

Penn State Cruise Report Cruise C-289A

Scientific Data Collected Aboard SSV *Corwith Cramer*

**Christiansted, St. Croix, U.S. Virgin Islands – San Juan, Puerto Rico
30 December 2019 – 6 January 2020**



**Sea Education Association
Woods Hole, Massachusetts**



Cover photo caption:

SEA/Pennsylvania State University Cruise C-289A participants aboard SSV
Corwith Cramer, dockside in San Juan, Puerto Rico. [Photo credit: Julia Stewart]

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Introduction

This cruise report provides a summary of scientific activities aboard the SSV *Corwith Cramer* during Cruise C-289A (30 December 2019 – 6 January 2020). This was the sea component portion of a spring semester course offered by Pennsylvania State University (PSU) in collaboration with Sea Education Association (SEA). Departing from Christiansted, St. Croix, U.S. Virgin Islands and ending in San Juan, Puerto Rico, the ~350nm cruise track sailed in the eastern Caribbean Sea north of St. Croix, through the British Virgin Islands, and into the North Atlantic Ocean north of the U.S. Virgin Islands and Puerto Rico. While in the British Virgin Islands, we cleared into Tortola and then snorkeled at the caves at Norman Island. Scientific sampling was conducted throughout the cruise.

Student participants completed the initial portion of PSU's *Biological Oceanography (PSU497B)* course during our 8-day voyage. This was an intensive field seminar program combining practical experience conducting oceanographic research in a deep-sea environment with working together as a team to sail a tall ship research vessel. While onboard ship, the students served as full, working members of the scientific team and sailing crew, deploying oceanographic sampling equipment, learning to operate the vessel, and collecting data for their scientific research projects. Life at sea was fast-paced, with activities continuing on a 24-hour basis throughout the program. Each student was assigned to a watch team of 10-11 people (7-8 students, a mate, an assistant scientist, and a sailing intern) with whom they rotated throughout a day-and-night schedule. In addition to the ongoing routine watch standing duties that are part of all students' experience at sea, afternoon classes and discussions were also an integral portion of the learning process. As a component of the course requirements, students kept a record of their activities aboard ship in the form of a notebook/journal.

The range of oceanographic research topics addressed by the students was broad, encompassing all sub-disciplines of biological, chemical, physical, and geological oceanography, to together provide a multidisciplinary look at the Caribbean and North Atlantic environments. Topics pursued took advantage of opportunities to explore important spatial patterns in the regions through which we sailed – e.g., shelf versus slope, shallow versus deep, Atlantic versus Caribbean, and such. The students worked collaboratively, in pairs or triplets within a watch and as an entire watch, to analyze and interpret the scientific data we collected, and to prepare a written research paper and poster presentations summarizing their research findings and conclusions. A watch focused on the physical and geological data we collected, B watch focused on surface station and hourly data, and C Watch focused on biological and chemical data. The student pairs/triplets presented preliminary summaries of their research results at the end of the cruise, and they will complete their projects after they return to the Pennsylvania State University campus. Final results will be presented at a campus-wide Undergraduate Research Exhibition in April 2020.

C-289A was an excellent cruise, with cooperative weather, interesting science, and an outstanding group of students. Thanks to all my 37 shipmates for such a terrific voyage. A special thanks to my faculty colleagues, SEA Captain Rick Miller and PSU professor Mónica Medina, PSU teaching assistant Julia Stewart, and the other 12 members of SEA's professional crew, who did a great job and made everything run so smoothly. It was a true pleasure sailing with you in delightfully warm weather, far away from chilly New England!

The summary of C-289A data contained in this report is not intended to represent final data interpretation and should not be excerpted or cited without written permission from SEA.

Audrey W. Meyer
Chief Scientist, C-289A

Data Description

This section provides a record of data collected aboard the SSV *Corwith Cramer* Cruise C-289A, which departed from Christiansted, St. Croix, U.S. Virgin Islands, sailed through the British Virgin Islands with a stop there to snorkel at Norman Island, and continued on into the North Atlantic north of the U.S. Virgin Islands before ending in San Juan, Puerto Rico (Figure 1).

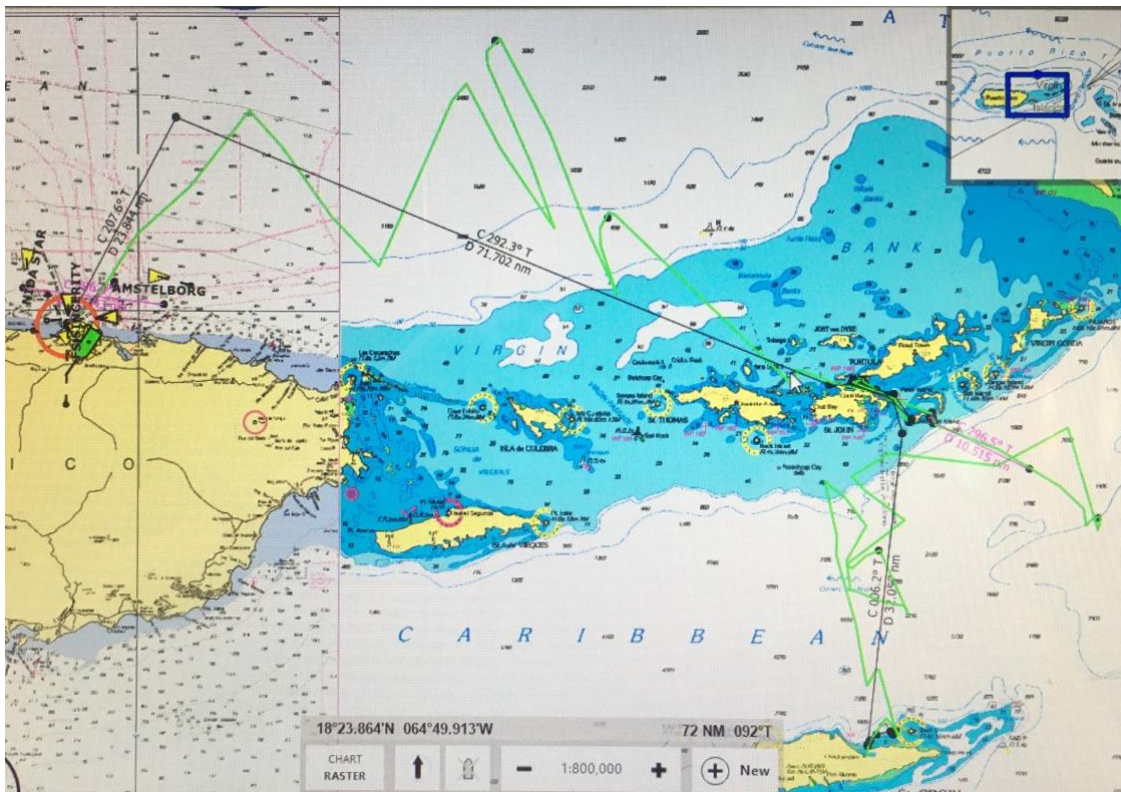


Figure 1. Voyage track of SSV *Corwith Cramer* Cruise C-289A, shown in solid green line.

During the 8-day voyage, we collected oceanographic samples and deployed scientific gear at 16 discrete stations (Table 1). Chemical analyses were made of 15 surface water samples, the majority of which occurred coincident with hydrocast and biological sampling (neuston net, meter net and phytoplankton net) stations (Table 2). Additionally, we continuously sampled water depth and sub-bottom profiles (CHIRP system), sea surface temperature and salinity (Figure 2), in-vivo chlorophyll fluorescence (Figure 3, top), transmissivity (Figure 4), and colored dissolved organic matter (CDOM) fluorescence. Surface current vectors determined by the ADCP are shown in Figure 5. Surface water samples were collected with a bucket deployed over the side of the ship and analyzed for extracted chlorophyll content (Figure 3, bottom), pH (Figure 6), and phosphate (Figure 7). CTD measurements of vertical temperature, salinity, and density profiles were collected at five stations (Figures 8-12), four of which were hydrocasts with Niskin bottles for water sampling at depth (Table 3). Additional instrumentation on these four hydrocast deployments allowed profiling of dissolved oxygen and chlorophyll fluorescence (Figures 8-11), and photosynthetically active radiation (PAR; Figures 8 and 11). Phosphate and pH profiles derived from water samples collected in the Niskin bottles are given in Figure 13. Summaries of sea surface and water column physical, chemical and biological properties are given in Tables 4-8. Results of sediment analyses of two shipek grab samples are given in Table 9 and Figure 14. Voluminous CTD, ADCP, CHIRP, and flow-through data are not fully presented here. All unpublished data can be made available by arrangement with the SEA data archivist (contact information, p. 2).

Table 1. C-289A oceanographic sampling stations. **X** indicates type of station. (NT = Neuston Tow, MN = Meter Net, PN = Phytoplankton Net, HC = Hydrocast with 12 Niskin bottles, CTD and optical instrumentation, CTD = Free CTD, SD = Secchi Disk, SG = Shipek Grab, SS = Surface Station.) See footnote at bottom of table.¹

Station	Date	Time (Local)	Log (nm)	Latitude (N)	Longitude (W)	General Locale	NT	MN ¹	PN	HC ¹	CTD ¹	SD ¹	SG ¹	SS
C289A-001	31-Dec-19	0918	0.0	17° 44.8'	064° 41.9'	Christiansted, St. Croix, USVI			X					X
C289A-002	31-Dec-19	1305	7.7	17° 46.9'	064° 38.6'	Buck Island, St. Croix, USVI							X (11m)	X
C289A-003	31-Dec-19	1551	16.1	17° 52.9'	064° 41.3'	Caribbean Sea	X							X
C289A-004	31-Dec-19	2200	47.5	18° 06.9'	064° 42.8'	Caribbean Sea	X	X (300m)						X
C289A-005	1-Jan-20	0500	58.8	18° 15.4'	064° 37.9'	Caribbean Sea								X
C289A-006	1-Jan-20	0936	67.6	18° 05.6'	064° 40.8'	Caribbean Sea	X		X	X (610m)		X (35m)		X
C289A-007	1-Jan-20	1747	100.0	18° 14.7'	064° 30.4'	Caribbean Sea								X
C289A-008	1-Jan-20	2129	122.7	18° 09.3'	064° 17.5'	Caribbean Sea	X		X	X (600m)				X
C289A-009	2-Jan-20	0615	138.0	18° 16.9'	064° 36.1'	Salt Pass, BVI								X
C289A-010	2-Jan-20	1236	158.9	18° 22.4'	064° 41.9'	Soppers Hole, BVI								X
C289A-011	3-Jan-20	1015	165.2	18° 18.8'	064° 37.6'	Norman Island, BVI			X				X (26m)	X
C289A-012	3-Jan-20	1730	178.2	18° 23.1'	064° 49.4'	Middle Passage, BVI	X							X
C289A-013	3-Jan-20	2205	207.4	18° 39.8'	065° 39.8'	Atlantic Ocean	X		X	X (625m)				X
C289A-014	4-Jan-20	0624	233.0	18° 47.6'	065° 15.5'	Atlantic Ocean								X
C289A-015	4-Jan-20	1000	243.3	18° 57.6'	065° 21.8'	Atlantic Ocean	X		X	X (625m)		X (33m)		X
C289A-016	4-Jan-20	2138	284.0	18° 53.3'	065° 25.1'	Atlantic Ocean					X (900m)			-

¹ Depths given in parentheses for MN, HC, CTD, and SD deployments are maximum wire-out values. This is usually greater than actual cast depth due to current-induced wireline angle. Depths given in parentheses for SG deployments are bottom depths determined from CHIRP data, which may differ slightly from maximum wire-out values.

Table 2. C-289A surface sampling station (SS) data. Associated oceanographic sampling stations are given in Table 1. Flow-through data are plotted in Figures 2-4. Extracted chlorophyll-*a* data are plotted in Figure 3 (bottom figure). Sea surface pH and PO₄ data are plotted in Figure 6 and Figure 7, respectively. See footnote at bottom of table.¹

Surface Station	Date	Time (Local)	Log (nm)	Latitude (N)	Longitude (W)	General Locale	Temp ¹ (°C)	Salinity ¹ (PSU)	Chl- <i>a</i> Fluor. ¹ (volts)	CDOM Fluor. ¹ (volts)	Transmissivity ¹ (volts)	Chl- <i>a</i> ¹ (µg/l)	PO ₄ ¹ (µM)	pH ¹
C289A-001-SS	31-Dec-19	0921	0.0	17° 44.8'	064° 41.9'	Christiansted, St. Croix, USVI	27.9	34.973	551.8	83.6	712.7	0.214	0.303	7.998
C289A-002-SS	31-Dec-19	1326	9.4	17° 47.9'	064° 39.0'	Buck Island, St. Croix, USVI	28.2	35.034	507.9	80.6	366.3	0.285	0.262	8.033
C289A-003-SS	31-Dec-19	1601	16.4	17° 52.6'	064° 41.5'	Caribbean Sea	28.3	34.830	449.1	73.9	561.3	0.049	0.285	8.078
C289A-004-SS	31-Dec-19	2330	49.9	18° 04.8'	064° 44.0'	Caribbean Sea	28.0	35.080	448.9	71.2	300.6	0.090	0.211	8.051
C289A-005-SS	1-Jan-20	0500	58.8	18° 15.4'	064° 37.9'	Caribbean Sea	27.9	34.977	456.4	71.0	1714.5	0.067	0.248	7.971
C289A-006-SS	1-Jan-20	1045	67.6	18° 00.1'	064° 38.1'	Caribbean Sea	27.9	34.986	445.7	71.0	2538.5	0.106	0.257	7.920
C289A-007-SS	1-Jan-20	1747	100.0	18° 14.7'	064° 30.4'	Caribbean Sea	28.2	35.071	426.3	69.3	709.3	0.051	0.000	8.022
C289A-008-SS	1-Jan-20	2227	123.2	18° 09.1'	064° 17.9'	Caribbean Sea	27.8	35.005	430.2	68.9	808.9	0.039	0.253	8.089
C289A-009-SS	2-Jan-20	0615	138.5	18° 16.9'	064° 36.1'	Salt Pass, BVI	28.0	35.082	426.1	68.9	2656.3	0.067	0.271	-
C289A-010-SS	2-Jan-20	1236	158.9	18° 22.4'	064° 41.9'	Soppers Hole, BVI	27.9	35.074	608.7	77.5	184.3	0.384	0.308	7.973
C289A-011-SS	3-Jan-20	1145	165.2	18° 18.8'	064° 37.6'	Norman Island, BVI	27.8	35.099	489.0	72.1	381.1	0.182	0.244	7.987
C289A-012-SS	3-Jan-20	1747	179.6	18° 23.1'	064° 49.4'	Middle Passage, BVI	27.8	35.390	643.0	77.8	784.2	0.368	0.345	7.990
C289A-013-SS	3-Jan-20	2235	207.4	18° 39.4'	065° 10.0'	Atlantic Ocean	27.9	35.200	483.5	71.6	275.5	0.107	0.207	8.038
C289A-014-SS	4-Jan-20	0624	233.0	18° 47.6'	065° 15.5'	Atlantic Ocean	27.9	35.044	470.5	74.5	311.4	0.138	0.188	8.024
C289A-015-SS	4-Jan-20	1059	246.1	18° 56.9'	065° 22.3'	Atlantic Ocean	27.8	35.005	439.2	74.9	418.9	0.139	0.142	7.981

¹ Surface water temperature, salinity, relative chlorophyll fluorescence, colored dissolved organic matter (CDOM) fluorescence, and transmissivity were determined from samples collected in lab by the flow-through seawater system. Extracted chlorophyll-*a*, phosphate, and pH were determined from surface water samples collected using a bucket, deployed over the side of the ship.

