Cruise Report: NF-04-03

Vertical distribution surveys at Gray's Reef National Marine Sanctuary
&
Assessment of pelagic resources at Gray's Reef National Marine Sanctuary: gear evaluation

Leg 1 (16-18 October 2003)
Leg 2 (21-27 October 2003)

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Submitted to:
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Introduction

A partnership between the National Centers for Coastal Ocean Science (NCCOS) and the Office of National Marine Sanctuaries (ONMS) was initiated in 1999 to provide a stronger and more effective science base for managing NOAA's National Marine Sanctuaries. Under this partnership, NCCOS's role is to work with ONMS to conduct research aimed at addressing sanctuary management needs and to help apply this and related information in the development and implementation of effective management plans. Priority topics for the Gray's Reef National Marine Sanctuary (GRNMS) include studies to improve our understanding of the ecological characteristics and dynamics of benthic and fish communities, and of the trophic relationships between these key components of the sanctuary ecosystem. Such needs were identified at a recent workshop (2001) on strategies for future research and monitoring at the sanctuary.

A continuing project has been funded in FY04 under the NCCOS-ONMS partnership to help address the needs of GRNMS. This research will address two questions: (1) at larger-scales, what are the source regions providing recruitment to GRNMS and what are the supply regions receiving recruitment from GRNMS, and (2) at smaller scales, what are the trophic relationships between reef fish inhabiting GRNMS and primary and secondary production in the surrounding ecosystem? The research conducted during this cruise will support the first objective and contribute to the determination of source and supply regions through the collection of larval and settlement stage fishes.

Cruise Scientific Objectives

Key objectives of this survey were to:

1) Collect depth-discrete vertical distribution data using a 1 m^2 Tucker trawl at 3 hour intervals around the clock. Trawls were scheduled for 0100, 0400, 0700, 1000, 1300, 1600, 1900, and 2200 (Leg 1).

2) Conduct CTD casts at 1.5 hour intervals around the clock (Leg 1).

3) Deploy and retrieve fish-settlement traps at five hard-bottom sites and five open-sand sites within the sanctuary boundaries for a juvenile fish recruitment study (Legs 1 & 2).

4) Deploy gill nets outside the Sanctuary to assess the gear's ability to catch pelagic fishes (Leg 2).

Research was conducted on board the NOAA Ship *Nancy Foster* out of Charleston, South Carolina. Members of the scientific party included Frank Hernandez, Jr. (NOAA, CCFHR), Mike Greene (NOAA, CCFHR), Brian Degan, (NOAA, CCFHR), Siya Lem (NOAA, CCFHR), Katey Marancik, (NOAA, CCFHR), Nick Scoville (Savannah State University (SSU), Leg 1), and Jean Eva (SSU, Leg 2).

The cruise departure date (originally 13 October) was pushed back to 15 October 2003 because of a federal holiday (Columbus Day on 13 October) and to ensure that all scientific cruise participants had up-to-date TB test results. Researchers from CCFHR arrived in Charleston, South Carolina at 1530 on 15 October. A SSU student volunteer, Nick Scoville, was already on board. The ship was unable to depart due to a lack of deckhands. Departure was delayed until 1000 on 16 October by which time three deckhands from the NOAA Ship *Delaware II* (Woods Hole, Massachusetts) had arrived.

Leg 1 (16-18 October 2003)

The *Nancy Foster* arrived on station and operations began at 2000 on 16 October. Due to a shortage of ship's crew, a member of the scientific team was pressed into service operating the ship's J-frame during CTD and Tucker trawl deployments (Figure 1). At three hour intervals, two Tucker trawl deployments were made from the port side of the ship (Table 1). The first Tucker trawl deployment sampled 20-15 m (net 2) and 15-10 m (net 3). The second Tucker trawl deployment sampled 10-5 m (net 2) and 5-0 m (net 3). No sample was collected in net 1 as it went down to depth. Targeted towing speeds were ~1.5 knots and the targeted angle of the net in the water was 45^{o}. A General Oceanics flowmeter was attached to each net to determine the volume of water sampled. A temperature-depth recorder (Minilogger, Vemco, Inc.) was attached to the Tucker trawl frame to record fishing depth.

Figure 1. SSU volunteer Nick Scoville operating the J-frame during a Tucker trawl deployment.

At 1.5 hour intervals a CTD was deployed from the port side (Table 1). The CTD was deployed at the surface and held there for 3 minutes. The CTD was slowly lowered to the bottom (approximately 20 m) at 10 m min^{-1}. The CTD was then retrieved to the surface at 20 m min^{-1}, brought on board and the data downloaded. The Minilogger was attached to the CTD on the cast immediately prior to a Tucker trawl tow. Since the Minilogger "surface" values fluctuate, the three minute duration for which the CTD was held at the surface (as recorded by the Minilogger) will serve as a baseline value for the surface, and be used to determine the depth of each tow.

A Eularian sampling approach was planned to sample the vertical distribution of larval fishes at a site just east of the Sanctuary (31^{o} 23' 42.26'' N, 80^{o} 47' 57.28''W) for the duration of Leg 1 (96+ hours). However, approximately 36 hours into the vertical

Table 1. Sampling schedule for vertical distribution study at GRNMS, October 2003 (NF-04-03).

