CRUISE REPORT

Williams College - Mystic Seaport
Program in Maritime Studies

W-134D

Scientific Activities Undertaken Aboard SSV *Westward*

Rockland ME - Lunenburg N.S. - Woods Hole MA

September 22 - October 6, 1994

Sea Education Association - Woods Hole, Massachusetts

Table of Contents

Table of Contents	ii
Table of Tables	iii
Table of Figures	iii
 Preface. <i>A Rough Passage</i>	 2
 Academic and Research Program	 3
<i>Academic Program</i>	3
<i>Research Program</i>	4
<i>Research Group Results</i>	6
Weber, M., Lord, P., Hougan, D., Heersink, D., Bowling, T., Baptista, T. <i>Physical and Chemical Characteristics of the Cruise Track.</i> ...	6
Wallace, D., Sacco, S., Gaffney, A., Evenson, T., Blumberg, M. <i>The Composition and Characteristics of the Neuston.</i>	8
Schaeffer, F., Power, M., Needleman, L., Lin, E., Knight, K., Jackson, C. <i>The Biological Characteristics of the Water Column.</i>	10
Walsh, J., Tassinari, S., Putnam, B., Hammond, L., Alter, J. <i>Aspects of the Benthic Biology and Geology of Cruise W-134D.</i>	12
 Appendix 1. W-134D Hourly Observations	 15
Appendix 2. W-134D Hydrocast Data	19
Appendix 3. W-134D Bathythermograph Data	20
Appendix 4. W-134D Conductivity-Temperature-Depth (CTD) Data	20
Appendix 5. W-134D Meter Net Data	20
Appendix 6. W-134D Neuston Net Data	20
Appendix 7. W-134D Phytoplankton Net Data	20
Appendix 8. W-134D Surface Station Data	21
Appendix 9. W-134D Shipek Grab Data	21
Appendix 10. <i>Notable Quotes</i>	22
Appendix 11. <i>A Parting Melody</i>	23

Table of Tables

Table I.	Ship's Complement for SSV <i>Westward</i> Cruise W-134D	3
Table II.	Student Research Groups.	5
Table III.	Neuston composition by station..	9
Table IV.	Meter net station data (also see Appendix 5). Chl. <i>a</i> data show chlorophyll concentrations for surface/50 m... ..	10

Table of Figures

Figure 1.	Hourly barometric pressure readings taken along the two week cruise track of W-134D (see Appendix 1)... ..	2
Figure 2.	Estimated wave height (upper figure) and Beaufort force wind conditions (lower figure) from the W-134D deck log.	2
Figure 3.	Cruise track for the Williams College - Mystic Seaport Fall 1994 cruise, W-134D.	5
Figure 4.	Temperature profile taken from surface bucket measurements.	6
Figure 5.	Depth profile along the cruise track as measured by the precision depth recorder (P.D.R.).	7
Figure 6.	Temperature-Salinity plot showing the water masses of profiles taken in slope water and within the warm core eddy	8
Figure 7.	Surface chlorophyll <i>a</i> concentrations plotted against meter net zooplankton biomass	11
Figure 8.	Cumulative percentage diagram showing the size-class based percentage of grain sizes in each shipek grab. Phi 0 = 1mm particles	14

Preface. *A Rough Passage*

While we didn't experience any *really* bad sea conditions, the Fall 1994 Williams College - Mystic Seaport cruise aboard the SSV *Westward* will certainly go down in the record books as one of the roughest Williams/Mystic cruises in history (six foot seas or greater, sometimes much greater, for over 50% of the days at sea).

Along with this, Peg's medical log was crammed with cases of walking pneumonia, bronchitis, several bruised (and one broken finger) as well as numerous cases of seasickness. The air force cocktail lounge was constantly open.

Sound like a vision of Hell? It could have been were it not for the incredible good humor and hard work by both students and staff. Despite the weather, we performed a great deal of work, to which this report attests. Throughout the two-week voyage, each individual on board had to invest a huge effort to make the *Westward* a clean and happy ship. During this time, I saw a group of individuals: students and crew, become a single community - living, laughing and working together. It was the enthusiasm and exhausting work which made cruise W-134D a success. Thank you.

- Rich Malatesta
Chief Scientist

Figure 1. Hourly barometric pressure readings taken along the two week cruise track of W-134D (see Appendix 1).

Figure 2. Estimated wave height (upper figure) and Beaufort force wind conditions (lower figure) from the W-134D deck log.

Academic and Research Program

This report is an outline of the academic program and scientific studies conducted on board the SSV *Westward* during the Williams College - Mystic Seaport Program Fall cruise of 1994. This report provides both a description of student research projects completed during the cruise as well as data which are being incorporated into a variety of long-term projects. As such, inquiries pertaining to this data are welcome, however materials reported within this report should not be excerpted or cited without written permission of the Chief Scientist.

Academic Program

The purpose of the SEA-Williams/Mystic cruise was to provide students of the marine

Table I. Ship's Complement for SSV *Westward* Cruise W-134D

Nautical Staff:			
Peg Brandon	Captain		
Deborah Hayes	First Mate (A Watch)		
Kevin Wood	Second Mate (B Watch)		
Mark Liebig	Third Mate (C Watch)		
Earl Boatman	Engineer		
Eric Jenkins	Steward		
Shawn Strange	Asst. Steward		
Science Staff:			
Rich Malatesta	Chief Scientist		
Leah Feinberg	First Scientist (C Watch)		
Michael McGilion	Second Scientist (B Watch)		
Robert Duran	Third Scientist (A Watch)		
Williams-Mystic Faculty and Staff:			
Jim Carlton	Program Director/Marine Science Faculty		
Glenn Gordinier	Maritime History Faculty		
Don Treworgy	Maritime Studies Celestial Wizard		
Anna Fitzgerald	Admissions Officer		
Students:			
A Watch	B Watch	C Watch	
Ann Gaffney	Tabitha Bowling	Kimberly Knight	
Jennifer Walsh	Binney Putnam	Leigh Needleman	
Molly Weber	Matthew Power	Sam Tassinari	
Janet Alter	Christie Jackson	Deirdre Heersink	
Peter Lord	Luna Hammond	Theresa Evenson	
Farah Schaeffer	Tony Baptista	Daisy Hougan	
Edward Lin	Steven Sacco	Daniel Wallace	
		Meaghan Blumberg	

sciences an opportunity to engage in actual data gathering aboard an ocean-going research vessel. Students were provided the opportunity to learn about and deploy a variety of oceanographic instrumentation designed for work in biological, chemical, physical, and geological research. In addition, formal instruction was provided on a daily basis in the form of lectures given by the marine science, history and nautical science faculty and staff.

Lecture topics were designed to cover oceanographic, marine and nautical science topics not readily acquired from practical on-board experience.

While on board the SSV *Westward* students maintained a twenty four hour science and deck watch throughout the two week voyage of W-134D. A watch consisted of seven or eight students who were responsible for the running of the vessel for periods of time lasting six hours during the day and four hours at night. With three watches, the ship was run twenty four hours a day. Each watch was divided into three or four students teamed with a scientist in the laboratory, another three students teamed with a mate on deck (see Table 1 - previous page), and a student responsible for the galley.

