



U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Atlantic Oceanographic and Meteorological Laboratory
4301 Rickenbacker Causeway Miami FL 33149
TEL: 305-361-4328
FAX: 305-361-4392
EMAIL: ryan.smith@noaa.gov

STANDARD FORM C

FINAL REPORT

Cruise Name/Number:	F2017-003 Coral Reef Ecosystem Research
---------------------	---

Authorizations:

Coastal State	Authorization Document Number	National Participant(s)
Anguilla	UK Foreign & Commonwealth Office 28/2017 response dated 30 MAR 2017	None
The Bahamas	Department of Marine Resources MAMR/FIS/13&17 dated 14 FEB 2017	None
British Virgin Islands	UK Foreign & Commonwealth Office 29/2017 response dated 31 MAR 2017	None
Dominican Republic	Ministerio de Relaciones Exteriores 008385 dated 15 MAR 2017	None
Turks and Caicos Islands	UK Foreign & Commonwealth Office 30/2017 response dated 07 APR 2017	None

Scientist in charge of reporting:

Name:	Ryan Smith
Country/Nationality:	USA
Affiliation:	NOAA/AOML/PhOD
Address:	4301 Rickenbacker Causeway, Miami, FL 33149 USA
Telephone:	305-361-4328
Email:	ryan.smith@noaa.gov
Website (for CV and photo):	www.aoml.noaa.gov/phod/people/smith/



NOTE: Research cruise # F2017-003 has a concurrent National Oceanic and Atmospheric Administration cruise identifier: NF-17-03. In the following materials, cruise # NF-17-03 is synonymous with F2017-003.

Coral Reef Ecosystem Research (2017) FINAL REPORT

CRUISE PERIOD (see Appendices for more information on scientific operations conducted on each leg listed below)

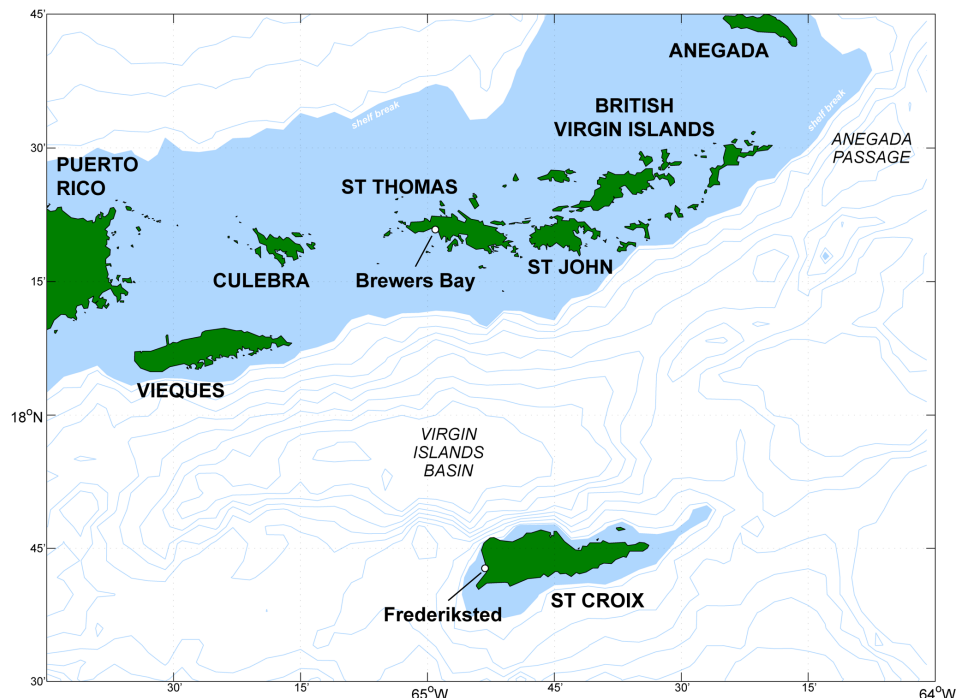
14 April 2017 through 03 May 2017 (NF-17-03)

- 14 April 2017Depart from San Juan, Puerto Rico (begin leg I)
- 15 April 2017Arrive at / Depart from Brewers Bay, St. Thomas, USVI (small boat personnel transfer only)
- 21 April 2017Arrive at / Depart from Brewers Bay, St. Thomas, USVI (small boat personnel transfer only)
- 25 April 2017Arrive at Frederiksted, St. Croix, USVI (end leg I)
- 29 April 2017Depart from Frederiksted, St. Croix, USVI (begin leg II, transit only)
- 03 May 2017Arrive at Key West, Florida (end leg II, transit only)

NOTE: Discrete oceanographic/biological station measurements were only collected on Leg I.

