Cruise Report
S-217

Scientific Data Collected Aboard
SSV *Robert C. Seamans*

Papeete, Tahiti –
Taiohae, Nuku Hiva, Marquesas – Honolulu, Hawaii
9 May – 14 June 2008

Argo Float Deployment
at Equator
Photo credit:
Carissa McQueen

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To obtain unpublished data, contact the Chief Scientist or SEA data archivist: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 *Robert C. Seamans*, Cruise S-217

Nautical Staff	
Jeremy Law	Captain
Jason Quilter	Chief Mate
Johnny O'Keeffe	Second Mate
Matt Glenn	Third Mate
Seth Murray	Engineer
Clara Hard	Assistant Engineer
Doreen Remillard	Steward
Anna Peters	Assistant Steward

Scientific Staff	
Amy Siuda	Chief Scientist
Carolyn Lipke	First Assistant Scientist
Katrina Phillips	Second Assistant Scientist
Liz Burakowski	Third Assistant Scientist

Students	
Erin Child	Oberlin College
Priya Deka	Drexel University
Nova Ewers	University of Pennsylvania
LeeAnne French	University of California, Berkley
Hannah Green	University of Chicago
Isaac Hur	University of Chicago
Chris Keinknecht	University of Delaware
Andrei Lojek	University of Denver
Ed Mack	Endicott College
Dierdre Madsen	University of Pennsylvania
Robin Matthews	University of East Anglia
Brittany Mauer	State University of New York, Stony Brook
Carissa McQueen	University of California, Santa Barbara
Markeith Pilot	University of California, Riverside
Marcie Ristich	Northeastern University
Eddie Strandberg	University of Oregon
Eliah Thanhauser	College of the Atlantic
Marley Weaver	City College of San Francisco

Introduction

This cruise report provides a summary of scientific activities aboard the SSV *Robert C. Seamans* during cruise S-217 (9 May – 14 June 08). The 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, 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.

With consistent E x S winds, force 3-4, for the first 4 days we were able to easily make our way north and a little east toward and through the Tuamotu Islands on our way to the Marquesas. Fairly calm seas allowed ample sampling for each research project prior to our arrival in Nuku Hiva on the 12^{th} day of our cruise.

In Nuku Hiva, we followed up on a connection made with the College of Taiohae during S-215. A group of 9 students from the middle school came out to the Seamans for a tour. The students arrived prepared with great questions about our research and life aboard. It was definitely educational for all, and we have plans to offer this visit to another group of students when the Seamans returns to Nuku Hiva in November.

Much of our three-week transit from Nuku Hiva to Honolulu, Hawaii was marked by moderate to strong winds. These conditions make it more difficult to sample, but the crew rose to the challenge, and completed our sampling agenda. One sample of note was from a Tucker Trawl deployed to a depth 50 meters. In this net, we collected the biggest salps I have ever seen, measuring approximately 15 to 20 cm in length!

We spent the last two days cruising up the north side of the Hawaiian Islands. At midnight on the first night, we sailed within a mile of the coast of the Big Island to see the molten red lava from Kilauea crater bubbling and sparking its way into the sea as the steam billowed into the sky. We then saw Maui and Lanai in the distance as we sailed farther to the west. Our arrival at the eastern end of Molokai coincided with sunrise, and we passed the day skirting downwind along the northern coast with its massive cliffs and waterfalls. . . a memorable way to end S-217. Thank you to an outstanding staff and equally outstanding group of students.

Amy NS Siuda
Chief Scientist, S-217

Table 1. Student research projects, S-217.

Title	Student Investigator(s)
Marine virus decay by UV radiation in the Equatorial Pacific.	Erin Child
Nutricline analysis of surface and deep nutrients in the Equatorial Pacific.	Priya Deka
The effects of zooplankton density and current fronts on Pacific Ocean *Halobates*.	Nova Ewers
Carbon footprint of the *Robert C. Seamans* along cruise track S217 from Tahiti to Hawaii.	LeeAnne French
The effect of pH on the photosynthetic efficiency of marine phytoplankton.	Hannah Green
Microplastic content in zooplankton diet.	Isaac Hur
Physalia physalis dimorphism as related to areas of productivity from the latitudes of 20° N to 20° S within the central Pacific Ocean.	Chris Kleinknecht
Competitive bioluminescence among zooplankton.	Andrei Lojek
Phytoplankton production in surface and DCM waters of the Equatorial Pacific.	Ed Mack Brittany Mauer
Diel vertical migration of copepods resulting from light intensity and UV radiation.	Dierdre Madsen Marley Weaver
Comparing historical methods of measuring sea surface temperature along a central Equatorial Pacific transect.	Robin Matthews
Copepod fecal pellet transport of POC from the surface ocean through the mixed layer in the Equatorial Pacific.	Carissa McQueen
Effect of microzooplankton grazing control on primary production in equatorial upwelling zones and oligotrophic zones in the Pacific.	Markeith Pilot
pH levels across the Equatorial Pacific and concentrations of calcifying marine organisms.	Marcie Ristich
Chromophoric dissolved organic matter concentrations in the open ocean.	Eddie Strandberg
The relationship between salp density and density of their prey.	Eliah Thanhauser

Table 2. Academic Program.

Date	Topic	Speaker(s)
10 May	Introduction to Academic Program	Siuda & Law
11 May	Heaving To & Deploying the CTD	Crew
12 May	Water Sampling Demonstration	Assistant Scientists
13 May	Line Chase	All Hands
14 May	Set, Strike, Furl	Mates
15 May	Coral Reefs	Phillips
16 May	Lab Practical	All Hands
19 May	Maritime Studies Readings	All Hands
20 May	Data Discussion I	Students
26 May	Seabirds	Siuda
27 May	Sailhandling Practice by Watches	Students
28 May	Marlin Spike Seamanship	Mates
29 May	Water Makers	Murray
30 May	Argo Float Program Summary and Deployment	Siuda
2 June	Junior Watch Officer Guidelines	Law
3 June	Data Discussion II	Students
4 June	Waves	Siuda
5 June	Refrigeration	Murray
6 June	Poster Presentations	Students
9 June	Recent Climate Change in New England	Burakowski
10 June	Chase the Buoy	Students
11 June	Marine Bacteria and Symbiosis	Lipke
12 June	Summary of Oceanographic Research	Siuda

Data Description

This section provides a record of data collected aboard the SSV *Robert C. Seamans* cruise S-217 (US State Department Cruise: 2007-098) on a general south-north transect of the Equatorial Pacific, beginning in Papeete, Tahiti and ending in Honolulu, Hawaii (Figure 1). A single port stop was made at Taiohae, Nuku Hiva, Marquesas.

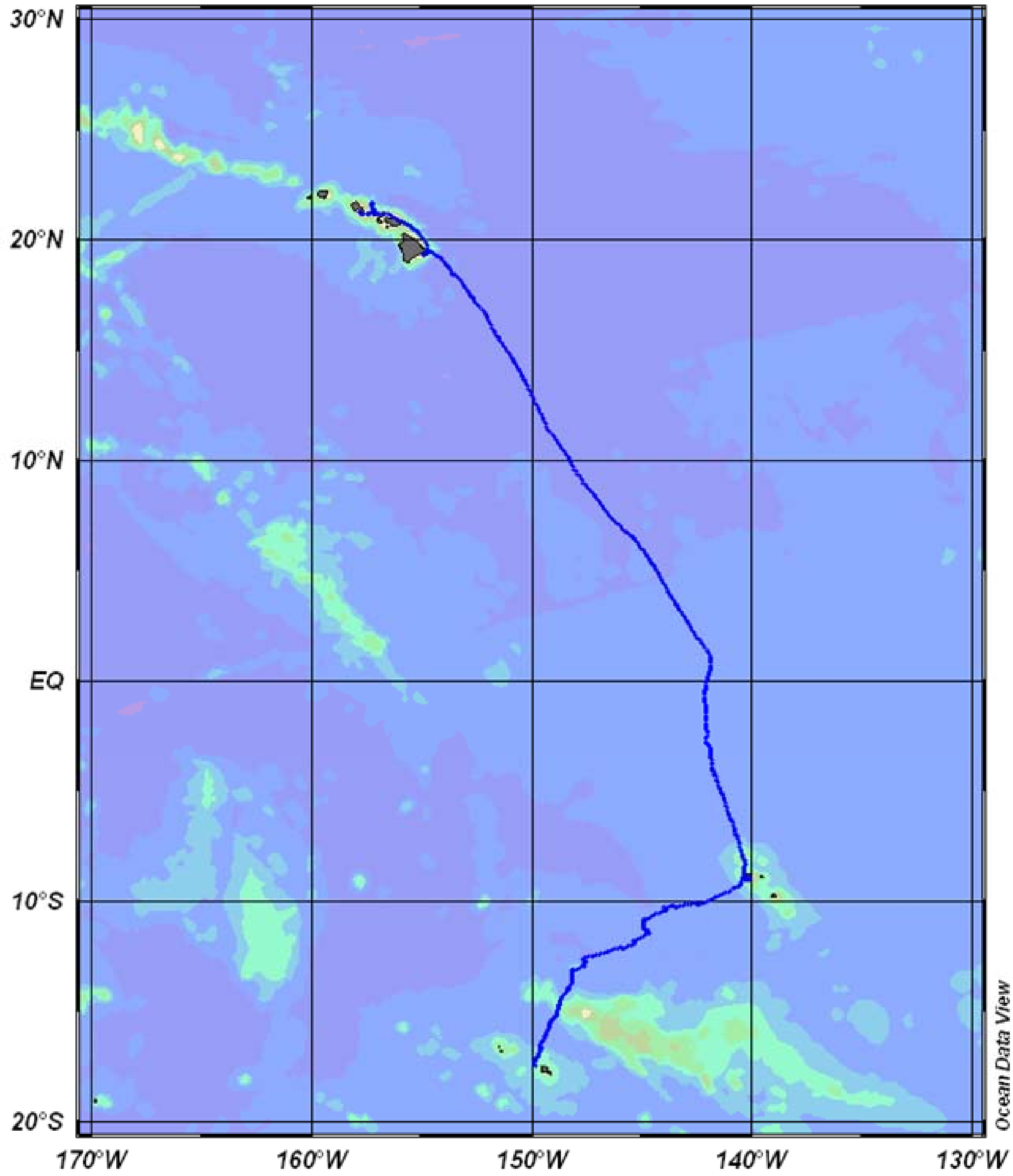


Figure 1. Hourly positions along the S-217 cruise track.

During the six-week voyage, we sampled at 94 discrete oceanographic sampling stations (Table 3). A total of 64 surface sampling stations were conducted during 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. Additional instrumentation allowed for profiling of dissolved oxygen, raw fluorescence and CDOM fluorescence (Figure 4). Summaries of sea surface and water column chemical and biological properties are found in Tables 4-7. 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	Longitude	Depth (m)	General Locale
CTD						
003	11-May-08	1538	16°34.4' S	149°36.0' W	467	Tuomotus
004	11-May-08	1623	16°34.9' S	149°36.1' W	908	Tuomotus
006	12-May-08	1046	15°38.9' S	149°11.4' W	469	50 nm W of Makatea
007	12-May-08	1134	15°39.3' S	149°12.2' W	146	50 nm W of Makatea
011	13-May-08	0916	14°43.5' S	148°45.6' W	445	NW of Mataiva
012	13-May-08	1016	14°44.0' S	148°46.8' W	970	NW of Mataiva
018	15-May-08	1033	12°44.0' S	147°35.1' W	486	NW of Tuomotus
019	15-May-08	1125	12°44.4' S	147°35.7' W	146	NW of Tuomotus
023	16-May-09	1139	12°9.3' S	145°51.4' W	499	N of Tuamotus
023	16-May-09	1139	12°9.3' S	145°51.4' W	146	N of Tuamotus
025	17-May-08	0945	11°20.7' S	144°43.2' W	469	N of Tuamotus
026	17-May-08	1035	11°21.3' S	144°43.9' W	74	N of Tuamotus
029	18-May-08	1119	10°24.0' S	143°55.2' W	490	N of Tuamotus
032	19-May-08	1042	10°7.4' S	142°30.3' W	486	W of Marquesas
032	19-May-08	1042	10°7.4' S	142°30.3' W	490	W of Marquesas
036	20-May-08	1013	9°16.1' S	140°32.8' W	6	Marquesas
036	20-May-08	1013	9°16.1' S	140°32.8' W	468	Marquesas
039	25-May-08	1010	8°7.1' S	140°20.4' W	480	N of Nuku Hiva
040	25-May-08	1102	8°7.3' S	140°21.4' W	290	N of Nuku Hiva
044	26-May-08	1012	6°17.2' S	140°55.3' W	427	N of Marquesas
045	26-May-08	1104	6°17.5' S	140°56.7' W	531	N of the Marquesas
048	27-May-08	1034	4°14.3' S	141°40.7' W	404	NW of Nuka Hiva
048	27-May-08	1034	4°14.3' S	141°40.7' W	413	NW of Nuka Hiva
051	28-May-08	1032	2°48.2' S	142°1.4' W	496	Tropical Pacific
052	28-May-08	1129	2°49.0' S	142°2.3' W	621	Tropical Pacific
055	29-May-08	1015	1°20.8' S	142°6.2' W	450	90nm S of Equator
056	29-May-08	1101	1°21.3' S	142°6.2' W	290	90nm S of Equator
060	30-May-08	1004	0°7.3' N	142°1.4' W	444	Equatorial Pacific
061	30-May-08	1056	0°7.3' N	142°0.7' W	265	Equatorial Pacific
064	31-May-08	1004	1°19.2' N	142°2.4' W	478	Equatorial Pacific
065	31-May-08	1058	1°19.4' N	142°2.0' W	642	Equatorial Pacific
068	1-Jun-08	1113	3°28.0' N	143°27.8' W	496	Equatorial Pacific
068	1-Jun-08	1113	3°28.0' N	143°27.8' W	490	Equatorial Pacific
071	2-Jun-08	0944	5°2.6' N	144°22.0' W	497	Equatorial Pacific
072	2-Jun-08	1035	5°2.3' N	144°22.0' W	498	Equatorial Pacific
076	3-Jun-08	1100	6°31.3' N	145°24.8' W	422	Northern Tropical Pacific
077	3-Jun-08	1150	6°30.3' N	145°25.8' W	348	Northern Tropical Pacific
081	5-Jun-08	1055	10°11.9' N	148°23.5' W	467	Northern Tropical Pacific
082	6-Jun-08	1117	12°33.7' N	149°49.5' W	472	Northern Tropical Pacific
083	6-Jun-08	1127	12°33.7' N	149°49.5' W	464	Northern Tropical Pacific
088	9-Jun-08	1555	18°27.0' N	153°33.1' W	2664	S of Hawaii
Hydrocast						
001	11-May-08	1111	16°39.3' S	149°35.0' W	5	NW of Tetiaroa
004	11-May-08	1623	16°34.9' S	149°36.1' W	877	Tuamotos

* blank spaces indicate no data collected

Table 3 continued.

