Cruise Report

C-214

Scientific Data Collected Aboard
SSV *Corwith Cramer*

Christiansted, St. Croix, USVI –
Roatan, Honduras – Key West, FL

24 November – 31 December 2007

Glaucus atlanticus &
Sargassum fluitans
Photo Credit: A. Kumm

Sea Education Association
Woods Hole, Massachusetts

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To obtain unpublished data, contact the Chief Scientist or SEA data archivist:
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Ship's Company

SSV *Corwith Cramer*, Cruise C-214

Nautical Staff

Grant Macdonald	Captain
Justin Smith	Chief Mate
Carl Herzog	Second Mate
Erin Bostrom	Third Mate
Seth Murray	Engineer
Jen Webber	Steward
David Bouck	Deckhand
Annika Savio	Deckhand
Jeremy Wansor	Deckhand

Scientific Staff

Amy Siuda	Chief Scientist
Jane McCamant	First Assistant Scientist
Abby Gray	Second Assistant Scientist
Katrina Phillips	Third Assistant Scientist

Students

Zoë Abram	New York University
John Armstrong	Colorado College
Anna Bromley	St. Lawrence University
Sandy Feuer	Colorado College
C. Meagan Gamble	Eckerd College
Tim Gamwell	Bowdoin College
A. Taylor Gotfredson	Roger Williams University
Margaux Howard	University of Pennsylvania
Adam Kumm	College of the Atlantic
Molly Lidz	Oberlin College
R. Chad Miller	St. Lawrence University
Clare O'Laughlin	Randolph-Macon Woman's College
Eliza O'Neil	Bates College
Leah Pine	Oberlin College
Katy Ranochak	Eckerd College
Chris Sullivan	Hamilton College
Tom Wootton	University of California, San Diego

Introduction

This cruise report provides a summary of scientific activities aboard the SSV *Corwith Cramer* during cruise C-214 (24 Nov - 31 Dec 07). The ~2800 nautical mile cruise served as the second half of a 12-week, semester program with Sea Education Association (SEA), during which extensive oceanographic sampling was conducted for both student research projects (Table 1) and the ongoing SEA research program. Students examined physical, chemical, geological, biological, and environmental oceanographic characteristics in accordance with their written proposals and presented their results in a final poster session and papers (available upon request from SEA). The brief summary of data collected and results of student research projects contained in this report are not intended to represent final data interpretation and should not be excerpted or cited without written permission from SEA.

From St. Croix on the afternoon of the 25th, we slogged our way to windward for three days in order to conduct research on carbonate sediment transport at Saba Bank. The persistent force 4-5 winds made for quite an adventurous transit. . . with sea legs hard to come by for nearly all on board.

After the Saba Bank sampling was complete, we headed downwind across the Caribbean to Roatan, Honduras. During this second leg of our voyage, we the weather was quite variable: sunny with calm seas one day, rainy and squally the next, and moderate sailing breeze the day after that. Besides the exciting weather, this transit was also punctuated with brief stops for sampling in Kingston harbor, Jamaica and atop Pedro Bank.

The third leg of our voyage was surprisingly uneventful. We encountered no wind or swell as we transited the Yucatan Strait under motor. Fortunately, the wind filled in for the last week of sailing following Christmas. We sailed northwest into the Gulf of Mexico during a three day mission in search of mesopelagic fish. We towed a net 2-meters in diameter to a depth of 684 m, and found some amazing creatures, including: giant amphipods, pyrosomes, a tiny cephalopod, gulper eels, lantern fish, and much more.

Thank you to all staff and students for making C-214 such a success.

Amy NS Siuda
Chief Scientist, C-214

Table 1. Student research projects, C-214.

Title	Student Investigator(s)
Using grain size on Pedro and Saba Banks to examine the effects of current activity on the shape of carbonate banks.	Zoë Abram Eliza O'Neil
Variance in primary productivity as a product of wind velocity in the wind-mixed layer across and east Caribbean transect.	John Armstrong Chris Sullivan
Water quality assessment of three Caribbean harbors: Christiansted, St. Croix, USVI; Kingston, Jamaica; Port Royal, Roatan, Honduras.	Anna Bromley Meagan Gamble Tim Gamwell
Plastic pollution in the Caribbean Sea.	Sandy Feuer Margaux Howard
The distribution of pelagic tar along and east-west transect in the Caribbean Sea.	Taylor Gotfredson
Macrofaunal densities in Sargassum spp. found in the Caribbean Sea based on age, size and geographic distribution.	Adam Kumm
Foraminiferal abundance in two carbonate banks.	Molly Lidz Leah Pine
A study of marine phytoplankton's reactions to chosen limiting variables.	Chad Miller
Examination of 1% light level and deep chlorophyll maximum on zooplankton diel vertical migration in the Caribbean Sea.	Clare O'Laughlin
Redfield ratios and phytoplankton size in the Caribbean Sea.	Katy Ranochak
A comprehensive study of surface currents, sedimentary composition and fluorescence on Saba Bank.	Tom Wootton

Table 2. Academic Program.

Date	Topic	Speaker(s)
25 Nov	Introduction to Academic Program Collecting Water Samples	Siuda & Macdonald Assistant Scientists
26 Nov	Heaving To	Macdonald
27 Nov	Set, Strike, Furl in Practice	Mates
28 Nov	Line Chase	All Hands
29 Nov	Sea Birds	Siuda
30 Nov	System Chase Demonstration	Murray
3 Dec	Lab Practical	All Hands
4 Dec	Historical Navigation	Herzog
5 Dec	System Chase Presentations	Students
6 Dec	Radar Navigation	Macdonald
7 Dec	Caribbean Geology	McCamant
10 Dec	Waves	Siuda
11 Dec	Evolution of the Rig	Smith
12 Dec	System Chase & Creature Feature Presentations	Students
13 Dec	Data Discussion I	Students
14 Dec	Coral Reefs	Gray
18 Dec	Cephalopods	Phillips
19 Dec	System Chase & Creature Feature Presentations	Students
20 Dec	Bosun Skills	Mates
21 Dec	Data Discussion II	Students
24 Dec	Poster Presentations	Students
26 Dec	System Chase & Creature Feature Presentations	Students
27 Dec	Crew Histories	Professional Crew
28 Dec	Summary of Oceanographic Research	Siuda

Data Description

This section provides a record of data collected aboard the SSV *Corwith Cramer* cruise C-214 (US State Department Cruise: 2007-076) on a general east-west transect of the Caribbean, beginning in St. Croix, USVI and ending in Key West, Florida (Figure 1). A single port stop was made at Port Royal, Roatan, Honduras.

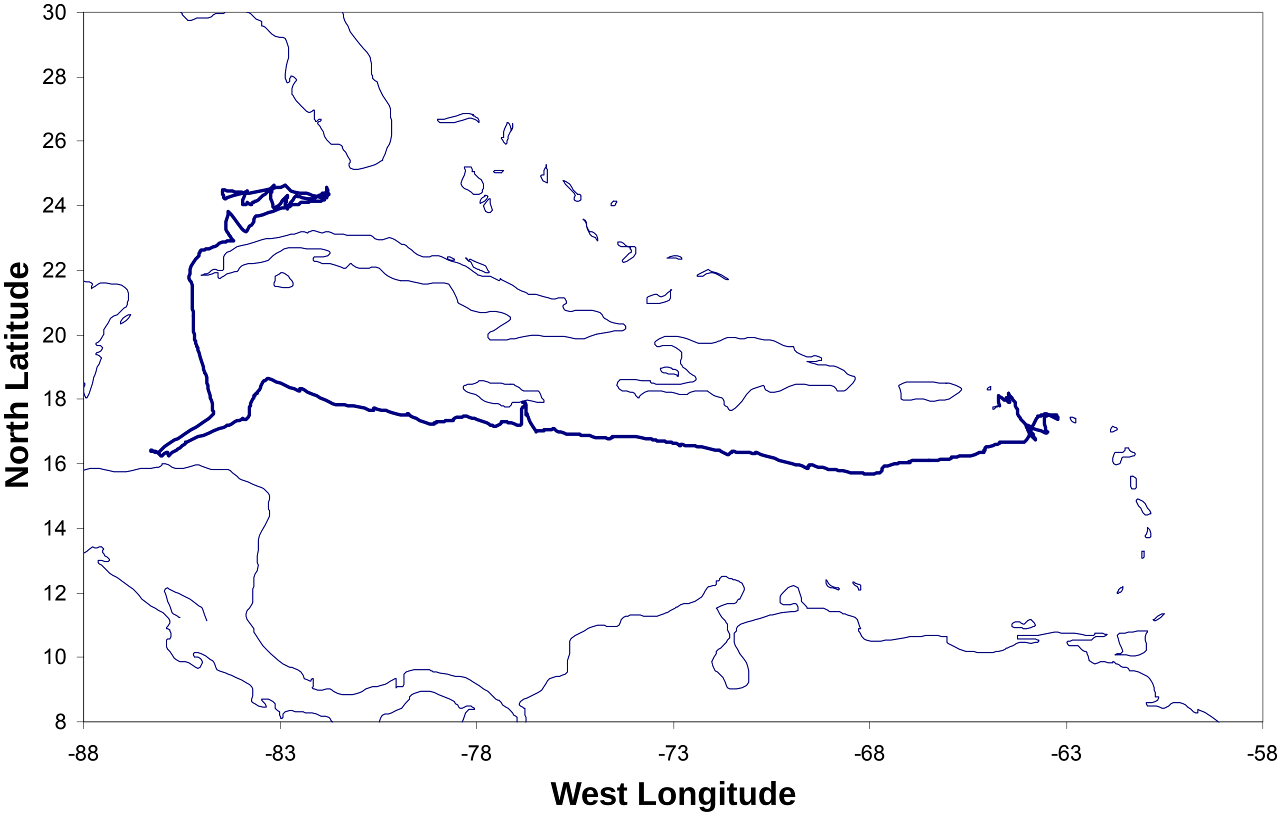


Figure 1. Hourly positions along the C-214 cruise track.

