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STANDARD FORM C

FINAL REPORT

Cruise Name/Number:	F2018-029 Coral Reef Ecosystem Research
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Authorizations:

Coastal State	Authorization Document Number	National Participant(s)
Anguilla	UK Foreign & Commonwealth Office 54/2018 response dated 17 MAY 2018	None
British Virgin Islands	UK Foreign & Commonwealth Office 38/2018 response dated 17 APR 2018	None

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NOTE: Research cruise # F2018-029 has a concurrent National Oceanic and Atmospheric Administration cruise identifier: NF-18-03. In the following materials, cruise # NF-18-03 is synonymous with F2018-029.

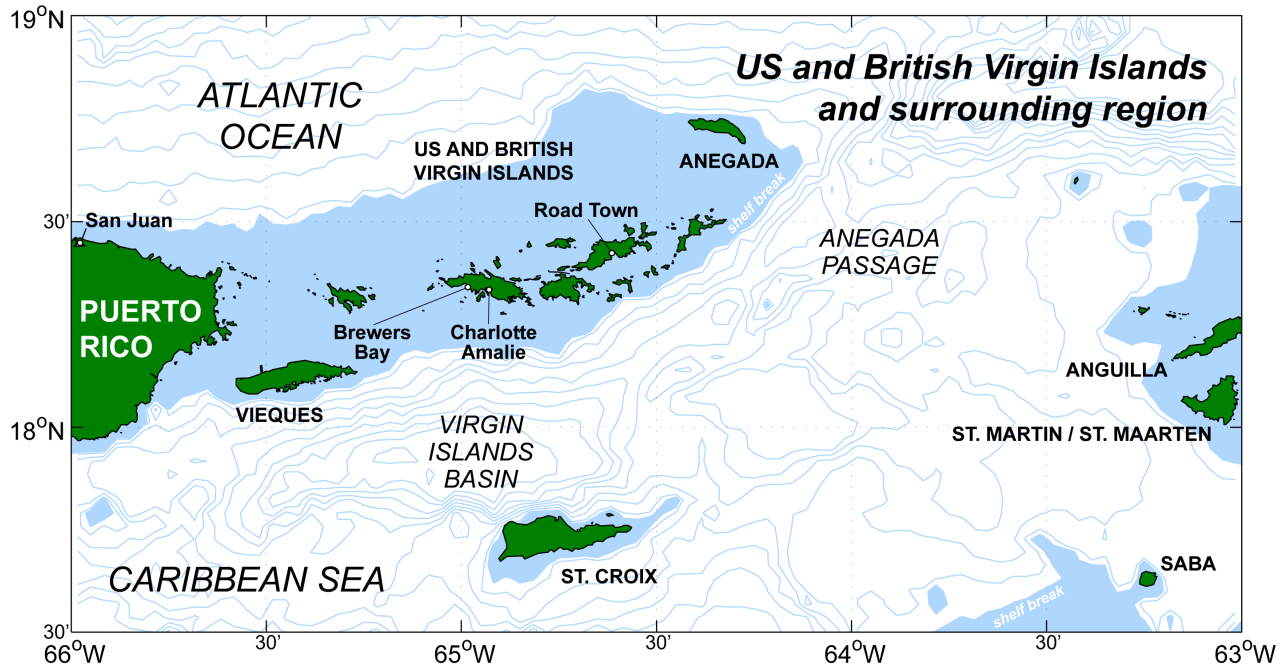
Coral Reef Ecosystem Research (2018) FINAL REPORT

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

06 June 2018 through 24 June 2018 (NF-18-03)

- 06 June 2018Depart from Charlotte Amalie, St. Thomas, USVI (begin leg I)
- 13 June 2018Arrive at Road Town, Tortola, BVI (end leg I)
- 16 June 2018Depart from Road Town, Tortola, BVI (begin leg II)
- 23 June 2018Arrive at / Depart from Brewers Bay, St. Thomas, USVI
(small boat personnel transfer only)
- 24 June 2018Arrive at San Juan, Puerto Rico (end leg II)

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 2018 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 2018 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 by 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 2018 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 mutton snapper and cubera snapper spawning events (both are economically important species for the region).

