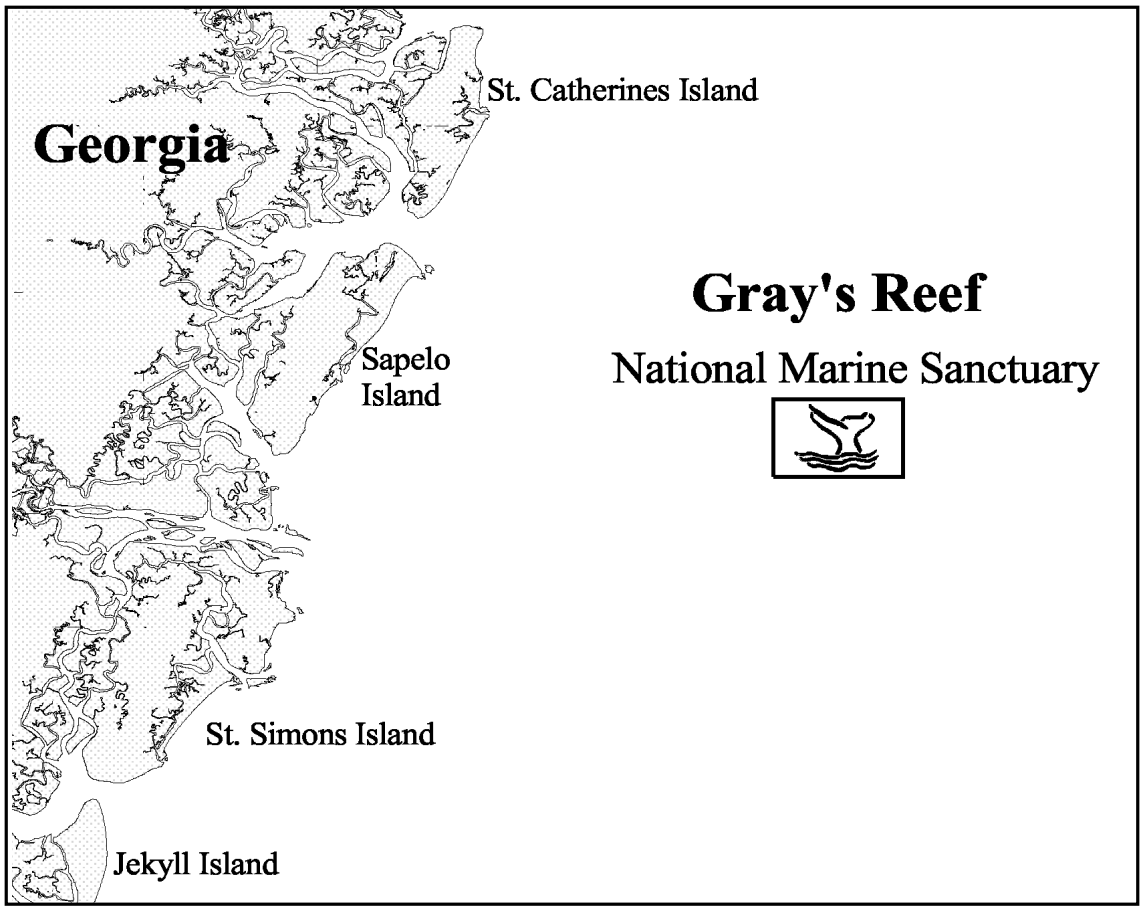
Cruise Report

NOAA Ship FERREL Cruise FE-02-09-MA
(April 3-10, 2002)

Benthic Survey of the Gray's Reef National Marine Sanctuary and Nearby Shelf Waters, Spring 2002



May 2002

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

National Ocean Service
National Centers for Coastal Ocean Science
Center for Coastal Environmental Health and Biomolecular Research

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Benthic Survey of Gray's Reef National Marine Sanctuary and Nearby Shelf Waters, Spring 2002

