



# Evaluation of and Motivations for Conservation Science in Gray's Reef National Marine Sanctuary



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U.S. Department of Commerce  
Gina Raimondo, Secretary

National Oceanic and Atmospheric Administration  
Richard W. Spinrad, Ph.D., Under Secretary of Commerce for Oceans and Atmosphere and  
NOAA Administrator

National Ocean Service  
Nicole LeBoeuf, Assistant Administrator

Office of National Marine Sanctuaries  
John Armor, Director

Report Authors:

*Robert Botta<sup>1</sup>, Jack Eynon<sup>1</sup>, Danielle Schwarzmann<sup>2</sup>*

<sup>1</sup>*National Marine Sanctuary Foundation, Silver Spring, MD*

<sup>2</sup>*Office of National Marine Sanctuaries, Silver Spring, MD*



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Cover photo: R/V *Gannet*, the dedicated research vessel for Gray's Reef National Marine Sanctuary. Photo: Ben Prueitt/NOAA

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## About the National Marine Sanctuaries Conservation Series

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Because of considerable differences in settings, resources, and threats, each national marine sanctuary has a tailored management plan. Conservation, education, research, monitoring, and enforcement programs vary accordingly. The integration of these programs is fundamental to marine protected area management. The National Marine Sanctuaries Conservation Series reflects and supports this integration by providing a forum for publication and discussion of the complex issues currently facing the National Marine Sanctuary System. Topics of published reports vary substantially and may include descriptions of educational programs, discussions on resource management issues, and results of scientific or historical research and monitoring projects. The series facilitates integration of natural sciences, socioeconomic and social sciences, education, and policy development to accomplish the diverse needs of NOAA's resource protection mandate. All publications are available on the [Office of National Marine Sanctuaries website](#).



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## Contact

Robert Botta  
Economist Associate  
[Rbotta@marinesanctuary.org](mailto:Rbotta@marinesanctuary.org)  
National Marine Sanctuary Foundation  
8455 Colesville Rd, Suite 1275  
Silver Spring, MD 201910



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## Abstract

National marine sanctuaries are located across the country, offering opportunities for a diverse group of scientists from government entities, academic institutions, non-profit organizations and citizen scientists to work collectively to enhance the understanding of natural and cultural resources. Gray's Reef National Marine Sanctuary (GRNMS) is located off the coast of Georgia, USA, and is home to one of the largest nearshore, live-bottom reefs of the southeastern USA. This report focuses on evaluating the activities associated with, objectives of, and motivations for the conservation science that has been conducted within GRNMS. These topics were assessed using a survey sent to 60 individuals who had conducted science in and around the sanctuary in the past. A total of 23 surveys were completed and returned, for a 41.1% response rate, with respondents providing information on the scientific activities conducted in and around GRNMS, reasons for site selection, information on sanctuary staff and support, spending, and in-kind staff support. The results illustrate a highly diverse research space in GRNMS, which includes a suite of focal points and technical capacity among collaborators from multiple institutions, states, and countries. Additionally, GRNMS was chosen as a study location by many respondents primarily engaged in research, monitoring, and/or characterization. Understanding the socioeconomic implications of the conservation science conducted at GRNMS is necessary not only to gauge the conservation outcomes of scientific investments, but also its benefits to local and regional economies, now and in the future.

## Key Words

Gray's Reef National Marine Sanctuary, research, monitoring, characterization, conservation science, motivation, value, economics

## Chapter 1: Introduction

National marine sanctuaries are areas set aside for long-term protection, conservation, and management of natural and cultural resources. In these areas, conservation science (which includes exploration, characterization, monitoring, and research) enhances the understanding of our natural and historical resources while simultaneously detecting changes to ecosystem processes, conditions, and services. Sanctuaries are located within the ocean and Great Lakes, offering opportunities for government entities, academic institutions, and citizen scientists to work collectively and share information on sanctuary conditions and emerging science needs. Research in marine sanctuaries focuses on a variety of topics, including social science, climate change and ocean acidification, fishing impacts, human health, integrity of heritage resources, invasive species, marine debris, vessel impacts, noise impacts, water quality, and biodiversity. The opportunity to study such a variety of topics has allowed for a multitude of collaborations among researchers from a large number of institutions.

Gray's Reef National Marine Sanctuary (GRNMS) is one of the few protected natural reefs on the southeastern U.S. continental shelf and one of the only marine protected areas along the mid-Atlantic coast (Figure 1.1). It is located 16 miles offshore and is home to one of the largest nearshore, live-bottom reefs of the southeastern United States, providing a complex biological habitat for over 200 species, including loggerhead sea turtles and North Atlantic right whales. The designation of GRNMS enabled opportunities to promote scientific understanding of this unique ecosystem (National Oceanic and Atmospheric Administration [NOAA], 2014). The National Oceanic and Atmospheric Administration (NOAA) considers GRNMS a “sentinel site,” where sustained scientific research enables a better understanding and early detection of changes in the ecosystem.

In 2011, NOAA designated approximately eight square miles of GRNMS as a dedicated research area (RA), where a permit is required to conduct research and all other activities, including fishing and diving, are prohibited (Figure 1.1). These regulations allow for controlled scientific studies in the absence of confounding pressures (Kendall & Eschelbach, 2006; Roberson et al., 2020). The RA in GRNMS has allowed scientists from various institutions to study live-bottom ecosystems in their natural state and understand how human activities affect the sanctuary.

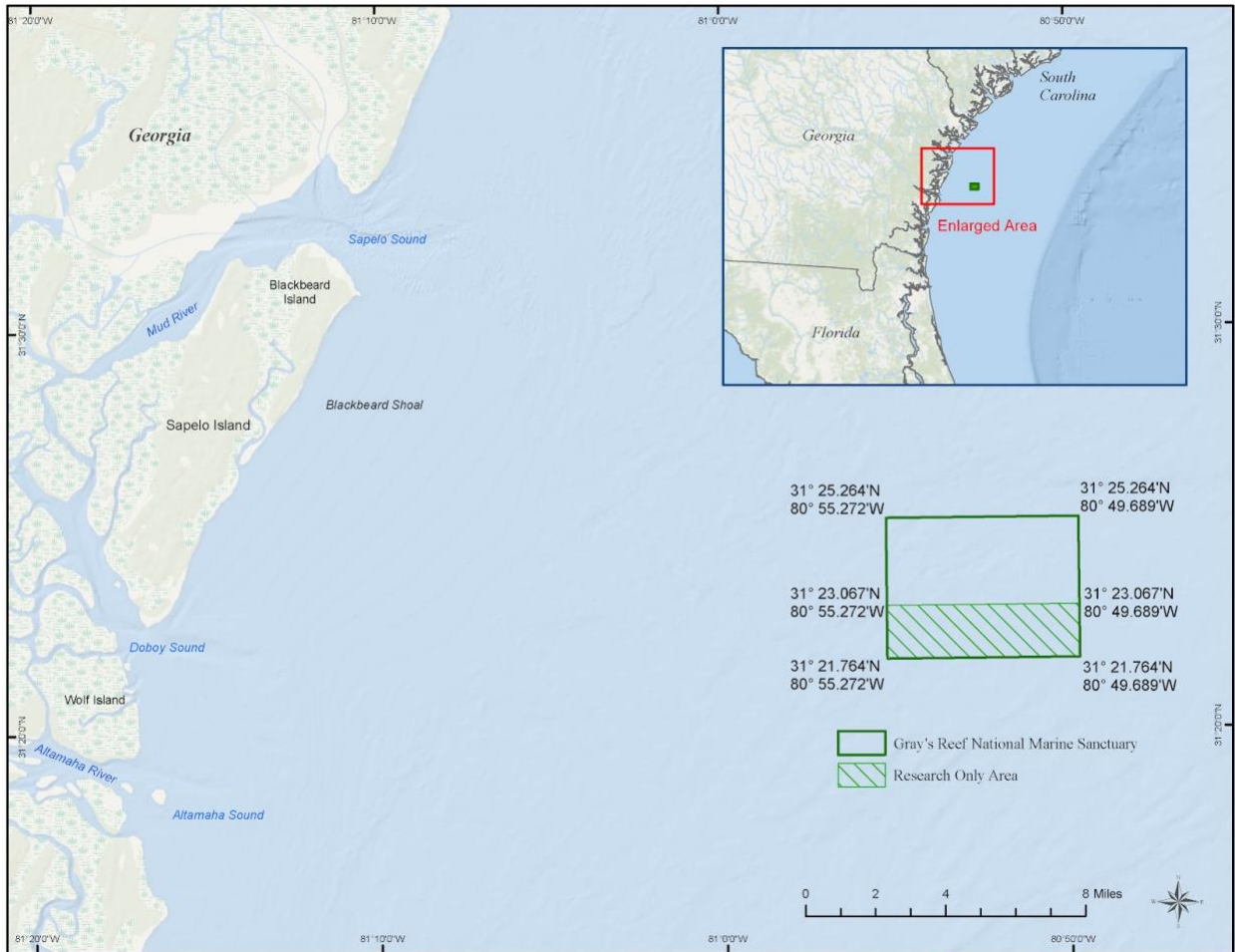


Figure 1.1 Location of GRNMS, including the RA. Image: T. Reyer/NOAA

As undisturbed or minimally disturbed habitats, RAs allow scientists to compare surrounding regions and understand how human impacts influence the environment. Roberson et al. (2020) published a review of 16 scientific efforts that were conducted in and around the GRNMS RA. Study topics included benthic invertebrate abundance and distribution, predator and prey fish distribution and abundance, movement patterns of demersal piscivores, and the presence of halo predators. Additionally, the National Marine Sanctuary Foundation compiled a list of 72 published articles on scientific studies conducted in and around GRNMS, including both white and gray literature (Appendix A). In total, there were 336 authors<sup>1</sup> associated with the 72 papers, and their affiliation locations spanned 14 countries and 26 states/territories (Table 1.1). The majority of U.S. publications were from institutions in Georgia ( $n = 75$ ), followed by Maryland ( $n = 38$ ), North Carolina ( $n = 32$ ), and Washington, DC ( $n = 25$ ). A number of Washington, DC metropolitan area<sup>2</sup> government agencies are located in Maryland (e.g., NOAA), explaining the high number from that state. The breadth of affiliations in Table 1.1 is an indication that GRNMS has international recognition, which can likely be attributed to its status as a national marine sanctuary, as well as the designated RA. The research indicates that the RA is being used

<sup>1</sup> This is not a list of 336 unique authors; in many instances, the same authors were associated with multiple projects.

<sup>2</sup> The Washington metropolitan area consists of Washington D.C., Maryland, and Virginia.

as intended; however, what is less clear is the impact the RA has on scientists' selection of study location, and how GRNMS resources (natural, technological, and staff expertise) influences this. Understanding the scientific activities, the institutions that are drawn to a region, and researcher motivations is important when evaluating the success and value of any sanctuary and its capacities. In order to better understand these factors, this study builds upon the collected literature in Appendix A by utilizing a survey administered by the National Marine Sanctuary Foundation to investigators who were associated with projects in and around GRNMS between 2008 and 2022.

Table 1.1 The top five countries (and U.S. states, where applicable) of home institutions of investigators who collaborated on a project in or around GRNMS between 2008 and 2022. See Appendix A for a list of source publications and Table App.C.1 for a complete list of all affiliation locations.

Affiliation Location	Frequency
United States: Total	294
United States: Georgia	75
United States: Maryland	38
United States: North Carolina	32
United States: Washington	25
United States: Connecticut	24
United States: All other states	100
Brazil	13
Portugal	4
United Kingdom	4
France	4
All other countries	17
Total	336

This study utilized a survey methodology to gain insight into the types of conservation science that have occurred within GRNMS since 2008, and the motivations behind science decisions. The survey was created in Google Forms and was administered to 60 individuals through an email invitation. The literature review presented in Appendix A includes more information on the respondent sample. Following Dillman et al. (2014), two follow up email reminders were sent to respondents. Of the 60 invitations, four were ultimately omitted from the sample because the respondents did not conduct research in GRNMS, resulting in a maximum potential sample size of 56. A total of 23 surveys were completed for a 41.1% response rate. The survey instrument was structured with seven sections, and the following information was requested from each respondent (see Appendix C):

1. Activity conducted in and around GRNMS
2. Reasons for site selection
3. Information on sanctuary staff and support that was used
4. Project spending in the 2019 calendar year
5. In-kind staff support and ship time for the 2019 calendar year
6. Project spending in the 2022 calendar year
7. In-kind staff support and ship time for the 2022 calendar year

## Chapter 2: Results

The survey results were categorized into six groupings: respondent representation; project objectives; study site selection; dissemination of results; funding; and site staff and personnel.

