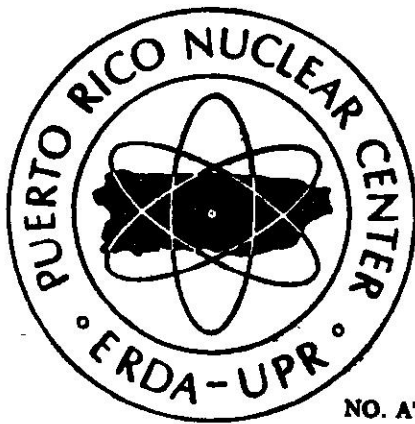


PUERTO RICO NUCLEAR CENTER

PUNTA MANATI
ENVIRONMENTAL STUDIES

Prepared for the Puerto Rico Water Resources Authority
By the Staff of Puerto Rico Nuclear Center of the
University of Puerto Rico

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PUNTA MANATI ENVIRONMENTAL STUDIES

by

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PREFACE

This report stems from investigations carried on by the Puerto Rico Nuclear Center. The studies were designed to provide data upon which to judge the suitability of a site for the construction of power generating facilities and to allow the determination of the impact of such construction and operation upon the environment.

The report represents the combined effort of the scientists, technicians and support staff of the Site Selection Survey Project.

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1.1 INTRODUCTION

The Puerto Rico Nuclear Center of the University of Puerto Rico has been under contract to the Puerto Rico Water Resources Authority since 1972 to conduct site selection surveys and environmental research studies of seven coastal sites. Experience gained from these investigations will add to the knowledge about these areas, and provide useful data which will aid in the assessment of the desirability and practicability of locating power generating plants on one or more of these sites.

Puerto Rico Nuclear Center scientists have studied the physical, chemical and geological parameters of the sites, and the ecological parameters of zooplankton, benthic invertebrate and fish communities. Plant associations, except for the Cabo Rojo Platform site, have been included.

The sites chosen for study were: Tortuguero Bay, Punta Manati, Punta Higuero, Cabo Rojo Platform, Punta Verraco, and Cabo Mala Pascua. The seventh site, Barrio Islote, was studied and reported under a separate contract.

The first site reported was Tortuguero Bay on the north coast of Puerto Rico. The present site reported is Punta Manati, also on the north coast, west of Tortuguero Bay (see Figure 4.1-F1).

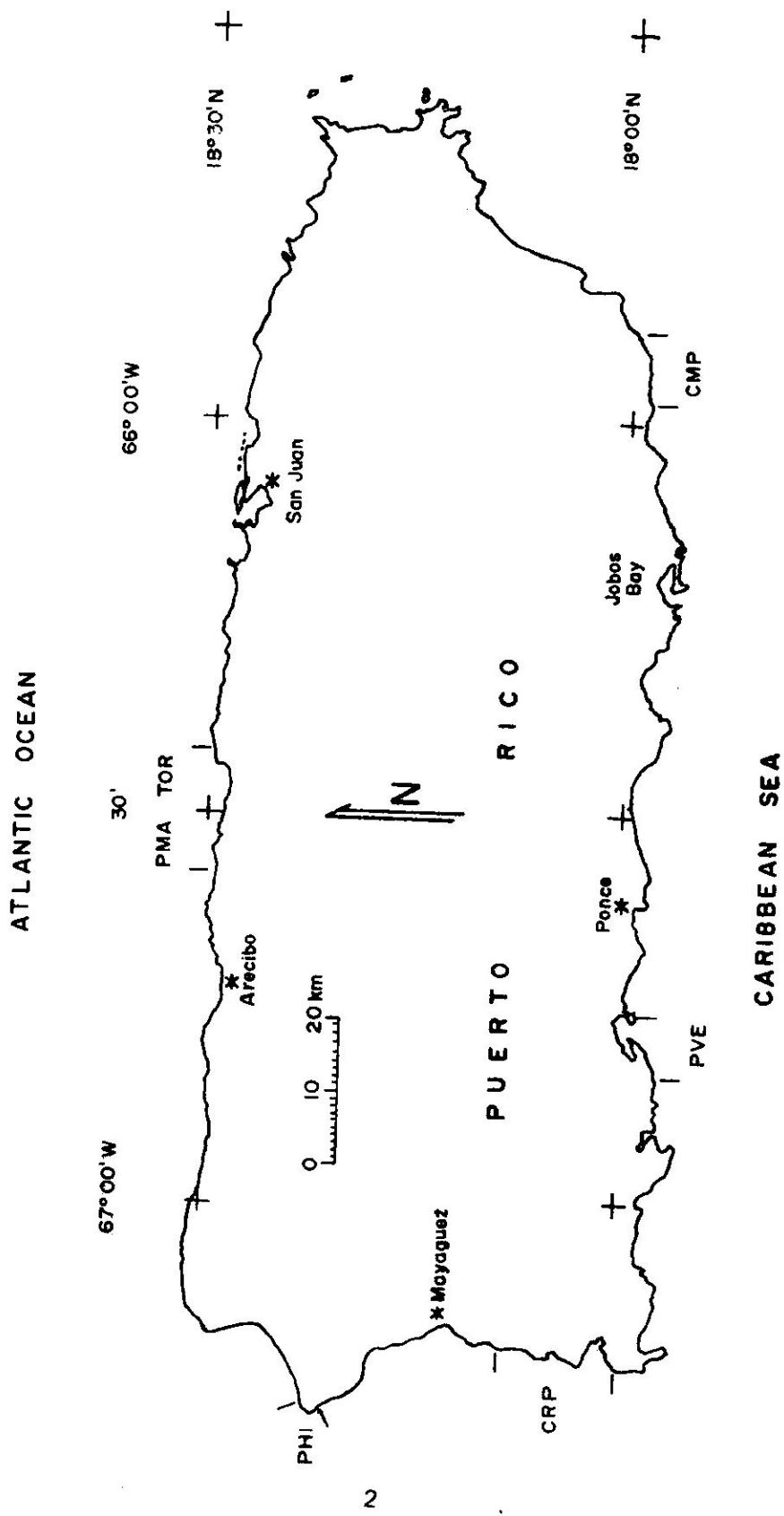


Fig. 1.1-F1. Site Selection Survey Study Sites. Tortuguero Bay (TOR); Punta Manati (PMA); Punta Higuero (PHI); Cabo Rojo Platform (CRP); Punta Verraco (PVE); and Cabo Mala Pascua (CMP). Barrio Islote site not shown.

2.1 PHYSICAL AND CHEMICAL PARAMETERS AT PUNTA MANATI

by

E.D. Wood

2.1.1 INTRODUCTION

Most of the physical, chemical and geological measurements at the Punta Manati site were made at or near the stations shown in Figure 2.1-F1. The transects were spaced at one nautical mile with the "A" stations located as near to shore as it was safe to sample with the RMV R.F. Palumbo. The "B" stations were located in excess of 125 meters and the "C" stations on latitude $18^{\circ}31.8'N$ in excess of 325 meters.

2.1.2 TIDES

The tidal waves that affect the north coast of Puerto Rico have their amphidromic point in the Central North Atlantic Ocean with the crest of the cotidal line moving in a counter-clockwise direction (Anikouchine and Steinberg, 1973), that is, from west to east past Punta Manati. The tides are predicted for San Juan by the National Oceanic Survey. An example of the tidal pattern over a lunar cycle has been plotted in Wood, et al. (1975b) for Tortuguero Bay. The north coast tides are semi-diurnal with a maximum excursion of about 75 cm and a minimum daily excursion of about 32 cm. The mean daily tidal excursion is 40 cm. The tides for the period of current measurement at Punta Manati have been plotted in Figure 2.1-F2.

2.1.3 CURRENTS

The general current pattern on the north coast of Puerto Rico is to the west with the highest flows during ebb currents (PRWRA, 1975). The usually strong afternoon winds from the east-northeast tend to increase the velocity of the surface currents to the west. There is a strong correlation between the current patterns and the tides with modification by the local winds, the North Equatorial Current and the direction and amplitude of sea swells impinging on the shoreline. Measurements at the Islote (PRWRA, 1975) and Tortuguero Bay (Wood et al., 1975b) sites west and east of Punta Manati, respectively, indicate that currents of nearshore surface waters reach about 30 cm/sec both east and west parallel to the coast with a net flow to the west of about 5 cm/sec. There appears to be some seasonal variation to this pattern (PRWRA, 1975).

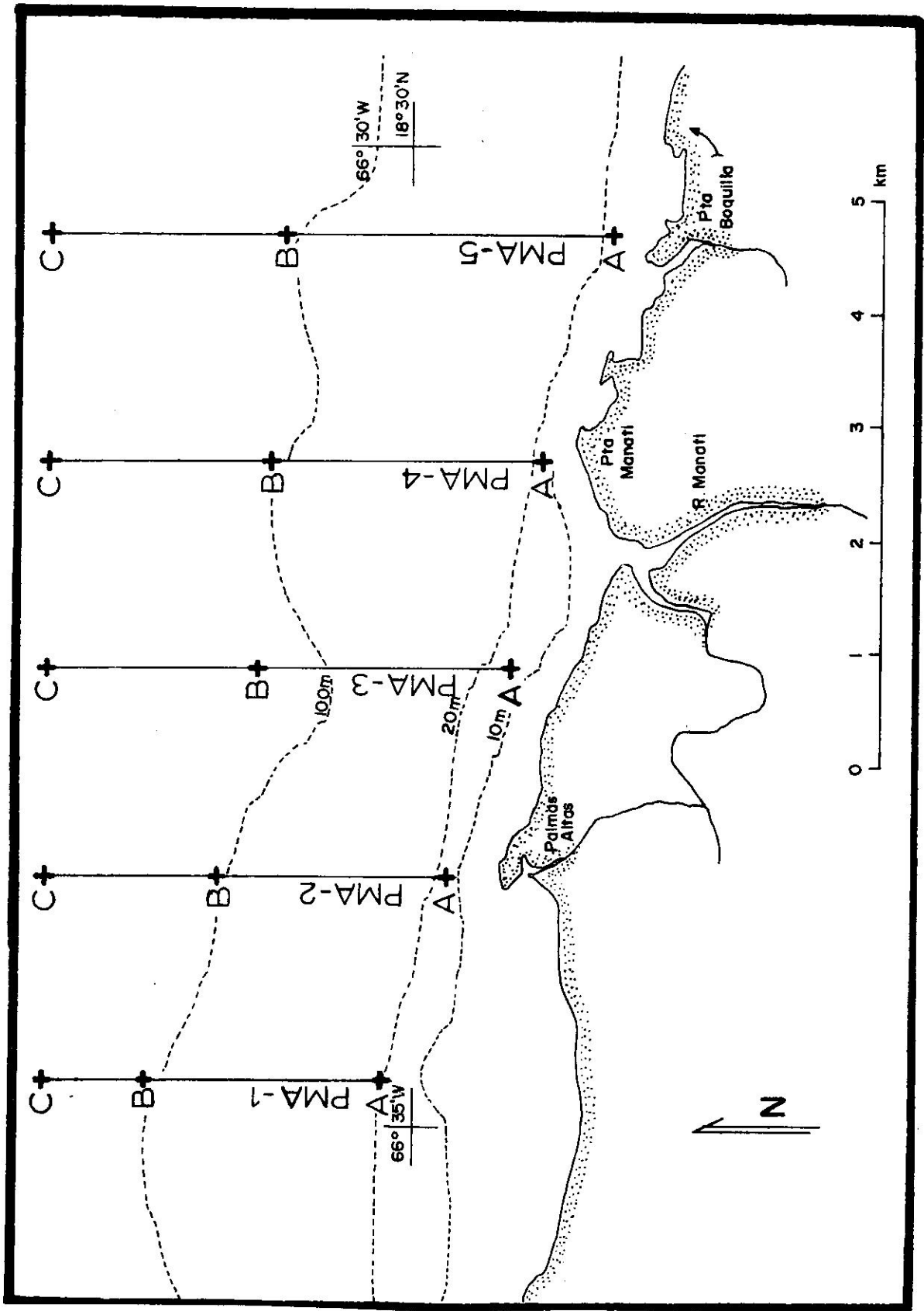


Fig. 2.1-F1 Punta Manati site with depth contour lines and hydrographic sampling transects each with three stations.

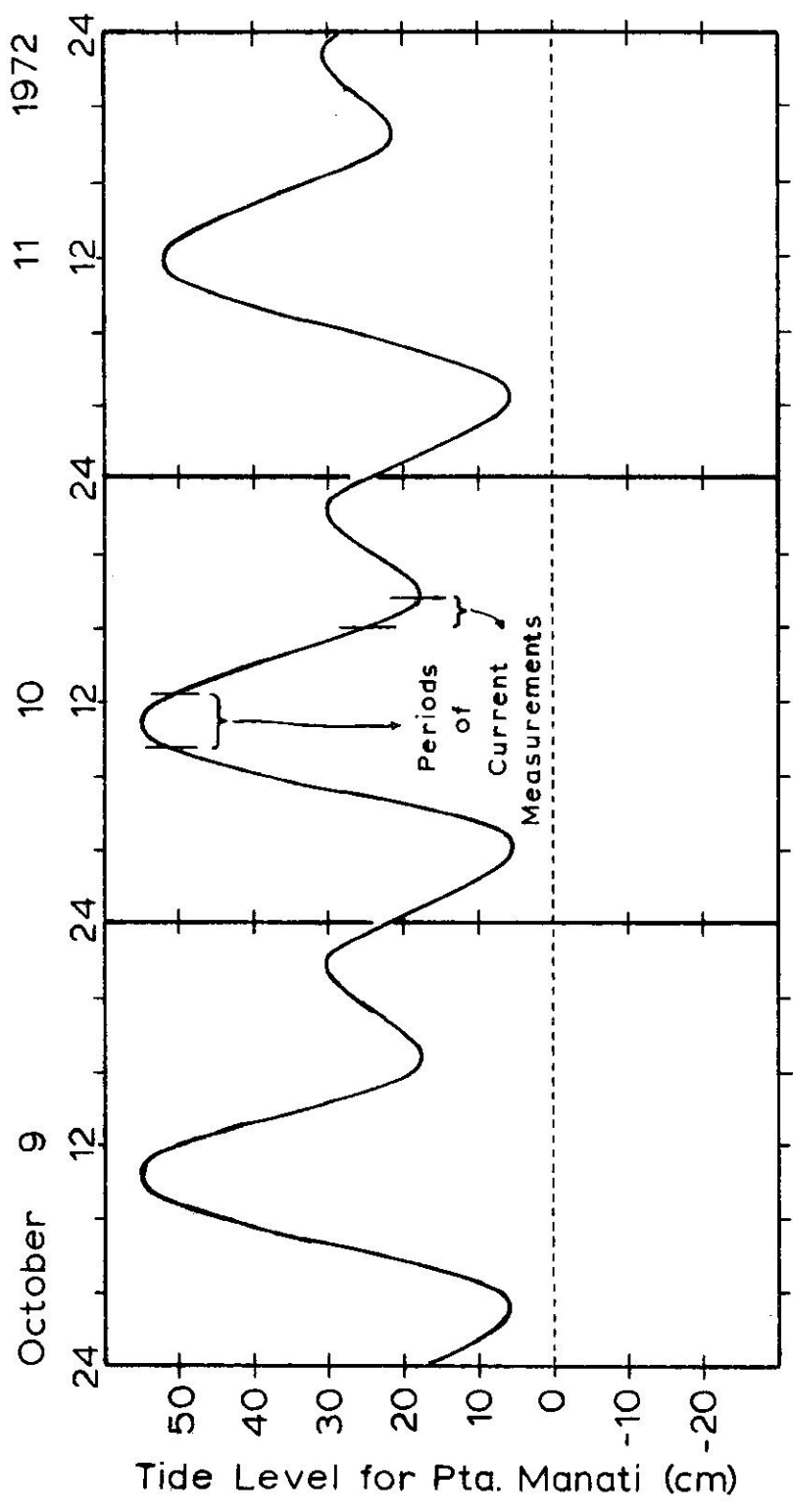


Fig. 2.1-F2 Tides at Punta Manati plotted from predictions for San Juan from October 9 to October 11, 1972.

The currents at Punta Manati were measured on two occasions, October 10, 1972, using dye drops and aerial photography. The first drop was intended to coincide with peak flood current, but was delayed until almost high slack tide (0940-1230). The second drop was made at 1600 and photographed until 1920 toward the end of the period of falling tide. The results are shown plotted in Figures 2.1-F3 and F4.

A distinct river plume from the Manati River existed throughout the current measurements. A detached plume was seen offshore north of Punta Manati while the river discharge was spreading to the northwest as shown in Figure 2.1-F3.

Eight drops were made for each of the periods with four nearshore and four parallel offshore. The drops furthest offshore moved slowly to the northeast then to the southwest and disappeared in a convergence. The offshore dye spots west of the river moved to the west at about 0.2 knots (10 cm/sec). The nearshore dye spots moved slowly to the west and were dispersed in the surf except for the drop in the river plume. Drop three, in the plume, moved at about 0.3 knots (15 cm/sec) to the west initially, then increased to about 0.8 knots (40 cm/sec) to the west-northwest. The outer drop just north of the river plume was seen to partially disappear under the river plume.

During the afternoon, the turbid water was confined to the nearshore regions. The river plume flowed to the west along the shore. The offshore dye spots moved westward and slightly shoreward at 0.6 to 0.8 knots (30 to 40 cm/sec). The drop just west of Punta Manati moved into an eddy toward the river mouth. The drop nearshore just east of Punta Manati disappeared in the surf after moving west at about 0.6 knots (30 cm/sec). The drop in the immediate plume was dispersed rather quickly to the west. The outer plume moved west near Palmas Altas at about 1 knot (50 cm/sec).

The surface currents measured at Punta Manati were weak to the west nearshore and weak to the east offshore near the top of the flood. When measured near the bottom of the ebb, they were to the west at 30 to 40 cm/sec similar to those measured at Tortuguero Bay (Wood et al., 1975b) and at Islote (PRWRA, 1975) as would be expected.

2.1.4 BATHYMETRY

Contour lines for 10, 20, and 100 meters are shown in Figure 2.1-F1 and offset depth profiles of the five Punta Manati site transects are shown in Figure 2.1-F5. The depths were taken from Chart No. C&GS 903 (NOS. 1972). The shelf

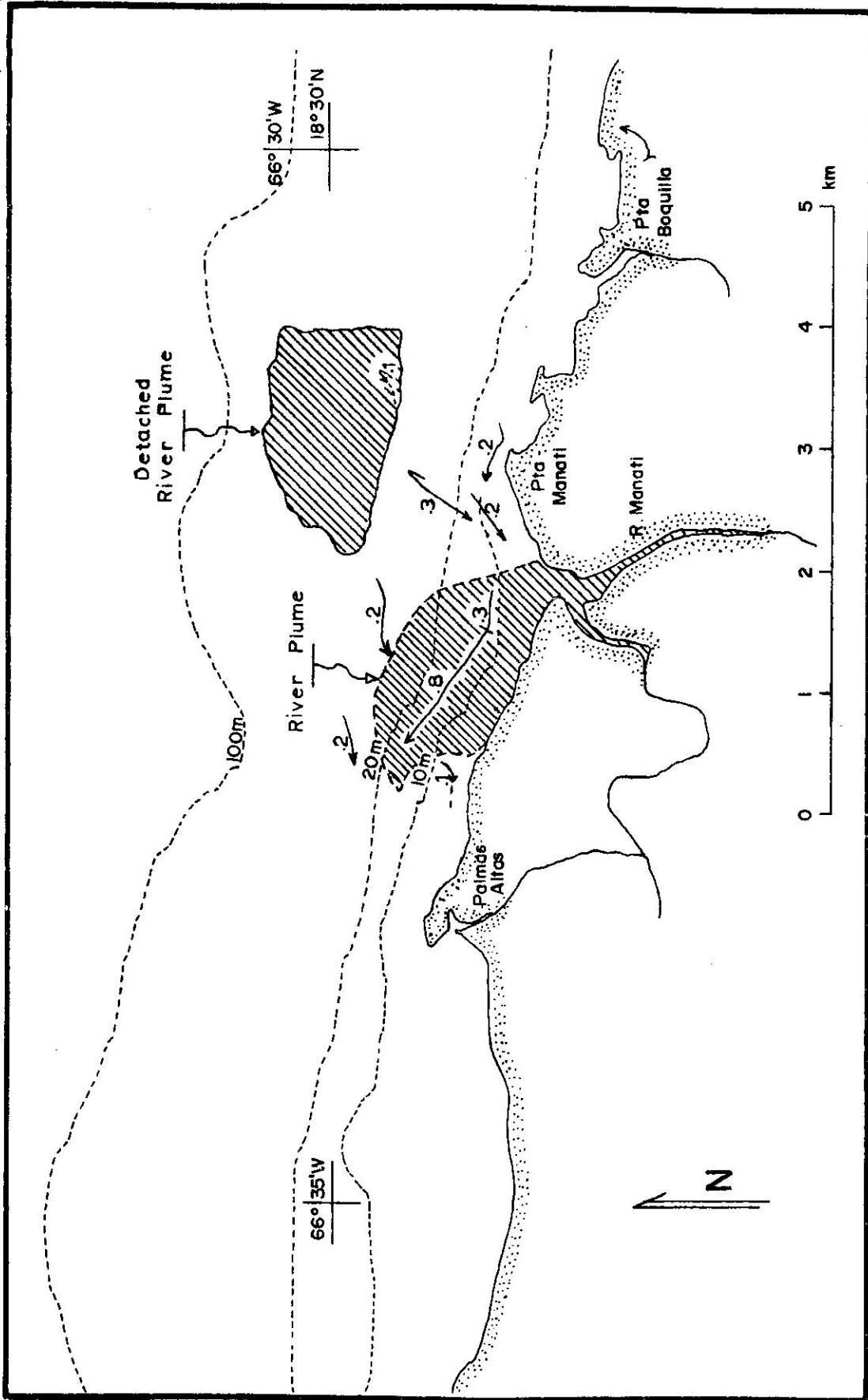


Fig. 2.1-F3 Surface currents for Punta Manati indicated by dye drops at high tide (0940-1200, October 10, 1972). Velocities are in knots, dashed extension of vectors indicates sub-merged dye spots.

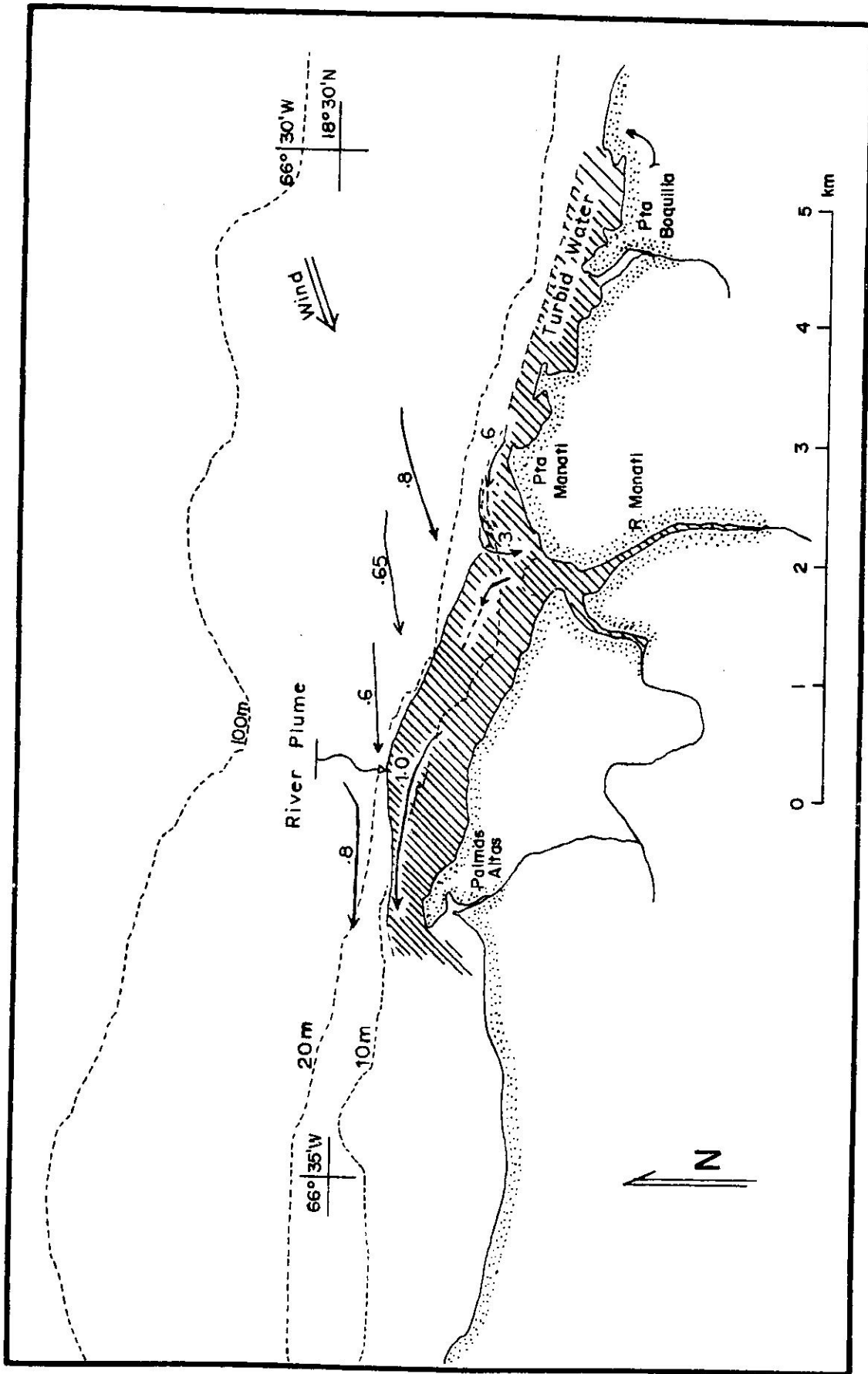


Fig. 2.1-F4 Surface currents for Punta Manati indicated by dye drops near the last of a falling tide (1600-1720, October 10, 1972). Velocities are in knots, dashed extension of vectors indicates submerged dye spots.

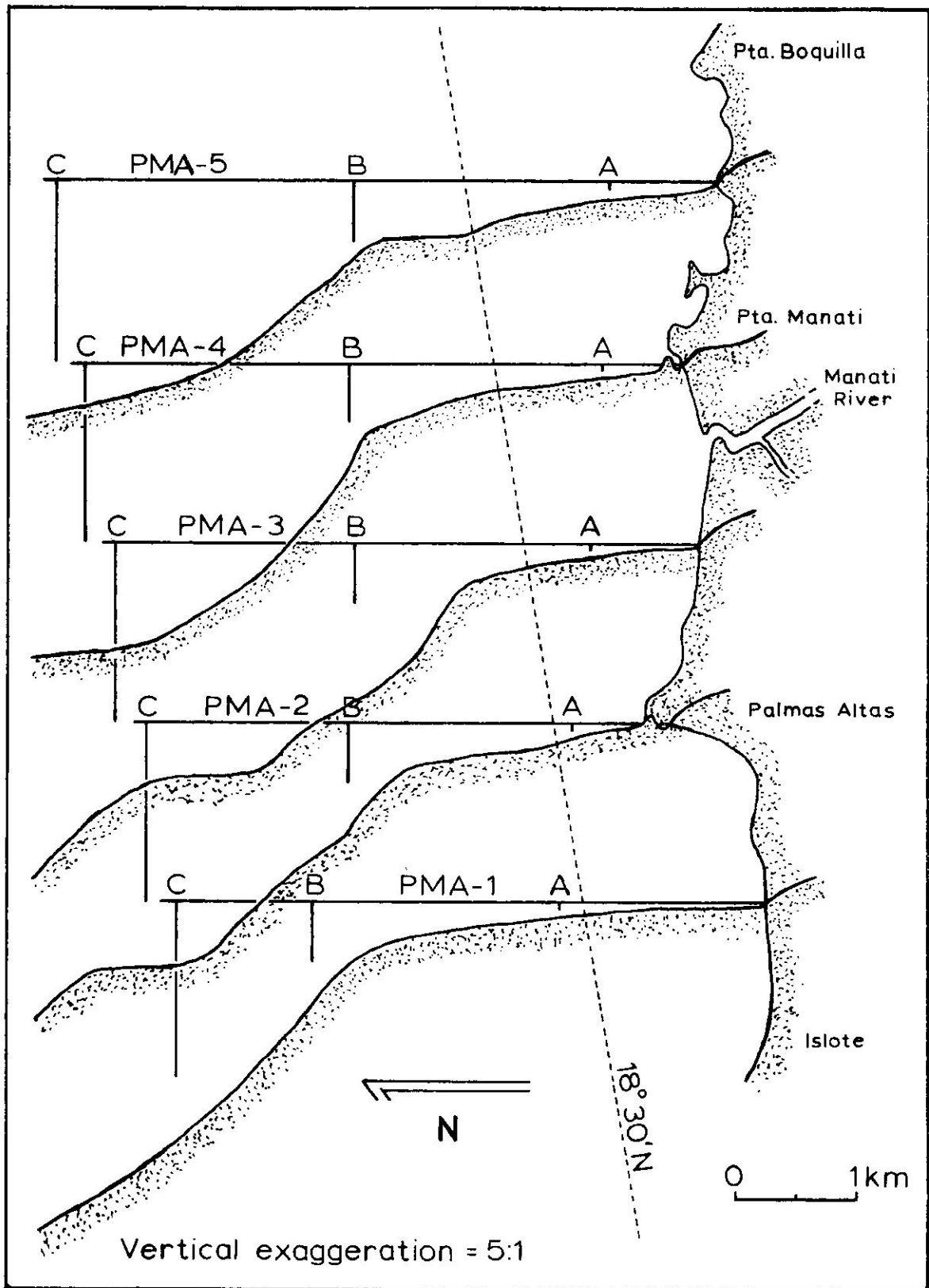


Fig. 2.1-F5 Offset bottom profiles along the sampling transects of Punta Manati. Vertical lines indicate relative positions of hydrographic casts.

width is fairly uniform at Punta Manati at about 25 kilometers to the 100 meter contour. The shelf is a little narrower to the northwest of the Manati River mouth suggesting a submarine canyon associated with the river. A broad shallow region exists just west of Palmas Altas with the broadest portion of the shelf about 2 kilometers west. There exist a few outcrops near the mouth of the Manati River and off Palmas Altas, but no extensive reefs are found here. The vertical lines descending from the surface (transect lines) in Figure 2.1-F5 indicate the relative positions and depths of the A, B, and C hydrographic stations. Most of the soundings indicated on the chart were found to be accurate. However, the nearshore regions (<10 m) are not well charted.

2.1.5 TEMPERATURE, SALINITY AND DENSITY

The physical parameters of temperature and salinity were measured at the Punta Manati site on seven cruises covering four seasons in two years (Table 2.1-T1).

TABLE 2.1-T1 Schedule of hydrographic cruises to Punta Manati

	WINTER	SPRING	SUMMER	FALL
1973	2/1	5/11-12	8/7	-
1974	1/28	5/22	8/15-16	11/1

The hydrographic sampling grid is shown in Figure 2.1-F1. A maximum of five north-south transects were made on each cruise. Each transect had three stations. The "A" stations were near-shore (ca 15 m) with two sampling depths at 0 and 10 meters. The "B" stations were seaward in about 125 meters of water with four depths at 0, 25, 50 and 100 meters. The most seaward sampling was at the "C" stations in excess of 325 meter depths at about 18°31.8'N latitude with eight depths: 0, 25, 50, 100, 150, 200, 250, and 300 meters. The sampling, analytical and data processing procedures are described in "A Manual for Hydrographic Cruises" (Wood, 1975a).

Temperature

Temperatures were measured using deep sea reversing thermometers accurate to better than $\pm 0.03^{\circ}\text{C}$. The thermometers were used in pairs, or in triplicate when possible.

Although only one temperature is shown on the computer print-out of the data (see Appendix 2.1A) for each depth, these values are often the average of two or three thermometers. Most temperatures below 50 meters were measured using both "protected" and "unprotected" reversing thermometers. A thermometer depth, TZ, was then calculated for the sampling depths and correlated quite well with the calculated depth, CZ, obtained from the amount of hydrowire paid out, WZ, and the cosine of the wire angle, θ . An example of this correlation is shown in Wood et al., (1975b).

The data were averaged by a computer program which first interpolated between the depths sampled to provide temperatures (and other hydrographic parameters) at "standard depths." The averaged standard depth temperatures and salinities are plotted by season in Figure 2.1-F6. The diagonal lines indicate density as sigma-t. Depth is not shown on the plot, but generally increases to the lower right corner of the plot, i.e., density increases with depth. Very little change is seen seasonally where sigma-t is greater than 25.2, however, a definite change can be seen in the lower densities (surface waters). The temperature increases between winter and summer, while salinity increases between fall and spring.

The averaging for the depth profiles was done first for all stations by season (Figures 2.1-F7, 9, 11 and 13) then by type of station by season (Figures 2.1-F8, 10, 12 and 14).

A comparison of the averaged "C" station standard depth temperature data by season is shown in Figure 2.1-F15. A sequence of events can be seen from this comparison. Surface temperatures were lowest in the winter (25.6°C) with the deepest thermocline (100 m) caused by cooling and deep mixing by winter storms. This mixing process tends to carry heat to the depths so that the highest temperatures between 100 and 250 meters occur during the winter. (This condition is also part of a phenomenon one might call "seasonal lag.") Little seasonal change is seen below 250 meters. There was a steady temperature decrease in the 100 to 250 meter depth interval between winter and fall. No sharp thermocline existed during the spring season as relatively calm warm weather conditions allowed surface warming to occur. Surface temperatures were at a maximum in the late summer months (28.2°C) with a thermocline at about 50 meters. There was a temperature range of about 2.6° between summer and winter in the nearshore surface waters at Punta Manati.

A temperature inversion occurs in the fall as surface cooling begins. The thermocline was at about 25 meters with generally cooler temperatures between 75 and 100 meters than during other seasons. Very little difference was seen in the temperatures with distance from shore for any of the seasons. Bathythermograph traces from the "C" stations are in Appendix 2.1A and surface temperatures were mapped seasonally by aerial infrared scanning (Wood, 1975c).

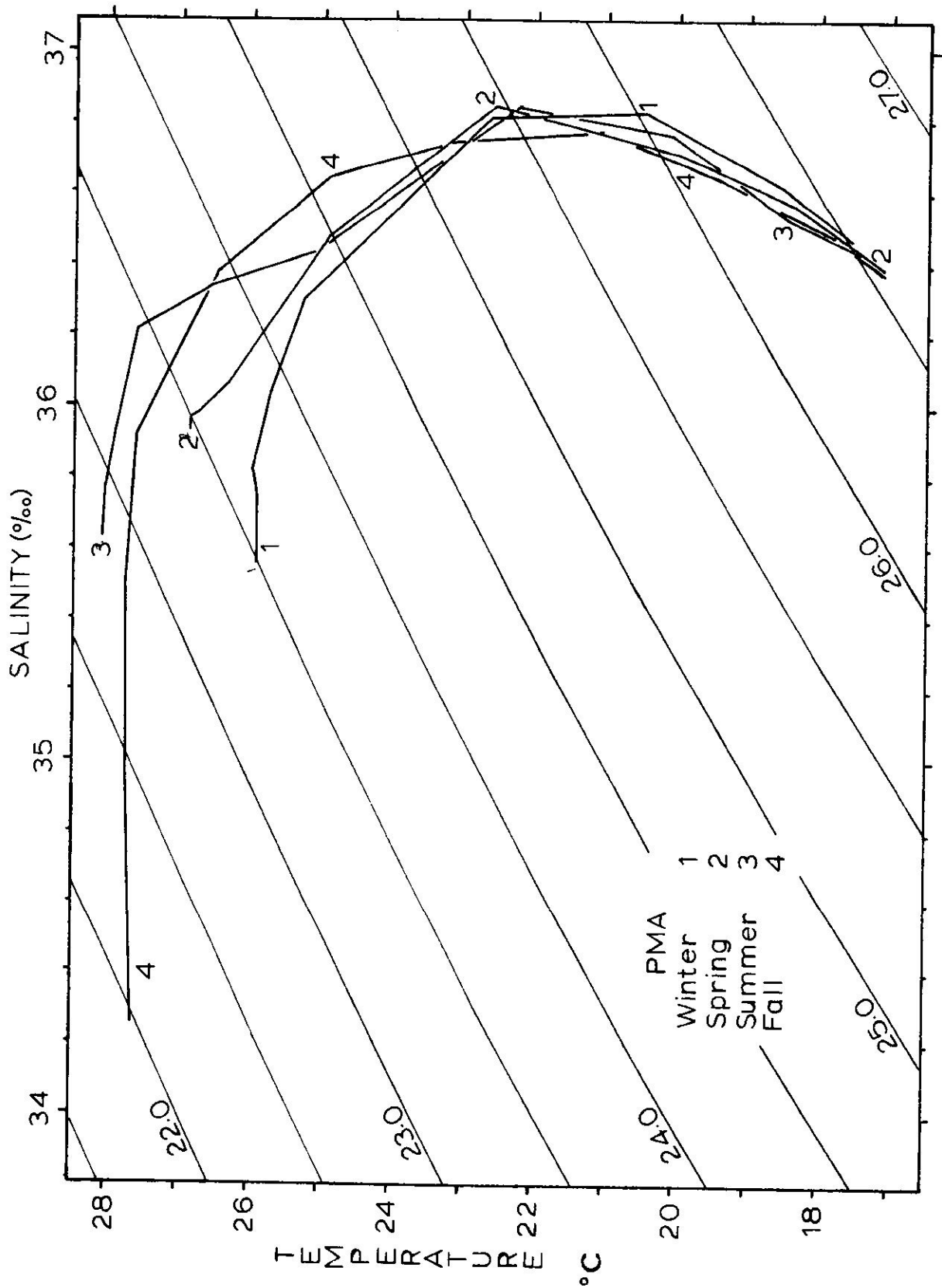


Fig. 2.1-F6 Temperature-salinity of averaged seasonal data at Punta Manati for the years 1973 and 1974.

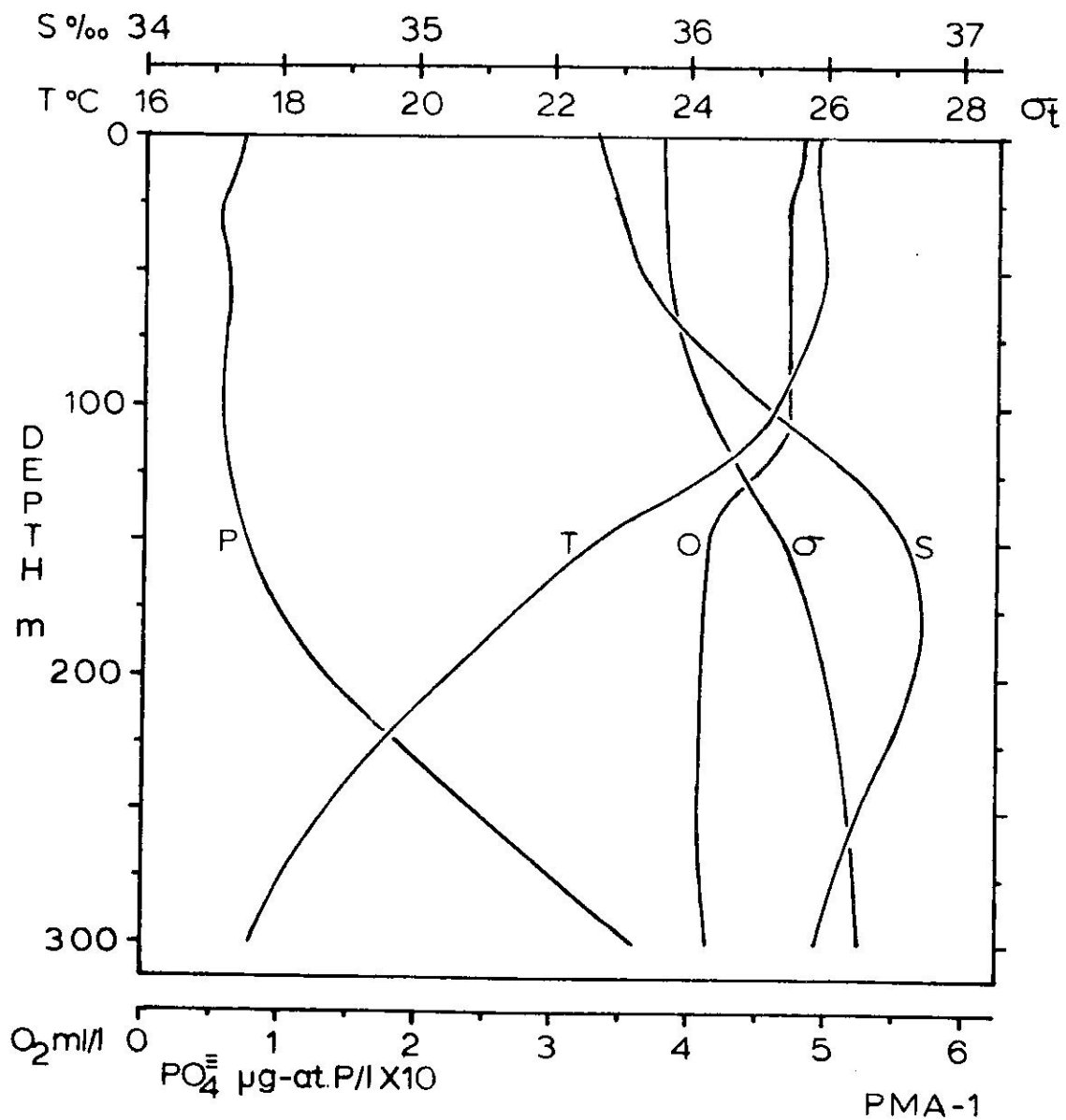


Fig. 2.1-F7 Averaged hydrographic parameters (temperatures, $T^{\circ}\text{C}$; salinity, S°/oo ; density, σ_t ; dissolved oxygen, O_2 ; and reactive phosphate, PO_4) vs. standard depth in meters for the winter season of 1973 and 1974 at Punta Manati.

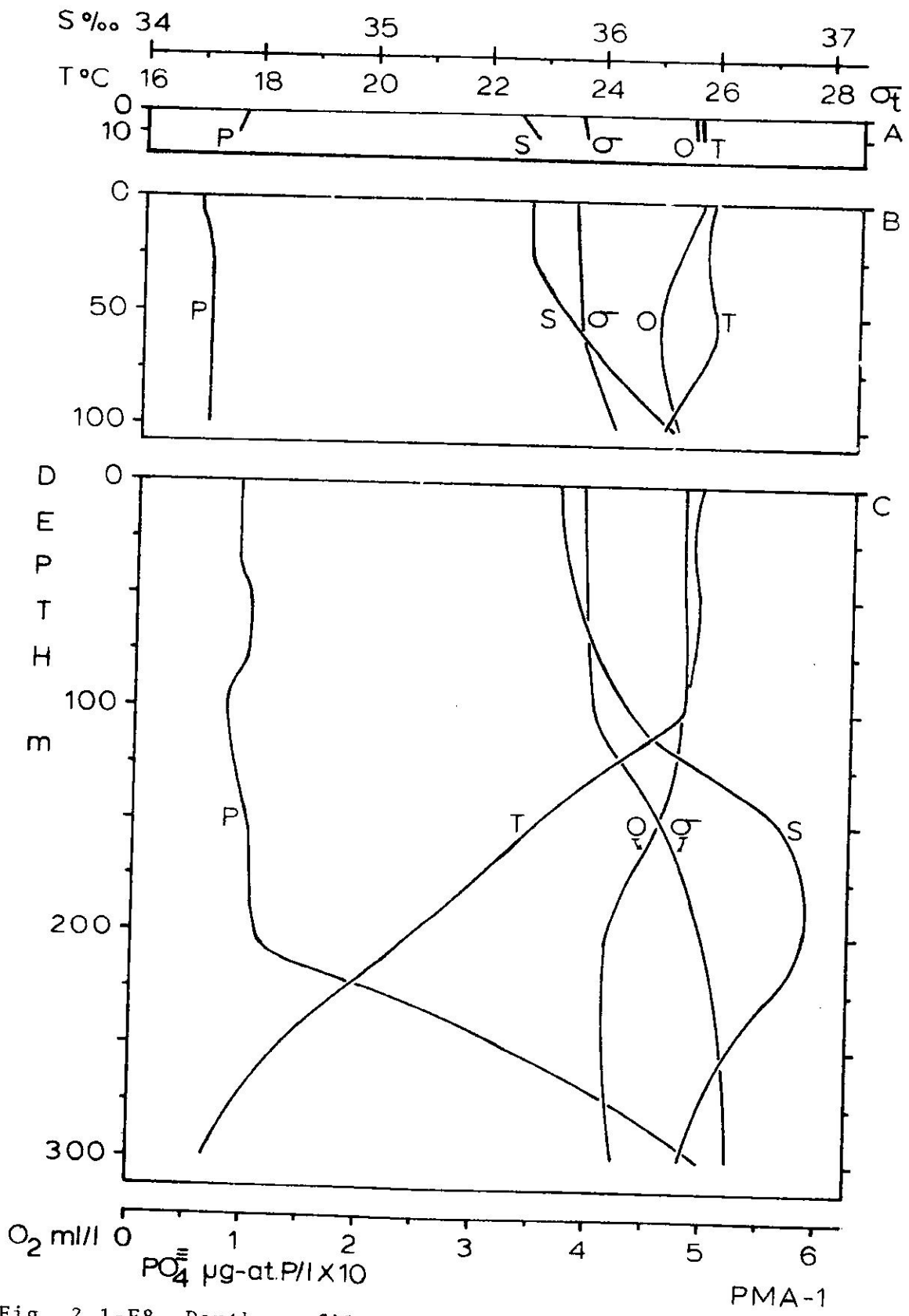


Fig. 2.1-F8 Depth profiles of hydrographic parameters averaged by type of station for the winter season of 1973 and 1974.

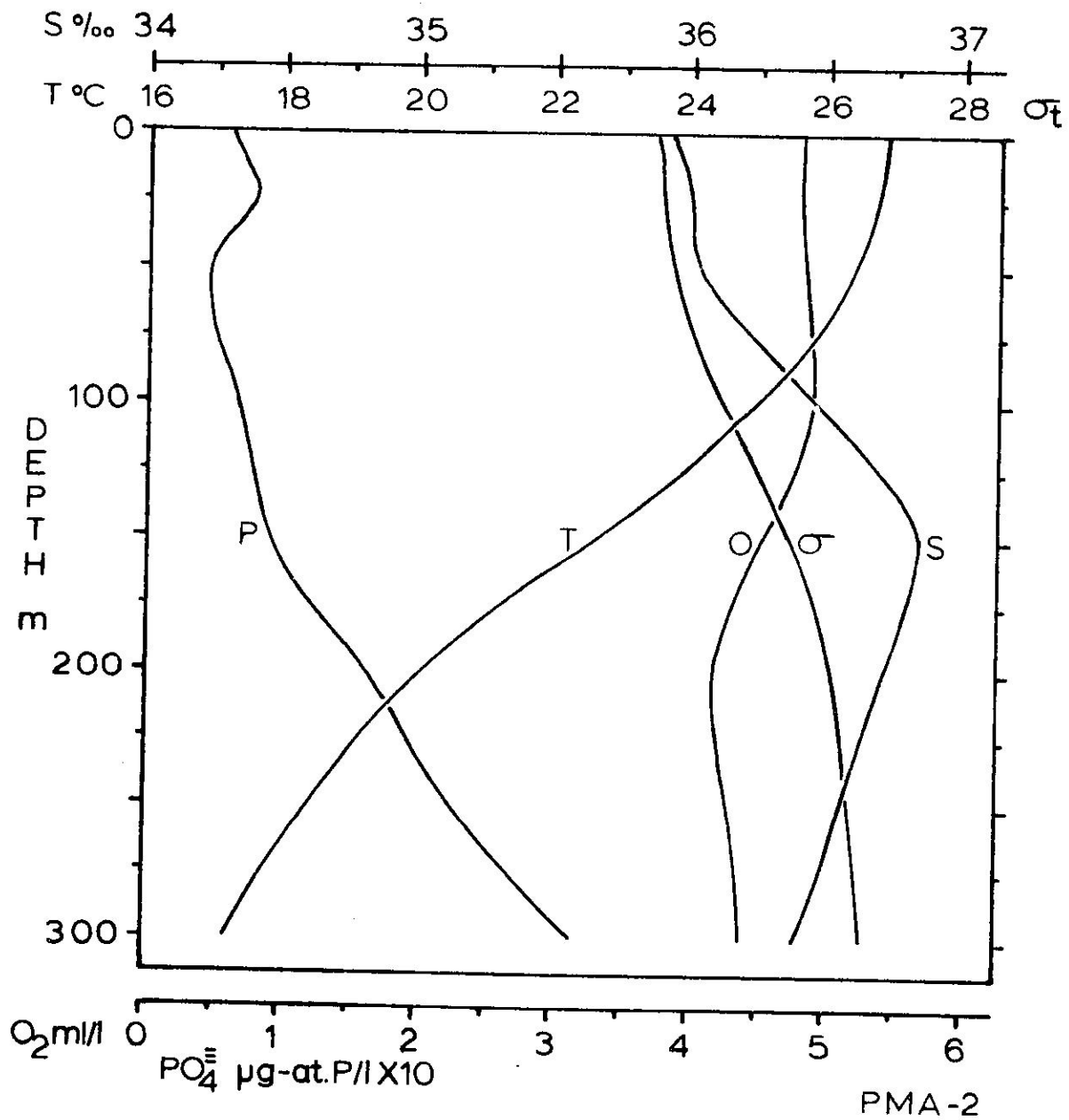


Fig. 2.1-F9 Averaged hydrographic parameter depth profiles for the spring season of 1973 and 1974 at Punta Manati.

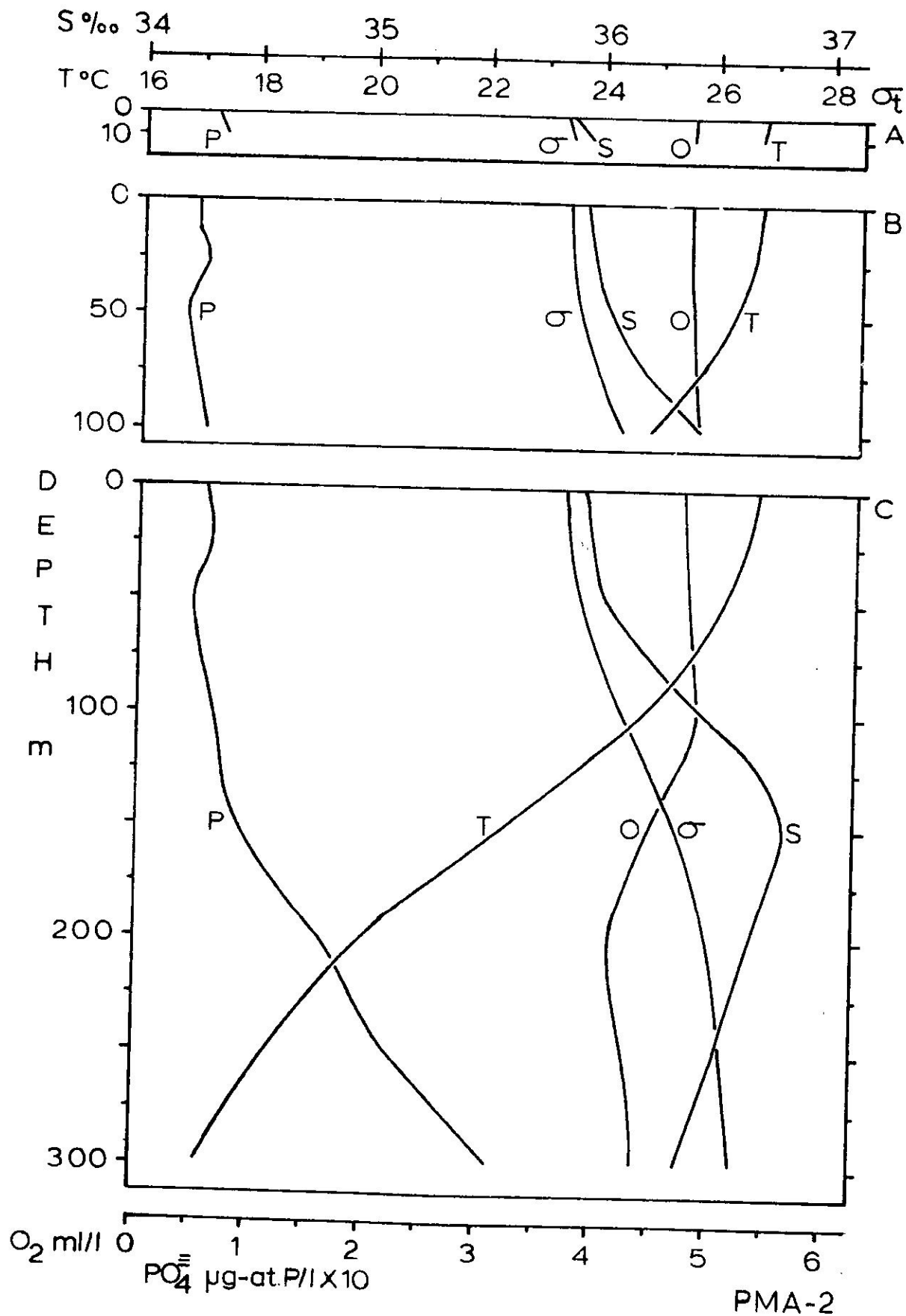


Fig. 2.1-F10 Depth profiles of hydrographic parameters averaged by type of station for the spring season of 1973 and 1974.