Additionally, a synoptic sampling effort (over 48 hours) across the VI shelf, from Virgin Gorda (BVI) to the west end of St. Thomas (USVI), 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 2018 NF-18-03 CRER survey outlined above included plankton tows using 90-cm bongo, 60-cm bongo, and mini bongo nets. Conductivity-Temperature-Depth (CTD) casts measuring temperature, salinity, dissolved oxygen, chlorophyll, and colored dissolved organic matter (CDOM) were also performed. At 8 locations, CTD casts also recorded ocean velocity measurements with Lowered Acoustic Doppler Current Profilers (LADCP). At 6 sampling sites, a profiling *free vehicle* was deployed concurrently the CTD casts for instrument testing and validation purposes. 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 (SADCP). 9 satellite-tracked, Lagrangian surface drifters were also deployed.

DISSEMINATION OF PROJECT DATA

Metadata:	January 2020
Raw Data:	Furnished upon request after 2020
Processed Data:	January 2020
Data Analysis:	January 2020
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 2020 AT THE FOLLOWING FTP SITE:

ftp://ftp.aoml.noaa.gov/phod/pub/rsmith/CRER/data/NF1803_State_Dept_DVD

HTTP MIRROR:

http://www.aoml.noaa.gov/ftp/phod/rsmith/CRER/data/NF1803_State_Dept_DVD

APPENDICES

The completed NF-18-03 (F2018-029) cruise track and station locations are illustrated in Appendix 1.

A complete listing of all NF-18-03 (F2018-029) station locations, station occupation times, and station operations are detailed in Appendix 2. Free vehicle test sites and drifter deployment sites are also detailed.

Appendix 1

NF-18-03 (F2018-029) Completed Cruise Track and Station Locations (CHARTLETS)

