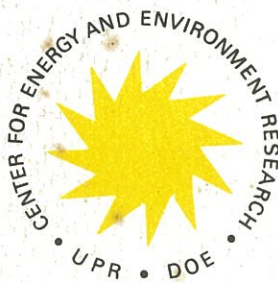


CEER-0-56

DATA REPORT

OHER - OTEC Cruise, 8-12 November 1979



CENTER FOR ENERGY AND ENVIRONMENT RESEARCH
UNIVERSITY OF PUERTO RICO — U.S. DEPARTMENT OF ENERGY

CEER-0-56

DATA REPORT

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INTRODUCTION

The ability to detect the effects of an OTEC plant on the marine environment is dependent upon the magnitude of its effects relative to the scale and intensity of variability (pattern) within this ecosystem. The scale of pattern examined in this study is approximately 10 km^2 which has been estimated to be the area whose alteration by the operation of an OTEC plant can be physically measured. The purpose of this cruise was to determine the magnitude of variability of various ecosystem components within and between such areas. Also, the effect of different sampling procedures within station variability was examined. One within station study was centered around a fixed geographical locale, the buoy moored at the benchmark site and the other around a drogue at a depth of 90 meters. For the remainder of the cruise, longshore and offshore transects were run to determine the presence of environmental gradients, if any, and the magnitude of between station variability.

Two current meters (InterOcean Model 135) were also moored at depths of 50 and 150 meters at the benchmark buoy during the period of the cruise.

METHODS

Hydrographic Data

Hydrocasts were made with 5 liter Niskin bottles usually lowered to depths of 500 m. Bottles were placed at nominal depths of 0, 10, 25, 50, 75, 100, 150, 200, 300, 400, 500 m for determinations of temperature, salinity, oxygen, chlorophyll and nutrients (nitrate-nitrite, phosphate, ammonia, silicate).

Temperature was measured with paired deep sea reversing thermometers. The thermometers were recently calibrated at the Physical Chemical Oceanographic Data Facility (PCODF) at Scripps Institution of Oceanography and measurements were considered accurate to 0.01°C. Unprotected thermometers were placed on bottles sampling at depths of 100 meters or greater.

Salinity was determined with a Hytech induction salinometer. Readings are considered accurate to 0.003‰.

Dissolved oxygen was determined by the Winkler method as revised by Carpenter (1965) and modified by Anderson (1971). Measurements are accurate to 0.02 ml/l. Nutrients were measured with a Technicon Auto-analyzer using methods described by Strickland and Parsons (1968). Chlorophyll was measured with a Turner Model 111 fluorometer using methods described by Strickland and Parsons.

Net Tows

Zooplankton tows were made with a 75 cm opening-closing net equipped with 202 µm mesh. Volume of water filtered was calculated from a flow-meter suspended off center in the mouth of the net.

PRELIMINARY ANALYSIS AND RESULTS

Initial analysis of the cruise data indicates the following properties of ecosystem variability in the Punta Tuna area:

1. No consistent difference in variability of hydrocast (temperature, salinity, oxygen) and net tow data was found between the drogue and benchmark stations. In other words, the precision of measurement was not appreciably improved by following a tagged water mass.

2. Contrary to expectations, variability of hydrocast data did not always decrease with depth. For instance, at the benchmark site the standard deviation of temperature at the surface and 500 m was $.07^{\circ}$ and $.18^{\circ}\text{C}$ respectively. T-S plots of all hydrocast data showed a consistent relationship indicating that variability of physical parameters at depth can be explained by vertical water motion rather than horizontal advection of water masses.
3. A plot of isotherms taken during the first two days suggest a semidiurnal (tidal?) period of vertical water motion.
4. Temperature and current velocities measured by the deep current meter (150 m) also show a 12.3 hour (tidal) periodicity. The shallow (50 m) current meter indicated two periodicities of 11.2 and 13.3 hours, respectively. Periodicity in current direction is not analyzed at present. (Analysis of periodicity was done by a analysis of variance (ANOVA) technique.)
5. Both the hydrocast and current meter data indicate the major component of deeper water (>50 m) motion during the cruise was due to internal waves of tidal periodicity.
6. Drogue movement was consistent with current meter measurements at 50 m.

7. No consistent difference was found in variability of the between (transect) stations compared to the within stations. This indicates that the magnitude of within station variability may make difficult the ability to detect spatial patterns on a scale of 10 km^2 .
8. Nitrate and phosphate profiles indicate that relatively low nutrient concentrations prevail in the surface waters. These increase progressively below 200 to 300 m. Analysis of additional samples is in progress.

IMPLICATIONS FOR FUTURE CRUISES

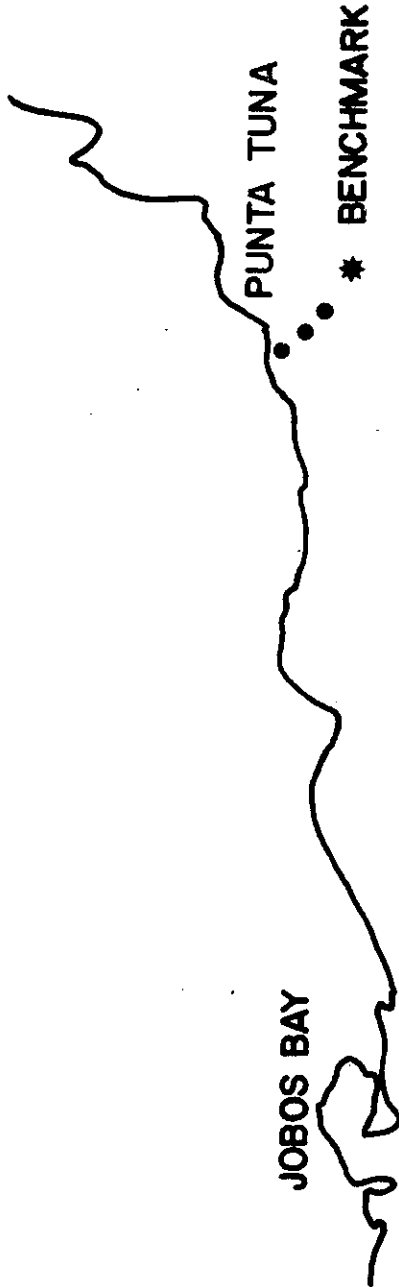
1. The lack of consistent difference in variability of the drogue and benchmark station indicates that neither is more preferable to the other in terms of sampling precision. Consequently, either one or the other (but not both) should be performed on future cruises.
2. Since the magnitude of within to between station variability was roughly equivalent, it may be difficult to distinguish pattern on this scale. T-S plots were quite similar throughout the cruise. This suggests that water mass properties are quite uniform over the spatial scales examined. This suggests that hydrocasts taken on such a scale may be overly redundant for sampling purposes. Hydrocasts taken at greater spatial separation (~10 mi.) may reveal larger scale regional differences and may be useful for geostrophic flow calculations.

Although no spatial pattern was detected for zooplankton, it must be noted that thus far identification has only proceeded to large taxonomic levels (kingdom or phylum). Until the samples are processed to this degree, it would seem advisable to continue sampling at the present spatial scales.