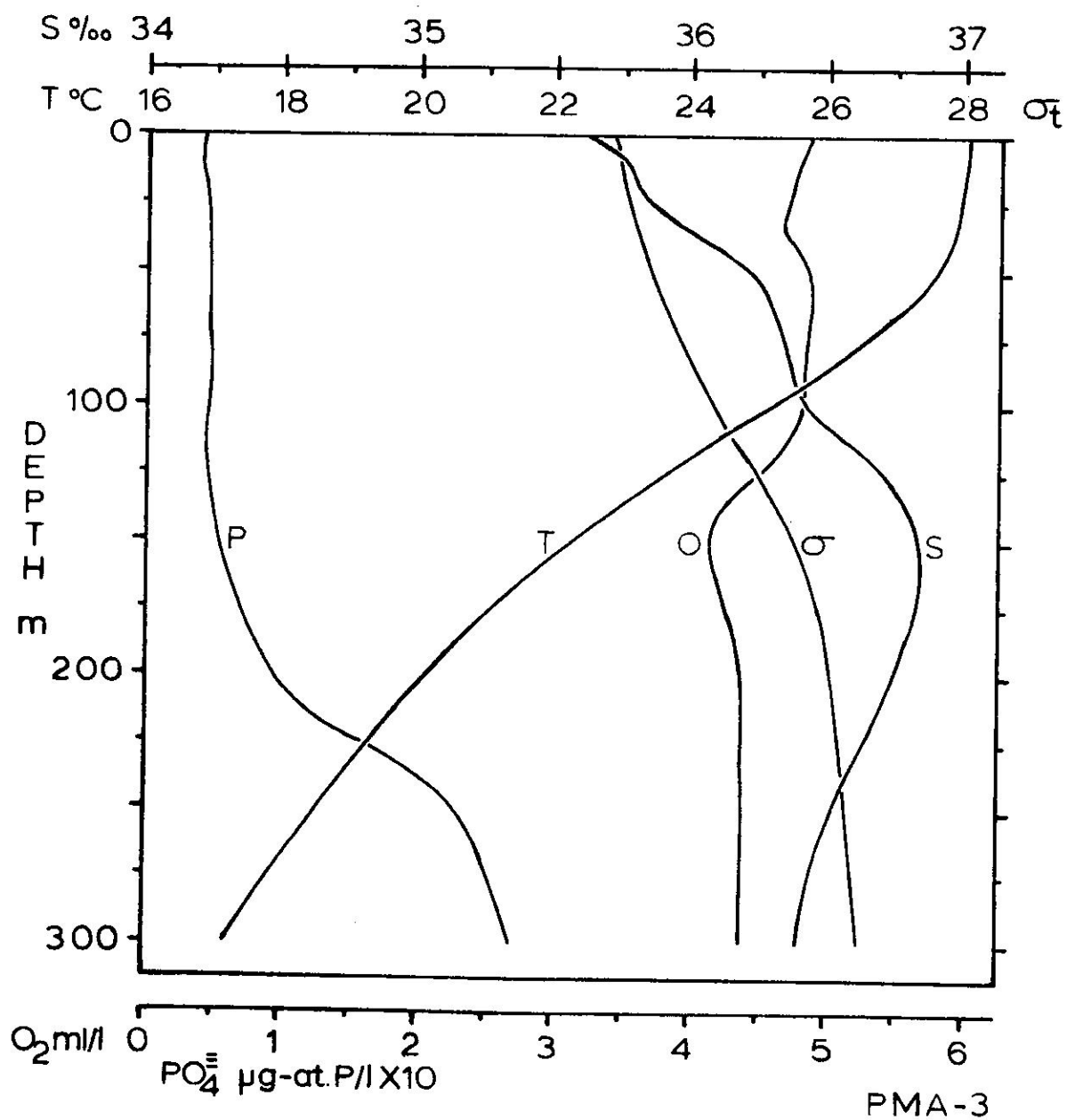


Fig. 2.1-F11 Averaged hydrographic parameter depth profiles for the summer season of 1973 and 1974.

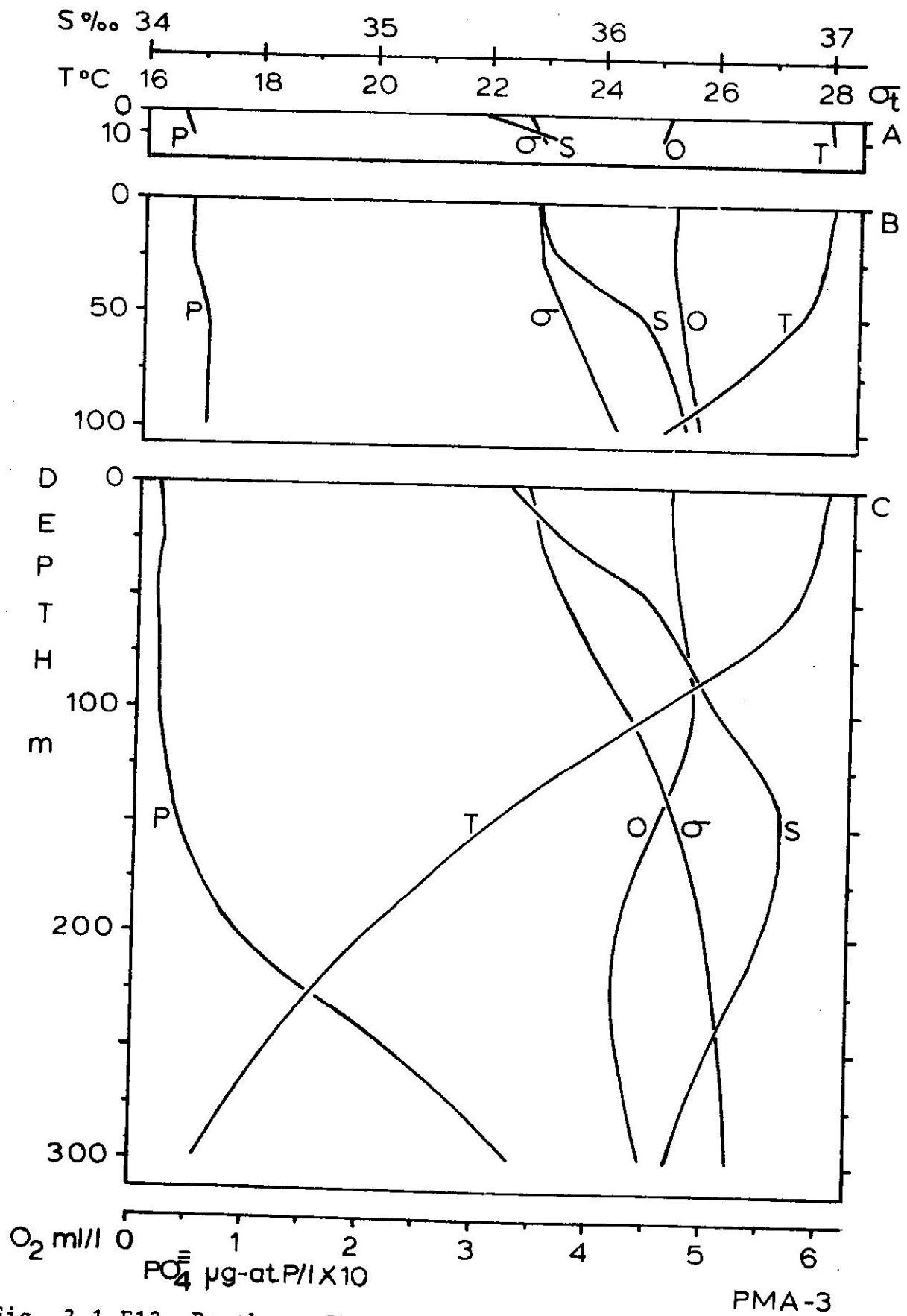


Fig. 2.1-F12 Depth profiles of hydrographic parameters averaged by type of station for the summer season of 1973 and 1974.

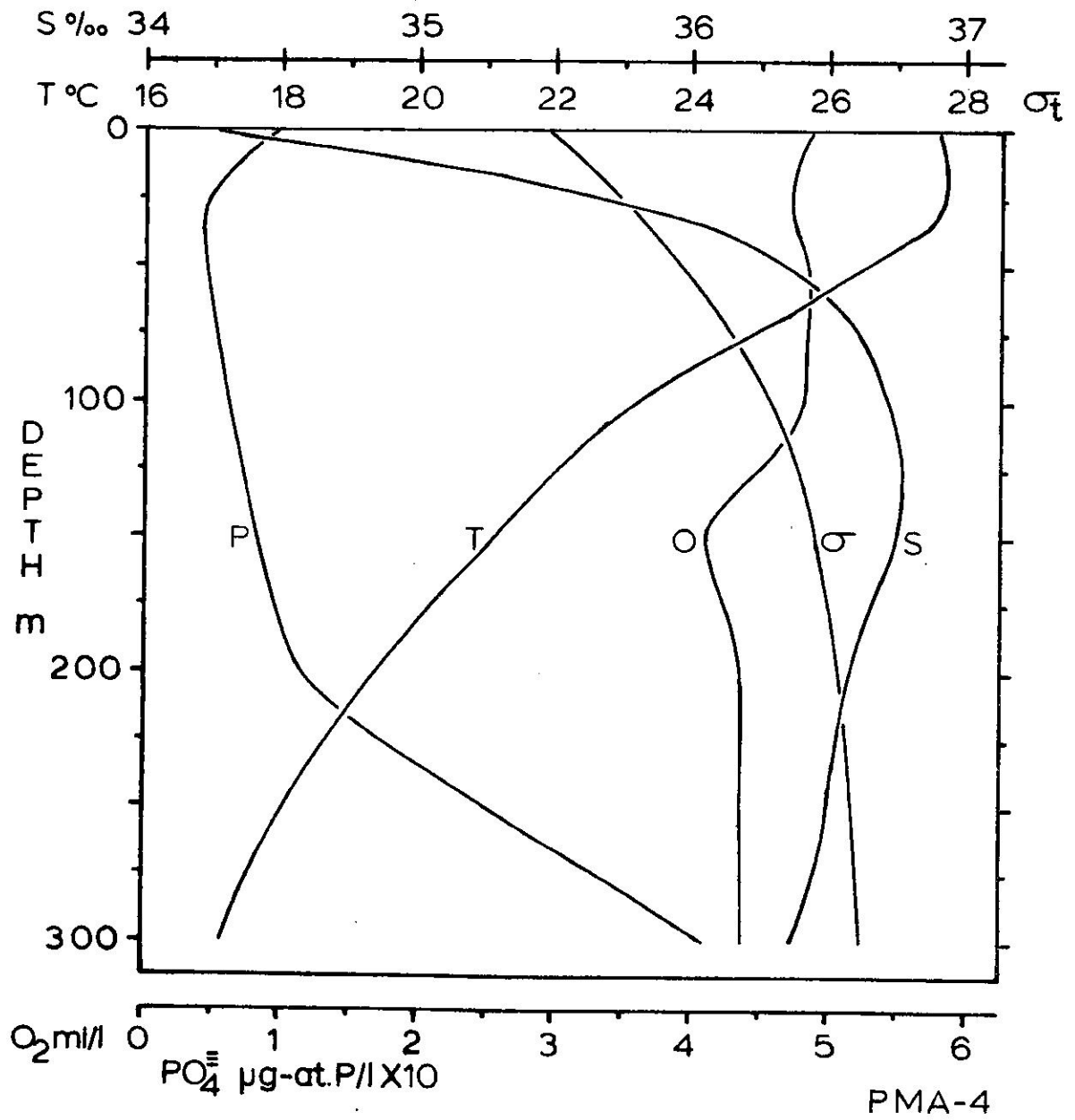


Fig. 2.1-F13 Averaged hydrographic parameter depth profiles for the fall season of 1974.

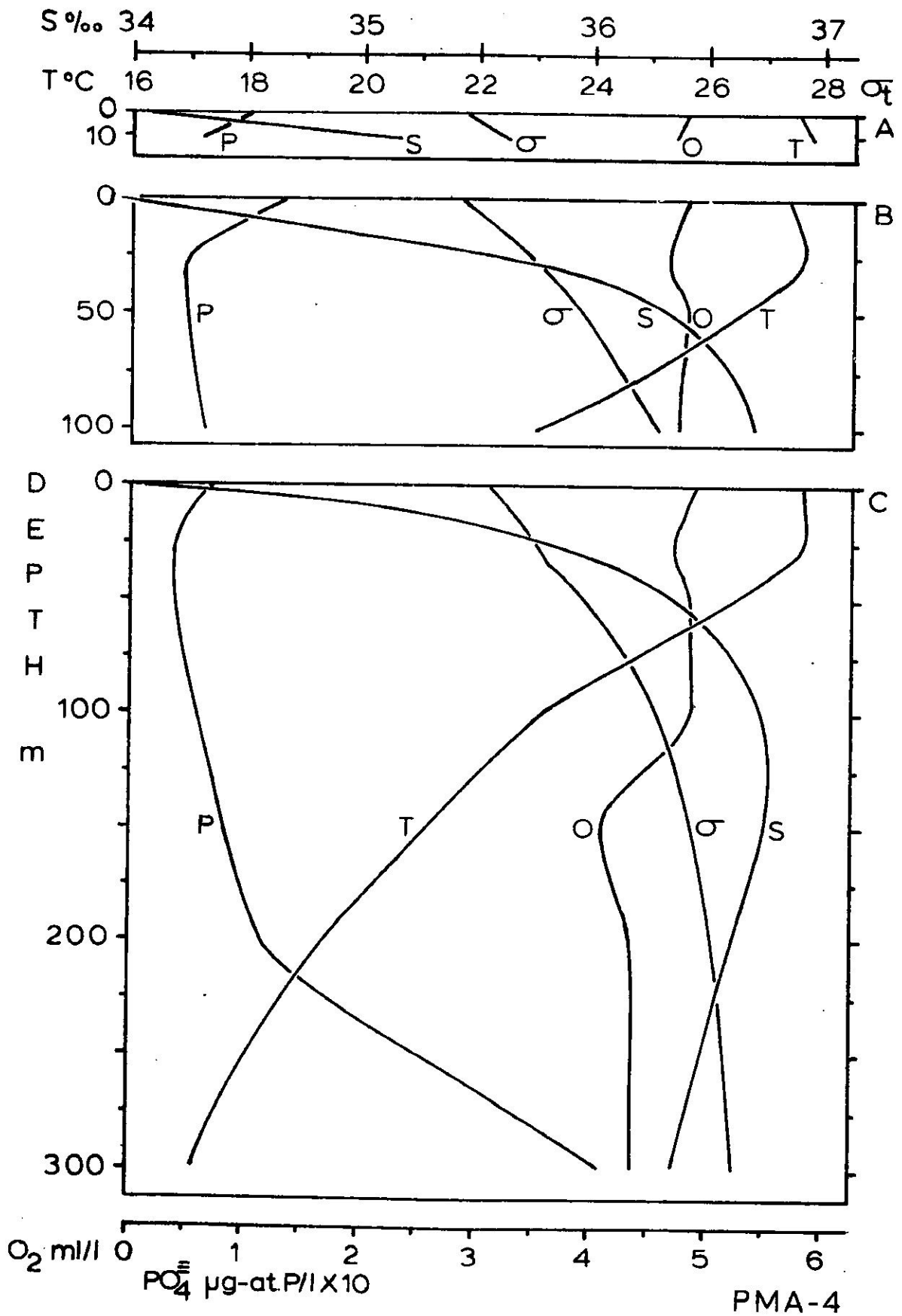


Fig. 2.1-F14 Depth profiles of hydrographic parameters averaged by type of station for the fall season of 1974.

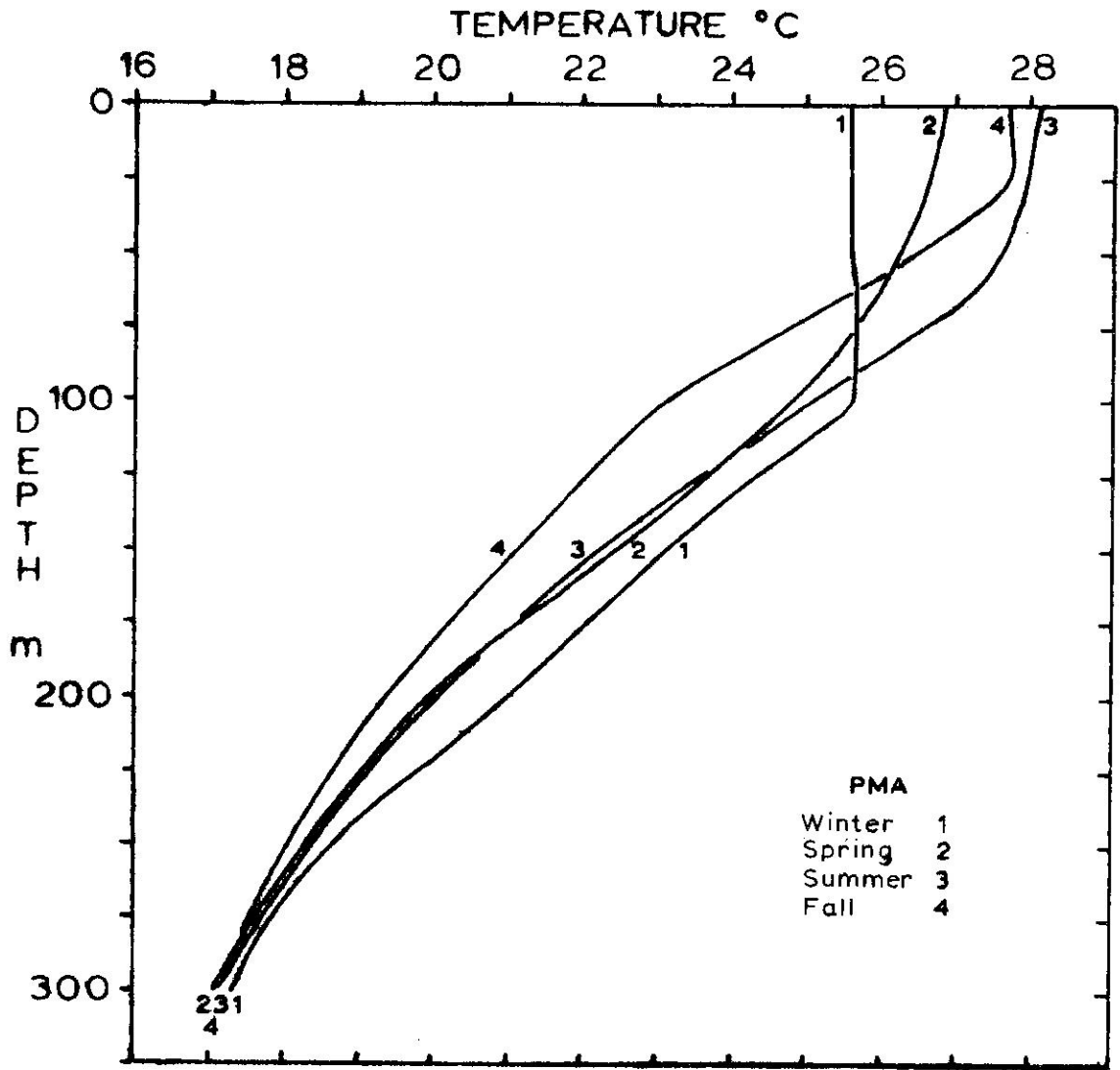


Fig. 2.1-F15 Averaged seasonal depth profiles of "C" station temperatures at Punta Manati for 1973 and 1974.

Salinity

Salinity, S°/oo , is the total salt content of water expressed in parts per thousand. It is used along with temperature to typify ocean water masses. Low salinity usually occurs at the surface and indicates dilution by precipitation, runoff, or fresh water intrusions. High salinities are found in sub-tropical regions and are the result of high rates of evaporation. The salinities at Punta Manati were determined using an induction salinometer with the readings good to better than $\pm 0.005^{\circ}/\text{oo}$. The average seasonal salinity data are shown plotted against depth with the other hydrographic parameters in Figures 2.1-F7 through F14. It is immediately obvious that there is a pattern throughout the year for salinity to increase with depth (as temperature decreases) to a depth of about 150 meters where salinity begins to decrease slightly becoming fairly uniform with depth at about $36^{\circ}/\text{oo}$. This layer of high salinity water with a maximum of about $37^{\circ}/\text{oo}$ was formed by evaporation in the sub-tropical North Atlantic Ocean.

A comparison of the averaged "C" station salinity data is shown in Figure 2.1-F16. The winter salinity profile shows a generally low salinity in the upper 150 meters and the deepest maximum at about 190 meters. The shallowest maximum occurs during the fall season at about 125 meters. The fall maximum is lower than during the remainder of the year and the lowest surface salinities ($34^{\circ}/\text{oo}$) occur during this season. Surface salinities generally increase from fall to spring (34 to $36^{\circ}/\text{oo}$) then decrease through the summer into fall during the intensification of the tropical rainy season. A general increase in salinity was observed in the 25 to 125 meters layer between winter and fall with almost the reverse true between 150 and 250 meters.

The salinity of the Manati River is near zero, however, the lowest salinity at the closest "A" stations was about $32^{\circ}/\text{oo}$ indicating how fast the river water is mixed with the sea water. The depression of the nearshore surface salinity rarely extends beyond the "B" stations. Isohaline lines have been drawn from surface salinities for the fall of 1974 in Figure 2.1-F17. The sampling was done during the night and early morning when wind conditions were light from the east. The tide during the time of sampling went from a level of 30 cm to a low of 0 then a high rising tide of about 60 cm. The combination of weak easterly winds and weak ebb current followed by a strong flood current during the rainy season explains the extent of the Manati River plume.

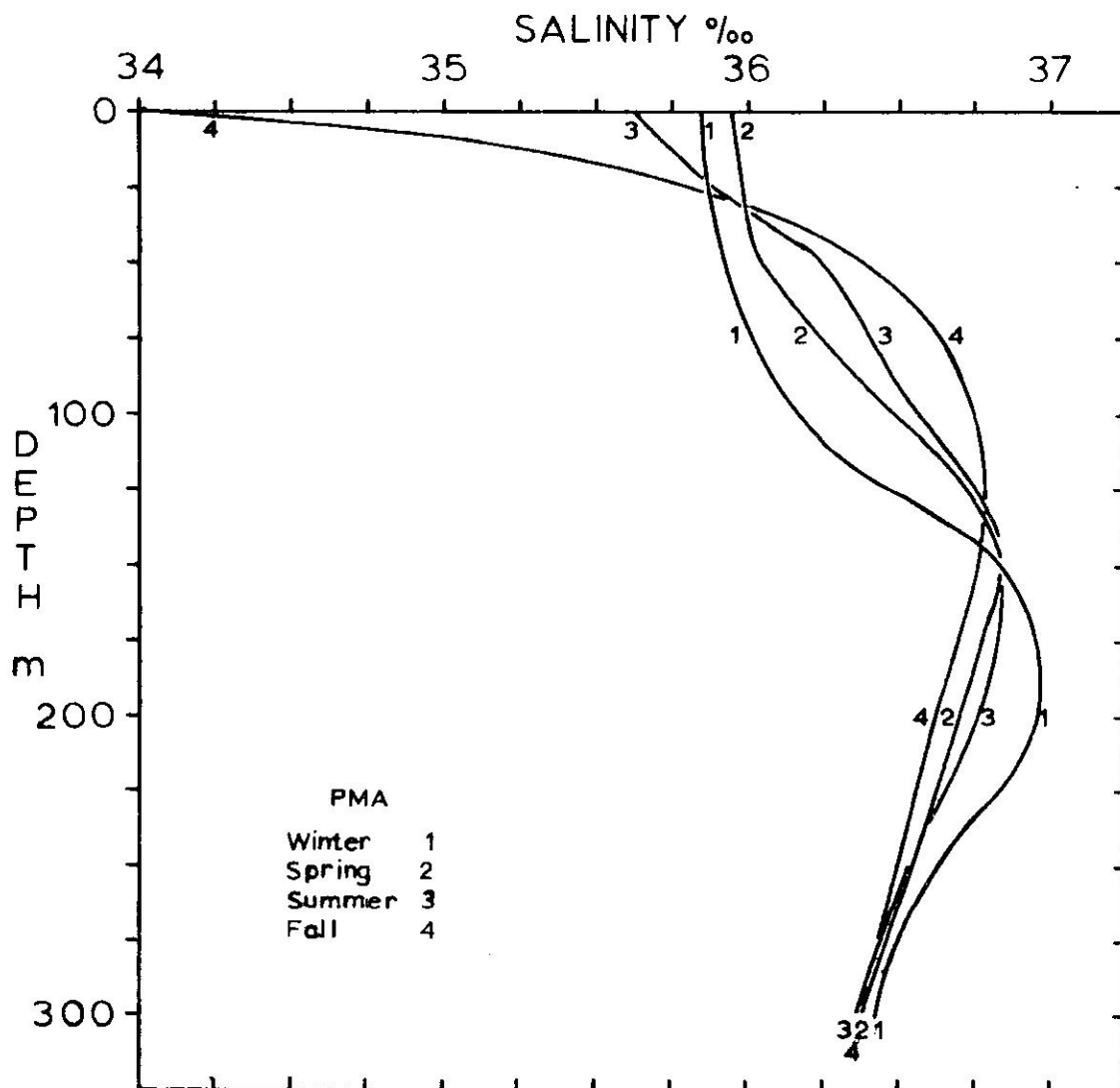


Fig. 2.1-F16 Averaged seasonal depth profiles of "C" station salinity at Punta Manati for 1973 and 1974.

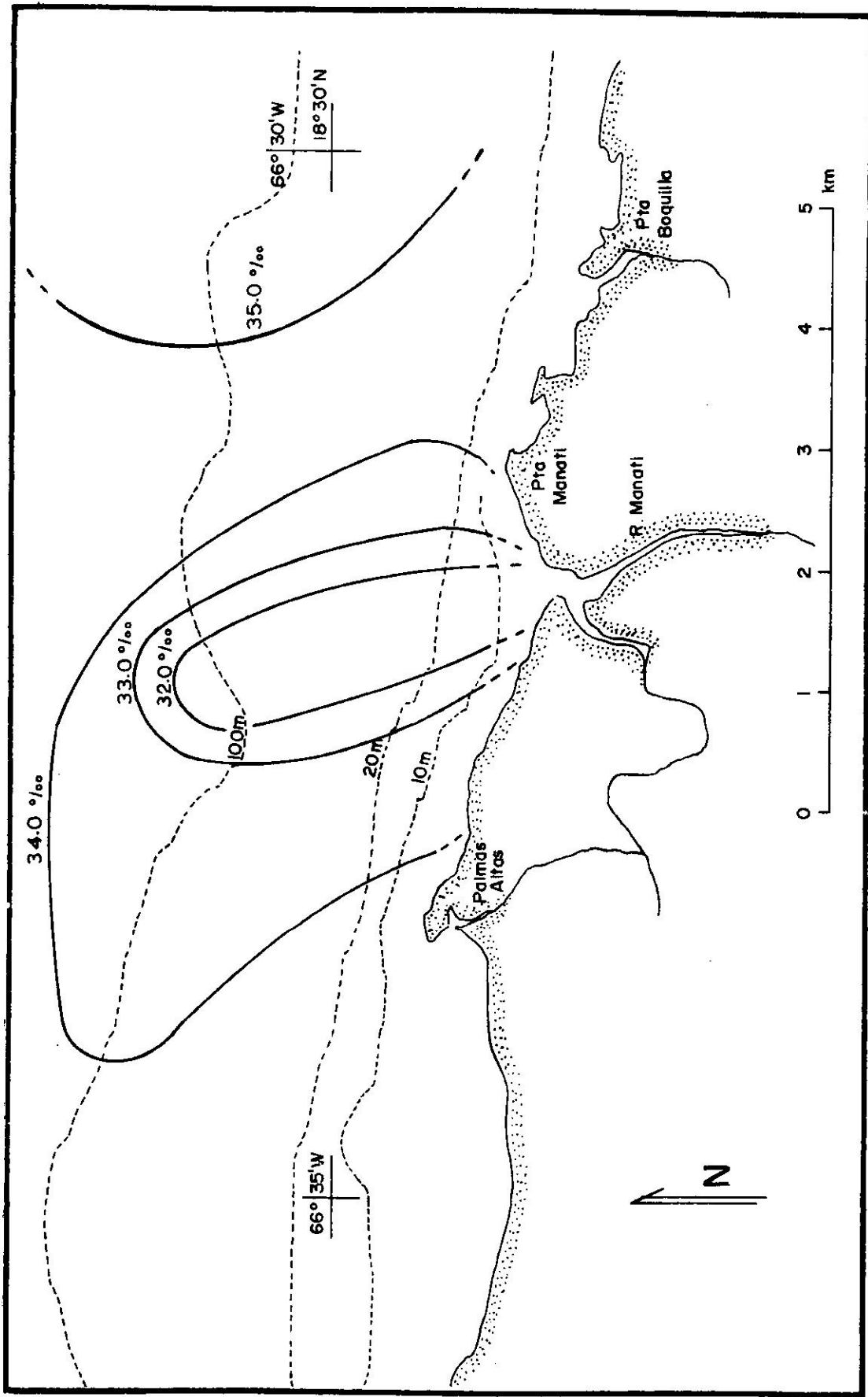


Fig. 2.1-F17 Isohaline lines drawn from surface salinity data for November 1, 1974 at the Punta Manati site.

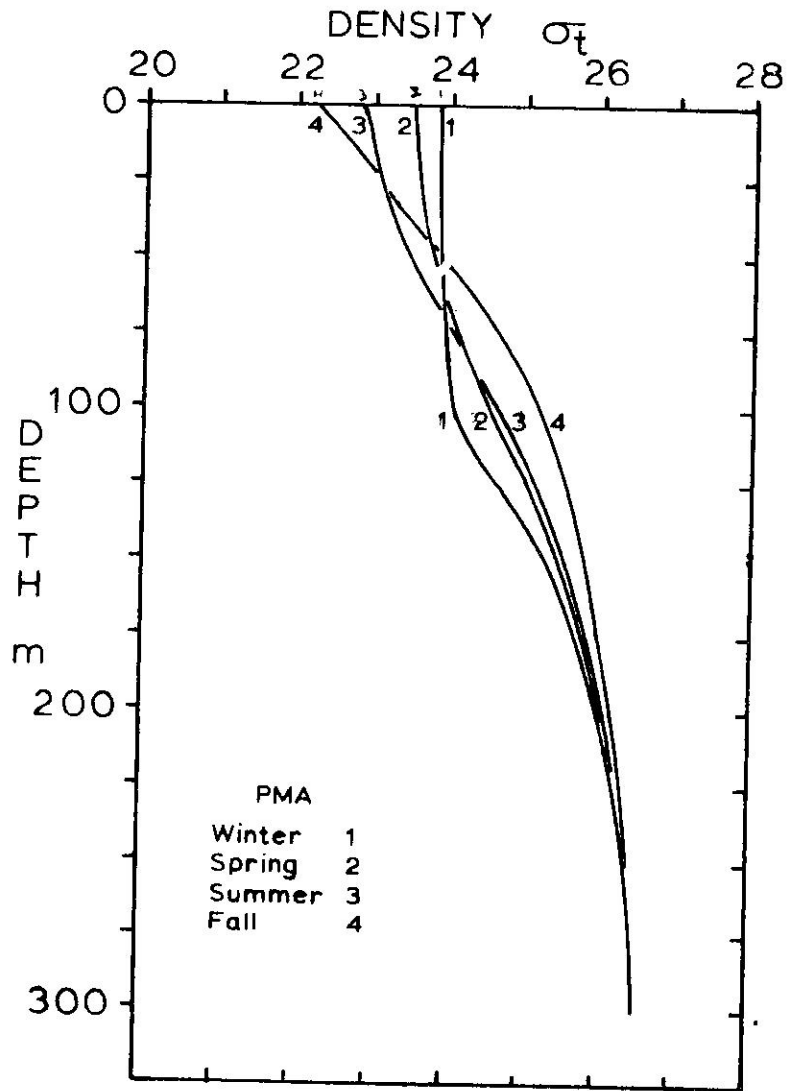


Fig. 2.1-F18 Averaged water density (sigma-t) profiles of "C" station data plotted by season for Punta Manati, 1973 and 1974.

Density

The stability of the water column is a function of the density gradient. Density, ρ , is a function of temperature and salinity, and always increases with depth in a stable water column. Density is usually converted for convenience to an expression, sigma-t, σ_t

$$\sigma_t = (\rho_t - 1) \times 10^3. \quad (2.1)$$

Small changes in sigma-t with depth indicate a well-mixed or unstable zone, whereas a high gradient is indicative of a very stable region of the water column.

A comparison of the averaged seasonal sigma-t profiles is shown in Figure 2.1-F18. Sigma-t varies from 22 to 24 in the surface waters and is highest in the winter months. The pycnocline occurs at about 100 meters in winter because of deep storm mixing and generally cooler surface temperatures. The most stable water column occurs in the fall when surface water density decreases because of dilution. A general decrease in sigma-t occurred from winter to fall at the surface, while the opposite was seen at about 100 meters. Very little seasonal change in sigma-t was seen below about 200 meters.

The tendency for slightly higher sigma-t values in the "A" station over the "B" and "C" stations noticed at the Tortuguero Bay site (Wood et al., 1975b) was not seen at Punta Manati probably because of contributions from the Manati River. Sigma-t profiles are shown in Figures 2.1-F7 through F14.

2.2 CHEMISTRY

2.2.1 DISSOLVED OXYGEN

The amounts of dissolved oxygen, D.O., in the water off Punta Manati were determined by the Winkler titration method with the analyses usually performed on shipboard within a few hours of sample collection. Some of the values were checked with a YSI polarographic probe with results similar to those reported for Punta Higuero (Wood, 1974). The titration values were more consistent and generally higher than the probe readings. The titration values are generally good to better than + 1%. However, some analytical problems were experienced on the 1973 winter cruise. Dissolved oxygen data are included with the hydrographic data in the Appendix 2.1A in ml/l, mg/l and % sat.

Oxygen saturation is a function of both temperature and salinity. Since neither shift drastically in the tropics little change in near surface D.O. is expected nor was it seen.

Averaged D.O. values in milliliters per liter are plotted with other hydrographic parameters in Figures 2.1-F7 through F14 by season and type of station. The highest values, except for the winter season, were found at about 100 meters. Surface values were near saturation with some super-saturation at depths of 25 to 75 meters because of photosynthesis. A comparison of seasonal averaged values is shown in Figure 2.2-F1. The oxygen minimum occurred at about 225 meters for all seasons except fall where a very pronounced minimum was seen at about 150 meters. Slightly higher D.O. in the surface waters during fall and winter seasons is consistent with higher D.O. saturation with lower temperature and salinity. Generally, very little seasonal change was noticed in D.O.

2.2.2 NUTRIENTS

Nutrients are important from two aspects. First, nutrients are generally low in the tropical Atlantic Ocean surface waters and limit primary productivity. Second, the discharge of wastes from agricultural, municipal or industrial sources may contain such high nutrient levels that they cause eutrophication and local ecological degradation.

Reactive phosphate can be determined quickly and accurately with the Murphy and Riley molybdate blue complex method (Strickland and Parsons, 1968) and is a good indicator of pollution. Only a limited number of nitrate analyses were performed on the waters off Punta Manati. The tropical and sub-tropical North Atlantic is generally deficient in nutrients, especially nitrate. Reactive silica is usually not regarded as a pollution problem.

Reactive Phosphate

The concentration of reactive phosphate is generally low in the surface waters ($0.05 \mu\text{g-at. P/l}$), slightly lower in the summer and slightly higher in the winter as seen in Figure 2.2-F2. The levels of phosphate were uniformly to about 200 meters where they began to increase being 0.3 to $0.5 \mu\text{g-at. P/l}$ at 300 meters. The increase in phosphate generally coincides with the decreased salinity below the salinity maximum. This is because the high salinity water was formed in the sub-tropical North Atlantic which is deficient in nutrients. Slightly higher phosphate values were seen in the nearshore surface waters, especially near the mouth of the Manati River, probably from agricultural runoff.

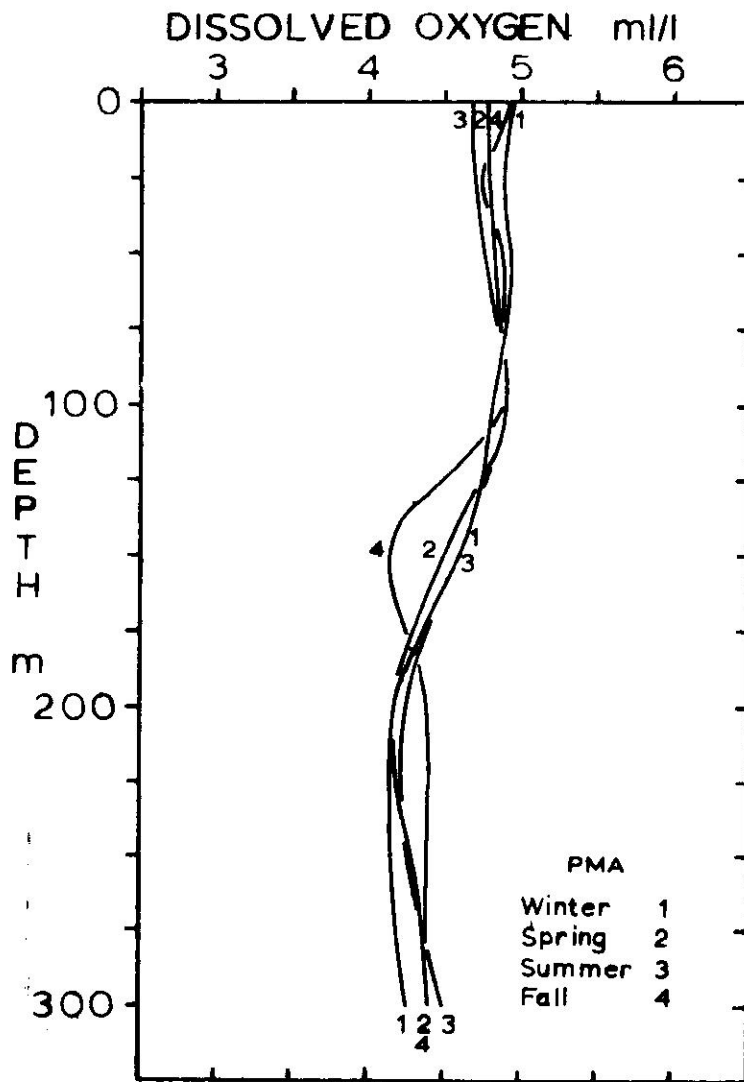


Fig. 2.2-F1 Averaged dissolved oxygen depth profiles by season, 1973 and 1974.

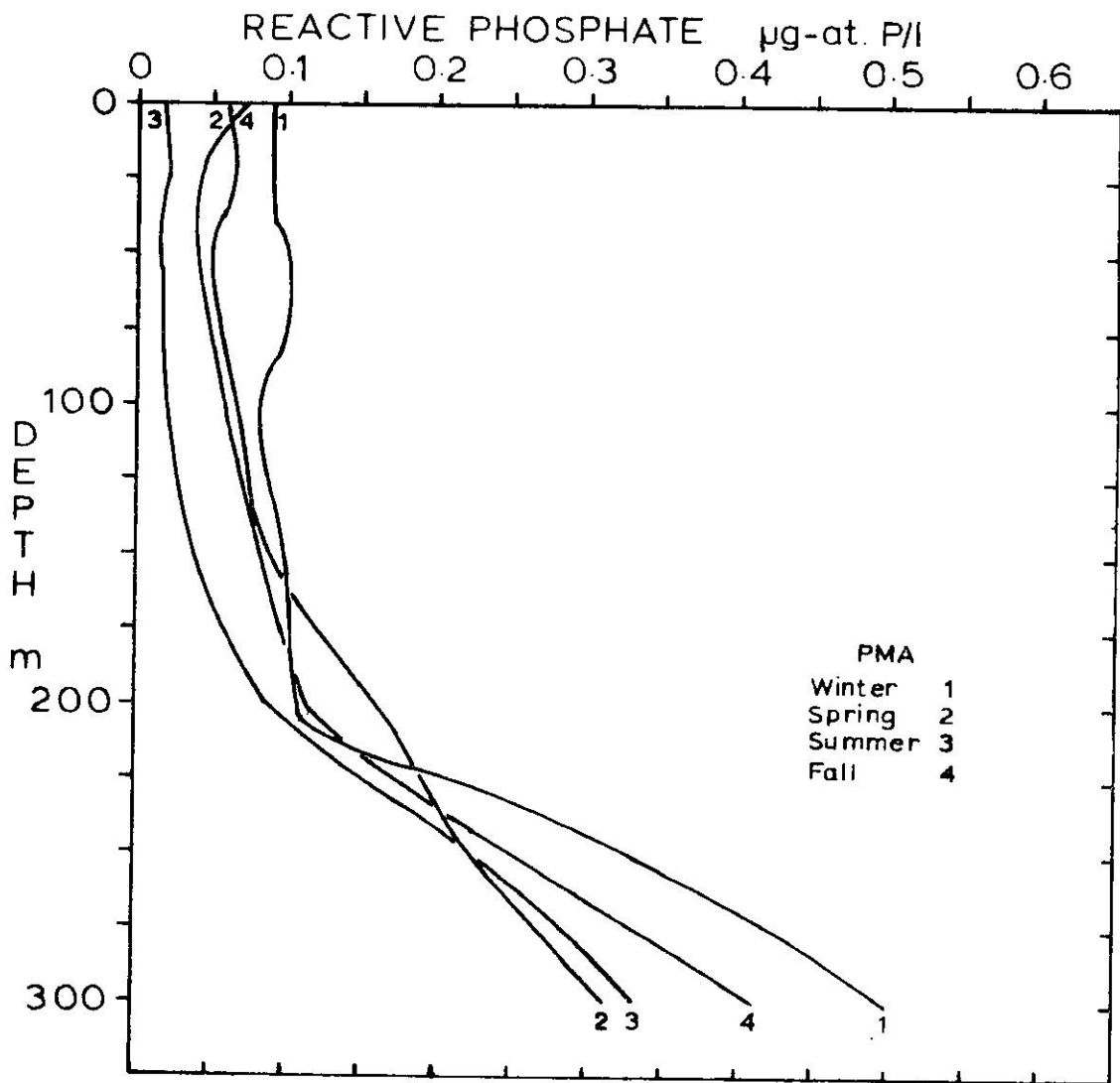


Fig. 2.2-F2 Averaged reactive phosphate depth profiles by season, 1973 and 1974.

Nitrate

Nitrate was determined by the cadmium-copper reduction method (Wood et al., 1967). Samples were analyzed for nitrate at Punta Manati only for the fall 1974 season. (Nitrates have been done routinely at the Islote site about 3 kilometers to the west and the data is available in Kendall et al., 1975).

Nitrate profiles for the PMA-3A, B, and C stations are shown in Figure 2.2-F3. They are similar in shape to the phosphate profiles for the same season except that the higher surface values for the "A" and "B" stations are much more pronounced. There is obviously a large source of nitrate in the Manati River region, possibly from agricultural sources or from industry.

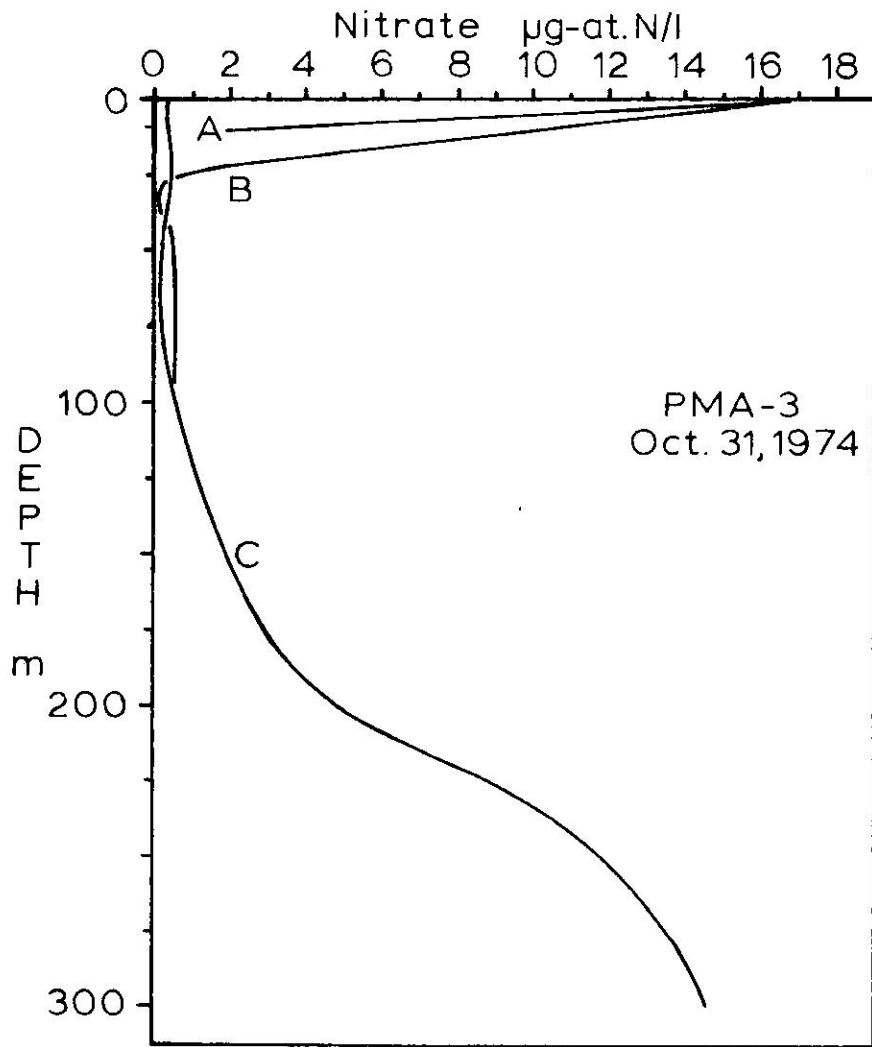


Fig. 2.2-F3 Plot of nitrate vs. standard depth for the fall season of 1974.

GEOPHYSICAL PARAMETERS AT PUNTA MANATI

by

E.D. Wood

The beach outcrops are Pleistocene cemented dunes as are the high grounds on either side of the Manati River (Briggs 1965). Much of the shoreline is composed of unconsolidated sand (Figure 3.1-F1). Some of the sand deposits landward from the beach contain fine-grained quartz sand and clay, especially near the Manati River.

The cross-hatched area is alluvium deposited by periodic river flooding (Hickenlooper 1967). Sediments in the shaded areas along the shore were deposited by storm and wave swash and wind (Fields and Jordan 1972).

Sediment deposits largely from the Manati River exist seaward and to the west of the river. There is a region just east of the river mouth that is usually hard bottom. This is just north of Punta Manati covered by Station PMA-4A (Figure 2.1-F1). It had been reported that sand moves on and off of some of the hard bottom, however, attempts to retrieve sediments from PMA-4A have been fruitless. The ocean bottom areas shaded in Figure 3.1-F1 were drawn from aerial photographs taken in August 1973. Sand was visible near Punta Boquilla and north and west of the Manati River with a tongue of sand running west just offshore north of Palmas Altas. The sand deposits west of Palmas Altas were confined to several patches. Sediments collected at PMA-1A, 2A, 3A, and 5A were sieved and the results are shown in Figures 3.1-F2 and F3. All of the samples are uni-modal with the highest percent of sediment collected on the 3 ϕ (125 μ m) screen. The statistics for the sediments are in Table 3.1-T1.

TABLE 3.1-T1 Statistics for the Punta Manati sediments

STATION	PMA-1A	PMA-2A	PMA-3A	PMA-5A
Median $Md\phi$	2.8	2.8	2.9	2.7
Mean $M\phi$	2.9	2.8	2.9	2.7
Std. Dev. $\sigma\phi$	0.5	0.6	0.6	0.5

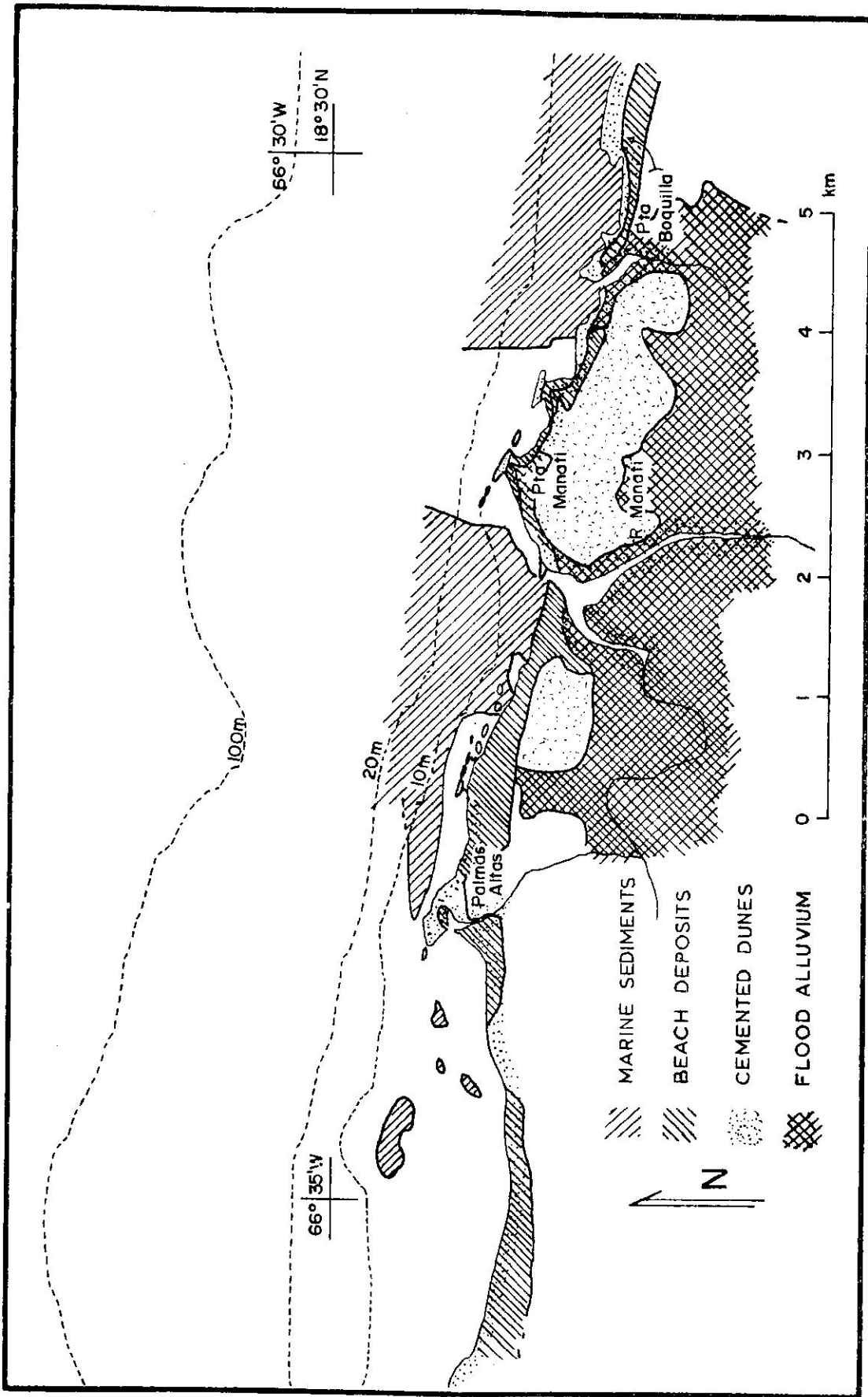


Fig. 3.1-F1 Principal types of surface deposits at Punta Manati.

