea coral and sponge ecosystems, particularly at mesophotic depths?	3

Gulf of Mexico

Research Question	*Theme*
What is the extent of the distribution of deep-sea coral and sponge ecosystems (throughout the entire Gulf of Mexico, in the northern Gulf of Mexico, in sites of interest to the GMFMC, at 200-600 m on the upper slope off Texas, at 1,000-2,600 m throughout the Gulf, at Campeche Bank, on the northern West Florida Escarpment between the known *Lophelia* sites west of St. Petersburg and DeSoto Canyon)?	1
What interactions (past, present and future) occur between fishing gear (e.g. golden crab, royal red shrimp etc.) and deep-sea coral and sponge ecosystems?	3
What buffer distances should be implemented between deep-sea coral and sponge ecosystems and human activities? How do these differ by activity type (e.g. oil and gas exploitation, fishing, shipping, lightering areas)?	3
What deep-sea coral and sponge sites could serve as sentinel sites to better understand the effects of climate change on these ecosystems (e.g. Viosca Knolls, Flower Garden Banks, West Florida Escarpment)? Can a long-term monitoring site be established to study the effects of climate change on deep-sea coral and sponges?	4
Which known seafloor features in the Northern Gulf of Mexico are in need of mapping, groundtruthing and characterization? These seafloor features need to be mapped and characterized.	1
What drives community differences between deep-sea coral and sponge ecosystems on hard bottom habitats in low-relief vs. high-relief sites?	1
What is the connectivity between coral ecosystems at different depths (shallow-water, mesophotic and deep-sea coral ecosystems)?	2

Regional (All geographic areas)

Research Question	*Theme*
Which species of deep-sea corals and sponges (as well as their associates) are present in these ecosystems?	1
What is the connectivity between different deep-sea coral and sponge ecosystems (both in terms of population genetics and source-sink dynamics)?	2
How can we assess the health and resilience of deep-sea coral and sponge ecosystems? Are there signs of recruitment or recovery in areas that have been impacted in the past?	3
What are the relationships between deep-sea corals and sponges and their epifauna?	2
How much can deep-sea fish and benthic communities be impacted and still maintain sustainable fisheries?	3
What is the reproductive biology and ecology of deep-sea corals and sponges (larval biology, colony size-frequency distribution, recruitment, environmental drivers, etc.)?	2
What is the variability of environmental parameters in locations that have deep-sea coral and sponge ecosystems (temperature, dissolved oxygen, salinity, aragonite saturation, pH, total alkalinity, etc.)?	4
What topographic features are associated with deep sea coral ecosystems? Where are the hotspots and what is their spatial extent?	1
What are the environmental limitations (i.e., temperature, depth, dissolved oxygen, aragonite saturation, pH) of deep-sea coral and sponges, as well as their associated species?	1
What is the most useful level of spatial and taxonomic resolution for models to guide research and management?	1
What is trophic ecology of deep-sea coral and sponge ecosystems? What is the food source?	2
What are the stressors on deep-sea coral and sponge ecosystems (e.g. invasive species, sedimentation, predation, temperature, climate change, fishing impacts)?	2
Can we reconstruct paleoclimates using deep-sea corals and sponges (radio isotopes, reef cores, black/gold/bamboo/cup/primnoid corals, and paired water samples)?	4
How do deep-sea corals calcify under low aragonite saturation states and low oxygen levels?	4

Group Discussion: Opportunities, Vessels, Platforms and Tools

Following the discussion about which research questions should be prioritized by the DSCRTP Southeast Research Initiative, the group discussed which vessels, platforms and tools could be used to address these questions. For this purpose, the group reviewed the list of opportunities, vessels, platforms and tools that had been compiled by the steering committee prior to the workshop (with input from invitees), and added additional information to the list (Appendix G). A presentation was also given by NOAA's Office of Marine and Aviation Operations (OMAO) to describe the ship-time allocation process for NOAA assets.

In addition to discussing potential vessels, platforms and tools, the group also discussed research programs other than the DSCRTP that could be leveraged by the DSCRTP Southeast Research Initiative. In particular, BOEM has proposed a four-year project beginning in 2017 to provide information for future outer continental shelf five-year oil and gas leasing plans for the Atlantic (BOEM 2016). If funded, this project would provide around $4M in funding over four years for work in the BOEM Mid and South Atlantic Regions, which extend south to the Georgia-Florida border. USGS and OER are planning to partner with this effort. NOAA's OER and the DSCRTP

(through the Southeast Research Initiative) have announced their intention to participate in this effort if BOEM decides to proceed. Additionally, the NOAA Ship *Okeanos Explorer* will transit back to the Atlantic in 2017-2018, and would also provide natural partnership for the DSCRTP Southeast Research Initiative, both with the BOEM-USGS effort, as well as in other geographic areas. Furthermore, NOAA has several funding opportunities outside of the DSCRTP that could provide supplementary funding for the Southeast Research Initiative (e.g. Advanced Sampling Technology Working Group, Cooperative Research Program, Untrawlable Habitat Initiative, MARFIN, Undergraduate Scholarship Program). The Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States (RESTORE) Act will provide substantial funding for work in the Gulf of Mexico and may also provide useful collaborative opportunities.

The complete list of opportunities, vessels, platforms and tools is presented in Appendix G, and includes contact information and notes for various research vessels, remotely operated vehicles (ROVs), human occupied vehicles (HOVs), autonomous underwater vehicles (AUV), moored instruments, specialized laboratories, supplemental funding opportunities and other resources that could be used as part of the DSCRTP Southeast Research Initiative.

Group Discussion: Products and Outputs of the Southeast Research Initiative

Following the discussion on opportunities and tools that could be employed by the DSCRTP Southeast Research Initiative, the group discussed specific data products and other outputs that should be developed as part of the effort. Specific outputs discussed included formal data products required by the DSCRTP, peer-reviewed journal articles, deep-sea species identification guides, education and outreach products, and media releases. Each of these outputs is briefly discussed below.

DSCRTP Data Products and Deliverables

The NOAA Deep-Sea Coral Data Portal (https://deepseacoraldata.noaa.gov/) provides a detailed and thorough repository for georeferenced deep-sea coral and sponge records in U.S. waters. All projects funded through the DSCRTP, including the DSCRTP Southeast Research Initiative, are required to submit their records and site characterizations to the NOAA Deep-Sea Coral Data Portal. Data analysis and development of key data products will need to be included upfront in the budget of the DSCRTP Southeast Research Initiative. A summary of the structure and purpose of the national database was published in 2015 (Hourigan et al. 2015). Data products that need to be submitted to the national database include coordinates of collected specimens and observations, maps, *in-situ* and deck photos, cruise reports and site characterization reports. Instructions on how to submit these products are provided at: https://deepseacoraldata.noaa.gov/internal-documents/program-guidance/science-team-guidance-for-data-management.

In addition to maintaining the NOAA Deep-Sea Coral Data Portal, the DSCRTP is required to publish reports to the U.S. Congress every two years describing their funded projects and Regional Research Initiatives (NOAA 2008, 2010b, 2012, 2014, 2016). Projects funded by the DSCRTP Southeast Research Initiative will be asked to provide brief research summaries for future versions of this report to Congress, as well as to update the DSCRTP website.

Additionally, the DSCRTP publishes the State of Deep Coral Ecosystems Report, which reviews all known information on deep-sea coral and sponge ecosystems in U.S. waters. The first State of Deep Coral Ecosystems Report was published in 2007 (Lumsden et al. 2007) and is one of the most downloaded documents from the Coral Reef Information System (CoRIS; http://www.coris.noaa.gov/). A new State of Deep Coral Ecosystems Report is scheduled to be released later in 2016, and some chapters are already available online (https://deepseacoraldata.noaa.gov/library/2015-state-of-deep-sea-corals-report).

Peer-Reviewed Journal Articles

Peer reviewed publications are encouraged by the DSCRTP. The publication of peer-reviewed journal articles provides additional repositories for data and information gained through this research program, and also ensures that research conducted is of high scientific integrity by being vetted through the peer-review process. Additionally, publishing peer-reviewed scientific articles will help communicate the results of this initiative to the broader scientific community, and thereby foster potential collaborations and additional funding for future research in the region.

Species Identification Guides and Handbooks

Since most of the deep-sea fauna is poorly known, there are relatively few resources available to help identify species taxonomically. Detailed and comprehensive species identification guides are not yet available for the deep-sea fauna of the Southeast Region, and the DSCRTP Southeast Research Initiative could help produce such reference materials to guide future research. Such species identification handbooks and online guides have previously been produced for deep-sea organisms in other U.S. regions (e.g. Wing & Barnard 2004; Stone et al. 2011; HURL 2016; NOAA, OER 2016), and these could provide the framework for a deep-sea species identification guide for the Southeast Region.

Catalog of Available and Desired Samples

As a result of logistical challenges of sampling the deep-sea, research in such habitats is inevitably opportunistic. The group discussed the need to create a catalog of samples that have been previously collected in the Southeast Region and are available for future scientific investigations. Additionally, this catalog could include a section where researchers list the samples needed for their work, along with instructions on how to collect, preserve and process samples. This list could help guide sample collections by the DSCRTP Southeast Research Initiative and thereby streamline collaborations.

Education and Outreach Products

Given how little the general public knows about deep-sea sponge and coral communities, and the increasing interest in STEM (Science, Technology, Engineering, Math) education, this initiative has a tremendous opportunity to educate students and the general public. Education and outreach are one of the main missions of NOAA's Office of National Marine Sanctuaries (ONMS). Ongoing outreach and education campaigns by ONMS could be leveraged to highlight the work by the DSCRTP Southeast Research Initiative. Educational materials previously developed by ONMS (e.g. mosaic canvas art, educational curricula) could be modified to include deep-sea research. Similarly, OER has previously developed educational curricula and outreach tools focusing on deep-sea exploration and research. These could easily be adapted to highlight work

by the DSCRTP Southeast Research Initiative. Additionally, the DSCRTP Southeast Research Initiative could host educator workshops. The group emphasized that education and outreach materials created by this initiative should also be translated into Spanish, given the pervasiveness of the Spanish language throughout the Southeast Region. The importance of aligning curricula with state and national education standards was also emphasized.