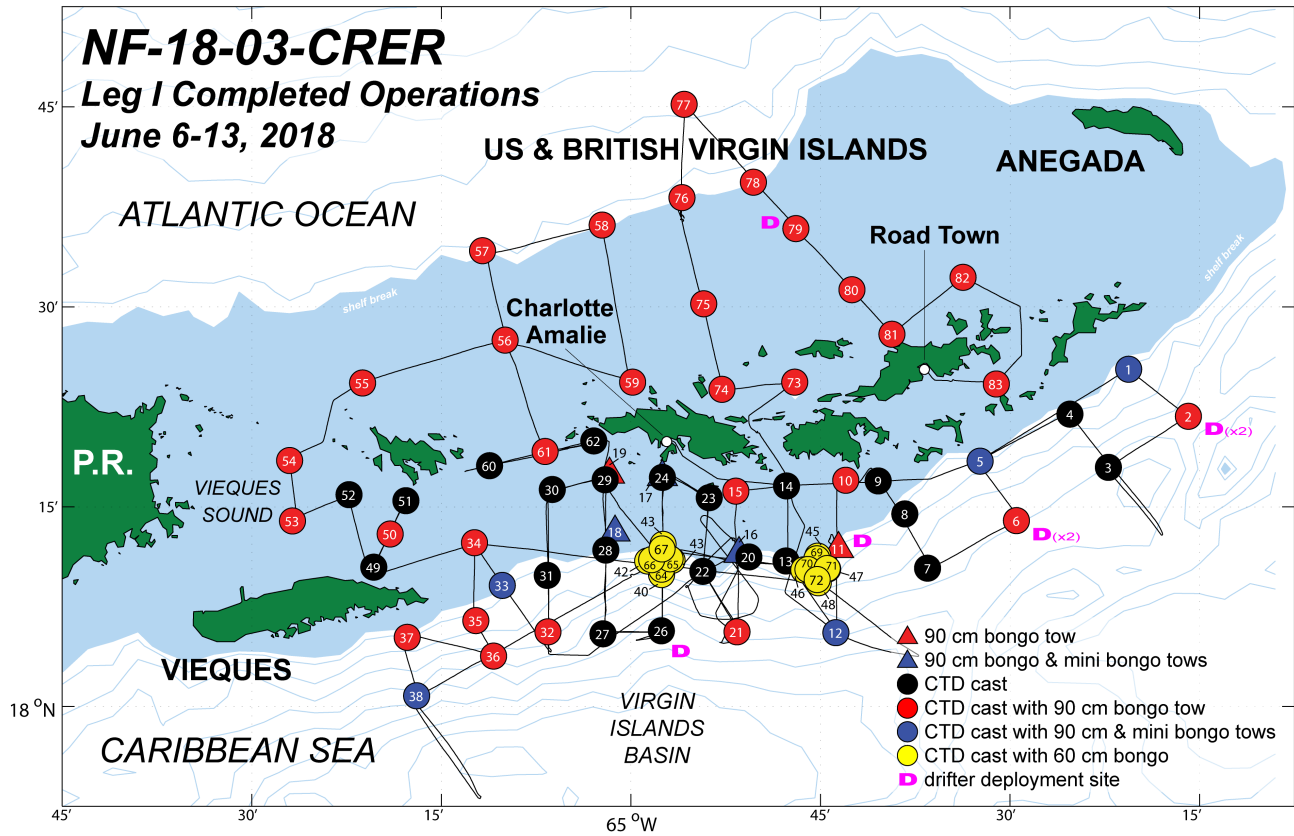


Figure 1. The cruise track (black line) and station numbers, locations, and operations (colored markers) completed during leg I of research cruise NF-18-03 (F2018-029) are shown above. Station markers are numbered in the order in which they were conducted. For a detailed description of station activities at each marker location see Appendix 2.

Appendix 1

NF-18-03 (F2018-029) Completed Cruise Track and Station Locations (CHARTLETS)