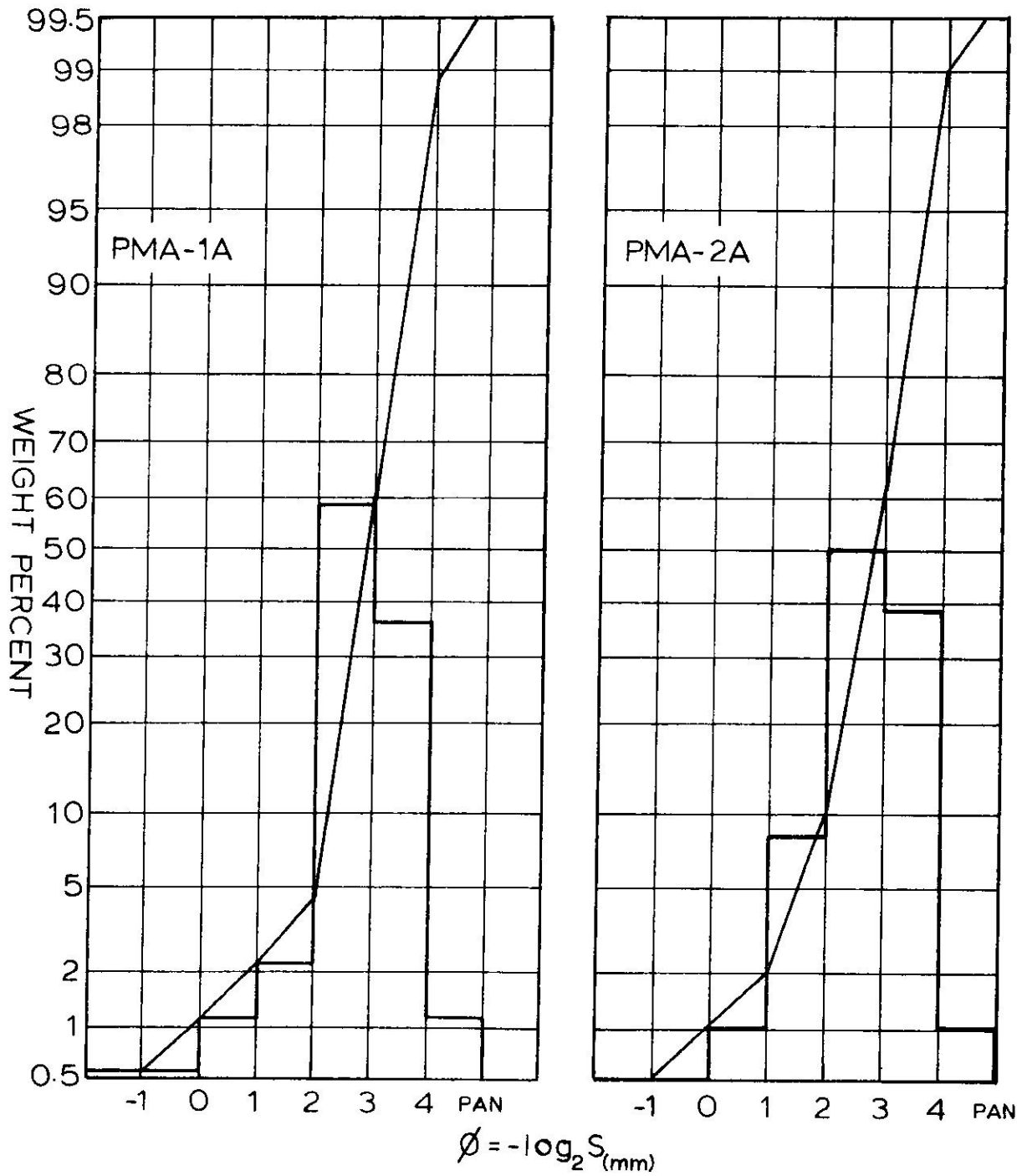


Fig. 3.1-F2 Histograms and cumulative weight percent plots of sediments from Stations PMA-1A and 2A.

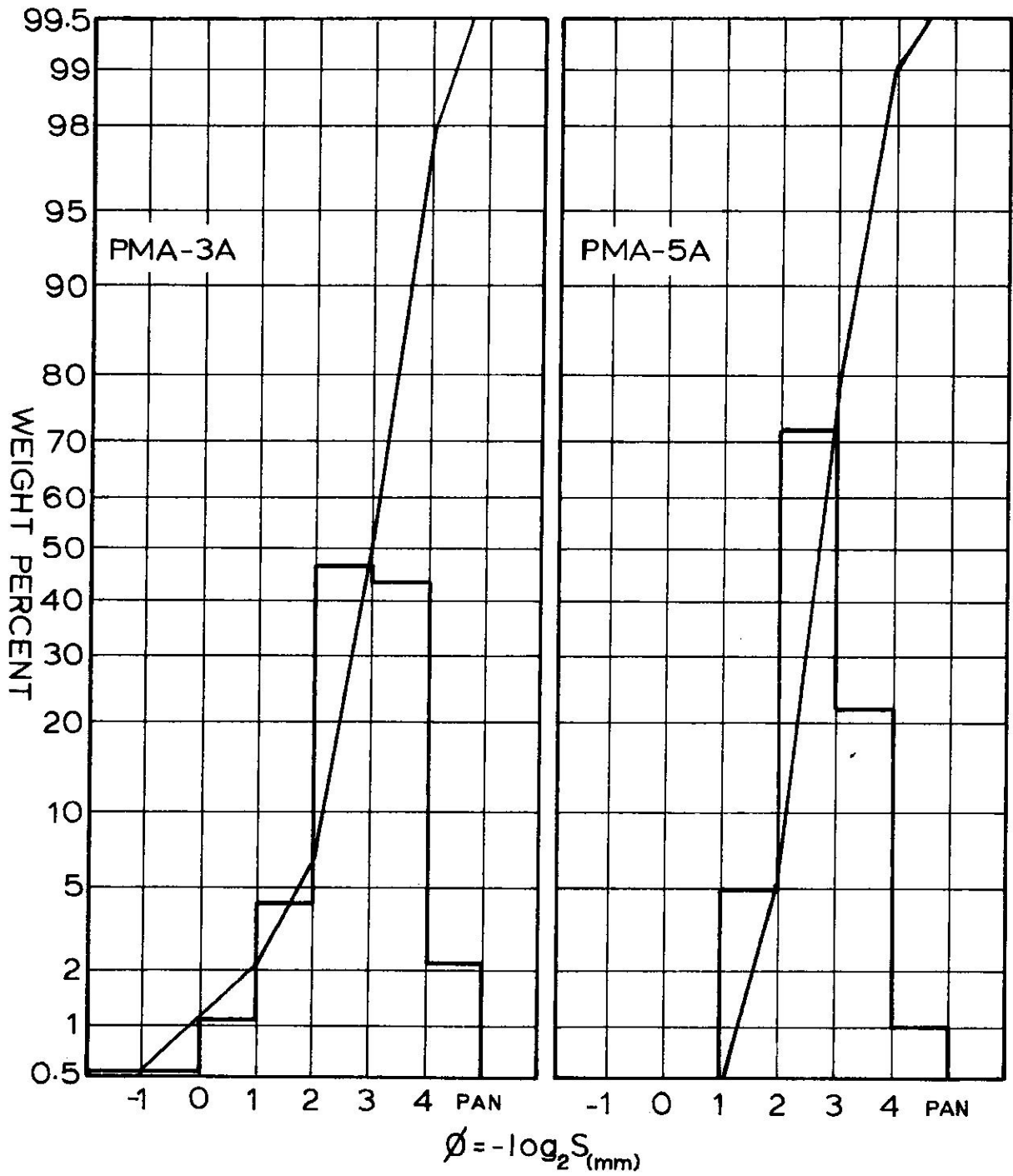


Fig. 3.1-F3 Histograms and cumulative weight percent plots of sediments from Stations PMA-3A and 5A.

The shape of the histogram of PMA-5A differs somewhat from those sediments west of the Manati River with over seventy percent of the sediment collected on the 3 ϕ screen and only 0.4% less than 1 ϕ .

The plume of the Manati River has been observed on numerous occasions. The dominant pattern is to the west along the shore as shown in Figure 3.1-F4. With periods of light winds and a flood current, the pattern changes to the east with more spreading. On rare occasions (high river discharge and a near calm sea) the plume may be seen to spread in an arc several kilometers from the river mouth as a thin layer of muddy, low salinity water overlying the sea water.

The river produces very little discharge during the dry season. The usually turbulent north coast sea conditions rapidly mix the river water with the sea water so that the effects (e.g., low salinity) are rarely seen beyond the "A" stations even during the rainy season.

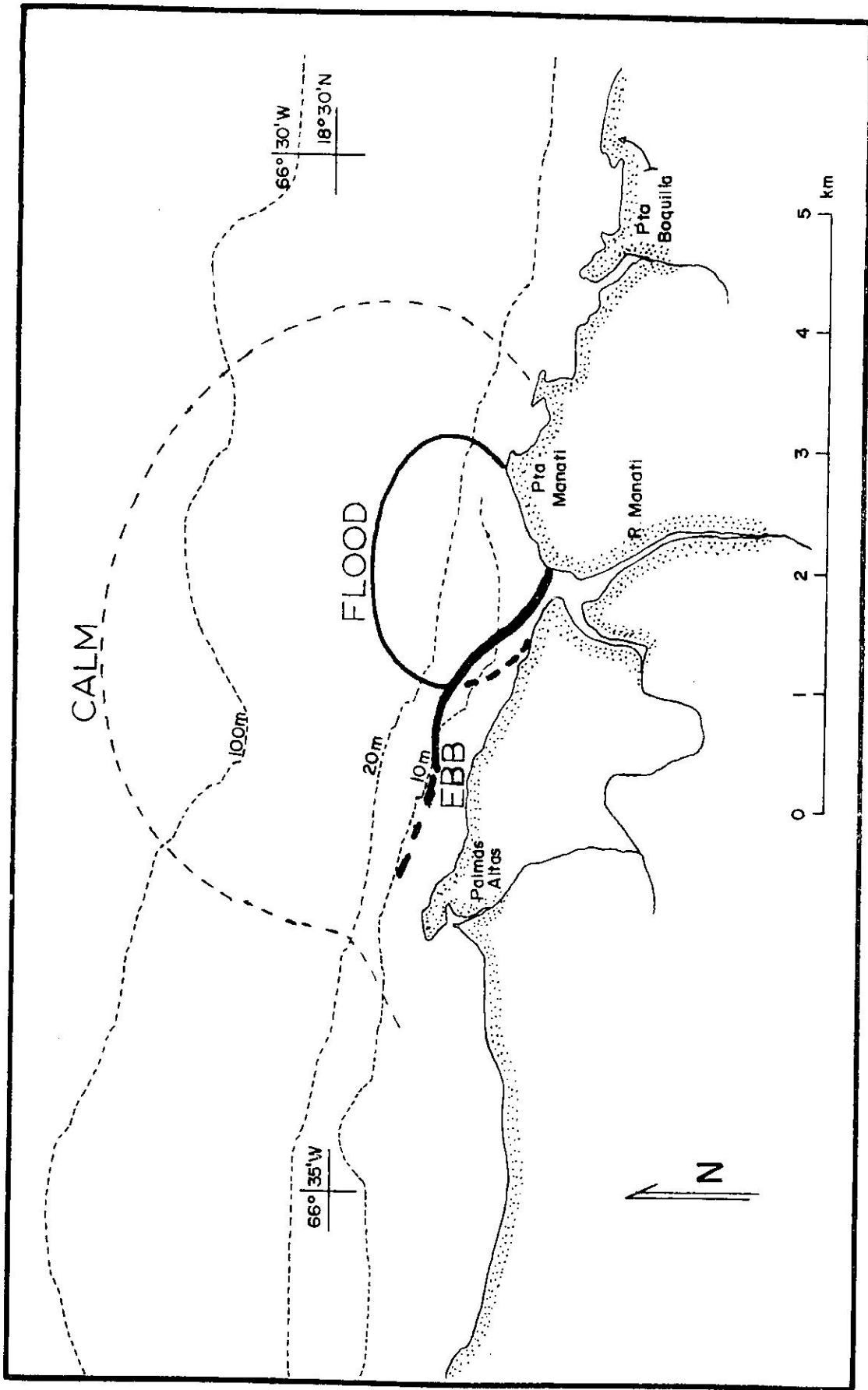


Fig. 3.1-F4 Diagram indicating the approximate shape and lateral extent of the Manati River plume during ebb current (and easterly wind), flood current (low wind) and slack current (and offshore breezes).

by

Marsh J. Youngbluth

4.1.1 INTRODUCTION

The following report provides estimates of the abundance and density of zooplankton in the surface waters along a portion of the north coast of Puerto Rico. These data form one part of an environmental survey conducted by the Puerto Rico Nuclear Center. All collections were gathered in an area adjacent to the region proposed for the siting of a future power plant. Samples were gathered on 3 days during 1973, 29 January, 11 May, and 7 August.

4.1.2 MATERIALS AND METHODS

Field Procedures

Zooplankton were collected with a 1/2 meter diameter cylinder-cone shaped nylon net. This net was designed to reduce clogging error (Smith et al., 1968). Mesh size was 233 microns. The net was towed from a 17 foot skiff in a circular path through the upper 2 meters. The speed of the vessel ranged from 2 and 3 knots (determined with a Sims yacht speedometer). The duration of a tow was 10 minutes. After each tow, before the cod end was removed, the net was washed with sea water with the aid of a battery driven pump (12 volt, Jabsco water-puppy). The catch was preserved in 4% sea water formalin buffered to pH 7.6. All samples were gathered during the daylight hours. The volume of water filtered through a net was estimated with a flowmeter (TSK or General Oceanics Model 2030) suspended off-center in the mouth of the net. The volumes usually ranged from 100 to 150 m³. The meters were calibrated every 2 months. Calibration factors fell within 8% of the mean.

At each site three tows were made in the area adjacent to the region where a power station may be located. Single tows were taken at the other stations. The regions sampled were chosen in such a way as to collect within and around the area where thermal alteration is likely to occur (Figure 4.1-F1).

Laboratory Procedures

Within 24 hours after samples were collected the pH was checked and adjusted, if necessary, to 7.6. If a sample contained a noticeable conglomerate of phytoplankton or detritus, the zooplankton were separated from such material by gentle

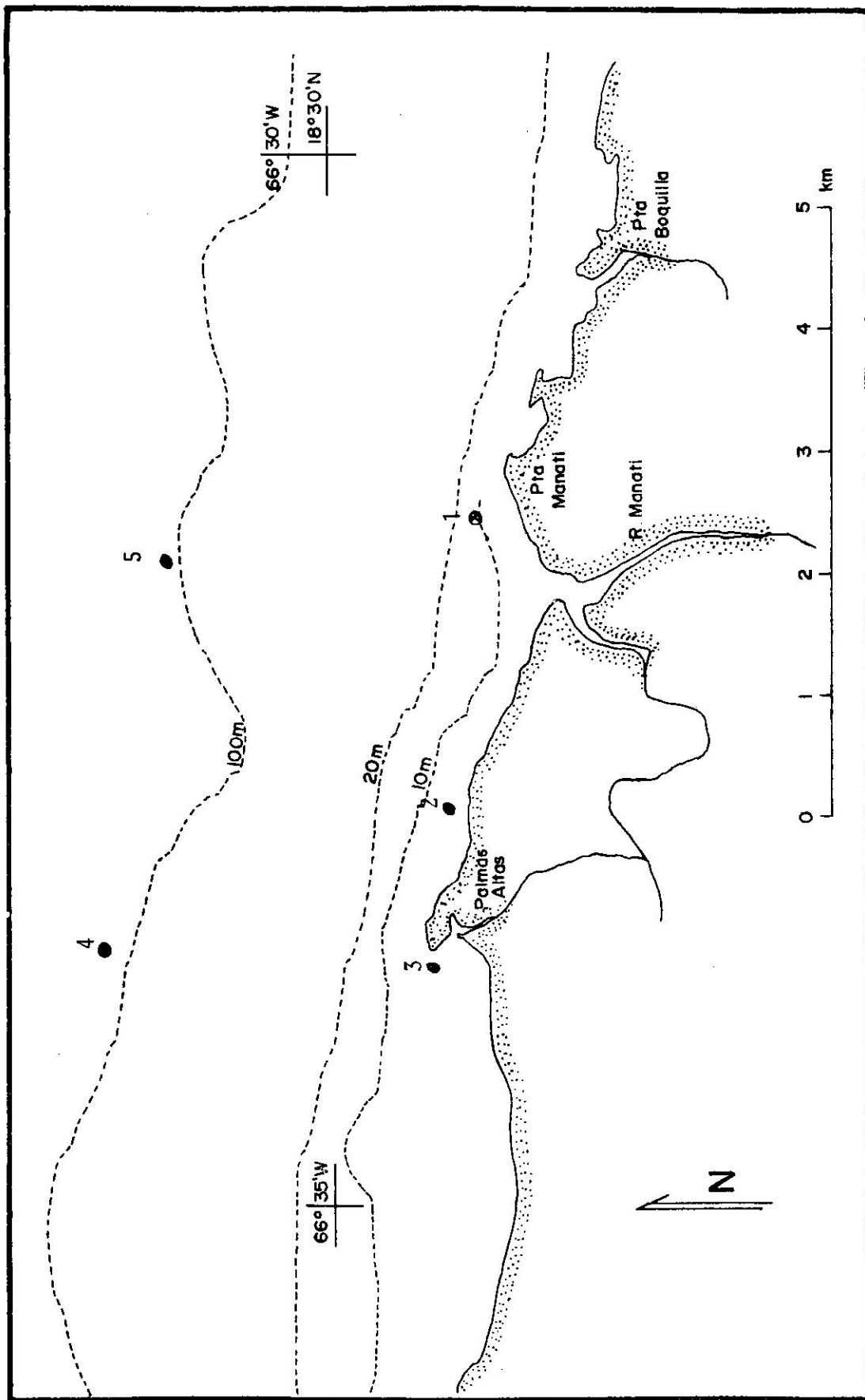


Fig. 4.1.-F1. Location of 1973 Punta Manati zooplankton stations.

filtration through 202 micron mesh netting. Before estimates of biomass or numbers were made all organisms larger than 1 cm, usually hydrozoan medusae, were removed.

Biomass was calculated as wet volume (Ahlstrom and Thraikill, 1962). This estimate is subject to considerable error and should be viewed only as a rough measure of standing stock. The measurements were reproducible but are undoubtedly biased toward higher than actual values by variable proportions of interstitial water and detritus.

The total number of organisms was estimated by volumetric subsampling with replacement (Brinton, 1962). Three aliquots from each sample were counted. The abundance of major taxonomic groups of holoplankton and meroplankton were determined from dilutions of 300 to 500 organisms. Copepods usually the most numerous of the zooplankters, were identified to species.

All biomass and enumeration data were standardized to a per cubic meter basis or multiple thereof. Data were initially reduced with hand calculators (Hewlett Packard Model 45) and more recently with a computer (PDP-10). See Appendix 4.1A for a listing of the program.

4.1.3 RESULTS

A total of 21 samples was collected from 5 stations (Figure 4.1-F1). The densities of several taxonomic groups of zooplankton at each station have been determined (Tables 4.1-T 6 through 17). These data are arranged to facilitate comparisons between sets of consecutive tows, nearshore tows, and offshore tows. The densities of total zooplankton usually differed more between catches from different areas than between consecutive samples from one area. The degree of variation between samples is expressed as a ratio formed by dividing the largest total number of zooplankton by the smallest within each set (Table 4.1-T1). The ratios are similar to those observed in other coastal regions around Puerto Rico. Another way of judging differences between samples was determined by calculating the variance between consecutive samples and estimating the number of tows needed to detect various levels of difference (Table 4.1-T2).

TABLE 4.1-T1. Summary of ratios between the highest and lowest density values of total zooplankton during each period

DATE	29 January	11 May	7 August
Consecutive Tows	1.2	1.4	1.6
Nearshore Tows	3.9	1.6	2.8
Offshore Tows	2.9	2.3	1.3
All Tows	3.9	2.8	3.1

TABLE 4.1-T2. Total zooplankton (\log_{10} transformed) from 3 sets of replicate tows. The number of replicate tows (n) needed to detect a 5 to 50% difference in density is indicated.*

DATE STATION	29 January 1	11 May 1	7 August 1
	2.69197	2.56110	2.33646
	2.78675	2.70753	2.18469
	2.73799	2.71517	2.13988
n5%	17	56	79
n20%	1	3	5
n50%	1	1	1

* $n = \frac{t^2 \times s^2}{d^2}$ Where (t) is Student's t for the 95% confidence level (d.f.=2), s^2 is the sample variance based on replicate tows, and d is the half-width of the confidence interval desired.

These data indicate that a large number of replicate tows would be necessary to detect density differences at the 5% level. However, on the average, differences of 20% can be noted with only 3 tows. Differences of 50% may be revealed with a single tow. Density estimates larger than 50% were found within and between nearshore and offshore catches. The range of density values during a sampling period was usually two to four-fold.

Seasonal changes in the abundance of total zooplankton at any station or among all samples fell within the same range (Table 4.1-T7). The highest concentrations occurred in January. The larger densities, however, probably represent the range of variation among tropical zooplankton communities in the coastal waters around Puerto Rico rather than recurrent seasonal pulses since the 95% confidence intervals from each station overlap (Table 4.1-T3).

TABLE 4.1-T3. Average density of all zooplankton collected
Total Zooplankton/m³

	29 January	11 May	7 August
Range	184-712	166-464	153-476
Median	550	373	199
Mean	480	340	242
95% C.L.	<u>+312</u>	<u>+145</u>	<u>+165</u>

These fluctuations in density refer primarily to holoplanktonic organisms since they composed, in most cases, 60 to 90% of the total zooplankton. Meroplankton formed 3 to 25% and were equally numerous during each sampling period. Copepods dominated the holoplankton and the larvae of gastropods and carideans formed the bulk of the meroplankton.

Fish eggs were abundant in this area, constituting 2 to 25% of the total zooplankton (Table 4.1-T4). The largest density, 87/m³, was observed at Station 4 on 29 January 1973. Fish eggs were somewhat more numerous in January and August when they averaged 39 and 33/m³, respectively. Most of the eggs were round and 0.5 to 2 mm in diameter. Oblong eggs were common. It is not known which groups of fish are represented by most of the eggs.

TABLE 4.1-T4. Summary of densities of fish eggs from all stations sampled at the Punta Manati Site

	STATION					ALL
	1	2	3	4	5	
Range	17-38	16-35	3-47	2-87	21-38	3-87
Median	25	28	14	29	21	28
Mean	27	26	21	39	31	29

Copepods formed 50 to 85% of the zooplankton community. A total of 39 species were identified. Time did not allow a detailed study of species abundance at all stations, consequently, one sample at Station 1 from each period was selected for study. The entire sample was scanned to form a species list and subsampled for quantitative analysis. Using these data, the species most numerous, those commonly observed, and others occasionally found, are listed in Table 4.1-T5.

TABLE 4.1-T5. Copepod populations observed at the Punta Manati Site

Species usually most numerous (> 10 individuals/m³)

Clausocalanus furcatus
Paracalanus spp. (P. aculeatus, P. crassirostris, P. parvus)
Farranula gracilis
Oithona spp. (O. plumifera, O. spp.)
Acartia spinata
Temora turbinata

Species commonly present (observed on 2 or more sampling periods)

Corycaeus spp. (C. giesbrechti, C. pacificus, C. speciosus, C. subulatus)
Oncaea spp. (O. mediterranea, O. venusta, O. spp.)
Calanopia americana
Undinula vulgaris
Calocalanus pavo
Mecynocera clausi

Species occasionally present

<u>Euchaeta marina</u>	<u>Eucalanus spp. (E. mucronatus, E. spp.)</u>
<u>Nannocalanus minor</u>	<u>Lucicutia flavicornis</u>
<u>Calocalanus pavoninus</u>	<u>Temora stylifera</u>
<u>Centropages furcatus</u>	<u>Miracia efferata</u>
<u>Scolecithrix danae</u>	<u>Copilia mirabilis</u>
<u>Labidocera spp.</u>	<u>Sapphirina spp. (S. tropica, S. spp.)</u>
<u>Candacia pachydactyla</u>	<u>Lubbockia squillimana</u>
<u>Acrocalanus longicornis</u>	<u>Pontella plumata</u>
	<u>Macrosetella gracilis</u>

4.1.4 DISCUSSION

The variety and abundance of zooplankton observed at the Punta Manati site were similar at each station and throughout the year. Holoplanktonic forms dominated the zooplankton community. Meroplanktonic organisms, particularly the larvae of gastropods and decapods, and fish eggs were equally numerous. No obvious patterns of distribution were apparent among the zooplankton sampled along the coast or offshore.

Limitations of the Data

The sampling program was designed to provide quantitative estimates of: 1) the standing stock of zooplankton, 2) the variety of major taxonomic groups, and 3) the diversity and abundance of the more numerous copepod species. The manner of field sampling determined the variety and biomass of organisms encountered. The data in this report are based on collections made in the surface waters during the daylight hours. The sampling gear and methods were kept uniform, i.e., net type, net mesh, tows speed, and depth range sampled. A small number of replicate tows were gathered at each site to obtain some measure of the variability between samples. To obtain a better understanding of the zooplankton community more sampling with replication should be done at frequent intervals, at a greater number of stations, at different depths, during the day and night, and during different seasons for several years. Information gathered in these ways will be necessary to interpret fluctuations in standing stock and diversity in relation to environmental changes in biotic interactions.

TABLE 4.1-T6 Total biomass of zooplankton (ml/m³) Punta Manati Site

Date	Nearshore Replicate Tows Stations			Nearshore Tows Stations			Offshore Tows Stations		
	1a	1b	1c	1	2	3	4	5	
290173	.181	.093	.077	.117	.201	.037	.199	.106	
110573*	-	-	-	-	-	-	-	-	
70873*	-	-	-	-	-	-	-	-	

TABLE 4.1-T7 Total number of zooplankton (number/m³)

Date	Nearshore Replicate Tows Stations			Nearshore Tows Stations			Offshore Tows Stations		
	1a	1b	1c	1	2	3	4	5	
290173	492	612	547	550	709	184	712	247	
110573	364	510	519	464	287	413	373	166	
70873	217	153	138	170	214	476	199	153	

* Not measured.

TABLE 4.1-T8 Total number of holoplankton (number/m³) Punta Manati Site.

Date	Nearshore Replicate Tows			Nearshore Tows			Offshore Tows		
	<u>Stations</u>			<u>Stations</u>			<u>Stations</u>		
	1a	1b	1c	1	2	3	4	5	
290173	443	534	430	469	626	145	615	203	
110573	333	466	487	429	260	374	345	139	
70873	171	122	106	133	176	363	148	103	

TABLE 4.1-T9 Total number of meroplankton (number/m³)

Date	Nearshore Replicate Tows			Nearshore Tows			Offshore Tows		
	<u>Stations</u>			<u>Stations</u>			<u>Stations</u>		
	1a	1b	1c	1	2	3	4	5	
290173	35	41	47	41	12	32	7	8	
110573	16	15	15	15	5	13	23	5	
70873	12	9	7	9	9	58	19	12	

TABLE 4.1-T10 Total number of copepods (number/m³) Punta Manati Site.

Date	<u>Nearshore Replicate Tows</u>			<u>Nearshore Tows</u>			<u>Offshore Tows</u>		
	1a	1b	1c	1	2	3	4	5	
290173	355	435	315	387	493	116	538	155	
110573	261	372	399	344	187	297	321	108	
70873	121	82	80	97	138	303	104	67	

TABLE 4.1-T11 Total number of chaetognaths (number/10m³).

Date	<u>Nearshore Replicate Tows</u>			<u>Nearshore Tows</u>			<u>Offshore Tows</u>		
	1a	1b	1c	1	2	3	4	5	
290173	349	267	260	292	171	122	162	164	
110573	123	130	56	103	102	110	22	20	
70873	19	10	18	16	47	121	47	19	

TABLE 4.1-T12 Total number of larvaceans (number/10m³) Punta Manati Site.

Date	Nearshore Replicate Tows			Nearshore Tows			Offshore Tows				
	1a	1b	1c	1	2	3	1	2	3	4	5
290173	138	93	138	123	216	27	262				156
110573	223	240	194	219	346	59	19				191
70873	22	37	49	36	83	33	61				141

TABLE 4.1-T13 Total number of veliger larvae (number/10m³)

Date	Nearshore Replicate Tows			Nearshore Tows			Offshore Tows				
	1a	1b	1c	1	2	3	1	2	3	4	5
290173	363	592	750	568	826	130	144				129
110573	207	292	444	314	242	475	183				80
70873	404	312	175	297	231	406	196				43

TABLE 4.1-T14 Total number of caridean larvae (number/10m³) Punta Manati Site.

Date	Nearshore Replicate Tows			Nearshore Tows			Offshore Tows		
	1a	1b	1c	1	2	3	Stations	Stations	Stations
290173	313	221	176	236	52	105	36	53	
110573	111	37	42	63	3	18	22	+	
70873	14	4	10	9	20	44	29	9	

TABLE 4.1-T15 Total number of brachyuran larvae (number/10m³)

Date	Nearshore Replicate Tows			Nearshore Tows			Offshore Tows		
	1a	1b	1c	1	2	3	Stations	Stations	Stations
290173	22	46	61	43	7	20	+	20	
110573	4	21	32	19	+	23	82	5	
70873	47	25	22	30	25	106	115	62	

TABLE 4.1-T16 Total number of cladocerans (number/10m³) Punta Manati Site.

Date	Nearshore Replicate Tows			Nearshore Tows			Offshore Tows		
	1a	1b	1c	1	2	3	4	5	
290173	+	12	+	4	+	+	+	+	
110573	111	57	28	66	3	23	8	2	
70873	30	19	7	19	+	16	7	36	

TABLE 4.1-T17 Total number of fish eggs (number/m³)

Date	Nearshore Replicate Tows			Nearshore Tows			Offshore Tows		
	1a	1b	1c	1	2	3	4	5	
290173	12	34	67	38	35	3	87	33	
110573	11	25	15	17	16	14	2	21	
70873	31	21	23	25	28	47	29	38	

by

Mary E. Nutt and Marian N. Yeaman

4.2.1 INTRODUCTION

The following report provides quantitative estimates of the biomass, abundance, and composition of the zooplankton at Punta Manati on 14 May, 15 August, and 31 October 1974. Comparisons are made with 1973 samples from the same location, and with 1974 samples from two other north coast sites, Islote and Manati.

4.2.2 MATERIALS AND METHODS

Field Procedures

Four stations were sampled on each occasion. Station 2 is located in 20 meters of water directly north of the proposed power plant site, and was sampled with three replicate tows. Stations 1 and 3 lie on either side of Station 2; Station 4 is offshore at a depth of 100 meters (Figure 4.2-F1).

Oblique tows from the bottom to the surface were made with 1/2 meter cylinder-cone shaped nets (202 μ mesh) towed at 2 knots. Oblique tows ensure that all zooplankton species are sampled regardless of their position in the water column at the time of sampling. This is important since many planktonic organisms migrate diurnally and will be found at different depths during different hours of the day. A 202 μ mesh net does not readily clog with phytoplankton and captures a wide size range of zooplankton. The net was equipped with a digital flowmeter and approximately 100 m³ of water were filtered. Samples were preserved in 4% buffered formalin.

Laboratory Procedures

Samples were washed to remove phytoplankton and detritus, and all animals larger than 1 cc were removed. Approximately 24 hours after collection, the biomass was measured by volume displacement (Ahlstrom and Thraillkill, 1962). Zooplankton abundances were estimated by subsampling. The sample was poured back and forth between two large beakers until thoroughly mixed, at which time a subsample was poured out. Repeated subsampling of a single sample showed all groups of organisms to be randomly distributed by this method.

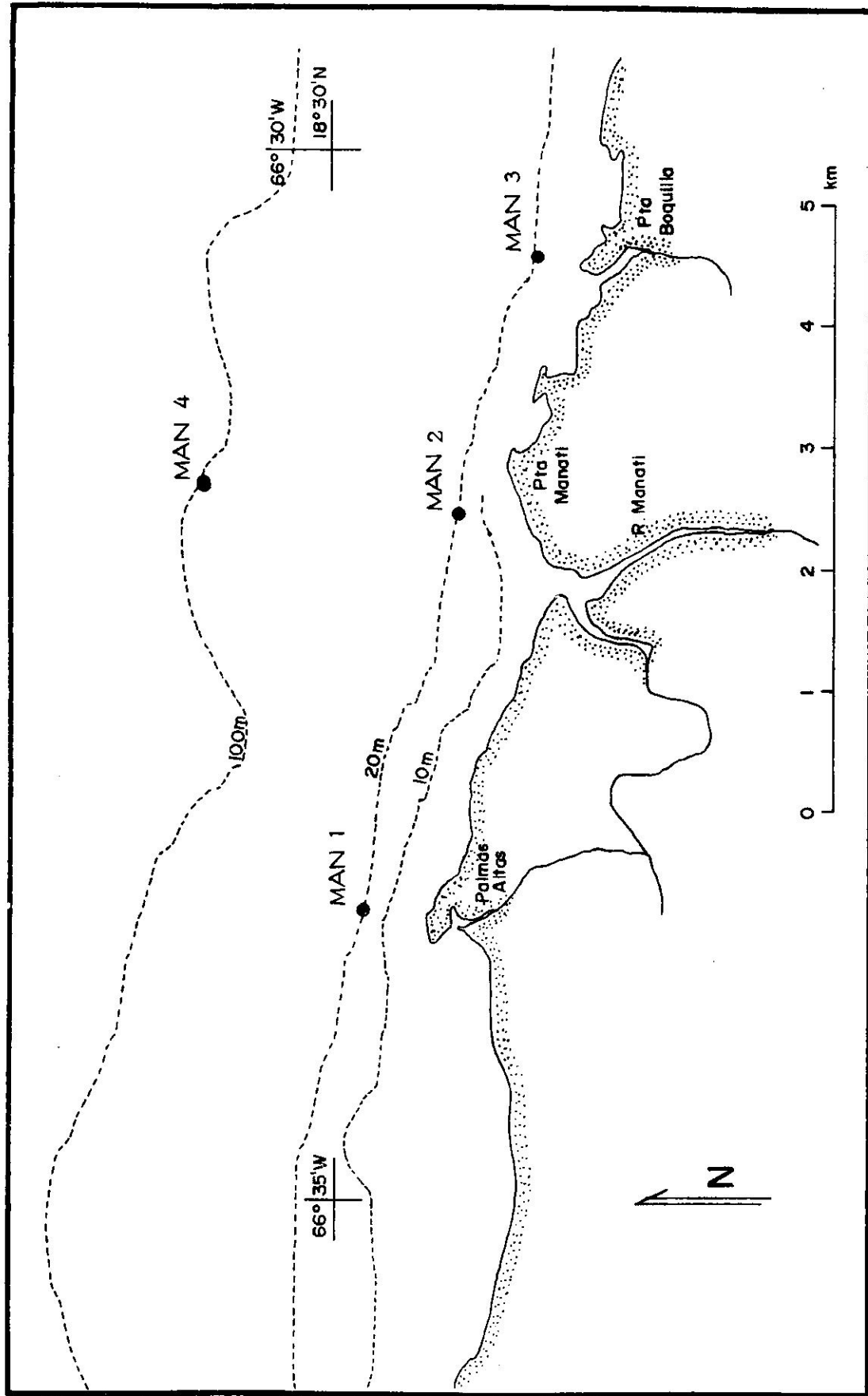


Fig. 4.2-F1 Location of Punta Manati zooplankton stations.

In all cases, subsamples contained more than 450 animals. Each animal was identified to major group and counted. The dominant copepods were identified to species.

When replicate tows were taken, confidence intervals were calculated from the equation,

$$\bar{y} \pm t \sqrt{s^2/n}$$

where \bar{y} is the estimated mean, t is Student's t -value, s^2 is the estimated variance, and n is the number of samples.

4.2.3 RESULTS

Zooplankton found in the Punta Manati samples are listed in Table 4.2-T1. Copepods are invariably the most abundant organisms, followed by fish eggs, chaetognaths, and larvaceans. Other animals such as ostracods, pteropods, and gastropod veligers are occasionally numerous, but are not always present in the plankton.

Copepods were represented by 48 species, but 80 to 90 percent of these consisted of four species (Temora turbinata, Clausocalanus furcatus, Paracalanus sp., and Oithona plumifera). Seven other species were consistently present (Temora stylifera, Nannocalanus minor, Calanopia americana, Acartia spinata, Farranula gracilis, Corycaeus sp., and Oncaea sp.). The remaining copepod species appeared sporadically and in numbers less than 5 per cubic meter.

Fish eggs ranged in abundance from 40 to 117 per cubic meter. Most were clear, round, pelagic eggs. No attempts were made at identification. Fish larvae ranged from 0 to 9 per cubic meter. No identifications were made.

No spiny lobster larvae appeared in the samples.

Table 4.2-T2 shows individual values, means, variances, and confidence intervals for one set of replicate tows made on 31 October 1974 at Station 2. Most of the variances are significantly higher than their means (χ^2 distribution for the variance-to-mean ratio) which indicates a non-random or "patchy" distribution. The confidence intervals are wide but realistic for marine zooplankton distributions (Wiebe and Holland, 1968) and must be considered whenever a mean value is used.

TABLE 4.2-T1. Zooplankton from Punta Manati

HOLOPLANKTON

COPEPODS

Calanoids:

Nannocalanus minor
Undinula vulgaris
Eucalanus attenuatus
Acrocalanus longicornis
Acrocalanus andersoni
Paracalanus aculeatus
Paracalanus parvus
Calocalanus pavo
Mecynocera clausii
Clausocalanus furcatus
Euchaeta marina
Scolecithrix danae
Temora stylifera
Temora turbinata
Pleuromamma gracilis
Centropages furcatus
Lucicutia flavicornis
Candacia pachydactyla
Paracandacia bispinosa
Calanopia americana
Labidocera sp.
Acartia spinata
Haloptilis longicornis

Harpacticoids:

Miracia efferata
Macrosetella gracilis
Oculosetella gracilis
Euterpina acutifrons

Cyclopoids:

<u>Oithona plumifera</u>	<u>Corycaeus (Agetus) typicus</u>
<u>Oithona setigera</u>	<u>Corycaeus (Urocorycaeus) latus</u>
<u>Oithona oculata</u>	<u>Corycaeus (Onychocorycaeus)</u>
<u>Saphirella tropica</u>	<u>giesbrechti</u>
<u>Copilia mirabilis</u>	<u>Corycaeus (Onychocorycaeus) latus</u>
<u>Copilia quadrata</u>	<u>Corycaeus (Onychocorycaeus) agilis</u>
<u>Corycaeus (Corycaeus) speciosus</u>	<u>Oncaea mediterranea</u>
<u>Corycaeus (Corycaeus) clausi</u>	<u>Oncaea venusta</u>
<u>Corycaeus (Agetus) flaccus</u>	<u>Saphirina sp.</u>
<u>Corycaeus (Agetus) limbatus</u>	<u>Farranula gracilis</u>
	<u>Lubbockia squillimana</u>

Table 4.2-T1 (continued)

CHAETOGNATHS

Sagitta hispida
Sagitta enflata
Sagitta tenuis
Sagitta serratodentata
Krohnitta mutabbi
Pterosagitta draco

LARVACEANS

Oikopleura sp.
Fritillaria pellucida

PTEROPODS

Limacina leseurii
Limacina retroversa
Creseis acicula
Styliola subula

OSTRACODS

Euconchoecia chierchiaie

MEROPLANKTON

STOMATOPOD LARVAE

AMPHIPODS

DECAPOD LARVAE

Caridea

Alpheus sp.
Acantheephyra sp.
Penaeidea
Scyllaridea
Palinurus sp.
Galatheidea
Porcellana sp.
Brachyura

SERGESTIDS

Lucifer sp.

CLADOCERANS

Evadne sp.
Penilia sp.

MEDUSAE

SIPHONOPHORES

CTENOPHORES

TUNICATES

Thalia democratica

POLYCHAETES

Tomopteris sp.

ECTOPROCT LARVAE

Membranipora membranacea

GASTROPOD VELIGERS

ANNELID LARVAE

CIRRIPEDE LARVAE

ECHINODERM LARVAE

Ophiopluteus larvae
Echinopluteus larvae

FISH LARVAE

FISH EGGS

TABLE 4.2-T2. Variability among zooplankton replicate tows at Punta Manati, Station 2, 31 October 1974 (Abundances in numbers per cubic meter)

	Total Zooplankton	Copepods	Chaetognaths	Larvaceans	Malacostracans	Fish eggs
Tow A	1412	1132	52	88	3	76
Tow B	1578	1312	48	85	6	63
Tow C	1702	1369	25	68	18	108
Mean	1564	1271	42	80	9	82
Variance	21048	15276	219	121	67	519
95% C.I.	1208 to 1924	964 to 1578	5 to 78	53 to 107	0 to 29	26 to 139

Figures 4.2-F2 and 4.2-F3 show the 95% confidence intervals for the more abundant zooplankton groups at Station 2: copepods, malacostracans, chaetognaths, larvaceans, fish larvae, and fish eggs, as well as total numbers, and biomass. Appendix 4.2A shows abundances of zooplankton groups for all stations and sampling data. Appendix 4.2B shows abundances of the common copepods species for all stations and sampling data. With the exception of fish eggs, the zooplankton is somewhat sparser at the offshore station.

4.2.4 DISCUSSION

In both species composition and abundance, the zooplankton at Punta Manati is similar to that at Islote and Tortuguero Bay (Figure 4.2-F4). No important differences between sites can be seen; when a zooplankton group dominates the plankton at Punta Manati it can usually be found in samples from the other two sites.

Youngbluth's data from the previous year (see Section 4.1 of this report) show substantially fewer zooplankton than were found in 1974. This discrepancy is probably due to differences in sampling methods; Youngbluth used surface tows, Nutt used oblique tows. (See Table 4.2-T3 for a comparison of surface and oblique tows at Islote.) In general, the same zooplankton groups and species were seen both in 1973 and in 1974.

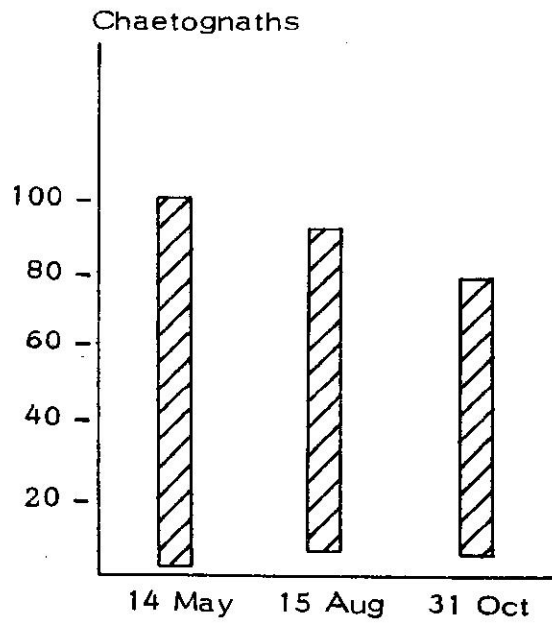
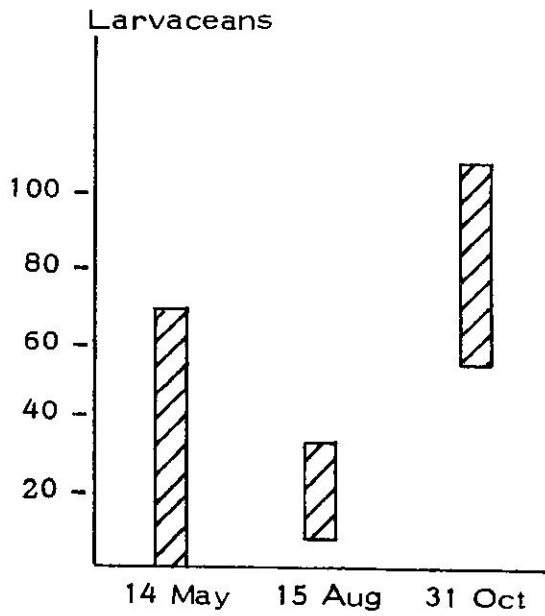
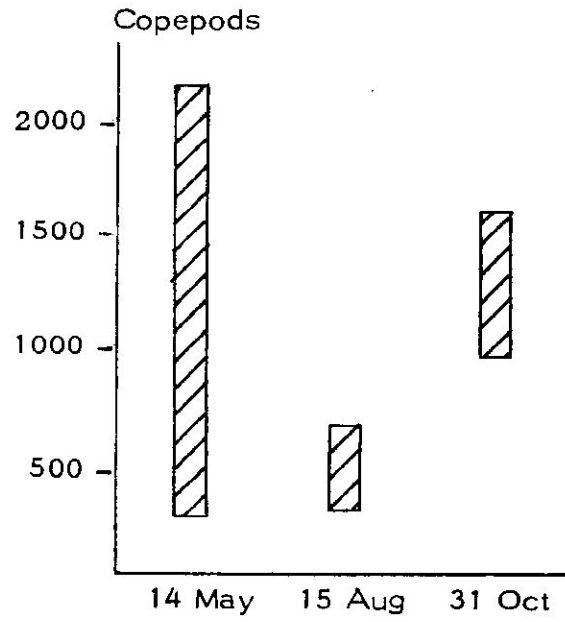
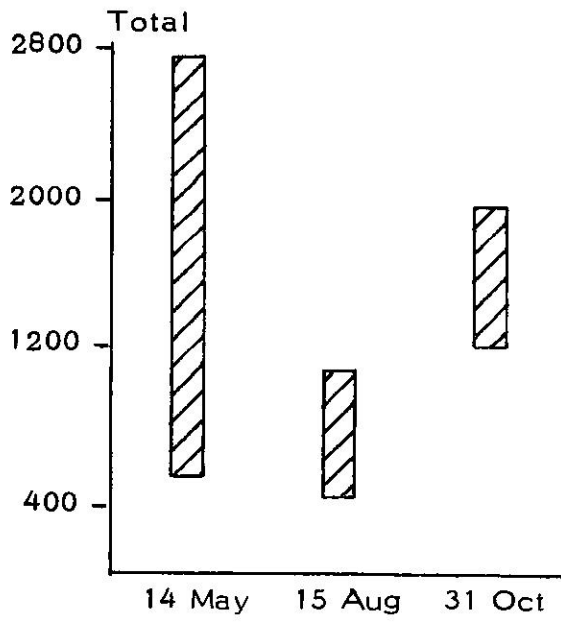


Fig. 4.2-F2 Zooplankton abundances at Station 2: 95% confidence intervals for total zooplankton, copepods, larvaceans, and chaetognaths.

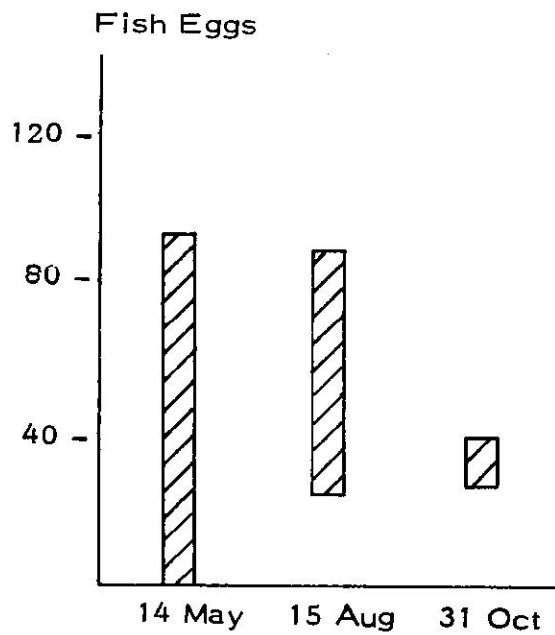
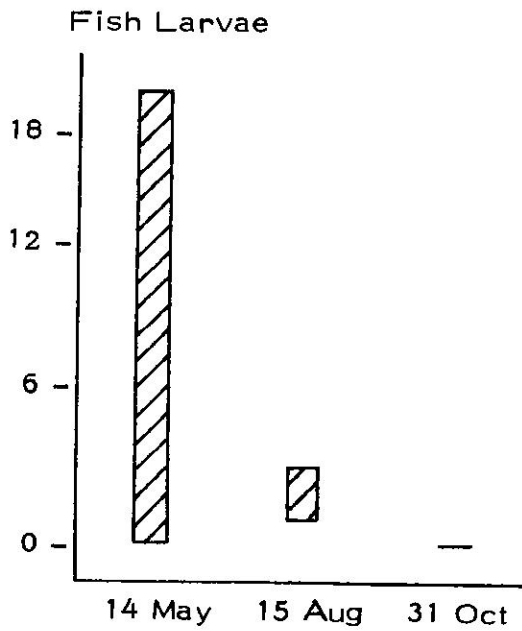
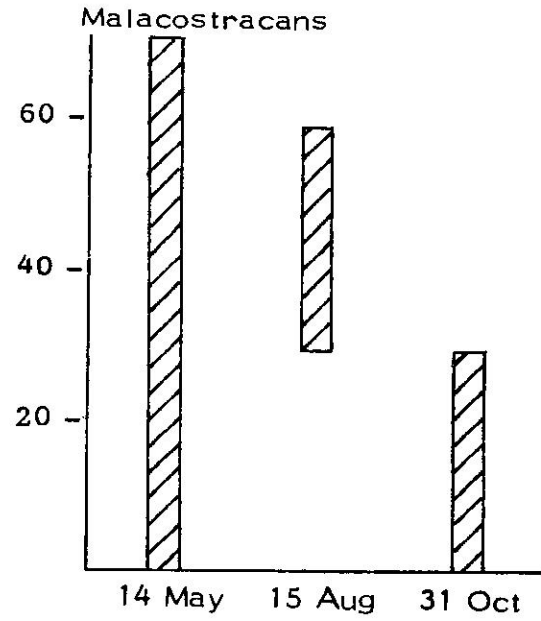
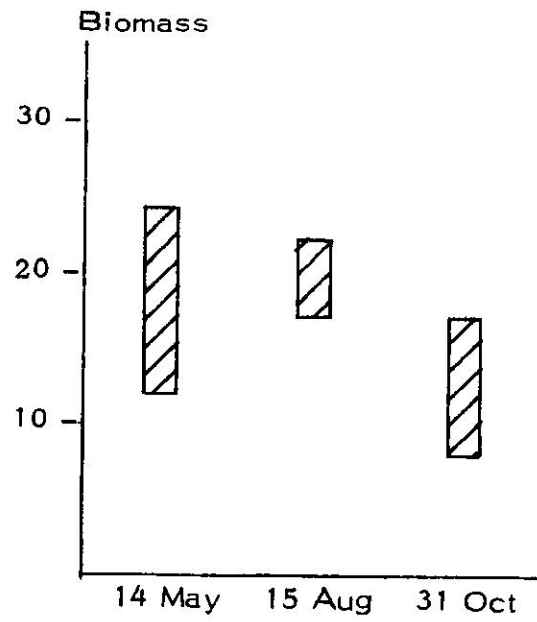


Fig. 4.2-F3 Zooplankton abundances at Station 2: 95% confidence intervals for biomass, malacostracans, fish larvae, and fish eggs.

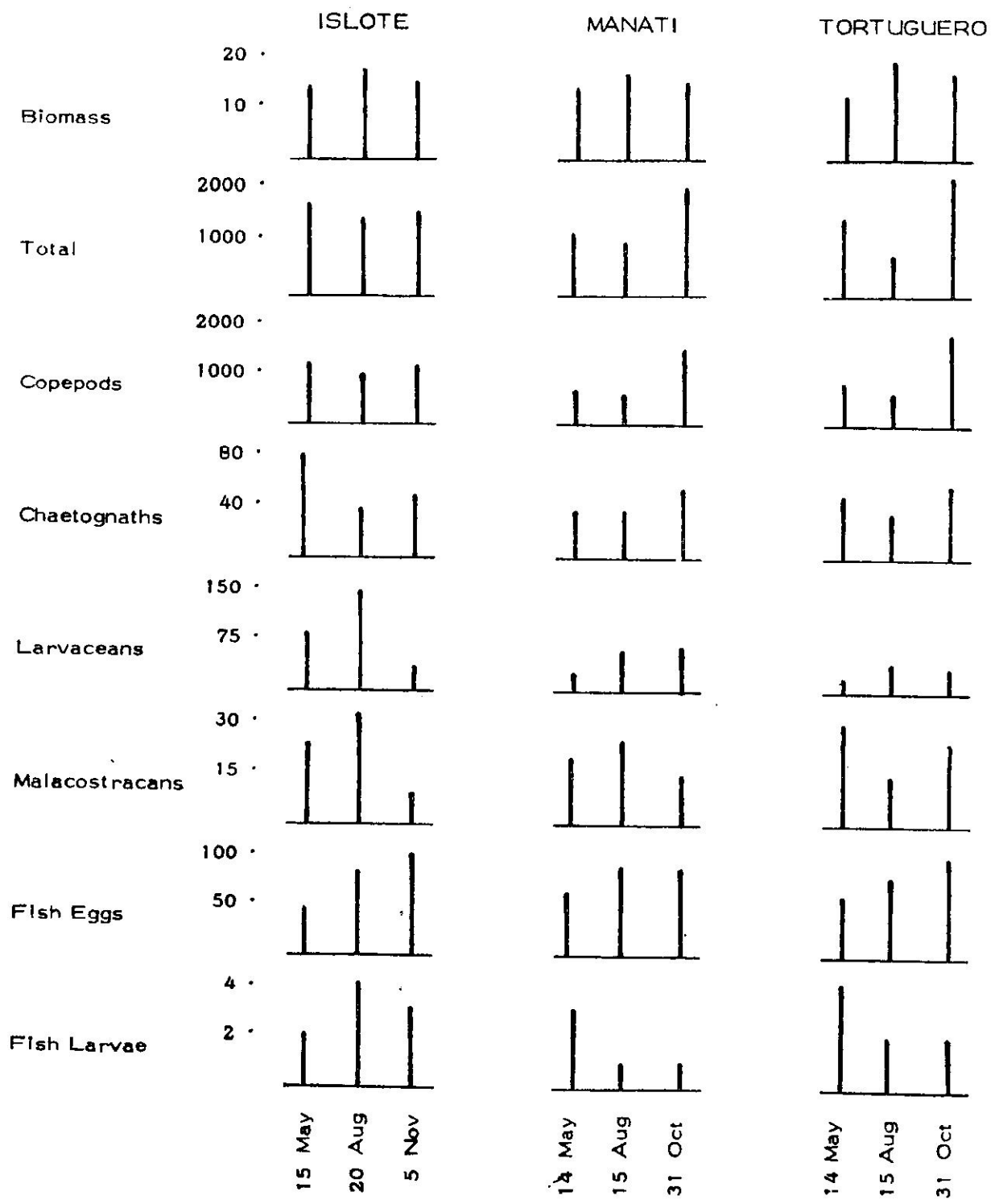


Fig. 4.2-F4 A comparison of zooplankton abundances at Islote, Punta Manati, and Tortuguero Bay.

