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PRELIMINARY CRUISE REPORT

NOAA CRUISE ID:
NF-10-01 and NF-10-02

US STATE DEPARTMENT CRUISE ID:
DOS-2009-107

SHIP NAME:
NOAA Ship *Nancy Foster*

OPERATING AGENCY:
National Oceanic and Atmospheric Administration (NOAA)

PROJECT TITLE:
Coral Reef Ecosystem Research / Reef Fish Resources

CRUISE DATES:
16 February 2010 – 2 March 2010 (NF-10-01)
5 – 15 March 2010 (NF-10-02)

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CLEARANCE COUNTRIES:
Antigua and Barbuda
Guadeloupe/France, for Guadeloupe, Saint Martin, and Saint Barthelemy
Netherlands Antilles, for Saba, Sint Eustatius, and Sint Maarten
United Kingdom, for Anguilla, British Virgin Islands, and Montserrat
Saint Kitts and Nevis

PORT OF EMBARKATION:
Charleston, South Carolina (USA)

PORT OF DISEMBARKATION:
Charlotte Amalie, St. Thomas, USVI (USA)



PRELIMINARY CRUISE REPORT

CORAL REEF ECOSYSTEM RESEARCH / REEF FISH RESOURCES

NOAA Ship *Nancy Foster*
NF-10-01 and NF-10-02
16 February 2010 – 15 March 2010

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 titled the *USVI Larval Reef Fish Distribution and Supply Study*. This collaborative endeavor utilizes the NOAA Ship *Nancy Foster* to perform biological and physical oceanographic surveys of the Virgin Islands (VI) bank ecosystems and surrounding regional waters, and to service oceanographic moorings deployed across Vieques Sound and Virgin Passage (US). 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.

1. Cruise Summary (continued)

Scientific Objectives:

This biological and oceanographic research 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.

In efforts to develop more specific hypotheses, project scientists began collecting data in 2007. Since that time, annual research cruises to the study area have sampled water properties, currents, and dispersal and transport of settlement-stage larvae in the VI and neighboring regions. Data collection efforts continued in the northeastern Caribbean in 2010, and were augmented by the deployment of an acoustic Doppler current profiler (ADCP) moored array in the area of Vieques Sound and Virgin Passage. This moored instrumentation will aid scientists in assessing the temporal variability and mean flow characteristics of nearshore currents affecting larval dispersal and transport.

This year, two scheduled NOAA Ship *Nancy Foster* research cruises (NF-10-01: Coral Reef Ecosystem Research, and NF-10-02: Reef Fish Resources) supported *USVI Larval Reef Fish Distribution and Supply Study* data collection efforts. This preliminary cruise report will provide a summary of the scientific operations performed during these two cruises.

1. Cruise Summary (continued)

Methods

Similar to previous project cruises, the 2010 *USVI Larval Reef Fish Distribution and Supply Study* 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. To this end, the February/March 2010 survey was extended to encompass the coastal regions surrounding St. Croix. This additional spatial coverage will help to determine whether MPAs and conservation areas south of St. Thomas should be managed together with sensitive coastal sites around St. Croix, or if each island's marine ecosystem can effectively be managed as a separate entity. Additionally, focused surveys of Vieques Sound and Virgin Passage were also conducted in conjunction with the ADCP moored array deployed there.

NF-10-01 and NF-10-02 cruise tracks and station locations are shown in Figure 1 and Figure 2 respectively. Station locations and arrival times are listed in Table 1. Discrete sampling operations included bongo and 1-meter MOCNESS trawl tows; CTD casts profiling temperature, salinity, dissolved oxygen, chlorophyll, and water velocity; and Profiling Reflectance Radiometer (PRR) casts profiling optical irradiance/radiance of the near-surface water column. Continuous surface measurements of temperature, salinity, chlorophyll, 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, and to direct adaptive sampling of these features as the survey progressed.

2. Itinerary

NF-10-01: Coral Reef Ecosystem Research

- 2/16/2010 – Depart from Charleston, SC (transit to work area)
- 2/21/2010 – Arrive at Frederiksted, St. Croix, USVI
- 2/23/2010 – Depart from Frederiksted, St. Croix (commence science operations)
- 3/02/2010 – Arrive at Road Town, Tortola, BVI

NF-10-02: Reef Fish Resources

- 3/05/2010 – Depart from Road Town, Tortola (commence science operations)
- 3/15/2010 – Arrive at Charlotte Amalie, St. Thomas, USVI

3. Scientific Personnel

NF-10-01 Participants:

Ryan Smith	USA	NOAA/AOML/PhOD	Chief Scientist
David Lindo	Spain	NOAA/AOML/PhOD	Scientist
Nelson Melo	USA	NOAA/AOML/PhOD	Scientist
Grant Rawson	USA	NOAA/AOML/PhOD	Scientist
Alex Ender	USA	NOAA/NMFS/SEFSC	Student
Francisco Fuenmayor	USA	NOAA/NMFS/SEFSC	Scientist
John Lamkin	USA	NOAA/NMFS/SEFSC	Scientist
Estrella Malca	USA	NOAA/NMFS/SEFSC	Scientist
Barbara Muhling	Australia	NOAA/NMFS/SEFSC	Scientist
Sarah Privoznik	USA	NOAA/NMFS/SEFSC	Scientist
Christine Quigley	USA	NOAA/NMFS/SEFSC	Student
Aki Shiroza	Japan	NOAA/NMFS/SEFSC	Scientist
Blake Bennett	USA	UVI, St. Thomas	Student

NF-10-02 Participants:

Ryan Smith	USA	NOAA/AOML/PhOD	Chief Scientist
Elizabeth Johns	USA	NOAA/AOML/PhOD	Scientist
David Lindo	Spain	NOAA/AOML/PhOD	Scientist
Nelson Melo	USA	NOAA/AOML/PhOD	Scientist
Grant Rawson	USA	NOAA/AOML/PhOD	Scientist
Francisco Fuenmayor	USA	NOAA/NMFS/SEFSC	Scientist
John Lamkin	USA	NOAA/NMFS/SEFSC	Scientist
Estrella Malca	USA	NOAA/NMFS/SEFSC	Scientist
Barbara Muhling	Australia	NOAA/NMFS/SEFSC	Scientist
Sarah Privoznik	USA	NOAA/NMFS/SEFSC	Scientist
Aki Shiroza	Japan	NOAA/NMFS/SEFSC	Scientist
Samantha Whitcraft	USA	NOAA/NMFS/SEFSC	Scientist
Kevin Brown	USA	UVI, St. Thomas	Scientist

4. Discrete Sampling

Bongo Tows

Bongo tows were conducted throughout the course of the survey at station locations listed in Table 1 and plotted in Figures 1 and 2. Catches were collected from 99 tows using a 0.9 m bongo net with a mesh size of 0.505 mm. Each horizontal subsurface tow was performed for approximately 10 minutes. Volumes filtered were calculated using a mechanical flow meter attached to the mouth of the bongo net.

MOCNESS Tows

A Multiple Opening/Closing Net and Environmental Sampling System (MOCNESS) was deployed at offshore and ‘shelf-break’ sampling stations (Table 1, Figs. 1 and 2). 58 MOCNESS tows were conducted to a depth of 100 meters. During each tow, at the device’s maximum depth, MOCNESS operators tripped a down-cast net, and then incrementally tripped nets during the up-cast every 25 meters (for a total of 5 nets/catches). Approximately 300 m³ of water were filtered by each net. All nets were constructed with a 0.333 mm mesh and designed with a 1 m² projected area (mouth opening).

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 14 of these casts, a 300 kHz RD Instruments (RDI) broadband lowered acoustic Doppler current profiler (LADCP) was 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 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 and 2.

PRR Casts

At 12 stations throughout the survey, PRR casts were performed using a Biospherical Instruments PRR-2600 Profiling Reflectance Radiometer. The PRR was lowered to approximately 30 m depth on each of the casts. The instrument is designed to measure 8 channels of downwelling irradiance and upwelling radiance, temperature, and pressure. PRR cast locations are listed in Table 1 (identified as “optics”) and plotted in Figures 1 and 2 (identified as “optical casts”).

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-10-01/02, 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 Anegada Passage where, in an effort to achieve maximum 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, 13 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-10-02, six ADCP moorings were deployed between Puerto Rico and St. Thomas. Three Nortek Aquadopp 600 kHz ADCPs were deployed in approximately 30 m of water between Vieques and Culebra (Vieques Sound). Three Nortek Aquadopp 600 kHz ADCPs were also deployed across Virgin Passage between Culebra and St. Thomas at similar depths. A single Sea-Bird MicroCat CT recorder was deployed in the middle of each passage attached to the center ADCP. Initially, mooring mounts were placed using the ship and a small boat. Upon completion, instruments were attached to the mounts by divers. The ADCPs will measure water velocity throughout the water column at each mooring location and together are designed to quantify volume transport across each section. The two CT recorders will provide a time-series of temperature and salinity in each passage. Mooring locations are plotted in Figure 3 and listed in Table 3.

8. Release of Project Data

In accordance with the provisions specified in the cruise instructions and application for foreign clearances, the complete data set assembled during the NF-10-01/02 research cruise will be provided to all clearance countries. Identification and analysis of biological samples and shipboard data analysis commenced immediately following the conclusion of the cruise and should be completed by mid 2011. All processed data (biological and oceanographic) collected during the cruise will be delivered to the U.S. Department of State within 18 months of the completion of the cruise.

9. Acknowledgments

The support and assistance provided by the officers and crew of the NOAA Ship *Nancy Foster*, and the dedicated efforts of UVI participants Kevin Brown and Blake Bennett are gratefully acknowledged.