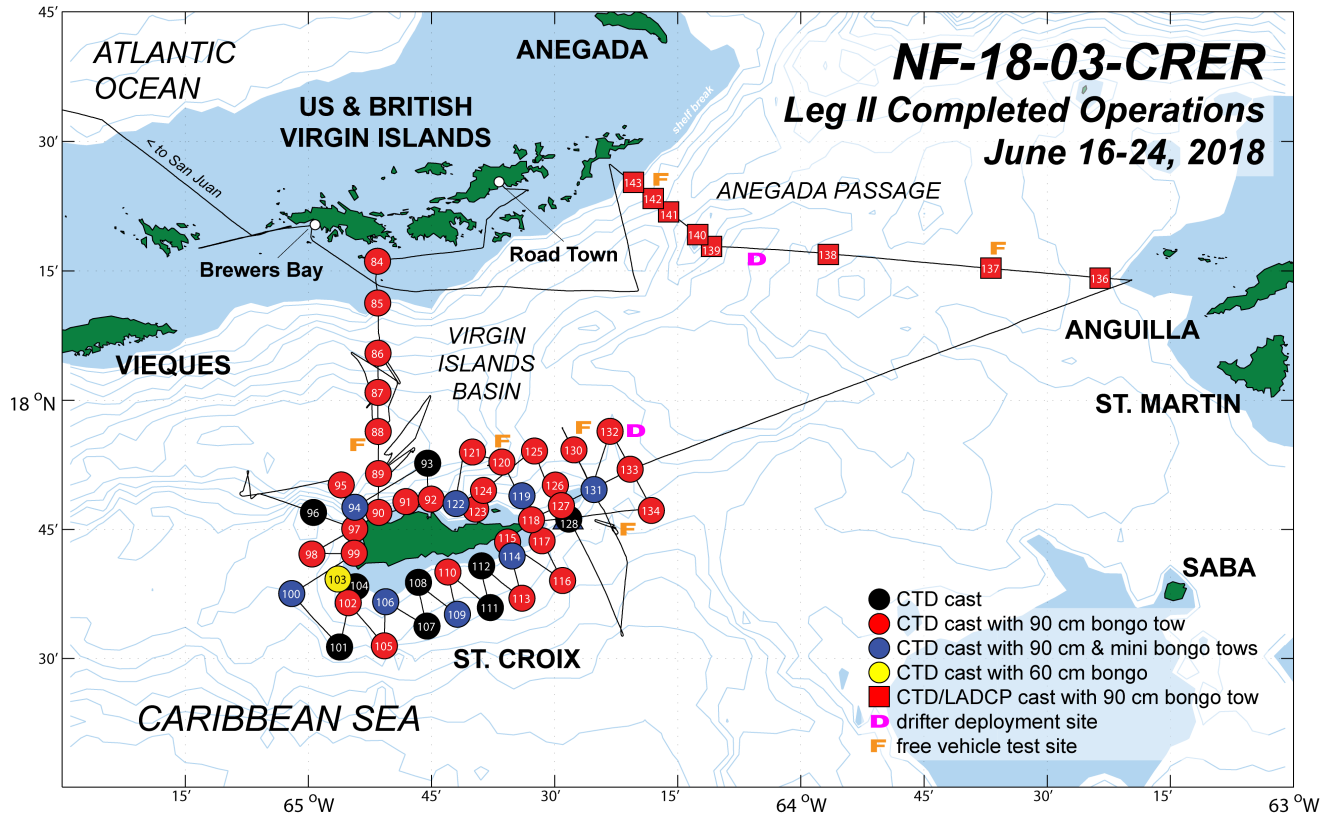


Figure 2. The cruise track (black line) and station numbers, locations, and operations (colored markers) completed during leg II of research cruise NF-18-03 (F2018-029) are shown above. Station markers are numbered in the order in which they were conducted. For a detailed description of station activities at each marker location see Appendix 2.

Appendix 2

NF-18-03 (F2018-029) Completed Station Positions, Occupation Times, and Activities