Media Engagement

The group discussed the need for a targeted roll-out plan for the major field expeditions and publications of the DSCRTP Southeast Research Initiative, in order to get maximum media coverage of this exciting work. Besides serving as a communication tool to the general public, roll-out plans are also important for keeping internal partners informed and speaking with one voice. There was a strong emphasis on production of short videos for sharing through social media. NOAA OER was recognized for its video productions. One researcher emphasized the need for professional quality and technical expertise to maximize public outreach and achieve market saturation. NOAA's Ocean Media Center has videographers and video-editing expertise to help generate video content on research expeditions. Story maps are another emerging tool that would be appropriate to showcase this research initiative, and it is essential to tap into social media channels whenever possible for maximum exposure. Regional zoos and aquaria, and local newspapers can also be an important partner for both outreach and media engagement with local communities.

Breakout Session 3: Logistic Feasibility

Following the discussion on what specific products the DSCRTP Southeast Research Initiative should accomplish, participants engaged in a breakout session during which they determined the logistical feasibility of answering the priority research questions identified during a previous workshop session. Specifically, workshop participants were asked to: (1) identify specific activities that would answer the priority research questions, (2) compare the priority versus cost/feasibility of the activity, and (3) provide suggestions on the most appropriate opportunity, vessel, platform or tool necessary to accomplish the activity. Due to time limitations at the workshop, participants mostly focused on identifying activities and techniques that could be used to address the priority research questions. The results of these discussions are presented in summary tables for each geographic area in Appendix H.

Next Steps

Discussions at the workshop helped prioritize research questions and geographic locations to be emphasized as part of the DSCRTP Southeast Research Initiative in 2016-2019. The workshop provided an opportunity to develop, expand and engage valued regional partners, and provided a forum for cross-regional collaboration. Additionally, the workshop laid the foundation for developing a science team that will oversee the scientific activities of the DSCRTP Southeast Research Initiative.

Dr. Peter Etnoyer (NOS/NCCOS/CCEHBR) will lead the DSCRTP Southeast Research Initiative, along with Dr. Daniel Wagner (NOS/CCEHBR), who will serve as a full-time research coordinator for the effort. Tom Hourigan (NMFS/DSCRTP) and Jennifer Schull (NMFS/SEFSC)

will advise the initiative, and Robert McGuinn (NOS/CCEHBR) will provide logistical support to ensure that data products are incorporated in the national database and archived with NOAA data centers. A science implementation team will develop and execute the scientific activities to be undertaken under the DSCRTP Southeast Research Initiative.

The science implementation team will consist of Dr. Peter Etnoyer (NOS/NCCOS/CCEHBR), Dr. Daniel Wagner (NOS/CCEHBR), Dr. Martha Nizinski (NMFS/NSL), Emma Hickerson (ONMS/FGBNMS), G.P. Schmahl (ONMS/FGBNMS), Andrew David (NMFS/SEFSC), Tim Battista (NOS/CCMA) and Amanda Netburn (NOAA/OER). This science team will meet in September 2016 in Charleston, South Carolina in order to develop a science implementation plan, which will outline the specific research projects that will be undertaken as part of the DSCRTP Southeast Research Initiative. In the first year of the initiative (FY2016), the DSCRTP Southeast Research Initiative will provide support for one research expedition (in partnership with OER) and for several small-scale, ready-to-go projects, focusing on data mining and data rescue activities. These small-scale projects will prepare the team for more substantial field-based projects in FY2017-2019.

Conclusion

The Southeast U.S. is a diverse region that contains three distinct geographic areas (the South Atlantic, the Gulf of Mexico and the U.S. Caribbean). Each of these geographic areas has its own Fishery Management Council, and each has different research and management needs relating to deep-sea coral and sponge ecosystems. There are different amounts of seafloor data available, and different stages of development in regard to Fishery Management Council priorities. For example, the South Atlantic region is far along, with several *established* deep-water coral HAPCs and MPAs that may need characterization and refinement. In contrast, the Gulf of Mexico is largely in the *proposal* stage for deep-water protected areas, with many areas that will benefit from surveys to support their designation. The U.S. Caribbean is in an intermediate stage, with some deep-water protected areas being designated, but still in need of characterization.

NOAA manages fisheries in federal waters, including fishery impacts to habitats, through fishery management plans developed in conjunction with the fishery management councils. The DSCRTP conducts research in consultation with each council, and provides information on deep-sea coral and sponge ecosystems in support of other NOAA management needs (e.g. National Marine Sanctuaries) and those of other federal agencies. Within funding constraints, and based on the availability of ship resources and partnerships, the DSCRTP Southeast Research Initiative will strive to supply information in order to improve the management of priority deep-sea ecosystems in each of the geographic areas of the Southeast Region.

The level of past research efforts varies among and within geographic areas, ranging from locations that have never been mapped or explored, such as those found throughout most of the U.S. Caribbean, to sites that have been surveyed extensively, such as the Viosca Knoll, which serves as a long-term monitoring site in the Gulf of Mexico. Each of the areas is deserving of support, but each has its own set of priorities and opportunities.

Despite the differences, there are several common research themes relating to deep-sea coral and sponge ecosystems that may be applied throughout the entire region. These themes include the need for: a) benthic habitat characterization and mapping, b) improving systematics and taxonomy, as well as c) conducting studies that will increase our understanding on population connectivity, trophic linkages, habitat use, climate change, ocean acidification and fishery impacts on deep-sea corals and sponges. Given their greater accessibility, cost effectiveness and relative ease of access, studies on heterotrophic corals in shallower mesophotic coral reefs may also provide relevant information for understanding ecosystems throughout the region. Such studies should not duplicate efforts by the CRCP or NCCOS to survey mesophotic ecosystems, but rather build on them.

Research conducted as part of the DSCRTP Southeast Research Initiative should use comparable methodologies and approaches throughout the region in order to facilitate cooperation, as well as allow for comparative studies among areas. There is opportunity to coordinate biological sampling protocols, benthic survey methods, and broadly regional research questions.

Additionally, the DSCRTP Southeast Research Initiative should maximize use of previously collected data in the area. The deep waters off the South Atlantic were the focus of a previous DSCRTP Research Initiative in 2009-2011. Numerous samples and datasets were collected during that previous effort, and should be available for further study. Similarly, mesophotic depths were the focus of many years of NCCOS research, and deep-water ecosystems were previously surveyed by OER in the U.S. Caribbean. These datasets offer great opportunities for data mining and habitat modeling.

Finally, the DSCRTP Southeast Research Initiative represents a major opportunity for outreach and education. Most of the general public is not aware of the existence of deep-sea coral and sponge ecosystems, and education and outreach are critically needed to raise awareness about these fragile and highly biodiverse ecosystems. The use of social media, as well as previously developed educational curricula and activities, will be needed to communicate the value of this important research effort. In the first year of funding of the DSCRTP Southeast Research Initiative (FY2016), small-scale, ready-to-go projects will be supported, focusing on data mining and data rescue activities along with a partnership research cruise. These activities will prepare the science team for more significant field-based investments in coming years.

Acknowledgments

We thank the Workshop Steering Committee for their guidance and input towards making this workshop a success. Special thanks to the NOAA Deep Sea Coral Research and Technology Program for funding the workshop and to Tom Hourigan, Fan Tsao and Robert McGuinn for providing help in planning and executing the workshop. We further thank the NMFS Southeast Regional Office for hosting the workshop, Maria Lopez for logistical support, Mark Mueller for assistance with mapping products, Heidi Stiller for facilitation guidance, and Graciela García-Moliner, John Froeschke and Chip Collier for providing input on the three Fishery Management Councils in the Southeast Region. Special thanks to Tom Hourigan, Andrew David, John Tomczuk, Bill Arnold and Jocelyn Karazsia for providing thoughtful reviews and comments on an earlier version of this report.

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Appendix A. Agenda of the three-day workshop hosted by the NMFS Southeast Regional Office in St. Petersburg, Florida.

Deep Sea Coral Research and Technology Program Southeast Initiative Priority Scoping Workshop November 18-20, 2015 St. Petersburg, FL

DAY 1
Wednesday, November 18, 2015

8:00 – 8:30	Check In and Registration	
8:30 – 9:00	Welcome, Introductions, and Agenda Review	Jennifer Schull
9:00 – 9:45	Overview of the Deep Sea Coral Research and Technology Program	Tom Hourigan
9:45 – 10:30	Review of Visual Aids and Summary Documents	Peter Etnoyer
10:30 – 10:45	BREAK	
10:45 – 11:45	Overview Presentation: South Atlantic	Chip Collier & John Reed
11:45 – 1:15	LUNCH	
1:15 – 2:15	Overview Presentation: US Caribbean	Graciela García-Moliner
2:15 – 3:15	Overview Presentation: Gulf of Mexico	Erik Cordes
3:15 – 3:30	BREAK	
3:30 – 4:30	Breakout Session 1: Priority Geographies	
4:30 – 5:00	Report out	
5:00	ADJOURN	

DAY 2
Thursday, November 19, 2015

8:30 – 9:00	Recap from Day 1, Preview of Day 2, and Introduce Breakout Session	Jennifer Schull
9:00 – 10:00	Breakout Session 2: Research Question Development (Round 1)	
10:00 – 10:15	BREAK	
10:15 – 11:15	Breakout Session 2: Research Question Development (Round 2)	
11:15 – 12:15	Breakout Session 2: Research Question Development (Round 3)	
12:15 – 1:45	LUNCH	
1:45 – 3:05	Report out	
3:05 – 3:20	BREAK	
3:20 – 3:50	Setting Priorities – Voting on Priority Research Questions	
3:50 – 4:20	Report Out	
4:20 – 5:00	Opportunities, Vessels, Platforms & Tools	Andy David
5:00	ADJOURN	

DAY 3
Friday, November 20, 2015

8:30 – 8:45	Recap of Day 2, Preview of Day 3	Jennifer Schull
8:45 – 9:15	Presentation: Ideas for Products of the Four Year Research Effort	Peter Etnoyer
9:15 – 10:15	Breakout Session 3: Logistics and Feasibility	
10:15 – 10:30	BREAK	
10:30 – 11:10	Report Out	
11:10 – 11:40	Priorities Matrix Discussion	Jocelyn Karazsia & Emma Hickerson
11:40 – 12:00	Wrap up & Next Steps	Jennifer Schull
12:00	ADJOURN	

Appendix B. Workshop participant list (*= member of the steering committee; steering committee member Brian Kinlan was not able to physically attend the meeting, but provided logistical support).

