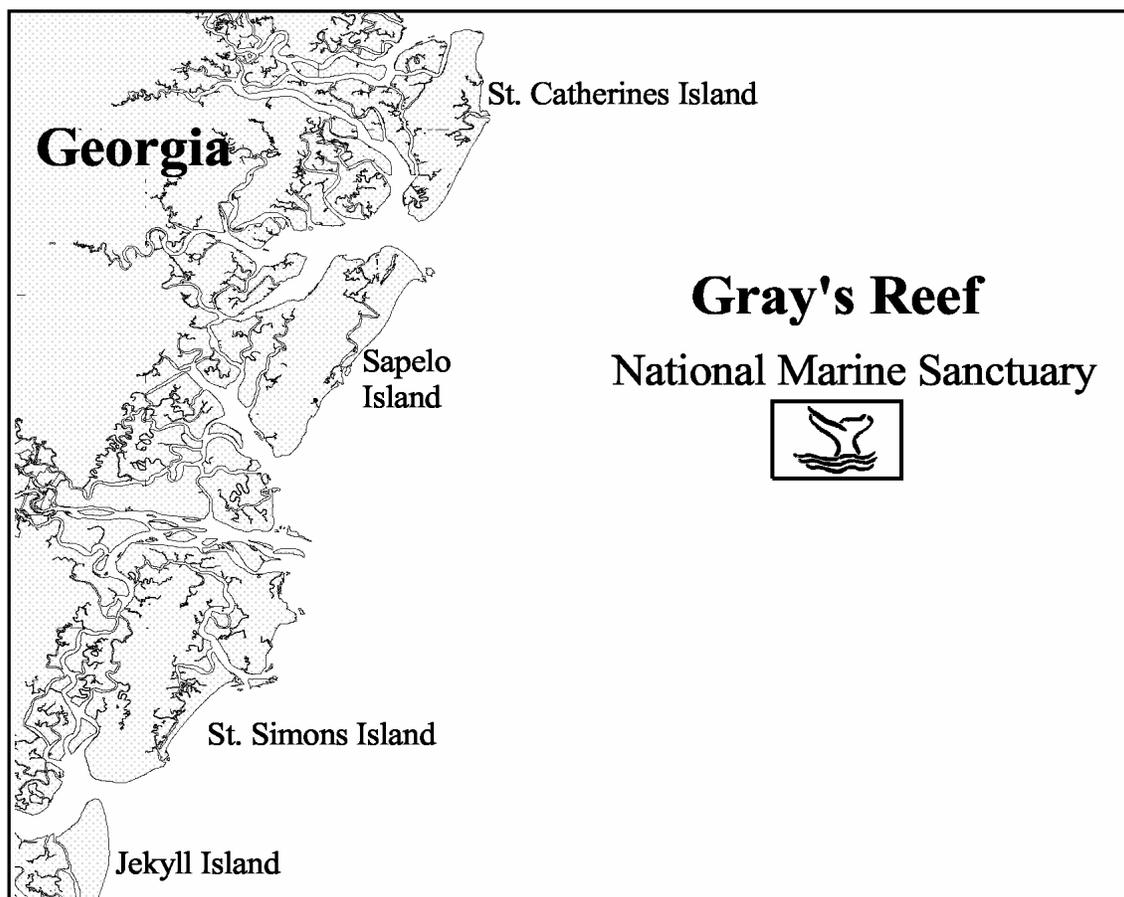


Cruise Report

Gray's Reef National Marine Sanctuary: A Survey of Soft-Bottom Macroinfaunal Assemblages and Levels of Chemical Contaminants in Sediments and Biota, Spring 2001



NOAA

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National Ocean Service

National Centers for Coastal Ocean Science

Center for Coastal Monitoring and Assessment

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Gray's Reef National Marine Sanctuary: A Survey of Soft-Bottom Macroinfaunal Assemblages and Levels of Chemical Contaminants in Sediments and Biota, Spring 2001

June 2001

Prepared by:

Ms. Cynthia Cooksey

NOAA/NOS/NCCOS
Center for Coastal Monitoring and Assessment
219 Fort Johnson Road
Charleston, SC 29412

NOAA

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



National Ocean Service
National Centers for Coastal Ocean Science
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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), May 2001, as the second year of a two-year study to assess the condition of macroinfaunal assemblages, concentrations of chemical contaminants in sediments, and contaminant body-burdens in target benthic species of GRNMS soft-bottom habitats. A total of 20 stations were sampled April 30 – May 3, 2000 from the NOAA ship FERREL (Cruise FE-01-08-MA Leg 1) along three cross-shelf transects of five stations each, including one station in GRNMS serving as the seaward end of the middle transect, and an additional five stations within the GRNMS boundaries.