Station #	Leg #	Latitude	Longitude	Date/Time	Operations Completed
001	1	18°25.330'N	064°20.608'W	06-Jun-2018, 17:55z	CTD cast with 90cm and (2) mini bongo tows
002	1	18°21.800'N	064°15.880'W	06-Jun-2018, 20:04z	CTD cast with 90cm bongo tow
003	1	18°17.970'N	064°22.210'W	06-Jun-2018, 21:55z	CTD cast
004	1	18°21.960'N	064°25.260'W	07-Jun-2018, 00:32z	CTD cast
005	1	18°18.430'N	064°32.370'W	07-Jun-2018, 02:05z	CTD cast with 90cm and (2) mini bongo tows
006	1	18°13.970'N	064°29.500'W	07-Jun-2018, 04:05z	CTD cast with 90cm bongo tow
007	1	18°10.400'N	064°36.520'W	07-Jun-2018, 06:05z	CTD cast
008	1	18°14.470'N	064°38.320'W	07-Jun-2018, 07:54z	CTD cast
009	1	18°16.950'N	064°40.430'W	07-Jun-2018, 08:50z	CTD cast
010	1	18°17.000'N	064°43.000'W	07-Jun-2018, 10:11z	CTD cast with 90cm bongo tow
011	1	18°11.855'N	064°43.563'W	07-Jun-2018, 11:05z	(2) 90cm bongo tows (no CTD cast)
012	1	18°05.560'N	064°43.780'W	07-Jun-2018, 14:59z	CTD cast with 90cm and (2) mini bongo tows
013	1	18°10.940'N	064°47.720'W	07-Jun-2018, 16:31z	CTD cast
014	1	18°16.570'N	064°47.680'W	07-Jun-2018, 17:35z	CTD cast
015	1	18°16.190'N	064°51.690'W	07-Jun-2018, 18:21z	CTD cast with 90cm bongo tow
016	1	18°11.484'N	064°51.444'W	07-Jun-2018, 19:57z	(2) 90cm and (2) mini bongo tows (no CTD cast)
017	1	18°17.250'N	064°57.510'W	08-Jun-2018, 02:47z	90cm and (2) mini bongo tows (no CTD cast)
018	1	18°13.092'N	065°01.254'W	08-Jun-2018, 08:41z	90cm and (2) mini bongo tows (no CTD cast)
019	1	18°17.436'N	065°01.692'W	08-Jun-2018, 09:54z	90cm bongo tow (no CTD cast)
020	1	18°11.240'N	064°50.660'W	08-Jun-2018, 13:52z	CTD cast
021	1	18°05.620'N	064°51.600'W	08-Jun-2018, 15:13z	CTD cast with 90cm bongo tow
022	1	18°10.160'N	064°54.300'W	08-Jun-2018, 17:08z	CTD cast
023	1	18°15.700'N	064°53.800'W	08-Jun-2018, 18:17z	CTD cast
024	1	18°17.210'N	064°57.510'W	08-Jun-2018, 19:02z	CTD cast
025	1	18°10.780'N	064°57.430'W	08-Jun-2018, 20:09z	CTD cast with 90cm bongo tow
026	1	18°05.700'N	064°57.590'W	08-Jun-2018, 21:55z	CTD cast
027	1	18°05.470'N	065°02.210'W	08-Jun-2018, 23:35z	CTD cast
028	1	18°11.760'N	065°01.980'W	09-Jun-2018, 01:05z	CTD cast
029	1	18°17.040'N	065°02.040'W	09-Jun-2018, 02:14z	CTD cast
030	1	18°16.310'N	065°06.220'W	09-Jun-2018, 02:57z	CTD cast
031	1	18°09.860'N	065°06.620'W	09-Jun-2018, 03:53z	CTD cast
032	1	18°05.620'N	065°06.560'W	09-Jun-2018, 04:56z	CTD cast with 90cm bongo tow
033	1	18°09.100'N	065°10.180'W	09-Jun-2018, 07:24z	CTD cast with (2) 90cm and (2) mini bongo tows
034	1	18°12.310'N	065°12.370'W	09-Jun-2018, 08:53z	CTD cast with 90cm bongo tow
035	1	18°06.460'N	065°12.270'W	09-Jun-2018, 10:04z	CTD cast with 90cm bongo tow
036	1	18°03.790'N	065°10.870'W	09-Jun-2018, 11:26z	CTD cast with 90cm bongo tow
037	1	18°05.200'N	065°17.690'W	09-Jun-2018, 14:05z	CTD cast with 90cm bongo tow
038	1	18°00.810'N	065°16.960'W	09-Jun-2018, 15:18z	CTD cast with 90cm and (2) mini bongo tows
039	1	18°11.030'N	064°57.540'W	09-Jun-2018, 21:34z	CTD cast with (3) 60cm bongo tows
040	1	18°09.920'N	064°57.580'W	09-Jun-2018, 23:32z	CTD cast with (3) 60cm bongo tows
041	1	18°10.990'N	064°56.740'W	10-Jun-2018, 01:38z	CTD cast with (3) 60cm bongo tows
042	1	18°10.940'N	064°58.670'W	10-Jun-2018, 03:43z	CTD cast with (3) 60cm bongo tows
043	1	18°12.180'N	064°57.460'W	10-Jun-2018, 05:44z	CTD cast with 60cm bongo tow
044	1	18°10.390'N	064°45.210'W	10-Jun-2018, 07:50z	CTD cast with (3) 60cm bongo tows
045	1	18°11.310'N	064°45.210'W	10-Jun-2018, 09:42z	CTD cast with 60cm bongo tow
046	1	18°10.280'N	064°46.320'W	10-Jun-2018, 10:40z	CTD cast with (3) 60cm bongo tows
047	1	18°10.340'N	064°44.430'W	10-Jun-2018, 13:04z	CTD cast with (3) 60cm bongo tows
048	1	18°09.300'N	064°45.170'W	10-Jun-2018, 15:22z	CTD cast with (3) 60cm bongo tows
049	1	18°10.480'N	065°20.350'W	10-Jun-2018, 20:06z	CTD cast
050	1	18°12.970'N	065°19.050'W	10-Jun-2018, 20:42z	CTD cast with 90cm bongo tow
051	1	18°15.470'N	065°17.800'W	10-Jun-2018, 21:35z	CTD cast
052	1	18°15.920'N	065°22.300'W	10-Jun-2018, 23:21z	CTD cast
053	1	18°13.950'N	065°26.780'W	11-Jun-2018, 00:06z	CTD cast with 90cm bongo tow
054	1	18°18.480'N	065°27.000'W	11-Jun-2018, 01:12z	CTD cast with 90cm bongo tow
055	1	18°24.300'N	065°21.230'W	11-Jun-2018, 02:51z	CTD cast with 90cm bongo tow
056	1	18°27.520'N	065°09.950'W	11-Jun-2018, 04:37z	CTD cast with 90cm bongo tow
057	1	18°34.220'N	065°11.740'W	11-Jun-2018, 06:22z	CTD cast with (2) 90cm bongo tows
058	1	18°36.140'N	065°02.280'W	11-Jun-2018, 08:55z	CTD cast with 90cm bongo tow
059	1	18°24.370'N	064°59.870'W	11-Jun-2018, 11:19z	CTD cast with 90cm bongo tow
060	1	18°18.100'N	065°11.180'W	11-Jun-2018, 16:50z	CTD cast
061	1	18°19.160'N	065°06.790'W	11-Jun-2018, 17:46z	CTD cast with 90cm bongo tow
062	1	18°19.960'N	065°02.930'W	11-Jun-2018, 19:04z	CTD cast

