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**PHYSICAL, CHEMICAL AND BIOLOGICAL MEASUREMENTS
OFF PUERTO RICO**

Appendices

By

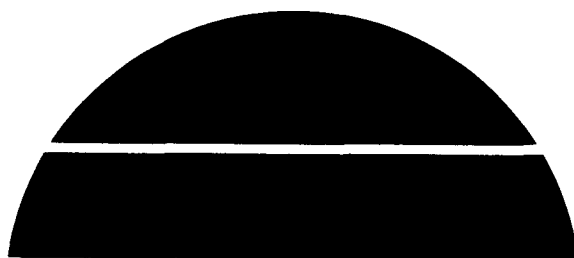
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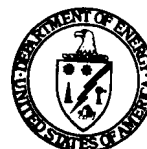
October 30, 1981

Work Performed Under Contract No. W-7405-ENG-48

**Lawrence Berkeley Laboratory
Berkeley, California**



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Solar Energy

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Volume II

Physical, Chemical and Biological Measurements Off Puerto Rico

Appendices

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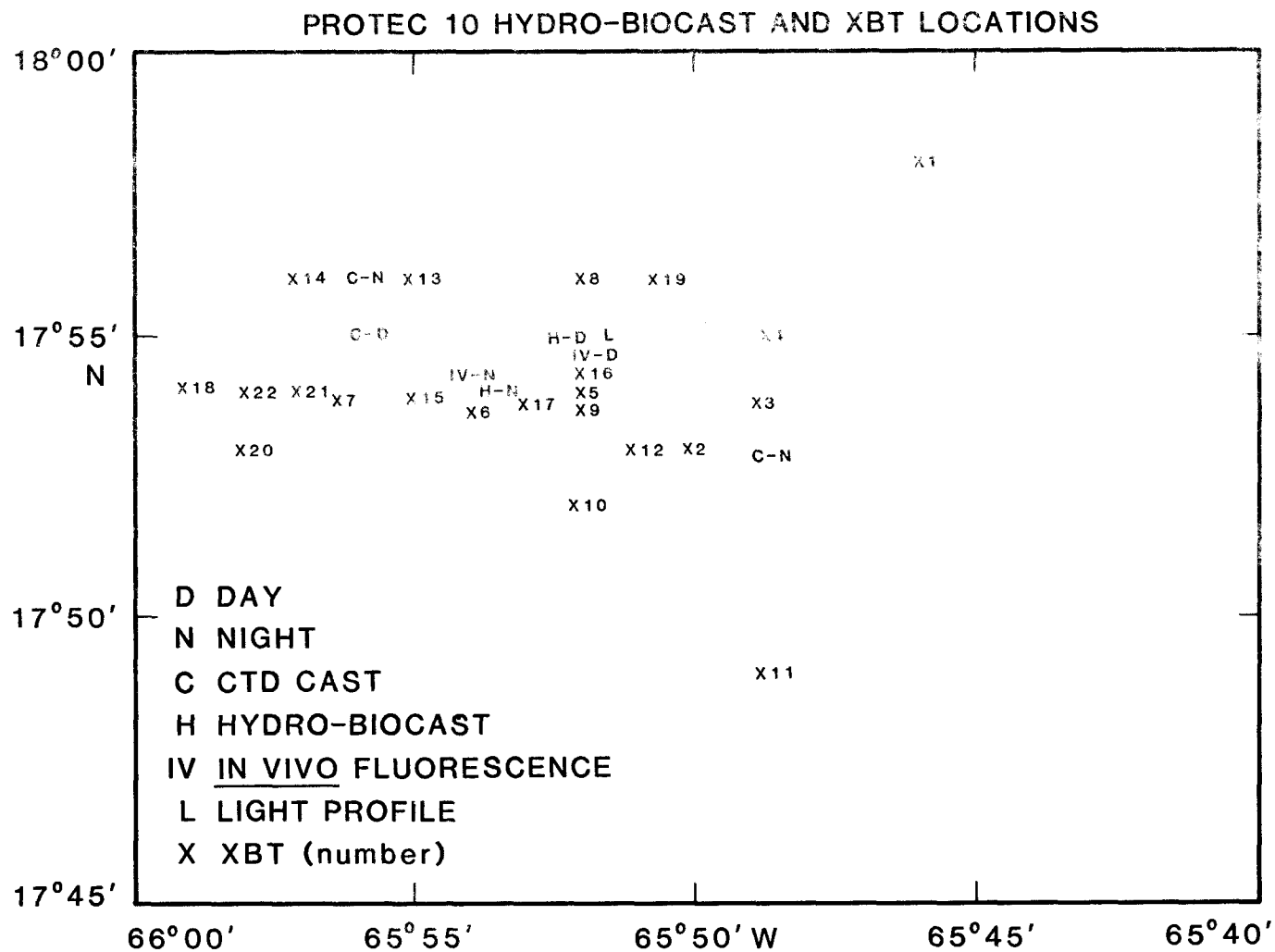
Appendix A

Data Report - PROTEC-10

Introduction

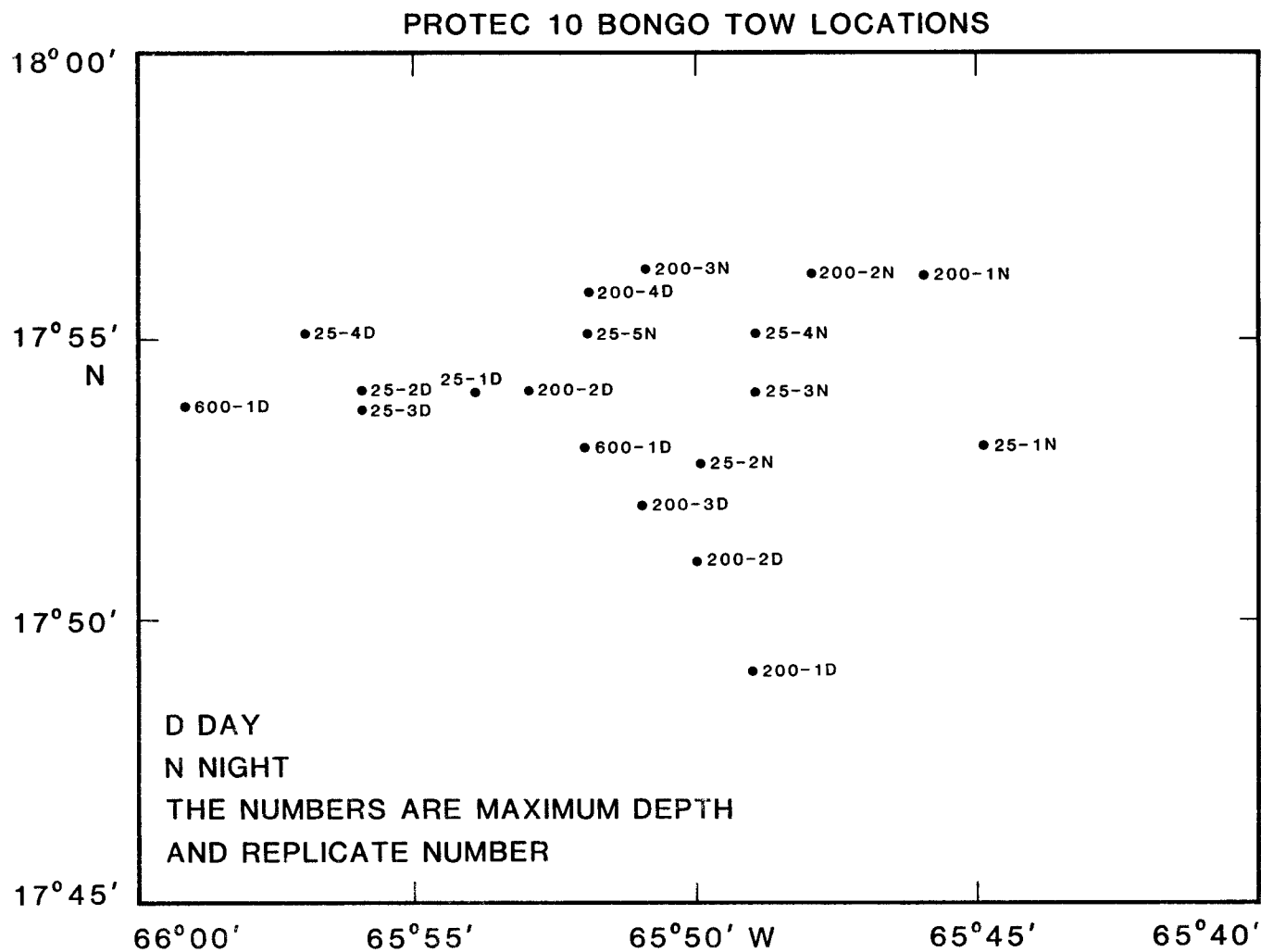
The PROTEC Benchmark site off the Southeast Coast of Puerto Rico at approximately $17^{\circ}57'N$ and $65^{\circ}48'W$ was occupied from November 16 to November 20, 1980. The majority of scheduled sampling was completed with specific dates and times given in the Operations Log of the Post Cruise Report (Section 3, Appendix A). The data collected is tabulated in the following sections with the principal investigator responsible indicated in parentheses next to the heading. The locations for all samples are shown in Figures 1, 2, and 3.

Figure 1 Sample Locations



XBL 8012-13177

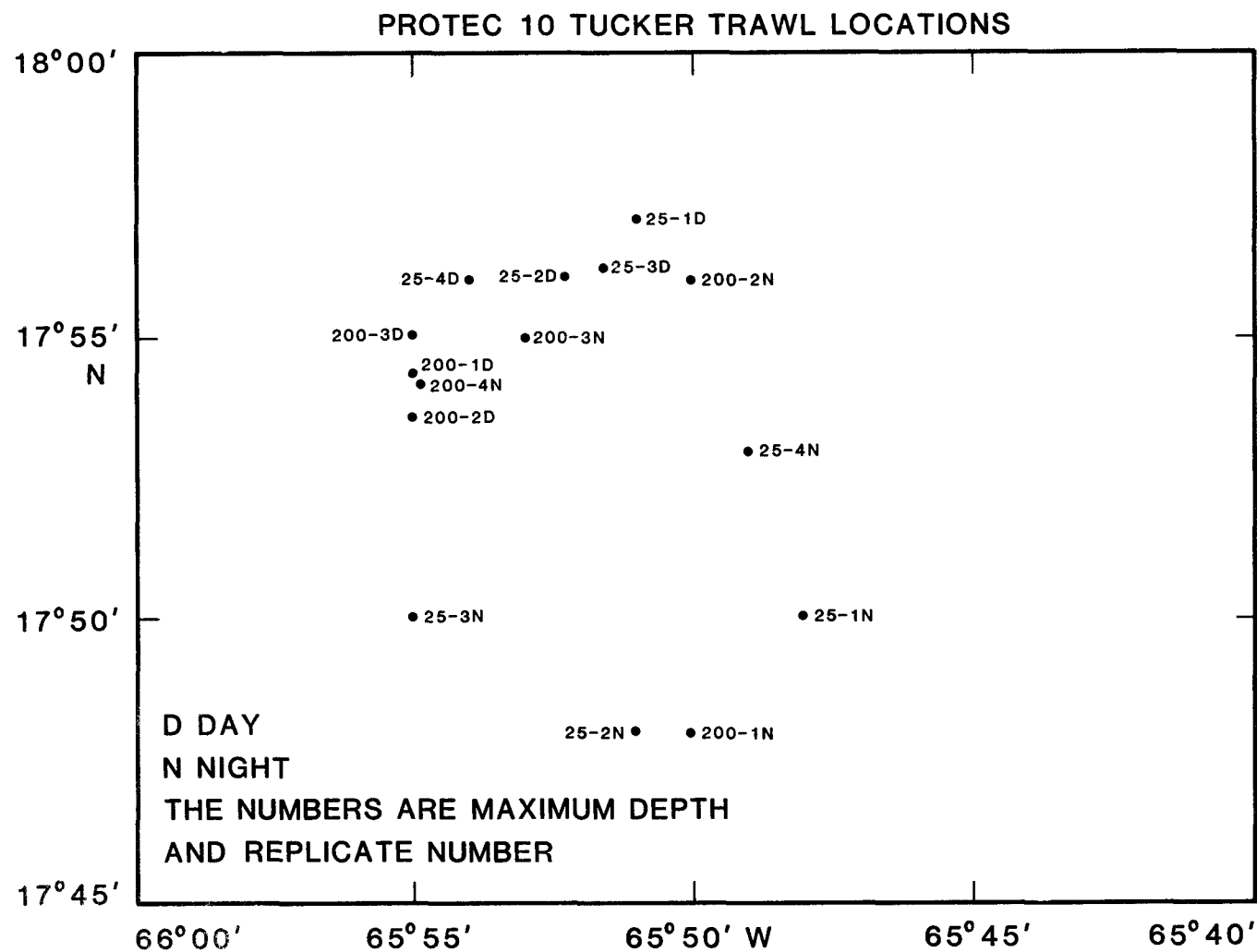
Figure 2. Sample Locations



XBL 8012-13179

Figure 3. Sample Locations

A-4



XBL 8012-13178

Cruise Data

A. Physical Measurements (S. Vargo)

1. CTD data

One ascent and two descents to 1000m were done during PROTEC-10 with a Grundy/Plessey 9051 CTD unit. Temperature, conductivity, and salinity values at approximately 25m intervals are shown for the descent in Table 1. As analog select was not used on the ascent and accuracy is reduced during ascent, this data is not reported in Table 1. The ranges utilized during Casts #1 and #2 on the descent are:

Setting	Temperature Range ($^{\circ}\text{C}$)	Conductivity Range (mmho/cm)
1	0-5	10-20
2	5-10	20-30
3	10-15	30-40
4	15-20	40-50
5	20-25	50-60
6	25-30	60-70
7	30-35	70-80

The depth range was full scale for all casts at 1200m to 30cm or 40m/cm. When not using the analog select as during the ascent of Cast #2 the full scale temperature range is -5 to $+35^{\circ}\text{C}$ and full scale range for conductivity is 0-80 mmho/cm. CTD Cast #1 was done in conjunction with the day hydrocast. The temperatures ranged from 28.32°C at 24m to 4.30°C at 1176m. The thermocline was between 50m and 175m, with a depth of the mixed layer of about 50m. The salinities determined by the temperature and conductivity values ranged from 37.25 0/00 at 120m to 35.70 0/00 at 1176m. Temperature, conductivity, and salinity values at approximately 25m intervals are shown in Table 1. Due to signal noise, values at 0m are not included.

CTD Cast #2, both descent and ascents were done in conjunction with the night hydrocast. The temperatures ranged from 29.18°C at 24m to 4.70°C at 1176m. The thermocline was between 50m and 175m, with a depth of the mixed layer of about 50m. The salinities determined by the temperature and conductivity values ranged from 37.40 0/00 at 72m to 35.60 0/00 at 1008m.

The calibration of the CTD unit was checked immediately before the cruise. In addition, a 1.7 liter Niskin bottle was placed immediately above the unit on each cast to take confirming samples for temperature, salinity, and depth. Due to malfunctions of the bottle or U-frame the

water samples were lost from both CTD casts, therefore confirming samples were not available for field calibration.

2. XBT Data

The XBT traces (Figs. 4-8) are numbered consecutively with the notation of position, time date and consecutive number as it appears in the Operations Log (Section E, Appendix A). The darkened area around each trace represents the total XBT data envelope for this cruise. The depth of the mixed layer was about 50m on all the traces with a thermocline from 50 to 175m. Traces taken over the five days on station show no major changes in the XBT traces. A slight shallowing of the mixed layer to 40m was shown in consecutive number 5 compared to 4 or 6 and in consecutive number 8 and 9 vs. 7 and 10. In both cases the traces were taken about five hours apart and indicate a reduction in the mixed layer depth over short time intervals. The magnitude of change in 5 hours was as great as the change observed in XBT profiles taken over 5 days.

3. Temperature

The temperature data from the reversing thermometers on the combined biocast and hydrocast is shown in Table 2. True depths calculated from the unprotected thermometer readings are shown below 100m. Above 100m the differences between the unprotected and protected thermometers were not sufficient to allow calculation of true depth. Temperatures recorded during the XBT and CTD profiles generally agreed well with those recorded by the reversing thermometers.

B. Chemical Measurements

Two hydrocasts were taken at the PROTEC-10 site. The daytime cast (Hydrocast #1) was taken 1632 AST (2032 GMT) on 11/18/80. After aliquots were drawn for duplicate determinations of oxygen and salinity, 250-ml aliquots were drawn into polyethylene bottles for nutrient analyses. Then 25-30 ml of each sample were filtered through pre-combusted Gelman Type A/E 25 mm glass-fiber filters. Then all filtered and unfiltered water samples were frozen in their polyethylene bottles. Elapsed times between the taking

XBT TRACE

PROTEC-10

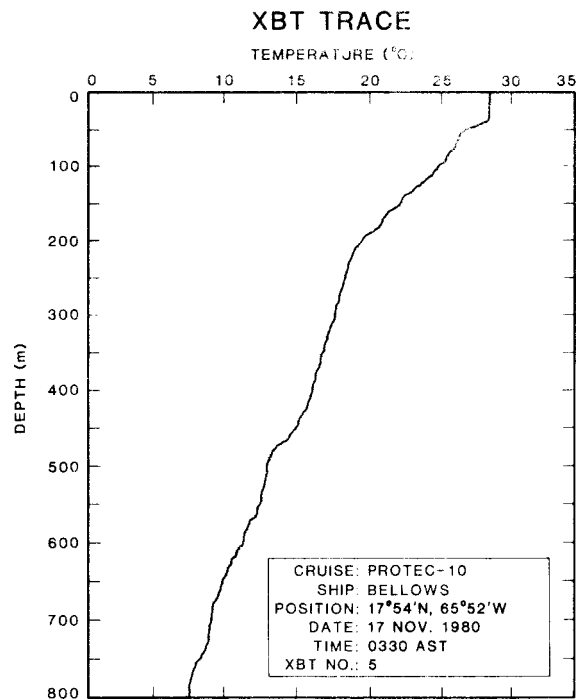
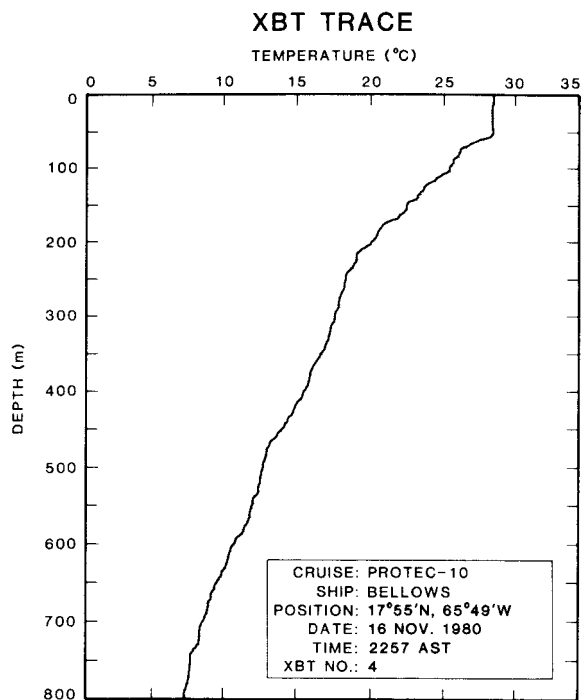
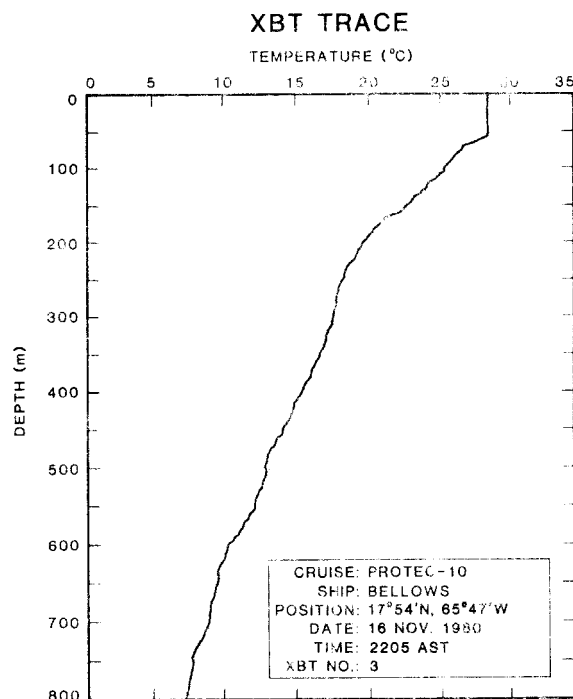
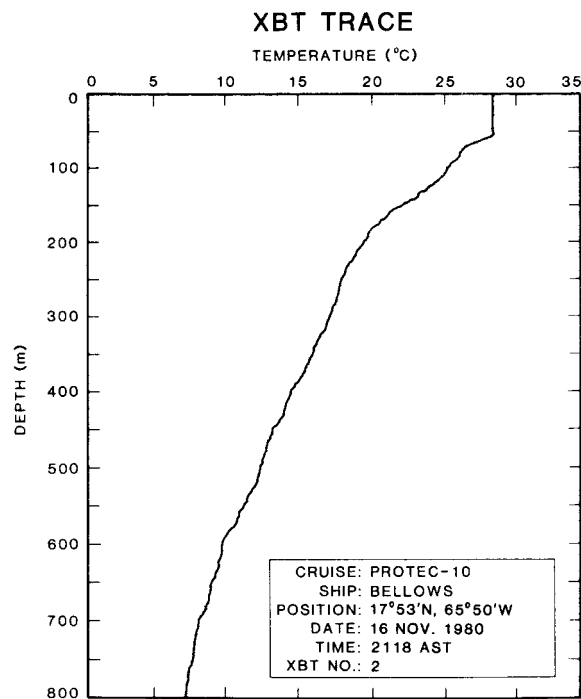


Figure 4. XBT Profiles

XBT TRACE

PROTEC-10

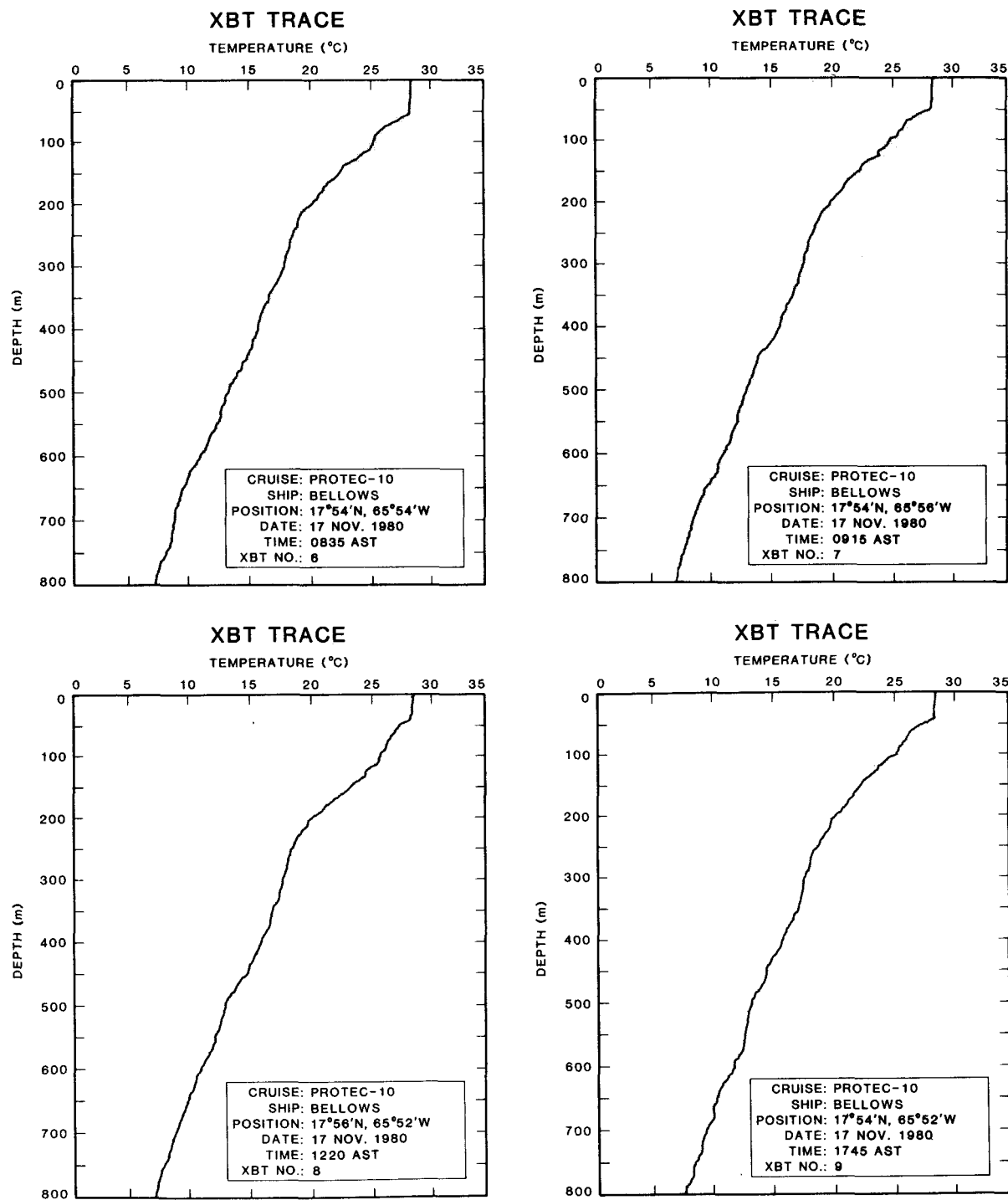


Figure 5. XBT Profiles

XBT TRACE

PROTEC-10

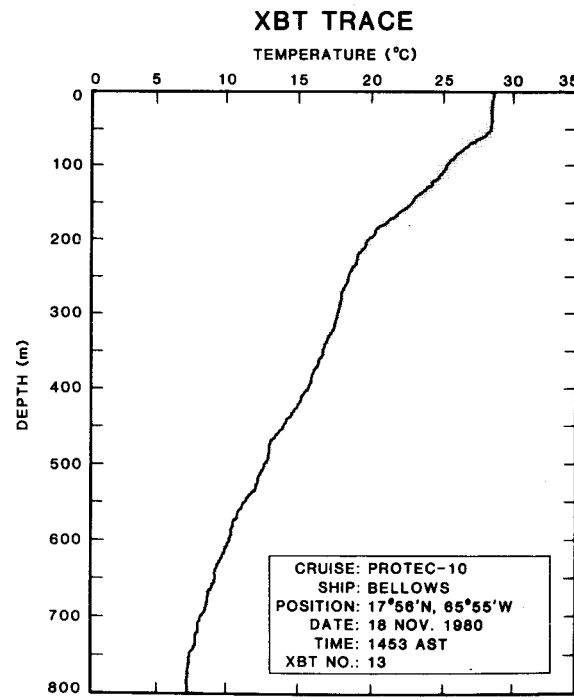
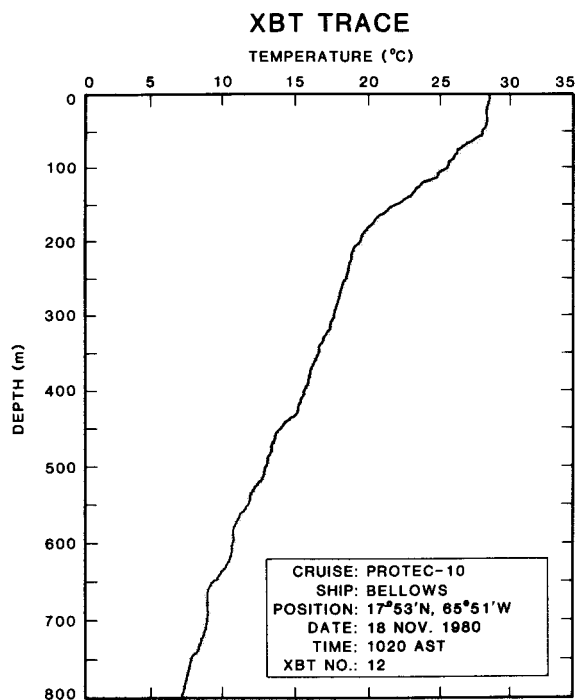
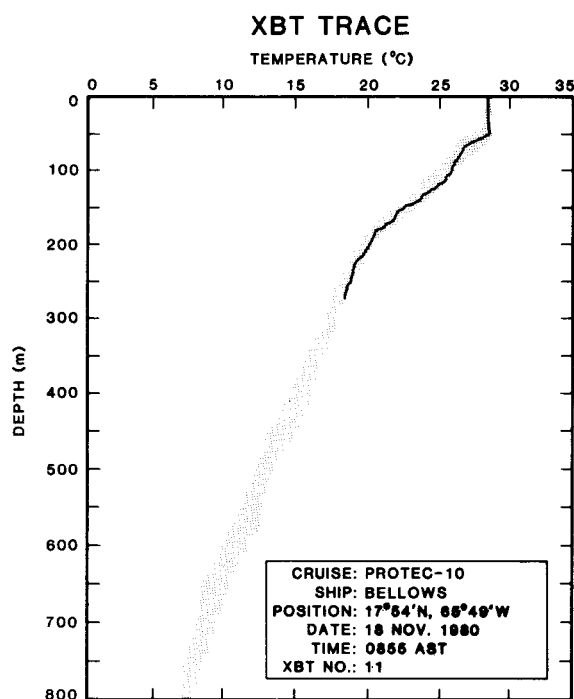
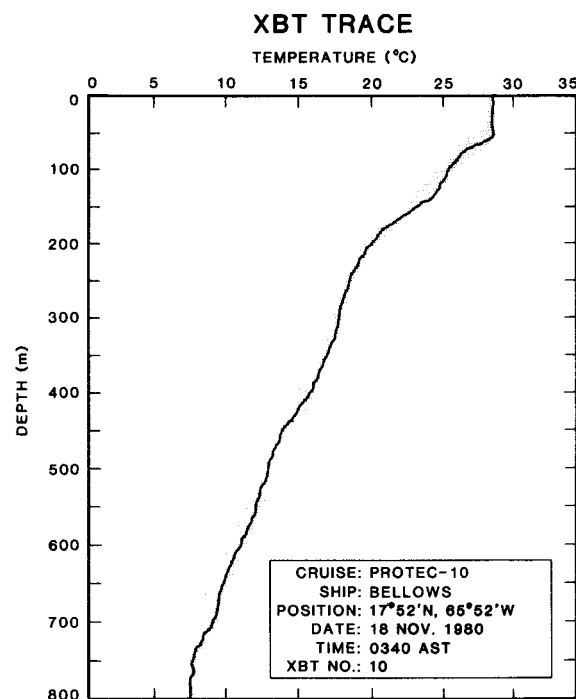


Figure 6. XBT Profiles

XBT TRACE

PROTEC-10

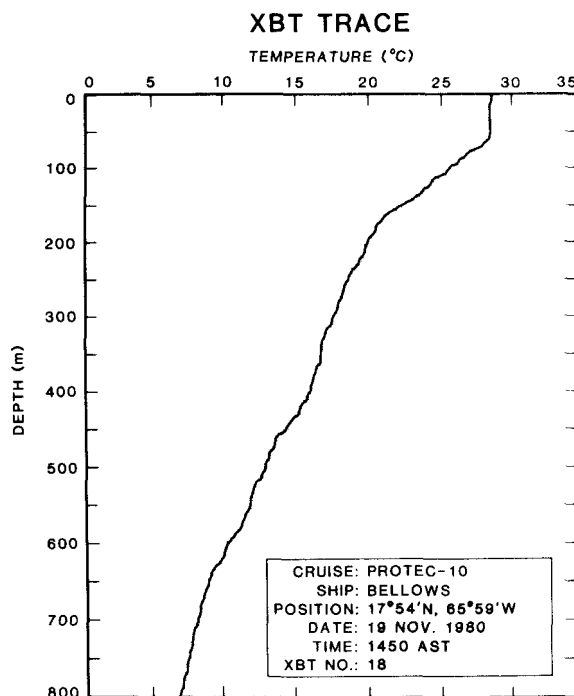
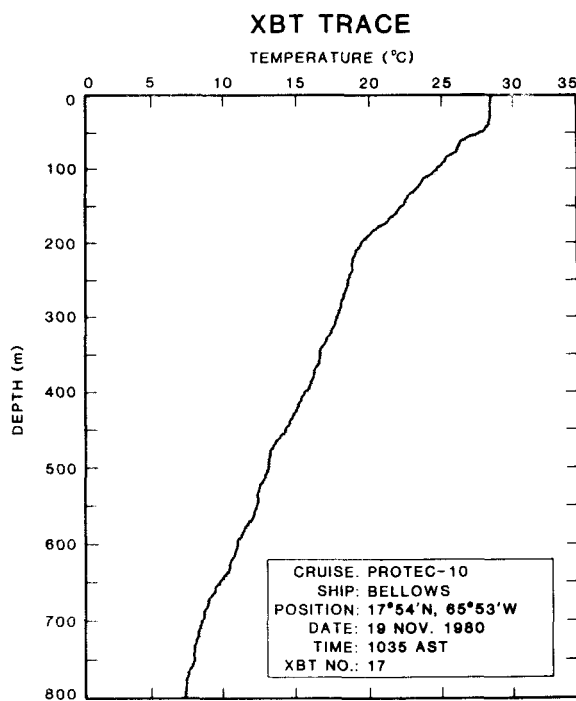
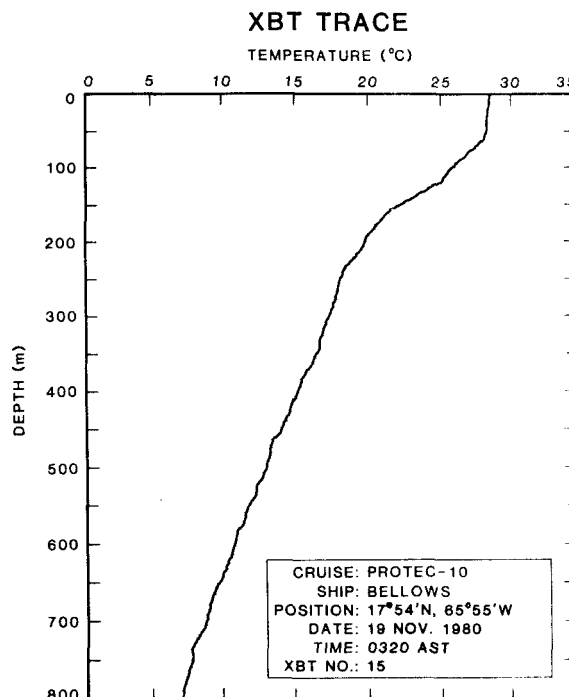
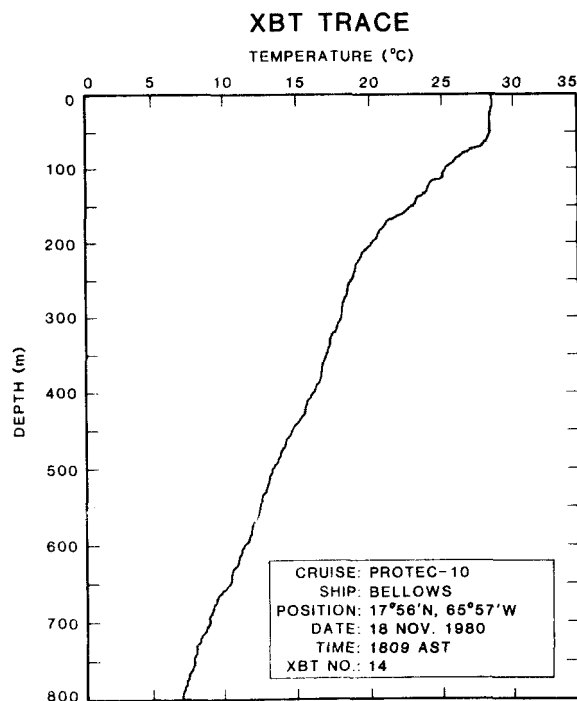


Figure 7. XBT Profiles

XBT TRACE

PROTEC-10

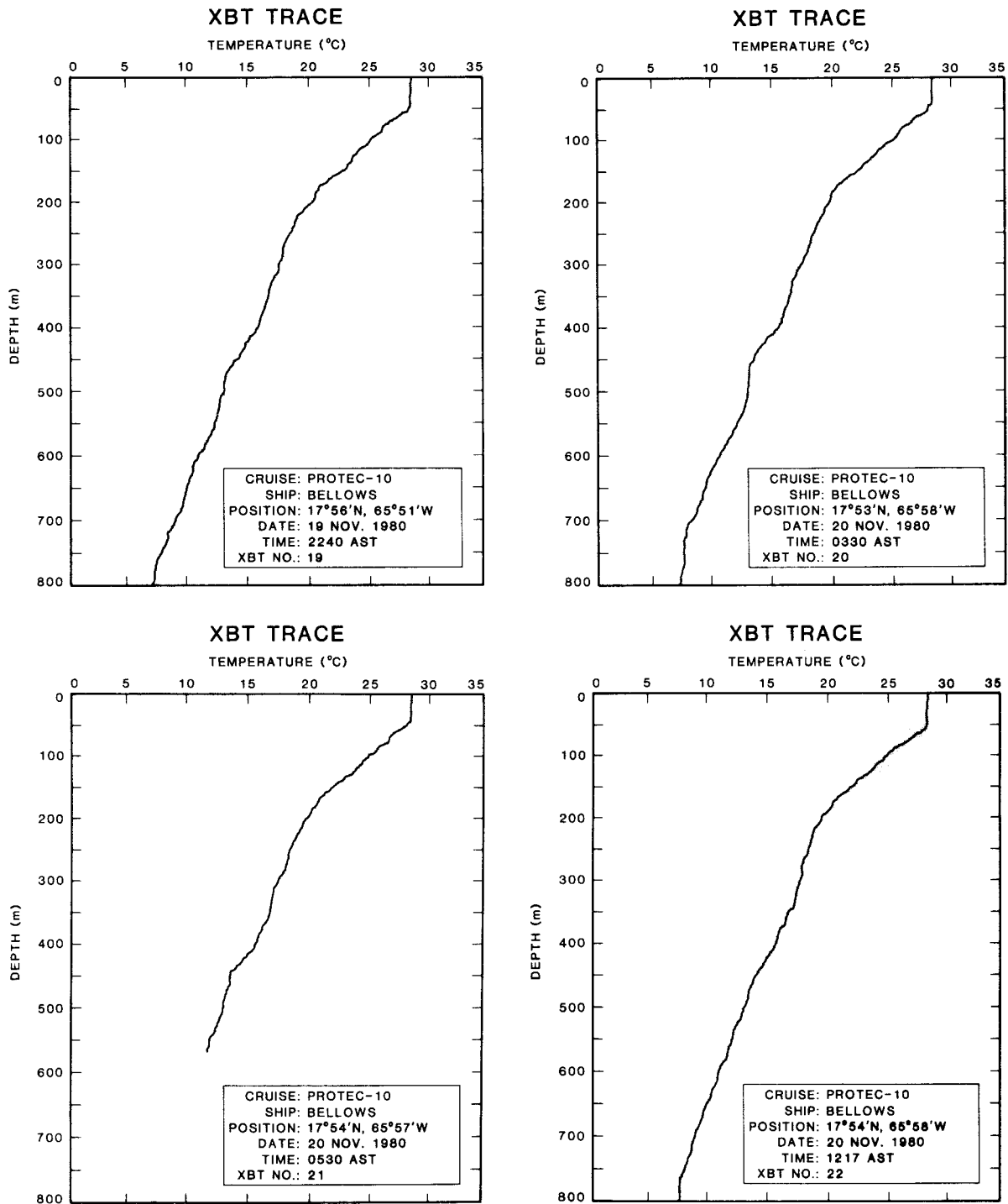


Figure 8. XBT Profiles

CTD Cast #1 Descent					CTD Cast #2 Descent			
Depth (m)	Temperature (°C)	Conductivity (mmho/cm)	Salinity (o/oo)	σ_t	Temperature (°C)	Conductivity (mmho/cm)	Salinity (o/oo)	σ_t
24	28.32	56.24			29.18	56.8		
48	28.30	56.16			26.58	57.34		
72	26.92	57.10			25.16	56.04	37.40	25.13
96	26.10	56.32			24.24	55.35	37.40	25.40
120	25.00	56.00	37.25	25.06	22.66	53.26	37.20	25.72
144	23.78	54.54	37.25	25.43	21.12	50.84	36.90	25.92
168	22.44	52.90	37.25	25.82	20.00	50.20	36.95	26.27
192	21.10	51.55	37.25	26.20	19.16	49.22	36.98	26.51
216	19.58	50.00	37.20	26.57	18.46	48.30	36.70	26.48
240	18.86	49.04	36.80	26.45	18.08	47.76	36.70	26.57
264	18.16	48.15	36.95	26.75	17.66	47.30	36.55	26.56
288	17.84	47.68	36.62	26.57	17.30	46.92	36.55	26.64
312	17.46	47.30	36.75	26.76	16.64	46.36	36.65	26.88
336	17.14	46.95	36.86	26.92	15.84	45.35	36.47	26.93
360	16.44	46.22	36.86	27.09	15.28	44.76	36.50	27.08
384	16.00	45.60	36.58	26.98	14.50	43.80	36.50	27.26
408	15.54	45.00	36.50	27.02	13.70	42.86	36.40	27.35
432	15.00	44.44	36.40	27.07	13.02	42.18	36.40	27.49
456	14.30	43.82	36.50	27.29	12.62	41.72	36.20	27.42
480	13.44	42.78	36.45	27.44	12.28	41.24	36.20	27.49
504	12.74	41.78	36.30	27.47	11.68	40.78	36.10	27.52
528	12.34	41.40	36.25	27.51	11.00	40.00	36.00	27.57
552	12.00	40.92	36.20	27.54	10.32	39.28	36.12	27.79
576	11.54	40.50	36.20	27.63	10.00	38.80	35.75	27.56
600	10.82	40.00	36.10	27.68	9.26	38.10	35.95	27.84
624	10.04	39.10	36.05	27.78	8.96	37.62	35.55	27.57
648	9.40	38.55	36.05	27.90	8.62	37.38	35.73	27.77
672	8.92	37.60	35.50	28.53	8.00	36.78	35.60	27.76
696	8.44	37.20	35.55	27.66	7.54	36.28	35.38	27.66
720	8.08	36.80	35.65	27.79	7.24	36.00	35.55	27.84
744	7.82	36.55	35.45	27.67	7.06	35.80	35.55	27.87
768	7.36	36.00	35.60	27.86	6.76	35.60	35.53	27.89
792	7.04	35.82	35.55	27.87	6.68	35.38	35.38	27.78
816	6.90	35.65	35.42	27.78	6.38	35.30	35.55	27.96
840	6.48	35.24	35.40	27.83	6.02	35.00	35.70	28.12
864	6.26	34.94	35.35	27.82	5.98	34.84	35.60	28.05
888	6.04	34.84	35.48	27.95	5.84	34.70	35.40	27.91
912	5.80	34.70	35.60	28.07	5.52	34.44	35.60	28.11
936	5.50	34.36	35.50	28.03	5.24	34.30	35.60	28.15
960	5.40	34.30	35.60	28.13	5.04	34.08	35.55	28.13
984	5.28	34.18	35.60	28.14	5.00	33.90	35.55	28.13
1008	5.02	34.00	35.60	28.17	4.70	33.78	35.60	28.21
1032	4.74	33.78	35.60	28.21				
1056	4.64	33.68	35.60	28.22				
1080	4.56	33.60	35.70	28.30				
1104	4.48	33.55	35.70	28.31				
1128	4.42	33.50	35.70	28.32				
1152	4.36	33.46	35.70	28.32				
1176	4.30	33.40	35.70	28.33				

*Salinity values determined using a Culbertson slide rule and a nomogram supplied by Grundy Environmental Systems, Inc. Temperatures above 25°C are not included and in the future a computer program will be used to determine these values.

Table 2. Depth, Temperature, Salinity and σ_t for Day and Night Hydrocast

<u>Hydrocast #1 (Day Cast)</u>					
Depth (m)	Temperature (°C)	Salinity (o/oo)	Cl (o/oo)	σ_t	ρ_t
Surfaced	-	34.78	-	-	-
10	-	34.79	-	-	-
15	28.48	34.76	19.241	22.08	1.022
20	28.54	34.79	19.258	22.08	1.022
35	-	34.78	-	-	-
45	28.28	35.83	19.834	22.95	1.023
50	27.82	36.13	20.000	23.32	1.023
60	27.01	36.32	20.105	23.73	1.024
75	26.27	36.55	20.232	24.14	1.024
85	25.73	36.64	20.282	24.38	1.024
100	25.17	36.90	20.426	24.74	1.025
159	22.44	-	-	-	-
207	20.24	36.84	20.393	26.12	1.026
301	17.58	36.43	20.166	26.49	1.026
406	15.53	36.11	19.989	26.73	1.027
504	12.88	35.69	19.756	26.97	1.027
600	10.59	35.33	19.557	27.13	1.027
792	7.38	34.98	19.363	27.37	1.027
997	5.33	34.94	19.341	27.61	1.028

<u>Hydrocast #2 (Night Cast)</u>					
0	28.40	34.87	19.302	22.19	1.022
10	28.36	34.80	19.263	22.15	1.022
15	28.49	34.79	19.258	22.10	1.022
20	-	34.78	-	-	-
35	28.41	34.78	19.250	22.12	1.022
45	28.07	35.24	19.507	22.57	1.023
50	28.10	35.97	19.911	23.11	1.023
60	27.14	36.27	20.077	23.65	1.024
75	26.35	36.51	20.210	24.08	1.024
85	25.90	36.71	20.321	24.38	1.024
100	25.29	36.74	20.338	24.59	1.025
153	22.95	36.99	20.476	25.48	1.025
200	19.90	36.71	20.321	26.11	1.026
291	17.65	36.45	20.177	26.49	1.026
397	15.32	36.07	19.967	26.74	1.027
498	12.49	35.62	19.717	26.99	1.027
595	10.22	35.31	19.546	27.17	1.027
808	7.27	34.99	19.368	27.39	1.027
993	5.16	34.97	19.357	27.65	1.028

of the cast and the freezing of the samples were 7-8 hours for Hydrocast #1 and 4-5 hours for Hydrocast #2.

Oxygen analyses were conducted during the cruise following the recommendations of Carrit and Carpenter (1966). The results are in Tables 3 and 4. The average differences between duplicates were 0.06 ml STP/L for Cast #1 and 0.03 ml STP/L for Cast #2. Apparently, we improved with practice.

Salinities were run back in the laboratory between 12/2/80 and 12/4/80 (Tables 3 and 4). Average differences between duplicates were consistent, about $0.020^{\circ}/_{\infty}$.

Between 12/4/80 and 12/9/80, studies were performed on the techniques to be used for the remaining analyses. Then, between 12/10/80 and 12/12/80 the frozen samples were thawed, processed, and analyzed by colorimetry using a Technicon Autoanalyzer II according to the approaches outlined in Carder et. al. (1977), Strickland and Parsons (1968), Grasshoff (1976), and EPA (1979a). Dissolved organic nitrogen and phosphorus were determined by difference. Ultraviolet light was first used to obtain total concentrations of dissolved nitrogen and phosphorus by oxidizing the organic matter in a flow-through system linked to the Autoanalyzer. Then the concentrations of dissolved inorganic nitrogen and phosphorus were subtracted to get the amounts of organic nitrogen and phosphorus. The UV-oxidation procedures are discussed by Armstrong and Tibbits (1968) and Armstrong et. al. (1966). All data on filtered samples are in Tables 3 and 4. Primary quality-control procedures followed those of EPA (1979b), see Table 5. A final quality-control procedure was to compare analyses of filtered versus unfiltered water samples (Table 6).

A number of interesting features of the data appeared but only two will be mentioned here. The first concerns dissolved organic phosphorus and nitrogen. Especially in the upper 200m organic phosphorus and nitrogen appeared to have quite large concentrations compared to their inorganic counterparts. Further, organic nitrogen appeared to increase with depth, although in shallow waters (upper 50m) in daylight, it was high as well. Organic nutrient distributions will be interesting to follow on future cruises. The second feature is that filtration seemed to contaminate the samples (Table 6). The glass in the filter raised silica concentrations about $1\mu\text{M}$., roughly doubled the nitrite concentrations and seemed to release substances that responded to UV oxidation like organic phosphorus and nitrogen. Thus, on the next cruise, we plan to freeze most of our samples without filtering and to filter only three samples - (20-50m, 500m, and 1000m) for comparison.

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Table 3: Chemical Data from Hydrocast #1(Day Cast), Cruise #1, PROTEC 10
 Position: 17°54'N, 65°54'W. All values are averages of duplicates except those marked with (*).
 All samples filtered through precombusted Gelman GA glass fiber filters before analysis.

Corrected Depth (meters)	Oxygen	Salinity	Dissolved	Dissolved Phosphate		Nitrate(μM)	Nitrogen-bearing solutes		
	ml STP L	(0/00)	Silica (μM)	Inorg. (μM)	Organ.(μM)		Nitrite(μM)	Ammonia(μM)	Organic N. (μM)
0	4.67	34.78	3.5	0.12	0.28	0.0*	0.1	0.2	1.5*
10	4.54	34.79	3.4	0.41	0.77	0.1	0.1	-	6.2
15	4.53	34.76	3.2	0.22	0.81	-	0.1	0.2*	1.6
20	4.56	34.79	2.9	0.21	0.85	0.0	0.1	0.3	5.6
35	4.52	34.78	2.8	0.09	0.83	0.0	0.1	0.2	4.8
45	4.57	35.83	1.2	0.47	0.98	0.1	0.1	0.4	2.3
50	4.62	36.13	1.0	0.14	0.95	0.1	0.1	0.2	1.5
60	4.63	36.32	0.8	0.38	0.88	0.1	0.1	0.4	1.8
75	4.57	36.55	0.9	0.13	0.84	0.0	0.1	0.3	1.2
85	4.54	36.64	0.8	0.34*	0.78	0.4	0.2	0.3	1.6
100	4.81	36.90	0.6	0.79	0.96	0.0	0.2	0.6	2.4
159	No Sample								
207	4.50	36.84	0.9	0.46	0.85	1.32	0.1	0.5	1.8
301	4.66	36.43	2.3	0.41	0.77	5.2	0.1	0.3	1.4
406	4.17	36.11	3.2	0.64	0.76	11.1	0.1	0.4	2.7
504	3.49	35.69	7.6	1.09	0.89	18.1	0.1	-	3.7
600	3.21	35.33	12.3	1.48	0.39	24.0	0.1	0.4	5.8
792	3.43	34.98	21.1	1.81	0.28	28.6	0.1	0.4	7.2
997	4.40	34.94	23.2	1.69	0.26	25.6	0.2*	0.4	7.3
Average Abs. value of Differences Between									
Duplicates:	0.06	0.020	0.06	0.01	0.17	0.06	0.01	0.02	0.6
Standard Dev.	0.04	0.050	0.06	0.01	0.12	0.06	0.01	0.02	0.8

Table 4: Chemical Data from Hydrocast #2 (Night Cast), Cruise #1 PROTEC 10.

Position: 17°54'N, 65°54'W. All values are averages of duplicates except those marked with (*).
All samples filtered through precombusted Gelman GA glass fiber filters before analysis.

Corrected Depth (meters)	Oxygen	Salinity	Dissolved	Dissolved Phosphate		Nitrate (μM)	Nitrogen-bearing solutes		
	ml STP L	(0/00)	Silica (μM)	Inorg. (μM)	Organ. (μM)		Nitrite (μM)	Ammonia (μM)	Organic N. (μM)
0	4.67	34.87	2.7	0.03	0.90	0.1	0.1	0.3*	1.5
10	4.71	34.80	2.8	-	-	0.1	0.1	-	1.0
15	4.67	34.79	4.2	0.15	0.39	0.6	0.0	0.2*	1.1
20	4.67	34.78	3.1	0.07	0.39	0.1	0.1	0.3	1.2
35	4.69	34.78	3.3	0.06	0.44	0.1	0.1	0.2*	0.2
45	4.68	35.24	2.9	0.10	0.40	0.1	0.1	0.2	0.7
50	4.72	35.97	1.4	0.09	0.37	0.0	0.1	0.2	0.3
60	4.68	36.27	1.5	0.06	0.41	0.0	0.1	0.2	0.8
75	4.73	36.51	0.7	0.23	0.37	0.2	0.1	0.4	1.3
85	4.80	36.71	1.1	0.07	0.37	0.3	0.2	0.2	0.4
100	4.62	36.74	0.8	0.14	0.37	0.5	0.2	0.2	0.2
153	4.73	36.99	0.8	0.10	0.36	0.5	0.1	0.2	1.0
200	4.50	36.71	1.5	0.18	0.34	1.7	-	0.2	-
291	4.66	36.45	1.5	0.32	0.30	5.2	0.1	0.2	0.9
397	3.99	36.07	4.0	0.72	0.35	12.0	0.1	0.2	0
498	3.42*	35.62	8.1	1.19	0.35	19.2	0.1	0.2	0.5
595	3.25	35.31	12.1	1.52	0.39	24.7	0.1	0.2	2.8*
808	3.51	34.99	18.8	1.79	0.39	27.7	0.1	0.2	2.6
993	4.42	34.97	23.3	1.66	0.40	25.6	0.1	0.2	5.9
Average Abs. value of Differences Between									
Duplicates:	0.03	0.025	0.03	0.02	0.04	0.05	0.01	0.01	0.4
Standard Dev.	0.03	0.054	0.03	0.02	0.03	0.06	0.02	0.01	0.6

Table 5. Quality Control on Seawater Nutrient Analyses After EPA (1979b)

Nutrient	Heptuplicate Analyses		Recoveries	
	Average Conc (uM)	Standard Dev.	Amount Added (uM)	Per Cent Recovered
$\text{NO}_3^- + \text{NO}_2^-$	0.04	0.01	2.5	85
	11.49	0.14	10.0	99
	18.46	0.08		
	25.52	0.27		
NO_2^-	0.03	0.01	0.25	94
	0.04	0.01	0.25	99
	0.03	0.00		
	0.01	0.01		
Silica	1.9	0.0	2.5	99
	2.3	0.1	10.0	99
	6.1	0.0		
	22.5	0.0		
NH_3	0.23	0.02	0.5	58
	0.43	0.05	1.5	59
	0.27	0.02		
	0.23	0.03		
Dissolved Inorganic PO_4	0.25	0.00	0.5	95
	0.68	0.01	1.0	99
	1.11	0.01		
	1.67	0.01		
Dissolved Inorg. + Organic PO_4	0.60	0.02	1.00	95
	0.94	0.05	2.00	99
	1.26	0.05		
	1.93	0.06		
Total Nitrogen ($\text{NO}_3^- + \text{NO}_2^- + \text{NH}_3^+$ Organic N)	5.2	0.8	5.0	102
	22.0	1.3	15.0	96
	30.6	0.7		
	29.2	2.4		

Table 6. Filtered* vs. Unfiltered Comparisons on Chemical Analyses of Samples from Hydrocasts 1 and 2, Cruise #1 PROTEC 10. Position: 17°54'N, 65°54'W

<u>Substance Determined</u>	<u>n = # of Comparisons</u>	<u>Filtered-Unfiltered Concentrations (μM)</u>	
		<u>Average Diff.</u>	<u>Standard Dev.</u>
Silica	37	1.2	0.5
Nitrite	36	0.07	0.02
Nitrate + nitrite	5	-0.05	0.17
Inorganic phosphate	35	0.005	0.08
Inorganic + Organic phosphate	37	0.22	0.22
Nitrogen = $\text{NO}_3^- + \text{NO}_2^- + \text{NH}_3 + \text{Organic N}$	5	0.65	0.86
Ammonia	3	0.01	0.06

*Filtered through pre-combusted Gelman GA glass fiber filters.

C. Biological Measurements

1. Phytoplankton (G. Vargo)

a. Chlorophyll and Phaeopigments

Calibration data for the Turner Designs fluorometer with 13 x 100 mm cuvette holder for acetone extracted samples is presented in Table 7. Pure chlorophyll a (Sigma Chemical) was used for all standards. Replication of readings and the linearity on each scale are reflected by the coefficients of variation for F_s calculations and r^2 values respectively. Chlorophyll values can be read directly from the instrument but all values presented in Tables 8 and 9 were calculated from the equations on Table 7, substituting the applicable constants for the appropriate scale. As calibrated, the instrument has a dynamic range of 0-500 $\mu\text{g}\ell^{-1}$ in the X1 mode and 0-5 $\mu\text{g}\ell^{-1}$ in the X100 mode. This means that full scale deflection on the most sensitive scale is equivalent to 0-0.158 $\mu\text{g}\ell^{-1}$.

Duplicate 250 ml samples were filtered and the filters stored frozen until analysis. Replication was not as good as expected primarily because needed filtration equipment had not arrived prior to the cruise. This equipment is now available and will be employed on the February cruise. With the exception of two values (15m and 45m, Day cast), phaeopigment concentration was greater than chlorophyll a (Figs. 9 and 10). Day and night vertical distributions were similar although some changes were observed, e.g. a decrease in the concentration between 45 to 60m from day to night and a dramatic increase at 75m from day to night. Grazing, sinking or simply differential current transport may contribute to the day-night differences.

b. In vivo fluorescence profiles

One successful fluorescence profile was obtained from the day biocast period. Data are presented in Fig. 11. The profile does not qualitatively

resemble that obtained from extracted chlorophyll concentrations although maxima in fluorescence between 40m and 60m and at 80m do correspond to peaks in extracted chlorophyll. In vivo fluorescence per unit chlorophyll was variable, therefore, no attempt was made to convert the fluorescence values to quantitative biomass estimates.

Our night profile suffered from variable to no flow during the pumping operation as a result of hoses kinking in heavier seas. We have modified our pumping system with heavy walled pressure hose in areas of potential kinking to alleviate this problem.

c. Transmissometer Profiles

The transmissometer did not function properly during either the noon or midnight profile. On both occasions transmittance was greater than 100% when the instrument was immersed although it could be calibrated properly on deck. The night profile was abandoned when a second problem developed which precluded obtaining any readings.

Data from the day profile were obtained by setting transmittance to approximately 70% then lowering the instrument. Values presented in Table 10 and Fig.12 were calculated as a percent of the maximum transmittance which occurred at 42 and 48 meters.

d. Irradiance Profile

Quantum sensor readings (Table 11) were used to obtain an extinction coefficient of $k = 0.051\text{m}^{-1}$. The relatively poor degree of fitness ($r^2 = 0.98$) resulted from not taking wire angle into account to recalculate depth. This profile was taken by lowering the submarine quantum sensor by hand - a most unprofitable method. A new lowering frame which attaches to the hydrowire has been constructed and will be used in the future.

e. Primary Productivity Estimates

Light levels in each compartment of the on-deck productivity incubator were measured in air (Table 12). Depths for samples corresponding to the appropriate light level were calculated from an extinction coefficient of $k = 0.05 \text{ m}^{-1}$.

Values for triplicate light bottle uptake were low and variable. The single dark bottle rate was high. Carbon uptake rates (Table 13) were calculated without subtracting the dark bottle values. Maximum uptake rates occurred at lower light levels which correspond to maximum chlorophyll concentrations (Fig. 9 and 10). Dark bottle adsorption and/or fixation did not necessarily correspond to maxima in phytoplankton biomass. An initial bottle as well as a dark bottle will be run on subsequent cruises. The integrated production rate of approximately $0.04 \text{ gCm}^{-2} \text{ day}^{-1}$ is within the range expected for oligotrophic Caribbean waters.

f. Phytoplankton Counts and Cell Volumes

Counts were obtained using the inverted microscope procedure. Ten milliliters of concentrate from a 200ml or 300ml sample were examined. The entire chamber bottom was counted except for monad counts in which one to four strips across the chamber diameter were examined. All size measurements were made to calculate cell volumes. Counts for the day and night cast (Tables 14, 15) do not reflect the chlorophyll peak at 75 m, but in general mirror the vertical distribution of pigment. Phytoplankton cell volumes for day and night cases at each depth are given in Table 16.

Table 7. Protec 10 #1
Calibration data for the Turner Designs Fluorometer
Model 10-000R

Scale	$\bar{X} F_s$ ①	$\bar{X} r_s$ ②	σF_s ③	σr_s ③	C.V. F_s ④	C.V. r_s ④	r^2 ⑤	n
1X/X100	0.4855	2.23	0.0224	0.0297	4.6	1.3	0.997	10
3.16X/X100	0.1586	2.39	0.0103	0.1699	6.5	7.1	0.995	12
10X/X100	0.0539	2.62	0.0045	0.2134	8.3	8.1	0.999	10
31.6X/X100	0.0175	2.77	0.0009	0.1453	5.1	5.2	0.996	6
1X/X1	49.3903	2.158	0.8623	-	1.7	-	0.996	5
3.16X/X1	15.8989	2.38	0.1429	0.1692	0.9	7.1	0.999	5
10X/X1	5.0504	2.39	0.1448	0.0698	2.9	2.9	0.999	6
31.6X/X1	1.5896	2.35	0.0582	0.0701	3.6	2.9	0.999	3

① $F_s = \frac{[Chl a]}{\bar{X} F_0}$ where F_0 = fluorescence before acidification

② $r_s = \frac{F_0}{F_a}$ where F_0 and F_a are fluorescence before and after acidification

③ $\sigma F_s, r_s$ = standard deviation of the mean

④ C.V., % - coefficient of variation: $\frac{\sigma}{\bar{X}}$

⑤ r^2 = correlation coefficient for the concentration of chlorophyll vs. fluorescent reading for n readings

$$chl a, \mu g l^{-1} = \bar{X} F_s \left(\frac{r_s \max}{r_s \max - 1} \right) (F_0 - F_a) \text{ (extract volume)}$$

$$phaeo., \mu g l^{-1} = \frac{\bar{X} F_s \left(\frac{r_s \max}{r_s \max - 1} \right) (r_s F_a - F_0) \text{ (extract volume)}}{\text{Volume filtered}}$$

Table 8. PROTEC 10 #1
Chlorophyll a, Phaeopigments ($\mu\text{g l}^{-1}$)
DAY CAST

Depth(m)	Chl a	Chl a $\bar{X}$	Phaeo	Phaeo $\bar{X}$	Phaeo/Chl
Surface	0.008 0.028	0.018	0.018 0.019	0.0185	1.03
10	0.017 0.005	0.011	0.017 0.013	0.015	1.36
15	0.023 0.027	0.025	0.017 0.017	0.017	0.67
20	0.013 0.007	0.01	0.013 0.020	0.017	1.65
35	0.017 0.019	0.018	0.022 0.020	0.021	1.22
45	0.072 0.068	0.07	0.043 0.038	0.041	0.58
50	0.049 0.072	0.060	0.057 0.067	0.062	1.02
60	0.054 0.049	0.052	0.052 0.063	0.058	1.11
75	0.035 0.079	0.057	0.058 0.133	0.096	1.67
100	0.035 0.035	0.035	0.054 0.071	0.063	1.8
207	0.005	0.005	0.025	0.025	5.0
301	0.001 0.001	0.001	0.013 0.015	0.014	13.04

Table 9. PROTEC 10 #1
Chlorophyll a, Phaeopigments ($\mu\text{g l}^{-1}$)
NIGHT CAST

Depth (m)	Chl a	Chl a $\bar{X}$	Phaeo	Phaeo $\bar{X}$	Phaeo/Chl
Surface	0.015 0.014	0.015	0.018 0.019	0.019	1.27
10	0.010 0.008	0.009	0.015 0.015	0.015	1.62
15	0.014 0.016	0.015	0.019 0.020	0.020	1.33
20	0.004 0.003	0.004	0.015 0.013	0.014	3.71
35	0.022 0.011	0.017	0.027 0.021	0.024	1.41
45	0.0299 0.037	0.033	0.057 0.060	0.059	1.76
50	0.042 0.033	0.038	0.058 0.045	0.051	1.35
60	0.0196 0.042	0.031	0.042 0.049	0.045	1.45
75	0.097 0.138	0.118	0.159 0.229	0.194	1.64
100	0.044 0.032	0.038	0.112 0.105	0.109	2.87
207	0.003 0.001	0.002	0.024 0.022	0.023	9.47
301	0.0003 0.0004	0.00035	0.009 0.011	0.010	25.29

Table 10 PROTEC 10 #1
Day Transmissometer Profile

Depth(m)	%T	% of T max
Surface	-	
6	-	
12	71.0	96.0
18	72.0	97.3
24	73.0	98.6
30	73.0	98.6
36	73.0	98.6
42	74.0	100.0
48	74.0	100.0
54	73.5	99.3
60	73.5	99.3
66	73.0	99.3
72	72.5	97.9
78	73.0	98.6
84	73.0	98.6
90	73.0	98.6
96	72.5	97.9
102	72.0	97.3
108	72.0	97.3
114	72.0	97.3
120	72.5	97.9
126	73.0	98.6
132	73.5	99.3
138	73.0	98.6
144	72.5	97.9
150	72.5	97.9
156	72.5	97.9
162	73.0	98.6
168	72.0	97.3
174	72.0	97.3
180	72.0	97.3
186	72.0	97.3
192	72.5	97.9
198	72.0	97.3
204	72.0	97.3
210	71.7	96.9
216	72.0	97.3
222	72.0	97.3
228	71.5	96.6
234	71.5	96.6
240	71.5	96.6
246	71.5	96.6
252	71.5	96.6
258	71.5	96.6
264	71.5	96.6
270	71.5	96.6
276	71.0	95.9
282	71.0	95.9
288	71.0	95.9
294	70.5	95.3
300	70.5	95.3

TABLE 11. PROTEC 10 #1
Quantum Sensor Profile

Depth(m)	$\mu\text{Em}^{-2}\text{sec}^{-1}$		% Surface ^(a)
	Deck cell	Sea cell	
Surface	1750	1500	85.7
1	1750	1000	57.1
2	1750	750	42.9
5	1750	700	40.0
10	1750	500	28.6
20	1750	300	17.1
30	1750	180	10.3
40	1750	125	7.1
50	1750	80	4.6
60	1750	50	2.9
65	1750	35	2.0

a) exponential curve fit yields:

$$a = 0.555$$

$$b_2 = -0.051 = K = \text{extinction coefficient}$$

$$r^2 = 0.98$$

$$I_z = I_0 e^{-kz}$$

$$-k = \frac{\ln \frac{I_z}{I_0}}{z}$$

$$y = ae^{bx} (a > 0)$$

Table 12 PROTEC 10 #1
Light gradient box
Irradiance measurements

Compartment	$\mu\text{Em}^{-2}\text{sec}^{-1}$				% I/O	Calculated depth(m)	Depth Sampled(m)
	Outside	$\bar{X}$	Inside	$\bar{X}$			
1	650 725	687.5	650 700	675	98.2	Surface	Surface
2	1500 1500	1500	900 950	925	61.7	9.4	10
3	1950 2000	1975	950 1000	975	49.4	13.8	15
4	1850 1875	1862.5	650 690	670	35.9	20.0	20
5	1250 1300	1275	110 140	125	9.8	45.5	45
6	950 1000 1000 1100	1012.5	55 58 50 58	55.3	5.5	56.9	60
7	950 1000 700 650	825	14 15 11 11	12.8	1.5	81.1	85

(1) Depth based on $k = 0.051 \text{ m}^{-1}$

(2) Depth sampled for ^{14}C uptake

Table 13 PROTEC 10 #1
Primary production estimates

Depth (meters)	Light level	①				
		DPM	$\mu\text{gCm}^{-3}\text{hr}^{-1}$	$\bar{X}$	Chla $_{-1}$ $\mu\text{g l}^{-1}$	mgC/mgChl $_{-1}$ /hr $^{-1}$
Surface	100%	245.80	21.08	30.43	0.015	2.028
		481.26	41.27			
		337.46	28.94			
		246.78	Dark			
10	62%	475.90	40.81	35.62	0.009	3.958
		364.62	31.27			
		405.41	34.77			
		483.15	Dark			
15	49%	391.90	33.08	36.94	0.015	2.462
		560.97	47.35			
		360.09	30.39			
		1041.65	Dark			
20	36%	371.10	29.94	30.16	0.004	7.54
		397.76	32.09			
		352.80	28.46			
		353.21	Dark			
45	10%	1121.50	88.78	64.09	0.033	1.942
		665.81	52.71			
		641.50	50.78			
		700.97	Dark			
60	5.5%	1136.36	94.74	71.73	0.031	2.31
		875.08	72.95			
		569.94	47.51			
		679.90	Dark			
85	1.6%	633.12	50.74	40.77	0.118 ^②	0.345
		444.28	35.60			
		448.87	35.97			
		396.35	Dark			

(1) Incubation time - 10.35 hours; Dark bottle not subtracted

$$\text{Integrated P vs. Depth} = 3487.85 \mu\text{gCm}^{-2}\text{hr}^{-1} \times 10.35 \text{ hrs.} = 36099.2 \mu\text{gCm}^{-2} \text{ day}$$

$$= .036 \text{ gCm}^{-2}\text{day}^{-1}, \text{ surface} \rightarrow 85\text{m}$$

(2) 75 m value

Table 14 Phytoplankton species composition and abundance (cells liter⁻¹), B8030, PROTEC 10 #1; DAYCAST

Taxa	DEPTH											
	Surface	10m	15m	20m	35m	45m	50m	60m	75m	100m	200m	300m
<u>Bacillariophyceae</u>												
Asteromphalus sp.	5.0											
Amphora sp.	3.3										3.3	
Bacteriastrum sp.	5.0				33.3	6.6						
Navicula spp.	15.0											
Chaetoceros spp.	20.0											
Nitzschia longissima	20.0	5.0			6.6	30.0	70.0	16.7		3.3		
Mastogloia sp.	10.0											
Skeletonema costatum	15.0			6.6			300.0		25.0			
Nitzschia pungens var. Atlantica	15.0			23.3	6.6	13.3	170.0					
Nitzschia spp.	40.0	30.0	15.0		3.3	6.6		6.7				
Rhizosolenia setigera	5.0			6.6			50.0					
R. styliformis w/Richelea	5.0			3.3		3.3	20.0					
Nitzschia closterium		10.0	5.0	6.6	13.2	6.6	80.0	10.0				
Leptocylindrus danicus		10.0					140.0		25.0			
Thalassionema nitzschiodes		10.0	15.0		6.6		20.0	:		13.3		
unidentified pennates		5.0								3.3		
Chaetoceros laciniosum			55.0									
Thalassiosira subtilis			125.0									
Bacteriastrum delicatulum			20.0									
Chaetoceros peruvianum			15.0		10.0							
Rhizosolenia sp.			5.0									
unidentified pennate "A"			35.0	10.0	3.3	3.3						3.3
Navicula sp. 1			5.0									
unidentified pennate "B"			10.0									
Navicula sp. 2				10.0								
Navicula sp. 3				10.0							3.3	
Dactyliosolen sp.				3.3	6.6	3.3						
Rhizosolenia hebetata					10.0							
Chaetoceros pendulus					3.3							
Ceratulina bergonii					6.6							
Navicula sp. 4					9.9							
unidentified sp. "C"					9.9							
Rhizosolenia fragilissima						6.6						
Navicula sp. 5						3.3						

Table 14(Cont'd.).

Taxa	DEPTH											
	Surface	10m	15m	20m	35m	45m	50m	60m	75m	100m	200m	300m
Navicula sp. 6						13.3	50.0					
Synedra sp.						3.3				3.3		
Rhizosolenia alata							20.0					
Chaetoceros sp.							20.0					
Nitzschia sp.							10.0	10.0				
Nitzschia seriata							50.0					
Nitzschia sp. A							10.0					
unidentified centric							10.0					
Nitzschia spp.							40.0	6.7	35.0			3.3
Grammatophora oceanica								6.7				
Navicula spp.								16.7				
Synedra gaillonii									5.0			
unidentified centric									15.0			
Grammatophora sp.										3.3		
Rhizosolenia bergonii											3.3	
Synedra affinis											3.3	
Leptocylindrus sp.											6.7	
<u>Dinophyceae</u>												
Peridinium sp.	5.0											
Ceratium pentagonium	5.0				3.3	3.3						
unidentified dinoflagellates	40.0						40.0					
Gonyaulax polygramma		5.0	5.0									
Prorocentrum gracile		10.0	5.0				30.0					
Gymnodinium spp.		5.0					20.0					
"rounded" dinoflagellates		30.0		6.6			10.0	6.7	5.0			
Dinophysis ovum				3.3								
Oxytoxum scolopax				3.3								
Peridinium sp.				3.3								
Gonyaulax digitalis				3.3			10.0					
Prorocentrum gracilis				6.6								
P. micans					3.3			3.3		3.3		
Gonyaulax birostris					3.3							
Ceratium teres					6.6	3.3	10.0					
Amphidinium sp. (1)					3.3							

Table 14(Cont'd.)

Taxa	DEPTH											
	Surface	10m	15m	20m	35m	45m	50m	60m	75m	100m	200m	300m
Ceratium kofoidii					3.3							
Peridinium grande						3.3						
Oxytoxum gladiolus						10.0		20.0				
Oxytoxum longum						3.3						
Amphidinium sp. 2						6.6						
Amphidinium sp. 3						3.3						
Amphidinium sp. 4						3.3						
Ceratium trichoceros							10.0					
Gonyaulax spp.							10.0		5.0			
Podolamorus spinifer								3.3			3.3	
Gonyaulax digensis								3.3				
Peridinium tuba								3.3				
Oxytoxum burbo								3.3				
Amphidinium spp.								13.3				
Podolampus palmipes									5.0	3.3		
Peridinium pallidum									5.0			
Amphidinium carteri											3.3	
Oxytoxum sp.											3.3	3.3
<u>Chrysophyceae. Coccolithophorids and Silicoflagellates</u>												
Rhabdosphaeria hispida	10.0											
Discosphaera thomsonii	40.0	115.0	50.0	56.6	72.6		80.0	13.3				
Pontosphaera huxleyi	15.0	30.0		13.3		3.3		3.3				
Pontosphaera spp.	25.0		5.0	16.6	173.2	20.0						
Discosphaera tubifer	130.0	95.0	240.0	106.6	13.2	363.3	90.0	590.0				
unidentified coccolithophorids		55.0	40.0		9.9	13.2	50.0	70.0	85.0		3.3	
Rhabdosphaeria stylifer			5.0	10.0		30.0	30.0					
Rhabdosphaeria claviger						3.3						
R. tignifer						3.3						
R. tubulosa						10.0						
Halopappus adriaticus						40.0		23.3				
Calyptosphaera sp.						3.3		16.7				
Syracosphaera sp.						3.3				6.6		
unidentified silicoflagellates (skeleton only)						6.6	10.0	16.7	10.0			

Table 14(Cont'd.)

Taxa	DEPTH											
	Surface	10m	15m	20m	35m	45m	50m	60m	75m	100m	200m	300m
Dictyocha sp. (skeleton only)						6.6	10.0	16.7	10.0			
Acanthoica aculeata							20.0					
Ophiaster hydroideus								6.7			3.3	
Rhabdosphaera sp.								6.7				
									10.0	3.3		3.3
Blue-greens (Trichodesmium) - filaments		40.0		6.6						6.6		
Unidentified monads	1155.0		2887.5	770.0		2695.0	6930.0			385.0		
Total diatoms	165.0	75.0	305.0	79.7	129.2	99.5	1060.0	66.8	105.0	26.5	19.9	6.6
Total dinoflagellates	50.0	50.0	15.0	26.4	23.1	39.7	150.0	56.5	20.0	9.9	9.9	3.3
Total coccolithophorids (1)	220.0	295.0	340.0	216.4	268.9	479.8	250.0	730.0	95.0	9.9	13.3	3.3
Total cells (2)	1590.0	460.0	3547.5	1099.1	421.2	3314.0	8390.0	853.3	220.0	437.9	43.1	13.2

(1) does not include Silicoflagellate skeletons

(2) does not include Silicoflagellate skeletons but does include blue-green filaments and monads.

Table 15. Phytoplankton species composition and abundance (cells liter⁻¹), B8030, PROTEC 10 #1; NIGHT CAST

Taxa	DEPTH											
	Surface	10m	15m	20m	35m	45m	50m	60m	75m	100m	200m	300m
<u>Bacillariophyceae</u>												
Amphiprora sp. "A"		6.6										
Amphora sp.						3.3						
Asterionella sp.						6.6						
Asterolampra flabellatus		3.3										
Bacteriastrium sp.	13.3	33.3		6.6	33.3							
Bellerochea sp. "A"							33.3					
Chaetoceros curvisetum						13.3						
C. decipiens						10.0	10.0				10.0	
C. diversus					13.3	10.0						
C. gracilis					6.6	6.6						
C. lorenzianum					16.6	40.0		10.0				
C. pendulus	13.3		3.3									
C. peruvianum		6.6		3.3								
C. spp.		10.0				20.0						
Corethron hystrix												
Dactyliosolen sp. "A"		43.3				26.6				3.3		
Fragilaria sp.						6.6	6.6					
Grammatophora marina	6.6											
Hantzschia sp.						3.3						
Hemiaulus hauckii					3.3							
H. membranaceus	6.6	6.6										
Leptocylindrus danicus						56.6						
Licmorpha gracilis						3.3						
L. jorgensii						3.3						
Licmorpha sp.												3.3
Mastogloia sp.		6.6					6.6					
Navicula sp. "A"	23.3	13.3	6.6	10.0	3.3	33.3				3.3		
N. sp. "B"		76.6			3.3							
N. sp. "C"		13.3										
N. sp. "D"		13.3										

Table 15. Phytoplankton species composition and abundance (cells liter⁻¹), B8030, PROTEC 10 #1; NIGHT CAST (Continued)

[illegible]

Table 15. Phytoplankton species composition and abundance (cells liter⁻¹), B8030, PROTEC 10 #1; NIGHT CAST
(Continued)

Taxa	DEPTH											
	Surface	10m	15m	20m	35m	45m	50m	60m	75m	100m	200m	300m
Rhizosolenia styliformis					3.3	3.3						
R. sp.											3.3	
Skeletonema costatum						10.0						
Synedra sp. "1"										3.3		
Sp. sp. "2"				3.3								
S. sp. "3"										3.3		
Thalassionema nitzschiodes		10.0	6.6		30.0	103.3	10.0		6.6	33.3	3.3	
Thalassiosira sp. "1"										6.6		
T. sp. "2"						140.0						
Thalassiothrix frauenfeldii						16.6	50.0					
Unid. pennate"1"							3.3					
Unid. pennate"2"				3.3								
Unid. pennate"3"						6.6						
Unid. centric						3.3						
<u>Dinophyceae</u>												
Amphidinium sp. "1"										3.3		
A. sp. "2"												
A. sp. "3"									20.0			
A. sp. "A"		10.0				30.0						
A. sp. "B"	3.3	23.3			3.3							
A. carteri		3.3										
Ceratium buceros var. tenue									3.3			
C. furca f. belonoides						3.3						
C. fusus									3.3			
C. pentagonum, var. tenerum									6.6			
C. pentagonum		6.6										
C. sp. "1"									3.3			
Gonyaulax diegensis						3.3						
G. kofoidei		3.3										
G. sp. "1"						3.3						

Table 15. Phytoplankton species composition and abundance (cells liter⁻¹), B8030, PROTEC 10 #1; NIGHT CAST
(Continued)

Taxa	DEPTH											
	Surface	10m	15m	20m	35m	45m	50m	60m	75m	100m	200m	300m
Gymnodinium sp. "1"												
G. sp. "2"				3.3				6.6				
G. sp. "3"		36.6										
Gymnodinium sp. "A"	10.0											
Histoneis sp.							3.3					
Ornithocercus magnificus						3.3	3.3					
O. steinii						3.3						
Oxytoxum sp. "1"				3.3								
O. parvum		6.6		3.3	6.6							
Peridinium globulus						3.3						
Phalacroma parvulum		6.6										
Podolampus spinifer												
Prorocentrum gracile		6.6					10.0			3.3		
Pyrocystis fusiformis f. biconica					3.3							
Pyrophacus horologium var. Steinii					3.3							
Torodinium sp.												
"Rounded-out dinos"	3.3	3.3		6.6	3.3	3.3		6.6				
Unid. dinos					3.3	6.6						
<u>Coccolithophorids</u>												
Acanthoica sp. "1"												
A. sp. "2"											3.3	
A. acanthos	20.0	20.0								6.6		
A. quattrosphina		3.3										6.6
Anthosphaera sp.												
Calyptrosphaera sp. "1"										3.3		
C. sp. "2"										3.3		
C. sp. "A"		6.6								6.6		
Coccolithophorid "A"												

Table 15. Phytoplankton species composition and abundance (cells liter⁻¹), B8030, PROTEC 10 #1; NIGHT CAST
(Continued)

Taxa	DEPTH											
	Surface	10m	15m	20m	35m	45m	50m	60m	75m	100m	200m	300m
Coccolithophorid "R"		43.3				83.3			43.3			
C. "C"						3.3						
C. "D"						3.3						
C. "E"						6.6						
C. "F"						3.3						
Coccolithophorid "G"									3.3			
Coccolithus sp.								20.0				
Discosphaera tubifer	246.6	216.6	143.3	130.0	216.6	73.3	36.6	733.3	6.6			
D. thomsonii	116.6	140.0	70.0	56.6	133.3	26.6		6.6	10.0			
Halopappus sp. "1"						3.3						
H. adriaticus							16.6	33.3	6.6			
H. vahseli						16.6						
Ophiaster hydroideus	20.0	13.3				10.0		6.6		10.0		
Pontosphaera sp. "1"							16.6					
P. sp. "2"												10.0
P. sp. "3"						6.6						
P. sp. "4"					3.3							
P. sp. "5"	6.6											
P. Huxleyi	6.6	23.3				16.6						
Michaelsarsia assymetrica								3.3				
Rhabdosphaera hispida		3.3				16.6				3.3		
R. claviger	3.3											
R. longistylus					10.0							
R. stvlifer	16.6	13.3	6.6		3.3	10.0	20.0					
R. tignifer		3.3										
R. sp. "1"									3.3			
Syracosphaera sp. "1"								10.0				
S. sp. "2"				6.6								
S. sp. "3"							3.3					
S. sp. "A"	10.0	13.3						3.3				
S. sp. "B"		33.3										
S. cornifera						3.3						
S. pulchra			10.0									
Silicoflagellates (skeleton only)							3.3					

Table 15. Phytoplankton species composition and abundance (cells liter⁻¹), B8030, PROTEC 10 #1; NIGHT CAST
(Continued)

Taxa	DEPTH											
	Surface	10m	15m	20m	35m	45m	50m	60m	75m	100m	200m	300m
Distephanus (skeleton only)									3.3			
Silicoflagellate (with chloro.)						3.3						
Blue-Green Filaments (Trichodesmium)				6.6	3.3			3.3			6.6	
Monads	422.2	636.6		211.1	211.1	506.6	1540.0	1540.0	884.5		385	
Total Diatoms	232.8	419.3	39.7	156.3	172.7	2388.9	272.9	23.2	36.5	103.0	26.5	3.3
Total Dinoflagellates	16.6	106.2	0	16.5	23.1	63.0	16.6	13.2	43.1	13.2	0	0
Total Coccolithophorids ¹	446.3	532.9	229.9	193.2	366.5	282.7	93.1	816.4	73.1	33.1	3.3	16.6
Silicoflagellate with cell contents						3.3						
Total Cells ²	1117.9	1695.0	269.6	583.7	776.7	3244.5	1922.6	2396.1	1037.2	149.3	421.4	19.9

¹Does not include silicoflagellate skeletons.