During the six-week voyage, we sampled at 87 discrete oceanographic sampling stations (Table 3). A total of 33 surface sampling stations were conducted during the first leg of the voyage (Table 4). Additionally, we continuously sampled water depth and sub-bottom profiles (CHIRP system), upper ocean currents (ADCP), and sea surface temperature, salinity and *in vivo* fluorescence (seawater flow-through system, Figure 2). Discrete CTD measurements of vertical temperature and salinity profiles are presented in Figure 3. Summaries of sea surface and water column chemical and biological properties are found in Tables 4-7, while a summary of sediment grain size distribution is found in Table 8. Lengthy CTD, CHIRP, ADCP and flow-through data are not fully presented here. All unpublished data can be made available by arrangement with the SEA data archivist (contact information, p. 2).

Table 3. Oceanographic sampling stations. Sampling depth indicated.

Station	Date	Local Time	Latitude (N)	Longitude (W)	Depth (m)	General Locale
CTD						
004	27-Nov-07	0851	16°57.2'	63°51.5'	1302	35 nm SW of Saba
005	27-Nov-07	1100	16°54.7'	63°52.5'	242	35nm southwest of Saba
022	30-Nov-07	0822	16°13.0'	65°54.7'	2394	South of Puerto Rico
023	30-Nov-07	1059	16°12.2'	65°55.6'	303	South of Puerto Rico
030	2-Dec-07	0951	15°56.3'	69°32.9'	2589	140nm south of DR
033	3-Dec-07	0855	16°22.4'	71°29.6'	1748	South of Haiti
034	3-Dec-07	1100	16°19.3'	71°33.2'	292	South of Hispanola
041	6-Dec-07	1050	17°5.2'	76°4.4'	303	50nm SE of Jamaica
043	6-Dec-07	1652	17°3.9'	76°14.7'	1766	50nm SE of Jamaica
044	6-Dec-07	2201	17°1.9'	76°24.3'	1583	50nm SE of Jamaica
045	7-Dec-07	0724	17°33.0'	76°42.9'	1614	South of Jamaica
062	10-Dec-07	0811	17°43.0'	80°36.1'	942	120nm W of Jamaica
063	10-Dec-07	0944	17°41.3'	80°37.6'	298	120 nm W of Jamaica
068	11-Dec-07	1743	18°14.0'	83°33.9'	1808	E of Misteriosa
085	30-Dec-07	0001	24°12.6'	82°7.9'	586	SW of Key West
087	30-Dec-07	0244	24°12.8'	82°8.6'	576	SW of Key West
Hydrocast						
005	27-Nov-07	1100	16°54.7'	63°52.5'	242	35nm southwest of Saba
020	29-Nov-07	2145	16°26.8'	65°3.8'	15	68 nm South of St. Croix
023	30-Nov-07	1059	16°12.2'	65°55.6'	303	South of Puerto Rico
025	30-Nov-07	2240	16°3.8'	66°59.6'	15	60 nm S of Puerto Rico
034	3-Dec-07	0000	16°19.3'	71°33.2'	292	South of Hispanola
041	6-Dec-07	1050	17°5.2'	76°4.4'	303	50nm SE of Jamaica
043	6-Dec-07	1652	17°3.9'	76°14.7'	1766	50nm SE of Jamaica
044	6-Dec-07	2201	17°1.9'	76°24.3'	1583	50nm SE of Jamaica
045	7-Dec-07	0724	17°33.7'	76°42.9'	1614	South of Jamaica
046	7-Dec-07	1404	17°54.7'	76°49.7'	4	Kingston Harbor
053	8-Dec-07	2030	17°29.2'	78°18.7'	15	Pedro Bank
060	9-Dec-07	2208	17°33.4'	79°45.4'	15	NW of Pedro Bank
063	10-Dec-07	0944	17°41.3'	80°37.6'	298	120 nm W of Jamaica
072	13-Dec-07	2307	16°39.7'	85°23.0'	15	NNW of Roatan
Neuston Net						
001	26-Nov-07	0059	18°3.4'	64°32.2'	0	East of St. Croix
002	26-Nov-07	1155	17°51.5'	64°18.3'	0	East of St. Croix
003	27-Nov-07	0015	17°4.9'	63°58.8'	0	Southwest of Saba Bank
006	27-Nov-07	1200	16°53.3'	63°53.0'	0	West of Saba Bank
007	28-Nov-07	0008	16°58.9'	63°29.0'	0	Southwest of Saba Bank
018	29-Nov-07	0010	17°28.5'	63°42.9'	0	West of Saba Bank
019	29-Nov-07	1151	16°40.5'	64°16.1'	0	West of Saba Bank
021	29-Nov-07	2357	16°24.6'	65°5.9'	0	West of Saba Bank
024	30-Nov-07	1209	16°11.7'	65°55.8'	0	South of Puerto Rico
026	1-Dec-07	0012	16°3.1'	66°58.6'	0	South of Puerto Rico
028	1-Dec-07	1155	15°46.3'	67°43.4'	0	South of Puerto Rico

Table 3 continued.

Station	Date	Local Time	Latitude (N)	Longitude (W)	Depth (m)	General Locale
Neuston Net cont.						
029	2-Dec-07	0000	15°47.7'	68°45.8'	0	South of Puerto Rico
031	2-Dec-07	1233	15°53.6'	69°34.5'	0	S of Dominican Republic
032	3-Dec-07	0225	16°19.9'	70°53.7'	0	South of Hispanola
035	3-Dec-07	1158	16°18.0'	71°34.5'	0	South of Hispanola
036	4-Dec-07	0024	16°35.0'	72°47.7'	0	East of Hatian waters
038	5-Dec-07	1030	16°48.7'	74°55.0'	0	W of Hatian waters
039	5-Dec-07	2358	16°55.1'	75°32.5'	0	NW of Mokant Cays
042	6-Dec-07	1135	17°3.8'	76°4.7'	0	50 nm SE of Jamaica
047	8-Dec-07	0048	17°12.0'	76°52.4'	0	SW of Kingston
052	8-Dec-07	1201	17°12.9'	77°35.9'	0	NE of Pedro Bank
054	8-Dec-07	2103	17°28.4'	79°19.1'	0	Pedro Bank
059	9-Dec-07	1155	17°15.4'	79°4.5'	0	Pedro Bank
061	9-Dec-07	2317	17°32.1'	79°45.4'	0	NW of Pedros Bank
064	10-Dec-07	1035	17°40.5'	80°38.1'	0	120 nm west of Jamaica
065	11-Dec-07	0019	18°20.3'	82°27.9'	0	SW of Grand Caymen
067	11-Dec-07	1328	18°34.7'	83°23.6'	0	E of Misteriosa Bank
069	12-Dec-07	0016	18°2.9'	83°41.0'	0	SE Misteriosa Bank
070	13-Dec-07	1155	17°12.6'	84°19.0'	0	NE of Honduras
071	13-Dec-07	2204	16°40.3'	85°24.5'	0	NE of Roatan Honduras
073	14-Dec-07	1243	16°23.6'	86°15.3'	0	S of Roatan Honduras
074	19-Dec-07	0000	16°44.2'	85°40.8'	0	Just NE of Roatan
075	19-Dec-07	1157	17°33.2'	84°41.7'	0	NE of Roatan, Honduras
076	19-Dec-07	2359	18°47.8'	84°53.9'	0	South of Cuban waters
077	23-Dec-07	1156	24°5.8'	82°27.9'	0	Just N of Cuban waters
078	23-Dec-07	1356	24°12.2'	81°56.0'	0	South of Key West
079	25-Dec-07	0000	24°15.7'	81°51.1'	0	West of Key West
081	27-Dec-07	1206	24°26.9'	83°51.1'	0	South of Dry Tortugas
082	27-Dec-07	2356	24°7.7'	83°41.2'	0	SW of Florida Keys
083	28-Dec-07	0000	24°33.8'	83°9.9'	0	West of Dry Tortugas
084	29-Dec-07	1202	24°1.0'	82°50.5'	0	SW of Key West
086	30-Dec-07	0057	24°13.3'	82°8.57'	0	SW of Key West
Meter Net						
080-2	27-Dec-07	0038	24°27.1'	84°27.2'	684	West of Dry Tortugas
080-1	27-Dec-07	0056	24°26.2'	84°27.2'	NA	West of Dry Torgugas
Tucker Trawl						
027	1-Dec-07	0914	15°52.2'	67°41.3'	177	South of Peurto Rico
037	5-Dec-07	1011	16°48.34'	74°54.35'	~200	W of Haitian Waters
066	11-Dec-07	1152	18°32.1'	83°20.4'	~200	E of Misteriosa Bank
Shipek Grab						
008	28-Nov-07	1005	17°26.2'	63°12.0'	230	Saba Bank
009	28-Nov-07	1030	17°25.5'	63°12.3'	30	Saba Bank
010	28-Nov-07	1311	17°30.8'	63°15.2'	65	Saba Bank

Table 3 continued.

Station	Date	Local Time	Latitude (N)	Longitude (W)	Depth (m)	General Locale
Shipek Grab cont.						
011	28-Nov-07	1323	17°30.5'	63°15.3'	34	Saba Bank
012	28-Nov-07	1614	17°29.5'	63°29.2'	25	Saba Bank
013	28-Nov-07	1700	17°29.32'	63°32.0'	32	Saba Bank
014	28-Nov-07	1850	17°30.89'	63°35.7'	91	Saba Bank
015	28-Nov-07	1835	17°31.52'	63°36.2'	190	Saba Bank
048	8-Dec-07	0734	17°18.6'	77°21.1'	157	Pedro Bank
049	8-Dec-07	0839	17°17.3'	77°22.3'	66	Pedro Bank
050	8-Dec-07	0848	17°17.1'	77°22.4'	36	Pedro Bank
051	8-Dec-07	1037	17°9.8'	77°20.1'	24	Pedro Bank
055	9-Dec-07	0532	17°19.1'	78°51.3'	31	Pedro Bank
056	9-Dec-07	0816	17°17.5'	79°1.1'	36	Pedro Bank
057	9-Dec-07	0902	17°16.6'	79°2.2'	240	Pedro Bank
Gravity Core						
058	9-Dec-07	1041	17°16.6'	79°4.1'	790	Pedro Bank

Table 4. Surface sampling station data (SS-XXX).

