Title

PRELIMINARY DATA REPORTS FOR THE GOTEC 04, 05, 06 AND 07 CRUISES TO THE GULF OF MEXICO, MOBILE AND TAMPA SITES JUNE 1978 THROUGH DECEMBER 1978

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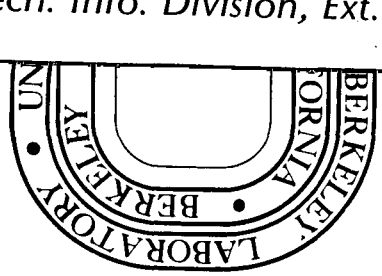

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DISCLAIMER

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Contributions by

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ABSTRACT

This volume reports data collected for the Ocean Thermal Energy Conversion Program (OTEC) at two potential OTEC sites in the Gulf of Mexico. The Mobile Site (at approximately 29°00'N, 88°00'W), was occupied three times and the Tampa Site (at approximately 27°39'N, 85°30'W), was visited four times. Cruises were in June, August, October and December, 1978.

Investigations at the sites were primarily a joint effort between the Lawrence Berkeley Laboratory and the Atlantic Oceanographic and Meteorological Laboratory (AOML) of the National Oceanic and Atmospheric Administration.

Chemical and biological oceanographic results are presented here with some physical data as background information. Current meter, XBT and STD data were taken by AOML and are presented by Molinari, Hazelworth and Ortman, 1979.

FOREWORD

This is one in a series of data reports derived from oceanographic cruises in support of the OTEC Program. The purpose of such reports is to make the uninterpreted data available to data users and interested scientists as soon as possible after post cruise corrections are made.* It is not the intent or purpose of these data reports to include detailed interpretations or critical review.

After the equivalent of one year's data are taken at any one site or region, an annual review will be published that will recapitulate the data in the cruise reports and include interpretations, summary graphs and tables, and topical discussions by the various project workers.

PW

ACKNOWLEDGEMENT

The authors wish to thank the officers, crew and other scientists who participated in the data collection efforts on these cruises aboard the NOAA ship R/V Virginia Key. Scientists from LBL who participated in these cruises were: J.C. Sandusky and A.J. Horne - GOTEC-04, and C.J.W.

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*Data is available from the
National Oceanographic Data Center,
Attention: E. Franklin Johnson,
2001 Wisconsin Avenue NW,
Washington, D.C. 20235.

Carmiggelt - GOTEC-07.

In particular we appreciate the efforts of the following analysts: R. Molinari who took the current meter, STD data, and discrete samples and made XBT's (Molinari, Hazelworth and Ortman, 1979), J. Morse and his coworkers who did the dissolved oxygen and nutrient analyses, and J. Steen and J. Bennett who analyzed the zooplankton samples.

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Cruise Report for GOTEC-05

Cruise Report for GOTEC-06

Cruise Report for GOTEC-07

INTRODUCTION

The operation of an Ocean Thermal Energy Conversion plant will involve the pumping of immense volumes of deep ocean and surface waters through heat exchangers followed by release into the environment. This operation could perturb the structure of the water column leading to possible disruption of the local species composition. A list of environmental concerns appeared in the Environmental Development Plan (U.S. Department of Energy, 1979). In order to assure adequate knowledge of the oceanic environment in which the OTEC plant is operating, which will allow more reliable prediction of the possible consequences of operating an OTEC plant on the oceanic environment and also the impact of the ocean on the OTEC plant, a series of cruises to potential OTEC sites were initiated.

One of the first sites to be investigated was the Mobile Site (29^{o}N, 88^{o}W) in the Gulf of Mexico. On the fourth through seventh cruises in this series, a second site, the Tampa Site ($27^{o}39'$N, $85^{o}30'$W), was visited (Figure 1). On the last of the cruises covered in this volume, GOTEC-07, only the Tampa Site was visited. This volume gives the data collected on those cruises (see Table 1 for the dates of each cruise). Data collected on the first three cruises (GOTEC-01 through GOTEC-03) appear in three separate cruise reports (Quinby-Hunt, et al., 1979, and Marine Sciences Group, 1980a and 1980b).

In addition, a number of archival studies of the ecosystem in the Gulf of Mexico have been made or are in progress.

Historical data on the thermal resource and currents were explored by Molinari and Festa (1978), and Craig et al. (1978). Thermal data taken since 1979 are analyzed in Thomas, Minton and Molinari (1979). Data concerning the Loop Current have been reported by Tidwell, Cardwell, Molinari and Ortman (1978), and Molinari et al. (1977).

Cummings, Atwood and Parker (1979) reviewed the literature on nutrients and dissolved oxygen of the area. Literature reporting concentrations of trace metals in the Gulf is notably scarce although a survey is currently in progress at Lawrence Berkeley Laboratory (LBL).

El-Sayed, et al. (1972) carried out an extensive survey of phytoplankton which included a review of previous studies in the area.

Currently at LBL, archival studies are in progress on a variety of topics: chemistry (nutrients and toxics), physical, geological, and biological (phytoplankton, zooplankton, mammals, fish and pigments).

A Word on the Organization of this Report. For aid in locating material relating to a specific cruise all sections referring to a specific cruise begin with the number of the cruise. For example, if a reader wished to locate the station log for GOTEC-05, he would refer to Table 5-1. If he wanted to find the introduction, methodology or results from GOTEC-07, he would refer to sections 7-I, 7-III and 7-IV, respectively.

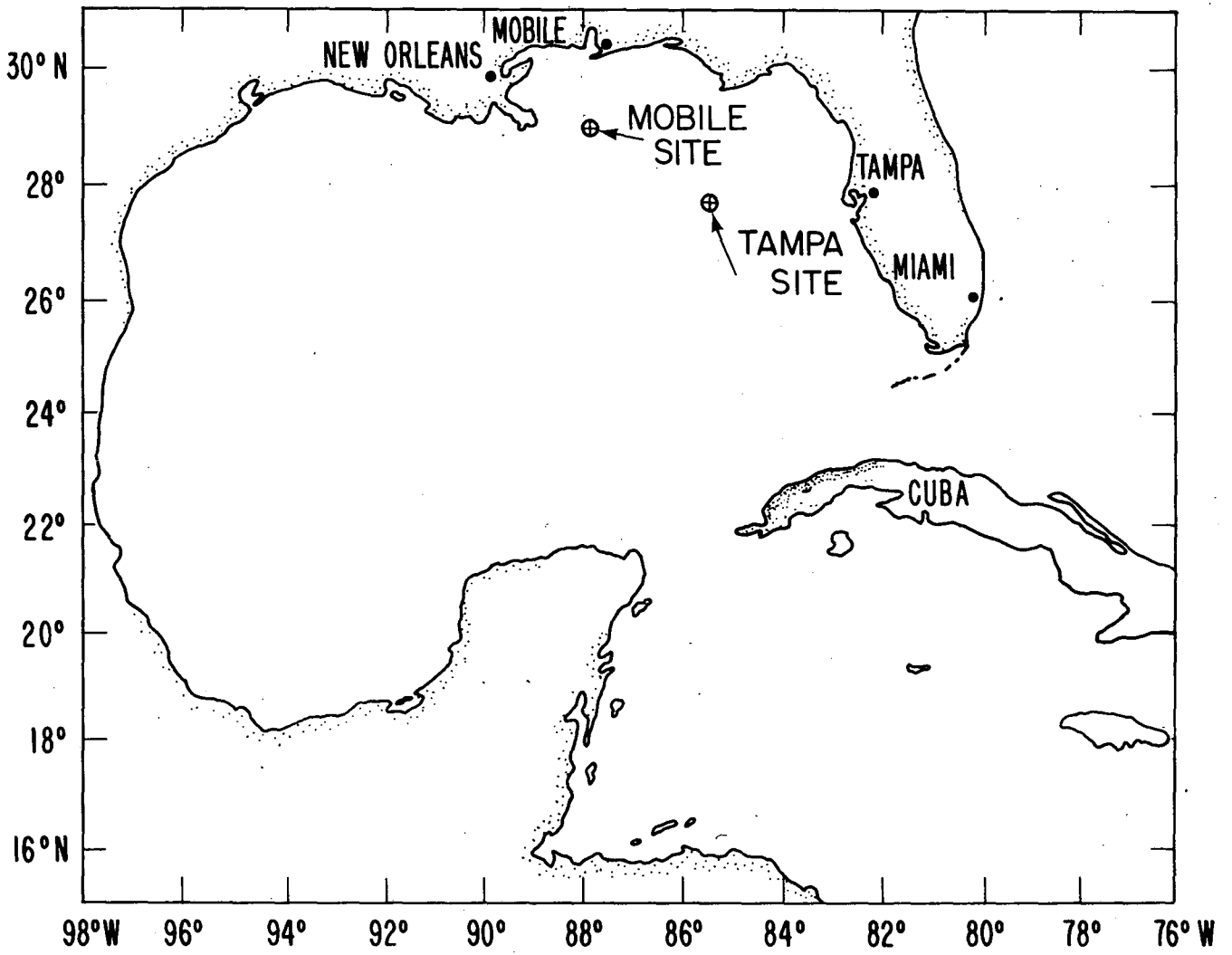


Figure 1. Gulf of Mexico; Tampa and Mobile Sites

TABLE 1. CRUISE DATES

Cruise	Dates
GOTEC-04	6-21 June 1978
GOTEC-05	15-27 August 1978
GOTEC-06	21 October-6 November 1978
GOTEC-07	17-20 December 1978

All figures containing data from the cruises appear in Appendix A. Those from GOTEC-04 in Appendix 4A, those from GOTEC-05 appear in Appendix 5A, etc. Tabular data appear in Appendix B. Tables from GOTEC-06 appear in Appendix 6B, etc.

References for all four reports were similar and therefore appear in a single section at the end of the text. Appendices appear at the end of the volume.

Cruise Report for GOTEC-04

4-I. INTRODUCTION to GOTEC-04

The fourth cruise in this series to the Gulf of Mexico, GOTEC-04, (6 to 21 June 1978, R/V Virginia Key) visited the Mobile site at 29°N, 88°W. (Figure 1). On this cruise a second site, the Tampa site (27°39'N, 85°30'W) also was visited. This fourth cruise was an effort of the Atlantic Oceanic and Meteorological Laboratories (AOML) of the National Oceanographic and Atmospheric Administration (NOAA). Molinari, Hazelworth and Ortman, (1979) published the expendable bathythermograph (XBT), Salinity-Temperature-Depth recorder (STD), and current meter analyses. Stations sampled within the general area of the site appear in the Station Log (Table 4-1). Ecological station results for GOTEC-04 are presented graphically in Appendix 4A, and Appendix 4B lists the station data in tables.

4-II. STATION MEASUREMENTS made on GOTEC-04

Five stations were sampled using an STD (Plessey Environmental Systems Model 9060) with a 12-bottle hydrocast equipped with 5 liter Niskin® bottles. Sea water from the hydrocasts was processed on deck. Twelve zooplankton tows were made. The Station Log (Table 4-1) summarizes the day, time, position and operations performed during this cruise. Methods are described in Section 4-III. Analytical methods will be published in greater detail in the future.

Physical Oceanographic Measurements

Temperature and Salinity. Samples were obtained at Stations 1, 2, 3, 4 (salinity only) and 6. The values are plotted in Appendix 4A, Figures 4A-1 through 4A-5 and appear in tabular form in Table 4B-1. They also appear in Molinari, Hazelworth and Ortman (1979).

Chemical Oceanographic Measurements

Dissolved Oxygen. Samples were taken at Stations 1 and 4. The water jackets surrounding the sample bottles were incompletely filled, causing erratic results. Therefore no dissolved oxygen data will appear for this cruise.

Nutrients. Samples were taken at Stations 1 and 4. Results are preliminary and have neither been evaluated nor interpreted. They appear in Table 4B-2, and in Figures 4A-6 and 4A-7. Under no circumstances should they be used in models or calculations until they have been evaluated.

Biomass Indicators. Samples to be analyzed for chlorophyll a, phaeophytin, and adenosine triphosphate (ATP) were collected at stations 2, 3 and 6. Results for chlorophyll a and phaoephytin are shown in Appendix 4A, Figures 4A-8 through 4A-10 and in tabular form in Appendix

Table 4-1. Station Log, R/V Virginia Key, Cruise GOTEC-04, Gulf of Mexico, 6-21 June 1978

Station	Date	Time Z Universal or GMT EDT in parentheses	Position	Operations
		TAMPA SITE OPERATIONS		
A	11 June 1978	162:2247Z, (1847) begin tow :2315(1915) end tow	27°39'N, 85°30'W	Phytoplankton net tow #1
1	12 June 1978	163:0755Z, (0355) begin cast :0900(0500) messenger down :1000(0600) end cast	27°39'N, 85°31'W	Hydrocast to 1000m Temp at 0,200,300,400,600,1000m Sal, DO, Nutr at 0,25,50,100,150, 200,300,400,600,1000m
2	12 June 1978	163:1555Z (1155) begin cast :1640(1240) messenger down :1708(1308) end cast	27°38'N, 85°33'W	Hydrocast to 500m Temp at 0,150,200,250,300,500m Sal at 0,50,75,100,125,150,200,300,400,500m Chl a, ATP at 0,25,50,75,100,125,150, 200,300,400,500m Phytoplankton at 0, 50, 200m
2A	12 June 1978	163:1841Z (1441) start tow :1900(1500) close net :1927(1527) nets on board	28°39'N, 87°33'W	Zooplankton net tow 1 (TAM 02)
3	13 June 1978 (GMT) 12 June 1978 (EDT)	164:0145Z (2145) start cast :0213(2213) on bottom :0224(2224) messenger down :0256(2256) end cast :0310(2310) AOML reported time	27°38'N, 85°33'W (Tampa Site)	Hydrocast to 500m Temp at 0m Sal, Chl a, ATP, Org at 0,25,50,75, 100,125,150,200,250,300,400,500m Phytoplankton at 0,25,50,75,100, 125,150,200,250m
3A	13 June 1978 (GMT) 12-13 June 1978 (EDT)	164:0333Z (2333) start tow :0355(2355) close net :0430(0030) end tow	27°37'N, 85°32'W	Zooplankton net tow 2 27m hor. (TAM-03)
3B	13 June 1978	164:0444Z (0044) start tow :0500(0100) end tow	27°37'N, 85°32'W	Zooplankton net tow 3, Surface, hor.
3C	13 June 1978	164:1227Z (0827) start tow :1245(0845) open net :1301(0901) close net :1323(0923) end tow	27°35'N, 85°30'W	Zooplankton net tow 4, 1000-800m obl. (TAM-04)
3D	13 June 1978	164:1348Z (0948) start tow :1408(1008) open net :1428(1028) close net	27°34'N, 85°30'W	Zooplankton net tow 5, 800-200m obl. (TAM-05)

Table 4-1. Station Log, RV Virginia Key, Cruise GOTEC-04, Gulf of Mexico, 6 - 21 June 1978 (cont.)

Station	Date	Time Z Universal or GMT EDT in parentheses	Position	Operations
		Tampa Site (continued).		
3E	13 June 1978	164:1450Z (1050) start tow :1505(1105) net on board	27°33'N, 85°30'W	Zooplankton net tow 6, 200-0m obl. (TAM-06)
3F	13 June 1978	164:1533Z (1133) start tow :1600(1200) net on board	27°33'N, 85°31'W	Phytoplankton net tow 2 150-0m obl.
3G	13 June 1978	164:1700Z (1300) start tow :1720(1320) net on board	27°33'N, 85°30'W	Zooplankton net tow, 27m hor. (TAM-07)
		MOBILE SITE OPERATIONS		
4	14-15 June 1978 (GMT) 14 June 1978 (EDT)	165:2349Z (1949) start cast 166:0049(2049) messenger down :0142(2142) end cast	29°10'N, 87°37'W	Hydrocast to 1000m Sal at 0,25,50,100,150,200,300,400,500, 600,1000m Nutr, DO at 0,25,50,100,150,200, 300,400,600,1000m
4A	15 June 1978 (GMT) 14 June 1978 (EDT)	166:0202Z (2202) start tow :0223(2223) messenger down :0254(2254) end tow	29°09'N, 87°37'W	Zooplankton Net tow, 1000-0m obl. (LBL #17)
4B	15 June 1978 (GMT) 14 June 1978 (EDT)	166:0315Z (2315) start tow :0334(2334) end tow	29°10'N, 87°37'W	Zooplankton net tow, 30m hor. (LBL #18)
6	15 June 1978	166:1008Z (0608) start cast :1044(0644) messenger down :1118(0718) end cast	29°08'N, 87°37'W	Hydrocast to 500m Temp at 0,150,200,250,300,500m Sal at 0,25,50,75,100,125,150,200,250,300, 400,500m Chl a, ATP, Org at 0,25,50,75,100,125,150, 200,250,300,400,500m Phytoplankton at 0,25,50,75,100m
6A	15 June 1978	166:1441Z (1041) start tow :1457(1057) open net :1510(1110) close net :1536(1136) net on surface	29°07'N, 87°38'W	Zooplankton net tow, 1000-800m obl. (LBL #19)
6B	15 June 1978	166:1606Z (1206) start tow :1622(1222) open net :1640(1240) close net :1647(1247) end tow	29°07'N, 87°38'W	Zooplankton net tow, 800-200m obl. (LBL #20)

Table 4-1. Station Log, R/V Virginia Key, Cruise GOTEC-04, Gulf of Mexico, 6 - 21 June 1978 (cont.)

Station	Date	Time Z Universal or GMT EDT in parentheses	Position	Operations
		Mobile Site Operations (continued)		
6C	15 June 1978	166:1700Z (1300) start tow :1723(1323) end tow	29°06'N, 87°38'W	Zooplankton net tow, 200-0m obl. (LBL #21)
6D	15 June 1978	166:1746Z (1346) start tow :1800(1400) end tow	29°06'N, 87°38'W	Zooplankton net tow, 30m hor. (LBL #22)
6E	15 June 1978	166:2140Z (1740) start tow :2145(1745) open net :2200(1800) close net :2205(1805) net on surface	29°07'N, 87°39'W	Phytoplankton net tow 3 200-100m obl.
6F	15 June 1978	166:2216Z (1816) start tow :2233(1833) end tow	29°07'N, 87°39'W	Phytoplankton net tow 4 100-0m obl.
6G	15 June 1978	166:2244Z (1844) start tow :2251(1851) end tow	29°07'N, 87°40'W	Phytoplankton net tow 5 5-0m obl.

Abbreviations and procedures:

ATP = Adenosine triphosphate - sea water filtered through 0.45 µm filter, filter placed in boiling tris buffer for 20min., then test tube, filter, and buffer frozen.

Chl *a* = Chlorophyll *a* - sea water filtered through glass filter.

Nutr = Nutrients - sea water decanted into glass or polyethylene bottles and frozen.

Temp = Temperature

Sal = Salinity

DO = Dissolved oxygen

obl. = oblique tow

hor. = horizontal tow

4B. The ATP log book which contained the sample volumes was lost at sea with the M/V Holo Holo and therefore the results cannot be determined.

Biological Oceanographic Measurements

Zooplankton. Samples were collected on twelve tows by John Steen, Gulf Coast Research Laboratory, of Ocean Springs, MI. Samples TAM 02 and LBL 17 were sent to LBL for analysis. A complete description of the samples taken is provided in Table 4-2.

Phytoplankton. Samples were taken from bottle casts at stations 1, 2, 3, 3F, 6, 6E, 6F, and 6G. Net tows were done at stations A, 3F, 6E, 6F and 6G. Results from Station 3 appear in Figure 4-15 in Appendix 4A, and in Table 4B-7 in Appendix 4B. Results from Station 2 (50m only) are also shown in Table 4B-7, and those from Station 6E are presented in Table 4B-8, Appendix 4B. The samples from the other stations have been archived at LBL.

4-III. ANALYTICAL METHODOLOGY used on GOTEC-04

Physical Oceanographic Measurements

Temperature and Salinity. Thermometric temperatures and depths were calculated using the techniques given by La Fond (1951). Thermometric depths computed from reversing thermometer data are accurate to within ± 5 m. Temperature data are accurate to within ± .01°C. Salinity samples analyzed on a Guildline Autosal 8400 are accurate to ± .005‰. The temperature and salinity data were quality controlled by constructing T-S plots and eliminating inconsistent points. The STD and Niskin® bottle data are available from National Oceanographic Data Center (NODC) and have been published by Molinari, Hazelworth and Ortman (1979).

Chemical Oceanographic Measurements

Dissolved Oxygen. Analyses were performed under the direction of John Morse at Rosenstiel School of Marine and Atmospheric Science (RSMAS) of the University of Miami using a procedure based on the classical Winkler method (Winkler, 1888) as modified by Strickland and Parsons (1972). A divalent manganese solution ($MnCl_2$) followed by an alkali - iodide solution (NaOH - NaI) is added to the sample on board ship. Manganese hydroxides are formed in the bottle. Because of the instability of Mn(II) in an alkaline medium, any dissolved oxygen oxidizes an equivalent amount of Mn (II) to Mn(III). The solution is then acidified to a pH of 2.5, the Mn(III) is reduced to Mn(II) and the equivalent amount of iodide in the solution is oxidized to I_2. The I_2 then reacts with the excess iodide in solution to form I_3^- which is then determined using a standard thiosulfate titration with a starch indicator. The detection limit was 0.056 ml O_2. The standard deviation for water containing 5.00 mL O_2/L was typically ± 0.030 mL O_2/L (Morse and Zullig, 1979).

Table 4-2. Zooplankton Tow Log from R/V Virginia Key, Gulf of Mexico, Mobile and Tampa Site, 6-21 June 1978 (GOTEC-04)

Station #	Sample #	Date (local)	Time (EDT)	Depth (m)	Tow Time (min)	Water Vol Filtered (m^3)
			TAMPA SITE			
2A	TAM 02*	12 June	1441-1527	-	-	-
3A	TAM 03	13 June	0030-0046	0-30	16	330
3C	TAM 04	13 June	0830 0840	1000-800	9.5	525
3D	TAM 05	13 June	1000 1013	800-200	13	666
3E	TAM 06	13 June	1045 1100	0-200	15	200
3G	TAM 07	13 June	1300 1500	0-27	15	277
			MOBILE SITE			
4A	17*	14 June	2202-2254	1000-0	31	-
4B	18	14 June	2320-2335	26	15	188
6A	19	15 June	1040 1117	1000-800	6	454
6B	20	15 June	1215 1249	800-200	13	308
6C	21	15 June	1300-1310	20-0	10	190
6D	22	15 June	1345-1400	25	15	250

*Sample sent to LBL without accompanying tow information. This information has been requested.

Nutrients. Analyses were performed under the direction of John Morse at RSMAS.

(1) Orthophosphate was measured using the method described by Murphy and Riley (1962) and Grasshoff (1976). This procedure depends on the reduction of a stable phospho-molybdate complex by ascorbic acid in the presence of antimony. Absorbance of the produced blue sol ("molybdenum blue") is measured at 8800 Å and compared with standards made from potassium phosphate.

(2) Nitrate plus nitrite were measured using the methods described by Grasshoff (1976) and Strickland and Parsons (1972). Nitrate is reduced to nitrite on a copper-cadmium reduction column. The resulting nitrite is then diazotized with sulphanilamide and coupled with N-(1-napththyl)-ethylenediamine dihydrochloride to form a red azo dye. Absorbance is then measured at 5430 Å.

(3) Nitrite was determined in a similar fashion without the reduction step.

(4) Silicate was measured using the methods of Strickland and Parsons (1972) and Grasshoff (1976). This procedure involves the formation of a silico-molybdate complex which is subsequently reduced using oxalic acid and metol. This reaction results in a blue complex which is measured at 8100 Å.

(5) Ammonia was determined by reaction of the sample in an alkaline citrate medium with sodium hypochlorite and phenol in the presence of sodium nitroprusside to form a blue indophenol. Absorbance is measured at 6300 Å.

Biomass Indicators. Analyses of samples of chlorophyll a and phaeophytin were performed by D.J. Estrella of LBL. ATP samples were analyzed by A.T. Jones of LBL.

(1) Chlorophyll a (Chl a) and phaeophytin (Phaeo) were measured using fluorometric methods described by Strickland and Parsons (1972) and Yentsch and Menzel (1963). About two liters of seawater (absolute volume varied) was filtered through Whatman GF/C filters for each Chl a and Phaeo determination. Chl a was extracted using 90% acetone.

(2) Adenosine triphosphate was extracted using the boiling tris(hydroxymethyl)aminomethane (tris) buffer method previously described by Holm-Hansen (1973). Samples were assayed using the luciferin-luciferase reaction first adapted by Holm-Hansen and Booth (1966) for oceanic waters. The peak light emission from the chemiluminescent reaction was compared with standard values according to procedures outlined by Karl and Holm-Hansen (1978).

Biological Oceanographic Measurements

Zooplankton. Samples were collected at both sites using the following methods described by John Steen:

A 0.75-meter diameter 202 µm nylon mesh, 5:1 cone plankton net, equipped with a digital flow meter, was used to make each zooplankton tow. The net was also equipped with a double-trip mechanism which allowed samples to be taken only at a determined depth and not be contaminated when returning to the surface.

As the R/V Virginia Key is not equipped with a variable clutch, it was necessary to start and stop the engines to maintain a towing speed; thus, the ship's velocity was not constant. For this reason, it was difficult to maintain a horizontal tow attitude. For the 1000 m - 0 m vertical sample, the net was lowered to depth in a closed position. When at 1000 m, it was opened by messenger and hauled to the surface.

To ensure enough biomass in the 1000 m - 800 m and the 200 m - 0 m samples, the net was opened at the upper depth, lowered through the depth zone, and then raised back to the upper depth where a second messenger closed it. The mid-depth zone (800 m - 200 m) was sampled only once; the net was opened at 800 m and closed at 200 m.

The length of each tow was timed with a stopwatch, beginning when a messenger opened the net and ending as the net was closed. The depth of each tow was determined trigonometrically using the angle of declination and the length of the ship's wire during the tow. The mean from eight wire angle measurements taken during each tow was used to calculate net depth. Wire length was determined from a meter block reading. The volume of water filtered during each tow was calculated from digital flow meter counts. When the nets were returned aboard ship, they were immediately washed down and the zooplankton were concentrated into a liter container and preserved in a 5% buffered formalin solution.

Samples were analyzed using the following methods:

(1) Tampa. The samples were analyzed by James Bennett of the University of South Florida using the following methods. Samples were subdivided with a Matoda box. Each collection was split until the counting tray contained an adequate number of the important biomass species for reliable cou ts. Animals smaller than 1 cm were analyzed using two aliquots for each sample. Larger (>1cm) or less common animals were counted in a larger fraction of the sample. Changes from this procedure occurred in TAM 04 and 05 where numerous large specimens obscured the counting field. In both, the large animals were identified, measured, and removed from each aliquot prior to further counting. The remainder of the aliquot of TAM 04 was counted in its entirety because of its small biomass.

Counting was carried out in a 10x10 cm plastic bacteriological media tray with a ruled bottom (1 ruled square = 1 cm^2). The number of squares counted was a function of the size and abundance of each type of organism. Copepods were identified to species as far as possible. Other plankton were identified to major group level. Measurements were made on lengths and widths of each category of plankton. In the case of copepods, metasome width and

total length was measured on five specimens of each species or type identified in each aliquot. Widths and lengths of five specimens of all other plankton categories were measured as well.

(2) Mobile. The samples were taken to the Gulf Coast Research Laboratory for analysis. From each sample an aliquot containing approximately 200 to 600 copepods was taken by a Folsom Plankton Sample Splitter. The number of splits needed to obtain a proper aliquot was recorded and used later in calculating numbers of individuals per cubic meter of water sampled. Under a dissecting microscope the zooplankton were separated into taxonomic groups. Copepods were identified, if possible, to genus and species and all other plankters were identified to their smallest recognized taxonomic unit. Copepods also were separated according to sex and stage (adult and copepodid). All individuals were counted, measured and preserved for future reference. The portion of each sample that was not included in the analysis was returned to its proper container and retained for future analyses.

Phytoplankton. Water samples for phytoplankton estimations were collected from depths ranging from 0 m to 250 m using a standard hydrocast. Samples (1-liter) were transferred from 5 liter Niskin® bottles to 1 liter Nalgene® bottles and preservative was added (Lugol's solution in a final concentration of 1% by volume).

Five net tows were made. The first tow (an equipment test at Station A) used a 0.2 m diameter 25 um mesh net with samples being examined live before being discarded. The remaining tows were made with a 0.5 m diameter 10 μm mesh net. The organisms from these latter net tows were preserved in 1% Lugol's solution for subsequent analysis at Lawrence Berkeley Laboratory.

Samples were analyzed by Peter Johnson, Keith Jones, and Alan Jassby of LBL. Due to the low density of phytoplankton in tropical oceans, samples were concentrated to facilitate counting. Each water sample (100 ml) was placed in a 20 cm settling tube for four days. The supernatant liquid was removed and the phytoplankton in 1 ml of water were sealed into the counting chamber with a coverslip greased with silicone. Samples were examined with a Leitz Diavert® inverted microscope using phase contrast at a magnification of 500x. Only organisms larger than 10 μm (long axis) were counted because the nannoplankton (less than 10 μm) require lengthy settling times and there is no guarantee of a quantitative recovery.

The area of the counting chamber surveyed varied with the density of organisms. Normally at least one hundred of the more common species were counted and the counts were extrapolated to cells per liter using the following formula:

$$\frac{(\text{Number counted})(\text{Total area of chamber})}{(\text{Area counted})(\text{Volume settled})} = \text{Number liter}^{-1}$$

Samples from net tows were more concentrated so counts were made on smaller amounts of water (5 ml) settled for only twenty four hours. Abundance was recorded as dominant, common or rare.

The unused portions of the original samples are archived in the phytoplankton laboratory of the Marine Sciences Group at the Lawrence Berkeley Laboratory.

Organisms were identified using the following references: dinoflagellates: Steidinger and Williams (1970), Wood (1968) and Balech (1967); diatoms: Saunders and Glenn (1969), Hendey (1964), and Cupp (1943); coccolithophorids: Schiller (1930); silicoflagellates: Gemeinhardt (1930) and Wood (1968).

4-IV. DATA SUMMARY of GOTEC-04

Physical Oceanographic Measurements

Temperature and Salinity. The density structure at the Mobile Site (Station 4) shows a light surface layer (less than 50 meters deep) which is caused by high temperatures and low salinities (33.148‰ at the surface compared with 36.316‰ at 50 m) and a surface temperature over 28°C. Similar conditions obtained at Station 6. At the Tampa Site (Stations 1, 2 and 3) surface salinities were greater than 35.5‰ but a sharp pycnocline was nonetheless observed between the surface and 75 meters.

Chemical Oceanographic Measurements

Dissolved Oxygen. The water jackets on all oxygen bottles were empty, leading to questionable results, which have not been included.

Nutrients. Nutrient samples were taken at Station 1 (Tampa) and 4 (Mobile). The values at the Tampa Site fall within the envelope presented by Cummings, Atwood and Parker (1979). The nitrate values do not display the maximum reported by El-Sayed et al. (1972) at approximately 600m.

At the Mobile Site the nitrate and silicate values from the surface to 200m fall within the envelope presented by Cummings, Atwood and Parker (1979) for this site. The nitrates and phosphates show the maximum near 600m as reported by El-Sayed et al. (1972). The phosphate values correspond to those in the archives, Cummings, Atwood and Parker, (1979), and El-Sayed, et al. (1972). Below 200m the nitrates appear to be high and the silicates low. It must be reemphasized that these results are preliminary and have not been extensively evaluated.

The ammonia values had to be discarded because the sample bottles were incompletely filled.

Biomass Indicators. Results for the Chl a determinations are shown in Figures 4A-8, 4A-9, 4A-10 and Table 4B-3. At Stations 2 and 3, a Chl a maximum occurred at 75m, while at Station 6 the maximum was at 25m.

At each station, below the maximum, chl a values decreased to about 0.003 ug/L (background) at 150m. Below 150m the value fluctuated about background levels.

The increase of Chl a with depth was greater at Stations 2 and 3 than at Station 6, as was the decrease from the maximum. Station 2 had the highest maximum, with a value of 0.13 ug/L with Station 6 being nearly equal (0.12 ug/L) and Station 3 being less (0.098 ug/L).

Phaeophytins exhibited similar characteristics, except at Station 6 (Mobile Site), where the maximum phaeophytin value was lower than the value for Chl a. In general, phaeophytins were more abundant at all depths. The phaeophytin maximum at Station 2 occurred above the Chl a peak, at Station 3 occurred at the Chl a peak, while that at Station 6 was at the surface.

Biological Oceanographic Measurements

Zooplankton.

(1) Tampa. Total zooplankton abundances and the abundances of the major groups: copepods, non-copepod crustaceans, other invertebrates, and fish larvae and eggs, are shown in Table 4B-4. Total zooplankton numbers ranged from 950 organisms m^{-3} (27m-0m tow, day) to 2 organisms m^{-3} (995m-798m tow, day). Numerically, copepods dominated the samples and comprised about 70% to 95% of total zooplankton. The remaining zooplankton were mostly non-copepod crustaceans (2%-5%) and other invertebrates (3%-30%). Fish eggs and larvae, when present, comprised only 0.1% to 0.4%. Cyclopoid copepods were five times more numerous than calanoid copepods in the surface night sample but calanoids were four times more numerous than cyclopoids in the deepest sample (995m-798m day). In the other samples calanoids and cyclopoids were roughly equal in number. Harpacticoids comprised only a small percentage of the copepods collected. From 28 to 41 copepod taxa were identified in each sample. The dominant genera of copepods present are shown in Table 4B-5.

The daytime vertical distribution of the zooplankton at the Tampa Site during June 1978 is shown in Figure 4A-11. Almost three quarters of the copepods were found in the 27m to 0m region with less than 2% below 200m. Non-copepod crustaceans also were most numerous in the surface layer (65%) and less than 3% below 200m. Other invertebrates were almost equally abundant in the 200m-0m and the 27m-0m regions. As with the other groups, less than 3% were found below 200m.

The zooplankton size distribution at the Tampa site as percent frequency is shown in Figure 4A-12 and Table 4B-6. Usually more than three quarters of the zooplankton population was in size classes 2 and 3 (0.5mm-1.9mm). Small numbers occurred in most other size classes (Figure 4A-12). An exception was the 995m-798m tow (day) sample in which the organisms were almost evenly divided between the first 8 size classes (up to 6.9mm). However, size class 5

(3.0mm to 3.9mm) contained more organisms than adjacent size classes (Figure 4A-12).

(2) Mobile. Total zooplankton abundances and the abundances of the major groups: copepods, non-copepod crustaceans, other invertebrates, and fish larvae and eggs, are shown in Table 4B-4. Total zooplankton numbers ranged from 4017 organisms m^{-3} (26 m horizontal tow, night) to 12 organisms per m^{-3} (999m-799m tow, day). Numerically copepods dominated the samples, and comprised about 60% to 80% of the total zooplankton. Most of the remaining zooplankton were non-copepod crustaceans (5%-20%) and other invertebrates (about 10%-20%). Fish eggs and larvae, when present, were only 0.1% to 0.3% of the samples. In all samples cyclopoid copepods were slightly more abundant than calanoid copepods. Harpacticoids comprised only a small percentage of the copepods collected. From 18 to 31 copepod taxa were identified in each sample. The dominant genera of copepods present are shown in Table 4B-5.

The daytime vertical distribution of the zooplankton at the Mobile Site during June 1978 is shown in Figure 4A-13. In all three major groups approximately 90% of the organisms occurred in the upper 25m and few organisms were present below 200m. No samples were taken on this cruise between 200m and 25m. The abundance of organisms in this region is inferred to be intermediate between the upper and lower depths.

The zooplankton size distribution at the Mobile Site as percent frequency is shown in Figure 4A-14 and Table 4B-6. Most organisms (75%-85%) were in size classes 2 and 3 (0.5mm - 1.9mm). The remaining organisms were concentrated in size classes up to 7 (5.0mm - 5.9mm) since very few large organisms were found.

Phytoplankton. The results shown in Figure 4A-15 and Tables 4B-7 and 4B-8 show that the maximum diversity of organisms is found at 25 and 50m, with total cell numbers being greatest at 50m. Similar data are discussed by Wood (1971), Hobson and Lorenzen (1972), and Steidinger (1973).

In samples from bottle casts, dinoflagellates are the predominant organisms (Table 4B-7). This also was reported previously in the Gulf of Mexico by El-Sayed et al, (1972). Steidinger (1973) suggests that dinoflagellates grow well in the Gulf's nutrient-poor waters. The bottle casts show a low species diversity and surprisingly few diatoms. This may be a function of the small amounts of water sampled by bottles. More species were obtained from the 100 m to the surface net tow where diatoms, not dinoflagellates predominated. Many of the algae from the bottle casts were smaller than those described in standard texts, and this, together with poor preservation in Lugol's solution, may have hindered identification and account for the number of unidentified cells. Some evidence that the lower parts of the photic zone are dominated by nannoplankton is shown by the large numbers of small cells counted from 200m. These organisms have been shown to be important primary producers in several studies (Hamilton, Holm-Hansen and Strickland, 1968; Beers, Reid and Stewart, 1975; Waterbury et al., 1979).

Cruise Report for GOTEC-05

5-I. INTRODUCTION to GOTEC-05

The fifth cruise in this series to the Gulf of Mexico, GOTEC-05, (15-27 August 1978, R/V Virginia Key) visited both the Tampa (27°40'N, 85°39'W) and Mobile (29°N, 88°W) sites (Figure 1). This cruise was primarily an effort of the Atlantic Oceanographic and Meteorological Laboratories (AOML) of the National Oceanic and Atmospheric Administration (NOAA). Researchers from Rosenstiel School of Marine and Atmospheric Science (RSMAS), University of Miami, Gulf Coast Research Laboratory and the University of South Florida also participated. Stations within the general area of the site appear in the Station Log (Table 5-1). Hydrocasts were made at four oceanographic stations to a maximum depth of 1000 meters. Temperatures were read. XBT's were made and STD's taken. Water was analyzed for dissolved oxygen, nutrients, chlorophyll a (Chl a), phaeophytin (phaeo), and adenosine triphosphate (ATP). Zooplankton samples were collected at thirteen stations.

Molinari, Hazelworth and Ortman (1979) published the XBT and STD data.

5-II. STATION MEASUREMENTS made on GOTEC-05

Four stations were sampled using an STD (Plessey Environmental Systems Model 9060) with a 12-bottle hydrocast equipped with 5 liter Niskin® bottles. Sea water from the hydrocasts was processed on deck. The Station Log (Table 5-1) summarizes the day, time, position and operations performed during this cruise. Methods are described in Section 5-III. Analytical methods will be published in greater detail in the future.

Physical Oceanographic Measurements

Temperature and Salinity. Samples were obtained at Stations 2, 7, 8 and 15. The values are plotted in Appendix 5A, Figures 5A-1 through 5A-4, and appear in tabular form in Appendix 5B, Table 5B-1. They also appear in Molinari, Hazelworth and Ortman (1979).

Chemical Oceanographic Measurements

Dissolved Oxygen. Samples were taken at Stations 7 and 8. The results appear in Figures 5A-2 and 5A-3, and Tables 5B-1 and 5B-2. Results are preliminary and should not be used in models or calculations.

Nutrients. Samples were collected by J. Zullig of RSMAS at Stations 7 and 8. Results are presented in Table 5B-2 and Figures 5A-5 through 5A-8. Results are preliminary, and should not be used in models or calculations.

Table 5-1. STATION LOG, R/V Virginia Key, Cruise GOTEC 05, Gulf of Mexico, 15-27 August 1978

Station	Date	Time, Z Universal or GMT EDT in parentheses	Position	Operations
		TAMPA SITE OPERATIONS		
A	19 August 1978	231:0513Z (0113) messenger down :0519(0119) haul back :0542(0142) on deck	27°39'N, 85°31'W	Zooplankton Net Tow 1000m-surface, obl. (TAM 08)
B	19 August 1978	231:0607Z (0207) start tow :0626(0226) end tow	27°39'W,85°31'W	Zooplankton Net Tow 25m, hor. (TAM 09)
2	19 August 1978	231:1400Z (1000) start cast :1457(1057) start to retrieve cast :1500(1100) cast on deck :1430 Time given for AOML Z	27°38'N, 85°35'W	Hydrocast to 300m Temp, Sal at 0,50,75,100,125 150,175,200,225,250,275 and 300m
2A	19 August 1978	231:1735Z (1335) start tow :1800(1400) finish tow	27°39'N,85°33'W	Zooplankton Net Tow, 25m, hor. (TAM 10)
2B	19 August 1978	231:1819Z (1419) start tow :1850(1450) messenger down :1900(1500) on deck	27°39'N, 85°33'W	Zooplankton net tow, 1000m-surface, obl. (TAM 11)
7	20 August 1978	232:1210Z (0810) start cast :1348(0940) messenger down :1500(1100) retake lower 3 bottle :1650(1250) end hydrocast	27°40'N, 85°32'W	Hydrocast to 1000m Temp at 25,50,100,150,200,300, 400,600,800,1000m Sal at 0,25,50,75,100,150, 200,300,400,600,800,1000m Nutr and DO at 0,25,50 75,100,150,200,300 400,600,800,1000m
7A	20 August 1978	232:1602Z (1202) start tow :1620(1220) first messenger :1625(1225) haul back :1634(1234) second messenger :1700(1300) on deck	27°40'N,85°33'W	Zooplankton Net Tow, 1000-800m, obl. (TAM 12)
7B	20 August 1978	232:1715Z (1315) start tow :1732(1332) first messenger :1750(1350) second messenger :1758(1358) on deck	27°40'N, 85°34'W	Zooplankton Net Tow 800-200m, obl. (TAM 13)

Table 5-1 STATION LOG R/V Virginia Key, Cruise GOTEC-05 Gulf of Mexico, 15-27 August 1978 (cont.)

Station	Date	Time Z Universal or GMT EDT in parentheses	Position	Operations
7C	20 August 1978	232:1806Z (1406) start tow :1823(1423) on deck	27°40'N, 85°34'W	Zooplankton Net Tow 200m-surface (TAM 14)
		MOBILE SITE OPERATIONS		
8	22 August 1978 (GMT) 21 August 1978 (EDT)	234:0200Z (2200) start tow :0236(2236) dropped messenger :0323(2323) on deck	29°13'N,87°38'W	Hydrocast to 1000m Temp at 25,50,75,150,200,300 400,600,800,1000m Sal at 0,25,50,100,150,200 300,400,600,800,1000m Nutr and DO at 0,25,50,75, 100,150,200,300,400,600,800,1000m
8A	22 August 1978 (GMT) 21 August 1978 (EDT)	234:0350Z (2350) start tow :0413(0013) messenger down :0448(0048) bad cast :0500(0100) recast begin :0531(0131) messenger down :0600(0200) cast on deck	29°14'N, 87°37'W	Zooplankton Net Tow, 1000m-surface, obl. (LBL 23)
8B	22 August 1978	234:0615Z (0215) start cast :0632(0232) end tow	29°15'N, 87°36'N	Zooplankton net tow, 25m hor. (LBL 24)
10A	22 August 1978	234:1457Z (1057) start tow :1519(1119) first messenger :1534(1134) second messenger :1600(1200) end tow	29°11'N,87°35'W	Zooplankton Net Tow, 1000-800m, obl. (LBL 25)
10B	22 August 1978	234:1615Z (1215) start tow :1623(1223) first messenger :1652(1252) second messenger :1700(1300) tow on deck	29°11'N, 87°35'W	Zooplankton Net Tow, 800-200m, obl. (LBL 26)
10C	22 August 1978	234:1708Z (1308) start tow :1717(1317) end tow	29°11'N, 87°35'W	Zooplankton net tow, 200m-surface, obl. (LBL 27)

Table 5-1 STATION LOG, R/V Virginia Key, Cruise GOTEC-05, Gulf of Mexico 15-27 August 1978 (cont.)

Station	Date	Time Z Universal or GMT EDT in parentheses	Position	Operations
10D	22 August 1978	234:1735Z (1335) start tow :1753(1353) end tow	29°11'N, 87°35'W	Zooplankton Net Tow 25m, hor. (LBL 28)
15	23 August 1978	235:1300Z (0900) start hydrocast :1345(0945) begin retrieving cast :1404(1004) cast on deck	29°11'N, 87°38'W	Hydrocast to 300m Temp at 0,50,70,190,220,240m Sal at 0,50,75,100,125,150,170, 190,220,240,260,290m

Abbreviations and procedures:

Nutr = Nutrients - sea water decanted into glass or polyethylene bottles and frozen.

Temp = Temperature

Sal = Salinity

DO = Dissolved oxygen

obl. = oblique tow
hor. = horizontal tow

Biological Oceanographic Measurements

Zooplankton. Samples were collected on 13 tows by John Steen, Gulf Coast Research Laboratory, and Paul Shuert, University of South Florida, at both the Mobile Site and Tampa Site. A complete description of the samples taken is provided in Table 5-2. Samples LBL-23 and TAM 08 were sent to LBL for analysis.

5-III. ANALYTICAL METHODOLOGY used on GOTEC-05

Methods were the same as those used on GOTEC-04 and are described in Section 4-III. Changes from procedure occurred in zooplankton samples TAM 09 and TAM 10 where large numbers of echinoderm larvae were counted independently and removed from the samples before further processing. TAM 12 was counted in its entirety because of its low numbers.