²Does not include silicoflagellate skeletons but does include Blue-Green Filaments and Monads.

Table 16 : Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-10.

Species/ Diatoms	DAY CAST													NIGHT CAST												
	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M		
Amphiprora sp. A														.06												
Amphora spp.											.01							.02								
Asterionella sp.																		.05								
Asterolampra flabellatus														.09												
Asteromphalus sp.	.10																									
Bacteriastrum delicatulum			.03																							
B. spp.					.47	.09							.19	.47		.09	.47									
Bellerochea sp. A																			1.57							
Cerataulina bergonii					2.92																					
Chaetoceros curvisetum																		.25								
C. decipiens																		.05	.55				.55			
C. diversus																		.12	.09							
C. gracilis																		.03	.03							
C. laciniosum			.22																							
C. lorenzianum																		.63	1.51		.38					
C. pendulus					.04								.15		.04											
C. peruvianum		.24			.30									.20		.10										
C. spp.														.11				.23								
Corethron hystris																							.09			
Dactyliosolen sp				1.40	2.80	1.40								18.36				10.18								
Fragilaria sp.																		.01	.11							
Grammatophora marina														.06												
G. oceanica								.02																		
G. sp.										.01																
Hantzschia sp.																		.01								
Hemiaulus hauckii																		.16								
H. membranaceus													.20	3.89												
Leptocylindrus danicus		.25					3.52		.63									1.42								
L. sp.											.01															
Liomorpha gracilis																		.12								
L. jorgensii																		.03								
L. sp.																								.02		
Mastogloia sp.	.01													.02					.02							
Navicula sp. A													.60	.32	.16	.28	.08	.08				.07				
N. sp. B														.29			.01									
N. sp. C														.23	.10											
Navicula sp. D														.02												
N. sp. E													.02	.01												
N. sp. I																				.12						

Table 16 : Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-10.
(Continued)

Species/ Diatoms	DAY CAST												NIGHT CAST											
	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M
N. sp. 2				.06														.06		.03				
N. sp. 3				.24														.10						
N. sp. 4																		.03						
N. sp. 5						.05																		
N. sp. 6						.32																		
N. spp.	.06		.10		.14		.54	.19													.02			
N. baileyana																		.01						
N. directa																		.03						
N. wawriake																	.10	.60						
Nitzschia 1																			.13					
2																							.01	
3																					.02			
4																						.02		
6																		.01						
7																		.02						
8																		.10						
9																	.08							
N. sp. A							.16																	
N. closterium		.02	.01	.01	.02	.01	.14	.02					.07	.07	.01	.11		1.10	.02		.02			
N. longissima	.06	.02			.02	.09	.21	.05		.01			.03	.04	.02		.04	.92	.08		.05	.04	.02	
N. pungens v. atlantica	.12			.19	.16	.19	1.36						.09	.30			.24	5.84	.43			.28		
N. serata							.74											.20						
N. spp.	.32	.75	.08		.01	.03	.003	.05	.26			.02		.60		.20		.20						
Pennate A			1.05	.30	.10	.10							.80	.04	.40	.32	.20	.91	.50	.10				
Pennate B			.05									.10	.04											
Pleurosigma sp.																		.18						
Rhizosolenia alata		4.24					16.96						2.80	2.80		9.22				33.97				
R. calcar avis														12.45										
R. flagillissima						.58																		
R. hebatata					9.42					.08				3.11										
R. setigera	.88			1.16			8.80									1.16			5.28					
R. stolterfothi														2.04										
R. bergonii										12.44														
Rhizosolenia imbricata																		2.44						
Rhizosolenia styliformis				2.81		2.81	1.70										2.81	2.81						
R. styliformis w/Richelina	4.25																						.32	
R. spp.																								
Skeletonema costatum	.12		.05				2.36		.20									.03						
Synedra affinis											.04													
S. gaillonii									.11															

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Table 16 : Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-10.
(Continued)

Species/ Diatoms	DAY CAST												NIGHT CAST											
	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M
S. sp.						.05				.05														.06
S. sp. 1																								
S. sp. 2																	.04							
S. sp. 3																								
Thalassionema nitzschiodes		.04		.03	.04		.07			.06				.04	.02		.11	.04	.05		.03	.05	.11	.02
Thalassiosira subtilis			1.23																					
T. sp. 1																								
T. sp. 2																						.41		
Thalassiothrix frauenfeldii																		.32						
Unid. pennate 1																		.22	.56					
Unid. pennate 2																			.004					
Unid. pennate 3																.05								
Unid. pennates		.52								.01								.001						
Unid. centric							3.93		.12									.06						
Unid. sp. C					.09																			

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Table 16 : Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-10.

[illegible]

Table 16 : Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-10.
(Continued)

Species/ Dinoflagellate	DAY CAST												NIGHT CAST											
	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M
Peridinium globulus																		1.68						
P. grande						3.73																		
P. pallidum									2.23															
P. sp. 1	.35																							
P. sp. 2				.17																				
P. tuba								.29																
Phalacroma parvulum														1.97										
Podolampus palmipes									.69	.46														
P. spinifer								1.47			1.47											1.47		
Prorocentrum gracile		.13	.06	.09			.13							.09					.13					
P. micans					.02			.03		.03														
Pyrocystis fusi-formis f. biconica																								
P. horologium v. steinii																	.70							
Torodinium sp.																					.76			
"Rounded out" dinos		2.45		.54			1.84	.54	.41				.30	.10		.24	.10	.27				.24		
Unidentified dinos	1.75		.03			.05											1.57				.76			

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Table 16 : Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-10.

[illegible]

Table 16 : Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-10
(Continued)

Species/ Coccolithophores	DAY CAST												NIGHT CAST											
	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M	0M	10M	15M	20M	35M	45M	50M	60M	75M	100M	200M	300M
Syracosphaera sp. 1																								
S. sp. 2																	1.57				.42			
S. sp. 3																			.08					
S. sp. A													.21	.44							.09			
S. sp. B														1.56										
S. sp.					.12					1.55														
S. cornifera																			1.84					
S. pulchra																.24								
Unid Coccolithophores	3.37	1.40	.56	.04	.20	1.92	.16	1.47	.02	.08														

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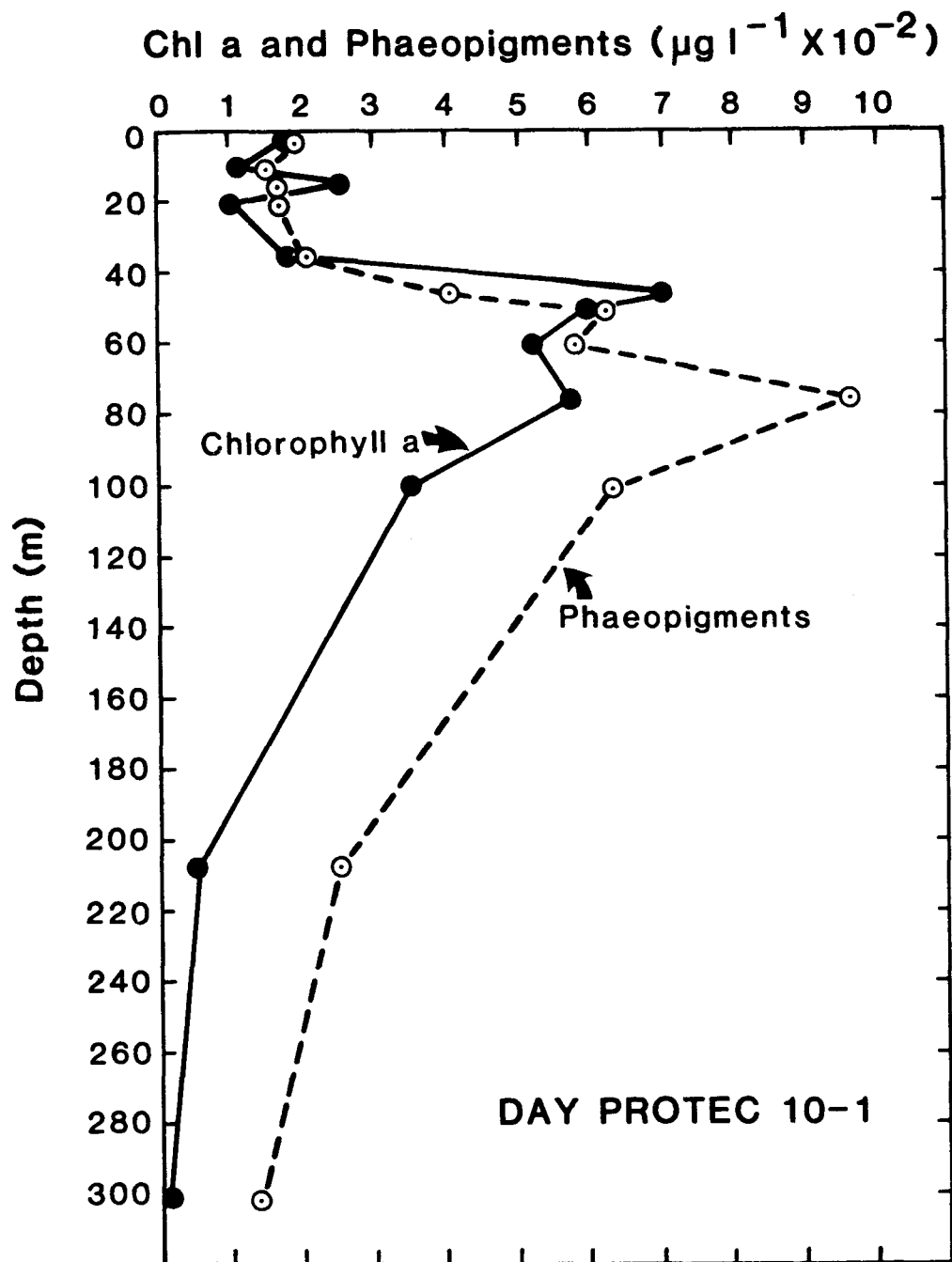


Figure 9. Chlorophyll and Phaeopigments - Day

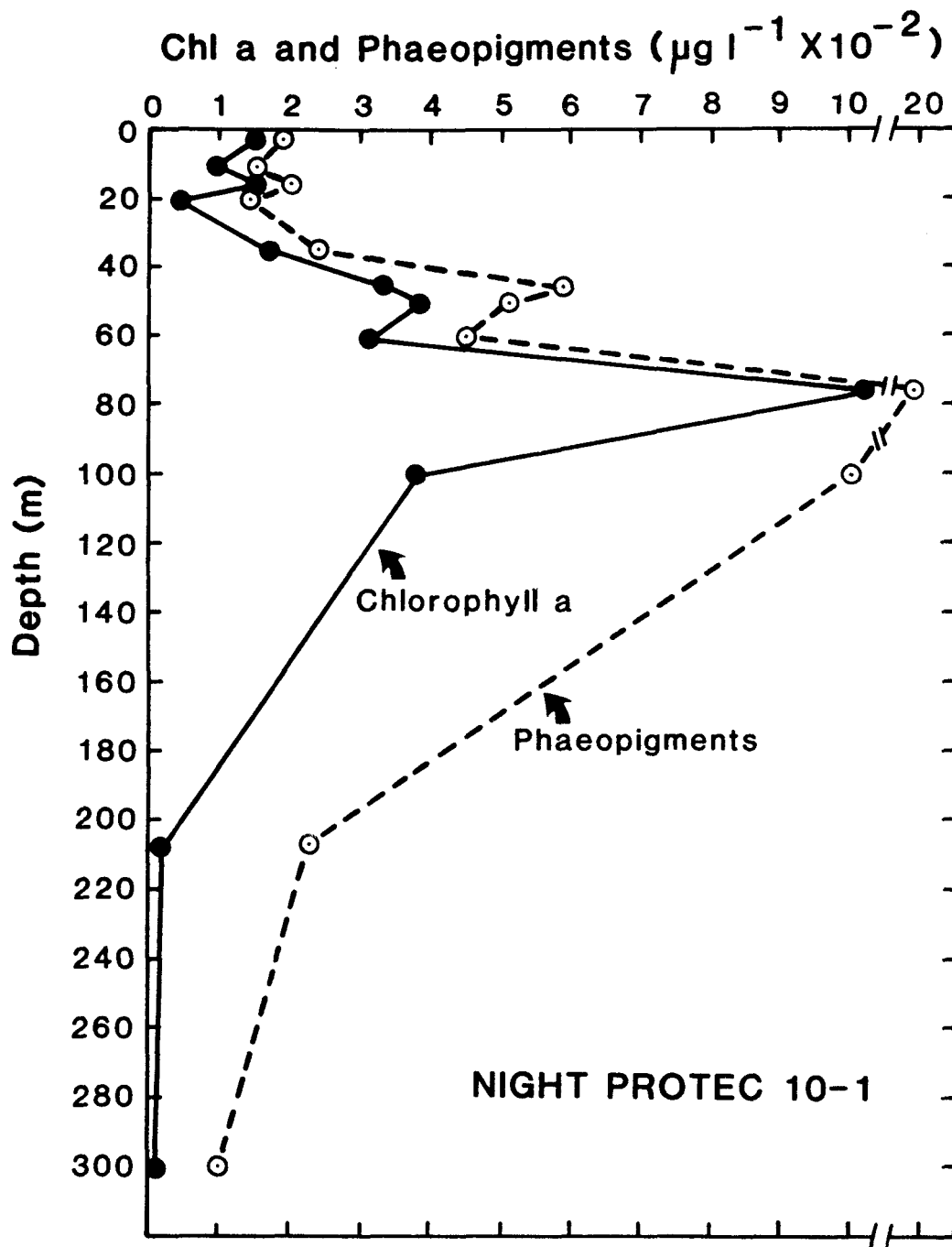
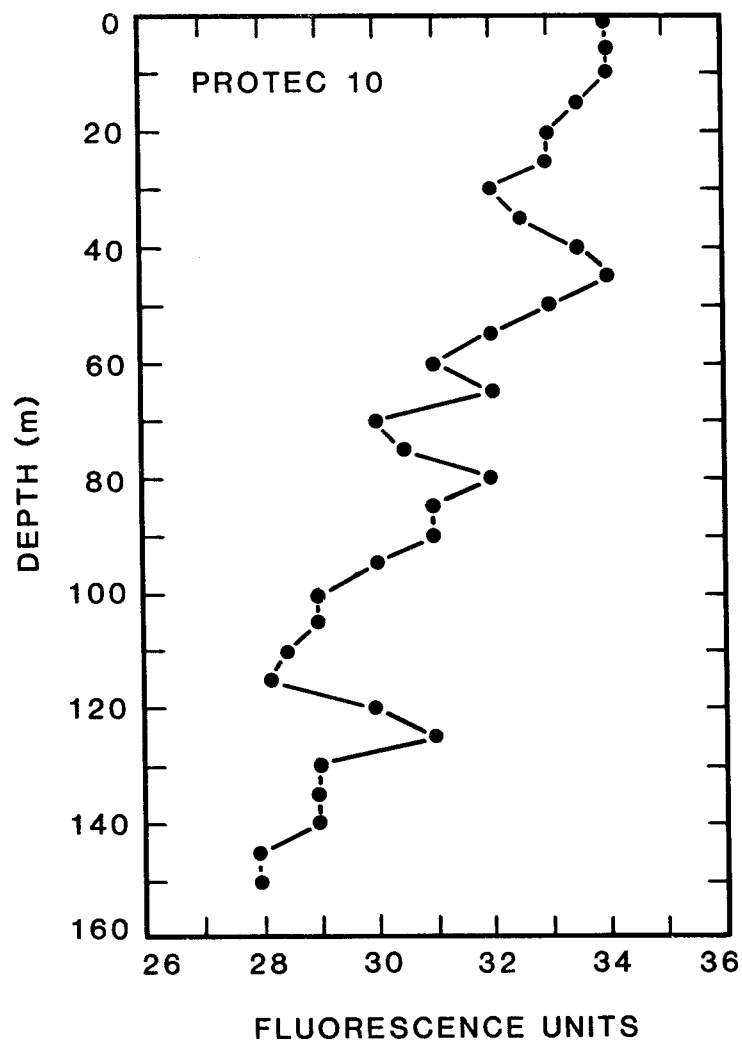
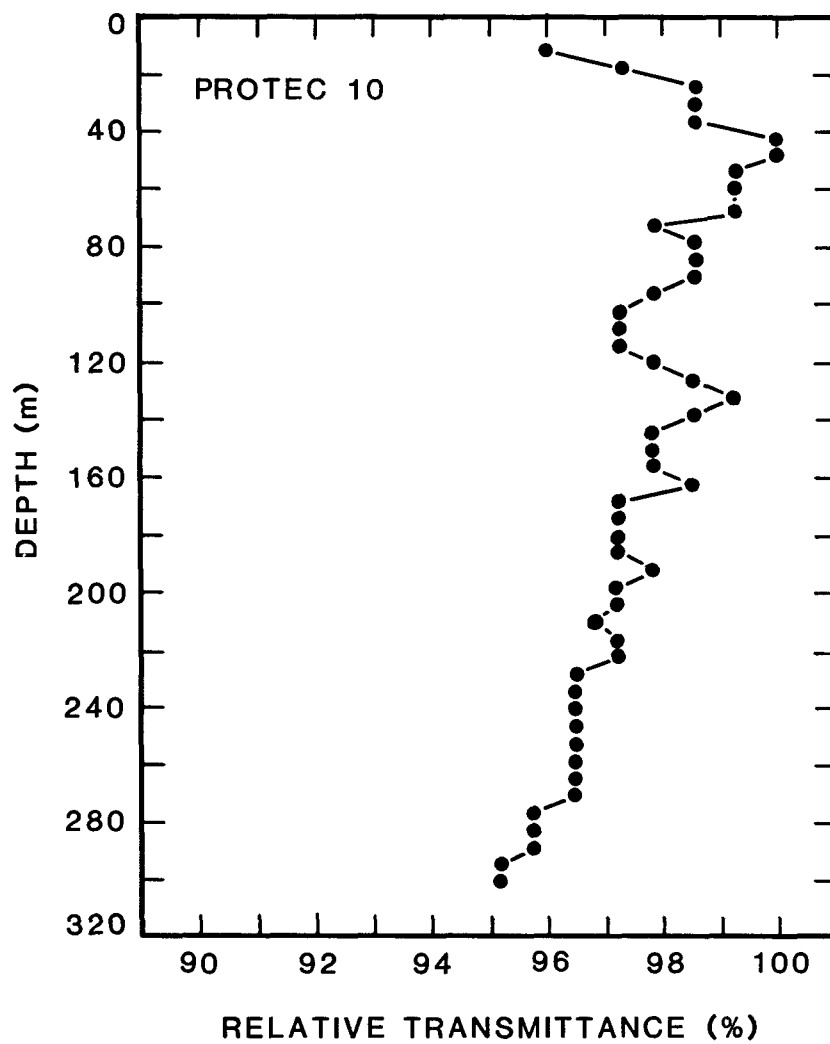


Figure 10. Chlorophyll and Phaeopigments



XBL 8012-13166

Figure 11. In vivo Profile



XBL 8012-13165

Figure 12. Transmissometer Profile

2. Zooplankton (H. Michel)

Oblique zooplankton tows were taken using a 0.6m, 202 μ mesh opening/closing Bongo nets (Tareq and Co., Miami, Fl.). The depth intervals sampled were 25-0m (Day and Night), 200-25m (Day and Night) and 600-200m (Day). Location and type of sample are listed in Table 17, tow data in Table 8. After completion of each tow, the samples from the inboard and outboard nets were preserved seperately using 5% buffered formalin. In the laboratory the samples were first split in half and half sent to LBL for dry weight determination. A displacement volume (Table 19) was determined on the remaining half and various splits taken for taxonomic analysis depending on the size and rarity of the organisms. The zooplankton counts from the samples are given in Table 19.

In the laboratory the presernved zooplankton samples were split using a Motoda box (Motoda, 1959) and one half sent to LBL for dry weight analysis. Displacement volume was determined on the other half and expressed as milliliters per meter cubed. The major groups were then enumerated for each sample. This data is presented in Table 20.

References

- Motoda, S. (1959). Devices of simple plankton apparatus. Mem. Fac. Fish., Hokkaido Univ. 7 (1-2), 73-94.

Table 17. Zooplankton Sample, Type, and Location.

Cruise: PROTEC-10

Site: Benchmark

Sample Number	Position Latitude & Longitude	Date (da,mo,yr)	Time Start (AST)	Length of Tow (min)	Net Type, Size, Mesh	Actual Depth of Sample (m)	Agrees with TDR	Sample & Tow Type	Comments
25-0m, Day, #1	17°54'N 65°54'W	17-11-80	0815	10	Bongo, 0.6m, 202u	20-0m	-	Oblique	No TDR used
25-0m, Day, #2	17 54'N 65 56'W	17-11-80	0841	10	"	"	"	"	
25-0m, Day, #3	17 54'N 65 56'W	17-11-80	0907	10	"	"	"	"	
25-0m, Day, #4	17 55'N 65 57'W	17-11-80	0944	16	"	"	"	"	
25-0m, Night,#1	17 53'N 65 45'W	16-11-80	2117	8	"	"	"	"	
25-0m, Night,#2	17 53'N 65 50'W	16-11-80	2144	13	"	"	"	"	
25-0m, Night,#3	17 54'N 65 49'W	16-11-80	2212	10	"	"	"	"	
25-0m, Night,#4	17 55'N 65 49'W	16-11-80	2234	10	"	"	"	"	
200-25m, Day, #1	17 49'N 65 49'W	18-11-80	0830	20	"	200-25		"	
200-25m, Day, #2	17 51'N 65 50'W	18-11-80	0920	15	"	"		"	
200-25m, Day, #3	17 52'N 65 51'W	18-11-80	1002	23	"	"		"	

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Table 17. Zooplankton Sample, Type, and Location. (Continued)

Cruise: PROTEC-10

Site: Benchmark

Sample Number	Position Latitude & Longitude	Date (da,mo,yr)	Time Start (AST)	Length of Tow (min)	Net Type, Size, Mesh	Actual Depth of Sample (m)	Agrees with TDR	Sample & Tow Type	Comments
200-25m, Day, #4	17 ⁰ 56'N 65 ⁰ 52'W	18-11-80	1057	20	Bongo, 0.6m, 202u	25-0m	-	Oblique	No TDR used
200-25m, Night, #1	17 56'N 65 46'W	19-11-80	1953	20	"	"		"	
200-25m, Night, #2	17 56'N 65 48'W	19-11-80	2107	14	"	"		"	
600-200m, Day, #1	17 53'N 65 52'W	19-11-80	0851	49	"	600-200m		"	
600-200m, Day, #2	17 54'N 65 59'W	20-11-80	1026	52	"	"		"	

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Table 18 . Zooplankton Tow Data.

Cruise: PROTEC-10			Wire	Wire	Flow	Flow	Vol.	Split	Split	Calibration Equation for Flow Meter:	
Depth/	Time	/Rep.	Out*	Angle*	Meter	Meter	Fil.	Size	Size	#1935-V=No.Rev.x0.152m/rev ^{x0.09π}	#3734-V=No.Rev.x0.147m/rev ^{x0.09π}
(m)		No.	(min.	(min.	Start	Finish	(m ³)	Taxon.	Dr. Wt.	Comments	
			of 2)	of 2)				Anal.	Anal.		
25-0	Day	1	35-	45 ⁰ -	0	3263 ¹	140.3	Various	1/2		
		1	0m	45 ⁰	0	3228 ²	134.0	"	"		
25-0	Day	2	35-	48 ⁰ -	0	3438 ¹	147.8	"	"		
		2	0m	45 ⁰	0	3795 ²	157.5	"	"		
25-0	Day	3	35-	45 ⁰ -	0	5713 ¹	245.7	"	"	Flowmeter seems to be malfunctioning	
		3	0m	45 ⁰	0	3963 ²	164.5	"	"		
25-0	Day	4	35-	45 ⁰ -	0	3442 ¹	148.0	"	"		
		4	0m	47 ⁰	0	4382 ²	181.8	"	"		
25-0	Night	1	35-	50 ⁰ -	0	3755 ¹	161.5	"	"		
		1	0	45 ⁰	0	3758 ²	156.0	"	"		
25-0	Night	2	35-	45 ⁰ -	0	1935 ¹	83.2	"	"		
		2	0	45 ⁰	0	2178 ²	90.4	"	"		
25-0	Night	3	35-	45 ⁰ -	0	4190 ¹	180.2	"	"		
		3	0	45 ⁰	0	4109 ²	170.5	"	"		
25-0	Night	4	35-	45 ⁰ -	0	4482 ¹	192.7	"	"		
		4	0	45 ⁰	0	4589 ²	190.4	"	"		
200-25	Day	1	400-	50 ⁰ -	0	5920 ¹	254.6	"	"		
		1	35m	45 ⁰	0	7110 ²	295.1	"	"		
200-25	Day	2	300-	50 ⁰ -	0	5600 ¹	240.8	"	"		
		2	35m	45 ⁰	0	5275 ²	218.9	"	"		
200-25	Day	3	285-	50 ⁰ -	0	6475 ¹	278.4	"	"		
		3	35m	55 ⁰	0	6390 ²	265.2	"	"		
200-25	Day	4	285-	48 ⁰ -	0	5280 ¹	227.0	"	"		
		4	35m	48 ⁰	0	7830 ²	325.0	"	"	Flowmeter still running at surface	

¹TSK #1935²TSK #3734

*Minimally taken at time of 1st and 2nd messenger.

Table 18. Zooplankton Tow Data. Continued

Cruise: PROTEC-10		Wire	Wire	Flow	Flow	Vol.	Split	Split	Calibration Equation for Flow Meter:	
Depth/	Time /Rep.	Out*	Angle*	Meter	Meter	File	Size	Size	#01273=No.Rev.x0.0269x0.09π	
(m)	No.	(min.	(min.	Start	Finish	(m ³)	Taxon.	Dr. Wt.	#01453=No.Rev.x0.0269x0.09π	
		of 2)	of 2)				Anal.	Anal.	Comments	
200-25 Night	1	285-	47 ⁰ -	656469	690280 ³	256.9	Various	1/2		
	1	35m	45 ⁰	114438	149101 ⁴	263.3	"	"		
200-25 Night	2	285-	45 ⁰ -	690321	722577 ³	245.1	"	"		
	2	35m	45 ⁰	149119	180185 ⁴	236.0	"	"		
600-200 Day	1	850-	40 ⁰ -	664853	765690 ³	766.1	"	"	Sample lost when cap came off in dry lab	
	1	280m	60 ⁰	001122	112627 ⁴	847.1	"	"		
600-200 Day	2	850-	45 ⁰ -	786203	911523 ³	952.1	"	"		
	2	285m	45 ⁰	246214	379374 ⁴	1011.6	"	"		

³ Niskin® Flowmeter #01273

⁴ Niskin® Flowmeter #01453

*Minimally taken at time of 1st and 2nd messenger.

Table 19. Zooplankton Displacement Volume.

Date	Time ¹ (AST)	Sample #	Displacement Volume (ml.)	m ³ Water Filtered	Vol./m
16 XI 80	2117-2125	25-0 m night	6	161.5	0.0371
			12	156.0	0.0769
	2144-2157		6	83.2	0.0721
			6	90.4	0.0664
	2212-2222		5	180.2	0.0277
			18	170.5	0.1056
	2234-2244		18	192.7	0.0934
			18	190.4	0.0945
17 XI 80	0815-0825	25-0 m day	6	140.3	0.0428
			2	134.0	0.0149
	0841-0851		9	147.8	0.0609
			10	157.5	0.0635
	0907-0917		8	245.7	0.0326
			7	164.5	0.0425
	0944-1000		14	148.0	0.0946
			6	181.8	0.0330
18 XI 80	0830-0850	200-25 m day	5	254.6	0.0196
			6	295.1	0.0203
	0920-0935		1	240.8	0.0041
			8	218.9	0.0365
	1002-1025		3	278.4	0.0108
			2	265.2	0.0075
	1057-1117		4	227.0	0.0176
19 XI 80	0851-0840	600-200 m day	Sample lost ²	766.1	
			6	847.1	0.0071

Table 19. Zooplankton Displacement Volume. Continued

Date	Time ¹ (AST)	Sample #	Displacement Volume (ml.)	m ³ Water Filtered	Vol./m
19 XI 80	1953-2013	200-25 m night	4	256.9	0.0156
			7	263.3	0.0266
	2107-2121		8	245.1	0.0326
			1	236.0	0.0042
	1026-1118	600-200 m day	5	952.1	0.0052
20 XI 80			8	1011.6	0.0079

¹Times of first and second messengers.

²Screw cap popped off plastic bottle when it fell over in dry lab.

TABLE 20. Zooplankton Counts

Site, Cruise, Station: PROTEC-10
 Date of Sample: 17-11-80
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 1
 Sample #: 25-0m, Day
 Time of Sample: 0815
 Sample Type: Zooplankton
 Vol. Fil. (M³): 140.3

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	1	0.03			1/32	38	8.67	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	53	1.51						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	33	0.94		LARVACEA				
Scyphozoa	1/4	0	0			1/32	198	45.16	
CTENOPHORA	1/4	2	0.06		SALPIDAE				
						1/32	16	3.65	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	5	0.14			1/4	4	0.11	
Thecosomata	1/4	31	0.88						
Gymnosomata	1/4	0	0		LARVAL FISH				
						1/4	5	0.14	
ANNELIDA (Polychaeta)	1/32	4	0.91		OTHER				
					Foraminifera	1/256	11	20.07	
					Radiolaria	1/256	13	23.72	
ARTHROPODA									
Copepoda Calanoida	1/256	225	410.55						
Copepoda Cyclopoida	1/256	107	195.24						
Copepoda Harpacticoida	1/256	4	7.30						
Ostracoda	1/32	1	0.23						
Amphipoda	1/32	2	0.46						
Euphausiacea	1/32	0	0						
Lucifer	1/3	0	0						
Decapod Larvae	1/32	4	0.91		TOTAL			720.68	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 17-11-80
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 1
 Sample #: 25-0m Day
 Time of Sample: 0815
 Sample Type: Zooplankton
 Vol. Fil.(M³): 134.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	1	0.01			1/2	57	0.85	
Leptomedusae	1/2	2	0.03						
Trachymedusae	1/2	5	0.07						
Narcomedusae	1/2	0	0						
Siphonophora	1/2	4	0.06		LARVACEA	1/2	112	1.67	
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/2	13	0.19	
MOLLUSCA					FISH EGGS				
Heteropoda	1/2	0	0			1/2	0	0	
Thecosomata	1/2	6	0.09						
Gymnosomata	1/2	0	0		LARVAL FISH	1/2	1	0.01	
ANNELIDA (Polychaeta)	1/2	5	0.07		OTHER				
					Foraminifera	1/32	6	1.43	
					Radiolaria	1/32	9	2.15	
ARTHROPODA									
Copepoda Calanoida	1/32	144	34.39						
Copepoda Cyclopoida	1/32	50	11.94						
Copepoda Harpacticoida	1/32	3	0.72						
Ostracoda	1/2	5	0.07						
Amphipoda	1/2	0	0						
Euphausiacea	1/2	2	0.03						
Lucifer	1/2	0	0						
Decapod Larvae	1/2	3	0.04		TOTAL			53.82	

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TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 17-11-80
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 2
 Sample #: 25-0m, Day
 Time of Sample: 0841
 Sample Type: Zooplankton
 Vol. Fil.(M³): 147.8

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/8	0	0			1/32	18	3.90	
Leptomedusae	1/8	0	0						
Trachymedusae	1/8	40	2.16						
Narcomedusae	1/8	1	0.05						
Siphonophora	1/32	30	6.49		LARVACEA	1/32	166	35.94	
Scyphozoa	1/8	0	0						
CTENOPHORA	1/8	0	0		SALPIDAE	1/32	23	4.98	
MOLLUSCA					FISH EGGS				
Heteropoda	1/8	1	0.05			1/8	0	0	
Thecosomata	1/32	3	0.65						
Gymnosomata	1/32	0	0		LARVAL FISH	1/8	3	0.16	
ANNELIDA (Polychaeta)									
	1/32	11	2.38		OTHER				
					Foraminifera	1/128	7	6.06	
					Radiolaria	1/128	12	10.39	
ARTHROPODA									
Copepoda Calanoida	1/128	207	179.27						
Copepoda Cyclopoida	1/128	104	90.07						
Copepoda Harpacticoida	1/128	2	1.73						
Ostracoda	1/32	2	0.43						
Amphipoda	1/8	2	0.11						
Euphausiacea	1/32	3	0.65						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	3	0.65		TOTAL			346.12	

TABLE 20. Zooplankton Counts (cont'd)

Rep. No.: 2
 Sample #: 25-0m, Day
 Time of Sample: 0841
 Sample Type: Zooplankton
 Vol. Fil.(M³): 157.5

Site, Cruise, Station: PROTEC-10
 Date of Sample: 17-11-80
 Depth of Sample (m): 25-0
 Net: Outboard

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	1	0.02			1/16	33	3.35	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	50	1.27						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	43	1.09		LARVACEA	1/16	229	23.26	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/16	23	2.34	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	6	0.15			1/4	2	0.05	
Thecosomata	1/4	12	0.30						
Gymnosomata	1/4	1	0.02		LARVAL FISH	1/4	4	0.10	
ANNELIDA (Polychaeta)	1/16	8	0.81		OTHER				
					Foraminifera	1/256	5	8.13	
					Radiolaria	1/256	6	9.75	
ARTHROPODA									
Copepoda Calanoida	1/256	124	201.55						
Copepoda Cyclopoida	1/256	56	91.02						
Copepoda Harpacticoida	1/256	3	4.88						
Ostracoda	1/16	5	0.51						
Amphipoda	1/16	4	0.41						
Euphausiacea	1/16	3	0.30						
Lucifer	1/16	0	0						
Decapod Larvae	1/16	3	0.30						
					TOTAL			349.61	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 17-11-80
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 3
 Sample #: 25-0m, Day
 Time of Sample: 6907
 Sample Type: Zooplankton
 Vol. Fil. (M³): 245.7

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	1	0.02			1/32	13	1.69	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	47	0.76						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	61	0.99		LARVACEA				
Scyphozoa	1/4	0	0			1/32	184	23.96	
CTENOPHORA	1/4	0	0		SALPIDAE				
						1/32	8	1.04	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	9	0.15			1/4	0	0	
Thecosomata	1/4	29	0.47						
Gymnosomata	1/4	0	0		LARVAL FISH				
						1/4	12	0.19	
ANNELIDA (Polychaeta)	1/32	7	0.91		OTHER				
					Foraminifera	1/256	16	16.67	
					Radiolaria	1/256	19	19.80	
ARTHROPODA									
Copepoda Galanoida	1/256	201	209.43						
Copepoda Cyclopoida	1/256	69	71.89						
Copepoda Harpacticoida	1/256	5	5.21						
Ostracoda	1/8	3	0.10						
Amphipoda	1/8	2	0.06						
Euphausiacea	1/8	5	0.16						
Lucifer	1/8	2	0.06						
Decapod Larvae	1/8	14	0.45		TOTAL			354.01	

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TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 17-11-80
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 3
 Sample #: 25-0m, Day
 Time of Sample: 0907
 Sample Type: Zooplankton
 Vol. Fil. (M³): 164.5

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/16	41	3.99	
Anthomedusae	1/4	1	0.02						
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	42	1.02						
Narcomedusae	1/4	0	0						
Siphonophora	1/16	40	3.89		LARVACEA	1/16	289	28.11	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/16	36	3.50	
MOLLUSCA					FISH EGGS	1/4	1	0.02	
Heteropoda	1/16	2	0.19						
Thecosomata	1/16	9	0.86						
Gymnosomata	1/16	0	0		LARVAL FISH	1/4	10	0.24	
ANNELIDA (Polychaeta)	1/16	22	2.14		OTHER				
					Foraminifera	1/256	2	3.11	
					Radiolaria	1/256	7	10.89	
ARTHROPODA									
Copepoda Calanoida	1/256	107	166.52						
Copepoda Cyclopoida	1/256	42	65.36						
Copepoda Harpacticoida	1/256	6	9.34						
Ostracoda	1/16	3	0.29						
Amphipoda	1/16	3	0.29						
Euphausiacea	1/16	0	0						
Lucifer	1/4	3	0.07						
Decapod Larvae	1/16	12	1.17		TOTAL			301.03	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 17-11-80
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 4
 Sample #: 25-0m, Day
 Time of Sample: 0944
 Sample Type: Zooplankton
 Vol. Fil.(M³): 148.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	1	0.03			1/32	19	4.11	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	36	0.97						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	44	1.19		LARVACEA	1/32	108	23.35	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/32	22	4.76	
MOLLUSCA					FISH EGGS	1/4	3	0.08	
Heteropoda	1/4	3	0.08						
Thecosomata	1/4	9	0.24		LARVAL FISH	1/4	11	0.30	
Gymnosomata	1/4	0	0						
ANNELIDA (Polychaeta)	1/8	13	0.70		OTHER				
					Foraminifera	1/128	11	9.51	
					Radiolaria	1/128	16	13.84	
ARTHROPODA									
Copepoda Calanoida	1/128	156	221.40						
Copepoda Cyclopoida	1/128	81	70.05						
Copepoda Harpacticoida	1/128	4	3.46						
Ostracoda	1/8	1	0.05						
Amphipoda	1/8	4	0.22						
Euphausiacea	1/8	0	0						
Lucifer	1/8	1	0.05						
Decapod Larvae	1/8	14	0.76						
					TOTAL			355.15	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROFEC-10
 Date of Sample: 17-11-80
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 4
 Sample #: 25-0m, Day
 Time of Sample: 0944
 Sample Type: Zooplankton
 Vol. Fil. (M³): 181.8

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/8	34	1.50	
Leptomedusae	1/2	1	0.01						
Trachymedusae	1/2	42	0.46						
Narcomedusae	1/2	0	0		LARVACEA	1/8	166	7.30	
Siphonophora	1/2	62	0.68						
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/8	31	1.36	
MOLLUSCA					FISH EGGS	1/2	2	0.02	
Heteropoda	1/2	3	0.03						
Thecosomata	1/2	9	0.10		LARVAL FISH	1/2	3	0.03	
Gymnosomata	1/2	0	0						
ANNELIDA (Polychaeta)	1/8	9	0.30		OTHER				
					Foraminifera	1/64	12	4.22	
					Radiolaria	1/64	29	10.21	
ARTHROPODA									
Copepoda Calanoida	1/64	119	41.89						
Copepoda Cyclopoida	1/64	80	28.16						
Copepoda Harpacticoida	1/64	3	1.06						
Ostracoda	1/8	1	0.04						
Amphipoda	1/8	3	0.13						
Euphausiacea	1/8	2	0.09						
Lucifer	1/8	1	0.04						
Decapod Larvae	1/8	7	0.31						
					TOTAL			97.94	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 16-11-80
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 1
 Sample #: 25-0m, Night
 Time of Sample: 2117
 Sample Type: Zooplankton
 Vol. Fil.(M³): 161.5

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/32	47	9.31	
Leptomedusae	1/4	2	0.05						
Trachymedusae	1/4	32	0.79						
Narcomedusae	1/4	1	0.02						
Siphonophora	1/4	19	0.47		LARVACEA	1/32	87	17.24	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/32	6	1.34	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	2	0.05			1/4	1	0.02	
Thecosomata	1/4	36	0.89						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	10	0.25	
ANNELIDA (Polychaeta)	1/32	11	2.18		OTHER				
ARTHROPODA					Foraminifera	1/256	12	19.02	
Copepoda Calanoida	1/256	130	206.07		Radiolaria	1/256	4	6.34	
Copepoda Cyclopoida	1/256	90	142.66		Amphioxus	1/32	1	0.20	
Copepoda Harpacticoida	1/256	1	1.58						
Ostracoda	1/32	5	0.99						
Amphipoda	1/32	3	0.59						
Euphausiacea	1/32	27	5.35						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	8	1.58						
					TOTAL			416.99	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 16-11-80
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 1
 Sample #: 25-0m, Night
 Time of Sample: 2117(0117)
 Sample Type: Zooplankton
 Vol. Fil.(M³): 156.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	1	0.02			1/32	59	12.10	
Leptomedusae	1/4	2	0.05						
Trachymedusae	1/4	73	1.87						
Narcomedusae	1/4	1	0.02						
Siphonophora	1/32	19	3.90		LARVACEA				
Scyphozoa	1/4	0	0			1/32	116	23.79	
CTENOPHORA	1/4	0	0		SALPIDAE	1/32	4	0.82	
MOLLUSCA					FISH EGGS				
Heteropoda	1/32	0	0			1/32	0	0	
Thecosomata	1/32	4	0.82						
Gymnosomata	1/32	0	0		LARVAL FISH	1/4	11	0.28	
ANNELIDA (Polychaeta)	1/32	26	5.33		OTHER				
ARTHROPODA					Foraminifera	1/128	7	5.74	
Copepoda Calanoida	1/128	264	216.61		Radiolaria	1/128	6	4.92	
Copepoda Cyclopoida	1/128	140	114.87		Amphioxus	1/32	1	0.20	
Copepoda Harpacticoida	1/128	1	0.82						
Ostracoda	1/32	5	1.02						
Amphipoda	1/32	4	0.82						
Euphausiacea	1/32	12	2.46						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	5	1.02						
					TOTAL			498.46	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 16-11-80
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 2
 Sample #: 25-0m, Night
 Time of Sample: 2144 (0144)
 Sample Type: Zooplankton
 Vol. Fil. (M³): 83.2

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/32	39	15.00	
Anthomedusae	1/4	0	0						
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	16	0.77						
Narcomedusae	1/4	1	0.05						
Siphonophora	1/4	13	0.62		LARVACEA	1/32	40	15.38	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/32	6	2.31	
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/4	3	0.14						
Thecosomata	1/4	15	0.72						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	5	0.24	
ANNELIDA (Polychaeta)	1/32	7	2.69						
					OTHER				
ARTHROPODA					Foraminifera	1/128	23	35.38	
Copepoda Calanoida	1/128	188	289.23		Radiolaria	1/128	7	10.76	
Copepoda Cyclopoida	1/128	86	132.31		Amphioxus	1/4	1	0.05	
Copepoda Harpacticoida	1/128	3	4.62		Octopod larvae	1/4	4	0.05	
Ostracoda	1/32	5	1.92						
Amphipoda	1/32	1	0.38						
Euphausiacea	1/32	10	3.85						
Lucifer	1/32	1	0.38						
Decapod Larvae	1/32	3	1.15		TOTAL			518.00	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 16-11-80
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 2
 Sample #: 25-0m, Night
 Time of Sample: 2144 (0144)
 Sample Type: Zooplankton
 Vol. Fil. (M³): 90.4

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/16	93	16.46	
Leptomedusae	1/4	1	0.04						
Trachymedusae	1/4	36	1.59						
Narcomedusae	1/4	4	0.18						
Siphonophora	1/16	22	3.89		LARVACEA	1/16	153	27.08	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/16	9	1.59	
MOLLUSCA					FISH EGGS				
Heteropoda	1/16	2	0.35			1/4	0	0	
Thecosomata	1/16	5	0.88						
Gymnosomata	1/16	0	0		LARVAL FISH	1/4	2	0.09	
ANNELIDA (Polychaeta)	1/16	27	4.78		OTHER				
					Foraminifera	1/128	2	0.09	
					Radiolaria	1/128	5	7.08	
					Amphioxus	1/4	4	5.66	
ARTHROPODA									
Copepoda Calanoida	1/128	182	257.70						
Copepoda Cyclopoida	1/128	90	127.43						
Copepoda Harpacticoida	1/128	2	2.83						
Ostracoda	1/16	13	2.30						
Amphipoda	1/16	4	0.71						
Euphausiacea	1/16	38	6.72						
Lucifer	1/4	3	0.13						
Decapod Larvae	1/16	1	0.18		TOTAL			476.67	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 16-11-80
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 3
 Sample #: 25-0m, Night
 Time of Sample: 2212(0212)
 Sample Type: Zooplankton
 Vol. Fil.(M³): 180.2

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	1	0.02			1/32	60	10.65	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	18	0.40						
Narcomedusae	1/4	0	0		LARVACEA				
Siphonophora	1/4	13	0.29			1/32	44	7.81	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/32	1	0.18	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	4	0.09			1/4	1	0.02	
Thecosomata	1/4	30	0.66						
Gymnosomata	1/4	2	0.04		LARVAL FISH	1/4	6	0.13	
ANNELIDA (Polychaeta)	1/32	9	1.60		OTHER				
ARTHROPODA					Radiolaria	1/128	2	1.42	
Copepoda Calanoida	1/128	236	167.63		Amphioxus	1/4	2	0.04	
Copepoda Cyclopoida	1/128	140	99.44		Squid Larvae	1/4	1	0.02	
Copepoda Harpacticoida	1/128	0	0						
Ostracoda	1/32	5	0.89						
Amphipoda	1/32	5	0.89						
Euphausiacea	1/32	19	3.37						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	12	2.13		TOTAL			297.72	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 16-11-80
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 3
 Sample #: 25-0m, Night
 Time of Sample: 2212
 Sample Type: Zooplankton
 Vol. Fil.(M³): 170.5

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/64	58	21.77	
Leptomedusae	1/16	0	0						
Trachymedusae	1/16	19	1.78						
Narcomedusae	1/16	1	0.09		LARVACEA				
Siphonophora	1/64	18	6.76			1/64	213	79.95	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/64	9	3.38	
MOLLUSCA					FISH EGGS				
Heteropoda	1/64	1	0.37			1/16	1	0.09	
Thecosomata	1/64	1	0.37						
Gymnosomata	1/64	1	0.37		LARVAL FISH	1/16	2	0.19	
ANNELIDA (Polychaeta)	1/64	20	7.51		OTHER				
ARTHROPODA					Foraminifera	1/256	4	6.00	
Copepoda Calanoida	1/256	381	572.06		Radiolaria	1/256	5	7.51	
Copepoda Cyclopoida	1/256	148	222.22		Amphioxus	1/64	1	0.37	
Copepoda Harpacticoida	1/256	2	3.00		Squid larvae	1/16	1	0.09	
Ostracoda	1/64	4	1.50		Unidentified Hydromedusa	1/16	1	0.09	
Amphipoda	1/64	6	2.25						
Euphausiacea	1/64	28	10.51						
Lucifer	1/16	3	0.28						
Decapod Larvae	1/64	0	0						
					TOTAL			948.51	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 16-11-80
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 4
 Sample #: 25-0m, Night
 Time of Sample: 2234
 Sample Type: Zooplankton
 Vol. Fil. (M³): 192.7

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/8	0	0			1/32	78	12.95	
Leptomedusae	1/8	1	0.04						
Trachymedusae	1/8	13	0.54						
Narcomedusae	1/8	0	0						
Siphonophora	1/8	10	0.41		LARVACEA				
Scyphozoa	1/8	0	0			1/32	118	19.59	
CTENOPHORA	1/8	0	0		SALPIDAE				
						1/32	11	1.83	
MOLLUSCA					FISH EGGS				
Heteropoda	1/8	1	0.04			1/8	1	0.04	
Thecosomata	1/8	14	0.58						
Gymnosomata	1/8	0	0		LARVAL FISH				
						1/8	5	0.21	
ANNELIDA (Polychaeta)	1/32	11	1.83		OTHER				
					Foraminifera	1/256	24	31.88	
					Amphioxus	1/8	1	0.04	
					Squid larvae	1/8	2	0.08	
ARTHROPODA									
Copepoda Calanoida	1/256	366	486.23						
Copepoda Cyclopoida	1/256	149	197.94						
Copepoda Harpacticoida	1/256	1	1.33						
Ostracoda	1/32	8	1.33						
Amphipoda	1/32	8	1.33						
Euphausiacea	1/32	34	5.65						
Lucifer	1/32	1	0.17						
Decapod Larvae	1/32	10	1.66						
					<u>TOTAL</u>			765.70	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 16-11-80
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 4
 Sample #: 25-0m, Night
 Time of Sample: 2234
 Sample Type: Zooplankton
 Vol. Fil.(M³): 190.4

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/32	67	11.26	
Anthomedusae	1/4	2	0.04						
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	49	1.03						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	22	0.46		LARVACEA	1/32	71	11.93	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/32	18	3.02	
MOLLUSCA					FISH EGGS	1/4	1	0.02	
Heteropoda	1/4	3	0.06						
Thecosomata	1/4	17	0.36						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	8	0.17	
ANNELIDA (Polychaeta)	1/32	6	1.01		OTHER				
					Foraminifera	1/256	4	5.38	
					Radiolaria	1/256	3	4.03	
ARTHROPODA									
Copepoda Calanoida	1/256	250	336.13						
Copepoda Cyclopoida	1/256	110	147.90						
Copepoda Harpacticoida	1/256	1	1.34						
Ostracoda	1/32	8	1.34						
Amphipoda	1/32	3	0.50						
Euphausiacea	1/32	22	0.27						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	11	1.85		TOTAL			528.10	

TABLE 20. Zooplankton Counts (cont'd)

Site, Cruise, Station: PROTEC-10
 Date of Sample: 18-11-80
 Depth of Sample (m): 200-25
 Net: Inboard

Rep. No.: 1
 Sample #: 200-25m, Day
 Time of Sample: 0830
 Sample Type: Zooplankton
 Vol. Fil.(M³): 254.6

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/16	29	1.82	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	7	0.11						
Narcomedusae	1/4	0	0						
Siphonophora	1/16	12	0.75		LARVACEA	1/16	35	2.20	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/16	19	1.19	
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/16	0	0						
Thecosomata	1/16	5	0.31						
Gymnosomata	1/16	0	0		LARVAL FISH	1/4	8	0.12	
ANNELIDA (Polychaeta)	1/16	10	0.63		OTHER				
ARTHROPODA					Foraminifera	1/128	0	0	
Copepoda Calanoida	1/128	156	78.43		Radiolaria	1/128	0	0	
Copepoda Cyclopoida	1/128	42	21.11		Amphioxus	1/4	2	0.03	
Copepoda Harpacticoida	1/128	1	0.50						
Ostracoda	1/16	135	8.48						
Amphipoda	1/16	2	0.12						
Euphausiacea	1/16	12	0.75						
Lucifer	1/4	6	0.09						
Decapod Larvae	1/16	3	0.19						
					<u>TOTAL</u>			116.83	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 18-11-80
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 1
 Sample #: 200-25m, Day
 Time of Sample: 0830 (AST)
 Sample Type: Zooplankton
 Vol. Fil.(M³): 295.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/16	48	2.60	
Anthomedusae	1/2	0	0						
Leptomedusae	1/2	2	0.01						
Trachymedusae	1/2	14	0.09						
Narcomedusae	1/2	2	0.01						
Siphonophora	1/2	15	0.10		LARVACEA	1/16	21	1.14	
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/16	6	0.32	
MOLLUSCA					FISH EGGS	1/2	4	0.03	
Heteropoda	1/2	3	0.02						
Thecosomata	1/2	31	0.21		LARVAL FISH	1/2	24	0.16	
Gymnosomata	1/2	1	0.01						
ANNELIDA (Polychaeta)	1/16	9	0.49		OTHER				
					Foraminifera	1/64	12	2.60	
					Radiolaria	1/64	3	0.65	
ARTHROPODA									
Copepoda Calanoida	1/64	327	70.92						
Copepoda Cyclopoida	1/64	104	22.55						
Copepoda Harpacticoida	1/64	8	1.73						
Ostracoda	1/16	129	6.79						
Amphipoda	1/16	8	0.43						
Euphausiacea	1/16	8	0.43						
Lucifer	1/16	1	0.05						
Decapod Larvae	1/16	12	0.65		TOTAL			111.99	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 18-11-80
 Depth of Sample (m): 200-25
 Net: Inboard

Rep. No.: 2
 Sample #: 200-25m, Day
 Time of Sample: 0920
 Sample Type: Zooplankton
 Vol. Fil.(M³): 240.8

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	23	0.38	
Leptomedusae	1/4	1	0.02						
Trachymedusae	1/4	1	0.02						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	5	0.08		LARVACEA				
Scyphozoa	1/4	0	0			1/4	10	0.17	
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	6	0.19	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	1	0.02			1/4	0	0	
Thecosomata	1/4	6	0.10						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	1	0.02	
ANNELIDA (Polychaeta)	1/4	5	0.08		OTHER				
ARTHROPODA					Foraminifera	1/16	6	0.40	
Copepoda Calanoida	1/16	182	12.09		Radiolaria	1/16	1	0.07	
Copepoda Cyclopoida	1/16	83	5.51						
Copepoda Harpacticoida	1/16	5	0.33						
Ostracoda	1/4	45	0.75						
Amphipoda	1/4	1	0.02						
Euphausiacea	1/4	5	0.08						
Lucifer	1/4	1	0.02						
Decapod Larvae	1/4	5	0.08						
					TOTAL			20.40	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 18-11-80
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 2
 Sample #: 200-25m, Day
 Time of Sample: 0950
 Sample Type: Zooplankton
 Vol. Fil. (M³): 218.9

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/16	65	4.75	
Leptomedusae	1/4	1	0.02						
Trachymedusae	1/4	26	0.47						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	21	0.38		LARVACEA	1/16	73	5.33	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/16	23	1.68	
MOLLUSCA					FISH EGGS	1/4	1	0.02	
Heteropoda	1/4	6	0.11						
Thecosomata	1/4	27	0.49		LARVAL FISH	1/4	1	0.02	
Gymnosomata	1/4	1	0.02						
ANNELIDA (Polychaeta)	1/16	10	0.73		OTHER				
					Foraminifera	1/64	17	4.97	
					Radiolaria	1/64	4	1.17	
ARTHROPODA									
Copepoda Calanoida	1/64	586	171.33						
Copepoda Cyclopoida	1/64	151	44.15						
Copepoda Harpacticoida	1/64	7	2.05						
Ostracoda	1/16	120	8.77						
Amphipoda	1/16	5	0.36						
Euphausiacea	1/16	8	0.58						
Lucifer	1/16	1	0.07						
Decapod Larvae	1/16	7	0.51						
					TOTAL			247.68	

TABLE 20: Zooplankton Counts (Cont'd).

Rep. No.: 3
 Sample #: 200-25m, Day
 Time of Sample: 1002
 Sample Type: Zooplankton
 Vol. Fil.(M³): 278.4

Site, Cruise, Station: PROTEC-10
 Date of Sample: 18-11-80
 Depth of Sample (m): 200-25
 Net: Inboard

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/8	20	0.57	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0						
Siphonophora	1/8	7	0.20		LARVACEA				
Scyphozoa	1/4	0	0			1/8	16	0.46	
CTENOPHORA	1/4	0	0		SALPIDAE				
						1/8	14	0.40	
MOLLUSCA					FISH EGGS				
Heteropoda	1/8	0	0			1/8	2	0.06	
Thecosomata	1/8	2	0.06						
Gymnosomata	1/8	0	0		LARVAL FISH				
						1/8	5	0.14	
ANNELIDA (Polychaeta)	1/8	5	0.14		OTHER				
					Foraminifera	1/4	11	0.16	
					Radiolaria	1/4	5	0.07	
ARTHROPODA									
Copepoda Calanoida	1/32	187	21.49						
Copepoda Cyclopoida	1/32	87	10.00						
Copepoda Harpacticoida	1/32	6	1.84						
Ostracoda	1/8	99	2.84						
Amphipoda	1/4	7	0.10						
Euphausiacea	1/8	3	0.09						
Lucifer	1/4	0	0						
Decapod Larvae	1/8	2	0.06		TOTAL			39.22	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 18-11-80
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 3
 Sample #: 200-25m, Day
 Time of Sample: 1002
 Sample Type: Zooplankton
 Vol. Fil. (M³): 265.2

A-80

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/4	32	0.48	
Leptomedusae	1/2	0	0						
Trachymedusae	1/2	7	0.05		LARVACEA				
Narcomedusae	1/2	0	0			1/4	43	0.65	
Siphonophora	1/2	10	0.07						
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/4	13	0.20	
MOLLUSCA					FISH EGGS				
Heteropoda	1/2	2	0.01			1/2	1	0.01	
Thecosomata	1/2	14	0.10						
Gymnosomata	1/2	0	0		LARVAL FISH	1/2	18	0.13	
ANNELIDA (Polychaeta)	1/4	11	0.16		OTHER				
ARTHROPODA					Foraminifera	1/64	12	2.89	
Copepoda Calanoida	1/64	154	37.16		Radiolaria	1/64	5	1.21	
Copepoda Cyclopoida	1/64	39	9.41		Amphioxus	1/2	5	0.04	
Copepoda Harpacticoida	1/64	3	0.72						
Ostracoda	1/4	201	3.03						
Amphipoda	1/4	8	0.12						
Euphausiacea	1/4	5	0.07						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	10	0.15						
					TOTAL			56.66	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 18-11-80
 Depth of Sample (m): 200-25
 Net: Inboard

Rep. No.: 4
 Sample #: 200-25m, Day
 Time of Sample: 1057
 Sample Type: Zooplankton
 Vol. Fil. (M³): 227.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/8	0	0			1/32	27	3.81	
Leptomedusae	1/8	0	0						
Trachymedusae	1/8	7	0.25						
Narcomedusae	1/8	0	0						
Siphonophora	1/32	7	0.99		LARVACEA				
Scyphozoa	1/8	0	0			1/32	27	3.81	
CTENOPHORA	1/8	0	0		SALPIDAE	1/32	13	1.83	
MOLLUSCA					FISH EGGS				
Heteropoda	1/32	0	0			1/8	1	0.03	
Thecosomata	1/32	7	0.99						
Gymnosomata	1/32	0	0		LARVAL FISH	1/8	4	0.14	
ANNELIDA (Polychaeta)	1/32	10	1.41		OTHER				
					Foraminifera	1/64	4	1.13	
					Radiolaria	1/64	4	1.13	
					Amphioxus	1/8	3	0.10	
ARTHROPODA									
Copepoda Calanoida	1/64	295	83.17						
Copepoda Cyclopoida	1/64	81	22.84						
Copepoda Harpacticoida	1/64	6	1.69						
Ostracoda	1/32	105	14.80						
Amphipoda	1/32	1	0.14						
Euphausiacea	1/32	5	0.70						
Lucifer	1/8	0	0						
Decapod Larvae	1/32	6	0.84		TOTAL			139.80	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 18-11-80
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 4
 Sample #: 200-25m, Day
 Time of Sample: 1057
 Sample Type: Zooplankton
 Vol. Fil.(M³): 324.9

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/16	60	2.95	
Leptomedusae	1/2	2	0.01						
Trachymedusae	1/2	46	0.28						
Narcomedusae	1/2	0	0		LARVACEA				
Siphonophora	1/2	39	0.24			1/16	64	3.15	
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/16	22	1.08	
MOLLUSCA					FISH EGGS	1/2	7	0.04	
Heteropoda	1/2	5	0.03						
Thecosomata	1/2	33	0.20						
Gymnosomata	1/2	0	0		LARVAL FISH	1/2	29	0.18	
ANNELIDA (Polychaeta)	1/16	10	0.49		OTHER				
					Foraminifera	1/128	3	1.18	
					Radiolaria	1/128	5	1.96	
ARTHROPODA									
Copepoda Calanoida	1/128	275	108.34						
Copepoda Cyclopoida	1/128	67	26.40						
Copepoda Harpacticoida	1/128	2	0.79						
Ostracoda	1/16	211	10.39						
Amphipoda	1/16	4	0.20						
Euphausiacea	1/16	7	0.34						
Lucifer	1/16	1	0.05						
Decapod Larvae	1/16	16	0.79		TOTAL			181.86	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 19-11-80
 Depth of Sample (m): 200-25
 Net: Inboard

Rep. No.: 1
 Sample #: 200-25m, Night
 Time of Sample: 1953
 Sample Type: Zooplankton
 Vol. Fil.(M³): 256.9

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/16	35	2.18	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	14	0.22						
Narcomedusae	1/4	1	0.01						
Siphonophora	1/16	9	0.56		LARVACEA				
Scyphozoa	1/4	0	0			1/16	48	2.99	
CTENOPHORA	1/4	0	0		SALPIDAE	1/16	22	1.37	
MOLLUSCA					FISH EGGS				
Heteropoda	1/16	1	0.06			1/4	0	0	
Thecosomata	1/16	4	0.25						
Gymnosomata	1/16	0	0		LARVAL FISH	1/4	8	0.12	
ANNELIDA (Polychaeta)	1/16	6	0.37		OTHER				
					Foraminifora	1/16	18	1.12	
					Radiolaria	1/16	3	0.19	
					Amphioxus	1/4	1	0.01	
ARTHROPODA									
Copepoda Calanoida	1/64	173	43.10						
Copepoda Cyclopoida	1/64	68	16.94						
Copepoda Harpacticoida	1/64	2	0.50						
Ostracoda	1/16	40	2.49						
Amphipoda	1/16	3	0.19						
Euphausiacea	1/16	9	0.56						
Lucifer	1/4	1	0.01						
Decapod Larvae	1/16	4	0.25		TOTAL			73.43	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 19-11-80
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 1
 Sample #: 200-25m, Night
 Time of Sample: 1953
 Sample Type: Zooplankton
 Vol. Fil. (M³): 263.3

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/8	57	1.73	
Leptomedusae	1/2	5	0.04						
Trachymedusae	1/2	15	0.11						
Narcomedusae	1/2	2	0.01		LARVACEA	1/8	101	3.07	
Siphonophora	1/2	43	0.33						
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/8	13	0.39	
MOLLUSCA					FISH EGGS	1/2	1	0.01	
Heteropoda	1/2	2	0.01						
Thecosomata	1/2	29	0.22		LARVAL FISH	1/2	12	0.09	
Gymnosomata	1/2	0	0						
ANNELIDA (Polychaeta)	1/8	10	0.30		OTHER				
					Foraminifera	1/64	23	5.59	
					Radiolaria	1/64	7	1.70	
ARTHROPODA									
Copepoda Calanoida	1/64	308	74.86						
Copepoda Cyclopoida	1/64	91	22.12						
Copepoda Harpacticoida	1/64	4	0.97						
Ostracoda	1/8	139	4.22						
Amphipoda	1/8	10	0.30						
Euphausiacea	1/8	37	1.12						
Lucifer	1/8	0	0		<u>TOTAL</u>			117.68	
Decapod Larvae	1/8	16	0.49						

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 19-11-80
 Depth of Sample (m): 200-25
 Net: Inboard

Rep. No.: 2
 Sample #: 200-25m, Night
 Time of Sample: 2107
 Sample Type: Zooplankton
 Vol. Fil.(M³): 245.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/16	59	3.85	
Leptomedusae	1/4	3	0.05						
Trachymedusae	1/4	43	0.70						
Narcomedusae	1/4	1	0.02		LARVACEA				
Siphonophora	1/4	19	0.31			1/16	109	7.11	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/16	14	0.91	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	2	0.03			1/4	2	0.03	
Thecosomata	1/4	41	0.67						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	19	0.31	
ANNELIDA (Polychaeta)	1/16	10	0.65		OTHER				
ARTHROPODA					Foraminifera	1/128	11	5.74	
Copepoda Calanoida	1/128	268	139.96		Radiolaria	1/128	1	0.52	
Copepoda Cyclopoida	1/128	66	34.47		Amphioxus	1/4	2	0.03	
Copepoda Harpacticoida	1/128	1	0.52		Cephalopods	1/4	1	0.02	
Ostracoda	1/16	113	7.38						
Amphipoda	1/16	5	0.33						
Euphausiacea	1/16	42	2.74						
Lucifer	1/16	3	0.19						
Decapod Larvae	1/16	19	1.24						
					TOTAL			207.78	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 19-11-80
 Depth of Sample (m): 200-25m
 Net: Outboard

Rep. No.: 2
 Sample #: 200-25m, Night
 Time of Sample: 2107
 Sample Type: Zooplankton
 Vol. Fil. (M³): 236.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/2	15	0.13	
Leptomedusae	1/2	1	0.01						
Trachymedusae	1/2	5	0.04						
Narcomedusae	1/2	0	0						
Siphonophora	1/2	2	0.02		LARVACEA				
Scyphozoa	1/2	0	0			1/2	34	0.29	
CTENOPHORA	1/2	0	0		SALPIDAE	1/2	9	0.06	
MOLLUSCA					FISH EGGS				
Heteropoda	1/2	0	0			1/2	0	0	
Thecosomata	1/2	1	0.01						
Gymnosomata	1/2	0	0		LARVAL FISH	1/2	2	0.02	
ANNELIDA (Polychaeta)	1/2	3	0.02		OTHER				
ARTHROPODA					Foraminifera	1/4	6	0.10	
Copepoda Calanoida	1/4	244	4.13		Radiolaria	1/4	1	0.02	
Copepoda Cyclopoida	1/4	65	1.10						
Copepoda Harpacticoida	1/4	3	0.05						
Ostracoda	1/2	23	0.19						
Amphipoda	1/2	2	0.02						
Euphausiacea	1/2	5	0.04						
Lucifer	1/2	0	0						
Decapod Larvae	1/2	6	0.05						
					TOTAL			6.30	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 19-11-80
 Depth of Sample (m): 600-200
 Net: Outboard (Inboard sample lost)

Rep. No.: 1
 Sample #: 600-200m, Day
 Time of Sample: 0851
 Sample Type: Zooplankton
 Vol. Fil.(M³): 847.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/2	23	0.11	
Leptomedusae	1/2	0	0						
Trachymedusae	1/2	1	0						
Narcomedusae	1/2	6	0.01						
Siphonophora	1/4	2	0.01		LARVACEA				
Scyphozoa	1/2	0	0			1/4	1	0	
CTENOPHORA	1/2	0	0		SALPIDAE	1/4	0	0	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	0	0			1/2	0	0	
Thecosomata	1/4	2	0.01						
Gymnosomata	1/4	0	0		LARVAL FISH	1/2	9	0.02	
ANNELIDA (Polychaeta)	1/4	7	0.03		OTHER				
ARTHROPODA					Foraminifera	1/16	2	0.04	
Copepoda Calanoida	1/16	210	3.97		Radiolaria	1/16	2	0.04	
Copepoda Cyclopoida	1/16	58	1.09		Amphioxus	1/16	1	0.02	
Copepoda Harpacticoida	1/16	3	0.06						
Ostracoda	1/4	281	1.33						
Amphipoda	1/4	2	0.01						
Euphausiacea	1/4	27	0.13						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	5	0.02						
					TOTAL			6.90	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10

Date of Sample: 20-11-80

Depth of Sample (m): 600-200

Net: Inboard

Rep. No.: 2

Sample #: 600-200m, Day

Time of Sample: 1026

Sample Type: Zooplankton

Vol. Fil.(M³): 952.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/8	30	0.25	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	2	0.01						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	2	0.01		LARVACEA	1/8	3	0.02	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/8	9	0.07	
MOLLUSCA					FISH EGGS	1/4	1	0.00	
Heteropoda	1/4	0	0						
Thecosomata	1/4	6	0.02						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	6	0.02	
ANNELIDA (Polychaeta)	1/8	4	0.03		OTHER				
ARTHROPODA					Foraminifera	1/32	17	0.57	
Copepoda Calanoida	1/32	153	5.14		Amphioxus	1/4	1	0.00	
Copepoda Cyclopoida	1/32	42	1.41						
Copepoda Harpacticoida	1/32	3	0.10						
Ostracoda	1/8	187	1.57						
Amphipoda	1/8	4	0.03						
Euphausiacea	1/8	18	0.15						
Lucifer	1/8	0	0						
Decapod Larvae	1/8	5	0.04						
					TOTAL			9.44	

TABLE 20: Zooplankton Counts (Cont'd).

Site, Cruise, Station: PROTEC-10
 Date of Sample: 20-11-80
 Depth of Sample (m): 600-200
 Net: Outboard

Rep. No.: 2
 Sample #: 600-200m, Day
 Time of Sample: 1026
 Sample Type: Zooplankton
 Vol. Fil. (M³): 1011.6

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/8	38	0.30	
Leptomedusae	1/2	1	0						
Trachymedusae	1/2	0	0						
Narcomedusae	1/2	0	0						
Siphonophora	1/2	6	0.01		LARVACEA	1/8	1	0.01	
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/8	2	0.01	
MOLLUSCA					FISH EGGS	1/2	2	0	
Heteropoda	1/2	0	0						
Thecosomata	1/2	4	0.01						
Gymnosomata	1/2	0	0		LARVAL FISH	1/2	14	0.03	
ANNELIDA (Polychaeta)	1/8	8	0.06		OTHER				
ARTHROPODA					Foraminifera	1/64	10	0.63	
Copepoda Calanoida	1/64	219	13.85		Radiolaria	1/64	1	0.06	
Copepoda Cyclopoida	1/64	40	2.53						
Copepoda Harpacticoida	1/64	0	0						
Ostracoda	1/8	371	2.93						
Amphipoda	1/8	3	0.02						
Euphausiacea	1/8	27	0.21						
Lucifer	1/8	0	0						
Decapod Larvae	1/8	8	0.06		TOTAL			20.51	

3. Micronekton (T. Hopkins)

Of the 24 scheduled trawls, 14 were completed (Table 21). All of the day-night 0-25m tows were taken, 3 of the 4 25-200m day trawls were completed as were 3 of the 4 night 25-200m tows. The 1600 micron mesh net ripped on the last tow attempted (OTEC-1-14) and in the future our standard 3.2 x 1.8m, 4mm mesh closing Tucker trawl will be used. In the absence of a depth transducer, there was considerable variance in trawling depths, the 25-200m tows, for example, ranging at the deep end from 198 to 137m. Also, the advantage of using 3 flowmeters (2 for the trawl; 1 in the plankton net) is apparent, there being a malfunction in at least one of the meters in 9 of the 14 tows. The volume of water filtered ranged from 10973m^3 to 19307m^3 and should approximately double on the next cruise with the use of the larger trawl.

The catch, broken down into major categories of fishes and invertebrates, is the Tables 22-25. Fishes larger than 15mm and invertebrates greater than 20mm in length were considered as micronekton, the remainder being classified as residue. In all cases residue constituted the largest fraction of the catch by weight. Apparent from the 0-25m samples is the greater night catches of micronekton. Day biomass values range from 0.2 to $9.5\text{ g WW}/10^4\text{m}^3$ and those for night, 6.6 to $44.9\text{ g WW}/10^4\text{m}^3$. The largest contributor both day and night to fish biomass were usually the anguilliformes. Among the invertebrates it was most frequently gelatinous types such as the hydrozoans and scyphomedusans.

In the 25-200m collections the increase in biomass at night is

also obvious. Daytime biomass values for micronekton ranged from 3.8 to 15.6 g WW/10⁴ m³. Also conspicuous in catches from this zone is the predominance of anguilliformes during the day and of myctophids at night. Apparent in night samples as well is the increased importance of caridean shrimps. Stomatopod larvae were relatively important in terms of biomass both day and night.

The micronekton data sheets are given in Table 26.

Table 21. Midwater Haul Data

Haul No.	Date	Time		Depth(m)	Meter Readings			Vol. fil. (10 ⁴ m ³)	Comments
		Open	Close		TSK C	TSK O-C	G.O.		
OTEC-1-1	17XI80	00:45	01:51	0-25	26377	26410	-	1.3890	G.O. malf.
OTEC-1-2	17XI80	02:18	03:20	0-26	23928	1849?	121455	1.2384 ¹	TSK O-C malf.
OTEC-1-3	17XI80	03:43	04:43	0-30	22196	8511?	124719	1.1482 ¹	TSK O-C malf.
OTEC-1-4	17XI80	20:45	21:45	0-25	-	17798?	156575	1.2447 ²	Both TSK malf.
OTEC-1-5	18XI80	02:04	03:32	0-270	27273	45072?	145790	1.3013 ¹	TSK O-C malf.
OTEC-1-6	18XI80	12:17	13:19	0-26	38910	36710	164388	1.9307	
OTEC-1-7	18XI80	13:41	14:39	0-26	21245	-	118936	1.1173 ¹	TSK O-C malf.
OTEC-1-8	18XI80	15:34	16:34	0-30	22775	11980?	130983	1.1978 ¹	TSK O-C malf.
OTEC-1-9	18XI80	16:48	17:50	0-25	9045?	-	99567	1.2861 ²	Both TSK malf.
OTEC-1-10	19XI80	11:34	12:54	25-170	32220	11220?	166570	1.6138 ¹	TSK O-C malf.
OTEC-1-11	19XI80	13:14	14:34	25-145	28790	25125	210416	1.3214	
OTEC-1-12	19XI80	14:52	17:12	25-198	33140	27170	152591	1.4289	
OTEC-1-13	19XI80	21:34	00:57	25-190	36755	29345	128444	1.5433	
OTEC-1-14	20XI80	01:37	03:03	25-137	33963	20864	187497	1.0973	Net ripped

TSK C = Tsurumi-Seitri flowmeter operating continuously

TSK O-C = Tsurumi-Seitri flowmeter operating only when trawl is open

G.O. = General Oceanics flowmeter in ichthyoplankton net operating only when trawl is open.

¹ = Water volume filtered estimated with TSK C reading and haul duration; TSK O-C malfunctioned.

² = Water volume filtered estimated with average TSK C reading calculated from 11 adjacent hauls; both TSK flowmeters failed.