In the laboratory, students were instructed in the purpose and proper use of all oceanographic equipment on board. This equipment was deployed with the goal of gathering data for student research group projects as well as to gather further data for long-term SEA research work. Routine meteorological and hourly oceanographic observations were also gathered (see Appendix 1).

Students standing deck watch were instructed by the nautical science staff in the variety of skills necessary to operate an active oceanographic research vessel. This included navigation (electronic as well as celestial), helmsmanship, procedures for scientific station work, as well as proper protocol for emergency shipboard situations. As *Westward* is primarily a sailing vessel, students also learned to set and strike the ship's sails, as well as becoming familiar with the difficult art of maneuvering a large vessel powered solely by the wind.

Research Program

This report represents a summary of the work performed aboard the SSV *Westward* during the SEA - Williams College/Mystic Seaport fall cruise of 1994. Cruise W-134D was conducted in the waters of the Gulf of Maine, Nova Scotian Shelf and the offshore waters of the western North Atlantic (Figure 3 - following page). Research activities focused on the biological, chemical, geological and physical oceanographic characteristics of the various oceanographic regions which the ship traversed over the course of our cruise track.

The scientific goal of the cruise was to completely characterize the oceanographic characteristics of the waters encompassing the cruise track. Aspects considered include: the physical environment; chemical variability; geological composition; and the biological makeup of the area sampled. To

perform this work (termed: descriptive

regional oceanography),

students were divided into four research groups, with each student group responsible for a specific subset of the data. The four research groups were composed of : (1) physical and chemical analysis, (2) neuston biology, (3) water column plankton biology, and (4) benthic

biology and geology (see Table 2). Each student research group examined the appropriate data from the ship's station work, and was responsible for the analysis and interpretation of that data. At the end of the cruise, a short oral presentation was given by each student group to summarize their findings.

Table II. Student Research Groups.

<u>Phys/Chem</u>	<u>Neuston</u>	<u>Plankton</u>	<u>Benthic</u>
Peter	Ann	Eddie	Jennifer
Molly	Meg	Farah	Janet
Daisy	Theresa	Leigh	Sam
Dierdre	Dan	Kimberly	Binney
Tabitha	Steve	Matt	Luna
Tony		Christie	

Simultaneously during the cruise, data were gathered for several long-term projects currently being conducted by the Sea Education Association's staff members and other associated organizations. Projects include, meteorological observations (weather reports taken for the National Oceanographic and Aeronautic Administration - NOAA), water column studies

Figure 3. Cruise track for the Williams College - Mystic Seaport Fall 1994 cruise, W-134D.

(Appendices 2, 4, and 6), as well as distribution and abundance analyses of various components of the neuston (Appendix 7). In addition, hourly oceanographic measurements (Appendix 1) were also gathered for surface temperature (Figure 4), depth (Figure 5) and barometric pressure .

Research Group Results

Weber, M., Lord, P., Hougan, D., Heersink, D., Bowling, T., Baptista, T. *The Physical and Chemical Characteristics of the Cruise Track.*

On *Westward* we journeyed through a specific area - the Gulf of Maine and Scotian Shelf. However we discovered that this area is actually comprised of many different physical and chemical features, each containing unique characteristics. Through sampling, we plumbed the featureless surface of the ocean to reveal the changing nature of what lay below us. Measuring temperature, salinity and density provided a physical snapshot of our environment. Recording oxygen and chlorophyll *a* levels supplied additional chemical data which is usually invisible to the casual observer. Areas of interest such as the Jordan Basin, the continental slope, and a warm core eddy gave us a chance to view how each different factor was influenced by the changing environment. Therefore our map not only tracked our journey, but provided a guide to our questions along the way.

The relationship between the surface salinity, chlorophyll *a* and temperature along our cruise track were taken from surface buckets. The data followed several logical trends which helped to explain the changes in salinity, chlorophyll level and

Figure 4. Temperature profile taken from surface bucket measurements.

temperature and the relationship between them. One of the most basic principles that was observed in this survey was the inverse relationship between temperature and chlorophyll *a*. For the most part where temperature was low the chlorophyll *a* level was high. Colder waters tended to have more nutrients and be more productive which resulted in the observed effect of more chlorophyll *a* in the water. Another general trend we observed was the effect of topography on the water temperature, salinity and chlorophyll content. Shallower waters, either near a coast or shoal, tended to have higher chlorophyll *a* and salinity levels because there was more mixing in the water. Although most of these trends were generally observed, there are certain disagreeable data points which leave unanswered questions. The Bay of Fundy is known as a very productive region, it has very low temperatures which normally corresponds with high chlorophyll levels - however our chlorophyll *a* readings from the Bay of Fundy are surprisingly low. This could be a result of the churning weather we were recovering from - it is hard to be certain. In general the two basic patterns of low temperature - high chlorophyll *a* and shallow mixed water to high chlorophyll were observed.

By a careful study of the temperature, depth, and log in our travels after departing Lunenburg, Nova Scotia, one can detect a slight upwelling which occurred between 448 nm and 502 nm.

Figure 5. Depth profile along the cruise track as measured by the precision depth recorder (P.D.R.).

Since upwelling usually occurs closer to the coast, it is interesting to note that this upwelling was situated well off the continental shelf (Figure 5). Apparently another good spot for upwelling.

In our survey of the water column in different regions of the Gulf of Maine, we detected various trends according to the topography of the ocean floor. In the Jordan Basin, a significant thermocline indicated that there

were two distinct water masses. The upper region which extended from the surface to 100 meters was warmer and less saline than the lower layer which remained trapped in the basin. In another profile, the Northeast Banks possessed a greater amount of vertical mixing, consequently showing one water mass. These coastal waters exhibited higher concentrations in chlorophyll *a* than those of the slope waters due to nutrient influx from tides and currents.

The slope waters were dramatically different than the coastal waters. Our first transect showed that the slope waters have three water masses: Surface waters (0-50m), slope waters (50-300m), and deep North Atlantic waters (300-2000 m).

Our second transect was done in a warm core eddy. We found three water masses as well but they were different due to the migration of warmer, more saline Gulf waters. A comparison of the salinity and temperature for these two transects (Figure 6) provided the tools to determine the dimensions of these water masses. It appeared that the warm core eddy reached a depth of 500 m.

Wallace, D., Sacco, S., Gaffney, A., Evenson, T., Blumberg, M. *The Composition and Characteristics of the Neuston.*

Neuston describes a collection of organisms found on the air-water interface in any given water mass. On our journey on the SSV *Westward*, we traveled from Rockland, ME, to Lunenburg, Nova Scotia, and then to Woods Hole, MA. Throughout our trip, we took seven neuston tows of approximately one nautical mile each. Six of the tows occurred in the area of the Gulf of Maine, and our last tow happened in a warm core eddy "Fluff", just off the

Figure 6. Temperature-Salinity plot showing the water masses of profiles taken in slope water and within the warm core eddy.

continental shelf break, west of Georges Bank. Three of the tows were taken at night, NT-002, NT-006, and NT-016.

