

of the bay. Even if such reduction effect occurred, the trophic state of the nutrient concentration is very high. If we assume that 0.05 mg/l for TP and p., 5 mg/l for TN are the maximum limits for eutrophication evolution (Tolendo Jr. A. et al. 1984), the entire Guanabara Bay area must be classified as an extensively eutrophicated ecosystem.

On the other hand, the amount of oxygen near the input of sewage is very low in the entire water column, reflecting high concentration of organic discharge. Away from the pollutant discharge area, super saturation of oxygen at the water surface is inferred to be caused by intensive photosynthetic activity. However, a very low concentration was observed at the bottom layer, except for the stretch corresponding to the entrance of the bay, and almost 100% of DO saturation levels in all water layers.

As an estuary regime was used, a significant salinity gradient of 7 to 17‰ of salinity at water surface was observed during the rainy season (November/92) near the Guapimirim and the Caceribu-Macacu basin, depending on the bay area. According to salinity variation, Guanabara Bay can be divided into eulitoral, polyhalino, meso and oligohalino regimes, from the entrance to the inner part of the bay.

Sludge composed of putrefied organic compounds hugely accumulate as a consequence of pollutant flow and eroded matters from the contribution basin, especially at the inner part of the bay. This could seriously affect water quality as well as benthos assemblage activities. The sediments found at the entrance and central areas of the bay are predominantly composed of fine sands and sands containing organic silt, respectively.

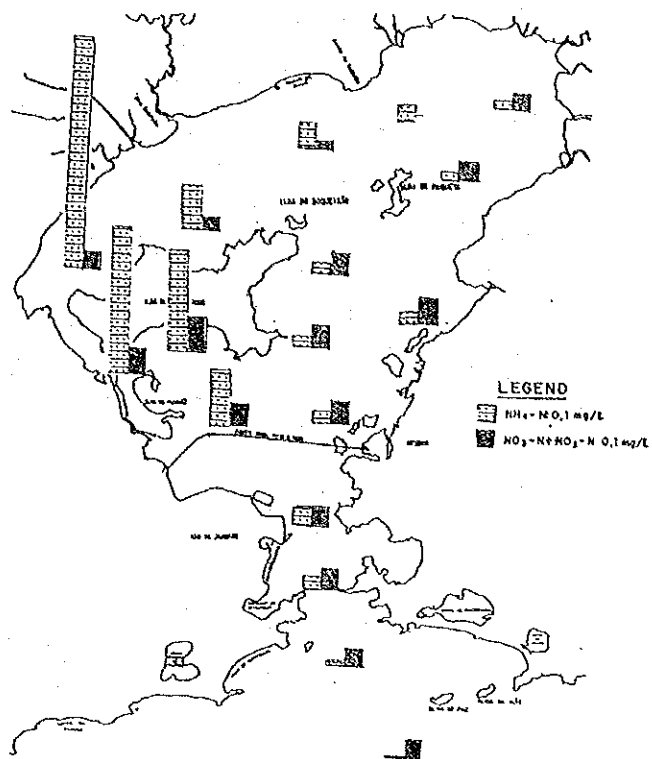


Fig. 7.1-1 Variation of  $\text{NH}_4\text{-N}$  and  $\text{NO}_3\text{-N} + \text{NO}_2\text{-N}$  Concentrations in the Guanabara Bay

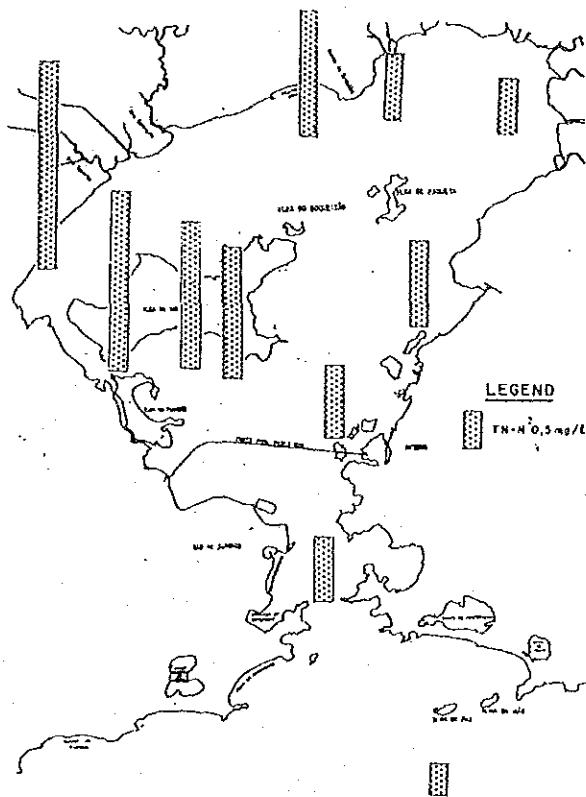


Fig. 7.1-2 Variation of TN Concentration in the Guanabara Bay

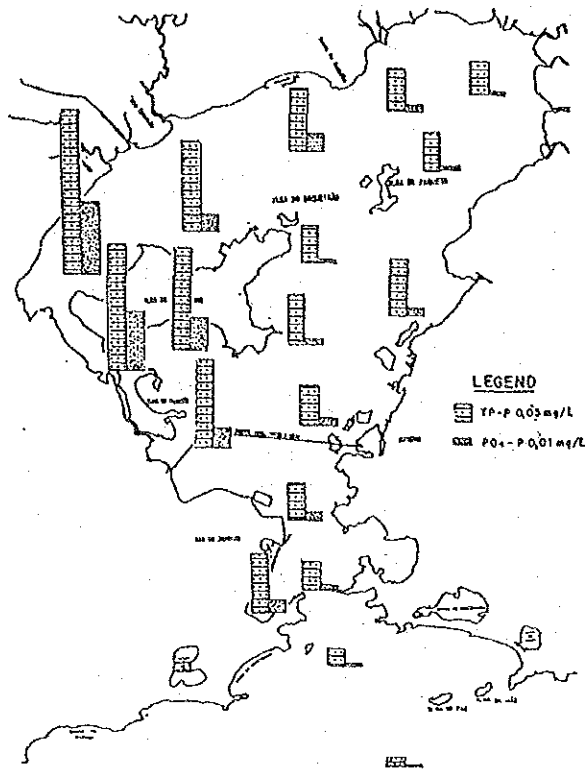


Fig. 7.1-3 Variation of TP and PO4 Concentration in the Guanabara Bay

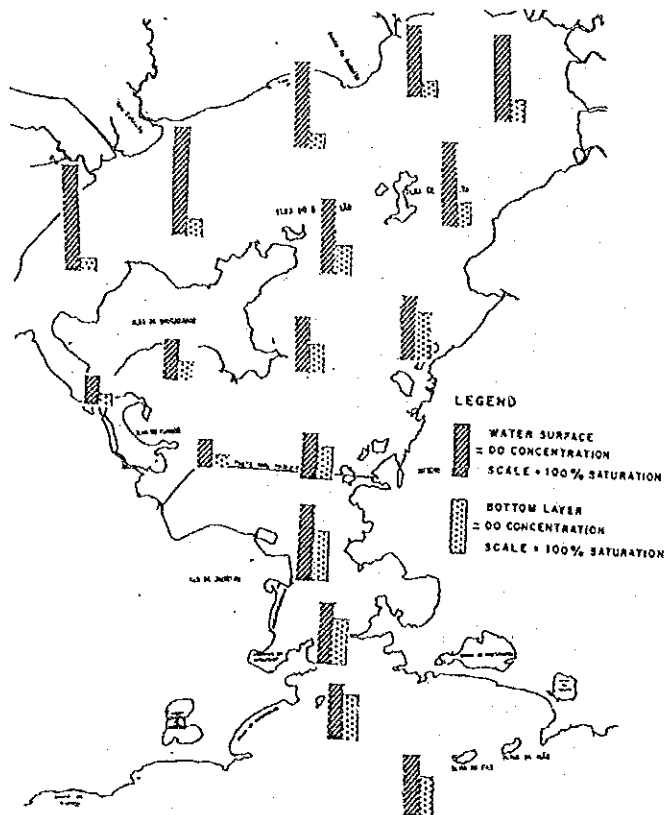


Fig. 7.1-4 Variation of DO Concentration in the Guanabara Bay

## 7.2 Phytoplankton Community

### 7.2.1 Sampling Procedures

During the three (3) simultaneous sampling surveys performed in 1992, chlorophyll and phytoplankton samples were collected at the eighteen (18) stations previously established in the Guanabara Bay.

Two (2) chlorophyll samples, one taken in the low tide and one during high tide, were collected during each survey with a Van Dorn sampler filtered immediately and preserved in the boat deck.

### 7.2.2 Phytoplankton Biomass Variation

The mean concentrations of phytoplankton biomass expressed as chlorophyll-a at water surface and bottom on 18 sampling stations according to tidal variations are presented in Table 7.2-1. Fig. 7.2-1, based on the mean value of surface layer, shows the chlorophyll-a variation pattern in the Guanabara Bay.

As shown in this figure, concentration of chlorophyll-a tends to be higher on the west side and in the inner part of the bay, lower in the central region, and the lowest concentration is observed in the mouth of the bay. This type of algae biomass variation reasonably coincides with nutrients variation in the bay, especially of phosphorous as previously presented.

Fig. 7.2-2 shows the relationship between chlorophyll-a and P, indicating an important function of this nutrient for phytoplankton production.

Besides the above behaviours a remarkable vertical variation of algae pigment, higher in water surface and lower at the bottom layer, was also observed at almost all of the sampling stations. This phenomenon is caused by floating mechanisms of *Oscillatoria* sp, the absolute predominant phytoplankton in terms of biomass in the bay which is associated with water mass stratification regime thereby contributing to the formation of algae bloom or green tide.

On the other hand, variation of algae concentration depending on tidal level was observed. Generally, a higher concentration of chlorophyll-a is verified during low tide and vice-versa as indi-

Table 7.2-1 Variation of chlorophyll-a concentration in the Guanabara Bay (ug/l)

STATION	1		2		3		4		5		6	
DEPTH	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.
High tide	1,44	1,29	3,65	5,11	6,61	6,31	4,38	8,11	4,15	2,06	20,61	9,75
Low Tide	0,46	0,80	17,77	5,13	23,11	8,74	77,34	77,34	36,40	6,61	69,75	11,05
Mean	0,95	1,05	10,71	5,12	14,86	7,53	44,36	44,36	20,28	4,34	45,18	10,4

STATION	7		8		9		10		11		12	
DEPTH	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.
High tide	45,24	12,70	42,52	32,06	49,36	10,85	17,45	8,54	87,58	16,15	30,02	14,55
Low Tide	65,46	20,75	65,55	32,50	63,82	16,88	50,75	11,87	75,36	29,20	35,52	14,80
Mean	55,35	16,73	54,04	32,28	56,59	13,87	34,12	10,21	81,47	22,70	32,77	14,68

STATION	13		14		15		16		17		18	
DEPTH	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.	SUR.	BOT.
High tide	56,14	60,14	85,09	14,68	25,17	10,69	38,41	18,71	36,98	20,91	46,78	23,73
Low Tide	51,23	64,15	108,26	36,53	25,84	13,63	27,48	10,08	57,24	23,70	98,46	57,87
Mean	53,69	62,15	96,68	25,61	25,51	12,16	32,95	14,40	47,11	22,31	72,62	42,30

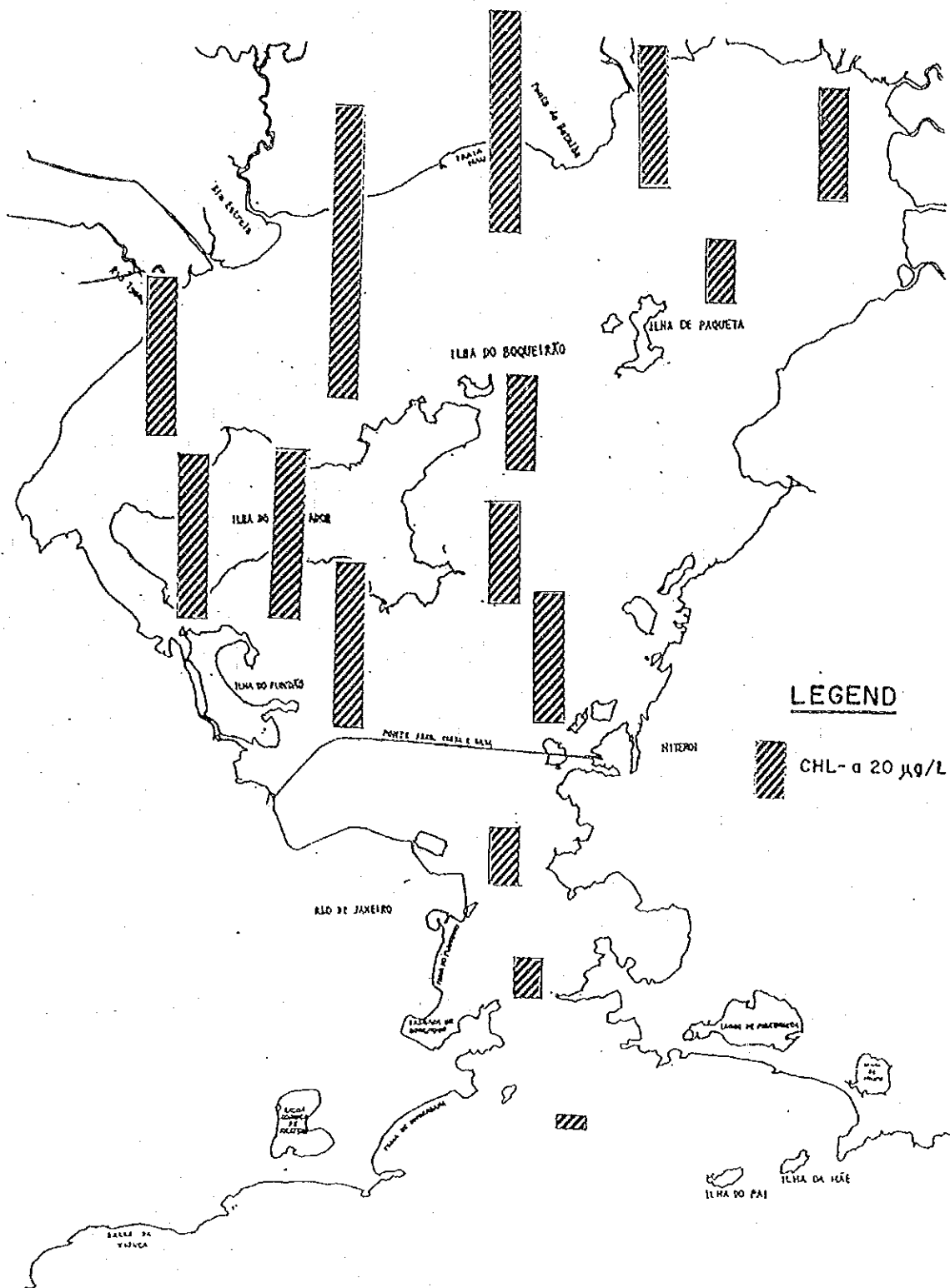


Fig. 7.2-1 Phytoplankton Biomass (chlorophyll-a) Distribution on the Guanabara Bay

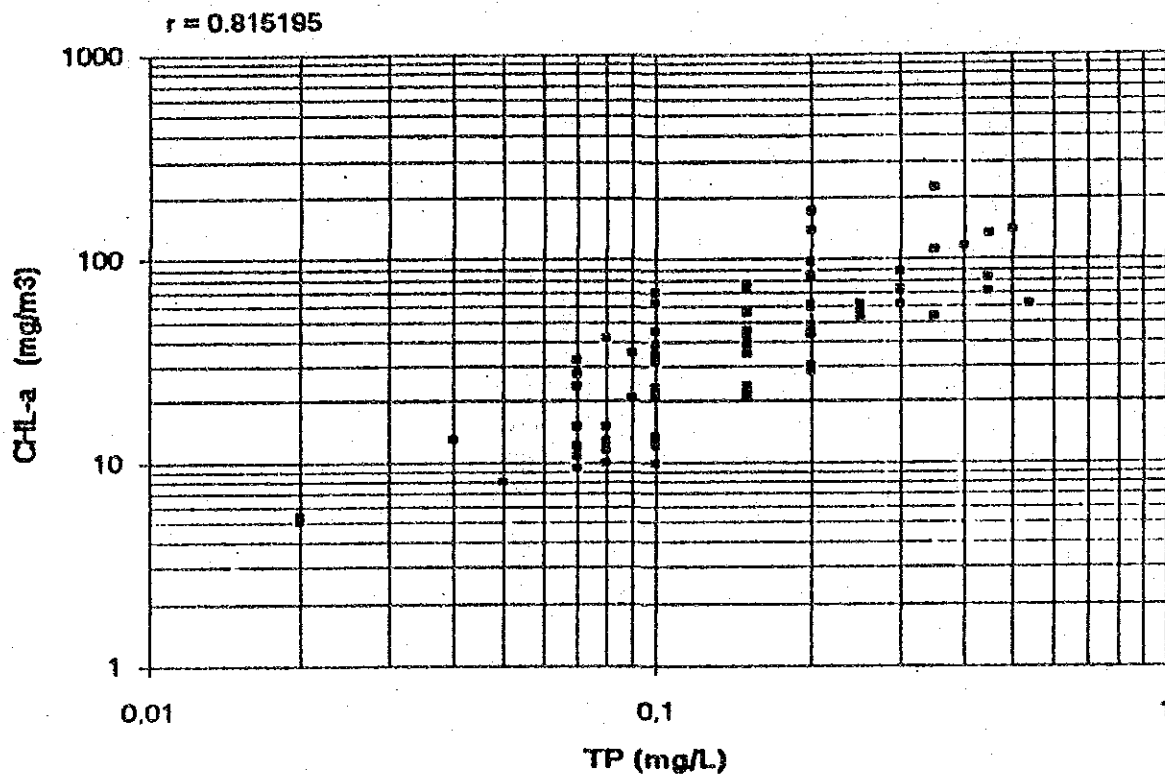


Fig. 7.2-2 Correlation between TP  
And Chlorophyll-A in the Guanabara Bay

cated in Table 7.2.-1, principally in the mouth of the bay where coastal waters of the ocean have a strong influence.