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Preface

This cruise report is a summary of field work conducted in and around the Gray's Reef National Marine Sanctuary (GRNMS), April 2002, as part of an ongoing ecological characterization of GRNMS and nearby shelf waters. An important goal of the current survey is to determine the extent to which land-based sources of pollutants and other materials are transported through river systems to the offshore shelf environment, inclusive of GRNMS, and the potential effects that these materials may be having on biological resources along the way. A total of 13 stations were sampled April 3 – April 10, 2002 from the NOAA ship FERREL (Cruise FE-02-09-MA) along two cross-shelf transects including one station in GRNMS serving as the seaward end of the southern transect. The primary focus of the cruise was on the collection of samples for the analysis of benthic macroinfaunal community structure and concentrations of chemical contaminants in sediments. Night-time trawling for fish assemblages also was conducted opportunistically at some stations to support a companion project.

The field work described herein was conducted by scientists and staff from the following NOAA organizations:

- NOAA, National Ocean Service (NOS), National Centers for Coastal Ocean Science (NCCOS), Center for Coastal Environmental Health and Biomolecular Research (CCEHBR), Charleston, SC.

- NOAA, National Ocean Service (NOS), National Centers for Coastal Ocean Science (NCCOS), Center for Coastal Fisheries and Habitat Research (CCFHR), Beaufort, NC.

- NOAA, Office of Marine and Aviation Operations (OMAO), NOAA Ship FERREL.

The work, sponsored by the National Marine Sanctuary Program, is a component of a broader coordinated site characterization of the sanctuary by the GRNMS office, CCEHBR, and one other NCCOS center: the Center for Coastal Fisheries Habitat Research (CCFHR).

Additional copies of this cruise report can be obtained by contacting:

1. NOAA, NOS, National Centers for Coastal Ocean Science, Center for Coastal Environmental Health and Biomolecular Research, 219 Fort Johnson Road, Charleston, South Carolina, 29412, Telephone: 843/762-8581; or

1.0 Introduction

As part of an ongoing ecological characterization of Gray's Reef National Marine Sanctuary (GRNMS) and nearby shelf waters (Hyland et al. 2001), surveys of benthic community characteristics, sediment contaminant levels, and other habitat conditions were conducted on two previous occasions during spring 2000 and 2001. The first survey was conducted at 20 stations within the sanctuary boundaries to document baseline environmental conditions and to provide a quantitative basis for tracking future changes in these properties with time due to either natural or human disturbances. The spring 2001 survey also was conducted at 20 stations, including a subset of Year-1 stations within the sanctuary, in addition to a new series of inner-shelf stations positioned along three cross-shelf transects of five stations each. These earlier transects, which extended from the mouths of three major sounds (Sapelo, Doboy, and Altamaha) out to GRNMS depths, have provided a means to examine spatial patterns in the measured environmental variables in relation to both natural factors (e.g., depth) and potential anthropogenic factors (e.g., proximity to land-based sources of contaminants). An important goal of this work has been to determine the extent to which land-based sources of pollutants and other materials are transported through river systems to the offshore shelf environment, inclusive of GRNMS, and the potential effects that these materials may be having on biological resources along the way. A significant finding from the first year of sampling was the presence of trace concentrations of pesticides and other man-made chemicals in both sediments and biota within GRNMS, which demonstrated that these materials are capable of making their way to the offshore sanctuary environment (albeit at low concentrations not likely of being associated with adverse bioeffects).

The purpose of this survey (NOAA Ship FERREL Cruise FE-02-09-MA) was to conduct the field work necessary to support the objectives of an ongoing ecological characterization of GRNMS and nearby shelf waters. Study objectives include: (1) to provide a basis for examining cross-shelf patterns in benthic fauna and potential chemical stressors in sediments in the general area of Grays Reef; (2) to provide a means for understanding the ecology and conditions of the sanctuary in relation to the surrounding South Atlantic Bight (SAB) and in the greater context of an inter-related system; (3) to provide background information on deeper areas of the SAB that are being considered for Marine Protected Area (MPA) designation; (4) test for inter-annual variability in macroinfaunal distributions; and (5) to provide input data in support of a collaborative effort with the NOAA Beaufort Lab to evaluate the functional role of benthic macroinfauna as prey to higher trophic levels (namely predatory fishes feeding on level-bottom sandy areas within the sanctuary and surrounding shelf waters).

