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FINAL CRUISE REPORT

NOAA CRUISE ID:
NF-11-02

US STATE DEPARTMENT CRUISE ID:
DOS F2010-122

SHIP NAME:
NOAA Ship *Nancy Foster*

OPERATING AGENCY:
National Oceanic and Atmospheric Administration (NOAA)

PROJECT TITLE:
Coral Reef Ecosystem Research

CRUISE DATES:
19 April 2011 through 7 May 2011

CHIEF SCIENTIST:
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CLEARANCE COUNTRIES:
The Bahamas (MAF/FIS/13 of 17 January 2011)
Dominican Republic (MRE reply to U.S. Embassy Dip. Note 4, undated)
United Kingdom (FCO Dip. Note 022/2011 of 15 April 2011),
for Anguilla, British Virgin Islands, and Turks and Caicos Islands

PORT OF EMBARKATION:
San Juan, Puerto Rico (USA), 19 April 2011

PORT OF DISEMBARKATION:
Miami, Florida (USA), 7 May 2011

CRUISE REPORT
CORAL REEF ECOSYSTEM RESEARCH

NOAA Ship *Nancy Foster* (NF-11-02)
19 April 2011 – 7 May 2011

1. Cruise Summary

Introduction

The United States Virgin Islands' (USVI) Grammanik Bank, located to the south of St. Thomas, is the site of a multi-species spawning aggregation for economically important fish including yellowfin grouper, Nassau grouper, tiger grouper, and dog snapper. Fishing pressure at this suspected source of larval recruits prompted the US Caribbean Fishery Management Council (CFMC) in 2005 to close the bank yearly from February to April. A series of banks south of the USVI (St. Thomas and St. John) and the British Virgin Islands (BVI) provide similar habitats and spawning aggregation sites. Prior to the inception of this study, the biological and physical processes which drive production on these banks, the circulation connecting these banks, and the flows across these banks had not been quantified. As the 2005 management decisions were made in the absence of these data, regional Marine Protected Area (MPA) designations and temporary closures are presently based on professional judgment rather than quantifiable, defensible scientific information. In addition, meeting new annual catch limit (ACL) requirements of the Magnuson-Stevens reauthorization has become a priority of the CFMC. However, data limitations preclude comprehensive stock assessments for most fisheries in the region.

To address these data gaps, National Oceanic and Atmospheric Administration (NOAA) scientists from the Southeast Fisheries Science Center (SEFSC) and the Atlantic Oceanographic and Meteorological Laboratory (AOML) in Miami, Florida, working with scientists from the University of the Virgin Islands (UVI) and Department of Planning and Natural Resources (DPNR) in St. Thomas, are presently conducting a multi-year, interdisciplinary research project utilizing the NOAA Ship *Nancy Foster* to conduct biological and physical oceanographic surveys of the Virgin Islands (VI) bank ecosystems and surrounding regional waters. The long-term sustainability of fisheries in the VI and surrounding regions will depend on a comprehensive understanding of regional spawning aggregations, larval transport, and overall larval recruitment in the study area.

Scientific Objectives:

This endeavor is directed at answering one over-arching question:
How are the unprotected VI banks, MPAs such as the Hind Bank Marine Conservation District, seasonally closed areas such as Grammanik Bank, inshore areas and adjacent islands ecologically linked via regional reef fish larval dispersal, transport, and life-history patterns?

Data collected from this program will not only provide information on a data-poor region, but will have the potential to address two specific needs identified through a comprehensive review process recently completed by SEFSC and CFMC. First, should fish stocks be delineated from individual island groups (e.g. Puerto Rico, St. Thomas/St. John, and St. Croix), from the US Caribbean, or from the broader Caribbean region? This interdisciplinary effort will provide information on the interconnectivity of fish populations and assist in this stock delineation. Secondly, *indices of abundance* have been identified as a critical component of the length-based assessment methods currently employed in the US Caribbean. However, regional indices are lacking, or in some cases nonexistent. This endeavor will serve to improve existing and generate new indices of abundance for the study area.

To gain the information necessary to develop more specific hypotheses, the fifth research cruise of this project was conducted between April 19, 2011 and May 7, 2011 aboard the NOAA Ship *Nancy Foster*. This survey sampled water properties, currents, and dispersal and transport of settlement-stage larvae in the VI and neighboring regions. It helped to provide an understanding of regional spatial variation in the supply of settlement-stage fishes, and also insights into the relative importance of Grammanik Bank and its MPAs as a source of juvenile fishes recruiting to the waters of the VI.

Specifically, the cruise provided a data collection platform to help us address the following questions: (1) How do the abundance and composition of ichthyoplankton around Grammanik Bank and other similar banks change with space and time? (2) How much of this variation in abundance and composition can be explained by the oceanographic setting? (3) How do the oceanography and ichthyoplankton assemblages interface with the boundary areas of seasonally or permanently closed MPAs?