### 7.2.3 Phytoplankton Species

The results of classification and quantification of phytoplankton in all samples are recorded in Appendix 7.1. Fig. 7.2-3 to 7.2-6 graphically illustrate the general behaviour of the phytoplankton community obtained in two water layers and from different periods of sampling.

According to the data computed from the first study (May 1992), the phytoplankton population tends to increase as we progress toward the centre of the Guanabara Bay. On the other hand, Nostocophyceae, constituted mostly by *Oscillatoria* sp., absolutely predominate the phytoplankton population in all the sampling stations of the two water layers, except station 18 where Dinophyceae predominates (*Pretoperidium trochoideum*, one of red tide organisms), followed by Prasinophyceae (*Tretraselmis* sp.).

A pronounced difference in phytoplankton density was also observed between the upper and bottom layers. The population in the bottom was nearly 30 to 80% less than in the upper layer.

As for the results obtained during the high tide of June 1992, a distribution pattern very different from the first study was verified. Although the tendency of the phytoplankton population to increase in the inner part of the bay was confirmed, the algae composition drastically changed. Among the phytoplankton group belonging to the Nostocophyceae, *Oscillatoria* sp. population dropped, whereas *Synechocystis* sp. population increased in the central and inner parts of the bay.

Besides, one of the most remarkable changes was that in spite of Nostocophyceae, Bacillariophyceae mainly composed of *Nitzschia* sp. appeared as the predominant species in the central zone of the bay, including the east side area of the inner part of the bay (St. 15, 16, and 18). In the stations located in the west side (St. 8, 9, 13 and 14) Nostocophyceae was still predominant in the water surface. However, in the deep layers, the Bacillariophyceae predominance extended in almost all the sampling stations in the bay, except for stations 8 and 18, a phenomenon suggesting the strong influence of oceanic water invading the bay, especially the deep layers.



The phytoplankton survey performed in the rainy season showed recuperation of Nostochophyceae predominance with an appreciable proliferation of *Synechosystes* sp., besides *Oscillatoria* sp.. Although the trend of phytoplankton density distribution is similar to the previously mentioned chlorophylla-a, the density index as well as similarity index were calculated statistically, and variation in a 56 species population was noted, though it is not a significant factor in the distribution characteristics in the bay. These suggests homogeneity in the phytoplankton community distribution as a consequence of a high eutrophication level which developed in the entire area of Guanabara Bay.



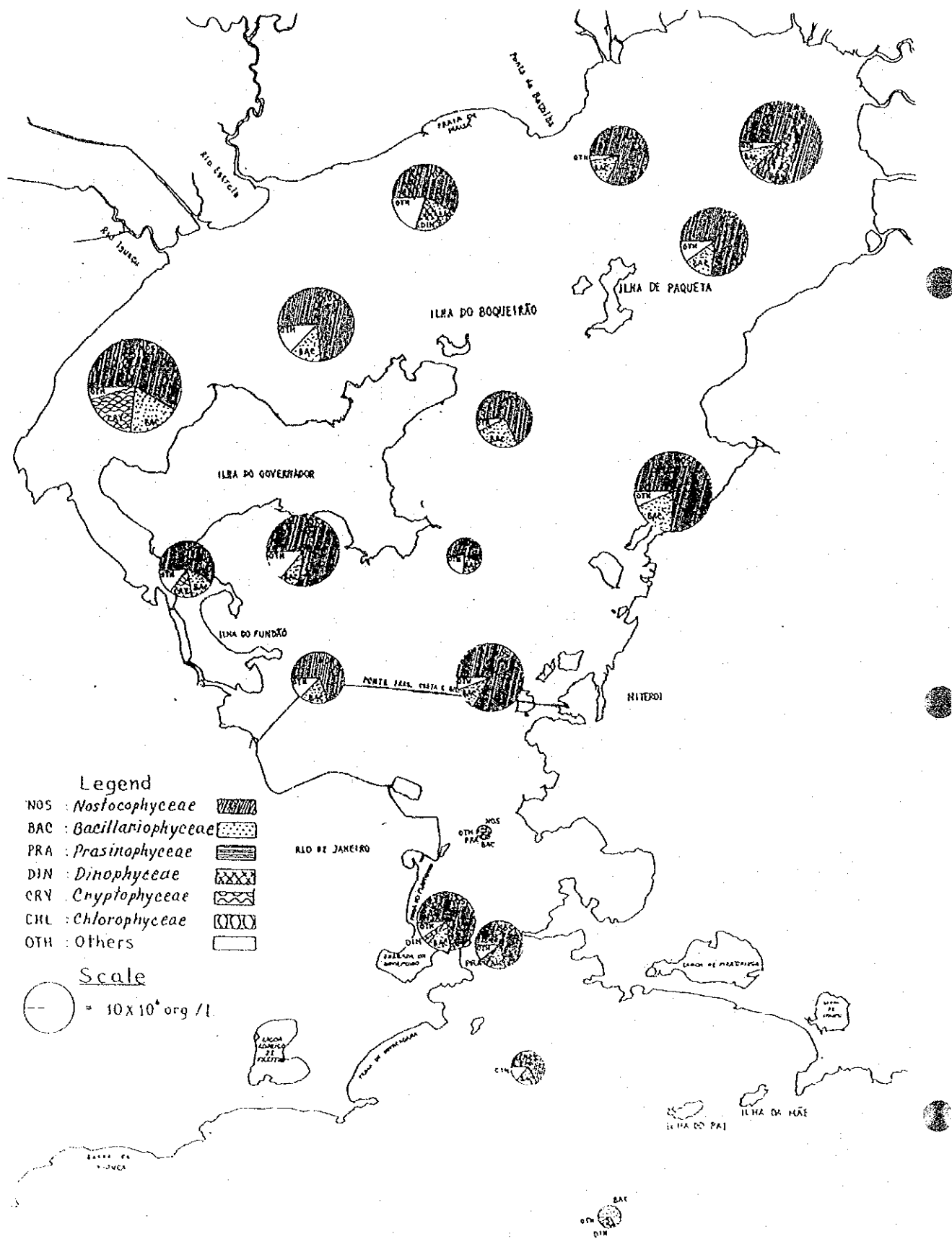


Fig. 7.2-4 Distribution of phytoplankton population  
 - May / 1992 - bottom -





#### 7.2.4 Limiting Factors for Phytoplankton Production

In ecosystems located in tropical regions characterized by high concentration of nutrients, like the Guanabara Bay, intense proliferation of phytoplankton may usually be expected.

The intensity of solar radiation in these regions does not normally constitute a limiting factor, at least not in the water surface, because saturation intensity for algae metabolism is much lower than that available in natural environments. At the same time, water temperature in the bay maintains almost always an optimum range for algae growth in terms of annual mean value (25°C). In these environmental conditions, the behaviour of nutrients constitutes an essential factor for the control of eutrophication evolution.

The relationship between nutrients and algae in an aquatic system from the viewpoint of physiological characteristics is very complex, since different algae species, different types and forms of nutrients interfere in this relationship.

However, a number of recent researches has demonstrated that N and P are more scarce in the natural environment, and these parameters have been introduced in the management and control planning of aquatic systems, associated with the biomass amount expressed by chlorophyll-a (7.2.1).

Since estuarine regime is different from continental aquatic systems, the dissolution of P from sediments is accelerated due to the presence of a significative amount of sulphur compounds that contribute to reduce the P retention capacity of  $Fe^3$  present at the sediment surface (7.2.2). Several studies performed in estuarine environment in this season laid emphasis on the tendency of N as being a limiting factor (7.2.3), even though this situation could change depending on the intensity of nutrients discharged from tributaries of the basin.

The definition of N or P as limiting factors in an aquatic system offers basic information for the planning of treatment facilities, as well as the application of simulation models.

A correlation between N and P ratio was carried out both in water and in algae biomass in the Guanabara Bay for verification.

In this correlation, N and P ratio in algae was assumed as being the same as that of the seston because algae concentration corresponds to a great part of suspended matter in water. Fig. 7.2-7 and 7.2-8 were prepared using all the data on N, P and chlorophyll-a collected at water surface through 3 sampling campaigns (2 samples collection for each campaign) at 18 stations during 1992. The correlation coefficient values computed in water and algae were, respectively, 0.77 and 0.89. N and P ratios in water considerably vary according to the concentration of nutrients while the same phenomenon does not occur in algae. The chemical composition of aquatic organisms is therefore relatively stable even if environmental conditions change. N/P ratios were obtained in ranges of 6 to 15 in water and 5 to 7.5 in algae, suggesting insufficient quantity of P for algae growth, especially in the bay area with lower concentration of nutrients, which corresponds to the mouth of the bay. In this area, the sediments are essentially composed of sand with a small portion of organic matter that can not constitute a significant source of nutrients. This fact coincides with the nutrient balance theory already mentioned.

Accordingly, it is possible to conclude that P is the most probable limiting factor for eutrophication in Guanabara Bay.

#### 7.2.5 Eutrophication Level

Exaggerated production of algae biomass caused by water enrichment brings about a series of negative consequences, resulting in eutrophication phenomenon, for practical uses of aquatic systems. Various criteria have been elaborated to position trophic levels of water for the purpose of water resource.

The relation between concentration of N, P and chlorophyll-a presented in Table 7.2-2 is one of the criteria used frequently to classify aquatic ecosystems in terms of eutrophication (7.2.4). Vollenweider (7.2.5) proposed ranges of chlorophyll-a according to the eutrophication level, as shown in Fig. 7.2-9.

Based on the referred criteria, most of the Guanabara Bay presents an extremely high eutrophic level, particularly the wide western area. If a mesotrophic level was adopted as water quality recuperation target (corresponding to 20 ug/l of chlorophyll-a), it would be necessary to reduce the phytoplankton biomass to approximately 70%.

O  
I  
P  
A  
A

Table 7.2-2 An example of trophic classification criteria of tropical aquatic system by CEPIS, 1990

	oligotrophic	mesotrophic	eutrophic
Total P (mg/m <sup>3</sup> )	21.3	39.6	118.7
Chlorophyll-a (mg/m <sup>3</sup> )	3.6	6.7	17.4

O  
I  
P  
A  
A



( ) = N/P RATIO

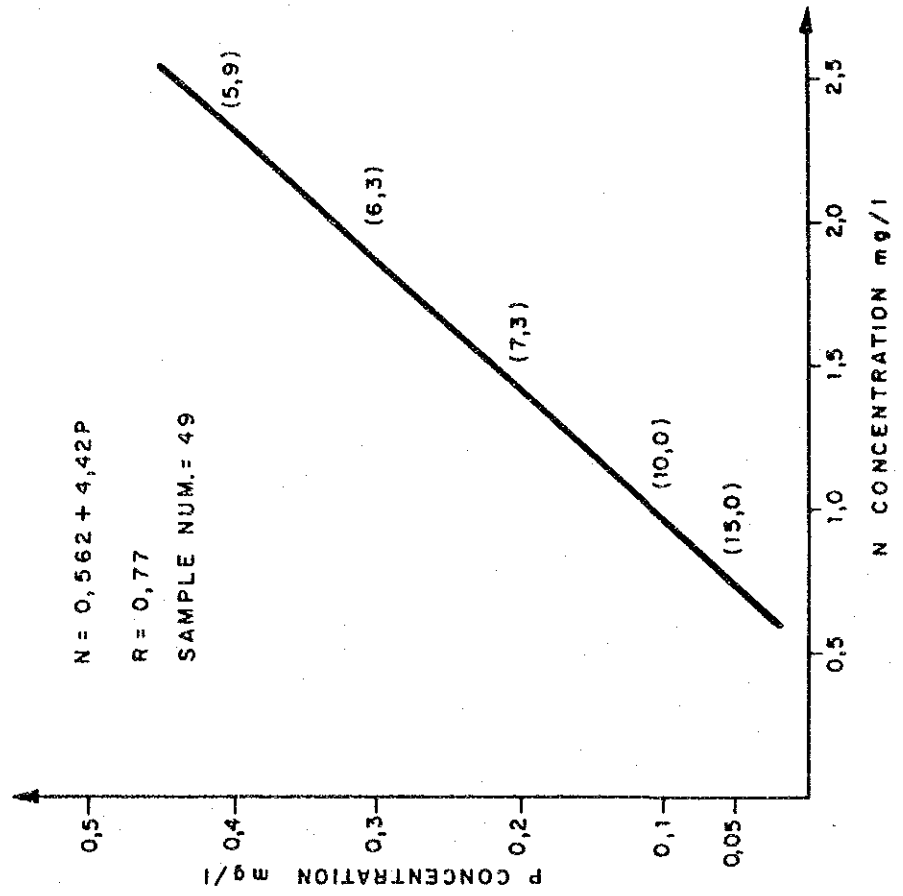


Fig. 7.2-7 N and P Ratio in Water

( ) = N/P RATIO

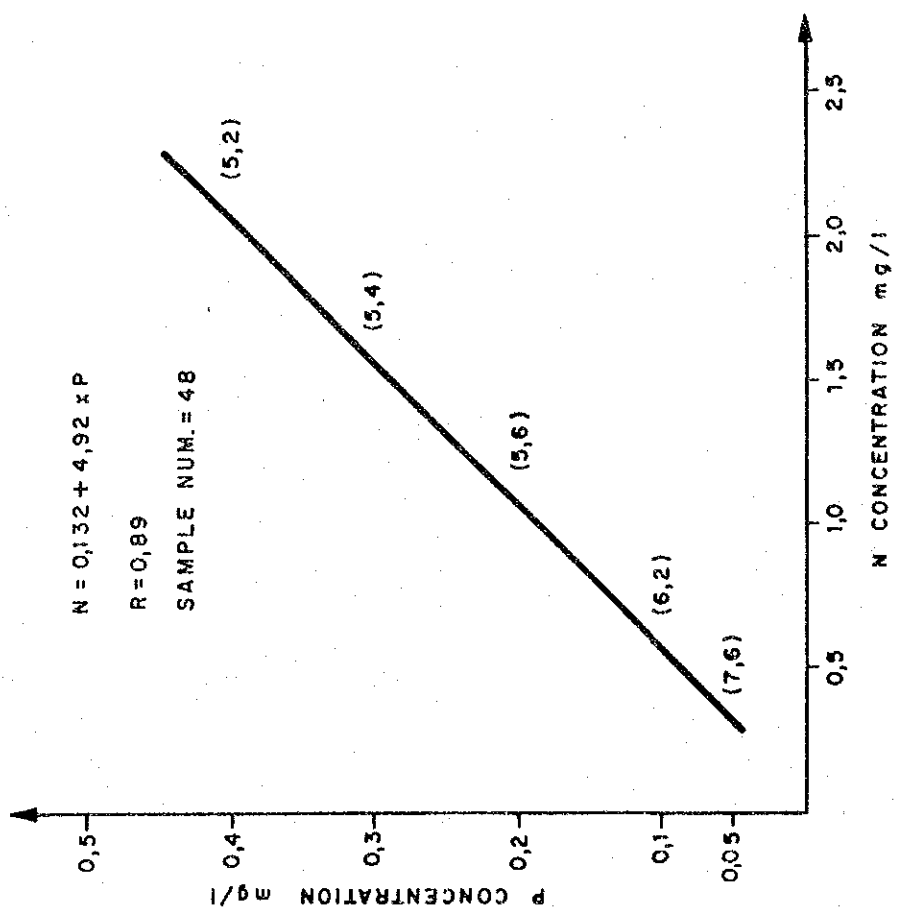


Fig. 7.2-8 N and P Ratio in Seston

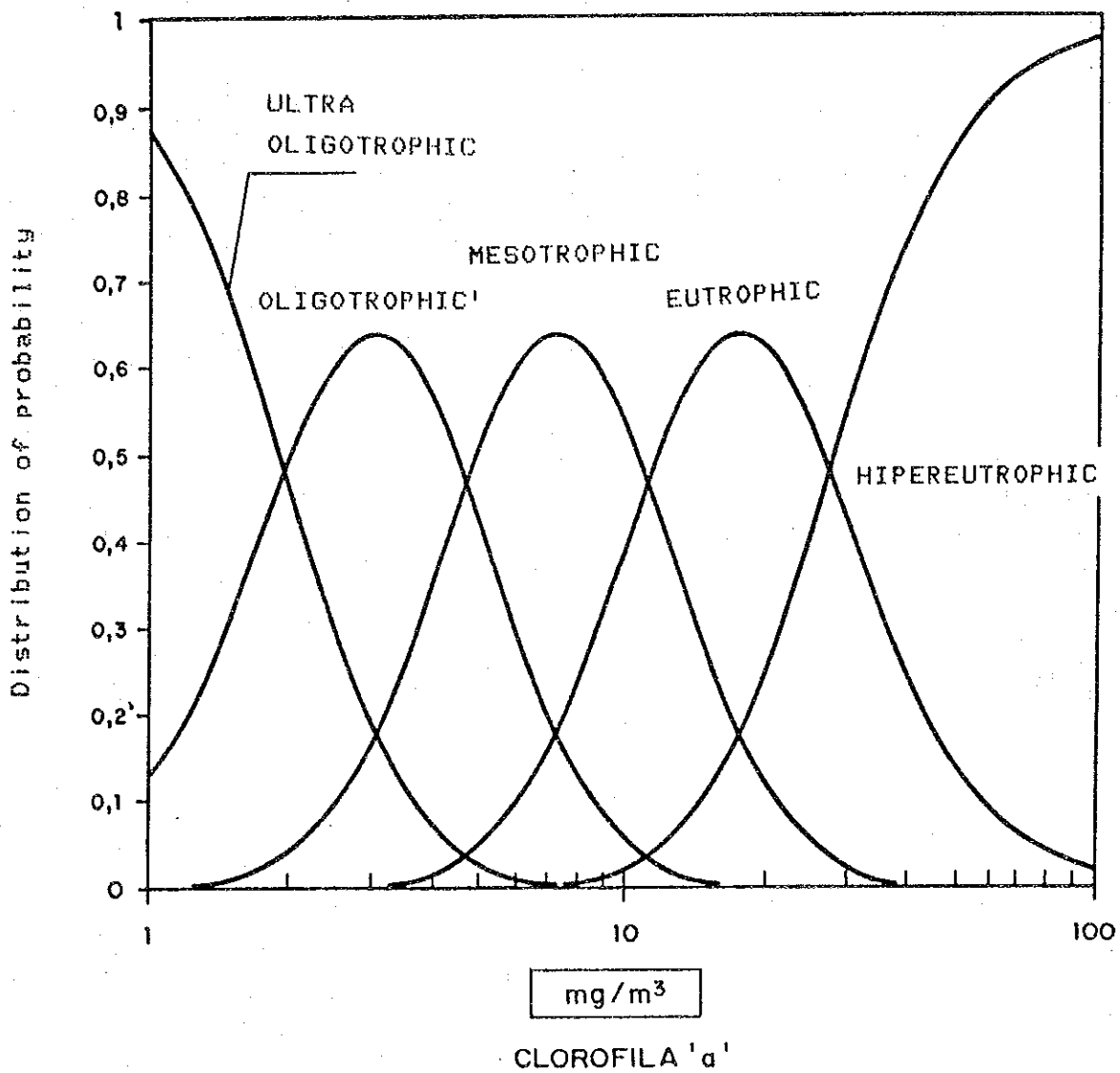


Fig. 7.2.-9. Distribution of Probability of Trophic Level (Vollenweider and Kerekes, 1981)

### 7.2.6 Contribution of Phytoplankton to Nutrient Balance

Phytoplankton constitutes the most important aquatic organism in the Guanabara Bay, given its presence in great quantity and its strong influence on the alternation of water quality.