Table 22. 0-25m DAY

Haul no. Parameter	OTEC - 1 - 6				OTEC - 1 - 7				OTEC - 1 - 8				OTEC - 1 - 9			
	A	B	C		A	B	C		A	B	C		A	B	C	
<u>Taxa Category</u>				$\bar{X}$ Rn				$\bar{X}$ Rn				$\bar{X}$ Rn				$\bar{X}$ Rn
Myctophidae	0.518	0.037		20												
Miscellaneous fish					0.895	0.255	41						1.555	6.476	54.0	53-55
Anguilliformes	0.518	0.126		54	3.580	1.282	56.0	55-58	3.339	0.850	50.3	38-56	3.883	1.215	59.2	44-79
Other fish larvae													1.555	0.137	30.5	18-43
Amphipoda													0.778	.009	55	-
Lobster larvae									0.835	0.073	21					
Stomatopoda larvae	0.518	0.076		21	1.790	0.483	27.0	26-28	1.670	0.082	22.5	21-24	1.555	0.135	41.0	-
Scyphozoa					0.895	1.862	27						0.778	1.527	31	-
Total sorted		0.239				3.882				1.005				9.501		
Residue		9.543				18.210				24.997				16.416		
Total biomass		9.781				22.092				26.003				25.916		

Parameters: A = No. organisms/ $10^4 m^3$ volume water filteredB = Biomass (g wet weight)/ $10^4 m^3$ C = Size (mm): $\bar{X}$:Range (SL for fish, TL for others)

Table 23. 0-25m NIGHT

Haul no. Parameter	OTEC - 1 - 1				OTEC - 1 - 1				OTEC - 1 - 3				OTEC - 1 - 4			
	A	B	C		A	B	C		A	B	C		A	B	C	
Taxa Category			$\bar{X}$	Rn			$\bar{X}$	Rn			$\bar{X}$	Rn			$\bar{X}$	Rn
Myctophidae	13.679	0.981	19.4	16-28	10.497	1.388	22.8	18-31	17.419	4.133	25.7	16-53	3.214	0.288	17.5	15-20
Gonostomatidae	2.880	0.096	20.5	19-22	7.267	0.648	26.7	23-33								
Chauliodontidae					0.807	0.036	23.0	-								
Anguilliformes	27.358	4.018	42.1	17-117	46.027	9.035	45.7	21-81	104.511	24.389	51.6	21-88	12.855	1.533	37.3	23-52
Other fish larvae	0.720	0.033	24.0	-	4.037	0.513	31.4	19-51	11.322	1.254	23.5	16-31	3.214	0.340	18.5	17-20
Penaeid decapods	6.479	0.726	26.7	26-28	2.422	0.271	27.0	26-28	5.226	0.463	24.0	21-28				
Euphausiacea	1.440	0.130	22.0	20-24	0.807	0.079	22.0	-	10.451	1.266	23.9	23-25				
Amphipoda	0.720	0.003	44.0	-					0.870	0.004	42.0	-				
Lobster larvae	2.880	0.168	25.5	20-32	4.845	0.883	32.5	31-35	3.484	0.844	31.5	26-38	0.803	0.107	24.0	-
Stomatopoda larvae	4.320	0.349	41.7	41-43	4.037	0.289	37.8	33-43	6.096	0.525	34.6	27-41	2.410	0.292	28.3	20-41
Hydrozoa									0.870	11.787	91.0	-				
Siphonophora													0.803	3.603	37.0	-
Scyphozoa					0.807	7.450	70.0	-								
Chaetognatha	0.720	0.058	21.0	-	3.230	0.251	24.8	23-26	4.355	0.185	22.4	21-27	14.461	1.164	27.8	21-34
Polychaeta									0.870	0.057	38.0	-	0.803	0.047	69.0	
Total sorted		6.563				20.843				44.909				7.374		
Residue		60.034				64.860				80.343				44.778		
Total biomass		66.597				85.703				125.252				52.156		

Parameters: A = No. organisms/ $10^4 m^3$ water volume filtered
 B = Biomass (g wet weight)/ $10^4 m^3$
 C = Size (mm): $\bar{X}$; Range (SL for fish, TL for others)

Table 24. 25-200m DAY

Haul no. Parameter	OTEC - 1 - 10				OTEC - 1 - 11				OTEC - 12			
	A	B	C		A	B	C		A	B	C	
Taxa Category			$\bar{X}$	Rn			$\bar{X}$	Rn			$\bar{X}$	Rn
Miscellaneous fish					1.514	3.431	36.5	20-53				
Anguilliformes	8.056	2.700	56.5	29-78	31.028	10.891	59.0	20-88	2.799	0.945	52.0	46.58
Other fish larvae	1.859	0.059	29.3	18-31					0.700	0.013	28.0	-
Amphipoda	0.620	0.041	20.0	-					0.700	0.011	50.0	-
Lobster larvae					1.514	0.185	38.0	33-43	2.100	0.378	29.3	24-32
Stomatopoda larvae	1.239	0.182	38.0	27-49	1.514	0.100	28.0	23-33	4.899	0.514	32.1	20.45
Chaetognatha	1.239	0.077	22.5	21-24								
Heteropoda	0.620	0.709	38.0	-	3.027	0.991	34.8	23-46				
Total sorted		3.768				15.598				1.862		
Residue		15.535				21.194				11.322		
Total biomass		19.303				36.792				13.184		

Parameters: A = No. organisms/ $10^4 m^3$ water volume filtered
 B = Biomass (g wet weight)/ $10^4 m^3$
 C = Size (mm): $\bar{X}$;Range (SL for fish, TL for others)

Table 25 - 25-200m NIGHT

Haul No. Parameter	OTEC - 1 - 5				OTEC - 1 - 13				OTEC - 1 - 14			
	A	B	C		A	B	C		A	B	C	
Taxa Category			$\bar{X}$	Rn			$\bar{X}$	Rn			$\bar{X}$	Rn
Myctophidae	13.064	2.199	24.4	17-33	26.566	8.177	28.0	16-52	39.187	12.759	29.8	18-53
Gonostomatidae	3.074	0.249	26.5	19-31	1.543	0.333	26.5	24-32	17.315	1.990	28.5	18.65
Chauliodontidae					1.296	0.069	26.0	24-28	0.911	0.054	31.0	-
Bregmacerotidae	2.305	0.108	21.7	16-26					20.049	1.094	21.8	15-39
Malacosteidae	0.788	4.532	111.0	-								
Anguilliformes	16.138	2.667	40.5	22-71	10.367	3.106	59.0	23-80	16.404	6.832	64.8	26-139
Otherfish larvae					1.944	0.157	33.7	17-43	1.823	0.178	24.0	27-26
Carideen decapods	3.074	4.069	61.5	31-75					1.823	1.937	38.0	-
Penaeid decapods	3.074	0.428	28.3	24-35	0.648	0.092	28.0	-	1.823	0.141	22.0	22-24
Euphausiacea									0.911	0.078	23.0	-
Lobster larvae									1.823	0.274	28.5	23-34
Stomatopoda larvae					4.536	0.675	35.1	23-44	10.025	1.934	34.1	24-44
Siphonophora	0.768	0.605	30.0	-	0.648	0.195	26.0	-				
Chaetognatha	5.379	0.306	26.6	22-32	3.888	0.240	28.2	25-34	1.823	0.096	29.5	27-32
Urochordata	0.768	0.973	24.0	-								
Heteropoda	0.768	0.274	30.0	-	0.648	0.119	32.0					
Polychaeta	1.537	0.217	29.5	27-32								
Total Sorted		16.668				13.047				27.357		
Residue		38.199				19.209				26.005		
Total biomass	-	54.867				33.021				53.362		

Parameters: A = No. organisms/ $10^4 m^3$ water, volume filtered
 B = Biomass (g wet weight)/ $10^4 m^3$
 C = Size (mm): $\bar{X}$; Range (SL for fish, TL for others)

Table 26
Micronekton Data Sheets
PROTEC-10

Cruise: PROTEC-10

Sample #: 1

Date of Sample: 17 XI 83

Time of Sample: 00:45-01:51

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>10^4 m^{-3}</u>	<u>Biomass(g)</u> <u>10^4 m^{-3}</u>	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Lepidophanes guentheri</u>	16	11.520	0.521	19.6	(16-23)
<u>Myctophum affine</u>	2	1.440	0.087	19.0	(17-21)
<u>Hygophum taaningi</u>	1	0.720	0.132	28.0	
<u>Vinciguerrria nimbaria</u>	4	2.830	0.096	20.5	(19-22)
Anguilliformes (larvae)	38	27.353	4.013	42.1	(17-117)
Other fish larvae	1	0.720	0.033	24.0	
<u>Sergestes atlanticus</u>	9	6.480	0.726	26.7	(26-28)
<u>Thysanopoda tricuspidata</u>	2	1.440	0.130	22.0	(20-24)
<u>Rhabdosoma sp.</u>	1	0.920	0.003	44.0	
Lobster larvae	4	2.880	0.168	25.5	(20-32)
Stomatopoda larvae	6	4.320	0.349	41.7	(41-43)
Chaetognatha	1	0.720	0.058	21.0	
Total sorted			6.373		
Residue			60.033		
Total biomass			66.411		

Cruise: PROTEC-10

Sample #: 2

Date of Sample: 17 XI 80

Time of Sample: 02:18-03:20

Depth of Sample: 0-26m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	Number $10^4 m^3$	Biomass(g) $10^4 m^3$	Size(mm)	Range(mm)
<u>Lepidophanes guentheri</u>	13	10.497	1.388	22.8	(18-31)
<u>Vinciguerrria nimbaria</u>	9	7.267	0.648	26.7	(23-33)
<u>Chauliodus sp.</u>	1	0.807	0.036	23.0	
Anguilliformes (larvae)	57	46.027	9.035	45.7	(21-81)
Other fish larvae	5	4.037	0.513	31.4	(19-51)
<u>Sergestes atlanticus</u>	3	2.422	0.271	27.0	(26-28)
<u>Thysanopoda tricuspidata</u>	1	0.807	0.079	22.0	
Lobster larvae	6	4.845	0.883	32.5	(31-35)
Stomatopoda larvae	5	4.037	0.289	37.8	(33-43)
Scyphozoa	1	0.807	7.450	70.0	
Chaetognatha	4	3.230	0.251	24.8	(23-26)
Total sorted			20.843		
Residue			64.860		
Total biomass			85.703		

Cruise: PROTEC-10

Sample #: 3

Date of Sample: 17 XI 80

Time of Sample: 03:43-04:43

Depth of Sample: 0-30m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>10⁴ m³</u>	<u>Biomass(g)</u> <u>10⁴ m³</u>	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Lepidophanes guentheri</u>	19	16.548	1.862	23.8	(16-35)
<u>Myctophum obtusirostre</u>	1	0.871	1.738	53.0	
Anguilliformes (larvae)	120	104.511	24.339	51.6	(21-83)
Other fish larvae	13	11.322	1.254	23.5	(16-31)
<u>Sergestes atlanticus</u>	3	2.613	0.282	26.7	(26-28)
<u>Sergestes vigilax</u>	3	2.613	0.181	21.3	(21-22)
<u>Thysanopoda tricuspidata</u>	12	10.451	1.266	23.9	(23-25)
<u>Rhabdosoma sp.</u>	1	0.870	0.004	42.0	
Lobster larvae	4	3.484	0.844	31.5	(26-33)
Stomatopoda larvae	7	6.096	0.525	34.6	(27-41)
Hydrozoa (not siphonophora)	1	0.870	11.787	91.0	
Chaetognatha	5	4.355	0.185	22.4	(21-27)
Polychaeta	1	0.870	0.057	38.0	
Total sorted			44.376		
Residue			80.343		
Total biomass			124.719		

Cruise: PROTEC-10

Sample #: 4

Date of Sample: 17 XI 80

Time of Sample: 20:45-21:45

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> 10^4 m^{-3}	<u>Biomass(g)</u> 10^4 m^{-3}	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Myctophum affine</u>	4	3.214	0.288	17.5	(15-20)
Anguilliformes (larvae)	16	12.855	1.533	37.3	(23-52)
Other fish larvae	4	3.214	0.340	18.5	(17-20)
Lobster larvae	1	0.803	0.107	24.0	
Stomatopoda larvae	3	2.410	0.292	28.3	(20-41)
Siphonophora (biomass only)			3.603		
Chaetognatha	18	14.461	1.164	27.8	(21-34)
Polychaeta	1	0.803	0.047	69.0	
Total sorted			7.374		
Residue			44.778		
Total biomass			52.156		

Cruise: PROTEC-10
 Date of Sample: 18 XI 80
 Depth of Sample: 0-270m

Sample #: 5
 Time of Sample: 02:04-03:32
 Sample Type: Micronekton
 Tucker Trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> $10^4 m^{-3}$	<u>Biomass(g)</u> $10^4 m^{-3}$	<u>Mean</u> <u>Size(mm)</u>	<u>Size</u> <u>Range(mm)</u>
<u>Lepidophanes quentheri</u>	7	5.379	0.797	25.1	(17-32)
<u>Diaphus splendidus</u>	7	5.379	0.740	22.4	(18-33)
<u>Lampadena luminosa</u>	2	1.537	0.637	32.0	(23-41)
<u>Lampanyctus alatus</u>	1	0.768	0.025	18.0	
<u>Vinciguerrria nimbaria</u>	4	3.074	0.249	26.5	(19-31)
<u>Bregmaceros atlanticus</u>	3	2.305	0.108	21.7	(16-26)
<u>Photostomias guernei</u>	1	0.768	4.532	111.0	
<u>Anguilliformes (larvae)</u>	21	16.138	2.667	40.5	(22-71)
<u>Sergestes splendens</u>	1	0.768	0.141	28.0	
<u>Sergestes sp.</u>	3	2.305	0.287	28.3	(24-35)
<u>Oplophorus spinicauda</u>	1	0.768	0.083	31.0	
<u>Oplophorus gracilirostris</u>	1	0.768	1.714	75.0	
<u>Systellaspis debilis</u>	2	1.537	2.073	70.0	(66-74)
Siphonophora (biomass only)			0.605		
Chaetognatha	7	5.379	0.396	26.6	(22-32)
Urochordata	1	0.768	0.973	24.0	
Heteropoda	1	0.768	0.274	30.0	
Polychaeta	2	1.537	0.217	29.5	(27-32)
Total sorted			16.462		
Residue			33.199		
Total biomass			54.667		

Cruise: PROTEC-10

Sample #: 6

Date of Sample: 18 XI 80

Time of Sample: 12:17-13:19

Depth of Sample: 0-26m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>$10^4 m^3$</u>	<u>Biomass(g)</u> <u>$10^4 m^3$</u>	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Diaphus splendidus</u>	1	0.518	0.037	20.0	
Anguilliformes (larvae)	1	0.518	0.126	54.0	
Stomatopoda larvae	1	0.518	0.076	21.0	
Total sorted			0.239		
Residue			9.543		
Total biomass			9.781		

Cruise: PROTEC-10

Sample #: 7

Date of Sample: 18 XI 80

Time of Sample: 13:41-14:39

Depth of Sample: 0-26m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	Number $10^4 \cdot 3$	Biomass(g) $10^4 \cdot 3$	Size(mm)	Range(mm)
Synonathidae	1	0.895	0.255	41.0	
Anguilliformes (larvae)	4	3.580	1.282	56.0	(55-53)
Stomatopoda larvae	2	1.790	0.483	27.0	(26-23)
Scyphozoa	1	0.895	1.862	27.0	
Total sorted			3.882		
Residue			18.210		
Total biomass			22.092		

Cruise: PROTEC-10

Sample #: 3

Date of Sample: 18 XI.80

Time of Sample: 15:34-16:34

Depth of Sample: 0-30m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 m^3$	<u>Biomass(g)</u> $10^4 m^3$	Size(mm)	Range(mm)
Anguilliformes (larvae)	4	3.339	0.850	50.3	(33-56)
Lobster larvae	1	0.835	0.073	21	
Stomatopoda larvae	2	1.670	0.082	22.5	(21-24)
Total sorted			1.005		
Residue			24.997		
Total biomass			26.003		

Cruise: PROTEC-10

Sample #: 9

Date of Sample: 18 XI 80

Time of Sample: 16:48-17:50

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u>	<u>Biomass(g)</u>	Size(mm)	Range(mm)
		10^4 m^{-3}	10^4 m^{-3}		
<u>Selar crumenophthalmus</u>	2	1.555	6.476	54.0	(53-55)
Anguilliformes (larvae)	5	3.888	1.215	59.2	(44-79)
Other fish larvae	2	1.555	0.137	30.5	(18-43)
<u>Rhabdosoma sp.</u>	1	0.778	0.009	55.0	
Stomatopoda larvae	2	1.555	0.135	41.0	
Scyphozoa	1	0.778	1.527	31.0	
Total sorted			9.501		
Residue			16.416		
Total biomass			25.916		

Cruise: PROTEC-10

Sample #: 10

Date of Sample: 19 XI 80

Time of Sample: 11:34-12:54

Depth of Sample: 25-170m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 \frac{4}{m^3}$	<u>Biomass(g)</u> $10^4 \frac{4}{m^3}$	Mean Size(mm)	Size Range(mm)
Anguilliformes (larvae)	13	8.056	2.700	56.5	(29-78)
Other fish larvae	3	1.859	0.059	29.3	(13-31)
<u>Rhabdosoma sp.</u>	1	0.620	0.041	20.0	
Stomatopoda larvae	2	1.239	0.182	38.0	(27-49)
Chaetognatha	2	1.239	0.077	22.5	(21-24)
Heteropoda	1	0.620	0.709	38.0	
Total sorted			3.768		
Residue			15.535		
Total biomass			19.303		

Cruise: PROTEC-10

Sample #: 11

Date of Sample: 19 XI 80

Time of Sample: 13:14-14:34

Depth of Sample: 25-145m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>$10^4 m^3$</u>	<u>Biomass(g)</u> <u>$10^4 m^3$</u>	<u>Mean</u> <u>Size(mm)</u>	<u>Size</u> <u>Range(mm)</u>
<u>Selar crumenophthalmus</u>	1	0.757	3.059	53.0	
Tetraodontidae	1	0.757	0.372	20.0	
Anguilliformes (larvae)	41	31.023	10.891	59.0	(20-33)
Lobster larvae	2	1.514	0.185	38.0	(33-43)
Stomatopoda larvae	2	1.514	0.100	28.0	(23-33)
Heteropoda	4	3.027	0.991	34.8	(23-46)
Total sorted			15.598		
Residue			21.194		
Total biomass			36.792		

Cruise: PROTEC-10

Sample #: 12

Date of Sample: 19 XI 80

Time of Sample: 14:52-17:12

Depth of Sample: 25-198m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 m^3$	<u>Biomass(g)</u> $10^4 m^3$	Mean Size(mm)	Size Range(m)
Anguilliformes (larvae)	4	2.799	0.945	52.0	(46-58)
Other fish larvae	1	0.700	0.013	23.0	
<u>Rhabdosoma sp.</u>	1	0.700	0.011	50.0	
Lobster larvae	3	2.100	0.378	29.3	(24-32)
Stomatopoda larvae	7	4.399	0.514	32.1	(20-45)
Total sorted			1.862		
Residue			11.322		
Total biomass			13.184		

Cruise: PROTEC-10

Sample #: 13

Date of Sample: 19 XI 80

Time of Sample: 23:34-00:57

Depth of Sample: 25-190m

Sample Type: Micronekton
Tucker Trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>10⁻³m³</u>	<u>Biomass(g)</u> <u>10⁻³m³</u>	<u>Mean</u> <u>Size(mm)</u>	<u>Size</u> <u>Range (mm)</u>
<u>Lepidophanes guentheri</u>	19	12.311	2.436	23.5	(13-42)
<u>Diaphus splendidus</u>	11	7.128	3.713	32.4	
<u>Diaphus lucidus</u>	1	0.648	0.055	19.0	
<u>Diaphus dumerilii</u>	1	0.648	0.112	34.0	
<u>Diaphus mollis</u>	4	2.592	1.120	29.5	(20-36)
<u>Lampadena luminosa</u>	1	0.648	0.033	19.0	
<u>Lampanyctus alatus</u>	1	0.648	0.033	22.0	
<u>Myctophum obusirostre</u>	1	0.648	0.038	17.0	
<u>Ceratoscopelus warmingii</u>	1	0.648	0.193	32.0	
<u>Hygophum taaningi</u>	1	0.648	0.070	21.0	
<u>Vinciguerrria nimbaria</u>	3	1.944	0.171	26.0	(25-27)
<u>Gonostoma elongatum</u>	3	1.944	0.162	27.0	(24-32)
<u>Chauliodus danae</u>	2	1.296	0.069	26.0	(24-23)
<u>Anguilliformes (larvae)</u>	16	10.367	3.106	59.0	(23-80)
<u>Other fish larvae</u>	3	1.944	0.157	33.7	(17-43)
<u>Sergestes corniculum</u>	1	0.468	0.092	28.0	
<u>Stomatopoda larvae</u>	7	4.536	0.675	35.1	(23-44)
<u>Siphonophora (biomass only)</u>			0.195		
<u>Chaetognatha</u>	6	3.888	0.240	20.2	(25-34)
<u>Heteropoda</u>	1	0.648	0.119	32.0	
Total sorted			12.791		
Residue			19.209		
Total biomass			32.000		

Cruise: PROTEC-10

Sample #: 14

Date of Sample: 20 XI 80

Time of Sample: 01:37-03:03

Depth of Sample: 25 - 137m

Sample Type: Micronekton
Tucker Trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>10⁴m³</u>	<u>Biomass (g)</u> <u>10⁴m³</u>	<u>Mean</u> <u>Size(mm)</u>	<u>Size</u> <u>Range(mm)</u>
<u>Lepidophanes guentheri</u>	19	17.315	6.306	33.4	(21-53)
<u>Diaphus splendidus</u>	4	3.645	3.499	44.0	(33-50)
<u>Diaphus garmani</u>	10	9.113	1.604	23.5	(18-27)
<u>Lampadena luminosa</u>	2	1.823	0.187	22.0	(21-23)
<u>Lampanyctus alatus</u>	1	0.911	0.061	22.0	
<u>Ceratoscopelus warmingii</u>	6	5.468	1.029	26.0	(18-34)
<u>Gonichthys cocco</u>	1	0.911	0.072	18.0	
<u>Vinciguerrria nimbaria</u>	16	14.581	1.121	26.1	(16-39)
<u>Gonostoma elongatum</u>	3	2.734	0.869	41.7	(29-65)
<u>Bregmaceros atlanticus</u>	22	20.049	1.034	21.3	(15-39)
<u>Chauliodus danae</u>	1	0.911	0.054	31.0	
Anguilliformes (larvae)	18	16.404	6.832	64.8	(26-130)
Other fish larvae	2	1.823	0.178	24.0	(22-26)
<u>Sergestes vigilax</u>	2	1.823	0.142	22.0	(22-24)
<u>Oplophorus spinicauda</u>	1	0.911	0.272	44.0	
<u>Systellaspis debilis</u>	1	0.911	1.441	71.0	
<u>Thysanopoda tricuspidata</u>	1	0.911	0.078	23.0	
Lobster larvae	2	1.823	0.274	28.5	(23-34)
Stomatopoda larvae	11	10.025	1.934	34.1	(24-46)
Chaetognatha	2	1.823	0.096	29.5	(27-32)
Total sorted			26.718		
Residue			26.005		
Total biomass			52.723		

4. Fish, Mammal, and Bird Sightings (S. Vargo)

Few animals were sighted and species identification of birds was impossible. The sightings are listed below in chronological order.

<u>Date</u>	<u>Time(AST)</u>	<u>Position</u>	<u>Animal (s)</u>
11/17/80	1345	17°56'N, 65°52'W	3' shark sighted, species unknown
11/17/80	2330-0300	17°53'N, 65°49'W	1 large needlefish and several flying fish around the stern
11/18/80	0855	17°49'N, 65°49'W	1 seabird - unknown
11/18/80	1535-1635	17°56'N, 65°50'W	Seabirds (albatross) - estimate 1 bird/5 min in 200m radius
11/19/80	0955	17°54'N, 65°52'W	3 large seabirds

5. DSL tracking (S. Vargo)

The PDR functioned for the first day and one half on station. During this time no DSL was detected but the PDR subsequently ceased functioning and may not have been picking up the DSL prior to that.

D. Meteorology Log (S. Vargo)

Meteorological observations were made every four hours while on station and are shown in Table 27.

Table 27. Meteorology Log.

Date	Time (AST)	Air Temperature		Wave Height (ft.)	Barometric Pressure	Wind		Cloud	Position
		Wet Bulb(°F)	Dry Bulb(°F)			Direction	Speed (Kts.)		
11/16/80	1722	-	-	3-4	30.03	East	15	Moderate	17°56'N, 65°47'W
11/16/80	2118	-	-	-	-	Northeast	9-10	-	17°53'N, 65°50'W
11/17/80	0045	-	-	1-3	30.1	East	8-10	Clear	17°50'N, 65°48'W
11/17/80	0345	-	-	1-3	30.1	Northeast	8-10	Clear	17°50'N, 65°53'W
11/17/80	0825	-	-	1-2	30.09	North	8-10	-	17°54'N, 65°54'W
11/17/80	1220	-	-	1-2	30.05	East	10	20-30%	17°56'N, 65°52'W
11/17/80	1750	-	-	2-3	30.05	ENE	15	50%	17°54'N, 65°52'W
11/17/80	2050	-	-	2-3	30.08	Northeast	12-15	-	17°53'N, 65°49'W
11/18/80	0155	-	-	2-4	30.06	ENE	15	-	17°53'N, 65°51'W
11/18/80	0350	-	-	2-3	30.06	East	15	-	17°52'N, 65°51'W
11/18/80	0855	-	-	3-5	30.09	Northeast	10-12	-	17°49'N, 65°49'W
11/18/80	1220	-	-	2-3	30.09	Northeast	15	30%	17°57'N, 65°51'W
11/18/80	1700	-	-	2-3	30.05	East	8-10	30%	17°56'N, 65°54'W
11/19/80	0340	-	-	2-3	30.06	Northeast	5-10	-	17°54'N, 65°55'W
11/19/80	0955	-	-	2-3	30.12	East	10	60%	17°54'N, 65°52'W
11/19/80	1220	-	-	2-3	30.10	East	10-12	100%	17°54'N, 65°55'W
11/19/80	1455	-	-	2-4	30.05	East	10-15	30-40%	17°54'N, 65°58'W
11/19/80	2000	-	-	3-4	30.08	Northeast	10	Rain	17°56'N, 65°46'W
11/19/80	2241	-	-	3-4	30.09	Northeast	10	-	17°56'N, 65°51'W
11/20/80	0450	-	-	4-6	30.07	ENE	15-20	80%	17°53'N, 65°58'W
11/20/80	0915	-	-	2-3	30.10	East	10-12	80%	17°54'N, 65°56'W
11/20/80	1217	-	-	3-4	30.09	East	20	-	17°54'N, 65°58'W

E. PROTEC-10
POST CRUISE REPORT
AND OPERATIONS LOG

FLORIDA INSTITUTE FOR OCEANOGRAPHY
UNIVERSITY OF SOUTH FLORIDA

POST-CRUISE REPORT

R/V BELLOWS PROTEC-10 (B-8030)

9 November - 27 November 1980

I. OBJECTIVES

- A. The first quarterly sampling program at the OTEC site off Puerto Rico was carried out during this cruise. The work was performed under Subcontract #4505010. Physical, chemical and biological parameters were sampled at the benchmark located off Punta Tuna at 17°57'N, 65°48'W. The sampling did not take place closer than 2 nautical miles to the current meter mooring in this area.

II. OPERATIONS LOG

<u>Date</u> 1980	<u>Time</u> EST	<u>Activity</u>	<u>Position</u>
Nov. 9	0800	Departed Key West	
14	1700	Arrived San Juan	
16	0800	Departed San Juan for Station	
	1715	Arrive Station	6 N Miles SE Pta Yequas 6 N Miles SE LCU (Tuna) 17°56'N 65°47'W Wind/Sea; E/3-4
1752-1811		Bongo Net Test	
	1943	XBT (T7) #1	17°38'N 65°46'W
	2045	25-0 Bongo #1 tripped	17°53'N 65°45'W
	2055	Bongo #1 done	
	2118	XBT (T7) #2	17°53'N 65°50'W
	2120	25-0 Bongo #2	17°53'N 65°50'W
	2142	25-0 Bongo #3	17°54'N 65°49'W
	2205	XBT (T7) #3	17°54'N 65°49'W
	2212	25-0 Bongo #4-in/open	17°55'N 65°49'W
	2221	Done	17°55'N 65°51'W
	2233	25-0 Bongo #5 (Extra-#1 was questionable)	17°55'N 65°52'W
	2257	XBT (T7) #4	17°55'N 65°49'W

CRUISE NO. B 8030-PROTEC-10 #1 Cont.

Date	Time	Activity	Position
11/18/80	2325	<u>In vivo</u> fluorescence	17°54'N 65°54'W
11/19/80	2400	<u>In vivo</u> up-no water-pump	
	2420	Hydrocast start	17°56'N 65°53'W
	2450	Hydro-aborted	
	0230	Hydrocast Rep.	17°54'N 65°54'W
	0320	XBT (T-5) #15	17°54'N 65°55'W
	0830	Bongo in 600-200#1	17°53'N 65°52'W
	0955	Bongo out	17°54'N 65°52'W
	1000	XBT (T-5) #16 paper jam	"
	1020	Bongo in 600-200 #2	17°54'N 65°53'W
	1035	XBT (T-5) #17	"
	1130	Tucker Trawl 200-25 #1	17°54'N 65°55'W
	1305	Tucker up	17°54'N 65°56'W
	1311	Tucker 200-25m #2	17°54'N 65°53'W
	1440	Tucker in	17°54'N 65°57'W
	1450	XBT (T-5) #18	17°54'N 65°59'W
	1550	Tucker 200-25 #3	17°55'N 65°55'W
	1710	Tucker out	17°54'N 65°52'W
	1940	Bongo 200-25m #1	17°56'N 65°46'W
	2013	Bongo out	
	2103	Bongo 200-25m #2	17°56'N 65°48'W
	2123	Bongo out	
	2135	Bongo 200-25m #3- Net failed to close	17°56'N 65°51'W
	2230	Bongo out	

CRUISE NO. B8030-PROTEC-10 #1 Cont.

Date	Time	Activity	Position
11/17/80	0040	Tucker Trawl 25-0#1	17°50'N 65°48'W
	0050	Commence trawl	
	0200	Tucker Trawl out	17°52'50N 65°50'.50W
	0220	Tucker Trawl 25-0m #2	17°48'N 65°51'W
	0225	Tucker Trawl out	17°54'N 65°52'W
	0330	XBT (T7) #5	17°54'N 65°52'W
	0345	Tucker in 25-0 #3	17°50'N 65°53'W
	0445	Tucker out	17°56'N 65°55'N
	0825	Bongo Nets 0-25m - AM #1	17°54'N 65°54'W
	0835	XBT (T7) #6	17°54'N 65°54'W
	0841	Bongo Net 0-25 - AM #2	17°54'N 65°56'N
	0857	Bongo Nets 0-25 - AM #3	17°54'N 65°56'W
	0915	XBT (T7) #7	17°54'N 65°56'W
	0926	Bongo #4 0-25 - AM	17°55'N 65°57'W
	0941	Orig. Tow did not trip Sent down again	
	0956	Bongo #4 Closed	17°55'N 65°55'W
	1030	CTD cast	17°55'N 65°56'W
	1220	XBT (T7) #8	17°56'N 65°52'W
	1237	<u>In vivo</u> fluorescence	17°55'N 65°52'W
	1345	<u>In vivo</u> out	17°55'N 65°52'W
	1350	Light profile/water trans.	
	1404	Light Profile up Retake at bow	
	1417	H ₂ O Transp. up	17°56'N 65°52'W
	1530	Hydrocast start Soak time & Mess. 30 min.	17°55'N 65°52'W
	1741	Hydrocast up	17°54'N 65°52'W

Date	Time	Activity	Position
11/17/80	1745	XBT (T-7) #9	17°54'N 65°52'W.
	1807	Transmissometer down	17°54'N 65°50'W (bad cast?)
	1835	Trans. up	
	2045	Tucker 25-0 #4 (Open)	17°53'N 65°49'W
	2145	Tucker closed 25-0 #4	17°53'N 65°51'W
	2210	CTD Cast	
11/18/80	0030	CTD Cast out	
	0155	Tucker trawl 200-25 #1	17°48'N 65°50'W
	0208	Tucker open	
	0330	Tucker up	17°52'N 65°51'W
	0340	XBT (T-5) #10	17°52'N 65°52'W
	0830	Bongo #1 200-25m	17°49'N 65°49'W
	0855	XBT (T-5) #11	
	0920	Bongo #2 200-25m Day	17°51'N 65°50'W
	1002	Bongo nets #3 200-25m Day	17°52'N 65°51'W
	1020	XBT (T-5) #12	17°53'N 65°51'W
	1057	Bongo nets #4 200-25m Day	17°56'N 65°52'W
	1217	Tucker trawl 25-0 #1	17°57'N 65°51'W
	1325	Tucker out	17°56'N 65°52'W
	1340	Tucker trawl in 25-0 #2	17°56'N 65°53'W
	1445	Tucker out	17°56'N 65°55'W
	1450	XBT (T-5) #13	
	1535	Tucker trawl 25-0 #3	17°56'N 65°52'W
	1650	Tucker trawl 25-0 #4	17°56'N 65°54'W
	1750	Tucker out	17°56'N 65°57'W
	1809	XBT (T-5) #14	
	2230	CTD Cast - SNAFU	Bad Trace 17°56'N 65°56'W
	2240	Retake CTD	
	2300	CTD on Deck	

Date	Time	Activity	Position
11/19/80	2240	XBT (T5) #19	17°56'N 65°51'W
	2334	Tucker 200-25 #2	17°56'N 65°50'W
11/20/80	0105	Tucker out	17°55'N 65°52'W
	0137	Tucker 200-25 #3	17°55'N 65°53'W
	0307	Tucker out	17°54'N 65°57'W
	0330	XBT (T5) #20	17°53'N 65°58'W
	0405	Tucker Trawl 200-25 #4	17°54'N 65°55'W
	0520	Tucker trawl out	17°54'N 65°58'W
	0530	XBT (T5) #21	17°54'N 65°57'W
	0920	Bongo 600-200 #1	17°54'N 65°59'W
	1106	Bongo up	17°54'N 66°00'N
	1217	XBT (T5) #22	17°54'N 65°58'W
	1220	B8030 PROTEC-10 #1 terminated	

III. STATION POSITION

The station is located at approximately 17°57'N 65°48'W in 1,000 m or more of water.

IV. PERSONNEL

R. Millender, Captain	FIO
T. Hayes, Mate/Engineer	FIO
R. Schultz, Cook	FIO
D. Milliken, Chief Scientist	FIO
A. Jones, LBL Representative	LBL
T. Hopkins, Principal Investigator	USF
T. Lancraft, Assistant in Research	USF
H. Michel, Principal Investigator	UM
J. Low, Marine Technician/Net Consultant	UM
G. Vargo, Principal Investigator	USF
B. Calvert, Technical Assistant	USF
V. Hensley, Chemical Technician	USF
T. Bryant, Marine Technician	FIO

V. DESCRIPTION OF OPERATIONS

The planned sampling of physical, chemical, and biological parameters was done as shown in the operations log. See Table 28 for a complete list of samples with status indicated.

VI. OPERATIONAL AND SAFETY INFORMATION

The R/V BELLOWS meets all safety and operational requirements as outlined by the University-National oceanographic Laboratory System (UNOLS). To maintain communication with shore, the ship checks in daily at 1000 EST, giving position, sea state, condition and progress.

VII. PROBLEMS

The cruise was terminated early due to mechanical malfunctions. This termination meant that the eight deep trawls and six of the deep zooplankton tows could not be completed. In addition, the PDR malfunctioned due to a burned out program board, therefore there is a record of the deep scattering layer for only 1 1/2 days. These problems have been corrected, and any changes or additions in sampling required on the second cruise will be discussed with the Technical Coordinator (E. Hartwig).

The only problems encountered with gear were with the 2m x 2m Tucker trawl with a 1600 μ m mesh. It is the recommendation of T. Hopkins (PI, micronekton) based on the trawl performance and the size range of organisms captured (See Data Report-PROTEC-10) that his standard trawl be used for this work which is 1.8m x 3.6m with 1.1 cm mesh. This is essentially the net described by Hopkins, Baird, and Milliken (1973, Limnol Oceanog. 18(3): 488-490) and Hopkins and Baird (1975, Fish Bull 73(4): 908-914) with a 0.75 m plankton net (333 μ m) in the mouth and a 500 μ m plankton net as the cod end of the trawl.

TABLE 28

Station Samples

<u>Hydrocast-Biocalst</u>	<u>Max depth (m)</u>	<u>Total No.</u> <u>-1200</u>	<u>Status</u>	<u>Total No.</u> <u>-2400</u>	<u>Status</u>
CTD	1000	1	Complete	1	Partial
In vivo fluorescence	150	1	Complete	1	Partial
Irradiance profile	75	1	Complete	-	
Water Samples					
(15-20 depths)					
Temperature	1000	15-20	Complete	15-20	Complete
Salinity	1000	15-20 (x2)	Complete	15-20(x2)	Complete
Oxygen	1000	15-20 (x2)	Complete	15-20(x2)	Complete
Nutrients	1000	15-20 (x2)	Complete	15-20(x2)	Complete
Productivity	(empirical- 10% light level)		Complete	7(x3)	Complete
ATP	300	10-15	Complete	10-15	Complete
Chlorophyll/Phaeopigments	300	10-15 (x2)	Complete	10-15(x2)	Complete
Phytoplankton Counts	300	10-15 (x2)	Complete	10-15(x2)	Complete
Water Transparency					
Profile	300	1	Complete	1	Incomplete
Zooplankton Tows (202 μ m)					
	25-0	4 (x2)	Complete	4(x2)	Complete
	200-25	4 (x2)	Complete	4(x2)	3 Complete
	600-200	2 (x2)	Complete	2(x2)	-
	1000-600	2 (x2)	-	2(x2)	-
Tucker Trawls (1600 μ m)					
	25-0	4	Complete	4	Complete
200-25	200-25	4	Complete	4	Complete
	600-200	2	-	2	-
	1000-600	2	-	2	-
Nested Plankton Net (333 μ m)					
	25-0	4	Complete	4	Complete
	200-25	4	Complete	4	Complete
	600-200	2	-	2	-
	1000-600	2	-	2	-
XBT (Hydrobiocalst)	1000	1	Complete	1	Complete
(Zooplankton and Tucker	750	4	Complete	4	Complete
Trawls)	750	4	Complete	4	Complete
	750	2	Complete	2	Complete
	1000	2	-	2	-
DSL	Bottom		Continuous - 1 1/2 days Only		

Table 29. STATION LOG, R/V BELLOWS, Cruise PROTEC 10, Puerto Rico, 9-27 November 1980

Date 1980	Time shown is GMT AST in parenthesis	Position	Operation
9 November	1300 (0800, EST)		Departed Key West
14 November	2200 (1700, EST)		Arrived San Juan
16 November	1200 (0800)		Departed San Juan for Station
	2115 (1715)	6 N Miles SE Pta Yequas 6 N Miles SE LCU (Tuna) 17°56'N 65°47'W Wind/Sea; E/3-4	Arrive Station
	2152-2211 (1752-1811)		Bongo Net Test
17 November	2342 (1943)	17°58'N 65°46'W	XBT (T7) #1
	0045 (2045)	17°53'N 65°45'W	25-0 Bongo #1 tripped
	0055 (2055)		Bongo #1 done
	0118 (2118)	17°53'N 65°50'W	XBT (T7) #2
	0120 (2120)	17°53'N 65°50'W	25-0 Bongo #2
	0142 (2142)	17°54'N 65°49'W	25-0 Bongo #3
	0205 (2205)	17°54'N 65°49'W	XBT (T7) #3
	0212 (2212)	17°55'N 65°49'W	25-0 Bongo #4-in/open
	0221 (2221)	17°55'N 65°51'W	Done
	0233 (2233)	17°55'N 65°52'W	25-0 Bongo #5 (Extra-#1 was questionable)
	0257 (2257)	17°55'N 65°49'W	XBT (T7) #4

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Table 29 (cont'd) STATION LOG, R/V BELLOWS, Cruise PROTEC 10, Puerto Rico, 9-27 November 1980

Date 1980	Time shown is GMT AST in parenthesis	Position	Operation
17 November	0440 (0040)	17°50'N 65°48'W	Tucker Trawl 25-0 #1
	0450 (0050)		Commence Trawl
	0600 (0200)	17°52'50"N 65°50'50"W	Tucker Trawl out
	0620 (0220)	17°48'N 65°51'W	Tucker Trawl 25-0m #2
	0625 (0225)	17°54'N 65°52'W	Tucker Trawl out
	0430 (0330)	17°54'N 65°52'W	XBT (T7) #5
	0745 (0345)	17°50'N 65°53'W	Tucker in 25-0 #3
	0845 (0445)	17°56'N 65°55'W	Tucker out
	1225 (0825)	17°54'N 65°54'W	Bongo Nets 0-25m - AM #1
	1235 (0835)	17°54'N 65°54'W	XBT (T7) #6
	1241 (0841)	17°54'N 65°56'W	Bongo Net 0-25 - AM #2
	1257 (0857)	17°54'N 65°56'W	Bongo Nets 0-25 - AM #3
	1315 (0915)	17°54'N 65°56'W	XBT (T7) #7
	1326 (0926)	17°55'N 65°57'W	Bongo #4 0-25 - AM
	1341 (0941)		Orig. Tow did not trip Sent down again
	1356 (0956)	17°55'N 65°55'W	Bongo #4 Closed
	1430 (1030)	17°55'N 65°56'W	CTD cast

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Table 29 (cont'd) STATION LOG, R/V BELLOWS, Cruise PROTEC 10, Puerto Rico, 9-27 November 1980

Date 1980	Time shown is GMT AST in parenthesis	Position	Operation
17 November	1620 (1220)	17°56'N 65°52'W	XBT (T7) #8
	1637 (1237)	17°55'N 65°52'W	<u>In vivo</u> fluorescence
	1745 (1345)	17°55'N 65°52'W	<u>In vivo</u> out
	1750 (1350)		Light Profile/water trans.
	1804 (1404)		Light Profile up
			Retake at bow
	1817 (1417)	17°56'N 65°52'W	H O Trans. up 2
	1930 (1530)	17°55'N 65°52'W	Hydrocast to 1000 m start Soak time & Mess. 30 min.; Temp. Sal., Nutr., DO, Phytoplankton, Chlor- ophyll, ATP-0,10,15,20,35,45,50,60,75, 85,100,159,207,301, Temp., Sal., Nutr., DO-406,504,600,792,997
	2141 (1741)	17°54'N 65°52'W	Hydrocast up
	2145 (1745)	17°54'N 65°52'W	XBT (T7) #9
	2207 (1807)	17°54'N 65°50'W (Bad Cast)	Transmissometer down
	2235 (1835)		Trans. up
18 November	0045 (2045)	17°53'N 65°49'W	Tucker 25-0 #4 (Open)
	0145 (2145)	17°53'N 65°51'W	Tucker closed 25-0 #4
	0210 (2210)		CTD Cast

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Table 29 (cont'd) STATION LOG, R/V BELLOWS, Cruise PROTEC 10, Puerto Rico, 9-27 November 1980

Date 1980	Time shown is GMT AST in parenthesis	Position	Operation
18 November	0430 (0030)		CTD Cast out
	0555 (0155)	17°48'N 65°50'W	Tucker trawl 200-25 #1
	0608 (0208)		Tucker open
	0730 (0330)	17°52'N 65°51'W	Tucker up
	0740 (0340)	17°52'N 65°52'W	XBT (T-5) #10
	1230 (0830)	17°49'N 65°49'W	Bongo #1 200-25m
	1255 (0855)	"	XBT (T-5) #11
	1320 (0920)	17°51'N 65°50'W	Bongo #2 200-25m Day
	1402 (1002)	17°52'N 65°51'W	Bongo nets #3 200-25m Day
	1420 (1020)	17°53'N 65°51'W	XBT (T-5) #12
	1457 (1057)	17°56'N 65°52'W	Bongo nets #4 200-25m Day
	1617 (1217)	17°57'N 65°51'W	Tucker trawl 25-0 #1
	1725 (1325)	17°56'N 65°52'W	Tucker out
	1740 (1340)	17°56'N 65°53'W	Tucker trawl in 25-0 #2
	1845 (1445)	17°56'N 65°55'W	Tucker out
	1850 (1450)	"	XBT (T-5) #13
	1935 (1535)	17°56'N 65°52'W	Tucker trawl 25-0 #3

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Table 29 (cont'd) STATION LOG, R/V BELLOWS, Cruise PROTEC 10, Puerto Rico, 9-27 November 1980

Date 1980	Time shown is GMT AST in parenthesis	Position	Operation
18 November	2050 (1650)	17°56'N 65°54'W	Tucker trawl 25-0 #4
	2150 (1750)	17°56'N 65°57'W	Tucker out
	2009 (1809)	17°56'N 65°57'W	XBT (T5) #14
19 November	0230 (2230)		CTD Cast - SNAFU
	0240 (2240)	17°56'N 65°56'W	Retake CTD
	0300 (2300)		CTD on Deck
			Bad Trace
	0325 (2325)	17°54'N 65°54'W	In vivo fluorescence
	0400 (2400)		In vivo up-no water-pump
	0430 (2420)	17°56'N 65°53'W	Hydrocast start
	0450 (2450)		Hydro-aborted
	0630 (0230)	17°54'N 65°54'W	Hydrocast Rep.; Temp., Sal., Nutr., D.D., Phytoplankton, Chlorophyll, ATP- 0, 10, 15, 20, 35, 45, 50, 60, 75, 85, 100, 153, 200, 291; Temp., Sal., D.D.- 397, 498, 595, 808, 993
	0720 (0320)	17°54'N 65°55'W	XBT (T5) #15
	1230 (0830)	17°53'N 65°52'W	Bongo in 600-200 #1
	1355 (0955)	17°54'N 65°52'W	Bongo out
	1400 (1000)	17°54'N 65°52'W	XBT (T5) #16 paper jam
	1420 (1020)	17°54'N 65°53'W	Bongo in 600-200 #2

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Table 29 (cont'd) STATION LOG, R/V BELLOWS, Cruise PROTEC 10, Puerto Rico, 9-27 November 1980

Date 1980	Time shown is GMT AST in parenthesis	Position	Operation
19 November	1435 (1035)	17°54'N 65°53'W	XBT (T5) #17
	1530 (1130)	17°54'N 65°55'W	Tucker Trawl 200-25m#1
	1705 (1305)	17°54'N 65°56'W	Tucker up
	1711 (1311)	17°54'N 65°53'W	Tucker 200-25m #2
	1840 (1440)	17°54'N 65°57'W	Tucker in
	1850 (1450)	17°54'N 65°59'W	XBT (T5) #18
	1950 (1550)	17°55'N 65°55'W	Tucker 200-25m#3
	2110 (1710)	17°54'N 65°52'W	Tucker out
20 November	2340 (1940)	17°56'N 65°46'W	Bongo 200-25m #1
	0013 (2013)		Bongo out
	0103 (2103)	17°56'N 65°48'W	Bongo 200-25m #2
	0123 (2123)		Bongo out
	0135 (2135)	17°56'N 65°51'W	Bongo 200-25m #3-Net failed to close
	0230 (2230)		Bongo out
	0240 (2240)	17°56'N 65°51'W	XBT (T5) #19
	0334 (2334)	17°56'N 65°50'W	Tucker 200-25 #2

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Table 29 (cont'd) STATION LOG, R/V BELLOWS, Cruise PROTEC 10, Puerto Rico, 9-27 November 1980

Date 1980	Time shown is GMT AST in parenthesis	Position	Operation
20 November	0505 (0105)	17°55'N 65°52'W	Tucker out
	0537 (0137)	17°55'N 65°53'W	Tucker 200-25 #3
	0707 (0307)	17°54'N 65°57'W	Tucker out
	0730 (0330)	17°53'N 65°58'W	XBT (T5) #20
	0805 (0405)	17°54'N 65°55'W	Tucker Trawl 200-25 #4
	0920 (0520)	17°54'N 65°58'W	Tucker trawl out
	0930 (0530)	17°54'N 65°57'W	XBT (T5) #21
	1320 (0920)	17°54'N 65°59'W	Bongo 600-200 #2
	1506 (1106)	17°54'N 66°00'N	Bongo up
	1717 (1217)	17°54'N 65°58'W	XBT (T5) #22
	1620 (1220)		B8030 PROTEC-10 #1 terminated

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APPENDIX B

Data Report - PROTEC 12

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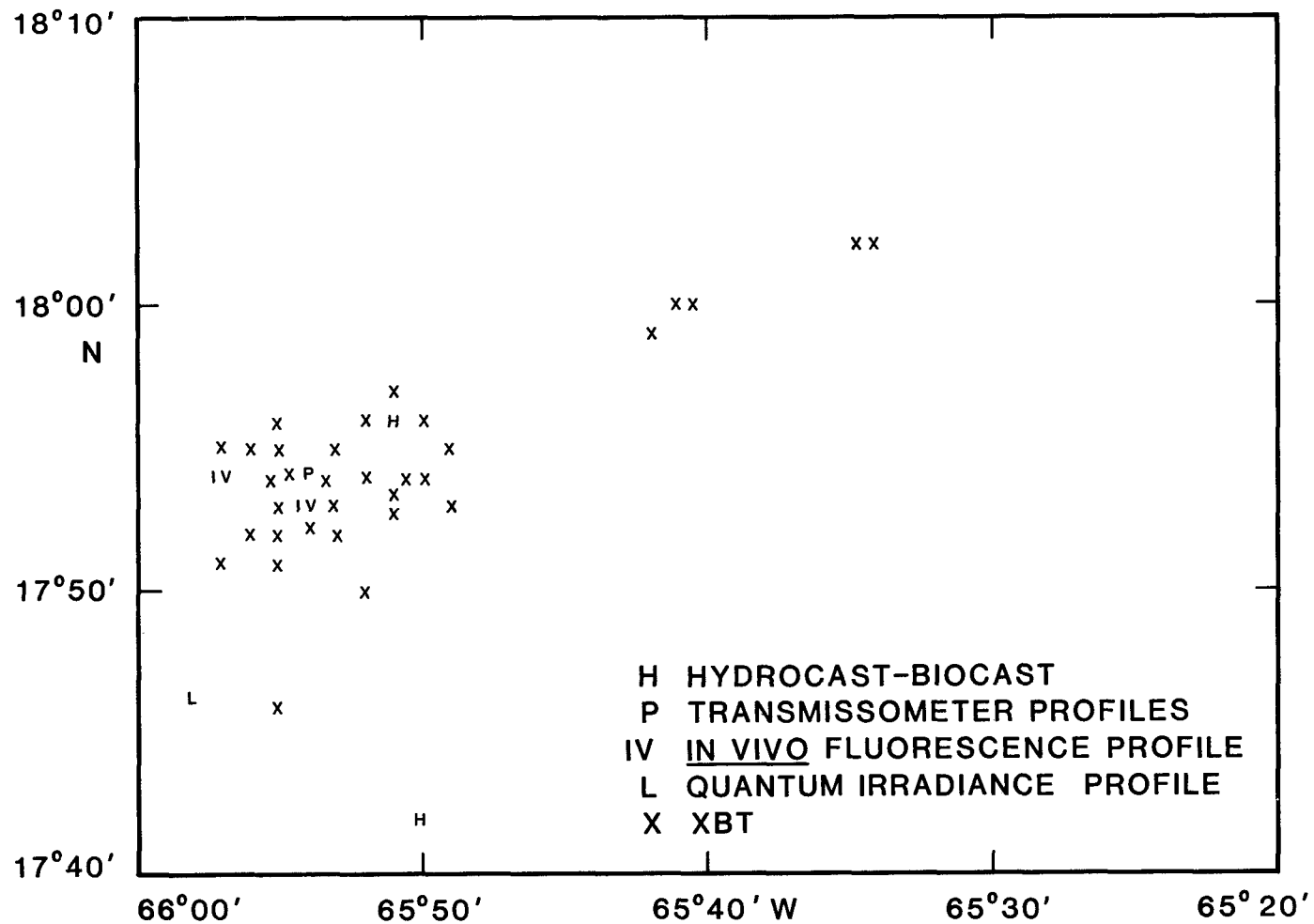
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INTRODUCTION

The PROTEC Benchmark site off the southeast coast of Puerto Rico at approximately $17^{\circ}57'N$ and $65^{\circ}48'W$ was occupied from February 18 to February 24, 1981. The scheduled sampling was completed and is shown in the Operations Log of the Post-Cruise Report (Section E, Appendix B). The actual locations where samples were taken in the vicinity of the Benchmark are shown in Fig. 1-3. The data collected is tabulated in the following sections with the principal investigator responsible indicated in parenthesis next to the heading.

PROTEC 12 HYDROCAST-BIOCAST AND XBT LOCATIONS

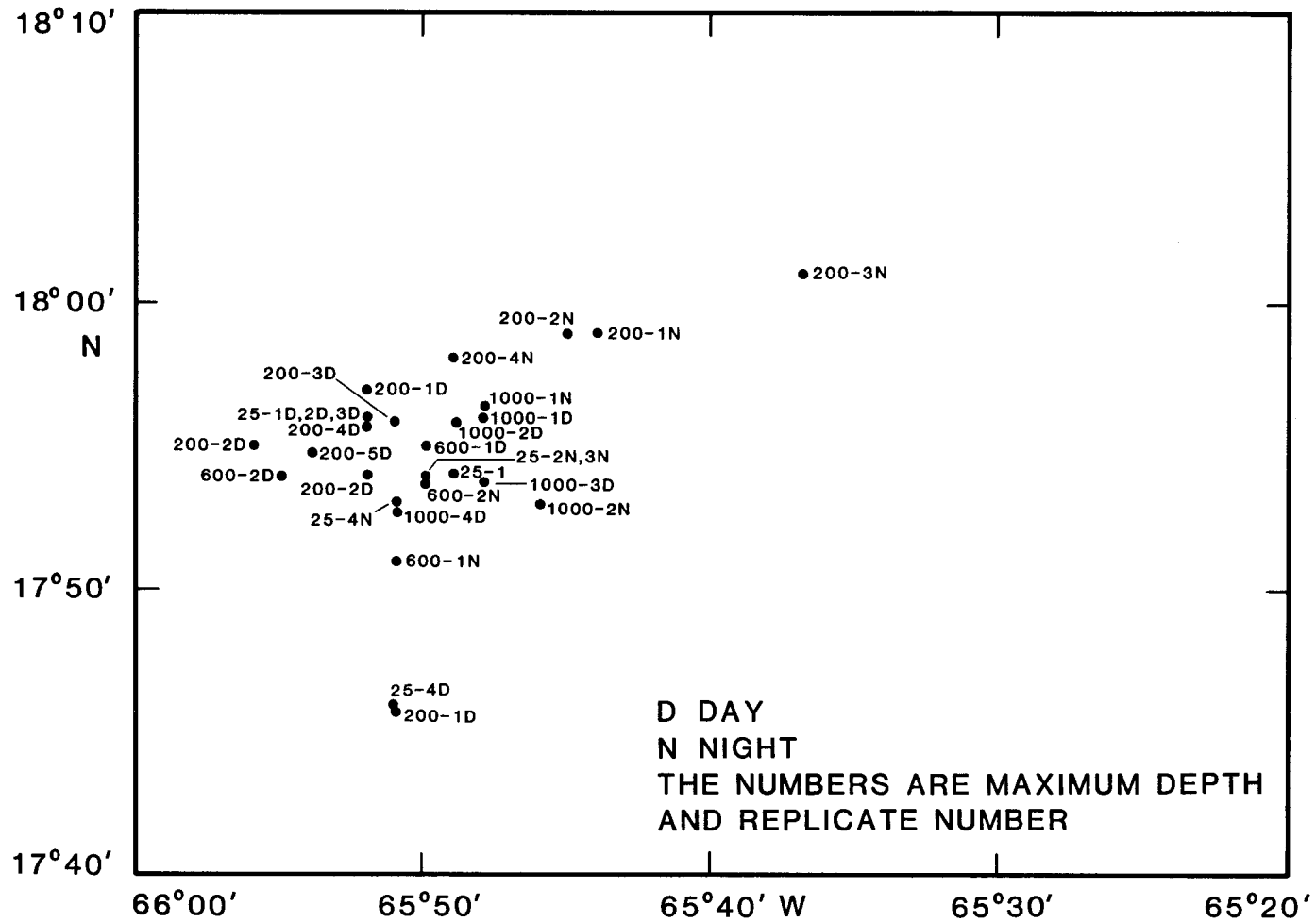
Figure 1. Sample Locations



XBL 8012-13174

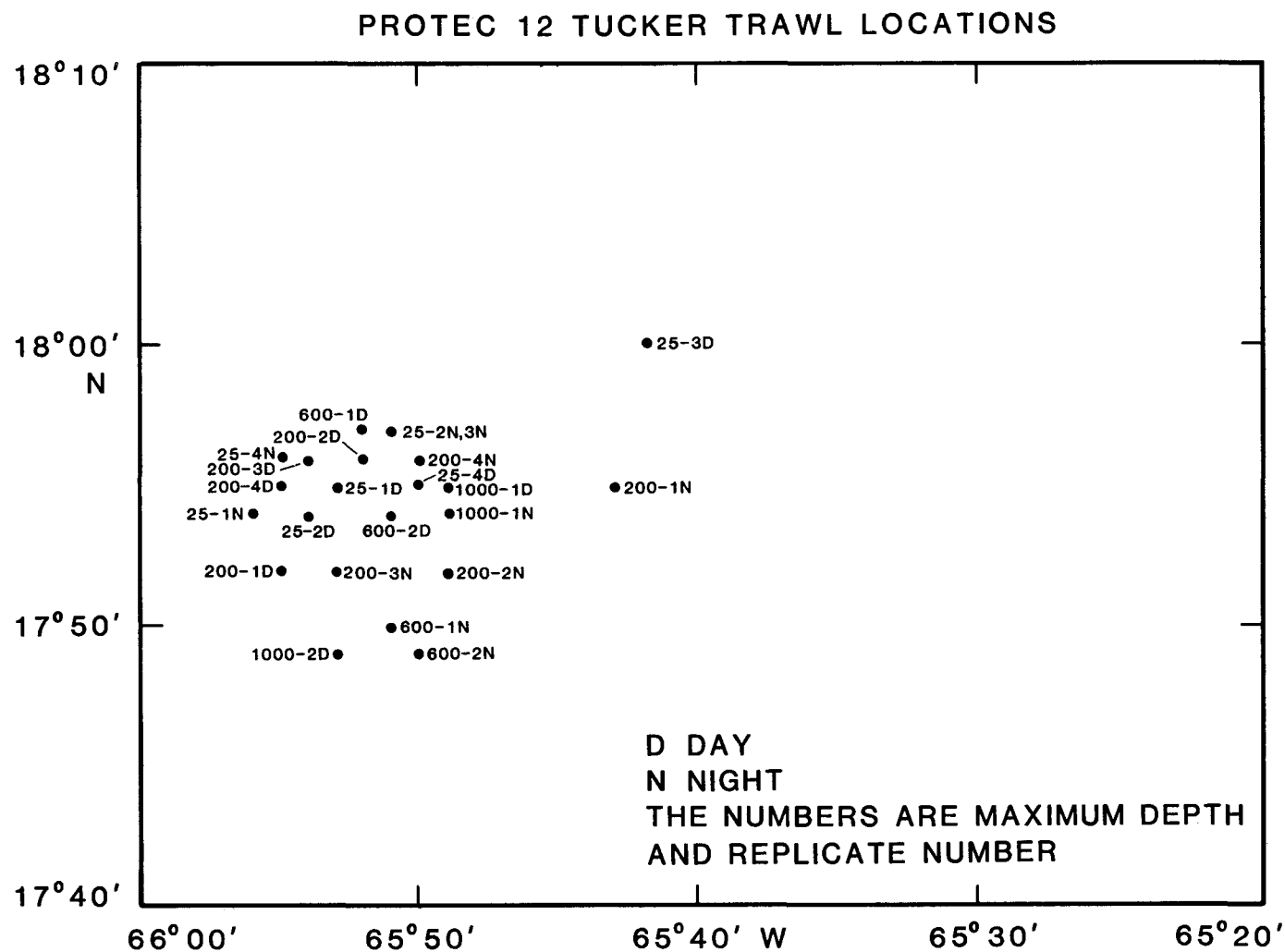
PROTEC 12 BONGO TOW LOCATIONS

Figure 2. Sample locations



XBL 8012-13175

Figure 3. Sample Locations



XBL 8012-13176

CRUISE DATA

A. Physical Measurements (S. Vargo)

1. CTD Data

The depth circuit on the CTD unit malfunctioned on the first CTD profile. Consequently no CTD data was taken during this cruise.

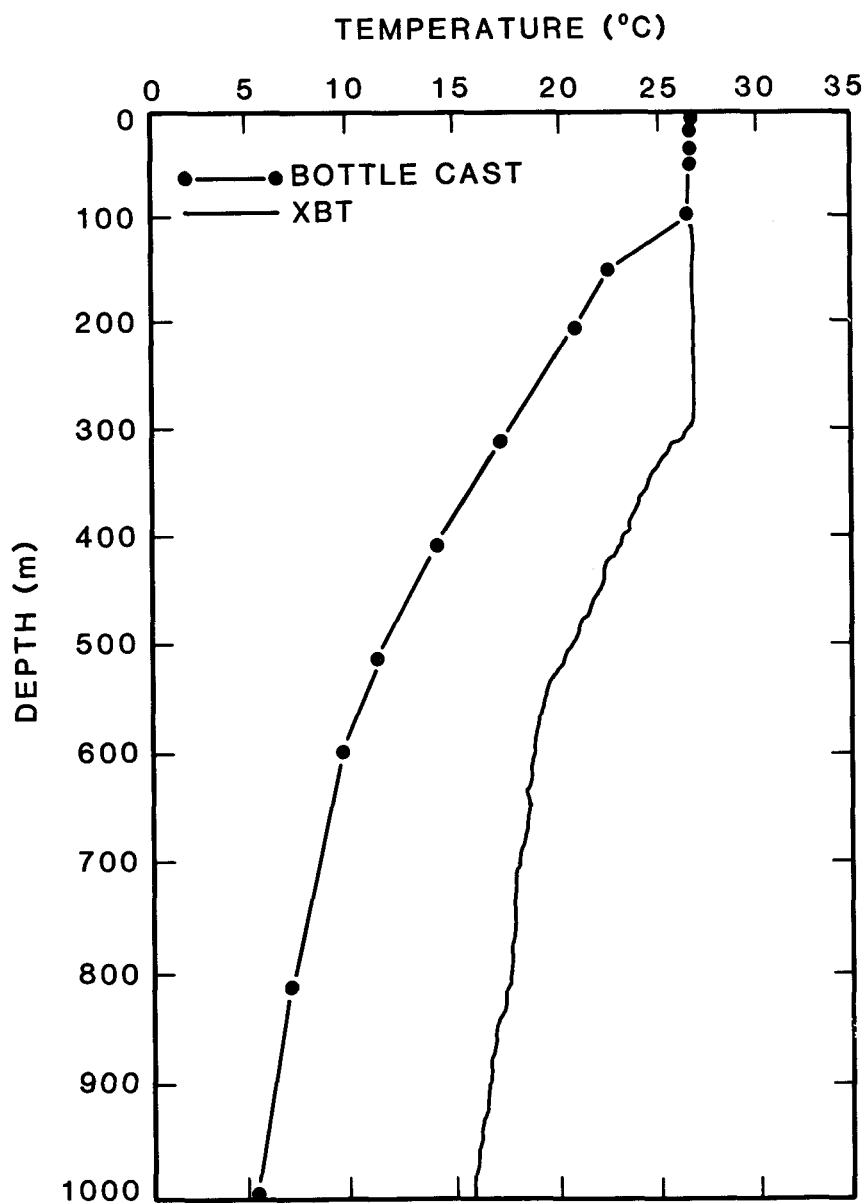
2. XBT Data

The XBT unit malfunctioned during the cruise. Although the calibration of the machine checked out, an accurate temperature trace was not obtained below 100m. The temperatures obtained with the reversing thermometers were compared with the XBT trace and differed markedly from the true temperature after 100m, not showing the thermocline between 100 and 150m and reaching approximately 9°C difference below 250m (Figs. 4 and 5). A short was found in the power supply after PROTEC-12 and this has been repaired.

3. Temperature and Salinity

The temperature data from the reversing thermometers on the combined biocast and hydrocasts are shown in Table 1 and Table 2. True depths calculated from the unprotected thermometer readings are shown below 100m. Above 100m unprotected thermometer readings are not sufficiently different from protected readings to allow calculation of true depth. The temperature data shows a marked thermocline beginning at 100m.

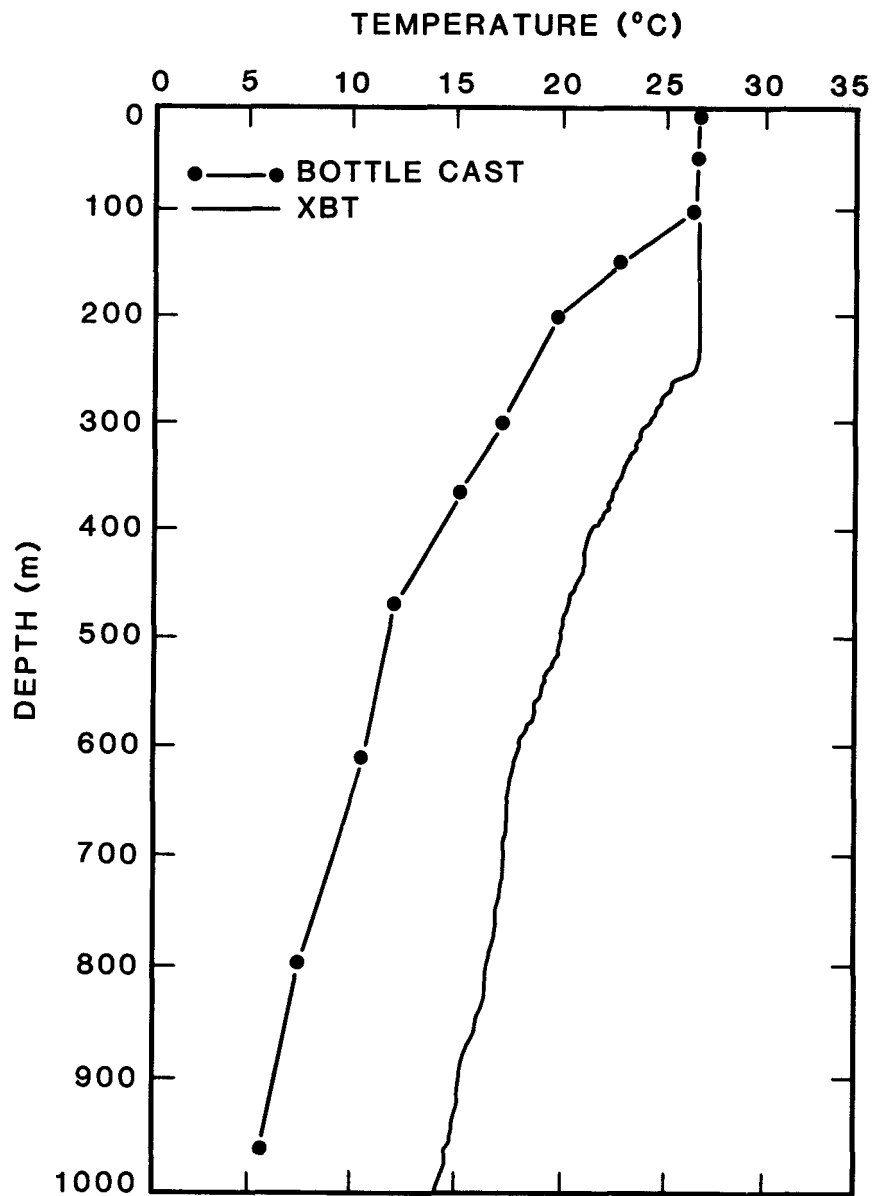
Temperature, salinity, and σ_t values for each depth are shown in Table 3 and 4. Salinities were run in the laboratory (see Section B) and σ_t values for each temperature were calculated



SHIP: BELLOWS
CRUISE: PROTEC 12
POSITION: 17°54.38' N, 15°52.58' W
TIME: 0900 (1300 Z)
DATE: FEB. 18, 1981
XBT NO.: 1(T5)

XBL 8012-13172

Figure 4. XBT Trace and True Temperature Profile



SHIP: BELLOWS
CRUISE: PROTEC 12
POSITION: 17°54'N, 65°56'W
TIME: 2055 (0055 Z)
DATE: FEB. 19, 1981
XBT NO.: 10

XBL 8012-13173

Figure 5. XBT Trace and True Temperature Profile

Table 1 . Corrected Temperatures and Depth.

Hydrocast 1, PROTEC-12. Date: 2/18/81 Start Time: 1545(1945) Soak Time: 15 min.
 Position: 17°42'N, 65°50'W Cast Down: 1713(2113) Cast Up: 1830(2230)

Bottle Number	Corrected Temperatures (°C)			Depth (m)	
	Left (P)	Middle (P)	Right (U)	Nominal	True
16	99.99	26.59	-	Surface	Surface
17	26.59	26.60	-	1	1
18	26.60	26.60	-	5	5
19	26.61	26.61	-	10	10
4	26.60	26.60	-	20	20
5	26.59	26.61	-	30	30
20	26.58	26.59	-	40	40
21	26.59	26.59	-	50	50
6	26.57	26.57	-	60	60
22	26.58	26.58	-	75	75
7	26.33	26.32	-	100	100
8	99.9	22.43	23.83	150	155
9	20.78	20.76	22.51	200	205
10	17.29	17.31	19.93	300	311
11	14.24	14.20	17.59	400	406
12	11.50	11.50	15.82	500	510
13	9.82	9.82	14.82	600	598
14	7.18	7.16	15.16	800	806
15	99.99	5.41	13.97	1000	1004

Table 2. Corrected Temperatures and Depth.

Hydrocast 2, PROTEC-12. Date 2/19/81 Start Time: 2345(0345) Soak Time: 15 min.
 Position: 17°55.72'N, 65°51.30'W Cast Down: 0100(0500) Cast Up: 0200(0600)

Bottle Number	Corrected Temperatures (°C)			Depth (m)	
	Left (P)	Middle (P)	Right (U)	Nominal	True
16	26.62	26.58	-	Surface	Surface
17	26.55	26.57	-	1	1
18	26.59	26.57	-	5	5
19	26.59	26.60	-	10	10
4	26.58	26.56	-	20	20
5	26.57	26.61	-	30	30
20	26.58	26.59	-	40	40
21	26.64	26.51	-	50	50
6	26.54	26.53	-	60	60
22	26.59	26.57	-	75	75
7	26.23	26.13	-	100	100
8	22.88	99.99	24.17	150	143
9	19.68	19.67	21.22	200	171
10	17.13	17.13	99.99	300	300
11	15.02	15.00	18.05	400	366
12	12.04	12.05	16.00	500	468
13	10.57	10.57	15.70	600	610
14	7.58	7.59	15.44	800	792
15	99.99	5.87	14.06	1000	959

99.99 - Thermometer failed

- - No thermometer present

Table 3. Temperature ($^{\circ}\text{C}$), Salinity (o/oo), and Sigma -t values for Hydrocast 1, PROTEC-12.

True Depth(m)	Temperature ($^{\circ}\text{C}$)	Salinity (o/oo)	Sigma -t (σ_t)
Surface	26.59	36.00	23.63
1	26.60	36.01	23.62
5	26.60	35.98	23.60
10	26.61	25.96	23.59
20	26.60	35.95	23.58
30	26.60	35.95	23.58
40	26.59	35.95	23.58
50	26.59	35.99	23.61
60	26.57	35.96	23.60
75	26.58	35.96	23.59
100	26.33	36.20	23.85
155	22.43	36.96	25.60
205	20.77	36.84	25.97
311	17.30	36.38	26.52
406	14.22	35.85	26.81
510	11.50	35.38	27.00
598	9.82	35.23	27.18
806	7.17	35.09	27.48
1004	5.41	34.99	28.43

Table 4. Temperature ($^{\circ}\text{C}$), Salinity (o/oo), and Sigma -t values for Hydrocast 2, PROTEC-12.

True Depth (m)	Temperature ($^{\circ}\text{C}$)	Salinity (o/oo)	Sigma -t (σ_t)
Surface	26.60	35.96	23.59
1	26.56	35.95	23.59
5	26.58	35.96	23.60
10	26.60	35.94	23.57
20	26.57	35.94	23.59
30	26.59	35.94	23.58
40	26.58	35.94	23.58
50	26.57	35.94	23.58
60	26.54	35.94	23.59
75	26.58	36.07	23.68
100	26.18	36.41	24.06
143	22.88	36.99	25.50
171	19.68	36.70	26.16
300	17.13	36.37	26.57
366	15.01	36.00	26.76
468	12.04	35.56	27.03
610	10.57	35.33	27.13
792	7.59	34.98	27.34
959	5.87	34.93	27.53

according to the methods in U.S. Navy Hydrographic Office Publ.

No. 614-Processing Oceanographic Data.

B. Chemical Measurements (K. Fanning)

The chemical data from the hydrocast-biocast samples for PROTEC-12 is shown in Table 5 and 6. The quality control data for the nutrient analyses is shown in Table 7. The filtered versus unfiltered data will be discussed in the final report.

Table 5. Chemical Data from Hydrocast #1 (Day Cast), Cruise #2, PROTEC 12. Position 17°54'N, 65°54'W.
All values are averages of duplicates except those marked with an asterisk.

Corrected Depth (m)	Oxygen	Salinity	Silica (μ M)	Phosphorus		Nitrogen-Bearing Solutes			
	ml STP L	(o/oo)		Inorganic (μ M)	Organic (μ M)	Nitrate (μ M)	Nitrite (μ M)	Ammonia (μ M)	Organic-N (μ M)
0	4.76	36.00	1.2	0.01	0.05	0	0.08	0.04	2.6
1	4.83	36.01	1.1	0.01	0.04	0.1	0.08	0.04	2.5
5	4.83	35.98	1.1	0.01	0.03	0.1	0.07	0.03	2.4
10	4.83	35.96	1.2	0.02	0.04	0.1	0.07	0.04	3.0
20	4.82	35.95	1.1	0.02	0.04	0	0.04	0.01	5.7
30	4.81	35.95	0.9	0.04	0.02	0.1	0.06	0.07	2.2
40	4.78	35.95	1.2	0.01	0.01	0.1	0.09	0.04	3.1
50	4.80	35.99	1.9	0.48	0	0	0.07	0.02	2.8
60	4.87	35.96	1.2	0.01	0.03	0.1	0.06	0.02	2.6
75	4.85	35.96	1.2	0.04	0.08	0.1	0.07	0.03	2.7
100	4.73	36.20	1.0	0.02	0	0.2	0.15	0.06	2.6
155	4.39	36.96	0.6	0.15	0.02	1.7	0.10	0.03	2.11
205	4.28	36.84	0.8	0.12	0	1.8	0.08	0.02	2.8
311	4.47	36.38	1.9	0.48	0	7.1	0.06	0.04	2.3
406	3.63*	35.85	6.0	0.91	0.07	17.3	0.07	0.05	2.2
510	3.20	35.38	10.0	1.27	0.12	23.8	0.06	-	2.1
598	3.21	35.23	13.6	1.52	0.09	28.0	0.07	0.06	1.1
806	3.52	35.09	20.0	1.76	0.05	31.7	0.07	0.03	1.3
1004	4.37	34.99	20.7	1.43	0.11	25.1	0.07	0.06	0.5
Average Absolute value of Difference between									
Duplicates:	0.04	0.036	0.07	0.02	0.03	0.03	0.01	0.01	0.54
Standard Deviation	0.04	0.063	0.08	0.02	0.03	0.04	0.01	0.01	0.73

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Table 6. Chemical Data from Hydrocast #2 (Night Cast), Cruise #2, PROTEC 12. Position 17°54'N, 65°54'W.
All values are averages of duplicates except those marked with an asterisk.

Corrected Depth (m)	Oxygen ml STP L	Salinity (o/oo)	Silica (μ M)	Phosphorus		Nitrogen-Bearing Solutes			
				Inorganic (μ M)	Organic (μ M)	Nitrate (μ M)	Nitrite (μ M)	Ammonia (μ M)	Organic-N (μ M)
0	4.84	35.96	1.1	0.02	0.01	0	0.05	0.15	2.3
1	4.79	35.95	1.1	0.02	0.05	0	0.07	0.15	2.5
5	4.84	35.96	1.1	0.01	0.03	0	0.05	0.13	2.7
10	4.82	35.94	1.2	0.04	0.01	0	0.04	0.26	2.0
20	4.78	35.94	1.1	0.01	0.03	0	0.04	0.06	1.8
30	4.84	35.94	1.1	0.03	0.05	0	0.07	0.16	2.4
40	4.83	35.94	1.4	0.03	0.05	0	0.04	0.18	3.9
50	4.79	35.94	1.1	0.01	0.03	0	0.04	0.09	3.8
60	4.86	35.94	1.1	0.02	0.04	0	0.05	0.16	2.4
75	4.83	36.07	1.1	0.02	0.03	0	0.07	0.12	1.9
100	4.72	36.41	0.6	0.04	0	0.2	0.14	0.12	1.4
143	4.45	36.99*	0.4	0.06	0	1.1	0.06	0.22	1.0
200	4.30	36.70	0.9	0.18	0.01	3.2	0.07	0.15	1.8
300	4.51	36.37	1.7	0.41	0	6.2	0.05	0.18	1.7
367	387	36.00	4.5	0.77	0	12.9	0.05	0.10	5.4
468	3.21	35.56	9.3	1.25	0.05	21.3	0.05	0.18	6.9
610	3.21	35.33	12.1	1.41	0	23.5*	0.04	0.13	5.0
793	3.37	34.98	19.4	1.78	0.03	28.8	0.07	0.11	1.8
959	4.14	34.93	22.2	1.68	0	26.7	0.03	0.16	6.4
Average Abs. value of Difference between									
Duplicates:	0.04	0.032	0.03	0.01	0.02	0.05	0.02	0.03	0.52
Standard									
Deviation	0.03	0.066	0.05	0.01	0.03	0.12	0.02	0.05	0.69

Table 7. Quality Control on Seawater Nutrient Analyses after E.P.A. (1979b).

Nutrient	Heptuplicate Analyses		Recoveries	
	Average Concen. (μM)	Standard Deviation	Amount Added (μM)	Percent Recovered
$NO_3^- + NO_2^-$	0	0	2.5	87
	13.1	0.1	10.0	102
	24.1	0.2		
	25.3	0.1		
NO_2	0.05	0.01	0.25	93
	0.05	0.02	0.25	94
	0.04	0.01		
	0.03	0.01		
NH_3	0.15	0.03	0.50	64
	0.10	0.04	1.50	56
	0.06	0.02		
	0.05	0.01		
Total N (NO_3^- , NO_2^- , NH_3 , Org.N)	2.7	0.3	5.0	100
	18.5	0.2	24.3	97
	25.5	0.9		
	26.0	1.1		
Inorg. PO_4	0.02	0	0.50	96
	0.78	0.04	1.00	100
	1.25	0.02		
	1.66	0.01		
Inorg. + Org. P	0.07	0.01	1.00	82
	0.69	0.08	2.00	96
	1.21	0.06		
	1.44	0.07		
Silica	1.1	0	2.5	102
	4.5	0.04	10.0	99
	9.3	0.03		
	22.2	0.05		

C. Biological Measurements

1. Phytoplankton (G. Vargo)

Methods and Problems

Irradiance Profile

After the difficulties of obtaining the irradiance profile by hand-lowering the sensor, a set of deck and sea sensor holders were constructed. The sea sensor is lowered using the hydrowinch with the ship maneuvering to maintain the sun off the starboard-stern quarter while holding a zero degree wire angle. The deck sensor is mounted in a special holder which fits atop a stanchion in the stern. Irradiance values, as a percent of the surface readings, are fitted to an exponential curve using a least-squares regression of which the slope of the line is equivalent to "k", the extinction coefficient. Sample depths are calculated by solving for depth (z) in:

$$I_z = I_o e^{-kz}$$

where I_z and I_o are the irradiance reading at depth and the surface respectively.

Transmissometer profile

No transmissometer profiles were made as a result of instrument malfunction. Upon return to USF the instrument was checked and the problem was determined to be in the slip-ring assembly. Repairs were made which will provide a functional instrument for PROTEC-13.

In vivo profiles

The addition of several feet of heavy walled hose at the pump end of the system alleviated the pumping problem experienced on PROTEC-10. Two

profiles were obtained using two different methods. The suction end of the hose was attached to the transmissometer during the day profile. In theory this should provide a continuous depth read-out with which to calculate a known depth for in vivo reading. Although excellent traces were obtained, the depths from which a sample was pumped cannot be determined for the day cast. Incorrect depths as well as unscheduled stops of unknown duration (which were not marked on the trace) preclude calculating sample depth.

The night in vivo profile was obtained by attaching the suction side of the hose to the hydroweight. Depths were read from the metering block. A stop was made at each predetermined sampling depth (10m intervals) for the duration of the lag time between sample intake and fluorescence reading (approx. 3 minutes). This method takes additional time but yields known depths and time intervals between stops from which intervening in vivo reading can be calculated. We will use the stop and go method on PROTEC-13.

Hydrocast/Biocast

Sample allocation and processing was reduced somewhat by using individual sample bottles for the replicate ATP and chlorophyll samples. Filtering time was reduced to about the minimum possible given the volumes filtered (see Table 5 for bottle volumes). Similar discrete samples will be used on PROTEC-13.

One liter samples for phytoplankton counts were preserved with buffered formalin. Counts were made after concentrating 500 mL or more to 10 mL. The entire 10 mL aliquot was counted.

There appeared to have been a shortage of water in the 8L bottles after samples were withdrawn for the day-cast. This prompted a decision to reduce the volume of samples for primary production estimates to a total of 1 liter (200 mL per bottle). As a result some bottles became

positively buoyant during incubation. This was not discovered until after mid-day. Bottles were then wedged in place, but the different bottle positions (while floating) may account for some of the variability in ^{14}C uptake reported in Table 11. Use of a splash box alleviated most of the leakage problem from the light-gradient box encountered during PROTEC-10. A new, larger diameter drain has been fitted to the splash box which should completely and rapidly drain any excess water.

Fluorometer calibration

Pure chlorophyll a in 90% acetone at $5\ \mu\text{g}\text{L}^{-1}$ was used to check the fluorometer calibration. Mean chlorophyll to fluorescence (F_s) and before-after acidification (r_s) ratios were within the limits determined for the initial calibration Table 16. Therefore the original equations were used to calculate chlorophyll a and phaeopigment concentrations.

Results

The irradiance profile yielded an extinction coefficient of $k = 0.049\ \text{m}^{-1}$, a value similar to the one obtained on PROTEC-10 (0.051m^{-1}). Depths corresponding to the light levels used in the primary productivity gradient box as well as the actual sample depth are also listed in Table 8.

Replicability for duplicate pigment analyses was somewhat better than obtained previously. Chlorophyll and phaeopigment maxima occurred at noon during both day and night casts (Figs. 6 and 7). Pigment concentrations in the upper 40m during PROTEC-12 were somewhat higher than cruise 10, with the principal difference being a lower phaeopigment/chlorophyll ratio at all depths during both day and night on PROTEC-12 (Tables 9 and 10). The 100m maxima occurred at approximately the base of the mixed layer (see temperature data, Sec. A).

The night in vivo chlorophyll fluorescence profile reveals considerably more detail than the extracted, discrete samples (Fig. 8). Peaks are narrow, particularly the 75m maximum, although the more general increase from 85m through 115m is in general agreement with 100m maxima observed in the discrete samples.

Primary productivity estimates were extremely variable. Part of the variability may have been the result of some bottles becoming buoyant (noted above). However, high counts from the initial bottles tend to indicate an additional problem was involved. All initial bottles were inoculated with the same ^{14}C solution used for the incubated bottles but were filtered within 15 minutes of inoculation. The high counts indicate that a precipitate may have formed in the ^{14}C stock solution (Table 11). Although a precipitate was not visible, it is the likely culprit since, if the sterilized ^{14}C solution had become contaminated with bacterial growth, such labelled particulate material should also have been found in the dark and light bottles. Additionally, through an oversight, the initial bottles were not subjected to fuming hydrochloric acid, whereas the incubated bottles did receive such treatment. Thus, if the precipitate was carbonate in nature it would have been removed from the incubated bottles. It is also possible that the precipitate dissolved during incubation.

Examination of the batch of ^{14}C solution prepared for PROTEC-13 revealed that a precipitate had formed following sterilization. Apparently autoclaving changes the pH in the sealed bottle enough to allow for the precipitation of some salts. The solution will be filtered through 0.22 μm Millipore filters before use.

Productivity rates again show a distinct low light maximum at the 10% light level (Table 11) but, in general, rates are considerably greater than

counts indicate that a precipitate may have formed in the ^{14}C stock solution (Table 11). Although a precipitate was not visible it is the likely culprit since, if the sterilized ^{14}C solution had become contaminated with bacterial growth, such labelled particulate material should also have been found in the dark and light bottles. Additionally, through an oversight, the initial bottles were not subjected to fuming hydrochloric acid, whereas the incubated bottles did receive such treatment. Thus, if the precipitate was carbonate in nature it would have been removed from the incubated bottles. It is also possible that the precipitate dissolved during incubation.

Examination of the batch of ^{14}C solution prepared for PROTEC 13 revealed that a precipitate had formed following sterilization. Apparently autoclaving changes the pH in the sealed bottle enough to allow for the precipitation of some salts. The solution will be filtered through 0.22 μm Millipore filters before use.

Productivity rates again show a distinct low light maximum at the 10% light level (Table 11) but, in general, rates are considerably greater than those found on PROTEC 10. An integrated production rate of $3.24 \text{ gC m}^{-2} \text{ day}^{-1}$ is considerably greater than that found previously and is greater than might be expected from the area. Although pigment levels were greater cell numbers were not dramatically different from PROTEC 10. Trichodesmium was, however, present in greater abundance than on PROTEC 10. Some of the variability between bottles may also be the result of the differential removal (or non-removal) of this blue-green alga by prefiltering the samples before ^{14}C inoculation.

Thus a combination of precipitate formation with differential removal or dissolution and/or the presence or absence of Trichodesmium in the sample bottle might account for the variability between replicate bottles.

Numerically, unidentified monads ($<5\mu\text{m}$ dia.) and coccolithophores, dominated the phytoplankton community (Tables 12 & 13). Diatoms, while less abundant,

those found on PROTEC-10. An integrated production rate of $3.24 \text{ gC m}^{-2} \text{ day}^{-1}$ is considerably greater than that found previously and is greater than might be expected from the area. Although pigment levels were greater, cell numbers were not dramatically different than PROTEC-10. Trichodesmium was, however, present in greater abundance than on PROTEC-10. Some of the variability between bottles may also be the result of the differential removal (or non-removal) of this blue-green alga by prefiltering the samples before ^{14}C inoculation.

Thus a combination of precipitate formation with differential removal or dissolution and/or the presence or absence of Trichodesmium in the sample bottle might account for the variability between replicate bottles.

Numerically, unidentified monads ($<5 \mu\text{m}$ dia.) and coccolithophores, dominated the phytoplankton community (Tables 12 and 13). Diatoms, while less abundant, displayed the greatest diversity. Total cell counts include blue-green filament, monads as well as diatoms, dinoflagellates, and coccolithophores. Cell volume measurements were made and are presented in Table 14.

Diatom and monad abundance may account for the 100m pigment maximum during the day cast (Table 12), however populations of both groups appear to have been reduced at that depth during the night cast. Such a reduction does not conform with the continued presence of the night chlorophyll maximum at 100m. Further investigation (a recount) of this and other samples (150, 200 and 300m, night cast) will be made.

Table 8. Irradiance Profile ($\mu\text{Es}^{-1}\text{m}^{-2}$), PROTEC 12, B8103 and Light gradient box light levels with corresponding calculated depths and actual sample depths.

Depth (m)	$\mu\text{Es}^{-1}\text{m}^{-2}$		%	Box Light Level	Calculated Depth (m)	Sample Depth (m)
	Deck	Sea				
Surface	1925	1500	77.9	100%	Surface	0
2	1925	1450	75.3	62%	0.53	1
5	1850	1000	54.1	49%	5.3	5
10	1850	750	40.5	36%	11.6	10
15	1875	525	28.0	10%	37.6	40
20	1875	275	14.7	5.5%	49.8	50
30	2050	200	9.7	1.6%	74.9	75
40	1850	135	7.3			
50	1900	130	6.8			
60	1900	85	4.5			

Exponential curve fit:

$$a = 0.6364$$

$$b = 0.049 = k$$

$$r^2 = 0.929$$

Table 9 Chlorophyll and Phaeopigment concentrations ($\mu\text{g l}^{-1}$) PROTEC 12, B8103.

DAY CAST

Depth (m)	Chlorophyll a		Phaeopigments		Phaeo/Chl
		$\bar{x}$		$\bar{x}$	
Surface	0.025 0.036	0.030	0.018 0.024	0.021	0.69
1	0.047 0.038	0.043	0.013 0.017	0.015	0.34
5	0.029 0.032	0.031	0.024 0.019	0.021	0.69
10	0.041 0.030	0.036	0.028 0.021	0.024	0.69
40	0.019 0.028	0.024	0.018 0.024	0.021	0.88
50	0.037 0.025	0.031	0.024 0.023	0.024	0.75
60	0.064 0.030	0.047	0.021 0.024	0.023	0.49
75	0.043 0.059	0.051	0.027 0.022	0.024	0.47
100	0.089 0.103	0.096	0.055 0.069	0.062	0.65
150	0.018 0.015	0.016	0.033 0.034	0.034	2.02
200	0.008 0.006	0.007	0.014 0.018	0.016	2.28
300	0.0005 0.0005	0.0005	0.0096 0.0077	0.009	16.5

Table 10. Chlorophyll and Phaeopigment concentrations ($\mu\text{g l}^{-1}$) PROTEC 12, B8103.
NIGHT CAST

Depth (m)	Chlorophyll a		Phaeopigments		Phaeo/Chl
		$\bar{x}$		$\bar{x}$	
Surface	0.019 0.021	0.020	0.016 0.021	0.019	0.96
1	0.017 0.025	0.021	0.018 0.018	0.018	0.85
5	0.024 0.028	0.026	0.019 0.019	0.019	0.75
10	0.024 0.020	0.022	0.019 0.016	0.018	0.79
40	0.037 0.024	0.031	0.012 0.020	0.016	0.52
50	0.027 0.015	0.021	0.021 0.022	0.022	1.02
60	0.013 0.027	0.020	0.019 0.024	0.022	1.09
75	0.025 0.036	0.030	0.019 0.025	0.022	0.72
100	0.087 0.072	0.079	0.056 0.053	0.055	0.68
150	0.020 0.018	0.019	0.035 0.033	0.034	1.79
200	0.0033 0.0032	0.0033	0.016 0.011	0.013	4.12
300	0.0007 0.0007	0.0007	0.008 0.007	0.0072	10.9

Table 11. Primary productivity ($\text{mgCm}^{-3}\text{hr}^{-1}$) and total carbonate carbon values (mg m^{-3})
PROTEC 12, B8103.

