Cruise Report
C-140A
SEA Experience

Scientific Activities Undertaken Aboard SSV *Corwith Cramer*

Sea Education Association

August 8 – 17, 1995

Sea Education Association, Woods Hole, Massachusetts

Table of Contents

Introduction	5
Academic Program	6
Figure 1: Cruise Track	7
Table 1: Daily Positions. SSV <i>Corwith Cramer</i>	8
Table 2: Ship's Complement	9
Cruise Narrative	11
Characteristics of the Inner Shelf	11
Physical Characteristics	11
Chemical Characteristics	12
Geological Characteristics	12
Biological Characteristics	13
Characteristics of the Outer Continental Shelf	14
Physical Characteristics	14
Geological Characteristics	15
Characteristics of the Slope Region and Hydrographer Canyon	15
Physical Characteristics	15
Chemical Characteristics	16
Chemical Characteristics of Surface Samples	17
Light Intensity	17
Geological Characteristics	18
Biological Characteristics	18
Appendices	20
Appendix A: C-140A Oceanographic Stations	21
Appendix B: Surface Sample Data	23
Appendix C: Hydrocast Station Data	24
Appendix D: Surface Data	25
Appendix E: CTD Data	26
Appendix F: Sediment Size Classification	29
Appendix G: Neuston Tow Data	30
Appendix I: Weather Fax Transmissions	32
Appendix J: NOAA Sea Surface Temperature Charts	33
Appendix K: SEA Experience Songs	34

Introduction

This cruise report outlines the scientific research and academic program conducted on board SSV *Corwith Cramer* during Cruise C-140A. The cruise was designed to introduce teachers to a wide variety of shipboard oceanographic techniques and to provide them with a broad multidisciplinary overview of the marine environment. The SEA Experience program is funded by the National Science Foundation's Directorate for Education and Human Resources, through the Teacher Enhancement Program, with additional funding from the Pew Charitable Trust, the William H. Donner Foundation, and the teacher's school districts.

The teachers actively participated in deploying oceanographic gear, in analyzing the samples collected and in compiling and interpreting data. In addition, their understanding and respect for the skills necessary to operate a vessel at sea was greatly enhanced by their roles as crew members on board the *Corwith Cramer*. Navigating and maneuvering the vessel to each oceanographic station, the teachers steered, worked the sails and determined the vessel's location throughout the cruise. Their practical experience was supplemented by lectures and demonstrations by SEA's staff.

During our ten-day cruise, we traveled over 500 nautical miles, collected hourly surface temperature readings and completed several major oceanographic stations, obtaining a variety of samples. This cruise was characterized by the most beautiful weather and sea conditions in memory, perfect for sampling and sailing, despite the threat of Hurricane Felix. I would like to thank the staff and teachers for the tremendous effort they put forth in accomplishing the scientific and educational missions of Cruise C-140A.

Paul Joyce
Chief Scientist, C-140A

Academic Program

This cruise report is the written record of the scientific program conducted during Cruise C140A, the seagoing portion of the SEA Experience program. The SEA Experience program is designed to provide teachers with a general knowledge of the marine sciences, ideas for field and lab work that they can implement in their classrooms and pass on to other teachers, and most importantly, a practical experience of working at sea as part of a team conducting scientific research and operating a vessel.

The cruise track (Fig. 1) was designed to allow the collection of physical, chemical, biological and geological data from several distinct oceanographic environments located on the US continental shelf and slope. Before the cruise, each student group carefully planned an investigation of one of these environments during the three-week shore component. These investigations were completed during the cruise. Each group prepared and presented written and oral presentations of their research efforts at the end of the cruise.

Formal instruction was provided daily during the cruise in the form of lectures given by the science and nautical staffs. Lecture topics were designed to cover aspects of oceanography and marine science not readily acquired from practical experience.

Materials reported herein are the property of Sea Education Association. These materials should not be excerpted or cited without the written permission of the Chief Scientist or Sea Education Association.

Figure 1: Cruise track of SSV *Corwith Cramer* Cruise C-140A. Daily noon and midnight positions are given in Table 1.

Table 1: Daily Positions. SSV *Corwith Cramer*, Cruise C-140A. Positions are plotted in Figure 1.

