CRUISE REPORT

C-136

SCIENTIFIC ACTIVITIES

St. Thomas-Bequia-Bonaire-Roatan-Miami

November 30, 1994 to January 10, 1995

SSV Corwith Cramer

Sea Education Association
Woods Hole, Massachusetts

PREFACE

The purpose of this cruise report is to summarize the scientific activities of cruise C-136 aboard the SSV *Corwith Cramer*. The research effort was directed towards the fulfillment of undergraduate research projects. These projects represent the final fruit of a process which began in Woods Hole during the shore component when topics were researched and then refined into written proposals. At sea, a variety of specimens, observations, and measurements were collected and analyzed by the students for presentation to their shipmates. The written projects have been returned to Woods Hole for use in the long-term science objectives of SEA and in helping future students design their work. Much of this work was written at sea and represents a first interpretation of the data.

The students and staff of C-136 traveled the length and breadth of the Caribbean Sea experiencing a variety of marine habitats and port stops. The hard work of all helped to ensure the success of the voyage. Terry Hayward, master of the *Cramer* and Nautical Science professor superbly guided us through the shallows and deeps in all sorts of breezes and brought us safely home. I am deeply grateful for your efforts, thanks Terry! First mate Al Hickey did his usual terrific work, on-watch or off- sailing with Al is good duty, it's always a pleasure. My shore colleague from the Maritime Studies Department Jim Millinger was the second mate. Jim's knowledge and hard work always prove to be a valuable asset to any venture, and our trip was no exception. Jeremy Bumagin our third mate proved again that he is a skilled, conscientious and hard working educator who gets outstanding results. Our engineer Rick Hamilton learned the pleasures of the *Cramer's* engine room, kept the electrons flowing and was a fine shipmate. Jana Herbener, the steward, was in control of the flow of food and a fine job she did of it as a series of toothsome morsels prepared in timely fashion continuously appeared from the galley. Your efforts were splendid and your company a pleasure, **thanks** for all you efforts!

The science program was the fortunate benefactor of three skilled and engaging assistant scientists. Vera Agostini took charge of the lab and saw that it ran smoothly; not only was the data and learning constantly being produced, but it was done with style! Jeff Schell, second assistant scientist, turned his energy to the production of education and research and we all benefitted from his intensive efforts. Ari Martinez, third assistant scientist, came out from the west coast with a powerful will to teach and do science and he succeeded admirably. It was a blast to work with you all. **Thanks** a million for your efforts!

Our cruise was made more delightful and interesting by the presence of two visitors, Mary Malloy of the SEA Maritime Studies Faculty and Hector Manuel de Abreu, the Venezuelan observer. I thank them for their efforts and the contribution they made to our voyage.

Nothing would have happened except for the students, they were the meaning and the true heart of this voyage. I thank them all for their hard work and good fellowship, it was a marvelous trip!

Chuck Lea
Chief Scientist

TABLE OF CONTENTS

	<u>Page</u>
Preface	i
Contents	ii
Introduction	iii
Figure 1. Cruise Track of SSV <i>Corwith Cramer</i> Cruise C-136 December 1, 1994 to January 10, 1995	1
Figure 2. Midnight Positions Along Cruise Track of C-136 From December 1-11, 1994	2
Table 1. Midnight and Noon Positions Cruise C-136	3
Table 2. Itinerary of C-136	5
Table 3. Ship's Complement for SSV <i>Corwith Cramer</i> Cruise C-136	6
Academic Program	7
Table 4. Oceanography Classes on C-136	8
Table 5. Student Projects Aboard C-136	9
Research Summary	11
Appendices	
A. Station Information Summary of C-136	14
B. C-136 Bathythermograph Station Information	17
C. Surface Station Information Summary C-136	18
D. Hydrocast Data Summary C-136	21
E. CTD Station Summary C-136	24
F. CTD Station Profiles C-136	25
G. Net Collections Made Aboard SSV <i>Corwith Cramer</i> on Cruise C-136	30
H. Shipek Grab Stations C-136	32

INTRODUCTION

This cruise report provides a record of academic and research activities conducted on C-136. Oceanographic research on the cruise was almost entirely devoted to accomplishing individual student projects as part of an academic program. The sea-going program is an extension of courses conducted for six weeks on-shore in Woods Hole and emphasizes the application of theoretical concepts to the study of the oceans.

The cruise track of C-136 (Figures 1 and 2, Table 1 give positions) was designed to study and contrast oceanic environments and ecosystems. The oceanography of the Caribbean Sea was well covered by two north-south and one east-west transect of the region. This coverage allowed examination of the complexities of water flow into the Caribbean and its associated biology. The itinerary for the cruise is given in Table 2 and the cruise participants are listed in Table 3.

The academic program is described and a list of student projects is included. The research summary briefly describes the student research efforts while the appendices give a more detailed listing of the sampling and analytical results.

Figure 1. Cruise track of SSV Corwith Cramer cruise C-136, Dec. 1 1994-Jan. 10, 1995. Midnight positions are indicated.

Figure 2. Midnight positions along cruise track of C-136, from December 1 to 11, 1994.

TABLE 1.
MIDNIGHT AND NOON POSITIONS CRUISE C-136.

DATE 1994/95	TIME	LAT. (N)	LONG. (W)	COMMENTS
12/1/94	0000	18 18.6	64 50.1	Anchored Christmas Cove USVI
	1200	18 18.6	64 50.1	Anchored Christmas Cove USVI
12/2	0000	18 21.9	64 43.5	Anchored Leinster Bay
	1200	18 20.8	64 24.2	
12/3	0000	17 41.2	64 03.1	
	1200	16 41.0	64 00.0	
12/4	0000	16 07.0	63 41.5	
	1200	15 13.7	63 20.0	
12/5	0000	14 40.0	62 58.0	
	1200	13 53.9	62 38.0	
12/6	0000	13 03.9	61 58.6	
	1200	12 34.2	61 38.4	
12/7	0000	12 32.6	61 38.2	
	1200	13 00.5	60 14.3	Anchored, Bequia, ST. Vincent & Grenadin
12/8	0000	12 59.9	61 17.2	
	1200	12 24.9	61 34.4	
12/9	0000	12 05.0	62 02.8	
	1200	11 33.5	62 17.9	
12/10	0000	11 50.0	62 42.0	
	1200	11 19.8	63 38.2	
12/11	0000	11 03.8	64 32.1	
	1200	10 31.0	64 40.6	
12/12	0000	10 18.5	64 56.2	
	1200	10 40.9	65 43.3	
12/13	0000	10 59.3	66 55.2	
	1200	11 20.6	66 19.6	
12/14	0000	11 33.1	66 55.2	
	1200	11 41.9	67 50.8	
12/15	0000	12 04.1	68 18.9	
	1200	12 09.0	68 16.7	Alongside Kralendijk, Bonaire, Neth. Antil.
12/16	0000	12 09.0	68 16.7	Alongside Kralendijk, Bonaire
	1200	12 09.0	68 16.7	Alongside Kralendijk, Bonaire
12/17	0000	12 09.0	68 16.7	Alongside Kralendijk, Bonaire
	1200	12 09.0	68 16.7	Alongside Kralendijk, Bonaire
12/18	0000	12 08.5	68 25.9	
	1200	12 54.8	68 54.0	
12/19	0000	13 34.0	69 17.2	
	1200	14 37.3	70 18.0	
12/20	0000	15 09.7	70 35.5	
	1200	16 02.7	71 04.3	
12/21	0000	17 06.1	71 26.6	
	1200	17 16.4	71 49.9	
12/22	0000	17 00.9	72 34.4	
	1200	17 01.6	73 06.8	
12/23	0000	17 08.5	73 21.5	
	1200	17 12.0	73 48.6	

TABLE 1.
MIDNIGHT AND NOON POSITIONS CRUISE C-136.

DATE 1994/95	TIME	LAT. (N)	LONG. (W)	COMMENTS
-----------------	------	--------------	---------------	----------

12/24	0000	17 09.5	74 44.5	
	1200	17 02.7	75 27.7	
12/25	0000	16 46.7	76 10.0	
	1200	16 58.0	76 50.0	
12/26	0000	17 10.4	77 23.9	
	1200	16 52.7	78 18.0	
12/27	0000	16 33.5	79 18.5	
	1200	16 21.0	80 27.0	
12/28	0000	16 20.5	81 24.9	
	1200	16 19.7	82 51.2	
12/29	0000	16 27.6	83 56.6	
	1200	16 21.6	85 12.8	
12/30	0000	16 20.4	85 56.8	
	1200	16 21.0	86 27.4	Alongside, French Harbor, Roatan, Hondur
12/31	0000	16 19.5	86 26.4	
	1200	16 24.2	86 17.5	Anchored, Port Royale, Roatan, Honduras
1/1/95	0000	16 24.2	86 17.5	Anchored, Port Royale, Roatan, Honduras
	1200	16 24.2	86 17.5	Anchored, Port Royale, Roatan, Honduras
1/2	0000	16 24.2	86 17.5	Anchored, Port Royale, Roatan, Honduras
	1200	16 24.2	86 17.5	
1/3	0000	17 05.0	86 02.2	
	1200	17 59.0	86 02.0	
1/4	0000	19 28.0	85 52.0	
	1200	20 23.5	85 35.0	
1/5	0000	21 11.5	85 29.0	
	1200	22 14.4	85 16.8	
1/6	0000	22 41.5	85 10.0	
	1200	23 33.5	84 39.1	
1/7	0000	23 47.8	83 40.5	
	1200	23 56.0	82 19.0	
1/8	0000	24 10.3	81 03.0	
	1200	24 44.2	79 43.1	
1/9	0000	25 01.7	79 35.9	
	1200	25 39.0	79 55.0	
1/10	0000	25 46.7	80 06.2	Anchored, Miami Beach, USA
	1200	25 46.3	80 10.0	Alongside, Miami, USA

Table 2. Itinerary of C-136.