Depth (m)	Light Level	DPM	W	$\text{MgCm}^{-3}\text{hr}^{-1}$ $\bar{x}$
Surface	100%	41,068 4,199 3,302	28855	2.613 * 0.2671 0.2101
	Dark Initial	39,183 375,741		0.2386
1	62%	26,799 17,952 15,700	28155	1.664 1.114 0.9746
	Dark Initial	21,989 409,894		1.2508
5	• 49%	10,501 38,555 57,176	28091	0.6504 * 2.388 3.542
	Dark Initial	16,410 368,371		2.965
10	36%	7,476 14,310 10,856	27508	0.4534 0.8679 0.6584
	Dark Initial	31,023 292,050		0.6599
40	10%	282,935 212,037 162,779	27944	17.432 13.064 10.029
	Dark Initial	149,612 223,087		13.508
50	5.5%	33,849 102,707 13,497	27906	2.083 6.319 * 0.830
	Dark Initial	2,353 127,039		4.201
75	1.6%	49,916 28,404 130,415	27348	3.009 1.713 * 7.864
	Dark Initial	87,627 132,385		2.361

* values not included in calculating the mean

Integrated total, 0-75m = $270.29 \text{ mgCm}^{-2}\text{hr}^{-1}$

Incubation period: 12 hrs (0630-1830)

Integrated daily total: $3.24 \text{ gCm}^{-2}\text{day}^{-1}$

Table 12. Phytoplankton species composition and abundance (cell L⁻¹), PROTEC 12, B8103
DAYCAST

Depth(m)												
Taxa	0	1	5	10	40	50	60	75	100	150	200	300
<u>Diatoms</u>												
<i>Amphora crassa</i>											2	
<i>A. dubia</i>	2											
<i>Bacteriastrum delicatulum</i>	14	32							44			
<i>B. hyalinum</i>	48	54	34	20	16	12	6		30			
<i>Chaetoceros affinis</i>									6			
<i>C. anastomosans</i>									42			
<i>C. atlanticum</i>						6						
<i>C. compressum</i>										10		
<i>C. decipiens</i>		10	6	10	6							
<i>C. laevis</i>	4		3		16							
<i>C. lauderi</i>									10			
<i>C. lorentzianum</i>	8				22	14						
<i>C. pendulus</i>		2			4		2					
<i>C. socialis</i>									18			
<i>Climacodium frauenfeldianum</i>									12			
<i>Coscinodiscus radiatus</i>							2					
<i>Guinardia flaccida</i>										2		
<i>Gyrosigma</i> sp.				2			2					
<i>Hemiaulus hauckii</i>	6	2	12	2	22	14	2	6	2			
<i>H. membranaceus</i>	2		2		10	2			10			
<i>H. sinensis</i>	2								2			
<i>Mastogloia</i> sp.				2								
<i>Navicula</i> sp. A	6	4	2	4	4	4	2	6	4			
<i>N. sp. B</i>				8	4			3				
<i>N. lyra</i>				2								
<i>N. wawriake</i>			2		11			2	4			
<i>Nitzschia closterium</i>		6			22							
<i>N. longissima</i>	10			6		4	8		6	2		
<i>N. pungens</i> v. <i>atlantica</i>	8			26	24				14			
<i>N. recta</i>											2	
<i>N. sp.</i>			2									
<i>Pennate</i> sp. A	2	2	2	6	4	8		12	2	2		
<i>Rhizosolenia alata</i> f. <i>gracillima</i>					2							

Table 12 (Cont'd.)

Depth(m) Taxa	0	1	5	10	40	50	60	75	100	150	200	300
<i>R. calcar-avis</i>						2						
<i>R. delicatula</i>					10							
<i>R. imbricata</i>			4					4				
<i>R. stolterforthii</i>			2		6	4						
<i>R. styliformis</i>	2	2	2			6	2	6	2		2	
<i>Skeletonema costatum</i>							8	10				
<i>Thalassionema nitzschioides</i>		4	8	4	4				52	6		
<i>Thalassiothrix frauenfeldii</i>	4	4	12	4		8			36			
<u>Dinoflagellates</u>												
<i>Amphidinium</i> sp. A				2								
<i>A. carteri</i>								4				
<i>A. schroederi</i>	2											
<i>Ceratium extensum</i>	2											
<i>C. fusus</i>					2							
<i>C. hexacanthum</i>							2					
<i>C. massiliense</i>					2							
<i>C. pentagonium</i>				2								
<i>C. teres</i>					2							
<i>C. trichoceros</i>				2	2		2					
<i>Gonyaulax diegensis</i>				2								
<i>G. kofoiidi</i>										2	2	
<i>G. polygramma</i>			2							2		
<i>Gymnodinium</i> spp.		4		2	4							
<i>Oxytoxum</i> sp.			2	2								
<i>O. scolopax</i>		2										
<i>Peridinium grande</i>											2	
<i>P. pallidum</i>		2										
<i>P. pellucidum</i>	2							2			2	
<i>P. sp.</i>		6									2	
<i>Podolampus palmipes</i>								2				
<i>P. spinifer</i>				2								
<i>Prorocentrum gracile</i>									2			
Rounded dinoflagellates	2			2								

Table 12 (Cont'd.)

Depth(m) Taxa	0	1	5	10	40	50	60	75	100	150	200	300
<u>Coccolithophores</u>												
Acanthoica acanthos					6							
Calyptrosphaera oblonga	2											
C. pyriformis				4								
C. uvella	4											
Discosphaera thomsonii	28	30	34	54	34	16	12	16	6			
D. tubifer	120	28	88	62	120	74	32	24	16			
Halopappus uahseli	2				4							
Lohmanosphaera sp.								4				
Ophiaster hydroideus						2						
Pontosphaera huxleyi				8								
P. syracusana	6											
Rhabdosphaera hispida					2							
R. longistylis												2
R. stylifera	8		24	12	10	4		6				
Syracosphaera sp. A.						2						
S. dentata								2				
S. molischii	2	6		2	6							
S. pulchra	10	10	16	10	2	6						
S. spinosa			4									
S. sp.					2							
unidentified coccolithophores							4		2			
<u>Other</u>												
blue-green filaments (Trichodesmium)	2	22	6	4	48	50	2	48	42			
Unidentified monads	887	127	380	127	380	253	127	253	506	127		127
Total diatoms	118	122	93	96	187	84	34	49	298	20	6	0
Total dinoflagellates	8	14	6	14	12	0	4	8	2	4	8	0
Total coccolithophores	182	74	166	152	184	104	48	52	24	0	0	2
Total cells	1197	359	651	393	751	491	215	410	872	151	14	129

Table 13. Phytoplankton species composition and abundance (cell L⁻¹), PROTEC 12, B8103

NIGHTCAST

Depth(m) Taxa	0	1	5	10	40	50	60	75	100	150	200	300
Diatoms												
Actinocyclus subtilis	2											
Amphiprora alata		2			2							
Amphora cingulata					2							
A. ostrearia									2			
A. peragalli									4			
Asteromphalus flabellatus		2										
A. marylandica	2											
Bacillaria paxillifer								12				
Bacteriastum delicatulum		6			10	2						
B. hyalinum			10					10				
Chaetoceros lorenzianum						8						
C. spp.					10							
Eucampia zoodialus					2							
Hantzschia amphioxys					4							
Hemiaulus haucki		20	26				4	8				
H. membranaceus		2					8					
H. sinensis	16			4				4				
Navicula sp. A		2	4	2		6	2	2				
N. sp. B		2	8									
N. sp. C											2	
N. clarata					2							
N. crabo		2										
N. lyra								2				
N. vacillans										2		
N. wawriksae		2						4				
N. sp.							2					
Nitzschia longissima		6	4				4	2				
N. pungens v. atlantica			16									
N. seriata		6										
N. sigma v. intercidens							2					
Pennate A	6		2	8	2	6	4	2	2			
Pleurosigma lanceolatum										4		

Table 1.3 (Cont'd.)

Depth (m)	0	1	5	10	40	50	60	75	100	150	200	300
<i>R. novifolius</i>											2	
<i>Rhizosolenia calcar-evis</i>		4			2							
<i>R. imbricata</i>									2			
<i>R. styliformis</i>		2		2								
<i>Thalassiosira weissflogii</i>			20		2			4				
<i>Thalassiosira nitzenoides</i>		4	4	6			10		10			
<i>Thalassiosira frauenfeldii</i>				2		15		12	18			
<i>T. longissima</i>					10				4			
<i>Trachynoe aspera</i>	2											
Dinoflagellates												
<i>Amphidinium carteri</i>			2									
<i>A. sp. A</i>		2										
<i>Ceratium declinatum f. normale</i>				2								
<i>C. furca</i>								2				
<i>C. pentagonum</i>			2				2					
<i>C. puchellum</i>							2					
<i>C. teres</i>		2	2		2			2				
<i>C. trichoceros</i>		2			1							
<i>C. tripos</i>							2					
<i>Gonyaulax diacantha</i>								2				
<i>G. polygramma</i>					2							
<i>G. sp.</i>								2				
<i>Gymnodinium sp.</i>						4						
<i>Heterosulcus acuminata</i>	4											
<i>Peridinium globulus</i>								2				
<i>T. tuba</i>	2											
<i>Podolampus palmipes</i>	2											
<i>Prorocentrum compressum</i>	2											
<i>Pyrophacus horologium</i>	2											
Rounded-out dinos	6											
Unidentified dino-dividing			2									

Table 13. (Cont'd.)

Depth(m)	Taxa	0	1	5	10	40	50	60	75	100	150	200	300
Coccolithophores													
	Acanthoica acanthos		8										
	A. monospina											2	
	Calciosolenia granii						4						
	Calyptrorphaera dalmatica									2			
	C. oblonga								8				
	C. sphaeroida	4					2		4				
	C. uvella		2										
	Discosphaera thomsonii	42	34	20	8	28	14	48	38	4			
	D. tubifer	58	76	24	26	30	62	36	58	4			
	Michaelsarsia assymetrica							2					
	Ophiaster hydroideus	8			6					4			
	Pontosphaera hartmanii					2					2		
	P. huxleyii						4						
	P. syracusana						2		2				
	P. sp.						2						
	Rhabdosphaera claviger		4	4					2				
	R. hispida							2					
	R. stylifer			6	4	4	4		2				
	R. tignifer				2			6	2				
	Syracosphaera apsteinii						2						
	S. brandtii						4						
	S. mediteranea						2						
	S. molischii		4				6		2				
	S. pulchra	4		4	6			2	12				
	S. spinosa							4					
	Unidentified cocco.	18					2		26				
Other:													
	blue-green filaments (Trichodesmium)	28	42	86	24	16		132	128				
	Silicoflagellates				4								
	Unidentified monads	760	380	380	127	127	253	253	506				
Total diatoms		28	62	94	94	46	38	38	62	42	8	2	2
Total dinoflagellates		18	8	8	2	6	4	6	10	0	0	0	0
Total coccolithophores		134	120	58	52	64	110	100	156	14	2	2	0
Total cells		968	612	626	303	259	404	529	862	56	10	4	2

Table 14: Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-12, B8103

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Species/ Diatoms	DAY CAST												NIGHT CAST												
	0M	1M	5M	10M	40M	50M	60M	75M	100M	150M	200M	300M	0M	1M	5M	10M	40M	50M	60M	75M	100M	150M	200M	300M	
Actinocyclus subtilis													.05												
Amphiprora alata														.07											
Amphora crassa										.02															
A. dubia	.01																								
A. ostrearia																									
A. peragalli																								.12	
A. cingulata																								.06	
Asteromphalus flabellatus														.05			.04								
A. marylandica													.08												
Bacillaria paxillifer																								.12	
Bacteriastrum delicatulum	.19	.30								.41				.06			.09	.02							
B. hyalinum	.90	1.02	.64	.38	.30	.23	.11			.57					.19								.19		
Chaetoceros affinis										.12															
C. anastomosans										.21															
C. atlanticum							.11																		
C. compressum											.19														
C. decipiens		.05	.03	.55	.03																				
C. laevis	.01		.02		.03																				
C. lauderi										.20															
C. lorenzianum	.30				.83	.53												.30							
C. pendulus					.04		.02																		
C. sociales		.02								.04															
C. spp.																	.10								
Climacodium fraenfeldianum										.14															
Coscinodiscus radiatus							.14																		
Eucampia zoodiacus																	.02								
Guinardia flaccida											2.01														
Gyrosigma sp.				.02			.05																		
Hantzschia amphioxys																	.04								
Hemiaulus hauckii	.28	.09	.57	.19	1.04	.66	.09	.28	.09					.94	1.23				.19	.38					
H. membranaceus	.06		.06		.30	.40			.30					.06					.02						
H. sinensis	.26								.26				2.11			.53					.53				
Mastogloia sp.				.04																					
Navicula sp. A	.14	.10	.05	.10	.10	.10	.05	.14	.10					.05	.10	.05		.14	.05	.05					
N. sp. B				.03	.01				.01					.01	.03										
N. sp. C																								.02	
N. clarata																	.06								
N. crabro														.40											
N. lyra				.05																	.05				
N. vacillans																								.02	
N. wawriake			.04		.08				.04	.08				.04						.02					

Table 14: Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-12, B8103
(Continued)

B-33

Species/ Diatoms	DAY CAST												NIGHT CAST											
	0M	1M	5M	10M	40M	50M	60M	75M	100M	150M	200M	300M	0M	1M	5M	10M	40M	50M	60M	75M	100M	150M	200M	300M
N. sp.			.01																	.00				
Nitzschia closterium		.01			.04																			
N. longissima	.03			.02		.01	.02			.02	.01			.02	.01				.01	.01				
N. pungens v. atlantica	.06			.23	.22			.09	.13						.14									
N. recta											.04													
N. seriata														.09										
N. sigma v. intercedens																			.04					
N. sp.																								
Pennate A	.06	.06	.06	.18	.12	.24		.36	.06	.06				.18	.06	.24	.06	.18	.05	.06	.06			
Pleurosigma lanceolatum																						.08	.06	
P. naviculaceum																								
Rhizosolenia alata f. gracillima					.46																			
R. calcaravis						7.58								15.10			7.55							
R. delicatula					.09																			
R. imbricata			3.18					3.18																
R. stolterfotnii			.41		1.22	.81																1.59		
R. Styliiformis	1.70	1.70	1.70			5.10	1.70	5.10	1.70		1.70			1.70	1.70	1.70				3.40				1.70
R. styliiformis w/Richelina							.06	.08																
Skeletonema costatum																								
Thalassionema nitzschioles		.01	.03	.02	.02					.21	.02			.02	.02	.02			.05		.04			
Thalassiothrix fravenfeldii	.04	.04	.13	.04		.09				.40						.02		.18		.13	.20			
T. longissima																	.21				.17			
Trachyneis aspera														.24										

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Table 14 : Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-12, B8103

Species/ Dinoflagellates	DAY CAST												NIGHT CAST											
	0M	1M	5M	10M	40M	50M	60M	75M	100M	150M	200M	300M	0M	1M	5M	10M	40M	50M	60M	75M	100M	150M	200M	300M
Amphidinium carteri								.02							.02									
A. sp. A				.12										.23										
A. schroederi	.22																							
Ceratium declinatum f. normale																.31								
C. extensum	.19																							
C. furca																						.05		
C. fusus					.15																			
C. hexacanthum							.13																	
C. massiliense				.36																				
C. pentagonum			.40													.40						.40		
C. puchellum																.56								
C. teres					.19									.19	.19		.19				.19			
C. trichoceros				.30	.30		.30							.30			.30							
C. tripos																				.82				
Gonyaulax diacantha																					.16			
G. diegensis				.50																				
G. kofoidii										.70	.70													
G. polygramma										.67							.67							
G. sp.		.12	.67	.05	.10														.10					
Gymnodinium spp.																								
Heteraulacus acuminata														4.52										
Oxytoxum sp.			.36	.35																				
O. scolopax		.50																						
Peridinium globulus																					1.02			
P. grande											16.10													
P. pallidum		.55																						
P. pellucidum	.55							.55			.55													
P. spp.		.15									.50													
P. tuba													.17											
Podolampus palmipes							.28						.28											
P. spiniifer				.89																				
Prorocentrum compressum													.03											
P. gracile									.03															
Pyrophacus horologium															.43									
Rounded out dinoflagellates		.37											.49											
Unidentified dividing dino			.21																					

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Table 14 : Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-12, B8103

Species/ Coccolithophorids	DAY CAST												NIGHT CAST												
	0M	1M	5M	10M	40M	50M	60M	75M	100M	150M	200M	300M	0M	1M	5M	10M	40M	50M	60M	75M	100M	150M	200M	300M	
Acanthoica acanthos					.23									.31											
A. monospina																								.02	
Calciosolenia granii																		.10							
Calyptrosphaera dalmatica																					.04				
C. oblonga	.11																			.45					
C. pyriformis				.002																					
C. sphaeroida												.07						.04		.07					
C. uvella	.02												.01												
Discosphaera Tnomsonii	1.01	1.08	1.22	1.94	1.22	.57	.43	.57	.22				1.51	1.22	.72	.29	1.01	.50	1.72	1.36	.14				
D. tubifer	2.12	.49	.06	1.10	2.12	1.31	.57	.42	.28				1.02	1.34	.42	.46	.53	1.10	.64	1.02	.08				
Halopappus vahseli	.10				.19																				
Lohmanosphaera sp.								.04																	
Michaelsarsia assymetrica																			.02						
Ophiaster hydroideus						.001							.01			.003					.002				
Pontosphaera hartmanii																	.10					.002		.10	
P. Huxleyi				.45															.04						
P. syracusana	.18																	.10		.10					
P. sp.																		.01							
Rhabdosphaera claviger														.02	.02						.01				
R. hispida					.06															.03					
R. longistylis												.90													
R. stylifer	.07		.22	.11	.09	.04									.05	.04	.04	.04	.05	.02					
R. tignifer																.07				.07					
Syracosphaera apsteinii																									
S. brandtii																									
S. dentata								.01											.05						
S. mediterannea																			.23						
S. molischii	.003	.01		.003	.01									.01					.01		.01				
S. pulchra	.17	.17	.28	.11		.11							.01		.01	.11				.01	.11				
S. spinosa			.002																	.02					
S. sp. A						.01																			
S. sp.					.01																				
Unid. coccolithophorid							.14		.01				.01						.01					.03	

Table 15. Bottle volumes (milliliters), ATP and Chlorophyll sample bottles.

Niskin Bottle #	ATP Bottles		Chlorophyll bottles	
6	543	542	286	285
7	542	542	285	286
8	541	542	287	287
9	541	541	288	287
10	541	542	287	287
16	541	542	288	286
17	540	542	288	287
18	542	542	287	286
19	542	542	286	288
20	542	542	288	286
21	542	542	288	288
22	542	540	287	286
	$\bar{x} = 541.67$		$\bar{x} = 286.8$	
	$S_x = 0.70$		$S_x = 0.96$	
	$S_{\bar{x}} = 0.14$		$S_{\bar{x}} = 0.19$	

Table 16. PROTEC 12 - B8103 Fluorometer Calibration Check

Chlorophyll a Standard $\mu\text{g l}^{-1}$									Original Calibration
	F_0	F_a	Scale	$\bar{x}F_0$	$\bar{x}F_a$	$\bar{x}F_s$	$\bar{x}r_s$	$\bar{x}F_s$	$\bar{x}r_s$
5	10.0	4.3	x100/min	9.83	4.27	0.5086	2.302	0.50	2.27
	9.75	4.3							
	9.75	4.2							
1.5	2.82	1.15	x100/min	2.77	1.17	0.5415	2.367	0.50	2.26
	2.75	1.15							
	2.75	1.2							
0.5	3.02	1.25	x100/3.16	2.99	1.23	0.1672	2.431	0.1653	2.42
	2.95	1.20							
	3.02	1.25							
0.15	2.85	1.1	x100/x10	2.82	1.12	0.0532	2.518	0.0555	2.45
	2.65	0.95							
	2.95	1.3							

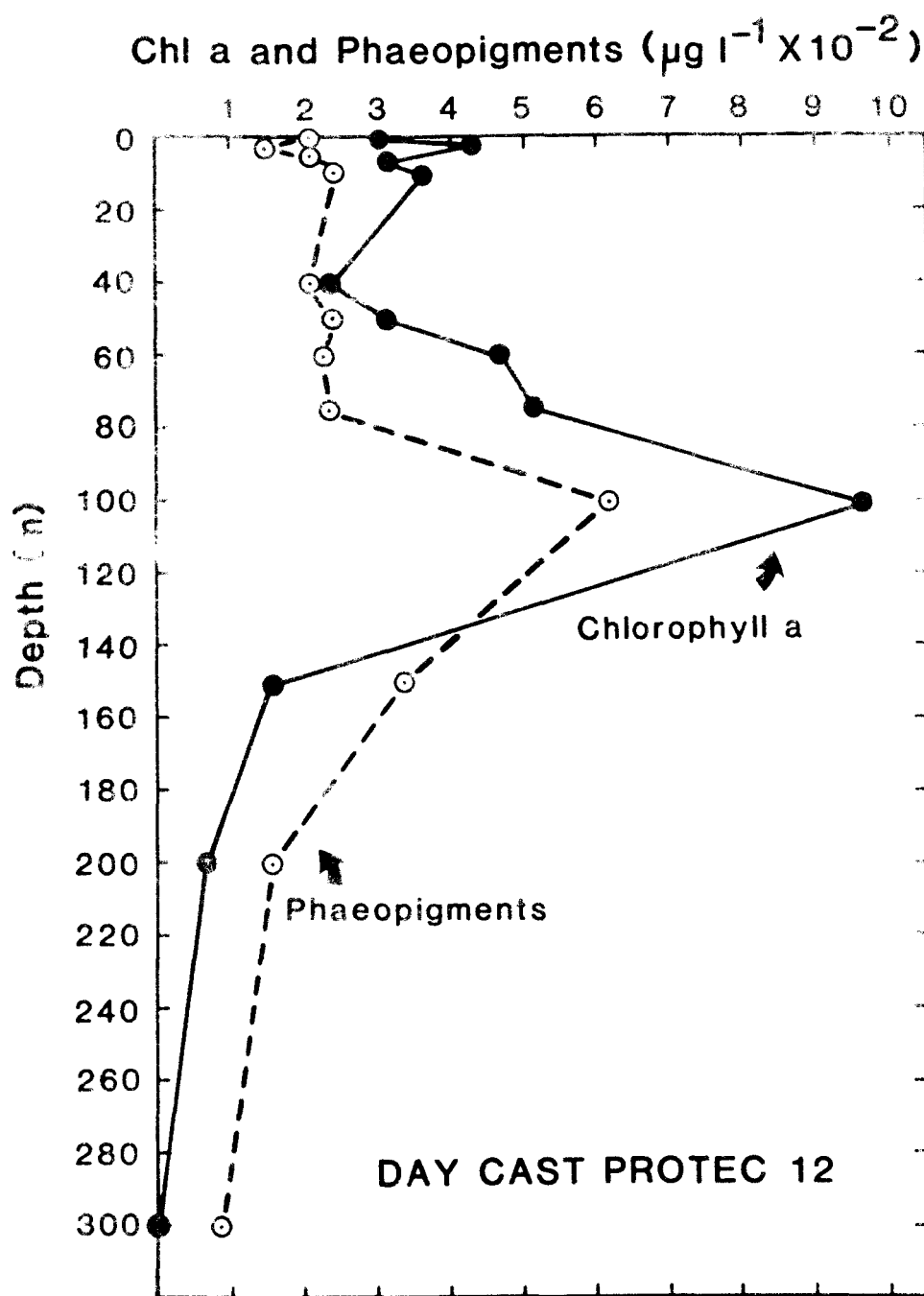


Figure 6. Chlorophyll and Phaeopigments

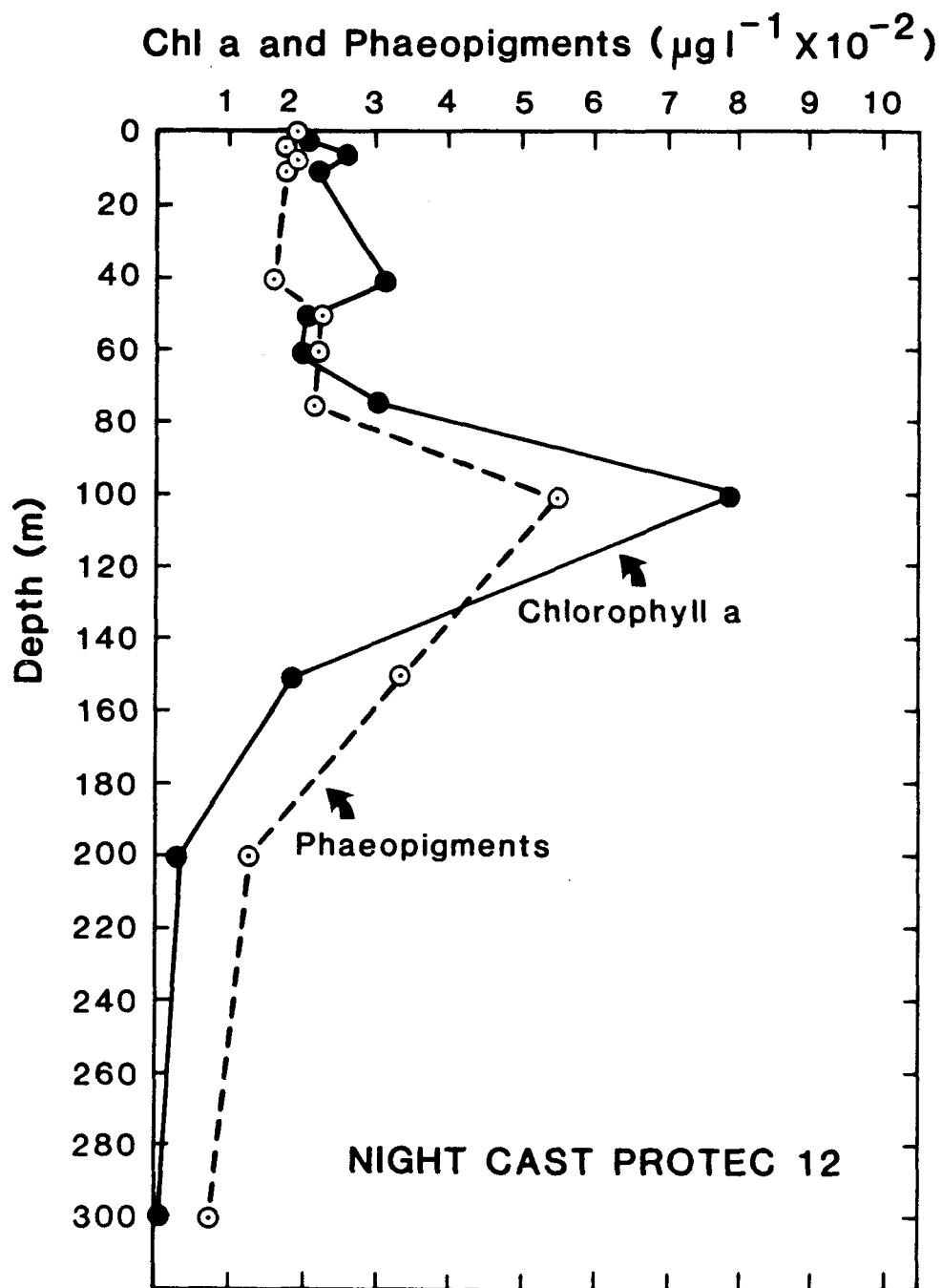
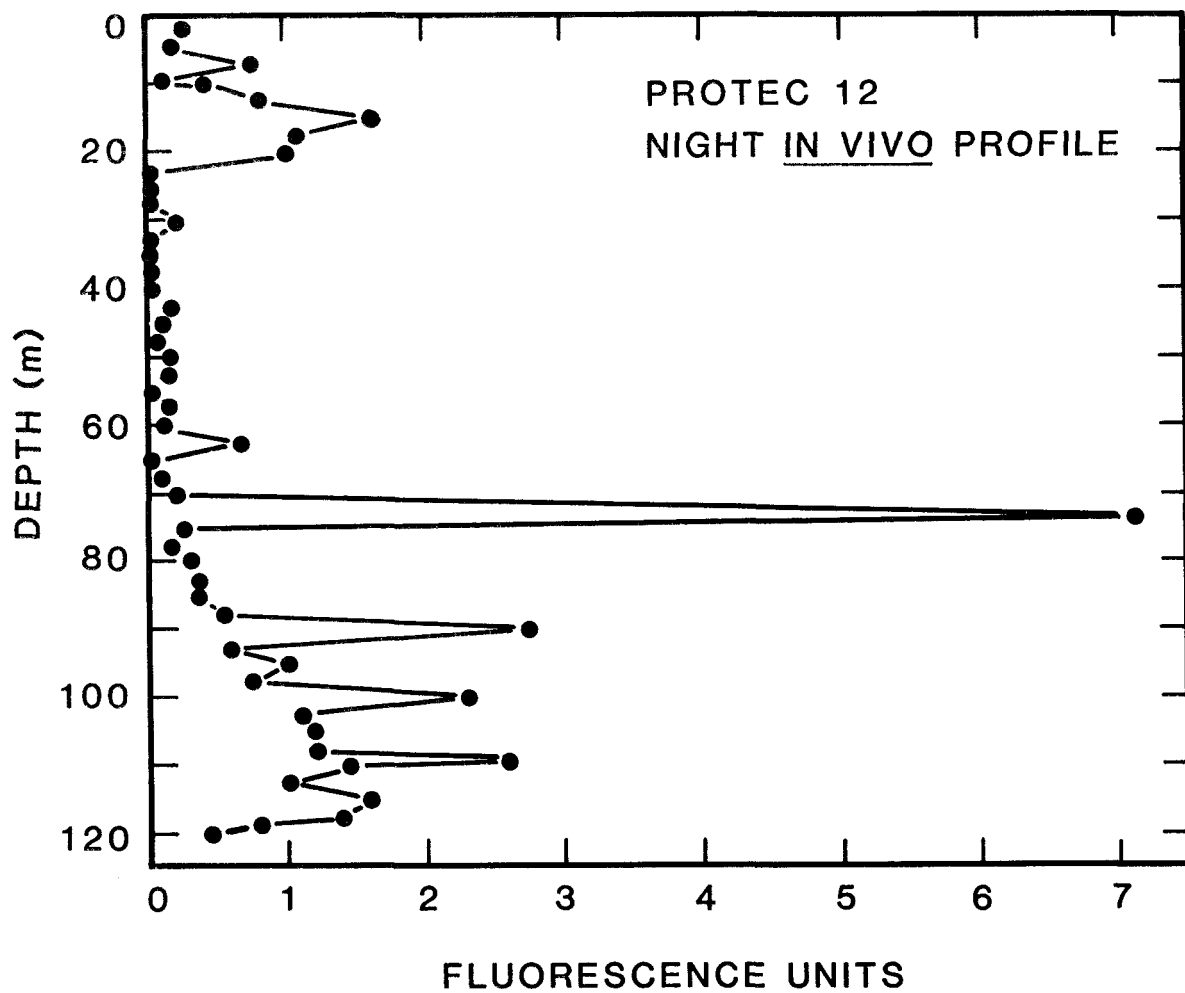


Figure 7. Chlorophyll and Phaeopigments



XBL 8012-13167

Figure 8. In Vivo Profile

2. Zooplankton (H. Michel)

Zooplankton samples were taken using a Tareq & Co. BNF-1[®] opening and closing paired (Bongo) net frame. The nets were each 0.6 m in diameter and made of 202 μ Nitex[®]. A flowmeter was mounted in the mouth of each net to determine the volume filtered. Flowmeter readings are shown in Table 17. If the volumes filtered by paired nets differed by more than 10%, the samples were considered somewhat suspect and were not processed if sufficient duplicates were available.

The zooplankton community was sampled by oblique tows over four depth series (25-0m, 200-25m, 600-200m, and 1000-600m) both during the day and night. Time, date length of tow, and location are shown in Table 18. Four replicate tows were made over the two shallower series and two replicates over each of the deeper series. Sample times were confined to an 8-hour period centered on noon or midnight. The paired samples from each tow were preserved separately in 5% buffered formalin. Depth was recorded by a Benthos[®] time depth recorder attached below the net. A 500-0m recorder was used on the 200-25m series, and a 1000-0m recorder on the 600-200m and 1000-600m series. The amount of wire out and wire angle are shown in Table 17. All replicate samples were completed for each depth series and time period. On PROTEC-12 the ship's crew had a difficult time holding a steady wire angle during zooplankton tows due to differing current directions between the surface and 200m and the strong winds. This resulted in a number of unusable tows. It was also found that for the 600-200m and 1000-600m series a double weight messenger (approx. 1.7 kg) was required to reliably open and close the nets.

In the laboratory the preserved zooplankton samples were split using a Motoda box (Motoda, 1959) and one half sent to Lawrence Berkeley Laboratory for dry weight analysis. Displacement volume was determined on the other half and expressed as milliliters per meter cubed. The results are shown in Table 19. The major groups were then enumerated for each sample. This data is presented in Table 20.

References

- Motoda, S. (1959). Devices of simple plankton apparatus. Mem. Fac. Fish., Hokkaido Univ. 7 (1-2), 73-94.

Table 17. Zooplankton Tow Data.

Cruise: PROTEC-12			Wire	Wire	Flow	Flow	Vol.	Split	Split	Calibration Equation for Flow Meter:	
Depth/	Time	Rep.	Out	Angle*	Meter	Meter	Fil.	Size	Size	Vol. Fil. (M ³)	No. Rev. X 0.2627 X 0.02687
(m)		No.	(m)	(min. of 2)	Start	Finish	(m ⁻³)	Taxon. Anal.	Dr. Wt. Anal.	Comments	
25-0	Day	1	35-	45°	136069	168594	247.1 ¹	Various** 1/2			
		1	0	45°	000049	034496	261.7 ²		"	"	
25-0	Day	2	35-	45°	168594	198630	228.2	"	"		
		2	0	45°	034496	067145	248.0	"	"		
25-0	Day	3	35-	45°	198630	224835	275.0	"	"		
		3	0	45°	067145	095011	211.7	"	"		
25-0	Day	4	35-	45°	224835	248532	180.0	"	"		
		4	0	45°	095011	118749	180.3	"	"		
25-0	Night	1	35-	45°	052608	078438	196.2	"	"		
		1	0	45°	602619	629558	204.7	"	"		
25-0	Night	2	35-	45°	078438	102620	183.7	"	"		
		2	0	45°	629558	653014	178.2	"	"		
25-0	Night	3	35-	45°	102620	127780	191.1	"	"		
		3	0	45°	653014	676356	177.3	"	"		
25-0	Night	4	35-	45°	127780	136055	62.9	"	"	Not processed due to difference in	" " " volumes filtered
		4	0	45°	676356	707463	236.3	"	"		
200-25	Day	1	230-	45°	248532	353525	797.5	"	"		
		1	35	45°	118749	226800	820.8	"	"		
200-25	Day	2	230-	45°	353525	067724	5425.2	"	"	Not processed due to diff. in vol. filtered.	Not processed due to diff. in vol. filtered.
		2	35	50°	226800	838412	4645.9	"	"		
200-25	Day	1A	310-39	50°	147981	636415	3710.2	"	"	Not processed due to diff. in vol. filtered.	Not processed due to diff. in vol. filtered.
		1A		50°	093846	490189	3010.7	"	"		
200-25	Day	2A	310-39	50°	636415	682668	351.3	"	"		
		2A		49°	490189	353294	342.6	"	"		
200-25	Day	3	310-	50°	682668	727115	337.6	"	"		
		3	39	50°	535294	582100	355.5	"	"		
200-25	Day	4	310-39	50°	727115	731855	36.0	"	"	Flowmeter readings low, nets did not fish	Flowmeter readings low, nets did not fish
		4		50°	582100	583358	9.5	"	"		
200-25	Day	5	310-39	50°	731855	773807	318.7	"	"	Outboard net twisted and some of the sample may have been lost	
		5		50°	583358	601190	135.4	"	"		

¹Inboard Net
²Outboard Net

*Minimum at time of 1st and 2nd messenger.
 **Split: and to enumerate groups depended on the relative abundance of the group and ranged from
 1/5 for numerous organisms and 1/15 for numerous organisms.

Table 17. Zooplankton Tow Data, (continued.)

Cruise: PROTEC-12			Wire	Wire	Flow	Flow	Vol.	Split	Split	Calibration Equation for Flow Meter:	
Depth/	Time	/Rep.	Out	Angle*	Meter	Meter	Fil.	Size	Size		
(m)		No.	(m)	(min. of 2)	Start	Finish	(m ⁻³)	Taxon. Anal.	Dr. Wt. Anal.	Comments	
200-25	Night	1	280-35	450	067493	448402	2893.4	Various	**1/2	Captain had difficulty keeping wire angle steady due to wind and current	
		1		500	839912	297609	4119.4	"	"		
200-25	Night	2	310-39	500	448400	491058	324.0	"	"		
		2		500	297634	346688	372.6	"	"		
200-25	Night	3	310-39	500	491058	535935	340.89	"	"		
		3		500	346688	393297	354.05	"	"		
200-25	Night	4	310-	500	535954	581330	344.7	"	"		
		4	39	500	393325	437267	333.8	"	"		
600-200	Day	1	930-310	600	101816	171881	532.2	"	"	TDR trace no good	
		1		500	970499	062102	695.8	"	"	TDR trace no good	
600-200	Day	2	840-280	500	171881	242600	537.2	"	"	TDR trace no good	
		2		500	062102	142052	607.3	"	"	TDR trace no good	
600-200	Night	1	930-310	600	242614	336303	711.7	"	"		
		1		600	142091	245515	785.6	"	"		
600-200	Night	2	840-280	550	336303	431363	722.1	"	"		
		2		550	245515	337900	701.8	"	"		
1000-600	Day	1	1400-930	600	773818	786879	99.2	"	"	Nets did not fish	
		1		420	601190	604329	23.8	"	"	Nets did not fish	
1000-600	Day	2	1400-840	420	786834	878117	693.4	"	"	Nets seem to have opened at 700m, fished as deep as 1225m and closed at 600m	
		2		500	604348	721285	888.3	"	"		
1000-600	Day	3	1700-1050	500	878135	915028	280.2	"	"	Nets did not fish at depth; nets closed at 100m.	
		3		600	721292	731253	75.7	"	"		
1000-600	Day	4	1550-930	600	431367	548826	892.2	"	"		
		4		600	337905	521841	1397.2	"	"		
1000-600	Night	1	1500-950	600	915065	002588	665.0	"	"		
		1		600	731397	855222	940.6	"	"		
1000-600	Night	2	1500-950	550	002588	101791	753.6	"	"		
		2		550	855222	970483	875.5	"	"		

*Minimally taken at time of 1st and 2nd messenger.

** Splits size used to enumerate groups depended on the relative abundance of the group and ranged from $\frac{1}{2}$ for rare organisms and 1/256 for numerous organisms.

Table 18. Zooplankton Sample, Type, and Location.

Cruise: PROTEC-12

Site: Benchmark

Sample Number	Position Latitude & Longitude	Date (da,mo,yr)	Time Start (AST) ¹	Length of Tow (min.)	Net Type, Size, Mesh	Actual Depth of Sample (m)	TDR ² (m)	Sample & Tow Type	Comments
25-0m, Day #1	17°56'N 65°52'W	19-2-81	0805	15	Bongo 0.6m 202μ	25-0		Oblique	No TDR used as tow too short for good trace
25-0m, Day #2	17°56'N 65°52'W	19-2-81	0843	12	"	"		"	"
25-0m, Day #3	17°56'N 65°52'W	19-2-81	0909	10	"	"		"	"
B-45 25-0m Day #4	17°56'N 65°51'W	19-2-81	1015	9	"	"		"	"
25-0m Night #1	17°54'N 65°49'W	18-2-81	2104	8	"	"		"	"
25-0m, Night #2	17°54'N 65°50'W	18-2-81	2132	10	"	"		"	"
25-0m, Night #3	17°54'N 65°50'W	18-2-81	2157	12	"	"		"	"
25-0m, Night #4	17°53'N 65°51'W	18-2-81	2222	11	"	"		"	"
200-25m, Day #1	17°46'N 65°51'W	19-2-81	1035	50	"	200-25		"	No TDR record due to malfunction
200-25m, Day #2	17°55'N 65°52'W	19-2-81	1300	17	"	"		"	"
200-25m, Day #1A	17°57'N 65°52'W	21-2-81	1420	22	"	"		"	"

Table 18. Zooplankton Sample, Type, and Location. (Continued)

Cruise: PROTEC-12

Site: Benchmark

Sample Number	Position Latitude & Longitude	Date (da,mo,yr)	Time Start (AST) ¹	Length of Tow (min.)	Net Type, Size, Mesh	Actual Depth of Sample (m)	TDR ² (m)	Sample & Tow Type	Comments
200-25m, Day #2A	17°55'N 65°56'W	21-2-81	1501	20	Bongo 0.6m 202μ	200-25	250-40	Oblique	No TDR record due to malfunction
200-25m, Day #3	17°57'N 65°51'W	21-2-81	1533	20	"	"	230-50	"	
200-25m, Day #4	17°55'N 65°54'W	21-2-81	1622	20	"	"	260-?	"	
200-25m, Day #5	17°55'N 65°54'W	21-2-81	1701	21	"	"	250-50	"	
200-25m, Night #1	17°59'N 65°45'W	21-2-81	0120	10	"	"		"	TDR Record no good
200-25m, Night #2	17°59'N 65°45'W	21-2-81	0223	21	"	"	225-25	"	
200-25m, Night #3	18°01'N 65°39'W	21-2-81	0308	22	"	"	235-30	"	
200-25m, Night #4	17°58'N 65°49'W	21-2-81	0359	20	"	"	235-25	"	
600-200m, Day, #1	17°55'N 65°51'W	23-2-81	0740	29	"	600-200		"	TDR Record no good
600-200m, Day, #2	17°54'N 65°55'W	23-2-81	0905	37	"	"		"	"
600-200m, Night, #1	17°51'N 65°51'W	23-2-81	1940	34	"	"	650-200	"	

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Table 18. Zooplankton Sample, Type, and Location. (Continued)

Cruise: PROTEC-12

Site: Benchmark

Sample Number	Position Latitude & Longitude	Date (da,mo,yr)	Time Start (AST) ¹	Length of Tow (min.)	Net Type, Size, Mesh	Actual Depth of Sample (m)	TDR ² (m)	Sample & Tow Type	Comments
600-200m, Night, #2	17°54'N 65°50'W	23-2-81	2105	40	Bongo, 0.6m 202μ	600-200	600-200	Oblique	
1000-600m, Day, #1	17°56'N 65°49'W	22-2-81	0740	45	"	1000-600		"	TDR Record not read
1000-600m, Day, #2	17°56'N 65°49'W	22-2-81	0945	44	"	1000-600	1225-600	"	Nets seem to have opened at 700m; fished as deep as 1225 m and closed at 600m.
1000-600m, Day, #3	17°54'N 65°48'W	22-2-81	1620	48	"	1000-600		"	TDR Record not read
1000-600m, Day, #4	17°53'N 65°51'W	23-2-81	0720	33	"	1000-600	800-300	"	
1000-600m, Night, #1	17°57'N 65°49'W	22-2-81	2005	48	"	1000-600	1000-?	"	
1000-600m, Night, #2	17°53'N 65°47'W	22-2-81	2400	40	"	1000-600	1025-500	"	

¹AST is GMT -4. Time is when nets enter the water.²500-0m TDR used on 200-25m tows; 2000-0m TDR used on all deeper series.

Table 19. Zooplankton Displacement Volume-PROTEC 12.

Date	Time (AST) ¹	Sample	Tow #	Displacement Volume (ml)	m ³ Water Filtered	Vol./m ³
19 II 81	0810-0825	25-0 m day	1	14	247.1*	0.06
				4	261.7**	0.01
	0843-0855		2	10	228.2	0.04
				11	248.0	0.04
	0909-0919		3	10	275.0	0.04
				12	211.7	0.06
	1016-1025		4	10	180.0	0.05
				10	180.3	0.05
18 II 81	2104-2112	25-0 m night	1	20	196.2	0.10
				18	204.7	0.09
	2132-2142		2	12	183.7	0.06
				14	178.2	0.08
	2157-2209		3	12	191.1	0.06
				12	177.3	0.07
	2222-2223		4	-- ²	62.9	--
				--	236.3	--
19 II 81	1048-1138	200-25 m day	1	28	797.5	0.03
				28	820.8	0.03
	1306-1323		2	--	5425.2	--
				--	4645.9	--
21 II 81	1420-1442		1A	--	3710.2	--
				--	3010.7	--
	1501-1521		2A	18	351.3	0.05
				14	342.6	0.04

¹Times of first and second messengers.²-- Not processed due to differences in volumes filtered.

Table 19. Zooplankton Displacement Volume-PROTEC 12 (Cont.)

Date	Time (AST)	Sample	Tow #	Displacement Volume (ml)	m ³ Water Filtered	Vol./m ³
21	II	81				
		1541-1601	3	14	337.6	0.04
				16	355.5	0.04
		1622-1642	200-25 m day	4	--	36.0
				--	9.5	--
		1701-1722	5	--	318.7	--
				--	135.4 ?	--
		0131-0141	200-25 m night	1	--	2893.4
				--	4119.4	--
		0223-0244	2	12	324.0	0.04
				18	372.6	0.05
		0308-0330	3	17	340.89	0.05
				12	354.15	0.03
		0359-0419	4	13	344.7	0.04
				3	333.8	0.009
22	II	81	1038-1122	1000-600 m day *	2	4
					4	888.3
		1735-1823	3	--	280.2	--
				--	75.7	--
		0815-0900	1	--	99.2	--
					23.8	
24	II	81	0822-0855	4	892.2	0.004
				4	1397.2	0.003

*Nets seem to have opened at 700m. Fished as deep as 1225m and closed at 600m.

Table 19. Zooplankton Displacement Volume - PROTEC 12 (Cont.)

Date	Time (AST)	Sample	Tow #	Displacement Volume (ml)	m ³ Water Filtered	Vol./m ³
22 II 81	0058-0138	1000-600 m night	2	3	753.6	0.004
				4	875.5	0.005
	2055-2143		1	4	665.0	0.006
				2	940.6	0.002
23 II 81	0815-0844	600-200 m day +	1	6	532.2	0.01
				6	695.8	0.009
	0939-1016		+ 2	2	537.2	0.004
				6	607.3	0.01
	2007- ~~2041~~	600-200 m night	1	4	711.7	0.006
				5	785.6	0.006
	2135-2215		2	4	722.1	0.005
				4	701.8	0.006

+ TDR trace no good.

*inboard net

**outboard net

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 19-2-81
 Depth of Sample (m): 25-0m
 Net: Inboard

Rep. No.: 1
 Sample #: 25-0m, Day
 Time of Sample: 0810
 Sample Type: Zooplankton
 Vol. Fil.(M³): 247.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/32	61	7.90	
Leptomedusae	1/16	1	0.06						
Trachymedusae	1/16	22	1.42						
Narcomedusae	1/16	0	0						
Siphonophora	1/32	41	5.31		LARVACEA	1/32	128	16.58	
Scyphozoa	1/32	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	41	5.31	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/32	0	0						
Thecosomata	1/32	2	0.26		LARVAL FISH	1/16	8	0.52	
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	7	0.91		OTHER				
					Foraminifera	1/256	11	11.40	
					Radiolaria	1/256	4	4.14	
ARTHROPODA									
Copepoda Calanoida	1/256	256	265.22						
Copepoda Cyclopoida	1/256	73	75.63						
Copepoda Harpacticoida	1/256	2	2.07						
Ostracoda	1/32	17	2.20						
Amphipoda	1/32	1	0.13						
Euphausiacea	1/32	3	0.39						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	21	2.72		TOTAL			402.17	

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TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 19-2-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 1
 Sample #: 25-0m, Day
 Time of Sample: 0810
 Sample Type: Zooplankton
 Vol. Fil.(M³): 261.7

Taxonomic identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/8	1	0.03			1/32	52	6.36	
Leptomedusae	1/8	0	0						
Trachymedusae	1/8	20	0.61						
Narcomedusae	1/8	0	0						
Siphonophora	1/8	55	1.68		LARVACEA	1/32	70	8.56	
Scyphozoa	1/8	0	0						
CTENOPHORA	1/8	0	0		SALPIDAE	1/32	31	3.79	
MOLLUSCA					FISH EGGS				
Heteropoda	1/8	1	0.03			1/8	4	0.12	
Thecosomata	1/8	14	0.43						
Gymnosomata	1/8	0	0		LARVAL FISH	1/8	17	0.56	
ANNELIDA (Polychaeta)	1/32	3	0.37		OTHER				
					Foraminifera	1/128	13	6.36	
					Radiolaria	1/128	14	6.85	
ARTHROPODA									
Copepoda Calanoida	1/128	497	243.09						
Copepoda Cyclopoida	1/128	55	26.90						
Copepoda Harpacticoida	1/128	6	2.93						
Ostracoda	1/32	9	1.10						
Amphipoda	1/32	1	0.12						
Euphausiacea	1/32	7	0.85						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	25	3.06		TOTAL			313.80	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 19-2-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 2
 Sample #: 25-0m, Day
 Time of Sample: 0843
 Sample Type: Zooplankton
 Vol. Fil. (M³): 228.2

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/32	76	10.66	
Leptomeusae	1/16	1	0.07						
Trachymedusae	1/16	32	2.24						
Narcomeusae	1/16	0	0						
Siphonophora	1/32	30	4.21		LARVACEA	1/32	85	11.92	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	13	1.82	
MOLLUSCA					FISH EGGS				
Heteropoda	1/32	0	0			1/16	2	0.14	
Thecosomata	1/32	4	0.56						
Gymnosomata	1/32	0	0		LARVAL FISH	1/16	5	0.35	
ANNELIDA (Polychaeta)	1/32	10	1.40		OTHER				
					Foraminifera	1/256	9	10.10	
					Radiolaria	1/256	11	12.34	
ARTHROPODA									
Copepoda Calanoida	1/256	178	199.68						
Copepoda Cyclopoida	1/256	78	87.50						
Copepoda Harpacticoida	1/256	2	2.24						
Ostracoda	1/32	6	0.84						
Amphipoda	1/32	2	0.28						
Euphausiacea	1/32	4	0.56						
Lucifer	1/16	0	0						
Decapod Larvae	1/32	22	3.08		TOTAL			349.69	

TABLE 20: Zooplankton Counts.

Rep. No.: 2
 Sample #: 25-0m, Day
 Time of Sample: 0843
 Sample Type: Zooplankton
 Vol. Fil. (m³): 248.0

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 19-2-81
 Depth of Sample (m): 25-0
 Net: Outboard

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/32	71	9.16	
Anthomedusae	1/16	0	0						
Leptomedusae	1/16	0	0						
Trachymedusae	1/16	29	1.87						
Narcomedusae	1/16	1	0.06						
Siphonophora	1/32	70	9.03		LARVACEA	1/32	82	10.58	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	35	4.52	
MOLLUSCA					FISH EGGS	1/16	1	0.06	
Heteropoda	1/32	1	0.13						
Thecosomata	1/32	3	0.39		LARVAL FISH	1/16	7	0.45	
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	7	0.90		OTHER				
					Foraminifera	1/256	8	8.26	
					Radiolaria	1/256	6	6.19	
ARTHROPODA									
Copepoda Calanoida	1/256	165	170.32						
Copepoda Cyclopoida	1/256	74	76.39						
Copepoda Harpacticoida	1/256	0	0						
Ostracoda	1/32	7	0.90						
Amphipoda	1/32	6	0.77						
Euphausiacea	1/32	6	0.77						
Lucifer	1/16	0	0						
Decapod Larvae	1/32	20	2.58		TOTAL			303.33	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 19-2-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 3
 Sample #: 25-0m, Day
 Time of Sample: 0909
 Sample Type: Zooplankton
 Vol. Fil. (M³): 275.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	1	0.06			1/32	94	10.94	
Leptomedusae	1/16	2	0.12						
Trachymedusae	1/16	45	2.62						
Narcomedusae	1/16	0	0		LARVACEA	1/32	99	11.52	
Siphonophora	1/32	27	3.14						
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	22	2.56	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/32	0	0						
Thecosomata	1/32	4	0.46		LARVAL FISH	1/16	3	0.17	
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	17	1.98		OTHER				
					Foraminifera	1/256	6	5.58	
					Radiolaria	1/256	7	6.52	
ARTHROPODA									
Copepoda Calanoida	1/256	176	163.84						
Copepoda Cyclopoida	1/256	5	49.34						
Copepoda Harpacticoida	1/256	2	1.86						
Ostracoda	1/32	3	0.35						
Amphipoda	1/32	3	0.35						
Euphausiacea	1/32	4	0.46						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	32	3.72						
					TOTAL			265.59	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 19-2-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 3
 Sample #: 25-0m, Day
 Time of Sample: 0909
 Sample Type: Zooplankton
 Vol. Fil. (m³): 211.7

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/32	96	14.51	
Leptomedusae	1/16	0	0						
Trachymedusae	1/16	44	3.32						
Narcomedusae	1/16	0	0						
Siphonophora	1/32	28	4.23		LARVACEA	1/32	103	15.57	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	41	6.20	
MOLLUSCA					FISH EGGS	1/16	1	0.07	
Heteropoda	1/32	4	0.60						
Thecosomata	1/32	6	0.91		LARVAL FISH	1/16	6	0.45	
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	12	1.81		OTHER				
					Foraminifera	1/256	8	9.67	
					Radiolaria	1/256	9	10.88	
ARTHROPODA									
Copepoda Calanoida	1/256	218	263.62						
Copepoda Cyclopoida	1/256	62	74.97						
Copepoda Harpacticoida	1/256	1	1.21						
Ostracoda	1/32	5	0.75						
Amphipoda	1/32	1	0.15						
Euphausiacea	1/32	3	0.45						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	29	4.38		TOTAL			413.75	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 19-2-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 4
 Sample #: 25-0m, Day
 Time of Sample: 1016
 Sample Type: Zooplankton
 Vol. Fil. (m³): 180.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/8	0	0			1/32	40	7.11	
Leptomedusae	1/8	3	0.13						
Trachymedusae	1/8	12	0.53						
Narcomedusae	1/8	0	0		LARVACEA	1/32	70	12.44	
Siphonophora	1/8	24	1.07						
Scyphozoa	1/8	0	0						
CTENOPHORA	1/8	1	0.04		SALPIDAE	1/32	39	6.93	
MOLLUSCA					FISH EGGS	1/8	0	0	
Heteropoda	1/8	3	0.13						
Thecosomata	1/8	5	0.22		LARVAL FISH	1/8	12	0.53	
Gymnosomata	1/8	0	0						
ANNELIDA (Polychaeta)	1/32	3	0.53		OTHER				
					Foraminifera	1/128	29	20.62	
					Radiolaria	1/128	16	11.38	
ARTHROPODA									
Copepoda Calanoida	1/128	286	203.38						
Copepoda Cyclopoida	1/128	108	76.80						
Copepoda Harpacticoida	1/128	4	2.84						
Ostracoda	1/32	1	0.18						
Amphipoda	1/32	2	0.35						
Euphausiacea	1/32	1	0.18						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	32	5.69		TOTAL			351.08	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 19-2-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 4
 Sample #: 25-0m, Day
 Time of Sample: 1016
 Sample Type: Zooplankton
 Vol. Fil. (ml): 180.3

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/16	61	5.41	
Anthomedusae	1/4	1	0.02						
Leptomedusae	1/4	1	0.02						
Trachymedusae	1/4	18	0.40						
Narcomedusae	1/4	1	0.02						
Siphonophora	1/4	49	1.09		LARVACEA	1/16	110	9.76	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/16	94	8.34	
MOLLUSCA					FISH EGGS	1/4	4	0.09	
Heteropoda	1/4	1	0.02						
Thecosomata	1/4	20	0.44		LARVAL FISH	1/4	27	0.60	
Gymnosomata	1/4	0	0						
ANNELIDA (Polychaeta)	1/16	1	0.09		OTHER				
					Foraminifera	1/128	31	22.01	
					Radiolaria	1/128	23	16.33	
ARTHIROPODA									
Copepoda Calanoida	1/128	319	226.47						
Copepoda Cyclopoida	1/128	101	71.70						
Copepoda Harpacticoida	1/128	5	3.55						
Ostracoda	1/16	2	0.18						
Amphipoda	1/16	5	0.44						
Euphausiacea	1/16	1	0.09						
Lucifer	1/16	0	0						
Decapod Larvae	1/16	45	3.99						
					TOTAL			379.97	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROFEC-12
 Date of Sample: 18-2-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 1
 Sample #: 25-0m, Night
 Time of Sample: 2104
 Sample Type: Zooplankton
 Vol. Fil. (ml): 196.2

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	1	0.02			1/32	132	21.53	
Leptomedusae	1/4	3	0.06						
Trachymedusae	1/4	15	0.31						
Narcomedusae	1/4	0	0		LARVACEA	1/32	62	10.11	
Siphonophora	1/4	77	1.57						
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/32	7	1.14	
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/4	2	0.04						
Thecosomata	1/4	134	2.73		LARVAL FISH	1/4	9	0.18	
Gymnosomata	1/4	1	0.02						
ANNELIDA (Polychaeta)	1/32	14	2.28		OTHER				
					Foraminifera	1/256	25	32.62	
					Radiolaria	1/256	14	18.27	
ARTHIROPODA									
Copepoda Calanoida	1/256	272	354.90						
Copepoda Cyclopoida	1/256	120	156.57						
Copepoda Harpacticoida	1/256	1	1.30						
Ostracoda	1/32	83	13.54						
Amphipoda	1/32	2	0.33						
Euphausiacea	1/32	27	4.40						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	20	3.30		TOTAL			625.22	

TABLE 20: Zooplankton Counts.

Rep. No.: 1
 Sample #: 25-0m, Night
 Time of Sample: 2104
 Sample Type: Zooplankton
 Vol. Fil. (H³): 204.7

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 18-2-81
 Depth of Sample (m): 25-0
 Net: Outboard

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/64	67	20.95	
Leptomedusae	1/16	0	0						
Trachymedusae	1/16	19	1.48						
Narcomedusae	1/16	2	0.16						
Siphonophora	1/64	20	6.25		LARVACEA	1/64	48	15.01	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/64	10	3.13	
MOLLUSCA					FISH EGGS				
Heteropoda	1/64	4	1.25			1/16	1	0.08	
Thecosomata	1/64	12	3.75						
Gymnosomata	1/64	0	0		LARVAL FISH	1/16	5	0.39	
ANNELIDA (Polychaeta)	1/64	12	3.75		OTHER				
					Foraminifera	1/256	11	13.76	
					Radiolaria	1/256	10	12.51	
					Cephalopoda	1/16	2	0.16	
ARTHROPODA									
Copepoda Calanoida	1/256	210	262.63						
Copepoda Cyclopoida	1/256	88	110.05						
Copepoda Harpacticoida	1/256	1	1.25						
Ostracoda	1/64	32	10.00						
Amphipoda	1/64	1	0.31						
Euphausiacea	1/64	22	6.88						
Lucifer	1/64	0	0						
Decapod Larvae	1/64	7	2.19						
					TOTAL			475.94	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 18-2-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 2
 Sample #: 25-0m, Night
 Time of Sample: 2132
 Sample Type: Zooplankton
 Vol. Fil. (M³): 183.7

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/32	97	16.90	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	7	0.15						
Narcomedusae	1/4	0	0		LARVACEA				
Siphonophora	1/4	32	0.70			1/32	72	12.54	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/32	6	1.04	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	3	0.06			1/4	1	0.02	
Thecosomata	1/4	106	2.31						
Gymnosomata	1/4	1	0.02		LARVAL FISH	1/4	9	0.19	
ANNELIDA (Polychaeta)	1/32	18	3.13		OTHER				
ARTHROPODA					Foraminifera	1/128	37	25.78	
Copepoda Calanoida	1/128	369	257.11		Radiolaria	1/128	11	7.66	
Copepoda Cyclopoida	1/128	131	91.28		Cephalopoda	1/4	4	0.09	
Copepoda Harpacticoida	1/128	1	0.70						
Ostracoda	1/32	43	7.49						
Amphipoda	1/32	2	0.35						
Euphausiacea	1/32	20	3.50						
Lucifer	1/32	1	0.17						
Decapod Larvae	1/32	17	2.96		TOTAL			434.15	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 18-2-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 2
 Sample #: 25-0m, Night
 Time of Sample: 2132
 Sample Type: Zooplankton
 Vol. Fil. (m³): 178.2

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/32	92	16.52	
Leptomedusae	1/16	2	0.18						
Trachymedusae	1/16	4	0.26						
Narcomedusae	1/16	0	0						
Siphonophora	1/32	24	4.31		LARVACEA				
Scyphozoa	1/16	0	0			1/32	61	10.95	
CTENOPHORA	1/16	0	0		SALPIDAE				
						1/32	7	1.26	
MOLLUSCA					FISH EGGS				
Heteropoda	1/32	1	0.18			1/16	1	0.09	
Thecosomata	1/32	19	3.41						
Gymnosomata	1/32	0	0		LARVAL FISH				
						1/16	4	0.32	
ANNELIDA (Polychaeta)	1/32	16	2.87		OTHER				
					Foraminifera	1/256	8	11.49	
					Radiolaria	1/256	2	2.87	
ARTHROPODA									
Copepoda Calanoida	1/256	171	245.66						
Copepoda Cyclopoida	1/256	58	83.32						
Copepoda Harpacticoida	1/256	0	0						
Ostracoda	1/32	51	9.16						
Amphipoda	1/32	4	0.72						
Euphausiacea	1/32	18	3.23						
Lucifer	1/16	1	0.09						
Decapod Larvae	1/32	12	2.15		TOTAL			399.14	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 18-2-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 3
 Sample #: 25-0m, Night
 Time of Sample: 2157
 Sample Type: Zooplankton
 Vol. Fil. (M³): 191.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/32	34	5.69	
Anthomedusae	1/4	0	0						
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	41	0.86		LARVACEA	1/32	26	4.35	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/32	11	1.84	
MOLLUSCA					FISH EGGS	1/4	1	0.02	
Heteropoda	1/4	1	0.02						
Thecosomata	1/4	90	1.88						
Gymnosomata	1/4	2	0.04		LARVAL FISH	1/4	8	0.17	
ANNELIDA (Polychaeta)	1/32	11	1.84		OTHER				
					Foraminifera	1/256	14	18.75	
					Radiolaria	1/256	10	13.40	
ARTHROPODA									
Copepoda Calanoida	1/256	208	278.64						
Copepoda Cyclopoida	1/256	69	92.43						
Copepoda Harpacticoida	1/256	2	2.68						
Ostracoda	1/32	35	5.86						
Amphipoda	1/32	5	0.84						
Euphausiacea	1/32	30	5.02						
Lucifer	1/32	0	0						
Ecapod Larvae	1/32	22	3.68		TOTAL			438.01	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 18-2-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 3
 Sample #: 25-0m, Night
 Time of Sample: 2157
 Sample Type: Zooplankton
 Vol. Fil. (M³): 177.3

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/16	67	6.05	
Leptomedusae	1/2	0	0						
Trachymedusae	1/2	1	0.01						
Narcomedusae	1/2	0	0						
Siphonophora	1/2	89	1.00		LARVACEA	1/16	41	3.70	
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/16	11	0.99	
MOLLUSCA					FISH EGGS	1/2	3	0.03	
Heteropoda	1/2	5	0.06			1/2			
Thecosomata	1/2	150	1.69			1/2	24	0.27	
Gymnosomata	1/2	0	0		LARVAL FISH				
ANNELIDA (Polychaeta)	1/16	13	1.17		OTHER				
ARTHROPODA					Foraminifera	1/256	16	23.10	
Copepoda Calanoida	1/256	321	333.54		Radiolaria	1/256	12	17.33	
Copepoda Cyclopoida	1/256	87	125.62						
Copepoda Harpacticoida	1/256	2	2.89						
Ostracoda	1/16	76	6.86						
Amphipoda	1/16	7	0.63						
Euphausiacea	1/16	43	3.88						
Lucifer	1/16	1	0.09						
Decapod Larvae	1/16	27	2.44		TOTAL			531.35	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 19-2-81
 Depth of Sample (m): 200-25
 Net: Inboard

Rep. No.: 1
 Sample #: 200-25m, Day
 Time of Sample: 1048
 Sample Type: Zooplankton
 Vol. Fil.(M³): 797.5

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/32	1	0.04			1/128	46	7.38	
Leptomedusae	1/32	0	0						
Trachymedusae	1/32	34	1.36						
Narcomedusae	1/32	0	0		LARVACEA				
Siphonophora	1/128	24	3.85			1/128	57	9.15	
Scyphozoa	1/32	1	0.04						
CTENOPHORA	1/32	0	0		SALPIDAE	1/128	16	2.57	
MOLLUSCA					FISH EGGS				
Heteropoda	1/128	2	0.32			1/32	1	0.04	
Thecosomata	1/128	4	0.64						
Gymnosomata	1/128	0	0		LARVAL FISH	1/32	9	0.36	
ANNELIDA (Polychaeta)	1/32	0	0		OTHER				
					Foraminifera	1/256	33	10.59	
					Radiolaria	1/256	13	4.17	
ARTHROPODA									
Copepoda Calanoida	1/256	486	156.01						
Copepoda Cyclopoida	1/256	160	51.36						
Copepoda Harpacticoida	1/256	2	0.64						
Ostracoda	1/128	69	11.07						
Amphipoda	1/128	3	0.48						
Euphausiacea	1/128	4	0.64						
Lucifer	1/32	0	0						
Decapod Larvae	1/128	17	2.73		TOTAL			263.44	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 19-2-81
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 1
 Sample #: 200-25m, Day
 Time of Sample: 1048
 Sample Type: Zooplankton
 Vol. Fil. (l³): 820.8

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/32	4	0.15			1/32	154	6.00	
Leptomedusae	1/32	1	0.04						
Trachymedusae	1/32	29	1.13						
Narcomedusae	1/32	3	0.12		LARVACEA	1/32	125	4.87	
Siphonophora	1/32	87	3.39						
Scyphozoa	1/32	0	0						
CTENOPHORA	1/32	0	0		SALPIDAE	1/32	18	0.62	
MOLLUSCA					FISH EGGS				
Heteropoda	1/32	2	0.08			1/32	1	0.04	
Thecosomata	1/32	11	0.43						
Gymnosomata	1/32	0	0		LARVAL FISH	1/32	10	0.39	
ANNELIDA (Polychaeta)	1/32	8	0.31		OTHER				
ARTHROPODA					Foraminifera	1/512	18	0.09	
Copepoda Calanoida	1/512	281	175.28		Radiolaria	1/512	11	6.86	
Copepoda Cyclopoida	1/512	88	54.89						
Copepoda Harpacticoida	1/512	1	0.62						
Ostracoda	1/32	157	6.12						
Amphipoda	1/32	2	0.08						
Euphausiacea	1/32	15	0.58						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	40	1.56						
					TOTAL			263.65	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12

Date of Sample: 21-2-81

Depth of Sample (m): 200-25

Net: Inboard

Rep. No.: 2A

Sample #: 200-25m, Day

Time of Sample: 150i

Sample Type: Zooplankton

Vol. Fil.(M³): 351.3

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	3	0.14			1/32	90	8.20	
Leptomedusae	1/16	3	0.14						
Trachymedusae	1/16	11	0.50						
Narcomedusae	1/16	2	0.09						
Siphonophora	1/32	27	2.46		LARVACEA	1/32	200	18.22	
Scyphozoa	1/16	2	0.09						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	16	1.46	
MOLLUSCA					FISH EGGS				
Heteropoda	1/32	1	0.09			1/32	2	0.18	
Thecosomata	1/32	7	0.64						
Gymnosomata	1/32	0	0		LARVAL FISH	1/32	0	0	
ANNELIDA (Polychaeta)	1/32	19	1.73		OTHER				
					Foraminifera	1/256	9	6.56	
					Radiolaria	1/256	15	10.93	
					Squid	1/32	1	0.09	
					Amphioxus	1/16	1	0.04	
ARTHROPODA									
Copepoda Calanoida	1/256	217	158.13						
Copepoda Cyclopoida	1/256	47	34.25						
Copepoda Harpacticoida	1/256	5	3.64						
Ostracoda	1/32	113	10.29						
Amphipoda	1/32	2	0.18						
Euphausiacea	1/32	5	0.45						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	9	0.82						
					TOTAL			259.32	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 21-2-81
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 2A
 Sample #: 200-25m, Day
 Time of Sample: 1501
 Sample Type: Zooplankton
 Vol. Fil. (l): 342.6

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	1	0.05			1/32	65	6.07	
Leptomedusae	1/16	3	0.14						
Trachymedusae	1/16	12	0.56						
Narcomedusae	1/16	3	0.14						
Siphonophora	1/32	38	3.55		LARVACEA	1/32	182	17.00	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	16	1.49	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/32	1	0.09						
Thecosomata	1/32	7	0.65		LARVAL FISH	1/16	10	0.47	
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	15	1.40		OTHER				
					Foraminifera	1/256	10	7.47	
					Radiolaria	1/256	3	2.24	
ARTHROPODA									
Copepoda Calanoida	1/256	201	150.19						
Copepoda Cyclopoida	1/256	41	30.64						
Copepoda Harpacticoida	1/256	1	0.75						
Ostracoda	1/32	114	10.65						
Amphipoda	1/32	6	0.56						
Euphausiacea	1/32	2	0.19						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	7	0.65						
					TOTAL			234.95	

TABLE 20: Zooplankton Counts.

Rep. No.: 3
 Sample #: 200-25m, Day
 Time of Sample: 1541
 Sample Type: Zooplankton
 Vol. Fil.(M³): 337.6

Site, Cruise, Station: PROTEC-12
 Date of Sample: 21-2-81
 Depth of Sample (m): 200-25
 Net: Inboard

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	1	0.05			1/64	44	8.34	
Leptomedusae	1/16	4	0.19						
Trachymedusae	1/16	23	1.09						
Narcomedusae	1/16	0	0		LARVACEA	1/64	113	21.42	
Siphonophora	1/64	19	3.60						
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/64	10	1.89	
MOLLUSCA					FISH EGGS	1/16	1	0.05	
Heteropoda	1/64	2	0.38						
Thecosomata	1/64	5	0.95		LARVAL FISH	1/16	10	0.47	
Gymnosomata	1/64	0	0						
ANNELIDA (Polychaeta)	1/64	3	0.57		OTHER				
ARTHROPODA					Foraminifera	1/256	15	11.37	
Copepoda Calanoida	1/256	253	191.85		Radiolaria	1/256	15	11.37	
Copepoda Cyclopoida	1/256	56	42.46		Juvenile Squid	1/16	1	0.05	
Copepoda Harpacticoida	1/256	6	4.55						
Ostracoda	1/64	75	14.22						
Amphipoda	1/64	1	0.19						
Euphausiacea	1/64	6	1.14						
Lucifer	1/64	2	0.38						
Decapod Larvae	1/64	5	0.95						
					TOTAL			317.53	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 21-2-81
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 3
 Sample #: 200-25m, Day
 Time of Sample: 1541
 Sample Type: Zooplankton
 Vol. FIL (H³): 355.5

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/32	112	10.08	
Anthomedusae	1/16	1	0.04						
Leptomedusae	1/16	1	0.04						
Trachymedusae	1/16	16	0.72						
Narcomedusae	1/16	7	0.31						
Siphonophora	1/32	42	4.68		LARVACEA	1/32	231	20.79	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	19	1.71	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/32	2	0.18						
Thecosomata	1/32	7	0.63		LARVAL FISH	1/16	12	0.54	
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	15	1.35		OTHER				
ARTHROPODA					Foraminifera	1/256	12	8.64	
Copepoda Calanoida	1/256	261	187.95		Radiolaria	1/256	5	3.60	
Copepoda Cyclopoida	1/256	65	46.81		Amphioxus	1/16	1	0.04	
Copepoda Harpacticoida	1/256	1	0.72						
Ostracoda	1/32	130	11.70						
Amphipoda	1/32	1	0.09						
Euphausiacea	1/32	10	0.90						
Lucifer	1/32	1	0.09						
Decapod Larvae	1/32	4	0.36		TOTAL			301.97	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12

Date of Sample: 21-2-81

Depth of Sample (m): 200-25

Net: Inboard

Rep. No.: 2

Sample #: 200-25m, Night

Time of Sample: 0223

Sample Type: Zooplankton

Vol. Fil. (m³): 324.0

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	1	0.05			1/64	28	5.53	
Leptomedusae	1/16	1	0.05						
Trachymedusae	1/16	8	0.39						
Narcomedusae	1/16	3	0.15						
Siphonophora	1/64	12	2.37		LARVACEA	1/64	75	14.81	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/64	16	3.16	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	3	0.59						
Gymnosomata	1/64	0	0		LARVAL FISH	1/16	13	0.64	
ANNELIDA (Polychaeta)	1/64	6	1.18		OTHER				
					Foraminifera	1/256	10	7.90	
					Radiolaria	1/256	3	2.37	
ARTHROPODA									
Copepoda Calanoida	1/256	190	150.12						
Copepoda Cyclopoida	1/256	51	40.30						
Copepoda Harpacticoida	1/256	0	0						
Ostracoda	1/64	88	17.38						
Amphipoda	1/64	0	0						
Euphausiacea	1/64	11	2.17						
Lucifer	1/16	0	0						
Decapod Larvae	1/64	4	0.79		TOTAL			249.95	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 21-2-81
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 2
 Sample #: 200-25m, Night
 Time of Sample: 0223
 Sample Type: Zooplankton
 Vol. Fil.(l³): 372.6

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/32	61	5.24	
Leptomedusae	1/16	2	0.08						
Trachymedusae	1/16	14	0.60						
Narcomedusae	1/16	2	0.08						
Siphonophora	1/32	18	1.54		LARVACEA	1/32	108	9.27	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	13	1.12	
MOLLUSCA					FISH EGGS	1/16	0	0	
* Heteropoda	1/32	1	0.08						
Thecosomata	1/32	8	0.69						
Gymnosomata	1/32	0	0		LARVAL FISH	1/16	12	0.51	
ANNELIDA (Polychaeta)	1/32	12	1.03		OTHER				
					Foraminifera	1/256	4	2.75	
					Radiolaria	1/256	5	3.43	
ARTHROPODA									
Copepoda Calanoida	1/256	235	161.46						
Copepoda Cyclopoida	1/256	37	25.42						
Copepoda Harpacticoida	1/256	2	1.37						
Ostracoda	1/32	177	15.20						
Amphipoda	1/32	2	0.17						
Euphausiacea	1/32	11	0.94						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	12	1.03		TOTAL			232.01	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 21-2-81
 Depth of Sample (m): 200-25
 Net: Inboard

Rep. No.: 3
 Sample #: 200-25m, Night
 Time of Sample: 0308
 Sample Type: Zooplankton
 Vol. Fil. (l): 340.9

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Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	1	0.05			1/32	77	7.23	
Leptomedusae	1/16	6	0.28						
Trachymedusae	1/16	22	1.03						
Narcomedusae	1/16	3	0.14		LARVACEA	1/32	88	8.26	
Siphonophora	1/32	29	2.72						
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	24	2.25	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/32	1	0.09						
Thecosomata	1/32	8	0.75		LARVAL FISH	1/16	8	0.37	
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	11	1.03		OTHER				
					Foraminifera	1/256	9	6.76	
					Radiolaria	1/256	9	6.76	
ARTHIPODA									
Copepoda Calanoida	1/256	206	154.70						
Copepoda Cyclopoida	1/256	53	39.80						
Copepoda Harpacticoida	1/256	0	0						
Ostracoda	1/32	182	17.08						
Amphipoda	1/32	1	0.09						
Euphausiacea	1/32	20	1.88						
Lucifer	1/32	0	0		TOTAL				
Decapod Larvae	1/32	15	1.41					387.32	

TABLE 20: Zooplankton Counts.

Rep. No.: 3
 Sample #: 200-25m, Night
 Time of Sample: 0308
 Sample Type: Zooplankton
 Vol. Fil. (M³): 354.1

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 21-2-81
 Depth of Sample (m): 200-25
 Net: Outboard

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	2	0.09			1/32	46	4.16	
Leptomedusae	1/16	3	0.13						
Trachymedusae	1/16	14	0.63						
Narcomedusae	1/16	1	0.05						
Siphonophora	1/32	20	1.81		LARVACEA	1/32	57	5.15	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	9	0.81	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/32	0	0						
Thecosomata	1/32	3	0.27						
Gymnosomata	1/32	0	0		LARVAL FISH	1/16	6	0.27	
ANNELIDA (Polychaeta)	1/32	9	0.81		OTHER				
					Foraminifera	1/256	8	5.78	
					Radiolaria	1/256	2	1.44	
					Squid	1/16	1	0.05	
ARTHIROPODA									
Copepoda Calanoida	1/256	178	128.69						
Copepoda Cyclopoida	1/256	58	41.93						
Copepoda Harpacticoida	1/256	3	2.17						
Ostracoda	1/32	149	13.46						
Amphipoda	1/32	0	0						
Euphausiacea	1/32	12	1.08						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	11	0.99		TOTAL			209.77	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 21-2-81
 Depth of Sample (m): 200-25
 Net: Inboard

Rep. No.: 4
 Sample #: 200-25m, Night
 Time of Sample: 0359
 Sample Type: Zooplankton
 Vol. Fil. (1³): 344.7

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/32	100	9.25	
Anthomedusae	1/16	0	0						
Leptomedusae	1/16	2	0.09						
Trachymedusae	1/16	29	1.35						
Narcomedusae	1/16	1	0.05						
Siphonophora	1/32	26	2.41		LARVACEA	1/32	139	12.90	
Scyphozoa	1/16	1	0.05						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	10	0.93	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/32	0	0						
Thecosomata	1/32	5	0.46						
Gymnosomata	1/32	0	0		LARVAL FISH	1/16	5	0.23	
ANNELIDA (Polychaeta)	1/32	9	0.83						
					OTHER				
ARTHIROPODA					Foraminifera	1/256	9	6.68	
Copepoda Calanoida	1/256	213	158.19		Radiolaria	1/256	5	3.71	
Copepoda Cyclopoida	1/256	60	44.56		Amphioxus	1/16	1	0.05	
Copepoda Harpacticoida	1/256	1	0.74						
Ostracoda	1/32	193	17.92						
Amphipoda	1/32	2	0.18						
Euphausiacea	1/32	22	2.04						
Lucifer	1/32	1	0.09						
Decapod Larva	1/32	13	1.21		TOTAL			263.92	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 21-2-81
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 4
 Sample #: 200-25m, Night
 Time of Sample: 0359
 Sample Type: Zooplankton
 Vol. Fil. (ml): 333.8

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/8	40	0.96	
Leptomedusae	1/4	2	0.02						
Trachymedusae	1/4	8	0.09						
Narcomedusae	1/4	0	0						
Siphonophora	1/8	14	0.33		LARVACEA	1/8	53	1.27	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/8	11	0.26	
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/8	0	0			1/4	9	0.11	
Thecosomata	1/8	2	0.05		LARVAL FISH				
Gymnosomata	1/8	0	0						
ANNELIDA (Polychaeta)	1/8	8	0.19		OTHER				
					Foraminifera	1/64	3	0.57	
					Radiolaria	1/64	2	0.38	
ARTHIROPODA									
Copepoda Calanoida	1/64	132	25.31						
Copepoda Cyclopoida	1/64	42	8.05						
Copepoda Harpacticoida	1/64	4	0.77						
Ostracoda	1/8	138	3.31						
Amphipoda	1/8	0	0						
Euphausiacea	1/8	19	0.45						
Lucifer	1/4	0	0						
Decapod Larvae	1/8	13	0.31						
					TOTAL			42.42	

TABLE 20: Zooplankton Counts.

Rep. No.: 1
 Sample #: 600-200m, Day
 Time of Sample: 0815
 Sample Type: Zooplankton
 Vol. Fil.(l): 695.8

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 23-2-81
 Depth of Sample (m): 600-200
 Net: Outboard

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/4	69	0.40	
Leptomedusae	1/2	2	0.00						
Trachymedusae	1/2	10	0.03						
Narcomedusae	1/2	1	0.00			1/4	1	0.00	
Siphonophora	1/4	12	0.07		LARVACEA				
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/4	14	0.08	
MOLLUSCA					FISH EGGS	1/2	0	0	
Heteropoda	1/4	1	0.00						
Thecosomata	1/4	13	0.07						
Gymnosomata	1/4	0	0		LARVAL FISH	1/2	11	0.03	
ANNELIDA (Polychaeta)	1/4	14	0.08		OTHER				
					Foraminifera	1/64	9	0.83	
					Radiolaria	1/64	12	1.10	
ARTHROPODA									
Copepoda Calanoida	1/64	149	13.71						
Copepoda Cyclopoida	1/64	24	2.21						
Copepoda Harpacticoida	1/64	1	0.09						
Ostracoda	1/4	246	1.41						
Amphipoda	1/4	1	0.00						
Euphausiacea	1/4	54	0.31						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	0	0						
					TOTAL			20.42	

TABLE 20: Zooplankton Counts.

Rep. No.: 2
 Sample #: 600-200m, Day
 Time of Sample: 0939
 Sample Type: Zooplankton
 Vol. Fil. (M³): 537.2

Site, Cruise, Station: PROTEC-12
 Date of Sample: 23-2-81
 Depth of Sample (m): 600-200
 Net: Inboard

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	29	0.21	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	3	0.02						
Narcomedusae	1/4	1	0.01						
Siphonophora	1/4	10	0.07		LARVACEA	1/4	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	1	0.01	
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/4	0	0						
Thecosomata	1/4	5	0.04						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	3	0.02	
ANNELIDA (Polychaeta)	1/4	8	0.06		OTHER	1/4	1	0.01	
					Foraminifera	1/4	6	0.04	
					Radiolaria				
ARTHROPODA									
Copepoda Calanoida	1/16	240	7.15						
Copepoda Cyclopoida	1/16	24	0.71						
Copepoda Harpacticoida	1/16	0	0						
Ostracoda	1/4	101	0.75						
Amphipoda	1/4	0	0						
Euphausiacea	1/4	14	0.10						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	0	0		TOTAL			9.20	

TABLE 20: Zooplankton Counts.

Rep. No.: 2
 Sample #: 600-200m, Day
 Time of Sample: 0939
 Sample Type: Zooplankton
 Vol. Fil.(H³): 607.3

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 23-2-81
 Depth of Sample (m): 600-200
 Net: Outboard

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/8	18	0.24	
Anthomedusae	1/4	0	0						
Leptomedusae	1/4	2	0.01						
Trachymedusae	1/4	3	0.02						
Narcomedusae	1/4	0	0						
Siphonophora	1/8	13	0.17		LARVACEA	1/8	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/8	5	0.06	
MOLLUSCA					FISH EGGS	1/8	2	0.03	
Heteropoda	1/8	0	0						
Thecosomata	1/8	7	0.09						
Gymnosomata	1/8	0	0		LARVAL FISH	1/4	1	0.01	
ANNELIDA Polychaeta)	1/8	5	0.06		OTHER				
					Foraminifera	1/32	6	0.32	
					Radiolaria	1/32	6	0.32	
ARTHROPODA									
Copepoda Calanoida	1/32	225	11.85						
Copepoda Cyclopoida	1/32	21	1.11						
Copepoda Harpacticoida	1/32	2	0.10						
Ostracoda	1/8	164	2.16						
Amphipoda	1/8	2	0.03						
Euphausiacea	1/8	29	0.38						
Lucifer	1/8	0	0						
Decapod Larvae	1/8	1	0.01						
					TOTAL			16.97	

TABLE 20: Zooplankton Counts.