Station	Date	Local Time	Latitude	Longitude	Depth (m)	General Locale
007	12-May-08	1134	15°39.3' S	149°12.2' W	113	Makatea
012	13-May-08	1016	14°44.0' S	148°46.9' W	893	Mataiva
019	15-May-08	1126	12°44.4' S	147°35.7' W	120	NW of Tuomotus
029	18-May-08	1119	10°24.0' S	143°55.2' W	5	N of Tuomotus
032	19-May-08	1042	10°7.4' S	142°30.3' W	446	W of Marquesas
036	20-May-08	1013	9°16.1' S	140°32.8' W	5	Marquesas
040	25-May-08	1102	8°7.3' S	140°21.4' W	80	N of Nuku Hiva
045	26-May-08	1104	6°17.5' S	140°56.7' W	446	N of the Marquesas
048	27-May-08	1034	4°14.3' S	141°40.7' W	100	NW of Nuka Hiva
052	28-May-08	1129	2°49.0' S	142°2.3' W	448	Tropical Pacific
056	29-May-08	1101	1°21.3' S	142°6.2' W	70	90nm S of Equator
061	30-May-08	1056	0°7.3' N	142°0.7' W	60	Equatorial Pacific
065	31-May-08	1058	1°19.4' N	142°2.0' W	496	Equatorial Pacific
068	1-Jun-08	1107	3°27.9' N	143°27.8' W	88	Equatorial Pacific
072	2-Jun-08	1035	5°2.3' N	144°22.0' W	397	Equatorial Pacific
077	3-Jun-08	1150	6°30.3' N	145°25.8' W	65	Tropical Pacific
082	6-Jun-08	1117	12°33.7' N	149°49.5' W	397	Northern Tropical Pacific
Neuston Net						
002	11-May-08	1143	16°39.7' S	149°35.5' W	0	NW of Tetiaora
005	12-May-08	0016	16°12.6' S	149°26.7' W	0	Tuamotus
008	12-May-08	1205	15°39.7' S	149°12.6' W	0	Tuamotus
010	13-May-08	0102	15°10.5' S	148°54.2' W	0	Tuamotus
013	13-May-08	1142	14°45.0' S	148°48.4' W	0	Mataiva
014	14-May-08	0010	14°4.6' S	148°23.6' W	0	N Tuamotus
015	14-May-08	1134	13°40.6' S	148°9.9' W	0	N of Tuamotus
017	15-May-08	0042	13°7.7' S	148°8.9' W	0	N Tuamotus
020	15-May-08	1152	12°44.9' S	147°35.8' W	0	N Tuamotus
021	16-May-08	0001	12°21.8' S	146°50.5' W	0	NW of Tuamotus
022	16-May-08	1030	12°8.8' S	145°52.7' W	0	S of Nuka Hiva
024	17-May-08	0019	11°44.7' S	145°13.2' W	0	S of Nuka Hiva
027	17-May-08	1133	11°21.7' S	144°44.4' W	0	S of Nuka Hiva
028	18-May-08	0003	10°51.3' S	144°57.4' W	0	N of Tuamotus
030	18-May-08	1231	10°24.9' S	143°55.9' W	0	N of Tuamotus
031	18-May-08	2327	10°15.5' S	143°30.2' W	0	S of Nuka Hiva
033	19-May-08	1141	10°8.2' S	142°30.0' W	0	W of Marquesas
035	20-May-08	0023	9°48.5' S	141°35.8' W	0	80nm SW of Nuka Hiva
037	20-May-08	1107	9°17.0' S	140°33.7' W	0	Marquesas
038	25-May-08	0030	8°45.7' S	140°20.8' W	0	6 nm W of Nuku Hiva
041	25-May-08	1142	8°7.6' S	140°22.2' W	0	N of Nuku Hiva
043	26-May-08	0048	6°59.4' S	140°42.5' W	0	N of Nuku Hiva
046	26-May-08	1203	6°18.0' S	140°48.2' W	0	N of Marquesas
047	27-May-08	0009	5°5.6' S	141°22.3' W	0	S Equatorial Current
049	27-May-08	1155	4°15.9' S	141°42.9' W	0	NW of Nuka Hiva
050	28-May-08	0014	3°25.2' S	141°51.9' W	0	Equatorial Pacific
053	28-May-08	1251	2°50.1' S	142°3.4' W	0	Equatorial Pacific

* blank spaces indicate no data collected

Table 3 continued.

Station	Date	Local Time	Latitude	Longitude	Depth (m)	General Locale
054	28-May-08	2357	2°0.7' S	142°4.0' W	0	Equatorial Pacific
057	29-May-08	1147	1°22.1' S	142°6.0' W	0	90nm S of Equator
059	30-May-08	0105	0°25.0' S	142°8.0' W	0	25nm S of Equator
062	30-May-08	1147	0°7.0' N	142°0.3' W	0	Equatorial Pacific
063	31-May-08	0016	0°40.3' N	141°53.3' W	0	Equatorial Pacific
066	31-May-08	1208	1°19.7' N	142°1.7' W	0	Equatorial Pacific
067	1-Jun-08	0008	2°37.6' N	142°56.2' W	0	Tropical Pacific
069	1-Jun-08	1200	3°27.5' N	143°27.6' W	0	Equatorial Pacific
070	1-Jun-08	2215	4°1.3' N	143°48.7' W	0	Equatorial Pacific
073	2-Jun-08	1121	5°1.9' N	144°21.9' W	0	Equatorial Pacific
074	3-Jun-08	0009	5°40.7' N	144°47.9' W	0	Tropical Pacific
075	3-Jun-08	1008	6°30.3' N	145°24.4' W	0	Northern Tropical Pacific
079	4-Jun-08	0101	7°18.7' N	146°19.6' W	0	N. Equatorial Pacific
080	4-Jun-08	1211	8°11.5' N	146°59.1' W	0	N. Equatorial Pacific
083	7-Jun-08	0011	13°39.2' N	150°21.2' W	0	Northern Tropical Pacific
084	7-Jun-08	1201	14°33.9' N	150°51.6' W	0	Northern Tropical Pacific
085	8-Jun-08	0008	15°34.2' N	151°31.7' W	0	North Pacific Gyre
086	9-Jun-08	0008	17°27.6' N	152°45.9' W	0	Tropical North Pacific
087	9-Jun-08	1154	18°17.5' N	153°21.7' W	0	S of Hawaii
089	10-Jun-08	0019	18°45.9' N	153°48.4' W	0	SE of Big Island
090	10-Jun-08	1159	19°19.9' N	154°25.3' W	0	SE of Big Island
091	11-Jun-08	1219	20°21.3' N	155°12.4' W	0	N. of Big Island
092	12-Jun-08	0000	20°48.2' N	155°47.6' W	0	East of Maui
093	12-Jun-08	1608	21°24.5' N	157°11.2' W	0	Molokai
2-Meter Net						
094	12-Jun-08	2134	21°38.8' N	157°15.9' W	750	Off Coast of Molokai
Phytoplankton Net						
068	1-Jun-08	1118	3°27.9' N	143°27.8' W	0	Equatorial Pacific
Tucker Trawl						
010	13-May-08	0053	15°10.3' S	148°54.2' W	60	Tuamotus
015	14-May-08	1109	13°40.0' S	148°9.3' W	303	N of Tuamotus
017	15-May-08	0031	13°7.5' S	148°8.7' W	64	N of Tuamotus
035	20-May-08	0015	9°48.4' S	141°36.1' W	50	80nm SW of Nuka Hiva
043	26-May-08	0040	6°59.4' S	140°42.2' W	68	N of Nuku Hiva
059	30-May-08	0057	0°24.8' S	142°8.3' W	61	25nm S of Equator
079	4-Jun-08	0054	7°19.1' N	146°19.4' W	58	N. Equatorial Pacific
Bathyphotometer						
009	13-May-08	0013	15°9.0' S	148°53.7' W	100	Tuamotos
042	26-May-08	0004	6°58.5' S	140°41.2' W	100	N of Nuku Hiva
058	30-May-08	0011	0°24.0' S	142°9.1' W	100	Equatorial Pacific
078	4-Jun-08	0009	7°20.5' N	146°18.5' W	100	Equatorial Pacific

* blank spaces indicate no data collected

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

Station	Date	Latitude	Longitude	Temp. (˚C)	Salinity (ppt)	pH *	>0.45 µm Chl *a* (µg/L) *	Raw Flour.
001	10-May-08	17°22.0' S	149°53.3' W	28.7	36.09	8.064		3.9
002	11-May-08	16°55.3' S	149°41.0' W	28.5	36.14			4.0
003	11-May-08	16°40.1' S	149°35.8' W	28.6	36.13		0.077	3.7
004	12-May-08	16°12.8' S	149°26.7' W	28.7	36.21	8.141	0.042	5.2
005	12-May-08	15°59.5' S	149°20.9' W	28.6	36.30			3.8
006	12-May-08	15°40.8' S	149°13.0' W	28.8	36.30	8.105	0.047	3.7
007	12-May-08	15°31.2' S	149°10.6' W	28.9	36.25			3.7
008	13-May-08	15°10.8' S	148°54.2' W	28.7	36.26	8.122	0.054	4.0
009	13-May-08	14°57.8' S	148°51.2' W	28.7	36.29			4.1
010	13-May-08	14°45.5' S	148°48.6' W	29.8	36.30	8.142	0.083	3.9
011	13-May-08	14°30.5' S	148°42.2' W	28.8	36.31			4.0
012	14-May-08	14°4.6' S	148°23.6' W	28.7	36.33	8.135	0.103	4.4
013	14-May-08	13°55.0' S	148°20.2' W	28.6	36.34			5.0
014	14-May-08	13°41.0' S	148°10.4' W	28.7	36.35	8.094	0.117	3.9
015	15-May-08	13°8.2' S	148°9.3' W	28.6	36.34	8.053	0.073	4.8
016	15-May-08	12°44.9' S	147°35.8' W	28.8	36.35	8.138	0.073	3.7
017	15-May-08	12°34.1' S	147°38.3' W	28.5	36.27			4.3
018	16-May-08	12°21.8' S	146°50.0' W	28.6	36.02	8.103	0.103	7.5
019	16-May-08	12°8.8' S	145°52.7' W	28.7	36.12	8.111	0.141	4.5
020	16-May-08	11°56.5' S	145°23.3' W	29.1	36.25			5.2
021	17-May-08	11°44.7' S	145°15.2' W	28.7	36.28	8.100	0.133	6.7
022	17-May-08	11°22.2' S	144°44.6' W	28.6	36.03	8.137	0.180	4.5
023	17-May-08	11°15.3' S	144°54.8' W	28.6	36.08			4.6
024	18-May-08	10°51.5' S	144°57.4' W	28.5	36.32	8.128	0.154	7.8
025	18-May-08	10°25.3' S	143°55.9' W	28.8	36.10	8.111	0.149	4.6
026	18-May-08	10°18.9' S	144°1.3' W	28.7	36.08			6.6
027	18-May-08	10°15.5' S	143°30.2' W	28.6	36.11	8.090	0.108	7.8
028	19-May-08	10°8.5' S	142°29.5' W	28.6	35.85	8.083	0.168	4.9
029	19-May-08	10°10.5' S	142°24.6' W	28.7	35.85			7.2
030	20-May-08	9°48.7' S	141°35.3' W	28.3	35.70	8.098	0.116	8.0
031	20-May-08	9°17.2' S	140°33.7' W	28.1	35.72	8.097	0.093	5.6
032	20-May-08	9°0.3' S	140°27.1' W	28.0	35.43			11.3
033	25-May-08	8°49.0' S	140°21.0' W	27.8	35.38	8.094	0.186	9.9
034	25-May-08	8°7.9' S	140°22.4' W	28.2	35.44	8.075	0.156	4.6
035	25-May-08	7°45.7' S	140°29.7' W	28.0	34.40			7.2
036	26-May-08	6°59.9' S	140°42.6' W	27.9	35.40	8.053	0.244	11.1
037	26-May-08	6°18.8' S	140°58.6' W	28.1	35.35	8.061	0.314	6.5
038	26-May-08	5°44.9' S	141°9.1' W	28.0	35.22			9.3
039	27-May-08	5°6.0' S	141°22.4' W	27.9	35.21	8.031	0.123	9.7
040	27-May-08	4°16.3' S	141°43.1' W	28.0	35.29	8.048	0.342	4.7
041	28-May-08	3°25.7' S	141°52.1' W	27.9	35.38	8.045	1.339	8.2
042	28-May-08	2°50.4' S	142°3.5' W	28.0	35.33	8.067	0.159	4.6
043	28-May-08	2°34.2' S	142°3.9' W	27.9	35.41			6.5
044	29-May-08	2°1.5' S	142°3.9' W	27.7	35.38	8.061	0.513	9.9

* blank spaces indicate no data collected

Table 4 continued.

