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Baseline Monitoring Studies, Mississippi, Alabama, Florida, Outer Continental Shelf, 1975-1976. Volume III. Results

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16. Abstracts Benchmark studies on the Eastern Gulf of Mexico Outer Continental Shelf were conducted seasonally to establish baseline information prior to extensive oil and gas development activity. No crude oil-like hydrocarbons were found in sediments, benthic organisms, zooplankton, suspended particulates nor dissolved phases on the Florida shelf. Moreover the abundance and diversity of organisms suggested that these organisms are living in an essentially pristine and natural ecological states, and show no evidence of stress owing to influx of pollutants. Some evidence of hydrocarbon anomalies were found in samples from the Mississippi-Alabama shelf probably due to drainage from the Mississippi River. A study of tissue pathology revealed only parasites in otherwise normal benthic organisms. Major features affecting the study area were the Mississippi River, the Loop Current and hurricane Eloise. Trace metal (Cd, Cr, Cu, Fe, Ni, Pb and V) concentrations in Eastern Gulf samples were at levels expected for non-polluted areas.

17. Key Words and Document Analysis. 17a. Descriptors

Marine Biology, Taxonomy, Chemical Oceanography, Primary Productivity, Hydrography

17b. Identifiers/Open-Ended Terms Mississippi-Alabama-Florida (MAFLA) area, Benchmark, Baseline, Outer Continental Shelf (OCS), Hydrocarbon, Trace Elements, Benthos, Histopathology, Hurricane, Florida Middle Ground, Macroinfauna, Macroepifauna, Offshore Oil Production, Suspended Particulate Matter, Microbial Biomass, Relative Abundance, Species Diversity.

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RESULTS

Water Column

Descriptive Physical Oceanography

It should be understood from the outset that the water column data were not synoptic. Within each of the three sampling seasons approximately 25-32 days of collection time were involved and these data can therefore only be examined for gross features of the transport system and not for the microstructure or the predictability of the effects on the transport from the forcing mechanisms of the Loop Current, wind stress, shelf circulation, tides and run-off. These data, therefore, represent only general support information as required for an interdisciplinary study and do not represent the definitive study of the shelf circulation and the water mass characteristics. Although the discussion will contain reference to the general weather conditions, the Loop Current, and river run-off, the existing tide conditions will not be discussed in detail and have been summarized from Mooer (1975) in a later section (Discussion) of this report.

A total of 23 STD lowerings and 14 XBT drops were made. Transects IV and III (off Pascagoula, Mississippi and Panama City, Florida respectively) are influenced by the river run-off characteristic of areas NORTHWEST (Mississippi Sound-St. Andrews Bay) and WEST (Mississippi River System) (Table 21) and in Hydro-Biological Zones IV, V (Bays, Lagoons, Estuaries), XIV, XV, XVI (nearshore) and XXIII (intermediate shelf) (Figure 3).

An examination of the vertical salinity distribution data from these

Table 21. MAFLA Subareas Based on River Discharge Characteristics.

	Mean Discharge (c.f.s.)	
West		
Mississippi River		478,028
Northwest		
Mississippi Sound	33,321	
Mobile Bay System	73,076	
Perdido Bay	1,868	
Pensacola Bay System	12,602	
Choctawhatchee Bay	8,352	
St. Andrew Bay	6,367	
TOTAL		135,586
Northeast		
Apalachicola Bay	26,635	
Apalochee Bay	5,444	
Deadman Bay	745	
Suwannee Sound	11,428	
Waccasassa Bay	200	
TOTAL		44,452
East		
Tampa Bay System	1,814	
Charlotta Harbor	2,255	
San Carlos Bay	1,226	
Florida Bay	N.D.	
TOTAL		5,295
		663,361

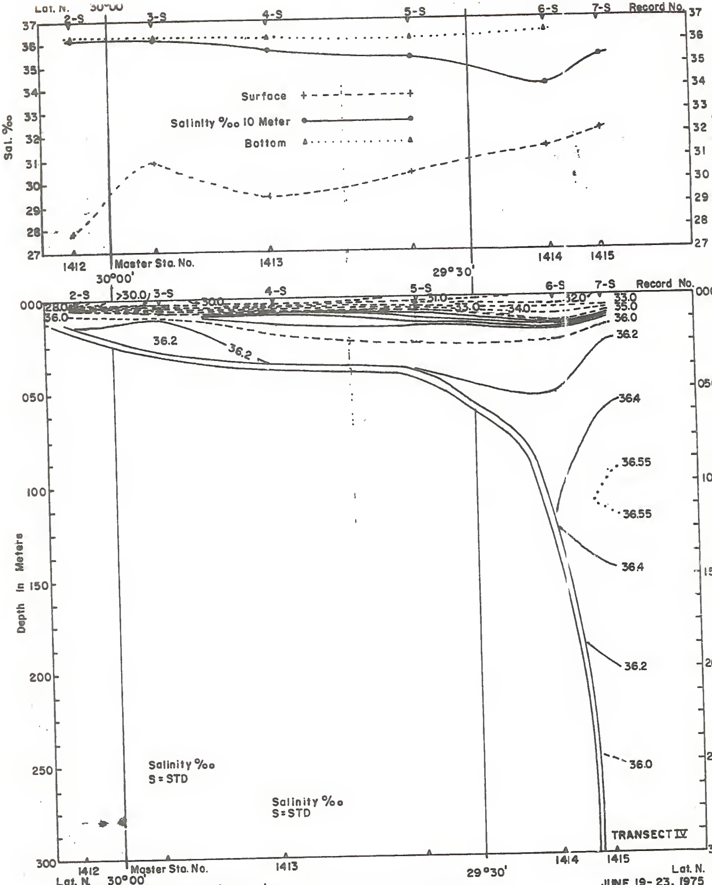
(From "Compilation and Summation of Historical and Existing Physical Oceanographic Data from the Eastern Gulf of Mexico," SUSIO, 1975) transects indicates that they can be characterized by the presence of two distinct low surface salinity pockets (Figures 9 and 10) in the upper seven to eight meters which may be associated with run-off effects on hydro-biological regions IV and V.

Edge Loop Current water defined by Molinari (1975) as water with salinity in excess of 36.55 $^{o}/_{oo}$ appears on both of the above sections and was located at approximately 100 m of depth along the slope area of the Shelf. Based on historical configurations and the location of the waters, the indication is that they were associated with break-off eddies from the main Loop Current. Such break-offs are usually associated with a low surface salinity pocket located approximately along the middle of the slope on the Continental Shelf.

The depth of the 22°C isotherm was used by Leipper (1970) to determine the location of the Loop Current. Molinari (1975) has used the topographic depth of the 20° isotherm to locate this same current.

Figure 11 depicts the 20°C isotherm topographic depth in the Eastern Gulf of Mexico (Molinari, 1975). Examination of this figure indicates the presence of two detached eddies located along the northwest Florida Continental Shelf near the Mississippi Delta and Panama City areas. These data establish the existence of Loop Current water in the MAFLA area as shown above and confirm that they were break-off eddies.

Figures 12 and 13 show the distribution of temperature along Transects IV and III. In general, the temperature values were uniform across the shelf except within the upper ten meters in the area of the low salinity pockets. The thermocline does not extend below ten meters



Along 88°45'-88°27'-88°13'-87°40'W.

JUNE 19-23, 1975

Figure 9 Vertical Distribution Salinity ‰ BLM-12

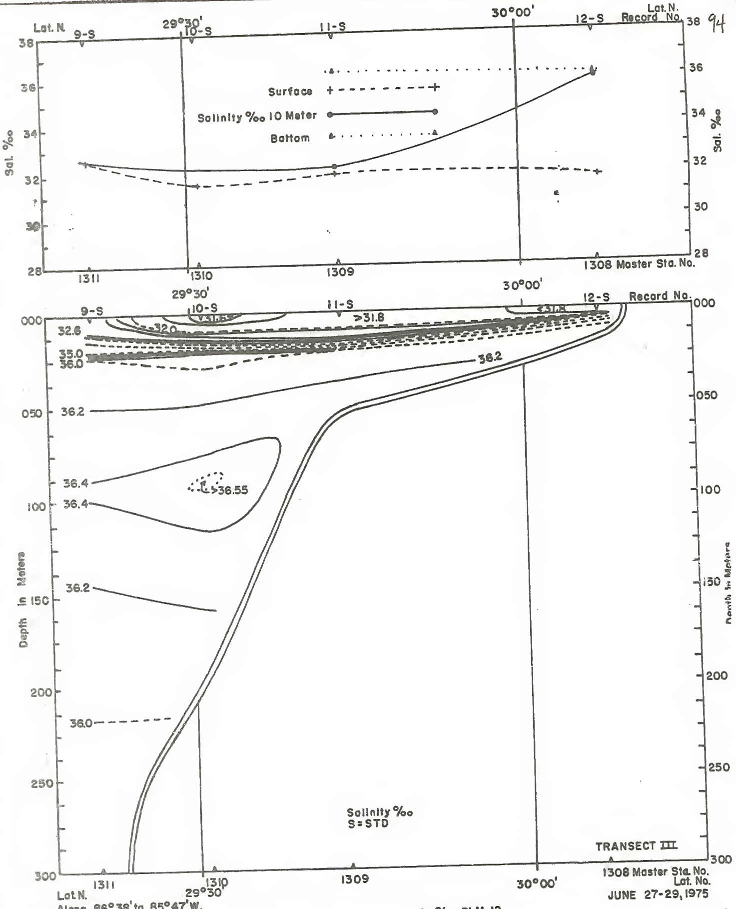


Figure 10. Vertical Distribution Salinity ‰ BLM-12

Figure II. Depth of 20° Isotherm Levels in Eastern Gulf of Mexico and Caribbean Sea During May-June, 1975 From XBT and STD Lowering. Data From Molinori, 1976

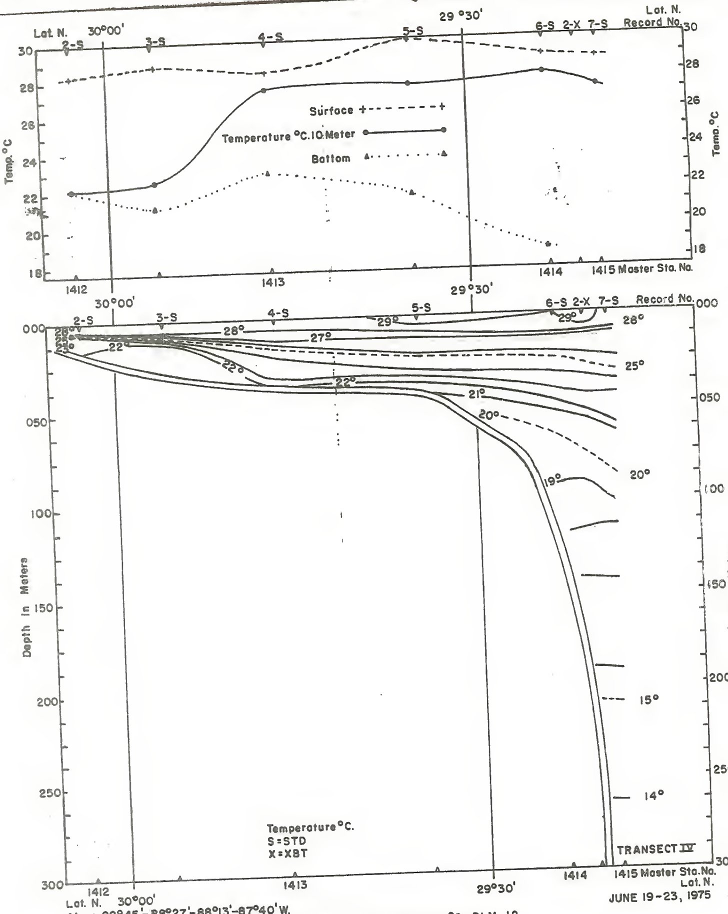


Figure 12. Vertical Distribution Temperature °C. BLM-12

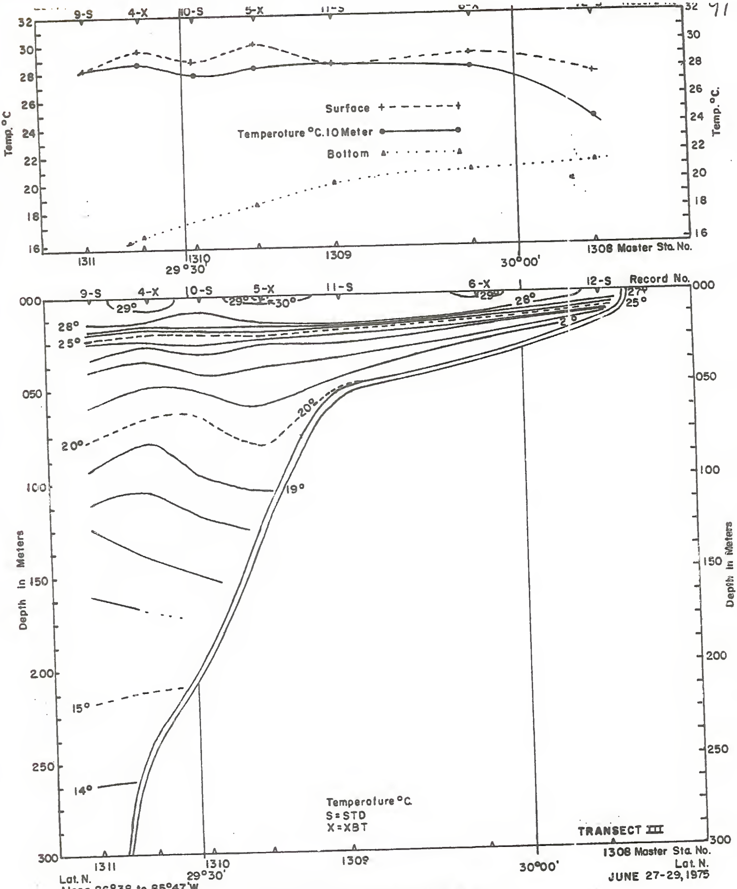


Figure 13. Vertical Distribution Temperature °C. BLM-12

and is shallower in areas of high- and deeper in areas of low-surface salinity values.

Strong sigma t and temperature gradients were present at approximately 15 m of depth. A similar gradient in salinity was also present at approximately five to ten meters.

Table 22 lists the ranges of temperature and salinity present along each of the four transects for the surface, ten meter and bottom waters.*

The temperature on Transects IV and III at the surface ranged from 29.87-28.25°C and 30.00-27.74°C respectively; at ten meters of depth the temperatures ranged from 28.00-22.19°C and 28.62-24.50°C respectively and at the bottom the temperatures ranged from 22.95-18.63°C and 21.34-16.60°C respectively. A comparison of the temperature along each of these transects showed that the greatest range was present in the surface and bottom waters of Transect III while the ten meter water along Transect IV showed a greater range in temperature than that of Transect III.

The salinity of the waters along these same transects (Table 22) at the surface ranged from 32.38-27.83 °/oo and 32.56-31.52 °/oo respectively; at ten meters of depth the salinity ranged between 36.17-34.00 °/oo and 35.92-32.20 °/oo respectively and at the bottom the salinity ranged between 36.40-35.82 °/oo and 36.29-36.12 °/oo.

Transect II is in the NORTHEAST river discharge area (Table 21), Marine Summary Zone B and Hydro-biological Region VI (Bays, Lagoons, and Estuaries), XVII (nearshore) and XXIV (Intermediate Shelf) (Figure 3).

* In this report the notation "bottom waters" represents the value taken either at the bottom or within five meters of it.

Table 22. Temperature (^{o}C) and Salinity ($^{o}/oo$) Ranges Along Each Transect at the Surface, 10 m, and the Bottom During the Summer and Fall, 1975 and Winter, 1976.

	Surface Temperature	10 m Temperature	Bottom Temperature	Surface Salinity	10 m Salinity	Bottom Salinity
			Transect IV			
Summer	29.87-28.25	28.00-22.19	22.95-18.63	32.38-27.83	36.17-34.00	36.40-35.82
Fall	29.65-28.61	29.43-28.86	25.89-14.69	34.70-27.00	35.31-29.00	36.50-34.55
Winter	18.62-13.73	18.90-13.93	18.30-14.04	35.40-31.83	35.69-31.91	36.38-32.08
			Transect III			
Summer	30.00-27.74	28.62-24.50	21.34-16.60	32.56-31.52	35.92-32.20	36.29-36.12
Fall	29.49-28.20	29.55-28.00	-- --	35.76-31.69	35.83-34.80	-- --
Winter	19.84-13.24	19.84-13.46	19.09-12.44	36.30-34.88	36.30-34.95	36.16-35.14
			Transect II			
Summer	28.62-28.40	28.62-28.20	28.25-17.88	36.27-31.52	36.28-31.54	36.28-33.60
Fall	27.39-26.01	27.73-26.11	27.22-24.11	35.56-31.95	35.60-31.98	36.48-31.98
Winter	17.68-11.97	17.68-11.97	17.53-11.97	36.24-34.30	36.27-34.31	36.25-34.30
			Transect I			
Summer	29.30-27.80	28.62-27.50	28.58-17.88	36.27-33.50	36.28-33.50	36.36-35.13
Fall	27.40-26.15	27.40-26.35	26.10-16.85	35.92-33.71	35.92-34.00	36.52-35.19
Winter	20.2 -14.12	19.80-14.14	20.9 -14.16	36.21-35.17	36.28-35.16	36.16-35.15

The average river run-off on this transect is one-third that of Transect III and one-tenth that of Transect IV. As a result of the bottom topography to the west associated with Cape San Blas the inner half is sheltered from bottom transport input generated from the hydro-biological zones described by Transects IV and III.

Figures 14 and 15 depict the distribution of temperature and salinity on Transect II. Thermocline depths ranged between 10-12 m with the deepest values located under or near the low salinity pocket in the Horseshoe Bend. The waters were isothermal at the inshore Master Station (1204). Strong gradients in both the temperature and sigma t field were either at the bottom or along the 25 m depth level. The temperature of the water at both the surface and ten meters of depth ranged between 28.62-28.20°C while the bottom waters ranged between 28.25-17.88°C. No significant ranges in temperature with depth across the section were noted except for a shallow depression located at or near the Florida Middle Ground Master Stations 1206 and 1207.

The predominant feature of the salinity distribution was the presence of two low salinity pockets of surface water. At Master Station 1205 the salinity was 32.06 °/oo while at the outer Master Station (1207) located to the west of the Florida Middle Ground the salinity was 31.52 °/oo. No Loop Current (≥36.55 °/oo) nor eastern Gulf of Mexico waters (36.4 °/oo) were observed on this transect.

The salinity at the surface on this transect ranged between 36.27-31.52 °/oo; at ten meters of depth the salinity ranged between 36.28-31.54 °/oo and at the bottom the observed range was 36.28-33.60 °/oo.

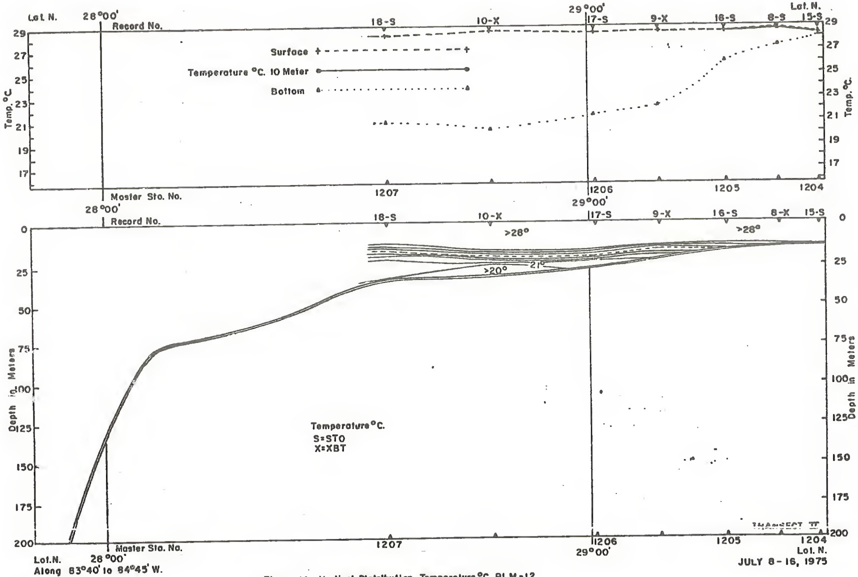


Figure 14. Vertical Distribution Temperature °C. BLM-12

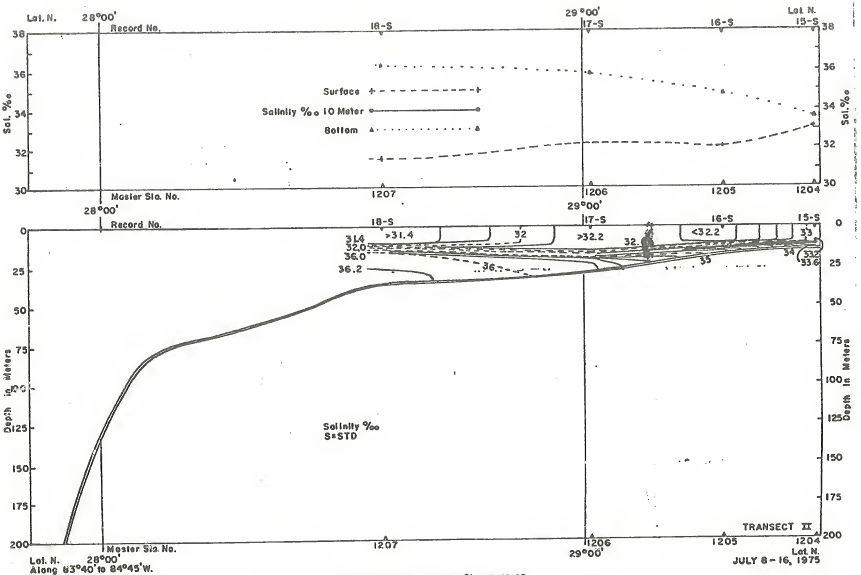


Figure 15. Vertical Distribution Salinity ‰ BLM-12

Both the temperature and the salinity of the waters present along this transect differed from those of Transects IV and III.

Transect I, located west of Tampa, Florida, lies in the EAST river run-off discharge characteristic area (Table 21), Marine Summary Zone B, and Hydro-biological Region VII (Bays, Lagoons, and Estuaries), Region XVIII (Nearshore), and Region XXIV (Intermediate Shelf) (Figure 3). The river run-off in this area is on the average approximately one percent of that associated with Transect IV, three percent of Transect III, and nine percent of Transect II.

Figures 16 and 17 depict the distribution of temperature and salinity along Transect I. The temperature at the surface ranged between 29.30-27.80°C; at ten meters of depth the temperature ranged between 28.62-27.50°C while near the bottom a much larger range (28.58-17.88°C) was present. The thermocline depths ranged from 10-28 m with a steady increase in depth with increasing distance from shore. Only at the inshore Master Station (1101) were the waters isothermal (or isohaline) to the bottom.

Salinity along this transect was characterized by the presence of a single, low surface salinity pocket (33.50 °/oo) and the presence of Loop Current water not only at the outer Master Station (1103) but also on the shelf to an approximate depth of 75 m. This water, along with a narrow band of eastern Gulf of Mexico water, intrudes onto the shelf as a mid-water phenomenon and was located at a depth of 55-125 m.

A strong gradient in salinity was located at approximately 20 m of depth and extended to the edge of the slope of the Continental Shelf. Strong gradients in both the temperature and sigma t fields also appeared between Master Stations 1102 and 1101 at approximately 20 m.

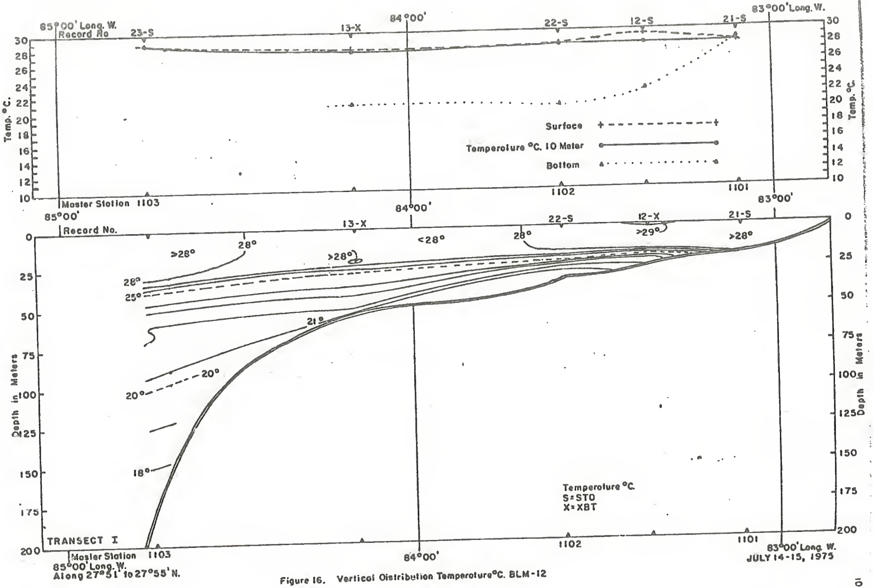


Figure 16. Vertical Distribution Temperature°C. BLM-12

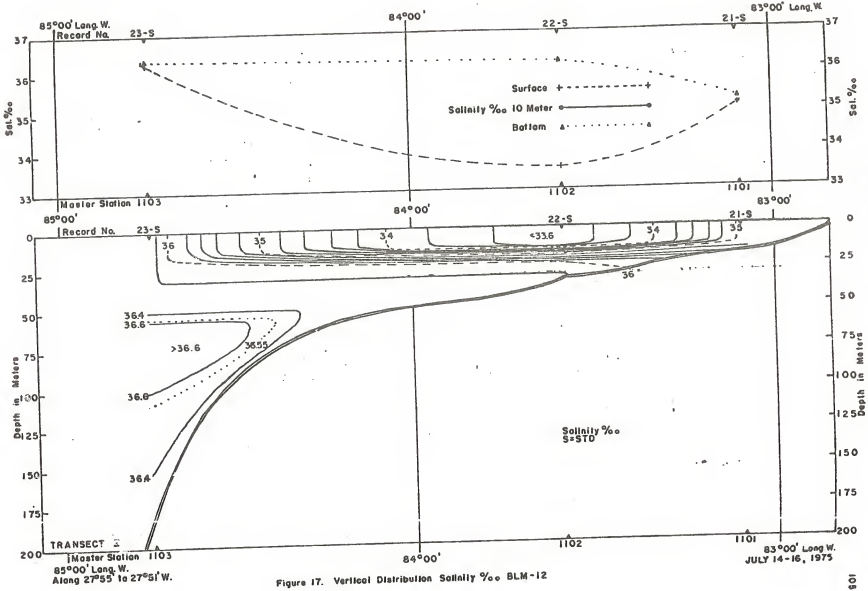


Figure 17. Vertical Distribution Salinity ‰ BLM-12

Weaker gradients extended seaward from these and descended to approximately 45 m in depth.

<u>Fall</u>

A total of 44 STD lowerings and 14 XBT's were made during this sampling period. An examination of the vertical sections for temperature (Figures 18-19) and salinity (Figures 20-21) indicates the presence of one low surface salinity pocket on Transect IV and two on Transect III. The inshore low salinity pocket on Transect IV had a surface salinity of 27.00 $^{\circ}/_{oo}$ the thickness of which is indicated by the strong salinity gradient at approximately 12 m in depth. The two low salinity surface pockets on Transect III consisted of an inshore pocket with a surface salinity of 31.69 $^{\circ}/_{oo}$ and another on the Continental Slope with a surface salinity of 34.63 $^{\circ}/_{oo}$. As on Transect IV the thickness of these pockets was approximately 12 m with the inshore pocket appearing to be associated with run-off from the NORTHWEST river characteristic run-off area (Transects IV and III) while the outer pocket on Transect III appeared to be associated with the Mississippi River System run-off area (WEST). It should also be noted that this WEST pocket has increased from 29.36 to 34.69 $^{\circ}/_{oo}$ from the summer sampling to the fall which is in accordance with continued low run-off (SUSIO, 1975) and Jones and Rinkel (1973).

Eastern Gulf of Mexico water (36.4 $^{\circ}/_{oo}$) is present in Transects IV and III at the upper edge of the Continental Slope between a depth of about 80-170 m. In the latter area, however, a broken-off ring of water with a maximum salinity of 36.62 $^{\circ}/_{oo}$ and a temperature range of 23.23-18.62°C was present. This ring of water is a spin-off eddy from the Loop Current.

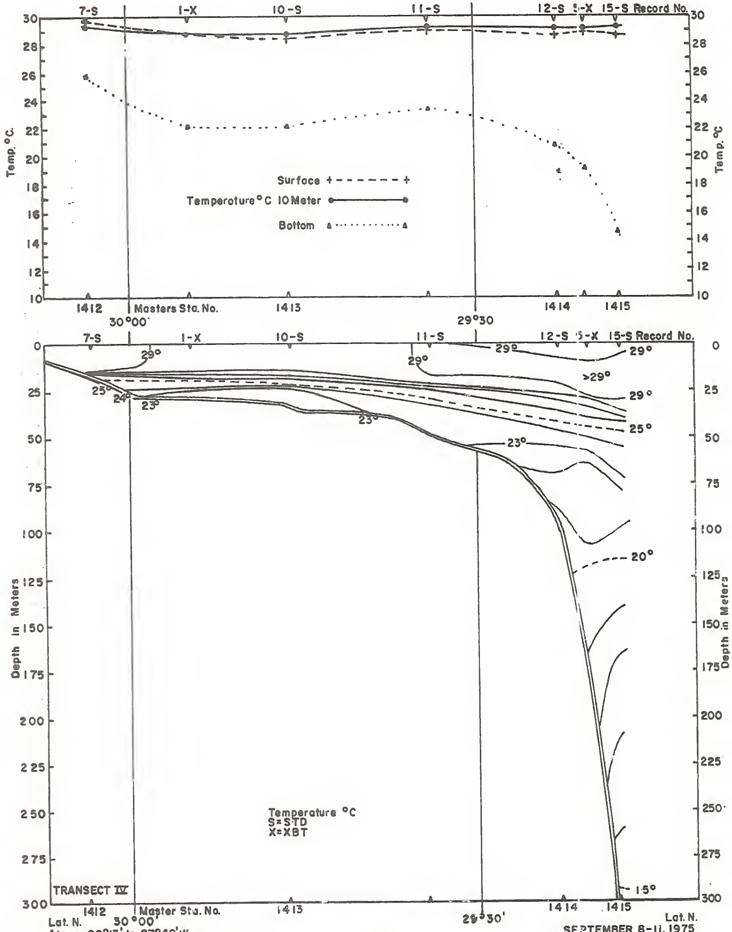


Figure 18. Vertical Distribution Temperature °C BLM-20

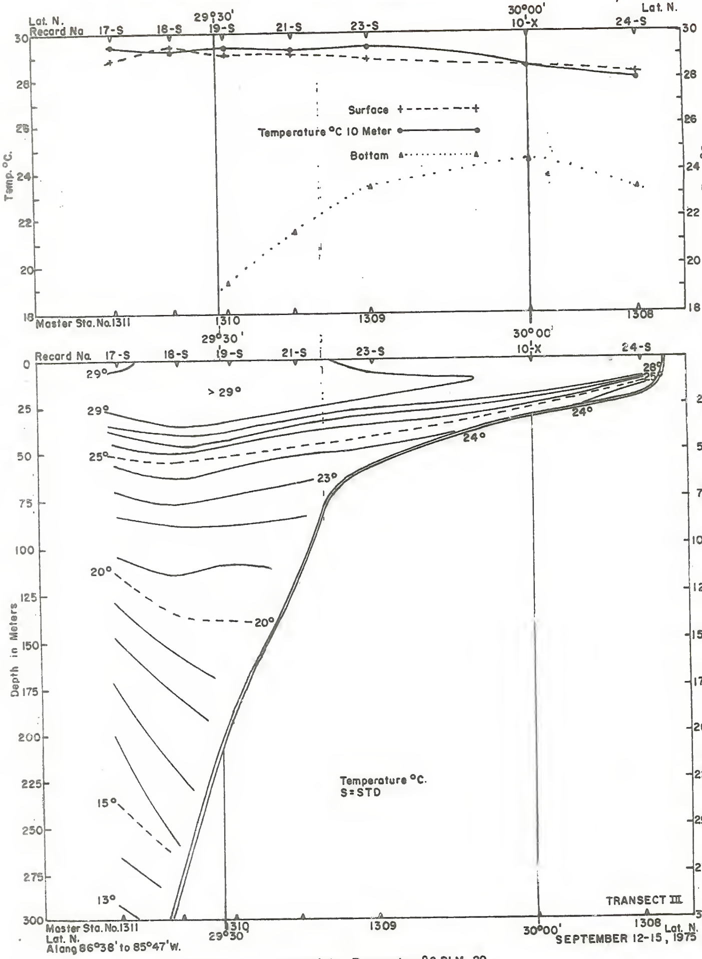


Figure 19. Vertical Distribution Temperature °C. BLM - 20

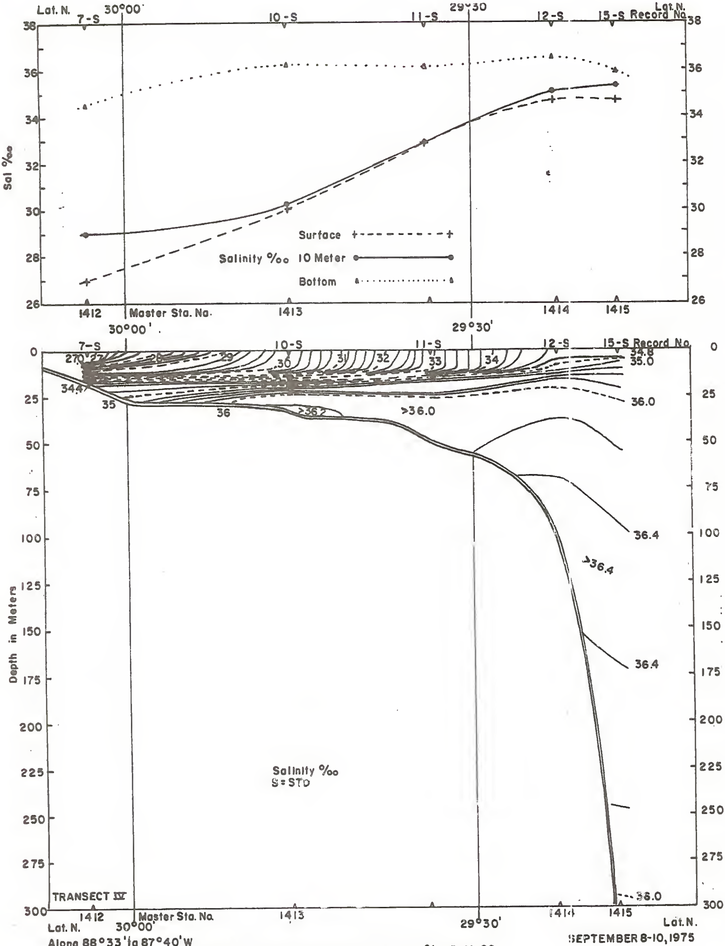


Figure 20. Vertical Distribution Salinity ‰ BLM-20

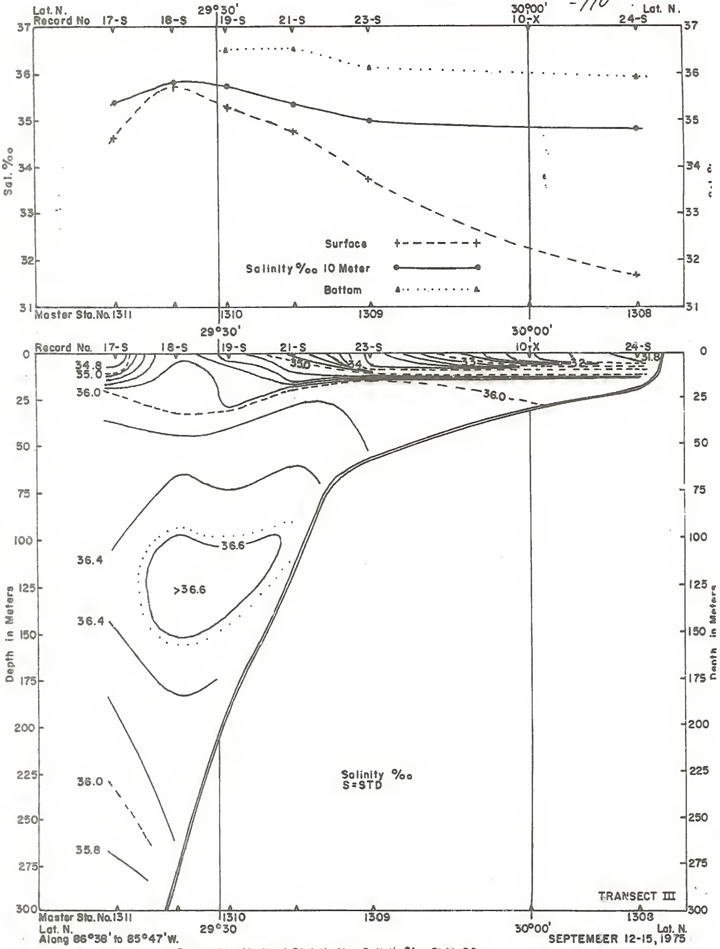


Figure 21. Vertical Distribution Salinity ‰ BLM-20

On both transects there was a tongue of warm water with temperatures in excess of 29°C entering onto the shelf at a depth of approximately 35 to 25 m. At no location on the two transects was the water either isothermal or isohaline to the bottom although there were well mixed waters on both sections as indicated by the thermocline depths.

On Transect IV the well-mixed layers appear as two pockets. One of these was associated with the NORTHWEST waters extending from Master Stations 1412 to 1413 and the other was associated with the Mississippi River System run-off waters with the thermocline depths ranging between eight to ten meters. On Transect III the thermocline extended across the entire section and increased in depth with increasing distance from the shore.

Strong salinity gradients located at 15 and 12 m on Transects IV and III respectively extended to the edge of the Continental Shelf. Similar gradients in temperature and sigma t were also present across the section. These were located between 15 and 50 m and each tended to increase with depth towards the open Gulf. This separation in the strong gradient of temperature and sigma t versus salinity is similar to the conditions encountered during the summer sampling.

Figure 22 depicts the topographic depth of the 20°C isotherm during October-November, 1975. Using this as an indicator of the location of the Loop Current, it would appear that detached eddies were present in the northern areas of the eastern Gulf of Mexico. This water appeared as two eddies, one of which was located to the west of the Mississippi River System drain-off area (WEST) while the other was present in the vicinity of Transect III. This explains the presence of Loop Current water on

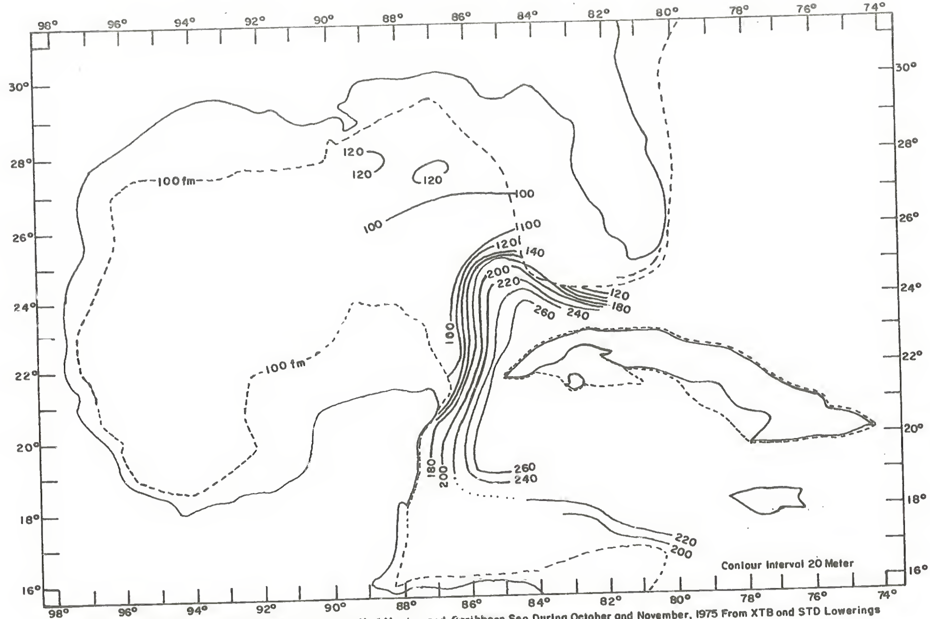


Figure 22 Depth of 20° C. Isotherm Levels In Eastern Gulf of Mexico and Caribbean Sea During October and November, 1975 From XTB and STD Lowerings (From Molinari, 1976)

Transect III and its absence on Transect IV. This also explains the presence of the Mississippi River System water (WEST) at Master Stations 1415 and 1311 (the Loop Current forcing mechanisms were not transporting water onto the shelf).

The surface temperature on Transects IV and III ranged between 29.65-28.61°C and 29.49-28.20°C respectively. At ten meters the temperatures ranged between 29.43-28.86°C and 29.55-28.00°C on the same respective transects. Bottom temperatures on Transect IV ranged between 25.89-14.69°C. Insufficient data were available and prevented this determination on Transect III.

The surface salinity values on these same transects ranged between 34.70-27.00 ‰ and 35.76-31.69 ‰ and the salinity at ten meters ranged between 35.31-29.00 ‰ and 35.83-34.80 ‰ on Transects IV and III respectively. Bottom salinity on Transect IV ranged between 36.50 and 34.55 ‰. Insufficient data precluded this determination for Transect III.

Figures 23 and 24 show the vertical distribution for temperature and salinity on Transect II during the fall. Three dominant features were evident. The first of these was the isothermal and isohaline structures on the inshore portion of the transect extending to a distance of approximately 30 miles offshore to Master Station 1205. Second was the lack of any surface salinity pockets coupled with a gradual increase of salinity with increasing distance from shore. The third was the appearance of pockets of bottom water between Master Stations 1206 and 1207 which had a maximum salinity of 36.33 ‰ and a minimum temperature of 24.62°C.

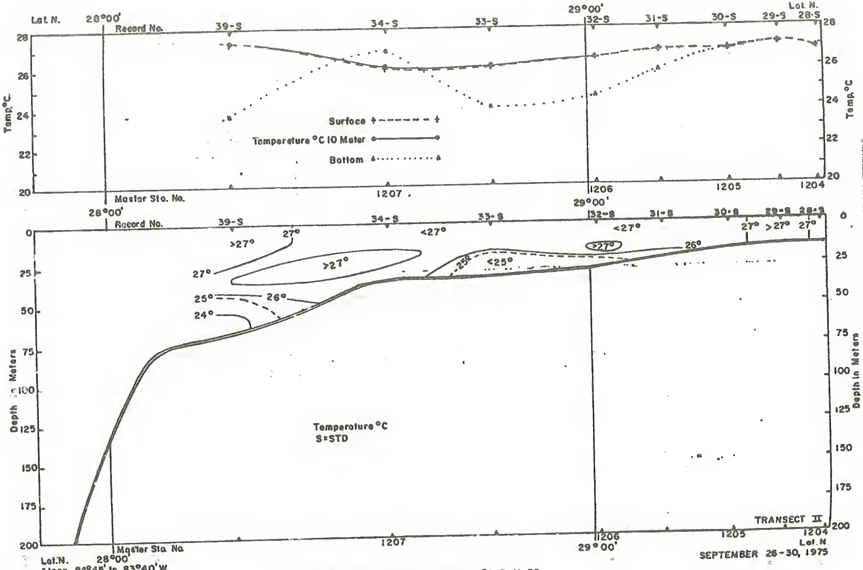


Figure 23. Vertical Distribution Temperature °C BLM-20

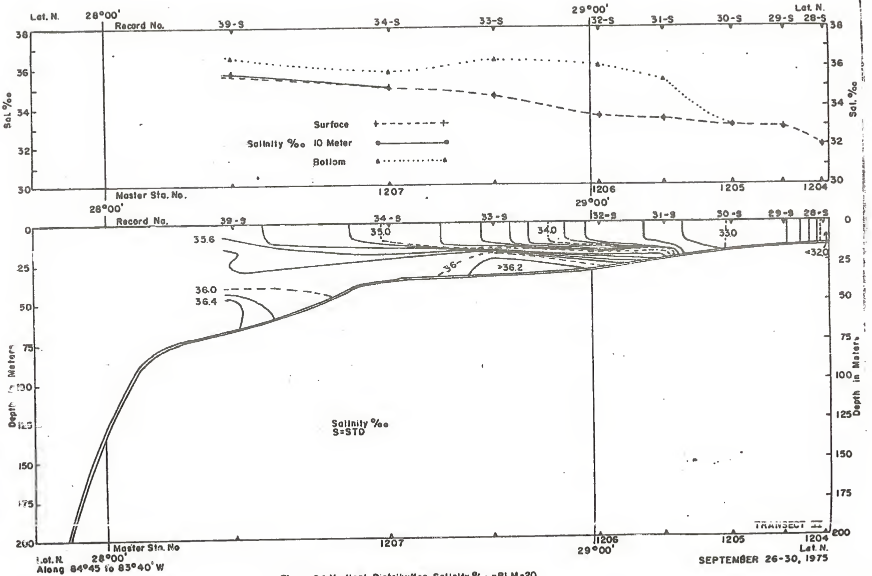


Figure 24. Vertical Distribution Salinity ‰ -BLM-20

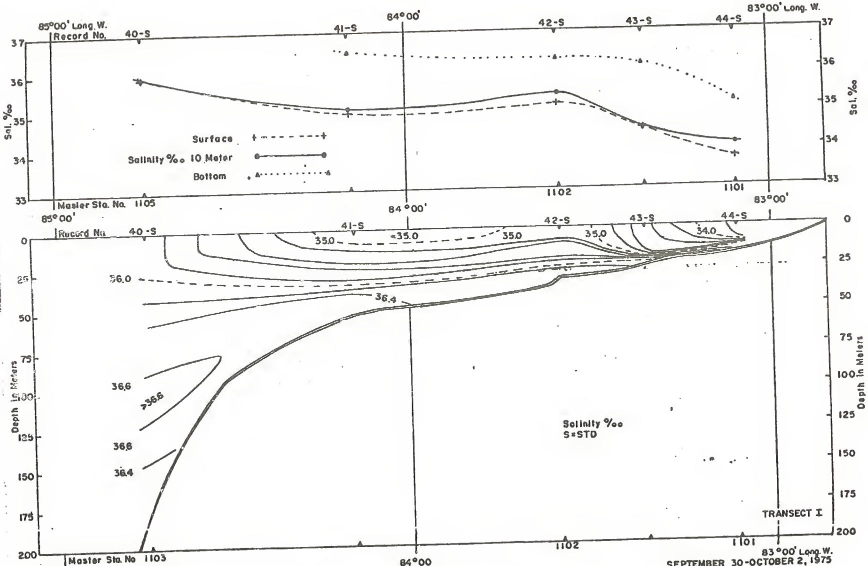
The thermocline was along the bottom at (and between) Master Stations 1204 and 1205 and then slowly decreased in depth until it reached the surface at the station intermediate to Master Stations 1207 and 1203.

No strong, continuous temperature gradients were present across this transect in the fall. However, at the depth at which the isothermal-isohaline ceased (20 m), there was a strong gradient of salinity and sigma t across the transect. The only strong temperature gradient present on Transect II was a lens of low temperature (and high salinity) water on the bottom between Master Stations 1206-1207.

The temperatures along this transect at the surface, ten meters and bottom ranged between 27.39-26.01°C, 27.73-26.11°C, and 27.22-24.11°C respectively. Over these same depth intervals the salinity ranged between 35.56-31.95 ‰, 35.60-31.98 ‰, and 36.48-31.98 ‰ respectively.

Figures 25 and 26 show the vertical distribution of salinity and temperature along Transect I. Three dominant features were evident. The first was the low salinity surface pocket located at Master Station 1101 with a surface salinity of 33.71 ‰. Second was a low salinity surface pocket located between Master Stations 1102-1103 with a minimum value of 34.94 ‰. Third was the appearance of Eastern Gulf of Mexico water protruding onto the shelf to 84°W longitude. This water extends inwards across the shelf to a depth of approximately 60 m. Accompanying this was an intrusion of Loop Current water extending upward from 189 to 75 m on the outer edge of the shelf.

The temperature was relatively uniform across the shelf except at the ten meter level at Master Station 1102 where the temperature increased



85°00' Long. W.
Along 27°55'-27°51'N.

SEPTEMBER 30-OCTOBER 2, 1975

Figure 25. Vertical Distribution Salinity ‰ BLM-20

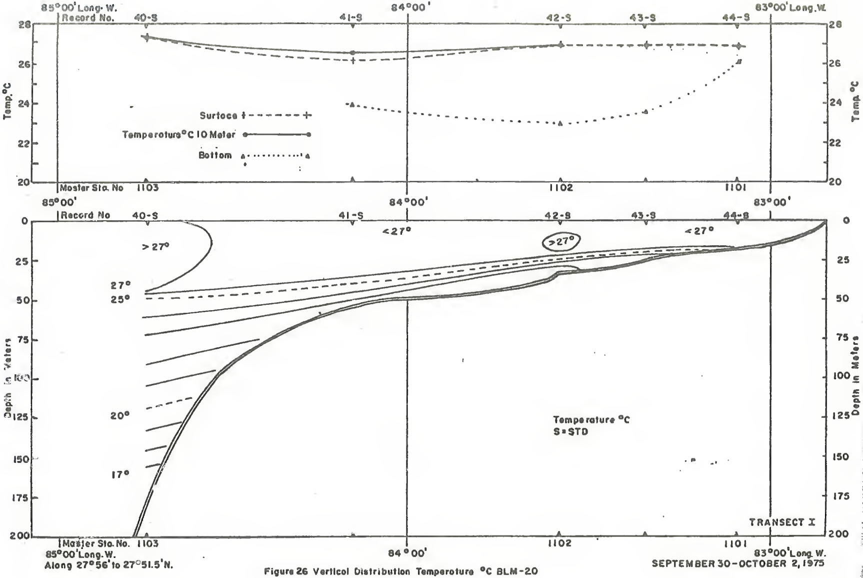


Figure 26 Vertical Distribution Temperature °C BLM-20

by 0.18°C and in the upper layers of the water column at Master Station 1103.

The salinity values at the surface, ten meters and the bottom ranged between 35.92-33.71 °/oo, 35.92-34.00 °/oo and 36.52-35.19 °/oo respectively. In general these were similar to those present on Transect II but differed from those of Transects III and IV.

The temperature on Transect I at the surface, ten meters and the bottom ranged between 27.40-26.15°C, 27.40-26.35°C, and 26.10-16.85°C respectively. No isothermal stations were present, and the thermoclines extended across the shelf at depths ranging between 10 and 40 m.

Winter

During the winter sampling period a total of 45 STD lowerings and 12 XBT drops were made. The vertical distribution of temperature and salinity along Transects IV and III is shown in Figures 27, 28, 29, and 30 respectively.

The inshore station on Transect IV was dominated by a low salinity isohaline layer (rather than the pocket evidenced in summer and fall), and Master Stations 1413 and 1415 contained the previously observed low salinity surface pocket. Eastern Gulf of Mexico water was present along the edge of the Continental Slope and was apparently moving up onto the break of the slope itself at an approximate depth of 100 m. Evidence for the presence of a very detailed microstructure eddy system was also present at Master Station 1415.

Only a single low salinity surface isohaline layer with a minimum salinity of 34.88 °/oo was present along the inner portion of Transect III. The salinity gradually increased until it reached 36.2 °/oo (Outer

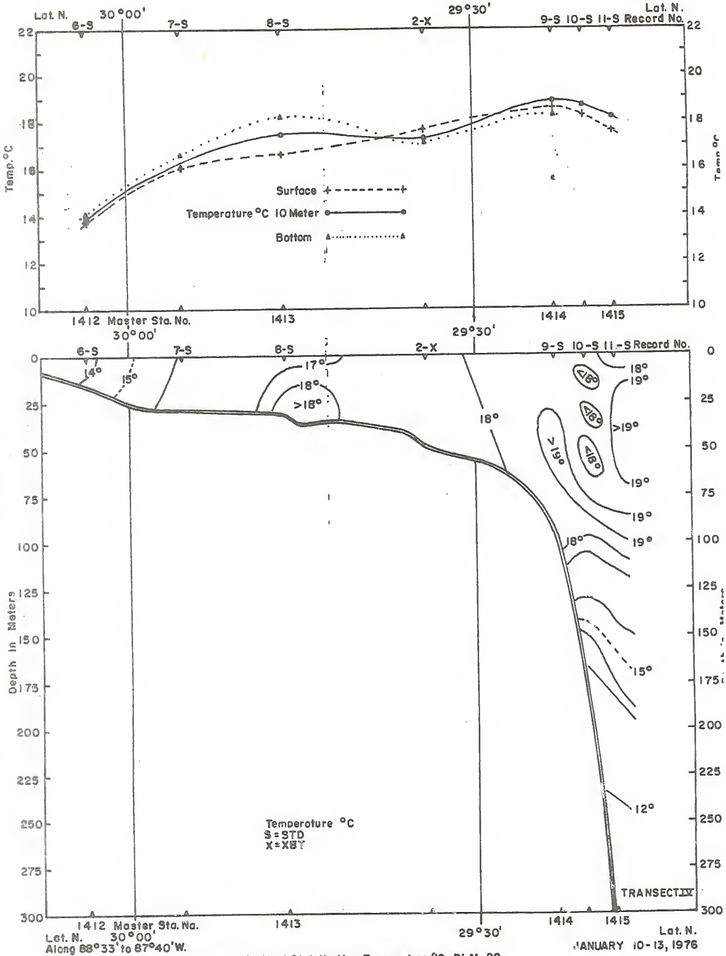


Figure 27. Vertical Distribution Temperature °C BLM-28

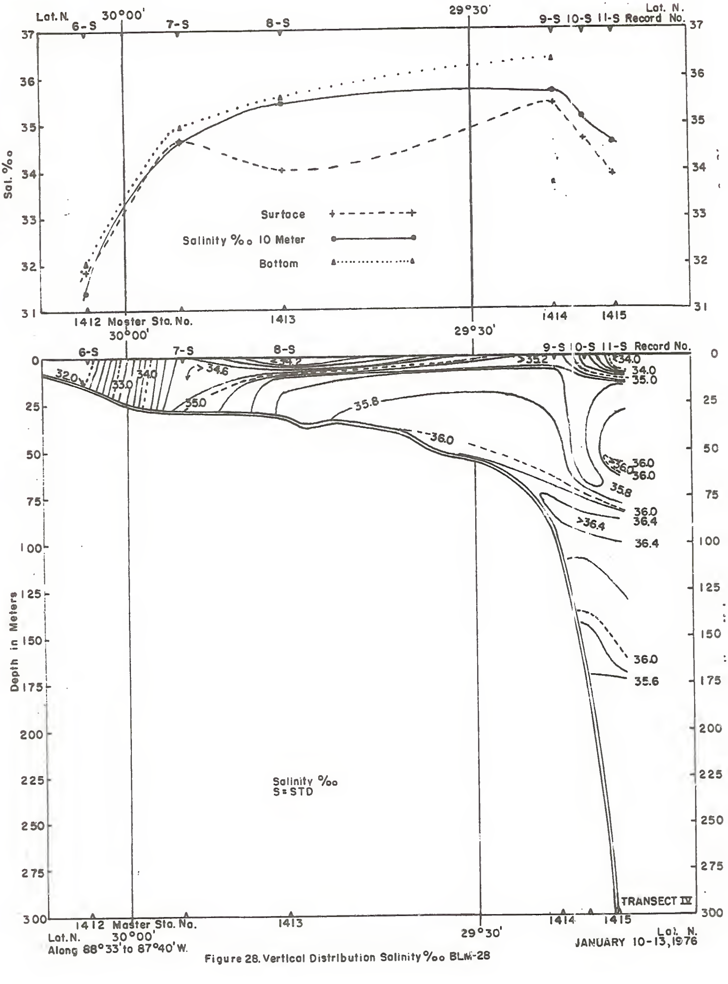
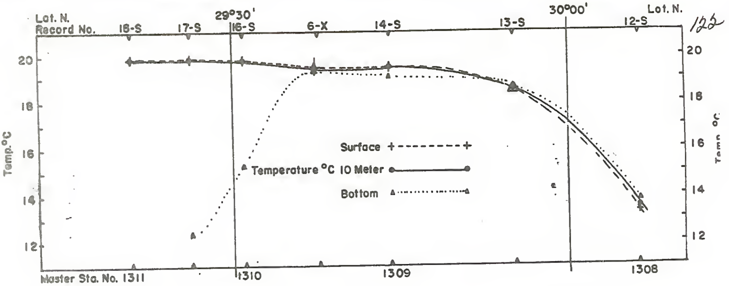


Figure 28. Vertical Distribution Salinity ‰ BLM-28



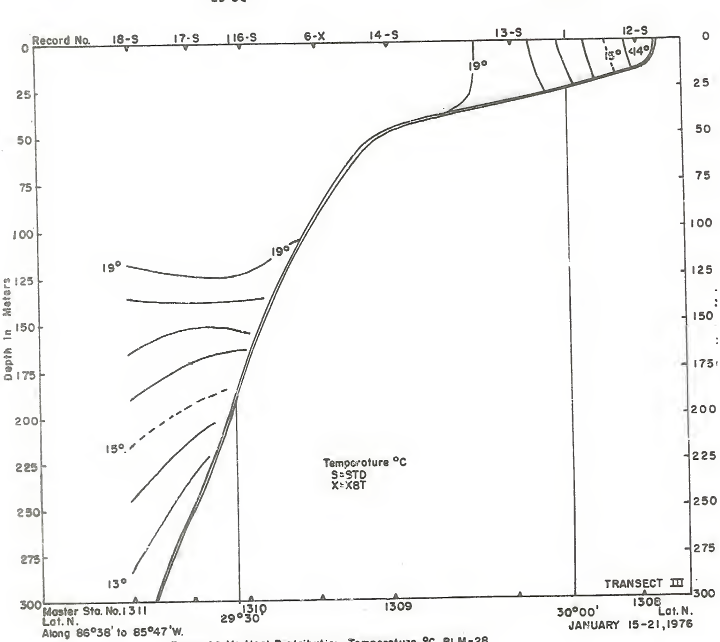


Figure 29. Vertical Distribution Temperature °C BLM-28

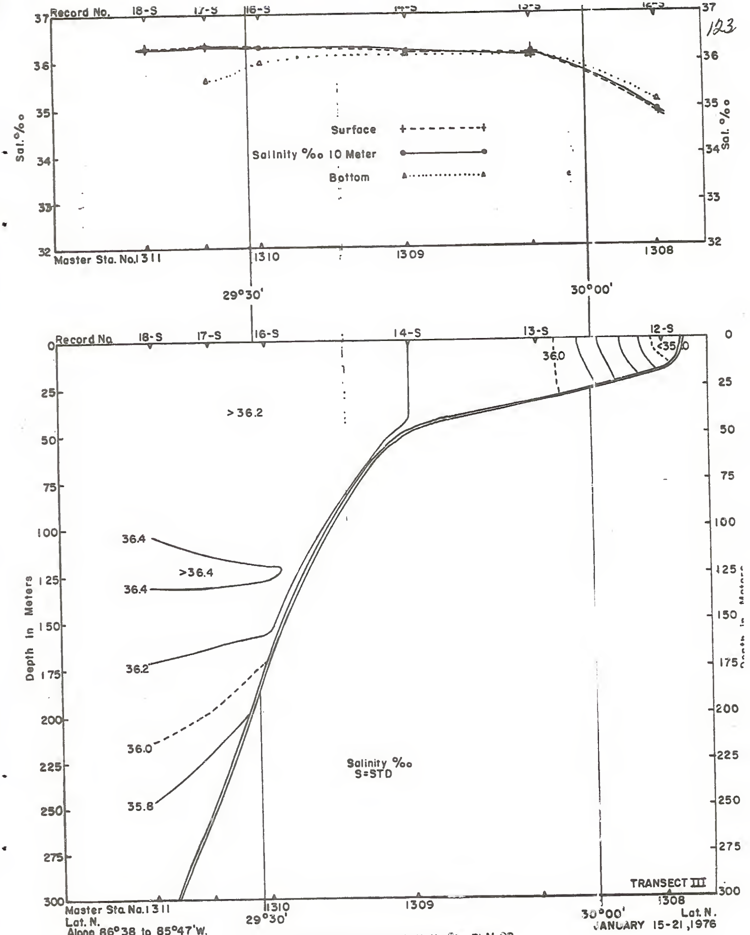


Figure 30. Vertical Distribution Salinity ‰ BLM-28

Shelf water) at the edge of the Continental Shelf. In contrast to this was the presence of two sub-surface salinity pockets in summer and fall. A small tongue of Eastern Gulf water was present at a depth of approximately 100-125 m.

The waters were isohaline to a depth of about 25 m on Transect IV and out to the edge of the Continental Slope on Transect III. Figure 31 shows the topography of the 20°C isotherm in February, 1976 as furnished by Molinari (1976). The figure indicates that no Loop Current water was north of 26°N; this is confirmed by the salinity distribution on both Transects IV and III. In general the distributions of temperature across both transects was similar and nearly isothermal. This was shown by the thermocline depth which reached 75 m on Transect IV and 100 m on Transect III at the outer station of each transect. A shallow thermocline was present on Transect IV at the outer station and was probably associated with the cooling created by the passage on January 12-13, 1976 of a cold front. This shallow thermocline was located at approximately five meters depth and extended from Master Station 1413 to Master Station 1415.

The distribution of temperature shows the presence of a low temperature and nearly isothermal distribution pattern. An interesting feature on Transect IV was the presence of a high temperature pocket of water at Master Station 1413. No major change in the salinity values occurred in that area.

Unlike the summer and fall conditions on Transect III no strong horizontal gradients were present in the winter on Transect III. On Transect IV, however, a weak salinity-sigma t gradient structure was present below the low salinity surface pocket near Master Station 1413 and was

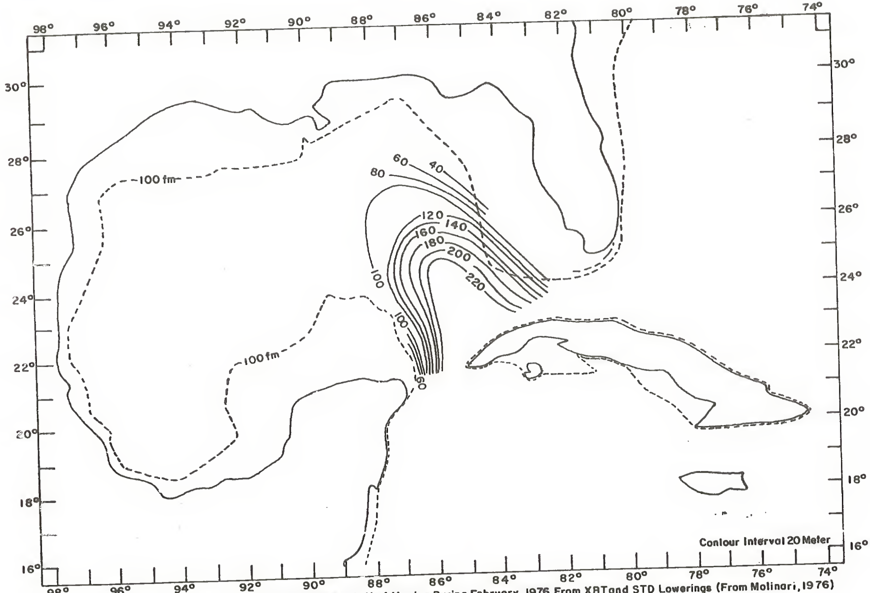


Figure 31. Depth of 20° C. Isotherm Levels in Eastern Gulf of Mexico During February, 1976 From XBT and STD Lowerings (From Molinari, 1976)

located at a depth of approximately 12 m. Similar gradients were recorded during the summer and fall.

The salinity at the surface, ten meters and at the bottom on Transect IV ranged between 35.40-31.83 °/oo, 35.69-31.91 °/oo, and 36.38-32.08 °/oo respectively. Temperatures over these same depth intervals ranged between 18.62-13.73°C, 18.90-13.93°C and 18.30-14.04°C respectively.

On Transect III the salinity at the surface, ten meters and at the bottom ranged between 36.30-34.88 °/oo, 36.30-34.95 °/oo, and 36.16-36.14 °/oo respectively. Temperatures over these same depth intervals ranged between 19.84-13.24°C, 19.84-13.46°C, and 19.09-12.44°C respectively.

The vertical distribution of salinity and temperature along Transect II is shown in Figures 32 and 33. The salinity distribution was dominated by an inshore, isohaline, low salinity layer extending 24 miles offshore to a ridge of isohaline, high salinity water (35.60 °/oo). To the west of this ridge lay a pocket of low salinity surface water between Master Stations 1205 and 1206 with a salinity of 35.38 °/oo. Another pocket was located between Master Stations 1206 and 1207 and near the Florida Middle Ground and showed a salinity of 35.87 °/oo. Both of these pockets extended downward to approximately 12-15 m and their boundary gradients were weak.

Neither Eastern Gulf of Mexico water nor Loop Current water was present in this transect, and in general the salinity increased with increasing distance from shore. The outer portion of the transect was covered with 36.2 °/oo isohaline water (outer shelf water).

Temperatures were isothermal across Transect II in the winter and generally increased with increasing distance from shore. The temperatures

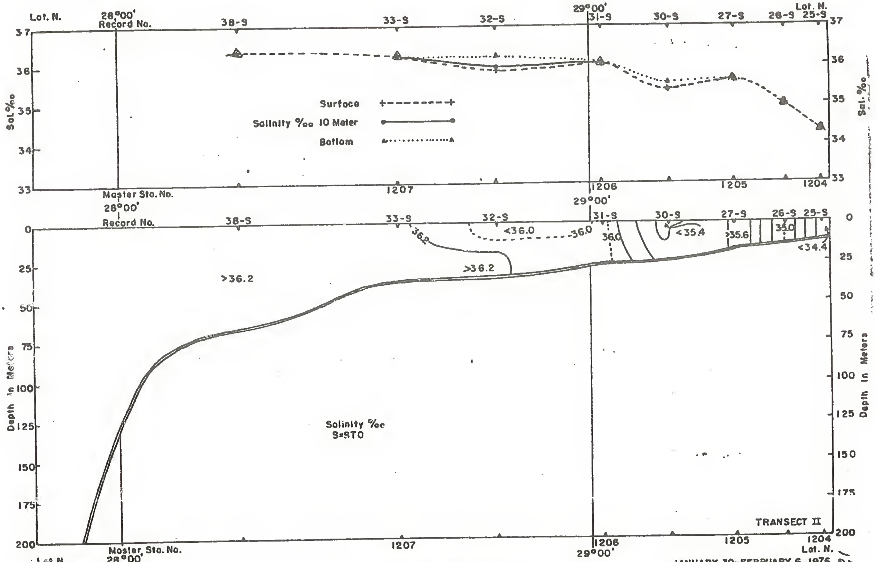


Figure 32. Vertical Distribution Salinity ‰ BLM-28

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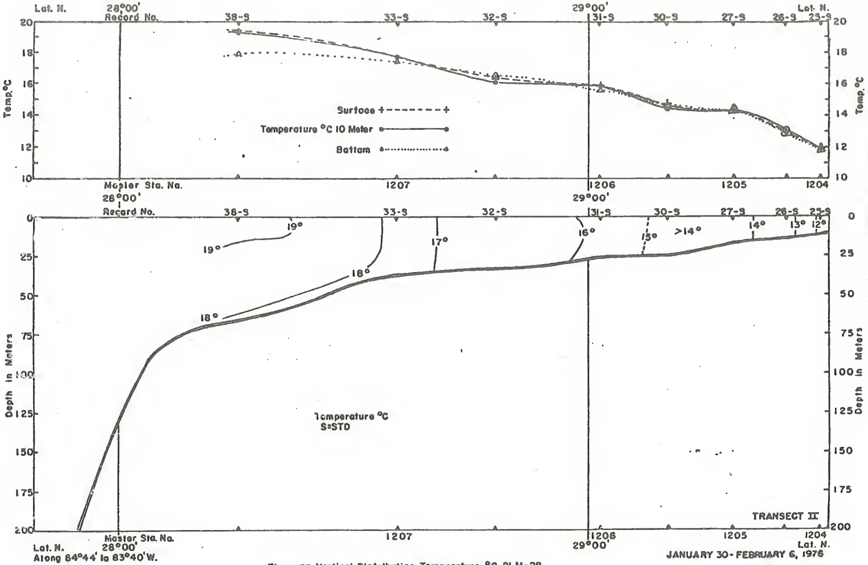


Figure 33. Vertical Distribution Temperature °C BLM-28

ranged from 11.97° to 17.68°C.

Associated with the low salinity surface pocket discussed above were 0.2-0.3°C temperature inversions, which were associated with the interface between the low salinity surface pockets and the underlying water. This results in two areas of shallow surface thermoclines which reach to a maximum depth of approximately ten meters.

The salinity at the surface, ten meters and the bottom on Transect II in the winter ranged between 36.24-34.30 ‰, 36.27-34.31 ‰, and 36.25-34.30 ‰ respectively. Temperatures over this same depth interval ranged between 17.68-11.97°C, 17.68-11.97°C, and 17.53-11.97°C respectively.

The vertical distribution of salinity and temperature on Transect I during February 6-8, 1976 is shown in Figures 34 and 35. Both of these distribution patterns were dominated by isohaline and isothermal layers out to approximately 84°00'N (or to a depth of 50 m). In both instances the temperature and salinity increased with increasing distance from shore.

Neither Eastern Gulf of Mexico water nor Loop Current water were detected at any of the stations on this transect. This was in agreement with the data shown on Figure 31 where the location of the Loop Current water is indicated as entering onto the outer edge of the Continental Shelf at approximately 25°N latitude or about 160 miles south of Transect I. No large or strong gradients were present in the salinity field. Outer Shelf Water (36.2 ‰) appears on the outer half of the shelf and on the slope. Vertically this layer extended to within five to ten meters of the bottom.

A low temperature surface pocket was present at Master Station 1103 which extended vertically to a depth of four meters and a low temperature bottom

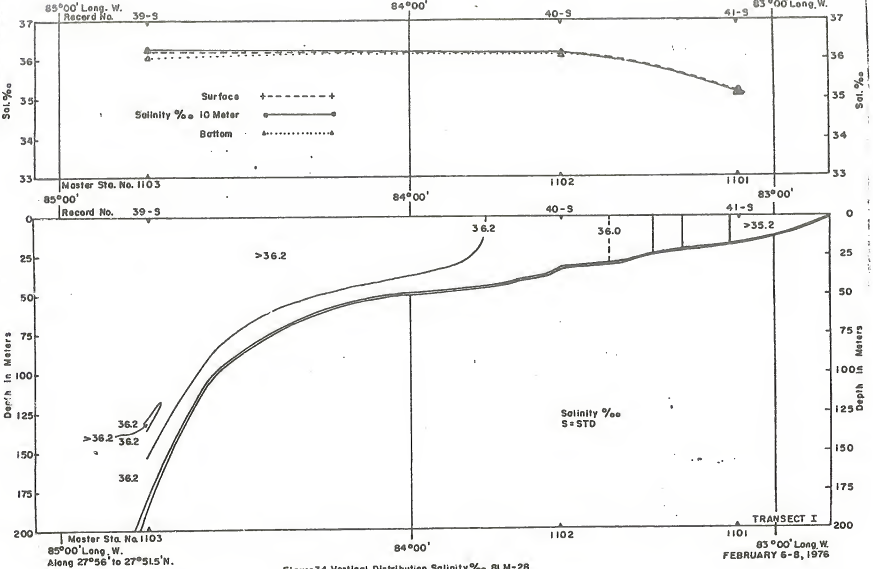


Figure 34. Vertical Distribution Salinity ‰ BLM-28

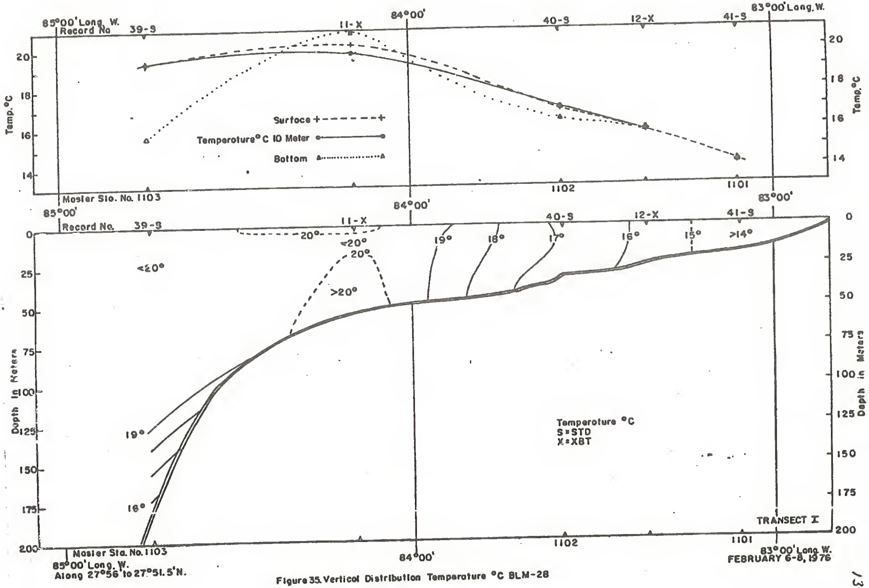


Figure 35. Vertical Distribution Temperature °C BLM-28

pocket located between 16 m and the bottom was present between Master Stations 1103 and 1102. Temperatures throughout the water column on this station ranged between 20.7-19.8°C. It should also be noted that the temperature data from this station were collected by an XBT and although the claimed reproducibility of the instrument indicates that the values were real, the inter comparison of XBT's and STD lowerings on the shelf makes one question whether these data are artifacts of the different collection system.

The salinity at the surface, ten meters and the bottom on this transect ranged between 36.21-35.17 °/oo, 36.28-35.16 °/oo, and 36.16-35.15 °/oo respectively. The temperature at the surface, ten meters and at the bottom ranged between 20.20-14.12°C, 19.80-14.14°C, and 20.90-14.16°C respectively. The uniformity of these ranges between the different depth levels was an additional indication of the isothermal-isohaline characteristics of this transect during the winter.

Due to difficulties with the transmissometer this transect was reoccupied, after a two day break, from the inshore station out to the edge of the Continental Shelf (but did not include Master Station 1103). Figures 36 and 37 depict the vertical distribution patterns for salinity and temperature on February 10, 1976 and serve to illustrate the horizontal changes that occur in the distribution over a short interval of time. Such changes reflect the combined effects of weather conditions, diurnal changes, internal waves and tidal oscillations on the shelf.

At Master Station 1102 the salinity values had not changed and were within the reproducibility of the data collection system throughout the

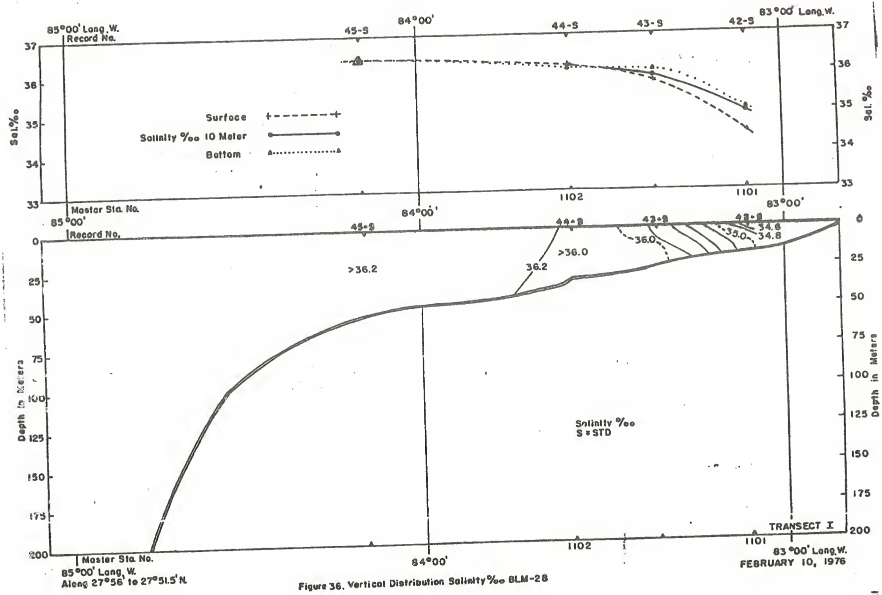


Figure 36. Vertical Distribution Salinity ‰ BLM-28

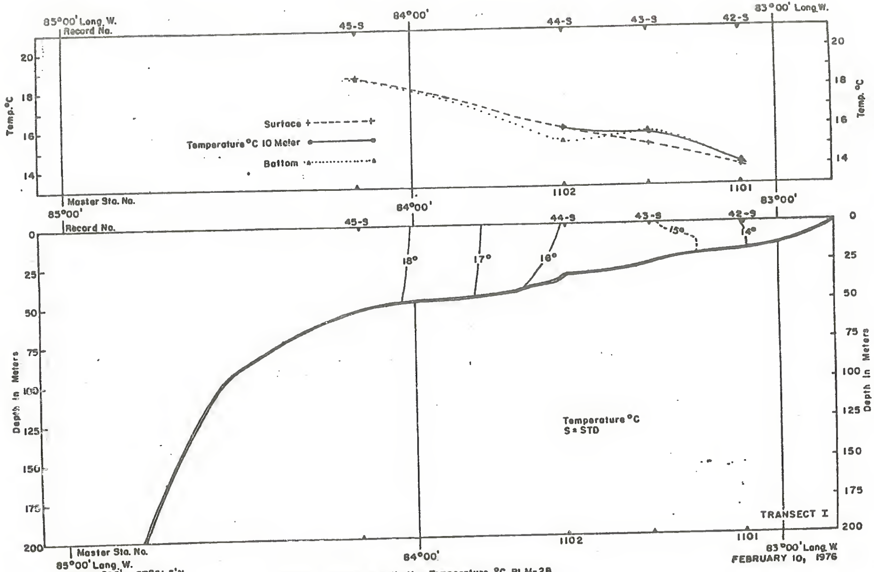


Figure 37. Vertical Distribution Temperature °C BLM-2B

water column. From that station to the edge of the shelf the salinity values had increased by 0.10 °/oo and 0.30 °/oo at the surface and bottom respectively over a 92 hr period. In this same time interval the outer continental shelf water was not only displaced downward but also showed a new movement of approximately ten miles to the east. At inshore Master Station 1101 the salinity had changed by 0.70 °/oo.

The temperature at Master Station 1101 showed a 0.5°C increase throughout the isothermal layer. At a shelf depth of 25 m and outward to the edge of the Continental Shelf the temperatures changed by approximately 1°C. During this sampling time period a cold front moved through the area on February 6 and 7 followed by a large high system on February 8, 9, and 10 which caused strong northeasterly and easterly winds on the 9th and 10th. Whether this shift in temperature was the result of the meteorological condition or whether this was the result of an internal oscillation of the outer shelf water cannot be determined from these data.

Transmissometry

Late negotiations of the contract and late arrival of equipment (which led to inadequate field testing prior to use) and failure of both the primary (Montedoro-Whitney) and the backup Hydro-Products transmissometers resulted in only a small recovery of information during the June-July sampling season. In the fall, although operational problems were still encountered, the yield of information was approximately 80%, while 100% of the transmissivity data was obtained in the winter. The bulk of these data was obtained with the Hydro-Products unit. In this report these data are displayed as sections of transmission (% T) based on depth profiles along transects extending from inshore to offshore.

Seasonal Shelf Transect

Summer data, although incomplete, did indicate the presence of a near bottom nepheloid zone on Transect I (Figure 38) at the inshore Master Station 1101 off Tampa Bay. This was evidenced by a sharp drop in the transmissivity (85% to 54% T) between 10-13 m of depth. The available data from Transect II (Master Stations 1204, 1204-1205, 1205, 1205-1206) were complex and indicate the presence of more than one water mass in the region. This was indicated by the greater transmissivity of the waters at Master Station 1205 as compared to the other stations on this transect.

Figures 39a, b, c and d show the transmissivity profiles obtained during September-October, 1975 for Transects I-IV. The main features of these profiles were the strong vertical stratification and the presence of bottom nepheloid layers. The latter were especially evident on Transect II which was occupied shortly after the passage of Hurricane ELOISE, and as shown later, the strongly developed, turbid, bottom layers were related to the effects of the hurricane. As expected, the overall turbidity increased markedly towards the northwest MAFLA region (Transects III and IV).

The transmission versus depth sections obtained during the winter sampling are shown in Figures 40a, b, c and d. The greater vertical homogeneity of the particle distribution was apparent. As indicated on the sections for Transects II, III and IV, meterological conditions introduced a perturbation into these data such that the more inshore stations were occupied several days (3-12) before the remainder of the stations. As found in the other seasons the transmissivity was greater in the offshore water. Strong vertical stratification was present at Master Stations 1412

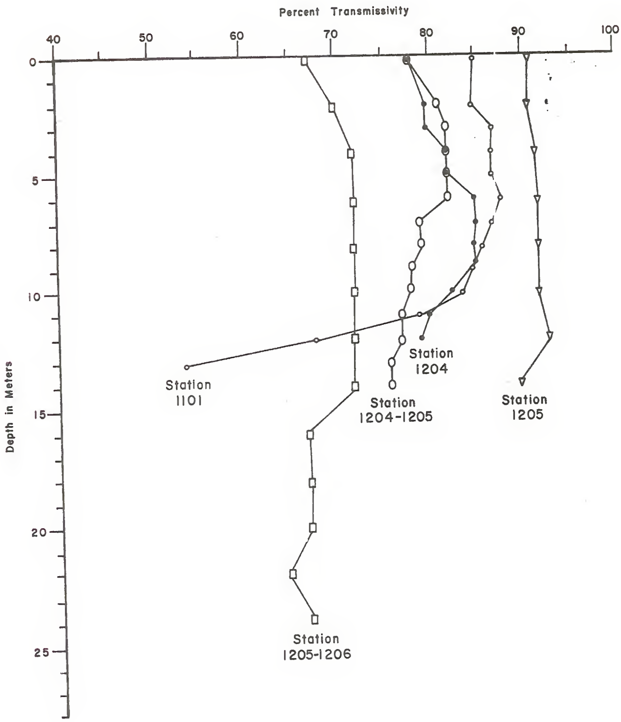


Figure 38. Transmissivity profile (June/July, 1975).

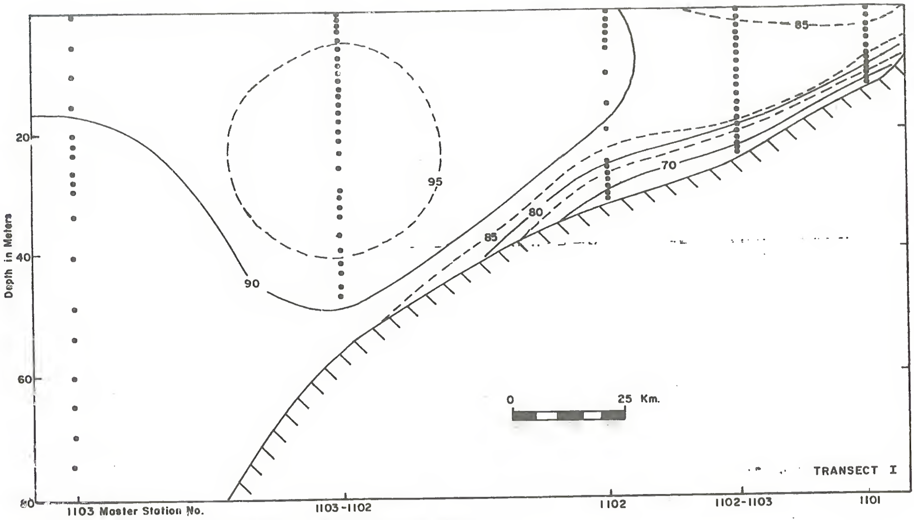


FIGURE 39a Vertical Distribution Transmission (T%) OCTOBER 1-2, 1975.