Additional sampling took place between Puerto Rico and the Dominican Republic and at selected sites in the Bahamas. Plankton sampling in these areas was designed to focus on tuna and billfish larvae. Previous surveys of gonadosomatic indices in adult fish captured from longline vessels in the eastern Caribbean have suggested that the region may be an important spawning ground for these species, especially swordfish (Xiphias gladius). Larval sampling in the region has been historically extremely sparse, but scattered catches of the larvae of swordfish, marlin and several tunas have been recorded previously in the northeastern Caribbean and Bahamas. In addition, we investigated the possibility of bluefin tuna (Thunnus thynnus) spawning outside of the documented Gulf of Mexico spawning ground. Although adult bluefin tuna have been captured on longline vessels between the Bahamas and Puerto Rico, there is no evidence thus far that they are spawning in the Caribbean, even though water temperatures are theoretically suitable. By completing plankton sampling concurrent with physical oceanographic sampling, we aim to better define the environmental conditions associated with tuna and billfish spawning in the Caribbean and tropical Atlantic. This will improve understanding of the biology of highly migratory and commercially important fish species, and contribute to the development of informed management practices.

Methods

Similar to previous project cruises, the 2011 shipboard survey was designed to gather data necessary for the assessment of regional spatial variations in the supply of settlement-stage fishes, linkages between VI regional spawning aggregation sites, and the effectiveness of existing CFMC management decisions (Figure 1). Additionally, the April/May 2011 survey was extended to cover the Mona Passage (Figure 2) and areas in the Bahamas (Figure 3) to sample for tuna and billfish larvae.

The NF-11-02 cruise track and station locations are shown in Figures 1-3. Station locations and arrival times are listed in Table 1. Discrete sampling operations included bongo and neuston tows, and CTD casts profiling temperature, salinity, dissolved oxygen, chlorophyll-a, and water velocity. Continuous surface measurements of temperature, salinity, chlorophyll-a, and water velocity were also collected via the ship's flow-through system and hull-mounted ADCP. Satellite-tracked, Lagrangian surface drifters were deployed across the survey domain to augment Eulerian current velocity measurements. Additionally, satellite ocean color images were downloaded, processed, and utilized during the cruise to determine the specific locations of oceanic features such as current fronts, recirculations, and gyres.

2. Itinerary

NF-11-02 LEG I

19 April 2011	Depart from San Juan, Puerto Rico, commence science operations
20 April 2011	Embark UVI scientists via small boat at Brewers Bay, St. Thomas, USVI
25 April 2011	Disembark UVI scientists via small boat at Charlotte Amalie, St. Thomas, USVI
27 April 2011	Arrive at Santo Domingo, Dominican Republic

NF-11-02 LEG II

30 April 2011	Depart from Santo Domingo, Dominican Republic, commence science operations
02 May 2011	Arrive at Mayaguez, Puerto Rico to disembark SEFSC scientist
02 May 2011	Depart from Mayaguez, Puerto Rico
05 May 2011	Arrive at Cockburn Town, San Salvador, Bahamas, foreign research clearance requirement
05 May 2011	Depart from Cockburn Town, San Salvador, Bahamas
07 May 2011	Arrive at Miami, Florida

3. Scientific Personnel

NF-11-02 LEG I Participants:

Ryan Smith	USA	NOAA/AOML/PhOD	Chief Scientist
Nelson Melo	USA	NOAA/AOML/PhOD	Scientist
Grant Rawson	USA	NOAA/AOML/PhOD	Scientist
Trika Gerard	USA	NOAA/NMFS/SEFSC	Scientist
Sarah Privoznik	USA	NOAA/NMFS/SEFSC	Scientist
Alex Ender	USA	NOAA/NMFS/SEFSC	Scientist
Aaron Maggied	USA	NOAA/NMFS/SEFSC	Scientist
Kevin Brown	USA	UVI, St. Thomas, USVI	Scientist
Bryan Legare	USA	UVI, St. Thomas, USVI	Scientist
Belitza Brocco	USA	UPR, San Juan, PR	Scientist
Maria Vega-Rodriguez	USA	USF, St. Petersburg, FL	Scientist
Mario Delgado	*DR	ANAMAR	Observer
Walterio Coll	*DR	ANAMAR	Observer

NF-11-02 LEG II Participants:

Ryan Smith	USA	NOAA/AOML/PhOD	Chief Scientist
Libby Johns	USA	NOAA/AOML/PhOD	Scientist
Nelson Melo	USA	NOAA/AOML/PhOD	Scientist
Grant Rawson	USA	NOAA/AOML/PhOD	Scientist
Trika Gerard	USA	NOAA/NMFS/SEFSC	Scientist
Sarah Privoznik	USA	NOAA/NMFS/SEFSC	Scientist
Alex Ender	USA	NOAA/NMFS/SEFSC	Scientist
Aaron Maggied	USA	NOAA/NMFS/SEFSC	Scientist
Belitza Brocco	USA	UPR, San Juan, PR	Scientist
Walterio Coll	*DR	ANAMAR	Observer
Manuel Montes	*DR	ANAMAR	Observer

*DR = Dominican Republic

4. Discrete Sampling

Bongo and Neuston Tows

Bongo and neuston tows were conducted throughout the course of the survey at station locations listed in Table 1 and plotted in Figures 1-3. Catches were collected from 163 tows (97 Bongo and 66 neuston). Each horizontal bongo tow was performed for approximately 10 minutes. Bongo nets were towed just below the sea surface, while neuston tows were performed with the net half in and half out of the water, to capture the sea surface. Neuston tows were conducted for either 5 or 10 minutes depending on location. Volumes filtered were calculated using a mechanical flow meter attached to the mouth of the nets.