GEOGRAPHIC COVERAGE AREA

The United States Virgin Islands and surrounding region have been the primary focus area of the Coral Reef Ecosystem Research project and were the location of biological and oceanographic sampling during the 2017 survey. A completed cruise track and discrete sampling locations are plotted and described in detail in the Appendices.



BACKGROUND AND OBJECTIVES

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 continued their collaboration in an ongoing field program in 2017 aboard the NOAA Ship *Nancy Foster* (NF). The project, titled Coral Reef Ecosystem Research (CRER), is described below.

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 U.S. Caribbean Fishery Management Council (CFMC) in 2005 to close the bank yearly from February to April. A series of banks south of St. Thomas and St. John, around St. Croix, and south of the British Virgin Islands (BVI) provides similar habitats and spawning aggregation sites. Prior to the inception of this study, the biological and physical processes which drive production on these banks, and the circulation connecting these areas, had not been quantified. As the 2005 management decisions were made in the absence of these data, regional 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, NOAA scientists from SEFSC and 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 NF 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.

Data collected from this program will not only provide information on a data-poor region, but have the potential to address two additional specific needs. First, should economically important species of grouper, snapper, and parrotfish be delineated from individual island groups (e.g. Puerto Rico, St. Thomas/St. John, and St. Croix), from the U.S. 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 Caribbean. However, regional indices are lacking, or in some cases nonexistent. This research will serve to improve existing and generate new indices of abundance for the study area, including not only U.S. waters, but also the surrounding regions.

During the 2017 survey aboard NF, in addition to our standard sampling of regional water properties, currents, and dispersal and transport of fish larvae, a special emphasis was placed on targeted, stratified sampling of Grammanik Bank during a Nassau grouper spawning event (the Nassau grouper is an economically important species for the region).

Additionally, a synoptic sampling effort (over 48 hours) across the VI shelf, from the BVI to Vieques (Puerto Rico), was conducted to examine along-shelf larval exchange. We hypothesize that the physical exchange of offshore waters may control the biological exchange and connectivity along the VI shelf break. Results from the survey should enhance our understanding of regional spatial variation in the supply of fish larvae between managed and non-managed

areas, shed light on the development of shelf break upwelling across the VI, as well as offer insights into the relative importance of Grammanik Bank as a source of juvenile fishes recruiting to the waters of the VI.

METHODOLOGY

The shipboard survey work associated with the 2017 NF-17-03 CRER survey outlined above included plankton tows using a Neuston net (towed from 0-10 meters, designated as an s10 tow), a 90-cm bongo net (towed to sample the full water column up to depths of 100 meters), and a Multiple Opening and Closing Net Environmental Sensing System (MOCNESS, towed to depths of 100 meters). Conductivity-Temperature-Depth (CTD) casts measuring temperature, salinity, dissolved oxygen, chlorophyll, colored dissolved organic matter (CDOM), and water velocity were also performed. Continuous surface measurements of temperature, salinity, chlorophyll, CDOM, and water velocity were collected via the ship's flow-through system and hull-mounted acoustic Doppler current profiler (ADCP). 22 expendable Bathy Thermograph (XBT) probes and 12 satellite-tracked, Lagrangian surface drifters were also deployed.

DISSEMINATION OF PROJECT DATA

Metadata:	January 2019
Raw Data:	Furnished upon request after 2019
Processed Data:	January 2019
Data Analysis:	January 2019
WODC Data Registration (if applicable):	N/A
Data Distribution Method:	This final report and a link to the final data collected during this research cruise will be sent to each coastal state through diplomatic channels. An identical data set will also be made available for public ftp download by the coastal states.