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 Monitoring and Assessment (CCMA) – Charleston, SC office.
- NOAA, National Ocean Service (NOS), National Centers for Coastal Ocean Science (NCCOS), Center for Coastal Fisheries and Habitat Research (CCFHR), Beaufort, NC.
- NOAA, NOS, Office of Ocean and Coastal Resource Management (OCRM), National Marine Sanctuary Program, Gray's Reef National Marine Sanctuary, Savannah, GA.
- 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, CCMA, and two other NCCOS centers: the Center for Coastal Fisheries Habitat Research (CCFHR) and the Center for Coastal Environmental Health and Biomolecular Research (CCEHBR).

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

1. NOAA, NOS, National Centers for Coastal Ocean Science, Center for Coastal Monitoring and Assessment, Regional Monitoring Team, 219 Fort Johnson Road, Charleston, South Carolina, 29412, Telephone: 843/762-8581; or
2. NOAA, NOS, National Centers for Coastal Ocean Science, Center for Coastal Monitoring and Assessment, N/SC11, SSMC-4, 1305 East-West Hwy, Silver Spring, MD 20910-3281, Telephone: 301/713-3028.

1.0 Introduction

This field work was conducted to complete the second and final phase of the scheduled, two-year sampling effort to assess the condition of macroinfaunal assemblages, concentrations of chemical contaminants in sediments, and contaminant body-burdens in target benthic species of the Gray's Reef National Marine Sanctuary (GRNMS) off the coast of Georgia. Prior research in the sanctuary has focused primarily on the impressive live-bottom assemblages of algae, invertebrates, fishes, and turtles associated with rock outcrops. In contrast, there has been limited work on the ecology of unconsolidated substrates surrounding the rocky-reef structures. The present study will provide a comprehensive baseline on condition of the soft-bottom benthos and background contaminant levels of this important natural underwater resource.

The purpose of Cruise FE-01-08-MA Leg 1 was to obtain samples for the Year-2 research effort. Samples were collected at 20 stations during the week of April 30 – May 3, 2000, 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 surface water triazine herbicide levels); and (3) general habitat conditions (water depth, dissolved oxygen, salinity, pH, temperature, water clarity, % silt-clay versus sand content of sediment, organic-carbon content of sediment). At 11 of the 21 benthic stations juvenile and small adult fishes were collected as part of a related project to determine the importance of non-reef habitats to juvenile stages of reef fishes and evaluate the linkages between non-reef and reef habitats, and determine the species of fish that spawn in the vicinity of Grays Reef National Marine Sanctuary.

This Year-2 sampling was designed to: (1) test for inter-annual and spatial variability in macroinfaunal distributions and (2) provide a closer look at specific areas where there was minor evidence of contaminant signals. Tests of spatial variability in benthic fauna include near-field and far-field comparisons to test for any differences that might be coupled to natural factors, such as foraging by reef species, or to potential anthropogenic influences associated with proximity to land. Preliminary results of the first year were used to help select station locations within GRNMS boundaries for the second year sampling.

2.0 Scientific Approach

A total of 20 stations (Table 1, Table 2, Figure 1 and Figure 2) were sampled April 30 – May 3, 2000 from the NOAA Ship FERREL. Three cross-shelf transects of five stations each, including one station in GRNMS serving as the seaward end of the middle transect, and an additional five stations within the GRNMS boundaries were sampled. The three cross-shelf transects will provide the means to examine spatial patterns in benthic communities and sediment contaminant levels in relation to both natural factors (such as depth) and potential anthropogenic factors (such as proximity to land-based sources of contaminants). Near-field versus far-field comparisons at similar offshore depths as the sanctuary (focusing on outermost stations along the three transects) will be used to test for spatial variability due to additional natural factors associated with proximity to the reef (including, for example, substrate differences and potential biological interactions such as predation effects from foraging by reef species). As noted above, sampling also was conducted at six of the former Year-1 stations within the GRNMS boundaries to

provide a basis for examining inter-annual temporal variability, in addition to two other functions. One of these stations serves as the seaward-most site along the middle transect (i.e., the 17 nm offshore category). In addition, two of these stations were selected to support follow-up sampling at Year-1 sites (Station GR010014 and GR01017) that showed evidence of contaminant signals (to test for the persistence of such effects).