BIBLIOGRAPHY

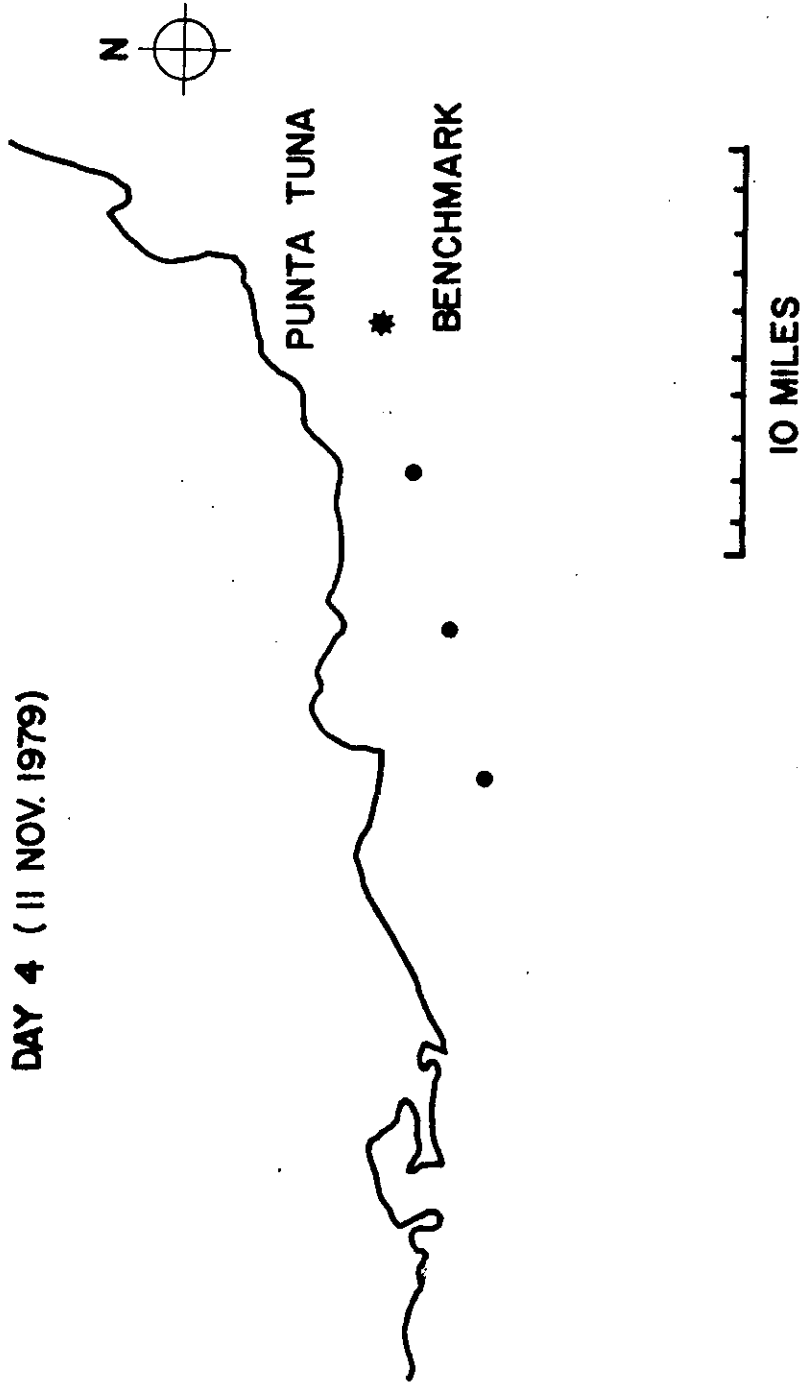
- Anderson, G.C. 1971. Oxygen analysis. Marine Technicians Handbook, SIO Ref. No. 71-10, Sea Grant Pub. No. 11.
- Carpenter, D.H. 1965. The Chesapeake Bay Institute technique for Winkler dissolved oxygen method. Limnol. Oceanogr. 10: 141-143.
- Strickland, J.D.H. and T.R. Parsons. 1968. A practical handbook of seawater analysis. Fish. Res. Board of Canada. Bull. No. 167: 311 pp.

OFFSHORE TRANSECT DAY 3 (10 NOV. 1979)



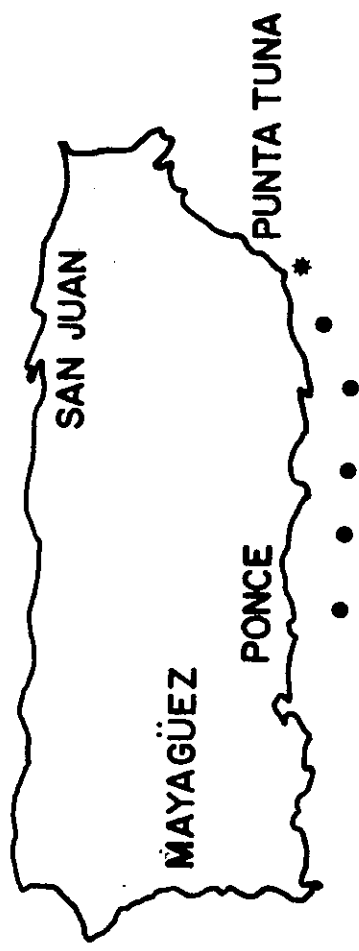
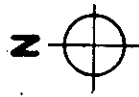
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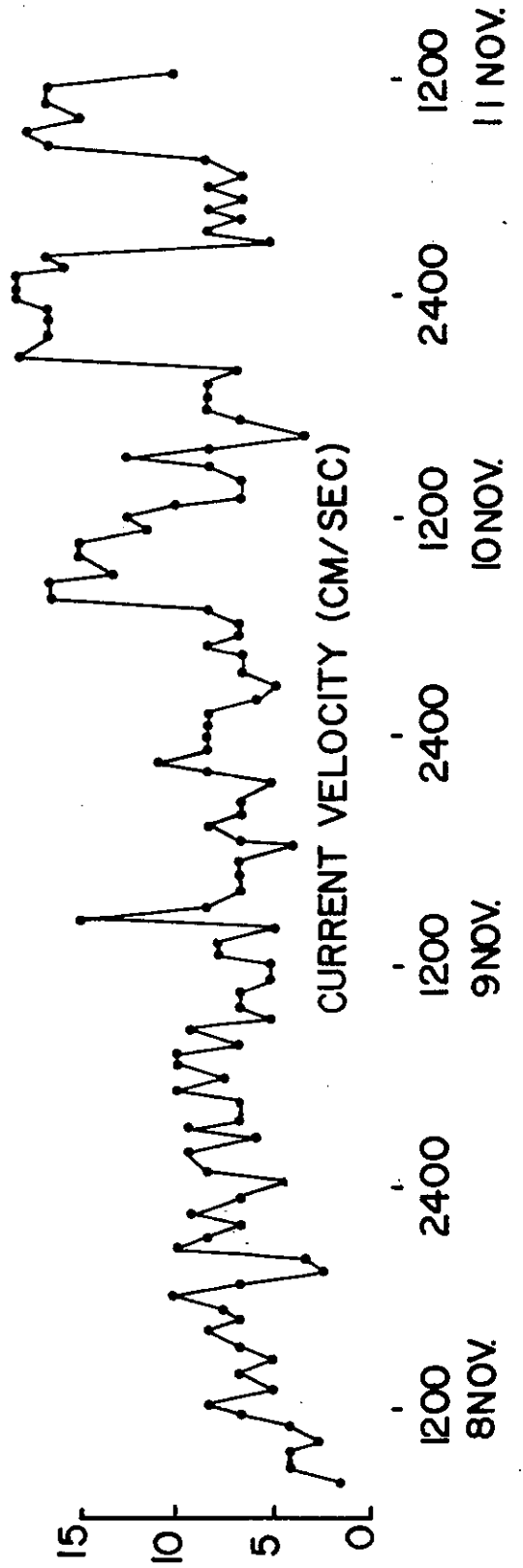
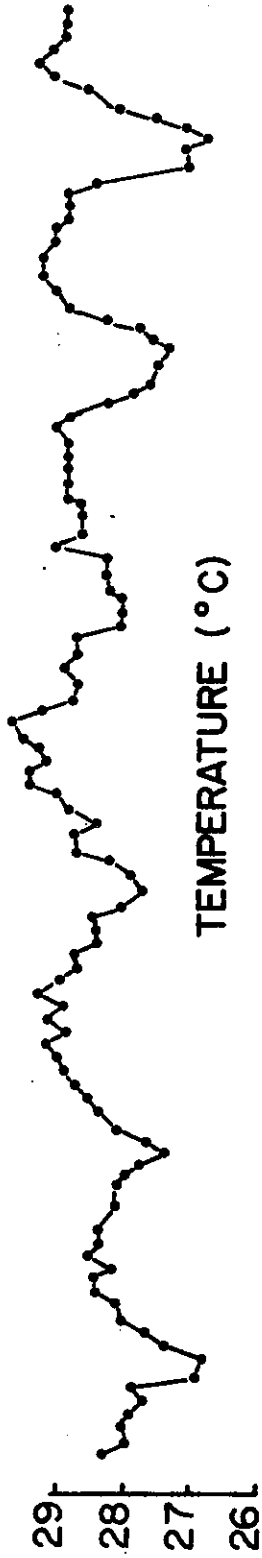
DAY 4 (11 NOV. 1979)