Station	**Date**	**Latitude (N)**	**Longitude (W)**	**Temp. (˚C)**	**Salinity (ppt)**	**PO_4 (μM) ***	**NO_2+NO_3 (μM) ***	**>0.45 μm Chl *a* (μg/L) ***
001	25-Nov-07	17°44.9'	64°42.2'	28.5	34.3	0.078	0.677	0.510
002	25-Nov-07	17°44.9'	64°42.5'	28.9	34.4	0.098	0.307	0.520
003	25-Nov-07	17°45.3'	64°42.9'	28.4	34.4	0.161	1.484	0.418
004	25-Nov-07	17°45.4'	64°43.2'	28.3	34.5	0.078	0.647	0.418
005	25-Nov-07	17°45.2'	64°42.2'	28.4	34.4	1.021	0.535	0.507
006	25-Nov-07	17°45.0'	64°41.8'	28.0	34.4	0.191	0.743	1.143
007	25-Nov-07	17°45.8'	64°42.1'	28.0	34.5	0.044	0.140	0.636
008	25-Nov-07	17°46.2'	64°42.6'	28.1	34.5	0.288	0.434	0.556
009	25-Nov-07	17°47.4'	64°42.4'	28.2	34.5	0.088	0.353	0.599
010	25-Nov-07	17°45.2'	64°42.9'	28.4	34.4	0.122		0.587
011	26-Nov-07	17°50.9'	64°18.4'	28.1	34.8	0.298	0.515	
012	27-Nov-07	16°40.2'	64°15.9'	28.2	33.6		0.338	
013	1-Dec-07	15°46.0'	67°43.3'	27.8	35.4	0.078	0.257	
014	2-Dec-07	15°52.8'	69°34.9'	20.2	34.9	0.039	0.221	0.563
015	5-Dec-07	16°48.6'	74°54.0'	29.1	34.8	0.010		0.399
016	7-Dec-07	17°57.3'	76°50.1'	29.5	32.4	0.142	0.728	2.996
017	7-Dec-07	17°56.9'	76°49.4'	30.0	32.8	0.293	0.399	4.949
018	7-Dec-07	17°57.2'	76°48.6'	29.5	32.7	0.137	0.652	1.237
019	7-Dec-07	17°56.9'	76°46.6'	29.3	33.0	0.186	0.170	1.817
020	7-Dec-07	17°57.4'	76°45.3'	29.6	30.9	0.191	0.297	0.166
021	7-Dec-07	17°58.0'	76°45.2'	29.8	31.0	0.709	11.369	
022	7-Dec-07	17°57.9'	76°48.4'	29.9	31.0	0.196	0.672	
023	7-Dec-07	17°58.6'	76°50.4'	29.1	8.6	0.274	0.211	
024	7-Dec-07	17°56.6'	76°50.3'	29.0	31.5	0.205		11.463
025	8-Dec-07	17°12.5'	77°37.1'	28.1	35.5	0.108		0.529
026	9-Dec-07	17°15.2'	79°4.6'	28.2	35.6	0.064		0.242
027	14-Dec-07	16°24.1'	86°15.2'	27.4	34.3	0.078	0.125	0.433
028	14-Dec-07	16°24.4'	86°17.4'	27.4	34.4	0.161	0.165	1.094
029	14-Dec-07	16°24.2'	86°18.3'	27.5	34.5	0.166		0.762
030	14-Dec-07	16°24.1'	86°18.8'	27.5	34.4	0.171		0.986
031	14-Dec-07	16°24.8'	86°17.9'	27.7	34.2	0.122		1.123
032	14-Dec-07	16°24.8'	86°17.1'	27.4	34.2	0.059		0.503
033	14-Dec-07	16°24.6'	86°16.6'	27.5	34.3	0.108	0.201	1.028

* blank spaces indicate no data collected

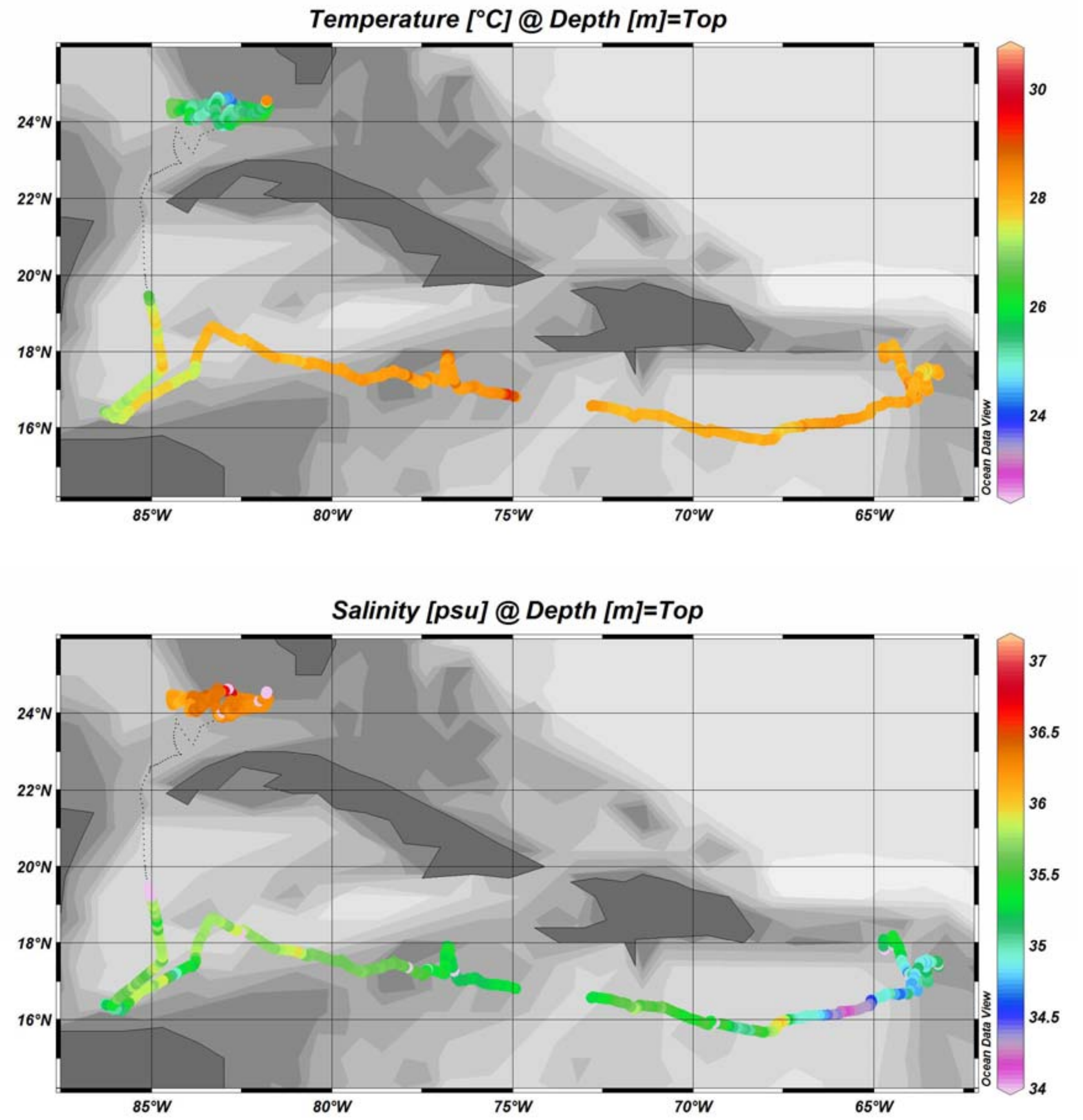


Figure 2. Surface temperature (upper panel) and salinity (lower panel) measurements from the continuous flow-through data logger. Data missing for regions in which research clearance was not requested or granted.

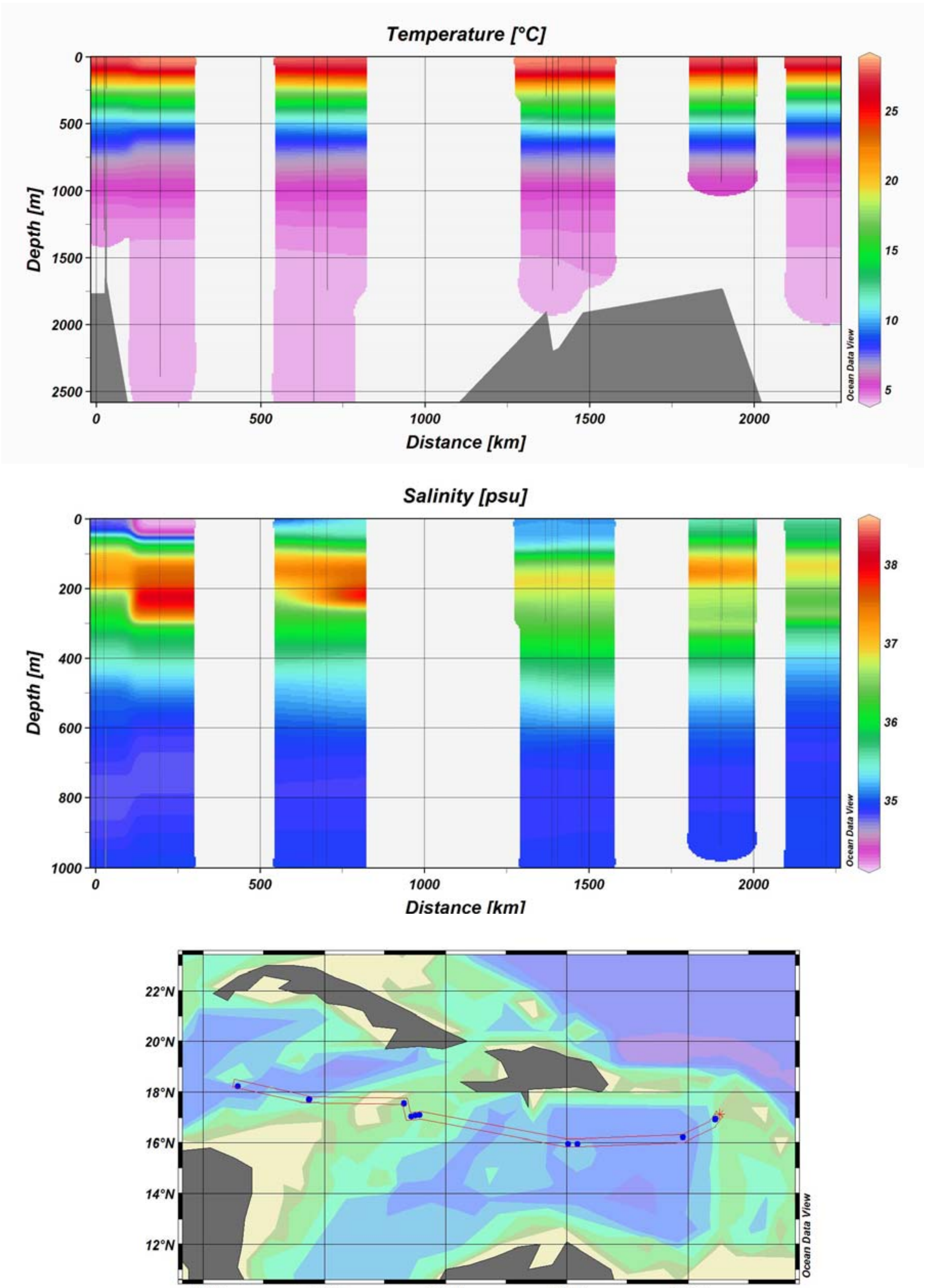


Figure 3. Temperature (upper panel) and salinity (middle panel) cross sections created from CTD data collected along the entire cruise track (lower panel).