Rep. No.: 1
 Sample #: 600-200m, Night
 Time of Sample: 2007
 Sample Type: Zooplankton
 Vol. Fil.(m³): 711.7

Site, Cruise, Station: PROTEC-12
 Date of Sample: 23-2-81
 Depth of Sample (m): 600-200
 Net: Inboard

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/8	39	0.44	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	3	0.02						
Narcomedusae	1/4	0	0		LARVACEA				
Siphonophora	1/8	11	0.12			1/8	1	0.01	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE				
						1/8	0	0	
MOLLUSCA					FISH EGGS				
Heteropoda	1/8	0	0			1/4	1	0.00	
Thecosomata	1/8	0	0						
Gymnosomata	1/8	0	0		LARVAL FISH				
						1/4	5	0.03	
ANNELIDA (Polychaeta)	1/8	16	0.18		OTHER				
					Foraminifera	1/32	6	0.27	
					Radiolaria	1/32	8	0.36	
ARTHROPODA									
Copepoda Calanoida	1/32	196	8.81						
Copepoda Cyclopoida	1/32	33	1.48						
Copepoda Harpacticoida	1/32	3	0.13						
Ostracoda	1/8	196	2.20						
Amphipoda	1/8	1	0.01						
Euphausiacea	1/8	15	0.17						
Lucifer	1/8	0	0						
Decapod Larvae	1/8	0	0						
					TOTAL			14.23	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 23-281
 Depth of Sample (m): 600-200
 Net: Outboard

Rep. No.: 1
 Sample #: 600-200m, Night
 Time of Sample: 2007
 Sample Type: Zooplankton
 Vol. Fil.(l): 785.6

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/8	33	0.34	
Leptomedusae	1/4	1	0.00						
Trachymedusae	1/4	0	0						
Narcomedusae	1/8	3	0.03		LARVACEA				
Siphonophora	1/4	0	0			1/8	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/8	0	0	
MOLLUSCA					FISH EGGS				
Heteropoda	1/8	0	0			1/4	0	0	
Thecosomata	1/8	2	0.02						
Gymnosomata	1/8	0	0		LARVAL FISH	1/4	4	0.02	
ANNELIDA (Polychaeta)	1/8	5	0.05		OTHER				
ARTHROPODA					Foraminifera	1/32	9	0.37	
Copepoda Calanoida	1/32	131	5.34		Radiolaria	1/32	6	0.24	
Copepoda Cyclopoida	1/32	33	1.34						
Copepoda Harpacticoida	1/32	6	0.24						
Ostracoda	1/8	152	1/55						
Amphipoda	1/8	6	0.06						
Euphausiacea	1/8	14	0.14						
Lucifer	1/8	0	0						
Decapod Larvae	1/8	1	0.01		TOTAL			9.75	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 23-2-81
 Depth of Sample (m): 600-200
 Net: Inboard

Rep. No.: 2
 Sample #: 600-200m, Night
 Time of Sample: 2135
 Sample Type: Zooplankton
 Vol. Fil. (M³): 722.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/8	50	0.55	
Leptomedusae	1/4	2	0.01						
Trachymedusae	1/4	2	0.01						
Narcomedusae	1/4	0	0						
Siphonophora	1/8	8	0.09		LARVACEA				
Scyphozoa	1/4	0	0			1/8	0	0	
CTENOPHORA	1/4	0	0		SALPIDAE				
						1/8	0	0	
MOLLUSCA					FISH EGGS				
Heteropoda	1/8	0	0			1/8	1	0.01	
Thecosomata	1/8	2	0.02						
Gymnosomata	1/8	0	0		LARVAL FISH				
						1/4	4	0.02	
ANNELIDA (Polychaeta)	1/8	10	0.11		OTHER				
					Foraminifera	1/32	12	0.53	
					Radiolaria	1/32	12	0.53	
					Amphioxus	1/8	1	0.01	
					Squid	1/4	1	0.00	
ARTHROPODA									
Copepoda Calanoida	1/32	239	10.59						
Copepoda Cyclopoida	1/32	33	1.46						
Copepoda Harpacticoida	1/32	7	0.31						
Ostracoda	1/8	173	1.92						
Amphipoda	1/8	3	0.03						
Euphausiacea	1/8	13	0.14						
Lucifer	1/4	1	0.00						
Decapod Larvae	1/8	1	0.01		TOTAL			16.35	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 23-2-81
 Depth of Sample (m): 600-200
 Net: Outboard

Rep. No.: 2
 Sample #: 600-200m, Night
 Time of Sample: 2135
 Sample Type: Zooplankton
 Vol. Fil.(M): 701.8

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/8	43	0.49	
Leptomedusae	1/4	1	0.00						
Trachymedusae	1/4	2	0.01						
Narcomedusae	1/4	0	0						
Siphonophora	1/8	9	0.10		LARVACEA	1/8	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/8	1	0.01	
MOLLUSCA					FISH EGGS	1/4	1	0.00	
Heteropoda	1/8	0	0						
Thecosomata	1/8	0	0		LARVAL FISH	1/4	4	0.02	
Gymnosomata	1/8	0	0						
ANNELIDA (Polychaeta)	1/8	6	0.07		OTHER				
					Foraminifera	1/32	8	0.36	
					Radiolaria	1/32	14	0.64	
ARTHROPODA									
Copepoda Calanoida	1/32	208	9.48						
Copepoda Cyclopoida	1/32	43	1.96						
Copepoda Harpacticoida	1/32	4	0.18						
Ostracoda	1/8	209	2.38						
Amphipoda	1/8	6	0.07						
Euphausiacea	1/8	14	0.16						
Lucifer	1/8	0	0						
Decapod Larvae	1/8	1	0.01		TOTAL			15.94	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 22-2-81
 Depth of Sample (m): 1000-600
 Net: Inboard

Rep. No.: 2
 Sample #: 1000-600m, Day
 Time of Sample: 1038
 Sample Type: Zooplankton
 Vol. Fil. (M³): 693.4

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	24	0.14	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	1	0.00						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	10	0.06		LARVACEA	1/4	5	0.03	
Scyphozoa	1/4	1	0.00						
CTENOPHORA	1/4	1	0.00		SALPIDAE	1/4	5	0.03	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	0	0			1/4	0	0	
Thecosomata	1/4	2	0.01						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	2	0.01	
ANNELIDA (Polychaeta)	1/4	5	0.03		OTHER				
					Foraminifera	1/16	11	0.25	
					Radiolaria	1/16	2	0.05	
					Amphioxus	1/4	1	0.00	
ARTHROPODA									
Copepoda Calanoida	1/16	81	1.87						
Copepoda Cyclopoida	1/16	20	0.46						
Copepoda Harpacticoida	1/16	3	0.07						
Ostracoda	1/4	23	0.13						
Amphipoda	1/4	0	0						
Euphausiacea	1/4	5	0.03						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	0	0						
					TOTAL			3.17	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 22-2-81
 Depth of Sample (m): 1000-600
 Net: Outboard

Rep. No.: 2
 Sample #: 1000-600m, Day
 Time of Sample: 1038
 Sample Type: Zooplankton
 Vol. Fil. (M³): 888.3

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/2	21	0.05	
Leptomedusae	1/2	0	0						
Trachymedusae	1/2	0	0						
Narcomedusae	1/2	0	0						
Siphonophora	1/2	14	0.03		LARVACEA	1/2	2	0.00	
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/2	1	0.00	
MOLLUSCA					FISH EGGS				
Heteropoda	1/2	0	0			1/2	1	0.00	
Thecosomata	1/2	3	0.01						
Gymnosomata	1/2	0	0		LARVAL FISH	1/2	3	0.01	
ANNELIDA (Polychaeta)	1/2	7	0.01		OTHER				
					Foraminifera	1/8	8	0.07	
					Radiolaria	1/8	12	0.11	
ARTHROPODA									
Copepoda Calanoida	1/8	226	2.03						
Copepoda Cyclopoida	1/8	112	1.01						
Copepoda Harpacticoida	1/8	3	0.03						
Ostracoda	1/2	90	0.20						
Amphipoda	1/2	0	0						
Euphausiacea	1/2	4	0.01						
Lucifer	1/2	0	0						
Decapod Larvae	1/2	2	0.00		TOTAL			3.57	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 24-2-81
 Depth of Sample (m): 1000-600
 Net: Inboard

Rep. No.: 4
 Sample #: 1000-600m, Day
 Time of Sample: 0822
 Sample Type: Zooplankton
 Vol. Fil. (M³): 892.2

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	8	0.03	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0		LARVACEA				
Siphonophora	1/4	4	0.02			1/4	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	1	0.00	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	0	0			1/4	1	0.00	
Thecosomata	1/4	1	0.00						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	4	0.02	
ANNELIDA (Polychaeta)	1/4	6	0.03		OTHER				
					Foraminifera	1/8	11	0.10	
					Radiolaria	1/8	11	0.10	
ARTHROPODA									
Copepoda Calanoida	1/8	124	1.11						
Copepoda Cyclopoida	1/8	18	0.16						
Copepoda Harpacticoida	1/8	4	0.04						
Ostracoda	1/4	38	0.17						
Amphipoda	1/4	3	0.01						
Euphausiacea	1/4	8	0.03						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	1	0.00						
					TOTAL			1.82	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 24-2-81
 Depth of Sample (m): 1000-600
 Net: Outboard

Rep. No.: 4
 Sample #: 1000-600m, Day
 Time of Sample: 0822
 Sample Type: Zooplankton
 Vol. Fil. (M³): 1397.2

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	16	0.04	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0		LARVACEA				
Siphonophora	1/4	7	0.02			1/4	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	2	0.00	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	0	0			1/4	1	0.00	
Thecosomata	1/4	2	0.00						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	8	0.02	
ANNELIDA (Polychaeta)	1/4	12	0.03		OTHER				
					Foraminifera	1/16	6	0.07	
					Radiolaria	1/16	11	0.12	
ARTHROPODA									
Copepoda Calanoida	1/16	227	2.60						
Copepoda Cyclopoida	1/16	78	0.89						
Copepoda Harpacticoida	1/16	5	0.06						
Ostracoda	1/4	95	0.27						
Amphipoda	1/4	2	0.00						
Euphausiacea	1/4	7	0.02						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	1	0.00		TOTAL			4.14	

TABLE 20: Zooplankton Counts.

Rep. No.: 1
 Sample #: 1000-600m, Nigh
 Time of Sample: 2055
 Sample Type: Zooplankton
 Vol. Fil. (ml): 665.0

Site, Cruise, Station: PROTEC-12
 Date of Sample: 22-2-81
 Depth of Sample (m): 1000-600
 Net: Inboard

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	9	0.05	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	2	0.01		LARVACEA	1/4	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	0	0	
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/4	0	0						
Thecosomata	1/4	0	0						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	2	0.01	
ANNELIDA (Polychaeta)	1/4	0	0		OTHER				
					Foraminifera	1/4	17	0.10	
					Radiolaria	1/4	15	0.09	
ARTHROPODA									
Copepoda Calanoida	1/4	173	1.04						
Copepoda Cyclopoida	1/4	60	0.36						
Copepoda Harpacticoida	1/4	7	0.04						
Ostracoda	1/4	24	0.14						
Amphipoda	1/4	0	0						
Euphausiacea	1/4	1	0.01						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	2	0.01		TOTAL			1.86	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 22-2-81
 Depth of Sample (m): 1000-600
 Net: Outboard

Rep. No.: 1
 Sample #: 1000-600m, Night
 Time of Sample: 2055
 Sample Type: Zooplankton
 Vol. Fil.(l): 940.6

B-90

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA	1/2	21	0.04	
Anthomedusae	1/2	0	0						
Leptomedusae	1/2	0	0						
Trachymedusae	1/2	0	0						
Narcomedusae	1/2	0	0						
Siphonophora	1/2	9	0.02		LARVACEA	1/2	2	0.00	
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/2	1	0.00	
MOLLUSCA					FISH EGGS	1/2	0	0	
Heteropoda	1/2	0	0						
Thecosomata	1/2	3	0.01						
Gymnosomata	1/2	0	0		LARVAL FISH	1/2	3	0.01	
ANNELIDA (Polychaeta)	1/2	6	0.01		OTHER	1/8	5	0.04	
					Foraminifera	1/8	10	0.08	
					Radiolaria				
ARTHROPODA									
Copepoda Calanoida	1/8	124	1.05						
Copepoda Cyclopoida	1/8	95	0.81						
Copepoda Harpacticoida	1/8	5	0.04						
Ostracoda	1/2	47	0.10						
Amphipoda	1/2	1	0.00						
Euphausiacea	1/2	0	0						
Lucifer	1/2	1	0.00						
Decapod Larvae					TOTAL			2.31	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC-12
 Date of Sample: 22-2-81
 Depth of Sample (m): 1000-600
 Net: Inboard

Rep. No.: 2
 Sample #: 1000-600m, Night
 Time of Sample: 0058
 Sample Type: Zooplankton
 Vol. Fil. (M³): 753.6

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	1	0.00			1/4	28	0.15	
Leptomedusae	1/4	1	0.00						
Trachymedusae	1/4	2	0.01						
Narcomedusae	1/4	0	0		LARVACEA				
Siphonophora	1/4	2	0.01			1/4	3	0.01	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE				
						1/4	2	0.01	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	0	0			1/4	1	0.00	
Thecosomata	1/4	0	0						
Gymnosomata					LARVAL FISH				
						1/4	1	0.00	
ANNELIDA (Polychaeta)	1/4	4	0.02		OTHER				
					Foraminifera	1/8	4	0.04	
					Radiolaria	1/8	8	0.08	
ARTHIROPODA									
Copepoda Calanoida	1/8	157	1.67						
Copepoda Cyclopoida	1/8	79	0.84						
Copepoda Harpacticoida	1/8	9	0.09						
Ostracoda	1/4	59	0.13						
Amphipoda	1/4	0	0						
Euphausiacea	1/4	4	0.02						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	1	0.00		TOTAL			3.08	

TABLE 20: Zooplankton Counts.

Site, Cruise, Station: PROTEC- 12
 Date of Sample: 22-2-81
 Depth of Sample (m): 1000-600
 Net: Outboard

Rep. No.: 2
 Sample #: 1000-600m, Night
 Time of Sample: 0058
 Sample Type: Zooplankton
 Vol. Fil.(M³): 875.5

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/2	21	0.05	
Leptomedusae	1/2	0	0						
Trachymedusae	1/2	0	0						
Narcomedusae	1/2	0	0						
Siphonophora	1/2	2	0.00		LARVACEA				
Scyphozoa	1/2	0	0			1/2	0	0	
CTENOPHORA	1/2	0	0		SALPIDAE	1/2	4	0.01	
MOLLUSCA					FISH EGGS				
Heteropoda	1/2	0	0			1/2	0	0	
Thecosomata	1/2	0	0						
Gymnosomata	1/2	0	0		LARVAL FISH	1/2	0	0	
ANNELIDA (Polychaeta)	1/2	7	0.01		OTHER				
ARTHROPODA					Foraminifera	1/8	11	0.10	
Copepoda Calanoida	1/8	161	1.47		Radiolaria	1/8	22	0.20	
Copepoda Cyclopoida	1/8	89	0.81						
Copepoda Harpacticoida	1/8	4	0.04						
Ostracoda	1/2	57	0.13						
Amphipoda	1/2	2	0.00						
Euphausiacea	1/2	1	0.00						
Lucifer	1/2	0	0						
Decapod Larvae	1/2	0	0						
					TOTAL			2.82	

3. Micronekton (T. Hopkins)

From Table 21 it is apparent that out sampling success with the midwater trawl-plankton net system on PROTEC-12 was greater than on PROTEC-10. Of the shallow collections, all of the 0-25m samples were taken successfully, as well as 7 of 8 of the 25-200m tows ("success" = at least one realistic meter reading and no net-closure malfunction). Of the deeper tows, the two night 200-600m trawls were completed successfully (the two day trawls were fished open to the surface), and 3 of the 4 600-1000m tows were completed successfully.

Table 22 presents a species list for both PROTEC-10 and 12. The effect of the larger number of deeper hauls from PROTEC-12 is apparent in the relative diversities of the two lists. Taxonomic data for PROTEC-12 is shown in Table 23. Aspects of species composition in comparison with other regions will be treated in the final report.

Largest catches for both shrimps and fishes in terms of biomass pro-rated to 10^4 m^3 of filtered water were from 600-1000m during the day and from 25-200m at night. The catch of the deep day-time tow undoubtedly would have been even greater had 500m rather than 600m been designated as the upper horizon of the zone sampled, as a number of migrating mesopelagic species occur between 500 and 600m during the day. Residue, i.e., mostly small zooplankton, was greatest in the upper 200m, particularly at night.

In an attempt to conserve shiptime and to fish more accurately within our depth zones, an attempt will be made to use a double-net trawl system. This would allow us to fish two depth zones within each trawl period and would obviate the need for the usual time requirements and ship-speed/wire angle adjustments necessary for the mechanical messenger release system. The latter release, however, will be taken on PROTEC-13 as back up.

Table 21. Midwater Haul Data

Haul No.	Date	Time		Depth(m)	Flowmeter Readings			Vol. fil. (10 ⁴ m ³)	Comments
		Open	Close		TSK C	TSK O-C	G.O.		
OTEC-2-3	19□81	14:11	15:09	0-25	19865	19710	33279?	1.4950	G.O. malf.
OTEC-2-4	19□81	15:44	16:39	0-25	17020	5050?	72868	1.2242 ¹	TSK O-C malf.
OTEC-2-5	20□81	09:15	10:35	25-200	27165	4050?	130357	1.8315 ¹	TSK O-C malf.
OTEC-2-6	20□81	11:37	13:08	0-200	28210	13530?	75264?	1.9089 ¹	G.O. and TSK O-C. malf.
OTEC-2-7	20□81	13:34	14:53	25-200	26200	18560?	132638	1.8045 ¹	TSK O-C malf.
OTEC-2-8	20□81	15:24	17:00	25-200	34330	11370?	177015	2.3362 ¹	TSK O-C malf.
OTEC-2-9	20□81	19:31	20:20	0-25	14830	-	69760	1.1023 ¹	TSK O-C malf.
OTEC-2-10	20□81	20:47	21:47	0-25	18960	18960	93205	1.4381	
OTEC-2-11	20□81	21:55	22:57	0-25	21250	-	89957	1.5862 ¹	TSK O-C malf.
OTEC-2-12	20-21□81	23:15	00:23	0-25	29100	-	102042	2.1752 ¹	TSK O-C malf.
OTEC-2-13	21□81	07:40	08:33	0-25	19190	-	65825	1.4286 ¹	TSK O-C malf.
OTEC-2-14	21□81	08:58	09:58	0-25	19980	19980	-	1.4472	G.O. malf.
OTEC-2-15	21□81	11:02	13:14	0-690	-	-	-	3.1325 ²	all flowmeters malf.
OTEC-2-16	21□81	19:48	21:18	25-200	33850	31910	154608	2.4203	
OTEC-2-17	21□81	21:46	23:20	25-200	32410	31735	160838	2.4070	
OTEC-2-18	21-22□81	23:40	01:17	25-200	29595	28905	153854	2.1924	
OTEC-2-19	22□81	01:29	02:56	25-200	29745	27715	126178	2.1021	
OTEC-2-20	22□81	13:43	15:11	600-1000	59520	30925	157236	2.3456	
OTEC-2-21	23□81	03:10	05:10	600-1000	44395	26630	89530	2.0198	
OTEC-2-22	23□81	12:10	14:25	0-600	44620	37380	191274	2.8352	
OTEC-2-23	23□81	15:21	17:06	600-1000	47662	28360	132283	2.1510	
OTEC-2-24	23-24□81	23:22	01:40	200-675	48135	39910	211950	3.0271	
OTEC-2-25	24□81	03:12	04:22	200-600	44365	34040	153625	2.5819	

TSK C = Tsurumi-Seiki flowmeter operating continuously

TSK O-C = Tsurumi-Seiki flowmeter operating only when trawl is open

G.O. = General Oceanics flowmeter in ichthyoplanktonnet operating only when trawl is open

¹ = Water volume filtered estimated with TSK C reading and haul duration; TSK O-C malfunctioned

² = Water volume filtered estimated with average TSK C reading calculated from 22 adjacent hauls; all flowmeters failed.

Table 22. TAXA CATEGORIES

Myctophidae

- A *Lepidophanes guentheri*
L. gaussi
A *Hygophum taaningi*
H. reinhardtii
H. macrochir
A *Lampadena luminosa*
Notolychnus valdiviae
Bolinichthys photothorax
B. supralateralis
A *Ceratoscopelus warmingii*
Lampanyctus cuprarius
A *L. alatus*
L. nobilis
L. photonotus
L. ater
L. lineatus
L. festivus
B *Myctophum affine*
A *M. obtusirostre*
A *Diaphus splendidus*
A *D. mollis*
A *D. garmani*
D. termophilus
A *D. dumerilii*
D. luetkeni
A *D. lucidus*
D. brachycephalus
Lobianchia gemallarii
Diogenichthys atlanticus
B *Gonichthys coccoi*
Taaningichthys minimus

Gonostomatidae

- Cyclothone braueri*
C. microdon
A *Vinceguerria nimbaria*
A *Gonastoma elongatum*
Valenciennellus tripunctulatus
Pollichthys mauli

Sternoptychidae

- Argyropelecus hemigymnus*
A. *aculeatus*
Sternoptyx diaphana

Bregmacerotidae

- A *Bregmaceros atlanticus*

Melamphidae

- Melamphaes* sp.
Scopeloberyx sp.
Scopelogadus sp.

Evermannellidae

- Coccorella atrata*

Scopelarchidae

- Scopelarchus analis*

Nemichthyidae

- Nemichthys scolopaceus*

Alepocephalidae

- Xenodermichthys copei*

Cheilodipteridae

Searsidae

Melanocetidae

- Melanocetus johnsoni*

Opisthoproctidae

- Dolichopteryx longipes*

Idiacanthidae

- Idiacanthus fasciola*

A Chauliodontidae

- Chauliodus danae*

Melanostomiatidae

- Melanostomias melanopogon*
Leptostomias analis
Eustomias bibulbosus
E. macrurus
E. brevibarbus
Echiostoma barbatum
Photoneustes phyllopon

A Malacosteidae

- Photostomias guernei*

Astronesthidae

- Astronesthes cyaneus*

Stomiatidae

- Stomias affinis*

Ephippidae

B Tetraodontidae

A Sygnathidae

Scombridae

Carangidae

- A *Selar crumenophthalmus*
Decapterus punctatus

Table 22. Taxa Categories, continued.

Peneidea

Sergestidae

- A *Sergestes vigilax*
- A *S. corniculum*
- S. grandis*
- A *S. splendens*
- S. armatus*
- S. talismani*
- A *S. atlanticus*
- S. filicium*
- S. pectinatus*
- S. sargassi*

Penaeidae

- Gennades scutatus*
- G. capensis*
- G. valens*
- G. bouvieri*
- G. talismani*
- Funchalia taaningi*

Caridea

Pasiphaeidae

- Pasiphaea merrimi*

Oplophoridae

- Acanthephyra purpurea*
- A. stylorostrata*
- Ephyrina hoskynii*
- Notostomus westergreni*
- A *Systellaspis debilis*
- S. cristata*
- Oplophorus spinosus*
- A *O. spinecauda*
- B *O. gracilirostris*

Pandalidae

- Parapandalus richardi*

Mysidacea

Lophogastridae

- Gnathophausia* sp.

Eucopiidae

- Eucopia major*

Amphipoda

Lanceolidae

- Lanceola* sp.

Hyperiididae

- A *Rhabdosoma* sp.

Euphausiidae

- Stylocheiron maximum*
- A *Thysanopoda tricuspidata*
- T. obtusifrons*
- T. monocantha*
- T. orientalis*
- Nematobrachion boopis*
- N. sexspinosus*
- Nematoscelis atlanticus*

Scyphozoa

- Atolla vanhoeffeni*

Urochordata

- Pyrosoma* sp.

Cephalopoda

Decapoda

Cranchiidae

Ommastrephidae

Vampyromorpha

- Vampyrotheuthis infernalis*

Octopoda

NOTE: All taxa categories collected on OTEC-2 unless otherwise noted.

A = collected on OTEC-1 and OTEC-2

B = collected on OTEC-1 only

Table 23
Micronekton Data Sheets
PROTEC-12

Cruise: PROTEC-12

Sample #: 3

Date of Sample: 19 II 81

Time of Sample: 14:11-15:09

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	$\frac{\text{Number}}{10^4 \text{ m}^3}$	$\frac{\text{Biomass(g)}}{10^4 \text{ m}^3}$	Size(mm)	Range(mm)
<u>Selar crumenophthalmus</u>	2	1.338	4.197	48.5	(47-50)
Siphonophora (biomass only)			0.975		
Chaetognatha	6	4.013	0.266	26.0	(21-30)
Urochordata	5	3.344	0.459	23.0	(20-28)
Total sorted			5.396		
Residue			11.664		
Total biomass			17.560		

Cruise: PROTEC-12

Sample #: 4

Date of Sample: 19 II 81

Time of Sample: 15:44-16:39

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>$10^4 m^3$</u>	<u>Biomass(g)</u> <u>$10^4 m^3$</u>	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Selar crumenophthalmus</u>	1	0.817	2.264	48.0	
Anguilliformes (larvae)	1	0.817	1.474	138.0	
Urochordata	16	13.070	2.068	26.5	(21-40)
Total sorted			5.807		
Residue			9.083		
Total biomass			14.990		

Cruise: PROTEC-12

Sample #: 5

Date of Sample: 20 II 81

Time of Sample: 09:15-10:35

Depth of Sample: 25-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> 10^4 m^{-3}	<u>Biomass(g)</u> 10^4 m^{-3}	Mean Size(mm)	Size Range(mm)
Anguilliformes (larvae)	8	4.368	2.273	48.8	(45-50)
Stomatopoda larvae	3	1.638	0.143	41.7	(41-42)
Urochordata	5	2.730	0.465	26.2	(22-31)
Total sorted			2.881		
Residue			3.378		
Total biomass			6.759		

Cruise: PROTEC-12

Sample #: 6

Date of Sample: 20 II 81

Time of Sample: 11:37-13:03

Depth of Sample: 0-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	$\frac{\text{Number}}{10^4 \text{ m}^3}$	$\frac{\text{Biomass(g)}}{10^4 \text{ m}^3}$	Mean Size(mm)	Size Range(mm)
Anguilliformes (larvae)	3	1.572	0.595	57.0	(49-63)
Stomatopoda larvae	1	0.524	0.052	43.0	
Urochordata	1	0.524	0.053	24.0	
Polychaeta	1	0.524	0.026	28.0	
Total sorted			0.726		
Residue			4.263		
Total biomass			4.988		

Cruise: PROTEC-12

Sample #: 7

Date of Sample: 20 II 81

Time of Sample: 13:34-14:53

Depth of Sample: 25-200M

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>$10^4 m^3$</u>	<u>Biomass(g)</u> <u>$10^4 m^3$</u>	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Selar crumenophthalmus</u>	1	0.554	1.401	45.0	
<u>Idiacanthus fasciola (larvae)</u>	1	0.554	0.119	44.0	
Anguilliformes (larvae)	7	3.879	3.051	77.0	(41-153)
<u>Rhabdosoma sp.</u>	2	1.108	0.009	30.5	(29-32)
Lobster larvae	4	2.217	0.223	28.3	(27-30)
Stomatopoda larvae	2	1.108	0.069	40.5	(37-44)
Chaetognatha	4	2.217	0.047	22.5	(20-25)
Urochordata	31	17.179	6.082	30.3	(20-69)
Heteropoda	2	1.108	0.166	21.5	(21-22)
Total sorted			11.160		
Residue			7.739		
Total biomass			18.899		

Cruise: PROTEC-12

Sample #: 8

Date of Sample: 20 II 81

Time of Sample: 15:24-17:00

Depth of Sample: 25-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	$\frac{\text{Number}}{10^4 \text{ m}^3}$	$\frac{\text{Biomass(g)}}{10^4 \text{ m}^3}$	Mean Size(mm)	Size Range(mm)
Ephippidae	1	0.428	0.154	17.0	
Tetraodontidae	1	0.428	0.126	16.0	
Anguilliformes (larvae)	3	1.234	1.613	106.7	(72-154)
Other fish larvae	1	0.428	0.012	30.0	
Lobster larvae	1	0.428	0.045	32.0	
Chaetognatha	1	0.428	0.022	28.0	
Urochordata	14	5.993	1.206	29.4	(21-41)
Heteropoda	2	0.856	0.208	27.0	(26-28)
Total sorted			3.385		
Residue			2.429		
Total biomass			5.814		

Cruise: PROTEC-12

Sample #: 9

Date of Sample: 20 II 81

Time of Sample: 19:31-20:20

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> <u>$10^4 m^3$</u>	<u>Biomass(g)</u> <u>$10^4 m^3$</u>	Size(mm)	Range(mm)
Anguilliformes (larvae)	17	15.422	22.534	101.5	(42-169)
<u>Sergestes vigilax</u>	1	0.907	0.101	25.0	
Lobster larvae	10	9.072	1.566	29.7	(25-33)
Stomatopoda larvae	14	12.701	0.888	38.8	(28-43)
Siphonophora (biomass only)			39.005		
Chaetognatha	4	3.629	0.247	22.5	(21-27)
Urochordata	16	14.515	3.181	26.3	(20-33)
Heteropoda	1	0.907	0.637	29.0	
Total sorted			68.157		
Residue			64.331		
Total biomass			132.488		

Cruise: PROTEC-12

Sample #: 10

Date of Sample: 20 II 81

Time of Sample: 20:47-21:47

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 m^3$	<u>Biomass(g)</u> $10^4 m^3$	Size(mm)	Range(mm)
<u>Hygophum taaningi</u>	1	0.695	0.308	32.0	
<u>Hygophum reinhardtii</u>	1	0.695	0.288	31.0	
Anguilliformes (larvae)	6	4.172	1.342	73.5	(59-108)
Other fish larvae	1	0.695	0.029	23.0	
<u>Thysanopoda tricuspidata</u>	1	0.695	0.080	21.0	
<u>Rhabdosoma sp.</u>	2	1.391	0.013	29.0	(23-35)
Lobster larvae	8	5.563	0.741	29.3	(26-32)
Stomatopoda larvae	16	11.126	0.675	40.2	(21-46)
Siphonophora (biomass only)			24.780		
Scyphozoa	1	0.695	12.133	70.0	
Chaetognatha	2	1.391	0.131	26.0	(25-27)
Urochordata	5	3.477	0.585	25.8	(20-34)
Total sorted			41.043		
Residue			22.935		
Total biomass			63.978		

Cruise: PROTEC-12

Sample #: 11

Date of Sample: 20 II 81

Time of Sample: 21:55-22:57

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>$10^4 \frac{4}{3}$</u>	<u>Biomass(g)</u> <u>$10^4 \frac{4}{3}$</u>	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Hygophum taaningi</u>	2	4.261	0.955	38.5	(32-45)
Anguilliformes (larvae)	4	2.522	0.926	59.5	(45-84)
Lobster larvae	6	3.783	0.505	29.7	(28-32)
Stomatopoda larvae	4	2.522	0.166	40.5	(36-42)
Siphonophora (biomass only)			12.440		
Scyphozoa	1	0.630	11.524	78.0	
Urochordata	12	7.565	2.925	25.3	(20-30)
Total sorted			29.441		
Residue			20.241		
Total biomass			49.682		

Cruise: PROTEC-12

Sample #: 12

Date of Sample: 20-21 II 81

Time of Sample: 23:15-00:23

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> 10^4 m^3	<u>Biomass(g)</u> 10^4 m^3	Size(mm)	Range(mm)
<u>Hygophum taaningi</u>	2	0.919	0.201	23.5	(23-24)
Anguilliformes (larvae)	2	0.919	1.013	109.5	(76-143)
<u>Rhabdosoma sp.</u>	1	0.460	0.004	30.0	
Lobster larvae	6	2.758	0.326	29.0	(22-31)
Stomatopoda larvae	7	3.218	0.225	41.1	(34-47)
Siphonophora			3.683		
Chaetognatha	5	2.299	0.364	29.8	(24-35)
Urochordata	22	10.114	4.600	27.7	(20-60)
<u>Pyrosoma sp.</u>	1	0.460	1.789	43.0	
Polychaeta	1	0.460	0.081	54.0	
Total sorted			12.149		
Residue			8.670		
Total biomass			20.819		

Cruise: PROTEC-12

Sample #: 13

Date of Sample: 21 II 81

Time of Sample: 07:40-08:33

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 \cdot 10^3$	<u>Biomass(g)</u> $10^4 \cdot 10^3$	Size(mm)	Range(mm)
Scombridae	1	0.700	0.343	36.0	
Anguilliformes (larvae)	2	1.400	0.641	73.0	(72-74)
Lobster larvae	7	4.900	0.589	27.7	(20-34)
Chaetognatha	2	1.400	0.094	25.5	(25-26)
Urochordata	44	30.800	4.234	28.2	(20-36)
Heteropoda	3	2.100	0.170	25.7	(22-28)
Total sorted			6.172		
Residue			20.173		
Total biomass			26.345		

Cruise: PROTEC-12

Sample #: 14

Date of Sample: 21 II 81

Time of Sample: 08:58-09:58

Depth of Sample: 0-25m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	$\frac{\text{Number}}{10^4 \text{ m}^3}$	$\frac{\text{Biomass(g)}}{10^4 \text{ m}^3}$	Size(mm)	Range(mm)
Anguilliformes (larvae)	2	1.382	3.841	161.5	(158-165)
Lobster larvae	1	0.691	0.207	31.0	
Chaetognatha	1	0.691	0.023	21.0	
Urochordata	11	7.601	0.706	24.3	(20-32)
Total sorted			4.778		
Residue			9.525		
Total biomass			14.303		

Cruise: PROTEC-12

Sample #: 15

Date of Sample: 21 II 81

Time of Sample: 11:02-13:14

Depth of Sample: 0-690m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>$10^{-4} m^3$</u>	<u>Biomass(g)</u> <u>$10^{-4} m^3$</u>	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Diaphus splendidus</u>	2	0.633	0.980	51.0	(49-53)
<u>Diaphus garmani</u>	2	0.633	0.086	20.5	(18-23)
<u>Diaphus termophilus</u>	1	0.319	0.027	21.0	
<u>Lampadena luminosa</u>	3	0.956	0.122	22.7	(20-23)
<u>Lampanyctus alatus</u>	1	0.319	0.015	20.0	
<u>Gonostoma elongatum</u>	1	0.319	0.035	33.0	
<u>Cyclothone braueri</u>	17	5.427	0.322	25.8	(15-34)
<u>Cyclothone microdon</u>	6	1.915	0.398	37.7	(23-46)
<u>Valenciennellus tripunctulatus</u>	1	0.319	0.056	27.0	
<u>Dolichopteryx longipes</u>	1	0.319	0.601	68.0	
<u>Idiacanthus fasciola</u>	1	0.319	0.013	46.0	
<u>Chauliodus danae</u>	1	0.319	0.873	103.0	
Anguilliformes (larvae)	7	2.235	4.982	133.0	(95-173)
Other fish larvae	1	0.319	0.041	20.0	
<u>Sergestes armatus</u>	2	0.633	0.135	30.5	(29-32)
<u>Sergestes sargassi</u>	1	0.319	0.043	26.0	
<u>Sergestes grandis</u>	1	0.319	0.490	60.0	
<u>Sergestes talismani</u>	7	2.235	0.440	31.0	(19-37)
<u>Pasiphaea sp.</u>	1	0.319	0.053	38.0	
<u>Thysanopoda tricuspidata</u>	1	0.319	0.027	24.0	
<u>Thysanopoda monocantha</u>	1	0.319	0.027	25.0	
<u>Nematoscelis atlanticus</u>	1	0.319	0.024	27.0	
Hyperiididae	1	0.319	0.134	32.0	

Cruise: PROTEC-12

Sample #: 15 (cont'd)

Date of Sample: 21 II 31

Time of Sample: 11:02-13:14

Depth of Sample: 0-690m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>10^4 m^3</u>	<u>Biomass(g)</u> <u>10^4 m^3</u>	<u>Size(mm)</u>	<u>Range(mm)</u>
Lobster larvae	3	0.956	0.155	30.0	(22-34)
Stomatopoda larvae	2	0.633	0.044	42.0	
Crab larvae	1	0.319	0.357	36.0	
Chaetognatha	12	3.831	0.161	28.7	(25-34)
Urochordata	1	0.319	0.660	44.0	
Heteropoda	1	0.319	0.053	65.0	
Total sorted			11.361		
Residue			6.838		
Total biomass			18.199		

Cruise: PROTEC-12

Sample #: 16

Date of Sample: 21 II 81

Time of Sample: 19:48-21:18

Depth of Sample: 25-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	Number 10^{-4} m^{-3}	Biomass(g) 10^{-4} m^{-3}	Size(mm)	Range(mm)
<u>Syngnathidae</u>	1	0.413	0.010	37.0	
<u>Decapterus punctatus</u>	1	0.413	4.418	103.0	
<u>Lepidophanes guentheri</u>	3	1.240	0.302	30.3	(23-42)
<u>Lampanyctus nobilis</u>	1	0.413	0.100	35.0	
<u>Ceratoscopelus warmingii</u>	1	0.413	0.865	56.0	
<u>Notolychnus valdiviae</u>	2	0.826	0.029	17.0	(16-18)
<u>Bolinichthys photothorax</u>	4	1.653	0.278	23.8	(19-31)
<u>Diaphus dumerilii</u>	3	1.240	0.194	23.0	(17-27)
<u>Diaphus leutkeni</u>	1	0.413	0.069	25.0	
<u>Diaphus lucidus</u>	1	0.413	0.023	17.0	
<u>Diaphus mollis</u>	2	0.826	0.496	35.5	(35-36)
<u>Diaphus splendidus</u>	7	2.892	1.960	38.3	(28-48)
<u>Hygophum taaningi</u>	3	1.240	0.333	24.3	(17-34)
<u>Myctophum obtusirostre</u>	1	0.413	0.070	21.0	
<u>Gonostoma elongatum</u>	1	0.413	0.040	31.0	
<u>Cyclothone braueri</u>	3	1.240	0.218	33.7	(21-42)
<u>Pollichthys mauli</u>	1	0.413	0.012	20.0	
<u>Argyropelecus aculeatus</u>	1	0.413	0.188	25.0	
<u>Melamphaes sp.</u>	1	0.413	0.060	19.0	
<u>Coccorella atrata</u>	1	0.413	0.195	38.0	
<u>Melanostomias melanopogon</u>	1	0.413	0.228	57.0	
<u>Leptostomias analis</u>	1	0.413	0.456	103.0	

Cruise: PROTEC-12

Sample #: 16 (cont'd)

Date of Sample: 21 II 81

Time of Sample: 19:48-21:18

Depth of Sample: 25-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^{-4} m^3$	<u>Biomass(g)</u> $10^{-4} m^3$	Size(mm)	Range(mm)
<u>Astronesthes cyaneus</u>	1	0.413	0.056	27.0	
<u>Chauliodus danae</u>	2	0.826	1.124	70.0	(36-104)
Anguilliformes (larvae)	5	2.066	1.519	111.0	(38-153)
Other fish larvae	1	0.413	0.093	16.0	
<u>Sergestes splendens</u>	4	1.653	0.452	33.5	(29-36)
<u>Sergestes talismani</u>	3	1.240	0.328	33.7	(32-36)
<u>Sergestes sp.</u>	3	1.240	0.349	36.7	(24-49)
<u>Gennadas scutatus</u>	3	1.240	0.119	20.7	(19-23)
<u>Funchiala taaningi</u>	2	0.826	1.377	66.0	(60-72)
<u>Systellaspis debilis</u>	1	0.413	0.493	63.0	
<u>Oplophorus spinosus</u>	1	0.413	0.086	38.0	
<u>Parapandalus richardi</u>	2	0.826	0.217	51.0	(45-57)
<u>Eucopia sp.</u>	1	0.413	0.071	26.0	
<u>Thysanopoda tricuspidata</u>	1	0.413	0.059	25.0	
Siphonophora (biomass only)			0.839		
Urochordata	3	1.240	1.523	47.0	(25-65)
Total sorted			19.276		
Residue			11.448		
Total biomass			30.724		

Cruise: PROTEC-12

Sample #: 17

Date of Sample: 21 II 81

Time of Sample: 21:46-23:20

Depth of Sample: 25-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 m^3$	<u>Biomass(g)</u> $10^4 m^3$	Size (mm)	Range(mm)
<u>Lepidophanes guentheri</u>	9	3.739	2.637	41.6	(34-55)
<u>Lampanyctus photonotus</u>	1	0.415	0.136	36.0	
<u>Lampanyctus cuprarius</u>	3	1.246	1.143	52.7	(42-63)
<u>Ceratoscopelus warmingii</u>	2	0.831	0.717	39.5	(32-47)
<u>Notolychnus valdiviae</u>	1	0.415	0.014	15.0	
<u>Bolinichthys photothorax</u>	2	0.831	0.292	24.5	(15-34)
<u>Diaphus dumerilii</u>	2	0.831	0.091	20.5	(17-24)
<u>Diaphus splendidus</u>	3	1.246	0.723	34.7	(21-46)
<u>Diaphus brachycephalus</u>	1	0.415	0.009	15.0	
<u>Hygophum taaningi</u>	2	0.831	0.381	32.5	(32-33)
<u>Hygophum macrochir</u>	1	0.415	0.256	35.0	
<u>Diogenichthys atlanticus</u>	1	0.415	0.029	18.0	
<u>Gonostoma elongatum</u>	1	0.415	0.119	46.0	
<u>Pollichthys mauili</u>	3	1.246	0.185	33.0	(23-40)
<u>Melamphaes sp.</u>	3	1.246	0.179	19.0	(13-21)
<u>Idiacanthus faciola</u>	1	0.415	0.796	186.0	
<u>Eustomias sp.</u>	1	0.415	1.140	102.0	
<u>Eustomias bibulbosus</u>	1	0.415	0.648	98.0	
<u>Anguilliformes (larvae)</u>	13	5.401	6.617	101.8	(47-166)
<u>Sergestes splendens</u>	5	2.077	0.582	31.8	(20-36)
<u>Sergestes talismani</u>	1	0.415	0.113	35.0	
<u>Sergestes armatus</u>	2	0.831	0.135	27.0	(25-23)
<u>Sergestes vigilax</u>	2	0.831	0.057	20.0	(19-21)

Cruise: PROTEC-12
 Date of Sample: 21 II 81
 Depth of Sample: 25-200m

Sample #: 17 (cont'd)
 Time of Sample: 21:46-23:20
 Sample Type: Micronekton
 Tucker trawl

<u>Taxonomic Identification</u>	Counted	Number $10^{-4} m^3$	Biomass(g) $10^{-4} m^3$	Size(mm)	Range(mm)
<u>Sergestes pectinatus</u>	1	0.415	0.022	19.0	
<u>Sergestes corniculum</u>	1	0.415	0.079	35.0	
<u>Gennadas scutatus</u>	2	0.831	0.061	19.5	(19-20)
<u>Gennadas sp.</u>	1	0.415	0.044	21.0	
<u>Systellaspis debilis</u>	5	2.077	1.786	56.6	(43-66)
<u>Oplophorus spinosus</u>	2	0.831	0.679	49.5	(32-67)
<u>Oplophorus spinicauda</u>	1	0.415	0.061	35.0	
<u>AcanthePHYra sp.</u>	1	0.415	0.034	43.0	
<u>Parapandalus richardi</u>	1	0.415	0.135	54.0	
Mysidacea	1	0.415	0.073	32.0	
<u>Thysanopoda tricuspidata</u>	9	3.739	0.392	22.3	(21-24)
Lobster larvae	2	0.831	0.131	33.5	(32-35)
Stomatopoda larvae	5	2.077	0.123	32.6	(21-46)
Siphonophora (biomass only)			4.616		
Chaetognatha	1	0.415	0.702	35.0	
Urochordata	9	3.739	0.236	30.1	(20-37)
Heteropoda	21	8.725	6.750	43.5	(21-95)
Cranchiidae	1	0.415	0.388	31.0	
Total sorted			33.324		
Residue			12.533		
Total biomass			45.857		

Cruise: PROTEC-12

Sample #: 18

Date of Sample: 21-22 II 81

Time of Sample: 23:40-01:17

Depth of Sample: 25-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	$\frac{\text{Number}}{10^4 \text{ m}^3}$	$\frac{\text{Biomass (g)}}{10^4 \text{ m}^3}$	Size(mm)	Range(mm)
Syngnathidae	1	0.456	0.007	37.0	
<u>Lepidophanes guentheri</u>	3	1.368	0.933	41.7	(34-46)
<u>Lampanyctus nobilis</u>	2	0.912	0.373	37.5	(37-38)
<u>Lampanyctus photonotus</u>	1	0.456	0.288	44.0	
<u>Ceratoscopelus warmingii</u>	1	0.456	0.157	31.0	
<u>Notolychnus valdiviae</u>	3	1.368	0.054	16.7	(16-17)
<u>Diaphus lucidus</u>	1	0.456	0.021	15.0	
<u>Diaphus splendidus</u>	2	0.912	0.592	34.0	(19-49)
<u>Hygophum taaningi</u>	3	1.368	0.436	26.7	(21-31)
<u>Hygophum macrochir</u>	2	0.912	0.221	25.0	(20-30)
<u>Hygophum reinhardtii</u>	1	0.456	0.112	26.0	
<u>Lobianchia gemellarii</u>	1	0.456	0.129	25.0	
<u>Gonostoma elongatum</u>	5	2.281	0.316	43.2	(33-71)
<u>Pollichthys mauli</u>	1	0.456	0.027	24.0	
<u>Melamphaes sp.</u>	1	0.456	0.052	18.0	
<u>Coccorella atrata</u>	1	0.456	0.066	24.0	
<u>Astronesthes sp.</u>	1	0.456	0.069	27.0	
Anguilliformes (larvae)	13	5.930	3.648	66.6	(17-115)
Other fish larvae	1	0.456	0.042	19.0	
<u>Sergestes armatus</u>	1	0.456	0.110	33.0	
<u>Sergestes vigilax</u>	1	0.456	0.039	25.0	
<u>Oplophorus spinosus</u>	1	0.456	0.042	31.0	
<u>Thysanopoda tricuspidata</u>	6	2.737	0.264	22.7	(20-24)

Cruise: PROTEC-12

Sample #: 18 (cont'd)

Date of Sample: 21-22 II 81

Time of Sample: 23:40-01:17

Depth of Sample: 25-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> <u>$10^4 m^3$</u>	<u>Biomass(g)</u> <u>$10^4 m^3$</u>	Size(mm)	Range(mm)
Lobster larvae	2	0.912	0.127	24.0	(21-27)
Stomatopoda larvae	1	0.456	0.036	43.0	
Siphonophora (biomass only)			5.179		
Chaetognatha	8	3.649	0.122	24.6	(21-27)
Urochordata	4	1.824	6.073	55.8	(23-125)
Total sorted			19.938		
Residue			19.155		
Total biomass			39.093		

Cruise: PROTEC-12

Sample #: 19

Date of Sample: 22 II 81

Time of Sample: 01:29-02:56

Depth of Sample: 25-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	Number $10^{-4} m^3$	Biomass(g) $10^{-4} m^3$	Size(mm)	Range(mm)
<u>Syngnathidae</u>	2	0.951	0.065	58.0	(55-61)
<u>Decapterus punctatus</u>	1	0.476	3.748	92.0	
<u>Lepidophanes guentheri</u>	5	2.379	1.395	36.0	(23-60)
<u>Lampanyctus photonotus</u>	2	0.951	0.477	40.5	(38-43)
<u>Lampanyctus cuprarius</u>	1	0.476	0.033	23.0	
<u>Lampanyctus ater</u>	1	0.476	0.104	35.0	
<u>Notolychnus valdiviae</u>	1	0.476	0.024	18.0	
<u>Hygophum taaningi</u>	3	1.427	0.215	21.7	(16-26)
<u>Gonostoma elongatum</u>	2	0.951	2.415	72.0	(27-117)
<u>Pollichthys maui</u>	1	0.476	0.065	72.0	
<u>Scopelarchus analis</u>	1	0.476	0.042	25.0	
<u>Idiacanthus faciola</u>	1	0.476	0.018	48.0	
Anguilliformes (larvae)	16	7.611	6.504	91.1	(40-153)
<u>Sergestes vigilax</u>	1	0.476	0.045	26.0	
<u>Sergestes corniculum</u>	1	0.476	0.167	44.0	
<u>Sergestes atlanticus</u>	1	0.476	0.067	29.0	
<u>Funchiala taaningi</u>	1	0.476	0.933	66.0	
<u>Thysanopoda tricuspidata</u>	5	2.379	0.251	23.6	(23-26)
Lobster larvae	11	5.233	0.652	29.4	(23-33)
Stomatopoda larvae	6	2.854	0.130	34.8	(29-43)
Chaetognatha	4	1.903	0.097	27.0	(23-30)
Urochordata	7	3.330	2.527	42.1	(25-80)
Cranchiidae	1	0.476	0.280	21.0	

Cruise: PROTEC-12

Sample #: 19 (cont'd)

Date of Sample: 22 II 81

Time of Sample: 01:29-02:56

Depth of Sample: 25-200m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 \cdot 3$	<u>Biomass(g)</u> $10^4 \cdot 3$	Size(mm)	Range(mm)
Polychaeta	1	0.476	0.005	30.0	

Total sorted 20.371

Residue 13.722

Total biomass 34.093

Cruise: PROTEC-12

Sample #: 20

Date of Sample: 22 II 81

Time of Sample: 13:43-15:11

Depth of Sample: 600-1000 m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $\frac{10^4}{10^3} m^3$	<u>Biomass(g)</u> $\frac{10^4}{10^3} m^3$	Size(mm)	Range(mm)
<u>Lepidophanes guentheri</u>	1	0.426	0.108	34.0	
<u>Lepidophanes gaussi</u>	3	1.279	0.094	32.3	(31-34)
<u>Lampadena luminosa</u>	2	0.853	0.955	44.0	(37-51)
<u>Bolinichthys supralateralis</u>	1	0.426	0.095	27.0	
<u>Bolinichthys photothorax</u>	1	0.426	0.078	26.0	
<u>Lampanyctus photonotus</u>	1	0.426	0.177	40.0	
<u>Lampanyctus nobilis</u>	1	0.426	0.120	35.0	
<u>Diaphus splendidus</u>	1	0.426	0.988	57.0	
<u>Hygophum taaningi</u>	2	0.853	0.612	38.5	(38-39)
<u>Cyclothone braueri</u>	23	9.806	0.743	29.0	(19-36)
<u>Cyclothone microdon</u>	49	20.890	3.291	34.1	(20-52)
<u>Bregmaceros atlanticus</u>	2	0.853	0.163	35.5	(33-38)
<u>Echiostoma barbatum</u>	1	0.426	17.324	210.0	
<u>Eustomias macrurus</u>	1	0.426	0.118	76.0	
<u>Photonectes phyllopon</u>	1	0.426	0.075	31.0	
<u>Astonesthes cyaneus</u>	1	0.426	0.043	22.0	
<u>Photostomias guernei</u>	1	0.426	1.354	94.0	
<u>Chauliodus danae</u>	1	0.426	4.622	165.0	
<u>Sergestes vigilax</u>	1	0.426	0.044	23.0	
<u>Sergestes talismani</u>	1	0.426	0.114	36.0	
<u>Sergestes grandis</u>	2	0.853	1.728	65.5	(63-68)
<u>Sergestes sp.</u>	1	0.426	0.073	34.0	
<u>Gennadas valens</u>	1	0.426	0.066	24.0	

Cruise: PROTEC-12

Sample #: 20 cont'd

Date of Sample: 22 II 81

Time of Sample: 13:43-15:11

Depth of Sample: 600-1000 m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 m^3$	<u>Biomass(g)</u> $10^4 m^3$	Size(mm)	Range(mm)
<u>Gennadas capensis</u>	4	1.705	0.220	23.8	(23-24)
<u>Gennadas bouvieri</u>	2	0.853	0.189	30.0	
<u>Gennadas sp.</u>	4	1.705	0.155	21.3	(19-23)
<u>Pasiphaea merriami</u>	3	1.279	3.372	70.0	(26-95)
<u>Systellaspis debilis</u>	1	0.426	0.544	45.0	
<u>Acanthephyra stylorostrata</u>	1	0.426	0.247	45.0	
<u>Lophogaster sp.</u>	1	0.426	0.052	21.0	
Mysidacea	1	0.426	0.116	35.0	
<u>Thysanopoda orientalis</u>	1	0.426	0.090	32.0	
<u>Lanceola sp.</u>	1	0.426	0.082	33.0	
Lobster larvae	1	0.426	0.022	35.0	
<u>Pyrosoma sp.</u>	1	0.426	0.486	30.0	
Cranchiidae	2	0.853	2.551	48.5	(45-52)
Total sorted			38.825		
Residue			4.815		
Total biomass			46.640		

Cruise: PROTEC-12

Sample #: 21

Date of Sample: 23 II 81

Time of Sample: 03:10-05:10

Depth of Sample: 600-1000m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> <u>10^4 m^3</u>	<u>Biomass(g)</u> <u>10^4 m^3</u>	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Lampanyctus lineatus</u>	2	0.990	0.145	32.0	(25-39)
<u>Lampanyctus ater</u>	1	0.495	0.481	56.0	
<u>Taaningichthys minimus</u>	1	0.495	0.161	34.0	
<u>Cyclothone braueri</u>	8	3.961	0.177	24.1	(20-31)
<u>Cyclothone microdon</u>	40	19.804	3.197	34.7	(18-55)
<u>Scopeloberyx sp.</u>	2	0.990	0.112	18.0	(16-20)
<u>Photostomias guernei</u>	1	0.495	1.325	82.0	
<u>Chauliodus danae</u>	1	0.495	1.178	102.0	
<u>Gennadas capensis</u>	2	0.990	0.198	29.5	(25-34)
<u>Gennadas sp.</u>	1	0.495	0.043	19.0	
<u>Ephyrina hoskynii</u>	1	0.495	0.921	60.0	
<u>Eucopia major</u>	6	2.971	0.523	31.8	(30-33)
<u>Stylocheiron maximum</u>	1	0.495	0.056	22.0	
<u>Nematobrachion boopis</u>	2	0.990	0.110	23.0	
<u>Chaetognatha</u>	9	4.456	0.160	25.8	(22-32)
Total sorted			8.787		
Residue			3.072		
Total biomass			11.859		

Cruise: PROTEC-12

Sample #: 22

Date of Sample: 23 II 81

Time of Sample: 12:10-14:25

Depth of Sample: 0-600m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 m^3$	<u>Biomass(g)</u> $10^4 m^3$	Mean Size(mm)	Size Range(mm)
<u>Diaphus splendidus</u>	3	1.058	0.828	40.0	(36-43)
<u>Diaphus dumerilii</u>	4	1.411	0.078	16.0	(15-18)
<u>Diaphus mollis</u>	1	0.353	0.056	22.0	
<u>Notolychnus valdiviae</u>	1	0.353	0.011	17.0	
<u>Gonostoma elongatum</u>	4	1.411	0.162	30.5	(22-45)
<u>Cyclothone braueri</u>	23	8.112	0.338	22.3	(17-31)
<u>Cyclothone microdon</u>	24	8.465	0.649	26.5	(17-48)
<u>Valenciennellus tripunctulatus</u>	1	0.353	0.040	23.0	
Anguilliformes (larvae)	1	0.353	0.169	92.0	
<u>Sergestes sargassi</u>	1	0.353	0.066	32.0	
<u>Nematobranchion boopis</u>	5	1.764	0.180	23.6	(20-27)
<u>Nematobranchion sexspinosum</u>	1	0.353	0.080	29.0	
<u>Stylocheiron maximum</u>	2	0.705	0.073	26.0	(25-27)
<u>Thysanopoda obtusifrons</u>	2	0.705	0.051	21.0	
<u>Euphausiidae</u>	1	0.353	0.027	25.0	
Chaetognatha	7	2.469	0.063	23.7	(20-32)
Heteropoda	1	0.353	0.211	95.0	
Total sorted			3.081		
Residue			4.310		
Total biomass			7.391		

Cruise: PROTEC-12

Sample #: 23

Date of Sample: 23 II 81

Time of Sample: 15:21-17:06

Depth of Sample: 600-1000 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number $10^4 m^3$	Biomass(g) $10^4 m^3$	Size(mm)	Range(mm)
<u>Lepidophanes guentheri</u>	9	4.184	2.229	37.6	(22-51)
<u>Bolinichthys photothorax</u>	1	0.465	0.044	19.0	
<u>Lampanyctus photonotus</u>	3	1.395	0.483	36.0	(33-38)
<u>Lampanyctus festivus</u>	1	0.465	0.265	43.0	
<u>Hygophum taaningi</u>	1	0.465	0.049	19.0	
<u>Gonostoma elongatum</u>	1	0.465	2.460	115.0	
<u>Cyclothone braueri</u>	14	6.509	0.233	23.6	(18-30)
<u>Cyclothone microdon</u>	46	21.385	3.421	33.3	(19-52)
<u>Valenciennellus tripunctulatus</u>	1	0.465	0.046	21.0	
<u>Sternoptyx diaphana</u>	1	0.465	0.264	21.0	
<u>Bregmaceros atlanticus</u>	1	0.465	0.265	48.0	
<u>Scopelogadus sp.</u>	1	0.465	0.190	30.0	
<u>Chauliodus danae</u>	1	0.465	1.833	113.0	
<u>Melanocetus johnsoni</u>	2	0.930	0.983	19.5	(17-22)
Other fish larvae	1	0.465	0.011	25.0	
<u>Sergestes atlanticus</u>	1	0.465	0.046	25.0	
<u>Sergestes filictum</u>	1	0.465	0.567	65.0	
<u>Sergestes sp.</u>	1	0.465	0.093	34.0	
<u>Gennadas valens</u>	1	0.465	0.091	22.0	
<u>Gennadas capensis</u>	5	2.325	0.659	30.0	(27-35)
<u>Gennadas bouvieri</u>	4	1.860	0.272	24.0	(23-25)
<u>Gennadas scutatus</u>	5	2.325	0.230	20.2	(19-23)
<u>Gennadas sp.</u>	2	0.930	0.095	23.0	(22-24)

Cruise: PROTEC-12

Sample #: 23 cont'd

Date of Sample: 23 II 81

Time of Sample: 15:21-17:06

Depth of Sample: 600-1000 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number $10^4 m^3$	Biomass(g) $10^4 m^3$	Size(mm)	Range(mm)
Penaeidae	1	0.465	0.049	23.0	
<u>Pasiphaea merriami</u>	1	0.465	2.461	96.0	
<u>Pasiphaea sp.</u>	1	0.465	0.047	29.0	
<u>Systellaspis debilis</u>	1	0.465	0.262	54.0	
<u>Acantheephyra stylorostrata</u>	1	0.465	0.037	24.0	
<u>Acantheephyra purpurea</u>	3	1.395	2.300	67.7	(42-81)
<u>Notostomus westergreni</u>	1	0.465	0.219	45.0	
Caridea	1	0.465	0.065	29.0	
<u>Eucopia major</u>	5	2.325	0.346	26.6	(25-32)
Mysidacea	2	0.930	0.154	27.5	(22-33)
<u>Lanceola sp.</u>	1	0.465	0.309	28.0	
Stomatopoda larvae	1	0.465	0.025	42.0	
<u>Atolla vanhoeffeni</u>	1	0.465	0.880	26.0	
Chaetognatha	8	3.719	0.183	24.5	(21-34)
<u>Vampyroteuthis infernalis</u>	1	0.465	0.333	26.0	
Octopoda	1	0.465	2.306	29.0	
Total sorted			24.408		
Residue			3.464		
Total biomass			26.872		

Cruise: PROTEC-12

Sample #: 24

Date of Sample: 23-24 II 81

Time of Sample: 23:22-01:40

Depth of Sample: 200-675 m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> 10^4 m^3	<u>Biomass(g)</u> 10^4 m^3	<u>Size(mm)</u>	<u>Range(mm)</u>
<u>Notolychnus valdiviae</u>	1	0.330	0.019	16.0	
<u>Bolinichthys supralateralis</u>	1	0.330	0.035	21.0	
<u>Vinciguerrria nimbaria</u>	1	0.330	0.036	22.0	
<u>Gonostoma elongatum</u>	2	0.661	2.739	86.0	(38-134)
<u>Cyclothone braueri</u>	11	3.634	0.100	19.8	(15-24)
<u>Valenciennellus tripunctulatus</u>	1	0.330	0.054	25.0	
<u>Argyropelecus hemigymnus</u>	3	0.991	0.151	17.3	(15-20)
<u>Cheilodipteridae</u>	1	0.330	0.042	24.0	
<u>Searsiidae</u>	1	0.330	0.012	21.0	
<u>Xenodermichthys copei</u>	1	0.330	9.918	160.0	
<u>Idiacanthus fasciola</u>	1	0.330	0.720	190.0	
<u>Sergestes vigilax</u>	1	0.330	0.074	35.0	
<u>Sergestes corniculum</u>	1	0.330	0.070	34.0	
<u>Sergestes grandis</u>	1	0.330	0.399	56.0	
<u>Sergestes spendens</u>	1	0.330	0.079	30.0	
<u>Gennadas valens</u>	2	0.661	0.122	28.0	(27-29)
<u>Gennadas talismani</u>	1	0.330	0.079	29.0	
<u>Gennadas scutatus</u>	4	1.321	0.101	19.3	(18-20)
<u>Gennadas bouvieri</u>	1	0.330	0.039	26.0	
<u>Gennadas sp.</u>	2	0.661	0.065	21.5	(21-22)
<u>Pasiphaea merriami</u>	1	0.330	0.023	24.0	
<u>Systellaspis debilis</u>	5	1.652	1.692	64.6	(60-72)
<u>Systellaspis cristata</u>	1	0.330	0.021	28.0	

Cruise: PROTEC-12

Date of Sample: 23-24 II 81

Depth of Sample: 200-675 m

Sample #: 24 cont'd

Time of Sample: 23:22-01:40

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number	Biomass(g)	Size(mm)	Range(mm)
		$\frac{10^4}{m^3}$	$\frac{10^4}{m^3}$		
<u>AcanthePHYra purpurea</u>	1	0.330	0.026	23.0	
<u>Parapandalus richardi</u>	1	0.330	0.070	47.0	
<u>Notostomus sp.</u>	1	0.330	0.027	28.0	
<u>Lophogaster sp.</u>	1	0.330	0.022	20.0	
<u>Nematobranchion sexspinosum</u>	2	0.661	0.089	24.5	(23-26)
<u>Stylocheiron sp.</u>	1	0.330	0.028	25.0	
Euphausiidae	1	0.330	0.025	22.0	
Chaetognatha	1	0.330	0.014	32.0	
Ommastrephidae	1	0.330	41.274	195.0	
Total sorted			58.160		
Residue			3.055		
Total biomass			61.215		

Cruise: PROTEC-12

Sample #: 25

Date of Sample: 24 II 81

Time of Sample: 03:12-04:22

Depth of Sample: 200-600 m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	<u>Counted</u>	<u>Number</u> $10^4 m^3$	<u>Biomass(g)</u> $10^4 m^3$	<u>Mean</u> <u>Size(mm)</u>	<u>Size</u> <u>Range(mm)</u>
<u>Lepidophanes guentheri</u>	1	0.387	0.058	26.0	
<u>Lampanyctus cuprarius</u>	1	0.387	0.080	32.0	
<u>Notolychnus valdiviae</u>	2	0.775	0.028	16.5	(16-17)
<u>Diaphus mollis</u>	2	0.775	0.363	30.0	
<u>Gonostoma elongatum</u>	2	0.775	1.648	79.0	(54-104)
<u>Cyclothone braueri</u>	4	1.549	0.050	19.8	(15-23)
<u>Valenciennellus tripunctulatus</u>	4	1.549	0.159	21.8	(18-24)
<u>Argyropelecus hemigymnus</u>	1	0.387	0.141	26.0	
<u>Argyropelecus aculeatus</u>	2	0.775	0.298	20.5	(20-21)
<u>Bregmaceros atlanticus</u>	1	0.387	0.045	57.0	
<u>Coccorella atrata</u>	1	0.387	1.241	68.0	
<u>Nemichthys scolopaceus</u>	1	0.387	4.250	842.0	
<u>Stomias affinis</u>	1	0.387	0.380	81.0	
<u>Eustomias brevibarbus</u>	1	0.387	0.245	70.0	
<u>Sergestes grandis</u>	2	0.775	1.767	74.0	
<u>Sergestes spendens</u>	1	0.387	0.095	33.0	
<u>Sergestes armatus</u>	1	0.387	0.114	37.0	
<u>Sergestes sp.</u>	3	1.162	0.390	35.3	(32-37)
<u>Gennadas valens</u>	1	0.387	0.116	34.0	
<u>Gennadas scutatus</u>	2	0.775	0.031	21.5	(20-23)
<u>Gennadas bouvieri</u>	1	0.387	0.028	21.0	
<u>Gennadas sp.</u>	1	0.387	0.026	20.0	
<u>Pasiphaea sp.</u>	1	0.387	0.043	30.0	

Cruise: PROTEC-12

Sample #: 25 cont'd

Date of Sample: 24 II 81

Time of Sample: 03:12-04:22

Depth of Sample: 200-600 m

Sample Type: Micronekton
Tucker trawl

<u>Taxonomic Identification</u>	Counted	<u>Number</u> $10^4 m^3$	<u>Biomass(g)</u> $10^4 m^3$	Size(mm)	Range(mm)
<u>Systellaspis debilis</u>	3	1.162	0.749	54.3	(51-60)
<u>AcanthePHYra purpurea</u>	1	0.387	0.397	65.0	
<u>Thypanopoda obtusifrons</u>	1	0.387	0.003	22.0	
<u>Thysanopoda monocantha</u>	5	1.937	0.310	25.2	(23-28)

Total sorted

13.133

Residue

5.994

Total biomass

19.127

4. Fish, Mammal, and Bird Sightings (S. Vargo)

Few animals were sighted and species identification of birds was difficult to impossible. The sightings are listed below in chronological order.

<u>Date</u>	<u>Time(AST)</u>	<u>Position</u>	<u>Animal(s)</u>
20-2-81	1650	17°54.74'N, 65°55.54'W	2 tan sea birds
21-2-81	0945	17°55'N, 65°52'W	2 porpoise
	1045	17°51.50'N, 65°42.50'W	1 porpoise
22-2-81	1630	17°53.88'N, 65°47.90'W	1 white-bellied booby

5. DSL Tracking (S. Vargo)

The PDR gave only a very faint double trace. No DSL was detectable but this may have been due to the malfunctioning. The problem has been corrected.

D. Meteorology Log (S. Vargo)

Meteorological observations were made every four hours while on station and are shown in Table 24.

Table 24. Meteorology Log

Date	Time (AST)	Air Temperature		Wave Height (ft.)	Baro- metric Pressure	Wind		Cloud	Position	
		Wet Bulb (°F)	Dry Bulb (°F)			Direction	Speed (Kts)			
18-2-81	0915	71.5	78.0	6-8	30.12	NE	15-20	60%	17°54.98'N	65°52.58'W
	1310	73.0	79.0	6-8	30.12	NE	20	35%	17°51.57'N	65°54.53'W
	1952	72.0	77.0	6-8	30.10	NE	20-25	40%	17°53.88'N	65°49.49'W
19-2-81	0012	73.0	78.0	4-6	30.14	NE	15-20	60%	17°55.79'N	65°51.53'W
	0300	72.0	77.0	4-6	30.10	NE	20	60%	17°55.62'N	65°53.85'W
	0810	71.0	79.0	4-6	30.10	NE	18	60%	17°56'N	65°52'W
	1245	71.0	78.0	6-8	30.10	NE	20-22	30%	17°54.55'N	65°52.20'W
	1550	71.0	80.0	4-6	30.09	NE	18	30%	17°53.91'N	65°54.75'W
	2035	71.0	78.0	2-4	30.10	NE	18	30%	17°55.01'N	65°55.67'W
20-2-81	0015	71.0	78.0	4-6	30.10	NE	18	30%	17°52.48'N	66°02.93'W
	0400	71.0	78.0	4-6	30.10	NE	18	30%	17°52.50'N	65°58.05'W
	0830	71.0	79.0	6-8	30.09	NE	20	30%	17°51.67'N	65°55.08'W
	1220	74.0	82.0	4-6	30.08	NE	10	30%	17°56.55'N	65°52.87'W
	1606	74.0	82.0	3-5	30.00	NE	6-10	40%	17°54.74'N	65°55.51'W
	1940	72.0	78.0	3-4	30.00	NE	10	30%	17°54.04'N	65°56.16'W
	2327	72.0	79.0	3-4	30.05	NE	5-10	20%	17°56.02'N	65°55.48'W
	0400	71.5	80.0	0	30.08	S	5-10	50%	17°58.09'N	65°49.07'W
21-2-81	0700	73.0	89.0	3-4	30.02	SE	10	50%	17°58.26'N	65°46.48'W
	1216	76.0	84.0	1-2	30.00	SE	10	30%	17°50.64'N	65°39.32'W
	1630	72.0	80.0	2-3	29.96	N	10	30%	17°55.79'N	65°52.42'W
	1954	72.0	86.0	3-4	29.99	NE	10	60%	17°54.81'N	65°43.28'W
	2354	73.0	80.0	0	29.99	-	0	30%	17°51.69'N	65°53.02'W
	0740	70.5	78.5	2-3	30.00	N-NW	4	30%	17°57.21'N	65°47.8'W
22-2-81	1148	74.0	86.0	0	29.94	-	0	30%	17°55.89'N	65°48.37'W
	1648	72.0	80.0	0	29.92	S	5	30%	17°53.69'N	65°49.17'W
	2010	76.0	82.0	0	29.95	E	6	0	17°56.35'N	65°49.15'W
	0050	71.5	78.0	0	29.90	NW	6	30%	17°53.28'N	65°46.62'W
	0445	73.0	82.0	0	29.95	NE	5	30%	17°51.24'N	65°47.98'W
23-2-81	0820	70.5	78.5	2-3	29.95	NW	10	0	17°54.90'N	65°50.59'W
	1225	74.0	84.0	2-3	29.96	S	10	60%	17°54.00'N	65°51.92'W
	1630	74.0	82.0	3-4	29.94	SE	5	60%	17°49.92'N	65°52.23'W
	2003	70.0	80.0	3-4	29.90	SE	10	30%	17°51.08'N	65°50.03'W
	0110	72.0	80.0	4-5	30.00	NE	15-20	30%	17°50.55'N	65°51.38'W
	0420	72.0	79.0	4-6	30.00	NE	15-20	30%	17°49.40'N	65°49.19'W
24-2-81	0825	69.0	76.0	2-3	29.96	NW	14	0	17°52.88'W	65°51.11'W

E. PROTEC-12
Post Cruise Report
and
Operations Log

March 31, 1981

TO: J. E. Vogt

FROM: Sandra L. Vargo
Florida Institute of Oceanography

SUBJECT: Post-cruise report for cruise PROTEC-12.

The following is a summary of the PROTEC-12 cruise on the R/V BELLOWS to Punta Tuna, Puerto Rico in the vicinity of 17°57'N and 65°48'W which took place from February 11 to March 5, 1981. The benchmark station was actually sampled from February 17 through February 24, 1981.

I. Purpose of cruise

The second quarterly sampling program at the OTEC benchmark site off Puerto Rico was carried out during this cruise. Physical, chemical and biological parameters were sampled at the benchmark location in the vicinity of 17°57'N, 65°48'W.

II. List of Participants

Scientific Personnel
D. Milliken, FIO
S. Vargo, FIO
T. Bryant, FIO
G. Vargo, USF
B. Calvert, USF
V. Hensley, USF
T. Hopkins, USF
T. Lancraft, USF
J. Low, UM

Ship's Personnel
B. Kelley
T. Hayes
R. Schultz

LBL Personnel
T. Jones

III. Safety

In case of emergency contact the following people:

William W. Behrens, Jr.	813/893-9100
Alan H. Purdy	"
Eugene Olson	"

The R/V BELLOWS meets all safety and operational requirements as outlined by the University-National Oceanographic Laboratory System (UNOLS). For details on safety equipment, vessel specifications, insurances, and master's license, see Appendix I. A safety radio check is made daily at 0930 local time (0830 EST).

IV. Chronological Summary

All times are AST unless otherwise indicated. GMT is AST plus 4 or EST plus 5.

<u>Date</u> 1981	<u>Time</u>	<u>Activity</u>
February 7	2200 (EST)	Departed Key West for San Juan, Puerto Rico
9	1030 (EST)	Cleared for Bahamas at Nassau
11	1600 (EST)	Anchored due to weather
12	0001 (EST)	Underway to San Juan
13	1300 (EST)	Anchored due to weather
13	2200 (EST)	Underway to San Juan
14	1700	Refueled on west coast of Puerto Rico
15	0200	Arrived San Juan
17	1600	Departed San Juan for benchmark location with scientific party on board
18	0430	Arrived at benchmark
18	0900	XBT (1000m) #1
18	0952-1002	Transmissometer profile - No trace
	1100-1142	<u>In vivo</u> fluorescence profile
	1234-1250	Quantum irradiance profile
	1349-1415	CTD profile-Unit not working
	1450	XBT (760m) #2
	1545-1820	Hydrocast to 1000m
	2100-2114	Bongo tow-25-0m #1 Night
	2130-2143	Bongo tow-25-0m #2 Night
	2145	XBT (760m) #3
	2157-2209	Bongo tow-25-0m #3 Night
	2221-2233	XBT (760m) #4 Night
19	0040-0145	Tucker trawl 25-0m, #1-Mistrawl
	0250-0356	Tucker trawl 25-0m, #2-Mistrawl
	0410	XBT (760m) #5
	0810-0825	Bongo tow 25-0m #1 Day
	0837	XBT (760) #6
	0843-0855	Bongo tow 25-0m #2 Day
	0907-0919	Bongo tow 25-0m #3 Day
	0930	XBT (760m) #7
	1015-1025	Bongo tow 25-0m #4 Day
	1035-1138	Bongo tow 200-25m #1 Day
	1150	XBT (760m) #8
	1300-1325	Bongo tow 200-25m #2 Day
	1310-1430	Tucker trawl 25-0m #1 Day
	1523	XBT (760m) #9
	1542-1645	Tucker trawl 25-0m #2 Day
	2055	XBT (1000m) #10
	2121-2213	<u>In vivo</u> fluorescence profile (120m)
	2245-2255	CTD profile-still not working
	2317	CTD tried again-still no depth signal
20	2345-0140	Hydrocast-1000m
	0855	XBT (760m) #11
	0910-1040	Tucker trawl 200-25m #1 Day
	1110	XBT (760m) #12
	1130-1312	Tucker Trawl 200-25m #2 Day
	1330-1457	Tucker trawl 200-25m #3 Day

<u>Date</u> 1981	<u>Time</u>	<u>Activity</u>
February 20	1505	XBT (760m) #13
	1521-1707	Tucker trawl 200-25m #4 Day
	1710	XBT (760m) #14
	1930-2025	Tucker trawl 25-0m #1 Night
	2028	XBT (760m) #15
	2047-2147	Tucker trawl 25-0m #2 Night
	2154-2257	Tucker trawl 25-0m #3 Night
	2302	XBT (760m) #16
21	2314-0023	Tucker trawl 25-0m #4 Night
	0120-0141	Bongo tow 200-25m #1 Night
	0223-0244	Bongo tow 200-25m #2 Night
	0250	XBT (760m) #17-Stopped short
	0255	XBT (760m) #18-Repeat
	0308-0330	Bongo tow 200-25m #3 Night
	0335	XBT (760m) #19-Stopped at 500m
	0340	XBT (760m) #20-Repeat
	0359-0419	Bongo tow 200-25m #4 Night
	0739-0833	Tucker trawl 25-0m #3 Day
	0845	XBT (760m) #21-Bad probe
	0858-0945	Tucker trawl 25-0m #4 Day
	0959	XBT (760m) #22
	1050-1330	Tucker trawl 600-200m #1 Day
	1420-1442	Bongo tow 200-25m #1A Day
	1447	XBT (760m) #23
	1501-1525	Bongo tow 200-25m #2A Day
	1541-1601	Bongo to 200-25m #3 Day
	1605	XBT (760m) #24
	1622-1642	Bongo tow 200-25m #4 Day-Catch small
	1701-1722	Bongo tow 200-25m #5 Day
	1942-2015	Tucker trawl 200-25m #1 Night
	2035	XBT (760m) #25
	2044-2117	Tucker trawl 200-25m #2 Night
22	2338-0117	Tucker trawl 200-25m #3 Night
	0130-0258	Tucker trawl 200-25m #4 Night
	0310	XBT (760m) #26
	0740-0935	Bongo tow-1000-600m #1 Day-Nets did not fish
	0945-1122	Bongo tow 1000-600m #2 Day
	1230	XBT (1000m) #27
	1250	Tucker trawl 1000-600m #1 Day
	1735-1823	Bongo tow 1000-600m #3 Day-Nets closed at 100m, bad tow
	2005-2230	Bongo tow 1000-600m #1 Night
	2250	Bongo tow-aborted hydrowire sawed through block
	2400-0222	Bongo tow 1000-600m #2 Night
23	0225	XBT (1000m) #28
	0238-0549	Tucker trawl 1000-600m #1 Night
	0740-0855	Bongo tow 600-200m #1 Day
	0905-1026	Bongo tow 600-200m #2 Day
	1035	XBT (1000m) #29
	1150-1425	Tucker trawl 600-200m #1 Day
	1455-1730	Tucker trawl 1000-600m #2 Day
	1850	XBT (1000m) #30
	1940-2052	Bongo tow 600-200m #1 Night
	2105-2230	Bongo tow 600-200m #2 Night

<u>Date</u>	<u>Time</u>	<u>Activity</u>
1981		
February 23	2235	XBT (100m) #31
24	2310-0145	Tucker trawl 600-200m #1 Night
	0210-0420	Tucker trawl 600-200m #2 Night
	0720-0930	Bongo tow 1000-600m #4 Day
	0944-0949	LBL Bongo tows 25-0 #1 (x1)
	0958-1003	LBL Bongo tows 25-0 #2 (x2)
	1020	XBT (760m) #32
	1028-1031	LBL Bongo tows 25-0m #3 (x3)
	1040-1045	LBL Bongo tows 25-0m #4 (x4)
	1131-1136	LBL Bongo tows 25-0m #5 (x5)
	1143-1147	LBL tows 25-0m #6 (x6)
	1200	Depart Pta. tuna area for San Juan
	2030	Arrived San Juan
	25	Offload scientific personnel
	26	0600-2100 Refueled and took on water
		2100 Departed San Juan for Miami
	27	Underway
	28	Underway
March	1	Underway
	2	Underway
	3	1100 Requested by Bahamian Patrol boat to clear at Great Exuma
		1400 Arrived Great Exuma
		1700 Departed Great Exuma
	4	1800 Arrived University of Miami dock

V. OPERATIONS LOG

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Station	Date 1981	TIME (AST) GMT in Paren.	POSITION	OPERATION
Benchmark	Feb. 18	0900(1300)	17°54.98'N 65°52.58'W	XBT (t5) #1 (T5-1830m Max.)
		18 0952(1352)	17°53.85'N 65°54.20'W	Transmissometer down
		1002(1402)		Trans. up-no trace
		1100(1500)	17°53.28'N 65°54.04'W	<u>In vivo</u> profile started (fix confirmed 1020 (1420))
		1115(1515)		At 127m 1115
		1118(1518)		Started up, 10m steps
		1142(15-12)		Profile completed, hose up
		1234(1634)	17°46.0'N 65°58.5'W	Start light profile (70m) - 5m intervals
		1250(1650)		Light profile complete
		1349(1749)		CTD in water
		1415(1815)		CTD aborted-sensor not working
		1450(1850)	17°51.55'N 65°55.90'W	XBT (T7) (Sat fix 1406(1806) #2 (T7-760m max.)
		1545(1945)	17°42'N 65°50'W	Hydrocast-biocast-started down
		1713(2113)		Hydrocast started up
		1820(2220)		Hydrocast out
				Bottles at 0m, 1m, 5m, 10m, 20m, 30m, 40m, 50m, 60m, 75m, 100m, 150m, 200m, 300m, 400m, 500m, 600m, 800m, and 1000m.
				Temperature, salinity, dissolved oxygen, and nutrient samples-all depths
				Chlorophyll, ATP, and phytoplankton samples-all depths from 0m to 300m
				Productivity- 0m, 1m, 5m, 10m, 40m, and 75m
		2100(0100)	17°53.88'N 65°49.49'W	Bongo tow (N) #1 25-0m N
		(open 2104)		
		2114 up AST		
		2130(in 2132 open)	17°54'N 65°50'W	Bongo 25m (N) #2
		2142 clsd 2143 up		Bongo out N
		2145(0145)	17°54'N 65°50'W	XBT(T7) #3
		2157(0157)open	17°54.14'N 65°50.02'W	Bongo 25-0 #3 N
		2209(0209)clsd		

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V. OPERATIONS LOG

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Station	Date 1981	TIME (AST) GMT in Paren.	POSITION	OPERATION
Benchmark	Feb. 18	2221(0221)open	17°53'N 65°51'W	Bongo 25-0 #4 N
		2233(0233)clsd		
		2235(0235)	17°53'N 65°51'W	XBT (T7) #4
	19	0040(0440)	17°55.79'N 65°51.53'W	Tucker 25-0 #1
		0145(0545)		out-mistrawl
		0250(0650)	17°53.65'N 65°57.40'W	Tucker 25-0 #2
		0356(0756)	17°55.62'N 65°53.85'W	Out-mistrawl
		0410(0710)	17°54.72'N 65°55.70'W	XBT (T7) #5
		0810(1210)	17°56'N 65°52'W	Bongo tow 25-0 #1 D Out
		0825(1225)		Bongo in
		0837(1237)	17°56'N 65°52'W	XBT (T7) #6
		0843(1243)	17°56'N 65°52'W	Bongo out #2 0-25m Nets open
		0855(1255)	17°56'N 65°52'W	Bongos in
		0907(1307)	17°56'N 65°52'W	Bongos in #3 0-25m
		0909(1309)		Nets open
		0910(1319)		Bongos out
		0930(1330)	17°46'N 65°55'W	XBT (T7) #7
		1015(1415)	17°46'N 65°51'W	Bongo tow #4 0-25m-nets in
		1016(1416)		Nets open
		1025(1425)		Nets closed and out
		1035(1435)	17°46'N 65°51'W	Bongo tow #1 200-25m-nets in water
		1048(1448)		Nets open
		1138(1538)		Bongos closed
		1150(1550)	17°51'N 65°57'W	XBT(T7) #8
		1300(1700)	17°54.55'N 65°52.20'W	Bongo tow 200-25m #2-nets in water
			Sat Nav Fix 1250	
		1306(1706)		Nets opened at 200m
		1323(1723)		Nets closed at 25m
		1325(1725)		Nets on deck
		1310(1710)in	17°55.07'N 65°53.28'W	Tucker 25-0 D #1
		1430(1830)out	17°54.38'N 65°53.42'W	
		1523(1923)	17°53.91'N 65°54.75'W	XBT (T7) #9
		1641(2042)in	17°54'N 65°54'W	Tucker trawl 25 D #2
		1645(2045) out		

V. OPERATIONS LOG

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Station	Date 1981	TIME (AST) GMT in Paren.	POSITION	OPERATION
Benchmark	Feb. 19	2055(0155)	17°54.70'N 65°56.57'W	XBT(T5) #10
		2121(0121)	17°54.46'N 65°57.26'W	In vivo fluorescence profile - start-max depth 120m
		2213(0213)		Fluorescence profile complete
				Sighted 1 needlefish - 24"
		2245(0245)		CTD profile-descent started
		2248(0248)		Descent stopped-not recording depth
		2255(0255)		CTD on deck-removed plugs in bottom
		2317(0317)		Tried CTD again, still no depth signal
				CTD cast aborted
		2345(0345)	17°55.72'N 65°51.30'W	Hydrocast to 100m-started down
	20	0036(0436)		Cast down, 15 min. Soak time
		0052(0452)		Messenger dropped
				Bottles at 0m, 1m, 5m, 10m, 20m, 30m, 40m, 50m, 60m, 75m, 100m, 150m, 200m, 300m, 400m, 500m, 600m, 800m, and 1000m
				Temperature, salinity, dissolved oxygen, and nutrient samples-all depths
				Chlorophyll, ATP, and phytoplankton samples,-all depths from 0m to 300m.
				Productivity-0m, 1m, 5m, 10m, 40m, and 75m
		0100(0500)		Cast started up
		0140(0540)		Cast up
				Redid bottle 21 to 50m
		0200(0600)		All bottles in
		0855(1255)	17°51.67'N 65°55.08'W	XBT(T7) #11
		0910(1310) in	17°51.67'N 65°55.08'W	Tucker D200 #1
		1040(1440) out		
		1110(1510)	17°53'N 65°54'W	XBT (T7) #12
		1130(1530)	17°56'N 65°52'W	Tucker 200 #2 D
		1312(1712)		
		1330(1730)	17°56.37'N 65°53.70'W	Tucker 200 #3D
		1457(1857)		
		1505(1905)	17°54'N 65°55'W	XBT (T7) #13
		1521(1921) in	17°54.74'N 65°55.54'W	Tucker 200 #4 D
		1707(2107) out		

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V. OPERATIONS LOG

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Station	Date 1981	TIME (AST) GMT in Paren.	POSITION	OPERATION
Benchmark	Feb. 20	1650(2150)		Birds sighted in distance, possibly working a school of fish (G.V.)
		1630(2130)		2 tan sea birds seen off starboard (S.L.V.)
		1710(2110)	17°54.74'N 65°55.54'W	XBT (T7) #14
		1930(0130)	17°54.04'N 65°56.16'W	Tucker 25N #1
		2025(0025)		
		2028(0028)	17°56.91'N 65°50.75'W	XBT (T7) #15
		2047(0047) in	17°56.94'N 65°50.79'W	Tucker 25N #2
		2147(0147) out		
		2154(0147) in	17°56.87'N 65°51.20'W	Tucker 25N #3
		2257(0257) out		
		2302(0302)	17°56.12'N 65°54.57'W	XBT (T7) #16
			Sat Nav fix 0238 Z	
		2314(0314) in	17°56.05'N 65°55.40'W	Tucker 25M N #4
	21	0023(0423) out	17°55.03'N 65°58.08'W	
		0131(0531)		Bongo tow 200-25m #1 nets open
		0141(0541)	17°59.09'N 65°44.74'W	Nets closed
		0223(0623)		Bongo tow 200-25m #2
		0244(0644)	17°58.79'N 65°44.60'W	Nets closed
		0250(0650)	18°0.02'N 65°41.04'W	XBT (T7) #17 Stopped short-repeated
		0255(0655)		XBT (T7) #18
		0308(0708)	18°0.62'N 65°39.31'W	Bongo tow 200-25m #3
				Nets open
				Nets closed
		0335(0735)	18°1.93'N 65°35.50'W	XBT (T7) #19 Stopped at 500m
		0340(0740)	18°1.93'N 65°35.50'W	XBT (T7) #20
		0359(0859)	17°58.09'N 65°49.07'W	Bongo tow 200-25m #4
		0419(0919)		Nets open
				Nets closed
		0739(1139)	17°59.76'N 65°42.53'W	Tucker 0-25 D #3
		0833(1239)		
		0845(1245)	17°59'N 65°42'W	XBT (T7) #21 problem trace, bad probe?
		0858(1258)	17°55.15'N 65°52.48'W	Tucker 0-25 D #4
		0945(1345)		2 porpoise sighted-1 answered to Flipper
		0959(1359)	17°55'N 65°52'W	XBT (T7) #22
		1045(1445)	17°51.50'N 65°42.50'W	1 porpoise-rode the bow wave 3-4 min.