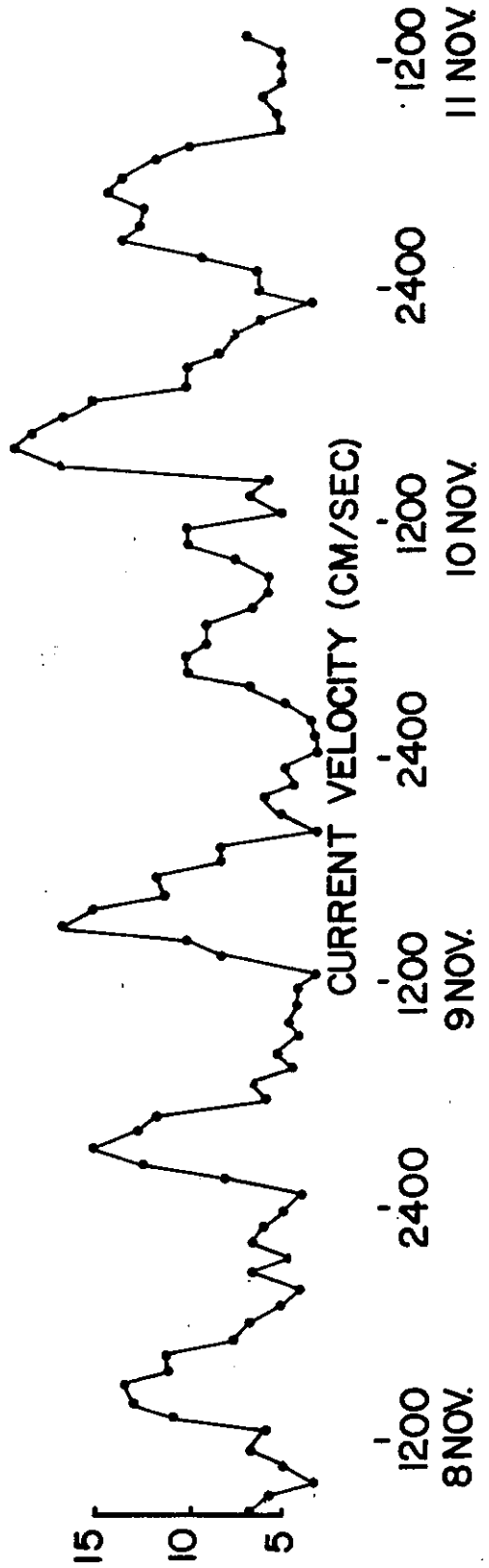
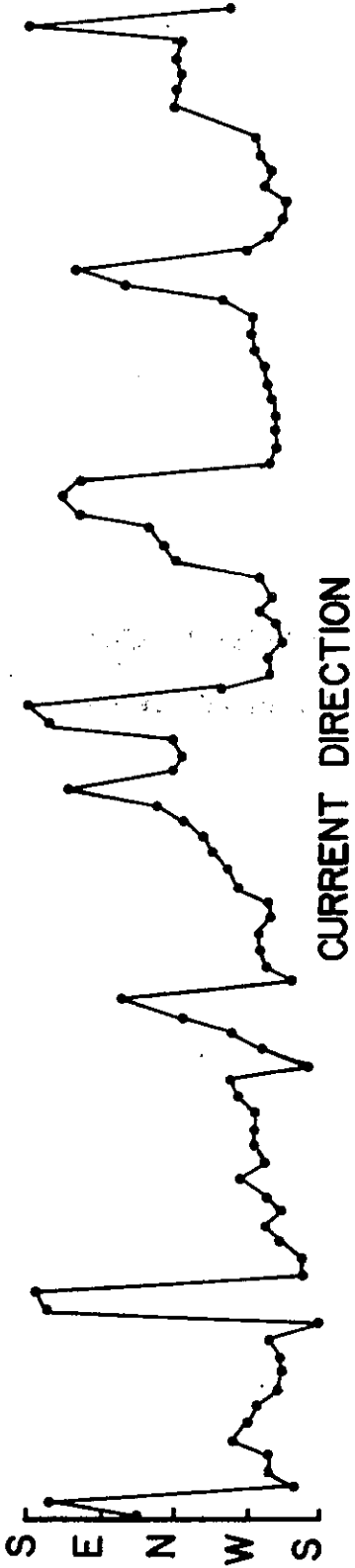
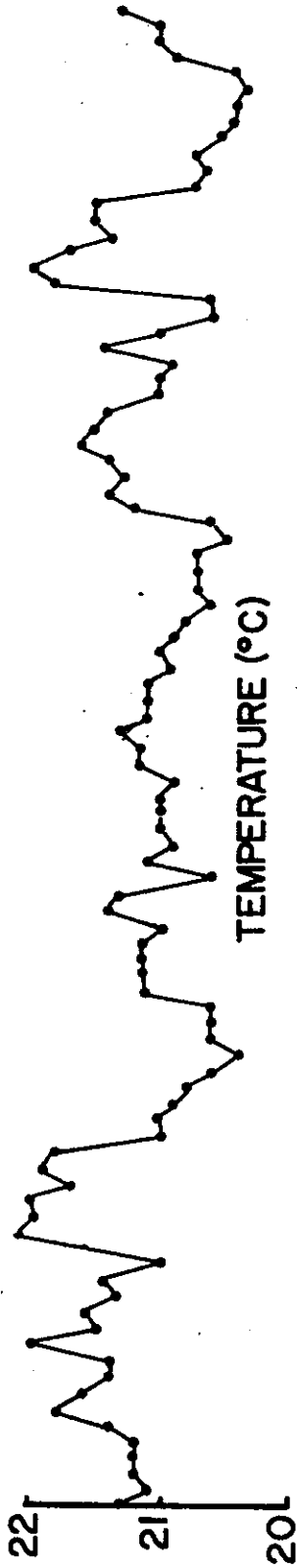