### *Respondent Representation*

Respondents were asked to identify their institutional affiliation(s) at the time they were conducting studies in GRNMS (Figure 2.1). Almost half indicated they were associated with a federal government agency (n = 11), followed by an academic institution (n = 10). Three respondents indicated they were associated with a state government agency, while three were associated with multiple institutions (i.e., academic institutions and non-profit organizations; state and federal government agencies).

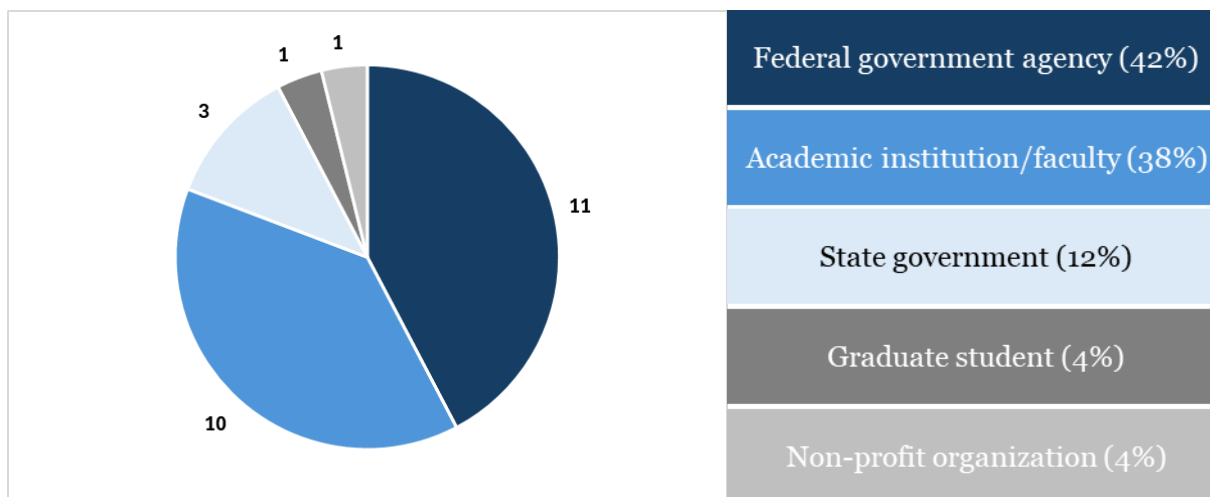


Figure 2.1. Institutional affiliation(s) of respondents at the time they conducted studies in and around GRNMS, 2008–2022 (n = 23). Note that some respondents selected multiple institutions.

### *Project Objectives*

Respondents were asked to characterize the objectives of the projects they conducted in GRNMS. Four options were provided, with specific definitions for each:

- *Research*: the process of generating knowledge through the systematic investigations of new and existing information.
- *Monitoring*: the systematic observation of indicators of natural resources, cultural resources, or ecosystem conditions.
- *Characterization*: the process of identifying, describing, and attributing qualities to natural/cultural resources or systems.
- *Exploration*: the process of discovering unknown, unusual, or unexpected aspects of a place, thing, or system.

Figure 2.2. illustrates the reported objectives of each of the 23 projects. All but one project had multiple objectives; 10 projects had two objectives (43%), four projects had three objectives (17%), and one project had all four objectives (4%).

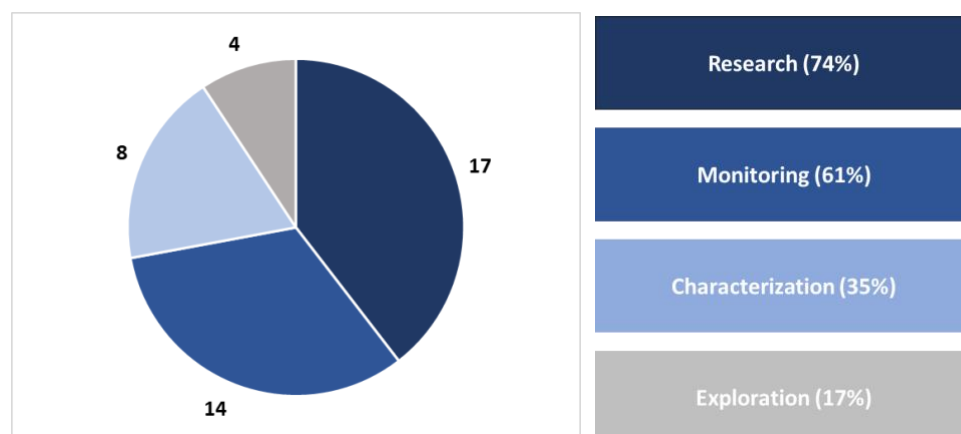


Figure 2.2. The number and percentage of projects associated with four specific objectives, 2008–2022 (n = 23).

Respondents were asked to indicate the topic of their projects. Fifteen topics were identified. Fauna studies and assessments were the primary topic (n = 10), followed by habitat studies and assessments (n = 7), water column studies and assessments (n = 4), socioeconomic monitoring and research (n = 3), pollutant and contaminant studies and assessments (n = 4), anthropogenic impact studies and assessments (n = 3), cultural heritage and archaeological research (n = 3), and flora studies and assessments (n = 3).

Table 2.1. Number of projects by study topic and objective. Note that some projects had multiple topics, accounting for the larger n-value than the total number of survey responses.

Study Topic	Research Objective	Monitoring Objective	Characterization Objective	Exploration Objective
Fauna study/assessment (n = 10)	8	7	5	1
Habitat study/assessment (n = 7)	5	4	2	1
Anthropogenic impact study/assessment (n = 4)	4	3	1	0
Water column study/assessment (n = 4)	4	2	0	1
Pollutant/contaminant study/assessment (n = 4)	3	4	0	0
Cultural heritage or archaeological research (n = 3)	0	0	2	1

Study Topic	Research Objective	Monitoring Objective	Characterization Objective	Exploration Objective
All others <sup>3</sup> (n = 5)	0	0	4	0

## Study Site Selection

Respondents were asked to indicate the reason for selecting GRNMS as a study site for their projects. Thirty unique reasons were indicated; these are summarized in Table 2.2. The most frequently cited reason was the site's status as a national marine sanctuary (n = 10). Nine respondents indicated that they were contacted with a specific request by GRNMS or another resource management agency, and nine cited the biodiversity/production of the sanctuary. Clearly, the recognition of an area as a national marine sanctuary attracts not only recreational users, but also researchers. Additionally, researchers were drawn to the resources available because of the area's status as a sanctuary, indicating that dive support (n = 8) and vessel availability (n = 7) were important factors.

Table 2.2. Top 10 reasons that study sites were selected in and around GRNMS, 2008–2022. Frequency is the number of respondents from the 23 returned surveys who listed these factors in study site selection. See Table C.2 for a detailed list of reasons included in the “all others” category.

Reason for Site Selection	Frequency
The site's status as a national marine sanctuary	10
GRNMS or another resource management agency contacted me with a specific request	9
Biodiversity/productivity of the area	9
Dive support	8
Vessel availability	7
The area contains the natural resources and/or process necessary for my research	7
Necessary part of larger-scale spatial project	7
Zoning of the area (site includes zones with restricted access or use, like “no take” or “research only” areas)	6
Presence of National Data Buoy Center Data Buoy 41008	6
All others	45

## Dissemination of Project Results

Respondents were asked to indicate where project results would be shared. The overwhelming majority of responses indicated that results would be shared with federal, state, or local governments (n = 17), submitted to peer-reviewed scientific journals (n = 16), and presented at professional conferences (n = 12). Additionally, respondents indicated that results would be shared with data libraries, repositories, networks, or portals; academic institutions; regional fisheries management councils; non-profit organizations; at GRNMS Sanctuary Advisory Council meetings; via institutional reports; and in web stories.

<sup>3</sup> The “all others” category included the following research topics: mapping (n = 1), socioeconomic monitoring/research (n = 1), flora study/assessment (n = 1), and geological study/assessment (n = 1).

## ***Funding***

Respondents were asked to provide information on funding that was awarded to conduct research in or around GRNMS. Specifically, they were asked to provide information on funding received in the 2019 and 2022 calendar years. Of the 23 responses received, nine respondents (39%) indicated that they received funding for projects in the 2019 calendar year. The funding came primarily from grants, including the NOAA workplan grant, as well as federal internal funding. On average, respondents indicated that they received \$48,000 in funding for research in 2019, though only five respondents report the amount they received. Seven respondents (30%) indicated that they received funding for projects in the 2022 calendar year. These funds came from the same sources as in 2019, including federal funding and grants. On average, respondents indicated that they received \$36,000 in funding for research in 2022. Given the low reporting rate for grant amounts, however, conclusions should not be drawn about average annual research funding or changes in funding levels from 2019 to 2022.

## ***Site Staff and Personnel***

Respondents indicated that they consulted or collaborated with a wide variety of GRNMS staff. Specifically, nine groups of individuals were consulted with for research. The research coordinator/ecologist was consulted the most (n = 17), followed by the superintendent (n = 11) and the education or outreach coordinator (n = 11). Others identified included the resource protection and permit coordinator (n = 8), Sanctuary Advisory Council members (n = 5), deputy superintendent (n = 4), volunteer/citizen scientist coordinator (n = 2), boat captains and ship time coordinators (n = 1), and NOAA Corps officers (n = 1).

## Chapter 3: Discussion

GRNMS contains a unique and diverse ecosystem that is highly attractive to the conservation science community at local, regional, national, and even international scales. Since the designation of the sanctuary in 1981, and the subsequent establishment of a dedicated RA within the sanctuary in 2011, GRNMS has been widely used to gain scientific understanding through a diversity of research efforts. It was clear from the survey responses that the science community sees multiple benefits from working at GRNMS, with projects that have a range of objectives, including research, monitoring, characterization, and exploration. Only eight of the 23 projects had single objectives, while the remaining 15 had some combination of multiple objectives. Additionally, there were 30 unique reasons for the selection of GRNMS as a study site by these investigators. GRNMS provides the opportunity for researchers from nearly any discipline to benefit from conducting their work there. However, it was clear that the site's status as a national marine sanctuary was the largest influence on its selection as a study site. This emphasizes that while diverse research opportunities exist in GRNMS, a sanctuary designation brings name recognition and attention to the site as a research hub. It also helps make investigators aware that resources such as expertise, equipment, and vessels may be available to support their work. Investments in technology and expertise to support the science community attracts researchers, which not only enhances grant funding for local and regional scientific institutions, but also promotes spending that contributes to the local and regional economy. Investments in sanctuary science also enable formal and informal STEM-based education and outreach. Samonte et al. (2023) found that support for scientific research and education were valued highly by both GRNMS users and non-users, and that there has been an increase in the perceived value of support for education and scientific research among GRNMS users. Thus, investments in sanctuaries enable continued scientific opportunities while providing services that the general public recognizes as important to the region.

This report highlights the importance of sustained scientific research in GRNMS. Discoveries and knowledge gained over more than 40 years since the sanctuary was designated have allowed GRNMS staff to understand and track changes, respond to potential problems quickly, and educate and communicate effectively with the public. This study is a step toward more fully understanding the scientific, social, and economic value of research at GRNMS. The results illustrate the diverse nature of research in and around the sanctuary, including a suite of focal points and technical capacity. The diversity of affiliations among respondents, which included federal and state agencies, academic institutions, and non-profit organizations, was evident in the published literature from work conducted in and around GRNMS, as well as in the survey responses. The affiliations spanned 14 countries and 26 states and territories. Additionally, most of these studies involved collaborators from multiple states or countries and institutions.