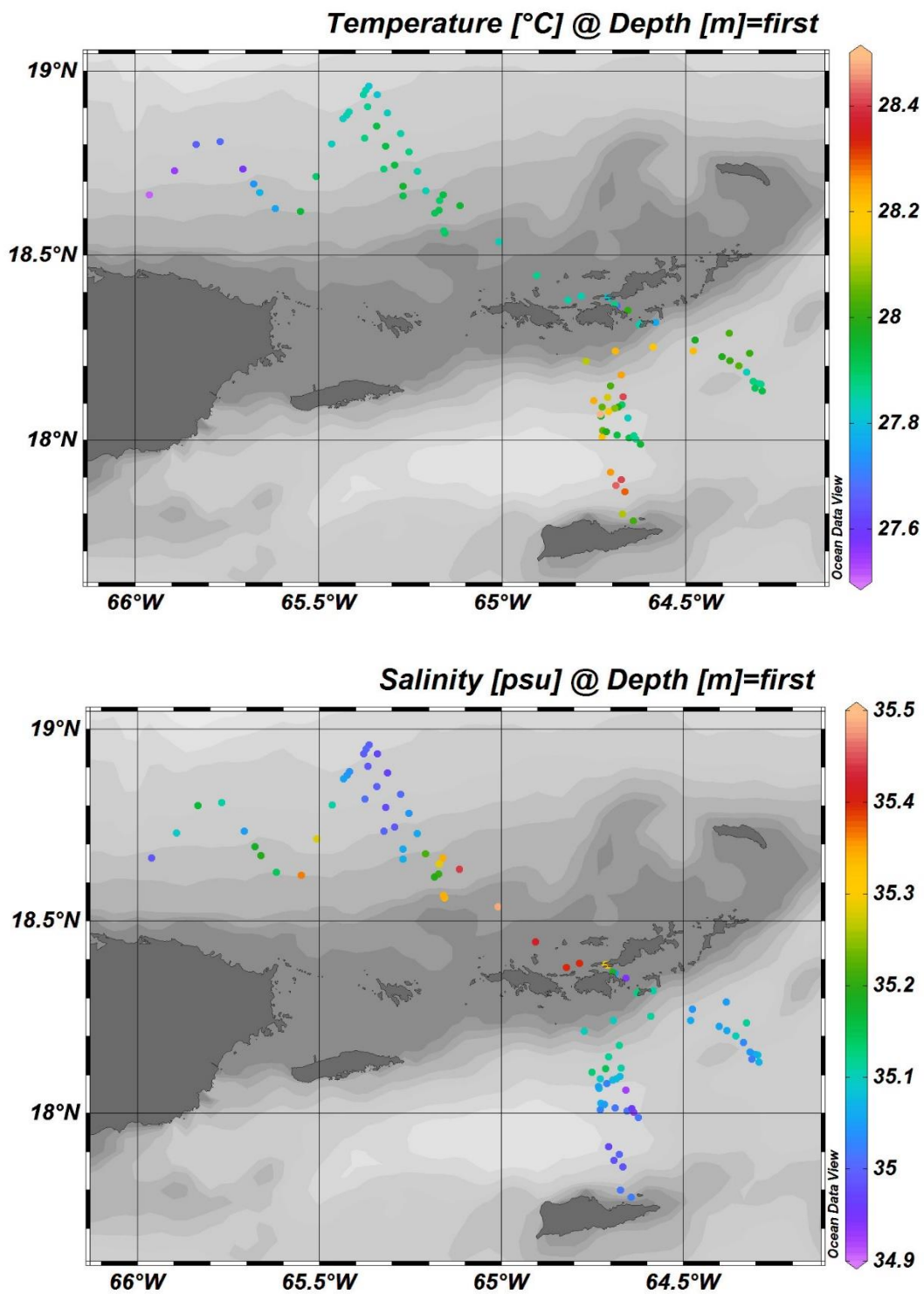


Figure 2. Hourly sea surface temperature (top figure) and sea surface salinity (bottom figure) measurements from the continuous flow-through SeaBird Thermosalinography (S/N 0022) data logger collected during Cruise C-289A.

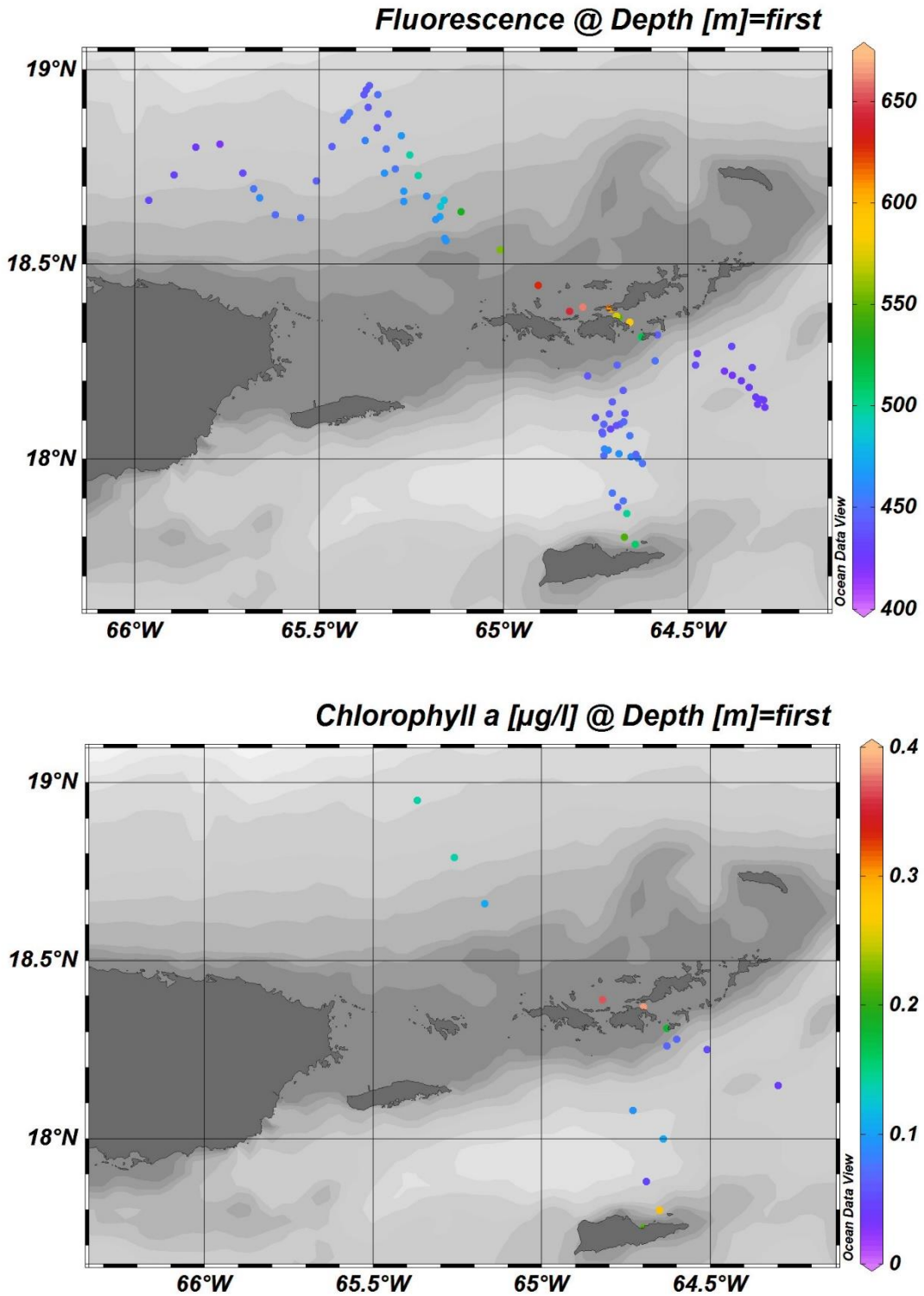


Figure 3. Top figure: Hourly sea surface relative chlorophyll in-vivo fluorescence (in volts) from the continuous flow-through system collected during Cruise C-289A. Bottom figure: Extracted chlorophyll-*a* data (in $\mu\text{g/l}$) from discrete surface station samples SS-001 through SS-015. Data values are given in Table 2.

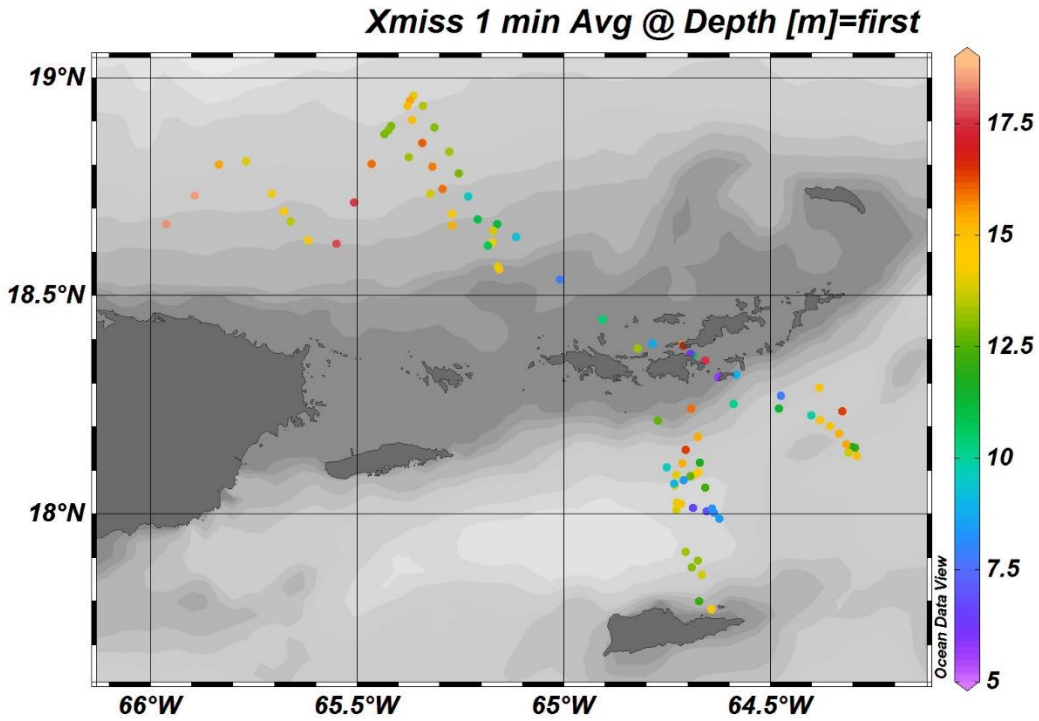


Figure 4. Hourly sea surface transmissivity (in volts) from the continuous flow-through system collected during Cruise C-289A.

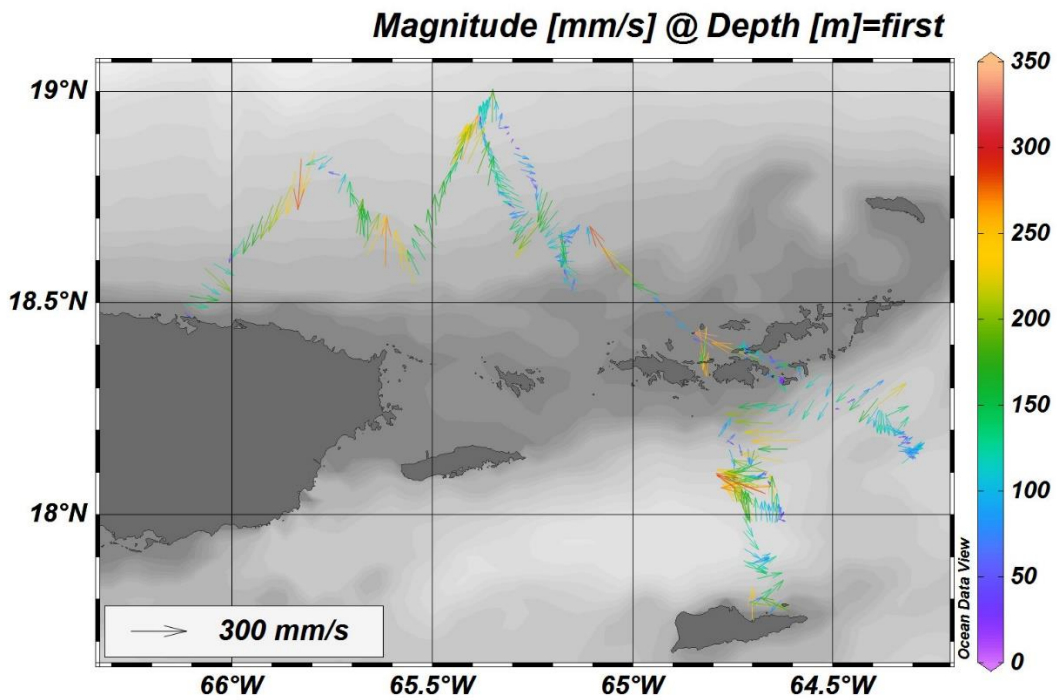


Figure 5. Sea surface current vectors (magnitude and direction) from the Acoustic Doppler Current Profiler (ADCP) collected during Cruise C-289A.

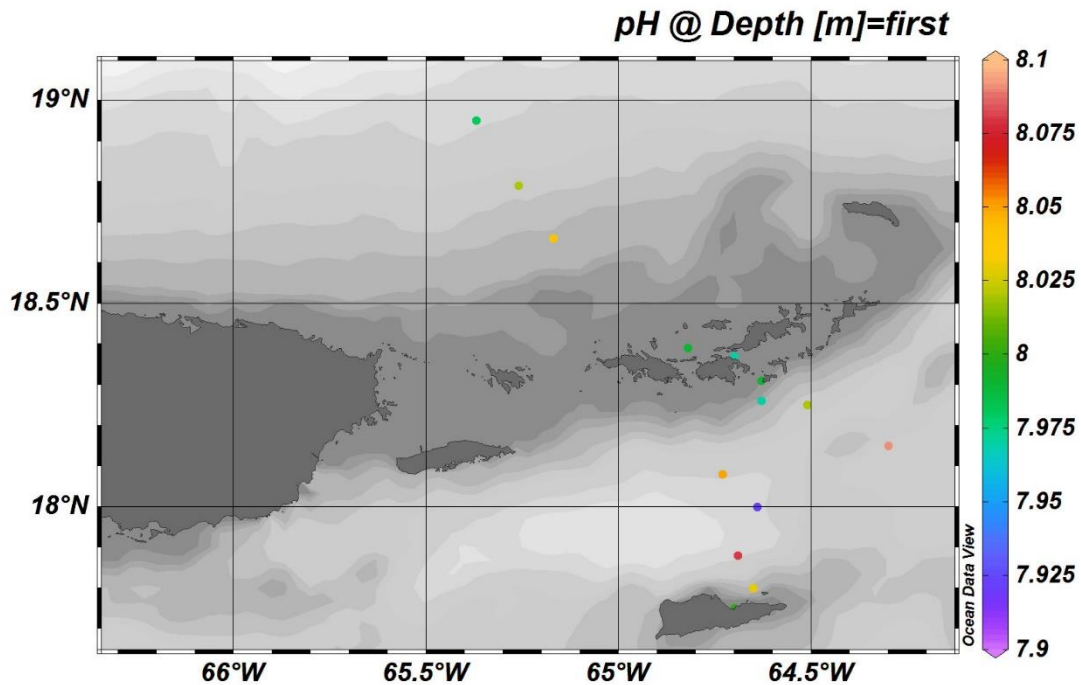


Figure 6. pH data from discrete surface station samples SS-001 through SS-015 collected during Cruise C-289A. Data values are given in Table 2.

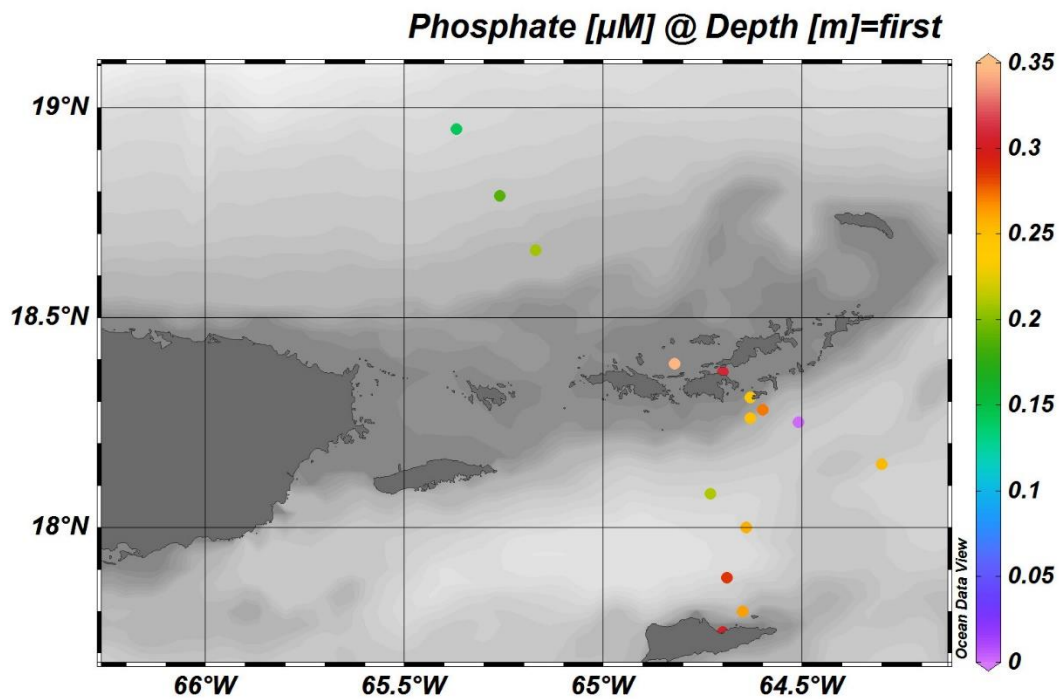


Figure 7. Phosphate data (in μ M) from discrete surface station samples SS-001 through SS-015 collected during Cruise C-289A. Data values are given in Table 2.