Table 5. Hydrocast bottle data.

Station	Bottle	Depth (m)	PO_4 (μM) *	NO_2+NO_3 (μM) *	Dissolved O_2 (ml/L) *	> 8 μm Chl *a* (μg/L) *
005	13	0.000	0	0.075		0.214
005	12	10.0	0.039	0.328		0.193
005	11	20.3	0.044	0.368		0.186
005	10	30.3	0.034	13.348		0.193
005	9	39.6	0.137	0.256		0.296
005	8	50.5	0.186	3.744		0.449
005	7	59.1	0.054	0.323		0.389
005	6	69.7	0.078	0.147		0.472
005	5	79.4	0.005	0.269		0.783
005	4	89.4	0.010	0.608		0.705
005	3	99.4	0.064	2.431		0.657
005	2	109.6				
005	1	149.7				
020	12-1	15.0	Phytoplankton Growth Experiment			
023	13	0	0.020	0.197		0.198
023	12	10.0	0.049	2.318		0.274
023	11	21.0	0.069	0.265		0.340
023	10	29.0	0.000	0.016		0.361
023	9	40.0	0	0.035		0.579
023	8	45.0	0.000	0.111		0.613
023	7	49.0	0.025	0.075		0.703
023	6	55.0	0.054	0.075		1.034
023	5	60.0	0.044	-0.029		0.271
023	4	70.0	0.171	0.156		0.841
023	3	90.0	0.088	0.477		0.411
023	2	110.0				
023	1	150.0				
025	12-1	15.0	Phytoplankton Growth Experiment			
034	13	0	0	0.224		0.111
034	12	10.1	0.010	0.170		0.135
034	11	20.9	0.108	0.265		0.179
034	10	29.4	0.127	0.116		0.052
034	9	40.7	0	0.350		
034	8	50.7	0.132	0.531		0.097
034	7	59.4	0.088	0.242		0.285
034	6	69.7	0.083	0.089		0.389
034	5	74.6	0.034	0.206		0.526
034	4	79.8	0.039	0.378		0.288
034	3	91.1	0.088	2.639		0.000
034	2	100.5				
034	1	140.2				
041	13	0	0.059	0.229		0.033
041	12	10.0	0.064	0.107		0.081
041	11	25.0	0.034	0.053		0.071

* blank spaces indicate no data collected

Table 5 continued.

Station	Bottle	Depth (m)	PO_4 (μM) *	NO_2+NO_3 (μM) *	Dissolved O_2 (ml/L) *	> 8 μm Chl *a* (μg/L) *
041	10	50.0	0.225	7.698		0
041	9	75.0	0.034	0.242		0.419
041	8	85.0	0.034	0.906		0.059
041	7	90.0	0.039	0.030		0.550
041	6	95.0	0.034	0		0.315
041	5	100.0	0	0.007		0.146
041	4	110.0	0.049	0.355		0.062
041	3	120.0	0.044	1.194		0.028
041	2	130.0				
041	1	150.0				
043	13	0	0.049	0.572	4.35	
043	12	10.3				
043	11	24.9			4.33	
043	10	64.8	0.039	1.587	4.25	
043	9	85.2			4.07	
043	8	99.8	0.044	1.361	4.12	
043	7	199.0	0.083	8.068	3.57	
043	6	397.0	0.914	33.332	3.27	
043	5	695.0	1.803	55.581		
043	4	992.0			4.07	
043	3	1190.0	1.671	48.631	4.30	
043	2	1486.0			4.73	
043	1	1735.0	1.510	26.585	4.78	
044	13	0.0	0.161	0.206	4.60	
044	12	10.7	0.059	0.585	4.23	
044	11	25.1			4.20	
044	10	64.5	0.117	0.165	4.38	
044	9	84.3			4.33	
044	8	99.8	0.039	1.786		
044	7	199.0	0.298	6.434	3.38	
044	6	398.0	0.738	32.384		
044	5	695.0	2.199	53.730		
044	4	992.0				
044	3	1190.0	1.486	44.749		
044	2	1485.0			4.76	
044	1	1556.0				
045	13	0	0.064	0.764	4.26	
045	12	11.0	0.034			
045	11	24.0			4.25	
045	10	45.0		45.968		
045	9	64.0				
045	8	84.0	0.054	0.730	4.33	
045	7	100.0	0.039	0.716	4.22	
045	6	199.0	0.308	58.424		

* blank spaces indicate no data collected; DNF = bottle did not fire

Table 5 continued.

Station	Bottle	Depth (m)	PO_4 (μM) *	NO_2+NO_3 (μM) *	Dissolved O_2 (ml/L) *	> 8 μm Chl *a* (μg/L) *
045	5	397.0			3.35	
045	4	596.0				
045	3	794.0	1.407	18.168		
045	2	992.0				
045	1	1190.0	1.574	0.436	4.65	
046	12-1	4	Phytoplankton Growth Experiment			
053	12-1	15	Phytoplankton Growth Experiment			
060	12-1	15	Phytoplankton Growth Experiment			
063	13	0	0.166	0.567		0.060
063	12	10.0	0.054	0.391		0.036
063	11	19.0	0.039	0.174		0.002
063	10	29.0	0.049	0.170		0.099
063	9	40.0	0.083	0.134		0.051
063	8	49.0	0.054	0.075		0.068
063	7	59.0	0.069	0.328		0.047
063	6	69.0	0.073	0.277		0.045
063	5	80.0		0.150		0.053
063	4	90.0	0.010	0.388		0.035
063	3	99.0	0	1.540		0.018
063	2	119.0				
063	1	149.0				
072	12-1	15	Phytoplankton Growth Experiment			

* blank spaces indicate no data collected

Table 6. Neuston net tow data.

Station	Tow Length (m)	Temp. (˚C)	Salinity (ppt)	Zoop. Biomass * (ml)	Zoop. Density * (ml/m^2)	Plastic Pellets * (#)	Plastic Pcs * (#)	Tar Pcs * (#)
001	2229	28.1	35.3	2.0	0.0009	0	0	0
002	2878	27.9	35.3	3.5	0.0003	0	0	0
003	2262	28.1	34.8	7.5	0.0033	0	0	0
006	2097	28.1	34.3	0.9	0.0004	0	0	0
007	1886	28.1	35.1	sample lost	sample lost	0	0	0
018	2574	27.6	34.8	124.0	0.0480	0	0	0
019	1812	28.1	34.6	6.8	0.0038	0	0	0
021	3111	28.0	34.5	13.0	0.0042	0	0	0
024	1886	28.3	33.7	2.2	0.0011	0	0	0
026	1158	28	34.4	9	0.0078	0	0	0
028	Unknown	28.1	34.8	3.5	unknown	0	0	0
029	1809	27.9	35.0	4.0	0.0022	0	0	0
031	2158	28.0	35.3	3.0	0.0014	0	3	0
032	2801	27.8	35.6	sample lost	sample lost	0	0	0
035	3651	28.0	35.7	2.1	0.0006	0	3	0
036	2565	28.2	35.2	10.5	0.0041	11	4	12
038	1046	28.6	35.3	38.5	0.0360	0	48	4
039	2158	28.4	35.3	13.5	0.0063	0	0	0
042	1676	28.4	35.2	0.9	0.0054	0	0	0
047	1725	28.2	35.3	7.0	0.0041	0	45	3
052	2953	28.1	35.6	2.0	0.0007	1	6	0
054	2297	29.0	35.5	16.0	0.0070	0	1	0
059	1749	28.2	35.6	3.0	0.0017	0	0	0
061	1926	28.1	35.6	8.0	0.0042	5	0	0
064	1298	28.1	35.6	1.5	0.0005	0	3	0
065	2131	27.9	35.7	10.5	0.0049	0	0	0
067	2551	27.9	35.7	3.0	0.0012	0	3	10
069	2951	27.9	35.7	13.8	0.0047	0	0	0
070	1198	27.5	34.9	6.3	0.0053	0	3	0
071	1760	27.6	35.8	25.0	0.0140	1	4	0
073	1631	27.3	35.0	6.5	0.0040	0	3	0
074	1932	27.0	35.6	18.0	0.0093	1	0	0
075	844	27.6	35.6	6.0	0.0071	0	0	0
076	2971	27.7	35.8	9.5	0.0032	6	0	0
077	1692	26.5	36.2	8.5	0.0050	0	31	24
078	3790	26.3	36.2	17.0	0.0040	0	1	0
079	4255	26.0	36.2	13.5	0.0032	0	2	2
081	2004	25.8	36.3	6.0	0.0030	0	0	0
082	2147	25.1	36.4	35.5	0.0165	0	1	0
083	1537	25.1	36.4	3.5	0.0023	0	0	0
084	2778	25.6	32.2	5.0	0.0018	0	0	0
086	457	25.3	36.2	20.0	0.0438	0	0	0

* blank spaces indicate no data collected

Table 7. Meter net tow and Tucker Trawl data.