Total phosphorus was determined using methods described by Grasshoff (1976) and Strickland and Parsons (1972). Samples are evaporated with perchloric acid. The residue is heated to oxidize all organic phosphorus compounds to inorganic phosphate. The residue is then redissolved and determined as orthophosphate.

5-IV. DATA SUMMARY of GOTEC-05

Physical Oceanographic Measurements

Temperature and Salinity. A well-defined surface layer was observed at Stations 8 and 15 at the Mobile Site. This separation was emphasized by the large salinity difference (32.3‰ to 36.3‰) between the surface and 25 meters at Station 8. At the Tampa Site, the surface salinity of Station 7 was greater than 36‰. Therefore the density gradient between the surface and the salinity maximum at 50 meters was less than at the Mobile Site.

Chemical Oceanographic Measurements

Dissolved Oxygen. The dissolved oxygen concentrations at both the Tampa and Mobile Sites fall within the envelopes reported by Cummings, Atwood and Parker (1979). The depth of the oxygen minimum, which appears at 400 m at the Tampa Site and at 300 m at the Mobile Site, also is in agreement with Cummings, Atwood and Parker.

Nutrients. The results have not yet been interpreted or evaluated but are presented in Table 5B-2 and in Figures 5A-5 through 5A-8. At depth the values for phosphates at both sites seem to be low as do the nitrate values (El-Sayed, et al., 1972), although the nitrate values fall well within the envelope reported by Cummings, Atwood and Parker (1979). The silicate values correspond to the same general shape and within the range reported by El-Sayed et al., and Cummings, Atwood and Parker.

No nitrite was detected at either site. The values for total

TABLE 5-2. Zooplankton Tow Log from R/V Virginia Key, Gulf of Mexico Mobile and Tampa Sites, 15-27 August 1978 (GOTEC-05)

Station	Sample #	Date (local)	Time (EDT)	Depth (m)	Tow Time (min)	Vol. Water Filtered (m^3)
			TAMPA SITE			
A	TAM 08	19 Aug 79	0119-0140	1000m-0m	21	410
B	TAM 09	19 Aug 79	0208-0222	25m	14	304
2A	TAM 10	19 Aug 79	1320-1336	25m	16	410
2B	TAM 11	19 Aug 79	1425-1449	1000m-0m	24	525
7A	TAM 12	20 Aug 79	1218-1232	1000m-800m	14	344
7B	TAM 13	20 Aug 79	1330-1348	800m-200m	18	321
7C	TAM 14	20 Aug 79	1405-1413	200m-0m	8	178
			MOBILE SITE			
8A	LBL 23	22 Aug 78	0003 0200	1000m-0m	23	529
8B	LBL 24	22 Aug 78	0215-0230	24m	15	338
10A	LBL 25	22 Aug 78	1100-1145	998-798m	9	405
10B	LBL 26	22 Aug 78	1215 1255	800-200m	15	314
10C	LBL 27	22 Aug 78	1315-1325	200-0m	8	174
10D	LBL 28	22 Aug 78	1330-1345	19m	15	439

phosphate are in general agreement with Spencer (1975). Wide discrepancies between total phosphorous and ortho-phosphate have been reported in some cases (Armstrong, 1965), although not at great depths. As might be expected, ammonia levels at the surface were significantly higher than the nitrite concentration (Vaccaro, 1965). Otherwise, the ammonia data were erratic, therefore they are questionable.

Biological Oceanographic Measurements

Zooplankton

(1) Tampa. Table 5B-3 shows total zooplankton abundances and the abundances of the major groups: copepods, non-copepod crustaceans, other invertebrates, and fish larvae and eggs. Total zooplankton numbers ranged from 3 organisms m^{-3} (1000m - 800m tow) to 896m^{-3} (25m - 0m tow, night). Numerically copepods dominated the deeper samples, comprising about 70% - 90% of the total plankton. They were nearly 50% of both the day and night surface samples. Other invertebrates, primarily the echinoderm pluteus larvae, also were nearly 50% of these samples. Other invertebrates made up only 2%-26% of the deeper samples. Non-copepod crustaceans were 1% - 10% and fish larvae and eggs 0.06% - 0.1% of all samples. Calanoid and cyclopoid copepods were nearly equal in number in the surface and 200 m - 0 m samples. In deeper samples (1000 m - 800 m and 800 m - 200 m) calanoids were 2 to 4 times more numerous than cyclopoids. Harpacticoids were less than 3% of the copepods in all samples. The dominant genera of copepods present are shown in Table 5B-4.

The daytime vertical distribution of the zooplankton at the Tampa Site during August 1978 is shown in Figure 5A-9. Half the copepods were near the surface (25 m - 0 m) with less than 3% below 200 m. Almost one-third of the non-copepod crustaceans were found in the surface region and two-thirds between 200 m - 0 m. Eight percent were found below 200 m. Other invertebrates also were most common (75%) at 25 m - 0 m and only 0.3% were found below 200 m.

The zooplankton size class distribution at the Tampa Site as percent frequency is shown in Figure 5A-10 and Table 5B-5. In the surface samples 95% of the organisms were in size classes 2 and 3 (0.5 mm - 1.9 mm). Organisms occurred more frequently in size class 4 (2.0 mm - 2.9 mm) with increasing depth. Also in deeper samples a greater number of organisms were in size classes 5-7 (3.0 mm - 5.9 mm).

(2) Mobile. Table 5B-3 shows total zooplankton abundances and the abundances of the major groups: copepods, non-copepod crustaceans, other invertebrates, and fish larvae and eggs. Total zooplankton numbers ranged from 1962 organisms m^{-3} (24m horizontal tow, night) to 8m^{-3} (998m - 798m tow). Numerically copepods dominated the deeper samples, comprising about 55% - 85% of the total zooplankton. The day and night surface samples were dominated (68%) by other invertebrates, primarily the dinoflagellate Pyrocystis with copepods only 30%. The other invertebrates group was 10% - 40% of

the deeper samples. Non-copepod crustaceans were 3% - 6% and fish larvae and eggs were 0.1% - 0.4% of all samples.

In most samples there were similar numbers of calanoid and cyclopoid copepods. However, in the 200 m - 0 m and the 20 m day samples, cyclopoids were roughly twice as common as calanoids. Harpacticoids comprised less than 4% of the copepods in all samples. The dominant genera of copepods present are shown in Table 5B-4.

The daytime vertical distribution of the zooplankton at the Mobile Site is shown in Figure 5A-11. (Notice the scale differs from Figure 5A-9). In all major groups, over 90% of the organisms occurred in the upper 200 m, with between 40% - 75% occurring near the surface (20 m).

The zooplankton size class distribution as percent frequency is shown in Figure 5A-12 and Table 5B-5. Most of the organisms (64% - 94%) were in size classes 2-3 (0.5 mm - 1.9 mm). This dominance was more pronounced in surface waters than in deeper water.

Cruise Report for GOTEC-06

6-I. INTRODUCTION to GOTEC-06

The sixth cruise in this series to the Gulf of Mexico, GOTEC 06, (21 October to 6 November 1978, R/V Virginia Key) visited both the Mobile (29°N, 88°W) and the Tampa (27°39'N, 85°30'N) Sites (Figure 1). This cruise was primarily an effort of the Atlantic Oceanographic and Meteorological Laboratories (AOML) of the National Oceanic and Atmospheric Administration (NOAA). Researchers from Gulf Coast Research Laboratories and the University of South Florida also participated. Stations sampled within the general area of the site appear in the Station Log (Table 6-1).

Hydrocasts were taken at 14 oceanographic stations to a maximum depth of 1000 meters. Temperatures were read from reversing thermometers attached to the sample bottles. STD's were taken and XBT's made. Water samples were taken to be analyzed for nutrients, dissolved oxygen, chlorophyll a (Chl a), phaeophytin (phaeo), and adenosine triphosphate (ATP). Zooplankton samples were taken at twenty stations. Molinari, Hazelworth and Ortman (1979) published the XBT, STD and current meter analyses. Ecological station results are presented graphically in Appendix 6A and Appendix 6B lists the data in tables.

6-II. STATION MEASUREMENTS made on GOTEC-06

Five stations were sampled using an STD (Plessey Environmental Systems Model 9060) with a 12-bottle hydrocast equipped with 5-liter Niskin® bottles. Sea water from the hydrocasts was processed on deck. The Station Log (Table 6-1) summarizes the day, time, position and operations performed during this cruise. Methods are described in Section 6-III. Analytical methods will be published in greater detail in the future.

Physical Oceanographic Measurements

Temperature and Salinity. Samples were obtained at Stations 2, 3, 5, 8 and 14. The values appear in tabular form in Appendix 6B and are plotted in Appendix 6A, Figures 6A-1 through 6A-5.

Chemical Oceanographic Measurements

Dissolved Oxygen. Samples were taken at Stations 5 and 8. The results appear in tabular form in Appendix 6B and in Figures 6A-3, and 6A-4, 6A-6 and 6A-8.

Nutrients. Samples were taken at Stations 5 and 8. Results must be considered preliminary. They have not yet been interpreted but appear in Table 6B-2 and in Figures 6A-6 through 6A-9. They should not be used in models or calculations without careful appraisal.

Table 6-1 STATION LOG R/V Virginia Key, Cruise GOTEC-06 Gulf of Mexico Mobile and Tampa Sites 21 October - 6 November 1978

Station	Date	Time Z Universal or GMT EDT in parentheses	Position	Operations
		TAMPA SITE OPERATIONS		
A	26 October 1978	299:0535Z (0135) start tow :0558(0158) first messenger :0630(0230) end tow	27°44'N, 85°38'W	Zooplankton Net Tow 800m-surface, obl. (TAM 15)
B	26 October 1978	299:0645Z (0245) start tow :0700(0300) end tow	27°44'N, 85°39'W	Zooplankton Net Tow 25m, hor. (TAM 16)
1A	26 October 1978	299:1505Z (1105) start tow :1620(1120) first messenger :1150(1150) second messenger :1558(1158) net on board	27°37'N, 85°36'W	Zooplankton Net Tow 800-200m, obl. (TAM 17)
1B	26 October 1978	299:1607Z (1207) start tow :1612(1217) end tow	27°43'N, 85°40'W	Zooplankton Net Tow 200m-surface, obl. (TAM 18)
1C	26 October 1978	299:1628Z (1228) start tow	27°42'N, 85°41'W	Zooplankton Net Tow 25m-surface, hor. (TAM 19)
2	28 October 1978	301:1602Z (1202) start cast :1644(1244) drop messenger :1717(1317) end cast	27°40'N, 85°32'W	Hydrocast to 800m Temp and Sal at 0,25,50,75,100,150, 200,300,400,500,600,800m
3	28 October 1978	301:1833Z (1433) start cast :1948(1548) drop messenger :2010(1610) end cast	27°40'N, 85°34'W	Hydrocast to 300m Temp at 0,50,75,100,125,150,175, 200,225,250,275,300m Sal at 50,75,100,125,150,175, 200,225,250,275,300m Chl , ATP and Org at 0,50,75,100 125,150,175,200,225,250,275,300m
5	29 October 1978 (GMT) 28 October 1978 (EDT)	302:0320Z (2320) start cast :0401(0001) dropped messenger :0445(0045) end hydrocast	27°50'N, 85°32'W	Hydrocast to 800m Temp at 5,50,75,100,150,200, 300,400,600,800m Sal at 0,25,50,75,100,150,200, 300,400,500,600,800m Nutr and DO at 0,25,50,75,100, 150,200,300,400,500,600,800m

Table 6-1 STATION LOG, R/V Virginia Key Cruise GOTEC-06 Gulf of Mexico, Mobile and Tampa Sites, 21 October - 6 November 1978 (cont.)

Station	Date	Time Z Universal or GMT EST in parentheses	Position	Operations
		MOBILE SITE OPERATIONS		
7A	31 October 1978 (GMT) 30 October 1978 :0225(EST)	304:0130Z (2030) start tow :0152(2052) dropped messenger :0225(2125) end tow	29°10'N, 87°39'W	Zooplankton Net Tow 800m-surface, obl. (LBL 29)
7B	31 October 1978 (GMT) 30 October 1978 (EST)	304:0238Z start tow :0250(2150) end tow	29°10'N, 87°40'W	Zooplankton Net Tow 22m, hor. (LBL 30)
8	31 October 1978 (GMT) 30 October 1978 (EST)	304:0345Z (2245) start cast :0443(2343) messenger down :0532(0032) end cast	29°10'N, 87°38'W	Hydrocast to 800m Temp, Sal, DO and Nutr at 0,25,50,75,100,150 200,300,400,500,600,800m
10A	31 October 1978	304:1512Z (1012) start tow :1536(1036) first messenger :1605(1105) second messenger :1611(1111) end tow	29°10'N, 87°38'W	Zooplankton Net Tow 702-182m, obl. (LBL 31)
10B	31 October 1978	304:1636Z (1130) start tow	29°10'N, 88°39'W	Zooplankton Net Tow 200m-surface, obl. (LBL 32)
10C	31 October 1978	304:1652Z (1152) start tow :1710(1210) finish tow	29°10'N, 87°40'W	Zooplankton Net Tow 30m, hor. (LBL 33)
13-1	1 November 1978	305:2308Z (1808) start tow :2311(1811) messenger down :2313(1813) abort :2341(1841) start over :2344(1844) first messenger :306:0009(1909) second messenger :0011(1911) end tow	29°11'N, 87°38'N	Net Tow - Type I
13-2	2 November 1978 (GMT) 1 November 1978 (EST)	306:0130Z (2030) start tow :0131(2031) first messenger :0200(2100) second messenger :0209(2109) end tow	29°12'N, 87°37'W	Net Tow-Type II
13-3	2 November 1978 1 November 1978 (EST)	306:0428Z (2318) start tow :0457(2357) second messenger	29°12'N, 87°36'W	Net Tow-Type I

Table 6-1 STATION LOG, R/V Virginia Key Cruise GOTEC-06 Gulf of Mexico, Mobile and Tampa Sites, 21 October - 6 November 1978 (cont.)

Station	Date	Time Z Universal or GMT EST in parentheses	Position	Operations
13-4	2 November 1978	306:0613Z (0113) start tow :0617(0117) first messenger :0644(0144) second messenger :0650(0150) end tow	29°10'N, 87°37'W	Net Tow-Type II
13-5	2 November 1978	306:0923Z (0423) start tow :0926(0426) first messenger :0950(0450) second messenger :0953(0453) end tow	29°09'N, 87°36'W	Net Tow-Type I
13-6	2 November 1978	306:1112Z (0612) start tow :1114(0614) first messenger :1143(0643) second messenger	29°09'N, 87°36'W	Net Tow-Type II
13-7	2 November 1978	306:1512Z (1016) start tow :1516(1016) first messenger :1541(1041) second messenger	29°08'N, 87°36'W	Net Tow-Type I
13-8	2 November 1978	306:1625Z (1125) start tow :1627(1127) first messenger :1652(1152) second messenger	29°09'N, 87°35'W	Net Tow-Type I
13-9	2 November 1978	306:1737Z (1237) start tow :1738(1238) first messenger :1802(1302) second messenger	29°09'N, 87°36'W	Net Tow-Type I
13A	2 November 1978	306:1908Z (1408) first messenger :1919(1419) second messenger	29°09'N, 87°36'W	Zooplankton Net Tow 500m-surface, obl.

Table 6-1 STATION LOG R/V Virginia Key, Cruise GOTEC-06 Gulf of Mexico, Mobile and Tampa Sites, 21 October - 6 November 1978 (cont.)

Station	Date	Time Z Universal or GMT EST in parentheses	Position	Operations
13B	2 November 1978	306:2017Z (1517) first messenger :2026(1526) second messenger	29°08'N, 87°37'W	Zooplankton Net Tow 500m-surface, obl.
14	2 November 1978	306:2110Z (1610) start cast :2145(1645) raising :2201 (1701) end cast	29°08'N, 87°36'W	Hydrocast to 300m Temp at 0,25,50,75,100,125 150,175,200,225,250m Salinity at 0,25,50,75,100,125,150 175,200,225,350,300m Chl *a*, Org and ATP at 0,25,50,75,100 125,150,175,200,225,250,300m

Abbreviations and procedures:

ATP = Adenosine triphosphate - sea water filtered through 0.45 µm filter, filter placed in boiling tris buffer for 20 min., then test tube, filter, and buffer frozen.

Chl *a* = Chlorophyll *a* - sea water filtered through glass filter.

Nutr = Nutrients - sea water decanted into glass or polyethylene bottles and frozen.

Temp = Temperature

Sal = Salinity

DO = Dissolved oxygen

obl. = oblique tow

hor. = horizontal tow

Net Tow Type-I and Type-II = A series of tows made after Station 13 to determine diel variability of zooplankton

Biomass Indicators. Samples to be analyzed for chlorophyll a, phaeophytin and adenosine triphosphate were collected at Stations 3 and 14. Results are shown in Appendix 6A, Figures 6A-10 and 6A-11 and in tabular form in Appendix 6B.

Biological Oceanographic Measurements

Zooplankton. Routine samples were collected on 12 tows by John Steen, Gulf Coast Research Laboratory and Paul Shuert, University of South Florida. A series of tows were made after Station 13 to determine diel variability of zooplankton. They are currently being analyzed by John Steen and will appear in a subsequent report. Samples LBL 29 and TAM 15 were sent to LBL for analysis. A complete description of the samples taken is provided in Table 6-2.

6-III ANALYTICAL METHODOLOGY used on GOTEC-06

Methods used were the same as those used in GOTEC-04 and GOTEC-05 and are described in section 4-III, with the exception of the method for total phosphorus which appears in Section 5-III.

6-IV. DATA SUMMARY of GOTEC-06

Physical Oceanographic Measurements

Temperature and Salinity. A well mixed surface layer 50 meters thick with a temperature of 25.6° C was observed at the Mobile Site (Station 8, Figure 6A-4). By comparison with the same site in July of the same year (Marine Sciences Group, 1979), the surface temperature has declined and the depth of the mixed layer has increased. This indicates that the drop in surface temperature is partly due to the mixing of warm surface water with cooler subsurface water. The Subtropical Underwater, characterized by a salinity maximum at 75 meters, is slightly deeper than in July (Marine Sciences Group, 1979). At Station 14 there was a slight (0.47°C) temperature inversion associated with a step in the salinity profile.

At the Tampa Site the depth of the thermocline varied from 75 meters at Station 2 (Figure 6A-1) to 50 meters at Station 5 (Figure 6A-3) some twelve hours later. There was no significant change (0.2°C) in surface temperature between these two stations. The salinity maximum of the Subtropical Underwater occurred at 75 meters.

Chemical Oceanographic Measurements

Dissolved Oxygen. At the Mobile Site (Station 8), the dissolved oxygen values fall within the envelope reported by Cummings, Atwood and Parker (1979, p. 40) for this site (see Table 6B-2). The oxygen minimum found at about 400 m.

At the Tampa Site (Station 5), the values reported correspond

TABLE 6-2. Zooplankton Tow Data Summary from R/V Virginia Key Mobile and Tampa Sites, 21 October - 6 November 1978 (GOTEC-06)

Station #	Sample #	Date (local)	Time (EDT)	Depth (m)	Tow Time (min)	Vol. Water Filtered (m^3)
			TAMPA SITE			
A	TAM 15	26 Oct 79	0215	800-0	30	506
B	TAM 16	26 Oct 79	0250	25	15	289
1A	TAM 17	26 Oct 79	1130	800-200	25	934
1B	TAM 18	26 Oct 79	1210	200-0	11	211
1C	TAM 19	26 Oct 79	1230	25	16	247
			MOBILE SITE			
7A	LBL 29	31 Oct 79	0130	819-0	22	944
7B	LBL 30	31 Oct 79	0240	22	15	307
10A	LBL 31	31 Oct 79	1500	702-182	20	923
10B	LBL 32	31 Oct 79	1630	203-0	12	224
10C	LBL 33	31 Oct 79	1650	27	15	300

closely to those reported at the Mobile Site (see Table 6B-2). Cummings, Atwood and Parker (1979) do not provide the archival data for dissolved oxygen at this site. However, the dissolved oxygen profile found at Tampa fits within the envelope reported for the Gulf of Mexico.

Nutrients. At the Tampa Site the phosphates and silicates are generally low, Figure 6A-6, but the nitrates (with the exception of the 400m value, which is suspect) fall within the values expected from the archives (El-Sayed, et al., 1972 and Cummings, Atwood and Parker, 1979). At the Mobile Site the nitrate, phosphate and silicate values appear to be anomalously low. Poor preservation is suspected and the values may not be reliable. Even the Tampa results should not be used without careful consideration.

Biomass Indicators. At the Tampa Site, Station 3 (Figure 6A-10), the chlorophyll a maximum appears at 50 m with a maximum value for phaeophytin appearing at 75 m. The adenosine triphosphate maximum occurs with the chlorophyll maximum at 50 m. Pigments and microbial biomass decrease from the maximum values to a background level at 150 m.

At the Mobile Site, Station 14 (Figure 6A-11), the chlorophyll a, phaeophytin and adenosine triphosphate maxima occur at 50 m. From 50 m to 175 m, the three parameters decrease in value.

Biological Oceanographic Measurements

Zooplankton.

(1) Tampa. Table 6B-4 shows the total zooplankton abundance and the abundance of the major groups: copepods, non-copepod crustaceans, other invertebrates, and fish. Total zooplankton numbers ranged from 9 organisms m^{-3} (800m-200m tow) to 1207 m^{-3} (25m-0m tow, day). Numerically, copepods dominated the samples, comprising about 68%-86% of the total zooplankton. Other invertebrates were between 9 and 26%, non-copepod crustaceans from 1% to 16%, and fish 0.2% or less.

The relative abundance of the major orders of copepods is shown in Table 6B-5. In most samples the calanoids were approximately 1 1/2 times more numerous than the cyclopoids. An exception was in the 200m-0m sample where cyclopoids were slightly more numerous than calanoids. In all samples, harpacticoids comprised only a small percentage of the total copepods. The dominant genera of copepods present are shown in Table 6B-5.

The daytime vertical distribution of the zooplankton at the Tampa Site during October 1978 is shown in Figure 6A-12. Over 95% of the organisms in each major group occurred in the upper 200m with between 47%-85% occurring near the surface (25m-0m). No samples were taken below 800m, but previous Tampa collections had shown deep zooplankton abundance to be extremely low (see GOTEC 04, 05).

The zooplankton size class distribution at the Tampa Site as percent frequency is shown in Figure 6A-13 and Table 6B-6. In the

surface samples most of the zooplankton (84%-90%) were in size classes 2 and 3 (0.5 mm to 1.9 mm). A wider range of size classes were commonly found in the 200m-0m sample where 94% of all organisms were in size classes 1, 2 and 3 (up to 1.9 mm). In the deepest sample 93% of the organisms were in size classes 2, 3, and 4 (0.5 mm - 2.9 mm).

(2) Mobile. Table 6B-4 shows total zooplankton abundance and the abundance of the major groups: copepods, non-copepod crustaceans, other invertebrates, and fish (larvae and Cyclothone spp.). Total zooplankton abundance ranged from 1380 organisms m^{-3} (27 m horizontal tow, day) to 59 m^{-3} (702m-182m tow). Numerically, copepods dominated most of the samples, comprising 47% - 78% of the total zooplankton. Copepods did not predominate in the 27m day tow where other invertebrates (50%) were most numerous. Other invertebrates ranged from 14% to 38% in the other samples. Non-copepod crustaceans comprised 4% to 7% and fish larvae and Cyclothone spp. made up only 0.1% to 0.5% of the samples.

In all samples calanoid copepods were slightly more numerous than cyclopoid copepods. Harpacticoids comprised a small percentage (less than 1%) of the copepods. The dominant genera of copepods are listed in Table 6B-5.

The daytime vertical distribution of the zooplankton at the Mobile site is shown in Figure 6A-14. In all major groups, over 90% of the organisms occurred in the upper 200m with over half occurring near the surface (approximately 25 m, in this case). No samples were taken below 700m on this cruise, but previous Mobile collections had shown deep zooplankton abundance to be extremely low (see GOTEC 04, 05).

The zooplankton size class distribution as percent frequency is shown in Figure 6A-15 and Table 6B-6. Approximately three quarters of the organisms in each sample were in size classes 2 and 3 (0.5mm - 1.9mm).

Cruise Report for GOTEC-07

7-I. INTRODUCTION to GOTEC-07

The seventh cruise in this series was to the Gulf of Mexico, GOTEC-07, (17 to 20 December 1978, R/V Virginia Key) Tampa Site (27°39'N, 85°30'W) (Figure 1). This cruise was a joint effort between the Atlantic Oceanographic and Meteorological Laboratories (AOML) of the National Oceanic and Atmospheric Administration (NOAA) and the Lawrence Berkeley Laboratory (LBL). Researchers from Gulf Coast Research Laboratories and the University of South Florida also participated. Stations sampled within the general area of the site appear in the Station Log (Table 7-1). Hydrocasts were taken at three oceanographic stations to a maximum depth of 1000 meters. Samples were taken to be analyzed for salinity, dissolved oxygen, nutrients, chlorophyll a (Chl a), phaeophytin (phaeo), and adenosine triphosphate (ATP). Zooplankton samples were taken at four stations.

Molinari, Hazelworth and Ortman (1979) published the XBT, STD and current meter analysis. Ecological station values are presented graphically in Appendix 7A, and in tabular form in Appendix 7B.

7-II. STATION MEASUREMENTS made on GOTEC-07

Three stations were sampled using an STD (Plessey Environmental Systems Model 9040) with two 6-bottle hydrocasts using a rosette sampler equipped with 5-liter Niskin® bottles. Sea water from the hydrocasts was processed on deck. The Station Log (Table 7-1) summarizes the day, time, position and operations performed during this cruise. Methods are described in Section 7-III. Analytical methods will be published in greater detail in the future.

Physical Oceanographic Measurements

Temperature and Salinity. Samples were was taken with bottles at Stations 1, 2 and 13. The values appear in tabular form in Appendix 7B and are plotted in Appendix 7A, Figures 7A through 1 - 7A-3. All physical data is available from NODC and also has been published by Molinari, Hazelworth and Ortman (1979).

Chemical Oceanographic Measurements

Dissolved Oxygen. Samples are taken at Station 1. The results appear in tabular form in Appendix 7B and in Figure 7A-1.

Nutrients. Samples were taken at Station 1. Results were suspect and will not be presented until they can be validated.

Biomass Indicators. Samples for chlorophyll a, phaeophytin and adenosine triphosphate were collected at Station 2. Results are shown in Table 7B-2 and in Figure 7A-4.

Table 7-1 STATION LOG R/V Virginia Key Cruise GOTEC-07 Gulf of Mexico 17-20 December 1978

Station	Date	Time Z Universal or GMT EDT in parentheses	Position	Operations
A	18 December 1978 GMT 17 December 1978 (EST)	352:0114Z (2014) start tow	27°40'N, 85°30'W	Zooplankton Net Tow 1000m-surface, obl. (TAM 20)
B	18 December 1978 (GMT) 17 December 1978 (EST)	352:0228Z (2128) start tow	27°40'N 85°30'N	Zooplankton Net Tow 25m, hor. (TAM 21)
1	18 December 1978	352:1552Z (1052) begin hydrocast :1657(1157) AOML station time	27°41'N, 85°32;W	Hydrocast to 1000m (2 parts) 1) first half of cast to 200,300, 400,600,800,1000m 2) second half of cast to 0,25,50, 100,150m Temp at 25,50,100,150,200,300, 400,600,800,1000m Sal, DO and Nutr at 0,25,50,75,100,150,200, 300,400,600,800,1000m
1A	18 December 1978	352:1900Z (1400) start tow :1919(1419) first messenger :1935(1435) second messenger :2000(1500) end tow	27°41'N, 85°33'W	Zooplankton Net Tow 1000-800m, obl. (TAM 22)
1B	18 December 1978	352:2017Z (1517) start tow :2034(1534) first messenger :2054(1554) second messenger :2105(1605) end tow	27°42'N, 85°33'N	Zooplankton Net Tow 800-200m, obl. (TAM 23)
1C	18 December 1978	352:2112Z (1612) start tow :2121(1621) end tow	27°42'W, 85°34W	Zooplankton Net Tow 200m-surface, obl. (TAM 24) (TAM 24)
1D	18 December 1978	352:2130Z (1630) start tow :2145(1645) end tow	27°42'W, 85°33'W	Zooplankton Net Tow 25m, hor. (TAM 25)

Table 7-1 STATION LOG, R/V Virginia Key, Cruise GOTEC-07 Gulf of Mexico, 17-20 December 1978 (cont.)

Station	Date	Time Z Universal or GMT EDT in parentheses	Position	Operations
2	18-19 December 1978 (GMT) 18 December (EST)	352:2300Z (1800) start station :2315(1815) begin hydrocast, part 1 :353:0030 (1930) begin hydrocast, part 2	27°40'N, 85°33'W	Hydrocast to 300m 1) first half of hydrocast to 150, 175,200,225,250,300m 2) second half of 300m hydrocast to 0,25,50,75, 100,125m Chl a, Org and ATP at 0,25,50,75, 100,125,150,200,250,300m
13	19 December 1978	353:0530Z(0030) begin cast :0652(0152) end cast	27°40'N, 85°32'W	Hydrocast from 200-1000m Temp and Sal at 200,300,400 600,800,1000m

Abbreviations and procedures:

ATP = Adenosine triphosphate - sea water filtered through 0.45 µm filter, filter placed in boiling tris buffer for 20min., then test tube, filter, and buffer frozen.

Chl a = Chlorophyll a - sea water filtered through glass filter.

Nutr = Nutrients - sea water decanted into glass or polyethylene bottles and frozen.

Temp = Temperature

Sal = Salinity

DO = Dissolved oxygen

obl. = oblique tow

hor. = horizontal tow

Biological Oceanographic Measurements

Zooplankton. Samples were collected from 6 tows. Sample TAM 20 was sent to LBL for analysis. A complete description of the samples taken is provided in Table 7-2.

7-III. ANALYTICAL METHODOLOGY used on GOTEC-07

Methods used were the same as those used in GOTEC-04 and are described in Section 4-III with the exception of samples for chlorophyll a and phaeophytin which were split and collected on 0.45 µm and 5.0 µm pore size membrane filters. The purpose of this procedure was to examine size fraction contribution in the chlorophyll profile.

7-IV. DATA SUMMARY of GOTEC-07

Physical Oceanographic Measurements

Temperature and Salinity. Surface temperatures were 7°C cooler in December 1978 than during the summer, and salinities were higher. (See GOTEC-04). This pattern shows up clearly in the TS plots of Capurro and Reid (1972) and Molinari, Hazelworth and Ortman (1979). The surface waters at the Tampa Site more closely approximate Subtropical Underwater in the winter, than in the summer. The mixed layer extended to 50 meters, with temperatures within the layer being uniform with depth, leading to a well defined thermocline. Salinities showed a characteristic maximum at the 20°C level indicating the presence of the loop current (R.L. Molinari, personal communication), see Figures 7A-1, 7A-2, Stations 1 and 2.

Chemical Oceanographic Measurements

Dissolved Oxygen. Dissolved oxygen concentrations observed at the Tampa Site (see Table 7B-1, Station 1) fall within the archival envelope presented by Cummmings, Atwood and Parker (1979, p.40) for the northern Gulf of Mexico OTEC region. In fact, they fall within ± 0.2 ml/L of the central trend line (p.51).

Nutrients. The nutrient data is suspiciously low and will not be presented unless it can be validated.

Biomass Indicators. At the Tampa Site, Station 2, size fractions for pigments were examined. Three depths (0, 25, 300 m) do not show the predicted higher chlorophyll concentration from the smaller pore filters (0.45 µm). At these depths the larger pore size (5.0 µm) retained more chlorophyll (Table 7B-2). The chlorophyll profile sampled with 0.45 µm pore size filters shows a typical sub-tropical water column distribution with a maximum at 75m (0.096 µm/L), then a decrease with depth to values below 100 m ranging from 0.002-0.015 µm/L.

Table 7-2. Zooplankton Tow Log from R/V Virginia Key, Gulf of Mexico, Tampa Site 17 - 20 December 1978 (GOTEC-07)

Station #	Sample #	Date (local)	Time (EST)	Depth (m)	Tow Time (mins)	Vol. Water Filtered (m^3)
A	TAM 20	17 Dec 78	2014-2113	1000-0	59	629
B	TAM 21	17 Dec 78	2128-2143	25	15	443
1A	TAM 22	18 Dec 78	1419-1434	1000-800	15	382
1B	TAM 23	18 Dec 78	1534-1554	800-200	20	410
1C	TAM 24	18 Dec 78	1612-1621	200-0	9	168
1D	TAM 25	18 Dec 78	1630-1646	25	16	482

The phaeophytin profile shows the expected results of higher pigment concentration on the smaller pore filters (0.45 µm). The phaeophytin profiles are typical of other sub-tropical areas, which show low surface concentrations increasing to a maximum at depths ranging from 50 to over 100 m, then decreasing to low levels below 150 m. The phaeophytin profile from the 0.45 µm pore size filter shows a low surface value (0.05 µm/L), increasing to a maximum at 75 m (0.26 µm/L), then decreasing with depth. Below 150 m, the phaeophytin ranged from 0.007 to 0.012 µm/L. The larger pore (5.0 µm) profile shows a low surface concentration (0.015 µm/L) increasing to a maximum at 75 m (0.030 µm/L), then decreasing with depth to a range of 0.0043 to 0.0067 µm/L. The ATP profile showed high values above 100 m. Below 125 m, the ATP concentration decreased and remained at a low level ranging from 3.3 to 8.4 ng/L.

Biological Measurements

Zooplankton. Table 7B-3 shows the total zooplankton abundance and the abundance of the major groups: copepods, non-copepod crustaceans, other invertebrates, and fish. Total zooplankton numbers ranged from 14 organisms m^{-3} (800-200m tow) to 500 m^{-3} (25m tow, night). Numerically, copepods dominated the samples, comprising 72% to 88% of the total zooplankton. Other invertebrates were between 11% to 24% of the samples, non-copepod crustaceans were from 2% to 12%, and fish less than 0.1% of the samples.

The relative abundance of the major orders of copepods present is shown in Table 7B-4. The calanoid copepods were generally about two times more numerous than the cyclopoids except in the 200m - 0m sample where they were nearly equal in number. In all samples the harpacticoids comprised a small percentage of the total copepods. The dominant genera of copepods present and the number of taxa also are shown in Table 7B-4.

The daytime vertical distribution of the zooplankton during December 1978 is shown in Figure 7A-5. This distribution is similar to that found in previous Tampa OTEC collections in that there was a relatively high number of organisms near the surface gradually decreasing with depth (see GOTEC-04 through -06).

The zooplankton size class distribution as percent frequency is shown in Figure 7A-6 and Table 7B-5. In all but the 800m-200m sample over three quarters of the organisms were in size classes 2 and 3 (0.5mm - 1.9mm). In the 800m - 200m zone, 64% of the organisms occurred in size classes 2-3 and 21% occurred in size class 4 (2.0 mm - 2.9mm).

REFERENCES

ARMSTRONG, F.A.J. (1965) Phosphorus. In: Chemical Oceanography, 1st ed. Vol. 1, J.P. RILEY and G. SKIRROW, editors, Academic Press, London, pp. 323-364.

BALECH, E. (1967) Dinoflagellates and Tintinnids in the Northeastern Gulf of Mexico. Bulletin of Marine Science, 17, 280-298.

BEERS, J.R., M.H. REID, and G.L. STEWART (1975) Microplankton of the North Pacific Central Gyre. Population Structure and Abundance, June 1973. Int. Revue ges. Hydrobiol., 60, (5) 607-638

CAPURRO, L.R.A. and J.L. REID (1972) Contributions on the Physical Oceanography of the Gulf of Mexico. Gulf Publishing Company, Houston, 288 pp.

CRAIG, H.L., T. LEE, H. MICHEL, S. HESS, R. MUNIER, and M. PERLMUTTOR (1978) A Source Book of Oceanographic Properties Affecting Biofouling and Corrosion of OTEC plants at Selected Sites. Rosenstiel School of Marine and Atmospheric Science, Miami, FL. for Pacific Northwest Laboratory, Richland, DC. No. TR78-1, 25 pp.

CUMMINGS, S.R., D.K. ATWOOD and J.M. PARKER (1979) Inorganic Nutrients and Dissolved Oxygen Variation Determined from Historical Data at Three Proposed Ocean Thermal Energy Conversion (OTEC) Sites: Puerto Rico, St. Croix and Northern Gulf of Mexico. Atlantic Oceanographic and Meteorological Laboratories, Miami, FL, 1979, National Oceanic and Atmospheric Administration, NOAA Technical Memorandum ERL AOML-36, 67 pp.

CUPP, E.E. (1943) Marine Plankton Diatoms of the West Coast of North America. Bulletin of Scripps Institute of Oceanography, University of California Press, 237 pp.

EL-SAYED, S.Z., W.M. SACKETT, L.M. JEFFREY, A.D. FREDERICKS, R.D. SAUNDERS, P.S. CONGER, G.A. FRYXELL, K.A. STEIDINGER and S.A. EARL (1972) Chemistry, Primary Productivity and Benthic Algae of the Gulf of Mexico, In: Serial Atlas of the Marine Environment. V.C. BUSHNELL, editor, Folio 22, American Geographical Society, 1-29 pp.

GEMEINHARDT, K. (1930) Silicoflagellates. In: Rabenhorst's Kryptogamen-Flora, Vol. 10(2), Akademische Verlagsellschaft m.b.H., Leipzig, pp.1-88.

GRASSHOFF, K. (1976) Methods of Seawater Analysis, Verlag Chemie, New York, 317 pp.

HAMILTON, R.D., O. HOLM-HANSEN and J.D.H. STRICKLAND (1968) Notes on the occurrence of living microscopic organisms in deep water. Deep Sea Research, 15 (6), 651-656.

HENDEY, N.I. (1964) An Introductory Account of the Smaller Algae of British Coastal Waters. Part V: Bacillariophyceae (Diatoms). HMSO, London, 317 pp.

HOBSON, L.A. and C.J. LORENZEN (1972) Relationships of chlorophyll maxima to density structure in the Atlantic Ocean and Gulf of Mexico. Deep Sea Research, 19, 297-306.

HOLM-HANSEN, O. (1973) Determination of total microbial biomass by measurement of adenosine triphosphate. In: Estuarine Microbial Ecology, L.H. STEVESON and R.R. COLWELL, editors, University of South Carolina Press, Columbia, South Carolina, pp. 73-89.

HOLM-HANSEN, O. and C.R. BOOTH (1966) The measurement of Adenosine Triphosphate in the Ocean and its ecological significance. Limnology and Oceanography, 11, 510-519.

KARL, D.M. and O. HOLM-HANSEN (1978) Methodology and Measurement of Adenosine Adenylate Energy Charge Ratios in Environmental Samples. Marine Biology, 48, 185-197.

LA FOND, E.C. (1951) Processing Oceanographic Data. U.S. Naval H.O. Pub. No. #614, 427 pp.

MARINE SCIENCES GROUP (1979) Ocean Thermal Energy Conversion, Ecological Data Report from O.S.S. Researcher in Gulf of Mexico, July 12-23, 1977. Lawrence Berkeley Laboratory Report LBL-8945, 54 pp.

MARINE SCIENCES GROUP (1980a) Preliminary Data Report for the November 1977 GOTEC-02 Cruise to the Gulf of Mexico, Mobile Site, March 1980. Lawrence Berkeley Laboratory Report LBL-9437, 20 pp.

MARINE SCIENCES GROUP (1980b) Preliminary Data Report for the February 1978 GOTEC-03 Cruise to the Gulf of Mexico Mobile Site, March 1980, Lawrence Berkeley Laboratory, Report LBL-9438, 26 pp.

MOLINARI, R.L., S. BAIG,. D.W. BEHRINGER, G.A. MAUL, R. LEGECKIS (1977) Winter intrusions of the Loop Current. Science, 189, 505-507.

MOLINARI, R.L. and T.F. FESTA (1978) Ocean Thermal and Velocity Characteristics of the Gulf of Mexico Relative to the Placement of a Moored OTEC Plant. Atlantic Oceanographic and Meteorological Laboratories, Miami, FL, October, 1978, National Oceanic and Atmospheric Administration, NOAA Technical Memorandum ERL AOML-33, 106 pp.

MOLINARI, R.L., J.B. HAZELWORTH and D.A. ORTMAN (1979) Data from OTEC site characterization studies in the Gulf of Mexico and Tropical South Atlantic. Atlantic Oceanographic and Meteorological Laboratories, Miami, FL, 1979, National Oceanic and Atmospheric Administration, NOAA Technical Memorandum ERL AOML-39. 16 pp. and 13 Appendices.

MORSE, J.W. and J.J. ZULLIG (1979) OTEC Gulf of Mexico, Oxygen and Nutrient Measurements, June 1978 - June 1979. Final Report Subcontract 4984002, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Fl., 138 pp.

MURPHY, J. and J.P. RILEY (1962) A modified single solution method for the determination of phosphate in natural waters. Analytica Chimica Acta, 27, 31-36.

SAUNDERS, B.P. and D.A. GLENN (1969) Memoirs of the Hourglass Cruises: Diatoms, Vol. 1, Part 3. Marine Research Laboratory, Florida. Department of Natural Resouces, St. Petersburg, Florida. 119 pp.

SCHILLER, J. (1930) Coccolithineae. In: Rabenhorst's Kryptogamen-Flora, Akademische Verlagsellschaft m.b.H., Leipzig, pp. 89-267.

SPENCER, C.P. (1975), The micronutrient elements. In: Chemical Oceanography, Vol. 2, J.P. RILEY and G. SKIRROW, editors, 2nd edition Academic Press, London pp. 245-300.

STEIDINGER, K.A. (1973) Phytoplankton ecology: a conceptual review based on eastern Gulf of Mexico research. CRC Critical reviews in Microbiology, 3, 49-68.

STEIDINGER, K.A. and J. WILLIAMS (1970) Memoirs of the Hourglass Cruises. Dinoflagellates. Vol. 12, Marine Research Laboratory, Florida Department of Natural Resources, St. Petersburg, Florida, 251 pp.

STRICKLAND, J.D.H. and T.R. PARSONS (1972) A Practical Handbook of Seawater Analysis. Fisheries Research Board of Canada, Ottawa, Bulletin 167.

SVERDRUP, H.U., M.N. JOHNSON and R.H. FLEMING, (1942) The Oceans: Their Chemistry and General Biology, Prentice Hall, Inc., Englewood Cliffs, N.J., 1087 pp.

THOMAS, G., S.M. MINTON, and R.L. MOLINARI (1979) Data from the Atlantic Oceanographic and Meteorological Laboratories OTEC Plant Site Study in the Gulf of Mexico, July 1977. Atlantic Oceanographic and Meteorological Laboratories, Miami, Fl, January 1979, National Oceanographic and Atmospheric Administration, NOAA Technical Memorandum ERL AOML-34, 15 pp.

TIDWELL, D., C. CARDWELL, R.L. MOLINARI and D. ORTMAN (1978) Data from the Atlantic Oceanographic and Meteorological Laboratories Loop Current Monitoring Cruises, May 1975 through August 1976. AOML-NOAA Miami, FL, 1978, NOAA Technical Memorandum ERL-AOML-29, 15 pp.

UNITED STATES DEPARTMENT OF ENERGY (1979) Environmental Development Plan Ocean Thermal Energy Conversion. U.S. DOE/EDP-0034, 48 pp.

VACCARO, R.F., (1965) Inorganic Nitrogen in Sea Water In: Chemical Oceanography, Vol. 1, J.P. RILEY and G. SKIRROW, editors, 1st edition, Academic Press, London, pp. 265-408.

WATERBURY, J.B., S.W. WATSON, R.R.L. GUILLARD, and L.E. BRAND (1979) Widespread occurrence of a unicellular, marine, planktonic, cyanobacherium. Nature, 277, 293-294.

WINKLER, L.W. (1888) "Die Loslichkeit des Sauerstoffs in Wasser" Wasser. Ber. Orsch. Chem. Ges., 22, 1764-1774.

WOOD, E.J.F. (1968) Dinoflagellates of the Caribbean Sea and adjacent areas. University of Miami Press, 143 pp.

WOOD, E.J.F. (1971) Phytoplankton Distribution Caribbean Region. Symposium on Invs. Res. Caribbean Sea Adj. Regions, UNESCO, Paris. pp. 399-410.

YENTSCH, C.S. and D.W. MENZEL (1963) A Method for the Determination of Phytoplankton, Chlorophyll and Phaeophytin by Fluorescence. Deep Sea Res., 10, 221-321.

Appendix 4A

Figures Containing Data

This appendix contains figures displaying the results obtained on Cruise GOTEC-04 (12-15 June 1978) to the Gulf of Mexico.

Figures 4A-1 through 4A-5 show the physical oceanographic data for temperature, salinity, and sigma-t. The standard deviations are too small to show in this scale and can be considered to be less than the size of the dot.

Figures 4A-6 and 4A-7 present the nutrient data. No standard deviations were taken at this time; however, a subsequent determination of the precision of the instrument used (A Technicon AutoAnalyser®) showed that the precision ranged from no detectable variation to an average of approximately ± 0.03 µg at/L for phosphates and total phosphate. Precision for silicates was very high (generally no detectable variation, however variation of ± 0.25 µg at/L did occur and a few rare occurrences ± 1.0 µg at/L. Precision for nitrates was generally better than ± 0.5 µg at/L however, a few rare analyses gave higher values. Deviations of ammonia values ranged from ± 0.1 to 1.0 µg at/L.