Table 3. C-289A hydrocast (HC) bottle data. Station locations and general locales are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. Phosphate and pH profiles are plotted in Figure 13. Analyses conducted as given in footnote at bottom of table on following page.¹

Station #	Bottle #	Depth (m)	Temp (°C)	Salinity (PSU)	Density (kg/m ³)	O ₂ (ml/l)	PO ₄ (μM)	Chl- <i>a</i> (μg/l)	pH	Associated Surface Station
C289A-006-HC	12	20.2	27.80	35.080	1022.61	4.51		0.072		SS-006
	11	39.7	27.80	35.117	1022.72	4.51		0.127		
	10	59.5	28.11	36.851	1024.01	4.44		0.188		
	9	79.6	26.59	37.039	1024.73	4.55		0.358		
	8	99.7	25.26	37.198	1025.35	4.65	0.211	0.112	7.804	
	7	124.6	24.33	37.262	1025.80	4.72		0.042		
	6	148.7	22.99	37.152	1026.21	4.83				
	5	198.3	20.42	36.846	1026.92	5.07	0.303	0.000	7.684	
	4	298.2	17.31	36.389	1027.82	5.39	0.667		7.339	
	3	397.4	14.41	35.908	1028.57	5.72	1.058		7.350	
	2	496.5	12.32	35.584	1029.21	5.99	1.187		7.673	
	1	591.1	10.16	35.233	1029.78	6.29	1.601		7.614	
C289A-008-HC	12	20.2	27.70	35.095	1022.65	4.51		0.018		SS-008
	11	39.7	27.79	35.272	1022.84	4.50		0.049		
	10	60.0	28.51	36.687	1023.75	4.42		0.155		
	9	80.3	27.19	37.046	1024.55	4.50		0.341		
	8	99.8	26.07	37.119	1025.04	4.59	0.193	0.329	8.040	
	7	123.7	24.97	37.300	1025.62	4.67		0.319		
	6	149.5	23.33	37.159	1026.12	4.80				
	5	198.6	20.80	36.903	1026.86	5.03	0.303	0.000	7.918	
	4	298.3	16.65	36.276	1027.89	5.46	0.612		7.833	
	3	398.0	13.99	35.854	1028.62	5.77	1.108		7.755	
	2	496.8	11.41	35.389	1029.24	6.11	1.509		7.682	
	1	582.0	9.93	35.170	1029.73	6.32	1.440		7.636	
C289A-013-HC	12	20.5	27.83	35.293	1022.76	4.50		0.069		SS-013
	11	40.4	28.19	35.495	1022.88	4.47		0.124		
	10	59.6	28.05	36.713	1023.92	4.45		0.458		
	9	80.0	26.97	36.910	1024.51	4.52		0.333		
	8	99.6	25.80	37.190	1025.18	4.61	0.202	0.116	8.050	
	7	124.5	24.59	37.159	1025.64	4.70		0.077		
	6	149.4	23.18	37.156	1026.16	4.82				
	5	199.0	20.18	36.840	1026.99	5.09	0.763	0.000	7.906	
	4	298.5	17.24	36.375	1027.83	5.40	1.145		7.817	
	3	397.1	14.33	35.905	1028.58	5.73	1.660		7.795	
	2	496.6	12.37	35.558	1029.18	5.98	1.959		7.737	
	1	539.0	11.70	35.461	1029.43	6.07	1.426		7.762	

Table 3, continued. C-289A hydrocast (HC) bottle data.

Station #	Bottle #	Depth (m)	Temp (°C)	Salinity (PSU)	Density (kg/m ³)	O ₂ (ml/l)	PO ₄ (μM)	Chl- <i>a</i> (μg/l)	pH	Associated Surface Station
C289A-015-HC	12	19.9	27.73	35.002	1022.57	4.51		0.124		SS-015
	11	39.3	28.12	35.358	1022.80	4.48		0.197		
	10	60.2	28.38	36.844	1023.91	4.42		0.327		
	9	79.1	26.82	37.077	1024.68	4.53		0.435		
	8	100.0	25.76	37.246	1025.24	4.61	0.152	0.131	7.901	
	7	124.4	24.09	37.235	1025.85	4.74		0.054		
	6	149.3	22.70	37.157	1026.31	4.86				
	5	199.2	19.88	36.749	1027.00	5.12	0.124	0.000	7.803	
	4	298.6	17.73	36.465	1027.78	5.34	0.382		7.710	
	3	396.8	15.04	36.026	1028.52	5.65	0.754		7.594	
	2	497.4	12.24	35.562	1029.21	6.00	1.306		7.453	
	1	596.3	10.20	35.229	1029.79	6.28	1.587		7.374	

¹ Temperature, salinity, and density data were determined from a SeaBird 19Plus V2 CTD on each the four hydrocast deployments. Dissolved oxygen was determined with a SeaBird SBE-43 oxygen sensor, deployed with the hydrocast carousel. Extracted chlorophyll-*a* samples were filtered through 0.45 μm filters and measured with a Turner Designs Model 10-AU benchtop fluorometer. Phosphate (PO₄) was assessed with colorometric spectrophotometry. pH was assessed using spectrophotometric analysis with a *m*-creosol purple indicator.

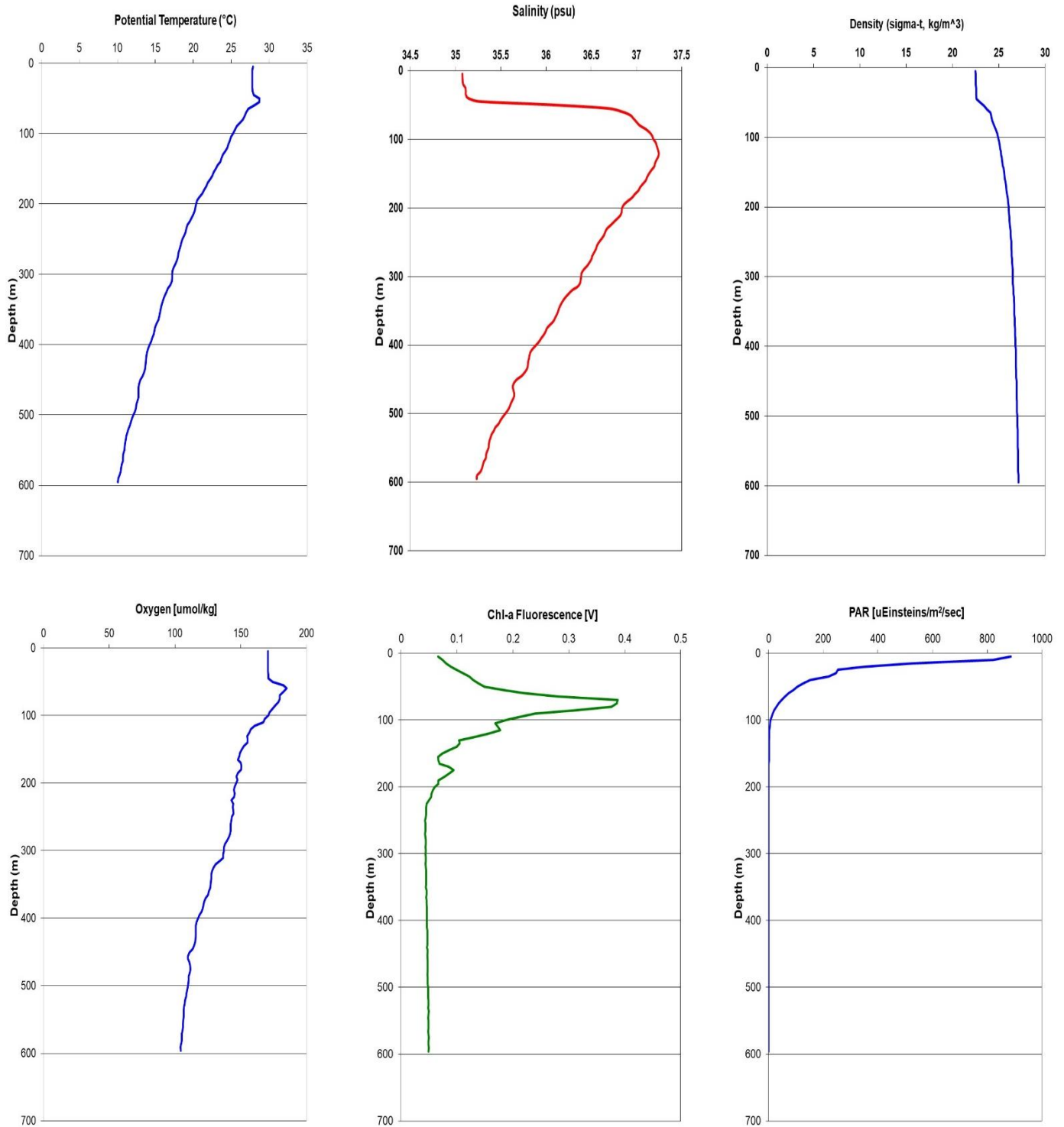


Figure 8. Temperature, salinity, density, dissolved oxygen, chlorophyll fluorescence, and photosynthetically active radiation (PAR) profiles for Station C289A-006-HC. Station location and general locale are given in Table 1. Data from water samples collected during this hydrocast are given in Table 3. Digital data are available from SEA upon request.

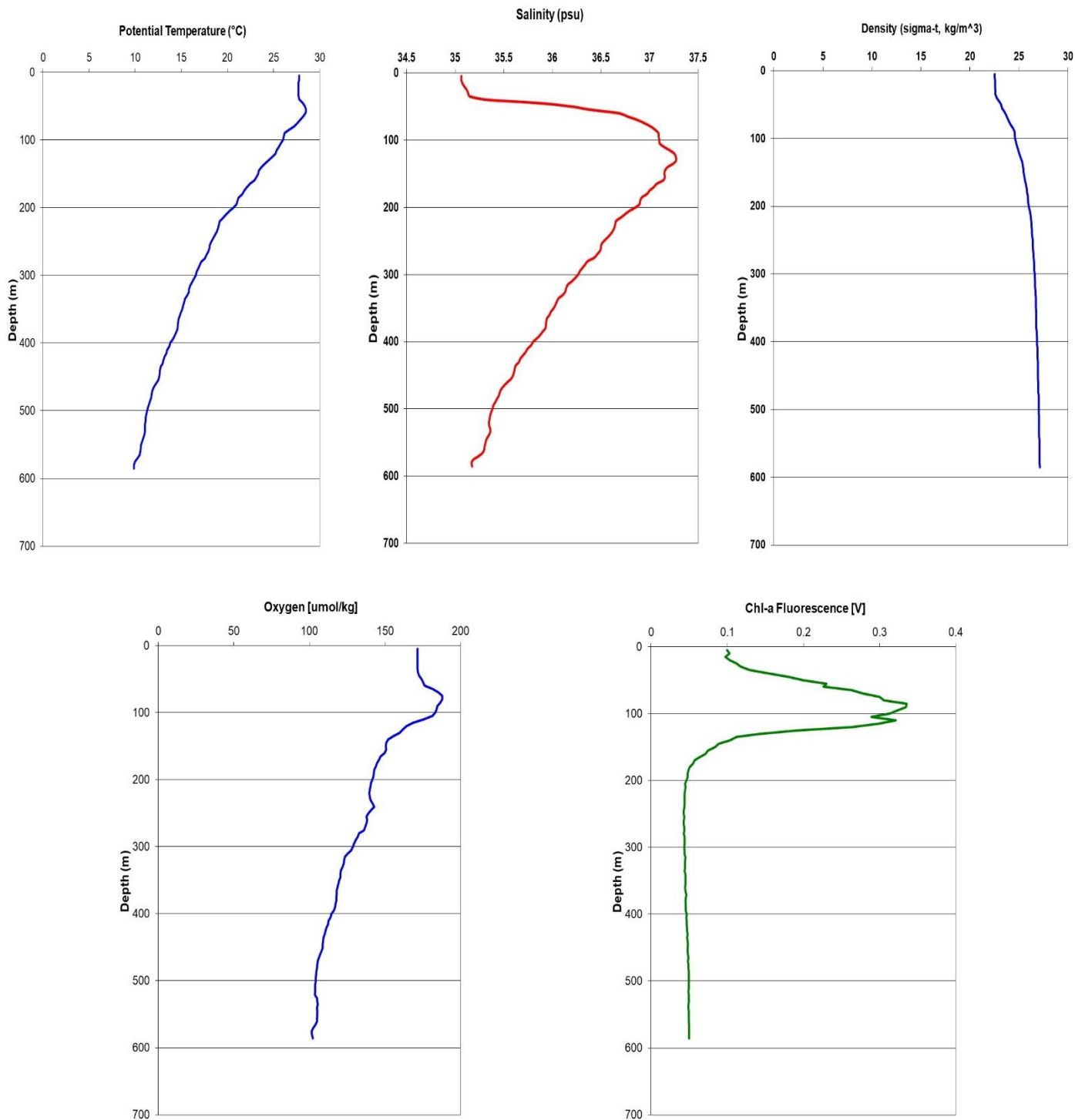


Figure 9. Temperature, salinity, density, dissolved oxygen, and chlorophyll fluorescence profiles for Station C289A-008-HC. No photosynthetically active radiation (PAR) profile is shown, as this was a nighttime hydrocast. Station location and general locale are given in Table 1. Data from water samples collected at depth during this hydrocast are given in Table 3. Digital data are available from SEA upon request.

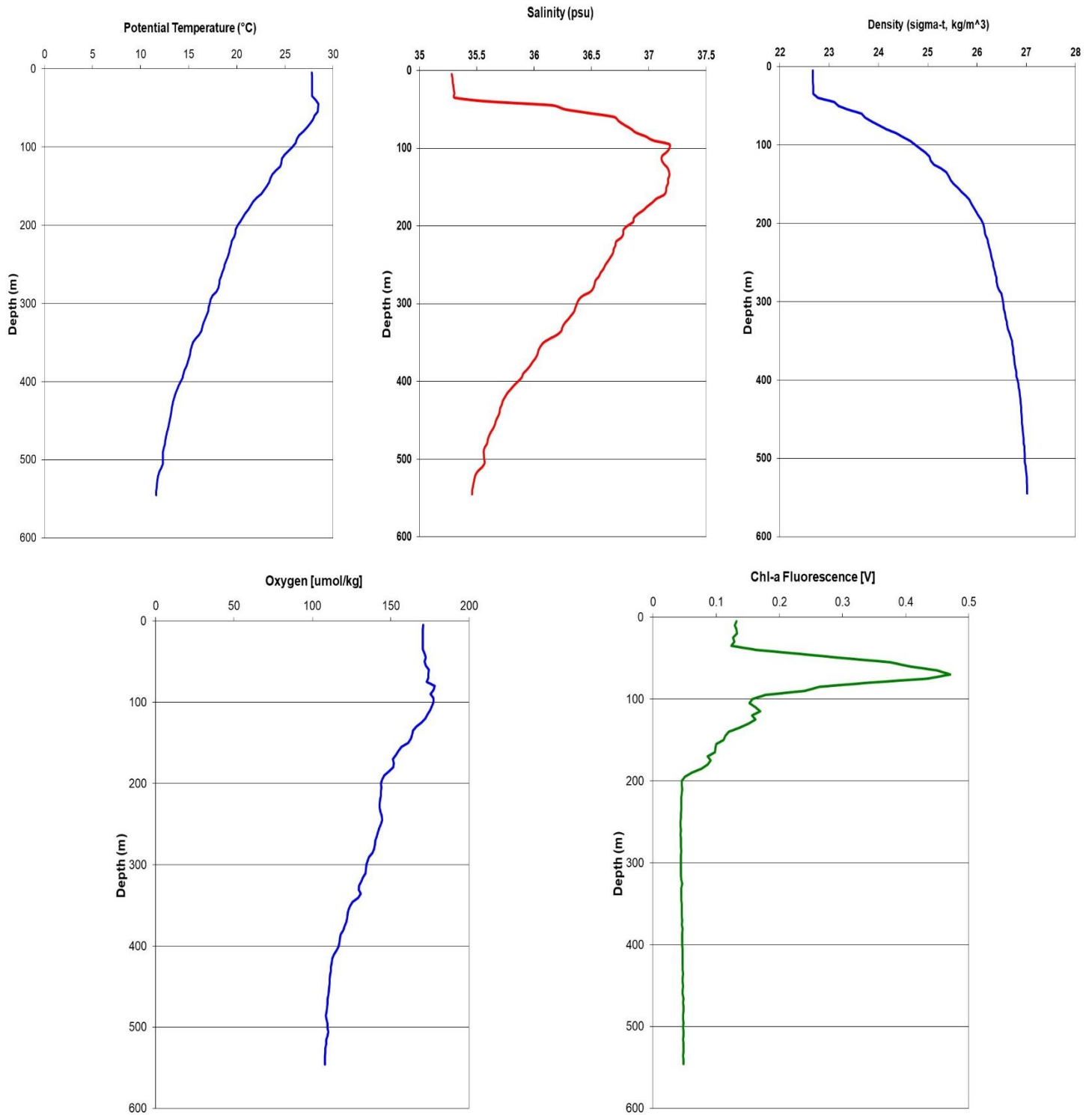


Figure 10. Temperature, salinity, density, dissolved oxygen, and chlorophyll fluorescence profiles for Station C289A-013-HC. No photosynthetically active radiation (PAR) profile is shown, as this was a nighttime hydrocast. Station location and general locale are given in Table 1. Data from water samples collected at depth during this hydrocast are given in Table 3. Digital data are available from SEA upon request.