PROCESSED PROJECT DATA WILL BE PUBLICLY AVAILABLE IN JANUARY 2019 AT THE FOLLOWING FTP SITE:

ftp://ftp.aoml.noaa.gov/phod/pub/rsmith/CRER/data/NF1703_State_Dept_DVD

HTTP MIRROR:

http://www.aoml.noaa.gov/ftp/phod/rsmith/CRER/data/NF1703_State_Dept_DVD

APPENDICES

The completed NF-17-03 (F2017-003) cruise track and station locations are illustrated in Appendix 1.

A complete listing of all NF-17-03 (F2017-003) station locations, station occupation times, and station operations are detailed in Appendix 2.

Appendix 1

NF-17-03 (F2017-003) Completed Cruise Track and Station Locations (CHARTLET)

NF-17-03 (F2017-003) Completed Survey Track and Station Operations

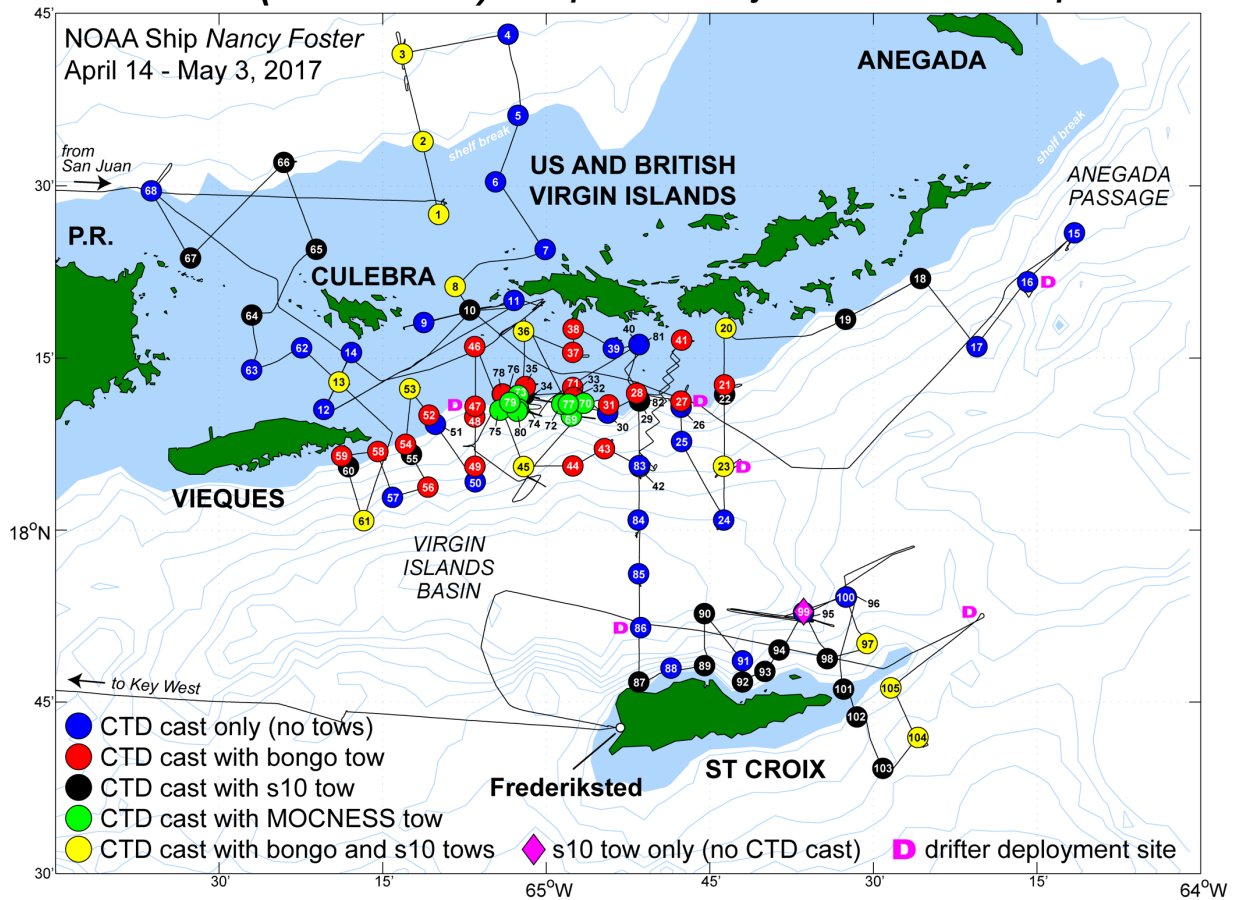


Figure 1. The cruise track (black line) and station numbers, locations, and operations (colored markers) completed during research cruise NF-17-03 (F2017-003) are shown above. Station markers are numbered in the order in which they were conducted. For a detailed description of station activities at each marker location see Appendix 2.

Appendix 2

NF-17-03 (F2017-003) Completed Station Positions, Occupation Times, and Activities

Station #	Leg #	Latitude	Longitude	Date/Time	Operations Completed
001	1	18°27.52'N	065°09.87'W	14-Apr-2017, 22:17z	CTD cast, s10 and bongo tows
002	1	18°33.84'N	065°11.31'W	15-Apr-2017, 00:18z	CTD cast, s10 and bongo tows
003	1	18°41.47'N	065°13.20'W	15-Apr-2017, 05:10z	CTD cast, s10 and bongo tows
004	1	18°43.18'N	065°03.51'W	15-Apr-2017, 08:21z	CTD cast
005	1	18°36.13'N	065°02.60'W	15-Apr-2017, 10:17z	CTD cast