Station	**Tow Depth (m)**	**Net Area (m^2)**	**Tow Length (m)**	**Mesh Size (μm)**	**Zoop. Biomass (ml)**	**Zoop. Density (ml/m^3)**
027	177	1	3822	333	54	0.014
037	~200	1	2037	333	18	0.009
066	~200	1	1801	333	17	0.009
080-2	684	3.14	1846	1000	196	0.034

Table 8. Sediment sampling data.

Station	% 4000 (μm) *	% 3000 (μm) *	% 2000 (μm) *	%1000 (μm) *	%500 (μm) *	%250 (μm) *	%125 (μm) *	%63 (μm) *	% <63 (μm) *
008	1.0	3.6	5.5	3.6	17.3	13.6	44.5	2.7	8.2
009	38.7	1.0	3.8	8.5	30.2	2.7	2.7	12.3	<.1
010	0.0	>.5	1.0	2.0	18.1	53.0	2.9	9.8	13.7
011									
012	<.5	5.0	2.0	2.5	51.0	18.0	11.0	3.0	7.5
013	1.0	1.0	4.0	45.0	27.0	3.0	6.0	1.5	11.5
014	0.0	0.0	0.0	1.2	0.5	30.0	33.0	5.0	30.3
015	0.2	0.4	0.2	0.6	1.3	2.7	16.0	16.0	62.6
048	59.9	2.4	3.9	2.7	4.9	3.9	0.9	0.3	0.0
049	11.2	3.0	4.0	7.1	52.0	10.2	3.5	1.0	7.6
050	19.0	16.9	15.8	29.6	12.6	3.1	1.0	0.5	1.0
051	16.6	0.0	0.0	0.0	33.3	33.3	16.6	0.0	0.0
055	8.5	1.9	10.4	43.8	29.5	3.8	0.9	0.4	0.4
056	7.9	2.9	6.9	21.8	42.7	9.9	5.9	1.4	0.0
057									
058									

* blank spaces indicate no data collected

Scientific Results: Student Abstracts

Using grain size on Pedro and Saba Banks to examine the effects of current activity on the shape of carbonate banks.

Zoë Abram and Eliza O'Neil

In this paper, we examine the relationship between depth, current magnitude and grain size distribution on carbonate banks by looking at Saba Bank and Pedro Bank. Based on previous research, we hypothesized that, due to currents flowing over carbonate banks and the critical entrainment velocity of different sized grains, coarse grained sediments tend to remain on the top of a bank while fine grained sediments are transported down-current. We deployed Shipek grabs along each bank and sieved the samples through various mesh sizes. We found that our hypothesis was generally confirmed, with exceptions attributed to a lack of sufficient sample collection. On Saba Bank, depth and most abundant grain size were negatively correlated, while current at depth and most abundant grain size had a positive correlation. This may be due to the unexpected current patterns we measured on Saba Bank, and the bank's proximity to the Lesser Antilles. On Pedro Bank, there was an unexpected negative correlation between depth and most abundant grain size, and current at depth and most abundant grain size were also negatively correlated. We found that Pedro Bank had a higher percentage of coarse-grained sediments, while Saba Bank tended to have smaller sediments in total. We attribute this discrepancy to the varying current patterns around the two banks. We concluded that grain sizes generally decrease with greater depths, while coarser grains tend to reside at shallower regions on the banks.

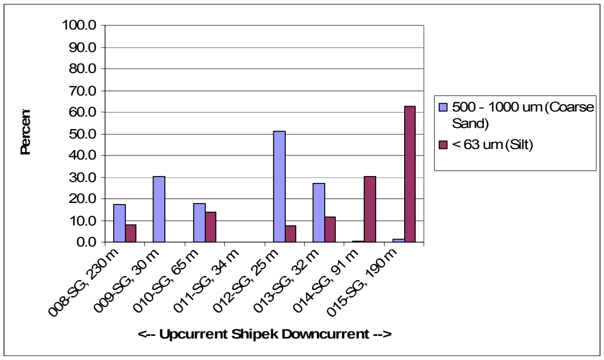


Figure 4. Percent of coarse sand (500-1000 um) and percent of silt (<63 um) in each Shipek taken on Saba Bank (7 samples). C214-012-SG, taken at 25 m, was composed of 7.5% silt and 51% coarse sand; C214-015-SG, taken at 190 m, was composed of 62.6% silt and 1.3% coarse sand.

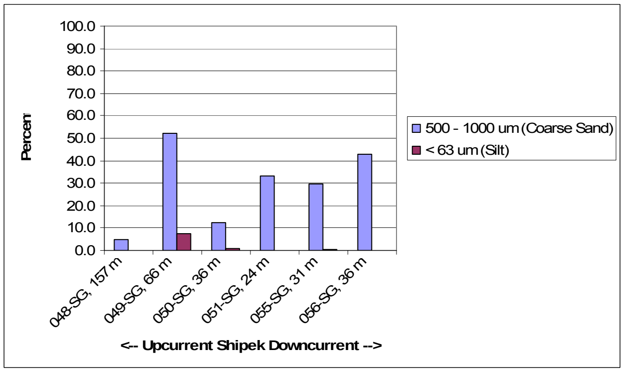


Figure 5. Percent of coarse sand (500-1000 um) and percent of silt (<63 um) in each Shipek taken on Pedro Bank (6 samples). C214-049-SG, taken at 66 m, was composed of 7.6% silt and 52% coarse sand; C214-055-SG, taken at 31 m, was composed of 0.4% silt and 29.5% coarse sand.

Variance in primary productivity as a product of wind velocity in the wind-mixed layer across and east Caribbean transect.

John Armstrong and Chris Sullivan

This study sought to explore the effect of short term changes in wind velocity on primary production in the wind mixed layer. As wind mixing maintains surface-water levels of phytoplankton, it was hypothesized that higher wind speeds would positively correlate with increased primary productivity in surface waters. Surface fluorescence and wind speed were measured for every minute of a six day period, and eight Neuston tows and three CTD deployments were conducted over a sampling transect in the eastern Caribbean Sea. While a significant linear relationship between wind speed and surface fluorescence was not established, a very highly significant difference was found between fluorescence values at times of high and low wind speeds. This finding supports the hypothesis of a significant relationship between wind speed and surface primary productivity and suggests that further studies with better controlled variables and a wider range of wind speeds would be worthwhile in order to gain a better understanding of this relationship.

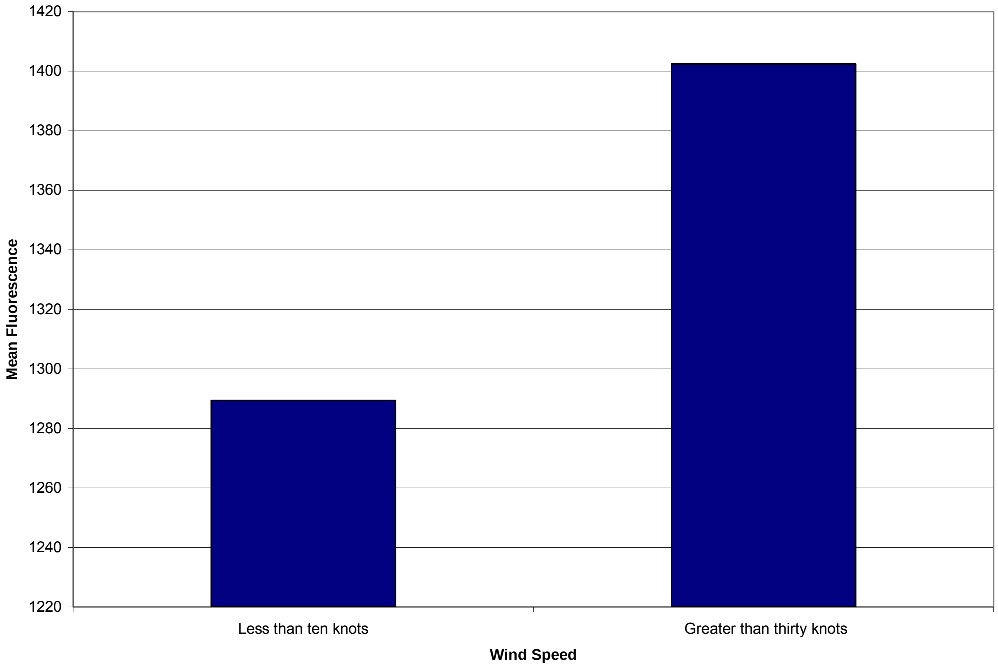


Figure 6. Mean fluorescence for wind speeds under ten knots and greater than thirty knots.

Water quality assessment of three Caribbean harbors: Christiansted, St. Croix, USVI; Kingston, Jamaica; Port Royal, Roatan, Honduras.

Anna Bromley, Meagan Gamble and Tim Gamwell

Harbors are areas of high maritime traffic due to the fact that they are often well sheltered and easily accessible to areas of trade. This is especially true for many harbors in the Caribbean, as ships head to and from the Panama Canal. The fact that harbors are heavily trafficked, have poor flushing rates, and various terrigenous inputs, produces an area where nutrients accumulate and lead to poor water quality (Meyer-Reil, 2000). Our goal was to study the three Caribbean harbors of Christiansted, St. Croix; Kingston, Jamaica; and Port Royal, Roatan, Honduras in terms of chlorophyll-a and total bacteria concentrations. These variables were compared against nitrates, phosphates, oxygen, temperature and salinity to assess any significant relationships between our two dependent variables and our independent variables. However, due to many different factors there was only one significant relationship and very few trends observed in the graphs. After averaging all of our, data appreciable differences were seen for each variable between harbors. No standard for water quality was established. However, after comparing each harbor to one another for each variable, we found Christiansted to be very similar to our control while Kingston had increased levels of all variables (excluding salinity) and Port Royal had lower levels for all variables. Variation in each harbor is likely due to the differences in size, population and amount of separation from open waters in each harbor.