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Appendix C. Fishery Management Council summaries describing the most critical research and management needs for deep-sea coral and sponge ecosystems in the Southeast Region pertaining to deep-sea coral and sponge ecosystems. These summaries were prepared by the three fishery management councils prior to the workshop and discussed during the regional presentations at the workshop.

CARIBBEAN FISHERY MANAGEMENT COUNCIL - Draft Management Priorities

The Caribbean Fishery Management Council Five-year Research Priorities under the MSRA is a plan being developed by the Scientific and Statistical Committee. This Research Plan specifically includes five major topics: (1) stock status; (2) assessment of the impacts of current federal management regulations; (3) ecosystem-based research (large spatial and temporal scale studies); (4) fishing associated human communities; and (5) new and alternative sampling techniques. Of special interest to the Deep-Sea Coral Workshop the CFMC's priorities include:

1. Collection of samples to identify deep-sea corals (e.g., black corals) and sponges, as well as other organisms from mesophotic and aphotic reefs.
2. Benthic mapping (high-resolution bathymetry and habitat data to guide future surveys), description and characterization of the mesophotic coral reefs (> 30 m) extending to aphotic reefs (>200 m), seamounts and ridges.
    a. El Seco, Vieques, Puerto Rico extending to the MCD Hind Bank and Grammanik Bank, St. Thomas and the Virgin Island Passage.
    b. Bajo de Sico, Desecheo Ridge, West Coast of Puerto Rico
    c. Off shore Banks: Pichincho, Grappler, Whiting
    d. Mona Passage Seamounts
    e. Puerto Rico to St. Croix seamounts
3. Description and characterization of the deep water grouper and snapper habitats (e.g., queen snapper *Etelis oculatus*). Quantitative assessment of the deep water snappers populations various sites including:
    a. Mona Passage: Los Placeres, Bajo de Sico
    b. North Coast Puerto Rico and St. Thomas; St. Croix
    c. Los Rabos, Northwest Puerto Rico
4. Quantitative assessment of the deep-water populations of groupers and snappers
5. Develop protocol for AUVs (<700 m) and ROVs (>700 m) to assess the highly productive fish populations at these depths
6. Habitat description, quantification and assessment of the functionality of these deep-water habitats
7. Exploratory surveys of fishers' selected sites (commercial and recreational) to describe
    a. well known fishing areas
    b. assess the impact of fishing at these sites
    c. collection of samples to identify corals and sponges, as well as other organisms from these sites (i.e., new fish species)
8. Assessment of the status of species subject to seasonal closures in the EEZ only and in the EEZ and state waters (deep-water snappers and groupers). Status of fish spawning aggregations (> 50 m) at protected and unprotected known locations (e.g., Bajo de Sico, MCD Hind Bank, Lang Bank) and determination of habitat dependency.

GULF OF MEXICO FISHERY MANAGEMENT COUNCIL

Coral and Habitat Related Management Priorities

The Gulf of Mexico Fishery Management Council recently provided ranked research priorities to the National Marine Fisheries Service for 2015-2019. The priorities are organized in four main sections: (1) broad multi-purpose research, monitoring, and survey programs; (2) fish biology and stock status concerns; (3) social, cultural, and economic concerns; and (4) ecosystem considerations. The list of monitoring and research priorities was reviewed by the Council's Scientific and Statistical Committee and their recommendations relative to the priorities were incorporated into this report. This updated list of priorities for 2015-2019 was reviewed and approved by the Council at their October 20-23, 2014 meeting in Mobile, Alabama. Priorities related to habitat and coral management are summarized below.

Ecosystem-Based Management Recommendations
The short-term goal is the continued development of predictive ecosystem models to project fisheries productivity, assess uncertainty in stock assessments, improve single-species management and evaluate impacts of proposed management actions from an ecosystem perspective. The long-term goals are to develop data and methods to conduct integrated ecosystem assessments (lEAs) for the Gulf of Mexico, and to provide the necessary information to effectively adapt management to mitigate the ecological, social, and economic impacts of major shifts in the productivity and mortality of living marine resources.

Data Needs:

- Biotic components (coastal habitat, coral, algal/zooplankton, fishery, etc.).
- Ecosystem components (valuation of ecosystem services, nutrient cycling, ecosystem management, ecosystem restoration, marine spatial planning). **Priority Code A**
- Physical components (GIS database development/mapping of habitat, climatology, geographic and oceanographic variables). **Priority Code B**

Ecosystem Model Development: Priority Code C
The development of an ecosystem model uses the ranking for the previous three sections' priorities, because this item builds upon the previous data collection and research needs outlined above.
Develop predictive models for ecosystem assessment and to project fish productivity based on:

- Habitat availability and quality
- Long-term climate change and its relationship with the interaction of anthropogenic factors, physical habitat, trophic dynamics and habitat availability
- Descriptive models - to provide a snapshot of the ecosystem (e.g., Ecopath, Ecosim, Atlantis)
- Identifying opportunities and strategies for collaborative management of resources that are outside the jurisdiction of NOAA Fisheries but affect fishery stocks (e.g. freshwater inflows, non-point source pollution, human dimensions, loss of habitat such as marshes)

SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

Deepwater Coral Research and Monitoring Needs for the South Atlantic Region *as derived from the 2008 Deepwater Coral Research and Monitoring Needs for the South Atlantic Region (SAFMC 2008)*

The Deepwater Coral Research and Monitoring Plan for the South Atlantic Region is a regional research plan intended to guide deepwater coral ecosystem research and monitoring efforts conducted by NOAA and partners through grants and contracts in the South Atlantic region. The primary goal of this Research and Monitoring Plan is to support conservation and management of deepwater coral ecosystems in the South Atlantic region, while addressing NOAA's strategy to balance long-term uses of the marine ecosystem with maintenance of biodiversity. For purposes of this plan, **Deepwater Coral Ecosystems (DWCE)** are defined as: *Deepwater coral, coral reefs, and live/hard bottom habitat in waters extending from the 200 m contour to the seaward boundary of the EEZ.*

Goal: To protect deepwater corals by:

A. Refining existing (proposed) and designating new deepwater Coral HAPCs.

B. Increasing our understanding of DWCEs' ecological role and function in the South Atlantic region to guide future management actions.

PHASE I: MAP AND DESCRIBE KNOWN AND EXPECTED DEEPWATER CORAL ECOSYSTEMS IN THE SOUTH ATLANTIC REGION

Objective 1: Map the distribution of DWCEs in the Southeastern U.S. EEZ.

1A. Determine the extent of known DWCEs in the South Atlantic region.

1B. Map human activities that may impact DWCEs.

1C. Assess condition of DWCEs in the South Atlantic.

Objective 2: Describe the physiographic environment of DWCEs.

2A. Describe abiotic features (i.e., hydrographic, chemical) of DWCEs.

2B. Investigate the internal structure of DWCEs, particularly in relation to overlying hydrodynamic and physicochemical conditions, and changing climate over time.

Objective 3: Describe and inventory biota of DWCEs.

3A. Qualitatively and quantitatively describe the composition, diversity, assemblage organization and distributional patterns of DWCE benthic and water column fauna (invertebrates and vertebrates).

3B. Determine relative abundance and occurrence of economically and ecologically important species associated with DWCE.

PHASE II: DETERMINE ECOLOGICAL ROLE OF DWCE, INCLUDING THE ROLE OF DEEPWATER CORAL HABITAT AS ESSENTIAL FISH HABITAT EXPAND UNDERSTANDING OF STRUCTURE-FORMING SPECIES' BIOLOGY AND ECOLOGY

Objective 1: Describe logistic and coordination efforts that could improve the efficiency and effectiveness of deepwater coral biological studies.

1A. Determine the extent of known DWCEs in the South Atlantic region.

1B. Map human activities that may impact DWCEs.

1C. Assess condition of DWCEs in the South Atlantic.

Objective 2: Describe the population dynamics, movements and habitat associations of both economically and ecologically important species (including potentially exploitable species) associated with DWCEs.

2A. Determine the habitat relationships between deepwater corals and their associates.

2B. Determine the migratory pathways of the economically and ecologically important species associated with DWCEs.

2C. Determine the age structure and growth rates of economically and ecologically important species associated with DWCE as well as the sex ratio within each species.

2D. Determine the recruitment processes for the economically and ecologically important species associated with DWCE.

2E. Examine the reproductive biology of economically and ecologically important species associated with DWCE.

2F. Determine the genetic structure of the economically and ecologically important species associated with DWCE.

Objective 3: Describe food web dynamics of DWCEs.

3A: Characterize the trophodynamics and the benthic-pelagic interactions of organisms associated with deepwater coral habitat using both traditional and novel approaches.

Objective 4: Describe relationships among DWCE composition, structure and distribution and abiotic and biotic factors.

4A. Identify relationships between the distribution and development of DWCEs and abiotic and biotic factors.

4B. Develop models to enable predictions of DWCE status and trends.

4C. Determine long-term temporal (decadal to epochal scales) relationships between DWCE structure and distribution relative to overlying hydrodynamic regime.

Objective 5: Describe reproductive strategies (gametogenic cycles, sex ratio, fecundity, larval development modes) of priority structure–forming groups, including scleractinians (*Lophelia pertusa*, *Enallopsammia profunda*, *Madrepora oculata*), octocorals, antipatharians and stylasterids.

5A: Determine the gametogenic cycles and spawning periods for structure-forming corals.

5B: Determine larval development and settlement processes for structure-forming species.

Objective 6: Describe patterns and processes of colony growth and mortality (e.g., calcification, carbon and energy budgets) of important structure-forming species, and determine how they are affected by environmental factors and stressors.

6A: Determine rates of colony growth (i.e. habitat production).

6B: Determine physiological responses to stress (sediment, temperature, pollutants, CO^2) and how growth rate is affected by environmental factors (i.e., how is habitat production affected by environmental factors?)

6C: Determine temporal patterns of coral mortality and bioerosion (habitat loss).

Objective 7: Describe the genetic characteristics of structure forming coral populations.

7A: Determine the clonal structure of *L. pertusa* across spatial scales.

7B: Determine the extent of genetic connectivity among populations of *L. pertusa*.

Objective 8: Determine the nature, patterns, and processes of communities of microbial coral associates.

8A: Identify the symbiotic microbial community of coral colonies in different places and environmental conditions.