006	1	18°30.34'N	065°04.64'W	15-Apr-2017, 11:34z	CTD cast
007	1	18°24.46'N	065°00.10'W	15-Apr-2017, 12:39z	CTD cast
008	1	18°21.24'N	065°08.35'W	15-Apr-2017, 14:03z	CTD cast, s10 and bongo tows
009	1	18°18.10'N	065°11.23'W	16-Apr-2017, 00:01z	CTD cast
010	1	18°19.19'N	065°07.01'W	16-Apr-2017, 01:07z	CTD cast and s10 tow
011	1	18°20.02'N	065°02.97'W	16-Apr-2017, 02:45z	CTD cast
012	1	18°10.53'N	065°20.40'W	16-Apr-2017, 05:32z	CTD cast
013	1	18°12.92'N	065°19.01'W	16-Apr-2017, 06:28z	CTD cast, s10 and bongo tows
014	1	18°15.49'N	065°17.86'W	16-Apr-2017, 08:02z	CTD cast
015	1	18°25.91'N	064°11.57'W	16-Apr-2017, 21:33z	CTD cast
016	1	18°21.65'N	064°15.86'W	17-Apr-2017, 00:29z	CTD cast
017	1	18°16.01'N	064°20.51'W	17-Apr-2017, 03:23z	CTD cast
018	1	18°21.93'N	064°25.69'W	17-Apr-2017, 06:07z	CTD cast and s10 tow
019	1	18°18.39'N	064°32.55'W	17-Apr-2017, 08:01z	CTD cast and s10 tow
020	1	18°17.62'N	064°43.53'W	17-Apr-2017, 10:16z	CTD cast, s10 and bongo tows
021	1	18°12.68'N	064°43.66'W	17-Apr-2017, 11:53z	CTD cast and bongo tow
022	1	18°11.85'N	064°43.65'W	17-Apr-2017, 13:35z	CTD cast and s10 tow
023	1	18°05.57'N	064°43.74'W	17-Apr-2017, 15:59z	CTD cast, s10 and bongo tows
024	1	18°00.88'N	064°43.73'W	17-Apr-2017, 20:34z	CTD cast
025	1	18°07.73'N	064°47.59'W	18-Apr-2017, 00:52z	CTD cast
026	1	18°10.72'N	064°47.64'W	18-Apr-2017, 02:53z	CTD cast
027	1	18°11.25'N	064°47.66'W	18-Apr-2017, 03:34z	CTD cast and bongo tow
028	1	18°11.94'N	064°51.72'W	18-Apr-2017, 05:57z	CTD cast and bongo tow