Hour	Gear	Watch[a]
0330	CTD	1
0400	1 m TT	1
0500	CTD	1
0630	CTD	1
0700	1 m TT	1
0800	CTD	1
0930	CTD	1
1000	1 m TT	1
1100	CTD	1
1230	CTD	1
1300	1 m TT	1
1400	CTD	1
1530	CTD	2
1600	1 m TT	2
1700	CTD	2
1830	CTD	2
1900	1 m TT	2
2000	CTD	2
2130	CTD	2
2200	1 m TT	2
2300	CTD	2
0030	CTD	2
0100	1 m TT	2
0200	CTD	2

[a] 1 = Mike Greene, Katey Marancik, Nick Scoville (Leg 1) and Jean Eva (Leg 2); 2 = Frank Hernandez, Jr., Siya Lem and Brian Degan

distribution study (13 Tucker trawl stations, 24 CTD stations), a seal broke on the ram of the J-frame, putting a halt to all sampling operations. After consulting with the captain, the ship departed for Savannah, Georgia (0900 on 18 October) in order to repair the seal. The ship arrived and docked on the Savannah waterfront at approximately 1500. Station data and volumes sampled for Leg 1 are summarized in Appendix I and Appendix II.

Figure 2. Mike Greene, Katey Marancik and Nick Scoville prepare for a Tucker trawl tow.

Savannah, Georgia (18-21 October 2003)

The ship, its crew and the scientific party stayed in Savannah until the seal was repaired on 21 October, three days later. Since the objectives of the first leg (vertical distribution study) were not successfully completed, it was decided that all CCFHR scientists would remain on board and attempt to complete all four objectives on the second leg. While docked, the ethanol was replaced in all samples from the first leg, the settlement traps and gill nets were assembled, and an outline for the second leg of the cruise was discussed in order to accomplish all objectives.

In addition, the crew from the *Delaware II* departed and three new deckhands and a NOAA officer were brought on board. Also, Nick Scoville left the scientific team and was replaced by Jean Eva, another SSU student. The ship departed Savannah at approximately 1400 on 21 October.

Leg 2 (21-27 October 2003)

The ship returned to station and operations resumed at 1930 on 21 October (Figure 2). The sampling schedule and protocol was the same as the first leg, except only one flowmeter (net 3) was used during Tucker trawl tows. The flowmeter for net 2 consistently popped out of the net during tows on the first leg of the cruise and therefore provided erroneous volume estimates (Appendix 2). Flowmeter readings from the net 3 flowmeter will be used to estimate ship's speed, and in conjunction with tow duration, estimate a volume for net 2 and 3.

Five settlement traps were deployed (from the ship's stern) on sand bottom habitats (Table 2) just within the Sanctuary boundaries on 23 October immediately after the 1300 Tucker trawl tows (Figure 3). The scheduled 1400 CTD cast was skipped to allow for transit time between the vertical distribution station and the settlement trap stations. Similarly, four settlement traps were deployed within the Sanctuary boundaries on live bottom habitats (Table 2) on 23 October immediately after the 1600 Tucker trawl tows (the scheduled 1700 CTD cast was skipped).

Vertical distribution sampling continued until 1000 on 25 October when the seal broke on the ram of the J-frame again, halting Tucker trawl and CTD operations after approximately 88 hours or 3.5 diel cycles (30 Tucker trawl stations, 56 CTD stations). Station data and volumes sampled for Leg 2 are summarized in Appendix III and Appendix IV.

At approximately 1630 on 25 October, three gill nets (100 feet in length, 6 panels with mesh size range of 0.5-3 inches) were deployed just outside the southeast corner of the Sanctuary using one of the ship's small boats. Net 1 was fished 3 m below the surface. Net 2 was fished 9 m below the surface. Net 3 was fished 15 m below the surface (3 m above the bottom). The nets were allowed to fish overnight.

Table 2. Location of settlement trap stations at GRNMS, October 2003 (NF-04-03-Leg 2).

Station	Latitude	Longitude
Sand Bottom 5	31°25.300	80°52.000
Sand Bottom 4	31°25.150	80°52.000
Sand Bottom 3	31°25.000	80°52.000
Sand Bottom 2	31°24.850	80°52.000
Sand Bottom 1	31°24.700	80°52.000
Live Bottom 5	31°24.300	80°52.000
Live Bottom 4	31°24.100	80°52.000
Live Bottom 3	31°23.850	80°52.000
Live Bottom 2	31°23.700	80°52.000

On 26 October (approximately 0800), the gill nets were retrieved. Net 1 (surface net) was found approximately 4 km away from its station, a probable result of wave/current action over night. Fish were sorted, counted and measured according to fishing depth (surface, mid and bottom) and mesh size. Several specimens were photographed for identification purposes (small sharks) and frozen for later identification and gut analyses (sea basses, carangids). One notable exception was a large bull shark, approximately 8-10 feet in length, which was wrapped in the surface net. Fortunately, it was untangled without apparent injury and released unharmed. Gill net results are summarized in Appendix V.

Figure 3. Mike Greene directing the deployment of a settlement trap.

After the gill nets were recovered, the settlement traps were located and retrieved. The traps were rinsed and any juvenile fish found in the traps were preserved in ethanol. Larger fish (black sea bass) and octopi found in the traps were measured (sea bass) and released. The last settlement trap was retrieved at approximately 1400 on 26 October, at which time the ship headed for Charleston, SC.

The *Nancy Foster*, its crew and scientific team arrived at the dock at approximately 2300 on 26 October. The next morning, the scientific gear and samples were off-loaded, the scientific team departed Charleston at approximately 1000 and arrived back in Beaufort, NC at approximately 1700.