Date	Time hrs.	Log nm.	Latitude ° North	Longitude ° West
9/Aug/95	0000	0	At Anchor,	Tarpaulin Cove
	1200	0.0	41°28	70°45
10/Aug/95	0000	39.6	41°01	70°43
	1200	69.0	41°06	70°37
11/Aug/95	0000	110.1	40°53	70°01
	1200	145.3	40°37	69°41
12/Aug/95	0000	172.7	40°18	69°29
	1200	219.5	40°09	69°04
13/Aug/95	0000	250.1	40°36	69°11
	1200	306.6	41°16	69°03
14/Aug/95	0000	380.5	41°59	69°49
	1200	440.5	42°09	70°18
15/Aug/95	0000	456.5	42°11	70°22
	1200	495.8	41°56	70°15
16/Aug/95	0000	521.2	41°31	70°44
	1200	531.6	41°25	70°49
17/Aug/95	0000		At Anchor,	Tarpaulin Cove

Table 2: Ship's Complement for SSV *Corwith Cramer* Cruise C-140A

Scientific Staff

Paul Joyce	Chief Scientist
Sarah McIlroy	First Assistant Scientist
Ellie Linen	Second Assistant Scientist
Chris Perle	Third Assistant Scientist

Nautical Staff

Peg Brandon	Captain
Al Hickey	First Mate
Kevin Wood	Second Mate
Erin Hagen	Third Mate
Rick Hamilton	Engineer
Kelly Taylor	Steward
Tamara Kittredge	Assistant Steward
Sophie Morse	Deckhand
Peter Barsness	Curriculum Facilitator

Participants

Hilary Carlson	Fay School
Gina Marie Del Sesto	Chatham Jr./Sr. High School
Susan Fountain	Akimel Aal Middle School
Jeffrey Gaeckle	Tabor Academy
Karen Gottsch	Cambridge Public Schools
Elisabeth Ann Harmon	Pacific Science Center
Rita Kaplan	Southwest Sr. High School
Susan Kappes	Nelson County High School
Edson Lott	Kamehameha Secondary School
Anne Madsen-Boydston	Isla Vista School
Jim McDonald	Monte Gardens Elementary School
Kay Meagle	Marietta High School
Carol Menck	Keene Middle School
Thomas Mulholland	Staten Island Technical High School
Jane Rose	Stonehedge Elementary
Lise Schickel	St. Andrew's School
Barbara Jo Silver	Houston Elementary School
Sandra Sweeney	Perkiomen Valley High School
Cynthia Wei	Saint Ann's School
James Weidner	Steven's Point Area Senior High
Janet Wellman	Manning Elementary
David White	Barre Town Elementary School
Linder Winter	Woodland Park Middle School

Cruise Narrative

The cruise track was designed to study regional variations in the physical, chemical and biological properties of the water column in three hydrographic regions. The inner continental shelf south of Cape Cod was investigated, with water column sampling being complemented by the collection of sediments and benthic organisms. The outer shelf region was sampled at locations on the southerly leg of the cruise, near the continental shelf break. The upper continental slope was sampled in Hydrographer Canyon. Stations were also conducted on Stellwagen Bank, northwest of Provincetown.

Student groups, established during the shore component, were responsible for the analysis of all data collected in each hydrographic region. They presented their results during a summary session during the final class session of the cruise. The discussions that follow represent the preliminary interpretation by the students of the data collected during Cruise C-140A.

Characteristics of the Inner Shelf

Physical Characteristics

Several physical characteristics of the inner shelf waters, including salinity, temperature, and density, were investigated. These data were collected by the CTD (conductivity, temperature, depth sensor) at station C140A-004.

In analyzing the data, several correlations were noticed. Temperature decreases with increasing water depth, and the first 10 mbsl and the last 10 mbsl showed a relatively constant temperature. The thermocline was located between 13 and 22 meters below sea level (mbsl) (Figure 4). Salinity remains relatively constant as depth increased, averaging 32.5‰. Density (σ_t) increases slightly with depth; the increase is from 23.3 at 8 mbsl

to 25.2 at 40 m. This slight increase in density with depth is controlled by the decrease in temperature.

Chemical Characteristics

Ten water samples were collected at station C140A-004, at water depths ranging from 5 to 31 mbsl (Appendix C). Chlorophyll *a*, dissolved oxygen concentration, salinity and water temperature were determined for all samples; phosphate was not determined due to equipment malfunction.