These large amounts of algae produced in the bay represent nothing more than organic matter, but alive organic matter, differing from those from pollution sources. One of the most remarkable behaviour of this biomass is oxygen production as the consequence of organic matter synthesis, which greatly contributes to the water purification process.

The growth velocity of these algae is fast, the multiplication of cells occurring 1/4 to 1 1/2 times a day in optimum conditions (7.2.6). However, actually, the specific growth rate has decreased due to several limitation factors involved in the aquatic environment.

Assuming that Guanabara Bay is a great biological reactor and with application of the Mono equation, it is possible to estimate the specific growth rate of algae within a range of  $0.25 \text{ d}^{-1}$ , which approximately corresponds to the 4 day turnover period of predominant algae in the bay. For this evaluation, 0.3 was used as saturation constant for *Oscillatoria* sp. (7.2.7), the most proliferating algae in the bay, and 0.2 mg p/l, the mean value obtained in the bay, as growth limiting substrate concentration.

Up to now, C contents in algae in Guanabara Bay was not analyzed due to operational problems with the TOC analyzer at the FEEMA laboratory. A C concentration of algae of  $6.15 \text{ g/m}^3$  could be estimated by applying the chemical composition of 41:7.2:1 for, respectively, C, N and P, proposed by Redfield (7.2.8) in marine algae group, and associating it with mean P contents analysed in seston in Guanabara Bay ( $0.15 \text{ g/m}^3$ ).

If we admit that all algae found at a water depth of four (4) meters can carry out photosynthetic reaction through vertical circulation of algae particles promoted by water mass movement, it is possible to estimate  $6,158 \text{ C/m}^3/\text{d}$  as the carbon production rate in the bay, using the specific growth rate presented above ( $0.25/\text{d}$ ).

During November 1992 and April and May 1993, a primary production survey was performed using oxygen method. The mean gross production obtained was in the range of 7.1 g O<sub>2</sub> g O<sub>2</sub>/m<sup>2</sup>/dx 5.25 g/m<sup>2</sup>/d of net carbon production, which is slightly lower than the value computed theoretically.

This difference of C production between the theoretical computation and practical determination can be attributed to discrepancies between some assumptions applied for theoretical calculation. Anyhow, the explanation presented above indicates occurrence of accelerated growth rate and renovation of algae cells in the Guanabara Bay.

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## 7.3 Zooplankton Community

### 7.3.1 Sampling Procedures

Zooplankton sampling was performed at 17 stations on June 1992 during the 1st phase of the study, and at 12 stations on October 1992 on the 2nd phase of the study, with the participation of the staff of the Institute of Biology, Universidade Federal do Rio de Janeiro.

During the 1st phase of the study, a "Rule 1500" type water pump was used to collect samples by pumping up 150 to 200 liters from the surface layer and bottom layer of each station. Pumped water was filtered by two types of plankton nets, a 50  $\mu\text{m}$  mesh and a 200  $\mu\text{m}$  mesh, to collect simultaneously micro and macro zooplanktons. Biological analysis of zooplanktons of the 1st phase pointed out a very small population due to insufficiency in pump potential for drawing water. For this reason, a STILL type pump with higher potential (3.4 HP) was used in the 2nd phase and 500 liters of water from two water layers was pumped up.

Concomitantly, a conical net (60 cm mouth diameter and 200  $\mu\text{m}$  mesh net) equipped with a flowmeter was used for horizontal water surface sampling. Approximately 25  $\text{m}^3$  of water volume were filtered at each station. The determination of water temperature, salinity and dissolved oxygen concentration were simultaneously performed at each station on the boat deck. The classification and quantification of collected samples were carried out in the Department of Biology of UFRJ.

### 7.3.2 Species Variation

In the 1st phase of the study, as previously mentioned, a very low zooplankton density was observed in all sampling stations as compared to the data obtained from earlier researches. Even so, these data indicated that the Copepode group predominated numerically and presented higher density in the mouth of the bay. In the area adjacent to Ilha do Governador near the pollution flow stretch, lower zooplankton density was observed.

In the 2nd phase of the study, 23 species of microzooplankton and 70 species of macrozooplankton were identified.

Table 7.3-1, 7.3-2 and 7.3-3 present, respectively, classification results and density counting conducted for microzooplankton and macrozooplankton caught by water pump and macrozooplankton collected by surface plankton net.

Predominant species represented by *Acartia lilljeborji*, *Paracalanus quasimodo*, *Paracalanus crassirostris*, etc. all of which belong to Copepoda group are typically of the coast region of the ocean. *p. quasimodo* is, for example, neritic, termofil and epiplanktonic, being considered opportunistic hervivorous, consuming, principally, phytoplankton, protozoa, etc. In case of absence of vegetable food, they admit introduce detrits.

Table 7.3-1 Zooplankton density of the Guanabara bay collected with pump (50 um mesh)

STATION TAXA	2			3			5			6			7			8		
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
ROMYDIA	0.00	0.00	0.00	0.00	0.20	0.10	0.00	0.04	2.60	0.14	0.20	0.00						
HOLMUSCA LARVAE	0.40	0.00	0.00	0.00	0.00	0.10	0.40	0.00	0.00	0.00	0.00	0.00						
POLYCHAETA LARVAE	0.00	0.04	0.00	0.00	0.00	0.04	0.20	0.02	2.40	0.04	2.20	0.04						
CIRRIPIEDIA LARVAE	0.00	0.14	0.00	17.32	76.60	1.30	11.20	0.50	3.00	0.04	13.60	0.00						
Brachyura	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
Calanoida	453.33	66.67	200.00	19.67	26.67	394.67	12.00	37.33	1.20	4.40	0.00	0.53						
A. lilljeborgi	13.33	2.67	100.67	09.33	30.00	597.33	08.00	73.33	17.60	23.20	1.00	17.60						
P. quasimodo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00						
P. crassirostris	0.00	0.00	26.67	5.33	13.33	10.67	2.67	0.67	0.00	0.00	0.00	0.00						
C. velificatus	0.00	1.33	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
T. stylifera	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00						
Cyclopoida	446.67	49.33	560.00	25.33	3.33	26.67	4.67	3.33	2.00	2.00	3.60	0.53						
Poecilostomatoida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
C. gibbirecti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
Corycaea sp.	0.00	1.33	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
Oceca sp.	613.33	114.67	1000.00	44.00	10.00	74.67	3.33	17.33	1.00	0.00	6.20	0.53						
Harpacticoida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
E. acutifrons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00						
Benthic Copepoda	133.33	21.33	133.33	9.33	0.00	10.67	0.00	1.33	0.40	0.40	1.40	0.53						
Parasite Copepoda	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
Copepoda Nauplii	3000.00	304.00	3053.33	440.00	576.67	2517.33	362.00	313.33	56.60	197.20	0.40	19.73						
ISOPODA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
E. tergestina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00						
TOTAL	4960.40	561.51	5160.00	651.90	760.13	3633.60	464.47	440.41	80.00	220.64	36.20	39.31						
AVERAGE	215.67	24.61	224.35	28.35	32.10	157.99	20.19	19.50	3.03	9.94	1.57	1.72						
STD	643.34	65.67	649.92	90.03	117.31	522.62	74.19	64.70	11.01	40.20	3.23	5.24						

STATION TAXA	9		12		13		15		17		10	
	0	0	0	0	0	0	0	0	0	0	0	0
ROMYDIA	0.00	0.00	0.10	0.20	0.00	0.02	0.60	0.06	0.00	0.02		
HOLMUSCA LARVAE	0.20	0.00	0.04	0.00	0.20	0.00	0.20	0.00	0.00	0.00		
POLYCHAETA LARVAE	0.20	0.00	0.04	0.20	0.20	0.02	0.00	0.00	0.00	0.00		
CIRRIPIEDIA LARVAE	1.00	5.00	0.10	0.40	0.40	0.20	30.00	2.26	6.00	1.34		
Brachyura	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00		
Calanoida	0.00	2.40	7.67	1.40	0.00	3.27	0.40	0.32	0.00	0.04		
A. lilljeborgi	0.20	14.00	56.33	14.00	2.40	15.07	1.60	0.92	7.40	1.00		
P. quasimodo	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
P. crassirostris	0.00	0.20	1.33	0.60	0.40	1.33	2.00	0.32	1.40	0.12		
C. velificatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
T. stylifera	0.00	0.20	0.00	0.20	0.00	0.07	0.00	0.00	0.00	0.00		
Cyclopoida	0.20	0.00	3.33	1.00	0.00	1.07	0.20	0.56	3.00	0.20		
Poecilostomatoida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
C. gibbirecti	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00		
Corycaea sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Oceca sp.	0.00	1.00	5.33	1.00	0.00	4.60	0.20	0.16	0.00	0.04		
Harpacticoida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
E. acutifrons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Benthic Copepoda	0.00	1.40	0.33	0.40	0.20	0.60	0.60	0.06	0.40	0.02		
Parasite Copepoda	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Copepoda Nauplii	4.40	36.60	203.33	10.20	75.00	15.00	56.40	30.67	106.00	7.20		
ISOPODA	0.20	0.20	0.00	0.00	0.00	0.00	0.00	0.05	0.20	0.02		
E. tergestina	0.00	0.20	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
TOTAL	7.40	65.40	277.07	30.00	07.60	42.30	101.40	33.37	125.60	11.02		
AVERAGE	0.33	2.04	12.09	1.34	3.01	1.04	4.61	1.45	5.46	0.46		
STD	0.94	7.73	42.35	3.53	15.45	4.23	13.99	5.02	21.92	1.92		



Table 7.3-1 Continue

STATION TAXA	9		12		13		15		17		19	
	\$	¢	\$	¢	\$	¢	\$	¢	\$	¢	\$	¢
<i>Muggies kochi</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEMATODA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MOLLUSCA LARVAE	22.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POLYCHAETA LARVAE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CEPHALOPODA LARVAE	19.00	6.00	0.00	6.00	50.00	54.00	470.00	249.00	12.00	52.00		
Alpheidae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Luciferidae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brachyura	0.00	0.00	10.00	0.00	2.00	12.00	0.00	2.00	0.00	0.00	0.00	0.00
Porcellanidae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paguridae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calanoida	0.00	2.00	26.44	2.00	2.00	66.44	2.00	10.00	4.00	0.00		
Fam. Calanidae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>A. lilljeborgi</i>	4.00	20.00	400.00	0.00	30.00	2000.00	6.00	10.00	2.00	50.00		
<i>P. quasimodo</i>	2.00	36.00	340.00	0.00	74.00	1000.00	33.00	102.00	6.00	42.00		
<i>P. crassirostris</i>	0.00	2.00	13.24	0.00	4.00	200.00	4.00	4.00	0.00	2.00		
<i>Paracalanus</i> sp.	0.00	10.00	200.00	0.00	20.00	2000.00	0.00	20.00	2.00	20.00		
<i>T. stylifera</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>P. acutus</i>	0.00	0.00	0.00	0.00	4.00	40.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>C. velificatus</i> cop	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>C. americana</i> cop	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Pseudocalanidae	0.00	14.00	73.24	0.00	0.00	33.24	0.00	2.00	0.00	0.00	0.00	0.00
<i>Calocalanus cifer</i>	0.00	2.00	100.44	0.00	4.00	200.00	2.00	2.00	0.00	0.00	0.00	0.00
<i>Nauplii</i>	0.00	0.00	0.00	0.00	2.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
<i>Calocalanus pavo</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Eucalanus</i> sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Nauplii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyclopoida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. planifera</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. similis</i>	0.00	0.00	13.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. setigera</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. hebes</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. oculata</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Nauplii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Poecilostomatoida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>C. giesbrechti</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Coccos curta</i>	0.00	4.00	40.00	0.00	0.00	300.00	0.00	2.00	0.00	0.00	0.00	0.00
<i>H. thalassina</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Narpacticoida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>E. acutifrons</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Beutonic Copepoda	0.00	2.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
ISOPODA	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
ANPHIPODA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CUMACEA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OSTRACODA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>E. tergestina</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ECHINODERMA LARVAE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHAETOGATNA	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Oikopleura dioica</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EGG FISH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>C. edentulus</i>	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00
Non Identifcate	0.00	0.00	2.00	0.00	0.00	0.00	4.00	0.00	2.00	2.00		
LARVAE FISH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>C. edentulus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gleasidae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	30.00	114.00	1342.00	20.00	730.00	6001.30	530.00	424.00	20.00	160.00		
AVERAGE	0.70	2.11	24.85	0.37	12.87	140.17	9.93	7.05	0.50	3.44		
STD	3.27	4.56	80.05	1.44	70.05	514.70	63.41	25.05	1.00	13.50		

Table 7.3-2 Zooplankton density of the Guanabara bay collected with pump (200 um mesh)