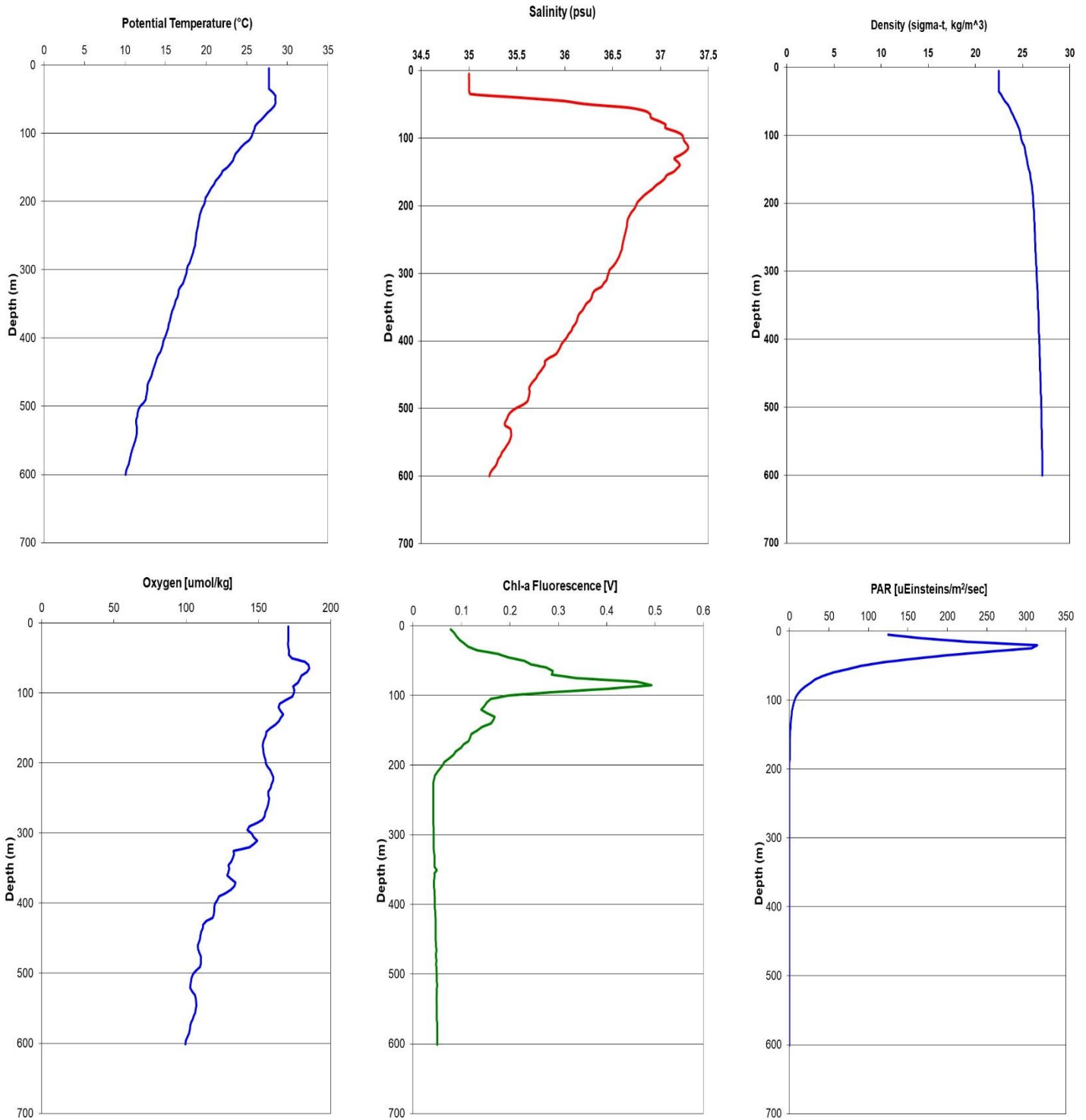


Figure 11. Temperature, salinity, density, dissolved oxygen, chlorophyll fluorescence, and photosynthetically active radiation (PAR) profiles for Station C289A-015-HC. Station location and general locale are given in Table 1. Data from water samples collected at depth during this hydrocast are given in Table 3. Digital data are available from SEA upon request.

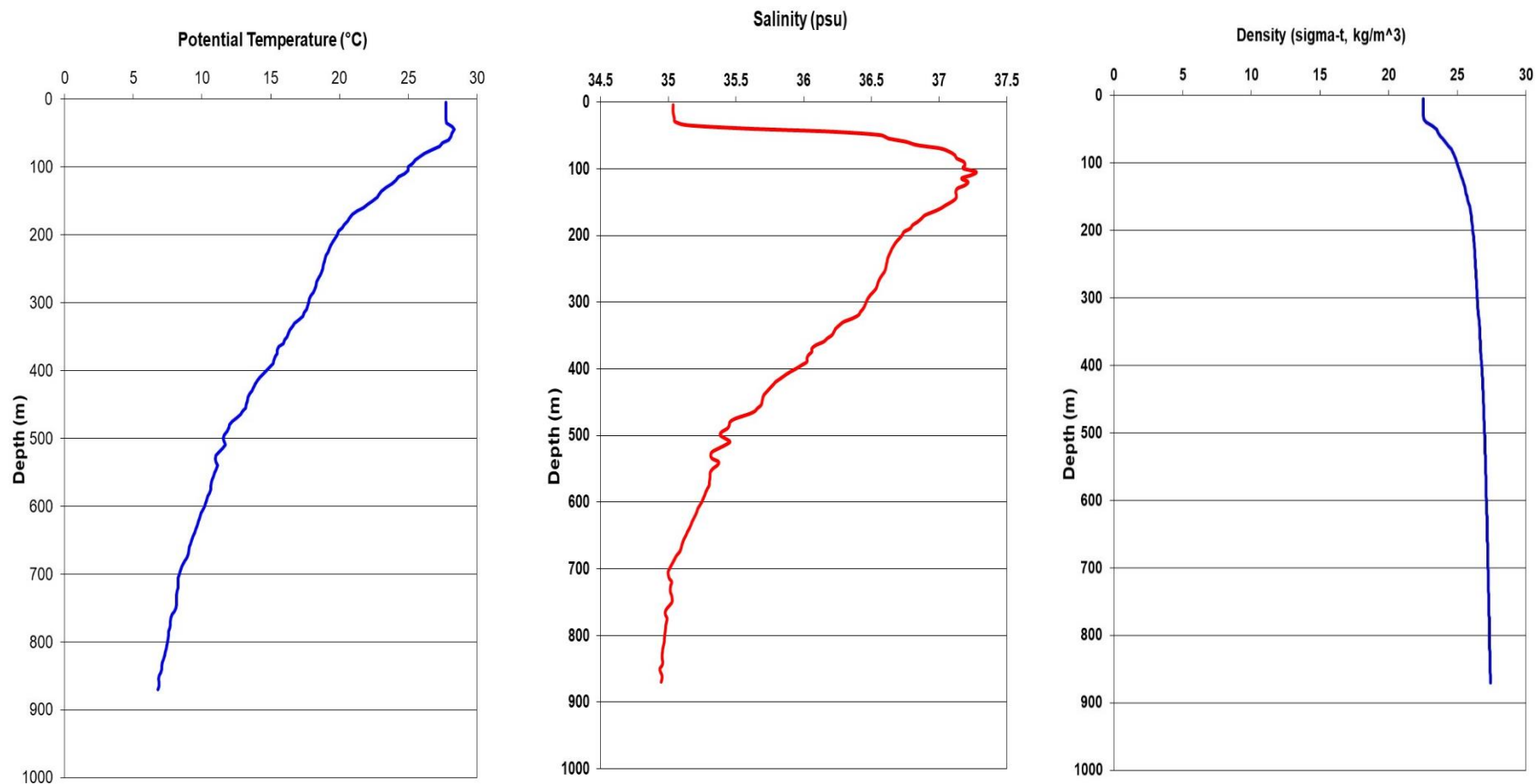


Figure 12. Temperature, salinity, and density profiles for Station C289A-016-CTD. Only the CTD was deployed at this station, so no other profiles or water samples were collected. Station location and general locale are given in Table 1. Digital data are available from SEA upon request.

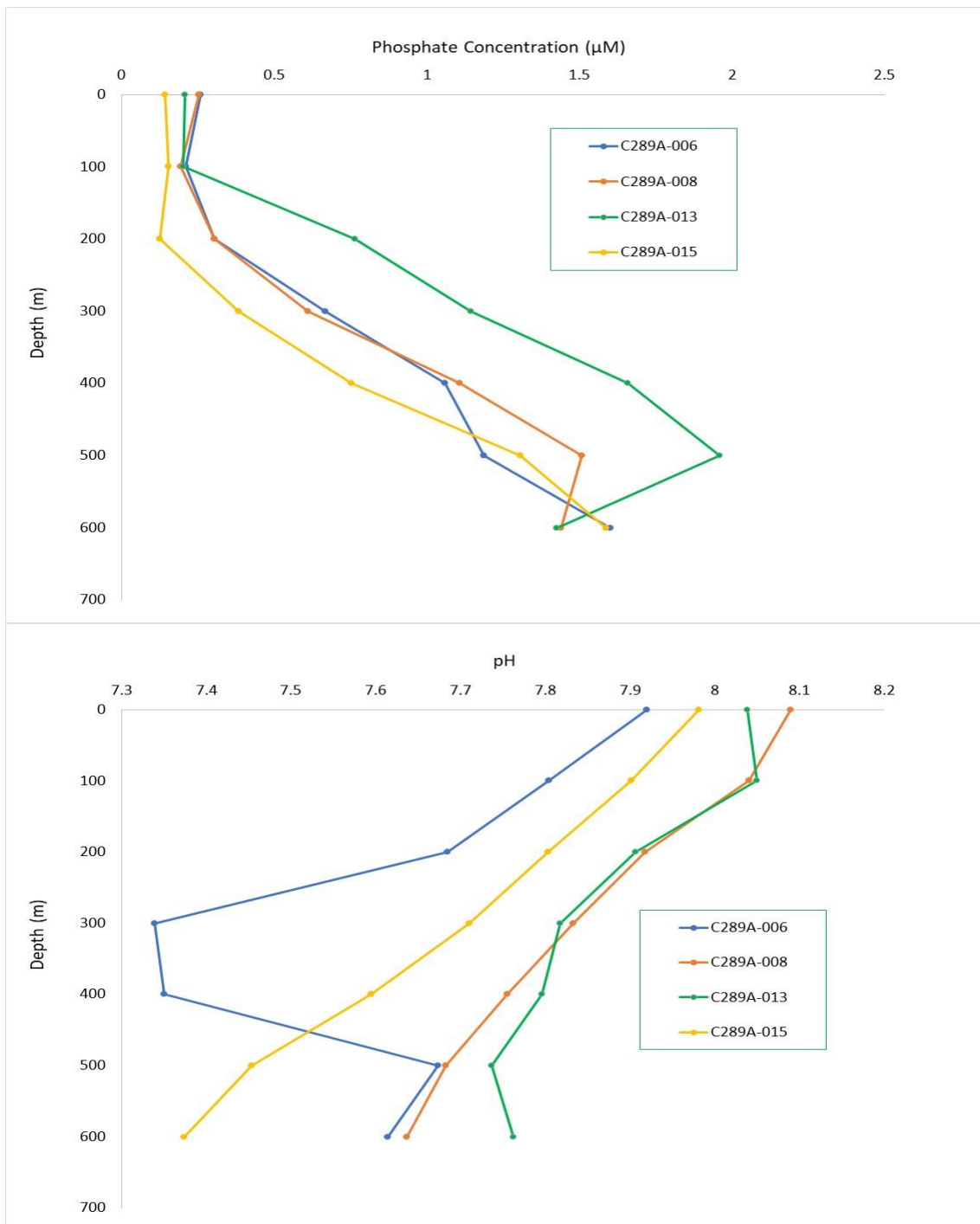


Figure 13. Phosphate concentration data (top figure) and pH data (bottom figure) from discrete water samples collected at depth from Niskin bottles at hydrocast stations during Cruise C-289A. Station locations and general locales are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. Data values are given in Table 3.

Table 4. C-289A neuston net tow (NT) data. Station locations and general locales are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. 100-count data of zooplankton samples are given in Table 5, next page. Explanatory footnotes are given below.^{1,2,3}

Station	Time In (Local)	Moon Phase (%)	Risen or Set?	Cloud Cover (%)	Tow Area ¹ (m ²)	Zoopl. Biomass ¹ (ml)	Zoopl. Density ¹ (ml/m ²)	Myctophids (#) ²	Other Nekton >2cm (#) ²	Total Nekton (#) ²	Total Nekton (ml) ²	Gelatinous Organisms >2cm (#) ²	Gelatinous Organisms >2cm (ml) ²	S. natans III (g) ³	S. natans VIII (g) ³	S. fluitans III (g) ³	Other Sargassum (g) ³	Plastic Pellets (#) ³	Plastic Pieces (#) ³	Tar Pieces (#) ³	Halobates (#) ³	Associated Surface Station
C289A-003-NT	1551	26	Risen	20	1460.1	3.5	0.0024	0	0	0	0.0	0	0.0	0.0	1.5	0.0	0.7	0	0	0	0	SS-003
C289A-004-NT	2305	26	Set	50	1006.3	15.0	0.0149	11	2	13	1.0	20	1.8	0.5	15.0	0.2	15.0	0	0	0	0	SS-004
C289A-006-NT	1152	34	Risen	65	1668.1	3.3	0.0019	0	0	0	0.0	0	0.0	0.0	1.0	0.0	2.0	0	1	0	1	SS-006
C289A-008-NT	2329	34	Set	100	1261.2	15.1	0.0120	3	5	8	6.6	0	0.0	0.0	13.5	0.0	2.5	0	9	0	4	SS-008
C289A-012-NT	1730	53	Risen	15	1717.3	10.0	0.0058	0	0	0	0.0	0	0.0	0.0	0.0	0.0	5.0	0	2	0	0	SS-012
C289A-013-NT	2340	53	Risen	35	1792.2	6.0	0.0033	6	8	14	6.0	5	1.5	0.0	18.0	0.0	38.5	0	0	0	0	SS-013
C289A-015-NT	1206	62	Risen	30	1297.3	2.5	0.0019	0	1	1	0.3	0	0.0	0.0	4.0	0.0	9.0	0	1	0	0	SS-015

¹ Tow area calculated using distance (meters) between successive minutes' GPS positions while net was deployed. Neuston net opening 1.0m wide by 0.5m tall, with 333 μm mesh net. Zooplankton density recorded as wet volume displacement of zooplankton biomass per tow area (ml/m²).

² Micronekton and gelatinous organisms >2cm were removed using a mesh sieve, identified, and biovolume (ml) recorded. No spiny lobster larvae (Phyllosoma), eel larvae (Leptocephali) or Cephalopods were found. In addition to Lantern fish (Myctophids) found in some of the neuston tows, other nekton recovered included: 1 stromatopod and 1 chaetognath (C289A-004-NT); 2 flying fish, 1 beaked fish, 1 stromatopod, and 1 unknown micronekton (C289A-008-NT); 3 silver fish and 5 *Sargassum* nudibranches (C289A-013-NT); and, 1 crab (C289A-015-NT). Gelatinous organisms recovered included 20 salps and 5 salps in samples C289A-004-NT and C289A-013-NT, respectively.