NF-10-01 Completed Cruise Track and Station Locations Feb. 23 - Mar. 2, 2010

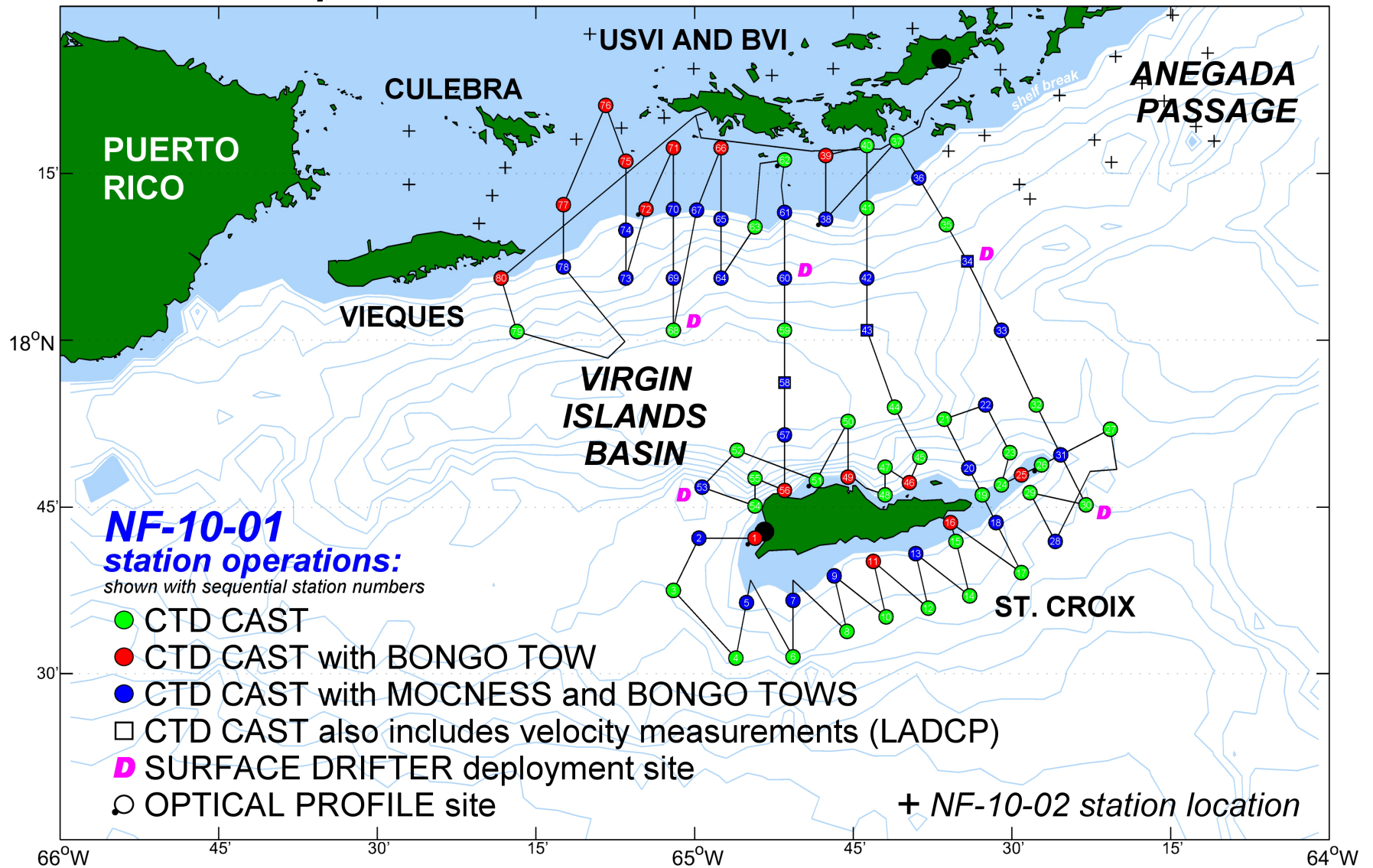


Figure 1. NF-10-01 discrete sampling locations and completed cruise track are shown above. Station numbers are shown for each location and can be referenced in Table 1. Marker colors indicate operations conducted at each site.

NF-10-02 Completed Cruise Track and Station Locations March 5 -15, 2010

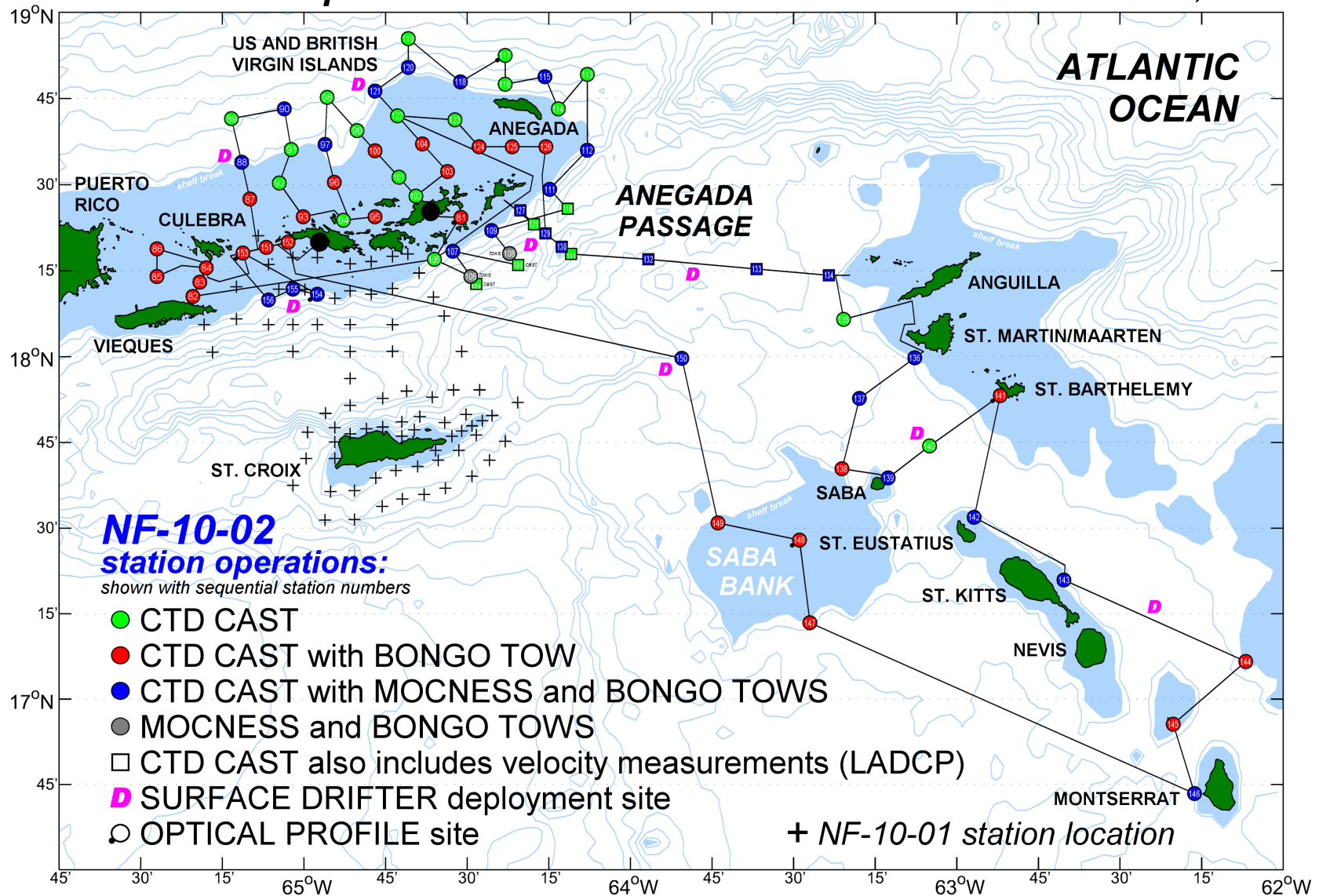


Figure 2. NF-10-02 discrete sampling locations and completed cruise track are shown above. Station numbers are shown for each location and can be referenced in Table 1. Marker colors indicate operations conducted at each site.