LONGSHORE TRANSECT (LARGE SCALE)

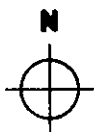
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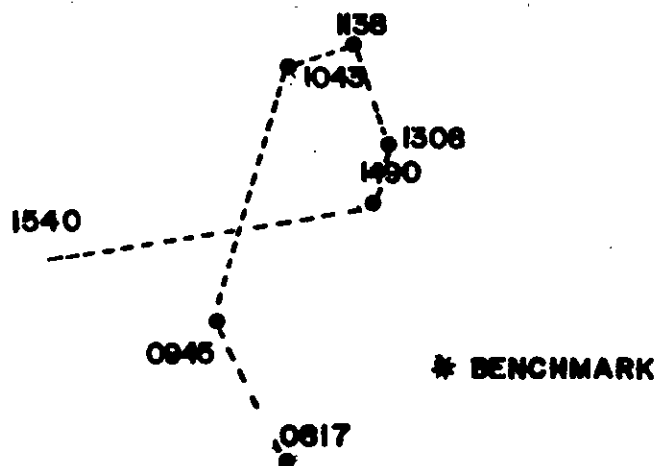




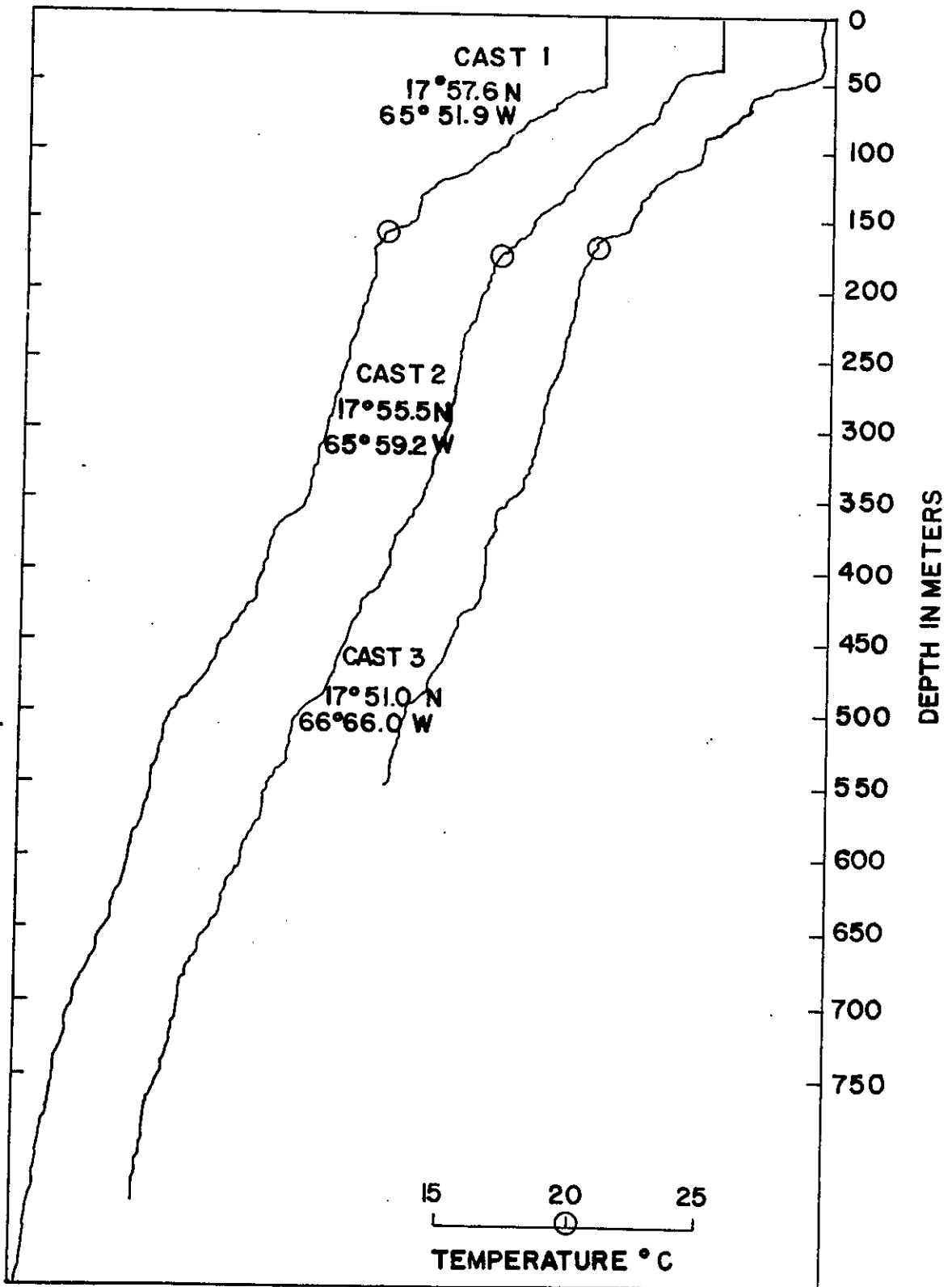
DROGUE DISTANCE FROM BENCHMARK 9 NOV. 1979



**LOW TIDE 0554
HIGH TIDE 1369
LOW TIDE 1989**



TIME	DISTANCE (M)	BEARING FROM BENCHMARK
0817	.20	241°
0945	.25	285°
1043	.37	335°
1138	.37	346°
1308	.25	347°
1400	.20	338°



HYDROCAST DATA
T, S, O₂, CHLOROPHYLL

R.V. SULTANAOTEC CRUISE 79-11BENCHMARK CAST 1

Latitude	Longitude	MO/DAY/YR	Messenger Time	Bottom	Wind Speed	Weather	Dominant Waves	Secchi
17°57.6N	65°51.9W	11/8/79	1330 (GCT)	>1000 (m)	100° 12 (Dir) (Kt)	1	090° 2 ft 4s (Dir) (Ht) (Period)	0926λ 22 m
Z	T	S	O ₂	CHLORO.				
0	29.12	34.272	4.75					
10	29.45	34.827	4.50					
25	29.34	35.017	4.56					
54	27.70	35.697	4.45					
84	25.42	36.784	4.22					
108	24.10	36.975	4.55					
163	20.90	36.780	4.46					
217	18.76	36.564	4.60					
327	17.25	36.371	4.34					
437	14.43	35.932	3.72					
547	11.48	35.460	3.20					

R.V. SULTANAOTEC CRUISE 79-11BENCHMARK CAST 2

Latitude 17°57.6
 Longitude 65°51.9
 MO/DAY/YR 11/8/79
 Messenger Time 1716 (GCT)
 1736 (GCT)
 Bottom >1000 (m)
 Wind 050° (Dir)
 Speed 09 (Kt)
 Weather 1
 Dominant Waves 2 ft 4s (Ht) (period)
 090° (Dir)
 Secchi 1313λ
 24/27 (m)

Z	T	S	O ₂	CHLORO.
0	29.25	34.295	4.54	
10	29.15	34.326	4.54	
26	29.17	35.065	4.53	
55	*	36.103	4.47	
85	24.88	36.924	4.28	
110	23.70	36.956	4.63	
164	21.50	36.837	4.38	
229	18.78	36.565	4.57	
348	17.10	36.350	4.23	
468	14.85	35.992	3.74	
588	11.40	35.453	3.21	

*Thermometer rack post tripped.