<u>Port</u>	<u>Arrive</u>	<u>Depart</u>
Chartlotte Amalie, St.Thomas		Nov.30,1994
Bequia, St.Vincent & Grenadines	Dec. 7,1994	Dec. 7,1994
Bonaire, Netherlands Antilles	Dec.15,1994	Dec.17,1994
Roatan, Honduras	Dec.30,1994	Jan. 2,1995
Miami, Florida USA	Jan.10,1995	

Table 3. Ship's Complement for SSV *Corwith Cramer* Cruise C-136

Nautical Staff

Terry Hayward	Captain
Al Hickey	First Mate
Jim Millinger	Second Mate
Jeremy Bumagin	Third Mate
Rick Hamilton	Engineer
Jana Herbener	Steward

Scientific Staff

Chuck Lea	Chief Scientist
Vera Agostini	First Assistant Scientist
Jeff Schell	Second Assistant Scientist
Ari Martinez	Third Assistant Scientist

Visitors

Mary Malloy	Maritime Studies Faculty, SEA
Hector Manuel de Abreu	Venezuelan Observer

Students

Meredith Birdsong	University of Virginia
Dirk Bjornstad	Oberlin College
Marcy Bogdon	Rutgers University
Ryan Brown	Colgate University
Theresa Clark	University of Rochester
Elizabeth Coppe	University of Rhode Island
Samantha Coyne	Bowdoin College
Aimee Cregier	Brandeis University
Edward Demling	University of Massachusetts
Oscar Echeverri	Old Dominion University
John Fichtman	University of Rhode Island
Wendy Fox	Colorado College
Victoria Gajda	Sweet Briar College
Valerie Guilfoyle	Cornell University
Sean Hipp	Georgetown University
Julia Hoggson	Smith College
Scott Hopkinson	Florida Atlantic University
Brett Jensen	University of Colorado
Catherine Lamenzo	Colorado College
Rebecca Merriam	University of New Hampshire
Jessica Tenenbaum	Cornell University
Julianna Wyman	Bates College

Academic Program

Cruise C-136 represents the second half of the twelve week SEA Semester program. During the first six weeks students took three courses: Oceanography, Nautical Science and Maritime Studies. The projects which the students undertook at sea were researched and proposed during the shore component. The proposal process included both written and oral presentations.

Throughout the cruise, a 24-hour science watch was maintained by a staff member and three students. During this time, students were instructed in the use of sampling and analytical equipment. Science watch workers were responsible for maintenance of the science log, conducting scientific stations, and routine observations and measurements of oceanographic and meteorologic conditions. Analyses of water and biological samples were also completed on science watch. The responsibility of the students for these procedures was gradually increased over the duration of the cruise, culminating in each student being designated Junior Science Watch Officer (JSWO) for two or three watches. Responsibility for the efficient running of the lab and the progress of the scientific program rested with these JSWOs.

Formal instruction was given each day in a class. The topics covered in the class lectures (Table 4) ranged from practical oceanographic sampling to presentations discussing timely or recently observed phenomena as well as theoretical oceanographic or marine biological subjects. Examinations and student presentations were also conducted during these instructional periods.

C-136 was comprised of two three-week courses in Practical Oceanography offered by SEA with credit granted through Boston University or other affiliates. Letter grades for the shipboard courses were determined on the basis of on-watch evaluations, exams, the research project presentation and final written report. These projects are listed in Table 5.

TABLE 4. OCEANOGRAPHY CLASSES ON C-136.

Day	Date (1994/95)	Topic	Speaker
Thur.	1 Dec.	Laboratory Safety	Chuck Lea
Fri.	2 Dec.	Bathymograph and Hydrowinch set-up and demonstration	Chuck Lea and Science Staff
Mon.	5 Dec.	Neuston Demonstration	Chuck Lea and Science Staff
	6 Dec.	Caribbean Geology	Chuck Lea
Fri.	9 Dec.	Sound in the ocean	Chuck Lea
Sat.	10 Dec.	Corals and coral reefs	Vera Agostini
Mon.	12 Dec.	The Winkler oxygen titration	Ari Martinez
Tue.	13 Dec.	Fun with the Spectrophotometer and the Fluorometer	Jeff Schell
Wed.	14 Dec.	Whales	Chuck Lea
Mon.	19 Dec.	Opening the Atlantic and Oil	Chuck Lea
Tue.	20 Dec.	Head of the Sperm Whale	Chuck Lea
Wed.	21 Dec.	Modern Oceanographic Equipment	Chuck Lea
Thur.	22 Dec.	Practical Exam	
Fri.	23 Dec.	Eutrophication, hypoxia and anoxia in two coastal systems	Vera Agostini
		Physical and behavioral processes in the modification of planktonic transport	Jeff Schell
Tue.	27 Dec.	Pollution assessment with larval settlement rates	Ari Martinez
Wed.	28 Dec.	Final Exam	
Thur.	29 Dec.	The scientific paper and its presentation	Chuck Lea
Mon.- Fri.	2-6 Jan. 1995	Student Project Presentations	C-136 Students

Table 5. Student Projects aboard C-136

Subtropical Underwater: The Location and Circulation in the Caribbean Sea Along the C-136 Cruise Track	Ryan Brown
Antarctic Intermediate Water: The Identification and Tracing of Antarctic Intermediate Water Through the Lesser Antilles and Into the Caribbean	Beth Coppe
The Transport and Velocity of the Water Entering the Caribbean Sea Through the Lesser Antilles	Julia Beck Hoggson
Geostrophic Flow Across the North Central Caribbean	Theresa M. Clark
Kick 'em Jenny: A Geological Hot Spot	Rebecca Merriam
The Chlorophyll- <i>a</i> Maximum Layer at the Continental Shelf and the Cariaco Basin off the Coast of Venezuela	Oscar G. Echeverri
A Study of the Change of Temperature, Salinity, and Oxygen with Depth in the Cariaco Basin	Victoria M. Gadjia
The Cariaco Basin as a Sink for Sediments Being Transported Along the Venezuelan Coastline	Marcy Bogdon
Variation of Surface Biomass Throughout the Caribbean	Meredith Birdsong
Chlorophyll Maxima in the Caribbean Sea and Their Profiles as Influenced by the Caribbean Current North and South of 15 Degrees North Latitude	Aimee Cregier
Diatom, Dinoflagellate, and <i>Trichodesmium</i> Distribution in the Caribbean Sea	Jessica Tenenbaum
Zooplankton Biomass and Diversity in the Caribbean Sea	Valerie Guilfoyle
A Study of the Distribution and Reproductive Cycle of the <i>Halobates micans</i> in the Caribbean Sea	Samantha Coyne
The Distribution of Stomatopod Larvae in Relation to Currents and Bottom Substrata Within the Caribbean Sea	Scott D. Hopkinson

Distribution Studies of the Phyllosoma Larvae of <i>Pamulirus argus</i> in the Caribbean Sea	Brett T. Jensen
Classifying Regions in the Caribbean Sea by Pteropod Speciation Distribution	Sean J. Hipp
Family Distribution of Leptocephali in the Caribbean Sea	Wendy Fox
A Zoogeographical Study of Myctophidae in the Caribbean Sea	John F. Fichtman, Jr.
Sediment Distribution and Phosphate/Chlorophyll- <i>a</i> Concentrations of Western Caribbean Carbonate Banks	Ed Demling
Carbonate Nodules and Allied Encrusting Forms of the Caribbean Sea: A Comparative Study of Composition as an Indicator of Environment	Cathy Lamenzo
The Distribution of Macrota and Microta in the Caribbean Sea	Dirk Bjornstad
Abundance and Distribution of Plastics in the Caribbean Sea	Julianna Wyman

RESEARCH SUMMARY

PHYSICAL OCEANOGRAPHY

The Subtropical Underwater in the Caribbean was examined by Ryan Brown. CTDs were made along three transects, from St. Thomas to Venezuela, Bonaire to Hispaniola, and Hispaniola to Roatan, and salinities of 36.5 ppt at densities near 25.4 mg/cm³ (sigma-t) were used to define the water mass. Subtropical Underwater was shown to be entering the Caribbean all along its eastern margin to the Grenada Passage which showed as high salinity as did the northeasterly stations at the beginning of the transect. A relatively high salinity station occurred south of the Windward Passage on the third transect, suggesting inflow from the Sargasso Sea.