Further, understanding the socioeconomic implications of the research conducted at GRNMS is necessary to gauge the outcomes of federal funding as well as the benefits to local and regional economies. Unfortunately, this survey had low response rates for the questions related to funding details, making it difficult to quantify the economic effects of research expenditures in the region. Despite this, it can be assumed that the funding reported in the survey had positive

benefits due to the extent of the research conducted here as well as the funding sources. Much of this funding was provided by federal grants, which have been found to have larger rates of social return (Ruttan, 2003; U.S. Department of the Interior, 2020). Future assessments will need to be modified to obtain more detailed funding information and identify if non-response bias<sup>4</sup> existed. Additional data would also allow for further economic analyses, including quantifying the regional economic impacts and societal benefits of the expenditures associated with conservation science in GRNMS.

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<sup>4</sup> Non-response bias refers to cases in which certain characteristics of survey respondents may be underrepresented due to a lack of responses.

## Chapter 4: Conclusions

National marine sanctuaries provide plenty of opportunities for conservation science, which have been utilized to promote scientific understanding through a multitude of research efforts. This report highlights the diverse research opportunities that are associated with a designated marine sanctuary, while emphasizing the importance of name recognition as a sanctuary for bringing attention to the site as a research hub. The sustained research that has occurred in GRNMS indicates the importance of public investment into sanctuaries. Investigators from across the globe have benefited from the existence of the RA in GRNMS, allowing for research and collaboration. Providing these nationally recognized areas as research spaces is of great importance to local communities, and supports long-term sustainability of the sanctuary by promoting research that contributes to education, scientific understanding, and the local economy through personal and government spending. This study is a step toward understanding the socioeconomic outcomes in areas associated with national marine sanctuaries, while specifically engaging with individuals who have actively conducted research in a sanctuary. While these results are specific to GRNMS, many of the findings are attributed to the site's status as a sanctuary. Thus, it is important to expand this study to other sites to fully understand the value of conservation science in sanctuaries.

## Acknowledgements

We would like to thank the researchers that took the time to complete this survey and provide feedback. We would also like to thank the anonymous peer reviewers of this work for their many insightful comments and suggestions.

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## Appendix A: Literature Review

Table App.A.1. Compiled literature describing research conducted in and around GRNMS.

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Tetranucleotide microsatellites for the barnacle <i>Megabalanus coccopoma</i>	2013	<ul style="list-style-type: none"> <li>• Introduced species</li> <li>• Invertebrates</li> <li>• Microsatellite primers</li> <li>• Non-native</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	Reigel, A. M., Harrison, J. S., & Gleason, D. F. (2015). Tetranucleotide microsatellites for the barnacle <i>Megabalanus coccopoma</i> (Darwin, 1854). <i>Biochemical Systematics and Ecology</i> , 62, 159–163. <a href="https://doi.org/10.1016/j.bse.2015.08.010">https://doi.org/10.1016/j.bse.2015.08.010</a>

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Autonomous seawater $p\text{CO}_2$ and pH time series from 40 surface buoys and the emergence of anthropogenic trends	2004–2013	<ul style="list-style-type: none"> <li>• <math>p\text{CO}_2</math></li> <li>• pH</li> <li>• Surface buoys</li> <li>• Time series</li> </ul>	<ul style="list-style-type: none"> <li>• Australia</li> <li>• Bermuda</li> <li>• California, USA</li> <li>• Delaware, USA</li> <li>• Hawaii, USA</li> <li>• Iceland</li> <li>• South Korea</li> <li>• Maryland, USA</li> <li>• Massachusetts, USA</li> <li>• Mississippi, USA</li> <li>• New Hampshire, USA</li> <li>• Oregon, USA</li> <li>• United Kingdom</li> <li>• Washington, USA</li> </ul>	Sutton, A. J., Feely, R. A., Maenner-Jones, S., Musielwicz, S., Osborne, J., Dietrich, C., Monacci, N., Cross, J., Bott, R., Kozyr, A., Andersson, A. J., Bates, N. R., Cai, W. J., Cronin, M. F., de Carlo, E. H., Hales, B., Howden, S. D., Lee, C. M., Manzello, D. P., ... Weller, R. A. (2019). Autonomous seawater $p\text{CO}_2$ and pH time series from 40 surface buoys and the emergence of anthropogenic trends. <i>Earth System Science Data</i> , 11(1), 421–439. <a href="https://doi.org/10.5194/essd-11-421-2019">https://doi.org/10.5194/essd-11-421-2019</a>

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Using present-day observations to detect when anthropogenic change forces surface ocean carbonate chemistry outside preindustrial bounds	2010–2015	<ul style="list-style-type: none"> <li>• Ocean acidification</li> <li>• pH</li> </ul>	<ul style="list-style-type: none"> <li>• California, USA</li> <li>• Delaware, USA</li> <li>• Iceland</li> <li>• Korea</li> <li>• Massachusetts, USA</li> <li>• New Hampshire, USA</li> <li>• Puerto Rico</li> <li>• Washington, USA</li> </ul>	Sutton, A. J., Sabine, C. L., Feely, R. A., Cai, W. J., Cronin, M. F., McPhaden, M. J., Morell, J. M., Newton, J. A., Noh, J. H., Ólafsdóttir, S. R., Salisbury, J. E., Send, U., Vandemark, D. C., & Weller, R. A. (2016). Using present-day observations to detect when anthropogenic change forces surface ocean carbonate chemistry outside preindustrial bounds. <i>Biogeosciences</i> , 13(17), 5065–5083. <a href="https://doi.org/10.5194/bg-13-5065-2016">https://doi.org/10.5194/bg-13-5065-2016</a>
The role of artificial structures in facilitating range expansion of the introduced barnacle <i>Megabalanus coccopoma</i> in the southeastern U.S.A.	2013–2014	<ul style="list-style-type: none"> <li>• Artificial structures</li> <li>• Invasive species</li> <li>• <i>Megabalanus coccopoma</i></li> <li>• Range expansion</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	Reigel, A.M. (2015). <i>The role of artificial structures in facilitating range expansion of the introduced barnacle Megabalanus coccopoma in the southeastern U.S.A.</i> [Master's thesis]. Georgia Southern University.

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Invertebrate endofauna associated with sponge and octocoral epifauna at Gray's Reef National Marine Sanctuary off the coast of Georgia	2005	<ul style="list-style-type: none"> <li>• Invertebrate epifaunal organisms</li> <li>• Live-bottom reef</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	Greene, A. K. (2008). <i>Invertebrate endofauna associated with sponge and octocoral epifauna at Gray's Reef National Marine Sanctuary off the coast of Georgia</i> [Master's thesis]. College of Charleston.
Virtual reality camera technology facilitates sampling of interactions between reef piscivores and prey	2018	<ul style="list-style-type: none"> <li>• Behavior</li> <li>• Fish</li> <li>• Forage</li> <li>• Predation</li> <li>• Video</li> </ul>	<ul style="list-style-type: none"> <li>• California, USA</li> <li>• Connecticut, USA</li> </ul>	Auster, P. J., & Giacalone, L. (2021). Virtual reality camera technology facilitates sampling of interactions between reef piscivores and prey. <i>Marine Technology Society Journal</i> , 55(2), 54–63. <a href="https://doi.org/10.4031/MTSJ.55.2.1">https://doi.org/10.4031/MTSJ.55.2.1</a>
Using acoustic telemetry to understand connectivity of Gray's Reef National Sanctuary to the U.S. Atlantic coastal ocean	2008–2017	<ul style="list-style-type: none"> <li>• Biotic communities</li> <li>• Ecosystem</li> <li>• Fish populations</li> <li>• Habitat</li> <li>• Sediments</li> <li>• Underwater acoustic telemetry</li> <li>• Unsteady flow</li> <li>• Veins</li> </ul>	<ul style="list-style-type: none"> <li>• Florida, USA</li> <li>• Georgia, USA</li> <li>• Maryland, USA</li> </ul>	Williams, B. L., Roberson, K., Young, J., & Kendall, M. S. (2019). <i>Using acoustic telemetry to understand connectivity of Gray's Reef National Marine Sanctuary to the U.S. Atlantic coastal ocean</i> . NOAA Technical Memorandum NOS NCCOS 259. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science. <a href="https://doi.org/10.25923/r2ma-5m96">https://doi.org/10.25923/r2ma-5m96</a>

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Sessile invertebrate colonization and succession patterns on rocky outcrops, 2012–2013	2012–2013	<ul style="list-style-type: none"> <li>• Sessile invertebrate communities</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	<p>Poirson, B., &amp; Gleason, D.F. (2020). Project 3. Sessile invertebrate colonization and succession patterns on rocky outcrops, 2012–2013. In K.W. Roberson, P.J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 18–27). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries.  <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>
Field and numerical studies to assess performance of acoustic telemetry collected by autonomous mobile platforms	2014	<ul style="list-style-type: none"> <li>• Acoustic telemetry</li> <li>• Glider and mobile platform data</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	<p>Edwards, C.R., Cho, S., Zhang, F., &amp; Fangman, S. (2020). Project 16. Field and numerical studies to assess performance of acoustic telemetry collected by autonomous mobile platforms, 2014. In K.W. Roberson, P.J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 158–178). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries.  <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>

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Chemical variability within marine sponge <i>Aplysina fulva</i>	2005	<ul style="list-style-type: none"> <li>• Marine sponges</li> </ul>	<ul style="list-style-type: none"> <li>• Brazil</li> <li>• Georgia, USA</li> </ul>	<p>Nuñez, C. V., de Almeida, E. V. R., Granato, A. C., Marques, S. O., Santos, K. O., Pereira, F. R., Macedo, M. L., Ferreira, A. G., Hajdu, E., Pinheiro, U. S., Muricy, G., Peixinho, S., Freeman, C. J., Gleason, D. F., &amp; Berlinck, R. G. S. (2008). Chemical variability within the marine sponge <i>Aplysina fulva</i>. <i>Biochemical Systematics and Ecology</i>, 36(4), 283–296.  <a href="https://doi.org/10.1016/j.bse.2007.09.008">https://doi.org/10.1016/j.bse.2007.09.008</a></p>
Niche structure of marine sponges from temperate hard-bottom habitats within Gray's Reef National Marine Sanctuary	2013	<ul style="list-style-type: none"> <li>• Isotopic niche space</li> <li>• Latitudinal gradient</li> <li>• Marine sponges</li> <li>• Microbesmicrobial abundance</li> <li>• Porifera</li> <li>• Stable isotopes</li> <li>• Standard ellipse area</li> <li>• Symbiosis</li> <li>• Temperate</li> </ul>	<ul style="list-style-type: none"> <li>• China</li> <li>• Georgia, USA</li> <li>• Tennessee, USA</li> </ul>	<p>Freeman, C. J., Easson, C. G., &amp; Baker, D. M. (2016). Niche structure of marine sponges from temperate hard-bottom habitats within Gray's Reef National Marine Sanctuary. <i>Journal of the Marine Biological Association of the United Kingdom</i>, 96(2), 559–565.  <a href="https://doi.org/10.1017/S0025315415000363">https://doi.org/10.1017/S0025315415000363</a></p>

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Geospatial sediment assessment for Georgia estuarine, coastal, and shelf environments	N/A	<ul style="list-style-type: none"> <li>• Community distribution</li> <li>• Marine sediment</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	<p>Alexander, C., Venherm, C., &amp; Robinson, M. (2020). Project 15. Geospatial sediment assessment for Georgia estuarine, coastal, and shelf environments. In K.W. Roberson, P.J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 151–157). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries.</p> <p><a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>
Sessile invertebrate colonization on rocky outcrops at Gray's Reef National Marine Sanctuary	2011–2016	<ul style="list-style-type: none"> <li>• Sessile benthic invertebrate populations</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	<p>Poirson, B. (2014). <i>Sessile invertebrate colonization on rocky outcrops at Gray's Reef National Marine Sanctuary</i> [Master's thesis]. Georgia Southern University.</p>