Station	Date	Latitude	Longitude	Temp. (˚C)	Salinity (ppt)	pH *	>0.45 µm Chl *a* (µg/L) *	Raw Flour.
045	29-May-08	1°22.6' S	142°5.9' W	27.2	35.36	8.021	0.283	5.4
046	29-May-08	0°59.5' S	142°8.0' W	27.0	35.40			7.2
047	30-May-08	0°25.0' S	142°7.9' W	26.6	35.39	8.133	0.292	10.5
048	30-May-08	0°6.6' N	142°0.3' W	26.6	35.42	7.922	0.327	5.2
049	31-May-08	0°41.1' N	141°53.2' W	26.3	35.36	7.961	0.192	10.6
050	31-May-08	1°20.0' N	142°1.8' W	27.7	35.25	8.039	0.099	5.1
051	31-May-08	1°51.0' N	142°23.8' W	27.8	35.06			6.6
052	1-Jun-08	2°38.3' N	142°56.6' W	27.5	34.83	8.080	0.293	13.5
053	1-Jun-08	3°27.4' N	143°27.6' W	27.9	34.88	8.022	0.147	6.1
054	1-Jun-08	3°47.9' N	143°39.9' W	28.0	34.78			9.2
055	1-Jun-08	4°1.7' N	143°48.8' W	27.7	34.73	8.063	0.182	9.5
056	2-Jun-08	5°1.9' N	144°21.9' W	27.7	34.54	8.039	0.151	6.4
057	2-Jun-08	5°16.8' N	144°31.6' W	27.8	34.46			8.1
058	3-Jun-08	5°40.9' N	144°48.0' W	27.5	34.59	8.099	0.154	10.1
059	3-Jun-08	6°30.5' N	145°24.4' W	27.1	34.73	8.122	0.280	7.1
060	3-Jun-08	6°46.9' N	145°43.6' W	26.9	34.72			8.8
061	4-Jun-08	7°18.6' N	146°19.6' W	26.8	34.75	8.086	0.198	13.9
062	4-Jun-08	8°11.5' N	146°59.1' W	27.0	34.77	8.098	0.749	11.9
063	4-Jun-08	8°29.4' N	147°14.3' W	27.1	34.74			14.0
064	6-Jun-08	13°2.5' N	150°4.2' W	25.0	34.45			4.8

* blank spaces indicate no data collected

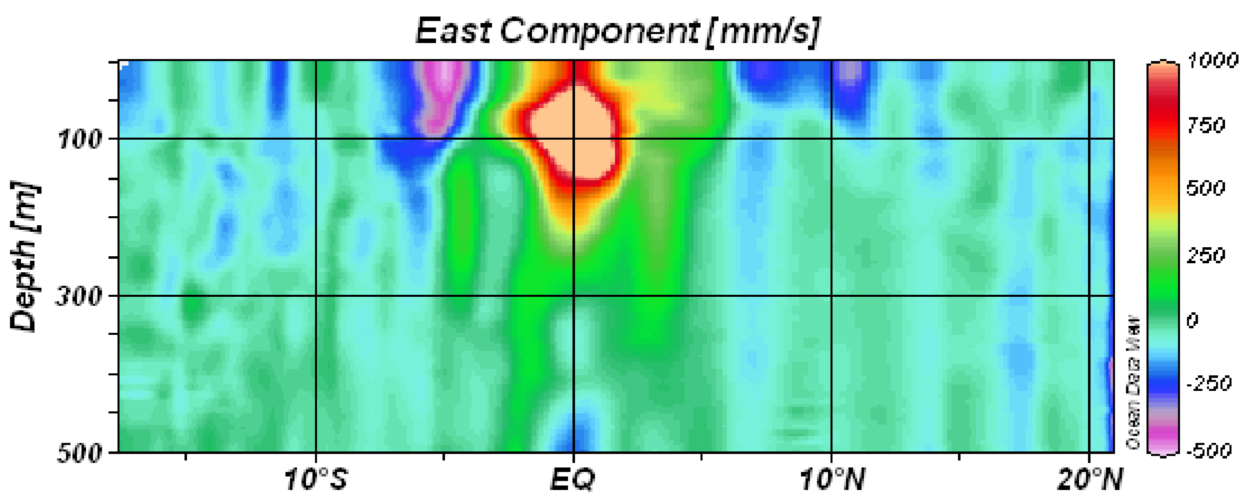


Figure 2. Eastward water velocity measured with the ADCP.

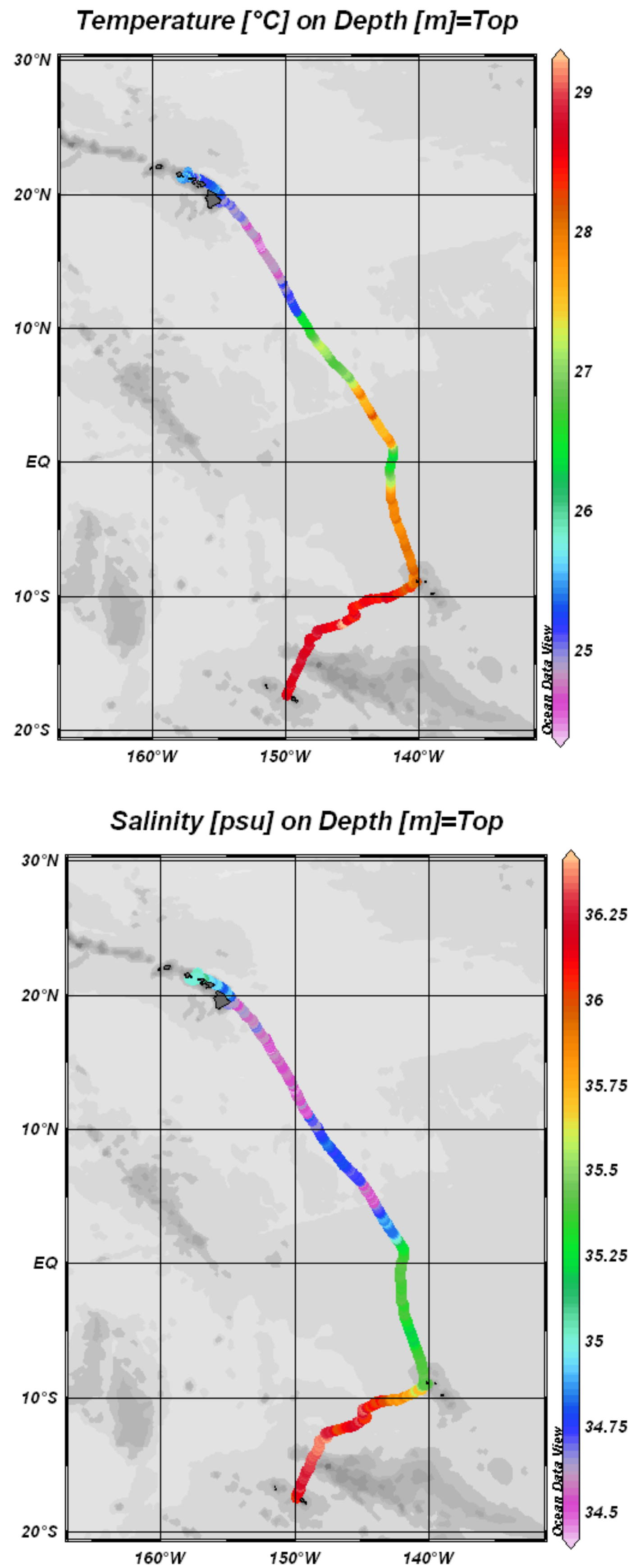


Figure 3. Surface temperature (upper panel) and salinity (lower panel) measurements from the continuous flow-through data logger.

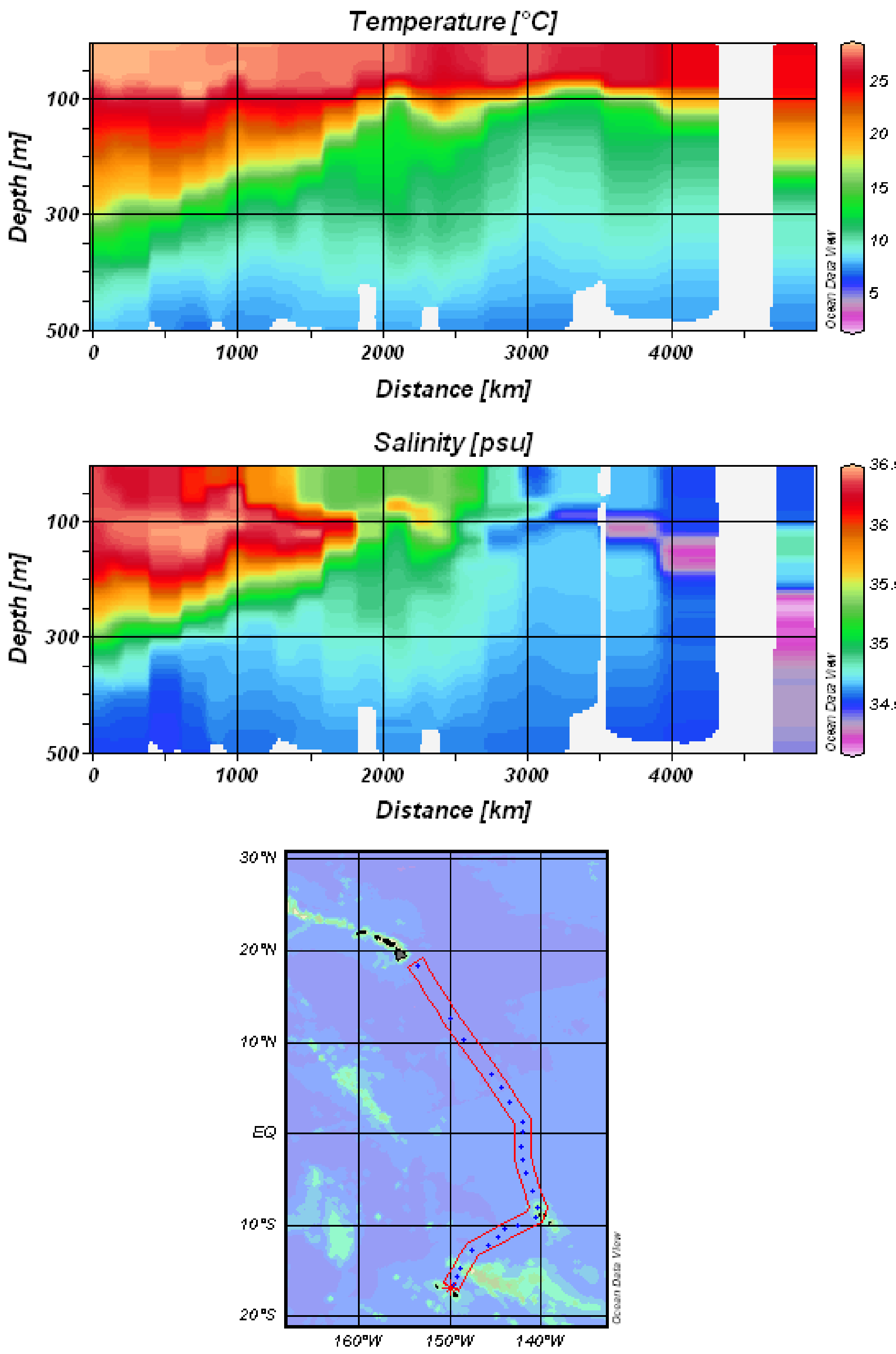


Figure 4. Temperature (upper panel) and salinity (middle panel) cross sections created from CTD data collected along the entire cruise track (lower panel).

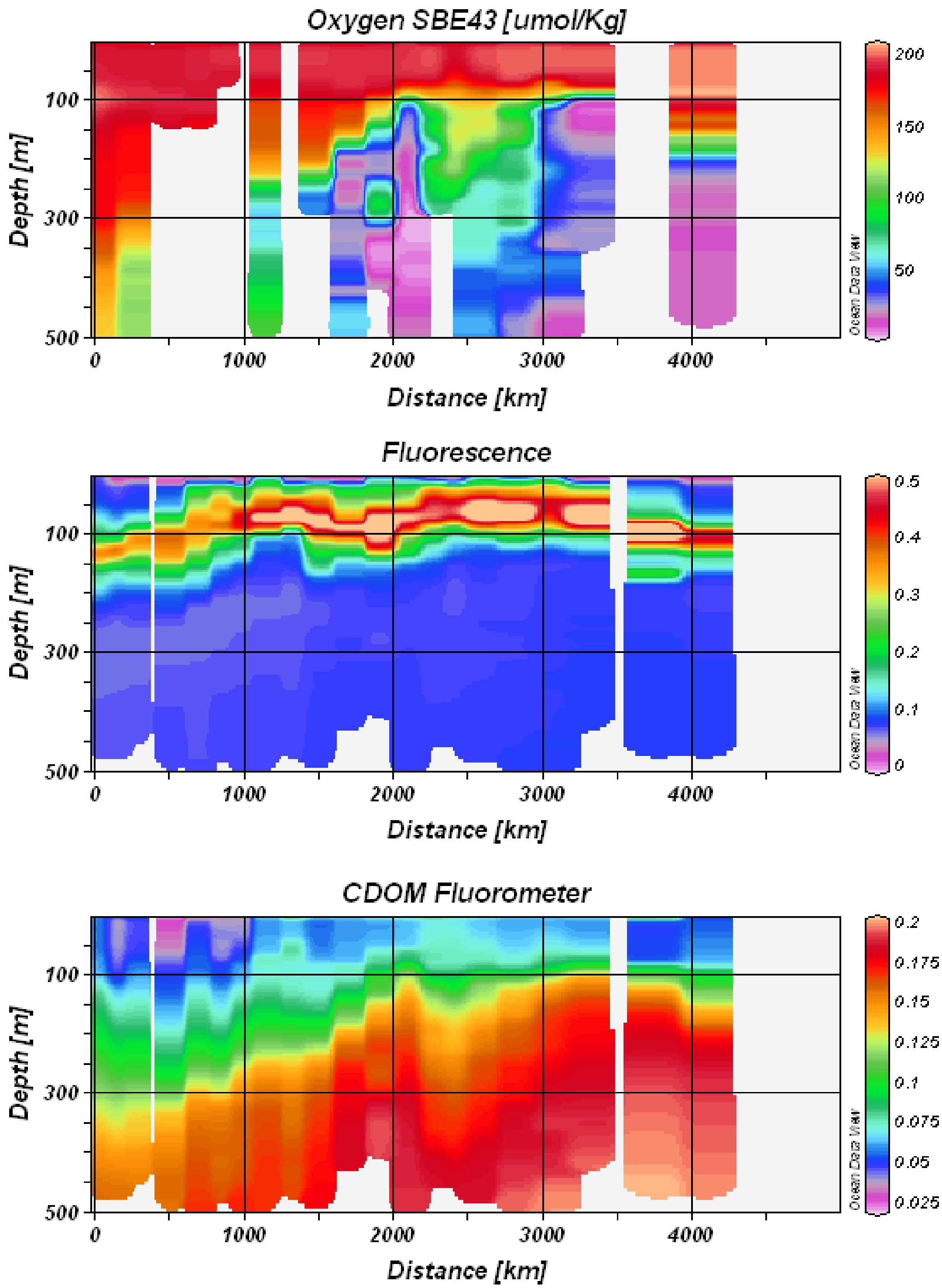


Figure 5. Oxygen (upper panel), raw fluorescence (middle panel), and CDOM fluorescence (lower panel) cross sections created from additional instruments mounted on the CTDs.