Table III. Neuston composition by station.

	NT-002	NT-003	NT-006	NT-009	NT-015	NT-016	NT-021
copepods	97	69	54	100	100	92	71
hyperiid	0	25	42	0	0	5	0
cladocerans	2	0	0	0	0	0	0
crab larvae	1	0	0	0	0	0	0
euphausiids	0	5	2	0	0	3	0
ctenophores	0	1	0	0	0	0	0
isopods	0	0	2	0	0	0	0
siphonophore	0	0	0	0	0	0	8
pteropods	0	0	0	0	0	0	6
globigerina	0	0	0	0	0	0	10
barnacle larvae	0	0	0	0	0	0	3
fish eggs	0	0	0	0	0	0	2

The accompanying tables present our results. Table 3 the neuston hundred count, quantifies a random sample of the organisms from each tow. From the data, we found that copepods were strongly dominant in all seven of the tows.

In NT-003 and NT-006, we also found a number of hyperiid amphipods. NT-021, our warm core eddy sample, contained several organisms we did not find in our Gulf of Maine samples.

A collection of physical/chemical and locational data associated with each of our neuston tows can be found in Appendix 6 (*Neuston Net Data*) and 8 (*Surface Station Data*). Included are the relative volumes of *Ascomphyllum* and *Sargassum* because of their role in the neuston community. Notice that chlorophyll *a* generally decreased with temperature within each tow, this is especially notable in the warm core tow.

When we analyzed our collections and data, we concluded there were more organisms at night. We feel this is because of diurnal vertical migration. Organisms tend to follow a line of light; as the sun goes down, they follow an isolume, or equal level of light, to the surface. This phenomenon has been widely documented, though it is still not completely understood.

Six of our neuston tows were taken in "green" water above the continental slope, whereas our last tow was in "blue" water, off of the shelf break. We discovered there was a greater density of organisms in green water, but a greater diversity of organisms in blue water. There

is probably a greater degree of nutrients in green water because of its proximity to land, supporting more organisms. There are also differences between *Ascophyllum* and *Sargassum* communities. *Ascophyllum* is a benthic, intertidal organism that is ripped off the rocky shore and could be considered relatively more transient in the ocean waters. In fact only one organism appears to be specifically adapted to floating fucoid algae, the isopod *Idotea metallica*. *Sargassum* on the other hand, is holoplanktonic and "true neuston". In contrast to the cold water floating fucoid flora, the *Sargassum* community has many specialized invertebrates associated with it. Therefore it can be hypothesized that the *Sargassum* communities have evolved over time.

"True neuston" were found only in the warm core ring. Examples include the "by-the-wind sailor", *Veilella velella*, the blue-green algae, *Trichodesmium*, and the pelagic gooseneck barnacle, *Lepas* sp.

Schaeffer, F., Power, M., Needleman, L., Lin, E., Knight, K., Jackson, C. *The Biological Characteristics of the Water Column*.

Several plankton samples were taken from the area between Rockland, Maine, Lunenburg, Nova Scotia, and Woods Hole, Massachusetts. Those samples were acquired by lowering a meter net with a mesh size of 333 microns into 50 meters of water and towing for ten minutes. This procedure

was repeated five times
in five different locations
of varying depth,
temperature, and salinity

(Table 4; Appendix 5).

Sample one was taken
close to Rockland Maine
where the depth of the
water column was 186.7
m, the surface

Table IV. Meter net station data (also see Appendix 5). Chl. *a* data show chlorophyll concentrations for surface/50 m.

	Faunal Richness	Biodensity (ml/m ³)	Chl <i>a</i> (mg/l)	<i>z</i> (m)	T _s (°C)	T _d (°C)	Salinity (ppt)
Rockland	8	0.31	3.8/0.32	186.7	13.8	--	32.8
West Jordan	8	0.56	1.7/0.02	197.6	14.2	11.0	33.5
Bay of Fundy	5	0.14	0.4/0.06	100.7	14.0	12.0	34.0
East Jordan	6	0.14	1.0/0.03	164.7	13.7	10.8	30.9
Warm Core Eddy	14	0.16	0.58/0.58	3367	21.2	23.0	36.4

temperature was 13.8 °C, and the salinity 32.8 ppt. The second sample was taken from West Jordan Basin where the depth of the water column was 197.6 m, the surface temperature was 14.2 °C, and the salinity was 33.5 ppt. The third sample was taken from the Bay of Fundy where the depth of the water column was 100.7 m, the surface temperature 14.0 °C, and the salinity 34 ppt. The final sample taken was from a warm core eddy where the depth of the water column was 3367 m, the surface temperature was 21.2 °C and the salinity 36.4 ppt.

For each sample, faunal richness, biodensity, and chlorophyll *a* concentration were measured. The faunal richness of sample one and two (MN-001 and MN-005) were the same and their biodensities were also similar however, their chlorophyll contents were very different. The faunal richness, biodensity, and chlorophyll content of samples three and four (MN-010 and MN-017) are all closely related. The sample taken from the eddy (MN-019), although having a somewhat low biodensity had a high faunal richness level as well as a high chlorophyll level. The salinities of all five samples were within a narrow range.

Our data illustrate a number of interesting connections; where there is more chlorophyll on the surface of the water, the biodensity is higher (Figure 7). The faunal richness in all of the areas sampled is relatively the same except in the warm core eddy where the faunal diversity

is much greater. Although this mass of warm water does not support a high number of organisms, the high diversity of planktonic creatures is typical of more stable, tropical waters.

Species diversity varied somewhat in each of the five sampling areas but copepods were by far the dominant taxa in each case. A greater number of shrimp and shrimp larvae were found in the sample taken closer

Figure 7. Surface chlorophyll *a* concentrations plotted against meter net zooplankton biomass.

to land. 1-2% chaetognaths were found in all the samples except the one with the lowest percentage of copepods. This is possibly due to the fact that chaetognaths feed on copepods. Most of the other species found were suspension feeders.

Our limited sampling sets up good hypotheses for further sampling. One hypothesis that may be drawn from the limited data is a general and tentative correlation between biodiversity and the amount of chlorophyll present. By plotting biodiversity vs. chlorophyll *a* concentration, a broad trend develops. This trend implies that higher biodiversities follow higher chlorophyll concentrations. Higher chlorophyll concentrations signify a higher phytoplankton concentration and a higher zooplankton productivity. However, no viable conclusion can be directly drawn from this trend. Observations can only point out that the trend divides into two areas: a higher biodiversity and chlorophyll group and a lower biodiversity and chlorophyll group. More data is needed to verify this hypothesis.

The warm core eddy, Fluff should also be discussed somewhat independently. While Fluff has a relatively low biodiversity and chlorophyll concentration, it also has a higher faunal richness. This data implies that this mass of water has a low phytoplankton concentration and low productivity but higher speciation. In other words, tropical zooplankton have more need for adaption and specialization. Hence, though the data is quite small and limited, a basis for further data retrieval can be sufficiently formulated.