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Fish-invertebrate associations at Gray's Reef National Marine Sanctuary	2015	<ul style="list-style-type: none"> <li>• Belted sandfish</li> <li>• <i>Oculina arbuscula</i></li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• North Carolina, USA</li> </ul>	<p>Gleason, D. F., Munoz, R., &amp; Henkel, T. (2020). Project 7. Fish-invertebrate associations at Gray's Reef National Marine Sanctuary, 2015. In K.W. Roberson, P.J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 68–76). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries. <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>
The role of larval supply and competition in controlling recruitment of the temperate coral <i>Oculina arbuscula</i>	2004–2009	<ul style="list-style-type: none"> <li>• Larval supply</li> <li>• <i>Oculina arbuscula</i></li> <li>• Recruitment</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	<p>Gleason, D. F., Harbin, L. R., Divine, L. M., &amp; Matterson, K. O. (2018). The role of larval supply and competition in controlling recruitment of the temperate coral <i>Oculina arbuscula</i>. <i>Journal of Experimental Marine Biology and Ecology</i>, 506, 107–114. <a href="https://doi.org/10.1016/j.jembe.2018.06.006">https://doi.org/10.1016/j.jembe.2018.06.006</a></p>

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Migration routes, foraging behavior, and site fidelity of loggerhead sea turtles ( <i>Caretta caretta</i> ) satellite tracked from a globally important rookery	2008–2017	<ul style="list-style-type: none"> <li>• <i>Caretta caretta</i></li> <li>• Loggerhead turtle</li> </ul>	<ul style="list-style-type: none"> <li>• Florida, USA</li> </ul>	Evans, D. R., Carthy, R. R., & Ceriani, S. A. (2019). Migration routes, foraging behavior, and site fidelity of loggerhead sea turtles ( <i>Caretta caretta</i> ) satellite tracked from a globally important rookery. <i>Marine Biology</i> , 166, 134. <a href="https://doi.org/10.1007/s00227-019-3583-4">https://doi.org/10.1007/s00227-019-3583-4</a>
Modeling larval dispersal and connectivity for Atlantic sea scallop ( <i>Placopecten magellanicus</i> ) in the Middle Atlantic Bight	2006–2012	<ul style="list-style-type: none"> <li>• Atlantic sea scallop</li> </ul>	<ul style="list-style-type: none"> <li>• Massachusetts, USA</li> <li>• Mississippi, USA</li> <li>• New Jersey, USA</li> <li>• Virginia, USA</li> </ul>	Munroe, D. M., Haidvogel, D., Caracappa, J. C., Klinck, J. M., Powell, E. N., Hofmann, E. E., Shank, B. V., & Hart, D. R. (2018). Modeling larval dispersal and connectivity for Atlantic sea scallop ( <i>Placopecten magellanicus</i> ) in the Middle Atlantic Bight. <i>Fisheries Research</i> , 208, 7–15. <a href="https://doi.org/10.1016/j.fishres.2018.06.020">https://doi.org/10.1016/j.fishres.2018.06.020</a>
Mollusks taken by beam trawl in the vicinity of Gray's Reef National Marine Sanctuary on the continental shelf off Georgia, Southeastern U.S.	2002	<ul style="list-style-type: none"> <li>• Beam trawl</li> <li>• Mollusks</li> <li>• Species recruitment</li> </ul>	<ul style="list-style-type: none"> <li>• North Carolina, USA</li> </ul>	Wolfe, D. A. (2008). <i>Mollusks taken by beam trawl in the vicinity of Gray's Reef National Marine Sanctuary on the Continental Shelf off Georgia, Southeastern U.S.</i> NOAA Technical Memorandum NOS NCCOS 88. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science.

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<p>Acidification in the U.S. Southeast: Causes, potential consequences and the role of the Southeast Ocean and Coastal Acidification Network</p>	N/A	<ul style="list-style-type: none"> <li>• Capacity-building</li> <li>• Coastal acidification</li> <li>• Coral</li> <li>• Crustacean</li> <li>• Hypoxia</li> <li>• Shellfish</li> <li>• Stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>• Delaware, USA</li> <li>• Florida, USA</li> <li>• Georgia, USA</li> <li>• Maryland, USA</li> <li>• North Carolina, USA</li> <li>• South Carolina, USA</li> </ul>	<p>Hall, E. R., Wickes, L., Burnett, L. E., Scott, G. I., Hernandez, D., Yates, K. K., Barbero, L., Reimer, J. J., Baalousha, M., Mintz, J., Cai, W. J., Craig, J. K., DeVoe, M. R., Fisher, W. S., Hathaway, T. K., Jewett, E. B., Johnson, Z., Keener, P., Mordecai, R. S., ... Styron, J. (2020). Acidification in the U.S. Southeast: Causes, potential consequences and the role of the Southeast Ocean and Coastal Acidification Network. <i>Frontiers in Marine Science</i>, 7, 548. <a href="https://doi.org/10.3389/fmars.2020.00548">https://doi.org/10.3389/fmars.2020.00548</a></p>
<p>Effects of predator presence and habitat complexity on reef fish communities in The Bahamas</p>	2014	<ul style="list-style-type: none"> <li>• <i>Epinephelus striatus</i></li> <li>• Nassau grouper</li> <li>• Reef ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>• Michigan, USA</li> <li>• North Carolina, USA</li> </ul>	<p>Hensel, E., Allgeier, J. E., &amp; Layman, C. A. (2019). Effects of predator presence and habitat complexity on reef fish communities in The Bahamas. <i>Marine Biology</i>, 166, 136. <a href="https://doi.org/10.1007/s00227-019-3568-3">https://doi.org/10.1007/s00227-019-3568-3</a></p>

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The archeology, sedimentology and paleontology of Gray's Reef National Marine Sanctuary and nearby hard bottom reefs along the mid continental shelf of the Georgia Bight	N/A	<ul style="list-style-type: none"> <li>• Geoarchaeology</li> <li>• Hard-bottom reef</li> <li>• South Georgia Bight</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	Garrison, E. G., Cook Hale, J., Cameron, C. S., & Smith, E. (2016). The archeology, sedimentology and paleontology of Gray's Reef National Marine Sanctuary and nearby hard bottom reefs along the mid continental shelf of the Georgia Bight. <i>Journal of Archaeological Science: Reports</i> , 5, 240–262. <a href="https://doi.org/10.1016/j.jasrep.2015.11.009">https://doi.org/10.1016/j.jasrep.2015.11.009</a>
Shallow marine margin sediments, modern marine erosion and the fate of sequence boundaries, George Bight	1996	<ul style="list-style-type: none"> <li>• Core samples</li> <li>• Optical stimulated luminescence methods</li> <li>• Uranium series methods</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	Garrison, E. G., McFall, G., & Noakes, S. E. (2008). Shallow marine margin sediments, modern marine erosion and the fate of sequence boundaries, Georgia Bight (USA). <i>Southeastern Geology</i> , 45(3), 127–142.
Dynamics of predator-prey habitat use and behavioral interactions over diel periods at sub-tropical reefs	2016	<ul style="list-style-type: none"> <li>• Acoustics</li> <li>• Animal behavior</li> <li>• Fish</li> <li>• Habitats</li> <li>• Marine fish</li> <li>• Predation</li> <li>• Predator-prey dynamics</li> <li>• Reefs</li> </ul>	<ul style="list-style-type: none"> <li>• Connecticut, USA</li> <li>• North Carolina, USA</li> <li>• United Kingdom</li> </ul>	Campanella, F., Auster, P. J., Taylor, J. C., & Muñoz, R.C. (2019) Dynamics of predator-prey habitat use and behavioral interactions over diel periods at sub-tropical reefs. <i>PLoS ONE</i> , 14(2), e0211886. <a href="https://doi.org/10.1371/journal.pone.0211886">https://doi.org/10.1371/journal.pone.0211886</a>

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Patterns of predator-prey co-occurrence and behavioral interactions over diel periods at sub-tropical reefs: Results from 2016 observations	2016	<ul style="list-style-type: none"> <li>• Predation</li> <li>• Predator-prey co-occurrence</li> </ul>	<ul style="list-style-type: none"> <li>• Connecticut, USA</li> <li>• North Carolina, USA</li> <li>• South Carolina, USA</li> </ul>	<p>Campanella, F., Auster, P.J., Taylor, C., Munoz, R., Fribance, D. (2020). Project 9: Patterns of predator-prey co-occurrence and behavioral interactions over diel periods at sub-tropical reefs: results from 2016 observations. In K.W. Roberson, P.J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 86–98). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries.</p> <p><a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>
Gray's Reef National Marine Sanctuary environmental assessment on the regulation of spearfishing gear	N/A	<ul style="list-style-type: none"> <li>• Environmental assessment</li> <li>• Regulatory actions</li> <li>• Spearfishing</li> </ul>	<ul style="list-style-type: none"> <li>• Maryland, USA</li> </ul>	<p>Basta, D. J., &amp; Kennedy, D. M. (2009). <i>Gray's Reef National Marine Sanctuary environmental assessment on the regulation of spearfishing gear</i>. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries.</p>
Time series $p\text{CO}_2$ at a coastal mooring: Internal consistency, seasonal cycles, and interannual variability	2011–2015	<ul style="list-style-type: none"> <li>• Ocean margin <math>\text{CO}_2</math></li> <li>• East coast</li> <li>• Inorganic carbon system</li> <li>• Internal consistency</li> </ul>	<ul style="list-style-type: none"> <li>• Delaware, USA</li> <li>• Florida, USA</li> <li>• Georgia, USA</li> <li>• Maryland, USA</li> <li>• Texas, USA</li> <li>• Washington, USA</li> </ul>	<p>Reimer, J. J., Cai, W., Xue, L., Vargas, R., Noakes, S., Hu, X., Signorini, S. R., Mathis, J. T., Feely, R. A., Sutton, A. J., Sabine, C., Musielewicz, S., Chen, B., &amp; Wanninkhof, R. (2017). Time series <math>p\text{CO}_2</math> at a coastal mooring: Internal consistency, seasonal cycles, and interannual variability. <i>Continental Shelf Research</i>, 145, 95–108.</p> <p><a href="https://doi.org/10.1016/j.csr.2017.06.022">https://doi.org/10.1016/j.csr.2017.06.022</a></p>

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Ecosystem services valuation of the central Georgia coast, including Sapelo Island National Estuarine Research Reserve and Gray's Reef National Marine Sanctuary	2015	<ul style="list-style-type: none"> <li>• Fishing surveys</li> <li>• Marine ecology</li> </ul>	<ul style="list-style-type: none"> <li>• Maryland, USA</li> </ul>	Loerzel, J., Fleming, C.S., & Gorstein., M. (2018). <i>Ecosystem services valuation of the central Georgia coast, including Sapelo Island National Estuarine Research Reserve and Gray's Reef National Marine Sanctuary</i> . NOAA Technical Memorandum NOS NCCOS 248. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, National Centers for Coastal Ocean Science. <a href="https://doi.org/10.25923/r522-xv78">https://doi.org/10.25923/r522-xv78</a>
Fish fauna of Gray's Reef National Marine Sanctuary and the implications for place-based management	N/A	<ul style="list-style-type: none"> <li>• Fish fauna</li> <li>• Fisheries management</li> <li>• Regulatory framework</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• North Carolina, USA</li> <li>• South Carolina, USA</li> </ul>	Hare, J. A., Walsh, H. J., Marancik, K. E., Score, D., Sedberry, G. R., Parker, R. O., Jr., & Mays, R.W. (n.d.). <i>Fish fauna of Gray's Reef National Marine Sanctuary and the implications for place-based management</i> . U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries, Gray's Reef National Marine Sanctuary.
Dispersal of black sea bass ( <i>Centropristis striata</i> ) larvae on the southeast U.S. continental shelf: Results of a coupled vertical larval behavior – 3D circulation model	2002–2004	<ul style="list-style-type: none"> <li>• Black sea bass</li> <li>• Circulation model</li> <li>• Larval behavior</li> <li>• Larval dispersal</li> </ul>	<ul style="list-style-type: none"> <li>• North Carolina, USA</li> </ul>	Edwards, K. P., Hare, J. A., & Werner, F. E. (2008). Dispersal of black sea bass ( <i>Centropristis striata</i> ) larvae on the southeast U.S. continental shelf: Results of a coupled vertical larval behavior – 3D circulation model. <i>Fisheries Oceanography</i> , 17(4), 299–315. <a href="https://doi.org/10.1111/j.1365-2419.2008.00480.x">https://doi.org/10.1111/j.1365-2419.2008.00480.x</a>