At each station, samples and in-situ measurements were taken for characterization of: (1) general habitat conditions (depth; water temperature, salinity, pH, and dissolved-oxygen; total organic carbon, silt-clay, and water content of sediment); (2) potential pollution exposure (sediment contaminant concentrations and surface water triazine herbicide levels); (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 (dissolved oxygen, temperature, pH, and salinity) were measured in surface, and near-bottom waters instantaneously with a “Datasonde 4” multiprobe data logger. Benthic macroinfauna were sampled in triplicate with a 0.04-m² 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. Quality-control tolerance ranges for Datasonde instrument calibrations and field measurements are provided in Table 5.

At 11 of the benthic stations nighttime beam trawl sampling was conducted to sample juvenile fish populations and at one benthic station a bongo net tow was made to sample ichthyoplankton. Additionally, beam trawls and bongo net tows were made at seven trawl only locations. The benthic stations sampled for juvenile fishes were all located along the three cross-shelf transects; no beam trawls were conducted within the GRNMS boundaries. For further information regarding the nighttime trawl operations please refer to Appendix A.

3.0 Sampling Logistics and Scientific Parties

The 20 randomly chosen stations were sampled on April 30 – May 3, 2000 from the NOAA ship FERREL, cruise FE-01-08-MA Leg 1. All samples were collected from the deck of the FERREL except for stations GR01021 and GR01026, which were sampled from the FERREL launch Monarch. The scientific crew consisted of three staff from NOAA, NOS, NCCOS, Center for Coastal Monitoring and Assessment, Charleston Office, two staff from NOAA, NOS, NCCOS, Center for Coastal Fisheries Habitat Research and two staff from NOAA, NOS, National Marine Sanctuary Program, Gray’s Reef National Marine Sanctuary. During the cruise one student intern from the Gray’s Reef National Marine Sanctuary office joined the scientific crew. Sampling time at each station ranged from 20 minutes to 88 minutes and averaged about 39 minutes. A summary of field logistics and scientific parties is given in Table 6.

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. Quality Control calibration records for the Datasonde instruments are included in Appendix C.

Average depth at the 20 stations sampled during the current study was 14.0m and ranged from 6.7 to 20.0m. Water temperature ranged from 18.2°C to 22.4°C and averaged 19.9°C. The average salinity was 34.5 ‰ and ranged from 22.8 to 36.1 ‰. Dissolved oxygen (DO) over the entire sampling area averaged 7.3 mg/L with a range of 6.9 – 7.9 mg/L. These DO levels are well above the general water quality standard of 5.0 mg/L used by many states to protect the more sensitive species and life stages. No detectable level of total triazines was found in any of the surface water samples collected within GRNMS or along the cross-shelf transects (Table 7).

The sediments of the soft-bottomed habitats of GRNMS consisted mostly of light-brown, coarse sand with shell hash, typical of offshore sediments in this area of the continental shelf and, visually, identical to what was collected during Year-1 sampling. Sediments collected along the three cross-shelf transects exhibited a wider 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. Members of the Cephalochordata (commonly called lancelets) were also encountered at numerous stations.

5.0 Ship Operations Evaluation Form

A copy of the Ship Operations Evaluation Form for NOAA ship FERREL cruise FE-01-08-MA Leg 1 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-01-08-MA Leg 1 in the Gray's Reef National Marine Sanctuary.