Walsh, J., Tassinari, S., Putnam, B., Hammond, L., Alter, J. *Aspects of the Benthic Biology and Geology of Cruise W-134D.*

The Gulf of Maine as we know it today is the result of several important geological occurrences. Fifteen to twenty million years ago the land lay completely submerged as a gently sloping shelf with an even coastline. As the ocean receded, the bottom surfaced about this time and processes of erosion began to work upon the exposed land. Streams and rivers began to carve out the characteristic shapes seen today. When glaciers came to cover this land one and a half million years ago, they continued to work the grooves created by land erosion. The land was soft and was easily compressed by the glaciers. By fifteen thousand years ago, the last in a series of glaciers had retreated. The water covered the compressed

bottom, but the land expanded and the sea level dropped. The fifty fathom isobath is a good representation of the approximate coastline at this time (see Figure 3). Since the end of the ice age, the sea level has risen more and covered land that was originally exposed. The idea of the coast as a fluctuating boundary is highlighted by the similar land shape along the coast and in the isobaths right off the coast. The glaciers affected all the land in a similar manner. Not only do we see glacial formation in the Gulf of Maine, but the glaciers also left sediment that now covers the floor of the Gulf. By sampling the bottom, or benthos, of the Gulf of Maine, a lot can be learned about currents, biota, and various other factors that now act upon the glacial deposition.

Seven benthos samples were taken with the shipek grab (Appendix 9). One sample was taken from Jordan Basin, one from the area between Jordan Basin and the Grand Manan Banks, and one from the area southeast off the Northern Grand Manan Bank. The other four samples were taken in a progressive order starting from the left side of the Southern Grand Manan Bank and then going northeast off the bank. The sample from Jordan Basin shows little or weak current here. This is indicated by the lack of large particles and the great quantity of fine clay. There was a strong smell of sulfuric/decay type odor with this sample indicating that the basin probably traps organisms that decay there. The shipek grab from between the basin and banks also indicates a weaker current. While there were some larger particles in the 2000-3000 mm range, these rocks were angular. The smaller particles were far more rounded showing that they had been moved more.

Our best sample of sediment distribution comes from the transect of the Southern Grand Manan Bank (SG Stations 011-014 - see Appendix 9). These samples illustrate the effect of tidal currents on sediments. Along the top of the bank, the sediment is influenced by tides from the Bay of Fundy. Larger particles are found as well as a generally even distribution of smaller particles showing that the tidal currents are stronger and mix the top of the upper bank. Descending off the bank, the larger sediments fell off and the proportion of smaller sediments increased. This shows how a depositional current flows off the bank. (The cumulative percentage diagram, Figure 8, next page, shows a higher proportion of smaller grain sizes in the deepest station of the Grand Manan Bank transect - Station W134-014-SG).

Figure 8. Cumulative percentage diagram showing the size-class based percentage of grain sizes in each shipek grab. Phi 0 = 1mm particles.

Also found in the sediment collected from the Gulf of Maine were many examples of typical benthic organisms. Along the transect of the Grand Manan Bank where currents wash the bottom with nutrient-rich upwellings, there were samples found of three different benthic lifestyles and filter feeders (barnacles, bracheopods) and sediment sifters (polychaetes).

The biota collected also express a broad range of adaptive features

which facilitate life on an ocean floor: spirobid worms have created calcareous tubes that cement them to surface rocks; brittle stars have developed highly muscular arms which provide great mobility along the bottom to travel to food sources, and mollusks such as bracheopods have a sturdy pedicle which allows them to burrow through the sediment. When compared to the scarcity of life found in the grab at the Jordon Basin, the importance of nutrient upwellings is stressed. It becomes clear that benthic communities contain highly specialized species which are adept at gathering nutrition from the dark ocean floor. This explains the relative uniformity of benthic communities with similar current situations around the globe.

Appendix 1. W-134D Hourly Observations

Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Pressure (mb)	Temp. (deg C)	z (m)
23-Sep-94	1300	0.0	44.06	69.05	1024.90	13.20	17
23-Sep-94	1400	0.0	44.07	69.01	1023.50	14.20	55
23-Sep-94	1500	0.0	44.06	68.57	1023.20	13.40	19
23-Sep-94	1600	0.0	43.57	68.57	1022.50	13.10	74
23-Sep-94	1700	0.0	43.50	68.58	1022.00	13.20	45
23-Sep-94	1800	0.0	43.44	68.56	1021.50	12.30	62
23-Sep-94	1900	8.0	43.37	68.55	1020.50	12.60	139
24-Sep-94	1100	16.5	43.37	69.19	1018.50	13.70	150
24-Sep-94	1200	16.5	43.31	69.20	1018.00	13.50	155
24-Sep-94	1300	16.5	43.30	69.20	1017.80	13.30	152
24-Sep-94	1400	25.7	43.27	69.21	1016.90	13.20	168
24-Sep-94	1500	29.1	43.22	69.23	1016.80	13.10	180
24-Sep-94	1600	30.5	43.20	69.24	1016.30	13.80	170
24-Sep-94	1700	31.8	43.20	69.24	1016.80	13.80	168
24-Sep-94	1900	32.5	43.21	69.26	1016.80	13.80	163
24-Sep-94	2000	34.0	43.24	69.24	1017.10	13.30	172
24-Sep-94	2100	34.5	43.25	69.24	1017.30	13.10	157
24-Sep-94	2200	37.2	43.28	69.23	1017.20	13.10	144
24-Sep-94	2300	40.0	43.32	69.22	1017.00	13.00	146
25-Sep-94	0200	45.0	43.34	69.18	1016.00	13.30	163
25-Sep-94	0300	49.5	43.33	69.12	1015.80	12.60	139
25-Sep-94	0400	54.3	43.31	69.04	1015.10	12.90	131
25-Sep-94	0500	58.7	43.29	68.58	1015.80	13.50	147
25-Sep-94	0600	63.2	43.28	68.50	1015.80	13.50	116
25-Sep-94	0700	66.9	43.27	68.46	1016.00	13.60	128
25-Sep-94	0800	71.6	43.26	68.40	1015.90	13.40	113
25-Sep-94	0900	75.6	43.25	68.32	1015.90	13.30	152
25-Sep-94	1000	80.9	43.24	60.25	1015.50	13.95	172
25-Sep-94	1200	85.0	43.22	68.19	1014.90	14.61	173
25-Sep-94	1300	88.0	43.22	68.14	1014.00	14.60	173
25-Sep-94	1400	92.0	43.22	68.07	1014.00	14.60	210
25-Sep-94	2300	92.0	43.24	67.52	1015.10	14.20	251
26-Sep-94	0000	102.7	43.26	67.55	1015.00	13.80	240
26-Sep-94	0100	103.5	43.28	67.52	1015.30	14.20	259
26-Sep-94	0200	104.5	43.29	67.49	1015.00	13.90	251
26-Sep-94	0300	104.8	43.30	67.48	1015.00	14.00	244
26-Sep-94	0400	104.8	43.30	67.48	1015.00	14.00	244
26-Sep-94	0500	112.5	43.34	67.36	1015.00	13.80	234
26-Sep-94	0600	117.2	43.36	67.30	1015.50	14.00	217
26-Sep-94	0700	122.5	43.39	67.22	1015.00	13.80	208
26-Sep-94	0800	125.5	43.42	67.20	1016.10	14.10	200
26-Sep-94	1200	128.9	43.48	67.20	1016.20	14.50	188
26-Sep-94	1300	128.9	43.48	67.21	1016.30	14.20	191
26-Sep-94	1400	129.0	43.49	67.21	1016.30	14.20	193
26-Sep-94	1500	129.3	43.51	67.22	1016.20	15.20	187
26-Sep-94	1600	129.4	43.51	67.23	1016.20	14.70	221
26-Sep-94	1700	131.1	43.52	67.21	1016.50	15.10	213
26-Sep-94	1800	135.7	43.56	67.15	1016.50	14.80	187
26-Sep-94	1900	140.6	43.59	67.91	1016.50	14.80	135
26-Sep-94	2000	141.0	44.00	67.07	1016.50	15.00	127
26-Sep-94	2200	141.0			1017.20	13.00	