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Ascidians of the genus <i>Aplidium</i> collected on shallow hard-bottom reefs of coastal Georgia (Atlantic coast of N America, U.S.A.)	2004	<ul style="list-style-type: none"> <li>• <i>Aplidium</i></li> <li>• Ascidiacea</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• Russia</li> </ul>	Sanamyan, K., & Gleason, D. F. (2009). Ascidians of the genus <i>Aplidium</i> collected on shallow hard-bottom reefs of coastal Georgia (Atlantic coast of N America, U.S.A.). <i>Zootaxa</i> , 2066(1), 50–58. <a href="https://doi.org/10.11646/zootaxa.2066.1.2">https://doi.org/10.11646/zootaxa.2066.1.2</a>
Rapid vulnerability assessment for Gray's Reef National Marine Sanctuary	2017	<ul style="list-style-type: none"> <li>• Adaption strategies</li> <li>• Climate change</li> <li>• Vulnerability</li> </ul>	<ul style="list-style-type: none"> <li>• California, USA</li> <li>• Florida, USA</li> <li>• Georgia, USA</li> <li>• Maryland, USA</li> </ul>	Shein, K., Cavanaugh, J., Scalliet, H., Hutto, S., Roberson, K., Shortland, B., & Wenzel, L. (2019). <i>Rapid vulnerability assessment for Gray's Reef National Marine Sanctuary</i> . National Marine Sanctuaries Conservation Series ONMS-19- 01. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries.
Benthic features as a determinant for fish biomass in Gray's Reef National Marine Sanctuary	2006	<ul style="list-style-type: none"> <li>• Benthic habitats</li> <li>• GIS</li> <li>• Underwater acoustics</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• Maryland, USA</li> <li>• South Carolina, USA</li> </ul>	Kracker, L., Kendall, M., & McFall, G. (2008). Benthic features as a determinant for fish biomass in Gray's Reef National Marine Sanctuary. <i>Marine Geodesy</i> , 31(4), 267–280. <a href="https://doi.org/10.1080/01490410802466611">https://doi.org/10.1080/01490410802466611</a>

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Incidence of marine debris and its relationships with benthic features in Gray's Reef National Marine Sanctuary, southeast US	2004–2005	<ul style="list-style-type: none"> <li>• Benthic marine debris</li> <li>• Derelict fishing gear</li> <li>• South Atlantic Bight</li> </ul>	<ul style="list-style-type: none"> <li>• Maryland, USA</li> </ul>	Bauer, L. J., Kendall, M. S., & Jeffrey, C. F. G. (2008). Incidence of marine debris and its relationships with benthic features in Gray's Reef National Marine Sanctuary, southeast USA. <i>Marine Pollution Bulletin</i> , 56, 402–413. <a href="https://doi.org/10.1016/j.marpolbul.2007.11.001">https://doi.org/10.1016/j.marpolbul.2007.11.001</a>
Inducible chemical defenses in temperate reef sponges of the South Atlantic Bight	2006	<ul style="list-style-type: none"> <li>• Inducible chemical defenses</li> <li>• Secondary metabolites</li> <li>• South Atlantic Bight</li> <li>• Sponge</li> <li>• Temperate reefs</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	Sarmiento, L. V. (2003). <i>Inducible chemical defenses in temperate reef sponges of the South Atlantic Bight, U.S.A.</i> [Master's thesis]. Georgia Southern University.
Keeping up with the Silver King: Using cooperative acoustic telemetry networks to quantify the movements of Atlantic tarpon ( <i>Megalops atlanticus</i> ) in the coastal waters of the southeastern United States	2015–2017	<ul style="list-style-type: none"> <li>• Acoustic telemetry</li> <li>• Atlantic tarpon</li> <li>• Migratory connectivity</li> <li>• Network analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Canada</li> <li>• Florida, USA</li> <li>• Massachusetts, USA</li> </ul>	Griffin, L. P., Brownscombe, J. W., Adams, A. J., Boucek, R. E., Finn, J. T., Heithaus, M. R., Rehage, J. S., Cooke, S. J., & Danylchuk, A. J. (2018). Keeping up with the Silver King: Using cooperative acoustic telemetry networks to quantify the movements of Atlantic tarpon ( <i>Megalops atlanticus</i> ) in the coastal waters of the southeastern United States. <i>Fisheries Research</i> , 205, 65–76. <a href="https://doi.org/10.1016/j.fishres.2018.04.008">https://doi.org/10.1016/j.fishres.2018.04.008</a>

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Molecular assessment of heterotrophy and prey digestion in zooxanthellate cnidarians	2013	<ul style="list-style-type: none"> <li>• <i>Aiptasia</i></li> <li>• Digestion</li> <li>• dIa-qPCR</li> <li>• Predator-prey interaction</li> <li>• qPCR</li> <li>• Scleractinian corals</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• Portugal</li> </ul>	Leal, M. C., Nejstgaard, J. C., Calado, R., Thompson, M. E., & Frischer, M. E. (2014). Molecular assessment of heterotrophy and prey digestion in zooxanthellate cnidarians. <i>Molecular Ecology</i> , 23(15), 3838–3848. <a href="https://doi.org/10.1111/mec.12496">https://doi.org/10.1111/mec.12496</a>
Reported lionfish sightings throughout Gray's Reef National Marine Sanctuary, 2007 and 2012–2017	2007; 2012–2017	<ul style="list-style-type: none"> <li>• Invasive species</li> <li>• Lionfish</li> <li>• Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	Head, M., Roberson, K. W., & Sawicki, E. (2020). Project 13. Reported lionfish sightings throughout Gray's Reef National Marine Sanctuary, 2007 and 2012–2017. In K. W. Roberson, P. J. Auster, S. Fangman, & M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 134–141). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries. <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a>
Migratory connectivity and philopatry of cownose rays <i>Rhinoptera bonasus</i> along the Atlantic coast, USA	2014–2016	<ul style="list-style-type: none"> <li>• Acoustic telemetry</li> <li>• Behavior</li> <li>• Connectivity</li> <li>• Conservation</li> <li>• Fisheries management</li> <li>• Migration</li> <li>• Philopatry</li> <li>• <i>Rhinoptera bonasus</i></li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• Maryland, USA</li> <li>• Virginia, USA</li> </ul>	Ogburn, M. B., Bangle, C. W., Aguilar, R., Fisher, R. A., Curran, M. C., Webb, S. F., & Hines, A. H. (2018). Migratory connectivity and philopatry of cownose rays <i>Rhinoptera bonasus</i> along the Atlantic coast, USA. <i>Marine Ecology Progress Series</i> , 602, 197–211. <a href="https://doi.org/10.3354/meps12686">https://doi.org/10.3354/meps12686</a>

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Influence of benthic features and fishing pressure on size distribution of three exploited reef fishes from the Southeastern United States	2004–2005	<ul style="list-style-type: none"> <li>• Black sea bass</li> <li>• Distribution</li> <li>• Gag</li> <li>• Habitat preference</li> <li>• Scamp</li> <li>• Size structure</li> </ul>	<ul style="list-style-type: none"> <li>• Maryland, USA</li> </ul>	Kendall, M. S., Bauer, L. J., & Jeffrey, C. F. G. (2008). Influence of benthic features and fishing pressure on size distribution of three exploited reef fishes from the Southeastern United States. <i>Transactions of the American Fisheries Society</i> , 137, 1134–1146. <a href="https://doi.org/10.1577/T07-210.1">https://doi.org/10.1577/T07-210.1</a>
MPA design using sliding windows: Case study designating a research area	2007	<ul style="list-style-type: none"> <li>• Coastal management</li> <li>• Marine protected area</li> </ul>	<ul style="list-style-type: none"> <li>• California, USA</li> <li>• Georgia, USA</li> <li>• Maryland, USA</li> </ul>	Kendall, M. S., Eschelbach, K. A., McFall, G., Sullivan, J., & Bauer, L. (2008). MPA design using sliding windows: Case study designating a research area. <i>Ocean and Coastal Management</i> , 51(12), 815–825. <a href="https://doi.org/10.1016/j.ocecoaman.2008.09.004">https://doi.org/10.1016/j.ocecoaman.2008.09.004</a>
Influence of hard bottom morphology of fish assemblages of the continental shelf off Georgia, southeastern USA	2004–2005	<ul style="list-style-type: none"> <li>• Fish assemblage</li> <li>• Habitat structure</li> <li>• Live-bottom habitat</li> </ul>	<ul style="list-style-type: none"> <li>• Maryland, USA</li> </ul>	Kendall, M. S., Bauer, L. J., & Jeffrey, C. F. G. (2009). Influence of hard bottom morphology on fish assemblages of the continental shelf off Georgia, southeastern USA. <i>Bulletin of Marine Science</i> , 84(3), 265–286.
Age, growth, natural mortality, and reproductive seasonality of knobbed porgy from southeastern United States waters	2015–2016	<ul style="list-style-type: none"> <li>• Age structure</li> <li>• <i>Calamus nodosus</i></li> <li>• Growth</li> <li>• Knobbed porgy</li> <li>• Mortality</li> <li>• Reproduction</li> </ul>	<ul style="list-style-type: none"> <li>• North Carolina, USA</li> </ul>	Burton, M. L., Potts, J. C., Poholek, A. K., Ostrowski, A., & Page, J. (2019). Age, growth, natural mortality, and reproductive seasonality of knobbed porgy from southeastern United States waters. <i>Marine and Coastal Fisheries</i> , 11(2), 231–245. <a href="https://doi.org/10.1002/mcf2.10074">https://doi.org/10.1002/mcf2.10074</a>

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Coral feeding on microalgae assessed with molecular trophic markers	N/A	<ul style="list-style-type: none"> <li>• Coral feeding</li> <li>• Heterotrophy</li> <li>• PCR</li> <li>• Phytoplankton</li> <li>• Specific primers</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• Monaco</li> <li>• Portugal</li> </ul>	Leal, M. C., Ferrier-Pages, C., Calado, R., Thompson, M. E., Frischer, M. E., & Nejstgaard, J. C. (2013). Coral feeding on microalgae assessed with molecular trophic markers. <i>Molecular Ecology</i> , 15, 3870–3876.
Shellfish restoration and alternative shoreline protection policies of the southeastern United States; Florida, Georgia, North Carolina and South Carolina	N/A	<ul style="list-style-type: none"> <li>• Coastal management</li> <li>• Policy</li> <li>• Shellfish restoration</li> <li>• Shoreline stabilization</li> </ul>	<ul style="list-style-type: none"> <li>• Mississippi, USA</li> </ul>	Pace, N. L., & Boyd, C. A. (2012). <i>Shellfish restoration and alternative shoreline protection policies of the southeastern United States: Florida, Georgia, North Carolina and South Carolina</i> . Technical report prepared for The Nature Conservancy.
Macroalgae at Gray's Reef National Marine Sanctuary, Georgia	2011	<ul style="list-style-type: none"> <li>• Biomass</li> <li>• Macroalgal assemblages</li> <li>• Species richness</li> </ul>	<ul style="list-style-type: none"> <li>• Florida, USA</li> </ul>	Goldberg, N. A., & Heine, J. N. (2012). Macroalgae at Gray's Reef National Marine Sanctuary, Georgia. <i>Southeastern Naturalist</i> , 11(3), 477–486.
Environmental interference factors affecting detection range in acoustic telemetry studies using fixed receiver arrays	2011–2012	<ul style="list-style-type: none"> <li>• Long-term monitoring</li> <li>• Seasonal variation</li> <li>• Signal-to-noise</li> <li>• Stratification</li> <li>• Tides</li> <li>• Time-series analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• Maryland, USA</li> </ul>	Mathies, N. H., Ogburn, M. B., McFall, G., & Fangman, S. (2014). Environmental interference factors affecting detection range in acoustic telemetry studies using fixed receiver arrays. <i>Marine Ecology Progress Series</i> , 495, 27–38. <a href="https://doi.org/10.3354/meps10582">https://doi.org/10.3354/meps10582</a>

