

Cruise Report C134B

A Report On The Academic & Scientific Activities Of The
Science At SEA Program

Shore Component
August 7 - August 19, 1994

Sea Component
August 21 - August 27, 1994

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Preface

In August 1994, 45 students participated in the Sea Education Association's "Science At SEA" program. They studied in Woods Hole for two weeks and then went to sea for seven days aboard either the SSV *Westward* or the SSV *Corwith Cramer*. While ashore, students took classes in oceanography, nautical science, and maritime studies. The material covered in these classes was designed to provide the student with the academic and practical background needed to function successfully aboard either of SEA's large sailing ships. Once aboard ship, the students would be required to help operate the vessel and, in a very real sense, conduct the scientific activities. The primary purpose of this report is to summarize the scientific aspects of the program as experienced by those students who sailed on the SSV *Corwith Cramer*.

Introduction

The class was composed of a highly intelligent and enthusiastic group of high school students from across the country. For many of the students this was their first experience in "cooperative" living in that each student shared a house with eight other students and a house master while ashore. Everyone shared the responsibility of keeping the house clean and doing the cooking. It was great preparation for going to sea. The normal day's routine had students in classes or some other academic activity from early morning to mid-afternoon. Late afternoon was a time to gather one's thoughts and to get the necessary chores done at the houses. On most evenings, there was an enrichment activity consisting of a video, guest speaker, or discussion. There were, of course, assignments that needed to be done as well.

At sea students helped operate the vessel. They operated all equipment, nautical and scientific, under the watchful eye of the mates and scientists. They learned by getting their hands dirty and they will never forget the experience. This class was a joy to teach. Their energy, curiosity, and spirit made the trip a tremendous success for student and instructor alike. Even when the weather got rough, people got sick, and it became necessary to alter the cruise track and research plan, the students were taking it all in and asking for more.

Ship's Complement for SSV *Corwith Cramer* C-134B

Nautical Staff

Sean Bercaw	Captain
Wendy Keith-Hardy	Chief Mate
Eliza Garfield	2nd Mate
Virginia Land	3rd Mate
Earl Boatman	Engineer
Eric Gura	Steward
Sally McGee	Assistant Steward
Casey Cherashore	Deckhand
Mike McGillion	Deckhand

Scientific Staff

Clifford Low	Chief Scientist
Carolyn Sheild	1st Assistant Scientist
Karen Gordon	2nd Assistant Scientist
Simon Colley	3rd Assistant Scientist

Students

A - Watch	Sarah Govil	Old Saybrook, CT
	Laura Kiernan	Cos Cob, CT
	Chad Silverberg	Ellicott City, MD
	Seres Costy-Bennett	Tucson, AZ
	Erica Kreutziger	Lexington, MA
	Aaron St. John	Amherst, MA
	Sara Strobe	New Baltimore, NY
B - Watch	Jennifer Anderson	Virginia Beach, VA
	David Boyd	Baltimore, MD
	Samantha Goldfinger	West Nyack, NY
	Julie Lin	Timonium, MD
	Audra Piskiel	Manalapan, NJ
	Dan Rosenblum	Ashland, MA
	Eric Statz	Kennett Square, PA
	Elizabeth White	Hollis, NH
C - Watch	Rebecca Cronin	Newton Center, MA
	Ethan Goetz	Northport, NY
	Carolyn Margolin	Crestwood, NY
	Hannah Smith	Tulsa, OK
	Katherine Visser	West Swanzey, NH
	Nicholas Taylor	Merrimack, NH
	Shaun Sakya	Honolulu, HI
	Mary Stone	Loudonville, NY

Course Activities - Shore Component

Monday 8/8

- Class - Introduction to Nautical Science
- Class - Navigation: Charts & Compasses
- Field Trip - Woods Hole Discovery
- Evening Activity - Video: NOVA "The Big Spill"

Tuesday 8/9

- Class - The History of Science
- Class - The Development of Maps, Charts, and their Decoration
- Class - Logbooks and Journals
- Class - Plate Tectonics/Formation of the N.E. Coast of the U.S.
- Evening Activity - Guest Speaker: Antarctica (Phil Sacks, SEA Captain)