Low levels of chlorophyll *a* exist to a depth of 18 mbsl, at which point an increase to a maximum of 4.31 micrograms/l was observed at 24 mbsl. This level decreases rapidly to 1.09 $\mu\text{g./l}$ at 27 mbsl, and continues to decrease to the seafloor.

Difficulties in oxygen fixation affected the absolute accuracy of samples collected at this station; however, the relative values remain meaningful. Oxygen levels average nearly 3 ml/liter to a depth of 15 mbsl. Oxygen concentration gradually increase between 18 and 22 mbsl, after which they return to their approximate surface levels. The increase in O₂ content beginning at 18 mbsl and peaking at 22 mbsl along with an increase in chlorophyll *a* levels between 18 and 24 mbsl may indicate increased primary productivity.

The chemical characteristics at our inner shelf sampling site were likely influenced by the close proximity to land. Fresh water runoff, re-suspension of nutrients from the shallow bottom, and human input all help determine the characteristics of this region.

Geological Characteristics

Sediments deposited on the inner shelf were sampled with the Shipek grab at two locations: south of Nantucket Island (station C140A-003) and on Stellwagen Bank (station C140A-022) (Appendix A). The Shipek grab at station C140A-003 consists primarily of coarse grain sands ranging from 125 microns to 1000 microns (Appendix F, Figure 9). This material is classified as well-sorted sand because of the preponderance of

two grain sizes (500–1000 and 250–500 microns), accounting for more than eighty percent of the sample.

The high-energy environment characteristic of the shallow waters of the inner shelf cause only the larger grains of sand to settle out, while finer grained material is transported to the outer shelf region and beyond. This is demonstrated by the outer shelf sample (C140A-009), which consisted of finer grained sediments, primarily 125–250 microns in diameter (Appendix F, Figure 10). The sediment collected at station C140A-003 was rounded and probably deposited by rivers and coastal runoff. The constant wave action in the inner shelf environment accounts for the roundness of the sand grains.

Composition of the sand grains is mostly quartz, with some green feldspar and some darker rock fragments, probably granite.

Biological Characteristics

The biology of the inner shelf was explored using a variety of sampling methods. Three Shipek grabs collected from the inner shelf environment recovered tube worms, shell fragments, and amphipods (Stations C140A-003, C140A-022, and C140A-025; Appendix A).

While under sail, a Fisher scoop was deployed (Station C140A-007; Appendix A). This smaller sample recovered tubeworms, nematodes, amphipods, and small bivalves.

A third method of sampling, the otter trawl, was also used in this biological investigation. Unlike the spatially-limiting techniques of the Shipek grab and Fisher scoop, the otter trawl is a large weighted net that is dragged along the bottom. The otter trawl allows the study of larger bottom dwellers whereas the other two retrieve only small organisms and sediment samples. The otter trawl deployed on the inner shelf (C140A-005; Appendix A), recovered various fishes, crustaceans, echinoderms, Porifera, and mollusks. Of these classes, skates, shrimp, flounder, starfish and moon snail egg cases were the numerically dominant specimens.

Within the surface waters (neuston and epipelagic zones) of the inner shelf, neuston and meter net tows captured a variety of the microscopic organisms that make up the zooplankton community.

Neuston tows were performed at several stations on the inner shelf (C140A-001, C140A-002, C140A-006, C140A-021, C140A-024; Appendix A). Copepods are the predominant organisms observed in the samples. While the variety of zooplankton varies from site to site, isopods, ctenophores, crustacean larvae and small fish were found most commonly. The sites do show, however, differences in biomass and zooplankton density. We attribute these variations to the following variables: time of day, moon phase, distance from shore, zooplankton net avoidance behavior and sampling/human error.

Also used in sampling zooplankton was the meter net. The sample biomass obtained at station C140A-027 was quite large (850 ml) when compared to the biomass volumes from the neuston tows, which had a mean biomass of 25 ml. This large biomass volume, however, does not necessarily reflect a huge zooplankton population as the meter net has a considerably larger mouth and is fished deeper in the water column. In addition, this particular sampling was performed at night when zooplankton are generally closer to the surface and less able to avoid sampling nets.

While isolated isopods and mysids are contained in the meter net sample, copepods dominate the biomass. The multitude of copepods collected also exhibited their characteristic bioluminescence with a fantastic evening light show.