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V. OPERATIONS LOG

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Station	Date 1981	TIME (AST) GMT in Paren.	POSITION	OPERATION
Benchmark	Feb. 21	1050(1450)in	17°56.81'N 65°52.20'W	Tucker 600 D #1
		1330(1730)out		
		1420(1820)	17°56.81'N 65°52.20'W	Bongo tows 200-25m Nets open Tow #1A Nets closed
		1442(1842)		XBT (T7) #23
		1447(1847)	17°55.43'N 65°55.25'W	Bongo tow 200-25m
		1501(1901)	17°55.22'N 65°55.71'W	Nets open Tow #2A Nets out
		1521(1921)		Bongo tow 200-25m
		1525(1925)		Nets opened Tow #3 Nets closed
		1541(1941)	17°56.52'N 65°50.80'W	XBT (T7) #24
		1601(2001)		Bongo tow 200-25m Nets opened Tow #4 Nets closed catch small, repeated tow
		1605(2005)	17°56.14'N 65°51.62'W	Bongo tow 200-25m
		1622(2022)	17°55.88'N 65°52.20'W	Nets opened Tow #5 Nets closed
		1642(2042)		Tucker trawl 200-25m #1 Night
		1701(2201)	17°55.06'N 65°54.01'W	
		1722(2222)	17°55.06'N 65°54.01'W	
		1942(2342)	17°55'N 65°43'W	
		2015(0015)		
		2035(0335)	17°52.10'N 65°52.72'W	XBT(T7) #25
		2044(0444)	17°52.05'N 65°49.92'W	Tucker trawl 200-25m #2 Night
		2325(0325)		Tucker out
		2338(0338)in	17°52.11'N 65°52.72'W	Tucker trawl 200-25m #3 Night
		0117(0517)out		
	22	0130(0530)	17°56.25'N 65°50.02'W	Tucker trawl 200-25m #4 Night
		0258(0658)		
		0310(0710)	17°56.25'N 65°50.02'W	XBT (T7) #26
		0740(1140)	17°56.03'N 65°48.68'W	Bongo tow 1000-600m #1 Nets in water Nets open Nets closed
		0815(1215)		Nets on deck-nets did not fish!
		0900(1300)		
		0935(1335)		

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V. OPERATIONS LOG

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Station	Date 1981	TIME (AST) GMT in Paren.	POSITION	OPERATION
B-143	Feb. 22	0945(1345)	17°56.20'N 65°49.13'W	Bongo tow 1000-600m #2
		1038(1438)		Nets in water
		1122(1522)		Nets open
				Nets closed
				Nets on deck
		1230(1630)	17°55.04'N 65°49.44'W	XBT (T5) #27
		1250(1650)	17°55.11'N 65°49.00'W	Tucker trawl 1000 #1 Day
		1515(1915)		
		1735(2235)	17°53.88'N 65°47.90'W	Bongo tow 1000-600m Tow #3
				Nets open
		1823(2223)		Nets closed - bad cast, nets closed at 100m
		1630(2030)		White-bellied bobby sighted
		2005(0005)	17°56.53'N 65°48.58'W	Bongo tow 1000-600m Tow #1 Night
		2055(0055)		Nets open
		2143(0143)		Nets closed
		2230(0230)		Nets on deck
		2250(0250)		Bongo tow 1000-600m Tow #2
	23	2400(0400)	17°53.28'N 65°46.62'W	Tow aborted, hydrowire sawed through block
		0058(0458)		Bongo tow 1000-600m Tow #2-repeat of above
		0138(0538)		Nets opened
		0222(0622)		Nets closed
		0225(0625)	17°52.96'N 65°50.92'W	Nets out
		0238(0638) in	17°54.18'N 65°49.29'W	XBT (T5) #28
		0549(0949) out		Tucker 1000 #1 N
		0740(1140)	17°54.90'N 65°50.58'W	Bongo tow 600-200m Tow #1
		0815(1215)		Nets in
		0844(1244)		Nets open
		0855(1255)		Nets closed
				Nets out
				Bongo tow 600-200 Tow #2
		0905(1305)	17°53.83'N 65°54.77'W	Nets in
		0939(1339)		Nets open
		1016(1416)		Nets closed
		1026(1426)		Nets out

V. OPERATIONS LOG

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Station	Date	TIME (AST)	POSITION	OPERATION		
	1981	GMT in Paren.				
Benchmark	Feb.	23	1035(1435)	17°53.85'N 65°54.56'W	XBT (T5) #29	
			1150(1550)	17°53.57'N 65°50.49'W	Tucker 600 #1 D	
			1425(1825)			
			1455(1855)	17°49.43'N 65°53.58'W	Tucker 1000 #2 D	
			1730(2130)			
			1725(2125)	17°49'N 65°53'W	75 <u>Cocos nucifera</u> var. <u>pelagicus</u> sighted	
			1850(2250)	17°50.30'N 65°51.91'W	XBT (T5) #30	
					Bongo tow 600-200m Tow #1	
			1940(2340)	17°51.09'N 65°50.93'W	Nets in	
			2007(0007)		Nets open	
			2041(0041)		Nets closed	
			2052(0052)		Nets out	
					Bongo tow 600-200m Tow #2	
			2105(0105)	17°53.60'N 65°49.94'W	Nets in	
			2135(0135)		Nets open	
			2215(0215)		Nets closed	
			2230(0230)		Nets out	
			2235(0235)	17°53'N 65°49'W	XBT (T5) #31	
			2310(0310) in	17°50.09'N 65°50.92'W	Tucker 600 #1 N	
		24		0145(0545) out		
				0210(0610)	17°49.48'N 65°50.31'W	Tucker 600 #2 N
				0420(0820)		
						Bongo tow 1000-600m Tow #4
			0720(1120)	17°52.91'N 65°51.15'W	Nets in	
			0822(1222)		Nets opened	
			0855(1255)		Nets closed	
			0930(1330)		Nets out	
			0944(1344)	17°52.43'N 65°54.93'W	LBL tow 25-0m #1 (Sample x1) Nets opened	
			0949(1349)		Nets closed	
			0958(1358)	17°52.13'N 65°54.57'W	LBL tow 25-0m #2 (Sample x2) Nets opened	
			1003(1403)		Nets closed	
			1020(1420)	17°53.13'N 65°54.57'W	XBT (T7) #32	
		1023(1428)	17°53.71'N 65°54.07'W	LBL Tow #3 (Sample x3) Nets opened		
		1031(1431)		Nets closed		
		1040(1440)		LBL Tow #4 (Sample x4) Nets opened		
		1045(1445)		Nets closed		

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V. OPERATIONS LOG

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Station	Date	TIME (AST)	POSITION	OPERATION
	1981	GMT in Paren.		
Benchmark	Feb. 24	1131(1531)	17 58.5'N 65 53'W	LBL Tow #5 (Sample x5) Nets open
		1136(1536)		Nets closed
		1143(1543)		LBL Tow #6 (Sample x6) Nets open
		1147(1547)		Nets closed

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VI. Track chart

All operations were carried out in the vicinity of 17°57'N and 65°48'W.

VII. Problem Areas

Transmissometer	The instrument malfunctioned and gave no useable trace. Checks were made at sea of connections and leads but this did not solve the problem. The electronics technician at USF is checking this out.
CTD	The instrument gave no depth trace. The electronics technician at USF was consulted by radio and some test procedures run. None of this solved the problem. The technician checked the instrument when we returned and found the depth circuit blown. This has been removed and returned to the manufacturer for repair.
PDR	The PDR was giving a double very faint trace. The problem appears to have been bad styluses. A replacement supply of these will be placed on board and the marine technician instructed in replacement procedures.
Bongo nets	On the deep tows (1000-600m) there was initially difficulty getting the nets to open and close properly. This was attributed to the configuration the wire was assuming at depth and was solved by using heavier messengers.
Tucker trawl	The depth transducer had a small leak which was repaired at sea. During the last trawl conducting cable caught in the winch gears and broke some leads. This bad cable is being snipped off and a new electromechanical termination made.
Hydroblock	This block was too large for 3/16" hydrowire and the long deep tows to 1000m put sufficient strain on it that the hydrowire sawed through it. A large trawl block was used as an emergency replacement. Permanent replacements are planned sized for 3/16" hydrowire.

APPENDIX C

Data Report - PROTEC-13

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INTRODUCTION

The PROTEC benchmark site off the southeast coast of Puerto Rico at approximately $17^{\circ}57'N$ and $65^{\circ}48'W$ was occupied during the third and final quarterly cruise (PROTEC-13) from May 9, 1981 to May 15, 1981. During PROTEC-13 all scheduled sampling was completed with the exception of two of the four replicate day midwater trawls from 25-0m. Specific dates and times are shown in the Operations Log of the Post-Cruise Report (Section E, Appendix C). The specific sampling locations are shown on the cruise track (Figures 1, 2 and 3). The data collected is tabulated in the following sections with the principal investigator responsible indicated in parentheses next to the heading.

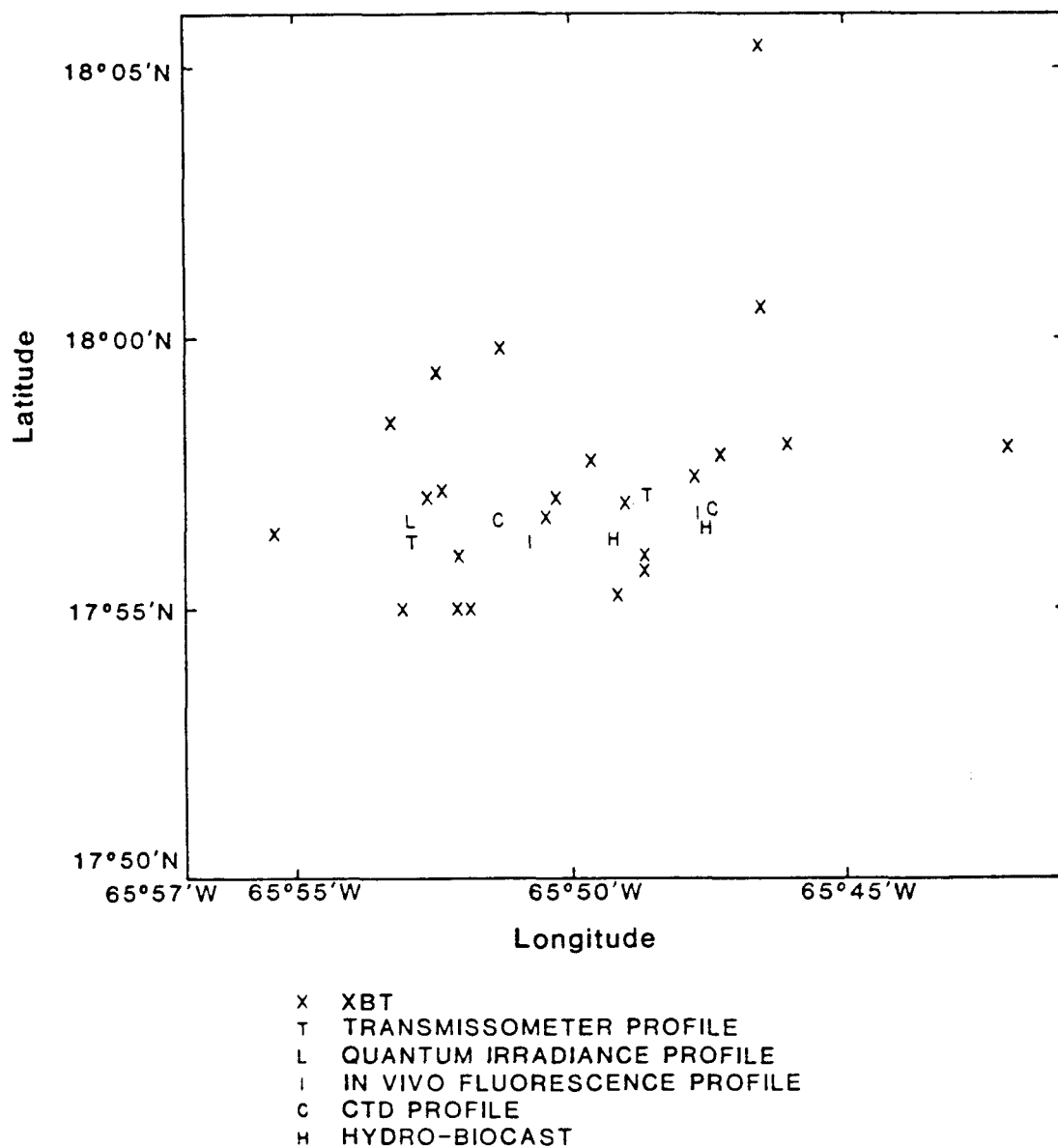


Figure 1. The XBT, transmissometer, quantum irradiance, in vivo fluorescence, CTD, and hydro-bioblast sample locations on PROTEC-13.

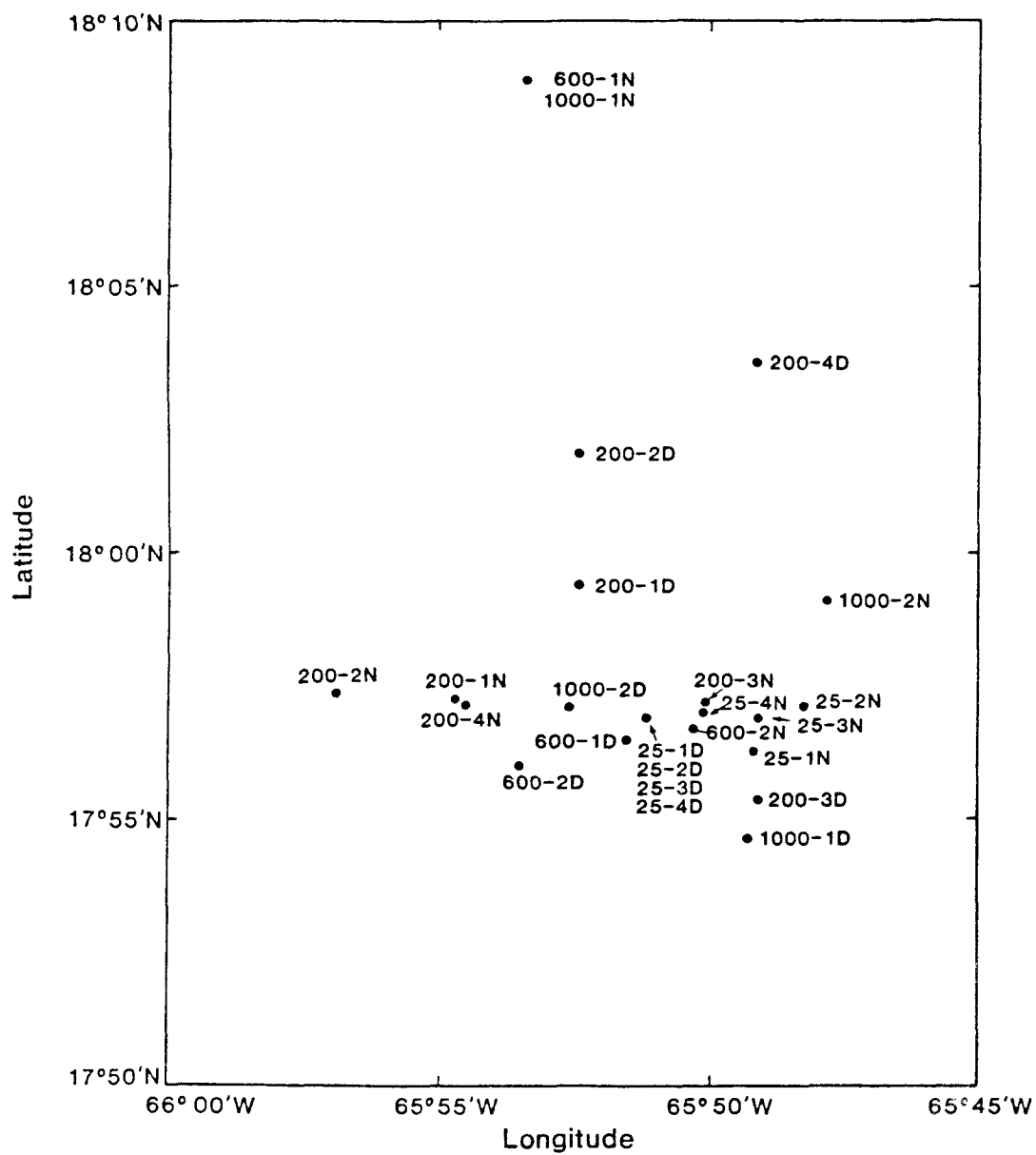


Figure 2. Zooplankton tow locations for PROTEC-13

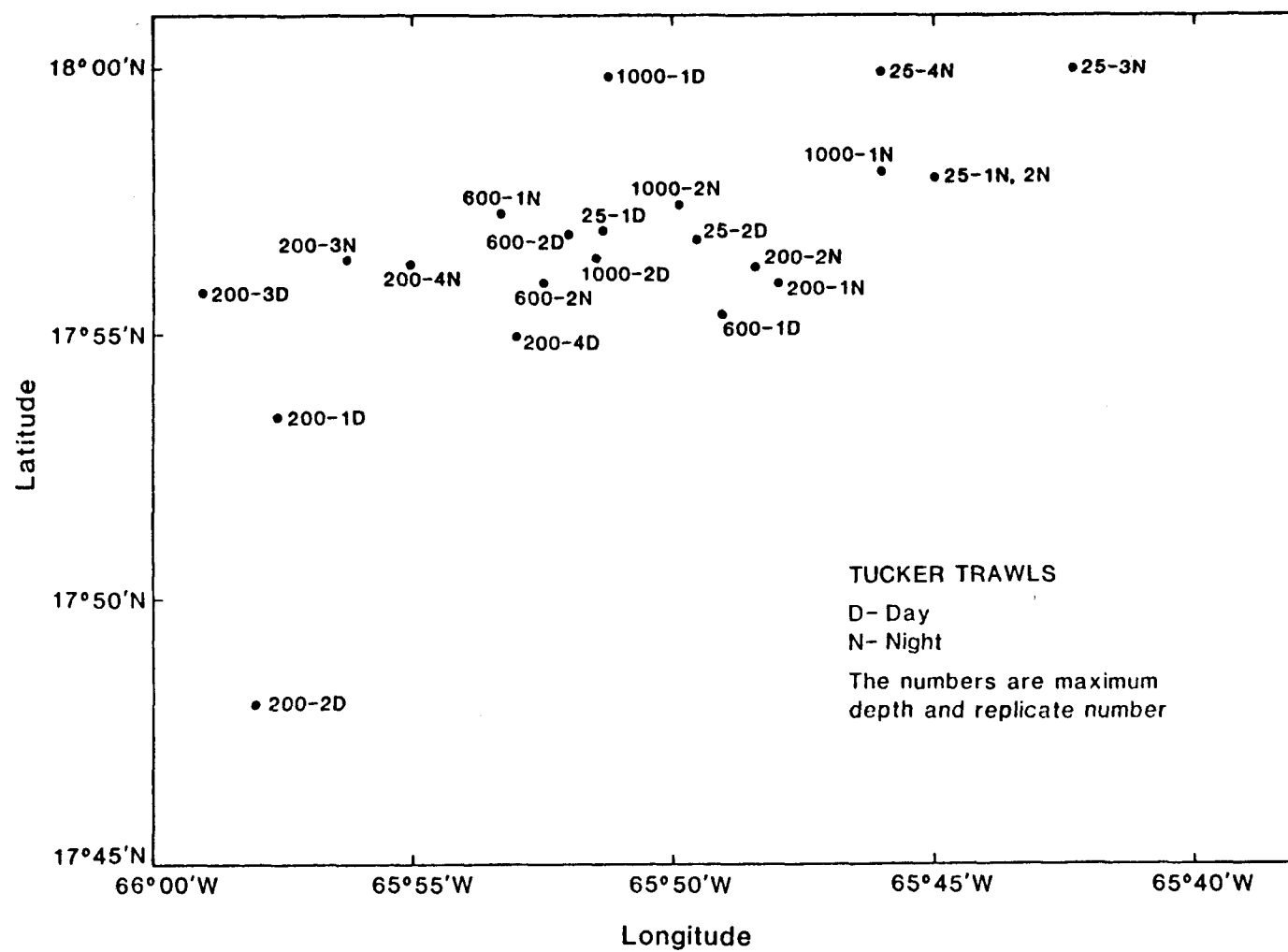


Figure 3. The tucker trawl locations for PROTEC-13

A. Physical Measurements (S. Vargo)

1. Conductivity-Temperature-Depth (CTD) Profiles

During PROTEC-13 the graphical output on the Grundy/Plessey 9051 CTD unit malfunctioned as there was no temperature trace. The graphical output was backed up by a recording of the acoustic signal from the instrument. However, the quality of this recording was insufficient and no temperature, conductivity, and depth trace could be obtained from the recording. Therefore, the only temperature and salinity profiles with depth for PROTEC-13 are those from the two hydro-bicasts.

2. Expendable Bathythermograph (XBT) Profiles

The XBT unit malfunctioned during the cruise. Although the calibration of the unit checked out, an accurate temperature was not obtained below 25m. Figures 4 and 5 show the XBT traces taken in conjunction with the 1000m hydro-bicasts. Below about 200m the difference between the true temperature and XBT profile was approximately 9°C. However, the thermocline between 25-60m does not show on the profiles. The XBT unit has been returned for a complete overhaul to the manufacturer.

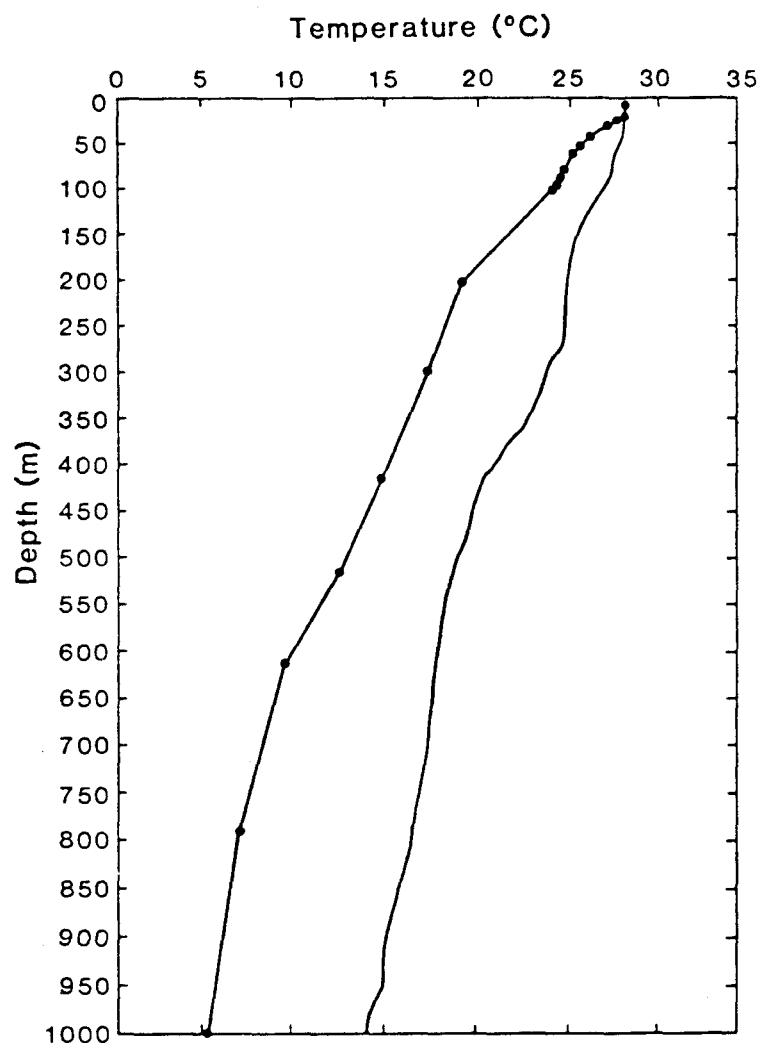


Figure 4. The 2000m XBT trace compared with the reversing thermometer data (.) from the 1000m day hydrobiocast (PROTEC-13) taken May 9, 1981 at 1610 AST.

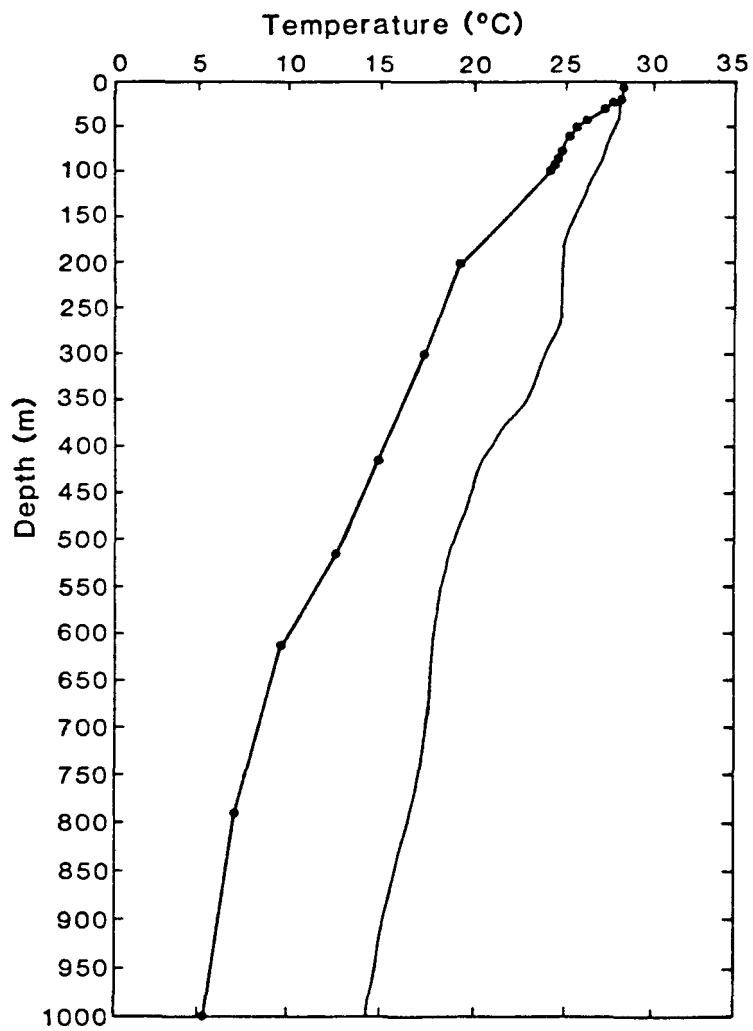


Figure 5. The 1000m XBT trace compared with the reversing thermometer data (.) from the 1000m night hydrobiocast (PROTEC-13) taken May 10, 1981 at 2340 AST.

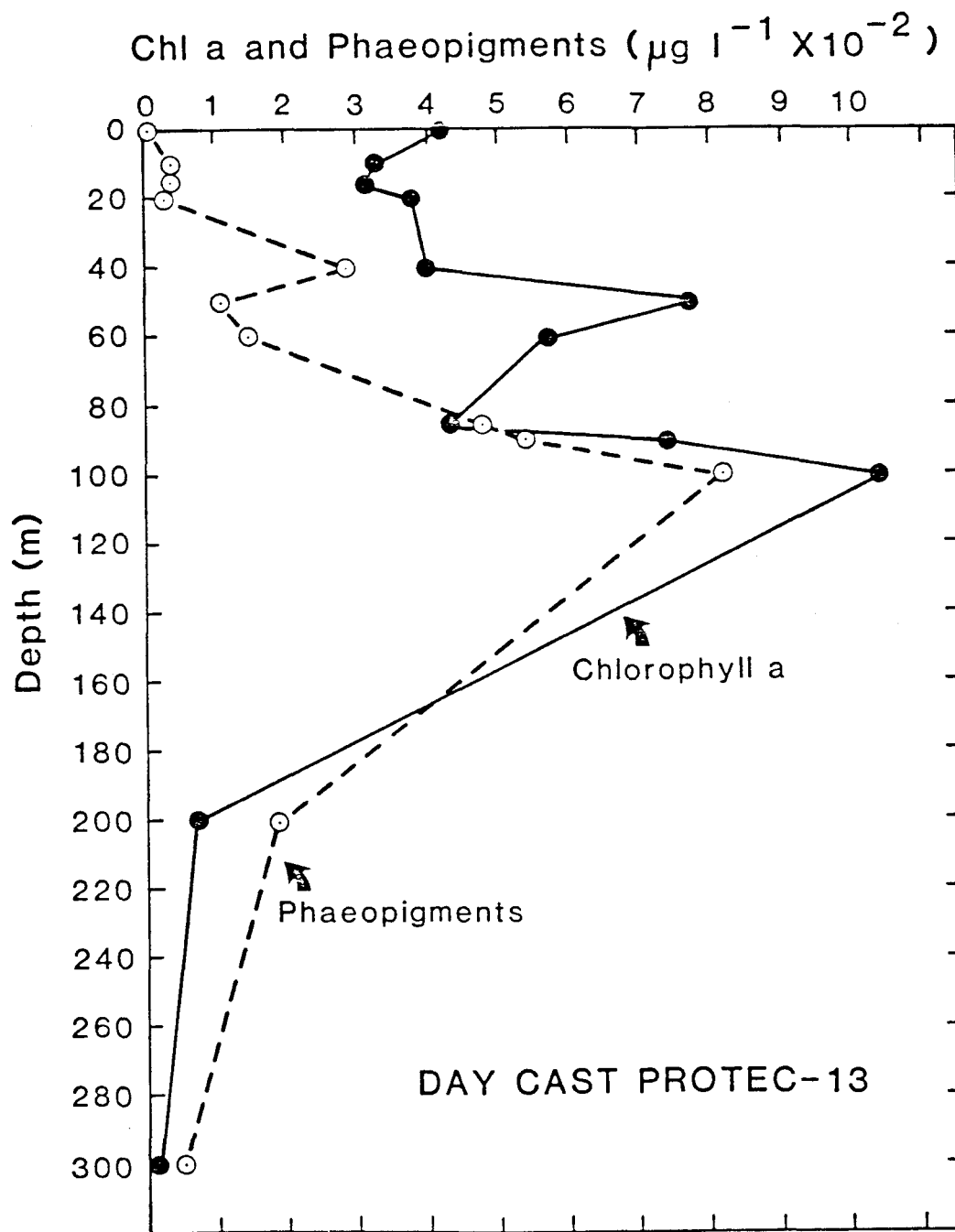


Figure 6

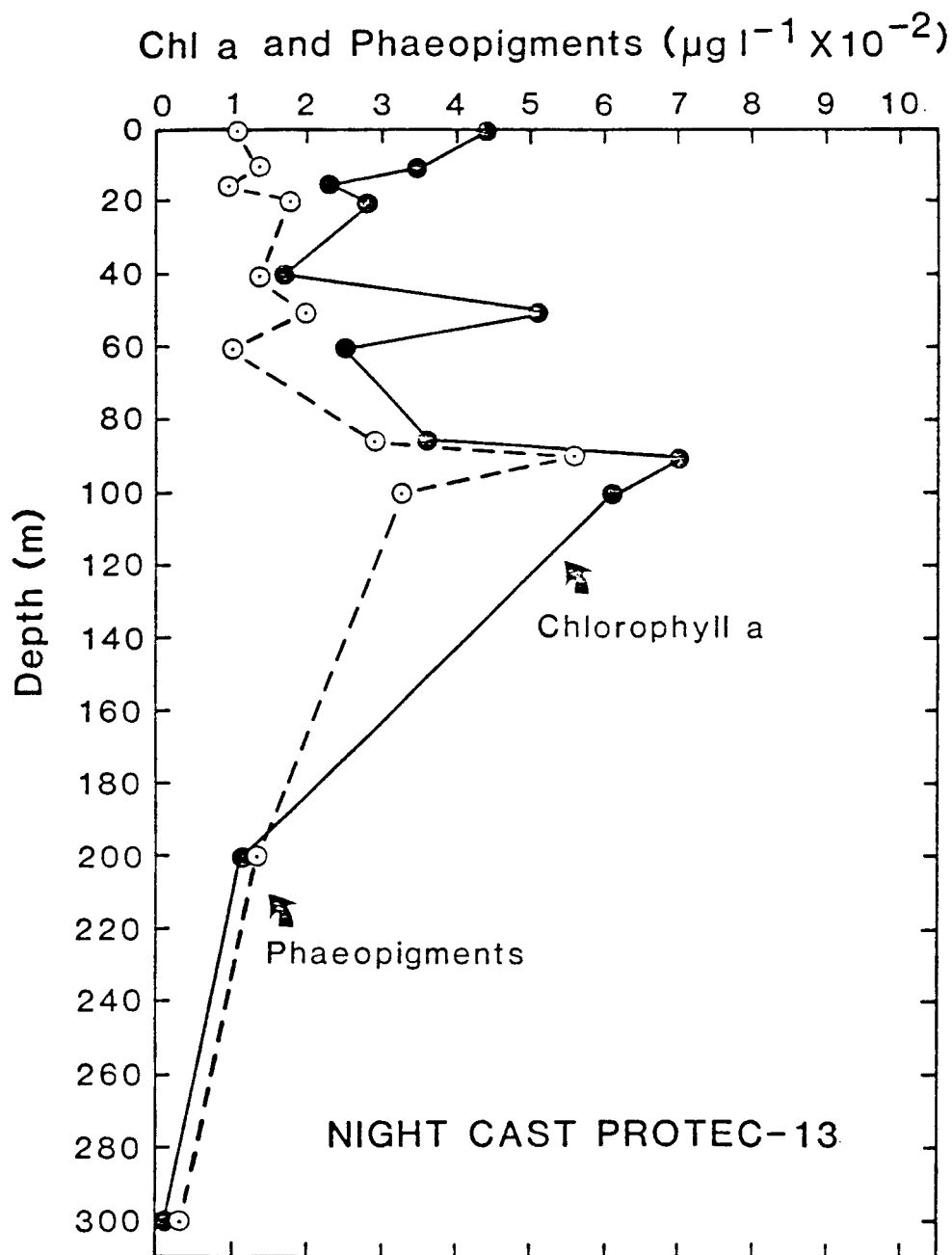


Figure 7

3. Temperature and Salinity

The day and night combined biocast and hydrocasts to 1000m were both completed on PROTEC-13. The temperature data from the reversing thermometers is shown in Table 1 and Table 2. True depths calculated from the unprotected thermometer readings are shown below 100m. Above 100m unprotected thermometer readings are not sufficiently different from protected readings to allow calculation of true depth. The termometric (true) depths are subject to a variety of errors. These inherent errors may result in a variation from actual depth to $\pm 5m$, and are due to limits of $0.01^{\circ}C$ readability on the main thermometers, movement of the thermometers over a temperature gradient due to ship motion (particularly true for 100 and 200m depths), and deviations of local density fields from the North Atlantic densities used in calculations on the Culbertson slide rule. The uneven deviations of true depths from nominal depths are probably due to a 1-2% error in the metering system and slippage during rapid lowering. During PROTEC-13 nineteen depths were sampled; 0, 10, 15, 20, 30, 40, 50, 60, 75, 85, 90, 100, 200, 300, 400, 500, 600, 800, and 1000m.

Temperature, salinity, and sigma-t values for each temperature and salinity were calculated according to the methods in U.S. Navy Hydrographic Office Publication No. 614 - Processing Oceanographic Data. The temperature and sigma-t values indicate the depth of the mixed layer is between 20 and 30m.

Table 1. Temperature (°C) and True Depth (m), Daycast PROTEC-13.

Bottle Number	Corrected Temperature (°C)			Depth (m)	
	Left (P)	Middle (P)	Right (U)	Nominal	True
16	28.08	28.05	-	Surface	Surface
17	28.05	28.05	-	10	10
18	28.06	28.04	-	15	15
19	99.99	27.73	-	20	20
3	27.30	27.30	-	30	30
4	26.39	26.39	-	40	40
20	25.64	25.64	-	50	50
21	25.18	25.21	-	60	60
5	24.95	24.93	-	75	75
22	24.78	24.78	-	85	85
6	24.69	24.72	-	90	90
7	24.03	24.02	24.94	100	118.2
8	99.99	19.30	21.08	200	208.5
9	17.48	17.47	19.98	300	297.5
11	14.95	15.02	18.46	400	414.0
12	12.73	12.71	17.04	500	516.2
13	99.99	9.83	15.35	600	612.0
14	7.25	7.29	13.88	800	787.0
15	5.35	5.38	13.85	1000	1000.0

99.99 - Thermometer malfunction

- - No thermometer present

Table 2. Temperature (°C) and True Depth (m), Nightcast PROTEC-13.

Bottle Number	Corrected Temperature (°C)			Depth (m)	
	Left (P)	Middle (P)	Right (U)	Nominal	True
16	27.92	27.88	-	Surface	Surface
17	28.00	28.01	-	10	10
18	28.01	28.01	-	15	15
19	28.01	28.01	-	20	20
3	27.99	27.99	-	30	30
4	26.99	27.01	-	40	40
20	26.36	26.36	-	50	50
21	25.76	25.76	-	60	60
5	25.33	25.33	-	75	75
22	25.05	25.05	-	85	85
6	24.87	24.86	-	90	90
7	24.44	24.44	25.34	100	107.2
8	19.17	18.93	20.72	200	195.6
9	17.22	17.18	20.49	300	306.0
2	14.03	14.03	17.75	400	410.5
13	11.48	11.46	15.76	500	511.0
10	9.70	9.69	15.24	600	612.5
14	7.27	7.27	13.91	800	791.0
11	5.61	5.61	14.26	1000	1026.0

Table 3. Temperature ($^{\circ}\text{C}$), Salinity (o/oo), and Sigma-t values, Daycast, PROTEC-13.

True Depth (m)	Temperature ($^{\circ}\text{C}$)	Salinity (o/oo)	Sigma-t (G_t)
Surface	28.07	36.03	23.17
10	28.05	36.08	23.21
15	28.05	36.03	23.17
20	27.73	36.19	23.40
30	27.30	36.09	23.46
40	26.39	36.24	23.87
50	25.64	36.43	24.24
60	25.20	36.53	24.46
75	24.94	36.67	24.64
85	24.78	36.73	24.73
90	24.71	36.76	24.78
118.2	24.02	36.91	25.10
208.5	19.30	36.66	26.23
297.5	17.48	36.50	26.56
414.0	14.99	36.01	26.77
516.2	12.72	35.69	27.00
612.0	9.83	35.21	27.16
787.0	7.26	34.97	27.38
1000.0	5.37	35.15	27.77

Table 4. Temperature ($^{\circ}\text{C}$), Salinity (o/oo), and Sigma-t values, Nightcast, PROTEC-13.

True Depth (m)	Temperature ($^{\circ}\text{C}$)	Salinity (o/oo)	Sigma-t (G_t)
Surface	27.90	35.30	22.67
10	28.00	36.04	23.20
15	28.01	36.05	23.20
20	28.01	36.12	23.25
30	27.99	36.08	23.23
40	27.00	36.15	23.60
50	26.36	36.26	23.89
60	25.76	36.50	24.26
75	25.33	36.49	24.38
85	25.05	36.62	24.57
90	24.87	36.72	24.70
107.2	24.44	36.80	24.89
195.6	19.05	36.60	26.25
306.0	17.20	36.39	26.55
410.5	14.00	35.86	26.86
511.0	11.47	35.58	27.16
612.5	9.70	35.19	27.17
791.0	7.25	34.93	27.35
1026.0	5.61	34.92	27.56

B. Chemical Measurements (K. Fanning)

The chemical data from the hydrocast-biocast samples for PROTEC-13 are shown in Tables 5 and 6. The quality control data for the nutrient analyses is shown in Table 7. The filtered versus unfiltered data will be discussed in the final report.

Table 5. Chemical Data from Hydrocast #1 (Day Cast), Cruise #3, PROTEC 13. Position 17°54'N, 65°54'W. All values are averages of duplicates except those marked with an asterisk.

Corrected Depth (m)	Oxygen ml STP L	Salinity (o/oo)	Silica (μM)	Phosphorus		Nitrogen-Bearing Solutes			
				Inorganic (μM)	Organic (μM)	Nitrate (μM)	Nitrite (μM)	Ammonia (μM)	Organic-N (μM)
0	4.67	36.03	0.9	0.05	0	0	0.08	0.04	1.7
10	4.67	36.08	0.8	0.05	0.03	0	0.06	0.13	2.5
15	4.71	36.03	1.0	0.03	0.01	0	0.06	0.01	1.6
20	4.66	36.19	0.7	0.10	0	0	0.08	0.13	1.6
30	4.71	36.09	0.8	0.06	0.02	0	0.08	0.57	2.6
40	4.77	36.24	1.0	0.02	0	0	0.07	0.09	2.1
50	4.88	36.43	0.7	0.04	0	0	0.07	0.03	1.4
60	4.92	36.53	0.8	0.08	0	0	0.07	0.05	1.8
75	4.92	36.67	0.8	0.03	0	0	0.06	0.15	1.7
85	4.88	36.73	0.4	0.12	0	0	0.05	0.24	1.9
90	4.88	36.76	0.2	0.04	0	0	0.08	0.02	1.5
118	4.74	36.91	0.8	0.07	0	0.3	0.20	0.12	1.4
208	4.51	36.66	0.4	0.16	0	2.3	0.10	0.13	0.5
298	4.68	36.50	1.7	0.32	0	5.5	0.08	0.02	0
414	3.87	36.01	4.7	0.74	0	13.4	0.07	0.17	0
516	3.39	35.69	8.0	1.15	0	19.7	0.07	0.07	0
612	3.03	35.21	13.8	1.69	0.08	26.5	0.06	0.23	0
787	3.29	34.97	20.5	1.85	0.01	29.8	0.08	0.14	0
1000	4.29*	35.15	23.7	1.66	0	26.3	0.08	0.13	0
Average Absolute value of Differences Between Duplicates:									
	0.02	0.07	0.04	0.03	0.05	0.05	0.01	0.03	0.57
Standard Deviation:									
	0.02	0.09	0.05	0.04	0.05	0.09	0.01	0.03	0.78

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Table 6. Chemical Data from Hydrocast #2 (Night Cast), Cruise #3, PROTEC 13. Position 17° 54'N, 65° 54'W.
All values are averages of duplicates except those marked with an asterisk.

Corrected Depth (m)	Oxygen ml STP L	Salinity (o/oo)	Silica (μM)	Phosphorus		Nitrogen-Bearing Solutes			
				Inorganic (μM)	Organic (μM)	Nitrate (μM)	Nitrite (μM)	Ammonia (μM)	Organic-N (μM)
0	4.65	35.30	1.2	2.36	0.11	0.3	-	0.28	1.3
10	4.64*	36.04	1.3	0.06	0.04	0	0.18	0.42	0.7
15	4.65	36.05	1.0	0.61	0.07	0	0.18	0.34	0.7
20	4.65	36.12	0.6	0.01	0.06	0	0.17	0.29*	0.8
30	4.66	36.08	0.6	0	0.06	0	0.19	0	0.9
40	4.69	36.15	0.6	0	0.07	0	0.17	0.10	0.3
50	4.72	36.26	0.6	0.03	0.01	0	0.18	0.15	0.4
60	4.81	36.50	0.8	0.03	0	0	0.17	0.13	0.7
75	4.88	36.49	0.7	0.03	0.01	0	0.17	0.04	0.3
85	4.91	36.62	0.4	0.03	0	0	0.21	0.14	0.6
90	4.88	36.72	0.6	0.02	0.01	0	0.18	0.26	0.3
107	4.86	36.80							
196	4.49	36.60	0.4	0.11	0.01	2.3	0.21	0.58	0
306	4.59	36.39	1.4	0.31	0	4.8	0.19	0.16	0
411	3.70	35.86	5.3	0.85	0.04	14.7	0.20	0.21	0
511	3.11	35.58	9.9	1.31	0.05	21.0	0.19	0.19	0
613	3.08	35.19	14.6	1.61	0.07	24.8	0.21	0.42	0
791	3.27	34.93	20.5	1.82	0.01	27.6	0.19	0.51	0
1026	4.06	34.92	23.3	1.74	0.08	25.9	0.24	0.43*	0
Average Absolute value of Differences Between Duplicates:									
	0.02	0.04	0.09	0.05	0.09	0.06	0.02	0.10	0.38
Standard Deviation:									
	0.02	0.07	0.16	0.10	0.13	0.16	0.03	0.15	0.60

C-16

Table 7. Quality Control on Seawater Nutrient Analyses after E.P.A. (1979b),
PROTEC 13.

Nutrient	Heptuplicate Analyses		Recoveries	
	Average Concen. (μM)	Standard Deviation	Amount Added (μM)	Percent Recovered
$\text{NO}_3^- + \text{NO}_2^-$	0	0	2.5	85
	14.9	0.06	10.0	90
	21.2	0.09		
	26.4	0.05		
NO_2^-	0.06	0.01	0.25	93
	0.19	0.02	0.25	88
	0.18	0.02		
	0.07	0.01		
NH_3	0.14	0.03	0.5	91
	0.18	0.02	1.5	87
	0.18	0.02		
	0.15	0.06		
Total N (NO_3^- , NO_2^- , NH_3 , Org. N)	2.5	0.2	5.5	77
	13.3	0.7	14.0	92
	19.3	0.5		
	23.7	1.1		
Inorg. PO_4	0.05	0.02	0.50	95
	0.85	0.01	1.00	94
	1.34	0.11		
	1.64	0.02		
Inorg. + Org. P	0.02	0.02	1.0	99
	0.88	0.04	2.0	94
	1.39	0.14		
	1.67	0.05		
Silica	0.95	0	2.5	100
	5.3	0.04	10.0	98
	9.9	0.07		
	23.7	0.05		

C. Biological Measurements

1. Phytoplankton (G. Vargo)

Methods

Irradiance Profile

The method described in the data report for PROTEC-12 was used with satisfactory results.

Transmissometer Profiles

The problems associated with previous attempts to obtain transmissometer profiles were corrected. Loose connections were repaired and corroded brushes were either cleaned or replaced. Both day and night profiles were obtained on PROTEC-13.

In vivo Profiles

Day and night profiles were obtained by attaching the intake end of the hose to the hydroweight and lowering the weight to pre-determined sampling depths (10m intervals). This method was described as the "stop and go" method in the PROTEC-12 data report. Subsamples from the pumped stream were taken during both the day and night cast for calibration but the day samples were inadvertently lost. Night calibration samples are identified in parentheses in the respective table (see Results).

Hydrocast/Biocal

Chlorophyll and phytoplankton samples were taken using individual sample bottles from the following depths: surface, 10, 15, 20, 40, 50, 60, 85, 90, 100, 200, and 300m. One liter samples for phytoplankton counts were preserved with buffered formalin. Counts were made on a 10 ml concentrate of a 500 ml subsample. The entire 10 ml aliquot was counted.

Sample vials of frozen TRIS buffer for ATP samples were forgotten, therefore, a full complement of ATP samples was not possible. Several samples from selected depths were processed using the TRIS brought by the LBL representative, T. Jones.

Fluorometer Calibration

Pure chlorophyll a in 90% acetone was used to check the fluorometer calibration. Mean chlorophyll to fluorescence (F_s) and before-after acidification (r_s) ratios were within the limits determined for the initial calibration (Table 8). Therefore, the original equation (see PROTEC-10 Data Report) were used to calculate chlorophyll a and phaeopigment concentration.

Results

Quantum Irradiance Profiles

An irradiance profile to 65 meters yielded an extinction coefficient of -0.048 (Table 13). This value was similar to those obtained on PROTEC-10 ($-.051$) and 12 ($-.049$).

Transmissometer Profile

Usable transmissometer profiles were only obtained on PROTEC-13. Instrument failure on the previous cruises precluded obtaining measurements.

The results for PROTEC-13, presented in Table 14 do not reflect the vertical distribution of phytoplankton in surface waters (0-100m) as deduced from chlorophyll concentrations (see Table). There was little vertical variability in the transmission characteristics of the water column although a slight increase in turbidity may have occurred in the upper 40m during the night profile.

Transmission values ranged from 88% to 94% for the day profile and 83% to 94% for the night profile (Table 14).

In vivo Fluorescence Profiles

Down traces for the in vivo fluorescence profiles generally reflect the vertical distribution of chlorophyll as determined by acetone extraction (compare Tables 11 and 12 with Figures 6 and 7). However, neither the day or night in vivo profiles indicate the extracted chlorophyll maximum at 100m and 90m respectively. Depths on the up traces were calculated assuming a constant retrieval speed. A constant speed was not attained since it was necessary to stop and detach the hose from the hydrowire. The up trace results do, however, qualitatively compare with the down trace. Chlorophyll: fluorescence ratios from both hydrocast data and subsamples of the pumped stream were variable (Table 12). No attempt was made to calculate chlorophyll concentration from the Chl:Fl ratio since the fluorometer was not calibrated as suggested by Teas (1980) and modified by Esaias (1980). This procedure calls for the determination of background fluorescence and use of a second fluorometer for calibration checks.

Chlorophyll and Phaeopigments

Concentrations of chlorophyll and phaeopigments were similar to those obtained on previous cruises (range $0.001 \rightarrow 0.014 \mu\text{g l}^{-1}$). Both day and night casts can be characterized by a bimodal vertical distribution with maxima at 50 and 100m during the day sample and 50 and 90m during the night sample (Figures 6 and 7). Phaeo-pigment:chlorophyll ratios were generally below 1 in the upper 100m during both day and night samples (Tables 9 and 10). Concentration

of chlorophyll between 15 and 100m decreased at all depths from day to night but especially at 100m ($-0.043 \mu\text{g}\ell^{-1}$) whereas near surface phaeopigment concentrations (0- to 20m) increased dramatically (cf. Figures 6 and 7).

Primary Productivity

Carbon-14 uptake rates were similar to those obtained during PROTEC-12 with an integrated water column rate of $4.98 \text{ gCm}^{-2} \text{ day}^{-1}$ (Table 15). Replicability was good among light bottles although dark and initial bottle counts were again greater than light bottle counts. Surface waters had the highest production rate with no photoinhibition evident. An increased photosynthetic rate at the 10% light level (50m) corresponded to an approximate doubling of chlorophyll concentration at that depth.

Values for carbon uptake per unit chlorophyll were greater than expected if compared with literature rates for other tropical oligotrophic waters (Parsons and Takahashi, 1973). If a carbon: chlorophyll ratio of 60:1 is assumed for nutrient stressed populations a turnover rate ($\text{mgC mgC}^{-1} \text{ hr}^{-1}$) of approximately 1.4 hr^{-1} can be calculated for the 50m sample. Such a rate is about an order of magnitude greater than would be expected. Dark bottle uptake of ^{14}C has not been subtracted prior to calculating the daily photosynthetic rate. If dark bottles had been subtracted, net counts would have occurred only at 10 and 15m. Photosynthetic rates would then be 0.54 and $0.092 \text{ mgCm}^{-3} \text{ hr}^{-1}$ at 10 and 15m respectively, yielding carbon per unit chlorophyll values of 15 and 4: rates analogous to those reported in the literature (Parsons and Takahasi, 1973).

High initial bottle counts, similar to those obtained during PROTEC-12, were again found. The ^{14}C solution used was made just prior to the May cruise and sterilized as for previous cruises. Just before inoculation into sample bottles the ^{14}C solution was syringe filtered through a 0.22 μm Millipore [®] filter. Such filtration should have removed any precipitate and/or particulate ^{14}C in the solution. After inoculation, the initial bottles were filtered and the filter rinsed with ~ 25 ml of unlabelled filtered sea water, the filter funnel removed and the edge of the filter rinsed with additional filtered sea water. Three reasons for the high initial counts can be suggested: 1) the ^{14}C immediately absorbs onto particles in the sample, 2) despite rinsing, the ^{14}C remains in the Nucleopore filter membrane or 3) a secondary precipitate forms which is filtered out and retained on the filter pad. Filters were not fumed with HCl, therefore, if a carbonate precipitate was formed it would not be removed.

A test was run to assess whether a secondary precipitate would form when the ^{14}C solution was inoculated into the sample bottles. Separate bottles were filled with deionized water and filtered sea water and inoculated with 1 ml of the 0.22 μm filtered ^{14}C solution used during PROTEC-13. The results suggest that, while the Nucleopore filters do retain some ^{14}C , no secondary precipitate forms (Table 16) since the DI water counts were essentially the same as the filtered sea water counts. Some amount of ^{14}C was retained by the filter, its removal obviously depends on treatment after filtering but the amount retained is still a small percentage of the total activity added to the bottle. The above results suggest that since secondary precipitate did not form then the presence of

particles in the water must therefore contribute to the high initial and dark bottle counts.

A second test was run on samples taken during a cruise in July. Offshore water (~60 miles offshore) yielded dark bottle counts similar to those which were found off Puerto Rico whereas inshore water (~15 miles offshore) did not (Table C 17). The same unfiltered batch of ^{14}C was used for both inshore and offshore samples although 8 μCi (2 ml) were added to offshore water and 4 μCi (1 ml) to inshore water. Higher activity added to the offshore samples cannot explain the higher dark bottle counts since final calculations are normalized to the amount of activity added. Thus, despite higher particle loads in inshore samples, offshore samples yield higher dark bottle counts. Time and space constraints precluded using initial bottles.

Both tests (Tables C 16 and C 17) indicate that the problem was not precipitate formation nor the concentration of particles. Recent discussions with G. Hitchcock (U.R.I) about the problem suggests a biological answer. Hitchcock (per comm.) informed me of a paper by Tuttle & Jannash (1977) which suggests that certain types of bacteria are present only in offshore, oligotrophic water. These particular bacteria are inhibited in the light but take up HCO_3 and CO_2 rapidly in the dark - yielding high dark bottle counts. A reference is forthcoming. If true, then the dark bottle problem may be solved but explanations are still required for what I feel are high light bottle counts and high initial bottle counts. Additional experimentation is required.

Species Abundance and Composition

Maximum phytoplankton abundance was found in the upper 20m during both day and night casts on PROTEC-13. Subsurface populations of monads and coccolithophores increased at 75m during both day and night casts (Table 18). Both groups contributed from 50% to greater than 90% of the total numerical abundance in the upper 100m water column (Table C 19). Diatom populations increased in importance (in terms of % of the total population) in the deeper samples whereas dinoflagellates contributed but a small percentage of the total cells (Table C 19). Nitzschia pungens v. *atlantica* and several Rhizosolenia spp. were the most abundant diatoms while Discosphaera thomsonii and D. tubifer were the most abundant coccolithophores. Although 74 dinoflagellate species were recorded for both day and night casts, their abundance was relatively evenly distributed with few individuals of each species (Table 18). Unidentified monads were again numerically dominant although their vertical distribution was patchy.

Cell Volume

Phytoplankton cell volume measurements were made using both day and night cast samples. The data are presented in Table C 20.

References

- Parsons, T.R. and M. Takahaski. 1973. Biological Oceanographic Processes. Pergamon Press, N.Y. 186 pp.
- Teas, H.J. 1980. A calibration procedure for the Turner Designs Model 10 fluorometer for in vivo measurement of chlorophyll. Manuscript forwarded by Turner Designs Corporation, 2247A Old Middlefield Way, Mountain View, California 94043, with appended review by W. Esaias.
- Tuttle, J.H. and H. Jannasch, 1977/78. Thiosulfate stimulation of Microbial dark assimilation of CO₂ in shallow marine waters. Microbial Ecol. 4 (1): 9-25.

Table C 8. PROTEC-13

Calibration check of Turner Designs Fluorometer

Chlorophyll Standard $\mu\text{g l}^{-1}$	F_0	F_α	Scale	$\bar{X} F_0$	$\bar{X} F_\alpha$	$\bar{X} F_S^{(1)}$	$\bar{X} \gamma_S^{(2)}$	Original Calibration	
								$\bar{X} F_{lo_S}$	$\bar{X} \gamma_S$
5	3.2	1.25	X1/31.6	3.2	1.25	1.5625	2.560	1.5773	2.2806
	3.2	1.25						1.05	1.07
2.5	5.15	2.00	X100/min	5.15	1.975	0.4854	2.607	0.4587	2.22
	5.15	1.95						1.02	1.03
1.0	5.95	2.20	X100/3.16	5.975	2.20	0.1674	2.716	ND	ND
	6.00	2.20							
0.5	3.05	1.15	X100/3.16	3.05	1.125	0.1639	2.711	0.1653	2.42
	3.05	1.10						1.01	1.17

$$(1) F_S = \frac{\text{conc. STD}}{\bar{X} F_0}$$

$$(2) \gamma_S = \frac{F_0}{F_\alpha}$$

Table C 9. PROTEC-13

DAY CAST

Chlorophyll & Phaeopigment concentrations
($\mu\text{g l}^{-1}$)

Bottle #	Depth(m)	Chlorophyll a		Phaeopigments		P/Chl
			$\bar{X}$		$\bar{X}$	
16	surface	0.043 0.041	0.042	0.0005 0.0002	0.0004	.009
17	10	0.030 0.036	0.033	0.005 0.002	0.003	0.10
18	15	0.041 0.023	0.032	0.001 0.007	0.004	0.13
19	20	0.031 0.045	0.038	0.003 neg	0.003	0.01
5	40	0.030 0.050	0.040	0.032 0.025	0.029	0.71
20	50	0.077 0.078	0.077	0.018 0.005	0.011	0.15
21	60	0.052 0.061	0.057	0.012 0.018	0.015	0.27
22	85	0.043	0.043	0.048	0.043	1.12
6	90	0.092 0.057	0.074	0.052 0.056	0.054	0.73
7	100	0.109 0.099	0.104	0.086 0.078	0.082	0.79
8	200	0.0068 0.0076	0.0072	0.017 0.020	0.019	2.59
9	300	0.0015 0.0016	0.0015	0.005 0.005	0.005	3.13

Table C 10. PROTEC-13
NIGHT CAST
Chlorophyll and Phaeopigment concentrations
($\mu\text{g l}^{-1}$)

Bottle #	Depth(m)	Chlorophylla		Phaeopigments		P/Chl
			$\bar{X}$		$\bar{X}$	
16	surface	0.052 0.035	0.044	0.014 0.008	0.011	0.26
17	10	0.049 0.021	0.035	0.015 0.013	0.014	0.40
18	15	0.024 0.023	0.023	0.009 0.011	0.010	0.43
19	20	0.033 0.024	0.028	0.019 0.017	0.018	0.64
5	40	0.013 0.019	0.017	0.017 0.012	0.014	0.85
20	50	0.055 0.047	0.051	0.019 0.022	0.020	0.39
21	60	0.021 0.028	0.025	0.008 0.013	0.010	0.42
22	85	0.037 0.035	0.036	0.030 0.029	0.029	0.83
6	90	0.072 0.069	0.070	0.058 0.054	0.056	0.79
7	100	0.054 0.069	0.061	0.028 0.039	0.033	0.54
8	200	0.016 0.006	0.011	0.013 0.014	0.013	1.18
9	300	0.001 0.001	0.001	0.004 0.003	0.003	3.02

Table C 11. PROTEC-13

Day Cast

In vivo Fluorescence Profiles

Chl/Fluorescence ratios calculated from hydrocast chlorophyll data. All in vivo values are from readings on the 10X, X100 scale.

Depth(m)	Down Trace			Up Trace		
	In vivo	Chl	$\times 10^{-4}$ Chl/FL	In vivo	Chl	$\times 10^{-4}$ Chl/FL
1	50	.042	8.4	20	.042	21.0
10	30	.033	1.1	25	.033	13.2
15	50	.032	6.4	26	.032	12.3
20	54	.038	7.0	27	.038	14.1
25	42			26		
30	50			29		
35	55			30		
40	45	.040	8.9	30	.040	13.3
42.5	74					
45	80			33		
47.5	67					
50	60	.077	12.8	33	.077	23.3
55	35					
60	48	.057	11.9	45	.057	12.7
65	45			37		
70	32			39		
75	93			38		
77	74					
80	56			43		
82.5	95					
85	87	.043	4.9	37	.043	11.6
87.5	78					
90	60	.074	12.3	34	.074	21.8
95	45			39		
100	42	.104	24.8	35	.104	29.7
105	41			39.5		
110	45			38		

Table C 11. PROTEC-13

Day Cast
In vivo Fluorescence Profiles
cont'd

Depth(m)	In vivo	Chl	$\times 10^{-4}$ Chl/FL	In vivo	Chl	$\times 10^{-4}$ Chl/FL
115	43			40		
120	35			35		

Table C 12. PROTEC-13

Night Cast

In vivo Fluorescence Profiles

Chl/Fluorescence ratios calculated from hydrocast chlorophyll data. Chlorophyll values in () from subsamples taken during profiling. All in vivo values are from readings on the 31.6X, X100 scale.

Depth(m)	Down Trace			Up Trace		
	In vivo	Chl	$\times 10^{-4}$ Chl/FL	In vivo	Chl	$\times 10^{-4}$ Chl/FL
2				43	(.032)	7.4
10	53	.035	6.6	43	.035	8.1
12	58			45		
14	49			46		
15	51	.023	4.5	48	.023	4.8
18	41			42		
20	42	.028	6.7	41	.028	6.8
22	73					
24	70			40		
26	65					
28	64					
30	58			42		
35	48			44		
40	43	.017(.063)	3.9(14.6)	49	.017(.063)	3.5(12.9)
46	46			50		
50	45	.051	11.3	52	.051	9.8
55	lost			63		
60	47	.025	5.3	63	.025	3.9
65	48			75		
70	47			70		
75	52			76		
78.5				80		
80	52			75		
85	55	.036	6.5	70	.036	5.1
90	51	.070	13.7	70	.070	10.0
95	69			68		
100	79	.061(.047)	7.7(5.9)	70	.061(.047)	8.7(6.7)

Table C 12. PROTEC-13

Night Cast

In vivo Fluorescence Profiles
cont'd

Depth(m)	In vivo	Chl	$\times 10^{-4}$ Chl/FL	In vivo	Chl	$\times 10^{-4}$ Chl/FL
105	78			72		
110	80			68		
115	80			70		
120	78			78		

Table C 13. PROTEC-13

Quantum Sensor Profile

May 9, 1981

Depth(m)	Deck	Cell $\bar{X}$	Sea	Cell $\bar{X}$	Surface % (a)
surface	1400		1050		75.0
1	1500		1050		70.0
3	1500		900		60.0
5	1450	1500	750		50.0
	1550				
10	1500		510		34.0
15	1450		400	425	29.3
			450		
20	1350	1400	320		23.0
	1450				
25	1350	1400	270		19.0
	1450				
30	1300	1325	190	195	14.7
	1350		200		
35	1300	1350	160		11.8
	1400				
40	1200	1250	105	107.5	8.6
	1300		110		
45	1150		85	87.5	7.6
			88		
50	1000	1025	60		5.8
	1050				
55	950	975	48	49.0	5.0
	1000		50		
60	950	975	35		3.6
	1000				
65	1050	1075	31		2.9
	1100				

(a) an exponential curve fit to depth vs. sea/deck yields:

$n = 15$
 $a = 0.6328$
 $b = 0.0478 = K = \text{extinction coefficient}$
 $r^2 = 0.995$

Table C 14. PROTEC-13

Day and Night Transmissometer Profiles

Depth(m)	DAY		Depth(m)	NIGHT	
	%T	$\ln\left(\frac{1}{T}\right)$		%T	$\ln\left(\frac{1}{T}\right)$
2	88.0	0.128	2	83.0	0.186
10	88.7	0.119	10	85.9	0.152
12	88.0	0.128	12	87.5	0.133
14	90.0	0.105	14	88.0	0.128
15	89.0	0.116	15	88.0	0.128
17	91.3	0.091	17	88.0	0.128
20	91.3	0.091	20	88.0	0.128
30	91.2	0.092	30	88.0	0.128
40	91.7	0.086	40	89.5	0.111
45	91.5	0.088	45	91.3	0.091
50	91.8	0.085	50	91.5	0.088
55	92.0	0.083	55	91.8	0.085
60	92.0	0.083	60	92.0	0.083
75	91.5	0.088	75	92.0	0.083
85	91.7	0.086	85	92.0	0.083
90	91.8	0.085	90	92.5	0.078
100	92.3	0.080	100	91.5	0.088
105	91.7	0.086	105	91.7	0.086
120	92.0	0.083	120	91.5	0.088
135	92.0	0.083	135	92.0	0.083
145	92.7	0.076	145	92.3	0.080
160	92.5	0.078	160	93.0	0.072
170	92.0	0.083	170	93.5	0.067
175	93.8	0.064	175	94.5	0.056
190	93.5	0.067	190	94.0	0.061
200	94.0	0.061	200	94.0	0.061
210	94.0	0.061	210	94.0	0.061
215	93.0	0.072	215	94.0	0.061
245	93.5	0.067	245	93.8	0.064
275	93.5	0.067	275	94.0	0.061
280	92.5	0.078	280	93.5	0.067
300	92.5	0.078	300	93.0	0.072

Table C 15. PROTEC-13

Primary productivity and total carbonate carbon (w)

5/10-11/81

Sample Depth	Light Level	DPM	W_{-3} mgCm ⁻³	mgCm ⁻³	$\frac{hr^{-1}(1)}{\bar{x} \pm 1sD}$	C.V. (2) %	Chl a ₃ mgm	mgCmgChl ⁻¹ hr ⁻¹
Surface	100%	115,383	27439	4.896	4.894 ±0.219	4.5	0.044	111.23
		120,469		5.112				
		110,112		4.673				
	Dark Initial	128,020	27439	5.433	4.171 ±0.198	4.7	0.035	119.17
		369,012						
10	62%	94,738	27439	4.020	4.171 ±0.198	4.7	0.035	119.17
		103,570		4.395				
		96,608		4.099				
	Dark Initial	85,451	27629	3.626	4.144 ±0.092	2.2	0.023	180.17
		72,732						
15	49%	96,829	27629	4.137	4.144 ±0.092	2.2	0.023	180.17
		99,233		4.240				
		94,902		4.055				
	Dark Initial	94,829	28152	4.052	3.763 ±0.116	3.1	0.028	134.39
		131,408						
20	36%	85,019	28152	3.702	3.763 ±0.116	3.1	0.028	134.39
		84,784		3.691				
		89,522		3.897				
	Dark Initial	89,541	27697	3.898	4.213 ±0.358	8.5	0.051	82.61
		204,015						
50	10%	92,472	27697	3.960	4.213 ±0.358	8.5	0.051	82.61
		182,336		7.810 *				
		104,254		4.466				
	Dark Initial	132,142	27135	5.660	3.512 ±0.292	8.3	0.025	140.48
		149,860						
60	5.5%	91,391	27135	3.835	3.512 ±0.292	8.3	0.025	140.48
		77,843		3.267				
		81,830		3.434				
	Dark Initial	133,838	27339	5.616	3.205 ±0.417	13.0	0.036	89.03
		136,008						
85	1.6%	80,176	27339	3.389	3.205 ±0.417	13.0	0.036	89.03
		82,748		3.499				
		64,521		2.728				
	Dark Initial	139,038	27339	5.879				
		157,093						

(1) Dark and initial bottles not subtracted

(2) coefficient of variation

* value not included in calculating the mean

Incubation period: 13.5 hrs (0530-1900)

Integrated total, 0-85m: 369.44 mgCm⁻²hr⁻¹Integrated daily total: 4.98gCm⁻²day⁻¹

Table C 16. Precipitate test for $\text{NaH}^{14}\text{CO}_5$ used for PROTEC 13 photosynthesis run.

Test	CPM ^①	
	DI water	filtered seawater
10 ml rinse + edge rinse	810	930
	780	970
10 ml rinse + edge rinse + HCL ^②	470	400
	530	570
60 ml rinse	360	260
	424	200

① 20 μCi or 38,515,430 CPM added to 100 ml of deionized (DI) or filtered sea water, 0.1 min counts

② 0.5 ml of 0.01 N HCL added and allowed to stand open for 5 mins. before NCS and cocktail added

Table C 17. ^{14}C uptake at representative light levels for offshore (~ 100 miles) and inshore (~ 12 miles) stations in the Gulf of Mexico. Samples incubated for equivalent day length with 8 μCi and 4 μCi in 250 ml for offshore and inshore samples, respectively.

<u>Sample</u>	<u>Light level</u>	<u>CPM</u>
Offshore	100% L	60,790
	L	51,180
	D	70,170
	62% L	50,740
	L	40,850
	D	40,510
	49% L	70,290
	L	70,200
	D	76,890
Inshore	100% L	20,890
	L	18,550
	D	720
	62% L	19,240
	L	22,040
	D	870
	49% L	16,430
	L	20,380
	D	1,080

Table 18. Phytoplankton species composition and abundance, PROTEC-13; cells l⁻¹

	DAY CAST												NIGHT CAST											
	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M
BACILLARIOPHYCEAE																								
<i>Amphora crassa</i>		2																						
<i>A. sp.</i>																					4			
<i>Asterolampra marylandica</i>																	2							
<i>Asteromphalus flabellatus</i>																	4							
<i>Avliscus coelatus</i>																						4		
<i>Biddulphia alternans</i>																	6							
<i>B. obtusa</i>		2																						
<i>Chaetoceros atlanticus</i>				10																				
<i>C. decipiens</i>								6																
<i>C. laevis</i>				4														4						
<i>C. lorenzianum</i>																	12							
<i>C. messanense</i>		6																						
<i>C. pendulus</i>															2	2						2		
<i>C. sp.</i>																	8							
<i>Coscinodiscus lineatus</i>										2														
<i>C. radiatus</i>		2																						
<i>C. sp.</i>																						2		
<i>Eucampia cornuta</i>				2																				
<i>Grammatophora oceanica</i>																		2						
<i>Guinardia flaccida</i>																						2		
<i>Hemiaulus hauckii</i>	4		10							2							10	4				2		
<i>H. membranaceus</i>	12																							
<i>Leptocylindrius danicus</i>																4		10						
<i>Mastogloia apiculata</i>													2											
<i>Melosira sulcata</i> (Paralias)															2									
<i>Navicula</i> sp. "A"			2	4	2	2				2			2		2		2	2						
<i>Navicula</i> sp. "B"						2									4									
<i>N. wawnkae</i>	2		2	4																				
<i>Nitzschia longissima</i>			6					4									2							
<i>N. pungens</i> v. <i>atlantica</i>	8			56												12	8							
<i>N. rigida</i>											2													
<i>N. sp.</i>				2																				
<i>Pleurosigma</i> sp.	2																					2		
<i>Rhizosolenia alata</i>													2				2							
<i>R. alata</i> f. <i>gracillima</i>																	2							
<i>R. imbricata</i>	8			20												16	4							
<i>R. setigera</i>	2																2	2	2					

Table C 18. Phytoplankton Species Composition and Abundance
cont'd

DINOPHYCEAE	DAY CAST												NIGHT CAST											
	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M
Oxytoxum milneri										2														
O. scolopax					4																			
O. tessalatum				2																				
O. turbo																			2					
Peridinium grande																		2						
P. nipponicum	2																							
P. pellucidum	2																							
P. spiniiferum					4																			
P. subsalsum			2	4																				
P. sp. #1											2													
P. sp. #2				2					2															
Phalacroma argus																			2					

Table C 18. (cont.)

DAY CAST

NIGHT CAST

[illegible]

Table C 18. (cont.)

	DAY CAST												NIGHT CAST											
	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M
Lohmannosphaera adriatica																	2							
Michaelsarsia Folklandica																	2							
M. splendens				2																				
Ophiaster hydroideus						2	2		8										2			4		
Pontosphaera echinofera										2										2				
P. Hartmanni																								
P. Huxleyi					4				2	4							2							
P. Nigra				2			2										4							
Pontosphaera stagnicola																								
Rhabdosphaera claviger					2		2		6															
P. hispida							2																	
R. stylifer	4		12		4			2																
R. tignifer								2	2															
R. tubulosa																								
R. sp.				2																				
Syracosphaera heinii																								
S. mediterranea									4															
S. molischii				2	10	2																		
S. prolongata									8															
S. pulchra	2	12	8			2																		
S. quadricornu																								
S. robusta					2																			
S. subsalsa																								
S. sp.				2																				
Unid. coccolithophond #1					2			2																
" " #2																								
" " #3									2															
" " #4																								
Monads																								
Trichodesmium	146			426									2	2										
Silicoflagellate skeleton	2																					2	2	
Total diatoms	68	16	24	136	14	10	6	16	4	40	2		16	4	46	48	72	32	4	0	8	26	2	0
Total dinoflagellates	12	16	24	20	26	2	14	12	2	4	2		6	30	18	12	26	16	28	14	0	4	6	0
Total coccolithophores	388	380	380	94	128	54	108	34	80	40	2		158	378	506	260	72	58	90	60	8	44	2	0
Total cells (1)																								

(1) Includes Monads and Trichodesmium but not silicoflagellate skeletons

Table 18 Phytoplankton species composition and abundance, PROTEC-13
cont'd

BACILLARIOPHYCEAE	DAY CAST												NIGHT CAST											
	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M
R. Stolterfothii				20												4	6							
R. Styliiformis		10	4		2								10	2	2	10								
R. Styliiformis w/Richelia	24			10		2	6	6																
Skeletonema costatum																		12					8	
Synedra sp.						2																		
Thalassionema nitzschiodes				4					4	34					14								6	
Thalassiothrix fravenfeldii					4												8				4			
T. longissima													2											
Unid. pennate					2											2		2						
Pennate "A"					4	2										4			2					
Pennate "B"																								
Pennate "C"																	2							

Table 18. Phytoplankton Species Composition and Abundance (cont.)

DINOPHYCEAE	DAY CAST												NIGHT CAST											
	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	φM	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M
Amphidinium carteri															4			4						
A. crassum																			4					
A. sp. #1					2												2							
#2																								
#3															2									
#4																			2					
#5																2								
#6														4										
#7														4										
#8							2																	
Blepharocysta splendor-maris																	2		2					
Ceratium buceros var.						2	2												2					
C. buceros var. tenue							2																	
C. contortum				2																				
C. declinatum f. normale	2																		2	2				
C. declinatum v. angusticornum															2									
C. extensum					2									2										
C. fusus								2							2						2			
C. pentagonum							2																	
C. setaceum					2		2																	
C. teres	4		2										2	6	2	2		2	2					
C. trichoceros																		2						
Dinophysis acuminata		2																						
D. hastata																	2						2	
D. ovum																				2				
Gonyavilax diegensis		4		2	2														2					
G. digitalis				2														4						
G. polygramma					2			2										4		2				
G. turbeyni															2									
G. sp.			2															2		2				
Gymnodinium sp. #1					2																	2		
G. sp. #2				2																				
G. sp. #3																								
G. sp. #4																								
G. sp. #5							2												6					
Gyrodinium sp. #1																2								
G. sp. #2		2																						
Heteravilacus acuminata		2															2	2						
Noctiluca sp.																			2					
Ornithocercus magnificus																		2						
Oxytoxum elegans																							2	

Table C 18. (cont.)

TOTAL MONADS

DAY CAST												NIGHT CAST											
ϕ M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	ϕ M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M
253.4	506.7	633.4	750.1	422.3		253.4		253.4				126.7	380	380	253.4	126.7	760.1	506.7					

TOTAL CELLS (1)

DAY CAST												NIGHT CAST											
ϕ M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	ϕ M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M
867.4	918.7	1487.4	1010.1	590.3	66	381.4	62	339.4	84	6	0	304.7	794	950	573.4	296.7	232.7	882.1	580.7	16	74	10	0

Table C 19.

Phytoplankton composition as a percent of total abundance for day (D) and night (N) casts, PROTEC-12 (top) and PROTEC-13 (bottom)

		PROTEC-12											
Group /		D	N	D	N	D	N	D	N	D	N	D	N
Depth, time		0		1		5		10		40		50	
Diatoms		9.8	2.9	33.9	10.1	14.3	15.0	24.4	31.0	24.9	17.8	17.1	9.4
Dinoflagellates		0.6	1.9	3.9	1.3	0.9	1.3	3.6	0.6	1.6	2.3	0	9.9
Coccolithophores		15.2	13.8	20.6	19.6	25.5	9.3	38.7	17.2	24.5	24.7	21.2	27.2
Monads		74.1	78.5	35.4	62.1	58.4	60.7	32.3	41.9	50.6	49.0	51.5	62.5
Blue-green filaments		0.01	2.9	6.1	6.9	0.9	13.7	1.0	7.9	6.4	6.2	10.2	0

		PROTEC-13											
Group /		D	N	D	N	D	N	D	N	D	N	D	N
Depth, time		0		10		15		20		50		60	
Diatoms		7.8	5.3	1.7	0.5	1.6	4.8	13.5	8.4	2.4	24.3	15.2	13.8
Dinoflagellates		1.4	2.0	1.7	3.8	1.6	1.9	2.0	2.1	4.4	8.8	3.0	6.9
Coccolithophores		44.7	50.5	41.4	47.6	25.5	53.3	9.3	45.3	21.7	24.3	81.8	24.9
Monads		29.2	41.6	55.2	47.9	42.6	40.0	75.2	44.2	71.5	42.7	0	54.4
Blue-green filaments		16.8	0.7	0	0.3	28.6	0	0	0	0	0	0	0

Table C 19. cont'd

Group Depth, time		PROTEC-12											
		D		N		D		N		D		N	
		60	75	100	150	200	300						
Diatoms	15.8	7.2	11.9	7.2	34.2	75.0	13.2	80.0	42.8	50.0	0	100.0	
Dinoflagellates	1.9	1.1	1.9	1.2	0.2	0	2.6	0	57.1	0	0	0	
Coccolithophores	22.3	18.9	12.7	18.1	2.7	25.0	0	20.0	0	50.0	1.6	0	
Monads	59.1	47.8	61.7	58.7	58.0	0	84.1	0	0	0	98.4	0	
Blue-green filaments	0.9	24.9	11.7	14.8	4.8	0	0	0	0	0	0	0	

PROTEC-13

[illegible]

Table 20
Phytoplankton Cell Volumes
PROTEC-13

Table 20: Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-13, cruise 3.

