

Cruise Report

**NOAA Ship Nancy Foster NF-04-08-CL
(March 30 - April 11, 2004)**

Spring 2004 Survey of Ecological Conditions of the U.S. South Atlantic Bight

May 2004

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NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



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Preface

This cruise report is a summary of field work conducted in near-coastal waters (~10-100 m) along the U.S. southeastern continental shelf, from Nags Head, North Carolina to West Palm Beach, Florida, March 30 - April 11, 2004, on NOAA Ship Nancy Foster NF-04-08-CL. For the present research cruise, representatives of NOAA (NOS/NCCOS), EPA, and the State of Florida (FMRI) combined efforts to carry out a joint survey of ecological condition of aquatic resources in near-coastal waters along the U.S. southeastern continental shelf, using multiple indicators of ecological condition. This study is an expansion of EPA's Environmental Monitoring and Assessment Program (EMAP), which seeks to assess condition of the Nation's environmental resources within a variety of resource categories. A total of fifty (50) stations were successfully sampled during the cruise. The primary focus of the cruise was on the collection of bottom sediment samples for the analysis of benthic macroinfaunal community structure and measurement of concentrations of chemical contaminants in sediments (metals, pesticides, PCBs, PAHs, PBDEs); characterization of general habitat conditions (water depth, dissolved oxygen, salinity, temperature, chlorophyll A, total suspended solids, water-column nutrients, % silt-clay versus sand content of sediment, organic-carbon content of sediment); and collection of selected demersal fish species by hook-n-line to evaluate condition (contaminant body burdens and visual evidence of pathological disorders).

The field work described herein was conducted by scientists and staff from the following 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, National Centers for Coastal Ocean Science, Center for Coastal Monitoring and Assessment (CCMA), Silver Spring, MD.
- NOAA, National Ocean Service, National Centers for Coastal Ocean Science, Headquarters, Silver Spring, MD.
- U.S. Environmental Protection Agency (EPA), National Health and Environmental Effects Research Laboratory (NHEERL), Gulf Ecology Division (GED), Gulf Breeze, FL.
- State of Florida, Florida Fish and Wildlife Conservation Commission (FFWCC), Florida Marine Research Institute (FMRI), St. Petersburg, FL.
- NOAA, Office of Marine and Aviation Operations (OMAO), NOAA ship Nancy Foster.

Funding for this project is provided through NOAA/NOS/NCCOS/CCEHBR (field sampling supplies and equipment) and the EPA/NHEERL/GED (sample processing). NOAA/NMAO provided the research ship (NOAA Ship Nancy Foster).

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

1. NOAA, Center for Coastal Environmental Health and Biomolecular Research, 219 Fort Johnson Road, Charleston, South Carolina, 29412, Telephone: 843/762-8511. Attention: Cynthia Cooksey.

1.0 Introduction

Both NOAA and EPA perform a broad range of research and monitoring activities to assess potential effects of human activities on the health of coastal ecosystems and to promote the use of this information in protecting and restoring the Nation's coastal resources. Where possible the two agencies have sought to coordinate related activities, and form partnerships with states and other institutions, to prevent duplications of effort and bring together complementary resources to fulfill common research and management goals. Accordingly, in spring 2004, NOAA, EPA, and state partners combined efforts to conduct a joint survey of ecological condition of aquatic resources in near-coastal waters of the South Atlantic Bight (SAB) along the U.S. southeastern continental shelf, using multiple indicators of ecological condition. The study is an expansion of EPA's Environmental Monitoring and Assessment Program (EMAP), which seeks to assess condition of the Nation's environmental resources within a variety of resource categories. The coastal component of EMAP on the east coast of the U.S. began in 1993 with a focus in estuaries. The new spring 2004 survey extends this work to near-coastal shelf waters (1 nm from shore seaward, or ~10m in depth, to the 100-m shelf break) from about Nags Head, North Carolina to West Palm Beach, Florida (Fig. 1, Table 1).