Appendix 2

NF-18-03 (F2018-029) Completed Station Positions, Occupation Times, and Activities

Station #	Leg #	Latitude	Longitude	Date/Time	Operations Completed
063	1	18°10.990'N	064°57.440'W	11-Jun-2018, 21:33z	CTD cast with (3) 60cm bongo tows
064	1	18°10.320'N	064°57.580'W	11-Jun-2018, 23:17z	CTD cast with (3) 60cm bongo tows
065	1	18°11.100'N	064°56.900'W	12-Jun-2018, 01:05z	CTD cast with (3) 60cm bongo tows
066	1	18°11.040'N	064°58.360'W	12-Jun-2018, 02:57z	CTD cast with (3) 60cm bongo tows
067	1	18°11.850'N	064°57.530'W	12-Jun-2018, 04:55z	CTD cast with 60cm bongo tow
068	1	18°10.280'N	064°45.360'W	12-Jun-2018, 06:38z	CTD cast with (3) 60cm bongo tows
069	1	18°11.100'N	064°45.290'W	12-Jun-2018, 08:58z	CTD cast with 60cm bongo tow
070	1	18°10.300'N	064°45.990'W	12-Jun-2018, 11:01z	CTD cast with (3) 60cm bongo tows
071	1	18°10.370'N	064°44.470'W	12-Jun-2018, 13:13z	CTD cast with (3) 60cm bongo tows
072	1	18°09.540'N	064°45.260'W	12-Jun-2018, 13:55z	CTD cast with (3) 60cm bongo tows
073	1	18°24.360'N	064°47.030'W	12-Jun-2018, 21:25z	CTD cast with 90cm bongo tow
074	1	18°23.820'N	064°52.800'W	12-Jun-2018, 22:41z	CTD cast with 90cm bongo tow
075	1	18°30.240'N	064°54.240'W	12-Jun-2018, 23:48z	CTD cast with 90cm bongo tow
076	1	18°38.200'N	064°55.960'W	13-Jun-2018, 01:50z	CTD cast with (2) 90cm bongo tows
077	1	18°45.180'N	064°55.780'W	13-Jun-2018, 03:43z	CTD cast with 90cm bongo tow
078	1	18°39.350'N	064°50.300'W	13-Jun-2018, 05:50z	CTD cast with 90cm bongo tow
079	1	18°35.880'N	064°46.950'W	13-Jun-2018, 07:26z	CTD cast with 90cm bongo tow
080	1	18°31.300'N	064°42.510'W	13-Jun-2018, 08:47z	CTD cast with 90cm bongo tow
081	1	18°27.960'N	064°39.340'W	13-Jun-2018, 10:03z	CTD cast with 90cm bongo tow
082	1	18°32.230'N	064°33.720'W	13-Jun-2018, 11:23z	CTD cast with 90cm bongo tow
083	1	18°24.230'N	064°31.080'W	13-Jun-2018, 13:08z	CTD cast with 90cm bongo tow
084	2	18°16.120'N	064°51.580'W	16-Jun-2018, 17:03z	CTD cast with 90cm bongo tow
085	2	18°11.290'N	064°51.550'W	16-Jun-2018, 18:30z	CTD cast with 90cm bongo tow
086	2	18°05.460'N	064°51.520'W	16-Jun-2018, 21:46z	CTD cast with 90cm bongo tow
087	2	18°00.900'N	064°51.520'W	17-Jun-2018, 01:37z	CTD cast with 90cm bongo tow
088	2	17°56.380'N	064°51.490'W	17-Jun-2018, 06:46z	CTD cast with 90cm bongo tow
089	2	17°51.490'N	064°51.450'W	17-Jun-2018, 23:49z	CTD cast with 90cm bongo tow
090	2	17°46.980'N	064°51.420'W	18-Jun-2018, 07:03z	CTD cast with 90cm bongo tow
091	2	17°48.230'N	064°48.110'W	18-Jun-2018, 08:47z	CTD cast with 90cm bongo tow