Table 5. Hydrocast bottle data.

Station	Bottle	Depth (m)	PO_4 (μM) *	NO_2+NO_3 (μM) *	> 0.45 μm Chl *a* (μg/L) *	pH
001	1	5			0.055	
004	1	876.8	2.389	18.157		
004	2	695.1	2.562	15.062		
004	3	496.5	1.966	15.518		
004	4	447.0	2.129	11.700		
004	5	397.6	1.599	9.065		
004	7	298.3	0.845	3.141		
004	8	248.8	0.208	1.957		
004	9	198.6	0.397	1.324		
004	10	149.3	0.020	0.214		
004	11	99.5	0.377	0.222		
007	6	113.1	0.086	0.554	0.264	
007	12	4.9	0.417	0.302	0.036	
012	1	893.2	2.521	29.945		
012	2	694.4	2.338	24.587		
012	3	496.7	2.226	25.460		
012	4	447.1	2.154	15.796		
012	5	397.5	2.017	12.621		
012	7	347.8	1.676	12.740		
012	8	298.4	1.059	6.672		
012	9	173.6	0.412	1.599		
012	10	109.1	0.270	0.141	0.252	8.077
012	12	39.0	0.020	0.147		
019	"1-6"	119.7			0.251	8.043
019	"7-12"	5.4			0.071	
029	"1-12"	4.5				
032	1	446.4	2.379	16.213		
032	2	396.8	2.399	15.002		
032	3	347.5				
032	4	298.1	2.424	11.867		
032	5	248.0	1.884	6.965		
032	6	199.3	1.013	4.612		
032	7	149.3	0.703	2.721		
032	8	123.6	0.641	2.234		
032	9	99.1	0.596	2.393		
032	10	79.8		0.448		8.801
032	11	50.3				
032	12	20.1	0.382	1.044		
036	1	5				
040	1	79.8	1.068	1.312		
040	2	79.1				8.088
040	7	5.7	1.571	2.510		
045	1	446.1	3.037	12.641		
045	2	347.3	2.880	10.617		

* blank spaces indicate no data collected

Table 5 continued.

Station	Bottle	Depth (m)	PO_4 (μM) *	NO_2+NO_3 (μM) *	> 0.45 μm Chl *a* (μg/L) *	pH
045	3	298.0				
045	4	248.3	3.194	10.220		
045	5	223.8	2.628	10.795		
045	6	198.7	2.853	8.989		
045	7	174.2	1.639	7.205		
045	8	148.9	0.984	3.828		
045	9	124.6	0.859	2.623		
045	10	89.4	0.597	0.583		8.053
045	11	50.1				
045	12	20.1	1.089	3.199		
048	1	99.8				
048	2	94.6				
048	3	89.8				7.996
048	4	83.8				
048	5	79.6				
048	6	73.9				
048	7	70.4				
048	8	64.8				
048	9	59.6				
048	10	54.6				
048	11	50.0				
048	12	46.0				
052	1	447.5	3.256	15.955		
052	2	397.8	3.414	15.756		
052	3	347.2	2.372	15.339		
052	4	297.6	2.984	13.018		
052	5	247.4	2.880	13.712		
052	6	199.1	3.010	13.673		
052	7	173.9				
052	8	150.1	2.921	11.051		
052	9	99.4				
052	10	74.4	1.068	4.233		7.972
052	11	50.0	0.654	2.096		
052	12	19.9				
056	1	70.2	0.906	4.064		8.067
056	7	5.5	0.963	2.957		
061	"1-2"	59.6				7.992
061	"3-12"	4.0	0.785	3.149		
065	1	496.1	3.691	17.535		
065	2	396.4	3.571	16.228		
065	3	347.5	2.832	12.612		
065	4	297.4	2.728	13.406		
065	5	248.4	2.461	12.193		
065	6	199.2	2.267	8.842		

* blank spaces indicate no data collected

Table 5 continued.

Station	Bottle	Depth (m)	PO_4 (μM) *	NO_2+NO_3 (μM) *	> 0.45 μm Chl *a* (μg/L) *	pH
065	7	173.9				
065	8	148.6	1.419	5.468		
065	9	123.7				
065	10	99.4	1.147	6.178		
065	11	64.7	1.084	5.387		8.005
065	12	20.7	0.628	2.798		
068	1	88.4				
068	2	83.9				
068	3	79.7				
068	4	74.8				
068	5	69.9				
068	6	63.8				
068	7	59.2				8.064
068	8	54.1				
068	9	49.6				
068	10	44.6				
068	11	39.2				
068	12	34.9				
072	1	397.1	7.796	18.940		
072	2	347.6	7.429	18.036		
072	3	298.0		16.471		
072	4	248.0	2.843	15.806		
072	5	223.5				
072	6	198.8	3.037	14.729		
072	7	173.7	3.084	15.038		
072	8	149.3	2.424	14.178		
072	9	123.4				
072	10	99.7	2.277	10.401		
072	11	59.6	0.707	0.961		8.058
072	12	20.1	0.325	0.979		
077	1	65.0	1.382	0.928		7.986
077	2	63.7				
077	3	63.2				
077	4	62.6				
077	5	62.3				
077	6	60.1				
077	7	5.1	0.895	0.384		
077	8	4.9				
077	9	5.0				
077	10	5.4				
077	11	5.3				
077	12	5.1				
082	1	397.3				
082	2	124.5				

* blank spaces indicate no data collected

Table 5 continued.

Station	Bottle	Depth (m)	PO_4 (μM) *	NO_2+NO_3 (μM) *	> 0.45 μm Chl *a* (μg/L) *	pH
082	3	119.3				
082	4	114.8				
082	5	109.3				
082	6	103.9				
082	7	99.1				7.972
082	8	94.3				
082	9	88.4				
082	10	79.2				
082	11	69.7				
082	12	19.8				

* 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)	Gelatinous Zoop. Biomass (>2 cm)	Micronekton Biomass (>2 cm)	Plastic Pcs (#)
002	1459	28.6	36.17	3.0	0.002	0.0	0.0	3
005	1619	28.7	36.20	6	0.004	0.0	0.0	0
008	1847	28.8	36.28	2.3	0.001	0.5	0.0	2
010	1328	28.7	36.30	4.5	0.003	0.4	0.0	0
013	1389	28.8	36.29	2	0.001	0.0	0.0	0
014	1976	28.7	36.30	4	0.002	0.0	0.0	0
015	1852	28.4	36.35	1.5	0.001	0.0	0.0	1
017	1689	28.7	36.34	4.0	0.002	0.0	0.0	0
020	1906	28.8	36.35	2	0.001	5.4	0.0	0
021	2390	28.6	36.02	8	0.003	0.0	0.0	0
022	1995	28.7	36.11	6	0.003	0.0	0.0	2
024	1778	28.7	36.28	16.4	0.009	155.0	0.0	4
027	1584	28.6	36.03	17	0.011	2.0	0.0	0
028	1815	28.5	36.32	9	0.005	11.0	0.0	0
030	2154	28.8	36.09	3	0.001	10.0	0.0	3
031	2027	28.6	36.11	36	0.018	8.0	0.5	0
033	1411	28.5	35.84	12	0.009	0.0	0.0	0
035	1408	28.3	35.75	25	0.018	1.0	0.0	0
037	2353	28.2	35.72	27.5	0.012	0.0	0.5	0
038	1996	27.8	35.36	50	0.025	62.0	0.0	0
041	1970	28.2	35.44	22	0.011	0.0	0.0	0
043	1826	27.9	35.39	11	0.006	9.0	0.0	0
046	2254	28.1	35.35	3	0.001	0.0	0.0	0
047	2963	27.9	35.21	12.5	0.004	5.5	0.5	0
049	2241	28.0	35.30	6.75	0.003	0.0	0.0	1
050	2023	27.9	35.38	16.2	0.008	0.0	2.7	0
053	2252	28.0	35.34	7	0.003	1.0	5.0	0
054	2255	27.7	35.36	39	0.017	2.0	5.0	0
057	2426	27.2	35.36	7	0.003	0.0	0.5	0
059	1922	26.6	35.46	21	0.011	95.5	0	0
062	1140	26.6	35.42	11	0.010	0.0	0.0	0
063	3308	26.3	35.36	22	0.007	135.0	170.0	0
066	1861	27.3	35.24	33	0.018	0.0	0.0	0
067	2676	27.5	34.83	75	0.028	72.0	18.0	0
069	1698	27.9	34.88	15	0.009	1.0	0.0	0
070	2957	27.7	34.73	175	0.059	35.0	45.0	1
073	2003	27.7	34.57	15	0.007	1.0	0.0	0
074	2150	27.5	34.58	80	0.037	3.0	26.0	0
075	2267	27.1	34.72	27	0.012	0.0	10.0	0
079	2121	26.8	34.75	32	0.015	1.5	1.9	0
080	2599	27.0	34.77	31.0	0.012	2.0	2.0	1
083	1926	24.9	34.52	8.0	0.004	16.0	1.0	0
084	1476	24.9	34.54	4.0	0.003	0.0	0.5	0
085	2519	24.8	34.56	2.3	0.001	2.1	0.5	0

Table 6 continued.

Station	Tow Length (m)	Temp. (˚C)	Salinity (ppt)	Zoop. Biomass (ml)	Zoop. Density (ml/m^2)	Gelatinous Zoop. Biomass (>2 cm)	Micronekton Biomass (>2 cm)	Plastic Pcs (#)
086	2514	24.9	34.57	4.0	0.002	4.0	3.0	0
087	2511	25.0	34.49	1.5	0.001	1.0	0.5	1
089	1846	25.0	34.63	17.2	0.009	10.0	1.5	0
090	1511	25.0	34.51	1.0	0.001	0.0	0.0	0
091	1954	25.4	34.89	21.0	0.011	0.0	0.0	1
092	1849	25.3	34.95	16.0	0.009	7.0	4.0	1
093	2499	25.7	35.02	6.8	0.003	0.2	0.2	0

Table 7. 2-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)	Notes
010	60	1	1125.5	333	12.0	0.011	
015	303	1	2218	333	9.0	0.004	
017	64	1	1688.7	333	100.0	0.059	
035	50	1					misfire
043	68	1	2123.7	333	92.0	0.043	
059	61	1	2452.6	333	247.0	0.101	
079	58	1	2789	333	368.0	0.132	
094	750	2.49	7014.9	1000	211	0.012	net 3 did not close

Scientific Results: Student Abstracts

Marine virus decay by UV radiation in the Equatorial Pacific.

Erin Child

The effect of UV Radiation on marine viruses was examined along a cruise track from Tahiti (17˚ 32' S) to Honolulu, Hawaii (21˚ 18'N) on board the Robert C. Seamans. Marine viruses are the largest biological entity in the oceans and in the surface waters are the predominate cause of bacteria mortality. The relationship between bacteria and viruses is important in the context of the microbial loop as the viruses lysing of bacteria increases the amount of dissolved organic matter (DOM) in the loop which sequesters the DOM from larger grazers. In this study the decay of viruses, how they are rendered unable to infect, was examined using UV radiation. Filtered marine viruses in seawater were place in 100% sunlight over the course of 8 hours, samples were taken at various time increments and incubated with a bacteria culture, *Synechoccocus*. These cultures were counted and growth rates for bacteria and bacteria with the viruses were determined. The mortality rate of the bacteria was graphed as a function of UV exposure time. The results showed that the bacteria mortality did decrease as the UV exposure of the viruses increased. The data also revealed a threshold point around time 4-5 hours where the viruses were no longer lysing the bacteria and before the bacteria growth increased.

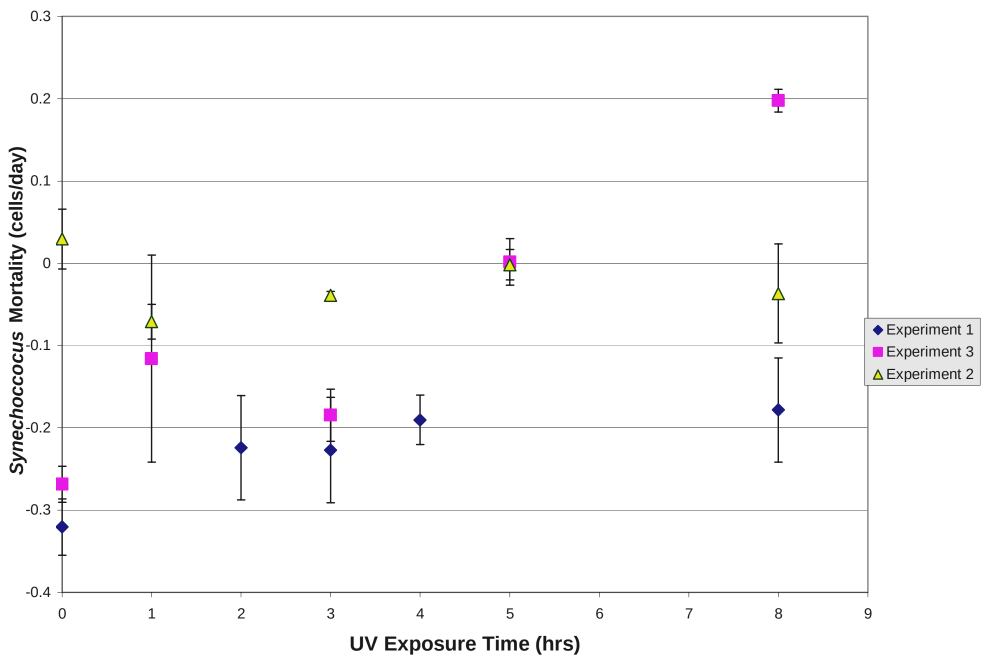


Figure 6. Average viral induced mortality rate of the *Synechococcus* (cells per day) as a function of virus UV exposure time. Time increments for experiment 1 are 0, 2, 3, 4, and 8 hours. Time increments for experiments 2 and 3 are 0, 1, 2, 3, 5, and 8 hours. Error bars represent standard error.