³ Pieces and clumps of *Sargassum* species (*Sargassum natans* III, *S. natans* VIII, *S. fluitans* III, and other *Sargassum*) were removed from net contents, identified, separated, and weighed using a spring balance scale. Floating plastic, tar, and water striders (Halobates) were removed from net contents, sorted, and recorded as numbers collected per tow.

Table 5. C-289A neuston net tow (NT) zooplankton 100-count data. Station locations and general locales are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. Details of net contents recovered are given in Table 4, previous page.

Station	Siphonophores	Ctenophores	Salps	Pteropods	Nudi-branch	Heteropods	Other Snails	Poly-cheate Worms	Chaetognaths	Copepods	Hyperiid Amphipods	Zoea	Shrimp	Lobster Larvae	Mysids	Euphausiids	Ostracods	Cladocera	Iso-pods	Fish Larvae	Fish Eggs	Other	Total # of Organisms Counted	Shannon-Weiner Diversity Index
C289A-003-NT	0	0	0	2	1	0	2	0	2	91	0	0	1	0	0	0	0	0	0	0	1	0	100	0.20
C289A-004-NT	0	0	0	0	0	0	3	0	0	84	2	0	11	0	0	0	0	0	0	0	0	0	100	0.25
C289A-006-NT	0	10	0	2	0	0	9	0	1	66	0	0	0	0	0	1	4	0	0	0	7	0	100	0.52
C289A-008-NT	4	0	0	4	0	2	5	0	3	53	0	1	0	0	1	23	2	0	2	0	0	1	101	0.68
C289A-012-NT	1	0	0	1	0	0	0	14	9	63	0	0	4	0	2	1	0	2	0	3	0	0	100	0.57
C289A-013-NT	1	0	0	0	0	0	33	5	0	58	0	0	3	0	0	0	0	0	0	0	0	0	100	0.43
C289A-015-NT	23	3	1	3	0	0	18	0	3	48	0	0	0	1	0	0	0	0	0	0	0	0	100	0.61

Table 6. C-289A meter net (MN) data. Station location and general locale are given in Table 1. Oceanographic data from associated surface station are given in Table 2. 100-count data of zooplankton samples and details of nekton and gelatinous organisms recovered are available from SEA. Explanatory footnotes are given below. ^{1,2}

Station	Time In (Local)	Tow Depth (m)	Tow Volume (m ³) ¹	Zoopl. Biomass (ml) ¹	Zoopl. Density (ml/m ³) ¹	Myctophids (#) ²	Other Nekton (#) ²	Total Nekton (#) ²	Total Nekton >2cm (ml) ²	Gelatinous Organisms >2cm (#) ²	Gelatinous Organisms >2cm (ml) ²	Plastic Pellets (#) ²	Plastic Pieces (#) ²	Tar Pieces (#) ²	Halobates (#) ²
C289A-004-MN	2200	128.4	2092.3	20.0	0.0096	2	6	8	3.5	1	1.0	0	1	0	1

¹ Meter net has 333µm mesh. Tow volume (m³) calculated from flowmeter measurements. Zooplankton density recorded as wet volume displacement of zooplankton biomass per tow volume (ml/m³).

² Micronekton and gelatinous organisms >2cm were removed using a mesh sieve, identified, and biovolume (ml) recorded. Recovered nekton included 2 Lantern fish (Myctophids), 5 shrimp larvae, and 1 unidentified small fish. The gelatinous organism >2cm recovered was a doliolid. Floating plastic, tar pieces, and water striders (Halobates) were removed from the net contents, sorted, and recorded as number collected. No *Sargassum* was recovered in this meter net tow.

Table 7. C-289A phytoplankton net (PN) data. Station locations are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. Diatom and dinoflagellate percentages are based on counts of 50 random phytoplankton.

Station	Date	Time In (Local)	General Locale	Water Temp (°C) ¹	Salinity (PSU) ¹	Chlorophyll Fluorescence (volts) ¹	Sample Type	Diatoms (%)	Dinoflagellates (%)	Associated Surface Sample
C289A-001-PN	31-Dec-19	0918	Christiansted, St. Croix, USVI	27.9	34.97	551.8	Drifted Surface	64	36	SS-001
C289A-006-PN	1-Jan-20	0914	Caribbean Sea	27.9	35.08	457.5	Drifted Surface	64	36	SS-006
C289A-008-PN	1-Jan-20	2129	Caribbean Sea	27.9	35.12	430.1	Drifted Surface	78	22	SS-008
C289A-011-PN	3-Jan-20	1015	Norman Island, BVI	27.8	35.10	481.1	Drifted Surface	62	38	SS-011
C289A-013-PN	3-Jan-20	2205	Atlantic Ocean	27.9	35.30	488.5	Drifted Surface	48	52	SS-013
C289A-015-PN	4-Jan-20	0943	Atlantic Ocean	27.8	34.99	442.9	Drifted Surface	28	72	SS-015

¹ Sea surface temperature, salinity, and chlorophyll fluorescence measurements from water samples collected in flow-through system while drifted surface plankton net was deployed.

Table 8. C-289A secchi disk (SD) data. Station locations are given in Table 1. Oceanographic data from associated surface stations are given in Table 2.

Station	Date	Time (Local)	General Locale	Water Depth (m)	Cloud Cover (%)	Wave Height (ft)	Wind Speed (BF) ¹	Secchi Depth (m)	Calculated Depth of 1% Light Level (m)	Associated Surface Station
C289A-006-SD	1-Jan-20	0936	Caribbean Sea	2610	60	2	2	33	89	SS-006
C289A-015-SD	4-Jan-20	1000	Atlantic Ocean	3219	60	4	4	31.5	85	SS-015

¹ BF = Beaufort Force.

Table 9. C-289A shipek grab (SG) sediment data. Station locations are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. Water depths determined from CHIRP data.

Station	Date	Time (Local)	Water Depth (m)	General Locale	Sediment Size Analysis (%)									Qualitative Description	Associated Surface Station
					>4mm	3-4mm	2-3mm	1-2mm	0.5-1mm	0.25-0.5mm	0.125-0.25mm	0.063-0.125mm	<0.063mm		
C289A-002-SG	31-Dec-19	1305	11	Near Buck Island, St. Croix, USVI	2.0	1.0	2.0	43.0	45.0	4.0	2.0	1.0	0.0	Coarse calcareous sand. Yellowish gray (5Y 8/1) color. Size of particles is predominately coarse and very coarse sand, with an average grain size $\Phi = 0.08$. Moderately sorted ($\Phi_{SD} = 0.81$). Sand grain shape is mostly subrounded to subangular. Sample is comprised of abundant biogenic particles, including many shell and coral fragments, and only very minor lithogenous mineral grains and small rock fragments. The recovered grab sample also included 2 large rounded coral chunks (each about 6cm in diameter) and 2 large shell fragments (each 4-5cm long).	SS-002
C289A-011-SG	3-Jan-20	1350	26	Norman Island	1.0	1.0	5.0	11.0	14.5	26.0	13.0	18.0	10.5	Medium calcareous sand. Light olive gray (5Y 6/1) color. Mode size of particles is in the medium sand range, with an average grain size $\Phi = 1.9$, but poorly sorted ($\Phi_{SD} = 2.01$). Sand grain shape is predominately angular to subangular. Sample is comprised of mainly shell and coral fragments; lithogenous grains (quartz, feldspar, rock & dark mineral fragments) are most abundant in the smaller size fraction (medium sand or finer).	SS-011

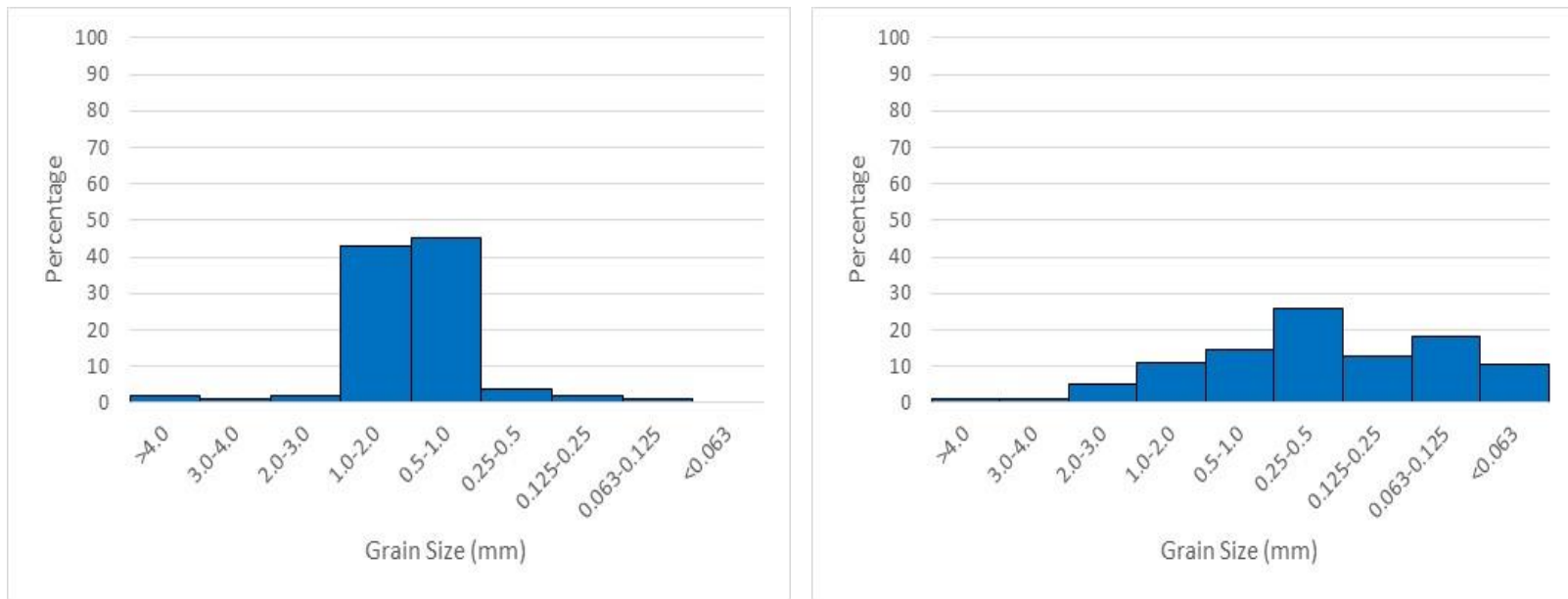


Figure 14. Sediment grain size distribution histograms for the two shipek grab (SG) samples collected during Cruise C-289A. Left figure: Sample C289A-002-SG, collected near Buck Island, St. Croix, USVI; Right figure: Sample C289A-011-SG, collected at Norman Island, BVI. Sediment grain size distribution was determined by wet sieving 100ml of sample through a standard sieve stack and calculating percentage of each size category by wet volume displacement in a graduated cylinder. Sediment <0.063 mm in diameter (silt and clay) passed through the smallest mesh sieve (0.063mm); the percentage of that finest size category was determined by summing the wet volume of the other size categories and subtracting that total from the initial 100ml sediment sample volume. Station locations are given in Table 1. General locales and grain size data, along with qualitative descriptions of sediment samples collected, are given in Table 9.

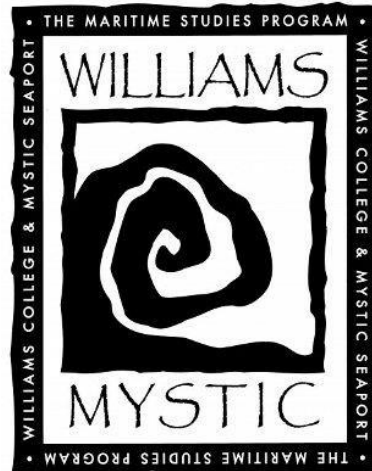
Williams-Mystic Voyage Cruise Report Cruise C289B

Scientific Data Collected Aboard SSV *Corwith Cramer*

**San Juan, Puerto Rico – San Juan, Puerto Rico
26 January 2020 – 5 February 2020**



**Sea Education Association
Woods Hole, Massachusetts**



Cover photo caption: Glamor shot from the rescue boat during man overboard drill in the Atlantic Ocean

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To obtain unpublished data, contact the SEA data archivist:

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C289B Ship's Company, SSV Corwith Cramer

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Lisa Gilbert	Chief Scientist/Williams Mystic Faculty
Kevin Murray	Chief Mate
Christine McCormick	Second Mate
Sara Martin	Third Mate
Dylan Whitney	Chief Engineer
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Introduction

This cruise report provides a summary of scientific activities aboard the SSV *Corwith Cramer* during Cruise C289B (26 January 2019 – 5 February 2019). This voyage was the offshore seminar of the Williams-Mystic Maritime Studies' Spring semester. This is a semester long program where students live in the historic Mystic Seaport and pursue both maritime and marine environmental studies through coursework, apprenticeship, and field seminar. Cruise C289B was their first field seminar starting only a week into the program. In addition to gaining oceanographic and maritime knowledge they focus on leadership and team building. Their time aboard the SSV *Corwith Cramer* not only provides long-term personal and professional development, but sets the stage for the rest of their semester at the seaport.

Students served as an integral and necessary part of the crew, participating in drills and contributing in lab or on deck while standing on one of the 3 watches. They were involved in all aspects of the science-sampling plan, from operating machinery during deployments to processing samples once on board. They attended a daily class focusing on art, environmental science, and practical nautical skills. They were responsible for working in groups to take ownership over a dataset and complete a poster to be presented to professional crew and faculty onboard.

Students boarded in San Juan, immediately beginning shipboard orientation. By the following afternoon they were underway heading north, sampling harbor to near shore to offshore waters including San Juan harbor and the Puerto Rico trench. The major stations were front loaded into this first leg so all water sample could be processed and analyzed for poster presentations. After the deep station, the cruise track headed southeast with the destination of Francis Bay, St. John, USVI. Students spent a day visiting the national park, experiencing the marine environment via swimming and snorkeling at Waterlemon Cay, and learning about island history at the Annenberg Sugar Plantation ruins. The remainder of the trip was spent focusing on projects, maritime studies, and a lighter science-sampling plan. All sampling took place in waters of US jurisdiction.

The brief summary of C289B data contained in this report is not intended to represent final data interpretation and should not be excerpted or cited without written permission from SEA.

Data Description

This section provides a record of data collected aboard SSV *Corwith Cramer* Cruise C289B, which departed and returned to San Juan, Puerto Rico with a stop at Francis Bay, St. John, U.S. Virgin Islands (Figure 1).

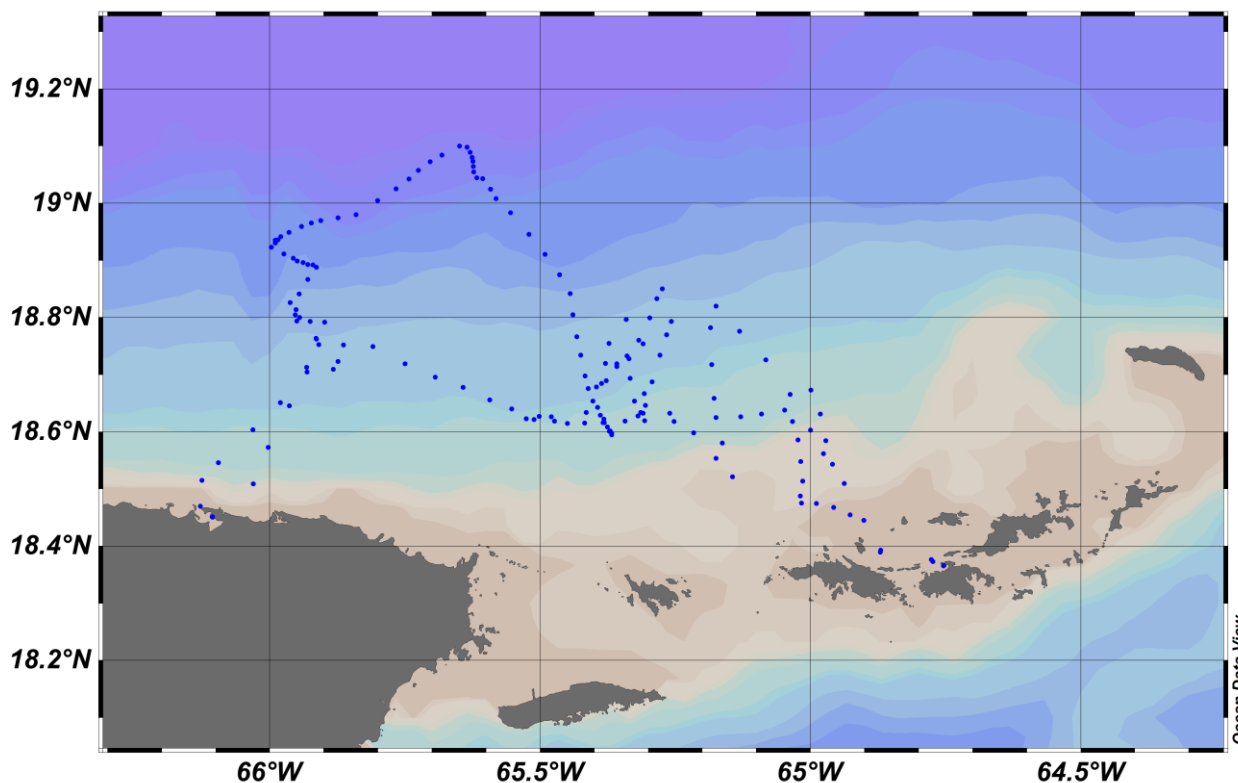


Figure 1. C289B voyage track, 26 January 2020 – 5 February 2020, from San Juan, Puerto Rico to San Juan, Puerto Rico. Dots display hourly GPS locations of the ship while underway.