R. V. SULTANA

OTEC CRUISE 79-11

BENCHMARK CAST 3

Latitude	Longitude	MO/DAY/YR	MO/18/79	Messenger Time	Bottom	Wind	Speed	Weather	Dominant Waves	Secchi
17°57.6	65°51.9	11/18/79		2128(GCT)	>1000 (m)	100° (Dir)	12 (Kt)	1	100° 3 ft. 4s (Dir) (Ht) (Period)	NA
Z	T	S	O ₂	CHLORO						
0	29.19	34.216	4.52							
9	29.22	34.223	4.51							
23	29.34	35.043	4.52							
51	27.69	35.728	4.45							
78	25.30	36.851	4.23							
101	24.28	36.989	4.47							
152	21.36	36.842	4.31							
207	18.95	36.578	4.55							
322	17.08	36.344	4.17							
437	14.04	35.872	3.77							
555	11.14	35.405	3.13							

R.V. SULTANAOPEC CRUISE 79-11DROGUE CAST 1

Latitude Longitude MO/DAY/YR Messenger Time Bottom Wind Speed Weather Dominant Waves Secchi
 17°57.5 65°52.2 11/9/79 1258(GCT) >1000 085° 08 5 075° 3 ft. 5 0857ℓ
 (m) (Dir) (Kt) (Dir) (Ht) (Period)
 (m)

CHLORO

O₂

S

T

Z

1	28.79	33.782	4.52							
10	29.04	34.071	4.50							
25	29.26	34.920	4.46						.305	
54	28.30	35.303	4.44						.105	
83	25.64	36.362	4.36						.062	
108	23.86	36.968	4.49						.025	
161	20.22	36.711	4.44						.016	
220	18.58	36.534	4.58						.006	
337	17.02	36.332	4.18						.005	
456	13.02	35.712	3.52						.006	
576	11.16	35.416	3.18						.005	

R.V. SULTANA

OPEC CRUISE 79-11

DROGUE CAST 2

Latitude	Longitude	MO/DAY/YR	MO/ 9 /79	Messenger Time	Bottom	Wind Speed	Weather	Dominant Waves	Secchi
17°58.0	65°52.0	11/ 9 /79	1619(GCT)	>1000 (m)	070° (Dir)	05 (kt)	2	080° 3 ft. (Dir) (Ht) (Period)	1218L 26/32 (m)

Z	T	S	O ₂	CHLORO
0	28.94	33.975	4.52	.299
10	29.08	34.116	4.52	.090
25	29.30	34.882	4.47	.281
54	27.14	36.066	4.40	.357
84	25.56	36.774	4.35	.213
109	24.41	36.994	4.45	.080
163	20.60	36.776	4.24	.017
223	18.62	36.543	4.56	.006
342	17.52	36.410	4.34	.007
462	14.59	35.951	3.69	.005
583	11.14	35.414	3.16	.005

R.V. SULTANA

OTEC CRUISE 79-11

DROGUE CAST 3

Latitude Longitude MO/DAY/YR Messenger Time Bottom Wind Speed Weather Dominant Waves Secchi
 17°57.8 65°52.5 11/ 9 /79 1838(GCT) >1000 070° 07 2 070° 3 ft. 6s 1437&
 (m) (Dir) (Kt) (Dir) (Ht) (Period) (m)

Z	T	S	O ₂	CHLORO
0	29.00	34.064	4.52	.232
10	29.11	34.257	4.48	.390
25	29.20	35.007	4.46	.290
54	26.44	36.434	4.34	.139
84	24.75	36.973	4.38	.109
108	24.23	36.990	4.45	.071
163	20.60	36.761	4.33	.018
223	18.80	36.579	4.31	.004
342	17.17	36.356	4.21	.006
463	15.08	36.029	3.84	.007
584	11.70	35.496	3.23	.006

R.V. SULTANA

OPEC CRUISE 79-11

DAY 3 STATION 1

Latitude	Longitude	MO/DAY/YR	Messenger Time	Bottom	Wind Speed	Weather	Dominant Waves	Secchi
17°58.8	65°53.8	11/ 10/79	1155 (GCT)	13 (m)				0745 10m
Z	T	S	O ₂	CHLORO				
1	28.68	34.020	4.50	.296				
8	28.71	34.030	4.52	.337				

R.V. SULTANA

OTEC CRUISE 79-11

DAY 3 STATION 2

Latitude	Longitude	MO/DAY/YR	Messenger Time	Bottom	Wind Speed	Weather	Dominant Waves	Secchi
17°58.6	65°53.5	11/10/79	1232(GCT)	12m	050° 09 (Dir) (Kt)	1	060° 2ft 4s (Dir) (Ht) (Period)	0832 4m

Z	T	S	O ₂	CHLORO
0	28.71	34.034	4.27	.631
7	28.76	34.070	4.23	.644

R.V. SULTANA

OTEC CRUISE 79-11

DAY 3 STATION 3

Latitude	Longitude	MO/DAY/YR	Messenger Time	Bottom	Wind	Speed	Weather	Dominant Waves	Secchi
17°58.2	65°52.8	11/10/79	1327(GCT)	400 (m)	060° (Dir)	12 (Kt)	1	080° 2ft 4s (Dir) (Ht) (Period)	0927 6m

Z	T	S	O ₂	CHLORO
0	28.72	34.029	4.32	.435
8	28.72	34.044	4.36	.417
21	28.81	34.213	4.29	.366
47	27.95	35.563	4.31	.355
70	26.90	36.334	4.33	.262
95	24.96	36.922	4.38	
141	21.13	36.821	4.33	.075
191	19.58	36.671	4.26	.011

R.V. SULTANAO TEC CRUISE 79-11DAY 3 STATION 4

Latitude Longitude MO/DAY/YR Messenger Time Bottom Wind Speed Weather Dominant Waves Secchi
 17°57.1 65°51.9 11/10/79 1454(GCT) >1000 (m) 070° (Dir) 10 (Kt) 1 080° (Dir) 4 ft 4s (Ht) (Period) 1050 30m

Z	T	S	O ₂	CHLORO
0	28.88	34.217	4.55	.275
9	28.86	34.215	4.54	.225
27	29.02	34.509	4.47	.378
53	27.77	35.655	4.47	.383
85	25.88	36.732	4.45	.218
108	24.64	36.984	4.37	.080
163	20.57	36.731	4.49	.037
219	18.98	36.603	4.29	.009

R.V. SULTANAOIEC CRUISE 79-11DAY 3 STATION 5

Latitude	Longitude	MO/DAY/YR	Messenger Time	Bottom	Wind	Speed	Weather	Dominant Waves	Secchi
17°49.8	65°49.8	11/10/79	1703(GCT)	>1000 (m)	070° (Dir)	10 (Kt)	1	070° 3 ft 4s (Dir) (Ht) (Period)	1302 30m 35<