Samples were collected at 13 stations during the week of April 3 – April 10, 2002, using the NOAA Ship FERREL. At each station, samples and in-situ measurements were obtained for characterization of: (1) biodiversity and abundances of macroinfauna (> 0.5 mm); (2) potential pollution exposure (sediment contaminant concentration); and (3) general habitat conditions (water depth, salinity, temperature, water clarity, % silt-clay versus sand content of sediment, organic-carbon content of sediment). At 5 of the 13 benthic stations juvenile and small adult fishes were collected as part of a related project to evaluate the functional role of benthic macroinfauna as prey to higher trophic levels.

2.0 Scientific Approach

A total of 13 stations (Table 1, Figure 1) were sampled April 3 – April 10, 2002 from the NOAA Ship FERREL. In the original sampling design we expanded the sampling framework used in 2001 by extending two of the cross-shelf transects (Sapelo and Doboy transects) into deeper waters seaward of the sanctuary out to the edge of the continental shelf (about 100m). These two transects flanked the 31˚30' latitude, a corridor that is beginning to draw a great deal of interest within the Sanctuary's management and research community. However, due to severe weather during the sampling cruise, only 13 of the 20 stations were sampled. Completed stations include: 9 stations along the Sapelo Transect (22, 23, 24, 24, 35, 36, 37, 38, 39) and 4 stations along the Doboy Transect (27, 28, 29, 12). While the cruise was successful in that the completed stations will allow us to address the key study objectives, we will return to the GRNMS to sample the remaining 7 stations by implementing a slight modification to the sampling design. Five of the remaining 7 stations are seaward of GRNMS and would require the use of the NOAA ship FERREL or similar NOAA research vessel which is not available. Instead, we will resample 5 stations within the GRNMS previously sampled in 2000 and 2001 (Table 2), thereby enhancing our ability to address one of our objectives examining temporal (year-to-year) variability in benthic fauna and contaminant levels within the sanctuary by now having data over a three-year period (3 separate annual sampling points). Understanding such natural temporal (short-term annual) variability will be invaluable in future efforts to detect potential long-term changes attributable to human disturbances or extreme natural events. Additionally we will sample the two inshore stations (21 and 26) that were too shallow for the FERREL to reach. We will accomplish the task of sampling the two inshore stations and the 5 stations within GRNMS by returning to GRNMS in late May or early June 2002 and use a 25 ft. trailerable research vessel as the sampling platform.

At each of the 13 stations, samples and in-situ measurements were taken for characterization of: (1) general habitat conditions (depth; water temperature and salinity; total organic carbon, silt-clay, and water content of sediment); (2) potential pollution exposure (sediment contaminant concentrations); (3) structure and composition of macroinfaunal assemblages; and (4) aesthetic quality (presence of anthropogenic debris, visible oil, noxious sediment odor, and water clarity based on secchi depths). Depth and water-quality parameters (temperature and salinity) were measured instantaneously with a "Seabird" CTD. Benthic macroinfauna were sampled in triplicate with a 0.04-m^2 Young grab. The benthic samples were sieved onboard through a 0.5-mm screen and preserved in 10% buffered formalin (with Rose Bengal stain added to facilitate subsequent sorting in the laboratory). Samples for the analysis of sediment contaminants, % silt-clay, % water, and % total organic carbon (TOC) were sub-sampled from composited surface sediment (upper 2-3 cm) collected from multiple grabs independent of the macroinfaunal grabs. Summaries of these parameters and corresponding sampling protocols are given in Tables 3 and 4.

At 5 of the 13 benthic stations night-time beam trawl sampling was conducted to sample juvenile fish populations. The benthic stations sampled for juvenile fishes were located along the Sapelo cross-shelf transect. Further information regarding the night-time trawl operations is available by contacting Jon Hare (jon.hare@noaa.gov) at the NOAA/NOS/NCCOS/Center for Coastal Fisheries and Habitat Research.