Appendix D. List of sites that should be prioritized for future research activities by the DSCRTP Southeast Research Initiative, along with justifications of why these sites should be prioritized. This list was compiled following a session at the workshop, during which participants brainstormed what specific locations should be prioritized for future research activities by the DSCRTP Southeast Research Initiative.

South Atlantic (in no particular order)

1. High Probability sites in Brian Kinlan's model (Kinlan et al. 2013)
    a. Connectivity studies
2. Pourtales Terrace – possible extensions of known *Lophelia* sites; unexplored gap areas among the 7 known sites found in Sept 2012 Foster cruise.
    a. Connectivity studies
3. Agassiz Valley Canyons
    a. Connectivity studies
4. Bahama Bank
    a. Connectivity studies
    b. Climate change studies
5. Edges of allowable fishing zones in CHAPC
    a. Fishers want to open more areas
6. South of Navy's Undersea Warfare Training Range (USWTR)
    a. Compare to Florida Straits
    b. Climate change studies
    c. Largely unexplored
7. Miami Terrance
    a. Logistically easy (except for strong currents)
    b. Connectivity studies
    c. Climate change studies
8. Florida Straits (incl. Miami and Pourtales Terraces, Bahamas Slopes, N. Cuba, Agassiz Valleys): unexplored *Lophelia* mounds that have golden crab fishery
    a. Climate change studies
    b. Fishing Impacts
9. Keller, Pamlico, and Hatteras Canyons off NC.
    a. Have different patterns and processes than elsewhere
10. Unexplored pinnacles/mounds
11. International Areas
    a. Abaco Canyon (Bahamas)
    b. Cuba - North Slope (oil impacts)
12. Shipwrecks
13. Unexplored sites in the shelf-edge MPAs between Florida and North Carolina
    a. e.g. Savannah Bank, Georgetown Hole, Devil's Hole
14. Glacial Scours
15. Charleston Bump
16. Blake Ridge/Escarpment

*Overarching Themes:

1. Connectivity and biogeography from North Carolina Canyons through Florida Straits and Bahamas
2. Unexplored areas
    a. Florida Straits, Agassiz Canyons, Cuba, Stetson and Savannah Banks

Management Areas – (e.g.: Shelf edge MPAs, including shipwrecks)

    a. Fishing Zones

b. Oil and Gas (Cuba)
c. Cables
d. Hydrokinetics

Climate Change and Sentinel sites

a. Florida Strait Monitoring (including Miami and Pourtales Terraces, Bahamas Slopes, N. Cuba, Agassiz Valleys)

Processes – long and short-term (baseline data)

Habitat function and trophodynamics

U.S. Caribbean (in no particular order)

1. Topographic features between West Puerto Rico and Dominican Republic (Pichanco/Bajo Placeras/etc.) Desecheo/Los Rabos
   a. Baseline – predictive model
2. NE of El Seco, Mesophotic & deep-sea corals; along shelf edge of platforms
   a. Fisheries management implications
   b. Baseline – predictive model
3. N. Coast of St. Croix , explore drop-off and deep-water shelf edge
   a. Interesting area/complex dynamics
4. Canyons and topographic features along north and south coasts of Puerto Rico
   a. Challenger reported *Lophelia* in this area
5. South coast PR shelf edge drop-off
   a. EFH and baseline data
6. SE of St. Croix, south of Lang Bank
   a. Recently discovered mounds with high diversity
7. Area North of Puerto Rico Trench
8. Puerto Rico Trench

*Overarching Theme: very limited data

Gulf of Mexico (in no particular order)

1. Campeche Escarpment – unexplored/high habitat suitability, connectivity, isolated. Yucatan Strait and shallow zonations
   a. Mesophotic
   b. International. EBM. Multibeam data from *Falkor*
2. South Texas Banks – and deeper reefs/not well explored. Greg Boland says he has historic video from mesophotic depths. Enough for management implications?
   a. Connectivity studies
   b. 100-200m
   c. Connectivity studies
3. Northwest Gulf of Mexico
   a. Mesophotic depths - varying levels of needs – from mapping, to characterization.
   b. Proposed HAPCs
   c. 100-200m – identify, map, characterize unexplored locations, and continue characterizing known areas
4. Upper Slope of Texas – potential *Lophelia* habitats and unexplored.
   a. 300+m – 600m. Habitat suitability availability (*Lophelia*)
5. West Florida Shelf and slope – least explored/high biodiversity. Existing multibeam data. *Lophelia* and black corals. Fishing threats.
   a. Beyond 50 miles – some oil & gas threat (limited oil and gas)
   b. Large proposed HAPC

6. Sigsbee Escarpment – high-diversity and deep
    a. Less stable
    b. Connectivity studies
    c. High reflectivity (hard bottom)
    d. Geology/sub test
7. DeSoto Canyon
    a. Own biogeographical province/aliens
    b. Largest deep-sea sponge population
8. Gap – West Florida Escarpment – comprehensive coverage (see number 5)
9. Viosca Knoll (826) – long-term study sites (temporal)
    a. Process vs. exploration – some unexplored
10. Oil rigs and shipwrecks with corals
    a. BOEM
    b. Logistically challenging
    c. Connectivity studies
    d. Outreach opportunity
11. Pulley Ridge sponge diversity
12. High intensity – royal red/VMS analysis
13. Western Part Florida Channel
14. Interesting biogeographical split, topographic complex, currents, climate
15. Proposed HAPC areas – needs further exploration

*Overarching Theme: Highly impacted areas

Appendix E. List of research questions that should be prioritized by the Southeast Research Initiative by geographic area. This list was compiled following a session at the workshop, during which participants brainstormed research questions by geographic area, and then voted for those questions they felt were most important for the DSCRTP Southeast Research Initiative to address. Research questions were ranked based on the number of votes they received, with the top third considered high priority, the bottom third considered low priority and the rest considered medium priority. Themes correspond to research themes in the Strategic Plan (see Breakout Session 2 section).

South Atlantic

Research Question	***Theme***	***Votes***	***Rank***
What drives community structure differences between sites (e.g. Miami Terrace vs. Portales, fish and microbenthic organisms, Straits of Florida vs. Carolina, East and West sides of Straits of Florida, *Lophelia* vs. *Enaplopsamnia*-dominated areas)?	2	16	High
How are populations connected and what factors shape the genetic connectivity of deep-sea coral ecosystems in the South Atlantic (e.g. stepping stone, dispersal barriers)?	1	16	High
How do deep-sea coral ecosystem communities differ inside and outside of protected areas (MPAs, HAPCs)?	3	14	High
How do upwelling regimes and variability in other ocean conditions impact deep-sea coral and sponge communities?	4	13	High
What topographic features are associated with deep-sea coral ecosystems (e.g. bumps, on the Carolina-Florida margin, within CHAPC)?	1	13	High
What interactions (past, present and future) occur fishing gear from the golden crab, royal red, and wreckfish fisheries and between deep-sea coral and sponge ecosystems?	3	10	High
How accurate are model predictions of deep-sea coral ecosystems, particularly for structure-forming taxa?	1	10	High
How do seeps influence deep-sea coral and sponge ecosystems?	2	8	Med.
What are the impacts from energy extraction, cable deployment and other human activities on deep-sea coral and sponge ecosystems?	3	7	Med.
What is the connectivity (i.e., ecological, genetic, evolutionary) between the Agassiz Valley and Western Atlantic Canyons (Bahama Bank/Terraces/Stetson Bank)?	2	6	Med.
How does the Gulf Stream influence deep-sea coral and sponge ecosystems?	2	5	Med.
What is the extent of unexplored areas?	2	4	Med.
What is the intra-annual variability of ocean conditions and how does it affect the distribution of *Lophelia* and *Oculina* communities (and their associates) at depths shallower than 400 m?	1	4	Med.
Can we identify and establish a monitoring site to better understand the climate envelope (e.g. Canaveral ~420m; Canaveral ~750m, Miami Terrace, Stetson Bank)?	4	3	Med.
Where are deep-sea coral and sponge ecosystems relative to locations that are threatened?	1	3	Med.
Can archived data (e.g. NSU archives) be synthesized to create publications?	3	2	Low
How much can we extrapolate data from the Gulf of Mexico to the South Atlantic?	2	2	Low

South Atlantic Research Question (continued)	*Theme*	*Votes*	*Rank*
What is causing the high abundance of dead corals on deep mounds (also applies to Gulf of Mexico)?	2	1	Low
Where are the topographic features associated with deep-sea coral and sponge ecosystems north of Cuba and at Bahama Bank?	1	1	Low
How do deep-sea coral and sponge ecosystems in the Agassiz Valley differ from those in Northeast Canyons?	1	1	Low
Is there more destruction to coral communities near canyons due to the transport of marine debris?	3	0	Low
What opportunities are available through partnerships with the Navy to mitigate impacts to deep-sea coral and sponge ecosystems in the new operating areas (AA, BB and CC live fire zones and USWTR)?	3	0	Low
What is the species richness, species composition and associated species of deep-sea coral and sponge ecosystems in the Agassiz Valley and beyond?	1	0	Low
What is the relationship between hydrographic/topographic features and deep-sea coral and sponge communities at Agassiz Valley and beyond??	1	0	Low
With Agassiz Valley as a starting point, where are the topographic features associated with DSC? Where are the DSC hotspots and what is their extent?	1	0	Low
How will deep-sea coral and sponge ecosystems respond to different levels of impact?	1	0	Low

U.S. Caribbean

Research Question	*Theme*	*Votes*	*Rank*
What is the extent of deep-sea coral ecosystems in sites with high rugosity (particularly at El Pinchincho, east of Vieques, the shelf edge, southeast of St. Croix, Barca del Guineo, #143, and Mona Passage)?	1	25	High
Which species of deep-sea corals and sponges are present? Need to resolve taxonomy, more sampling and include molecular analyses.	2	19	High
Do deep-sea coral and sponge ecosystems exist in areas that are heavily fished for deep-water snappers? Can we partner with fishers to better understand deep-sea coral and sponge ecosystems?	3	16	High
Where are deep-sea coral and sponge ecosystems located? What existing datasets can be incorporated into models in order to predict the distribution of deep-sea coral and sponge ecosystems?	1	14	High
What are the most significant anthropogenic impacts to deep-sea coral and sponge ecosystems, particularly at mesophotic depths?	3	13	High
What is the community structure of deep-sea coral and sponge ecosystems and what environmental conditions (e.g. temperature) are these exposed to?	1	10	Med.
What is the relationship between deep-sea coral and sponge ecosystems and pelagic communities (do corals enhance pelagic fish productivity)? Are there surface environmental factors that can serve as proxies for the presence of deep-sea coral and sponge ecosystems?	1	9	Med.
Are mesophotic reefs genetic refuges from shallow-water stressors? Are these two systems connected, and which one is more resilient to stressors?	2	8	Med.
What deep-sea coral and sponge habitats are associated with snappers targeted by the deep-water fishery?	1	8	Med.
Are *Lophelia* bioherms present in the U.S. Caribbean? Is their presence driven by productivity or caused by other factors?	1	7	Med.
What are the trophic dynamics in deep-sea coral and sponge ecosystems?	2	6	Med.