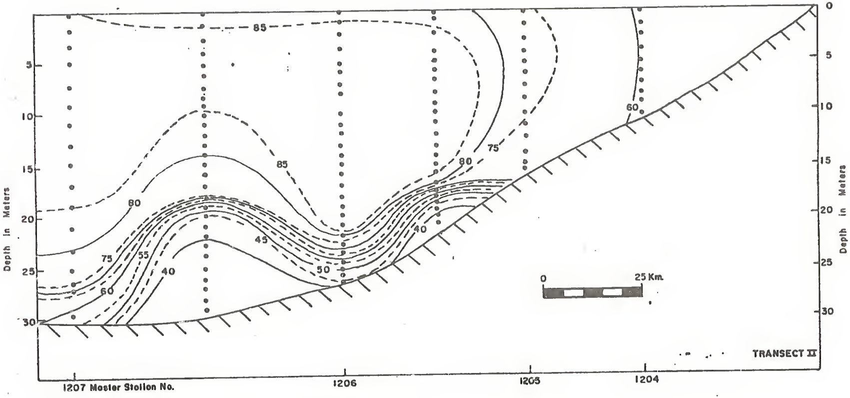


Figure 39b. Vertical Distribution Transmission (%) SEPTEMBER 26-27, 1975

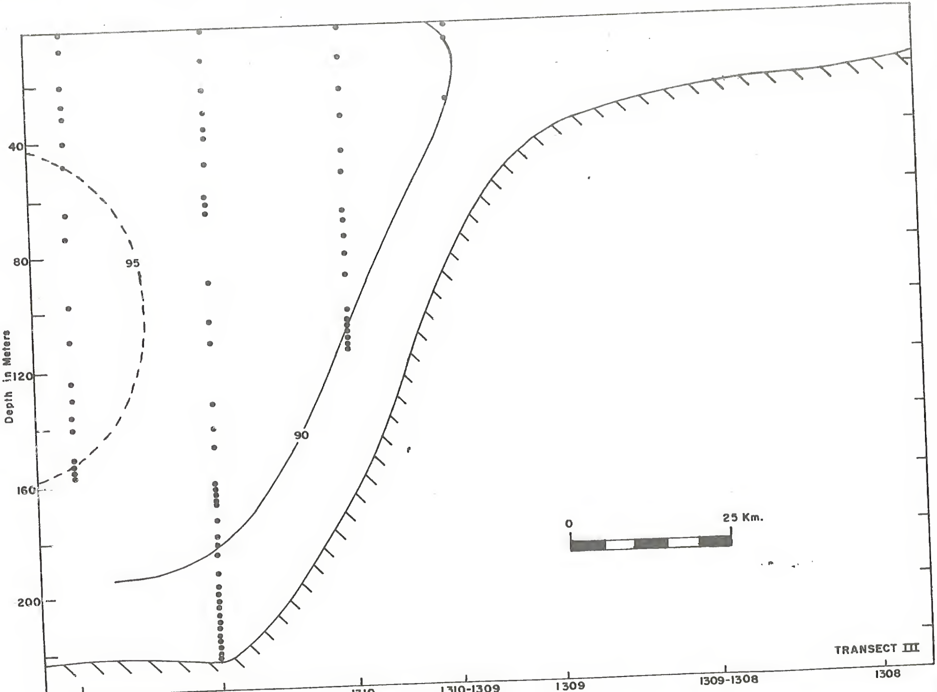


FIGURE 39c. Vertical Distribution Transmission (T%) SEPTEMBER 9, 1975

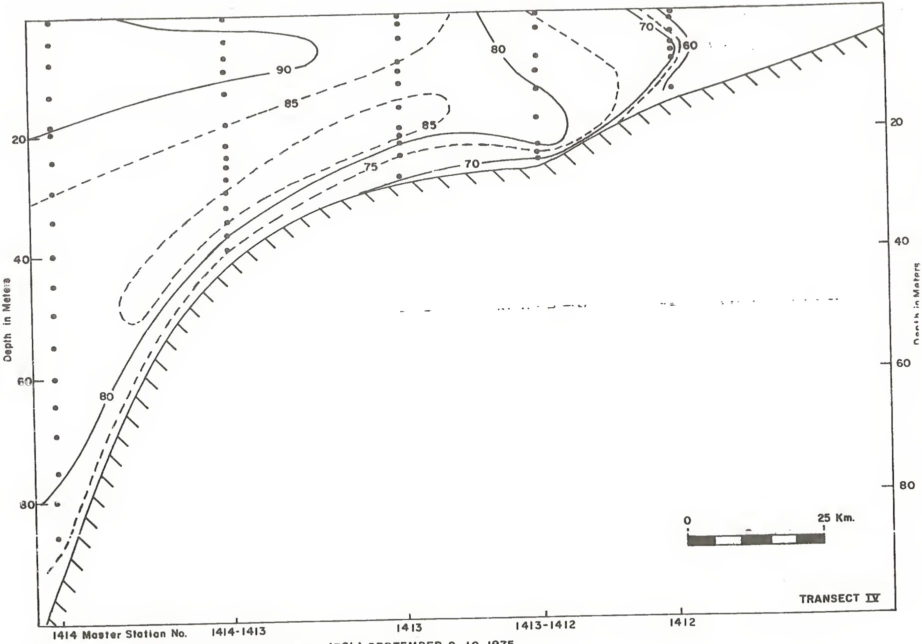
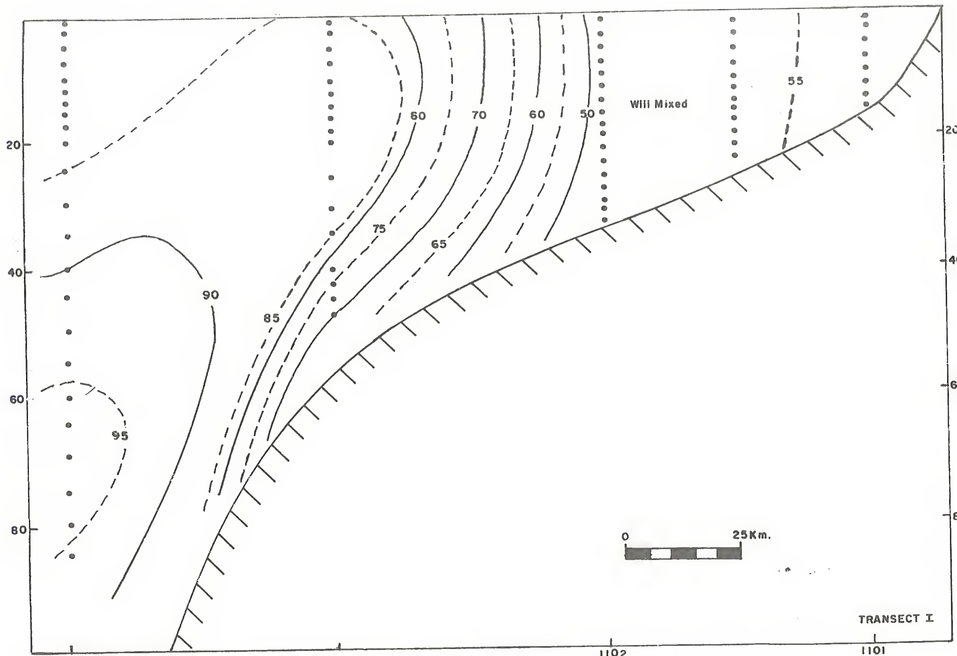


Figure 39d. Vertical Distribution Transmission (T%) SEPTEMBER 9-10, 1975



1103 Master Station No.
FIGURE 40a. Vertical Distribution Transmission (T %) FEBRUARY 10, 1976

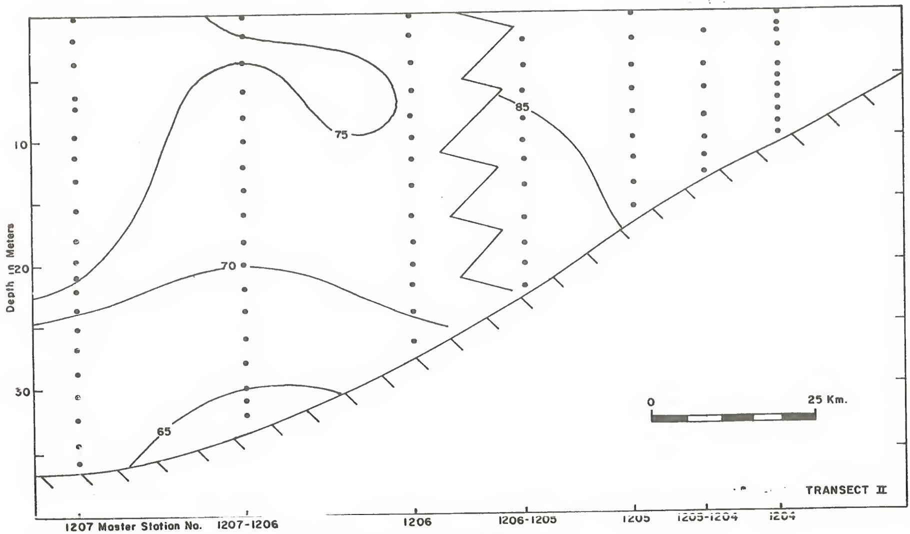


FIGURE 40b. Vertical Distribution Transmission (T%) JANUARY 30 - FEBRUARY 2, 1976

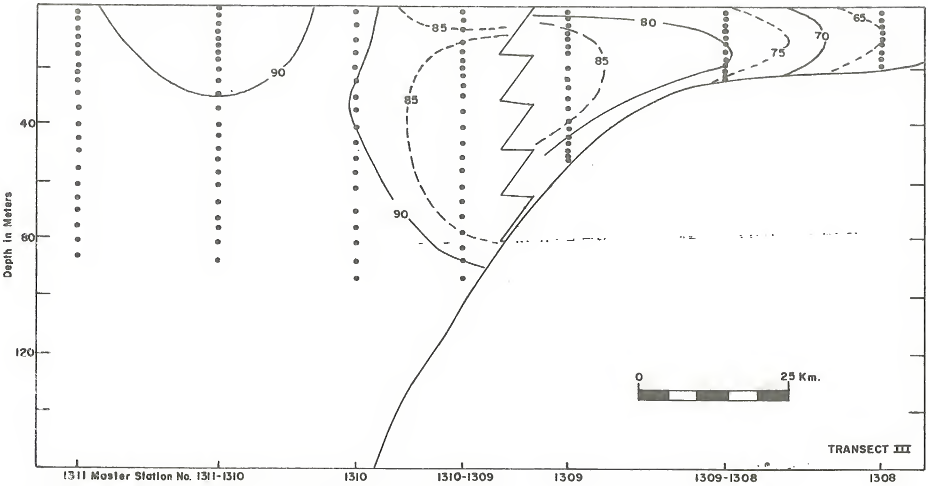


FIGURE 40c Vertical Distribution Transmission (T %) JANUARY 15-21, 1976

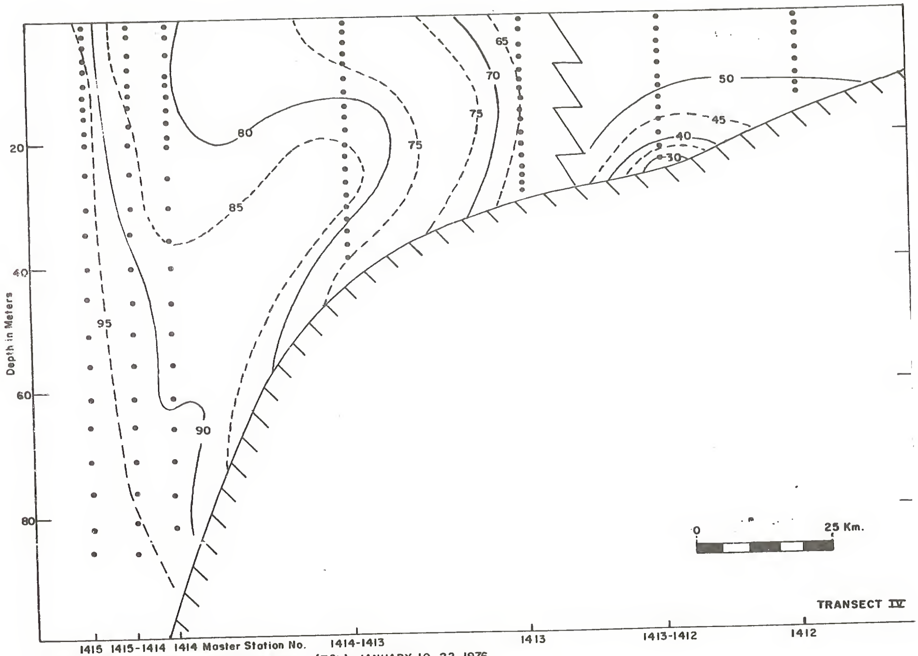


FIGURE 40d. Vertical Distribution Transmission (T%) JANUARY 10-22, 1976

and 1412-1413 on Transect IV while the inshore waters on Transects I and II were well mixed.

Twenty-four Hour Transmissometer Stations

To provide an initial estimate of the short-term temporal variability of particle concentration in the water column, two 24-hour time series stations were occupied during the fall and winter seasons. One station was located on the Florida Middle Ground (Master Station 1207) and the other near the Mississippi Delta (Master Station 1412). The temporal spacing of each cast was approximately six hours.

Figures 41a,b depict the fall time series for the two stations. A near bottom nepheloid layer (Figure 41a) apparently resulting from Hurricane ELOISE was present at Master Station 1207 throughout the observational period. Slight, semi-diurnal tidal or internal wave (26-27 hr duration) variations in the thickness of this layer were also noted. Waters above 20 m of depth were generally characterized by transmissivity values of 85% and these were associated with Intermediate Shelf Water ($\geq$36.0 $^{\circ}/_{\circ\circ}$). Figure 41b depicts 24-hour transmissivity data at the inshore station (1412) on Transect IV. A relatively clear layer was present between the turbid water at the surface and bottom and generally persisted throughout the observational period. This layer was associated with Intermediate ($\geq$36.0 $^{\circ}/_{\circ\circ}$) and Outer Shelf Water ($\geq$36.2 $^{\circ}/_{\circ\circ}$). The transmissivity of the surface layers generally increased with time (which may indicate a tidal oscillation), while the near bottom turbidity remained essentially constant with only the layer thickness changing with time.

Figure 42 shows the winter sequences for these same stations. At Master Station 1207 a nepheloid layer was present throughout most of the

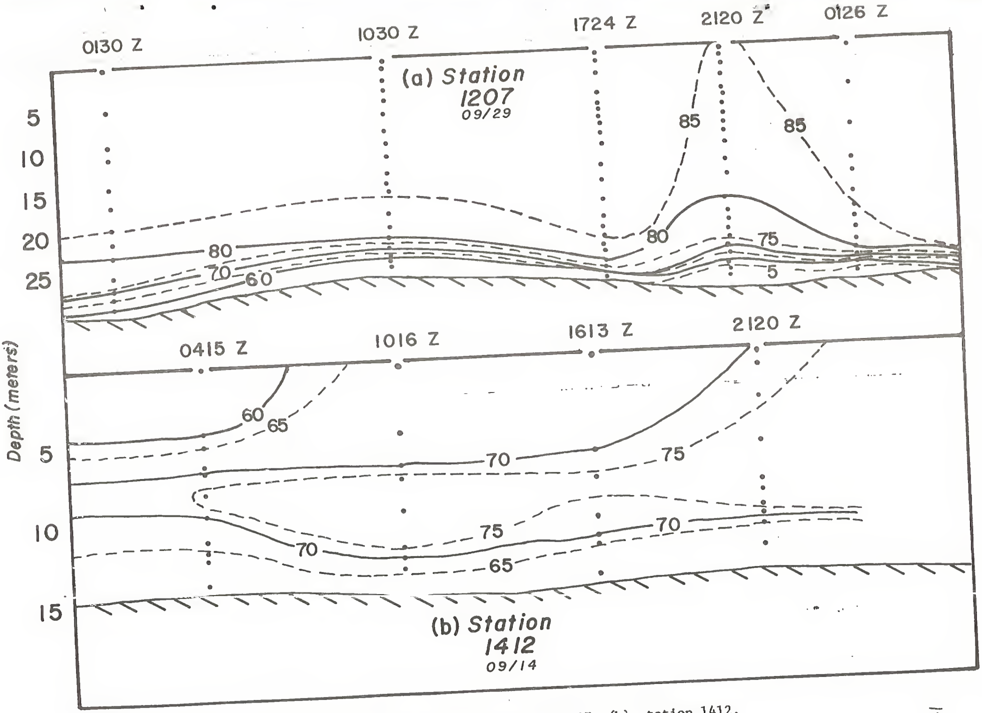


Figure 41a & b. Transmissometer stations (24 hour). (a) station 1207, (b) station 1412.

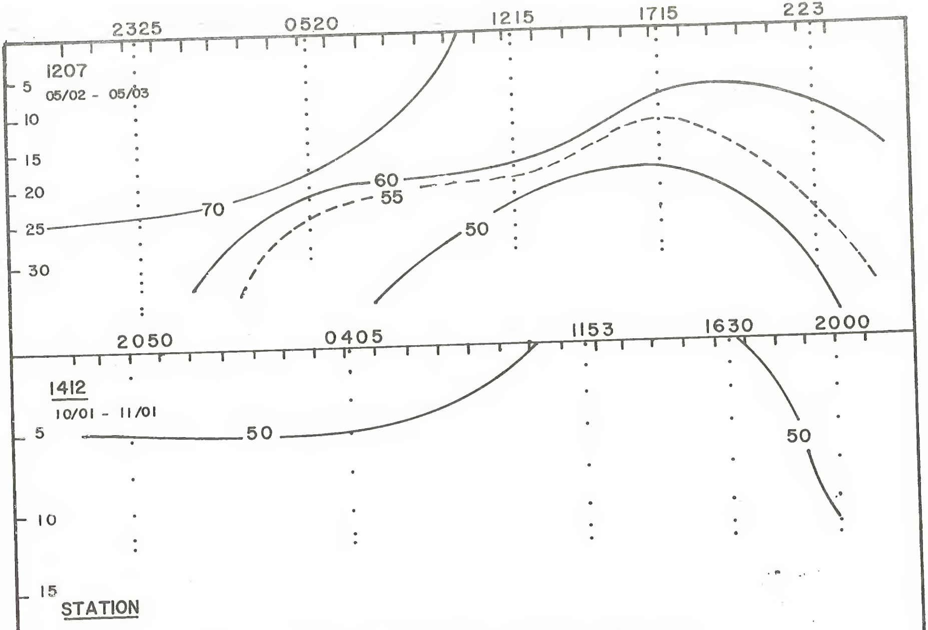


Figure 42. 24-HOUR WINTER TIME SERIES

time series study and showed evidence of vertical and/or horizontal oscillation. The Mississippi Delta series (Master Station 1412) depicts a turbid water column with little variation in time.

Clay Mineralogy

Figures 43a, b, and c through 46a, b and c illustrate the clay mineral content of the suspended matter collected at the ten meter level on the West Florida Shelf in the summer, fall and winter. Smectite, with few exceptions, was not detected along Transects I-III. Trace quantities were present at Master Stations 1102 and 1310 in the summer and at Master Station 1308 in the winter. Measurable quantities were present at Master Station 1412 (11%) in the summer, Master Station 1415 (26%) in the fall, Master Station 1207 (9%) and all stations on Transect IV during the winter where the smectite concentration ranged between 63-83%. The lower values were present at the two inshore stations.

Figures 43a, b and c show the seasonal distribution of chlorite at the ten meter level during the summer, fall and winter. Table 23 shows the average content (%) and range of concentration of chlorite on each transect during each season.

No consistent distribution patterns were apparent in the summer when the transects were compared with each other and in general, the concentrations were relatively uniform throughout the area. Transect IV showed lowest average concentration of chlorite.

In the fall, the lowest concentrations were present on Transect I. Elevated concentrations of chlorite were found at Master Station 1205

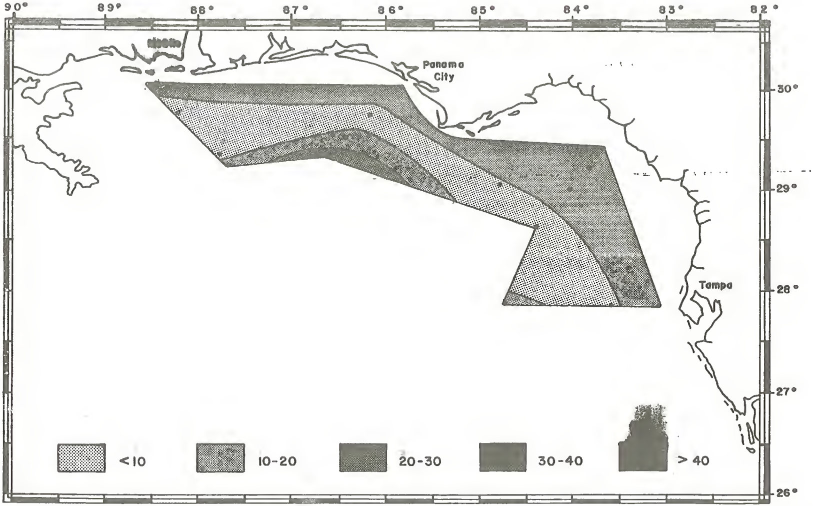


Figure 43a. The horizontal distribution of suspended chlorite (%) at the 10 meter level, June-July, 1975.

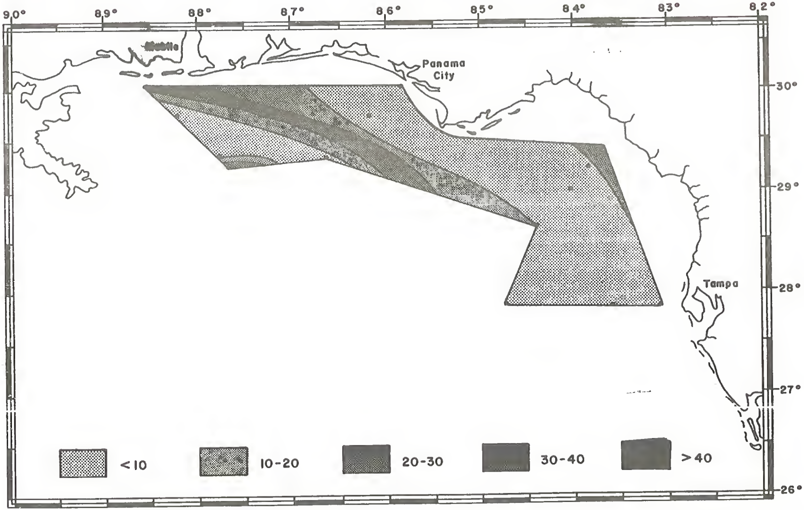


Figure 43b. The horizontal distribution of suspended chlorite (%) at the 10 meter level, September-October, 1975.

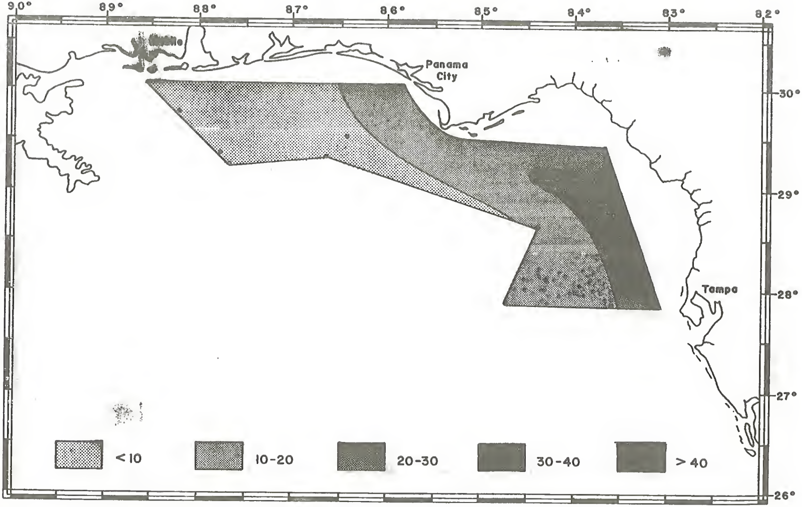


Figure 43c. The horizontal distribution of suspended cholorite (%) at the 10 meter level, January-February, 1976.

Table 23. The average concentration of chlorite (%) and the observed range of concentration in the suspended matter at the ten meter level along each transect during each sampling season.

	Transect			
Season	I	II	III	IV
Summer	12	12	17	7
(Range)	7-18	T-19	6-32	T-18
Fall	5	12	7	16
(Range)	N.D.-9	T-31	N.D.-26	N.D.-38
Winter	22	19	10(1)	1
(Range)	15-31	12-24	T-16	T-2

T Trace.
N.D. Not detectable.
(1) Three stations only. Insufficient sample at Master Station 1311.

after the passage of Hurricane ELOISE. The values had increased by 22% (9-31%) as a result of the storm. The highest concentrations of chlorite were found at Master Stations 1313 (26%), 1412 (24%) and 1415 (38%) (Transects III and IV had been sampled before the hurricane).

Winter chlorite distribution patterns differed from those of the fall. The outer two stations on Transect III and all stations on Transect IV contained amounts of chlorite ranging from non-detectable to two percent. Concentrations on Transect I and II ranged between eight and 31% and the highest values were present at Master Stations 1101 (31%) and 1206 (24%).

On a seasonal basis, Transect IV was unique in that the highest average chlorite concentrations were present in the fall (16%) and the lowest in the winter (1%). Seasonal patterns on Transects I and III were similar in that the lowest average chlorite values were present in the fall.

They differed only in that the highest concentration on Transect I was present in the winter (22%) while on Transect III the highest average values were present in the summer (17%).

Figures 44a, b and c illustrate the distribution of kaolinite at the ten meter level in the summer, fall and winter. Table 24 shows the average content (%) and the range of concentration on each transect during each season.

Table 24. The average concentration of kaolinite (%) and the observed range of concentration in the suspended matter at the ten meter level along each transect during each sampling season.

	Transect			
Season	I	II	III	IV
Summer	34	36	31	35
(Range)	27-40	20-62	24-42	16-54
Fall	32	46	48	40
(Range)	23-38	26-79	34-60	24-57
Winter	37	55	55(1)	17
(Range)	15-51	31-71	30-70	10-26

(1) Three stations. Insufficient sample at Master Station 1311.

The distribution of kaolinite in the summer on Transects I, II and III was similar in that the concentration generally increased towards the edge of the shelf. On Transect IV the values tended to decrease with increasing distance from shore. No differences were noted between the average concentration of kaolinite present on each transect. Transects II and IV showed the greatest range of concentrations.

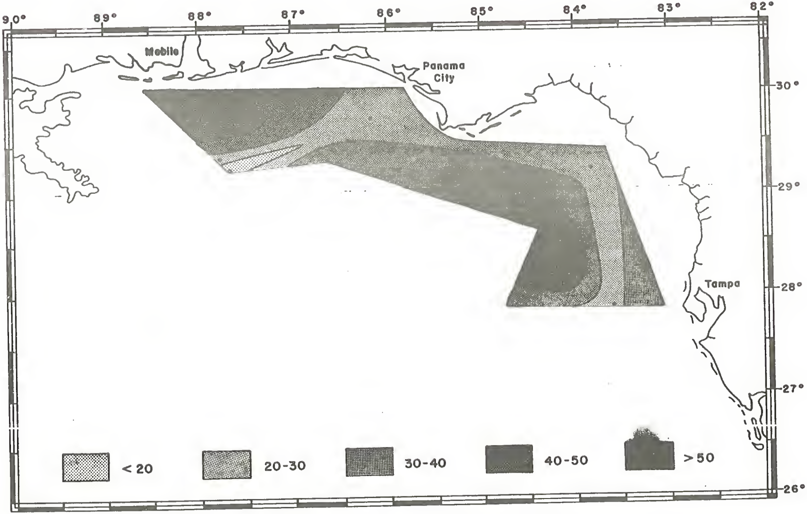


Figure 44a. The horizontal distribution of suspended kaolinite (%) at the 10 meter level, June-July, 1975.

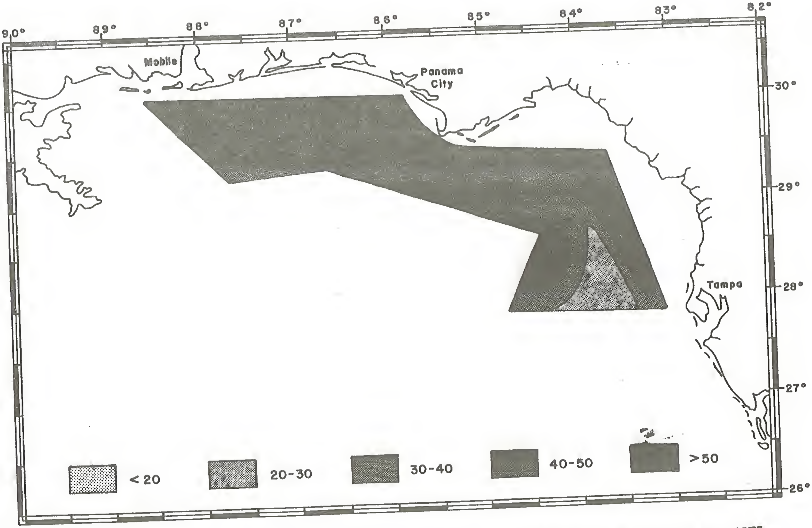


Figure 44b. The horizontal distribution of suspended kaolinite (%) at the 10 meter level, September-October, 1975.

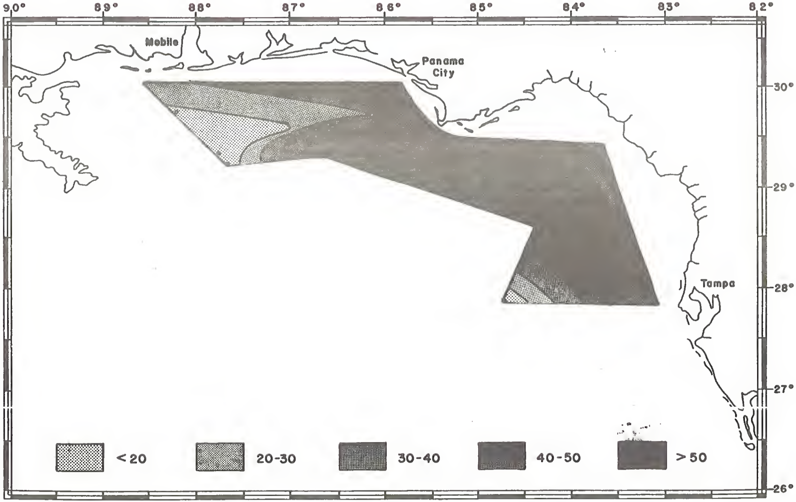


Figure 44c. The horizontal distribution of suspended kaolinite (%) at the 10 meter level, January-February, 1976.

In the fall the concentrations throughout the area had generally increased and distribution trends on Transects I and III were similar to those present in the summer. Prior to the passage of Hurricane ELOISE the suspended material at Master Station 1205 contained 79% kaolinite while after the storm, this had decreased to 38%. On Transect IV the concentrations tended to increase towards the edge of the Shelf. The highest average concentrations were present on Transects II and III where the average values were 46 and 48% respectively.

In the winter the highest average concentrations of kaolinite were again present on Transects II and III and the lowest average values and ranges occurred on Transect IV. Kaolinite values generally tended to decrease (Transects I and IV) and increase (Transect II) towards the edge of the Shelf.

Seasonal changes were not apparent in the average concentration of kaolinite on Transect I and increased from summer through winter on Transects II and III. Average kaolinite values for the summer and fall were 35 and 40% respectively on Transect IV. In the winter the average kaolinite content of the suspended matter decreased to 17%. A feature common to all seasons was the high concentration on the Outer Shelf on Transects II and III.

Figures 45a, b, and c show the distribution of illite in the summer, fall and winter. Table 25 shows the average illite content (%) and range of concentration in the suspended material at the ten meter level during the same interval of time.

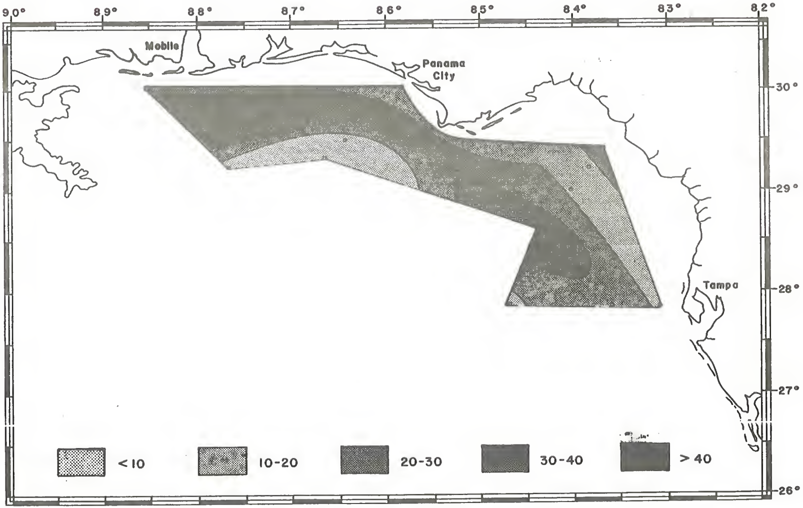


Figure 45a. The horizontal distribution of suspended Illite (%) at the 10 meter level, June-July, 1975.

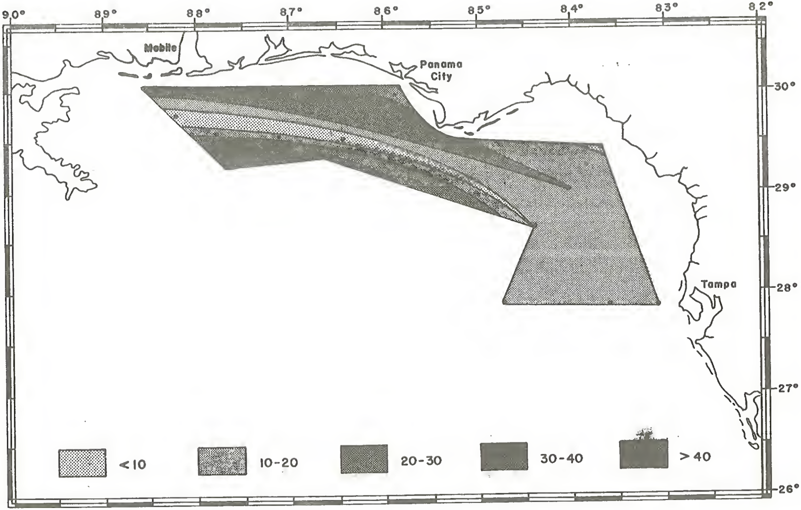


Figure 45b. The horizontal distribution of suspended Illite (%) at the 10 meter level, September October, 1975.

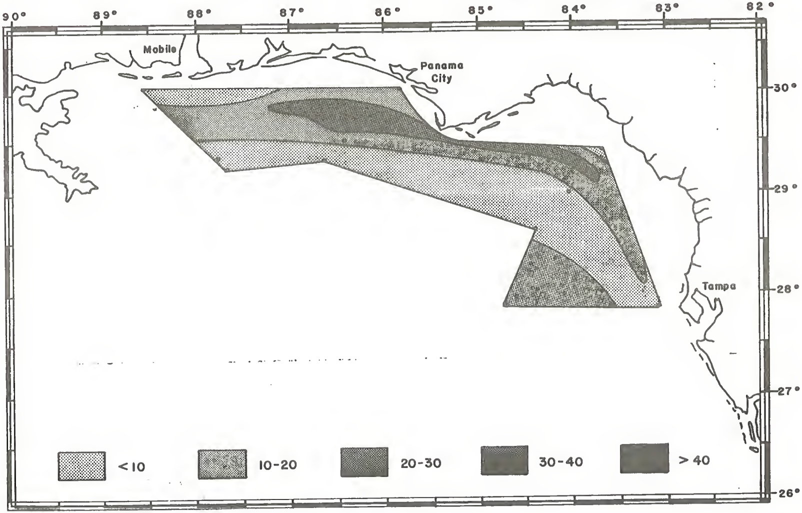


Figure 45c. The horizontal distribution of suspended Illite (%) at the 10 meter level, January-February, 1976.

Table 25. The average concentration of illite (%) and the observed range of concentration in the suspended matter at the ten meter level along each transect during each sampling season.

Season	Transect I	Transect II	Transect III	Transect IV
Summer	21	25	18	25
(Range)	18-25	15-38	16-23	12-46
Fall	14	14	21	17
(Range)	11-16	T-31	T-40	N.D.-43
Winter	12	11	16(1)	9
(Range)	9-17	5-23	11-27	7-12

T Trace.
N.D. Not detectable.
(1) Three samples. Insufficient sample at Master Station 1311.

Illite distribution patterns varied from transect to transect and reflected the presence of differing water masses in the summer. The least variability was on Transect I and highest average concentration (25%) was present on Transects II and IV while the lowest average concentration (18%) was present on Transect III.

In the fall the distributional pattern of illite was reversed on Transect IV when compared to the summer. Concentrations of illite increased from 10% to 31% at the ten meter level at Master Station 1205 as a result of Hurricane ELOISE. The lowest values were generally present on Transect I. The highest concentrations were present at Master Stations 1311 and 1414 where the values were 40 and 43% respectively.

In the winter, illite concentrations increased with increasing distance from shore on Transect I, and variable patterns were present on the remaining transects. Values of illite were generally low throughout the area, and with only two exceptions, were less than 10%. Suspended matter at Master Stations 1103 and 1309 contained 13 and 11% illite respectively.

Illite on Transect I decreased in concentration from summer to winter (21-12%); Hurricane ELOISE introduced higher amounts of illite (on the average) on Transect II into the water column than would have been present if the storm had not occurred. On Transects I, II and IV, the illite content of the suspended matter decreased from the summer through the winter sampling period. Average illite concentrations were highest in the fall and little difference was apparent between the summer and winter.

Figures 46a, b and c illustrate the distribution of talc at the ten meter level in the summer, fall and winter. Table 26 shows the average concentration (%) and range of concentration along each transect during each season.

Table 26. The average concentration (%) of talc and the observed range of concentration in the suspended matter at the ten meter level along each transect during each sampling season.

Season	Transect I	II	III	IV
Summer	33	28	40	30
(Range)	23-36	T-50	16-57	N.D.-61
Fall	49	27	25	21
(Range)	37-60	T-63	N.D.-48	N.D.-57
Winter	30	13	19(1)	1
(Range	16-49	0-28	10-27	0-5

T Trace.
N.D. Not detectable.
(1) Three stations. Insufficient sample at Master Station 1311.

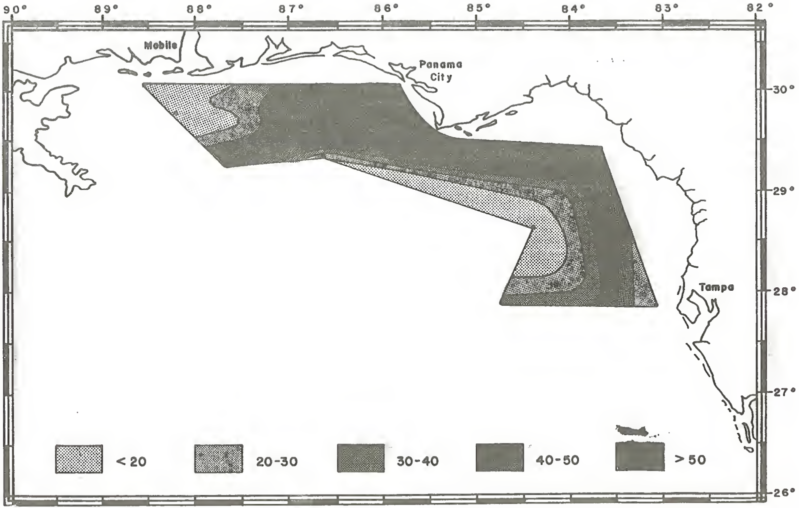


Figure 46a. The horizontal distribution of suspended talc (%) at the 10 meter level, June-July, 1975.

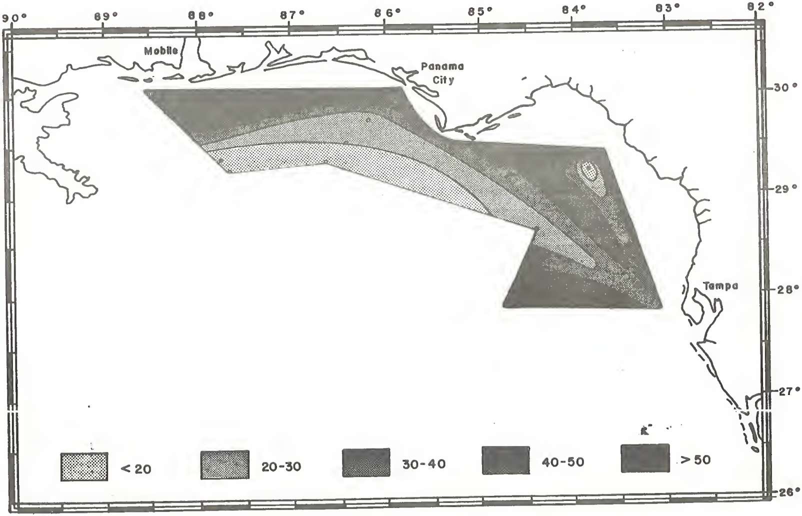


Figure 46b. The horizontal distribution of suspended talc (%) at the 10 meter level, September - October, 1975.

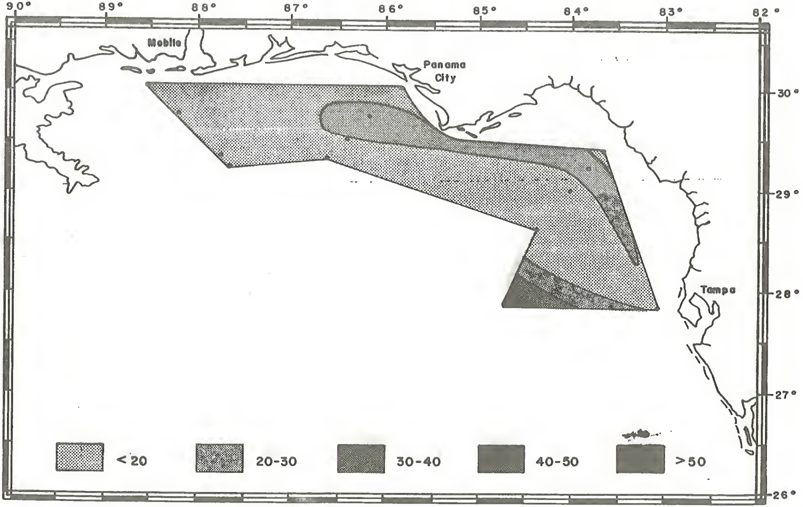


Figure 46c. The horizontal distribution of suspended talc (%) at the 10 meter level, January-February, 1976.

The distribution of talc in the summer was complex and was influenced by the water masses present. Distribution trends were similar on Transects I, II and III. On the latter two transects the lowest concentrations were present at the offshore stations. The highest concentrations were present at Master Stations 1414, 1415 and 1310 where the talc content ranged between 49 and 57%. As determined from the salinity distribution this was probably associated with Mississippi River System run-off.

The talc content of the waters at the ten meter level during the fall at Master Station 1205 decreased from two percent to traces as a result of the passage of Hurricane ELOISE. The highest concentrations were generally present on Transect I and at Master Stations 1204 and 1413. The average concentration of talc on Transect I increased over the summer values, showed no change on Transect II and decreased on Transects III and IV.

The distribution of talc on Transect I was similar to that observed in the summer and in general tended to increase in concentration toward the edge of the Shelf while on Transects III and IV, the opposite was generally true. Alternating bands of high-low concentrations of talc were present on Transect II.

Talc concentrations in the winter were generally lower throughout the area. Average talc concentrations tended to decrease toward the north and west. The lowest values were present on Transect IV and talc was not detectable at Master Stations 1412 and 1413 and was present in trace amounts at Master Station 1414. Suspended material at Master Station 1415 contained five percent talc.

Talc distribution along Transects I and IV were similar in that they increased with increasing distance from shore. Transects III and IV were similar in that levels of talc increased from the inshore station out to the next and then decreased to the edge of the shelf, (similar to illite).

On a seasonal basis, average talc concentrations decreased steadily from summer through winter on Transects III and IV. Winter values on Transect II were less than one-half that of the previous two seasons. On Transect I the highest values were present in the fall with a steady movement from inshore to the Continental Slope from summer to winter of the maximum values.

Trace Metals

Particulate Trace Metals

In this study, only the particulate form of the trace metals cadmium, chromium, copper, iron, lead, nickel and vanadium were determined. Particulate aluminum, calcium and silica were also measured to aid in data interpretation. So that additional information on the "biological availability" of the particulate trace metals could be obtained, the filter pads were leached with dilute acetic acid prior to final dissolution. The resultant fractions are referred to as the "weak acid soluble fraction" and the "refractory fraction."

Figures 47a, b and c depict the distribution of the suspended materials (on which the above determinations were made) in the summer, fall and winter. Table 27 shows the average seasonal concentration in micrograms per liter and the observed range during each sampling season.

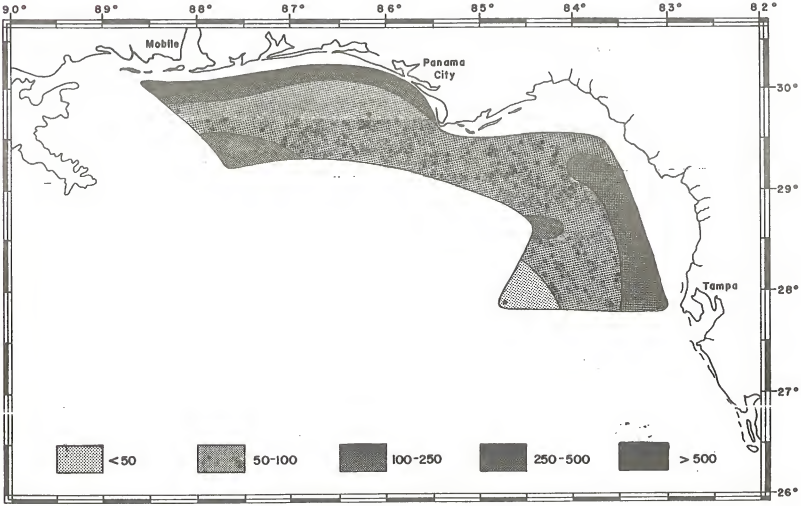


Figure 47 a. The horizontal distribution of suspended matter (ug/l) at the 10 meter level, June-July, 1975.

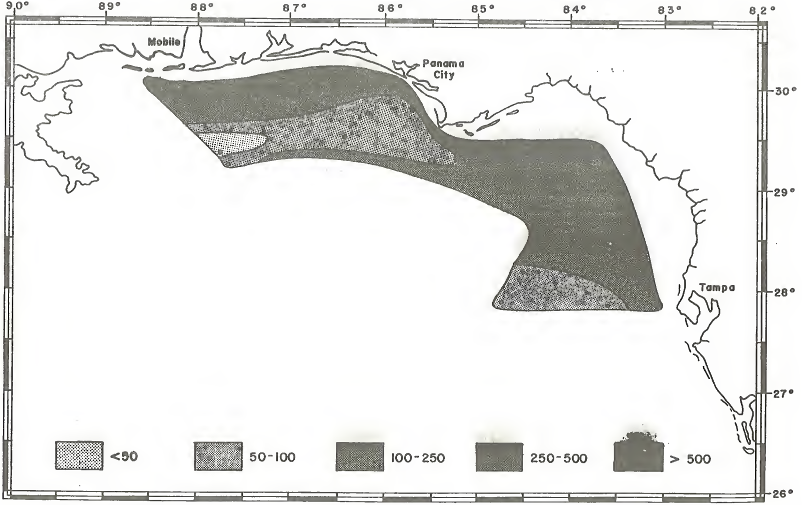


Figure 47b. The horizontal distribution of suspended matter (ug/l) at the 10 meter level, September-October, 1975.

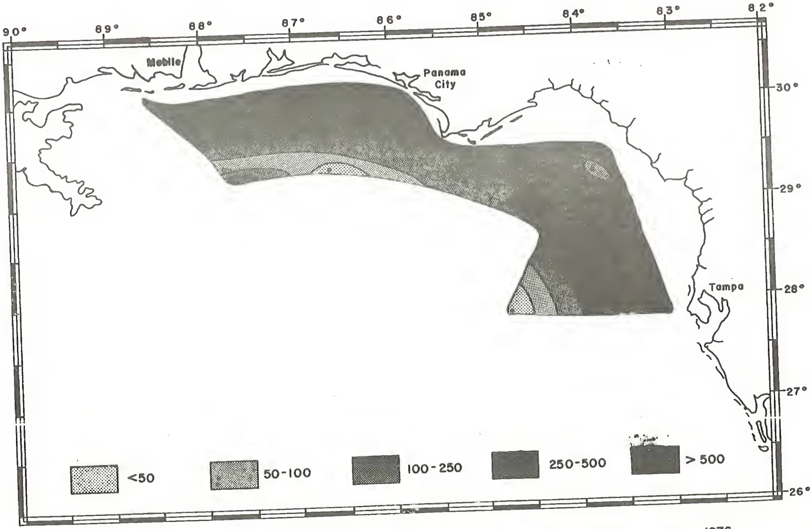


Figure 47 c. The horizontal distribution of suspended matter (ug/l) at the 10 meter level, January-February, 1976.

Table 27. The average seasonal concentration (μg/ℓ) of the suspended load and the observed range along each transect during the three sampling seasons.

Season	Transect I	II	III	IV
Summer	79	101	78	170
(Range)	17-145	58-169	55-106	76-298
Fall	104	152	101	98
(Range)	53-197	104-210	54-144	37-158
Winter	351	352	141	287
(Range)	70-547	57-758	25-231	91-483

In the summer the highest concentrations were present along Transect IV where the average value was 170 μg/ℓ with a range of 76-298 μg/ℓ. A general trend of decreasing amounts of suspended material with increased distance from shore was apparent along Transects I and III. The remaining two transects showed patterns of alternating concentration along each transect.

In the fall the concentration of the suspended material was relatively uniform throughout the MAFLA area. The highest average concentration was present on Transect II and this in part reflects the effect of the passage of Hurricane ELOISE. At Master Station 1205 the suspended load increased by 82 μg/ℓ after the storm had passed. Except for Transect III the overall trend was for a general decrease in concentration towards the offshore waters.

As expected, the highest amounts of suspended material were present during the winter. The minimum average value (141 μg/ℓ and a range of 25-231 μg/ℓ) were found on Transect III.

Seasonal changes in the suspended load were evident along all four transects with lowest values in the summer and highest values in the winter along Transects I-III. Transect IV had highest levels in the winter and lowest levels in the fall.

Weak Acid Soluble Fraction

Weak acid soluble aluminum and vanadium were not determined on this fraction. Silica was below the detection limit at all times during the three sampling seasons and chromium was detected at eight stations during the winter only. Where present in measurable quantities (Transects I, II and IV) the concentrations were less than 0.01 μg/ℓ.

Nickel concentrations were below detection limits in the summer and winter. Fall concentrations of 0.05 μg/ℓ and 0.02 μg/ℓ were present at Master Stations 1308 and 1310 respectively on Transect III, 0.14 μg/ℓ at the inshore station (1412) on Transect IV and 0.02 μg/ℓ on Transect II. At Master Station 1205 the nickel content increased from below detection limits (<.02 μg/ℓ) to 0.13 μg/ℓ after the passage of Hurricane ELOISE.

Weak Acid Soluble Iron

Figures 48a, b and c show the distribution of weak acid soluble iron in the Eastern Gulf of Mexico during the summer, fall and winter. Table 28 shows the average concentration of iron and the observed range for each transect during the three sampling seasons.

In the summer the average iron level along Transect IV was from five to eight times higher than those along the other three transects. Transect II had the lowest average iron content in the summer. In general, the higher concentrations (0.1-0.5 μg/ℓ) were present at the inshore stations.

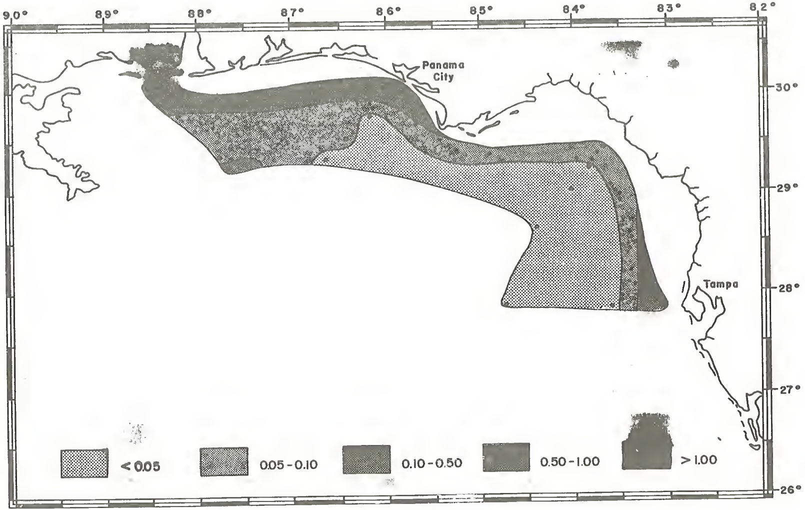


Figure 48a. The horizontal distribution of the weak acid soluble iron content (ug/l) of the suspended material at the 10 meter level, June - July, 1975.

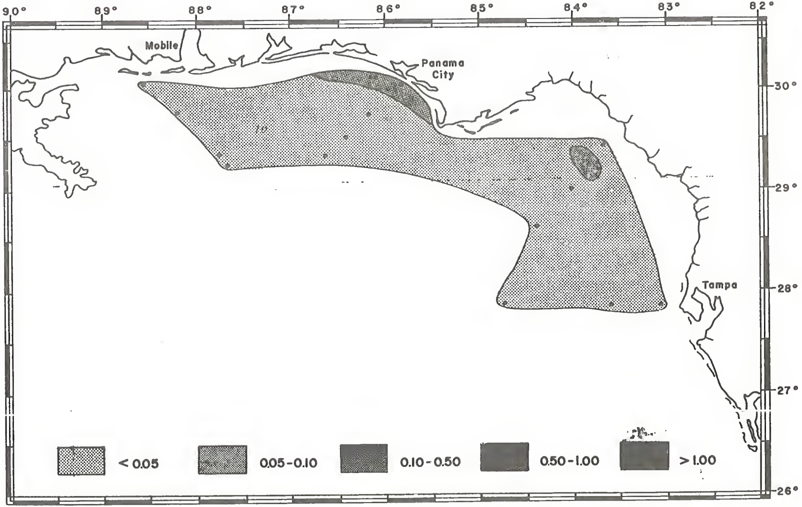


Figure 48b. The horizontal distribution of the weak acid soluble iron content (ug/l) of the suspended material at the 10 meter level, September-October, 1975.

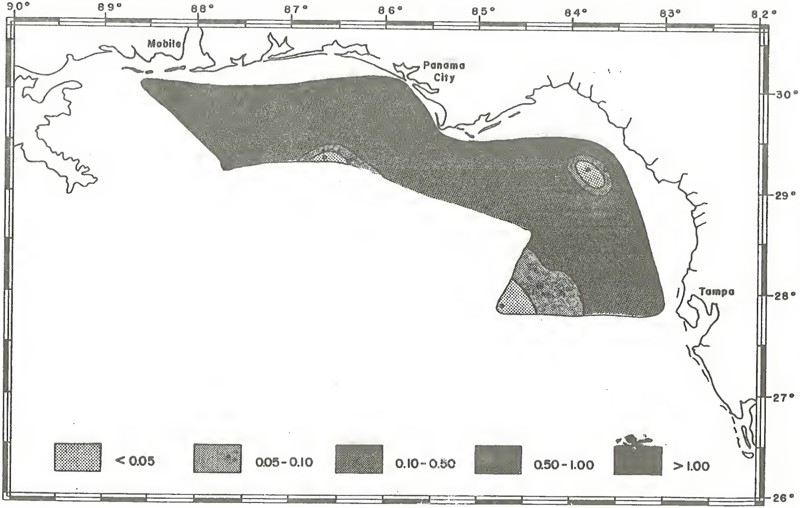


Figure 48c. The horizontal distribution of the weak acid soluble iron content (ug/l) of the suspended material at the 10 meter level, January - February, 1976.

Table 28. The average seasonal concentration of weak acid soluble iron (μg/ℓ) in the suspended fraction.

Season	Transect I	II	III	IV
Summer	0.070	0.054	0.082	0.427
(Range)	0.018-0.173	0.028-0.095	0.031-0.188	0.066-1.091
Fall	0.013	0.023	0.016	0.014
(Range)	<0.001-0.029	0.002-0.057	0.001-0.060	0.001-0.027
Winter	0.163	0.175	0.243	2.81
(Range)	0.008-0.350	0.038-0.326	0.019-0.698	0.295-6.12

In the fall (Figure 48b) the weak acid soluble iron concentrations were, with few exceptions, less than 0.05 μg/ℓ and no major differences were observed between the transects. The passage of Hurricane ELOISE caused only a slight increase in the suspended iron at Master Station 1205 on Transect II from 0.01 to 0.06 μg/ℓ.

The winter was characterized by the presence of general higher concentrations of weak acid soluble iron (Figure 48c) throughout the study area. This increase from 0.05 to 0.10 μg/ℓ seems to match the area of the isothermal-isohaline water structure caused by weather conditions (out to 50-60 m depth). The average concentration per transect, as shown in Table 28, increased from south to north and ranged from 0.16 μg/ℓ on Transect I to 2.81 μg/ℓ on Transect IV. The highest concentration of 6.12 μg/ℓ occurred at Master Station 1412.

Seasonal differences existed on all transects with maximal levels in the winter and minimal levels in the fall.

Weak Acid Soluble Copper

Figures 49a, b and c show the distribution of weak acid soluble copper at the ten meter level during the summer, fall and winter respectively. Table 29 shows the average distribution of copper and the observed range for each transect during the three sampling seasons.

Table 29. The average seasonal concentration of weak acid soluble copper ($\mu g/\ell \times 10^{-3}$) in the suspended fraction.

Season	Transect I	Transect II	Transect III	Transect IV
Summer	7.0	16.75	22.8	26.0
(Range)	4.8-9.1	7.5-30.7	15.7-33.7	17.2-44.1
Fall	1.70	3.86	2.63	3.05
(Range)	0.8-3.0	<0.5-12.6	<0.5-4.8	0.5-9.2
Winter	0.70	0.78	0.68	<0.5
(Range)	<0.5-1.1	<0.5-1.6	<0.5-1.20	-

In the summer the average concentration of copper present on each of the four transects decreased consistently between Transect IV and Transect I from 26.0 $\mu g/\ell \times 10^{-3}$ on Transect IV to 7.0 $\mu g/\ell \times 10^{-3}$ on Transect I. The range of concentrations along each transect also increased from the south to the north and west and may be attributed to differing water masses and run-off into the area.

The lateral distribution of weak acid soluble copper is shown in Figure 49a. Elevated concentrations (>20.0 $\times 10^{-3}$ $\mu g/\ell$) were present in the nearshore waters south of Horn Island and Panama City, Florida and in a

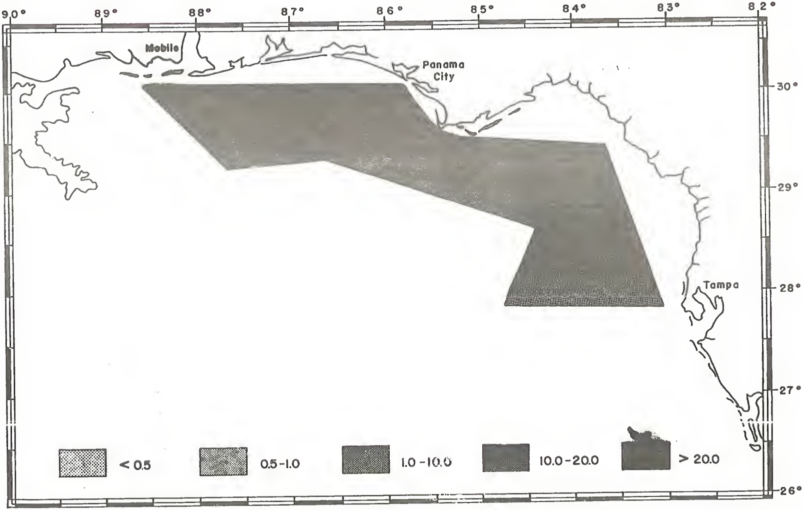


Figure 49a. The horizontal distribution of the weak acid soluble copper content ($ug/l \times 10^{-3}$) of the suspended material at the 10 meter level, June-July, 1975.

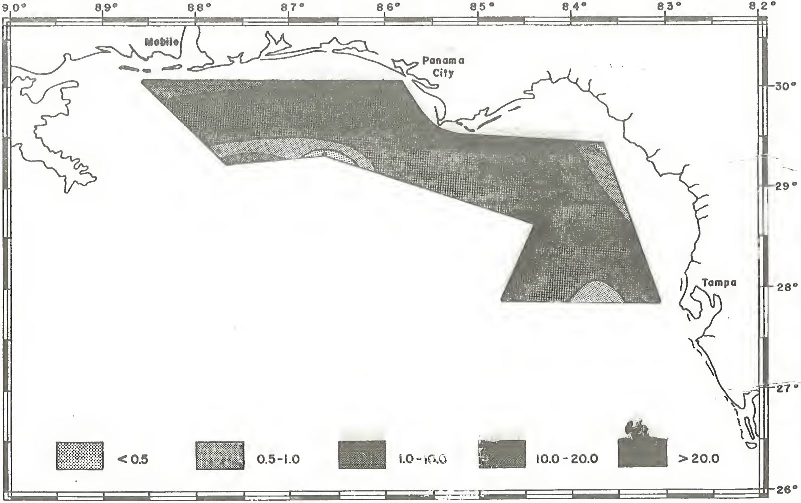


Figure 49b. The horizontal distribution of the weak acid soluble copper content ($ug/l \times 10^{-3}$) of the suspended material at the 10 meter level, September - October, 1975.

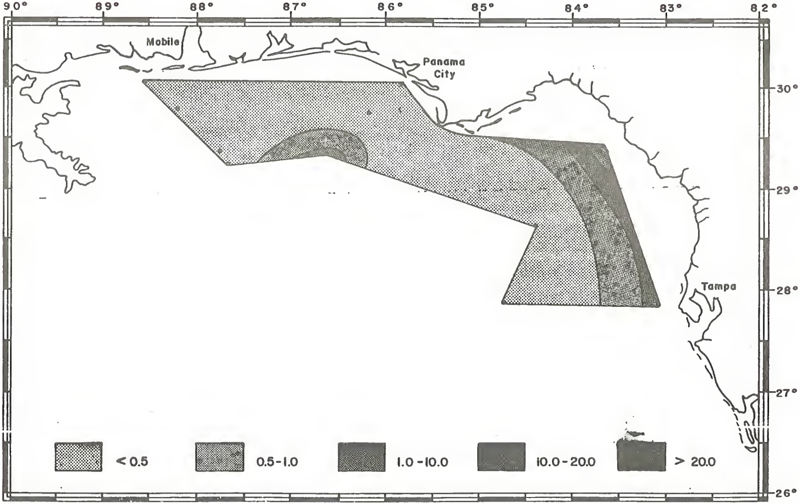


Figure 49c. The horizontal distribution of the weak acid soluble copper content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, January - February, 1976.

tongue of water extending from Master Stations 1415 through 1310 and 1205. The concentration of weak acid soluble copper along Transect I and at Master Station 1204 ranged between 1.0-10.0 x 10^{-3} μg/ℓ.

In the fall (Figure 49b) the presence of regions of differing concentrations occurred with low concentrations at the inshore stations on Transects III and IV (Master Stations 1308 and 1412 respectively) and high concentrations near the Florida Middle Ground Master Station 1207.

Weak acid soluble copper concentrations during January-February, 1976 (Figure 49c), with few exceptions, were less than 0.5 x 10^{-3} μg/ℓ. Master Stations 1101, 1206, and 1311 west of Tampa and Tarpon Springs and south of Pensacola contained concentrations of copper ranging from 1.1 x 10^{-3}-1.6 x 10^{-3} μg/ℓ.

Seasonal differences in the copper concentration were apparent on all transects and levels decreased ten to fifty-fold between summer and winter. The higher values present in the summer reflect the higher run-off seen previously on Transects III and IV and across the outer shelf area between Transects II, III and IV in association with Mississippi River System water. The complexity of the distribution pattern was minimal in the winter when concentrations were also at their minimum.

<u>Weak Acid Soluble Cadmium</u>

Figures 50a, b and c show the distribution of weak acid soluble cadmium at the ten meter level during the summer, fall, and winter. Table 30 shows the average seasonal concentration of cadmium (μg/ℓ x 10^{-3}) and the observed range in the suspended fraction along each transect.

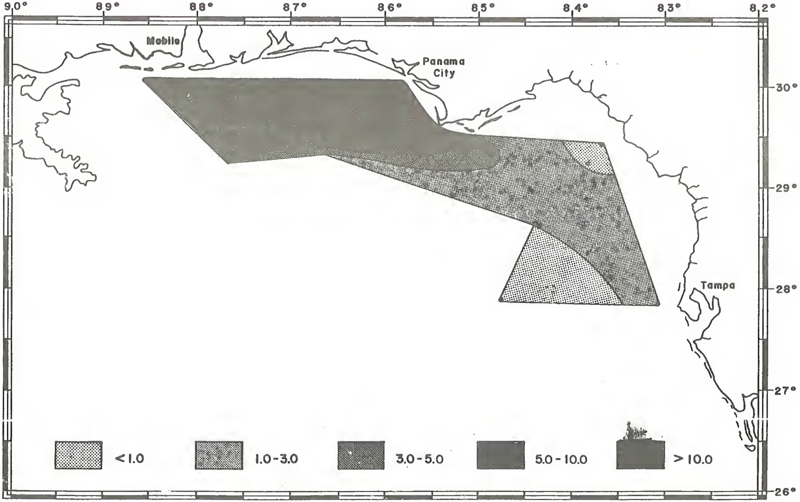


Figure 50a. The horizontal distribution of the weak acid soluble cadmium content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, June-July, 1975.

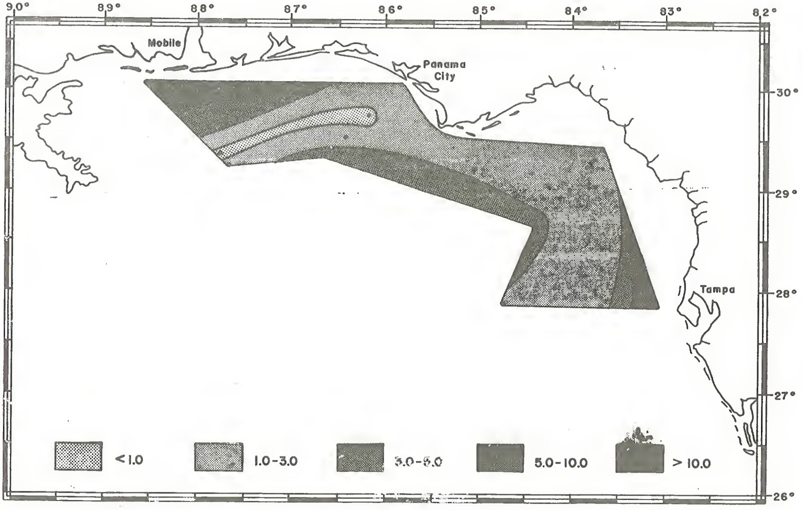


Figure 50b. The horizontal distribution of the weak acid soluble cadmium content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, September - October, 1975.

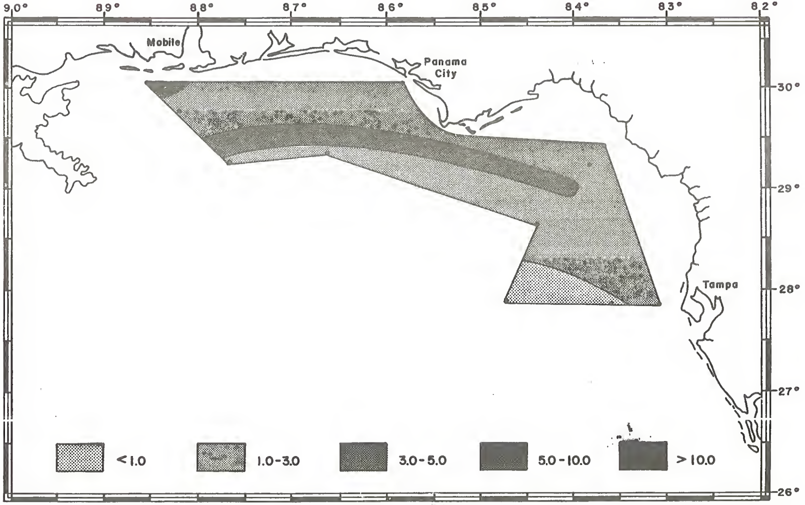


Figure 50c. The horizontal distribution of the weak acid soluble cadmium content ($ug/l \times 10^{-3}$) of the suspended material at the 10 meter level, January - February, 1976.

Table 30. The average seasonal concentration of weak acid soluble cadmium ($\mu g/\ell \times 10^{-3}$) in the suspended fraction.

Season	Transect I	II	III	IV
Summer	0.87	1.2	7.9	10.4
(Range)	0.3-1.6	0.9-1.8	3.0-16.9	4.8-20.8
Fall	3.7	2.5	2.2	4.9
(Range)	1.5-6.7	1.8-3.1	0.9-3.5	1.0-10.9
Winter	1.3	1.7	1.9	2.8
(Range)	0.8-2.2	1.0-3.0	1.6-3.1	1.9-3.4

In the summer the average concentration of cadmium decreased southward from an average of 10.4×10^{-3} $\mu g/\ell$ on Transect IV to 0.87×10^{-3} $\mu g/\ell$ on Transect I. The overall trend for cadmium concentrations to increase from south to north and west in the summer is also shown in Figure 50a. This distribution pattern agrees with the ten meter salinity patterns and the lowest concentration occurs on the outer half of Transect I which is the only area where Outer Shelf water is present.

The concentrations of cadmium in the fall were always less than 10.9×10^{-3} $\mu g/\ell$ and the distribution of the metal was more uniform (Figure 50b) than had been observed in the summer. The average concentration on Transect IV was higher than those of the other three transects.

Cadmium concentrations in the winter were generally lower than in the previous seasons. A ridge of high concentration on the outer to middle part of the shelf was present on Transects II, III and IV, while Transect I exhibited a decrease in concentration with increasing distance from shore. Again, the highest average concentrations were present on Transect IV.

Seasonal changes were apparent during the three sampling periods on Transects I-IV. Transects I and II had highest levels in the fall and lowest in the summer. Transects III and IV had highest levels in the summer and lowest in the winter.

Weak Acid Soluble Lead

Figures 51a, b and c show the distribution of weak acid soluble lead at the ten meter level during the summer, fall and winter. Table 31 shows the average seasonal concentration of lead ($\mu g/\ell \times 10^{-3}$) and the observed range in the suspended fraction along each transect.

Table 31. The average seasonal concentration of weak acid soluble lead ($\mu g/\ell \times 10^{-3}$) and the observed range in the suspended fraction along each transect.

	Transect			
Season	I	II	III	IV
Summer	11.1	11.2	13.4	51.6
(Range)	3.4-20.0	5.8-15.0	6.8-16.0	6.5-96.9
Fall	4.2	8.1	4.5	10.6
(Range)	2.8-5.2	4.4-18.9	2.0-7.7	4.1-21.8
Winter	18.4	12.1	3.6	11.4
(Range)	2.7-39.9	1.4-23.5	<1.3-6.9	7.1-15.3

In the summer the concentration of lead present on each transect increased from Transect I to Transect IV and the average level on Transect IV was approximately four times greater than those of Transects I-III.

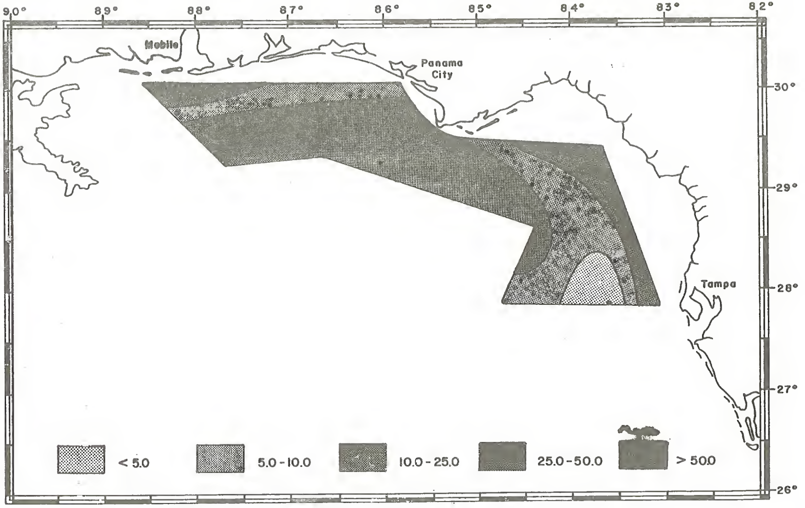


Figure 51a. The horizontal distribution of the weak acid soluble lead content ($ug/l \times 10^{-3}$) of the suspended material at the 10 meter level, June - July, 1975.

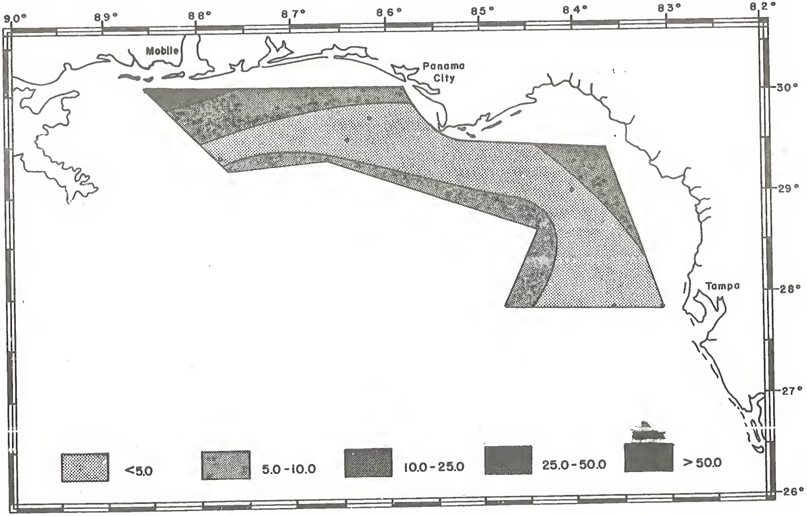


Figure 51b. The horizontal distribution of the weak acid soluble lead content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, September-October, 1975.

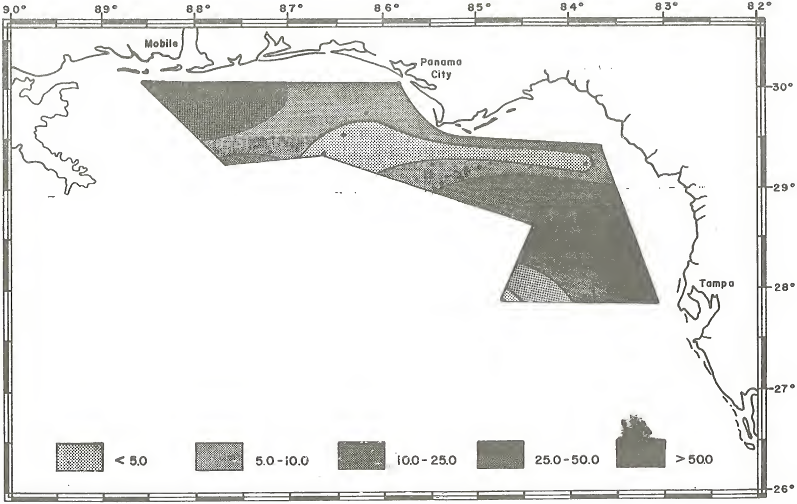


Figure 51c. The horizontal distribution of the weak acid soluble lead content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, January-February, 1976.

The lateral distribution of lead as depicted in Figure 51a was generally similar to that observed for the other metals. The highest concentrations were present on Transect IV while the least were present on Transect I.

The concentrations of lead in the fall were less than in the summer and differed between transects. Concentrations were higher on the inshore, outer and slope areas and were lower on the intermediate sections. Lead concentrations at Master Station 1205 showed a three-fold increase after the passage of Hurricane ELOISE.

Regional differences in the distribution of lead in the winter were apparent in Figure 51c. Higher concentrations were located in the inshore region of Transects I and IV. Waters with a low concentration of lead enter at Master Station 1311 on Transect III and move across to Transect II. High concentrations on Transect IV relate to the discharges from drainage areas WEST and NORTHWEST which were not moving to the East to the extent they do during the summer and fall.

Seasonal changes were apparent on all transects. Transects I and II had highest levels in the winter and lowest levels in the fall. Transects III and IV had highest levels in the summer, and fall and winter levels were relatively similar. General distribution patterns across Transect IV were similar during all seasons with higher concentrations being present at the inshore (1412) and the offshore (1415) stations and lower values at the intermediate stations. The observed decrease in concentration from summer to winter relates to variation in the drainage area (or river) run-off. The seasonal variation along the outer station relates to input from the WEST drainage, i.e., high in summer, low in fall and increasing in winter.

Table 32 shows the weak acid soluble trace metal correlation coefficients for the summer, fall and winter. Strong correlations were present between Cd/Cu and Fe/Pb in the summer, and Ca/Cu, Cd/Fe, Cd/Pb, in the fall and between Ca/Pb in the winter. Both weak acid soluble lead and iron correlated with salinity in the fall and winter respectively.

Table 32. Weak acid soluble trace metal correlation coefficients.

Summer

	Ca	Cd	Cr	Cu	Fe	Pb
Ca	-	0.499	-	0.485	0.362	0.395
Cd		-	-	0.824	0.305	0.203
Cr			-	-	-	-
Cu				-	0.275	0.277
Fe					-	0.753
Pb						

Fall

	Ca	Cd	Cr	Cu	Fe	Pb
Ca	-	0.127	-	0.738	0.507	-0.170
Cd		-	-	0.019	0.825	0.822
Cr			-	-	-	-
Cu				-	-0.130	-0.106
Fe					-	0.409
Pb						-

Winter

	Ca	Cd	Cr	Cu	Fe	Pb
Ca	-	-0.125	-	-	-0.239	0.891
Cd		-	-	-	0.379	0.205
Cr			-	-		-
Cu				-	-	-
Fe					-	-0.247
Pb					-	-

Refractory Trace Metals

Refractory Iron

Figures 52a, b and c show the distribution of refractory iron in the Eastern Gulf of Mexico during the summer, fall and winter. Table 33 shows the average concentration of iron and the observed range for each transect during the three sampling seasons.

Table 33. The average seasonal concentration of refractory iron (μg/ℓ) in the suspended fraction.

Season	Transect I	II	III	IV
Summer (Range)	0.39 0.19-0.66	0.31 0.23-0.44	0.31 0.15-0.53	1.14 0.38-3.07
Fall (Range)	0.19 0.04-0.30	0.60 0.18-1.58	0.21 0.07-0.32	0.29 0.11-0.56
Winter (Range)	2.04 0.15-3.34	2.35 0.34-4.57	1.44 0.09-2.44	9.19 2.94-18.4

Figure 52a shows the lateral distribution of refractory iron in the summer. Concentrations throughout most of the area ranged between 0.1-0.5 μg/ℓ; elevated concentrations of iron were present at Master Stations 1412 and 1101 (3.07 μg/ℓ and 0.66 μg/ℓ respectively). The average iron concentration on Transect IV was approximately three times greater than those of the other three transects. High concentrations along Transect IV were associated with the onshore discharge area.

Similar patterns of distribution were generally observed in the fall. The main exceptions to this occurred along Transect II where

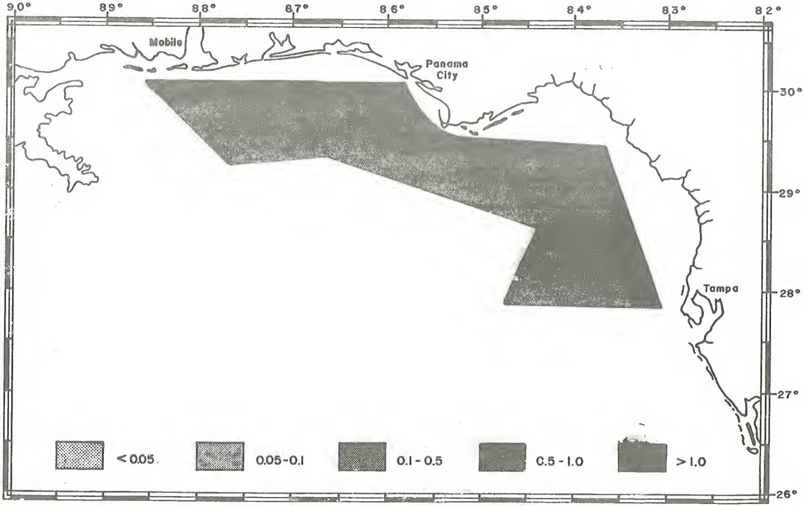


Figure 52a. The horizontal distribution of the refractory iron content (ug/l) of the suspended material at the 10 meter level, June - July, 1975.

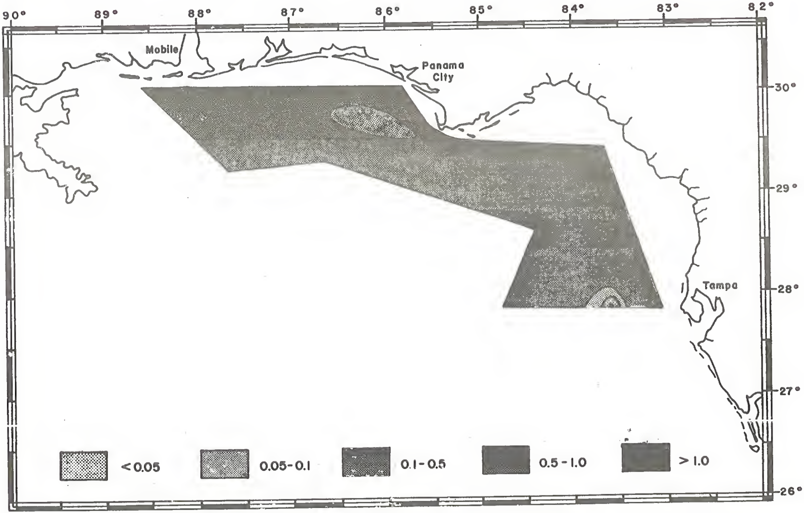


Figure 52b. The horizontal distribution of the refractory iron content (ug/l) of the suspended material at the 10 meter level, September-October, 1975.

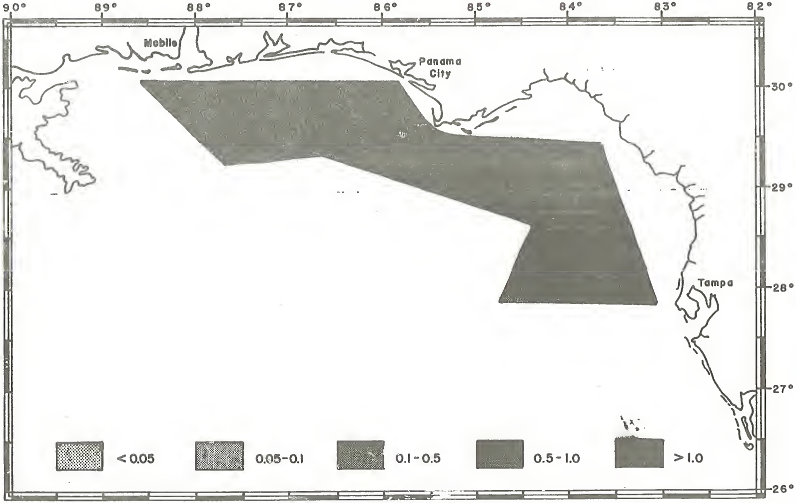


Figure 52c. The horizontal distribution of the refractory iron content (ug/l) of the suspended material at the 10 meter level, January-February, 1976

"pockets" of higher concentrations were present at Master Staticns 1205 and 1207. A six-fold increase in the refractory iron content of the water at the ten meter level occurred (0.243 → 1.58 μg/ℓ) at the former station which was sampled before and after Hurricane ELOISE. Concentrations on Transects I and III were similar and Transect II had the highest average concentration.

Concentrations of iron were generally higher in the winter. As indicated in Table 33 the average concentration ranged from 1.41 μg/ℓ on Transect III to 9.19 μg/ℓ on Transect IV. These two transects also exhibited the minimum and maximum concentration ranges. The higher average concentration on Transect IV was several times greater than those of the other transects.

Only those stations strongly affected by Hurricane ELOISE showed strong seasonal differences between summer and fall. The January-February concentrations were considerably greater than those collected during the previous two seasons.

Refractory Copper

Figures 53a, b and c shcw the distribution of refractory copper during the summer, fall and winter. Table 34 shows the average concentration of copper and the observed range for each transect during the three sampling seasons.

Marked distributional patterns in copper were evident during June-July, 1975 (Figure 53a). Concentrations were highest in the Transect III-IV region (average concentrations were 34.5×10^{-3} and 28.7×10^{-3} μg/ℓ respectively). The range of concentrations found along each of these

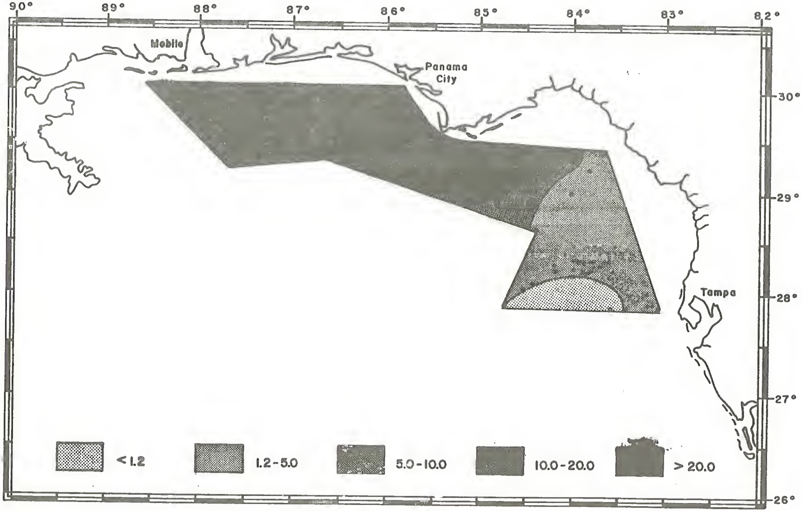


Figure 53a. The horizontal distribution of the refractory copper content ($\mu g/l \times 10^{-3}$) of the suspended material at the 10 meter level, June - July, 1975.

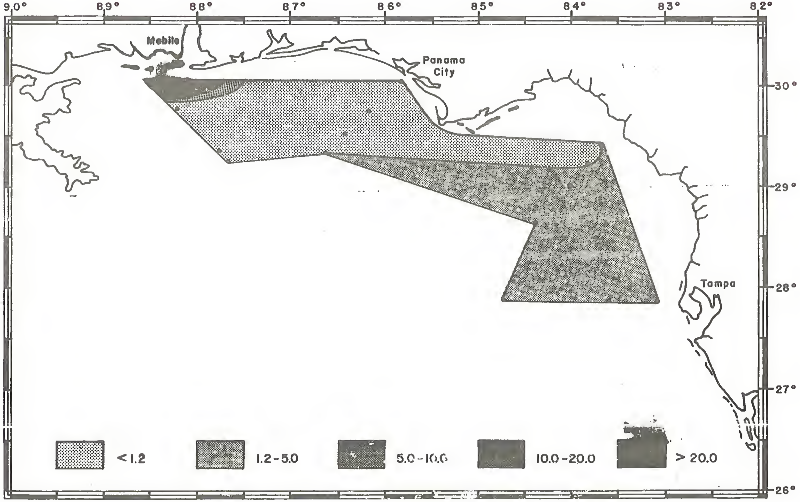


Figure 53b. The horizontal distribution of the refractory copper content ($\mu g/l \times 10^{-3}$) of the suspended material at the 10 meter level, September-October, 1975.

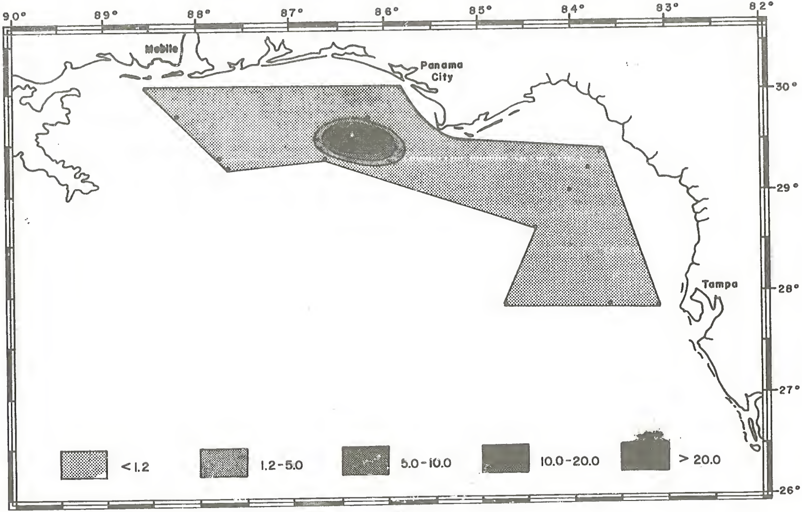


Figure 53c. The horizontal distribution of the refractory copper content ($\mu g/l \times 10^{-3}$) of the suspended material at the 10 meter level, January - February, 1976.

Table 34. The average seasonal concentration of refractory copper ($\mu g/\ell \times 10^{-3}$) in the suspended fraction.

Season	Transect I	II	III	IV
Summer	1.2	3.6	34.5	28.7
(Range)	1.2-1.3	1.8-4.8	18.5-48.0	14.4-55.7
Fall	1.6	1.8	1.2	10.4
(Range)	1.2-1.9	1.2-3.2	-	1.2-38.1
Winter	1.2	1.2	18.0	1.2
(Range	-	-	1.2-68.4	-

transects was also much larger than those of Transects I and II.

Refractory copper concentrations were less than 3.2×10^{-3} $\mu g/\ell$ throughout the area in the fall except at Master Station 1412 where the concentration was 38.1×10^{-3} $\mu g/\ell$.

Winter levels of copper, with one exception, were below detection limits (1.2×10^{-3} $\mu g/\ell$). At Master Station 131C, 68.4×10^{-3} $\mu g/\ell$ of the element were present and the presence of high values of cadmium and lead at this same station indicate the possible presence of a contaminant on the filter pad.

Seasonal changes in refractory copper concentrations were not similar for all four transects. Seasonal changes were greatest along Transects III and IV with high summer levels at least twenty times greater than the minimal average levels of fall (Transect III) and winter (Transect IV). Transect II also had the highest average level in the summer, and seasonal changes along Transect I were barely discernible.

Refractory Cadmium

Figures 54a, b and c depict the distribution of refractory cadmium in the summer, fall and winter. Table 35 shows the average concentration of refractory cadmium and the observed range for each transect during this same time period.

Table 35. The average seasonal concentration of refractory cadmium ($\mu g/\ell \times 10^{-3}$) in the suspended fraction.

Season	Transect I	Transect II	Transect III	Transect IV
Summer	0.6	0.3	0.8	3.7
(Range)	0.2-1.4	0.2-0.5	0.6-1.0	0.3-12.5
Fall	1.7	1.1	1.6	3.7
(Range)	1.0-2.7	0.6-1.9	0.7-3.8	0.2-11.9
Winter	0.9	2.6	1.9	<0.2
(Range)	0.2-2.2	0.2-6.3	0.2-6.9	-

Except for Transect IV Master Stations 1415 in the summer and 1412 in the fall, the concentrations of refractory cadmium were less than 3.0×10^{-3} $\mu g/\ell$ throughout the area during these two seasons. The concentrations present throughout the area were always less than 0.2×10^{-3} $\mu g/\ell$ in the winter.

Pronounced seasonal changes were observed between the summer, fall and winter data on Transect II. Similar differences were apparent between the summer and fall data only on Transects I and III. The observed average seasonal changes along Transect IV ranged from 3.7×10^{-3} $\mu g/\ell$ in the summer and fall to less than 0.2×10^{-3} $\mu g/\ell$ in the winter.

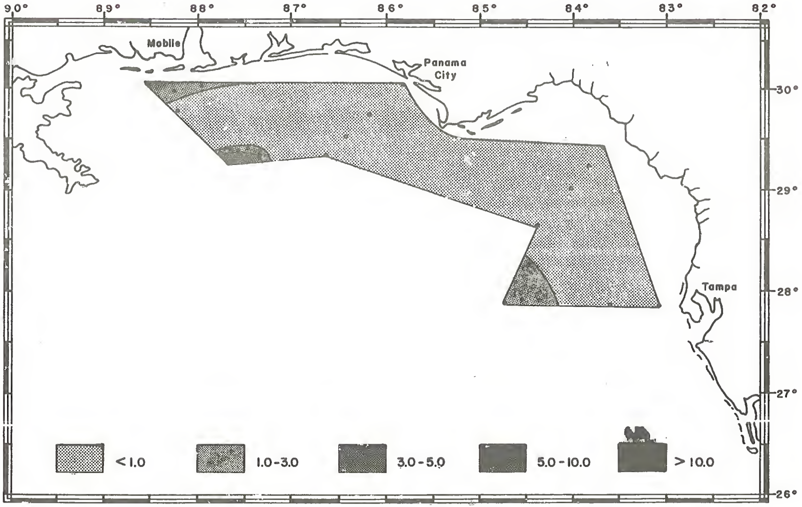


Figure 54a. The horizontal distribution of the refractory cadmium content ($\mu g/l \times 10^{-3}$) of the suspended material at the 10 meter level, June - July, 1976.