Shelf waters of the SAB are valuable reservoirs of both living and mineral resources and include one of NOAA's marine sanctuaries, the Gray's Reef National Marine Sanctuary (GRNMS) off the coast of Georgia. In the present study, sampling was conducted at 50 stations in shelf waters throughout the SAB, using the random probabilistic sampling design of EMAP. Accordingly, the resulting data can be used to make estimates of the spatial extent of the region's health with respect to the various measured indicators, and to provide this information as a baseline for determining how environmental conditions may be changing in the future. This is the first such baseline for the near-coastal (shelf) waters of the SAB region. Scientists involved in the present study also have conducted recent surveys of condition within the boundaries of the GRNMS itself, using the same protocols as in the present SAB-wide survey. Thus, results of these companion surveys can be integrated to provide an opportunity to compare conditions within the sanctuary to non-sanctuary areas of the shelf.

This survey involved the cooperation of multiple organizations. NOAA/NMAO provided the research ship (NOAA ship Nancy Foster). Funds for the project are provided by NOAA/NOS/NCCOS/CCEHBR (sampling supplies and equipment) and by EPA/NHEERL/GED (sample processing). Representatives from NOAA/NOS/NCCOS headquarters and two of its centers (CCEHBR and CCMA), EPA/NHEERL/GED, and the State of Florida (FFWCC/FMRI) participated on the cruise as members of the scientific staff. Additional partners involved in the overall program include the NOAA/GRNMS Office, South Carolina Department of Natural Resources (SCDNR), and the Georgia Department of Natural Resources (GADNR).

2.0 Scientific Approach

Sampling was conducted March 30 - April 11, 2004 at each of 50 stations positioned randomly throughout shelf waters of the SAB (Fig. 1, Table 1). One station was included within the GRNMS. At each station, multiple ecological indicators were sampled (Table 2), including: (1) general habitat condition (depth, salinity, temperature, sediment characteristics); (2) water

quality indicators (total suspended solids, chlorophyll a, nutrients); (3) pollutant exposure indicators (dissolved oxygen concentration, sediment contaminants, fish tissue contaminants); and (4) benthic condition indicators (diversity and abundance of benthic infaunal species, fish pathological anomalies).

Sediment sampling was conducted using a 0.04m², Young modified van Veen grab. Sample material will be used for analysis of macroinfaunal communities, concentration of sediment contaminants, % silt-clay, and organic-carbon content. Four grab samples were required at the majority of stations to acquire adequate sediment for both benthic infauna (2 replicate grabs) and chemistry sample processing. A grab sample was deemed successful when the grab unit was >75% full (with no major slumping). The benthic samples were sieved onboard through 0.5-mm screen and preserved in 10% buffered formalin with rose bengal stain.

Both a Seabird 9/11 and a Seabird 19 CTD unit, supplied by the NOAA ship Nancy Foster, were used to acquire profiles of salinity, temperature, dissolved oxygen, and depth. The Seabird 9/11 was equipped with 12 Niskin bottles to acquire discrete water samples at three designated water depths: 1 m below sea surface, mid-water column, and 1 m off seabed. Continuous profiles of conductivity, temperature, dissolved oxygen, and depth were recorded during the descent and ascent of the units. Discrete water samples were processed for nutrients, total suspended solids, and chlorophyll.

Hook-and-line fishing methods (up to six fishing rods) were used in an effort to capture bottom fish for inspection of external pathologies and for subsequent analysis of chemical contaminants in tissues of selected species at all 50 stations. Any captured fish were identified and inspected for gross external pathologies. Selected species, primarily sand perch (*Diplectrum formosum*) and black seabass (*Centropristis striata*), also were preserved for subsequent chemical contaminant body-burden analysis.

3.0 Sampling Logistics and Scientific Parties

Sampling for the spring 2004 southeastern shelf survey was conducted on NOAA ship Nancy Foster, Cruise NF-04-08-CL, March 30 - April 11, 2004. The cruise consisted of two legs: Leg 1 for the northern section of the sampling area (Charleston, SC to Nags Head, NC, March 30 - April 5); and Leg 2 for the southern section of the sampling area (Charleston, SC to West Palm Beach, FL, April 6 - April 11). Samples were collected from the deck of the Nancy Foster around-the-clock. A summary of scientific parties is provided in Table 3.