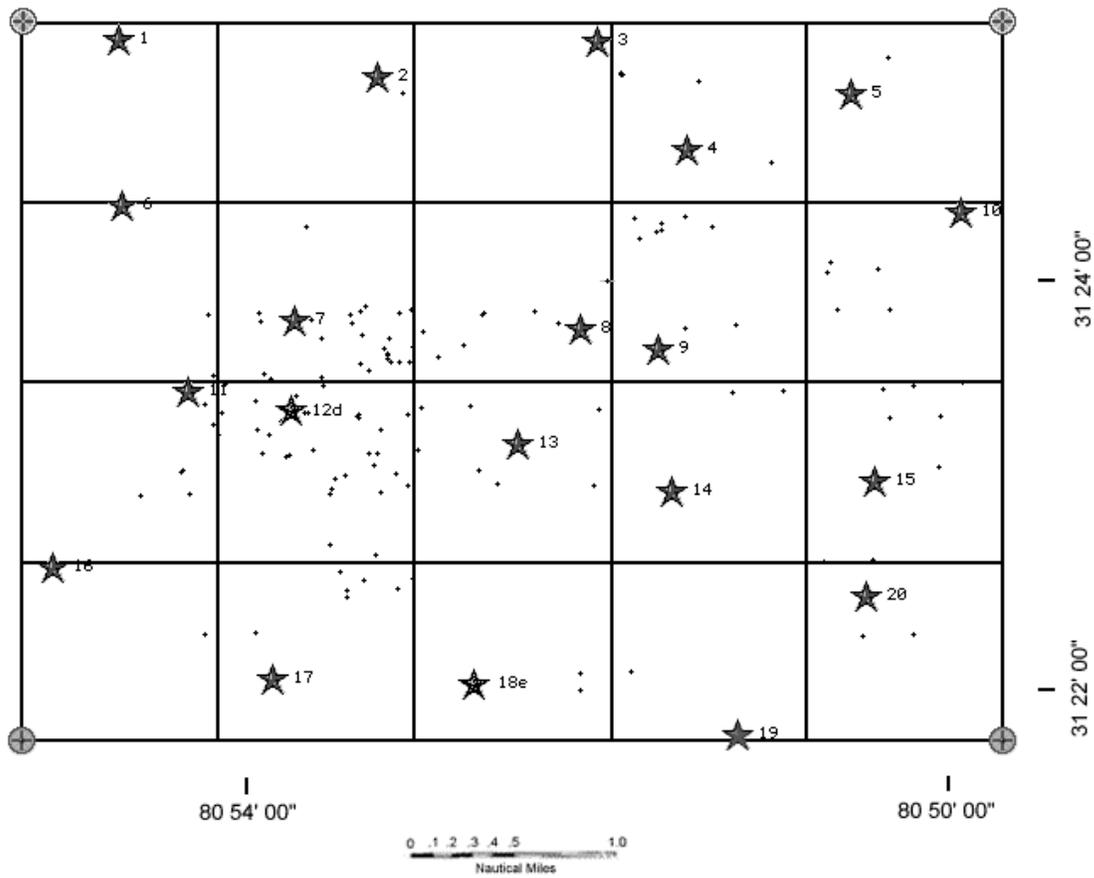


Figure 1. Locations of YR-1 soft-bottom sampling sites (numbered stars) in relation to Gray's Reef National Marine Sanctuary boundaries (crosshairs). Each sampling cell measures 0.875 minutes of latitude by 1.117 minutes of longitude. Small cross marks indicate locations of confirmed live bottom, based on MARMAP data (McGovern, personal communication).