TABLE 4.2-T3. A comparison of oblique and surface zooplankton tows at Islote, Station 2
17 April 1974 (Number per cubic meter)

SURFACE TOW

	Total	Copepods	Chaetognaths	Ostracods	Gastropods	Malacostracan larvae	Fish Eggs	Fish Larvae
0915	484	254	6	0	63	12	48	1
0925	214	106	2	0	28	21	20	1
0940	259	114	4	0	28	16	38	1
Mean	319	158	4	-	40	16	35	1
Variance	20925	6928	4	-	408	20	201	-
95% C.I.	0 to 678	0 to 365	0 to 9	-	0 to 90	5 to 27	0 to 70	-

OBLIQUE TOW

0745	608	306	40	75	28	24	32	2
0800	788	494	33	57	30	14	52	2
0815	684	371	45	67	22	37	22	3
Mean	693	390	39	66	27	25	35	2
Variance	8165	9116	36	81	17	133	233	0.3
95% C.I.	469 to 918	153 to 627	24 to 54	44 to 89	16 to 37	0 to 54	0 to 73	1 to 2

With quarterly sampling it is difficult to assess seasonality in the plankton at Punta Manati, but the data seem to indicate changes which repeat themselves. For example, the copepod Temora turbinata dominates the plankton on 14 May 1974, is sparse on 15 August, and appears again on 31 October in numbers greater than before. This pattern is seen also at Islote and Tortuguero Bay. At this time it is not known whether this repetition is seasonal or random, and there has been no attempt to correlate these fluctuations with physical, chemical, or other biological parameters.

As both fish eggs and fish larvae are abundant along the north coast of Puerto Rico, we recommend that any further work at Punta Manati involve a full-scale study of ichthyoplankton. Many of the reef fishes produce clear round pelagic eggs, but so do the commercially important snapper, grouper, and other food and game fishes. It is not known whether the eggs found in the Manati region are produced locally or by fish living in other areas of the north coast.

The existing data provide little information on the vertical distribution of the zooplankton. Since oblique tows capture more animals than surface tows, evidence exists that the majority of the zooplankton are not at the surface during the daytime hours. We recommend that oblique tows, or a combination of surface and bottom tows, be used in the future. Studies at Islote revealed a significant diurnal migration of Brachyuran and Caridean larvae (Youngbluth, 1974). Future work at Punta Manati should include a study of vertical distribution and migration.

4.3 BENTHIC INVERTEBRATES AND FISH STUDIES

by

Paul Yoshioka

4.3.1 INTRODUCTION

This report covers benthic studies made at Punta Manati from May, 1973 to August, 1974. The Punta Manati site was visited, but not on a predetermined schedule during this interval. Study stations ranged in depth from 5 to 33 meters.

The scope of studies ranged from preliminary descriptive surveys to the establishment of a permanent station. Organisms examined in this study ranged in size from the microscopic in-faunal populations to the macroalgae and fish.

During the latter part of this study a major portion of the investigative effort was spent on the macroalgae. Various aspects of the ecology of the macroalgae were examined as to distributional and temporal patterns of presence and absence, abundance, and species diversity.

4.3.2 MATERIALS AND METHODS

Field Procedures

Field stations at Punta Manati are given in Figure 4.3-F1 and Appendix 4.3A. Field collections are divided into three categories: fish collections, transect dives, and station dives.

Fish collections. All fish collections were done in the nearshore (+ 5 m) area. Fish were poisoned with roterone (PRONOX-FISH) and collected with dip nets. Fish were collected on four occasions. Sampling sites included both sand beach and rock areas.

Transect dives. Transects were traversed on a predetermined compass direction by two divers, either swimming or propelled by a diver propulsion vehicle (DPV). Notes were taken on depth, bottom type, topography, and dominant or unusual organisms.

Most of the transects were run in a direction perpendicular to the shoreline, thereby transversing a depth gradient. Several transects were run parallel to the shoreline to observe changes in benthic communities relative to factors other than depth.

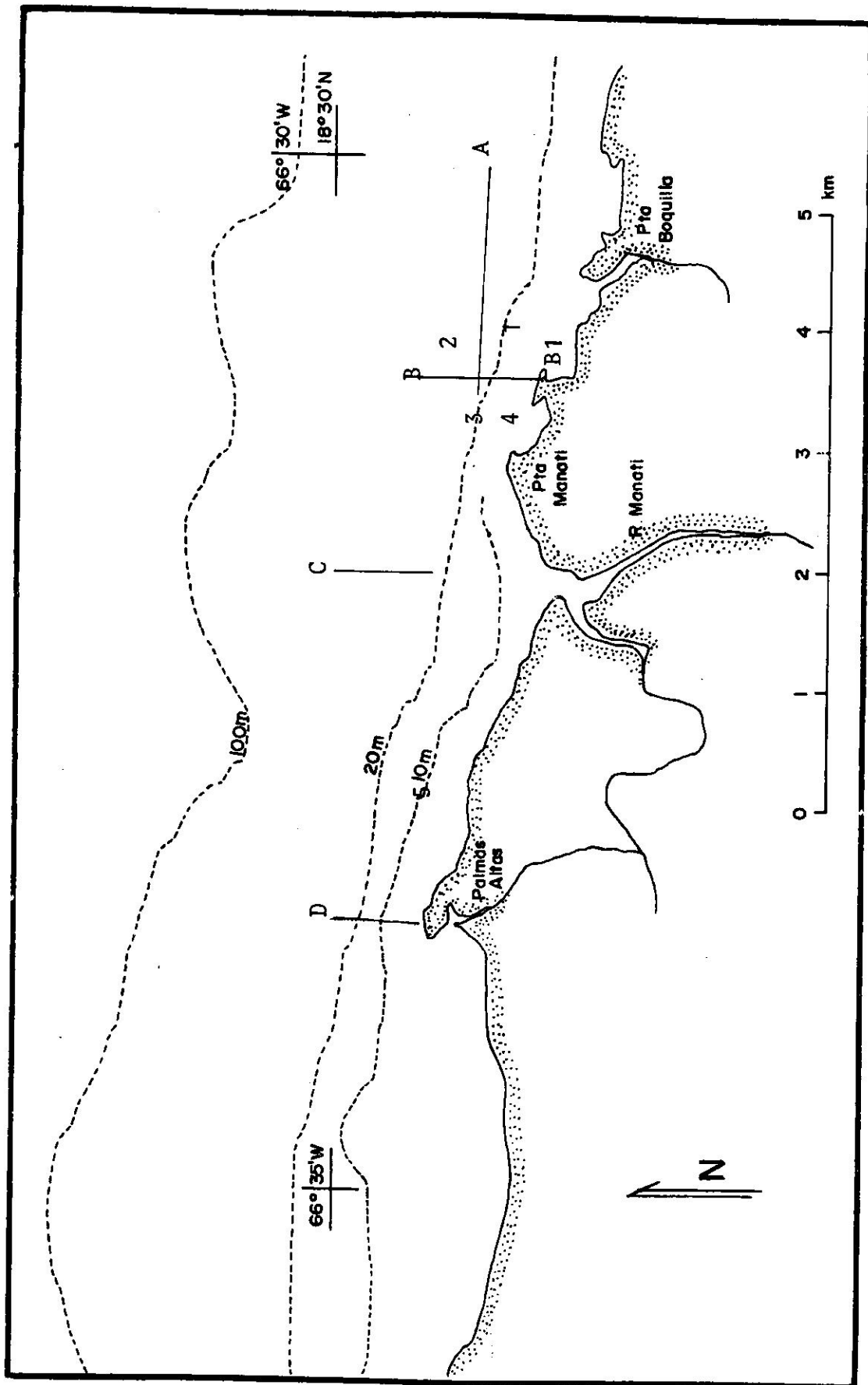


Fig. 4.3-F1 Benthic and fish studies field stations at Punta Manati

Stations dives. Dives were made at several stations to collect quantitative samples. Algae and bottom substrate were collected in 1/4 m² samples. Replicates were taken whenever possible. Algae were sampled by hand, and bottom substrate with the aid of a hammer and chisel. Both were placed immediately in plastic bags held adjacent to the collecting site. Algae and/or bottom substrate were collected at stations.

Photographs were taken when conditions permitted to aid in the general description at the area. The presence and absence and relative abundance of the larger invertebrates and fish were noted during the latter stages of the investigation.

Laboratory Procedures

Algal and substrate samples were brought to the laboratory, sorted in phylogenetic groups, and preserved in 70% ethyl alcohol or 10% formalin for later identification. References used in identifications are listed in the bibliography. The samples were often frozen prior to sorting. When sufficiently abundant, both the dry and wet weight of the algal species were recorded.

4.3.3 RESULTS

Description of the study site. A fine-grained blackish sand, probably of terrigenous origin, was found to be the predominant substrate in the immediate vicinity of the mouth of the Manati River. The same substrate was observed at depths over 25 meters, about 1/2 mile offshore of the river. No demersal fishes were observed in the sandy areas. The only noticeable benthic organisms were occasional patches of the plant Halophila, observed at 25 meters. Other organisms observed on the sand habitat at the Punta Manati site were the sand dollar Mellita sexies perforata, the sea pansy Renilla sp., the starfish Astropecten sp., and the crab Callinectes sp.

Beachrock is the predominant substrate offshore from the rocky headlands to the east and at depths less than 15 meters to the west of the Manati River. The substrate is usually flat, although at places a depth gradient is noticeable. Occasional rocky outcrops or depressions up to 1.5 meters high, or deep, and several meters across are encountered.

At depths greater than 15 meters, about 80% of the rock substrate is covered by a lush algal mat dominated by Dictyopteris. Among the more visibly conspicuous algae are Halimeda discoida (~5 plants per m²) and the large Styopodium zonale (<1 plant per m²). Sponges are common (<10% surface cover), and a sparse hard coral fauna exists (<1% surface cover). Occasional gorgonian colonies are found, principally Pseudopterogorgia followed by Eunicea. Gorgonian densities probably average from one to two colonies per 10 m².

Most of the fish life observed (~90% of the individuals, ~70% of the species) occurred in the vicinity of rocky outcrops or depressions. Also, the urchin Diadema and the delicately colored hydroid Stylaster were found only in such areas. Shelter appears to be a major factor determining the presence of these animals. Stylaster grows under ledges and Diadema was found only in crevices.

Fish and large invertebrate species observed and identified at the Punta Manati site are listed in Appendix 4.3B. Fish species collected at the nearshore poison stations are listed in Appendix 4.3C.

Quantitative Samples

Infaunal and epifaunal species identified in the 1/4 m² substrate samples are listed in Appendix 4.3D. Excluding algae and colonial forms, a total of 48 species were found in the three substrate samples. The numbers of individuals were quite equally distributed among the species. Most species were represented by only one or two individuals which suggests that they are "rare" or relative to the quadrat size. For instance, the 14 species found in replicate A (Station 3) were represented by only 22 individuals and the 11 species in replicate B by 17 individuals. The "rareness" of the species probably accounts for the lack of similarity between the samples; only one species was found in common between replicate B (Station 3 and Station 1), and 4 species between Station 1 and replicate A (Station 3). The lack of similarity between the samples cannot be attributed to large-scale habitat differences. Replicates A and B (Station 3) had only three species in common although the samples were taken a few meters apart. It would appear that due to infaunal distribution patterns, the 1/4 m² quadrat is inadequate to representatively sample the infaunal community.

A total of 28 algal species were recorded from three 1/4 m² quadrat samples at Station 2 in June 1974 (see Appendix 4.3E). Only 11 species occurred in all three samples, but these species accounted for 88% of the algal biomass. These species also showed a significant concordance in their relative abundance in biomass (Kendall Concordance Test, $p < 0.01$), indicating that a 1/4 m² sample gives an adequate portrayal of the algal community structure. The dominant algal species in decreasing order of abundance were Dictyopteris plagiogramma, Bryothamnion triquetrum, coralline algae, Pocockiella variegata, and Amansia multifida. These species accounted for over 80% of the total algal biomass. Algal biomass ranged from 182 to 219 g. (wet weight).

Samples taken at Station 2 in August showed several differences. Algal species diversity was lower; each replicate contained 13 species. In June the number of species per

replicate ranged from 16 to 20. The difference is significant at the 0.1 level (Fisher Randomization Test). No correlation was found between the relative abundances of species in the two replicates, consequently, algal community structures derived from these replicates may be artifacts of sampling variability. However, the more abundant algal species appear to be coralline red algae, Dictyopteris plagiogramma, Bryothamnion triquetrum, and Halimeda discoidea.

The two replicate samples taken at Station 4 in August displayed an even greater amount of variability. Algal biomass ranged from 3.6 to 119 g per 1/4 m and the number of algal species from 6 to 15 per quadrat. No correlation was found between the relative abundances of species in the two replicates. However, the most abundant algae was Sargassum polyceratum.

A significant correlation between the relative abundances of algal species was found for the two replicates taken at Station 3 in June (Kendall-Tau, $p < .05$). Algal biomass ranged from 304 to 558 per quadrat which was greater than the algal biomass at Station 4 in June. The dominant algal species in decreasing order of abundance were the coralline red algae, Dictyopteria plagiogramma, Amansia multifida, Bryothamnion triquetrum and Botryocladia occidentalis. These species account for over 90% of the algal biomass.

In summary, no trend was found for algal biomass through time or depth. Algal species diversity increased with depth (Stations 2 and 3 in June, and Stations 2 and 4 in August) and decreased from June to August (Station 2). However, these trends were not significant at the 0.05 level.

4.1.4 DISCUSSION

The most noticeable difference of the benthic biota between the Punta Manati site and the Tortuguero Bay site, a few miles to the east, is the dominance of the algal community which is probably associated with the exposed condition of the Punta Manati site. Most of the Tortuguero Bay site is sheltered by Punta Chivato from the predominantly northeasterly swell.

Visual estimates of the cover of the hard bottomed substrate by algae ranged between 50 to 80% depending upon station or season. The relatively high abundance of algae suggests that competition for substrate space may play an important role in the algal community. Competition usually tends to reduce species diversity. However, algal species diversity was at least moderately high; the number of algal

species found in any single $1/4 \text{ m}^2$ sample ranged between 6 and 20. Grazing by urchins has been found to maintain high algal species diversity in other algal communities (Paine and Vadas 1969, Ogden et al., 1973). However, only a few individuals of the urchin Diadema were observed, all of which occurred in crevices or other sheltered positions. No other macroinvertebrate grazers have been observed in the area. The only other algal grazers observed were schools of surgeon fish, Acanthurus sp..

Consequently, if competition is a major feature of the algal community and if the effect of grazers is minimal, then other ecological processes may be responsible for maintaining algal species diversity at Punta Manati. One possibility is the role of physical disturbance. If environmental changes on a time scale are roughly equivalent to the generation time of the competing species, competitive exclusion will not occur (Hutchinson 1961). Several factors suggest harsh, possibly seasonal, changes in the benthic environment at Punta Manati. The Punta Manati site is exposed to the predominant northeasterly swell and its accompanying surge and scouring action. When visited, the rocky substrate at Punta Manati was always found to be covered by a thin layer (~4 cm) of sand which suggests considerable sand movement across the bottom. In addition, Diadema were always observed in crevices or other protected situations whereas in other less exposed areas along the south coast they are often found in open water. The greatest abundance of gorgonians and hard corals was often found on rock outcrops where they would be less exposed to scouring action.

With sufficient physical disturbance in the form of surge and scour, the domination of the bottom substrates by one or more algal species could be prevented. Further long term studies would be required to test this hypothesis.

Limitations of the Data

From May 1973 to the present, benthic studies at the Manati site have been headed by a number of different investigators. As a consequence, the research emphasis has changed in the course of this study.

There are little data relevant to seasonal or other temporal changes in the benthic communities at Punta Manati. The preliminary portions of this study were necessarily concerned with general descriptive surveys of the Tortuguero Bay site. Only gross temporal changes in the benthic communities would have been noted in such circumstances. Studies at permanent stations did not begin until the terminal portions of this study, and with site visits only occurring on a quarterly basis it was impossible to distinguish between seasonal and other temporal changes in the biota.

If the ultimate goal of any environmental study is the prediction of the effects of a pollutant on a natural community, many of the parameters which have been examined (species lists, distributions, biomass, diversity indices) in this or other investigations, though often necessary as preliminary studies, are inadequate in this regard. Distributional studies or species lists no matter how complete provide little insight into the interactions of their component species. Diversity indices are highly speculative in their origin and their ecological implications remain a source of controversy (Fager 1972, Hedgpeth 1973). These parameters provide only a static outlook on a community.

What is required is an awareness of the dynamic processes responsible for the control and regulation of natural communities. In order to predict the effect of a disturbance such as thermal pollution, first it is necessary to understand the mechanisms which maintain the organization of a community, and then how these organizing mechanisms will be affected by this pollutant (Dayton 1972). Several studies have shown that ecological processes such as predation and competition are responsible for the observed structure of many natural communities (Janzen 1970, Harper 1969, Huffaker and Kenneth 1959, Brooks and Dodson 1965, Hall et al., 1970, Paine 1969, Conell 1961, Dayton 1971, Paine and Vadas 1969, Kitching and Ebling 1961, and Ogden et al., 1973).

by

Michael J. Canoy

4.4.1 INTRODUCTION

The north central coast of Puerto Rico is bounded by a narrow beach/dune community. The mean height of the forest is 2-4 meters with coconut palms rising higher.

The prime site at Punta Manati occupies a low hill just east of the mouth of the Manati River. The area is predominantly sand, consolidated beach rock and limestone.

Plant communities in and around the plant site are typical of the area from Palmas Altas to Tortuguero. There are four distinct major community types. Two of these, moist grasslands and successional "fence row" communities, are human artifacts. The other systems, the beach community and secondary growth mesophytic communities on the two hills are disturbed but more diverse. Mango, Mamey and Cupey del rio trees occasionally occur up to 30 feet tall.

The exposed beach and oceanward face of the dune represent a continuous attempt by plants to maintain themselves in a high energy environment. One of the worst things that can happen to this association is disruption of the dune integrity. This allows erosion to begin and the association to be washed away.

4.4.2 MATERIALS AND METHODS

For the adjacent north coast sites (Tortuguero Bay, Punta Manati and Punta Chivato) a simple survey method was used. Beginning 1/2 kilometer west of the Manati site and continuing 1/2 kilometer east of Punta Chivato, a transect following the coastal highway was covered. (See Figure 4.4-F1). Within every kilometer a 10 meter transect was walked on both sides of the road. The major vegetation along this transect was noted and unknown species were taken to the Mayaguez laboratory for identification.

At the end of each sample transect a one meter square was sampled for grasses, vines, and forbs. A common plant species list for the Punta Manati area is given in Appendix 4.4A. The area was surveyed for animal species, also. Appendix 4.4B

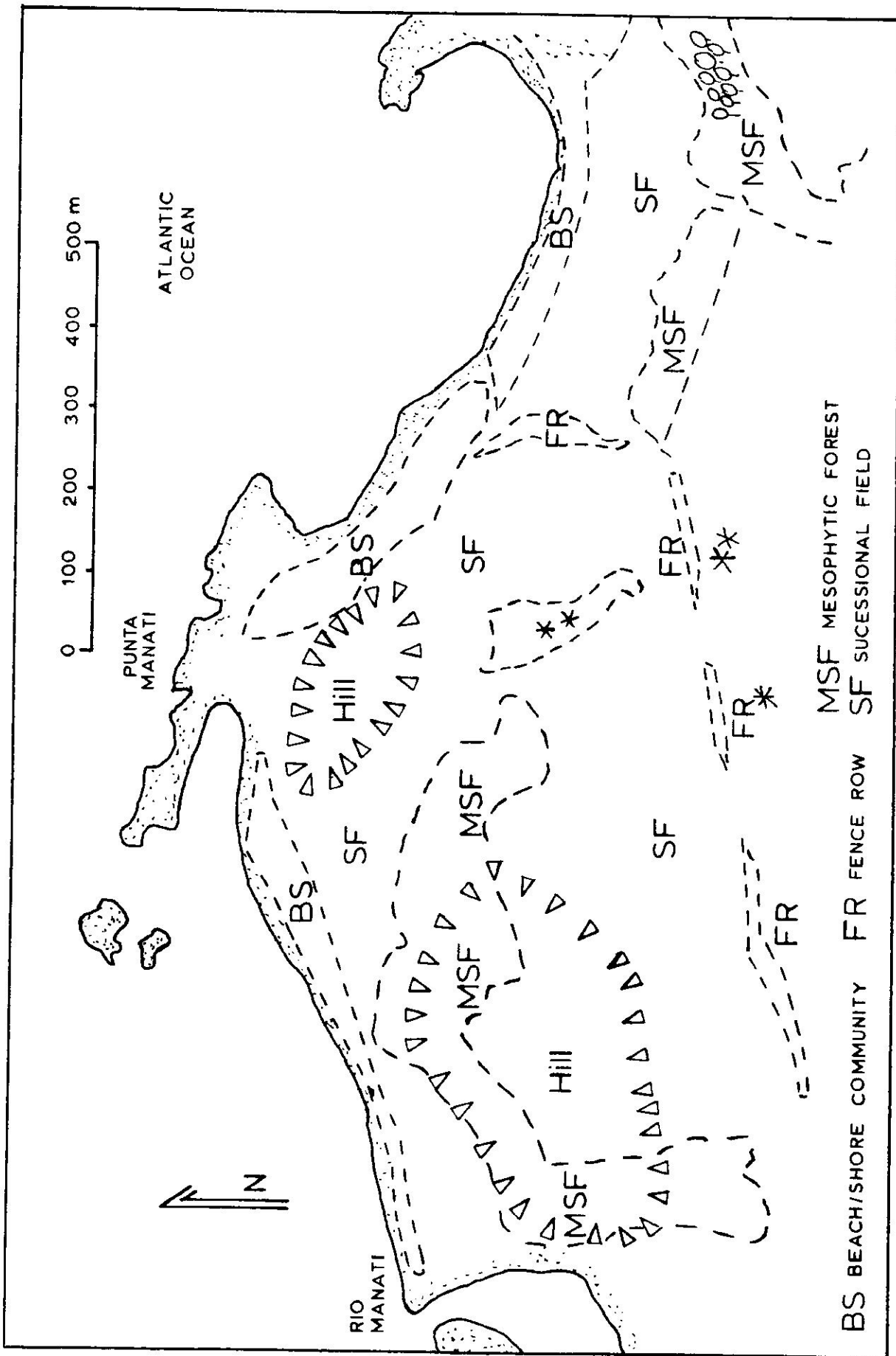


Fig. 4.4-F1. Punta Manati area survey for plant associations.

lists vertebrate and invertebrate species observed during the study period. None of the species observed is known to be on any list of threatened or endangered species. The species lists derived were smaller but very similar to the extensive lists derived from the study made at Barrio Islote (see Environmental Report for NORCO-NP-1), therefore it was assumed this method was qualitatively accurate.

4.4.3 RESULTS

Generally the vegetation can be divided into four distinct community types: beach community, secondary growth mesophytic communities, moist grasslands and successional "fence row" communities.

The beach community is largely composed of Ipomea spp., Sporobolus, Kyllinga, and Remireia. This community is a very vagil entity and expands or contracts monthly. In storm periods it may disappear entirely and return a season later.

Beach thickets more or less extend from the mean storm wave level into the edge of the pasture and fields. The seaward edge of the thicket is about one meter in height. This increases inland to about 5-6 meters. A few coconuts, almonds, and Tabebuia reach 8-10 meters.

Mesophytic growth here is typified by Chrysobalanus, Byrosonima, Mamey, Cupey del rio, with undergrowth of Smilax, Nepsera, Portullaca and Crotolaria. The beach xerarch is typically dominated by Ipomea, Remireia, Coccoloba and Lantana. Chrysobalanus and Tebebuia are developing 50 to 60 meters from the shore.

Secondary growth is typically composed of human satellite plants such as Tabebuia, coconut, almond, and black olive. Flamboyant and Cassia trees appear occasionally and Mamey apples have been planted. Around "fence row" communities and human habitation are bananas, plantains, oranges, and avocados. These plants should be surveyed for resident background radiation (total beta and gamma spectrum and total) prior to operating any nuclear facilities.

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APPENDIX 2.1A

ALL DEPTHS ARE IN METERS. NUTRIENTS IN $\mu\text{G-AT./L.}$
 MAX-SAMP. DEPTH = MAXIMUM SAMPLING DEPTH X 0.01.
 TRANSPARENCY - SECCHI DISC DEPTH.
 WAVE HEIGHT - H.O. 215 WIND WAVE CODE.
 WAVE PERIOD - IN SECONDS.
 WIND SPEED - IN METERS PER SECOND.
 WEATHER, VISIBILITY, CLOUD TYPE AND AMOUNT - H.O. 215 CODE.

FOREL WATER COLOR SCALE CODE

Code	Description
00	Deep blue.
10	Blue.
20	Greenish-blue (or green blue).
30	Bluish-green (or blue green).
40	Green.
50	Light green.
60	Yellowish-green.
70	Yellow green.
80	Green yellow.
90	Greenish-yellow.
99	Yellow.

WEATHER STATE CODE

00-49.	No precipitation at the ship at the time of observation.
00-19.	No precipitation, fog, duststorm, sandstorm, or drifting snow at the ship at the time of observation or during the preceding hour, except for 09.
00	Cloud development not observed or not observable. No hydrometeors except clouds.
01	Clouds generally dissolving or becoming less developed.
02	State of sky on the whole unchanged. Characteristic change of the state of sky during past hour.
03	Clouds, generally forming or developing. Higher number indicate various rain conditions.

STATE OF SEA-WIND WAVES
(WMO Code 75)

Code	Description	Height Meters
0	Calm-glassy	0
1	Calm-ripples	0-1/10
2	Smooth-wavelets	1/10-1/2
3	Slight	1/2-1 1/4
4	Moderate	1 1/4-2 1/2
5	Rough	2 1/2-4
6	Very rough	4-6
7	High	6-9
8	Very high	9-14
9	Phenomenal	over 14

COMPASS DIRECTION CODE

True Direction From Which Surface Wind is Blowing
or From Which Wave System is Approaching, in
10° intervals. (WMO Code 23)

Code	Direction
00	Calm
01	5° to 14°
02	15° to 24° NNE.
03	25° to 34°
04	35° to 44°
05	45° to 54° NE.
06	55° to 64°
07	65° to 74° ENE.
08	75° to 84°
09	85° to 94° E.
10	95° to 104°
11	105° to 114° ESE.
12	115° to 124°
13	125° to 134°
14	135° to 144° SE
15	145° to 154°
16	155° to 164° SSE.
17	165° to 174°
18	175° to 184° S.
19	185° to 194°
20	195° to 204° SSW.
21	205° to 214°
22	215° to 224°
23	225° to 234° SW,
24	235° to 244°
25	245° to 254° WSW.
26	255° to 264°
27	265° to 274° W.
28	275° to 284°
29	285° to 294° WNW.
30	295° to 304°
31	305° to 314°
32	315° to 324° NW,
33	325° to 334°
34	335° to 344° NNW.
35	345° to 354°
36	355° to 4° N.
99	Direction variable or unknown.

VISIBILITY CODE

(Use range-finder readings of known landmarks
if possible).

Objects not visible

Code	at-	Description
0	50 yards	Dense fog.
1	200 yards	Thick fog.
2	400 yards	Fog.
3	1,000 yards	Moderate fog.
4	1 nautical mile	Thin fog or mist.
5	2 nautical miles	Visibility poor.
6	5 nautical miles	Visibility moderate.
7	10 nautical miles	Visibility good.
8	30 nautical miles	Visibility very good.
9	Over 30	Visibility excellent.

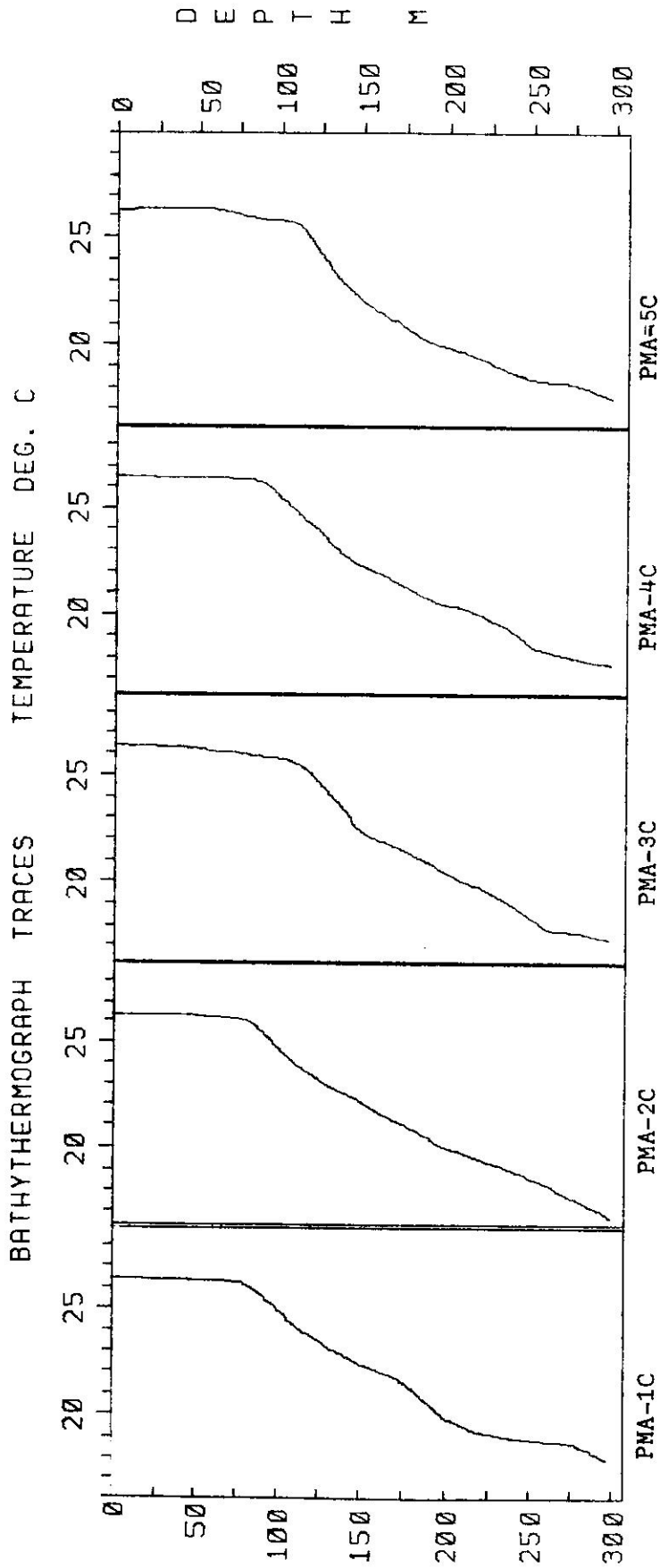
CLOUD COVER CODE

Amount of sky covered in tenths

Code	Description
0	No clouds.
1	Less than 1 and 1.
2	2 and 3.
3	4.
4	5.
5	6.
6	7 and 8.
7	9 and 9 plus.
8	10.
9	Sky obscured.

CLOUD TYPE CODE

Code	Cloud Type
0	Stratus or Fractostratus (St or Ts).
1	Cirrus (Ci).
2	Cirrostratus (Cs).
3	Cirrocumulus (Cc).
4	Alto cumulus (Ac).
	Cloud Type
5	Altostratus (As).
6	Stratocumulus (Sc).
7	Nimbostratus (Ns).
8	Cumulus or Fractocumulus (Cu or Fc).
9	Cumulonimbus (Cb).



Cruise No. PA-022
February 1, 1973

R V PALUMBO CRUISE 022 STATION PMA-1A PRNC REFERENCE 022293

DATE 02 /01/73 BARO 1019.8 WEATHER 02 WIND VELOC 13 WAVE PERIOD 6
 HOUR 15.9 TEMP DRY 28.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR *
 LAT 18-30.2 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0018
 LONG 066-34.8 W REL HUMID 074 CLOUD AMT 7 WAVE HEIGHT 4 COLOR 10

CAST 1 MESS TIME 15.9 GMT, 1156 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER .997 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA	OXYGEN	
														4.73	6.75
0	0	0	12	26.40	26.39	26.40	0.000	0.00	4.68	6.68	*****	.03	0.00	4.68	6.68
10	10	9	16	26.43	0.00	26.43	0.000	0.00	4.73	6.75	*****	.04	0.00	4.73	6.75
022 293 STANDARD DEPTHS														0.03	0.00
														0.04	0.00

R V PALUMBO CRUISE 022 STATION PMA-1B PRNC REFERENCE 022291

DATE 02 /01/73 BARO 1020.5 WEATHER 02 WIND VELOC 13 WAVE PERIOD 5
 HOUR 15.1 TEMP DRY 27.5 VISIBILITY 8 WIND DIREC 09 TRANSPAR *
 LAT 18-31.3 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP
 LONG 066-34.7 W REL HUMID 075 CLOUD AMT 6 WAVE HEIGHT 4 COLOR 10

CAST 1 MESS TIME 15.1 GMT, 11 7 LOCAL MAX DEPTH 100 WIRE ANGLE 27
 OXYGEN TITER .997 METER WHEEL FACTOR .997

WIRE	CZ	DEPTH (M)	TEMP			OXYGEN			XSAT	PHOS	NITRA			
			TZ	BN	TL	TM	TAVE	SALIN				SIG T	ML/L	MG/L
0	0	0	0	11	26.38	26.42	26.40	35.580	23.37	4.69	6.70	97.25	.05	0.00
25	23	0	0	15	25.37	0.00	25.37	35.544	23.66	4.64	6.62	94.89	.02	0.00
50	45	0	0	12	26.39	0.00	26.39	35.721	23.48	4.40	6.28	91.48	.02	0.00
100	89	0	0	16	24.97	0.00	24.97	36.492	24.50	4.49	6.41	86.85	.04	0.00

WIRE	CZ	DEPTH (M)	TEMP			OXYGEN			XSAT	PHOS	NITRA			
			TZ	BN	TL	TM	TAVE	SALIN				SIG T	ML/L	MG/L
0	0	0	0	11	26.38	26.42	26.40	35.580	23.37	4.69	6.70	97.25	.05	0.00
10	10	0	0	15	25.37	0.00	25.37	35.544	23.66	4.64	6.62	94.89	.02	0.00
20	20	0	0	12	26.39	0.00	26.39	35.721	23.48	4.40	6.28	91.48	.02	0.00
30	30	0	0	16	24.97	0.00	24.97	36.492	24.50	4.49	6.41	86.85	.04	0.00
50	50	0	0	11	26.38	26.42	26.40	35.580	23.37	4.69	6.70	97.25	.05	0.00
75	75	0	0	15	25.37	0.00	25.37	35.544	23.66	4.64	6.62	94.89	.02	0.00
100	100	0	0	12	26.39	0.00	26.39	35.721	23.48	4.40	6.28	91.48	.02	0.00

022 291 STANDARD DEPTHS

R V PALUMBO CRUISE 022

STATION PMA-1C

PRNC REFERENCE 022290

DATE 02 /01/73 BARO 1020.3 WEATHER 02 WIND VELOC 00 WAVE PERIOD 5
 HOUR 13.9 TEMP DRY 27.8 VISIBILITY 8 WIND DIREC 11 TRANSPAR *
 LAT 18-31.6 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0320
 LONG 066-34.8 W REL HUMID 072 CLOUD AMT 5 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 14.4 GMT, 1025 LOCAL MAX DEPTH 100 WIRE ANGLE 10
 OXYGEN TITER .997 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														TEMP	DEPTH (M)
0	0	0	11	26.36	26.41	26.38	35.548	23.35	4.72	6.74	97.79	.02	0.00		
25	25	27	15	26.39	0.00	26.39	35.675	23.44	4.72	6.74	98.03	.01	0.00		
50	50	49	12	26.40	0.00	26.40	35.709	23.46	4.84	6.91	100.59	.04	0.00		
100	99	90	16	24.68	0.00	24.68	36.556	24.63	4.80	6.85	92.95	.03	0.00		

CAST 2 MESS TIME 13.9 GMT, 956 LOCAL MAX DEPTH 300 WIRE ANGLE 15
 OXYGEN TITER .997 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														TEMP	DEPTH (M)
150	145	0	11	22.51	22.75	22.63	36.834	25.45	4.51	6.45	87.13	.05	0.00		
200	193	200	15	20.20	0.00	20.20	36.754	26.06	4.69	6.70	88.73	.11	0.00		
250	241	243	12	18.98	0.00	18.98	36.659	26.31	4.38	6.25	77.89	.22	0.00		
300	289	301	16	18.10	0.00	18.10	36.575	26.47	4.25	6.07	74.94	.27	0.00		

022 290 STANDARD DEPTHS

DEPTH (M)	WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	0	11	26.36	26.41	26.38	35.548	23.35	4.72	6.74	97.79	0.02	0.00
10	10	0	0	11	26.36	26.41	26.38	35.548	23.35	4.72	6.74	97.79	0.02	0.00
20	20	20	15	26.39	0.00	26.39	35.675	23.44	4.72	6.74	97.99	0.01	0.00	
30	30	30	12	26.40	0.00	26.40	35.709	23.46	4.74	6.77	98.51	0.01	0.00	
50	50	49	12	26.40	0.00	26.40	35.709	23.46	4.84	6.91	100.59	0.04	0.00	
75	75	75	16	24.68	0.00	24.68	36.556	24.63	4.80	6.85	92.95	0.03	0.00	
100	100	100	16	24.68	0.00	24.68	36.556	24.63	4.80	6.85	92.95	0.03	0.00	
150	150	150	16	24.68	0.00	24.68	36.556	24.63	4.80	6.85	92.95	0.03	0.00	
200	200	200	16	24.68	0.00	24.68	36.556	24.63	4.80	6.85	92.95	0.03	0.00	
250	250	250	16	24.68	0.00	24.68	36.556	24.63	4.80	6.85	92.95	0.03	0.00	
300	300	300	16	24.68	0.00	24.68	36.556	24.63	4.80	6.85	92.95	0.03	0.00	

R V PALUMBO CRUISE 022 STATION PMA-2A PRNC REFERENCE 022292

DATE 02 /01/73 BARO 1019.9 WEATHER 02 WIND VELOC 13 WAVE PERIOD 5
 HOUR 15.7 TEMP DRY 27.6 VISIBILITY 7 WIND DIREC 09 TRANSPAR *
 LAT 18-29.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0025
 LONG 066-33.7 W REL HUMID 075 CLOUD AMT 7 WAVE HEIGHT 4 COLOR 10

CAST 1 MESS TIME 15.7 GMT, 1144 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER .997 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	0	0	11	26.40	26.41	26.41	35.563	23.35	4.74	6.77	98.26	.07	0.00		
10	10	11	15	26.40	0.00	26.40	35.562	23.35	4.66	6.65	96.59	.03	0.00		
022 292 STANDARD DEPTHS															
						26.41	35.563	23.35	4.74	6.77	98.26	0.07	0.00		
						26.40	35.562	23.35	4.66	6.65	96.59	0.03	0.00		

R V PALUMBO CRUISE 022 STATION PMA-2B PRNG REFERENCE 022288

DATE 01 /31/73 BARO 1017.6 WEATHER 02 WIND VELOC 10 WAVE PERIOD 6
 HOUR 19.9 TEMP DRY 28.0 VISIBILITY 8 WIND DIREC 08 TRANSPAR *
 LAT 18-30.9 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0180
 LONG 066-33.7 W REL HUMID 072 CLOUD AMT 2 WAVE HEIGHT 4 COLOR 10

CAST 1 MESS TIME 19.8 GMT, 1550 LOCAL MAX DEPTH 100 WIRE ANGLE 19
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		SIG T	OXYGEN		%SAT	PHOS	NITRA
		CZ	TL		ML/L	MG/L			
0	0	0	26.51	23.39	4.83	6.90	100.53	.05	0.00
25	24	27	26.44	23.41	3.69	5.27	76.72	.00	0.00
50	48	49	26.40	23.45	2.61	3.73	54.27	.07	0.00
100	95	104	25.17	24.40	5.13	7.32	105.16	.11	0.00

022 288 STANDARD DEPTHS

0	26.51	35.653	23.39	4.83	6.90	100.53	0.05	0.00
10	26.48	35.656	23.40	4.36	6.22	90.60	0.03	0.00
20	26.45	35.658	23.41	3.88	5.54	80.66	0.03	0.00
30	26.43	35.665	23.42	3.34	4.77	69.46	0.04	0.00
50	26.36	35.721	23.48	2.65	3.79	55.19	0.07	0.00
75	25.79	36.074	23.93	3.68	5.26	76.27	0.09	0.00
100	25.04	36.528	24.50	5.39	7.71	110.64	0.11	0.00

R V PALUMBO CRUISE 022 STATION PMA-2C PHNC REFERENCE 022289

DATE 02 /01/73 BARO 1019.6 WEATHER 02 WIND VELOC 03 WAVE PERIOD 6
 HOUR 12.4 TEMP DRY 23.2 VISIBILITY 8 WIND DIREC 16 TRANSPAR *
 LAT 16-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0378
 LONG 066-33.7 W REL HUMID 084 CLOUD AMT 4 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 12.7 GMT, 843 LOCAL MAX DEPTH 100 WIRE ANGLE 4
 OXYGEN TITER .997 METER WHEEL FACTOR .997

DEPTH (M)	TEMP				OXYGEN				PHOS	NITRA				
	WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN			SIG T	ML/L	MG/L	%SAT
0	0	0	0	11	26.36	26.35	26.36	35.629	23.42	4.78	6.82	99.14	.05	0.00
25	25	27	15	26.37	0.00	26.37	35.604	23.39	4.86	6.94	100.77		.03	0.00
50	50	50	12	26.32	0.00	26.32	35.778	23.54	4.48	6.40	93.14		.06	0.00
100	100	101	16	24.21	0.00	24.21	36.652	24.85	4.61	6.58	89.38		.05	0.00

CAST 2 MESS TIME 12.4 GMT, 021 LOCAL MAX DEPTH 300 WIRE ANGLE 2
 OXYGEN TITER .997 METER WHEEL FACTOR .997

DEPTH (M)	TEMP				OXYGEN				PHOS	NITRA				
	WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN			SIG T	ML/L	MG/L	%SAT
150	150	0	11	22.17	22.19	22.18	36.763	25.92	4.24	6.05	81.34		.08	0.00
200	200	200	15	20.01	0.00	20.01	36.733	26.10	4.13	5.90	78.05		.18	0.00
250	250	244	12	18.49	0.00	18.49	36.590	26.38	4.18	5.97	73.92		.17	0.00
300	299	301	16	17.69	0.00	17.69	36.441	26.47	4.31	6.15	75.53		.32	0.00

022 289 STANDARD DEPTHS

0	0	23.42	4.78	6.82	99.14	0.05	0.00
10	10	23.41	4.81	6.87	99.79	0.04	0.00
20	20	23.40	4.84	6.92	100.44	0.03	0.00
30	30	23.41	4.79	6.85	99.49	0.03	0.00
50	50	23.54	4.48	6.40	93.14	0.06	0.00
75	75	24.15	4.54	6.49	93.07	0.06	0.00
100	100	24.85	4.61	6.58	89.38	0.05	0.00
150	150	25.52	4.24	6.05	81.34	0.08	0.00
200	200	26.10	4.13	5.90	78.05	0.18	0.00
250	250	26.38	4.18	5.97	73.92	0.17	0.00
300	300	26.47	4.31	6.16	75.57	0.32	0.00

R V PALUMBO CRUISE 022 STATION PMA-3B PRNC REFERENCE 022287

DATE 01 /31/73 BARO 1017.7 WEATHER 02 WIND VELOC 12 WAVE PERIOD 7
 HOUR 19.4 TEMP DRY 27.0 VISIBILITY 8 WIND DIREC 08 TRANSPAR *
 LAT 18-30.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0250
 LONG 066-32.7 W REL HUMID 078 CLOUD AMT 2 WAVE HEIGHT 4 COLOR 10

CAST 1 MESS TIME 19.4 GMT, 1526 LOCAL MAX DEPTH 100 WIRE ANGLE 22
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	0	0	11	26.52	26.51	26.52	35.642	23.38	5.50	7.86	114.51	.02	0.00		
25	24	28	12	26.42	0.00	26.42	35.691	23.44	4.79	6.84	99.63	.06	0.00		
50	47	48	12	26.40	0.00	26.40	35.742	23.49	4.85	6.93	100.97	.05	0.00		
100	93	102	16	25.81	0.00	25.81	36.325	24.11	3.98	5.68	81.67	.03	0.00		

022 267 STANDARD DEPTHS

0	26.52	35.642	23.38	5.50	7.86	114.51	0.02	0.00
10	26.48	35.662	23.40	5.21	7.44	108.31	0.04	0.00
20	26.43	35.683	23.43	4.89	6.99	101.80	0.05	0.00
30	26.41	35.704	23.46	4.81	6.87	99.97	0.06	0.00
50	26.37	35.770	23.52	4.81	6.88	100.22	0.05	0.00
75	26.08	36.059	23.83	4.40	6.28	91.57	0.04	0.00
100	25.72	36.414	24.21	3.84	5.49	78.99	0.03	0.00

R V PALUMBO CRUISE 022 STATION PMA-3C PRNC REFERENCE 022286

DATE 01 /31/73 BARO 1018.2 WEATHER 02 WIND VELOC 12 WAVE PERIOD 6
 HOUR 18.7 TEMP DRY 28.0 VISIBILITY 8 WIND DIREC 08 TRANSPAR *
 LAT 18-30.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0420
 LONG 066-32.8 W REL HUMID 073 CLOUD AMT 3 WAVE HEIGHT 4 COLOR 10

CAST 1 MESS TIME 19.0 GMT, 15 0 LOCAL MAX DEPTH 100 WIRE ANGLE 0
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	0	0	11	26.45	26.43	26.44	35.625	23.39	4.83	6.90	100.38	.02	0.		
25	25	26	15	26.42	0.00	26.42	35.684	23.44	4.62	6.60	96.02	.06	0.		
50	50	47	12	26.35	0.00	26.35	35.769	23.52	5.67	8.10	117.91	.05	0.		
100	100	95	16	25.88	0.00	25.88	36.431	24.17	4.88	6.97	100.48	.04	0.		

CAST 2 MESS TIME 18.7 GMT, 1440 LOCAL MAX DEPTH 300 WIRE ANGLE 17
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
150	144	0	11	22.79	22.78	22.79	36.761	25.35	4.02	5.74	77.54	.06	0.		
200	191	199	15	20.96	0.00	20.96	36.763	25.86	3.70	5.29	70.43	.15	0.		
250	239	246	12	18.52	0.00	18.52	36.576	26.36	3.28	4.69	58.05	.24	0.		
300	287	299	16	17.61	0.00	17.61	36.461	26.50	3.75	5.36	65.78	.28	0.		
022 286 STANDARD DEPTHS															
	0					26.44	35.625	23.39	4.83	6.90	100.38	0.02	0.		
	10					26.43	35.649	23.41	4.75	6.78	98.64	0.04	0.		
	20					26.43	35.672	23.43	4.66	6.66	96.89	0.05	0.		
	30					26.41	35.693	23.45	4.80	6.85	99.79	0.06	0.		
	50					26.35	35.769	23.52	5.67	8.10	117.91	0.05	0.		
	75					26.17	36.078	23.81	5.53	7.90	115.31	0.04	0.		
	100					25.88	36.431	24.17	4.88	6.97	100.48	0.04	0.		
	150					22.52	36.761	25.42	3.97	5.66	76.32	0.07	0.		
	200					20.47	36.732	25.98	3.63	5.18	68.81	0.17	0.		
	250					18.24	36.546	26.41	3.35	4.79	59.11	0.25	0.		
	300					17.36	36.430	26.54	3.88	5.54	67.87	0.29	0.		