Figures 4A-8 through 4A-10 show the biomass indicators phaeophytin and chlorophyll *a*. No standard deviations were obtained for the chlorophyll *a* determinations as only one sample from each depth at each station was taken. This was due to constraints on the volume of water available for biological analysis from each hydrocast.

Figures 4A-11 and 4A-13 show zooplankton vertical distributions during day-night for copepods, non-copepod crustaceans, and other invertebrates. Figures 4A-12 and 4A-14 show zooplankton size class distributions. Figure 4A-15 illustrates the vertical distribution of phytoplankton cells at Station 3.

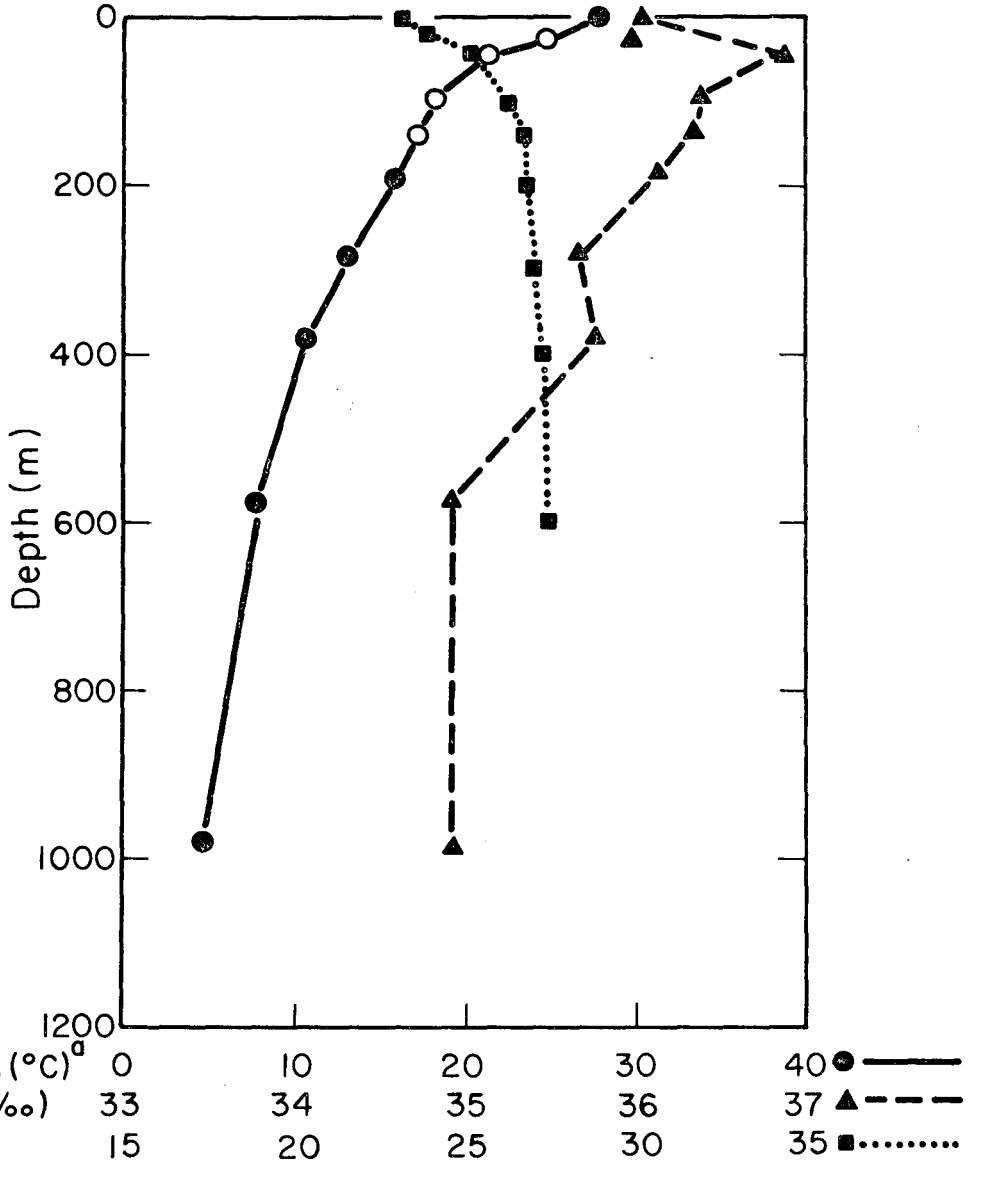
PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Sigma-t

GOTEC-04

Station I : Gulf of Mexico, Tampa Site, 27°39'N, 85°30'W

12 June 1978, 163:0900Z (0500 h EDT)



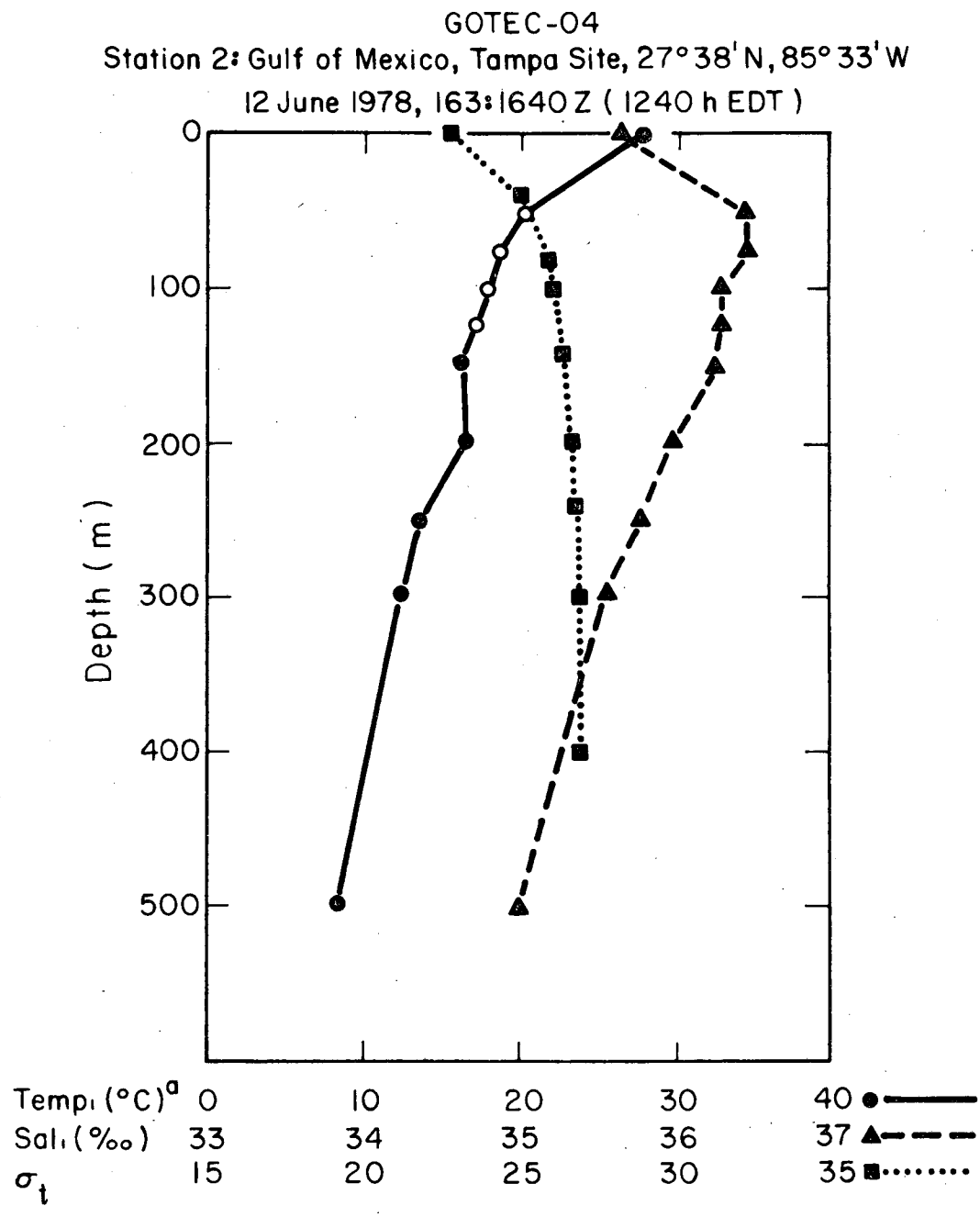
[a] *An open circle "o" indicates XBT data*

XBL 803-396

Figure 4A-1.

PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Sigma-t



[a] *An open circle "o" indicates XBT data*

XBL 803-395

Figure 4A-2.

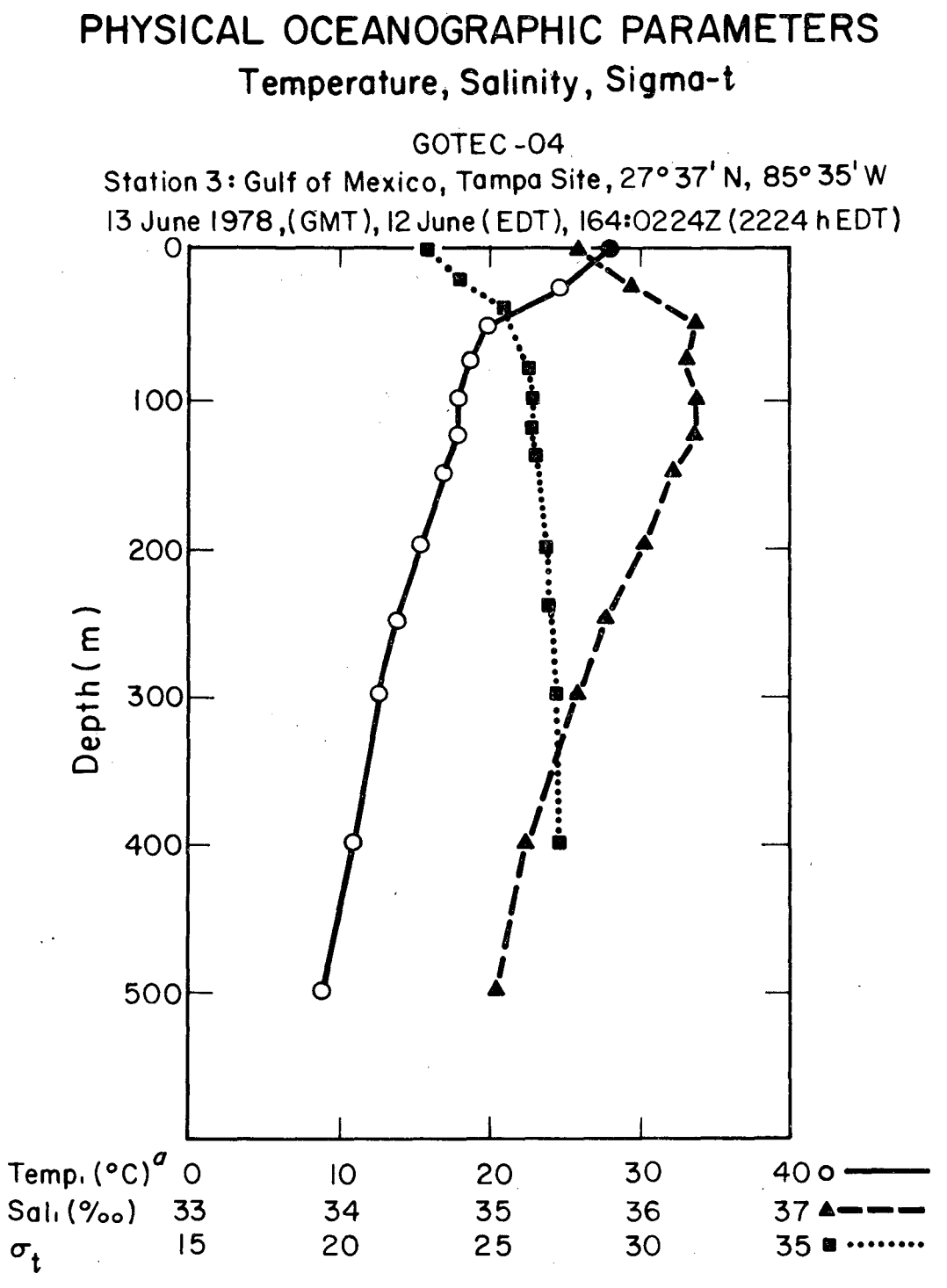

PHYSICAL OCEANOGRAPHIC PARAMETERS
Temperature, Salinity, Sigma-t
GOTEC-04
Station 3: Gulf of Mexico, Tampa Site, 27° 37' N, 85° 35' W
13 June 1978, (GMT), 12 June (EDT), 164:0224Z (2224 h EDT)
Depth (m)
0
100
200
300
400
500
Temp. (°C)[a] 0 10 20 30 40
Sali (‰) 33 34 35 36 37
σt 15 20 25 30 35
[a] An open circle "o" indicates XBT data
XBL 803-402

Figure 4A-3.

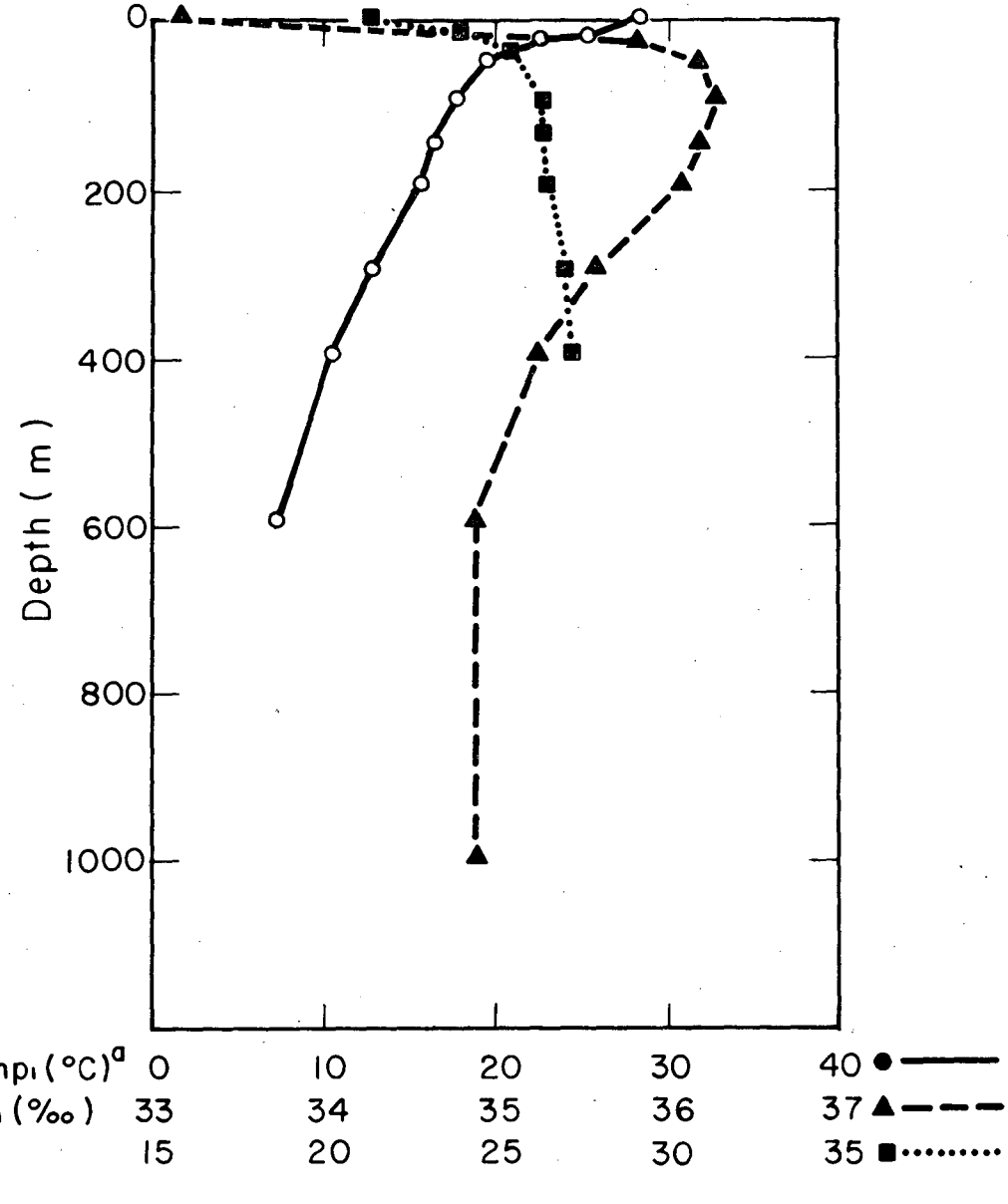
PHYSICAL OCEANOGRAPHIC DATA

Temperature, Salinity, Sigma-t

GOTEC-04

Station 4: Gulf of Mexico, Mobile Site, 29° 10' N, 87° 37' N

15 June 1978, (GMT), 14 June (EDT), 166:0049Z (2049 h EDT)



[a] *An open circle "o" indicates XBT data*

XBL 803-394

Figure 4A-4.

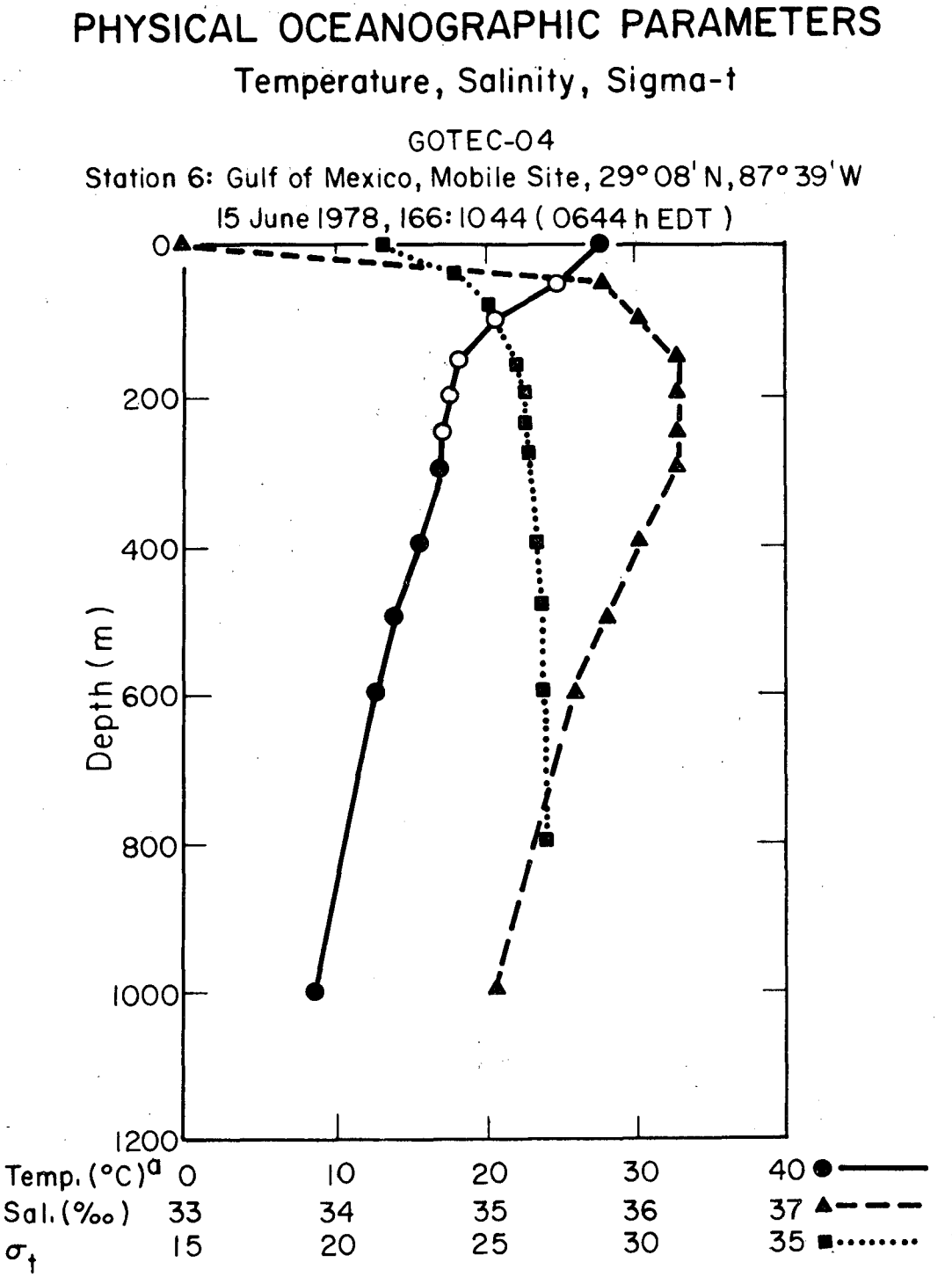

PHYSICAL OCEANOGRAPHIC PARAMETERS
Temperature, Salinity, Sigma-t
GOTEC-04
Station 6: Gulf of Mexico, Mobile Site, 29°08'N, 87°39'W
15 June 1978, 166:1044 (0644 h EDT)
Depth (m)
0
200
400
600
800
1000
1200
Temp. (°C)[a] 0 10 20 30 40
Sal. (‰) 33 34 35 36 37
σt 15 20 25 30 35
[a] An open circle "o" indicates XBT data
XBL 803-403

Figure 4A-5.

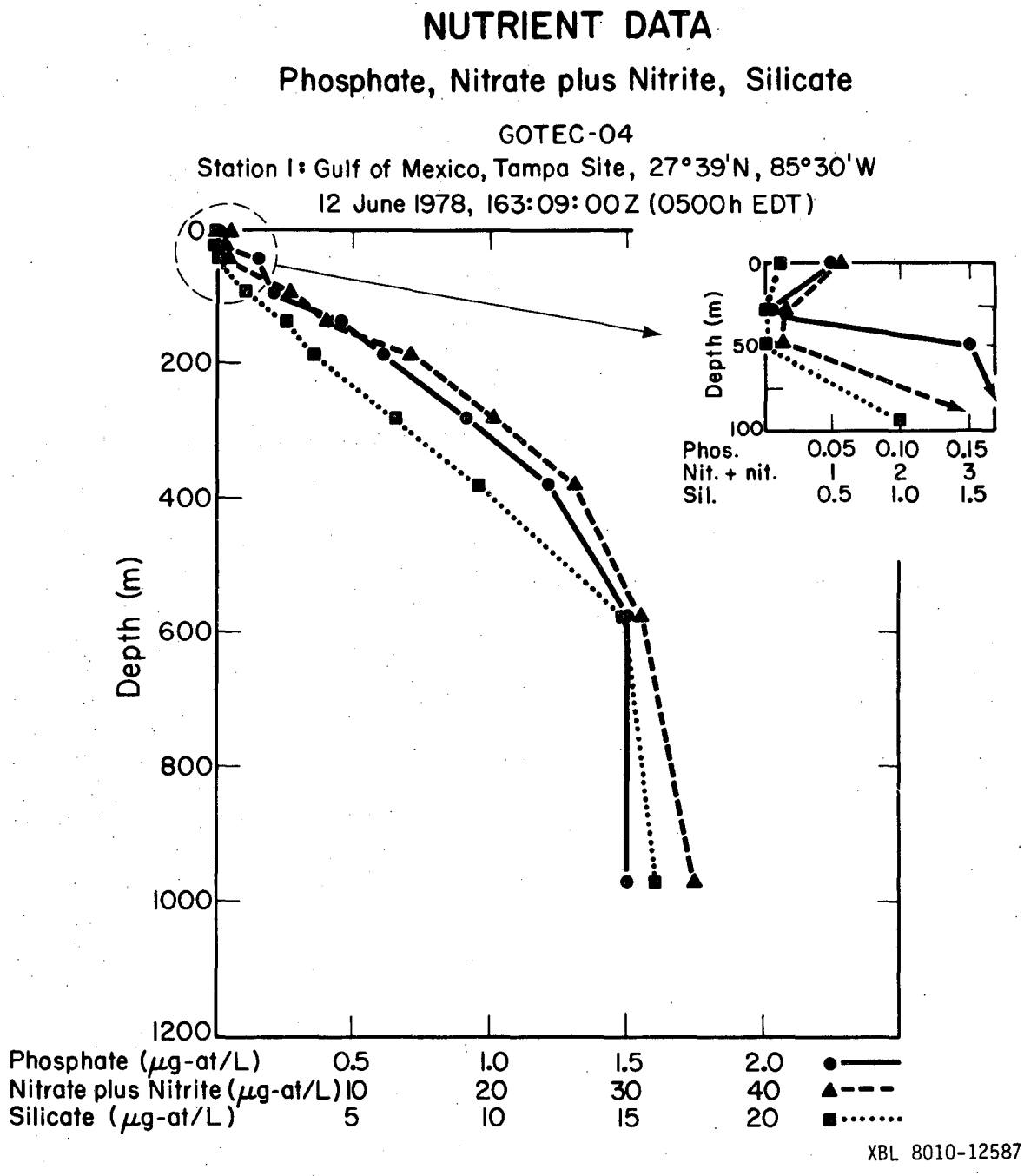

NUTRIENT DATA
Phosphate, Nitrate plus Nitrite, Silicate
GOTEC-04
Station 1: Gulf of Mexico, Tampa Site, 27°39'N, 85°30'W
12 June 1978, 163:09:00Z (0500h EDT)
Depth (m)
0
200
400
600
800
1000
1200
Depth (m)
0
50
100
Phos. 0.05 0.10 0.15
Nit. + nit. 1 2 3
Sil. 0.5 1.0 1.5
Phosphate (μg-at/L) 0.5 1.0 1.5 2.0
Nitrate plus Nitrite (μg-at/L) 10 20 30 40
Silicate (μg-at/L) 5 10 15 20
XBL 8010-12587

Figure 4A-6.

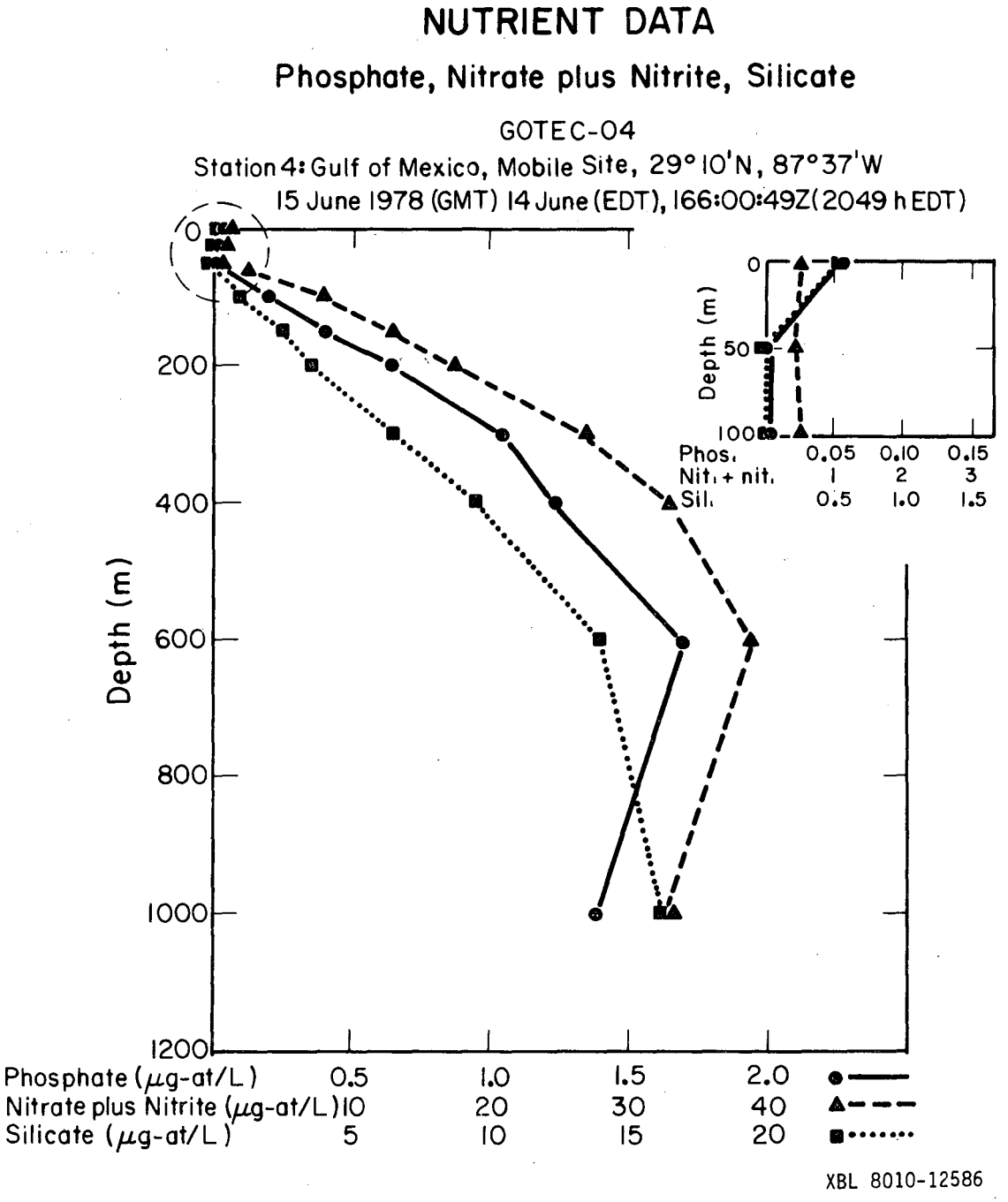

NUTRIENT DATA
Phosphate, Nitrate plus Nitrite, Silicate
GOTEC-04
Station 4: Gulf of Mexico, Mobile Site, 29° 10'N, 87°37'W
15 June 1978 (GMT) 14 June (EDT), 166:00:49Z (2049 h EDT)
Depth (m)
0
200
400
600
800
1000
1200
Phosphate (μg-at/L) 0.5 1.0 1.5 2.0
Nitrate plus Nitrite (μg-at/L) 10 20 30 40
Silicate (μg-at/L) 5 10 15 20
Depth (m)
0
50
100
Phos. 0.05 0.10 0.15
Nit. + nit. 1 2 3
Sil. 0.5 1.0 1.5
XBL 8010-12586

Figure 4A-7.

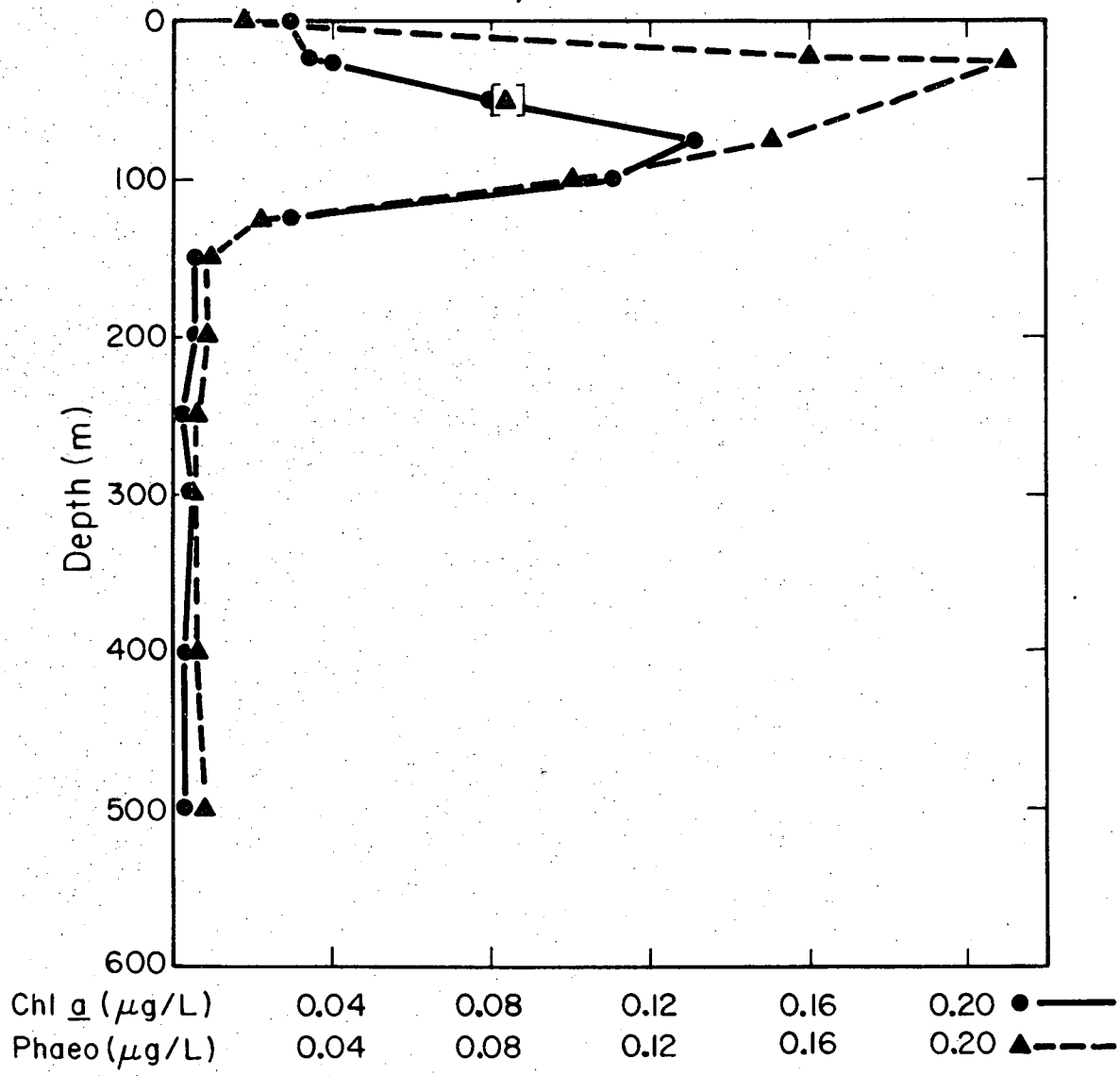
BIOMASS INDICATORS

Chlorophyll a, Phaeophytin

GOTEC-04

Station 2: Gulf of Mexico, Tampa Site, 27°38'N, 85° 33'W

12 June 1978, 163:1640Z (1240 h EDT)



[▲] *Points in brackets indicate questionable results*

XBL 803-404

Figure 4A-8.

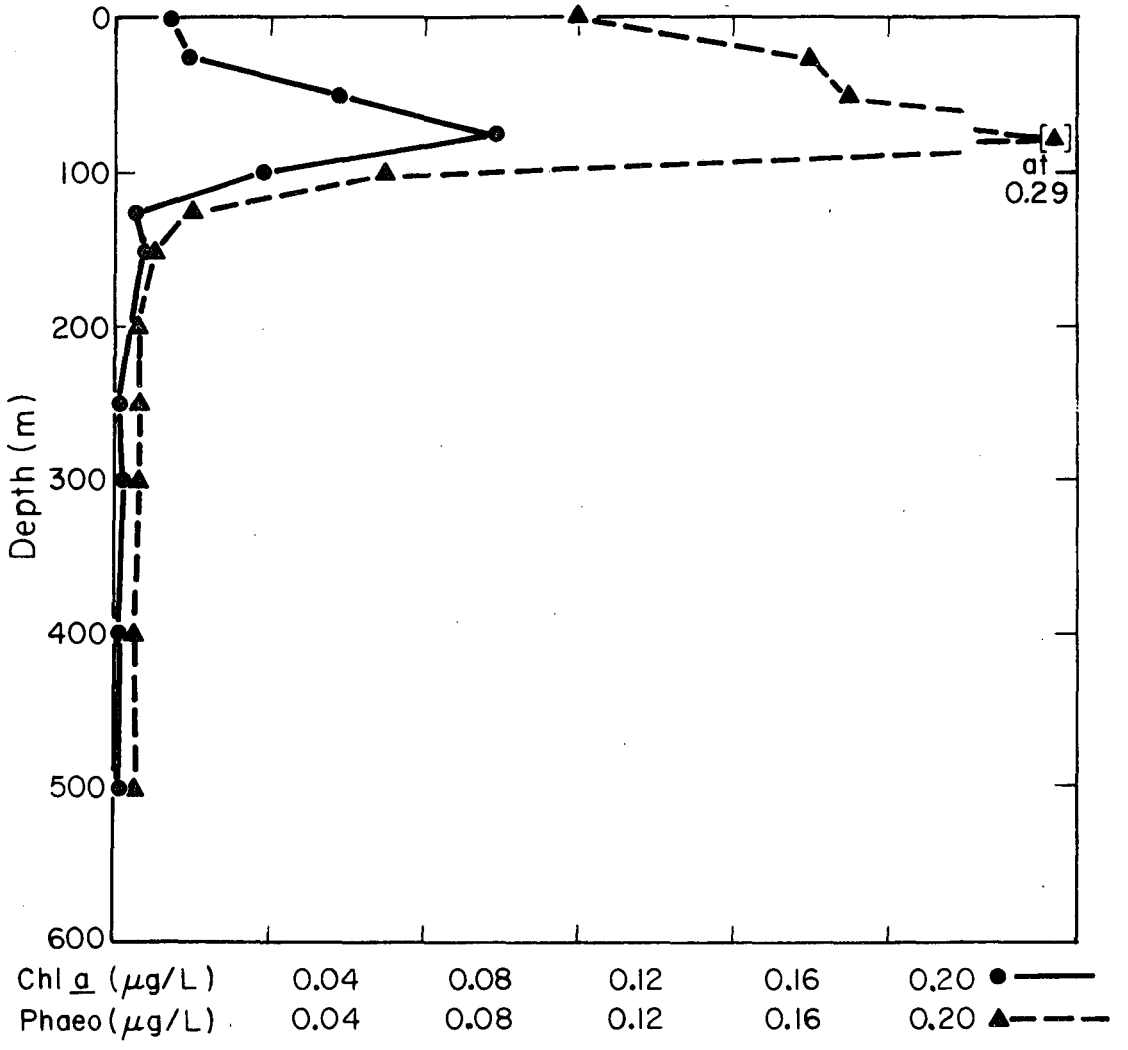
BIOMASS INDICATORS

Chlorophyll *a*, Phaeophytin

GOTEC-04

Station 3: Gulf of Mexico, Tampa Site, 27° 37'N, 85° 35'W

13 June 1978 (GMT), 12 June (EDT), 164:0224Z (2224h EDT)



[▲] *Points in brackets indicate questionable results*

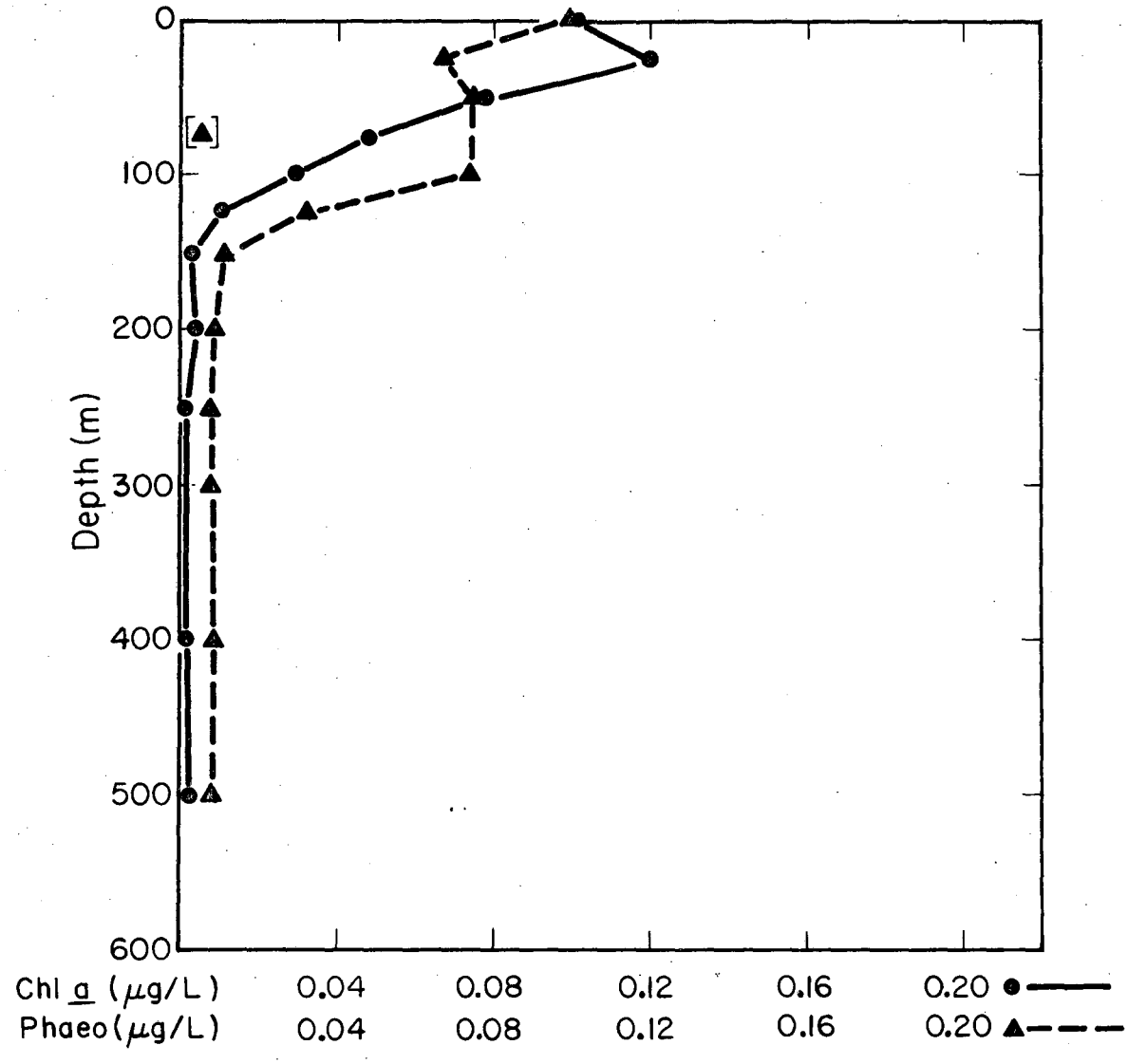
XBL 803-393

Figure 4A-9.

BIOMASS INDICATORS

Chlorophyll a, Phaeophytin

GOTEC-04
Station 6: Gulf of Mexico, Mobile Site, 29° 08'N, 87° 37'W
15 June 1978, 166:1044 Z (0644 h EDT)



[▲] *Points in brackets indicate questionable results*

XBL 803-397

Figure 4A-10.

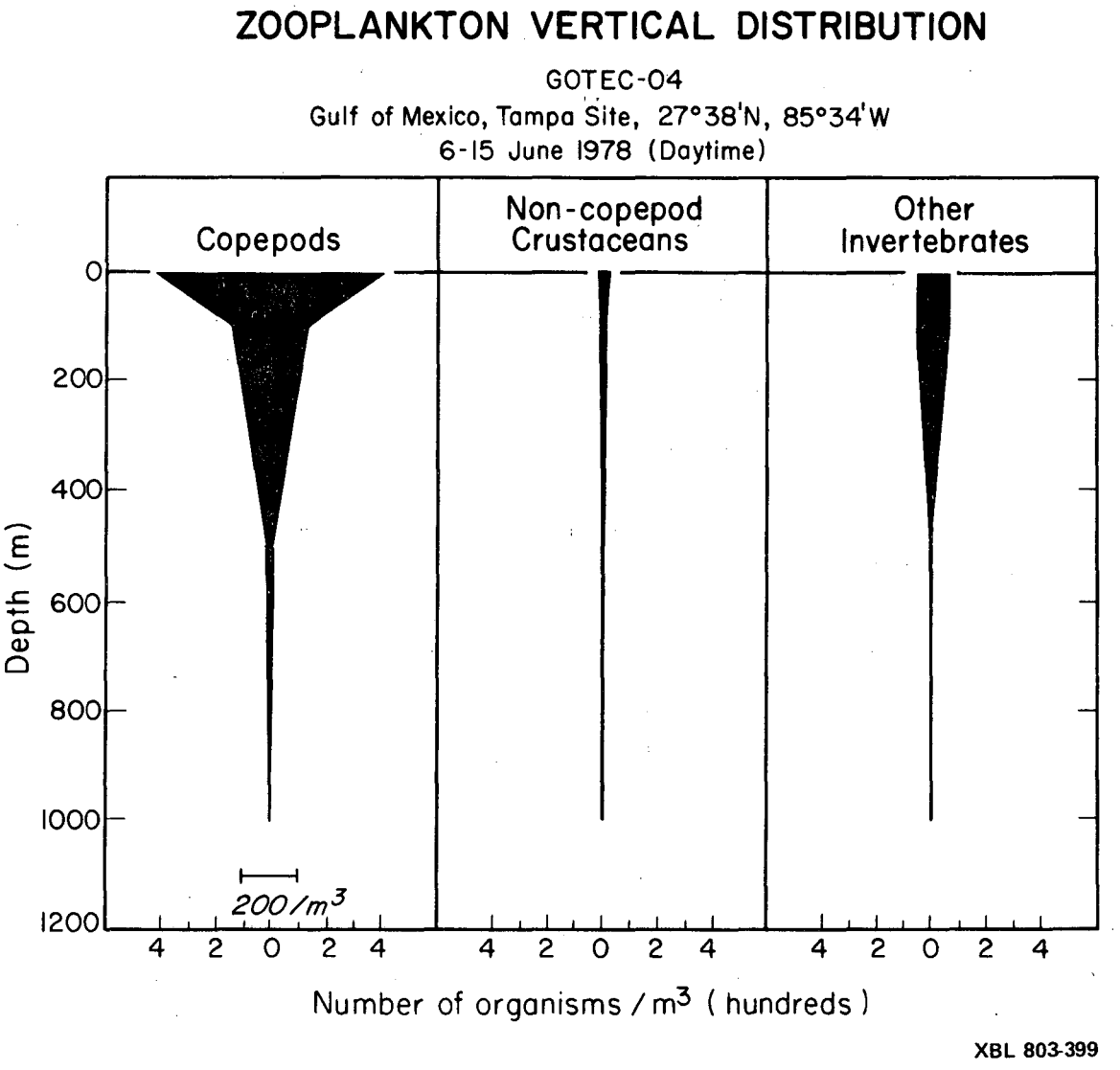

ZOOPLANKTON VERTICAL DISTRIBUTION
GOTEC-04
Gulf of Mexico, Tampa Site, 27°38'N, 85°34'W
6-15 June 1978 (Daytime)
Copepods
Non-copepod Crustaceans
Other Invertebrates
Depth (m)
0
200
400
600
800
1000
1200
200/m3
4 2 0 2 4
Number of organisms / m3 (hundreds)
XBL 803-399

Figure 4A-11.