Species / Diatoms	DAY CAST												NIGHT CAST												
	0M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	0M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	
Amphora crassa		.02																							
A. sp.																						.87			
Asterolampra marylandica																	.05								
Asteromphalus flabellatus																	.09								
Auliscus coelatus																							.18		
Giddulphia alternans																.51									
B. obtusa		.14																							
Chaetoceros atlanticus				.19																					
C. decipiens								.03																	
C. laevis				.01													.01								
C. lorenzianum																	.45								
C. messanense	.09																								
C. pendulus															.02	.02							.02		
C. sp.																	.12								
Coscinodiscus radiatus		1.13								.05															
C. sp.																							.79		
Eucampia cornuta				.01																					
Grammatophora oceanica																			.12						
Guinardia flaccida																							.09		
Hemiaulus hauckii	.19		.47							.09							.47	.19					.09		
H. membranaceus	.36																								
Leptocylindrus danicus																.16		.40							
Mastogloia apiculata															.06										
Melosira sulcata																	.02								
Navicula sp. A				.06	.11	.06	.06			.05				.06		.06	.06	.06	.06						
N. sp. B							.04										.08								
N. wawriake	.04		.04	.08																					
Nitzschia longissima			.18						.01																
N. pungens v. atlantica	.11			.78													.17	.11							
N. sp.				.04																					
Pennate A					.12	.06											.12			.06				.11	
Pleurosigma sp.	.11																								
Rhizosolenia alata													1.70					1.70							
R. alata f. gracillima																		.40							
R. imbricata	6.36			15.90													12.72	3.18							
R. setigera	.35																.35	.35	.35						
R. stolterfothii				4.07													.81	1.22							
R. styliformis		8.50	3.40	8.50	1.70								1.70	1.70		8.50									
R. styliformis w/R chelia	20.41						1.70	5.10	5.10																
Skeletonema costatum																		.09				.06			

C-48

Table 20: Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-13, cruise 3.

Species/ Dinoflagellate	DAY CAST												NIGHT CAST											
	0M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	0M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M
Amphidinium carteri															.16		.16							
A. crassum																				.14				
A. sp. #1																	.04							
#2					.03																			
#3															.03									
#4																				.02				
#5																.03								
#6														.05										
#7														.06										
#8								.03																
Blepharocysta splendor-maris																	.34		.34					
Ceratium buceros v.						.36	.36												.36					
C. buceros f. tenue							.37																	
C. contortum			.36																					
C. declinatum f. normale	.31																		.31	.31				
C. declinatum v. angusticorneum															.27									
C. extensum					.19									.19										
C. fusus								.15												.15				
C. pentagonum							.40																	
C. setaceum					.06		.06																	
C. teres	.38		.19										.19	.57	.19	.19		.19	.19					
C. trichoceros																		.30						
Dinophysis acuminata		.30																						
D. hastata																	.85							
D. ovum																					.41			
Gonyaulax diegensis		1.40		.70	.70														.70					
G. digitalis				.95																				
G. polygramma					.67				.67									1.91						
G. turbeyni																.60								
G. sp.			.56															.56		.56				
Gymnodinium sp. #1					.04																			
#2																						.38		
#3																								
#4				.11																				
#5								.21												.34				
Gyrodinium sp. #1																	.72							
#2			.72																					
Heteraulacus acuminata		2.26															2.26	2.26						
Noctiluca sp.																								
Ornithocercus magnificus																		.95						

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Table 20: Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-13, cruise 3.
(Continued)

Species / Diatoms	DAY CAST												NIGHT CAST											
	0M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	0M	10M	15M	20M	50M	60M	75M	85M	90M	100M	20	
Synedra sp.							.04																	
Thalassionema nitzschioides				.02					.02	.07						.05								.02
Thalassiothrix frauenfeldii					.04												.09					.01		
T. longissima									.03					.04										
Unid. pennate																	.01	.02	.01					
Pennate B					.02																			
Pennate G																								
Nitzschia rigida											.04													

Table 20: Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-13,
(Continued) cruise 3.

C-51

Species/ Dinoflagellate	DAY CAST													NIGHT CAST												
	0M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M	0M	10M	15M	20M	50M	60M	75M	85M	90M	100M	200M	300M		
Oxytoxum elegans																								1.26		
O. milneri										1.23																
O. scolopax					.53																					
O. tessalatum					1.08																					
O. turbo																			.02							
Peridinium grande																		2.26								
P. nipponicum	.62																									
P. pellucidum	.34																									
P. spiniferum					1.78																					
P. subsalsum		.40	.80																							
P. sp. #1											.06															
#2			.26						.16																	
Phalacroma argus														.95												
Phalacroma parvulum			.60																				.60			
Pndolampus bipes			.66																							
P. palmipes							.28						.28													
P. spinifer																		.89								
Polykrikos schwartzii			8.84															8.84								
Prorocentrum gracile					.05										.03											
P. micans	.01			.01										.02												
P. sp. #1			.02																							
Rounded out dinoflagellate		.33		.29														.28	.16			.34				
Dividing dino.																		.16								
Unid. dino																		.08								
#1																										
#2																										
#3																										
#4																										
#5																										
#6																										
#7			.04																							
#8			.67																							
#9					.14																					
#10				.21																						
Dinoflagell te cyst							.31											.29	.16							

C-51

Table 20: Cell volume ($\mu\text{m}^3 \times 10^5$) for all identifiable and designated species enumerated for day and night during PROTEC-13, cruise 3.

C-52

2. Zooplankton (H. Michel)

Zooplankton samples were taken using a Tareq & Co. BNF-1[®] opening and closing paired (Bongo) net frame. The nets were each 0.6m in diameter and made of 202 μ Nitex[®]. A flowmeter was mounted in the mouth of each net to determine the volume filtered. Flowmeter readings are shown in Table C 21-1. If the volumes filtered by paired nets differed by more than 10% the samples were considered somewhat suspect and were not processed if sufficient duplicates were available.

The zooplankton community was sampled by oblique tows over four depth series (25-0m, 200-25m, 600-200m, and 1000-600m) both during the day and night. Time, date, length of tow, and location are shown in Table C 22-2. Four replicate tows were made over the two shallower series and two replicates over each of the deeper series. Sample times were confined to an 8-hour period centered on noon or midnight. The paired samples from each tow were preserved separately in 5% buffered formalin. Depth was recorded by a Benthos[®] time depth recorder attached below the net. A 500-0m recorder was used on the 200-25m series, and a 1000-0m recorder on the 600-200m and 1000-600m series. The amount of wire out and wire angle are shown in Table C 21-1. All replicate samples were completed for each depth series and time period on PROTEC-13.

In the laboratory the preserved zooplankton samples were split using a Motoda box (Motoda, 1959) and one half sent to Lawrence Berkeley Laboratory for dry weight analysis. Displacement volume was determined on the other half and expressed as milliliters per meter cubed. The results are shown in Table C 23-2. The major groups

were then enumerated for each sample. This data is presented
Table C 24-4.

References

Motoda, S. (1959). Devices of simple plankton apparatus.
Mem. Fac. Fish., Hokkaido Univ. 7 (1-2), 73-94.

Table 21. Zooplankton Tow Data.

Page 1 of 5

Cruise: PROTEC-13			Wire	Wire	Flow	Flow	Vol.	Split	Split	Calibration Equation for Flow Meter:	
Depth/	Time	Rep.	Out	Angle*	Meter	Meter	File	Size	Size	Vol.	File
(m)		No.	(m)	(min. of 2)	Start	Finish	(m ⁻³)	Taxon. Anal.	Dr. Wt. Anal.	(m ³)=No.Rev. X 0.2827 X 0.02687	Comments
25-0	Day	1	36-0	35°	857953	864869	52.5	Various**	1/2		
		1		45°	640002	645153	39.1	"	"		
25-0	ay	2	36-0	40°	864847	874405	72.6	"	"		
		2		40°	645167	653891	66.3	"	"		
25-0	Day	3	36-0	45°	874388	885331	83.1	"	"		
		3		45°	653900	665648	89.2	"	"		
25-0	Day	4	36-0	40°	886523	897278	81.7	"	"		
		4		45°	665724	675746	76.1	"	"		
25-0	Night	1	36-0	40°	030713	053148	170.5	"	"		
		1		45°	439820	460370	156.1	"	"		
25-0	Night	2	36-0	47°	053179	071651	140.3	"	"		
		2		45°	460361	478844	140.4	"	"		
25-0	Night	3	36-0	42°	071651	094215	171.4	"	"		
		3		45°	478844	498929	152.6	"	"		
25-0	Night	4	36-0	45°	094215	117033	173.3	"	"		
		4		45°	498929	522790	181.2	"	"		
200-25	Day	1	280-30	47°	649934	685347	269.0	"	"		
		1		30°	243305	274594	237.7	"	"		
200-25	Day	2	280-36	45°	685347	724051	294.0	"	"		
		2		40°	274594	309605	266.0	"	"		
200-25	Day	3	280-36	46°	724048	756316	245.1	"	"		
		3		46°	309594	340926	238.0	"	"		
200-25	Day	4	280-36	45°	756341	782553	199.1	"	"		
		4		45°	340925	364084	175.9	"	"		
200-25	Night	1	280-39	45°	117042	156842	302.3	"	"		
		1		50°	522830	556933	295.0	"	"		
200-25	Night	2	280-36	45°	556957	588533	239.8	"	"		Nets did not close
		2		45°	156851	186223	223.1	"	"		
200-25	Night	3	280-36	45°	588569	622973	261.3	"	"		
		3		42°	186232	216533	230.2	"	"		
200-25	Night	4	280-36	45°	622914	649927	205.2	"	"		
		4		45°	216533	243304	203.3	"	"		

*Minimally taken at time of 1st and 2nd messenger.

**Splits size used to enumerate groups depended on the relative abundance of the group and ranged from 1/2 for rare organisms and 1/256 for numerous organisms

Table 21. Zooplankton Tow Data. (Continued)

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Cruise: PROTEC-13		Wire	Wire	Flow	Flow	Vol.	Split	Split	Calibration Equation for Flow Meter:	
Depth/	Time /Rep.	Out	Angle*	Meter	Meter	Fil.	Size	Size		
(m)	No.	(m)	(min. of 2)	Start	Finish	(m ⁻³)	Taxon. Anal.	Dr. Wt. Anal.	Comments	
600-200 Day	1	850-280	45°	038622	120005	618.2	Various ***	1/2		
	1		53°	625919	718069	700.00	"	"		
600-200 Day	2	850-280	60°	234585	333438	750.9	"	"		
	2		45°	834229	939489	799.5	"	"		
600-										
200**Night	1	735-285	45°	782636	869469	868.5	"	"		
	1		43°	364132	444018	881.8	"	"		
600-200 Night	2	850-280	52°	120015	234348	868.5	"	"		
	2		55°	718068	834155	881.8	"	"		
1000-600 Day	1	1415-850	45°	700460	857953	1196.3	"	"		
	1		45°	488728	640006	1149.1	"	"		
1000-600 Day	2	1500-1200	65°	947887	038625	689.2	"	"		
	2		45°	533376	625902	702.8	"	"		
1000-600Night	1	1300-850	45°	592330	700434	821.2	"	"		
	1		43°	394188	488722	718.1	"	"		
1000-600Night	2	1415-870	50°	869516	947884	592.3	"	"		
	2		45°	444031	533353	678.5	"	"		

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*Minimally taken at time of 1st and 2nd messenger.

**Two pairs of nets were used in this cast, one set to fish over 600-200m and the other 1000-600m.

The TDR was attached below the lower pair of nets.

***Splits size used to enumerate groups depended on the relative abundance of the group and ranged from 1/2 for rare organisms and 1/256 for numerous organisms

Table 22. Zooplankton Sample, Type, and Location.

Cruise: PROTEC-13

Site: Benchmark

Sample Number	Position Latitude & Longitude	Date (da,mo,yr)	Time Start ¹ (AST)	Length of Tow (min.)	Net Type, Size, Mesh	Actual Depth of Sample (m)	TDR (m)	Sample & Tow Type	Comments
25-0m, Day #1	17°57'N 65°51'W	13-5-81	1143	2	Bongo 0.6m 202μ	25-0	-	Oblique	No TDR used due to short fishing time
25-0m Day #2	17°57'N 65°51'W	13-5-81	1159	4	"	25-0	-	"	
25-0m Day #3	17°57'N 65°51'W	13-5-81	1223	5	"	25-0	-	"	
25-0m Day #4	17°57'N 65°51'W	13-5-81	1242	5	"	25-0	-	"	
25-0m Night #1	17°58'N 65°45'W	9-5-81	2045	8	"	25-0	-	"	
25-0m Night #2	17°57'N 65°48'W	11-5-81 ²	0228	10	"	25-0	-	"	
25-0m Night #3	17°57'N 65°49'W	11-5-81	0251	11	"	25-0	-	"	
25-0m Night #4	17°57'N 65°50'W	11-5-81	0315	11	"	25-0	-	"	
200-25m Day #1	17°59'N 65°52'W	12-5-81	0809	16	"	200-25	200-25	"	
200-25m Day #2	18°02'N 65°52'W	12-5-81	0904	17	"	200-25	250-25	"	
200-25m Day #3	17°55'N 65°49'W	12-5-81	1001	16	"	200-25	210-25	"	

Table 22. Zooplankton Sample, Type, and Location. (continued)

Cruise: PROTEC-13

Site: Benchmark

Sample Number	Position Latitude & Longitude	Date (da,mo,yr)	Time Start ¹ (AST)	Length of Tow (min.)	Net Type, Size, Mesh	Actual Depth of Sample (m)	TDR (m)	Sample & Tow Type	Comments
200-25m Day #4	18°04'N 65°49'W	12-5-81	1102	16	Bongo 0.6m 202 µ	200-25	250-25	Oblique	
200-25m Night #1	17°57'W 65°55'W	11-5-81	2009	17	"	200-25	225-25	"	
200-25m Night #2	17°57'W 65°57'N	11-5-81	2128	19	"	200-25	210-0	"	
200-25m Night #3	17°57'N 65°50'W	11-5-81	2219	16	"	200-25	240-25	"	
200-25m Night #4	17°57'N 65°55'W	11-5-81	2324	15	"	200-25	250-25	"	
600-200m Day #1	17°56'N 65°52'W	14-5-81	1154	48	"	600-200	675-200	"	
600-200m Day #2	17°56'N 65°53'W	15-5-81	1033	43	"	600-200	600-200	"	
600-200m Night #1	18°09'N(?) 65°53'W	12-5-81	2305	50	"	600-200	600 250 **	"	
600-200m Night, #2	17°57'N 65°50'W	14-5-81	1945	47	"	600-200	650-200	"	
1000-600m Day #1	17°55'N 65°49'W	13-5-81	0936	50	"	1000-600	1050-625	"	
1000-600m Day #2	17°57'N 65°53'N	14-5-81	0853	31	"	1000-600	-	"	No TDR Record

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Table 22. Zooplankton Sample, Type, and Location. (continued)

Cruise: PROTEC-13

Site: Benchmark

Sample Number	Position Latitude & Longitude	Date (da,mo,yr)	Time Start ¹ (AST)	Length of Tow (min.)	Net Type, Size, Mesh	Actual Depth of Sample (m)	TDR (m)	Sample & Tow Type	Comments
1000-600m Night, #1	18°09'N(?) 65°53'W	12-5-81	2305	50	"	1000-600	1000-650**	Oblique	
1000-600m Night #2	17°59'N 65°48'W	13-5-81	2058	50	"	1000-600	1050-600	"	

¹ Time started fishing

² These and other casts made on or after this date were made after the winch motor was replaced.

**Two pairs of nets were used in this cast, one set to fish over 600-200m, and the other 1000-600m.

Table 23. Zooplankton Displacement Volume-PROTEC 13.

Date	Time (AST)	Sample	Tow#	Displacement Volume (ml)	m ³ Water Filtered	Vol./m ³
13 V 81	1143-1145	25-0m day ³	1	4	52.5	0.076
				1	39.1	0.025
	1159-1203		2	5	72.6	0.069
				5	66.3	0.075
	1223-1228		3	7 ⁴	83.1	0.084
				6	89.2	0.067
9 V 81	1242-1247		4	7	81.7	0.086
				6	76.1	0.079
				2045-2053	25-0m night	1
11 V 81	0228-0238		2	12	156.1 ²	0.077
				16	140.3	0.114
	0251-1302		3	16	140.4	0.114
				20	171.4	0.117
	0315-0326		4	18	152.6	0.118
				18	173.3	0.104
12 V 81	0809-0825	200-25m day	1	20	181.2	0.110
				9	269.0	0.033
	0904-0921		2	9	237.7	0.038
				8	294.0	0.027
	1001-1017		3	10	266.0	0.037
				8	245.1	0.033
11 V 81	1102-1118		4	10	238.0	0.042
				4	199.1	0.020
	2009-2027	200-25m night	1	4	175.9	0.023
				12	302.3	0.040
	2128-2147		2	7	295.0	0.024
				9	239.8	0.037
14 V 81	2219-2235		3	10	223.1	0.045
				9	261.3	0.038
	2324-2339		4	9	230.2	0.039
				8	205.2	0.039
	1154-1242	600-200m day	1	10	203.2	0.049
				2	618.2	0.003
15 V 81	1033-1116		2	4	700.0	0.006
				2	750.9	0.003
12 V 81	2315-2355	600-200m night	1	4	799.5	0.005
				3	659.6	0.004
14 V 81	1945-2032		2	2	606.8	0.003
				5	868.5	0.006
				4	881.8	0.004

¹ Inboard net.² Outboard net.³ These and other casts on and after this date were made after winch motor was replaced. There was no range in rate of paying out or retrieving of wire.⁴ Sample spilled in laboratory.

Table 23. Zooplankton Displacement Volume-PROTEC 13. (Cont.)

Date	Time (AST)	Sample	Tow#	Displacement Vol. (ml)	m ³ Water Filtered	Vol./m ³
13 V 81	0936-1026	1000-600m day	1	6	1196.3	0.005
				4	1149.1	0.003
14 V 81	0853-0924		2	3	689.2	0.004
				1	702.8	0.001
12 V 81	2315-2355	1000-600m night ⁵	1	3	821.2	0.004
				2	718.1	0.003
13 V 81	2058-2148		2	1	592.3	0.002
				1	678.5	0.001

⁵Two pairs of nets were used in this cast, one set to fish over 600 to 200m and the other, 1000 to 600m. The TDR was attached below the lower pair of nets. It appears that the shallower nets fished from approximately 600 to 250m.

Table C 24. PROTEC-13

Zooplankton Counts

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13

Date of Sample: 13-5-81

Depth of Sample (m): 25-0

Net: Inboard

Rep. No.: 1

Sample No.: 25-0m, Day

Time of Sample: 1143

Sample Type: Zooplankton

Vol. Fil. (M³): 52.5

Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)	Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/16	34	10.36	2.6-10.4
Leptomedusae	1/16	2	0.61	1.6-2.8					
Trachymedusae	1/16	0	0						
Narcomedusae	1/16	0	0						
Siphonophora	1/16	4	1.22	2.0-8.0	LARVACEA				
Scyphozoa	1/16	0	0			1/128	21	51.20	2.4-3.2
CTENOPHORA					SALPIDAE				
						1/16	9	2.74	1.0-5.8
MOLLUSCA					FISH EGGS				
Heteropoda	1/16	0	0			1/16	3	0.91	0.8-1.4
Thecosomata	1/128	1	2.44	2.2					
Gymnosomata	1/16	0	0		LARVAL FISH				
						1/16	4	1.22	2.6-6.0
ANNELIDA (Polychaeta)	1/16	3	0.91	0.8-1.8	OTHER				
					Foraminifera	1/16	2	0.61	0.3-0.5
					Radiolaria	1/16	0	0	
					Amphioxus	1/16	2	0.61	6.8
ARTHROPODA									
Copepoda Calanoida	1/128	105	256.00	0.6-2.6					
Copepoda Cyclopoida	1/128	46	112.15	0.5-1.0					
Copepoda Harpacticoida	1/16	28	8.53	0.9-1.6	Cladocera	1/16	2	0.61	0.7-0.8
Ostracoda	1/16	8	2.44	0.3-1.8					
Amphipoda	1/16	0	0						
Euphausiacea	1/16	3	0.91	4.8-6.0					
Lucifer	1/16	0	0		<u>TOTAL</u>			457.43	
Decapod Larvae	1/16	13	3.96	1.6-3.6					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 13-5-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 1
 Sample No.: 25-0m, Day
 Time of Sample: 1143
 Sample Type: Zooplankton
 Vol. Fil. (M³): 39.1

Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)	Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/2	29	1.48	2.6-15.6
Leptomedusae	1/8	1	0.20	6.4					
Trachymedusae	1/2	0	0						
Narcomedusae	1/2	0	0	0					
Siphonophora	1/2	4	0.20	1.6-7.2	LARVACEA				
Scyphozoa	1/2	0	0			1/16	6	2.46	2.4-2.8
CTENOPHORA	1/2	0	0		SALPIDAE				
						1/2	3	0.15	1.2-3.0
MOLLUSCA					FISH EGGS				
Heteropoda	1/2	0	0			1/2	8	0.41	0.9-1.4
Thecosomata	1/8	1	0.20	2.8					
Gymnosomata	1/2	0	0		LARVAL FISH				
						1/2	1	0.05	5.6
ANNELIDA (Polychaeta)	1/2	1	0.05	1.0	OTHER				
					Foraminifera	1/2	1	0.05	0.3-0.9
					Radiolaria	1/2	0	0	
					Amphioxus	1/2	0	0	
ARTHROPODA									
Copepoda Calanoida	1/16	51	20.87	0.5-4.2					
Copepoda Cyclopoida	1/16	35	14.32	0.7-1.2					
Copepoda Harpacticoida	1/2	23	1.18	0.8-1.8					
Ostracoda	1/2	2	0.10	0.5-0.6					
Amphipoda	1/2	1	0.05	1.9					
Euphausiacea	1/2	1	0.05	6.8					
Lucifer	1/2	0	0		TOTAL			42.18	
Decapod Larvae	1/2	7	0.36	2.2-2.6					

Zooplankton Counts

Site, Cruise, Station: PROTEC-13
 Date of Sample: 13-5-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 2
 Sample #: 25-0m, Day
 Time of Sample: 1159
 Sample Type: Zooplankton
 Vol. Fil. (m³): 72.6

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/16	26	5.73	
Leptomedusae	1/4	9	0.49						
Trachymedusae	1/4	8	0.44						
Narcomedusae	1/4	0	0						
Siphonophora	1/16	7	1.54		LARVACEA	1/16	202	44.52	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/16	13	2.86	
MOLLUSCA					FISH EGGS	1/4	14	0.77	
Heteropoda	1/16	0	0						
Thecosomata	1/16	3	0.66		LARVAL FISH	1/4	18	0.99	
Gymnosomata	1/16	0	0						
ANNELIDA (Polychaeta)	1/16	11	2.42		OTHER				
ARTHROPODA					Foraminifera	1/128	7	12.34	
Copepoda Calanoida	1/128	143	252.12		Radiolaria	1/128	4	7.05	
Copepoda Cyclopoida	1/128	53	93.44		Amphioxus	1/4	0	0	
Copepoda Harpacticoida	1/128	2	3.53						
Ostracoda	1/16	0	0						
Amphipoda	1/16	1	0.22						
Euphausiacea	1/16	1	0.22						
Lucifer	1/16	0	0						
Decapod Larvae	1/16	9	1.98		TOTAL			451.32	

Zooplankton Counts

Site, Cruise, Station: PROTEC- 13
 Date of Sample: 13-5-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 2
 Sample #: 25-0m, Day
 Time of Sample: 1159
 Sample Type: Zooplankton
 Vol. Fil. (M³): 66.3

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/8	53	6.39	
Anthomedusae	1/4	1	0.06						
Leptomedusae	1/4	8	0.48						
Trachymedusae	1/4	4	0.24						
Narcomedusae	1/4	0	0		LARVACEA	1/8	199	24.01	
Siphonophora	1/8	6	0.72						
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/8	6	0.72	
MOLLUSCA					FISH EGGS	1/4	8	0.48	
Heteropoda	1/8	5	0.60						
Thecosomata	1/8	2	0.24		LARVAL FISH	1/4	6	0.36	
Gymnosomata	1/8	0	0						
ANNELIDA (Polychaeta)	1/8	17	2.05		OTHER	1/64	2	1.93	
					Foraminifera	1/64	0	0	
					Radiolaria				
ARTHROPODA									
Copepoda Calanoida	1/64	206	198.85						
Copepoda Cyclopoida	1/64	67	64.67						
Copepoda Harpacticoida	1/64	6	5.79						
Ostracoda	1/8	0	0						
Amphipoda	1/8	7	0.84						
Euphausiacea	1/8	0	0						
Lucifer	1/8	0	0						
Decapod Larvae	1/8	26	3.14		TOTAL			315.57	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEG-13

Date of Sample: 13-5-81

Depth of Sample (m): 25-0

Net: Inboard

Rep. No.: 3

Sample No.: 25-0m, Day

Time of Sample: 1223

Sample Type: 3 Zooplankton

Vol. Fil. (M): 83.1

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/32	7	2.70	1.6-2.4		1/32	22	8.47	1.8-6.4
Leptomedusae	1/32	4	1.54	1.6-2.4					
Trachymedusae	1/32	0	0						
Narcomedusae	1/32	0	0						
Siphonophora	1/32	7	2.70	2.8-3.2	LARVACEA	1/256	21	64.69	1.2-3.2
Scyphozoa	1/32	0	0						
CTENOPHORA	1/32	0	0		SALPIDAE	1/32	0	0	
MOLLUSCA					FISH EGGS	1/32	2	0.77	0.9-1.0
Heteropoda	1/32	0	0						
Thecosomata	1/32	0	0		LARVAL FISH	1/32	2	0.77	1.2-4.0
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	5	1.93	1.4-1.5	OTHER				
ARTHROPODA					Foraminifera	1/32	0	0	
Copepoda Calanoida	1/256	119	366.59	0.6-2.6	Radiolaria	1/32	0	0	
Copepoda Cyclopoida	1/256	30	92.42	0.6-1.2	Amphioxus	1/32	0	0	
Copepoda Harpacticoida	1/256	1	3.08	0.4					
Ostracoda	1/32	0	0						
Amphipoda	1/256	1	3.08	1.2					
Euphausiacea	1/32	0	0						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	5	1.93	1.8-3.2					
					TOTAL			550.67	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13

Date of Sample: 13-5-81

Depth of Sample (m): 25-0

Net: Outboard

Rep. No.: 3

Sample No.: 25-0m, Day

Time of Sample: 1223

Sample Type: 3 Zooplankton

Vol. Fil. (M³): 89.2

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/8	6	0.54	1.2-2.2		1/8	54	4.84	2.8-14.4
Leptomedusae	1/8	0	0						
Trachymedusae	1/8	0	0						
Narcomedusae	1/8	0	0						
Siphonophora	1/8	43	3.86	1.6-8.4	LARVACEA	1/64	52	37.31	1.4-2.6
Scyphozoa	1/8	0	0						
CTENOPHORA	1/8	0	0		SALPIDAE	1/8	2	0.18	1.2-3.2
MOLLUSCA					FISH EGGS	1/8	2	0.18	0.8-0.9
Heteropoda	1/8	0	0						
Thecosomata	1/8	1	0.09	2.2	LARVAL FISH	1/8	8	0.72	3.2-5.0
Gymnosomata	1/8	0	0						
ANNELIDA (Polychaeta)	1/8	14	1.26	0.8-2.8	OTHER				
					Foraminifera	1/8	0	0	
					Radiolaria	1/8	0	0	
					Amphioxus	1/8	0	0	
ARTHROPODA									
Copepoda Calanoida	1/64	299	214.53	0.6-2.5					
Copepoda Cyclopoida	1/64	114	81.79	0.8-1.0					
Copepoda Harpacticoida	1/8	22	1.97	1.2-1.8	Cladocera	1/8	3	0.27	0.6-0.9
Ostracoda	1/8	0	0						
Amphipoda	1/8	4	0.36	1.4-2.8					
Euphausiacea	1/8	0	0						
Lucifer	1/8	0	0		TOTAL			349.33	
Decapod Larvae	1/8	16	1.43	1.4-5.2					

Zooplankton Counts

Site, Cruise, Station: PROTEC-13
 Date of Sample: 13-5-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 4
 Sample #: 25-0m, Day
 Time of Sample: 1242
 Sample Type: Zooplankton
 Vol. Fil. (H³): 81.7

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	2	0.39			1/32	27	10.57	
Leptomedusae	1/16	10	1.96						
Trachymedusae	1/16	3	0.59						
Narcomedusae	1/16	0	0						
Siphonophora	1/32	7	2.74		LARVACEA	1/32	152	59.53	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	3	1.17	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/32	2	0.78						
Thecosomata	1/32	1	0.39						
Gymnosomata	1/32	0	0		LARVAL FISH	1/16	1	0.19	
ANNELIDA (Polychaeta)	1/32	18	7.05		OTHER				
					Foraminifera	1/256	1	3.13	
					Radiolaria	1/256	3	9.40	
ARTHROPODA									
Copepoda Calanoida	1/256	162	507.61						
Copepoda Cyclopoida	1/256	44	137.87						
Copepoda Harpacticoida	1/256	1	3.13						
Ostracoda	1/32	0	0						
Amphipoda	1/32	4	1.54						
Euphausiacea	1/32	0	0						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	8	3.13		TOTAL			751.2	

Zooplankton Counts

Site, Cruise, Station: PROTEC-13
 Date of Sample: 13-5-81
 Depth of Sample (m): 25-0m
 Net: Outboard

Rep. No.: 4
 Sample #: 25-0m, Day
 Time of Sample: 1242
 Sample Type: Zooplankton
 Vol. Fil. (m³): 76.1

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Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/32	16	6.73	
Anthomedusae	1/16	0	0						
Leptomedusae	1/16	7	1.44						
Trachymedusae	1/16	4	0.84						
Narcomedusae	1/16	0	0						
Siphonophora	1/32	6	2.52		LARVACEA	1/32	125	52.56	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	5	2.10	
MOLLUSCA					FISH EGGS	1/16	5	1.05	
Heteropoda	1/32	5	2.10						
Thecosomata	1/32	2	0.84		LARVAL FISH				
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	15	6.31		OTHER				
					Foraminifera	1/256	7	23.55	
					Radiolaria	1/256	2	6.73	
ARTHROPODA									
Copepoda Calanoida	1/256	144	484.41						
Copepoda Cyclopoida	1/256	23	74.34						
Copepoda Harpacticoida	1/256	2	6.43						
Ostracoda	1/32	0	0						
Amphipoda	1/32	5	2.10						
Euphausiacea	1/32	0	0						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	6	2.52						
					TOTAL			681.61	

Zooplankton Counts

Site, Cruise, Station: PROTEC- 13
 Date of Sample: 9-5-81
 Depth of Sample (m): 25-0m
 Net: Inboard

Rep. No.: 1
 Sample #: 25-0m, Night
 Time of Sample: 2045
 Sample Type: Zooplankton
 Vol. Fil.(l): 170.5

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/32	45	8.44	
Leptomedusae	1/16	3	0.28						
Trachymedusae	1/16	6	0.56						
Narcomedusae	1/16	6	0.56						
Siphonophora	1/32	9	1.69		LARVACEA	1/32	73	13.70	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	4	0.75	
MOLLUSCA									
Heteropoda	1/32	1	0.19		FISH EGGS	1/16	0	0	
Thecosomata	1/32	9	1.69						
Gymnosomata	1/32	0	0		LARVAL FISH	1/16	1	0.94	
ANNELIDA (Polychaeta)	1/32	19	3.56		OTHER				
					Foraminifera	1/128	1	0.75	
					Radiolaria	1/128	0	0	
ARTHROPODA									
Copepoda Calanoida	1/128	360	270.26						
Copepoda Cyclopoida	1/128	143	107.35						
Copepoda Harpacticoida	1/128	4	3.00						
Ostracoda	1/32	13	2.44						
Amphipoda	1/32	1	0.19						
Euphausiacea	1/32	4	0.75						
Lucifer	1/32	1	0.19						
Decapod Larvae	1/32	36	6.76		TOTAL			424.33	

Zooplankton Counts

Site, Cruise, Station: PROTEC- 13
 Date of Sample: 9-5-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 1
 Sample #: 25-0m
 Time of Sample: 2045
 Sample Type: Zooplankton
 Vol. Fil. (M³): 156.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/32	44	9.02	
Anthomedusae	1/16	0	0						
Leptomedusae	1/16	3	0.31						
Trachymedusae	1/16	13	1.33						
Narcomedusae	1/16	7	0.72						
Siphonophora	1/32	18	3.69		LARVACEA	1/32	121	24.80	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	5	1.02	
MOLLUSCA					FISH EGGS	1/16	1	0.10	
Heteropoda	1/32	0	0						
Thecosomata	1/32	8	1.64		LARVAL FISH	1/16	5	0.51	
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	26	5.33		OTHER				
ARTHROPODA					Foraminifera	1/256	0	0	
Copepoda Calanoida	1/256	279	457.55		Radiolaria	1/256	0	0	
Copepoda Cyclopoida	1/256	108	177.12		Amphioxus	1/16	4	0.41	
Copepoda Harpacticoida	1/25	4	6.56		Squid	1/16	1	0.10	
Ostracoda	1/32	8	1.64						
Amphipoda	1/32	0	0						
Euphausiacea	1/32	6	1.23						
Lucifer	1/32	1	0.20		TOTAL			702.09	
Decapod Larvae	1/32	43	8.81						

Zooplankton Counts

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 2
 Sample #: 25-0m, Night
 Time of Sample: 0228
 Sample Type: Zooplankton
 Vol. Fil.(ml): 140.3

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	2	0.23			1/32	33	7.53	
Leptomedusae	1/16	3	0.34						
Trachymedusae	1/16	18	2.05						
Narcomedusae	1/16	4	0.46						
Siphonophora	1/32	10	2.28		LARVACEA	1/32	143	32.61	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	4	0.91	
MOLLUSCA					FISH EGGS	1/16	1	0.11	
Heteropoda	1/32	1	0.23						
Thecosomata	1/32	1	0.23						
Gymnosomata	1/32	0	0		LARVAL FISH	1/16	8	0.91	
ANNELIDA (Polychaeta)	1/32	5	1.14		OTHER				
					Foraminifera	1/256	4	7.30	
					Radiolaria	1/256	1	0.11	
ARTHROPODA									
Copepoda Calanoida	1/256	262	448.06						
Copepoda Cyclopoida	1/256	162	295.59						
Copepoda Harpacticoida	1/256	2	3.65						
Ostracoda	1/32	4	0.91						
Amphipoda	1/32	5	1.14						
Euphausiacea	1/32	7	1.60						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	145	33.07		TOTAL			870.92	

Zooplankton Counts

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 2
 Sample #: 25-0m, Night
 Time of Sample: 0228
 Sample Type: Zooplankton
 Vol. Fil. (H³): 140.4

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	7	0.80			1/32	37	8.43	
Leptomedusae	1/16	5	0.57						
Trachymedusae	1/16	13	1.48						
Narcomedusae	1/16	1	0.11		LARVACEA	1/32	166	37.83	
Siphonophora	1/32	11	2.51						
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/32	3	0.68	
MOLLUSCA					FISH EGGS	1/16	0	0	
Heteropoda	1/32	4	0.91						
Thecosomata	1/32	5	1.14		LARVAL FISH	1/16	7	0.80	
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	11	2.51		OTHER				
ARTHROPODA					Foraminifera	1/256	3	5.47	
Copepoda Calanoida	1/256	340	619.94		Radiolaria	1/256	0	0	
Copepoda Cyclopoida	1/256	117	213.33		Amphioxus	1/16	4	0.45	
Copepoda Harpacticoida	1/256	2	3.65		Squid	1/16	1	0.13	
Ostracoda	1/32	9	2.05						
Amphipoda	1/32	4	0.91						
Euphausiacea	1/32	15	3.42						
Lucifer	1/32	0	0						
Decapod Larvae	1/32	169	38.52						
					TOTAL			945.64	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13

Date of Sample: 11-5-81

Depth of Sample (m): 25-0

Net: Inboard

Rep. No.: 3

Sample No.: 25-0m, Night

Time of Sample: 0251

Sample Type: ³ Zooplankton

Vol. Fil. (M): 171.4

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	6	2.24	1.2-2.2		1/64	59	22.03	5.6-17.2
Leptomedusae	1/64	4	1.49	0.8-5.6					
Trachymedusae	1/64	0	0						
Narcomedusae	1/64	0	0						
Siphonophora	1/64	21	7.84	2.0-11.2	LARVACEA	1/512	20	59.74	2.4-3.8
Scyphozoa									
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	2	0.75	4.8
MOLLUSCA					FISH EGGS	1/64	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	4	1.49	1.2-2.2					
Gymnosomata	1/64	0	0		LARVAL FISH	1/64	7	2.61	1.8-3.8
ANNELIDA (Polychaeta)	1/64	7	2.61	0.6-5.6	OTHER				
ARTHROPODA					Foraminifera	1/64	0	0	
Copepoda Calanoida	1/512	381	1138.11	0.8-2.6	Radiolaria	1/64	0	0	
Copepoda Cyclopoida	1/512	185	552.62	0.7-1.4	Amphioxus	1/64	2	0.75	7.6
Copepoda Harpacticoida	1/64	8	2.99	0.8-1.6					
Ostracoda	1/64	5	1.87	0.8-1.6					
Amphipoda	1/64	3	1.12	1.6-2.4					
Euphausiacea	1/64	3	1.12	3.6-6.4					
Lucifer	1/64	0	0		TOTAL			1890.86	
Decapod Larvae	1/64	245	91.48	1.2-9.6					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 3
 Sample No.: 25-0m, Night
 Time of Sample: 0251
 Sample Type: 3 Zooplankton
 Vol. Fil. (M³): 152.6

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	4	1.68	0.9-1.4		1/64	32	13.42	4.0-16.0
Leptomedusae	1/64	0	0						
Trachymedusae	1/64	0	0						
Narcomedusae	1/64	0	0						
Siphonophora	1/64	21	8.81	1.4-8.8	LARVACEA	1/512	21	70.46	1.2-4.0
Scyphozoa	1/64	0	0						
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	9	3.77	2.4-5.2
MOLLUSCA					FISH EGGS	1/64	1	0.42	3.2
Heteropoda	1/64	0	0						
Thecosomata	1/64	2	0.84	1.2					
Gymnosomata	1/64	0	0		LARVAL FISH	1/64	8	3.36	1.8-4.4
ANNELIDA (Polychaeta)	1/64	5	2.10	1.8-2.0	OTHER				
					Foraminifera	1/64	2	0.84	0.4
					Radiolaria	1/64	0	0	
					Amphioxus	1/64	6	2.52	6.0-7.6
ARTHROPODA									
Copepoda Calanoida	1/512	321	1077.01	0.6-2.6					
Copepoda Cyclopoida	1/512	145	486.50	0.5-2.0					
Copepoda Harpacticoida	1/64	10	4.19	0.6-1.5					
Ostracoda	1/64	6	2.52	0.8-1.2					
Amphipoda	1/64	5	2.10	1.7-3.6					
Euphausiacea	1/64	12	5.03	2.4-8.0					
Lucifer	1/64	0	0		TOTAL			1774.06	
Decapod Larvae	1/64	211	88.49	0.9-8.8					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 25-0
 Net: Inboard

Rep. No.: 4
 Sample No.: 25-0m, Night
 Time of Sample: 0315
 Sample Type: Zooplankton
 Vol. Fil. (M): 173.3

Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m^{-3}	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/32	1	0.18	1.6		1/32	99	18.28	4.2-24.0
Leptomedusae	1/32	6	1.11	2.4-6.8					
Trachymedusae	1/32	0	0	0					
Narcomedusae	1/32	1	0.18	1.4					
Siphonophora	1/32	53	9.79	1.8-17.6	LARVACEA	1/512	15	44.32	1.3-2.4
Scyphozoa	1/32	0	0						
CTENOPHORA	1/32	0	0		SALPIDAE	1/32	15	2.77	1.6-10.0
MOLLUSCA					FISH EGGS	1/32	15	2.77	1.3-3.0
Heteropoda	1/32	0	0						
Thecosomata	1/32	6	1.11	1.1-2.8	LARVAL FISH	1/32	26	4.80	1.4-6.8
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	7	1.29	0.6-4.6	OTHER				
ARTHROPODA					Foraminifera	1/32	0	0	
Copepoda Calanoida	1/512	294	868.60	0.6-2.9	Radiolaria	1/32	0	0	
Copepoda Cyclopoida	1/512	146	431.34	0.8-1.6	Amphioxus	1/32	4	0.74	6.6-7.4
Copepoda Harpacticoida	1/32	8	1.48	1.6-1.9					
Ostracoda	1/32	9	1.66	0.9-2.3	Cladocera	1/512	1	2.95	0.8
Amphipoda	1/512	1	2.95	1.0					
Euphausiacea	1/32	10	1.85	6.0-7.6					
Lucifer	1/512	1	2.95	14.4	TOTAL			1457.44	
Decapod Larvae	1/32	305	56.32	1.0-10.1					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 25-0
 Net: Outboard

Rep. No.: 4
 Sample No.: 25-0m, Night
 Time of Sample: 0315
 Sample Type: 3 Zooplankton
 Vol. Fil. (M³): 181.2

Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)	Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/32	13	2.30	0.8-1.6		1/32	59	10.42	3.6-16.8
Leptomedusae	1/32	10	1.77	2.4-4.8					
Trachymedusae	1/32	0	0						
Narcomedusae	1/32	0	0						
Siphonophora	1/32	31	5.47	1.0-10.4	LARVACEA	1/32	172	30.38	1.0-3.0
Scyphozoa	1/32	0	0						
CTENOPHORA	1/32	0	0		SALPIDAE	1/32	9	1.59	1.6-3.8
MOLLUSCA					FISH EGGS	1/32	4	0.71	1.3-1.4
Heteropoda	1/32	0	0						
Thecosomata	1/32	10	1.77	1.0-3.6	LARVAL FISH	1/32	21	3.71	1.4-6.4
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	2	0.35	1.0-1.1	OTHER				
ARTHROPODA					Foraminifera	1/32	0	0	
Copepoda Calanoida	1/512	193	545.34	0.7-2.6	Radiolaria	1/32	0	0	
Copepoda Cyclopoida	1/512	89	251.48	0.8-1.8	Amphioxus	1/32	1	0.18	7.5
Copepoda Harpacticoida	1/32	12	2.12	1.2-1.6					
Ostracoda	1/32	9	1.59	0.5-1.2	Cladocera	1/32	2	0.35	0.8-0.9
Amphipoda	1/32	6	1.06	1.4-1.8					
Euphausiacea	1/32	0	0						
Lucifer	1/32	0	0		TOTAL			862.53	
Decapod Larvae	1/32	124	1.94	1.0-8.0					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13

Date of Sample: 12-5-81

Depth of Sample (m): 200-25

Net: Inboard

Rep. No.: 1

Sample No.: 200-25m, Day

Time of Sample: 0809

Sample Type: ³ ZooplanktonVol. Fil. (M³): 269.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm).
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	3	0.71	0.5-0.8		1/64	17	4.04	2.4-14.4
Leptomedusae	1/64	4	0.95	0.9-4.6					
Trachymedusae	1/64	0	0						
Narcomedusae	1/64	0	0						
Siphonophora	1/64	9	2.14	1.0-4.0	LARVACEA				
Scyphozoa	1/64	0	0			1/64	78	18.55	1.6-5.4
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	12	2.85	0.8-4.4
MOLLUSCA					FISH EGGS	1/64	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	2	0.48	1.0-1.2					
Gymnosomata	1/64	0	0		LARVAL FISH	1/64	3	0.71	1.7-3.2
ANNELIDA (Polychaeta)	1/64	6	1.43	1.2-2.4	OTHER				
ARTHROPODA					Foraminifera	1/64	1	0.24	0.6
Copepoda Calanoida	1/512	76	144.65	0.6-2.8	Radiolaria	1/64	0	0	
Copepoda Cyclopoida	1/512	64	121.81	0.9-1.8	Amphioxus	1/64	0	0	
Copepoda Harpacticoida	1/64	0	0						
Ostracoda	1/64	53	12.61	0.5-1.4					
Amphipoda	1/64	6	1.43	1.4-1.9					
Euphausiacea	1/64	0	0						
Lucifer	1/64	0	0						
Decapod Larvae	1/64	26	6.18	1.2-6.4					
					<u>TOTAL</u>			318.78	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 12-5-81
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 1
 Sample No.: 200-25m, Day
 Time of Sample: 0809
 Sample Type: ³ Zooplankton
 Vol. Fil. (M³): 237.7

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/32	5	0.67	0.5-1.4		1/32	30	4.04	3.8-12.0
Leptomedusae	1/32	4	0.54	2.0-4.0					
Trachymedusae	1/32	0	0						
Narcomedusae	1/32	0	0						
Siphonophora	1/32	11	1.48	1.6-6.6	LARVACEA	1/32	67	9.02	1.3-4.0
Scyphozoa	1/32	0	0						
CTENOPHORA	1/32	0	0		SALPIDAE	1/32	18	2.42	0.9-6.4
MOLLUSCA					FISH EGGS	1/32	2	0.27	0.6
Heteropoda	1/32	2	0.27	1.6					
Thecosomata	1/32	3	0.40	1.0-2.4					
Gymnosomata	1/32	0	0		LARVAL FISH	1/32	5	0.67	1.6-2.8
ANNELIDA (Polychaeta)	1/32	3	0.40	1.1-2.0	OTHER				
					Foraminifera	1/32	3	0.40	0.5-0.6
					Radiolaria	1/32	0	0	
					Amphioxus	1/32	2	0.27	5.6-6.8
ARTHROPODA									
Copepoda Calanoida	1/256	107	115.24	0.6-2.2					
Copepoda Cyclopoida	1/256	70	75.39	0.7-2.4					
Copepoda Harpacticoida	1/32	5	0.67	0.7-1.8					
Ostracoda	1/32	44	5.92	0.9-1.4					
Amphipoda	1/32	2	0.27	1.3-3.2					
Euphausiacea	1/32	4	0.54	5.4-5.6					
Lucifer	1/32	0	0		TOTAL			222.24	
Decapod Larvae	1/32	25	3.36	1.0-6.0					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 12-5-81
 Depth of Sample (m): 250-25
 Net: Inboard

Rep. No.: 2
 Sample No.: 200-25m, Day
 Time of Sample: 0904
 Sample Type: 3 Zooplankton
 Vol. Fil. (M³): 294.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/32	5	0.54	0.5-1.6		1/32	39	4.24	3.2-20.8
Leptomedusae	1/32	4	0.44	0.8-5.2					
Trachymedusae	1/32	0	0						
Narcomedusae	1/32	0	0						
Siphonophora	1/32	30	3.27	0.9-4.0	LARVACEA	1/32	104	11.32	2.0-4.0
Scyphozoa	1/32	0	0						
CTENOPHORA	1/32	0	0		SALPIDAE	1/32	28	3.05	1.3-6.8
MOLLUSCA					FISH EGGS	1/32	0	0	
Heteropoda	1/32	0	0						
Thecosomata	1/32	0	0		LARVAL FISH	1/32	4	0.44	2.2-3.2
Gymnosomata	1/32	0	0						
ANNELIDA (Polychaeta)	1/32	4	0.44	2.8-7.2	OTHER				
ARTHROPODA					Foraminifera	1/32	2	0.22	0.2-0.3
Copepoda Calanoida	1/256	222	193.31	0.6-3.2	Radiolaria	1/32	0	0	
Copepoda Cyclopoida	1/256	99	86.20	0.6-1.7	Amphioxus	1/32	1	0.11	7.3
Copepoda Harpacticoida	1/32	7	0.76	1.0-1.6					
Ostracoda	1/32	49	5.33	0.4-1.1					
Amphipoda	1/32	3	0.33	2.0-3.6					
Euphausiacea	1/32	8	0.87	1.8-5.8					
Lucifer	1/32	0	0						
Decapod Larvae	1/32	21	2.29	1.0-5.6	<u>TOTAL</u>			313.16	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 12-5-81
 Depth of Sample (m): 250-25
 Net: Outboard

Rep. No.: 2
 Sample No.: 200-25m, Day
 Time of Sample: 0904
 Sample Type: Zooplankton
 Vol. Fil. (M³): 266.0

Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)	Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/32	2	0.24	0.6-0.9		1/32	27	3.25	2.1-11.2
Leptomedusae	1/32	1	0.12	1.2					
Trachymedusae	1/32	0	0						
Narcomedusae	1/32	0	0						
Siphonophora	1/32	6	0.72	1.2-4.4	LARVACEA	1/256	14	13.47	1.2-3.1
Scyphozoa									
CTENOPHORA	1/32	0	0		SALPIDAE	1/32	18	14.20	1.4-4.4
MOLLUSCA					FISH EGGS	1/32	0	0	
Heteropoda	1/32	1	0.24	1.4					
Thecosomata	1/32	4	0.48	1.3-1.8					
Gymnosomata	1/32	0	0		LARVAL FISH	1/32	4	0.48	2.4-56
ANNELIDA (Polychaeta)	1/32	8	0.96	2.1-4.4	OTHER				
ARTHROPODA					Foraminifera	1/32	1	0.12	0.2
Copepoda Calanoida	1/256	141	135.70	0.6-2.5	Radiolaria	1/32	0	0	
Copepoda Cyclopoida	1/256	57	54.86	0.7-2.4	Amphioxus	1/32	1	0.12	6.4
Copepoda Harpacticoida	1/32	1	0.12	1.6					
Ostracoda	1/32	39	4.69	0.4-1.6					
Amphipoda	1/32	4	0.48	1.4-2.1					
Euphausiacea	1/32	6	0.72	2.4-6.0					
Lucifer	1/32	0	0		TOTAL			234.10	
Decapod Larvae	1/32	26	3.13	1.0-5.6					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 12-5-81
 Depth of Sample (m): 200-25m
 Net: Inboard

Rep. No.: 3
 Sample No.: 200-25m, Day
 Time of Sample: 1001
 Sample Type: Zooplankton
 Vol. Fil. (M³): 245.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	2	0.52	0.8-1.6		1/64	18	4.70	4.5-12.0
Leptomedusae	1/64	1	0.26	3.6					
Trachymedusae	1/64	0	0						
Narcomedusae	1/64	0	0						
Siphonophora	1/64	6	1.57	1.6-3.6	LARVACEA	1/64	85	22.20	1.4-4.0
Scyphozoa									
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	16	4.18	0.8-4.4
MOLLUSCA					FISH EGGS	1/64	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	3	0.78	1.4-1.6					
Gymnosomata	1/64	1	0.26	2.4	LARVAL FISH	1/16	7	1.83	2.2-7.8
ANNELIDA (Polychaeta)	1/64	4	1.04	0.8-4.8	OTHER				
ARTHROPODA					Foraminifera	1/64	0	0	
Copepoda Calanoida	1/256	258	269.47	0.5-2.4	Radiolaria	1/64	0	0	
Copepoda Cyclopoida	1/256	100	104.45	0.8-1.8	Amphioxus	1/64	0	0	
Copepoda Harpacticoida	1/256	1	1.04	1.4					
Ostracoda	1/64	28	7.31	0.3-3.2					
Amphipoda	1/64	2	0.52	1.0-2.0					
Euphausiacea	1/64	1	0.26	9.4					
Lucifer	1/64	0	0						
Decapod Larvae	1/64	23	6.01	1.0-4.2					
					<u>TOTAL</u>			426.40	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 12-5-81
 Depth of Sample (m): 200-25
 Net: Outboard

Rep. No.: 3
 Sample No.: 200-25m, Day
 Time of Sample: 1001
 Sample Type: 3 Zooplankton
 Vol. Fil. (M³): 238.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	5	1.34	0.8-1.2		1/64	7	1.88	4.0-8.4
Leptomedusae	1/64	1	0.27	3.2					
Trachymedusae	1/64	0	0						
Narcomedusae	1/64	0	0						
Siphonophora	1/64	11	2.96	1.7-7.2	LARVACEA	1/64	69	18.55	1.0-3.4
Scyphozoa	1/64	0	0						
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	7	1.88	1.2-4-8
MOLLUSCA					FISH EGGS	1/64	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	0	0						
Gymnosomata	1/64	0	0		LARVAL FISH	1/64	2	0.54	2.2-3.4
ANNELIDA (Polychaeta)	1/64	2	0.54	1.6-2.4	OTHER				
ARTHROPODA					Foraminifera	1/64	0	0	
Copepoda Calanoida	1/256	184	197.92	0.6-2.6	Radiolaria	1/64	0	0	
Copepoda Cyclopoida	1/256	52	55.93	0.6-3.2	Amphioxus	1/64	1	0.27	4.8
Copepoda Harpacticoida	1/64	1	0.27	1.4					
Ostracoda	1/64	20	5.38	0.5-1.2					
Amphipoda	1/64	0	0						
Euphausiacea	1/64	3	0.81	2.6-4.4					
Lucifer	1/64	0	0						
Decapod Larvae	1/64	10	2.69	1.7-4.8					
					TOTAL			291.23	

Zooplankton Counts

Site, Cruise, Station: PROTEC-13
 Date of Sample: 12-5-81
 Depth of Sample (m): 250-25
 Net: Inboard

Rep. No.: 4
 Sample #: 200-25m, Day
 Time of Sample: 1102
 Sample Type: Zooplankton
 Vol. Fil.(M³): 199.1

C-85

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/8	27	1.08	
Leptomedusae	1/4	2	0.04						
Trachymedusae	1/4	16	0.32						
Narcomedusae	1/4	1	0.02		LARVACEA				
Siphonophora	1/8	10	0.40			1/8	30	1.20	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/8	38	1.53	
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/8	1	0.04						
Thecosomata	1/8	6	0.24						
Gymnosomata	1/8	0	0		LARVAL FISH	1/4	17	0.34	
ANNELIDA (Polychaeta)	1/8	21	0.84		OTHER				
					Foraminifera	1/64	2	0.64	
					Radiolaria	1/64	3	0.96	
ARTHROPODA									
Copepoda Calanoida	1/64	159	51.11						
Copepoda Cyclopoida	1/64	48	15.43						
Copepoda Harpacticoida	1/64	0	0						
Ostracoda	1/8	75	3.01						
Amphipoda	1/8	6	0.24						
Euphausiacea	1/8	10	0.40						
Lucifer	1/8	0	0		TOTAL			78.48	
Decapod Larvae	1/8	16	0.64						

Zooplankton Counts

Site, Cruise, Station: PROTEC- 13
 Date of Sample: 12-5-81
 Depth of Sample (m): 250-25
 Net: Outboard

Rep. No.: 4
 Sample #: 200-25m, Day
 Time of Sample: 1102
 Sample Type: Zooplankton
 Vol. Fil. (M³): 175.9

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	3	0.03			1/4	43	0.90	
Leptomedusae	1/2	5	0.06						
Trachymedusae	1/2	28	0.32						
Narcomedusae	1/2	2	0.02						
Siphonophora	1/4	12	0.27		LARVACEA	1/4	62	1.41	
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/4	44	1.00	
MOLLUSCA					FISH EGGS	1/2	1	0.01	
Heteropoda	1/4	3	0.07						
Thecosomata	1/4	14	0.32		LARVAL FISH	1/2	9	0.10	
Gymnosomata	1/4	0	0						
ANNELIDA (Polychaeta)	1/4	25	0.57		OTHER				
ARTHROPODA					Foraminifera	1/32	1	0.18	
Copepoda Calanoida	1/32	167	30.38		Radiolaria	1/32	0	0	
Copepoda Cyclopoida	1/32	74	13.46		Amphioxus	1/2	7	0.08	
Copepoda Harpacticoida	1/32	1	0.18		Squid	1/2	1	0.01	
Ostracoda	1/4	146	3.32						
Amphipoda	1/4	0	0						
Euphausiacea	1/4	13	0.29						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	27	0.61		TOTAL			53.67	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 225-25
 Net: Inboard

Rep. No.: 1
 Sample No.: 200-25m, Night
 Time of Sample: 2009
 Sample Type: 3 Zooplankton
 Vol. Fil. (M³): 302.3

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	1	0.21	1.0		1/64	35	7.41	3.2-14.4
Leptomedusae	1/64	3	0.64	0.5-2.0					
Trachymedusae	1/64	0	0						
Narcomedusae	1/64	0	0						
Siphonophora	1/64	6	1.27	2.6-8.6	LARVACEA	1/64	33	6.99	2.0-4.0
Scyphozoa	1/64	0	0						
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	19	4.02	1.6-7.2
MOLLUSCA					FISH EGGS	1/64	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	5	1.06	0.8-1.6					
Gymnosomata	1/64	0	0		LARVAL FISH	1/64	7	1.48	2.2-3.4
ANNELIDA (Polychaeta)	1/64	4	0.85	4.4-12.0	OTHER				
ARTHROPODA					Foraminifera	1/64	0	0	
Copepoda Calanoida	1/256	209	176.99	0.6-3.0	Radiolaria	1/64	0	0	
Copepoda Cyclopoida	1/256	107	90.61	0.8-2.7	Amphioxus	1/64	0	0	
Copepoda Harpacticoida	1/64	3	0.64	0.9-1.4					
Ostracoda	1/64	38	8.04	0.3-1.4	Cladocera	1/64	1	0.21	0.5
Amphipoda	1/64	2	0.43	1.2-2.4					
Euphausiacea	1/64	4	0.85	2.2-12.0					
<u>Lucifer</u>	1/64	0	0		<u>TOTAL</u>			304.87	
Decapod Larvae	1/64	15	3.18	1.6-10.4					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 225-25
 Net: Outboard

Rep. No.: 1
 Sample No.: 200-25m, Night
 Time of Sample: 2009
 Sample Type: 3 Zooplankton
 Vol. Fil. (M³): 295.0

C-88

Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)	Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)
COELENTERATA					CHAETOGNATHA	1/32	29	3.15	2.1-12.8
Anthomedusae	1/32	2	0.22	0.8-1.7					
Leptomedusae	1/32	3	0.33	0.9-5.2					
Trachymedusae	1/32	0	0						
Narcomedusae	1/32	1	0.11	0.8					
Siphonophora	1/32	7	0.76	0.8-5.2	LARVACEA	1/32	39	4.23	2.3-4.2
Scyphozoa	1/32	0	0						
CTENOPHORA	1/32	0	0		SALPIDAE	1/32	7	0.76	1.0-5.2
MOLLUSCA					FISH EGGS	1/32	0	0	
Heteropoda	1/32	1	0.11	0.8					
Thecosomata	1/32	8	0.87	0.9-2.6					
Gymnosomata	1/32	0	0		LARVAL FISH	1/32	10	1.08	1.7-8.0
ANNELIDA (Polychaeta)	1/32	3	0.33	2.0	OTHER				
ARTHROPODA					Foraminifera	1/32	3	0.33	0.2-0.6
Copepoda Calanoida	1/256	83	72.03	0.5-3.2	Radiolaria	1/32	0	0	
Copepoda Cyclopoida	1/256	75	65.08	1.4-2.8	Amphioxus	1/32	1	0.11	6.2-7.0
Copepoda Harpacticoida	1/32	2	0.22	0.8-1.0					
Ostracoda	1/32	51	5.53	0.3-1.4	Cladocera	1/32	1	0.11	1.0
Amphipoda	1/32	2	0.22	1.0-1.4					
Euphausiacea	1/32	1	0.11	3.3					
Lucifer	1/32	0	0		TOTAL			159.27	
Decapod Larvae	1/32	33	3.58	1.0-2.8					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 210-0
 Net: Inboard

Rep. No.: 2
 Sample No.: 200-25m, Night
 Time of Sample: 2128
 Sample Type: Zooplankton
 Vol. Fil. (M³): 239.8

C-89

Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)	Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	7	1.87	0.6-1.8		1/64	21	5.60	7.2-18.0
Leptomedusae	1/64	4	1.07	0.9-6.4					
Trachymedusae	1/64	0	0						
Narcomedusae	1/64	0	0						
Siphonophora	1/64	4	1.07	1.0-5.7	LARVACEA	1/256	24	25.62	1.3-4.0
Scyphozoa									
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	13	3.47	1.3-6.4
MOLLUSCA					FISH EGGS	1/64	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	2	0.53	1.3-2.8					
Gymnosomata	1/64	0	0		LARVAL FISH	1/64	10	2.67	1.2-4.4
ANNELIDA (Polychaeta)	1/64	10	2.67	0.2-2.6	OTHER				
ARTHROPODA					Foraminifera	1/64	2	0.53	0.2-0.5
Copepoda Calanoida	1/256	286	305.32	0.6-3.4	Radiolaria	1/64	0	0	
Copepoda Cyclopoida	1/256	165	176.15	0.8-2.1	Amphioxus	1/64	3	0.80	6.7-7.6
Copepoda Harpacticoida	1/64	3	0.80	1.0-1.4					
Ostracoda	1/64	45	12.01	0.3-1.6					
Amphipoda	1/64	1	0.27	1.6					
Euphausiacea	1/64	14	3.74	1.2-9.6					
Lucifer	1/64	0	0						
Decapod Larvae	1/64	30	8.01	0.8-8.0					
					TOTAL			552.20	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 210-0
 Net: Outboard

Rep. No.: 2
 Sample No.: 200-25m, Night
 Time of Sample: 2128
 Sample Type: ³Zooplankton
 Vol. Fil. (M³): 223.1

C-90

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	2	0.57	1.1-3.6		1/64	13	3.37	3.4-13.6
Leptomedusae	1/64	6	1.72	0.3-6.4					
Trachymedusae	1/64	0	0						
Narcomedusae	1/64	0	0						
Siphonophora	1/64	13	3.37	0.8-4.8	LARVACEA	1/256	21	24.10	1.1-3.7
Scyphozoa	1/64	0	0						
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	8	2.29	1.2-3.2
MOLLUSCA					FISH EGGS	1/64	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	2	0.57	0.6-1.2					
Gymnosomata	1/64	0	0		LARVAL FISH	1/64	4	1.15	1.6-6.5
ANNELIDA (Polychaeta)	1/64	8	2.29	0.7-2.8	OTHER				
ARTHROPODA					Foraminifera	1/64	1	0.29	0.3
Copepoda Calanoida	1/256	131	150.32	0.4-4.4	Radiolaria	1/64	0	0	
Copepoda Cyclopoida	1/256	64	73.44	0.7-2.0	Amphioxus	1/64	0	0	
Copepoda Harpacticoida	1/64	4	1.15	1.0-1.6					
Ostracoda	1/64	31	8.89	0.4-1.1	Cladocera	1/64	1	0.29	0.9
Amphipoda	1/64	1	0.29	1.0					
Euphausiacea	1/64	5	1.43	2.2-7.2					
Lucifer	1/64	0	0		TOTAL			280.84	
Decapod Larvae	1/64	16	4.59	1.4-3.5					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13

Date of Sample: 11-5-81

Depth of Sample (m): 200-25m

Net: Inboard

Rep. No.: 3

Sample No.: 200-25m, Night

Time of Sample: 2219

Sample Type: 3, Zooplankton

Vol. Fil. (M³): 261.3

C-91

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	0	0			1/64	26	6.37	1.6-12.8
Leptomedusae	1/64	1	0.24	4.0					
Trachymedusae	1/64	0	0						
Narcomedusae	1/64	0	0		LARVACEA	1/64	43	10.53	1.3-3.0
Siphonophora	1/64	12	2.94	1.4-6.4					
Scyphozoa	1/64	0	0						
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	19	4.65	1.2-5.2
MOLLUSCA					FISH EGGS	1/64	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	2	0.49	0.6-0.9					
Gymnosomata	1/64	0	0		LARVAL FISH	1/64	12	2.94	2.0-4.8
ANNELIDA (Polychaeta)	1/64	3	0.73	0.5-7.2	OTHER				
ARTHROPODA					Foraminifera	1/64	2	0.50	0.4-0.5
Copepoda Calanoida	1/256	182	178.31	0.6-2.4	Radiolaria	1/64	0	0	
Copepoda Cyclopoida	1/256	113	110.71	0.9-2.8	Amphioxus	1/64	1	0.24	7.0
Copepoda Harpacticoida	1/64	0	0	0					
Ostracoda	1/64	41	10.04	0.5-1.9					
Amphipoda	1/64	1	0.24	1.6					
Euphausiacea	1/64	11	2.69	2.4-7.6					
Lucifer	1/64	0	0		TOTAL			337.25	
Decapod Larvae	1/64	23	5.63	1.4-7.2					

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 200-25m
 Net: Outboard

Rep. No.: 3
 Sample No.: 200-25m, Night
 Time of Sample: 2219
 Sample Type: 3 Zooplankton
 Vol. Fil. (M³): 230.2

Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)	Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/64	1	0.28	0.5		1/64	11	3.06	5.2-15.2
Leptomedusae	1/64	3	0.83	0.7-3.2					
Trachymedusae	1/64	1	0.28	2.9					
Narcomedusae	1/64	0	0		LARVACEA	1/64	24	6.67	1.2-3.2
Siphonophora	1/64	1	0.28	2.0					
Scyphozoa	1/64	0	0						
CTENOPHORA	1/64	0	0		SALPIDAE	1/64	8	2.22	1.6-17.6
MOLLUSCA					FISH EGGS	1/64	0	0	
Heteropoda	1/64	0	0						
Thecosomata	1/64	2	0.56	1.2		1/64	8	2.22	1.4-4.0
Gymnosomata	1/64	0	0		LARVAL FISH				
ANNELIDA (Polychaeta)	1/64	2	0.56	2.0-4.0	OTHER				
ARTHROPODA					Foraminifera	1/64	0	0	
Copepoda Calanoida	1/256	106	117.88	0.6-2.5	Radiolaria	1/64	0	0	
Copepoda Cyclopoida	1/256	81	90.08	0.7-2.8	Amphioxus	1/64	1	0.28	5.7
Copepoda Harpacticoida	1/64	3	0.83	0.8-1.0					
Ostracoda	1/64	22	6.12	0.4-1.7					
Amphipoda	1/64	1	0.28	3.2-5.7					
Euphausiacea	1/64	4	1.11	2.2-3.6					
Lucifer	1/64	0	0		TOTAL			237.43	
Decapod Larvae	1/64	14	3.89	0.9-5.6					

Zooplankton Counts.

Site, Cruise, Station: PROTEC-13
 Date of Sample: 11-5-81
 Depth of Sample (m): 250-25
 Net: Inboard

Rep. No.: 4
 Sample #: 200-25m, Night
 Time of Sample: 2324
 Sample Type: Zooplankton
 Vol. Fil. (M³): 205.2

C-93

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/8	3	0.12			1/16	35	2.73	
Leptomedusae	1/8	6	0.23						
Trachymedusae	1/8	20	0.78						
Narcomedusae	1/8	6	0.23						
Siphonophora	1/16	12	0.93		LARVACEA	1/16	149	11.62	
Scyphozoa	1/8	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/16	25	1.95	
MOLLUSCA									
Heteropoda	1/16	2	0.15		FISH EGGS	1/8	0	0	
Thecosomata	1/16	14	1.09						
Gymnosomata	1/16	0	0		LARVAL FISH	1/8	29	1.13	
ANNELIDA (Polychaeta)	1/16	7	0.54		OTHER				
ARTHROPODA					Foraminifera	1/256	2	2.49	
Copepoda Calanoida	1/256	136	169.67		Radiolaria	1/256	1	1.25	
Copepoda Cyclopoida	1/256	54	67.37		Amphioxus	1/8	5	0.19	
Copepoda Harpacticoida	1/256	0	0		Squid	1/8	1	0.04	
Ostracoda	1/16	79	6.16						
Amphipoda	1/16	0	0						
Euphausiacea	1/16	22	1.71						
Lucifer	1/16	0	0		TOTAL				
Decapod Larvae	1/16	34	2.65					273.03	

Zooplankton Counts.

Site, Cruise, Station: PROTEC-13
Date of Sample: 11-5-81
Depth of Sample (m): 250-25
Net: Outboard

Rep. No.: 4
Sample #: 200-25m, Night
Time of Sample: 2324
Sample Type: Zooplankton
Vol. Fil. (l): 203.2

C-94

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/16	43	3.38	
Anthomedusae	1/8	1	0.04						
Leptomedusae	1/8	17	0.67						
Trachymedusae	1/8	29	1.14						
Narcomedusae	1/8	5	0.20						
Siphonophora	1/16	12	0.94		LARVACEA	1/16	154	12.12	
Scyphozoa	1/8	0	0						
CTENOPHORA	1/8	0	0		SALPIDAE	1/16	57	4.49	
MOLLUSCA					FISH EGGS	1/8	1	0.04	
Heteropoda	1/16	2	0.16						
Thecosomata	1/16	12	0.94						
Gymnosomata	1/16	0	0		LARVAL FISH	1/8	21	0.83	
ANNELIDA (Polychaeta)	1/16	14	1.10		OTHER	1/256	2	2.52	
ARTHROPODA					Foraminifera	1/256	0	0	
Copepoda Calanoida	1/256	138	173.86		Radiolaria	1/8	1	0.04	
Copepoda Cyclopoida	1/256	41	51.65						
Copepoda Harpacticoida	1/256	0	0						
Ostracoda	1/16	88	6.93						
Amphipoda	1/16	4	0.31						
Euphausiacea	1/16	26	2.05						
Lucifer	1/16	0	0						
Decapod Larvae	1/16	44	3.46						
					TOTAL			266.87	

Zooplankton Counts.

Site, Cruise, Station: PROTEC- 13
 Date of Sample: 14-5-81
 Depth of Sample (m): 675-200
 Net: Inboard

Rep. No.: 1
 Sample #: 600-200m, Day
 Time of Sample: 1154
 Sample Type: Zooplankton
 Vol. Fil.(l): 618.2

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	19	0.12	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0		LARVACEA	1/4	0	0	
Siphonophora	1/4	0	0						
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	2	0.01	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	0	0			1/4	0	0	
Thecosomata	1/4	3	0.02						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	1	0.01	
ANNELIDA (Polychaeta)	1/4	4	0.02		OTHER				
					Foraminifera	1/8	9	0.12	
					Radiolaria	1/8	3	0.04	
ARTHROPODA									
Copepoda Calanoida	1/8	234	3.03						
Copepoda Cyclopoida	1/8	45	0.58						
Copepoda Harpacticoida	1/8	0	0						
Ostracoda	1/4	114	0.74						
Amphipoda	1/4	1	0.01						
Euphausiacea	1/4	18	0.12						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	0	0		TOTAL			4.82	

Zooplankton Counts.

Site, Cruise, Station: PROTEC- 13
Date of Sample: 14-5-81
Depth of Sample (m): 675-200
Net: Outboard

Rep. No.: 1
Sample #: 600-200m, Day
Time of Sample: 1154
Sample Type: Zooplankton
Vol. Fil. (M³): 700.0

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	24	0.14	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	4	0.02		LARVACEA	1/4	1	0.00	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	2	0.01	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	0	0			1/4	0	0	
Thecosomata	1/4	5	0.03						
Gymnosomata	1/4	0	0						
					LARVAL FISH	1/4	3	0.02	
ANNELIDA (Polychaeta)	1/4	2	0.01		OTHER				
					Foraminifera	1/16	27	0.62	
					Radiolaria	1/16	2	0.04	
ARTHROPODA									
Copepoda Calanoida	1/16	212	4.84						
Copepoda Cyclopoida	1/16	38	0.87						
Copepoda Harpacticoida	1/16	1	0.02						
Ostracoda	1/4	143	0.82						
Amphipoda	1/4	1	0.00						
Euphausiacea	1/4	40	0.23						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	1	0.00		TOTAL			7.67	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13

Date of Sample: 15-5-81

Depth of Sample (m): 600-200

Net: Inboard

Rep. No.: 2

Sample No.: 600-200m, Day

Time of Sample: 1033

Sample Type: Zooplankton

Vol. Fil. (M³): 750.9

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	1	0.01	3.2		1/4	37	0.20	3.6-16.8
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	3	0.02	1.6-5.6	LARVACEA	1/4	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	0	0	
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/4	0	0						
Thecosomata	1/4	3	0.02	1.6-1.9					
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	3	0.02	1.6-2.4
ANNELIDA (Polychaeta)	1/4	7	0.04	1.2-1.6	OTHER				
ARTHROPODA					Foraminifera	1/4	4	0.02	0.3-0.6
Copepoda Calanoida	1/64	65	5.54	0.6-4.4	Radiolaria	1/4	0	0	
Copepoda Cyclopoida	1/64	26	2.22	1.0-1.8	Amphioxus	1/4	0	0	
Copepoda Harpacticoida	1/4	3	0.02	0.8-1.6					
Ostracoda	1/64	14	1.20	1.0-1.6					
Amphipoda	1/4	0	0						
Euphausiacea	1/4	36	0.19	3.0-16.0					
Lucifer	1/4	0	0						
Decapod Larvae	1/4	2	0.01	2.4-13.6	TOTAL			9.51	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 15-5-81
 Depth of Sample (m): 200-600
 Net: Outboard

Rep. No.: 2
 Sample No.: 600-200m, Day
 Time of Sample: 1033
 Sample Type: 3 Zooplankton
 Vol. Fil. (M³): 799.5

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	2	0.01	1.4-1.6		1/4	54	0.27	3.6-15.2
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	2	0.01	2.4-4.4	LARVACEA	1/4	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	2	0.01	6.4-7.2
MOLLUSCA					FISH EGGS	1/4	2	0.01	0.9-1.0
Heteropoda	1/4	0	0						
Thecosomata	1/4	1	0.01	2.2					
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	3	0.02	8.0-12.0
ANNELIDA (Polychaeta)	1/4	4	0.02	1.4-9.6	OTHER				
ARTHROPODA					Foraminifera	1/4	0	0	
Copepoda Calanoida	1/32	140	5.60	0.4-5.2	Radiolaria	1/4	0	0	
Copepoda Cyclopoida	1/32	80	3.20	0.5-1.4	Amphioxus	1/4	0	0	
Copepoda Harpacticoida	1/4	3	0.02	1.6					
Ostracoda	1/32	55	2.20	0.4-4.4					
Amphipoda	1/4	1	0.01	3.2					
Euphausiacea	1/4	45	0.23	4.2-16.0					
Lucifer	1/4	0	0		TOTAL			16.67	
Decapod Larvae	1/4	10	0.05	1.0-2.4					

Zooplankton Counts.

Site, Cruise, Station: PROTEC-13
 Date of Sample: 12-5-81
 Depth of Sample (m): 600-250
 Net: Inboard

Rep. No.: 1
 Sample #: 600-200m, Night
 Time of Sample: 2315
 Sample Type: Zooplankton
 Vol. Fil. (M³): 659.6

C-99

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	33	0.20	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	2	0.01		LARVACEA	1/4	2	0.01	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	2	0.01	
MOLLUSCA									
Heteropoda	1/4	0	0		FISH EGGS	1/4	0	0	
Thecosomata	1/4	3	0.02						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	3	0.02	
ANNELIDA (Polychaeta)	1/4	10	0.06		OTHER				
ARTHROPODA					Foraminifera	1/8	23	0.28	
Copepoda Calanoida	1/8	174	2.11		Radiolaria	1/8	4	0.05	
Copepoda Cyclopoida	1/8	41	0.50						
Copepoda Harpacticoida	1/8	4	0.05						
Ostracoda	1/4	112	0.68						
Amphipoda	1/4	4	0.02						
Euphausiacea	1/4	14	0.08						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	2	0.01		TOTAL			4.11	

Zooplankton Counts.

Site, Cruise, Station: PROTEC- 13
Date of Sample: 12-5-81
Depth of Sample (m): 600-250
Net: Outboard

Rep. No.: 1
Sample #: 600-200m, Night
Time of Sample: 2315
Sample Type: Zooplankton
Vol. Fil.(M³): 606.8

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/2	0	0			1/2	35	0.11	
Leptomedusae	1/2	0	0						
Trachymedusae	1/2	1	0.00						
Narcomedusae	1/2	0	0						
Siphonophora	1/2	10	0.03		LARVACEA	1/2	0	0	
Scyphozoa	1/2	0	0						
CTENOPHORA	1/2	0	0		SALPIDAE	1/2	3	0.01	
MOLLUSCA					FISH EGGS	1/2	0	0	
Heteropoda	1/2	1	0.00						
Thecosomata	1/2	1	0.00						
Gymnosomata	1/2	0	0		LARVAL FISH	1/2	1	0.00	
ANNELIDA (Polychaeta)	1/2	16	0.05		OTHER				
					Foraminifera	1/8	31	0.41	
					Radiolaria	1/8	3	0.04	
					Amphioxus	1/2	1	0.00	
ARTHROPODA									
Copepoda Calanoida	1/8	132	1.74						
Copepoda Cyclopoida	1/8	26	0.34						
Copepoda Harpacticoida	1/8	1	0.01						
Ostracoda	1/2	87	0.29						
Amphipoda	1/2	3	0.01						
Euphausiacea	1/2	3	0.01						
Lucifer	1/2	0	0						
Decapod Larvae	1/2	0	0		TOTAL			3.05	

C-100

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13

Date of Sample: 14-5-81

Depth of Sample (m): 650-200m

Net: Inboard

Rep. No.: 2

Sample No.: 600-200m, Night

Time of Sample: 1945

Sample Type: ³ ZooplanktonVol. Fil. (M³): 868.5

C-101

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/16	0	0			1/16	50	0.92	2.8-20.0
Leptomedusae	1/16	0	0						
Trachymedusae	1/16	0	0						
Narcomedusae	1/16	0	0						
Siphonophora	1/16	6	0.11	1.8-9.2	LARVACEA	1/16	0	0	
Scyphozoa	1/16	0	0						
CTENOPHORA	1/16	0	0		SALPIDAE	1/16	0	0	
MOLLUSCA					FISH EGGS	1/16	1	0.02	0.9
Heteropoda	1/16	0	0						
Thecosomata	1/16	0	0		LARVAL FISH	1/16	1	0.02	4.0
Gymnosomata	1/16	0	0						
ANNELIDA (Polychaeta)	1/16	8	0.15	0.8-3.6	OTHER				
ARTHROPODA					Foraminifera	1/16	2	0.04	0.3-0.6
Copepoda Calanoida	1/128	105	15.47	0.7-4.8	Radiolaria	1/16	1	0.02	0.3
Copepoda Cyclopoida	1/128	44	6.48	0.7-1.8	Amphioxus	1/16	0	0	
Copepoda Harpacticoida	1/16	7	0.13	1.0-1.6					
Ostracoda	1/128	28	4.13	0.3-1.9					
Amphipoda	1/16	4	0.07	1.0-4.0					
Euphausiacea	1/16	7	0.13	1.5-9.6					
Lucifer	1/16	0	0						
Decapod Larvae	1/16	7	0.13	0.8-5.6	TOTAL			278.2	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 14-5-81
 Depth of Sample (m): 650-200
 Net: Outboard

Rep. No.: 2
 Sample No.: 600-200m, Night
 Time of Sample: 1945
 Sample Type: ³ Zooplankton
 Vol. Fil. (M³): 881.8

C-102

Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)	Taxonomic Identification	Split	Number Counted	Number -3 m	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/8	1	0.01	1.6		1/8	33	0.30	4.2-21.4
Leptomedusae	1/8	0	0						
Trachymedusae	1/8	0	0						
Narcomedusae	1/8	0	0						
Siphonophora	1/8	7	0.06	2.8-7.2	LARVACEA	1/8	0	0	
Scyphozoa	1/8	0	0						
CTENOPHORA	1/8	0	0		SALPIDAE	1/8	1	0.01	9.6
MOLLUSCA					FISH EGGS	1/8	0	0	
Heteropoda	1/8	0	0						
Thecosomata	1/8	0	0						
Gymnosomata	1/8	0	0		LARVAL FISH	1/8	3	0.03	3.4
ANNELIDA (Polychaeta)	1/8	6	0.05	0.8-2.4	OTHER				
ARTHROPODA					Foraminifera	1/8	3	0.03	0.4-0.7
Copepoda Calanoida	1/64	80	5.81	0.7-5.0	Radiolaria	1/8	1	0.01	0.5-2.0
Copepoda Cyclopoida	1/64	45	3.27	0.4-2.4	Amphioxus	1/8	0	0	
Copepoda Harpacticoida	1/8	6	0.05	0.9-1.8					
Ostracoda	1/64	29	2.10	0.4-2.8					
Amphipoda	1/8	11	0.10	1.2-4.8					
Euphausiacea	1/8	6	0.05	2.6-10.4					
Lucifer	1/8	0	0		TOTAL			11.94	
Decapod Larvae	1/8	7	0.06	1.0-1.4					

Zooplankton Counts.

Site, Cruise, Station: PROTEC- 13
 Date of Sample: 13-5-81
 Depth of Sample (m): 1050-625
 Net: Inboard

Rep. No.: 1
 Sample #: 1000-600m, Day
 Time of Sample: 0936
 Sample Type: Zooplankton
 Vol. Fil. (m³): 1196.3

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	55	0.18	
Leptomedusae	1/4	7	0.02						
Trachymedusae	1/4	11	0.04						
Narcomedusae	1/4	0	0		LARVACEA	1/4	135	0.45	
Siphonophora	1/4	21	0.07						
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	21	0.07	
MOLLUSCA					FISH EGGS	1/4	5	0.02	
Heteropoda	1/4	5	0.02						
Thecosomata	1/4	12	0.04						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	6	0.02	
ANNELIDA (Polychaeta)	1/4	21	0.07		OTHER				
					Foraminifera	1/32	4	0.11	
					Radiolaria	1/32	4	0.11	
					Amphioxus	1/4	4	0.11	
					Squid	1/4	1	0.00	
ARTHROPODA									
Copepoda Calanoida	1/32	230	6.15						
Copepoda Cyclopoida	1/32	113	3.02						
Copepoda Harpacticoida	1/32	4	0.11						
Ostracoda	1/4	126	0.42						
Amphipoda	1/4	8	0.03						
Euphausiacea	1/4	16	0.05						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	45	0.15		TOTAL			11.26	

Zooplankton Counts.