STATION TIME	2	3	5	6	7	8	9	12	13	15	17	18
<i>L. tetraphylla</i>	15.44	5.49	3.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>B. ranca</i>	21.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Ephysora gracilis</i>	0.00	0.00	4.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>T. nutricula</i>	0.00	0.00	0.00	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Mugiliza kochi</i>	54.05	0.00	0.00	4.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HEMIGONIA	0.00	0.00	0.00	0.00	0.00	16.00	0.93	0.00	0.00	0.00	0.00	0.00
BOULANGERIA LARVAE	11.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
POLYCHAETA LARVAE	3.00	0.00	3.44	0.00	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00
CIRRIPELIA LARVAE	30.41	93.70	3049.47	900.90	60.54	650.00	500.00	207.05	137.40	5576.92	1590.52	276.36
Alpheidae	0.00	5.49	10.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Luciferidae	10.61	0.00	0.00	0.00	0.00	3.12	0.00	0.00	0.00	3.43	0.00	0.00
Brachyura	200.77	615.30	271.40	549.55	56.07	00.00	116.07	54.79	07.11	126.92	77.59	70.50
Porcellanidae	3.00	5.49	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00
Callinectesidae	0.00	0.00	3.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Stomatopoda	30.00	32.97	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Carapida	900.00	312.00	0.00	100.10	0.00	0.00	64.04	0.00	0.00	34.44	4.31	0.00
F. Calanidae	120.00	34.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.60	0.00	0.00
A. Illijeborgi	1015.71	1721.59	5700.64	6504.50	0722.74	4370.00	092.04	297.95	1047.20	3769.23	573.20	934.44
P. quasiado	4247.10	1391.92	1601.60	675.60	571.12	1210.00	590.21	30.02	615.57	472.31	224.14	505.77
P. cressirostris	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paracalanus parvus	3732.32	549.45	572.75	540.34	103.03	200.00	196.43	13.70	01.79	500.00	30.79	03.60
T. stylifera	120.00	109.00	57.29	45.05	51.93	0.00	17.04	17.12	0.00	76.92	0.62	0.00
P. oculus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. velificatus cop	304.10	73.24	0.00	45.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. americana cop	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Pseudocalanidae	2316.60	512.00	0.00	0.00	0.00	120.00	44.64	23.97	13.60	20.46	0.00	0.00
Ctenocalanus citer	2316.60	146.34	0.00	90.07	0.00	0.00	0.00	3.42	23.24	0.00	0.00	0.00
Eucalanus pilatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.60	0.00	0.00	0.00
Eucalanus sp.	257.41	0.00	0.00	45.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F. Pontellidae	514.79	34.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
L. fluvialilis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nauplii	1544.40	146.34	0.00	45.05	0.00	0.00	0.00	0.00	11.60	0.00	4.31	0.00
Cyclopoidea	514.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O. plumifera	732.20	73.24	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00
O. sinilis	0.00	73.24	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00
O. setigera	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O. hebes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O. oculata	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nauplii	615.51	146.34	741.57	405.41	155.76	00.00	35.71	20.55	0.00	30.41	30.17	27.91
Poecilostomatoida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.42	0.00	0.00	0.00	0.00
C. gibbrechti	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.12	0.00	0.00	0.00	0.00
Oncocercus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
N. thalassius	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marpacicoidea	0.00	34.45	0.00	0.00	0.00	40.00	44.64	0.00	0.00	0.00	0.00	0.00
E. acutifrons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benthic Copepoda	0.00	34.45	0.00	0.00	0.00	40.00	44.64	0.00	0.00	0.00	0.00	0.00
Parasitic Copepoda	0.00	0.00	0.00	0.00	51.93	60.00	0.93	0.00	0.00	0.00	0.00	0.00
ISOPODA	0.00	0.00	0.00	4.50	0.00	4.00	0.93	0.00	0.00	7.69	12.93	0.00
AMPHIPODA	0.00	0.00	0.00	0.00	0.00	12.00	17.04	0.00	6.97	3.05	6.62	10.74
CRUSTACEA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nysidina gracile	0.00	5.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TARSIPODA	0.00	0.00	0.00	0.00	0.00	17.04	0.00	0.00	0.00	0.00	0.00	0.00
OSTRACODA	0.00	0.00	0.00	21.53	0.00	0.00	0.00	0.00	0.00	3.05	0.00	0.00
Erodium tergestine	714.29	1546.15	261.17	230.74	59.19	0.00	0.00	0.00	0.00	0.00	4.31	0.00
Penella avirostris	0.00	5.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CMETOPODA	3.00	0.00	17.10	0.00	0.00	0.00	0.00	0.00	3.43	0.00	0.00	0.00
ECOLIPODEA LARVAE	23.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B. nationalis	3.00	0.00	6.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EGG FISH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clupeidae	1.72	0.00	72.16	4.50	6.23	92.00	107.14	0.00	73.17	7.69	142.24	75.31
Engraulidae type 0	19.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. oedentatus	61.70	60.44	151.20	45.05	6.23	32.00	71.43	6.65	6.97	50.00	0.67	0.37
Non identify	01.00	45.93	154.02	67.57	6.23	64.00	205.36	6.65	41.01	11.54	25.00	30.30
FISH LARVAE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clupeidae	0.00	0.00	0.00	0.00	3.12	0.00	0.00	0.00	0.00	3.05	0.00	0.00
Engraulidae	0.00	5.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C. oedentatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blenniidae	23.17	5.49	21.05	33.51	0.00	0.00	0.00	0.00	0.00	23.00	0.00	0.00
Non identify	0.00	5.49	0.00	0.00	0.00	0.00	0.00	0.00	3.43	0.00	0.00	0.00
Perciforme	0.00	0.00	3.44	0.00	6.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	2167.30	7060.15	12601.41	6441.44	9072.27	7160.00	3000.93	604.93	2072.60	10969.23	2762.93	2196.65
AVERAGE	302.39	112.40	194.31	110.59	141.03	102.40	42.90	9.70	35.32	156.70	39.47	21.30
STD	791.57	319.64	840.39	553.00	1035.60	534.53	101.20	62.04	175.12	795.97	201.05	135.09

Table 7.3-3 Zooplankton density of the Guanabara bay collected with net (200 um mesh)

STATION TAXA	1	2	3	4	5	6	7	8	9	10	11	12
<i>Megilona kochi</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NEMATODA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MOLLYSCA LARVAE	0.00	4.00	0.00	0.00	4.00	12.00	0.00	0.00	0.00	0.00	0.00	0.00
POLYCHAETA LARVAE	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00
CIRRIPEDIA LARVAE	4.00	76.00	164.00	222.00	154.00	448.00	10.00	92.00	0.00	43.00	4.00	20.00
Alpheidae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Luciferidae	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brachyura	4.00	12.00	12.00	14.00	4.00	80.00	2.00	30.00	0.00	6.00	0.00	2.00
Porcellanidae	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00
Paguridae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calanoida	10.00	40.00	33.34	80.00	2.00	133.34	0.00	0.00	0.00	20.00	12.00	64.00
Fam. Calanidae	0.00	0.00	0.00	0.00	0.00	0.00	0.00	420.00	0.00	0.00	0.00	0.00
<i>A. billjorgi</i>	20.00	30.00	53.34	400.00	70.00	400.00	30.00	400.00	0.00	140.00	34.00	400.00
<i>P. quasimodo</i>	60.00	40.00	20.00	0.00	10.00	933.34	12.00	653.34	0.00	740.00	0.00	400.00
<i>P. crassirostris</i>	0.00	0.00	0.00	13.34	4.00	60.00	0.00	140.00	0.00	20.00	0.00	33.34
<i>Paracalanus</i> sp.	170.00	990.00	440.00	120.00	10.00	800.00	14.00	1444.00	0.00	540.00	0.00	200.00
<i>T. stylifera</i>	0.00	60.00	0.00	0.00	4.00	33.34	2.00	40.00	0.00	80.00	0.00	0.00
<i>P. acutus</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.00
<i>C. volficatus</i> cop	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>C. americanus</i> cop	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00
<i>F. pseudocalanidae</i>	12.00	180.00	20.00	33.34	0.00	200.00	0.00	200.00	0.00	0.00	0.00	0.00
<i>Otanocalanus citer</i>	10.00	220.00	0.00	40.00	0.00	33.34	0.00	100.00	0.00	0.00	0.00	0.00
<i>Nauplii</i>	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Calocalanus pavo</i>	0.00	40.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Eucalanus</i> sp.	0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Nauplii</i>	0.00	80.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Cyclopoidea</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. plumifera</i>	2.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. similis</i>	0.00	80.00	40.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. setigera</i>	0.00	40.00	13.34	13.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. hebes</i>	2.00	80.00	0.00	13.34	0.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>O. oculata</i>	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Nauplii</i>	12.00	40.00	13.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Poecilostomatoida</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>C. giesbrechti</i>	60.00	60.00	100.00	100.00	4.00	0.00	4.00	40.00	4.00	0.00	0.00	0.00
<i>Oncaea curta</i>	10.00	60.00	20.00	0.00	0.00	60.00	0.00	40.00	0.00	0.00	0.00	0.00
<i>H. thalassius</i>	0.00	0.00	13.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Harpeticoidea</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>E. acutifrons</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Senecioicopepoda</i>	2.00	0.00	13.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ISOPODA	0.00	0.00	2.00	0.00	0.00	2.00	0.00	2.00	0.00	0.00	2.00	0.00
ARMPHOPODA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00
CUMACEA	0.00	2.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OSTRACODA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00
<i>E. tergestina</i>	142.00	3720.00	142.00	124.00	2.00	0.00	0.00	4.00	0.00	0.00	0.00	0.00
ECHINODERMA LARVAE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CHAETOGRATHA	0.00	10.00	0.00	0.00	0.00	2.00	0.00	0.00	0.00	2.00	0.00	0.00
<i>Oikopleura dioica</i>	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EGG FISH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>C. ocellatus</i>	0.00	0.00	4.00	0.00	4.00	0.00	0.00	4.00	0.00	0.00	0.00	4.00
Non identified	2.00	0.00	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	4.00
LARVAE FISH	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>C. ocellatus</i>	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Blennidae	0.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	870.00	7030.00	1430.00	1370.00	200.00	7700.00	92.00	8077.00	24.00	3030.00	64.00	5107.00
AVERAGE	10.47	130.30	20.57	25.40	5.44	164.32	1.70	169.50	0.44	60.11	1.00	102.74
STD	31.00	521.10	72.01	74.70	23.10	604.00	0.05	650.40	1.00	230.00	4.05	630.00

### 7.3.3 Distribution Pattern

Fig. 7.3-1 shows the distribution pattern of macrozooplankton that indicates higher values at the mouth region and lower values at the central and the inner part of the bay, specially at the area adjacent to Ilha do Governador. Microzooplankton showed the same distribution pattern and its distribution characteristics specially stand out at water surface. The population found at the western side of the bay is extremely restricted but larger at the entrance of the bay. The area corresponding to the center stretch of the bay present intermediate values.

The density at the bottom layer commonly showed higher values than those at the water surface, following, however, the same regional variation pattern observed at the surface layer.

This type of zooplankton distribution could be explained, partially by complex pollution effects represented by high ammonia concentration, grease and oil contamination, heavy metals, organic toxic substances and sulfide compounds influences, etc., and by meso and oligohalino condition which occurs in the rainy season at the western side and inner part of the bay where a huge river water flow is derived from the basin.

Fig. 7.3-2 shows the correlation degree between zooplankton and salinity variation measured in the Guanabara Bay. Although zooplanktons are generally observed to increase, the rise in salinity concentration shows a disperse correlation pattern and the absence of consistent interdependency, indicating interferences of some others factors that could affect zooplankton distribution in the bay. This conditioning factor could be attributed to complex pollution effects as already mentioned above.

The influence of pollution effects, however, was more moderate at the central area of the bay although salinity dilution still prevails, conditioning the generation of the Copepoda group principally at water surface layer where the influence of continental water discharge is more pronounced.

The mouth region of the bay can be considered to be almost without the toxic effects of pollution and presents, on the other hand, euhalino regime that offers favorable conditions to the predominant group of zooplankton originating from the coastal area of the ocean. Population density obtained by surface plankton net resulted in higher values than those in the pumped samples, showing, nevertheless, the same tendencies in zooplankton composition and distribution characteristics observed in other samples.

The correlation coefficient of the Person as well as the Sannon Weaver diversity index applied in 3 different types of zooplankton data demonstrated tendencies of giving higher index values at the mouth region than at the central and inner parts of the bay. A variation in the significant index value at the western side area of the bay with higher pollution level, however, was not observed.

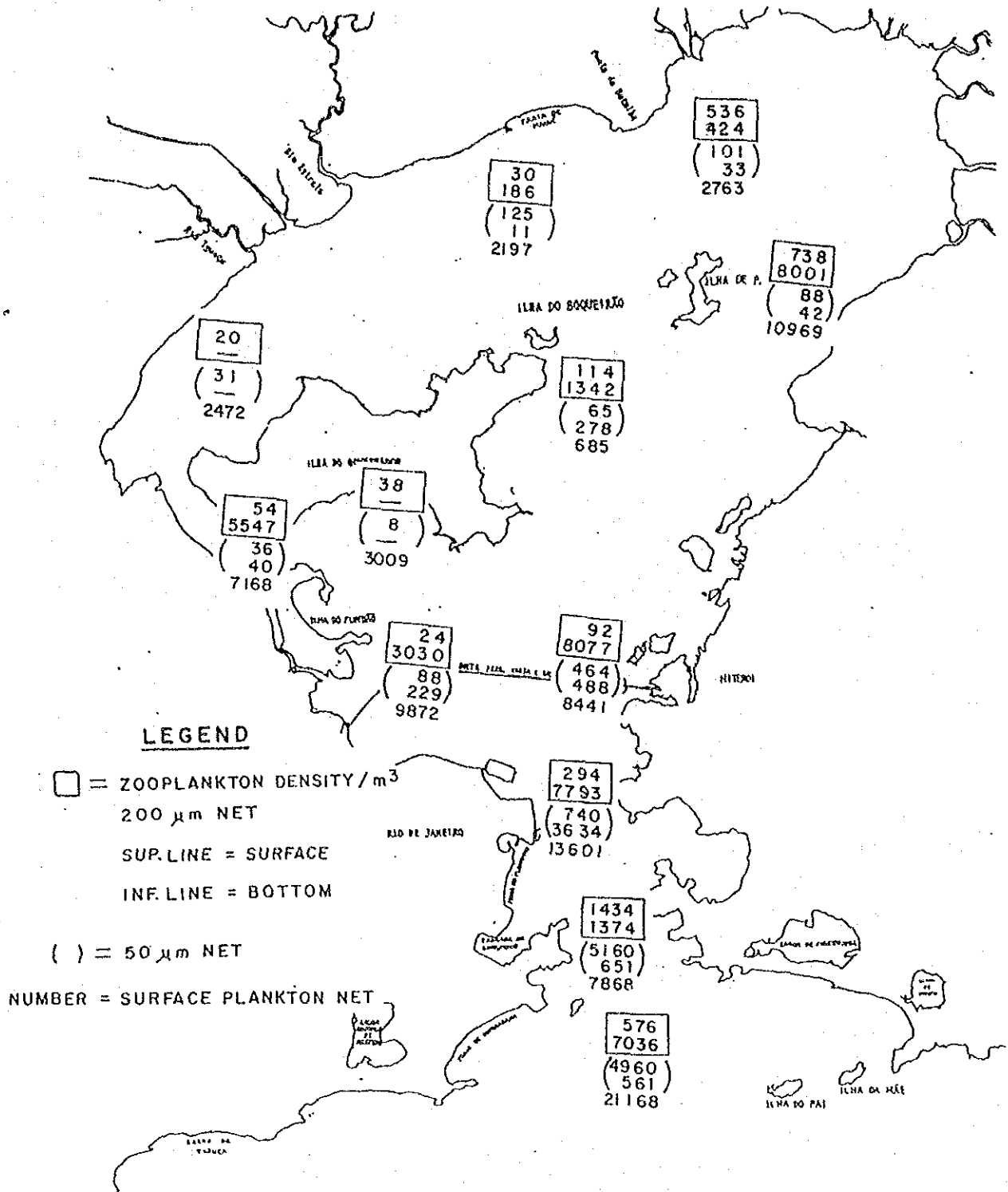


Fig. 7.3-1 Zooplankton Community Distribution in the Guanabara Bay

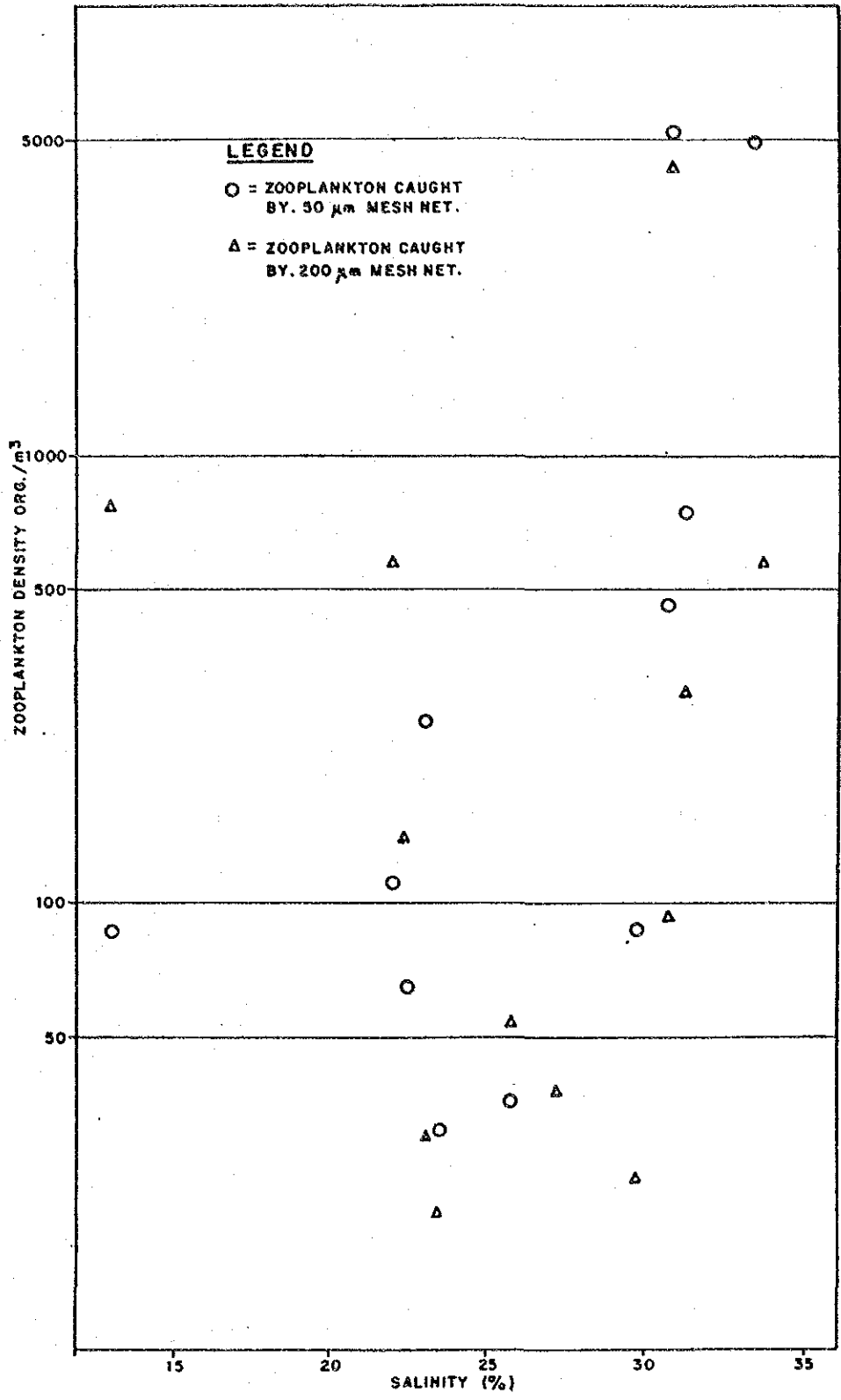


Fig. 7.3-2 Zooplankton density and salinity relationships.

### 7.3.4 Zooplankton Density

Concerning zooplankton density, Table 7.3-4 gives an idea about size of zooplankton biomass in the Guanabara Bay.