R V PALUMBO CRUISE 022 STATION PMA-4B PRNC REFERENCE 022284

DATE 01 /31/73 BARO 1018.9 WEATHER 02 WIND VELOC 12 WAVE PERIOD 6
 HOUR 17.2 TEMP DRY 28.2 VISIBILITY 8 WIND DIREC 08 TRANSPAR *
 LAT 18-30.6 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0234
 LONG 066-31.6 W REL HUMID 072 CLOUD AMT 2 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 17.2 GMT, 1312 LOCAL MAX DEPTH 100 WIRE ANGLE 4
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

WIRE	CZ	DEPTH (M)	TEMP		OXYGEN		SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
			TL	TM	TAVE	SALIN						
0	0	0	11	26.48	26.46	26.47	35.608	23.36	4.83	6.90	100.39	.03
25	25	27	15	26.41	0.00	26.41	35.669	23.43	4.71	6.73	97.88	.04
50	50	0	12	26.74	0.00	26.74	35.694	23.34	4.75	6.79	99.24	.04
100	100	104	16	25.22	0.00	25.22	36.420	24.37	4.78	6.83	98.05	.08

022 264 STANDARD DEPTHS

0	26.47	35.608	23.37	4.83	6.90	100.39	0.03
10	26.45	35.632	23.39	4.78	6.83	99.39	0.03
20	26.42	35.658	23.42	4.73	6.76	98.32	0.04
30	26.43	35.678	23.43	4.71	6.73	97.94	0.04
50	26.74	35.694	23.34	4.75	6.79	99.24	0.04
75	26.34	35.944	23.66	4.77	6.82	99.64	0.05
100	25.22	36.420	24.37	4.78	6.83	98.05	0.08

R V PALUMBO CRUISE 022 STATION PMA-4C PKNC REFERENCE 022285

DATE 01 /31/73 BARO 1018.6 WEATHER 02 WIND VELOC 12 WAVE PERIOD 7
 HOUR 17.7 TEMP DRY 28.8 VISIBILITY 8 WIND DIREC 08 TRANSPAR 4
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0340
 LONG 066-31.6 W REL HUMID 071 CLOUD AMT 5 WAVE HEIGHT 4 COLOR 10

CAST 1 MESS TIME 18.1 GMT, 14 5 LOCAL MAX DEPTH 100 WIRE ANGLE 6
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN				
									ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	11	26.45	26.45	26.45	35.621	23.38	4.83	6.90	100.39	.03	
25	25	26	15	26.38	0.00	26.38	35.678	23.45	4.35	6.22	90.45	.01	
50	50	48	12	26.37	0.00	26.37	35.718	23.48	4.45	6.36	92.62	.04	
100	100	97	16	25.62	0.00	25.62	36.498	24.30	4.48	6.41	92.26	.02	

CAST 2 MESS TIME 17.7 GMT, 1344 LOCAL MAX DEPTH 300 WIRE ANGLE 14
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN				
									ML/L	MG/L	%SAT	PHOS	NITRA
150	146	0	11	22.42	22.41	22.41	36.771	25.47	3.97	5.67	76.35	.10	
200	194	199	15	20.67	0.00	20.67	36.741	25.93	3.54	5.05	67.18	.14	
250	242	241	12	18.70	0.00	18.70	36.568	26.31	3.80	5.43	67.30	.24	
300	291	295	16	17.85	0.00	17.85	36.504	26.48	3.71	5.30	65.22	.29	

022 285 STANDARD DEPTHS

0
10
20
30
50
75
100
150
200
250
300

R V PALUMBO CRUISE 022 STATION PMA-58 PRNC REFERENCE 022283

DATE 01 /31/73 BARO 1019.1 WEATHER 02 WIND VELOC 12 WAVE PERIOD 5
 HOUR 16.7 TEMP DRY 27.7 VISIBILITY 8 WIND DIREC 08 TRANSPAR *
 LAT 18-31.1 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0300
 LONG 066-30.6 W REL HUMID 074 CLOUD AMT 3 WAVE HEIGHT 4 COLOR 10

CAST 1 MESS TIME 16.7 GMT, 1242 LOCAL MAX DEPTH 100 WIRE ANGLE 3
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

WIRE	CZ	DEPTH (M)	TEMP		TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
			TZ	BN								
0	0	0	11	26.38	26.40	26.39	35.607	23.39	4.66	6.65	96.69	.02
25	25	19	15	26.37	0.00	26.37	35.625	23.41	4.75	6.79	98.60	.10
50	50	48	12	26.40	0.00	26.40	35.742	23.49	4.63	6.61	96.31	.04
100	100	97	16	24.31	0.00	24.31	36.613	24.79	4.36	6.23	84.55	.05

022 283 STANDARD DEPTHS

0	26.39	35.607	23.39	4.66	6.65	96.69	0.02
10	26.38	35.614	23.40	4.69	6.71	97.45	0.05
20	26.37	35.621	23.41	4.74	6.77	98.30	0.09
30	26.37	35.635	23.42	4.74	6.77	98.35	0.09
50	26.40	35.742	23.49	4.63	6.61	96.31	0.04
75	25.71	36.071	23.95	4.50	6.43	93.09	0.04
100	24.31	36.613	24.79	4.36	6.23	84.55	0.05

R V PALUMBO CRUISE 022 STATION PMA-5C PRNC REFERENCE 022282

DATE 01 /31/73 BARO 1020.4 WEATHER 53 WIND VELOC 08 WAVE PERIOD 5
 HOUR 13.8 TEMP DRY 26.9 VISIBILITY 8 WIND DIREC 12 TRANSPAR *
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 09 SONIC DEP 0375
 LONG 066-30.6 W REL HUMID 100 CLOUD AMT 7 WAVE HEIGHT 2 COLOR 10

CAST 1 MESS TIME 14.4 GMT, 1021 LOCAL MAX DEPTH 100 WIRE ANGLE 0
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

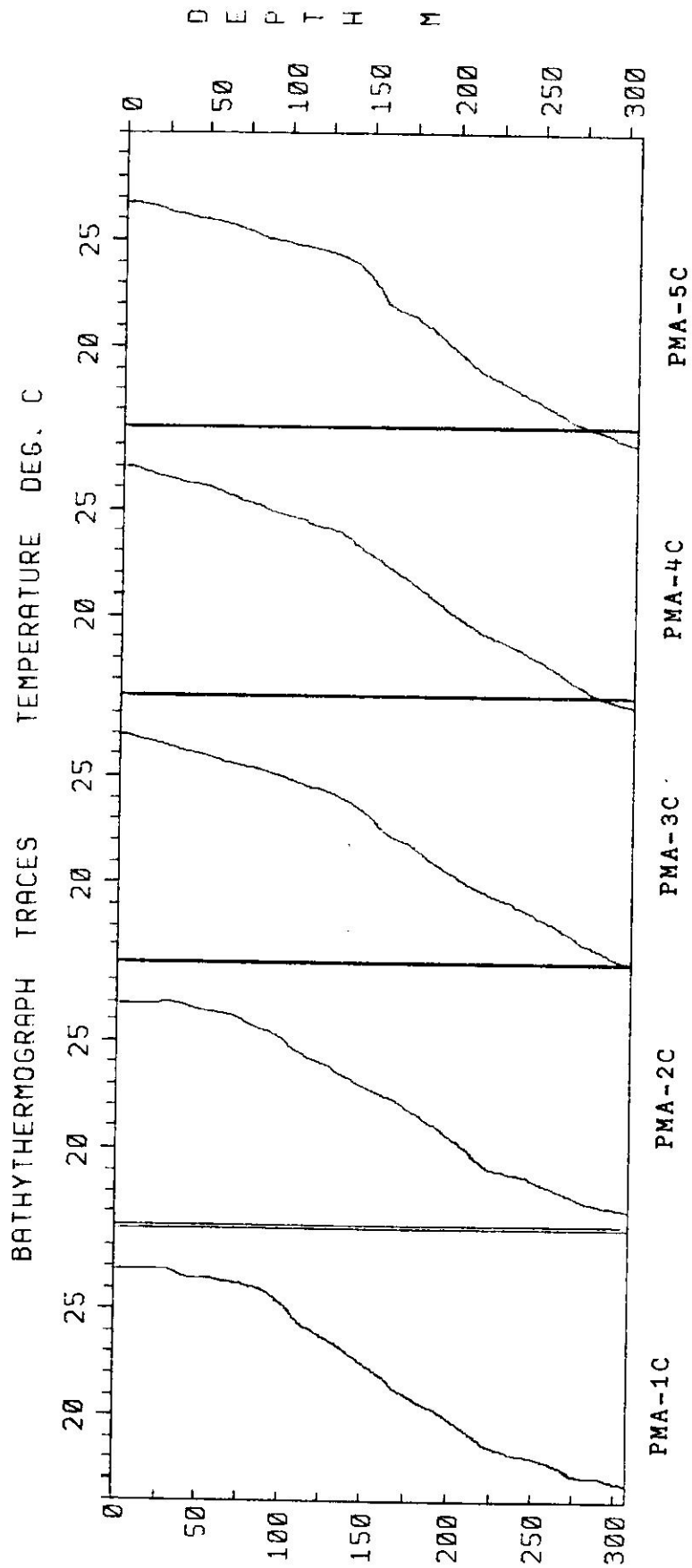
WIRE	DEPTH (M)	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN			PHOS	NITRA
										ML/L	MG/L	%SAT		
0	0	0	11	26.31	26.29	26.30	35.612	23.42	4.83	6.90	100.17	.03		
25	25	27	15	26.35	0.00	26.35	35.677	23.45	4.86	6.95	100.99	.02		
50	50	47	12	26.35	0.00	26.35	35.794	23.54	4.83	6.90	100.57	.03		
100	100	105	16	25.79	0.00	25.79	36.411	24.18	4.83	6.90	99.36	.03		

CAST 2 MESS TIME 13.9 GMT, 951 LOCAL MAX DEPTH 300 WIRE ANGLE 4
 OXYGEN TITER 1.019 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN			PHOS	NITRA
										ML/L	MG/L	%SAT		
150	150	0	11	22.13	22.12	22.13	36.789	25.56	2.11	3.02	40.53	.10		
200	199	199	15	20.02	0.00	20.02	36.699	26.07	3.99	5.69	75.33	.17		
250	249	247	12	18.55	0.00	18.55	36.567	26.35	4.21	6.01	74.44	.22		
300	299	299	16	17.66	0.00	17.66	36.458	26.49	4.45	6.36	78.12	.28		

022 282 STANDARD DEPTHS

0	23.42	4.83	6.90	100.17	0.03
10	23.43	4.84	6.92	100.50	0.03
20	23.45	4.86	6.94	100.85	0.02
30	23.47	4.86	6.94	100.94	0.02
50	23.54	4.83	6.90	100.57	0.03
75	23.82	4.83	6.90	100.78	0.03
100	24.18	4.83	6.90	99.36	0.03
150	25.56	2.11	3.02	40.53	0.10
200	26.08	4.00	5.71	71.74	0.17
250	26.35	4.21	6.02	74.51	0.22
300	26.49	4.46	6.37	78.20	0.28



Cruise No. PA-028
 May 11, 1973

R V PALUMBO CRUISE 028 STATION PMA-1A PRNC REFERENCE 028473

DATE 05 /11/73 BARO 1016.5 WEATHER 02 WIND VELOC 04 WAVE PERIOD 4
 HOUR 23.7 DRY 26.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-30.3 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 02 SONIC DEP 0021
 LONG 066-34.8 W REL HUMID 086 CLOUD AMT 5 WAVE HEIGHT 2 COLOR 20

CAST 1 MESS TIME 23.7 GMT, 1943 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA
		TZ	BN								
0	0	27.22	27.23	27.23	35.942	23.38	5.00	7.14	105.83	.03	0.00
10	10	27.21	0.00	27.21	35.943	23.38	4.91	7.02	104.02	.03	0.00

028 473 STANDARD DEPTHS

0	27.23	35.942	23.38	5.00	7.14	0.00	0.03	0.00
10	27.21	35.943	23.38	4.91	7.02	0.00	0.03	0.00

R V PALUMBO CRUISE 028 STATION PMA-10 PRNC REFERENCE 028474

DATE 05 /12/73 BARO 1016.5 WEATHER 02 WIND VELOC 04 WAVE PERIOD 5
 HOUR 0.1 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-30.2 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 02 SONIC DEP 0164
 LONG 066-34.7 W REL HUMID 086 CLOUD AMT 5 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 0.1 GMT, 20 6 LOCAL MAX DEPTH 100 WIRE ANGLE 2
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	CZ	TZ	BN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	0	11	27.04	27.03	27.04	36.013	23.49	4.84	6.91	102.34	.03	0.00	
25	25	27	26.80	12	26.80	0.00	26.80	36.032	23.58	4.90	7.00	103.31	.30	0.00	
50	50	54	26.64	12	26.64	0.00	26.64	36.065	23.65	4.86	6.94	102.21	.09	0.00	
100	100	99	25.03	16	25.03	0.00	25.03	36.505	24.49	4.96	7.00	101.61	.09	0.00	
STANDARD DEPTHS															
0	0	0	27.04	36.013	23.49	4.84	6.91	0.00	0.03	0.00					
10	10	26.94	36.021	23.53	4.86	6.95	0.00	0.16	0.00						
20	20	26.85	36.028	23.56	4.89	6.99	0.00	0.31	0.00						
30	30	26.76	36.037	23.60	4.90	7.00	0.00	0.33	0.00						
50	50	26.64	36.065	23.66	4.86	6.94	0.00	0.09	0.00						
75	75	26.05	36.223	23.96	4.88	6.97	0.00	0.09	0.00						
100	100	25.03	36.505	24.49	4.96	7.00	0.00	0.09	0.00						

R V PALUMBO CRUISE 028

STATION PMA-1C

PRNC REFERENCE 028477

DATE 05 /12/73 BARO 1017.1 WEATHER 02 WIND VELOC 03 WAVE PERIOD 6
 HOUR 1.9 TEMP DRY 25.0 VISIBILITY 8 WIND DIREC 08 TRANSPAR
 LAT 18-31.9 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 05 SONIC DEP 0365
 LONG 066-34.8 W REL HUMID 085 CLOUD AMT 2 WAVE HEIGHT 4 COLOR 10

CAST 1 MESS TIME 1.9 GMT, 2155 LOCAL MAX DEPTH 100 WIRE ANGLE 4
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

DEPTH (M)		TEMP		TAVE		SALIN		SIG T		OXYGEN		PHOS		NITRA	
WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA		
0	0	0	11	27.05	27.05	27.05	35.996	23.47	4.81	6.87	101.65	.06	0.00		
25	25	24	12	27.07	0.00	27.07	35.976	23.45	4.82	6.88	101.86	.05	0.00		
50	50	52	15	26.68	0.00	26.68	36.037	23.62	4.83	6.90	101.55	.04	0.00		
100	100	99	16	24.92	0.00	24.92	36.514	24.53	4.98	7.11	96.38	.10	0.00		

97 CAST 2 MESS TIME 2.4 GMT, 2222 LOCAL MAX DEPTH 300 WIRE ANGLE 0
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

DEPTH (M)		TEMP		TAVE		SALIN		SIG T		OXYGEN		PHOS		NITRA	
WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA		
150	150	0	11	22.25	22.26	22.26	36.823	25.55	4.58	6.54	88.13	.11	0.00		
200	200	201	12	19.72	0.00	19.72	36.660	26.12	4.25	6.07	75.97	.17	0.00		
250	250	255	15	18.41	0.00	18.41	36.545	26.37	4.35	6.22	76.89	.22	0.00		
300	300	299	16	17.53	0.00	17.53	36.438	26.51	4.46	6.37	78.15	.28	0.00		
STANDARD DEPTHS															
0	0					27.05	35.996	23.47	4.81	6.87	0.00	0.06	0.00		
10	10					27.06	35.988	23.46	4.81	6.87	0.00	0.06	0.00		
20	20					27.07	35.980	23.46	4.82	6.88	0.00	0.05	0.00		
30	30					27.03	35.979	23.47	4.82	6.89	0.00	0.05	0.00		
50	50					26.68	36.037	23.62	4.83	6.90	0.00	0.04	0.00		
75	75					25.94	36.256	24.02	4.88	6.97	0.00	0.07	0.00		
100	100					24.92	36.514	24.53	4.98	7.11	0.00	0.10	0.00		
150	150					22.26	36.823	25.55	4.58	6.54	0.00	0.11	0.00		
200	200					19.72	36.660	26.12	4.25	6.07	0.00	0.17	0.00		
250	250					18.41	36.545	26.37	4.35	6.22	0.00	0.22	0.00		
300	300					17.53	36.438	26.51	4.46	6.37	0.00	0.28	0.00		

R V PALUMBO CRUISE 028 STATION PMA-2A PRNC REFERENCE 026472

DATE 05 /11/73 BARO 1016.0 WEATHER 02 WIND VELOC 07 WAVE PERIOD 4
 HOUR 23.4 TEMP DRY 27.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-29.7 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 01 SONIC DEP 00.0
 LONG 066-33.6 W REL HUMID 087 CLOUD AMT 8 WAVE HEIGHT 3 COLOR 20

CAST 1 MESS TIME 23.4 GMT, 1924 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	11	27.20	27.20	27.20	35.879	23.34	4.83	6.90	102.05	.25	0.00
10	10	13	12	27.11	27.11	27.11	35.999	23.46	4.84	6.91	102.44	.00	0.00

028 472 STANDARD DEPTHS
 0 27.20 35.879 23.34 4.83 6.90 0.00 0.06 0.00
 10 27.11 35.999 23.46 4.84 6.91 0.00 0.06 0.00

R V PALUMBO CRUISE 028 STATION PMA-28 PRNC REFERENCE 026475

DATE 05 /12/73 BARO 1016.5 WEATHER 02 WIND VELOC 04 WAVE PERIOD 5
 HOUR 0.5 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-31.0 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 04 SONIC DEP 0146
 LONG 066-33.7 W REL HUMID 088 CLOUD AMT 4 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 0.5 GMT, 2033 LOCAL MAX DEPTH 100 WIRE ANGLE 0
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		OXYGEN		SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	
		CZ	TM	TL	TM							TAVE
0	0	0	27.08	27.10	27.09	35.997	23.46	4.83	6.90	102.17	.08	0.00
25	25	27	26.93	0.00	26.93	36.006	23.52	4.85	6.93	102.36	.08	0.00
50	50	52	26.74	0.00	26.74	36.030	23.60	4.88	6.97	102.75	.07	0.00
100	100	103	24.99	0.00	24.99	36.423	24.44	5.01	7.15	96.64	.05	0.00

028 475 STANDARD DEPTHS

0	27.09	35.997	23.46	4.83	6.90	0.00	0.08	0.00
10	27.03	36.001	23.48	4.84	6.91	0.00	0.08	0.00
20	26.96	36.004	23.51	4.85	6.92	0.00	0.08	0.00
30	26.90	36.009	23.53	4.85	6.94	0.00	0.08	0.00
50	26.74	36.030	23.60	4.88	6.97	0.00	0.07	0.00
75	26.09	36.169	23.91	4.93	7.05	0.00	0.06	0.00
100	24.99	36.423	24.44	5.01	7.15	0.00	0.05	0.00

R V PALUMBO CRUISE 028

STATION PMA-2C

PRNC REFERENCE 020476

DATE 05 /12/73 BARO 1017.0 WEATHER 02 WIND VELOC 04 WAVE PERIOD 5
 HOUR 0.9 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-31.7 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 04 SONIC DEP 0300
 LONG 066-33.6 W REL HUMID 087 CLOUD AMT 5 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 1.0 GMT, 2057 LOCAL MAX DEPTH 100 WIRE ANGLE 2
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TEMP		TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
					TM	TM								
0	0	0	11	27.04	27.04	27.04	35.996	23.48	4.79	6.84	101.19	.06	0.00	
25	25	28	12	27.07	0.00	27.07	36.017	23.48	4.82	6.88	101.97	.05	0.00	
50	50	56	15	26.72	0.00	26.72	36.038	23.61	4.83	6.90	101.62	.01	0.00	
100	100	101	16	24.80	0.00	24.80	36.541	24.59	4.94	7.06	95.82	.05	0.00	

CAST 2 MESS TIME 1.3 GMT, 2120 LOCAL MAX DEPTH 300 WIRE ANGLE 0
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TEMP		TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
					TM	TM								
150	150	0	11	23.03	23.00	23.02	36.832	25.34	4.80	6.86	92.97	.08	0.00	
200	200	210	12	20.01	0.00	20.01	36.694	26.07	4.20	6.00	79.31	.16	0.00	
250	250	255	15	18.68	0.00	18.68	36.597	26.34	4.31	6.16	76.40	.21	0.00	
300	300	297	16	17.52	0.00	17.52	36.441	26.51	4.48	6.40	78.50	.27	0.00	

028 476 STANDARD DEPTHS

DEPTH (M)	OXYGEN	PHOS	NITRA
0	27.04	35.996	23.48
10	27.05	36.004	23.48
20	27.06	36.013	23.48
30	27.04	36.021	23.50
50	26.72	36.038	23.61
75	25.85	36.264	24.05
100	24.80	36.541	24.59
150	23.02	36.832	25.34
200	20.01	36.694	26.07
250	18.68	36.597	26.34
300	17.52	36.441	26.51

R V PALUMBO CRUISE 028 STATION PMA-3A PRNC REFERENCE 028466

DATE 05 /11/73 BARO 1018.0 WEATHER 02 WIND VELOC 07 WAVE PERIOD 5
 HOUR 15.3 TEMP DRY 29.0 VISIBILITY 8 WIND DIREC 06 TRANSPAR
 LAT 18-29.4 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0020
 LONG 066-32.6 W REL HUMID 074 CLOUD AMT 2 WAVE HEIGHT 3 COLOR 20

CAST 1 MESS TIME 15.3 GMT, 1118 LOCAL MAX DEPTH 10 WIRE ANGLE 3
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN				
									ML/L	MG/L	%SAT		
0	0	0	11	27.24	27.22	27.23	35.664	23.16	4.77	6.81	100.19	.08	0.00
10	10	12	12	26.98	0.00	26.98	36.006	23.50	4.80	6.85	101.34	.17	0.00

028 466 STANDARD DEPTHS

0	27.23	35.664	23.16	4.77	6.81	0.00	0.08	0.00
10	26.98	36.006	23.50	4.80	6.85	0.00	0.17	0.00

R V PALUMBO CRUISE 028 STATION PMA-38 PRNC REFERENCE 028465

DATE 05 /11/73 BARO 1018.3 WEATHER 02 WIND VELOC 07 WAVE PERIOD 2
 HOUR 14.9 TEMP DRY 29.0 VISIBILITY 8 WIND DIREC 06 TRANSPAR
 LAT 18-30.5 N TEMP WET 0.0 CLOUD TYPE 6 WAVE DIREC 06 SONIC DEP 0164
 LONG 066-32.6 W REL HUMID 074 CLOUD AMT 1 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 15.0 GMT, 1058 LOCAL MAX DEPTH 100 WIRE ANGLE 9
 OXYGEN TITER 1.094 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP			TAVE	SALIN	SIG T	OXYGEN ML/L	%SAT	PHOS	NITRA
		TZ	BN	TL							
0	0	0	11	27.19	27.17	23.43	4.82	6.88	102.11	.04	0.00
25	25	27	12	26.93	0.00	23.53	4.78	6.82	100.85	.06	0.00
50	50	52	13	26.26	0.00	23.85	4.83	6.90	99.12	.03	0.00
100	99	109	16	24.95	0.00	24.55	4.91	7.02	95.34	.03	0.00

028 465 STANDARD DEPTHS

0	27.18	35.999	23.43	4.82	6.88	0.00	0.04	0.00
10	27.08	36.010	23.47	4.80	6.86	0.00	0.05	0.00
20	26.99	36.021	23.51	4.78	6.83	0.00	0.06	0.00
30	26.82	36.047	23.59	4.78	6.83	0.00	0.06	0.00
50	26.26	36.167	23.85	4.83	6.90	0.00	0.03	0.00
75	25.59	36.355	24.20	4.87	6.96	0.00	0.03	0.00
100	24.92	36.561	24.56	4.91	7.02	0.00	0.03	0.00

R V PALUMBO CRUISE 028 STATION PMA-3C PRNC REFERENCE 028464

DATE 05 /11/73 BARO 1018.0 WEATHER 02 WIND VELOC 04 WAVE PERIOD 5
 HOUR 14.2 TEMP DRY 30.0 VISIBILITY 8 WIND DIREC 08 TRANSPAR
 LAT 18-31.7 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0490
 LONG 066-32.6 W REL HUMID 073 CLOUD AMT 2 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 14.3 GMT, 1015 LOCAL MAX DEPTH 300 WIRE ANGLE 8
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	11	27.18	27.19	27.19	36.005	23.44	4.80	6.85	101.69	.06	0.00	
25	25	26	12	26.77	0.00	26.77	36.056	23.61	4.81	6.87	101.31	.03	0.00	
50	50	53	15	26.29	0.00	26.29	36.145	23.83	4.89	6.99	100.99	.05	0.00	
100	99	99	16	25.05	0.00	25.05	36.509	24.49	5.02	7.17	102.92	.05	0.00	
150	149	147	1	22.88	0.00	22.88	36.859	25.40	4.47	6.39	86.51	.17	0.00	
200	198	197	2	20.47	0.00	20.47	36.751	25.99	4.29	6.13	81.40	.09	0.00	
250	247	251	3	18.32	0.00	18.32	36.559	26.40	4.40	6.28	77.63	.11	0.00	
300	297	295	4	17.05	0.00	17.05	36.389	26.58	4.47	6.39	78.05	.24	0.00	

028 464 STANDARD DEPTHS

0	27.19	36.005	23.44	4.80	6.85	0.00	0.06	0.00
10	27.02	36.025	23.50	4.80	6.86	0.00	0.05	0.00
20	26.85	36.045	23.57	4.81	6.87	0.00	0.04	0.00
30	26.68	36.069	23.65	4.82	6.89	0.00	0.03	0.00
50	26.29	36.145	23.83	4.89	6.99	0.00	0.05	0.00
75	25.74	36.316	24.13	4.96	7.09	0.00	0.05	0.00
100	25.01	36.518	24.50	5.01	7.16	0.00	0.05	0.00
150	22.83	36.857	25.41	4.46	6.38	0.00	0.17	0.00
200	20.37	36.744	26.01	4.29	6.13	0.00	0.09	0.00
250	18.23	36.548	26.42	4.40	6.29	0.00	0.12	0.00
300	16.97	36.379	26.60	4.47	6.39	0.00	0.25	0.00

R V PALUMBO CRUISE 028 STATION PMA-4A PRNC REFERENCE 028467

DATE 05 /11/73 PARO 1017.9 WEATHER 02 WIND VELOC 07 WAVE PERIOD 3
 HOUR 15.8 TEMP DRY 29.0 VISIBILITY 8 WIND DIREC 27 WAVE TRANSPAR
 LAT 18-29.3 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0020
 LONG 066-31.6 W REL HUMID 076 CLOUD AMT 2 WAVE HEIGHT 3 COLOR 20

CAST 1 MESS TIME 15.8 GMT, 1146 LOCAL MAX DEPTH 10 WIRE ANGLE 5
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
		TZ	TL								
0	0	0	27.18	27.17	27.18	23.44	4.79	6.84	101.46	.12	0.00
10	10	13	27.03	0.00	27.03	23.48	4.80	6.85	101.40	.09	0.00
STANDARD DEPTHS											
	0		27.18	36.009	23.44	4.79	6.84		0.00	2.10	0.00
	10		27.03	35.998	23.48	4.80	6.85		0.00	0.09	0.00

R V PALUMBO CRUISE 028 STATION PMA-4B PRNC REFERENCE 028471

DATE 05 /11/73 BARO 1016.0 WEATHER 02 WIND VELOC 06 WAVE PERIOD 4
 HOUR 22.8 TEMP DRY 26.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-30.6 N TEMP WET 0.0 CLOUD TYPE 0 WAVE DIREC 01 SONIC DEP 0182
 LONG 066-31.6 W REL HUMID 084 CLOUD AMT 8 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 22.9 GMT, 1852 LOCAL MAX DEPTH 100 WIRE ANGLE 2
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TEMP		TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
					TM	TM								
0	0	0	11	27.04	27.03	27.04	36.004	23.48	4.85	6.93	102.54	.03	0.00	
25	25	25	12	27.03	0.00	27.03	35.999	23.48	4.85	6.93	102.52	.06	0.00	
50	50	51	15	26.60	0.00	26.60	36.084	23.68	4.88	6.97	102.62	.03	0.00	
100	100	99	16	25.36	0.00	25.36	36.421	24.32	4.93	7.05	101.28	.00	0.00	

028 471 STANDARD DEPTHS

0	27.04	36.004	23.48	4.85	6.93	0.00	0.03	0.00
10	27.03	36.002	23.48	4.85	6.93	0.00	0.04	0.00
20	27.03	36.000	23.48	4.85	6.93	0.00	0.06	0.00
30	26.97	36.009	23.51	4.85	6.94	0.00	0.05	0.00
50	26.60	36.084	23.68	4.88	6.97	0.00	0.03	0.00
75	26.04	36.225	23.96	4.91	7.01	0.00	0.05	0.00
100	25.36	36.421	24.32	4.93	7.05	0.00	0.05	0.00

R V PALUMBO CRUISE 028 STATION PMA-4C PRNC REFERENCE 028463

DATE 05 /11/73 BARO 1018.0 WEATHER 02 WIND VELOC 02 WAVE PERIOD 5
 HOUR 13.5 TEMP DRY 30.0 VISIBILITY 8 WIND DIREC 07 TRANSPAR
 LAT 18-31.7 N TEMP WET 0.0 CLOUD TYPE 6 WAVE DIREC 07 SONIC DEP 0420
 LONG 066-31.6 W REL HUMID 077 CLOUD AMT 2 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 13.5 GMT, 928 LOCAL MAX DEPTH 300 WIRE ANGLE 0
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TEMP		TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
					TM	TM								
0	0	0	11	27.16	27.16	27.16	35.984	23.43	4.78	6.82	101.14	.04	0.00	
25	25	26	12	26.74	0.00	26.74	36.035	23.60	4.82	6.88	101.43	.03	0.00	
50	50	57	12	26.34	0.00	26.34	36.118	23.79	4.84	6.91	101.33	.03	0.00	
100	100	103	16	25.14	0.00	25.14	36.472	24.43	4.99	7.12	102.30	.04	0.00	
150	150	152	1	23.11	0.00	23.11	36.844	25.32	4.45	6.36	86.22	.07	0.00	
200	200	209	2	20.46	0.00	20.46	36.703	25.95	4.24	6.06	80.35	.13	0.00	
250	250	251	3	18.34	0.00	18.34	36.564	26.40	4.45	6.36	76.58	.20	0.00	
300	300	299	4	17.28	0.00	17.28	36.422	26.55	4.45	6.36	77.82	.34	0.00	

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028 463 STANDARD DEPTHS

0	27.16	35.984	23.43	4.78	6.82	0.00	0.04	0.00
10	26.99	36.004	23.50	4.79	6.85	0.00	0.04	0.00
20	26.82	36.024	23.57	4.81	6.87	0.00	0.03	0.00
30	26.66	36.047	23.63	4.82	6.89	0.00	0.03	0.00
50	26.34	36.118	23.79	4.84	6.91	0.00	0.03	0.00
75	25.83	36.278	24.07	4.90	6.99	0.00	0.03	0.00
100	25.14	36.472	24.43	4.99	7.12	0.00	0.04	0.00
150	23.11	36.844	25.32	4.45	6.36	0.00	0.07	0.00
200	20.46	36.703	25.95	4.24	6.06	0.00	0.13	0.00
250	18.34	36.564	26.40	4.45	6.36	0.00	0.20	0.00
300	17.28	36.422	26.55	4.45	6.36	0.00	0.34	0.00

R V PALUMBO CRUISE 028 STATION PMA-5A PRNC REFERENCE 028469

DATE 05 /11/73 BARO 1015.5 WEATHER 02 WIND VELOC 04 WAVE PERIOD 5
 HOUR 22.1 TEMP DRY 28.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-29.0 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 01 SONIC DEP 0020
 LONG 066-30.6 W REL HUMID 077 CLOUD AMT 8 WAVE HEIGHT 3 COLOR 20

CAST 1 MESS TIME 22.1 GMT, 18 6 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	11	27.15	27.15	27.15	36.001	23.44	4.87	6.96	103.18	.00	0.00
10	10	12	12	27.15	0.00	27.15	36.004	23.45	4.91	7.02	104.08	.05	0.00

028 469 STANDARD DEPTHS
 0 27.15 36.001 23.44 4.87 6.96 0.00 0.00 0.00
 10 27.15 36.004 23.45 4.91 7.02 0.00 0.05 0.00

R V PALUMBO CRUISE 028 STATION PMA-58 PRNC REFERENCE 028470

DATE 05 /11/73 BARO 1015.5 WEATHER WIND VELOC 08 WAVE PERIOD 5
 HOUR 22.5 TEMP DRY 28.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-30.6 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 02 SONIC DEP 0190
 LONG 066-30.7 W REL HUMID 081 CLOUD AMT 7 WAVE HEIGHT 3 COLOR 10

CAST 1 MESS TIME 22.5 GMT, 1028 LOCAL MAX DEPTH 100 WIRE ANGLE 2
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		TL	RN	TZ	TAVE	SALIN	SIG T	OXYGEN		%SAT	PHOS	NITRA
		TM	TM							ML/L	MG/L			
0	0	11	27.08	27.09	27.09	27.09	36.005	23.47	4.85	6.93	102.63	.05	0.00	
25	25	12	27.04	0.00	27.04	27.04	36.007	23.48	4.86	6.94	102.78	.03	0.00	
50	50	12	26.68	0.00	26.68	26.68	36.066	23.64	4.83	6.90	101.61	.00	0.00	
100	100	16	25.65	0.00	25.65	25.65	36.340	24.17	4.89	6.99	100.46	.04	0.00	

028 470 STANDARD DEPTHS

0	27.09	36.005	23.47	4.85	6.93	0.00	0.05	0.00
10	27.07	36.006	23.47	4.85	6.93	0.00	0.04	0.00
20	27.05	36.007	23.48	4.86	6.94	0.00	0.03	0.00
30	26.99	36.014	23.51	4.85	6.94	0.00	0.02	0.00
50	26.68	36.066	23.64	4.83	6.90	0.00	0.00	0.00
75	26.22	36.177	23.87	4.84	6.91	0.00	0.02	0.00
100	25.65	36.340	24.17	4.89	6.99	0.00	0.04	0.00

R V PALUMBO CRUISE 028 STATION PMA-5C PRNC REFERENCE 028462

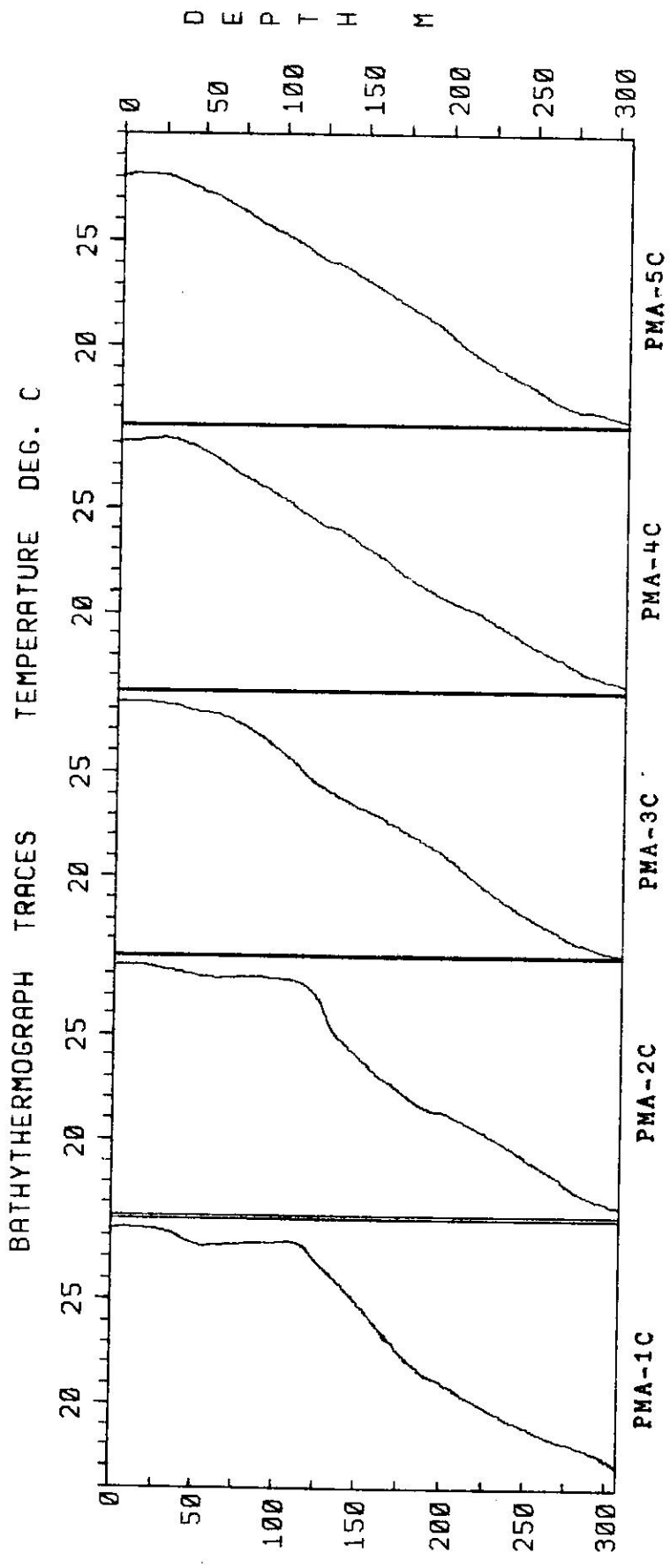
DATE 05 /11/73 BARO 1016.8 WEATHER 02 WIND VELOC 02 WAVE PERIOD 5
 HOUR 12.6 TEMP DRY 31.0 VISIBILITY 8 WIND DIREC 06 TRANSPAR
 LAT 18-31.5 N TEMP WET 0.0 CLOUD TYPE 0 WAVE DIREC 07 SONIC DEP 0429
 LONG 066-30.5 W REL HUMID 074 CLOUD AMT 1 WAVE HEIGHT 3 COLOR 1W

CAST 1 MESS TIME 12.6 GMT, 837 LOCAL MAX DEPTH 300 WIRE ANGLE 5
 OXYGEN TITER 1.054 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TEMP		TAVE	SALIN	SIG T	OXYGEN		PHOS	NITRA
						ML/L	MG/L				%SAT			
0	0	0	11	27.11	27.12	27.12	35.973	23.43	4.81	6.87	101.71	.04	0.00	
25	25	24	12	26.81	0.00	26.81	36.027	23.57	4.80	6.85	101.09	.03	0.00	
50	50	54	12	26.48	0.00	26.48	36.094	23.73	4.83	6.90	101.31	.04	0.00	
100	100	101	16	25.62	0.00	25.62	36.314	24.16	4.96	7.08	101.71	.03	0.00	
150	149	149	1	23.19	0.00	23.19	36.822	25.28	4.51	6.45	87.44	.04	0.00	
200	199	200	2	20.45	0.00	20.45	36.704	25.96	4.28	6.12	81.15	.12	0.00	
250	249	247	3	18.55	0.00	18.55	36.546	26.33	4.38	6.25	77.32	.20	0.00	
300	298	298	4	17.28	0.00	17.28	36.403	26.54	4.48	6.40	78.34	.33	0.00	

028 462 STANDARD DEPTHS

0	27.12	35.973	23.43	4.81	6.87	0.00	0.04	0.00
10	26.99	35.995	23.49	4.80	6.86	0.00	0.04	0.00
20	26.87	36.016	23.54	4.80	6.86	0.00	0.03	0.00
30	26.75	36.039	23.60	4.80	6.86	0.00	0.03	0.00
50	26.48	36.094	23.73	4.83	6.90	0.00	0.04	0.00
75	26.17	36.178	23.89	4.88	6.97	0.00	0.04	0.00
100	25.62	36.314	24.16	4.96	7.08	0.00	0.03	0.00
150	23.13	36.820	25.29	4.51	6.44	0.00	0.04	0.00
200	20.40	36.701	25.97	4.28	6.12	0.00	0.12	0.00
250	18.52	36.543	26.34	4.38	6.25	0.00	0.20	0.00
300	17.23	36.397	26.55	4.49	6.41	0.00	0.34	0.00



Cruise No. PA-032
August 7, 1973

R V PALUMBO CRUISE 332 STATION PMA-1A PRNC REFERENCE 032523

DATE 08 /07/73 BARO 1019.5 WEATHER 02 WIND VELOC 02 WAVE PERIOD 4
 HOUR 11.8 TEMP DRY 27.0 VISIBILITY 8 WIND DIREC 07 TRANSPAR
 LAT 18-30.2 N TEMP WET 0.0 CLOUD TYPE 6 WAVE DIREC 07 SONIC DEP 0017
 LONG 056-34.7 W REL HUMID 084 CLOUD AMT 1 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 11.0 GMT, 747 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.040 METER WHEEL FACTOR .997

WIRE	CP	TZ	8N	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0		0	11	28.29	28.30	28.30	35.981	23.06	4.56	6.51	98.38	.02	0.00
10		9	12	28.32	0.02	28.30	35.983	23.06	4.53	6.46	97.72	.03	0.00
032 523 STANDARD DEPTHS													
						25.30	35.981	23.06	4.56	6.51	98.38	2.00	0.00
						25.30	35.983	23.06	4.53	6.46	97.72	0.20	0.00

R V PALUMBO CRUISE 032 STATION PMA-18 PRNC REFERENCE 032534

DATE 26 / 27 / 73 BARO 1018.0 WEATHER 03 WIND VELOC 14 WAVE PERIOD
 HOUR 17.4 TEMP DRY 31.0 VISIBILITY 3 WIND DIREC 09 TRANSPAR
 LAT 16-31.5 N TEMP WET 0.2 CLOUD TYPE 8 WAVE DIREC 09 SONIC DEP 0182
 LONG 066-34.7 W REL HUMID 374 CLOUD AMT 2 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 17.4 GMT, 1323 LOCAL MAX DEPTH 120 WIRE ANGLE 11
 OXYGEN TITER 2.440 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	CZ	TZ	PN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	0	11	23.41	28.42	25.42	35.821	22.92	4.61	6.58	99.22	.00	0.00	
25	25	24	12	26.34	0.00	23.74	35.916	22.99	4.62	6.60	99.56	.04	0.00		
52	49	50	15	27.95	0.00	27.95	36.146	23.29	4.72	6.75	97.34	.00	0.00		
120	98	0	16	28.07	0.00	28.77	36.146	23.25	4.80	6.85	98.87	.04	0.00		

432 534 STANDARD DEPTHS

10	25.42	35.851	22.92	4.61	6.58	99.22	0.00	0.00
20	26.39	35.877	22.95	4.61	6.59	99.36	0.02	0.00
30	28.36	35.899	22.97	4.62	6.60	99.48	0.03	0.00
50	28.26	35.961	23.05	4.64	6.63	99.99	0.04	0.00
70	27.95	36.146	23.29	4.73	6.75	97.39	0.04	0.00
100	26.01	36.146	23.27	4.77	6.82	98.39	0.04	0.00
	24.07	36.146	23.25	4.80	6.86	98.93	0.04	0.00

R V PALUMBO CRUISE #32 STATION PMA-10 PRNG REFERENCE 032535

DATE 08 /07/73 BARO 1017.5 WEATHER 02 WIND VELOC 16 WAVE PERIOD 4
 HOUR 17.9 TEMP DRY 31.2 VISIBILITY 09 WIND DIREC 09 TRANSPAR
 LAT 16-31.8 N TEMP WFT 0.0 CLOUD TYPE 6 WAVF DIREC 07 SONIC DEP 0360
 LONG 066-54.8 W REL HUMID. 074 CLOUD AMT. 2 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 17.9 GMT, 1555 LOCAL MAX DEPTH 500 WIRE ANGLE 15
 OXYGEN TITER 1.040 METER WHEEL FACTOR .997

WIPE	CE	DEPTH (M)	TEMP			TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
			TZ	RV	TL								
2	2	0	14	28.39	28.38	28.35	35.146	22.40	4.67	6.67	97.96	.04	0.00
25	25	27	14	24.32	0.00	25.30	36.002	23.07	4.67	6.67	100.93	.04	0.00
50	49	52	15	27.69	0.00	27.69	36.148	23.38	4.82	6.88	99.20	.04	0.00
107	97	0	10	27.84	0.00	27.84	36.129	23.72	5.11	7.30	109.94	.04	0.00
157	147	147	4	23.92	0.00	23.92	36.861	25.09	4.72	6.72	92.16	.03	0.00
200	173	194	2	26.98	0.00	26.96	36.918	25.98	4.19	5.99	79.98	.09	0.00
251	241	0	5	19.16	2.00	19.16	36.586	26.21	4.30	6.14	76.31	.21	0.00
300	209	293	4	17.36	0.00	17.36	36.420	26.53	4.41	6.30	77.18	.31	0.00

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STANDARD DEPTHS	DEPTH (M)	TEMP	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
10	20.35	35.488	22.67	4.67	6.67	99.14	0.04	0.00	
20	23.32	35.845	22.95	4.67	6.67	100.39	0.04	0.00	
30	20.18	36.073	23.16	4.69	6.71	101.46	0.04	0.00	
50	27.69	36.148	23.38	4.82	6.89	99.33	0.04	0.00	
75	27.77	36.138	23.35	4.97	7.11	102.44	0.04	0.00	
100	27.64	36.174	23.42	5.10	7.23	105.02	0.04	0.00	
150	23.55	36.898	25.25	4.66	6.65	90.72	0.03	0.00	
200	21.60	36.877	26.23	4.21	6.01	80.03	0.11	0.00	
250	17.32	36.549	26.27	4.32	6.17	76.42	0.25	0.00	
300	16.95	36.382	26.60	4.44	6.34	77.42	0.33	0.00	

R V PALUMBO CRUISE 032 STATION PMA-2A PRNC REFERENCE 032524

DATE 05 / 07 / 73 BARO 1016.5 WEATHER 02 WIND VELOC 07 WAVE PERIOD 4
 HOUR 12.1 TEMP DRY 29.0 VISIBILITY 8 WIND DIREC 07 TRANSPAR
 LAT 18-29.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0022
 LONG 066-34.6 W REL HUMID CLOUD AMT 1 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 12.1 GMT, 8 4 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.040 METER WHEEL FACTOR .997

DEPTH (M)	TEMP	OXYGEN
WIRE 02	TL TM TAVE SALIN SIG T ML/L MG/L %SAT PHOS NITRA	
0	11 28.32 28.32 28.32 35.985 23.05 4.58 6.54 98.88 .03 0.00	
10	11 14 28.31 0.00 28.31 35.980 23.05 4.60 6.57 99.30 .03 0.00	
032 524	STANDARD DEPTHS	
0	28.32 35.985 23.05 4.58 6.54 98.88 0.03 0.00	
10	28.31 35.980 23.05 4.60 6.57 99.30 0.03 0.00	

R V PALUMBO CRUISE 032 STATION PMA-2B PHNC REFERENCE 032533

DATE 08 /07/73 BARO 1018.5 WEATHER 01 WIND VELOC 11 WAVE PERIOD 5
 HOUR 17.0 TEMP DRY 31.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-31.0 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0190
 LONG 066-33.6 W REL HUMID 074 CLOUD AMT 2 WAVE HEIGHT 3 COLOR

CASI 1 MESS TIME 17.0 GMT, 13.0 LOCAL MAX DEPTH 100 WIRE ANGLE 10
 OXYGEN TITER 1.040 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	0	0	11	28.46	28.44	28.45	35.877	22.93	4.64	6.63	100.05	.04	0.00		
25	25	12	28.29	0.00	28.29	35.889		22.99	4.61	6.58	99.16	.04	0.00		
50	50	15	28.15	0.00	28.15	36.059		23.16	4.57	6.52	98.62	.00	0.00		
100	99	16	26.11	0.00	26.11	36.183		23.91	4.91	7.01	100.77	.03	0.00		

032 533 STANDARD DEPTHS

0	28.45	35.877	22.93	4.64	6.63	100.05	0.04	0.00
10	28.39	35.882	22.95	4.63	6.61	99.69	0.04	0.00
20	28.32	35.887	22.98	4.62	6.59	99.34	0.04	0.00
30	28.26	35.917	23.02	4.60	6.57	99.06	0.04	0.00
50	28.15	36.029	23.16	4.57	6.52	98.62	0.04	0.00
75	27.26	36.140	23.51	4.71	6.72	96.81	0.04	0.00
100	26.07	36.186	23.93	4.92	7.02	100.91	0.03	0.00

R V PALUMBO CRUISE 032

STATION PMA-2C

PRNC REFERENCE 032536

DATE 08 /07/73 BARO 1017.5 WEATHER 03 WIND VELOC 14 WAVE PERIOD
 HOUR 19.0 TEMP DRY 0.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0370
 LONG 066-33.7 W REL HUMID 074 CLOUD AMT 4 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 19.0 GMT, 15 0 LOCAL MAX DEPTH 300 WIRE ANGLE 17
 OXYGEN TITER 1.040 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
															DEPTH (M)	WIRE ANGLE
0	0	0	11	28.42	28.39	28.42	35.917	22.97	4.70	6.72	101.45	.06	0.00			
25	24	22	12	26.35	0.00	28.35	36.006	23.06	4.62	6.60	99.91	.03	0.00			
50	48	53	15	27.90	0.00	27.90	36.148	23.31	4.83	6.90	99.47	.03	0.00			
100	96	0	16	27.71	0.00	27.71	36.121	23.35	4.94	7.06	106.08	.10	0.00			
150	144	150	1	23.33	0.00	23.33	36.896	25.29	4.69	6.70	91.23	.03	0.00			
200	191	185	2	21.35	0.00	21.36	36.991	25.93	4.22	6.03	80.94	.06	0.00			
250	239	245	3	18.66	0.00	18.66	36.606	26.35	4.23	6.05	75.03	.16	0.00			
300	287	286	4	17.39	0.00	17.39	36.435	26.54	4.48	6.41	78.49	.32	0.00			

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032 536 STANDARD DEPTHS

0	28.40	35.917	22.97	4.70	6.72	101.45	0.06	0.00
10	28.38	35.954	23.01	4.67	6.67	100.81	0.05	0.00
20	28.36	35.990	23.04	4.63	6.62	100.16	0.03	0.00
30	28.25	36.043	23.12	4.66	6.65	100.70	0.03	0.00
50	27.87	36.147	23.32	4.84	6.91	99.73	0.03	0.00
75	27.79	36.133	23.34	4.94	7.06	101.74	0.06	0.00
100	27.39	36.183	23.51	4.93	7.05	101.59	0.09	0.00
150	23.03	36.945	25.42	4.63	6.61	89.84	0.03	0.00
200	20.83	36.929	26.03	4.23	6.04	80.53	0.07	0.00
250	18.31	36.557	26.40	4.28	6.12	75.57	0.19	0.00
300	17.05	36.389	26.59	4.55	6.50	79.46	0.36	0.00

R V PALUMBO CRUISE 032 STATION PMA-3A PRNC REFERENCE 032525

DATE 08 /07/73 RARO 1018.5 WEATHER 03 WIND VELOC 07 WAVE PERIOD 4
 HOUR 12.3 TEMP DRY 29.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-29.6 N TEMP WET 0.0 CLOUD TYPE 0 WAVE DIREC 07 SONIC DEP 0019
 LONG 066-32.7 W REL HUMID 075 CLOUD AMT 1 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 12.3 GMT, 820 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.240 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		TAVE	SALIN	SIG T	ML/L	%SAT	PHOS	NITRA	
		TZ	BN								
0	0	0	11	28.32	28.28	28.42	4.64	6.63	97.15	.12	0.00
10	10	16	12	28.32	28.32	23.06	4.61	6.58	99.58	.00	0.00

032	525	STANDARD DEPTHS		28.29	35.126	22.42	4.64	6.63	97.15	0.06	0.00
		0	10								
0	0	0	10	28.32	35.993	23.06	4.61	6.58	99.58	0.05	0.00

R V PALUMBO CRUISE 032 STATION PMA-3B PRNC REFERENCE 032532

DATE 08 /07/73 BARO 1018.5 WEATHER 01 WIND VELOC 11 WAVE PERIOD 4
 HOUR 16.6 TEMP DRY 31.0 VISIBILITY 8 WIND DIREC 10 TRANSPAR
 LAT 18-30.8 N TEMP WFT 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0180
 LONG 066-35.8 W REL HUMID 474 CLOUD AMT 2 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 16.6 GMT, 1237 LOCAL MAX DEPTH 100 WIRE ANGLE 14
 OXYGEN TITR 1.040 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	0	0	11	28.40	28.39	26.40	35.814	22.90	4.65	6.64	99.95	.04	0.00		
25	26	26	12	26.29	0.00	26.29	35.885	22.99	4.62	6.60	99.37	.03	0.00		
50	50	50	15	28.10	0.00	26.12	36.063	23.18	4.67	6.67	100.79	.07	0.00		
100	97	97	16	26.10	0.00	26.10	36.186	23.92	4.89	6.98	100.35	.07	0.00		

032 532 STANDARD DEPTHS

0	26.40	35.814	22.90	4.65	6.64	99.95	0.04	0.00
10	28.35	35.842	22.93	4.64	6.63	99.72	0.04	0.00
20	26.31	35.868	22.97	4.62	6.61	99.44	0.03	0.00
30	28.26	35.919	23.02	4.62	6.61	99.55	0.04	0.00
50	20.27	36.067	23.20	4.67	6.68	100.83	0.07	0.00
75	27.15	36.149	23.56	4.78	6.83	98.31	0.07	0.00
100	25.97	36.194	23.96	4.90	7.00	100.60	0.07	0.00

R V PALUMBO CRUISE 032 STATION PMA-3C PRNC REFERENCE 032531

DATE 08 /07/73 BARO 1018.5 WEATHER 03 WIND VELOC 13 WAVE PERIOD
 HOUR 15.7 TEMP DRY 31.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-30.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0365
 LONG 066-33.7 W REL HUMID 076 CLOUD AMT 5 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 15.7 GMT, 1141 LOCAL MAX DEPTH 300 WIRE ANGLE 8
 OXYGEN TITER 1.040 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
															DEPTH (M)	TEMP
0	0	0	11	28.36	28.38	28.37	35.881	22.96	4.64	6.63	99.93	.03	0.00			
25	25	24	12	26.34	0.00	26.34	35.919	22.99	4.62	6.60	99.57	.04	0.00			
50	50	51	15	27.94	0.00	27.94	36.270	23.24	4.66	6.66	100.30	.03	0.00			
100	99	97	16	25.68	0.00	25.68	36.311	24.14	4.97	7.10	102.09	.00	0.00			
150	149	154	1	23.38	0.00	23.38	36.829	25.23	4.60	6.57	89.25	.00	0.00			
200	198	200	2	20.53	0.00	20.53	36.798	26.01	4.18	5.97	79.40	.06	0.00			
250	247	0	3	25.13	0.00	25.13	36.484	24.49	4.30	6.14	88.14	.20	0.00			
300	297	295	4	17.18	0.00	17.18	36.324	26.50	4.44	6.35	77.48	.32	0.00			

032 531 STANDARD DEPTHS

0	28.37	35.881	22.96	4.64	6.63	99.93	0.03	0.00
10	26.36	35.896	22.97	4.63	6.62	99.79	0.03	0.00
20	28.35	35.909	22.99	4.62	6.60	99.61	0.04	0.00
30	28.30	35.944	23.03	4.62	6.60	99.64	0.04	0.00
50	27.94	36.070	23.24	4.66	6.66	100.30	0.03	0.00
75	26.91	36.181	23.66	4.78	6.83	98.36	0.04	0.00
100	25.64	36.323	24.16	4.97	7.10	102.01	0.04	0.00
150	23.33	36.828	25.24	4.59	6.55	89.00	0.03	0.00
200	20.57	36.786	25.99	4.19	5.98	79.50	0.07	0.00
250	24.83	36.472	24.52	4.30	6.15	80.19	0.21	0.00
300	16.70	36.314	26.61	4.45	6.36	77.47	0.33	0.00

R V PALUMBO CRUISE 732 STATION PMA-4A PNMC REFERENCE 032526

DATE 06/07/73 RAPD 1019.2 WEATHER 02 WIND VELOC 11 WAVE PERIOD 4
 HOUR 12.7 TEMP DRY 29.2 VISIBILITY 8 WIND DIREC 08 TRANSPAR
 LAT 18-29.5 N TEMP WET 0.2 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0020
 LONG 066-31.4 W REL HUMID 081 CLOUD AMT 1 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 12.7 SWI, 842 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.240 METER WHEEL FACTOR .997

WIRE	CZ	TZ	RN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
10	14	14	12	26.31	0.00	29.31	35.968	23.04	4.62	6.60	99.70	0.00	0.00	0.04	0.00
032	526														
						28.31	35.968	23.24	4.62	6.60	99.70	0.03	0.00		
						28.31	35.968	23.04	4.60	6.57	99.25	0.03	0.00		