Accomplishments

Despite the shortage of ship's crew and the J-frame breakdowns, all of the objectives of the cruise were accomplished to some degree.

Objective 1. Depth-discreet ichthyoplankton samples were collected every three hours over the course of 88 hours (30 stations x 4 depths = 120 samples). Many of the samples were split due to large volumes of phytoplankton/algae collected in the samples. Observations of samples upon processing confirmed the presence of many larval fishes, including carangids, bothids, leptocephali, serranids, gobiids and ophidiids, among other taxa.

Objective 2. CTD casts were made every 1.5 hours as scheduled during the vertical distribution study, with the exception of two stations which were skipped in order to deploy settlement traps. Throughout the vertical distribution survey the water column remained unstratified, varying only slightly in temperature, salinity and density with depth (Figure 4).

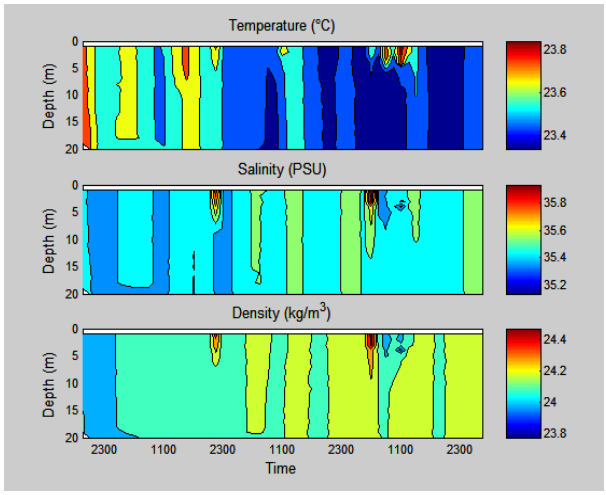

Figure 4. Contour plots of temperature, salinity and density over time for the vertical distribution survey (21-25 October 2003, NF-04-03-Leg 2).

Objective 3. The settlement traps were successfully deployed during the second leg of the cruise. Only larger, adult fish (black sea bass) were found in association with the live bottom traps. Smaller, post-larval and juvenile fish were found in several of the sand bottom traps, as well as two octopi.

Objective 4. The gill nets were successfully deployed once during the second leg of the cruise. Pelagic fishes (e.g., Atlantic bumper, sharks, pilotfish) were collected, as well as some reef-associated fishes (e.g., black sea bass, Atlantic spadefish).

Acknowledgements

We would like to thank our Savannah State University volunteers, Nick Scoville and Jean Eva for helping us on this cruise and for a job well done. We thank LT Peter Fischel, Executive Officer at GRNMS for getting us in touch with our volunteers. We are grateful to the officers and crew of the NOAA Ship *Nancy Foster* for their assistance and cooperation during the cruise.

Appendix I. Station data, including date and time of gear deployment, number of tows and sampling depth for NF-04-03-Leg 1.

Cruise	Station	Gear	Rep (Tow)	Day	Month	Year	Time	Depth (m)	Pres%
NF-04-03-L1	001	CTD	1	16	Oct	2003	2000		
NF-04-03-L1	002	1 m TT	2	16	Oct	2003	2030		95% EtOH
NF-04-03-L1	003	CTD	1	16	Oct	2003	2130	21.5	
NF-04-03-L1	004	1 m TT	2	16	Oct	2003	2200		95% EtOH
NF-04-03-L1	005	CTD	1	16	Oct	2003	2300	21.5	
NF-04-03-L1	006	CTD	1	17	Oct	2003	0030	22	
NF-04-03-L1	007	1 m TT	2	17	Oct	2003	0100		95% EtOH
NF-04-03-L1	008	CTD	1	17	Oct	2003	0200	22	
NF-04-03-L1	009	CTD	1	17	Oct	2003	0330	19	
NF-04-03-L1	010	1 m TT	2	17	Oct	2003	0400		95% EtOH
NF-04-03-L1	011	CTD	1	17	Oct	2003	0500	22	
NF-04-03-L1	012	CTD	1	17	Oct	2003	0630	21.5	
NF-04-03-L1	013	1 m TT	2	17	Oct	2003	0700		95% EtOH
NF-04-03-L1	014	CTD	1	17	Oct	2003	0800	21.5	
NF-04-03-L1	015	CTD	1	17	Oct	2003	0930		
NF-04-03-L1	016	1 m TT	2	17	Oct	2003	1000		95% EtOH
NF-04-03-L1	017	CTD	1	17	Oct	2003	1100		
NF-04-03-L1	018	CTD	1	17	Oct	2003	1230		
NF-04-03-L1	019	1 m TT	2	17	Oct	2003	1300		95% EtOH
NF-04-03-L1	020	CTD	1	17	Oct	2003	1400		
NF-04-03-L1	021	CTD	1	17	Oct	2003	1530	22	
NF-04-03-L1	022	1 m TT	2	17	Oct	2003	1600		95% EtOH
NF-04-03-L1	023	CTD	1	17	Oct	2003	1700	22	
NF-04-03-L1	024	CTD	1	17	Oct	2003	1830	21.5	
NF-04-03-L1	025	1 m TT	2	17	Oct	2003	1900		95% EtOH
NF-04-03-L1	026	CTD	1	17	Oct	2003	2000	21.6	
NF-04-03-L1	027	CTD	1	17	Oct	2003	2130	21.6	
NF-04-03-L1	028	1 m TT	2	17	Oct	2003	2200		95% EtOH
NF-04-03-L1	029	CTD	1	17	Oct	2003	2300	21.7	
NF-04-03-L1	030	CTD	1	18	Oct	2003	0030	22	
NF-04-03-L1	031	1 m TT	2	18	Oct	2003	0100		95% EtOH
NF-04-03-L1	032	CTD	1	18	Oct	2003	0200		
NF-04-03-L1	033	CTD	1	18	Oct	2003	0330	22	
NF-04-03-L1	034	1 m TT	2	18	Oct	2003	0400		95% EtOH
NF-04-03-L1	035	CTD	1	18	Oct	2003	0500		
NF-04-03-L1	036	CTD	1	18	Oct	2003	0630		
NF-04-03-L1	037	1 m TT	2	18	Oct	2003	0700		95% EtOH