3.0 Sampling Logistics and Scientific Parties

The 13 stations were sampled on April 3 – April 10, 2002 from the NOAA ship FERREL, cruise FE-02-09-MA. All samples were collected from the deck of the FERREL. The scientific crew consisted of four staff from NOAA, NOS, NCCOS, Center for Coastal Environmental Health and Biomolecular Research and two staff from NOAA, NOS, NCCOS, Center for Coastal Fisheries Habitat Research. Sampling time at each station ranged from 20 minutes to 50 minutes and averaged about 32 minutes. A summary of field logistics and scientific parties is given in Table 5.

4.0 Preliminary Results

All in-situ measurements and records of sampling were recorded on standard field sheets. Copies of the field sheets with the recorded raw data are included in Appendix B.

Average depth at the 13 stations sampled was 26m and ranged from 8 to 100m. Water temperature ranged from 18.4ºC to 23.0ºC and averaged 19.5ºC. The average salinity was 35.9 PSU and ranged from 34.5 to 36.5 PSU.

The sediments collected along the two cross-shelf transects exhibited a wide range of types from coarse sand with shell hash to muddy, fine sand. A wide variety of animals were visible to the naked eye in the sediment samples collected to characterize the macroinfaunal assemblages both within GRNMS and along the transects. Animals that were commonly seen include molluscs, crustacea, polychaetes, sponges, and echinoderms.

5.0 Ship Operations Evaluation Form

A copy of the Ship Operations Evaluation Form for NOAA ship FERREL cruise FE-02-09-MA is included in Appendix D.

6.0 Acknowledgements

Funding for this field work is provided by the NOAA National Marine Sanctuary Program.

All members of the field crew (see Table 5 for lists) are commended for their high level of technical expertise, teamwork and dedication to getting the required sampling completed. Special appreciation also is extended to the officers and crew of the NOAA ship FERREL for the superb job performed on FE-02-09-MA in the Gray's Reef National Marine Sanctuary.