Wednesday 8/10

- Class - Navigation & Piloting
- Class - Sediments
- Field Trip - WHOI Core Lab
- Evening Activity - Video: NATIONAL GEOGRAPHIC "Dive to the Edge of Creation"

Thursday 8/11

- Class - Exploration and Trade in New England
- Class - Traditional Fishing on Georges Bank and Introduction to *Captain's Courageous*
- Class - The Life of a Sailor
- Class - Guest Lecture: Hydrothermal Vent Systems (Dr. Susan Humphris, WHOI)
- Evening Activity - Discussion "Science Aboard the SSV's"

Friday 8/12

- Class - Sail Theory/Seamanship
- Class - Properties of Water Lab, Discussion
- Evening Activity - Caroline Sheild on her research - Sea Stars
Video: NATIONAL GEOGRAPHIC "Killer Whales:
Wolves of the Sea"

Monday 8/15

- Class - Marine Engineering
- Class - Mechanical Advantage
- Class - Project Presentations
- Class - Group presentations on ocean currents
- Evening Activity - MYSTIC "Around Cape Horn"

Tuesday 8/16

Class - Lecture "Primary Production at Sea"
Field Trip - Salt Marsh Field Trip
Field Trip - Visit the ships
Class - Discussion of *Captain's Courageous*
Video - *Captain's Courageous*
Evening Activity - Study Night

Wednesday 8/17

Field Trip - Cape Cod National Seashore - Coast Guard Beach
Evening Activity - Video "Fisherman Q"

Thursday 8/18

Class - Biological Group Presentations
Class - The Marine Environment & Tuna "The Speed Machine"
Class - Whales, Whaling and Whale Policy
Class - Fishing Policy Today
Evening Activity - Study for Exams

Friday 8/19

Exams

Instructors

Oceanography - Cliff Low and Anne Woomeer
Nautical Science - Wendy Keith Hardy and Ken Neal
Maritime Studies - Mary Malloy

Summary Of Scientific Activity At Sea

The original research plan for C-134B called for a circumnavigation of Cape Cod giving each watch the opportunity to perform a "complete" oceanographic station in a different water mass. It was hoped that the first watch would work on shelf water just south of Woods Hole, the second watch would work on Georges Bank water, and the third watch would work on water from the Gulf of Maine. As so often happens at sea, however, the weather kicked up out of the north on the first day out forcing the implementation of a new plan. The ship headed south. Station 001 was just south of Gay Head as planned, station 003 was a couple of miles past Newport up Narragansett Bay and station 005 was in "The Race" just at the mouth of Long Island Sound. Each watch had the opportunity to collect and work up the data for a particular station. Each watch was then responsible for the preparation of a report describing their findings and comparing their data to the other stations. This report had to be delivered orally to the entire crew. The following report is arguably the best of the student summaries. It reveals the wide range of research activities that the students were involved with and it is an excellent first attempt at the analysis of real data.

The first station (C134B-001) was done on Monday, August 22, from 1320 hours to 1720 hours. It was done at 41 12.56' North by 70 58.33' West, off Gay Head. First a CTD (Conductivity, Temperature, Density) was deployed, and its analysis of the water column took about half an hour. Then a Shipek grab was deployed to retrieve a sample of the sea floor. Next a hydrocast was deployed with Niskin bottles at the surface, as well as the 5, 15 and 25 meter depths. These water samples were analyzed for oxygen content, as well as chlorophyll (a crude measure of primary production). Lastly a meter net was deployed at a 15 meter depth to find biomass and diversity. All this was done with a ship full of violently ill students with only two students still working on data collection by the end of the meter net tow.

The CTD was deployed down to a depth of 25 meters, so that the Niskin bottles and meter net could be used at the optimum depths for our learning purposes. The CTD's data showed a fairly well mixed water column, in which the density increased slowly from the surface to about ten meters deep. At the surface the density was about 22.8 (σ_t) and it increased very slowly as the CTD descended. After the ten meter mark, the density increased much more rapidly, until around 19 meters, where the density strangely decreased. This decrease continued to a depth of 22 meters, at which time the density started increasing very rapidly, reaching 24.4 by the 25 meter mark. The density decrease may have been caused by a fast flowing river's outflow forcing its self down below the more dense sea water, or by the weird vertical currents caused by tidal mixing. Salinity followed the exact same pattern as density, as it caused the density pattern. This can be said, because temperature only decreased 3 degrees in the first 23 meters, before beginning a sharp decline. Because of these characteristics, a surface sample was taken, to check the surface primary production. Another sample was taken at 5 meters, to compare with surface production. One was taken at 15, soon after the first density increase. Lastly a sample was retrieved from 25 meters, during the last density increase. The meter net tow was done at 15 meters, to get a good middle ground data set.