Beth Coppe studied the Antarctic Intermediate Water mass (AAIW) which travels to the Caribbean at mid-depths from the South Atlantic. The AAIW was widespread in the area we sampled. Using a density of 27.3 to 27.5 mg/cm³, the salinity minimum, oxygen minimum and the phosphate maximum as guides to the location of the water masses, it was generally found at depths which ranged between 550 and 900 meters. The strongest input to the Caribbean was through the Grenada Passage yet there was also evidence of AAIW entering from the north at the Windward and Mona Passages.

The geostrophic equation was used by Julia Hoggson to calculate transports and current velocities along the eastern margin of the Caribbean. Transports were considerably lower than previous observations with no north-south difference calculated between the transport above and below 15° north.

Theresa Clark used the geostrophic equation to examine the transport and velocity structure from Hispaniola to the Nicaraguan Rise. She found an anticyclonic eddy south of Haiti with about 3 sverdrups of transport, also of interest was the lack of westerly flow southeast of Pedro.

KICK 'EM JENNY VOLCANO

The topography of the underwater volcano Kick 'em Jenny was examined by Rebecca Merriam. The region near 12°17'N by 61°37'W north of Grenada was bathymetrically surveyed with the Precision Depth Recorder (PDR) using GPS positions. The shallowest depth recorded was 8.6 meters, and it appears that no dramatic growth occurred since the last survey.

STUDIES AT THE CARIACO BASIN

The hydrography of the Cariaco Basin was described by Victoria Gajda using temperature, salinity and oxygen profiles of the deep basins. She found that the anoxic layer begins between 400 and 500 meters with hypoxia occurring in the upper 200 meters. Some warming and increase in salinity was observed when compared with previous years.

The depth of the chlorophyll *a* maximum layer in comparison to the phosphate and density structure in the waters of the Cariaco Basin and the surrounding continental shelf were studied by Oscar Echeverri. He found that the deep chlorophyll maxima in the deep waters of the basin resembled those found in open ocean areas of similar structure. Values on the continental shelf around the basin were generally larger and appeared to be less tied to the nutricline as represented by the phosphate concentrations.

Sediment samples were collected from the Cariaco Basin and the surrounding continental shelf and studied by Marcy Bogdon. Fine grains were collected in the basin and on the shelf to the south of it and coarser grains and some carbonate sediments were collected to the north and east of the basin.

The Amazon and Orinoco Rivers were thought to be the source of the fine grain material which was transported by the currents and deposited in the lower energy basin environment.

BIOLOGICAL OCEANOGRAPHY

Surface values of chlorophyll *a* were used by Meredith Birdsong to look for patterns in surface phytoplankton biomass across the Caribbean. Groups of surface values were averaged to compare areas thought to be dominated by various oceanic processes such as convergent and divergent waters, the area of tropical river influence, the continental shelf and waters influenced by island masses. While none of the averages were significantly different from one another the magnitudes did form a pattern which showed convergent waters poorer in surface plant biomass when compared to all other areas. The greatest values were found in the Amazon/Orinoco area, followed by the continental shelf, and the island area.

Deep chlorophyll *a* maxima in the open ocean Caribbean were studied by Aimee Cregier. The hypothesis that waters north of 15°N would reflect their convergent subtropical origin, and those south of 15°N their tropical divergent origin, was generally supported. Divergent water maxima generally occurred near the one percent light level, near the top of the pycnocline and nutricline. Those from convergent water were comparatively small in magnitude, deeper and not in proximity to increasing nutrients. The station near Roatan, while north of 15°N, shared characteristics of both areas.

The collections of net phytoplankton were studied by Jessica Tenenbaum. In general, she found dinoflagellates in phosphate poor surface water and diatoms in water of divergent origin where phosphate, and presumably other nutrients, were more available. *Trichodesmium* was collected throughout the study area. Dinoflagellates dominated the samples taken on the Venezuelan continental shelf, despite the high phosphate concentrations indicating possible differences between coastal and open ocean systems.

Zooplankton biomass and diversity in the Caribbean were studied by Valerie Guilfoyle using meter net collections taken at 50 and 100 meters. The biomass did not follow the expected pattern with the most being found in waters of subtropical origin and little correlation was indicated between biomass and the diversity at higher taxonomic levels. There did appear to be a relationship between shallow zooplankton biomass and the surface chlorophyll measurements.

Samantha Coyne examined the distribution and maturity of the *Halobates micans* collected in the neuston net tows. The highest concentrations of the insect were in the southeast and north-central Caribbean, reflecting populations advected from Sargasso Sea and tropical areas respectively. The subtropical (Sargasso Sea) *Halobates* had a higher proportion of nymphs to adults than did the specimens from tropical water suggesting that breeding in both populations continues into the winter months. This was the second year in a row that SEA observed this population pattern.

The distributions of the pelagic larvae of stomatopods, the mantis shrimp, were studied by Scott Hopkinson who proposed that differences might occur in the distribution of the larvae based on the adult habitat and the current structure of the Caribbean. Squillidea and Lysosquillidea larvae dominated the collections in both the northern and southern Caribbean preventing current-based generalizations, however it was found that most larvae were found in proximity to land with no specimens collected from the central waters of the Caribbean.

Brett Jensen's examination of the spiny lobster larvae also showed very few specimens in the central Caribbean region. The specimens, largely stages eight and nine, appeared to enter the Caribbean through both tropical as well as subtropical waters. This would be consistent with

Caribbean population replenishment from both subtropical, possibly Floridian, sources as well as local and a not well understood tropical source.

The distribution of the planktonic molluscs known as pteropods was the focus of Sean Hippi's work. He separated pteropods from the meter net samples and identified them to species. The distribution of these species within the Caribbean was compared to their Atlantic-wide occurrences. These distributions indicated that the pteropod plankton of the Caribbean has its origins in both tropical and subtropical regions. Indicator species for subtropical waters included *Cavolinia pyramidata*, *C. inflexa*, *Limacina lesueri*, *Creseis virgula*, and *Cuvierina columnella*. *C. longirostris*, and *Cresies acicula* were indicative of tropical water.

Leptocephali, the pelagic larvae of eels, are carried to the Caribbean from their spawning grounds. Wendy Fox examined the distribution of these fish for patterns associated with their origins. Family identifications suggest more diversity in the fauna north of 15° N latitude, and include more Muraenidae than previously collected at SEA. Congridae eels tended to be larger in the south than in the north and general length increased to the west, the direction of planktonic drift.

Examination of myctophid (lantern fish) occurrence and distribution across the Caribbean was done by John Fichtman. He found the collections of these vertical migrators to be heavily influenced by the moon phase with poor catches coinciding with full moons. The distribution of the species showed no dramatic differences between convergent and divergent boundaries tropical; species were found throughout the region while those of strictly subtropical origin were less abundant.

GEOLOGICAL OCEANOGRAPHY

Ed Demling's work on the sediment of the shallow carbonate banks of the western Caribbean suggested general fining of sediments to leeward. The benthic fauna suggested that increasing percentages of deposit feeders accompanied this change. Water samples taken near the bottom samples could not confirm the presence of bank-top resuspension of nutrients or bank-edge upwelling.

Carbonate nodules and other encrusted benthos were examined by Cathy Lamenzo. In general, the windward side of carbonate platforms appeared more productive of these forms than the leeward side. Coralline algae was present at all depth ranges sampled (to 75 meters) as was the foraminifera *Hometrema*. Another foraminifera, *Gypsina vesicularis*, occurred from 18 to 50 meters, also the depth of occurrence of the green algae in this study.

ANTHROPOGENIC POLLUTION

Concentrations of both visible (macro) and microscopic (micro) tar were studied by Dirk Bjornstad. Neustonic concentrations of macrotar were generally very low (< 1 mg/m²) throughout the Caribbean except in those waters south of the Windward passage where inflow from the Sargasso Sea was thought to raise the concentration. The low concentrations suggest a continued decline in macrotar floating in the Caribbean. The microtar results did not conform to patterns of large-scale oceanic circulation, although large differences in particle concentration were observed.

Macro- and microplastic concentrations and distributions were examined by Julianna Wyman. She found macroplastic amounts at very low levels when compared with past years, with the only concentration southwest of Hispaniola. Microplastic concentrations appeared to be influenced by both ocean circulation patterns and local terrestrial input. The highest values of microplastic were just downwind of the Lesser Antilles and south of the Windward Passage.

APPENDIX A.
STATION INFORMATION SUMMARY OF C-136.