Characteristics of the Outer Continental Shelf

Physical Characteristics

One CTD cast was conducted on the outer shelf (C140A-010; Appendices A & C). Water temperature at this station drops from 21.9°C at the surface to 9.3°C at 60 mbsl, displaying a distinct thermocline at approximately 30 m (Appendix E, Figure 5). Salinity was higher above the thermocline, 33.5‰, decreased in the thermocline and increased

with increasing depth below the thermocline. The high salinity water at the surface may have come from slope water. These profiles indicate that stratification was present at the time of sampling.

Geological Characteristics

Sediments of the outer shelf were collected in a Shipek grab (Station C140A-009; Appendix A; Appendix F, Figure 10). The sediment is muddy in consistency, and green in color, and well-sorted. Tube worms and amphipods are numerous in the sample.

Most of the grains in the sample are within the 125–250 μm size range; other size classes, >2000 μm down to 63 μm , are evenly distributed (Appendix F, Figure 10). The 125–250 μm size category is composed of a high percentage of foraminifera.

Characteristics of the Slope Region and Hydrographer Canyon

Physical Characteristics

CTD and hydrocast data were collected from Hydrographer Canyon at station C140A-016 (Appendices A & C; Appendix E, Figure 6).

The shallow area of Hydrographer Canyon sampled is near the shelf break, a point which divides the outer continental shelf from the progressively deeper continental slope.

Because of adverse weather predictions (Hurricane Felix), this relatively shallow shelf/slope interface was the only deep water station where salinity and temperature data were collected. As a result, temperature and salinity profiles reflect the close proximity to the outer shelf with a shallow (20–50 m) thermocline and a similarly shallow (20–50 m) but less pronounced halocline (Appendix E, Figure 6).

At this time, NOAA/NOS/OPB Oceanographic Features Analysis (Appendix J, Figure 16) indicates a warm core eddy close to the sampling site ($40^{\circ}\text{N} \times 65^{\circ}\text{W}$). It was hypothesized that this parcel of Gulf Stream water might affect the temperature and deep

water salinity. However, analysis of the data indicates a typical range of temperature and salinity for this location. Water temperature decreased from a surface high of 22.5° C to a low of 9.77° C at 290 mbsl. Salinity increases from 33.9‰ at the surface to 35.2‰ at 290 mbsl. These data correlate well with temperature and salinity data collected in a similar shelf/slope interface (Oceanographers Canyon) in August 1994 (SEA Cruise report C-134A).

Data were analyzed to test the hypothesis that the unusually warm, dry New England weather over the past several months may have resulted in an increased surface water salinity relative to SEA samples collected in previous years, because of excessive evaporation and salt concentration at this level. However, there was no significant difference in the surface salinity at the stations where data was collected and those data collected on previous cruises.

Chemical Characteristics

Ten water samples were collected at depths ranging from 8 to 291 mbsl at station C140A-016 (Appendix C). These samples were analyzed for temperature, salinity, chlorophyll *a*, and oxygen. Phosphate data were not collected due to equipment problems.

The deep chlorophyll maximum (DCM) was found at 30 mbsl, approximately 10 m shallower than last year's result of 40 mbsl (SEA Cruise Report C-134A). One reason for this difference could be that the cruise last year sampled a further offshore, deeper site in Oceanographers Canyon. The coldest peak of the thermocline was slightly deeper last year than this year, resulting in a deeper DCM. Temperature and DCM differences this year could have been affected by the station being in close proximity to the mixed water of the outer shelf and the possible mixing of the surface waters as a result of storms.

Maximum oxygen and chlorophyll *a* levels occur this year at 30 mbsl, directly above the thermocline, with values of 5.95 ml/l and 1.56 µg/l, respectively. Last year's maximum dissolved oxygen concentration was 3.4 ml/l; last year's maximum chlorophyll *a*

concentration was 0.8 $\mu\text{g/l}$. These differences are likely the result the different sampling locations from year to year, with this year's sampling being conducted at the head of a canyon, while last year's sampling was in much deeper water near the base of the continental slope.

Chemical Characteristics of Surface Samples

Chemical characteristics (temperature, salinity, and chlorophyll *a*) were determined from surface water samples collected in Hydrographer Canyon.

The surface water over the shallow end of the canyon has higher salinity and temperature than surface water collected on the outer shelf. Chlorophyll *a* concentrations indicate the lowest level of productivity of all the sites sampled during this cruise (Appendix B; Appendix D, Figure 3).