The Shipek grab revealed a black and greenish brown, sandy material mostly composed of particles in the 250-500 μm size. The sediments were retrieved from the sea floor at a depth of 30 meters. The size suggest a moderate current, because these small particles would be washed away by one too strong. On the other hand, the current was not very slow, because silt and clay sized particles were not too common. The organic content of the grab included a few worms, some amphipods, and isopods. Also contained in the sample were worm tubes, shell fragments, and small pebbles. Group C's first grab (Station C134B-005), taken in 92 meters of water, was much coarser, with a average grain size of 500 μm . This indicates a faster current than our sample. Group C's second sample, taken in 19 meters of water was very coarse grained. The particles seem to decrease in size as you go out into the ocean, due to a lack of swift tidal currents.

The water samples retrieved using the Niskin bottles showed high chlorophyll contents near the surface, decreasing exponentially as the depth increased. The oxygen content of the samples decreased from the surface to a five meter depth, and was higher than the surface value at 15 meters. At the 25 meter mark it was way down again. The small oxygen bump at 15 meters may have been caused by a decreased population of heterotrophs at that layer, or by the ability of cooler water to hold more dissolved gases.

The biomass was 135 ml for our meter net tow, giving a density of .622 ml/m . Group A (Station C134B-003) had a bio density of .497 ml/m , and group C had a bio density of .911 ml/m . An interesting fact that goes along with this is that the density seems to be directly proportional to the salinity of the water. Group A had the least density, Group B, a moderate density, and C, the highest. This could be evidence of dense ocean-bottom water upwelling from the deeps.

The 100 count test for our tow yielded: 99% copepods, and 1% amphipods. A side note is that crab larvae were also picked up by the tow. Group C had a very high diversity. Group A had sampled a very small quantity of water, and depended on currents to bring the organisms to them instead of the net chasing the creatures, giving a low bio-diversity.

The bio-density of the meter net tow was directly related to the phytoplankton levels. Group C had a chlorophyll level of 2.3 at the level of the tow, while B a level of 1.8. Group A's chlorophyll data was completely messed up, having impossible negative numbers. Thus we made the comparison with only B's & C's data.

The data collected by groups A, B, and C can be used to show the relation of primary production to secondary production, and how the primary production is effected by physical factors.

As is typical of any scientific venture, the students learned that their research had just begun. Many more questions were raised than were answered. The conclusions that they reached based on their observations were not final answers but rather hypotheses waiting to be tested in the next round of science. The scientific process never ends.