Site, Cruise, Station: PROTEC-13
Date of Sample: 13-5-81
Depth of Sample (m): 1050-625
Net: Outboard

Rep. No.: 1
Sample #: 1000-600m, Day
Time of Sample: 0936
Sample Type: Zooplankton
Vol. Fil. (M³): 1149.1

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	49	0.17	
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	3	0.01		LARVACEA	1/4	56	0.19	
Narcomedusae	1/4	0	0						
Siphonophora	1/4	8	0.03						
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	25	0.09	
MOLLUSCA					FISH EGGS	1/4	9	0.03	
Heteropoda	1/4	2	0.01						
Thecosomata	1/4	5	0.02		LARVAL FISH	1/4	8	0.03	
Gymnosomata	1/4	0	0						
ANNELIDA (Polychaeta)	1/4	15	0.05		OTHER				
ARTHROPODA					Foraminifera	1/32	1	0.03	
Copepoda Calanoida	1/32	139	3.87		Radiolaria	1/32	2	0.05	
Copepoda Cyclopoida	1/32	80	2.23		Amphioxus	1/4	1	0.00	
Copepoda Harpacticoida	1/32	2	0.05						
Ostracoda	1/4	97	0.34						
Amphipoda	1/4	5	0.02						
Euphausiacea	1/4	9	0.03						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	24	0.08						
					TOTAL			7.33	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13

Date of Sample: 14-5-81

Depth of Sample (m): 1000-600m

Net: Inboard

Rep. No.: 2

Sample No.: 1000-600m, Day

Time of Sample: 0853

Sample Type: ³ ZooplanktonVol. Fil. (M³): 689.2

C-105

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	16	0.09	5.8-12.0
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	0	0		LARVACEA	1/4	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	0	0	
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/4	0	0						
Thecosomata	1/4	0	0						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	0	0	
ANNELIDA (Polychaeta)	1/4	0	0		OTHER				
					Foraminifera	1/4	0	0	
ARTHROPODA					Radiolaria	1/4	4	0.02	0.4-0.7
Copepoda Calanoida	1/16	71	1.65	0.9-7.6	Amphioxus	1/4	0	0	
Copepoda Cyclopoida	1/16	60	1.39	0.7-2.2					
Copepoda Harpacticoida	1/4	1	0.01	0.9					
Ostracoda	1/4	28	0.16	0.5-2.1					
Amphipoda	1/4	11	0.06	1.0-9.0					
Euphausiacea	1/4	4	0.02	9.6-15.6					
Lucifer	1/4	0	0		TOTAL			3.40	
Decapod Larvae	1/4	0	0						

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 14-5-81
 Depth of Sample (m): 1000-600
 Net: Outboard

Rep. No.: 2
 Sample No.: 1000-600m, Day
 Time of Sample: 0853
 Sample Type: Zooplankton
 Vol. Fil. (M³): 702.8

C-106

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/1	0	0			1/1	3	0.00	8.0-9.2
Leptomedusae	1/1	0	0						
Trachymedusae	1/1	0	0						
Narcomedusae	1/1	0	0		LARVACEA	1/1	0	0	
Siphonophora	1/1	0	0						
Scyphozoa	1/1	0	0						
CTENOPHORA	1/1	0	0		SALPIDAE	1/1	0	0	
MOLLUSCA					FISH EGGS	1/1	0	0	
Heteropoda	1/1	0	0						
Thecosomata	1/1	0	0		LARVAL FISH	1/1	0	0	
Gymnosomata	1/1	0	0						
ANNELIDA (Polychaeta)	1/1	0	0		OTHER				
					Foraminifera	1/1	0	0	
ARTHROPODA					Radiolaria	1/1	3	0.00	0.4-0.7
Copepoda Calanoida	1/2	46	0.13	0.6-4.8	Amphioxus	1/1	0	0	
Copepoda Cyclopoida	1/2	61	0.17	0.8-1.0					
Copepoda Harpacticoida	1/1	0	0						
Ostracoda	1/1	8	0.01	0.8-1.6					
Amphipoda	1/1	8	0.01	8.8					
Euphausiacea	1/1	0	0						
<u>Lucifer</u>	1/1	0	0		<u>TOTAL</u>			0.32	
Decapod Larvae	1/1	0	0						

Zooplankton Counts.

Rep. No.: 1
 Sample #: 1000-600m, Night
 Time of Sample: 2315
 Sample Type: Zooplankton
 Vol. Fil.(M³): 821.2

Site, Cruise, Station: PROTEC- 13
 Date of Sample: 12-5-81
 Depth of Sample (m): 1000-650
 Net: Inboard

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	24	0.12	
Leptomedusae	1/4	1	0.00						
Trachymedusae	1/4	1	0.00						
Narcomedusae	1/4	0	0		LARVACEA	1/4	2	0.01	
Siphonophora	1/4	2	0.01						
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	7	0.03	
MOLLUSCA					FISH EGGS				
Heteropoda	1/4	0	0			1/4	0	0	
Thecosomata	1/4	0	0						
Gymnosomata	1/4	0	0		LARVAL FISH	1/4	4	0.02	
ANNELIDA (Polychaeta)	1/4	10	0.05		OTHER				
					Foraminifera	1/8	15	0.15	
					Radiolaria	1/8	5	0.05	
ARTHROPODA									
Copepoda Calanoida	1/8	205	2.00						
Copepoda Cyclopoida	1/8	113	1.10						
Copepoda Harpacticoida	1/8	3	0.03						
Ostracoda	1/4	57	0.28						
Amphipoda	1/4	0	0						
Euphausiacea	1/4	1	0.00						
Lucifer	1/4	0	0						
Decapod Larvae	1/4	9	0.04		TOTAL			3.89	

Zooplankton Counts.

Site, Cruise, Station: PROTEC-13
 Date of Sample: 12-5-81
 Depth of Sample (m): 1000-650
 Net: Outboard

Rep. No.: 1
 Sample #: 1000-600m.Night
 Time of Sample: 2315
 Sample Type: Zooplankton
 Vol. Fil. (l³): 718.1

C-108

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1	1	0.00			1	15	0.02	
Leptomedusae	1	0	0						
Trachymedusae	1	0	0						
Narcomedusae	1	0	0						
Siphonophora	1	5	0.01		LARVACEA	1	0	0	
Scyphozoa	1	0	0						
CTENOPHORA	1	0	0		SALPIDAE	1	2	0.00	
MOLLUSCA					FISH EGGS	1	0	0	
Heteropoda	1	0	0						
Thecosomata	1	0	0						
Gymnosomata	0	0	0		LARVAL FISH	1	3	0.05	
ANNELIDA (Polychaeta)	1	6	0.01		OTHER				
					Foraminifera	1/4	4	0.02	
					Radiolaria	1/4	9	0.05	
					Amphioxus	1	1	0.00	
ARTHROPODA									
Copepoda Calanoida	1/4	117	0.65						
Copepoda Cyclopoida	1/4	91	0.51						
Copepoda Harpacticoida	1/4	1	0.00						
Ostracoda	1	36	0.05						
Amphipoda	1	4	0.00						
Euphausiacea	1	0	0						
Lucifer	1	0	0						
Decapod Larvae	1	5	0.01		TOTAL			1.33	

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
 Date of Sample: 13-5-81
 Depth of Sample (m): 1050-600
 Net: Inboard

Rep. No.: 2
 Sample No.: 1000-600m, Night
 Time of Sample: 2058
 Sample Type: ₃ Zooplankton
 Vol. Fil. (M³): 592.3

C-109

Taxonomic Identification	Split	Number Counted	Number ⁻³ m	Size (mm)	Taxonomic Identification	Split	Number Counted	Number ⁻³ m	Size (mm)
COELENTERATA					CHAETOGNATHA				
Anthomedusae	1/4	0	0			1/4	12	0.08	9.6-18.4
Leptomedusae	1/4	0	0						
Trachymedusae	1/4	0	0						
Narcomedusae	1/4	0	0						
Siphonophora	1/4	1	0.01	3.6	LARVACEA	1/4	0	0	
Scyphozoa	1/4	0	0						
CTENOPHORA	1/4	0	0		SALPIDAE	1/4	1	0.01	4.8
MOLLUSCA					FISH EGGS	1/4	0	0	
Heteropoda	1/4	0	0						
Thecosomata	1/4	0	0		LARVAL FISH	1/4	0	0	
Gymnosomata	1/4	0	0						
ANNELIDA (Polychaeta)	1/4	3	0.02	1.2-1.8	OTHER				
ARTHROPODA					Foraminifera	1/4	0	0	
Copepoda Calanoida	1/16	56	1.51	1.0-9.4	Radiolaria	1/4	0	0	
Copepoda Cyclopoida	1/16	56	1.51	0.6-1.7	Amphioxus	1/4	0	0	
Copepoda Harpacticoida	1/4	9	0.06	0.8-1.3					
Ostracoda	1/4	25	0.17	0.4-2.6					
Amphipoda	1/4	0	0						
Euphausiacea	1/4	2	0.01	2.6-4.4					
<u>Lucifer</u>	1/4	0	0		<u>TOTAL</u>			3.38	
Decapod Larvae	1/4	0	0						

ZOOPLANKTON COUNTS

Site, Cruise, Station: PROTEC-13
Date of Sample: 13-5-81
Depth of Sample (m): 1050-600
Net: Outboard

Rep. No.: 2
Sample No.: 1000-600m, Night
Time of Sample: 2058
Sample Type: ³Zooplankton
Vol. Fil. (M³): 678.5

C-110

Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)	Taxonomic Identification	Split	Number Counted	Number m ⁻³	Size (mm)
COELENTERATA					CHAETOGNATHA	1/1	11	0.02	2.2-10.4
Anthomedusae	1/1	0	0						
Leptomedusae	1/1	0	0						
Trachymedusae	1/1	0	0						
Narcomedusae	1/1	0	0		LARVACEA	1/1	0	0	
Siphonophora	1/1	0	0						
Scyphozoa	1/1	0	0						
CTENOPHORA	1/1	0	0		SALPIDAE	1/1	0	0	
MOLLUSCA					FISH EGGS	1/1	0	0	
Heteropoda	1/1	0	0						
Thecosomata	1/1	1	0.00	1.4	LARVAL FISH	1/1	0	0	
Gymnosomata	1/1	0	0						
ANNELIDA (Polychaeta)	1/1	1	0.00	1.0	OTHER				
					Foraminifera	1/1	0	0	
ARTHROPODA					Radiolaria	1/1	0	0	
Copepoda Calanoida	1/1	140	0.21	0.6-8.0	Amphioxus	1/1	0	0	
Copepoda Cyclopoida	1/1	157	0.23	0.7-1.1					
Copepoda Harpacticoida	1/1	8	0.01	0.8-1.3					
Ostracoda	1/1	21	0.03	0.5-1.4					
Amphipoda	1/1	2	0.00	1.0-1.2					
Euphausiacea	1/1	1	0.00	3.2					
Lucifer	1/1	0	0						
Decapod Larvae	1/1	2	0.00	0.5-2.7					
					TOTAL			0.50	

3. Micronekton (T. Hopkins)

In all, 22 midwater trawls were taken at the PROTEC site on PROTEC 13. Day and night samples were taken from each of the four designated depth zones (i.e., 0-25 m; 25-200 m; 200-600 m; 600-1000 m), though only two of the four required replicates were taken during the daylight hours from the 0-25 m layer. Also, the mechanical release failed to close the net on three tows, a day and a night tow at 25-200 m and a night haul at 600-1000 m.

The average volumes of water filtered by trawls were 11210 m^3 , 17700 m^3 , 19200 m^3 and 13600 m^3 in the four above depth zones, respectively. The reason for the relatively small filtration volumes for the 0-25 m layer derives from the short duration of these shallow tows. The comparatively low average for the 600-1000 m zone resulted from slowing the vessel down to insure reaching the deepest required trawling depth (1000 m).

As the actual depth sampled column in Table 25 indicates, the deeper zones in particular were sampled imprecisely and in a sense the "replicates" are not true replicates. This stemmed from the failure of the depth transducer - conducting cable system, which necessitated estimating trawl depth through triangulation. Given the shifts in current and wind velocity and direction as well as ship course changes the observed variations in depth among the "replicates" is not surprising.

The micronekton catch for each trawl is listed in Table 26. As in PROTEC 10 and 12 reports, the number counted of each species, the calculation of number/ 10^4 m^3 , biomass ($\text{g}/10^4 \text{ m}^3$ wet weight), the mean size (mm) and the size range are indicated in the table. These data have been discussed in detail in the final report.

NET TYPE, SIZE, MESH: 1.8 m X 3.2 m Tucker trawl, 4 mm

TOW TYPE: Micronekton Horizontal

Table 25

SITE, CRUISE & STATION	SAMPLE #	POS. LAT. & LONG.	DATE(DA, MON, YR)	TIME START D(DAY) OR N(NIGHT)	LENGTH OF TOW (min.)	VOL. FIL. (10 ⁴ m ³)	ACTUAL DEPTH (TDR) OF SAMPLE (m)	COMMENTS
PROTEC-13	1	17°58'N 65°45'W	9 V 81	23:00 N	69	1.3698	0-25	
"	2	17°58'N 65°45'W	10 V 81	00:49 N	61	1.3798	0-25	
"	3	18°00'N 65°42'W	10 V 81	02:10 N	64	1.6721	0-25	
"	4	18°00'N 65°46'W	10 V 81	03:33 N	62	1.5424	0-25	
"	5	17°53'N 65°57'W	11 V 81	09:32 D	83	1.8659	0-210	Net didn't close Oblique
"	6	17°48'N 65°58'W	11 V 81	11:30 D	87	1.9421	25-195	
"	7	17°55'N 65°59'W	11 V 81	13:18 D	78	1.7024	25-190	
"	8	17°55'N 65°53'W	11 V 81	15:02 D	73	1.8264	25-175	
"	9	17°56'N 65°48'W	12 V 81	00:10 N	85	2.0210	25-200	
"	10	17°56'N 65°48'W	12 V 81	02:05 N	92	1.8131	0-180	Net did not close Oblique
"	11	17°55'N 65°49'W	12 V 81	12:01 D	87	2.3611	220-700	
"	12	17°57'N 65°52'W	12 V 81	15:20 D	90	1.6166	200-580	
"	13	17°57'N 65°53'W	13 V 81	02:45 N	115	2.1347	220-700	
"	14	17°59'N 65°51'W	13 V 81	14:05 D	87	0.9875	780-1200	
"	15	17°58'N 65°45'W	14 V 81	00:07 N	125	2.0047	0-900	Net didn't close Oblique
"	16	17°57'N 65°49'W	14 V 81	03:32 N	83	1.2841	600-980	
"	17	17°55'N 65°51'W	14 V 81	16:05 D	45	0.8214	0-25	

NET TYPE, SIZE, MESH: 1.8 m X 3.2 m Tucker trawl, 4 mm

Page 2 of 2

TOW TYPE: Micronekton Horizontal

Table 25

SITE, CRUISE & STATION	SAMPLE #	POS. LAT. & LONG.	DATE(DA, MON, YR)	TIME START D(DAY) OR N(NIGHT)	LENGTH OF TOW (min.)	VOL. FIL. (10 ⁴ m ³)	ACTUAL DEPTH (TDR) OF SAMPLE (m)	COMMENTS
PROTEC-13	18	17°57'N 65°49'W	14 V 81	16:59 D	43	1.0274	0-25	
"	19	17°56'N 65°52'W	14 V 81	22:11 N	84	1.5811	210-550	
"	20	17°56'N 65°56'W	15 V 81	00:39 N	91	1.2530	25-200	
"	21	17°56'N 65°55'W	15 V 81	03:12 N	85	1.7627	25-210	
"	22	17°56'N 65°50'W	15 V 81	07:22 D	80	1.1715	640-1140	

C-113

Table 26

Site, Cruise, Station: PROTEC-13

Sample #: 17

Date of Sample: 14 V 81

Time of Sample: 16:05-16:50

Depth of Sample: 0-25 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Number Counted	<u>Number</u> $10^4 m^3$	<u>Biomass(g)</u> $10^4 m^3$	Mean Size (mm)	Size Range(mm)
<u>Selar crumenophthalmus</u>	1	1.217	7.451	64.0	
Scombridae	1	1.217	6.424	72.0	
Anguilliformes (larvae)	1	1.217	0.643	70.0	
Stomatopoda larvae	1	1.217	0.091	41.0	
Scyphozoa	19	23.131	18.070	22.2	20-24
Polychaeta	3	3.652	0.253	34.7	24-42
Total sorted			32.932		
Residue			17.141		
Total biomass			50.073		

Table 26

Site, Cruise, Station: PROTEC-13 Sample #: 18
 Date of Sample: 14 V 81 Time of Sample: 16:59-17:42
 Depth of Sample: 0-25 m Sample Type: Micronekton
 Tucker trawl

Taxonomic Identification	Number Counted	Number	Biomass(g)	Mean	Size
		$\frac{\text{Number}}{10^{\frac{4}{3}} \text{ m}^3}$	$\frac{\text{Biomass(g)}}{10^{\frac{4}{3}} \text{ m}^3}$	Size(mm)	Range
<u>Selar crumenophthalmus</u>	8	7.787	16.097	43.9	37-48
Syngnathidae	1	0.973	0.003	24.0	
Anguilliformes (larvae)	4	3.893	1.766	66.0	61-70
<u>Rhabdosoma sp</u>	1	0.973	0.015	54.0	
Stomatopoda larvae	5	4.867	0.733	36.6	24-44
Total sorted			18.614		
Residue			19.903		
Total biomass			38.517		

Table 26

Site, Cruise, Station: PROTEC-13 Sample #: 1
 Date of Sample: 9 V 81 Time of Sample: 23:00-00:09
 Depth of Sample: 0-25 m Sample Type: Micronekton
 Tucker Trawl

Taxonomic Identification	Number Counted	Number $\frac{10^4}{10^3} m^3$	Biomass(g) $\frac{10^4}{10^3} m^3$	Mean Size(mm)	Size Range(mm)
<u>Decapterus punctatus</u>	3	2.190	5.169	56.3	(52-62)
<u>Selar crumenophthalmus</u>	1	0.730	1.124	43.0	
Bothidae	2	1.460	0.169	16.5	(15-18)
<u>Myctophum obtusirostre</u>	2	1.460	0.073	16.0	(15-17)
<u>Pollichthys mauli</u>	2	1.460	0.060	21.5	(21-22)
Anguilliformes (larvae)	15	10.951	5.138	63.1	(42-155)
<u>Rhabdosoma sp.</u>	1	0.730	0.012	35.0	
<u>Phronima sp.</u>	1	0.730	0.129	25.0	
Stomatopoda larvae	3	2.190	0.407	33.3	(27-45)
Lobster larvae	2	1.460	0.157	28.0	(24-32)
Chaetognatha	2	1.460	0.072	23.5	(23-24)
Urochordata	2	1.460	9.669	94.0	(70-118)
Polychaeta	1	0.730	0.014	31.0	
Total sorted			22.193		
Residue			42.538		
Total biomass			64.731		

Table 26

Site, Cruise, Station: PROTEC-13 Sample #: 2
 Date of Sample: 10 V 81 Time of Sample: 00:49-01:50
 Depth of Sample: 0-25 m Sample Type: Micronekton
 Tucker trawl

Taxonomic Identification	Number Counted	<u>Number</u> $10^4 \cdot 3$ m^3	<u>Biomass(g)</u> $10^4 \cdot 3$ m^3	Mean Size(mm)	Size Range
Syngnathidae	1	0.725	0.073	56.0	
<u>Myctophum nitidulum</u>	2	1.449	4.188	44.5	19-70
<u>Diaphus dumerilii</u>	1	0.725	0.029	14.0	
<u>Pollichthys maui</u>	5	3.624	0.159	21.8	20-23
Anguilliformes (larvae)	7	5.073	0.975	57.9	45-64
Stomatopoda larvae	7	5.073	0.512	37.4	20-46
Chaetognatha	4	2.899	0.228	26.8	23-29
Siphonophora (biomass only)			2.555		
Heteropoda	1	0.725	1.423	51.0	
Total sorted			10.142		
Residue			17.326		
Total biomass			27.468		

Table 26

Cruise: PROTEC-13

Sample #: 3

Date of Sample: 10 V 81

Time of Sample: 02:10-03:14

Depth of Sample: 0-25 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number $10^4 m^3$	Biomass(g) $10^4 m^3$	Size(mm)	Range(mm)
<u>Selar crumenophthalmus</u>	1	0.598	2.177	63.0	
<u>Lepidophanes gaussi</u>	1	0.598	0.162	33.0	
<u>Diaphus dumerilii</u>	1	0.598	0.036	17.0	
<u>Pollichthys mauli</u>	4	2.392	0.094	20.8	(18-25)
Anguilliformes (larvae)	28	16.745	3.092	55.7	(34-87)
<u>Sergestes atlanticus</u>	1	0.598	0.032	21.0	
<u>Sergestes vigilax</u>	1	0.598	0.043	22.0	
Stomatopoda (larvae)	2	1.196	0.087	44.5	(44-45)
Scyphozoa	1	0.598	6.155	45.0	
Siphonophora (biomass only)			1.925		
Urochordata	2	1.196	0.607	41.0	(35-47)
Chaetognatha	1	0.598	0.034	24.0	
Total sorted			14.444		
Residue			19.790		
Total biomass			34.234		

Table 26

Site, Cruise, Station: PROTEC-13

Sample #: 4

Date of Sample: 10 V 81

Time of Sample: 03:33-04:35

Depth of Sample: 0-25 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Number Counted	Number $\frac{4}{10^3} m^3$	Biomass(g) $\frac{4}{10^3} m^3$	Mean Size(mm)	Size Range(mm)
<u>Selar crumenophthalmus</u>	3	1.945	20.964	82.0	71-94
<u>Mullus auratus</u>	1	0.648	1.345	55.0	
<u>Lepidophanes guentheri</u>	2	1.297	0.521	35.5	32-39
<u>Pollichthys maui</u>	2	1.297	0.172	31.5	30-33
Anguilliformes (larvae)	13	8.428	1.743	54.9	40-67
Other fish larvae	1	0.648	0.019	18.0	
Stomatopoda larvae	7	4.538	0.370	45.3	43-48
Scyphozoa	1	0.648	0.411	20.0	
Siphonophora (biomass only)			13.319		
Urochordata	4	2.593	0.973	35.3	31-41
Total sorted			38.873		
Residue			28.640		
Total biomass			68.477		

Table 26

Cruise: PROTEC-13
 Date of Sample: 11 V 81
 Depth of Sample: 0-210 m

Sample #: 5
 Time of Sample: 09:32-10:51
 Sample Type: Micronekton
 Tucker trawl

Taxonomic Identification	Counted	Number $10^4 \frac{3}{m}$	Biomass(g) $10^4 \frac{3}{m}$	Size(mm)	Range(mm)
Bothidae	1	0.536	0.046	16.0	
<u>Spheoeroides parvus</u>	1	0.536	0.192	17.0	
<u>Rosenblattichthys sp.</u>	1	0.536	0.036	21.0	
Anguilliformes (larvae)	2	1.072	0.420	91.5	(25-158)
Penaeidae	1	0.536	0.023	29.0	
Stomatopoda (larvae)	2	1.072	0.097	43.5	(43-44)
Scyphozoa	1	0.536	0.400	20.0	
Heteropoda	1	0.536	1.936	46.0	
Total sorted			3.150		
Residue			14.669		
Total biomass			17.819		

Table 26

Site, Cruise, Station: PROTEC-13

Sample #: 6

Date of Sample: 11 V 81

Time of Sample: 11:30-12:47

Depth of Sample: 25-195 m

Sample Type: Micronekton
Tucker Trawl

Taxonomic Identification	Number Counted	Number $\frac{\text{Number}}{10^4 \text{ m}^3}$	Biomass(g) $\frac{\text{Biomass}}{10^4 \text{ m}^3}$	Mean Size(mm)	Size Range(mm)
Aulostomidae	1	0.515	0.539	109.0	
<u>Idiacanthus fasciola</u>	1	0.515	0.007	40.0	
Stomatopoda larvae	5	2.575	0.227	44.4	43-46
Scyphozoa	2	1.030	1.212	23.0	23-26
Siphonophora (biomass only)			0.584		
Urochordata	5	2.575	6.255	51.6	26-115
Total sorted			8.824		
Residue			21.417		
Total biomass			30.241		

Table 26

Site, Cruise, Station: PROTEC-13 Sample #: 7
 Date of Sample: 11 V 81 Time of Sample: 13:18-14:36
 Depth of Sample: 25-190 m Sample Type: Micronekton
 Tucker trawl

Taxonomic Identification	Number Counted	Number $\frac{4}{10} \frac{3}{m^3}$	Biomass(g) $\frac{4}{10} \frac{3}{m^3}$	Mean Size(mm)	Size Range(mm)
Syngnathidae	1	0.587	0.021	39.0	
Anguilliformes (larvae)	1	0.587	1.002	210.0	
<u>Rhabdosoma sp.</u>	1	0.587	0.010	47.0	
Scyphozoa	4	2.350	2.597	24.8	21-30
Chaetognatha	2	1.175	0.083	24.5	23-26
Polychaeta	1	0.587	0.066	52.0	
Total sorted			3.779		
Residue			37.255		
Total biomass			41.034		

Table 26

Site, Cruise, Station: PROTEC-13 Sample #: 8
 Date of Sample: 11 V 81 Time of Sample: 15:02-16:15
 Depth of Sample: 25-175 m Sample Type: Micronekton
 Tucker trawl

Taxonomic Identification	Number Counted	Number $\frac{10^4}{m^3}$	Biomass(g) $\frac{10^4}{m^3}$	Mean Size(mm)	Size Range(mm)
Pomacentridae	1	0.548	0.182	18.0	
Fistulariidae	1	0.548	0.005	30.0	
<u>Idiacanthus fasciola</u>	1	0.548	0.012	26.0	
Anguilliformes (larvae)	5	2.738	1.111	60.2	41-84
Stomatopoda larvae	2	1.095	0.110	45.5	45-46
Scyphozoa	4	2.190	4.174	29.5	21-43
Urochordata	1	0.548	5.304	95.0	
Polychaeta	3	1.643	0.233	36.7	30-47
Heteropoda	1	0.548	0.045	22.0	
Cranchiidae	2	1.095	0.866	32.0	30-34
Total sorted			12.042		
Residue			19.064		
Total biomass			31.106		

Table 26

Cruise: PROTEC-13

Sample #: 9

Date of Sample: 12 V 81

Time of Sample: 00:10-01:35

Depth of Sample: 25-200 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number	Biomass(g)	Size(mm)	Range(mm)
		$10^4 \frac{3}{m}$	$10^4 \frac{3}{m}$		
Syngnathidae	1	0.495	0.006	30.0	
Tetraodontidae	1	0.495	0.121	16.0	
Fistulariidae	1	0.495	0.071	78.0	
<u>Lepidophanes guentheri</u>	4	1.979	1.013	36.8	(16-47)
<u>Lampanyctus nobilis</u>	1	0.495	0.295	44.0	
<u>Lampanyctus lineatus</u>	1	0.495	0.100	40.0	
<u>Lampanyctus cuprarius</u>	1	0.495	0.381	53.0	
<u>Diaphus dumerilii</u>	2	0.990	0.136	21.5	(20-23)
<u>Diaphus splendidus</u>	3	1.484	1.360	39.0	(26-58)
<u>Diaphus brachycephalus</u>	1	0.495	0.032	16.0	
<u>Hygophum taaningi</u>	1	0.495	0.261	34.0	
<u>Ceratoscopelus warmingii</u>	1	0.495	0.035	20.0	
<u>Gonostoma elongatum</u>	1	0.495	0.097	37.0	
<u>Pollichthys maui</u>	1	0.495	0.040	21.0	
<u>Bregmaceros atlanticus</u>	1	0.495	0.016	21.0	
<u>Coccorella atrata</u>	1	0.495	0.044	20.0	
<u>Idiacanthus fasciola</u> (larva)	1	0.495	0.006	24.0	
Melanostomiatidae	1	0.495	0.034	28.0	
Anguilliformes (larvae)	6	2.969	0.696	60.3	(44-102)
<u>Sergestes grandis</u>	1	0.495	0.056	28.0	
<u>Sergestes armatus</u>	2	0.990	0.117	28.0	(26-30)

Table 26

Cruise: PROTEC-13

Sample #: 9 cont'd

Date of Sample: 12 V 81

Time of Sample: 00:10-01:35

Depth of Sample: 25-200 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number	Biomass(g)	Size(mm)	Range(mm)
		$10^4 \frac{3}{m}$	$10^4 \frac{3}{m}$		
<u>Sergestes splendens</u>	1	0.495	0.081	33.0	
<u>Sergestes talismani</u>	2	0.990	0.255	35.0	
<u>Funchalia taaningi</u>	3	1.484	2.325	71.0	(68-74)
<u>Systellaspis debilis</u>	5	2.474	1.805	59.6	(37-74)
<u>Thysanopoda tricuspidata</u>	2	0.990	0.103	23.0	(22-24)
<u>Thysanopoda orientalis</u>	1	0.495	0.046	22.0	
Mysidacea	1	0.495	0.037	21.0	
Cranchiidae	1	0.495	1.498	55.0	
Heteropoda	1	0.495	4.820	130.0	
Total sorted			15.886		
Residue			30.259		
Total biomass			46.145		

Table 26

Cruise: PROTEC-13

Sample #: 10

Date of Sample: 12 V 81

Time of Sample: 02:05-03:34

Depth of Sample: 0-180 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number 10^4 m^3	Biomass(g) 10^4 m^3	Size(mm)	Range(mm)
Bothidae	1	0.552	0.069	23.0	
Carangidae	1	0.552	0.104	18.0	
<u>Lepidophanes guentheri</u>	4	2.206	1.423	41.0	(36-55)
<u>Lampanyctus cuprarius</u>	1	0.552	0.118	33.0	
<u>Diaphus splendidus</u>	2	1.103	0.403	30.0	(27-33)
<u>Lampadena luminosa</u>	1	0.552	0.046	21.0	
<u>Hygophum taaningi</u>	3	1.655	1.000	36.3	(34-39)
<u>Notolychnus valdiviae</u>	1	0.552	0.026	17.0	
<u>Gonostoma elongatum</u>	1	0.552	0.030	20.0	
<u>Pollichthys mauli</u>	2	1.103	0.104	30.0	(27-33)
<u>Scopelogadus sp.</u>	1	0.552	0.035	15.0	
<u>Coccorella atrata</u>	1	0.552	0.074	24.0	
Anguilliformes (larvae)	2	1.103	0.136	43.5	(37-50)
<u>Sergestes atlanticus</u>	4	2.206	0.249	28.8	(27-34)
<u>Sergestes splendens</u>	2	1.103	0.285	36.5	(36-37)
<u>Sergestes robustus</u>	1	0.552	0.104	36.0	
<u>Gennadas scutatus</u>	2	1.103	0.074	18.0	(16-20)
<u>Gennadas sp.</u>	1	0.552	0.063	23.0	
<u>Funchalia taaningi</u>	1	0.552	0.883	69.0	
<u>Systellaspis debilis</u>	8	4.412	4.023	64.4	(59-70)
<u>Rhabdosoma sp.</u>	1	0.552	0.006	37.0	
<u>Stylocheiron maximum</u>	1	0.552	0.050	21.0	

Table 26

Cruise: PROTEC-13

Sample #: 10 cont'd

Date of Sample: 12 V 81

Time of Sample: 02:05-03:34

Depth of Sample: 0-180 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number 10^4 m^3	Biomass(g) 10^4 m^3	Size(mm)	Range(mm)
<u>Thysanopoda tricuspidata</u>	2	1.103	0.158	25.0	(23-27)
<u>Thysanopoda monocantha</u>	1	0.552	0.119	27.0	
<u>Thysanopoda orientalis</u>	1	0.552	0.045	21.0	
Stomatopoda (larvae)	2	1.103	0.103	45.0	(44-46)
Scyphozoa	2	1.103	0.891	23.5	(20-27)
Urochordata	1	0.552	0.200	63.0	
Total sorted			10.826		
Residue			19.317		
Total biomass			30.143		

Table 26

Cruise: PROTEC-13

Sample #: 20

Date of Sample: 15 V 81

Time of Sample: 00:39-02:10

Depth of Sample: 25-200 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number $10^4 \cdot 3$ m	Biomass(g) $10^4 \cdot 3$ m	Size(mm)	Range(mm)
<u>Halientichthys aculeatus</u>	1	0.798	1.863	23.0	
<u>Lepidophanes guentheri</u>	2	1.596	1.344	45.5	(44-47)
<u>Lampanyctus lineatus</u>	1	0.798	0.736	56.0	
<u>Diaphus dumerilii</u>	3	2.394	2.048	36.0	(21-55)
<u>Diaphus fragilis</u>	1	0.798	0.726	39.0	
<u>Diaphus taaningi</u>	1	0.798	2.331	59.0	
<u>Bolinichthys supralateralis</u>	1	0.798	0.059	18.0	
<u>Lampadena luminosa</u>	1	0.798	1.026	46.0	
<u>Gonostoma elongatum</u>	1	0.798	0.355	50.0	
<u>Cyclothone braueri</u>	3	2.394	0.077	20.0	(18-24)
<u>Bregmaceros atlanticus</u>	1	0.798	0.032	21.0	
<u>Stomias affinis</u>	1	0.798	0.093	36.0	
<u>Eustomias bibulbosus</u>	1	0.798	0.992	95.0	
<u>Sergestes splendens</u>	2	1.596	0.304	35.5	(34-37)
<u>Sergestes corniculum</u>	1	0.798	0.200	39.0	
<u>Gennadas scutatus</u>	1	0.798	0.060	21.0	
<u>Systellaspis debilis</u>	2	1.596	1.271	58.5	(48-69)
<u>Lophogaster sp.</u>	1	0.798	0.160	29.0	
Stomatopoda (larvae)	4	3.192	0.664	35.8	(27-44)
Scyphozoa	1	0.798	15.716	95.0	
Siphonophora (biomass only)			0.569		

Table 26

Cruise: PROTEC-13

Sample #: 20 cont'd

Date of Sample: 15 V 81

Time of Sample: 00:39-02:10

Depth of Sample: 25-200 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number	Biomass(g)	Size(mm)	Range(mm)
		$10^4 \frac{4}{3} m$	$10^4 \frac{4}{3} m$		
Chaetognatha	1	0.798	0.052	26.0	
Urochordata	1	0.798	0.164	30.0	
Heteropoda	1	0.798	0.904	59.0	
Polychaeta	1	0.798	0.025	21.0	
Total sorted			31.771		
Residue			14.334		
Total biomass			46.105		

Table 26

Cruise: PROTEC-13 Sample #: 21
 Date of Sample: 15 V 81 Time of Sample: 03:12-04:37
 Depth of Sample: 25-210 m Sample Type: Micronekton
 Tucker trawl

Taxonomic Identification	Counted	Number $10^4 \frac{3}{m}$	Biomass(g) $10^4 \frac{3}{m}$	Size(mm)	Range(mm)
<u>Lepidophanes guentheri</u>	6	3.404	3.070	46.2	(36-53)
<u>Lampanyctus nobilis</u>	1	0.567	0.456	49.0	
<u>Diaphus dumerilii</u>	3	1.702	0.319	22.0	(15-36)
<u>Diaphus mollis</u>	1	0.567	0.498	38.0	
<u>Myctophum selenops</u>	1	0.567	0.094	25.0	
<u>Pollichthys maui</u>	3	1.702	0.069	21.7	(20-25)
<u>Coccorella atrata</u>	1	0.567	0.226	30.0	
<u>Astronesthes richardsoni</u>	1	0.567	0.347	50.0	
Anguilliformes (larvae)	3	1.702	0.482	64.7	(46-76)
<u>Sergestes talismani</u>	3	1.702	0.482	37.3	(33-40)
<u>Sergestes corniculum</u>	3	1.702	0.236	32.0	(28-37)
Penaeidae	1	0.567	0.027	22.0	
<u>Lophogaster sp.</u>	3	1.702	0.260	26.3	(20-37)
Stomatopoda (larvae)	3	1.702	0.247	36.0	(22-43)
Scyphozoa	3	1.702	3.191	31.7	(25-35)
Siphonophora (biomass only)			6.010		
Urochordata	1	0.567	0.778	35.0	
Polychaeta	1	0.567	0.071	37.0	
Chaetognatha	2	1.135	0.115	34.0	(31-37)
Total sorted			16.978		
Residue			18.936		
Total biomass			35.914		

Table 26

Site, Cruise, Station: PROTEC-13

Sample #: 11

Date of Sample: 12 V 81

Time of Sample: 12:01-13:28

Depth of Sample: 220-700 m

Sample Type: Micronekton
Tucker Trawl

Taxonomic Identification	Number Counted	Number $10^4 \frac{4}{m^3}$	Biomass(g) $10^4 \frac{4}{m^3}$	Mean Size(mm)	Size Range(mm)
<u>Diaphus dumerilii</u>	1	0.424	0.045	20.0	
<u>Diaphus splendidus</u>	1	0.424	0.232	37.0	
Myctophidae	1	0.424	0.064	25.0	
<u>Cyclothone braueri</u>	15	6.353	0.116	21.0	16-24
<u>Argyropelecus hemigymnus</u>	1	0.424	0.158	27.0	
<u>Valencienellus tripunctulatus</u>	2	0.847	0.155	26.0	23-29
Anguilliformes (larvae)	3	1.271	0.678	49.7	47-52
Euphausiidae	2	0.847	0.078	25.0	24-26
Chaetognatha	5	2.118	0.083	27.6	24-31
Total sorted			1.609		
Residue			6.198		
Total biomass			7.806		

Table 26

Cruise: PROTEC-13

Sample #: 12

Date of Sample: 12 V 81

Time of Sample: 15:20-16:50

Depth of Sample: 200-580 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number $10^4 \frac{3}{m}$	Biomass(g) $10^4 \frac{3}{m}$	Size(mm)	Range(mm)
<u>Lepidophanes guentheri</u>	1	0.619	0.478	46.0	
<u>Lampanyctus cuprarius</u>	1	0.619	0.142	34.0	
<u>Diaphus dumerilii</u>	2	1.237	0.230	24.5	(23-26)
<u>Diaphus splendidus</u>	1	0.619	0.056	22.0	
<u>Cyclothone braueri</u>	11	6.804	0.229	19.9	(15-23)
<u>Cyclothone microdon</u>	9	5.567	0.964	35.4	(22-49)
<u>Argyrops leucogaster</u>	1	0.619	0.072	18.0	
<u>Scopeloberyx sp.</u>	1	0.619	0.055	18.0	
<u>Idiacanthus fasciola</u>	1	0.619	0.058	58.0	
<u>Stomias affinis</u>	1	0.619	0.434	72.0	
<u>Sergestes atlanticus</u>	1	0.619	0.027	22.0	
<u>Sergestes vigilax</u>	1	0.619	0.046	23.0	
<u>Sergestes grandis</u>	3	1.856	0.382	35.7	(32-41)
Penaeidae	1	0.619	0.038	29.0	
<u>Systellaspis debilis</u>	1	0.619	0.558	66.0	
<u>Stylocheiron maximum</u>	1	0.619	0.058	25.0	
<u>Thysanopoda orientalis</u>	1	0.619	0.056	30.0	
<u>Nematobrachion boopis</u>	2	1.237	0.122	23.0	(21-25)
Lysianassidae	1	0.619	0.053	16.0	
Scyphozoa	1	0.619	0.636	18.0	
Chaetognatha	5	3.093	0.169	30.0	(28-32)

Table 26

Cruise: PROTEC-13

Sample #: 12 cont'd

Date of Sample: 12 V 81

Time of Sample: 15:20-16:50

Depth of Sample: 200-580 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number	Biomass(g)	Size(mm)	Range(mm)
		$10^4 \frac{4}{m} \frac{3}{m}$	$10^4 \frac{4}{m} \frac{3}{m}$		

Total sorted

4.863

Residue

5.734

Total biomass

10.597

Table 26

Cruise: PROTEC-13

Sample #: 13

Date of Sample: 13 V 81

Time of Sample: 02:45-04:40

Depth of Sample: 220-700 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number $10^4 \cdot 10^3$	Biomass(g) $10^4 \cdot 10^3$	Size(mm)	Range(mm)
<u>Cyclothone braueri</u>	10	4.684	0.235	24.3	(15-35)
<u>Cyclothone microdon</u>	8	3.748	0.770	36.6	(23-51)
<u>Pollichthys mauli</u>	2	0.937	0.089	27.0	(23-31)
<u>Chauliodus sloani</u>	1	0.468	0.347	57.0	
Anguilliformes (larvae)	2	0.937	0.340	59.0	(57-61)
<u>Sergestes talismani</u>	15	7.027	1.661	32.2	(26-45)
<u>Sergestes filictum</u>	1	0.468	0.071	29.0	
<u>Sergestes sp.</u>	1	0.468	0.105	22.0	
<u>Gennadas valens</u>	1	0.468	0.304	31.0	
Penaeidae	1	0.468	0.030	22.0	
<u>Oplophorus gracilirostris</u>	3	1.405	4.694	83.7	(80-89)
<u>Pasiphaea merriami</u>	1	0.468	0.210	49.0	
<u>Stylocheiron maximum</u>	5	2.342	0.199	24.0	(22-25)
<u>Nematobrachion boopis</u>	2	0.937	0.106	26.0	(25-27)
Lysianassidae	1	0.468	0.022	21.0	
Chaetognatha	3	1.405	0.058	28.0	(23-31)
Total sorted			9.241		
Residue			5.656		
Total biomass			14.897		

Table 26

Cruise: PROTEC-13

Sample #: 19

Date of Sample: 14 V 81

Time of Sample: 22:11-23:35

Depth of Sample: 210-550 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number $10^4 \frac{4}{m^3}$	Biomass(g) $10^4 \frac{4}{m^3}$	Size(mm)	Range(mm)
<u>Cyclothone braueri</u>	2	1.265	0.058	20.5	(20-21)
<u>Cyclothone microdon</u>	1	0.632	0.084	31.0	
<u>Argyropelecus hemigymnus</u>	2	1.265	0.144	17.5	(16-19)
<u>Argyropelecus aculeatus</u>	1	0.632	0.439	25.0	
<u>Sergestes grandis</u>	1	0.632	1.666	76.0	
<u>Sergestes atlanticus</u>	1	0.632	0.055	25.0	
<u>Sergestes splendens</u>	1	0.632	0.072	24.0	
<u>Sergestes sp.</u>	1	0.632	0.044	24.0	
<u>Gennadas bouvieri</u>	4	2.530	0.502	30.5	(28-34)
<u>Gennadas capensis</u>	3	1.897	0.352	32.0	(30-34)
<u>Gennadas sp.</u>	3	1.897	0.128	24.3	(22-23)
<u>AcanthePHYRA purpurea</u>	5	3.162	5.533	69.3	(34-88)
<u>Pasiphaea merriami</u>	1	0.632	0.020	24.0	
<u>Gnathophausia ingens</u>	1	0.632	5.989	130.0	
<u>Stylocheiron maximum</u>	1	0.632	0.118	28.0	
<u>Thysanopoda orientalis</u>	2	1.265	0.164	32.5	(28-37)
<u>Nematobrachion boopis</u>	2	1.265	0.108	23.0	(22-24)
Scyphozoa	1	0.632	0.488	20.0	
Chaetognatha	6	3.795	0.166	26.3	(22-31)
Brachioteuthidae	1	0.632	0.971	25.0	

Table 26

Cruise: PROTEC-13

Sample #: 19 cont'd

Date of Sample: 14 V 81

Time of Sample: 22:11-23:35

Depth of Sample: 210-550 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number	Biomass(g)	Size(mm)	Range(mm)
		10^4 m^3	10^4 m^3		

Total sorted

17.101

Residue

5.372

Total biomass

22.473

Table 26

Cruise: PROTEC-13

Sample #: 14

Date of Sample: 13 V 81

Time of Sample: 14:05-15:32

Depth of Sample: 780-1200 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number $10^4 \frac{4}{m^3}$	Biomass(g) $10^4 \frac{4}{m^3}$	Size(mm)	Range(mm)
<u>Lepidophanes guentheri</u>	1	1.013	0.594	43.0	
<u>Lampanyctus cuprarius</u>	4	4.051	7.381	63.5	(57-71)
<u>Cyclothone braueri</u>	1	1.013	0.033	20.0	
<u>Cyclothone microdon</u>	11	11.139	2.307	38.8	(25-50)
<u>Sternoptyx diaphana</u>	1	1.013	1.036	27.0	
<u>Scopelogadus mizolepis</u> <u>mizolepis</u>	1	1.013	0.648	33.0	
<u>Cetomimus sp.</u>	1	1.013	3.268	72.0	
<u>Stomias affinis</u>	2	2.025	2.070	74.0	(65-83)
Anguilliformes (larvae)	1	1.013	0.109	64.0	
<u>Sergestes talismani</u>	1	1.013	0.306	36.0	
<u>Sergestes splendens</u>	1	1.013	0.118	26.0	
<u>Sergestes sp.</u>	1	1.013	0.295	36.0	
<u>Gennadas bouvieri</u>	3	3.038	0.527	28.7	(26-30)
<u>Gennadas scutatus</u>	2	2.025	0.180	21.5	(21-22)
<u>Gennadas capensis</u>	1	1.013	0.106	22.0	
<u>Gennadas sp.</u>	4	4.051	0.408	23.3	(21-27)
<u>Systellaspis debilis</u>	3	3.038	2.938	65.0	(59-73)
<u>Acanthephyra curtirostris</u>	1	1.013	4.315	85.0	
Caridea	1	1.013	0.088	26.0	
Cephalopoda (dismembered)			3.654		

Table 26

Cruise: PROTEC-13

Sample #: 14 cont'd

Date of Sample: 13 V 81

Time of Sample: 14:05-15:32

Depth of Sample: 780-1200 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number	Biomass(g)	Size(mm)	Range(mm)
		$10^4 \frac{3}{m}$	$10^4 \frac{3}{m}$		

Total sorted

30.381

Residue

71.787

Total biomass

101.762

Table 26

Cruise: PROTEC-13
 Date of Sample: 15 V 81
 Depth of Sample: 640-1140 m

Sample #: 22
 Time of Sample: 07:22-08:42
 Sample Type: Micronekton
 Tucker trawl

Taxonomic Identification	Counted	Number $10^4 \frac{3}{m^3}$	Biomass(g) $10^4 \frac{3}{m^3}$	Size(mm)	Range(mm)
<u>Lampanyctus lineatus</u>	1	0.854	0.735	55.0	
<u>Lampanyctus photonotus</u>	1	0.854	0.917	51.0	
<u>Cyclothone braueri</u>	1	0.854	0.049	25.0	
<u>Cyclothone microdon</u>	4	3.414	0.924	43.3	(25-55)
<u>Idiacanthus fasciola</u>	1	0.854	0.054	55.0	
<u>Melanocetus sp.</u>	1	0.854	0.161	15.0	
<u>Gennadas scutatus</u>	1	0.854	0.043	17.0	
<u>Gennadas capensis</u>	1	0.854	0.147	27.0	
<u>Gennadas sp.</u>	1	0.854	0.079	22.0	
<u>Funchalia taaningi</u>	1	0.854	0.387	43.0	
Penaeidae	1	0.854	0.042	21.0	
<u>Systellaspis debilis</u>	1	0.854	1.204	73.0	
<u>AcanthePHYra purpurea</u>	2	1.708	0.955	51.0	(44-58)
<u>AcanthePHYra stylorostrata</u>	1	0.854	0.190	33.0	
<u>Siriella sp.</u>	1	0.854	0.177	35.0	
Scyphozoa	1	0.854	9.735	60.0	
Chaetognatha	4	3.414	0.192	24.3	(23-26)
Total sorted			15.991		
Residue			2.953		
Total biomass			18.944		

Table 26

Cruise: PROTEC-13

Sample #: 15

Date of Sample: 14 V 81

Time of Sample: 00:07-02:12

Depth of Sample: 0-900 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number $10^4 \frac{4}{m^3}$	Biomass(g) $10^4 \frac{4}{m^3}$	Size(mm)	Range(mm)
<u>Lampanyctus cuprarius</u>	1	0.499	0.187	38.0	
<u>Myctophidae</u>	2	0.998	0.067	18.5	(18-19)
<u>Gonostoma elongatum</u>	1	0.499	23.092	227.0	
<u>Cyclothone braueri</u>	9	4.489	0.205	23.6	(15-32)
<u>Cyclothone microdon</u>	13	6.485	1.338	35.9	(18-55)
<u>Sternoptyx diaphana</u>	1	0.499	0.323	21.0	
<u>Scopelogadus mizolepis</u> <u>mizolepis</u>	1	0.499	0.479	39.0	
<u>Anguilliformes (larvae)</u>	2	0.998	0.610	140.0	(111-169)
<u>Sergestes filictum</u>	1	0.499	0.567	57.0	
<u>Sergestes grandis</u>	1	0.499	0.367	50.0	
<u>Gennadas bouvieri</u>	3	1.497	0.364	29.7	(27-33)
<u>Gennadas talismani</u>	1	0.499	0.194	34.0	
<u>Gennadas sp.</u>	1	0.499	0.090	25.0	
<u>Systellaspis debilis</u>	1	0.499	0.294	55.0	
<u>AcanthePHYRA stylorostrata</u>	2	0.998	0.580	46.5	(45-48)
<u>AcanthePHYRA acutifrons</u>	1	1.497	0.408	34.0	(30-38)
<u>Gnathophausia ingens</u>	1	0.499	5.130	124.0	
<u>Eucopia sp.</u>	2	0.998	0.136	32.0	(24-40)
<u>Stylocheiron maximum</u>	2	0.998	0.112	27.5	(27-28)
<u>Thysanopoda orientalis</u>	3	1.497	0.148	23.3	(22-26)
Crab larva	1	0.499	0.383	29.0	
Chaetognatha	5	2.494	0.061	23.8	(22-25)

Table 26

Cruise: PROTEC-13

Sample #: 15 cont'd

Date of Sample: 14 V 81

Time of Sample: 00:07-02:12

Depth of Sample: 0-900 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number	Biomass(g)	Size(mm)	Range(mm)
		$10^4 m^3$	$10^4 m^3$		

Total sorted

35.135

Residue

6.007

Total biomass

41.142

Table 26

Cruise: PROTEC-13

Sample #: 16

Date of Sample: 14 V 81

Time of Sample: 03:32-04:55

Depth of Sample: 600-980 m

Sample Type: Micronekton
Tucker trawl

Taxonomic Identification	Counted	Number 10^4 m^3	Biomass(g) 10^4 m^3	Size(mm)	Range(mm)
<u>Lampanyctus cuprarius</u>	2	1.558	1.366	50.5	(42-59)
<u>Cyclothone braueri</u>	2	1.558	0.056	21.5	(18-25)
<u>Cyclothone microdon</u>	20	15.575	3.032	38.0	(24-55)
<u>Idiacanthus fasciola</u>	1	0.779	5.049	221.0	
<u>Stomias affinis</u>	1	0.779	0.936	78.0	
<u>Rouleina sp.</u>	1	0.779	51.149	182.0	
<u>Gennadas sp.</u>	3	2.336	0.385	26.7	(25-28)
<u>Systellaspis debilis</u>	1	0.779	0.057	33.0	
<u>Eucopia major</u>	3	2.336	0.310	29.3	(26-34)
<u>Thysanopoda orientalis</u>	1	0.779	0.117	27.0	
<u>Periphylla periphylla</u>	1	0.779	1.310	24.0	
Hydrozoa	2	1.558	1.396	23.0	(22-24)
<u>Pyrosoma sp.</u>	6	4.673	8.496	30.5	(20-42)
Chaetognatha	6	4.673	0.192	22.5	(21-26)
Total sorted			73.851		
Residue			7.173		
Total biomass			81.024		

4. Fish, Mammal, and Bird Sightings (S. Vargo)

Few animals were sighted during PROTEC-13. The sightings are listed below in chronological order.

<u>Date</u>	<u>Time (AST)</u>	<u>Position</u>	<u>Animals</u>
09/5/81	1010	17°56'N, 65°53'W	6-7 porpoise
11/5/81	1745	17 55'n, 65 53'W	Large, colonial floating <u>Lepas cylindricus</u> -yellow phase
12/5/81	0850	18 2'N, 65 52'W	1 tropic bird
12/5/81	0955	17 55'N, 65 49'W	2 dark tan seabirds
12/5/81	1115	18 4'N(?), 65 49'W	1 gannet, 1 swallow
13/5/81	0945	17 55'N, 65 49'W	1 brown booby (<u>Sula leucogaster</u>)
13/5/81	1030	17 55'N, 65 49'W	Flock of Mother Carrie's Chickens

5. DSL Tracking (S. Vargo)

An EDO precision depth recorder with a 12.5 kHz pulse was used to detect the deep scattering layer (DSL). The unit worked well throughout the time on station for PROTEC-13. However, no DSL was detected at any time during the cruise.

D. Meteorology Log (S. Vargo)

Meteorological observations were made every four hours while at the benchmark site during PROTEC-13 and are shown in Table 27.

Table 27. Meteorology Log, PROTEC 13.

Date (Day/Mo/Yr)	Time* (AST)	Air Temperature		Wave Height (ft)	Barometric Pressure	Wind		Percent Cloud Cover	Position	
		Wet Bulb (°F)	Dry Bulb (°F)			Direction	Speed (Kts)		Latitude	Longitude
9/5/81	0801	80	86	2	30.05	E	5	100	17°57.40'N	65°49.63'W
9/5/81	1213	80	84	2	30.06	E	10	100	17 56.69'N	65 52.89'W
9/5/81	1625	78	82	1-2	30.04	SE	9	100	17 56.64'N	65 52.95'W
9/5/81	2027	80	82	2-3	30.01	E	10-15	30	17 57.30'N	65 46.41'W
10/5/81	0054	78	84	2-4	30.06	E	5-10	30	17 58.49'N	65 45.15'W
10/5/81	0446	78	82	2-4	30.04	E	5	30	17 01.06'N	65 45.16'W
10/5/81	2008	77	82	1-2	30.04	SE	8	30	17 57.17'N	65 48.54'W
11/5/81	0345	78	80	2	30.02	S	9	0	17 57.11'N	65 50.19'W
11/5/81	0722	77	81	3	30.04	NE	5-10	0	17 54.60'N	65 57.87'W
11/5/81	1240	80	88	1-2	30.04	E	5	0	17 55.77'N	65 52.67'W
11/5/81	1654	80	86	1	30.00	E	5	50	17 56.13'N	65 57.08'W
11/5/81	2200	78	80	1-2	30.05	N	9	50	17 57.38'N	65 57.02'W
11/5/81	2400	79	84	1-2	30.05	S	9	50	17 57.19'N	65 57.41'W
12/5/81	0822	79	83	2-4	30.08	NE	8	50	17 59.58'N	65 52.41'W
12/5/81	1149	80	83	2-4	30.09	E	10	75	17 55'N	65 49'W
12/5/81	1608	81	88	1-2	30.01	E-SW	8	50	17 56.29'N	65 51.07'W
12/5/81	1950	78	81	1-2	30.05	NE	10	0	18 04.37'N	65 55.10'W
12/5/81	2400	79	81	1-3	30.05	S	12	25	18 08.93'N	65 53.39'W
13/5/81	0402	78	83	2-3	30.06	E	10-15	25	17 57.33'N	65 53.29'W
13/5/81	0955	79	81	4-6	30.10	SE	11	25	17 54.64'N	65 49.30'W
13/5/81	1234	78	83	6-8	30.05	S	15-20	50	17 56.92'N	65 51.20'W
13/5/81	1556	79	85	4-6	30.04	E	15-20	100	17 57.89'N	65 47.18'W
13/5/81	2000	78	80	2-4	30.06	S	10	50	17 58.81'N	65 44.56'W
14/5/81	0201	73	76	4-5	30.06	E	15-20	50	17 57.64'N	65 47.76'W
14/5/81	0800	78	84	2-3	30.01	S	15	50	17 56.90'N	65 49.80'W
14/5/81	1225	78	81	2-4	30.03	SE	17	90	17 57.12'N	65 52.55'W
14/5/81	1642	78	82	3-4	30.00	SE	10-15	100	17 57.80'N	65 49.61'W
14/5/81	2030	78	82	2-4	30.01	SE	12	50	17 56.76'N	65 50.37'W
15/5/81	0645	74	81	2-4	30.05	E	15	30	17 55.59'N	56 52.63'W

* GMT + 4 hours

E. PROTEC-13
Post-Cruise Report
and
Operations Log

June 16, 1981

TO: J. E. Vogt

FROM: Sandra L. Vargo
Florida Institute of Oceanography

SUBJECT: Post-cruise report for cruise PROTEC-13.

The following is a summary of the PROTEC-13 cruise on the R/V BELLOWS to Punta Tuna, Puerto Rico in the vicinity of 17°57'N and 65°48'W which took place from April 30 to May 26, 1981. The benchmark station was actually sampled from May 9 through May 15, 1981. The LBL current meters were retrieved May 16, 1981.

I. Purpose of cruise

The third quarterly sampling program at the OTEC benchmark site off Puerto Rico was carried out during this cruise. Physical, chemical and biological parameters were sampled at the benchmark location in the vicinity of 17°57'N, 65°48'W and a LBL current meter array retrieved.

II. List of Participants

Scientific Personnel	Ship's Personnel	LBL Personnel
D. Milliken, FIO	T. Hayes	Tony Jones
S. Vargo, FIO	C. Horan	
T. Bryant, FIO	R. Schultz	
G. Vargo, USF		
B. Calvert, USF		
V. Hensley, USF		
T. Hopkins, USF		
T. Lancraft, USF		
H. Michel, UM		
J. Low, UM		
P. Skipp, Daubin Systems		

III. Safety

In case of emergency contact the following people:

William W. Behrens, Jr.	813/893-9100
Alan H. Purdy	"
Eugene Olson	"

The R/V BELLOWS meets all safety and operational requirements as outlined by the University-National Oceanographic Laboratory System (UNOLS). For details on safety equipment, vessel specifications, insurances, and master's license, see Appendix I. A safety radio check is made daily at 0930 local time (0830 EST).

IV. Chronological Summary

All times are AST unless otherwise noted. GMT is AST plus 4 or EDT plus 4.

Date	Time	Activity
1981		
Apr. 30	1445 (EDT)	Departed St. Petersburg, Florida
May 1	1400 (EDT)	Arrived Key West, Florida
	1800 (EDT)	Departed Key West, Florida for Puerto Rico
2	0900 (EDT)	Underway to Puerto Rico
3	0900 (EDT)	" "
4	0900 (EDT)	" "
5	0900 (EDT)	" "
6	0900 (EDT)	" "
7	1100 (AST)	Arrived San Juan, P.R.
8	1200	Scientific Party arrived
	2040	Departed San Juan for Punta Tuna Benchmark site
9	0630	Arrived Benchmark site
	1230 (0830)	T-5 XBT #1
	0830 (1230)	Transmissometer In
	0900 (1300)	Transmissometer Out
	0955 (1355)	<u>In Vivo</u> Start
	1000 (1400)	Hose compressed, cut and refastened
	1005 (1405)	Lost the prime
	1010 (1410)	Pod of porpoises off stern, 6-7 individuals
	1030 (1430)	Reprimed, dropped to 10m, waited 3.5 min.
	1040 (1440)	Started down, 10m intervals
	1125 (1525)	Profile started up
	1130 (1530)	Hose at surface, waited 3.5 min.
	1134 (1534)	before bringing it in
	1157 (1557)	Hose out of the water
	1209 (1609)	Light meter at surface, starting down
	1213 (1613)	End of cast, starting ascent
	1255 (1655)	Light meter out of water
	1256 (1656)	CTD in water
		Profile begun
	1300 (1700)	Profile stopped due to cable lay
	1335 (1735)	CTD in water again
	1337 (1737)	Profile started
	1530 (1930)	CTD on deck
	1610 (2010)	Hydrocast-Biocast (1000 m)
		Depths 0, 10, 15, 20, 30, 40, 50, 60, 75, 85, 90, 100, 200, 300, 400, 500, 600, 800, 1000m
		ATP 10, 50, 75, 90, 100, 300
		ChL 0, 10, 15, 20, 50, 60, 75, 85, 90, 100, 200, 300
		Nutrients, salinity, D. O. All depths
	1730 (2130)	Cast in-soak 10 min.
	1745 (2145)	Messenger dropped, felt at least 7 trips
	1800 (2200)	Hydrocast started up
	1900 (2300)	Cast up
	1910 (2310)	All samples drawn
	1915 (2315)	All chlorophyll filtered

IV. Chronological Summary (Continued)

Date	Time	Activity
May 9	2130 (0130)	Bongo tow #1, Night 25-0m Hydrowinch problems Bongos terminated
	2230 (0230) In	Tucker 25-0m #1, Night
10	0010 (0410) Out	
	0015 (0415)	XBT T-7 #2
	0050 (0450) In	Tucker 25-0 #2, Night
	0200 (0600) Out	
	0210 (0610) In	Tucker 25-0 #3, Night
	0318 (0718) Out	
	0325 (0725)	XBT T-7 #3
	0333 (0733) In	Tucker 25-0 #4, Night
	0430 (0830) Out	
	1500 (1900)	Left station for hydrowinch motor
	1800 (2200)	Back on station
	1925 (2325)	XBT T-5 #4
	1945 (2345)	Transmissometer Start
	2005 (2405)	Transmissometer End
	2030 (0030)	<u>In Vivo</u> fluorescence profile 3.5 min. at surface, 10 m intervals with 3.5 min wait
	2130 (0130)	Max depth (120 m) started up
	2140 (0140)	Hose on deck
	2205 (0205)	CTD profile to 1000 m--start
	2310 (0310)	CTD out
	2330 (0330)	School of squid, 1' long (Loligo)
	2340 (0340)	Hydro-biocalt to 1000 m begun Depths 0, 10, 15, 20, 30, 40, 50, 60, 75 85, 90, 100, 200, 300, 400, 500, 600, 800, 1000m ATP 10, 50, 75, 90, 100, 300 ChL 0, 10, 15, 20, 50, 60, 75, 85, 90, 100, 200, 300 Nutrients, Salinity, D. O. all depths
11	0020 (0420)	Cast Down, 15 min. soak
	0035 (0435)	Messenger sent, Bottles tripped
	0045 (0445)	Cast started up
	0200 (0600)	Cast on deck--all samples drawn
	0230 (0630)	All samples filtered

IV. Chronological Summary (Continued)

Date	Time	Activity
May 11	0220 (0620)	Bongo tow 25-0m #2, Night Bongo tow 25-0m #3, Night Bongo tow 25-0m #4, Night
	0320 (0720)	All Bongos complete
	0345 (0745)	XBT T-7 #4
	0635 (1035)	Tucker Trawl
	0800 (1200)	Calibration and Test
	0930 (1330)In	Tucker 200-25 #1, Day
	1055 (1455)Out	
	1100 (1500)	XBT T-7 #5
	1130 (1530)In	Tucker 200-25 #2, Day
	1245 (1645)Out	
	1310 (1710)In	Tucker 200-25 #3, Day
	1430 (1830)Out	
	1445 (1845)	XBT T-7 #6
	1455 (1855)In	Tucker 200-25 #4, Day
	1614 (2014)Out	
	1620 (2020)	XBT T-7 #7
	1745 (2145)	Sighted large colonial floating <u>Lepas cylindricus</u> -yellow phase
	1950 (2350)In	Bongo tow 200-25m #1, Night
	2029 (0029)Out	
	2110 (0110)In	Bongo tow 200-25m #2, Night (didn't close
	2147 (0147)Out	
	2201 (0201)In	Bongo tow 200-25m #3, Night
	2237 (0237)Out	
	2250 (0250)	XBT T-7 #8
	2305 (0305)In	Bongo tow 200-25m #4, Night
	2339 (0339)Out	
May 12	0005 (0405)In	Tucker 200-25 #1, Night
	0142 (0542)Out	
	0150 (0550)	XBT T-7 #9
	0220 (0620)In	Tucker 200-25 #2, Night
	0334 (0734)Out	
	0750 (1150)In	Bongo tow 200-25m #1, Day
	0828 (1228)Out	
	0830 (1230)	XBT T-7 #10
	0842 (1242)In	Bongo tow 200-25m #2, Day
	0924 (1324)Out	
	0850 (1250)	One tropic bird sighted
	0935 (1335)In	Bongo tow 200-25m #3, Day
	1017 (1417)Out	Last fix 0922 (1322)
	0955 (1355)	2 dark tan seabirds sighted
	1033 (1433)	XBT T-7 #11
	1042 (1442)In	Bongo tow 200-25m #4, Day
	1120 (1520)Out	
	1115 (1515)	1 gannet, 1 swallow
	1145 (1545)In	Tucker trawl 200-600m #1, Day
	1400 (1800)Out	
	1410 (1810)	XBT T-7 #12
	1450 (1850)In	Tucker 200-600 #2
	1710 (2110)Out	
	1942 (2342)	Bongo tow 600-200m and 600-1000m #1, Night Tow aborted due to men overboard; got the men back on board within 30 seconds; small cut on G. Vargo

IV. Chronological Summary (Continued)

Date	Time	Activity
May 13	2132 (0132)In	Repeated Bongo tow 600-200m and
	0020 (0420)Out	600-1000m #1, Night
		Last fix 1806(2206)
	0212 (0612)	XBT T-5 #13
	0230 (0630)In	Tucker 600-200m #1, Night
	0500 (0900)Out	
	0802 (1202)In	Bongo tow, 1000-600m #1, Day
	1125 (1525)Out	
	0945 (1345)	1 Brown Booby (<u>Sula leucogaster</u>)
	1030 (1430)	Flock of Mother Carrie's Chickens
	1138 (1538)In	Bongo tow 25-0 #1, Day
	1145 (1545)Out	
	1154 (1554)In	Bongo tow 25-0m #2, Day
	1203 (1603)Out	
	1220 (1620)In	Bongo tow 25-0m #3, Day
	1228 (1628)Out	
	1238 (1638)In	Bongo tow 25-0m #4, Day
	1247 (1647)Out	
	1300 (1700)	XBT T-7 #14
	1316 (1716)In	Tucker trawl 600-1000m #1, Day
	1618 (2018)Out	
	1620 (2020)	XBT T-5 #15
	1909 (2309)In	Bongo tow 1000-600m #2, Night
	2245 (0245)Out	
	2300 (0300)	XBT T-5 #16
	2325 (0325)In	Tucker trawl 1000m-600m #1, Night
May 14	0208 (0608)Out	
	0223 (0623)	XBT T-5 #17
	0250 (0650)In	Tucker 1000-600m #2, Night
	0530 (0930)Out	
	0702 (1102)In	Bongo tow 1000-600m #2, Day
	1050 (1450)Out	last fix 0924 (1324)
	1100 (1500)	XBT T-5 #18
	1137 (1537)In	Bongo tow 600-200m #1, Day
	1305 (1705)Out	
	1420 (1820)	Tucker trawl 1000-600m #2
		Cable trouble
	1600 (2000)In	Tucker 25-0m #1, Day
	1650 (2050)Out	
	1658 (2058)In	Tucker 25-0m #2, Day
	1745 (2145)Out	
	1750 (2150)	XBT T-7 #19
	1830 (2230)	LBL Hydrocast to 100m
	1926 (2326)In	Bongo tow 600-200m #2, Night
	2052 (0052)Out	
	2110 (0110)	XBT T-7 #20
	2145 (0145)In	Tucker 600-200m #2
	2355 (0355)Out	

IV. Chronological Summary (Continued)

Date	Time	Activity	
May 15	0000	XBT T-7 #21	
	0030 (0430)In	Tucker trawl 200-25m #3	
	0215 (0615)Out		
	0302 (0702)In	Tucker 200-25m #4, Night	
	0445 (0845)Out		
	0645 (1045)In	Tucker trawl 1000-600m #2, Day	
	0955 (1355)Out		
	1010 (1410)In	Bongo tow 600-200m #2, Day	
	1140 (1540)Out		
	1145 (1545)	XBT T-7 #22	
	1145 (1545)	Left station for Palmas del Mar	
	1315 (1715)	Arrived Palmas del Mar	
		The following personnel disembarked at this time: B. Calvert (USF), V. Hensley(USF), T. Hopkins(USF), T. Lancraft (USF), H. Michel(UM), J. Low(UM); P.Skipp embarked for current meter array retrieval.	
May 16	0700 (1100)	Departed Palmas del Mar	
	0830 (1230)	Arrive current meter array site	
	0900 (1300)	Current array up	
	1015 (1415)	Line on top buoy	
	1020 (1420)	Top buoy (48") on board	
	1055 (1455)	NB-ACM on board	
	1110 (1510)	RCM-5-4606 out of water, no rotor	
	1140 (1540)	41" buoy out of water	
	1140 (1540)	RCM-5 S.N. 4607 out of water, tangled with buoy, broken vane, no rotor; probably came out during retrieval as something red floated away	
	1250 (1750)	RCM-5 S.N. 4993 out of water, no rotor	
	1353 (1753)	44" buoy out of water	
	1411 (1811)	RCM-4 S.N. 3350 out of water-has rotor	
	1420 (1820)	Code 7 release on board	
	1423 (1823)	Code 4 release on board; retrieval completed	
	1440 (1940)	LBL water sample from 90m	
		Last fix 1410 (1810)	
	1500 (1900)	Departed for San Juan	
	16	2300	Arrived San Juan, P.R.
	17		Docked in San Juan for fueling
	18	1200	Scientific party departed
		1300	Departed San Juan, P.R.
		2300	Returned to San Juan-Engine trouble
	19-20		Engine repair
21	0600	Departed San Juan, P.R.	
22	0830	Underway for Miami, Florida	
23, 24, 25	0830	" "	
26	1830 (EDT)	Arrived University of Miami dock	

Date 1981	Time shown is AST GMT in Parenthesis	Position	Operation
May 9	1230 (0830)	17°57'N 65°49'W	T-5 XBT #1
	0830 (1230)		Transmissometer In
	0900 (1300)	17°56.35'N 65°52.79'W	Transmissometer Out
	0955 (1355)	17°56.35'N 65°50.72'W	In Vivo Start
	1000 (1400)		Hose compressed, cut and refastened
	1005 (1405)		Lost the prime
	1010 (1410)	17°56.35'N 65°52.57'W	Pod of porpoises off stern, 6-7 individuals
	1030 (1430)		Reprimed, dropped to 10m, waited 3.5 min.
	1040 (1440)	17°56.51'N 65°52.27'W	Started down, 10m intervals
	1125 (1525)	17°27'N 65°52.40'W	Profile started up
	1130 (1530)		Hose at surface, waited 3.5 min.
	1134 (1534)		before bringing it in
	1157 (1557)		Hose out of the water
	1209 (1609)		Light meter at surface, starting down
	1213 (1613)	17°56.69'N 65°52.89'W	End of cast, starting ascent
	1255 (1655)		Light meter out of water
	1256 (1656)		CTD in water
			Profile begun
	1300 (1700)		Profile stopped due to cable lay
	1335 (1735)		CTD in water again
	1337 (1737)	17°56.69'N 65°51.30'W	Profile started
	1530 (1930)		CTD on deck
	1610 (2010)	17°56.64'N 65°52.95'W	Hydrocast-Biocast (1000 m)
			Depths 0, 10, 15, 20, 30, 40, 50, 60, 75, 85, 90, 100, 200, 300, 400, 500, 600, 800, 1000m
			ATP 10, 50, 75, 90, 100, 300
			ChL 0, 10, 15, 20, 50, 60, 75, 85, 90, 100, 200, 300
			Nutrients, salinity, D. O. All depths
	1730 (2130)		Cast in-soak 10 min.
	1745 (2145)	17°56.32'N 65°49.18'W	Messenger dropped, felt at least 7 trips
	1800 (2200)		Hydrocast started up
	1900 (2300)		Cast up
	1910 (2310)		All samples drawn
	1915 (2315)		All chlorophyll filtered

C-153

Date 1981	Time shown is AST GMT in Parenthesis	Position	Operation
May 9	2130 (0130)	17°56.32'N 65°49.18'W	Bongo tow #1, Night 25-0m Hydrowinch problems Bongos terminated
C-154	May 10 2230 (0230)In	17 58'N 65 45'W	Tucker 25-0m #1, Night
	0010 (0410)Out		
	0015 (0415)	17 58'N 65 42'W	XBT T-7 #2
	0050 (0450)In	17 58'N 65 45'W	Tucker 25-0 #2, Night
	0200 (0600)Out		
	0210 (0610)In	18 00.02'N 65 42.35'W	Tucker 25-0 #3, Night
	0318 (0718)Out		
	0325 (0725)	18 0.69'N 65 46.38'W	XBT T-7 #3
	0333 (0733)In	18 00'N 65 46'W	Tucker 25-0 #4, Night
	0430 (0830)Out		
	1500 (1900)		Left station for hydrowinch motor
	1800 (2200)		Back on station
	1925 (2325)	18 5.53'N 65 46.54'W	XBT T-5 #4
	1945 (2345)	17 57.17'N 65 48.58'W	Transmissometer Start
	2005 (2405)		Transmissometer End
	2030 (0030)	17 57.17'N 65 48.58'W	In Vivo fluorescence profile 3.5 min. at surface, 10 m intervals with 3.5 min wait
C-154	2130 (0130)	17 56.94'N 65 47.62'W	Max depth (120 m) started up
	2140 (0140)		Hose on deck
	2205 (0205)	17 57.94'N 65 47.62'W	CTD profile to 1000 m--start
	2310 (0310)		CTD out
	2330 (0330)		School of squid, 1' long (Loligo)
	2340 (0340)		Hydro-biocalt to 1000 m begun
			Depths 0, 10, 15, 20, 30, 40, 50, 60, 75, 85, 90, 100, 200, 300, 400, 500, 600, 800, 1000m
			ATP 10, 50, 75, 90, 100, 300
			ChL 0, 10, 15, 20, 50, 60, 75, 85, 90, 100, 200, 300
			Nutrients, Salinity, D. O. all depths
			Cast Down, 15 min. soak
May 11	0020 (0420)	17 57.94'N 65 47.62'W	Messenger sent, Bottles tripped
	0035 (0435)		Cast started up
	0045 (0445)		Cast on deck--all samples drawn
	0200 (0600)		All samples filtered
	0230 (0630)		

Date 1981	Time shown is AST GMT in Parenthesis	Position	Operation
May 11	0220 (0620)	17°57.11'N 65°48.30'W	Bongo tow 25-0m #2, Night
		17 56.90'N 65 49.11'W	Bongo tow 25-0m #3, Night
		17 57.05'N 65 50.10'W	Bongo tow 25-0m #4, Night
	0320 (0720)		All Bongos complete
	0345 (0745)	17 57.11'N 65 50.19'W	XBT T-7 #4
	0635 (1035)		Tucker Trawl
	0800 (1200)		Calibration and Test
	0930 (1330) In	17 53.50'N 65 57.59'W	Tucker 200-25 #1, Day
	1055 (1455) Out		
	1100 (1500)	17 55'N 65 52'W	XBT T-7 #5
	1130 (1530) In	17 48'N 65 58'W	Tucker 200-25 #2, Day
	1245 (1645) Out		
	1310 (1710) In	17 55.77'N 65 59.05'W	Tucker 200-25 #3, Day
	1430 (1830) Out		
	1445 (1845)	17 55'N 65 52'W	XBT T-7 #6
	1455 (1855) In	17 55'N 65 53'W	Tucker 200-25 #4, Day
	1614 (2014) Out		
	1620 (2020)	17 55'N 65 53'W	XBT T-7 #7
	1745 (2145)		Sighted large colonial floating <u>Lepas cylindricus</u> -yellow phase
	1950 (2350) In	17 57.24'N 65 54.65'W	Bongo tow 200-25m #1, Night
	2029 (0029) Out		
	2110 (0110) In	17 57.38'N 65 56.90'W	Bongo tow 200-25m #2, Night (didn't clos
	2147 (0147) Out		
	2201 (0201) In	17 57.19'N 65 50.09'W	Bongo tow 200-25m #3, Night
	2237 (0237) Out		
	2250 (0250)	17 57.19'N 65 52.28'W	XBT T-7 #8
	2305 (0305) In	17 57.19'N 65 54.54'W	Bongo tow 200-25m #4, Night
	2339 (0339) Out		
May 12	0005 (0405) In	17 56'N 65 48'W	Tucker 200-25 #1, Night
	0142 (0542) Out		
	0150 (0550)	17 56.07'N 65 48.57'W	XBT T-7 #9
	0220 (0620) In	17 56.27'N 65 48.44'W	Tucker 200-25 #2, Night
	0334 (0734) Out		
	0750 (1150) In	17 59.45'N 65 52.41'W	Bongo tow 200-25m #1, Day
	0828 (1228) Out		

Date 1981	Time shown is AST GMT in Parenthesis	Position	Operation
C-156 May 12	0830 (1230)	17°59.45'N 65°52.41'W	XBT T-7 #10
	0842 (1242)In	18 1.87'N 65 52.41'W	Bongo tow 200-25m #2, Day
	0924 (1324)Out		
	0850 (1250)		One tropic bird sighted
	0935 (1335)In	17 55.37'N 65 49.09'W	Bongo tow 200-25m #3, Day
	1017 (1417)Out		Last fix 0922 (1322)
	0955 (1355)	17 55.37'N 65 49.09'W	2 dark tan seabirds sighted
	1033 (1433)	17 55.37'N 65 49.09'W	XBT T-7 #11
	1042 (1442)In	18 3.57'N 65 49.09'W	Bongo tow 200-25m #4, Day
	1120 (1520)Out		
	1115 (1515)	18 3.57'N 65 49.09'W	1 gannet, 1 swallow
	1145 (1545)In	17 55.37'N 65 49.05'W	Tucker trawl 200-600m #1, Day
	1400 (1800)Out		
	1410 (1810)	17 56.45'N 65 56.28'W	XBT T-7 #12
	1450 (1850)In	17 57.92'N 65 52.00'W	Tucker 200-600 #2
	1710 (2110)Out		
	1942 (2342)		Bongo tow 600-200m and 600-1000m #1, Night Tow aborted due to men overboard; got the men back on board within 30 seconds; small cut on G. Vargo
May 13	2132 (0132)In	18 8.82'N 65 53.39'W	Repeated Bongo tow 600-200m and 600-1000m #1, Night Last fix 1806(2206)
	0020 (0420)Out		
	0212 (0612)	17 58.51'N 65 53.24'W	XBT T-5 #13
	0230 (0630)In	17 57.33'N 65 53.29'W	Tucker 600-200m #1, Night
	0500 (0900)Out		
	0802 (1202)In	17 54.64'N 65 49.26'W	Bongo tow, 1000-600m #1, Day
	1125 (1525)Out		
	0945 (1345)		1 Brown Booby (<u>Sula leucogaster</u>) Flock of Mother Carrie's Chickens
	1030 (1430)		
	1138 (1538)In	17 56.92'N 65 51.20'W	Bongo tow 25-0 #1, Day
	1145 (1545)Out		
	1154 (1554)In		Bongo tow 25-0m #2, Day
	1203 (1603)Out		

Date 1981	Time shown is AST GMT in Parenthesis	Position	Operation
May 13	1220 (1620) In	17°56.92'N 65°51.20'W	Bongo tow 25-0m #3, Day
	1228 (1628) Out		
	1238 (1638) In		Bongo tow 25-0m #4, Day
	1247 (1647) Out		
	1300 (1700)		XBT T-7 #14
	1316 (1716) In	17 59.92'N 65 51.20'W	Tucker trawl 600-1000m #1, Day
	1618 (2018) Out		
	1620 (2020)	17 57.89'N 65 47.18'W	XBT T-5 #15
	1909 (2309) In	17 59.07'N 65 47.79'W	Bongo tow 1000-600m #2, Night
	2245 (0245) Out		
	2300 (0300)		XBT T-5 #16
	2325 (0325) In	17 58.08'N 65 45.97'W	Tucker trawl 1000m-600m #1, Night
	0208 (0608) Out		
	0223 (0623)	17 57.64'N 65 47.76'W	XBT T-5 #17
May 14	0250 (0650) In	17 57.50'N 65 49.92'W	Tucker 1000-600m #2, Night
	0530 (0930) Out		
	0702 (1102) In	17 57.12'N 65 52.55'W	Bongo tow 1000-600m #2, Day
	1050 (1450) Out		last fix 0924 (1324)
	1100 (1500)	17 57.12'N 65 52.55'W	XBT T-5 #18
	1137 (1537) In	17 56.50'N 65 51.52'W	Bongo tow 600-200m #1, Day
	1305 (1705) Out		
	1420 (1820)		Tucker trawl 1000-600m #2
			Cable trouble
	1600 (2000) In	17 55.97'N 65 51.37'W	Tucker 25-0m #1, Day
	1650 (2050) Out		
	1658 (2058) In	17 57.80'N 65 49.61'W	Tucker 25-0m #2, Day
	1745 (2145) Out		
	1750 (2150)	17 57.80'N 65 49.61'W	XBT T-7 #19
	1830 (2230)		LBL Hydrocast to 100m
	1926 (2326) In	17 56.76'N 65 50.37'W	Bongo tow 600-200m #2, Night
	2052 (0052) Out		
	2110 (0110)	17 56.76'N 65 50.37'W	XBT T-7 #20
	2145 (0145) In	17 56.01'N 65 52.56'W	Tucker 600-200m #2
	2355 (0355) Out		

C-157

Date 1981	Time shown is AST GMT in Parenthesis	Position	Operation
May 15	0000	17°56'N 65°52'W	XBT T-7 #21
	0030 (0430)In	17 56.41'N 65 56.33'W	Tucker trawl 200-25m #3
	0215 (0615)Out		
	0302 (0702)In	17 56.45'N 65 55.05'W	Tucker 200-25m #4, Night
	0445 (0845)Out		
	0645 (1045)In	17 56.42'N 65 50.51'W	Tucker trawl 1000-600m #2, Day
	0955 (1355)Out		
	1010 (1410)In	17 56.03'N 65 53.49'W	Bongo tow 600-200m #2, Day
	1140 (1540)Out		
	1145 (1545)	17 55.96'N 65 48.58'W	XBT T-7 #22
	1145 (1545)		Left station for Palmas del Mar
	1315 (1715)		Arrived Palmas del Mar
			The following personnel disembarked at this time: B. Calvert (USF), V. Hensley(USF), T. Hopkins(USF), T. Lancra (USF), H. Michel(UM), J. Low(UM); P.Skip embarked for current meter array retriev.
C-158 May 16	0700 (1100)		Departed Palmas del Mar
	0830 (1230)		Arrive current meter array site
	0900 (1300)		Current array up
	1015 (1415)		Line on top buoy
	1020 (1420)		Top buoy (48") on board
	1055 (1455)		NB-ACM on board
	1110 (1510)		RCM-5-4606 out of water, no rotor
	1140 (1540)		41" buoy out of water
	1140 (1540)		RCM-5 S.N. 4607 out of water, tangled with buoy, broken vane, no rotor; probab came out during retrieval as something red floated away
	1250 (1750)		RCM-5 S.N. 4993 out of water, no rotor
	1353 (1753)		44" buoy out of water
	1411 (1811)		RCM-4 S.N. 3350 out of water-has rotor
	1420 (1820)		Code 7 release on board
	1423 (1823)		Code 4 release on board; retrieval completed
	1440 (1940)	17 51.00'N 65 44.79'W	LBL water sample from 90m
			Last fix 1410 (1810)
	1500 (1900)		Departed for San Juan

VI. Track Chart

All operations were carried out in the vicinity of 17°57'N and 65°48'W.

VII. Problem Areas

CTD	The instrument gave no temperature trace but depth and conductivity were shown. Consultation with electronics technician at USF subsequent to the cruise revealed an internal break in one of the leads from the temperature sensor.
Hydrowinch	The hydraulic motor on the winch failed. A new motor was shipped from St. Petersburg and the defective motor replaced within 24 hours.
Electromechanical Cable	This cable has a break in the conducting leads somewhere between 200 and 1000m. This was due to the cable catching in the winch gears due to a malfunctioning level wind. Repairs in the cable and winch are being made.
Exhaust Manifold	The manifold on the port engine cracked. The engine was shut down, the crack braised and the engine returned to service.
Seawater Toilet	The seawater feed line on the toilet ruptured necessitating the shut down of the pump feeding the starboard toilet for replacement of the line. The forward head was usable during the time of the starboard head shutdown.
Stanchion Break	The stanchion at one side of the hydro platform which supports the safety chain broke off because of weakening due to internal rust. G. Vargo and J. Low went overboard although both managed to hold on to the hydrowire and Bongo net frames. Both were back on board within 30-45 seconds. The only injuries were a slight cut and a pulled shoulder for G. Vargo. A safety rope was rigged for the remainder of the cruise until more permanent eyes can be welded to the A-frame.