Nutricline analysis of surface and deep nutrients in the Equatorial Pacific.

Priya Deka

Areas of geostrophic upwelling are the main source for nutrient circulation in the equatorial pacific. The nutricline becomes shallower in this area of upwelling and nutrients enter the wind mixing layer where they can be redistributed for phytoplankton productivity. The objective of the research was to sample nutrient concentrations at a series of depths across an area of upwelling to determine any significant, demonstrable relationships between nutrient concentration, nutricline depth and the ratio of nutrients at the surface and depth in areas of upwelling. Research confirmed the nutricline occurring at shallower depths as the cruise track crossed an area of geostrophic upwelling. Data also confirmed that the ratio of deep to surface nutrients diminished as the nutricline occurred at shallower depths. However, further extrapolation and sampling are necessary to fully determine a steadfast relationship, and whether the ITCZ is a more appropriate latitude to expect the trends to reverse.

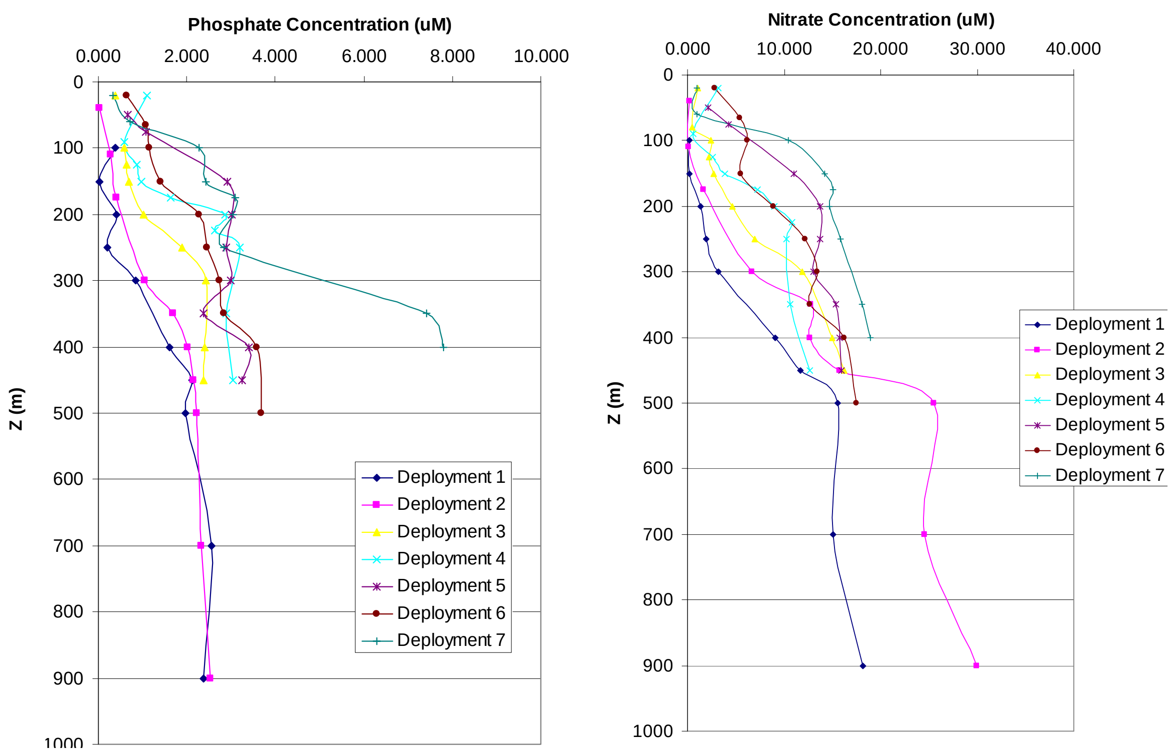


Figure 7. Phosphate and nitrate concentration profiles for each of the 7 stations.

The effects of zooplankton density and current fronts on Pacific Ocean *Halobates* distribution.

Nova Ewers

The goal of this research was to determine the relationship of zooplankton density and frontal boundaries to the distribution of *Halobates* along a cruise track from Tahiti to Hawaii. It was hypothesized that zooplankton density would be insignificant, while frontal boundaries would be directly related to *Halobates* densities. The ADCP and thermosalinograph, monitoring the flow-through water, were used to map the South Equatorial Current, the Equatorial Countercurrent, and the North Equatorial Current. The findings supported the hypothesis. No correlation was found between *Halobates* density and zooplankton density, whereas the latitudinal positions of peaks in *Halobates* density correlated with frontal boundaries.

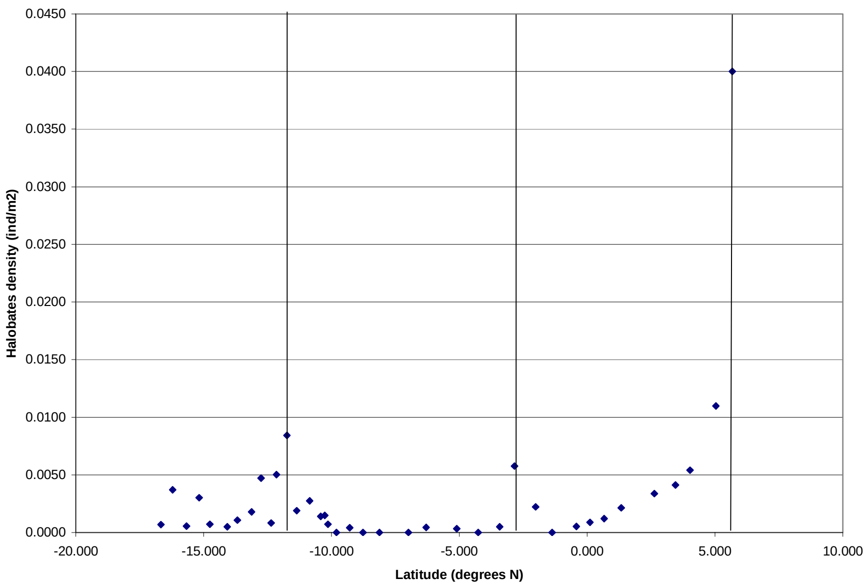


Figure 8. Neuston tow latitude positions in degrees N, where *Halobates* were collected. Vertical lines indicate latitudes of high density.

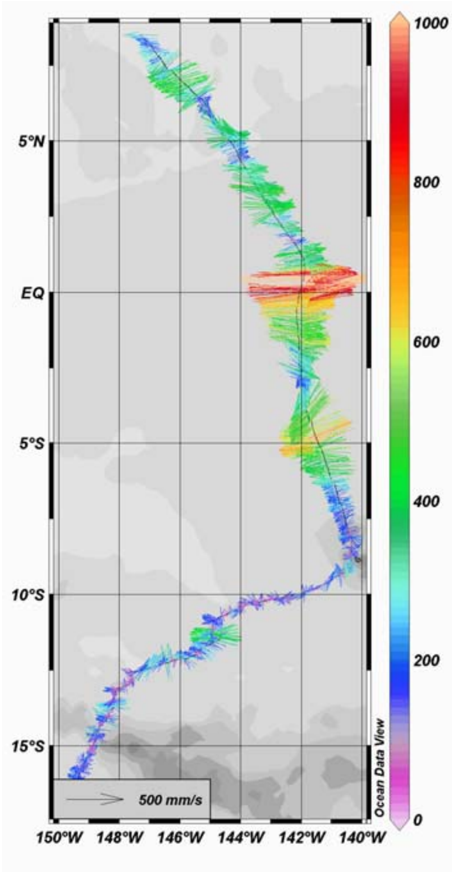


Figure 9. ADCP current data. Arrows indicate direction, length of arrow and color indicates magnitude of current. Change in current direction corresponds with high *Halobates* density.

The carbon footprint of the *Robert C. Seamans* along cruise track S-217 from Tahiti to Hawaii.

LeeAnne French

The objective of this study is to measure the greenhouse gas emissions or “carbon footprint” of the Robert C. Seamans, cruise track S-217, in route from Tahiti to Honolulu. I measured the three primary sources of emissions: the crew and student air travel to Tahiti and from Honolulu, engine and generator diesel usage, and food and beverage consumables. This study does not analyze nor does it burden the cruise with carbon emissions from the support team at SEA headquarter in Woods Hole, MA. The total carbon footprint for the cruise track was 169.96 metric tons of CO_2 and due to the relative efficiency of a sailing vessel, air travel to/from port constituted 77% of the total or 131.67 metric tons of CO_2 emissions. Diesel usage contributed 26.45 metric tons of CO_2 or 16% of the total carbon footprint and the impact from food and beverage consumables was 11.84 metric tons of CO_2 representing 7% of the total carbon footprint. Suggestions on how SEA could reduce and remediate the carbon footprint from this and future cruises are also included.

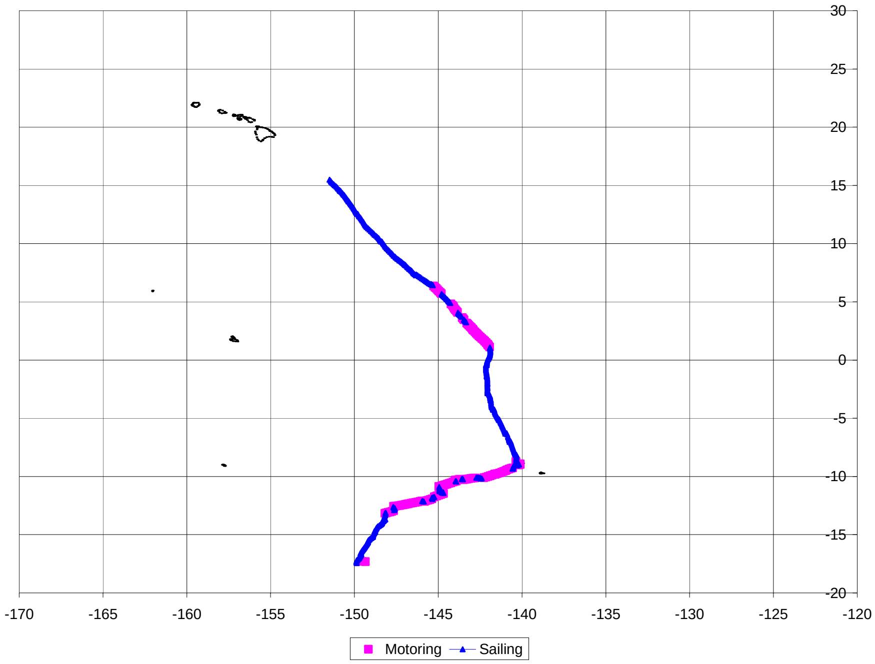
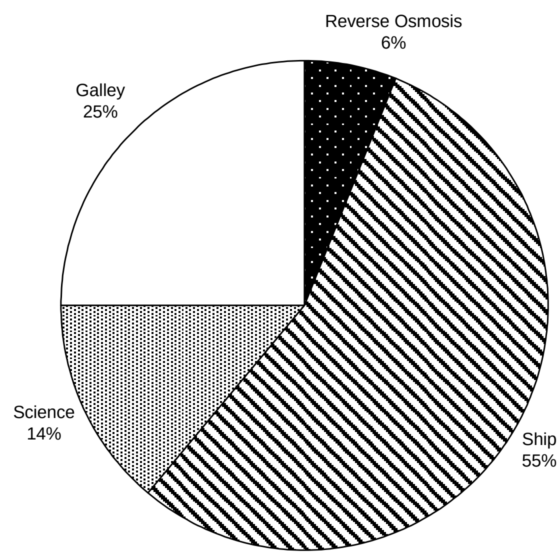


Figure 10. Cruise track S-217 Papeete, Tahiti to Honolulu, Hawaii via Nuku Hiva. From May 9 through June 7, 2008, the Robert C. Seamans motored 118.1 hours covering 780 nautical miles, while she was under sail 578 hours covering 1,867 nautical miles. The Seamans saved 1,340 gallons of diesel while sailing, resulting in a savings of 13.54 metric tons of CO_2.

Figure 11. Percentage emissions attributed to generator subsystems. The total CO_2 emissions from the use of the two generators aboard the Robert C. Seamans are 14.54 metric tons. The reverse osmosis water making system is accountable for 6.6 % or 0.9 metric tons of CO_2, the ships machine room and subsystems account for 55%, 8.02 metric tons of CO_2. Science produces 2.0 metric tons or 13.75% of the CO_2 emissions produced by the generator and the Galley was accountable for 25% of the generator’s emissions or 3.57 metric tons of CO_2.



The effect of pH on the photosynthetic efficiency of marine phytoplankton.