U.S. Caribbean Research Question (continued)	*Theme*	*Votes*	*Rank*
What is the biodiversity inside the HAPC at Bajo de Sico below 50 m depths?	2	3	Low
Does fishing pressure alter the community structure of deep-sea corals and sponges? Is there a relationship between fishing pressure and distance from shore?	3	2	Low
What can be learned about the impacts of cable installation, ocean thermal energy conversion and other human activities on deep-sea coral and sponges from existing data sets?	3	2	Low
Which deep-sea corals and sponges recruit and grow on shipwrecks?	3	1	Low
Do blooms of *Sargassum* affect deep-sea coral and sponge ecosystems? How will *Sargassum* blooms be affected by climate change?	2	1	Low
Do dump sites impact the deep-water grouper fishery?	3	0	Low

Gulf of Mexico

Research Question	*Theme*	*Votes*	*Rank*
What is the extent of the distribution of deep-sea coral and sponge ecosystems (throughout the entire Gulf, in the northern Gulf of Mexico, in sites of interest to the GMFMC, at 200-600 m on the upper slope off Texas, at 1,000-2,600 m throughout the Gulf, at Campeche Bank, at the northern West Florida Escarpment between the known *Lophelia* sites west of St. Petersburg and DeSoto Canyon)?	1	20	High
What interactions (past, present and future) occur between fishing gear from the golden crab, royal red, and wreckfish fisheries and deep-sea corals and sponges?	3	16	High
What buffer distances should be implemented between deep-sea coral and sponge ecosystems and human activities? How do these differ by activity type (e.g. oil and gas exploitation, fishing, shipping, lightering areas)?	3	14	High
What deep-sea coral and sponge sites could serve as sentinel sites to better understand the effects of climate change on these ecosystems (e.g. Viosca Knolls, Flower Garden Banks, West Florida Escarpment)? Can a long-term monitoring site be established to study the effects of climate change?	4	13	High
Which known seafloor features in the Northern Gulf of Mexico are in need of mapping, groundtruthing and characterization?	1	12	High
What drives community differences between deep-sea coral and sponge ecosystems on hard bottom habitats in low-relief vs. high-relief sites?	1	10	High
What is the connectivity between coral ecosystems at different depths (shallow-water, mesophotic and deep-sea coral ecosystems)?	2	9	High
What is the community structure of deep-sea coral and sponge ecosystems below 1000 m depths?	2	8	Med.
What is the impact of low dissolved oxygen levels on the survival of deep-sea corals and sponges? Do dead zones in the Gulf of Mexico impact dissolved oxygen levels at depth, particularly in the North-Central Gulf, Green Canyon 354, Mississippi Canyon 751 and the West Gulf unexplored area?	4	8	Med.
What is the health status of deep-sea coral and sponge ecosystems and how do we to develop health indices for these ecosystems? (Mesophotic sites in the Gulf of Mexico represent particularly good locations to answer these questions)	1	7	Med.
What is the relative importance of vertical relief and bottom hardness for deep-sea corals and sponges?	1	7	Med.

Gulf of Mexico Research Question (continued)	*Theme*	*Votes*	*Rank*
How will removals of oil rigs affect the connectivity of deep-sea coral and sponge ecosystems? Will the removal of oil rigs increase fishing impacts on natural reefs?	3	5	Med.
Where are structure-forming deep-sea corals and sponges at the South Texas Banks? Is historic data of good quality available that can inform management decisions?	1	2	Low
How do eddies from loop currents influence deep-sea coral and sponge ecosystems?	2	2	Low
What is the diversity of the glass sponge community at Elvers Bank?	2	2	Low
Are mesophotic reefs refugia from shallow water stressors?	2	1	Low
Are the unexplored deep western slopes off Texas and Florida similar to other previously explored areas?	2	1	Low
What is the extent of the bioherms in the northwestern Gulf of Mexico, particularly at Elvers and Geyer Banks?	2	1	Low
What effects do hurricanes have on deep-sea coral and sponge ecosystems?	2	1	Low
How does ongoing oil and gas exploration impact deep-sea coral and sponge ecosystems?	3	1	Low
Can the oil industry be used to better understand oceanic and climate conditions of deep-sea habitats (e.g. sensors on rigs, current monitoring with fiberoptic network)?	4	0	Low

Regional (All geographic areas)

Research Question	*Theme*	*Votes*	*Rank*
Which species of deep-sea corals and sponges (as well as their associates) are present in deep-sea coral and sponge ecosystems?	1	10	High
What is the connectivity between different deep-sea coral and sponge ecosystems (both in terms of population genetics and source-sink dynamics)?	2	9	High
How can we assess the health and resilience of deep-sea coral and sponge ecosystems? Are there signs of recruitment or recovery in areas that have been impacted in the past?	3	8	High
What are the relationships between deep-sea corals and sponges and their epifauna?	2	8	High
How much can deep-sea fish and benthic communities be impacted and still maintain sustainable fisheries?	3	7	High
What is reproductive biology and ecology of deep-sea corals and sponges (larval biology, colony size-frequency distribution, recruitment, environmental, etc.)?	2	7	High
What is the variability of environmental parameters in locations that have deep-sea coral and sponge ecosystems (temperature, dissolved oxygen, salinity, aragonite saturation, pH, total alkalinity, etc.)?	4	7	High
What topographic features are associated with deep sea coral ecosystems? Where are the hotspots and what is their spatial extent?	1	7	High
What are the environmental limitations (i.e., temperature, depth, dissolved oxygen, aragonite saturation, pH, etc.) of deep-sea coral and sponges, as well as their associated species?	1	7	High
What is the most useful level of spatial and taxonomic resolution for models to guide cruise planning and management?	1	7	High

Regional Research Question (continued)	*Theme*	*Votes*	*Rank*
What is trophic ecology of deep-sea coral and sponge ecosystems? What is the food source?	2	6	High
What are the stressors on deep-sea coral and sponge ecosystems (e.g. invasive species, sedimentation, predation, temperature, fishing impacts, etc.)?	2	5	High
Can we reconstruct paleoclimates using deep-sea corals and sponges (radio isotopes, reef cores, black/gold/bamboo/cup/primnoid corals, and paired water samples)?	4	5	High
How much do deep-sea corals calcify under low aragonite saturation states and under low oxygen levels?	4	5	High
How do we resolve the taxonomy of habitat-forming species (development of genetic markers and increase sampling)?	2	4	Med.
Can we use deep-sea coral and sponge ecosystems to better understand changes in ocean circulation (AOML/Loop/Gulf Stream)?	4	4	Med.
What is the impact and extent of invasive species (i.e., Lionfish) on mesophotic and deep-sea coral and sponge habitats? Are there differences based on depth, geography or length of time lionfish have been at sites?	3	3	Med.
What is the “halo effect" of deep-sea coral and sponge ecosystems?	2	3	Med.
What are the relationships and interactions of deep-sea coral and sponge ecosystems with fisheries?	2	3	Med.
Can we construct meaningful carbonate budgets and use these as a tool to examine influences of climate change? How would declining pH and bioerosion influence live and dead deep-sea coral reefs?	4	3	Med.
What are the predicted abundance and density of deep-sea corals and sponges? Can these be modeled?	1	3	Med.
What are the influences of deep-sea corals and sponges on pelagic communities? Can this information be used to inform management of MPA design and fishing best practices?	3	2	Med.
What are the impacts of plastics and micro-plastics on deep-sea coral and sponge ecosystems?	3	2	Med.
How do fish assemblages affect deep-sea coral and sponge ecosystems?	2	2	Med.
How do we measure health and condition of deep-sea corals and sponges (e.g. symbionts, microbial communities, visual signs of disease)?	2	2	Med.
What scale is relevant to management and what tools are available to inform management decisions?	2	2	Med.
What type of outreach is needed to protect deep-sea coral and sponge ecosystems?	2	2	Med.
What are the species compositions and relative abundances of associated species in deep-sea coral and sponge communities?	1	2	Med.
Are there indicators of the presence of deep-sea coral and sponge communities in data from the overlaying water column?	1	2	Med.
What is the relationship between deep-sea coral growth and local productivity?	1	2	Med.
How does diversity and abundance change with latitude?	1	2	Med.
Do artificial structures (e.g., rigs, shipwrecks) influence population connectivity and what can we learn about coral growth and colonization rates from looking at artificial structures?	3	1	Low
How do we define vulnerable deep-sea coral and sponge marine ecosystems?	2	1	Low
What is the relationship between hydrographic/topographic features and local deep-sea coral and sponge communities?	1	1	Low

Regional Research Question (continued)	***Theme***	***Votes***	***Rank***
What is the health status of deep-sea coral and sponge communities and how to develop health indices?	1	1	Low
What is the anthropogenic acoustic environment at deep-sea coral and sponge habitats?	3	0	Low
Are there critical services provided by deep-sea corals and sponges across depth ranges?	2	0	Low
Are zooxanthellae present in deep-sea corals? If so, how are they transferred there (e.g. brooders vs. spawners)?	2	0	Low
How do migratory species affect deep-sea corals and sponges?	2	0	Low
How does habitat specificity vary by region?	2	0	Low
What are the growth rates and ages of deep-sea corals and sponges (rates of accretion, calcification, other biological processes)?	2	0	Low
What are the competitive relationships?	2	0	Low
Are deep-sea corals and sponges vulnerable to harmful algal blooms?	2	0	Low
What data and literature exist to describe past conditions (temperature, climate, ocean circulation) for deep-sea coral and sponge ecosystems (e.g. OOS Program)?	4	0	Low
How does the microbial community respond to climate changes (i.e., disease)?	4	0	Low
How will expected changes in climate influence deep ocean currents?	4	0	Low
What is the potential for coral adaptability/resilience to climate change?	4	0	Low
What is the ecological zonation of deep-sea corals and sponges in the Southeast Region?	1	0	Low

Appendix F. Interactive calendar with research expeditions and projects in the Southeast Region that are already planned for 2015-2019.