Light Intensity

Using a Secchi disk we obtained a 18% light reading at 17.5 mbsl in Hydrographer Canyon, indicating that the 1% light level occurs at a depth of 23.5 mbsl. The 1% light level generally indicates the maximum depth in the water column at which photosynthesis can occur. This was shallower than we expected and our reading was probably affected by substantial glare on the water surface. This theory is supported by the finding of the chlorophyll *a* peak of 1.6 $\mu\text{g/l}$ was in the depth range of 25.4 to 32.4 m at station C140A-016.

We conducted an M&M experiment to investigate the light absorbing properties of seawater. In this experiment, red, green, brown, orange, yellow, and blue (new) M&Ms were deployed over the side to see what color was visible for the longest time and therefore, which colors penetrate to the deepest depth. This test indirectly determines the absorption of light of different wavelengths by seawater. Using the average (mean) time of three tosses, we found the color that could be seen the longest time (= greatest depth) was green, at 26.68 seconds, followed by yellow (24.83 sec), orange (22.81 sec), brown

(15.69 sec), red (12.87 sec), and blue (8.5 sec) (Appendix H, Figure 13). The data on the blue M&M is questionable because some time recordings were highly variable.

Geological Characteristics

We had planned to do a deep sea core, a Shipek grab and a Fisher scoop at Hydrographer Canyon. Due to the threat of Hurricane Felix, we took our samples at water depths of 325–450 mbsl (the top of the canyon) rather than the lower, but more distant, areas of the canyon with water depths greater than 1500 m. Unfortunately, our Fisher scoop brought up nothing and our core appeared to have hit rock. Our sole sediment sample from this region came from the Shipek grab (C140A-015; Appendix A).

Our sample is unimodal in nature. The greatest percentage of grain distribution is in the 125–250 μm size range, with an average grain size of 127 μm . This is coarser grained and lacks the silt and clay we expected to find deeper in the canyon. This is also a coarser grain size than we recovered in the outer shelf sample, probably due to the increase in energy in the top of the slope of the canyon caused by gravity currents pulling the flow down the canyon slope.

The coarsest fraction of the slope sample consisted of quartz, feldspar, and mica. We observed a significant number of forams, and a few shells or shell particles. We found a worm tube covered with sand and possibly tiny pieces of *Sargassum* fallen from the surface. The 125–250 μm grain size range consisted of quartz and mica with noticeable less feldspar. The smaller are more well rounded and spherical in shape.

Biological Characteristics

The biology of the slope region of Hydrographer Canyon was studied in two neuston tows (Stations C140A-012 and C140A-019; Appendix A; Appendix G, Figures 11 and 12). The neuston tow at the border of the outer shelf and slope regions collected an array of creatures including two juvenile fish, a *Sargassum* crab, ctenophores, three “gooseberries”, eight nudibranchs, and a variety of zooplankton as measured by a 100

count (Appendix G, Figure 11). In addition, there were 100 grams of *Fucus*, 100 grams of *Ascophyllum*, and 50 grams of *Sargassum* seaweed (this may account for a rather large number of isopods).

Neuston tow C140A-019 in Hydrographer Canyon recovered stomatopods, pteropods, pontellid copepods, about 70% “sea snot”, a.k.a. smooshed jellies, as well as other types of zooplankton (Appendix G, Figure 12). The total biomass of this tow yielded 90 ml. No bacteria was found growing on the bacteria plates taken at this station. The phytoplankton tow yielded very low biomass such that a 100 count was not feasible. However, some dinoflagellates (*Ceratium*) were observed, as was expected.

Biological studies conducted in Hydrographer Canyon revealed a great diversity of species including numerous whales (pilot, humpback, finback) who may have been feeding upon the plankton. The biomass in Hydrographer Canyon is nearly double the amount of biomass at the border of outer shelf and slope. However, a definite comparison is difficult as these tows were done at different times of the day. Perhaps this diversity is due to the increase in nutrient levels caused by upwelling in this region.

Appendices

Figure 2: Oceanographic Station Locations, C-140A. Station locations listed in Appendix A.