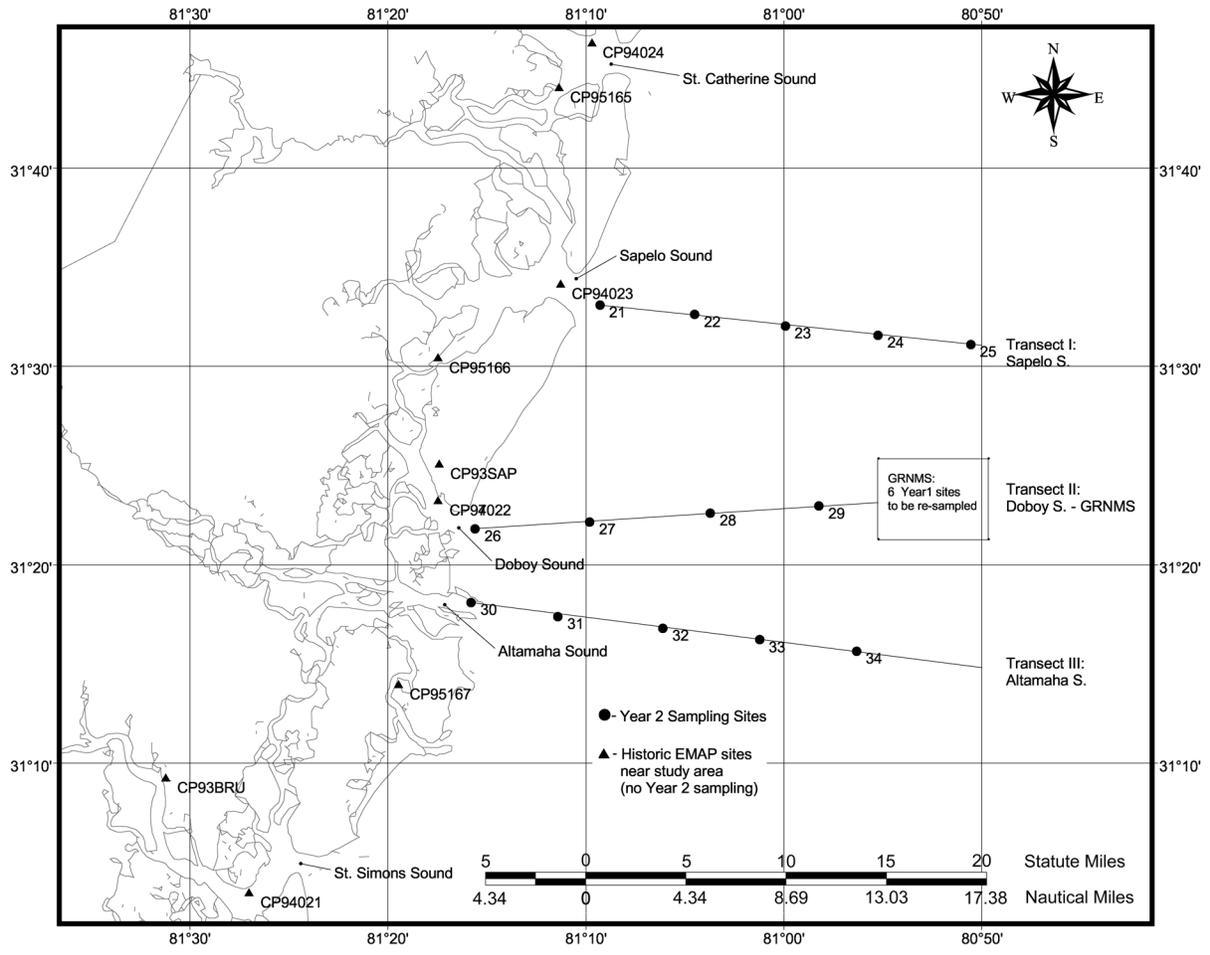


Figure 1. GRNMS study area for the Year 2 benthic survey (April 30 – May 3, 2001).

Table 1. Locations of sampling sites for Year 2 benthic survey (April 30 – May 4, 2001) at GRNMS.

Station	Transect*	Latitude	Longitude	Approx. Distance From Land (nm)
21	I	31° 31.9'	81° 9.4'	1
22	I	31° 31.5'	81° 4.6'	5
23	I	31° 31.0'	81° 0.0'	9
24	I	31° 30.6'	80° 55.3'	13
25	I	31° 30.2'	80° 50.6'	17
26	II	31° 22.2'	81° 15.7'	1
27	II	31° 22.5'	81° 9.9'	5
28	II	31° 22.9'	81° 3.8'	9
29	II	31° 23.2'	80° 58.3'	13
30	III	31° 19.0'	81° 15.9'	1
31	III	31° 18.4'	81° 11.5'	5
32	III	31° 17.9'	81° 6.2'	9
33	III	31° 17.4'	81° 1.3'	13
34	III	31° 16.9'	80° 56.4'	17

*Note:

Transect I = Sapelo Sound to 5 nm N of Grays Reef

Transect II = Doboy Sound to Grays Reef

Transect III = Altamaha Sound to 5 nm S of Grays Reef

Table 2. Locations of the six 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
12(d)	31	23.37043	-80	53.75872
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).
Surface Water	1 (collected with Niskin Bottle)	500 ml Glass Jar	2/3 Full	Refrigerate.

Table 4. Summary of in-situ measurements collected at each of the 20 stations.

- Station depth (boat fathometer)
- Presence of surface debris
- Visible Oil (on sea surface, in bottom sediment grabs)
- Noxious odors in sediment grabs (H₂S, sewage, oil)
- Visible appearance of grabs (sediment color, sediment type, visible biota)
- Secchi depth
- DataSonde pre-deployment calibration checks (see QC tolerance ranges, Table 4)
- DataSonde instantaneous profiles (depth, temperature, salinity, pH, DO, conductivity)
 - Surface
 - Near-bottom

Table 5. Quality control tolerance ranges for Datasonde instrument calibration and field measurements.