NF-10-01/02 Vieques Sound and Virgin Passage Mooring Locations

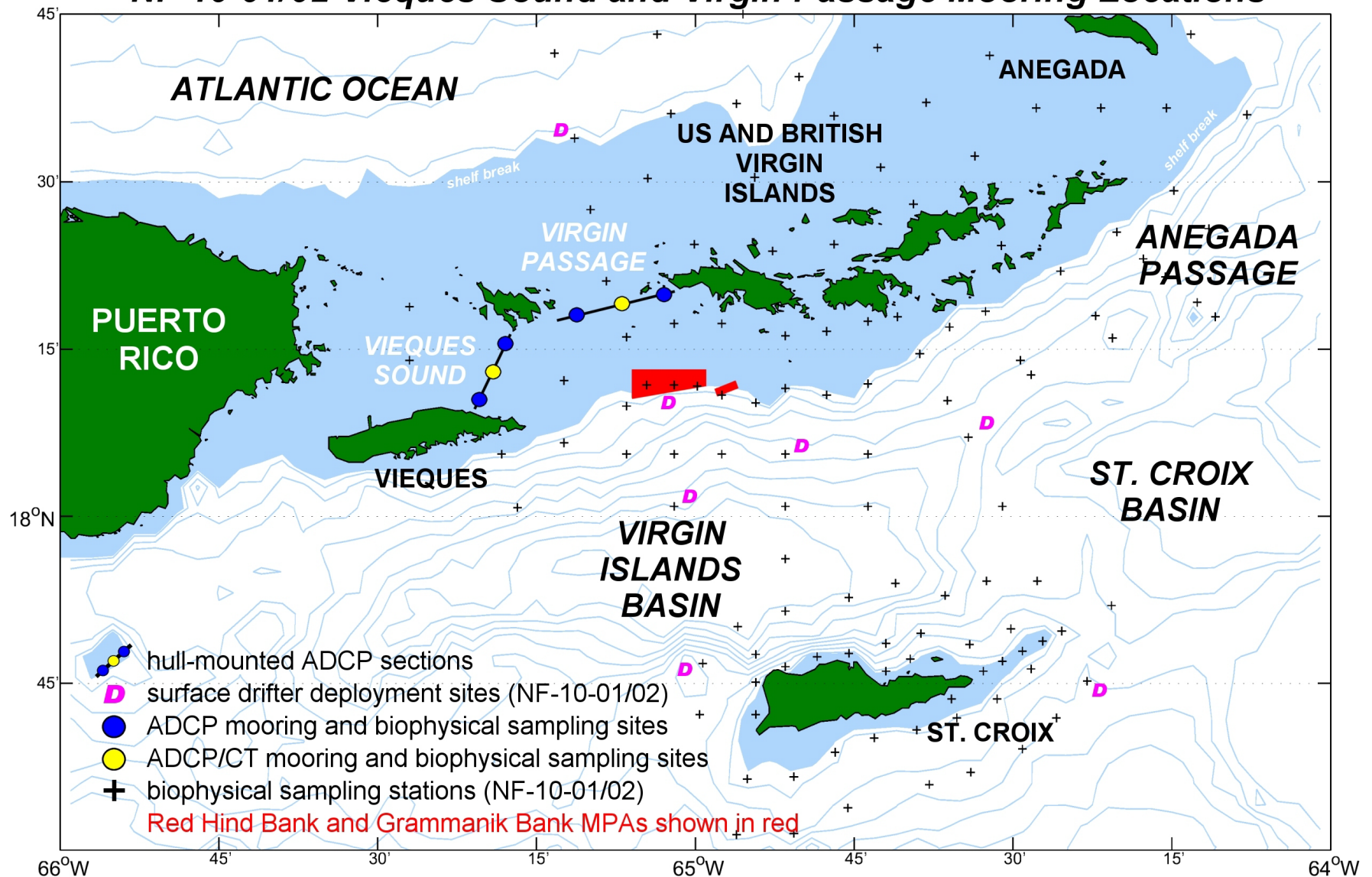


Figure 3. Vieques Sound and Virgin Passage mooring locations are shown above. The six moorings (4 ADCP, 2 ADCP/CT) were deployed during NF-10-01 and NF-10-02.