029	1	18°11.26'N	064°51.44'W	18-Apr-2017, 07:24z	CTD cast and s10 tow
030	1	18°10.21'N	064°54.37'W	18-Apr-2017, 08:51z	CTD cast
031	1	18°10.92'N	064°54.28'W	18-Apr-2017, 09:37z	CTD cast and bongo tow
032	1	18°10.89'N	064°57.34'W	18-Apr-2017, 10:53z	CTD cast
033	1	18°11.58'N	064°57.51'W	18-Apr-2017, 11:58z	CTD cast and bongo tow
034	1	18°11.80'N	065°02.03'W	18-Apr-2017, 13:19z	CTD cast and s10 tow
035	1	18°12.53'N	065°01.93'W	18-Apr-2017, 14:47z	CTD cast and bongo tow
036	1	18°17.35'N	065°02.08'W	18-Apr-2017, 16:15z	CTD cast, s10 and bongo tows
037	1	18°15.50'N	064°57.57'W	18-Apr-2017, 17:51z	CTD cast and bongo tow
038	1	18°17.54'N	064°57.53'W	18-Apr-2017, 19:19z	CTD cast and bongo tow
039	1	18°15.85'N	064°53.85'W	18-Apr-2017, 20:21z	CTD cast
040	1	18°16.17'N	064°51.50'W	18-Apr-2017, 21:11z	CTD cast, s10 and bongo tows
041	1	18°16.57'N	064°47.59'W	19-Apr-2017, 00:10z	CTD cast and bongo tow
042	1	18°05.53'N	064°51.45'W	19-Apr-2017, 03:45z	CTD cast, s10 and bongo tows
043	1	18°07.10'N	064°54.66'W	19-Apr-2017, 06:56z	CTD cast and bongo tow
044	1	18°05.60'N	064°57.56'W	19-Apr-2017, 09:29z	CTD cast and bongo tow
045	1	18°05.55'N	065°02.08'W	19-Apr-2017, 11:58z	CTD cast, s10 and bongo tows
046	1	18°16.00'N	065°06.55'W	19-Apr-2017, 16:55z	CTD cast and bongo tow
047	1	18°10.81'N	065°06.53'W	19-Apr-2017, 18:17z	CTD cast and bongo tow
048	1	18°09.87'N	065°06.56'W	19-Apr-2017, 19:20z	CTD cast and bongo tow
049	1	18°05.58'N	065°06.54'W	19-Apr-2017, 21:04z	CTD cast and bongo tow
050	1	18°04.22'N	065°06.52'W	19-Apr-2017, 22:19z	CTD cast