STATION C136-	DATE 1994	LOG (nm)	LAT. (N)	LONG. (W)	AREA	EQUIPMENT
001	2 Dec.	11.0	18 10.7	64 20.8	Anagada Passage	CTD
002	3 Dec.	44.6	17 39.7	64 07.2	North East Caribbean	Neuston net
003	3 Dec.	94.0	16 41.8	63 51.6	North East Caribbean	CTD Secchi disc Niskin bottles Phytoplankton net Neuston net
004	3 Dec.	133.3	16 16.0	63 39.0	North East Caribbean	Meter nets 2 meter net
005	4 Dec.	189.5	15 14.0	64 20.0	Central East Caribbean	CTD Neuston net
006	4 Dec.	233.3	14 34.2	62 53.7	Central East Caribbean	Neuston net
007	5 Dec.	281.2	13 55.9	62 35.3	Central East Caribbean	Neuston net
008	6 Dec.	394.8	12 37.2	61 37.0	South East Caribbean	CTD Secchi disc Niskin bottles Phytoplankton net Neuston net
009	6 Dec.	411.0	12 33.3	61 36.7	South East Caribbean	Meter nets 2 meter net Neuston net
010	8 Dec.				Grenadine Platform	Fisher scoop
011	8 Dec.				Kick 'em Jenny	Fisher scoop
012	8 Dec.	518.9	12 16.1	61 36.5	Grenadine Platform	Shipek grab
013	8 Dec.	548.0	12 05.2	62 01.5	Southwest of Grenada	Neuston nets
014	9 Dec.	557.2	11 56.7	62 08.0	Southwest of Grenada	CTD
015	9 Dec.	570.5	11 39.9	62 10.5	Grenada Passage	CTD Secchi disc Niskin bottles Phytoplankton net Neuston net
016	9 Dec.	576.1	11 28.8	62 25.7	Venezuelan Cont.Shelf	Shipek grab
017	9 Dec.	603.5	11 50.2	62 52.8	South East Caribbean	Meter nets 2 meter net Neuston net
018	10 Dec.	604.4	11 47.4	62 56.7	South East Caribbean	Neuston nets
020	10 Dec.	687.4	11 08.0	64 30.0	South East Caribbean	Neuston nets Shipek grab
021	11 Dec.	704.8	10 49.5	64 33.5	N.of E. Cariaco Basin	Phytoplankton net Shipek grab
022	11 Dec.	717.8	10 31.6	64 40.5	E. Cariaco Basin	CTD Secchi disc Niskin bottles Shipek grab
023	11 Dec.	729.9	10 19.5	64 50.2	Shelf S.of Car.Basin	CTD Niskin bottles Phytoplankton net Shipek grab
024	12/12	735.3	10 18.5	64 56.2	Shelf S.of Car.Basin	Neuston nets

APPENDIX A, cont.
STATION INFORMATION SUMMARY OF C-136,

STATION C-136	DATE 1994	LOG (nm)	LAT. (N)	LONG. (W)		EQUIPMENT
025	12/12	781.5	10 41.6	65 40.4	W. Cariaco Basin	CTD Niskin bottles Phytoplankton net Shipek grab
026	12/12	797.9	10 53.8	66 00.4	Shelf N.ofW.Cariaco Basin	CTD Niskin bottles Shipek grab
027	12/13	803.8	11 00.3	66 04.1	Shelf N.ofW.Cariaco Basin	Neuston nets
028	12/13	838.9	11 19.6	66 18.4	Bonaire Basin	Neuston net
029	12/13	839.9	11 18.9	66 20.4	Bonaire Basin	Neuston net
030	12/13	866.1	11 37.2	66 48.6	Bonaire Basin	Meter nets 2 meter net
031	12/14	869.0	11 33.4	66 54.9	Bonaire Basin	Neuston nets
032	12/14	901.3	11 40.9	67 37.5	Bonaire Basin	CTD Niskin bottles Phytoplankton net Secchi disc Neuston nets
033	12/14	920.3	11 58.0	68 12.0	Bonaire Basin	2 meter net
033	12/17	948.3	10 19.5	64 50.2	W.of Bonaire	CTD
034	12/18	994.4	13 00.0	69 00.2	S.Central Caribbean	Neuston nets
035	12/18	1012.8	13 15.0	69 15.5	S.Central Caribbean	CTD Secchi disc Niskin bottles Phytoplankton net
036	12/19	1040.0	13 48.8	69 43.9	S.Central Caribbean	Neuston nets
037	12/19		14 38.0	70 16.9	Central Caribbean	CTD Neuston nets
038	12/20	1126.5	15 09.2	70 36.1	Central Caribbean	Neuston nets
039	12/20	1186.5	16 03.1	71 02.9	Central Caribbean	CTD Neuston nets
040	12/21	1259.0	17 05.7	71 27.0	N.Central Caribbean	Neuston nets
041	12/21		17 20.4	71 39.2	N.Central Caribbean	CTD Secchi disc Niskin bottles Phytoplankton net
042	12/21	1291.5	17 17.0	71 48.1	N.Central Caribbean	Neuston nets
043	12/22	1343.5	17 00.9	72 34.4	N.Central Caribbean	Neuston nets
044	12/22	1374.7	17 06.7	73 15.4	N.Central Caribbean	CTD
045	12/23	1378.3	17 08.5	73 21.5	N.Central Caribbean	Neuston nets
046	12/24	1462.1	17 09.7	74 44.7	N.Central Caribbean	Neuston nets
047	12/24	1497.5	17 04.1	75 20.5	N.Central Caribbean	CTD Phytoplankton net
048	12/24	1536.8	16 50.7	76 07.6	N.Central Caribbean	Meter nets 2 meter net

APPENDIX A,cont.
STATION INFORMATION SUMMARY OF C-136,

STATION C-136	DATE 1994	LOG (nm)	LAT. (N)	LONG. (W)		EQUIPMENT
049	12/24	1530.0	17 08.7	77 09.4	East of Pedro Bank	CTD Secchi disc Niskin bottles Phytoplankton net
050	12/25	1619.2	17 10.5	72 24.1	East Pedro Bank	Shipek grab Niskin bottles
051	12/26	1624.7	17 08.6	77 29.2	East Pedro Bank	Shipek grab Niskin bottles
052	12/26	1657.3	17 06.1	78 02.4	Central Pedro Bank	Shipek grab Niskin bottles
053	12/26	1678.2	16 52.4	78 18.2	Southwest Pedro Bank	Shipek grab Niskin bottles
054	12/26	1698.5	16 39.7	78 37.4	South of Pedro Bank	CTD
054	12/26	1756.9	16 27.9	79 35.5	E.of Rosalind Bank	CTD
056	12/27	1801.2	16 21.5	80 20.8	E.Rosalind Bank	Shipek grab
057	12/27	1822.5	16 20.2	80 40.3	W.Rosalind Bank	Shipek grab
058	12/28	1936.6	16 18.4	82 39.4	Nicaraguan Rise	Shipek grab
059	12/28	1969.5	16 21.6	83 12.3	Nicaraguan Rise	Shipek grab
060	12/28	1974.3	16 21.2	83 17.4	Nicaraguan Rise	Shipek grab
061	12/28	2012.9	16 27.8	83 56.6	East of Roatan	CTD Niskin bottles Phytoplankton net
062	12/29	2115.7	16 19.4	85 51.0	Southeast of Roatan	Meter nets 2 meter net

APPENDIX B.
C-136 Bathythermograph Station Information.