Table 1. NF-10-01 and NF-10-02 Discrete Sampling Stations

Station Number	Station Operations Casts and Tows	Station Arrival		Station Position	
		Date	Time	Latitude	Longitude
001	CTD, bongo, optics	23-Feb-2010	15:57z	17 ° 42.21 ' N	64 ° 54.38 ' W
002	CTD, MOCNESS, bongo	23-Feb-2010	18:30z	17 ° 42.23 ' N	64 ° 59.69 ' W
003	CTD	23-Feb-2010	21:42z	17 ° 37.47 ' N	65 ° 02.11 ' W
004	CTD	23-Feb-2010	23:18z	17 ° 31.46 ' N	64 ° 56.01 ' W
005	CTD, MOCNESS, bongo	24-Feb-2010	00:33z	17 ° 36.36 ' N	64 ° 55.03 ' W
006	CTD	24-Feb-2010	03:58z	17 ° 31.49 ' N	64 ° 50.63 ' W
007	CTD, MOCNESS, bongo	24-Feb-2010	05:03z	17 ° 36.61 ' N	64 ° 50.68 ' W
008	CTD	24-Feb-2010	08:09z	17 ° 33.90 ' N	64 ° 45.56 ' W
009	CTD, MOCNESS, bongo	24-Feb-2010	09:18z	17 ° 38.74 ' N	64 ° 46.82 ' W
010	CTD	24-Feb-2010	11:53z	17 ° 35.15 ' N	64 ° 42.02 ' W
011	CTD, bongo	24-Feb-2010	13:05z	17 ° 40.21 ' N	64 ° 43.16 ' W
012	CTD	24-Feb-2010	14:35z	17 ° 35.98 ' N	64 ° 37.97 ' W
013	CTD, MOCNESS, bongo	24-Feb-2010	15:39z	17 ° 40.84 ' N	64 ° 39.10 ' W
014	CTD	24-Feb-2010	18:24z	17 ° 36.95 ' N	64 ° 33.94 ' W
015	CTD	24-Feb-2010	19:31z	17 ° 41.87 ' N	64 ° 35.38 ' W
016	CTD, bongo	25-Feb-2010	00:20z	17 ° 43.50 ' N	64 ° 35.84 ' W
017	CTD	25-Feb-2010	01:50z	17 ° 38.96 ' N	64 ° 29.10 ' W
018	CTD, MOCNESS, bongo	25-Feb-2010	03:08z	17 ° 43.42 ' N	64 ° 31.52 ' W
019	CTD	25-Feb-2010	05:36z	17 ° 46.23 ' N	64 ° 32.82 ' W
020	CTD, MOCNESS, bongo	25-Feb-2010	06:09z	17 ° 48.68 ' N	64 ° 34.23 ' W
021	CTD	25-Feb-2010	08:47z	17 ° 52.79 ' N	64 ° 36.31 ' W
022	CTD, MOCNESS, bongo	25-Feb-2010	09:53z	17 ° 54.06 ' N	64 ° 32.46 ' W
023	CTD	25-Feb-2010	12:50z	17 ° 49.75 ' N	64 ° 30.13 ' W
024	CTD	25-Feb-2010	13:34z	17 ° 47.06 ' N	64 ° 31.03 ' W
025	CTD, bongo	25-Feb-2010	14:07z	17 ° 47.88 ' N	64 ° 29.22 ' W
026	CTD, optics	25-Feb-2010	14:56z	17 ° 48.68 ' N	64 ° 27.18 ' W
027	CTD	25-Feb-2010	16:20z	17 ° 51.95 ' N	64 ° 20.62 ' W
028	CTD, MOCNESS, bongo	25-Feb-2010	18:12z	17 ° 41.87 ' N	64 ° 25.86 ' W
029	CTD	25-Feb-2010	20:58z	17 ° 46.34 ' N	64 ° 28.26 ' W
030	CTD	25-Feb-2010	22:07z	17 ° 45.12 ' N	64 ° 23.13 ' W
031	CTD, MOCNESS, bongo	25-Feb-2010	23:14z	17 ° 49.62 ' N	64 ° 25.22 ' W
032	CTD	26-Feb-2010	01:56z	17 ° 54.30 ' N	64 ° 27.63 ' W
033	CTD, MOCNESS, bongo	26-Feb-2010	03:23z	18 ° 00.85 ' N	64 ° 30.98 ' W
034	CTD/LADCP, MOCNESS, bongo	26-Feb-2010	05:52z	18 ° 07.04 ' N	64 ° 34.17 ' W
035	CTD	26-Feb-2010	10:32z	18 ° 10.40 ' N	64 ° 36.30 ' W
036	CTD, MOCNESS, bongo	26-Feb-2010	11:40z	18 ° 14.44 ' N	64 ° 38.50 ' W
037	CTD	26-Feb-2010	14:24z	18 ° 17.84 ' N	64 ° 41.08 ' W
038	CTD, MOCNESS, bongo, optics	26-Feb-2010	15:45z	18 ° 10.79 ' N	64 ° 47.66 ' W
039	CTD, bongo	26-Feb-2010	18:48z	18 ° 16.67 ' N	64 ° 47.55 ' W
040	CTD	26-Feb-2010	19:41z	18 ° 17.49 ' N	64 ° 43.64 ' W
041	CTD	26-Feb-2010	20:35z	18 ° 11.77 ' N	64 ° 43.55 ' W
042	CTD, MOCNESS, bongo	26-Feb-2010	21:51z	18 ° 05.52 ' N	64 ° 43.62 ' W
043	CTD/LADCP, MOCNESS, bongo	27-Feb-2010	00:54z	18 ° 00.75 ' N	64 ° 43.71 ' W
044	CTD	27-Feb-2010	06:58z	17 ° 54.02 ' N	64 ° 41.13 ' W
045	CTD	27-Feb-2010	08:03z	17 ° 49.48 ' N	64 ° 38.73 ' W
046	CTD, bongo	27-Feb-2010	08:48z	17 ° 47.29 ' N	64 ° 39.58 ' W
047	CTD	27-Feb-2010	10:08z	17 ° 48.60 ' N	64 ° 41.97 ' W
048	CTD	27-Feb-2010	11:02z	17 ° 46.37 ' N	64 ° 42.25 ' W
049	CTD, bongo	27-Feb-2010	12:23z	17 ° 47.70 ' N	64 ° 45.59 ' W
050	CTD	27-Feb-2010	15:35z	17 ° 52.50 ' N	64 ° 45.69 ' W
051	CTD, optics	27-Feb-2010	16:46z	17 ° 47.44 ' N	64 ° 48.59 ' W
052	CTD	27-Feb-2010	18:26z	17 ° 50.18 ' N	64 ° 56.10 ' W
053	CTD, MOCNESS, bongo	27-Feb-2010	19:23z	17 ° 46.77 ' N	64 ° 59.23 ' W
054	CTD	27-Feb-2010	23:07z	17 ° 45.11 ' N	64 ° 54.31 ' W
055	CTD	27-Feb-2010	23:58z	17 ° 47.54 ' N	64 ° 54.41 ' W
056	CTD, bongo	28-Feb-2010	00:49z	17 ° 46.51 ' N	64 ° 51.50 ' W