Appendix 1. W-134D Hourly Observations

Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Pressure (mb)	Temp. (deg C)	z (m)
27-Sep-94	0000	144.2	44.07	67.04	1017.00	13.50	105
27-Sep-94	0200	144.2	44.08	67.08	1016.80	13.50	153
27-Sep-94	0300	144.2	44.08	67.08	1016.80	13.60	153
27-Sep-94	0400	144.2	44.09	67.02	1016.30	13.40	158
27-Sep-94	0500	144.4	44.10	67.00	1016.50	13.70	160
27-Sep-94	0600	144.4	44.10	67.00	1016.50	13.90	158
27-Sep-94	0700	145.0	44.09	67.01	1016.50	13.60	150
27-Sep-94	0800	146.0	44.07	67.02	1016.80	14.00	131
27-Sep-94	0900	147.3	44.08	67.01	1017.00	14.20	149
27-Sep-94	1000	151.0	44.11	57.58	1017.00	12.70	161
27-Sep-94	1300	155.0	44.15	66.56	1016.50	12.20	171
27-Sep-94	1400	157.5	44.13	66.57	1016.20	13.40	169
27-Sep-94	1600	167.0	44.08	67.02	1015.80	14.50	146
27-Sep-94	1700	171.0	44.04	67.06	1015.50	14.50	105
27-Sep-94	1800	174.0	44.01	67.09	1015.20	13.90	131
27-Sep-94	1900	177.8	43.57	67.12	1015.00	13.80	148
27-Sep-94	2000	184.0	43.50	67.15	1014.50	13.80	180
27-Sep-94	2100	191.0	43.45	67.15	1013.80	14.40	169
27-Sep-94	2300	194.7	43.42	67.14	1013.50	14.20	161
28-Sep-94	0100	194.7	43.38	67.15	1011.70	13.00	174
28-Sep-94	0200	194.7	43.36	67.15	1010.50	14.30	174
28-Sep-94	0300	204.0	43.33	67.15	1010.70	13.20	214
28-Sep-94	0500	209.0	43.25	67.19	1000.90	14.40	210
28-Sep-94	0600	212.0	43.22	67.21	1009.00	14.70	191
28-Sep-94	0700	215.7	43.17	67.23	1009.10	14.50	202
28-Sep-94	0800	217.2	43.19	67.21	1009.50	14.70	216
28-Sep-94	0900	221.2	43.18	67.12	1010.00	14.60	225
28-Sep-94	1000	226.3	43.17	67.05	1010.10	14.70	187
28-Sep-94	1100	231.2	43.15	67.56	1010.10	14.90	203
28-Sep-94	1200	236.7	43.15	67.17	1010.00	14.20	
28-Sep-94	1300	242.9	43.14	66.38	1009.80	14.50	128
28-Sep-94	1400	248.0	43.14	66.29	1009.00	12.50	84
28-Sep-94	1500	251.5	43.16	66.26	1008.90	12.40	60
28-Sep-94	1600	255.5	43.17	66.19	1009.00	12.50	75
28-Sep-94	1700	270.0	43.13	65.38	1008.90	12.70	71
28-Sep-94	1800	270.0	43.16	66.01	1009.00	13.70	34
28-Sep-94	1900	276.0	43.13	65.50	1009.20	15.00	43
28-Sep-94	2000	282.8	43.13	65.38	1009.50	14.40	49
28-Sep-94	2100	289.4	43.14	65.29	1009.80	16.20	62
28-Sep-94	2200	294.5	43.18	65.20	1009.80	16.00	85
28-Sep-94	2300	298.6	43.21	65.15	1009.80	16.20	118
29-Sep-94	0000	305.6	43.25	65.07	1009.20	16.20	112
29-Sep-94	0100	311.5	43.29	64.60	1009.00	16.40	124
29-Sep-94	0200	317.8	43.33	64.53	1008.20	16.20	90
29-Sep-94	0300	323.3	43.38	64.46	1002.50	16.40	99
29-Sep-94	0400	332.0	43.42	64.38	1007.00	16.30	112
29-Sep-94	0500	338.5	43.48	64.30	1006.00	16.00	108
29-Sep-94	0600	345.0	43.53	64.27	1006.00	16.80	100
29-Sep-94	0700	351.9	44.00	64.21	1005.80	17.00	81
29-Sep-94	0800	367.2	44.07	64.16	1005.50	16.40	75
29-Sep-94	0900	366.0	44.19	64.13	1005.10	16.50	53