Appendix II. Station data, including depths sampled, flowmeter revolutions, volumes sampled and estimates of ship speed for NF-04-03-Leg 2.

Sta.	Tow	Net	Depth (m)	No. Jars	Time	Flowmeter Begin	Flowmeter Finish	Total Rev.	Time (sec)	Vol. (m^3)	Speed (m/s)	Speed (kn)	Notes
2	1	2	20-15	2	2020	8281	8561	280	530	7.5	0.0	0.0	flowmeter out
2	1	3	15-10	2	2028	199540	200873	1333	400	35.8	0.1	0.2	
2	2	2	10-5	2	2059	8561	9487	926	353	24.9	0.1	0.1	
2	2	3	5-0	2	2105	200873	202012	1139	285	30.6	0.1	0.2	
4	1	2	20-15	2	2207	9487	10231	744	323	20.0	0.1	0.1	flowmeter out
4	1	3	15-10	2	2214	202012	211188	9176	385	246.6	0.6	1.2	
4	2	2	10-5	1	2242	10231	13841	3610	326	97.0	0.3	0.6	
4	2	3	5-0	1	2247	211188	213256	2068	313	55.6	0.2	0.3	
7	1	2	20-15	1	0059	13834	20227	6393	416	171.8	0.4	0.8	flowmeter out
7	1	3	15-10	2	0104	213253	222903	9650	384	259.3	0.7	1.3	
7	2	2	10-5	2	0133	20278	33910	13632	312	366.3	1.2	2.3	
7	2	3	5-0	1	0138	222983	228273	5290	323	142.2	0.4	0.9	
10	1	2	20-15	2	0402	33902	49209	15307	337	411.3	1.2	2.4	flowmeter out
10	1	3	15-10	2	0407	228271	234995	6724	363	180.7	0.5	1.0	flowmeter out
10	2	2	10-5	2	0441	49209	67325	18116	382	486.8	1.3	2.5	flowmeter out
10	2	3	5-0	2	0448	234995	238123	3128	374	84.1	0.2	0.4	out, check out,
13	1	2	20-15	2	0649	67332	67491	159	355	4.3	0.0	0.0	shortened line
13	1	3	15-10	2	0655	238127	245980	7853	370	211.0	0.6	1.1	
13	2	2	10-5	2	0714	67491	87001	19510	305	524.3	1.7	3.3	flowmeter out
13	2	3	5-0	2	0719	245980	255733	9753	374	262.1	0.7	1.4	
16	1	2	20-15	2	0955	87001	110390	23389	355	628.5	1.8	3.4	flowmeter out
16	1	3	15-10	2	0959	458000	466172	8172	370	219.6	0.6	1.2	new meter in, adjusted
16	2	2	10-5	1	1022	110390	127989	17599	382	472.9	1.2	2.4	lines
16	2	3	5-0	1	1029	466172	474534	8362	331	224.7	0.7	1.3	ok
19	1	2	20-15	1	1246	127989	149527	21538	320	578.8	1.8	3.5	flowmeter out
19	1	3	15-10	1	1251	474534	488015	13481	361	362.3	1.0	1.9	
19	2	2	10-5	1	1316	149527	160694	11167	335	300.1	0.9	1.7	in
19	2	3	5-0	1	1322	488015	502735	14720	441	395.6	0.9	1.7	
22	1	2	20-15	1	1600	160674	175632	14958	305	402.0	1.3	2.6	flowmeter out
22	1	3	15-10	1	1605	502729	512421	9692	340	260.5	0.8	1.5	
22	2	2	10-5	1	1619	175636	191854	16218	303	435.8	1.4	2.8	flowmeter out
22	2	3	5-0	2	1624	512426	520785	8359	335	224.6	0.7	1.3	
25	1	2	20-15	2	1846	191854	214142	22288	314	598.9	1.9	3.7	flowmeter out
25	1	3	15-10	2	1851	520796	532074	11278	366	303.1	0.8	1.6	
25	2	2	10-5	1	1915	214171	228895	14724	305	395.7	1.3	2.5	flowmeter out
25	2	3	5-0	1	1920	532078	542141	10063	317	270.4	0.9	1.7	
28	1	2	20-15	1	2154	228895	228895	0	321	0.0	0.0	0.0	flowmeter broke
28	1	3	15-10	2	2159	542143	555091	12948	372	348.0	0.9	1.8	

Appendix II. Continued.