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Benthic plastic debris in marine and freshwater environments	N/A	<ul style="list-style-type: none"> <li>• Benthic plastic debris</li> <li>• Literature review</li> </ul>	<ul style="list-style-type: none"> <li>• Canada</li> </ul>	Corcoran, P. L. (2015). Benthic plastic debris in marine and freshwater environments. <i>Environmental Science: Processes and Impacts</i> , 17, 1363–1369. <a href="https://doi.org/10.1039/C5EM00188A">https://doi.org/10.1039/C5EM00188A</a>
Cryptic diversity of the symbiotic cyanobacterium <i>Synechococcus spongiarum</i> among sponge hosts	2004	<ul style="list-style-type: none"> <li>• Coral reef</li> <li>• Cyanobacteria</li> <li>• Phylogeny</li> <li>• Porifera</li> <li>• Symbiosis</li> <li>• <i>Synechococcus spongiarum</i></li> </ul>	<ul style="list-style-type: none"> <li>• Alabama, USA</li> <li>• North Carolina, USA</li> </ul>	Erwin, P., & Thacker, R.W. (2008). Cryptic diversity of the symbiotic cyanobacterium <i>Synechococcus spongiarum</i> among sponge hosts. <i>Molecular Ecology</i> , 17(12), 2937–2947. <a href="https://doi.org/10.1111/j.1365-294X.2008.03808.x">https://doi.org/10.1111/j.1365-294X.2008.03808.x</a>
Preliminary results assessing movement patterns of select demersal piscivores at the sub-tropical reefs of Gray's Reef National Marine Sanctuary (Northwest Atlantic, Carolinian Province), 2008–2013	2008–2013	<ul style="list-style-type: none"> <li>• Acoustic receiver</li> <li>• Fish movement</li> <li>• Fish tagging</li> </ul>	<ul style="list-style-type: none"> <li>• California, USA</li> <li>• Connecticut, USA</li> <li>• Georgia, USA</li> </ul>	Auster, P., Lindholm, J., Pereira, J., Fangman, S., Bolton, H., Cramer, A., Jensen, L., & Moye, J. (2020). Project 10. Preliminary results assessing movement patterns of selected demersal piscivores at the sub-tropical reefs of Gray's Reef National Marine Sanctuary (Northwest Atlantic Carolinian Province), 2008–2013. In K. W. Roberson, P. J. Auster, S. Fangman, & M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 98–115). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries. <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a>

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Behavior webs of piscivores at subtropical live-bottom reefs	2009–2011	<ul style="list-style-type: none"> <li>• Acoustic observations</li> <li>• Fish behavior</li> <li>• Live-bottom reefs</li> </ul>	<ul style="list-style-type: none"> <li>• Connecticut, USA</li> <li>• Maryland, USA</li> <li>• Massachusetts, USA</li> <li>• New Hampshire, USA</li> </ul>	Auster, P. J., Laura, K., Price, V., Heupel, E., McFall, G., & Grenda, D. (2013). Behavior webs of piscivores at subtropical live-bottom reefs. <i>Bulletin of Marine Science</i> , 89(1), 377–396. <a href="http://dx.doi.org/10.5343/bms.2011.1123">http://dx.doi.org/10.5343/bms.2011.1123</a>
Identifying habitat associations of sea turtles within an area of offshore sub-tropical reefs (NW Atlantic)	2017	<ul style="list-style-type: none"> <li>• Habitat associations</li> <li>• Sea turtles</li> <li>• Time-lapse videos</li> </ul>	<ul style="list-style-type: none"> <li>• Connecticut, USA</li> <li>• North Carolina, USA</li> <li>• United Kingdom</li> </ul>	Auster, P. J., Campanella, F., Kurth, R., Munoz, R. C., & Taylor, J. C. (2020). Identifying habitat associations of sea turtles within an area of offshore sub-tropical reefs (NW Atlantic). <i>Southeastern Naturalist</i> , 19(3), 460–471. <a href="https://doi.org/10.1656/058.019.0302">https://doi.org/10.1656/058.019.0302</a>
Behavior of prey links midwater and demersal piscivorous reef fishes	2008	<ul style="list-style-type: none"> <li>• Habitat</li> <li>• Live bottom</li> <li>• Prey density</li> <li>• Reef</li> </ul>	<ul style="list-style-type: none"> <li>• Connecticut, USA</li> <li>• Georgia, USA</li> </ul>	Auster, P. J., Godfrey, J., Watson, A., Paquette, A., & McFall, G. (2009). Behavior of prey links midwater and demersal piscivorous reef fishes. <i>Neotropical Ichthyology</i> , 7(1), 109–112. <a href="https://doi.org/10.1590/S1679-62252009000100014">https://doi.org/10.1590/S1679-62252009000100014</a>

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Assessing variation in composition of mixed-species groups of piscivores, 2009–2011 and 2013–2014	2009–2011; 2013–2014	<ul style="list-style-type: none"> <li>• Roving diver transects</li> <li>• Species abundance</li> <li>• Species composition</li> </ul>	<ul style="list-style-type: none"> <li>• Connecticut, USA</li> </ul>	Auster, P. (2020). Project 11. Assessing variation in composition of mixed-species groups of piscivores, 2009–2011 and 2013–2014. In K. W. Roberson, P. J. Auster, S. Fangman, & M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 116–122). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries. <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a>
Latitudinal variation in spongivorous fishes and the effectiveness of sponge chemical defenses	2003–2004	<ul style="list-style-type: none"> <li>• Atlantic reefs</li> <li>• Chemical defenses</li> <li>• Predation</li> <li>• Secondary metabolites</li> <li>• Sponge</li> </ul>	<ul style="list-style-type: none"> <li>• Florida, USA</li> <li>• Georgia, USA</li> </ul>	Ruzicka, R., Gleason, D.F. (2008). Latitudinal variation in spongivorous fishes and the effectiveness of sponge chemical defenses. <i>Oecologia</i> , 154, 785–794. <a href="https://doi.org/10.1007/s00442-007-0874-0">https://doi.org/10.1007/s00442-007-0874-0</a>
Sponge community structure and anti-predator defenses on temperate reefs of the South Atlantic Bight	2003–2004	<ul style="list-style-type: none"> <li>• Chemical defenses</li> <li>• Community structure</li> <li>• South Atlantic Bight</li> <li>• Sponge</li> <li>• Spongivorous fish</li> <li>• Structural defenses</li> <li>• Temperate reefs</li> </ul>	<ul style="list-style-type: none"> <li>• Florida, USA</li> <li>• Georgia, USA</li> </ul>	Ruzicka, R., & Gleason, D. F. (2009). Sponge community structure and anti-predator defenses on temperate reefs of the South Atlantic Bight. <i>Journal of Experimental Marine Biology and Ecology</i> , 380, 36–46. <a href="https://doi.org/10.1016/j.jembe.2009.08.011">https://doi.org/10.1016/j.jembe.2009.08.011</a>

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Benthic fish communities and structural habitat measurements from Gray's Reef National Marine Sanctuary, 2010–2016	2010–2016	<ul style="list-style-type: none"> <li>• Benthic fish community</li> <li>• Community composition</li> <li>• Diver-based surveys</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• North Carolina, USA</li> </ul>	<p>Munoz, R. C., Buckel, C. A., &amp; Fangman, S. (2020). Project 5. Benthic fish communities and structural habitat measurements from Gray's Reef National Marine Sanctuary, 2010–2016. In K.W. Roberson, P.J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 36–51). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries. <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>
A greater Gray: A larval connectivity assessment of Gray's Reef National Marine Sanctuary	2009–2015	<ul style="list-style-type: none"> <li>• Ecological connectivity</li> <li>• Larval dispersal</li> <li>• Marine geospatial ecology tools</li> </ul>	<ul style="list-style-type: none"> <li>• California, USA</li> </ul>	<p>Furtner, S., Gad, S., Marill, I., &amp; Qian, A. (2017). <i>A greater Gray: A larval connectivity assessment of Gray's Reef National Marine Sanctuary</i>. Group project prepared for NOAA and Gray's Reef National Marine Sanctuary. University of California Santa Barbara, Bren School of Environmental Science and Management.</p>
Underwater paleontology: Recovery of a prehistoric whale mandible offshore Georgia	2006–2008	<ul style="list-style-type: none"> <li>• Baleen whale</li> <li>• Gray whale</li> <li>• Marine paleontology</li> <li>• Prehistoric</li> <li>• Scientific diving</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	<p>Noakes, S. E., Garrison, E. G., &amp; McFall, G. B. (2009). Underwater paleontology: Recovery of a prehistoric whale mandible offshore Georgia. In N. W. Pollock (Ed.), <i>Diving for science 2009: Proceedings of the American Academy of Underwater Sciences 28<sup>th</sup> Symposium</i> (pp. 245–251).</p>

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Late Pleistocene gray whales ( <i>Eschrichtius robustus</i> ) offshore Georgia, U.S.A., and the antiquity of gray whale migration in the North Atlantic Ocean	N/A	<ul style="list-style-type: none"> <li>• Gray whale</li> <li>• Marine paleontology</li> <li>• Paleoecology</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> <li>• Washington DC, USA</li> <li>• Washington, USA</li> </ul>	Noakes, S. E., Pyenson, N. D., & McFall, G. (2013). Late Pleistocene gray whales ( <i>Eschrichtius robustus</i> ) offshore Georgia, U.S.A., and the antiquity of gray whale migration in the North Atlantic Ocean. <i>Paleogeography, Palaeoclimatology, Paleoecology</i> , 392, 502–509. <a href="https://doi.org/10.1016/j.palaeo.2013.10.005">https://doi.org/10.1016/j.palaeo.2013.10.005</a>
Carbon dioxide and water quality monitoring at Gray's Reef National Marine Sanctuary, 2006–2014	2006–2014	<ul style="list-style-type: none"> <li>• Time series</li> <li>• Water quality</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	Noakes, S. (2020). Project 14. Carbon dioxide and water quality monitoring at Gray's Reef National Marine Sanctuary, 2006–2014. In K. W. Roberson, P. J. Auster, S. Fangman, & M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 142–150). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries. <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a>

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Assessing patterns of prey fish abundance and patchiness at live-bottom reefs using hydroacoustics	2011–2013	<ul style="list-style-type: none"> <li>• Fish abundance</li> <li>• Hydroacoustic</li> <li>• Prey fish</li> </ul>	<ul style="list-style-type: none"> <li>• Connecticut, USA</li> <li>• Maryland, USA</li> <li>• Pennsylvania, USA</li> </ul>	<p>Gabriel, S., Auster, P. J., &amp; Kracker, L. (2020). Project 8. Assessing patterns of prey fish abundance and patchiness at live-bottom reefs using hydroacoustics, 2011–2013. In K. W. Roberson, P. J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 77–85). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries.</p> <p><a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>
Assessing the presence of halo predators at sub-tropical reefs, 2014	2014	<ul style="list-style-type: none"> <li>• Halo predators</li> <li>• Sub-tropical reefs</li> <li>• Towed video monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Connecticut, USA</li> <li>• Pennsylvania, USA</li> </ul>	<p>Gabriel, S., &amp; Auster, P. J. (2020). Project 12. Assessing the presence of halo predators at sub-tropical reefs, 2014. In K. W. Roberson, P. J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 123–133). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries.</p> <p><a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Survey of sea urchins and sea stars within Gray's Reef National Marine Sanctuary, 2014–2017	2014–2017	<ul style="list-style-type: none"> <li>• Density</li> <li>• Linear transect</li> <li>• Sea star</li> <li>• Sea urchin</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	<p>Henkel, T. P. (2020). Project 2. Survey of sea urchins and sea stars within Gray's Reef National Marine Sanctuary, 2014–2017. In K. W. Roberson, P. J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 9–17). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries. <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>
Characterizing mean and extreme diurnal variability of ocean CO <sub>2</sub> system variables across marine environments	2004–2017	<ul style="list-style-type: none"> <li>• CO<sub>2</sub> chemistry</li> <li>• Diurnal variability</li> <li>• Ocean acidification</li> </ul>	<ul style="list-style-type: none"> <li>• France</li> <li>• Washington, USA</li> </ul>	<p>Torres, O., Kwiatkowski, L., Sutton, A. J., Dorey, N., &amp; Orr, J.C. (2021). Characterizing mean and extreme diurnal variability of ocean CO<sub>2</sub> system variables across marine environments. <i>Geophysical Research Letters</i>, 48, e2020GL090228. <a href="https://doi.org/10.1029/2020GL090228">https://doi.org/10.1029/2020GL090228</a></p>
Use of high-resolution DIDSON sonar to quantify attributes of predation at ecologically relevant space and time scales	2009	<ul style="list-style-type: none"> <li>• Behavior</li> <li>• Hydroacoustics</li> <li>• Predator</li> <li>• Prey</li> <li>• Reef</li> </ul>	<ul style="list-style-type: none"> <li>• Connecticut, USA</li> <li>• South Carolina, USA</li> </ul>	<p>Price, V. E., Auster, P. J., &amp; Kracker, L. (2013). Use of high-resolution DIDSON Sonar to quantify attributes of predation at ecologically relevant space and time scales. <i>Marine Technology Society Journal</i>, 47(1), 33–46. <a href="https://doi.org/10.4031/MTSJ.47.1.6">https://doi.org/10.4031/MTSJ.47.1.6</a></p>