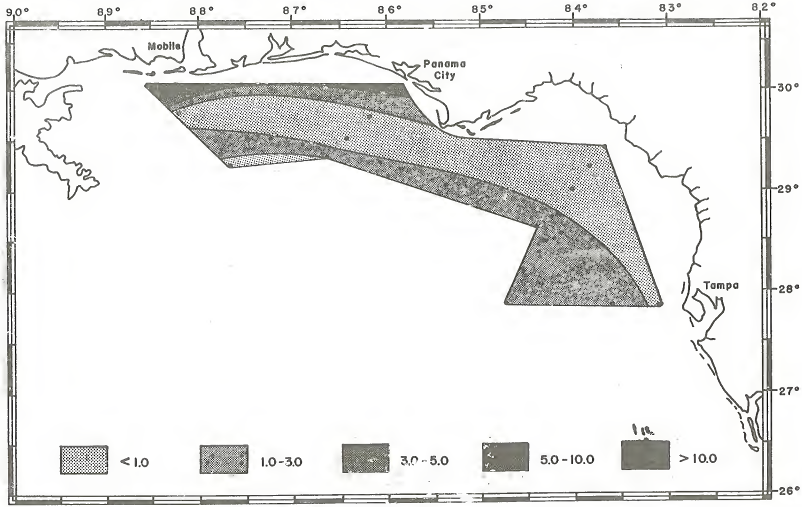


Figure 54b. The horizontal distribution of the refractory cadmium content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, September-October, 1975.

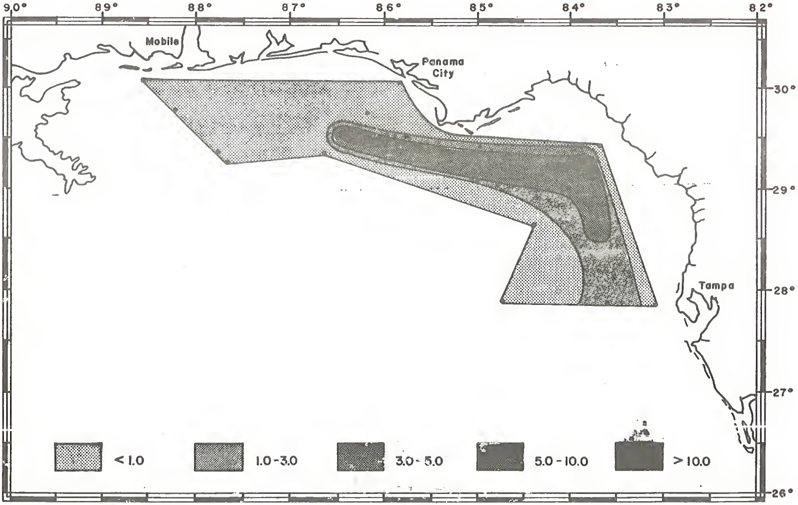


Figure 54c. The horizontal distribution of the refractory cadmium content ($ug/l \times 10^{-3}$) of the suspended material at the 10 meter level, January-February, 1976.

Refractory Lead

Figures 55a, b and c show the distribution of refractory lead in June-July and September-October, 1975 and January-February, 1976. Table 36 shows the average concentration of lead and the observed range for each transect during the three sampling seasons.

Table 36. The average seasonal concentration of refractory lead ($\mu g/\ell \times 10^{-3}$) in the suspended fraction.

Season	Transect I	Transect II	Transect III	Transect IV
Summer	1.9	5.4	9.3	11.2
(Range)	0.4-3.0	1.2-9.3	5.5-14.9	5.0-25.0
Fall	11.9	9.9	9.2	33.1
(Range)	6.9-19.3	8.3-11.3	7.1-11.2	12.6-77.1
Winter	8.6	8.8	18.6	21.6
(Range)	6.2-12.6	7.2-9.9	4.4-50.5	12.9-26.6

Refractory lead concentrations in the summer increased between transects going from Transect I to Transect IV. The average concentration on Transect IV was approximately six times greater than that along Transect I.

An increase in the lead content of the waters throughout the area was observed in the fall. Concentration differences between transects were conspicuous and Transect IV had the highest average concentration by a factor of approximately ten.

Seasonal changes were apparent along all transects when the summer, fall and winter data were compared.

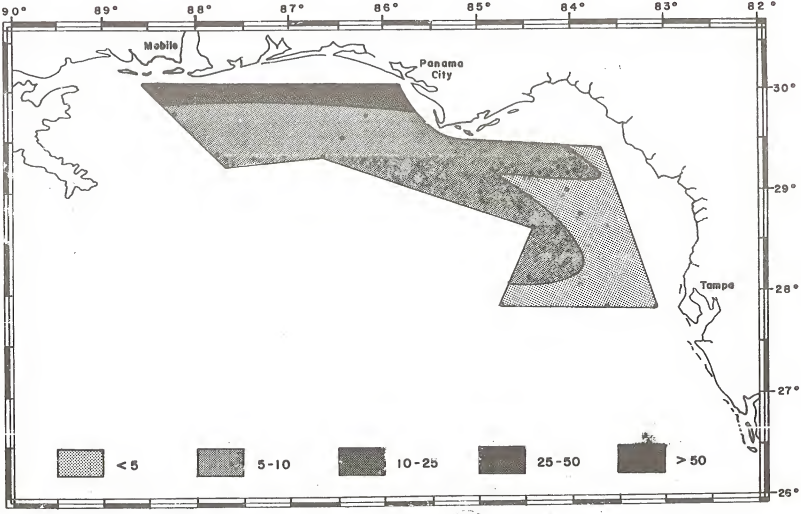


Figure 55 a. The horizontal distribution of the refractory lead content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, June-July, 1975.

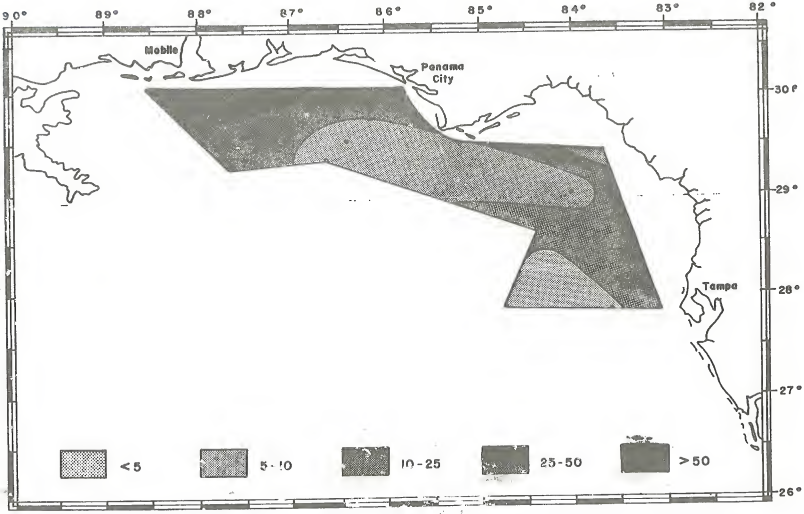


Figure 55 b. The horizontal distribution of the refractory lead content ($\mu g/l \times 10^{-3}$) of the suspended material at the 10 meter level, September-October, 1975.

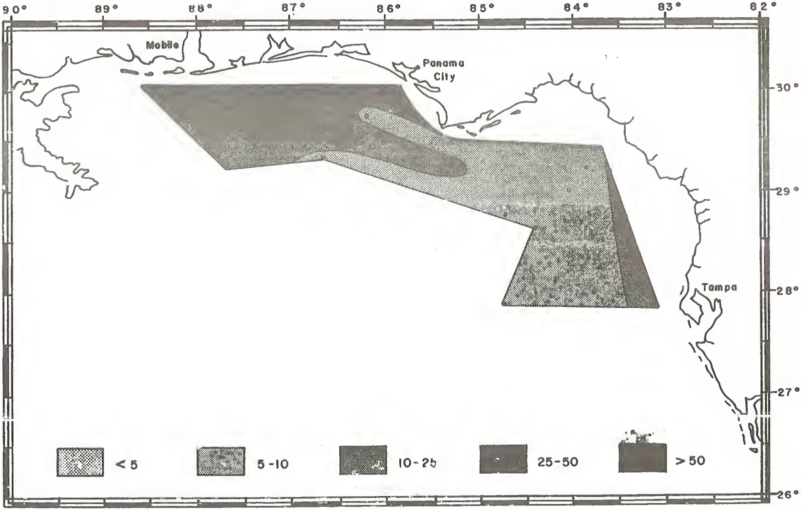


Figure 55 c. The horizontal distribution of the refractory lead content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, January-February, 1976.

Refractory Chromium

Summer, fall and winter distributions of refractory chromium are presented in Figures 56a, b and c. Table 37 shows the average concentration of chromium and the observed range for each transect during the three sampling seasons.

Table 37. The average seasonal concentration of refractory chromium ($\mu g/\ell \times 10^{-3}$) in the suspended fraction.

Season	Transect I	Transect II	Transect III	Transect IV
Summer	3.3	5.0	4.9	11.3
(Range)	1.7-4.5	3.6-6.8	3.0-6.3	2.5-22.3
Fall	5.9	6.8	18.8	16.0
(Range)	3.3-8.6	4.6-10.7	4.1-52.4	8.2-25.5
Winter	13.3	14.0	9.3	32.7
(Range)	3.2-19.2	4.7-22.7	2.6-12.9	18.5-43.5

Transect IV exhibited the greatest degree of variability (2.6-22.3 x 10^{-3} $\mu g/\ell$) and the highest concentration of chromium (22.3 x 10^{-3} $\mu g/\ell$) during the summer, and the concentrations tended to decrease to the east and south.

Although similar distributional trends were apparent in the fall, the average concentration of refractory chromium on each transect was higher in the fall. Average concentrations on Transects III and IV were more than double those on Transects I and II.

The highest concentrations of chromium were present during the winter months. The average chromium level on Transect IV was several times higher than those of the other three transects.

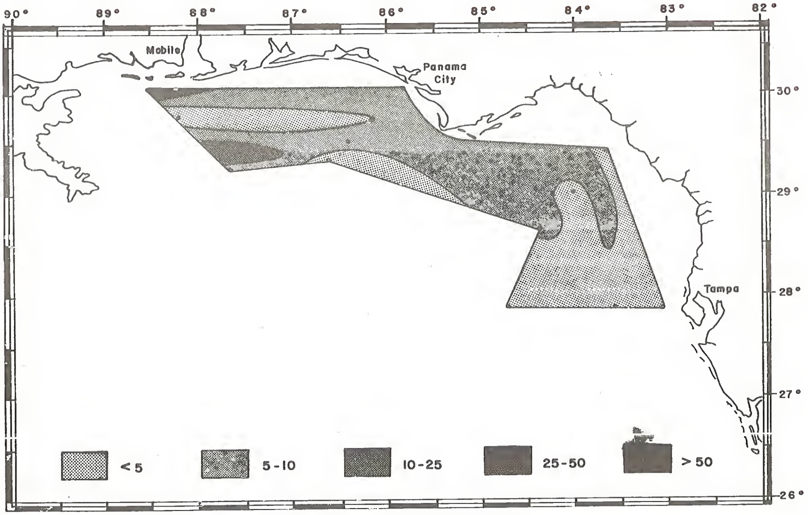


Figure 56 a. The horizontal distribution of the refractory chromium content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, June-July, 1975.

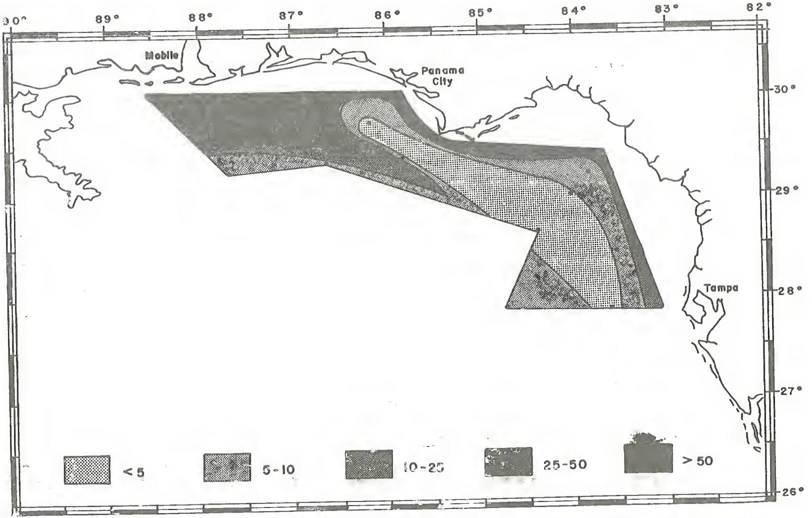


Figure 56 b. The horizontal distribution of the refractory chromium content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, September-October, 1975.

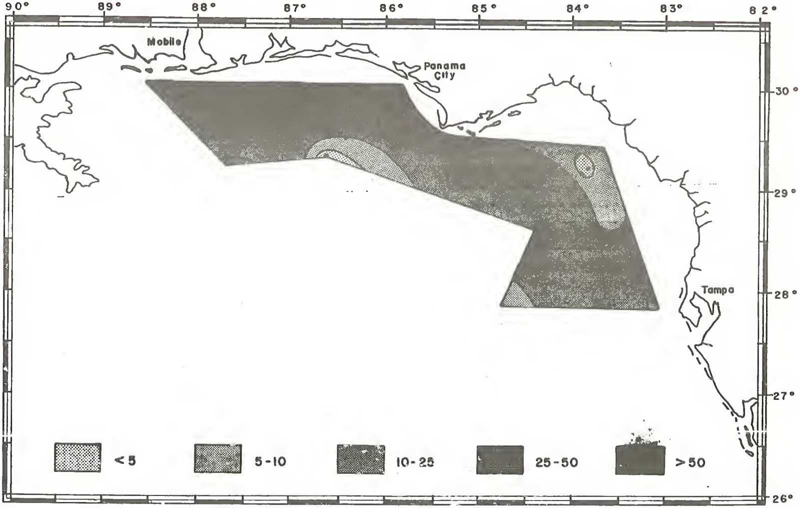


Figure 56c. The horizontal distribution of the refractory chromium content (ug/l x 10^{-3}) of the suspended material at the 10 meter level, January-February, 1976.

Seasonal changes were apparent on Transects I-IV. Transects I, II and IV had highest concentrations in the winter and Transect III had highest concentrations in the fall.

Table 38 shows the refractory trace metal interelement correlation coefficients for the summer, fall and winter. Although strong relationships existed between Al/Fe and Fe/Si throughout the three sampling seasons the relationship between Al/Si was significant only during the summer and winter. Strong correlations were also noted between Al-Pb, Fe-Pb and Pb-Si in the summer, between Cd-Pb, Cu-Pb and Cu-Si in the fall and between Cr-Fe and Cr-Si during the winter. Strong relationships between Cu-, Fe-, Pb-, Si and S $^{o}/_{oo}$ were also present in the fall.

Trace Metals in Zooplankton

Table 39 shows the average iron content (ppm) and the observed range of concentrations on each transect during each season.

Table 39. The average iron content (ppm) and the observed range of concentration present in zooplankton on each transect during each season.

	Transect			
Season	I	II	III	IV
Summer	94	99	91	254
(Range)	61-116	51-151	54-161	87-553
Fall	61	101	78	116
(Range)	55-69	62-192	52-144	49-237
Winter	182	108	615	679
(Range)	53-381	60-173	100-1,892	N.D.-1,542

N.D. Not detectable.

Table 38. Refractory trace metal correlation coefficients.

Summer

	Al	Cd	Cr	Cu	Fe	Pb	Si
Al	-	0.041	0.244	0.142	0.986	0.809	0.876
Cd		-	0.194	0.581	0.023	-0.056	0.233
Cr			-	0.191	0.246	0.415	0.625
Cu				-	0.134	0.385	0.177
Fe					-	0.790	0.886
Pb						-	0.720
Si							-

Fall

	Al	Cd	Cr	Cu	Fe	Pb	Si
Al	-	0.192	-	0.085	0.814	0.270	0.517
Cd		-	-	0.221	0.145	0.893	0.340
Cr			-	-	-	-	-
Cu				-	0.592	0.958	0.711
Fe					-	0.522	0.789
Pb						-	0.546
Si							-

Winter

	Al	Cd	Cr	Cu	Fe	Pb	Si
Al	-	-	0.928	-	0.974	0.283	0.945
Cd		-	-	-	-	-	-
Cr			-	-	0.910	0.336	0.934
Cu				-	-	-	-
Fe					-	0.358	0.945
Pb						-	0.439
Si							-

Average iron concentrations in zooplankton in the summer ranged between 91 and 99 ppm on Transects I, II and III. On Transect IV the average value was 254 ppm. Zooplankton at the inshore station (1412) on this transect contained the highest concentrations (553 ppm) of iron. The range of concentration present in the zooplankton generally increased from Transect I (61-116 ppm) to Transect IV (86-553). No consistent distribution pattern between transects was found.

In the fall, with few exceptions, little variation was found between stations. The only exceptions were Master Stations 1311, 1415 and the post hurricane sample collected from Master Station 1205. Values at these stations were 237, 144 and 192 ppm respectively. At Master Station 1205 which was sampled both before and after the passage of Hurricane ELOISE, the iron content of the zooplankton rose from 97 to 192 ppm. Distribution patterns on Transect I were similar to those present in the summer although the range of concentrations had decreased from 55 to 14 ppm. On Transect II the values of iron had generally decreased towards the edge of the Shelf whereas in the fall no marked changes (except for those apparently induced by Hurricane ELOISE) were found from the inshore to offshore station. Except for the variations present at the two inshore stations the trends present in the summer and fall at the two outer stations on Transect III were similar. On Transect IV the concentration had generally declined in the summer from inshore to offshore. In the fall the opposite was true. The greatest range of concentrations in the fall was present on Transect IV (198 ppm) and the least on Transect I (14 ppm).

Zooplankton generally contained higher concentrations of iron during the winter. Marked increase in the iron content of zooplankton on Transects

I, III and IV were apparent. The magnitude of the increases was approximately three-fold on Transect I, eight-fold on Transect III and six-fold on Transect IV. Zooplankton at the inshore stations contained higher amounts of iron than those in the offshore waters.

Seasonal patterns were similar for Transects I, III and IV in that the lowest average values were present in the fall. The seasonal changes occurring on Transect II were influenced by Hurricane ELOISE.

Table 40 shows the average copper content (ppm) of zooplankton and the observed range of concentrations on each transect during each season.

Table 40. The average copper content (ppm) and the observed range of concentrations present in zooplankton on each transect during each season.

Season	Transect I	II	III	IV
Summer	15.92	14.1	12.5	18.03
(Range)	8.07-28.98	9.40-26.34	8.09-15.86	9.55-31.95
Fall	15.2	15.1	17.2	41.9
(Range)	9.78-21.66	12.15-21.88	12.44-23.44	16.71-88.01
Winter	13.1	19.0	15.9	17.7
(Range)	10.54-14.54	12.48-33.26	12.47-18.16	11.89-24.09

Average concentrations of copper in zooplankton showed no marked variations during the summer in the Eastern Gulf of Mexico. The least variability in the copper content was found in those zooplankton collected on Transect III. No consistent distribution patterns were present when the transects were compared.

In the fall the average concentration of copper in zooplankton on Transects I, II and III show no difference when compared to that present in the summer. The average concentration on Transect IV was elevated from 18 ppm in the summer to 41.9 ppm in the fall. The range of concentrations present on Transect IV was also much greater than that of the other transects. The passage of Hurricane ELOISE resulted in a slight rise (17.05 to 21.88 ppm) in the amount of copper present in the zooplankton.

The distribution of copper on Transects I and II was similar to that present in the summer in that the amount of copper increased towards the edge of the Shelf on Transect I. Except for the increase at Master Station 1205 the copper content of zooplankton on Transect II was essentially uniform. In both the summer and the fall the zooplankton populations present on Transects III and IV showed great variation in their copper content.

The average copper content of the zooplankton on each transect was similar throughout the area in the winter. The average copper concentration in the zooplankton was 14.8 ppm with a range of 10.54 to 19.43 ppm (excluding Master Stations 1204 and 1413). Copper concentrations at these stations were 33.26 and 24.09 ppm respectively. The distribution of the metal along each transect was different from that present in the summer and fall and showed no consistent trends between transects.

No marked seasonal changes were evident in the copper content of the zooplankton on Transects I, II and III while on Transect IV the highest average values were present in the fall and no difference existed between the summer and fall populations.

Table 41 shows the average cadmium content (ppm) and the range of concentration on each transect during each season.

Table 41. The average cadmium content (ppm) and the observed range of concentration in zooplankton on each transect during each season.

Season	Transect I	II	III	IV
Summer	8.3	7.5	6.9	5.6
(Range)	4.36-13.66	6.95-8.33	4.96-11.85	4.20-10.96
Fall	7.7	4.46	9.6	13.0
(Range)	2.09-17.95	2.60-10.70	2.83-12.70	2.65-23.99
Winter	8.1	4.8	6.9	3.9
(Range)	6.78-9.57	3.12-6.16	4.66-8.21	2.69-6.12

Cadmium concentrations in zooplankton were, on the average, higher on Transect I (8.3 ppm) and lowest on Transect IV (5.6 ppm). No differences in the average concentration of the metal on Transects II and III were noted. The highest values of cadmium were present at the offshore stations on Transects I and III (13.66 and 11.85 ppm respectively. Concentrations showed no major change between stations on Transect II but decreased with increasing distance from shore along Transect IV.

Hurricane ELOISE caused over a three-fold decrease (10.7 to 2.8 ppm) in the cadmium content of the zooplankton at Master Station 1205 in the fall. The highest concentrations were present at the outer station on Transect I (17.95 ppm), the three outer stations on Transect III (10.65-12.7 ppm) and Master Stations 1414 and 1415 on Transect IV (23.99 and 22.19 ppm). Values on Transect II, with the exception of the high value of 10.7 ppm at Master Station 1205, were essentially uniform and ranged between 2.60 to 3.19 ppm.

Winter concentrations of cadmium decreased with increasing distance from shore on Transect I while the opposite was true on Transect II. Although the average values were different, the patterns of distribution were similar on Transects III and IV in that higher amounts of the metal were present at the inner and outer stations.

No seasonal changes were detected in the average cadmium content of zooplankton on Transects I and II. Seasonal changes were small on Transect III with the fall concentrations being slightly higher. The fall values were also higher than those of the summer and winter on Transect IV.

Table 42 shows the average lead content (ppm) and the observed range of concentration on each transect during each season.

Table 42. The average lead content (ppm) and the range of concentration in zooplankton on each transect during each season.

Season	Transect I	Transect II	Transect III	Transect IV
Summer	1.6	2.0	1.8	2.1
(Range)	0.72-2.17	1.24-3.63	0.40-3.28	0.98-3.03
Fall	0.6	2.4	1.3	5.0
(Range)	0.25-0.86	1.17-4.22	0.69-2.09	0.66-13.37
Winter	2.5	0.7	5.5	0.8
(Range)	0.67-3.44	0.16-1.78	0.69-12.49	0.16-1.17

Average lead concentrations in zooplankton were uniform throughout the MAFLA area in the summer. Concentrations tended to increase along Transects I and III away from shore while the opposite was generally true on Transect II. The inshore and the offshore stations contained the highest concentrations of lead on Transect IV.

The lead content of the zooplankton at Master Station 1205 increased from 3.54 to 4.22 ppm after the passage of Hurricane ELOISE. The lowest average values (0.6 ppm) of lead in the zooplankton were present on Transect I and the highest were on Transect IV (5.0 ppm). Zooplankton at Master Station 1415 contained 13.37 ppm lead. The distribution of lead on Transects I, III and IV tended to increase towards the edge of the Shelf. Lead values on Transect II were higher in the central region than at the inshore and offshore stations.

Average concentrations of lead in zooplankton on Transects II and IV were similar (0.7-0.8 ppm) during the winter The highest average value was present on Transect III. The lowest concentrations were generally found at the inshore stations on Transects I, II and IV. Alternating concentrations of lead were present along the length of Transect III.

The seasonal changes in the lead content of zooplankton were similar on Transects I and III in that the lowest average values were present in the fall and highest in the winter. The opposite situation was present on Transects II and IV.

Table 43 shows the average chromium content (ppm) and the range of concentration on each transect during each season.

Average chromium concentrations in the summer were similar on Transects I, II and III with the average value for the three transects being 0.5 ppm. The average concentration on Transect IV was approximately twice that present on the other transects. Chromium values generally

Table 43. The average chromium content (ppm) and the range of concentration in zooplankton on each transect during each season.

Season	Transect I	II	III	IV
Summer	0.6	0.5	0.5	1.2
(Range)	0.21-0.91	0.25-0.84	0.06-1.06	0.28-3.23
Fall	0.2	0.4	1.3	1.8
(Range)	0.16-0.37	0.30-1.05	0.17-3.81	0.21-5.46
Winter	0.9	0.3	1.2	1.0
(Range)	0.19-1.59	N.D.-0.54	0.33-2.79	0.32-1.98

N.D. Not detectable.

tended to increase towards the edge of the Shelf on Transects I and III with the opposite being true on Transects II and IV.

In the fall the distribution of the metal along Transects I, III and IV was similar in that the metal content of the zooplankton at the outer stations was higher than that of the inshore station (the opposite was true on Transect II). In the MAFLA area as a whole the trend was for the chromium content of the zooplankton to increase from the transect west of Tampa to Transect IV south of Horn Island. Although the difference in the average chromium values on Transect I and II was small, the average concentration on Transect IV was nine times that of Transect I. Zooplankton samples collected after Hurricane ELOISE showed that the chromium content had increased 3.5 times (0.30 to 1.05 ppm).

In the winter the lowest average concentration of chromium was present on Transect II (0.3 ppm). Chromium was not detectable in the zooplankton at Master Station 1207. The average concentration of chromium in zooplankton on Transects I, III and IV was 0.9, 1.2 and 1.0 ppm respectively. Distribution patterns were similar along all transects in that the concentrations decreased with increasing distance from shore.

The lowest average concentration of chromium in zooplankton on Transect I was present in the fall; on Transect II the average content of the zooplankton decreased from summer to winter; on Transect III the lowest average values for chromium were found in the summer and little difference was present between the fall and winter data. Zooplankton on Transect IV contained the highest amounts of chromium during the fall and no major differences were present between the summer and fall data.

Table 44 shows the average nickel content (ppm) and the range of concentration on each transect during each season.

Table 44. The average nickel content (ppm) and the range of concentration in zooplankton on each transect during each season.

Season	Transect I	II	III	IV
Summer	2.2	1.6	2.2	2.4
(Range)	1.18-3.80	1.40-1.86	0.88-3.59	1.47-3.79
Fall	4.0	1.5	5.8	4.4
(Range)	3.15-5.27	0.91-2.14	0.98-9.74	1.23-9.75
Winter	2.5	1.2	3.6	2.4
(Range)	1.68-3.76	0.90-1.32	2.10-5.49	1.54-3.54

Average nickel concentrations in zooplankton during the summer showed little variation between Transects I, III and IV (2.2-2.4 ppm).

Zooplankton nickel values were more uniform on Transect II (1.40-1.86 ppm) and the average value was 1.6 ppm. Nickel concentrations generally tended to increase towards the edge of the Shelf on Transects I and III. Transect II contained alternating levels of nickel in zooplankton while on Transect IV the highest concentrations were present at Master Stations 1412 and 1415.

In the fall the lowest average value was again on Transect II (1.5 ppm). The highest concentrations of the metal were present at Master Stations 1310 (9.74 ppm), 1311 (9.22 ppm) and 1415 (9.75 ppm). Values of nickel at the other stations ranged between 0.91-5.52 ppm. The distribution of the nickel content of zooplankton along each transect generally increased with increasing distance from shore. No effects on the nickel content of zooplankton as a result of the passage of Hurricane ELOISE were noted.

No differences in the average nickel content of zooplankton were apparent between the populations on Transects I and IV in the winter. Zooplankton on Transect II contained the lowest average value (1.2 ppm) while the average value in Transect III zooplankton was 3.6 ppm of nickel. Distribution patterns on Transects I and III were similar to that observed in the fall. Stations on Transect II showed little variation in nickel while alternating nickel values were present on Transect IV.

Zooplankton on Transects I, III and IV contained the highest concentrations of nickel in the fall. The nickel content of zooplankton on Transect II decreased from summer to winter. No differences were apparent between the summer and winter nickel values on Transect I and IV. On Transect I the summer concentrations were less than those in the winter.

Table 45 shows the average vanadium content (ppm) and the observed range of concentrations on each transect during each sampling season.

Table 45. The average vanadium content (ppm) and the range of concentration in zooplankton on each transect during each season.

Season	Transect I	II	III	IV
Summer	9.2	7.4	1.4	9.8
(Range)	5.65-13.02	3.95-12.22	1.01-2.17	4.59-15.32
Fall	2.7	1.9	1.8	9.3
(Range)	0.80-5.66	N.D.-5.40	0.19-4.75	0.92-34.92
Winter	1.7	1.9	6.0	9.7
(Range)	0.99-2.35	1.21-2.88	1.77-15.22	3.04-25.41

The average vanadium content of zooplankton on Transects I, II and IV were similar in the summer. The average value for all three transects was 8.8 ppm with an average range of 4.73-13.52 ppm. Zooplankton on Transect III contained concentrations of vanadium ranging from 1.01 to 2.17 ppm. Concentrations along Transects I, II and III generally decreased towards the edge of the Shelf while the opposite was true on Transect IV.

The average values of vanadium on Transects I, II and III were similar in the fall. The average for these three transects was 2.1 ppm. Zooplankton on Transect IV contained (on the average) over four times as much vanadium as the average zooplankton on Transects I, II and III. Zooplankton at Master Station 1205 contained non-detectable quantities of vanadium while after Hurricane ELOISE had passed the concentration had risen to 0.37 ppm. Distribution patterns were generally similar on Transects I and III and the amount of vanadium was lowest at the offshore station. Alternating patterns of high and low concentration were present on Transects II and IV.

In the winter the average vanadium content of the zooplankton on Transects I and II was 1.7 and 1.9 ppm respectively. The average value on Transects III and IV was 6.0 and 9.7 ppm. The range of concentrations on both of these transects was larger than that on Transects I and II.

Seasonal changes in the average vanadium content of the zooplankton on Transect IV were minimal. On Transect I the average concentration decreased from summer to winter while the opposite was true on Transect III. On Transect II the average vanadium content of the zooplankton was higher in the summer than in the fall or winter. No differences were present between the average fall and winter data on this transect.

Strong relationships were present between Cr-Fe in the summer ($r = 0.9$) and winter ($r = 0.7$), and between Cu-Ni in the summer ($r = 0.8$) and between Fe-Pb ($r = 0.9$), Cd-Ni ($r = 0.7$) and Cr-Ni ($r = 0.7$) in the fall.

Trace Metals in Neuston

The trace metal content of the neuston was determined on those samples collected during the fall and winter. Table 46 shows the average iron content (ppm) and the observed range of concentration in the neuston during the day and night in the fall and winter.

The observed differences between the day and night iron content of the neuston were significant on Transects II and IV in the fall and on Transect IV only in the winter. The general trend in the average concentration

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* Tests for significant differences between means are t tests ($\alpha \leq 0.05$) unless otherwise specified.

Table 46. The average iron content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

Season	Transect I	II	III	IV
Fall				
Day	157.7	205.5	1,315.5	1,287.5
(Range)	47.6-288.5	127.0-388.0	94.0-3,130.0	467.0-2,920.0
Night	77.5	570.5	737.5	231.9
(Range)	58.3-98.6	236.0-1,460.0	186.0-1,796.0	29.2-464
Winter				
Day	625.9	140.4	263.4	215.5
(Range)	140.9-1,249.2	102.7-195.8	76.1-465.8	55.9-377.7
Night	352.9	211.0	181.2	297.8
(Range)	42.6-906.2	65.6-602.3	50.7-300.2	178.6-482.1

of iron in the fall was for the values to increase from south to north (although this was less apparent during the night). The average day values on Transects III and IV were more than six times those of Transects I and II. The greatest ranges of concentration were present on Transects III and IV.

Concentrations of iron on all transects were consistently higher at the inshore stations and least at the offshore stations during the night in the fall. Iron concentrations along Transects I and III generally decreased with increasing distance from shore during the day and on Transects II and IV alternating high and low concentrations were present. The iron content of the neuston at Master Station 1215 increased from 123 to 228 ppm after the passage of Hurricane ELOISE.

The highest average (day) iron values in the winter were present on

Transect I (although this high value was due to the high value of 1,249.2 ppm in the neuston at Master Station 1120), and the lowest average iron values were present on Transect II. The highest average night level also occurred on Transect I.

The winter distribution of iron along each transect differed from that in the fall. On Transects I, II and III during the night the observed concentration of iron was higher at the offshore station than inshore and alternating low and high values were present along Transect IV. Iron values along Transects I, III and IV during the day were similar in that the concentration was highest in the offshore region. On Transect II the highest values were present at Master Station 1204 (196 ppm).

The average copper content (ppm) and the observed range of concentraion in the neuston during the day and night in the fall and winter is presented in Table 47.

Table 47. The average copper content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

Season	Transect I	Transect II	Transect III	Transect IV
Fall				
Day	15.5	11.7	20.4	21.7
(Range)	8.60-21.04	6.89-13.92	17.37-23.86	11.86-38.30
Night	30.2	29.0	30.4	25.8
(Range)	16.40-49.74	1[illegible].80-51.13	17.11-57.90	14.90-33.50
Winter				
Day	12.2	7.1	10.0	10.5
(Range)	7.45-20.77	6.48-7.78	8.60-12.55	6.73-13.93
Night	11.9	11.6	13.6	14.7
(Range)	7.16-15.82	10.41-13.44	6.51-16.28	11.25-23.03

The observed differences between the day and night values for copper in neuston were significant except along Transect I in the winter. In the fall average day levels on Transects III and IV were higher than those on Transects I and II. Average night levels were similar among transects and the average copper content of the neuston during the night was 28.9 ppm. The concentration of copper increased with increasing distance from shore on Transects I and IV during the day and III and IV during the night. Minimum concentrations of copper were present at Master Stations 1205 (6.89 ppm) and 1309 (17.37 ppm) during the day and the maximum values for copper during the night on Transects I and II were present at Master Stations 1102 (49.74 ppm) and 1206 (51.13 ppm).

The average copper content of the neuston in the winter was less than that in the fall. Patterns of change between transects for both day and night samples paralleled those of the fall.

Table 48 shows the average cadmium content (ppm) and the observed range of concentration in the neuston during the day and night in the fall and winter.

Table 48. The average cadmium content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

Season	Transect I	Transect II	Transect III	Transect IV
Fall				
Day	2.5	2.1	8.9	2.1
(Range)	1.81-3.39	0.48-3.21	0.31-26.85	1.00-3.52
Night	5.9	3.2	3.4	2.0
(Range)	3.58-10.40	1.34-4.52	0.40-6.19	0.35-5.42

Table 48. Continued.

Season	Transect I	II	III	IV
Winter				
Day	4.1	5.2	5.0	2.2
(Range)	2.59-6.61	2.86-6.88	3.58-6.77	1.74-2.72
Night	4.0	4.3	4.7	2.0
(Range)	1.66-6.04	2.56-7.03	1.85-5.71	0.81-2.90

The observed differences in the cadmium content of the neuston when the day and night data were tested were significant on Transect I in the fall and Transects III and IV in the winter.

The average day cadmium content of the neuston was similar on Transects I, II and IV. The neuston sample collected during the day at Master Station 1310 contained 26.85 ppm cadmium and accounted for the high average concentration on Transect III. As discussed later, contamination caused by the presence of foreign objects occurred in some of these samples. Average night levels were greatest on Transect I and lowest on Transect IV; Transects II and III were similar.

In general, the cadmium content of the neuston increased towards the edge of the Shelf on Transects I, II and IV during the day and night. Neuston at Master Stations 1308 and 1309 contained 2.25 and 6.00 ppm cadmium respectively while the two outer stations (1310 and 1311) contained 26.85 and 0.31 ppm cadmium respectively.

The average day-night cadmium content of the neuston on Transects I

II and III were similar. The levels on Transect IV were at least two-fold less than the others. As indicated previously, day-night differences in winter were significant on Transects III and IV only. The distribution of cadmium along the transects differed from that present in the fall in that the concentration generally increased towards the edge of the Shelf on Transects II and III in the day and on all transects during the night.

Table 49 shows the average lead content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

Table 49. The average lead content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

	Transect			
Season	I	II	III	IV
Fall				
Day	0.43	3.71	2.86	0.90
(Range)	0.16-0.72	0.94-7.47	1.45-5.34	0.86-1.11
Night	7.87	1.96	4.79	1.79
(Range)	1.20-12.27	1.14-2.64	0.45-12.13	0.99-2.92
Winter				
Day	2.83	4.91	4.14	3.13
(Range)	0.50-4.55	0.10-14.46	0.30-11.61	0.15-10.09
Night	0.68	1.28	9.70	2.92
(Range)	0.12-1.74	0.04-4.40	0.38-36.41	0.44-10.20

Significant day-night differences occurred only on Transects I and IV in the fall. The concentration of lead on Transect I in the fall was lower than that of the remaining transects during the day but higher than that of the other transects during the night. The lead content of the neuston on Transects II, III and IV during the day and I, II and III during the night generally decreased with increasing distance from shore. The reverse was true on Transects I and IV during the day and night respectively.

The observed differences between transects in the winter were relatively small with the exception of the high night-time level on Transect III. The lead content of the neuston generally decreased towards the edge of the Shelf on Transects I, II and IV during the day and night. The distribution of lead on Transect III was variable and ranged from 0.30-11.61 ppm during the day and 0.38-36.41 ppm during the night. The high value of 36.41 ppm occurred at Master Station 1310

Table 50 shows the average chromium content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

Table 50. The average chromium content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

Season	Transect I	II	III	IV
Fall				
Day	0.25	0.76	0.70	0.61
(Range)	0.02-0.40	0.28-1.91	0.36-1.27	0.30-0.84
Night	2.03	0.85	0.91	0.34
(Range)	0.09-4.61	0.42-1.63	0.04-2.13	0.11-0.56
Winter				
Day	1.90	1.78	1.96	0.57
(Range)	0.24-3.11	0.18-6.08	0.31-3.44	0.05-1.29
Night	1.01	0.67	1.00	0.95
(Range)	0.18-2.38	0.26-1.02	0.15-2.61	0.29-2.63

The observed seasonal differences in the chromium content of the neuston when the day and night data were compared were not significant except on Transect I in the fall.

The concentration of chromium on Transect I in the fall was at least 50% less than that of the remaining transects during the day and at least twice that of the other transects during the night. In the winter the differences between the day and night samples along the various transects were not significant.

No consistent offshore pattern was apparent during the day (fall) in the distribution of chromium in the neuston. During the night the concentration generally decreased towards the edge of the Shelf. The chromium content of the neuston during the winter was always lowest in the offshore samples.

Table 51 shows the average nickel content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

Table 51. The average nickel content (ppm) and the range of concentration present in the neuston during the day and night in the fall and winter.

	Transect			
Season	I	II	III	IV
Fall				
Day	4.2	2.9	6.3	6.0
(Range)	0.77-9.47	1.77-4.50	1.34-9.25	2.07-11.25
Night	3.8	4.1	3.6	2.9
(Range)	1.80-5.73	2.42-5.59	2.19-6.34	1.05-6.54
Winter				
Day	4.3	1.74	2.9	2.8
(Range)	1.74-8.23	1.03-2.64	1.60-3.85	1.29-5.91
Night	6.5	1.5	3.2	1.5
(Range)	1.96-14.90	1.02-2.17	0.92-6.76	1.03-1.93

The observed day-night differences in the nickel content of the neuston on Transect II in the fall and on Transects II and III in the winter were significant.

Day nickel concentrations in the fall were highest and similar on Transects III and IV. The lowest average concentration was on Transect II. This situation was reversed during the night when the level on Transect II was slightly higher than those on Transects I and III and the Transect IV level was minimal. Nickel concentrations were higher in the offshore neuston during the day on all transects and on Transects I and II during the night. On Transects III and IV the highest concentrations were present at Master Stations 1310 (6.34 ppm) and 1414 (6.54 ppm).

The day and night average concentrations in the winter were highest on Transect I. On Transects I and III the nickel values generally increased toward the edge of the Shelf while the concentrations on Transects II and IV were variable.

Table 52 shows the average vanadium content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

Table 52. The average vanadium content (ppm) and the range of concentration in the neuston during the day and night in the fall and winter.

Season	Transect I	II	III	IV
Fall				
Day	3.4	1.4	4.9	3.4
(Range)	1.51-7.00	1.14-2.02	<0.37-11.40	0.37-10.20
Night	0.9	4.2	1.3	1.6
(Range)	0.71-1.13	2.16-6.13	0.41-2.57	<0.37-2.65
Winter				
Day	2.6	3.7	1.5	4.7
(Range)	0.91-3.92	0.54-12.30	0.47-2.66	0.80-10.81
Night	0.9	9.1	1.4	2.1
(Range)	<0.46-1.40	<0.46-34.56	<0.46-2.37	0.46-4.82

The observed differences in the vanadium content of the neuston when the day and night data were compared were significant only on Transect II in the fall.

Vanadium concentrations during the day in the fall were similar except on Transect II where the average concentration was 1.4 ppm. Similar differences were present on Transects I and III during the night. The pattern of the distribution of vanadium was similar within each of the Transects I, II and III during both the day and night. On Transects I and III both sets of data indicated generally increasing concentrations towards the edge of the Shelf (although the latter was variable along the length of the transect). On Transect IV the vanadium content of the neuston increased with increasing distance from shore during the day while the opposite was true during the night.

Winter values of vanadium in neuston during the day on Transects I, II and IV ranged from an average 2.6-4.7 ppm with the highest average concentration being present on Transect IV. Neuston on Transect III contained an average of 1.5 ppm vanadium. With the exception of the average vanadium content of the neuston on Transect II (9.1 ppm) the average concentration of vanadium ranged between 0.9 ppm on Transect I to 2.1 ppm on Transect IV. The distribution of vanadium within the individual transects was generally similar during both the day and night in the winter but the patterns varied between the transects.

Strong correlations existed between chromium and lead in the fall ($r = 0.8$-0.9) and winter ($r = 0.7$) during both the day and night. Significant correlations were also present between Ni-V ($r = 0.7$) in the fall (day) and between Cu-Fe ($r = 0.9$) during the day and Cr-Fe ($r = 0.7$) during the night in the winter.

Hydrocarbons

Dissolved Hydrocarbons

The gas chromatographically-derived concentrations of the aliphatic and unsaturates/aromatic fractions are listed in Table 53 for all three seasons. In summer and fall the concentrations of the unsaturated/aromatic fraction generally exceeded that of the aliphatic fraction; this situation was reversed in the winter. The fall season had the lowest average hydrocarbon concentrations and the winter the highest.

Qualitatively, the dissolved hydrocarbons displayed regional differences during each sampling season. In the summer, two distinct regions were apparent. Transects I and II displayed a unique bimodal envelope of unresolved components in the aliphatic fraction, with the maxima centered at C_{17} and C_{27} (Figure 57). Master Stations 1308-1415 on Transects III and IV, had a broad envelope with no clear maximum (Figure 58). Both groups of samples displayed a series of n-alkanes from C_{21} to C_{32} with the weight ratio of total odd carbon number to total even carbon number n-alkanes averaging 1.1 ± 0.1. The unsaturates/aromatic fraction of both groups were similar (Figure 59) and were generally dominated by a peak at RI=3060. Chromatography on a non-polar column confirmed the identity of this molecule as squalene. The concentration of squalene averaged 0.12 ± 0.06 μg/ℓ. The concentrations of hydrocarbons in both fractions from the two groups were not significantly different (Table 53).

During the fall season, the concentration of dissolved hydrocarbons decreased to approximately 50% of the summer values (Table 53). This was true of both the aliphatic and unsaturates/aromatic fractions. Aliphatic

Table 53. Concentrations (μg/ℓ) of aliphatic (H), unsaturates/aromatic (B) and total (T) dissolved hydrocarbons.

Master Station	Summer			Fall			Winter		
	H	B	T	H	B	T	H	B	T
1101	0.11	1.01	1.12	0.01	0.15	0.16	0.69	0.49	1.17
1102	0.14	0.22	0.36	0.05	0.12	0.17	0.45	0.18	0.63
1103	0.13	0.19	0.32	0.08	0.06	0.14	0.40	0.06	0.69
1204	0.39	0.30	0.69	0.04	0.40	0.45	0.14	0.10	0.24
1205	0.14	0.32	0.46	0.02	0.12	0.13	1.08	0.10	1.18
1206	0.08	0.23	0.31	0.02	0.08	0.10	0.05	0.23	0.28
1207	0.25	0.22	0.47	0.10	0.14	0.24	0.08	0.04	0.12
1308	0.05	0.06	0.11	0.02	0.19	0.21	0.11	0.03	0.14
1309	0.17	0.09	0.26	0.11	0.12	0.23	0.07	0.35	0.42
1310	0.25	0.38	0.63	0.06	0.27	0.32	0.21	0.07	0.28
1311	0.10	0.30	0.40	0.09	0.18	0.27	0.07	0.08	0.14
1412	0.17	0.36	0.53	0.12	0.38	0.50	0.41	0.09	0.49
1413	0.09	0.43	0.52	0.06	0.16	0.22	0.46	0.15	0.62
1414	0.13	0.23	0.36	0.02	0.10	0.12	1.14	0.17	1.31
1415	0.06	0.22	0.28	0.16	0.09	0.25	0.33	0.03	0.36
Avg	0.15 ±0.09	0.30 ±0.22	0.45 ±0.24	0.06 ±0.04	0.17 ±0.10	0.23 ±0.12	0.38 ±0.35	0.14 ±0.13	0.54 ±0.40

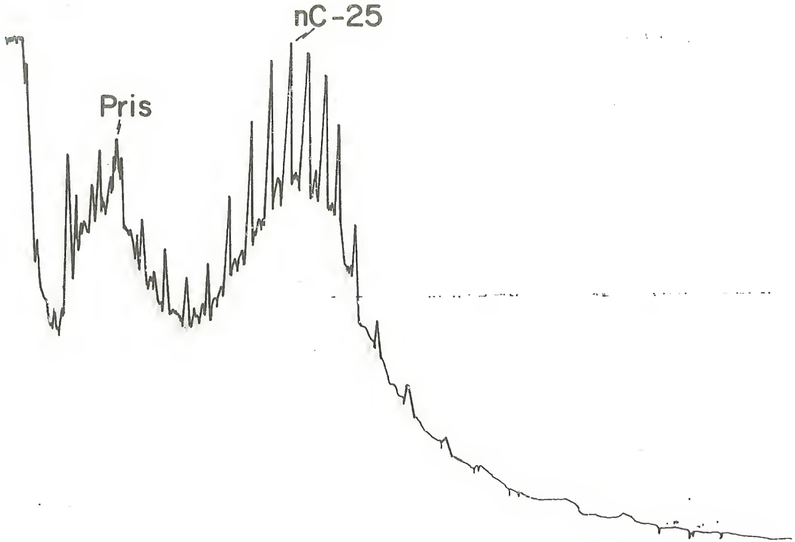

Figure 57. Station 1102: Aliphatic fraction of dissolved hydrocarbons, summer, 1975.

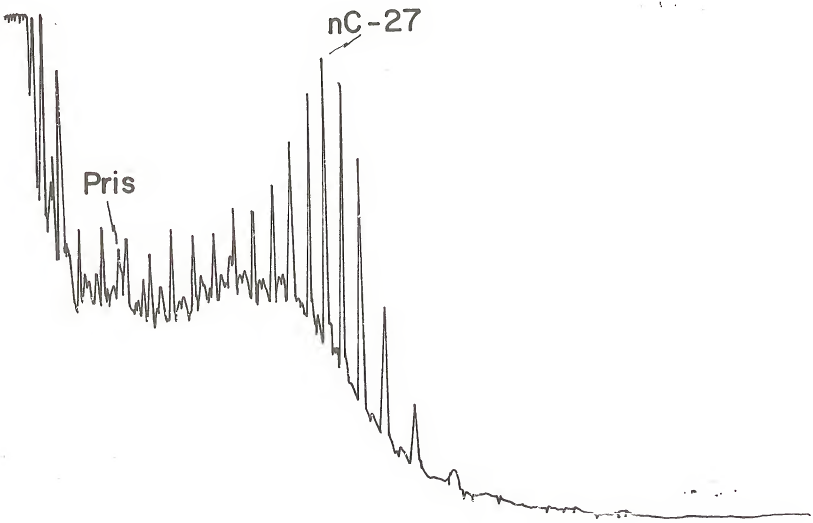

Figure 58. Station 1412: Aliphatic fraction of dissolved hydrocarbons, summer, 1975.

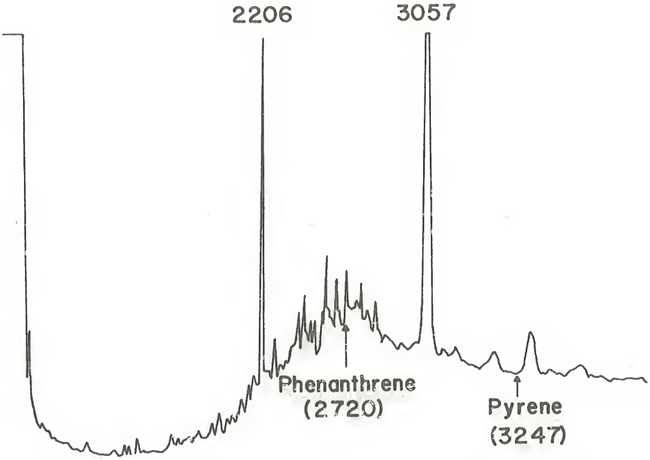

Figure 59. Station 1101: Unsaturates/aromatic fraction of dissolved hydrocarbons, summer, 1975.

Table 54. Average concentrations of aliphatic (H) and unsaturates/ aromatic (B) dissolved hydrocarbons.

	H	B
Summer		
Master Stations 1101-1207 (bimodal envelope)	.18 ± .11	.36 ± .29
Master Stations 1308-1415 (unimodal envelope)	.13 ± .07	.26 ± .13
Fall		
Master Stations 1101-1308 (no envelope)	.04 ± .03	.15 ± .10
Master Stations 1309-1413 (envelope)	.10 ± .04	.20 ± .11
Winter		
Master Stations 1101-1415, 1412-1415 (envelope)	.56 ± .34	.15 ± .14
Master Stations 1206-1311 (no envelope)	.10 ± .06	.13 ± .13

fractions from Master Stations 1101 through 1308, and 1414 (Figure 60) were characterized by a series of n-alkanes predominantly from C_{21} to C_{32}. The odd/even ratio for these fractions averaged 1.09±0.10. There was no detectable unresolved envelope at these stations. The remaining stations, 1309 through 1413 and 1415, contained a definite envelope with a maximum near C_{27} (Figure 61). The envelope was of lesser magnitude relative to the n-alkanes at Master Stations 1309 and 1310. The series of from C_{21} to C_{32} was still present and had an average odd/even ratio of 1.04±0.14, excluding one value of 0.17. Samples which contained the envelope also had greater concentrations of resolved hydrocarbons in the aliphatic fraction, averaging 0.10±0.04 μg/ℓ versus 0.04±0.03 μg/ℓ for those samples without an envelope (Table 54).

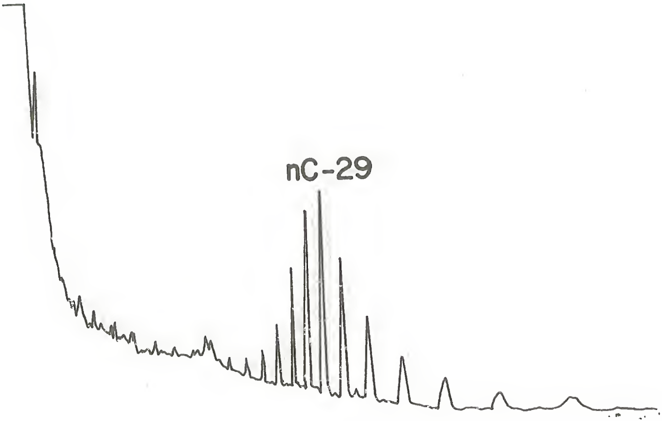

Figure 60. Station 1102: Aliphatic fraction of dissolved hydrocarbons, fall, 1975.

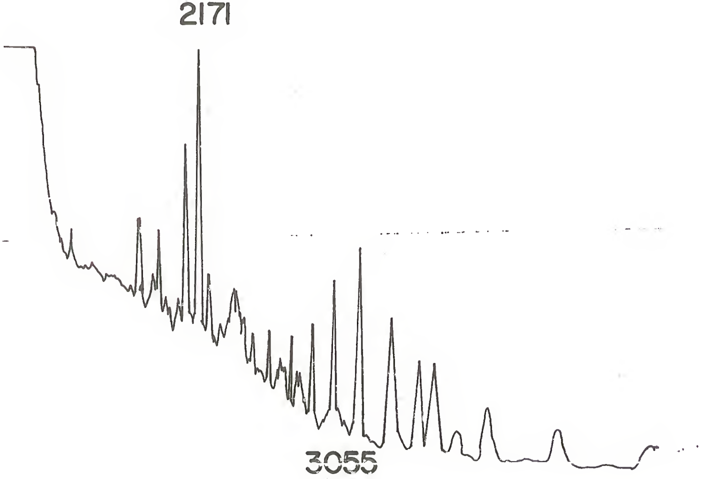

Figure 61. Station 1415: Aliphatic fraction of dissolved hydrocarbons, fall, 1975.

The unsaturates/aromatic fractions from the shoreward stations (Figure 62) of each transect were similar to the summer samples in that squalene was the dominant molecule in this fraction. The concentration of squalene at these stations averaged 0.06±0.03 μg/ℓ, excluding one value of 0.26 μg/ℓ at Master Station 1412. The offshore stations contained very little squalene averaging 0.002±0.002 μg/ℓ.

During the winter season, the presence or absence of an envelope in the aliphatic fraction divided the stations into coherent geographical units. Master Stations 1101 through 1205 on Transects I and II and 1412-1414 on Transect IV contained a large envelope with a maximum at C_{25} (Figure 63) while Master Stations 1206-1311 did not contain an envelope (Figure 64). The concentration of resolved aliphatic hydrocarbons averaged 0.56 μg/ℓ at stations exhibiting the envelope and 0.10 μg/ℓ at stations without an envelope (Table 53). The odd/even ratio from both groups averaged 1.1. At all stations, a poorly resolved cluster of peaks with RI between 1600 and 1900 was present in relatively large amounts.

The concentration of resolved hydrocarbons in the unsaturates/aromatic fraction did not depend on the presence or absence of an envelope in the aliphatic fraction, averaging 0.15 μg/ℓ and 0.13 μg/ℓ at stations with and without the aliphatic envelope. Squalene was present in the unsaturates/aromatic fraction in all samples with an average concentration at 0.04±0.03 μg/ℓ. Many of the samples also contained an unresolved envelope in this fraction, a feature not seen in previous seasons (Figure 65).

Particulate Hydrocarbons

The average concentration of resolved particulate hydrocarbons was 0.18 μg/ℓ in the summer, with most of the material being in the aliphatic

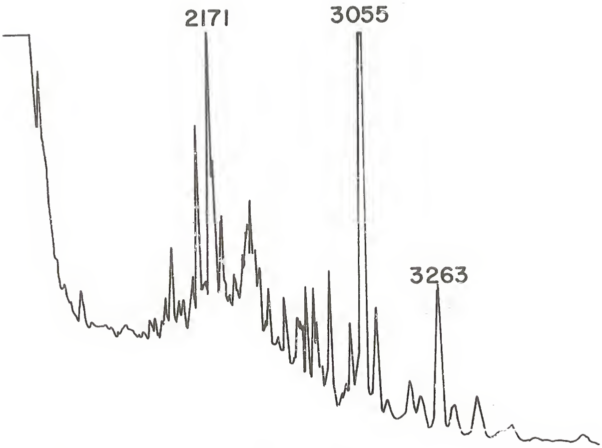

Figure 62. Station 1101: Unsaturates/aromatic fraction of dissolved hydrocarbons, fall, 1975.

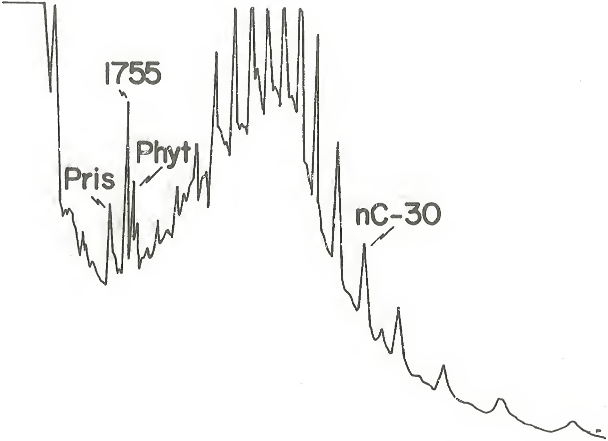

Figure 63. Station 1101: Aliphatic fraction of dissolved hydrocarbons, winter, 1976.

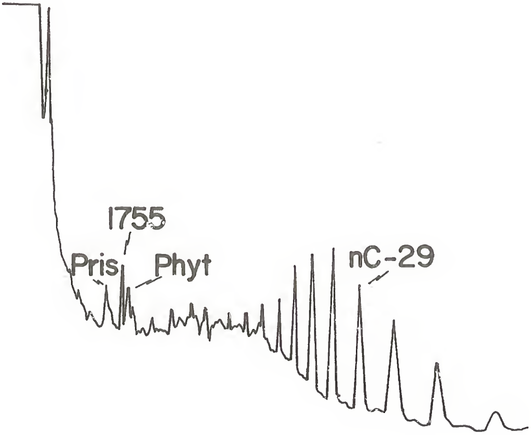

Figure 64. Station 1310: Aliphatic fraction , dissolved hydrocarbons, winter, 1976

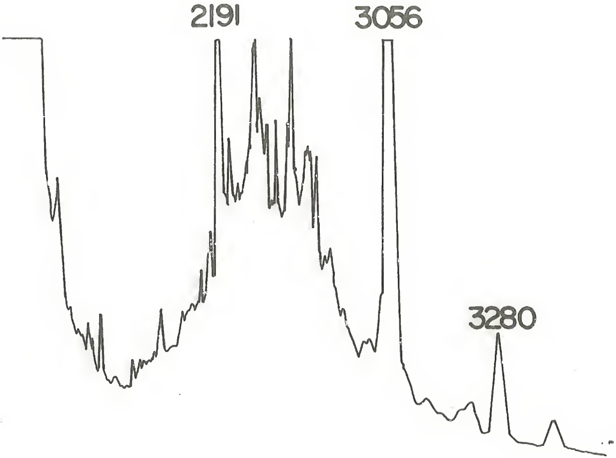

Figure 65. Station 1101: Unsaturates/aromatic fraction of dissolved hydrocarbons, winter, 1976.

fraction (Table 55). The dominant peak in the aliphatic fraction was nC_{15} with an average concentration of 0.044±0.029 μg/ℓ. Pristane and nC_{17} were present in all samples. An envelope in the aliphatic fractions was evident at some stations. Its distribution maximum occurred around nC_{23} (Figure 66). A series of n-alkanes was superimposed on the envelope.

In the unsaturates/aromatic fraction, squalene was the dominant molecule with an average concentration of 0.016 0.014 μg/ℓ. A peak at RI=2350 was also prominent (Figure 67).

In the fall, the concentration of particulate hydrocarbons fell to about 40% of summer time values and averaged 0.069 μg/ℓ (Table 55). The dominant feature was the presence or absence of the biogenic hydrocarbons nC_{15}, pristane, nC_{17} and squalene. In the aliphatic fractions, nC_{15} was the dominant molecule and nC_{17} and pristane were present at many stations.

The unsaturates/aromatic fractions in the fall contained squalene and in general little else. The concentration of squalene averaged 0.01±0.01 μg/ℓ and 0.003±0.004 μg/ℓ at stations having and lacking, respectively, the aliphatic biogenic hydrocarbons.

The concentration of particulate hydrocarbons was greater during the winter than the preceding seasons, averaging 0.62 μg/ℓ. However, there was a large range of 0.07 to 3.6 μg/ℓ (Table 55). Aliphatic and unsaturates/aromatic fractions at all stations contained envelopes. Biogenic hydrocarbons were essentially absent at all stations. Squalene was very low or absent at all stations except one!

Table 55. Concentration (μg/ℓ) of aliphatic (H), unsaturates/aromatic (B) and total (T) particulate hydrocarbons.

Master Station	Summer H	Summer B	Summer T	Fall H	Fall B	Fall T	Winter H	Winter B	Winter T
1101	0.03	0.04	0.07	16.02*	1.36	17.38*	0.087	0.027	0.114
1102	0.66	0.03	0.69	0.015	0.002	0.017	0.050	0.036	0.086
1103	0.03	0.01	0.04	0.011	0.000	0.011	0.323	0.040	0.363
1204	0.21	1.36*	1.57*	0.113	0.028	0.141	0.187	0.022	0.209
1205	0.06	0.01	0.07	0.045	0.006	0.051	0.151	0.038	0.189
1206	0.04	0.03	0.07	0.050	0.016	0.066	0.070	0.024	0.094
1207	0.18	0.03	0.21	0.007	0.004	0.011	0.058	0.036	0.094
1308	0.09	0.05	0.14	0.144	0.022	0.167	0.434	0.193	0.627
1309	0.07	0.01	0.08	0.007	0.003	0.010	0.073	0.019	0.092
1310	0.29	0.01	0.10	0.014	0.004	0.018	0.050	0.020	0.070
1311	0.09	0.02	0.11	0.025	0.010	0.035	0.080	0.028	0.108
1412	0.19	0.21	0.40	0.095	0.033	0.128	3.341	0.272	3.613
1413	0.13	0.06	0.19	0.103	0.052	0.155	0.391	0.775	1.166
1414	0.09	0.05	0.14	0.050	0.007	0.057	1.340	0.046	1.386
1415	0.13	0.01	0.14	0.088	0.011	0.099	0.697	0.220	0.917
Avg	0.14 ±0.15	0.04 ±0.05	0.18 ±0.17	0.055 ±0.046	0.014 ±0.015	0.069 ±0.058	0.49 ±0.86	0.12 ±0.20	0.62 ±0.93

* Omitted from average.

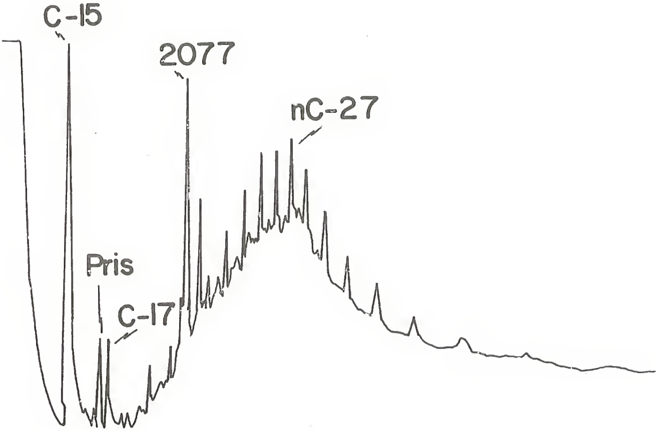

Figure 66. Station 1204: Aliphatic fraction of particulate hydrocarbons, summer, 1975.

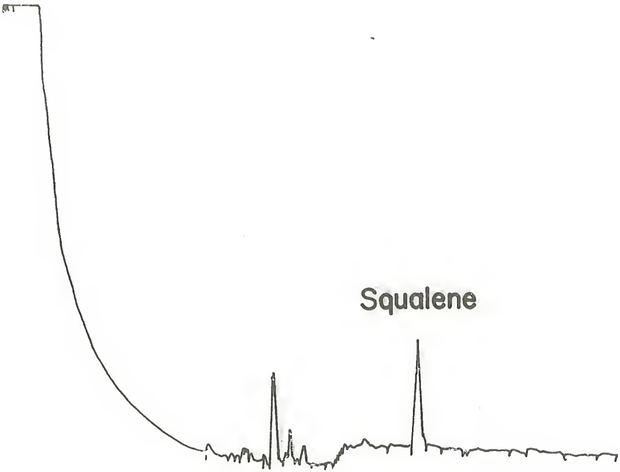

Figure 67. Station 1207. Unsaturates/aromatic fraction of particulate hydrocarbons, summer, 1975.

Zooplankton Hydrocarbons

As shown in Table 56, although the zooplankton biomass averaged 44 mg dry weight/m^3 in summer, 21 mg dry weight/m^3 in fall and 70 mg dry weight/m^3 in winter, the total lipid content was nearly constant at 38-50 mg/g dry weight. The total hydrocarbon content (sum of all integratable peaks in both hexane and benzene fractions) averaged 212 μg/g dry weight in summer, 135 μg/g dry weight in fall and 719 μg/mg dry weight in winter.

Table 56. Gravimetric data - seasonal.

	Summer	Fall	Winter
Zooplankton biomass, mg dry weight/m^3	44	21	70
Total lipid extract, mg/g dry weight	49.9	37.7	49.8
Total hydrocarbon, μg/g dry weight	212	135	719
Total hydrocarbon, μg/m^3	19.3	2.4	9.4

Visual inspection of chromatograms from the summer indicated that the zooplankton hydrocarbons fell into three compositional patterns, which were differentiated primarily by the unstaurates/aromatic fraction. The same groupings recurred in fall and winter. The first group, A (Figures 68a,b,c) was characterized by high concentrations of pristane and variable amounts of n-alkanes in the C_{21}-C_{32} region (Blumer, et al., 1963). The higher n-alkanes were generally not as abundant in this sample. Two peaks with retention indices of 1950 and 1976 appeared frequently. These may be the

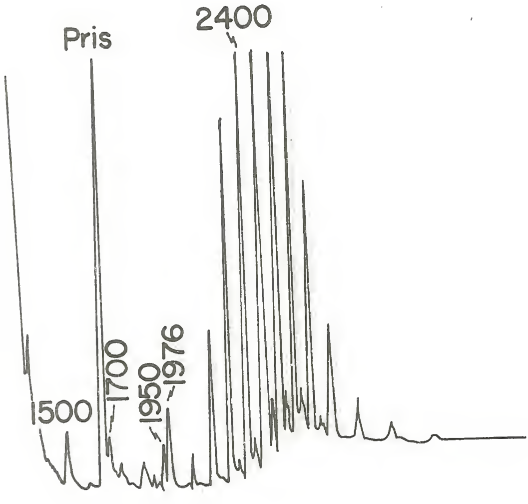

Figure 68a. Zooplankton hydrocarbons, Group A, Station 1102: Hexane fraction, summer, 1975.

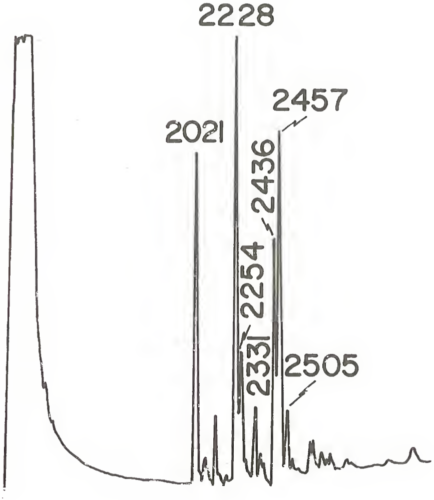

Figure 68b. Zooplankton hydrocarbons, Group A, Station 1102: Benzene fraction, summer 1975.

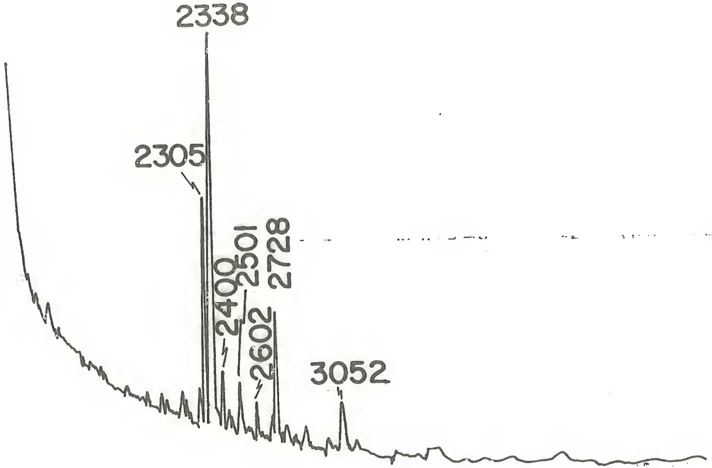

Figure 68c. Zooplankton hydrocarbons, Group A, Station 1415: Benzene fraction, fall, 1975.

phytadienes originally reported by Blumer and Thomas (1975). The benzene fraction of group A samples contained a group of peaks with retention indices from 2000 to 3200. There was considerable variation in composition from station to station and season to season but the retention index range mentioned above was not exceeded. The concentration of total hydrocarbon averaged 250 μg/g dry weight. A peak in the benzene fraction at RI ~3055 corresponds to squalene (Blumer, 1967). This peak has at least one other component which was resolved from squalene on a non-polar column (SP2100).

The second group, B (Figures 69a,b) contained very low amounts of hydrocarbons, primarily pristane in the hexane fraction and a peak at RI= 2350 in the benzene fraction. The total hydrocarbon content averaged 29 μg/g dry weight.

The last group, C (Figures 70a,b,c), was most interesting. The hexane fractions were much like those of group B, containing pristane and little else. The benzene fractions contained a group of peaks in the 2000-3200 retention index range although they were generally fewer in number and lower in concentration than those in group A. The interesting feature was the group of peaks with retention index 3400 and greater, to an estimated 4000. The same peaks seem to be recurring in this RI range; a pair at 3415 and 3450, a pair at ~3600 and a very large peak at ~3800. Total hydrocarbon content was 640 μg/g dry weight. The higher retention index peaks in the benzene fraction account for the bulk of the total hydrocarbon weight. The identity of these components is still a subject of investigation. Table 57 summarizes the characterizations of Groups A, B, and C.

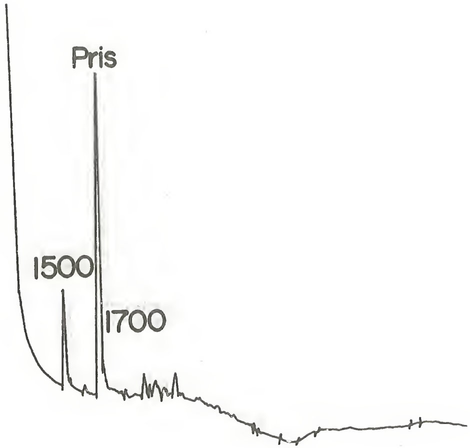

Figure 69a. Zooplankton hydrocarbons, Group B, Station 1205: Hexane fraction, summer, 1975.

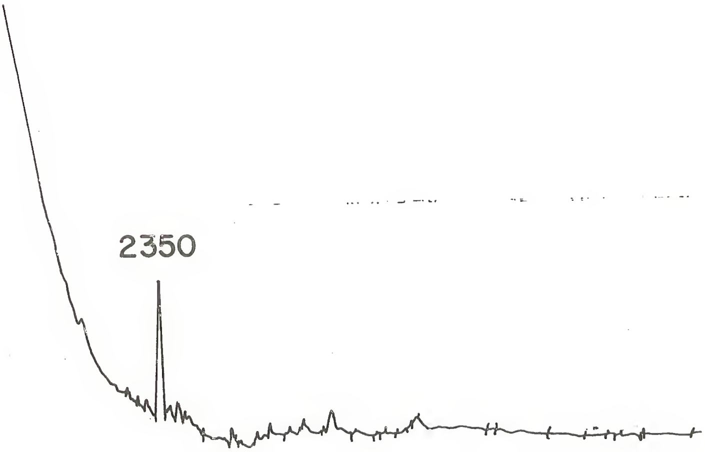

Figure 69b. Zooplankton hydrocarbons, Group B, Station 1205: Benzene fraction, summer, 1975.

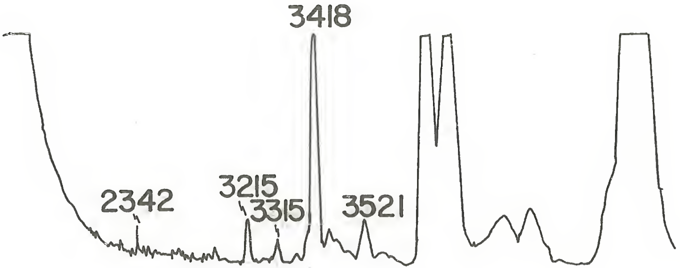

Figure 70a. Zooplankton hydrocarbons, Group C. Station 1415: Benzene fraction, summer, 1975

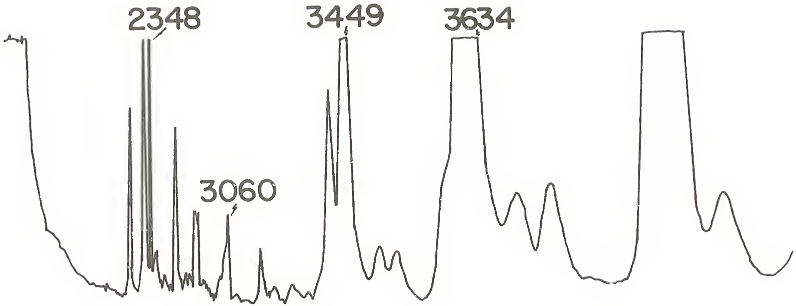

Figure 70b. Zooplankton hydrocarbons, Group C. Station 1309: Benzene fraction, fall, 1975

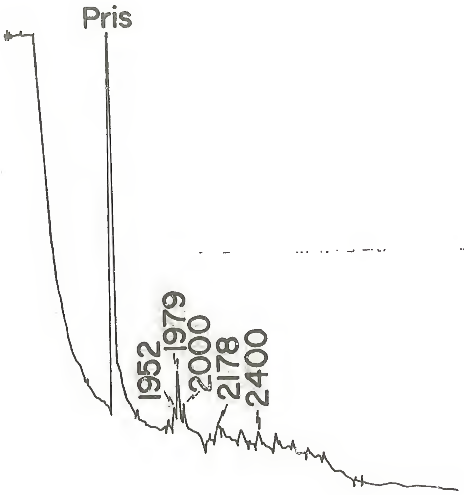

Figure 70c. Zooplankton hydrocarbons, Group C. Station 1309: Hexane fraction, winter, 1976.

Table 57. Characteristics of Zooplankton Hydrocarbon Groups.

Group	Hexane Fraction	Benzene Fraction	Average Total Hydrocarbons, μg/g dry
A	High pristane, variable n-alkanes C_{21}-C_{32}	Variable peaks between RI 2000-3200	250
B	Pristane mostly	Peak @ RI 2350	29
C	Pristane mostly	Peaks @ RI 2000-3200 and 3400-4000	640

Neuston Hydrocarbons

Tar balls were ubiquitous in neuston samples and on rare occasions were found in zooplankton samples. In June-July tar balls were found in 11 night, 14 day neuston and five zooplankton samples. Wherever possible, the tar balls were removed before analysis. Figures 71a and b show typical chromatograms of a contaminated sample.

In the winter the heaviest quantities of tar were found in the neuston tows conducted along Transects III and IV. Most of these were in the smaller size distributions and the difficulty associated with the complete removal of these complicated the chromatographic data. Tar was sparsely distributed on Transects I and II and was generally present in the smaller size range. The exception to this was the night neuston tow at Master Station 1207 which contained the most tar of any single station (sufficient to fill a 35 ml vial). Tar at this station was composed of small, medium and several very large lumps.

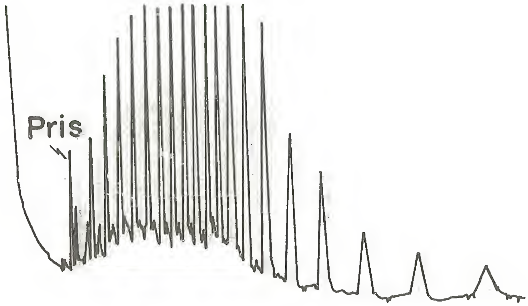

Figure 71a. Tar ball contaminated neuston sample: Hexane fraction

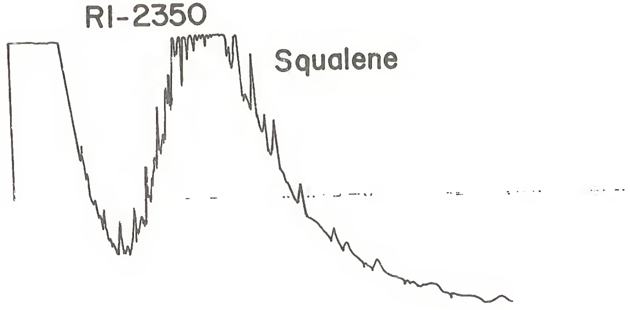

Figure 71b. Tar ball contaminated neuston sample: Benzene fraction

Neuston samples collected along Transect IV in the winter contained the highest quantities of tar and these were presently in the small size.

Day Neuston Chromatograms (Summer)

Hexane Fractions

Visual observations of the presence or absence of a dominant C_{12}-C_{32} n-paraffin series which dwarfs almost everything else in the chromatogram, notably pristane, is a fairly reproducible indicator of tar ball contamination of the neuston layer. When this evidence is accompanied by a pristane/phytane ratio which approaches 1.0, as well as observations by the analytical staff performing the chemical analyses, indications become certainties. Chromatograms run in this study indicate a high level of tar in the neuston of Master Stations 1101, 1102, 1103, 1309 and 1311; perhaps a moderate content at Master Stations 1205, 1206, 1207, 1414 and 1415; probably none at Master Stations 1204, 1308, 1310, 1412 and 1413. These indications reasonably conformed with the observed presence of small tar balls ($\leq$1 mm diam.) in the neuston sample, obviously the most difficult to completely remove by the tedious hand-sorting technique. Pristane/phytane ratios for the stations with and without tar contamination are:

Master Station	Pris/Phyt	Master Station	Pris/Phyt
1101	0.89	1204	∞
1102	$\approx$1.0	1308	25.71
1103	0.92	1310	440.1
1309	1.49	1412	∞
1311	2.62	1413	∞

On Transect II Master Station 1204 contained high C_{15}, pristane, C_{17}, and 2063 peaks and a very reduced n-paraffin series. Proceeding offshore along the transect, pristane reduces to a minor peak and the paraffin series increases; the pristane/phytane ratio progresses offshore from ∞ at 1204 to 8.8, 2.9, and 7.6.

Transect III, Master Station 1308, chromatogram predominantly contains pristane and some C_{15}, with a negligible n-paraffin series. The chromatogram for Master Station 1310 is similar, with additional large peaks at C_{25}-C_{28} and at RI=2920 and 2550. Master Stations 1309 and 1311 have similar chromatograms showing a high tar ball content and very reduced pristane and C_{15}.

The chromatogram for Master Station 1412 is mostly pristane with a negligible n-paraffin envelope; moderately large peaks are present at C_{15}, C_{17}, RI=1750, 1950 and 2050. Master Station 1413 shows mostly pristane; 1414 is predominantly pristane plus a heavy n-paraffin (tar) series; 1415 shows minor pristane relative to a heavy tar series. Overall, the biological characteristics of this transect give way to an increasing pattern of probable petroleum hydrocarbons as the stations proceed offshore.

Benzene Fractions

All stations on Transect I had similar chromatograms: major peaks occur at RI=2000, 2100, 2200, 2233, 2309, 2371, 2386, 2465, 2639, 2691 and 2719. Master Station 1101 contained a large peak at RI=2977 which disappears with increasing distance from shore. Presumably the consistent peaks in these runs were basically tar constituents since the respective hexane fractions also showed such evidence.

As with the hexane chromatograms, Master Stations 1309 and 1311 were similar and were probably representative of weathered oil benzene fractions: they contained a large envelope from RI=1900-3400 with small peak distributions atop; the largest peak was at RI=3300. Master Stations 1308 and 1310 benzene fractions were not as similar as their respective hexane fractions, although they roughly resembled each other. Both contained a small squalene peak; Master Station 1308 contained major peaks at RI=2214, 2309 and 2420. Master Station 1310 contained major peaks at 2350 and 2513; additionally, this chromatogram contained an interesting series of large, high molecular weight (RI=3500-4500) peaks. Some of these peaks have calculated retention indices of 3310, 3412, 3610, 3629.

As with the Day Neuston hexane runs, Master Stations 1412 and 1413 resembled each other: both had a dominant peak at RI=2350 and a low intensity high molecular weight series. Master Station 1412 had other large peaks at RI=2192, 2312, 2772, 2881 and 3200. Master Station 1413 had large peaks at 2284, 2844, 2938 and 3058 (squalene) and Master Station 1414 was more similar to Master Stations 1412 and 1413 than 1415 and showed large peaks at RI=2190, 2211, 2309, 2346, 2418, 2059 (squalene) and 3245, as well as a low intensity series of high molecular weight molecules often found in neuston benzene fractions. The benzene fraction of Master Station 1415 was the same as that of Master Stations 1309 and 1311.

Night Neuston Chromatograms (Summer)

Hexane Fractions

These chromatograms showed an interesting combination of biological and petrochemical influence as the residents of this layer at night were largely zooplankton migrating to the surface for feeding. The chromatogram for Master Station 1101 looked essentially the same as for zooplankton at the same station. Proceeding offshore towards Master Station 1103, however, pristane and C_{15} and the abbreviated zooplankton paraffin series gives way to the extensive paraffin envelope characteristic of tar. The pristane/phytane ratio for Master Stations 1101 = ∞, 1102 = 15.35, and 1103 = 1.3.

Transect II showed a trend of losing the dominant pristane, C_{15}, C_{17} of 1204 and increasing the n-paraffin series as the stations proceed offshore. A major peak at RI=2926 appeared at Master Stations 1206 and 1207.

Master Stations along Transect III do not show a regular progression of this type. Rather, Master Stations 1308 and 1311 appear more biological, Master Station 1309 more tar-like and 1310 possibly a mixture. That is, the 1308 chromatogram, like that of 1101, had a large pristane, short paraffin series and a pristane/phytane ratio = ∞. At Master Station 1309, pristane was much reduced, the paraffin series expanded from C_{17}-C_{36}, and the pristane/phytane ratio = 2.42. Master Station 1310 exhibited both a large pristane and the long paraffin series as well; pristane/phytane = 17.23. At Master Station 1311, only pristane was evident; pristane/phytane = ∞.

Master Stations 1412-1415 were uniformly biological, resembling the zooplankton extracts at these stations. They were predominantly pristane; only Master Station 1415 showed any increase in possible tar components, but it was not the dominant feature of the chromatogram. A large peak appears at RI=2928 at Master Station 1415.

Benzene Fractions

While Master Station 1101-hexane appeared to be predominantly biological in content, the benzene fraction appeared to be more a mixture of biological and petroleum influences. The basis for this conclusion rests in the high degree of similarity between the benzene fraction of the next station in this transect (1102) and all of the Transect I benzene fractions in the day neuston. That is, the day neuston from this transect were almost entirely characterized by tar components. The benzene chromatograms of these stations matched the Master Station 1102 night neuston benzene and a subset of peaks in the benzene fraction of the night neuston at Master Station 1101. For this reason, the major peaks at these stations might be designated as follows, ("b" denotes probable biological origin and "p" denotes probable petroleum origin):

1101			1102
2014(p)	2447(p)	3166(b)	2017(p)
2117(p)	2741(b)	3196(b)	2119(p)
2220(p)	2847(b)	3420(b)	2219(p)
2317(p)	2945(b)		2322(p)
2357(b)	2987(b)		2425(p)
2427(p)	3066(squalene)		2447(p)

Master Station 1103 was different from Master Stations 1101 and 1102; it contained the broad envelope with small peaks on top identical to the heavily tar-contaminated day neuston benzene fractions at Master Stations 1309, 1311 and 1415. Two large peaks were present as well at RI=2314 and 3067 (squalene).

The (probable) biological influence was present at relatively low levels in all benzene fractions of Transect II. The evidence for this was derived from the low intensity of very high molecular weight series of peaks as well as the low intensity peaks at RI=2288, 2350, 2440, 2520 and squalene.

Master Station 1308 was characterized by some (probable) biological peaks at RI=2250, 2350, 2502 and 3062 (squalene) but was also quite full of probable petroleum peaks. Grouping the night-neuston benzene fractions from Master Stations 1101, 1102, 1103 and 1308, which highly resemble each other, produces the same grouping as for zooplankton group A.

Master Station 1309 was the same as for the 1103 night neuston benzene; large peaks also occurred at 2350 and 3313. Master Station 1310 had major peaks at RI=2364, 2627, 2832, 3033 and 3240; major peaks at lesser relative intensity occur at 3268, 3350 and 3538. Master Station 1311 contained almost no peaks, having only two small peaks of biological origin at 2350 and 3060 (squalene).

Master Station 1412 contained a giant peak at RI=2350; other major peaks occurred at 1923, 1953, 1981, 2870 and 3060 (squalene). The chromatogram at Master Station 1413 also showed a major peak at 2350; the chromatogram, however, was totally dominated by the presence of the higher molecular weight peak series (typical of zooplankton) having extremely high relative intensities. The RI and time values for this series were 3425, 3458, 3527, 3560, 3618, 3633, 101 min, 116 min, 122 min, 132 min. Master Station 1414 contained only one major peak at RI=2350. Master Station 1415 had large peaks at 2738, 2814, 3016, 3217, 3247; medium peaks occurred at RI=2311, 2349, 2476, 2612 and 3060 (squalene); a low intensity high molecular weight series is present, having peaks at 3423, 3453, 88 min and 116 min. Overall, this transect indicates a largely biological character with perhaps some added petroleum input at Master Station 1415.

Day Neuston Chromatograms (Fall)

Hexane Fractions

Master Station 1101 chromatograms were largely pristane, nC_{17} and peaks at RI=1926, 1950 and 2000. Master Station 1102 contained mostly pristane, nC_{17}, a more noticeable and moderately intense n-paraffin series, as well as large peaks at RI=2724 and 2923. Phytane was noticeable at this station. Master Station 1103 contained large amounts of pristane and phytane, but the chromatogram was dominated by an extensive and very intense n-paraffin envelope extending from nC_{15} to nC_{40}. This pattern is usually an indicator of tar contamination.

Master Stations on Transect II were fairly uniform in appearance and concentration of material. The chromatograms were dominated by a pristane peak followed in intensity by nC_{15} and nC_{17} peaks. An n-paraffin series of moderate intensity was present. A peak at RI=1742 appeared at Master Station 1204 and decreased as the stations progress offshore.

Chromatograms of the Transects III and IV were dominated by increasing tar content as the stations proceed offshore. The chromatogram of Master Station 1308 contained a major peak at nC_{13}, followed by pristane, nC_{15} and nC_{17}. An n-paraffin series of moderate intensity was present as well as peaks at RI=2919 and 3121; phytane was present. Proceeding offshore, this pattern was dwarfed by the increasing n-paraffin series which extended from nC_{15} to nC_{45}. A substantiation of this trend was noted as a decrease in the pristane/phytane ratio occurred in tandem with the increase in tar content. These changes are summarized (Table 58) and as pointed out above, Master Station 1103 was heavily contaminated with tar. Qualitatively and quantitatively it was equivalent to Master Station 1311. In addition to the massive n-paraffin series, Master Stations 1103, 1311, 1414 and 1415 contained very intense peaks at RI=2628, 2656, 2726, 2759, 2853 and 2926.

Table 58. Day neuston hexane fractions.

Station Number	Concentration (μg/g)	Pristane/ Phytane
1101	166,242	∞
1102	25,814	18.23
1103	2,739,453	1.41
1204	26,953	34.37
1205A	37,268	22.28
1206	58,598	80.12
1207	48,645	44.78
1308	235,346	19.35
1309	314,829	7.08
1310	2,159,557	0.78
1311	3,021,963	0.00
1412	25,545	6.47
1413	39,565	5.38
1414	8,771,729	0.54
1415	2,858,463	1.58

Benzene Fractions

Chromatograms of Transect I were dominated by a peak at RI=2341 which was very intense at the nearshore station and decreased as the stations move offshore. Squalene was also intense at Master Station 1101, less so at Master Station 1102 and absent at Master Station 1103. Other peaks were very intense at Master Station 1101 and disappeared offshore: RI-2177, 2216 and 2277. Master Station 1103 contained a minor intensity, unresolved envelope extending from RI=2200-3200. On Transect II the stations showed the presence of low intensity high molecular weight molecules at Master Station 1204 and the post hurricane sample from Master Station 1205. Squalene and a peak at RI=2334 were minor at the nearshore station and increased to Master Station 1207. Other than the peaks listed, these two transects contained only a very few peaks of negligible intensity.