Sta.	Tow	Net	Depth (m)	No. Jars	Time	Flowmeter Begin	Flowmeter Finish	Total Rev.	Time (sec)	Vol. (m^3)	Speed (m/s)	Speed (kn)	Notes
28	2	2	10-5	1	2232	13451	15469	2018	302	54.2	0.2	0.3	flowmeter broke
28	2	3	5-0	2	2237	555097	564391	9294	320	249.8	0.8	1.5	
31	1	2	20-15	1	0049	15881	38032	22151	308	595.3	1.9	3.7	flowmeter out
31	1	3	15-10	2	0054	564394	575700	11306	392	303.8	0.8	1.5	
31	2	2	10-5	1	0118	38038	57560	19522	302	524.6	1.7	3.4	flowmeter out
31	2	3	5-0	1	0123	575697	585910	10213	340	274.5	0.8	1.6	
34	1	1	20-15	1	0359	59565	77270	17705	393	475.8	1.2	2.3	flowmeter out
34	1	1	15-10	1	0405	585912	595352	9440	320	253.7	0.8	1.5	ok
34	2	1	10-5	1	0430	77279	91627	14348	335	385.6	1.2	2.2	flowmeter out
34	2	1	5-0	1	0435	595352	602299	6947	376	186.7	0.5	1.0	ok
37	1	2	20-15	1	0659	91627	112374	20747	330	557.5	1.7	3.3	flowmeter out
37	1	3	15-10	1	0704	602299	602835	536	327	14.4	0.0	0.1	flowmeter out
37	2	2	10-5	1	0723	112374	132391	20017	335	537.9	1.6	3.1	flowmeter out
37	2	3	5-0	1	0729	602835	612647	9812	336	263.7	0.8	1.5	ok

Appendix III. Station data, including date and time of gear deployment, number of tows and sampling depth for NF-04-03-Leg 2.

Cruise	Station	Gear	Rep (Tow)	Day	Month	Year	Time	Depth	Pres%
NF-04-03-L2	001	1m TT	2	21	Oct	2003	1930		95% EtOH
NF-04-03-L2	002	CTD	1	21	Oct	2003	2030	22	
NF-04-03-L2	003	CTD	1	21	Oct	2003	2130	21	
NF-04-03-L2	004	1m TT	2	21	Oct	2003	2200		95% EtOH
NF-04-03-L2	005	CTD	1	21	Oct	2003	2300	21.3	
NF-04-03-L2	006	CTD	1	22	Oct	2003	0030	21.5	
NF-04-03-L2	007	1m TT	2	22	Oct	2003	0100		95% EtOH
NF-04-03-L2	008	CTD	1	22	Oct	2003	0200	21	
NF-04-03-L2	009	CTD	1	22	Oct	2003	0330	21	
NF-04-03-L2	010	1m TT	2	22	Oct	2003	0400		95% EtOH
NF-04-03-L2	011	CTD	1	22	Oct	2003	0500	21.6	
NF-04-03-L2	012	CTD	1	22	Oct	2003	0630	21.8	
NF-04-03-L2	013	1m TT	2	22	Oct	2003	0700		95% EtOH
NF-04-03-L2	014	CTD	1	22	Oct	2003	0800	21.6	
NF-04-03-L2	015	CTD	1	22	Oct	2003	0930		
NF-04-03-L2	016	1m TT	2	22	Oct	2003	1000		95% EtOH
NF-04-03-L2	017	CTD	1	22	Oct	2003	1100		
NF-04-03-L2	018	CTD	1	22	Oct	2003	1230		
NF-04-03-L2	019	1m TT	2	22	Oct	2003	1300		95% EtOH
NF-04-03-L2	020	CTD	1	22	Oct	2003	1400		
NF-04-03-L2	021	CTD	1	22	Oct	2003	1530	22	
NF-04-03-L2	022	1m TT	2	22	Oct	2003	1600		95% EtOH
NF-04-03-L2	023	CTD	1	22	Oct	2003	1700	22.5	
NF-04-03-L2	024	CTD	1	22	Oct	2003	1830	23	
NF-04-03-L2	025	1m TT	2	22	Oct	2003	1900		95% EtOH
NF-04-03-L2	026	CTD	1	22	Oct	2003	2000		
NF-04-03-L2	027	CTD	1	22	Oct	2003	2130	21.6	
NF-04-03-L2	028	1m TT	2	22	Oct	2003	2200		95% EtOH
NF-04-03-L2	029	CTD	1	22	Oct	2003	2300		
NF-04-03-L2	030	CTD	1	23	Oct	2003	0030	21.6	
NF-04-03-L2	031	1m TT	2	23	Oct	2003	0100		95% EtOH
NF-04-03-L2	032	CTD	1	23	Oct	2003	0200	21.3	
NF-04-03-L2	033	CTD	1	23	Oct	2003	0330		
NF-04-03-L2	034	1m TT	2	23	Oct	2003	0400		95% EtOH
NF-04-03-L2	035	CTD	1	23	Oct	2003	0500		
NF-04-03-L2	036	CTD	1	23	Oct	2003	0630	22	

Appendix III. Continued.