The biomass value of phytoplankton in this table was evaluated based on chlorophyll-a and that of zooplankton was determined in the UFRJ Department of Zoology laboratory. Percentage of zooplankton biomass in relation to phytoplankton obtained by this evaluation is considerably low, except in stations 1 and 2 located at the mouth of the bay, if compared to biomass ratio usually found in eutrophic environment where it varies normally from 1 to 10%. (7.3-1)

Table 7.3-4. Ratios of algae and zooplankton biomass in the Guanabara bay

Biomass	STATION											
	1	2	3	4	5	6	7	8	9	10	11	12
Algae biomass	0,87	2,23	3,00	6,78	8,31	8,51	8,10	7,98	10,89	7,07	3,20	4,92
Zoo biomass	0,033	0,022	0,021	0,011	0,010	0,040	0,004	0,001	0,003	0,006	0,005	0,026
A/Z ratio (%)	4	1	0,7	0,2	0,1	0,5	0,05	--	0,03	0,2	0,2	0,5

This low density of zooplankton in the bay seems to enable zooplanktons to survive almost interdependently from phytoplankton proliferation that serves commonly as their food.

Fig. 7.3-3 indicated negative correlation between zoo and phytoplankton population, as an increase in zooplankton density was observed regardless of a decrease in chlorophyll-a.

Generally speaking, zooplankton must increase, accompanying algae proliferation according to the food web relation. This relation, however, tends to have low eutrophic systems because of large contents of bacteria and suspended organic matters that are another zooplankton source of food, besides phytoplankton. (7.3.2)

On the other hand, phytoplankton produced predominantly in eutrophicated ecosystems are mostly of the Cianophyceae group that presents, usually, a colony with large dimension not edible for zooplankton consumption.

The zoo and chlorophyll relation observed in Fig. 7.3-3 could be explained satisfactorily by the behavior above mentioned, suggesting that zooplankton production in the Guanabara Bay is almost independent from phytoplankton proliferation.

The explanation presented leads to the conclusion that the present Guanabara Bay condition is not favorable for zooplankton production.

On the other hand, the lower correlation among these organisms suggests that secondary production represented by zooplankton is not an important factor for the application of the eutrophication simulation model.

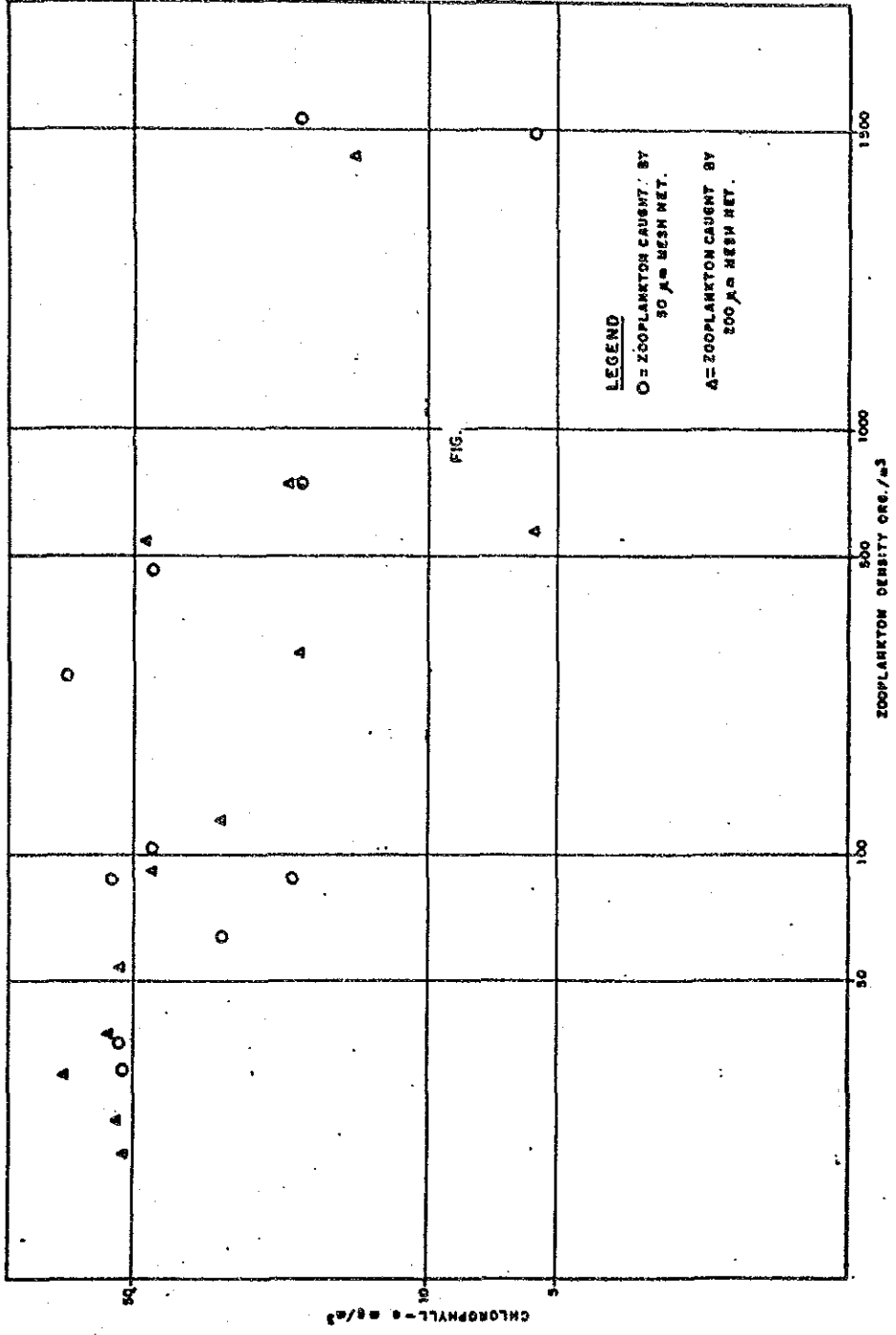


Fig. 7.3-3 Chlorophyll-a and zooplankton density relationships



## REFERENCES

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#### 7.4 Benthic Community

Data on benthos were collected at 16 stations (see Fig. 7.4-1) during the 1st phase study (June/92) and at 13 stations (except 3 stations located near the entrance of the bay) during the 2nd phase of the study (Oct/92) using the Peterson dredge samples. The exception of the 3 stations included in the 1st survey phase in the 2nd phase was made when the Peterson dredge samples were lost during the sampling operation. All collected bottom samples were properly preserved and sent to the FEEMA laboratory for classification and quantification, the results of which are shown in Appendix 7.2.

The result of the benthic community surveys performed in the two study phases indicated three distinct areas for their distribution pattern (Fig. 7.4-1 and 7.4-2). At the inner part of the bay delimited by the northern region of Ilha do Governador and Ilha de Paqueta, very few or a total absence of benthic organisms was observed, a phenomenon attributed to largely reduced oxygen concentrations at the bottom layer and, at the same time, in the sediment composed of silt with organic concentration maintained in anaerobic condition, together with reduced sulfide compounds that produce toxic effects in benthic animals.

At the area circled by the southern side of Ilha do Governador and Fundao, a great amount of Gastropoda, Littoridina australias was collected. In this region a relatively high level of pollution is observed and only 1 to 2 mg/l of DO was measured at the bottom layer of the sampling station located near the Galeao bridge (St. 8). The great difference in the biological distribution found between the two areas above referred could be attributed to the difference in the sediments' characteristics. The predominant characteristic of the sediments in this area is sand mixed with some proportion of unnoticeable silt without H<sub>2</sub>S production. The environment characterized by such pollution condition allows for the development of only a few kinds of organisms called opportunistic. Of the total population of 33000 org./m<sup>2</sup> found in the 1st phase of the study and of 44000 org./m<sup>2</sup> in the 2nd phase at St. 8, only 2 species consequently showed very low diversity index value, suggesting that the environment is extremely selective for few species of benthic organisms.

On the stretch which extends between the entrance and the Rio-Niteroi bridge, water quality is much better as compared to the areas already mentioned, and the sediments constitute fine sand with very little proportion of organic matter. In this condition, benthos community appeared more diversified, with the polychaeta errantia population predominating.

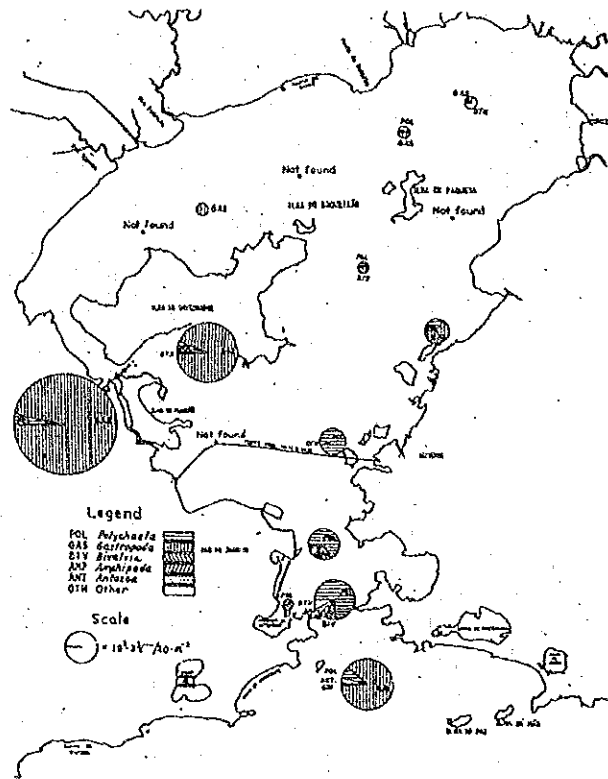


Fig. 7.4-1 Benthic Community Distribution in the Guanabara Bay

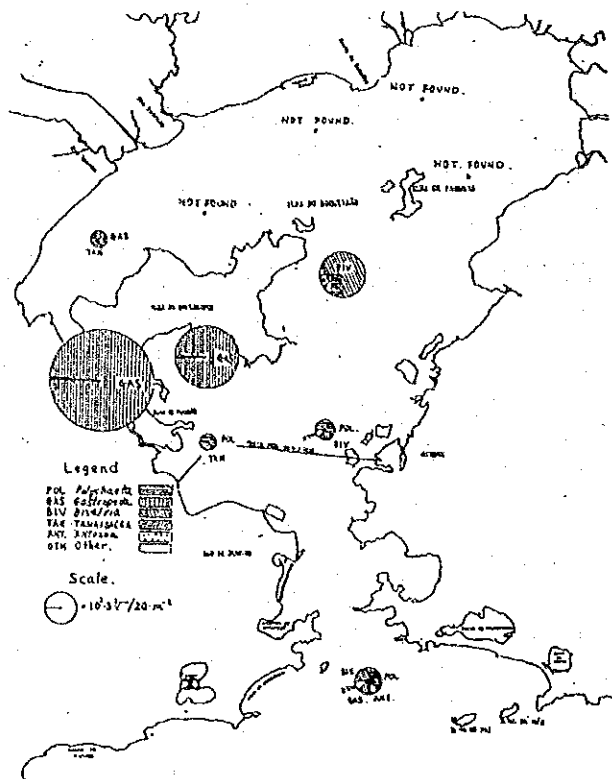


Fig. 7.4-2 Benthic Community Distribution in the Guanabara Bay in October, 1992

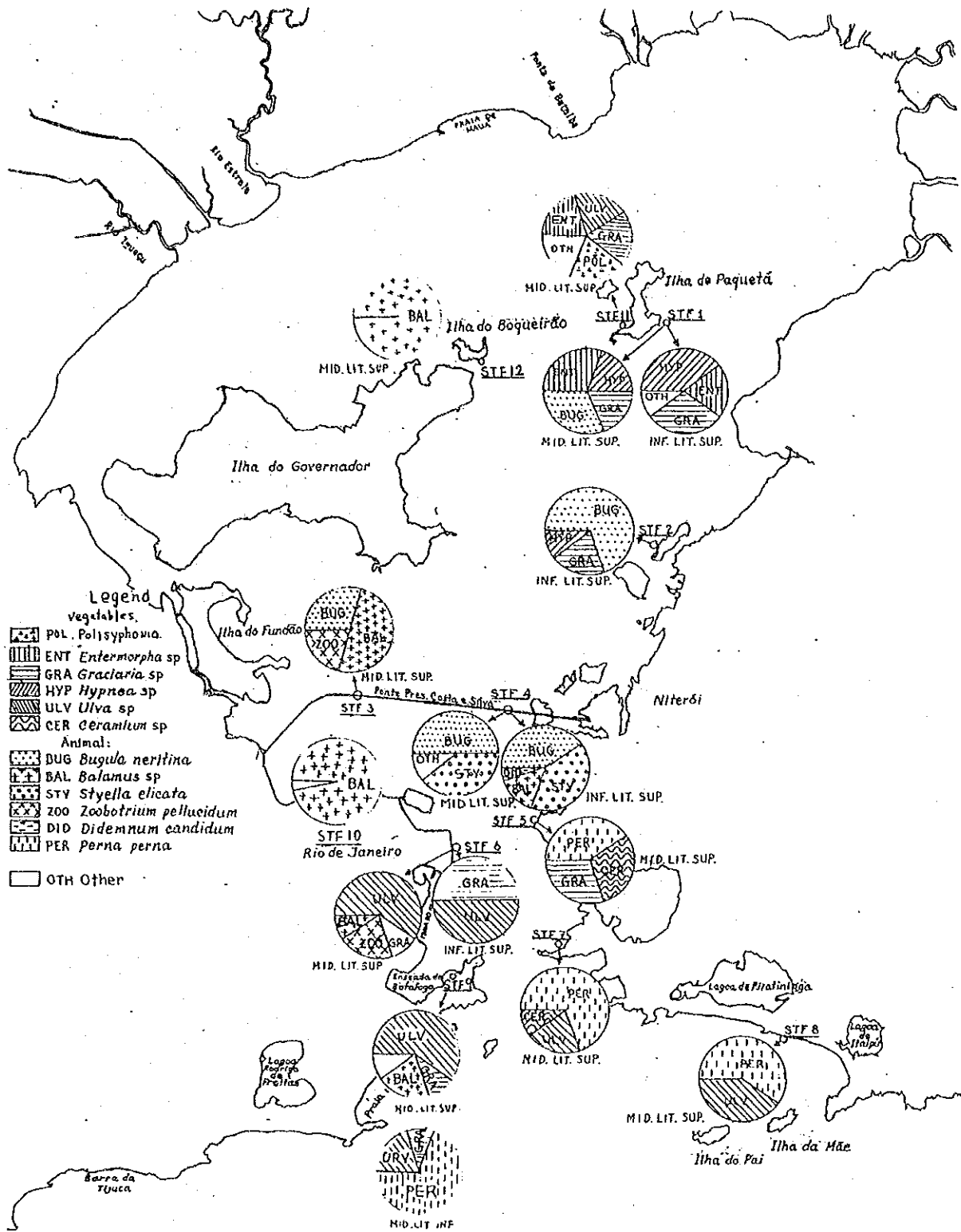


Fig. 7.5-1 Surface Distribution Ratio of Fouling Community at the Coastline of the Guanabara Bay

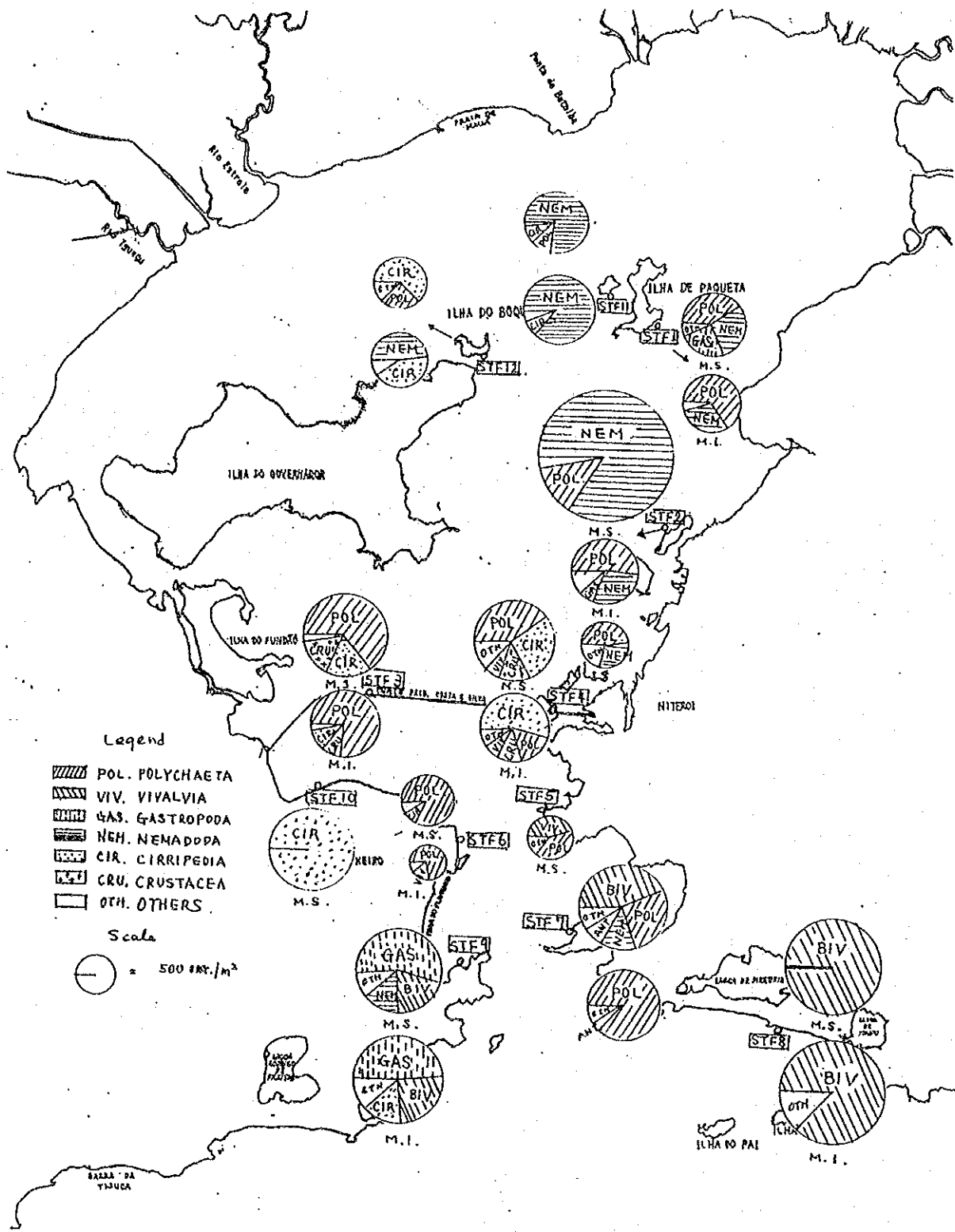


Fig. 7.5-2 Zoobenthos Community Distribution at the Coastline of the Guanabara Bay

## 7.5 Fouling Community

At the Guanabara Bay, the Rocky Coast that consists basic substrate for the production of fouling organisms occupies a relatively small spread found mainly at the entrance region of the bay and around Ilha de Paqueta.