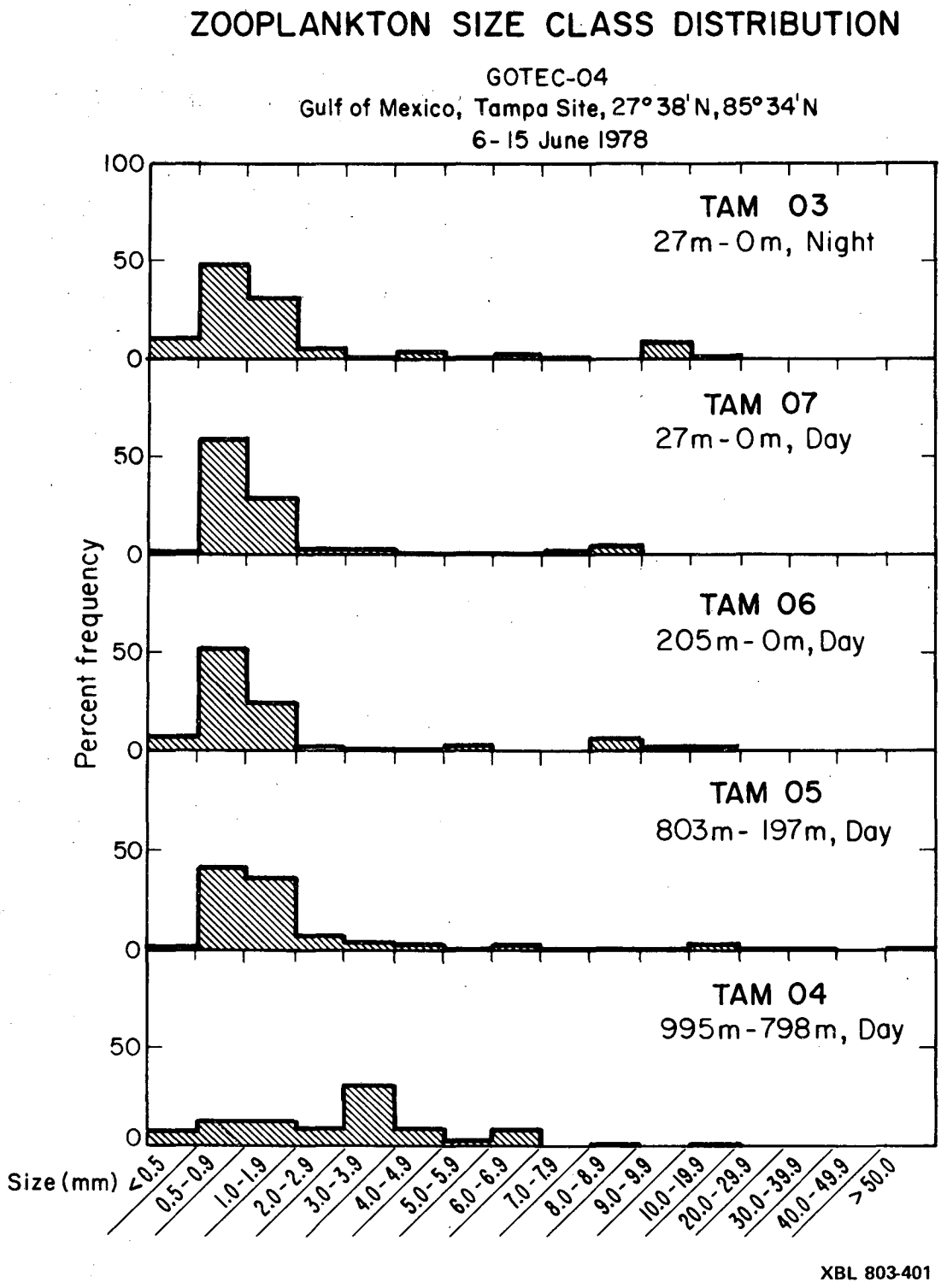

ZOOPLANKTON SIZE CLASS DISTRIBUTION
GOTEC-04
Gulf of Mexico, Tampa Site, 27°38'N, 85°34'N
6-15 June 1978
TAM 03
27m-0m, Night
TAM 07
27m-0m, Day
TAM 06
205m-0m, Day
TAM 05
803m-197m, Day
TAM 04
995m-798m, Day
Percent frequency
100
50
0
Size (mm)
<0.5
0.5-0.9
1.0-1.9
2.0-2.9
3.0-3.9
4.0-4.9
5.0-5.9
6.0-6.9
7.0-7.9
8.0-8.9
9.0-9.9
10.0-19.9
20.0-29.9
30.0-39.9
40.0-49.9
>50.0
XBL 803-401

Figure 4A-12.

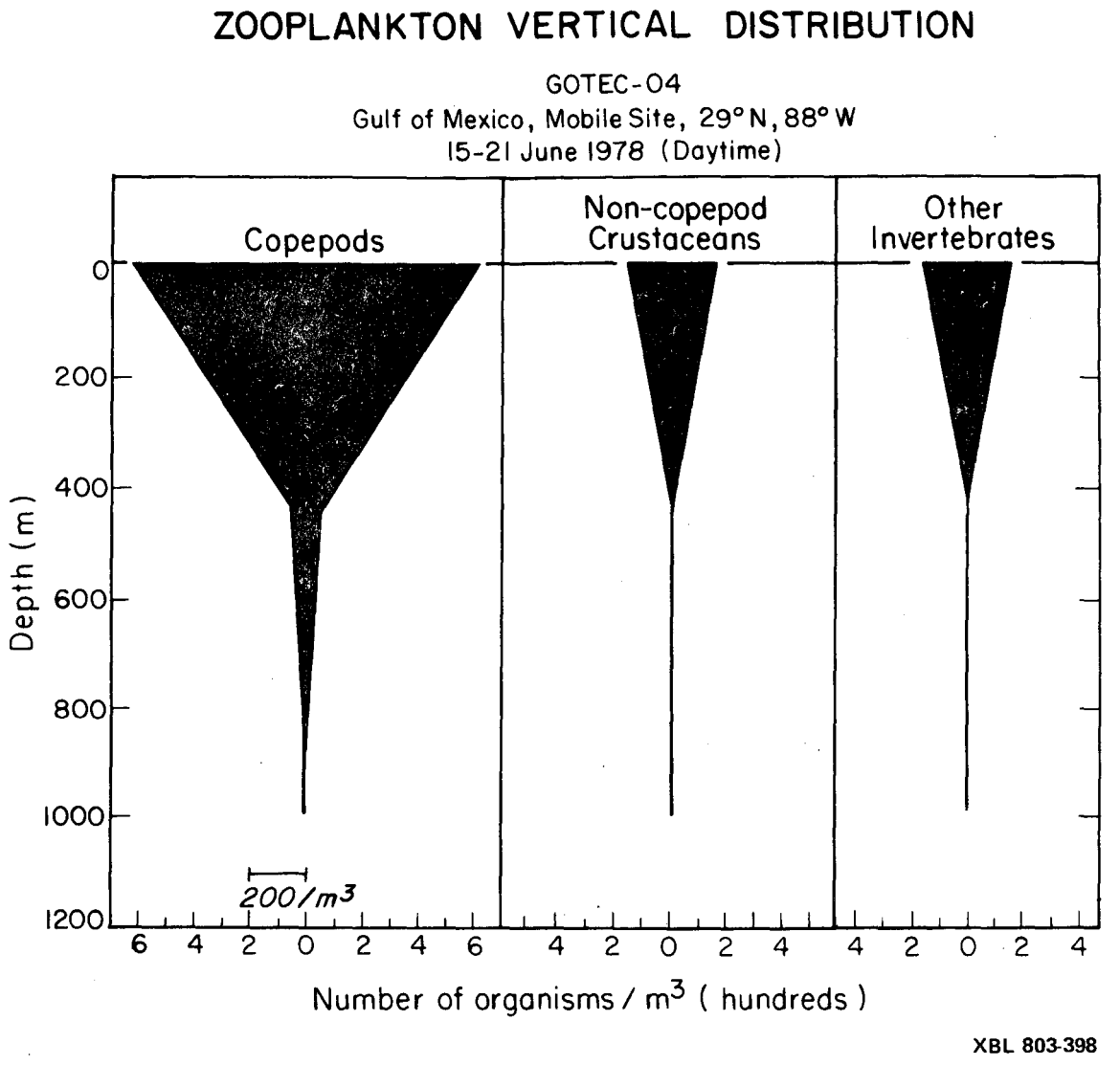

ZOOPLANKTON VERTICAL DISTRIBUTION
GOTEC-04
Gulf of Mexico, Mobile Site, 29° N, 88° W
15-21 June 1978 (Daytime)
Copepods
Non-copepod Crustaceans
Other Invertebrates
Depth (m)
0
200
400
600
800
1000
1200
200/m3
6 4 2 0 2 4 6
4 2 0 2 4
4 2 0 2 4
Number of organisms / m3 (hundreds)
XBL 803-398

Figure 4A-13.

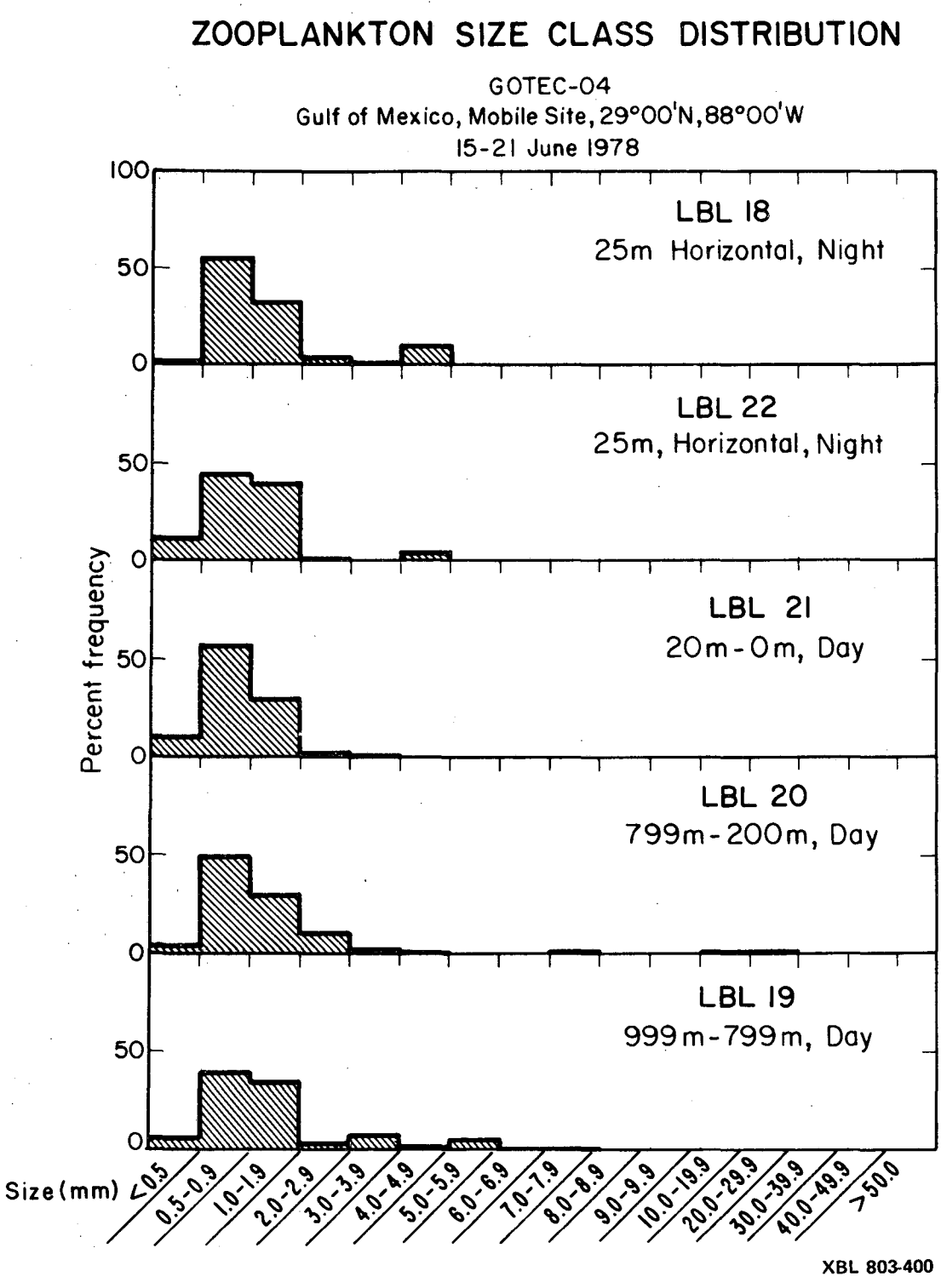

ZOOPLANKTON SIZE CLASS DISTRIBUTION
GOTEC-04
Gulf of Mexico, Mobile Site, 29°00'N, 88°00'W
15-21 June 1978
LBL 18
25m Horizontal, Night
LBL 22
25m, Horizontal, Night
LBL 21
20m-0m, Day
LBL 20
799m-200m, Day
LBL 19
999m-799m, Day
Percent frequency
100
50
0
Size (mm)
<0.5
0.5-0.9
1.0-1.9
2.0-2.9
3.0-3.9
4.0-4.9
5.0-5.9
6.0-6.9
7.0-7.9
8.0-8.9
9.0-9.9
10.0-19.9
20.0-29.9
30.0-39.9
40.0-49.9
>50.0
XBL 803-400

Figure 4A-14.

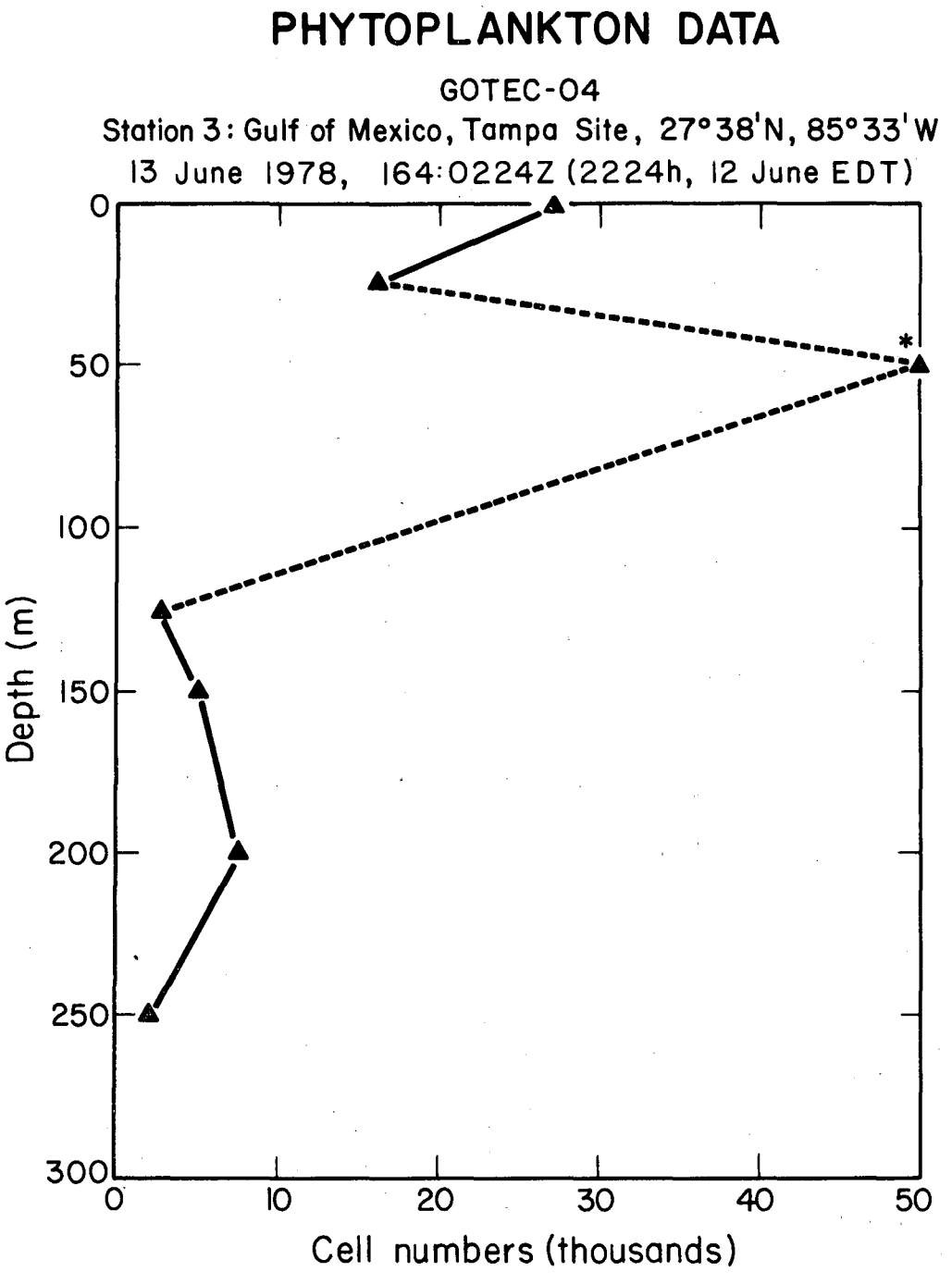

PHYTOPLANKTON DATA
GOTEC-04
Station 3: Gulf of Mexico, Tampa Site, 27°38'N, 85°33'W
13 June 1978, 164:0224Z (2224h, 12 June EDT)
Depth (m)
0
50
100
150
200
250
300
0
10
20
30
40
50
Cell numbers (thousands)
*50 m sample from Cast #2, 12 June 1978, 163:1640Z
(1240 h EDT), 27°38'N, 85°33'W
XBL 806-1255

Figure 4A-15.

Appendix 4B

Tables

Standard deviations were not routinely calculated for the data in Tables 4B-1 through 4B-3. Generally the following variabilities may be expected:

Temperature:	Bottle Thermometer	±0.01
	STD's	±0.02
Salinity		±0.003

No standard deviations were calculated for the nutrients at this time; however, a subsequent determination of the precision of the instrument used (A Technicon AutoAnalyser®) showed that the precision ranged from no detectable variation to an average of approximately ± 0.03 µg at/L for phosphates and total phosphate. Precision for silicates was very high (generally no detectable variation, however variation of ± 0.25 µg at/L did occur and a few rare occurrences ± 1.0 µg at/L. Precision for nitrates was generally better than ± 0.5 µg at/L however, a few rare analyses gave higher values. Deviations of ammonia values ranged from ± 0.1 to 1.0 µg at/L.

As has been mentioned in the introduction to Appendix 4A, volume constraints prevented statistical analysis for the biological data.

Table 4B-1. Physical oceanographic parameters from R/V Virginia Key, Gulf of Mexico, Tampa Site, 6-21 June 1978 (GOTEC-04)

OBSERVED			INTERPOLATED			COMPUTED
Observed depth (m)	Temp. (°C)	Salinity (‰)	Standard depth (m)	Temp. (°C)	Salinity (‰)	Sigma-t
Station 1. Position: 27°39'N, 85°31°W (Tampa Site), 12 June 1978 Time: 163:0900Z (0500 EDT)						
0	27.90	36.025	0	27.90	35.89	23.11
22[a]	25.0[b]	36.022	20	26.09	36.28	23.99
25[a]	24.6[b]	35.965				
28[a]	24.0[b]	35.964				
44[a]	21.3[b]	[36.858]*[c]	40	22.12	36.36	25.23
98[a]	18.2[b]	[36.362]	100	18.18	36.42	26.33
139[a]	17.3[b]	36.317	140	17.24	36.34	26.49
186	15.97	36.138	200	15.31	36.09	26.76
283	13.03	35.656	300	12.17	35.66	27.08
380	10.52	35.263	400	9.77	35.33	27.26
576	7.62	34.921	600	7.11	35.01	27.43
972	4.78	34.929				
Station 2. Position: 27°38'N, 85°33'W (Tampa Site), 12 June 1978 Time: 163:1640Z (1240 EDT)						
0	28.00	35.676	0	28.00	35.68	22.92
			20	25.43	36.00	23.98
50[a]	20.4[b]	36.445	40	21.70	36.07	25.13
75[a]	19.0[b]	36.462	80	18.81	36.29	26.07
100[a]	18.2[b]	36.292	100	18.06	36.32	26.28
125[a]	17.4[b]	36.290				
150	16.78	36.251	140	17.36	36.31	26.44
198	[16.83]	[35.996]	200	15.10	36.06	26.78
247	13.89	35.779	240	13.80	35.87	26.91
297	12.60	35.586	300	12.15	35.62	27.05
395	-[d]	-	400	9.91	35.23	27.16
490	8.69	35.030				
Station 3. Position: 27°38'N, 85°33'W (Tampa Site), 13 June, 12 June 1978 (EST) Time: 164:0224Z (2224 EST)						
0	28.0[b]	35.620	0	28.8	35.61	22.84
25[a]	24.5[b]	35.931	20	25.13	35.83	23.94
50[a]	19.8[b]	36.361	40	20.44	36.19	25.56
75[a]	18.5[b]	36.318	80	18.22	36.30	26.22
100[a]	17.8[b]	36.365	100	17.96	36.35	26.33
125[a]	17.6[b]	36.353	120	17.61	36.35	26.41
150[a]	16.7[b]	36.226	140	17.04	36.31	26.52
200[a]	15.4[b]	36.007	200	15.02	36.07	26.80
250[a]	13.8[b]	35.772	240	13.52	35.88	26.98
300[a]	12.5[b]	35.570	300	11.89	35.65	27.13
400[a]	10.7[b]	35.235	400	9.81	35.30	27.23
500[a]	8.7[b]	35.031				

[a]Wire out

[b]XBT temperature

[c]Brackets indicate questionable data

[d]Dashes indicate data not available

Table 4B-1 (continued). Physical oceanographic parameters from R/V Virginia Key, Gulf of Mexico, Mobile Site, 6-21 June 1978 (GOTEC-04)

OBSERVED			INTERPOLATED			COMPUTED
Observed depth (m)	Temp. (°C)	Salinity (‰)	Standard depth (m)	Temp. (°C)	Salinity (‰)	Sigma-t
Station 4. Position: 29°10'N, 87°37'W (Mobile Site), 15 June 1978 (14 June EDT) Time: 166:0049Z (2049 EDT)						
0	28.3[b]	33.148	0	28.16	33.72	21.42
			20	24.73	35.88	24.10
25[a]	24.9[b]	35.842				
28[a]	22.5[b]	35.826				
50[a]	19.6[b]	36.216	40	20.04	35.90	25.45
100[a]	17.9[b]	36.309	100	17.40	36.30	26.43
150[a]	16.8[b]	36.216	140	16.64	36.23	26.55
200[a]	15.9[b]	36.114	200	14.26	36.07	26.47
300[a]	12.7[b]	35.608	300	11.39	35.55	27.15
400[a]	10.4[b]	35.256	400	8.99	35.28	27.35
600[a]	7.3[b]	34.903				
995	-[d]	34.929				
1000	-	34.936				
Station 6. Position: 29°08'N, 87°37'W (Mobile Site), 15 June 1978 Time: 166:1044Z (0644 EDT)						
0	27.70	32.962	0	28.34	33.62	21.26
25[a]	25.0[b]	35.844	20	24.75	35.91	24.12
50[a]	20.8[b]	36.088	40	21.36	36.01	25.18
75[a]	18.4[b]	36.272	80	18.35	36.35	26.23
100[a]	17.7[b]	36.267	100	17.86	36.39	26.38
125[a]	17.3[b]	36.270	120	17.49	36.38	26.47
150	17.06	36.283	140	17.24	36.37	26.52
200	15.59	36.049	200	15.44	36.12	26.75
250	14.03	35.820	240	14.06	35.93	26.90
300	12.65	35.599	300	12.33	35.68	27.07
400	-	-	400	10.19	35.33	27.19
500	8.66	35.077				

[a]Wire out
[b]XBT temperature
[c]Brackets indicate questionable data
[d]Dashes indicate data not available

Table 4B-2. Nutrient data from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Sites, 6-21 June 1978 (GOTEC-04)

Observed Depth (m)	Dissolved Oxygen (ml/l)	Phosphates (µg-at/L)	Nitrites (µg-at/L)	Nitrates and Nitrites (µg-at/L)	Silicates (µg-at/L)	Ammonia (µg-at/L)
Station 1. Position: 27°39'N, 85°31'W (Tampa Site) Time: 163:0900Z, 12 June 1978 (0500 EDT)						
0	a	0.0	0.17	1.2	0.1	b
22	a	ND[e]	0.10	0.2	ND	b
25	a	ND	0.05	0.3	ND	b
28	a	ND	ND	0.1	0.5	b
44	a	0.1	0.03	0.2	ND	b
98	a	0.2	0.05	5.00	1.0	b
139	a	0.45	0.06	8.0	2.5	b
186	a	0.6	0.07	14.0	3.5	b
283	a	0.9	0.08	20.0	6.5	b
380	a	1.2	0.05	26.0	9.5	b
576	a	1.5	0.06	31.0	15.0	b
972	a	1.5	0.12	35.0	[16.0][c]	b
Station 4. Position: 29°10'N, 87°37' (Mobile Site) Time: 166:0049Z, 15 June 1978 (14 June, 2049 EDT)						
0	a	0.0	ND	0.5	0.5	b
25[d]	a	ND	ND	0.4	ND	b
28[d]	a	ND	ND	0.2	ND	b
50[d]	a	ND	0.05	0.5	ND	b
100[d]	a	0.2	0.05	8.0	1.0	b
150[d]	a	0.4	0.10	13.0	2.5	b
200[d]	a	0.6	0.08	17.5	3.5	b
300[d]	a	1.1	0.08	[27.0][c]	6.5	b
400[d]	a	1.3	0.09	[33.0]	9.5	b
600[d]	a	1.7	0.10	[39.0]	[14.0][c]	b
955[d]	a	1.4	0.10	[33.0]	[16.5]	b
1000[d]	a	1.4	0.10	[33.0]	[16.5]	b

[a]No usable dissolved oxygen data - sample jackets not filled
[b]No usable ammonia data - bottles not adequately filled
[c]Brackets indicate questionable data
[d]Wire out
[d]ND = None Detected

Table 4B-3. Biomass indicator data from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Sites, 6-21 June 1978 (GOTEC-04)

Observed depth[a] (m)	Chl a (µg/L)	Phaeo (µg/L)
Station 2. Position: 27°38'N, 85°33'W (Tampa Site) Time: 163:1640Z, 12 June 1978 (1240 EDT)		
0	0.029	0.017
22	0.034	0.16
25	0.039	0.21
50	0.079	0.083
75	0.13	0.15
100	0.11	0.10
125	0.029	0.022
150	0.005	0.009
200	0.005	0.008
250	0.002	0.006
300	0.005	0.004
400	0.003	0.006
500	0.003	0.008
Station 3. Position: 27°38'N, 85°33'W (Tampa Site) Time: 164:0224Z, 13 June 1978 (12 June, 2224 EDT)		
0	0.024	0.12
25	0.029	0.18
50	0.058	0.19
75	0.098	0.29
100	0.038	0.07
125	0.005	0.01
150	0.008	0.01
200	0.003	0.006
250	0.001	0.006
300	0.002	0.006
400	0.001	0.005
500	0.001	0.005
Station 6. Position: 29°08'N, 87°37'W (Mobile Site) Time: 166:1044Z, 15 June 1978 (0644 EDT)		
0	0.10	0.067
25	0.12	0.075
50	0.078	0.005
75	0.048	0.074
100	0.029	0.032
125	0.010	0.011
150	0.002	0.008
200	0.003	0.005
250	0.001	0.007
300	-[c]	0.007
400	0.001	0.008
500	0.002	0.007

[a] All depths are wire out, except surface

[b] No data for ATP

[c] Dash indicates no data

Table 4B-4. Zooplankton Abundance Data from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Sites, 6-21 June 1978 (GOTEC-04)

LBL sample no. and tow description	Copepods		Non-copepod Crustaceans		Other invertebrates		Fish larvae and eggs		Total zooplankton
	Density[a]	Percent	Density	Percent	Density	Percent	Density	Percent	Density
				TAMPA SITE					
TAM-03 27-0 m obl. night	383.7	74.8	13.8	2.7	113.2	22.1	2.0	0.4	512.7
TAM-04 995-798 m obl. day	2.1	92.9	0.10	4.4	0.06	2.7	-	-	2.26
TAM-05 803-197 m obl. day	23.1	86.5	1.2	4.5	2.4	9.0	0.03	0.1	26.7
TAM-06 205-0 m obl. day	277.0	68.2	11.5	2.8	117.5	28.9	-	-	406.0
TAM-07 27-0 m obl. day	799.3	84.1	23.2	2.4	123.8	13.0	3.7	0.4	950.0
				MOBILE SITE					
18. 26 m hor. night	2474.3	61.6	730.7	18.2	806.8	20.1	5.4	0.1	4017.2
19. 999-799 m obl. day	9.2	77.3	1.1	9.2	1.6	13.5	-	-	11.9
20. 799-200 m obl. day	85.0	82.8	7.6	7.4	9.9	9.6	0.2	.2	102.7
21. 20-0 m obl. day	1255.6	66.4	335.1	17.7	294.8	15.6	5.3	0.3	1890.8
22. 25 m hor. day	824.1	78.5	61.5	5.9	164.0	15.6	-	-	1049.6

[a]Density measured as number of organisms per cubic meter

Table 4B-5. Copepod Taxonomic Composition from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Sites, 6-21 June 1978 (GOTEC-04)

LBL Sample No.	Tow type	Depth[a] (m)	Dominant genera (% total copepods)		% composition by order		No. of taxa[b]
			TAMPA SITE				
TAM-03	Obl. night	27-0	Oncaea	55.4	Cyclopoida	80.9	39
			Oithona	14.7	Calanoida	17.3	
			Corycaeus	5.9	Harpacticoida	1.8	
			Farranula	3.4			
			Clausocalanus	3.2			
			Mecynocera	3.2			
TAM-04	Obl. day	995-798	Eucalanus	49.8	Calanoida	79.5	33
			Conaea	10.9	Cyclopoida	18.8	
			Rhincalanus	7.9	Harpacticoida	1.7	
			Oncaea	5.7			
			Mormonilla	4.6			
TAM-05	Obl. day	803-197	Oncaea	29.6	Cyclopoida	55.5	41
			Oithona	13.3	Calanoida	44.3	
			Eucalanus	9.0	Harpacticoida	0.2	
			Mormonilla	6.2			
			Paracalanus	5.0			
TAM-06	Obl. day	205-0	Clausocalanus	20.6	Cyclopoida	54.6	38
			Oncaea	20.3	Calanoida	44.4	
			Oithona	17.1	Harpacticoida	1.0	
			Farranula	12.1			
			Paracalanus	6.5			
TAM-07	Obl. day	27-0	Clausocalanus	32.6	Calanoida	58.0	28
			Oncaea	16.5	Cyclopoida	40.8	
			Paracalanus	11.1	Harpacticoida	1.2	
			Oithona	10.2			
			Farranula	9.3			

[a]Depth given is average depth for horizontal tows, starting and ending depths for vertical tows
[b]Represents number of species identified plus genera not identified to species level

Table 4B-5 (continued) Copepod Taxonomic Composition from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Sites, 6-21 June 1978 (GOTEC-04)

LBL Sample No.	Tow type	Depth[a] (m)	Dominant genera (% total copepods)		% composition by order		No. of taxa[b]
			MOBILE SITE				
18	Hor. night	26	Oncaea	27.8	Cyclopoida	58.6	25
			Oithona	14.6	Calanoida	40.7	
			Corycaeus	14.3	Harpacticoida	0.7	
			Temora	9.9			
			Paracalanus	7.6			
19	Obl. day	999-799	Conaea	26.2	Cyclopoida	56.0	26
			Oithona	15.3	Calanoida	43.2	
			Oncaea	10.5	Harpacticoida	0.8	
			Eucalanus	10.5			
			Mormonilla	5.4			
20	Obl. day	799-200	Oithona	40.5	Cyclopoida	53.9	27
			Eucalanus	10.3	Calanoida	46.1	
			Conaea	7.2	Harpacticoida	0	
			Mormonilla	6.6			
			Oncaea	5.3			
21	Obl. day	20-0	Oithona	23.9	Cyclopoida	56.8	31
			Oncaea	22.6	Calanoida	42.4	
			Temora	9.4	Harpacticoida	0.8	
			Corycaeus	7.0			
			Paracalanus	7.0			
22	Hor. day	25	Oncaea	40.8	Cyclopoida	73.1	18
			Oithona	19.9	Calanoida	23.9	
			Temora	9.0	Harpacticoida	3.0	
			Corycaeus	8.5			
			Calocalanus	7.5			

[a]Depth given is average depth for horizontal tows, starting and ending depths for vertical tows
[b]Represents number of species identified plus genera not identified to species level

Table 4B-6. Zooplankton Size Class Distribution Data from R/V Virginia Key, Gulf of Mexico, 6-21 June 1978 (GOTEC-04)

TAMPA SITE
LBL tow number and description

	TAM-03 27-0 m night		TAM-04 995-798 m day		TAM-05 803-197 m day		TAM-06 205-0 m day		TAM-07 27-0 m day	
Size class	Density[a]	Percent	Density	%	Density	%	Density	%	Density	%
0.5	49.7	9.7	0.2	9.0	0.5	1.9	36.7	9.0	18.5	1.9
0.5-0.9	236.1	46.0	0.3	13.5	11.1	41.7	218.2	53.5	546.6	59.2
1.0-1.9	148.0	28.9	0.3	13.5	9.7	36.4	102.3	25.1	270.3	28.3
2.0-2.9	23.5	4.6	0.2	9.0	1.9	7.1	7.3	1.8	28.6	3.0
3.0-3.9	0.8	0.2	0.7	31.5	1.1	4.1	2.1	0.5	21.3	2.2
4.0-4.9	11.1	2.2	0.2	9.0	1.0	3.8	0.4	0.1	0.5	0.05
5.0-5.9	0.6	0.1	0.1	4.5	0.08	0.3	8.3	2.0	1.2	0.1
6.0-6.9	7.9	1.5	0.2	9.0	0.3	1.1	-	-	0.1	0.01
7.0-7.9	0.2	0.04	-	-	0.2	0.8	-	-	13.4	1.4
8.0-8.9	-	-	0.02	0.9	0.05	0.2	25.6	6.3	35.3	3.7
9.0-9.9	34.9	6.8	-	-	0.01	0.04	0.04	0.01	-	-
10.0-19.9	0.1	0.02	0.004	0.2	0.6	2.3	7.0	1.7	-	-
20.0-29.9	-	-	-	-	0.1	0.4	-	-	-	-
30.0-39.9	-	-	-	-	0.003	0.01	-	-	-	-
40.0-49.9	-	-	-	-	-	-	-	-	-	-
50.0	-	-	-	-	0.01	0.04	-	-	-	-

MOBILE SITE
LBL tow number and description

	18 25 m hor. night		19 999-799 m day		20 799-200 m day		21 20-0 m day		22 25 m hor. day	
Size class	Density[b]	Percent	Density	%	Density	%	Density	%	Density	%
0.5	27.2	0.7	0.8	6.8	5.2	5.1	211.8	11.2	98.4	9.4
0.5-0.9	2158.9	54.0	4.8	40.7	51.2	49.9	1091.2	57.7	475.6	45.3
1.0-1.9	1308.1	32.7	4.3	36.5	30.3	29.5	566.9	30.0	426.4	40.6
2.0-2.9	125.0	3.1	0.2	1.7	11.5	11.2	18.3	1.0	4.1	0.4
3.0-3.9	10.9	0.2	0.9	7.6	2.2	2.1	2.6	0.1	-	-
4.0-4.9	365.5	9.2	0.06	0.5	0.2	0.2	-	-	45.1	4.3
5.0-5.9	-	-	0.6	5.1	-	-	-	-	-	-
6.0-6.9	-	-	0.1	0.9	-	-	-	-	-	-
7.0-7.9	-	-	0.03	0.3	0.4	0.4	-	-	-	-
8.0-8.9	-	-	-	-	-	-	-	-	-	-
9.0-9.9	-	-	-	-	-	-	-	-	-	-
10.0-19.9	-	-	-	-	1.5	1.5	-	-	-	-
20.0-29.9	-	-	-	-	0.2	0.2	-	-	-	-
30.0-39.9	-	-	-	-	-	-	-	-	-	-
40.0-49.9	-	-	-	-	-	-	-	-	-	-
50.0	-	-	-	-	-	-	-	-	-	-

[a]Density measured as number of organisms per size class per cubic meter

Table 4B-7. Phytoplankton Hydrocast Sample Data from R/V Virginia Key, Gulf of Mexico, Tampa Site, 6-12 June 1978 (GOTEC-04).

Organism	Size (um)	Concentration (No./liter)
Station 2. Position:27°38'N, 85°33'W Time: 163:1640Z (12 June 1978, 1240 EDT) Hydrocast sample at 50 m		
U.D. #1	20-35	43060
U.D. #1	35-50	1870
Scrippsiella trochoidea	13-20	1520
Prorocentrum sp.	16-22	700
Oxytoxum gracile	25	580
Oxytoxum variabile	30	230
Cladopyxis setifera	15	120
Oxytoxum longiceps	45	120
Oxytoxum sp. #1	35	120
U.D. #1 (colony?)	100	120
Pennate diatom #1	16	470
Nitszchia sp. #1	150	230
Dictyocha fibula	50-70	230
Silicoflagellates	30	120
U.C. #3	25-32	230
U.C. #6	92	120
Unidentified cells	11-30	230
Station 3. Position: 27°38'N, 85°33'W Time: 164:2224Z (13 June 1978, 0224 EDT) Hydrocast sample at surface		
U.C. #1	11	17000
Scrippsiella trochoidea	13-25	8160
U.D. #1	40-60	700
Prorocentrum sp.	27	470
U.D. #1	17	470
Oxytoxum gracile	25	230
U.C. #7	14	230
Station 3. Hydrocast at 25 m		
U.D. #1	11-20	4420
Scrippsiella trochoidea	12-25	3384
U.D. #3	11	2440
Oxytoxum gracile	27	880
Oxytoxum variabile	17	728
U.D. #1	21-30	624
Prorocentrum sp.	11-20	520
Oxytoxym/Amphidinium*	28	208
Podolampas spinifer	120	104
Amphidinium schroederi	17	52
Ceratium fusus	300	52
Gyrodinium sp.	70	52
U.D. #4	20	52
Nitzschia sp. #2	32	208
U.C. #1	11-20	3480
U.C. #1	21-30	680
U.C. #8	13	52
Flagellates	30	52
Unidentifiable cells	13	104
Unidentifiable cells	73	104
Coccolithophores	14	52
Station 3. Hydrocast sample at 125 m		
U.C. #10	70	1612
Dinophysis sp. #1	95	156
Oxytoxum/Amphidinium*	11-20	156
Prorocentrum sp.	11-20	104
U.C. #6	78	156
U.C. #12	73	156
U.C. #11	70	52
Coccolithophores	11-20	156
Distephanus sp. #1	30	52
Station 3. Hydrocast sample at 150 m		
Unidentified cells	11-20	1924
Unidentified cells	30-60	416
Unidentified cells	125	52
U.C. #3	25-32	52
U.C. #13	42	52
U.D. #1	11-20	832
U.D. #1	21-30	520
U.D. #1	31-40	520
Prorocentrum sp.	12	260
Oxytoxum gracile	27	52
Oxytoxum variabile	17	156
Silicoflagellates	-	104
Station 3. Hydrocast sample at 200 m		
Unidentifiable cells	11-30	5565
U.C. #14	80	800
U.C. #6	80	530
Unidentifiable cells	60-90	165
Oxytoxum variabile	28	265
Scrippsiella trochoidea	11	265
Nannoplankton estimate	<3	200000
Station 3. Hydrocast at 250 m		
U.C. #9	50	520
Unidentified cells	11-30	260
U.C. #6	84	208
U.D. #1	11-20	156
Unidentified cells	31-60	104
Prorocentrum sp.	11-20	364
Oxytoxum/Amphidinium*	21	260
Dinophysis sp. #1	90	52
Oxytoxum sp. #2	11	52
Oxytoxum viride	11-20	52
Navicula sp. #1	14	52

U.C. numbers are unidentified cells of a consistently identifiable type. Photographs and descriptions are archived with the Marine Sciences Group at Lawrence Berkeley Laboratory.

U.D numbers are unidentified dinoflagellates of a consistently identifiable type. Photographs and descriptions are archived with the Marine Sciences Group at the Lawrence Berkeley Laboratory

*Identification uncertain

Table 4B-8. Phytoplankton Net Tow Sample Data from R/V Virginia Key, Gulf of Mexico, Mobile Site, 12-15 June 1978 (GOTEC-04).

Organism	Occurrence
Station 6E. Position: 29°07′N, 87°39′W Time: 15 June 1978, 17:45 EDT Oblique tow from 100 to 0 m	
Ceratium pentagonum	rare
Exuviaella compressa	common
Exuviaella sp. #1	common
Exuviaella sp. #2	common
Exuviaella vaginula	rare
Ornithocercus quadratus	rare
Peridinium pedunculatum	common
Prorocentrum micans	common
Chaetoceros didymus	rare
Chaetoceros lorenzianus	dominant
Coscinodiscus lineatus	common
Guinardia flaccida	rare
Leptocylindrus danicus	common
Nitzschia longissima	rare
Nitzschia sp.	dominant
Rhizosolenia bergonii	rare
Thalassionema nitzschioides	rare
Thalassiothrix frauenfeldi	rare

Appendix 5A

Figures Containing Data

This appendix contains figures displaying the results obtained on Cruise GOTEC-05 (15-27 August 1978) to two sites in the Gulf of Mexico, Mobile and Tampa.

Figures 5A-1 through 5A-4 show the physical oceanographic data for temperature, salinity, dissolved oxygen, and density. The standard deviations are too small to show in this scale and can be considered to be less than the size of the dot.

Figures 5A-5 through 5A-8 present the nutrient data. No standard deviations were taken at this time; however, a subsequent determination of the precision of the instrument used (A Technicon AutoAnalyser®) showed that the precision ranged from no detectable variation to an average of approximately ± 0.03 µg at/L for phosphates and total phosphate. Precision for silicates was very high (generally no detectable variation, however variation of ± 0.25 µg at/L did occur and a few rare occurrences ± 1.0 µg at/L. Precision for nitrates was generally better than ± 0.5 µg at/L however, a few rare analyses gave higher values. Deviations of ammonia values ranged from ± 0.1 to 1.0 µg at/L.

Figures 5A-9 and 5A-10 show zooplankton vertical distributions during day-night for copepods, non-copepod crustaceans, and other invertebrates. Figures 5A-10 and 5A-12 show the zooplankton size class distributions.

PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Sigma t

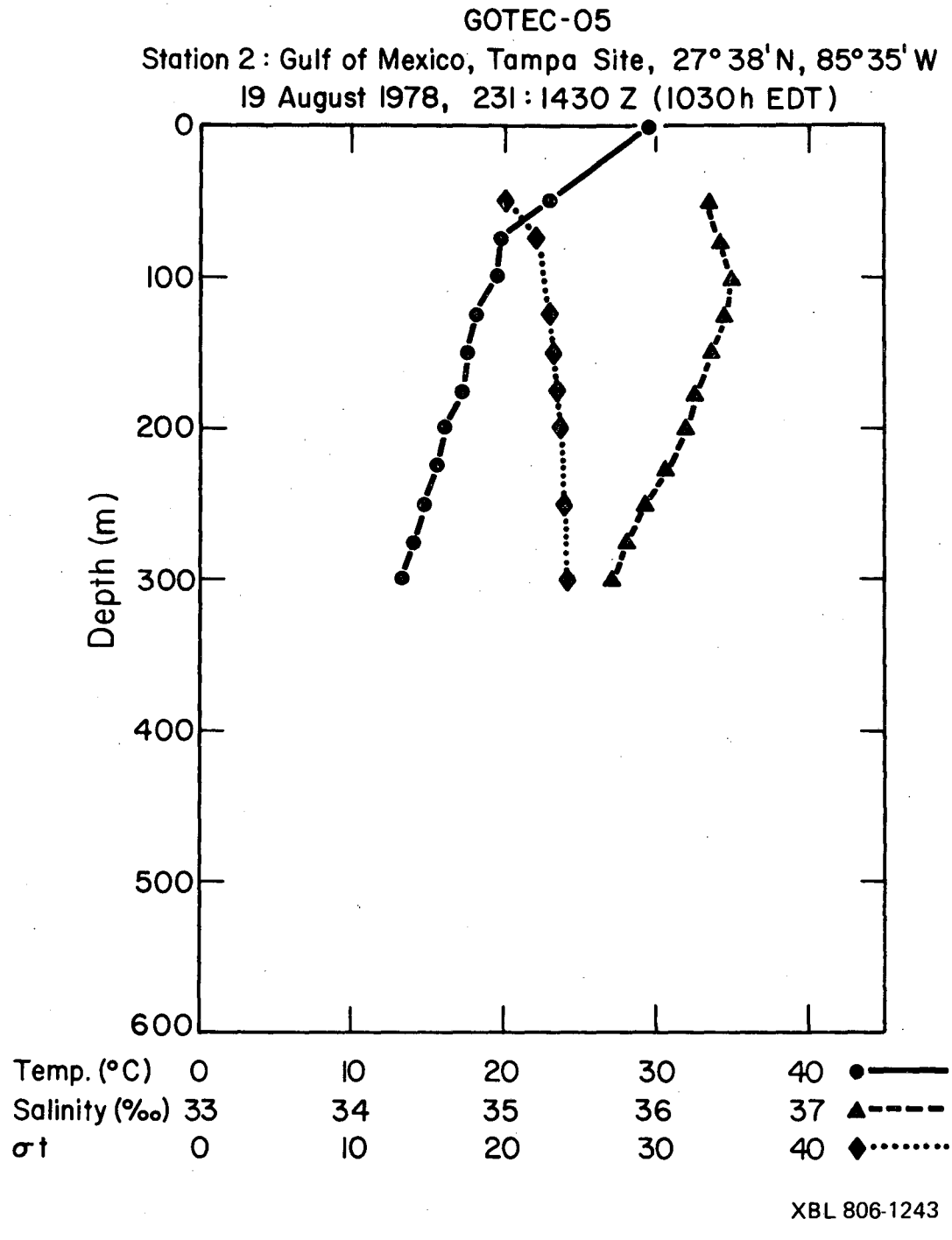


Figure 5A-1.

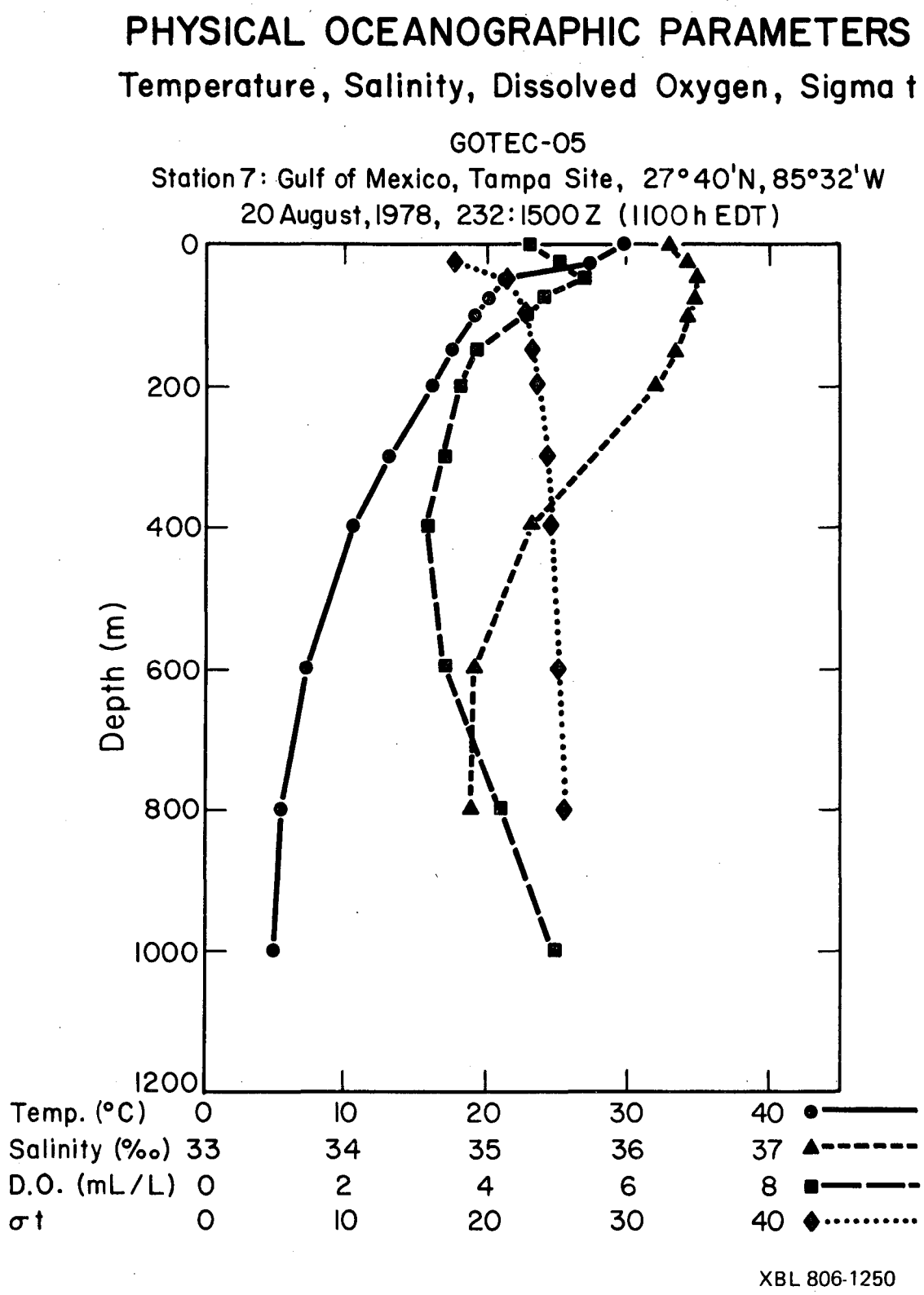

PHYSICAL OCEANOGRAPHIC PARAMETERS
Temperature, Salinity, Dissolved Oxygen, Sigma t
GOTEC-05
Station 7: Gulf of Mexico, Tampa Site, 27°40'N, 85°32'W
20 August, 1978, 232:1500 Z (1100 h EDT)
Depth (m)
0
200
400
600
800
1000
1200
Temp. (°C) 0 10 20 30 40
Salinity (‰) 33 34 35 36 37
D.O. (mL/L) 0 2 4 6 8
σt 0 10 20 30 40
XBL 806-1250

Figure 5A-2.

PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Dissolved Oxygen, Sigma t

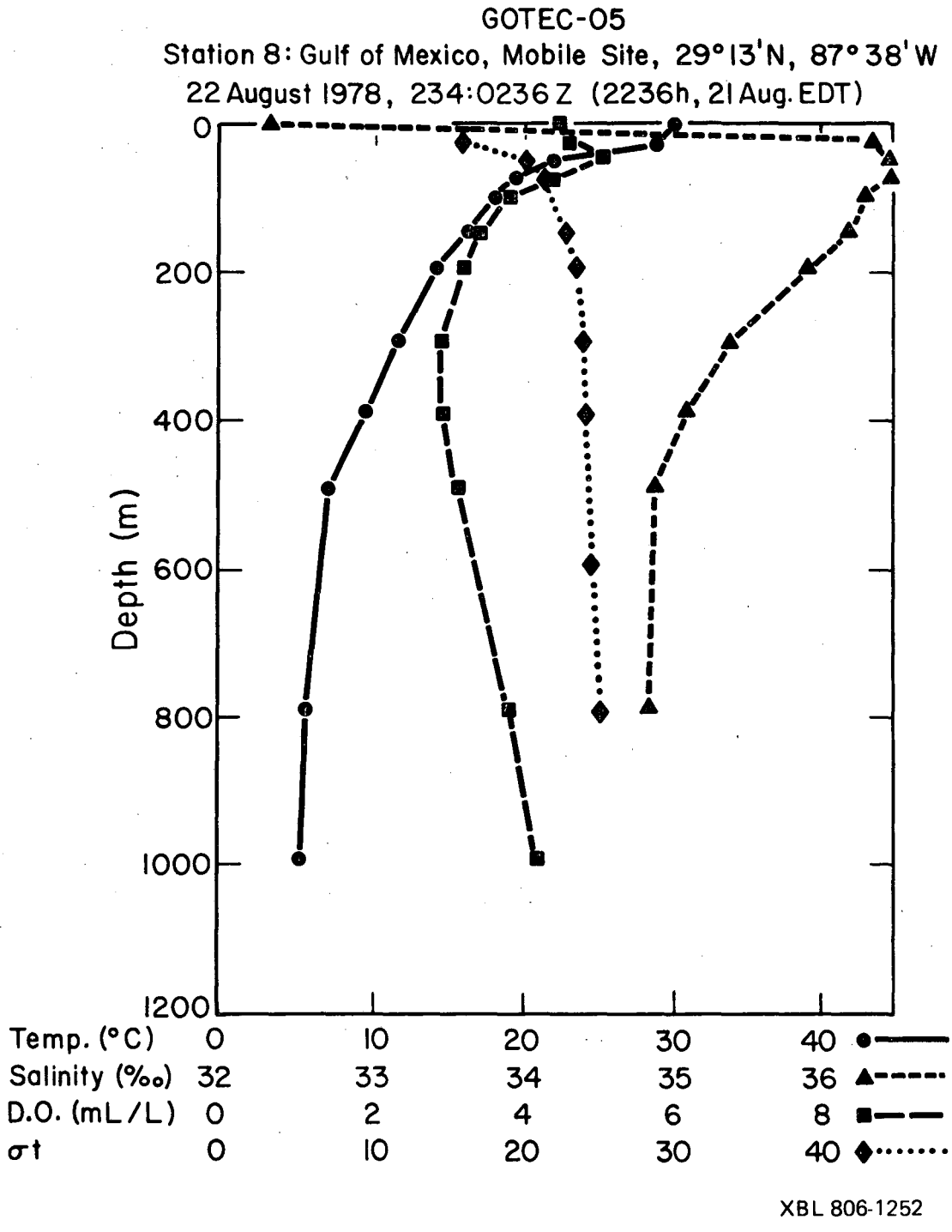


Figure 5A-3.

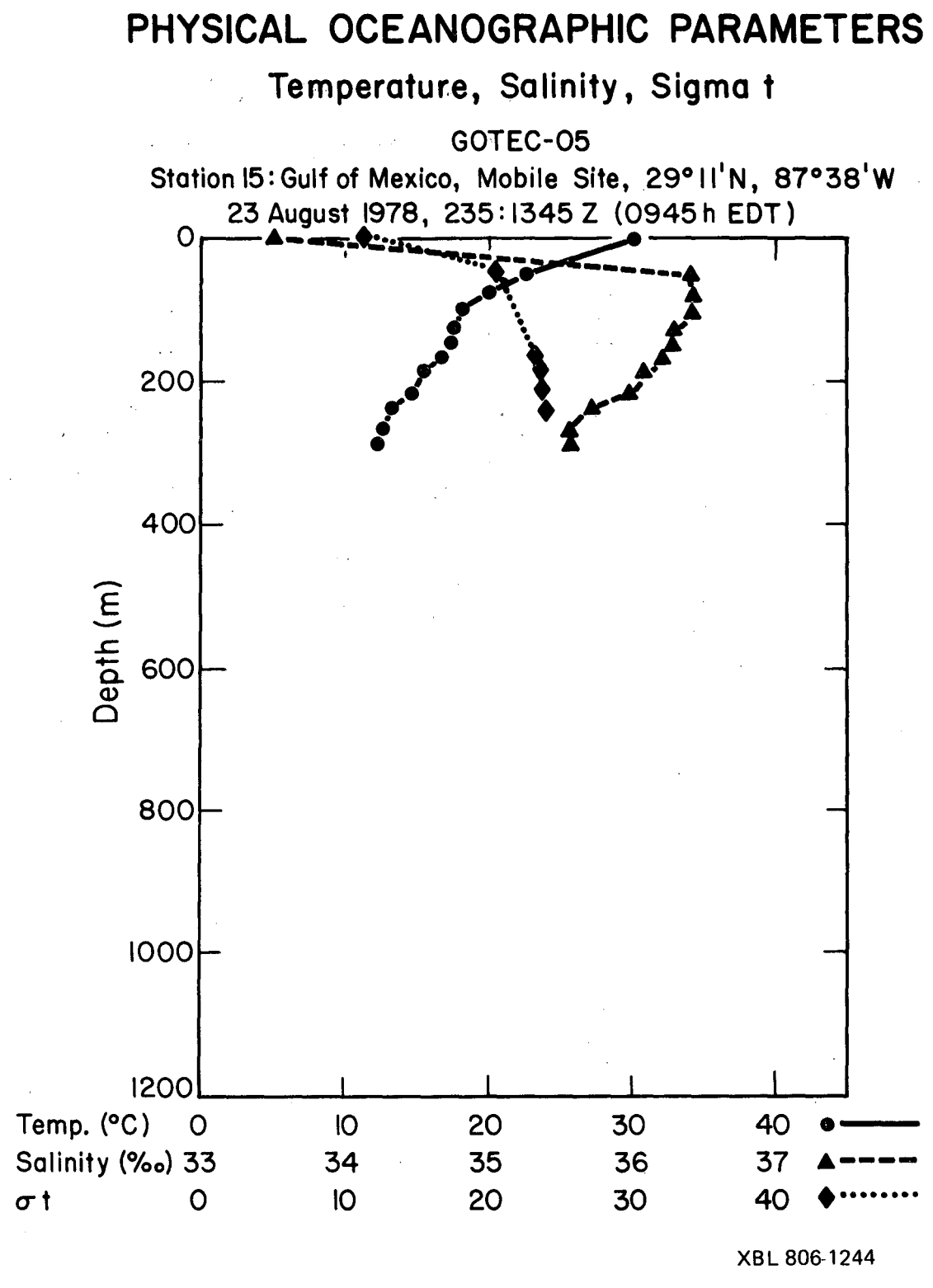

PHYSICAL OCEANOGRAPHIC PARAMETERS
Temperature, Salinity, Sigma t
GOTEC-05
Station 15: Gulf of Mexico, Mobile Site, 29°11'N, 87°38'W
23 August 1978, 235:1345 Z (0945 h EDT)
Depth (m)
0
200
400
600
800
1000
1200
Temp. (°C) 0 10 20 30 40
Salinity (‰) 33 34 35 36 37
σ t 0 10 20 30 40
XBL 806-1244

Figure 5A-4.

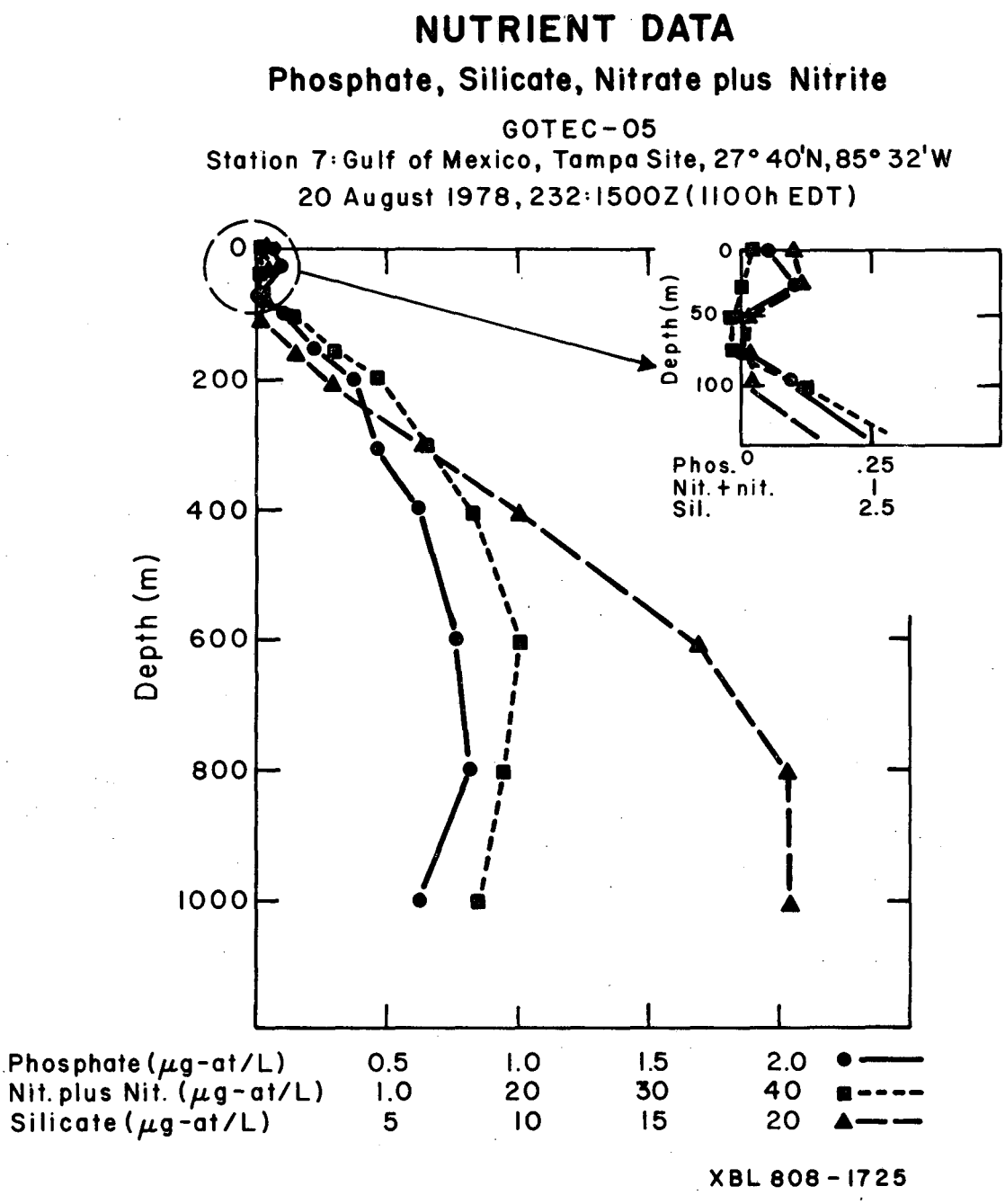

NUTRIENT DATA
Phosphate, Silicate, Nitrate plus Nitrite
GOTEC-05
Station 7: Gulf of Mexico, Tampa Site, 27° 40'N, 85° 32'W
20 August 1978, 232:1500Z (1100h EDT)
Depth (m)
0
200
400
600
800
1000
50
100
Phos.
Nit. + nit.
Sil.
.25
2.5
Phosphate (μg-at/L) 0.5 1.0 1.5 2.0
Nit. plus Nit. (μg-at/L) 1.0 20 30 40
Silicate (μg-at/L) 5 10 15 20
XBL 808-1725

Figure 5A-5.

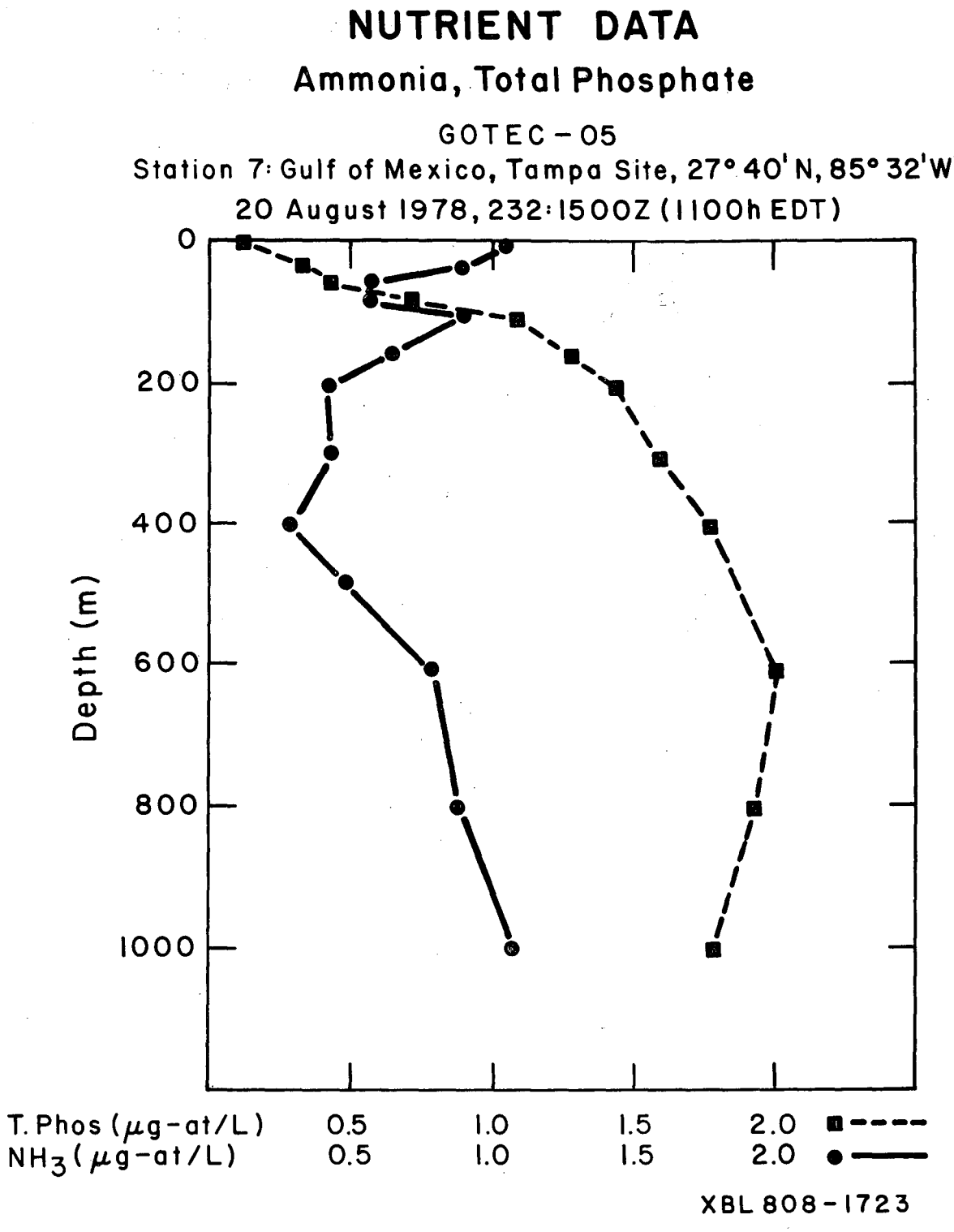

NUTRIENT DATA
Ammonia, Total Phosphate
GOTEC – 05
Station 7: Gulf of Mexico, Tampa Site, 27° 40' N, 85° 32' W
20 August 1978, 232:1500Z (1100h EDT)
Depth (m)
0
200
400
600
800
1000
T. Phos (μg-at/L) 0.5 1.0 1.5 2.0
NH3 (μg-at/L) 0.5 1.0 1.5 2.0
XBL 808-1723

Figure 5A-6.

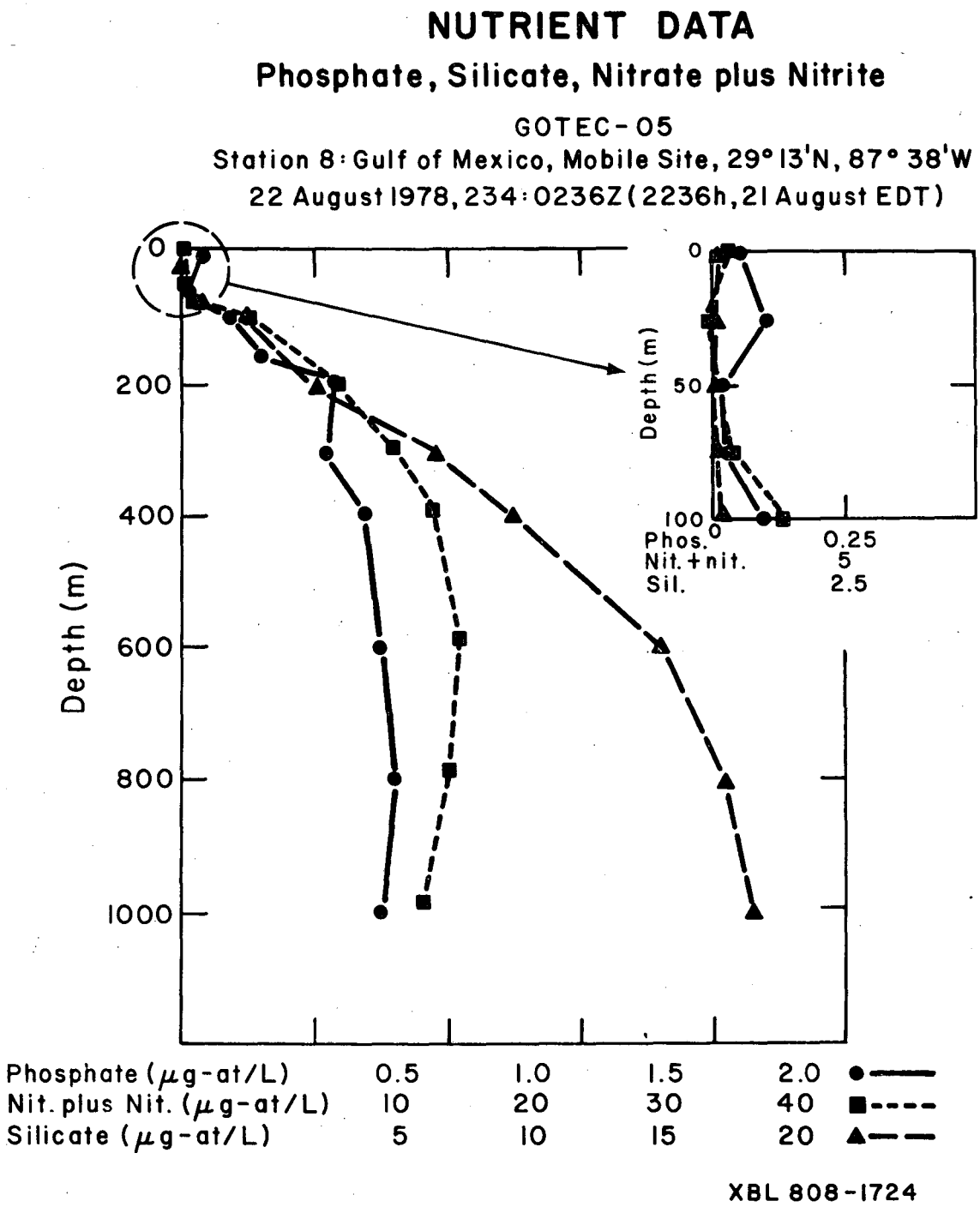

NUTRIENT DATA
Phosphate, Silicate, Nitrate plus Nitrite
GOTEC-05
Station 8: Gulf of Mexico, Mobile Site, 29° 13'N, 87° 38'W
22 August 1978, 234:0236Z (2236h, 21 August EDT)
Depth (m)
0
200
400
600
800
1000
Depth (m)
0
50
100
Phos. 0 0.25
Nit.+nit. 5
Sil. 2.5
Phosphate (μg-at/L) 0.5 1.0 1.5 2.0
Nit. plus Nit. (μg-at/L) 10 20 30 40
Silicate (μg-at/L) 5 10 15 20
XBL 808-1724

Figure 5A-7.

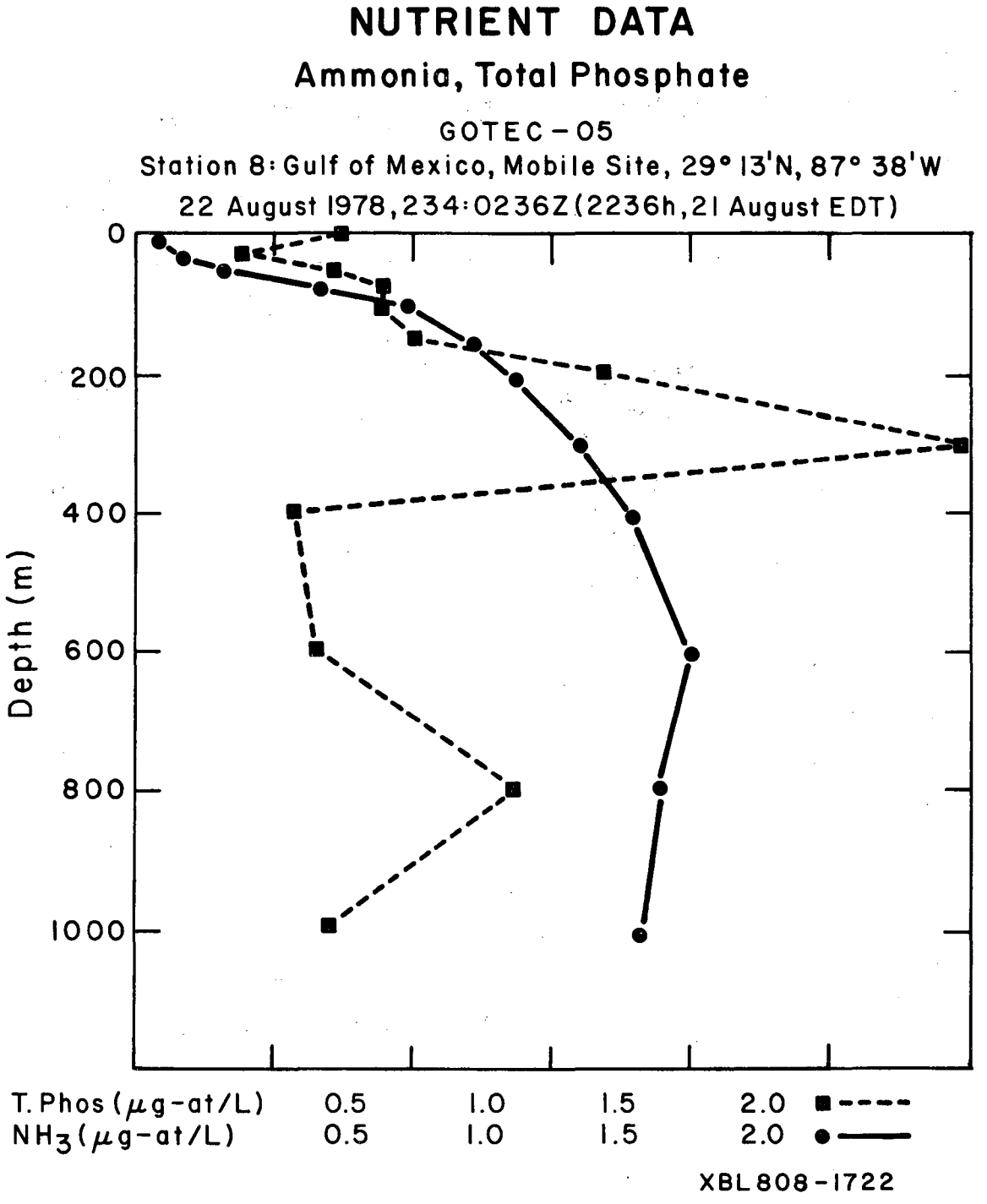

NUTRIENT DATA
Ammonia, Total Phosphate
GOTEC – 05
Station 8: Gulf of Mexico, Mobile Site, 29° 13'N, 87° 38'W
22 August 1978, 234:0236Z (2236h, 21 August EDT)
Depth (m)
0
200
400
600
800
1000
T. Phos (μg-at/L) 0.5 1.0 1.5 2.0
NH3 (μg-at/L) 0.5 1.0 1.5 2.0
XBL 808-1722

Figure 5A-8.

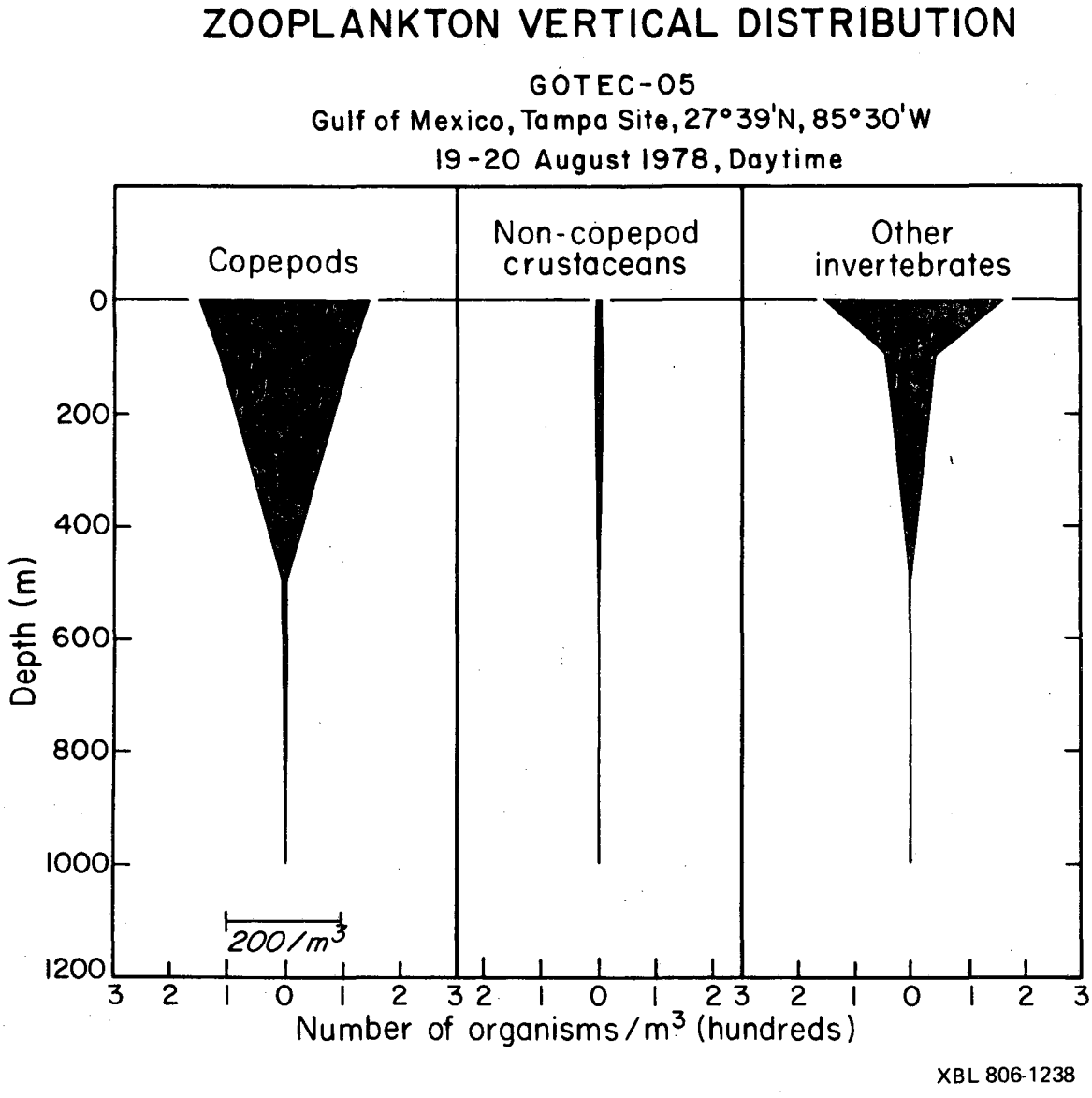

ZOOPLANKTON VERTICAL DISTRIBUTION
GOTEC-05
Gulf of Mexico, Tampa Site, 27°39'N, 85°30'W
19-20 August 1978, Daytime
Copepods
Non-copepod crustaceans
Other invertebrates
Depth (m)
0
200
400
600
800
1000
1200
200/m³
3 2 1 0 1 2 3
Number of organisms/m³ (hundreds)
XBL 806-1238

Figure 5A-9.

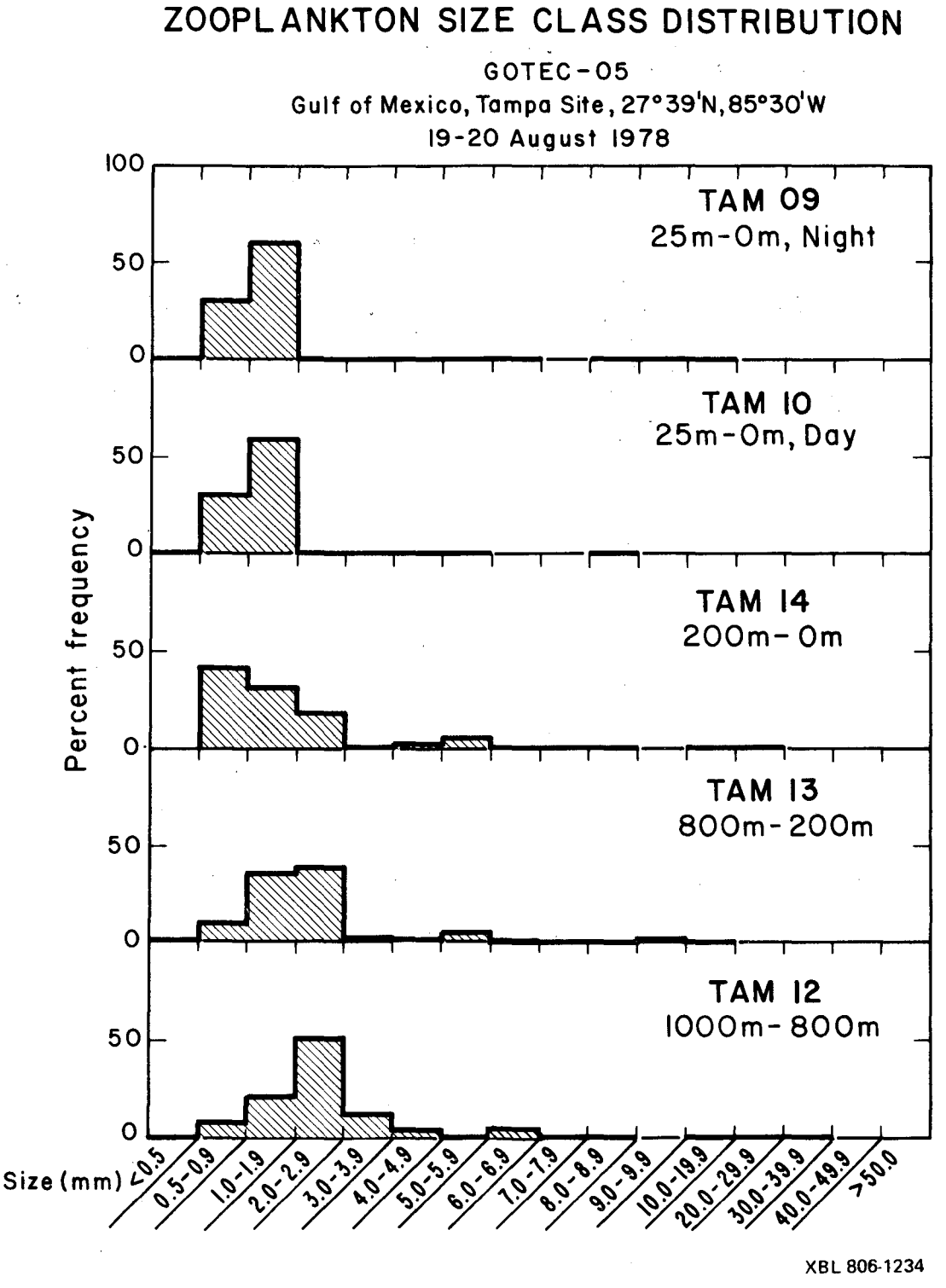

ZOOPLANKTON SIZE CLASS DISTRIBUTION
GOTEC-05
Gulf of Mexico, Tampa Site, 27°39'N, 85°30'W
19-20 August 1978
TAM 09
25m-0m, Night
TAM 10
25m-0m, Day
TAM 14
200m-0m
TAM 13
800m-200m
TAM 12
1000m-800m
Percent frequency
100
50
0
Size (mm) <0.5
0.5-0.9
1.0-1.9
2.0-2.9
3.0-3.9
4.0-4.9
5.0-5.9
6.0-6.9
7.0-7.9
8.0-8.9
9.0-9.9
10.0-19.9
20.0-29.9
30.0-39.9
40.0-49.9
>50.0
XBL 806-1234

Figure 5A-10.

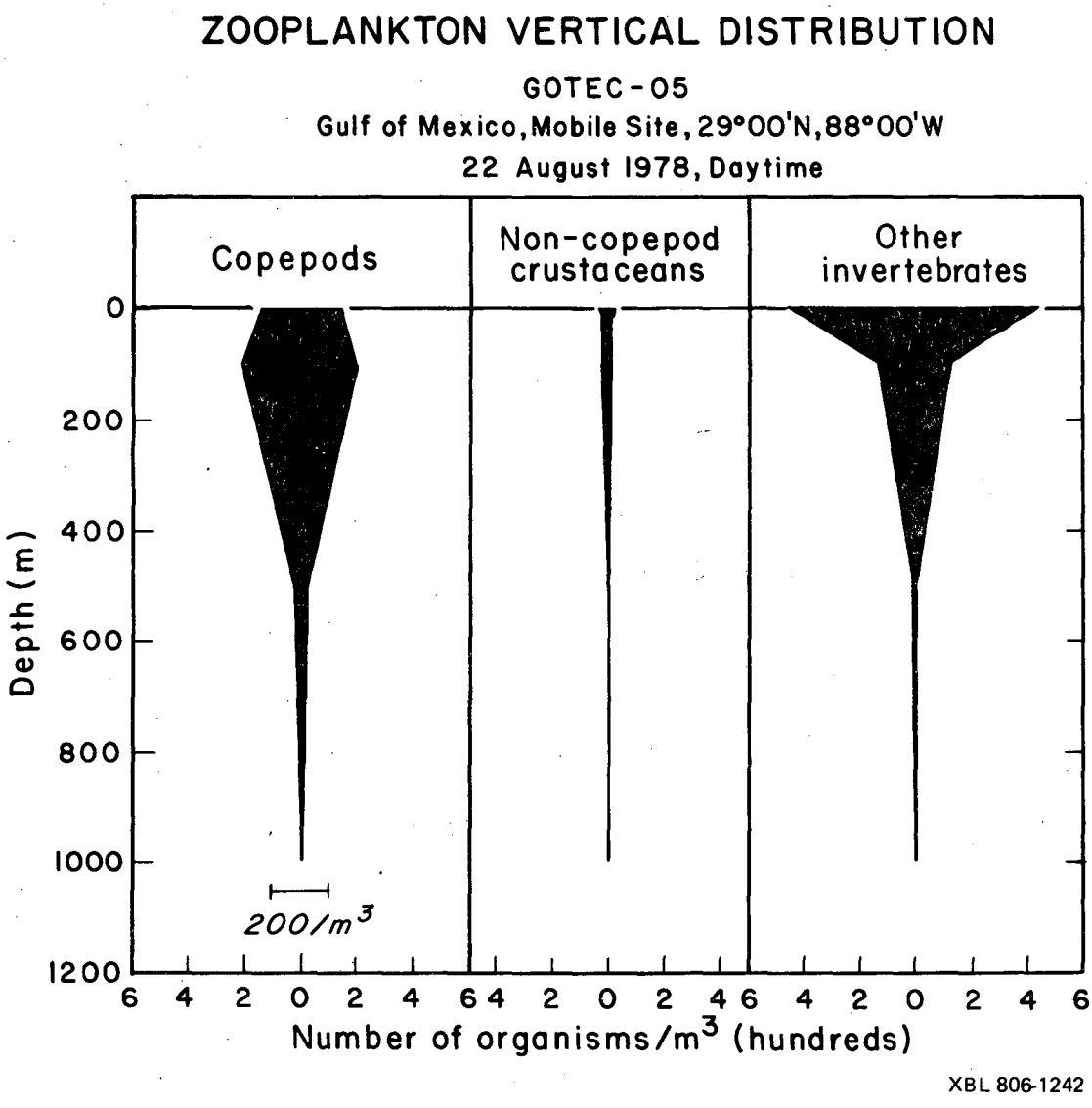

ZOOPLANKTON VERTICAL DISTRIBUTION
GOTEC-05
Gulf of Mexico, Mobile Site, 29°00'N, 88°00'W
22 August 1978, Daytime
Copepods
Non-copepod crustaceans
Other invertebrates
Depth (m)
0
200
400
600
800
1000
1200
200/m3
6 4 2 0 2 4 6 4 2 0 2 4 6 4 2 0 2 4 6
Number of organisms/m3 (hundreds)
XBL 806-1242

Figure 5A-11.