R V PALUMBO CRUISE 032 STATION PMA-4B PRNC REFERENCE 032537

DATE 08/07/73 BARO 1016.5 WEATHER 01 WIND VELOC 16 WAVE PERIOD 5
 HOUR 19.8 TEMP DRY 32.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-51.7 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0180
 LONG 366-51.6 W REL HUMID 079 CLOUD AMT 3 WAVE HEIGHT 3 COLOR

CASI 1 MESS TIME 19.8 GMT, 1548 LOCAL MAX DEPTH 100 WIRE ANGLE 19
 OXYGEN TITER 1.040 METER WHEEL FACTOR .997

WIRE	CZ	Z	TEMP			TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
			TL	TM	BN								
121	25	24	28.40	28.36	11	28.39	35.950	23.00	4.63	6.61	100.00	.00	0.00
	50	48	26.33	0.00	12	28.33	35.965	23.03	4.61	6.58	99.50	.00	0.00
	100	95	27.84	0.00	12	27.84	36.124	23.31	4.72	6.75	101.64	.25	0.00
			25.75	0.00	16	25.75	36.368	24.16	4.89	6.98	100.48	.04	0.00
032 537 STANDARD DEPTHS													
		0	28.39	35.950	23.00	4.63	6.61	100.00	0.03	0.00	0.00		
		10	28.37	35.956	23.01	4.62	6.60	99.79	0.03	0.00	0.00		
		20	28.34	35.963	23.03	4.61	6.59	99.58	0.04	0.00	0.00		
		30	28.25	35.997	23.08	4.63	6.61	99.94	0.04	0.00	0.00		
		50	27.77	36.135	23.35	4.73	6.76	97.42	0.23	0.00	0.00		
		75	26.73	36.270	23.78	4.82	6.89	99.35	0.04	0.00	0.00		
		100	25.53	36.394	24.25	4.91	7.01	100.78	0.04	0.00	0.00		

R V PALUMBO CRUISE 232 STATION PMA-4C PRNC REFERENCE 032530

DATE 08 /07/73 BARO 1010.5 WEATHER 03 WIND VELOC 11 WAVE PERIOD 5
 HOUR 14.9 TEMP DRY 29.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-31.7 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0360
 LONG 166-31.6 W REL HUMID 079 CLOUD AMT 3 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 14.9 GUT, 1052 LOCAL MAX DEPTH 300 WIRE ANGLE 8
 OXYGEN TITR 1.040 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	OXYGEN			
											%SAT	PHOS	NITRA	
25	25	27	12	28.35	28.09	28.22	35.968	23.07	4.72	6.75	101.79	.00	0.00	
50	50	52	12	28.29	28.00	28.29	35.958	23.04	4.70	6.72	101.43	.00	0.00	
100	99	101	16	27.66	27.00	27.66	36.123	23.37	4.93	7.04	102.76	.00	0.00	
150	149	148	1	25.41	25.00	25.41	36.515	24.38	4.88	6.97	100.27	.03	0.00	
200	198	0	2	23.00	23.00	23.00	37.048	25.50	4.44	6.35	86.53	.06	0.00	
250	247	249	3	20.94	20.00	20.94	36.838	25.93	4.20	6.00	80.08	.11	0.00	
300	297	0	4	18.51	18.00	18.51	36.527	26.33	4.32	6.17	76.23	.18	0.00	
				17.37	17.00	17.37	36.326	26.46	4.59	6.55	80.08	.34	0.00	

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032 530 STANDARD DEPTHS

0	28.22	35.968	23.07	4.72	6.75	101.79	0.03	0.00
10	28.25	35.964	23.06	4.71	6.74	101.64	0.03	0.00
20	28.28	35.960	23.05	4.71	6.72	101.50	0.04	0.00
30	28.22	35.981	23.08	4.74	6.77	102.23	0.04	0.00
50	27.66	36.123	23.37	4.93	7.04	102.76	0.03	0.00
75	26.60	36.309	23.85	4.90	7.01	101.06	0.04	0.00
100	25.36	36.529	24.41	4.87	6.96	100.10	0.01	0.00
150	22.96	37.048	25.52	4.43	6.34	86.34	0.06	0.00
200	20.83	36.825	25.95	4.21	6.01	80.09	0.11	0.00
250	18.42	36.513	26.34	4.33	6.19	76.40	0.19	0.00
320	17.30	36.314	26.47	4.60	6.58	80.32	0.35	0.00

R V PALUMBO CRUISE 032 STATION PMA-5A PRNC REFERENCE 032527

DATE 08 / 07/73 BARO 1019.0 WEATHER 02 WIND VELOC 11 WAVE PERIOD 4
 HOUR 13.1 TEMP DRY 28.5 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-29.3 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0020
 LONG 066-30.4 W REL HUMID 080 CLOUD AMT 1 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 13.0 GMT, 9 3 LOCAL MAX DEPTH 10 WIRE ANGLE 2
 OXYGEN TITER 1.240 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	2	0	11	28.30	28.31	28.31	35.962	23.04	4.61	6.58	99.45	.00	0.00		
10	10	10	12	28.29	0.00	28.29	35.964	23.04	4.59	6.55	98.98	.03	0.00		
032 527 STANDARD DEPTHS															
						28.31	35.962	23.04	4.61	6.58	99.45	0.03	0.00		
						28.29	35.964	23.04	4.59	6.55	98.98	0.03	0.00		

R V PALUMBO CRUISE 032 STATION PMA-5B PRNC REFERENCE 032528

DATE 08 /07/73 BARO 1019.2 WEATHER 03 WIND VELOC 12 WAVE PERIOD 5
 HOUR 13.5 TEMP DRY 29.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-30.4 N TEMP WET 0.0 CLOUD TYPE 0 WAVE DIREC 07 SONIC DEP 0155
 LONG 066-30.5 W REL HUMID 077 CLOUD AMT 2 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 13.5 GMT, 931 LOCAL MAX DEPTH 100 WIRE ANGLE 9
 OXYGEN TITER 1.040 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		OXYGEN				PHOS	NITRA		
		TL	TM	TAVE	SALIN	SIG T	ML/L			MG/L	%SAT
0	0	28.30	28.31	28.31	35.964	23.04	4.64	6.63	100.13	.04	0.00
25	25	26.30	0.00	28.30	35.977	23.05	4.63	6.61	99.94	.00	0.00
50	50	27.76	0.00	27.76	36.136	23.35	4.89	6.98	100.68	.00	0.00
100	99	26.93	0.00	26.93	36.145	23.62	4.86	6.94	99.85	.00	0.00

032 528 STANDARD DEPTHS

0	28.31	35.964	23.04	4.64	6.63	100.13	0.03	0.00
10	28.30	35.969	23.04	4.64	6.62	100.05	0.03	0.00
20	28.30	35.974	23.05	4.63	6.62	99.98	0.04	0.00
30	28.22	36.005	23.10	4.67	6.68	100.87	0.04	0.00
50	27.76	36.136	23.35	4.89	6.98	100.68	0.03	0.00
75	27.32	36.141	23.50	4.87	6.96	100.26	0.04	0.00
100	26.91	36.145	23.63	4.86	6.94	99.84	0.01	0.00

R V PALUMBO CRUISE 032

STATION PMA-50

PRNC REFERENCE 032529

DATE 28 / 07 / 73 RARO 1018.5 WEATHER 02 WIND VELOC 11 WAVE PERIOD 4
 HOUR 14.1 TEMP DRY 29.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-31.6 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0360
 LONG 066-30.5 W REL HUMID 079 CLOUD AMT 2 WAVE HEIGHT 3 COLOR

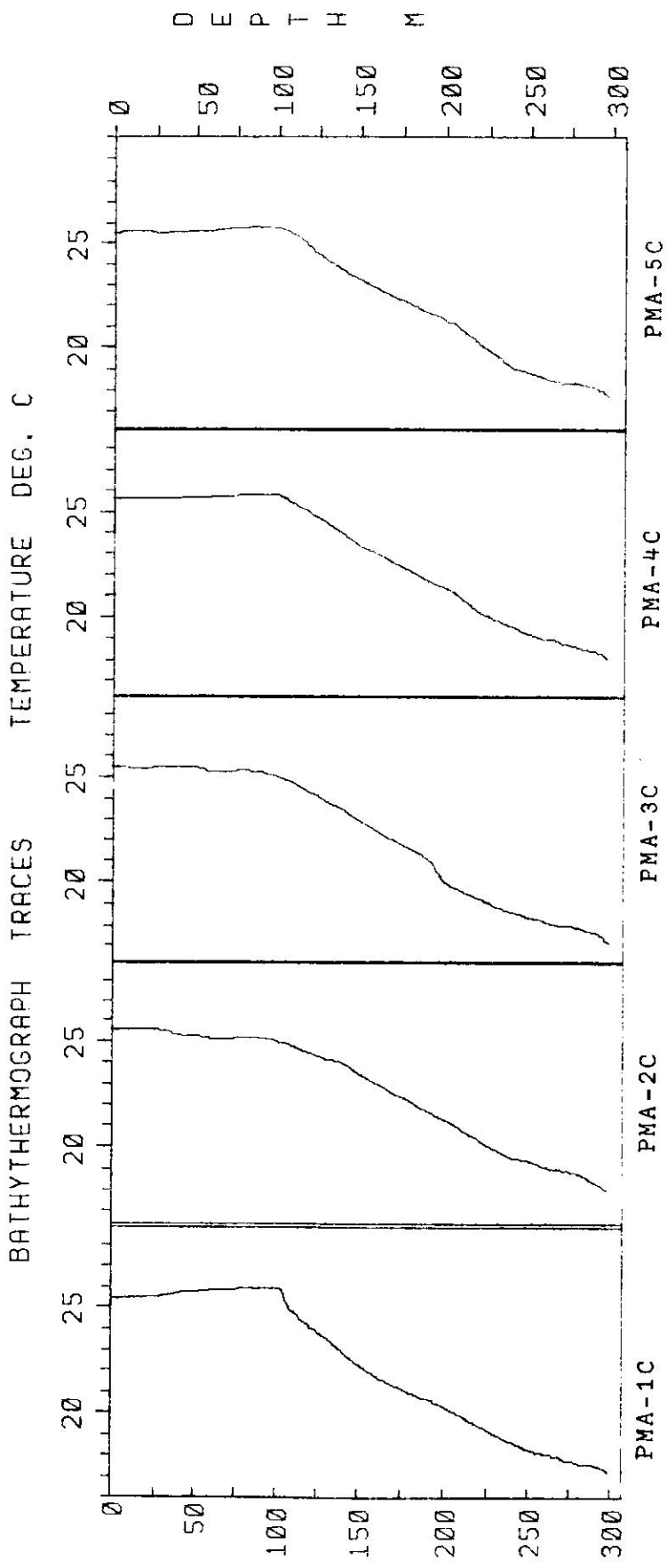
CAST 1 MESS TIME 14.1 GMT, 10 4 LOCAL MAX DEPTH 300 WIRE ANGLE 7
 OXYGEN TITER 1.040 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN				
									ML/L	MG/L	%SAT	PHOS NITRA	
0	0	0	11	28.32	28.33	28.33	35.999	23.06	4.62	6.60	99.84	.00	0.00
25	27	12	12	28.25	0.00	28.25	35.975	23.07	4.65	6.64	100.30	.00	0.00
50	53	15	15	27.46	0.00	27.46	36.126	23.44	4.83	6.90	103.16	.04	0.00
100	99	16	16	25.45	0.00	25.45	36.501	24.36	4.86	6.94	99.85	.03	0.00
150	149	148	1	23.19	0.00	23.19	37.020	25.43	4.50	6.44	87.82	.05	0.00
200	198	196	2	20.41	0.00	27.41	36.853	26.08	4.24	6.06	80.55	.11	0.00
250	248	246	3	18.29	0.00	18.29	36.573	26.42	4.28	6.11	72.51	.23	0.00
300	297	296	4	17.22	0.00	17.22	36.414	26.56	4.43	6.33	77.48	.32	0.00

125

032 529 STANDARD DEPTHS

0	28.33	35.999	23.06	4.62	6.60	99.84	0.03	0.00
10	28.30	35.989	23.06	4.63	6.62	100.02	0.03	0.00
20	28.27	35.980	23.07	4.64	6.63	100.21	0.04	0.00
30	28.14	35.995	23.12	4.68	6.69	100.86	0.04	0.00
50	27.46	36.126	23.44	4.83	6.90	103.16	0.04	0.00
75	26.49	36.303	23.88	4.84	6.92	99.75	0.03	0.00
100	25.41	36.514	24.38	4.85	6.93	99.73	0.03	0.00
150	23.13	37.017	25.44	4.50	6.43	87.63	0.05	0.00
200	20.31	36.842	26.10	4.25	6.07	80.51	0.11	0.00
250	18.24	36.565	26.43	4.28	6.12	75.56	0.23	0.00
300	17.15	36.404	26.57	4.44	6.34	77.60	0.33	0.00



Cruise No. PA-038
 January 24, 1974

R V PALUMBO CRUISE 038 STATION PMA-1A PRNG REFERENCE 038631

DATE 01 /24/74 BARO 1018.5 WEATHER 00 WIND VELOC 09 WAVE PERIOD 7
 HOUR 19.4 TEMP DRY 0.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-30.2 N TEMP WET 27.0 CLOUD TYPE 8 WAVE DIREC 09 SONIC DEP 0021
 LONG 066-34.6 W REL HUMID 630 CLOUD AMT 3 WAVE HEIGHT 4 COLOR

CAST 1 MESS TIME 19.3 GMT, 1518 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.046 METER WHEEL FACTOR .997

WIRE	CZ	IZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	0	5	1	25.51	0.00	25.51	35.495	23.58	4.90	7.00	100.33	.07	0.00		
10	10	9	2	25.52	0.00	25.52	35.585	23.64	4.91	7.01	100.66	.08	0.00		
038 631 STANDARD DEPTHS															
						25.51	35.495	23.58	4.90	7.00	100.33	0.07	0.00		
						25.52	35.585	23.64	4.91	7.01	100.66	0.08	0.00		

R V PALUMBO CRUISE 038 STATION PMA-18 PRNC REFERENCE 038632

DATE 01 /24/74 BARO 1018.5 WEATHER 02 WIND VELOC 09 WAVE PERIOD 7
 HOUR 19.8 TEMP DRY 0.0 VISIBILITY 8 WIND DIREC 09 TRANSPAR
 LAT 18-31.6 N TEMP WET 27.0 CLOUD TYPE 8 WAVE DIREC 09 SONIC DEP 0184
 LONG 066-35.7 W REL HUMID 620 CLOUD AMT 3 WAVE HEIGHT 4 COLOR

CAST 1 MESS TIME 19.8 GMT, 1548 LOCAL MAX DEPTH 100 WIRE ANGLE 20
 OXYGEN TITER 1.046 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN				PHOS	NITRA
									ML/L	MG/L	XSAT			
0	0	2	1	25.49	0.00	25.49	35.573	23.64	4.90	7.00	100.39	.07	0.00	
25	24	0	2	25.52	0.00	25.52	35.589	23.65	4.90	7.00	100.45	.09	0.00	
50	47	46	3	25.78	0.00	25.78	35.635	23.75	4.87	6.95	100.40	.10	0.00	
100	94	95	4	24.64	0.00	24.64	36.687	24.74	4.75	6.79	92.54	.06	0.00	

038 632 STANDARD DEPTHS

0	25.49	35.573	23.64	4.90	7.00	100.39	0.07	0.0
10	25.50	35.580	23.65	4.90	7.00	100.42	0.08	0.0
20	25.52	35.586	23.65	4.90	7.00	100.44	0.09	0.0
30	25.56	35.633	23.67	4.89	6.99	100.44	0.09	0.0
50	25.74	35.682	23.80	4.86	6.94	100.35	0.10	0.0
75	25.24	36.314	24.28	4.80	6.86	98.39	0.08	0.0
100	24.49	36.796	24.87	4.74	6.77	92.58	0.05	0.0

R V PALUMBO CRUISE 038 STATION PMA-1C PRNC REFERENCE 038633

DATE 01 /24/74 BARO 1018.5 WEATHER 02 WIND VELOC 11 WAVE PERIOD 7
 HOUR 20.6 TEMP DRY 0.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-32.0 N TEMP WET 27.0 CLOUD TYPE 8 WAVE DIREC 09 SONIC DEF 0438
 LONG 066-34.8 W REL HUMID 720 CLOUD AMT 2 WAVE HEIGHT 4 COLOR

CAST 1 MESS TIME 20.5 GMT, 1633 LOCAL MAX DEPTH 300 WIRE ANGLE 10
 OXYGEN TITER 1.046 METER WHEEL FACTOR .997

DEPTH (M)		TEMP		OXYGEN									
WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA
0	0	0	11	25.43	0.00	25.43	35.579	23.67	4.93	7.04	100.96	.07	0.00
25	25	28	12	25.45	0.00	25.45	36.259	24.17	4.90	7.00	100.38	.07	0.00
50	50	46	10	25.75	0.00	25.75	35.890	23.80	4.92	7.03	101.59	.07	0.00
100	99	0	16	25.89	0.00	25.89	35.872	23.75	5.11	7.29	105.68	.07	0.00
150	148	141	1	22.32	0.00	22.32	37.050	25.70	4.35	6.22	84.25	.11	0.00
200	197	0	2	20.30	0.00	20.30	36.902	26.15	4.14	5.92	78.60	.16	0.00
250	246	249	3	18.16	0.00	18.16	36.659	26.52	4.13	5.90	73.13	.35	0.00
300	295	285	4	17.03	0.00	17.03	36.447	26.63	4.14	5.92	72.43	.52	0.00

038 633 STANDARD DEPTHS

0	25.43	35.579	23.67	4.93	7.04	100.96	0.07	0.0
10	25.44	35.851	23.87	4.92	7.02	101.01	0.07	0.0
20	25.45	36.144	24.09	4.90	7.00	100.37	0.07	0.0
30	25.50	36.231	24.14	4.90	7.00	100.46	0.07	0.0
50	25.75	35.890	23.80	4.92	7.03	101.59	0.07	0.0
75	25.82	35.881	23.77	4.99	7.13	103.17	0.07	0.0
100	25.83	35.897	23.78	5.09	7.28	105.34	0.07	0.0
150	22.22	37.044	25.73	4.34	6.20	83.85	0.11	0.0
200	20.16	36.888	26.18	4.14	5.91	78.38	0.17	0.0
250	18.05	36.641	26.53	4.13	5.91	73.05	0.36	0.0
300	16.91	36.425	26.65	4.14	5.92	72.37	0.54	0.0

R V PALUMBO CRUISE 038 STATION PMA-2A PRNG REFERENCE 038634

DATE 01 /20/74 BARO 1023.5 WEATHER 00 WIND VELOC 04 WAVE PERIOD 5
 HOUR 13.8 TEMP DRY 0.0 VISIBILITY 6 WIND DIREC 09 TRANSPAR
 LAJ 18-29.7 N TEMP WET 25.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEF 0021
 LONG 066-33.8 W REL HUMID 830 CLOUD AMT 6 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 13.7 GMT, 943 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA	TEMP		OXYGEN	
														DEPTH (M)	STANDARD DEPTHS	ML/L	MG/L
0	0	0	11	25.51	0.00	25.51	35.832	23.83	4.76	6.80	97.84	.10	0.00				
10	10	10	12	25.51	0.00	25.51	35.749	23.77	4.84	6.92	99.47	.12	0.00				
038	634																
	0					25.51	35.832	23.83	4.76	6.80	97.84	0.10	0.0				
	10					25.51	35.749	23.77	4.84	6.92	99.47	0.12	0.0				

R V PALUMBO CRUISE 038 STATION PMA-28 PRNC REFERENCE 038644

DATE 01 /28/74 BARO 1020.5 WEATHER 02 WIND VELOC 11 WAVE PERIOD 6
 HOUR 19.4 TEMP DRY 0.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-31.3 N TEMP WET 20.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0182
 LONG 066-33.9 W REL HUMID 680 CLOUD AMT 8 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 19.3 GMT, 1520 LOCAL MAX DEPTH 100 WIRE ANGLE 0
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		TAVE	SALIN	SIG T	OXYGEN		PHOS	NITRA	
		CZ	TL				ML/L	XSAT			
0	0	0	25.47	0.00	35.773	23.80	4.89	6.99	100.51	.05	0.00
25	25	25	25.46	0.00	35.758	23.79	4.85	6.93	99.62	.05	0.00
50	50	49	25.60	0.00	35.867	23.83	4.87	6.96	100.38	.04	0.00
100	100	52	25.46	0.00	35.788	23.82	5.19	7.41	106.51	.04	0.00

038 644 STANDARD DEPTHS

0	25.47	35.773	23.80	4.89	6.99	100.51	0.05	0.
10	25.47	35.767	23.80	4.88	6.97	100.15	0.05	0.
20	25.46	35.761	23.79	4.86	6.94	99.77	0.05	0.
30	25.49	35.777	23.80	4.86	6.94	99.76	0.05	0.
50	25.60	35.867	23.83	4.87	6.96	100.38	0.04	0.
75	25.60	35.828	23.80	4.98	7.12	102.63	0.04	0.
100	25.46	35.788	23.82	5.19	7.41	106.51	0.04	0.

R V PALUMBO CRUISE 038 STATION PMA-2C PRNC REFERENCE 038645
 DATE 01 /28/74 BARO 1018.5 WEATHER 02 WIND VELOC 11 WAVE PERIOD 6
 HOUR 20.1 TEMP DRY 0.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-31.7 N TEMP WET 29.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0384
 LONG 066-33.6 W REL HUMID 705 CLOUD AMT 2 WAVE HEIGHT 3 COLOR
 CAST 1 MESS TIME 20.1 GMT, 16 5 LOCAL MAX DEPTH 300 WIRE ANGLE 0
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP				OXYGEN				PHOS	NITRA			
		CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T			ML/L	MG/L	XSAT
0	0	0	0	11	25.49	0.00	25.49	35.659	23.71	4.88	6.98	100.20	.43	0.00
25	25	27	25.48	12	25.48	0.00	25.48	35.707	23.75	4.85	6.93	99.59	.08	0.00
50	50	0	25.27	10	25.27	0.00	25.27	35.708	23.81	5.26	7.51	107.63	.10	0.00
100	100	94	25.20	16	25.20	0.00	25.20	35.578	23.74	4.68	6.69	95.69	.07	0.00
150	150	0	0.00	1	0.00	0.00	0.00	36.733	0.00	4.69	6.71	*****	.04	0.00
200	200	0	21.23	2	21.23	0.00	21.23	36.997	25.97	4.32	6.17	82.68	.04	0.00
250	250	0	19.39	3	19.39	0.00	19.39	36.750	26.27	4.22	6.02	75.48	.15	0.00
300	300	0	17.96	4	17.96	0.00	17.96	36.546	26.48	4.15	5.93	73.13	.29	0.00

038.645 STANDARD DEPTHS

0	25.49	35.659	23.71	4.88	6.98	100.20	0.43	0.
10	25.49	35.678	23.73	4.87	6.96	99.96	0.29	0.
20	25.48	35.698	23.74	4.86	6.94	99.72	0.14	0.
30	25.44	35.707	23.76	4.93	7.04	101.11	0.08	0.
50	25.27	35.708	23.81	5.26	7.51	107.63	0.10	0.
75	25.24	35.665	23.79	5.05	7.22	103.29	0.09	0.
100	25.20	35.578	23.74	4.68	6.69	95.69	0.07	0.
150	23.51	36.733	25.12	4.69	6.71	90.92	0.04	0.
200	21.23	36.997	25.97	4.32	6.17	82.68	0.04	0.
250	19.39	36.750	26.27	4.22	6.02	75.48	0.15	0.
300	17.96	36.546	26.48	4.15	5.93	73.13	0.29	0.

R V PALUMBO CRUISE 038 STATION PMA-3A PRNC REFERENCE 030635

DATE 01 /28/74 BARO 1023.5 WEATHER 02 WIND VELOC 04 WAVE PERIOD 5
 HOUR 13.9 TEMP DRY 0.0 VISIBILITY 6 WIND DIREC 08 TRANSPAR
 LAT 18-29.6-N TEMP WET 25.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0020
 LONG 066-32.7 W REL HUMID 830 CLOUD AMT 6 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 14.0 GMT, 958 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	CZ	T2	BN	TL	TM	TEMP				OXYGEN			
						TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA
0	0	0	10	25.44	0.00	25.44	35.742	23.79	4.86	6.95	99.79	.09	0.00
10	10	14	16	25.49	0.00	25.49	35.778	23.80	4.92	7.03	101.19	.11	0.00
038 635 STANDARD DEPTHS													
				25.44	35.742	23.79	4.86	6.95	99.79	0.09	0.00		
				25.49	35.778	23.80	4.92	7.03	101.19	0.11	0.00		

R V PALUMBO CRUISE 038 STATION PMA-38 PRNC REFERENCE 038642

DATE 01 /28/74 BARO 1021.5 WEATHER 02 WIND VELOC 11 WAVE PERIOD 6
 HOUR 17.8 TEMP DRY 0.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-30.6 N TEMP WET 28.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0182
 LONG 066-32.6 W REL HUMID 710 CLOUD AMT 2 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 17.8 GMT, 1348 LOCAL MAX DEPTH 100 WIRE ANGLE 0
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	CZ	IZ	BN	TL	TEMP		TAVE	SALIN	SIG T	OXYGEN			PHOS	NITRA
					IM	TM				ML/L	MG/L	%SAT		
0	0	0	11	25.54	0.00	0.00	25.54	35.777	23.78	4.92	7.03	101.26	.00	0.00
25	25	29	12	25.52	0.00	0.00	25.52	35.789	23.80	4.87	6.96	100.17	.00	0.00
50	50	42	10	25.68	0.00	0.00	25.68	35.998	23.91	4.74	6.77	97.87	.00	0.00
100	100	0	16	25.66	0.00	0.00	25.66	35.966	23.89	4.81	6.87	99.31	.00	0.00
038 642 STANDARD DEPTHS														
	0			25.54			25.54	35.777	23.78	4.92	7.03	101.26	0.09	0.
	10			25.53			25.53	35.782	23.79	4.90	7.01	100.82	0.11	0.
	20			25.52			25.52	35.787	23.80	4.88	6.98	100.42	0.14	0.
	30			25.55			25.55	35.826	23.82	4.84	6.92	99.69	0.00	0.
	50			25.68			25.68	35.998	23.91	4.74	6.77	97.87	0.10	0.
	75			25.67			25.67	35.982	23.90	4.77	6.82	98.59	0.09	0.
	100			25.66			25.66	35.966	23.89	4.81	6.87	99.31	0.07	0.

R V PALUMBO CRUISE 038 STATION PMA-3C PRNC REFERENCE 038643

DATE 01 /28/74 BARO 1022.5 WEATHER 02 WIND VELOC 11 WAVE PERIOD 6
 HOUR 18.5 TEMP DRY 0.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-31.7 N TEMP WET 27.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0402
 LONG 066-32.7 W REL HUMID 680 CLOUD AMT 1 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 18.5 GMT, 1430 LOCAL MAX DEPTH 300 WIRE ANGLE 0
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN ML/L MG/L	%SAT	PHOS	NITRA	
		CZ	TZ											
0	0	0	0	11	25.53	0.00	25.53	35.760	23.77	4.87	6.96	100.15	.03	0.00
25	25	25	29	12	25.50	0.00	25.50	35.759	23.78	4.86	6.95	99.89	.00	0.00
50	50	50	50	10	25.49	0.00	25.49	35.770	23.79	4.84	6.92	99.46	.03	0.00
100	100	101	148	16	25.15	0.00	25.15	36.610	24.53	4.71	6.72	96.63	.05	0.00
150	150	148	194	1	23.02	0.00	23.02	36.821	25.33	4.65	6.65	90.04	.06	0.00
200	200	194	245	2	20.12	0.00	20.12	36.834	26.14	4.14	5.92	78.42	.15	0.00
250	250	245	296	3	18.54	0.00	18.54	36.626	26.40	4.16	5.95	73.76	.28	0.00
300	300	296		4	17.16	0.00	17.16	36.416	26.58	4.17	5.96	72.94	.45	0.00

038 643 STANDARD DEPTHS

0	25.53	35.760	23.77	4.87	6.96	100.15	0.03	0.
10	25.52	35.760	23.78	4.87	6.95	100.05	0.02	0.
20	25.51	35.759	23.78	4.86	6.95	99.95	0.02	0.
30	25.50	35.760	23.78	4.86	6.94	99.84	0.02	0.
50	25.49	35.770	23.79	4.84	6.92	99.46	0.03	0.
75	25.37	36.161	24.12	4.78	6.82	97.78	0.04	0.
100	25.15	36.610	24.53	4.71	6.72	96.63	0.05	0.
150	23.02	36.821	25.33	4.65	6.65	90.04	0.06	0.
200	20.12	36.834	26.15	4.14	5.92	78.42	0.15	0.
250	18.54	36.626	26.40	4.16	5.95	73.76	0.28	0.
300	17.16	36.416	26.58	4.17	5.96	72.94	0.45	0.

R V PALUMBO CRUISE 038 STATION PMA-4A PRNC REFERENCE 038636

DATE 01 /28/74 BARO 1023.5 WEATHER 02 WIND VELOC 04 WAVE PERIOD 5
 HOUR 14.3 TEMP DRY 0.0 VISIBILITY 6 WIND DIREC 09 TRANSPAR
 LAT 18-29.3 N TEMP WET 25.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0021
 LONG 066-31.6 W REL HUMID 830 CLOUD AMT 4 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 14.3 GMT, 1016 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA	DEPTH (M)							
														0	10						
0	0	0	11	25.43	0.00	25.43	36.470	24.34	4.92	7.03	101.17	.16	0.00	0	10						
10	10	11	12	25.48	0.00	25.48	35.832	23.84	4.88	6.98	100.37	.08	0.00	0	10						
038 636 STANDARD DEPTHS														0	10						
														25.43	36.470	24.34	4.92	7.03	101.17	0.16	0.0
														25.48	35.832	23.84	4.88	6.98	100.37	0.08	0.0

R V PALUMBO CRUISE 038 STATION PMA-48 PRNC REFERENCE 030640

DATE 01 /28/74 BARO 1022.5 WEATHER 02 WIND VELOC 11 WAVE PERIOD 6
 HOUR 16.2 TEMP DRY 0.0 VISIBILITY 6 WIND DIREC 08 TRANSPAR
 LAT 18-30.4 N TEMP WET 26.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0102
 LONG 066-31.7 W REL HUMID 760 CLOUD AMT 7 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 16.2 GMT, 1212 LOCAL MAX DEPTH 100 WIRE ANGLE 8
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	0	0	11	25.61	0.00	25.61	35.837	23.81	4.87	6.96	100.36	.07	0.00		
25	25	25	12	25.60	0.00	25.60	35.846	23.82	4.84	6.92	99.71	.09	0.00		
50	50	50	10	25.69	0.00	25.69	36.013	23.91	4.80	6.86	99.20	.10	0.00		
100	99	71	16	25.67	0.00	25.67	36.071	23.96	4.75	6.78	98.16	.06	0.00		

038 640 STANDARD DEPTHS

0	25.61	35.837	23.81	4.87	6.96	100.36	0.07	0.
10	25.61	35.841	23.81	4.86	6.94	100.10	0.08	0.
20	25.60	35.844	23.81	4.85	6.93	99.85	0.09	0.
30	25.62	35.875	23.83	4.83	6.90	99.60	0.09	0.
50	25.69	36.013	23.91	4.80	6.86	99.20	0.10	0.
75	25.68	36.065	23.96	4.77	6.81	98.65	0.08	0.
100	25.67	36.072	23.97	4.75	6.78	98.14	0.06	0.

R V PALUMBO CRUISE 038 STATION PMA-4C PRNC REFERENCE 038641

DATE 01 /28/74 BARO 1022.5 WEATHER 02 WIND VELOC 11 WAVE PERIOD 6
 HOUR 16.6 TEMP DRY 0.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-32.3 N TEMP WET 26.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0356
 LONG 066-31.8 W REL HUMID 730 CLOUD AMT 1 WAVE HEIGHT 4 COLOR

CAST 1 MESS TIME 16.9 GMT, 1255 LOCAL MAX DEPTH 300 WIRE ANGLE 2
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		OXYGEN				PHOS	NITRA				
		TZ	BN	TL	TM	TAVE	SALIN			SIG T	ML/L	MG/L	%SAT
0	0	0	11	25.53	0.00	25.53	35.802	23.80	4.93	7.05	101.49	.07	0.00
25	25	30	12	25.52	0.00	25.52	35.802	23.81	5.08	7.26	104.47	.05	0.00
50	50	0	10	25.57	0.00	25.57	35.804	23.79	5.10	7.29	104.98	.06	0.00
100	100	0	16	25.73	0.00	25.73	35.998	23.89	4.82	6.89	99.68	.05	0.00
150	150	0	1	23.43	0.00	23.43	36.766	25.17	4.66	6.66	90.36	.04	0.00
200	200	0	2	21.55	0.00	21.55	36.972	25.86	4.27	6.10	81.88	.09	0.00
250	250	233	3	19.28	0.00	19.28	36.787	26.33	4.15	5.93	74.41	.20	0.00
300	299	271	4	18.03	0.00	18.03	36.562	26.48	4.14	5.92	73.01	.36	0.00

038 641 STANDARD DEPTHS

0	25.53	35.802	23.80	4.93	7.05	101.49	0.07	0.
10	25.53	35.802	23.81	4.99	7.13	102.68	0.06	0.
20	25.52	35.802	23.81	5.05	7.22	103.93	0.05	0.
30	25.53	35.802	23.81	5.10	7.28	104.84	0.05	0.
50	25.57	35.804	23.79	5.10	7.29	104.98	0.06	0.
75	25.64	35.869	23.82	4.98	7.11	102.67	0.06	0.
100	25.73	35.998	23.89	4.82	6.89	99.68	0.05	0.
150	23.43	36.766	25.17	4.66	6.66	90.36	0.04	0.
200	21.55	36.972	25.86	4.27	6.10	81.88	0.09	0.
250	19.28	36.787	26.33	4.15	5.93	74.41	0.20	0.
300	18.00	36.557	26.48	4.14	5.92	72.99	0.36	0.

R V PALUMBO CRUISE 038 STATION PMA-5A PRNC REFERENCE 038637

DATE 01 /28/74 BARO 1023.5 WEATHER 02 WIND VELOC 06 WAVE PERIOD 6
HOUR 14.7 TEMP DRY 0.0 VISIBILITY 6 WIND DIREC 08 TRANSPAR
LAT 18-29.3 N TEMP WET 26.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0024
LONG 066-30.5 W REL HUMID 830 CLOUD AMT 2 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 14.6 GMT, 1035 LOCAL MAX DEPTH 10 WIRE ANGLE 9
OXYGEN TITER 1.043 METER WHEEL FACTOR .997

DEPTH (M)		TEMP		OXYGEN		PHOS		NITRA					
WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	1	10	25.48	0.00	25.48	35.824	23.84	4.85	6.93	99.72	.09	0.00
10	10	13	16	25.41	0.00	25.41	35.794	23.84	4.91	7.02	100.87	.10	0.00
038 637 STANDARD DEPTHS													
				25.48	35.824	23.84	4.85	6.93	99.72	0.09	0.0		
				25.41	35.794	23.84	4.91	7.02	100.87	0.10	0.0		

R V PALUMBO CRUISE 038 STATION PMA-5B PHNC REFERENCE 038638

DATE 01 /28/74 BARO 1022.5 WEATHER 02 WIND VELOC 07 WAVE PERIOD 5
 HOUR 14.9 TEMP DRY 0.0 VISIBILITY 6 WIND DIREC 08 TRANSPAR
 LAT 18-30.6 N TEMP WET 26.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0182
 LONG 066-30.6 W REL HUMID 780 CLOUD AMT 1 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 15.0 GMT, 1058 LOCAL MAX DEPTH 100 WIRE ANGLE 10
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

WIRE	CZ	DEPTH (M)	TEMP			OXYGEN			XSAT	PHOS	NITRA				
			TZ	BN	TL	TM	TAVE	SALIN				SIG T	ML/L	MG/L	
0	0	0	0	11	25.60	0.00	0.00	25.60	35.841	23.81	4.86	6.95	100.14	.08	0.00
25	25	25	0	12	25.60	0.00	0.00	25.60	35.848	23.82	4.86	6.95	100.15	.07	0.00
50	50	50	46	10	25.67	0.00	0.00	25.67	36.037	23.94	4.76	6.80	98.33	.10	0.00
100	99	100	57	16	25.57	0.00	0.00	25.57	36.033	23.97	4.89	6.99	100.96	.08	0.00

038 638 STANDARD DEPTHS

0	25.60	35.841	23.81	4.86	6.95	100.14	0.08	0.
10	25.60	35.844	23.81	4.86	6.95	100.14	0.08	0.
20	25.60	35.847	23.82	4.86	6.95	100.14	0.07	0.
30	25.61	35.881	23.84	4.84	6.92	99.79	0.07	0.
50	25.67	36.037	23.94	4.76	6.80	98.33	0.10	0.
75	25.64	36.035	23.95	4.80	6.86	99.13	0.10	0.
100	25.57	36.033	23.97	4.90	6.99	101.01	0.08	0.

R V PALUMBO CRUISE 038 STATION PMA-5C PRNC REFERENCE 038639

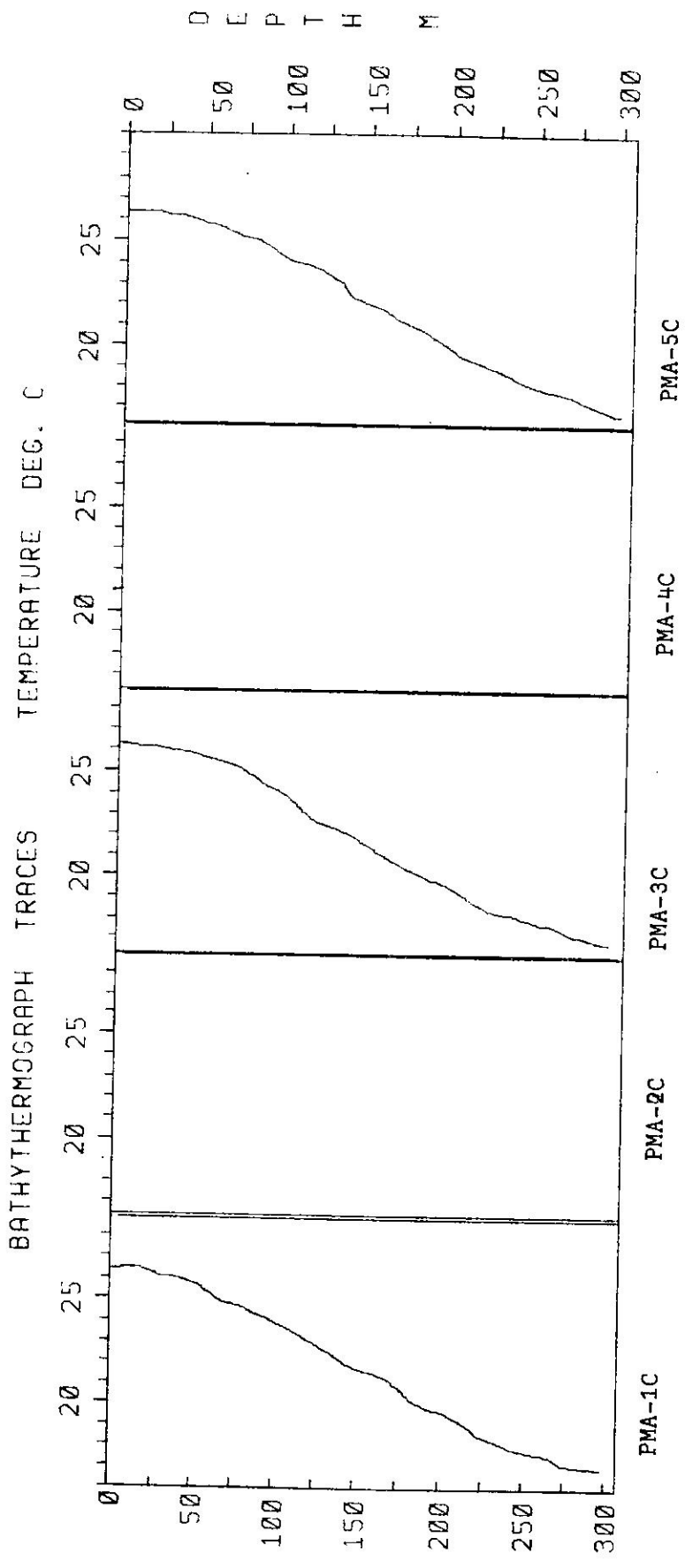
DATE 01 /28/74 BARO 1022.5 WEATHER 02 WIND VELOC 08 WAVE PERIOD 6
 HOUR 15.6 TEMP DRY 0.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-31.4 N TEMP WET 26.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0375
 LONG 066-30.6 W REL HUMID 760 CLOUD AMT 8 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 15.5 GMT, 1132 LOCAL MAX DEPTH 300 WIRE ANGLE 16
 OXYGEN TITER 1.043 METER WHEEL FACTOR .997

DEPTH (M)		TEMP		OXYGEN		SIG T		ML/L		%SAT		PHOS		NITRA	
WIRE	CZ	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA				
0	0	11	25.59	25.59	35.861	23.83	4.95	7.06	101.86	.09	0.00				
25	24	12	25.57	25.57	35.871	23.84	4.87	6.96	100.34	.09	0.00				
50	48	10	25.59	25.59	35.928	23.88	4.93	7.05	101.73	.10	0.00				
100	96	10	25.78	25.78	36.116	23.96	4.81	6.87	99.70	.08	0.00				
150	144	1	23.33	23.33	36.782	25.21	4.66	6.66	90.35	.10	0.00				
200	192	2	21.47	21.47	36.998	25.90	4.20	6.01	80.66	.08	0.00				
250	240	3	18.96	18.96	36.680	26.33	4.14	5.92	73.74	.29	0.00				
300	288	4	17.67	17.67	36.475	26.50	4.25	6.07	74.52	.46	0.00				

038 639 STANDARD DEPTHS

0	25.59	35.861	23.83	4.95	7.06	101.86	0.09	0.
10	25.58	35.865	23.84	4.91	7.02	101.23	0.09	0.
20	25.57	35.869	23.84	4.88	6.97	100.54	0.09	0.
30	25.58	35.881	23.85	4.88	6.98	100.59	0.09	0.
50	25.59	35.934	23.88	4.93	7.05	101.71	0.10	0.
75	25.67	36.022	23.93	4.89	6.98	100.98	0.10	0.
100	25.61	36.171	24.06	4.80	6.85	98.32	0.08	0.
150	23.10	36.834	25.31	4.60	6.58	89.18	0.10	0.
200	21.03	36.960	25.99	4.17	5.95	79.58	0.11	0.
250	18.64	36.633	26.38	4.16	5.94	73.72	0.33	0.
300	17.35	36.424	26.54	4.27	6.10	74.75	0.50	0.



Cruise No. PA-043
 May 23, 1974

R V PALUMBO CRUISE STATION PMA-1A PRNC REFERENCE 43764

DATE 5/22/74 BARO 1000.0 WEATHER 02 WIND VELOC 03 WAVE PERIOD 4
 HOUR 5.7 TEMP DRY 23.0 VISIBILITY 7 WIND DIREC 10 TRANSPAR 10
 LAT 18-30.2 N TEMP WET 0.0 CLOUD TYPE 4 CLOUD AMT 2 WAVE DIREC 10 SONIC DEP 0024
 LONG 66-34.7 W REL HUMID 087 WAVE HEIGHT 1 COLOR

CAST 1 MESS TIME 3.6 GMT, 2330 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER .670 METER WHEEL FACTOR .997

DEPTH (M)	TEMP		OXYGEN		SIG T	ML/L	MG/L	XSAT	PHOS	NITRA
	TZ	BN	TL	TM						
0	1	1	26.53	26.53	23.55	4.75	6.79	99.41	.05	.
10	10	8	26.56	26.56	23.53	4.68	6.69	97.91	.07	.

R V PALUMBO CRUISE STATION PMA-1B PRNC REFERENCE 43765

DATE 5/22/74 BARO 1018.5 WEATHER 02 WIND VELOC 03 WAVE PERIOD 4
 HOUR 6.2 TEMP DRY 23.0 VISIBILITY 7 WIND DIREC 10 TRANSPAR
 LAT 18-31.2 N TEMP WET 0.0 CLOUD TYPE 4 WAVE DIREC 09 SONIC DEP 0228
 LONG 66-33.7 W REL HUMID 090 CLOUD AMT 2 WAVE HEIGHT 1 COLOR

CAST 1 MESS TIME 4.0 GMT, 0 2 LOCAL MAX DEPTH 100 WIRE ANGLE 7
 OXYGEN TITER .670 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	CZ	TZ	BN	TL	TEMP		TAVE	SALIN	SIG T	OXYGEN		XSAT	PHOS	NITRA
						TM	TL				ML/L	MG/L			
0	0	1	0	1	26.49	26.49	26.49	35.877	23.56	4.77	6.81	99.63	.06	.	.
25	15	2	15	2	26.48	26.48	26.48	35.860	23.55	4.68	6.69	97.76	.06	.	.
50	50	3	50	3	26.12	26.12	26.12	35.926	23.71	4.81	6.87	99.97	.05	.	.
100	101	4	101	4	23.99	23.99	23.99	35.637	24.15	4.81	6.88	94.96	.05	.	.

R V PALUMBO CRUISE STATION PMA-1C PRNC REFERENCE 43766
 DATE 5/23/74 BARO 1018.1 WEATHER 02 WIND VELOC 03 WAVE PERIOD 4
 HOUR 6.4 TEMP DRY 24.0 VISIBILITY 7 WIND DIREC 10 TRANSPAR
 LAT 18=31.7 N TEMP WET 0.0 CLOUD TYPE 4 WAVE DIREC 09 SONIC DEP 0393
 LONG 66=33.7 W REL HUMID 092 CLOUD AMT 2 WAVE HEIGHT 3 COLOR
 CAST 1 MESS TIME 4.4 GMT, 027 LOCAL MAX DEPTH 300 WIRE ANGLE 7
 OXYGEN TITER .670 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	CZ	TZ	BN	TL	TEMP		TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA
						TM	TH								
0		1	0	10	26.50	26.50	26.50	35.815	23.51	4.76	6.80	99.38	.09	.	
25		25	0	11	26.43	26.43	26.43	35.858	23.57	4.73	6.76	98.80	.08	.	
50		50	52	12	25.79	0.00	25.79	36.039	23.90	4.75	6.78	98.34	.14	.	
100		99	0	16	24.15	24.15	24.15	36.584	24.81	4.89	6.98	94.55	.16	.	
150		149	156	1	21.76	21.76	21.76	36.888	25.74	4.34	6.20	83.28	.14	.	
200		198	188	2	19.62	19.62	19.62	36.771	26.23	4.08	5.83	73.22	.24	.	
250		248	247	3	17.96	17.96	17.96	35.516	25.69	4.01	5.73	71.47	.36	.	
300		297	289	4	17.04	17.04	17.04	35.376	25.81	4.25	6.07	74.57	.51	.	