The coast constructed of stone and concrete, even if its area is more extensive than the Rocky Coast, is limited to the southern and central parts of the coastline where anthropic activity is more intensive.

Fouling fauna sampling were performed at 8 stations during the 1st phase of the study and 5 stations in the 2nd phase, selected strategically, taking into consideration the geological characteristics of the coastline and the water quality of Guanabara Bay.

The samples collected were in two tide levels (middle littoral superior and infra littoral superior), except at the station located on Ilha de Tavares where collection was performed besides in the two zones above mentioned, also in the middle littoral inferior, scrapping all fouling faunas adhesive inside the screen at 0.09 m<sup>2</sup>. The collected samples, after preservation, were sent to the Department of Oceanography of the Universidade Estadual do Rio de Janeiro for classification and quantification. We had also the collaboration of Prof. Iva Nilce da Silva Brum of the National Museum and Universidade Federal do Rio de Janeiro for classification of zoobenthos, Cirripedia group in the observation conducted at the station established at the Rio de Janeiro harbor.

The results of the two surveys performed showed the presence of 41 species of zoobenthos and 5 species of macroalgae, thus obtaining relatively rich population of organisms at most sampling stations. Generally speaking, the middle littoral superior zone presented a higher fauna population than the infra littoral superior zone (see Appendix 7.3).

Fig.7.5-1 graphically shows the surface distribution ratio of macrofaunas estimated visually at all sampling stations. This figure presents the predominance in the Rocky surface of macroalgae (*Enteromorpha* sp., *Ulva gracilaria* and *Hypnea* sp.) that are relatively sensitive to pollution and salinity changes at the stations of Ilha de Paqueta, Santos Dumond Domestic airport, Ponta de Gragoata and Enseada de Botafogo.

Mussel *Perna perna* belonging to Cirripedia group is widely used commercially and was abundantly observed at the entrance of the bay. Approximately 95 of the posts of the Rio-Niteroi bridge extending to 8.5km are known as important production and commercialization sources of these mussels. However, very little amount of mussels were caught in the two phases of the sampling survey because the frequent scrapping of fishermen has caused a decrease in this fauna. Instead, observation was carried out on zoobenthos, *Bugula nentina* and *Styliella plicata*, which cover the surfaces of the bridge posts situated at Niteroi side.

General distribution pattern of the main zoobenthos can be seen in Fig.7.5-2 the Polychaeta group, found in 11 sampling stations, constitutes organisms with the large distribution area among the fouling fauna.

Balanaus sp. of Cirripedia group, specially B. amphirite and amphirite, which are considered biological pollution indicators, were observed to be predominant at the Rio de Janeiro harbor, where pollution level is high.

The Nematoda and Gastropoda groups as well as Perna perna, as explained, were each observed in limited areas.

Data presented above indicated the proliferation tendencies of each fouling fauna group in a restricted area without any general trends in their distribution pattern.

The statistical analysis that was realized using the Morita similarity index resulted in the formation of 7 groups of distribution trends with an 80% similarity ratio that could justify the observation results mentioned above.

## 7.6 Fish Production

During the two phases of the study, the main techniques in fishing, fish production, marketing of main commercial fish species, state of the fishermen and biological behavior of fishes were verified by viewing the bay as a-nursery ground.

Today, about 5,000 fishermen, grouped into 4 colonies, using boats and canoes are estimated to be working in the bay. The main fishing techniques used within the bay are "set nets", "trap nets", "bamboo screens", "hand lines", "sand trawls", etc.

According to the statistical data of IBAMA registered at Maua and Ramos fishermen colonies and the inventory data obtained at the Niteroi market by JICA/FEEMA study, about 6 tons/day of commercial fish production was estimated as the maximum production within the bay, in addition to about 1 ton per day of mussel Perna perna. About 80% of the catch is composed of Corvina, Bagre, Tainha, Sardinha de boca torta, Parati, Espada and Enchove. Depending on our field inventory, the minimum size of the fish captured by set nets was longer than 12cm and the biggest was 70cm. The weight varied from 100 to 3,000g. Fish captured by bamboo screens rane from 22 to 68cm long and from 570 to 790g in weight (see Appendix 7.4).

The total income by set nets and bamboo screens was estimated at about US\$ 10 to US\$ 20 per day, hence a total monthly yield of US\$ 200 to US\$ 400 can be estimated. Although their amount has decreased last year, it is still possible to catch shrimp in Guanabara Bay. Each operation can capture about 10kg of shrimp, using 15m x 15m mesh net, obtaining about US\$ 25 in gain.

The extraction and cleaning of mussels are usually done as a family scale activity. About 300 people, usually forming groups of

6, dedicate themselves exclusively to this activity which yields about US\$ 5,000 per group. The annual production of mussels meat in the colony of Jurujuba and Boa Viagem is 300 tons, producing a profit of about US\$ 250,000.

The detailed investigation realized by the FEEMA laboratory showed that almost all of the heavy metals and PCB's found in the meat and kidney of various species of fishes and in mussels were lower in concentration than the criteria adapted.

Even though there are no historical statistical data, fish production reduction has been evident, recently causing serious anxiety among the fishermen. According to our investigation, the main reason for the fish production decadence is owed mainly to recent predatory fishing practices for maximum profits. Further, water quality deterioration might have affected also, without doubt, fish population composition and production.

According to Prof. Gustavo W. a. Nenon of the National Museum, and Universidade Federal do Rio de Janeiro, Guanabara bay plays a very important role as a fish nursery ground. Some of the fish, for instance, Tainha, Parati, Sardinha, some species of Manjuba, that are most popular in these regions enter the bay to grow up and return to the ocean after reaching maturity.

On the other hand, Enchova, some species of Linguado, Corvina and Pescadinhas enter the bay for reproduction. This fish behavior signified the close relationship between the bay and the ocean in view of fish production, as can be seen in many other cases of the estuarine system. So, if predatory fishing activities and water quality deterioration continue, it would cause the rupture of such an interdependent relationship in the near future, affecting severely fish production not only in the Guanabara Bay but also in the adjacent coastal areas of the ocean.

One of the best available solution in this situation that could meet the fishermen's requirement, and at the same time maintain fish communities according to the original function of the bay, would be the practice of artificial culture of commercial fauna, for instance mussels, oysters or other similar marine production, that can offer a renewable production without damaging the fundamental function of Guanabara Bay as a nursery ground.



## 7.7 Salt Marsh and Mangrove Swamps

### 7.7.1 General Situation of Mangrove in the Guanabara Bay

The profile of the main area of salt marsh and mangrove swamps and the general aspect of the present distribution of mangrove forest at the Guanabara Bay basin is drafted in Fig. 7.7-1. This figure was elaborated based on the information extracted by satellites images (LANDSAT) registered in 1991 and interpreted by I.E.F. (Instituto Estadual de Floresta) and the Study team in association with the field observations works performed during the 2nd phase of the study.

Although the Guapimirim and Cacerebu basins are preserved by the Federal Register, significant interference of human activities, principally at the southeast side of its area is already noticeable.

The mangrove forests extended in Rio Estrela and Rio Iguacu, mainly on the right side of Rio Estrela and the left side of Rio Iguacu, are seriously devastated. On the other hand, an appreciable area located at the lower side of the garbage landfill site, Jardim Gramacho, presents a mangrove forest almost non-existent. The ground of this area is completely dried and water can only be extracted at approximately 30cm below the ground.

The general distribution of mangrove forests observed in the study shows *Laguncuraria* sp., normally near the river side, *Avicennia* sp. at the inner part and, in some cases, *Rhizophora* sp. on the river side. The mangrove forest existing in the Guapimirim basin is generally higher in elevation than the other areas; approximately 3-5meters for *Laguncuraria* sp., and 10-12meters for *Avicennia* sp. It is important to mention that *Spartina* sp., *Hibiscus* sp., and *typha* sp. are observed to largely invade the appreciable area of the mangrove forest.

### 7.7-2 Characteristics of Sediments

As for the characteristics of the sediments in the researched basins that consist fundamental substrates to support all the biological and forestal evolution, as well as casual utilization for sewage disposal, the physico chemical analysis performed in the 12 stations generally showed light acid and high concentrations of organic matters (8 to 49% of volatile matter lost) (Table 7.7-1). The concentrations of N and P were also relatively high compared to normal soil composition, ranging from 1.3 to 2.0% and 0.71 to 0.26%, respectively. This fertility could be derived, mainly, from the contribution of litters originating from mangrove forests and pollution sources. On the other hand, the sediments are black in color due to reduction process and are composed almost of clay and silt (94-99%), indicating very low permeability.

It was verified that organic matter and phosphorous in the Iguacu and Estrela basins affected by pollution flow tend to have higher

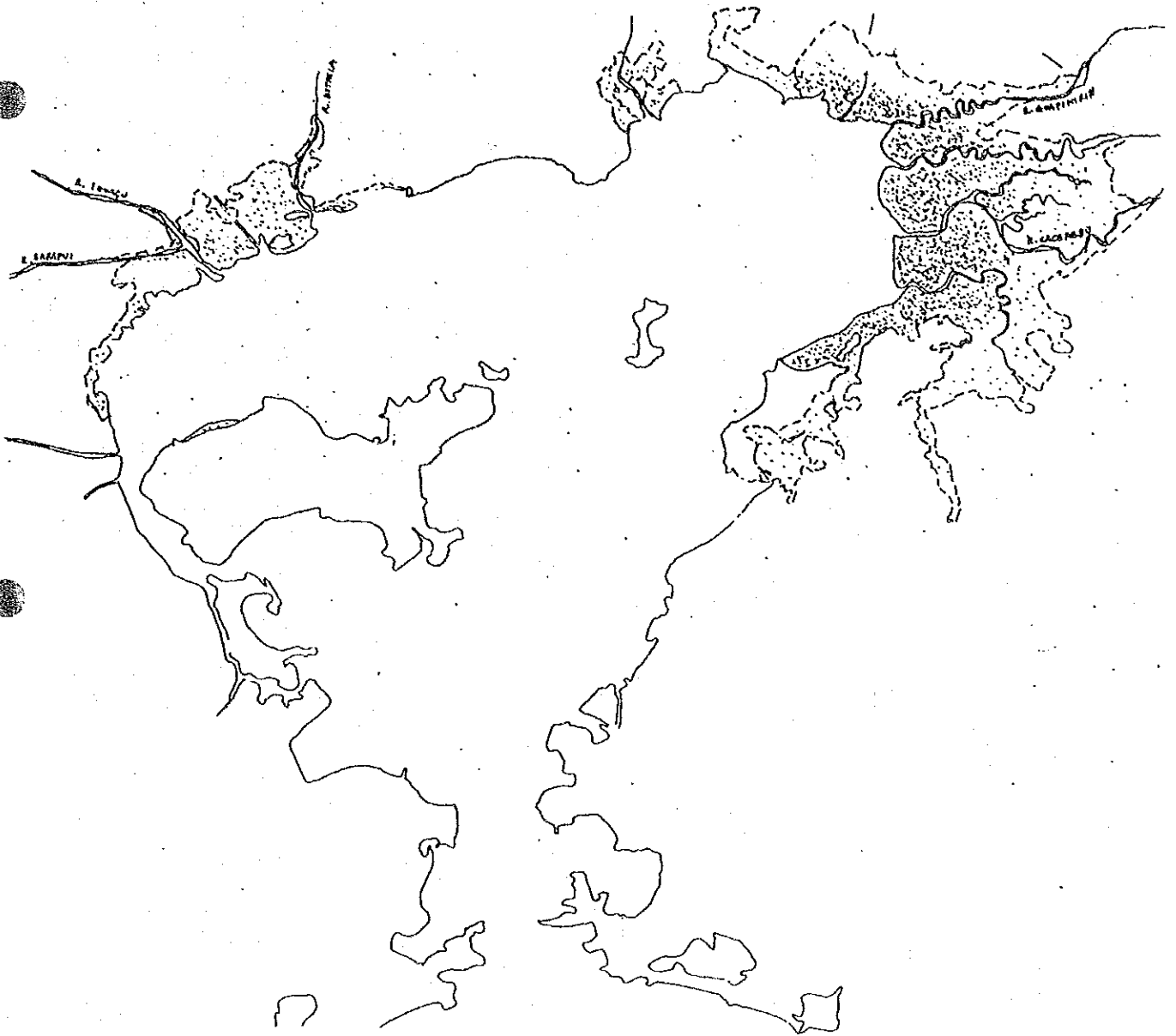


Fig. 7.7-1 Profile of Silt Marsh and Mangrove Swamps

concentrations than in Guapimirim and Cacerebu. The station located at the middle part of Estrela basin especially showed extremely high organic matter content (48%); this area is found to be highly populated by crabs.

As for heavy metals, all parameters analyzed showed very inferior values than the maximum limit for the criteria for practical agricultural use proposed by EPA/USA (Table 7.7-1). Higher Hg concentrations in Iguacu and Estrela basins located near the pollution source were obtained however as compared to the Guapimirim basin.

### 7.7-3 Crabs Community Inventory

Based on the investigation on the community of crabs performed in the transversal sections, the predominance of the *Uca* group followed by *Ucides* sp. and *Chasmagnathus* sp. was verified. The crab population ranges from 20 to 80 org./m<sup>2</sup>, and the population in Estrela and Iguacu basins is observed to be higher. (Table 7.7-2)

Detailed information on to crab inventories are stated in Appendix 7.5. (May 1992 and November 1992)

Based on the data obtained, it seems that the destruction and the pollution level of the mangrove forest in researched areas has not yet reached the level where it can adversely affect the production of crabs. On the contrary, some crab groups such as *Uca* sp. already referred to, yield a higher population growth ratio in Estrela and Iguacu basins where more intensive environmental changes can be observed, as compared to APA-Guapimirim.

Crabs seem to be the most important consumers of organic matters in mangrove swamps, representing almost 75% of all animal biomass in this environment (Table 7.7-2). On the other hand, they essentially contribute to the oxidation of organic matter and reduction of compound contents in sediments through excavation when constructing their burrows.

As for the benthos community, the results showed predominant presence of the Polychaeta Errantia group in major sampling stations. The total population of organisms in each station ranged from 22 to 4653 org./m<sup>2</sup>, generally showing a high population in the station situated near the sea-shore. Significant features of benthic distribution in the studied basins were not observed.

Table 7.7-1 Physical and Chemical Composition of Sediment Deposited in Mangrove Swamps around the Guanabara Bay, Rio de Janeiro, Brazil

Parameter	Station			Iguaçu Basin			Estrela Basin			Guapimirim Basin			Cacerebu Basin		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Colour	black	black	brown	black	black	black	brown	black	black	brown	black	black	brown	black	black
H2S odor	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
PH	5.2			6.7	6.2	6.5	6.6	6.5	6.6	6.6	6.6	6.6	6.6	7.1	6.6
Humidity (e/θ)	67.9	59.6	54.2	53.5	59.4	661.3	63.2	67.1	76.7	49.1	66.0	67.0	66.0	66.0	67.0
Vol. Solid, 550°C (mg/l)	233	147	136	164	486	79	144	140	229	102	157	154	157	157	154
N-Kjeld hal (mg/l)	18.0	15.0	16.0	10.0	20.0	16.6	13.0	14.0	24.0	17.0	16.0	7.0	17.0	16.0	7.0
T.P. (mg/l)	2.5	2.4	1.3	1.5	2.6	1.1	1.0	0.9	1.1	1.0	1.1	0.7	1.0	1.1	0.7
Clay and Silt (mg/l)	97.1	96.0	95.6	96.2	97.2	95.0	97.0	98.3	96.2	94.0	99.0	97.0	94.0	99.0	97.0
Cd (mg/l)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Pb (mg/l)	0.04	0.03	0.03	0.05	0.04	0.04	0.01	0.02	0.01	0.01	0.02	0.01	0.01	0.02	0.01
Cu (mg/l)	0.045	0.035	0.025	<0.002	0.200	0.140	0.006	0.008	0.006	0.015	0.020	0.015	0.015	0.020	0.015
Cr (mg/l)	0.80	0.35	0.65	0.02	0.08	0.04	0.01	0.02	0.01	0.03	0.03	0.02	0.03	0.03	0.02
Hg (µg/l)	0.60	0.45	0.40	0.60	0.60	0.40	0.10	0.10	0.10	0.05	0.10	0.15	0.05	0.10	0.15
Zn (mg/l)	0.10	0.14	0.08	0.10	0.11	0.11	0.08	0.05	0.04	0.05	0.10	0.03	0.05	0.10	0.03
Fe (mg/l)	27.0	22.0	27.0	47.0	25.0	17.0	24.0	32.0	18.0	43.0	51.0	32.0	43.0	51.0	32.0
Ni (mg/l)	0.015	0.010	0.015	<0.005	0.015	0.005	0.010	0.010	0.010	0.010	0.015	0.005	0.010	0.015	0.005
Mg (mg/l)	0.095	0.100	0.090	<0.005	0.095	0.24	0.16	0.20	0.18	0.26	0.28	0.22	0.26	0.28	0.22

Table 7.7-2 Distribution of main species of crab on the marsh and mangrove.