Master Station 1308 contained a large peak at RI=2336. Several moderately intense peaks were present between RI=2500-3200. A low intensity series of high molecular weight peaks extended out to about RI=4000; the largest of these occurred at RI=3395. Master Station 1309 exhibited a significant enhancement of these medium and high molecular weight peaks. These high molecular weight peaks were consistent with those found in chromatograms of the benzene fractions of zooplankton of Group C. Only Master Station 1309, however, was represented in the stations which comprise Group C.

Master Stations 1310, 1311, 1414 and 1415 contained peak patterns which matched Master Stations 1103, i.e. an unresolved envelope with a few small peaks atop. These five stations were the ones with extensive tar contamination as discussed above; undoubtedly these benzene chromatograms reflect only non-biogenic contributions of the tar. Master Stations 1412 and 1413 were virtually devoid of material and contained only a very few peaks of negligible intensity.

Night Neuston Chromatograms (Fall)

Hexane Fractions

Chromatograms from Transect I were dominated by pristane. A large nC_{15} peak was present at Master Station 1101 and minor at the other stations and $\underline{n}C_{17}$ increased to a very large peak as the stations proceed offshore. Master Station 1103 contained a noticeable n-paraffin series and a large peak at RI=2923.

Master Stations of Transect II predominantly contain pristane, nC_{15}

and nC_{17}; the pristane/C_{17} ratio varied markedly throughout the transect. A peak at RI=2073 was present at Master Station 1204 only. Proceeding offshore, the n-paraffin series became progressively more pronounced. Phytane was noticeable at Master Station 1207.

The chromatogram from Master Station 1308 was identical to that of Master Station 1101. The remainder of this transect contained heavy tar contamination as evidenced by an intense, extended n-paraffin series atop an unresolved envelope. The heaviest content occurred at Master Station 1310. At Master Station 1309, substantial peaks at RI-2725, 2928 and 3145 occurred; at Master Station 1311 additional peaks included RI=2726, 2928 and 3124.

Transect IV data beginning at Master Station 1412 had few components: a moderate intensity n-paraffin series, a minor pristane peak, and a pristane/phytane ratio of 3.4. A peak at RI=2924 was also present. Master Station 1413 was virtually all pristane, which again was of minor intensity. Master Station 1414 had a minor intensity n-paraffin series; pristane and a peak at RI=2924 was the largest in the chromatogram, being 2-3 times the intensity of the others. Master Station 1415 had the very pronounced, high intensity n-paraffin series typical of tar contamination, a pristane peak of comparable intensity, and a pristane/phytane ratio of 1.64. Other major peaks in this chromatogram occurred at RI=2724, 2760, and 2925.

Benzene Fractions

Chromatograms from Transect I showed an increase in complexity as the stations progressed offshore. Master Station 1101 contained three main peaks at RI=2345, 2504, and 3053 (squalene). Master

Station 1102 contained these peaks as well as peaks at RI=2142, and 2771. The chromatogram of Master Station 1103 contained these same peaks and a series of massive, high molecular weight peaks.

With the exception of Master Station 1205, all chromatograms from Transect II contained a few small peaks of negligible intensity. The Master Station 1205 chromatogram contained a series of minor intensity peaks ranging from about RI=2000-3000. Only one major peak at RI=3048 (squalene) was present.

Master Station 1308 exhibited an intense 2329 peak which was of negligible intensity at the other stations in this transect. Other peaks of moderate intensity at Master Station 1308 occurred at RI=2434, 2497, 2768, and 3042 (squalene). An unresolved envelope with many small peaks atop occurred at Master Station 1309, 1310, and 1311, probably reflecting the tar contamination evidenced in the hexane fractions at these stations.

Chromatograms from Transect IV were quite meager at Master Stations 1412 and 1413 and only a few negligible peaks were present. Master Stations 1414 and 1415 were more complex, containing a series of moderately intense peaks from about RI=2500-3000. Notable among these were peaks at RI=2727 and 3053 (squalene). The chromatogram of Master Station 1415 also had a moderately intense series of high molecular weight peaks.

Tar balls were ubiquitous in the winter neuston samples. Figures 71a and b show the chromatogram of a contaminated sample. In those rare instances where the sample was free of contamination the chromatogram resembled that of the zooplankton.

Organic Carbon

Particulate Organic Carbon

Figures 72a, b and c show the distribution of particulate organic carbon during the three sampling seasons. Table 59 shows the average seasonal concentration of particulate organic carbon and the observed range along each transect.

Table 59. The average seasonal concentration (mg/ℓ) of particulate organic carbon and the observed range along each transect.

Season	Transect I	II	III	IV
Summer	0.08	0.11	0.16	0.24
(Range)	0.03-0.13	0.09-0.12	0.12-0.22	0.15-0.47
Fall	0.12	0.10	0.05	0.08
(Range)	0.06-0.22	0.07-0.15	0.03-0.10	0.04-0.11
Winter	0.14	0.13	0.09	0.15
(Range)	0.09-0.21	0.09-0.16	0.06-0.13	0.08-0.24

Particulate organic carbon levels were higher during the summer on Transects IV and III than in the other two seasons. Figure 72a shows that along Transects IV and III the concentration decreased with increasing distance from shore while the converse was generally true along Transect I. Transect II shows the influence of the Horseshoe Bend eddy. The observed differences between transects were significant.

In the fall the particulate organic carbon concentrations were generally less than those found in the summer except on Transect I. Significant differences were present between Transects III and IV only. In all instances

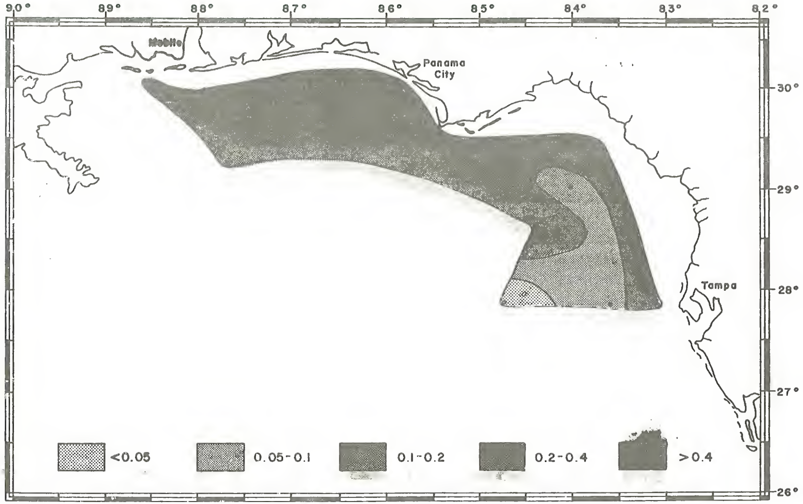

Figure 72 a. The horizontal distribution of particulate organic carbon (mg/l) at the 10 meter level, June - July, 1975.

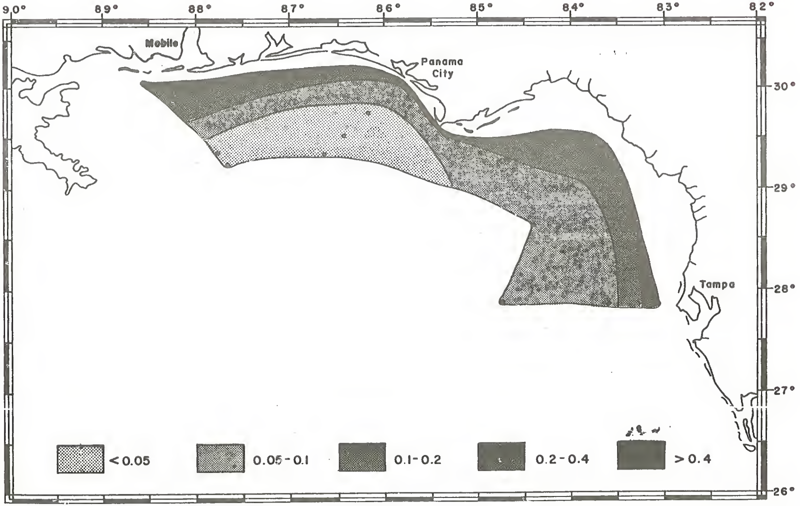

Figure 72 b. The horizontal distribution of particulate organic carbon (mg/l) at the 10 meter level, September - October, 1975.

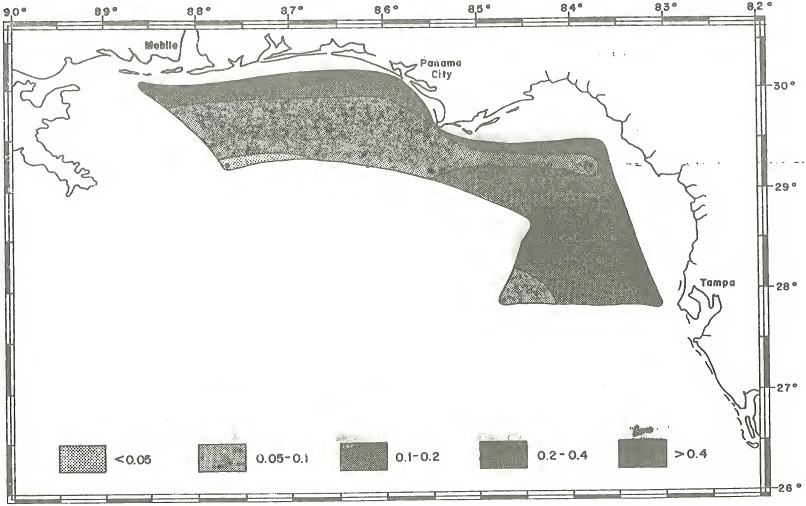

Figure 72c. The horizontal distribution of particulate organic carbon (mg/l) at the 10 meter, January - February, 1976.

the amount of particulate organic carbon was less in the offshore waters than in the inshore region. An increase in values was noted in the Horseshoe Bend eddy.

In general, a slight increase in particulate organic carbon (compared to the fall) was noted in the winter.

The observed seasonal differences on Transect I were significant between the summer and winter only. Seasonal changes were significant during all seasons on Transect II. No differences were found between the summer and winter data on Transect III. Seasonal changes were evident on Transect IV.

Dissolved Organic Carbon

Figures 73a, b and c illustrate the distribution of dissolved organic carbon during the three sampling seasons. Table 60 shows the average seasonal concentration of dissolved organic carbon and the observed range along each transect.

Table 60. The average seasonal concentration (mg/ℓ) of dissolved organic carbon and the observed range along each transect.

	Transect			
Season	I	II	III	IV
Summer	1.54	0.95	1.05	1.30
(Range)	0.71-2.57	0.56-1.25	0.62-1.36	0.92-1.89
Fall	0.96	1.16	0.99	1.30
(Range)	0.47-1.61	0.89-1.42	0.91-1.19	0.89-1.75
Winter	2.18	1.89	1.83	2.17
(Range)	1.68-2.47	1.67-2.18	1.71-1.87	1.68-2.71

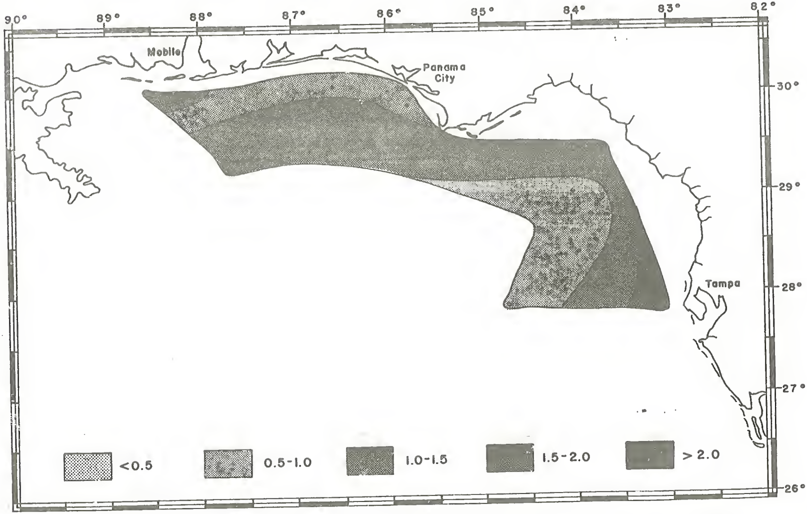

Figure 73 a. The horizontal distribution of dissolved organic carbon (mg/l) at the 10 meter level, June - July, 1975.

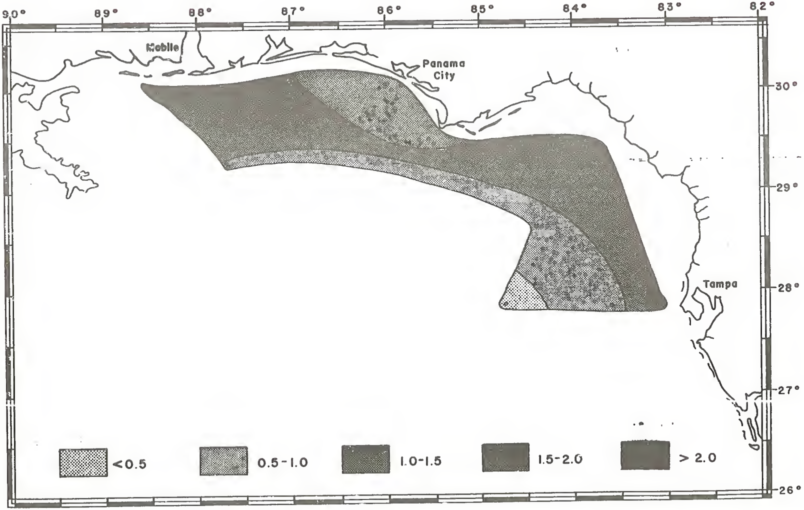

Figure 73 b. The horizontal distribution of dissolved organic carbon (mg/l) of the 10 meter level, September - October, 1975.

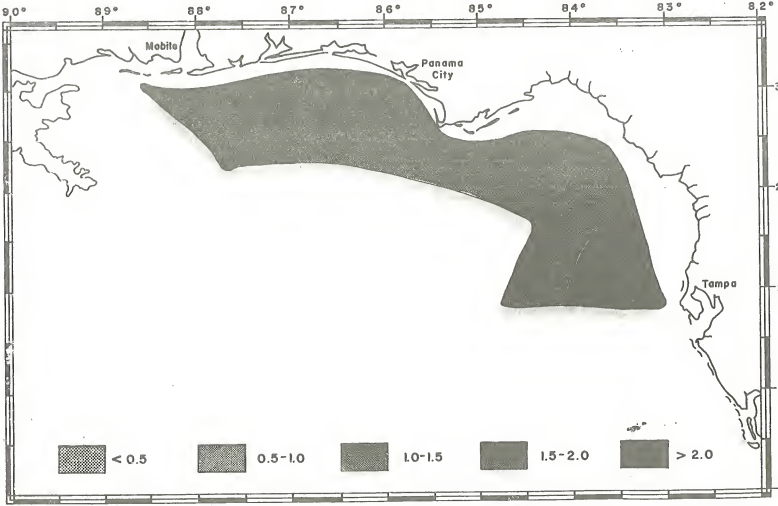

Figure 73c. The horizontal distribution of dissolved organic carbon (mg/l) at the 10 meter level, January - February, 1976.

As shown in Figure 73a and Table 60 the highest concentrations of dissolved organic carbon in the summer were present along Transect I where the observed range was 0.71-2.57 mg/ℓ. In spite of this the observed differences between transects were significant only between Transects II, III and IV. Values of dissolved organic carbon were lower in the offshore waters than in the inshore on Transects I and II while a general decrease was noted with increasing distance from shore.

The highest fall concentrations (Figure 73b and Table 60) were present on Transects II and IV where the average values were 1.16 and 1.30 mg/ℓ respectively. The differences noted between transects were significant, and, with the exception of Transect III, the amount of dissolved organic carbon was less in the offshore waters. Uniform concentrations were present along Transect III except for a slight increase at Master Station 1310.

As shown in Table 60 and Figure 73c the highest concentrations of dissolved organic carbon were present in the winter. The highest concentrations were found along Transects I and IV where average values of 2.18 and 2.17 mg/ℓ were present. As noted in the fall, generally uniform concentrations were present across Transect III.

Significant differences among all three seasons were evident along all transects except Transect I where the differences were significant only between the summer and winter and fall and winter data.

Phytoplankton

Figures 74a, b, c, 75a, b, c and 76a, b and c depict the distribution of chlorophyll a in surface and bottom waters and primary productivity

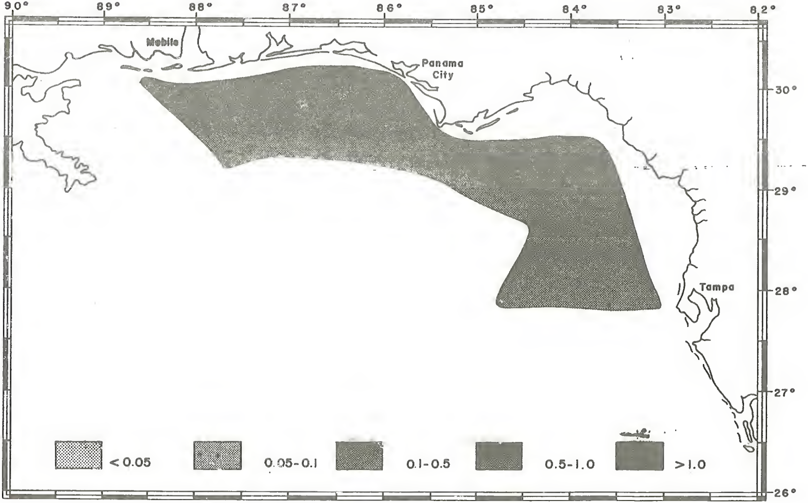

Figure 74a. The horizontal distribution of the surface chlorophyll a (mg/m³), June-July, 1975.

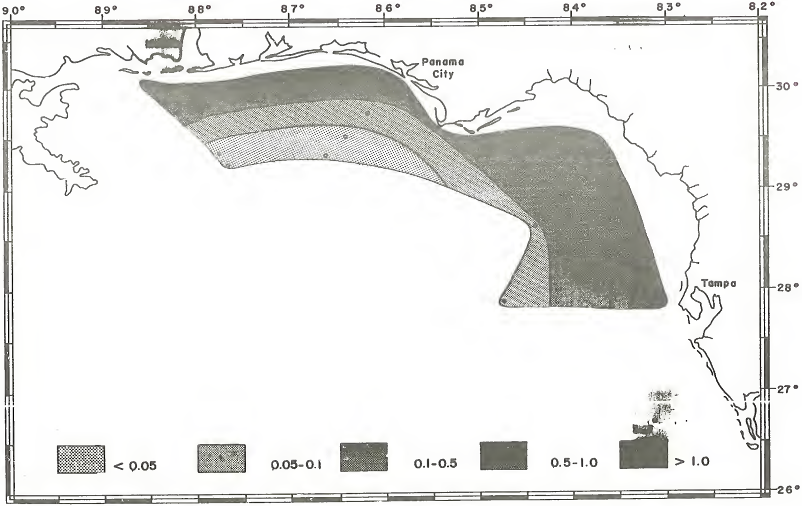

Figure 74b. The horizontal distribution of the surface chlorophyll a (mg/m³), September-October, 1975.

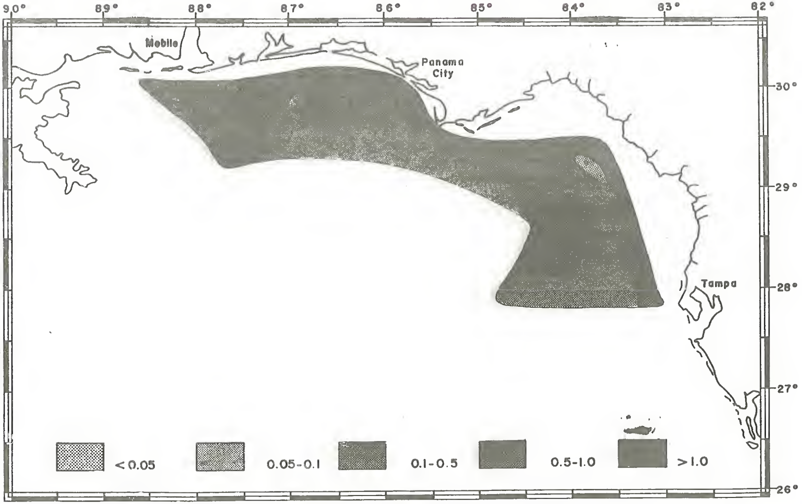

Figure 74c. The horizontal distribution of the surface chlorophyll a (mg/m³), January-February, 1976.

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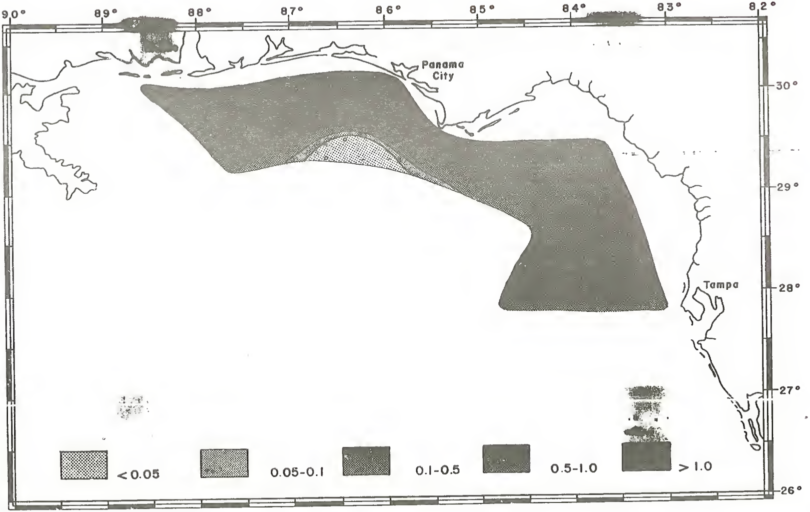

Figure 75a: The horizontal distribution of the bottom chlorophyll a (mg/m³), June-July, 1975.

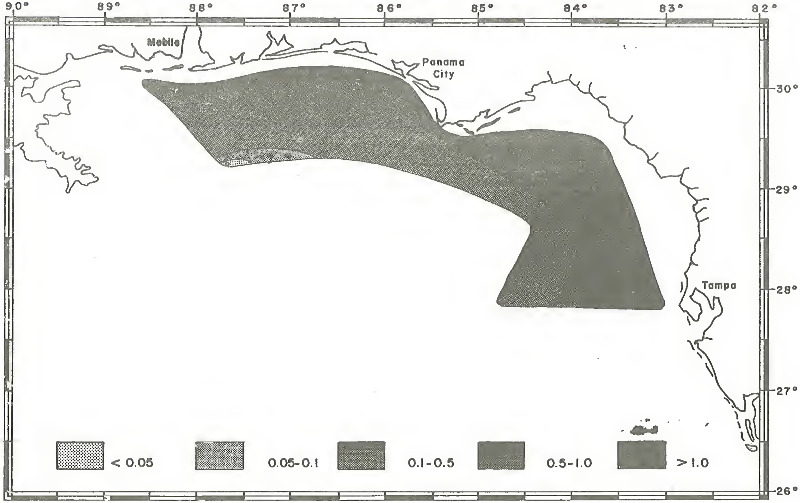

Figure 75b. The horizontal distribution of the bottom chlorophyll a (mg/m³) September-October, 1975.

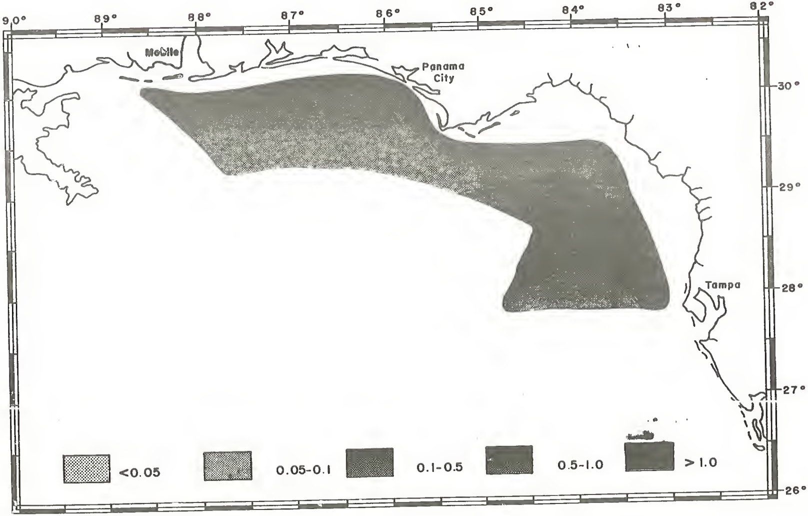

Figure 75c. The horizontal distribution of the bottom chlorophyll a (mg/m³) January-February, 1976.

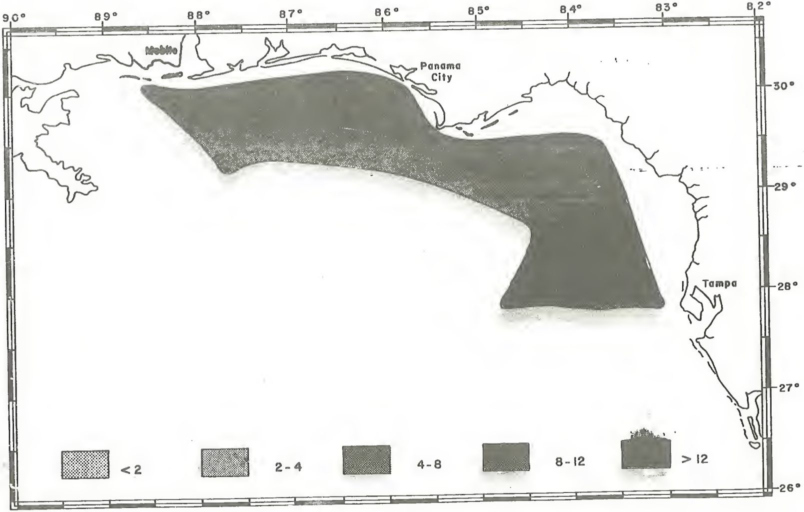

Figure 76a. The horizontal distribution of surface primary productivity (g C/m³/hr) June - July, 1975.

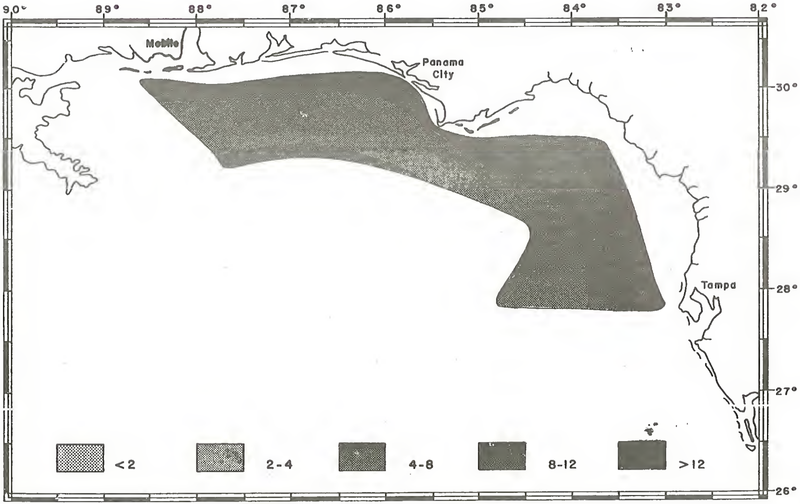

Figure 76b. The horizontal distribution of surface primary productivity (g C/m³/hr) September-October, 1975.

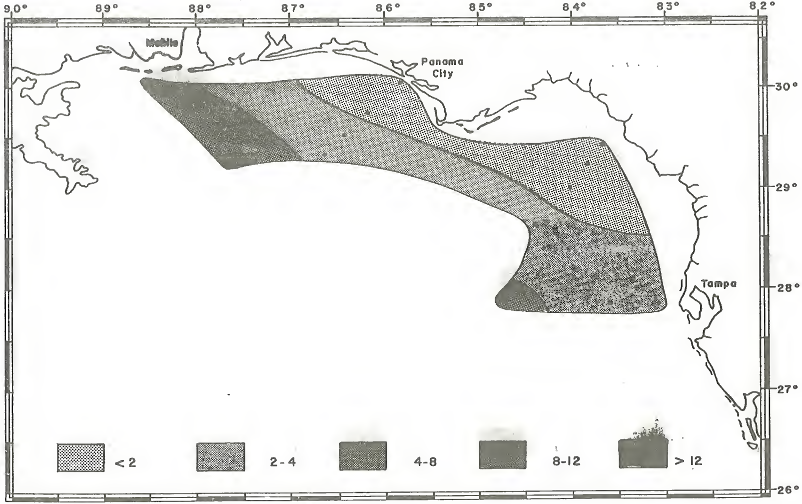

Figure 76c. The horizontal distribution of surface primary productivity (gC/m³ /hr) January-February, 1976.

in surface waters during summer, fall and winter. Tables 61 and 62 show the average seasonal concentration of chlorophyll a and the observed range present along each transect during these same sampling seasons.

Table 61. Average surface concentrations of chlorophyll a and the observed range of concentrations (mg/m^3) along each transect.

Season	Transect I	Transect II	Transect III	Transect IV
Summer	0.21	0.13	0.36	0.80
(Range)	0.13-0.31	0.10-0.17	0.26-0.49	0.39-1.48
Fall	0.47	0.31	0.12	0.33
(Range)	0.09-1.18	0.10-0.57	0.03-0.35	0.04-1.09
Winter	0.37	0.27	0.34	0.94
(Range)	0.22-0.57	0.09-0.50	0.27-0.36	0.54-1.73

Table 62. Average bottom concentrations of chlorophyll a and the observed range of concentrations (mg/m^3) along each transect.

Season	Transect I	Transect II	Transect III	Transect IV
Summer	0.57	0.28	0.49	1.70
(Range)	0.11-0.86	0.26-0.29	0.01-0.97	0.51-4.37
Fall	1.90	0.63	0.22	0.27
(Range)	0.21-4.85	0.34-0.95	0.11-0.51	0.05-0.54
Winter	0.45	1.12	0.36	0.55
(Range)	0.21-0.73	0.10-3.38	0.24-0.45	0.28-1.04

Surface concentrations of chlorophyll a generally ranged between 0.1-0.5 mg/m^3 throughout most of the area in the summer. The main exceptions to this were the concentrations present along Transect IV where chlorophyll a values ranged between 0.39-1.48 mg/m^3. Significantly higher concentrations were present in the bottom waters and with the exception of Transect I there was a trend for decreasing concentration with increasing distance from shore. The range of concentrations throughout the area was also much greater in the bottom waters than at the surface.

In the fall (Figures 74b and 75b, Tables 61 and 62), the concentration of chlorophyll a in the surface and bottom waters increased (compared to the summer) along Transects I and II and decreased along Transects III and IV. In both instances the changes were more than two-fold. The former two transects were sampled after Hurricane ELOISE and the increased concentration of chlorophyll a may reflect the increased availability of nutrients in the water at this time. The lower values of the pigment found along Transects III and IV are more reflective of the seasonal change to be expected at this time of the year.

Winter chlorophyll a values generally ranged between 0.1-0.5 mg/m^3 in both the surface and bottom waters throughout most of the area (Figures 74c and 75c; Tables 61 and 62). The major exception to this occurred on Transect IV where the surface concentrations ranged between 0.54-1.73 mg/m^3. This was also true in the bottom waters along this same transect (0.28-1.04 mg/m^3) and along Transect II (0.10-3.38 mg/m^3).

Primary Productivity

Figures 76a, b and c show the net primary production (C^{14} uptake) in the summer, fall and winter. Table 63 lists the average seasonal primary productivity data and the observed range along each transect.

Table 63. The average seasonal primary productivity and the observed range along each transect (g $C/m^3/hr$).

Season	Transect I	II	III	IV
Summer	9.4	7.9	8.8	7.6
(Range)	8.1-11.8	4.3-10.9	7.7-9.3	6.3-9.1
Fall	12.0	7.3	8.3	8.7
(Range)	6.9-18.8	6.0-8.8	4.2-10.9	7.6-10.4
Winter	3.4	1.5	2.0	8.0
(Range)	2.1-4.5	1.1-2.4	1.8-2.1	6.7-13.6

Net primary productivity in the summer (Figure 76a) showed an average range of 7.6-9.4 g $C/m^3/hr$ throughout the area. Values observed along each transect were significantly different from those of the neighboring transect. A general trend of decreasing activity with increasing distance from shore was observed.

Productivity in the fall (Figure 76b) was higher than that observed in the summer. The greatest variability was present on Transect I where the average activity was 12.0 g $C/m^3/hr$ with a range of 6.9-18.8 and no consistent trends were noted between activity level and distance from shore.

Dramatic decreases in the net primary productivity were found in the winter (Figure 76c). Average values along Transects I, II and III ranged between 1.5-3.4 g $C/m^3/hr$ with an actual range for these transects of 1.1-4.5. The highest activity was found along Transect IV where an average value of 8.0 g $C/m^3/hr$ was present with a range of 6.7-13.6 g $C/m^3/hr$.

Activities at this time of year increased with increasing distance from shore.

Average surface assimilation rates together with ranges are presented in Table 64. Differences between the largest and smallest mean values were reduced by about a factor of 4 for the assimilation rates on Transects I, II and III compared to the productivity values.

Table 64. Average surface assimilation values and observed ranges along each transect (mg C/mg chl a/Em^{-2}/hr).

	Transect			
Season	I	II	III	IV
Summer	2.8	2.1	2.1	1.1
(Range)	0.1-8.2	0.4-3.6	0.7-3.9	0.3-1.4
Fall	2.0	4.4	2.8	2.5
(Range)	1.2-2.9	1.3-18.3	0.9-4.6	1.8-3.3
Winter	2.6	0.9	1.9	1.4
(Range)	0.6-4.6	0.5-1.6	0.2-7.9	0.6-2.1

Average assimilation rates for Transect IV show more variance than the productivity values. Apparently the use of assimilation rates reduces variability caused by differences in chlorophyll a and light both of which influence productivity rates.

Zooplankton

The distribution of zooplankton and dry weight biomass during the summer, fall and winter are shown in Figures 77a, b, c and 78a, b, c respectively.

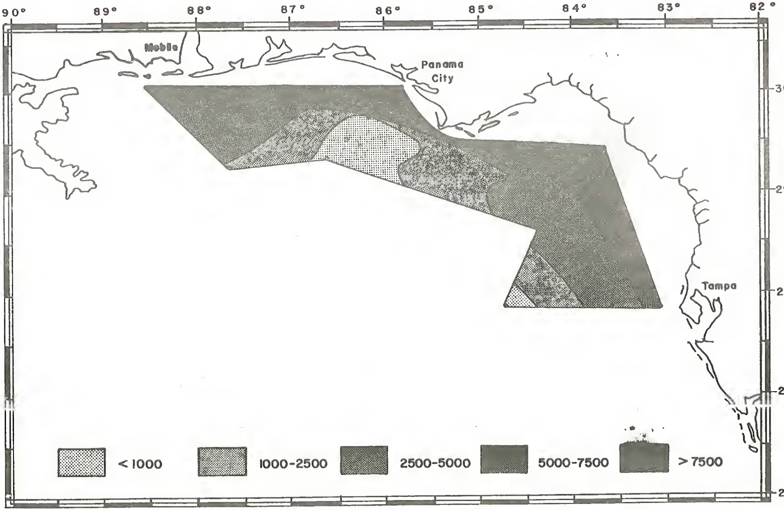

Figure 77a. The horizontal distribution of zooplankton (organisms/m^3), June - July, 1975.

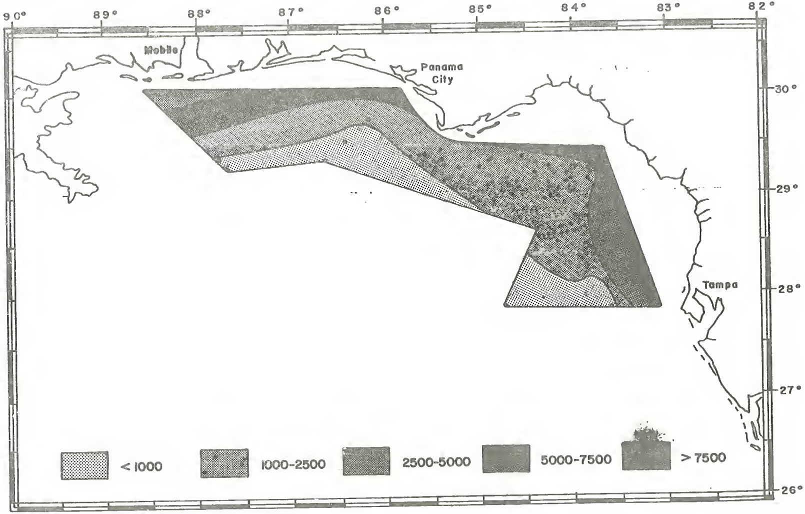

Figure 77b. The horizontal distribution of zooplankton (organisms/m^3), September - October, 1975.

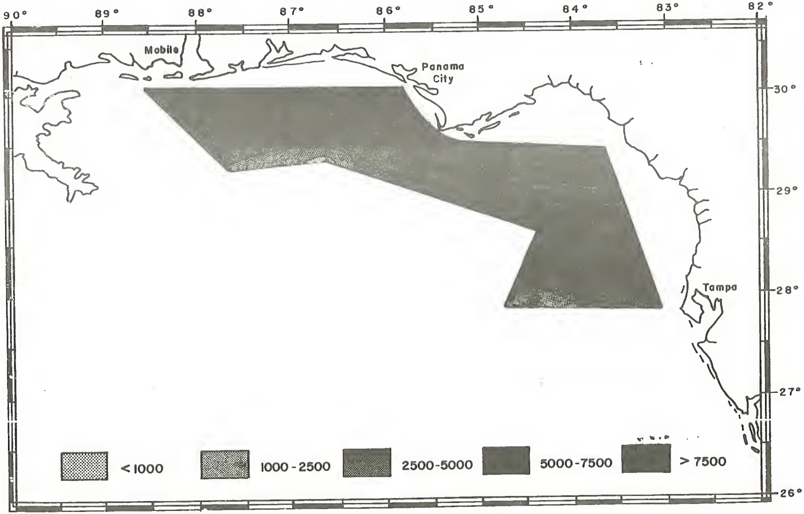

Figure 77 c. The horizontal distribution of zooplankton (organisms/m^3), January - February, 1976.

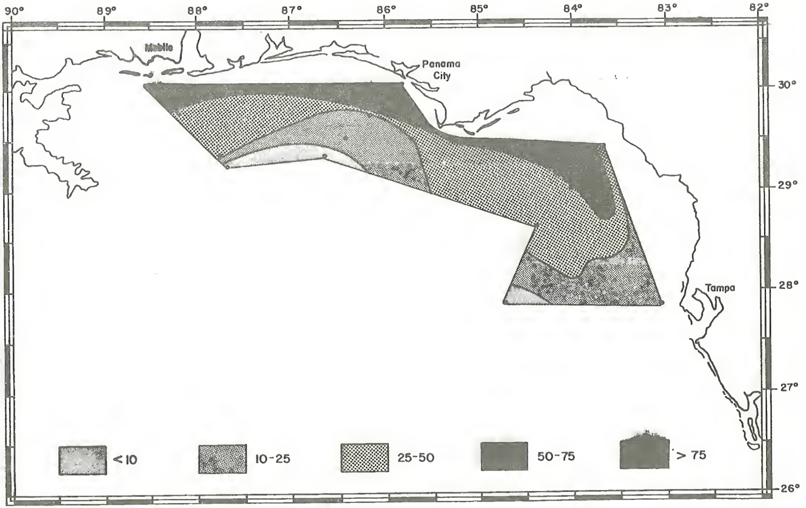

Figure 78 a. The horizontal distribution of zooplankton dry weight biomass (mg/m^3), June-July, 1975.

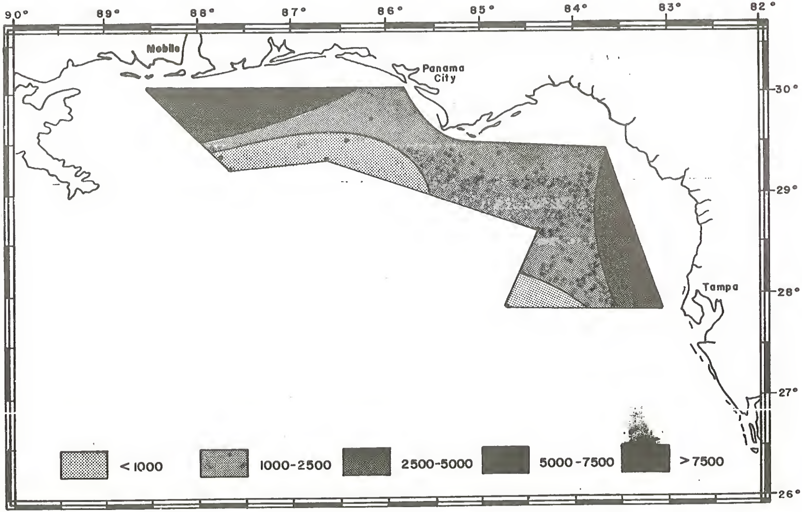

Figure 78 b. The horizontal distribution of zooplankton dry weight biomass (mg/m^3), September-October, 1975.

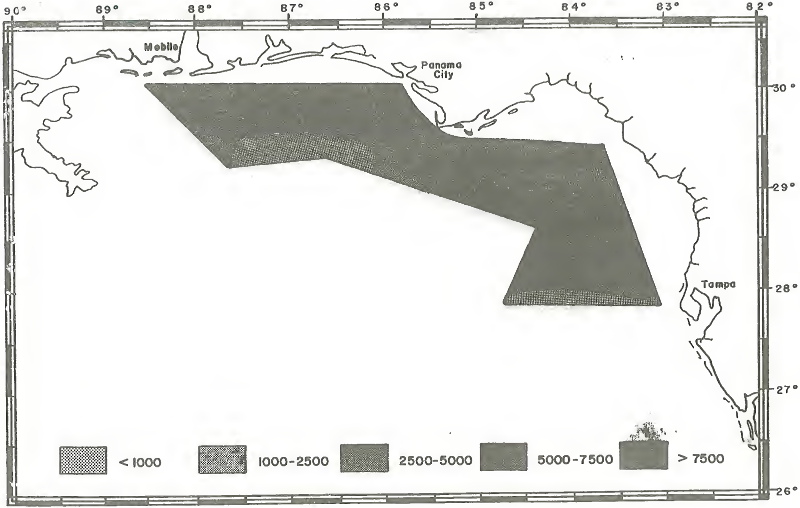

Figure 78 c. The horizontal distribution of zooplankton dry weight biomass (mg/m^3), January-February, 1976.

Summer, 1975

In the summer the average organism density and biomass (Figures 77a and 78a) were highest on Transect II although Master Station 1308 of Transect III showed the greatest density and biomass of any single station. The high population estimates at Master Station 1308 were due primarily to an abundance of the ostracod, Conchoecia sp., other calanoids, Centropages furcatus (calanoid copepod), Eucalanus elongatus (calanoid copepod), Oncaea sp., and cladocerans (probably Evadne sp.) which made up the bulk of the sample (Table 65). High density values recorded for Master Stations 1204 and 1205 were due to an abundance of cladocerans (>50% of the entire sample). The biomass estimates for Master Station 1204, however, were the lowest for the entire Transect II. In general, a pattern of decreasing density was exhibited with increasing distance from shore. With the major exception of Master Stations 1308, 1204 and 1205, calanoid copepods were the dominant zooplankton group in most areas.

Fall, 1975

Lowest density and biomass estimates were recorded during the fall sampling period (Figures 77b and 78b) and in general both of these parameters decreased with increasing distance from shore. Master Stations 1415 and 1311 showed the lowest density and biomass estimates (209 and 220 individuals/m^3 and 2.3 and 2.4 mg/m^3, respectively) while Master Station 1101 showed the highest biomass estimate (72.6 mg/m^3) and Master Station 1205 the highest specimen abundance (7,021/m^3). The post hurricane station (1205A) showed a drop in specimen abundance as compared to Master Station 1205 but retained virtually the same biomass.

Table 65. Dominant Zooplankton Groups

Station	Summer, 1975	Fall, 1975	Winter, 1976
1101	other calanoids, Doliolida	cladocerans, *Oikopleura*	*Paracalanus* sp.
1102	cladocerans, Doliolida	cladocerans	*Conchoecia* sp., *Corycaeus* sp.
1103	other calanoids, *Oithona* sp.	other calanoids, *Pyrocystis*	*Paracalanus* sp., *Oithona* sp.
1204	cladocerans	cladocerans, *Paracalanus* sp.	*Paracalanus* sp., *Corycaeus* sp.
*1205	cladocerans	cladocerans	*Paracalanus* sp.
**1205A	--	cladocerans, *Temora turbinata*	--
1206	other calanoids, cladocerans	*Oncaea* sp., *Oikopleura*	*Paracalanus* sp.
1207	other calanoids, chaetognaths, gastropod veligers	Conchoecia sp., *Paracalanus* sp., other calanoids	*Paracalanus* sp.
1308	*Conchoecia* sp.,other calanoids, *Centropages furcatus*, *Eucalanus elongatus*, *Oncaea* sp., cladocerans	*Paracalanus* sp., cladocerans	*Paracalanus* sp., *Oikopleura*
1309	chaetognaths, other calanoids, *Oithona* sp., *Eucalanus elongatus*	*Paracalanus* sp., *Oncaea* sp.	*Paracalanus* sp., *Conchoecia* sp.
1310	other calanoids	*Paracalanus* sp., *Oncaea* sp.	*Paracalanus* sp.

* Pre Hurricane Eloise
** Post Hurricane Eloise

Table 65. Dominant Zooplankton Groups (continued).

Station	Summer, 1975	Fall, 1975	Winter, 1976
1311	other calanoids	*Paracalanus* sp., other calanoids	*Paracalanus* sp., *Oikopleura*
1412	cladocerans, other calanoids, *Undinula vulgaris* (males)	*Centropages furcatus*, *Acartia* sp.	fish eggs, foraminiferans, *Paracalanus* sp., *Eucalanus elongatus*
1413	anomurans, other calanoids	*Oncaea* sp., Doliolida	*Paracalanus* sp.
1414	other calanoids, *Rhincalanus coronatus*, *Undinula vulgaris* (males)	*Paracalanus* sp., *Oncaea* sp.	*Paracalanus* sp., *Conchoecia* sp.
1415	other calanoids	cyclopoid copepodites, *Paracalanus* sp.	*Paracalanus* sp.

Again, the dominant zooplankton group during this period was primarily the calanoid copepods, although cladocerans were abundant at the inshore stations of Transects I and II. *Acartia* sp. was found at Master Station 1412, suggesting the presence of water more estuarine in origin. The appearance of *Temora turbinata* as a dominant group at the post-hurricane station (1205A) was the result of a decrease in the cladoceran population rather than an increase in this calanoid. This would suggest that the mixing of the water column by the hurricane adversely affected the cladoceran population.

Winter, 1976

Samples collected during the winter sampling period compared favorably, in terms of organism density and biomass (Figures 77c and 78c) with the summer samples. This period also showed the highest population density and biomass of all the seasons. This was due, primarily, to the great abundance of *Paracalanus* sp. in almost all of the samples (Table 65 which suggests that this calanoid copepod is an active winter breeder. The highest density and biomass were recorded at Master Station 1206, with *Paracalanus* sp. being the dominant taxa. Although the same general inshore-offshore trend was present as in other seasons, it was much less pronounced. This is especially true in Transect IV, where it remained relatively constant throughout all the stations; in Transect II the trend was almost reversed, the offshore stations showing greater density and biomass than the inshore stations.

As mentioned previously, the dominant zooplankton group is *Paracalanus* sp. Exceptions to this include Master Station 1102 where the ostracod

Conchoecia sp. and the cyclopoid copepod Oncaea sp. were dominant and Master Station 1412, where fish eggs and foraminifera were the dominant groups as well as Paracalanus. The abundance of fish eggs at this particular station could be the result of the net passing through a recent spawn or a group of eggs which were clumped together.

Neuston

Adult specimens of 50 invertebrate families and 28 fish families were identified to at least the family level from the neuston collections obtained. The families are listed in Table 66. Some of the adult forms were identified to other taxonomic levels as follows: Orthoptera, Diptera (insects); Sagitta and Eukrohnia (chaetognatha); Oikopleura (Larvacea); Foraminifera; Phascolosoma (Sipuncula); Physalia (Siphonophore); Valella (chondrophora); Branchiostoma (Cephalochordata); an unidentified cephalapod; a prosobranch gastropod juvenile; an isopod, a cumacean; a caridean; a siphonophore; and salp fragments. In addition, 27 different larval types, including fish and invertebrate eggs, were identified from the collections (Table 67).

Analysis of Variance tests (ANOVA's) were carried out for statistical testing of possible station, day-night and seasonal differences in neuston composition. One hundred and eight ANOVA's were conducted, and 25 of these yielded differences significant at the 95% confidence level ($\alpha \leq 0.05$). The results of these tests (Table 68) are considered to be only provisionally accurate since in many instances measures of dispersion about the means (variance, standard deviation, standard error) were high and overlapped "0".

Table 66. Invertebrate and fish families represented in the neuston.

Invertebrates

Hydrozoa

Campanularidae
Plumularidae

Siphonophora

Diphyidae
Monofidae

Gastropoda

Cavolinidae
Limacinidae

Polychaeta

Nereidae - juveniles
Spionidae - juveniles
Touropteridae

Copepoda

Acartiidae
Autideidae
Calanidae
Calocalanidae
Candaeiidae
Centrophagidae
Clausidiidae
Corycaeidae
Engasilidae
Eucalanidae
Euchaetidae
Laophontidae
Loficidae
Oithonidae
Oncasidae
Paracalanidae
Pontellidae
Sapphirinidae
Temoridae
Trachiidae

Cladocara

Polypheuridae
Sididae

Amphipoda

Gammaridae
Hyperiidae

Ostracoda

Conchoecidae

Mysidacea

Mysidae

Isopoda

Cinolanidae
Gnathidae

Decapoda

Hyppolytidae
Palaemonidae
Pasiphaeidae
Penaeidae
Pontunidae
Sergestidae
Upogeidae - juveniles

Euphausiacea

Euphausiidae

Thalliacea

Doliolidae
Salpidae

Insecta

Gryllidae
Bibionidae
Gerridae

Table 66 - continued.

Fish	
Balistidae	Molidae
Belonidae	Monacanthidae
Bothidae	Mugilidae
Carangidae	Myctophidae
Centriscidae	Ophichthyidae
Clupeidae	Pleuronectidae
Coryphaenidae	Priacanthidae
Diodontidae	Scombridae
Exocoetidae	Serranidae
Gadidae	Stromateidae
Hemiramphidae	Syngnathidae
Holocentridae	Synodontidae
Istiophoridae	Tetradontidae
Lobotidae	Trigliadae

Table 67. Larval taxa represented in the neuston collections.

Brachiuran megalops	Invertebrate eggs
Brachiuran zoeae	Mysid mysis
Caridean zoeae	Pelycopod veligers
Cirripede nauplii	Penaeid (various: zoeae, mysis)
Copepod copepodids (Stages I-VI)	Polychaete juveniles
Copepod nauplii	Polychaete nectochaetes
Cumacean	Prosobranch juveniles
Ectoproct cyphonautes	Sipunculid larvae
Euphausiid furcilla	Squillid antizoeae
Fish eggs	Squillid "postlarvae"
Fish larvae (unidentified)	Squillid pseudozoeae
Fish leptocephalus	Tunicate "larvae"
Fish pleuronectiform	Upogeid larvae-juveniles
Foraminiferida	
Gastropod veligers	

Table 68. ANOVA summary.*

TAXONOMIC CATEGORY TESTED

	All Invertebrate Families			All Adult Families			No. of Eggs and Larvae			No. of Fish Families			No. of Copepods			No. of Copepod Families		
	Row	√	Log	Row	√	Log	Row	√	Log	Row	√	Log	Row	√	Log	Row	√	Log
Model 1, one-way ANOVA - Day only																		
Season	Φ	Φ	NS		NS			NS			NS			NS		Φ	Φ	Φ
Station	NS	NS	NS													NS	Φ	NS
Model 1, one-way ANOVA - Night only																		
Season	Φ	NS	NS	Φ	Φ	NS		NS			NS		Φ	Φ	NS	Φ	NS	NS
Station	NS	Φ	Φ	NS	NS	Φ							NS	NS	Φ	NS	Φ	Φ
Two-way ANOVA, Day/Night vs station, replication by season	Φ	Φ	Φ	NS	NS	Φ		NS			NS		NS	NS	Φ		NS	
	Φ	Φ	NS					NS			NS			NS			NS	
Nested ANOVA, Day/Night within station, replication by season		NS			NS			NS			NS			NS			NS	

* A total of 108 ANOVA tests were made. No significant interaction or residual effects were found.

Φ = F values significant at the p ≤ .05 level
NS= F values with p >.05 (Not significant)

During daylight hours, significant differences occurred between seasons with respect to "all invertebrate families," and "number of copepod families" categories. At night, significant seasonal differences occurred in the "all adult family" and "number of copepods" categories. Thus, day-night seasonal distributions were different, particularly with regard to the copepods.

Daytime station variation was reflected only in the "number of copepod families" collected. Since 20 of the 51 families of adult invertebrates identified were copepods, and geographic coverage was broad, this result was expected. Night station differences were found in four of the six categories, indicating a geographic difference in subsurface "water masses."

Table 69 presents a correlation matrix based on 70 independent correlation analyses between neustonic composition characters and abiotic environmental factors. Generalization of these results shows that invertebrate neuston abundance (taxa and specimen) is negatively correlated with light intensity, air temperature and tar in the surface waters.

Affinity and diversity indices were not presented because of the high variances in the sample statistics and because these indices have little, if any, biological significance for family taxa levels and mixed taxonomic categories.

Spatial and temporal distributions of the invertebrate neuston taxa are presented in Tables 70-72.

Table 69. Correlation Matrix

	Number Adult Animals	Number Inv. Phyla	Number Inv. Families	No. Crust. Families	No. Copepod Families
Length of time fished (min)	-	-	-	-	-
Time of day fished (CDT)	0.303*	-	-	-	-
Bucket temperature (°C)	-	-	-	-0.263*	-0.421*
Light (f.c.)	-	-0.502*	-0.459*	-0.548*	-0.298*
Air temperature (°C)	-	-	-0.240*	-0.388*	-0.459*
Wind speed (kt)	-	-	-	-	-
Sea state (Beaufort)	-	-	-	-	-
Forel color	-	-0.510*	-0.482*	-0.512*	-0.326*
Barometer (mm Hg)	-	-	-	-	-
Secchi disk depth (m)	-	-	-0.208*	-	-0.266*
Cloud cover (eights)	0.214*	-	-	-	-
Sargassum volume (ml)	-	-	-	-	-
Tar weight (g)	-	-0.213*	-0.244*	-0.269*	-0.231*
Total volume of sample (ml)	0.205*	-	-	-	-0.221*

\- indicates correlations non-significant at $\alpha \leq 0.05$.
* indicates correlations significant at $\alpha \leq 0.05$.
All tests are two-tailed with n = 90.

Table 70. Distribution of Neuston, Summer, 1975.

	Water Column Stations														
	1412	1413	1414	1415	1308	1309	1310	1311	1204	1205	1206	1207	1101	1102	1103
1. Invertebrates =															
Polyphemidae	B			B				D	N	N	N		B	B	
Conchoecidae	B														N
Tomopteridae	N	N				D			N						N
Oikopleura	B	N	D		B				N	D				D	N
Penaeidae	D								N	N		N	B		
Sagitta	B	B	B	N	N	B	B	B	B	B	N	B	B	B	B
Hyperidae		N	N	N	N	D		N		D			N		N
Euphausiacea		N		N								N	N		
Sergestidae		B	N	N	D	B	N	N		D	B	D		N	N
Portunidae		N	D	N	N	B		D	N			D			B
Sididae		N							B	N			B		D
Cumacea		N								N	D				
Gerridae		D					B	N				N		N	B
Gammaridae			N						N	B	N		D		
Dyphyidae			N			N	D			N			D		N
Cavolinidae			B	B	N	B	N		D		N	B			B
Hyppolytidae			D	N		N		D	D		D	D			D
Palaemonidae			D	N		N	N	D	D	N	D	D	B	N	B
Campanularidae			D			B		D				D	D	N	D
Plumularidae				N	D	D	N							N	D
Eucalanidae	N		B	B	B	B	B	N	D	B	N	B	N	N	N
Centrophagidae	B	B	B	B	B	B	N	N	B	B	N	B	B	B	B
Temoridae		N	D	B	B	B	N	N	B	B	B	B	B	B	B
Paracalanidae	D	B	B	B	B	B	B	B	B	B	N	B	B	B	B
Pontellidae	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Corycaeidae	N	B	B	B	N	B	N	B	B	B	B	B	B	B	B
Oncaeidae		N	B			B	B		D	D	N	B		D	B
Oithonidae	B					D	N					D			N
Cirolanidae						N				D		N	N	N	N
Eukrohnita						N									
Tunicata						N									
Isopoda									N						
Doliolidae									B	D		B	D	B	
Calanidae										N		B			
Loficidae										D					
Acartiidae	D	B	N									D		B	D
Clausiidae								D							
Mysidae										B				N	
Pasiphaeidae										D					
Harpactacoidae	D		B		N	N			N				B		B

Table 70 . Continued.

	Water Column Stations														
	1412	1413	1414	1415	1308	1309	1310	1311	1204	1205	1206	1207	1101	1102	1103
2. Fishes =															
Synodontidae										D		N	N		
Istiophoridae															D
Diodontidae															D
Lobotidae						N									
Scombridae						N									
Coryphaenidae						N	N	D		D					
Carangidae				N	D	N		N							N
Molidae							N								
Exocoetidae				N		N			N	D	D	B	B	N	N
Serranidae												N			
Pleuronectidae												N			
Balistidae				N		B			B		D	B	D	B	B
Hemiramphidae									N	B			B		
Syngnathidae													B		
Mugilidae											N				
Belonidae									N	N					
Ophichthyidae									N						
Clupeidae									N	N	N				
Stromateidae	D														
Bothidae							D								
Leptocephalus												N			
3. Larvae =															
Harpactacoid Copepodid						N		D		D	N				N
Brachyuran zoeae	N	B	N	N	N		B		B	B	B	B	B	B	N
Brachyuran megalopa				N	N	D		D	B	D	N	D	B		N
Caridean zoeae										N				N	
Squillid antizoeae	D	N	B	N	N	B	B		N		B	B	B	N	
Squillid postlarvae	B	N	D					N	N						N
Polychaete larvae	N					N									
Gastropod veligers	D	B	B	B	N	B	B	D	B	B	B	B	B	B	B
Pelecypod veligers	B	B	B	D	B	B	B	B	B	B	B	N	N	B	B
Copepod nauplii		D	B	N		D								D	
Fish eggs	B	D	D	B	D	D	D	N	N	B	B	B	B	B	B
Invertebrate eggs	N		B									N			

D = Day occurrence only
N = Night
B = Both day and night occurrence

Table 71. Distribution of Neuston, Fall, 1975.

	Water Column Stations														
	1412	1413	1414	1415	1308	1309	1310	1311	1204	1205	1206	1207	1101	1102	1103
1. Invertebrates =															
Polyphemidae		N		B	B			B	B	B	B	B			D
Conchoecidae	N	N	N	N	B	B	B	N		N		N	N		N
Tomopteridae	N		D	N	N	N		N		N	N		N	N	
Oikopleura	N	N	B	B	B	B	B	B		B	B	B	B	B	B
Penaeidae								N		N					
Sagitta	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Hyperidae		B	N	N		N	N	N		N	N	N	N	N	D
Euphausiacea								N							
Sergestidae		B	N	N	B	B	N		N		B	D	B	B	B
Portunidae	N	D							D	B	N	B			
Sididae									B	B			B		D
Cumacea					N		N	N	N		N				
Gerridae	N	N	N	B		N	N	B			D	D			D
Gammaridae							N	N	N	B	B	B	N	N	N
Cavolinidae		N	N		N	N	B	N				N		N	N
Hyppolytidae			D							N					
Campanularidae	N	D			D								D		
Plumularidae	N		D				D			B		B		D	
Eucalanidae	B	B	B	B	B	B	B	N	B		N	N	B	N	N
Centrophagidae	B	B		N	B	N			B	N	N	B		B	N
Temoridae	B	N	B	B	B		D	B	B	B	B	N	B	B	D
Paracalanidae	B	N	B	B	B	B	B	B	B	B	B	B	B	B	B
Pontellidae	D	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Corycaeidae		B	B	B	B	B	B	B	B	B	B	B	B	B	B
Oncaeidae		B	D	B	N	B	B	B		B	B	N	B	B	B
Oithonidae	B	N	N	N	N	B	D	N		B	N		B		D
Cirolanidae						D				B	N	N	N	N	D
Doliolidae		D			B	N			B	N	B	N	B	N	B
Acartiidae	B	B	N		N									D	
Monifidae	N														
Limioinidae			N			B	N	N				N			
Salpidae	N	B						N	B						
Siphonophroa		B	B	B	B	N	B	B	B		B			B	B
Candaciidae							N	B							
Calocalanidae							B	B			N				D
Sapharinidae			N	N		D									
Harpactacoidae		N	B	B	B		B	B	D	B		D		N	B

Table 71. Continued.

	Water Column Stations: 1412	1413	1414	1415	1308	1309	1310	1311	1204	1205	1206	1207	1101	1102	1103
Calanoidae				N	D	D		B					N	B	
Orthoptera		D													
Phascolosoma		B			D	D		N				D			
Palaemonidae			B		N				N	N					
Upogeidae					N										
Caridian												N			
2. Fishes =															
Synodontidae	N	B	N		B			N	D	D					
Lobotidae	N	D													
Scombridae		N			N			N							
Coryphaenidae	N	D	N			N	N	N							
Carangidae				N		N	D	N							
Exoceotidae	N	B		N		B		B			I	N			
Serranidae						N									
Balistidae			D	N	D	N	B	N	N	D	I	B		N	
Hemiramphidae		D						D	B	B	N		D		
Syngnathidae				N				N			D				N
Ophichthyidae												N			
Stromateidae		N	N												
Leptocephalus								N							
Tetradontidae		D	D			B	D				D			D	
Myctophidae				N				N							
Holocentridae							N								
3. Larvae =															
Brachyuran zoeae	B	B	N	N	B	B	N	N	B	N	B	B	B	B	N
Brachyuran megalopa	N	B	N	N	B	N	D	D	D	N	B	N	D	B	N
Caridean zoeae		N		N				B			N	N			N
Squillid antizoeae		N	D		B			N	N	D	N	N		B	
Polychaet larvae		B	D												
Gastropod veligers	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
Pelecypod velifers	B	B	B	B	B	B	B	B	N	B	N	B	D	B	B
Copepod nauplii				D				B							N
Squillid pseudozoeae	N		B	B				N							

Table 71. Continued.

	Water Column Stations[a]														
	1412	1413	1414	1415	1308	1309	1310	1311	1204	1205	1206	1207	1101	1102	1103
Fish leptocephalus		B	D	N				N							
Mysid				N				N	N	N	N	N			N
Copepodids		D		N	B	D		B		N		B			D
Prosobranch juveniles			B	N	N	N	B	N			B	N	N	B	N

D = Day occurrence only
N = Night
B = Both day and night occurrence

Table 72. Distribution of Neuston, Winter, 1976.

	Water Column Stations														
	1412	1413	1414	1415	1308	1309	1310	1311	1204	1205	1206	1207	1101	1102	1103
1. Invertebrates															
Polyphemidae					B										
Conchoecidae	N	N	B	N	B	B	N	B	B	B	D	N	B	B	B
Oikopleura		B	N	D	B	B	B	B	D		D	B	D	B	N
Penaeidae							N								
Sagitta	B	B	N	B	B	B	B	B	B	B	D	B	B	B	B
Hyperidae	N	N	N	B	D	B	N	N	B	N	D	N		B	B
Euphausiacea			N	N		B		N							
Sergestidae	N	B	N	N			N	B			D	B		B	B
Portunidae		N	D									N			
Cumacea											D	B		B	D
Gerridae					D										
Gammaridae							N				D	B		N	
Dyphydae	B	B	B	B	D	B	B	B	B	N		N		B	B
Cavolinidae			B			B	D	B				B			
Hyppolytidae											D			D	
Campanularidae									B	D					
Plumularidae										D					
Eucalanidae	B	N	N	B	B	B	B	B	B	N	D	B	D	B	B
Centrophagidae	B	N	D	B	B	B			B	N	D			B	B
Temoridae	B	N	B	B	B	B	B	B	B	N	D	B	N	B	B
Paracalanidae	B	B	B	B	B	B	B	B	B	B	D	B	B	B	B
Pontellidae	B	B	B	B	N	B	B	B	B	B	D	B	D	B	B
Corycaeidae	B	N	B	B	B	B	B	B	B	B	D	D	B	B	B
Oncaeidae	B	N	B	N	N	B	B	B	B	N	D	N	N	B	B
Oithonidae	B	N	D	B	B	B	B	B	N	N			B	D	
Cirolanidae							N			N		N	N	N	
Doliolidae	N			D		B	B	B	B			B			N
Calanidae							D					N	N	D	B
Acartiidae	B	B	B	B	B	N	D	B			D				
Mysidae	N					N	N	N		N	D			D	
Pasiphaeidae	N	N	B	B	N	B	B	N	B	N	D	B	B	B	B
Limicinidae				N		D		B	N						
Salpidae								N							
Siphonophora		D													
Candaciidae		D													

Table 72. Continued.

	Water Column Stations														
	1412	1413	1414	1415	1308	1309	1310	1311	1204	1205	1206	1207	1101	1102	1103
Calocalanidae		D				B	N	N							D
Sapharinidae						B	N	D							B
Phascolosoma								B							
Diptera			D		N	N				D					
Euchaetidae	N		D				D	D							
Copepoda	B			D	B	D	B	N	D	B	D	B	B	D	D
Branchiostoma				D			N							N	N
Cephalopoda				N							D				
Physalia								N							B
Velella						D									N
2. Fishes															
Synodontidae		B	D				D								
Exocoetidae								D							
Serranidae												B			
Hemiramphidae	N												N		
Syngnathidae			D						N						
Mugilidae	N	B	D	N	N	N	D	D	N			D	N		
Ophichthyidae									N	N					
Stromateidae		D													
Myctophidae				N				N							
Gadidae	N	B	D		N	B	D	D	B	D	D		N		
Centriscidae							D	D							
3. Larvae															
Brachyuran zoeae	B	N	B	N		N		N	N	B	D	N		B	B
Brachyuran megalopa		D	B	N	N	B	N	N	N	N	D				D
Caridean zoeae	N		D					N		N	D		N	B	N
Squillid antizoeae			D	N		N		N							
Gastropod veligers	N	N	B	N		B	B	B	N	N	D	B	B	B	B
Pelecypod veligers	B	N	B	B		B	B	B	B	B		N	B	B	B

Table 72. Continued.

Water Column Stations

	1412	1413	1414	1415	1308	1309	1310	1311	1204	1205	1206	1207	1101	1102	1103
Copepod nauplii	B	B	B	B	B	B	B	B		D		N		N	D
Fish eggs	B	B	B	B	B	B	B	B	B	D	D	B	B	B	B
Squillid pseudozoeae	N		B	B				N							
Fish leptocephalus		B	D	N				N							
Mysid		N	N	N										N	
Copepodids	B	B	B	B	B	B	B	B	D	N			N		B
Prosobranch juveniles			B												
Tunicate larvae											D				
Polychaete juveniles			D						B						
Ectoproct cyphonautes larvae			N	B		D	N	D			D	N	D	B	B
Euphausiid furcilia								N				N			
Cirripede nauplii					N				N	N				B	
Pleauronectiform	N														

D = Day occurrence only
N = Night
B = Both day and night occurrence

Sea Floor

Geology

Standard Sediment Parameters

Characteristics of the MAFLA sediment sheet are summarized in Figures 79 and 80 and cross sections 81a, b, and c of the lithologic map which depict, among other parameters, the graphic mean grain size, the sand/fine ratio (sand/silt + clay = sand/fine ratio), and the percent $CaCO_3$ in the sediments. The sand/fine figure (79) shows the MAFLA continental shelf and upper slope divided into a number of textural zones and serves as a convenient base upon which to build a discussion of the MAFLA sediment sheet. It should be kept in mind that zone boundaries were arbitrary and that transitions between zones were gradational.

Zone I reflects the influence of deposition of Mississippi River sediments. It was characterized by a sand/fine ratio of less than 1.0 and a low (less than 25%) calcium carbonate content and silt predominates over clay sizes. Sand and silt sized particles were dominantly quartz while the clay minerals were dominated by smectite (Huang, et al., 1975) The heavy mineral suite was relatively depaupered in the most resistant minerals such as zircon and was dominated by hematite, micas, amphiboles, and pyroxenes.

Zone II has a sand/fine ratio ranging between 1.0 and 58.5. The ratio increases toward the east showing the diminishing, though still detectable, influence of Mississippi deposition and the exposure of the relict quartz sand sheet. Calcium carbonate in the sediments remained low (less than 25 percent). Kaolinite became a major constituent of the

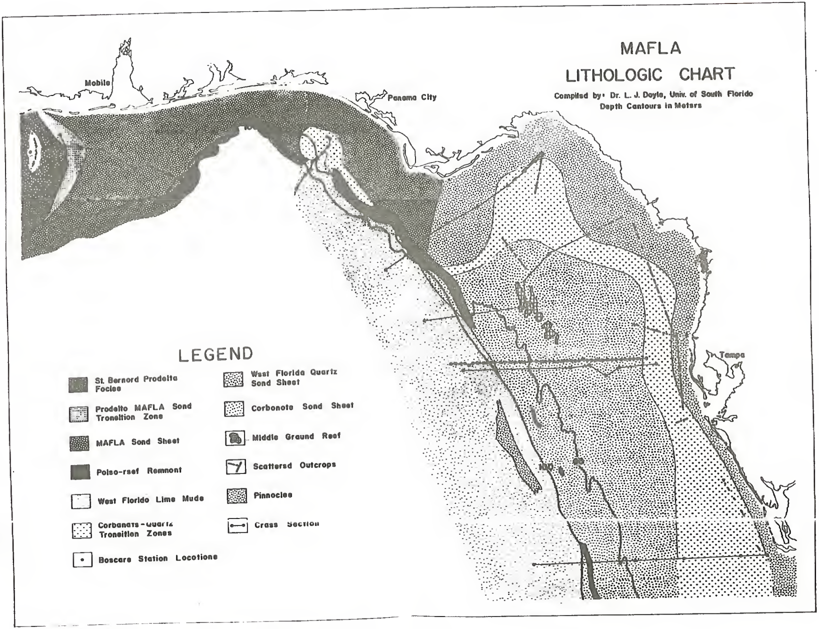

Figure 79. MAFLA lithologic chart.

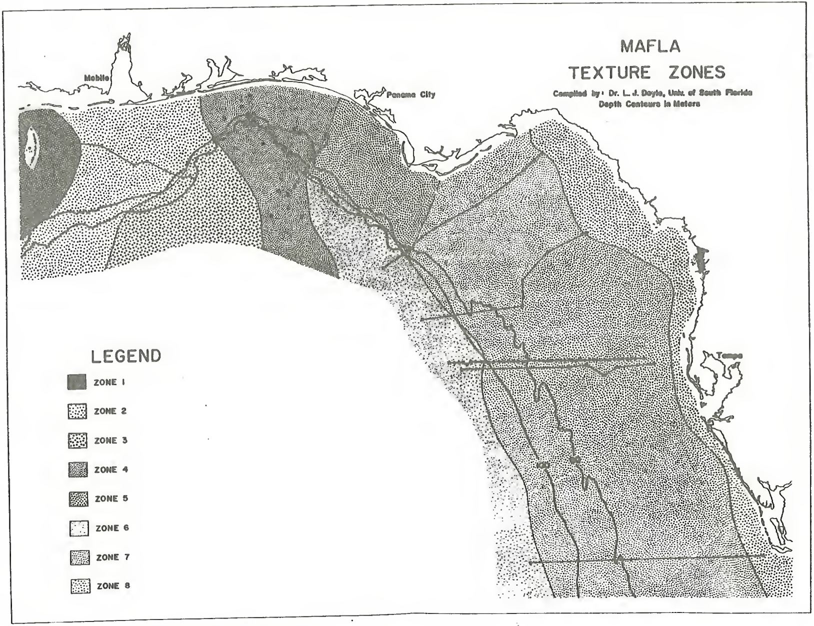

Figure 80. MAFLA texture chart.

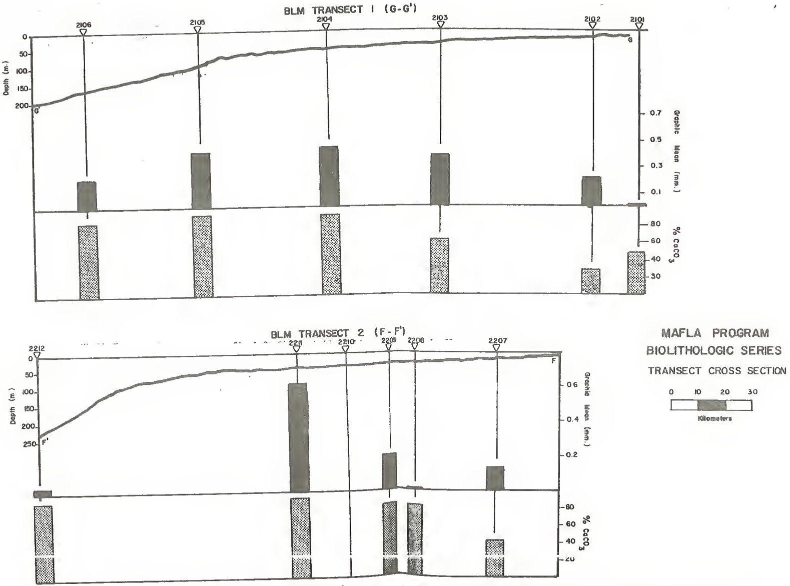

Figure 81a. Transects I (G G'), and II (F-F') cross sections showing depth (m), graphic mean (mm), and $CaCO_3$ content.

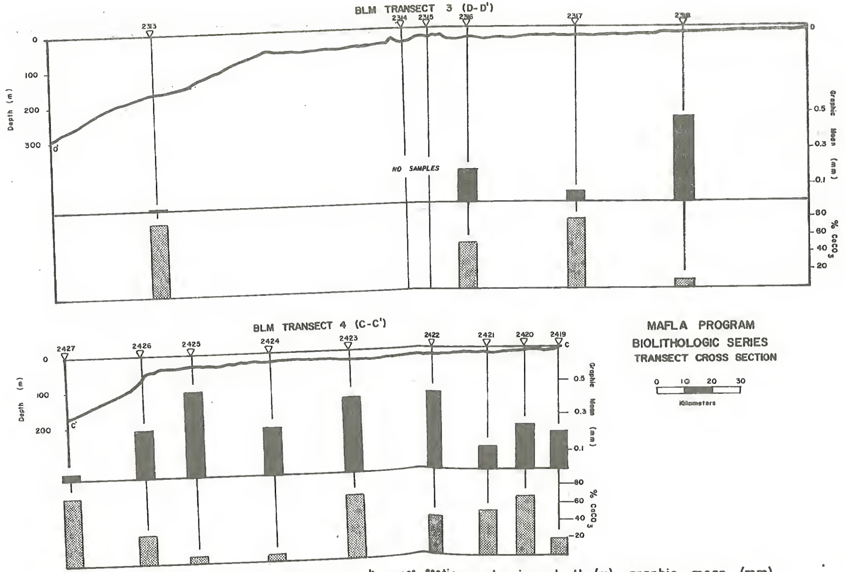

Figure 81b. Transects III (D-D') and IV (C-C') cross sections showing depth (m), graphic mean (mm), and $CaCO_3$ content (%).

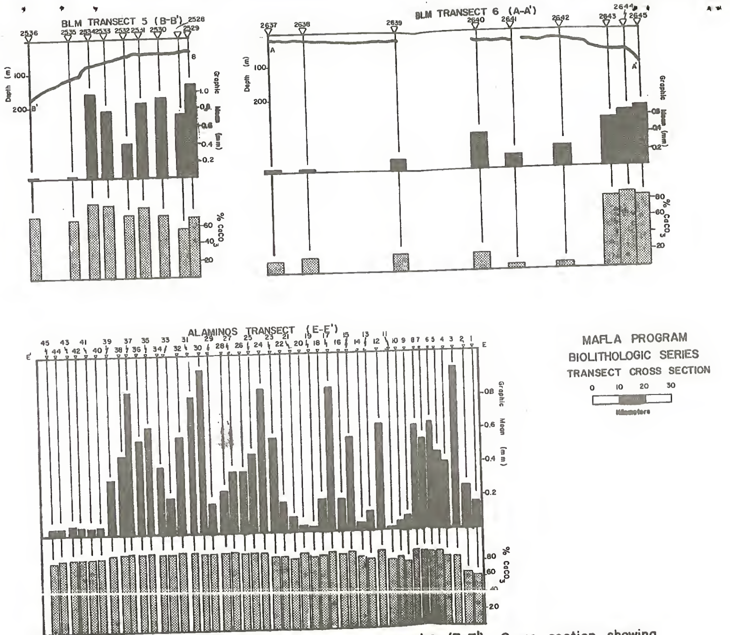

Figure 81c. Transects V (B-B'), VI (A-A'), and Alaminos (E-E'). Cross section showing depth (m), graphic mean (mm), and $CaCO_3$ content (%).

clay mineral assemblage though smectite remained dominant. Heavy minerals reflect a southern Appalachian provenance and are characterized as a kyanite/staurolite suite (Van Andel and Poole, 1960, and Fairbank, 1962) with ilmenite, zircon, and tourmaline common, but hematite, pyroxenes, and amphiboles diminished.

Zone III reflects the abrupt bathymetric change at the western margin of DeSoto Canyon. Sediments were still sands, but had a lower sand/fine ratio than did those of the eastern portion of Zone II. Calcium carbonate content increased to greater than 75% at the shelf edge. Sediments shoreward were still dominated by quartz. Heavy minerals were similar to those of Zone II.

Zone IV, which also encompasses the more gently sloping eastern margin of DeSoto Canyon, was characterized by lowered sand/fine ratios and high carbonate content typical of the western Florida lime-mud facies of Ludwick (1964) on the upper continental slope.

Zone V represented a transition between the slope muds and the quartz sand sheet south and west of Cape San Blas. West of Cape San Blas the clay mineral suite becomes dominated by kaolinite showing the continued waning influence of the Mississippi River. Heavy minerals were similar to those of Zones II and III. The eastern portion of Zone V was transitional to the west Florida carbonate sand sheet.

Zone VI represents the upper continental slope of the west Florida margin. It was characterized by limey muds with a sand/fine ratio less than 1.0 and a high (>75%) carbonate content. It was similar to Zone IV.

Zone VII is the carbonate sand sheet of the west Florida shelf.

While sand/fine ratios were generally greater than 1.0, they vary from 1.0 to 90.0 reflecting the effect of local bathymetry. This variation may be seen in Figure 81c which shows the graphic mean grain size of a series of stations at 1.6 km intervals across the west Florida shelf (see Figure 82 for locations). The variation is impressive. Master Stations 40-45 of Figure 79 are in the upper continental slope Zone IV. Carbonate constituents of cross sections A through D show that the banding reported by Gould and Stewart (1955) is not present with one notable exception, the inner shelf quartz band. The carbonate sand sheet was thin with many outcrops of tertiary rocks exposed through it.

Zone VIII is the inner portion of the west Florida shelf. It is a relatively pure quartz sand that also makes up the beaches of west Florida. The heavy mineral suite of MAFLA Zone VIII, east of Cape San Blas, was dominated by zircon, staurolite, tourmaline, and garnet (Fairbank, 1962). As expected, heavy minerals decrease as carbonate increases and were essentially absent in Zone VII. Clay minerals were dominated in both Zones VII and VIII by kaolinite with chlorite next in abundance (Huang, _et al_., 1975).

Clay Mineralogy

Figures 83 a, b, c, d and e show the distribution of clay minerals in the sediments of the MAFLA area. Table 73 lists the average content of clay minerals at each station.

Based on the above observed distribution of the clay minerals (Table 73) the shelf was divided into the West Florida Shelf and the Mississippi-Alabama Shelf.

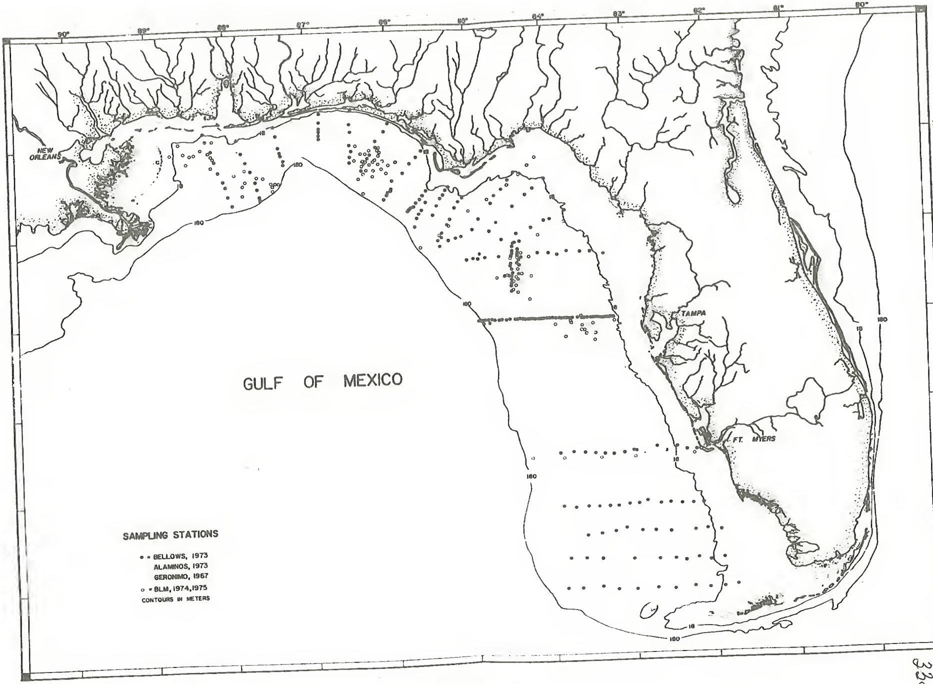

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Figure 82. MAFLA and historical sampling stations.

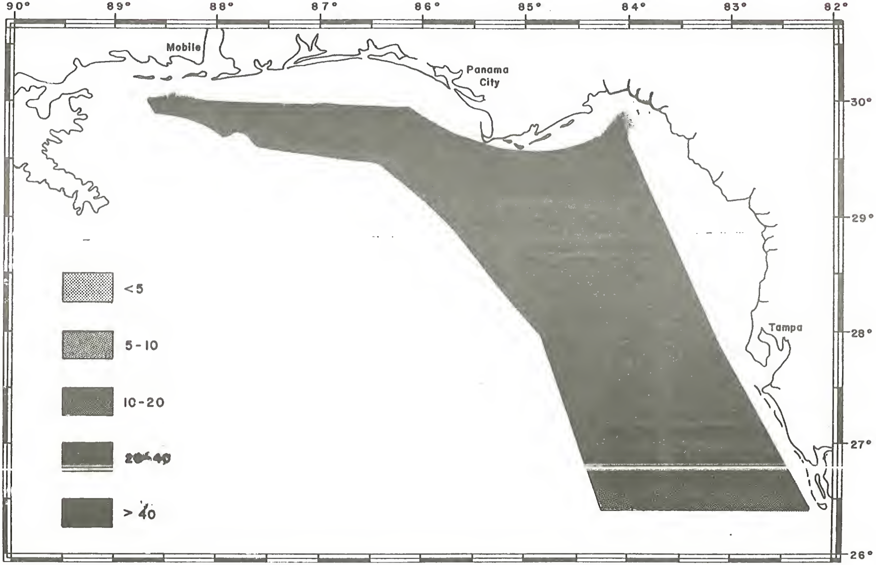

Figure 83a. The average kaolinite content (%) of the surface sediments, June-July, 1975

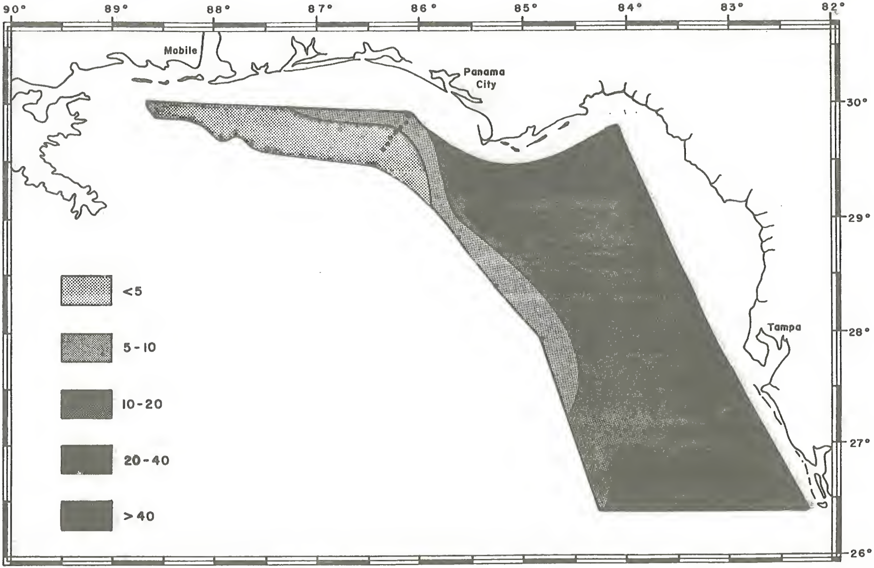

Figure 83b. The average chlorite-vermiculite content (%) of the surface sediments, June-July, 1975.

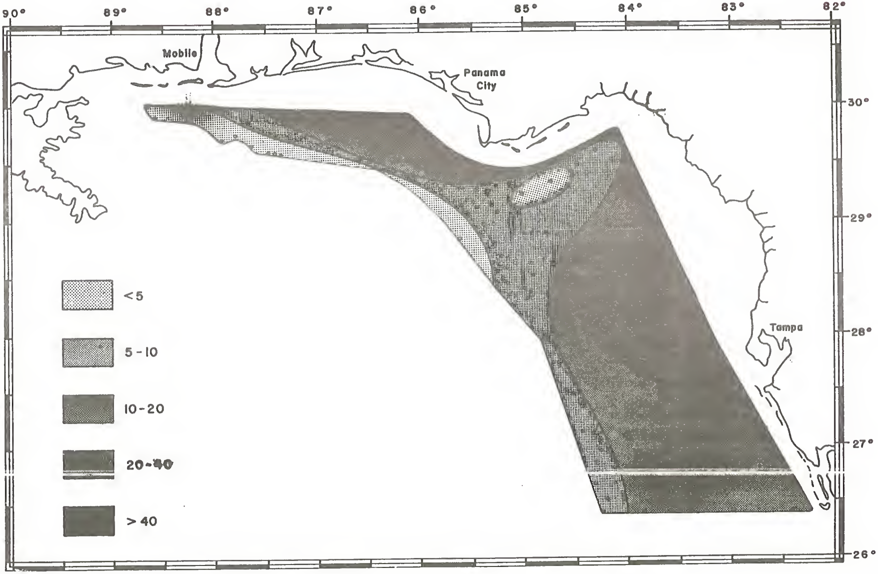

Figure 83c. The average chlorite content (%) of the surface sediments, June-July, 1975

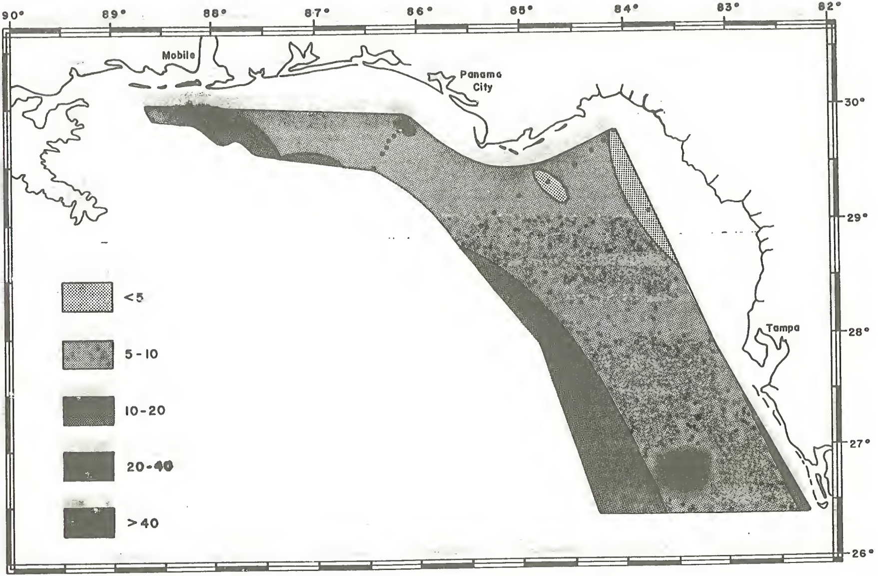

Figure 83d. The average illite content (%) of the surface sediments, June-July, 1975.