BT # C-136	DATE 1994	LOG (nm)	LAT. (N)	LONG. (W)	GENERAL LOCALE	Surf.Temp. (C)	100m Temp (C)	200m Temp (C)
001	12/2	9.5	18 12.9	64 20.0	NE Caribbean	27.9	25.0	19.0
002	12/2	30.0	17 52.8	64 12.9	NE Caribbean	27.2	25.0	20.0
003	12/3	80.5	17 03.7	64 00.2	NE Caribbean	27.9	24.7	-
004	12/4	177.5	15 25.6	63 24.9	NE Caribbean	27.9	25.0	17.5
005	12/5	232.0	14 39.5	62 55.0	Central East Carib.	27.8	24.9	17.5
006	12/5	292.2	13 46.1	62 36.5	Central East Carib.	28.0	25.0	-
007	12/6	359.2	12 59.0	61 52.9	SE Caribbean	27.8	21.5	-
008	12/6	407.4	12 59.0	61 59.2	SE Caribbean	27.6	22.8	16.6
009	12/8	474.3	12 50.3	61 24.2	SE Caribbean	27.7	21.5	14.3
010	12/8	500.0	12 27.5	61 32.9	SE Caribbean	27.8	23.0	15.0
011	12/8	523.1	12 15.2	61 40.8	SE Caribbean	27.7	23.0	-
012	12/9	557.5	11 54.5	62 08.5	SE Caribbean	27.9	23.1	14.9
013	12/9	596.6	11 44.1	62 49.1	SE Caribbean	27.7	24.3	-
014	12/10	638.8	11 21.9	63 34.3	Ven.Cont.Shelf	27.1	-	-
015	12/11	700.8	10 54.2	64 32.8	E.Cariaco Basin	26.4	21.4	-
016	12/12	775.0	10 37.0	65 34.0	W,Cariaco Basin?	26.4	22.0	-
017	12/13	816.5	11 10.0	66 08.3	Bonaire Basin	26.6	18.0	12.2
018	12/13	861.8	11 35.2	66 45.2	Bonaire Basin	27.4	19.0	-
019	12/14	916.1	11 56.0	68 03.4	Bonaire Basin	26.9	21.5	15.8
020	12/18	977.9	12 43.4	68 47.5	S.Central Caribbean	26.6	20.5	-
021	12/19	1040.0	13 48.8	69 43.9	S.Central Caribbean	27.5	24.5	17.4
022	12/19	1101.1	14 46.7	70 26.1	Central Caribbean	26.8	23.0	-
023	12/20	1171.5	15 48.7	70 56.7	Central Caribbean	27.6	25.7	18.9
024	12/20	1237.0	16 42.4	71 21.0	Central Caribbean	27.4	25.4	-
025	12/21	1309.0	17 11.6	72 03.1	N.Central Caribbean	27.7	26.5	20.6
026	12/23	1403.6	17 09.2	73 49.5	N.Central Caribbean	27.6	26.0	-
027	12/24	1470.0	17 09.6	74 53.4	N.Central Caribbean	27.5	26.3	19.7
028	12/24	1533.3	16 58.5	76 00.6	N.Central Caribbean	27.0	25.3	-
029	12/25	1594.7	17 04.8	77 03.9	N.Central Caribbean	28.1	27.5	-
030	12/26	1716.3	16 35.2	78 54.3	N.Central Caribbean	27.7	27.0	-
031	12/27	1785.8	16 25.3	80 06.2	Western Caribbean	27.6	26.0	-
032	12/28	1992.8	16 23.5	83 36.1	Western Caribbean	27.4	24.5	-
033	12/29	2062.8	16 22.3	89 45.5	Western Caribbean	27.1	23.8	-
034	12/30	2129.3	16 20.6	86 03.7	Western Caribbean	27.4	23.5	-

Appendix C.

SURFACE STATION INFORMATION SUMMARY, C-136

Station C-136-SS	Date 12/94	Time	Log (nm)	Latitude (°N)	Longitude (°W)	Surf. Temp (°C)	Salinity (‰)	Phosphate ($\mu\text{M/l}$)	Silicate ($\mu\text{M/l}$)	Chlorophyll <i>a</i> ($\mu\text{g/l}$)
SS-001	12/02/94	0300	0.0	18°24'	64°29'	27.700	0.000	0.094	---	0.292
SS-002	12/02/94	2050	26.8	17°56'	64°14'	27.900	0.000	0.000	---	0.122
SS-003	12/03/94	0200	53.1	17°31'	64°06'	27.600	---	0.470	3.469	0.232
SS-004	12/03/94	0605	80.5	17°04'	64°00'	27.900	---	---	---	0.221
SS-005	12/03/94	1600	111.8	16°37'	63°52'	28.100	---	---	---	0.182
SS-006	12/04/94	0200	150.0	15°57'	63°37'	27.400	---	---	---	0.247
SS-007	12/04/94	0850	177.5	15°25'	63°24'	27.900	---	---	---	0.169
SS-008	12/04/94	1820	207.6	14°58'	63°11'	28.000	---	---	3.390	0.161
SS-009	12/05/94	0127	236.8	14°33'	62°52'	27.800	---	---	---	0.119
SS-010	12/05/94	0700	262.2	14°13'	62°40'	27.700	---	0.023	4.535	0.278
SS-011	12/05/94	1408	292.2	13°46'	62°37'	28.000	---	---	---	0.166
SS-012	12/05/94	2000	328.4	13°22'	62°13'	27.800	---	---	1.647	0.259
SS-013	12/06/94	0118	359.3	12°59'	61°53'	27.800	---	0.127	0.636	0.396
SS-016	12/06/94	0534	432.5	12°50'	61°38'	27.300	---	0.142	0.584	0.574
SS-014	12/06/94	0703	385.5	12°41'	61°40'	27.100	---	1.904	0.945	0.952
SS-015	12/06/94	2000	407.4	12°31'	61°34'	27.600	---	0.107	0.367	0.574
SS-016	12/07/94	0534	432.5	12°30'	61°13'	27.700	---	0.024	0.532	---
SS-017	12/08/94	0040	464.4	12°58'	61°18'	27.700	35.470	0.470	0.264	0.571
SS-018	12/08/94	0430	475.8	12°49'	61°24'	27.700	35.162	0.832	0.285	0.208
SS-019	12/08/94	1030	496.1	12°30'	61°13'	27.700	35.599	0.024	0.532	0.777
SS-020	12/08/94	1727	520.7	12°15'	61°30'	27.800	35.599	0.000	---	0.963
SS-021	12/08/94	2155	540.0	12°11'	61°55'	28.000	34.832	0.152	0.296	0.279
SS-022	12/09/94	0318	557.2	11°56'	62°08'	27.900	---	0.401	0.470	0.270
SS-023	12/09/94	1700	576.1	11°28'	62°25'	27.800	34.352	0.162	0.446	0.661
SS-024	12/10/94	2200	596.6	11°44'	62°49'	27.700	35.324	---	2.285	0.764
SS-025	12/10/94	0624	617.0	11°38'	63°14'	26.900	31.919	---	9.183	1.209
SS-026	12/10/94	1050	638.8	11°22'	63°34'	27.100	35.509	---	2.097	0.514

Station C-136-SS	Date 12/94	Time	Log (nm)	Latitude (°N)	Longitude (°W)	Surf. Temp (°C)	Salinity (‰)	Phosphate ($\mu\text{M}/1$)	Silicate ($\mu\text{M}/1$)	Chlorophyll <i>a</i> ($\mu\text{g}/1$)
SS-027	12/10/94	1710	663.8	11°12'	64°04'	25.900	36.659	---	4.762	2.141
SS-028	12/10/94	0900	683.5	11°08'	64°26'	25.900	36.688	0.341	---	0.371
SS-029	12/11/94	0229	699.1	10°56'	64°33'	26.600	36.676	---	0.042	0.626
SS-031	12/12/94	0525	755.1	10°25'	65°15'	25.800	36.728	---	0.550	0.806
SS-031	12/12/94	0525	755.1	10°25'	65°15'	25.800	36.728	---	---	0.806
SS-032	12/12/94	0911	775.0	10°38'	65°35'	26.480	36.728	---	---	---
SS-032	12/12/94	0911	775.5	10°38'	64°35'	26.480	36.728	0.034	---	0.528
SS-033	12/12/94	1930	794.6	10°51'	65°58'	26.400	36.696	0.044	---	0.268
SS-030	12/12/94	2335	733.5	10°18'	64°55'	25.600	36.754	0.121	---	0.349
SS-034	12/13/94	0410	814.5	11°00'	66°09'	26.600	36.671	0.006	---	0.339
SS-035	12/13/94	1240	838.9	11°19'	66°18'	27.000	---	---	0.351	0.225
SS-036	12/13/94	2030	861.8	11°35'	66°45'	27.350	35.892	0.001	---	0.278
SS-037	12/14/94	0415	884.3	11°33'	67°16'	26.800	---	---	1.752	0.331
SS-038	12/14/94	1705	916.1	11°56'	68°03'	26.900	36.580	0.221	---	0.492
SS-039	12/15/94	0400	935.0	12°05'	68°22'	26.700	36.421	---	---	0.713
SS-040	12/18/94	0030	948.3	12°09'	68°28'	26.800	---	---	---	3.240
SS-041	12/18/94	0808	977.9	12°43'	68°48'	26.600	36.639	---	---	0.382
SS-042	12/18/94	1710	1012.8	13°15'	69°16'	27.000	---	---	---	---
SS-043	12/19/94	0030	1040.0	14°49'	69°44'	27.500	35.522	---	---	0.204
SS-044	12/19/94	0900	1070.0	13°27'	70°10'	27.300	35.747	---	---	0.152
SS-045	12/19/94	1957	1102.0	14°48'	70°27'	26.800	35.586	---	---	0.218
SS-046	12/20/94	0223	1135.8	15°14'	70°41'	27.300	35.663	0.480	---	0.180
SS-047	12/20/94	0803	1169.5	15°47'	70°56'	27.600	35.211	---	---	0.348
SS-048	12/20/94	1620	1206.1	16°15'	71°12'	27.700	34.882	---	---	0.123
SS-049	12/20/94	2140	1242.6	16°51'	71°22'	27.700	34.920	---	---	0.218
SS-050	12/21/94	0331	1273.0	17°15'	71°32'	27.600	---	0.235	---	0.876
SS-051	12/21/94	1640	1309.0	17°12'	72°03'	27.700	---	---	---	0.149