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Reef fish monitoring by MARMAP and the SERFS program at Gray's Reef National Marine Sanctuary	1993–2014	<ul style="list-style-type: none"> <li>• Marine Resources Monitoring, Assessment, and Prediction Program</li> <li>• Reef fish</li> <li>• Sampling</li> </ul>	<ul style="list-style-type: none"> <li>• South Carolina, USA</li> </ul>	<p>Buble, W. J., Wyanski, D. M., Reichert, M. J. M., &amp; Willis, C. M. (2020). Project 6. Reef fish monitoring by MARMAP and the SERFS program at Gray's Reef National Marine Sanctuary, 1993–2014. In K. W. Roberson, P. J. Auster, S. Fangman, &amp; M. Harvey (Eds). <i>Review of scientific research in and around the designated Research Area of Gray's Reef National Marine Sanctuary (NW Atlantic)</i> (pp. 52–67). National Marine Sanctuaries Conservation Series ONMS-20-08. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries. <a href="https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html">https://sanctuaries.noaa.gov/science/conservation/grnms-research-area-report-2020.html</a></p>
Temporal and vertical distributions of bacterioplankton at the Gray's Reef National Marine Sanctuary	2011	<ul style="list-style-type: none"> <li>• Bacterial community composition</li> <li>• Nonmetric multidimensional scaling analysis</li> <li>• South Atlantic Bight</li> </ul>	<ul style="list-style-type: none"> <li>• California, USA</li> <li>• China</li> <li>• Georgia, USA</li> <li>• Ohio, USA</li> </ul>	<p>Lu, X., Sun, S., Zhang, Y., Hollibaugh, J. T., &amp; Mou, X. (2015). Temporal and vertical distributions of bacterioplankton at the Gray's Reef National Marine Sanctuary. <i>Applied Environmental Microbiology</i>, 81(3), 910–917. <a href="https://doi.org/10.1128/AEM.02802-14">https://doi.org/10.1128/AEM.02802-14</a></p>
GIS based multi-criteria assessment of tidal stream power potential: A case study for Georgia, USA	N/A	<ul style="list-style-type: none"> <li>• GIS</li> <li>• Power potential</li> <li>• Tidal streams</li> </ul>	<ul style="list-style-type: none"> <li>• Georgia, USA</li> </ul>	<p>Defne, Z., Haas, K. A., &amp; Fritz, H. M. (2011). GIS based multi-criteria assessment of tidal stream power potential: A case study for Georgia, USA. <i>Renewable and Sustainable Energy Reviews</i>, 15(5), 2310–2321. <a href="https://doi.org/10.1016/j.rser.2011.02.005">https://doi.org/10.1016/j.rser.2011.02.005</a></p>

Title	Study Time Period	Research Keywords	Affiliation Locations	Citation
Late Quaternary paleoecology and Heinrich events at Gray's Reef National Marine Sanctuary, South Atlantic Bight, Georgia	1996; 2000	<ul style="list-style-type: none"> <li>• Paleoecology</li> <li>• Palynofacies analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Florida, USA</li> <li>• Georgia, USA</li> <li>• India</li> <li>• Virginia, USA</li> </ul>	Garrison, E. G., Weaver, W., Littman, S. L., Hale J. C., & Srivastava, P. (2012). Late Quaternary paleoecology and Heinrich events at Gray's Reef National Marine Sanctuary, South Atlantic Bight, Georgia. <i>Southeastern Geology</i> , 48(4), 165–184.
Autonomous wintertime observations of air-sea exchange in the Gulf Stream reveal a perfect storm for ocean CO <sub>2</sub> uptake	2019	<ul style="list-style-type: none"> <li>• Air-sea exchange</li> <li>• pCO<sub>2</sub></li> <li>• Unscrewed surface vehicle</li> </ul>	<ul style="list-style-type: none"> <li>• Bermuda</li> <li>• California, USA</li> <li>• Rhode Island, USA</li> <li>• United Kingdom</li> <li>• Washington, USA</li> </ul>	Nickford, S., Palter, K. B., Donohue, K., Fassbender, A. K., Gray, A. R., Long, J., Sutton, A. J., Bates, N. R., & Takeshita, Y. (2022). Autonomous wintertime observations of air-sea exchange in the Gulf Stream reveal a perfect storm for ocean CO <sub>2</sub> uptake. <i>Geophysical Research Letters</i> , 49, e2021GL096805. <a href="https://doi.org/10.1029/2021GL096805">https://doi.org/10.1029/2021GL096805</a>
Why are surface ocean pH and CaCO <sub>3</sub> saturation state often out of phase in spatial patterns and seasonal cycles?	N/A	<ul style="list-style-type: none"> <li>• CaCO<sub>3</sub></li> <li>• Ocean acidification</li> <li>• pH</li> </ul>	<ul style="list-style-type: none"> <li>• China</li> <li>• Delaware, USA</li> <li>• Maryland, USA</li> </ul>	Xue, L., Cai, W-J., Jiang, L-Q., & Wei, Q. (2021). Why are surface ocean pH and CaCO <sub>3</sub> saturation state often out of phase in spatial patterns and seasonal cycles? <i>Global Biogeochemical Cycles</i> , 35(7), e2021GB006949. <a href="https://doi.org/10.1029/2021GB006949">https://doi.org/10.1029/2021GB006949</a>
Large temporal variations in air-sea CO <sub>2</sub> flux off the coast of Georgia	2006–2008	<ul style="list-style-type: none"> <li>• Air-sea CO<sub>2</sub></li> <li>• Ocean acidification</li> </ul>	<ul style="list-style-type: none"> <li>• Colorado, USA</li> <li>• Delaware, USA</li> <li>• Maryland, USA</li> <li>• Washington, USA</li> </ul>	Rugenstein, J. K. C., Chris, S., Cai, W-J., & Alin, S. (2008). <i>Large temporal variations in air-sea CO<sub>2</sub> flux off the coast of Georgia</i> [Abstract]. 2008 American Geophysical Union Fall Meeting, San Francisco, CA, United States.

## Appendix B: Survey Instrument<sup>5</sup>

This is a voluntary survey conducted by the National Marine Sanctuary Foundation, a non-profit organization that is a leading voice for U.S. protected waters (<https://marinesanctuary.org/>).

We are collecting information on research activity that occurred at least partly within Gray's Reef National Marine Sanctuary or that involved collecting information on sanctuary users between 2008 and present. This includes both ongoing and past research. This period has been selected to align with information collected for the Gray's Reef Condition Report (for background, see <https://sanctuaries.noaa.gov/science/condition/>). The information we are collecting from you will be used to improve support provided to researchers within Gray's Reef National Marine Sanctuary and to increase understanding of how research within national marine sanctuaries supports local economies. All information will be reported in aggregate form. At the end of the study, materials identifying you as an individual, government agency, business, or academic institution will be destroyed. The National Marine Sanctuary Foundation is not a government entity and will not share or release raw survey data you provide with any government organization.

The time required to complete this survey is estimated to average 30 minutes, including time for reviewing instructions and completing the survey. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing burden, to Robert Botta at the National Marine Sanctuary Foundation ([robert.botta@noaa.gov](mailto:robert.botta@noaa.gov)). Participation in this survey is voluntary.

If you have records for recent research projects, especially related to research funding in 2019 and 2022, it may be useful to have them on hand as a reference while completing the survey.

### **Research activity**

Please consider the research activities for which you acted as principal investigator (PI) that a) occurred at least partly within Gray's Reef National Marine Sanctuary or focused on sanctuary users and that b) occurred between 2008 and the present. An activity involving data collection across multiple years (e.g., a monitoring project) should be considered a single project, as long as there is a connecting purpose or set of research questions.

1. How many projects fit those criteria?

For the following questions, please provide information for only the *most recent* project that fits the criteria outlined in the previous question.

1. Are you the principal investigator (PI) on this project?
  - a. Yes
  - b. No

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<sup>5</sup> The survey in this appendix is reproduced exactly as it was presented to respondents and has not been copy edited for the purposes of this report.

2. What type of organization were you representing while conducting this research (check all that apply)?
  - a. Academic institution/faculty
  - b. Non-profit organization
  - c. Federal government agency
  - d. National laboratory
  - e. State government
  - f. Local government
  - g. Tribal government
  - h. Private business
  - i. Other
3. What is the name of the organization you were affiliated with while conducting this research?
4. Were there other partnering organizations on this project? Please note, this refers to more formalized partnerships, as opposed to informal collaborations.
  - a. Yes
  - b. No
5. Please identify which types of organizations you partnered with (check all that apply).
  - a. Academic institution/faculty
  - b. Non-profit
  - c. Federal government agency
  - d. National laboratory
  - e. State government
  - f. Local government
  - g. Tribal government
  - h. Private business
  - i. Other
6. How would you characterize this project (check all that apply)?
  - a. Research - the process of generating knowledge through the systematic investigations of new and existing information, e.g., through modeling or process studies
  - b. Monitoring - the systematic observation of indicators of natural resources, cultural resources, or ecosystem conditions to measure change over time
  - c. Characterization - the process of identifying, describing, and attributing qualities to natural or cultural resources or systems
  - d. Exploration - the process of discovering unknown, unusual or unexpected aspects of a place, thing, or system
  - e. Other
7. In what year did you begin collecting data for this project?
8. Was there a seasonal, monthly, or other temporal aspect to this project? This can refer to either project operations or data collection/monitoring.
  - a. Yes
  - b. No
9. Please explain the seasonal, monthly, or other temporal aspects of this project.

10. Is the project ongoing?
  - a. Yes
  - b. No
11. Were there any disruptions to this project?
  - a. Yes
  - b. No
12. Please briefly explain the disruption(s) and project impacts.
13. What was the topic or research focus of this project (check all that apply)?
  - a. Habitat study/assessment
  - b. Flora study/assessment
  - c. Fauna study/assessment
  - d. Water column study/assessment
  - e. Physical oceanographic study/assessment
  - f. Geological study/assessment
  - g. Climatological study/assessment
  - h. Mapping
  - i. Anthropogenic impact study/assessment
  - j. Pollutant/contaminant study/assessment
  - k. Socioeconomic monitoring/research
  - l. Cultural heritage/archaeological research
  - m. Other
14. Please indicate whether you have or will provide these research results to any of the following organizations (check all that apply).
  - a. Regional Fisheries Management Council/Group
  - b. Federal, state, or local governments
  - c. Data library/repository/network/portal
  - d. Academic institution
  - e. Peer-reviewed scientific journal
  - f. Professional conference
  - g. Non-profit organization
  - h. Other
15. If you indicated that you provided these research results to at least one of the organizations listed, please provide the link(s) or citation(s) to any completed projects.
16. If you indicated that you provided these research results to at least one of the organizations listed, please provide the plan of submission for in progress results.
17. Has or will this research be used to inform policy or planning?
  - a. Yes
  - b. No
  - c. Unsure
18. Please describe how this research has/will inform policy or planning.
19. Will data collected as part of this research project be made publicly available (for example, through a public data portal)?
  - a. Yes
  - b. No