			2015			2016											
Area	**Project/Expedition**	**Contact and Agency**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
U.S. Caribbean	NOAA Ship *Nancy Foster* in the U.S. Caribbean	Chris Taylor (NCCOS)						29 days									
	Data mining deep coral records from NCCOS ROV video missions in the U.S. Caribbean	Randy Clark, Tim Batista (NCCOS)															
Gulf of Mexico	Data rescue, synthesis and compilation	Brian Kinlan, Peter Etnoyer (NCCOS). Rebecca Green, Michelle Nannen (BOEM).						Temp Univ. (*Lophelia* II/ Leslie Wickes), FGBNMS (TBD) and HBOI (Modeling Gold Mine/ Andrew Shuler)										
	Mapping commercial bottom-contact fishing intensity in the Gulf of Mexico in relation to deep-sea coral habitat suitability	Randy Clark (NCCOS)	Funded for FY15, DSCRTP small grants														
	Ecosystem Impacts of Oil and Gas Inputs to the Gulf of Mexico (ECOGIG)	Mandy Joye, Erik Cordes (https:/www.ecogig.org)															
	R/V Manta ROV surveys in and around FGBNMS	Emma Hickerson (ONMS)												Sep. 4-9			
South Atlantic	Data rescue, synthesis and compilation	Brian Kinlan (NCCOS), Rebecca Green, Michelle Nannen (BOEM)						DSCRTP visit John Reed/Stephanie Farrington									
	Nancy Foster in S. Atlantic (locating habitats ~75-100 m) - may be able to use/add time for DSCRTP work	Chris Taylor (NCCOS)												30 days			

			2015			2016											
Area	**Project/Expedition**	**Contact and Agency**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
South Atlantic (continued)	Ship time on *PISCES* (Wilmington Canyon, S and N Carolina Canyons), using Sentry AUV (?)	Martha Nizinski (NMFS S&T)											24 Aug - 7 Sept				
	South Atlantic mapping priorities workshop	Chris Taylor (SECART, NCCOS)						May 15									
	South Atlantic *Oculina* experimental closed area and deep-water marine protected areas: characterization of benthic habitat and fauna (Project funded for 2014-2017 for work on continental shelf edge of the South Atlantic Bight)	Stacey Harter (NMFS), Andrew David (NMFS) and John Reed (HBOI)									June 7-22 PISCES						
Other	PASS ship time requests for 2017 - 2019 OPEN (FY17 due by 12/4, FY 18 and 19 due by 1/15)		PASS Open 10/16/2015		Dec 4- FY17 Requests due	Jan 15 FY18 & FY19 Requests Due											
	National EFH Summit in Annapolis, MD									May 17-19							
	DSCRTP SE science team meeting in Charleston, SC													Sept. 27-28			
	International Deep-Sea Coral Symposium in Boston, MA													Sept 12-16			

			2017											
Region	**Project/Expedition**	**Contact and Agency**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
U.S. Caribbean														
Gulf of Mexico	Data rescue, synthesis and compilation	Brian Kinlan, Peter Etnoyer (NCCOS), Rebecca Green, Michelle Nannen (BOEM)												
	Ecosystem Impacts of Oil and Gas Inputs to the Gulf of Mexico (ECOGIG)	Mandy Joye, Erik Cordes (www.ecogig.org)											could be renewed for an additional 3 years	
South Atlantic	Data rescue, synthesis and compilation	Brian Kinlan, Peter Etnoyer (NCCOS), Rebecca Green, Michelle Nannen (BOEM)												
	12 DAS on *PISCES* for ROV and multibeam mapping of deep-sea coral habitat	Martha Nizinski (NMFS S&T)								12 days				
	South Atlantic *Oculina* experimental closed area and deep-water marine protected areas: characterization of benthic habitat and fauna (Project funded for 2014-2017 for work on continental shelf edge of the South Atlantic Bight)	Stacey Harter (NMFS), Andrew David (NMFS) and John Reed (HBOI)						June 20 - July 5 on Pisces						

			2018											
Region	**Project/Expedition**	**Contact and Agency**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
U.S. Caribbean														
Gulf of Mexico	Data rescue, synthesis and compilation	Brian Kinlan, Peter Etnoyer (NCCOS), Rebecca Green, Michelle Nannen (BOEM).												
	Ecosystem Impacts of Oil and Gas Inputs to the Gulf of Mexico (ECOGIG)	Mandy Joye/Erik Cordes (www.ecogig. org)											could be renewed for an additional 3 years	
South Atlantic	Data rescue, synthesis and compilation	Brian Kinlan, Peter Etnoyer (NCCOS), Rebecca Green, Michelle Nannen (BOEM)												
Other	*Okeanos Explorer* heads to Atlantic via Panama Canal	Jeremy Potter (OER)												

			2019											
Region	**Project, Expedition**	**Contact and Agency**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
U.S. Caribbean														
Gulf of Mexico	Data rescue, synthesis and compilation	Brian Kinlan, Peter Etnoyer (NCCOS), Rebecca Green, Michelle Nannen (BOEM)												
South Atlantic	Data rescue, synthesis and compilation	Brian Kinlan (NCCOS), Rebecca Green, Michelle Nannen (BOEM)											Through 2020	
Other														

Appendix G. List of opportunities, vessels, platforms and tools that could be used as part of the DSCRTP Southeast Research Initiative. List includes research vessels, human occupied vehicles, remotely operated vehicles, autonomous underwater vehicles, specialized laboratories, supplemental funding opportunities and other resources.

Research Vessel	Point of Contact	Notes
R/V Atlantis	U.S. Navy/WHOI ; https://www.whoi.edu/main/ships/atlantis	Support ship for *HOV Alvin*
R/V Baseline Explorer	Brownies Global Logistics, Global Sub Dive http://globalsubdive.com/docs/BaselineExplorerSpecSheet.pdf	Uses Triton Submersibles
E/V Nautilus	Ocean Exploration Trust; http://www.nautiluslive.org/ev-nautilus	*ROV Hercules* and *ROV Argus*, multibeam sonar and telepresence technology
M/V Sea Scout	Oceaneering (Acquired C&C Technologies, a Global Survey Company) http://www.allamericanmarine.com/project/134-sea-scout-research-vessel/	134 ft. aluminum catamaran, docked in Louisiana, good fit for Global Explorer ROV system
M/V SPREE	SPREE Expeditions, Inc. http://www.researchvesselspree.com/spreeexpeditions/boatInfo.aspx	Diving, tech diving, can accommodate ROV, $6500/day, NOAA IDIQ contract for $5000/day
NOAA *SRV Manta*	Flower Garden Banks National Marine Sanctuary http://flowergarden.noaa.gov/about/rvmantaspecs.html Emma Hickerson ; emma.hickerson@noaa.gov	A-Frame, experienced crew, polemount system, no DP (but jet driven), has multibeam access, $7500/day
NOAA Ship *Henry B. Bigelow*	NOAA; http://www.omao.noaa.gov/learn/marine-operations/ships/henry-b-bigelow	Multibeam sonar, dynamic positioning
NOAA Ship *Gordon Gunter*	NOAA/NMFS; http://www.omao.noaa.gov/learn/marine-operations/ships/gordon-gunter	
NOAA Ship *Ferdinand R. Hassler*	NOAA; http://www.omao.noaa.gov/learn/marine-operations/ships/ferdinand-r-hassler	Hydrographic vessel
NOAA Ship *Nancy Foster*	NOAA/NOS; http://www.omao.noaa.gov/learn/marine-operations/ships/nancy-foster	Multibeam (optimal <2000 m), A frame, capable of small ROV/AUV operations, Dynamic positioning
NOAA Ship *Okeanos Explorer*	NOAA/OAR; http://oceanexplorer.noaa.gov/okeanos/about.html	multibeam, telepresence, 6, 000 m ROV, prefers >500m, but can work as shallow as 250m
NOAA Ship *Oregon II*	NOAA/NMFS; http://www.omao.noaa.gov/learn/marine-operations/ships/oregon-ii	
NOAA Ship *Pisces*	NOAA/NMFS; http://www.omao.noaa.gov/learn/marine-operations/ships/pisces	Dynamic positioning, multibeam
NOAA Ship *Ronald H. Brown*	NOAA; http://www.omao.noaa.gov/learn/marine-operations/ships/ronald-h-brown	Multibeam (full ocean depth), capable of large ROV/AUV operations, Dynamic Positioning, depth limits usually governed by asset onboard
NOAA Ship *Thomas Jefferson*	NOAA; http://www.omao.noaa.gov/learn/marine-operations/ships/thomas-jefferson	Hydrographic vessel

Research Vessel (continued)	Point of Contact	Notes
R/V Dorado Discovery	Odyssey Marine Exploration; http://www.odysseyminerals.com/documents/RVDoradoDiscoveryShipSpecifications7.12.pdf	Deepwater multibeam echosounder, has ROV
R/V Falkor	Schmidt Institute; http://schmidtocean.org/rv-falkor/	Will have a 4500 m ROV within a year, and are soliciting for project letters of intent for 2018 and beyond, 272 ft. ship, ROV/AUV Capacity, Dynamic Positioning, no cost to PI for ship, Letters of Intent for 2018 due Dec 4, 2015; Several PIs putting in Letters of Intent for 2018 and beyond for Atlantic/Caribbean region
R/V Odyssey Explorer	Odyssey Marine Exploration; http://www.odysseymarine.com/documents/explorerbrochure3-16.pdf	Dynamic Positioning, Multibeam mapping
R/V Pelican	University of Southern Mississippi LUMCON; http://lumconvessels.com/rv-pelican Joe Malbrough; jmalbrough@lumcon.edu; Tel:985-851-2809,	A-Frame, berthing for 14
R/V Point Sur	University of Southern Mississippi, https://www.usm.edu/marine/rv-point-sur Joe Malbrough; jmalbrough@lumcon.edu; Tel:985-851-2809	A-Frame, berthing for 11, has worked in deepwater; 5000 m of cable, CTD
R/V Sea Scout	Oceaneering Survey Services; http://www.allamericanmarine.com/project/134-sea-scout-research-vessel/; Joe Gelpi; jgelpi@oceaneering.com; Tel: 985-518-0899	134 ft. catamaran, can combine with ROV *Global Explorer*
R/V Walton Smith	UNOLS/University of Miami-RSMAS; http://www.rsmas.miami.edu/resources/marine-department/fg-walton-smith/	A-Frame, experienced captain, berthing for 12, $13.5K/day
R/V Weatherbird	Florida Institute of Oceanography; http://fio.usf.edu/vessels/rv-weatherbird	
Small Research Vessel Experimental (SRVX)	NOAA Sanctuaries (East Coast Sanctuaries) http://sanctuaries.noaa.gov/about/vessels/vessels.html	85 ft. vessel; 28 passengers on day trips and 12 passengers on overnight trips