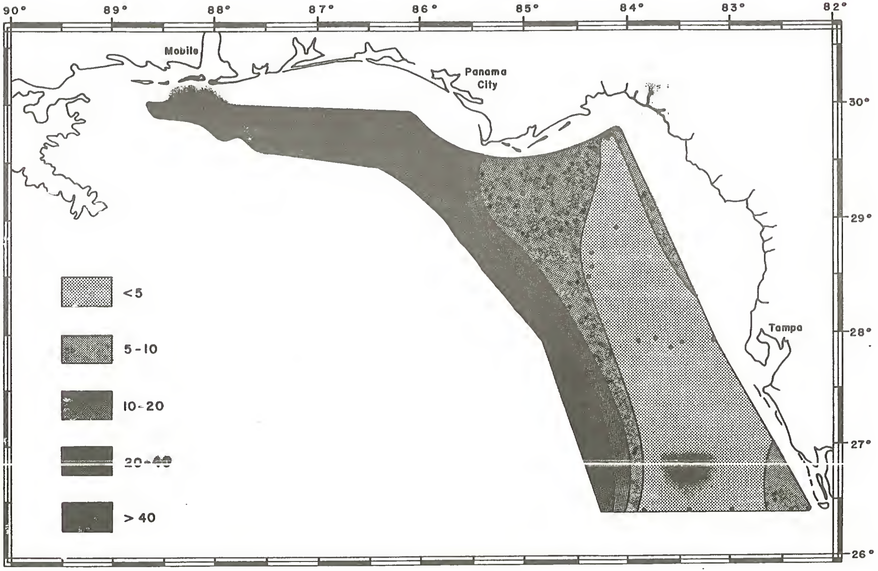

Figure 83e. The average surface smectite content (%) of the surface sediment, June-July, 1975.

Table 73. The average content (%) of clay minerals in surface sediments from the MAFLA OCS baseline monitoring sites (A & B set), June-July, 1975.

Station Number	Smectite	Chlorite	Chlorite-Vermiculite Mixed Layer	Illite	Kaolinite
2101	8	14	45	13	20
2102	10	13	38	9	30
2103	2	14	42	6	37
2104	T	18	42	5	35
2105	T	11	31	17	41
2106	25	8	19	12	36
2207	-	36	17	8	39
2208	5	24	14	7	50
2209	5	30	15	5	45
2210	*	*	*	*	*
2211	4	32	16	5	43
2212	40	10	8	12	30
2313	44	6	6	11	33
2314	*	*	*	*	*
2315	*	*	*	*	*
2316	T	21	23	5	51
2317	5	17	19	8	51
2318	11	17	21	4	47
2419	7	16	21	5	51
2420	4	9	31	4	52
2421	3	6	22	6	63
2422	8	5	18	5	64
2423	8	4	15	4	69
2424	10	4	17	10	59
2425	5	8	30	10	47
2426	14	6	23	9	48
2427	46	2	6	10	36
2528	17	10	10	6	57
2529	6	22	9	8	55
2530	14	21	7	9	49
2531	11	17	8	11	53
2532	22	17	7	10	44
2533	24	18	4	7	47
2534	26	16	2	8	47
2535	39	17	-	8	36
2536	56	5	-	6	33
2637	70	3	-	8	19
2638	80	5	-	5	10
2639	72	2	-	11	15
2640	53	4	-	19	24
2641	52	T	-	17	31
2642	41	9	-	17	33
2643	67	4	-	9	20
2644	54	5	-	10	31
2645	55	6	-	14	25

T Trace amount.
* No sample taken.

West Florida Shelf

Generally, kaolinite was the most abundant clay mineral, followed by chlorite and a chlorite-vermiculite mixed layer which was unique to this area of the shelf. Maximum concentrations of the chlorite-vermiculite mixed layer were present near Fort Myers, Florida. Smectite in this area was present in small amounts along the outer shelf and decreased to the southeast. The distribution patterns of individual clay minerals were further documented as follows.

Kaolinite, in general, decreased to the east and south and also toward the edge of the shelf. The chlorite-vermiculite mixed layer which was unique to this area increased from trace amounts near Pensacola to a maximum of 45% west of Fort Myers. Concentrations of this clay mineral also tended to decrease with increasing distance from shore.

Mississippi - Alabama Shelf

The distribution pattern of clay mineral assemblages differed from that of the West Florida Shelf. Smectite was the most abundant clay mineral in the bottom sediments and the chlorite-vermiculite layer was virtually absent.

Smectite concentrations ranged up to 80% and decreased seaward. Illite was essentially uniform in abundance throughout the area and generally ranged between 5-20% in concentration. Slightly higher amounts were present along the outer stations.

Bioturbation

Each benthic station was characterized by a 100% level of bioturbation at least once during the three sampling periods with the level being above the 60% level. Primary physical sedimentary structures, when present, consisted of the following types (in decreasing frequency): shell concentration layers, thin silt/clay laminations, thin sandy laminations and cross bedding, and faint heavy mineral concentration layers. Average bioturbation, by transect and station are presented in Figures 84a through 84f.

Chemistry

Trace Metals

Sediments

The distribution of the trace metals cadmium, chromium, copper, iron, lead, nickel and vanadium in the surface sediments of the MAFLA region are shown in Figures 85a through 85g. Barium was present in measurable quantities at five out of the 63 stations sampled (45 in June-July, 1975 and 18 repeat stations in January-February, 1976). Three of the five, Master Stations 2637, 2638, 2642, were located on Transect VI and showed barium concentrations ranging between 136±45-321±76 ppm. The sediments at Master Stations 2101 and 2425 on Transects I and IV respectively, contained 53±27 and 81±25 ppm barium respectively.

As shown in Figures 85a to 85g a wide variability was observed for most metals not only over the MAFLA area but also along each transect. In general, the concentration of the trace metals tended to increase with increasing distance from shore and this was especially apparent along Transects II, III, IV and V for copper, iron, nickel and vanadium. The highest concentrations of the trace metals were generally present on Transects IV and V.

When the ratio of the difference between the average concentration on

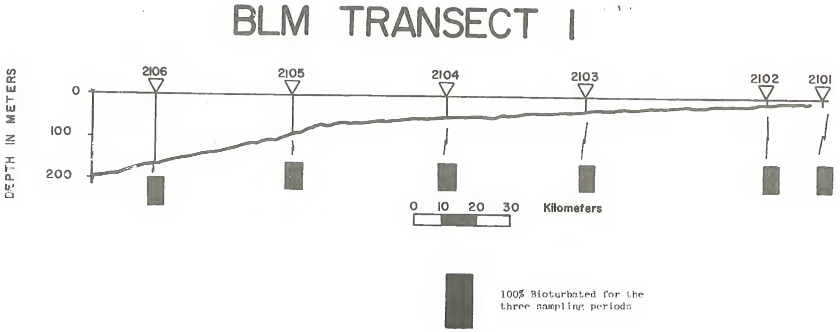

Figure 84a. Geophysical Profile of Transect 1 with Station Locations plotted against Depth and Distance. Rectangular Figure represents percent Bioturbation at Stations during three sampling periods.

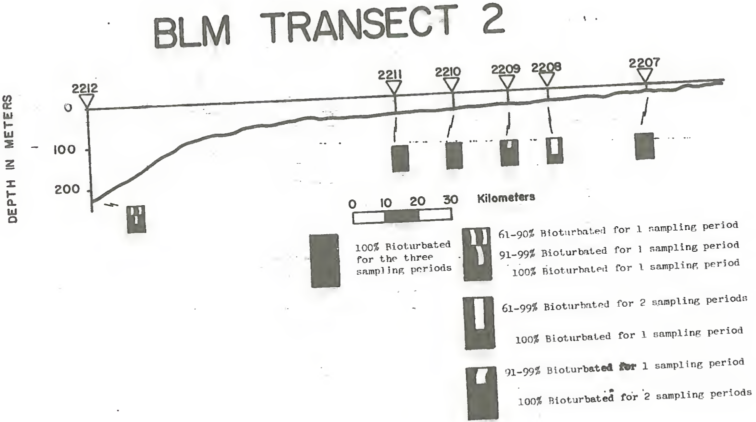

Figure 84b. Geophysical Profile of Transect 2 with Station Locations plotted against Depth and Distance. Rectangular Figures represent percent Bioturbation at Stations during three sampling periods.

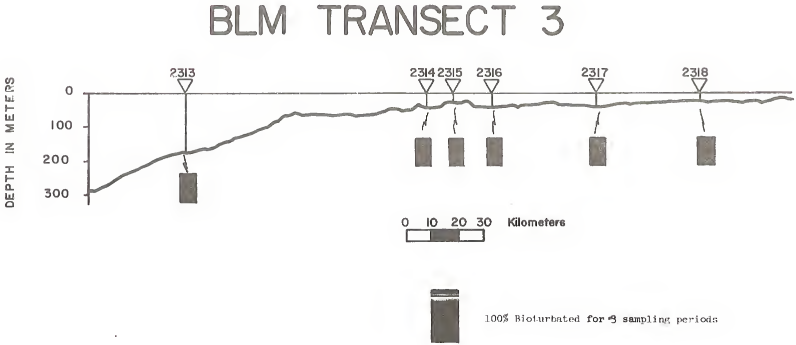

Figure 84c. Geophysical Profile of Transect 3 with Station Locations plotted against Depth and Distance. Rectangular Figure represents percent Bioturbation at Stations during three sampling periods. Station 2314 was only sampled once.

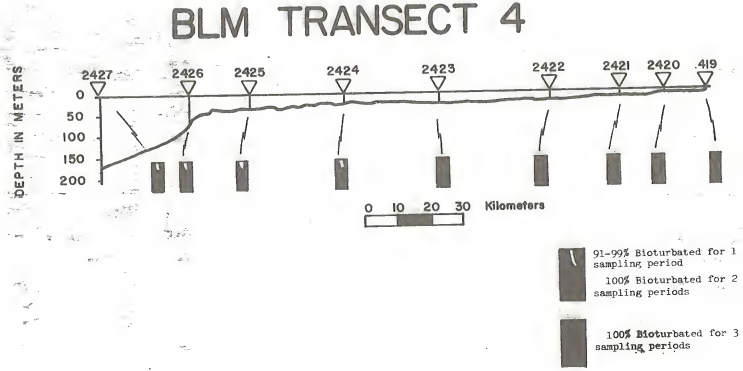

Figure 84d. Geophysical Profile of Transect 4 with Station Locations plotted against Depth and Distance. Rectangular Figures represent percent Bioturbation at Stations during three sampling periods.

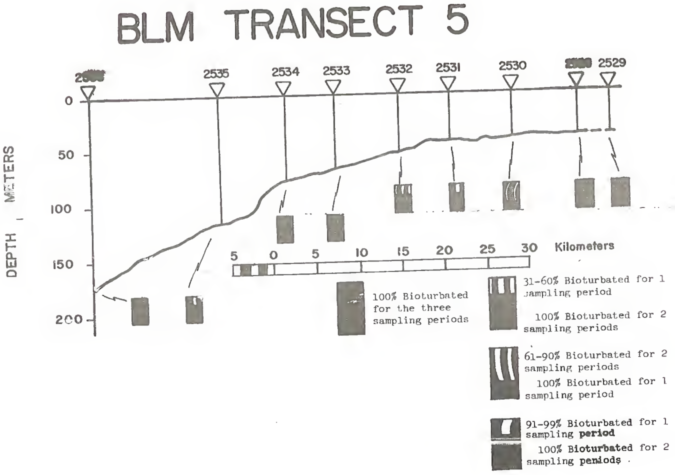

Figure 84e.. Geophysical Profile of Transect 5 with Station Locations plotted against Depth and Distance. Rectangular Rigures represent percent Bioturbation at Stations during three sampling periods.

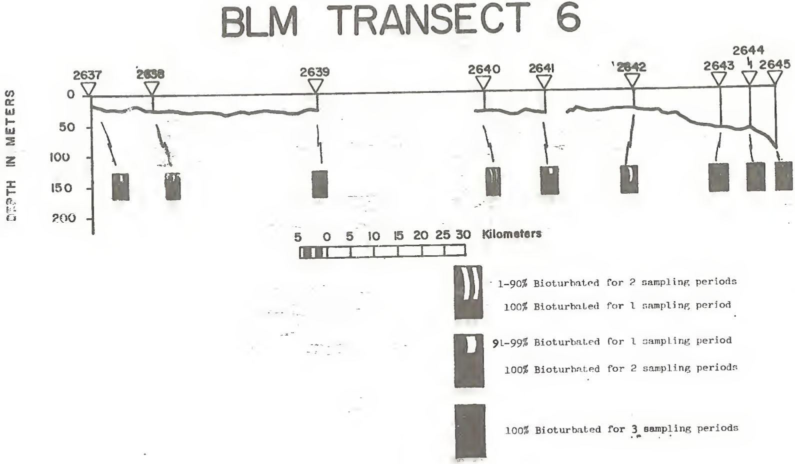

Figure 84f. Geophysical Profile of Transect 6 with Station Locations plotted against Depth and Distance. Rectangular Figures represents percent Bioturbation at Stations during three sampling periods.

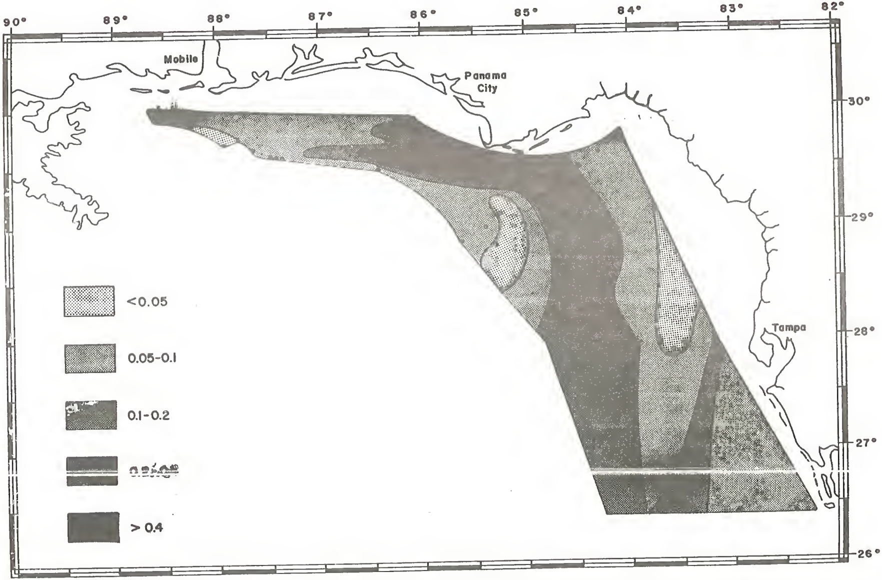

Figure 85 a. Surface sediment cadmium content (ppm) averaged for two sampling periods (June-July, 1975 and January-February, 1976).

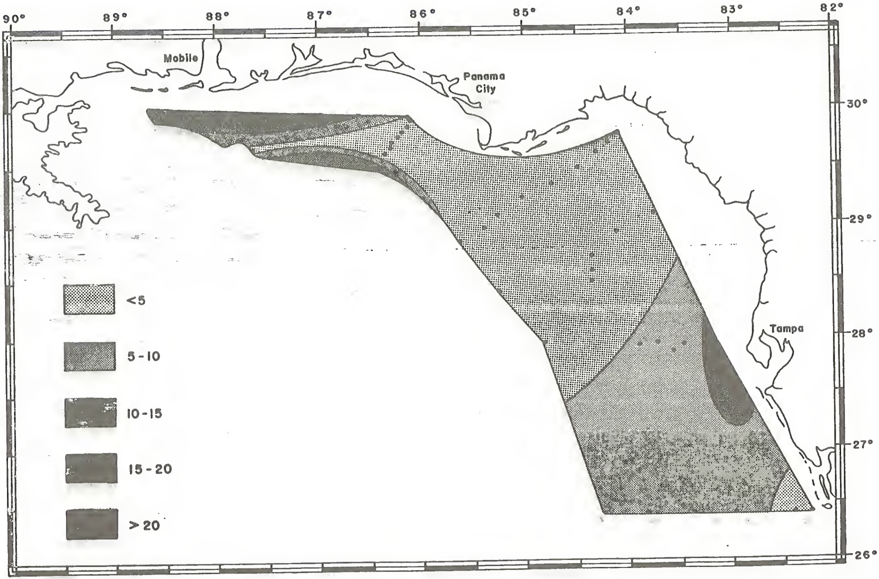

Figure 85 b. Surface sediment chromium content (ppm) averaged for two sampling periods (June-July, 1975 and January-February, 1976).

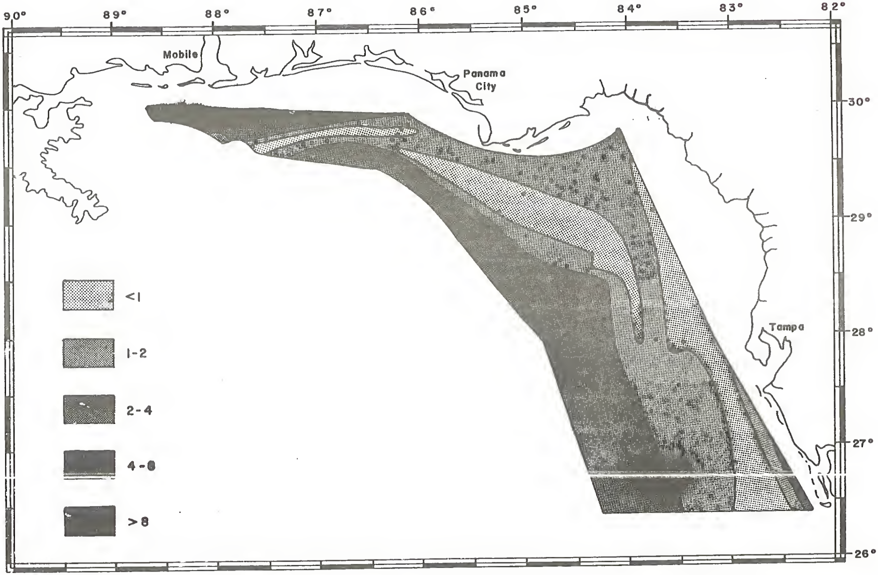

Figure 85c. Surface sediment copper content (ppm) averaged for two sampling periods (June-July, 1975 and January-February, 1976).

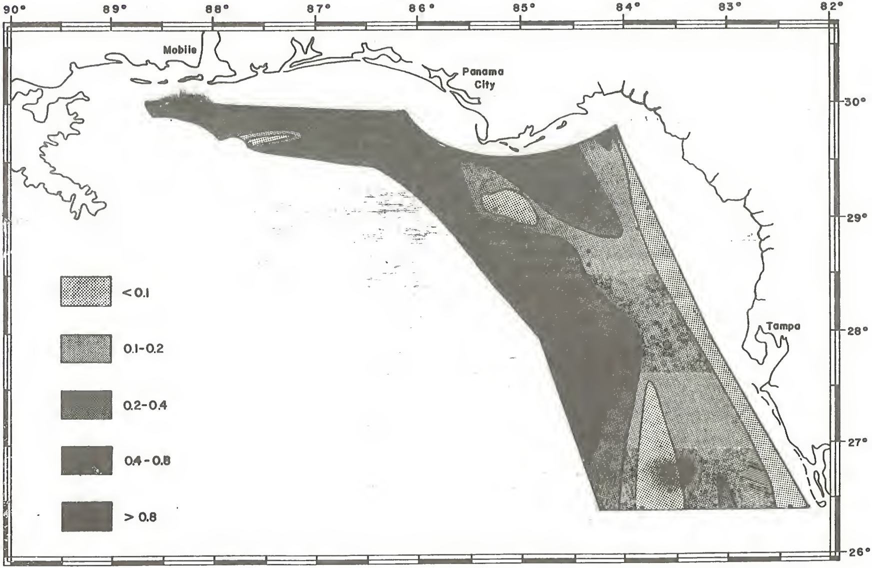

Figure 85 d. Surface sediment iron content (ppm) averaged for two sampling periods (June-July, 1975 and January-February, 1976).

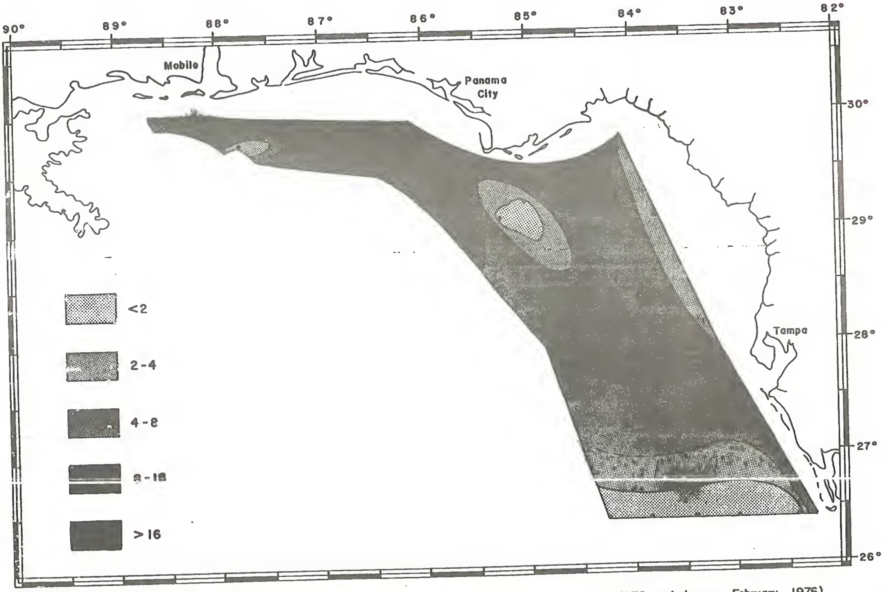

Figure 85 e. Surface sediment lead content (ppm) averaged for two sampling periods (June-July, 1975 and January-February, 1976).

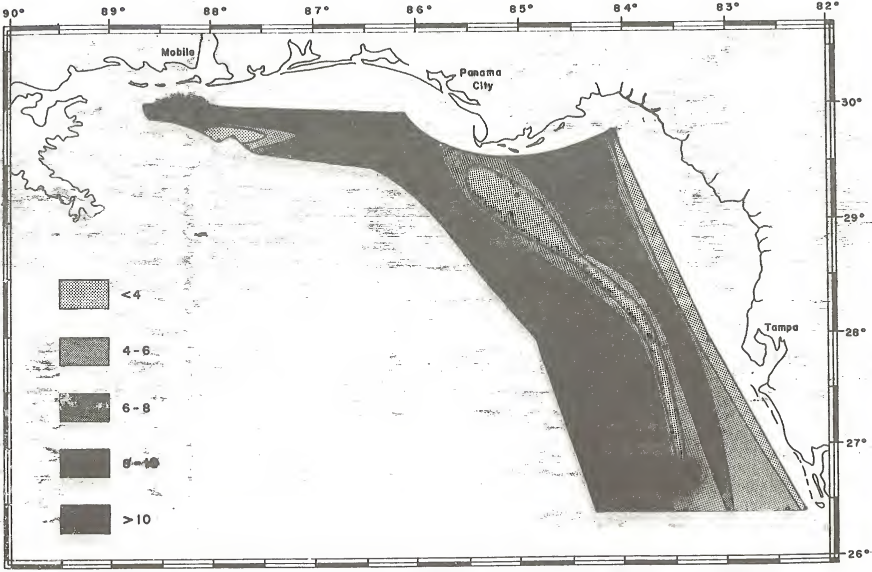

Figure 85 f. Surface sediment nickel content (ppm) averaged for two sampling periods (June-July, 1975 and January-February, 1976).

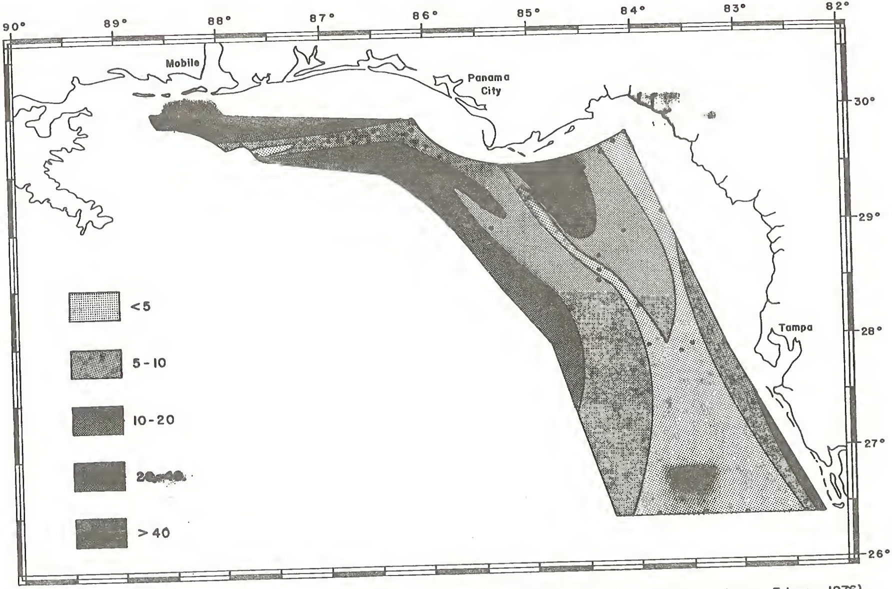

Figure 85 g. Surface sediment vanadium content (ppm) averaged for two sampling periods (June-July, 1975 and January-February, 1976).

each transect to the standard deviation of this difference was determined, it was found that the lead, nickel and vanadium content of the surface sediments were significantly different from transect to transect. In general, the same pattern was found for chromium, copper and iron. The exceptions were between Transects II and III for iron, I, II and III for copper, and II, III, and IV for chromium. The cadmium concentrations present on Transect IV were significantly different from those of the other transects and Transect V differed from Transect VI.

Epifauna

The metal content of selected benthic macrofauna are summarized in Table 74. The organisms included in this table represent the dominant and/or commercially important species that were collected from Master Stations IA-C through VIA-C by dredge and trawl. The remaining organisms were collected from either the Florida Middle Ground (Master Stations 047, 146, 147, 151, 247 and 251) or off Clearwater (Master Stations 062 and 064).

Cadmium concentrations in the sponges were highest in the summer and lowest in the winter. Lead concentrations were highest in the fall, and no consistent patterns were apparent in the seasonal distribution of chromium, copper, iron, nickel and vanadium. Metal concentrations in the corals, molluscs, crustaceans and echinoderms were variable, not only among the various groups but also among the species within a group. Most metal values varied at least ten-fold within a group and at least five-fold within a species.

The sponge *Guitarra* sp. appears to concentrate cadmium and chromium

Table 74. Seasonal variations in the trace metal content (ppm) of selected macroepifauna from the eastern Gulf of Mexico.

Name of Species	Season	Cd	Cr	Cu	Fe	Pb	Ni	V	Station
Sponges									
Guitarra sp.	Summer	8.27	29.8	7.6	708	5.13	5.9	8.8	VI-A
	Fall	8.58	10.4	7.6	4500	0.58	6.3	6.2	
	Winter	6.73	2.7	8.7	2030	2.87	2.4	2.1	
Cinachyra sp.	Summer	2.02	0.43	6.3	65.8	0.22	25.1	0.8	247
	Fall	1.50	1.39	4.7	130.0	0.16	16.8	<0.4	
	Winter	0.24	0.46	5.0	143	0.49	13.9	<0.4	
Pseudoceratina sp.	Summer	6.06	0.36	6.5	79.6	0.46	18.8	1.7	251
	Fall	1.00	0.89	8.1	67.0	0.23	31.8	<0.4	
	Winter	0.37	0.80	6.5	157	0.55	10.5	3.9	
Corals									
Solenastrea hyades	Summer	0.105	2.45	5.3	60.8	0.55	0.6	2.3	062
	Fall	0.091	0.03	7.5	35.1	0.26	<0.2	<0.4	
	Winter	0.041	0.03	8.6	34.7	0.25	<0.2	0.8	
Cladocora arbuscula	Summer	0.85	1.18	7.35	177	0.98	0.35	3.25	064
	Fall	0.94	0.03	6.8	56.7	0.21	<0.2	2.9	
	Winter	0.025	0.14	8.4	63.2	0.20	<0.2	0.7	
Madracis decactis	Summer	0.113	0.40	7.0	24.8	0.31	0.3	1.9	047
	Fall	0.045	<0.01	7.1	35.7	0.35	<0.2	1.9	
	Winter	0.068	0.06	7.6	41.9	0.11	<0.2	1.7	
	Summer	0.48	0.21	5.5	16.9	0.16	0.22	1.0	151
	Fall	0.47	<0.01	6.9	35.1	0.17	<0.2	3.5	
	Winter	0.07	0.05	7.7	41.1	0.17	<0.2	<0.4	
	Summer	1.33	0.38	3.7	18.0	0.11	0.3	1.0	251
	Fall	0.041	<0.01	7.0	35.9	0.14	<0.2	2.1	
	Winter	0.039	0.01	7.6	38.2	0.11	<0.2	1.7	
	Summer	0.060	0.28	5.7	22.1	0.24	0.5	1.4	146
	Fall	0.045	<0.01	7.1	35.7	0.35	<0.2	1.9	
	Winter	0.040	0.07	7.6	36.3	0.11	<0.2	1.4	
	Summer	0.771	0.17	5.2	17.3	0.11	6.5	1.2	147
	Fall	0.045	<0.01	6.5	31.8	0.13	<0.2	2.5	
	Winter	0.038	0.08	7.8	40.4	0.12	<0.2	<0.4	
	Summer	0.116	0.38	4.6	22.3	0.24	1.5	2.8	247
	Fall	0.07	<0.01	6.8	36.5	0.16	<0.2	6.0	
	Winter	0.02	0.09	8.5	44.9	0.22	<0.2	1.9	

Table 74. Continued.

Name of Species	Season	Cd	Cr	Cu	Fe	Pb	Ni	V	Station
Corals									
Porites divaricata	Summer	0.215	0.26	6.9	21.7	0.16	<0.2	1.9	047
	Fall	0.325		6.8	35.6	0.27	<0.2	3.8	
	Winter	0.068	0.06	7.6	41.9	0.11	<0.2	1.7	
	Summer	1.11	0.59	6.5	19.1	2.72	0.3	4.9	151
	Fall	0.108	<0.01	7.0	35.9	0.07	<0.2	2.2	
	Winter	0.112	0.20	6.8	32.2	0.31	<0.2	1.5	
	Summer	0.438	0.43	5.1	20.8	0.16	0.3	0.4	251
	Fall	0.211	<0.01	6.8	36.1	0.08	<0.2	0.5	
	Winter	0.28	0.07	7.6	41.4	0.15	<0.2	1.3	
	Summer	0.461	0.27	6.1	18.3	0.13	0.4	1.2	147
	Fall	0.193	<0.01	6.8	34.2	0.20	1.8	3.7	
	Winter	0.127	0.15	7.7	36.0	0.13	<0.2	<0.4	
	Summer	0.251	0.32	6.9	20.6	0.28	1.0	1.5	247
	Fall	0.229	<0.01	6.3	31.6	0.18	<0.2	1.7	
	Winter	0.07	<0.01	8.5	42.3	0.17	<0.2	<0.4	
Molluscs									
Spondylus americanus	Summer	20.8	2.59	9.2	80.8	1.42	20.5	6.0	151
	Fall	11.5	0.44	2.3	69.5	0.51	25.8	3.2	
	Winter								
	Summer	20.4	1.89	6.9	71.9	1.04	5.4	5.6	251
	Fall	26.6	7.72	6.1	70.2	1.49	30.6	3.4	
	Winter	3.875	4.33	3.3	66.1	0.71	17.1	3.9	
Sicyiona Brevirostras	Summer	0.149	0.44	12.7	11.2	0.80	<0.2	<0.4	IV-A
	Fall	0.228	<0.01	93.4	91.9	0.67	0.5	2.1	
	Winter	0.827	0.20	110	71.3	0.35	0.7	<0.4	
Stenorhynchus seticornis	Summer	1.61	0.35	23.3	38.1	0.83	0.9	1.8	047
	Fall	0.771	0.72	28.5	43.5	0.34	1.4	1.5	
	Winter	0.661	0.09	29.5	66.9	0.30	0.7	3.0	
	Summer	1.16	0.31	19.3	35.2	0.61	0.8	2.4	146
	Fall	0.849	0.41	36.7	47.8	0.46	1.2	1.4	
	Winter	0.397	0.16	25.6	56.4	0.22	<0.4	<0.4	
	Summer	1.83	0.25	21.7	32.1	0.73	0.9	2.2	147
	Fall	1.260	0.28	57.8	69.7	0.48	1.6	1.9	
	Winter	0.417	0.28	35.9	80.4	0.74	0.6	<0.4	

Table 74. Continued.

Name of Species	Season	Cd	Cr	Cu	Fe	Pb	Ni	V	Station
Molluscs									
Stenorhynchus seticornis	Summer	1.89	0.37	24.6	39.2	0.17	1.7	2.5	151
	Fall	0.635	0.44	59.4	39.4	0.43	0.5	1.7	
	Winter	0.430	0.01	32.3	52.4	0.47	<0.2	<0.4	
	Summer	1.07	0.46	29.2	61.9	0.25	0.9	2.0	247
	Fall	1.24	0.89	37.2	71.4	0.36	0.3	1.8	
	Winter	0.430	0.23	39.1	86.3	0.52	<0.2	<0.4	
	Summer	1.72	0.40	34.3	41.9	0.31	1.0	1.4	251
	Fall	1.000	0.47	40.0	69.9	0.56	<0.2	2.5	
	Winter	0.461	0.21	27.7	71.4	0.47	<0.2	<0.4	
Echinoderms									
Clypeaster raveneli	Summer	0.162	0.79	7.6	81.4	0.35	0.6	1.9	IV-B
	Fall	0.207	0.28	7.2	140	0.43	0.3	2.4	
	Winter	0.234	0.91	6.6	278	0.47	0.3	4.6	
Clypeaster durandi	Summer	0.210	0.78	7.2	229	0.54	0.8	1.8	VI-A
	Fall	0.107	0.74	7.4	704	1.58	0.5	<0.4	
	Winter	0.056	0.36	5.9	94.2	0.67	0.2	2.0	

to a greater extent in the summer (and to a lesser degree iron and vanadium). Both iron and lead values showed a high degree of scatter both within the group and within a species. Copper concentrations were consistent, and the least variation was shown in the nickel and vanadium concentration.

In the fall Guitarra sp. concentrated cadmium more than the other metals and generally more so than any other sponge. The exception to this was Anthosigmella varians. The high cadmium, iron and nickel values found in this organism indicate contamination. Elevated concentrations of chromium and iron were present in Cliona celata, Ircina campana, and Neofibularia molitangere oxeata. Copper and vanadium concentrations were consistent with those found during the summer. Large variations in the nickel concentrations were present.

Relatively high concentrations of cadmium and iron were present in Guitarra sp. during the winter. Copper and lead showed little variation and vanadium was not detected.

Corals tended to be consistent in their metal concentrations and the values for trace elements in corals were remarkably uniform for all species during the three sampling periods. The only exceptions to this were Millepora alcicornis and Phyllangia americana.

Only one species of mollusc of any dominance was analyzed. Cadmium appeared to be the only element in which the concentrations were above normal.

Crustaceans were the most diverse group of benthic macrofauna that were collected. This is true not only because of the various feeding habits, but also because some species have a great deal more mobility than others (i.e., Sicyiona brevirostris). Five species were collected during the summer, all of which were dominant. Cadmium, chromium, copper, lead, nickel and vanadium values were similar in most samples. Iron concentrations in Stenorhynchus seticornis were lowest during the summer. Crustaceans collected in the fall and winter showed little deviation from the trends present during the summer.

Except for copper the metal concentrations present in the echinoderms in the summer showed a great deal of scatter. Similar patterns were present during the winter.

Hydrocarbons

Sediments

A total of 63 sediment samples were analyzed for high molecular weight hydrocarbons. Of the total number of sediment samples collected during the year, 42 were collected in the summer and 21 were collected in the winter. The latter were collected to gain additional insight into (1) the seasonality of the data and (2) the presence of terrestrial hydrocarbons on the outermost shelf.

Table 75 summarizes the hydrocarbon content of the sediments. Where two numbers are presented for a station, these represent the summer and winter data. Table 76 summarizes the organic carbon data for the summer and winter. Figure 86 shows the total hydrocarbon content (ppm) along each transect during the summer of 1975.

Figure 87 demonstrates one of the peculiarities present in the sediments on Transect I; namely the presence of many peaks between C_{16} and C_{19} and a very large peak atK.I.2500 which was probably not all C_{25}.

Table 75. High Molecular Weight Hydrocarbons in Sediments.

Station Number	Total Alkanes, ppm*	Total Arom., ppm*	Pristane/ nC_{17}	Normal/ Total Alk.	Odd/Even Ratio	Pristane/ Phytane
2101	1.75 1.93	1.58 1.05	0.10 0.05	.087 .085	3.6 3.4	∞
2102	0.91	1.06	0.47	0.07	2.2	1.5
2103	0.97	1.08	0.64	0.08	1.7	∞
2104	0.87 0.83	1.15 0.99	- 0.22	.111 .110	2.3 1.5	5.4
2105	0.29	0.39	0.56	0.22	3.2	1.3
2106	0.87 1.14	0.94 0.89	0.70 0.57	.191 .225	3.8 2.7	1.5
2207	1.39 1.04	1.13 0.93	0.02 0.92	.070 .074	2.2 2.4	2.8
2208	1.48	2.16	0.36	.076	2.5	0.8
2209	1.14	1.89	0.0	.077	2.5	0.0
2210	0.72	0.80	0.24	.081	2.2	-
2211	0.79	1.04	0.35	0.18	1.6	0.9
2212	1.23 1.14	1.07 1.06	0.75 0.58	.26 .27	2.5 3.1	2.0
2313	1.60 1.34	1.24 0.67	0.45 0.63	.29 .278	1.9 2.6	1.4
2314	1.30	1.70	0.50	.069	2.5	-
2315	0.78	1.02	0.21	.118	2.4	-
2316	0.61	1.97	0.15	0.12	2.4	0.3
2317	0.57	1.35	0.30	0.12	1.4	0.4
2318	0.32 0.28	0.28 0.30	0.82 0.55	.04 .068	2.6	0.7
2419	0.60	0.55	0.28	0.12	7.2	0.4
2420	0.46	0.57	-	0.06	-	-
2421	1.00	1.10	0.0	0.05	2.9	0.0
2422	4.00	1.70	0.33	0.083	2.6	0.5
2423	0.52	1.92	0.32	0.138	2.1	0.6
2424	0.42 0.46	0.26 0.42	0.29 0.16	.112 .123	2.8 2.2	0.5
2425	0.52 0.32	0.42 0.25	0.32 0.13	.216 .155	1.5 1.4	0.6
2426	0.53	0.72	0.51	0.183	1.6	1.5
2427	1.54 1.39	1.90 0.98	0.59 0.62	.356 .279	3.9 3.1	1.4
2528	0.98	0.64	0.20	0.164	1.7	1.6
2529	0.74	0.38	0.094	0.178	2.2	0.3
2530	0.56	0.67	0.173	0.133	1.5	∞
2531	0.69 0.33	0.76 0.38	0.21 0.41	.21 .14	2.8 2.2	-
2532	0.73	1.44	0.27	0.156	2.0	0.6
2533	0.48	0.55	0.22	0.32	1.5	∿5
2534	0.57	0.58	0.61	0.31	1.2	1.6
2535	3.29	2.77	0.44	0.20	2.7	1.9
2536	4.00 3.55	2.20 2.52	0.43 0.58	.301 .250	3.3 2.7	2.1
2637	6.15 6.12	7.21 0.98	0.77 0.57	.67 .45	3.3 2.9	2.9
2638	7.86 5.21	5.35 5.21	0.88 0.76	.685 .510	2.8 2.5	2.2
2639	2.82 2.78	1.73 1.64	0.79 0.93	.37 .25	3.9 2.8	2.0
2640	0.65	0.64	0.98	0.34	2.3	2.3
2641	1.13	1.36	0.96	0.35	2.0	2.4
2642	0.69	0.68	0.42	0.44	1.5	0.3
2643	1.49 1.72	1.16 0.91	0.51 0.71	.38 .20	2.7 2.7	1.1
2644	1.60 0.86	1.40 0.52	0.62 0.74	.29 .33	3.1 3.2	1.1
2645	2.63 2.04	2.40 1.14	0.44 0.63	.43 .35	2.5 2.7	1.5

* Gravimetric data - remainder is derived from chromatographic parameters.

Table 76. Organic Carbon and Calcium Carbonate in MAFLA Sediments.

Station No.	Organic Carbon, % (acidified basis)	Calcium Carbonate, % w (dry)
2101	3.0, 0.37	94.1, 47.6
2102	0.19	34.1
2103	0.70	68.3
2104	3.2, 8.0	98.4, 97.5
2105	7.5	98.1
2106	7.2, 8.8	96.5, 96.5
2207	0.40,0.24	47.6, 51.1
2208	2.0	86.2
2209	1.9	86.0
2210	0.21	92.0
2211	6.8	97.2
2212	4.8, 5.5	92.9, 92.3
2313	1.2, 4.3	87.6, 90.2
2314	2.9	10.3
2315	4.6	96.1
2316	0.60	79.6
2317	3.3	95.4
2318	0.10,0.10	10.9, 9.8
2419	0.15	21.6
2420	0.32	71.1
2421	0.40	53.6
2422	0.36	51.3
2423	2.1	80.6
2424	0.10,0.13	8.81, ___
2425	0.10, ___	11.5, 14.7
2426	0.57	61.2
2427	3.0, 1.5	80.5, ___
2528	0.40	65.0
2529	0.68	77.9
2530	0.48	75.7
2531	2.0, 2.6	92.1, ___
2532	0.87	80.7
2533	0.34	44.0
2534	2.4	93.4
2535	4.1	73.7
2536	4.1, 3.7	74.4, 74.4
2637	0.72, ___	14.2, ___
2638	0.84,1.1	11.5, ___
2639	0.29, ___	18.7, ___
2640	0.11	12.5
2641	0.23	5.7
2642	0.10	4.1
2643	2.4, 2.1	32.9, ___
2644	2.7, 1.9	93.1, ___
2645	3.1, 2.0	90.0, 85.0

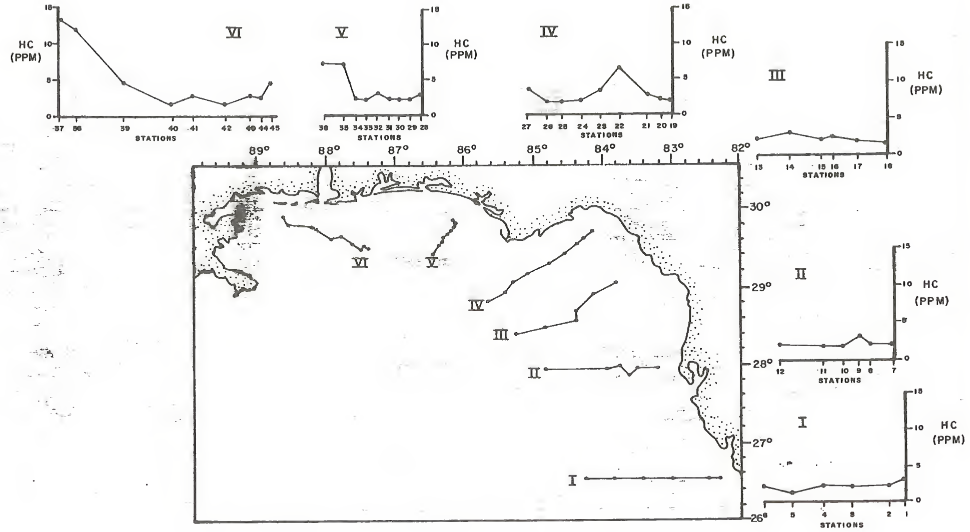

Figure 86. Surface sediment total hydrocarbon content (ppm), June-July, 1975.

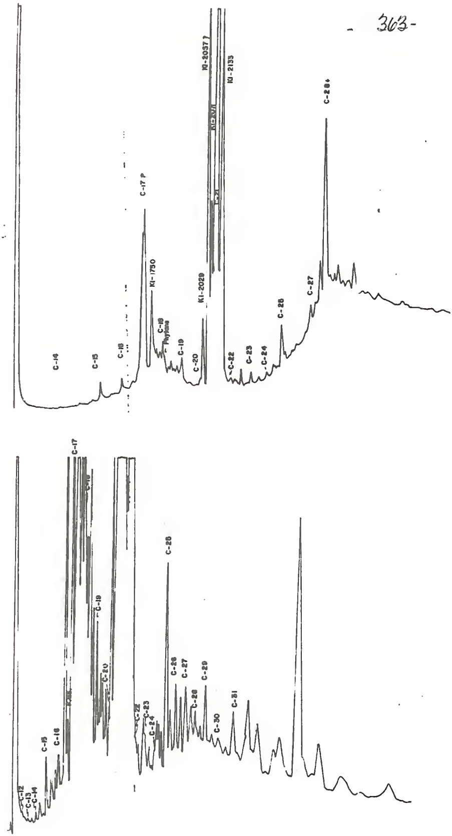

Figure 87. Aliphatic gas chromatograms (FFAP) of station 2101, aliphatics from summer (above) and winter (below), 1975-1976.

The presence of large amounts of compounds above C_{31} provides sufficient proof that these peaks were not artifacts or laboratory contaminants.

The peak at K.I. 2500 also shows up at Master Station 2104 where it is even larger. C_{17} was the largest n-alkane in both the summer and winter with the 2075 complex the dominant compound. The winter sample contained a peak at K.I. 2850 that occurred on such a random basis that it was attributed, (for the present) to laboratory contamination.

The striking dissimilarity of Master Station 2106 and the remaining Transect I sediments was confirmed in the winter (the chromatograms were almost identical). The high predominance of high molecular weight (HMW) n-alkanes with a strong odd/even preference suggests a terrestrial source of hydrocarbons on the outer edge of the shelf. The low molecular weight (LMW) n-alkanes have no dominant peak(s) and were similar to the distribution of aliphatics from the "polluted" Mississippi samples of 1974.

The abundance of unidentified peaks found in the summer at Master Station 2207 were in evidence during the winter. A very large peak at ca. K.I. 3400 appeared to be a characteristic of this station.

On the outer shelf of Transect II, Master Station 2212 again displays an aliphatic distribution appearing to be of terrestrial origin. The HMW's had a pronounced odd/even preference (Figure 88), and the 2075 peak was greatly reduced compared to the samples nearer shore. Master Station 2313, the outermost station of Transect III, also contained a HMW distribution characteristic of terrestrial organic matter in both seasons. Here the evidence of pollution was more pronounced than in Master Stations 2212 and 2106. Figure 89 demonstrates the even distribution of LMW n-alkanes

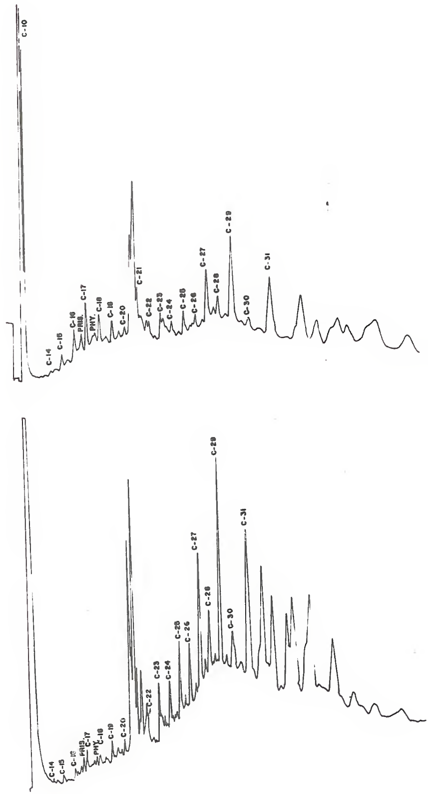

Figure 88. Aliphatic gas chromatograms (FFAP) of station 2212, aliphatics from summer (above) and winter (below), 1975 - 1976.

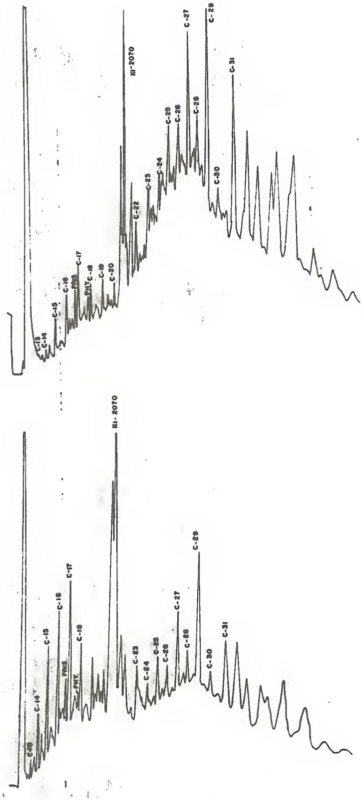

Figure 6.9. Aliphatic gas chromatograms (FFAP) of station 2313, aliphatics from summer (above) and winter (below), 1975 - 1976.

supporting a suggested pollution origin. Considering the problem of reproducible sampling in 153 m of water, the chromatograms were remarkably similar.

The peak at 2075 and the group between 2500 and 2600 were strongly in evidence at Master Station 2318 during both samplings. The amount of n-alkanes present in either sample was small.

Samples from Master Station 2424 were remarkable in that the chromatograms were almost identical (Figure 90). A peak which has been labelled as phytane proved to be the remarkable feature of Master Station 2425 being large in both chromatograms.

As was apparent in the summer, Master Station 2427 (Figure 91) can be distinguished from the remaining transect by the absence of material other than n-alkanes.

The summer and winter data collected at Master Station 2531 differed from the previous year's sampling in that the large peak at ca. K.I. 2800 was not present. Replicate checks in the laboratory have produced an erratic peak in this region and, for the moment, this was attributed to laboratory contamination and was probably a phthalate ester. All three chromatograms contain an abundance of the K.I. 2075 peak with small amounts of n-alkanes. The HMW region of n-alkanes shows a notable odd/even preference indicating the presence of some terrestrial material With the possible exception of the extraneous peak at ca. K.I. 2800 in 1974-75, the chromatograms were identical. Master Station 2536 yielded chromatograms (Figure 92) that were similar. This station follows the trend of all deep water stations with only a slight odd/even dominance in the LMW n-alkanes and a shift to a decided odd/even dominance in the HMW region implying

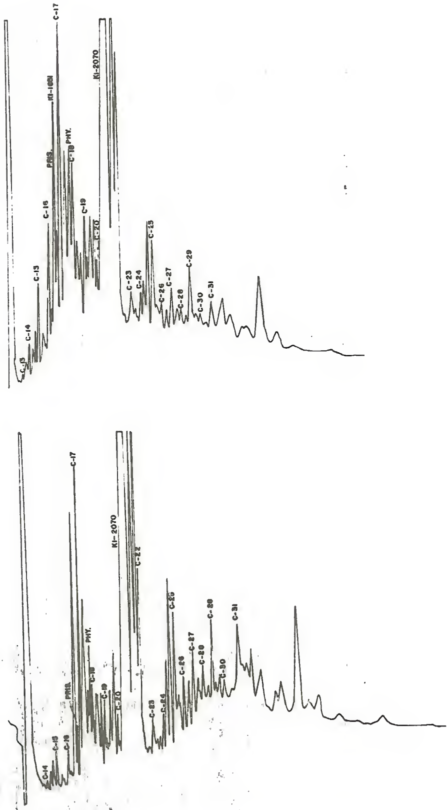

Figure 90. Aliphatic gas chromatograms (FFAP) of station 2424, aliphatics from summer (above) and winter (below), 1975-1976.

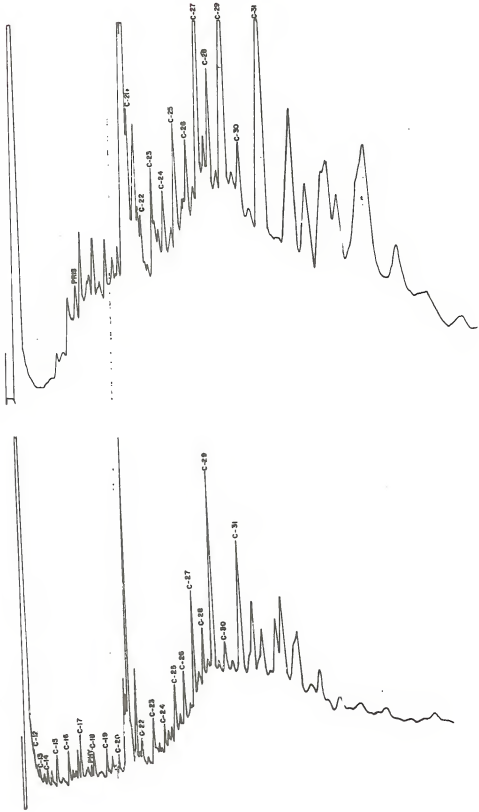

Figure 91. Aliphatic gas chromatograms (FFAP) of station 2427, aliphatics from summer (above) and winter (below), 1975 - 1976.

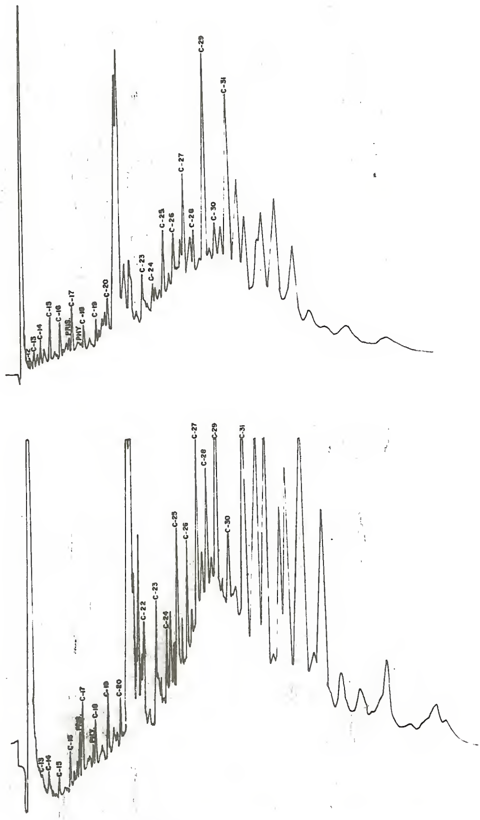

Figure 92. Aliphatic gas chromatograms (FFAP) of station 2536, aliphatics from summer (above) and winter (below), 1975 - 1976.

terrestrial sources of input. Noted here was the suite of n-alkenes of ca. one-fifth the concentration of the corresponding n-alkanes.

The 2075 peak, still in evidence, was at approximately the same concentration level as C_{29} in both periods at Master Station 2535 but falls short of C_{29} at Master Station 2637, the shallowest station of Transect VI, eight kilometers off Pascagoula. The chromatograms from this station (Figure 93) show a distribution of aliphatic hydrocarbons very similar to all the deep water stations. The LMW n-alkanes seem to indicate some pollution; the HMW n-alkanes reflect a terrestrial source commonly seen in the Mississippi sediments with a dominance of C_{27}, C_{29}, and C_{31}. There was no noticeable difference in the samples collected during the two periods; nor was there any at Master Station 2639 which resembled Master Station 2637.

Master Stations 2643-2645 on the outer shelf region of Transect VI produced chromatograms in the two sampling periods that were similar, and all three stations were similar to each other, to other Transect VI stations and to all deep water transects. At Master Station 2645 (Figure 94), the terrestrial signature in the HMW n-alkanes and the petroleum pollution in the LMW range was present. Here the C_{29} has decreased to somewhat less than the 2075 peak.

Epifauna

A total of 183 macroepifauna were analyzed for high molecular weight hydrocarbons. The results of these are summarized in Table 77. Data from biologically related organisms are grouped together in each period. Certain aliphatic hydrocarbons in these samples could

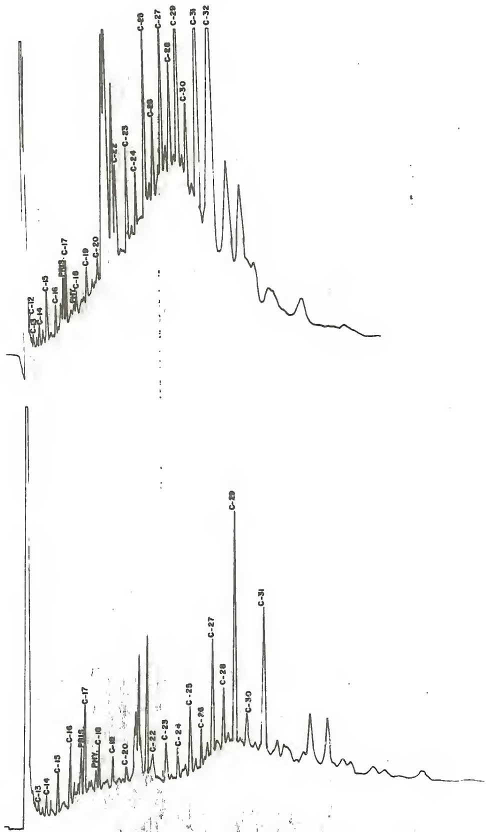

Figure 93. Aliphatic gas chromatograms (FFAP) of station 2637, aliphatics from summer (above) and winter (below), 1975-1976.

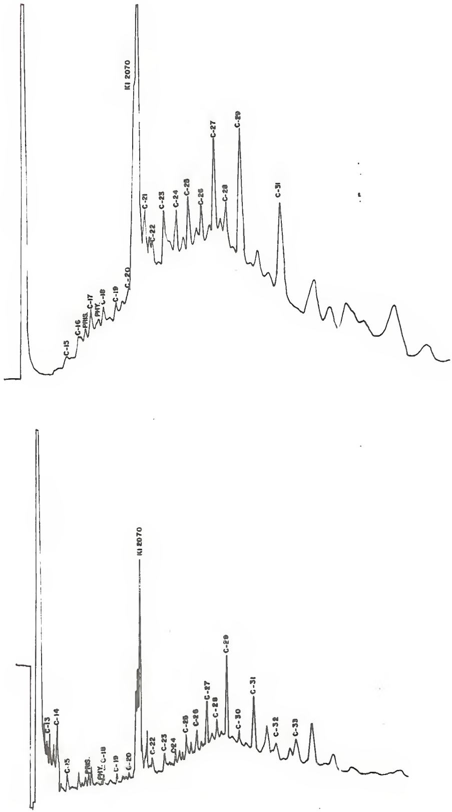

Figure 94. Aliphatic gas chromatograms (FFAP) of station 2645, aliphatics from summer (above) and winter (below), 1975 - 1976.

Table 77. Summary Tabulation of Hydrocarbon Analyses - Summer Benthic Epifauna.

Sample Number	Analysis Number	Organism	A	B	C	D	E	F	G
I-A-1 (A+B-4)	120	*Placospongia* sp.	3.71	0.08	10.9	2.31	0.72	8.2	1103.5
III-251-1 (A-9)	117	*Tethya* sp.	1.20	2.09	59.5	2.01	0.41	33.7	2104.1
III-A-1 (C-5)	122	*Tethya* sp.	0.14	0.02	6.16	1.03	0.68	24.9	2034.4
VI-B-1 (A-3)	132	unidentified sponge	1.74	0.02	2.07	1.34	0.83	14.5	331.4
V-A-3 (A-8)	138	unidentified sponge	1.56	0.08	1.42	1.21	0.65	5.8	352.4
I-B-2 (C-3)	121	unidentified sponge	1.64	0.06	4.65	1.28	0.28	21.3	756.3
III-A-2 (C-7)	123	unidentified sponge	1.64	0.33	1.70	3.02	1.86	8.9	484.0
III-047-3 (A-13)	103	*Madracis decactis*	1.19	0.28	2.57	1.19	0.73	343.9	20079.8
III-146-4 (B-10)	112	*Madracis decactis*	1.18	0.03	1.44	1.02	0.63	209.7	2556.7
III-247-4 (B-8)	116	*Madracis decactis*	1.14	0.01	0.79	1.28	0.68	248.6	2049.7
III-151-3 (A-18)	146	*Madracis decactis*	19.12	0.11	2.22	0.00	0.52	69.9	2086.7
III-251-3 (B-5)	148	*Madracis decactis*	3.82	0.14	1.94	0.00	0.62	134.7	1252.7
III-147-4 (A-13)	102	*Porites divaricata*	1.06	0.03	0.57	1.38	0.57	191.6	3053.7
III-047-2 (A-11)	109	*Porites divaricata*	1.44	0.05	0.82	1.57	0.60	66.5	1004.8
II-64-4 (C-7)	104	*Solenastrea hyades*	2.75	0.00	33.23	1.37	0.64	9089.4	7274.3
II-62-1 (A-11)	108	*Solenastrea hyades*	1.21	0.08	1.46	1.44	0.76	1820.5	10477.8
III-146-5 (B-24)	110	*Millepora alcicornis*	0.78	0.12	2.25	1.33	0.78	103.3	351.7
III-147-3 (A-12)	111	*Millepora alcicornis*	1.20	0.02	0.57	1.11	0.70	596.2	5173.9
III-151-2 (A-17)	145	*Millepora alcicornis*	1.47	0.06	1.72	0.89	0.45	1643.9	1793.7
III-247-2 (A-5)	147	*Millepora alcicornis*	0.81	1.22	2.68	13.98	4.28	757.0	1568.1
III-251-4 (B-6)	149	*Millepora alcicornis*	0.36	0.15	1.83	0.65	0.63	211.7	968.8
IV-B-1 (C-5)	125	*Clypeaster* sp.	1.94	0.17	6.80	1.70	0.89	10.7	78.0
II-064-3 (A-22)	100	*Luidia alternata*	1.44	0.03	1.18	1.52	0.17	5.6	560.4
II-062-2 (A-12)	101	*Arbacia punctulata*	1.64	0.04	2.03	1.43	0.55	10.7	387.4
IV-A-1 (A+B-4)	126	*Encope* sp.	1.75	0.04	1.77	0.86	0.51	1.9	778.2
VI-C-1 (C-4)	143	*Moira* sp.	1.95	0.01	1.00	1.78	0.71	27.4	26.4
VI-B-2 (A-4)	130	*Stylodaris affinis*	2.01	0.01	1.99	2.25	0.58	4.8	259.0
V-A-2 (A-2)	144	*Stylodaris affinis*	0.52	0.01	0.82	1.03	0.45	4.3	120.5
V-A-1 (A-1)	137	unidentified sea cucumber	1.48	0.19	2.66	1.97	1.15	6.5	586.2
III-146-6 (B-25)	99	*Astrophyton muricatum*	1.90	0.36	2.31	9.36	2.89	10.8	1171.3
III-047-7 (A-51)	107	*Astrophyton muricatum*	0.38	0.01	0.72	1.59	0.65	17.7	379.3
III-151-4 (A-33)	113	*Astrophyton muricatum*	1.87	0.04	0.57	1.86	0.76	50.9	466.4
III-251-5 (C-8)	155	*Astrophyton muricatum*	2.39	0.03	0.74	2.22	0.61	1.5	296.6
III-247-5 (B-9)	157	*Astrophyton muricatum*	2.81	0.01	0.63	1.99	0.65	2.2	1756.3
I-B-1 (B-3)	119	*Tropiometra* sp.	1.54	0.11	2.46	1.20	0.73	9.4	220.2

Table 77. Summer - continued.

Sample Number	Analysis Number	Organism	A	B	C	D	E	F	G
VI-C-3 (C-6)	133	*Loligo pealeii*	1.94	1.67	2.16	247.37	40.68	7.0	2425.4
V-B-3 (C-5)	140	*Loligo pealeii*	1.00	0.78	1.72	2.11	1.35	3.6	2466.5
V-B-1 (B-2)	156	*Mercenaria campechiensis*	1.82	0.04	1.58	1.89	0.55	12.9	929.4
VI-C-2 (C-5)	134	*Acanthocarpus alexandri*	1.94	0.44	1.96	2.30	1.24	4.8	1113.4
IV-C-1 (C-4)	135	*Acanthocarpus alexandri*	1.59	0.19	0.81	1.62	0.86	1.4	771.3
V-C-1 (C-3)	141	*Acanthocarpus alexandri*	1.93	0.18	1.56	0.73	1.00	5.2	838.9
IV-C-2 (C-5)	136	*Callidactylus asper*	1.31	0.02	0.24	2.18	1.08	6.6	1926.1
V-C-2 (C-4)	142	*Callidactylus asper*	1.52	0.01	1.17	0.90	0.68	5.9	2381.4
II-A-1 (C-5)	131	*Portunus gibberi*	2.57	0.42	2.59	1.56	1.43	6.7	430.5
II-B-1 (C-3)	124	*Portunus spinicarpus*	1.20	0.34	1.79	3.72	1.64	7.4	2054.9
IV-B-2 (C-6)	127	*Portunus spinicarpus*	1.96	0.47	2.86	1.64	2.00	9.4	587.5
VI-A-1 (A-4)	128	*Portunus spinicarpus*	1.47	0.84	3.65	0.00	2.07	51.4	10940.4
V-B-2 (C-4)	139	*Portunus spinicarpus*	1.81	0.54	2.45	4.55	2.15	8.6	592.2
VI-A-3 (C-3)	129	*Sicyiona brevirostris*	1.73	0.09	0.87	0.00	0.86	1.7	1031.4
III-047-5 (A-49)	98	*Stenorhynchus seticornis*	1.96	0.03	1.08	1.90	0.47	1.9	1648.9
III-146-3 (B-9)	105	*Stenorhynchus seticornis*	1.88	0.12	0.92	2.58	0.75	10.9	399.3
III-147-5 (C-5)	106	*Stenorhynchus seticornis*	1.81	0.03	1.24	2.02	0.59	7.3	1310.7
III-247-3 (A-6)	114	*Stenorhynchus seticornis*	1.48	0.03	0.85	1.53	0.60	3.8	758.5
III-151-5 (A-34)	115	*Stenorhynchus seticornis*	1.02	0.05	1.09	1.15	0.65	17.1	2191.2
III-251-2 (B-4)	118	*Stenorhynchus seticornis*	1.27	0.03	0.78	1.56	0.56	31.2	1597.6

A = odd/even ratio
B = isoprenoid/n-alkane ratio
C = branched/n-alkane ratio
D = pristane/phytane ratio
E = pristane/n-heptadecane ratio
F = total aliphatics; μgm/gm
G = total aromatics; μgm/gm

Table 77. Summary Tabulation of Hydrocarbon Analyses - Fall
Benthic Epifauna

Sample Number	Analysis Number	Organism	A	B	C	D	E'	F	G
I-A-A-5	186	*Haliclona viridis*	1.50	0.03	6.66	0.0	0.0	5.7	286.6
III-047-1	152	*Tethya* sp.	6.37	0.01	3.17	0.0	0.08	22.5	818.8
II-064-1	158	*Tethya* sp.	2.51	0.39	4.95	1.96	0.39	16.9	4649.8
III-146-1	161	*Tethya* sp.	7.65	0.03	9.15	0.0	0.15	18.7	1192.8
III-147-1	163	*Tethya* sp.	0.84	1.41	23.49	0.0	0.29	54.3	1036.4
III-151-1	167	*Tethya* sp.	1.61	1.99	22.5	0.0	0.40	5.4	1821.8
III-251-1	174	*Tethya* sp.						0.4	184.1
III-247-1	181	*Tethya* sp.	1.67	0.06	4.43	1.40	0.27	59.7	772.0
II-A-A-3	191	*Tethya* sp.	0.97	0.04	5.98	2.90	0.45	13.9	1173.7
III-151-3	206	*Verongia* sp.	4.89	0.58	211.8	0.0	0.35	13.7	272.7
III-147-3	207	*Verongia* sp.	2.92	0.09	9.65	1.54	0.33	7.4	523.4
I-B-A-6	188	unidentified sponge	2.36	0.06	8.79	2.29	0.69	44.6	184.7
II-B-C-6	192	unidentified sponge	1.25	0.23	1.85	1.90	0.97	2.1	290.5
III-B-C-9	193	unidentified sponge							140.3
V-A-A-7	194	unidentified sponge	2.79	0.0	3.14	0.0	0.07	1.1	148.8
VI-B-A-2	195	unidentified sponge	11.21	0.0	32.59	0.0	0.0	15.4	4180.8
III-247-2	184	*Madracis decactis*	4.74	0.02	6.63	0.0	0.15	259.4	1790.9
III-146-2	183	*Madracis decactis*	3.34	0.0	5.58	0.0	0.32	842.0	12792.4
III-A-3	198	*Madracis decactis*	1.48	0.17	2.57	0.44	0.0	16.8	111.8
III-047-2	175	*Porites divaricata*	1.22	0.18	3.69	1.73	0.55	77.3	8089.9
III-151-2	180	*Porites divaricata*	1.84	0.07	3.74	0.94	0.42	538.7	750.2
III-251-2	182	*Porites divaricata*	1.00	0.03	3.25	1.12	0.65	557.8	696.9
II-62-5	177	*Solenastrea hyades*	3.75	0.0	2.47	0.0	0.23	65.9	636.8
II-64-3	178	*Solenastrea hyades*	2.15	0.07	4.71	2.23	0.56	42.4	2570.6
II-A-2	196	*Solenastrea hyades*	1.07	0.07	1.34	0.0	0.0	41.9	1371.1
III-147-4	179	*Millepora alcicornis*	2.71	0.11	4.00	1.33	0.59	124.1	981.3
VI-A-A-3	216	*Astropectin* sp.	0.34	0.88	68.57	0.0	0.16	2.1	632.6
II-064-4	159	*Arbacia punctulata*	10.31	0.03	5.20	1.31	0.51	33.4	198.2
II-062-4	153	*Lytechinus variegatus*	1.96	0.05	4.22	1.72	0.44	5.4	213.7
V-A-A-5	210	*Stylodaris affinis*	3.34	0.04	0.98	2.03	0.39	1.1	80.2
I-C-C-5	190	unidentified soft urchin	1.36	0.35	2.57	9.49	3.39	23.2	1130.8
III-047-7	154	*Astrophyton muricatum*	2.00	0.28	3.25	0.0	0.0	8.05	718.0
III-146-7	162	*Astrophyton muricatum*	1.97	0.02	1.52	2.55	0.40	2.7	347.8
III-151-6	168	*Astrophyton muricatum*	3.07	0.42	10.51	0.0	0.0	49.6	936.0
III-247-7	172	*Astrophyton muricatum*	2.06	0.02	2.76	2.39	0.39	12.2	477.9
III-251-7	170	*Astrophyton muricatum*	1.31	0.18	2.28	5.56	1.35	1.6	208.3

Table 77. Fall - continued.

Sample Number	Analysis Number	Organism	A	B	C	D	E	F	G
III-B-A-2	200	*Astroporpa annulata*	0.59	0.01	1.77	1.95	0.40	11.3	483.6
VI-B-A-1	217	*Astroporpa annulata*	4.26	0.34	3.11	0.0	2.76	2.0	324.6
I-B-A-2	187	unidentified crinoids	1.79	0.30	6.36	2.29	0.79	1.3	238.0
V-B-C-9	212	*Loligo pealeii*	3.73	0.56	2.45	6.58	2.19	2.2	6474.0
V-C-C-2	214	*Loligo pealeii*							
III-C-C-7	201	*Loligo pealeii*	1.42	0.0	10.02	8.45	2.13	14.0	7746.1
IV-C-C-5	208	*Loligo pealeii*	1.30	0.30	0.76	4.25	1.27	6.5	3094.4
V-B-A-2	211	*Mercenaria campechiensis*	0.82	0.16	1.01	1.80	0.53	11.1	695.5
III-047-8	150	*Spondylus americanus*	2.64	0.03	6.12	0.0	0.0	6.1	266.2
IV-C-C-6	209	*Acanthocarpus alexandri*	10.4	0.23	1.85	3.19	1.39	1.6	3031.7
V-C-C-1	213	*Acanthocarpus alexandri*	1.5	0.33	2.79	2.70	1.99	2.8	776.2
I-C-C-1	189	*Calappa* sp.	1.73	0.41	2.26	4.50	1.59	10.1	4097.9
1-A-A-6	185	*Portunus spinicarpus*	0.90	1.48	5.05	8.19	2.43	2.6	1386.9
III-A-C-7	199	*Portunus spinicarpus*	3.26	0.46	3.42	25.4	0.0	2.2	902.6
III-C-C-8	202	*Portunus spinicarpus*	3.86	0.67	3.46	9.64	1.36	1.1	565.9
VI-A-A-2	215	*Portunus spinicarpus*	0.70	0.18	3.11	0.0	1.10	5.1	754.1
IV-B-A-1	204	*Portunus spinicarpus*	1.82	0.60	4.12	13.88	4.07	4.0	1590.8
IV-A-A-2	203	*Sicyiona brevirostris*	4.02	0.0	45.50	8.09	2.33	2.9	755.2
IV-B-C-7	205	*Sicyiona brevirostris*	1.88	0.04	17.90	2.60	0.62	1.9	463.6
III-047-6	151	*Stenorhynchus seticornis*	1.50	0.14	1.12	1.68	0.61	4.8	697.3
III-146-5	160	*Stenorhynchus seticornis*	0.97	0.26	2.53	3.57	1.23	4.5	352.7
III-147-5	166	*Stenorhynchus seticornis*	2.01	0.22	2.31	4.15	0.97	31.9	2094.6
III-151-7	169	*Stenorhynchus seticornis*	2.25	0.34	1.69	7.12	1.84	2.6	860.9
III-247-6	171	*Stenorhynchus seticornis*	2.58	0.16	1.48	46.57	0.60	4.1	1059.6
III-251-6	173	*Stenorhynchus seticornis*	2.03	0.16	0.82	2.85	0.70	3.1	493.8
II-C-C-5	197	unidentified shrimp	1.20	0.22	1.44	0.0	0.0	10.3	5158.0
VI-C-C-2	218	unidentified shrimp	19.18	0.93	8.66	1.97	1.44	1.0	729.6

A = odd/even ratio
B = isoprenoid/n-alkane ratio
C = branched/n-alkane ratio
D = pristane/phytane ratio
E = pristane/n-heptadecane ratio
F = total aliphatics; μgm/gm
G = total aromatics; μgm/gm

Table 77. Summary Tabulation of Hydrocarbon Analyses - Winter

Benthic Epifauna

Sample Number	Analysis Number	Organism	A	B	C	D	E	F	G
I-A-A-5	279	Haliclone rubens	0.86	0.87	2.39	1.42*	0.87*	6.3	196.9
064-A-1	300	Tethya sp.	5.48	0.01	2.62	0.88*	0.33*	16.9	297.3
I-A-A-4	280	Verongia longissima	3.83	0.01	2.09	1.82*	0.24*	5.3	772.7*
247-A-20	306	Trachygellius cinachyra	16.57	0.01	5.36	0.0 *	0.15*	19.7	305.4
147-A-15	307	Trachygellius cinachyra	12.81	0.01	3.06	0.0 *	0.10*	16.7	488.1
151-A-22	314	Trachygellius cinachyra	1.45	0.03	1.70	0.0 *	0.39*	12.6	290.8
247-A-7	299	Verongia sp.	3.02	0.01	2.68	1.08*	0.66*	10.0	314.6
VI-B-C-5	278	unidentified sponge	0.88	0.04	12.76	1.37*	1.12*	67.0	1159.4
V-A-A-2	277	unidentified sponge	8.67	0.01	1.12	0.0 *	0.09*	5.0	293.8
II-A-A-9	292	unidentified sponge	3.87	0.06	1.77	0.57*	0.53*	51.3*	1106.1
I-B-A-3	293	unidentified sponge	3.29	0.14	1.73	1.26*	0.49*	11.3*	317.2
III-A-C-10	312	unidentified sponge	5.79	0.12	0.55	0.0 *	0.37*	1.4	42.8
II-B-A-4	313	unidentified sponge	1.60*	0.38*	5.08*	4.31*	0.99*	2.0*	42.7
III-B-A-3	315	unidentified sponge	30.00	0.03	4.52	0.0 *	1.07*	1.3	169.3
062-A-3	309	Occulina diffusa	1.23	0.42	3.72	0.0 *	0.42*	13.5	225.7
147-A-18	334	Madracis decactis	1.69*	0.14*	9.70*	0.0 *	0.54*	48.0	783.9
III-A-C-9	327	Madracis decactis	1.30*	0.15*	2.47*	0.0 *	0.31*	1.5*	266.2
151-A-25	340	Madracis decactis	4.04	0.10	2.20	1.20*	0.61*	134.3	2140.1
146-A-22	357	Madracis decactis	2.58*	0.13*	5.22*	1.36*	0.40*	114.5	1166.2
251-A-6	358	Madracis decactis	0.84*	0.12*	21.87*	0.0 *	0.57*	200.8	2074.4
047-A-9	359	Madracis decactis	0.52*	0.07*	7.21*	0.0 *	0.56*	60.3*	2398.2
247-A-22	298	Madracis decactis	2.04	0.08	0.51	1.30*	0.31*	79.1*	546.2
247-A-25	316	Porites divaricata	1.34*	0.21*	3.05*	0.0 *	0.65*	9.3*	209.6
147-A-16	332	Porites divaricata	0.86*	0.06*	3.11	1.24*	0.57*	35.9*	86.1
151-A-24	339	Porites divaricata	0.47	0.51	1.31	1.10*	0.44*	6.7*	559.3
146-A-36	341	Porites divaricata	1.24*	0.16*	3.58*	1.64*	0.68*	10.9*	1052.8*
251-A-5	360	Porites divaricata	1.46	1.32	11.40	1.45*	0.74*	160.9*	1970.6
047-A-3	366	Porites divaricata	0.18	1.72	31.83	2.51*	0.75*	5.9	150.8
II-A-A-7	308	Solenastrea hyades	3.16	0.0	1.34	0.0 *	0.53*	15.2*	142.2
064-A-11	310	Solenastrea hyades	0.93	0.67	2.86	1.80*	0.53*	10.1	123.8
062-B-8	311	Solenastrea hyades	0.88*	1.74	4.88	1.29*	0.43*	6.4*	65.4
247-A-24	317	Millepora alcicornis	30.97	0.13	0.64	0.0 *	0.61*	10.6*	346.2
147-A-17	333	Millepora alcicornis	8.45	0.01	1.59	1.49*	0.69*	26.5*	129.0
151-A-26	326	Millepora alcicornis	0.37	0.01	2.63	0.57*	0.57*	55.1	445.1
146-A-21	361	Millepora alcicornis	0.72*	0.16*	11.17*	0.0 *	0.52*	38.4*	890.7

Table 77. Winter - continued.

Sample Number	Analysis Number	Organism	A	B	C	D	E	F	G
047-A-6	369	Millepora alcicornis	2.78	0.11	5.12	2.28*	0.82*	5.8*	98.6
IV-A-A-1	350	Astropecten nitidus	4.47	1.68	10.69	3.93*	0.75*	0.6*	109.6
I-C-A-2	301	Astropecten sp.	0.39	0.55	35.79	0.0 *	0.67*	13.1	117.4
IV-B-A-2	318	Clypeaster raveneli	0.87	0.31	2.21	0.0 *	1.06*	2.7*	31.4
II-B-A-2	349	Clypeaster raveneli	0.34*	0.07*	1.30*	0.0 *	0.62*	0.2*	177.8
VI-A-A-3	294	Clypeaster sp.	1.94	0.17	2.10	1.64*	1.00*	7.3*	63.2
IV-A-A-2	325	Encope michelini	6.34	0.01	2.78	0.78*	0.64*	11.8	22.9*
II-A-A-8	271	Lytechinus variegatus							54.6*
062-A-7	272	Lytechinus variegatus							150.4*
062-A-7	273A	Lytechinus variegatus	0.0	1.66	3.08	0.0 *	0.0 *	0.2	8.0*
062-A-7	273B	Lytechinus variegatus	1.54	0.17	3.69	2.67*	0.55*	0.6	8.7
062-A-7	273C	Lytechinus variegatus	1.00	0.78	1.16	2.66*	0.50*	1.7*	8.6
062-A-7	370	Lytechinus variegatus							
V-A-A-3	274	Stylocidaris affinis	5.60	0.01	3.74	2.94*	0.49*	5.0	42.5
VI-B-C-4	290	Stylocidaris affinis	6.01	0.01	2.78	1.90*	0.91*	15.9	108.3
I-C-A-1	324	unidentified urchin	13.65	0.50	4.17	6.05*	2.50*	18.2	1034.8
VI-C-C-5	288	unidentified urchin	3.68	0.01	2.01	2.34*	0.94*	12.5	162.5
VI-C-C-6	289	unidentified urchin	2.44	0.01	3.96	1.87*	0.0 *	8.0	67.3
146-A-34	348	Astrophyton muricatum	1.39	0.44	1.67	1.28*	0.80*	6.9*	636.4
V-B-A-2	275	Astroporpa annulata	3.15	0.88	3.55	16.07*	5.92*	2.0	56.7
III-B-A-8	291	Astroporpa annulata	1.82	1.12	5.11	0.0 *	0.0 *	4.0	753.3
VI-B-C-3	346	Astroporpa annulata	0.55	0.39	2.82	6.41*	1.33*	1.7	270.4
I-B-A-3	319	Comactina echinoptera	14.61	0.01	1.25	0.0 *	1.01*	19.3	122.6
IV-C-C-2	322	Loligo pealeii	17.86	0.01	0.96	39.4*	9.4 *	13.4*	4011.6*
II-C-A-3	323	Murex beauii	23.98	0.03	1.30	1.85*	0.77*	129.8*	713.2
247-A-33	295	Spondylus americanus	3.41	0.01	13.49	0.0 *	0.41*	16.8	814.5*
147-A-19	296	Spondylus americanus	1.87	0.01	5.41	0.0 *	0.36*	15.9	253.7
151-A-28	297	Spondylus americanus	7.78	0.01	2.29	0.0 *	0.57*	11.6	485.2
047-A-33	351	Spondylus americanus	4.72	0.01	5.29	0.0 *	0.24*	12.0*	1169.7*
146-A-28	352	Spondylus americanus	9.80	0.01	2.69	2.00*	0.12*	7.0	1302.4*
III-C-A-1	321	Acanthocarpus alexandri	1.43*	0.18*	1.46*	4.12*	1.08*	0.8*	225.5
II-C-A-4	347	Hymenopenaeus tropicalis	0.85*	0.28*	1.50*	4.53*	1.12*	3.4*	763.3
IV-B-A-3	320	Portunis spinicarpus	2.08	0.11	8.78	0.0 *	4.03*	3.15	427.3

* FFAP column data; A = odd/even ratio; B = isoprenoid/n-alkane ratio; C = branched/n-alkane ratio; D = pristane/phytane ratio; E = pristane/n-heptadecane ratio; F = total aliphatics, μg/g; G = total aromatics, μg/g

be identified by retention indices, but no unsaturated hydrocarbons were identified.

For the June-July period, the carbon preference index (CPI), or odd-to-even ratio of n-alkanes, for all 55 samples ranged from 0.14 to 19.12 and averaged 1.93±2.46. For the seven samples of Porifera, the mean was 1.66±1.06, and for the 14 Cnidaria it was 2.68±4.81. The 14 Echinodermata average 1.69±0.64, and the three Mollusca 1.59±0.51. The mean CPI for the 17 Arthropoda was 2.12±1.81. All the animals contained pristane, and over 90% contained phytane. The pristane/phytane ratio was usually between one and three, although it reached a high of 247 in a squid (Loligo pealeii) whose aliphatic hydrocarbon content was more than 50% pristane. The ratio of total branched hydrocarbons to total n-alkanes was commonly between one and three, indicating that n-alkanes did not dominate hydrocarbon composition. Concentrations of aliphatic hydrocarbons were usually between three and ten micrograms per gram dry weight of organism. Unsaturated hydrocarbon concentrations were ten to 100 times larger.

The CPI of the 64 samples collected in the September-October period averaged 2.98±3.15. The 16 Porifera had an average CPI of 3.47±3.03, while the average of the ten Cnidaria was 2.33±1.27. For the 13 samples of Echinodermata, 2.64±2.54 was the mean, and it was 1.98±1.19 for the six Mollusca. The mean of the 18 Arthropoda was 3.43±4.50. Only 85% of the animals contained pristane, and slightly less than 70% contained phytane. Squid again had high pristane levels. As in the first period, n-alkanes did not dominate the aliphatic hydrocarbon fractions of these organisms. Branched-to-n-alkane ratios generally were between two and six. Total aliphatic hydrocarbon concentrations were usually between two and 50 micrograms per gram dry weight, and the total unsaturates some ten to 100 times higher.

The CPI value of the 64 samples collected in the February-March period ranged from 0.18 to 30.97, with a mean of 4.84. For the 14 samples of Porifera, the mean was 7.01±8.06. For the 22 Cnidaria, it was 3.09±6.48. The 18 samples of echinoderms averaged 3.88, with a standard deviation of 4.20. The seven molluscs averaged 9.92±8.16, and the three arthropods 1.45±0.62. All but two of these samples contained pristane; this was usually at concentrations lower than those of n-heptadecane. In 24 of the samples having pristane, no phytane was present. Of these related isoprenoid hydrocarbons, pristane was usually dominant. The pristane/phytane ratio was normally between one and three, although it reached a high of 39.4 in a sample of the squid Loligo pealeii. The hydrocarbon compositions of most of these animals was not dominated by n-alkanes; the ratio of saturated branched hydrocarbons to n-alkanes was usually between two to five. Total saturated hydrocarbon concentrations ranged from 0.2 to 200.8 μg/g of dry tissue, and concentrations of unsaturated hydrocarbons were usually one to two orders of magnitude greater.

Algae

Algae were collected during the summer, fall and winter and analyzed for hydrocarbons. Fifteen of the 36 samples examined indicated the presence, to a greater or lesser degree, of petroleum hydrocarbons. Table 78 gives the results and provides confirming evidence of this pollution. All samples not designated as "polluted" had a very simple

Table 78. Benthic algae 1975-1976. Chromatographic parameters.

	Sample Number	Location	Species	ppm Dry weight hydrocarbons Aliphatics	Aromatics	n-Alkanes
PERIOD 1						
Transect I	IA-A+B-6	26°25.5'N, 82°59.5'W	*Halimeda* sp.	3.8	1.0	2.5
	IA-A+B-7	26 25.5'N, 82°59.5'W	*Rhodymenia* sp.	34.6	11.3	29.5
	IA-A+B-8	26°25.5'N, 82°59.5'W	*Cystodictyon pavonium*	68	8.7	35
Transect II	IIA-A+B-1	27°50'N, 83°31'W	*Laurencia corallopsis*, *Gracilaria cylindrica* + *blodgettii*	38	12	25
	IIA-A+B-2	27°50'N, 83°31'W	*Gracilaria mammilaris*	171	8	129
	IIA-A+B-3	27°50'N, 83°31'W	*Eucheuma* sp.	50	7	19
	062-A-17	27°49'N, 55°90'W	*Caulerpa sertularoides*	153	11.5	95
Transect III	IIIA-A+B-2		*Codium* sp.	20.8	1.1	16.1
	047-A-3	28°34'N, 84°20'12"W	*Codium repens*	50.5	1.1	38.7
	047-A-5	28°34'N, 84°20'12"W	*Halimeda discoidea*	96.2	6.7	83.5
	146-B-1	28°41'N, 84°24'W	*Kallymenia perforata* + *Dictyota dichotoma*	143	14.0	133
	147-B-5	28°40'N, 84°13'W	*Halimeda discoidea*	71.6	11.6	61.7
	247-A-2	28°36'16"N, 84°15'40"W	*Codium repens*	44	5	38
	251-B-25	28°33'N, 84°16'W	*Halimeda discoidea*	31.0	4.3	26.1
PERIOD 2						
Transect II	IIA-A-12	27°50'N, 83°31'W	*Halymenia* sp.	42.8	5.7	40.4
	062-A-5	27°49'55"N, 83°31'10"W	*Caulerpa sertularoides*	30.6	11.5	19.7
	064-A-3	27°50'N, 83°25'W	*Gracilaria blodgetti* + *compressa*	61.1	13.6	56.4
	064-B-3	27°50'N, 83°25'W	*Gracilaria blodgetti*	66.5	0.9	63.8

Table 78. Continued.