CTD Casts

At each station location, hydrographic measurements were recorded with a pumped Sea-Bird 911*plus* CTD system. In total, 156 CTD casts were conducted over the course of the survey. On 12 of these casts, two 300 kHz RD Instruments (RDI) broadband lowered acoustic Doppler current profilers (LADCP) were employed to measure water velocity. The CTD was configured with a Paroscientific *Digiquartz* pressure sensor and dual temperature, conductivity, and oxygen sensors. A Wetlabs *ECO-AFL* chlorophyll-a fluorometer was also attached to the CTD. All temperature (model SBE 3*plus*), conductivity (model SBE 4), and oxygen sensors (model SBE 43) were calibrated by the manufacturer prior to the research cruise. Raw fluorometer voltages were correlated to chlorophyll-a concentration following the cruise. The CTD was connected to a 24-position Sea-Bird Carousel water sampler. Twenty 10-liter Niskin bottles were attached to the sampler.

The instrument package was typically lowered from the surface to 10-20 m above the sea floor, or to a predetermined maximum depth of 300 m. During the cast, continuous measurements of salinity, temperature, dissolved oxygen, and chlorophyll-a were obtained from the 9*plus* (the 9*plus* is the underwater unit/component of the CTD 911*plus* system). Niskin bottles were fired at predetermined depths providing water samples for use in conductivity, oxygen, and fluorometer sensor calibration. CTD cast locations are listed in Table 1 and plotted in Figures 1-3.

5. Continuous Sampling

Flow-Through System

The NOAA Ship *Nancy Foster* is equipped with a continuous flow-through seawater system, designed to measure water properties of the sea surface. During NF-11-02, the system was equipped with a Sea-Bird SBE21 thermosalinograph, a Turner 10 fluorometer, and a Seapoint fluorometer. The thermosalinograph, or *TSG*, measured sea surface temperature and salinity. The fluorometers measured surface chlorophyll-a concentration. These data were logged by the ship's Scientific Computer System (SCS) at 10-second intervals and paired with shipboard GPS position data.

Hull-Mounted ADCP

Continuous measurements of upper-ocean current velocity were collected throughout the survey via the shipboard acoustic Doppler current profiler (SADCP). The *Foster* is equipped with an RDI 150 kHz Ocean Surveyor SADCP. The instrument range varied from 150 to 200 m depth during the cruise depending on SADCP resolution (bin size). SADCP bin size was set to 4 m for the entire survey except for the section conducted across Mona Passage and in the Bahamas, where, in an effort to achieve maximum depth penetration with the instrument, the bin size was set to 8 m.

6. Lagrangian Surface Drifters

Based on in situ data collected and satellite ocean color images downloaded during the course of the survey, 11 Standard Velocity Profiler (SVP), satellite-tracked, Lagrangian surface drifters were deployed at targeted features present in the study area. Deployment locations are listed in Table 2.

7. Moored Array

During NF-11-02, six shallow water Nortek Aquadopp 600 kHz ADCP moorings deployed between Puerto Rico and St. Thomas in 2010 were recovered. Five of the moorings were relocated to banks south of St. Thomas in the USVI, near Grammanik Bank and Frenchcap Cay (Table 3). The ADCPs will measure water velocity throughout the water column at each mooring location and together are designed to quantify volume transport across the USVI coastal shelf south of St. Thomas.

8. Release of Project Data / Location of Results

In accordance with the provisions specified in the cruise instructions and application for foreign clearances, the complete data set assembled during the NF-11-02 research cruise will be provided to all clearance countries.

Data DVDs will be dispatched to all clearance countries through official channels (via the US State Department).

These results (which include raw and processed data, and metadata descriptors) are also presently available on line at the following FTP site:
ftp://ftp.aoml.noaa.gov/phod/pub/rsmith/CRER/data/NF1102_State_Dept_DVD/

9. Acknowledgments

The support and assistance provided by the officers and crew of the NOAA Ship *Nancy Foster*, and the dedicated efforts of UVI, UPR, USF, and ANAMAR participants are gratefully acknowledged. We are also grateful for our conversations with ANAMAR officials and for their hospitality during our Santo Domingo port stop. We feel that our discussions of regional marine resource issues provided valuable insight.