Station	Date	Time	Log (nm)	Latitude (°N)	Longitude (°W)	Surf. Temp (°C)	Salinity (‰)	Phosphate ($\mu\text{M}/\text{l}$)	Silicate ($\mu\text{M}/\text{l}$)	Chlorophyll <i>a</i> ($\mu\text{g}/\text{l}$)
C-136-SS	12/94									
SS-052	12/21/94	2300	1338.5	17°02'	72°30'	27.700	---	---	---	0.428
SS-053	12/22/94	0945	1368.8	17°01'	73°03'	27.700	---	0.001	---	0.329
SS-054	12/23/94	0916	1403.6	17°09'	73°49'	27.600	---	---	---	---
SS-055	12/23/94	1946	1437.5	17°11'	74°20'	27.400	---	---	---	---
SS-056	12/24/94	0315	1471.2	17°09'	74°55'	27.500	---	---	---	---
SS-057	12/24/94	1125	1501.6	17°40'	75°26'	27.050	---	---	---	---
SS-058	12/24/94	1645	1532.3	16°59'	75°40'	27.000	---	0.081	---	0.290
SS-059	12/25/94	1000	1564.0	16°51'	76°38'	27.600	---	---	---	---
SS-060	12/25/94	1512	1594.7	17°05'	77°04'	28.100	---	---	---	---
SS-061	12/26/94	0127	1624.5	17°08'	77°29'	27.900	---	2.578	---	0.650
SS-062	12/26/94	0730	1654.5	17°07'	77°59'	27.600	---	---	---	---
SS-063	12/26/94	1357	1686.0	16°48'	78°24'	27.600	---	0.128	---	---
SS-064	12/26/94	2026	1716.3	16°35'	78°54'	27.700	---	---	---	0.511
SS-065	12/27/94	0340	1756.9	16°28'	79°36'	27.600	---	---	---	0.253
SS-066	12/27/94	0748	1785.6	16°25'	80°06'	27.400	---	---	---	0.248
SS-067	12/27/94	1300	1815.9	16°20'	80°35'	27.500	---	---	---	0.823
SS-068	12/27/94	1923	1845.5	16°20'	81°05'	27.300	---	---	---	---
SS-069	12/28/94	0108	1876.0	16°21'	81°39'	27.400	---	---	---	0.295
SS-070	12/28/94	0513	1905.6	16°19'	82°05'	27.100	---	---	---	0.766
SS-071	12/28/94	0910	1933.8	16°19'	82°37'	27.500	---	0.041	---	1.235
SS-072	12/28/94	1402	1961.5	16°22'	83°04'	27.400	---	---	---	---
SS-073	12/28/94	1950	1992.5	16°24'	83°36'	27.400	---	---	---	0.052
SS-074	12/29/94	0145	2023.2	16°27'	84°07'	27.300	---	---	---	0.445
SS-075	12/29/94	0705	2060.8	16°22'	84°46'	27.100	---	---	---	0.045
SS-076	12/29/94	1733	2090.1	16°20'	85°25'	27.400	---	---	---	---
SS-077	12/30/94	0110	2129.3	16°21'	86°04'	27.400	---	0.000	---	---

APPENDIX D.
HYDROCAST DATA SUMMARY C-136.

STATION # C-136	BOTTLE	DEPTH (m)	TEMP (C)	SAL (0/00)	O2 (ml/l)	PO4 (ug/l)	CHLOR (ug/l)
003	12	0	-	-	4.16	0.005	0.1279
NE Caribbean	11	25	28.027	34.759	4.32	0.024	0.2244
Secchi z:	10	36	28.030	34.762	4.29	0.009	0.2239
12m	9	50	28.042	34.777	4.01	0.012	0.1979
	8	100	25.178	36.854	3.92	0.078	0.1548
	7	150	23.121	37.139	3.52	0.054	0.0000
	6	250	17.143	36.377	3.33	0.067	
	5	350	14.550	35.843	3.06	0.203	
	4	500	10.358	35.145	2.84	0.341	
	3	600	8.661	34.971	3.00	0.369	
	2	800	6.521	34.780	2.40	-	
	1	1000	5.653	34.964	3.56	0.310	
008	12	0	-	-	3.44	3.326	0.0398
W.of Grenadines	11	25	27.618	35.631	4.41	0.171	1.2665
Secchi z:	10	45	27.612	35.664	4.36	-	1.0212
16m	9	60	26.777	36.103	3.96	1.160	1.3276
	8	75	25.264	36.903	4.04	-	0.5246
	7	125	22.201	37.031	3.61	-	-
	6	225	16.042	36.279	2.79	1.185	0.0047
	5	350	11.795	35.395	2.74	1.606	
	4	500	8.535	34.920	2.52	-	
	3	600	7.689	34.822	2.80	2.232	
	2	800	5.855	34.780	3.26	2.100	
	1	1000	4.873	34.913	3.84	1.802	
015	12	0	27.983	35.833	4.14	0.103	0.1653
Grenada Passage	11	25	27.951	35.777	4.55	0.093	0.0071
Secchi z:	10	50	26.439	36.700	4.10	0.020	0.3925
26m	9	75	24.652	36.685	3.11	0.034	0.8180
	8	100	23.720	36.948	3.84	0.083	0.2702
	7	125	22.377	36.945	3.12	0.343	0.1155
	6	225	14.688	35.866	3.05	0.764	
	5	350	9.401	35.080	2.66	1.518	
	4	500	7.438	34.713	3.23	0.612	
	3	600	6.611	34.640	2.48	2.110	
	2	750			3.01	2.159	
	1	800			2.92	2.051	
022A	9	0	26.359	36.461	-	0.093	0.3708
E.Cariaco Basin	8	15	25.682	36.745	4.30	0.103	0.4607
Secchi z:	7	25	24.624	36.831	3.51	0.191	1.0517
12m	6	35	24.524	36.808	3.54	0.362	0.8164
	5	50	24.082	36.822	3.47	0.450	0.2322
	4	75	22.991	36.848	3.09	0.563	0.0491
	3	100	21.197	36.809	3.00	0.749	0.0338
	2	150	18.436	36.545	1.39	1.204	0.0048
	1	200	17.947	36.432	0.41	1.924	0.0021
022B	12	0	26.340	36.327			
E.Cariaco Basin	11	100	21.249	36.730	2.82		
Secchi z:	10	200	18.004	36.452	0.54	1.772	
12m	9	250	17.802	36.403	0.37	2.311	
	8	300	17.674	36.838	0.15	2.570	
	7	350	17.545	36.357	0.20	2.996	
	6	400	17.425	36.338	1.25	3.026	
	5	500	17.244	36.295	0.00	3.153	
	4	700	17.096	36.252	0.00	3.226	
	3	800	17.084	36.247	0.00	3.432	
	2	1000	17.091	36.241	0.00	3.447	
	1	1250	17.117	36.239	0.00	3.545	

APPENDIX D cont.
HYDROCAST DATA SUMMARY C-136.

STATION # C-136	BOTTLE	DEPTH (m)	TEMP (C)	SAL (0/00)	O2 (ml/l)	PO4 (ug/l)	CHLOR (ug/l)
023	9	0	25.960	33.990		0.038	1.1045
Shelf S.of Car- iaco Basin	8	5	25.560	36.750		0.040	0.5672
	7	10	25.580	36.760	4.26	0.063	1.9496
	6	15	25.560	36.770	4.29	0.116	1.6595
	5	25	24.530	36.840	2.90	0.069	1.5144
	4	30	24.490	36.850	3.52	0.040	0.5016
	3	40	24.000	36.890	2.64	0.064	0.6032
	2	50	23.760	36.920	3.37	0.050	-
	1	60	23.680	36.920	4.05	0.071	0.3209
025	12	0	26.580	36.900			0.2566
W.Cariaco Basin	11	25	26.130	36.810	4.02	0.103	0.7635
	10	56	24.830	36.900	4.03	0.113	0.8799
	9	70	24.360	36.900	4.01	0.240	2.4483
	8	125	19.530	36.790	2.60	0.920	0.0188
	7	250	17.890	36.450	1.33	1.674	0.0149
	6	350	17.590	36.380	0.31	2.830	
	5	400	17.490	36.360	0.23	2.815	
	4	500	17.300	36.320	0.00	3.231	
	3	750	17.010	36.270	0.00	3.510	
	2	1000	17.090	36.230	0.00	-	
	1	1250	17.110	36.260	0.00	3.510	
026	9	0				0.142	0.1419
Shelf N.of Car- iaco Basin	8	5			4.48	0.122	0.0054
	7	10			4.56	0.122	0.4035+
	6	15			4.34	0.073	0.0989
	5	25			3.64	0.250	1.2417
	4	30			3.59	0.289	1.2069
	3	40			3.47	0.294	0.4536
	2	50			3.43	0.308	0.3173
032	12	0	26.890	36.430		0.063	0.0379
Bonaire Basin	11	25	26.630	36.680	4.40		0.3644
Secchi z:	10	45	26.600	36.710	4.38		0.5090
16m	9	60	26.370	36.740	4.25	0.056	0.1485
	8	75	23.780	37.000	3.76	0.058	0.0187
	7	125	19.800	36.760	3.21	0.111	0.0340
	6	225	15.360	36.030	2.99		
	5	350	11.110	35.310	2.76		
	4	500	8.300	34.910	2.63	2.174	
	3	600	7.350	34.830	2.78		
	2	800	5.790	34.830	3.17	0.432	
	1	1000	5.060	34.920	3.84	0.379	
035	12	0			4.30		0.3062
S.Central Caribbean	11	25	26.900	36.424	4.90		0.3174
Secchi z:	10	35	26.854	36.471	4.54		0.0206
18m	9	50	26.685	36.558	4.51		0.9168
	8	65	26.149	36.683	4.29		
	7	100	23.190	37.099	3.54		1.0706
	6	200	17.534	36.414	3.32		
	5	350	12.512	35.630	3.26		
	4	500	8.830	35.000	3.04		
	3	600	7.530	34.880	3.34		
	2	800	5.840	34.820	3.39		
	1	1000			3.19		22

APPENDIX D cont.
HYDROCAST DATA SUMMARY C-136.