Type of crab	Basin		Rio Iguacu			Rio Estrela			Rio Guapimirim			Rio Cacerebu		
	Station		1	2	3	4	5	6	7	8	9	10	11	12
Uca sp			23,6	31,0	25,0	27,5	70,0	52,0	17,6	11,3	17,3	22,6	20,8	23,4
Chasmagnathus sp.			6,6	5,2	17,2	6,4	8,0	10,0	2,2	5,3	3,9	20,1	12,9	9,2
Ucides sp			4,0	2,8	0,4	3,6	1,4	1,0	2,8	3,5	3,2	0,1	3,1	3,3
Contopsis sp						1,0	0,4	0,6			0,6			2,0
Total			34,0	39,0	42,6	38,5	79,8	63,6	22,6	20,1	25,0	42,8	26,8	37,9

#### 7.7-4 Mangrove Swamps Purification Capacity and its Utilization for Waste Treatment.

The mangrove swamps and marshes form the coastline and maintain a semi-independent ecological environment of its own. The soil of these areas receives nutrient through the watershed and estuarine system and relays it to vegetal and animal biomasses. Some of the organic matter produced might be recycled in a mangrove forest, while others could be exported to the estuarine system.

There are no available data on standing stock and the productivity of mangrove trees in the Guanabara Bay basin that are essential to any nutrient balance study. It is, however possible to have a general idea through data researched in others basins. In the Panamanian *Rhizophora* forest (7.7-3), standing stock data showed estimates of 3,5tons/ha of leaves, 159tons/ha of stems, 116tons/ha of roots. In terms of productivity, 8ge/m<sup>2</sup> and 14ge/m<sup>2</sup> were found, respectively, in Puerto Rican and Malaya *Rhizophora* mangrove forests.

In relation to litter production that directly affects nutrient balance, a production of 1.26 and 2.3g/m<sup>2</sup> was registered respectively at the region of Bertioga and Camboa in Brazil and this data (7.7-4) coincides with data obtained at Puerto Rico, Florida and Panama (7.7-5) whereby values ranging from 1.3 to 2.0 g/m<sup>2</sup>/d were measured.

When litters fall on humid ground, as in the case of swamps and marshes, they suffer rapid decomposition by fungals and bacterial acvtions, breaking down into detritus particles which will be consumed by various kinds of benthic animals. Crabs assemblages are the most important consumer of organic matter in mangrove forests, representing almost 75% of the animal biomass in this enviroment.

In the case of Guanabara Bay, assuming that each crab weighs 1g, it is possible to estimate 20g to 80g of crab biomass per square meter, basing on the 20 to 80crabs/m<sup>2</sup> found in 4 mangrove basins. If we assume that each of them daily eats organic matter correspondent to 3% of their own weight, the consumption of litters by crabs can be estimated in a range of 0.6 to 2,4g/m<sup>2</sup>, a reasonable value compared to litter production in a mangrove environment.

As for nutrient and organic matter balance between mangrove swamps and the estuarine system, there are no consensus among the published papers. Some study suggests that marshes may be important sources of organic matter for coastal ecosystem, while others suggest swamps and marshes are relatively unimportant (7.7-6). In addition, marshes have been described both as sinks and sources of inorganic nutrient (7.7-7).

In conformity to the study carried out by Golly (7.7-3) in Puerto Rico, around 2.3g/m<sup>2</sup> of organic matter was registered to be exported from swamps to the estuarine. However, it seems to be the reverse in Guanabara Bay. This conclusion was reached because of

the presence of high concentration of organic matter in the sediments at the Iguacu and Estrela mangrove basins where pollution effects are presently more evident than in Guapimirim and Caceribu (Table 7.7-1). If exportation occurs more than accumulation a difference in the organic matter amount in the two referred areas will not be observed.

As for nutrient exchange, sediments in mangrove swamps normally contain large amount of sulfide compounds which accelerate the dissolution of P, therefore increasing P concentration in the water. On the other hand, large amount of nutrients are found in Guanabara Bay, especially in the sediments in the Iguacu and Estrela swamps. In the Bay, P is observed to accumulate rather than dissolve from sediments and due to exportation.

Given the above explanation, it is reasonable to conclude that mangrove swamps and marshes in the Guanabara Bay area contribute to the retention of nutrient and organic matter, thereby taking part in the purification of the bay water.

The use of coast wetlands as natural sewage treatment plant can be considered a very interesting solution in the region where sophisticated mechanical facilities are beyond economic reach.

A mangrove forest must be supported by constant nutrient supply in order to keep the specific rate of growth, according to experiments performed in a system models of Florida, U.S.A. (7.7-8). Sediments of mangrove swamps and marshes of the Guanabara Bay present, yet, very low nutrient concentration to achieve the maximum production of trees, showing a possibility for the use of tertiary sewage treatment in the area. Walsh (7.7-9) reported that large amounts of nitrate and phosphate were removed from water running through mangrove swamps. The high proportions of fine clay found in the Guanabara swamps and marshes has an efficient removal capacity. Ammonia ions can also be retained within the lattice structure of clay minerals and reduced for biological activities.

On the other hand, by denitrifying (7.7-8) bacteria, nitrogen in  $N^2$  in sediments can be reduced. The disposal of sewage with large amounts of organic matter is not recommendable because it could provoke clogging of mangrove soil composed of not very permeable fine clay and silt. The heavy coating of soil as well as lenticels caused by large organic matter discharge can destroy the mangrove forest.

Therefore, sewage to be discharged in mangrove swamps should be subject to pre-treatment to prevent the over accumulation of nutrients which could destroy the mangrove forest.

It is also very important to take note of the vulnerable nature of mangrove forests, where constant sediment accumulation and invasion of several grasses that could overcome the mangrove tree population through the years may occur. Global and aggressive measures should be adopted, therefore, to maintain and preserve mangroves.

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## 7.8 Water Area Division Based on the Aquatic Organisms

As it was evidenced through explanations on nutrient and chlorophyll-a variation feature, the division of Guanabara Bay into three areas was considered reasonable (see Fig. 7.8-1) in view of the phytoplankton biomass distribution pattern.

Table 7.8-1 indicated the main characteristics of the trophic state of each specific area, based on the mean values obtained from the 3 simultaneous surveys/92. Phytoplankton species distribution did not significantly vary in the bay area.

Zooplankton community is composed predominantly by the Copepoda group and its numerical distribution showed tendencies similar to phytoplankton suggesting the application of the same area division already presented. However, zooplankton distribution characteristics have to be considered in relation to toxic effects and salinity regime than nutrient amount variation.

Benthic community showed a clear distribution pattern according to the influence of water quality and especially of sediment characteristics allowing the division of the bay into 3 parts, into areas slightly different from those divided for the phyto and zooplankton community (Fig. 7.8-2)

It was not possible to divide the water area of the bay according to fouling fauna distribution, because the general distribution trend of these organisms was not found. It would be reasonable to divide marshes and mangrove swamps in two regions, one constituting the Iguacu and Estrela basins where the devastation of trees, influence of pollution, others are in its advanced states, the Guapimirim and Cabecebu basins where a satisfactorily preserved condition can still be found in its central area regardless of anthropic interferences mainly at the south-east side and large scale invasions of vegetables in the forest.

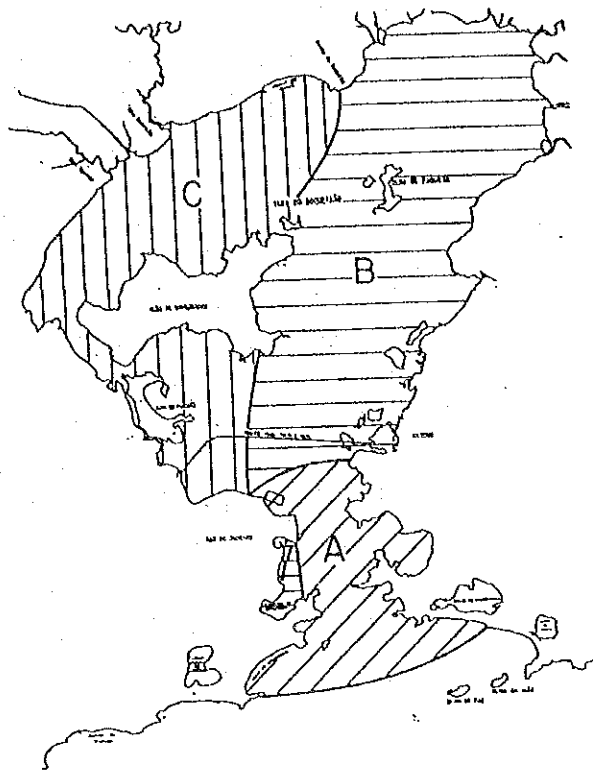


Fig. 7.8-1 Water Area Division Accordind to Phytoplankton and Zooplankton Distribution

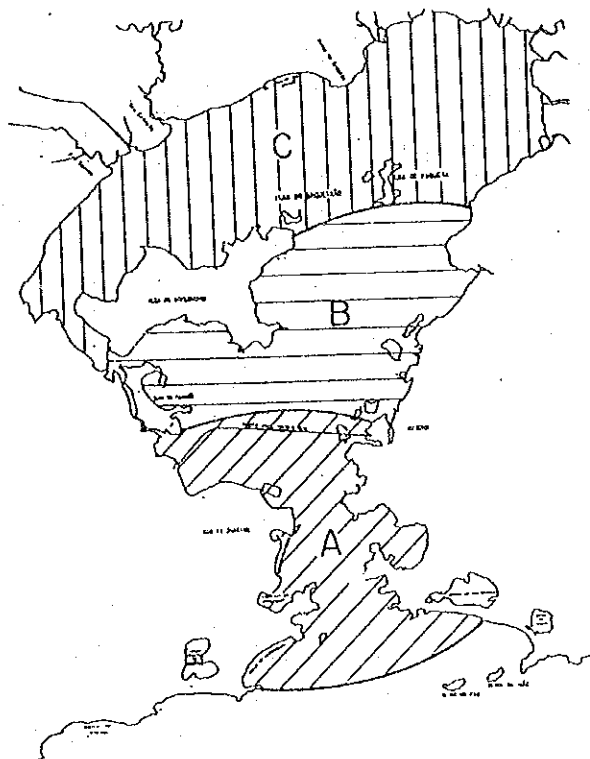


Fig. 7.8-2 Water Area Division According Benthic Community Distribution

Table 7.8-1 Characteristics of Trophic Levels  
of the Three Areas

PARAMETER	Area of the Guanabara bay		
	A	B	C
TP mg/l	0.03 - 0.10	0.10 - 0.15	0.15 - 0.45
PO <sub>4</sub> -P mg/l	0.01 - 0.025	0.01 - 0.020	0.05 - 0.22
TN mg/l	0.45 - 1.0	0.5 - 1.3	1.3 - 2.9
NH <sub>4</sub> -N mg/l	0.02 - 0.10	0.04 - 0.10	0.15 - 1.3
CHL-a mg/l	1 - 20	20 - 50	50 - 97
Secchi Depth.	2.0 - 8.0	0.8 - 1.2	0.5 - 1.2
Trophic State	meso-eutrophic	super-eutrophic	ultra-eutrophic
Carlson Trophic State Index	50 - 60	60 - 70	70 - 80

# APPENDIX

# **APPENDIX 1**

**DISTRIBUTION OF ENVIRONMENTAL FACTORS IN THE BAY**

Table APP 1.2-1(1) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 09:05 - 10:00  
 Station: 1  
 Location: 22°54'58.9" S, 43°09'29.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 26.48 °C (09:00)  
 Wind force: 1 m/s  
 Wind direction: E  
 Water color: Light blue  
 Secchi-disk reading: 15.9 m  
 Water depth: 51.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.28	35.02	6.0	89	7.78	23.59
2.0	24.19	35.02	5.8	86	-	23.62
4.0	24.16	35.02	5.7	85	-	23.63
5.0	24.11	35.03	6.0	89	7.63	23.65
6.0	24.10	35.04	5.7	85	-	23.66
8.0	23.91	35.12	5.8	86	-	23.78
10.0	23.80	35.28	5.8	86	-	23.93
12.0	23.74	35.23	5.8	86	-	23.91
14.0	23.68	35.27	5.0	87	-	23.96
16.0	23.59	35.39	5.9	87	-	24.08
18.0	23.46	35.55	5.9	87	-	24.24
20.0	23.25	35.66	5.9	86	-	24.38
22.0	23.38	35.53	5.9	86	-	24.24
24.0	23.46	35.50	5.9	87	-	24.20
25.0	23.47	35.51	6.0	88	7.56	24.20
26.0	23.23	35.66	5.9	87	-	24.39
35.0	22.94	35.66	5.9	86	-	24.47
40.0	22.63	35.68	5.8	84	-	24.58
50.0	21.88	35.64	5.6	81	-	24.76

Table APP 1.2-1(3) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 12:05 - 12:25  
 Station: 3  
 Location: 22°58'38.7" S, 43°08'23.2" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 24.0 °C (11:35)  
 Wind force: 4 m/s  
 Wind direction: SSW  
 Water color: Light green  
 Secchi-disk reading: 1.2 m  
 Water depth: 51.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.94	32.60	5.9	89	7.54	21.27
0.5	24.60	33.35	5.8	86	-	22.24
1.0	24.58	33.40	5.8	86	-	22.28
2.0	24.22	33.93	5.8	85	-	22.79
3.0	24.53	34.01	5.6	83	-	22.76
4.0	24.18	33.57	5.7	84	-	22.53
5.0	24.22	33.92	5.5	82	7.60	22.78
6.0	24.17	34.04	5.4	80	-	22.89
8.0	24.14	34.05	5.3	79	-	22.90
9.8	24.17	34.01	5.3	78	-	22.86
15.0	24.02	34.29	5.3	78	-	23.12
20.0	23.99	34.31	5.2	76	-	23.14
25.0	23.96	34.32	5.1	75	-	23.16
27.2	23.96	34.40	5.1	75	-	23.22
31.8	23.75	34.52	5.1	75	-	23.37
35.0	23.91	34.52	5.1	75	-	23.33
45.0	23.78	34.92	5.2	77	-	23.67
49.0	23.86	34.56	5.2	77	7.7	23.37

Table APP 1.2-1(2) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 11:05 - 11:25  
 Station: 2  
 Location: 22°58'27.8" S, 43°08'02.4" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Wind force: 1 m/s  
 Wind direction: SSW  
 Water color: Light green  
 Secchi-disk reading: 1.7 m  
 Water depth: 17.3 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.31	33.01	7.6	114	7.40	21.77
1.0	24.68	33.33	8.1	122	-	22.20
2.0	24.23	34.03	5.4	80	-	22.86
3.0	23.92	34.52	5.3	79	-	23.32
5.0	23.91	34.59	5.3	79	7.51	23.38
5.8	23.91	34.62	5.4	80	-	23.40
8.0	23.92	34.92	5.6	84	-	23.62
10.0	23.92	34.96	5.7	85	-	23.65
12.0	23.91	34.95	5.6	84	-	23.65
14.0	23.89	34.96	5.6	84	-	23.66
16.0	23.84	34.98	5.5	81	-	23.69
16.6	23.82	34.98	5.6	82	7.66	23.70

Table APP 1.2-1(4) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 12:50 - 13:10  
 Station: 4  
 Location: 22°56'25.5" S, 43°10'02.1" W  
 Weather on the day: Slightly cloudy  
 Air temperature: -  
 Wind force: 7 m/s  
 Wind direction: SSW  
 Water color: Light brown  
 Secchi-disk reading: 1.3 m  
 Water depth: 12.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.16	32.68	8.0	119	7.64	21.57
1.0	25.17	32.69	7.9	117	-	21.57
2.0	24.66	33.12	7.7	114	-	22.05
3.0	24.60	33.16	6.5	96	7.40	22.10
4.0	24.61	33.18	6.0	88	-	22.11
5.0	24.61	33.21	5.8	86	-	22.13
6.0	24.37	33.55	5.4	79	-	22.46
8.0	24.11	33.96	4.3	63	7.60	22.84
10.0	24.02	34.09	4.1	61	-	22.97
11.7	24.01	24.17	4.4	61	7.60	15.52

Table APP 1.2-1(5) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 13:35 - 14:00  
 Station: 5  
 Location: 22°54'15.6" S, 43°09'03.3" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 25.3 °C (13:35)  
 Wind force: 10 m/s  
 Wind direction: SSW  
 Water color: Green  
 Secchi-disk reading: 3.0 m  
 Water depth: 30.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.97	34.04	6.8	102	7.53	24.40
1.0	24.10	34.29	5.6	83	-	24.91
2.0	24.09	34.32	5.5	81	-	24.94
3.0	24.05	34.33	5.5	81	-	24.97
3.5	23.97	34.41	5.4	80	-	25.07
5.0	24.00	34.33	5.4	80	7.62	24.98
7.7	23.92	34.42	5.4	80	-	25.09
8.0	23.92	34.49	5.3	79	-	25.16
10.0	-	-	-	-	7.48	-
15.0	23.89	34.58	5.3	79	-	25.24
20.0	23.82	34.58	5.3	79	-	25.28
25.0	23.85	34.58	5.3	79	-	25.27
30.0	23.84	34.59	5.3	79	-	25.29
35.0	23.84	34.60	5.2	77	-	25.30
37.5	23.81	34.63	5.4	80	7.63	25.34