Hannah Green

Ocean acidification due to anthropogenic carbon emissions is alternately expected to harm phytoplankton or to aid their photosynthesis. This study tested the hypothesis that phytoplankton would experience greater photosynthetic efficiency in areas of lower pH, due to the higher concentrations of $CO_{2(aq)}$ in those areas. Samples were collected from the deep chlorophyll maximum (DCM) and analyzed spectrophotometrically for pH and fluorometrically for photosynthetic efficiency. The results nullified my hypothesis, finding instead a positive correlation between photosynthetic efficiency and pH. These findings have important implications given the projections of continued decreases in ocean pH with continued global carbon emissions.

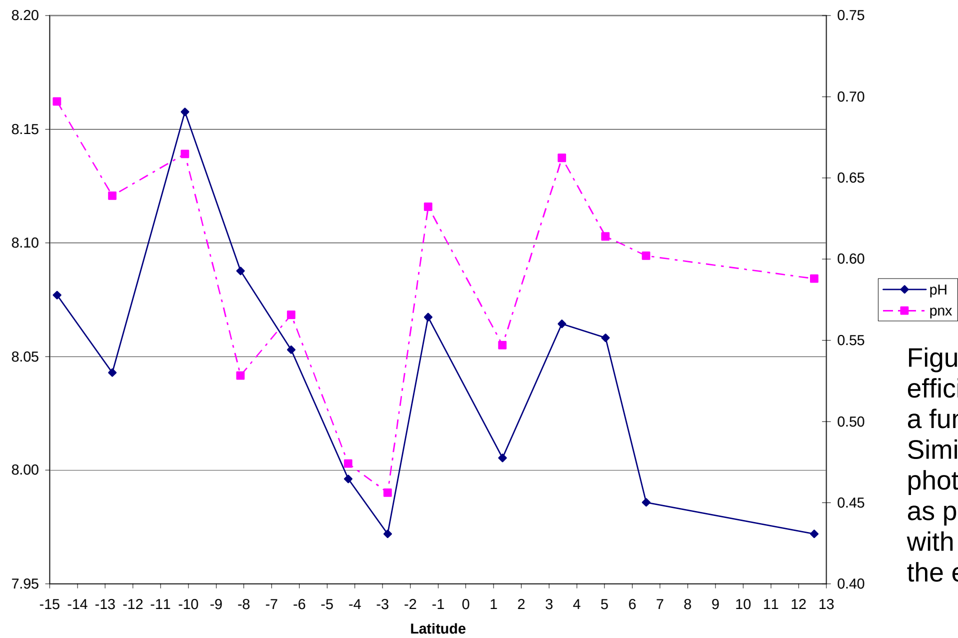


Figure 12. Photosynthetic efficiency (pnx) and pH as a function of latitude. Similar trends in pH and photosynthetic efficiency as plotted against latitude, with a minimum in both at the equator.

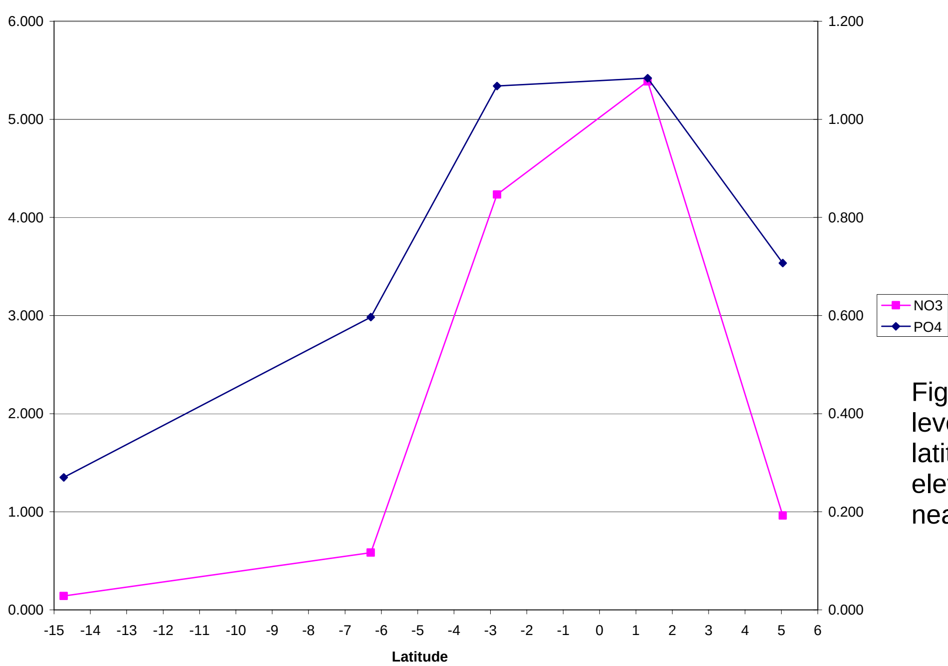


Figure 13. Nutrient levels as a function of latitude, indicating elevated nutrient levels near the Equator.

Microplasitc content in zooplankton diet.

Isaac Hur

Toxic substances in plastic may pass on to the food chain due to bioaccumulation at the lowest trophic levels. This paper tries to realize the potential plastic consistency in zooplankton diet assuming that the zooplankton are feeding non-selectively. This was done by collecting 500 mL samples each for both microplastic and phytoplankton from 14 degrees south to 6 degrees North in the Pacific Ocean. Both samples were then put through a .45 micron filter in order to make sure particles were of similar size (microplastics are >1.6 micrometers). Once data was collected at surface stations for both, a ratio was created for microplastics to phytoplankton. This ratio indicated the amount of plastic and phytoplankton that were available to be consumed by the zooplankton. If the zooplankton were feeding non-selectively, this ratio can also be considered to be the diet distribution as well. The microplastic distribution fluctuated throughout the latitudes while the phytoplankton distribution fluctuated as well until the equator where it experienced a sudden dropoff. These two factors affected the ratio at different latitudes. Certain areas contained a smaller number of microplastic because of currents, causing the ratio to go as low as .032 microplastic pieces per mL to phytoplankton cells per mL. At the equatorial region, the ratio reached a high of .6 because of the small number of phytoplankton. While the ratios did not follow a specific trend through the latitudes, they were affected by currents and phytoplankton distribution.

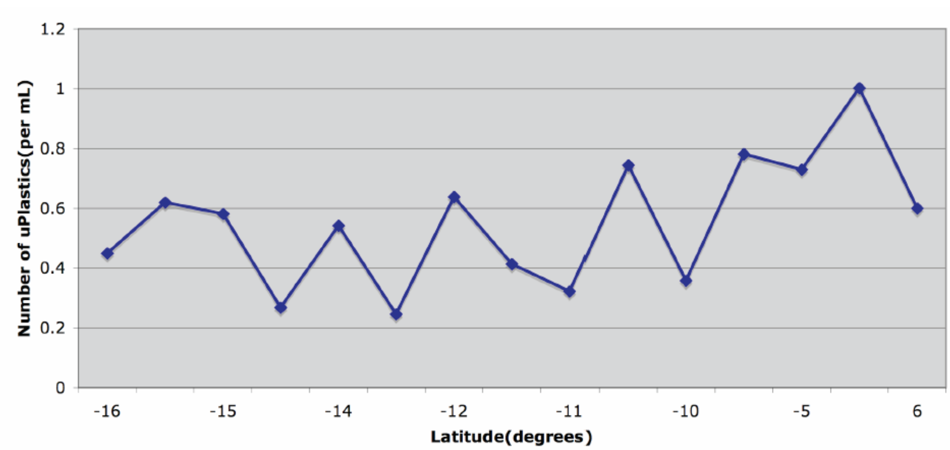


Figure 14. This figure shows the distribution of microplastic that was collected at 16 different surface stations throughout the latitudes.

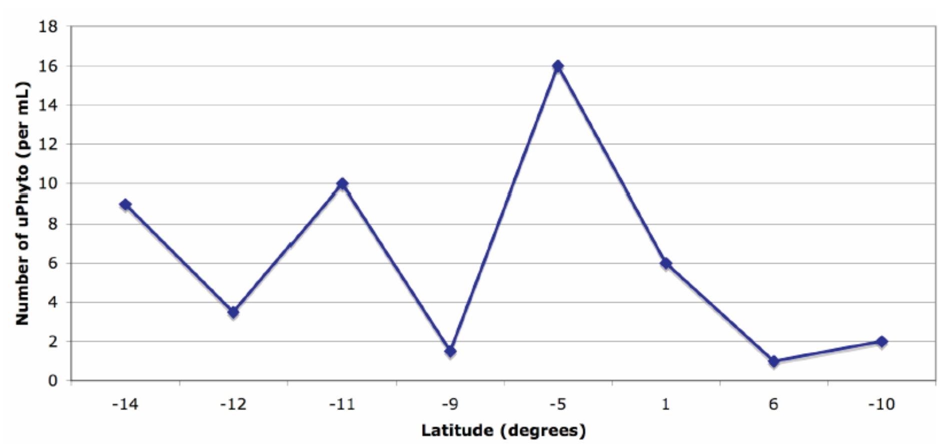


Figure 15. The number of phytoplankton per mL at the surface stations fluctuates towards the equator.

Physalia physalis dimorphism as related to areas of productivity from the latitudes of 20° N to 20° S within the central Pacific ocean.

Chris Kleinknecht

Physalia physalis, also known as the Portugese man-of-war, is a colony of hydrozoans with a bulbous float which acts as a sail, and whose movement is largely based on oceanic current and surface winds. They display dimorphism, or mirrored forms, and are classified as either right handed or left handed. This study addresses the bulbous float and its mirrored orientation in the Northern and Southern hemispheres as related to areas of upwelling and productivity. The float assists in their ability to maintain course in high productivity zones, whereas they otherwise would be swept out of these zones by surface current. Right handedness would be preferable in south easterly winds, where the opposite is true in a north east wind. In this study, twice daily neuston tows were deployed to collect *Physalia physalis* samples and compared to zooplankton density and wind direction at time of each tow. Results indicate that right handed man-of-war occur more frequently than their left handed counter parts, and that an increase in man-of-war density is observed in lower latitude high productivity waters. A shift in handedness is not observed from southern to northern hemisphere as hypothesized.

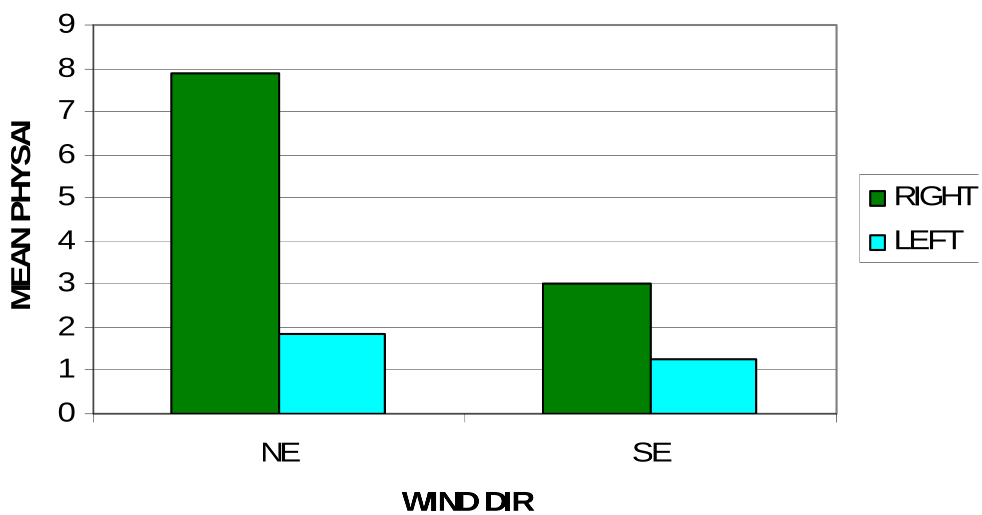


Figure 16. Mean *Physalia physalis* density and handedness versus wind direction.

Competitive bioluminescence among zooplankton.

Andrei Lojek

It is suggested that bioluminescence acts as a sort of alarm system for zooplankton within the ocean. It has been found to lower predation rates among certain species of zooplankton. Other research suggests that plankton could be competing to stand out in an environment among other bioluminescent life forms. This research paper was designed on the premise that zooplankton respond to high zooplankton density by raising their level of bioluminescence. In those areas the need to compete with other luminescent plankton is raised. The resulting data from this study show a positive correlation between the zooplankton density and the bioluminescent counts per individual at 50m depth. However, a negative correlation was found at the surface, which could be related to outside factors affecting the data, such as ambient surface light.

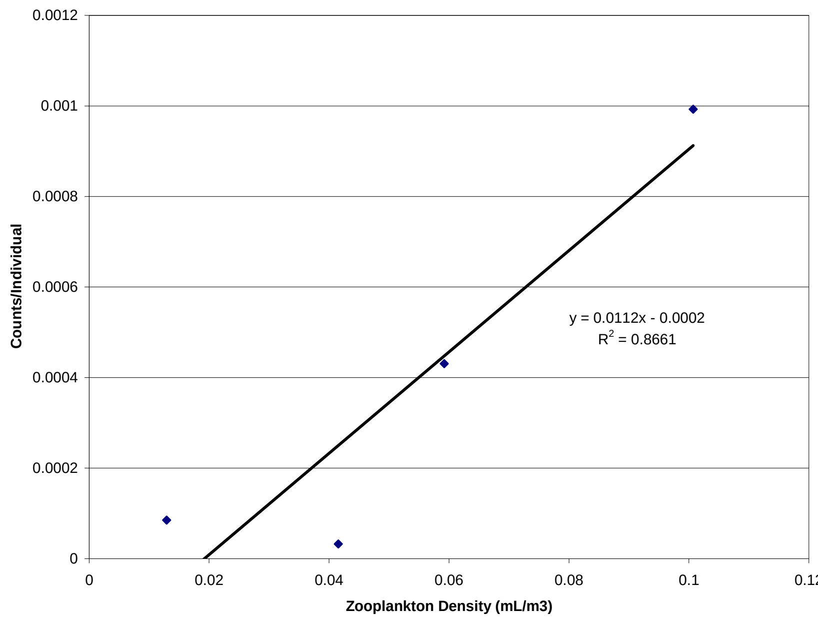


Figure 17. Number of the luminescent counts per individual versus zooplankton density from 50 meters depth.