10. Figures and Tables

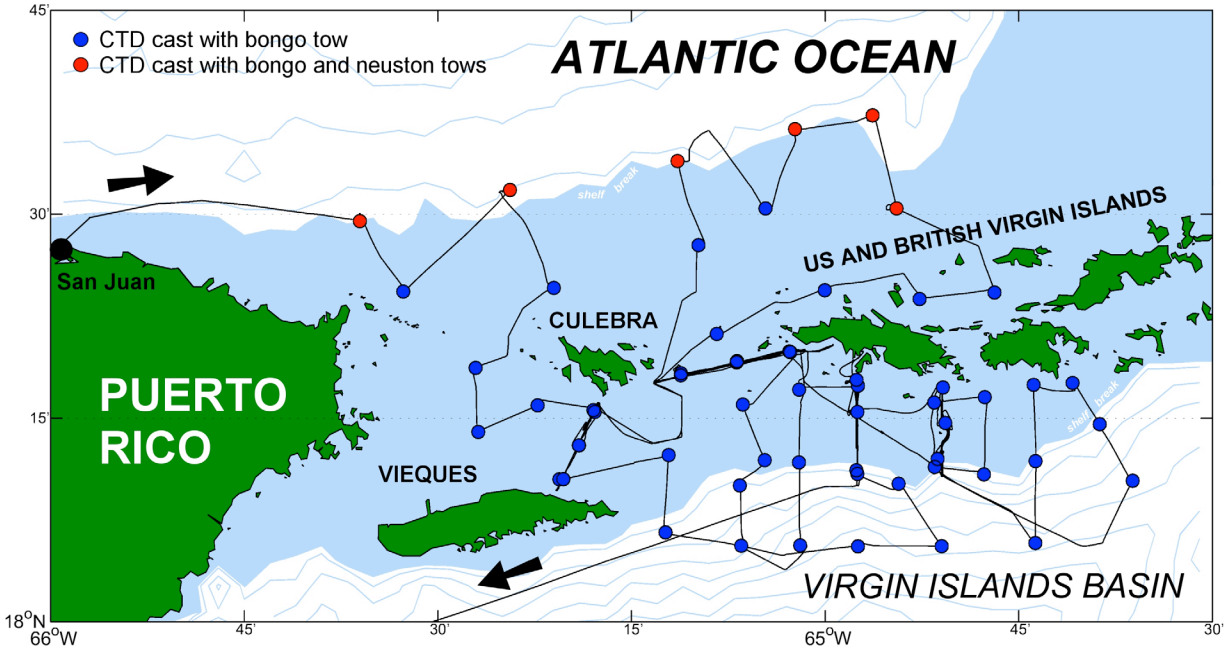

Figure 1. NF-11-02 cruise track and station locations in the Virgin Islands and surrounding region. The survey originated in San Juan, Puerto Rico on April 19, 2011.

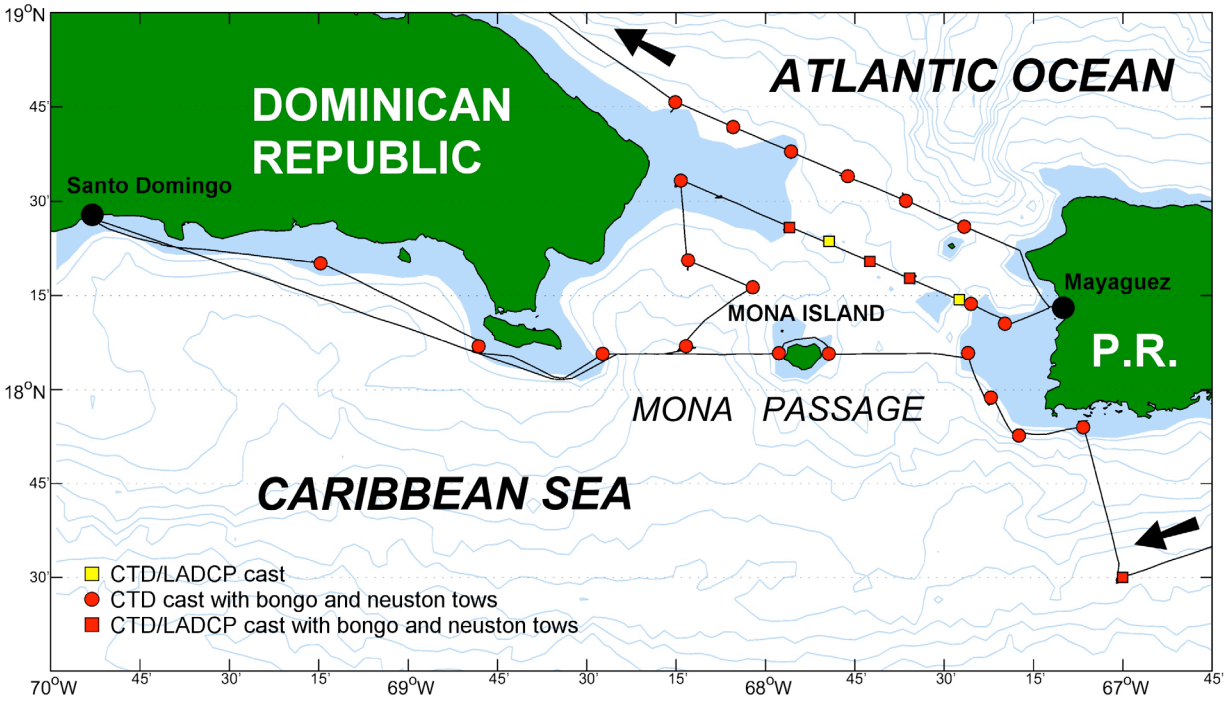

Figure 2. NF-11-02 cruise track and station locations in Mona Passage and surrounding region.