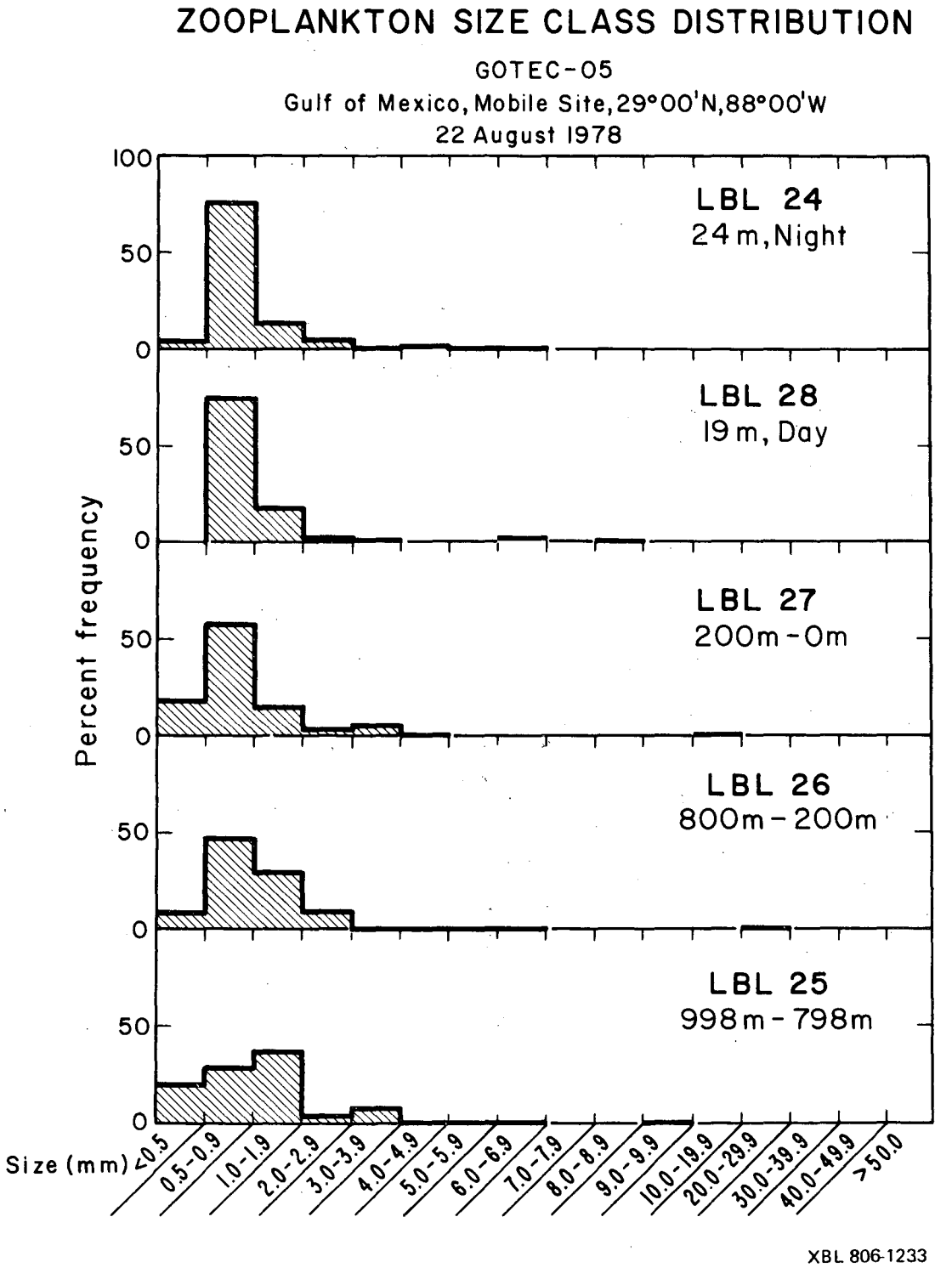

ZOOPLANKTON SIZE CLASS DISTRIBUTION
GOTEC-05
Gulf of Mexico, Mobile Site, 29°00'N, 88°00'W
22 August 1978
LBL 24
24 m, Night
LBL 28
19 m, Day
LBL 27
200m - 0m
LBL 26
800m - 200m
LBL 25
998m - 798m
Percent frequency
100
50
0
Size (mm) <0.5
0.5-0.9
1.0-1.9
2.0-2.9
3.0-3.9
4.0-4.9
5.0-5.9
6.0-6.9
7.0-7.9
8.0-8.9
9.0-9.9
10.0-19.9
20.0-29.9
30.0-39.9
40.0-49.9
>50.0
XBL 806-1233

Figure 5A-12.

Appendix 5B

Tables

Standard deviations were not routinely calculated for the data in Tables 5B-1 through 5B-4. Generally the following variabilities may be expected:

Temperature:	Bottle thermometer	±0.01
	STD's	±0.02
Salinity		±0.003

No standard deviations were calculated at this time for the nutrient data; however, a subsequent determination of the precision of the instrument used (A Technicon AutoAnalyser®) showed that the precision ranged from no detectable variation to an average of approximately ± 0.03 µg at/L for phosphates and total phosphate. Precision for silicates was very high (generally no detectable variation, however variation of ± 0.25 µg at/L did occur and a few rare occurrences ± 1.0 µg at/L. Precision for nitrates was generally better than ± 0.5 µg at/L however, a few rare analyses gave higher values. Deviations of ammonia values ranged from ± 0.1 to 1.0 µg at/L.

As has been mentioned in the introduction to Appendix 4A, volume constraints prevented statistical analysis for the biological data.

Table 5B-1. Physical oceanographic parameters from R/V Virginia Key, Gulf of Mexico, 15-27 August 1978 (GOTEC-05)

OBSERVED			INTERPOLATED	COMPUTED			
Observed depth (m)	Temp. (°C)	Salinity (‰)	Sigma-T (bottles)	Standard depth (m)	Temp. (°C)	Salinity (‰)	Sigma-t (XBT)
Station 2. Position: 27°38'N, 85°34'W (Tampa Site) Time: 231:14:30Z, 19 August 1978							
0	29.60	-	24.96	0	29.70	36.11	22.08
50	23.00	36.326	25.89	40	25.42	36.40	24.29
75	19.80	356.388	26.32	80	20.07	36.38	25.81
100	19.5*	36.466	26.40	100	19.22	36.36	26.01
125	18.25	36.428	26.52	120	18.41	36.34	26.20
150	17.68	36.344	26.69	140	18.01	36.30	26.27
175	17.07	36.295	26.80	180	16.92	26.14	26.42
200	16.20	36.170	-	200	16.24	36.02	26.40
225	15.7*	36.040	-	220	15.54	35.89	26.55
250	14.65	35.920	26.809	240	14.90	35.82	26.64
275	14.0*	35.800	-				
300	13.4	35.700	26.887				

TABLE 5B-1 (continued). Physical Oceanographic Parameters from R/V Virginia Key, Gulf of Mexico, 15-27 August 1978 (GOTEC-05)

OBSERVED				CALCULATED[a]	INTERPOLATED[b]			CALCULATED[b]
Observed Depth M	Temperature °C	Salinity ‰	Dissolved Oxygen ml/L	Sigma-t	Standard Depth M	Temperature °C	Salinity ‰	Sigma-t
Station 7. Position: 27°40'N, 85°23'W (Tampa Site)								
Time: 232:1525Z 20 August 1978 (1125 hrs EDt)								
0[a]	29.8[b]	36.30	4.69		0	29.93	36.19	22.66
25	27.24	36.402	5.06	23.74	20	29.05	36.23	22.99
50	21.02	36.47	5.38	25.63	40	24.60	36.35	24.50
75	20.5[b]	36.47	4.89		80	20.01	36.39	25.83
100	19.05	36.40	4.59	26.10	100	19.06	36.37	26.06
150	17.54	36.32	3.86	26.42	140	17.86	36.32	26.33
200	16.06	36.17	2.62	26.66	200	16.12	36.16	26.62
300	13.33	35.703	3.37	26.91	300	13.30	35.67	26.86
400	10.59	35.31	3.17	27.13	400	10.70	35.34	27.11
600	7.47	34.91	3.40	27.32	600	7.64	34.93	27.32
800	5.53	34.90	4.22	27.57	800	5.72	34.85	27.49
1000	5.02		4.98					
Station 8: Position: 29°13.2'N, 87°38.4'W (Mobile Site), 21 August 1978								
Time: 233:0230Z (2230 EDT) Messenger Time = 02:36Z								
0[a]	30.2[b]	32.32	4.54		0	30.55	35.46	21.96
23	29.38	36.39	4.69	23.08	20	29.53	36.29	22.87
47	22.45	36.47	5.12	25.22	40	24.10	36.31	24.62
71	19.87	36.47	4.41	25.94	80	19.37	36.40	26.01
95[a]	18.4[b]	36.32	3.88		100	18.26	36.35	26.25
144	16.69	36.24	3.46	26.56	140	16.89	36.26	26.52
192	14.51	35.94	3.27	26.83				
292	11.59	35.436	2.91	27.04				
390	9.57	35.141	2.98	27.17				
590	7.22	34.90	3.18	27.35				
790	5.71	34.87	3.86	27.54				
990	5.09		4.22					
Station 15: Position: 29°11.3'N, 87°38.1'W (Mobile Site), 23 August 1978								
Time: 235:13:28Z (0928 EDT) 13:45Z								
0	30.24	33.50		20.50				
50	22.71	36.40		25.10				
75[a]	20.1[b]	36.42						
100[a]	18.3[b]	36.40						
125[a]	17.6[b]	36.28						
144[a]	17.3[b]	36.25						
166	16.6	36.20		26.55	160	17.03	36.07	26.34
188	15.51	36.06		26.70	200	15.26	35.86	26.59
213	14.92	35.97		26.76	220	14.50	35.75	26.67
238	13.31	35.73		26.93	240	13.50	35.60	26.76
263[a]	12.6[b]	35.58			260	12.88	35.49	26.81
288	12.2[b]	35.49			280	12.42	35.41	26.84

[a] From bottle data

[b] From XBT or STD data (XBT temperature, so line out depth)

Table 5B-2. Nutrient data from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Sites, 15-27 August 1978 (GOTEC-05)

Observed Depth M	Dissolved Oxygen (ml/L)	Phosphates (μg-at/L)	Nitrites (μg-at/L)	Nitrites (μg-at/L)	Nitrates and Silicates (μg-at/L)	Ammonia[b] (μg-at/L)	Total Phosphate (μg-at/L)
Station 7, Position: 27°40'N, 85°32'W (Tampa Site), 20 August 1978 Time: 232:1525Z (1125 EDT)							
0	4.69	0.0	ND	0.1	0.1	1.1	0.1
25	5.06	0.1	ND	ND	0.1	0.1	0.3
50	5.38	ND[c]	ND	ND	0.0	0.6	0.4
75	4.89	ND	ND	0.5	0.1	0.6	0.7
100	4.59	0.1	ND	2.8	0.1	0.9	1.1
150	3.86	0.2	ND	6.0	1.5	0.6	1.3
200	3.62	0.4	ND	9.0	3.0	0.4	1.4
300	3.37	[0.4][a]	ND	13.0	6.5	0.4	1.6
400	3.17	[0.6]	ND	16.5	10.0	0.3	1.8
600	3.40	[0.8]	ND	20.0	17.0	0.8	2.0
800	4.22	[0.8]	ND	19.0	20.5	0.9	1.9
1000	4.98	[0.6]	ND	17.0	[20.5]	1.1	1.8
Station 8. Position: 29°13'N, 87°38'W (Mobile Site), 22 August (GMT) 21 August 1978 (EDT) Time: 233:0230Z (2230 EDT)							
0	4.54	0.1	0.10	0.2	0.5	0.8	0.1
23	4.69	0.0	ND	ND	0.5	0.4	0.2
47	5.12	ND	ND	ND	ND	0.7	0.3
71	4.41	0.1	ND	1.5	0.0	0.9	0.7
95	3.88	0.2	ND	5.5	2.5	0.9	1.1
144	3.46	0.3	ND	9.0	3.0	1.0	1.2
192	3.27	0.6	ND	12.0	5.0	1.7	1.4
292	2.91	[0.6]	ND	16.0	9.5	3.0	1.6
390	2.98	[0.7]	ND	19.0	12.5	0.6	1.8
590	3.18	[0.8]	ND	21.0	18.0	0.6	2.0
790	3.86	[0.8]	ND	20.0	20.5	1.4	1.9
990	4.22	[0.8]	ND	18.0	21.5	0.7	1.8

[a] points in brackets are questionable
[b] all ammonia data is questionable
[c] ND = None Detected

Table 5B-3. Zooplankton Abundance Data from R/V Virginia Key, Gulf of Mexico, Mobile and Tampa Sites, 15-27 August 1978 (GOTEC-05)

LBL sample no. and tow description	Copepods Density[a]	Copepods Percent	Non-copepod Crustaceans Density	Non-copepod Crustaceans Percent	Other invertebrates Density	Other invertebrates Percent	Fish larvae and eggs Density	Fish larvae and eggs Percent	Total zooplankton Density
				TAMPA SITE					
TAM 09 night (25-0m)	412.4	56.0	7.0	0.8	476.2	53.1	0.6	0.1	896.2
TAM 10 day (25-0m)	285.3	49.0	7.2	1.2	289.5	49.7	0.2	0.03	582.2
TAM 14 (200-0m)	232.4	69.9	14.9	4.5	85.2	25.6	0.2	0.06	332.7
TAM 13 (800-200m)	14.1	83.4	1.7	10.1	1.1	6.5	0.01	0.06	16.9
TAM 12 (1000-800m)	2.3	90.4	0.2	7.9	0.04	1.6	0.003	0.1	2.5
				MOBILE SITE					
LBL 24 night (24m horizontal)	567.3	28.9	52.9	2.7	1394.8	68.4*	-		1962.1
LBL 28 day (20m horizontal)	327.9	28.8	30.3	2.7	777.9	68.4	2.4	0.2	1138.5
LBL 27 day (200-0m)	388.1	56.6	25.1	3.7	269.2	39.3	2.9	0.4	685.3
LBL 26 day (800-200m)	52.5	83.6	4.0	6.4	6.1	9.7	0.2	0.3	62.8
LBL 25 day (998m-798m)	5.5	71.4	0.3	3.9	1.9	24.7	-	-	7.7

*These figures are unusually high because of large numbers of dinoflagellate Pyrocystis.

Table 5B-4. Copepod Taxonomic Composition from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Site, 15-27 August 1978 (GOTEC-05)

LBL Sample No.	Tow type	Depth (m)	Dominant genera (% total copepods)		% composition by order	
			TAMPA SITE			
TAM 09	night	25-0m	Oncaea	35.4	Cyclopoida	54.8
			Clausocalanus	12.4	Calanoida	42.6
			Oithona	10.4	Harpacticoida	2.6
			Mecynocera	5.3		
			Temora	4.7		
TAM 10	day	25-0m	Oithona	25.0	Calanoida	48.9
			Clausocalanus	24.4	Cyclopoida	48.3
			Oncaea	11.5	Harpacticoida	2.8
			Mecynocera	9.9		
			Farranula	5.7		
TAM 14		200-0m	Oithona	16.2	Cyclopoida	50.8
			Oncaea	14.2	Calanoida	47.6
			Clausocalanus	7.9	Harpacticoida	1.6
			Farranula	7.1		
			Mecynocera	5.5		
			Corycaeus	5.5		
TAM 13		800-200m	Oncaea	22.8	Calanoida	60.7
			Eucalanus	21.8	Cyclopoida	38.7
			Conaea	9.2	Harpacticoida	0.6
			Rhincalanus	5.7		
			Pleuromamma	5.5		
TAM 12		1000-800m	Eucalanus	47.9	Calanoida	80.5
			Conaea	15.4	Cyclopoida	18.7
			Rhincalanus	13.5	Harpacticoida	0.7
			Lucicutia	3.1		
			Bathypontia	1.5		

Table 5B-4 (continued). Copepod Taxonomic Composition from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Site, 15-27 August 1978 (GOTEC-05)

LBL Sample No.	Tow type	Depth (m)	Dominant genera (% total copepods)		% composition by order	
			MOBILE SITE			
LBL 24	horizontal night	24m	Oncaea	25.7		
			Oithona	18.4	Cyclopoidaa	48.1
			Clausocalanus	7.2	Calanoida	47.9
			Corycaeus	5.0	Harpacticoida	4.0
			Mecynocera	4.5		
LBL 28	horizontal day	20m	Oithona	48.4	Cyclopoida	69.1
			Calocalanus	21.4	Calanoida	28.8
			Corycaeus	8.9	Harpacticoida	2.1
			Paracalanus	4.2		
			Macrostella	2.1		
			Oncaea	2.1		
LBL 27	day	200-0m	Oithona	25.4	Cyclopoida	60.4
			Oncaea	20.1	Calanoida	39.2
			Clausocalanus	8.0	Harpacticoida	0.4
			Farranula	7.9		
			Calocalanas	7.2		
LBL 26	day	800-200m	Oithona	25.9	Calanoida	51.1
			Conaea	12.4	Cyclopoida	47.8
			Mormonilla	12.0	Harpacticoida	1.1
			Eucalanus	9.0		
			Oncaea	7.6		
LBL 25	day	998-798m	Conaea	19.4		
			Oncaea	15.6	Cyclopoida	48.9
			Oithona	9.5	Calanoida	48.9
			Eucalanus	9.5	Harpacticoida	2.2
			Mormonilla	7.7		

TABLE 5B-5. Zooplankton Size Class Distribution from cruise GOTEC-05, Tampa and Mobile sites.

	TAMPA SITE									
Size Class (mm)	TAM 09 25-0m night		TAM 10 25-0m day		TAM 14 200-0m		TAM 13 800-200m		TAM 12 1000-800m	
	Density	Percent	Density	Percent	Density	Percent	Density	Percent	Density	Percent
<0.5	14.0	1.6	2.2	0.4	-	-	0.3	1.8	0.01	0.4
0.5-0.9	273.7	30.5	178.9	30.7	136.4	41.0	1.7	10.1	0.2	7.9
1.0-1.9	582.3	65.0	375.5	64.5	106.1	31.9	6.1	36.3	0.5	19.8
2.0-2.9	11.5	1.3	8.5	1.5	58.1	17.5	6.5	38.7	1.3	51.4
3.0-3.9	3.0	0.3	9.8	1.7	0.7	0.2	0.4	2.4	0.3	11.8
4.0-4.9	4.1	0.5	2.3	0.4	9.2	2.8	0.2	1.2	0.08	3.2
5.0-5.9	2.3	0.3	4.3	0.7	18.5	5.6	0.9	5.4	0.006	0.2
6.0-6.9	5.1	0.6	-	-	0.2	<0.1	0.3	1.8	0.1	4.0
7.0-7.9	-	-	-	-	3.2	1.0	0.04	0.2	0.006	0.2
8.0-8.9	0.03	<0.1	0.7	0.1	0.006	<0.1	0.06	0.4	0.02	0.8
9.0-9.9	0.003	<0.1	-	-	-	-	0.2	1.2	-	-
10.0-19.9	0.05	<0.1	-	-	0.2	<0.1	0.1	0.6	0.003	0.1
20.0-29.9	-	-	-	-	0.2	<0.1	-	-	0.003	0.1
30.0-39.9	-	-	-	-	-	-	-	-	0.003	0.1
40.0-49.9	-	-	-	-	-	-	-	-	-	-
>50.0	-	-	-	-	-	-	-	-	-	-

TABLE 5B-5 (continued). Zooplankton Size Class Distribution from cruise GOTEC-05, Tampa and Mobile Site.

	MOBILE SITE									
Size Class (mm)	LBL 24 24m night		LBL 28 19m day		LBL 27 200m-0m		LBL 26 800m-200m		LBL 25 998m-798m	
	Density	Percent	Density	Percent	Density	Percent	Density	Percent	Density	Percent
<.05	68.1	3.5	-	-	128.0	18.7	5.5	8.8	1.5	19.7
0.5-0.9	1496.3	76.4	852.6	75.0	392.5	57.3	29.8	47.5	2.2	28.9
1.0-1.9	261.3	13.3	211.1	18.6	104.5	15.3	18.2	29.0	2.8	36.8
2.0-2.9	90.6	4.6	26.9	2.4	22.0	3.2	6.1	9.7	0.3	3.9
3.0-3.9	10.5	0.5	19.8	1.7	33.9	5.0	1.2	1.9	0.6	7.9
4.0-4.9	19.7	1.0	-	-	2.9	0.4	0.6	1.0	0.02	0.3
5.0-5.9	12.1	0.6	-	-	-	-	0.2	0.3	0.08	1.1
6.0-6.9	1.5	<0.1	25.7	2.3	-	-	1.0	1.6	0.1	1.3
7.0-7.9	-	-	-	-	-	-	-	-	-	-
8.0-8.9	-	-	1.2	0.1	-	-	-	-	-	-
9.0-9.9	-	-	-	-	-	-	-	-	0.02	0.3
10.0-19.9	-	-	-	-	1.5	0.2	-	-	-	-
20.0-29.9	-	-	-	-	-	-	0.2	0.3	-	-
30.0-39.9	-	-	-	-	-	-	-	-	-	-
40.0-49.9	-	-	-	-	-	-	-	-	-	-
50.0	-	-	-	-	-	-	-	-	-	-

Appendix 6A

Figures Containing Data

This appendix contains figures displaying the results obtained on Cruise GOTEC-06 (21 October to 6 November 1978) to the Gulf of Mexico.

Figures 6A-1 through 6A-5 show the physical oceanographic data for salinity. The standard deviations are too small to show in this scale and can be considered to be less than the size of the dot.

Figure 6A-6 through 6A-9 gives the nutrient data from the Tampa and Mobile Sites. No standard deviations were taken at this time; however, a subsequent determination of the precision of the instrument used (A Technicon AutoAnalyser®) showed that the precision ranged from no detectable variation to an average of approximately ± 0.03 µg at/L for phosphates and total phosphate. Precision for silicates was very high (generally no detectable variation, however variation of ± 0.25 µg at/L did occur and a few rare occurrences ± 1.0 µg at/L. Precision for nitrates was generally better than ± 0.5 µg at/L however, a few rare analyses gave higher values. Deviations of ammonia values ranged from ± 0.1 to 1.0, µg at/L.

Figures 6A-10 and 6A-11 show the biomass indicators phaeophytin, chlorophyll a and ATP (adenosine triphosphate). No standard deviations were obtained for the chlorophyll a determinations as only one sample from each depth at each station was taken. This was due to constraints on the volume of water available for biological analysis from each hydrocast.

Figure 6A-12 and 6A-14 show zooplankton vertical distributions during day-night for copepods, non-copepod crustaceans, and other invertebrates. Figures 6A-13 and 6A-15 give the zooplankton size class distribution.

PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Sigma t

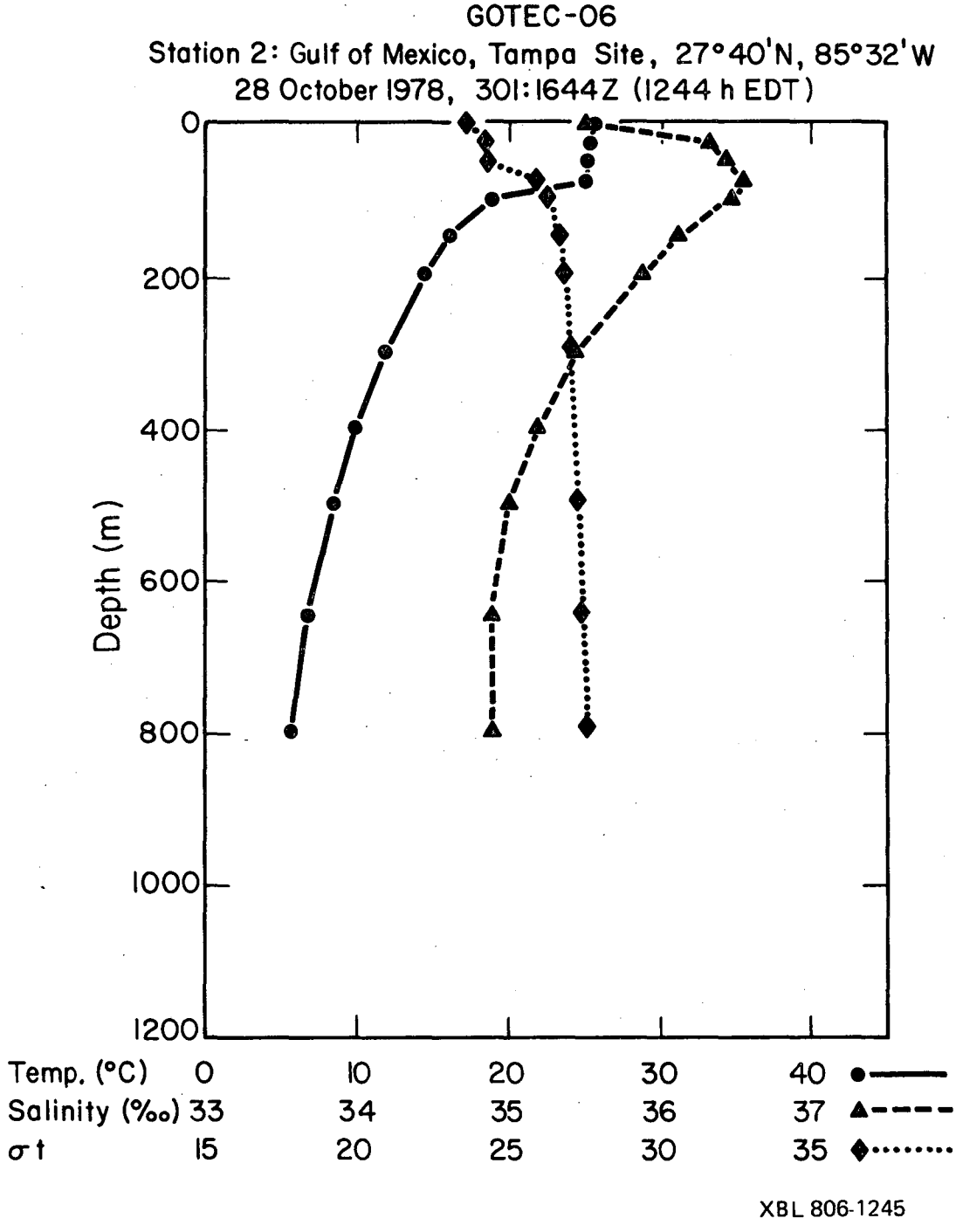


Figure 6A-1.

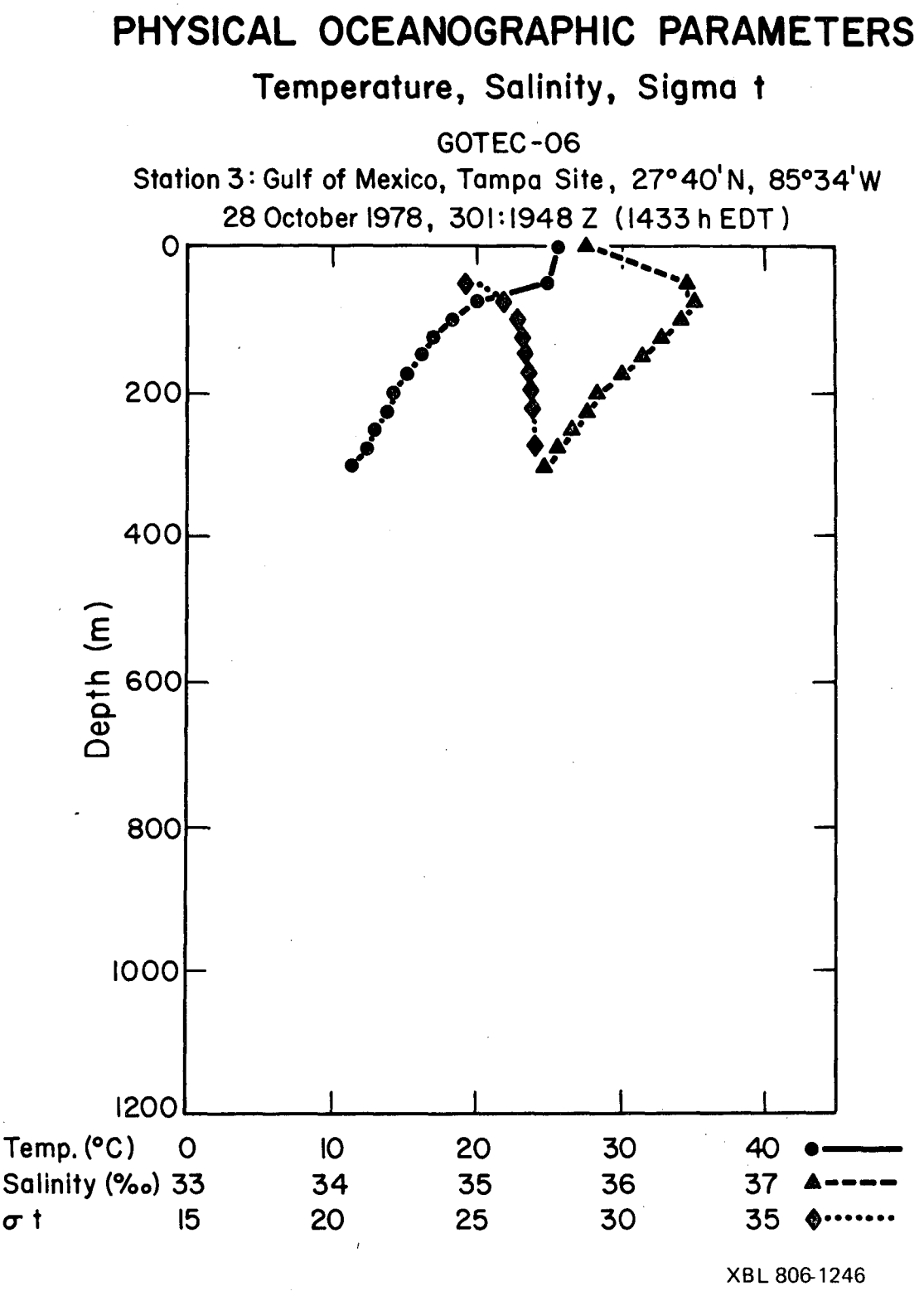

PHYSICAL OCEANOGRAPHIC PARAMETERS
Temperature, Salinity, Sigma t
GOTEC-06
Station 3: Gulf of Mexico, Tampa Site, 27°40'N, 85°34'W
28 October 1978, 301:1948 Z (1433 h EDT)
Depth (m)
0
200
400
600
800
1000
1200
Temp. (°C) 0 10 20 30 40
Salinity (‰) 33 34 35 36 37
σ t 15 20 25 30 35
XBL 806-1246

Figure 6A-2.

PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Dissolved Oxygen, Sigma t

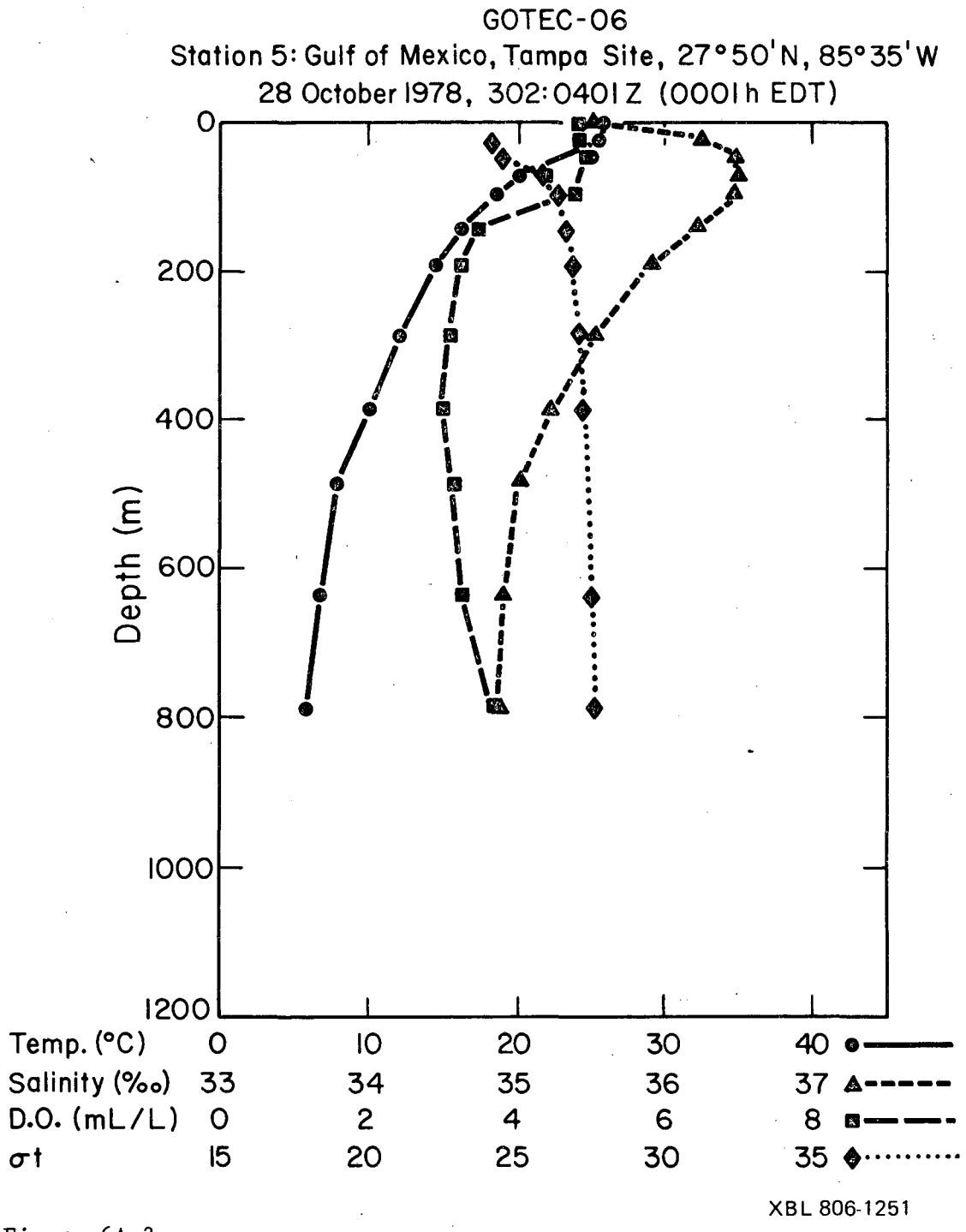


Figure 6A-3.

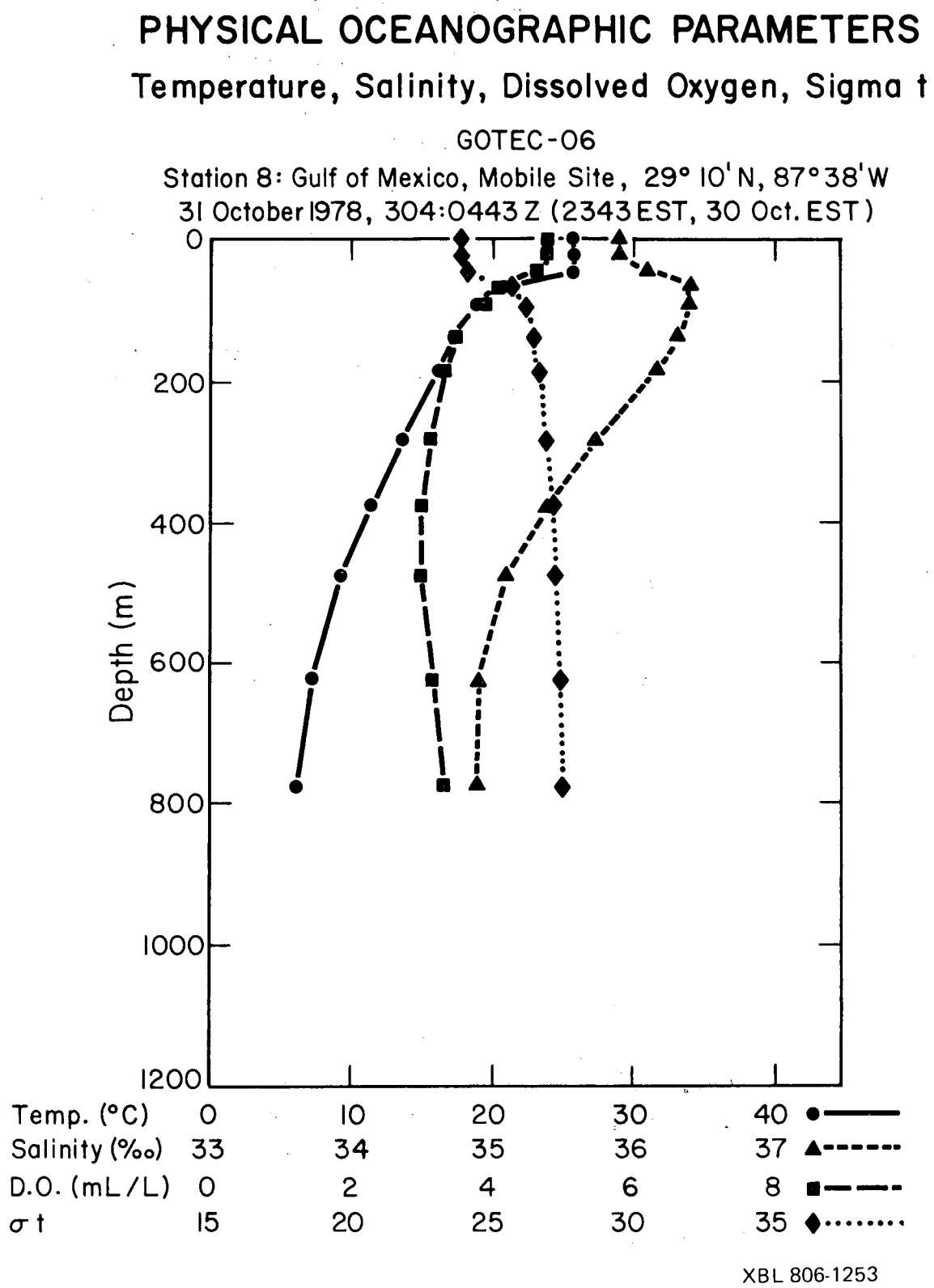

PHYSICAL OCEANOGRAPHIC PARAMETERS
Temperature, Salinity, Dissolved Oxygen, Sigma t
GOTEC-06
Station 8: Gulf of Mexico, Mobile Site, 29° 10' N, 87° 38' W
31 October 1978, 304:0443 Z (2343 EST, 30 Oct. EST)
Depth (m)
0
200
400
600
800
1000
1200
Temp. (°C) 0 10 20 30 40
Salinity (‰) 33 34 35 36 37
D.O. (mL/L) 0 2 4 6 8
σ t 15 20 25 30 35
XBL 806-1253

Figure 6A-4.

PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Sigma t

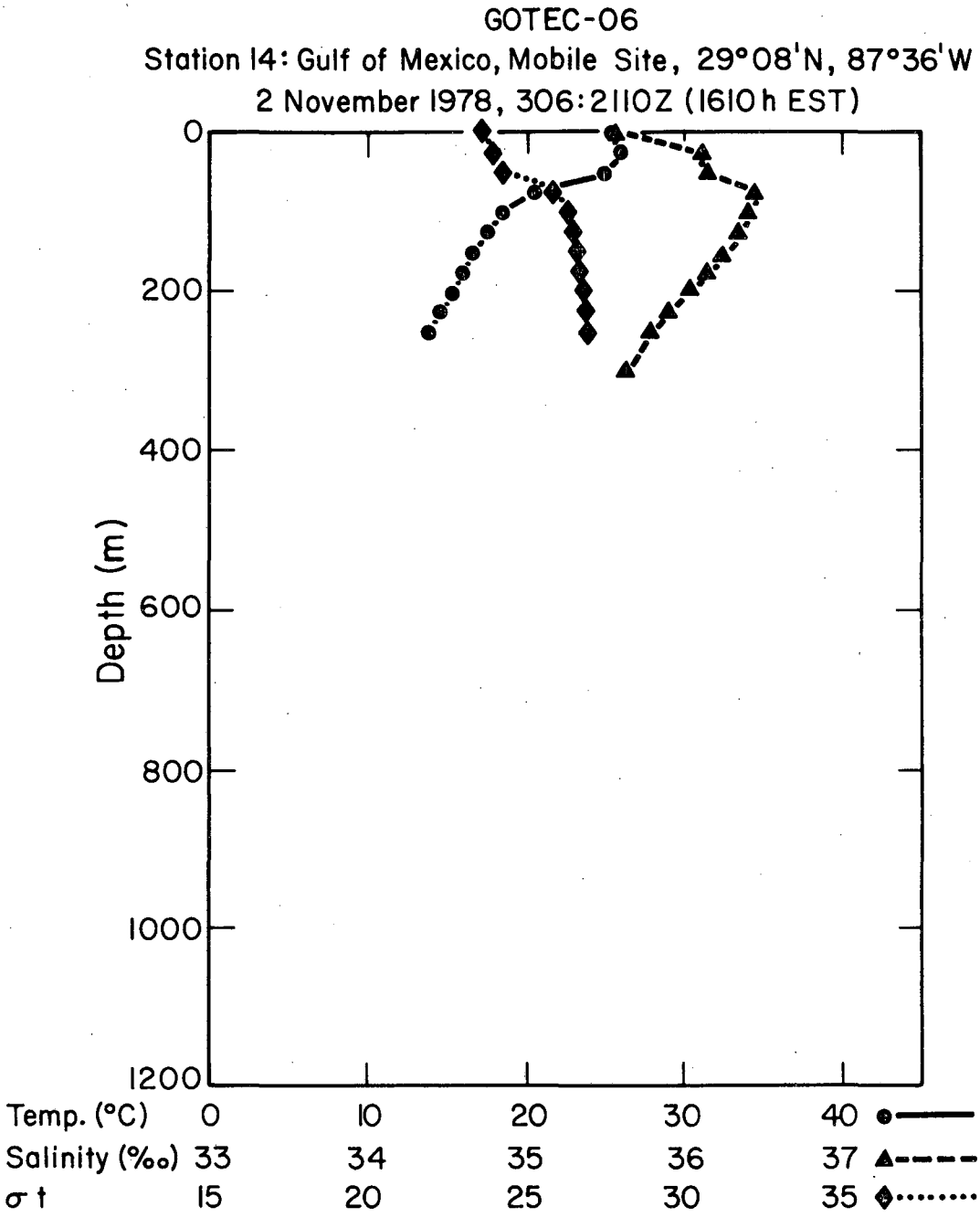


Figure 6A-5.

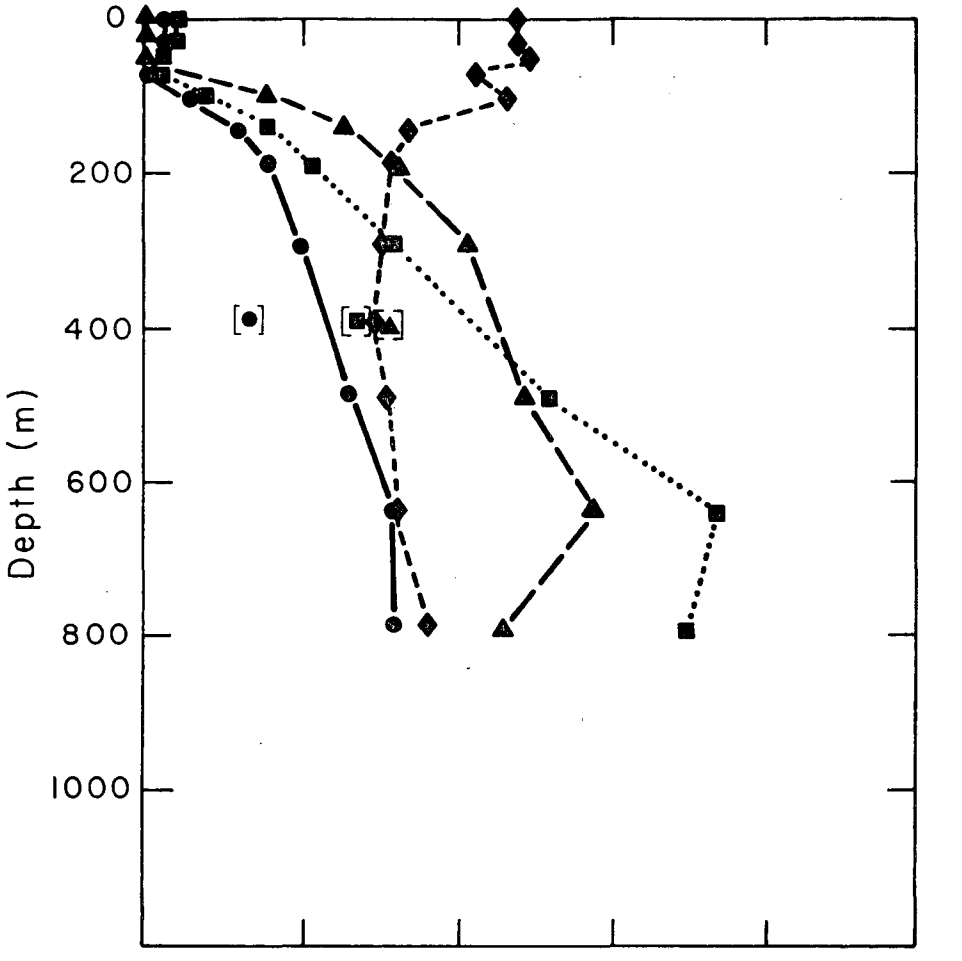
NUTRIENT DATA

Phosphate, Nitrate plus Nitrite, Silicate, Dissolved Oxygen

GOTEC-06

Station 5: Gulf of Mexico, Tampa Site, 27° 50'N, 85° 32'W

29 October 1978, 302:0401Z (0001h EDT)



Phosphate (μg-at/L)	0.5	1.0	1.5	2.0	● ——
Nitrate plus Nitrite (μg-at/L)	10	20	30	40	▲ — —
Silicate (μg-at/L)	5	10	15	20	■ ·····
D.O. (ml/L)	2	4	6	8	◆ - - - -

[●] Points in brackets indicate questionable results.