092	2	17°48.530'N	064°45.040'W	18-Jun-2018, 10:45z	CTD cast with 90cm bongo tow
093	2	17°52.690'N	064°45.470'W	18-Jun-2018, 12:55z	CTD cast
094	2	17°47.580'N	064°54.330'W	18-Jun-2018, 14:39z	CTD cast with 90cm and (2) mini bongo tows
095	2	17°50.180'N	064°55.990'W	18-Jun-2018, 17:06z	CTD cast with 90cm bongo tow
096	2	17°46.980'N	064°59.370'W	18-Jun-2018, 20:38z	CTD cast
097	2	17°45.070'N	064°54.350'W	18-Jun-2018, 21:48z	CTD cast with 90cm bongo tow
098	2	17°42.150'N	064°59.560'W	18-Jun-2018, 23:56z	CTD cast with 90cm bongo tow
099	2	17°42.240'N	064°54.410'W	19-Jun-2018, 01:33z	CTD cast with 90cm bongo tow
100	2	17°37.540'N	065°02.020'W	19-Jun-2018, 03:46z	CTD cast with 90cm and (2) mini bongo tows
101	2	17°31.340'N	064°56.210'W	19-Jun-2018, 05:56z	CTD cast
102	2	17°36.470'N	064°55.150'W	19-Jun-2018, 07:08z	CTD cast with 90cm bongo tow
103	2	17°39.240'N	064°56.380'W	19-Jun-2018, 08:39z	CTD cast with (3) 60cm bongo tows
104	2	17°38.350'N	064°54.220'W	19-Jun-2018, 11:06z	CTD cast
105	2	17°31.460'N	064°50.740'W	19-Jun-2018, 13:36z	CTD cast with 90cm bongo tow
106	2	17°36.600'N	064°50.590'W	19-Jun-2018, 14:55z	CTD cast with 90cm and (2) mini bongo tows
107	2	17°33.760'N	064°45.560'W	19-Jun-2018, 16:42z	CTD cast
108	2	17°38.850'N	064°46.590'W	19-Jun-2018, 17:58z	CTD cast
109	2	17°35.130'N	064°41.850'W	19-Jun-2018, 19:09z	CTD cast with 90cm and (2) mini bongo tows
110	2	17°40.050'N	064°43.000'W	19-Jun-2018, 20:46z	CTD cast with 90cm bongo tow
111	2	17°35.910'N	064°37.830'W	19-Jun-2018, 22:42z	CTD cast
112	2	17°40.760'N	064°38.900'W	19-Jun-2018, 23:59z	CTD cast
113	2	17°37.000'N	064°33.990'W	20-Jun-2018, 01:29z	CTD cast with 90cm bongo tow
114	2	17°41.910'N	064°35.190'W	20-Jun-2018, 04:10z	CTD cast with 90cm and (2) mini bongo tows
115	2	17°43.550'N	064°35.730'W	20-Jun-2018, 05:06z	CTD cast with 90cm bongo tow
116	2	17°39.060'N	064°29.040'W	20-Jun-2018, 06:45z	CTD cast with 90cm bongo tow
117	2	17°43.670'N	064°31.540'W	20-Jun-2018, 09:19z	CTD cast with 90cm bongo tow
118	2	17°46.130'N	064°32.820'W	20-Jun-2018, 10:54z	CTD cast with 90cm bongo tow
119	2	17°48.920'N	064°33.980'W	20-Jun-2018, 12:16z	CTD cast with 90cm and (2) mini bongo tows
120	2	17°52.830'N	064°36.420'W	20-Jun-2018, 14:52z	CTD cast with 90cm bongo tow
121	2	17°54.000'N	064°40.010'W	20-Jun-2018, 20:28z	CTD cast with 90cm bongo tow
122	2	17°48.000'N	064°42.000'W	20-Jun-2018, 21:47z	CTD cast with 90cm and (2) mini bongo tows
123	2	17°47.360'N	064°39.630'W	20-Jun-2018, 23:20z	CTD cast with 90cm bongo tow