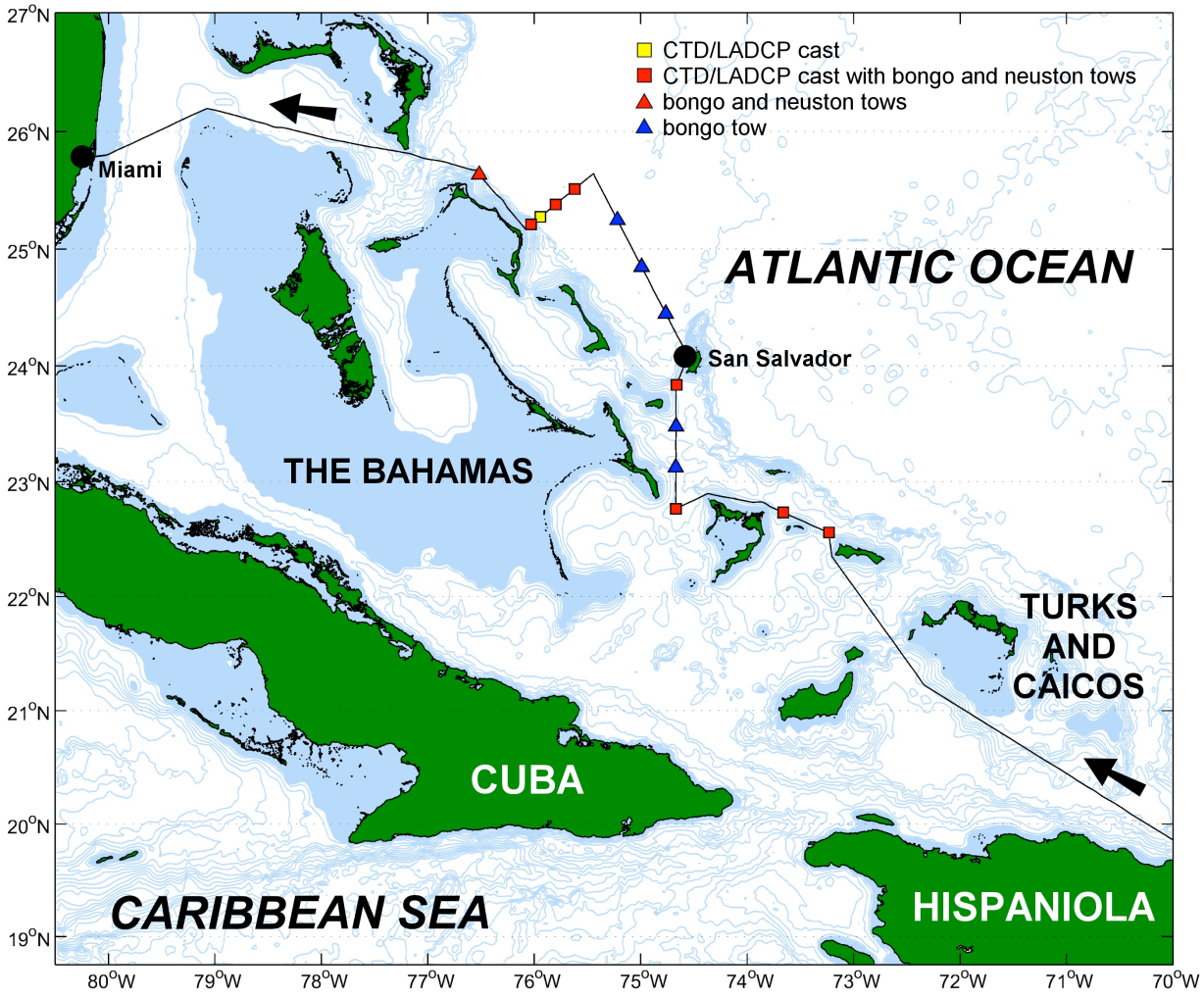

Figure 3. NF-11-02 cruise track and station locations in the Bahamas.
The survey concluded in Miami on May 7, 2011.