Z	T	S	O ₂	CHLORO.
0	28.82	33.960	4.58	.205
10	28.81	33.969	4.59	.240
28	29.28	35.005	4.56	.350
58	27.01	36.342	4.64	.290
92	24.90	36.852	4.92	.178
117	23.80	36.852	4.90	.058
175	20.34	36.709	4.49	.037
235	18.67	36.565	4.37	.006

R.V. SULTANA

OTEC CRUISE 79-11

DAY 3 STATION 6

Latitude Longitude MO/DAY/YR 11/10/79 Messenger Time 1943(GCT) Bottom >1000 (m) Wind Speed 10 (Kt) Weather 1 Dominant Waves 080° (Dir) 4 ft 6s (Ht) (Period) Secchi 1545 22m

Z	T	S	O ₂	CHLORO
0	28.86	33.778	4.55	.252
10	28.88	33.782	4.54	.270
29	28.62	34.938	4.63	.255
59	27.43	35.901	4.53	.428
88	24.66	36.885	4.89	.160
117	22.74	36.874	4.76	.062
175	19.74	36.684	4.46	
219	18.70	36.570	4.43	.014
337	17.07	36.341	4.27	.007
456	13.67	35.807	3.65	.006
575	10.36	35.286	3.04	.008

R.V. SULTANA

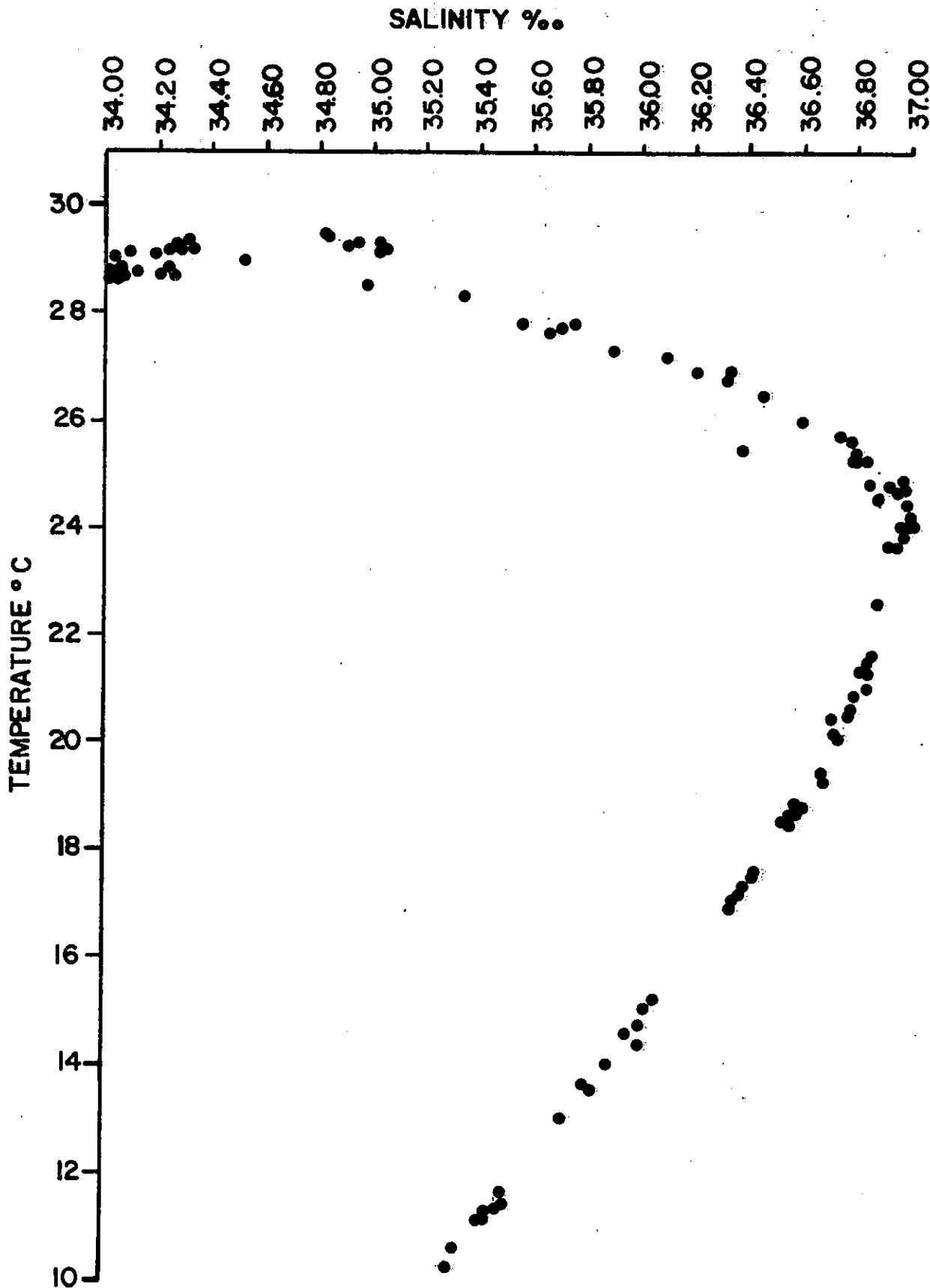
OTEC CRUISE 79-11

DAY 4 STATION 2

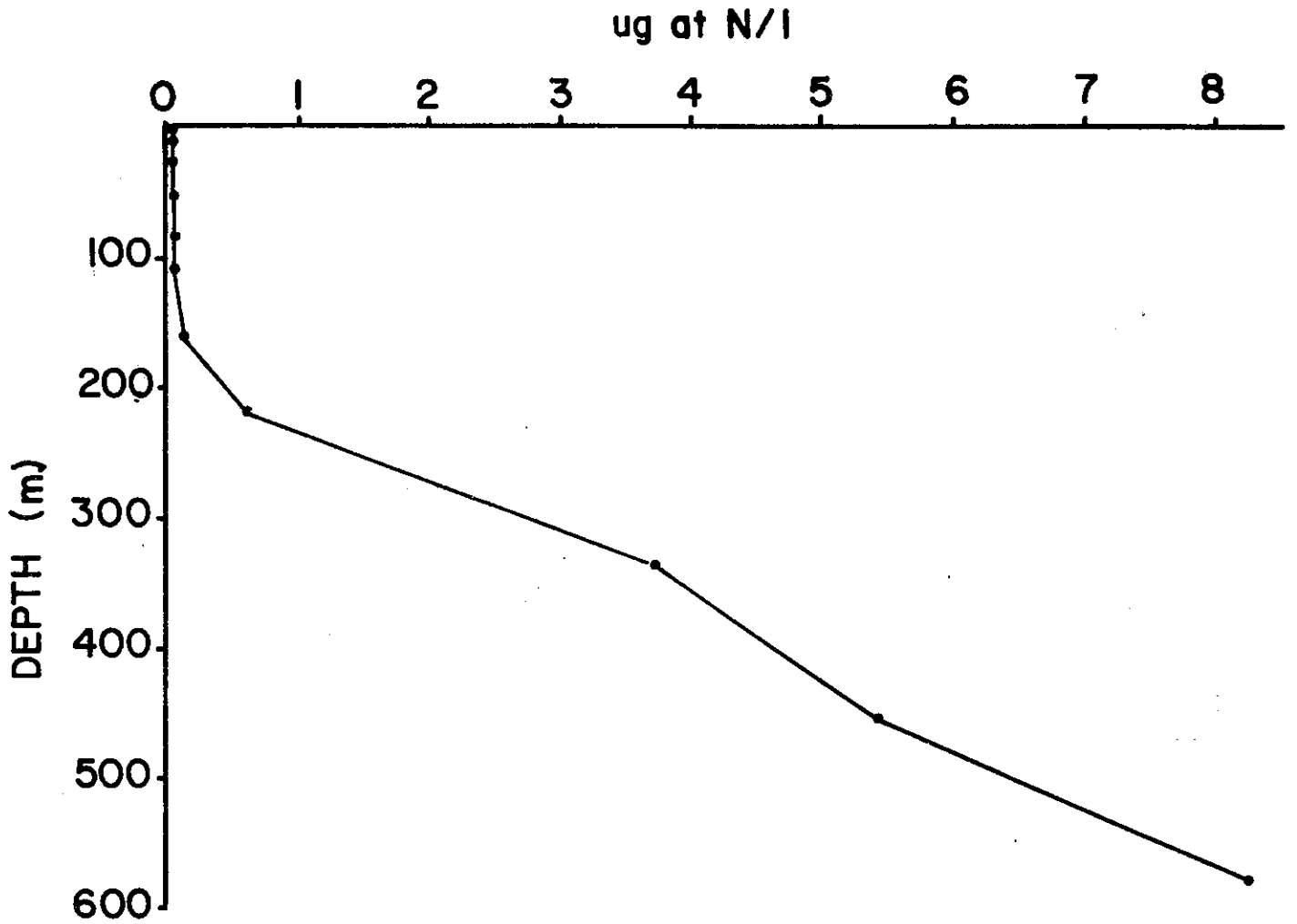
Latitude	Longitude	M0/DAY/YR	Messenger Time	Bottom	Wind	Speed	Weather	Dominant Waves	Secchi