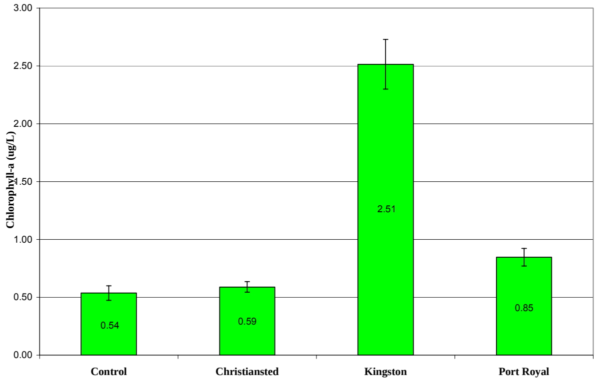


Figure 7. Kingston has the highest average concentration followed by Port Royal and Christiansted. Kingston and Port Royal have higher concentrations than open ocean samples. The error bars for the control and Christiansted overlap.

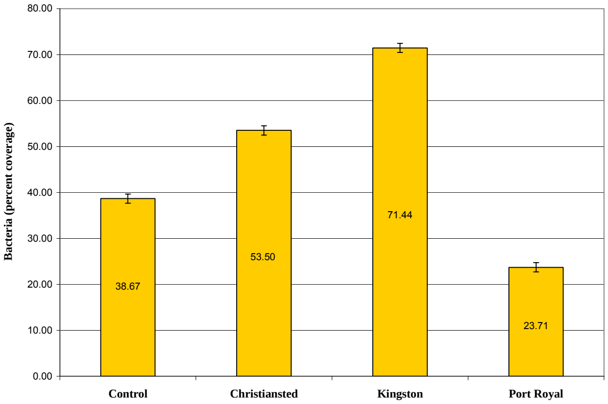


Figure 8. Average bacteria coverage is highest in Kingston, followed by Christiansted, the Control and Port Royal. Bacteria measured is the average of total bacteria from each sample.

Plastic pollution in the Caribbean Sea.

Sandy Feuer and Margaux Howard

Plastic pollution has become a growing concern due to its increase in production. We expected to find higher concentrations of macro plastic on our cruise track between St. Croix, USVI and Roatan, Honduras compared to previous Sea Semester Caribbean cruise tracks. Higher macro plastic concentrations were also expected in areas near shore. Micro plastic concentrations were expected to be higher at the surface and at the base of the mixed layer compared to the rest of the water column. Macro plastic samples were collected twice daily with neuston tows between St. Croix and Roatan, and micro plastic samples were collected at the surface and at depth using a carousel to determine micro plastic distributions.

Macro plastic was much more plentiful in number on our Caribbean transect than in previous years. More macro plastic was found in areas near Hispaniola, Jamaica, and Roatan, whereas none was found near St. Croix. Stronger winds and weather near St. Croix may have pushed the macro plastic south of our cruise track. Higher micro plastic concentrations were found at the surface, and micro plastic distributions at depth were inconsistent, showing no accumulation at the pycnocline.

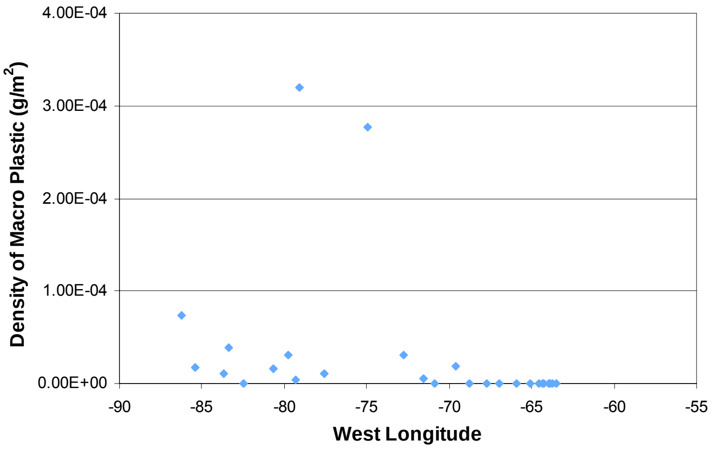


Figure 9. Density of Macro Plastic across the Caribbean: On our cruise track, masses of macro plastic collected in longitudes near Jamaica were much higher than the masses collected near Roatan and Hispaniola. Note that one data point has been omitted due to its high numerical value (.003g/m^2).

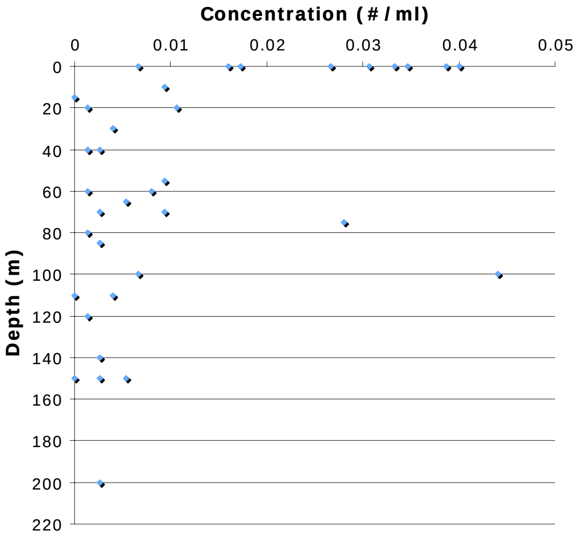


Figure 10. Concentrations of Micro Plastic at Depth: Most micro plastic samples collected were at varying depths throughout the water column in low concentrations. The largest concentration of micro plastic found at depth was .044/ml at 100m. Most micro plastic was found at the surface.

The distribution of pelagic tar along and east-west transect in the Caribbean Sea.

Taylor Gotfredson

The distribution of pelagic tar was studied on an East- West transect of the Caribbean Sea from St. Croix USVI to Roatan, Honduras aboard the SSV Corwith Cramer from November 22nd to December 31st 2007.Neuston tows were performed every twelve hours and any tar found was dried and weighed in Roatan. I hypothesized that I would find higher concentrations to the west of the Windward Passage based on the large concentration of shipping traffic through the region and the general wind and surface currents of the Caribbean Sea. Though a higher concentration of tar was found to west, my data did not show a significant difference between the east and west. I did find a lower concentration in this transects then previous transects which may indicate a high effectiveness of the international regulatory administrators on enforcing strict oil pollution prevention laws.

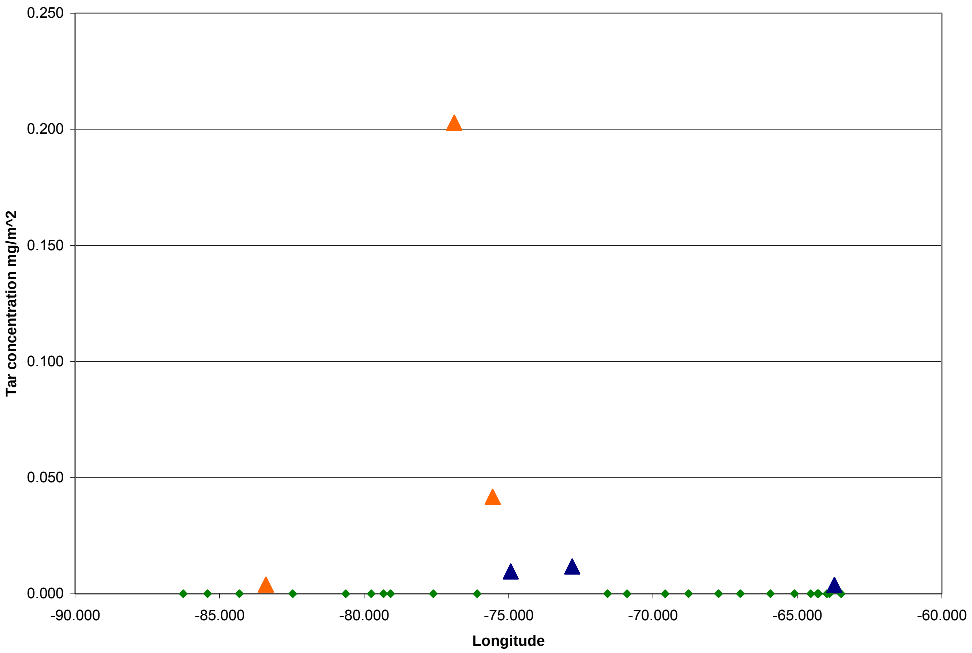


Figure 11. Tar concentration as a function of longitude. The orange triangles represent tows found to the west of 75° west longitude and the blue triangles represent the tows found to the east of the 75° west longitude.

Macrofaunal densities in Sargassum spp. found in the Caribbean Sea based on age, size and geographic distribution.

Adam Kumm

Pelagic Sargassum was collected via Neuston net in the Caribbean Sea from late November through December of 2007 along an east-west transect. Examination of the algae attempted to determine how location and age affected mat size and macrofaunal density of the associated species found within the Sargassum rafts. Location and age were recorded on sight; the biomass and density of fauna recorded later. Several organisms were identified and documented. Faunal density of tows yielding Sargassum was then compared to the density of tows without the fucoid. Mat size and macrofaunal density were positively correlated with age. However, location and age showed no relationship and as a result geography shared no correlation with mat size or faunal density. There was no significant difference between the mean faunal density of tows with Sargassum and tows without it, although the average density of the tows yielding the algae appeared greater.

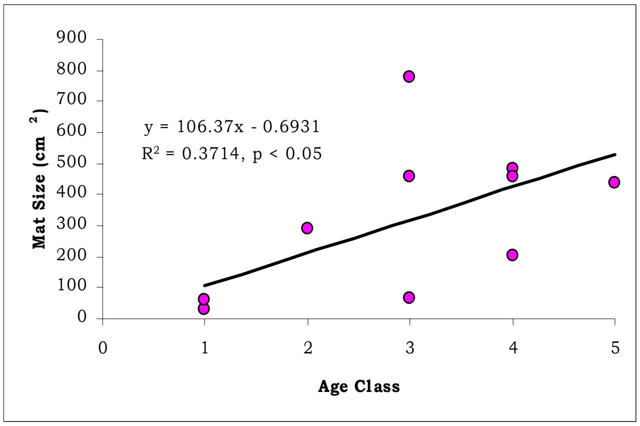


Figure 12. A positive trend is seen between age and mat size.