- c. Unsure
20. Were any of the following ship-based technologies used for this study (check all that apply)?
- Unmanned surface vehicle
  - Autonomous Underwater Vehicle (AUV)
  - Manned submersible vehicle
  - Acoustic sampling
  - Diving
  - Autonomous underwater hydrophone
  - Autonomous underwater camera
  - Net tows
  - Water sampling device
  - Benthic sampling device
  - Sampling devices dropped by cable over the ship
  - Expendable Bathythermograph (XBT)
  - N/A
  - Other
21. Were any of the following air-based technologies used for this study (check all that apply)?
- Manned aircraft
  - Unmanned Aircraft System (UAS)
  - Satellite imagery
  - LiDar
  - Radar
  - Aerial photography/videography/imagery
  - N/A
  - Other
22. Were any other technologies used for this study (check all that apply)?
- High frequency radar
  - Automatic Identification System (AIS)
  - Vessel Monitoring System (VMS) Telemetry tag
  - eDNA sampling device Underwater camera
  - Camera (not underwater)
  - Telepresence technology
  - Laser range finder
  - Temperature logger
  - Submerged multi-sensor platform
  - Data buoy
  - N/A

### Reasons for site selection

- What factors influenced the site selection for your research (check all that apply)?
  - Geophysical environment
  - The area contains the natural resources and/or process necessary for my research

- c. Biodiversity/productivity of the area
  - d. Presence of archeological and/or cultural resources
  - e. Remote nature of managed site
  - f. Zoning of the area (site includes zones with restricted access or use, like "No Take" or "Research Only" areas)
  - g. Regulations in the area
  - h. Accessibility/proximity to research institutions, access points, etc.
  - i. Necessary part of larger scale spatial project
  - j. The site provides an opportunity to study an emerging issue (e.g., invasive species, ocean acidification) (Please describe in "other")
  - k. The sanctuary or other resource management agency contacted me with a specific request
  - l. The area is included in the Ecosystem Status Report for the U.S. South Atlantic Region (NOAA Fisheries, 2021)
  - m. National Marine Sanctuary Management Plan Action Item
  - n. Office of National Marine Sanctuaries Sentinel Site Issue
  - o. Science Needs section of sanctuary website
  - p. Creating a new partnership/collaboration or expanding an existing one
  - q. Presence of National Data Buoy Center (NDBC) Data Buoy 41008
  - r. Existing data available
  - s. Continuation of long-term dataset at the site
  - t. Availability of ancillary data
  - u. Funding opportunity
  - v. Vessel availability
  - w. Dive support
  - x. The sanctuary staff has the necessary expertise, equipment, or existing projects to support my research
  - y. Opportunity to publicize research through outreach, education, and media
  - z. The site's status as a National Marine Sanctuary
  - aa. Other
2. Were you aware that the proposed research would occur within a national marine sanctuary?
    - a. Yes
    - b. No
  3. Were you approached by sanctuary staff to conduct this research?
    - a. Yes
    - b. No
  4. Were you approached by a partner or organization other than the Office of National Marine Sanctuaries or Gray's Reef National Marine Sanctuary to conduct this research?
    - a. Yes
    - b. No
  5. Which partner(s) approached you about conducting this research?
  6. Did you approach the sanctuary to collaborate on this research?
    - a. Yes

- b. No
- 7. Did you need to apply for a sanctuary permit to conduct this research?
  - a. Yes
  - b. No
  - c. Unsure

### **Sanctuary staff/support**

1. Did you collaborate with the sanctuary on this project (e.g., through project planning, data collection, or communication of results)?
  - a. Yes
  - b. No
2. Did you collaborate with sanctuary staff for any project in which you were principal investigator (PI)?
  - a. Yes
  - b. No
3. Were sanctuary scientists involved in the research?
  - a. Yes
  - b. No
4. How were sanctuary scientists involved in this research (check all that apply)?
  - a. Co-lead research
  - b. Observed research
  - c. Collaborated on planning
  - d. Participated in data collection
  - e. Other
5. Did you coordinate with sanctuary staff during the following research stages (check all that apply)?
  - a. Prior to writing the research proposal/plan
  - b. While writing the research proposal/plan
  - c. During the permit application process
  - d. While conducting your research
  - e. While analyzing your data
  - f. While finalizing your report
  - g. After finalizing the report
  - h. To request operational support using Sanctuary assets or personnel
  - i. Other
6. During research, who did you consult with at the sanctuary site?
  - a. Superintendent
  - b. Deputy Superintendent
  - c. Research Coordinator/Ecologist
  - d. Resource Protection/Permit Coordinator
  - e. Education or Outreach Coordinator
  - f. Volunteer/Citizen Science Coordinator
  - g. Sanctuary Advisory Council Member
  - h. Other

7. How satisfied were you with the consultation/interactions you had with site staff?
  - a. 1: Extremely dissatisfied – 10: Extremely satisfied
8. (Optional) Please describe the reasons for your level of satisfaction/dissatisfaction here.
9. Do you have suggestions for how the sanctuary could improve support provided to researchers?

### Research spending – 2019

For this next section, we are going to ask you about project funding and expenditures. When responding to these questions, please consider *all projects* at GRNMS for which you were Principal Investigator (**not only the most recent project, as in Section "Research Activity"**).

1. Did you receive funding in the 2019 calendar year for any projects for which you acted as principal investigator (PI)?
  - a. Yes
  - b. No
2. Did you receive in-kind support or ship-time (paid or in-kind) in 2019 for any projects in which you acted as principal investigator (PI)?
  - a. Yes
  - b. No

#### Funding Source A

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)
3. Award/funding amount
4. Number of years to spend the funds

#### Funding Source B

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)
3. Award/funding amount
4. Number of years to spend the funds

#### Funding Source C

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)
3. Award/funding amount
4. Number of years to spend the funds

#### Funding Source D

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)
3. Award/funding amount
4. Number of years to spend the funds

### Funding Source E

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)
3. Award/funding amount
4. Number of years to spend the funds

### In-kind staff support - 2019

For the next two questions, please only provide information on *in-kind* staff time on 2019 projects. In other words, do not provide information on staff or contractors whose salaries are funded through grants or other funding sources reported above.

1. For projects in 2019 in which you were PI, please estimate the total number of in-kind staff hours spent on the project.
2. For projects in 2019, please provide the job titles of staff who conducted the research, along with the number of staff in each role (e.g., research biologist (2), archaeologist (1)). Please group the job titles by project, if necessary.

### In-kind support and ship time – 2019

For projects in 2019 in which you were PI, please detail any form of in-kind support that you received, excluding ship time and staff time (e.g., 80 volunteer-hours, X equipment, and Y services).

1. For projects in 2019, please provide an estimate of the amount of NOAA ship time (in vessel-days) used for the project. Leave blank if NA.
2. For projects in 2019, please provide an estimate of amount of Gray's Reef NMS ship time (in vessel-days) used for the project. Leave blank if NA.

### Research Spending – 2022

For this next section, we are going to ask you about project funding and expenditures. When responding to these questions, please consider *all projects* at GRNMS in which you were PI (**not only the most recent project, as in Section "Research Activity"**).

1. Did you receive funding in the 2022 calendar year for any projects in which you acted as principal investigator (PI)?
  - a. Yes
  - b. No
2. Did you receive in-kind support or ship-time (paid or in-kind) in 2022 for any projects in which you acted as principal investigator (PI)?
  - a. Yes
  - b. No

### Funding Source A

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)

3. Award/funding amount
4. Number of years to spend the funds

#### Funding Source B

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)
3. Award/funding amount
4. Number of years to spend the funds

#### Funding Source C

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)
3. Award/funding amount
4. Number of years to spend the funds

#### Funding Source D

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)
3. Award/funding amount
4. Number of years to spend the funds

#### Funding Source E

1. Type of funding (e.g., grant, internal funding, etc.)
2. Source of funding (e.g., federal, state, private, etc.)
3. Award/funding amount
4. Number of years to spend the funds

### **In-kind staff support - 2022**

For the next two questions, please only provide information on *in-kind* staff time on 2022 projects. In other words, do not provide information on staff or contractors whose salaries are funded through grants or other funding sources reported above.

1. For projects in 2022 in which you were PI, please estimate the total number of in-kind staff hours spent on the project.
2. For projects in 2022, please provide the job titles of staff who conducted the research, along with the number of staff in each role (e.g., research biologist (2), archaeologist (1)). Please group the job titles by project, if necessary.

### **In-kind staff support and ship time – 2022**

1. For projects in 2022 in which you were PI, please detail any form of in-kind support that you received, excluding ship time and staff time (e.g., 80 volunteer-hours, X equipment, and Y services).
2. For projects in 2022, please provide an estimate of amount of NOAA ship time (in vessel-days) used for the project. Leave blank if NA.

3. For projects in 2022, please provide an estimate of amount of Gray's Reef NMS ship time (in vessel-days) used for the project. Leave blank if NA.
4. During your most recent project, did you spend additional days on-site (in coastal counties near Gray's Reef for reasons not directly related to your research, i.e., personal travel or recreation)?
  - a. Yes
  - b. No
5. During your most recent project, did you spend additional days on-site (in coastal counties near Gray's Reef for reasons not directly related to your research, i.e., personal travel or recreation)?
  - a. Yes
  - b. No
6. How many additional days did you spend on-site for reasons not directly related to research?
7. Is your main office or place of business one of the counties within the study region (Beaufort [SC], Brantley, Bryan, Chatham, Effingham, Glynn, Hampton, Jasper, Liberty, or McIntosh County)?
  - a. Yes
  - b. No

### **End Survey**

1. Do we have permission to contact you with follow-up questions related to your survey responses?
  - a. Yes
  - b. No
2. If so, please provide your email address.

## Appendix C: Additional information

Table App. C.1. Detailed list of home institutions of investigators who collaborated on a project in or around GRNMS between 2008 and 2022.

Affiliation Location	Frequency
United States: All states	294
United States: Georgia	75
United States: Maryland	38
United States: North Carolina	32
United States: Washington	25
United States: Connecticut	24
United States: Florida	20
United States: South Carolina	16
United States: California	14
United States: Delaware	11
United States: Massachusetts	8
United States: New Hampshire	5
United States: Virginia	4
United States: Rhode Island	3
United States: Mississippi	3
United States: New Jersey	3
United States: Pennsylvania	2
United States: Ohio	2
United States: Colorado	1
United States: Hawaii	1
United States: Tennessee	1
United States: Michigan	1
United States: Washington, DC	1
United States: Oregon	1
United States: Texas	1
United States: Alabama	1
United States: Alaska	1
Brazil	13
Portugal	4
United Kingdom	4
France	4
China	4
Bermuda	2
Korea	2
Canada	2
Iceland	2
Monaco	1

Affiliation Location	Frequency
Australia	1
Puerto Rico	1
India	1
Russia	1
Total	336

Table App.C.2. Top 10 reasons that study sites were selected in and around GRNMS, 2008–2022. Frequency is the number of respondents from the 23 returned surveys who listed these as factors in the study site selection.

Reason for site selection	Frequency
The site's status as a national marine sanctuary	10
The sanctuary or other resource management agency contacted me with a specific request	9
Biodiversity/productivity of the area	9
Dive support	8
Vessel availability	7
The area contains the natural resources and/or process necessary for my research	7
Necessary part of larger scale spatial project	7
Zoning of the area (site includes zones with restricted access or use, like "no take" or "research only" areas)	6
Presence of National Data Buoy Center Data Buoy 41008	6
All others <sup>6</sup>	45

<sup>6</sup> "All others" includes 21 additional reasons for site selection. These reasons included: opportunity to publicize research through outreach, education, and media; the sanctuary staff has the necessary expertise, equipment, or existing projects to support research; science needs section of the sanctuary website; national marine sanctuary management plan action item; existing data available; geophysical environment; funding opportunity; the site provides an opportunity to study an emerging issue; continuation of long-term dataset at the site; creating a new partnership/collaboration or expanding an existing one; continuation of long-term dataset at the site; the sanctuary staff has the necessary expertise, equipment, or existing projects to support my research; availability of ancillary data; regulations in the area; remote nature of managed site; presence of archeological and/or cultural resources; emerging issue of the role of positive species interactions for conservation of diversity and ecosystem function; part of a larger study regarding the non-market valuation of national marine sanctuaries and national estuarine research reserves; National Ocean Service Science Board research needs; accessibility/proximity to research institutions/access points/etc.; ocean acidification monitoring.



NATIONAL MARINE  
**SANCTUARIES**

AMERICA'S UNDERWATER TREASURES