4.0 Preliminary Results

A total of 50 stations in near-coastal waters of the South Atlantic Bight (SAB) along the U.S. southeastern continental shelf from the Nags Head, NC to West Palm Beach, FL was successfully sampled as part of Cruise NF-04-08-CL (Figure 1, Table 1). One of the 50 stations occurred within the GRNMS boundaries. All in-situ measurements and records of sampling were recorded on standard field sheets (available upon request).

Water depths at the 50 stations averaged 30 m and ranged from 10 – 83 m. Bottom water physical characteristics were highly variable across the region (Table 4). Temperature ranged from 6.8°C to 24.2°C, salinity ranged from 21.2 psu to 37.2 psu, and dissolved oxygen ranged from 6.8 mg/L to 9.8 mg/L. In general, cooler water temperatures occurred north of Cape Hatteras compared to the remainder of the sampling area. A variety of bottom types were encountered among the various stations including coarse sand with shell hash, and fine, silty sand. None of the stations had to be abandoned due to unsamplable bottom substrate (e.g., excessive rocks or live bottom).

One station (SE040049) was deeper than 100m (outside the sampling frame) and, therefore, deemed unsamplable due to depth. An alternate station, SE04ALT0011, was sampled in place of SE040049.

Fishing was attempted at all 50 stations, fish were collected at 22 stations, and targeted species were collected at 19 (38%) of the stations (Table 5). The catch was dominated by black seabass (*Centropristis striata*; n = 182) and sand perch (*Diplectrum formosum*; n = 113). No fish were collected that exhibited any visual evidence of external pathological disorders. Fish samples will be analyzed for presence of chemical contaminants.

Data for other biological and abiotic environmental variables listed in Table 2 will be available once the processing of these samples has been completed.

5.0 Acknowledgements

Funding for this project is provided through NOAA/NOS/NCCOS/CCEHBR (field sampling supplies and equipment) and the EPA/NHEERL/GED (sample processing). All members of the two field crews (Table 3) 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 Nancy Foster for the superb job performed on NF-04-08-CL.