XBL 808-1720

Figure 6A-6.

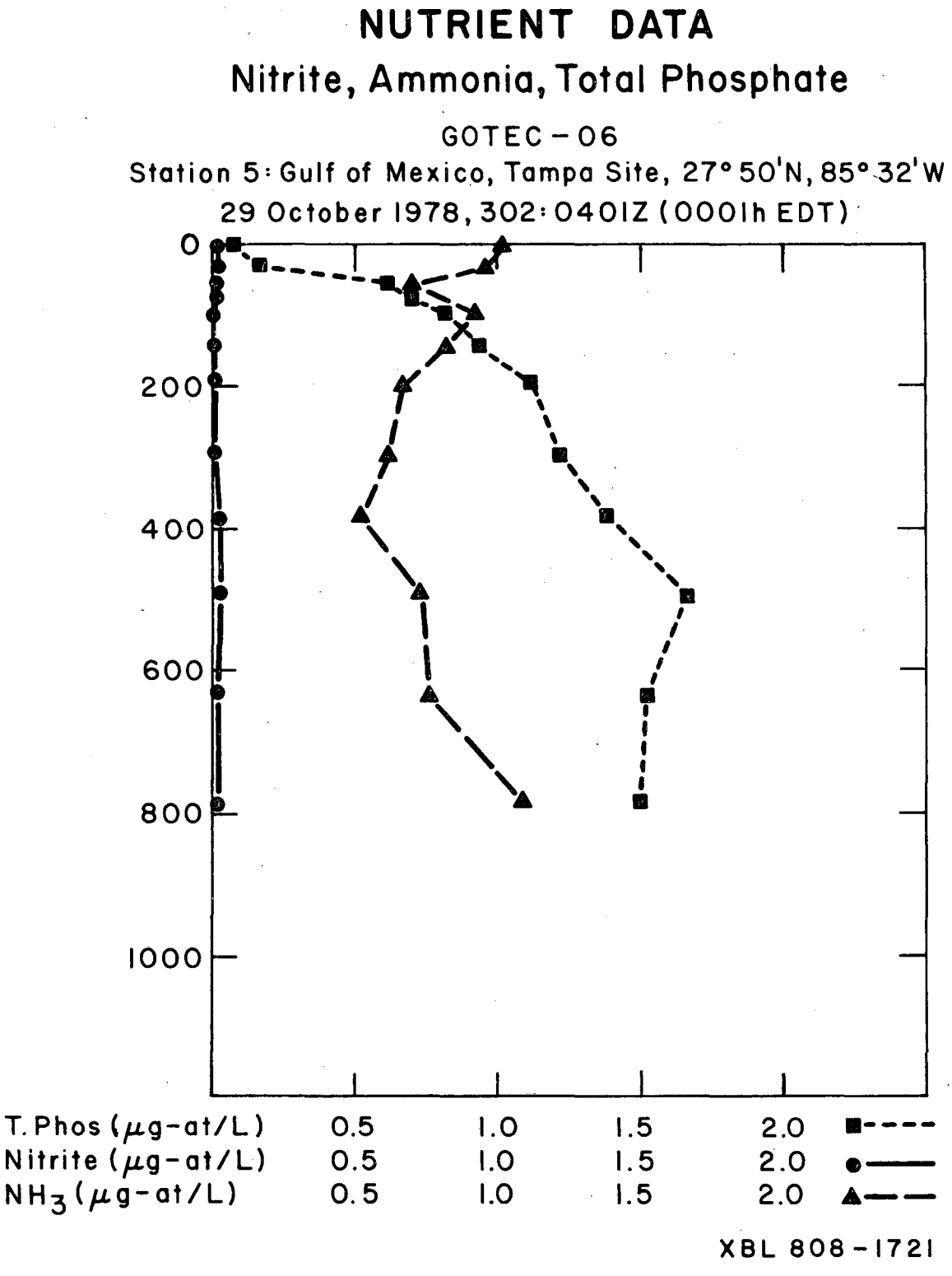

NUTRIENT DATA
Nitrite, Ammonia, Total Phosphate
GOTEC – 06
Station 5: Gulf of Mexico, Tampa Site, 27° 50'N, 85° 32'W
29 October 1978, 302: 0401Z (0001h EDT)
0
200
400
600
800
1000
T. Phos (μg-at/L) 0.5 1.0 1.5 2.0
Nitrite (μg-at/L) 0.5 1.0 1.5 2.0
NH3 (μg-at/L) 0.5 1.0 1.5 2.0
XBL 808-1721

Figure 6A-7.

NUTRIENT DATA

Phosphate, Nitrate plus Nitrite, Silicate, Dissolved Oxygen

GOTEC-06

Station 8: Gulf of Mexico, Mobile Site, 29° 10'N, 87° 38'W

31 October 1978, 304:0443Z (2343h, 30 October EST)

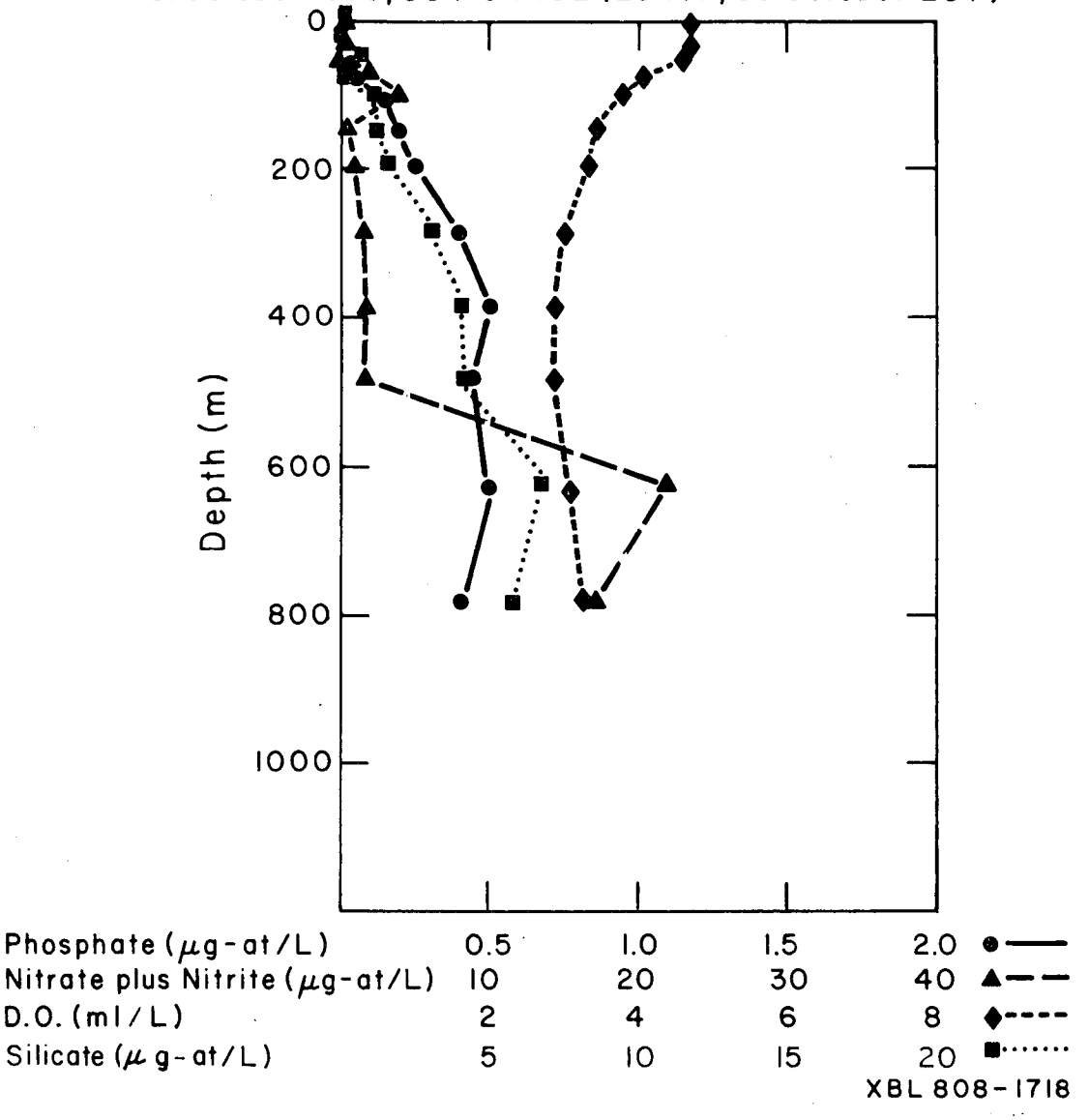


Figure 6A-8.

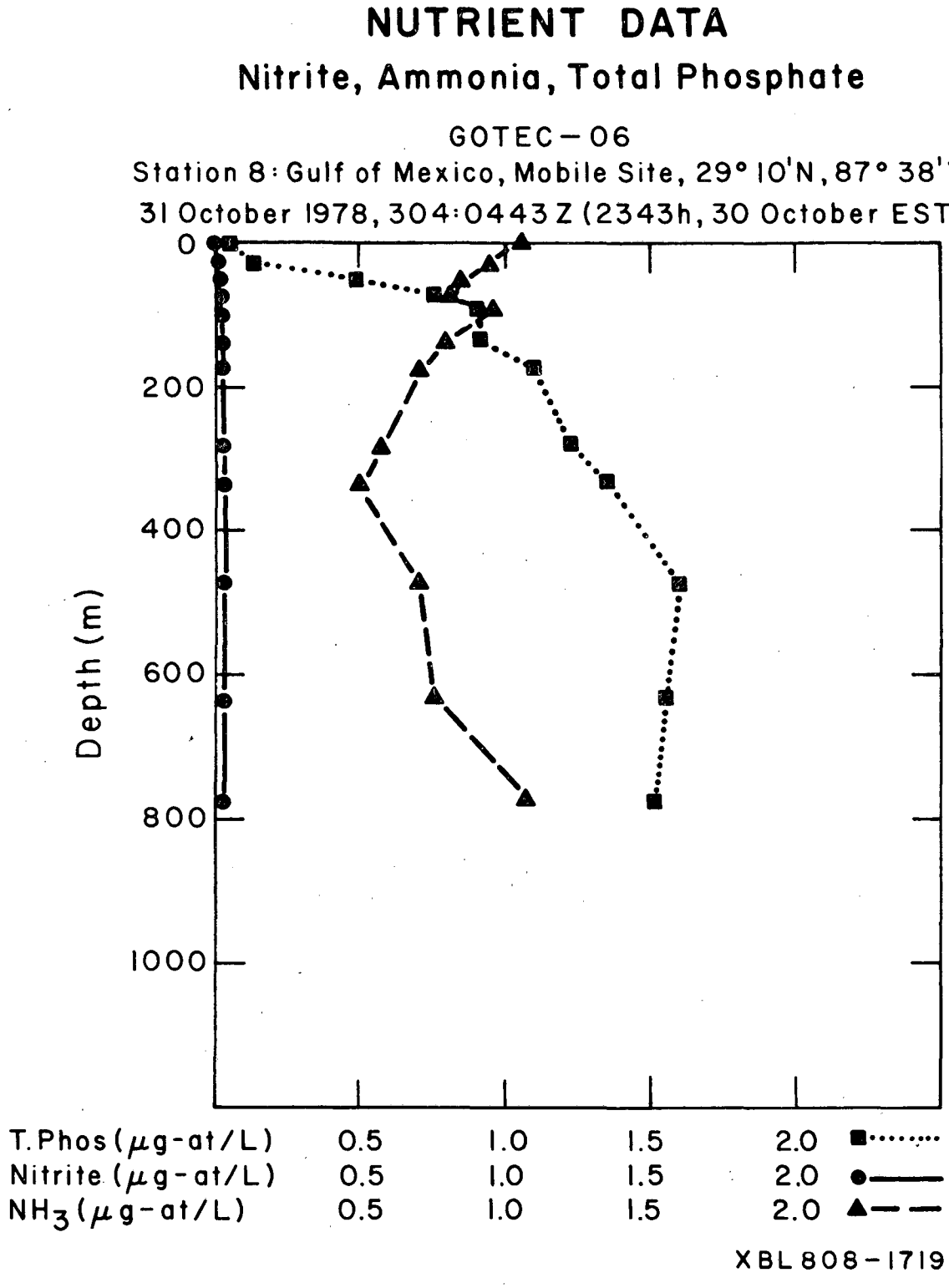

NUTRIENT DATA
Nitrite, Ammonia, Total Phosphate
GOTEC – 06
Station 8: Gulf of Mexico, Mobile Site, 29° 10'N, 87° 38'W
31 October 1978, 304:0443 Z (2343h, 30 October EST)
Depth (m)
0
200
400
600
800
1000
T. Phos (μg-at/L) 0.5 1.0 1.5 2.0
Nitrite (μg-at/L) 0.5 1.0 1.5 2.0
NH3 (μg-at/L) 0.5 1.0 1.5 2.0
XBL 808-1719

Figure 6A-9.

BIOMASS INDICATORS

Chlorophyll a, Phaeophytin, Adenosine Triphosphate

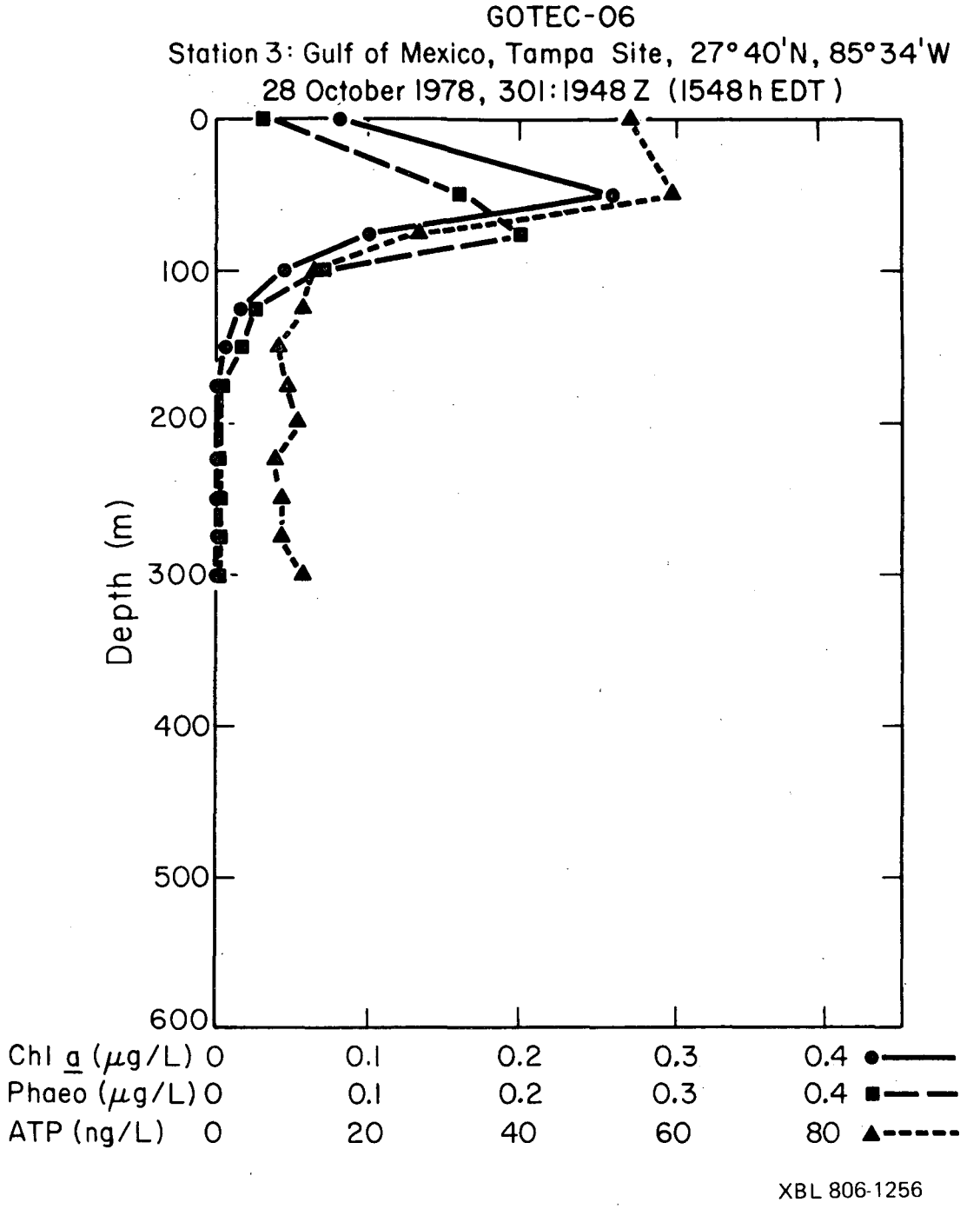


Figure 6A-10.

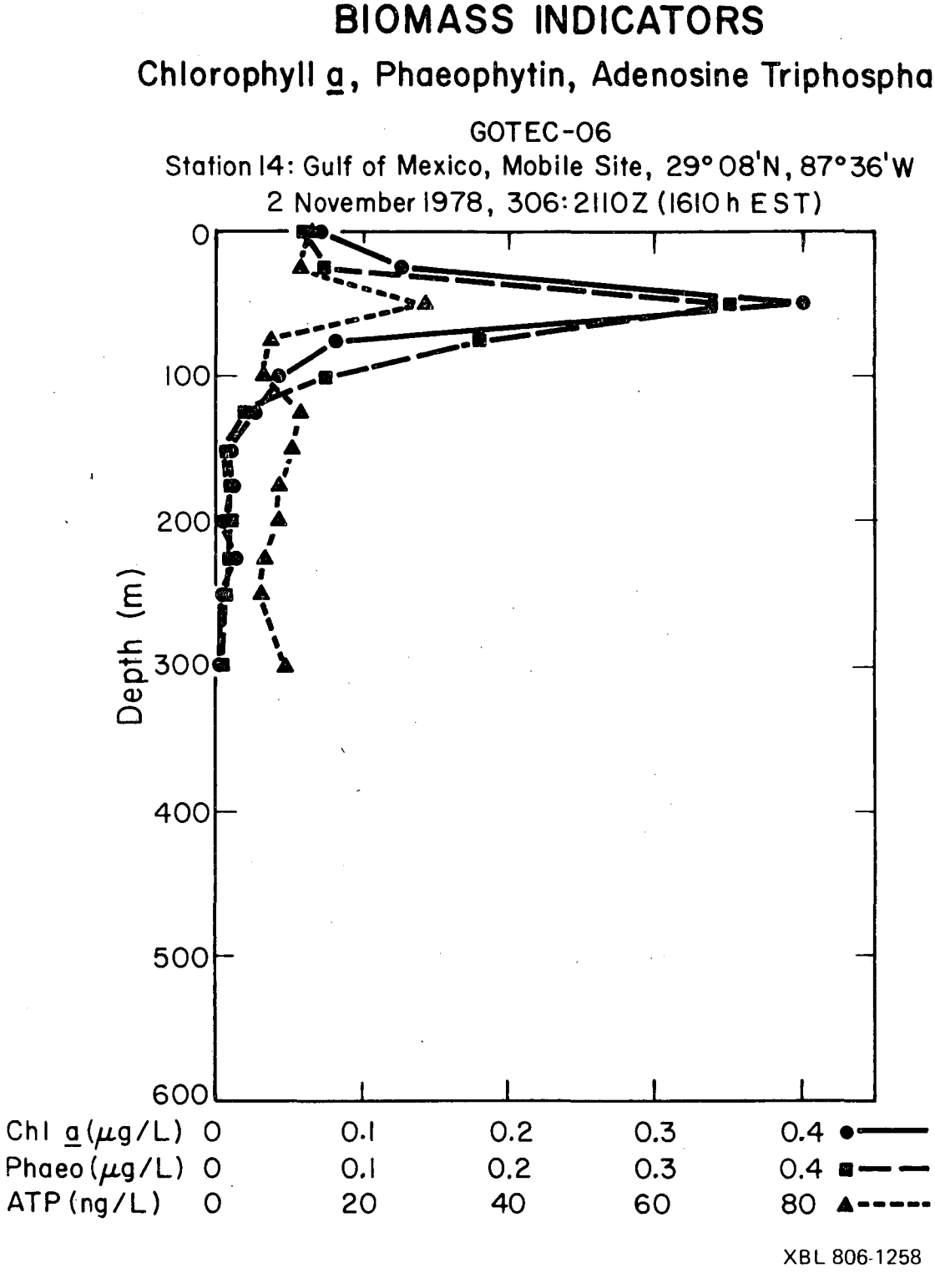

BIOMASS INDICATORS
Chlorophyll a, Phaeophytin, Adenosine Triphosphate
GOTEC-06
Station 14: Gulf of Mexico, Mobile Site, 29° 08'N, 87° 36'W
2 November 1978, 306: 2110Z (1610 h EST)
Depth (m)
0
100
200
300
400
500
600
Chl a (μg/L) 0 0.1 0.2 0.3 0.4
Phaeo (μg/L) 0 0.1 0.2 0.3 0.4
ATP (ng/L) 0 20 40 60 80
XBL 806-1258

Figure 6A-11.

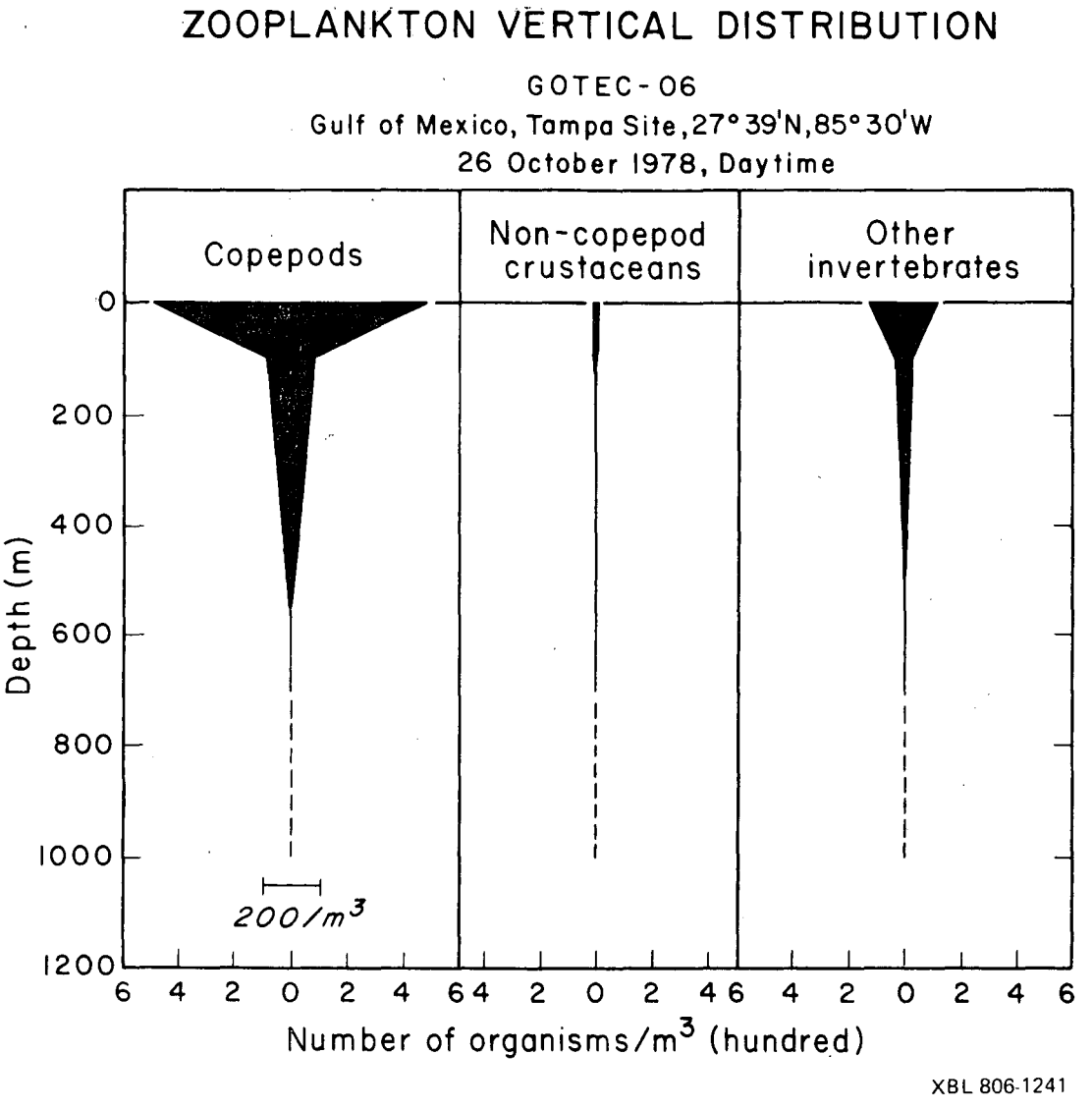

ZOOPLANKTON VERTICAL DISTRIBUTION
GOTEC-06
Gulf of Mexico, Tampa Site, 27°39'N, 85°30'W
26 October 1978, Daytime
Copepods
Non-copepod crustaceans
Other invertebrates
Depth (m)
0
200
400
600
800
1000
1200
200/m3
6 4 2 0 2 4 6 4 2 0 2 4 6 4 2 0 2 4 6
Number of organisms/m3 (hundred)
XBL 806-1241

Figure 6A-12.

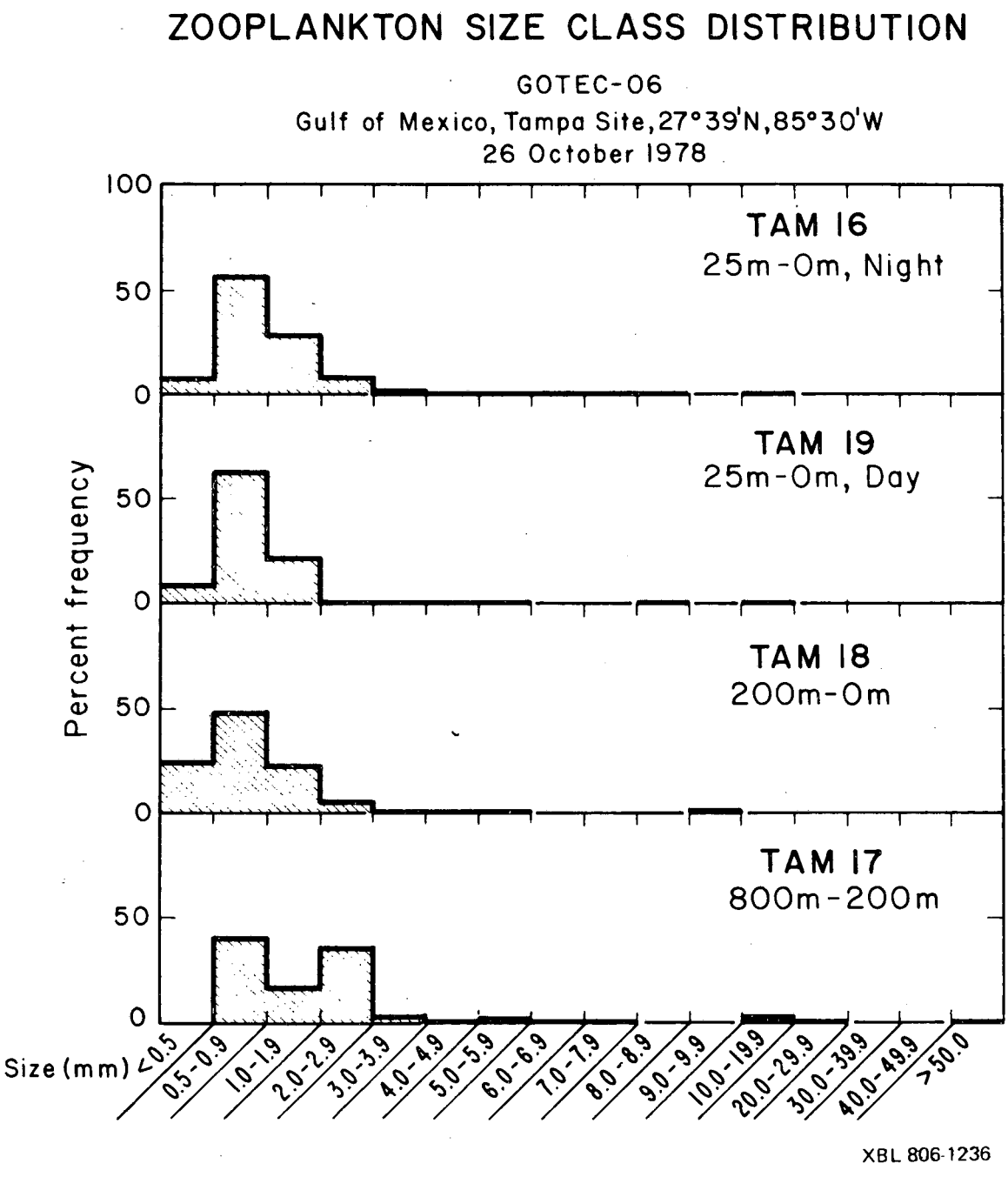

ZOOPLANKTON SIZE CLASS DISTRIBUTION
GOTEC-06
Gulf of Mexico, Tampa Site, 27°39'N, 85°30'W
26 October 1978
TAM 16
25m-0m, Night
TAM 19
25m-0m, Day
TAM 18
200m-0m
TAM 17
800m-200m
Percent frequency
100
50
0
Size (mm) <0.5
0.5-0.9
1.0-1.9
2.0-2.9
3.0-3.9
4.0-4.9
5.0-5.9
6.0-6.9
7.0-7.9
8.0-8.9
9.0-9.9
10.0-19.9
20.0-29.9
30.0-39.9
40.0-49.9
>50.0
XBL 806-1236

Figure 6A-13.

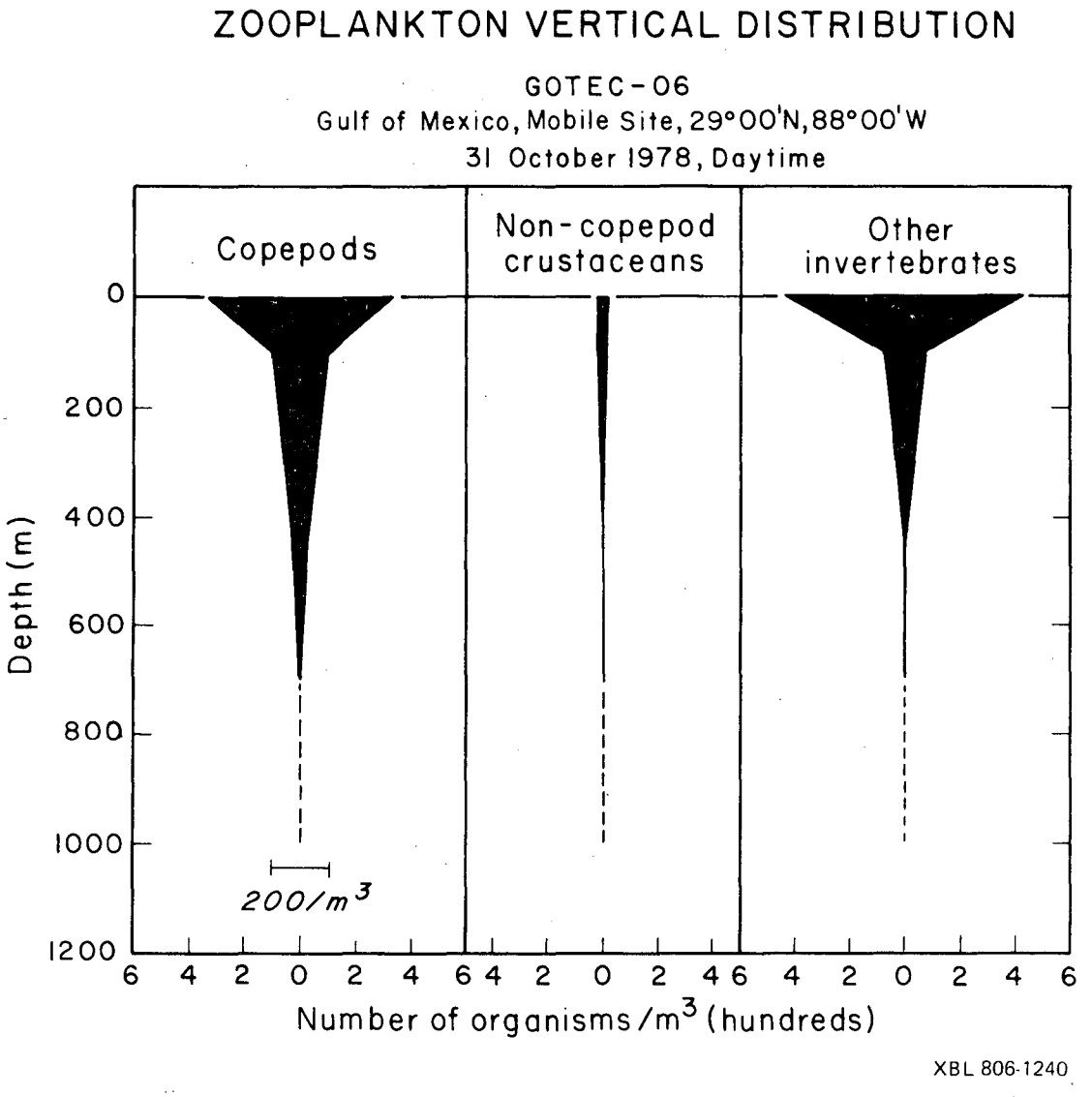

ZOOPLANKTON VERTICAL DISTRIBUTION
GOTEC-06
Gulf of Mexico, Mobile Site, 29°00'N, 88°00'W
31 October 1978, Daytime
Copepods
Non-copepod crustaceans
Other invertebrates
Depth (m)
0
200
400
600
800
1000
1200
200/m3
6 4 2 0 2 4 6 4 2 0 2 4 6 4 2 0 2 4 6
Number of organisms/m3 (hundreds)
XBL 806-1240

Figure 6A-14.

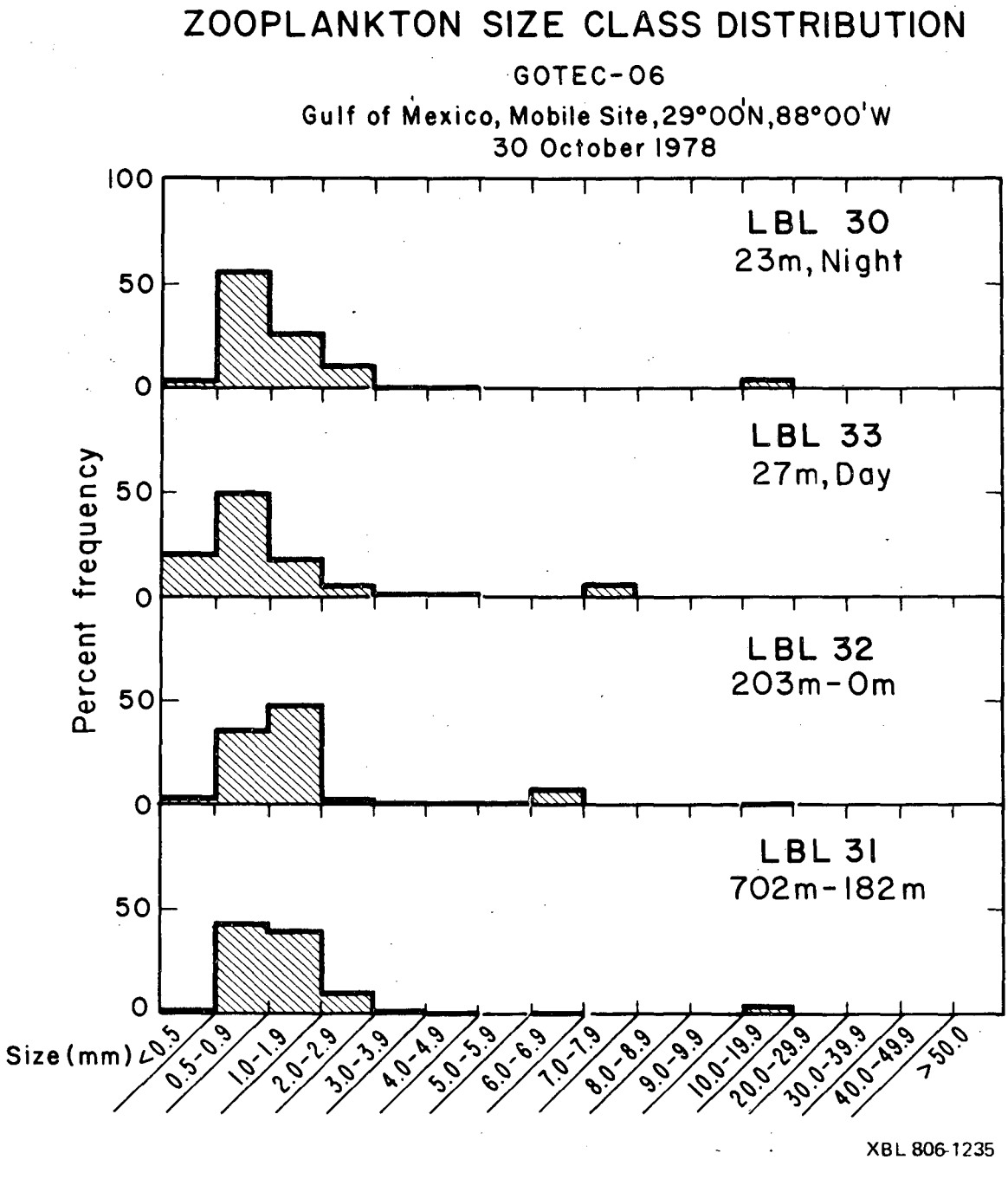

ZOOPLANKTON SIZE CLASS DISTRIBUTION
GOTEC-06
Gulf of Mexico, Mobile Site, 29°00'N, 88°00'W
30 October 1978
LBL 30
23m, Night
LBL 33
27m, Day
LBL 32
203m-0m
LBL 31
702m-182m
Percent frequency
100
50
0
Size (mm) <0.5
0.5-0.9
1.0-1.9
2.0-2.9
3.0-3.9
4.0-4.9
5.0-5.9
6.0-6.9
7.0-7.9
8.0-8.9
9.0-9.9
10.0-19.9
20.0-29.9
30.0-39.9
40.0-49.9
>50.0
XBL 806-1235

Figure 6A-15.

Appendix 6B

Tables

Standard deviations were not routinely calculated for the data in Tables 6B-1 through 6B-3. Generally the following variabilities may be expected:

Temperature:	Bottle Thermometer	±0.01
	STD's	±0.02
Salinity		±0.003

No standard deviations were calculated at this time for the nutrients; however, a subsequent determination of the precision of the instrument used (A Technicon AutoAnalyser) showed that the precision ranged from no detectable variation to an average of approximately ± 0.03 µg at/L for phosphates and total phosphate. Precision for silicates was very high (generally no detectable variation, however variation of ± 0.25 µg at/L did occur and a few rare occurrences ± 1.0 µg at/L. Precision for nitrates was generally better than ± 0.5 µg at/L however, a few rare analyses gave higher values. Deviations of ammonia values ranged from ± 0.1 to 1.0 µg at/L.

As has been mentioned in the introduction to Appendix 4A, volume constraints prevented statistical analysis for the biological data.

Table 6B-1. Physical oceanographic parameters from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Site, 21 October - 6 November 1978 (GOTEC-06)

OBSERVED			CALCULATED	INTERPOLATED			COMPUTED
Observed depth M	Temperature °C	Salinity ‰	Sigma-t	Standard depth M	Temperature °C	Salinity ‰	Sigma-t
Station 2: Position: 27°40.7N, 35°31.6'W (Tampa Site), 28 October 1978 Time: 301:1602Z (1202 EDT)							
0	25.54	35.51	23.59	0	25.40	35.71	23.77
24	23.37	36.32	24.26	20	25.33	36.01	24.02
48	25.05	36.43	24.44	40	25.05	36.35	24.36
73	19.95	36.53	25.97	80	19.62	36.47	26.00
97	18.51	36.46	26.28	100	18.19	36.43	26.33
147	15.97	36.12	26.65	140	16.28	36.13	26.56
196	14.46	35.89	26.81	200	14.12	35.91	26.93
295	11.74	35.45	27.08	300	11.53	35.47	27.06
395	9.87	35.18		400	9.77	35.20	27.16
494	8.45	35.00	27.24	500	8.38	35.06	27.28
644	6.74	34.87	27.39	600	7.32	34.93	27.33
796	5.69	34.89	27.54				
Station 3: Position: 27°40.6'N, 85°34.2'W (Tampa Site), 28 October 1978 Time: 301:1833Z (1433 EDT)							
0	25.64			0	25.42	35.75	23.79
50	24.88	36.46	24.50	40	25.08	36.35	24.35
75	20.00	36.51	25.93	80	19.62	36.48	26.00
100	18.19	36.41	26.33	100	18.30	36.39	26.27
125	16.87	36.27	26.54	120	17.17	36.34	26.51
150	16.02	36.13	26.62	140	16.35	36.12	26.54
175	15.09	36.00	26.75	180	14.39	35.91	26.82
200	14.12	35.84	26.84	200	13.92	35.83	26.86
225	13.68	35.76	26.87	220	13.46	35.74	26.88
250[a]	12.8[b]	35.67					
275	12.36	35.55	26.98				
300[a]	11.4[b]	35.47					
Station 5: Position: 27°40'N, 85°31'W (Tampa Site) 28 October 1978 Time: 32:0329Z (2320 EDT)[c]							
0	25.75	35.53	4.82		0	25.52	36.72
23	25.43	36.25	4.82	24.18	20	25.33	36.19
46	25.13	36.47	5.05	24.44	40	25.05	36.29
70	20.12	36.49	4.32	25.89	80	19.06	36.35
94	18.57	36.45	4.74	26.26	100	18.12	36.38
141	16.37	36.19	3.45	26.60	140	16.40	36.21
190	14.49	35.90	3.21	26.81	200	13.78	35.84
287	12.10	35.51	3.08	27.00	300	11.41	35.45
386	10.11	35.21	2.97	27.13	400	9.65	35.19
485[a]	7.8[b]	35.01	3.12	17.39	500	8.18	35.03
634	6.87	34.90	3.21	17.39	600	7.08	34.93
784	5.86	34.90	3.66	27.54			

[a] Wire

[b] XBT Temperature

Table 6B-1 (continued). Physical oceanographic parameters from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Site, 21 October - 6 November 1978 (GOTEC-06)

OBSERVED			CALCULATED	INTERPOLATED			COMPUTED
Observed depth M	Temperature °C	Salinity ‰	Sigma-t	Standard depth M	Temperature °C	Salinity ‰	Sigma-t
Station 8: Position: 29°C9.9N, 87°C38.7'W (Mobile Site) 30 October 1978 Time: 304:0345Z (2245 EST)							
0	25.63	35.90	4.73	23.86	0	25.60	36.00
23	25.67	35.91	4.74	23.85	20	25.62	36.02
45	25.53	36.11	4.61	24.05	40	25.70	36.20
69	20.64	36.42	4.09	25.69	60	22.83	36.39
92	18.93	26.40	3.83	26.13	100	18.61	36.46
138	17.27	36.32	3.42	26.49	140	17.07	36.33
186	16.06	36.16	3.30	26.65	200	15.50	36.15
282	13.54	35.74	3.07	26.89	300	13.10	35.69
379	11.28	35.38	2.97	27.06	400	10.90	35.32
477	9.1	35.10	2.94	27.19	500	9.06	35.12
625	7.26	34.90	3.13	27.34	600	7.45	34.96
773	6.04	34.88	3.29	27.49			
Station 14: Position: 29°08'N, 87°36'W (Mobile Site) 2 November 1978 Time: 306:2110 (1610 EST)							
0	25.28	35.51	23.67	0	25.15	35.55	23.73
25	25.75	36.09	23.96	20	25.61	36.00	23.93
50	24.89	36.12	24.25	40	25.65	36.12	24.00
75	20.35	36.42	25.77	80	19.80	36.39	25.89
100	18.27	36.36	26.27	100	18.25	36.36	26.26
125	17.39	36.30	26.44	120	17.45	36.33	26.44
150	16.47	36.22	26.60	140	16.87	36.29	26.54
175	15.86	36.12	26.67	180	15.75	36.08	26.65
200	15.18	36.01	26.74	200	15.09	36.03	26.76
225	14.33	35.88	26.83	220	14.42	35.94	26.83
250	13.69	35.77	26.88	240	13.80	35.81	26.86
300		35.61		240	13.80	35.81	26.86

[a] Wire
[b] XBT Temperature

Table 6B-2. Nutrient data from R/V Virginia Key, Gulf of Mexico, Tampa and Mobile Sites, 21 October - 6 November 1978 (GOTEC-06)

Observed Depth (M)	Dissolved Oxygen (ml/L)	Phosphates (µg-at/L)	Nitrites (µg-at/L)	Nitrates and Nitrites (µg-at/L)	Silicates (µg-at/L)	Ammonia (µg-at/L)	Total Phosphate (µg-at/L)
Station 05, Position: 27°40'N x 85°31'W (Tampa Site) Time: 302:03:15Z (2315 EDT) 29 October 1978 (10-29Z)							
0	4.82	0.1	0.05	0.1	1.0	1.1	0.1
23	4.83	0.1	0.05	0.1	1.0	1.0	0.2
46	5.05	0.0	0.05	0.1	0.5	0.7	0.6
70	4.32	ND	0.05	1.2	ND	0.7	0.7
94	4.74	0.2	ND	8.0	2.0	0.9	0.8
141	3.45	0.3	ND	13.0	4.0	0.8	0.9
190	3.21	0.4	ND	16.5	5.5	0.7	1.1
287	3.08	0.5	ND	21.0	8.0	0.6	1.2
386	2.97	[0.4][b]	0.05	[16.0]	[7.0]	0.5	1.4
485	3.12	[0.6]	0.10	24.5	13.0	0.7	1.7
634	3.21	[0.8]	0.05	29.0	18.5	0.8	1.5
784	3.66	[0.8]	0.10	23.0	16.5	1.1	1.5
Station 08, Position: 29°11'N, 87°39'W (Mobile Site) Time: 304:0345Z (2255 EST) 29 October 1978 (30 October 1978Z)							
0	4.73	ND	0.02	0.1	ND	1.1	0.0
23	4.74	ND	0.05	0.1	ND	1.0	0.1
45	4.61	0.0	0.10	0.4	1.0	0.8	0.5
69	4.09	0.0	0.10	1.7	0.5	0.8	0.8
92	3.83	0.2	0.10	4.2	2.0	1.0	0.8
138	3.42	0.2	0.05	[1.0]	2.5	0.8	0.9
186	3.30	0.2	0.05	[1.2]	3.0	0.7	1.1
282	3.07	[0.4]	0.05	[1.7]	6.0	0.6	1.2
379	2.96	[0.5]	0.08	[2.0]	8.0	0.5	1.4
477	2.94	[0.4]	0.05	[2.0]	9.0	0.7	1.6
625	3.13	[0.5]	0.07	22.0	13.5	0.8	1.6
773	3.29	[0.4]	0.10	17.0	11.5	1.1	1.5

[a] Wire out
[b] points in brackets are questionable
[c] ND = None Detected

TABLE 6B-3. Biomass indicator data from R/V Virginia Key, Gulf of Mexico, Tampa Site, 21 October - 6 November 1978 (GOTEC-06)

OBSERVED BIOLOGICAL				OBSERVED BIOLOGICAL			
Observed Depth M	Chl a (µg/L)	Phaeo (µg/L)	ATP (ng/L)	Observed Depth M	Chl a (µg/L)	Phaeo (µg/L)	ATP (µg/L)
Station 3: Position: 27°40.6'N, 85°34.2'W, 28 October 1978 Time: 301:1833Z (1433 EDT)				Station 14: Position: 29°08'N, 87°36'W, 2 November 1978 Time: 306:2110Z (1610h EST)			
0	0.08[c]	0.03	54.8	0	0.07[c]	0.059	12.7
50	0.26	0.16	59.2	25	0.13	0.074	11.7
75	0.10	0.20	26.6	50	0.40	0.350	27.1
100	0.04	0.07	13.2	75	0.08	0.179	7.0
125	0.02	0.02	11.0	100	0.04	0.076	6.6
150	0.006	0.02	8.0	125	0.23	0.019	11.5
175	0.001	0.01	9.0	150	0.006	0.009	10.2
200	N.S.[b]	N.S.[b]	10.8	175	0.004	0.012	8.0
225	0.001	0.006	7.3	200	0.005	0.010	8.0
250[a]	0.007	0.006	8.3	225	0.002	0.008	6.6
275	0.001	0.006	8.5	250	0.002	0.007	6.6
300[a]	0.001	0.006	11.0	300[a]	0.002	0.006	9.5

[a] Line out.
[b] N.S. - no sample, insufficient volume of water
[c] STD deviation to be approximately 8% of the value given for all values less than 0.5 mg^3.