Appendix A: C-140A Oceanographic Stations ¹

Station	Date	Time	Log	Latitude	Longitude	Depth	Locale
		hrs	nm.	° North	° West	m.	
CTD ²							
C-140A-004	8/10/95	1007	68.5	41°05	70°38	44	Inner Shelf
C-140A-010	8/11/95	1800	164.8	40°18	69°37	55	Outer Shelf
C-140A-016	8/12/95	1347	221.0	40°09	69°03	291	Hydrographer Canyon
C-140A-023	8/14/95	1235	441.5	42°10	70°18	21	Stellwagen Bank
C-140A-026	8/14/95	1942	453.3	42°10	70°23	60	West of Stellwagen Bank
Hydrocast ³							
C-140A-004	8/10/95	1007	68.5	41°05	70°38	44	Inner Shelf
C-140A-010	8/11/95	1800	164.8	40°18	69°37	55	Outer Shelf
C-140A-016	8/12/95	1347	221.0	40°10	69°03	291	Hydrographer Canyon
Neuston Tow ⁴							
C-140A-001	8/9/95	1453	0.0	41°25	70°53		Vineyard Sound
C-140A-002	8/10/95	0049	41.8	40°59	70°59		Marthas Vineyard
C-140A-006	8/10/95	1652	81.0	41°87	70°33		SE of Noman's Land
C-140A-008	8/11/95	0100	112.0	40°51	70°00		S of Nantucket Shoals
C-140A-012	8/12/95	0030	173.9	40°18	69°30		Shelf Break
C-140A-019	8/12/95	1800	223.3	40°11	69°02		Hydrographer Canyon
C-140A-021	8/13/95	1233	307.0	41°18	69°02		West of Georges Bank
C-140A-024	8/14/95	1337	441.5	42°10	70°17		Stellwagen Bank
Meter Net							
C-140A-027	8/14/95	2138	453.3	42°10	70°23	25	Stellwagen Bank
Phytoplankton Net							
C-140A-017	8/12/95	1250	221.0	40°09	69°03		Hydrographer Canyon
Shipek Grab ⁵							
C-140A-003	8/10/95	0915	68.5	41°04	70°38	42	Inner Shelf
C-140A-009	8/11/95	1700	164.8	40°18	69°36	73	Outer Shelf
C-140A-015	8/12/95	1235	221.0	40°08	69°03	325	Hydrographer Canyon
C-140A-022	8/14/95	1214	441.5	42°10	70°18	21	Stellwagen Bank
C-140A-025	8/14/95	1840	453.5	42°10	70°23	63	West of Stellawagen Bank

Station	Date	Time	Log	Latitude	Longitude	Depth	Locale
		hrs	nm.	° North	° West	m.	
<hr/>							
Otter Trawl							
C-140A-005	8/10/95	1230	69.0	41°08	78°37	39	Inner Shelf
C-140A-011	8/11/95	1840	165.0	48°17	69°38	74	Outer Shelf
Fisher Scoop							
C-140A-007	8/10/95	2026	95.4	41°02	70°18	38	Inner Shelf
C-140A-014	8/12/95	0948	205.1	40°17	68°57	97	SE of Cape Cod
C-140A-013	8/12/95	0931	205.1	40°18	69°00	97	SE of Cape Cod
C-140A-020	8/12/95	2230	242.9	40°28	69°10	82	SE of Cape Cod

- ¹ Station locations are plotted in Figure 2.
- ² CTD data are given in Appendix E.
- ³ Hydrocast data are given in Appendix C.
- ⁴ Neuston tow data are given in Appendix G.
- ⁵ Grain size data of sediments are given in Appendix F.

Appendix B: Surface Sample Data *

Station	Date	Time hrs	Log nm.	Lat ° North	Long ° West	Temp ° C	Salinity ‰	Chlorophyll a µg/l
SS-001	8/9/95	1210	0.0	41°28	70°45	20.9	31.87	4.47
SS-002	8/9/95	2100	29.2	41°14	70°51	19.7	31.90	0.62
SS-003	8/10/95	0100	42.0	40°59	70°40	20.0	32.27	0.15
SS-004	8/10/95	0350	51.0	40°54	70°37	19.2	32.26	0.38
SS-005	8/10/95	1714	81.7	41°07	70°33	20.0	32.55	0.61
SS-006	8/10/95	2239	104.5	40°58	70°08	17.4	32.03	0.88
SS-007	8/11/95	0800	134.0	40°39	69°55	19.7	32.13	0.52
SS-008	8/12/95	0030	173.9	40°18	69°30	20.0	32.88	0.39
SS-009	8/12/95	0816	198.0	40°17	69°06	23.3	35.10	0.09
SS-010	8/12/95	2100	236.3	40°71	69°08	23.6	34.93	0.22

* Data are plotted in Appendix D, Figure 3.