Positions SSV *Corwith Cramer* C-134B

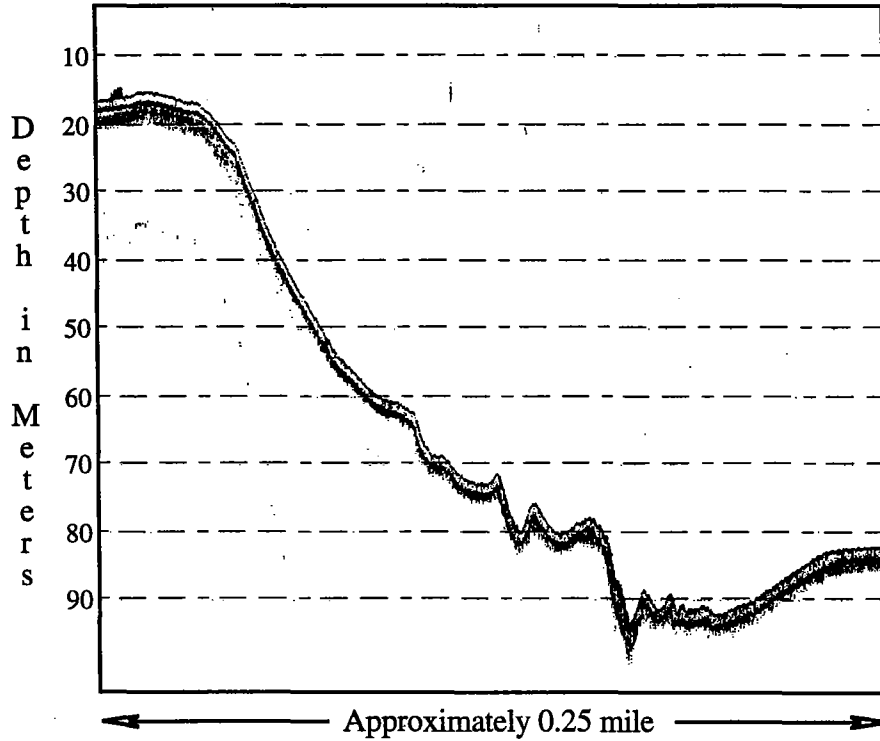
<u>Date</u>	<u>Time</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Location</u>
8/21	1620			Underway from Dyers Dock Woods Hole, MA
8/21	1830			Anchored, Menemsha Bight Martha's Vineyard
8/22	1300	41° 21.9' N	70° 54.5' W	Southwest of Gay Head
8/22	1800	41° 16.3' N	71° 05.8' W	Southwest of Gay Head
8/23	0000	41° 32.3' N	71° 12.7' W	Anchored, Sakonnet River Rhode Island
8/23	1200	41° 28.6' N	71° 21.2' W	Narragansett Bay
8/24	0000	41° 19.7' N	71° 25.5' W	Block Island Sound
8/24	1200	41° 07.1' N	71° 58.0' W	"The Race"
8/25	0000	41° 11.3' N	71° 34.7' W	Anchored, Block Island
8/25	1200	41° 14.4' N	71° 23.2' W	Southwest of Gay Head
8/25	1817			Anchored, Menemsha Bight
8/26	1800			Anchored off Vineyard Haven
8/27	0800			Dyers Dock, Woods Hole

C-134B Oceanographic Station Summary

<u>Sample</u>	<u>Date</u>	<u>Time</u>	<u>Log nm</u>	<u>Latitude</u>	<u>Longitude</u>	<u>Locale</u>
CTD						
C134B-001	8/22/94	1423	10.0	41° 16.2' N	70° 55.3' W	South of Gay Head
C134B-003	8/23/94	1422	50.1	41° 34.4' N	71° 18.8' W	Narragansett Bay
C134B-005	8/24/94	1335	89.8	41° 11.9' N	72° 04.0' W	"The Race"
Hydrocast						
C134B-001	8/22/94	1559	10.0	41° 14.4' N	70° 56.8' W	South of Gay Head
C134B-003	8/23/94	1650	50.1	41° 34.4' N	71° 18.8' W	Narragansett Bay
C134B-005	8/24/94	1505	89.8	41° 12.3' N	72° 03.6' W	"The Race"
Meter Net Tows						
C134B-001	8/22/94	1721	10.0	41° 12.6' N	70° 58.3' W	South of Gay Head
C134B-003	8/23/94	1452	50.1	41° 34.4' N	71° 18.8' W	Narragansett Bay
C134B-004	8/24/94	0005	67.8	41° 19.7' N	71° 25.5' W	Block Island Sound
C134B-005	8/24/94	1530	89.9	41° 12.3' N	72° 03.3' W	"The Race"
Shipek Grab						
C134B-001	8/22/94	1458	10.0	41° 15.4' N	70° 55.3' W	South of Gay Head
C134B-003	8/23/94	1421	50.1	41° 34.4' N	71° 18.8' W	Narragansett Bay
C134B-005	8/24/94	1418	89.8	41° 12.2' N	72° 05.1' W	"The Race"
C134B-006	8/25/94	0858	109.8	41° 11.6' N	71° 30.4' W	North of Block Island
Otter Trawl						
C134B-006	8/25/94	0940	109.8	41° 11.9' N	71° 29.9' W	North of Block Island

Bottom Profile

Sample Bottom Profile Taken At Station C134B-005
41° 11.7' N 72° 03.7' W



CTD Data