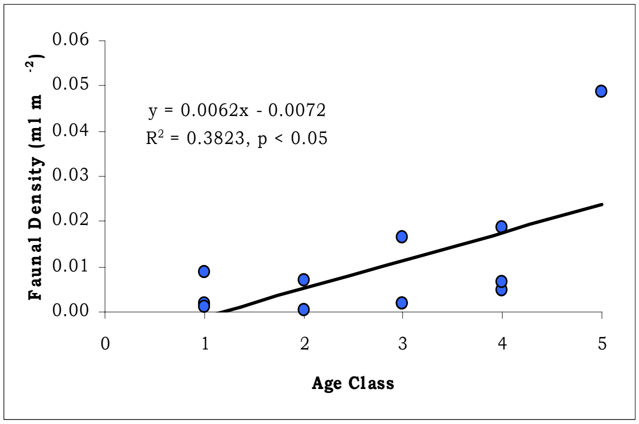


Figure 13. A positive trend is seen between age and free-floating macrofaunal densities.

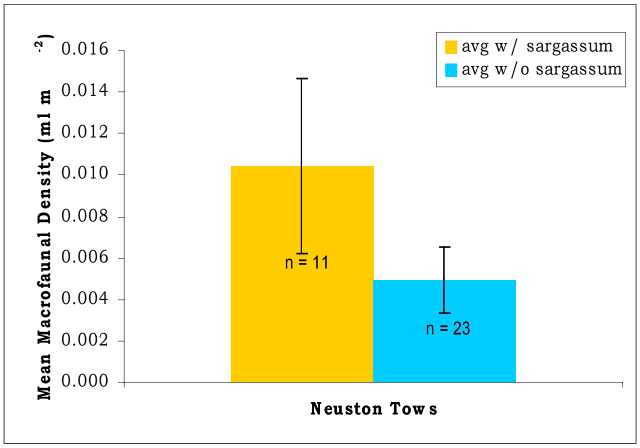


Figure 14. Mean faunal density between tow shows greater density in *Sargassum* tows, but error bars indicate that there is no significant difference.

Foraminiferal abundance in two carbonate banks.

Molly Lidz and Leah Pine

An analysis of foraminiferal abundance over two Caribbean carbonate banks (Saba Bank and Pedro Bank) with similar climate is used to examine the consistency of foraminifera as direct paleoclimatic indicators of sea surface temperature (SST). General abundance is plotted against SST and found to have no discernible correlation. Relative abundance of *Globigerinoides ruber* is plotted by bank and found to be significantly higher at Pedro Bank. Variables other than SST are discussed as possible causes for variance in abundance.

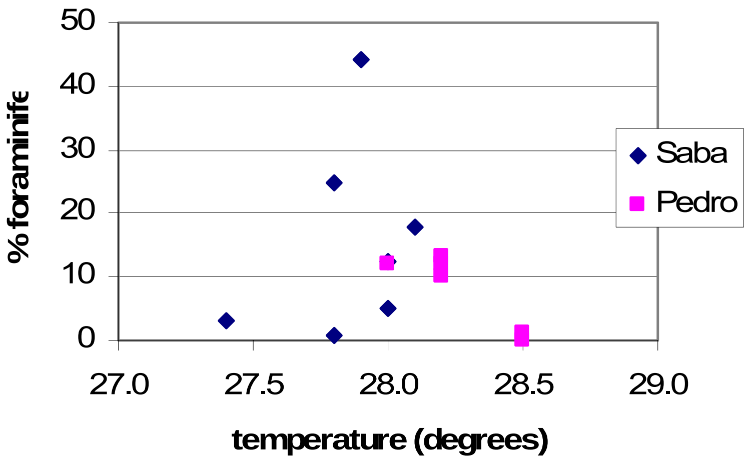


Figure 15. Though foraminiferal abundance is generally thought to correlate with SST, we found great variability in abundance within the small range of 1.1 ˚C.

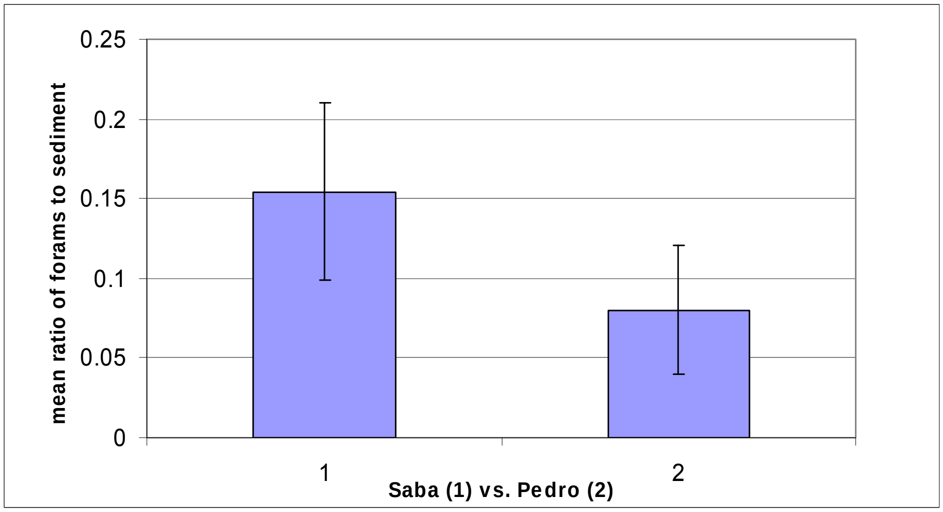


Figure 16. The number of foraminifera per 100-count varied widely. Though Saba bank had more foraminifera, the data were not significant.

A study of marine phytoplankton’s reactions to chosen limiting variables.

Chad Miller

This experiment was devised to determine how average marine phytoplankton react to changes in their environment. Variables tested include: silicates, light, phosphates, nitrates, trace metals, and salinity. It was expected that the first four variables would bolster the phytoplankton communities, while the last two would be detrimental. Location was also suspected of playing a role in phytoplankton’s ability to handle certain concentrations. Changes in salinity, trace metals, phosphates, and nitrates were expected to show more drastic changes in the open ocean phytoplankton, whereas the other variables (light and silicates) would have smaller changes in the open ocean water; due to localized adaptations. After 24-hour incubation periods of phytoplankton collected from the 50% light level in the eastern to western Caribbean nothing conclusive was observed. Trends indicate that: it is impossible for marine phytoplankton to survive in brackish water, phosphates are a limiting nutrient in the water column, and there is localized adaptation.

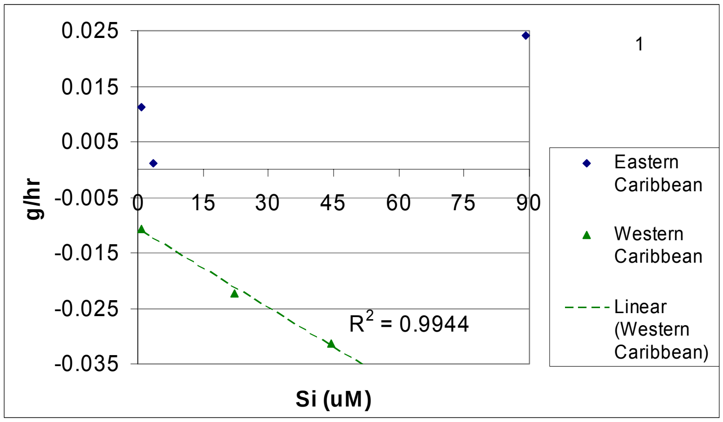


Figure 17. the effect of silicate’s on phytoplankton growth rates for eastern (blue diamonds) and western (green triangles) phytoplankton. The experiment had a 24-hour incubation period. Higher concentrations of silicates caused a higher growth rate for the eastern phytoplankton. The western phytoplankton displayed a negative trend with increased silicate.

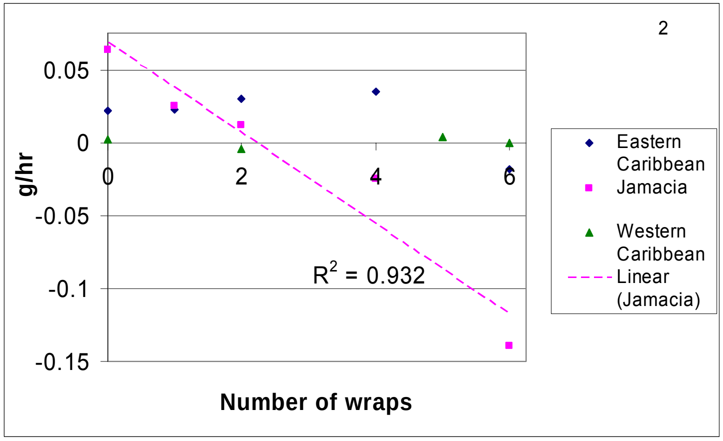
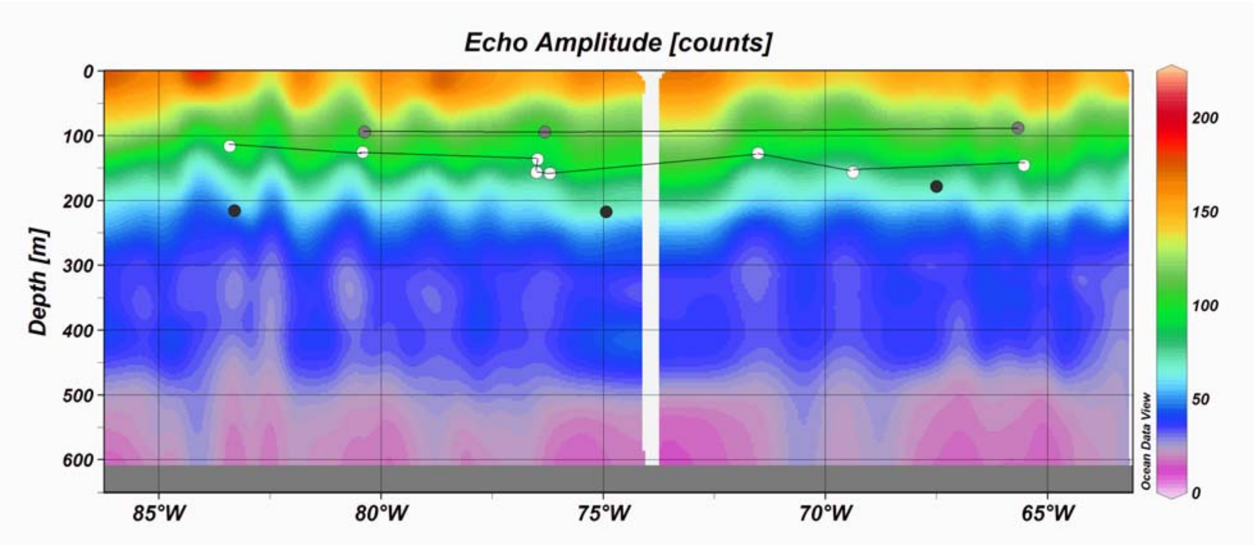


Figure 18. light’s effect on phytoplankton growth rates. Intensity was manipulated by wrapping mesh screening around the incubation bottles, the number of wraps are indicated on the x-axis. The Jamaican sample (pink squares) was collected in Kingston Harbor, interestingly it shows a strong positive correlation with light intensity. The western (green triangles) growth rate had no correlation, and very little change for the different light intensities. The eastern phytoplankton (blue diamond) growth rates drop for lower light levels and remain fairly constant at high and mid level concentrations.