Frequency of Check	Parameter	Checked Against	Max. Acceptable Difference
Pre-survey Calibration	Temperature	Thermometer	± 1 °C
	Salinity	Standard seawater	± 0.2 %
	DO	Manufacturer's setting	± 0.3 mg/L
	% Sat. DO	Manufacturer's setting	± 2.5 % (100 – 105% range)
	pH	pH buffer solution	± 0.1 pH units

Table 6. Field logistics summary.

Date	Vessel	Scientific Crew	Launch Site, Staging Area	Field Activities
04/29/01	NOAA Ship FERREL	J. Hyland*, L. Balthis*, C. Cooksey*	In port at Priest's Landing	Arrive Savannah, GA. Sampling preparation and orientation.
04/30/01	NOAA Ship FERREL	J. Hyland, C. Cooksey, L. Balthis, G. McFall ^o , C. Sakas ^o , M. Duncan ^o , H. Walsh ⁺ , B. Degan ⁺	Depart Priest's Landing for GRNMS	Sample Stations 022, 023, 024, and 025.
05/01/01	NOAA Ship FERREL	J. Hyland, C. Cooksey, L. Balthis, G. McFall, C. Sakas, M. Duncan, H. Walsh, B. Degan	At Sea.	Sample Stations 001, 010, 011, 012, 014, 017, 026, 027, 028, and 029.
05/02/01	NOAA Ship FERREL	J. Hyland, C. Cooksey, L. Balthis, G. McFall, C. Sakas, M. Duncan, H. Walsh, B. Degan	At Sea.	Sample Stations 021, 030, 031, 032, 033, and 034.
05/03/01	NOAA Ship FERREL	J. Hyland, C. Cooksey, L. Balthis	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 Monitoring and Assessment (CCMA) – Charleston, SC Office; ^oNOAA, NOS, Office of Ocean and Coastal Resource Management (OCRM), National Marine Sanctuary Program, Gray's Reef National Marine Sanctuary (GRNMS), Savannah, GA; ⁺NOAA/NOS/NCCOS/Center for Coastal Fisheries and Habitat Research (CCFHR).

Table7. Total Triazines in surface water samples. All samples were below the lower limit of detection (25 ng/L) of the test kit.

Site Designation	NOAA CCEHBR Sample ID #	Concentration of Total Triazines (ng/L)	Calibration Range (ng/L)
GR01001	01-341	0	25 - 2000
GR01010 *	01-342	0	25 - 2000
GR01011	01-343	0	25 - 2000
GR01012	01-344	0	25 - 2000
GR01014 *	01-345	0	25 - 2000
GR01017 *	01-346	0	25 - 2000
GR01021	01-347	0	25 - 2000
GR01022 *	01-348	0	25 - 2000
GR01023	01-349	0	25 - 2000
GR01024	01-350	0	25 - 2000
GR01025	01-351	0	25 - 2000
GR01026	01-352	0	25 - 2000
GR01027	01-353	0	25 - 2000
GR01028 *	01-354	0	25 - 2000
GR01029	01-355	0	25 - 2000
GR01030	01-356	8 **	25 - 2000
GR01031	01-357	0	25 - 2000
GR01032	01-358	0	25 - 2000
GR01033	01-359	0	25 - 2000
GR01034	01-360	0	25 - 2000

* Sample jar broken in transit to laboratory (analyzed remaining water in jar)

** Less than lowest calibration point

APPENDIX A

Gray's Reef Juvenile Fish and Ichthyoplankton Sampling: Cruise FE-01-08-MA Leg 1

**ADDENDUM TO CRUISE INSTRUCTIONS
FE-01-08-MA: LEG 1 (GRAYS REEF NMS)**

3.0 BACKGROUND INFORMATION

In April 2000, the National Centers for Coastal Ocean Science (NCCOS) initiated a new project in cooperation with the National Marine Sanctuary Program: Support of Monitoring Activities and Site Characterization at Grays Reef National Marine Sanctuary (GRNMS). Nine objectives were defined in the original, three year proposal. Night sampling conducted on FE-01-08-MA: LEG 1 would contribute to two of these objectives: *Determine the importance of non-reef habitats to juvenile stages of reef fishes and evaluate the linkages between non-reef and reef habitats* and *Determine the species of fish that spawn in the vicinity of Grays Reef National Marine Sanctuary*.