Appendix C: Hydrocast Station Data ¹

Station	Bottle no.	Depth m.	Temp. ° C	Salinity ² ‰	Chl <i>a</i> ² µg/l	Oxygen ml/l
C-140A-004	1	31	10.40	32.47	0.23	2.80
	2	32	10.43	32.47	0.00	2.51
	3	27	10.70	32.27	1.09	2.28
	4	24	11.25	32.32	4.31	2.41
	5	22	11.52	32.33	1.83	3.02
	6	18	14.55	31.63	0.75	1.33
	7	15	15.67	31.73	0.74	2.62
	8	13	16.62		0.61	2.55
	9	10	17.15		0.56	2.51
	10	5	17.17	31.92	0.56	3.03
C-140A-010	1	55	9.40	33.22	0.13	5.52
	2	50	9.45	33.08	0.19	5.72
	3	43	10.56	32.60	0.74	6.22
	5	31	10.87	32.61	0.94	6.22
	6	27	11.40	32.53	0.53	6.45
	7	25	12.94	33.13		7.71
	8	20	18.44	33.21	0.30	5.95
	9	11	18.81	33.12	0.27	5.97
	10	8	20.60	33.07		6.06
	11	3	21.95		0.33	5.88
C-140A-016	1	291	9.77	35.23	0.00	4.07
	2	195	11.33	35.35	0.00	3.71
	3	95	12.54	35.42	0.01	4.42
	4	69	12.85	35.27	0.02	4.81
	5	48	12.41	34.90	0.07	5.36
	6	32	13.44	35.01	1.23	5.95
	7	25	15.52	34.33	1.56	5.95
	8	20	22.31	34.49	0.57	5.65
	9	13	22.62	33.71	0.13	5.40
	10	8	22.66	33.90	0.19	5.31

¹ Station locations given in Appendix A.

² Blanks in data columns mean data were not determined for sample

Appendix D: Surface Data

Figure 3: Surface Water Temperature, Salinity, and Chlorophyll *a*. Surface Station data are given in Appendix B.

Appendix E: CTD Data ¹

Figure 4: Potential Temperature, Salinity, and Density (Sigma theta). C140A-004

Figure 5: Potential Temperature, Salinity, and Density (Sigma theta). C140A-010

Figure 6: Potential Temperature, Salinity, and Density (Sigma theta). C140A-016

Figure 7: Potential Temperature, Salinity, and Density (Sigma theta). C140A-023

Figure 8: Potential Temperature, Salinity, and Density (Sigma theta). C140A-026

¹ CTD station locations are given in Appendix A.

Appendix F: Sediment Size Classification

Figure 9: Sediment Size Classification. C140A-003.

Figure 10: Sediment Size Classification. C140A-009.

Appendix G: Neuston Tow Data ¹

Figure 11: Neuston Tow C40A-012

Figure 12: Neuston Tow C140A-019

¹ Neuston tow sample locations are given in Appendix A.

Appendix H: M&M Light Transmission Data

Figure 13: Time to disappearance of M&M candies of different colors.

Appendix I: Weather Fax Transmissions

Figure 14: August 12, 1995

Figure 15: August 15, 1995

Figure 16: August 7, 1995

Appendix K: SEA Experience Songs

A Biological Rendition of "These are a few of my favorite things"

Bioluminescence and cute little puffers
Nudibranchs and ctenophores and blue-green pontellids
Lots of *Sargassum* all covered with snot
Look at all of these things we have caught!

When the squid bite, when the crabs fight
When formalin smells,
I simply remember my favorite things,
and then I don't mind the swells.

Whales who're breaching while crew mates are teaching
Lowering equipment while sails are reaching,
All of the species who land in our net,
These are the memories we'll never forget.

Seeing creature, with microscopes,
Oh, how do they cope?
That you might adore them as much as we do
Well, that is our highest hope!

A Sedimental Journey

Gonna take a sedimental journey
through the silt and mud and sand
gonna take a sedimental journey
with a corer in my hand.

Headin' out to the mud patch
on the outer shelf of Georges Bank
gonna see those snakes and sarps and tarballs
and the forams where they sank

Gonna take a sedimental journey
through the silt and mud and sand
gonna take a sedimental journey
with a corer in my hand