17°55.5	65°59.2	11/11/79	1505	800 (m)	60°	12	1	75° 4 ft 5s	25
Z	T	S	O ₂	CHLORO					
1	28.72	34.042	NA	.157					
11	28.73	34.044	4.69	.176					
26	28.75	34.158	4.71	.198					
56	26.01	36.604	4.45	.256					
85	24.49	36.991	4.58	.124					
109	23.75	36.931	5.01	.041					
163	20.54	36.721	4.77	.036					
223	18.67	36.569	4.75	.006					
341	17.44	36.400	4.56	.006					
460	13.66	35.813	3.80	.006					
580	10.71	35.346	3.36	.006					

R.V. SULTANAOTEC CRUISE 79-11DAY 4 STATION 4

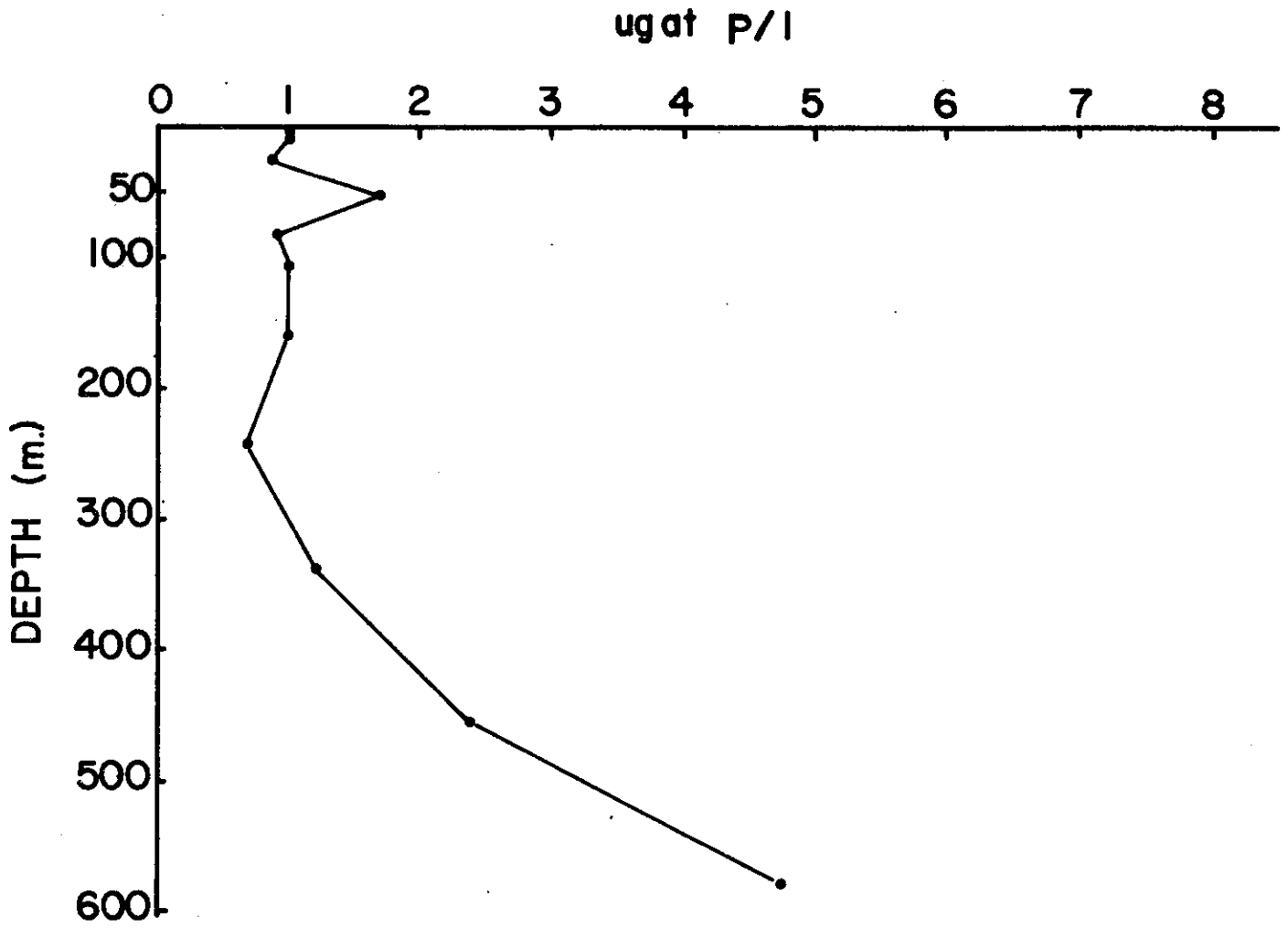
Latitude	Longitude	MO/DAY/YR	Messenger Time	Bottom	Wind	Speed	Weather	Dominant Waves	Secchi
17°57.7	65°55.4	11/11/79	1946	1000 (m)	70°	10	1	70° 2 ft 5 s	
Z	T	S	O ₂	CHLORO					
1	28.72	34.096		.117					
10	28.69	34.096		.193					
25	28.68	34.143		.290					
53	26.90	36.239		.485					
82	25.48	36.815		.143					
106	24.08	36.982		.051					
159	21.32	36.819		.031					
217	18.96	36.587		.010					
336	17.71	36.434		.005					
455	15.32	36.071		.006					
577	11.36	35.448		.006					