Table 1. NF-11-02 Discrete Sampling Stations

Station Number	Station Operations Casts and Tows	Station Arrival Date	Time	Station Position Latitude	Longitude
001	CTD, bongo, 10-min neuston	19-Apr-2011	19:51z	18 ° 29.51 'N	65 ° 36.04 'W
002	CTD, bongo	19-Apr-2011	22:56z	18 ° 24.32 'N	65 ° 32.69 'W
003	CTD, bongo, 10-min neuston	20-Apr-2011	00:20z	18 ° 31.80 'N	65 ° 24.41 'W
004	CTD, bongo	20-Apr-2011	02:31z	18 ° 24.59 'N	65 ° 21.02 'W
005	CTD, bongo	20-Apr-2011	04:05z	18 ° 18.71 'N	65 ° 27.08 'W
006	CTD, bongo	20-Apr-2011	05:19z	18 ° 14.00 'N	65 ° 26.87 'W
007	CTD, bongo	20-Apr-2011	06:31z	18 ° 15.94 'N	65 ° 22.27 'W
008	CTD, bongo	20-Apr-2011	07:48z	18 ° 15.60 'N	65 ° 17.94 'W
009	CTD, bongo	20-Apr-2011	09:02z	18 ° 13.00 'N	65 ° 19.08 'W
010	CTD, bongo	20-Apr-2011	10:13z	18 ° 10.50 'N	65 ° 20.58 'W
011	CTD, bongo	20-Apr-2011	20:32z	18 ° 27.74 'N	65 ° 09.81 'W
012	CTD, bongo, 10-min neuston	20-Apr-2011	22:01z	18 ° 33.92 'N	65 ° 11.43 'W
013	CTD, bongo	21-Apr-2011	00:13z	18 ° 30.43 'N	65 ° 04.61 'W
014	CTD, bongo, 10-min neuston	21-Apr-2011	01:27z	18 ° 36.27 'N	65 ° 02.33 'W
015	CTD, bongo, 10-min neuston	21-Apr-2011	03:16z	18 ° 37.28 'N	64 ° 56.31 'W
016	CTD, bongo, 10-min neuston	21-Apr-2011	05:14z	18 ° 30.43 'N	64 ° 54.46 'W
017	CTD, bongo	21-Apr-2011	07:21z	18 ° 24.26 'N	64 ° 46.87 'W
018	CTD, bongo	21-Apr-2011	08:28z	18 ° 23.78 'N	64 ° 52.68 'W
019	CTD, bongo	21-Apr-2011	09:56z	18 ° 24.42 'N	65 ° 00.02 'W
020	CTD, bongo	21-Apr-2011	11:24z	18 ° 21.20 'N	65 ° 08.39 'W
021	CTD, bongo	21-Apr-2011	13:07z	18 ° 18.32 'N	65 ° 11.16 'W
022	CTD, bongo	21-Apr-2011	14:46z	18 ° 19.21 'N	65 ° 06.83 'W
023	CTD, bongo	21-Apr-2011	16:24z	18 ° 19.92 'N	65 ° 02.77 'W
024	CTD, bongo	21-Apr-2011	17:40z	18 ° 17.10 'N	65 ° 02.01 'W
025	CTD, bongo	21-Apr-2011	18:43z	18 ° 11.75 'N	65 ° 02.03 'W
026	CTD, bongo	21-Apr-2011	20:33z	18 ° 05.64 'N	65 ° 01.92 'W
027	CTD, bongo	21-Apr-2011	22:09z	18 ° 05.61 'N	65 ° 06.49 'W
028	CTD, bongo	21-Apr-2011	23:27z	18 ° 10.05 'N	65 ° 06.60 'W
029	CTD, bongo	22-Apr-2011	00:32z	18 ° 11.91 'N	65 ° 04.68 'W
030	CTD, bongo	22-Apr-2011	01:30z	18 ° 16.01 'N	65 ° 06.38 'W
031	CTD, bongo	22-Apr-2011	09:28z	18 ° 15.46 'N	65 ° 17.85 'W
032	CTD, bongo	22-Apr-2011	10:18z	18 ° 13.00 'N	65 ° 19.06 'W
033	CTD, bongo	22-Apr-2011	17:40z	18 ° 10.52 'N	65 ° 20.28 'W
034	CTD, bongo	22-Apr-2011	19:28z	18 ° 12.28 'N	65 ° 12.12 'W
035	CTD, bongo	22-Apr-2011	20:32z	18 ° 06.59 'N	65 ° 12.36 'W
036	CTD, bongo	22-Apr-2011	23:04z	18 ° 05.57 'N	64 ° 57.45 'W
037	CTD, bongo	23-Apr-2011	00:33z	18 ° 05.58 'N	64 ° 50.96 'W
038	CTD, bongo	23-Apr-2011	02:05z	18 ° 10.18 'N	64 ° 54.30 'W
039	CTD, bongo	23-Apr-2011	03:10z	18 ° 10.90 'N	64 ° 57.49 'W
040	CTD, bongo	23-Apr-2011	04:53z	18 ° 17.38 'N	64 ° 57.45 'W
041	CTD, bongo	23-Apr-2011	11:34z	18 ° 18.15 'N	65 ° 11.18 'W
042	CTD, bongo	23-Apr-2011	18:09z	18 ° 19.11 'N	65 ° 06.85 'W
043	CTD, bongo	23-Apr-2011	19:22z	18 ° 19.87 'N	65 ° 02.69 'W
044	CTD, bongo	23-Apr-2011	23:31z	18 ° 10.40 'N	64 ° 36.17 'W
045	CTD, bongo	24-Apr-2011	00:47z	18 ° 14.57 'N	64 ° 38.72 'W
046	CTD, bongo	24-Apr-2011	01:56z	18 ° 17.60 'N	64 ° 40.82 'W
047	CTD, bongo	24-Apr-2011	03:07z	18 ° 17.46 'N	64 ° 43.84 'W
048	CTD, bongo	24-Apr-2011	04:16z	18 ° 11.84 'N	64 ° 43.69 'W
049	CTD, bongo	24-Apr-2011	05:41z	18 ° 05.81 'N	64 ° 43.71 'W
050	CTD, bongo	24-Apr-2011	20:46z	18 ° 16.55 'N	64 ° 47.62 'W
051	CTD, bongo	24-Apr-2011	21:54z	18 ° 10.86 'N	64 ° 47.69 'W
052	CTD, bongo	24-Apr-2011	23:13z	18 ° 11.41 'N	64 ° 51.50 'W
053	CTD, bongo	25-Apr-2011	00:37z	18 ° 16.16 'N	64 ° 51.54 'W
054	CTD, bongo	25-Apr-2011	01:53z	18 ° 17.26 'N	64 ° 50.87 'W
055	CTD, bongo	25-Apr-2011	04:06z	18 ° 14.66 'N	64 ° 50.69 'W
056	CTD, bongo	25-Apr-2011	05:12z	18 ° 12.00 'N	64 ° 51.28 'W
057	CTD, bongo	25-Apr-2011	08:52z	18 ° 11.16 'N	64 ° 57.57 'W
058	CTD, bongo	25-Apr-2011	11:21z	18 ° 15.46 'N	64 ° 57.49 'W
059	CTD, bongo	25-Apr-2011	15:09z	18 ° 17.83 'N	64 ° 57.56 'W
060	CTD/LADCP, bongo, 5-min and 10-min neust.	26-Apr-2011	10:31z	17 ° 30.00 'N	67 ° 00.06 'W
061	CTD, bongo, 5-min and 10-min neust.	26-Apr-2011	17:07z	17 ° 53.98 'N	67 ° 06.67 'W
062	CTD, bongo, 5-min and 10-min neust.	26-Apr-2011	19:39z	17 ° 52.67 'N	67 ° 17.45 'W
063	CTD, bongo, 5-min and 10-min neust.	26-Apr-2011	22:15z	17 ° 58.74 'N	67 ° 22.16 'W
064	CTD, bongo, 5-min and 10-min neust.	27-Apr-2011	00:29z	18 ° 05.81 'N	67 ° 26.00 'W