Appendix 1. W-134D Hourly Observations

Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Pressure (mb)	Temp. (deg C)	z (m)
30-Sep-94	1200	366.0	0.00	0.00	1000.00	16.60	12
30-Sep-94	1300	373.5	44.19	64.13	999.00	16.20	25
30-Sep-94	1400	376.9	44.16	64.11	998.90	16.90	40
30-Sep-94	1700	383.9	44.09	64.08	998.90	15.80	69
30-Sep-94	1800	387.5	44.03	64.08	998.90	16.20	
30-Sep-94	1900	387.5	43.57	64.90	998.90	16.20	
30-Sep-94	2000	400.0	43.48	64.08	999.70	14.90	
30-Sep-94	2100	407.0	43.34	64.08	999.80	15.80	
30-Sep-94	2200	415.0	43.31	64.08	1000.80	15.90	
01-Oct-94	0000	430.0	43.13	64.09	1000.50	15.90	
01-Oct-94	0100	435.0	43.04	64.10	1000.80	15.70	
01-Oct-94	0200	443.0	42.56	64.09	1001.00	15.40	
01-Oct-94	0300	446.0	42.55	64.11	1000.60	15.30	
01-Oct-94	0500	446.0	42.52	64.09	1001.50	14.60	
01-Oct-94	0600	446.0	42.49	64.08	1002.10	14.70	
01-Oct-94	0700	446.0	42.47	64.07	1002.50	14.90	
01-Oct-94	0800	446.0	42.44	64.06	1003.50	14.40	
01-Oct-94	0900	446.0	42.40	64.06	1004.00	14.80	253
01-Oct-94	1000	446.0	42.39	64.06	1004.00	15.00	745
01-Oct-94	1100	446.0	42.36	64.06	1004.00	14.50	973
01-Oct-94	1200	446.0	42.34	64.05	1004.00	13.90	1122
01-Oct-94	1300	446.0	42.51	64.04	1004.20	14.00	1230
01-Oct-94	1400	446.0	42.29	64.03	1004.50	14.90	1380
01-Oct-94	1600	446.0	42.22	64.06	1005.10	15.30	
01-Oct-94	1700	453.0	42.18	64.08	1005.50	16.20	
01-Oct-94	1800	455.5	42.14	64.14	1006.40	16.40	
01-Oct-94	2000	460.3	42.07	64.17	1007.90	16.50	
01-Oct-94	2200	464.7	42.02	64.22	1008.60	16.00	
01-Oct-94	2300	466.1	42.00	64.23	1008.50	15.10	
02-Oct-94	0000	468.8	41.57	64.24	1008.00	15.50	
02-Oct-94	0100	471.0	41.54	64.25	1007.30	15.80	
02-Oct-94	0200	472.5	41.52	64.26	1007.00	16.30	2610
02-Oct-94	0300	474.0	41.50	64.26	1006.00	15.90	2700
02-Oct-94	0400	474.0	41.50	64.26	1006.00	15.20	2700
02-Oct-94	0500	478.0	41.45	64.28	1006.00	15.20	2715
02-Oct-94	0600	479.4	41.44	64.29	1005.60	15.20	2760
02-Oct-94	0700	485.0	41.39	64.34	1006.10	20.90	2790
02-Oct-94	0900	485.0	41.38	64.36	1006.40	21.40	2850
02-Oct-94	1100	485.0	41.37	64.33	1006.40	20.40	2910
02-Oct-94	1200	485.0	41.35	64.31	1006.40	21.50	2970
02-Oct-94	1300	491.6	41.33	64.35	1006.10	20.90	3000
02-Oct-94	1400	496.0	41.30	64.42	1006.50	20.40	3056
02-Oct-94	1500	501.0	41.26	64.50	1006.70	16.80	3131
02-Oct-94	1600	504.5	41.29	64.55	1007.00	16.30	3220
02-Oct-94	1700	511.0	41.17	64.59	1008.00	17.20	3169
02-Oct-94	1800	517.0	41.12	65.04	1008.00	20.80	3263
02-Oct-94	1900	523.5	41.07	65.09	1008.50	20.80	3225
02-Oct-94	2000	530.5	0.00	0.00	1008.70	21.00	3337
02-Oct-94	2100	534.0	40.58	65.18	1009.00	19.00	305
02-Oct-94	2300	534.0	40.55	65.20	1009.00	21.20	3450
03-Oct-94	0000	534.0	40.56	65.24	1008.50	24.00	3225

Appendix 1. W-134D Hourly Observations

Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Pressure (mb)	Temp. (deg C)	z (m)
03-Oct-94	0100	547.0	40.59	65.23	1007.50	26.00	
03-Oct-94	0200	549.1	40.58	65.28	1008.00	22.50	
03-Oct-94	0300	553.2	40.57	65.31	1008.00	23.00	
03-Oct-94	0800	553.2	40.54	65.22	1009.00	21.40	3281
03-Oct-94	0900	563.0	40.53	65.26	1009.00	20.00	3413
03-Oct-94	1000	566.0	40.51	65.32	1009.00	21.40	3188
03-Oct-94	1100	573.0	40.51	65.32	1009.50	21.40	3169
03-Oct-94	1300	578.0	40.51	65.47	1009.30	21.50	3112
03-Oct-94	1600	585.1	40.52	66.01	1009.20	18.50	2812
03-Oct-94	1800	592.5	40.33	66.11	1009.90	22.50	2475
03-Oct-94	1900	596.7	40.53	66.16	1010.50	22.00	2325
03-Oct-94	2000	603.0	40.53	66.24	1010.00	21.80	1762
03-Oct-94	2100	608.3	40.53	66.31	1011.10	21.50	600
03-Oct-94	2200	612.2	40.54	66.37	1011.50	20.90	120
03-Oct-94	2300	616.8	40.54	66.45	1010.50	19.70	90
04-Oct-94	0000	622.0	40.54	66.53	1010.50	16.00	90
04-Oct-94	0100	628.0	40.51	67.01	1010.80	16.20	90
04-Oct-94	0200	633.0	40.49	67.10	1010.00	15.20	90
04-Oct-94	0300	638.0	40.47	67.17	1009.80	16.00	90
04-Oct-94	0400	643.6	40.48	67.27	1010.20	13.80	83
04-Oct-94	0500	648.5	40.44	67.56	1010.10	14.10	75
04-Oct-94	0600	658.0	40.44	67.49	1010.50	13.60	68
04-Oct-94	0700	660.5	40.44	67.56	1010.90	14.10	75
04-Oct-94	0800	667.0	40.42	68.07	1011.00	14.10	77
04-Oct-94	0900	674.0	40.41	68.18	1012.00	14.20	71
04-Oct-94	1000	680.5	40.39	68.28	1012.00	13.80	64
04-Oct-94	1100	686.0	40.38	68.37	1012.50	14.40	60
04-Oct-94	1200	693.1	40.35	68.46	1013.00	14.80	62
04-Oct-94	1300	693.1	40.33	68.54	1012.80	14.80	68
04-Oct-94	1400	704.5	40.30	69.03	1013.00	14.60	75
04-Oct-94	1500	704.5	40.28	69.06	1012.80	14.60	79
04-Oct-94	1600	710.0	40.28	69.10	1012.50	14.80	75
04-Oct-94	1700	714.0	40.28	69.18	1012.50	13.90	67
04-Oct-94	1800	719.0	40.30	69.26	1012.50	14.50	60
04-Oct-94	1900	724.0	40.32	69.35	1012.50	14.70	64
04-Oct-94	2000	729.5	40.36	69.45	1012.80	15.00	58
04-Oct-94	2100	735.5	40.39	69.52	1013.00	15.00	52
04-Oct-94	2200	740.3	40.41	69.59	1013.10	15.00	43
04-Oct-94	2300	746.5	40.45	70.05	1013.10	15.30	38
05-Oct-94	0000	751.0	40.09	70.12	1013.00	15.70	39
05-Oct-94	0100	757.9	40.53	70.20	1013.00	15.80	44
05-Oct-94	0200	763.5	40.56	70.28	1013.00	15.70	44
05-Oct-94	0300	769.0	41.00	70.35	1012.70	15.80	45
05-Oct-94	0400	772.5	41.06	70.43	1012.20	15.40	40
05-Oct-94	0500	776.5	41.10	70.50	1012.00	15.30	27
05-Oct-94	0600	780.0	41.15	70.55	1012.00	14.80	30
05-Oct-94	0700	780.0	41.17	70.54	1012.20	14.80	33
05-Oct-94	0800	783.5	41.20	70.53	1012.30	15.40	26
05-Oct-94	0900	797.6	41.23	70.57	1012.08	15.40	23