R V PALUMBO CRUISE 043

STATION PMA-3A

PRNC REFERENCE 043757

DATE 05 /22/74 BARO 1018.0 WEATHER 00 WIND VELOC WAVE PERIOD 4
 HOUR 11.8 TEMP DRY 31.0 VISIBILITY 7 WIND DIREC TRANSPAR
 LAT 18-29.6 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 09 SONIC DEP 0023
 LONG 066-32.7 W REL HUMID 062 CLOUD AMT 1 WAVE HEIGHT 1 COLOR

CAST 1 MESS TIME 11.9 GMT, 751 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER .670 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	0	3	1	26.25	0.00	26.25	35.713	23.51	4.75	6.79	98.69	.09	0.00		
10	10	0	2	26.35	0.00	26.35	35.847	23.58	4.69	6.71	97.82	.09	0.00		

043 757 STANDARD DEPTHS

0	26.25	35.713	23.51	4.75	6.79	0.00	0.09	0.00
10	26.35	35.847	23.58	4.69	6.71	0.00	0.09	0.00

R V PALUMBO CRUISE 043

STATION PMA-3B

PRNC REFERENCE 043758

DATE 05 /22/74 BARO 1010.4 WEATHER 02 WIND VELOC WAVE PERIOD 4
 HOUR 12.2 TEMP DRY 31.0 VISIBILITY 7 WIND DIREC TRANSPAR
 LAT 18-30.6 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 09 SONIC DEP 0175
 LONG 066-32.8 W REL HUMID 061 CLOUD AMT 1 WAVE HEIGHT 1 COLOR

CAST 1 MESS TIME 12.2 GMT, 011 LOCAL MAX DEPTH 100 WIRE ANGLE 0
 OXYGEN TITER .670 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN			PHOS	NITRA
									ML/L	MG/L	%SAT		
0	0	2	1	26.27	0.00	26.27	35.772	23.55	4.75	6.79	98.82	.04	0.20
25	25	22	2	26.21	0.00	26.21	35.892	23.66	4.68	6.69	97.40	.00	0.00
50	50	51	3	25.95	0.00	25.95	35.973	23.80	4.79	6.85	99.49	.00	0.00
100	100	104	4	24.75	0.00	24.75	36.355	24.46	4.77	6.82	91.77	.05	0.00

043 758 STANDARD DEPTHS

DEPTH (M)	0	10	20	30	50	75	100
0	26.27	35.772	23.55	4.75	6.79	0.00	0.04
10	26.25	35.820	23.60	4.73	6.75	0.00	0.02
20	26.22	35.869	23.64	4.69	6.70	0.00	0.02
30	26.18	35.907	23.68	4.70	6.71	0.00	0.03
50	25.95	35.973	23.80	4.79	6.85	0.00	0.03
75	25.46	36.127	24.07	4.78	6.84	0.00	0.04
100	24.75	36.355	24.46	4.77	6.82	0.00	0.05

R V PALUMBO CRUISE 043 STATION PMA-30 PRNC REFERENCE 043759

DATE 05 /22/74 BARO 1018.5 WEATHER 02 WIND VELOC 03 WAVE PERIOD 4
 HOUR 12.6 TEMP DRY 32.0 VISIBILITY 7 WIND DIREC 10 TRANSPAR
 LAT 18-31.7 N TEMP WET 0.0 CLOUD TYPE 0 WAVE DIREC 09 SONIC DEP 0400
 LONG 066-32.5 W REL HUMID 067 CLOUD AMT 1 WAVE HEIGHT 2 COLOR

CAST 1 MESS TIME 12.6 GMT, 835 LOCAL MAX DEPTH 300 WIRE ANGLE 3
 OXYGEN TITER .670 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP				OXYGEN				PHOS	NITRA			
		CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T			ML/L	MG/L	%SAT
0	0	0	0	10	26.40	0.00	26.40	35.847	23.57	4.79	6.84	99.85	.12	0.00
25	25	0	0	14	26.24	0.00	26.24	35.880	23.64	4.73	6.76	98.55	.19	0.00
50	50	55	55	12	25.98	0.00	25.98	35.944	23.77	4.81	6.88	99.91	.10	0.00
100	100	0	0	16	24.44	0.00	24.44	36.465	24.64	4.76	6.80	91.80	.11	0.00
150	150	155	155	1	21.69	0.00	21.69	36.851	25.73	4.35	6.22	83.43	.10	0.00
200	200	193	193	2	19.77	0.00	19.77	36.754	26.18	4.01	5.73	72.04	.22	0.00
250	249	249	249	3	18.56	0.00	18.56	36.592	26.37	4.08	5.83	72.18	.29	0.00
300	299	297	297	4	16.80	0.00	16.80	36.315	26.59	4.26	6.08	74.16	.40	0.00

043 759 STANDARD DEPTHS

0	26.40	35.847	23.57	4.79	6.84	0.00	0.12	0.00
10	26.34	35.860	23.60	4.77	6.81	0.00	0.15	0.00
20	26.27	35.873	23.63	4.74	6.78	0.00	0.18	0.00
30	26.21	35.889	23.66	4.75	6.76	0.00	0.16	0.00
50	25.98	35.944	23.77	4.81	6.88	0.00	0.10	0.00
75	25.37	36.180	24.14	4.79	6.84	0.00	0.11	0.00
100	24.44	36.465	24.64	4.76	6.80	0.00	0.11	0.00
150	21.69	36.851	25.73	4.35	6.22	0.00	0.10	0.00
200	19.77	36.754	26.18	4.01	5.73	0.00	0.22	0.00
250	18.53	36.587	26.37	4.08	5.83	0.00	0.29	0.00
300	16.76	36.309	26.59	4.26	6.08	0.00	0.40	0.00

R V PALUMBO CRUISE 043 STATION PMA-5A PRNC REFERENCE 043756

DATE 05 /22/74 BARO 1016.8 WEATHER 02 WIND VELOC 02 WAVE PERIOD 4
 HOUR 11.5 TEMP DRY 24.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-29.4 N TEMP WET 0.0 CLOUD TYPE 0 WAVE DIREC 09 SONIC DEP 0022
 LONG 066-30.6 W REL HUMID 084 CLOUD AMT 1 WAVE HEIGHT 1 COLOR

CAST 1 MESS TIME 11.4 GMT, 725 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER .670 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	1	26.27	0.00	26.27	35.956	23.69	4.71	6.74	98.31	.10	0.00
10	10	7	2	26.18	0.00	26.18	35.945	23.71	4.69	6.70	97.59	.06	0.00

043 756 STANDARD DEPTHS
 0 26.27 35.956 23.69 4.71 6.74 0.00 0.10 0.00
 10 26.18 35.945 23.71 4.69 6.70 0.00 0.06 0.00

R V PALUMBO CRUISE 043 STATION PMA-5B PRNC REFERENCE 043755

DATE 05 /22/74 BARO 1017.5 WEATHER 02 WIND VELOC 02 WAVE PERIOD 4
 HOUR 10.9 TEMP DRY 24.0 VISIBILITY 7 WIND DIREC 10 TRANSPAR
 LAT 18-30.2 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 09 SONIC DEP 0190
 LONG 066-30.3 W REL HUMID 085 CLOUD AMT 1 WAVE HEIGHT 2 COLOR

CAST 1 MESS TIME 10.9 GMT, 654 LOCAL MAX DEPTH 100 WIRE ANGLE 4
 OXYGEN TITER .670 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	3	1	26.28	0.00	26.28	35.891	23.64	4.79	6.85	99.88	.07	0.00	
25	25	23	2	26.23	0.00	26.23	35.919	23.67	4.67	6.68	97.34	.08	0.00	
50	50	52	3	25.90	0.00	25.90	36.021	23.82	4.83	6.90	100.17	.06	0.00	
100	100	101	4	24.12	0.00	24.12	36.584	24.82	4.75	6.78	91.82	.13	0.00	

043 755 STANDARD DEPTHS

0	26.28	35.891	23.64	4.79	6.85	0.00	0.07	0.00
10	26.26	35.902	23.65	4.75	6.78	0.00	0.07	0.00
20	26.24	35.912	23.67	4.69	6.70	0.00	0.08	0.00
30	26.19	35.931	23.70	4.70	6.71	0.00	0.08	0.00
50	25.90	36.021	23.86	4.83	6.90	0.00	0.06	0.00
75	25.20	36.243	24.24	4.79	6.84	0.00	0.08	0.00
100	24.12	36.584	24.82	4.75	6.78	0.00	0.13	0.00

R V PALUMBO CRUISE 043 STATION PMA-5C PRNC REFERENCE 043754

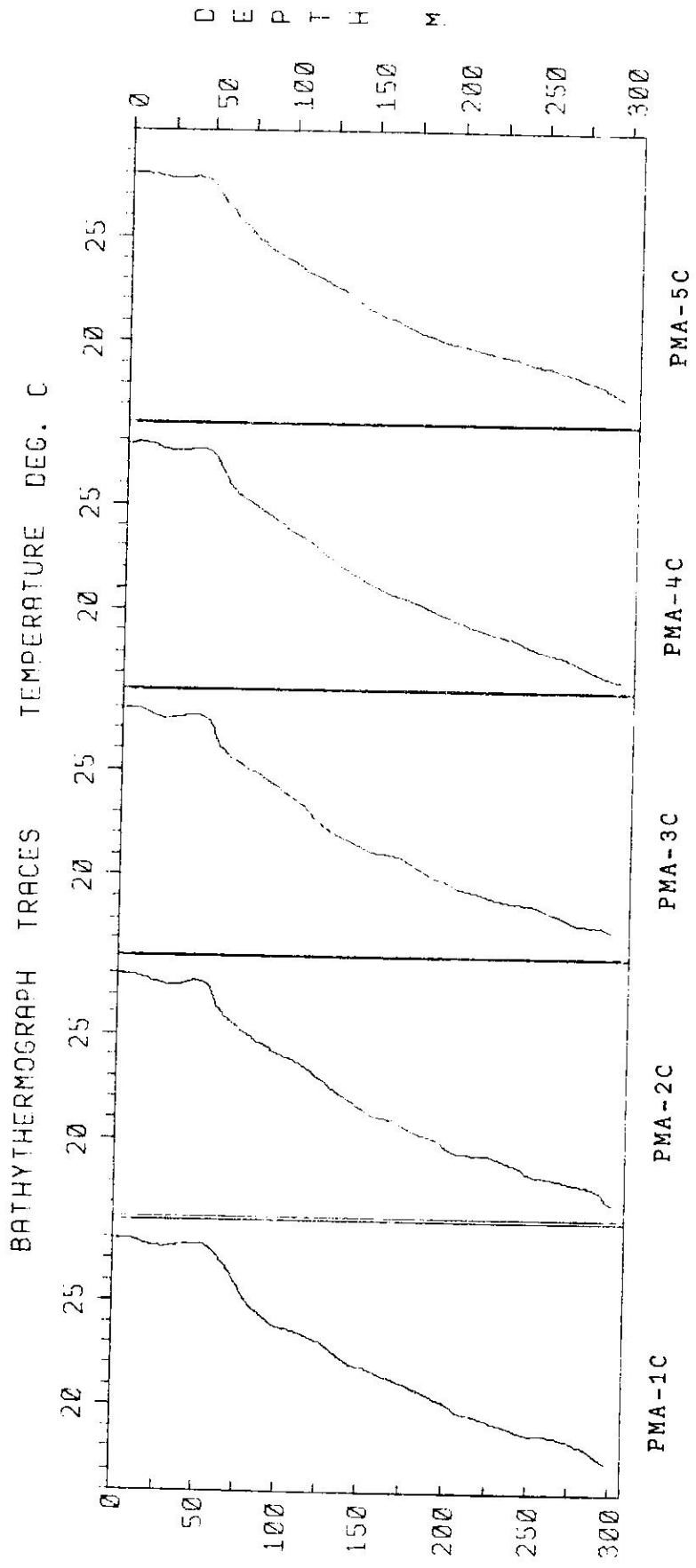
DATE 05 /22/74 BARO 1017.0 WEATHER 02 WIND VELOC 04 WAVE PERIOD 4
 HOUR 10.4 TEMP DRY 23.0 VISIBILITY 7 WIND DIREC 10 TRANSPAR
 LAT 18-31.6 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 09 SONIC DEP 0435
 LONG 066-30.4 W REL HUMID 068 CLOUD AMT 1 WAVE HEIGHT 2 COLOR

CAST 1 MESS TIME 10.4 GMT, 623 LOCAL MAX DEPTH 300 WIRE ANGLE 0
 OXYGEN TITER .670 METER WHEEL FACTOR .997

WIRE	CE	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	OXYGEN		PHOS	NITRA
										MG/L	%SAT		
0	0	0	10	26.36	0.00	26.36	35.847	23.58	4.77	6.81	99.37	.05	0.00
25	25	0	14	26.15	0.00	26.15	35.909	23.69	4.78	6.83	99.43	.09	0.00
50	50	57	12	25.79	0.00	25.79	36.016	23.89	4.82	6.89	99.84	.05	0.00
100	100	0	16	24.25	0.00	24.25	36.526	24.74	4.83	6.90	93.23	.09	0.00
150	150	152	1	21.94	0.00	21.94	36.848	25.66	4.41	6.30	84.74	.06	0.00
200	200	193	2	19.59	0.00	19.59	36.727	26.20	3.98	5.69	71.38	.24	0.00
250	250	246	3	17.99	0.00	17.99	36.547	26.48	4.14	5.91	72.90	.32	0.00
300	300	296	4	16.77	0.00	16.77	36.349	26.62	4.19	5.99	73.03	.33	0.00

043 754 STANDARD DEPTHS

0	26.36	35.847	23.58	4.77	6.81	0.00	0.05	0.00
10	26.28	35.872	23.62	4.77	6.82	0.00	0.07	0.00
20	26.20	35.896	23.67	4.78	6.83	0.00	0.08	0.00
30	26.10	35.924	23.72	4.79	6.84	0.00	0.08	0.00
50	25.79	36.016	23.89	4.82	6.89	0.00	0.05	0.00
75	25.14	36.258	24.27	4.83	6.89	0.00	0.06	0.00
100	24.25	36.526	24.74	4.83	6.90	0.00	0.09	0.00
150	21.94	36.848	25.66	4.41	6.30	0.00	0.06	0.00
200	19.59	36.727	26.20	3.98	5.69	0.00	0.24	0.00
250	17.99	36.547	26.48	4.14	5.91	0.00	0.32	0.00
300	16.77	36.349	26.62	4.19	5.99	0.00	0.33	0.00



Cruise No. PA-045
 August 15, 1974

R V PALOMAR CRUISE STATION PMA-1A PRNC REFERENCE 45812

DATE 8/15/74 BASO 1222.K WEATHER 02 WIND VELOC 05 WAVE PERIOD 4
HOUR 11.4 TEMP DRY 25.0 VISIBILITY 6 WIND DIREC 08 TRANSPAR
LAT 15-32.2 N TEMP WET 2.2 CLOUD TYPE B WAVE DIREC 07 SONIC DEP 0027
LONG 60-34.7 W REL HUMID 486 CLOUD AMT 3 WAVE HEIGHT 3 COLOR

CAST 1 WESS TIME 11.3 GAT, 720 LOCAL MAX DEPTH 10 WIRE ANGLE 4
OXYGEN TITR .71 WIER WHEEL FACDR .927

DEPTH (M)	TEMP	OXYGEN												
WIRE	CZ	TZ	BU	TL	TA	TAVE	SALIN	SIG	I	ML/L	MG/L	%SAT	PHOS	NITRA
0	1	0	1	27.82	0.22	27.82	35.331	22.72	4.65	0.65	97.62	.12	.35	
12	2	2	27.86	0.20	27.86	35.483	22.82	4.66	0.66	98.28	.04	.00		

R V EALUBO CRUISE STATION PMA-1B PRNC REFERENCE 45803

DATE 8/15/74 PAPD 1.21.2 WEATHER P2 WIND VELOC W5 WAVE PERIOD
 HOUR 7.4 TEMP DRY 26.0 VISIBILITY 7 WIND DIREC W9 TRANSPAR
 LAT 10-31.6 N TEMP WET 1.0 CLOUD TYPE 8 WAVE DIREC W9 SONIC DEP 0237
 LONG 66-34.8 W DEL WIND 194 CLOUD AMT 1 WAVE HEIGHT 1 COLOR

CAST 1 WESS TIME 7.4 G T, 324 LOCAL MAX DEPTH 10W WIRE ANGLE 9
 OXYGEN TITR 7.40 LIER WHEEL FACIOR .997

WIRE	CZ	TZ	BX	TL	TM	TAVE	SALIN	SIG. T	ML/L	MG/L	%SAT	PHOS	NITRA
25	0	0	1	27.84	0.00	27.84	35.397	22.77	4.74	6.77	99.61	.04	.00
50	0	0	2	27.57	0.00	27.57	35.779	23.14	4.78	6.85	101.00	.03	.05
100	46	0	0	27.53	0.00	27.53	36.160	23.43	4.70	6.72	96.84	.00	.00
	99	100	0	24.23	0.00	24.23	36.617	24.67	5.25	7.21	97.63	.04	.34

R V PALUMBO CRUISE STATION PMA-1C PRNC REFERENCE 45802

DATE 8/15/74 BARO 1021.5 WEATHER 02 WIND VELOC 05 WAVE PERIOD 5

HOUR 6.3 TEMP DRY 27.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR

LAT 18-31.8 N TEMP WET 2.4 CLOUD TYPE 6 WAVE DIREC 08 SONIC DEP 0360

LONG 66-34.8 W REL HUMID 294 CLOUD AMT 2 WAVE HEIGHT 1 COLOR

CAST 1 WESS TIME 6.9 GMT, 254 LOCAL MAX DEPTH 300 WIRE ANGLE 10

OXYGEN TITER 0.26% METERS WHEEL FACIOR .997

WIRE	CZ	TZ	RN	TL	TM	TAVE	SALIN	SIG	T	ML/L	MG/L	XSAT	PHOS	NITRA
25	0	0	0	27.86	0.02	27.65	35.408	22.77	4.76	6.72	96.95	00	7.33	
50	0	0	0	27.69	0.00	27.49	35.645	23.00	4.88	6.97	103.14	00	7.85	
100	0	0	0	27.63	0.00	27.65	36.270	23.46	4.66	6.66	96.31	04	8.83	
150	0	0	0	23.74	0.00	23.74	36.660	24.99	5.01	7.16	96.93	04	10.00	
200	0	0	0	21.73	0.00	21.73	36.750	25.64	4.72	6.75	90.39	04	4.57	
250	0	0	0	20.30	0.00	20.30	36.780	26.76	4.32	6.17	81.81	12	4.70	
300	0	0	0	18.57	0.00	18.57	36.588	26.66	4.22	6.03	74.67	25	9.25	
304	0	0	0	17.02	0.00	17.62	36.461	26.50	4.25	6.47	74.48	35	1.35	

R V PALUMBO CRUISE 045

STATION PMA-2A

PRNC REFERENCE 045813

DATE 08 /15/74 BARO 1022.5 WEATHER 00 WIND VELOC 05 WAVE PERIOD 4
 HOUR 11.7 TEMP DRY 26.0 VISIBILITY 6 WIND DIREC 07 TRANSPAR
 LAT 18-29.8 N TEMP WFT 0.0 CLOUD TYPE 8 WAVE DIREC 06 SONIC DEP 0023
 LONG 066-33.6 W REL HUMID 084 CLOUD AMT 3 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 11.6 GMT, 738 LOCAL MAX DEPTH 10 WIRE ANGLE 4
 OXYGEN TITER .686 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA
0	0	5	6	27.85	0.00	27.85	35.335	22.72	4.64	6.63	97.44	.05	0.00
10	10	8	4	27.89	0.00	27.89	35.575	22.88	4.45	6.36	94.17	.06	0.00
045 813 STANDARD DEPTHS													
						27.85	35.335	22.72	4.64	6.63	97.44	0.05	0.00
						27.89	35.575	22.88	4.45	6.36	94.17	0.06	0.00

R V PALUMBO CRUISE 045 STATION PMA-28 PRNC REFERENCE 045824

DATE 08 /16/74 BARO 1021.5 WEATHER 02 WIND VELOC 06 WAVE PERIOD 4
 HOUR 5.3 TEMP DRY 25.0 VISIBILITY 6 WIND DIREC 08 TRANSPAR
 LAT 18-31.2 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0196
 LONG 066-33.6 W REL HUMID 078 CLOUD AMT 2 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 5.3 GMT, 116 LOCAL MAX DEPTH 100 WIRE ANGLE 4
 OXYGEN TITER .686 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA	OXYGEN	
														TEMP	DEPTH (M)
0	0	0	1	27.76	0.00	27.76	35.531	22.89	4.72	6.75	99.66	.06	0.00		
25	25	0	2	27.62	0.00	27.62	35.674	23.05	4.71	6.73	99.61	.05	0.00		
50	50	46	6	26.92	0.00	26.92	36.273	23.72	4.74	6.78	97.81	.04	0.00		
100	100	102	4	23.55	0.00	23.55	36.629	25.03	4.88	6.96	94.11	.05	0.00		

045 824 STANDARD DEPTHS

0	27.76	35.531	22.89	4.72	6.75	99.66	0.06	0.00
10	27.70	35.588	22.95	4.72	6.74	99.65	0.06	0.00
20	27.65	35.645	23.02	4.71	6.73	99.63	0.05	0.00
30	27.54	35.781	23.15	4.71	6.73	99.88	0.05	0.00
50	26.92	36.273	23.72	4.74	6.78	97.81	0.04	0.00
75	25.56	36.591	24.39	4.80	6.86	98.82	0.04	0.00
100	23.55	36.629	25.03	4.88	6.96	94.11	0.05	0.00

R V PALUMBO CRUISE 045 STATION PMA-2C PRNC REFERENCE 045817

DATE 08 /16/74 PARO 1022.5 WEATHER 02 WIND VELOC 06 WAVE PERIOD 6
 HOUR 0.8 TEMP DRY 28.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0365
 LONG 066-33.7 W REL HUMID 088 CLOUD AMT 2 WAVE HEIGHT 2 COLOR

CAST 1 MESS TIME 0.8 GMT, 2049 LOCAL MAX DEPTH 300 WIRE ANGLE 0
 OXYGEN TITER .656 METER WHEEL FACTOR .997

DEPTH (M)	WIRE	CE	TZ	BN	TL	TEMP	TAVE	SALIN	SIG T	OXYGEN	MG/L	%SAT	PHOS	NITRA
0	0	0	0	1	27.86	0.00	27.86	35.448	22.80	4.71	6.73	99.24	.00	0.00
25	25	0	0	2	27.60	0.00	27.60	35.752	23.11	4.67	6.67	98.94	.04	0.00
50	50	51	0	6	27.73	0.00	27.73	36.397	23.55	4.72	6.74	97.90	.00	0.00
100	100	97	0	4	24.02	0.00	24.02	36.608	24.87	4.95	7.07	95.77	.04	0.00
150	150	0	0	5	21.29	0.00	21.29	36.724	25.74	4.59	6.55	87.47	.05	0.00
200	200	197	0	7	19.58	0.00	19.58	36.654	26.15	4.35	6.21	77.63	.07	0.00
250	250	246	0	8	18.37	0.00	18.37	36.548	26.38	4.26	6.08	75.17	.26	0.00
300	300	0	0	16	19.23	0.00	19.23	36.664	26.25	4.57	6.53	81.52	.00	0.00

045 817 STANDARD DEPTHS

0	27.86	35.448	22.80	4.71	6.73	99.24	0.00
10	27.76	35.570	22.92	4.69	6.71	99.14	0.00
20	27.64	35.684	23.05	4.68	6.68	98.95	0.00
30	27.63	35.877	23.20	4.67	6.68	99.42	0.00
50	27.73	36.397	23.52	4.72	6.74	97.90	0.00
75	26.14	36.598	24.21	4.81	6.87	99.43	0.00
100	24.02	36.608	24.87	4.95	7.07	95.77	0.00
150	21.29	36.724	25.74	4.59	6.55	87.47	0.00
200	19.58	36.654	26.15	4.35	6.21	77.63	0.00
250	18.37	36.548	26.38	4.26	6.08	75.17	0.00
300	19.23	36.664	26.25	4.57	6.53	81.52	0.00

pre-trip 19.23 36.664 26.25 4.57 6.53 81.52 0.33 0.00

pre-trip ?

R V PALUMBO CRUISE 045 STATION PMA-3A PRNC REFERENCE 045814

DATE 06 /15/74 BARO 1022.5 WEATHER 02 WIND VELOC 05 WAVE PERIOD 4
HOUR 11.8 TEMP DRY 26.0 VISIBILITY 6 WIND DIREC 07 TRANSPAR
LAT 18-29.6 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 06 SONIC DEP 0021
LONG 066-32.8 W REL HUMID 081 CLOUD AMT 4 WAVE HEIGHT 3 COLOR

CAST 1 MESS TIME 11.9 GMT, 754 LOCAL MAX DEPTH 10 WIRE ANGLE 0
OXYGEN TITER .686 METER WHEEL FACTOR .997

159

DEPTH (M)		TEMP		OXYGEN									
WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	1	27.65	0.00	27.65	34.887	22.45	4.68	6.68	96.65	.00	0.00
10	10	0	2	27.78	0.00	27.78	35.637	22.97	4.58	6.54	96.97	.03	0.00
045 814 STANDARD DEPTHS													
	0			27.65	34.887	22.44	4.68	6.68	96.65	0.06	0.00		
	10			27.78	35.637	22.97	4.58	6.54	96.97	0.22	0.00		

R V PALUMBO CRUISE 045

STATION PMA-38

PRNC REFERENCE 045823

DATE 08 /16/74 BARO 1022.5 WEATHER 02 WIND VELOC 06 WAVE PERIOD 4
 HOUR 4.8 TEMP DRY 25.0 VISIBILITY 6 WIND DIREC 08 TRANSPAR
 LAT 18-30.9 N TEMP WFT 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0198
 LONG 066-32.7 W REL HUMID 078 CLOUD AMT 3 WAVE HEIGHT 4 COLOR

CAST 1 MESS TIME 4.9 AMT, 2453 LOCAL MAX DEPTH 100 WIRE ANGLE 0
 OXYGEN TITR .686 METER WHEEL FACTOR .997

WIPE	CZ	TZ	RN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
															DEPTH (M)	STANDARD DEPTHS
0	0	0	1	27.76	0.00		27.76	35.549	22.91	4.93	7.04	104.06	.04	0.00		
25	25	0	2	27.63	0.00		27.63	35.678	23.25	4.68	6.68	98.92	.95	0.00		
50	50	47	6	26.62	0.00		26.62	36.012	23.62	4.79	6.84	100.50	.06	0.00		
100	100	98	4	23.74	0.00		23.74	36.596	24.95	4.93	7.04	95.17	.07	0.00		

045 823 STANDARD DEPTHS

13	27.76	35.549	22.91	4.93	7.04	104.06	.04	0.00
20	27.71	35.601	22.96	4.83	6.90	102.01	.04	0.00
30	27.66	35.648	23.22	4.72	6.74	99.78	.05	0.00
50	27.49	35.735	23.14	4.68	6.69	98.95	.05	0.00
75	26.62	36.012	23.62	4.79	6.84	100.50	.06	0.00
100	25.32	36.318	24.26	4.87	6.96	99.86	.07	0.00

R V PALUMBO CRUISE 045 STATION PMA-3C PRNC REFERENCE 045818

DATE 08 /16/74 BARO 1021.5 WEATHER 02 WIND VELOC 06 WAVE PERIOD 5
 HOUR 1.8 TEMP DRY 27.0 VISIBILITY 7 WIND DIREC 08 TRANSPAR
 LAT 18-31.7 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0475
 LONG 066-32.7 W REL HUMID 087 CLOUD AMT 2 WAVE HEIGHT 2 COLOR

CAST 1 MESS TIME 1.7 GMT, 2143 LOCAL MAX DEPTH 300 WIRE ANGLE 13
 OXYGEN TITER .686 METER WHEEL FACTOR .997

DEPTH (M) TEMP OXYGEN

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	1	27.84	0.00	27.84	35.460	22.81	4.68	6.68	98.53	.00	0.00
25	25	0	2	27.64	0.00	27.64	35.721	23.07	4.78	6.83	101.24	.00	0.00
50	49	46	6	27.54	0.00	27.54	36.406	23.62	4.75	6.79	98.55	.00	0.00
100	98	97	4	23.99	0.00	23.99	36.579	24.86	4.93	7.04	95.25	.00	0.00
150	146	0	2	21.21	0.00	21.21	36.693	25.74	4.63	6.61	88.16	.03	0.00
200	195	196	7	19.57	0.00	19.57	36.650	26.15	4.34	6.20	77.49	.06	0.00
250	243	245	8	16.44	0.00	16.44	36.541	26.36	4.22	6.03	74.58	.25	0.00
300	292	0	16	19.26	0.00	19.26	36.382	26.03	4.79	6.85	84.48	.07	0.00

← pre-trip

045 818 STANDARD DEPTHS

0	27.84	35.460	22.81	4.68	6.68	98.53	0.00
10	27.76	35.564	22.92	4.72	6.74	99.62	0.00
20	27.68	35.660	23.02	4.76	6.80	100.73	0.00
30	27.61	35.856	23.19	4.77	6.82	101.48	0.00
50	27.49	36.418	23.65	4.75	6.79	98.57	0.00
75	25.89	36.498	24.22	4.81	6.87	99.04	0.00
100	23.86	36.586	24.90	4.92	7.03	95.05	0.00
150	21.04	36.689	25.79	4.60	6.57	87.55	0.12
200	19.40	36.641	26.19	4.32	6.17	77.02	0.08
250	18.50	36.520	26.33	4.28	6.12	75.61	0.24
300	19.39	36.356	25.97	4.89	6.98	86.08	0.04

← pre-trip

?

R V PALUMBO CRUISE 045 STATION PMA-4A PKNC REFERENCE 045815

DATE 08 / 12 / 74 PASO 1022.5 WEATHER 92 WIND VELOC 05 WAVE PERIOD 4
 HOUR 12.2 TEMP DRY 26.0 VISIBILITY 6 WIND DIREC 07 TRANSPAR
 LAT 18-29.4 N TEMP WET 2.0 CLOUD TYPE 8 WAVE DIREC 06 SONIC DEP 0022
 LONG 206-31.3 W REL HUMID 280 CLOUD AMT 3 WAVE HEIGHT 3 COLOR

CASI 1 WESS TIME 12.1 GMT, 8 9 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITR .856 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
10	10	4	6	27.74	0.00	27.74	34.809	22.36	4.64	6.62	95.64	.04	0.00	
10	10	6	6	27.91	0.00	27.91	35.538	22.85	4.52	6.44	95.24	.06	0.00	
STANDARD DEPTHS														
045 515							27.74	34.809	22.36	4.64	6.62	95.64	0.04	0.00
							27.91	35.538	22.85	4.50	6.44	95.24	0.06	0.00

R V PALUMBO CRUISE 042

STATION PMA-48

PRNC REFERENCE 045822

DATE 08 /16/74 BARO 1021.5 WEATHER 02 WIND VELOC 06 WAVE PERIOD 5
 HOUR 4.3 TEMP DRY 23.0 VISIBILITY 6 WIND DIREC 08 TRANSPAR
 LAT 18-32.9 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 06 SONIC DEP 0197
 LONG 066-31.6 W REL HUMID 086 CLOUD AMT 3 WAVE HEIGHT 4 COLOR

CAST 1 MESS TIME 4.2 G.I. 029 LOCAL MAX DEPTH 100 WIRE ANGLE 15
 OXYGEN TITER .680 METER WHEEL FACTOR .997

DEPTH (M)	WIPE	CR	TZ	BN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	1	27.77	0.20	27.77	35.527	22.89	4.70	6.72	99.23	.05	0.00		
25	25	0	2	27.61	0.20	27.61	35.702	23.07	4.71	6.73	99.68	.07	0.00		
50	49	51	6	27.40	0.20	27.40	36.358	23.63	4.65	6.64	96.22	.07	0.00		
100	57	96	4	23.66	0.20	23.66	36.629	24.99	4.85	6.94	93.78	.04	0.00		
045 822 STANDARD DEPTHS															
0							27.77	35.527	22.89	4.70	6.72	99.23	0.05	0.00	
10							27.71	35.597	22.96	4.71	6.72	99.42	0.06	0.00	
20							27.64	35.627	23.03	4.71	6.73	99.57	0.07	0.00	
30							27.57	35.827	23.16	4.70	6.71	99.70	0.07	0.00	
50							27.34	36.371	23.66	4.65	6.64	96.28	0.07	0.00	
75							25.65	36.591	24.36	4.73	6.76	97.50	0.06	0.00	
100							23.43	36.646	25.06	4.87	6.92	93.94	0.04	0.00	

R V PALUMBO CRUISE 045

STATION PMA-4C

PRNC REFERENCE 045819

DATE 06 /16/74 BARO 1021.5 WEATHER 02 WIND VELOC 06 WAVE PERIOD 5
 HOUR 2.7 TEMP DRY 27.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0347
 LONG 066-35.8 W REL HUMID 086 CLOUD AMI 2 WAVE HEIGHT 2 COLOR

CAST 1 MESS TIME 2.0 GMT, 2237 LOCAL MAX DEPTH 300 WIRE ANGLE 10
 OXYGEN TITR .690 METER WHEEL FACTOR .997

DEPTH (M)	WIRE	CZ	TZ	RN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	OXYGEN	%SAT	PHOS	NITRA
25	25	0	0	2	27.83	0.20	27.83	27.83	35.445	22.81	4.65	6.64	97.89	.00	0.00
50	50	0	0	2	27.54	0.00	27.54	27.54	35.762	23.14	4.83	6.90	102.23	.00	0.00
100	59	48	97	6	27.62	0.00	27.62	27.62	36.420	23.61	4.76	6.80	98.77	.00	0.00
150	146	0	0	4	23.95	0.20	23.95	23.95	36.586	24.88	4.92	7.02	94.99	.00	0.00
200	197	0	0	5	21.25	2.00	21.25	21.25	36.711	25.74	4.90	7.00	93.46	.03	0.00
250	246	247	0	7	19.59	0.00	19.59	19.59	36.636	26.13	4.37	6.24	77.95	.08	0.00
300	295	0	0	8	18.44	2.00	18.44	18.44	36.567	26.35	4.17	5.96	73.60	.26	0.00
				16	19.26	0.00	19.26	19.26	36.416	26.05	4.71	6.73	83.15	.06	0.00

← pre-trip

045 019 STANDARD DEPTHS

0	27.83	35.445	22.81	4.65	6.64	97.89	0.0	0.00
10	27.71	35.572	22.94	4.72	6.74	99.64	0.0	0.00
20	27.59	35.692	23.07	4.80	6.85	101.44	0.0	0.00
30	27.50	35.891	23.23	4.82	6.89	102.54	0.0	0.00
50	27.62	36.420	23.61	4.76	6.80	98.77	0.0	0.00
75	26.00	36.505	24.19	4.83	6.89	99.49	0.0	0.00
100	23.89	36.590	24.90	4.92	7.02	94.96	0.0	0.00
150	21.20	36.710	25.76	4.88	6.98	93.03	0.03	0.00
200	12.48	36.631	26.16	4.35	6.21	77.48	0.09	0.00
250	18.47	36.528	26.34	4.27	6.00	74.12	0.25	0.00
300	19.34	36.404	26.02	4.77	6.81	84.11	0.04	0.00

← pre-trip

R V PALUMBO CRUISE 045

STATION PMA-5A

PRNC REFERENCE 045816

DATE 08 /15/74 BARO 1022.5 WEATHER 02 WIND VELOC 05 WAVE PERIOD 4
 HOUR 12.5 TEMP DRY 26.2 VISIBILITY 6 WIND DIREC 06 TRANSPAR
 LAT 18-29.3 N TEMP WFT 0.0 CLOUD TYPE 8 WAVE DIREC 05 SONIC DEP 0021
 LONG 166-30.6 W REL HUMID 079 CLOUD AMT 3 WAVE HEIGHT 3 COLOR

CASI 1 MESS TIME 12.4 GJT, 026 LOCAL MAX DEPTH 10 WIRE ANGLE 3

OXYGEN TITER .506 METER WHEEL FACTOR .997

165

WIRE	CZ	TZ	SN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
2	0	0	1	27.81	0.00	27.81	35.474	22.83	4.54	6.48	95.65	.00	0.00
10	10	0	2	27.88	0.00	27.68	35.555	22.87	4.48	6.41	94.82	.04	0.00

045 816 STANDARD DEPTHS

0	27.81	35.474	22.83	4.54	6.48	95.65	0.05	0.00
10	27.88	35.555	22.87	4.48	6.41	94.82	0.06	0.00

R V PALUMBO CRUISE 045 STATION PMA-58 PRNC REFERENCE 045821

DATE 08 /16/74 BARO 1022.0 WEATHER 02 WIND VELOC 06 WAVE PERIOD 5
 HOUR 3.9 TEMP DRY 27.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-30.7 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0201
 LONG 066-30.5 W REL HUMID 087 CLOUD AMT 2 WAVE HEIGHT 2 COLOR

CAST 1 MESS TIME 3.9 SFI, 2355 LOCAL MAX DEPTH 100 WIRE ANGLE 11
 OXYGEN TITER .626 METER WHEEL FACTOR .997

WIRE	CZ	DEPTH (M)	TEMP		OXYGEN		SIG T	SALIN	%SAT	PHOS	NITRA		
			T2	TL	TM	TL						ML/L	MG/L
0	0	0	27.88	27.88	0.00	27.88	35.608	22.91	4.64	6.63	98.32	.07	0.00
25	0	25	27.77	27.77	0.00	27.77	35.608	22.95	4.73	6.76	100.06	.03	0.00
50	49	49	27.76	27.76	0.00	27.76	36.423	23.58	4.84	6.92	100.23	.00	0.00
100	97	97	23.71	23.71	0.00	23.71	36.641	24.99	5.06	7.25	97.82	.06	0.00

WIRE	CZ	DEPTH (M)	TEMP		OXYGEN		SIG T	SALIN	%SAT	PHOS	NITRA		
			T2	TL	TM	TL						ML/L	MG/L
0	0	0	27.88	27.88	0.00	27.88	35.608	22.91	4.64	6.63	98.32	.07	0.00
10		10	27.84	27.84	0.00	27.84	35.608	22.93	4.68	6.60	99.02	.05	0.00
20		20	27.79	27.79	0.00	27.79	35.608	22.94	4.71	6.73	99.70	.04	0.00
30		30	27.75	27.75	0.00	27.75	35.753	23.06	4.75	6.79	100.94	.03	0.00
50		50	27.64	27.64	0.00	27.64	36.437	23.61	4.85	6.92	100.64	.04	0.00
75		75	23.90	23.90	0.00	23.90	36.539	24.24	4.96	7.08	102.21	.05	0.00
100		100	23.55	23.55	0.00	23.55	36.620	25.24	5.07	7.24	97.93	.06	0.00

045 821 STANDARD DEPTHS

R V PALUMBO CRUISE 045 STATION PMA-5C PRNC REFERENCE 045820

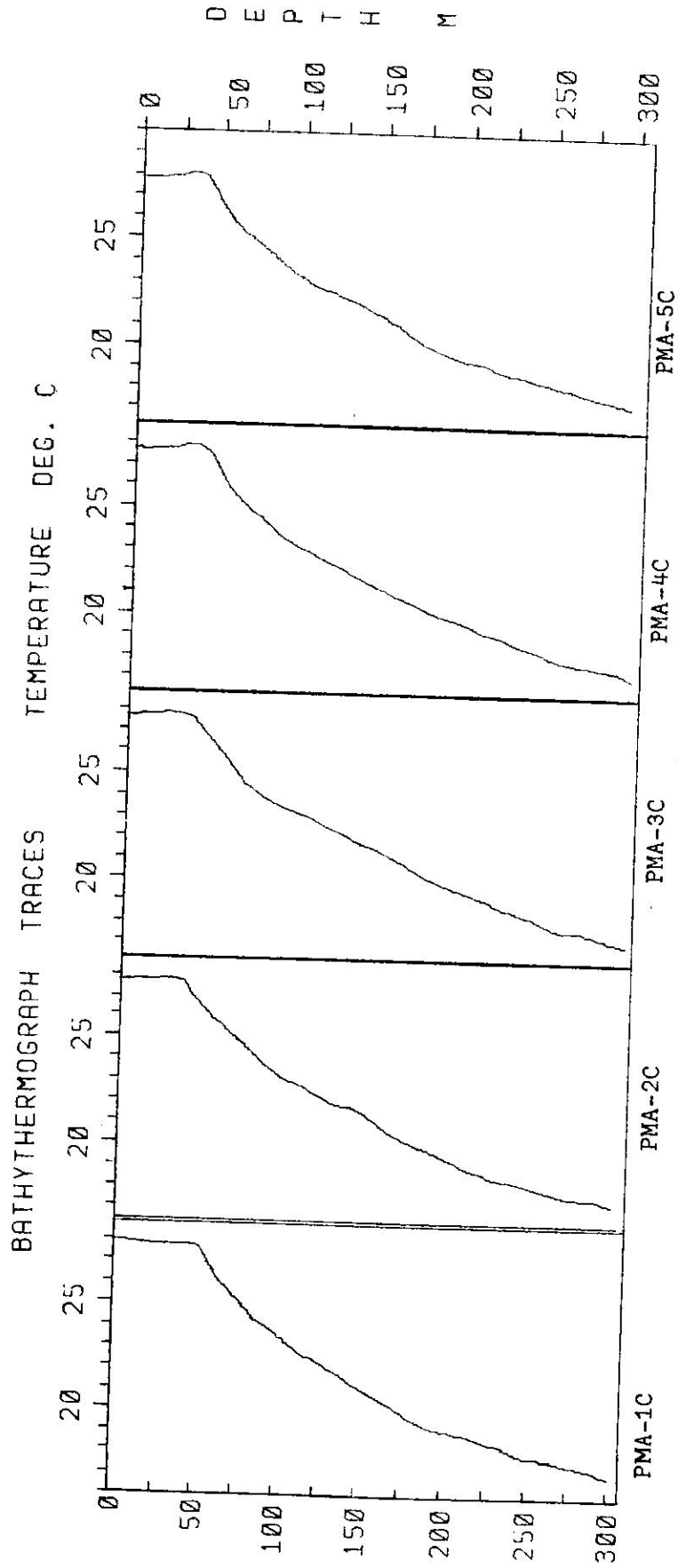
DATE 08 /16/74 BARO 1021.5 WEATHER 02 WIND VELOC 06 WAVE PERIOD 5
 HOUR 3.4 TEMP DRY 27.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0362
 LONG 066-30.5 W REL HUMID 086 CLOUD AMT 2 WAVE HEIGHT 2 COLOR

CAST 1 MESS TIME 3.3 GMT, 2319 LOCAL MAX DEPTH 300 WIRE ANGLE 25
 OXYGEN TITER .606 METER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA	OXYGEN	
														DEPTH (M)	TEMP
0	0	0	1	27.83	0.00	27.83	35.464	22.82	4.75	6.79	100.12	.06	0.00		
25	23	0	2	27.59	0.00	27.59	35.765	23.12	4.72	6.74	99.99	.05	0.00		
50	46	48	6	27.66	0.00	27.66	36.408	23.58	4.60	6.57	95.48	.00	0.00		
100	91	90	4	23.97	0.00	23.97	36.974	24.86	4.96	7.08	95.75	.05	0.00		
150	136	0	5	21.47	0.00	21.47	36.697	25.67	4.72	6.74	90.02	.04	0.00		
200	181	187	7	20.05	0.00	20.05	36.703	26.06	4.36	6.23	82.45	.08	0.00		
250	226	239	8	18.85	0.00	18.85	36.579	26.28	4.24	6.06	75.22	.21	0.00		
300	272	0	16	17.84	0.00	17.84	36.470	26.45	4.42	6.32	77.66	.28	0.00		

045 820 STANDARD DEPTHS

0	27.83	35.464	22.82	4.75	6.79	100.12	0.06	0.00
10	27.73	35.595	22.95	4.74	6.77	100.08	0.06	0.00
20	27.62	35.720	23.08	4.72	6.75	100.01	0.05	0.00
30	27.61	35.957	23.26	4.68	6.68	99.73	0.04	0.00
50	27.41	36.453	23.70	4.63	6.61	96.07	0.00	0.00
75	25.50	36.515	24.35	4.82	6.89	99.12	0.03	0.00
100	23.36	36.605	25.06	4.94	7.05	95.15	0.05	0.00
150	20.96	36.699	25.82	4.60	6.57	87.49	0.05	0.00
200	19.52	36.658	26.17	4.28	6.12	76.46	0.13	0.00
250	18.31	36.521	26.38	4.32	6.17	76.15	0.25	0.00
300	17.23	36.404	26.55	4.53	6.47	79.20	0.32	0.00



Cruise No. PA-050
 October 31, 1974

R V PALUMBO CRUISE STATION PMA-1A PRNC REFERENCE 50923

DATE 10/31/74 BAROM 1010.6 WEATHER 02 WIND VELOC 02 WAVE PERIOD 2
HOUR 10.0 TEMP DRY 26.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
LAT 18-30.3 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 06 SONIC DEP 0017
LONG 66-35.7 W REL HUMID 091 CLOUD AMT 5 WAVE HEIGHT 7 COLOR

CAST 1 MESS TIME 10.9 GMT. 652 LOCAL MAX DEPTH 10 WIRE ANGLE 2
OXYGEN TIER 710 METER WHEEL FACTOR .997

DEPTH (M)	TEMP		OXYGEN				PHOS	NITRA			
	TZ	TL	TAVE	SALIN	SIG T	ML/L			MG/L	%SAT	
0	0	27.24	0.00	27.24	34.152	22.03	4.76	6.80	99.58	.05	.06
10	0	27.97	0.00	27.97	34.843	22.31	4.85	6.93	100.37	.06	.03

R V PALUMBO CRUISE STATION PMA-1B PRNC REFERENCE 50922

DATE 10/31/74 BARO 1016.5 WEATHER 02 WIND VELOC WAVE PERIOD 4
 HOUR 10.1 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC TRANSPAR
 LAT 18-31.0 N TEMP WET 0.0 CLOUD TYPE 0 WAVE DIREC 07 SONIC DEP 0176
 LONG 66-34.8 W REL HUMID 090 CLOUD AMT 8 WAVE HEIGHT 5 COLOR

CAST 1 MESS TIME 10.1 GMT, 6 LOCAL MAX DEPTH 100 WIRE ANGLE 0
 OXYGEN TIER .718 MEIER WHEEL FACTOR .997

WIRE	CZ	TZ	BN	TL	IM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA
0	0	0	1	27.32	0.00	27.32	34.183	22.02	4.84	6.91	101.45	.10	.67	
25	0	0	2	27.81	0.00	27.81	35.437	22.81	4.78	6.83	100.61	.07	0.40	
50	50	50	3	27.56	0.00	27.56	36.263	23.51	4.69	6.71	96.96	.03	3.99	
100	99	99	4	24.00	0.00	24.00	36.655	24.91	4.85	6.93	94.01	.05	1.99	

R V PALUMBO CRUISE STATION PMA-10 PRNC REFERENCE 50913

DATE 10/31/74 BARO 1017.6 WEATHER 02 WIND VELOC 02 WAVE PERIOD 4
 HOUR 4.3 TEMP DRY 25.0 VISIBILITY WIND DIREC 09 TRANSPAR
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 06 SONIC DEP 0402
 LONG 66-34.8 W REL HUMID 086 CLOUD AMT 6 WAVE HEIGHT 5 COLOR

CAST 1 MESS TIME 4.2 GMT, 013 LOCAL MAX DEPTH 300 WIRE ANGLE 0
 OXYGEN TITER .718 MEYER WHEEL FACTOR .997

WIRE	DEPTH (M)		TZ	BN	TL	TM	TAVE	SALIN	SIG. T	OXYGEN			PHOS	NITRA
	CZ	0Z								ML/L	MG/L	XSAT		
0	0	0	0	1	27.87	0.00	27.87	34.238	21.89	4.94	7.05	104.71	.07	.79
25	25	0	0	2	27.81	0.00	27.81	35.396	22.78	4.87	6.95	102.29	.05	4.01
50	50	48	0	3	28.21	0.00	28.21	36.322	23.34	4.74	6.77	98.28	.04	.20
100	100	100	0	4	23.33	0.00	23.33	36.714	25.15	4.78	6.83	92.40	.05	5.39
150	150	144	0	5	20.66	0.00	20.66	36.706	25.90	4.44	6.35	84.33	.11	5.39
200	200	197	0	6	19.02	0.00	19.02	36.591	26.25	4.40	6.29	78.09	.15	6.73
250	250	251	0	7	17.77	0.00	17.77	36.457	26.46	4.39	6.27	77.08	.30	8.18
300	300	293	0	8	16.95	0.00	16.95	36.324	26.56	4.41	6.30	76.79	.42	15.46

R V PALUMBO CRUISE 050 STATION PMA-2A PRNC REFERENCE 050928

DATE 10 /31/74 BARO 1017.7 WEATHER 00 WIND VELOC 02 WAVE PERIOD 4
 HOUR 12.9 TEMP DRY 26.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-29.6 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 04 SONIC DEP 0019
 LONG 066-33.8 W REL HUMID 086 CLOUD AMT 7 WAVE HEIGHT 7 COLOR

CAST 1 MESS TIME 13.0 GMT, 859 LOCAL MAX DEPTH 10 WIRE ANGLE 2
 OXYGEN TITER .710 METER WHEEL FACTOR .997

DEPTH (M)	WIRE	CZ	TZ	BN	TL	TM	TEMP	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA
0	0	0	5	3	27.72	0.00	27.72	34.660	22.25	4.79	6.85	98.47	.08	0.00	
10	10	11	4	4	27.86	0.00	27.86	35.233	22.64	4.85	6.93	101.52	.06	0.00	
050 928 STANDARD DEPTHS															
0					27.72	34.660	22.25	4.79	6.85	98.47	0.08	0.00			
10					27.86	35.233	22.64	4.85	6.93	101.52	0.06	0.00			

R V PALUMBO CRUISE 050 STATION PMA-28 PRNC REFERENCE 050939

DATE 11 /01/74 BARQ 1017.7 WEATHER 02 WIND VELOC 03 WAVE PERIOD 5
 HOUR 2.0 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-30.9 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 08 SONIC DEP 0169
 LONG 066-34.1 W REL HUMID 083 CLOUD AMT 6 WAVE HEIGHT 7 COLOR

CAST 1 MESS TIME 2.8 GMT, 2245 LOCAL MAX DEPTH 100 WIRE ANGLE 0
 OXYGEN TITER .710 METER WHEEL FACTOR .997

WIRE	CZ	DEPTH (M)	TEMP				OXYGEN				XSAT	PHOS	NITRA	
			TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L				MG/L
0	0	0	0	1	27.31	0.00	27.31	33.796	21.74	4.87	6.96	101.16	.15	0.00
25	25	0	0	2	27.75	0.00	27.75	35.797	23.10	4.68	6.69	99.52	.04	0.00
50	50	54	54	3	26.36	0.00	26.36	36.362	23.97	4.72	6.75	97.31	.05	0.00
100	100	100	100	4	22.83	0.00	22.83	36.742	25.32	4.79	6.84	92.30	.08	0.00
STANDARD DEPTHS														
050	939	0			27.31			33.796	21.73	4.87	6.96	101.16	0.15	0.00
		10			27.49			34.596	22.28	4.80	6.85	98.21	0.11	0.00
		20			27.66			35.426	22.85	4.71	6.73	99.00	0.06	0.00
		30			27.58			35.997	23.30	4.69	6.70	100.03	0.04	0.00
		50			26.36			36.362	23.97	4.72	6.75	97.31	0.05	0.00
		75			24.72			36.677	24.71	4.76	6.80	92.71	0.06	0.00
		100			22.83			36.742	25.32	4.79	6.84	92.30	0.08	0.00

R V PALUMBO CRUISE 050
 STATION PMA-2C
 PRNC REFERENCE 050938

DATE 11 /01/74 BARO 1017.6 WEATHER 02 WIND VELOC 04 WAVE PERIOD 5
 HOUR 2.2 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 CLOUD AMT 6 WAVE DIREC 08 SONIC DEP 0410
 LONG 066-33.8 W REL HUMID 076 METER WHEEL FACTOR .997 WAVE HEIGHT 5 COLOR

CAST 1 MESS TIME 2.2 GMT, 2213 LOCAL MAX DEPTH 300 WIRE ANGLE 5
 OXYGEN TITER .718

WIRE	DEPTH (M)		TEMP		TAVE	SALIN	SIG T	OXYGEN		XSAT	PHOS	NITRA	
	CZ	TZ	TL	TM				ML/L	MG/L				
0	0	0	1	27.71	0.00	27.71	34.680	22.27	4.99	7.13	102.51	.10	0.00
25	25	0	2	27.82	0.00	27.82	35.830	23.10	4.72	6.75	100.65	.00	0.00
50	50	51	3	26.28	0.00	26.28	36.398	24.02	4.92	7.02	101.33	.04	0.00
100	100	100	4	23.06	0.00	23.06	36.749	25.26	4.85	6.93	93.71	.04	0.00
150	149	149	5	21.04	0.00	21.04	36.766	25.84	4.47	6.39	85.17	.07	0.00
200	199	197	6	19.14	0.00	19.14	36.603	26.23	4.41	6.31	78.44	.13	0.00
250	249	253	7	17.89	0.00	17.89	36.472	26.44	4.43	6.33	77.79	.25	0.00
300	298	298	8	17.10	0.00	17.10	36.358	26.55	4.38	6.25	76.40	.42	0.00
STANDARD DEPTHS													
050 938	0												
	10			27.71	34.680	22.27	4.99	7.13	102.51	0.10	0.00		
	20			27.75	35.140	22.60	4.88	6.97	101.75	0.06	0.00		
	30			27.80	35.612	22.94	4.77	6.81	100.86	0.05	0.00		
	50			27.60	35.985	23.29	4.74	6.78	101.20	0.05	0.00		
	75			26.28	36.398	24.02	4.92	7.02	101.33	0.04	0.00		
	100			24.61	36.660	24.73	4.88	6.98	95.02	0.04	0.00		
	150			23.06	36.749	25.26	4.85	6.93	93.71	0.04	0.00		
	200			21.00	36.763	25.85	4.47	6.38	85.08	0.07	0.00		
	250			19.11	36.600	26.23	4.41	6.31	78.42	0.13	0.00		
	300			17.87	36.470	26.45	4.43	6.33	77.76	0.25	0.00		
				17.07	36.353	26.55	4.38	6.25	76.34	0.43	0.00		

R V PALUMBO CRUISE 050 STATION PMA-3C PRNC REFERENCE 050937

DATE 11 /01/74 BARO 1017.7 WEATHER 02 WIND VELOC 05 WAVE PERIOD 4
 HOUR 1.7 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 06 SONIC DEP 0390
 LONG 066-32.9 W REL HUMID 081 CLOUD AMT 5 WAVE HEIGHT 7 COLOR

CAST 1 MESS TIME 1.4 GMT, 2123 LOCAL MAX DEPTH 100 WIRE ANGLE 2
 OXYGEN TITER .718 METER WHEEL FACTOR .997

DEPTH (M)		TEMP				OXYGEN				PHOS		NITRA	
WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	1	27.75	0.00	27.75	34.677	22.25	4.92	7.03	101.19	.05	0.33
25	25	0	2	27.73	0.00	27.73	35.820	23.12	4.72	6.75	100.47	.03	0.45
50	50	50	3	26.40	0.00	26.40	36.372	23.96	4.79	6.84	98.68	.04	0.16
100	100	100	4	23.27	0.00	23.27	36.746	25.20	4.85	6.93	93.84	.10	0.56

CAST 2 MESS TIME 1.6 GMT, 2137 LOCAL MAX DEPTH 300 WIRE ANGLE 0
 OXYGEN TITER .718 METER WHEEL FACTOR .997

DEPTH (M)		TEMP				OXYGEN				PHOS		NITRA	
WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
150	150	149	2	21.52	0.00	21.52	36.757	25.70	3.22	4.60	61.57	.09	1.90
200	200	194	6	19.62	0.00	19.62	36.640	26.13	4.36	6.22	77.77	.09	4.76
250	250	248	7	18.04	0.00	18.04	36.497	26.42	4.38	6.25	77.02	.26	11.79
300	300	292	8	17.10	0.00	17.10	36.407	26.59	4.36	6.22	76.11	.42	14.62

050 937 STANDARD DEPTHS

0	0	27.75	34.677	22.25	4.92	7.03	101.19	0.05	0.33
10	10	27.74	35.134	22.60	4.84	6.92	100.92	0.04	0.38
20	20	27.73	35.603	22.96	4.76	6.80	100.55	0.03	0.43
30	30	27.54	35.972	23.30	4.74	6.77	100.90	0.03	0.40
50	50	26.40	36.372	23.96	4.79	6.84	98.68	0.04	0.16
75	75	24.79	36.643	24.67	4.83	6.90	94.01	0.07	0.20
100	100	23.27	36.746	25.20	4.85	6.93	93.84	0.10	0.56
150	150	21.52	36.757	25.71	3.22	4.60	61.57	0.09	1.90
200	200	19.62	36.640	26.13	4.36	6.22	77.77	0.09	4.76
250	250	18.04	36.497	26.43	4.38	6.25	77.02	0.26	11.79
300	300	17.10	36.407	26.59	4.36	6.22	76.11	0.42	14.62

R V PALUMBO CRUISE 050 STATION PMA-4A PRNC REFERENCE 050930

DATE 10 /31/74 BARO 1017.7 WEATHER 02 WIND VELOC 02 WAVE PERIOD 4
 HOUR 13.6 TEMP DRY 26.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-29.4 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 05 SONIC DEP 0018
 LONG 066-31.3 W REL HUMID 086 CLOUD AMT 7 WAVE HEIGHT 1 COLOR

CAST 1 MESS TIME 13.5 GMT, 932 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER .718 METER WHEEL FACTOR .997

DEPTH (M)	WIRE	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	%SAT	PHOS	NITRA
0	0	0	1	3	27.69	0.00	27.69	33.872	21.67	4.84	6.92	101.30	.18	0.00
10	10	9	4	27.89	0.00	27.89	35.158	22.57	4.78	6.83	99.81	.00	0.00	

050 930 STANDARD DEPTHS
 0
 10
 27.69 33.872 21.67 4.84 6.92 101.30 0.05 0.
 27.89 35.158 22.57 4.78 6.83 99.81 0.04 0.