Table 1. NF-10-01 and NF-10-02 Discrete Sampling Stations

Station Number	Station Operations Casts and Tows	Station Arrival		Station Position	
		Date	Time	Latitude	Longitude
057	CTD, MOCNESS, bongo	28-Feb-2010	02:31z	17 ° 51.38 ' N	64 ° 51.46 ' W
058	CTD/LADCP, MOCNESS, bongo	28-Feb-2010	05:09z	17 ° 56.15 ' N	64 ° 51.48 ' W
059	CTD	28-Feb-2010	11:08z	18 ° 00.95 ' N	64 ° 51.51 ' W
060	CTD, MOCNESS, bongo	28-Feb-2010	12:21z	18 ° 05.62 ' N	64 ° 51.68 ' W
061	CTD, MOCNESS, bongo	28-Feb-2010	15:00z	18 ° 11.44 ' N	64 ° 51.45 ' W
062	CTD, optics	28-Feb-2010	17:38z	18 ° 16.19 ' N	64 ° 51.57 ' W
063	CTD	28-Feb-2010	19:05z	18 ° 10.12 ' N	64 ° 54.30 ' W
064	CTD, MOCNESS, bongo	28-Feb-2010	20:14z	18 ° 05.66 ' N	64 ° 57.52 ' W
065	CTD, MOCNESS, bongo	28-Feb-2010	23:14z	18 ° 10.84 ' N	64 ° 57.50 ' W
066	CTD, bongo	01-Mar-2010	02:09z	18 ° 17.29 ' N	64 ° 57.41 ' W
067	CTD, MOCNESS, bongo	01-Mar-2010	03:27z	18 ° 11.42 ' N	64 ° 59.91 ' W
068	CTD	01-Mar-2010	06:39z	18 ° 00.78 ' N	65 ° 02.01 ' W
069	CTD, MOCNESS, bongo	01-Mar-2010	07:43z	18 ° 05.59 ' N	65 ° 02.09 ' W
070	CTD, MOCNESS, bongo	01-Mar-2010	11:01z	18 ° 11.67 ' N	65 ° 02.28 ' W
071	CTD, bongo	01-Mar-2010	14:02z	18 ° 17.26 ' N	65 ° 02.17 ' W
072	CTD, bongo, optics	01-Mar-2010	15:08z	18 ° 11.71 ' N	65 ° 04.69 ' W
073	CTD, MOCNESS, bongo	01-Mar-2010	16:34z	18 ° 05.46 ' N	65 ° 06.47 ' W
074	CTD, MOCNESS, bongo	01-Mar-2010	19:52z	18 ° 09.96 ' N	65 ° 06.51 ' W
075	CTD, bongo	01-Mar-2010	22:51z	18 ° 16.15 ' N	65 ° 06.40 ' W
076	CTD, bongo	02-Mar-2010	00:00z	18 ° 21.10 ' N	65 ° 08.21 ' W
077	CTD, bongo	02-Mar-2010	01:33z	18 ° 12.15 ' N	65 ° 12.42 ' W
078	CTD, MOCNESS, bongo	02-Mar-2010	02:38z	18 ° 06.54 ' N	65 ° 12.28 ' W
079	CTD	02-Mar-2010	06:37z	18 ° 00.71 ' N	65 ° 16.61 ' W
080	CTD, bongo	02-Mar-2010	07:42z	18 ° 05.52 ' N	65 ° 18.19 ' W
081	CTD, bongo, optics	05-Mar-2010	14:28z	18 ° 24.29 ' N	64 ° 31.24 ' W
082	CTD, bongo	05-Mar-2010	22:55z	18 ° 10.48 ' N	65 ° 20.47 ' W
083	CTD, bongo	05-Mar-2010	23:52z	18 ° 12.91 ' N	65 ° 19.09 ' W
084	CTD, bongo	06-Mar-2010	00:46z	18 ° 15.56 ' N	65 ° 17.98 ' W
085	CTD, bongo	06-Mar-2010	02:25z	18 ° 13.85 ' N	65 ° 27.24 ' W
086	CTD, bongo	06-Mar-2010	03:33z	18 ° 18.84 ' N	65 ° 26.94 ' W
087	CTD, bongo	06-Mar-2010	20:14z	18 ° 27.41 ' N	65 ° 09.83 ' W
088	CTD, MOCNESS, bongo	06-Mar-2010	21:48z	18 ° 33.92 ' N	65 ° 11.39 ' W
089	CTD	07-Mar-2010	02:01z	18 ° 41.24 ' N	65 ° 13.26 ' W
090	CTD, MOCNESS, bongo	07-Mar-2010	03:45z	18 ° 42.97 ' N	65 ° 03.75 ' W
091	CTD	07-Mar-2010	06:33z	18 ° 36.25 ' N	65 ° 02.31 ' W
092	CTD	07-Mar-2010	07:52z	18 ° 30.22 ' N	65 ° 04.42 ' W
093	CTD, bongo	07-Mar-2010	08:56z	18 ° 24.37 ' N	65 ° 00.09 ' W
094	CTD	07-Mar-2010	10:27z	18 ° 23.75 ' N	64 ° 52.74 ' W
095	CTD, bongo	07-Mar-2010	11:16z	18 ° 24.42 ' N	64 ° 46.91 ' W
096	CTD, bongo	07-Mar-2010	13:04z	18 ° 30.37 ' N	64 ° 54.37 ' W
097	CTD, MOCNESS, bongo	07-Mar-2010	14:31z	18 ° 37.10 ' N	64 ° 56.09 ' W
098	CTD	07-Mar-2010	17:17z	18 ° 45.19 ' N	64 ° 55.73 ' W
099	CTD	07-Mar-2010	18:33z	18 ° 39.34 ' N	64 ° 50.17 ' W
100	CTD, bongo	07-Mar-2010	19:31z	18 ° 35.96 ' N	64 ° 46.89 ' W
101	CTD	07-Mar-2010	20:39z	18 ° 31.34 ' N	64 ° 42.42 ' W
102	CTD	07-Mar-2010	21:20z	18 ° 28.00 ' N	64 ° 39.33 ' W
103	CTD, bongo	07-Mar-2010	22:20z	18 ° 32.24 ' N	64 ° 33.49 ' W
104	CTD, bongo	07-Mar-2010	23:42z	18 ° 37.03 ' N	64 ° 38.08 ' W
105	CTD	08-Mar-2010	06:03z	18 ° 16.86 ' N	64 ° 35.74 ' W
106C	CTD/LADCP	08-Mar-2010	08:15z	18 ° 12.59 ' N	64 ° 28.32 ' W
106T	MOCNESS, bongo	08-Mar-2010	10:46z	18 ° 14.00 ' N	64 ° 29.30 ' W
107	CTD, MOCNESS, bongo	08-Mar-2010	12:47z	18 ° 18.29 ' N	64 ° 32.45 ' W
108C	CTD/LADCP	08-Mar-2010	16:04z	18 ° 15.97 ' N	64 ° 20.62 ' W
108T	MOCNESS, bongo	08-Mar-2010	18:45z	18 ° 18.00 ' N	64 ° 22.20 ' W
109	CTD, MOCNESS, bongo	08-Mar-2010	20:35z	18 ° 22.00 ' N	64 ° 25.50 ' W
110	CTD/LADCP	08-Mar-2010	23:54z	18 ° 25.63 ' N	64 ° 11.54 ' W