	Sample Number	Location	Species	ppm Dry weight hydrocarbons Aliphatics	Aromatics	n-Alkanes
PERIOD 2 contd.						
Transect III	IIIA-A-10	28°29'N,84°21'W	Caulerpa sp.	854	25.5	42
	047-A-5	28°34'N, 84°20'12"W	Halimeda discoidea	79.8	10.4	49.1
	146-B-14	28°41'N, 84°23'40"W	Dictyota dichotoma	327.	137	220
	147-A-2	28°38'18"N, 84°13'54"W	Halimeda discoidea	22	4	19
	151-A-3	28°32'07"N, 84°18'24"W	Laurencia intricata	20	50	15
	247-A-4	28°36'16"N, 84°15'40"W	Codium repens	92.2	10.1	74.9
	251-A-3	28°32'40"N, 84°16'03"W	Halimeda discoidea	39.2	2.5	25.7
Transect IV	IVA-A-6	29°04'N, 85°14'W	Codium sp.	33.0	2.6	16.7
Transect V	VA-A-12	29°50'N, 86°05.5'W	Pryssonnelia rubra	6.5	3.0	5.3
PERIOD 3						
Transect II	IIA-A-17	27°50'N, 83°31'W	Codium sp.	4.2	5.3	3.1
	062-A-1	27°49'55"N, 83°31'10"W	Codium isthmocladium	4.4	3.3	3.4
	064-A-9	27°50'N, 83°25'W	Eucheuma isiforme	35.9	2.7	34.0
Transect III	047-A-25	28°34'N, 84°20'12"W	Codium caroliniarum	30.5	3.5	18.4
	146-A-1	28°41'N, 84°23'40"W	Codium caroliniarum	80.4	10.3	47.4
	147-A-2	28°38'18"N, 84°13'54"W	Halimeda discoidea	38.8	9.3	23.8
	151-A-1	28°32'07"N, 84°18'24"W	Codium caroliniarum	66.9	6.3	57.0
	247-A-27	28°36'16"N, 84°15'40"W	Codium caroliniarum	40.9	3.1	23.5
	251-A-10	28°32'40"N, 84°16'03"W	Codium caroliniarum	28.5	1.3	24.3

aliphatic hydrocarbon distribution dominated by the suite of n-alkanes from C_{15} to C_{23}. In this range C_{17} typically constituted the majority of the n-alkanes. Also present in many of the specimens was a series of n-alkenes of odd-carbon number. In some cases a series of n-alkanes from C_{20}-C_{33} with no odd/even preference occurred with little additional evidence of pollution. The 15 samples designated as polluted contained this series superimposed on a large unresolved envelope. This was considered a sufficient evidence of petroleum pollution.

There were no discernible trends of pollution, i.e., pollution as a function of species, depth, proximity to polluted sediments or season of collection. The pollution seemed to be of random occurrence. The winter collection of algae did not clarify the condition noted in earlier collections. About all that can be said for algal hydrocarbons is that they reflect in a sensitive manner petroleum pollution but at a very localized level.

Looking at pollution along the various sampling transects it can be seen that two of the three algae from Transect I off Fort Myers showed a very slight degree of pollution though in neither of these was pristane and phytane detectable.

All of the Transect II algal samples displayed signs of pollution in the summer; three out of four, in the fall; and none in the winter. Only *Caulerpa sertularoides* was collected in more than one period and then not at the same location so conclusions based upon this seeming decline are, for the moment, at best speculative.

The percentage of samples from Transect III that demonstrates at least some degree of pollution remained about the same in all three sampling periods. Again only two species were sampled twice. In one instance, Codium repens from the first period showed no pollution but in the second period was clearly polluted. The Halimeda discoidea from all three periods showed no signs of pollution.

Transects IV and V were sampled only during the fall to yield one specimen each, neither of which contained abundant evidence of pollution.

Blumer and Thomas (1965) have suggested that phytadienes present in some zooplankton are genuine but that they may occur as artifacts from any number of laboratory procedures commonly associated with hydrocarbon analysis. Since their precursor is assumed to be phytol, their creation by saponification and/or adsorption chromatography would seem feasible in algal extracts. Blumer and Thomas (1965) report that the four phytadienes elute from the gas chromatograph (Carbowax column) between K.I. 1900 and 2000 and can be hydrogenated to phytane. This provided the clue to the identification of phytadienes in the benthic algae. These results are similar to those given by the Carbowax column.

A series of four peaks between ca. K.I. 1900 and 2000 occurred in many algal samples as can be seen in Table 79. Two of these samples were chosen to verify the natural occurrence of phytadienes in benthic algae. The samples were a Caulerpa sp. and a Eucheuma sp. The alipahtics and untreated lipid extracts were analyzed before and after hydrogenation with Adam's catalyst and yielded chromatograms shown in Figures 95a and b.

Additional identification of the phytadienes was provided by subjecting

Table 79. Benthic algae 1975-1976. Chromatographic parameters.

Sample Number	Series of HMW n-alkanes, CPI 1	Unidentified series, K.I. 1712, 2117, 2320, 2524	Phytadienes 1928, 1957, 1984, 2011	Sample Polluted?
IA-A+B-6	No.	No.	No.	No.
IA-A+B-7	Yes, 1/12 of n-C_{17}	No.	Yes, 2 ppm	Slightly?
IA-A+B-8	Yes, 1/9 of n-C_{17}	No.	Yes, 1.3 ppm.	Slightly?
IIA-A+B-1	Yes, 1/5 of n-C_{17}	No.	Yes, 8.5 ppm.	Definitely.
IIA-A+B-2	Yes, 1/10 of n-C_{17}	No.	Yes, 22.9 ppm.	Yes.
IIA-A+B-3	Yes, 1/15 of n-C_{17}	No.	Yes, 29 ppm.	Slightly?
062-A-17	Yes, 1/9 of n-C_{17}	Yes.	No.	Yes.
IIIA-A+B-2	Yes, 1/7 of n-C_{17}	Yes.	No.	Perhaps, slightly.
047-A-3	No.	No.	No.	No.
047-A-5	No.	Yes.	No.	No.
146-B-1	Yes, 1/25 of n-C_{17}	No.	No.	Slightly?
147-B-5	Yes, 1 1/7 of n-C_{17}	No.	No.	Yes, definitely.
247-A-2	Yes, 1/50 of n-C_{17}	No.	Yes, 3.0 ppm.	No.
251-B-25	No.	Yes.	Yes, 1.5 ppm.	No.
IIA-A-12	Yes, 1/8 of n-C_{17}	No.	No.	Yes.
062-A-5	No.	Yes.	No.	No.
064-A-3	Yes, 1/7 of n-C_{17}	No.	No.	Slightly?
064-B-3	Yes, 1/50 of n-C_{17}	No.	Yes, 2 ppm.	Slightly?
IIIA-A-10	Yes, 3/4 of n-C_{17}	Yes.	Yes, 740. ppm.	Possibly.
047-A-5	No.	Yes.	Yes, 22.9 ppm.	No.
146-B-14	No.	No.	No.	No comment - peak at 2064; (FFAP) = 72 ppm.
147-A-2	No.	Yes.	No.	No.
151-A-3	No.	No.	No.	No.
247-A-4	Yes, 1/16 of n-C_{17}	No.	Yes, 2.6 ppm.	Very definitely. (Lots of HMW unresolved material.)
251-A-3	No.	Yes.	No.	No.

Table 79. Continued.

Sample Number	Series of HMW n-alkanes, CPI 1	Unidentified series, K.I. 1712, 2117, 2320, 2524	Phytadienes 1928, 1957, 1984, 2011	Sample Polluted?
IVA-A-6	Yes, 1/16 of n-C_{17}	No.	Yes, 14.5 ppm.	Slightly?
V-A-A-12	No.	No.	No.	No.
IIA-A-17	Yes, 1/10 of n-C_{17}	No.	No.	No.
062-A-1	No.	No.	Yes, 0.5 ppm.	No.
064-A-9	No.	No.	Yes, 0.3 ppm.	No.
047-A-25	No.	No.	Yes, 10 ppm.	No.
146-A-1	Yes (hard to measure)	No.	Yes, 5 ppm.	Yes definitely. (Lots of HMW unresolved material.)
147-A-2	No.	Yes.	No.	No.
151-A-1	No.	No.	Yes, 3 ppm.	No.
247-A-27	Yes, 1/12 of n-C_{17}	No.	Yes, 2.5 ppm.	Yes definitely. (Lots of HMW unresolved material.)
251-A-10	No.	No.	Yes, 1.8 ppm.	No.

Table 79. Continued.

Sample Number	Pris+Phy/ $\underline{n}$-alkane	Pris/ $\underline{n}$-C_{17}	Phy/ $\underline{n}$-C_{18}	Pris/ Phy	$\underline{n}$-Alk/ $\underline{n}$-C_{16}	% $\underline{n}$-Alk/ aliph	Odd/ Even	C_{10}-C_{20} Odd/Even	C_{21}-C_{31} Odd/Even	C_{12}-C_{20}/ C_{21}-C_{31}
IA-A+B-6	0.008	0.011	0.0		247.	64.3	11.3	26.2	3.0	10.9
IA-A+B-7	0.002	0.0	0.0	-	630.	85.3	120.	150.	1.0	50.8
IA-A+B-8	0.0	0.0	0.0	-	173.	52.0	-	-	0.9	15.0
IIA-A+B-1	0.017	0.005	2.5	0.3	167.	66.0	10.0	44.0	1.0	7.9
IIA-A+B-2	0.012	0.005	1.4	0.6	142.	76.0	-	-	0.9	11.5
IIA-A+B-3	0.005	0.003	0.5	1.1	351.	38.2	23.7	106.0	0.9	19.2
062-A-17	0.001	0.003	0.0	-		61.7	15.5	19.5	2.0	37.2
IIIA-A+B-2	0.009	0.010	0.0		434.	77.5	6.6	9.8	1.4	19.8
047-A-3	0.002	0.002	0.0		690.	76.8	35.8	39.1	3.0	105.0
047-A-5	0.004	0.003	0.6	0.8	1170.	86.9	29.9	85.9	5.5	9.6
146-B-1	0.0	0.002	0.0	-		92.7			1.5	107.0
147-B-5	0.003	0.004	0.7	0.9	1150.	86.2	5.0	78.0	1.4	3.0
247-A-2	0.006	0.001	0.5	0.2	412.	85.9	44.5	73.0	0.8	103.0
251-B-25	0.001	0.002	0.0	-	880.	84.2	62.0	73.0	5.8	16.3
IIA-A-12	0.005	0.003	0.8	1.4	860.	94.2	52.0	60.0	1.0	16.5
062-A-5	0.0	0.0	0.0	-		64.4	55.0	63.5	2.8	14.4
064-A-3	0.006	0.003	0.0	1.0	400.	92.3	41.0	46.3	1.6	13.7
064-B-3	0.002	0.002	0.0		805.	98.1	62.2	156.0	0.5	84.3
IIIA-A-10	0.031	0.040	0.2	1.8	53.5	5.1	3.2	7.4	1.1	4.2
047-A-5	0.001	0.001	0.0	-		61.6	9.8	11.9	7.1	12.2
146-B-14	0.002	0.101	0.0	-		67.1	245.0	262.0	0.8	103.0
147-A-2	0.004	0.004	-	-	4300.	86.1	35.7	78.1	7.4	10.5

Table 79. Continued.

Sample Number	Pris+Phy/ n-alkane	Pris/ n-C_{17}	Phy/ n-C_{18}	Pris/ Phy	n-Alk/ n-C_{16}	% n-Alk/ aliph	Odd/ Even	C_{10}-C_{20} Odd/Even	C_{21}-C_{31} Odd/Even	C_{12}-C_{20}/ C_{21}-C_{31}
151-A-3	0.0	0.0	0.0	-	460.	68.1	72.0	72.0	-	32.4
247-A-4	0.004	0.002	0.0	0.45	560.	83.0	61.0	67.2	1.3	21.5
251-A-3	0.002	0.003	-	-	1090	65.0	10.9	81.2	-	7.5
IVA-A-6	0.003	0.004	0.0		2880.	51.8	21.0	40.2	1.5	50.0
VA-A-12	0.014	0.017	0.0		171.	81.8	14.9	28.0	1.3	18.4
IIA-A-17	0.014	0.017	-	-	201.	73.7	11.9	21.5	2.4	13.9
062-A-1	0.020	0.014	0.4	1.4	278.	77.0	17.4	36.3	1.3	16.2
064-A-9	-	-	-	-	1000.	94.0	-	-	-	v. large
047-A-25	0.002	0.002	0.0		630.	60.2	44.9	41.8	1.7	74.0
146-A-1	0.002	0.002	0.0	-	590.	59.0	-	45.9	-	28.4
147-A-2	0.003	0.004	0.0		571.	61.2	23.9	61.1	4.7	7.8
151-A-1	0.001	0.001	0.0		750.	85.0	45.4	60.7	0.5	52.7
247-A-27	0.007	0.005	0.3	1.4	338.	57.6	23.7	51.3	0.9	12.6
251-A-10	0.001	0.002	0.0	-	760.	85.0	50.0	75.0	2.4	44.0

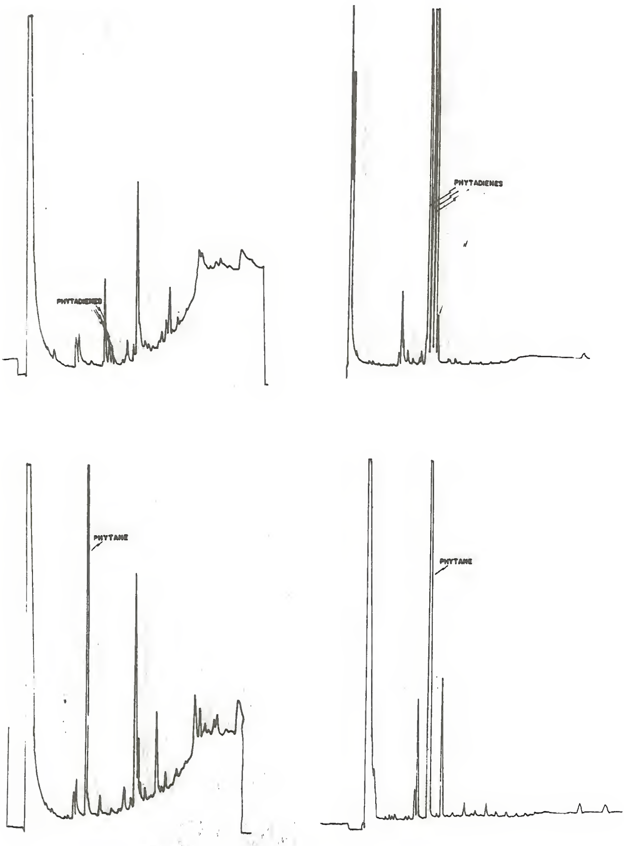

Figure 95a. Phytdienes in Algae. The FFAP gas chromatograms are of lipids before hydrogenation (upper left), after hydrogenation (lower left), aliphatics before hydrogenation (upper right), and after hydrogenation (lower right) taken from <u>Caulerpa</u> sp.

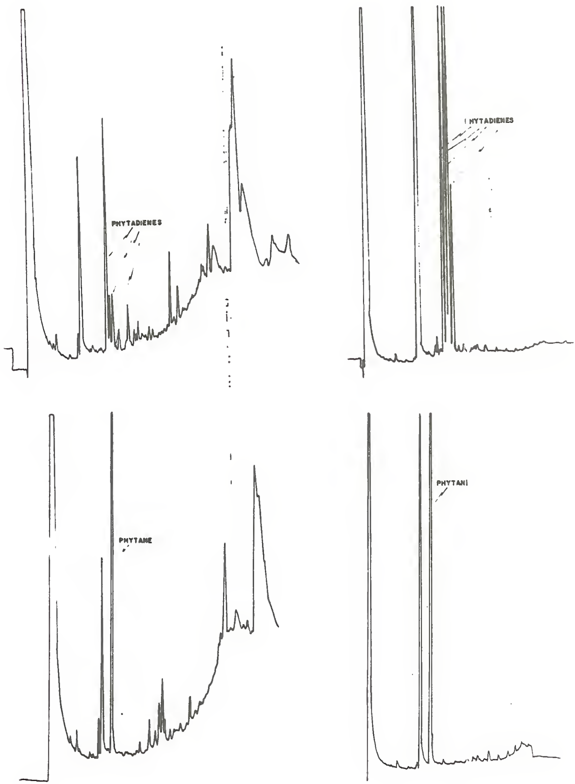

Figure 95b. Phytadienes in Algae. The FFAP gas chromatograms are of lipids before hydrogenation (upper left), after hydrogenation (lower left), aliphatics before hydrogenation (upper right), and after hydrogenation (lower right) taken from *Euchema* sp.

pure phytol to Activity I alumina and silica gel chromatography. Four peaks between K.I. 1900 and 2000 resulted in the hexane and benzene fractions. The total weight ratios were ca. 30 (total phytadienes/phytol), a negligible amount when considering the amount of chlorophyll in algae. The K.I.'s however correspond exactly to those found in the algae. The quantitative results of this experiment are shown in Table 80 and clearly demonstrate that phytadienes do occur in algae and that phytol degradation during the laboratory analysis produced only very small, if any, amounts of phytadienes. Their presence in both polluted and non-polluted algae suggests that they are biosynthesized by certain algae and not by others.

Phytadienes were present in all Codium spp. collected. No great differences were noted in the overall characteristics of these specimens. C_{17} was the major n-alkane with lesser amounts of C_{15} and pristane. Analytical results for three of the Codium spp. suggest weathered oil pollution.

Phytadienes occurred only in the unidentified species of Caulerpa. All three, however, contained a homologous series of aliphatics just following C_{19}, C_{21}, C_{23} and C_{25} which were abundant in themselves. C_{17} was still the major peak.

The C_{17} peak was also the most abundant component of the Gracilaria spp. All four samples had phytadienes and contained a series of HMW n-alkanes with no odd/even preference.

Halimeda sp., as in the Caulerpa samples, also contained the homologous series of compounds following the odd-C-n-alkanes. Large components between K.I. 1900 and 2000 showed up in all samples and in certain instances were identified as phytadienes. The order of abundance was $C_{17}>C_{19}>C_{23}>C_{25}=C_{15}=C_{21}$.

Table 80. Phytadienes in algal extracts.

Sample	Total μg of phytadienes[1]	Total μg of phytane after hydrogenation
Caulerpa sp.		
IIIA-A-10 lipid[2]	74	208
IIIA-A-10 aliphatics[2]	288	301
Eucheuma sp.		
IIA-A+B-3 lipid[2]	193	247
IIA-A+B-3 aliphatics[2]	136	96
Phytol treated with		
alumina-silica gel[3]	22	12.6

1. Phytadienes are the four compounds with K.I. *ca*. 1921, 1949, 1977 and 2001.

2. Weights were calculated to represent the same initial weight of alga.

3. Phytol treated was 50X greater than would normally be found in the weight of algae analyzed for this experiment.

Hydrocarbons in the Eucheuma sp. were relatively simple compared to Caulerpa and Halimeda. Both samples of the organism contained phytadienes and had C_{17} as the major constituent.

Neither of the Dictyota sp. sampled contained the phytadienes and C_{15} was the dominant aliphatic hydrocarbon.

Biology

Infauna

Adenosine Triphosphate (ATP)

A total of 128 mean ATP concentrations, taken during the three sampling periods, were recorded for the 45 box coring stations lying along the six benthic transects located in the MAFLA study area. Table 81 presents the ATP data on a transect, station and seasonal basis. Mean ATP levels varied greatly within transects, among transects and among sampling periods and ranged from a low of 25 ng/g of wet sediment to a high of 2019 ng/g of wet sediment. Over 70% of the values were present in the range of 100 to 700 ng/g of wet sediment.

ATP concentrations for any given transect at any given sampling period were usually lowest at the outermost stations and highest at the innermost stations. With few exceptions Transects I-V showed patterns of decreasing ATP levels with increasing distance from shore. Transect VI did not follow this trend and yielded high ATP levels at several of the offshore stations. Five of the nine highest ATP levels measured in this study occurred at the four outermost stations of Transect VI. Reference to Table 82 shows that averaged ATP levels of Transects IV-VI were considerably higher than those of Transects I-III for all sampling periods. Transect II

Table 81. Mean Adenosine Triphosphate Concentrations (ng/g of Wet Sediment) for the 45 Boxcore Stations

Station Number*	$\overline{X}$ ATP Concentrations (ng/g)		
	Summer	Fall	Winter/Spring
2101	548	363	219
2102	1,146	269	204
2103	316	318	63
2104	404	563	260
2105	85	137	181
2106	79	63	-*
2207	208	536	114
2208	31	54	54
2209	80	166	120
2210	-**	512	-*
2211	216	718	68
2212	127	208	-*
2313	120	173	89
2314	-**	-*	42
2315	-**	241	25
2316	309	552	241
2317	196	319	187
2318	413	696	382
2419	1,020	999	581
2420	740	494	565
2421	210	474	111
2422	270	535	579
2423	645	508	308
2424	1,791	680	415
2425	627	519	921
2426	102	311	548
2427	97	82	94
2528	390	312	529
2529	350	343	394
2530	1,237	458	552
2531	478	547	325
2532	319	145	337
2533	647	403	309
2534	546	614	136
2535	201	131	246
2536	137	170	177

Table 81. Continued.

Station Number*	$\bar{X}$ ATP Concentrations (ng/g)		
	Summer	Fall	Winter/Spring
2637	326	735	659
2638	617	928	574
2639	466	595	509
2640	1,114	555	991
2641	576	440	598
2642	1,006	611	2,019
2643	1,106	389	1,000
2644	590	392	337
2645	902	210	35

* The first 2 digits are the Transect Number.
** No ATP data; boxcore samples not taken.

had the lowest averaged ATP levels while Transect VI had the highest.

Table 82. Averaged ATP concentrations (ng/g of wet sediment) for each of the six transects for each of the three sampling periods.

Transect Number	$\bar{X}$ ATP concentrations (ng/g)		
	Summer	Fall	Winter/Spring
I	430	285	185
II	132	366	89
III	259	396	161
IV	611	511	469
V	478	347	334
VI	745	539	747

Evidence for patterns of seasonality were apparent only on Transects I and III. The majority of stations along both of these transects had the lowest ATP levels during the winter sampling period. Less than half of the stations along the other transects had minimal ATP levels in winter. Maximal ATP levels along Transects II and III occurred during the fall sampling period, while Transects I, IV and V had maximal ATP levels during the summer sampling period. Transect VI had maximal ATP levels during the summer and winter sampling periods; five of nine highest ATP levels recorded in the study occurred along Transect VI during summer (3) or winter (2). Reference to Table 82 shows that the averaged ATP levels were lowest in winter for Transects I-V and highest in summer and winter for Transect VI.

ATP levels showed significant relationships with sediment grain size for all transects for at least one sampling period. Data pairs for Transects I-IV lay in the same plane and these were considered together. Data pairs for Transects V and VI lay in different planes and were considered separately. The results of these correlation/regression analyses are presented in Figures 96a-e. Not all data pairs (stations), after hand plotting, adhered to the hypothesized ATP-sediment grain size relationship, and those deviating greatly from a straight line plot were not used in the computations of the correlation coefficients and regression lines. Thus, the results are biased and should be considered accordingly. Also, even though the results are graphically presented as regression lines (ATP regressed on sediment grain size), a direct cause and effect can not be assumed.

ATP levels of Transects I-IV combined were significantly and positively correlated with sediment grain size for the summer and fall sampling periods. This relationship also held for Transects II-IV in the winter sampling period but not for Transect I. Transects V and VI showed significant ATP-sediment grain size relationships for the fall sampling period only. The Transect V correlation was positive and the Transect VI correlation was negative. Thus, ATP levels along Transects I-V show a tendency to increase as sediment grain size increases while the ATP levels of Transect VI showed the reverse tendency.

Correlation/regression analyses were also computed to determine the relationship between the ATP and organic carbon for the summer sampling period (only sampling period in which complete organic carbon data were available). The statistical methodology is the same as the ATP-sediment grain size analyses and should be viewed accordingly. The results (Figures 97a and 97b) show that ATP levels for Transects I-IV combined and Transect VI increase as organic carbon decreases. The Transect VI regression is vertically displaced upwards from the Transects I-IV regression line.

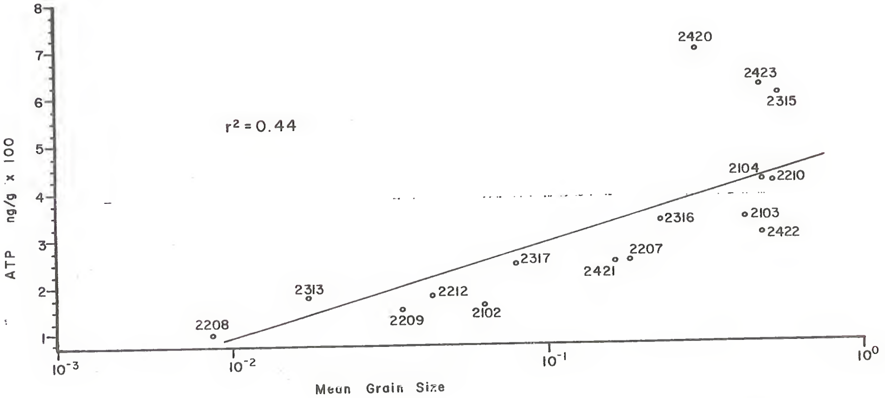

Figure 96a. ATP/mean grain size relationships for box core transects I-IV (summer, 1975). Data pairs used to generate regression line are plotted by stations.

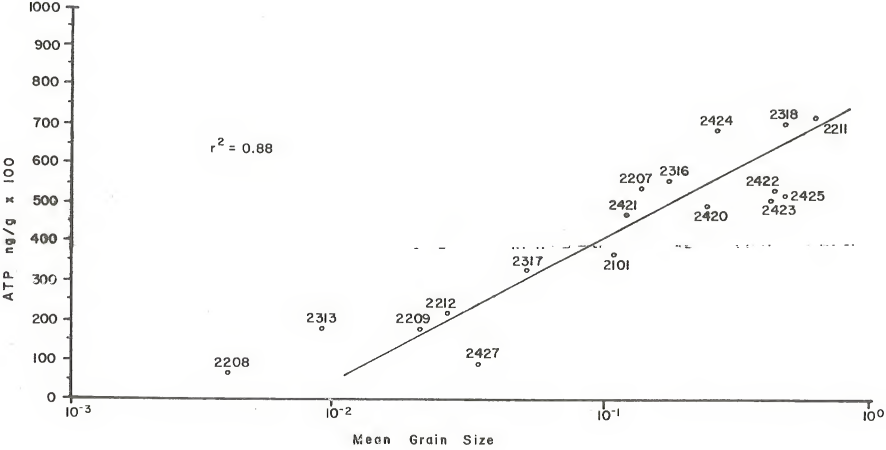

Figure 96b. ATP/mean grain size relationships for box core transects I-IV (fall, 1975). Data pairs used to generate regression line are plotted by stations.

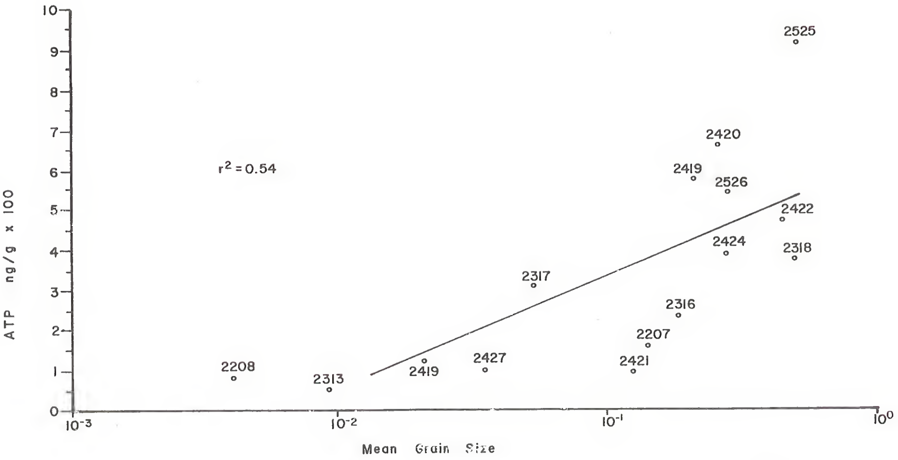

Figure 96c. ATP/mean grain size relationships for box core transects II-IV (winter, 1976). Data pairs used to generate regression line are plotted by stations.

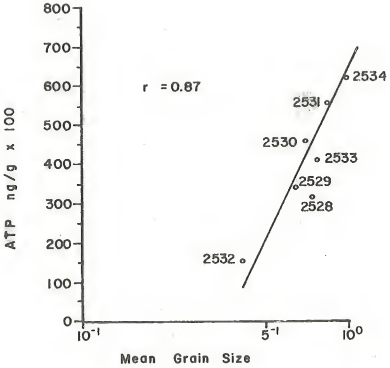

Figure 96d. ATP/mean grain size relationships for box core transect V (fall, 1975). Data pairs used to generate regression line are plotted by station.

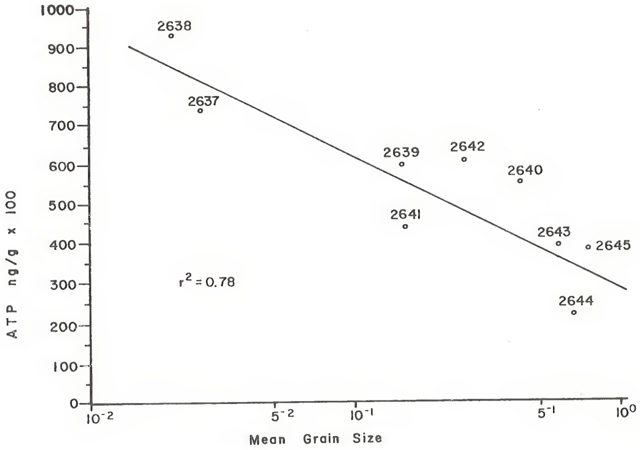

Figure 96c. ATP/mean grain size relationships for box core transect VI (Fall, 1975). Data pairs used to generate regression line are plotted by station.

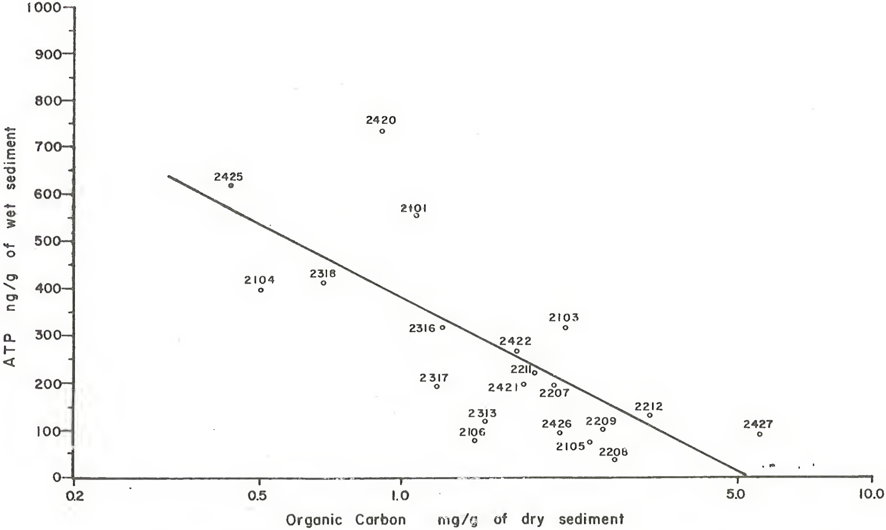

Figure 97a. ATP/organic carbon relationship for transects I-IV (summer, 1975). Station data are plotted on the graph.

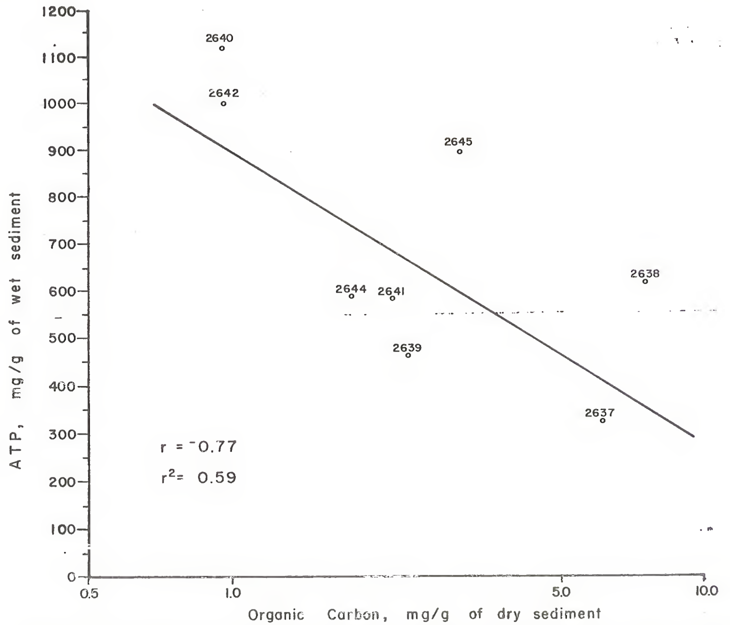

Figure 97b. ATP/organic carbon relationship for transect VI (summer, 1975). Station data are plotted on the graph.

ATP levels along Transect V showed no significant correlation with organic carbon.

Plots of ATP levels against hydrocarbon and trace metal levels in the sediment yielded "shotgun" patterns and it was statistically determined that there were no significant correlations between ATP levels and aliphatic and aromatic hydrocarbons or trace metals in the sediment.

Meiofauna

Nematodes and harpacticoid copepods were the most abundant metazoan groups in the meiofauna followed by turbellarians and gastrotrichs. In only a few samples were the copepods more numerous than nematodes. Turbellarians were identified to species where possible, and gastrotrichs were identified to genus with the exception of one difficult group of genera clumped as Mesodasys. Other metazoan taxa which were often conspicuous components of the meiofauna are priapulids (mostly larvae), crustacean larvae, polychaete larvae, kinorynchs, tardigrads, coelentorates and halacarid mites. Ostracods were uncommon and eliminated from consideration when extraction techniques for recovering them proved to be inadequate. This section will, by necessity then, be limited to a consideration of the nematode and copepod meiofauna.

Yearly mean nematode densities ranged from 37,000 individuals/m^2 at Master Station 2543 to 1,189,000 individuals/m^2 at Master Station 2207 and averaged 330,775 individuals/m^2 for the entire MAFLA study tract. Tables 83a, b and c present mean nematode densities on a depth (station) basis for each of the three sampling periods. Reference to these tables will show that nematode densities generally decrease with increasing depth and

Table 83a. Sampling Period I - June 1975
Average number of nematodes per m^2 ($x\ 10^3$)

Approximate Station Depth	Transect VI	V	IV	III	II	I
10 m			1205			862
			650			
			1253	338	1205	858
20 m	345		353			
	397		140	548		
30 m	611		354		460	
	432				1610	
	616	132		525		
	348	100	210	X		476
40 m		57		X	196	
		67				
50 m						348
60 m	187	47				
70 m	67	40				
80 m			219			
90 m						78
100+m	101	227				
		113	114	152	179	173

Table 83b. Sampling Period II - September 1975
Average number of nematodes per m^2 ($x\ 10^3$)

Approximate Station Depth	VI	V	IV	III	II	I
10 m			498			1164
			42			
			535	449	1542	1562
20 m	526		173			
	321		95	505		
30 m	442		188		360	
	264				1135	
	140	207		310		
	376	82	188	721	410	553
40 m		116		X	103	
		69				
50 m		81				305
60 m	155	47				
70 m	51	39				
80 m			151			
90 m						85
100+m	39	68				
		57	182	133	127	169

Table 83c. Sampling Period III - January 1976
Average number of nematodes per m^2 ($x\ 10^3$)

Approximate Station Depth	Transect VI	V	IV	III	II	I
10 m			1424			406
			263			
			353	696	821	355
20 m	474		131			
	204		64	560		
30 m	322		206		374	
	157				676	
	572	62		130		
	307	53	181	116	658	105
40 m		52		579	48	
		54				
50 m		131				69
60 m	139	104				
70 m	18	32				
80 m			112			
90 m						55
100+m	16	121				
		126	26	50	76	72

were seasonally minimal during the winter sampling period. Sixty-one percent of the stations had their highest mean densities during the summer sampling period, 27% during the fall and 12% during the winter. Nematode densities exceeding 1 x 10^6 individuals/m^2 occurred only at the shallow (<40 m) stations of Transects I, II and IV, while, for each sampling period, densities along Transect V were lower than corresponding densities along Transects I-IV and VI.

Seasonal mean densities for copepods were 57,600 individuals/m^2 for the summer sampling period, 64,500 individuals/m^2 for the fall and 52,900/m^2 for the winter/spring. Mean copepod densities on a depth (station) basis for each of the three sampling periods are presented in Tables 84a, b and c. As for nematodes, it was apparent that copepod densities generally decrease with increasing depth and were seasonally minimal during the winter sampling period. Copepod densities were lower along Transect VI compared to Transects I-V. Forty-four percent of the stations had their highest mean densities during the summer sampling period, 46% during the fall and 10% during the winter.

Tables 85 and 86 present for nematodes and copepods, respectively, the range between maximum and minimum mean seasonal densities as a proportion of the yearly mean density for each station. In most instances the range between seasons approaches or exceeds the yearly mean. Reference to this table also shows the seasonal pattern of minimum densities occurred during the winter sampling period.

Correlation analyses between densities of the various meiofauna taxa and sediment grain size were conducted and the results are presented in

Table 84a. Sampling Period I - June 1975
Average number of copepods per m^2 ($x\ 10^3$)

Approximate Station Depth	Transect VI	V	IV	III	II	I
10 m			137			5
			101			
			78	348	80	131
20 m	9		19			
	11		23	106		
30 m	14		53		23	
	45				57	
	52	34		75		
	56	97	84			14[illegible]
40 m		99			49	
		68				
50 m			28			6[illegible]
60 m	36	31				
70 m	36	39				
80 m						
90 m						18
100+m	24	32				
		8	8	15	9	15

Table 84b. Sampling Period II - September 1975
Average number of copepods per m^2 ($x\ 10^3$)

Approximate Station Depth	VI	V	IV	III	II	I
10 m			163			45
			72			
			212	234	228	111
20 m	2		114			
	1		57	84		
30 m	3		75		74	
	16				192	
	33	58		66		
	10	85	98	32	52	50
40 m		85			54	
		84				
50 m		30				28
60 m	37	28				
70 m	42	38				
80 m			52			
90 m						35
100+m	12	4				
		2	15	10	8	19

Table 84c. Sampling Period III - January 1976
Average number of copepods per m^2 ($x\ 10^3$)

Approximate Station Depth	Transect VI	V	IV	III	II	I
10 m			52			22
			96			
			147	684	108	20
20 m	16		58			
	3		8	78		
30 m	12		19		46	
	48				174	
	42	15		100		
	45	26	42	53	48	5
40 m		39		46	23	
		29				
50 m		24				26
60 m	22	24				
70 m	20	20				
80 m			17			
90 m						19
100+m	12	2				
		6	6	10	7	12

Table 85. Nematodes
Range of average number per m^2 ($x\ 10^3$) over seasons ÷ annual average number m^2 ($x\ 10^3$)

Sampling season of highest density in roman numerals (I, II, or III)

Approximate Station Depth	Transect VI	V	IV	III	II	I
10 m			.9 III			.9 II
			1.9 I			
			1.3 I	.7 III	.6 II	1.3 II
20 m	.4 II		1.0 I			
	.6 I		.8 I	.1 III		
30 m	.6 I		.7 I		2 I	
	1.0 I				.8 I	
	1.1 I	1.1 II		1.2 I		
	.2 II	.6 I	.1 I			1.2 II
40 m		.8 II			1.3 I	
		.2 II				
50 m						1.2 I
60 m	.3 I	.9 III				
70 m	1.1 I	.2 I				
80 m			.6 I			
90 m						.4 II
100+m	1.6 I	1.1 I				
		.7 III	1.5 II	.9 I	.8 I	.7 I

Frequency of highest means

I	61%
II	27%
III	12%

Table 86. Copepods
Range of average number per m^2 ($x\ 10^3$) over season ÷
annual average number per m^2 ($x\ 10^3$)

Sampling period with highest mean in roman numerals (I, II or III)

Approximate Station Depth	Transect VI	V	IV	III	II	I
10 m			.9 II			1.7 II
			.3 I			
			.9 II	1.1 III	1.1 II	1.3 I
20 m	1.6 III		1.5 II			
	2.0 I		1.7 II	.3 I		
30 m	1.1 I		1.1 II		1.1 II	
	.9 III				1.0 II	
	.4 I	1.2 II		.4 III		
	1.2 I	1.0 I	.7 II			4.1 I
40 m		.8 I			.7 II	
		.9 II				
50 m						.9 I
60 m	.5 II	.2 I				
70 m	.7 II	.6 I				
80 m			1.1 II			
90 m						.7 II
100+m	.8 I	2.3 I				
		1.2 I	.9 II	.4 I	.2 -	.5 II

Frequency of highest means

I	44%
II	46%
III	10%

Table 87. All correlations were statistically significant but less than half of them suggest a strong, biologically significant relationship.

Definitive species affinities and distributions are not apparent for most groups, either because distributions are highly variable as are those of nematodes and copepods or because specimen abundance and occurrence was low and sporadic.

The distributions and relationship of the turbellarian taxa Carcharodorhyncus and eukalyptorhynchs seems to be consistent. Carcharodorhynchus is the dominant halyptorhynch at the two shallowest stations (2101 and 2102), then declines in abundance to be completely replaced by eukalyptorhynchs in the deeper stations (Table 88).

Foraminifera

Species of foraminifera collected from the MAFLA study region totalled 314. Eighty-seven species were represented by dead specimens only and 38 species were represented by live specimens only. Species lists are presented in Tables 89 and 90. Dominant species composition for the individual transects remained uniform regardless of sampling season but differed among transects and deep (>90 m) and shallow (<90 m) stations. Table 91 lists the dominant species associations for the individual transects.

Table 92 lists, by station and sampling season, the total specimen density, percentage of living specimens and species abundance. Seasonal changes in density varied considerably between stations and transects. Twenty-two stations showed density increases between summer and fall and 21 showed decreases. Ten of the 12 stations located on Transects I and II and seven of the nine stations on Transect V increased in density between summer and fall with only the deepest, outermost station on each transect

Table 87. Correlations between meiofaunal taxonomic groupings and sediment mean grain size. $\alpha \leq 0.0001$ for all correlations

Taxonomic group	Correlation
Nematoda	0.23
Copepoda	0.24
crustacean larvae	0.22
polychaete larvae	0.20
Kinorhynchia	0.20
Priapulida	0.23
Tardigrada	0.26
all above groups combined	0.99
all Gastrotricha	0.98
Acanthodasys	0.26
Diplodasys	0.23
Mesodasys group	0.20
Tetranchyroderma	0.26
Urodasys	0.20
other gastrotrichs	0.26
all Turbellaria	0.93
Acoela	0.24
Macrostomida	0.26
Retronecitdae	0.25
Proseriata	0.93
Prolecithophora	0.95
Typhloplanoida	0.99
Dalyellioida	0.99
Eukalyptorhynchia	0.93
Karkinorhynchidae	0.99
Carcharodorhynchus	0.98
other Schizorhynchidae	0.99

Table 88. Ratio Carcharodorhynchus: Eukalyptorhynchia (Turbellaria)
Average values over seasons II and III

(∿ indicates pattern not consistent between seasons)

Approximate Station Depth	Transect VI	V	IV	III	II	I
10 m			2			>10
			→ .2			
			4	.05	13	2
20 m	0		.4			
	*		1	.3		
30 m	.2		.2		∿	
	∿				∿	
	.5	.3		.1		
	.3	0	.7	0	.5	∿
40 m		0			0	
		0				
50 m		.1				0
60 m	0	.1				
70 m	0	0				
80 m			0			
90 m						0
100+m	*	0				
		0	0	0	0	0

* Both groups absent from all samples
→ Arrow indicates station 2420, which does not conform to expected patterns

Table 89. Total species of foraminiferans collected:

Ammobaculites sp.
Ammonia beccarii partinsoniana
Ammonia beccarii tepida
Ammonitum salsum
Amphicorgne sublineata
Amphicorgne sp.
Amphistegina gibbosa
Archaias angulatus
Articulina lineata
Articulina mayori
Articulina mexicana
Articulina mucronata
Articulina poucicostata
Articulina sagra
Articulina sulcata
Articulina sp.
Astocolus crepidulus
Asterigerina carinata
Bigenerina carinata
Bigenerina irregularis
Bigenerina textulareida
Brizalina albatrossi
Brizalina barbata
Brizalina pragilis
Brizalina goessii
Brizalina laneolata
Brizalina lowmani
Brizalina minima
Brizalina paula
Brizalina striatula
Brizalina subaenariensis mexicana
Brizalina subspinescens
Brizalina sp.
Buccella hannai
Bulimina affinis
Bulimina marginata
Bulimina spicata
Bulimina straita mexicana
Bulimina sp.
Buliminella cf. B. bassendorfensis
Buliminella elegantissima
Cancris oblonga
Cancris sagra
Carpenteria proteiformis
Carterina spiculotesta
Cassidulina carinata
Cassidulina crassa
Cassidulina carvata
Cassidulina subglobosa
Cheilostomella oolisa
Cibicides concentricus
Cibicides ciroykebtys
Cibicides deprimus
Cibicides floridanus
Clavulina mexicana
Clavulina norangulae
Gribroelphidium popvanum
Cyclogyra involvens
Cyclogyra planorbis
Cyclorbiculina compressa
Cymbaloparetta squammosa
Dentalina advena
Dentalina filiformis
Dentalina sp.
Discorbis mina
Elphidium advenum
Elphidium delicatulum
Elphidium discoidale
Elphidium galvestonense
Elphidium gunteri
Elphidium incertum mexicanum
Elphidium sagrum
Elphidium translucens
Elphidium spp.
Eponides antillarum
Eponides regularis
Eponides turgidus
Eponides umbonatus
Eponides sp.
Fissurina formosa
Fissurina marginata-perforata
Fissurina spp.

Table 89. Continued

Florilus grateloupi
Frondicularia sagitulla
Fursenkoina complanta
Fursenkoina mexicana
Fursenkoina pontoni
Fursenkoina sp.
Fursenstoina compressa
Gaudryina aequa
Gaudryina (Pseudogandryina) atlantica
Globulina caribaea
Glomospira ? sp.
Guttulina australis
Guttulina laevis
Gypsina vesicularis
Gyroidina orbicularis
Gyroidina soldanii altiformi
Hamerinella inconstans
Hanzawaia strattoni
Haplophragmoides sp.
Haplophragmoides ? sp.
Hoeglundinu elegans
Karreriella bradyi
Lagena hispida
Lagena laevis
Lagena perlucida
Lagena striata
Lagena sulcata
Lagena sp.
Labrospire ? sp.
Lenticulina calcar
Lenticulina gibba
Lenticulina orbicularis
Lenticulina peregrion
Lenticulina thalmanni
Liebusella soldanii
Loxostomum abruptum
Loxostomum sp.
Martinetiella occidentalis
Marginulina glabra
Marginulina marginulinoides
Marginulina planata
Marginulina sp.
Marginulina villa
Marginulinopsis bradyi
Miliolinella circularis
Miliolinella fichteliana
Miliolinella labiosa
Miliolinella subrotunda
Miliolinella sp.
Miliolids (abnormal)
M nalysidium polityon
Neoconorbina orbicularis
Nodobaculariella cassis
Nodosaria albatrossi
Nodosaria pyrula
Nodosaria sp.
Nonion affinis?
Nonion depressulum matagordarum
Nonion pormousum
Nonion sp.
Nonionella atlantica
Nonionella opima
Nouria polymorphinoides
Nubercularia cf. N. lucifuga
Colina melo
Palmeriaella gardenislandensis
Pavonia atlantica
Peneroplis bradyi
Peneroplis carinatus
Peneroplis discoideus
Peneroplis proteus
Planispirella rf. P. exigua
Planorbulina acervalis
Planorbulina mediterranensis
Planulina ariminensis
Planulina exorna
Planulina poveolata
Planulina sp.
Poroeponides latenalis
Proteonina difflugiformis
Pseudonodosaria comatula
Pseudonodosaria rotundata
Pullenia bulloides
Pullenia quinqueloba
Pyrgo depressa
Pyrgo comata

Table 89. Continued

Pyrgo elongata
Pyrgo pornasinii
Pyrgo murrhina
Pyrgo nasutus
Pyrgo subsphaerica
Pyrgo sp.
Pyrgoella sphaera
Pyrgoella sp.
Quinqueloculina agglutinans
Quinqueloculina bicostata
Quinqueloculina bidentata
Quinqueloculina bosciana
Quinqueloculina compta
Quinqueloculina cultrata
Quinqueloculina distorgneata
Quinqueloculina funafutiensis
Quinqueloculina horrida
Quinqueloculina laerigata
Quinqueloculina lamarckiana
Quinqueloculina parkeri occidentalis
Quinqueloculina poeyana
Quinqueloculina polygona
Quinqueloculina sabulosa
Quinqueloculina seminulum
Quinqueloculina subpoeyana
Quinqueloculina tenagos
Quinqueloculina venusta
Quinqueloculina spp.
Ramulina globulifera
Rectobolivina advena
Remaneica sp.
Reophax irregularis
Reophax nana
Reophax scorpiurus
Reussella atlantica
Robertinoides bradyi
Rosalina bulbosa
Rosalina cf. R. columbiensis
Rosalina concinna
Rosalina floridana
Rosalina floridensis
Rotamorphina laerigata
Sagrina pulchella primitiva
Saracenaria italica
Saracenaria latiprons
Schlumbergerina dreoloniformis occidentalis
Seabroatia earlandi
Sigmoilina distorta
Sigmoilina sigmoidea
Sigmoilina tenuis
Sigmoilopsis schlumbergeri
Siphonia bradyana
Siphonia pulchra
Siphotextularia rolshausenі
Siphotextularia sp.
Sorites bofkeri orbitolitoides
Spirillina decorata
Spirillina denticulata
Spirillina obconica
Spirillina vivipara
Spiroluculina antillarum
Spiroloculina arenata
Spiroloculina cf. S. communis
Spiroloculina grata
Spiroloculina planulata
Spiroloculina rotunda
Spiroloculina soldanii
Spiroloculina spp.
Spiroloculina sp. (abnormal)
Spiroplectammina floridana
Spitalina asicularis
Stomatorbina concentrica
Syphotextulana secusensis
Textularia agglutinens
Textularia candeiana
Textularia conica
Textularia earlandi
Textularia foliacea occidentalis
Textularia mayori
Textularia secanensis
Textularia sp.

Table 89. Continued

Textulariella n. sp. ?
Textulariella barrettii
Tretomphalus atlanticus
Tretomphalus planus
Trifarina bella
Trifarina bradyana
Trifarina jamaicensis
Triloculina brevidentata
Triloculina comis
Triloculina rotunda
Triloculina sidebottemi
Triloculina tricarineta
Triloculina trigonula
Triloculina trigonula multistriata
Triloculina spp.
Trochammina advena
Trochammina quadriloba
Trochammina sp.
Tubinella (?) sp.
Uvigerina plintii
Uvigerina laevis
Uvigerina parvula
Uvigerina peregrina
Uvigerina sp.
Valvulineria minuta ?
Wiesherella auriculata

Table 90. Species of live foraminiferans collected.

Ammobaculites sp.
Ammodiscus anguillae
Ammonia beccarii parkinsoniana
Ammonia beccarii tepida
Ammontium salsum
Amphicorgne intercellularis
Amphicorgne cublineata
Amphicorgne sp.
Amphistegina gibbosa
Archaias angulatus
Articulina sagra
Articulina sulcata
Astacolum crepidulus
Asterigerina carinata
Bigenerina irregularis
Brizalina albatrossi
Brizalina barbata
Brizalina pragilis
Brizalina goessii
Brizalina lanceolata
Brizalina lowmani
Brizalina minima
Brizalina paula
Brizalina subaenariensis mexicana
Brizalina subspinescens
Brizalina sp.
Buccella hannai
Bulimina affinis
Bulimina marginata
Bulimina spicata
Buliminella cf. B. bassendorfensis
Buliminella elegantissima
Cancris oblonga
Cancris sagra
Carpenteria proteiformis
Carterina spiculotesta
Cassidulina carinata
Cassidulina crassa
Cassidulina curvata
Cassidulina subglobosa
Chrysalidinella miocenica
Cibicides concentricus
Cibicides corpulentus
Cibicides deprimus
Cibicides aff. C. floridanus
Cibicides sp.
Cribroelphidium porganum
Cyclogyra involvens
Cyclogyra planorbis
Dentalina advena
Dentalina filiformis
Dentalina sp.
Eggerella bradyi
Ehrenbergina spinea
Elphidium advenum
Elphidium delicatulum
Elphidium disoidale
Elphidium galvestonense
Elphidium gunteri
Elphidium translucens
Elphidium spp.
Eponides antillarum
Eponides regularis
Eponides turgidus
Eponides umbonatus
Fissurina formosa
Fissurina longispina
Fissurina spp.
Florilus grateloupi
Frondicularia sagitulla
Fursenkoina complanata
Fursenkoina compressa
Fursenkoina mexicana
Fursenkoina pontoni
Gaudryina aequa
Globulina caribaea
Glomospira ? sp.
Guttulina australis
Guttulina laeris
Gypsina vesicularis
Gyroidina orbicularis
Hanzawaia strattoni
Haplophragmoides sp.
Haplophragmoides ? sp.
Hoeglundina elegans
Karreriella bradyi
Labrospira ? sp.
Lagena laevis

Table 90. Continued

Lagena striata	Pyrgoella sphaera
Lenticulina calcar	Quinqueloculina bicostata
Lenticulina gibba	Quinqueloculina bidentata
Lenticulina orbicularis	Quinqueloculina bosciana
Lenticulina peregrina	Quinqueloculina compta
Loxostomum abruptum	Quinqueloculina distorqueata
Loxostomum sp.	Quinqueloculina funafutiensis
Marginulina glabra	Quinqueloculina horrida
Marginulina marginulinoides	Quinqueloculina laevigata
Marginulina planata	Quinqueloculina lamarckiana
Marginulina sp.	Quinqueloculina poeyana
Marginulinopsis bradyi	Quinqueloculina polygora
Miliolinella circularis	Quinqueloculina seminulum
Miliolinella fichteliana	Quinqueloculina tenagos
Miliolinella obliquinoda	Quinqueloculina venusta
Miliolinella subrotunda	Quinqueloculina vulgaris
Miliolids (abnormal)	Quinqueloculina spp.
Neuconerbina orbicularis	Rectobolivina advena
Nodobaculariella cassis	Remaneica sp.
Nodosaria albatrossi	Reophax hispidulus
Nonion affinis?	Reophax irregularis
Nonion formosum	Reophax nana
Nonion sp.	Reophax scorpiurus
Nonionella atlantica	Reophax sp.
Nonionella opina	Reussella atlantica
Nourja polymorphinoides	Robertinoides bradyi
Oolina melo	Rosalina bulbosa
Pavonia atlantica	Rosalina cf. R. columbiensis
Peneroplis bradyi	Rosalina concinna
Peneroplis carinatus	Rosalina floridana
Peneroplis discoideus	Rosalina floridensis
Peneroplis proteus	Rotamorphina laevigata
Planorbulina acervalis	Sagrina pulchella primitive
Planorbulina mediterranensis	Saracenaria italica
Planulina ariminensis	Saracenaria latifrons
Planulina exorma	Seabrookia earlandi
Poroeponides lateralis	Sigmavirgulina tortuosa
Pseudonobodosaria ? sp.	Sigmoilina distorta
Pullenia bulloides	Sigmoilina tenuis
Pullenia quinqueloba	Sigmoilopsis schlumbergeri
Pyrgo depressa	Siphonina bradyana
Pyrgo elongata	Siphonina pulchra
Pyrgo nasutus	Siphotextularia rolshauseni
Pyrgo subsphaerica	Sorites hofkeri orbitolitoides
Pyrgo sp.	Spirillina senticulata

Table 90. Continued

Spirillina vivipara
Spiroloculina grata
Spiroloculina planulata
Spiroloculina rotunda
Spiroloculina soldarii
Spiroloculina sp.
Spiroplectammina floridana
Syphotextularia secusensis
Textularia agglutinans
Textularia condeiana
Textularia conica
Textularia earlandi
Textularia folicea occidentalis
Textularia mayori
Textularia parvula
Textularia n. sp. ?
Textulariella barrettii
Tiphotrocha comprimata
Tretomphalus atlanticus
Tretomphalus bulloides
Tretomphalus planus
Trifarina bella
Trifarina bradyana
Trifarina jamaicensis
Triloculina brevidentata
Triloculina fitterei meningoi
Triloculina linneiana comis
Triloculina tricarinata
Triloculina trigonula
Triloculina trigonula multistriata
Triloculina spp.
Trochammina advena
Trochammina sp.
Uvigerina bellula
Uvigerina flintii
Uvigerina laeuss
Uvigerina parvula
Uvigerina peregrina
Uvigerina sp.
Valvulineria minuta
Wiesnerella auriculata

Table 91. Dominant species associations. Species below the dashed lines are deep water (>30 m) dominants.

Transect 1

Ammonia beccarii
Asterigerina carinata
Cibicides aff. *C. floridanus*
Cibicides deprimus
Hanzawaia strattoni
Neoconorbina orbicularis
Quinqueloculina lamarckiana
Remaneica sp.
Rosalina concinna
Rosalina columbiensis
Rosalina foridana

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Amphistegina gibbosa
Cassidulina curvata
Cassidulina subglobosa
Planulina ariminensis

Transect 2

Asterigerina carinata
Cibicides aff. *C. floridanus*
Hanzawaia strattoni
Neoconorbina orbicularis
Quinqueloculina lamarckiana
Reussella atlantica
Rosalina columbiensis
Rosalina concinna
Textularia mayori

- - - - - - - - - - - - - - -

Cassidulina curvata
Cassidulina subglobosa
Cibicides concentricus
Planulina ariminensis
Siphonina pulchra
Trochammina advena

Transect 3

Asterigerina carinata
Cibicides aff. *C. floridanus*
Cibicides deprimus
Hanzawaia strattoni
Planulina exorna
Quinqueloculina lamarckiana
Rosalina columbiensis
Rosalina concinna

- - - - - - - - - - - - - - -

Brizalina lowmani
Cassidulina curvata
Cassidulina subglobosa
Planulina ariminensis
Siphonina pulchra
Uvigerina flintii

Transect 4

Ammonia beccarii
Cibicides aff. *C. floridanus*
Elphidium discoidale
Hanzawaia strattoni
Planulina exorna
Quinqueloculina lamarckiana
Remaneica sp.
Rosalina columbiensis
Rosalina concinna

- - - - - - - - - - - - - - -

Amphistegina gibbosa
Cassidulina curvata
Cassidulina subglobosa
Cibicides concentricus
Lenticulina orbicularis
Siphonina pulchra
Uvigerina flintii

Table 91. Continued

Transect 5

Amphistegina gibbosa
Brizalina lowmani
Cassidulina curvata
Cassidulina subglobosa
Cibicides aff. C. floridanus
Hanzawaia strattoni
Lenticulina orbicularis
Nonionella atlantica
Planulina exorna
Quinqueloculina lamarckiana
Reussella atlantica
Rosalina columbiensis
Trochammina advena

- - - - - - - - - - - - - - - -

Brizalina subaenariensis mexicana
Cibicides concentricus
Hoeglundina elegans
Lenticulina calcar
Uvigerina flintii

Transect 6

Ammonia beccarii
Amphistegina gibbosa
Buliminella cf. B. bassendorfensis
Buliminella elegantissima
Cassidulina curvata
Cassidulina subglobosa
Cibicides aff. C. floridanus
Elphidium galvestonense
Fursenkoina pontoni
Hanzawaia strattoni
Nonionella atlantica
Planulina exorna
Quinqueloculina lamarckiana
Rosalina columbiensis
Rosalina concinna

- - - - - - - - - - - - - - - - - -

Brizalina lowmani
Lenticulina orbicularis

Table 92. Foraminiferal total density (No/m^2 x 10^5), percentage of live specimens and total number of species for the "A" samples for each of the three sampling periods.

Station Number	Summer, 1975 Density	% Live	Species	Fall, 1975 Density	% Live	Species	Winter, 1976 Density	% Live	Species
2101	57.5	2.9	47	204.9	15.1	42	27.8	15.4	44
2102	6.5	11.5	36	131.8	13.4	43	62.5	17.8	35
2103	15.8	6.0	54	120.7	10.8	57	170.4	6.7	54
2104	28.3	12.3	66	33.4	6.5	65	84.1	18.8	55
2105	38.8	4.4	69	102.1	11.6	65	32.4	6.9	59
2106	164.8	17.2	70	114.7	22.7	69	71.5	9.7	62
2207	103.5	12.8	43	124.8	12.1	31	73.3	9.5	35
2208	302.4	12.6	60	328.8	13.3	51	161.1	9.7	49
2209	302.6	7.5	58	358.2	19.7	57	162.3	9.1	48
2210	26.5	14.1	60	176.5	17.1	47	56.5	16.0	50
2211	14.3	13.9	76	100.2	11.7	62	17.6	13.4	67
2212	162.1	27.8	72	49.7	20.6	52	25.8	24.3	49
2313	79.5	37.6	53	161.9	39.3	46	152.4	27.3	49
2314	NS	-	-	38.5	14.1	52	18.5	30.8	71
2315	NS	-	-	250.5	21.7	56	21.5	19.6	67
2316	399.8	2.6	58	15.3	10.5	55	4.4	16.3	51
2317	314.2	10.6	63	41.2	11.3	50	201.2	8.2	64
2318	25.9	21.9	41	12.9	49.6	37	3.6	40.1	40
2419	33.1	32.7	43	26.3	16.3	49	13.1	27.5	49
2420	7.3	29.4	49	8.6	17.9	44	4.9	16.8	39
2421	310.1	2.0	48	64.6	20.2	51	43.2	22.6	62
2422	17.4	33.5	59	5.3	36.1	48	2.4	28.4	48
2423	55.1	24.6	57	49.9	46.5	54	11.1	44.7	58
2424	20.4	22.4	57	6.3	41.0	49	1.9	42.5	46
2425	6.4	30.5	65	5.7	35.9	55	2.2	24.7	59
2426	42.1	9.9	59	35.3	13.0	63	17.3	28.1	70
2427	145.6	19.5	57	13.3	21.3	42	79.0	31.3	59
2528	8.9	22.8	63	14.7	27.7	63	8.2	16.9	50
2529	10.4	13.9	64	13.9	12.7	62	7.4	23.2	75
2530	9.1	11.4	61	14.5	20.3	49	12.9	17.8	33
2531	23.4	11.3	61	53.4	22.7	61	66.8	29.9	65
2532	66.6	16.3	64	18.7	12.5	63	16.1	23.3	70
2533	30.1	9.2	65	54.8	23.9	60	26.3	10.7	70
2534	16.1	12.6	57	19.4	11.0	57	28.4	28.8	50
2535	217.1	20.0	72	33.2	34.4	60	70.8	59.6	80
2536	68.0	31.8	71	71.9	51.9	55	143.2	33.4	54
2637	181.8	34.2	35	81.9	32.4	27	147.9	54.9	30
2638	256.7	48.7	32	182.8	31.4	32	197.4	55.1	28
2639	429.3	52.8	52	146.7	37.8	50	54.6	59.0	58
2640	6.5	26.2	56	20.5	39.5	40	10.7	46.3	38
2641	59.9	33.0	69	2.2	35.2	43	18.2	46.1	63
2642	3.2	45.5	60	3.9	46.6	45	2.3	26.3	42
2643	51.9	17.0	74	35.0	18.5	61	22.9	24.2	58
2644	32.9	21.4	48	15.5	26.1	58	10.8	22.8	56
2645	21.7	14.9	65	34.7	27.4	55	25.9	19.2	79

NS No sample.

decreasing. The remaining five stations showing summer to fall increases were scattered among Transects II, IV and VI. Nine stations showed increases in density between the fall and the winter and 35 showed decreases; seven of these nine stations were located on Transects V and VI. Nineteen stations had highest densities in the fall, 21 in the summer and five in the winter. Within each season the highest density values occurred at stations with fine sediment substrates and the lowest densities occurred at stations with coarse sediment substrates.

Species abundance varied from a minimum of 27 species at Master Station 2637 in the fall to a maximum of 80 at Master Station 2535 in the winter. On a comparative basis Master Stations 2637 and 2638 on Transect VI had the lowest species abundances for all three sampling seasons. No seasonal geographical or bathymetric abundance patterns were apparent for the study region other than that mentioned above.

The percentage of living specimens increased with distance northward and westward during all three sampling periods. Another notable pattern was the elevated percentage of living specimens in areas of low sedimentation rates. The frequency distribution of percentage of living specimens for all stations and seasons was as follows: <10%, 16; 10-20%, 47; 20-30%, 32; 30-40%, 19; 40-50%, 11; and >50%, 8.

Species diversity and evenness are listed in Table 93 by station for all three sampling periods. Diversity plotted by individual transect (Figures 98a and 98b) showed a seaward increase along Transects I-III. Transect IV follows the same pattern with the exception of a suppressed diversity at Master Station 2424 in the fall and winter. Transects V and VI showed no appreciable seaward increase in diversity. Patterns of species

Table 93. Foraminiferal species diversity (H') and evenness (J') for all stations for each of the three sampling seasons.

Station Number	Summer 1975 H'	Summer 1975 J'	Fall 1975 H'	Fall 1975 J'	Winter 1975 H'	Winter 1975 J'
2101	2.6124	0.7348	2.4084	0.6774	2.1983	0.6597
2102	2.7515	0.7678	2.0311	0.6032	2.1261	0.6451
2103	3.1515	0.7938	3.6032	0.8111	3.1896	0.7822
2104	3.2224	0.8155	3.1016	0.7376	2.5837	0.6787
2105	3.1823	0.7542	3.1241	0.7540	2.8276	0.6825
2106	3.4256	0.8176	3.4986	0.8007	3.1624	0.7965
2207	2.0032	0.5949	1.9830	0.6086	2.1282	0.6457
2208	3.1015	0.7928	3.0470	0.7871	2.6237	0.7020
2209	3.1630	0.7929	3.1560	0.7876	3.0503	0.7335
2210	3.4707	0.8283	3.4238	0.7980	3.0147	0.7558
2211	3.3934	0.8255	3.2940	0.7834	3.1022	0.7577
2212	3.4987	0.8235	3.2631	0.8003	3.1243	0.8256
2313	3.2276	0.7949	3.2082	0.7603	2.9507	0.7468
2314			3.5515	0.8037	3.4002	0.8271
2315			3.1869	0.7752	3.0862	0.7701
2316	3.2477	0.8104	3.0106	0.7583	2.7830	0.7544
2317	3.1927	0.7897	2.9532	0.7304	2.8643	0.7258
2318	2.1349	0.6217	1.7397	0.5628	1.6385	0.5226
2419	1.8653	0.5382	1.9673	0.5784	2.2240	0.6206
2420	1.6640	0.5170	2.1153	0.5950	0.9974	0.5126
2421	2.6260	0.6783	2.4841	0.6350	2.6451	0.6727
2422	3.3331	0.8045	2.6023	0.6962	2.1766	0.6532
2423	3.0563	0.7559	2.7746	0.7207	2.7726	0.7466
2424	3.0844	0.7697	0.4631	0.1303	0.7206	0.4022
2425	3.0684	0.7804	2.6259	0.6981	2.7820	0.7825
2426	3.0381	0.7689	3.2087	0.7775	2.9844	0.7751
2427	3.5234	0.8571	3.0060	0.8095	3.2053	0.7894
2528	3.1285	0.7880	3.0600	0.7744	2.8247	0.8010
2529	3.1378	0.8063	2.9685	0.7798	3.4578	0.8346
2530	3.3671	0.8127	2.9768	0.7395	2.5593	0.7951
2531	3.2074	0.7968	3.3221	0.8114	3.2116	0.8089
2532	3.2291	0.8172	3.2875	0.8131	3.2262	0.7880
2533	3.1368	0.7828	3.2408	0.7707	3.0876	0.7267
2534	2.7559	0.7119	2.6460	0.6911	2.8150	0.7272
2535	3.1602	0.7687	3.2447	0.7862	3.1992	0.7582
2536	3.3382	0.8187	3.1528	0.7798	2.9927	0.7957
2637	2.5060	0.7231	2.4301	0.7217	2.5394	0.7541
2638	2.7007	0.7659	2.6474	0.7446	2.4372	0.7773
2639	2.4155	0.6548	2.6538	0.6855	2.5916	0.7074
2640	2.6491	0.7088	2.2706	0.6114	1.9495	0.5625
2641	2.5104	0.6634	2.3835	0.6941	2.6534	0.6818
2642	2.3028	0.6839	2.3354	0.6289	0.8001	0.4465
2643	3.0219	0.7411	3.0363	0.7446	2.6320	0.7135
2644	2.5762	0.7082	2.9084	0.6993	2.9797	0.7308
2645	3.3182	0.7734	2.9495	0.7502	2.9942	0.7343

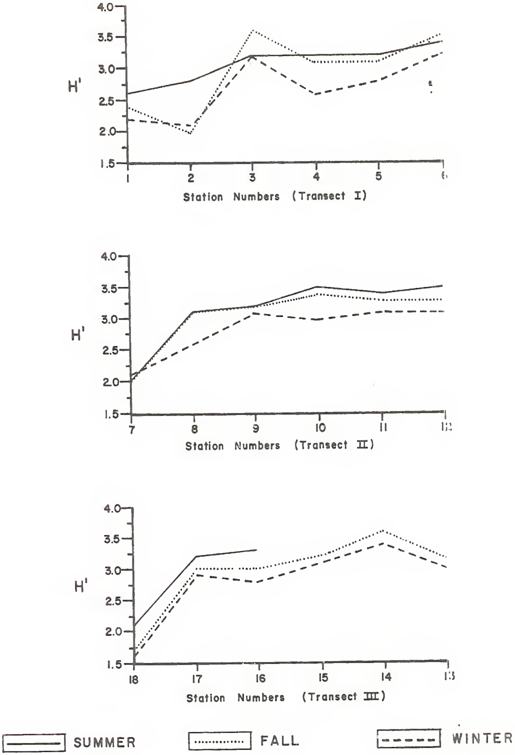

Figure 98a. Foraminifera: Shannon-Weaver diversity indices plotted by transect.

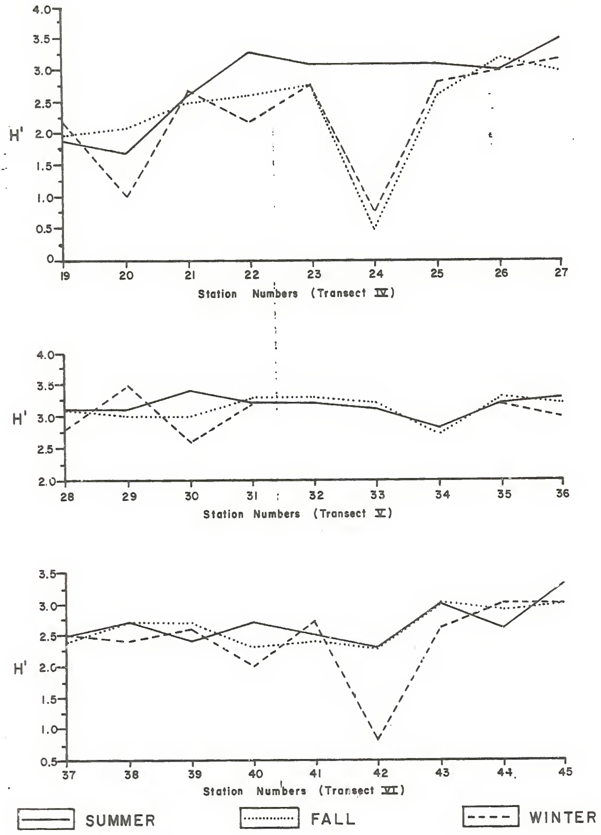

Figure 98b. Foraminifera: Shannon-Weaver diversity indices plotted by transect.

diversity evenness generally followed those of species diversity. Species diversity and evenness, where averagedby transect, show a high degree of uniformity throughout the MAFLA study region (Figure 99). The low point on the graph (Transect IV) was primarily due to the low values recorded from Master Station 2424. In general, species diversity was highest at stations with fine sediment and lowest at stations with coarse sediments.

Free-living/attached specimen ratios are presented in Table 94. Stations with the lowest ratios were generally located in depths of 10-32 m. Only at stations in depths greater than 100 m did the free-living/attached specimen ratios exceed unity. Attached specimens of Asterigerina carincata and Rosalina concinna occurred at the shallow stations of Transects I-IV; these two species had always been considered as free living.

Two varieties of Ammonia beccarii, an indicator species of environmental stress, occurred in abundance only at the shallower stations of Transect VI and Master Station 2101 of Transect I.

Sander's affinities indicate the midpoints of each transect were similar to all other stations in the transects, with the exception of Transect VI where the trend is skewed shoreward by one station. In a north-south trend at the deepest stations (183 m), Master Station 2313, again the midpoint, has the greatest affinity to all other stations in the trend. The nearshore stations of Transects I-IV also show the highest affinities to all other stations along the north-south trend at the midpoint, Master Station 2318.

Montford cluster analysis shows the greatest affinities between seasonal samplings at the same stations. This reflects a high degree of uniformity of the species composition of the faunas seasonally. The second highest

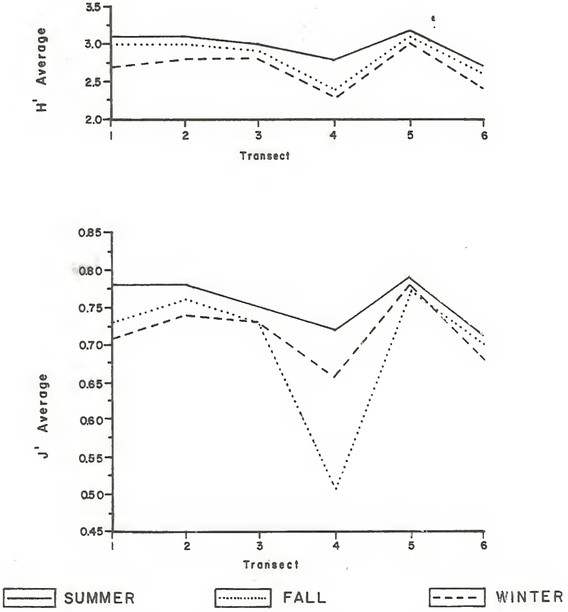

Figure 99. Foraminifera: species diversity and evenness averaged by transect.

Table 94. Free living/attached foraminifera ratios for all stations for all three sampling seasons (A samples).

Station Number	Summer, 1975	Fall, 1975	Winter, 1976
2101	0.00	0.00	0.00
2102	0.00	0.00	0.00
2103	0.01	0.03	0.03
2104	0.12	0.08	0.08
2105	0.52	0.86	0.89
2106	2.63	3.33	3.45
2207	0.00	0.00	0.00
2208	0.00	0.01	0.01
2209	0.01	0.02	0.02
2210	0.02	0.01	0.01
2211	0.10	0.13	0.12
2212	3.13	3.85	4.00
2313	2.94	4.55	4.55
2314	NS	0.13	0.13
2315	NS	0.05	0.08
2316	0.02	0.04	0.04
2317	0.01	0.01	0.01
2318	0.00	0.00	0.00
2419	0.00	0.00	0.00
2420	0.00	0.00	0.00
2421	0.00	0.00	0.01
2422	0.02	0.00	0.00
2423	0.00	0.00	0.03
2424	0.02	0.03	0.07
2425	0.03	0.07	0.03
2426	0.17	0.19	0.20
2427	3.03	3.33	3.70
2528	0.19	0.07	0.19
2529	0.07	0.07	0.16
2530	0.06	0.06	0.12
2531	0.11	0.11	0.11
2532	0.16	0.15	0.15
2533	0.17	0.26	0.14
2534	0.20	0.19	0.18
2535	1.25	1.27	0.20
2536	3.33	2.33	1.96
2637	0.02	0.01	0.02
2638	0.02	0.03	0.02
2639	0.04	0.09	0.07
2640	0.05	0.05	0.05
2641	0.06	0.04	0.07
2642	0.08	0.03	0.03
2643	0.28	0.16	0.25
2644	0.30	0.37	0.36
2645	0.59	0.78	0.47

NS No sample.

affinities are between adjacent stations, both along transects and north-south trends. The least affinities, as one would expect, are between the shallowest and deepest stations and between distal ends of the overall area. In general, cluster analysis indicates a high degree of affinity over the entire MAFLA area over all seasons, only four group memberships falling lower than 26.1774.

Micromolluscs

A total of 46 species and 317 specimens of live micromolluscs and 106 species and 24,443 specimens of dead micromolluscs were collected from the 45 box core stations. Numbers of specimens and species per station per sampling period are presented in Table 95 for live micromolluscs and in Table 96 for dead molluscs. The live and dead micromolluscs considered together yield a total of 124 identified species (eight identified to genus only). These species are listed in Table 97. The highest concentrations of both live and dead micromolluscs occurred at Master Stations 2103 and 2104; 2209, 2210 and 2211; 2315, 2316 and 2317; 2529, 2531 and 2532; 2639, 2640, 2641 and 2643, all of which were near the center of their respective transects. Only on Transect IV was there a variation in the pattern and the live micromolluscs were higher in the Horseshoe Bend area in the fall and winter.

Live micromollusc fauna were extremely "impoverished" and the maximum number of specimens (39) for a single collection was taken from Master Station 2421 during the winter sampling period. The next two most abundant collections were also obtained during the winter sampling period from Master Stations 2317 and 2210, respectively. Fifty-five of the collections contained no live micromolluscs and thirty-five of these were from Transects V and VI.

Table 95. Live Molluscs collected during each of the box core sampling periods. Values are combined totals of two replicate samples.

Stations	Summer Specimens	Summer Species*	Fall Specimens	Fall Species*	Winter/Spring Specimens	Winter/Spring Species*
2101	5	5	3	2	3	3
2102	1	1	2	1	1	1
2103	5	1	4	3	6	3
2104	0	0	1	1	2	2
2105	0	0	2	2	1	1
2106	1	1	3	3	0	0
2207	1	1	2	2	2	2
2208	1	1	5	3	2	2
2209	8	3	1	1	3	3
2210	0	0	7	6	31	6
2211	2	2	0	0	1	1
2212	0	0	0	0	0	0
2313	0	0	0	0	2	1
2314	0	0	0	0	7	4
2315	0	0	4	2	1	1
2316	6	4	7	6	1	1
2317	9	3	5	3	37	4
2318	0	0	6	5	2	2
2419	2	2	0	0	2	2
2420	1	1	0	0	1	1
2421	4	2	5	5	39	6
2422	3	3	1	1	3	3
2423	2	2	0	0	0	0
2424	6	5	1	1	4	4
2425	0	0	1	1	2	2
2426	3	2	3	3	2	1
2427	0	0	0	0	0	0
2528	2	1	0	0	0	0
2529	4	1	0	0	1	1
2530	0	0	0	0	3	3
2531	1	1	3	3	3	3
2532	0	0	0	0	2	2
2533	1	1	0	0	0	0
2534	1	1	0	0	0	0
2535	0	0	0	0	0	0
2536	0	0	0	0	0	0

Table 95. Continued

Stations	Summer Specimens	Summer Species*	Fall Specimens	Fall Species*	Winter/Spring Specimens	Winter/Spring Species*
2637	0	0	0	0	0	0
2638	0	0	0	0	3	2
2639	1	1	0	0	0	0
2640	1	1	2	2	1	1
2641	0	0	0	0	5	2
2642	0	0	0	0	1	1
2643	2	2	1	1	0	0
2644	0	0	0	0	0	0
2645	0	0	0	0	0	0

* Including some identified to genus only and some unidentified forms.

Table 96. Dead Micromolluscs collected during the summer box core sampling period.

Station**	Total Specimens	Identified Specimens	Identified Species*
2101	225	135	23
2102	147	111	26
2103	1303	1122	3[illegible]
2104	1397	1115	3[illegible]
2105	260	139	2[illegible]
2106	153	119	2[illegible]
2207	746	553	35
2208	1102	919	30
2209	1147	1025	27
2210	1154	972	27
2211	1243	905	34
2212	392	359	19
2313	411	378	19
2314	23	16	12
2315	1594	1349	32
2316	702	612	23
2317	306	306	27
2318	422	304	23
2419	170	124	17
2420	75	54	17
2421	314	255	25
2422	1687	954	38
2423	2199	1565	48
2424	164	126	20
2425	136	86	26
2426	225	144	21
2427	306	290	14
2528	336	153	23
2529	545	286	30
2530	336	166	22
2531	525	235	23
2532	927	555	37
2533	291	166	26
2534	208	145	27
2535	442	276	21
2536	361	346	11

Table 96. Continued

Station**	Total Specimens	Identified Specimens	Identified Species*
2637	54	41	9
2638	62	53	6
2639	581	417	24
2640	156	70	23
2641	120	62	19
2642	82	41	15
2643	322	200	35
2644	153	153	24
2645	340	244	32

* Including some identifies to genus only

** First two digits are transect designation

Table 97 . Micromollusc Species List
MAFLA - 1975-76

1. Nucula proxima (Say, 1822)
2. Nucula crenulata (A. Adams, 1856)
3. Nuculana acuta (Conrad, 1831)
4. Nuculana concentrica (Say, 1824)
5. Nuculana aspecta (Dall, 1927)
6. Nuculana carpenteri (Dall, 1881)
7. Solemya occidentalis (Deshayes, 1857)
8. Limopsis sulcata (Verrill and Bush, 1898)
9. Glycymeris pectinata (Gmelin, 1791)
10. Cratis antillensis (Dall, 1881)
11. Arcopsis adamsi (Dall, 1886)
12. Bathyarca sp.
13. Crenella divaricata (d'Orbigny, 1845)
14. Dacrydium vitreum (Hölboll, 1842)
15. Musculus lateralis (Say, 1822)
16. Cyclopecten nanus (Verrill and Bush, 1897)
17. Cyclopecten simplex (Verrill, 1897)
18. Dimya tigrina (Bayer, 1971)
19. Limea bronniana (Dall, 1886)
20. Crassinella lunulata (Conrad, 1834)
21. Crassinella dupliniana (Dall, 1903)

Table 97. Continued

22. Glans dominguensis (d'Orbigny, 1845)
23. Pleuromeris armilla (Dall, 1902)
24. Carditopsis smithi (Dall, 1896)
25. Astarte nana (Dall, 1886)
26. Pteromeris perplana (Conrad, 1841)
27. Cuna dalli (Vanatta, 1904)
28. Pythinella cuneata (Verrill and Bush, 1898)
29. Vesicomya pilula (Dall, 1881)
30. Montacuta triquetra (Verrill and Bush, 1898)
31. Lucina nassula (Conrad, 1846)
32. Linga amiantus (Dall, 1901)
33. Parvilucina multilineata (Tuomey and Holmes, 1857)
34. Parvilucina blanda (Dall and Simpson, 1901)
35. Divaricella quadrisulcata (d'Orbigny, 1842)
36. Thyasira trisinuata (d'Orbigny, 1842)
37. Diplodonta sp.
38. Nemocardium peramabile (Dall, 1881)
39. Laevicardium mortoni (Conrad, 1830)
40. Ervilia concentrica (Holmes, 1860)
41. Tellina versicolor (DeKay, 1843)
42. Tellina sp.

Table 97 . Continued

43. Abra aequalis (Say, 1822)

44. Abra lioica (Dall, 1881)

45. Semele bellastriata (Conrad, 1837)

46. Semele nuculoides (Conrad, 1841)

47. Semele purpurascens (Gmelin, 1791)

48. Gouldia cerina (C.B. Adams, 1845)

49. Chione grus (Holmes, 1858)

50. Pitar morrhuanus (Linsley, 1848)

51. Pitar simpsoni (Dall, 1895)

52. Dosinia discus (Reeve, 1850)

53. Cyclinella tenuis (Recluz, 1852)

54. Parastarte triquetra (Conrad, 1846)

55. Hiatella arctica (Linne, 1767)

56. Corbula swiftiana (C.B. Adams, 1852)

57. Varicorbula operculata (Philippi, 1848)

58. Bushia elegans (Dall, 1886)

59. Verticordia ornata (d'Orbigny, 1842)

60. Verticordia fischeriana (Dall, 1881)

61. Cardiomya ornatissima (d'Orbigny, 1842)

62. Cardiomya perrostrata (Dall, 1881)

63. Myonera lamellifera (Dall, 1881)

Table 97. Continued

64. Scissurella proxima (Dall, 1927)

65. Diodora sp.

66. Arene tricarinata (Stearns, 1872)

67. Skenea sp.

68. Didianema pauli (Pilsbry and McGinty, 1945)

69. Tricolia thalassicola (Robertson, 1958)

70. Alvania auberiana (d'Orbigny, 1842)

71. Alvania cf. auberiana

72. Alvania precipitata (Dall, 1889)

73. Zebina browniana (d'Orbigny, 1842)

74. Parviturboides interruptus (C.B. Adams, 1850)

75. Solariorbis shimeri (Clapp, 1914)

76. Anticlimax pilsbryi (McGinty, 1945)

77. Cyclostremiscus cubanus (Pilsbry and Aguayo, 1933)

78. Cyclostremiscus jeannae (Pilsbry and McGinty, 1945)

79. Teinostoma incertum (Pilsbry and McGinty, 1945)

80. Teinostoma parvicallum (Pilsbry and McGinty, 1945)

81. Macromphalina palmalitoris (Pilsbry and McGinty, 1950)

82. Aorotrema pontogenes (Schwengel and McGinty, 1942)

83. Caecum pulchellum (Stimpson, 1851)

84. Caecum bipartitum (Folin, 1870)

Table 97. Continued
85. Caecum imbricatum (Carpenter, 1858)
86. Caecum floridanum (Stimpson, 1851)
87. Caecum plicatum (Carpenter, 1858)
88. Caecum clava (Folin, 1867)
89. Caecum ryssotitum (Folin, 1867)
90. Caecum heladum (Olsson and Harbinson, 1953)
91. Brochina sp.
92. Meioceras cubitatum (Folin, 1868)
93. Meioceras nitidum (Stimpson, 1851)
94. Meioceras cornucopiae (Carpenter, 1858)
95. Finella dubia (d'Orbigny, 1842)
96. Diastoma varium (Pfeiffer, 1840)
97. Cerithiopsis crystallinum (Dall, 1881)
98. Seila adamsi (H.C. Lea, 1845)
99. Aclis sp.
100. Calyptraea centralis (Conrad, 1841)
101. Eulima sp.
102. Strombiformis bilineatus (Alder, 1848)
103. Natica pusilla (Say, 1822)
104. Olivella pusilla (Marrat, 1871)
105. Marginella sp.

Table 97. Continued

106. Marginella lavalleeana (d'Orbigny, 1842)
107. Granulina ovuliformis (d'Orbigny, 1841)
108. Terebra protexta (Conrad, 1845)
109. Odostomia didyma (Verrill and Bush, 1900)
110. Turbonilla sp.
111. Odostomia dianthophila (Wells and Wells, 1961)
112. Odostomia sp.
113. Cyclostremella humilis (Bush, 1897)
114. Acteon punctostiratus (C.B. Adams, 1840)
115. Ringicula semistriata (d'Orbigny, 1842)
116. Acteocina candei (d'Orbigny, 1842)
117. Acteocina canaliculata (Say, 1822)
118. Cylichna verrilli (Dall, 1889)
119. Pyrunculus caelatus (Bush, 1885)
120. Retusa sulcata (d'Orbigny, 1842)
121. Volvulella persimilis (Morch, 1875)
122. Cadulus iota (Henderson, 1920)
123. Cadulus mayori (Henderson, 1920)
124. Chaetopleura apiculata (Say, 1830)

Seven stations yielded no live micromolluscs for any of the sampling periods and five of these stations were on Transects V and VI. Six of the stations with no live micromolluscs were located at the offshore stations of Transects II, III, IV, V and VI. The other was at the inshore station on Transect VI in the NORTHWEST drainage area. The only transect with live micromolluscs present at each station was Transect I which was under the influence of Loop Current forcing on the shelf circulation pattern for each season. The maximum number of live micromollusc species for any single collection was six and this occurred in only four collections.

Seasonal totals of live micromolluscs show that winter abundance was about 2.5 times greater than those of summer and fall which were similar (176 vs 70 and 71, respectively).

The dead micromollusc fauna (collected and analyzed only for the summer) was "rich" compared to the living micromollusc fauna. The minimum number of dead micromolluscs in any one collection was 23 at Master Station 2314 and the maximum was 2199 at Master Station 2423. The minimum number of identified species for any given collection was six at Master Station 2638 and the maximum was 48 at Master Station 2423. In general, the dead micromolluscs were least numerous along Transects V and VI.

Of the 24,443 dead specimens collected, 74% were identified to the species level (including six taxa identified to the genus level). Reference to Table 95 shows that unidentified specimens made up a goodly portion of each collection.

Table 98 lists the dominant species and frequency of dominance for each. Table 99 gives the total dominance data for the individual stations.