R V PALUMBO CRUISE 050 STATION PMA-48 PRNC REFERENCE 050935

DATE 11 /01/74 BARO 1017.7 WEATHER 02 WIND VELOC 04 WAVE PERIOD 4
 HOUR 24.4 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-30.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 06 SONIC DEP 0173
 LONG 066-31.7 W REL HUMID 085 CLOUD AMT 7 WAVE HEIGHT 5 COLOR

CAST 1 MESS TIME 0.4 GMT, 2023 LOCAL MAX DEPTH 100 WIRE ANGLE 4
 OXYGEN TITER .710 METER WHEEL FACTOR .997

WIRE	CZ	DEPTH (M)	TEMP				OXYGEN				XSAT	PHOS	NITRA	
			TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L				MG/L
0	0	0	0	1	27.82	0.00	27.82	34.978	22.46	4.84	6.92	100.53	.03	0.00
25	25	0	0	2	27.78	0.00	27.78	35.589	22.93	4.67	6.67	98.77	.03	0.00
50	50	53	0	3	26.97	0.00	26.97	36.348	23.76	4.83	6.90	99.77	.04	0.00
100	100	100	0	4	23.25	0.00	23.25	36.713	25.18	4.74	6.78	91.65	.06	0.00

050 935 STANDARD DEPTHS

0	27.82	34.978	22.46	4.84	6.92	100.53	0.03	0.
10	27.80	35.222	22.65	4.78	6.82	99.84	0.03	0.
20	27.79	35.464	22.83	4.70	6.71	98.98	0.03	0.
30	27.69	35.748	23.08	4.69	6.70	99.53	0.03	0.
50	26.97	36.348	23.76	4.83	6.90	99.77	0.04	0.
75	25.46	36.530	24.38	4.79	6.84	98.43	0.05	0.
100	23.25	36.713	25.18	4.74	6.78	91.65	0.06	0.

R V PALUMBO CRUISE 050 STATION PMA-4C PRNC REFERENCE 050934

DATE 10 /31/74 BARO 1017.5 WEATHER 02 WIND VELOC 05 WAVE PERIOD 4
 HOUR 23.8 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-31.8 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 07 SONIC DEP 0402
 LONG 066-31.8 W REL HUMID 079 CLOUD AMT 6 WAVE HEIGHT 5 COLOR

CAST 1 MESS TIME 23.8 GMT, 1950 LOCAL MAX DEPTH 300 WIRE ANGLE 4
 OXYGEN TITER .718 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP		BN	TL	TM	TAVE	SALIN	SIG T	OXYGEN		XSAT	PHOS	NITRA
		CZ	TZ							ML/L	MG/L			
0	0	0	0	1	27.75	0.00	27.75	34.549	22.16	4.95	7.06	101.25	.09	0.00
25	25	0	0	2	27.76	0.00	27.76	35.774	23.08	4.71	6.73	100.07	.04	0.00
50	50	60	0	3	27.04	0.00	27.04	36.374	23.76	4.92	7.02	101.64	.05	0.00
100	100	99	0	4	23.19	0.00	23.19	36.757	25.23	4.94	7.05	95.49	.05	0.00
150	150	151	0	5	21.13	0.00	21.13	36.796	25.84	4.46	6.37	84.99	.08	0.00
200	199	198	0	6	19.65	0.00	19.65	36.659	26.14	4.39	6.26	78.37	.11	0.00
250	249	253	0	7	18.11	0.00	18.11	36.516	26.42	4.38	6.25	77.10	.21	0.00
300	299	293	0	8	17.21	0.00	17.21	36.371	26.53	4.40	6.29	76.83	.38	0.00

050 934 STANDARD DEPTHS

0	27.75	34.549	22.16	4.95	7.06	101.25	.09	0.00
10	27.75	35.039	22.53	4.85	6.93	100.79	.07	0.00
20	27.76	35.542	22.90	4.75	6.78	100.16	.05	0.00
30	27.69	35.938	23.22	4.73	6.76	100.96	.04	0.00
50	27.04	36.374	23.76	4.92	7.02	101.64	.05	0.00
75	25.20	36.655	24.55	4.93	7.04	101.26	.05	0.00
100	23.19	36.757	25.23	4.94	7.05	95.49	.05	0.00
150	21.13	36.796	25.84	4.46	6.37	84.99	.08	0.00
200	19.62	36.656	26.14	4.38	6.26	78.32	.11	0.00
250	18.09	36.513	26.43	4.38	6.25	77.09	.21	0.00
300	17.19	36.368	26.53	4.40	6.29	76.83	.38	0.00

R V PALUMBO CRUISE 050 PRNC REFERENCE 050931 STATION PMA-5A

DATE 10 /31/74 BARO 1017.7 WEATHER 02 WIND VELOC 03 WAVE PERIOD 4
 HOUR 13.8 TEMP DRY 28.0 VISIBILITY 7 WIND DIREC 09 TRANSPAR
 LAT 18-29.3 N TEMP WET 0.0 CLOUD TYPE 5 WAVE DIREC 05 SONIC DEP 0017
 LONG 066-30.3 W REL HUMID 070 CLOUD AMT 6 WAVE HEIGHT 6 COLOR

CAST 1 MESS TIME 13.9 GMT, 954 LOCAL MAX DEPTH 10 WIRE ANGLE 0
 OXYGEN TITER .710 METER WHEEL FACTOR .997

DEPTH (M)	TEMP		TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA
	TZ	BN								
0	0	1	27.76	34.853	22.38	4.85	6.93	100.25	.05	0.00
10	0	2	27.86	35.156	22.58	4.76	6.80	99.33	.00	0.00
050931 STANDARD DEPTHS										
0			27.76	34.853	22.38	4.85	6.93	100.25	0.09	0.
10			27.86	35.156	22.58	4.76	6.80	99.33	0.07	0.

R V PALUMBO CRUISE 050 STATION PMA-50 PRNG REFERENCE 050932

DATE 10 /31/74 BARO 1016.0 WEATHER 02 WIND VELOC 05 WAVE PERIOD 4
 HOUR 22.6 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC 07 TRANSPAR
 LAI 18-30.3 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 05 SONIC DEP 0182
 LONG 066-30.5 W REL HUMID 082 CLOUD AMT 7 WAVE HEIGHT 5 COLOR

CAST 1 MESS TIME 22.5 GMT, 1027 LOCAL MAX DEPTH 100 WIRE ANGLE 6
 OXYGEN TITER .710 METER WHEEL FACTOR .997

WIRE	DEPTH (M)	TEMP				OXYGEN			PHOS	NITRA				
		CZ	TZ	BN	TL	TM	TAVE	SALIN			SIG T	ML/L	MG/L	%SAT
0	0	0	0	1	27.74	0.00	27.74	35.019	22.51	4.78	6.83	99.25	.08	0.00
25	25	0	0	2	27.79	0.00	27.79	35.603	22.94	4.70	6.72	99.43	.07	0.00
50	50	49	49	3	26.93	0.00	26.93	36.361	23.79	4.87	6.96	100.67	.07	0.00
100	100	99	99	4	22.81	0.00	22.81	36.745	25.33	4.78	6.83	92.15	.06	0.00

050 932 STANDARD DEPTHS

0	27.74	35.019	22.51	4.78	6.83	99.25	0.08	0.
10	27.76	35.253	22.68	4.75	6.78	99.32	0.08	0.
20	27.78	35.483	22.85	4.72	6.74	99.38	0.07	0.
30	27.70	35.760	23.09	4.73	6.75	100.36	0.07	0.
50	26.93	36.361	23.79	4.87	6.96	100.67	0.07	0.
75	25.27	36.742	24.59	4.83	6.90	99.32	0.07	0.
100	22.81	36.745	25.33	4.78	6.83	92.15	0.06	0.

R V PALUMBO CRUISE 050 STATION PMA-5C PRNC REFERENCE 050933

DATE 10 /31/74 BARO 1016.5 WEATHER 02 WIND VELOC 05 WAVE PERIOD 4
 HOUR 23.1 TEMP DRY 25.0 VISIBILITY 7 WIND DIREC TRANSPAR
 LAT 18-31.4 N TEMP WET 0.0 CLOUD TYPE 8 WAVE DIREC 06 SONIC DEP 0393
 LONG 066-30.5 W REL HUMID 080 CLOUD AMT 7 WAVE HEIGHT 7 COLOR

CAST 1 MESS TIME 23.1 GMT, 19 7 LOCAL MAX DEPTH 300 WIRE ANGLE 2
 OXYGEN TITER .710 METER WHEEL FACTOR .997

WIRE	DEPTH (M)				TEMP				OXYGEN				PHOS		NITRA	
	CZ	TZ	BN	TL	TM	TAVE	SALIN	SIG T	ML/L	MG/L	XSAT	PHOS	NITRA			
0	0	0	1	27.76	0.00	27.76	34.909	22.43	4.89	6.99	101.32	.05	0.00			
25	25	0	2	27.94	0.00	27.94	35.901	23.11	4.77	6.82	102.15	.04	0.00			
50	50	51	3	26.41	0.00	26.41	36.389	23.97	4.92	7.02	101.38	.03	0.00			
100	100	100	4	23.27	0.00	23.27	36.742	25.19	4.92	7.03	95.22	.04	0.00			
150	150	150	5	21.04	0.00	21.04	36.754	25.83	4.39	6.27	83.65	.09	0.00			
200	200	199	6	19.26	0.00	19.26	36.625	26.21	4.39	6.27	78.18	.13	0.00			
250	250	253	7	18.29	0.00	18.29	36.529	26.39	4.41	6.30	77.71	.27	0.00			
300	299	299	8	17.24	0.00	17.24	36.391	26.54	4.40	6.29	76.88	.41	0.00			

050 933 STANDARD DEPTHS

0	27.76	34.909	22.43	4.89	6.99	101.32	0.05
10	27.83	35.306	22.70	4.85	6.92	101.60	0.05
20	27.90	35.713	22.98	4.79	6.85	101.87	0.04
30	27.73	36.034	23.28	4.79	6.84	102.60	0.04
50	26.41	36.389	23.97	4.92	7.02	101.38	0.03
75	24.79	36.639	24.66	4.92	7.03	95.74	0.03
100	23.27	36.742	25.19	4.92	7.03	95.22	0.04
150	21.04	36.754	25.84	4.39	6.27	83.65	0.09
200	19.26	36.625	26.21	4.39	6.27	78.18	0.13
250	18.29	36.529	26.39	4.41	6.30	77.71	0.27
300	17.22	36.388	26.54	4.40	6.28	76.88	0.41

AVERAGE DATA FOR 022293 THROUGH 038639

- PMA WINTER AVERAGE

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	25.913	35.617	23.552	4.860	0.073	0.0
10	25.895	35.611	23.552	4.825	0.067	0.0
20	25.915	35.726	23.628	4.765	0.059	0.0
30	25.925	35.751	23.643	4.733	0.055	0.0
50	26.003	35.820	23.671	4.730	0.062	0.0
75	25.737	36.038	23.919	4.738	0.060	0.0
100	25.271	36.306	24.264	4.748	0.056	0.0
150	22.670	36.810	25.420	4.172	0.076	0.0
200	20.492	36.827	26.039	4.100	0.136	0.0
250	18.649	36.633	26.376	4.071	0.245	0.0
300	17.566	36.474	26.524	4.144	0.362	0.0

AVERAGE DATA FOR 028473 THROUGH 043754

PMA -SPRING AVERAGES

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	26.895	35.928	23.471	4.809	0.060	0.000
10	26.828	35.964	23.519	4.803	0.069	0.000
20	26.749	35.978	23.554	4.798	0.078	0.000
30	26.662	35.995	23.595	4.804	0.071	0.000
50	26.361	36.057	23.737	4.840	0.044	0.000
75	25.763	36.232	24.057	4.865	0.050	0.000
100	24.929	36.467	24.491	4.906	0.065	0.000
150	22.568	36.839	25.471	4.510	0.090	0.000
200	20.047	36.712	26.072	4.179	0.162	0.000
250	18.386	36.562	26.388	4.302	0.223	0.000
300	17.152	36.391	26.561	4.401	0.315	0.000

PMA- SUMMER AVERAGES

AVERAGE DATA FOR 032523 THROUGH 245820

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	28.102	35.627	22.853	4.659	0.041	0.000
10	28.086	35.767	22.964	4.637	0.040	0.000
20	28.026	35.911	23.016	4.677	0.043	0.000
30	27.949	35.917	23.121	4.686	0.044	0.000
50	27.617	36.219	23.457	4.753	0.045	0.000
75	26.556	36.337	23.884	4.835	0.047	0.000
100	25.188	36.428	24.373	4.921	0.046	0.000
150	22.278	36.840	25.550	4.608	0.053	0.000
200	20.131	36.760	26.085	4.263	0.094	0.000
250	18.509	36.530	26.337	4.286	0.220	0.000
300	17.171	36.403	26.543	4.582	0.270	0.000

PMA- FALL AVERAGES

AVERAGE DATA FOR 050928 THROUGH 050933

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	27.638	34.250	21.970	4.882	0.096	0.000
10	27.756	34.988	22.486	4.799	0.070	0.000
20	27.750	35.483	22.858	4.740	0.052	0.000
30	27.628	35.931	23.237	4.730	0.043	0.000
50	26.544	36.377	23.921	4.870	0.045	0.000
75	24.923	36.636	24.621	4.854	0.052	0.000
100	23.146	36.734	25.225	4.634	0.060	0.000
150	21.172	36.768	25.810	4.135	0.083	0.000
200	19.401	36.630	26.180	4.387	0.116	0.000
250	18.073	36.502	26.421	4.398	0.249	0.000
300	17.145	36.379	26.555	4.383	0.411	0.000

AVERAGE DATA FOR 022293 THROUGH 030637

PMA-WINTER A

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	25.739	35.655	28.66	4.815	0.087	0.000
10	25.749	35.716	28.71	4.836	0.080	0.000

AVERAGE DATA FOR 022291 THROUGH 030638

PMA-WINTER B

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	25.999	35.689	28.573	4.896	0.049	0.014
10	25.944	35.594	28.594	4.810	0.052	0.014
20	25.885	35.699	28.617	4.723	0.057	0.014
30	25.907	35.725	28.629	4.642	0.061	0.014
50	26.060	35.852	28.677	4.528	0.060	0.014
75	25.742	36.059	28.933	4.589	0.060	0.016
100	25.176	36.331	29.313	4.726	0.059	0.020

AVERAGE DATA FOR 022290 THROUGH 030639

PMA-WINTER C

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	25.950	35.670	28.674	4.855	0.084	0.051
10	25.947	35.710	28.686	4.832	0.087	0.079
20	25.944	35.753	28.639	4.807	0.051	0.077
30	25.944	35.777	28.657	4.723	0.046	0.072
50	25.946	35.787	28.664	4.632	0.053	0.054
75	25.732	36.17	28.905	4.937	0.055	0.037
100	25.366	36.281	29.216	4.770	0.049	0.059
150	22.670	35.810	25.420	4.172	0.076	0.031
200	20.492	36.527	26.039	4.100	0.136	0.036
250	18.649	36.633	26.376	4.271	0.245	0.036
300	17.566	36.674	26.524	4.144	0.362	0.044

AVERAGE DATA FOR 028473 THROUGH 043756 PMA SPRING A

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	26.929	35.61	23.424	4.817	0.064	0.000
10	26.859	35.63	23.509	4.856	0.070	0.000

AVERAGE DATA FOR 028474 THROUGH 043759 PMA-SPRING B

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	26.854	35.954	23.504	4.819	0.049	0.000
10	26.808	35.966	23.527	4.811	0.049	0.000
20	26.763	35.977	23.550	4.802	0.057	0.000
30	26.687	35.993	23.586	4.805	0.051	0.000
50	26.396	36.058	23.727	4.844	0.031	0.000
75	25.808	36.217	24.031	4.858	0.049	0.000
100	24.975	36.456	24.468	4.890	0.056	0.000

AVERAGE DATA FOR 028477 THROUGH 043754 PMA-SPRING C

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	26.901	35.050	23.485	4.792	0.061	0.000
10	26.818	35.964	23.522	4.793	0.054	0.000
20	26.735	35.978	23.559	4.795	0.056	0.000
30	26.637	35.996	23.614	4.803	0.054	0.000
50	26.326	36.156	23.748	4.836	0.050	0.000
75	25.719	36.247	24.082	4.872	0.055	0.000
100	24.883	36.479	24.513	4.923	0.068	0.000
150	22.568	36.539	25.171	4.510	0.090	0.000
200	20.047	36.712	26.072	4.179	0.162	0.000
250	18.586	36.562	26.308	4.302	0.223	0.000
300	17.152	36.391	26.561	4.401	0.315	0.000

AVERAGE DATA FOR 032523 THROUGH 045810 PMA-SUMMER A

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	25.063	35.503	22.773	4.610	0.033	0.000
10	28.110	35.799	22.980	4.549	0.040	0.000

AVERAGE DATA FOR 032534 THROUGH 045821 PMA-SUMMER B

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	28.125	35.741	22.931	4.585	0.042	0.000
10	28.083	35.769	22.966	4.674	0.042	0.000
20	28.041	35.794	22.999	4.662	0.041	0.000
30	27.956	35.877	23.009	4.568	0.044	0.002
50	27.581	36.182	23.440	4.735	0.055	0.000
75	26.545	36.320	23.872	4.813	0.055	0.000
100	25.202	36.398	24.346	4.903	0.056	0.000

AVERAGE DATA FOR 032535 THROUGH 045820 PMA-SUMMER C

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	28.117	35.636	22.855	4.683	0.018	0.000
10	28.065	35.733	22.945	4.687	0.020	0.000
20	28.010	35.827	23.033	4.693	0.021	0.000
30	27.943	35.957	23.154	4.705	0.020	0.000
50	27.653	36.256	23.473	4.771	0.016	0.000
75	26.867	36.382	24.051	4.880	0.019	0.000
100	25.174	36.557	24.680	4.920	0.021	0.000
150	22.277	36.840	25.551	4.608	0.039	0.000
200	20.123	36.761	26.088	4.263	0.090	0.000
250	18.423	36.546	26.366	4.271	0.225	0.000
300	17.126	36.367	26.550	4.503	0.337	0.000

AVERAGE DATA FOR 050932 THROUGH 050931

PMA-FALL A

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	27.653	34.766	22.842	4.852	0.103	
10	27.878	35.103	22.578	4.755	0.060	

AVERAGE DATA FOR 050939 THROUGH 050932

PMA-FALL B

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	27.520	33.961	21.791	4.855	0.133	12.473
10	27.619	34.645	22.273	4.767	0.025	7.914
20	27.718	35.349	22.770	4.713	0.061	2.300
30	27.617	35.879	23.202	4.710	0.046	0.144
50	26.555	36.371	23.912	4.855	0.050	0.420
75	24.998	36.624	24.588	4.817	0.026	0.628
100	23.095	36.720	25.229	4.776	0.063	0.435

AVERAGE DATA FOR 050938 THROUGH 050933

PMA-FALL C

DEPTH	TEMPERATURE	SALINITY	SIGMA T	OXYGEN	PHOS	NITROGEN
0	27.743	34.704	22.277	4.938	0.072	0.247
10	27.771	35.155	22.617	4.855	0.054	0.264
20	27.799	35.617	22.946	4.756	0.043	0.320
30	27.639	35.982	23.272	4.750	0.039	0.301
50	26.533	36.383	23.929	4.864	0.040	0.120
75	24.848	36.649	24.654	4.890	0.040	0.148
100	23.198	36.748	25.221	4.891	0.050	0.420
150	21.172	36.768	25.810	4.135	0.083	1.025
200	19.401	36.637	26.187	4.387	0.116	3.577
250	18.073	36.502	26.421	4.398	0.249	6.042
300	17.145	36.370	26.556	4.303	0.341	10.965

APPENDIX 4.1A

Data Reduction Program - 12 Mar. '75
TAB

```

REAL*8 ST,STNEW
DIMENSION TABLE(25,10,36),IT(25),ST(10),DATA0(15),DATA(18)
1  TITLE(8,34), TITL(16)
100 FORMAT(16,3X,A6,5X,F5.0,F5.3,3F10.0,14X,A1,15)
101  FORMAT(15X,A5,15F4.0)
102  FORMAT(16A5)
103  FORMAT('1',17X,'TABLE',I3,',',',',8A5//20X,16A5///30X,'STATIONS'////
1  18X,' DATE',',10A10)
104  FORMAT('0',I23,13F10.3)
105  FORMAT('0',I23,11F10.0)
106  FORMAT('0',I23,10F10.1)
107  FORMAT('0',16,3X,A6,5X,5F10.3,114)
108  FORMAT(' ',A5,15F6.0)
109  FORMAT('1',16A5)
DATA DATAN, TABLE/9018*0./
DATA ((TITLE(I,J),I=1,8),J=1,17) /
1'TOTAL BIOMASS OF ZOOPLANKTON (ML/100M3)
2'TOTAL NUMBER OF ZOOPLANKTON PER 100M3
3'TOTAL NUMBER OF COPEPODS PER 100M3
4'TOTAL NUMBER OF CHAETOGNATHS PER 100M3
5'TOTAL NUMBER OF LARVACEANS PER 100M3
6'TOTAL NUMBER OF CLADOCERANS PER 100M3
7'TOTAL NUMBER OF PTEROPODS PER 100M3
H'TOTAL NUMBER OF OTHER PER 100M3
8'TOTAL # OF VELIGER LARVAE PER 100M3
9'TOTAL # OF CIRRIPEDE NAUPLII PER 100M3
A'TOTAL # OF CIRRIPEDE CYPRIS PER 100M3
B'TOTAL # OF PENAEID LARVAE PER 100M3
C'TOTAL # OF BRACHYURAN LARVAE PER 100M3
D'TOTAL NUMBER OF OTHER PER 100M3
E'TOTAL NUMBER OF FISH EGGS PER 100M3
F'TOTAL NUMBER OF FISH LARVAE PER 100M3
G'TOTAL NUMBER OF HOLOPLANKTON PER 100M3
DATA ((TITLE(I,J),I=1,8),J=18,34)/
1'TOTAL NUMBER OF MEROPLANKTON PER 100M3
2'PERCENTAGE OF COPEPODS
3'PERCENTAGE OF CHAETOGNATHS
4'PERCENTAGE OF LARVACEANS
5'PERCENTAGE OF CLADOCERANS
6'PERCENTAGE OF PTEROPODS
H'PERCENTAGE OF OTHER
7'PERCENTAGE OF VELIGER LARVAE
8'PERCENTAGE OF CIRRIPEDE NAUPLII
9'PERCENTAGE OF CIRRIPEDE CYPRIS
A'PERCENTAGE OF PENAEID LARVAE
B'PERCENTAGE OF BRACHYURAN LARVAE
C'PERCENTAGE OF OTHER
D'PERCENTAGE OF FISH EGGS
E'PERCENTAGE OF FISH LARVAE
F'PERCENTAGE OF HOLOPLANKTON
G'PERCENTAGE OF MEROPLANKTON
READ TITLE,
1 READ (2,102,END=98) TITL

```

```

PRINT 109,TITL
ITIME=1
IS=1
ISTATN=1
TABLE (1,1,36)=1.
C   READ FIRST CARD.
READ 100,IT(1),ST(1),DILUT,PIR2,REVSPM,REVS,WET, AS,IREP
DO 20 I=1,12720
PRINT 107,IT(ITIME),ST(ISTATN),DILUT,PIR2,REVSPM,REVS,WET,IREP
Z=PIR2*REVS/REVSPM/100.
DILDZ=DILUT/Z/IREP
TABLE(ITIME,ISTATN,1)=TABLE(ITIME,ISTATN,1)+WET/Z
DO 30 J=1,IREP
READ 101,TOW,DATA0
PRINT 108,TOW,DATA0
DO 28 K=2,16
DATAN(K)=DATAN(K)+DATA0(K-1)
28 CONTINUE
30 CONTINUE
C   SUM HOLOPLANKTON.
DO 22 K=2,7
DATAN(17)=DATAN(K)+DATAN(17)
22 CONTINUE
C   SUM MEROPLANKTON.
DO 25 K=8,13
DATAN(18)=DATAN(K)+DATAN(18)
25 CONTINUE
TABLE(ITIME,ISTATN,36)=TABLE(ITIME,ISTATN,36)+DATAN(2)
DO 32 K=19,34
TABLE(ITIME,ISTATN,K)=TABLE(ITIME,ISTATN,K)+DATAN(K-16)
32 CONTINUE
DO 31 K=2,18
TABLE(ITIME,ISTATN,K)=TABLE(ITIME,ISTATN,K)+DATAN(K)*DILDZ
DATAN(K)=0.
31 CONTINUE
C   CHECK FOR END OF A DATA SET.
IF (AS.EQ.1H*) GO TO 99
READ 100,IT(ITIME+1),STNEW,DILUT,PIR2,REVSPM,REVS,WET,AS,IREP
IF(IT(ITIME+1).NE.IT(ITIME)) ITIME=ITIME+1
DO 33 ISTATN=1,IS
IF (STNEW.EQ.ST(ISTATN)) GO TO 34
33 CONTINUE
C   NEW STATION.
IS=IS+1
ISTATN=IS
ST(IS)=STNEW
50 34 TABLE(ITIME,ISTATN,35)=TABLE(ITIME,ISTATN,35)+1.
CONTINUE
C   PRINT TITLES.
99 DO 82 I=1,18
PRINT 103,I,(TITLE(J,I),J=1,8),TITL,(ST(K),K=1,IS)
DO 82 J=1,ITIME
DO 55 K=1,IS

```

```

C      DIVIDE BY NUMBER OF ROWS.
      IF(TABLE(J,K,35).EQ.0.) GO TO 55
      TABLE(J,K,I) =TABLE(J,K,I) /TABLE(J,K,35)
55     CONTINUE
      IF (I.GT.1) GO TO 81
      PRINT 104,IT(J),(TABLE(J,K,I),K=1,IS)
      GO TO 82
81     PRINT 105,IT(J),(TABLE(J,K,I),K=1,IS)
82     CONTINUE
      DO 84 I=19,34
      PRINT 103,I,(TITLE(J,I),J=1,8),TITL,(ST(K),K=1,IS)
      DO 84 J=1,ITIME
      DO 60 K=1,IS
C      CONVERT TO PERCENTAGES.
      IF(TABLE(J,K,36).EQ.0.) GO TO 60
      TABLE (J,K,I) =TABLE(J,K,I)/TABLE(J,K,36)*100.
60     CONTINUE
      PRINT 106,IT(J),(TABLE(J,K,I),K=1,IS)
84     CONTINUE
      DO 90 I=1,36
      DO 90 J=1,ITIME
      DO 90 K=1,IS
      TABLE(J,K,I)=0.
90     CONTINUE
      GO TO 1
98     CALL EXIT
      END

```

APPENDIX 4.2A

Major zooplankton groups at each station
and for each sampling date.

Explanatory notes for computer printouts.

PTEROPODS: non-coiled species (e.g., Creseis acicula)

SIPHONOPHORES: siphonophore bracts, not whole animals

THALIACEA: includes salps and doliolids

ZOOPLANKTON

MAVATI

MAY 14/74

BIOMASS IN ML/100 CUBIC METERS
 ABUNDANCE IN #/CUBIC METER

	STATION 1 (2 TOWS)	STATION 2 (3 TOWS)	STATION 3 (2 TOWS)	OFFSHORE (2 TOWS)
BIOMASS	16	18	9	10
TOTAL	964	1635	1206	457
COPEPODS	575	1209	785	240
CHAETOGNATHS	34	51	36	18
LARVACEANS	7	24	26	18
PTEROPODS	36	20	9	0
OSTRACODS	30	48	135	1
CLADOCERANS	0	1	2	1
MEDUSAE	23	1	3	8
SIPHONOPHORES	7	1	6	3
CTENOPHORES	0	0	0	0
THALIACEA	2	2	2	2
ANNELID LARVAE	11	12	7	3
CIRRIPEDE LAR	0	4	5	2
ECHINODERM LAR	10	3	6	4
ECTOPROCT LAR	1	3	4	1
BIVALVE LARVAE	1	9	0	1
GASTROPOD VEL	55	81	43	30
FORAMINIFERA	1	2	3	1
MALACOSTRACANS	22	23	25	6
FISH LARVAE	0	9	3	1
FISH EGGS	40	44	44	53

ZOOPLANKTON

MAJATI

15 AUGUST 1974

BIOMASS IN ML/100 SURFACE NETS
ABUNDANCE IN #/CUBIC METER

	STATION 1 (1 TON)	STATION 2 (3 TONS)	STATION 3 (1 TON)	OFFSHORE (1 TON)
BIOMASS	16	19	17	13
TOTAL	1511	755	688	780
COPEPODS	1012	477	495	483
CHAETOGNATHS	50	49	27	18
LARVACEANS	0	20	0	75
PTEROPODS	3	1	0	2
OSTRACODS	3	4	2	0
CLADOCERANS	0	0	0	0
MEDUSAE	5	1	1	2
SIPHONOPHORES	8	1	1	5
CTENOPHORES	0	0	0	0
THALIACEA	3	1	1	7
ANNELID LARVAE	8	6	4	0
CIRRIPEDE LAR	8	3	1	0
ECHINODERM LAR	10	1	3	3
ECTOPROCT LAR	0	1	0	2
BIVALVE LARVAE	15	3	4	3
GASTROPOD VEL	80	42	30	28
FORAMINIFERA	15	3	7	7
MALACOSTRACANS	23	44	18	8
FISH LARVAE	3	2	0	0
FISH EGGS	115	56	70	105

ZOOPLANKTON

PUNTA MAJATI

31 OCTOBER /74

BIOMASS IN ML/100 CUBIC METERS
 ABUNDANCE IN #/CUBIC METER

	STATION 1 (1 TOW)	STATION 2 (3 TOWS)	STATION 3 (1 TOW)	OFFSHORE (1 TOW)
BIOMASS	12	12	19	13
TOTAL	1270	1564	3892	861
COPEPODS	1008	1271	3510	610
CHAETOGNATHS	46	42	93	24
LARVACEANS	77	30	29	43
PTEROPODS	7	4	0	2
OSTRACODS	7	2	5	4
CLADOCERANS	0	1	5	0
MEDUSAE	2	9	5	10
CIPHONOPHORES	2	1	0	2
CTENOPHORES	0	0	0	0
THALIACEA	0	0	0	0
ANNELID LARVAE	15	4	20	4
CIRRIPEDE LAR	0	4	0	6
ECHINODERM LAR	0	5	0	4
ECTOPROCT LAR	4	2	15	2
BIVALVE LARVAE	0	4	5	0
GASTROPOD VEL	18	14	44	31
FORAMINIFERA	0	2	5	0
MALACOSTRACANS	18	9	20	8
FISH LARVAE	2	0	0	0
FISH EGGS	64	82	117	75

ZOOPLANKTON

MAVATI

MAY 14/74

BIOMASS IN ML/100 CUBIC METERS
 ABUNDANCE IN NUMBERS/CUBIC METER

STATION 2
 3 REPLICATES

	MEAN	VARIANCE	.95 C.I.
BIOMASS	18	5	12 TO 24
TOTAL	1635	194650	540 TO 2731
COPEPODS	1209	142701	272 TO 2147
CHAETOGNATHS	51	388	2 TO 100
LARVACEANS	24	321	0 TO 68
PTEROPODS	20	41	4 TO 36
OSTRACODS	48	258	8 TO 88
CLADOCERANS	1	3	0 TO 6
MEDUSAE	1	2	0 TO 4
SIPHONOPHORES	1	2	0 TO 5
CTENOPHORES	0	0	0 TO 0
THALIACEA	2	1	1 TO 4
ANNELID LARVAE	12	4	7 TO 17
CIRRIPEDA LAR	4	27	0 TO 17
ECHINODERM LAR	3	10	0 TO 11
ECTOPROCT LAR	3	0	2 TO 4
BIVALVE LARVAE	9	77	0 TO 31
GASTROPOD VEL	81	197	46 TO 116
FORAMINIFERA	2	15	0 TO 12
MALACOSTRACANS	23	358	0 TO 70
FISH LARVAE	9	14	0 TO 18
FISH EGGS	44	401	0 TO 93

ZOOPLANKTON

MAJATI

15 AUGUST 1974

BIOMASS IN ML/100 CUBIC METERS
ABUNDANCE IN NUMBERS/CUBIC METERSTATION 2
3 REPLICATES

	MEAN	VARIANCE	.95 C.I.
BIOMASS	19	1	17 TO 22
TOTAL	755	17764	424 TO 1335
COPEPODS	477	5398	295 TO 660
CHAETOGNATHS	49	304	3 TO 92
LARVACEANS	22	24	7 TO 32
PTEROPODS	1	3	0 TO 6
OSTRACODS	4	12	0 TO 12
CLADOCERANS	0	0	0 TO 0
MEDUSAE	1	1	0 TO 3
SIPHONOPHORES	1	2	0 TO 5
CTENOPHORES	0	0	0 TO 0
THALIACEA	1	1	0 TO 3
ANNELID LARVAE	6	9	0 TO 13
CIRRIPEDE LAR	3	11	0 TO 11
ECHINODERM LAR	1	2	0 TO 5
ECTOPROCT LAR	1	1	0 TO 3
BIVALVE LARVAE	3	6	0 TO 9
GASTROPOD VEL	42	346	0 TO 88
FORAMINIFERA	3	1	1 TO 6
MALACOSTRACANS	44	35	29 TO 58
FISH LARVAE	2	0	1 TO 3
FISH EGGS	56	172	24 TO 89

ZOOPLANKTON

PUITA LAIATI

31 OCTOBER 1961

BIOMASS IN ML/100 CUBIC METERS
ABUNDANCE IN NUMBERS/CUBIC METERSTATION
3

	MEAN	VARIANCE	.95 C.I.
BIOMASS	12	3	8 TO 16
TOTAL	1564	21248	1204 TO 1924
COPEPODS	1271	15276	964 TO 1577
CHAETOGNATHS	42	219	5 TO 78
LARVACEANS	80	121	53 TO 107
PTEROPODS	4	3	0 TO 9
OSTRACODS	2	3	0 TO 5
CLADOCERANS	1	3	0 TO 5
MEDUSAE	9	9	2 TO 16
SIPHONOPHORES	1	3	0 TO 5
CTENOPHORES	0	0	0 TO 0
THALIACEA	0	0	0 TO 0
ANNELID LARVAE	4	22	0 TO 16
CIRRIPEDE LAR	4	22	0 TO 16
ECHINODERM LAR	5	12	0 TO 14
ECTOPROCT LAR	2	12	0 TO 11
BIVALVE LARVAE	4	3	0 TO 8
GASTROPOD VEL	14	39	0 TO 32
FORAMINIFERA	2	13	0 TO 11
MALACOSTRACANS	9	67	0 TO 29
FISH LARVAE	0	0	0 TO 0
FISH EGGS	82	519	26 TO 139

APPENDIX 4.2B

Copepod species at each station
and for each sampling date.

Explanatory notes for computer printouts-

T. TURBINATA: Temora turbinata

T. STYLIFERA: Temora stylifera

SM CALANOIDS: Includes Paracalanus aculeatus
Paracalanus parvus
Clausocalanus furcatus
Mecynocera clausi
Calocalanus sp.
Acrocalanus sp.
and other juvenile
calanoids

4.2B

COPEPODS

MAIATI

MAY 14/74

ABUNDANCE IN #/CUBIC METER

	STATION 1 (2 TOW)	STATION 2 (3 TOWS)	STATION 3 (2 TOWS)	OFFSHORE (2 TOWS)
T. TURBINATA	137	675	219	11
T. STYLIFERA	3	8	9	1
SM CALANOIDS	197	204	279	103
CALANOPIA	1	5	11	0
ACARTIA	9	65	10	0
LUCICUTIA	1	5	7	0
FARRANULA	15	11	15	5
CORYCAEUS	38	46	67	7
CITHONA	104	82	136	108
ONCAEA	18	19	7	2

COPEPODS

MANATI

15 AUGUST /74

ABUNDANCE IN #/CUBIC METER

	STATION 1 (1 TOW)	STATION 2 (3 TOWS)	STATION 3 (1 TOW)	OFFSHORE (1 TOW)
T. TURBINATA	20	37	3	5
T. STYLIFERA	13	2	0	5
SM CALANIDS	692	260	351	323
NAVNOCALANUS	5	3	6	13
CALANOPIA	3	2	0	0
ACARTIA	45	22	10	3
UNDINULA	5	2	6	10
EUCHAETA	5	0	1	5
EUCALANUS	13	9	7	3
FARRANULA	18	29	19	8
CORYCAEUS	18	10	6	30
OITHONA	130	58	57	73
ONCAEA	30	16	18	33

COPEPODS

MAVATI

31 OCTOBER /74

ABUNDANCE IN #/CUBIC METER

	STATION 1 (1 TOW)	STATION 2 (3 TOWS)	STATION 3 (1 TOW)	OFFSHORE (1 TOW)
T. TURBINATA	173	225	514	81
T. STYLIFERA	2	12	5	0
SM CALANIDS	589	766	2590	324
NANNOCALANUS	2	3	0	6
CALANOPIA	0	0	20	2
ACARTIA	0	13	29	4
LUCICUTIA	13	3	0	0
EUCALANUS	9	2	0	6
FARRANULA	15	24	49	35
CORYCAEUS	39	38	73	37
OITHONA	107	169	186	112
ONCAEA	22	18	29	26

COPEPODS

MANATI

MAY 14/74

ABUNDANCE IN NUMBERS/CUBIC METER

STATION 2
3 REPLICATES

	MEAN	VARIANCE	.95 C.I.
T. TURBINATA	675	127628	0 TO 1562
T. STYLIFERA	8	4	3 TO 13
S1 CALANOIDS	204	730	137 TO 271
CALANOPIA	5	2	1 TO 9
ACARTIA	65	7387	0 TO 278
LUCICUTIA	5	2	1 TO 9
FARRANULA	11	18	1 TO 22
CORYCAEUS	46	1398	0 TO 138
OITHONA	82	757	14 TO 150
ONCAEA	19	183	0 TO 52

COPEPODS

MANATI

15 AUGUST /74

ABUNDANCE IN NUMBERS/CUBIC METER

STATION 2
3 REPLICATES

	MEAN	VARIANCE	.95 C. I.
T. TURBINATA	37	12	28 TO 45
T. STYLIFERA	2	2	0 TO 6
SM CALANOIDS	260	1573	161 TO 358
NANNOCALANUS	3	3	0 TO 7
CALANOPIA	2	6	0 TO 8
ACARTIA	22	40	6 TO 37
UNDINULA	2	4	0 TO 7
EUCHAETA	0	0	0 TO 0
EUCALANUS	9	23	0 TO 21
FARRANULA	29	34	14 TO 43
CORYCAEUS	10	18	0 TO 20
OITHONA	58	135	29 TO 86
ONCAEA	16	14	6 TO 25

COPEPODS

MAVATI

31 OCTOBER /74

ABUNDANCE IN NUMBERS/CUBIC METER

STATION 2
3 REPLICATES

	MEAN	VARIANCE	.95 C.I.
T. TURBINATA	225	2907	92 TO 359
T. STYLIFERA	12	36	0 TO 27
SM CALANIDS	766	8849	532 TO 999
NANNOCALANUS	3	9	0 TO 11
CALANOPIA	0	0	0 TO 0
ACARTIA	13	133	0 TO 42
LUCICUTIA	3	9	0 TO 11
EUCALANUS	2	3	0 TO 6
FARRANULA	24	38	9 TO 40
CORYCAEUS	38	13	29 TO 46
OITHONA	169	1299	79 TO 258
ONCAEA	18	108	0 TO 44

APPENDIX 4.3A*

Benthic Stations at Punta Manati

STATION 1	Location:	east of Manati River (Pt. Manati)
	Date:	2 January 1973
	Depth:	7 - 20 m
	Investigator:	S. Martin
STATION 2	Location:	Pt. Manati (East of Manati River)
	Date:	6 June 1974, 14 August 1974
	Depth:	21 m
	Investigator:	P.M. Yoshioka
STATION 3	Location:	Pt. Manati (East of Manati River)
	Date:	6 June 1974
	Depth:	17 m
	Investigator:	P.M. Yoshioka
TRANSECT A	Location:	east of Manati River, parallel to shore
	Date:	24 May 1974
	Depth:	15 - 20 m
	Investigator:	P.M. Yoshioka
TRANSECT B	Location:	Pt. Manati (East of Manati River)
	Date:	11 May 1973
	Depth:	10 - 17 m
	Investigator:	V. Vicente
TRANSECT C	Location:	Offshore of Manati River mouth
	Date:	29 Mar. 1974
	Depth:	28 m
	Investigator:	P.M. Yoshioka
TRANSECT D	Location:	west of Manati River (Palmas Altas)
	Date:	11 May 1973
	Depth:	10 - 17 m
	Investigator:	V. Vicente

*Refer to Figure 4.3-F1.

APPENDIX 4.3A (continued)

STATION 4

Location: Inshore of Station 2
Date: 14 August 1974
Depth: 8 m
Investigator: P.M. Yoshioka

STATION 5

Location: west of Manati River (1/2 mile W)
Date: 31 January 1973
Depth: 7 - 20 m (15 m)
Investigator: S. Martin

B1

Location: Rocky area east of the Manati River
mouth
Date: 30 January 1973, 14 June 1973,
21 February 1974, 9 April 1974
Investigator: D. Martin

APPENDIX 4.3B Macro invertebrates and fish observed
at Punta Manati.

	STATION 2	STATION 3
<u>ANIMAL KINGDOM</u>		
Phylum Porifera		
<u>Anthosigmella varians</u>	X	X
<u>Callyspongia vaginalis</u>	X	X
<u>Cinachira cavernosa</u>		X
<u>Ircinia sp.</u>	X	X
<u>Ircina strobilina</u>	X	X
<u>Neofibularia masca</u>		X
<u>Sphaeciospongia vesparia</u>	X	X
<u>Verongia lacunosa</u>	X	X
<u>Verongia fistularia</u>	X	X
<u>Verongia longissima</u>	X	
<u>Xestospongia muta</u>	X	X
Phylum Cnidaria		
Class Hydrozoa		
<u>Stylaster roseus</u>	X	
<u>Millepora sp.</u>		X
Subclass Zoantharia		
<u>Agaricia sp.</u>		X
<u>Dichocoenia stokesii</u>	X	X
<u>Diploria sp.</u>	X	X
<u>Favia sp.</u>	X	
<u>Meandrina sp.</u>	X	X
<u>Montastrea cavernosa</u>	X	X
<u>Porites asteroides</u>		X
<u>Siderastrea siderea</u>	X	
Phylum Chordata		
Subphylum Vertebrata		
Class Pisces		
Family Holocentridae		
<u>Holocentrus sp.</u>	X	X
Family Serranidae		
<u>Cephalopholis fulva</u>	X	X
Family Carangidae		
<u>Caranx crysos</u>		X

APPENDIX 4.3B (continued)

	STATION 2	STATION 3
Phylum Chordata (continued)		
Family Lutjanidae		
<u>Ocyurus chrysurus</u>	X	
Family Sciaenidae		
<u>Equetus</u> sp.	X	
Family Mullidae		
<u>Pseudupeneus maculatus</u>	X	
Family Chaetodontidae		
<u>Holocanthus ciliaris</u>	X	
<u>Holocanthus tricolor</u>	X	
Family Pomacentridae		
<u>Pomacentrus partitus</u>	X	X
Family Labridae		
<u>Bodianus rufus</u>	X	
<u>Thalassoma bifasciatum</u>	X	X
Family Acanthuridae		
<u>Acanthurus</u> sp.	X	X
Family Scombridae		
<u>Scomberomorus</u> sp.	X	

APPENDIX 4.3C Fish species collected at nearshore poison stations.

<u>FAMILY</u>	<u>SPECIES</u>	30 Jan 73	14 June 73	21 Feb 74	9 Apr 74
Moringuidae	<u>Moringua edwardsi</u>	25	8	20	10
Muraenidae	<u>Echidna catenata</u>	1		1	
	<u>Echelycore nigricans</u>				1
	<u>Gymnothorax vicinus</u>	1		1	1
	<u>Muraena miliaris</u>			1	
Muraenesocidae	<u>Muraenesox savanna</u>			1	
Ophichthidae	<u>Myrophis punctatus</u>				1
Clupeidae	<u>Harengula clupeiola</u>		44		
Synodontidae	<u>Synodus synodus</u>			1	
Gobiesocidae	<u>Arcos rubrigenosus</u>				2
	<u>Tomiodox fasciatus</u>	6		3	7
	<u>Arcos artius</u>	2			
Ophideidae	<u>Ogilbia sp.</u>	3		2	2
Belontiidae	<u>Platybelone argalus</u>			2	9
	<u>Strongylura marina</u>	1	3		2

APPENDIX 4.3C (continued)

<u>FAMILY</u>	<u>SPECIES</u>	30 Jan 73	14 June 73	21 Feb 74	9 Apr 74
Atherinidae	<u>Atherinomorus stipes</u>	11	1		
	<u>Melanorhinus microps</u>				15
Holocentridae	<u>Adioryx vexillarius</u>	16	16	11	3
	<u>Holocentrus ascensionis</u>	4		1	1
Syngnathidae	<u>Corythoichthys</u>		1		
Scorpaenidae	<u>Scorpaena plumieri</u>			1	1
	<u>Scorpaenodes sp.</u>			5	
	<u>Pontinus rathbuni</u>		3		
Serranidae	<u>Epinephelus adscensionis</u>			5	2
Grammistidae	<u>Pseudogrammus gregoryi</u>			21	1
	<u>Rypticus bistrispinus</u>	1			
	<u>Rypticus saponaceus</u>	1		2	
	<u>Rypticus subbifrenatus</u>			2	
Apogonidae	<u>Apogon maculatus</u>	1	9	7	3
Carangidae	<u>Caranx latus</u>				
	<u>Trachynotus falcatus</u>	8	1		

APPENDIX 4.3C (continued)

<u>FAMILY</u>	<u>SPECIES</u>	30 Jan 73	14 June 73	21 Feb. 74	9 Apr 74
Lutjanidae	<u>Lutjanus apodus</u>	1		8	
Gerridae	<u>Eucinostomus argenteus</u>	3	6		
	<u>Eucinostomus havana</u>			31	
	<u>Eucinostomus jonesii</u>	1			
	<u>Eucinostomus</u>		1		
	<u>Eucinostomus melanopterus</u>			3	5
Pomadasyidae	<u>Haemulon chrysargyreum</u>		1	3	
	<u>Haemulon flavolineatum</u>		1	2	
	<u>Haemulon macrostomum</u>			1	
Sciaenidae	<u>Equetus acuminatus</u>			2	
Mullidae	<u>Mulloidichthys martinicus</u>			1	
Pempheridae	<u>Pempheris schomburgki</u>			25	
Chaetodontidae	<u>Chaetodon striatus</u>			2	1
	<u>Pomacanthus paru</u>			4	
Pomacentridae	<u>Abudefduf taurus</u>			4	
	<u>Abudefduf saxatilis</u>	33	47	47	29
	<u>Pomacentrus fuscus</u>		4	19	18
	<u>Pomacentrus leucostictus</u>	10		32	2
	<u>Pomacentrus variabilis</u>	22			

APPENDIX 4.3C (continued)

<u>FAMILY</u>	<u>SPECIES</u>	30 Jan 73	14 June 73	21 Feb 74	9 Apr 74
Mugilidae	<u>Mugil curema</u>	1			281
	<u>Mugil trichodon</u>	9		52	
Labridae	<u>Halichoeres bivittatus</u>	6	3	69	7
	<u>Halichoeres maculipinna</u>		7	2	1
	<u>Halichoeres poeyi</u>		3		1
	<u>Thalassoma bifasciatum</u>	21	13	20	66
Scaridae	<u>Sparisoma chrysopterum</u>		1		2
	<u>Sparisoma radians</u>		1		
	<u>Sparisoma rubripinne</u>		9	43	13
Dactyloscopidae	<u>Gillellus rubrocinctus</u>		2	1	1
Blenniidae	<u>Blennius cristatus</u>		3	7	5
	<u>Blennius marmoreus</u>			2	
	<u>Entomacrodus nigricans</u>	21	5	6	7
	<u>Hypleurochilus springeri</u>			1	
Tripterygiidae	<u>Enneanectes boehlkei</u>			9	
Clinidae	<u>Labrisomus bucciferus</u>		3	15	14
	<u>L. guppyi</u>	27			1
	<u>L. nigricinctus</u>		1		
	<u>L. nuchipinnis</u>	1	13	68	30
	<u>Malacoctenus aurolineatus</u>		1	1	
	<u>M. erdmani</u>			2	4
	<u>M. gilli</u>			1	
	<u>M. triangulatus</u>		2		3
	<u>Paraclinus cingulatus</u>			15	3
	<u>P. fasciatus</u>			1	1

APPENDIX 4.3C (continued)

<u>FAMILY</u>	<u>SPECIES</u>	30 Jan 73	14 June 73	21 Feb 74	9 Apr 74
Clinidae (cont.)	<u>P. nigripinnis</u>		2	1	7
	<u>Coralliozetus cardonae</u>				1
Gobiidae	<u>Bathygobius curacae</u>			17	
	<u>Bathygobius mystacium</u>				21
	<u>Bathygobius soporator</u>	71	8	133	21
	<u>Gobionellus saepepallens</u>				8
Acanthuridae	<u>Acanthurus bahianus</u>	1	4	10	8
	<u>Acanthurus chirurgus</u>			1	
Bothidae	<u>Bothus lunatus</u>			6	5
	<u>Bothus ocellatus</u>			7	
Balistidae	<u>Stephanolepis hispidus</u>		1		
Tetraodontidae	<u>Canthigaster rostrata</u>		1		
	<u>Sphaeroides marmoratus</u>			1	
	<u>Sphaeroides spengleri</u>		1		

APPENDIX 4.3D Infaunal and epifaunal species collected
in 1/4 m² samples

	STATION 3		STATION 1
	A	B	
Phylum Annelida			
CLASS Polychaeta			
Family Aphroditidae			
<u>Eunice rubra</u>	2		X
<u>Eunice sp.</u>	2	2	X
<u>Lysidice sulcata</u>	1		X
<u>Onuphis sp.</u>	3	2	
Sabellidae (family)	1		
Syllidae (family)	1		
Unid. polychaete	1		X
<u>Syllis prolifera</u>			X
Phylum Sipunculida			
<u>Sipunculid sp. #8</u>	1		
<u>Sipunculid sp. #7</u>	5		
Unid. sipunculoid			X
Phylum Mollusca			
CLASS Gastropoda			
<u>Vermicularia knorri</u>		1	
<u>Anachis pulchella</u>			X
<u>Cerithiopsis emersoni</u>			X
<u>Cymatium poulsoni</u>			X
<u>Pusia gemmata</u>			X
<u>Rissoina multicostata</u>			X
<u>Trivia nix</u>			X
CLASS Pelecypoda			
<u>Anadara notabilis</u>		1	
<u>Arca imbricata</u>		1	
<u>Diplodonta nucleiformis</u>		1	
<u>Pinctada radiata</u>			X
<u>Petricola lapicida</u>	1		
<u>Lima pellucida</u>			X

APPENDIX 4.3D (continued)

	STATION 3		STATION 1
	A	B	
Phylum Arthropoda			
CLASS Crustacea			
SUBCLASS Malacostraca			
Order Isopoda			
<u>Alicirona hirsuta</u>			X
<u>Cirolana obtruncata</u>			X
Order Amphipoda			
Unid. gammarid		2	
Order Decapoda			
Suborder Natantia			
Section Caridea			
Unid. caridea	1		
<u>Synalpheus minus</u>			X
Suborder Reptantia			
Section Brachyura			
<u>Epialtus dilatatus</u>	1		
<u>Portunus sp.</u>		1	
Section Anomura			
<u>Pachycheles ackleianus</u>			X
Phylum Bryozoa			
Unid. Bryozoa	3**	2*	
Phylum Echinodermata			
CLASS Echinoidea			
<u>Eucidaris tribuloides</u>	1	3	
<u>Mellita sexiesperforata</u>			X
CLASS Asteroidea			
<u>Asterina folium</u>		1	
CLASS Ophiuroidea			
Amphiuridae (family)		2	
<u>Ophiactis mulleri</u>			X
<u>Ophiocoma echinata</u>			X
<u>Ophioderma cinereum</u>	1		
<u>Ophionereis squamulosa</u>			X

APPENDIX 4.3D (continued)

	STATION 3		STATION 1
	A	B	
Phylum Chordata			
Subphylum Urochordata			
CLASS Ascidea			
Unid. ascidian			X

* 2 species

** 3 unid. bryozoan=
3 different species

APPENDIX 4.4A Common plant species list for the Punta Manati area.

Grasses, Vines, Herbs:

Bidens pilosa
Borreria verticillata
Burserea simaruba
Chrysobalanus sp.
Coccoloba uvifera
Cocos nucifera
Crotalaria retusa
Diodia maritima
Erithalis fructicosa
Ipomea pes-caprae
Ipomea sp.
Kyllinga peruviana
Lantana involucrata
Plumiera alba
Psychotria undata
Randia sp.
Rauwolfia tetraphylla
Remirea maritima
Scaevola plumieri
Sideroxylon foetidissimum
Smilax sp.
Sporobolus virginicus
Tabebuia pallida
Zamia latifoliolata

APPENDIX 4.4B Terrestrial species list at Punta Manati.

SPECIES

Reptilia:

Bufo marinus

Leptodactylus sp.

Anolis crostatelis

Anolis sp.

Aves:

Columbigallina passerina

Mimus polyglottus

Todus mexicanus

Pelecanus occidentalis

Bubulens ibis

Mammalia:

Rattus rattus (Probable)

Canis

Felix

Bos

Capra

Sus scrofa

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