Cruise C289B, Williams Mystic S20, collected biological, chemical, and physical oceanographic data over the duration of 10 days. The cruise track provided opportunity to sample near-shore to offshore, both surface waters and at depth, and sample benthic sediments.

Sampling was front-loaded into 3 major deployment stations (C289B-002, 004, and 007) starting at 0700 on the 3rd, 4th, and 5th days of the cruise. These provided each watch an opportunity to deploy the CTD and Niskin rosette carousel, 63 μm phytoplankton net, 333 μm neuston net, and 30cm Secchi disk. The Secchi disk and CTD were deployed using the hydraulic winch over boarding system while neuston and phytoplankton nets were deployed by hand. Surface stations were taken with each neuston deployed and served as bottle 13, the surface depth for the hydrocast water samples. A sediment sample was obtained using hydraulic winch and Shipek grab during station C289B-007-SG, and freeCTD (no carousel) was deployed to a depth of 1680m with “styrocast” cups attached during C289B-004-CTD.

Smaller deployments including neuston tow and surface station occurred at 2300 each night and at 1100 with the three major deployment stations and continuing after they were complete. Surface stations were taken every 6 hours, with neuston tows and at 0500 and 1700.

Continuous underway sampling included surface and depth current data from the Acoustic Doppler Current Profiler (ADCP), water depth and sub-bottom profiles from the 3.5kHz CHIRP echo sounder, and surface water properties such as temperature, salinity, chl- α fluorescence, colored dissolved organic matter (CDOM), and transmittance from a seawater flow-through system. Hourly sea surface water temperature, salinity, chlorophyll fluorescence, and transmittance data was recorded in logbook and data files, (figures 2-4).

Vertical transects from CTD casts included salinity, temperature, density, dissolved oxygen, Chl- α fluorescence, and photosynthetically active radiation. The freeCTD cast included salinity, temperature, and depth (figures 5-8).

Whole water samples for pH, PO₄, and Chl- α were collected from the niskin rosette at 12 different depths ranging from 1000-10m (table 3), in addition to surface station bucket (table 2). Chl- α was filtered from samples using a 0.45um cellulose filter and vacuum pump and frozen prior to being batch processed using an acetone lysing procedure and Turner Designs 10AU fluorometer to determine concentration in $\mu\text{g/l}$. PO₄ samples were placed directly in the freezer to be batch processed using colorimetric spectrometry and a known standard curve. pH was determined within 2 hours of the samples collection using m-cresol dye and colorimetric spectrometry.*

Net tow samples were processed in the lab to account for biovolume of zooplankton. Larger nekton was biovolumed and sargassum communities were defined by form and mass (table 6). A 1mL subsample of plankton biovolume was used to count the first 100 individuals and determine biodiversity using a Shannon Weiner index (table 7). The first 50 individuals of Phytoplankton net contents were identified to determine diatom to dinoflagellate ratio of subsample (table 5).

Certain large datasets, namely CTD, CHIRP, ADCP and flow-through data, are not fully presented here due to their size but are available by request. All unpublished data can be made available by arrangement with the SEA data archivist (contact information, p. 2).

*pH samples that were not run within 2 hours of collected are noted in the data tables, notably C289B-002-HC.

Table 1.

C289B oceanographic sampling stations. X indicates type of station. (NT = Neuston Tow, PN = Phytoplankton Net, HC = Hydrocast with 12 Niskin bottles, CTD and optical instrumentation, SD = Secchi Disk, SG = Shipek Grab, SS = Surface Station.) See footnotes at bottom of table.^{1,2}

Station summary	Date	Start Time (Local)	Latitude (N) ¹	Longitude (W) ¹	General Locale	NT	PN	HC ²	FreeCTD	SD ²	SG ²	Associated Surface Station
C289B-001	27-Jan-20	2342	18°47.6'	65°54.9'	-	X	-	-	-	-	-	SS-002
C289B-002	28-Jan-20	0725	18°53.6'	65°56.1'	Puerto Rico Slope	X	X	X(1000)	-	X(21.8)	-	SS-004
C289B-003	28-Jan-20	2304	18°58.8'	65°50.4'	-	X	-	-	-	-	-	SS-006
C289B-004	29-Jan-20	0728	19°5.7'	65°38.0'	Puerto Rico Trench		X	X(1000)	X(1680)	X(46.3)	-	SS-009
C289B-005	29-Jan-20	1315	19°2.7'	65°36.9'	-	X	-	-	-	-	-	SS-009
C289B-006	29-Jan-20	2305	18°45.8'	65°25.9'	-	X	-	-	-	-	-	SS-011
C289B-007	30-Jan-20	0740	18°35.8'	65°22.0'	5nm N of Virgin Bank	X	X	X(1000)	-	X(28.0)	X(705)	SS-013
C289B-008	30-Jan-20	2340	18°43.5'	65°21.2'	-	X	-	-	-	-	-	SS-015
C289B-009	31-Jan-20	1103	18°38.7'	65°18.4'	-	X	-	-	-	-	-	SS-017
¹ Start time and latitude/longitude taken as first equipment was deployed during each station.												
² Depths given in parentheses for HC, SD, FreeCTD and SG deployments represent maximum wire out which may differ from actual depth of instrument due to wire angle.												

Table 2.

C289B surface sampling station (SS) data. Associated oceanographic sampling stations are given in Table 1. See footnote at bottom of table.¹

Surface Station	Date	Time (Local)	Log (nm)	Latitude (N)	Longitude (W)	Temp (°C) ¹	Salinity (PSU) ¹	Fluoro. Chl- α (Volts) ¹	Tx (1/min) Avg ¹	Chl- α ($\mu\text{g/l}$) ¹	PO ₄ (μM) ¹	pH ¹
SS-001	27-Jan-20	1705	6.1	18.525	-66.120	27.1	35.300	507.0	104.0	0.303	0.021	8.030
SS-002	28-Jan-20	0004	29.8	18.797	-65.928	27.2	35.405	451.5	135.2	0.216	0.036	8.090
SS-003	28-Jan-20	0500	47.4	18.888	-65.913	27.1	35.512	406.5	357.1	0.113	0.075	7.980
SS-004	28-Jan-20	1120	41.9	18.917	-65.987	27.2	35.532	376.4	261.1	0.108	0.070	7.840
SS-005	28-Jan-20	1707	45.5	18.942	-65.977	27.9	35.773	382.7	227.8	0.054	0.051	8.080
SS-006	28-Jan-20	2310	54.1	18.982	-65.935	27.5	35.798	445.0	272.6	0.041	0.041	8.090
SS-007	29-Jan-20	0506	64.8	19.085	-65.680	26.8	35.780	404.0	518.2	0.004	0.055	8.090
SS-008	29-Jan-20	1103	70.1	19.065	-65.623	27.2	35.820	416.0	279.0	0.000	0.154	7.850
SS-009	29-Jan-20	1328	71.7	19.045	-65.613	28.0	35.824	404.9	330.0	0.148	0.095	8.020
SS-010	29-Jan-20	1657	76.9	19.045	-65.613	28.1	35.849	433.1	310.0	0.191	0.085	7.980
SS-011	29-Jan-20	2310	92.3	18.762	-65.430	27.2	35.848	393.2	391.0	0.004	0.041	8.100
SS-012	30-Jan-20	0503	101.4	18.622	-65.382	27.2	35.550	410.0	258.0	0.070	0.042	7.990
SS-013	30-Jan-20	1224	106.5	18.628	-65.397	27.5	35.602	426.1	264.0	0.081	0.396	7.790
SS-014	30-Jan-20	1706	120.8	18.802	-65.335	27.4	35.668	484.9	1448.9	0.043	0.090	8.060
SS-015	31-Jan-20	0023	138.0	18.701	-65.365	27.2	35.700	474.0	942.0	0.042	0.139	8.090
SS-016	31-Jan-20	0453	150.3	18.787	-65.265	27.2	35.628	458.6	1482.0	0.187	0.134	8.080
SS-017	31-Jan-20	1110	167.7	18.628	-65.307	27.5	35.682	457.4	1394.0	0.070	0.100	7.930
SS-018	31-Jan-20	1710	182.9	18.597	-65.212	27.7	35.700	460.0	1394.0	0.007	0.000	8.080

¹Temperature, Salinity, Chl- α (fluoro.), and transmittance were determined using underway flow through system and real time data recording, from a depth of 2m. Chl- α ($\mu\text{g/l}$) was determined by filtering 250mL of whole water sample through a 0.45mm filter, freezing, and then batch processing with acetone lysing process and Turner Designs 10AU fluorometer. PO₄ and pH was determined using colorimetric spectrometry.

Figure 2.

Hourly sea surface temperature measurements from the continuous flow-through SeaBird Thermosalinograph (S/N 0022) data logger collected during Cruise C-289B. Sea surface temperatures recorded ranged from a minimum of 26.8205°C to a maximum of 28.4014°C. Color scale is provided on right side of figure.

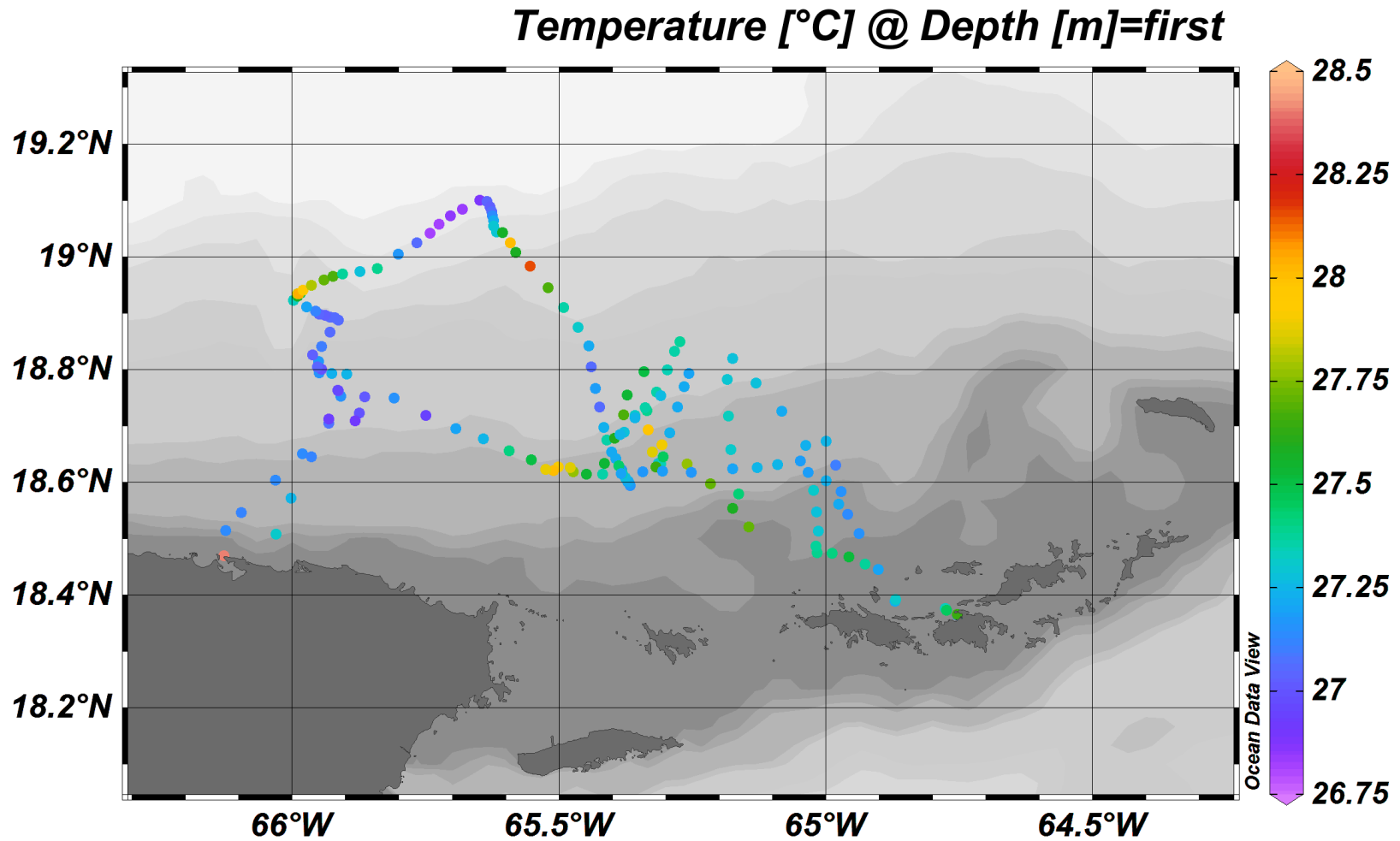


Figure 3.

Hourly sea surface salinity measurements from the continuous flow-through SeaBird Thermosalinograph (S/N 0022) data logger collected during Cruise C289B. Sea surface salinities recorded ranged from a minimum of 35.2006 PSU to a maximum of 35.8863 PSU. Color scale is provided on right side of figure.

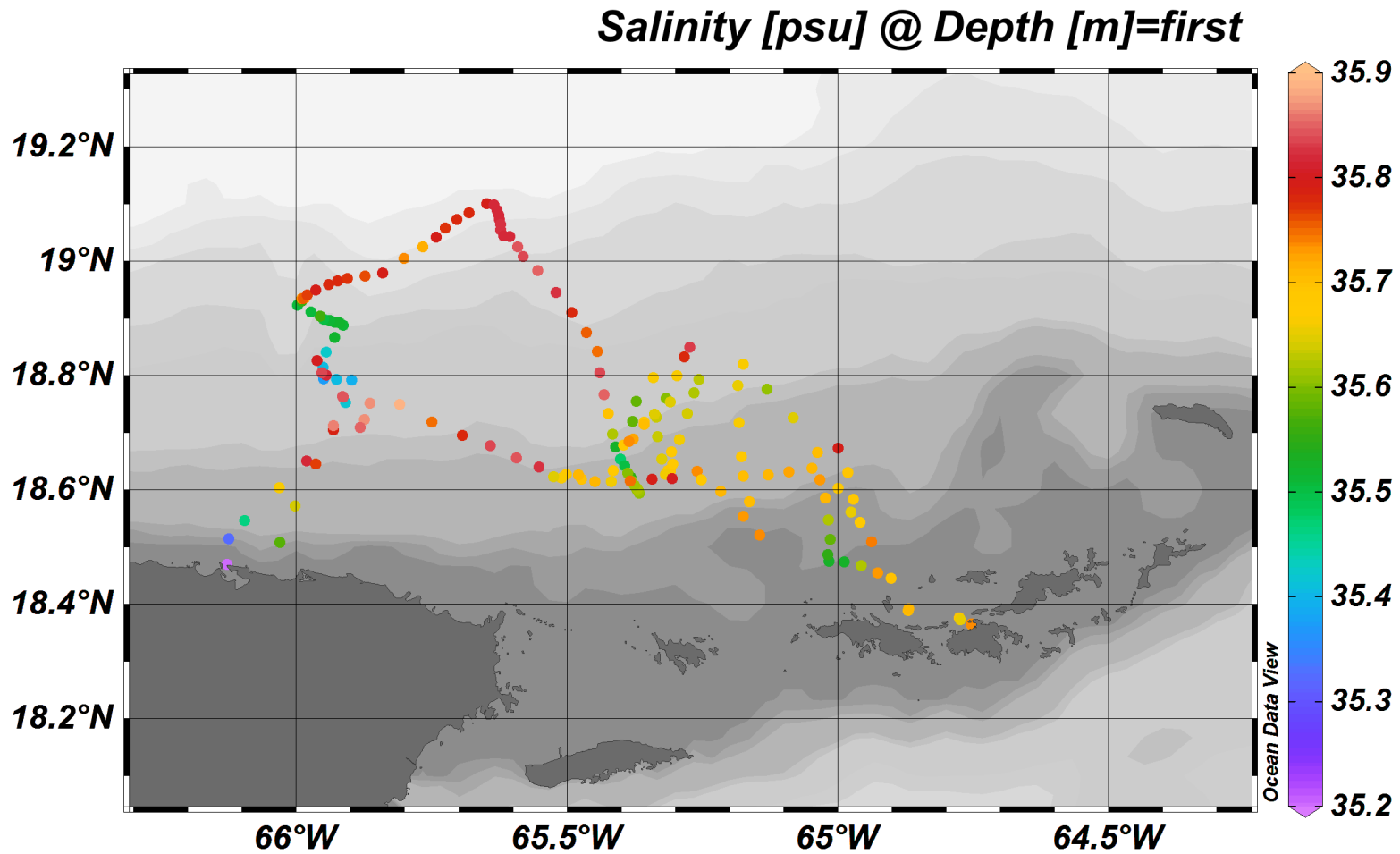


Figure 4.