Cruise	Station	Gear	Rep (Tow)	Day	Month	Year	Time	Depth	Pres%
NF-04-03-L2	037	1m TT	2	23	Oct	2003	0700		95% EtOH
NF-04-03-L2	038	CTD	1	23	Oct	2003	0800		
NF-04-03-L2	039	CTD	1	23	Oct	2003	0930	21.8	
NF-04-03-L2	040	1m TT	2	23	Oct	2003	1000		95% EtOH
NF-04-03-L2	041	CTD	1	23	Oct	2003	1100		
NF-04-03-L2	042	CTD	1	23	Oct	2003	1230		
NF-04-03-L2	043	1m TT	2	23	Oct	2003	1300		95% EtOH
NF-04-03-L2	044	CTD	1	23	Oct	2003	1530	21.6	
NF-04-03-L2	045	1m TT	2	23	Oct	2003	1600		95% EtOH
NF-04-03-L2	046	CTD	1	23	Oct	2003	1830		
NF-04-03-L2	047	1m TT	2	23	Oct	2003	1900		95% EtOH
NF-04-03-L2	048	CTD	1	23	Oct	2003	2000	22	
NF-04-03-L2	049	CTD	1	23	Oct	2003	2130	21	
NF-04-03-L2	050	1m TT	2	23	Oct	2003	2200		95% EtOH
NF-04-03-L2	051	CTD	1	23	Oct	2003	2300	21.3	
NF-04-03-L2	052	CTD	1	24	Oct	2003	0030		
NF-04-03-L2	053	1m TT	2	24	Oct	2003	0100		95% EtOH
NF-04-03-L2	054	CTD	1	24	Oct	2003	0200		
NF-04-03-L2	055	CTD	1	24	Oct	2003	0330	21.6	
NF-04-03-L2	056	1m TT	2	24	Oct	2003	0400		95% EtOH
NF-04-03-L2	057	CTD	1	24	Oct	2003	0500		
NF-04-03-L2	058	CTD	1	24	Oct	2003	0630		
NF-04-03-L2	059	1m TT	2	24	Oct	2003	0700		95% EtOH
NF-04-03-L2	060	CTD	1	24	Oct	2003	0800		
NF-04-03-L2	061	CTD	1	24	Oct	2003	0930	21	
NF-04-03-L2	062	1m TT	2	24	Oct	2003	1000		95% EtOH
NF-04-03-L2	063	CTD	1	24	Oct	2003	1100		
NF-04-03-L2	064	CTD	1	24	Oct	2003	1230	22	
NF-04-03-L2	065	1m TT	2	24	Oct	2003	1300		95% EtOH
NF-04-03-L2	066	CTD	1	24	Oct	2003	1400	20.7	
NF-04-03-L2	067	CTD	1	24	Oct	2003	1530	21.5	
NF-04-03-L2	068	1m TT	2	24	Oct	2003	1600		95% EtOH
NF-04-03-L2	069	CTD	1	24	Oct	2003	1700		
NF-04-03-L2	070	CTD	1	24	Oct	2003	1830	22.7	
NF-04-03-L2	071	1m TT	2	24	Oct	2003	1900		95% EtOH
NF-04-03-L2	072	CTD	1	24	Oct	2003	2000	23	
NF-04-03-L2	073	CTD	1	24	Oct	2003	2130	22.6	
NF-04-03-L2	074	1m TT	2	24	Oct	2003	2200		95% EtOH
NF-04-03-L2	075	CTD	1	24	Oct	2003	2300		
NF-04-03-L2	076	CTD	1	25	Oct	2003	0030		
NF-04-03-L2	077	1m TT	2	25	Oct	2003	0100		95% EtOH
NF-04-03-L2	078	CTD	1	25	Oct	2003	0200	20.1	
NF-04-03-L2	079	CTD	1	25	Oct	2003	0330		

Appendix III. Continued.

Cruise	Station	Gear	Rep (Tow)	Day	Month	Year	Time	Depth	Pres%
NF-04-03-L2	080	1m TT	2	25	Oct	2003	0400		95% EtOH
NF-04-03-L2	081	CTD	1	25	Oct	2003	0500		
NF-04-03-L2	082	CTD	1	25	Oct	2003	0630		
NF-04-03-L2	083	1m TT	2	25	Oct	2003	0700		95% EtOH
NF-04-03-L2	084	CTD	1	25	Oct	2003	0800	22.7	
NF-04-03-L2	085	CTD	1	25	Oct	2003	0930		
NF-04-03-L2	086	1m TT	2	25	Oct	2003	1000		95% EtOH

Appendix IV. Station data, including depths sampled, flowmeter revolutions, volumes sampled and estimates of ship speed for NF-04-03-Leg 2.