Appendix 2

NF-17-03 (F2017-003) Completed Station Positions, Occupation Times, and Activities

Station #	Leg #	Latitude	Longitude	Date/Time	Operations Completed
051	1	18°09.24'N	065°10.17'W	20-Apr-2017, 00:22z	CTD cast
052	1	18°10.03'N	065°10.75'W	20-Apr-2017, 01:12z	CTD cast and bongo tow
053	1	18°12.34'N	065°12.51'W	20-Apr-2017, 02:20z	CTD cast, s10 and bongo tows
054	1	18°07.49'N	065°12.90'W	20-Apr-2017, 03:53z	CTD cast and bongo tow
055	1	18°06.60'N	065°12.36'W	20-Apr-2017, 04:51z	CTD cast and s10 tow
056	1	18°03.76'N	065°10.85'W	20-Apr-2017, 06:37z	CTD cast and bongo tow
057	1	18°02.87'N	065°14.10'W	20-Apr-2017, 08:58z	CTD cast
058	1	18°06.86'N	065°15.44'W	20-Apr-2017, 10:49z	CTD cast and bongo tow
059	1	18°06.47'N	065°18.76'W	20-Apr-2017, 12:06z	CTD cast and bongo tow
060	1	18°05.54'N	065°18.14'W	20-Apr-2017, 13:00z	CTD cast and s10 tow
061	1	18°00.83'N	065°16.73'W	20-Apr-2017, 14:29z	CTD cast, s10 and bongo tows
062	1	18°15.90'N	065°22.44'W	20-Apr-2017, 19:34z	CTD cast
063	1	18°13.97'N	065°27.02'W	20-Apr-2017, 20:23z	CTD cast
064	1	18°18.75'N	065°27.00'W	20-Apr-2017, 21:29z	CTD cast and s10 tow
065	1	18°24.48'N	065°21.09'W	20-Apr-2017, 23:17z	CTD cast and s10 tow
066	1	18°32.04'N	065°24.07'W	21-Apr-2017, 00:58z	CTD cast and s10 tow
067	1	18°23.72'N	065°32.62'W	21-Apr-2017, 03:14z	CTD cast and s10 tow
068	1	18°29.56'N	065°36.21'W	21-Apr-2017, 06:06z	CTD cast
069	1	18°09.97'N	064°57.70'W	21-Apr-2017, 16:40z	CTD and MOCNESS tow
070	1	18°11.07'N	064°56.56'W	21-Apr-2017, 17:38z	CTD and MOCNESS tow
071	1	18°12.45'N	064°57.58'W	21-Apr-2017, 20:07z	CTD cast and bongo tow
072	1	18°10.99'N	064°58.58'W	21-Apr-2017, 21:10z	CTD and MOCNESS tow
073	1	18°11.75'N	065°02.57'W	21-Apr-2017, 23:19z	CTD and MOCNESS tow
074	1	18°10.56'N	065°02.54'W	22-Apr-2017, 01:29z	CTD and MOCNESS tow
075	1	18°10.47'N	065°04.25'W	22-Apr-2017, 03:50z	CTD and MOCNESS tow
076	1	18°11.87'N	065°03.99'W	22-Apr-2017, 06:15z	CTD cast and bongo tow
077	1	18°10.99'N	064°57.97'W	22-Apr-2017, 08:13z	CTD and MOCNESS tow
078	1	18°11.88'N	065°04.03'W	22-Apr-2017, 15:49z	CTD cast and bongo tow
079	1	18°11.15'N	065°03.33'W	22-Apr-2017, 16:52z	CTD and MOCNESS tow
080	1	18°10.44'N	065°02.63'W	22-Apr-2017, 19:01z	CTD and MOCNESS tow
081	1	18°16.19'N	064°51.49'W	22-Apr-2017, 21:52z	CTD cast
082	1	18°11.45'N	064°51.50'W	22-Apr-2017, 22:45z	CTD cast
083	1	18°05.63'N	064°51.47'W	22-Apr-2017, 23:54z	CTD cast
084	1	18°00.89'N	064°51.58'W	23-Apr-2017, 02:26z	CTD cast
085	1	17°56.19'N	064°51.53'W	23-Apr-2017, 07:45z	CTD cast
086	1	17°51.50'N	064°51.35'W	23-Apr-2017, 12:18z	CTD cast
087	1	17°46.75'N	064°51.52'W	23-Apr-2017, 15:48z	CTD cast and s10 tow
088	1	17°47.95'N	064°48.57'W	23-Apr-2017, 17:10z	CTD cast
089	1	17°48.18'N	064°45.48'W	23-Apr-2017, 18:08z	CTD cast and s10 tow
090	1	17°52.72'N	064°45.50'W	23-Apr-2017, 19:37z	CTD cast and s10 tow
091	1	17°48.60'N	064°42.00'W	23-Apr-2017, 21:38z	CTD cast
092	1	17°46.75'N	064°42.01'W	23-Apr-2017, 22:39z	CTD cast and s10 tow
093	1	17°47.67'N	064°39.95'W	24-Apr-2017, 00:00z	CTD cast and s10 tow
094	1	17°49.54'N	064°38.65'W	24-Apr-2017, 01:20z	CTD cast and s10 tow
095	1	17°52.82'N	064°36.41'W	24-Apr-2017, 03:02z	CTD cast
096	1	17°54.16'N	064°32.52'W	24-Apr-2017, 12:22z	CTD cast
097	1	17°50.12'N	064°30.59'W	24-Apr-2017, 16:23z	CTD cast, s10 and bongo tows
098	1	17°48.78'N	064°34.24'W	24-Apr-2017, 18:15z	CTD cast and s10 tow
099	1	17°52.90'N	064°36.40'W	24-Apr-2017, 19:00z	s10 tow
100	1	17°54.17'N	064°32.49'W	24-Apr-2017, 20:26z	CTD cast, s10 and bongo tows