Hourly sea surface relative chlorophyll in-vivo fluorescence (in volts) from continuous flowthrough Seapoint fluorometer collected during Cruise C289B. Sea surface chlorophyll fluorescence recorded ranged from a minimum of 419.2 volts to a maximum of 1279.28 volts. The high value was significantly higher than the second highest, a value of 652.67 volts. This may have been due to cleaning the pre-filter and allowing algae built up in the tubing to pass through to the sensor. The Color scale is provided on right side of figure.

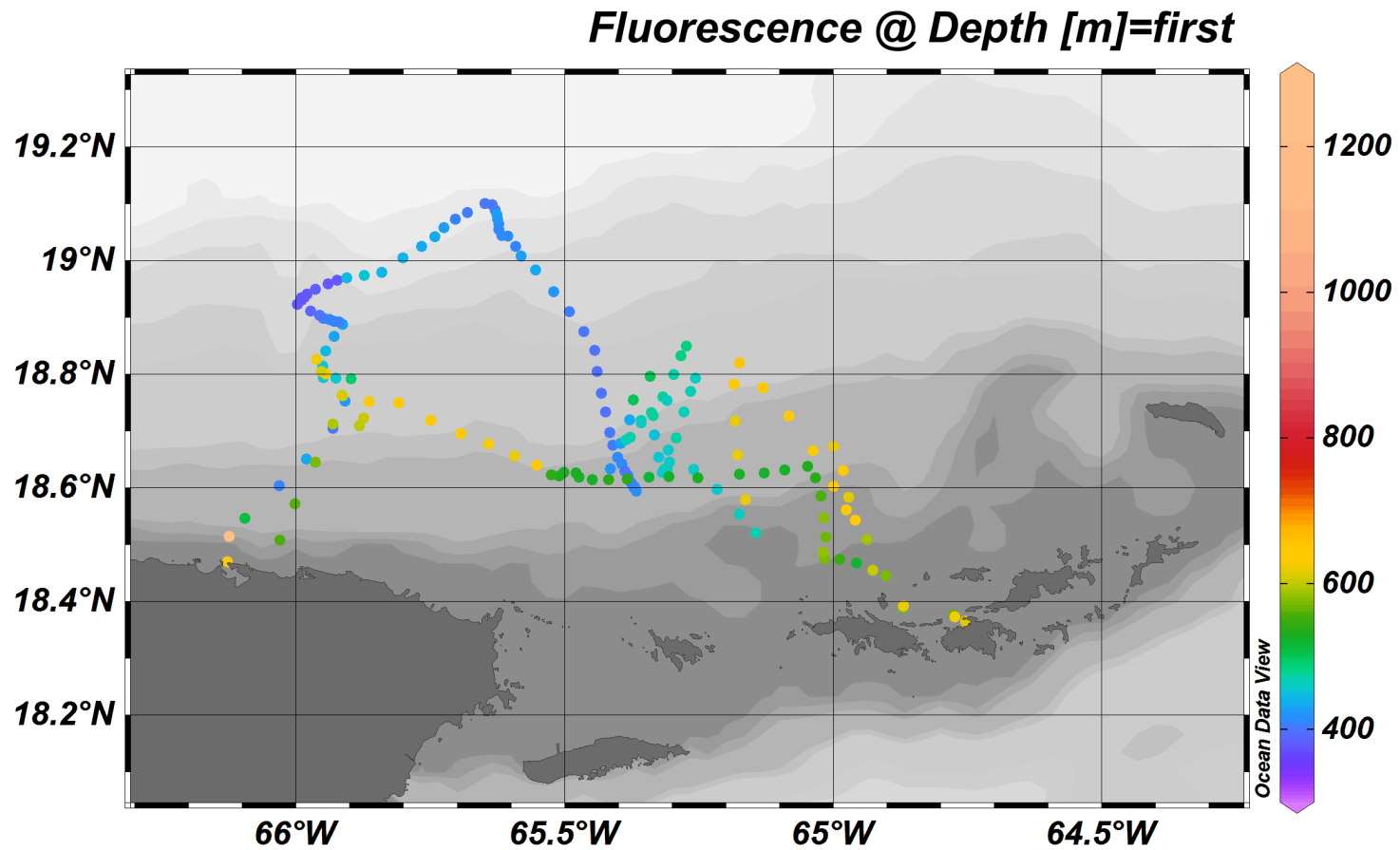


Table 3.

C289B hydrocast (HC) bottle data. Station locations of the three hydrocasts are given in Table 1. Oceanographic data from associated surface stations (SS-004, SS-008, and SS-013) are given in Table 2. See footnotes at bottom of table.^{1,2,3}

Station	Bottle# ¹	Water Depth (m)	Temp (°C)	Salinity (PSU)	Density (kg/m ³)	Dissolved Oxygen (mg/l)	Chl-α (µg/L)	PO ₄ (µM)	pH ²
C289B-002-HC ³	13 (SS-004)	0.0	27.2	35.53	-	-	0.108	0.070	7.84326531
	12	10.605	27.0952	35.7525	1023.2991	4.54307	0.050	0.105	8.0397428
	11	DNF	DNF	DNF	DNF	DNF	DNF	DNF	DNF
	10	30.077	27.0279	35.8343	1023.4649	4.54571	0.073	0.115	8.02323153
	9	39.881	27.0737	35.8896	1023.5334	4.54069	0.107	0.075	8.01051566
	8	49.897	27.0887	35.9653	1023.628	4.53746	0.252	0.085	7.97780124
	7	59.832	27.2072	36.1905	1023.8015	4.52271	0.420	0.085	7.97875872
	6	99.651	25.2425	37.1656	1025.3279	4.64728	0.203	0.065	7.9536074
	5	149.596	22.8934	37.1366	1026.2265	4.83934	0.016	0.258	7.89129862
	4	298.18	17.4433	36.4383	1027.8129	5.36861	0.000	0.455	7.82438726
C289B-004-HC	13 (SS-008)	0	27.2	35.82	-	-	0.000	0.154	7.84976283
	12	10.437	26.8623	35.8078	1023.4146	4.55921	0.068	0.041	-
	11	19.619	26.7358	35.7978	1023.4865	4.56889	0.025	0.070	8.02224538
	10	29.836	26.7263	35.816	1023.5465	4.56896	0.014	0.055	-
	9	49.899	26.7222	35.8341	1023.6465	4.56846	0.037	0.055	-
	8	74.354	26.9823	36.8831	1024.4573	4.52167	0.159	0.046	8.04666982
	7	99.582	25.5962	37.1532	1025.2081	4.61992	0.405	0.075	7.93431701
	6	119.561	25.023	37.2279	1025.5275	4.66261	0.149	0.070	8.03324752
	5	129.364	24.3049	37.2126	1025.7773	4.72041	0.100	0.080	8.01927665
	4	248.306	18.8495	36.6264	1027.3818	5.22197	0.000	0.272	7.86041097
C289B-007-HC	13 (SS-013)	0	27.5	35.60	-	-	0.081	0.396	7.87599504
	12	10.56	27.1337	35.616	1023.1837	4.54366	0.064	0.110	7.89402955
	11	20.21	27.1439	35.7526	1023.3242	4.53925	0.056	0.095	7.8767694
	10	30.273	27.0558	35.8158	1023.4428	4.54408	0.080	0.120	7.83269417
	9	40.099	27.0803	35.885	1023.5287	4.5403	0.113	0.105	7.85412644
	8	50.079	26.9864	35.9706	1023.6656	4.545	0.387	0.110	7.72555856
	7	59.851	27.2334	36.1467	1023.7601	4.52186	0.482	0.110	7.72212332
	6	69.65	27.3693	36.9096	1024.332	4.49236	0.545	0.085	7.71762108
	5	79.808	26.7488	36.9375	1024.5965	4.53768	0.383	0.060	7.6584952
	4	99.339	25.5361	37.1015	1025.1869	4.62596	0.212	0.090	7.41872506
C289B-007-HC	3	297.841	17.0025	36.3712	1027.869	5.41672	0.000	0.445	7.35301471
	2	496.876	11.7074	35.4561	1029.2208	6.06312	0.000	1.317	7.4131051
	1	767.266	7.6765	34.9874	1030.8044	6.64493	0.000	1.776	7.4131051

¹ More data on bottle # 13 (associated surface station), including Chl-α fluorescence and transmittance can be found in Table 2. Chl-α fluorescence of surface stations and skin samples should not be related as they were taken with different fluorometers.

² pH measurements on C289B-002-HC were taken outside of the 2 hr window considered acceptable. Values may be effected by this.

³ Bottle # 11 for station C289B-002-HC did not fire.

Figure 5.

Depth profiles of temperature, salinity, density, chlorophyll fluorescence, dissolved oxygen, and photosynthetically active radiation data for hydrocast Station C289B-002-HC. Station location and general locale are given in Table 1. Data from water samples collected in bottles at depth during hydrocast deployment are given in Table 3. Digital data are available from SEA upon request.

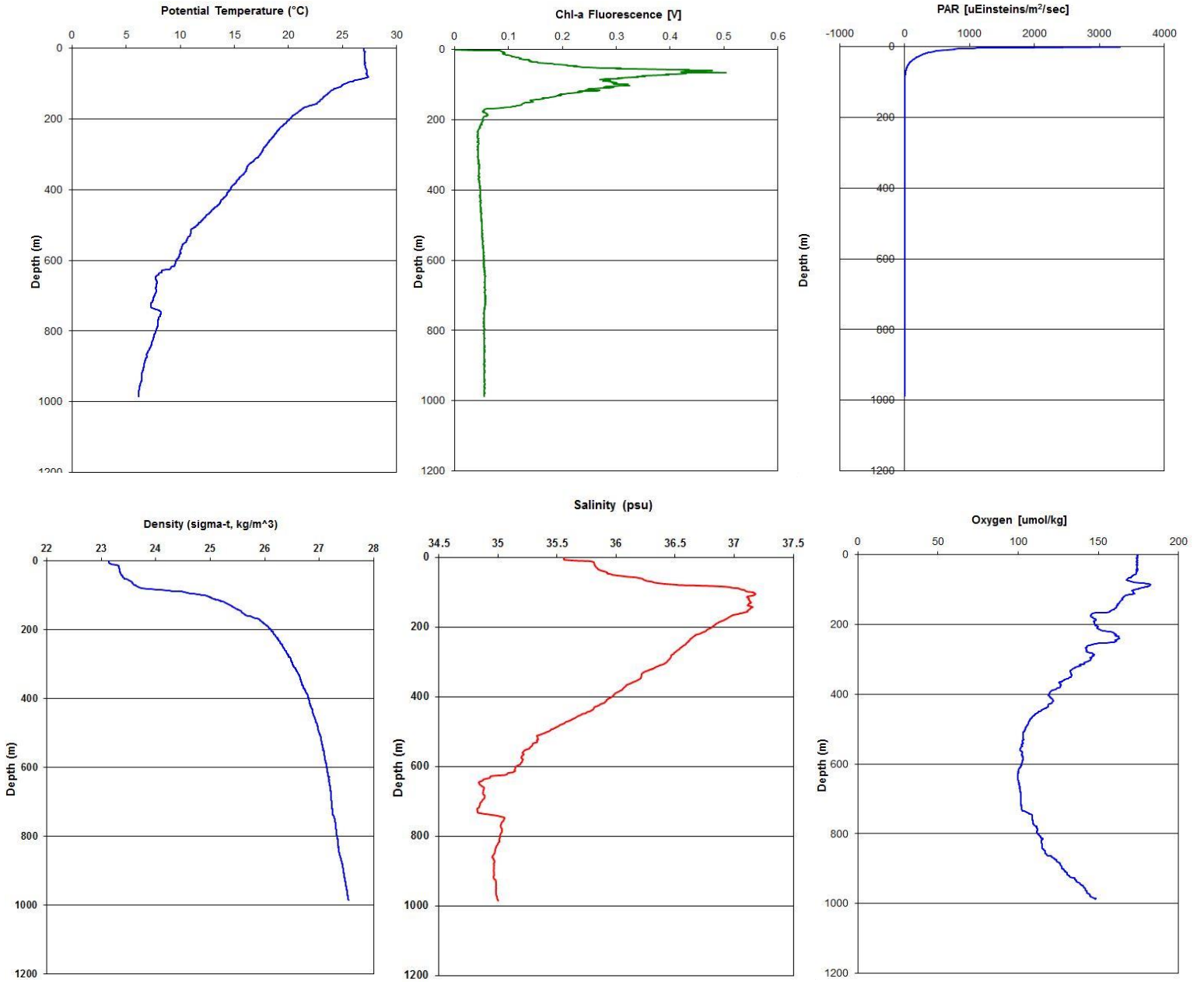


Figure 6.

Depth profiles of temperature, salinity, density, chlorophyll fluorescence, dissolved oxygen, and photosynthetically active radiation data for hydrocast Station C289B-004-HC. Station location and general locale are given in Table 1. Data from water samples collected in bottles at depth during hydrocast deployment are given in Table 3. Digital data are available from SEA upon request.

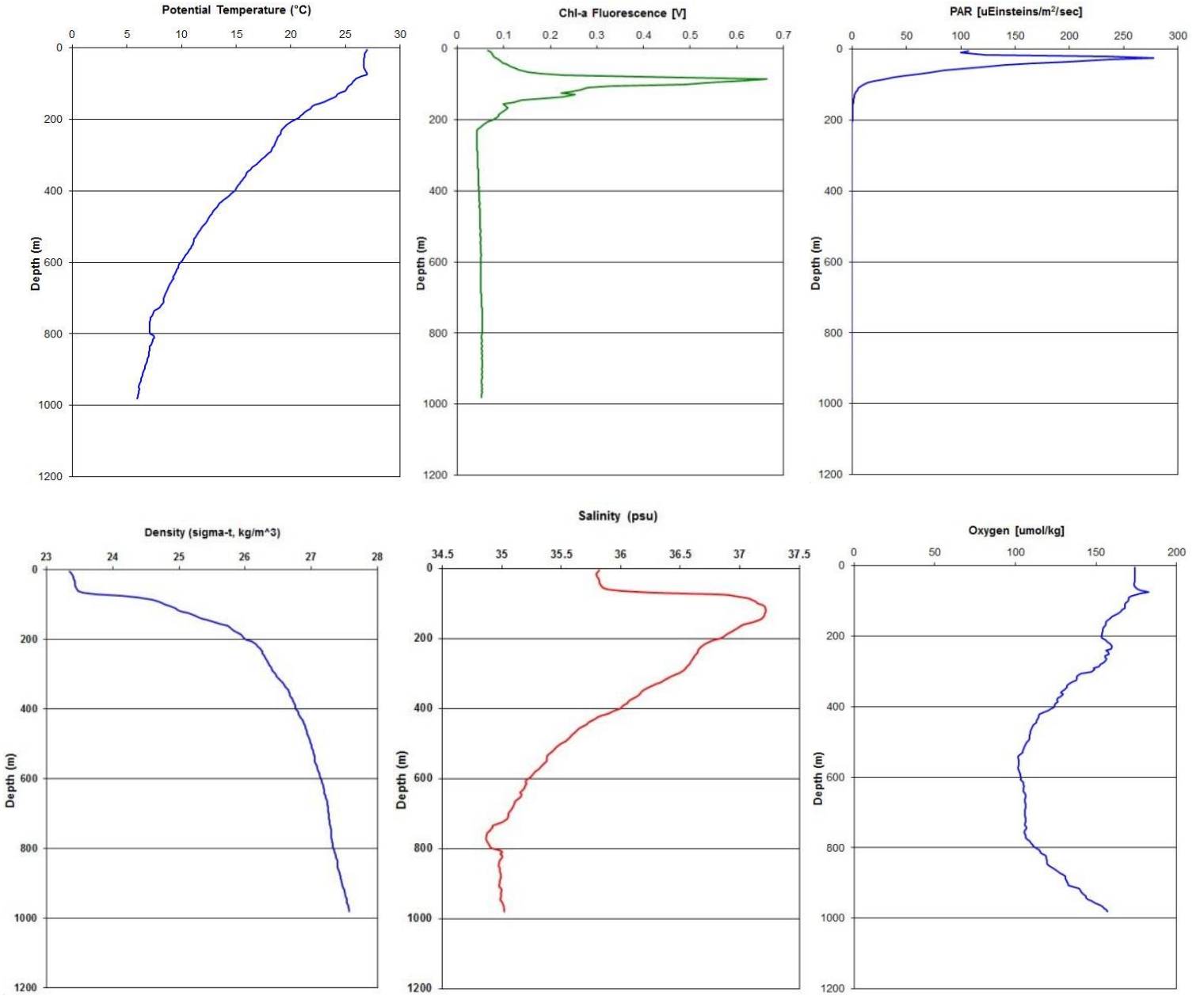


Figure 7.