Sta.	Tow	Net	Depth (m)	No. Jars	Time	Flowmeter Begin	Flowmeter Finish	Total Rev.	Time (sec)	Vol (m^3)	Speed (m/s)	Speed (kn)	Notes
1	1	2	20-15	1	1938				327				
1	1	3	15-10	1	1944	613826	624786	10960	340	294.5	0.9	1.7	
1	2	2	10-5	1	2012				318				
1	2	3	5-0	1	2017	624786	633146	8360	330	224.7	0.7	1.3	
4	1	2	20-15	1	2152				329				
4	1	3	15-10	1	2158	633143	641771	8628	344	231.9	0.7	1.3	
4	2	2	10-5	1	2222				316				
4	2	3	5-0	1	2227	641803	651917	10114	314	271.8	0.9	1.7	
7	1	2	20-15	1	0100				333				
7	1	3	15-10	1	0106	651937	664431	12494	362	335.8	0.9	1.8	
7	2	2	10-5	1	0135				328				
7	2	3	5-0	1	0140	664405	668818	4413	338	118.6	0.4	0.7	
10	1	2	20-15	1	0413				275				
10	1	3	15-10	1	0419	668882	689090	20208	355	543.1	1.5	3.0	
10	2	2	10-5	1	0442				222				
10	2	3	5-0	1	0448	689090	703688	14598	422	392.3	0.9	1.8	
13	1	2	20-15	1	0707				320				
13	1	3	15-10	1	0713	703688	706200	2512	365	67.5	0.2	0.4	changed flowmeter
13	2	2	10-5	1	0746				321				
13	2	3	5-0	1	0751	706200	710097	3897	389	104.7	0.3	0.5	
16	1	2	20-15	1	0955				302				
16	1	3	15-10	1	1001	134042	146095	12053	351	323.9	0.9	1.8	new flow meter
16	2	2	10-5	1	1020				303				
16	2	3	5-0	1	1025	146095	156930	10835	361	291.2	0.8	1.6	
19	1	2	20-15	1	1251				362				
19	1	3	15-10	1	1257	156930	171625	14695	355	394.9	1.1	2.2	
19	2	2	10-5	1	1327				338				
19	2	3	5-0	1	1333	171625	184207	12582	365	338.1	0.9	1.8	
22	1	2	20-15	2	1548				335				
22	1	3	15-10	2	1554	184204	184495	291	396	7.8	0.0	0.0	flowmeter tangled up
22	2	2	10-5	2	1620				351				
22	2	3	5-0	1	1625	184548	192074	7526	316	202.2	0.6	1.2	
25	1	2	20-15	2	1900				322				
25	1	3	15-10	2	1905	192080	200959	8879	382	238.6	0.6	1.2	
25	2	2	10-5	2	1931				328				
25	2	3	5-0	2	1937	200968	207336	6368	339	171.1	0.5	1.0	
28	1	2	20-15	2	2150				353				
28	1	3	15-10	2	2156	207337	215676	8339	350	224.1	0.6	1.2	
28	2	2	10-5	2	2219				318				

Appendix IV. Continued.

Sta.	Tow	Net	Depth (m)	No. Jars	Time	Flowmeter Begin	Flowmeter Finish	Total Rev.	Time (sec)	Vol (m^3)	Speed (m/s)	Speed (kn)	Notes
28	2	3	5-0	2	2225	215680	222503	6823	316	183.4	0.6	1.1	
31	1	2	20-15	2	0055				336				
31	1	3	15-10	2	0101	222500	233368	10868	368	292.1	0.8	1.5	
31	2	2	10-5	2	0131				334				
31	2	3	5-0	2	0137	233380	237527	4147	320	111.4	0.3	0.7	flowmeter tangled up
34	1	2	20-15	2	0357				352				
34	1	3	15-10	2	0403	237530	248298	10768	404	289.4	0.7	1.4	
34	2	2	10-5	2	0428				349				
34	2	3	5-0	2	0434	248298	258788	10490	391	281.9	0.7	1.4	
37	1	2	20-15	2	0653				362				
37	1	3	15-10	2	0659	258788	259403	615	352	16.5	0.0	0.1	
37	2	2	10-5	2	0719				299				
37	2	3	5-0	2	0725	259403	266633	7230	332	194.3	0.6	1.1	
40	1	2	20-15	2	0956				322				
40	1	3	15-10	2	1001	266633	273749	7116	306	191.2	0.6	1.2	
40	2	2	10-5	2	1030				303				
40	2	3	5-0	2	1035	273749	278946	5197	300	139.7	0.5	0.9	
43	1	2	20-15	2	1254				321				
43	1	3	15-10	2	1259	278946	293942	14996	416	403.0	1.0	1.9	
43	2	2	10-5	2	1326				365				
43	2	3	5-0	2	1332	293942	306421	12479	307	335.3	1.1	2.1	
45	1	2	20-15	2	1600				344				
45	1	3	15-10	1	1606	306421	321017	14596	376	392.2	1.0	2.0	
45	2	2	10-5	1	1629				316				
45	2	3	5-0	1	1634	321017	325885	4868	328	130.8	0.4	0.8	
47	1	2	20-15	1	1849				318				
47	1	3	15-10	1	1854	325890	333688	7798	340	209.6	0.6	1.2	
47	2	2	10-5	2	1919				325				
47	2	3	5-0	2	1924	333684	342934	9250	406	248.6	0.6	1.2	
50	1	2	20-15	2	2150				322				
50	1	3	15-10	2	2155	342935	344313	1378	342	37.0	0.1	0.2	
50	2	2	10-5	1	2218				310				
50	2	3	5-0	1	2223	344313	347095	2782	310	74.8	0.2	0.5	
53	1	2	20-15	2	0053				323				
53	1	3	15-10	1	0059	346779	355532	8753	330	235.2	0.7	1.4	
53	2	2	10-5	1	0123				335				
53	2	3	5-0	1	0129	355532	362385	6853	310	184.2	0.6	1.2	
56	1	2	20-15	1	0427				349				
56	1	3	15-10	1	0433	364260	374060	9800	349	263.4	0.8	1.5	
56	2	2	10-5	1	0507				401				
56	2	3	5-0	1	0514	374060	384829	10769	415	289.4	0.7	1.4	

Appendix IV. Continued.