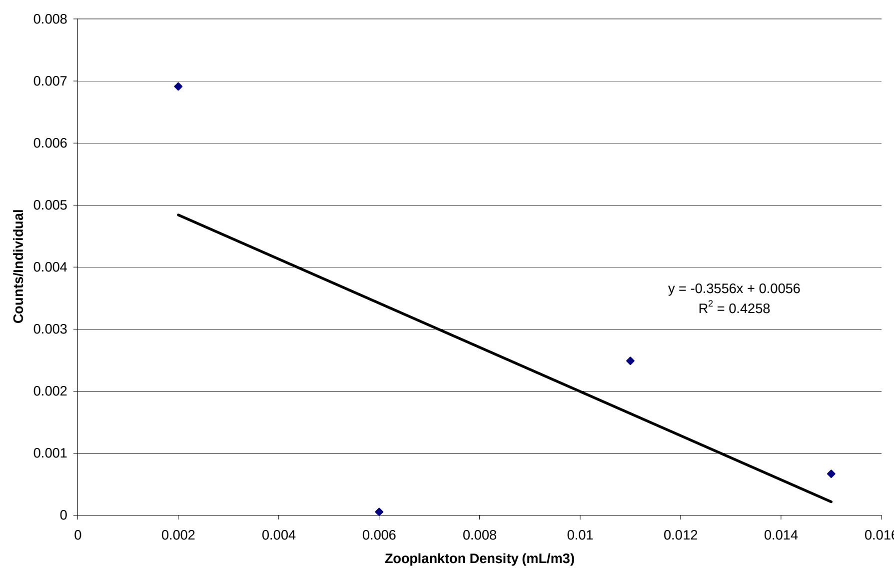


Figure 18. Number of the luminescent counts per individual versus zooplankton density from surface samples.

Phytoplankton production in surface and DCM waters of the equatorial Pacific.

Ed Mack and Brittany Mauer

As an important factor in reducing anthropogenic CO_2, phytoplankton in the equatorial Pacific demands more attention. In this study, a thorough analysis of how primary production rates are affected by depth, nutrient concentration, and latitude is conducted to help in this understanding. Biomass samples were taken from waters at the surface and deep chlorophyll maximum (DCM). Incubation experiments were run to detect phytoplankton growth rates and primary production. It was found that the deep water close to the equator had a greater biomass than that from the surface. A positive correlation between biomass concentration and nutrient concentration was identified. Due to these factors primary production from these waters was highest. Results supported the hypothesis that nutrients, appropriate light levels and latitude influenced the rate of primary production of phytoplankton.

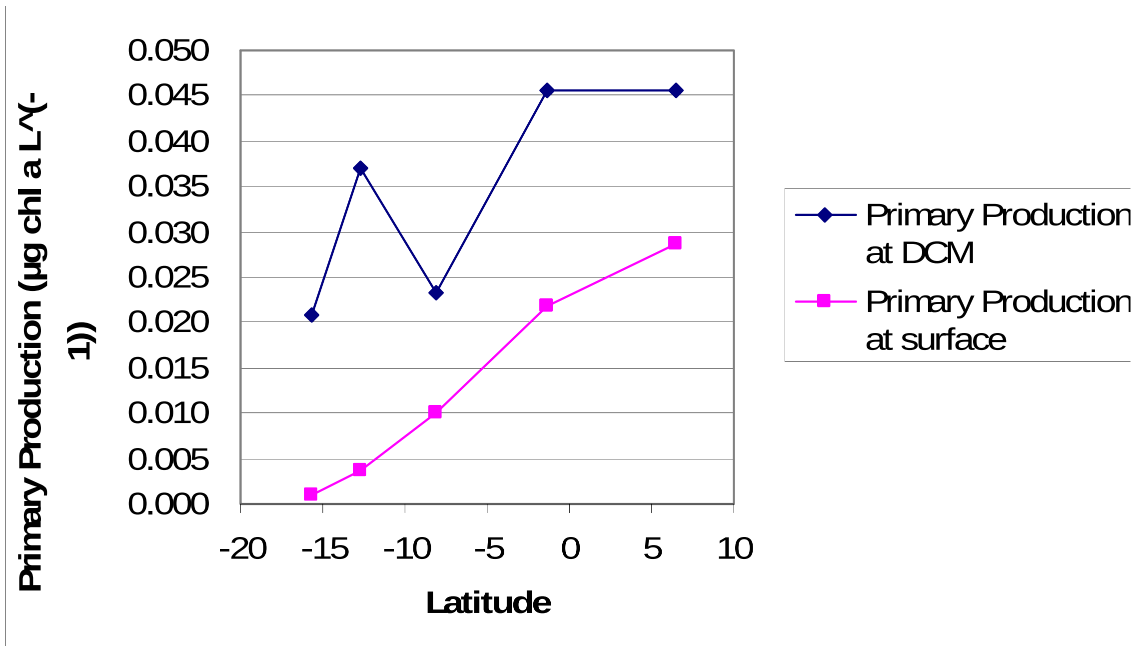


Figure 19. Primary production over latitude. The darker line represents samples from the DCM while the lighter line represents samples from surface waters. Primary production at the DCM is higher than primary production in surface waters. The lower latitudes had lower initial chl-*a* values, resulting in lower production even though the DCM growth rates were higher.

Diel vertical migration of copepods resulting from light intensity and UV radiation.

Dierdre Madsen and Marley Weaver

Predator evasion and UV radiation are two of the most commonly hypothesized reasons for the diel vertical migration of copepods. However, little is known about which is more influential to the migratory behavior of the copepods. We tested the predator avoidance hypothesis by comparing the percentages of different sized and colored copepods at the surface during the night with the moon phase during that tow. We tested the UV radiation hypothesis by comparing the percentage of translucent copepods at the surface during the day with the cloud cover during that tow. After 39 Neuston tows split between day and night, we found that cloud cover had no correlation with the percentage of translucent copepods at the surface proving that, despite previous research, UV radiation has no influence on the DVM of copepods. The moon phase, however, had a very strong correlation with the percentage of different copepods at the surface proving that predator avoidance is extremely influential to the DVM of copepods. Different types of copepods showed varied styles of DVM depending on their size and color only further backing up our hypothesis.

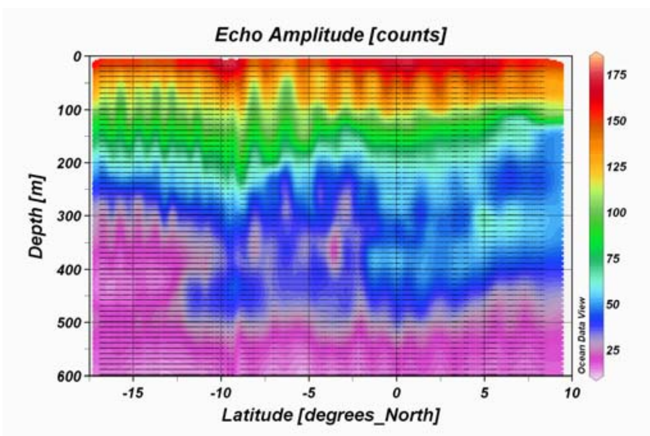


Figure 20. Acoustic Doppler Current Profiler (ADCP) projection of average zooplankton migration from 0-600m in latitudes 15º S to 10º North.

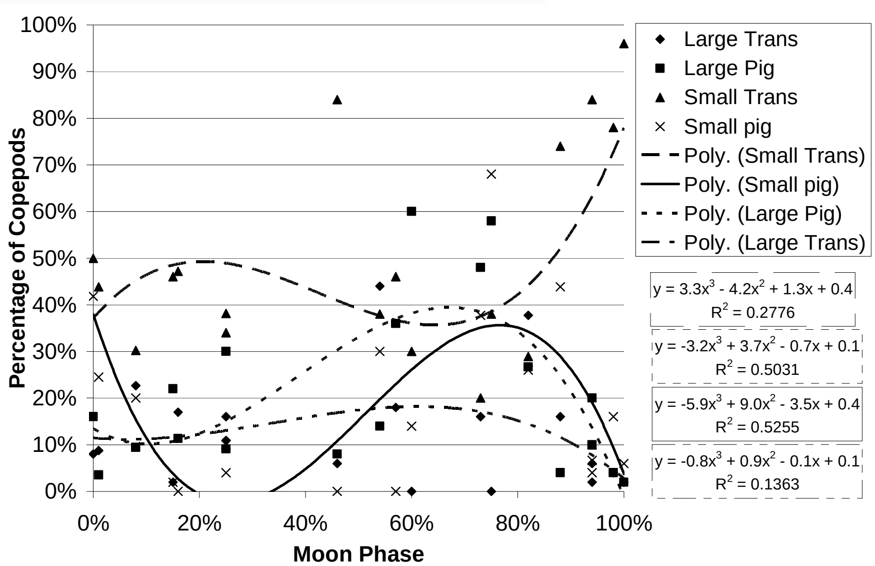


Figure 21. Nighttime average percentages of large translucent, large pigmented, small translucent, and small pigmented throughout the moon phases. Moon phase is used as a measurement of light level without radiation.

Comparing historical methods of measuring sea surface temperature along a Central Equatorial Pacific transect.

Robin Matthews

Methodologies for measuring Sea Surface Temperature (SST) have advanced dramatically over the past century; from sample collection using wood and canvas buckets to the introduction of buoy and satellite measurements. Applying corrections to centennial SST datasets to account for these transitions is especially relevant to the tropical Pacific where the two major records show opposite trends. It is vital that the discrepancies between these records are accounted for and corrected in order to make reliable predictions for how this region is likely to respond to global warming in the coming decades.

In this project SSTs were recorded along a transect of the Central Equatorial Pacific from ~17°S to ~3°N. A probe thermometer was used to measure the temperature of surface seawater samples collected in a wood (pine), canvas and Zubrycki (rubber scientific) bucket. Corresponding SSTs for each of the 311 bucket stations undertaken were obtained from a continuously monitoring hull-mounted flow-thru thermosalinograph system. SSTs were found to typically fall within the range 28.0 to 29.8°C and to follow a diurnal cycle. My hypothesis was that there would be a significant difference between the SSTs measured using the canvas and wood buckets but that the canvas and Zubrycki bucket SST measurements would be insignificantly different. No significant differences were found between any of the three bucket SST datasets. Deviations of the canvas bucket temperatures from the wood bucket at bucket stations were found to be independent of the hour of measurement.

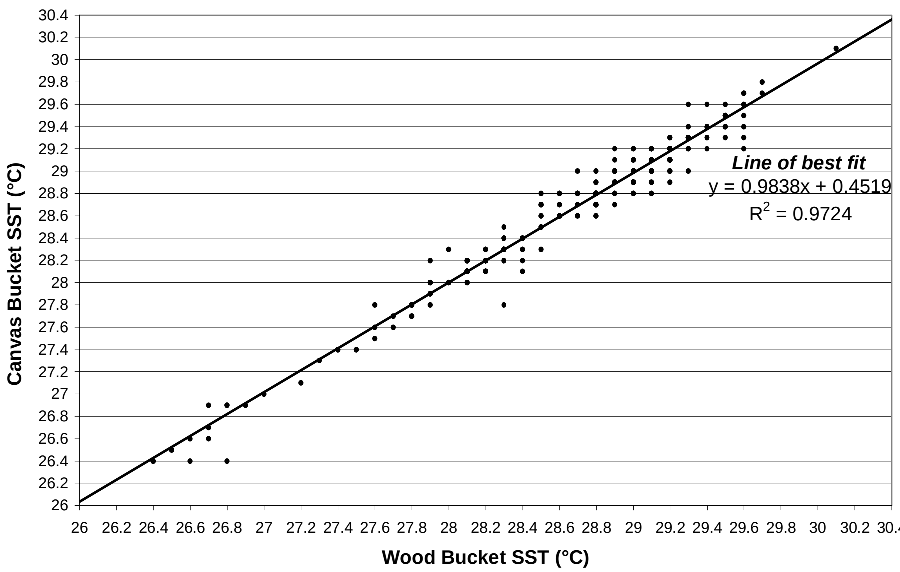


Figure 22. Canvas bucket sea surface temperature v wood bucket sea surface temperature.

Copepod fecal pellet transport of POC from the surface ocean through the mixed layer in the Equatorial Pacific**.**

Carissa McQueen

This study analyzed copepod fecal pellet production to determine transport of particulate organic carbon from the mixed layer in the Tropical Pacific Ocean. Samples were taken from a S-N transect from Tahiti to Honolulu using a Neuston Tow and a fecatron collection method. The pellets were analyzed for volume, sinking rate, and carbon content. The mixed layer depth and carbon decay rate were used to determine total carbon export per copepod per hour. The copepod density then yielded a carbon export rate for the surface ocean. Individual export rates ranged from 0.23-0.67 ng of C per copepod per hour. The surface export rate ranged from 5.08E-4 to 2.31E-3 ng of C per square meter per hour. At these locations, the average export is 3997 ng of C per square meter per year.