Appendix 2

NF-18-03 (F2018-029) Completed Station Positions, Occupation Times, and Activities

Station #	Leg #	Latitude	Longitude	Date/Time	Operations Completed
124	2	17°49.540'N	064°38.670'W	21-Jun-2018, 00:43z	CTD cast with 90cm bongo tow
125	2	17°54.110'N	064°32.460'W	21-Jun-2018, 02:43z	CTD cast with 90cm bongo tow
126	2	17°50.160'N	064°29.910'W	21-Jun-2018, 05:51z	CTD cast with 90cm bongo tow
127	2	17°47.770'N	064°29.180'W	21-Jun-2018, 07:40z	CTD cast with 90cm bongo tow
128	2	17°46.190'N	064°28.280'W	21-Jun-2018, 08:39z	CTD cast
130	2	17°54.250'N	064°27.640'W	21-Jun-2018, 18:28z	CTD cast with 90cm bongo tow
131	2	17°49.640'N	064°25.210'W	21-Jun-2018, 22:14z	CTD cast with 90cm and (2) mini bongo tows
132	2	17°56.390'N	064°23.250'W	21-Jun-2018, 23:44z	CTD cast with 90cm bongo tow
133	2	17°51.990'N	064°20.800'W	22-Jun-2018, 02:22z	CTD cast with 90cm bongo tow
134	2	17°47.200'N	064°18.220'W	22-Jun-2018, 05:20z	CTD cast with 90cm bongo tow
135	2	17°46.068'N	064°28.368'W	22-Jun-2018, 08:11z	90cm and (2) mini bongo tows (no CTD cast)
136	2	18°14.170'N	063°23.550'W	22-Jun-2018, 19:00z	CTD/LADCP cast with 90cm bongo tow
137	2	18°15.320'N	063°36.860'W	22-Jun-2018, 22:26z	CTD/LADCP cast with 90cm bongo tow
138	2	18°16.920'N	063°56.680'W	23-Jun-2018, 02:16z	CTD/LADCP cast with 90cm bongo tow
139	2	18°17.850'N	064°10.890'W	23-Jun-2018, 05:15z	CTD/LADCP cast with 90cm bongo tow
140	2	18°19.210'N	064°12.570'W	23-Jun-2018, 07:22z	CTD/LADCP cast with 90cm bongo tow
141	2	18°21.850'N	064°16.110'W	23-Jun-2018, 09:27z	CTD/LADCP cast with 90cm bongo tow
142	2	18°23.390'N	064°18.000'W	23-Jun-2018, 12:46z	CTD/LADCP cast with 90cm bongo tow
143	2	18°25.270'N	064°20.390'W	23-Jun-2018, 15:34z	CTD/LADCP cast with 90cm bongo tow

NF-18-03 (F2018-029) Free Vehicle Deployment and Recovery Sites

Site	Operation	Latitude	Longitude	Date/Time
D1	deployment	17°56.40'N	064°51.50'W	17-Jun-2018, 13:14z
D1	recovery	17°57.53'N	064°51.26'W	17-Jun-2018, 17:07z
D2	deployment	17°52.40'N	064°37.30'W	20-Jun-2018, 14:29z
D2	recovery	17°52.41'N	064°37.34'W	20-Jun-2018, 17:55z
D3	deployment	17°45.10'N	064°22.53'W	21-Jun-2018, 14:31z
D3	recovery	17°45.28'N	064°22.80'W	21-Jun-2018, 15:51z
D4	deployment	17°54.13'N	064°27.69'W	21-Jun-2018, 18:19z
D4	recovery	17°53.97'N	064°27.70'W	21-Jun-2018, 20:56z
D5	deployment	18°15.31'N	063°36.89'W	22-Jun-2018, 21:03z
D5	recovery	18°15.53'N	063°37.02'W	22-Jun-2018, 22:10z
D6	deployment	18°23.50'N	064°17.86'W	23-Jun-2018, 12:32z
D6	recovery	18°23.71'N	064°17.93'W	23-Jun-2018, 14:26z

NF-18-03 (F2018-029) Drifter Deployment Locations

Leg #	Drifter #	Latitude	Longitude	Date/Time
1	65380680	18°21.45'N	064°16.48'W	06-Jun-2018, 21:08z
1	65382700	18°21.45'N	064°16.48'W	06-Jun-2018, 21:08z
1	65942880	18°13.98'N	064°29.34'W	07-Jun-2018, 05:17z
1	65384700	18°13.98'N	064°29.34'W	07-Jun-2018, 05:17z
1	65920130	18°11.71'N	064°43.70'W	07-Jun-2018, 12:27z
1	66614930	18°05.59'N	064°57.80'W	08-Jun-2018, 23:07z
1	65381680	18°34.92'N	064°50.33'W	13-Jun-2018, 06:49z
2	66614940	17°56.47'N	064°23.12'W	22-Jun-2018, 01:43z
2	65382680	18°17.51'N	064°04.17'W	23-Jun-2018, 04:29z