Depth profiles of temperature, salinity, density, chlorophyll fluorescence, dissolved oxygen, and photosynthetically active radiation data for hydrocast Station C289B-007-HC. Station location and general locale are given in Table 1. Data from water samples collected in bottles at depth during hydrocast deployment are given in Table 3. Digital data are available from SEA upon request.

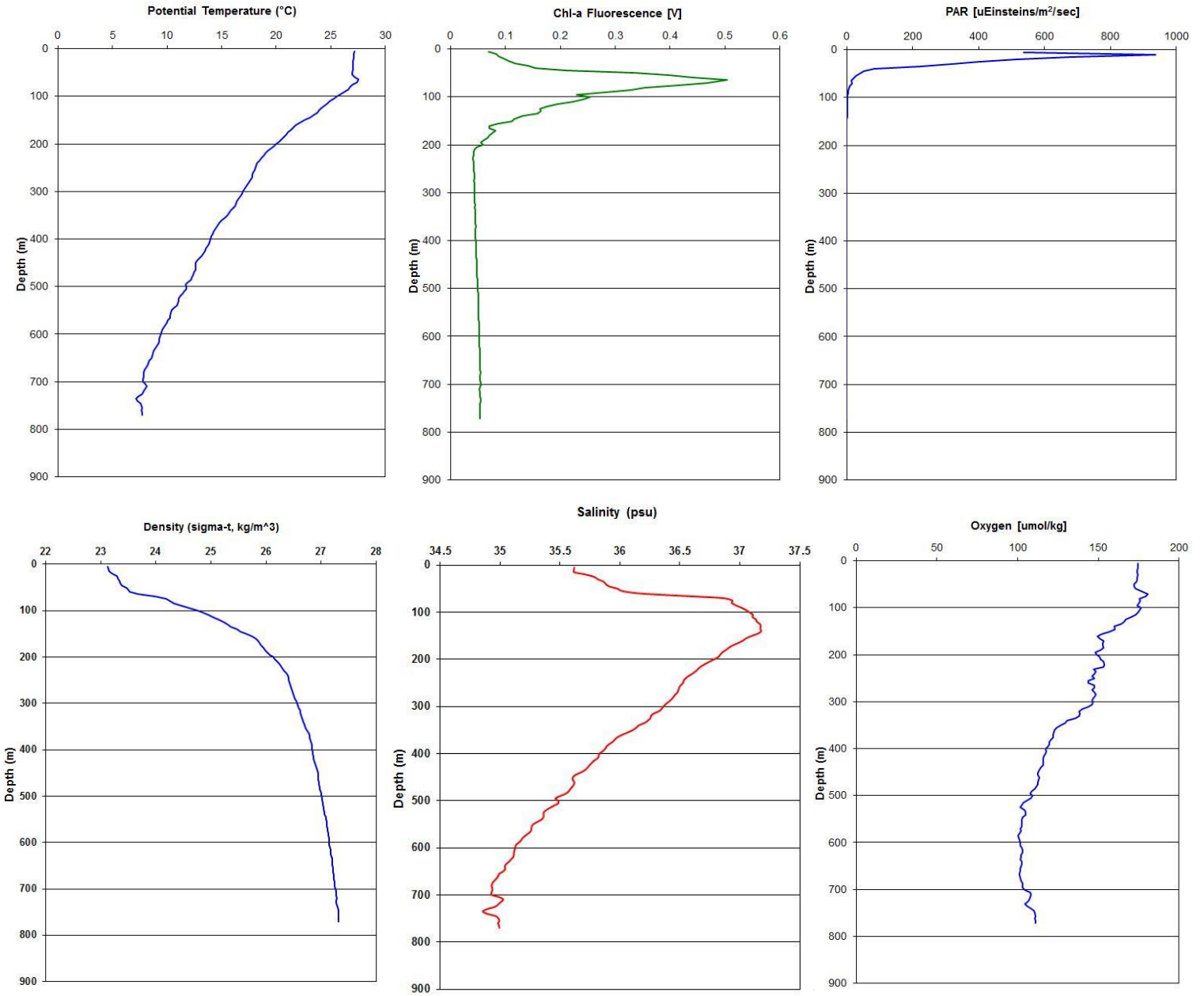


Figure 8.

Depth profiles of temperature, salinity, and density for freeCTD station C289B-004-HC. Station location and general locale are given in Table 1. Digital data are available from SEA upon request.

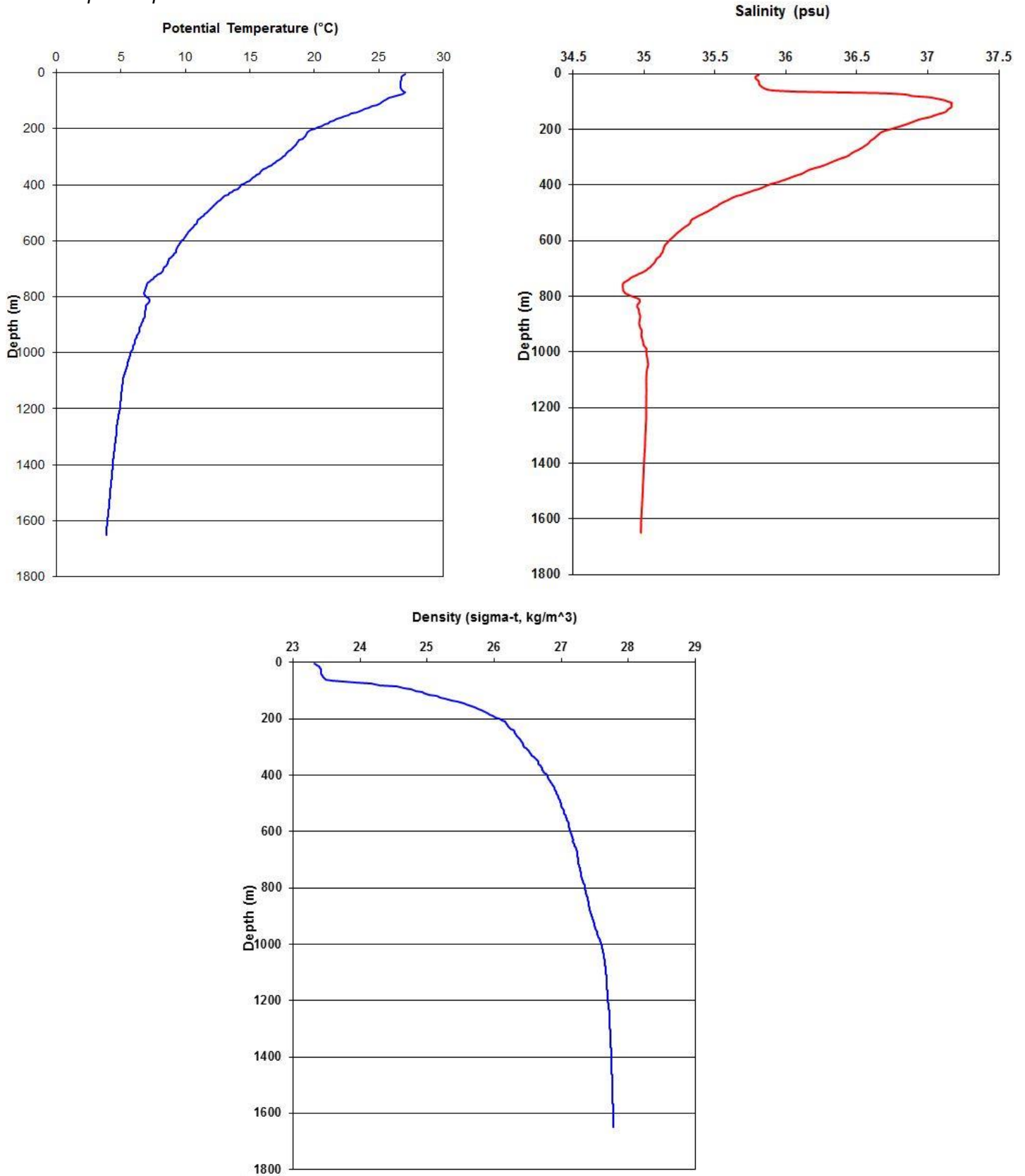


Table 4.

C289B secchi disk (SD) data. Station locations are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. See explanatory footnote at bottom of table.¹

Station	Date	Time (Local)	Log (nm)	Water Temp (°C)	Salinity (PSU)	Fluoro. Chl- α (Volts) ¹	CDOM Fluoro. (volts)	Transmissivity (volts)	Cloud Cover (%)	Wave Height (ft)	Wave Speed (BF) ¹	Secchi Depth (m)	Calculated Depth (ft)	Associated Surface Station
C289B-002-SD	28-Jan-20	0725	38.6	27.0	35.50	413.0	104.3	275.6	30%	1	2	21	56	SS-004
C289B-004-SD	29-Jan-20	0728	68.2	27.1	35.80	403.0	102.6	324.8	20%	1	1	45	122	SS-008
C289B-007-SD	30-Jan-20	0842	103.8	27.2	35.60	414.7	104.9	310.4	-	1	3	27	73	SS-013

Table 5.

C289B phytoplankton net (PN) data. Station locations are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. Diatom and dinoflagellate percentages are based on 50-count data of collected samples.

Station	Date	Time (Local)	Log (nm)	Water Temp (°C)	Salinity (PSU)	Fluoro. Chl- α (Volts) ¹	Diatoms (%)	Dinoflagellates (%)	Associated Surface Station
C289B-002-PN	28-Jan-20	0858	39.9	27.0	35.50	406.0	100.0%	0.0%	SS-004
C289B-004-PN	29-Jan-20	0852	69.1	27.0	35.82	446.0	88.0%	12.0%	SS-008
C289B-007-PN	30-Jan-20	0959	104.3	27.3	35.62	400.0	94.0%	6.0%	SS-013

Table 6.

C289B neuston net tow (NT) data. Station locations are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. 100-count data of zooplankton samples are given in Table 7. Qualitative descriptions of neuston net tow contents are available from SEA. Explanatory footnotes are given below.^{1,2,3,4}

Station	Date	Time (local)	Moon Phase (%)	Risen or Set?	Cloud Cover (%)	Tow Area (m ²) ¹	Zoopl. Biomass (ml) ¹	Zoopl. Density (ml/m ²) ¹	Phyllosoma (#) ²	Leptocephali (#) ²	Myctophids (#) ²	Nekton >2cm (#) ²	Other Nekton types	Total Nekton >2cm (#) ²	Nekton >2cm (ml) ²	Gelatinous >2cm (#) ²	S. natans VIII (#) ³	S. fluitans III (#) ³	Total Sargassum (g) ³	Plastic Pieces (#) ⁴	Tar Pieces (#) ⁴	Halobates (#) ⁴	Associated Surface Station
C289B-001-NT	27-Jan-20	2342	12%	set	5%	1654.3	15.0	0.0091	0	7	0	2	2 flying fish	9	10.0	0	0	0	185	10	0	0	SS-002
C289B-002-NT	28-Jan-20	1114	0	risen	10	1464.1	6.5	0.0044	0	0	0	1	1 juvenile fish	1	2.0	0	0	0	19	15	0	0	SS-006
C289B-003-NT	28-Jan-20	2304	19%	set	20%	2072.3	13.0	0.0063	16	1	19	2	1 stomatopod, 1 pipefish	38	1.4	0	0	0	19	3	0	0	SS-006
C289B-005-NT	29-Jan-20	1315	19%	risen	50%	2407.6	42.0	0.0174	0	0	0	0	None	0	0.0	0	4.5	3	0	18	0	0	SS-009
C289B-006-NT	29-Jan-20	2305	27%	set	10%	1727.7	15.8	0.0091	57	9	0	13	1 juvenile crab, 2 juvenile fish	79	13.8	0	80	80	200	34	0	2	SS-011
C289B-007-NT	30-Jan-20	1219	27%	risen	20%	1516.5	4.4	0.0029	0	0	0	1	1 juvenile fish	1	0.7	0	0	0	0	3	0	0	SS-013
C289B-008-NT	30-Jan-20	2340	27%	set	15%	1082.1	14.0	0.0129	0	0	0	0	none	0	0.0	2	0	0	0	16	0	0	SS-015
C289B-009-NT	31-Jan-20	1103	35%	risen	25%	1174.0	3.2	0.0027	0	0	0	2	2 rabs	2	1.5	0	0	44	11	5	0	0	SS-017

¹Tow area was calculated using distance between each minute of GPS location during the tow with the exception of C289B-005-NT when the lab GPS connection was disrupted. For this one deployment the ship's log was used to calculate distance. Zooplankton was collected using a 33um mesh net with 1.0m x 0.5m opening. Volumes were calculated using wet sample and displacement method. Biovolume values for stations C289B-001, 002, and 004, were affected by sargassum fragments while 005 contained enormous amounts of Trichodesmium algae.

²Nekton >2cm were removed from sample using a 33um sieve, then identified, counted and biovolumed. Notable amounts of phyllosoma were found in C289B-003 and 006. Phyllosoma was often times smaller than 2cm but for the purposes of sample preservation, they were removed from the zooplankton biomass.

³Sargassum was removed from net contents and sorted by for and fragment vs. lump prior to being weighed using spring scales. Sargassum forms were mixed with benthic sargassum and other algae species for most tows and often new growth and abundant float production on pelagic sargassum made determining form challenging.

⁴Floating plastic and marine water striders (halobates) were removed from net contents prior to sieving and preserved in scintillation vials. No tar or plastic pellets were found in any net tows for this cruise.

Table 7.

100-count data of zooplankton collected in C289B neuston tows. Station locations and associated surface stations are given in Table 1. Oceanographic data from associated surface stations are given in Table 2. Information on net contents is given in Table 6. Explanatory footnotes are given below.^{1,2}

Station	Siphonophores	Salp/Doliolids	Pteropods	Other Snails ¹	Chaetognaths	Copepods	Gammarid	Hyperiid	Zoea	Shrimp	Mysid	Euphausiid	Stomatopod	Ostracods	Cladocera	Isopods	Fish Larvae	Fish Eggs	Tunicate ¹	Total organisms
C289B-001-NT	0	0	4	29	0	48	0	2	5	1	0	0	0	8	0	0	0	0	0	99
C289B-002-NT	6	0	2	57	0	25	0	0	0	3	2	1	0	0	0	0	1	0	0	100
C289B-003-NT	5	0	6	18	4	43	0	14	5	0	1	0	3	1	0	0	0	0	0	100
C289B-005-NT	2	0	0	5	0	51	0	0	2	1	0	0	0	0	49	0	1	2	0	113
C289B-006-NT	1	0	2	70	0	9	0	1	0	5	1	1	0	3	0	3	0	0	9	105
C289B-007-NT	2	0	1	0	0	80	0	0	0	0	0	0	0	0	0	0	11	2	0	98
C289B-008-NT	4	3	4	6	5	43	31	7	0	0	0	7	0	5	0	0	0	0	0	119
C289B-009-NT	3	0	2	41	0	40	3	0	0	8	1	0	0	0	0	8	1	1	0	108

¹C289B-001, 002, 006, and 009 tows dominated by sessile species (tunicates, other snails) that may have detached from *Sargassum* or other algae when in the net or sieve.

²Other organisms included 2 Cyciprids (C289B-001-NT), 3 Nauplii (C289B-002-NT), 2 Hermit crab larvae (C289B-007-NT), 1 Leptopcephali (C289B-008-NT), and 3 Bivalve larvae (C289B-008-NT).

Table 8.

C289B Shipek grab (SG) meta data. Station locations are given in Table 1. Explanatory footnotes are given below.¹

Station ¹	Date	Time (Local)	Water Depth (m)	General Locale
C289B-007-SG	30-Jan-20	0740	686.3	5nm North of Virgin Bank
¹ Sediment size process to be completed onshore at Williams-Mystic facilities				