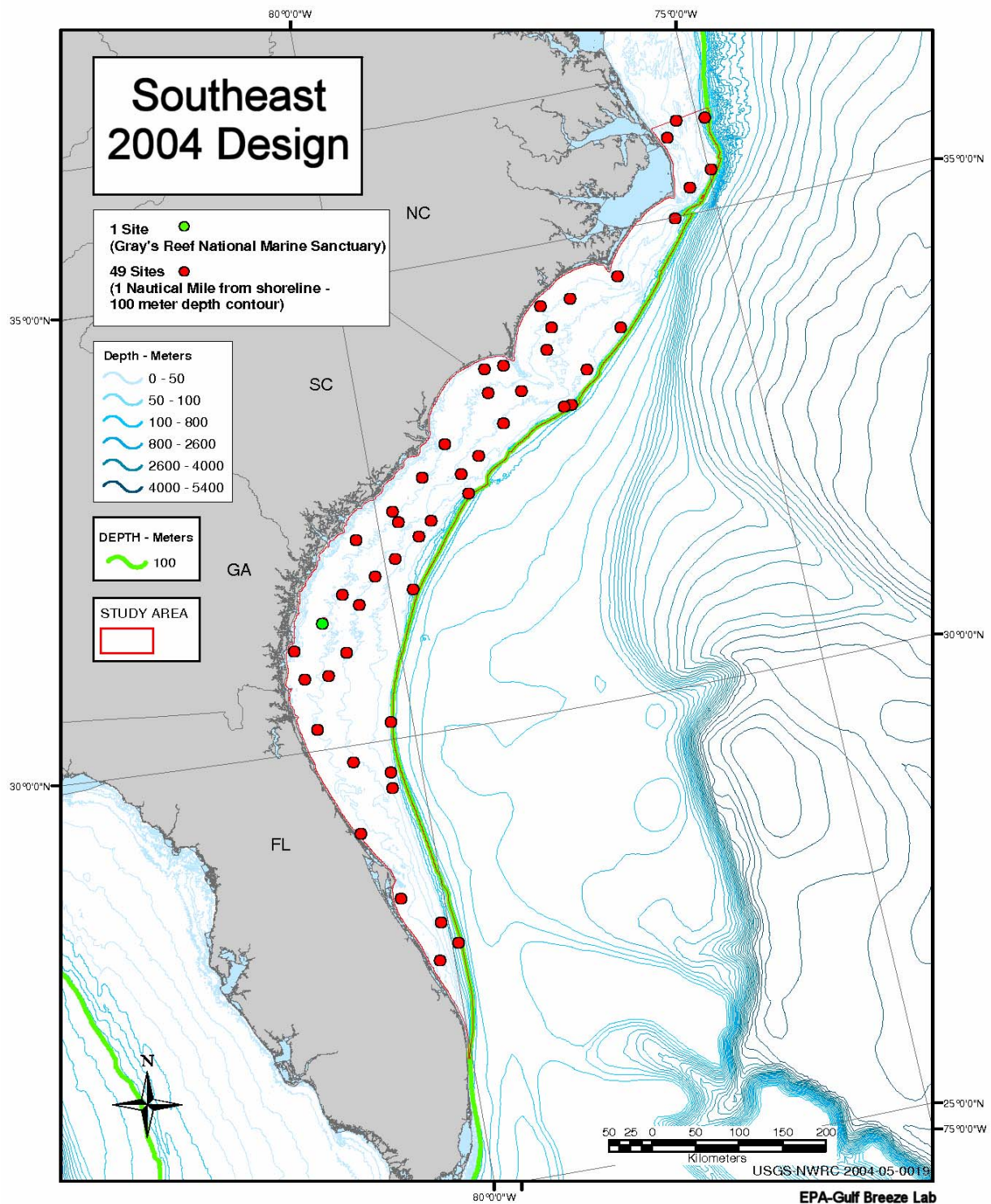


Figure 1. Study area and sampling sites for SAB 2004 survey of ecological conditions of the southeastern U.S. continental shelf (NOAA Ship Nancy Foster Cruise NF-04-08-CL).



Figure 2. SAB 04 leg 2 crew (from left to right, top to bottom): CDR Frederick Rossmann (NOAA), Josh Collins (FMRI), Cindy Cooksey (NOAA), Stephanie Rexing (NOAA), LCDR Ralph Rogers (NOAA), Ed Johnson (NOAA), Ensign Amy Daniel (NOAA), Tracy Gill (NOAA), Dennis Moore (NOAA), Jesse Stiggins (NOAA), Bob Quarles (EPA), Kelly McCoy (FMRI), JD Dubick (NOAA), George Craven (EPA), AK Leight (NOAA), Amanda Middlemiss (NOAA), Alonzo Sanz (NOAA), Jeff Brawley (NOAA), Susan Baker (NOAA), Tim Olsen (NOAA).

Table 1. Locations of stations successfully sampled during the SAB 2004 survey of ecological conditions of the southeastern U.S. continental shelf.

Station ID	Latitude - Decimal Degrees	Longitude - Decimal Degrees	Station Depth (m)
SE040001	31.36625	-80.87812	20
SE040002	32.27212	-79.34330	41
SE040003	33.06317	-78.99763	14
SE040004	27.95232	-80.07897	40
SE040005	31.63705	-80.57387	20
SE040006	30.23263	-81.14682	21
SE040007	31.57760	-79.71103	60
SE040008	27.54257	-80.17257	18
SE040009	33.52407	-78.34247	23
SE040010	31.00938	-80.64163	25
SE040011	32.19853	-80.29453	16
SE040012	31.50058	-80.38985	29
SE040013	33.87035	-77.51060	28
SE040014	31.92925	-79.86140	35
SE040015	32.12618	-79.52537	41
SE040016	34.49895	-76.43633	13
SE040017	29.04322	-80.83685	21
SE040018	36.01737	-75.26730	33
SE040019	29.82830	-80.78468	27
SE040020	30.19302	-80.25955	53
SE040021	33.95535	-76.53930	42
SE040022	29.65300	-80.36010	43
SE040023	33.22947	-77.44340	45
SE040024	34.09792	-77.39780	26
SE040025	33.78810	-78.08550	15
SE040026	30.79113	-80.90655	25
SE040027	34.36198	-77.09250	23
SE040028	34.34528	-77.47862	16
SE040029	28.27788	-80.49652	16
SE040030	32.87658	-78.61013	43
SE040031	30.79103	-81.19778	15
SE040032	32.74693	-79.35072	19
SE040033	31.77548	-80.14060	30
SE040034	33.17650	-78.23268	33
SE040035	35.85053	-75.42660	24
SE040036	33.23763	-77.34313	47
SE040037	35.98105	-74.89810	83
SE040038	32.44360	-79.79097	16
SE040039	34.98853	-75.56278	37
SE040040	35.43008	-74.95900	41
SE040041	33.58008	-77.06697	40
SE040042	32.49767	-78.81927	50
SE040043	33.78847	-78.33452	16
SE040044	32.71425	-78.86517	33
SE040045	29.48200	-80.37595	40
SE040046	32.31815	-79.73765	25
SE040047	31.10745	-81.27568	10
SE040048	35.27827	-75.29312	23
SE04ALT0011	27.99100	-80.28477	22
SE040050	33.48602	-77.92563	28