Appendix 2. W-134D Hydrocast Data

Station	Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Bot. #	z targ. (m)	z corr. (m)	Temp. (deg C)	Salinity (ppt)	Ch a (ug/ml)	Oxygen (ml/l)
W-134D-004	25-Sep-94	1630	94.5	43.22	68.03	1	200	200	9.01	34.68	0.04	4.34
W-134D-004	25-Sep-94	1630	94.5	43.22	68.03	2	150	150	8.78	34.44	0.07	4.39
W-134D-004	25-Sep-94	1630	94.5	43.22	68.03	3	100	100	8.64	34.25	0.04	4.94
W-134D-004	25-Sep-94	1630	94.5	43.22	68.03	4	50	50	10.54	33.62	0.524	5.54
W-134D-004	25-Sep-94	1630	94.5	43.22	68.03	5	25	25	13.15	32.71	0.27	6.31
W-134D-004	25-Sep-94	1630	94.5	43.22	68.03	6	0	0	14.45	32.85	0.85	0
W-134D-007	26-Sep-94	0950	125.5	43	67.19	1	150	150	9.52	34.77	0.03	4.8
W-134D-007	26-Sep-94	0950	125.5	43	67.19	2	100	100	9.98	34.39	0.486	4.9
W-134D-007	26-Sep-94	0950	125.5	43.46	67.2	3	50	50	10.95	33.95	0.072	5.44
W-134D-007	26-Sep-94	0950	125.5	43.46	67.2	4	25	25	13.78	33.05	0.63	6.35
W-134D-007	26-Sep-94	0950	125.5	43.46	67.2	5	10	10	13.9	32.99	2.38	6.31
W-134D-007	26-Sep-94	0950	125.5	43.46	67.2	6	0	0	13.91	32.99	2.2	
W-134D-014	27-Sep-94	1115	154	44.14	66.55	1	100	100	10.76	33.94	0.13	5.27
W-134D-014	27-Sep-94	1115	154	44.14	66.55	2	50	50	10.59	33.27	0.36	6.14
W-134D-014	27-Sep-94	1115	154	44.14	66.55	3	25	25	10.74	33.07	0.54	6.14
W-134D-014	27-Sep-94	1115	154	44.14	66.55	4	10	10	10.99	32.86	1.25	6.72
W-134D-014	27-Sep-94	1115	154	44.14	66.55	5	0	0	11.37		0.4	
W-134D-018	02-Oct-94	0820	488	41.37	64.37	1	2000	1561	3.62	34.93	0.499	6.97
W-134D-018	02-Oct-94	0820	488	41.37	64.37	2	1000	780	4.71	34.99	0.007	6
W-134D-018	02-Oct-94	0820	488	41.37	64.37	3	500	390	7.98	35.12	0.012	4.32
W-134D-018	02-Oct-94	0820	488	41.37	64.37	4	200	156	12.76	35.63	0.01	5.01
W-134D-018	02-Oct-94	0820	488	41.37	64.37	5	150	117	14.63	35.83	0.719	4.76
W-134D-018	02-Oct-94	0820	488	41.37	64.37	6	100	78	16.87	36	0.41	5.62
W-134D-018	02-Oct-94	0820	488	41.37	64.37	7	50	39	21.98	35.55	0.388	5.58
W-134D-018	02-Oct-94	0820	488	41.37	64.37	8	25	19	22	35.55	0.011	5.69
W-134D-018	02-Oct-94	0820	488	41.37	64.37	9	10	7	21.97	35.55	0.289	5.69
W-134D-018	02-Oct-94	0820	488	41.37	64.37	10	0	0	21.92	34.94	0.48	
W-134D-020	03-Oct-94	0425	559	40.56	65.36	1	2000	900	5	35.02	0	5.93
W-134D-020	03-Oct-94	0425	559	40.56	65.36	2	1000	454	11.36	35.43	0	4.08
W-134D-020	03-Oct-94	0425	559	40.56	65.36	3	500	225	17.55	36.39	0	4.65
W-134D-020	03-Oct-94	0425	559	40.56	65.36	4	200	166	18.19	36.51	0.01	4.53
W-134D-020	03-Oct-94	0425	559	40.56	65.36	5	150	125	18.74	36.52	0.06	5.36
W-134D-020	03-Oct-94	0425	559	40.56	65.36	6	100	83	20.19	36.58	0.14	5.01
W-134D-020	03-Oct-94	0425	559	40.56	65.36	7	50	42	22.86	36.35	0.45	5.67
W-134D-020	03-Oct-94	0425	559	40.56	65.36	8	25	21	22.87	36.35	0.43	5.73
W-134D-020	03-Oct-94	0425	559	40.56	65.36	9	10	8	22.85	36.35	0.49	5.52
W-134D-020	03-Oct-94	0425	559	40.56	65.36	10	0	4	22.86	36.35	0.52	

Appendix 3. W-134D Bathythermograph Data

Station	Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	z (m)	Temp. (deg C)
W-134D-001	26-Sept-94	0637	22.1	43.38	67.25	140	14.1
W-134D-002	27-Sept-94	1007	151	44.11	66.58	120	12.7
W-134D-003	28-Sept-94	0900	221.2	43.18	67.12	100	14.6
W-134D-004	28-Sept-94	1235	240.8	43.15	66.41	90	15
W-134D-005	28-Sept-94	1723	265	43.17	66.07	50	13.6
W-134D-006	02-Oct-94	0430	477	41.47	64.27	225	15
W-134D-007	02-Oct-94	0635	482.2	41.41	64.32	85	15
W-134D-008	02-Oct-94	1522	502	41.25	64.52	260	17.5
W-134D-009	02-Oct-94	2010	530.5	41.02	65.14	165	21

Appendix 4. W-134D Conductivity-Temperature-Depth (CTD) Data

Station	Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	z (m)	Local
W-134D-004	25-Sep-94	1620	94.5	43.22	68.03	200	JORDAN BASIN
W-134D-007	26-Sep-94	0950	125.5	43.22	68.03	150	NORTH JORDAN BASIN
W-134D-014	27-Sep-94	1125	154	44.14	66.55	100	EAST OF N.E. BANK
W-134D-018	28-Sep-94	0820	488	41.37	64.37	1561	N. OF TRUXTON SWALL
W-134D-020	02-Oct-94	0425	559	40.56	65.36	900	EDDY FLUFF

Appendix 5. W-134D Meter Net Data

Station	Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Tow z (m)	Flow in	Flow out	Biomass (ml)
W-134D-001	24-Sep-94	1810	32.5	43.2	69.24	50	3389	36877	135
W-134D-005	25-Sep-94	2113	94.5	43.23	68.01	50	36951	67453	360
W-134D-010	26-Sep-94	2110	141.5	44.01	67.07	50	67527	98253	90
W-134D-017	28-Sep-94	0020	107.5	43.38	67.15	50	87177	118398	90
W-134D-019	02-Oct-94	2145	535.5	40.57	65.18	50	118410	147847	100