Table 1. NF-11-02 Discrete Sampling Stations

Station Number	Station Operations Casts and Tows	Station Arrival Date	Time	Station Position Latitude	Longitude
065	CTD, bongo, 5-min and 10-min neust.	27-Apr-2011	04:05z	18 ° 05.72 'N	67 ° 49.37 'W
066	CTD, bongo, 5-min and 10-min neust.	27-Apr-2011	06:26z	18 ° 05.79 'N	67 ° 57.73 'W
067	CTD, bongo, 5-min and 10-min neust.	30-Apr-2011	20:43z	18 ° 20.14 'N	69 ° 14.68 'W
068	CTD, bongo, 5-min and 10-min neust.	01-May-2011	01:36z	18 ° 06.91 'N	68 ° 48.17 'W
069	CTD, bongo, 5-min and 10-min neust.	01-May-2011	05:09z	18 ° 05.69 'N	68 ° 27.34 'W
070	CTD, bongo, 5-min and 10-min neust.	01-May-2011	08:46z	18 ° 06.92 'N	68 ° 13.34 'W
071	CTD, bongo, 5-min and 10-min neust.	01-May-2011	11:45z	18 ° 16.31 'N	68 ° 02.15 'W
072	CTD, bongo, 5-min and 10-min neust.	01-May-2011	14:09z	18 ° 20.60 'N	68 ° 13.00 'W
073	CTD, bongo, 5-min and 10-min neust.	01-May-2011	16:52z	18 ° 33.30 'N	68 ° 14.21 'W
074	CTD/LADCP, 5-min and 10-min neust.	01-May-2011	18:57z	18 ° 30.61 'N	68 ° 07.42 'W
075	CTD/LADCP, bongo, 5-min and 10-min neust.	01-May-2011	21:44z	18 ° 25.80 'N	67 ° 55.98 'W
076	CTD/LADCP	02-May-2011	00:26z	18 ° 23.65 'N	67 ° 49.32 'W
077	CTD/LADCP, bongo, 5-min and 10-min neust.	02-May-2011	02:09z	18 ° 20.43 'N	67 ° 42.47 'W
078	CTD/LADCP, bongo, 5-min and 10-min neust.	02-May-2011	04:17z	18 ° 17.74 'N	67 ° 35.81 'W
079	CTD/LADCP	02-May-2011	06:46z	18 ° 14.34 'N	67 ° 27.47 'W
080	CTD, bongo, 5-min and 10-min neust.	02-May-2011	07:45z	18 ° 13.67 'N	67 ° 25.50 'W
081	CTD, bongo, 5-min and 10-min neust.	02-May-2011	09:32z	18 ° 10.53 'N	67 ° 19.80 'W
082	CTD, bongo, 5-min and 10-min neust.	02-May-2011	17:54z	18 ° 25.95 'N	67 ° 26.62 'W
083	CTD, bongo, 5-min and 10-min neust.	02-May-2011	20:15z	18 ° 30.04 'N	67 ° 36.42 'W
084	CTD, bongo, 5-min and 10-min neust.	02-May-2011	22:54z	18 ° 34.00 'N	67 ° 46.18 'W
085	CTD, bongo, 5-min and 10-min neust.	03-May-2011	01:40z	18 ° 37.91 'N	67 ° 55.70 'W
086	CTD, bongo, 5-min and 10-min neust.	03-May-2011	03:55z	18 ° 41.80 'N	68 ° 05.42 'W
087	CTD, bongo, 5-min and 10-min neust.	03-May-2011	06:13z	18 ° 45.75 'N	68 ° 15.14 'W
088	CTD, bongo, 5-min neuston	04-May-2011	19:26z	22 ° 33.50 'N	73 ° 13.84 'W
089	CTD, bongo, 5-min neuston	04-May-2011	22:55z	22 ° 43.89 'N	73 ° 39.61 'W
090	CTD/LADCP, bongo, 5-min neuston	05-May-2011	05:51z	22 ° 45.81 'N	74 ° 40.12 'W
091	bongo	05-May-2011	10:56z	23 ° 07.34 'N	74 ° 40.20 'W
092	bongo	05-May-2011	13:20z	23 ° 28.67 'N	74 ° 40.02 'W
093	CTD, bongo, 5-min neuston	05-May-2011	15:41z	23 ° 50.15 'N	74 ° 39.80 'W
094	bongo	05-May-2011	23:30z	24 ° 26.91 'N	74 ° 45.88 'W
095	bongo	06-May-2011	2:25z	24 ° 50.87 'N	74 ° 59.47 'W
096	bongo	06-May-2011	4:52z	25 ° 14.81 'N	75 ° 13.11 'W
097	CTD/LADCP, bongo, 5-min neuston	06-May-2011	09:19z	25 ° 30.66 'N	75 ° 37.20 'W
098	CTD/LADCP, bongo, 5-min neuston	06-May-2011	12:18z	25 ° 22.79 'N	75 ° 47.93 'W
099	CTD/LADCP	06-May-2011	14:39z	25 ° 16.43 'N	75 ° 56.54 'W
100	CTD/LADCP, bongo, 5-min neuston	06-May-2011	16:25z	25 ° 12.61 'N	76 ° 01.79 'W
101	bongo, 5-min neuston	06-May-2011	21:10z	25 ° 38.03 'N	76 ° 31.07 'W