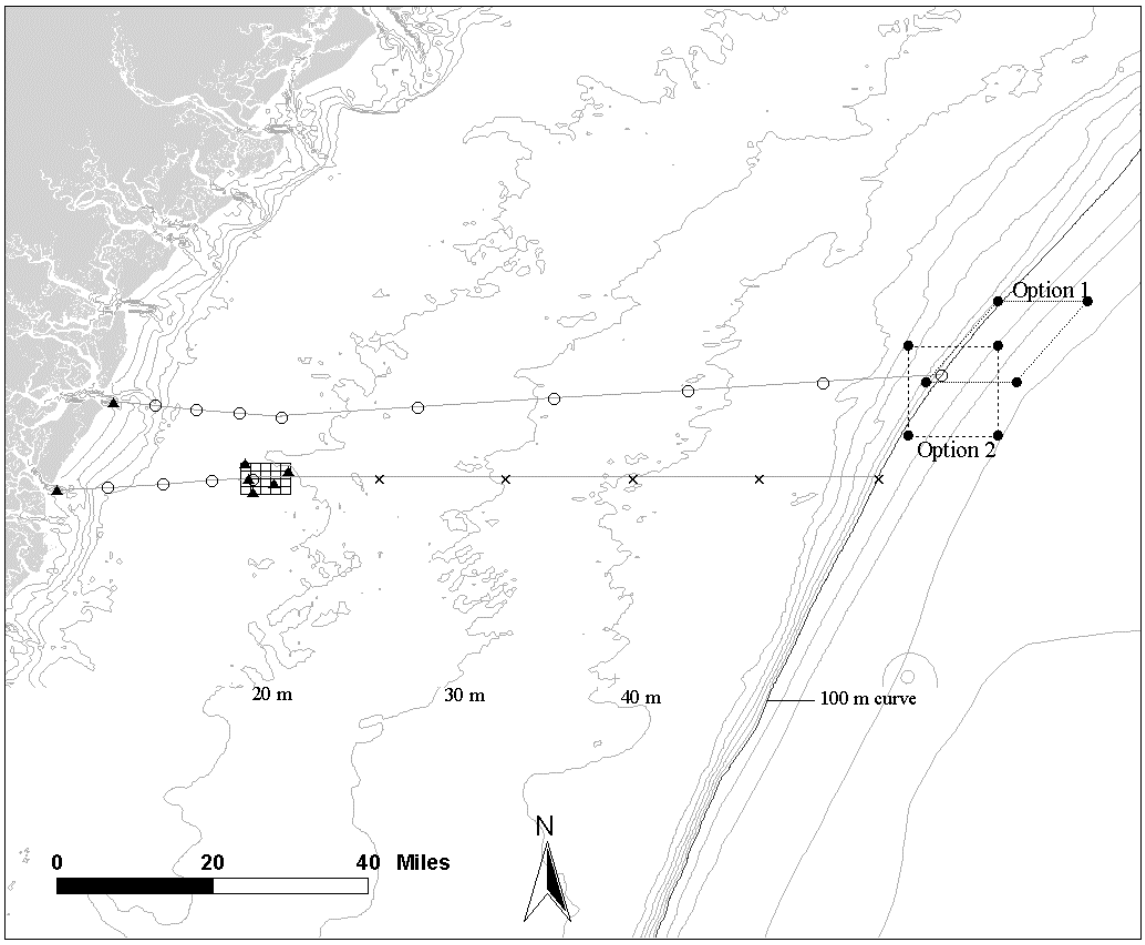

Figure 1. Study area and sampling sites for the spring 2002 benthic survey at GRNMS and nearby shelf waters (NOAA Ship FERREL Cruise FE-02-09-MA). Boxes labeled "Option 1" and "Option 2" refer to adjacent areas that the Southeast Fisheries Management Council is considering as candidates for Marine Protected Area (MPA) status. O - Stations successfully sampled during April 2002 benthic survey. X – Stations not sampled due to severe weather during April 2002 benthic survey. ▲ - Stations to be sampled during return trip in May/June 2002.

Table 1. Locations of sampling sites for spring 2002 benthic survey at GRNMS and nearby shelf waters. Transect I = Sapelo Sound transect. Transect II = Doboy Sound transect.

Station	Transect	Latitude		Longitude		Approx. distance from land (nm)
21*	I	31°	31.9000	-81°	9.4500	1
22	I	31°	31.5100	-81°	4.5900	5
23	I	31°	30.9700	-81°	0.0000	9
24	I	31°	30.6000	-80°	55.3100	13
25	I	31°	30.2100	-80°	50.6000	17
35	I	31°	31.2180	-80°	35.4000	29
36	I	31°	32.1840	-80°	20.4000	41
37	I	31°	33.1200	-80°	5.4000	54
38	I	31°	34.0260	-79°	50.4000	66
39	I	31°	34.8000	-79°	37.200	77
26*	II	31°	22.2000	-81°	15.7300	1
27	II	31°	22.5300	-81°	9.8500	5
28	II	31°	22.8900	-81°	3.7900	9
29	II	31°	23.2000	-80°	58.3100	13
12	II	31°	23.3600	-80°	53.7800	17
40^	II	31°	23.3598	-80°	39.7398	30
41^	II	31°	23.3598	-80°	25.6860	42
42^	II	31°	23.3598	-80°	11.6460	54
43^	II	31°	23.3598	-79°	57.6000	66
44^	II	31°	23.3598	-79°	44.2800	77

* Unable to sample because too shallow for the NOAA ship FERREL, will return to sample at later date.
^ Unable to sample due to severe weather.

Table 2. Locations of the five benthic sampling sites within GRNMS boundaries at the seaward end of Transect II (refer to Table 1).