Examination of 1% light level and deep chlorophyll maximum on zooplankton diel vertical migration in the Caribbean Sea.

Clare O’Laughlin

Diel vertical migration, a daily rise to the surface of the water at night and descent into the deeper waters during the day, is a widely observed behavior exhibited by zooplankton in the water column. Light penetration and the deep chlorophyll maximum were examined along an east to west transect of the Caribbean Sea to determine if these were the limiting factors in this behavior. Daily daytime and nighttime surface neuston tows, along with Tucker trawls at depth, Secchi disks and CTD deployments were executed in order to clarify if the 1% light level and deep chlorophyll maximum were the boundaries to which zooplankton vertically migrate. The ADCP was constantly run to monitor the acoustic backscatter as well. The peak of maximum fluorescence was found at a depth deeper than 1% light level. This deep water fluorescence and location of the 1% light level were established not to be the limiting factors of this behavior. However, the difference in zooplankton density observed in surface and depth net tows did confirm that the zooplankton were exhibiting diel vertical migration.



● Tucker Trawl Locations
○ Depth of Maximum Fluorescence
● Secchi Disk 1% Light Level

Figure 19. Echo amplitude of ADCP backscatter along cruise track from Saba Bank to Roatan, Honduras. Locations of observed 1% light level and fluorescence maximum with Tucker trawl depths. The break in the profile indicates Haitian waters where sampling was not permitted. The three maximum fluorescence points located near 76° W were CTDs deployed essentially in the same location, though plotted slightly apart to show the depth at which the maximum fluorescence occurred in each of these deployments.

Redfield ratios and phytoplankton size in the Caribbean Sea.

Katy Ranochak

Growing concerns of climate change ocean health and food chain stability, coupled with ever increasing pollution monitoring has increased human interest in phytoplankton health. Redfield observed that both the water column and phytoplankton share a similar average ratio of 16N:1P. This experiment investigated a link between N:P ratio and phytoplankton abundance. Size class abundances were compared to changes in N:P. Surface stations and hydrocasts were deployed to collect water samples. N and P concentrations and chl-a concentrations were determined through standard flourimetric and colorimetric techniques. Chl-a samples were consecutively filtered through various micron filters to create size classes. The N:P ratio observed was not near the Redfield ratio and no statistically significant correlation was found between the observed concentrations and N:P. N concentrations stayed relatively constant while P varied greatly between sample sites. The largest size class (>8µm) of chl-a was found within all of P variance where as the smaller size classes (0.45 µm -8 µm)were found in a more steady and abundant concentrations of P indicating that P is the limiting nutrient in this area. It also indicates that larger phytoplankton as a group is better able to handle a change in P concentration in the water column.

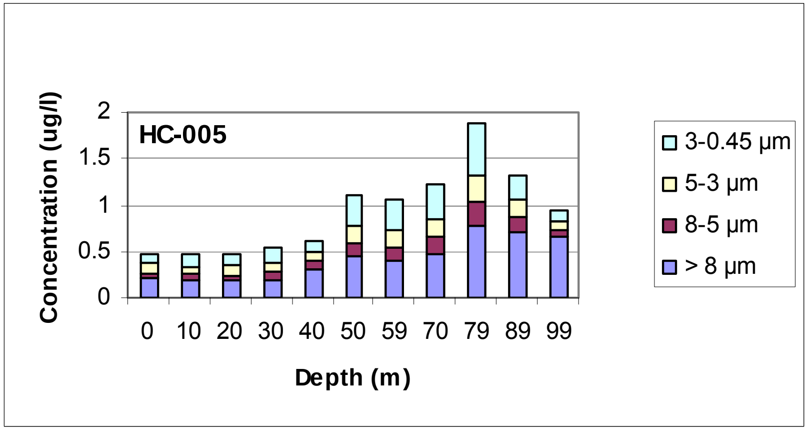


Figure 20. Chl-A concentration of each size class a function of depth for HC-005. Size class > 8µm is the most abundant size class.

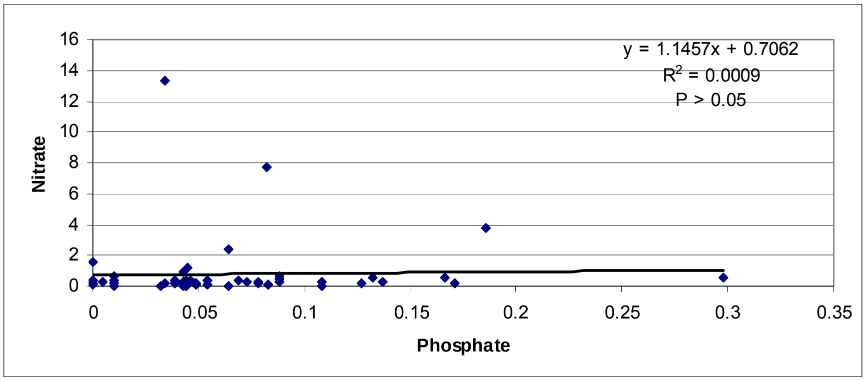


Figure 21. Concentration of phosphate compared to nitrate of all collections. Nitrate stays relatively constant, while phosphate varies with station.

A comprehensive study of surface currents, sedimentary composition and fluorescence on Saba Bank.

Tom Wootton

Saba Bank is a carbonate bank at 17° 30’N X 64° 35’W off of Saba Island in the Lesser Antilles. Upon studying the fluorescence, current velocities, grain size distribution and depth of this bank certain clear patterns arise. My data shows that current velocities increase with a decrease in depth. Also it is clear that as depth increases, smaller grain sizes are able to settle out of the water column, so with increasing depth, the percentage of smaller grain sizes increases. I used ADCP to trace the surface currents beneath our cruise track. A Chirp Sonar was used to obtain a bathymetric profile of the bank and depict sedimentary layers on top of the ocean floor. A fluorometer was used to measure bio-fluorescence along our transects of the bank. Lastly, sediment samples from windward to leeward were obtained with the Shipek Grab. This data serves as a basic profile of Saba Bank and could provide a basis for future research.

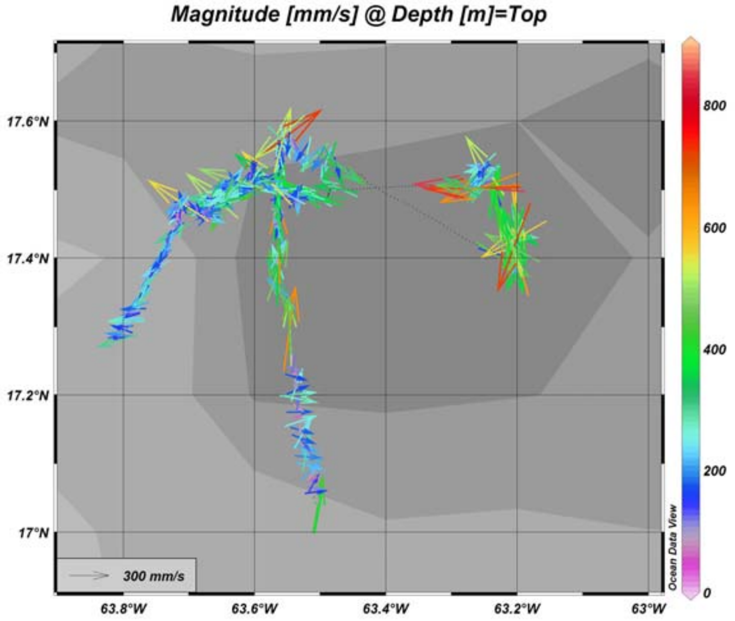


Figure 22. Magnitude and direction of surface currents over Saba Bank.

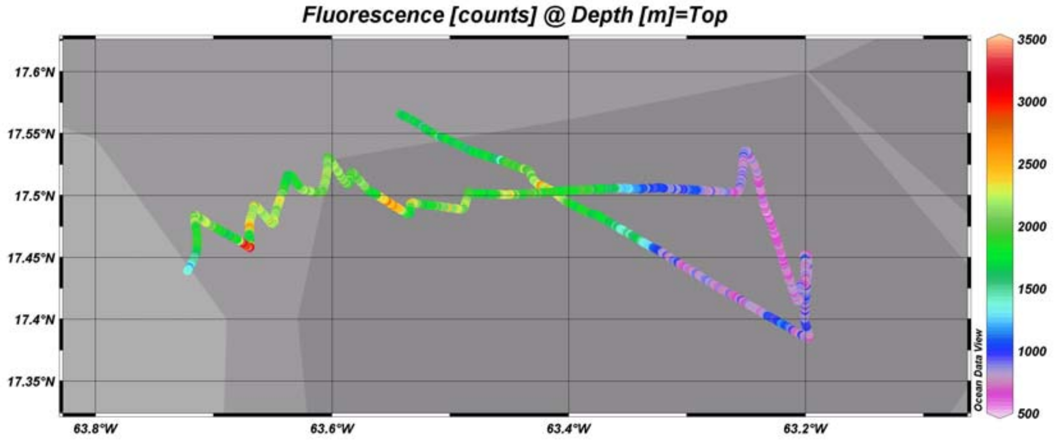


Figure 23. Raw fluorescence in surface waters over Saba Bank.