Table 2. Summary of types of field samples collected at each 2004 South Atlantic Bight station.

Parameters	# of Replicates	Container	Sample Size	Preservation
Infauna	2	1000 ml Polypropylene jar	All material retained on 0.5mm sieve	10% Buffered Formalin in the field
Metal Contaminants	1 (composited sediment)	250 HDPE jar	2/3 full	frozen
Organic Contaminants	1 (composited sediment)	500 ml I-Chem glass jar	2/3 full	frozen
TOC	1 (composited sediment)	125 ml Polypropylene jar	2/3 full	frozen
% Silt/Clay & % Moisture	1 (composited sediment)	500 ml HDPE jar	2/3 full	frozen
PBDE (polybrominated diphenyl ethers)	1 (composited sediment)	125 ml I-Chem glass jar	2/3 full	frozen
Total Suspended Solids	3 (water column - surface, mid, bottom)	47 mm preweighed filter pads	TSS retained on filter pad	frozen
Nutrients	3 (water column - surface, mid, bottom)	60 ml HDPE containers	2/3 full	frozen
Chlorophyll a	3 (water column - surface, mid, bottom)	25 mm filter pads	cells retained on pad	frozen
Fish Tissue	--	ziplock bag	5-6 specimens from up to 3 species	frozen

Table 3. Scientific crew for SAB 2004 survey of ecological conditions of the southeastern U.S. continental shelf. * - indicates Chief Scientist.

Cruise Leg	Name	Affiliation
Leg 1	March 30 – April 5, 2004	
	Cynthia Cooksey*	NOAA/NOS/NCCOS/CCEHBR
	Len Balthis	NOAA/NOS/NCCOS/CCEHBR
	George Craven	USEPA/Gulf Ecology Division
	JD Dubick	NOAA/NOS/NCCOS/CCEHBR
	Michelle Harmon	NOAA/NOS/NCCOS
	Jeff Hyland	NOAA/NOS/NCCOS/CCEHBR
	Christian Jones	NOAA/NOS/NCCOS/CCEHBR
	Laura Kracker	NOAA/NOS/NCCOS/CCEHBR
	Bob Quarles	USEPA/Gulf Ecology Division
	Stephanie Rexing	NOAA/NOS/NCCOS/CCEHBR
	Blaine West	NOAA/NOS/NCCOS/CCEHBR
Leg 2	April 6 – April 11, 2004	
	Cynthia Cooksey*	NOAA/NOS/NCCOS/CCEHBR
	Susan Baker	NOAA/NOS/NCCOS
	Josh Collins	Florida Marine Research Institute
	George Craven	USEPA/Gulf Ecology Division
	JD Dubick	NOAA/NOS/NCCOS/CCEHBR
	Tracy Gill	NOAA/NOS/NCCOS/CCMA
	Ed Johnson	NOAA/NOS/NCCOS/CCMA
	AK Leight	NOAA/NOS/NCCOS/CCEHBR
	Kelly McCoy	Florida Marine Research Institute
	Bob Quarles	USEPA/Gulf Ecology Division
	Stephanie Rexing	NOAA/NOS/NCCOS/CCEHBR

Table 4. Water quality measurements as measured with a SeaBird 19 CTD during the SAB 2004 survey of ecological conditions of the southeastern U.S. continental shelf.