Table 1. NF-10-01 and NF-10-02 Discrete Sampling Stations

Station Number	Station Operations Casts and Tows	Station Arrival		Station Position	
		Date	Time	Latitude	Longitude
111	CTD, MOCNESS, bongo	09-Mar-2010	02:22z	18 ° 29.28 ' N	64 ° 14.86 ' W
112	CTD, MOCNESS, bongo	09-Mar-2010	05:15z	18 ° 36.04 ' N	64 ° 07.88 ' W
113	CTD	09-Mar-2010	08:36z	18 ° 49.17 ' N	64 ° 07.87 ' W
114	CTD	09-Mar-2010	09:54z	18 ° 43.65 ' N	64 ° 12.81 ' W
115	CTD, MOCNESS, bongo	09-Mar-2010	11:10z	18 ° 48.77 ' N	64 ° 15.66 ' W
116	CTD	09-Mar-2010	14:07z	18 ° 47.53 ' N	64 ° 22.98 ' W
117	CTD, optics	09-Mar-2010	15:10z	18 ° 52.52 ' N	64 ° 22.98 ' W
118	CTD, MOCNESS, bongo	09-Mar-2010	16:53z	18 ° 47.91 ' N	64 ° 31.19 ' W
119	CTD	09-Mar-2010	19:51z	18 ° 55.35 ' N	64 ° 40.84 ' W
120	CTD, MOCNESS, bongo	09-Mar-2010	20:53z	18 ° 50.37 ' N	64 ° 40.69 ' W
121	CTD, MOCNESS, bongo	10-Mar-2010	00:04z	18 ° 46.24 ' N	64 ° 46.84 ' W
122	CTD	10-Mar-2010	03:10z	18 ° 41.95 ' N	64 ° 42.73 ' W
123	CTD	10-Mar-2010	04:26z	18 ° 41.24 ' N	64 ° 32.25 ' W
124	CTD, bongo	10-Mar-2010	05:18z	18 ° 36.51 ' N	64 ° 27.78 ' W
125	CTD, bongo	10-Mar-2010	06:20z	18 ° 36.50 ' N	64 ° 21.73 ' W
126	CTD, bongo	10-Mar-2010	07:20z	18 ° 36.58 ' N	64 ° 15.53 ' W
127	CTD/LADCP, MOCNESS, bongo	10-Mar-2010	13:04z	18 ° 24.90 ' N	64 ° 20.25 ' W
128	CTD/LADCP	10-Mar-2010	14:20z	18 ° 23.07 ' N	64 ° 17.69 ' W
129	CTD/LADCP, MOCNESS, bongo	10-Mar-2010	16:21z	18 ° 21.29 ' N	64 ° 15.50 ' W
130	CTD/LADCP, MOCNESS, bongo	10-Mar-2010	19:22z	18 ° 19.43 ' N	64 ° 12.69 ' W
131	CTD/LADCP	10-Mar-2010	22:35z	18 ° 17.92 ' N	64 ° 11.01 ' W
132	CTD/LADCP, MOCNESS, bongo	11-Mar-2010	02:00z	18 ° 16.96 ' N	63 ° 56.73 ' W
133	CTD/LADCP, MOCNESS, bongo	11-Mar-2010	07:01z	18 ° 15.27 ' N	63 ° 36.85 ' W
134	CTD/LADCP, MOCNESS, bongo	11-Mar-2010	11:07z	18 ° 14.18 ' N	63 ° 23.48 ' W
135	CTD	11-Mar-2010	15:43z	18 ° 06.46 ' N	63 ° 20.90 ' W
136	CTD, MOCNESS, bongo	11-Mar-2010	23:08z	17 ° 59.80 ' N	63 ° 07.79 ' W
137	CTD, MOCNESS, bongo	12-Mar-2010	02:38z	17 ° 52.67 ' N	63 ° 17.96 ' W
138	CTD, bongo	12-Mar-2010	06:03z	17 ° 40.30 ' N	63 ° 21.02 ' W
139	CTD, MOCNESS, bongo	12-Mar-2010	07:52z	17 ° 38.98 ' N	63 ° 12.43 ' W
140	CTD	12-Mar-2010	10:57z	17 ° 44.37 ' N	63 ° 05.03 ' W
141	CTD, bongo, optics	12-Mar-2010	13:12z	17 ° 53.12 ' N	62 ° 51.92 ' W
142	CTD, MOCNESS, bongo	12-Mar-2010	16:16z	17 ° 31.83 ' N	62 ° 56.49 ' W
143	CTD, MOCNESS, bongo	12-Mar-2010	20:33z	17 ° 20.97 ' N	62 ° 40.00 ' W
144	CTD, bongo	13-Mar-2010	03:18z	17 ° 06.60 ' N	62 ° 07.72 ' W
145	CTD, bongo	13-Mar-2010	06:01z	16 ° 55.59 ' N	62 ° 20.12 ' W
146	CTD, MOCNESS, bongo	13-Mar-2010	07:48z	16 ° 43.43 ' N	62 ° 16.36 ' W
147	CTD, bongo	13-Mar-2010	16:49z	17 ° 13.34 ' N	63 ° 27.02 ' W
148	CTD, bongo, optics	13-Mar-2010	19:12z	17 ° 27.90 ' N	63 ° 28.89 ' W
149	CTD, bongo	13-Mar-2010	21:22z	17 ° 30.91 ' N	63 ° 43.92 ' W
150	CTD, MOCNESS, bongo	14-Mar-2010	00:57z	17 ° 59.65 ' N	63 ° 50.50 ' W
151	CTD, bongo	14-Mar-2010	16:18z	18 ° 18.95 ' N	65 ° 06.84 ' W
152	CTD, bongo	14-Mar-2010	16:55z	18 ° 19.91 ' N	65 ° 02.89 ' W
153	CTD, bongo, optics	14-Mar-2010	18:08z	18 ° 18.17 ' N	65 ° 11.27 ' W
154	CTD, MOCNESS, bongo, optics	14-Mar-2010	20:26z	18 ° 10.91 ' N	64 ° 57.49 ' W
155	CTD, MOCNESS, bongo	14-Mar-2010	23:17z	18 ° 11.78 ' N	65 ° 01.98 ' W
156	CTD, MOCNESS, bongo	15-Mar-2010	01:53z	18 ° 09.81 ' N	65 ° 06.49 ' W