Station ID	Latitude (deg.)	Latitude (min.)	Longitude (deg.)	Longitude (min.)
1	31	25.16894	-80	54.73736
10	31	24.33443	-80	49.94133
11	31	23.46176	-80	54.34569
14	31	22.98005	-80	51.58678
17	31	22.05454	-80	53.86067

Table 3. Summary of field samples collected at each station.

Parameters	# Replicates	Container Type	Sample Size	Preservation
Infauna	3 (0.04 m^2 Young grab, 0.5 mm sieve)	500 ml Polypropylene jar	All material retained on 0.5 mm sieve	10% buffered formalin in field. Transferred to 70% ethanol within ~ 1 month.
Metal Contaminants	1 (Composited upper 2 cm of sediment from multiple grabs.)	250 ml HDPE jar	2/3 Full	Frozen (-20°C).
Organic Contaminants	1 (Composited upper 2 cm of sediment from multiple grabs.)	500 ml I-Chem glass jar	2/3 Full	Frozen (-20°C).
TOC	1 (Composited upper 2 cm of sediment from multiple grabs.)	125 ml Polypropylene jar	2/3 Full	Frozen (-20°C).
Silt-Clay & % Moisture	1 (Composited upper 2 cm of sediment from multiple grabs.)	500 ml HDPE jar	2/3 Full	Frozen (-20°C).

Table 4. Summary of in-situ measurements collected at each station.

- Station depth (boat fathometer)
- Presence of surface debris
- Visible Oil (on sea surface, in bottom sediment grabs)
- Noxious odors in sediment grabs (H_2S, sewage, oil)
- Visible appearance of grabs (sediment color, sediment type, visible biota)
- Secchi depth
- Seabird CTD instantaneous profiles (depth, temperature, salinity)

Table 5. Field logistics summary.

Date	Vessel	Scientific Crew	Launch Site, Staging Area	Field Activities
04/03/02	NOAA Ship FERREL	J. Hyland*, L. Balthis*, C. Cooksey*, J. Dubick*, B. Degen[+], F. Hernandez[+]	In port at Priest's Landing	Arrive Savannah, GA. Sampling preparation and orientation.
04/04/02	NOAA Ship FERREL	J. Hyland, C. Cooksey, L. Balthis, J. Dubick, B. Degan, F. Hernandez	In port at Priest's Landing	None due to severe weather offshore.
04/05/02	NOAA Ship FERREL	J. Hyland, C. Cooksey, L. Balthis, J. Dubick, B. Degan, F. Hernandez	Depart Priest's Landing for GRNMS.	Sample Stations 022, 023, 024, 025, and 035.
04/06/02	NOAA Ship FERREL	J. Hyland, C. Cooksey, L. Balthis, J. Dubick, B. Degan, F. Hernandez	Return to Priest's Landing.	Sample Stations 027, 028, 029, and 012.
04/07/02	NOAA Ship FERREL	J. Hyland, L. Balthis, J. Dubick, B. Degan, F. Hernandez	In port at Priest's Landing	None due to severe weather offshore.
04/08/02	NOAA Ship FERREL	J. Hyland, L. Balthis, J. Dubick, B. Degan, F. Hernandez	In port at Priest's Landing	None due to severe weather offshore.
04/09/02	NOAA Ship FERREL	J. Hyland, L. Balthis, J. Dubick	Depart Priest's Landing for GRNMS.	Sample stations 036, 037, 038, and 039.
04/10/02	NOAA Ship FERREL	J. Hyland, L. Balthis, J. Dubick	Return to Priest's Landing.	Demobilization. Depart for Charleston, SC.

*NOAA, National Ocean Service (NOS), National Centers for Coastal Ocean Science (NCCOS), Center for Coastal Environmental Health and Biomolecular Research (CCEHBR);
[+]NOAA/NOS/NCCOS/Center for Coastal Fisheries and Habitat Research (CCFHR).

APPENDIX A

Field Sheets for Gray's Reef Sampling: Cruise FE-02-09-MA

APPENDIX B

Ship Operations Evaluation Form: Cruise FE-02-09-MA