Station ID	Depth (m)	Temperature (°C)	Salinity (PSU)	Dissolved Oxygen (mg/L)
SE040001	18.3	18.1	33.8	7.7
SE040002	40.7	18.7	36.5	7.5
SE040003	13.9	13.9	34.7	8.3
SE040004	39.6	23.2	36.4	6.9
SE040005	20.6	18.2	34.5	7.7
SE040006	20.0	19.7	34.8	7.4
SE040007	65.7	24.2	36.3	6.8
SE040008	16.5	23.6	36.3	6.9
SE040009	22.0	14.4	35.6	8.2
SE040010	24.9	19.4	35.7	7.4
SE040011	15.6	15.9	35.7	7.9
SE040012	28.6	17.6	35.5	7.7
SE040013	26.1	18.6	36.3	7.5
SE040014	35.8	18.3	36.1	7.6
SE040015	41.7	18.9	36.9	7.4
SE040016	16.8	13.4	33.3	8.5
SE040017	20.1	20.0	35.8	7.3
SE040018	32.4	7.8	33.5	9.6
SE040019	26.6	20.9	35.9	7.2
SE040020	51.5	22.7	36.4	7.0
SE040021	42.1	23.1	36.1	6.9
SE040022	40.6	23.7	36.3	6.9
SE040023	44.4	20.3	36.6	7.3
SE040024	25.5	16.1	36.9	7.9
SE040025	14.3	13.9	33.8	8.4
SE040026	24.1	19.1	35.2	7.5
SE040027	22.4	14.8	35.4	8.1
SE040028	15.7	13.6	34.6	8.4
SE040029	16.5	21.5	36.4	7.1
SE040030	32.4	19.4	36.4	7.4
SE040031	14.3	18.9	34.3	7.6
SE040032	18.5	17.2	25.0	8.3
SE040033	29.5	18.7	36.2	7.5
SE040034	37.2	19.4	36.3	7.4
SE040035	23.6	8.8	30.9	9.5
SE040036	68.0	21.4	36.1	7.1
SE040037	56.8	6.8	33.5	9.8
SE040038	16.2	16.2	36.4	7.9
SE040039	37.0	18.6	35.3	7.6
SE040040	39.4	8.7	32.2	9.5
SE040041	39.4	20.5	37.2	7.2
SE040042	50.5	20.2	36.5	7.3
SE040043	14.8	13.6	35.0	8.4
SE040044	31.9	19.2	36.4	7.4
SE040045	39.4	21.7	36.5	7.1
SE040046	25.1	17.5	36.3	7.7
SE040047	9.1	18.3	33.4	7.7
SE040048	23.5	9.0	31.2	9.5
SE04alt0011	21.9	23.4	21.2	7.5
SE040050	26.2	14.1	35.4	8.3

Table 5. Summary of fish taxa collected during the SAB 2004 survey of ecological conditions of the southeastern U.S. continental shelf.

Common Name	Scientific Name	Number Caught
Black Seabass	<i>Centropristis striata</i>	182
Sand Perch	<i>Diplectrum formosum</i>	113
Lizardfish	<i>Synodus foetens</i>	12
Snake fish	<i>Trachinocephalus myops</i>	12
Tomtate	<i>Haemulon aurolineatum</i>	11
Dusky Flounder	<i>Syacium papillosum</i>	6
Scup	<i>Stenotomus chrysops</i>	4
Spiny Dogfish	<i>Squalus acanthias</i>	4
Atlantic Sharpnose	<i>Rhizoprionodon terraenovae</i>	2
Bluefish	<i>Pomatomus saltatrix</i>	2
Dogfish	<i>Squalus sp.</i>	2
Longspine Porgy	<i>Stenotomus caprinus</i>	2
Whitebone Porgy	<i>Calamus leucosteus</i>	2
Blue Runner	<i>Caranx crysos</i>	1
Pearly Razorfish	<i>Xyrichtys novacula</i>	1
Red Porgy	<i>Pagrus pagrus</i>	1
Snake Eel (spotted)	Ophichthidae	1
White Grunt	<i>Haemulon plumierii</i>	1