Human Occupied Vehicle (HOV)	Point of Contact	Notes
Alvin	U.S. Navy/WHOI ; http://www.whoi.edu/main/hov-alvin/	3-person sub, *R/VAtlantis* is the support ship, 4500 m
Ictineu Submarine	Ictineu; http://www.ictineu.net/en/	New 1200 meter design observation class submersible, 20-continuous hours of propulsion at 1 knot cruise and many hours at 3-4 knots. She should have class approval for 1000-meter service this year
Pisces IV and *V*	Hawaii Undersea Research Lab; http://www.soest.hawaii.edu/HURL/subops/piscesIV.html http://www.soest.hawaii.edu/HURL/subops/piscesV.html	In Hawaii; has dedicated vessel, but may be discontinued due to funding.
Idabel	Roatan Institute of Deepsea Exploration (RIDE) http://www.stanleysubmarines.com/submarine/ Karl Stanley	In Roatan, Honduras, may be liability issues, no manipulator arms, $2500/day, 915m, no dedicated support vessel
Triton Submarine	Brownie's Global Logistics (Project baseline); robert@globalsubdive.com; http://www.projectbaseline.org; http://www.globalsubdive.com	2 submersibles and 1 ROV, 305 m, procurring a 1,000 m sub, $3.3-10k/day (depending on the amount of days); for 5 days at $10k/day, they match with 10 days, has MOU with HBOI, may be procuring a 1000m sub

Remotely Operated Vehicle (ROV)	Point of Contact	Notes
Argus	On E/V *Nautilus*, http://www.nautiluslive.org/tech/rov-argus	Usually tethered to *Hercules*, 6000 m
Beagle	Marine Applied Research and Education (MARE) - California, Dirk Rosen (510) 232-1541; http://www.maregroup.org/the-beagle-rov.html	Photo/HD video/sampling; 1000 m, but best to 600 m; not great in high current, $8K/day, very dependable, team spends almost 100 days a year at sea
Deep Discoverer	NOAA OER; http://oceanexplorer.noaa.gov/technology/subs/deep-discoverer/deep-discoverer.html Jeremy Potter, jeremy.potter@noaa.gov	HD video/sampling/ CTD/ DO sensor, 6000 m, D2 is integrated into *Okeanos Explorer*, telepresence technology
Deep Reef	MIT; Brennan Phillips; btphillips@g.harvard.edu	1000m, needs upgrade, hire of 2 ROV contractors=$20K, rental of USBL system (Sonardyne Scout)=$10K, new tether/UNOLS winch rental/termination hardware=$42K
Global Explorer	Deep Sea Systems Int'l; http://www.deepseasystems.com/	Photo/stereo video/sampling, 3000 m
Hercules	On *E/V Nautilus*, Institute for Exploration, http://oceanexplorer.noaa.gov/technology/subs/hercules/hercules.html	4000 m

ROV (continued)	Point of Contact	Notes
Jason	UNOLS/WHOI; http://www.whoi.edu/fileserver.do?id=55543&pt=10&p=38332 Cathy Offinger; coffinger@whoi.edu	6500 m, $20,000-$24,000/day, UNOLS, Cost was $30K per day in 2010. Requires Ron Brown or similar size ship
Kraken II	University of Connecticut; http://www.nurtec.uconn.edu/technology/kraken-2-rov/	Photo/video/sampling, 1000 m, does not spend a lot of time at sea, ~$7500/day
Mohawk	UNCW-UVP/FGBNMS; http://flowergarden.noaa.gov/document_library/scidocs/mohawkrov.pdf	300 m, crew of 2, new collection skid (Biobox with dividers), suction hose, 5 rotating buckets, photo, video, sampling, can upgrade to 1000 m (TMS, umbilical, floatation), $4K/day (with collection skid) - upgrade of $315K would include the new flotation to allow the vehicle to go to 1000 m. This setup is just like Kraken II. They would still maintain capability to operate as they do now - with a 365 m tether as needed.
ROPOS	Canadian Scientific Submersible Facility, West Coast; http://www.ropos.com/index.php/ropos-rov	Photo/video/sampling, has intermediate and deep-water configurations, 3000-5000 m
Zeus I and II	Odyssey Marine Exploration; http://www.odysseymarine.com/tools.html	2500 m

Autonomous Underwater Vehicle/Glider	Point of Contact	Notes
Eagle Ray	NOAA NIUST/University of Mississippi; http://www.gulfbase.org/asset/view.php?aid=era; Arne-Roland Diercks; arne.diercks@usm.edu; Tel.: 662-915-2301	High-resolution seafloor mapping down to 2200, can deploy and recover instruments
Remus	U.S. Navy; http://my.nps.edu/web/cavr/auv	100 m, NOAA has MOU with U.S. Navy to use their AUVs for only the cost of travel for operators
Sentry	WHOI; https://www.whoi.edu/main/sentry	Bathymetric, sidescan, subbottom, and magnetic maps of the seafloor and is capable of taking digital bottom photographs in a variety of deep-sea terrains such as mid-ocean ridges, deep-sea vents, and cold seeps at ocean margins. 6000 m
Sea Bed	WHOI; http://auvac.org/configurations/view/74	2000 m

Moored Instrument	Point of Contact	Notes
Benthic landers	Various research groups	
Temperature loggers	Star-Oddi loggers, HOBO loggers, TidBit loggers	Price is $150-1000/ea. depending on depth rating, logs data for one year or more.
Time-lapse cameras	Florida State University; Dr. Ian MacDonald; imacdonald@fsu.edu	requires at least one berth

Specialized Laboratory	Point of Contact	Notes
NOAA NCCOS Deep-Coral Lab	Dr. Peter Etnoyer; peter.etnoyer@noaa.gov	Image annotation, phylogenetics, species identification, cold aquaria, SEM, toxicology, sediment chemistry
Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution	Dr. Steve Cairns; cairnss@si.edu	Phylogenetics, species identification, archival material
Texas A&M University Geology	Dr. Brendan Roark; broark@geos.tamu.edu	Radio-isotopes, age and growth, geosciences, radio-isotopes, radio-carbon, uranium/thorium, stable isotopes, trace elements, total Alkalinity
USGS, Menlo Park, CA	Dr. Nancy Prouty; Nprouty@usgs.gov	Radio-isotopes, stable isotopes, age and growth
USGS, West Virginia.	Dr. Cheryl Morrison; Cmorrison@usgs.gov	Population genetics of corals and crabs
NOAA's National Systematics Lab	http://www.nefsc.noaa.gov/nefsc/systematics/ Dr. Martha Nizinski; martha.nizinski@noaa.gov	Systematic, taxonomic, and life history research on marine organisms

Other Resources	Point of Contact	Notes
Passive Acoustic Receivers	Vemco; http://vemco.com/products/vr2w-69khz/	Measures presence of tagged individuals when tag and receiver in close proximity. Fishery management applications
Technical SCUBA diving	University of Puerto Rico University of Virgin Islands NOAA Diving Program; greg.mcfall@noaa.gov	100 m depth capacity within NOAA
Drop Cameras	University of Virgin Islands	300m
Go Pro Cameras	https://www.tindie.com/products/GroupBinc/extreme-depth-underwater-housing-for-gopro/	1500 m housings commercially available
360 Cameras	FSU (Koenig)	

Other Resources (continued)	Point of Contact	Notes
SeaSketch Website	http://www.seasketch.org/home.html	Opportunity to put priority mapping polygons for consideration by vessels
Towcam	WHOI; http://www.whoi.edu/main/towcam	Operates in high currents, tows at 0.25 knot and flies 3 m off bottom, needs DP, 6000 m
ISIS2 Towed Camera System	University of Connecticut; http://www.nurtec.uconn.edu/isis2-towed-system/	images and video, 1000 m
BOBSled Towed Camera System	USGS; http://soundwaves.usgs.gov/2013/06/	
Cam-Crawl Drop Stereo-Camera System	Alaska Fisheries Science Center http://www.sea-technology.com/features/2010/1210/cam-trawl.php	
TONGS - camera system, limited ROV capability	Navy	
SEAFET Ocean pH Sensors	Satlantic; http://satlantic.com/seafet	Measure pH

Supplemental Funding Opportunities	Point of Contact	Notes
NOAA Advanced Sampling Technology Working Group	NMFS/OST	Annual RFP
NOAA Fisheries National Cooperative Research Program	NOAA/NMFS/OST http://www.st.nmfs.noaa.gov/cooperative-research/index	Funding for commercial and recreational fishermen to become involved in collecting fisheries information for management purposes
NOAA Undergraduate Student Scholarship	NOAA Office of Education and Research; http://www.epp.noaa.gov/ssp_undergrad_page.html	Provides funding for undergraduate students to do 11-week paid internship within NOAA offices, good opportunity for data analysis
NOAA Marine Fisheries Initiative (MARFIN)	NOAA/NMFS http://sero.nmfs.noaa.gov/operations_management_information_services/state_federal_liaison_branch/marfin/index.html Robert Sadler; robert.sadler@noaa.gov	Funds projects seeking to optimize research and development benefits from U.S. marine fishery resources through cooperative efforts involving the research and management activities
NOAA Untrawlable Habitat Strategy Initiative	NOAA/NMFS/OST	Supports multi-disciplinary, collaborative field experiments focused on issues that are widespread among NMFS Science Centers

Appendix H. List of specific activities and techniques that could be used to accomplish the priority research questions of the DSCRTP Southeast Research Initiative. This list was compiled following a breakout session at the workshop, during which participants were asked to: (1) identify specific activities that would answer the priority research questions, (2) compare the priority versus cost/feasibility of the activity, and (3) provide suggestions on the most appropriate opportunity, vessel, platform or tool necessary to accomplish the activity.