5.0 OBJECTIVES

Objectives of the FE-01-08-MA: LEG 1 night sampling are:

- 1) Collect juvenile and small adult fishes at each station on Jeff Hyland's three cross-shelf transects.
- 2) Collect juvenile and small adult fishes and ichthyoplankton at a cross-shelf transect that bisects GRNMS (Table 1).

7.0 SURVEY LOCATION AND DESCRIPTION

First priority for collection of juvenile and small adult fishes will be placed on sampling at Jeff Hyland's 14 stations (no sampling will be done in the sanctuary) on the three cross-shelf transects. The cross-shelf transect which bisects GRNMS (Table 1) will be second priority.

8.0 SURVEY/SAMPLING METHODOLOGIES

Sampling for ichthyoplankton and juvenile and small adult fishes will be conducted after sunset and finish before sunrise. At Hyland's 14 stations, 1 CTD cast and 3 beam trawl tows will be made. The cross-shelf transect that bisects GRNMS, 1 CTD cast, 1 oblique bongo tow and 3 beam trawl tows will be made.

11.0 EQUIPMENT AND SUPPLIES

Vessel Provided

- Winch with meter block

Program Provided

- 2 m beam trawl

- 60 cm bongo
- SeaBird 19 CTD
- 54 gallons ETOH (1 drum)
- 10 liters 10% formalin

13.0 SCIENTIFIC PARTY

Scientific Personnel List:

<u>Name</u>	<u>Affiliation</u>	<u>Status</u>
Harvey Walsh	NOS/CCFHR	M-USA
Brian Degan	NOS/CCFHR	M-USA

Table 1. Locations of beam trawl stations that bisect GRNMS.

<u>Station</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Depth (m)</u>
BT01	31o27.00' N	081o01.60' W	11
BT2.1	31o24.57' N	080o49.30' W	20
BT2.2	31o26.10' N	080o54.00' W	19
BT2.3	31o21.47' N	080o51.00' W	19
BT2.4	31o22.48' N	080o55.48' W	18
BT03	31o20.00' N	080o39.40' W	21
BT04	31o17.50' N	080o28.40' W	33
BT05	31o14.20' N	080o17.70' W	37
BT06	31o11.95' N	080o06.90' W	43
BT07	31o08.10' N	079o56.30' W	47

Juvenile fish sampling during FE-01-08-MA leg 1 cruise.