Sta.	Tow	Net	Depth (m)	No. Jars	Time	Flowmeter Begin	Flowmeter Finish	Total Rev.	Time (sec)	Vol (m^3)	Speed (m/s)	Speed (kn)	Notes
59	1	2	20-15		0653				452				
59	1	3	15-10		0701	384829	397309	12480	375	335.4	0.9	1.7	
59	2	2	10-5		0723				385				
59	2	3	5-0		0729	397309	406425	9116	360	245.0	0.7	1.3	
62	1	2	20-15	1	0957				331				
62	1	3	15-10	1	1002	406425	407667	1242	342	33.4	0.1	0.2	flowmeter tangled up
62	2	2	10-5	1	1022				300				
62	2	3	5-0	1	1027	407667	414426	6759	294	181.6	0.6	1.2	
65	1	2	20-15	1	1248				309				
65	1	3	15-10	1	1253	414426	422700	8274	303	222.3	0.7	1.4	
65	2	2	10-5	1	1318				324				
65	2	3	5-0	1	1323	422700	430339	7639	329	205.3	0.6	1.2	
68	1	2	20-15	1	1548				353				
68	1	3	15-10	1	1554	430369	440972	10603	363	284.9	0.8	1.5	
68	2	2	10-5	1	1615				316				
68	2	3	5-0	1	1620	440972	451178	10206	321	274.3	0.9	1.7	
71	1	2	20-15	1	1850				325				
71	1	3	15-10	1	1855	451178	460382	9204	401	247.3	0.6	1.2	
71	2	2	10-5	1	1918				301				
71	2	3	5-0	1	1923	460385	466734	6349	322	170.6	0.5	1.0	low wire angles
74	1	2	20-15	1	2156				320				
74	1	3	15-10	1	2201	466736	475517	8781	342	236.0	0.7	1.3	
74	2	2	10-5	1	2228				323				
74	2	3	5-0	1	2233	475517	482907	7390	342	198.6	0.6	1.1	
77	1	2	20-15	1	0053				340				
77	1	3	15-10	1	0058	482898	493975	11077	362	297.7	0.8	1.6	
77	2	2	10-5	1	0129				326				
77	2	3	5-0	1	0134	493975	503062	9087	316	244.2	0.8	1.5	
80	1	2	20-15	1	0358				362				
80	1	3	15-10	1	0404	503062	513308	10246	3603	275.3	0.1	0.1	
80	2	2	10-5	1	0429				345				
80	2	3	5-0	1	0435	513308	524687	11379	365	305.8	0.8	1.6	
83	1	2	20-15	1	0651				375				
83	1	3	15-10	1	0657	524687	533885	9198	338	247.2	0.7	1.4	
83	2	2	10-5	1	0735				361				
83	2	3	5-0	1	0741	533739	541781	8042	312	216.1	0.7	1.3	
86	1	2	20-15	1	1030				357				
86	1	3	15-10	1	1036	547302	556620	9318	360	250.4	0.7	1.3	

Appendix V. Summary of fish species collected in gill nets deployed adjacent to GRNMS (southeast corner) 25-25 October 2003 (NF-04-03). SL = standard length. TL = total length.

Net	Depth (m)	Panel No.	Panel Size (in)	No. Fish	Common Name	Scientific Name	SL	TL
Surface	3	1	0.5	0				
		2	1.0	0				
		3	1.5	1	Pilotfish	*Naucrates ductor*	270	305
		4	2.0	0				
		5	2.5	2	Atlantic sharpnose shark	*Rhizoprionodon longurion*	990	1206
					Atlantic sharpnose shark	*Rhizoprionodon longurion*	940	1143
		6	3.0	1	Bull shark	*Carcharhinus leucas*		3000+
Mid	9	1	0.5	0				
		2	1.0	1	Atlantic bumper	*Chloroscomburs chrysurus*	50	76
		3	1.5	9	Black seabass	*Centropristis striata*	200	250
					Black seabass	*Centropristis striata*	240	300
					Black seabass	*Centropristis striata*	215	272
					Black seabass	*Centropristis striata*	222	275
					Black seabass	*Centropristis striata*	205	250
					Black seabass	*Centropristis striata*	183	227
					Weakfish	Cynoscion regalis	345	370
					Pinfish	*Lagaodon rhomboides*	150	192
					Stenotomus	*Stenotomus* sp.	141	178
		4	2.0	3	Atlantic spadefish	*Chaetodipterus faber*	142	174
					Atlantic sharpnose shark	*Rhizoprionodon longurion*	787	946
		5	2.5	0	Atlantic sharpnose shark	*Rhizoprionodon longurion*	711	902
		6	3.0	0				
Bottom	15	1	0.5	1	Northern searobin	*Prionotus carolinus*	190	242
		2	1.0	14	Atlantic bumper	*Chloroscombrus chrysurus*	150	193
					Atlantic bumper	*Chloroscombrus chrysurus*	139	176
					Atlantic bumper	*Chloroscombrus chrysurus*	142	177
					Atlantic bumper	*Chloroscombrus chrysurus*	140	181
					Atlantic bumper	*Chloroscombrus chrysurus*	132	172
					Atlantic bumper	*Chloroscombrus chrysurus*	143	184
					Black seabass	*Centropristis striata*	123	157
					Black seabass	*Centropristis striata*	148	185
					Black seabass	*Centropristis striata*	140	178
					Black seabass	*Centropristis striata*	140	180
					Black seabass	*Centropristis striata*	151	190
					Black seabass	*Centropristis striata*	142	180
					Stenotomus	*Stenotomus* sp.	120	160
					Stenotomus	*Stenotomus* sp.	121	160
		3	1.5	3	Black seabass	*Centropristis striata*	240	310
					Black seabass	*Centropristis striata*	190	248
					Black seabass	*Centropristis striata*	148	190
		4	2.0	0				
		5	2.5	3	Atlantic sharpnose shark	*Rhizoprionodon longurion*	724	965
					Atlantic sharpnose shark	*Rhizoprionodon longurion*	660	882
					Atlantic bumper	Chloroscombrus chrysurus	140	182
		6	3.0	0				