Appendix 2

NF-17-03 (F2017-003) Completed Station Positions, Occupation Times, and Activities

Station #	Leg #	Latitude	Longitude	Date/Time	Operations Completed
101	1	17°46.12'N	064°32.74'W	24-Apr-2017, 22:08z	CTD cast and s10 tow
102	1	17°43.69'N	064°31.51'W	24-Apr-2017, 22:53z	CTD cast and s10 tow
103	1	17°39.20'N	064°29.14'W	25-Apr-2017, 00:21z	CTD cast and s10 tow
104	1	17°41.90'N	064°25.92'W	25-Apr-2017, 02:01z	CTD cast, s10 and bongo tows
105	1	17°46.23'N	064°28.40'W	25-Apr-2017, 04:11z	CTD cast, s10 and bongo tows

Appendix 2

NF-17-03 (F2017-003) Surface Drifter Deployment Times and Positions

Drifter ID #	Leg #	Latitude	Longitude	Date/Time
64908860	1	18°21.88'N	064°15.99'W	17-Apr-2017, 02:29z
64900880	1	18°21.88'N	064°15.99'W	17-Apr-2017, 02:29z
64012050	1	18°05.61'N	064°43.72'W	17-Apr-2017, 19:37z
63517600	1	18°05.61'N	064°43.72'W	17-Apr-2017, 19:37z
BD-CRUISE1	1	18°11.39'N	064°47.63'W	18-Apr-2017, 04:06z
BD-CRUISE2	1	18°11.39'N	064°47.63'W	18-Apr-2017, 04:06z
BD-CRUISE3	1	18°10.80'N	065°06.51'W	19-Apr-2017, 19:07z
BD-CRUISE4	1	18°10.80'N	065°06.51'W	19-Apr-2017, 19:07z
64909810	1	17°51.33'N	064°51.48'W	23-Apr-2017, 15:15z
63513580	1	17°51.33'N	064°51.48'W	23-Apr-2017, 15:15z
63519980	1	17°51.99'N	064°20.72'W	25-Apr-2017, 04:14z
63510950	1	17°51.99'N	064°20.72'W	25-Apr-2017, 04:14z

NF-17-03 (F2017-003) XBT Deployment Times and Positions

XBT #	Leg #	Latitude	Longitude	Date/Time
01	1	18°18.42'N	064°32.58'W	17-Apr-2017, 09:02z
02	1	18°11.88'N	064°43.68'W	17-Apr-2017, 15:03z
03	1	18°05.58'N	064°43.74'W	17-Apr-2017, 19:37z
04	1	18°07.74'N	064°47.52'W	18-Apr-2017, 02:25z
05	1	18°10.74'N	064°47.70'W	18-Apr-2017, 03:22z
06	1	18°11.49'N	064°51.50'W	18-Apr-2017, 08:25z
07	1	18°10.20'N	064°54.30'W	18-Apr-2017, 09:20z
08	1	18°10.89'N	064°57.50'W	18-Apr-2017, 11:31z
09	1	18°11.86'N	065°02.01'W	18-Apr-2017, 14:35z
10	1	18°05.58'N	064°51.48'W	19-Apr-2017, 06:28z
11	1	18°07.20'N	064°54.59'W	19-Apr-2017, 08:59z
12	1	18°05.59'N	064°57.49'W	19-Apr-2017, 11:14z
13	1	18°05.57'N	065°01.95'W	19-Apr-2017, 14:21z
14	1	18°09.90'N	065°06.50'W	19-Apr-2017, 20:16z
15	1	18°05.60'N	065°06.50'W	19-Apr-2017, 22:02z
16	1	18°09.17'N	065°10.19'W	20-Apr-2017, 00:56z
17	1	18°03.79'N	065°10.78'W	20-Apr-2017, 08:31z
18	1	18°00.89'N	064°51.49'W	23-Apr-2017, 06:31z
19	1	17°51.33'N	064°51.48'W	23-Apr-2017, 15:14z
20	1	17°54.00'N	064°32.40'W	24-Apr-2017, 13:41z
21	1	17°41.83'N	064°25.09'W	25-Apr-2017, 03:18z
22	1	17°52.26'N	064°20.14'W	25-Apr-2017, 07:08z