Table 2. NF-10-01 and NF-10-02 Surface Drifter Deployments

Drifter ID Number	Deployment Comments	Deployment		Deployment	
		Date	Time	Latitude	Longitude
90233	stn #030, east of St. Croix	25-Feb-2010	22:34z	17 ° 45.34 ' N	64 ° 23.21 ' W
90231	stn #034, southeast of St. John	26-Feb-2010	10:01z	18 ° 07.02 ' N	64 ° 34.38 ' W
90219	stn #053, west of St. Croix	27-Feb-2010	22:31z	17 ° 46.13 ' N	60 ° 58.58 ' W
90221	stn #060, south of St. Thomas	28-Feb-2010	14:17z	18 ° 06.00 ' N	64 ° 51.29 ' W
90232	stn #068, south of St. Thomas	01-Mar-2010	07:07z	18 ° 01.00 ' N	65 ° 02.08 ' W
90229	stn #088, north of Culebra	07-Mar-2010	00:47z	18 ° 33.54 ' N	65 ° 10.53 ' W
90223	stn #121, north of USVI/BVI banks	10-Mar-2010	02:21z	18 ° 46.98 ' N	64 ° 46.98 ' W
90220	stn #129, Anegada Passage	10-Mar-2010	18:27z	18 ° 21.39 ' N	64 ° 15.47 ' W
90230	Anegada Passage	11-Mar-2010	05:55z	18 ° 16.17 ' N	63 ° 46.89 ' W
90236	stn #140, northeast of Saba	12-Mar-2010	11:25z	17 ° 45.52 ' N	63 ° 05.00 ' W
90222	east of St. Kitts	13-Mar-2010	01:00z	17 ° 15.48 ' N	62 ° 25.24 ' W
90234	stn #150, Anegada Passage	14-Mar-2010	02:49z	17 ° 57.82 ' N	63 ° 49.67 ' W
90238	stn #155, south of St. Thomas	15-Mar-2010	01:20z	18 ° 11.41 ' N	65 ° 02.29 ' W

Table 3. NF-10-01 and NF-10-02 Mooring Deployments

Mooring Name	Deployment Comments	Deployment		Deployment	
		Date	Time	Latitude	Longitude
VS1	Vieques Sound - ADCP	05-Mar-2010	21:30z	18 ° 10.6 ' N	65 ° 20.5 ' W
VS2	Vieques Sound - ADCP, CT	06-Mar-2010	12:05z	18 ° 13.1 ' N	65 ° 19.2 ' W
VS3	Vieques Sound - ADCP	06-Mar-2010	15:10z	18 ° 15.6 ' N	65 ° 18.0 ' W
VP1	Virgin Passage - ADCP	06-Mar-2010	17:40z	18 ° 18.2 ' N	65 ° 11.3 ' W
VP3	Virgin Passage - ADCP	14-Mar-2010	13:05z	18 ° 20.1 ' N	65 ° 03.0 ' W
VP2	Virgin Passage - ADCP, CT	14-Mar-2010	15:15z	18 ° 19.2 ' N	65 ° 07.0 ' W