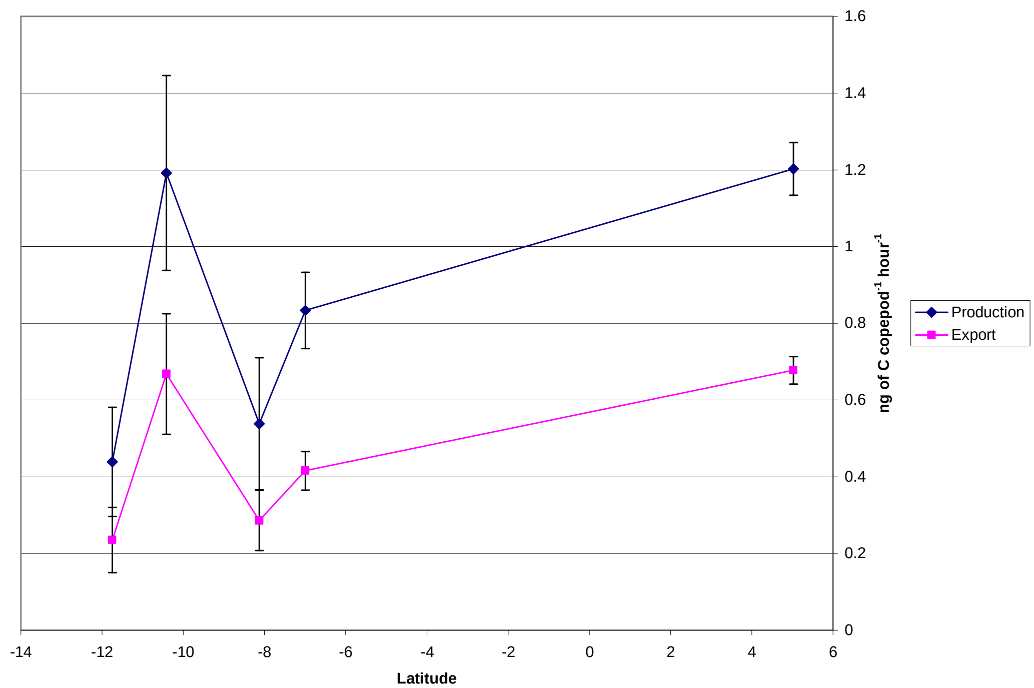


Figure 23. Latitudinal variation in individual copepod carbon production and carbon export calculated in ng of C copepod^{-1} hour^{-1}. Standard error is indicated. Decreased error in more northerly samples is attributed to greater precision in measurement and collection techniques.

Effect of mircrozooplankton grazing control on primary production in equatorial upwelling zones and oligotrophic zones in the Pacific.

Markeith Pilot

In order to understand the importance of microzooplankton, and the gap in the trophic levels between picoplankton and mesoplankton, the grazing rate of microzooplankton and size selectivity will be examined. The grazing impact will be compared between the subtropical gyres and equatorial upwelling zone. It would be expected that the grazing rate of microzooplankton will be greater in the oligotrophic zones than in the equatorial upwelling zones, for picoplankton and the microbial loop are more integral for life in regions of downwelling than in regions of upwelling. Making use of the dilution experiments devised by Landrey and Hasset in 1982, the eutrophic and oligotrophic waters of the south pacific will be tested. It is found that microzooplankton have a greater grazing impact upon phytoplankton in the subtropical gyres than the equatorial regions.

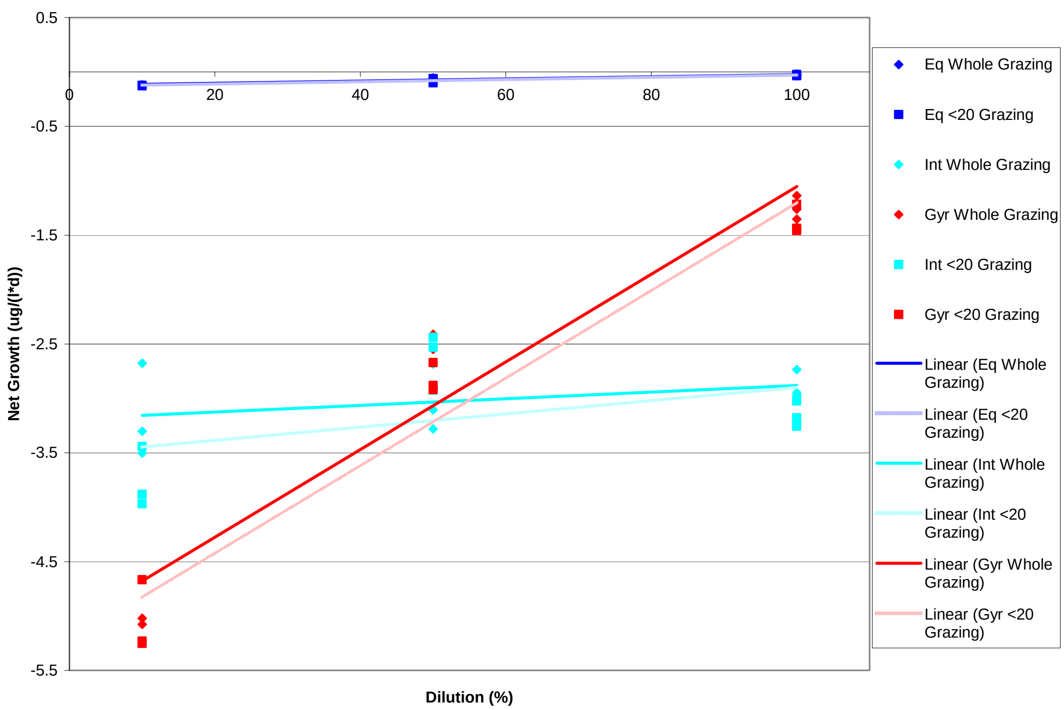


Figure 24. Net growth rate vs dilution results from the three experiments: within the subtropical gyre (Gyr) at latitude 16°39.3' S, the intermediate latitude (Int) at 10°24.0' S, and the equatorial latitude (Eq) of 0°7.3' N. The slope is the zooplankton grazing rate, and the y-intercept is the growth rate of phytoplankton. The diamonds represent <200µm cultures (Whole), and the squares represent <20µm cultures (<20). The grazing rates between the <20µm and Whole are generally parallel.

pH levels across the Equatorial Pacific and concentrations of calcifying marine organisms.

Marcie Ristich

Increased atmospheric CO_2 concentration due to anthropogenic practices is causing our Earth's oceans to become more acidic. It is unknown what effect decreasing sea surface pH will have on the marine environment. Prior lab experiments and computer generated scenarios suggest that decreasing ocean pH could have serious impacts on the marine ecosystem, species stability, and food web dynamics. In an effort to gain more in situ knowledge of ocean acidification a study of its effect on calcifying organisms was conducted along a transect of the equatorial Pacific. Neuston tows and surface water samples were collected concurrently twice daily during the months of May and June. Biomass samples from the neuston tows were analyzed for foraminifera and pteropods ratios. Surface samples were analyzed for pH using the spectrophotometric m-cresol purple indicator method (Clayton, 1993). A positive, but not statistically significant correlation was found between ratio of pteropods and pH level. The author proposes that a significant relationship may not have been observed because exposure of pteropods to lower pH waters affects their ability to form their shells, but does not cause mortality. If this is true then an effect on the ratio of pteropods would not be immediately observed. Limitations to this study are discussed and suggestions for future research are offered. Further studies should include more low pH samples and, if possible, use high resolution scanning microscopes to determine if exposure to lower pH waters is having an effect on shell formation.

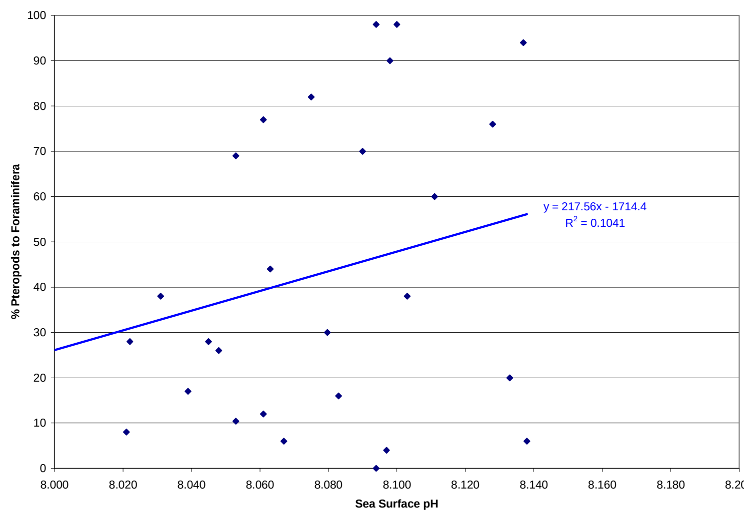


Figure 25. Percent of pteropods observed in biomass 50 counts of pteropods and foraminifera relative to sea surface pH values.

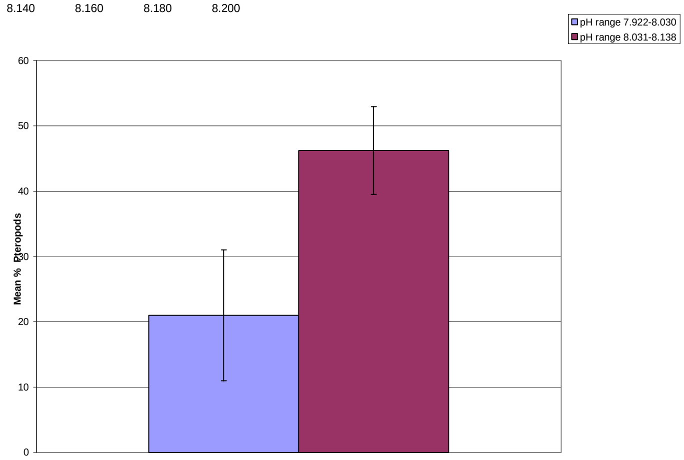


Figure 26. Mean percent pteropods observed in biomass 50 counts of pteropods and foraminifera within pH range 7.922-8.030 and 8.031-8.138.

Chromophoric dissolved organic matter concentrations in the open ocean.

Eddie Strandberg

Since CDOM absorbs light, its effects on production and relationships with salinity and light absorbance in the water column are possibly notable. Measuring these things in situ in an open ocean environment away from land gives a new perspective on the subject. This study investigated factors influencing and influenced by CDOM in the water column. Due to upwelling and evaporation, CDOM shares little that is generally in common with salinity. CDOM does not affect production or light absorbance at the surface of open ocean regions because of lack of upwelled CDOM when compared with coastal environments.

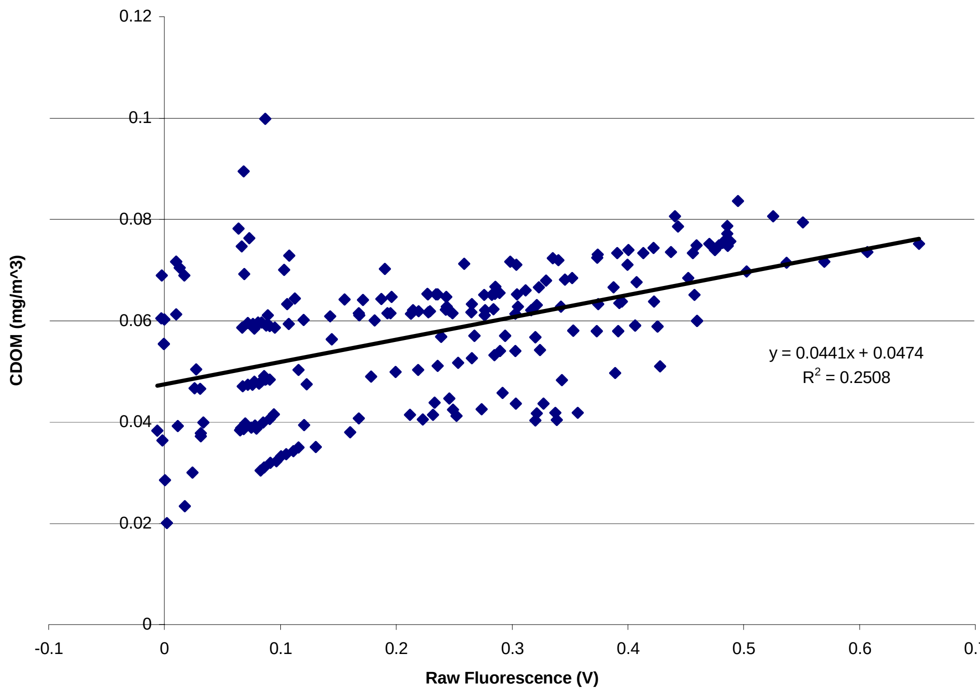


Figure 27. shows a direct relationship between CDOM and raw fluorescence.

The relationship between salp density and density of their prey.

Eliah Thanhauser

This study looks at the impact of salp grazing on the food web in the pelagic South Pacific. During this study data was collected on a transect from Papeete, Tahiti to Honolulu, Hawaii. The purpose of this study was to look at the relationship between salp density and the density of phytoplankton and zooplankton. Salp densities increase with latitude. Salp density is not directly correlated to chl-a concentration, however salp density increases slightly as zooplankton density increases. Samples lacking salp biomass occurred mostly near Tahiti, but also occurred sporadically throughout the cruise track. Future studies in this field may take multiple samples from sampling locations over the course of several days to determine the growth rate of salps, zooplankton and phytoplankton in each location. With this information much more could be understood about how salps impact the food web.

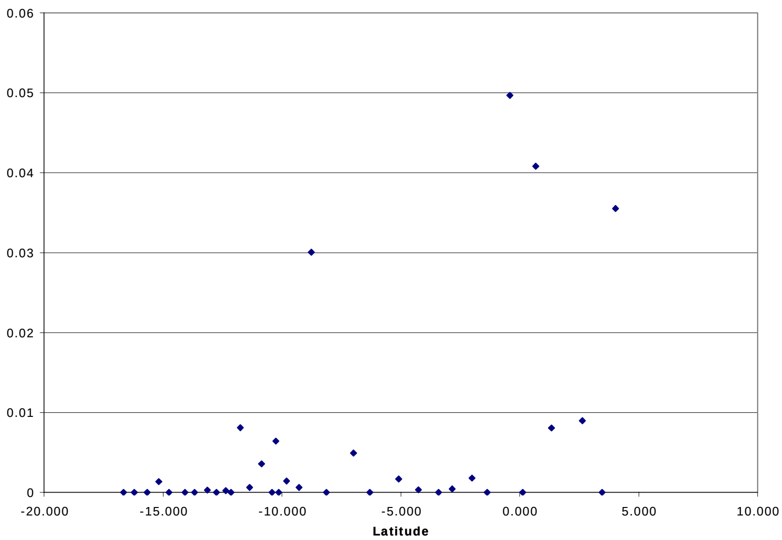


Figure 28. Salp density and latitude.

Figure 29. Salp density in relation to zooplankton density, tows with no salp biomass are excluded.