STATION # C-136	BOTTLE	DEPTH (m)	TEMP (C)	SAL (0/00)	O2 (ml/l)	PO4 (ug/l)	CHLOR (ug/l)
041	12	0			4.36		0.0183
N. Central Caribbean	11	25	27.690	35.046	4.25		0.4339
Secchi z:	10	35	27.675	35.049	4.16		0.4715
20m	9	50	27.670	35.058	3.65		0.5034
	8	65	27.664	35.088	4.41		0.8225
	7	100	25.896	36.702	4.08		0.3905
	6	200	20.924	36.833	3.88		0.0258
	5	350	16.739	36.305	3.71		
	4	500	12.074	35.487	3.26		
	3	600	9.922	35.212	3.02		
	2	800	6.790	34.892	3.08		
	1	1000	5.217	34.937	2.45		
049	12	0	27.974	35.052	4.51		
East of Pedro Bank	11	25	28.014	35.387	4.42		
Secchi z:	10	50	28.030	35.410	4.41		
25m	9	80	28.166	36.083	3.21		
	8	100	27.662	36.283	3.21		
	7	125	25.797	36.666	3.86		
	5	350	15.669	36.125	3.44		
	4	500	11.932	35.503	3.17		
	3	600	9.502	35.137	3.52		
	2	800	6.641	34.836	3.77		
	1	1000	5.247	34.932	4.29		
050	2	0					
East Pedro Bank	1	30					
051	2	0					
East Pedro Bank	1	20					
052	2	0					
Central Pedro Bank	1	18					
052	2	0					
Southwest Pedro Ba	1	18					
061							
East of Roatan	12	0	26.825	33.100			
	11	25	27.394	35.946	3.46		
	10	50	27.466	36.054	4.39		
	9	80	26.788	36.492	4.15		
	8	100	25.048	36.732	3.45		
	7	125	23.081	36.890	3.54		
	6	225	15.657	36.172	3.68		
	5	350	11.744	35.475	3.38		
	4	500	8.486	35.007	3.92		
	3	600	7.092	34.896	3.85		
	2	800	5.370	34.911	4.17		
	1	1000	4.742	34.945	3.96		

APPENDIX E.
CTD STATION SUMMARY, C-136.

STATION C-136	DATE 1994	LOG (nm)	LAT. ('N)	LONG. ('W)	DEPTH (m)	LOCALE
001	2 Dec.	11.0	18 10.7	64 20.8	1280	Anagada Passage
003	3 Dec.	94.0	16 41.8	63 51.6	1230	NE Caribbean
005	4 Dec.	189.5	15 14.0	63 20.0	1100	Central E Caribbean
007	5 Dec.	281.2	13 56.0	62 35.3	1044	Central E Caribbean
008	6 Dec.	394.8	12 37.2	61 37.0	1000	West of Grenadines
014	9 Dec.	557.2	11 56.7	62 07.9	1200	Southwest of Grenada
015	9 Dec.	570.5	11 39.9	62 10.5	800	Grenada Passage
022	11 Dec.	717.8	10 31.6	64 40.5	1400	E.Cariaco Basin
023	11 Dec.	729.9	10 19.5	64 50.2	65	Shelf S.of Cariaco Basin
025	12 Dec.	780.5	10 53.8	66 00.4		W.Cariaco Basin
026	12 Dec.	797.9	10 41.5	65 41.0	75	Shelf N.of Cariaco Basin
028	13 Dec.	838.9	11 19.6	66 18.4	900	Bonaire Basin
032	14 Dec.	901.3	11 40.9	67 37.5	1000	Bonaire Basin
033	18 Dec.	948.3	12 08.5	68 27.4	1100	West of Bonaire
035	18 Dec.	1012.8	13 15.0	69 15.5	900	S.Central Caribbean
037	19 Dec.	1085.5	14 38.0	70 16.9	900	S.Central Caribbean
039	20 Dec.	1186.5	16 03.1	71 02.9	1200	Central Caribbean
041	21 Dec.	1284.5	17 20.4	71 34.2	1050	Central Caribbean
044	22 Dec.	1374.7	17 06.7	73 15.4	1050?	N.Central Caribbean
047	24 Dec.	1497.5	17 04.1	73 20.5	1050?	N.Central Caribbean
049	25 Dec.	1602.1	17 08.7	73 09.4	1050?	East of Pedro Bank
054	26 Dec.	1698.5	16 39.7	78 37.4	1050?	SW of Pedro Bank
055	26 Dec.	1756.9	16 27.9	79 35.5	1050?	East of Rosalind Bank
061	28 Dec.	2012.9	16 27.8	83 56.6	1025	East of Roatan

APPENDIX F.CTD PROFILES,C-136.

APPENDIX F,(cont.)

008 West of Grenadines

014 Southwest of Grenada

015 Grenada Passage

022 E. Cariaco Basin

APPENDIX F,(cont.)

APPENDIX F.(cont.)

APPENDIX G. NET COLLECTIONS MADE ABOARD SSV CORWITH CRAMER ON CRUISE C-136.

NEUSTON DATA SUMMARY, C-136.