Table 98. Dominance frequency of species which appeared as dominants two or more times in the dead micromolluscs collections; Total number of collections = 45.

Species	Dominant* Abs.	Dominant* Rel.(%)	Major** Dominant Abs.	Major** Dominant Rel.(%)
Finella dubia	29	64.4	7	15.6
Caecum pulchellum	24	53.3	9	20.0
Goldia cerina	24	53.3	1	2.2
Crassinella lunulata	18	40.0	3	6.7
Meioceras cubitatum	15	33.3	2	4.4
Parvilucina multilineata	13	28.9	5	11.1
Vesicomya pilula	10	22.2	6	13.1
Vesicorbula operculata	8	17.8	1	2.2
Caecum imbricatum	7	15.6	0	
Tellina versicolor	6	13.3	2	4.4
Ervillia concentrica	6	13.3	1	2.2
Natica pusilla	6	13.3	0	
Alvania auberiana	5	11.1	0	
Caecum bipartitum	6	13.3	0	
Bathyarca sp.	5	11.1	1	2.2
Nuculana concentrica	4	8.9	3	6.7
Arcopsis adamsi	4	8.9	0	
Chione grus	3	6.7	0	
Linga amiantus	2	4.4	0	
Limopsis sulcata	2	4.4	0	
Nucula proxima	2	4.4	0	
TOTAL			41	90.8

* Accounts for 5% or more of the sample specimens.
** Accounts for the highest percentage of the sample specimens.

Table 99. Dominant species of micromolluscs, dead fauna.

Sample No.	Species	% of Sample
2101	*Caecum bipartitum*	5.9
	Finella dubia	5.9
	Natica pusilla	5.9
	Ervillia concentrica	6.6
	Tellina versicolor	6.6
	Parvilucina multilineata	44.4
	other identified	24.7
2102	*Ervilia concentrica*	5.4
	Natica pusilla	10.8
	Parvilucina multilineata	13.5
	Finella dubia	21.6
	other identified	48.7
2103	*Parvilucina multilineata*	4.9
	Crassinella lunulata	7.2
	Caecum pulchellum	7.4
	Meioceras cubitatum	9.2
	Gouldia cerina	10.3
	Finella dubia	15.6
	other identified	45.4
2104	*Gouldia cerina*	7.2
	Alvania auberiana	7.4
	Crassinella lunulata	10.4
	Finella dubia	14.8
	Meioceras cubitatum	18.1
	Caecum pulchellum	21.6
	other identified	20.5
2105	*Arcopsis adamsi*	6.9
	Alvania precipitata	10.4
	Nuculana aspecta	11.1
	Caecum pulchellum	13.1
	Crassinella lunulata	18.7
	other identified	39.8

Table 99. Continued.

Sample No.	Species	% of Sample
2106	*Cyclopecten simplex*	5.0
	Vesicomya pilula	5.0
	Abra lioica	5.8
	Astarte nana	7.5
	Crassinella lunulata	7.5
	Dacrydium vitreum	7.5
	Montacuta triquetra	8.3
	Bathyarca sp.	24.1
	other identified	29.3
2207	*Varicorbula operculata*	6.1
	Caecum imbricatum	6.8
	Caecum pulchellum	9.5
	Finella dubia	20.9
	Parvilucina multilineata	28.2
	other identified	28.5
2208	*Meioceras cubitatum*	5.0
	Gouldia cerina	7.7
	Finella dubia	12.0
	Varicorbula operculata	14.4
	Caecum bipartitum	18.3
	Parvilucina multineata	25.5
	other identified	17.1
2209	*Varicorbula operculata*	8.6
	Caecum bipartitum	10.5
	Meioceras cubitatum	10.5
	Finella dubia	13.0
	Parvilucina multilineata	39.3
	other identified	18.1
2210	*Varicorbula operculata*	6.1
	Gouldia cerina	6.7
	Caecum bipartitum	9.2
	Meioceras cubitatum	15.9
	Parvilucina multilineata	21.3
	Finella dubia	21.6
	other identified	19.2

Table 99. Continued.

Sample No.	Species	% of Sample
2211	Cyclostremiscus cubanus	5.1
	Finella dubia	5.3
	Alvania auberiana	5.4
	Crassinella lunulata	5.7
	Gouldia cerina	10.7
	Caecum pulchellum	44.9
	other identified	20.9
2212	Limopsis sulcata	14.6
	Bathyarca sp.	20.2
	Vesicomya pilula	40.8
	other identified	24.4
2313	Cerithiopsis crystallinum	5.4
	Bathyarca sp.	14.4
	Vesicomya pilula	54.6
	other identified	25.6
2314	Crenella divaricata	6.3
	Crassinella lunulata	6.3
	Parvilucina multilineata	6.3
	Verticordia ornata	6.3
	Caecum pulchellum	6.3
	Finella dubia	6.3
	Zebina browniana	6.3
	Semele nuculoides	6.3
	Abra aequalis	6.3
	Tellina versicolor	12.5
	Caecum imbricatum	12.5
	Bittium varium	18.8
	other identified	0.0
2315	Caecum bipartitum	5.4
	Meioceras cubitatum	19.9
	Parvilucina multilineata	25.3
	Finella dubia	27.9
	other identified	21.5

Table 99. Continued.

Sample No.	Species	% of Sample
2316	Crassinella lunulata	5.2
	Gouldia cerina	7.1
	Meioceras cubitatum	11.0
	Caecum pulchellum	21.8
	Finella dubia	23.1
	other identified	31.8
2317	Parvilucina multilineata	6.9
	Gouldia cerina	8.2
	Meioceras cubitatum	18.6
	Caecum pulchellum	19.6
	Finella dubia	19.9
	other identified	26.8
2318	Caecum imbricatum	8.2
	Finella dubia	10.9
	Ervilia concentrica	13.5
	Crassinella dupliniana	34.2
	other identified	33.2
2419	Finella dubia	12.1
	Parvilucina multilineata	12.9
	Ervilia concentrica	38.7
	other identified	36.3
2420	Tellina versicolor	6.3
	Caecum bipartitum	6.3
	Finella dubia	6.3
	Ervillia concentrica	14.1
	Parvilucina multilineata	20.3
	other identified	46.7
2421	Parvilucina multilineata	7.8
	Finella dubia	16.8
	Caecum bipartitum	23.4
	Varicorbula operculata	25.8
	other identified	26.2

Table 99. Continued.

Sample No.	Species	% of Sample
2422	*Alvania auberiana*	6.4
	Varicorbula operculata	9.0
	Gouldia cerina	9.1
	Finella dubia	12.6
	Chione grus	13.6
	Caecum pulchellum	22.5
	other identified	26.8
2423	*Gouldia cerina*	5.1
	Alvania auberiana	9.4
	Chione grus	11.8
	Caecum pulchellum	16.7
	Finella dubia	19.6
	other identified	37.4
2424	*Gouldia cerina*	5.6
	Finella dubia	15.9
	Varicorbula operculata	21.4
	Meioceras cubitatum	27.8
	other identified	29.3
2425	*Pteromeris perplana*	5.8
	Crassinella lunulata	7.0
	Gouldia cerina	7.0
	Finella dubia	7.0
	Caecum imbricatum	10.5
	Caecum pulchellum	11.6
	Meioceras cubitatum	11.6
	other identified	39.5
2426	*Nuculana acuta*	7.6
	Montacuta triquetra	5.6
	Meioceras cubitatum	8.3
	Cadulus iota	9.0
	Limopsis sulcata	9.7
	Vesicoyma pilula	9.7
	Caecum pulchellum	9.7
	Crassinella lunulata	10.4
	Nuculana aspecta	13.9
	other identified	16.1

Table 99. Continued.

Sample No.	Species	% of Sample
2427	Bathyarca sp.	6.8
	Vesicomya pilula	79.0
	other identified	14.2
2528	Gouldia cerina	5.2
	Chione grus	5.8
	Glans dominguensis	8.5
	Crassinella lunulata	11.7
	Finella dubia	14.3
	Caecum pulchellum	33.9
	other identified	20.6
2529	Caecum floridanum	5.2
	Finella dubia	5.2
	Gouldia cerina	6.2
	Crassinella lunulata	18.5
	Caecum pulchellum	31.1
	other identified	33.8
2530	Caecum imbricatum	5.4
	Gouldia cerina	6.0
	Alvania auberiana	6.6
	Finella dubia	6.6
	Caecum pulchellum	48.1
	other identified	27.3
2531	Finella dubia	5.2
	Gouldia cerina	8.9
	Crassinella lunulata	10.0
	Caecum pulchellum	56.8
	other identified	19.1
2532	Alvania auberiana	6.6
	Meioceras cubitatum	8.0
	Gouldia cerina	12.0
	Limea bronniana	15.9
	Caecum pulchellum	26.1
	other identified	31.4

Table 99. Continued.

Sample No.	Species	% of Sample
2533	Meioceras cubitatum	6.7
	Arcopsis adamsi	6.7
	Cyclostremiscus cubanus	7.3
	Crassinella lunulata	9.8
	Caecum pulchellum	44.7
	other identified	24.8
2534	Arcopsis adamsi	8.2
	Gouldia cerina	8.9
	Cratis antillensis	10.3
	Caecum pulchellum	14.4
	Crassinella lunulata	17.9
	other identified	40.3
2535	Nuculana acuta	23.4
	Vesicomya pilula	58.0
	other identified	18.6
2536	Vesicomya pilula	87.5
	other identified	12.5
2637	Natica pusilla	14.6
	Linga amiantus	17.0
	Nuculana concentrica	48.7
	other identified	19.7
2638	Linga amiantus	5.8
	Nucula proxima	15.0
	Nuculana concentrica	73.5
	other identified	5.7
2639	Crassinella lunulata	6.0
	Nucula proxima	8.4
	Corbula swiftiana	9.6
	Pythinella cuneata	10.8
	Gouldia cerina	12.7
	Nuculana concentrica	26.9
	other identified	25.6

Table 99. Continued.

Sample No.	Species	% of Sample
2640	Meioceras cubitatum	6.1
	Caecum pulchellum	7.6
	Caecum imbricatum	7.6
	Tellina versicolor	9.2
	Finella dubia	10.7
	Natica pusilla	10.7
	Gouldia cerina	20.0
	other identified	18.1
2641	Gouldia cerina	6.4
	Natica pusilla	6.4
	Nuculana concentrica	9.6
	Varicorbula operculata	9.6
	Caecum imbricatum	9.6
	Finella dubia	12.9
	Tellina versicolor	16.1
	other identified	29.4
2642	Gouldia cerina	7.3
	Meioceras cubitatum	9.7
	Natica pusilla	12.1
	Ervilia concentrica	12.1
	Tellina versicolor	29.2
	other identified	29.6
2643	Finella dubia	5.4
	Caecum pulchellum	6.4
	Crassinella lunulata	11.3
	Gouldia cerina	12.8
	Vesicomya pilula	24.2
	other identified	39.9
2644	Vesicomya pilula	6.1
	Arcopsis adamsi	6.8
	Gouldia cerina	6.8
	Finella dubia	6.8
	Crassinella lunulata	14.2
	Caecum pulchellum	27.8
	other identified	31.5

Table 99. Continued.

Sample No.	Species	% of Sample
2645	Cratis antillensis	5.1
	Vesicomya pilula	6.0
	Arcopsis adamsi	6.4
	Caecum plicatum	6.4
	Caecum pulchellum	6.8
	Alvania precipitata	7.2
	Gouldia cerina	10.7
	Crassinella lunulata	17.5
	other identified	33.9

The majority of stations contained from four to six dominant species; the minimum number of dominants was one and the maximum was 12. The dominant species comprised the greatest specimen abundance for each station and usually accounted for over 75% of the total sample.

Live/dead ratios for each replicate series major species are presented in Tables 100a and b. Live/dead ratios were small due to the dearth of living specimens for all stations and species.

Table 101 summarizes the dead fauna sample variables and substrate characteristics for all stations. In general, sample size (ml), specimen abundance and species abundance were low where the substrate was composed of fine sand or silt and high where the substrate was medium to coarse sand or silt and high when the substrate was a medium to coarse sand.

Most of the species identified were either bivalves or gastropods and some scaphopods with the occurrence of several chitons in a few of the samples. In the live fauna, bivalves were more abundant than gastropods while in the dead fauna they occurred about equally.

Macromolluscs

Sample replication of nine box cores per station proved adequate for describing macromollusc benthic assemblages at the Transects V and VI shallow stations. Species saturation was not reached at some of the shallow stations of Transects I-IV with nine replicates. This lack of species saturation is attributed to the continued addition of rare or uncommon species occurring at these stations; the same applies to the deep water stations. Figure 100 shows representative plots of cumulative numbers of species vs number of replicates for shallow water stations as determined

Table 100a. Live/dead ratio, "A Samples".

Station	Species	Sampling Period I	II	III
2101	*Tellina versicolor*	1/9	-	-
	Semele bellastriata	1/0	-	-
	Solemya occidentalis	-	1/0	-
	Acteocina candei	-	-	1/2
	Chitons	-	2/0	-
2102	*Tellina versicolor*	-	1/4	-
2103	*Parvilucina multilineata*	-	1/76	1/38
	Tellina versicolor	-	1/28	-
	Acteocina candei	-	1/4	-
	Abra aequalis	1/5	-	-
2104	*Semele bellastriata*	-	1/0	-
2105	-	-	-	-
2106	*Parvilucina blanda*	-	1/0	-
	Myonera lamellifera	1/0	-	-
	Scissurella proxima	-	1/0	-
2207	*Solemya occidentalis*	1/0	-	-
	Tellina versicolor	-	-	1/6
2208	*Lucina nassula*	1/8	-	-
	Parvilucina multilineata	-	-	1/235
	Caecum bipartitum	-	-	2/169
	Glottidea pyramidata(brachiopod)		1/0	-
2209	*Nucula proxima*	-	-	1/0
	Parvilucina multilineata	-	1/403	-
	Acteocina candei	-	-	1/6
2210	*Crassinella lunulata*	-	1/43	-
	Parvilucina multilineata	-	1/104	1/208
	Varicorbula operculata	-	-	1/15
	Caecum bipartitum	-	-	1/90
	Meioceras cubitatum	-	-	1/155
	Finella dubia	-	1/210	-
	Retusa sulcata	-	1/6	-
	immature *Turridae*	-	1/0	0
	Aclis sp.	-	-	1/0

I = Summer
II = Fall
III = Winter/Spring

Table 100a. Continued.

Station	Species	Sampling Period I	II	III
2211	immature Pectinid	1/0	-	-
	Pleuromeris armilla	-	-	1/0
2212	-	-	-	-
2313	Nucula crenulata	-	-	2/1
2314	Parvilucina multilineata	-	-	2/1
	Natica pusilla	-	-	1/0
2315	Tellina versicolor	-	1/9	-
	Marginella sp.	-	-	1/2
2316	Lucina nassula	1/0	-	-
	Parvilucina multilineata	3/26	-	-
	Tellina versicolor	1/4	-	-
	Varicorbula operculata	1/8	-	1/8
2317	Parvilucina multilineata	1/21	1/7	-
	Strombiformis bilineatus	-	1/0	
2318	Meioceras cubitatum	-	1/1	-
	Turbonilla sp.	-	1/0	-
	Venerid clam	-	1/0	-
2419	very small clam	1/-	-	-
2420	Abra sp.	-	-	1/-
2421	Parvilucina multilineata	2/19	-	-
	Varicorbula operculata	-	-	32/63
	Caecum bipartitum	2/57	-	-
	Clam	-	-	1/-
	Marginella lavalleeana	-	1/0	-
2422	Nucula proxima	1/14	-	-
	Clam	-	-	1/-
	Macromphalina palmalitoris	-	1/0	-
2423	Nucula proxima	1/18	-	-

I = Summer
II = Fall
III = Winter/Spring

Table 100a. Continued.

Station	Species	Sampling Period I	II	III
2424	Bushia elegans	-	-	1/0
	Solemya occidentalis	-	1/0	-
	Semele bellastriata	-	-	1/0
2425	-	-	-	-
2426	Cadulus iota	-	-	2/13
	Nuculana aspecta	1/10	1/20	-
	Cylichna verrilli	1/10	-	-
2427	-	-	-	-
2528	Crassinella lunulata	1/9	-	-
2529	Varicorbula operculata	-	-	1/9
2530	Varicorbula operculata	-	-	1/0
2531	Varicorbula operculata	-	-	1/1
	Brochina antillarum	-	-	1/1
	Semele purpurascens	-	-	1/0
2532	-	-	-	-
2533	-	-	-	-
2534	Pitar morrhuanus	1/0	-	-
2535	-	-	-	-
2536	-	-	-	-
2637	-	-	-	-
2638	-	-	-	-
2639	Nuculana concentrica	1/112	-	-
2640	Brochina antillarum	-	-	1/0
2641	Tellina versicolor	-	-	1/10

I = Summer
II = Fall
III = Winter/Spring

Table 100a. Continued.

Station	Species	Sampling Period I	II	III
2642	-	-	-	-
2643	Tellina versicolor	-	1/2	-
2644	-	-	-	-
2645	-	-	-	-

I = Summer
II = Fall
III = Winter/Spring

Table 100b. Live/dead ratio, "K Samples".

Station	Species	Sampling Period I	II	III
2101	*Calyptrea centralis*	1/1	-	-
2102	*Tellina versicolor*	-	1/4	-
2103	*Crassinella lunulata*	1/111	-	-
	Parvilucina multilineata	-	1/76	1/76
	Varicorbula operculata	-	-	1/9
	Finella dubia	-	-	1/238
2104	-	-	-	-
2105	-	-	-	-
2106	-	-	-	-
2207	*Varicorbula operculata*	-	-	1/34
	Caecum imbricatum	-	1/38	-
2208	*Parvilucina multilineata*	-	2/235	-
	Caecum bipartitum	-	2/169	-
2209	*Parvilucina multilineata*	1/403	-	2/403
	Caecum bipartitum	1/18	-	-
	Finella dubia	1/134	-	-
2210	*Parvilucina multilineata*	-	-	1/104
	Varicorbula operculata	-	-	17/60
	Caecum bitartitum	-	-	1/90
	Meioceras cubitatum	-	-	2/155
2211	-	-	-	-
2212	-	-	-	-
2313	-	-	-	-
2314	*Parvilucina multilineata*	-	-	1/1
	Tellina versicolor	-	-	1/1
2315	*Parvilucina multilineata*	-	3/682	-

I = Summer
II = Fall
III = Winter/Spring

Table 100b. Continued.

Station	Species	Sampling Period I	II	III
2316	Parvilucina multilineata	-	1/26	-
	Meioceras cubitatum	-	1/34	-
	Finella dubia	-	1/142	-
	Volvulella persimilis	-	1/8	-
2317	Crassinella lunulata	-	1/20	-
	Parvilucina multilineata	5/84	-	1/12
	Tellina versicolor	-	-	1/12
	Varicorbula operculata	1/4	-	1/54
	Acteocina candei	-	-	1/4
2318	Parvilucina multilineata	-	-	1/7
	Caecum imbricatum	-	2/25	-
	Meioceras cubitatum	-	-	1/1
	Brochina antillarum	-	1/3	-
2419	Tellina versicolor	-	-	1/6
	Diplodonta sp.	-	-	1/2
2420	-	-	-	-
2421	Crenella divaricata	-	-	1/2
	Crassinella lunulata	-	1/4	-
	Tellina versicolor	-	-	1/4
	Varicorbula operculata	-	-	1/63
	Caecum bipartitum	-	-	2/57
	Caecum imbricatum	-	1/8	1/8
2422	Crassinella lunulata	1/13	-	-
	Varicorbula operculata	1/87	-	-
2423	Cyclostremiscus cubanus	1/7	-	-
2424	Tellina versicolor	-	-	1/6
	Caecum bipartitum	1/6	-	-
2425	Crassinella lunulata	-	1/12	-
2426	Nuculana acuta	-	1/22	-
	Pyrunculus caelatus	-	1/2	-

I = Summer
II = Fall
III = Winter/Spring

Table 100b. Continued.

Station	Species	Sampling Period I	II	III
2427	-	-	-	-
2528	-	-	-	-
2529	*Brochina* sp.	4/3	-	-
2530	*Brochina* sp.	-	-	1/1
2531	-	-	-	-
2532	-	-	-	-
2533	-	-	-	-
2534	-	-	-	-
2535	-	-	-	-
2536	-	-	-	-
2637	-	-	-	-
2638	*Nucula proxima*	-	-	1/8
	Nuculana concentrica	-	-	2/39
2639	-	-	-	-
2640	*Tellina versicolor*	-	1/12	-
2641	-	-	-	-
2642	-	-	-	-
2643	*Nuculana concentrica*	1/9	-	-
2644	-	-	-	-
2645	-	-	-	-

I = Summer
II = Fall
III = Winter/Spring

Table 101. Dead fauna, MAFLA micromolluscs.

Station #	(m) depth	(ml) Sample Size	(ident'd) total # specimens	(specimens/ml) density	(# of spp) diversity	(% of remaining in pareth.) # dominant spp	Substrate* Grain Size	Substrate* Compos.
2101	11	55	135	2.45	23	6(24.7)	f	qtz, $CaCO_3$
2102	17.4	77	111	1.44	26	4(48.7)	f	$CaCO_3$, qtz
2103	36.6	126	1522	12.07	38	6(45.4)	m	qtz, $CaCO_3$
2104	53.3	97	1115	11.49	33	6(20.5)	m	$CaCO_3$
2105	89.6	103	144	1.39	27	5(39.8)	c	$CaCO_3$
2106	161.5	65	120	1.84	24	8(29.3)	f	$CaCO_3$
2207	18.3	33	555	16.81	36	5(28.5)	f	qtz, $CaCO_3$
2208	34.1	19	919	48.36	30	6(17.1)	slt	$CaCO_3$
2209	29.3	36	1025	28.47	28	5(18.1)	slt	$CaCO_3$
2210	36.6	54	972	18.00	27	6(19.2)	no data	
2211	42.1	130	905	6.96	34	6(20.9)	csd	$CaCO_3$
2212	186.5	39	375	9.61	20	3(24.4)	slt	$CaCO_3$
2313	164.6	42	388	9.23	19	3(25.6)	slt	$CaCO_3$
2314	42.7	04	16	4.00	12	12(0%)	no data	
2315	36.6	43	2698	62.74	32	4(21.5)	no data	
			1349x2					
2316	37.2	84	616	7.33	28	5(31.8)	fsd	Qtz, $CaCO_3$
2317	29.3 27.4	75	1224	16.32	27	5(26.8)	vfsd	$CaCO_3$
			306x4					
2318	18.9	159	304	1.91	28	4(33.2)	msd	$CaCO_3$, qtz

Table 101. Continued.

Station #	(m) depth	(ml) Sample Size	(ident'd) total # specimens	(specimens/ml) density	(# of spp) diversity	(% of remaining in pareth.) # dominant spp	Substrate Grain Size	Substrate Compos.
2419	9.8	93	124	1.33	17	3(36.3)	fsd	$CaCO_3$,qta
2420	14.6	83	64	0.77	17	5(46.7)	f to msd	Qtz,$CaCO_3$
2421	19.2	36	244	6.77	24	4(26.2)	vf to fsd	Qtz,$CaCO_3$
2422	24.1	99	922	9.31	34	6(26.8)	msd	Qtz,$CaCO_3$
2423	29.6	122	1565	12.82	48	5(37.4)	c-vcsd	Qtz,$CaCO_3$
2424	28.3	119	252 126x2	2.11	20	4(29.3)	msd	$CaCO_3$,qtz
2425	36.6	98	172 86x2	1.75	26	7(39.5)	m-csd	$CaCO_3$,qtz
2426	86.3	101	288 144x2	2.85	21	9(16.1)	msd	Qtz,$CaCO_3$
2427	172.2	21	291	13.85	15	2(14.2)	slt	$CaCO_3$
2528	37.2	23	612 153x4	4.97	23	6(20.6)	c-vcsd	Qtz,$CaCO_3$
2529	37.5	88	286	3.25	30	5(33.8)	vcsd	$CaCO_3$
2530	40.2	91	166	1.82	22	5(27.3)	csd	qtz,$CaCO_3$
2531	44.5	98	269	2.74	23	4(19.1)	c-vcsd	$CaCO_3$
2532	50.3	117	1116 558x2	9.53	37	5(31.4)	msd	qtz,$CaCO_3$
2533	66.4	110	326 163x2	2.96	26	5(24.8)	csd	$CaCO_3$
2534	72.5	81	145	1.79	27	5(40.3)	vcsd	$CaCO_3$
2535	115.8	13	260	20.0	21	2(18.6)	slt	$CaCO_3$
2536	180.4	11	346	31.45	11	1(12.5)	slt	$CaCO_3$

Table 101. Continued.

Station #	(m) depth	(ml) Sample Size	(ident'd) total # specimens	(specimens/ml) density	(# of spp) diversity	(% of remaining in pareth.) # dominant spp	Substrate Grain Size	Substrate Compos.
2637	21.3	2	41	20.5	9	3(19.7)	slt	$CaCO_3$,qtz
2638	25.6	5	53	10.6	6	2(5.7)	slt	Qtz,$CaCO_3$
2639	32.0	47	834 417x2	17.74	25	6(25.6)	vf fsd	$CaCO_3$,qtz
2640	35.7	119	130	1.09	22	7(18.1)	msd	$CaCO_3$,qtz
2641	35.1	95	62	0.65	19	7(29.4)	fsd	$CaCO_3$,qtz
2642	36.0	133	41	0.30	15	5(29.6)	fsd	$CaCO_3$,qtz
2643	68.0	92	202	2.19	36	5(39.9)	m-csd	Qtz,$CaCO_3$
2644	70.7	99	147	1.48	23	6(31.5)	csd	$CaCO_3$
2645	107.3	104	233	2.24	31	8(33.9)	vcsd	$CaCO_3$

slt - 4 - 64
vfsd - 64 - 125
vsd - 125 - 250
msd - 250 - 500
csd - 500 - 1000
vcsd - 1mm - 2mm

* Substrate (desc. based on major constituents as reported by Wanless)

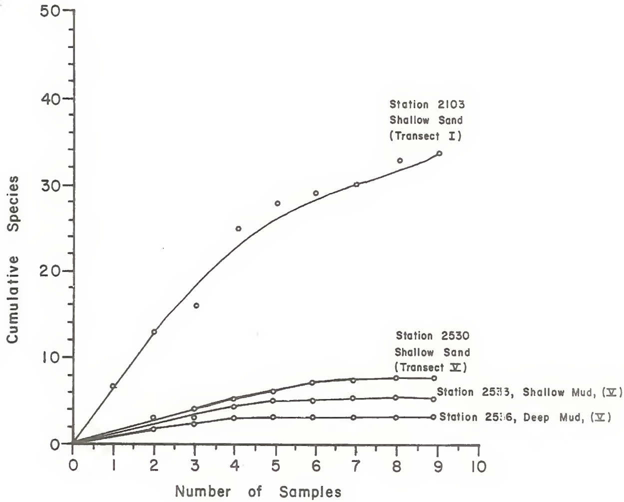

Figure 100. The cumulative number of species of macromolluscs collected with nine box cores in four habitat types.

in the summer 1975 sampling period.

A total of 282 species of macromolluscs, including 14 identified to genus only, were collected from the MAFLA study region (Table 102). Breakdown by class reveals 141 gastropod species, 120 bivalve species, 13 scaphopod species, seven polyplacophoran species and one aplacophoran species. The list contains some species which are basically temperate in geographical distribution as well as others which are basically subtropical to tropical in geographical distribution. Although little is known about the ecology of the vast majority of species identified, both filter feeders and deposit feeders were represented in the list. Since all individuals collected by the box core and anchor dredge were identified to the lowest practical taxonomic level, the species list contains a limited number of epifaunal molluscs as well as infaunal molluscs.

The specimen abundances of the individual species ranged from very rare (two individuals/m^2) to common (1120 individuals/m^2). The most abundant species collected in the study were Tellina versicolor, Parvilucina multilineata, Abra lioica, and Varicorbula operculata respectively. Tellina versicolor occurred over broad areas of the MAFLA shelf (28 out of 45 stations) especially at sand stations in less than 90 m of water. The deeper water mud stations had generally lower abundances of all species. Table 103 shows all the dominant species which were collected at the 45 stations during the three seasons. There were relatively more dominant species at the shallow (<90 m) stations on Transects I-IV than there were at the deep (>90 m) stations and the shallow stations on Transects V and VI.

Table 102. Infaunal molluscs collected from MAFLA Transects I-VI during 1975-76.

GASTROPODA

Scissurellidae
Scissurella crispata

Fissurellidae
Emarginula phrixodes
Emarginula pumila
Rimula frenulata
Hemitoma sp.
Diodora dysoni
Diodora jaumei
Lucapinella limatula

Trochidae
Solariella lucunella
Calliostoma roseolum
Calliostoma fascinans

Cyclostrematidae
Arene tricarinata

Turbinidae
Turbo castanea

Phasiaellidae
Tricolia thalassicola

Rissoidae
Alvania auberiana

Rissoinidae
Rissoina bryerea
Rissoina multicostata
Zebina browniana

Vitrinellidae
Cyclostremiscus sp.
Episcynia inornata
Teinostoma biscaynens

Tornidae
Macromphalina palmalitoris
Macromphalina floridana
Cochliolepis striata

GASTROPODA - continued

Caedidae
Caecum pulchellum
Caecum bipartitum
Caecum floridanum
Caecum imbricatum
Caecum cubitatum
Caecum stigosum
Caecum cornucopiae

Turritellidae
Turritella acropora

Architectonicidae
Pseudomalaxis centrifuga

Modulidae
Modulus modulus

Cerithiidae
Cerithium atratum
Cerithium litteratum
Finella dubia
Cerithiopsis crystallinum
Cerithiopsis taeniolata
Seila adamsi

Triphoridae
Triphora sp.

Epitoniidae
Opalia sp.
Epitonium krebsii
Epitonium novangliae

Mellanellidae
Mellanella arcuata
Vitreolina bermudezi
Eulima bifasciatus
Eulimostrica hemphilli
Niso aeglees
Ocenida scalaris

Aclididae
Henrya sp.

Table 102. Continued.

GASTROPODA - continued

Atlantidae
Atlanta peronii

Crepidulidae
Caluptraea centralis
Crucibulum auricula
Crepidula fornicata

Strombidae
Strombus alatus

Eratoidae
Triva maltbiana

Naticidae
Polinices lacteus
Polinices duplicatus
Sigatica carolinensis
Sigatica semisulcata
Sinum perspectivum
Natica livida
Natica marochiensis
Natica canrena
Natica pusilla

Cassidae
Phalium granulatum

Cymatiidae
Distorsio constricta macgintyi

Muricidae
Murex cabritii
Murex macgintyi
Murex leviculus
Murex pomum
Ocenebra minirosea
Poirieria stimpsonii
Calotrophon ostrearum

Columbellidae
Anachis hotessieriana
Anachis obesa
Anachis iontha
Mitrella lunata
Psarostola glypta
Psarostola minor
Psarostola sp.

GASTROPODA - continued

Buccinidae
Cantharus cancellarius

Nassariidae
Nassarius albus

Fasciolariidae
Fasciolaria lilium hunteria

Olividae
Oliva sayana
Olivella sp.

Vexillinae
Costellaria laterculatum

Cancellariidae
Cancellaria reticulata
Trigonostoma tenerum

Marginellidae
Marginella hartleyanum
Marginella eburneola
Hyalina avena
Hyalina veliei

Conidae
Conus jaspideus

Terebridae
Terebra dislocata
Terebra glossema
Terebra nassula
Terebra concava

Turridae
Cochlespria radiata
Microdrillia comatoropis
Mitrolumna biplicata
Cerodrillia simpsoni
Glyphoturris sp.
Brachycythara biconica
Brachycythara barbarae
Cryoturris fargoi
Cryoturris filifera
Cryoturris citronella
Cryoturris quadrilineata
Kurtziella atrostyla

Table 102. Continued.

GASTROPODA - continued

- Turridae - continued
  - *Rubellatoma rubella*
  - *Ithycythara lanceolata*
  - *Nannodiella melanitica*
  - *Glyphostoma hendersoni*
  - *Pyrocythara* sp.
  - *Daphnella*
  - *Platycythara elata*
  - *Rimosodaphnelle morra*
  - *Thelecythara floridana*
- Pyramidellidae
  - *Odostomia seminuda*
  - *Turbonilla* sp.
- Acteonidae
  - *Acteon punctostriatus*
  - *Acteon candens*
- Acteocinidae
  - *Acteocina candei*
- Cylichnidae
  - *Cyclichna* sp.
  - *Scaphander* sp.
- Philinidae
  - *Philine sagra*
- Bullidae
  - *Bulla striata*
- Haminoeidae
  - *Atys riiseana*
  - *Haminoea succinea*
- Retusidae
  - *Retusa sulcata*
  - *Pyrunculus caelatus*
  - *Volvulella persimilis*
  - *Volvulella recta*
  - *Volvulella texasiana*
  - *Volvulella paupercula*

GASTROPODA - continued

- Volvatellidae
  - *Cylindrobulla beauii*
- Cuvieridae
  - *Diacria trispinosa*
  - *Cavolinia uncinata*
- Siphonariidae
  - *Williamia krebsii*

SCAPHOPODA

- Dentaliidae
  - *Dentalium laqueatum*
  - *Dentalium texasianum*
  - *Dentalium ceratum*
  - *Dentalium bartletti*
  - *Dentalium semistriolatum*
  - *Dentalium ensiculus*
  - *Dentalium sowerbyi*
  - *Dentalium callipeplum*
  - *Dentalium eboreum*
- Siphonodentaliidae
  - *Cadulus carolinensis*
  - *Cadulus quadridentatus*
  - *Cadulus tetrodon*
  - *Cadulus parvus*

POLYPLACOPHORA

- Ischnochitonidae
  - *Ischnochiton boogii*
  - *Ischnochiton floridanus*
  - *Ischnochiton papillosus*
  - *Ischnochiton hartmeyeri*
- Chaetopleuridae
  - *Chaetopleura apiculata*
- Chitonidae
  - *Chiton squamosus*
- Acanthochitonidae
  - *Acanthochitona pygmaea*

Table 102. Continued.

APLACOPHORA

Chaetodermatidae
- *Chaetoderma* sp.

I ALVIA

Nuculidae
- *Nucula proxima*
- *Nucula aegeensis*

Nuculanidae
- *Nuculana carpentri*
- *Nuculana acuta*
- *Nuculana concentrica*
- *Yoldia solenoides*

Solemyacidae
- *Solemya velum*

Arcidae
- *Arca zebra*
- *Barbatia domingensis*
- *Anadara baughmani*
- *Bathyarca* sp.
- *Arcopsis adamsi*

Limopsidae
- *Limopsis cristata*
- *Limopsis minuta*
- *Limopsis sulcata*

Glycymerididae
- *Glycymenis pectinata*

Manzanellidae
- *Nucinella adamsi*

Mytilidae
- *Crenella divaricata*
- *Gregariella coralliophaga*
- *Musculus lateralis*
- *Lithophaga aristata*
- *Modiolus americanus*
- *Amygdalum papyrium*
- *Amygdalum sagittatum*
- *Botula fusca*
- *Dacrydium vitreum*

BIVALVIA - continued

Pinnidae
- *Atrina* sp.

Pteriidae
- *Pteria colymbus*

Malleidae
- *Malleus candeanus*

Pectinidae
- *Pecten raveneli*
- *Chlamys benedicti*
- *Aequipentin muscosus*
- *Cyclopecten nanus*
- *Argopecten gibbus*

Plicatulidae
- *Plicatula gibbosa*

Anomiidae
- *Anomia simplex*

Limidae
- *Lima pellucida*
- *Limatula setifera*
- *Limea bronniana*

Ostreidea
- *Ostrea equestris*

Lucinidae
- *Linga pensylvanica*
- *Linga sombrerensis*
- *Linga excavata*
- *Linga amiantus*
- *Linga leacocyma*
- *Parvilucina multilineata*
- *Parvilucina blanda*
- *Lucina nassula*
- *Lucina muricata*
- *Lucina radians*
- *Anodontia philippiana*
- *Anodontia albu*
- *Divaricella dentata*

Table 102. Continued.

BIVALVIA - continued

Thyasiridae
- *Thyasira trisinuata*
- *Thyasira flexuosa*

Ungulinidae
- *Diplodonta punctata*

Chamidae
- *Chama macerophylla*
- *Chama congregata*
- *Arcinella cornuta*

Lasaeidae
- *Erycina emmonsi*

Leptonidae
- *Montacuta limpida*
- *Mysella* sp.
- *Pythinella cuneata*

Carditidae
- *Glans dominguensis*
- *Pleuromersis tridentata*
- *Pteromeris perplana*

Astartidae
- *Astatre nana*

Crassatellidae
- *Eucrassatella speciosa*
- *Crassinella lunulata*

Cardidiidae
- *Trachycardium egmontianum*
- *Americardia media*
- *Nemocardium peramabile*
- *Nemocardium tinctum*
- *Laevicardium laevigatum*
- *Laevicardium pictum*

Mactridae
- *Ervilia concentrica*

BIVALVIA - continued

Tellinidae
- *Tellina magna*
- *Tellina listeri*
- *Tellina squamifera*
- *Tellina aequistriata*
- *Tellina guoldii*
- *Tellina alternata*
- *Tellina versicolor*
- *Tellidora cristata*
- *Macoma tageliformis*
- *Cymatoica orientalis*

Semelidae
- *Semele purpurascens*
- *Semele bellastriata*
- *Semele nuculoides*
- *Abra aequalis*
- *Abra lioica*

Solecurtidae
- *Solecurtus cumingianus*
- *Solecurtus sanctaemarthae*

Vesicomyidae
- *Vesicoma* sp.

Veneridae
- *Periglypta listeri*
- *Ventricolaria rugatina*
- *Circomphalus strigillinus*
- *Chione cancellata*
- *Chione latilirata*
- *Chione grus*
- *Gouldia cerina*
- *Pitar simpsoni*
- *Pitar cordatus*
- *Callista eucymata*
- *Madrocallista maculata*
- *Dosinia discus*

Cooperellidae
- *Cooperella atlantica*

Table 102. Continued.

BIVALVIA - continued

Corbulidae
Varicorbula operculata
Corbula contracta
Corbula cymella

Gastrochaenidae
Gastrochaena hians

Hiatellidae
Hiatella arctica

Lyonsiidae
Lyonsia hyalina floridana

Pandoridae
Pandora inflata

Periplomatidae
Periploma cf. compressa

Poromyidae
Poromya granulata

Verticordiidae
Verticordia ornata

Cuspidariidae
Cuspidaria jeffreysi
Cardiomya costellata
Cardiomya perrostrata

TABLE 103. Species Dominance At The 45 Box Core Stations During 1975 - 1976

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2101						
Parvilucina multilineata	15.82	25	9.69	22	-----	--
Tellina versicolor	12.03	19	-----	--	-----	--
Solemya velum	9.49	15	16.30	37	11.97	28
Crepidula fornicata	7.59	12	-----	--	-----	--
Calyptraea centralis	6.96	11	-----	--	-----	--
Diplodonta punctata	5.06	8	5.29	12	-----	--
Ischnochiton papillosus	-----	--	32.16	73	26.07	61
Cerithium atratum	-----	--	5.73	13	-----	--
Plicatula gibbosoa	-----	--	-----	--	5.56	13
Station 2102						
Tellina versicolor	25.97	20	54.12	92	33.16	64
Atys riiseana	11.69	9	-----	--	-----	--
Caecum bipartitum	10.39	8	-----	--	7.77	15
Eulimostrica hemphilli	10.39	8	-----	--	13.47	26
Laevicardium pictum	7.79	6	-----	--	-----	--
Varicorbula operculata	-----	--	-----	--	9.33	18
Station 2103						
Crenella divaricata	8.00	8	-----	--	-----	--
Varicorbula operculata	7.00	7	-----	--	--	--
Tellina versicolor	6.00	6	14.62	19	6.96	16
Laevicardium pictum	6.00	6	-----	--	-----	--
Atys riiseana	5.00	5	-----	--	-----	--
Parvilucina multilineata	5.00	5	14.62	19	6.52	15
Abra lioica	5.00	5	-----	--	-----	--
Diplodonta punctata	-----	--	6.15	8	-----	--
Caecum pulchellum	-----	--	8.46	11	-----	--

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2103 (continued)						
Lyonsia hyalina floridana	-----	--	-----	--	6.96	16
Finella dubia	-----	--	-----	--	5.65	13
Station 2104						
Tellina versicolor	11.67	7	-----	--	9.09	8
Olivella sp.	6.67	4	-----	--	-----	--
Amygdalum papyrium	6.67	4	-----	--	-----	--
Abra lioica	5.00	3	6.86	7	-----	--
Eulima bifasciatus	5.00	3	-----	--	-----	--
Brachycythara barbarae	5.00	3	-----	--	-----	--
Ischnochiton papillosus	-----	--	13.73	14	-----	--
Crassinella lunata	-----	--	6.86	7	6.82	6
Cadulus parvus	-----	--	5.88	6	-----	--
Semele nuculoides	-----	--	-----	--	9.09	8
Varicorbula operculata	-----	--	-----	--	5.68	5
Station 2105						
Abra lioica	31.58	12	51.72	15	8.77	5
Nucinella adamsi	10.53	4	-----	--	-----	--
Eucrassatella speciosa	7.89	3	-----	--	-----	--
Nuculana acuta	5.26	2	-----	--	-----	--
Cadulus parvus	-----	--	6.90	2	-----	--
Ischnochiton papillosus	-----	--	6.90	2	15.79	9
Parvilucina multilineata	-----	--	-----	--	8.77	5
Semele nuculoides	-----	--	-----	--	7.02	4
Limopsis sulcata	-----	--	-----	--	5.26	3
Barbatia dominguensis	-----	--	-----	--	5.26	3

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2106						
Abra lioica	14.63	6	14.29	6	10.71	1
Linga sombrerensis	14.63	6	-----	--	-----	--
Cardiomya sp.	7.32	3	-----	--	-----	--
Thyasira trisinuata	-----	--	19.05	8	-----	--
Cyclopecten nanus	-----	--	14.29	6	-----	--
Limopsis cristata	-----	--	7.14	3	17.86	5
Parvilucina multilineata	-----	--	-----	--	25.00	7
Chaetoderma sp.	-----	--	-----	--	14.29	4
Dentalium texasianum	-----	--	-----	--	7.14	2
Station 2207						
Tellina versicolor	29.76	50	23.16	41	------	--
Solemya velum	9.52	16	38.98	69	-----	--
Varicorbula operculata	------	--	7.91	14	24.44	33
Station 2208						
Parvilucina multilineata	36.09	61	29.41	65	8.33	14
Caecum bipartitum	18.34	31	-----	--	14.88	25
Caecum cubitatum	11.83	20	13.12	29	5.95	10
Acteocina candei	8.28	14	-----	--	-----	--
Tellina versicolor	7.69	13	-----	--	5.36	9
Caecum pulchellum	-----	--	37.10	82	-----	--
Abra lioica	-----	--	-----	--	16.07	27
Station 2209						
Parvilucina multilineata	26.60	50	29.71	71	31.40	38
Caecum bipartitum	24.47	46	-----	--	9.92	12
Finella dubia	11.17	21	-----	--	-----	--

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2209 (continued)						
Acteocina candei	10.11	19	15.90	38	-----	--
Caecum pulchellum	-----	--	22.59	54	-----	--
Abra lioica	-----	--	-----	--	17.36	21
Station 2210						
Parvilucina multilineata	50.74	241	33.21	87	5.45	43
Caecum bipartitum	9.68	46	-----	--	-----	--
Caecum cubitatum	7.79	37	26.72	70	-----	--
Caecum pulchellum	-----	--	10.69	28	-----	--
Varicorbula operculata	-----	--	-----	--	34.22	270
Station 2211						
Crassinella lunulata	18.75	15	12.31	8	5.48	4
Gouldia cerina	6.25	5	-----	--	-----	--
Pitar simpsoni	6.25	5	-----	--	-----	--
Parvilucina multilineata	5.00	4	-----	--	6.85	5
Corbula cymella	-----	--	6.15	4	-----	--
Frycina emmonsi	-----	--	6.15	4	-----	--
Gastrochaena hians	-----	--	-----	--	5.48	4
Varicorbula operculata	-----	--	-----	--	5.48	4
Station 2212						
Abra lioica	20.51	8	24.14	7	23.26	10
Cerithiopsis crystallinum	10.26	4	17.24	5	9.30	4
Verticordia ornata	7.69	3	6.90	2	-----	--
Cyclopecten nanus	7.69	3	-----	--	-----	--
Bathyarca glomerula	5.13	2	6.90	2	-----	--
Dentalium sp.	5.13	2	-----	--	-----	--
Nuculana acuta	5.13	2	-----	--	-----	--
Thyasira trisinuata	5.13	2	-----	--	-----	--
Chaetoderma sp.	-----	--	-----	--	25.58	11
Parvilucina multilineata	-----	--	-----	--	11.63	5

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2313						
Abra lioica	47.62	10	92.86	13	40.00	6
Nuculana carpenteri	9.52	2	-----	--	-----	--
Nemocardium peramabile	-----	--	7.14	1	-----	--
Amygdalum papyrium	-----	--	-----	--	6.67	1
Cardiomya perrostrata	-----	--	-----	--	6.67	1
Lyonsia hyalina floridana	-----	--	-----	--	20.00	3
Cerithiopsis crystallinum	-----	--	-----	--	6.67	1
Dentalium sp.	-----	--	-----	--	6.67	1
Station 2314						
Parvilucina multilineata	37.23	51	-----	--	-----	--
Tellina versicolor	13.14	18	-----	--	15.79	6
Gastrochaena hians	-----	--	51.08	118	-----	--
Barbatia dominguensis	-----	--	5.19	12	-----	--
Botula fasca	-----	--	7.79	18	-----	--
Atys riiseana	-----	--	-----	--	5.26	2
Philine sagra	-----	--	-----	--	7.89	3
Varicorbula operculata	-----	--	-----	--	5.26	2
Tellina aequistriata	-----	--	-----	--	5.26	2
Pitar simpsoni	-----	--	-----	--	5.26	2
Cardiomya perrostrata	-----	--	-----	--	21.05	8
Station 2315						
Parvilucina multilineata	39.59	116	17.02	16	-----	--
Tellina versicolor	7.51	22	43.62	41	-----	--
Philine sagra	-----	--	6.38	6	-----	--
Varicorbula operculata	-----	--	5.32	5	-----	--

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2315 (continued)						
Gastrochaena hians	-----	--	-----	--	32.67	33
Corbula cymella	-----	--	-----	--	8.91	9
Station 2316						
Tellina versicolor	43.84	32	-----	--	7.38	9
Acanthochitona pygmaea	-----	--	15.85	13	-----	--
Abra lioica	-----	--	8.54	7	-----	--
Crassinella lunulata	-----	--	8.54	7	-----	--
Varicorbula operculata	-----	--	-----	--	14.75	18
Ischnochiton papillosus	-----	--	-----	--	7.38	9
Corbula cymella	-----	--	-----	--	5.74	7
Dentalium bartletti	-----	--	-----	--	5.74	7
Station 2317						
Cymatoica orientalis	15.63	10	-----	--	-----	--
Tellina versicolor	10.94	7	55.56	45	-----	--
Parvilucina multilineata	6.25	4	-----	--	-----	--
Lucina radians	6.25	4	-----	--	-----	--
Varicorbula operculata	6.25	4	-----	--	73.78	605
Station 2318						
Diplodonta punctata	16.67	4	5.26	6	-----	--
Abra lioica	8.33	2	19.30	2	-----	--
Tellina versicolor	8.33	2	10.53	12	18.52	5
Semele nuculoides	-----	--	5.26	6	-----	--
Thyasira trisinuata	-----	--	6.14	7	-----	--

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2318 (continued)						
Cadulus quadridentatus	-----	--	-----	--	51.85	14
Acteocina candei	-----	--	-----	--	7.41	2
Station 2419						
Tellina versicolor	48.53	33	27.27	18	64.00	16
Abra lioica	7.35	5	-----	--	-----	--
Ervilia concentrica	-----	--	10.61	7	-----	--
Solemya velum	-----	--	27.27	18	-----	--
Diplodonta punctata	-----	--	12.12	8	8.00	2
Station 2420						
Cadulus sp.	17.07	14	-----	--	-----	--
Diplodonta punctata	12.20	10	-----	--	-----	--
Abra lioica	8.54	7	-----	--	-----	--
Tellina versicolor	6.10	5	-----	--	-----	--
Acanthochitona pygmaea	-----	--	30.49	25	-----	--
Rissoinea multicostata	-----	--	7.32	6	-----	--
Eulima bifasciatus	-----	--	-----	--	14.29	1
Lyonsia hyalina floridana	-----	--	-----	--	14.29	1
Turbonilla sp.	-----	--	-----	--	28.57	2
Crassinella lunulata	-----	--	-----	--	28.57	2
Gastrochaena hians	-----	--	-----	--	14.29	1
Station 2421						
Varicorbula operculata	17.50	7	-----	--	88.29	407
Caecum pulchellum	15.00	6	-----	--	-----	--
Caecum bipartitum	15.00	6	-----	--	-----	--

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2421 (continued)						
Tellina versicolor	7.50	3	7.59	6	-----	--
Volvulella persimilis	5.00	2	-----	--	-----	--
Solemya velum	-----	--	53.16	42	-----	--
Parvilucina multilineata	-----	--	6.33	5	-----	--
Station 2422						
Semele bellastriata	10.87	5	-----	--	-----	--
Cymatoica orientalis	8.70	4	-----	--	-----	--
Corbula cymella	8.70	4	6.67	3	-----	--
Acanthochitona pygmaea	6.52	3	-----	--	-----	--
Varicorbula operculata	6.52	3	-----	--	-----	--
Laevicardium laevigatum	6.52	3	-----	--	-----	--
Macrocallista maculata	6.52	3	-----	--	11.54	6
Semele nuculoides	-----	--	6.67	3	-----	--
Parvilucina multilineata	-----	--	20.00	9	-----	--
Tellina versicolor	-----	--	11.11	5	-----	--
Cylindrobulla beauii	-----	--	6.67	3	-----	--
Diplodonta punctata	-----	--	-----	--	9.62	5
Pitar cordatus	-----	--	-----	--	23.08	12
Dosinia discus	-----	--	-----	--	7.69	4
Station 2423						
Laevicardium laevigatum	11.76	4	-----	--	-----	--
Macrocallista maculata	8.82	3	-----	--	-----	--
Tellina versicolor	5.88	2	-----	--	-----	--
Pitar simpsoni	5.88	2	-----	--	-----	--
Lyonsia hyalina floridana	5.88	2	-----	--	-----	--
Corbula cymella	5.88	2	----	--	33.33	3

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2423 (continued)						
Caecum stigosum	-----	--	23.53	12	-----	--
Macromphalina floridana	-----	--	11.76	6	-----	--
Gouldia cerina	-----	--	9.80	5	-----	--
Parvilucina multilineata	-----	--	5.88	3	-----	--
Amygdalum papyrium	-----	--	-----	--	11.11	1
Diplodonta punctata	-----	--	-----	--	11.11	1
Amygdalum sagittatum	-----	--	-----	--	11.11	1
Chione cancellata	-----	--	-----	--	11.11	1
Varicorbula operculata	-----	--	-----	--	11.11	1
Station 2424						
Tellina versicolor	6.25	2	19.51	16	23.08	6
Chione cancellata	6.25	2	-----	--	-----	--
Crenella divaricata	6.25	2	-----	--	-----	--
Diplodonta punctata	6.25	2	-----	--	-----	--
Cadulus quadridentatus	6.25	2	-----	--	-----	--
Caecum cubitatum	-----	--	6.10	5	-----	--
Crassinella lunulata	-----	--	7.32	6	-----	--
Corbula cymella	-----	--	6.10	5	-----	--
Varicorbula operculata	-----	--	6.10	5	-----	--
Semele nuculoides	-----	--	-----	--	15.38	4
Corbula contracta	-----	--	-----	--	11.54	3
Station 2425						
Tellina versicolor	13.33	2	5.88	2	55.38	72
Crucibulum auricula	13.33	2	-----	--	-----	--
Solemya velum	13.33	2	-----	--	-----	--
Pecten raveneli	13.33	2	-----	--	-----	--

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2425 (continued)						
Semele bellastriata	13.33	2	-----	--	-----	--
Pteromeris perplana	13.33	2	-----	--	-----	--
Marginella hartleyanum	6.67	1	8.82	3	-----	--
Crassinella lunulata	-----	--	14.71	5	-----	--
Gastrochaena hians	-----	--	8.82	3	-----	--
Lima pellucida	-----	--	5.88	2	-----	--
Chlamys benedicti	-----	--	5.88	2	-----	--
Ischnochiton sp.	-----	--	-----	--	8.46	11
Station 2426						
Tellina versicolor	21.05	4	20.00	2	15.79	3
Abra lioica	5.26	1	-----	--	10.53	2
Poromya granulata	5.26	1	-----	--	-----	--
Nucinella adamsi	5.26	1	-----	--	-----	--
Dentalium sp.	-----	--	10.00	1	-----	--
Parvilucina multilineata	-----	--	10.00	1	-----	--
Cadulus sp.	-----	--	20.00	2	-----	--
Nuculana acuta	-----	--	10.00	1	15.79	3
Pandora inflata	-----	--	-----	--	5.26	1
Limopsis cristata	-----	--	-----	--	5.26	1
Olivella sp.	-----	--	-----	--	5.26	1
Solariella lacunella	-----	--	-----	--	5.26	1
Cardiomya perrostrata	-----	--	-----	--	5.26	1
Philine sagra	-----	--	-----	--	10.53	2
Station 2427						
Abra lioica	50.00	4	55.56	5	68.75	11
Cuspidaria sp.	12.50	1	-----	--	-----	--
Dentalium sp.	-----	--	-----	--	6.25	1

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2427 (continued)						
Cardiomya perrostrata	-----	--	-----	--	6.25	1
Dentalium ensiculus	-----	--	-----	--	6.25	1
Nemocardium peramabile	-----	--	-----	--	6.25	1
Station 2528						
Ischnochiton boogii	26.09	6	7.69	1	------	--
Chlamys benedicti	13.04	3	-----	--	------	--
Gastrochaena hians	8.70	2	7.69	1	------	--
Gouldia cerina	-----	--	7.69	1	5.26	1
Tellina versicolor	-----	--	7.69	1	10.53	2
Varicorbula operculata	-----	--	7.69	1	5.26	1
Diplodonta punctata	-----	--	15.38	2	-----	--
Pteromersis perplana	-----	--	7.69	1	-----	--
Volvulella persimilis	-----	--	7.69	1	-----	--
Tellina listeri	-----	--	7.69	1	-----	--
Natica marochiensis	-----	--	7.69	1	-----	--
Semele bellastriata	-----	--	-----	--	5.26	1
Polinices duplicatus	-----	--	-----	--	5.26	1
Chione cancellata	-----	--	-----	--	5.26	1
Cyclopecten nanus	-----	--	-----	--	26.32	5
Semele purpurascens	-----	--	-----	--	5.26	1
Crassinella lunulata	-----	--	-----	--	5.26	1
Corbula contracta	-----	--	-----	--	5.26	1
Abra lioica	-----	--	------	--	5.26	1
Station 2529						
Diplodonta punctata	5.88	1	7.14	1	-----	--
Semele purpurascens	5.88	1	-----	--	-----	--
Dentalium ceratum	5.88	1	-----	--	-----	--

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2529 (continued)						
Crenella divaricata	-----	--	14.29	2	-----	--
Lima pellucida	-----	--	7.14	1	-----	--
Pleuromeris tridentata	-----	--	14.29	2	-----	--
Crassinella lunulata	-----	--	7.14	1	-----	--
Gouldia cerina	-----	--	7.14	1	-----	--
Gastrochaena hians	-----	--	7.14	1	-----	--
Solecurtus sanctaemarthae	-----	--	-----	--	8.33	1
Tellina versicolor	-----	--	-----	--	8.33	1
Cyclopecten nanus	-----	--	-----	--	16.67	2
Philine sagra	-----	--	-----	--	8.33	1
Ischnochiton papillosus	-----	--	-----	--	8.33	1
Varicorbula operculata	-----	--	-----	--	16.67	2
Amygdalum papyrium	-----	--	-----	--	8.33	1
Station 2530						
Crenella divaricata	18.18	2	14.29	3	-----	--
Astarte nana	18.18	2	-----	--	-----	--
Pleuromeris tridentata	9.09	1	-----	--	-----	--
Chione cancellata	9.09	1	-----	--	-----	--
Nassarius	9.09	1	-----	--	-----	--
Cuspidaria jeffreysi	9.09	1	-----	--	-----	--
Crassinella lunulata	-----	--	14.29	3	-----	--
Ischnochiton boogii	-----	--	14.29	3	-----	--
Tellina versicolor	-----	--	-----	--	30.00	3
Diplodonta punctata	-----	--	-----	--	20.00	2
Semele bellastriata	-----	--	-----	--	20.00	2
Pecten raveneli	-----	--	-----	--	10.00	1
Chione latilirata	-----	--	-----	--	10.00	1

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2531						
Gastrochaena hians	12.50	2	-----	--	-----	--
Amygdalum papyrium	6.25	1	-----	--	-----	--
Diplodonta punctata	6.25	1	-----	--	-----	--
Semele bellastriata	6.25	1	-----	--	8.33	1
Crenella divaricata	6.25	1	5.00	1	-----	--
Dentalium sp.	6.25	1	-----	--	-----	--
Semele purpurascens	6.25	1	10.00	2	-----	--
Crassinella lunulata	-----	--	20.00	4	8.33	1
Ischnochiton papillosus	-----	--	20.00	4	-----	--
Pitar simpsoni	-----	--	5.00	1	8.33	1
Laevicardium larvigatum	-----	--	5.00	1	-----	--
Polinices duplicatus	-----	--	5.00	1	-----	--
Marginella hartleyanum	-----	--	5.00	1	-----	--
Ischnochiton boogii	-----	--	10.00	2	-----	--
Varicorbula operculata	-----	--	-----	--	8.33	1
Macoma sp.	-----	--	-----	--	16.67	2
Tellina versicolor	-----	--	-----	--	33.33	4
Station 2532						
Tellina versicolor	17.65	3	-----	--	30.77	4
Amygdalum papyrium	5.88	1	-----	--	-----	--
Dentalium sowerbyi	5.88	1	-----	--	-----	--
Acanthochitona pygmaea	5.88	1	-----	--	-----	--
Macoma sp.	5.88	1	-----	--	-----	--
Corbula sp.	5.88	1	-----	--	-----	--
Pitar simpsoni	-----	--	28.57	2	-----	--
Astarte nana	-----	--	14.29	1	-----	--
Solemya velum	-----	--	14.29	1	-----	--
Diplodonta punctata	-----	--	-----	--	15.38	2

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2533						
Limopsis sulcata	30.77	4	50.00	2	16.67	1
Pitar simpsoni	15.38	2	-----	--	-----	--
Limopsis cristata	7.69	1	-----	--	-----	--
Limopsis minuta	7.69	1	-----	--	-----	--
Solariella lacunella	7.69	1	-----	--	-----	--
Abra lioica	-----	--	25.00	1	-----	--
Astarte nana	-----	--	25.00	1	-----	--
Cuspidaria jeffreysi	-----	--	-----	--	16.67	1
Station 2534						
Pitar simpsoni	44.44	4	100.00	3	12.50	1
Limopsis sulcata	22.22	2	-----	--	-----	--
Abra lioica	22.22	2	-----	--	12.50	1
Gouldia cerina	-----	--	-----	--	25.00	2
Varicorbula operculata	-----	--	-----	--	12.50	1
Cyclopecten nanus	-----	--	-----	--	25.00	2
Nassarius vibex	-----	--	-----	--	12.50	1
Station 2535						
Abra lioica	40.00	2	No living molluscs		40.00	2
Tellina versicolor	20.00	1			-----	--
Nuculana acuta	20.00	1			-----	--
Nassarius vibex	-----	--			20.00	1
Anadara baughmani	-----	--			20.00	

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2536						
Yoldia solenoides	20.00	1	-----	--	14.29	1
Nuculana acuta	20.00	1	100.00	1	-----	--
Cerithiopsis crystallinun	20.00	1	-----	--	-----	--
Abra lioica	-----	--	-----	--	14.29	1
Amygdalum sagittatum	-----	--	-----	--	14.29	1
Chaetoderma sp.	-----	--	-----	--	28.57	2
Station 2637						
Abra lioica	33.33	1	-----	--	-----	--
Varicorbula operculata	33.33	1	-----	--	-----	--
Nuculana concentrica	33.33	1	100.00	1	-----	--
Tellina versicolor	-----	--	-----	--	42.86	3
Urosalpinx sp.	-----	--	-----	--	14.29	1
Cardiomya perrostrata	-----	--	-----	--	14.29	1
Nuculana sp.	-----	--	-----	--	14.29	1
Station 2638						
Nuculana concentrica	66.67	24	-----	--	57.14	8
Tellina versicolor	13.89	5	33.33	1	14.29	2
Anachis obesa	5.56	2	-----	--	-----	--
Nucula proxima	-----	--	66.67	2	7.14	1
Chione latilirata	-----	--	-----	--	7.14	1
Station 2639						
Nuculana concentrica	32.93	27	14.29	1	-----	--
Pythinella cuneata	12.20	10	-----	--	-----	--
Tellina versicolor	10.98	9	-----	--	-----	--

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2639 (continued)						
Solecurtus cumingianus	-----	--	14.29	1	-----	--
Nuculana proxima	-----	--	14.29	1	8.33	3
Tellina squamifera	-----	--	14.29	1	11.11	4
Tellina alternata	-----	--	28.57	2	-----	--
Gouldia cerina	-----	--	14.29	1	-----	--
Amygdalum papyrium	-----	--	-----	--	5.56	2
Psarostola glypta	-----	--	-----	--	5.56	2
Chione latilirata	-----	--	-----	--	5.56	2
Diplodonta punctata	-----	--	-----	--	8.33	3
Sinum perspectivum	-----	--	-----	--	8.33	3
Lyonsia hyalina floridana	-----	--	-----	--	5.56	2
Station 2640						
Tellina versicolor	40.79	31	46.43	13	25.00	5
Macoma sp.	5.26	4	-----	--	-----	--
Lyonsia hyalina floridana	-----	--	7.14	2	-----	--
Varicorulb operculata	-----	--	10.71	3	-----	--
Crassinella lunulata	-----	--	-----	--	5.00	1
Chione latilirata	-----	--	-----	--	10.00	2
Nuculana concentrica	-----	--	-----	--	5.00	1
Amygdalum papyrium	-----	--	-----	--	10.00	2
Arcopsis adamsi	-----	--	-----	--	5.00	1
Gouldia cerina	-----	--	-----	--	5.00	1
Philine sagra	-----	--	7.14	--	-----	--
Station 2641						
Tellina versicolor	26.19	11	67.57	25	29.85	20
Cadulus quadridentatus	14.29	6	-----	--	-----	--
Cardiomya costellata	7.14	3	-----	--	-----	--

TABLE 103. (continued)

Species	Summer % by number	number	Fall % by number	number	Winter % by number	number
Station 2641 (continued)						
Tellina aequistriata	7.14	3	-----	--	-----	--
Abra lioica	-----	--	5.41	2	-----	--
Carciomya ornatissima	-----	--	5.41	2	-----	--
Solemya velum	-----	--	-----	--	8.96	6
Diplodonta punctata	-----	--	-----	--	7.46	5
Station 2642						
Tellina versicolor	43.18	19	56.00	14	56.25	18
Macoma sp.	6.82	3	-----	--	-----	--
Lyonsia hyalina floridana	-----	--	8.00	2	-----	--
Cadulus quadridentatus	-----	--	8.00	2	-----	--
Tellina aequistriata	-----	--	-----	--	6.25	2
Station 2643						
Tellina versicolor	41.18	7	30.77	4	29.41	5
Abra lioica	23.53	4	-----	--	-----	--
Macoma sp.	5.88	1	7.69	1	5.88	1
Nuculana acuta	5.88	1	-----	--	23.53	4
Scaphander sp.	5.88	1	-----	--	-----	--
Amygdalum papyrium	-----	--	7.69	1	-----	--
Tellina squamifera	-----	--	15.38	2	-----	--
Massarius albus	-----	--	7.69	1	-----	--
Tellina alternata	-----	--	7.69	1	-----	--
Gouldia cerina	-----	--	-----	--	5.88	1
Cyclopecten nanus	-----	--	-----	--	5.88	1
Verticordia ornata	-----	--	-----	--	5.88	1
Cardiomya perrostrata	-----	--	-----	--	5.88	1
Octopus sp.	-----	--	-----	--	5.88	1

TABLE 103. (continued)

Species	Summer % by number	Summer number	Fall % by number	Fall number	Winter % by number	Winter number
Station 2644						
Abra lioica	50.00	3	-----	--	-----	--
Linga sombrerensis	16.67	1	-----	--	-----	--
Macoma sp.	16.67	1	-----	--	-----	--
Pitar simpsoni	-----	--	50.00	1	50.00	2
Pleuromeris tridentata	-----	--	-----	--	25.00	1
Station 2645						
Abra lioica	20.00	3	No living molluscs		No living molluscs	
Limopsis minuta	6.67	1				
Astarte nana	6.67	1				
Limopsis cristata	6.67	1				
Olivella sp.	6.67	1				

Abra lioica was the major dominant species at most of the deep water (>90 m) stations, although it occurred in abundances of only 2-29 individuals/m^2. Seasonality of species abundances is also suggested in Table 103. Some of the species which were completely absent from any of the nine replicates of one sampling were present in four to six of the nine replicates of another sampling and at times became the major dominant species. The most abundant species showed a definite trend toward maximum abundances during the winter sample suggesting a fall or winter recruitment. For example, Varicorbula operculata increased from 13 individuals/m^2 in the summer to 1120 in the winter, the latter number being mostly juveniles.

Indices of community structure as well as total specimen densities are shown in Table 104. The Shannon-Wiener index of species diversity (H') and evenness (J') are graphically presented in Figure 101. In general, H', which ranged from 0.26 to 3.36, declined from nearshore to offshore and also from south (Transect I) to north (Transect VI). This index was therefore higher for the assemblages inhabiting the coarser sand sediment than for those inhabitating the finer mud sediments. Evenness (J') showed no consistent trend with either latitude or depth and ranged from 0.20 to 1.00. Diversity also varied between seasons. At the nearshore stations at the southern transects (I, II, III, IV), H' was usually lowest during the fall sampling as a result of both the decline in the number of species and changes in dominance.

Similarity relationships at all stations between seasons are depicted after Mountford clustering in a dendrogram (Figure 102). Visual examination of the dendrogram reveals the following general tendencies about the

Table 104. Species diversity (H'), evenness (J'), species richness (SR) and density (specimens/m^2) at the 45 box core stations during the 1975-1976 seasonal sampling.

	Summer 1975				Fall 1975				Winter 1975			
Station Number	H'	J'	SR	Density	H'	J'	SR	Density	H'	J'	SR	Density
2101	3.08	0.83	7.9	293	2.14	0.67	4.2	420	2.85	0.76	7.5	433
2102	2.35	0.81	3.9	143	1.89	0.58	4.9	315	2.47	0.71	6.1	357
2103	3.37	0.92	8.2	185	2.92	0.84	6.6	241	3.36	0.87	8.5	425
2104	3.23	0.94	7.3	111	3.13	0.88	7.4	189	3.12	0.91	6.7	163
2105	1.99	0.80	3.0	70	1.25	0.64	1.8	54	1.8	0.91	4.2	105
2106	2.09	0.87	2.7	76	2.43	0.86	4.3	78	2.03	0.33	2.7	52
2207	3.05	0.78	9.4	311	2.08	0.62	5.4	327	2.45	0.77	4.7	250
2208	2.07	0.67	4.1	313	1.70	0.57	3.5	409	2.52	0.83	3.9	310
2209	2.27	0.69	5.0	348	2.15	0.66	4.6	442	2.27	0.76	4.0	224
2210	*2.26	0.55	9.7	880	2.04	0.60	5.2	485	1.45	0.44	3.9	1460
2211	2.74	0.85	5.4	148	2.86	0.93	5.0	120	3.08	0.94	5.8	135
2212	2.02	0.92	2.2	72	1.88	0.86	3.4	54	1.76	0.80	2.1	79
2313	0.90	0.65	1.0	39	0.26	0.37	2.6	26	1.48	0.83	1.8	28
2314	*2.55	0.74	6.3	254	*1.84	0.60	3.9	427	2.40	0.89	3.8	70
2315	*2.67	0.68	8.8	543	1.85	0.65	3.5	174	2.33	0.77	4.3	187
2316	2.11	0.68	5.0	115	2.57	0.84	4.5	152	3.24	0.91	7.5	166
2317	3.01	0.89	6.7	118	1.92	0.62	4.8	150	0.99	0.35	2.5	1184
2318	1.93	0.93	2.2	44	2.81	0.84	5.7	211	1.36	0.70	1.8	50
2419	1.46	0.59	2.6	126	2.07	0.74	3.6	122	1.01	0.56	1.6	46
2420	2.47	0.85	3.9	152	2.34	0.78	4.3	152	2.95	0.93	6.0	85
2421	2.15	0.87	3.0	74	1.76	0.61	3.9	146	*0.59	0.20	3.3	853
2422	2.87	0.94	5.2	85	2.59	0.90	4.5	83	*2.62	0.87	4.8	96
2423	2.70	0.95	4.5	63	2.47	0.84	4.6	94	1.67	0.93	2.3	17
2424	2.78	0.98	4.6	59	2.76	0.87	5.2	152	2.02	0.88	2.8	48
2425	1.93	0.99	2.2	28	2.47	0.93	3.7	63	1.72	0.56	4.3	240
2426	1.15	0.83	1.0	35	1.55	0.96	1.7	18	2.08	0.95	2.7	35
2427	0.50	0.72	2.1	15	-	-	-	17	0.95	0.59	1.4	30
2528	1.54	0.86	1.6	43	2.27	0.99	3.5	24	2.18	0.91	2.6	35
2529	1.10	1.00	0.7	31	2.04	0.98	2.6	26	1.89	0.97	2.4	22
2530	1.73	0.97	2.1	20	1.93	0.93	2.3	39	1.52	0.95	1.7	18
2531	1.91	0.98	2.2	30	2.02	0.92	2.7	37	1.61	0.90	2.0	22
2532	1.67	0.93	1.8	31	1.04	0.95	1.0	13	0.64	0.92	0.4	24
2533	1.43	0.89	2.6	24	1.04	0.95	1.4	7	0.69	1.00	0.6	11
2534	1.04	0.95	0.9	17	-	-	-	5	1.73	0.97	2.4	15
2535	1.04	0.95	1.2	9	-	-	-	-	1.04	0.95	1.2	9
2536	1.10	1.00	1.2	9	-	-	-	2	1.33	0.96	1.5	13
2637	1.10	1.00	1.8	6	-	-	-	2	1.25	0.90	1.5	13
2638	1.11	0.57	1.7	67	0.64	0.92	0.9	5	1.36	0.84	1.5	26
2639	2.04	0.74	3.4	152	1.75	0.98	2.6	13	2.76	0.95	4.7	67
2640	1.45	0.63	2.1	141	1.84	0.77	3.0	52	1.73	0.89	2.0	37
2641	1.90	0.82	2.4	78	1.08	0.52	1.9	68	2.2	0.78	3.6	124
2642	1.43	0.62	2.4	81	1.41	0.68	2.2	46	1.53	0.64	2.9	59
2643	1.27	0.79	1.4	31	1.61	0.90	2.0	24	1.80	0.87	2.5	31
2644	0.95	0.86	1.1	11	-	-	-	4	0.64	0.92	0.7	7
2645	1.48	0.92	1.5	28	-	-	-	-	-	-	-	-

* Based on two anchor dredges rather than nine box cores.

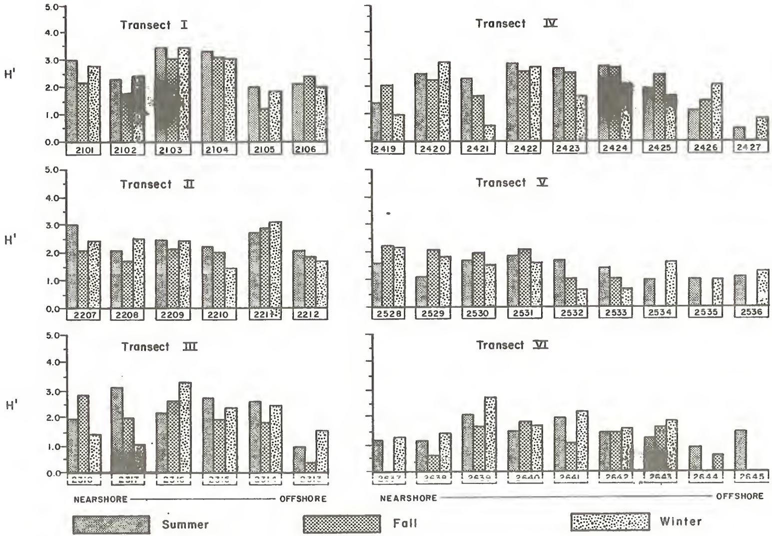

Figure 101. The Shannon - Wiener index for the MAFLA boxcore stations.

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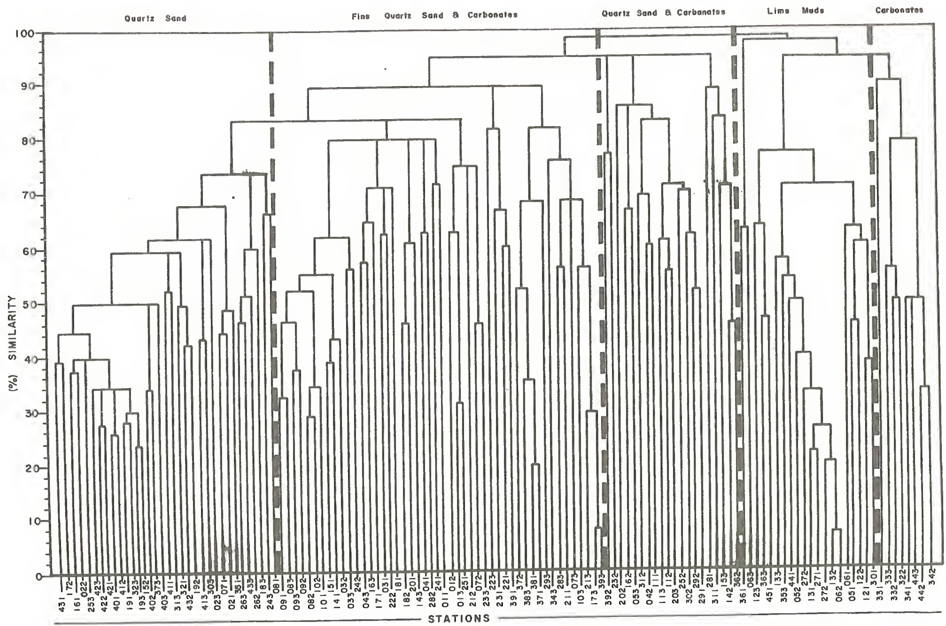

Figure 102. Dendrogram resulting from the Mountford clustering of the 45 box core stations over three seasons. Station number is indicated by the first two digits and season by the last digit (1 = summer, 2 = fall, and 3 = winter). Dashed vertical lines separate major groups. The major sediment classifications within these groups are shown.

molluscan assemblages:

1. Species composition at most stations was highly seasonally dependent throughout the MAFLA area. Affinities between any two seasons for any station vary as little as 20% (deep water or northern stations) to as much as 60% (nearshore, southern stations). There was, therefore, little within station seasonal continuity especially at the nearshore southern stations.
2. Stations exhibiting low diversities (Table 104)show greater affinity. The tendency was for the northern and deep water stations. For example, Master Stations 2534 and 2644 during the fall sampling were 100% similar and Master Stations 2313 and 2427 were 92.9% similar for the fall sampling.
3. Approximately one-third of the stations showed similarities exceeding 50% indicating that approximately two-thirds of the assemblages exhibit taxonomic heterogeneity of 50% or greater. The mean affinity for the stations considered as a whole is approximately 30%.

Five major clusters are created at very low similarity levels (4.2% to 15.6%). These faunal breaks appear to be only partially related to sediment classification. Other factors which appear to be of importance, are season, latitude, depth, and even sampling problems.

Because of the variability in species composition indicated by low between season affinities, anomalies to the classification based upon the truncation are apparent within the dendrogram. For example, Master Station 2424 which has a sediment classification of carbonate sand, appears within one cluster for the summer and fall samplings and a different cluster for the winter sampling.

Polychaetes

Polychaetes were extremely abundant in the MAFLA study tract and representatives of 51 families were collected. The total number of identified, recognized species was 508 plus 31 tentative new species and 77 other categories identified to only genus or higher. Thus, a total of 616 possible species was collected. A polychaete species list for the MAFLA study tract is presented in Table 105.

Polychaete density, biomass and species abundance at each station for each sampling period are presented in Table 106. These three parameters displayed wide fluctuations between and within transects and sampling periods. Between-transects and between-sampling periods variations were random for Transects I-IV but were non-random for Transects V and VI. Polychaete density was significantly ($\alpha \leq 0.05$) and negatively correlated with depth for all three sampling periods ($r = -0.47$, summer; $r = -0.60$, fall; $r = -0.61$, winter). Polychaete density and biomass did not co-vary to the extent that might have been expected, and biomass was not significantly correlated with either density or depth.

Indices of species diversity (H', H max, J') at each station for each sampling period are given in Table 107. Species diversity (H') ranged from 1.9 to 5.8 but, with few exceptions, evenness of distribution (J') was high for all stations. Only five J' values (4%) were less than 0.60, while 89 J' values (66%) were 0.80 or greater. Between-transects and between-sampling periods variations in species diversity were similar to those for

Table 105 . Polychaete species list by family.

Family: Aphroditidae
- Aphrodite Sp. A
- Hermione hystrix
- Pontogenia laeviseta

Family: Polynoidae
- Antinoella angusta
- Antinoella sarsi
- Eunoe spinulosa
- Gattyana cirrosa
- Harmothoe dictyaphora
- Harmothoe aculeata
- Harmothoe impar
- Harmothoe imbricata
- Harmothoe lunulata
- Hermenia verruculosa
- Iphione muricata
- Iphione sp.
- Lepidametria commensalis
- Lepidasthenia mossambica
- Lepidasthemia sp.
- Lepidasthemia sp. nov.

Family: Polyodötidae
- Eupanthalis kinbergi
- Polyodontes frons
- Polyodontes lupina
- Polyodontes oculea

Family: Eulepethidae
- Grubeulepis fimberiata
- Grubeulepis mexicana
- Grubeulepis sulcatisetis
- Grubeulepis sp. nov. S.
- Mexieulepis weberi
- Pareculepis sp.

Family: Sigalionidae
- Euleanira ehlersi
- Euthalanessa Sp. A
- Leanira n. hystricis
- Pholoe minuta
- Psammolyce ctenidophora
- Sigalion arenicola
- Sthenelais boa
- Stenelais limicola
- Pholoe dursipapillata
- Pholoe sp. nov.
- Pholoe sp. nov. A
- Psammolyce arenosa
- Sthenelais japonica

Family: Chrysopetalidae
- Bhawania goodei
- Paleanotus chrysolepis
- Paleanotus heteroseta
- Chrysopetalum occidentale
- Dysponetus sp. nov.

Family: Euphrosinidae
- Euphrosine Sp. A
- Euphrosine armadillo
- Euphrosine sp. nov. R
- Euphrosine sp.
- Euphrosine foliosa

Family: Amphinomidae
- Amphinomid Sp. A
- Chloeia viridis
- Chloeia englochis
- Paramphinome pulchella
- Pseudoeurythoe n. ambigua
- Eurythoe complanata
- Paraeurythoe americana
- Pseudoeurthoe hirusta
- Notopygos sp.

Family: Pisonidae
- Pisione remota

Family: Phyllodocidae
- Anaitides groenlandica
- Anaitides panamensis
- Eteone heteropoda
- Eteone lactea
- Eteone Sp. A
- Eulalia bilineata
- Eulalia sanguinea
- Hesionura elongata
- Lugia rarica
- Mystides Sp. A
- Paranaitis speciosa
- Phyllodoce castanea
- Phyllodoce tubicola
- Protomystides bidentata
- Anaitides arenae
- Anaitides mucosa
- Anaitides madeirensis
- Anaitides lineata
- Anaitides norvegica
- Eteone longa
- Eulalia virdis
- Nereiphylla fragilis

Table 105. Continued.

Family: Phyllodocidae (continued)

- Paranaitis kosteriensis
- Paranaitis pusilla
- Phyllodoce Sp. X
- Pterocirrus macroceros
- Hesperophyllum tectum
- Mystides borealis

Family: Pilargidae

- Ancistrosyllis jonesi
- Otopsis Sp. A
- Pilargis pacifica
- Sigambra tentaculata
- Synelmis albini
- Ancistrosyllis hamata
- Cabira incerta
- Cabira pettiboneae
- Cabira pilargiformis
- Sigambra Sp. Z
- Sigambra Sp. X
- Sigambrabassi
- Sigambra wassi
- Sigarebra orellata
- Pilargis tardigrada

Family: Hesionidae

- Gyptis vittata
- Hesionella Sp. A
- Hesionid Sp. A
- Kefersteinia cirrata
- Nereimyra Sp. A
- Parahesione luteola
- Podarke agilis
- Podarke berrisfordi
- Podarke obscura
- Hesionid n gen. n sp.
- Hesionid sp. nov. F
- Hesione splendida
- Nereimyra punctata

Family: Syllidae

- Autolytus prolifer
- Autolytus Sp. A
- Brania clavata
- Brania pusilla
- Eurysyllis tuberculata
- Eusyllis lamelligera
- Eusyllis Sp. A
- Exogene dispar
- Exogene gemmifera
- Exogene Sp. A
- Odontosyllis Sp. A
- Odontosyllis fulgarans
- Pionosyllis uraga

Family: Syllidae (continued)

- Sphaerosyllis pirifera
- Syllis alternata
- Syllis n. armillaris
- Syllis cornuta
- Syllis ferrugina
- Syllis gracilis
- Syllis hyalina
- Syllis prolifera
- Syllis regulata
- Syllis spongicola
- Trypanosyllis ankyloseta
- Trypanosyllis prampramensis
- Trypanosyllis sebra
- Spermosyllis sp.
- Eusyllinid O
- Odontosyllis polycera
- Odontosyllis procera
- Eurysyllis sp. nov
- Eurysyllis Sp. Y
- Esyllid F
- Sphaerosyllis erinaceus
- Sphaerosyllis fortuita
- Sphaerosyllis pirifera
- Sphaerosyllis bulbosa
- Eusyllis assimilis
- Brania prolifera
- Brania limbata
- Exogene verugera
- Parapionosyllis longocirrata
- Pionosyllis ehlersiaformis
- Pionosyllis lumelligena
- Pionosyllis malmgreni
- Syllis krohnii
- Syllis variegata
- Syllis pusilla
- Syllis amica
- Sphaerosyllis hystrix
- Sphaerosyllis Sp. Y
- Streptosyllis arenae
- Proceraea fasciata
- Procecaea cornuta
- Syllis acculata
- Syllis sp. nov.
- Parapionosyllis minuta
- Syllides longocirrata
- Pionosyllis Sp. S
- Exogonides sp. nov. A

Family: Sphaerodoridae

- Ephesiella claparedii
- Sphaerodoridium benguellarium
- Ephesiella sp. nov.

Table 105. Continued.

Family: Chaetopteridae
- *Mesochaetopterus* n. *capensis*
- *Phyllochaetopterus* Sp. A
- *Spiochaetopterus oculatus*
- *Chaetopterus variopedatus*
- *Mesochaetopterus taylori*
- *Phyllochaetopterus* sp. nov.
- *Spiochaetopterus typicus*

Family: Cirratulidae
- *Caulleriella killariensis*
- *Chaetozone gayheadia*
- *Chaetozone setosa*
- *Cirratulus hedgpethic*
- *Dodecacaeria concharum*
- *Tharyx annulosus*
- *Tharyx marioni*
- *Tharyx setigera*
- *Cauleriella alata*
- *Cauleriella bioculatume*
- *Cauleriella acicula*
- *Cauleriella caputesocis*
- *Cauleriella gracilis*
- *Cirratulus cirratus*
- *Cirratulus filiformis*
- *Cirriformia tentaculata*
- *Chaetozone corona*
- *Dodecaceria diceria*

Family: Cossuridae
- *Cossura delta*
- *Cossura* Sp. A

Family: Orbiniidae
- *Haploscoloplos foliosus*
- *Haploscoloplos fragilis*
- *Haploscoloplos robostus*
- *Orbinia americana*
- *Phylo felix*
- *Scoloplos capensis*
- *Scoloplos rubra*
- *Schroederella parliani*
- *Nainereis laevigata*
- *Nainereis setosa*
- *Scoloplos acmeceps*
- *Scoloplos pilargiduncus*
- *Scoloplos* sp. nov.
- *Scoloplos* sp. nov. C
- *Orbinia riseri*

Family: Paraonidae
- *Aedicira belgicae*
- *Aricidea fauveli*
- *Aricidea fragilis*
- *Aricidea jeffreysii*
- *Aricidea suecica*
- *Aricidea taylori*
- *Aricidea wassi*
- *Cirrophorus branchiatus*
- *Cirrophorus lyriformis*
- *Paraonis gracilis*
- *Paraonides lyra*
- *Aricides ramosa*
- *Aricidea uschakovii*
- *Cirrophorus aciculata*
- *Cirrophorus furcata*

Family: Questidae
- *Questa caudicirra*

Family: Opheliidae
- *Ammotrypane* Sp. A
- *Armandia agilis*
- *Armandia maculata*
- *Ophelina cylindricaudata*
- *Ophelina* Sp. A
- *Polyophthalmus translucens*
- *Travisia forbesii*
- *Travisia* Sp. A
- *Polyopathalmus pictus*
- *Trachytrypane jeffreysii*

Family: Scalibregmidae
- *Asclerocheilus* Sp. A
- *Hyboscolex longiseta*
- *Paraschlerocheilus* Sp. A
- *Scalibregma inflatum*
- *Scalibregma* Sp. A
- *Sclerocheilus oculatus*
- *Sclerocheilus* Sp. A
- *Paraschlerockeilus capensis*
- *Sclerockeilus minutus*
- *Diplocirrus capensis*

Family: Capitellidae
- *Capitella capitata*
- *Capitellid* Sp. A
- *Leiocapitella glabra*
- *Leiochrides pallidior*
- *Mediomastus californiensis*
- *Notomastus americanus*

Table 105. Continued.

Family: Neridae

Ceratocephala Sp. B
Ceratonereis irritablis
Ceratonereis mirabilis
Ceratonereis versipedata
Neanthes Sp. A
Neanthes Sp. B
Nereis falsa
Nereis grayi
Nereis riisei
Nereis Sp. A
Websterinereis tridentata
Kinbergineris inermis
Laeonereis culveri
Nereis zonata
Nereis irrorata
Nereis pelagica
Neanthes acuminata
Neanthes succinea
Platynereis dumerili
Rullierinereis sp.
Stenonereis sp. nov.
Ceratonereis sp. nov.
Ceratonereis costae

Family: Nephtyidae

Aglaophamus circinata
Aglaophamus verrilli
Micronephtys Sp. A
Nephtys bucera
Nephtys picta
Nephtys squamosa
Aglaophamlus malmgreni
Micromaldane sp.
Nephtys incisa

Family: Paralacydoniidae

Paralacydonia paradoxa

Family: Glyceridae

Glycera americana
Glycera capitata
Glycera longipinnis
Glycera oxycephala
Glycera papillosa
Glycera tesselata
Hemipodus roseus
Glycera convoluta
Glycera dibranchiata
Glycera tenuis
Glycera assymetrica

Family: Goniadidae

Glycinde nordmanni
Goniada littorea
Goniada norvegica
Goniada teres
Goniadella gracilis
Progoniada regularis
Goniada maculata
Goniada brunnea
Glycinde digodon

Family: Eunicidae

Eunice antennata
Eunice indica
Eunice kinbergi
Eunice siciliensis
Eunice vittata
Eunice websteri
Eunice Sp. A
Lysidice ninetta collaris
Lysidice ninetta ninetta
Marphysa sanguinea
Nematonereis unicornis
Marphysa martenseni
Lumbrineris parvapedata
Eunice aphroditois
Paramarphysa longula

Family: Onuphidae

Diopatra cuprea cuprea
Diopatra cuprea spirobranchus
Diopatra n. dubia
Epidiopatra papillosa
Leptoecia Sp. A
Onuphis conchylega
Onuphis eremita
Onuphis holobranchiata
Onuphis magna
Onuphis microcephala
Onuphis nebulosa
Onuphis pallidula
Onuphis Sp. A
Paraonuphis antarctica
Rhamphobranchium atlanticum
Edidiopatra sp. nov.
Nothria sp. nov. U
Nothria dula
Onuphius eremite occulata
Rhamphobrachium Sp. B

Family: Lysaretidae

Lysarete brasiliensis
Oenone fulgida

Table 105. Continued.