Appendix 6. W-134D Neuston Net Data

Station	Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Temp (deg C)	Biomass (ml)	# Plastic
W-134D-002	25-Sep-94	0033	0	43.34	69.21	14	250	1
W-134D-003	25-Sep-94	1105	84	43.24	68.19	14.1	110	1
W-134D-006	26-Sep-94	0003	101.8	43.26	67.55	13.8	100	1
W-134D-009	26-Sep-94	1652	130.5	43.53	67.22	15.1	100	3
W-134D-015	27-Sep-94	1650	170.5	44.05	67.05	14.5	40	0
W-134D-016	27-Sep-94	2155	192.5	43.45	67.13	14.2	800	0
W-134D-021	03-Oct-94	1140	574.5	40.5	65.41	21.5	2	0

Appendix 7. W-134D Phytoplankton Net Data

Station	Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Local
W-134D-004	25-Sep-94	1620	94.5	43.22	68.03	JORDAN BASIN
W-134D-007	26-Sep-94	0950	125.5	43.22	68.03	NORTH JORDAN BASIN
W-134D-014	27-Sep-94	1125	154	44.14	66.55	EAST OF N.E. BANK
W-134D-018	28-Sep-94	0820	488	41.37	64.37	N. OF TRUXTON SWALL
W-134D-020	02-Oct-94	0425	559	40.56	65.36	EDDY FLUFF

Appendix 8. W-134D Surface Station Data

Station	Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Temp. (deg C)	Salinity (ppt)	Ch a (ug/ml)
SS-001	22-Aug-94	1630	14.9	41.20	70.56	19.2	36.386	0.000
SS-001	23-Sep-94	1720	0.0	43.48	68.58	13.4	32.760	15.061
SS-002	24-Sep-94	1400	25.7	43.27	69.21	13.2	33.270	3.810
SS-003	25-Sep-94	0040	0.0	43.34	69.21	13.0	32.885	3.400
SS-004	25-Sep-94	0545	61.0	43.29	68.54	13.5	33.140	1.438
SS-005	25-Sep-94	1000	81.2	43.25	68.24	14.0	33.070	1.291
SS-006	25-Sep-94	1105	84.0	43.23	68.19	14.1	33.063	1.203
SS-007	26-Sep-94	0003	101.8	43.26	67.55	13.8	32.690	1.656
SS-008	26-Sep-94	0637	122.1	43.38	67.25	14.1	33.062	0.765
SS-009	26-Sep-94	1700	131.1	43.53	67.21	15.1	33.133	0.433
SS-010	27-Sep-94	1007	151.0	44.05	67.05	12.7	32.802	0.260
SS-011	27-Sep-94	1650	170.5	44.05	67.05	14.5		1.000
SS-012	27-Sep-94	2155	192.5	43.45	67.13	14.2	32.860	1.000
SS-013	28-Sep-94	0545	210.2	43.23	67.20	14.6	32.951	0.169
SS-014	28-Sep-94	0900	221.2	43.18	67.12	14.6	32.824	1.713
SS-015	28-Sep-94	1235	240.8	43.15	66.41	15.0	33.520	0.586
SS-016	28-Sep-94	1723	265.0	43.17	66.07	13.6	31.130	0.332
SS-017	28-Sep-94	2005	283.0	43.12	65.38	14.4	30.909	0.294
SS-018	28-Sep-94	2336	303.0	43.24	65.10	16.1	30.740	0.089
SS-019	29-Sep-94	0245	323.3	43.37	64.47	16.4	30.490	0.259
SS-020	29-Sep-94	0615	345.0	43.53	64.27	16.8	30.605	0.122
SS-021	29-Sep-94	0800	367.2	44.07	64.16	16.4	30.661	0.388
SS-022	30-Sep-94	1940	397.6	43.50	64.08	14.9	30.667	0.800
SS-023	30-Sep-94	2300	421.0	43.22	64.08	16.0		0.057
SS-024	01-Oct-94	1030	441.0	42.37	64.05	14.8	31.711	0.460
SS-025	01-Oct-94	1312	460.0	42.30	64.03	14.3	32.258	0.030
SS-026	02-Oct-94	0200	472.5	41.52	64.26	16.3	33.040	0.008
SS-027	02-Oct-94	0640	482.3	41.42	64.32	18.0	34.205	0.095
SS-028	02-Oct-94	1500	501.0	41.26	64.50	16.8		1.170
SS-029	02-Oct-94	1522	511.5	41.15	65.01	18.2	35.280	0.400
SS-030	02-Oct-94	1830	521.0	41.09	65.07	20.5	35.837	0.760
SS-031	02-Oct-94	2010	530.5	41.01	65.14	21.0	36.120	0.540
SS-032	03-Oct-94	0100	547.0	40.59	65.25	26.0	36.100	0.580

Appendix 9. W-134D Shipek Grab Data

Station	Date	Time	Log (nm)	Lat. (deg)	Long. (deg)	Local
W-134D-004	25-Sep-94	1710	94.5	43.21	68.04	JORDAN BASIN
W-134D-007	26-Sep-94	0950	125.5	43.22	68.03	NORTH JORDAN BASIN
W-134D-014	27-Sep-94	1135	154	44.14	66.55	EAST OF NORTH EAST BAN
W-134D-018	02-Oct-94	0855	488	41.37	64.37	WARM CORE FLUFF

Appendix 10. *Notable Quotes*

On the final day of our cruise, each of the research groups described above presented an oral version of the written descriptions documented in this report. These presentations were uniformly well done and quite informative. They provided the ships company the opportunity to question and comment on the research carried out during the course of our voyage. They also provided a bit of humor which the following selected quotations from the presentations document:

Daisy, trying to express how she (and everyone else) felt about having to present their projects that morning after working through most of the night to finish them:

"I'm thrilled - How 'bout y'all?"

Peter made the concept of high productivity on shallow water banks easy to comprehend, by drawing on a "Carlton-style" metaphor:

"Think bank - rich in money - this bank is rich in nutrients"

Christie, attempting to share with us, her profound appreciation for the vastness of the marine realm:

"The ocean is just so... big!"

With a natural flair for making complex concepts simple, Luna succinctly summarized the entire process of the Gulf of Maine's circulation:

"Huge chunks of water just screaming out of here - everyone get that?"

Appendix 11. *A Parting Melody*

Raindrops and fog bands and low pressure systems
Warm sunny days - I guess we just missed them
Spilled hot peach cobbler, knocked down by the sea
These are some things from trip 134-D

Beaufort force eight and cold blowy weather
Dead sparrows and flickers all birds of a feather
Viruses rampant infecting with glee
These are some things from trip 134-D

When the ship rolled
When the boat pitched
We could feel so bad
But now with the sunset this all fades behind
And ending it will be sad

Slogging through head winds and long motorboat rides
Foul weather gear our waterproof hides
Cold running noses and hot aching ears
Wet evening watches could seem like years

When the ship rolled
When the boat pitched
We could feel so bad
But now with the sunset this all fades behind
And ending it will be sad

- Deborah Hayes