STATI C-136-	DATE 1994	TIME	LOG (nm)	LAT. (° N)	LONG. (° W)	LOCALE	TOW DIS (m)	ZOOP.DISP (ml)	PLASTIC Pieces	PLASTIC Pellets	SARGASSUM S. natans (g)	HAL- OBATES (g)	LIN- UCHE (ml)	LEPTO.
002	12/3	0026	44.6	17 39.7	64 07.2	NE Caribbean	1852	15.1	1	2	50	-	3	12
003	12/3	1335	105.0	16 37.8	63 51.9	NE Caribbean	1852	5.0	-	1	-	-	-	-
005	12/4	0250	190.0	15 14.0	63 29.0	Cent. E. Caribbean	1852	3.5	-	1	-	-	1	-
006	12/5	0019	233.3	14 37.2	62 53.7	Cent. E. Caribbean	1852	10.0	-	-	-	-	4	-
007	12/5	1208	282.0	13 53.3	62 38.2	Cent. E. Caribbean	259	3.3	3	-	-	-	-	-
008	12/6	1240	394.8	12 33.8	61 38.0	W. of Grenadines	1389	3.0	-	-	-	-	-	-
009	12/6	2244	411.0	12 32.1	61 36.8	W. of Grenadines	1389	15.0	1	-	-	24	2	2
013A	12/8	2357	548.0	12 05.2	62 01.5	SW. of Grenadines	1852	18.0	-	-	-	85	2	2
013B	12/8-9	0034	549.0	12 05.2	62 01.5	SW. of Grenadines	2357	18.5	-	-	-	86	3	3
015	12/9	1054	570.9	11 37.8	62 14.6	Grenada Passage	2778	19.0	-	-	-	5	-	-
018A	12/10	0136	604.4	11 47.4	62 56.7	SE Caribbean	1759	22.0	-	-	-	3	3	3
018B	12/10	0223	604.8	11 47.4	62 56.7	SE Caribbean	1759	31.0	-	-	-	1	-	4
019A	12/10	1201	642.3	11 19.8	63 38.2	Ven. Cont. Shelf	1852	39.0	-	-	-	-	-	-
019B	12/10	1234	643.6	11 19.8	63 38.2	Ven. Cont. Shelf	1852	24.0	-	-	-	-	-	-
020A	12/10	2317	688.2	11 05.9	64 30.6	SE Caribbean	1852	100.0	-	-	-	-	-	-
020B	12/11	0001	690.4	11 05.9	64 30.6	SE Caribbean	1852	60.0	2	-	-	-	-	-
024A	12/12	0007	736.2	10 18.5	64 56.2	Cariaco Basin	1852	60.0	2	-	-	-	-	-
024B	12/12	0047	736.8	10 18.5	64 56.2	Cariaco Basin	1852	62.0	-	-	-	-	-	-
027A	12/13	0011	803.3	11 00.3	66 04.1	W. Cariaco Basin	1111	37.0	-	-	-	1	-	-
027B	12/13	0053	804.0	11 00.3	66 04.1	W. Cariaco Basin	1852	35.0	-	-	-	-	-	-
028	12/13	1319	839.0	11 18.9	66 20.4	Bonaire Basin	1852	8.0	-	-	-	-	-	-
031A	12/13-14	2351	867.0	11 33.4	66 54.9	Bonaire Basin	1852	5.0	-	-	-	-	-	-
031B	12/14	0051	869.8	11 33.4	66 54.9	Bonaire Basin	1852	10.0	-	-	-	1	-	3
032A	12/14	1157	902.0	11 43.0	67 45.2	Bonaire Basin	1852	7.0	-	-	-	-	-	-
032B	12/14	1248	904.4	11 43.0	67 45.2	Bonaire Basin	2130	13.0	-	-	-	1	-	-
034A	12/18	1159	994.4	13 00.0	69 00.2	W. of Bonaire	1852	4.0	-	-	-	-	-	-
034B	12/18	1233	995.8	13 00.0	69 00.2	W. of Bonaire	1852	7.0	-	-	-	7	-	-
035A	12/19	0014	1040.0	13 48.8	69 43.9	S. Central Caribbean	1852	14.0	-	-	-	-	-	-
035B	12/19	0101	1042.9	13 48.8	69 43.9	S. Central Caribbean	1852	15.0	2	-	-	8	-	-
037A	12/19	1236	1085.7	14 38.0	70 16.9	Central Caribbean	1574	10.0	2	-	-	1	-	-
037B	12/19	1313	1086.6	14 38.0	70 16.9	Central Caribbean	1852	3.0	4	-	-	1	-	-
038A	12/20	0014	1126.5	15 09.2	70 36.1	Central Caribbean	1852	12.0	-	-	-	22	-	-
038B	12/20	0036	1127.6	15 09.2	70 36.1	Central Caribbean	2035	27.0	-	-	-	16	-	-
039A	12/20	1231	1186.6	16 02.3	70 04.8	Central Caribbean	1852	5.0	-	-	-	-	-	-
039B	12/20	1306	1187.8	16 02.3	70 04.8	Central Caribbean	1667	6.0	-	-	-	-	-	-
040A	12/21	0013	1259.0	17 05.7	71 27.0	N. Central Caribbean	1667	38.0	-	-	-	4	-	-
040B	12/21	0048	1259.8	17 05.7	71 27.0	N. Central Caribbean	1574	45.0	-	-	-	13	-	-
042A	12/21	1207	1292.5	17 17.0	71 48.1	N. Central Caribbean	1852	2.5	-	-	1	41	-	-
042B	12/21	1242	1293.8	17 17.0	71 48.1	N. Central Caribbean	1852	4.5	8	-	-	45	-	-
043A	12/22	0014	1343.5	17 00.9	72 34.4	N. Central Caribbean	1852	19.0	1	-	8	48	-	1
043B	12/22	0043	1345.6	17 00.9	72 34.4	N. Central Caribbean	2037	23.0	3	-	5	53	-	-
045A	12/23	0000	1378.2	17 08.5	73 21.5	N. Central Caribbean	463	12.5	-	-	-	12	-	-
045B	12/23	0034	1378.8	17 08.5	73 21.5	N. Central Caribbean	463	12.5	2	-	-	30	-	-
046A	12/24	0013	1462.1	17 09.7	74 44.7	N. Central Caribbean	1389	15	-	-	-	2	-	1
046B	12/24	0048	1462.6	17 09.7	74 44.7	N. Central Caribbean	1389	25	1	-	-	5	-	-

APPENDIX G (cont.) NET COLLECTIONS MADE ABOARD SSV CORWITH CRAMER ON CRUISE C-136.

METER AND 2-METER NET DATA SUMMARIES, C-136.

Station # C-136-	Date 1994	Time (start)	Log (nm)	Lat. (N)	Long. (W)	Locale	Net Type/ Net #	Tow Type	Depth (m)	Tow Vol. (m ³)	Zoop. Volum (ml)	Zpl Dens. (ml/100m ³)
004	12/3	2137	133.3	16 16.0	63 39.0	NE Caribbean	2meter/1 meter/2 meter/3	oblique " "	0-125 0-100 0-50	9580 1543 1099	275.0 95.0 122.0	2.87 6.16 11.10
009	12/6	2126	411.0	12 33.3	61 36.7	W.of Grenadines	2meter/1 meter/2 meter/3	oblique " "	0-125 0-100 0-50	6779 1372 741	80.0 50.0 45.0	1.18 3.64 6.07
017	12/9	2343	603.5	11 50.2	62 52.8	SE Caribbean	2meter/1 meter/2 meter/3	oblique " "	0-125 0-100 0-50	11962 2065 1141	433.0 199.0 120.0	3.60 9.70 10.50
030	12/13	2112	866.1	11 37.7	66 48.6	Bonaire Basin	2meter/1 meter/2 meter/3	oblique " "	0-125 0-100 0-50	10609 1700 1385	175.0 90.0 45.0	1.60 5.30 3.30
033A 048	12/14 12/24	2042 2152	920.3 1536.8	11 58.0 16 50.7	68 12.0 76 07.6	Bonaire Basin N. Central Carib.	2meter/1 2meter/1 meter/2 meter/3	oblique oblique " "	0-200 0-125 0-100 0-50	11566 12180 1296 324	126.0 150.0 115.0 75.0	1.08 1.23 8.88 23.15
062	12/29	2134	2115.7	16 19.4	85 51.0	SE of Roatan	2meter/1 meter/2 meter/3	oblique " "	0-125 0-100 0-50	6370 255 -	102.0 55.0 65.0	1.60 2.43 -

PHYTOPLANKTON NET STATIONS, C-136.

STATION C-136-	DATE 1994	TIME	LOG (nm)	LAT. (N)	LONG. (W)	LOCALE	DEPTH (m)
003	12/3	1025	94.0	16 41.8	63 51.6	NE Caribbean	0
008	12/6	0936	394.8	12 37.2	61 37.0	West of Grenadines	0
015	12/9	0850	570.5	11 39.9	62 10.5	Grenada Passage	0
021	12/11	0524	704.8	10 47.5	64 36.0	N. of Cariaco Basin	0
023	12/11	2107	729.9	10 19.5	64 50.2	Cariaco Basin	0
025	12/12	1043	781.5	10 41.6	65 40.5	West Cariaco Basin	0
032	12/14	0848	901.3	11 41.2	67 38.8	Bonaire Basin	0
035	12/18	1647	1017.8	13 15.0	69 15.5	S. Central Caribbean	0
041	12/21	0832	1284.5	17 20.2	71 39.6	Central Caribbean	0
047	12/24	0922	1495.7	17 04.1	75 20.5	N. Central Caribbean	0
049	12/25	1630	1602.1	17 08.7	77 09.4	East of Pedro Bank	0
061	12/28	1057	2012.9	16 27.8	83 56.6	East of Roatan	0

All tows were taken at the surface with a net of 63 micron mesh.

APPENDIX H.
SHIPEK GRAB STATIONS, C-136.

STATION # C-136-	DATE 1994	TIME	LOG (nm)	LAT. ('N)	LONG. ('W)	LOCALE	DEPTH (m)
012	12/8	1621	518.9	12 16.1	61 36.5	Grenadine Platform	36-39.8
016	12/9	1653	576.1	11 28.3	62 25.7	Ven. Cont. Shelf	103.2
020	12/10	2210	687.4	11 08.0	64 30.0	Ven. Cont. Shelf	27.5
021	12/11	0415	704.8	10 49.5	64 33.5	Ven. Cont. Shelf	200.0
022	12/11	1420	717.8	10 31.6	64 40.5	E. Cariaco Basin	1380.0
023	12/11	2107	729.9	10 17.5	64 50.2	Ven. Cont. Shelf	75.0
025	12/12	1107	781.5	10 41.6	65 40.4	W. Cariaco Basin	1300.0
026	12/12	2044	797.9	10 53.8	66 00.4	Ven. Cont. Shelf	75.0
050	12/25	2346	1619.2	17 10.5	72 24.1	East Pedro Bank	34.5
051	12/26	0136	1624.7	17 08.6	77 29.2	East Pedro Bank	22.8
052	12/26	0815	1657.3	17 06.1	78 02.4	Central Pedro Bank	20.0
053	12/26	1220	1678.2	16 52.4	78 18.2	Southwest Pedro Bank	18.0
056	12/27	1000	1801.2	16 21.5	80 20.8	East Rosalind Bank	21.0
057	12/27	1452	1822.5	16 20.2	80 40.3	West Rosalind Bank	25.0
058	12/28	0950	1936.6	16 18.4	82 39.4	Nicaraguan Rise	49.0
059	12/28	1530	1959.5	16 21.6	82 12.3	Nicaraguan Rise	50.0
060	12/28	1650	1974.3	16 21.2	82 17.4	Nicaraguan Rise	56.0