NITRATE- NITRITE



PHOSPHATE



Station	Date	Local Time	Depth (m)	Latitude	Longitude	Water Filtered (m ³)	Tow Length (min)	Biomass (ml/1000 m ³)	Total Copepods (#/m ³)	Total Larvacean (#/m ³)	Total Chaetognaths (#/m ³)
Benchmark	11/8/79	1130	0-69	17°57.6'N	65°51.9'W	416	21.5	132	490	82	37
Benchmark	11/8/79	1430	0-100	17°57.6'N	65°51.9'W	362	20.3	124	586	122	27
Benchmark	11/8/79	1605	0-100	17°57.6'N	65°51.9'W	446	20	168	868	232	77
Benchmark	11/8/79	1023	100-200	17°57.6'N	65°51.9'W	251	15.75	7.9	53	2.4	1.4
Benchmark	11/8/79	1515	100-200	17°57.6'N	65°51.9'W	362	20.4	8.0	45	5.5	2.9
Drogue	11/9/79	1001	0-100	17°57.5'N	65°52.2'W	245	20.1	269	753	300	65
Drogue	11/9/79	1130	0-100	17°58'N	65°52'W	304	20.1	181	769	253	58
Drogue	11/9/79	1300	0-100	17°57.8'N	65°52.5'W	283	19.5	161	534	89	134
Drogue	11/9/79	1001	100-200	17°57.5'N	65°52.2'W	245	20.1	16.3	51	10	2.4
Drogue	11/9/79	1130	100-200	17°58'N	65°52'W	304	20.1	6.9	36	6	1
Drogue	11/9/79	1300	100-200	17°57.8'N	65°52.5'W	283	19.5	8.1	52	3.2	1.4
Offshore	11/10/79	0745	0-10	17°58.8'N	65°53.8'W	152	9.9	92	756	62	47
Offshore	11/10/79	0845	0-8	17°58.6'N	65°53.5'W	211	10	123	155	25	29
Offshore	11/10/79	0950	0-163	17°58.2'N	65°52.8'W	258	22.4	70	363	99	72
Offshore	11/10/79	1146	0-200	17°57.6'N	65°51.9'W	306	21.25	78	360	28	16
Offshore	11/10/79	1330	0-200	17°49.8'N	65°49.8'W	344	21.0	71	277	25	15
Offshore	11/10/79	1630	0-125	17°49'N	65°45'W	431	20.1	109	352	58	29
Longshore	11/11/79	0855	0-100	17°53.8'N	66°03.2'W	319	19.7	113	354	139	38
Longshore	11/11/79	1045	0-100	17°55.5'N	65°59.2'W	267	19.5	83	295	48	28
Longshore	11/11/79	1200	0-100	17°56.6'N	66°55.3'W	203	19.5	99	402	87	68
Longshore	11/11/79	1530	0-100	17°57.6'N	65°51.9'W	273	20.0	88	345	66	37
Longshore	11/12/79	0937	0-100	17°57.6'N	65°51.9'W	441	20.1	125	630	102	59
Longshore	11/12/79	1102	0-100	17°55.5'N	65°59.3'W	477	20	126	706	145	68
Longshore	11/12/79	1229	0-100	17°51.0'N	66°66'W	488	20	184	664	513	42
Longshore	11/12/79	1400	0-100	66°15'W	66°15'W	365	20	151	698	173	69
Longshore	11/12/79	1507	0-100	17°48.8'N	66°22.6'W	372	20	134	576	402	53
Longshore	11/12/79	1621	0-100	17°48.6'N	66°30.6'W	314	20	222	782	292	80

CRUISE PLAN

DAY 1 - Intensive Studies (Benchmark site)

0600 Depart Yabucoa
0700 Arrive Benchmark site
0705 Deploy current meters
0800 Hydrocast* (11 depths to 500 m), secchi
0930 Net tow (0 - 100, 100 - 200 m)
1100 Net tow " "
1230 Light profile + secchi
1330 Hydrocast (11 depths to 500 m), secchi
1500 Net tow (0 - 100 m, 100 - 200 m)
1630 Hydrocast (11 depths to 500 m), secchi
1800 Depart for Yabucoa

*(0, 10, 25, 50, 75, 100, 150, 200, 300 400, 500 m; for chlorophyll,
nutrients, DO, salinity),

DAY 2 - Intensive Studies (Drogue Station)

0600 Depart Yabucoa
0700 Arrive Benchmark site
0705 Deploy drogues
0730 Hydrocast (10 depths, 500 m), secchi
0900 Net tow (0 - 100, 100 - 200 m)
1030 Net tow (0 - 100, 100 - 200 m)
1200 Light profile, secchi
1300 Hydrocast (10 depths, 500 m), secchi
1430 Net tow (0 - 100 m, 100 - 200 m)
1600 Hydrocast (10 depths, 500 m), secchi
1730 Depart for Yabucoa

DAY 3 - Offshore Transect

0600 Depart Yabucoa
0700 Arrive Sta. 0-1
0705 Hydrocast (0, 10 m) + secchi
0715 Net tow (0-10 m)
0735 Depart for Sta. 0-2
0745 Hydrocast (0, 10, 20 m) + secchi
0800 Net tow (0-20 m)
0830 Depart for Sta. 0-3
0840 Arrive Sta. 0-3
0845 Hydrocast (to 200 m) + secchi
0930 Net tow (0-200 m)
1000 Depart for Benchmark Station
1015 Hydrocast (to 500 m) + secchi
1145 Light profile
1215 Net tow (0-200 m)

DAY 3 (continued)

1245 Depart for Sta. 0-4
1315 Hydrocast (to 200 m), secchi
1400 Net tow (to 200 m)
1430 Depart sta. 0-5
1515 Hydrocast (to 200 m), secchi
1600 Net tow
1630 Depart for Sta. 0-6
1730 Arrive Sta. 0-6
1730 Hydrocast (to 200 m), secchi
1815 Net tow (to 200 m)
1845 Depart for Yabucoa

DAY 4 - Longshore Transect

0600 Depart Yabucoa
0800 Arrive Station L-1
0800 Hydrocast (to 200 m), secchi
0845 Net tow (to 200 m)
0915 Depart for Sta. L-2*
0930 Arrive L-2
0930 Hydrocast (to 200 m), secchi
1015 Net tow (to 200 m)
1045 Depart for Sta. L-3
1100 Arrive L-3
1100 Hydrocast (to 200 m), secchi
1145 Net tow
1215 Depart for Fenchmark
1230 Arrive Benchmark
1230 Hydrocast (to 500 m), secchi
1400 Light profile
1430 Net tow
1500 Depart for L-4
1515 Arrive L-4
1600 Hydrocast (to 500 m), secchi
1645 Net tow
1715 Depart for L-5
1730 Arrive L-5
1730 Hydrocast (to 200 m), secchi
1815 Net tow
1845 Depart for Yabucoa

DAY 5 - Longshore transect

0600	Depart Yabucoa
0700	Arrive Benchmark
0700	Retrieve current meters
0730	Net tow, XBT, secchi
0800	Steam West
0900	Net tow, XBT, secchi
0930	Steam West
1030	Net tow, SBT, secchi
1100	Steam West
1200	Net tow, SBT, secchi
1230	Steam West
1330	Net tow, SBT, secchi
1400	Steam West
1430	Net tow, SBT, secchi
1500	Steam West
1500	Net tow, SBT, secchi
1630	Steam West