TABLE 6B-4. Zooplankton Abundance from R/V Virginia Key, Gulf of Mexico, 21 October - 6 November 1978 (GOTEC-06)

LBL Sample No. and tow description	Copepods Density[a]	Copepods Percent	Non-copepod crustaceans Density	Non-copepod crustaceans Percent	Other Invertebrates Density	Other Invertebrates Percent	Fish larvae Density	Fish larvae Percent	Total Zooplankton Density
				TAMPA SITE					
16. 25m hor. night	946.6	85.4	40.4	3.6	122.0	11.0	0.02	<0.1	1109.0
19. 25m hor. day	898.6	74.4	13.1	1.1	295.7	24.5	-	-	1207.4
18. 200-0m obl. day	157.8	67.9	13.1	5.9	50.2	26.1	0.08	<0.1	221.2
17. 800-200m obl. day	6.9	75.8	1.4	15.4	0.8	8.8	0.02	0.2	9.1
				MOBILE SITE					
30. 22m hor. night	793.0	59.3	53.6	4.0	488.6	36.5	3.3	0.2	1338.5
33. 27m hor. day	654.4	47.4	27.2	2.0	697.4	50.5	1.7	0.1	1380.7
32. 203-0m obl. day	232.8	56.2	21.7	5.2	158.4	38.3	1.1	0.3	414.0
31. 702-182m obl. day	46.0	78.1	4.3	7.3	8.3	14.1	0.3	0.5	58.9

[a]Density measured as number of organisms per cubic meter.

TABLE 6B-5. Copepod Taxonomic Composition from R/V Virginia Key, Gulf of Mexico, 21 October - 6 November 1978 (GOTEC-06)

Sample #	Tow Type	Depth (m)	Dominant Genera (% total copepods)		% Composition	
			TAMPA SITE			
TAM 16	Hor. night	25-0	Oncaea	24.4	Calanoida	59.1
			Clausocalanus	22.8	Cyclopoida	40.8
			Temora	10.0	Harpacticoida	0.1
			Farranula	9.4		
			Calocalanus	8.1		
TAM 19	Hor. day	25-0	Clausocalanus	32.7	Calanoida	57.0
			Oncaea	19.7	Cyclopoids	40.9
			Oithona	11.6	Harpacticoida	2.1
			Farranula	7.3		
			Euchaeta	6.5		
TAM 18	Obl. day	200-0	Clausocalanus	27.2	Cyclopoida	52.4
			Oncaea	25.7	Calanoida	47.3
			Oithona	14.4	Harpacticoida	0.3
			Farranula	9.5		
			Calocalanus	4.5		
TAM 17	Obl. day	800-200	Eucalanus	34.0	Calanoida	64.1
			Oncaea	18.8	Cyclopoida	35.3
			Conaea	12.8	Harpacticoida	0.6
			Rhincalanus	5.4		
			Pleuromamma	3.6		
			MOBILE SITE			
30	Hor. night	22	Clausocalanus	33.3	Calanoid	59.8
			Oncaea	20.4	Cyclopoids	39.6
			Farranula	13.9	Harpacticoid	0.6
			Temora	6.8		
			Calocalanus	5.7		
33	Hor. day	27	Clausocalanus	31.8	Calanoid	61.4
			Oncaea	17.4	Cyclopoid	38.3
			Farranula	10.2	Harpacticoid	0.3
			Calocalanus	6.0		
			Oithona	5.7		
32	Obl. day	203-0	Oithona	17.9	Calanoid	52.9
			Oncaea	15.2	Cyclopoid	46.4
			Clausocalanus	11.3	Harpacticoid	0.7
			Farranula	5.4		
			Corycaeus	5.1		
31	Obl. day	702-182	Oncaea	26.7	Calanoid	50.5
			Conaea	10.4	Cyclopoid	48.4
			Eucalanus	9.8	Harpacticoid	1.1
			Corycaeus	5.9		
			Clausocalanus	5.4		

TABLE 6B-6. Zooplankton Size Class Distribution Data from R/V Virginia Key, Gulf of Mexico, 21 October - 6 November 1978 (GOTEC-06).

	TAMPA SITE							
	TAM 16		TAM 19		TAM 18		TAM 17	
Size Class	25m hor. night		25m hor. day		200-0m obl. day		800-200m obl. day	
(mm)	Density	Percent	Density	Percent	Density	Percent	Density	Percent
<0.5	79.3	7.2	95.8	8.6	49.9	23.4	-	-
0.5-0.9	624.0	56.4	757.9	68.3	103.3	48.3	3.6	40.5
1.0-1.9	300.0	27.1	241.1	21.7	48.1	22.5	1.5	16.9
2.0-2.9	86.2	7.8	9.8	0.9	10.9	5.1	3.2	36.0
3.0-3.9	17.1	1.5	0.5	<0.1	0.5	0.2	0.2	2.3
4.0-4.9	0.02	<0.1	1.6	0.1	0.2	<0.1	0.04	0.5
5.0-5.9	0.01	<0.1	0.5	<0.1	0.5	0.2	0.1	1.1
6.0-6.9	0.06	<0.1	-	-	-	-	0.02	0.2
7.0-7.9	0.05	<0.1	-	-	-	-	0.03	0.3
8.0-8.9	0.05	<0.1	1.7	0.2	-	-	-	-
9.0-9.9	-	-	-	-	0.3	0.1	-	-
10.0-19.9	0.01	<0.1	1.0	<0.1	-	-	0.2	2.3
20.0-29.9	-	-	-	-	-	-	0.004	<0.1
30.0-39.9	-	-	-	-	-	-	-	-
40.0-49.9	-	-	-	-	-	-	-	-
>50.0	-	-	-	-	-	-	0.004	<0.1

	MOBILE SITE							
	LBL 30		LBL 33		LBL 32		LBL 31	
Size Class	22m hor. night		27m hor. day		203-0m obl. day		702-182m obl. day	
(mm)	Density[a]	Percent	Density	Percent	Density	Percent	Density	Percent
<0.5	28.5	2.1	248.9	18.0	13.2	3.2	0.8	1.4
0.5-0.9	739.1	55.2	731.3	53.0	145.6	35.2	25.1	42.6
1.0-1.9	356.5	26.6	221.5	16.0	202.6	48.9	23.3	39.6
2.0-2.9	140.6	10.5	76.7	5.9	10.3	2.5	5.4	9.2
3.0-3.9	23.5	1.8	23.9	1.8	2.9	0.7	1.0	1.7
4.0-4.9	8.4	0.6	3.4	0.3	1.8	0.4	0.5	0.9
5.0-5.9	-	-	-	-	2.8	0.7	-	-
6.0-6.9	-	-	-	-	33.7	8.1	0.6	1.0
7.0-7.9	-	-	75.0	5.4	-	-	-	-
8.0-8.9	-	-	-	-	-	-	-	-
9.0-9.9	-	-	-	-	-	-	-	-
10.9-19.9	43.5	3.3	-	-	1.1	0.3	2.2	3.7
20.0-29.9	-	-	-	-	-	-	-	-
30.0-39.9	-	-	-	-	-	-	-	-
40.0-49.9	-	-	-	-	-	-	-	-
>50.0								

[a]Density measured as number of organisms per cubic meter

Appendix 7A

Figures Containing Data

This appendix contains figures displaying the results obtained on Cruise GOTEC-07 (12-15 June 1978) to the Gulf of Mexico.

Figures 7A-1 and 7A-3 show the physical oceanographic data for temperature, salinity, dissolved oxygen, and density. The standard deviations are too small to show in this scale and can be considered to be less than the size of the dot.

Figure 7A-4 shows the biomass indicators phaeophytin, chlorophyll a and ATP (adenosine triphosphate). No standard deviations were obtained for the chlorophyll a determinations as only one sample from each depth at each station was taken. This was due to constraints on the volume of water available for biological analysis from each hydrocast.

Figure 7A-5 shows zooplankton vertical distributions during day-night for copepods, non-copepod crustaceans, and other invertebrates. Figure 7A-6 gives the zooplankton size distributions.

PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Dissolved Oxygen, Sigma t

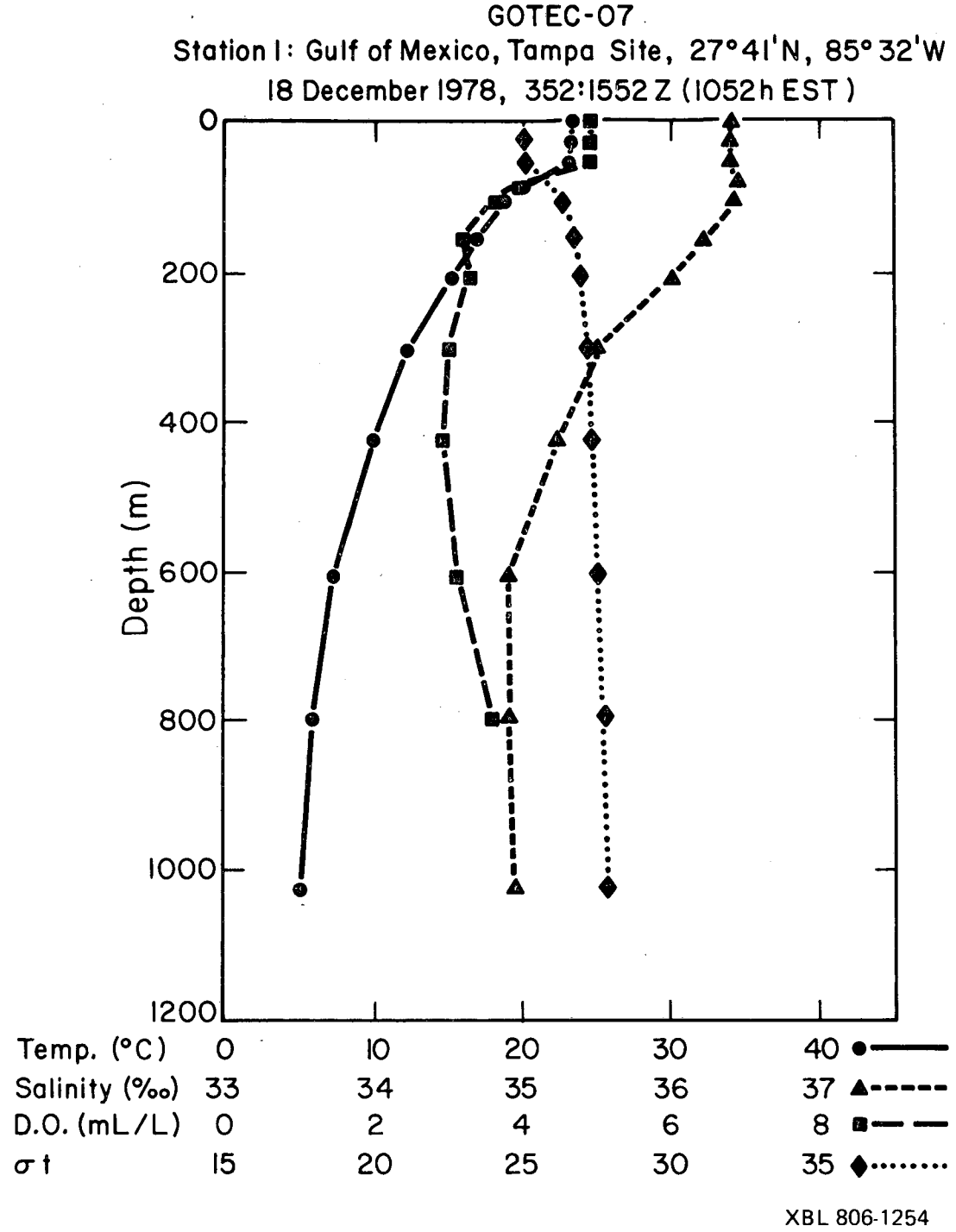


Figure 7A-1.

PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Sigma t

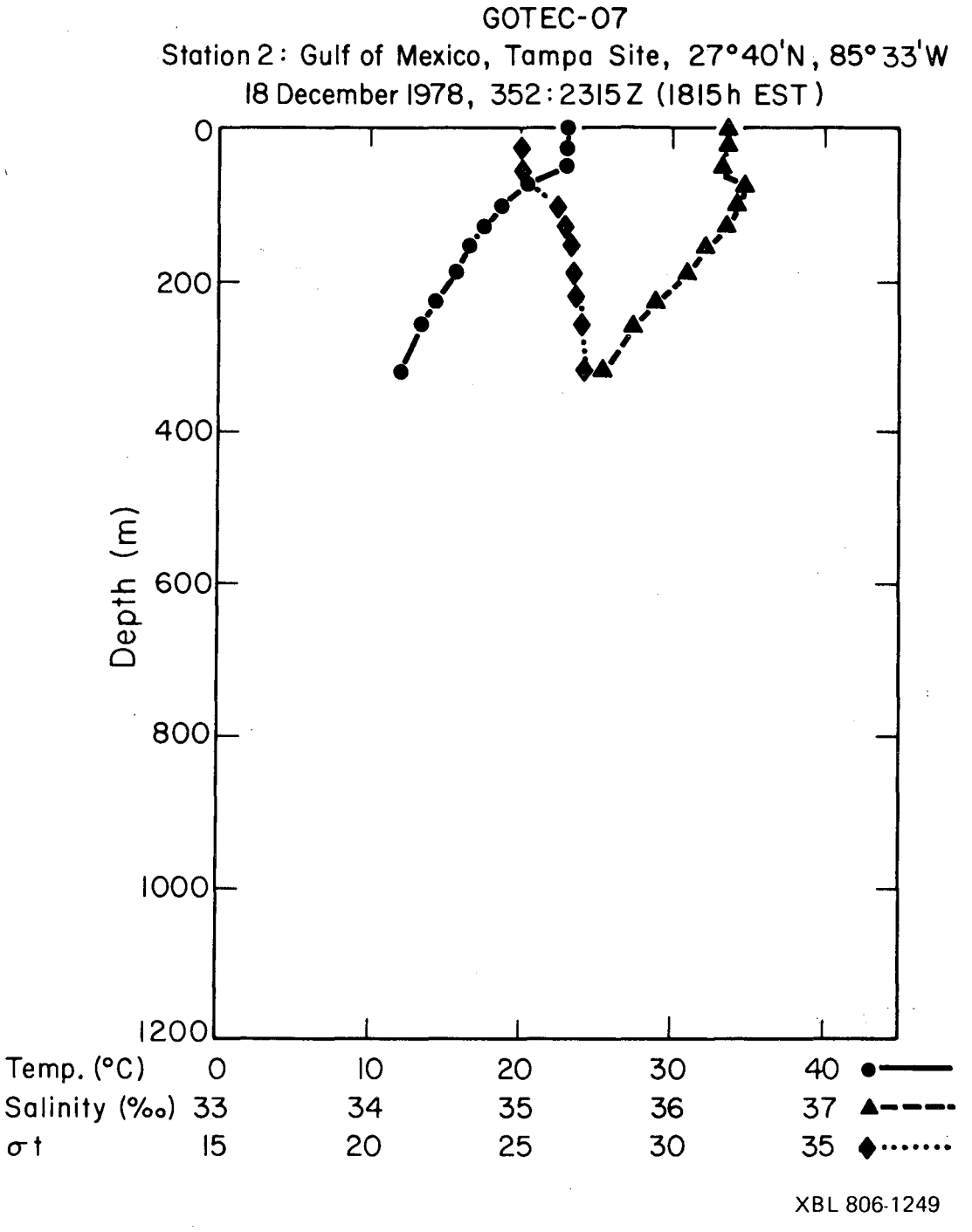


Figure 7A-2.

PHYSICAL OCEANOGRAPHIC PARAMETERS

Temperature, Salinity, Sigma t

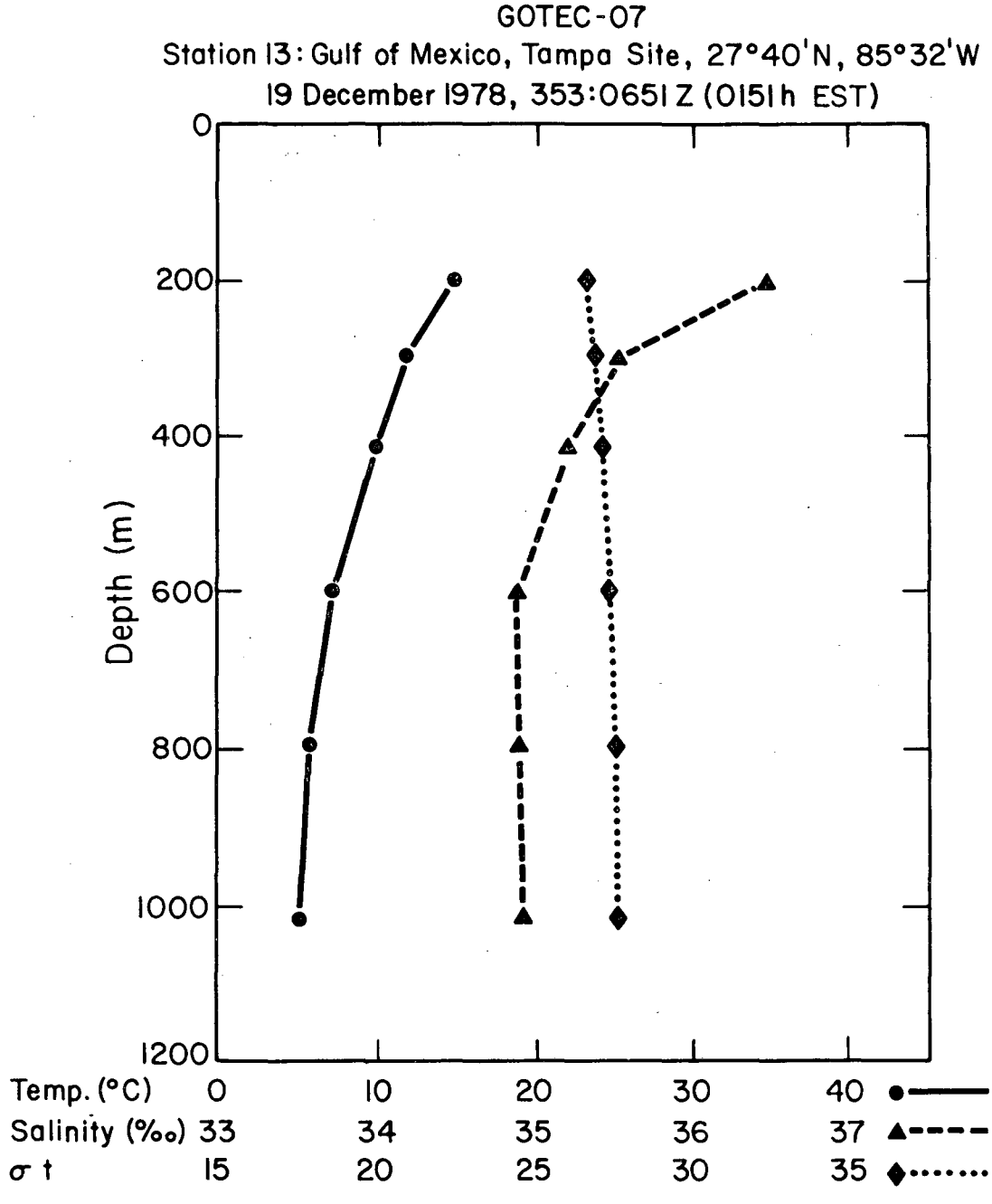


Figure 7A-3.

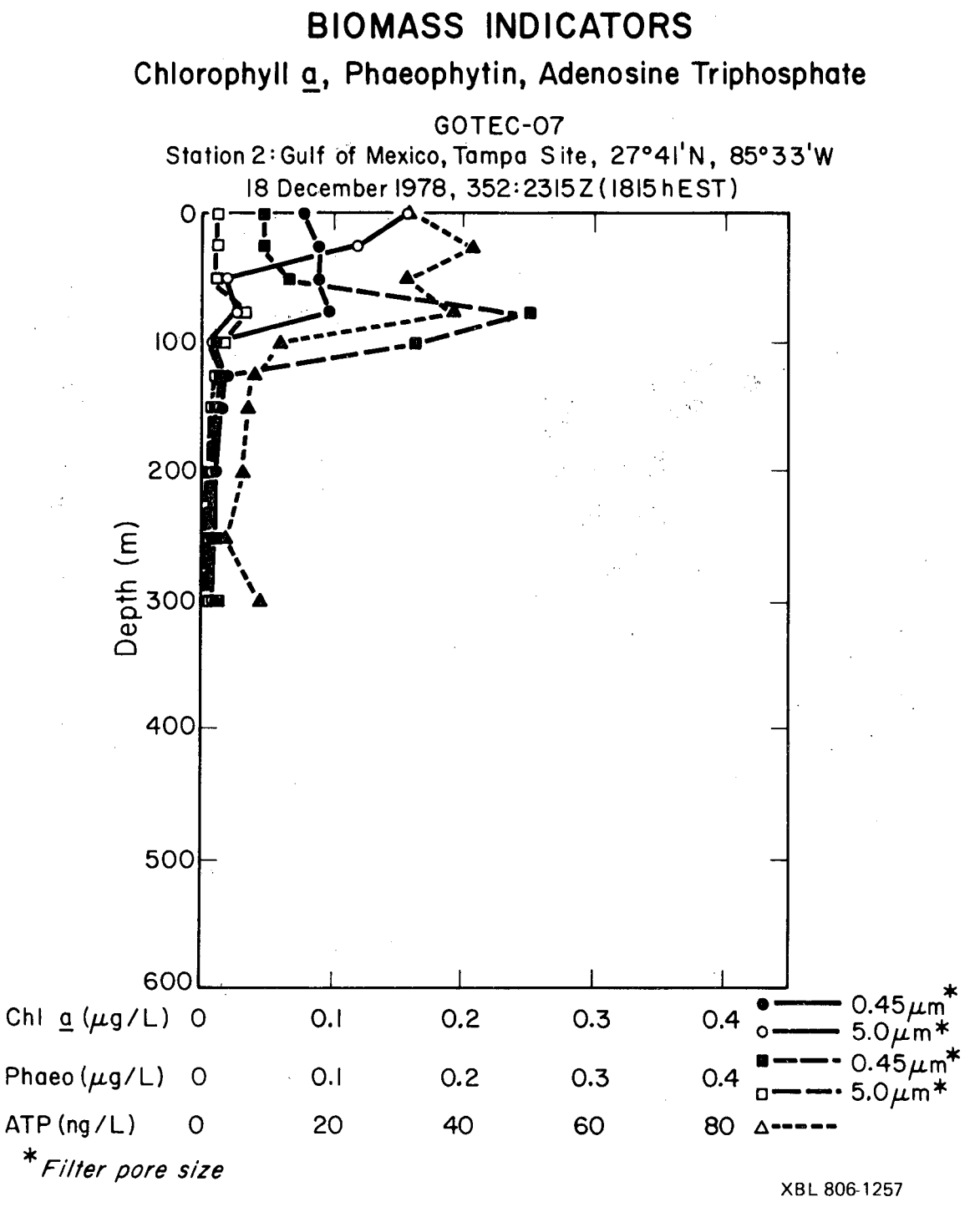

BIOMASS INDICATORS
Chlorophyll a, Phaeophytin, Adenosine Triphosphate
GOTEC-07
Station 2: Gulf of Mexico, Tampa Site, 27°41'N, 85°33'W
18 December 1978, 352:2315Z (1815h EST)
Depth (m)
0
100
200
300
400
500
600
Chl a (μg/L) 0 0.1 0.2 0.3 0.4
Phaeo (μg/L) 0 0.1 0.2 0.3 0.4
ATP (ng/L) 0 20 40 60 80
0.45μm*
5.0μm*
0.45μm*
5.0μm*
*Filter pore size
XBL 806-1257

Figure 7A-4.

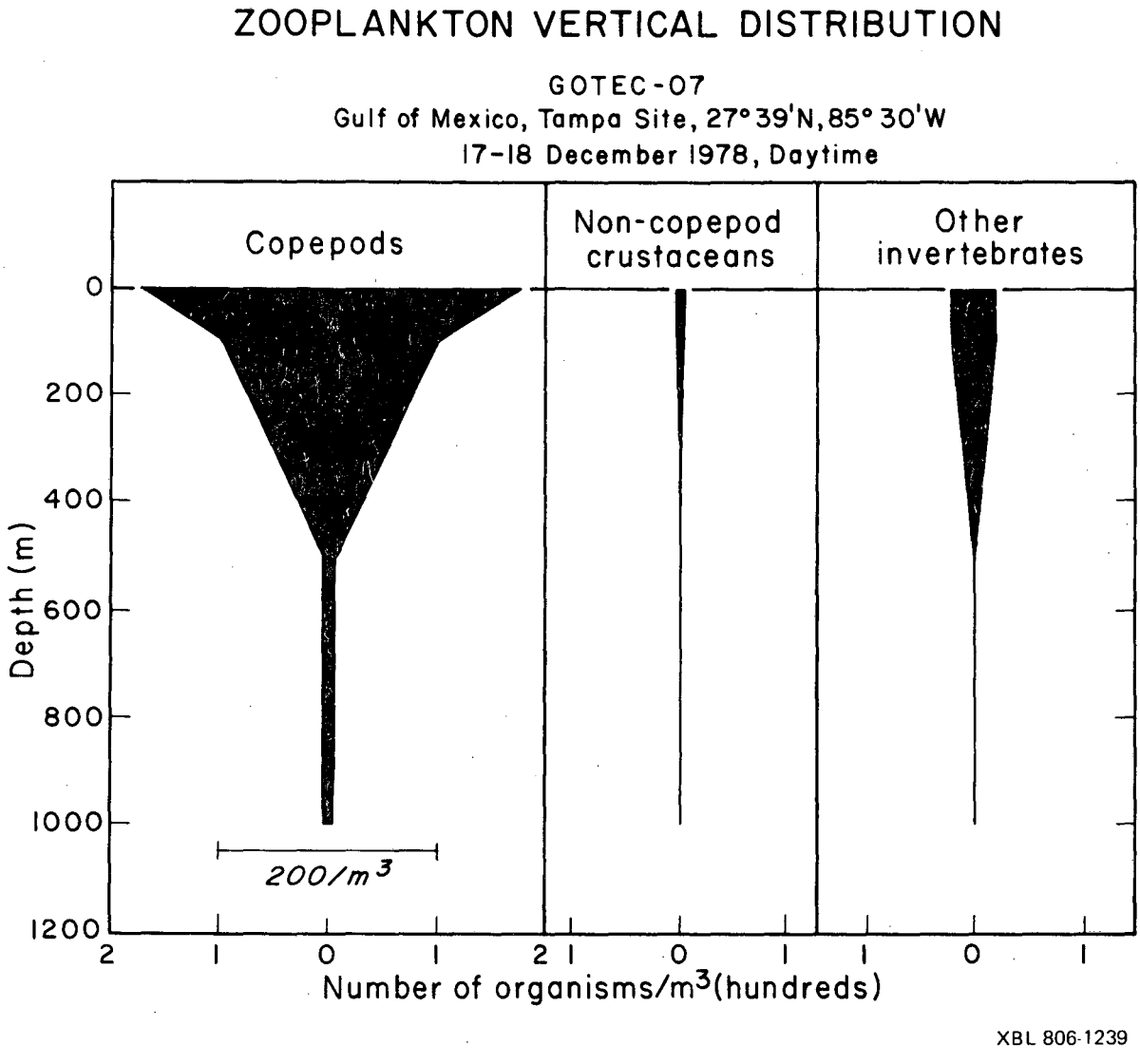

ZOOPLANKTON VERTICAL DISTRIBUTION
GOTEC-07
Gulf of Mexico, Tampa Site, 27°39'N, 85°30'W
17-18 December 1978, Daytime
Copepods
Non-copepod crustaceans
Other invertebrates
Depth (m)
0
200
400
600
800
1000
1200
200/m3
2 1 0 1 2 1 0 1 1 0 1
Number of organisms/m3(hundreds)
XBL 806-1239

Figure 7A-5.

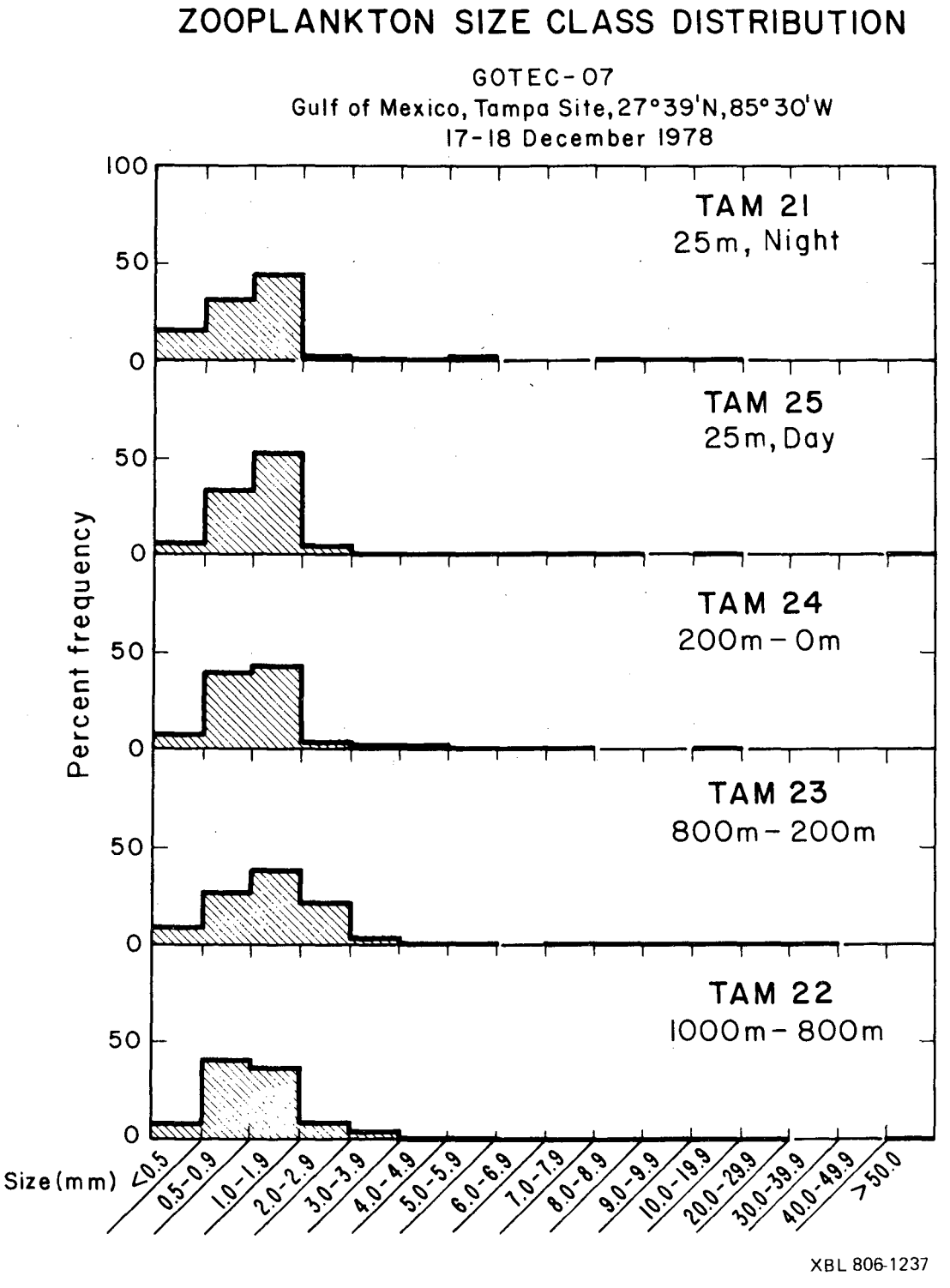

ZOOPLANKTON SIZE CLASS DISTRIBUTION
GOTEC-07
Gulf of Mexico, Tampa Site, 27°39'N, 85°30'W
17-18 December 1978
TAM 21
25m, Night
TAM 25
25m, Day
TAM 24
200m - 0m
TAM 23
800m - 200m
TAM 22
1000m - 800m
Percent frequency
100
50
0
Size (mm)
<0.5
0.5-0.9
1.0-1.9
2.0-2.9
3.0-3.9
4.0-4.9
5.0-5.9
6.0-6.9
7.0-7.9
8.0-8.9
9.0-9.9
10.0-19.9
20.0-29.9
30.0-39.9
40.0-49.9
>50.0
XBL 806-1237

Figure 7A-6.

Appendix 7B

Tables

Standard deviations were not routinely calculated for the data in Tables 7B-1 through 7B-3. Generally the following variabilities may be expected:

	Salinity	±0.003
	Temperature: Bottle Thermometer	±0.01
STD's	±0.02	

As has been mentioned in the introduction to Appendix 4A, volume constraints prevented statistical analysis for the biological data.

TABLE 7B-1. Physical Oceanographic Parameters from R/V Virginia Key, Gulf of Mexico, Tampa Site, 17-20 December 1978 (GOTEC-07)

OBSERVED				CALCULATED	INTERPOLATED			CALCULATED
Observed Depth M	Temperature °C	Salinity ‰	Dissolved Oxygen ml/L	Sigma-t	Standard Depth M	Temperature °C	Salinity ‰	Sigma-t
Station 1: Position: 27°40.8'N, 85°32.1'W, Tampa Site, 18 December 1978 Time: (a) 352:1552Z (1052 EST) (b) 352:1729Z (1229 EST): 1067Z AOML time								
2[a]	23.3[b]	36.38	4.9		0	23.13	36.36	24.95
29	23.14	36.38	4.9	24.96	20	23.13	36.37	24.96
54	23.14	36.38	4.9	24.96	40	23.13	36.37	24.96
81[a]	20.2[b]	36.45	4.0		80	20.30	36.48	25.83
103	18.62	36.41	3.6	26.22	100	19.04	36.44	26.13
156	16.60	30.21	3.2	26.56	140	17.41	36.33	26.45
208	15.02	35.99	3.3	26.76	200	15.40	36.04	26.70
304	12.02	35.50	3.0	27.01	300	12.39	35.55	26.96
423	9.93	35.22	2.9	27.17	400	10.32	35.24	27.10
608	7.24	34.90	3.1	27.35	600	7.43	34.91	27.31
797	5.82	34.91	3.6	27.55	800	5.85	34.89	27.51
1025	5.19	34.95	-[c]	27.66	1000	5.22	34.92	27.61
Station 2: Position: 27°38'N, 85°30'W, Tampa Site, 18 December 1978 Time: (3) 2315 (1815 EST) (4) 353:0030 (1915 EST)[d]								
2[a]	23.1[b]	36.35	No		0	23.18	36.40	24.96
25	23.03	36.37	Samples	24.99	20	23.18	36.40	24.96
50	23.01	36.34	Taken	24.97	40	23.18	36.40	24.97
75[a]	20.4[b]	36.47			80	19.95	36.47	25.91
100	18.67	36.42		26.21	100	18.85	36.45	26.19
125	17.62	36.37		26.44	120	17.96	36.38	26.36
51	16.57	36.24		26.60	140	17.16	36.29	26.49
184	15.70	36.10		26.69				
217	15.15	36.01		26.75				
225	14.3	35.89						
253	13.39	35.72		76.91				
312	12.10	35.55		27.03				
Station 13: Position: 27°40.4'N, 85°31.9W, Tampa Site, 19 December 1978 Time: 353:0651Z (0151 EST)								
200	15.04	35.99	No	26.75	200	15.51	36.03	26.73
297	12.13	35.52	Samples	27.01	300	12.40	35.57	26.97
413	10.13	35.23	Taken	27.15	400	10.33	35.25	27.11
599	7.34	34.91		27.34	600	7.41	34.90	27.30
792	5.6	34.91		27.56	800	5.78	34.89	27.52
1015	5.02	34.94		27.66	1000	5.12	34.92	27.62

[a]Wire out
[b]XBT temperature
[c]Brackets indicate questionable data

TABLE 7B-2. Biomass Indicators from the R/V Virginia Key, Gulf of Mexico, Tampa Site, 17-20 December 1978 (GOTEC-07).

Observed Depth M	Chl a (μg/L) Filter Size 0.45	Chl a (μg/L) Filter Size 5.0	Phaeo (μg/L) Filter Size 0.45	Phaeo (μg/L) Filter Size 5.0	ATP (ng/L)
Station 2: Position: 27°41.1'N, 85°32.7'W 18 December 1978 Time: 352:2315Z (1815 EST)					
0[a]	.078	.153	.047	.015	31.0
25	.089	.114	.047	.010	41.7
50	.089	.014	.065	.0060	31.5
75	.096	.021	.257	.030	38.9
100	.011	.007	.167	.014	11.2
125	.015	.0065	.081	.012	7.6
151	.010	.0028	.012	.0043	6.7
184					
217	.0041	.00092	.011	.0065	5.6
225					
253	.0048	.0018	.0090	.0047	3.3
312	.0021	.0046	.0072	.0067	8.4

[a] Line out.

TABLE 7B-3. Zooplankton Abundance Data from R/V Virginia Key, Gulf of Mexico, Tampa Site, 17-20 December 1978 (GOTEC-07).

Sample No. and tow description	Copepods		Non-copepod crustaceans		Other invertebrates		Fish larvae		Total
	Density[a]	Percent	Density	Percent	Density	Percent	Density	Percent	
TAM 21 25m horizontal night	368.0	73.7	11.4	2.3	119.7	24.0	0.3	<0.1	499.4
TAM 25 25m horizontal day	314.0	87.9	5.2	1.5	38.1	10.7	0.002	<0.1	357.3
TAM 24 200-0m horizontal day	194.1	80.2	7.1	2.9	40.8	16.9	-	-	242.0
TAM 23 800-200m oblique day	11.2	82.9	0.7	5.2	1.6	11.8	0.01	<0.1	13.5
TAM 22 1000-800m oblique day	15.9	72.3	2.7	12.3	3.4	15.5	-	-	22.0

[a]Density measured as number of organisms per cubic meter

TABLE 7B-4. Zooplankton Taxonomic Composition from R/V Virginia Key, Gulf of Mexico, Tampa Site, 17-20 December 1978 (GOTEC-07).

Sample #	Tow type/depth	Dominant Genera (% of total copepods)		% Composition by order		Number of taxa*	
						Total Plankton	Copepods
TAM 21	hor. night 25m	Clausocalanus	28.9	Calanoida	65.6	43	29
		Oithona	12.3	Cyclopoida	34.4		
		Oncaea	10.0	Harpacticoida	0.0		
		Euchaeta	3.7				
		Nannocalanus	3.1				
TAM 25	25m	Clausocalanus	44.9	Calanoida	68.7	35	22
		Oithona	19.2	Cyclopoida	28.7		
		Euchaeta	7.7	Harpacticoida	0.6		
		Oncaea	3.8				
		Farranula	3.3				
TAM 24	obl. day 200-0m	Oithona	30.1	Cyclopoida	51.5	45	34
		Clausocalanus	18.3	Calanoida	48.1		
		Oncaea	10.0	Harpacticoida	0.2		
		Corycaeus	8.9				
		Euchaeta	4.9				
TAM 23	obl. day 800-200m	Eucalanus	15.9	Calanoida	67.9	51	40
		Oncaea	14.8	Cyclopoida	31.2		
		Conaea	11.6	Harpacticoida	0.5		
		Pleuromamma	4.6				
		Rhincalanus	4.6				
TAM 22	obl. day 1000-800m	Oncaea	19.0	Calanoida	58.1	50	43
		Conaea	8.5	Cyclopoida	38.0		
		Oithona	8.4	Harpacticoida	3.4		
		Lucicutia	6.9				
		Eucalanus	5.0				

*Represents number of species identified plus groups not identified to species level.

TABLE 7B-5. Zooplankton Size Class Distribution from R/V Virginia Key, Gulf of Mexico, 17-20 December 1978 (GOTEC-07)

	TAM 21 25m hor. night		TAM 25 25m hor. day		TAM 24 200-0m obl. day		TAM 23 800-200m obl. day		TAM 22 1000-800m obl. day	
Size Class	Density[a]	Percent	Density	Percent	Density	Percent	Density	Percent	Density	Percent
<0.5mm	78.3	15.7	22.2	6.2	17.3	7.2	1.2	8.9	1.6	7.3
0.5-0.9	158.4	31.7	117.8	33.0	95.1	39.3	3.6	26.8	8.8	40.1
1.0-1.9	221.6	44.4	188.3	52.7	105.2	43.5	5.0	37.2	8.0	36.4
2.0-2.9	14.1	2.8	19.1	5.4	9.5	3.9	2.8	20.8	1.7	7.7
3.0-3.9	8.6	1.7	3.6	1.0	4.4	1.8	0.3	2.2	0.7	3.2
4.0-4.9	4.4	0.9	3.5	1.0	3.5	1.5	0.2	1.5	0.4	1.8
5.0-5.9	10.6	2.1	0.6	0.2	2.1	0.9	0.2	1.5	0.4	1.8
6.0-6.9	-	-	0.9	0.3	2.9	1.2	-	-	0.2	0.9
7.0-7.9	-	-	0.6	0.2	1.0	0.4	0.06	0.5	0.04	0.2
8.0-8.9	1.3	0.3	0.6	0.2	-	-	0.01	<0.1	0.08	0.4
9.0-9.9	0.07	<0.1	-	-	-	-	0.005	<0.1	0.04	0.2
10.0-19.9	2.0	0.4	0.1	<0.1	1.0	0.4	0.04	0.3	0.003	<0.1
20.0-29.9	-	-	-	-	-	-	0.02	0.2	0.003	<0.1
30.0-39.9	-	-	-	-	-	-	0.002	<0.1	-	-
40.0-49.9	-	-	-	-	-	-	-	-	-	-
>50.0	-	-	0.002	<0.1	-	-	-	-	0.003	<0.1

Density measured as number of organisms per size class per cubic meter.

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