Family: Lumbrineridae

Lumbrineris aberrans
Lumbrineris albidentata
Lumbrineris bassi
Lumbrineris coccinea
Lumbrineris cruzensis
Lubrineris erecta
Lumbrineris impatiens
Lumbrineris inflata
Lumbrineris latreilli
Lumbrineris paradoxa
Lumbrineris parvipedata
Lumbrineris tenuis
Lumbrineris tetraura
Lumbrineris Sp. A
Ninoe nigripes
Lumbrineris acuta
Lumbrineris branchiata
Lumbrinerio mucronata
Lumbrineris sp. nov. B

Family: Arabellidae

Arabella iricolor
Arabella mutans
Arabellid Sp. A
Arabella semimaculata
Drilonereis filum
Drilonereis longa
Drilonereis magna
Notocirrus Sp. A

Family: Dorvilleidae

Dorvillea caeca
Dorvillea neglecta
Dorvillea rubrovittata
Dorvillea rudolphi
Dorvillea sociabilis
Ophryotrocha peurilis
Protodorvillea kefersteini

Family: Spionidae

Aonides mayaguezensis
Apoprionospio dayi
Apoprionospio pygmaea
Dispio uncinata
Laonice cirrata
Malacoceros vanderhorsti
Microspio pigmentata
Minuspio cirrifera
Minuspio japonica
Minuspio longibranchiata
Nerine agilis
Nerinides tridentata
Paraprionospio pinnata
Polydora ciliata
Polydora ligni
Polydorella Sp. A

Family: Spionidae (continued)

Polydora websteri
Polydora Sp. A.
Prionospio cirrobranchiata
Prionospio cristata
Prionospio heterobranchiata
Prionospio steenstrupi
Pygospio elegans
Rhynchospio inflatus
Scolecolepides viridis
Scolelepis squamata
Scolelepis texana
Spio pettiboneae
Spiophanes bombyz
Spiophanes berkeleyorum
Spiophanes wigleyi
Aonides oxycephala
Nerinides foliosa
Malacoceros indicus
Polydora convexa
Polydora tetabranchia
Polydora socialis
Polydora colonia
Plutynereis domerili
Prionospia ehlersi
Spio filicornus
Spionid H
Apoprionospio sp. nov.
Dispio sp. nov. T
Boccardia proboscidea
Prionospio plumosa
Rhynchospio glutaeus

Family: Magelonidae

Magelona n. pacifica
Magelona pettiboneae
Magelona polydentata
Magelona Sp. B
Magelona Sp. C
Magelona alleni
Magelona californica
Magelona cincta
Magelona japonica
Magelona longicornis
Magelona obockensis

Family: Poecilochaetidae

Poecilochaetus johnsoni
Poecilochaetus serpens

Table 105. Continued.

Family: Capitellidae (continued)

Notomastus hemipodus
Notomastus latericeus
Barantolla americana
Anotomastus nudus
Capitita ambiseta
Capitellides jonesi
Capitomastus minimus
Dasybranchus lumbricoides
Dasybranchus lunulatus
Decamasturs gracilis
Heteromastus filiformis
Nephetermastus lineus
Pseudocapitella incerta
Pulliella sp.
Scyphoproctus plantyproctus
Scyphoproctus oculatus
Scyphoproctus sp. nov.
Scyphoproctus Sp. X
Scyphoproctus Sp. Y

Family: Maldanidae

Asychis carolinae
Asychis elongata
Asychis Sp. A
Axiothella mucosa
Clymenella torquata
Euclymene delineata
Euclymene lumbricoides
Euclymene lumbricoides
Euclymene oerstedii
Euclymene Sp. B
Macroclymene zonalis
Praxillella elongata
Praxillura ornata
Praxillura Sp. A
Clymenura cirrata
Heteroclymene globra
Lumbriclymenella robusta
Maldane sarsi
Nicomache lumbericolis
Nimomache trispinata
Branchiosychis americana
Clymsenella sp. nov.

Family: Oweniidae

Myriochele bioculatum
Owenia fusiformis
Myriochele oculata
Myriochele sp. nov.
Myrionenia Sp. K

Family: Flabelligeridae

Diplocirrus capensis
Pherusa ehlersi
Pherusa inflata
Flabelligera affinis
Flabelliderma sp. nov.

Family: Sabellariidae

Lydamis Sp. A
Sabellaria vulgaris vulgaris
Sabellaria floridus

Family: Pectinariidae

Cistenides gouldii
Lagis Sp. A
Pectinaria koreni koreni

Family: Ampharetidae

Amage auricula
Ampharete acutifrons
Ampharete americana
Ampharete parvidentata
Ampharetid Sp. A
Amphicteis gunneri
Amphicteis Sp. A
Isolda pulchella
Melinna maculata
Samythella eliasoni
Archenoplax sp.
Amphicteis scyphobranchiata
Ampharete sp. nov. O
Lysippe labiata
Lysippides sp.
Melinnopsis atlantica
Melinna monoceroides

Family: Terebellidae

Amaeana accraensis
Amaeana trilobata
Loimia viridis
Loimia Sp. A
Pista brevibranchiata
Pista cristata
Pista macrolobata
Pista palmata
Pista quadrilobata
Polycirrus caroliensis
Polycirrus n. eximius
Telothelepus Sp. A
Thelepus setosus
Lanice conchylega

Table 105. Continued.

Family: Terebellidae (continued)

Loimia medusa
Proclea sp.
Streblosoma hartmanae
Terebella pterochaeta
Terebella sp. nov. A
Polycirrus plumoseus
Amphitrite cirreata
Lysilla sp.
Lysilla loveni
Leaena videns
Leaena abranchiata
Nicolea cetrata
Lanassa sp. nov. G
Lanassagracilis

Family: Trichobranchidae

Terebellides stroemi
Trichobranchus glacialis

Family: Sabellidae

Choneduneri
Desdemona Sp. A
Euchone incolor
Fabricia n. atlantica
Hypsicomus elegans
Hypsicomus Sp. A
Jasmineira bilobata
Jasmineira caudata
Megalomma bioculatum
Megalomma lobiferum
Megalomma quadrioculatum
Potamilla reniformis
Potamilla spathiferus
Sabella melanostigma
Sabella microphthalma
Brachiomma nigromacula
Chone americana
Chone mollis
Chone ecaudata
Chone filicaudata
Euchne ocellata sp. nov.
Fabricia limnicola
Fabricia cabella
Jasmineira elegans
Laonome sp.
Oridia armandi
Sabellid O
Hypsicomus phaeotaenia
Potamilla torelli
Vermiliopsis multiannulata
Sabellastarte sp.
Fabrisabella sp. nov. O

Family: Serpulidae

Ficopomatus n. macrodon
Hydroides bandaensis
Hydroides crucigera
Hydroides elegans
Hydroids protulicola
Metavermilia Sp. A
Neovermilia capensis
Pomatoceros americanus
Pomatoleios caerulescens
Protula tubularia
Pseudovermilia occidentalis
Serpula vermicularis
Vermiliopsis annulata
Apomalus similus
Ditrupa arietina
Filograna implexa
Hydroides lunulifera
Hydroides norvegica
Hydroides uncinata
Hydroides heteroceros
Hydroides sp. nov.
Metacermilia multecristata
Placostegus tridentatus
Salmacine dysteri
Serpula lobiancoi
Spirorbis corrogatum
Vemiliopsis biformis
Vemiliopsis infundibulum
Vemiliopsis multiannulatum
Spirobranchus giganteus
Pomotoleios sp. nov.
Dexiospira spieillum

Family: Disomidae

Trochochaeta multisetosa

Family: Heterospionidae

Longosoma prionota

Family: Lacydoniidae

Paralacydonia paradoxa
Laydonia miranda

Table 106. Density, biomass (wet weight) and species abundance of polychaetes for all three sampling periods.

	Summer 1975			Fall 1975			Winter 1976				
Station	Density $\#/m^2$	Biomass g/m^2	# of Species	Density $\#/m^2$	Biomass g/m^2	# of Species	Density $\#/m^2$	Biomass g/m^2	# of Species	Depth (m)	Sediment Classification*
Transect I											
2101	2686	19.78	80	893	10.76	56	1457	17.55	72	11.0	fsd
2102	1113	3.47	57	1358	8.06	34	1112	5.75	52	17.4	fsd
2103	1513	14.73	125	3046	9.73	109	689	5.39	65	36.6	msd
2104	1346	3.73	93	1310	2.94	94	817	3.52	89	53.3	msd
2105	560	1.40	81	272	0.57	55	450	0.44	53	89.6	csd
2106	382	1.32	71	269	0.27	53	207	0.19	34	161.5	fsd
Transect II											
2207	3784	13.75	95	2046	8.55	68	3177	13.51	67	18.3	fsd
2208	1291	4.02	49	743	1.23	40	864	2.85	46	34.1	slt
2209	3682	4.25	60	1855	2.77	57	2298	4.87	49	29.3	slt
2210	1393	10.66	67	1717	2.87	61	1493	4.38	70	36.6	
2211	1105	4.09	94	1831	6.28	113	2734	7.92	110	42.1	csd
2212	432	0.55	44	222	0.86	34	441	1.55	46	186.5	slt
Transect III											
2313	155	0.64	41	109	0.76	29	91	0.26	24	164.6	slt
2314	4240	11.70	61	838	13.04	69	1195	3.75	76	42.7	
2315	2872	20.79	94	1734	10.57	105	1808	14.08	117	36.6	
2316	1720	11.39	147	2170	6.69	123	2050	9.43	121	37.2	fsd
2317	1282	7.66	116	2336	9.84	146	2079	11.40	74	27.4	vfsd
2318	450	1.41	53	1519	5.62	90	1879	3.76	54	18.9	msd

Table 106. Continued.

Station	Summer 1975 Density #/m^2	Summer 1975 Biomass g/m^2	Summer 1975 # of Species	Fall 1975 Density #/m^2	Fall 1975 Biomass g/m^2	Fall 1975 # of Species	Winter 1976 Density #/m^2	Winter 1976 Biomass g/m^2	Winter 1976 # of Species	Depth (m)	Sediment Classification
Transect IV											
2419	568	2.59	61	1015	4.88	74	838	4.48	55	9.8	fsd
2420	937	6.74	105	1748	5.84	113	1253	8.25	88	14.6	f to msd
2421	1158	8.76	85	1746	13.39	100	1483	7.11	73	19.2	vf to fsd
2422	2084	21.78	141	1336	12.60	114	1115	8.59	58	24.1	msd
2423	1551	12.48	115	2282	20.72	127	1377	33.14	83	29.6	c-vcsd
2424	598	5.63	86	1879	11.76	102	1191	12.00	84	28.3	msd
2425	650	7.55	101	1858	11.47	133	1776	12.79	104	36.6	m-csd
2426	370	1.19	67	393	9.46	52	372	3.94	39	86.3	msd
2427	118	2.59	31	95	2.33	29	141	4.69	34	172.2	slt
Transect V											
2528	2165	14.91	129	822	8.03	102	2033	5.35	96	37.2	c-vcsd
2529	1609	7.35	95	1252	3.11	102	1626	5.05	81	37.5	vcsd
2530	1443	8.30	106	1128	3.24	88	2291	7.53	87	40.2	csd
2531	970	6.22	108	1159	4.27	99	2107	8.07	90	44.5	c-vcsd
2532	817	3.83	103	622	0.80	75	1776	7.36	84	50.3	msd
2533	904	6.26	93	296	0.48	52	1054	4.63	66	66.4	csd
2534	844	3.30	108	170	0.30	46	759	3.72	76	72.5	vcsd
2535	237	6.07	45	76	0.06	21	515	1.13	33	115.8	slt
2536	157	1.83	38	94	0.26	31	218	0.83	34	180.4	slt

Table 106. Continued.

Station	Summer 1975 Density #/m^2	Summer 1975 Biomass g/m^2	Summer 1975 # of Species	Fall 1975 Density #/m^2	Fall 1975 Biomass g/m^2	Fall 1975 # of Species	Winter 1976 Density #/m^2	Winter 1976 Biomass g/m^2	Winter 1976 # of Species	Depth (m)	Sediment Classification*
Transect VI											
2637	639	8.66	44	172	1.70	26	533	1.15	34	21.3	slt
2638	415	5.01	44	306	1.76	30	281	1.09	29	25.6	slt
2639	1942	14.01	95	724	4.14	71	1474	9.62	68	32.0	vf-fsd
2640	2661	9.99	102	1009	5.57	77	1850	8.05	77	35.7	msd
2641	1168	4.42	79	728	3.76	89	2326	4.75	63	35.1	fsd
2642	942	4.14	89	715	4.77	83	1311	2.61	64	36.0	fsd
2643	665	7.73	94	492	2.35	68	748	2.29	61	68.0	m-csd
2644	685	4.33	88	594	2.78	73	963	5.35	73	70.7	csd
2645	1185	5.55	108	520	1.96	74	670	3.17	66	107.3	vcsd

* slt = silt, 4-64 microns
vfsd= very fine sand, 64-125 microns
fsd = fine sand, 125-250 microns
msd = medium sand, 250-500 microns
csd = coarse sand, 500-1000 microns
vcsd= very coarse sand, 1-2 microns

Table 107. Species diversity of polychaetes for all three sampling periods.

Station	Summer 1975 H'	Summer 1975 Hmax	Summer 1975 J'	Fall 1975 H'	Fall 1975 Hmax	Fall 1975 J'	Winter 1976 H'	Winter 1976 Hmax	Winter 1976 J'	Depth (m)	Sediment Classification*
Transect I											
2101	2.4	4.3	0.56	3.06	4.02	0.76	3.17	4.27	0.74	11.0	fsd
2102	2.9	4.1	0.71	2.43	3.53	0.69	2.89	3.95	0.73	17.4	fsd
2103	5.8	6.9	0.83	2.99	4.69	0.64	3.35	4.17	0.80	36.6	msd
2104	3.6	4.5	0.80	3.48	4.54	0.77	3.68	4.49	0.82	53.3	msd
2105	3.15	4.4	0.72	3.57	4.01	0.89	3.49	3.97	0.88	89.6	csd
2106	3.5	4.2	0.83	3.57	3.97	0.89	3.15	3.53	0.89	161.5	fsd
Transect II											
2207	2.1	4.5	0.47	3.15	4.22	0.75	2.90	4.20	0.69	18.3	fsd
2208	2.92	3.8	0.75	2.86	3.69	0.77	2.92	3.83	0.76	34.1	slt
2209	2.43	4.1	0.59	2.62	4.04	0.65	2.73	3.89	0.70	29.3	slt
2210				2.78	4.11	0.68	3.37	4.25	0.79	36.6	
2211	3.74	4.54	0.82	3.85	4.73	0.81	3.41	4.70	0.72	42.1	csd
2212	2.99	3.74	0.79	3.02	3.53	0.86	3.35	3.83	0.87	186.5	slt
Transect III											
2313	3.47	3.6	0.94	3.18	3.37	0.94	2.83	3.18	0.89	164.6	slt
2314	2.5	4.1	0.61	3.63	4.23	0.86	3.40	4.33	0.78	42.7	
2315	3.26	4.54	0.72	3.79	4.65	0.81	4.11	4.76	0.86	36.6	
2316	4.2	4.9	0.85	3.99	4.81	0.83	3.88	4.79	0.81	37.2	fsd
2317	4.0	4.7	0.84	4.18	4.98	0.84	3.23	4.30	0.75	27.4	vfsd
2318	3.0	3.9	0.77	3.60	4.49	0.80	1.94	3.99	0.49	18.9	msd

Table 107. Continued

Station	Summer 1975 H'	Summer 1975 Hmax	Summer 1975 J'	Fall 1975 H'	Fall 1975 Hmax	Fall 1975 J'	Winter 1976 H'	Winter 1976 Hmax	Winter 1976 J'	Depth (m)	Sediment Classification*
ansect IV											
2419	3.2	4.1	0.78	3.56	4.30	0.83	3.18	4.01	0.79	9.8	fsd
2420	3.9	4.6	0.84	3.96	4.73	0.84	3.68	4.48	0.82	14.6	f to msd
2421	3.4	4.4	0.77	3.78	4.60	0.82	3.49	4.29	0.81	19.2	vf to fsd
2422	4.0	4.9	0.80	3.93	4.74	0.83	3.29	4.06	0.81	24.1	msd
2423	3.9	4.7	0.83	3.83	4.84	0.79	3.17	4.42	0.72	29.6	c-vcsd
2424	3.87	4.4	0.87	3.73	4.62	0.81	3.63	4.43	0.82	28.3	msd
2425	4.0	4.6	0.88	4.20	4.89	0.86	3.74	4.64	0.80	36.6	m-csd
2426	3.6	4.2	0.86	3.20	3.95	0.81	2.88	3.66	0.79	86.3	msd
2427	3.1	3.4	0.92	3.14	3.37	0.93	3.17	3.53	0.89	172.2	slt
ansect V											
2528	3.95	4.86	0.81	4.08	4.62	0.88	3.83	4.53	0.84	37.2	c-vcsd
2529	3.76	4.55	0.83	3.74	4.62	0.81	3.46	4.37	0.79	37.5	vcsd
2530	3.83	4.65	0.82	3.59	4.48	0.80	3.80	4.47	0.85	40.2	csd
2531	3.89	4.67	0.83	3.80	4.60	0.83	3.40	4.50	0.75	44.5	c-vcsd
2532	4.18	4.60	0.91	3.51	4.32	0.81	3.67	4.43	0.83	50.3	msd
2533	4.08	4.52	0.90	3.39	3.95	0.86	3.38	4.19	0.81	66.4	csd
2534	4.22	4.67	0.90	3.64	3.83	0.95	3.84	4.33	0.89	72.5	vcsd
2535	3.39	3.78	0.90	2.75	3.04	0.90	2.02	3.47	0.58	115.8	slt
2536	3.31	3.64	0.91	3.21	3.43	0.94	2.95	3.53	0.84	180.4	slt

Table 107. Continued.

Station	Summer 1975 H'	Summer 1975 Hmax	Summer 1975 J'	Fall 1975 H'	Fall 1975 Hmax	Fall 1975 J'	Winter 1976 H'	Winter 1976 Hmax	Winter 1976 J'	Depth (m)	Sediment Classification*
Transect VI											
2637	2.91	3.78	0.77	2.73	3.26	0.84	2.66	3.53	0.76	21.3	slt
2638	3.08	3.78	0.81	2.44	3.40	0.72	2.76	3.37	0.82	25.6	slt
2639	3.79	4.55	0.83	3.79	4.26	0.89	3.42	4.22	0.81	32.0	vf-fsd
2640	3.60	4.62	0.78	3.18	4.34	0.73	3.70	4.33	0.85	35.7	msd
2641	3.44	4.36	0.79	3.87	4.47	0.87	3.10	4.13	0.75	35.1	fsd
2642	3.75	4.49	0.84	3.95	4.42	0.89	3.46	4.16	0.83	36.0	fsd
3643	4.07	4.54	0.90	3.60	4.22	0.85	3.57	4.11	0.87	68.0	m-csd
2644	3.87	4.48	0.86	3.75	4.29	0.87	3.64	4.29	0.85	70.7	csd
2645	3.99	4.78	0.85	3.87	4.30	0.90	3.91	4.17	0.94	107.3	vcsd

* slt = silt, 4-64 microns
vfsd= very fine sand, 64-125 microns
fsd = fine sand, 125-250 microns
msd = medium sand, 250-500 microns
csd = coarse sand, 500-1000 microns
vcsd= very coarse sand, 1-2 microns

density, biomass and species abundance. Although correlation analyses indicated no significant relationship between species diversity and sediment-grain size or depth, a frequency distribution (Table 108) did suggest a partial relationship between species diversity and sediment type.

One hundred and three (103) of the possible 616 polychaete species were dominants (accounted for 5% or more of the total specimens) at least once. Table 109 lists the dominant species and the number of stations per transect at which they were dominant for one or more of the three sampling periods. Thirty-two species were dominants at only one station; 22 species were dominants at two or more stations but at only one transect; 13 species were dominant at four or more transects; and only one species was a dominant at all six transects. Aedicira belgicae had the greatest frequency of station dominance (21 stations along five transects).

Table 110 presents maximum, minimum and mean station homogeneity values for Transects I-VI for each sampling period. These data show wide variation in homogeneity within stations (nine replicates per sampling period) and between stations, transects and sampling.

Table 111 presents community classification of stations for Transects I-IV based on characteristics of polychaete species groups collected during the summer sampling program.

Epifauna/Epiflora

Results of the benthic macro-epifaunal/epifloral study through dredging, trawling, and diving can be summarized by groups as follows:

Table 108. Frequency distribution of H' values occurring at different sediment grain sizes. Numbers in parentheses are relative frequencies (%).

H'	slt + vfsd	vf-fsd + fsd	f-msd + msd	m-csd + csd	c-vcsd + vcsd
<3.00	17 (56)	6 (20)	3 (11)		
≥3.00; <3.50	11 (37)	12 (40)	6 (22)	5 (24)	3 (17)
≥3.50; <4.00	2 (7)	11 (37)	15 (56)	12 (57)	13 (72)
≥4.00; <4.50		1 (3)	2 (7)	4 (19)	2 (11)
≥4.50; <5.00					
≥5.00			1 (4)		
TOTAL	30(100)	30(100)	27(100)	21(100)	18(100)

* slt = silt
vfsd = very fine sand
fsd = fine sand
msd = medium sand
csd = coarse sand
vcsd = very coarse sand

Table 109. List of dominant species by transect of occurrence. Values are the number of stations at which a species was a dominant for one or more sampling periods. Dominant species is defined as one which comprised 5% or more of the total specimens in the collection.

Species	I	II	III	IV	V	VI
Lepidonotus sublevis						1
Amphinomid A						2
Syllis spongicola	2	1	1		1	
Syllis cornuta					2	1
Syllis hyalina	1				5	
Syllis regulata			1		1	
Syllis alternata			1			
Exogene dispar					4	4
Exogene A						1
Exogene verugera		1				
Sphaerosyllis pirifera					5	1
Syllid A						1
Ceratocephale B						2
Websterinereis tridentata						5
Neanthes B						2
Neanthes acuminate	1			2		
Aglaophamus circinata						1
Aglaophamus verrilli	3	1	1	5		
Paralacydonia paradoxa				1	1	1
Euclymene oerstedii				1		
Glycera papillosa					2	
Glycera capitata					7	2
Glycera tesselata			1	4		
Goniada littorea					4	
Goniada teres				1	1	
Eunice vittata	1	2	1		2	1
Onuphis A						1
Onuphis microcephala		1		1		
Lumbrineris parvipedata	1	1	4	4	1	5
Lumbrineris (acuta)				1		
Lumbrineris cruzensis			1			1
Protodorvillea kefersteini	1			1		1
Spio pettiboneae					2	1
Paraprionospio pinnata	2		2	5	2	5
Scolelepis squamata					2	
Prionospio cirrobranchiata					4	

Table 109. Continued.

Species	I	II	III	IV	V	VI
Prionospio cristata				1	6	2
Prionospio ehlersi	1					
Prionospio steenstrupi	4	5	1	3		
Apoprionospio dayi	2	3			1	
Apoprionospio pygmaea				2		
Pygospio elegans					1	
Magelona pacifica						1
Magelona californica	2	3	1			
Magelona longicornis			2			
Magelona B						2
Poecilochaetus johnsoni						1
Tharyx annulosus						1
Tharyx marioni					1	2
Tharyx setigers						1
Cossura A					1	3
Cossura delta	1	2	1			
Heploscoloplos foliosus						1
Cirrophorus lyriformis						1
Cirrophorus branchiatus				1		
Aricidea fauveli	1	4				2
Aricidea fragilis						1
Aricidea suecica						2
Aricidea jeffreysii						1
Aricidea wassi						1
Paraonis gracilis	5	5	2		2	2
Paraonides lyra	2	2	1	4		2
Aedicira belgicae	3	5	4	5		4
Armandia maculata	2		1	2		3
Mediomastus californiensis						4
Asychis carolinae						1
Samythelia eliasoni						3
Ampharete A						3
Ampharete acutifrons	3					
Ampharete americana			1	1		
Bhawania goodei	1	1		1		
Chone filicaudata		1	3	2		
Chone duneri		1	1			
Cirratulus filiformis	1					
Hemipodus roseus	1	1	1	2		
Hesionid ngen nsp				1		
Kinberginereis inermis	2	1	3	2		

Table 109. Continued.

Species	I	II	III	IV	V	VI
Lysidice ninetta			2			
Minuspio cirrifera	1	4	2	2		
Nephtys bucera			1			
Nephtys picta				1		
Nothria pallidula		1	1			
Nothria sp nov U		1	1	1		
Pholoe minuta				1		
Pholoe sp nov A		1				
Polydora tetrabranchiata	2					
Polydora socialis	1					
Progoniada regularis		1		2		
Pseudoeurythoe ambigua		1		1		
Sigambra tentaculata		1	1			
Spionid H			1	1		
Spiophanes bombyx				2		
Synelmis albini	2			2		
Tachytrypane jeffreysii				2		
Caulleriella cioculata	1					
Filograna implexa	1		2			
Hydroides sp nov			1			
Pionosyllis ehlersiaformis	1					
Paleanotus heteroseta				1		
Laonice conchilega	1					
Anaitides madeirensis			1			
Nereis zonata				2		
Notomastus latericeus				3		

Table 110. Maximum, minimum and mean morisita affinity indices as a measure of sample homogeneity for polychaetes. The number of replicates per station is nine (9).

	Summer			Fall			Winter/Spring		
Station	Max	Min	Max+Min / 2	Max	Min	Max+Min / 2	Max	Min	Max+Min / 2
2101	1.01	0.74	0.88	1.09	0.62	0.85	1.00	0.45	0.72
2102	1.04	0.58	0.81	1.01	0.75	0.88	1.08	0.34	0.71
2103	0.98	0.0	0.49	1.00	0.05	0.52	0.99	0.17	0.58
2104	1.04	0.44	0.74	1.03	0.0	0.51	1.23	0.25	0.74
2105	1.05	0.62	0.83	6.43	0.32	3.37	1.25	0.34	0.79
2106	1.20	0.36	0.78	1.93	0.0	0.96	4.08	0.0	2.04
2207	0.99	0.12	0.55	0.99	0.71	0.85	0.97	0.61	0.79
2208	1.13	0.27	0.70	1.07	0.57	0.82	1.02	0.41	0.71
2209	1.01	0.84	0.92	1.02	0.53	0.77	1.01	0.69	0.85
2210	0.51	0.0	0.25	1.03	0.75	0.89	1.00	0.53	0.75
2211	1.10	0.06	0.58	0.97	0.46	0.71	0.89	0.01	0.45
2212	1.28	0.37	0.82	1.56	0.09	0.82	1.22	0.23	0.72
2313	1.48	0.0	0.74	3.30	0.0	1.65	5.33	0.0	2.6
2314	0.94	0.0	0.45	0.68	0.0	0.34	1.03	0.35	0.69
2315	0.02	0.0	0.01	0.98	0.49	0.73	0.96	0.13	0.54
2316	0.89	0.11	0.50	1.03	0.61	0.82	0.99	0.33	0.66
2317	1.10	0.35	0.72	0.92	0.18	0.55	0.97	0.60	0.78
2318	3.25	0.0	1.62	1.01	0.40	0.70	1.00	0.79	0.89
2419	1.25	0.36	0.80	1.04	0.33	0.68	1.04	0.57	0.80
2420	0.97	0.09	0.53	0.95	0.47	0.71	1.05	0.01	0.53
2421	1.13	0.57	0.85	1.02	0.76	0.89	1.13	0.67	0.90
2422	1.00	0.03	0.51	1.03	0.18	0.60	0.22	0.0	0.11
2423	0.89	0.19	0.54	1.00	0.33	0.62	1.01	0.13	0.57
2424	1.24	0.25	0.75	1.08	0.68	0.88	1.01	0.49	0.75
2425	1.01	0.13	0.57	0.97	0.46	0.71	0.96	0.23	0.59
2426	4.50	0.0	2.25	1.09	0.09	0.59	2.25	0.37	1.31
2427	4.17	0.0	2.08	3.33	0.0	1.66	4.40	0.0	2.20
			True Mean			True Mean			True Mean
2528	0.81	0.03	0.46	0.99	0.06	0.43	1.09	0.29	0.68
2529	0.98	0.42	0.69	1.17	0.32	0.75	0.98	0.47	0.77
2530	1.00	0.12	0.46	0.97	0.17	0.65	1.03	0.33	0.71
2531	1.09	0.45	0.82	1.05	0.19	0.67	1.01	0.22	0.68
2532	1.08	0.07	0.45	1.05	0.21	0.67	1.02	0.10	0.62
2533	0.89	0.08	0.55	1.36	0.0	0.70	0.99	0.15	0.62
2534	0.83	0.09	0.52	4.00	0.0	0.69	0.98	0.15	0.57
2535	2.04	0.0	0.90	5.00	0.0	0.73	1.03	0.57	0.80
2536	6.60	0.0	1.01	6.67	0.0	0.14	1.25	0.0	0.48

Table 110. Continued

Station	Summer Max	Summer Min	Summer True Mean	Fall Max	Fall Min	Fall True Mean	Winter/Spring Max	Winter/Spring Min	Winter/Spring True Mean
2637	1.10	0.64	0.92	2.15	0.0	0.83	1.17	0.12	0.69
2638	1.13	0.48	0.82	1.25	0.69	0.93	1.11	0.0	0.36
2639	1.02	0.52	0.77	1.16	0.13	0.59	1.02	0.54	0.81
2640	1.01	0.39	0.74	1.03	0.01	0.53	1.02	0.19	0.58
2641	1.02	0.54	0.77	0.99	0.10	0.55	1.04	0.63	0.89
2642	1.10	0.38	0.72	1.03	0.09	0.53	1.04	0.55	0.85
2643	1.43	0.04	0.57	1.33	0.17	0.77	1.27	0.70	0.98
2644	1.15	0.44	0.72	1.28	0.19	0.72	1.28	0.71	0.98
2645	0.98	0.35	0.66	1.87	0.08	0.63	1.19	0.34	0.71

Table 111. Classification of stations on MAFLA benthic transects I, II, III and IV - Summer, 1975 sampling - based on characteristic polychaete groups.

Station	Primary	Secondary	Representation	Homogeneity	J prime
2101	I	mixed	fair	good	.56
2102	I	mixed	fair	fair	.71
2103	Transitional	mixed	?	?	?
2104	Transitional	mixed	poor	fair	.80
2105	II	?	good	good	.72
2106	II	none	excellent	fair	.83
2207A	I	mixed	poor	poor	
2207B	mixed	?	?	?	.47
2208	I	mixed	poor	fair	
2209	I	I	good	good	.75
2210	mixed	none	?	?	.59
2211A	mixed	mixed	excellent	excellent	?
2211B	I	?	excellent	excellent	
2212	Transitional	Transitional	poor	poor	.82
2213	Transitional	none	good	fair	
2314	Transitional	none	?	?	.79
2315	III	none	?	?	.94
2316A	mixed	mixed	good	fair	?
2316B	mixed	II	good	fair	?
2317	I	none	poor	poor	
2318	mixed	none	fair	poor	.85
2419	II	none	fair	fair	.84
2420A	II	Transitional	fair	fair	.77
2420B	Transitional	none	fair	fair	.78
2421	I	none	good	good	
2422	III	none	excellent	good	.84
2423	III	mixed	good	good	
2424	I	none	good	fair	.77
2425	Transitional	none	poor	poor	.80
2426	mixed	none	poor	poor	.83
2427	mixed	none	poor	poor	.87

I. Molluscs

A. Number of species recorded overall - 236

1. Total through Dredge/Trawl - 189

a. Transect I - 70
b. Transect II - 57
c. Transect III - 68
d. Transect IV - 60
e. Transect V - 59
f. Transect VI - 70

2. Total through Diving - 105

a. Florida Middle Ground (FMG) - 70
b. Clearwater (CW) - 57

B. Prospective "new" species

Dendrodoria sp. (from Stations IIA and VIB); specimens are now being examined by a specialist.

C. New distribution records

1. Dredge/Trawl

a. *Platydoris angustipes*
b. *Anisdoris prea*
c. *Peltodoris greeleyi*
d. *Malluvium benthophilum*
e. *Dentalium taphrium*
f. *Dentalium floridense*
g. *Dentalium laqueatum*

2. Diving

a. *Coralliophila abbreviata*
b. *Antillophos adelus*
c. *Crassispira cubana*
d. *Pisania tincta*
e. *Muricopsis oxytatus*

In addition we have 46 possible additional new records. These await verification.

D. Predominant species at each station.

1. Dredge/Trawl

IA *Chlamys benedicti*, *Aequipecten muscosus*, *Hiatella artica*
IB *Chlamys benedicti*, *Turritella exoleta*, *Xenophora*

1. Dredge/Trawl - continued

IC Murex beauii, Murex hidalgo, Tugurium caribeaum
IIA Aequipecten muscosus, Hiatella arctica, Calliostoma pulchrum
IIB Chlamys benedicti, Chama congregata, Antillophos candei
IIC Murex beauii, Tugurium caribeaum, Antillophos candei
IIIA Chlamys benedicti, Lima pellucida, Spondylus americanus
IIIB Pteria colymbus, Lima pellucida, Barbatia domingensis
IIIC Murex beauii, Tugurium caribeaum, Aequipecten glyptus
IVA Chlamys benedicti, Aequipecten muscosus, Argopecten gibbus
IVB Oliva sayana, Mercenaria campechiensis, Argopecten gibbus
IVC Murex beauii, Tugurium caribeaum, Polystira tellea
VA Pecten raveneli, Turritella exolata, Argopecten gibbus
VB Turritella exoleta, Mercenaris campechiensis, Barbatis domingensis
VC Aequipecten glyptus, Nuculana acuta, Polystira tellea
VIA Distorsio clathrata, Murex fulvescens, Jouannetic quillingi
VIB Turritella exoleta, Malluvium benthophilium, Barbatia domingensis
VIC Murex beauii, Antillophos candei, Fusinus eucosmius

2. Diving

FMG* Stations 047, 147, 151, 247, 251:
Spondylus americanus, Cerithium litteratum, Pteria colymbus

Station 146:
Spondylus americanus, Cerithium litteratum, Hiatella arctica

CW** Station:
062 - Aequipecten muscosus, Calliostoma pulchrum, Hiatella artica
064 - Aequipecten muscosus, Calliostoma pulchrum, Crapidula plana

ARTHROPODS

II. Decapod Crustacea

A. Number of species recorded overall - ~190

1. Dredge/Trawl by Transect Total 134

a. Transect I - 76
b. Transect II - 51

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* Florida Middle Ground
** Clearwater

c. Transect III - 66
d. Transect IV - 47
e. Transect V - 59
f. Transect VI - 63

2. Diving by Area   Total 74

a. Florida Middle Ground - 55
b. Clearwater - 35

B. Prospective "new" species

1. Dredge/Trawl

a. Periclimenaeus n. sp. (from Stations IA, IIIA)
b. Alpheus n. sp. I (from Stations IIC, IIIB, IIIC)

2. Diving

a. Pericliminaeus n. sp. (from Station 151)
b. Synalpheus n. sp. I (from Stations 147, 151, 146, 247, 047)
c. Synalpheus n. sp. II (from Stations 047, 251, 151, 147)

C. New distribution records

1. Dredge/Trawl

a. Gulf of Mexico

Alpheus n. sp. I (near A. macrocheles)
Periclimenaeus n. sp.

b. Eastern Gulf

Periclimenaeus caraibicus
Lysmata intermedia
Lysmata rathbunae
Alpheopsis labis
Lipkebe holthuisi
Upogebia operculata

2. Diving

a. Gulf of Mexico

Synalpheus brevifrons
Synalpheus n. sp. I (near S. Rathbunae)
Synalpheus n. sp. II (near S. townsendi)
Trachycaris restrictus
Alpheopsis labis
Periclimenaeus bredini

b. Eastern Gulf

Gnathophyllum modestum
Pontonia margarita
Periclimenaeus perryae
Periclimenaeus ascidiarum
Periclimenaeus perlatus
Periclimenes iridescens
Lysmata rathbunae

D. Predominant species at each station

1. Dredge/Trawl Station

IA Portunus spinicarpus, Stenocionops furcata coelata, Stenorynchus seticornis
IB Dormidia antillensis, Portunus spinicarpus, Parthenope agona
IC Pylopagurus discoidalis, Pyromaia arachna, Palicus sica
IIA Calappa flammea, Sicyonia brevirostris, Penaeus duorarum
IIB Dardanus insignis, Iliacantha subglobosa, Anasimus latus
IIC Myropsis quinquespinosa, Acanthocarpus alexandri, Goneplax hirusta
IIIA Mithrax acuticornis, Stenorynchus seticornis, Portunus spinicarpus
IIIB Portunus spinicarpus, Podochela gracilipes, Palicus sica
IIIC Goneplax hirusta, Acanthocarpus alexandri, Portunus spinicarpus
IVA Ranilia muricata, Osaclita semitovis, Stenocionops furcata coelata
IVB Portunus spinicarpus, Anasimus latus, Sicyonia brevirostris
IVC Acanthocarpus alexandri, Goneplax hirusta, Myropsis quinquespinosa
VA Parthenope fraterculus, Collodes trispinosus, Portunus spinicarpus
VB Anasimus latus, Osachila semilevis, Sicyonia brevirostris
VC Pyromaia arachna, Ethusa microphthalma, Myropsis quinquespinosa
VIA Portunus spinicarpus, Sicyonia brevirostris, Drigopagurus dispar
VIB Stenorynchus seticornis, Anasimus latus, Podochela sp.
VIC Pyromaia arachna, Ethusa microphthalma, Dardanus insignis

2. Diving

FMG Stations 047, 147, 251, 151, 247, 146:
Stenorynchus seticornis, Synalpheus townsendi, Mithrax acuticornis
CW Station 062:
Stenorynchus seticornis, Mithrax pleuracanthus, Lobopilumnus agassizii

III. Echinoderms

A. Number of species recorded overall - 65+

1. Total through Dredge/Trawl - 61

    a. Transect I - 32
    b. Transect II - 17
    c. Transect III - 38
    d. Transect IV - 20
    e. Transect V - 18
    f. Transect VI - 28

2. Total through Diving - 20

    a. Florida Middle Ground - 18
    b. Clearwater - 6

B. Prospective "new" species

Ophiactis sp. (from all FMG stations)

C. New distribution records

1. Dredge/Trawl

    a. Gulf of Mexico - none verified as yet.

2. Diving

    a. Gulf of Mexico - Prospective new species (above).

D. Predominant species at each station (maximum of three)

1. Dredge/Trawl Stations

IA	Luidia clathrata, Ophiothrix angulata, Lytechinus variegatus
IB	Comactinia meridionalis, Anthenoides piercei, Astroporpa annulata
IC	Astropecten cingulatus, Araeosoma violaceum, Brissopsis elongata
IIA	Luidia clathrata, Lytechinus variegatus, Arbacis punctulata
IIB	Astroporpa annulata, Clypeaster ravenelli
IIC	No truly dominant form established
IIIA	Goniaster tesselatus, Ophiolepis elegans, Eucidaris tribuloides
IIIB	Luidia elegans, Astroporpa annulata, Clypeaster ravenelli
IIIC	No truly dominant form established

IVA <u>Luidia clathrata</u>, <u>Ophiolepis elegans</u>, <u>Lytechinus variegatus</u>
IVB <u>Anthenoides piercei</u>, <u>Clypeaster ravenelli</u>
IVC No truly dominant form established
VA <u>Luidia clathrata</u>, <u>Ophiolepis elegans</u>, <u>Eucidaris tribuloides</u>
VB <u>Astroporpa annulata</u>, <u>Clypeaster ravenelli</u>, <u>Schizaster orbignyaqus</u>
VC No truly dominant form established
VIA <u>Luidia clathrata</u>, <u>Ophiolepis elegans</u>, <u>Clypeaster durandi</u>
VIB <u>Anthenoides piercei</u>, <u>Astroporpa annulata</u>, <u>Stylocidaris affinis</u>
VIC <u>Luidia elegans</u>, <u>Clypeaster ravenelli</u>, <u>Coelopleurus floridanus</u>

2. Diving

FMG Stations 047, 146, 147, 151, 251:
<u>Coscinasterias tenuispina</u>, <u>Ophiothrix angulata</u>, <u>Diadema antillarum</u>
Station 247:
<u>Coscinasterias tenuispina</u>, <u>Ophiothrix angulata</u>, <u>Arbacia punctulata</u>
CW Station 062:
<u>Arbacia punctulata</u>, <u>Lytechinus variegatus</u>, <u>Ophiothrix angulata</u>
Station 064:
<u>Arbacis punctulata</u>, <u>Lytechinus variegatus</u>

COELENTERATES (Octocorallia/Scleractinia)

IV. <u>Octocorallia</u>

A. Number of species recorded - 25

1. Total through <u>Dredge/Trawl</u> - 19

a. Transect I - 3
b. Transect II - 8
c. Transect III - 15
d. Transect IV - 8
e. Transect V - 1
f. Transect VI - 8

2. Total through <u>Diving</u> -

a. Florida Middle Ground - 13
b. Clearwater - 1

B. Prospective "new" species - none at this time

C. New distribution records

1. Dredge/Trawl

a. Bebryce parastellata
b. Bebryce grandis
c. Nidalia occidentalis
d. Villogorgia nigrescens
e. Neospongodes agassizi
f. Scleracis quadaloupensis

2. Diving

a. Lophogorgia cardinalis
b. Diodogorgia nodulifera
c. Pterogorgia quadalupensis
d. Pseudopterogorgia rigidia

D. Predominant species at each station

1. Dredge/Trawl

IA Diodogorgia nodulifera, Bebryce parastellata, Ellisella barbadensis
IB Bebryce parastellata
IC No truly dominant form established
IIA Diodogorgia nodulifera, Bebryce grandis
IIB Bebryce parastellata, Neospongodes agassizii
IIC Bebryce grandis
IIIA Bebryce parastellata, Villogorgia nigrescens, Muricea elongata
IIIB Bebryce parastellata, Bebryce grandis, Paramuricea sp. A
IIIC Bebryce parastellata, Villogorgia nigrescens
IVA Bebryce parastellata, Bebryce grandis, Ellisella elongata
IVB Bebryce parastellata, Bebryce grandis, Nidalia occidentalis
IVC Ellisella barbadensis
VA Bebryce parastellata
VB Bebryce parastellata
VC No truly dominant form established
VIA Bebryce parastellata, Scleracis guadalupensis, Ellisella barbadensis
VIB Bebryce parastellata, Bebryce grandis, Villogorgia nigrescens

2. Diving

FMG - all stations
Muricea laxa, M. elongata, Eunicea calvculata
CW - all stations
Diodogorgia nodulifera

V. Scleractinia

A. Number of species recorded - 30

1. Total through Dredge/Trawl - 21

a. Transect I - 5
b. Transect II - 9
c. Transect III - 4
d. Transect IV - 2
e. Transect V - 5
f. Transect VI - 7

2. Total through Diving - 17

a. Florida Middle Ground - 1
b. Clearwater - 8

B. Prospective "new" species

Caryophyllia horologium n. sp.
Flabellum fragile n. sp.

C. New distribution records

1. Dredge/Trawl

a. *Cladocora debilis*
b. *Solenastrea hyades*
c. *Paracyathus defilippi*
d. *Oculina tenella*

2. Diving

a. *Manicina arelolata*
b. *Scolymia lacera*
c. *Scolymia cubensis*
d. *Dichoccenia stokesii*
e. *Dichocoenia stellanis*
f. *Meandrina meandites*
b. *Cladocora arbuscula*

D. Predominant species at each station

1. Dredge/Trawl Stations

IA *Cladocora arbuscula*, *Oculina diffusa*, *Oculina tenella*
IB
IC *Paracyathus defilippi*

IIA	*Phyllangia americana*, *Oculina diffusa*, *Stephanocoenia michelini*, *Cladocora arbuscula*
IIB	*Cladocora arbuscula*, *Paracyathus defilippi*
IIC	*Madracis decactis*, *Oculina diffusa*
IIIA	*Madracis decactis*
IIIB	*Paracyathus defilippi*
IIIC	
IVA	*Oculina tenella*
IVB	
IVC	
VA	*Cladocora debilis*, *Oculina tenella*
VB	*Madracis asperula*
VC	*Paracyathus defilippi*
VIA	
VIB	*Paracyathus defilippi*
VIC	*Paracyathus defilippi*

2. Diving

   FMG - all stations
   Madracis decactis, *Porites divaricata*, *Dichocoenia stellaris*

   CW - all stations
   Solenastrea hyades, *Cladocora arbuscula*, *Phyllangis americana*

VI. Polychaete Annelids

A. Number of species recorded overall - 100+

1. Total through Dredge/Trawl - 97

   a. Transect I - 31
   b. Transect II - 14
   c. Transect III- 46
   d. Transect IV - 34
   e. Transect V - 47
   f. Transect VI - 34

2. Total through Diving - 41

   a. Florida Middle Ground - 41
   b. Clearwater - 0

B. Prospective "new" species - awaiting examination and comparison with type material.

C. New distribution records

1. Dredge/Trawl

   a. *Euphrosine triloba*

2. Diving

D. Predominant species at each station

1. Dredge/Trawl Stations

IA	Eunice sp. A, Eunice antennata, Ceratoneris mirabilis
IB	Polyodontes sp. A
IC	Aphrodita sp. A, Armandia maculata, Sabella melanostigma
IIA	Pomatoceros americanus, Eunice antennata, Nereis sp. A
IIB	Eunice rubra, Phyllodoce groenlandica, Thelepus setosus
IIC	Polyodontes lupina
IIIA	Eunice rubra, Hermenia verraculosa, Spirobranchus giganteus
IIIB	Vermiliopsis sp. A, Nereis sp. A, Eunice sp. A
IIIC	Potogenia sericoma
IVA	Eunice sp. A, Eunice antennata, Ceratoneris mirabilis
IVB	Eunice sp. A
IVC	Hydroides protulicola, Eunice rubra
VA	Hermodice carunculata, Eunice sp. A, Eunice rubra
VB	Melinna maculata, Glycera americana
VC	Eunice sp. A, Eupanthalis kinbergi, Sabellid sp.
VIA	Pseudovermilia sp. A
VIB	Eunice sp. A, Phyllodoce groenlandica
VIC	Eupanthalis kinbergi, Lepidametria commensalis (spp. of Eunicidae dominate both in numbers and biomass)

2. Diving Stations

FMG - all stations
Eunice rubra, Ceratoneris mirabilis, Hermenia verraculosa, Spirobranchus giganteus
CW - all stations

VII. Porifera

A. Number of species recorded to date - 48

1. Total from Dredge/Trawl to date - 30

2. Total from Diving - 48

a. Florida Middle Ground - 41
b. Clearwater - 12

B. Prospective "new" species

Prosuberites sp.
Cliona sp.

We anticipate many more.

C. New distribution records

1. Dredge/Trawl

2. Diving

a. _Verongia cauliformis rufa_
b. _Aeglas dispar_
c. _Erylus_ sp.
d. _Pseudoceratina crassa_
e. _Thalysias_ sp.
f. _Pseudaxinella lunaecharta_
g. _Guitara_ sp.
h. _Spongosorites_
i. _Epallax_
j. _Asteropus_ sp.
k. _Yvesia_ sp.
l. _Grayella_ sp.
m. _Prosuberites_ sp.
n. _Cliona_ sp.

D. Predominant species at each station

1. Dredge/Trawl

2. Diving

FMG - _Ircinia strobilina_, _Cinachyra_ sp., _Pseudoceratina crassa_
CW - Names not established

VIII. Algae

A. Number of species recorded overall - 194

1. Total through Dredge/Trawl - 106

a. Transect I - 25
b. Transect II - 72
c. Transect III - 41
d. Transect IV - 13
e. Transect V - 16
f. Transect VI - 0

2. Total through Diving - 164

a. Florida Middle Ground - 163
b. Clearwater - 71

B. Prospective "new" species - we anticipate at least eleven new species and two new genera.

C. New distribution records

Approximately 99 species have been added to those Cheney and Dyer (1974) reported.

D. Predominant species at each station

1. Dredge/Trawl

IA <u>Halymenia floridana Gracilaris mammillaris</u>, <u>Caulerpa mexicana</u>
IIA <u>Caulerpa sertularioides</u>, <u>Pseudocodium floridanum</u>, <u>Halymenia floridana</u>
IIIA <u>Caulerpa sertularioides</u>, <u>Halymenis floridana</u>, <u>Pseudocodium floridanum</u>
IVA <u>Halymenia</u> sp., <u>Gracilaria mammillaris</u>, <u>Agardhinula browneae</u>
VA <u>Gracilaris mammillaris</u>, <u>Rhodymenia pseudopalmata</u>, <u>Sargassum filipendula</u>

2. Diving

FMG Station 147:
<u>Botryocladia occidentalis</u>, <u>Codium carolinianum</u>, <u>Halimeda discoidea</u>
47: <u>Laurencia intricata</u>, <u>Dictyota bartayresii</u>, <u>Codium Carolinianum</u>
146: <u>Codium intertextum</u>, <u>Halimeda discoidea</u>, <u>Botryocladia occidentalis</u>
151: <u>Laurencis intricata</u>, <u>Codium intertextum</u>, <u>Codium carolinianum</u>
251: <u>Halimeda discoidea</u>, <u>Galaxaura squalida</u>, <u>Botryocladia occidentalis</u>
247: <u>Codium intertextum</u>, <u>Halimeda discoidea</u>, <u>Kalymenia perforata</u>
64: <u>Pseudocodium floridanum</u>, <u>Caulerpa sertularioides</u>, <u>Gracilaria mammillaris</u>
62: <u>Caulerpa sertularioides</u>, <u>Udotea conglutinata</u>, <u>Halimeda</u> cf. <u>tuna</u>

Species composition similarity between stations for the molluscs, decapod crustaceans, echinoderms, polychaetes and corals collected in the trawl/dredge program are presented in Figures 103a through 103e. The values shown in the "trellis diagrams" are Bray-Curtis similarity percentages. The boxes in the lower left-hand triangle portion of the diagrams are the

	I A	II A	III A	IV A	V A	VI A	I B	II B	III B	IV B	V B	VI B	I C	II C	III C	IV C	V C	VI C
I-A		40	33	44	36	28	20	16	15	7	14	20	18	4	8	7	7	6
II-A			34	35	26	7	15	27	13	8	16	12	13	0	4	4	0	3
III-A				36	32	19	12	19	25	6	18	18	13	3	3	3	3	6
IV-A					44	24	17	18	18	11	14	20	14	4	4	4	3	6
V-A						11	28	14	11	8	13	23	14	8	0	0	4	7
VI-A							6	10	5	14	9	10	9	7	14	13	6	5
I-B								30	18	9	21	25	22	26	18	8	14	25
II-B									36	7	37	36	33	21	15	14	12	26
III-B										7	23	25	19	7	7	7	6	10
IV-B											12	12	6	22	12	10	9	7
V-B												36	21	12	12	24	21	23
VI-B													27	19	8	11	28	29
I-C														31	39	42	38	28
II-C															47	42	52	34
III-C																67	45	21
IV-C																	42	33
V-C																		41
VI-C																		

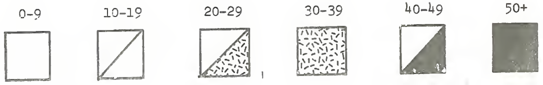

Figure 103a. Trellis diagram of the molluscan fauna (MAFLA, 1975).

	I A	II A	III A	IV A	V A	VI A	I B	II B	III B	IV B	V B	VI B	I C	II C	III C	IV C	V C	VI C
I-A		39	46	44	44	31	26	21	30	24	20	25	12	6	3	7	6	21
II-A			42	48	47	36	29	19	25	28	23	21	12	4	9	5	0	13
III-A				48	49	22	30	17	29	17	16	25	4	4	0	0	4	15
IV-A					67	28	32	23	44	19	23	24	10	4	5	5	8	13
V-A						37	36	17	46	30	41	42	23	11	8	8	13	28
VI-A							16	39	31	28	50	30	11	12	13	13	11	16
I-B								33	47	23	27	52	32	26	14	14	16	29
II-B									44	42	48	47	32	31	13	26	13	17
III-B										36	35	53	31	13	22	14	12	22
IV-B											48	30	13	7	17	30	6	9
V-B												50	31	21	16	25	19	27
VI-B													44	28	26	22	19	42
I-C														53	32	33	37	56
II-C															67	69	47	52
III-C																52	32	37
IV-C																	47	43
V-C																		52
VI-C																		

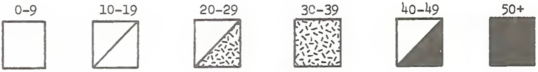

Figure 103b. Trellis diagram of the decapod crustacean fauna (MAFLA, 1975).

	I A	II A	III A	IV A	V A	VI A	I B	II B	III B	IV B	V B	VI B	I C	II C	III C	IV C	V C	VI C
I-A		69	63	59	64	32	15	9	7	10	0	0	0	0	0	0	0	0
II-A			34	50	45	50	26	30	16	23	0	0	12	17	0	0	0	9
III-A				43	34	21	11	3	11	3	0	0	0	0	0	0	0	0
IV-A					83	33	24	18	30	0	0	0	11	14	0	0	0	0
V-A						25	17	10	16	0	0	0	0	0	0	0	0	0
VI-A							12	14	11	0	25	0	18	33	0	0	0	13
I-B								48	54	33	38	54	11	15	0	14	0	35
II-B									52	27	31	52	13	17	0	0	0	20
III-B										30	44	36	10	13	0	0	0	24
IV-B											0	0	17	29	0	0	29	0
V-B												44	0	0	0	0	0	27
VI-B													0	0	25	0	0	32
I-C														29	0	0	0	12
II-C															0	0	0	17
III-C																0	0	0
IV-C																	0	0
V-C																		0
VI-C																		

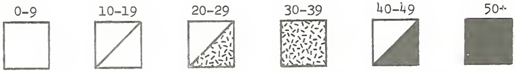

Figure 103c. Trellis diagram of the echinoderm fauna (MAFLA, 1975).

	I A	II A	III A	IV A	V A	VI A	I B	II B	III B	IV B	V B	VI B	I C	II C	III C	IV C	V C	VI C
I-A		13	56	42	40	12	1	29	21	21	13	37	29	0	0	21	11	29
II-A			10	18	14	35	0	0	18	17	0	6	10	0	0	0	0	0
III-A				37	44	20	6	22	70	17	21	31	23	6	3	11	19	19
IV-A					28	0	6	6	36	3	6	8	15	6	0	23	0	10
V-A						26	5	5	27	10	14	39	16	5	5	5	25	29
VI-A							0	0	24	13	12	12	6	17	18	0	27	9
I-B								2	0	22	18	17	1	33	0	40	12	12
II-B									0	20	17	8	0	0	0	36	0	0
III-B										30	18	23	22	0	0	19	15	30
IV-B											17	24	35	0	0	9	12	12
V-B												39	10	0	0	31	10	32
VI-B													25	0	0	15	19	38
I-C														14	0	22	17	17
II-C															67	25	14	0
III-C																0	15	0
IV-C																	0	22
V-C																		33
VI-C																		

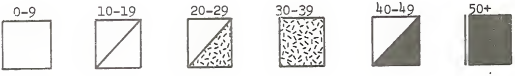

Figure 103d. Trellis diagram of the polychaete fauna (MAFLA, 1975).

	I A	II A	III A	IV A	V A	VI A	I B	II B	III B	IV B	V B	VI B	I C	II C	III C	IV C	V C	VI C
I-A		40	42	36	40	36	25	25	27	27	18	18	0	18	18	25	0	0
II-A			16	17	0	0	0	12	12	13	0	9	0	17	0	0	0	0
III-A				29	20	10	22	15	32	24	0	19	0	19	0	0	0	0
IV-A					57	25	40	31	17	33	25	21	0	25	25	0	0	0
V-A						29	50	0	18	18	29	22	0	0	29	0	0	0
VI-A							40	31	33	33	25	42	0	0	25	40	0	0
I-B								40	22	44	40	25	0	0	40	0	0	0
II-B									47	24	46	42	44	0	31	0	18	20
III-B										63	17	61	25	33	33	0	20	22
IV-B											33	61	25	17	33	22	0	0
V-B												11	40	0	50	0	0	0
VI-B													27	11	21	13	12	13
I-C														0	0	0	100	100
II-C															25	0	0	0
III-C																0	33	0
IV-C																	0	0
V-C																		67
VI-C																		

0-9 10-19 20-29 30-39 40-49 50+

Figure 103e. Trellis diagram of the octocorals and scleractinia (MAFLA, 1975).

similarity indices in graphical rather than numerical form. All stations are grouped along the axes by depth (A stations then B stations then C stations). To determine the relationship between the molluscan species similarity between the B stations of Transects II and IV, locate II-B on the vertical axis and follow it across the page until the column with IV-B in the horizontal axis is reached. The reader should find a value of seven indicating a seven percent Bray-Curtis similarity between these two stations. Entering the diagram in reciprocal fashion will lead the reader to an empty box in the lower portion of the diagram. This corresponds to a Bray-Curtis similarity of between 0-9%. Values greater than 50% similarity were considered to be highly significant and values between 40 and 50% similarity were considered to be highly indicative.

Molluscs showed species affinities which were highly depth dependent. Species similarities were generally greatest at stations of equal depth on different transects than between stations of different depths on the same transect. Among stations of the same depth species similarities were highest between C stations, less between A stations and least between B stations. Among stations of different depths the least similarity was between the A and C stations.

Decapod crustacean species similarities were also depth dependent. Similarity values were greatest between stations of equal depth and least between the A and C stations of the same and different transects. Similarity values between stations of equal depth were high with half or more of the values for each depth exceeding the 40% values of highly indicative affinities.

Echinoderm species similarities were generally high between A stations, less for B stations and zero for 12 of the 18 C station comparisons. Station B on Transect IV had zero similarity with the B Stations on Transects V and VI. Similarities between stations of different depths were low and those between A and C stations were usually zero within and between transects.

Polychaete similarities between stations were disjunct. For stations of equal depth, values between adjacent transects were low while values between separated transects were often considerably higher. Similarity values between B stations and between C stations were generally lower than A station values and several of the values were zero. There were many zero similarities between stations of different depths although several of these values were in excess of 30% similarity. A and C stations were the most dissimilar.

Coral species similarities were greatest between A stations and between B stations although Station A on Transect II had no similarity to the A stations of Transects V and VI. Most of the C stations had low similarities between themselves and ten of the comparisons yielded zero similarity. Surprisingly Station C on Transect I was 100% similar (perfect species similarity) with the C stations of Transects V and VI. Similarities between stations of different depths were generally low with many similarity values of zero.

Table 112 lists the major epibenthic groups studied in the Florida Middle Ground and the dominant taxa within each. Figure 104 portrays the typical, dominant epibenthic compositions at two stations, Stations 151 and 247. At both of these stations the region of the shelf break was dominated by the hydrozoan coral, Millepora alcicornis. Moving in from

Table 112. Major epibenthic groups observed in the Florida Middle Ground and dominant taxa of each.

Coelenterata

Hydrozoa

Millepora alcinornis
Millepora camplanata
Aglaophenia
Monostaeches
Plumularia
Sertularis

Anthozoa

Anemones

Condylactis gigantea
Bartholomae annulata
Phymauthus crucifer

Scleractinia: 13 spp

Madracis spp
Porites divaricata
Dichocoenia spp

Octocorallia: 15 spp

Muricea laxa
Muricea elongata

Mollusca: 75 spp

Gastropoda: 43 spp

Cerithium litteratum

Mollusca - continued

Pelecypoda: 24 spp

Lithophaga spp
Malleus candeanus
Chlamys benedicti
Chama macerophylla
Lopha frons
Pteria colymbus
Spondylus americanus

Cephalopods: 3 spp

Polyplacophora: 1 spp

Decapod Crustaceans: 56 spp

Palaemonidae: 12 spp
Majidae: 11 spp
Xanthidae: 10 spp
Alphaeidae: 9 spp

Polychaetous Annelids: 41 spp

Eunice rubra
Ceratonereis mirabilis
Hermenia verraculosa
Spirobranchus giganteus

Porifera: 40 spp to date (potential final number could approach 100)

Spongiidae: 6 spp
Axinellidae: 4 spp

Table 112. Continued.

Algae: 103 spp

Rhodophyta: 63 spp

Kallymenia perforata
Coelarthum albertisii
Champia sp

Chlorophyta: 29 spp

Codium spp
Halimeda discoidea
Valonia macrophysa

Phaeophyta: 11 spp

Dictyota bartayresii
Dictyota dichotoma

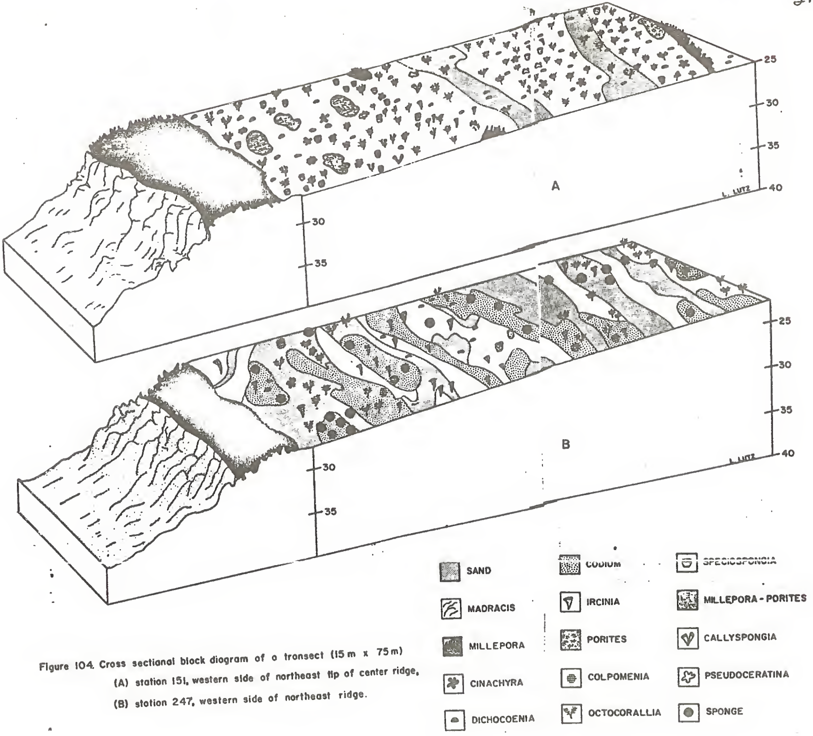

Figure 104. Cross sectional block diagram of a transect (15 m x 75 m)
(A) station 151, western side of northeast tip of center ridge,
(B) station 247, western side of northeast ridge.

the reef break a shift in scleractinian dominance was readily apparent. Madracis decactis was replaced reefward first by Porites divaricata which in turn was replaced in the inner portion of the reef by Dichocoenia stellaris. This distributional pattern indicates a change in substrate from unconsolidated sediment to a hard bottom surface. The dominant octocorallinians were Muricea laxa and M. elongata. Station 247 was characterized by large clumps of the green algae, Codium intertexum; this was not the case for Station 151 even though Codium carolinianium is present. In general, the total specimen abundance along Station 151 increased reefward and that of Station 247 decreased reefward from the reef break to the inner edge.

The overall algal composition of the Florida Middle Ground area can be broken down by species as follows:

Rhodophyta, 61% of the species
Chlorophyta, 28% of the species
Phaeophyta, 11% of the species

Abundance in any given area varied greatly although the Chlorophyta usually dominated the total algal biomass. Species abundance in the winter was about one-third that of the summer and fall and the winter biomass was predominantly attributable to perennial greens. Species diversity and abundance were greater in the northern portion of the reef compared to the southern portion. Hurricane ELOISE caused a large reduction in the algal populations of the reef. This was apparently due to the scouring and tearing effects of the storm surge. Similar storm effects were observed in the winter period and were most pronounced in reef regions of unstable substrate (i.e., sandy bottoms).

Demersal Fish

A total of 54 demersal fish collections (a collection is the combined trawl and dredge samples) were analyzed for species diversity, abundance, dominance, occurrence, length frequency and total biomass. Each collection represents one depth station from one of the six geographical transects for one of the three seasonal sampling periods. The collections yielded a total of 8844 specimens representing 204 species and a total biomass of 304,009 g.

Species diversity, abundance, dominance, occurrence, number of specimens and biomass varied considerably with geographical location, season and depth. Species diversity consistently decreased between Stations A and C for Transect I during all sampling periods and for Transect V during the October and February/March sampling periods (Table 113). Species diversity along Transects II, III and VI decreased between Station A and B and increased between B and C; this pattern was consistent for all three sampling periods. Changes in species diversity bewteen Transect IV stations show that Station A values were consistently higher than the corresponding values for Stations B and C for all sampling periods. Seasonal variation in species diversity was inconsistent, but nine of the 18 stations sampled had their highest species diversity in the October sampling period.

Species abundance (number of species per collection) varied from four to 36 species and displayed no consistent patterns of variation with either sampling periods, stations or transects (Table 114) But, as with species diversity, 50% of the stations sampled had greater abundances during the October sampling period. Eight of the total 54 collections had

Table 113. Species diversity (H) of demersal fishes collected during 1975-1976 MAFLA program.

	Transect	I	II	III	IV	V	VI
	July, 1975	2.74	2.14	1.21	2.91	2.36	1.83
Station A	October, 1975	2.79	3.01	2.29	2.62	2.58	2.26
	February/March, 1976	2.63	2.56	2.29	2.02	2.02	1.88
	July, 1975	2.30	2.06	2.38	2.36	1.67	1.53
Station B	October, 1975	1.86	1.85	2.87	1.93	2.31	1.36
	February/March, 1976	2.54	2.07	2.24	1.49	1.99	0.93
	July, 1975	1.77	2.11	1.56	2.00	2.07	2.11
Station C	October, 1975	1.79	2.10	2.26	1.94	2.24	2.23
	February/March, 1976	1.80	2.37	2.14	1.93	1.52	1.21

Table 114. Numbers of species of fishes collected during 1975-1976 MAFLA program.

	Transect	I	II	III	IV	V	VI
Station A	July, 1975	3	16	17	36	17	27
	October, 1975	36	32	33	25	28	26
	February/March, 1976	31	35	24	14	24	8
Station B	July, 1975	18	15	13	10	27	9
	October, 1975	19	15	35	23	18	18
	February/March, 1976	19	15	13	11	18	13
Station C	July, 1975	10	11	7	11	14	26
	October, 1975	11	18	23	19	25	21
	February/March, 1976	20	19	10	15	8	4

ten or less species while eight collections had 30 or more species. Three of the five "minimum species abundance" collections were from Transect VI while seven of the eight "maximum species abundance" collections were from the A Stations of Transects I, II, III and VI.

Specimen abundance (total number of fish per collection) also varied considerably with depth, location and season and patterns of variation were not consistent for all stations (Table 115). However, recognition of the fact that Station C tows were twice as long as those for Stations A and B would suggest that, with few exceptions, specimen densities at Station C locations were considerably less than at Station A and B locations. Specimen abundances were generally higher in the fall than during the summer and winter sampling periods. This pattern of seasonal abundance was not totally consistent for the individual station collections but was apparent in the monthly totals for each station.

Although the species dominance (Tables 116a,b and c) varied among the collections, two species appeared as major dominants* in approximately 39% of the collections; Syacium papillosum was the major dominant in 13 collections (24%) and Citharichthys cornutus was the major dominant in eight collections (15%). The species with the next highest frequency of major dominant status was Bellator militaris with four occurrences.

Syacium papillosum was the major dominant in seven Station A collections and six Station B collections, and its major dominant status occurred at least once for all transects except Transect IV and for all sampling

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* The species which contributes the greatest number of specimens to the collection.

Table 115. Number of specimens of fishes collected during 1975-1976 MAFLA program.

	Transect	I	II	III	IV	V	VI	Totals
	July, 1975	102	127	127	219	63	264	902
Station A	October, 1975	216	138	435	122	157	119	1,187
	February/March, 1976	153	269	203	53	185	15	878
	Station A Totals	471	534	765	394	405	398	2,967
	July, 1975	193	100	24	16	307	68	708
Station B	October, 1975	255	97	359	473	114	315	1,613
	February/March, 1975	137	160	26	57	68	192	640
	Station B Totals	585	357	409	546	489	575	2,961
	July, 1975	59	27	29	52	92	369	628
Station C	October, 1975	72	210	345	290	552	347	1,816
	February/March, 1975	214	123	22	78	27	8	472
	Station C Totals	345	360	396	420	671	724	2,916
Transect Totals		1,401	1,251	1,570	1,360	1,565	1,697	8,844

Table 116a. The major dominant species and their absolute and relative (%) specimen numbers and biomass (g wet weight) for each demersal fish collection for the July sampling period.

Transect-Station	Major Dominant Species	Specimens Absolute	Specimens Relative	Biomass Absolute	Biomass Relative
I - A	*Syacium papillosum*	31	30.4	1,302	28.7
I - B	*Syacium papillosum*	32	16.7	1,492	19.6
I - C	*Citharicthys cornutus*	23	38.9	82	10.7
II - A	*Bellator militaris*	42	33.1	149	4.0
II - B	*Scorpaena agassizi*	36	36.0	949	31.4
II - C	*Citharicthys cornutus*	8	29.6	35	6.3
III - A	*Chromis scotti*	92	72.4	544	37.2
III - B	*Syacium papillosum*	4	16.7	142	16.4
	Prionotus alatus	4	16.7	99	11.4
III - C	*Citharicthys cornutus*	11	37.9	45	16.1
IV - A	*Branchiostoma floridae*	37	16.9	1	<1.0
	Emblemaria piratula	37	16.9	3	<1.0
IV - B	*Peristedion gracile*	3	18.7	82	20.0
	Symphurus diomedianus	3	18.7	87	21.2
IV - C	*Zalieutes mcgintyi*	18	34.6	72	4.8
V - A	*Branchiostoma floridae*	17	26.9	1	<1.0
V - B	*Prionotus stearnsi*	198	64.5	3,051	58.3
V - C	*Pontinus longispinus*	24	26.1	1,476	37.3
VI - A	*Etropus rimosus*	126	39.2	439	7.7
VI - B	*Syacium papillosum*	22	32.3	717	55.6
VI - C	*Macrorhamphosus scolopax*	173	46.9	858	15.1

Table 116b. The major dominant species and their absolute and relative (%) specimen numbers and biomasses (g wet weight) for each demersal fish collection for the October sampling period.

Transect-Station	Major Dominant Species	Specimens Absolute	Specimens Relative	Biomass Absolute	Biomass Relative
I - A	Syacium papillosum	62	28.7	2,245	9.9
I - B	Syacium papillosum	127	49.8	3,436	57.2
I - C	Prionotus stearnsi	25	34.7	134	20.6
II - A	Monacanthus hispidus	18	13.0	579	10.5
II - B	Syacium papillosum	40	41.2	1,880	35.1
II - C	Citharichthys cornutus	80	38.1	312	4.4
III - A	Syacium papillosum	119	27.4	5,000	33.7
III - B	Monacanthus ciliatus	56	15.6	1,142	7.1
III - C	Citharichthys cornutus	143	41.4	534	5.4
IV - A	Monacanthus hispidus	23	18.8	607	5.7
IV - B	Bellator militaris	182	38.5	2,554	19.9
IV - C	Citharichthys cornutus	112	38.6	299	5.0
V - A	Syacium papillosum	45	28.7	2,307	30.1
V - B	Urophycis regius	29	25.4	1,247	23.8
V - C	Pontinus longispinis	148	26.8	6,421	31.5
VI - A	Syacium papillosum	35	29.4	1,417	37.2
VI - B	Serranus notospilus	212	67.3	1,185	27.1
VI - C	Steindachneria argentea	101	29.1	2,552	33.1

Table 116c. The major dominant species and their absolute and relative (%) specimen numbers and biomasses (g wet weight) for each demersal fish collection for the February/March sampling period.

Transect-Station	Major Dominant Species	Specimens Absolute	Specimens Relative	Biomass Absolute	Biomass Relative
I - A	*Syacium papillosum*	36	23.5	1,327	18.1
I - B	*Syacium papillosum*	57	41.6	3,915	48.7
I - C	*Citharichthys cornutus*	104	48.6	361	25.2
II - A	*Monacanthus hispidus*	94	34.9	3,765	21.4
II - B	*Mullus auratus*	50	31.2	2,454	39.7
II - C	*Saurida normani*	34	27.6	2,624	63.4
III - A	*Etropus rimosus*	42	20.7	381	5.7
III - B	*Bellator militaris*	7	26.9	124	19.7
III - C	*Peristedion miniatum* *Citharichthys cornutus*	4 4	18.2 18.2	582 16	56.8 1.6
IV - A	*Etrumeus teres*	22	41.5	13	<1.0
IV - B	*Bellator militaris*	33	57.9	530	31.3
IV - C	*Saurida normani*	36	46.1	2,740	71.7
V - A	*Syacium papillosum*	100	54.0	3,632	45.4
V - B	*Scorpaena agassizi*	23	33.8	433	32.1
V - C	*Scorpaena agassizi*	12	44.4	612	40.3
VI - A	*Etropus rimosus*	4	26.7	15	2.8
VI - B	*Serranus notospilus*	152	79.2	707	50.2
VI - C	*Zalieutes mcgintyi*	4	50.0	11	17.2

periods. Syacium papillosum did not occur in any of the Station C collections but was present in 17 of the Station A collections and 17 of the Station B collections. Citharichthys cornatus was the major dominant for eight Station C collections from Transects I, II, III and IV and occurred infrequently in the Station B collections and was non-existent in the Station A collections. Like Syacium papillosum its role as a major dominant was not limited seasonally.

Reference to Table 117 shows that fish biomass for most stations was generally much greater in the October collections. Comparison of biomasses between station collections on the individual transects suggests that the biomass at Station C was usually less than those of Station A and B (recalling Station C tows were double those of Stations A and B). Geographical variations in biomass appeared to be mostly random. Transect VI values, however, were considerably lower than those of the other five transects and Transect I values were considerably higher. There was a general decrease in biomass with depth between Stations A and C.

Length frequency data for most of the species' specimens lie in the size classes spanning from 0-20 cm.

Histopathology

Figures 105a through 105i are representative photomicrographs of the corals Madracis decactis and Phyllangia americana, the bivalves Argopectin gibbus, Ostrea frons and Pteria columbus, and the crabs Portunus spinicorpus and Stenorynchus seticornis.

The results from the examination of all of the slides prepared from the tissues of the hard and soft corals, crustaceans, sponges, gastropods, bivalves, echinoderms and cephalopods show that these macroinvertebrates

Table 117. Total biomass (grams wet weight) of specimens of fishes collected during 1975-1976 MAFLA program.

	Transect	I	II	III	IV	V	VI	Totals
	July, 1975	4,541	3,755	2,059	7,162	1,558	5,699	24,774
Station A	October, 1975	22,593	5,498	14,832	10,598	7,654	3,809	64,984
	February/March, 1976	7,335	17,578	6,685	1,370	8.003	542	41,513
	Station A Totals	34,469	26,831	23,576	19,130	17,215	10,050	131,271
	July, 1975	7,618	3,022	867	410	5,234	1,289	18,440
Station B	October, 1975	14,749	5,361	15,997	12,836	5,244	4,371	58,558
	February/March, 1976	8,034	6,188	628	1,694	1,349	1,408	19,301
	Station B Totals	30,401	14,571	17,492	14,940	11,827	7,068	96,299
	July, 1975	768	560	280	1,490	3,956	5,687	12,741
Station C	October, 1975	649	7,131	9,829	5,979	20,406	7,707	51,701
	February/March, 1976	1,431	4,139	1,025	3,821	1,517	64	11,997
	Station C Totals	2,848	11,830	11,134	11,290	25,879	13,458	76,439
Transect Totals		67,718	53,232	52,202	45,360	54,921	30,576	304,009

Figure 105a. Madracis decactis (station 147). Photomicrograph of zooxanthellae (400X).

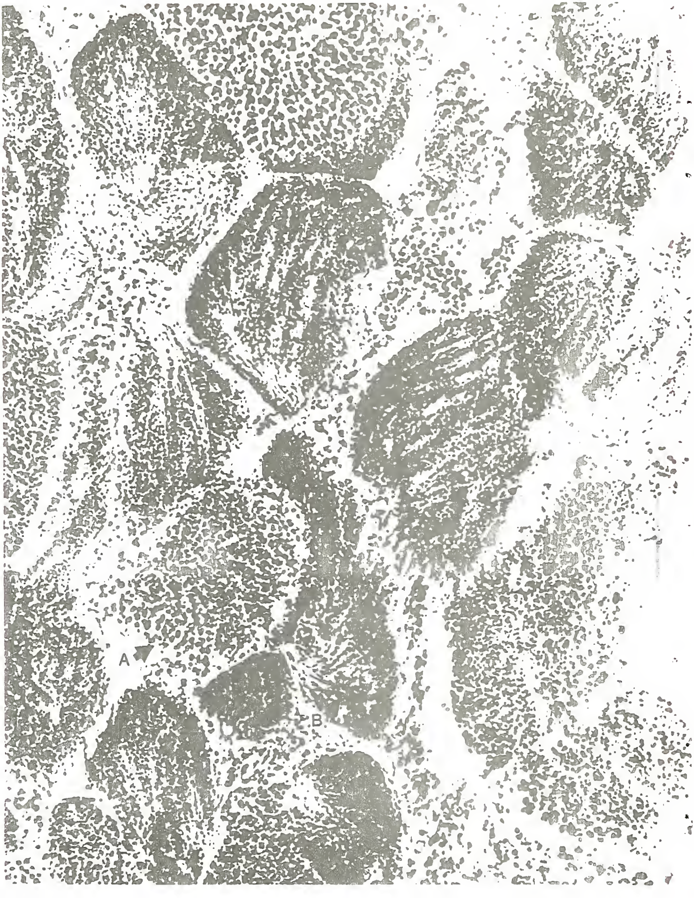

Figure 105b. Phyllangia americana (station 64). Photomicrograph of (a) spermatocytes and (b) spermatozoa (160X).

Figure 105c. Argopecten gibbus (station VI-A). Photomicrograph of outer covering of eye (25X).

Figure 105d. Ostrea frons (station 151). Photomicrograph of (a) digestive diverticula and (b) testes (10X).

Figure 105e. Pteria colymbus (station 147). Photomicrograph of gills (63X).

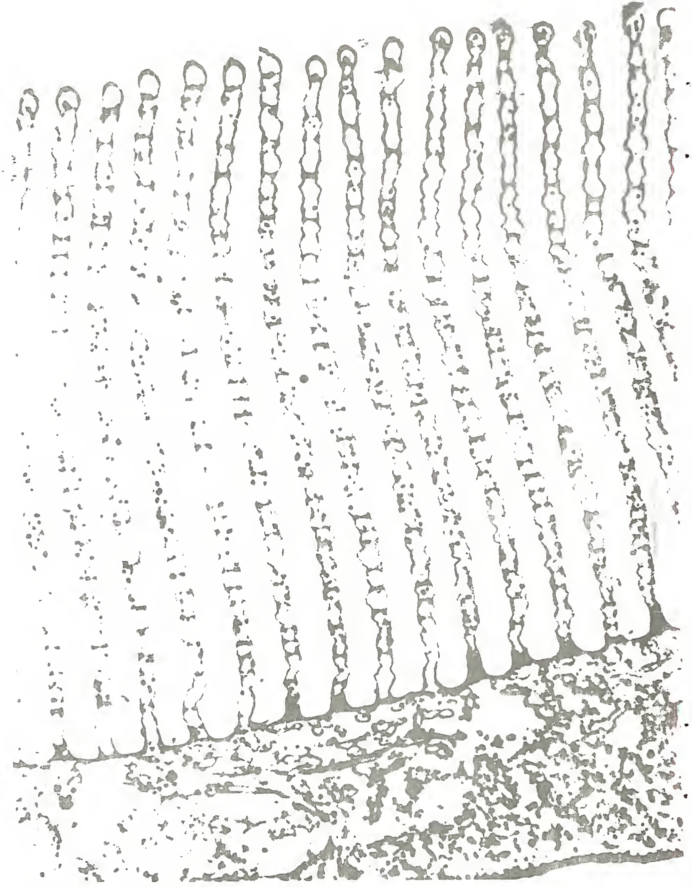

Figure 105f. Portunus spinicarpus (station IV-B). Photomicrograph of gills (63X).

Figure 105g. Stenorhynchus seticornis (station 047). Photomicrograph of shell (63X).

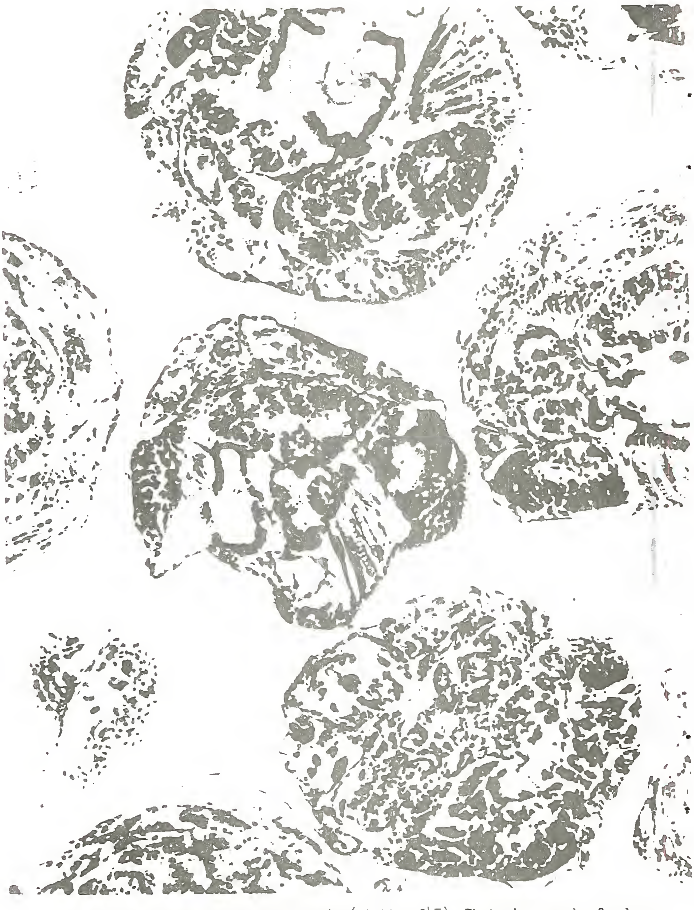

Figure 105h. Stenorhynchus seticornis (station 247). Photomicrograph of embryos attached to abdomen (63X).

Figure 105i. Stenorhynchus seticornis (station 247). Photomicrograph of eye (25X).

are essentially free of pathological conditions.

Some evidence of parasitism existed and was most prevalant in the bivalves and shrimp. This condition could not be associated with either the trace metals or the hydrocarbons nor with any other environmental factor (Figs, 105j to 105n).

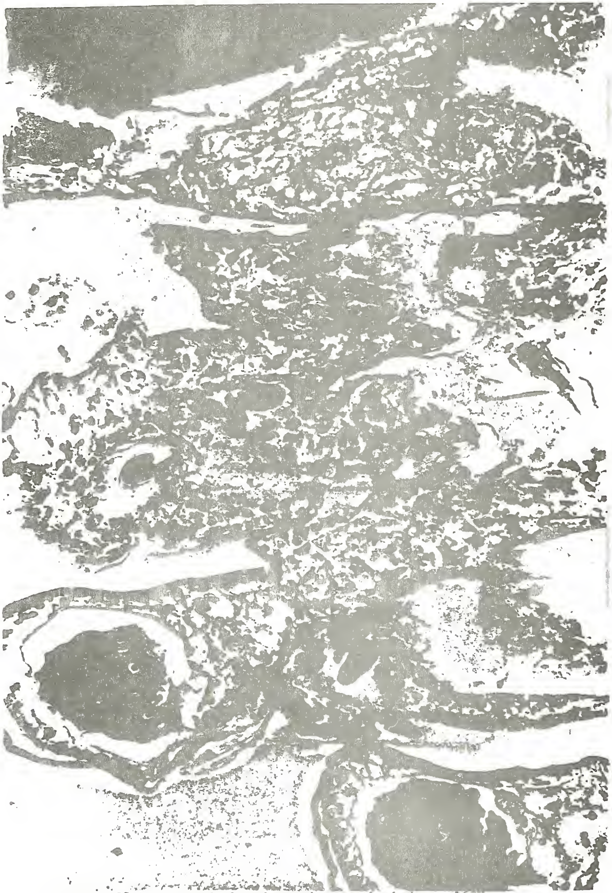

Figure 105j. Sicyonia brevirostris - rock shrimp 160X
Collected 7-19-75 Station No. VI A
Pathology No. 75-890
Ciliates in gills

Figure 105k. Pecten ravenli - scallop 400X
Collected 10-22-75 Station No. 1 A Pathology No. 76-1743
Metacercaria of digenetic trematode, intertubular area of digestive diverticula

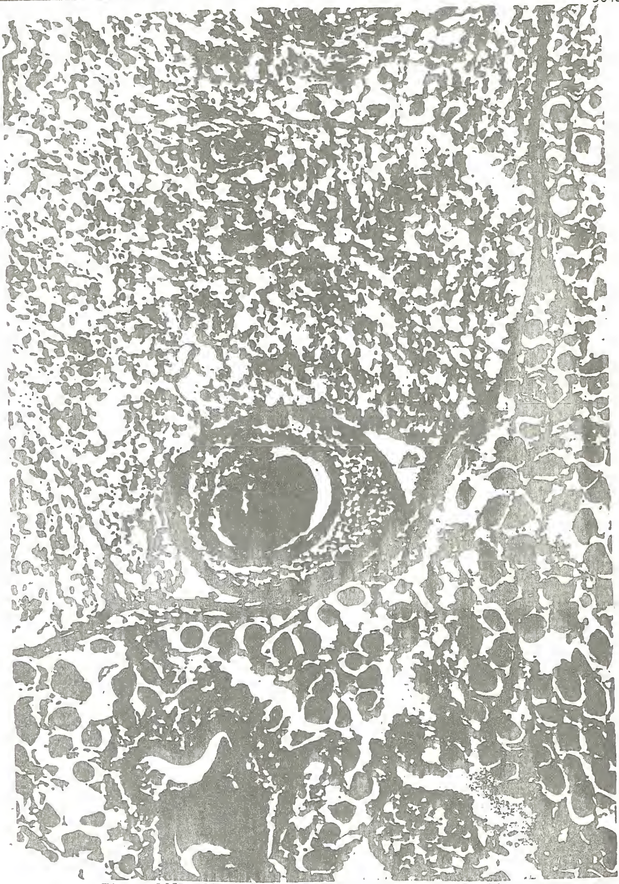

Figure 105L. Sicyonia brevirostris - rock shrimp 160X
Collected 7-19-75 Station No. VI A
Pathology No. 75-890
Probable metacestode (Metazoan parasite) along the reproductive tract

Figure 105m. Sicyonia brevirostris - rock shrimp 160X
Collected 7-19-75 Station No. VI A
Pathology No. 75-890
Sporozoan trophozoites possibly Nematopsis sp. intertubular area of digestive diverticula

564-f

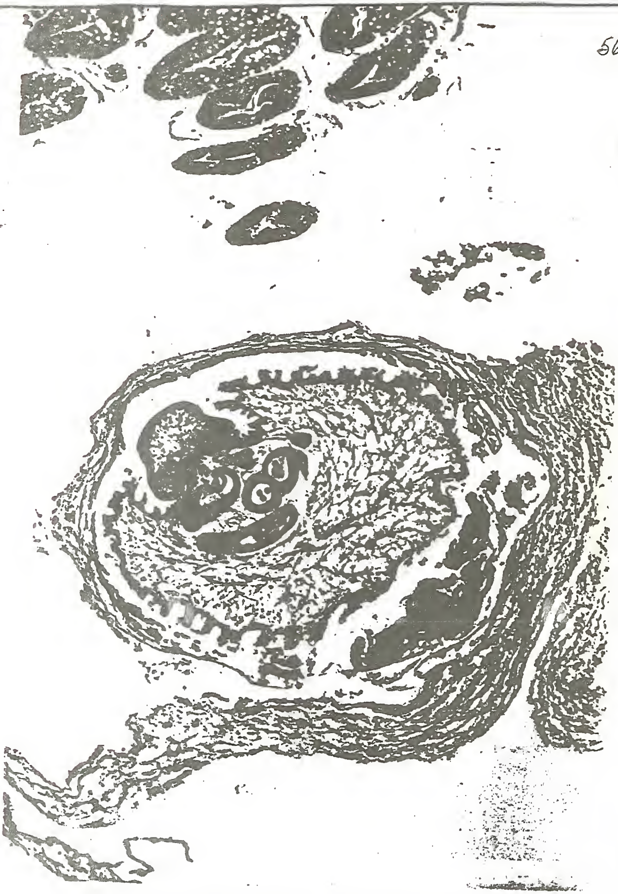

Figure 105n. Penaeus setiferus - white shrimp 63X
Collected 12-3-75 Station No. 19
Pathology No. 76-156
Unidentified Helminth in the digestive tract