Station	Tow	Day	Month	Year	Gear	Mesh (mm)	Time	Fishing Time (sec)
GR01022	1	30	4	2001	2m Beam trawl	3000	2017	300
GR01022	2	30	4	2001	2m Beam trawl	3000	2034	330
GR01022	3	30	4	2001	2m Beam trawl	3000	2050	300
GR01023	1	30	4	2001	2m Beam trawl	3000	2144	300
GR01023	2	30	4	2001	2m Beam trawl	3000	2202	300
GR01023	3	30	4	2001	2m Beam trawl	3000	2219	300
GR01024	1	30	4	2001	2m Beam trawl	3000	2318	300
GR01024	2	30	4	2001	2m Beam trawl	3000	2340	300
GR01024	3	1	5	2001	2m Beam trawl	3000	2	300
GR01025	1	1	5	2001	2m Beam trawl	3000	122	300
GR01025	2	1	5	2001	2m Beam trawl	3000	142	300
GR01025	3	1	5	2001	2m Beam trawl	3000	201	330
BT01	1	1	5	2001	2m Beam trawl	3000	355	300
BT01	2	1	5	2001	2m Beam trawl	3000	410	300
BT01	3	1	5	2001	2m Beam trawl	3000	429	300
BT2.2	1	1	5	2001	2m Beam trawl	3000	548	300
BT2.2	2	1	5	2001	2m Beam trawl	3000	606	300
BT2.2	3	1	5	2001	2m Beam trawl	3000	622	300
GR01027	1	1	5	2001	2m Beam trawl	3000	2150	300
GR01027	2	1	5	2001	2m Beam trawl	3000	2206	300
GR01027	3	1	5	2001	2m Beam trawl	3000	2221	300
GR01028	1	1	5	2001	2m Beam trawl	3000	2321	300
GR01028	2	1	5	2001	2m Beam trawl	3000	2338	330
GR01028	3	1	5	2001	2m Beam trawl	3000	2355	300
GR01029	1	2	5	2001	2m Beam trawl	3000	103	300
GR01029	2	2	5	2001	2m Beam trawl	3000	119	300
GR01029	3	2	5	2001	2m Beam trawl	3000	134	300
BT03	1	2	5	2001	2m Beam trawl	3000	419	300
BT03	2	2	5	2001	2m Beam trawl	3000	440	300
BT03	3	2	5	2001	2m Beam trawl	3000	500	300
GR01031	1	2	5	2001	2m Beam trawl	3000	2011	300
GR01031	2	2	5	2001	2m Beam trawl	3000	2021	390
GR01031	3	2	5	2001	2m Beam trawl	3000	2036	300
GR01032	1	2	5	2001	2m Beam trawl	3000	2121	300
GR01032	2	2	5	2001	2m Beam trawl	3000	2133	300
GR01032	3	2	5	2001	2m Beam trawl	3000	2144	300
GR01033	1	2	5	2001	2m Beam trawl	3000	2226	330
GR01033	2	2	5	2001	2m Beam trawl	3000	2238	300
GR01033	3	2	5	2001	2m Beam trawl	3000	2249	300
GR01034	1	2	5	2001	2m Beam trawl	3000	2333	300
GR01034	2	2	5	2001	2m Beam trawl	3000	2348	300
GR01034	3	3	5	2001	2m Beam trawl	3000	2	300
BT2.4	1	3	5	2001	2m Beam trawl	3000	101	300
BT2.4	2	3	5	2001	2m Beam trawl	3000	117	300
BT2.4	3	3	5	2001	2m Beam trawl	3000	131	300
BT2.3	1	3	5	2001	2m Beam trawl	3000	242	300
BT2.3	2	3	5	2001	2m Beam trawl	3000	258	300
BT2.3	3	3	5	2001	2m Beam trawl	3000	313	300

BT2.1	1	3	5	2001	2m Beam trawl	3000	359	300
BT2.1	2	3	5	2001	2m Beam trawl	3000	416	300
BT2.1	3	3	5	2001	2m Beam trawl	3000	434	300
BT07	1	3	5	2001	2m Beam trawl	3000	2150	300
BT07	2	3	5	2001	2m Beam trawl	3000	2209	300
BT07	3	3	5	2001	2m Beam trawl	3000	2239	300
BT06	1	4	5	2001	2m Beam trawl	3000	11	300
BT06	2	4	5	2001	2m Beam trawl	3000	32	300
BT06	3	4	5	2001	2m Beam trawl	3000	51	330
BT05	1	4	5	2001	2m Beam trawl	3000	214	300
BT05	2	4	5	2001	2m Beam trawl	3000	232	300
BT05	3	4	5	2001	2m Beam trawl	3000	250	330
BT04	1	4	5	2001	2m Beam trawl	3000	415	330
BT04	2	4	5	2001	2m Beam trawl	3000	436	315
BT04	3	4	5	2001	2m Beam trawl	3000	455	300

Ichthyoplankton sampling during FE-01-08-MA leg 1 cruise.

Station	Day	Month	Year	Gear-Tow	Mesh (μm)	Fishing Time	Fishing Time (sec)	Net 1 Volume (m^{-3})	Net 2 Volume (m^{-3})
GR01025	1	5	2001	60-Bongo-OBL	505	222	240	78	78
BT01	1	5	2001	60-Bongo-OBL	505	341	289	77	80
BT03	2	5	2001	60-Bongo-OBL	505	521	300	90	91
BT2.4	3	5	2001	60-Bongo-OBL	505	147	319	89	90
BT07	3	5	2001	60-Bongo-OBL	505	2130	420	117	119
BT06	4	5	2001	60-Bongo-OBL	505	2	416	106	107
BT05	4	5	2001	60-Bongo-OBL	505	206	319	99	101
BT04	4	5	2001	60-Bongo-OBL	505	405	286	100	101

APPENDIX B

Field Sheets for Gray's Reef Sampling: Cruise FE-01-08-MA Leg 1

APPENDIX C

Calibration Service Records for Datasonde Instruments

APPENDIX D

Ship Operations Evaluation Form: Cruise FE-01-08-MA Leg 1