Table 2. NF-11-02 Surface Drifter Deployments

Drifter ID Number	Deployment Comments	Deployment Date	Deployment Time	Deployment Latitude	Deployment Longitude
90225	Deployed near stn #012	20-Apr-2011	23:07	18 ° 34.37 ' N	65 ° 10.52 ' W
90226	Deployed near stn #015	21-Apr-2011	04:25	18 ° 37.05 ' N	64 ° 56.26 ' W
90235	Deployed near stn #026	21-Apr-2011	21:30	18 ° 04.85 ' N	65 ° 01.98 ' W
90205	Deployed near stn #029	22-Apr-2011	01:00	18 ° 12.70 ' N	65 ° 05.07 ' W
90204	Deployed near stn #034	22-Apr-2011	19:55	18 ° 11.70 ' N	65 ° 12.18 ' W
102577	Deployed near stn #037	23-Apr-2011	01:18	18 ° 05.50 ' N	64 ° 51.20 ' W
102571	Deployed near stn #044	24-Apr-2011	00:12	18 ° 10.80 ' N	64 ° 36.55 ' W
90206	Deployed near stn #045	24-Apr-2011	01:29	18 ° 14.80 ' N	64 ° 38.90 ' W
102572	Deployed near stn #048	24-Apr-2011	04:58	18 ° 11.31 ' N	64 ° 43.66 ' W
102570	Deployed near stn #075	01-May-2011	22:15	18 ° 25.58 ' N	67 ° 56.58 ' W
102568	Deployed between stn #077 and #078	02-May-2011	02:36	18 ° 20.20 ' N	67 ° 42.43 ' W

Table 3. NF-11-02 Mooring Recoveries and Deployments

Mooring Name	Deployment Comments	Deployment Latitude		Deployment Longitude	
VS1	Recovered Vieques Sound - ADCP	18 °	10.6 ' N	65 °	20.5 ' W
VS2	Recovered Vieques Sound - ADCP, CT	18 °	13.1 ' N	65 °	19.2 ' W
VS3	Recovered Vieques Sound - ADCP	18 °	15.6 ' N	65 °	18.0 ' W
VP1	Recovered Virgin Passage - ADCP	18 °	18.2 ' N	65 °	11.3 ' W
VP3	Recovered Virgin Passage - ADCP	18 °	20.1 ' N	65 °	03.0 ' W
VP2	Recovered Virgin Passage - ADCP, CT	18 °	19.2 ' N	65 °	07.0 ' W
GB2	Deployed Grammanik Bank - ADCP	18 °	15.5 ' N	64 °	57.5 ' W
GB3	Deployed Grammanik Bank - ADCP	18 °	17.8 ' N	64 °	57.5 ' W
FC1	Deployed Frenchcap Cay - ADCP, CT	18 °	11.9 ' N	64 °	51.3 ' W
FC2	Deployed Frenchcap Cay - ADCP	18 °	14.5 ' N	64 °	51.0 ' W
FC3	Deployed Frenchcap Cay - ADCP	18 °	17.3 ' N	64 °	50.9 ' W