South Atlantic

Research Question	***Activity/Techniques***
What drives community structure differences between sites (e.g. Miami Terrace vs. Portales, fish and macrobenthic organisms, Straits of Florida vs. Carolina, East and West sides of Straits of Florida, *Lophelia* vs. *Enaplopsamnia*-dominated areas)?	Habitat characterization is needed via ROV and video analysis. Ship time could be leveraged to accomplish this and next two priority questions for the South Atlantic. Moorings could also help address this question. BOEM study ADEON (all North of Florida) could help influence the site selections.
How are populations connected and what factors shape the genetic connectivity of deep-sea coral ecosystems in the South Atlantic (e.g. stepping stones, dispersal barriers)?	Activities should be combined with the ship time needed for question #1. Will need ability to collect samples.
How do deep-sea coral ecosystem communities differ inside and outside of protected areas (MPAs, HAPCs)?	Activities should be combined with the ship time needed for question #1. Select sites to represent both protected and non-protected areas.
How do upwelling regimes and variability in other ocean conditions impact deep-sea coral and sponge communities?	Use underwater vehicles to look at impacts from fishing and connectivity targets. Also target a few areas with data gaps. Will require ROVs.
What topographic features are associated with deep-sea coral ecosystems (e.g. bumps, on the Carolina-Florida margin, within CHAPC)?	Ground truth models and continue model development. This would be relatively inexpensive and have high management value.
What interactions (past, present and future) occur between fishing gear from the golden crab, royal red, and wreckfish fisheries and deep-sea coral and sponge ecosystems?	Use underwater vehicles to look at impacts from fishing and connectivity targets. Also target a few areas with data gaps. Will require ROVs.
How accurate are model predictions of deep-sea coral ecosystems, particularly for structure-forming taxa?	Ground truth models and further develop Kinlan and Reed habitat suitability models.

U.S. Caribbean

Research Question	***Activity/Techniques***
What is the extent of deep-sea coral ecosystems in sites with high rugosity (particularly at El Pinchincho, east of Vieques, the shelf edge, southeast of St. Croix, Barca del Guineo, #143, and Mona Passage)?	Conduct data mining and modeling as first step. Focus general multibeam surveys on high rugosity sites, tune equipment needs to location and depth. Use multibeam to help guide AUV, so the ship can be doing multibeam of totally unmapped areas, and AUV can do finer scale mapping of high-value targets. If there is overlap with adjacent mesophotic reefs, we could do some surveys to explore connectivity.
What deep-sea coral and sponge species are present (need to resolve taxonomy, more sampling and include molecular analyses)?	Make specific efforts to collect specimens at different depths and catalog them. Follow-on cruise from mapping activities, so need a big ROV with

	manipulator arms to collect organisms. Analysis needs to be included. Need to increase local capacity for taxonomy and technology. Quatrini/Demopolous have OE proposal for 2017 for collections from 200-2000m in the U.S. Caribbean (Mona Passage, sea mounts south of St. Croix). Also scoping out *Deep Discoverer* ROV or Global Explorer. Needs additional leverage for analysis, video reading etc. OE proposal includes more modeling (E. Cordes) and some stable isotope work to track sewage outfall impacts - using corals as a proxy.
Do deep-sea coral and sponge ecosystems exist in areas that are heavily fished for deep-water snappers? Can we partner with fishers to better understand deep-sea coral and sponge ecosystems?	Give drop cameras to fishers to document fishing activity for deep snappers. Ask fishers for information on any bycatch of deep-sea corals. Conduct workshop with fishers to show bathymetry and habitat characterization, and work with fishers on ID and information sharing (good project for CRCP). Any deep-sea organisms that are caught could be used for genetic, age and growth analyses. Need to identify other sensors and specialized gear that could be used in conjunction with fishing activities.
Where are deep-sea coral and sponge ecosystems located? What existing datasets can be incorporated into models in order to predict the distribution of deep-sea coral and sponge ecosystems?	Review previous data and determine data gaps. Use existing data to validate predictive models and use models to inform field work. Important contacts: Andrea Quatrini, Amanda Demopolous, Tim Batista (habitat map for mesophotic depths). Find records from *Nancy Foster* work in Mona Passage and *Okeanos Explorer*. Use SEDAR reports/data for info on deep snapper fishing locations (~100-600 m). Determine impacts of deep-water snapper fishing on north coast of St. Thomas (*Lophelia* has been identified there). Review silk snapper trap fishery and determine if there is an interaction with deep habitats. There are Department of Agriculture reports from the 1970s describing fishing activities.
What are the most significant anthropogenic impacts to deep-sea coral and sponge ecosystems, particularly at mesophotic depths?	Need to explore the impacts of ship anchoring (e.g. traffic to/from tuna canneries in Mayaguez), marine debris, sewage outfalls (especially in PR and USVI on septic), Navy ordnance. Partner with Navy to better understand locations of ordnance, habitats and maybe removal. Look at how currents move terrigenous pollution throughout archipelago. Concern sewage outfall near Ponce impacts the shelf. Look at trawling impacts (historical and present in EEZ). More than 100 years ago, there was exploratory trawling (commercial fishing, FishHawk, *Oregon II*). In areas of dead coral rubble, collect and age it to determine time/age of death and find out if threats are current or historical.

Gulf of Mexico

Research Question	***Activity/Techniques***
What is the extent of the distribution of deep-sea coral and sponge ecosystems (throughout the entire Gulf of Mexico, in the northern Gulf of Mexico, in sites of interest to the GMFMC, at 200-600 m on the upper slope off Texas, at 1,000-2,600 m throughout the Gulf, at Campeche Bank, at the northern Florida escarpment between the known *Lophelia* sites and DeSoto Canyon)?	Need higher resolution mapping for GMFMC HAPC proposal. Focus on HAPCs with knowledge gaps. Conduct ground-truthing of bathymetry, multibeam & ROV. Stratify investigations by depth. Will require considerable ship time. Possible vessels: *Manta, Pisces, Okeanos Explorer, Baseline Explorer, Falkor, Nancy Foster, Walton Smith, Thomas Jefferson, Beagle*. *Mohawk* is option but needs $375K upgrade.
What interactions (past, present and future) occur between fishing gear from the golden crab, royal red, and wreckfish fisheries and deep-sea coral and sponge ecosystems?	Data mine VMS and other fisheries data. Work with GMFMC and fishers to identify interactions with deep habitat. Explore impacts of fishers from outside the Gulf in Gulf waters (maybe extend VMS requirements to both regions). Conduct ROV surveys for relic gear and impacted reefs on West Florida slope. Explore parsing out data from shrimp versus royal red shrimp fisheries. Work with GMFMC (John Froeschke), NCCOS (Randy Clark) and the NMFS Galveston Lab on data. Encourage all ROV teams to include observations of fishing gear. Depth range is 400-600 m.
What buffer distances should be implemented between deep-sea coral and sponge ecosystems and human activities? How do these differ by activity type (e.g. oil and gas exploitation, fishing, shipping, lightering areas)?	Convene working group with oil and gas sector, conduct data mining and discussion. Related to question above regarding fishing impacts.
What deep-sea coral and sponge sites could serve as sentinel sites to better understand the effects of climate change on these ecosystems (e.g. Viosca Knoll, Flower Garden Banks, West Florida Escarpment)? Can a long-term monitoring site be established to study the effects of climate change on deep-sea coral and sponges?	Good opportunity to establish sentinel sites (repeated, standard measures/instruments over time). Will require deployment and recovery of instruments, centralized reporting. Mine data to find suitable sites which have historical data already. Ease of access to the sentinel site would reduce cost, since most sites are not easily accessed. Create centralized infrastructure so other partners can leverage field work to reduce overall costs. Another strategy is purchasing the instrumentation and making them available to partners to deploy opportunistically. Explore: SeaPHOX, CTD rosette, temperature loggers, and repeated ROV surveys. All equipment should be climate quality.
What known seafloor features in the Northern Gulf of Mexico are in need of mapping, groundtruthing and characterization?	Data gaps in Northern Gulf are fairly well known. Current quote is $150K for mapping and $125K for ship time. Need to leverage with partners (BOEM, USGS, OE). NOAA should put in ship time requests. Groundtruthing needs to be conducted. Explore: *Manta, RESON 7125, OE, Mohawk*, Univ. of S. Mississippi AUV (Contact: Dr. Vernon Asper).

Regional (All geographic areas)

Research Question	***Activity/Techniques***
What deep-sea coral and sponge species (as well as their associates) are present in deep-sea coral and sponge ecosystems?	Collect samples, conduct genetic analyses and perform visual surveys to document (drop camera, AUV, ROV). Explore the idea of exhaustive sampling at a single site. *Sentry* AUV may work well (long dives, can use to document corals, pick collection sites and can collect environmental data). Infauna difficult to capture at depth.
What is the connectivity between different deep-sea coral and sponge ecosystems (both in terms of population genetics and source-sink dynamics)?	Collect samples for genetic studies (~50). Need manipulator arm, preservation, plenty of dive time (~15 min/collection). Identify regions where genetic work is needed (based on currents, spawning frequency, life history traits, dispersal modeling). Settling plate experiments to see what material works (INDEEP has uniform design, recover plates without disturbance). Use habitat suitability as input. Develop a wanted list for collaborators that need specific samples to answer connectivity, genetics, or age/growth questions.
How can we best assess the health and resilience of deep-sea coral and sponge ecosystems? Are there signs of recruitment or recovery in areas that have been impacted in the past?	Visual surveys to identify footprint of impact and deploy settling plates. Compare inside vs. outside of protected areas (disturbed vs. control sites). Conduct repeated observations. Define health indices. Identify sources of mortality, which is difficult.
What are the relationships between deep-sea corals and sponges and their epifauna?	Use benthic landers. Conduct alkalinity anomaly study (ask Ocean Observing System). Need to adhere to climate quality data standards for temperature and pH). Ask OAP about standards for ocean acidification. Coordinate with AOML.