Table APP 1.2-1(6) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 11:50 - 12:15  
 Station: 6  
 Location: 22°51'52.0" S, 43°09'31.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 29.0 °C (11:54)  
 Wind force: -  
 Wind direction: -  
 Water color: Greenish brown  
 Secchi-disk reading: 1.3 m  
 Water depth: 20.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	26.1	32.1	8.9	134	8.09	22.12
1.0	26.0	32.1	8.5	128	-	22.15
1.5	25.4	32.1	7.9	118	-	22.33
2.0	25.8	32.1	7.2	107	-	22.27
3.0	25.1	32.2	6.3	94	-	22.52
4.0	25.3	32.5	5.2	76	-	22.76
5.0	25.0	32.6	4.2	62	8.38	22.95
10.0	24.4	33.4	3.1	45	8.29	23.93
15.0	24.1	34.2	3.6	54	-	24.82
19.0	23.9	34.4	3.9	50	8.31	25.08

Table APP 1.2-1(7) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 11:15 - 11:30  
 Station: 7  
 Location: 22°51'59.1" S, 43°11'57.8" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 30.0 °C (11:23)  
 Wind force: Light wind  
 Wind direction: -  
 Water color: Greenish brown  
 Secchi-disk reading: 1.0 m  
 Water depth: 6.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	27.1	31.5	4.5	69	8.27	21.20
0.5	26.6	31.5	4.2	63	-	21.36
1.0	25.7	31.6	4.3	64	-	21.74
1.5	25.1	31.9	2.8	42	-	22.22
2.0	25.3	32.7	2.7	41	-	22.96
2.5	24.7	32.8	2.0	29	-	23.24
3.0	25.0	32.8	2.1	31	8.15	23.15
4.0	24.8	33.1	2.1	31	-	23.51
5.0	24.6	33.3	2.0	29	8.13	23.77

Table APP 1.2-1(8) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 10:20 - 10:40  
 Station: 8  
 Location: 22°59'10.0" S, 43°14'11.9" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 29.5 °C (10:32)  
 Wind force: -  
 Wind direction: -  
 Water color: Greenish brown  
 Secchi-disk reading: 1.2 m  
 Water depth: 6.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	26.2	28.7	2.8	42	8.13	18.89
1.0	25.8	29.9	1.4	21	-	20.01
2.0	25.8	30.3	1.3	20	8.00	20.41
3.0	25.7	30.7	1.0	15	-	20.84
4.0	25.6	30.8	1.0	15	-	20.97
5.0	25.6	30.8	1.0	15	8.01	20.97

Table APP 1.2-1(9) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 09:40 - 09:55  
 Station: 9  
 Location: 22°49'33.8" S, 43°12'28.4" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: -  
 Wind force: Light wind  
 Water color: Greenish brown  
 Secchi-disk reading: 1.3 m  
 Water depth: 5.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.9	30.2	3.0	45	8.16	19.48
1.0	25.8	30.4	1.8	26	-	19.66
2.0	25.5	30.4	1.3	20	-	19.75
3.0	25.3	32.1	1.7	26	-	21.08
4.0	25.2	32.3	1.7	26	8.10	21.26
4.5	25.1	32.4	1.6	24	-	21.37

Table APP 1.2-1(10) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 08:30 - 09:00  
 Station: 10  
 Location: 22°50'01.0" S, 43°09'10.4" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 26.5 °C (09:00)  
 Wind force: -  
 Water color: -  
 Secchi-disk reading: Greenish brown  
 Water depth: 1.4 m  
 Water depth: 24.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.3	32.2	6.7	99	8.51	21.16
2.5	24.9	32.3	5.4	80	-	21.35
5.0	24.4	33.0	3.6	53	8.29	22.03
7.5	24.1	33.8	3.0	44	-	22.72
10.0	23.9	34.3	3.3	48	-	23.15
15.0	23.8	34.2	3.6	53	-	23.11
20.0	23.8	34.2	3.6	56	-	23.11
23.0	23.8	34.4	3.9	58	8.20	23.26

Table APP 1.2-1(12) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 10:30 - 11:15  
 Station: 12  
 Location: 22°47'49.1" S, 43°07'56.1" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 29.5 °C (10:30)  
 Wind force: -  
 Water color: -  
 Secchi-disk reading: Greenish brown  
 Water depth: 0.9 m  
 Water depth: 16.4 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	26.1	28.3	10.7	158	8.51	18.00
0.5	25.5	28.4	10.7	157	-	18.26
1.0	25.3	28.5	9.4	136	-	18.39
1.5	25.0	28.8	6.0	88	-	18.71
2.0	25.0	29.2	5.8	84	-	19.00
2.5	25.0	29.3	5.2	76	-	19.08
3.0	24.8	30.0	5.5	80	-	19.66
5.0	24.4	30.5	4.0	59	8.19	20.15
7.0	24.4	30.6	3.7	54	-	20.23
10.0	24.1	30.8	3.1	45	-	20.47
15.0	23.9	31.1	3.0	44	-	20.75
15.4	23.9	31.1	-	-	8.08	20.75
16.0	23.9	31.1	-	-	-	20.75

Table APP 1.2-1(11) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 09:05 - 09:35  
 Station: 11  
 Location: 22°49'01.1" S, 43°06'13.4" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 26.5 °C (09:15)  
 Wind force: 0 m/s  
 Wind direction: -  
 Water color: Dark greenish brown  
 Secchi-disk reading: 0.9 m  
 Water depth: 2.6 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.5	26.5	9.1	132	8.38	16.84
0.5	25.6	26.8	8.9	129	-	17.06
1.0	25.4	26.9	8.5	123	-	17.17
1.5	25.4	27.5	6.3	91	-	17.62
2.0	25.1	27.9	5.0	73	8.26	18.00
2.2	25.1	28.1	4.7	68	-	18.15
2.5	25.0	28.3	4.6	67	-	18.33

Table APP 1.2-1(13) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 11:55 - 12:10  
 Station: 13  
 Location: 22°47'00.0" S, 43°15'00.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 31.5 °C (12:08)  
 Wind force: 5 m/s  
 Wind direction: NW  
 Water color: Brown  
 Secchi-disk reading: 0.4 m  
 Water depth: 1.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	27.0	26.7	3.8	56	9.17	16.53
0.5	26.6	25.9	3.1	46	-	16.06
1.0	26.4	26.9	3.3	48	9.20	16.87
1.5	25.8	28.2	1.3	19	-	18.02

Table APP 1.2-1(14) Field Record of the First Simultaneous Survey (Spring Tide - Low Tide)

Date: May 18, 1992 Time: 11:05 - 11:30  
 Station: 14  
 Location: 22°49'33.8" S, 43°12'00.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 28.0 °C (11:07)  
 Wind force: 1 m/s  
 Wind direction: N  
 Water color: Greenish brown  
 Secchi-disk reading: 0.6 m  
 Water depth: 4.7 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	26.0	28.2	10.7	158	9.70	17.95
0.5	25.9	28.2	10.5	154	-	17.98
1.0	25.3	28.3	9.2	134	-	18.24
1.5	25.3	29.3	7.6	112	-	18.99
2.0	25.3	29.8	5.8	86	-	19.36
2.5	25.2	30.4	4.0	59	-	19.84
3.0	25.1	30.9	2.9	42	9.25	20.25
3.5	24.8	31.8	2.0	29	-	21.07
4.0	24.4	32.3	2.0	29	9.32	21.51
4.5	24.4	32.4	1.4	21	-	21.58



Table APP 1.2-1(15) Field Record of the First Simultaneous Survey  
(Spring Tide - Low Tide)

Date: May 18, 1992 Time: 11:45 - 12:25  
 Station: 15  
 Location: 22°46'09.1" S, 43°05'29.2" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: -  
 Wind force: -  
 Wind direction: -  
 Water color: Dark greenish brown, transpare  
 Secchi-disk reading: 0.7 m  
 Water depth: 7.5 m

Depth (m)	Temp. (°C)	Salinity (%)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	27.3	28.1	15.4	230	8.51	17.47
0.5	25.8	28.3	12.4	181	-	18.09
0.7	25.5	28.4	10.0	147	-	18.25
1.0	25.3	28.4	7.1	104	-	18.31
1.5	25.1	28.6	5.4	78	-	18.52
3.0	25.1	29.5	3.9	57	8.16	19.20
5.0	24.7	30.5	2.9	42	-	20.07
6.5	24.5	30.7	2.6	37	8.12	20.28

Table APP 1.2-1(18) Field Record of the First Simultaneous Survey  
(Spring Tide - Low Tide)

Date: May 18, 1992 Time: 10:20 - 10:40  
 Station: 18  
 Location: 22°44'00.0" S, 43°15'00.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 28.0 °C (10:20)  
 Wind force: 2 m/s  
 Wind direction: NE  
 Water color: Brown  
 Secchi-disk reading: 0.5 m  
 Water depth: 3.5 m

Depth (m)	Temp. (°C)	Salinity (%)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.9	31.1	7.1	106	9.75	20.15
0.5	25.9	31.1	4.4	66	-	20.15
1.0	25.8	31.7	2.1	31	-	20.70
1.5	24.8	31.9	2.1	31	-	21.09
2.0	24.6	32.1	1.2	19	-	21.30
2.5	24.5	32.3	0.7	11	-	21.48
3.0	24.4	32.4	0.6	9	9.34	21.58
3.5	24.4	32.4	0.2	4	-	21.58

Table APP 1.2-1(16) Field Record of the First Simultaneous Survey  
(Spring Tide - Low Tide)

Date: May 18, 1992 Time: 13:05 - 13:20  
 Station: 16  
 Location: 22°43'13.3" S, 43°05'41.9" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 27.5 °C (13:05)  
 Wind force: 1 - 2 m/s  
 Wind direction: -  
 Water color: Greenish brown  
 Secchi-disk reading: 0.9 m  
 Water depth: 4.3 m

Depth (m)	Temp. (°C)	Salinity (%)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	27.4	27.5	14.0	208	8.55	17.00
0.5	27.6	27.2	12.6	169	-	16.71
1.0	26.4	28.5	9.9	146	-	18.05
1.5	25.6	29.1	6.9	101	-	18.75
2.0	25.4	29.5	5.6	82	-	19.11
2.5	25.0	29.9	4.3	63	-	19.53
3.0	24.4	30.3	3.0	44	-	20.01
3.3	24.7	30.5	2.9	43	8.20	20.07
4.0	24.7	30.6	2.2	32	-	20.14

Table APP 1.2-1(17) Field Record of the First Simultaneous Survey  
(Spring Tide - Low Tide)

Date: May 18, 1992 Time: 09:25 - 09:50  
 Station: 17  
 Location: 22°44'00.0" S, 43°07'00.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 26.5 °C (09:45)  
 Wind force: Light wind  
 Wind direction: N  
 Water color: Brown  
 Secchi-disk reading: 0.9 m  
 Water depth: 5.2 m

Depth (m)	Temp. (°C)	Salinity (%)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.1	30.6	8.6	126	9.81	20.02
0.5	25.1	30.6	8.3	122	-	20.02
1.0	25.6	30.7	7.7	114	-	19.95
1.5	24.9	31.6	5.8	82	-	20.83
2.0	24.5	31.9	2.5	37	-	21.18
2.5	24.5	32.0	2.6	38	-	21.25
3.0	24.3	32.2	2.3	34	-	21.46
3.5	24.3	32.4	1.8	27	-	21.81
4.0	24.3	32.5	1.9	28	-	21.69
4.5	24.2	32.6	1.5	22	9.40	21.79

Table APP 1.2-2(1) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 15:20 - 15:35  
 Station: 2  
 Location: 22°58' 38.7" S, 43°08' 23.2" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Wind force: 13 m/s  
 Wind direction: SSW  
 Water color: Blue  
 Secchi-disk reading: 7.0 m  
 Water depth: 20.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.20	34.56	6.0	89	7.54	23.27
1.0	24.19	34.99	6.0	89	-	23.60
2.0	24.20	35.00	5.9	88	-	23.60
3.0	24.16	35.00	6.1	91	-	23.61
5.0	24.06	35.00	5.9	88	7.46	23.64
6.0	24.17	35.02	5.9	88	-	23.63
8.0	23.79	35.05	5.7	85	-	23.76
10.0	23.66	35.10	5.6	83	-	23.84
15.0	23.65	35.11	5.5	81	-	23.85
19.5	23.60	35.11	5.5	81	7.30	23.86

Table APP 1.2-2(3) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 14:50 - 17:10  
 Station: 4  
 Location: 22°56' 24.8" S, 43°10.' 01.4" W  
 Weather on the previous day: Clear  
 Weather on the day: Cloudy  
 Air temperature: -  
 Wind force: 8 m/s  
 Wind direction: SW  
 Water color: Green  
 Secchi-disk reading: 1.6 m  
 Water depth: 7.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.66	33.37	6.2	92	7.56	22.24
1.0	24.69	33.36	6.2	92	-	22.22
2.0	24.70	33.39	6.3	93	-	22.24
3.0	24.54	33.56	5.8	86	7.57	22.41
4.0	24.54	33.53	5.9	88	-	22.39
5.0	24.50	33.59	5.6	83	-	22.45
6.0	24.31	33.83	5.5	82	-	22.69
7.0	24.08	34.34	5.3	78	7.60	23.14

Table APP 1.2-2(2) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 16:00 - 16:25  
 Station: 3  
 Location: 22°55' 39.8" S, 43°08' 32.3" W  
 Weather on the previous day: Clear  
 Weather on the day: Cloudy  
 Air temperature: -  
 Wind force: 14 m/s  
 Wind direction: SW  
 Water color: Green  
 Secchi-disk reading: 2.5 m  
 Water depth: 50.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.23	34.32	5.7	84	7.46	23.08
1.0	24.12	34.38	5.7	84	-	23.16
2.0	24.08	34.48	5.6	83	-	23.25
3.0	24.01	34.59	5.7	84	-	23.35
4.0	23.88	34.80	5.7	84	-	23.55
5.0	23.87	34.83	5.6	82	7.48	23.57
6.0	23.88	34.84	5.6	82	-	23.58
10.0	23.84	34.82	5.6	83	-	23.57
14.1	23.91	34.83	5.6	82	-	23.56
20.0	23.89	34.85	5.5	81	-	23.58
25.0	23.88	34.84	5.5	81	-	23.58
30.0	23.93	34.85	5.5	81	-	23.57
35.0	23.89	34.85	5.6	82	-	23.58
40.0	23.90	34.84	5.5	81	-	23.57
45.0	23.90	34.85	5.2	78	-	23.58
48.0	23.90	34.87	5.1	75	7.61	23.59

Table APP 1.2-2(4) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 17:20 - 17:40  
 Station: 5  
 Location: 22°54' 34.5" S, 43°08' 56.7" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 23.5 °C (17:25)  
 Wind force: 5 m/s  
 Wind direction: SW  
 Water color: -  
 Secchi-disk reading: 2.3 m  
 Water depth: 34.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.13	34.07	4.9	73	7.55	24.68
1.0	24.13	34.07	4.9	73	-	24.68
2.0	24.13	34.06	4.9	72	-	24.67
3.0	24.13	34.10	4.9	73	-	24.71
4.0	24.13	34.09	4.9	72	-	24.70
5.0	24.14	34.12	5.1	75	7.45	24.73
6.0	24.16	34.09	5.0	74	-	24.69
7.0	24.14	34.09	5.0	74	-	24.70
10.0	24.20	34.09	5.1	75	7.50	24.68
14.1	24.17	34.17	5.3	78	-	24.77
20.0	23.92	34.64	5.3	79	-	25.31
25.0	23.90	34.68	5.4	80	-	25.36
28.2	23.89	34.69	5.5	81	-	25.37
34.6	23.68	34.71	5.5	80	-	25.45
35.0	23.89	34.70	5.5	81	7.63	25.38

Table APP 1.2-2(5) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 16:50 - 17:15  
 Station: 8  
 Location: 22°51'53.1" S, 43°09'31.7" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 24.5 °C (16:25)  
 Wind force: Light wind  
 Wind direction: -  
 Water color: Dark green  
 Secchi-disk reading: 2.0 m  
 Water depth: 22.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.4	33.6	6.5	96	8.34	24.13
1.0	24.4	33.6	6.1	90	-	24.13
2.0	24.4	33.6	6.0	89	-	24.13
3.0	24.3	33.6	6.0	89	-	24.16
4.0	24.2	34.0	6.1	90	-	24.59
5.0	24.0	34.2	6.0	89	8.33	24.85
10.0	23.7	34.5	6.1	91	8.28	25.24
15.0	23.8	34.5	6.1	91	-	25.21
20.0	23.9	34.6	6.3	93	-	25.28
21.0	23.9	34.6	6.2	92	8.27	25.28

Table APP 1.2-2(8) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 15:25 - 15:35  
 Station: 9  
 Location: 22°49'35.6" S, 43°12'27.3" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 27.0 °C(15:34)  
 Wind force: -  
 Water color: Greenish brown  
 Secchi-disk reading: 1.2 m  
 Water depth: 5.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	26.2	31.4	5.7	85	8.41	20.28
1.0	26.3	31.4	5.9	88	-	20.25
2.0	26.1	31.5	4.4	65	-	20.39
2.5	25.9	-	-	-	-	-2.86
3.0	25.4	31.9	2.4	36	-	20.90
3.5	-	33.2	-	-	-	26.91
4.0	24.7	33.2	2.6	38	-	22.09
5.0	24.6	33.2	2.5	37	8.17	22.12

Table APP 1.2-2(6) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 16:25 - 16:35  
 Station: 7  
 Location: 22°52'00.7" S, 43°11'55.6" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 25.0 °C (16:26)  
 Wind force: Light wind  
 Wind direction: -  
 Water color: Dark green  
 Secchi-disk reading: 1.7 m  
 Water depth: 6.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.1	32.0	4.3	64	8.32	22.32
1.0	24.9	32.9	4.1	60	-	23.28
2.0	24.7	33.0	3.4	50	-	23.44
3.0	24.7	33.0	3.1	45	8.22	23.44
4.0	24.6	33.1	3.1	46	-	23.57
5.0	24.6	33.1	3.0	44	-	23.57
5.5	24.5	33.2	2.8	42	8.23	23.70

Table APP 1.2-2(9) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 14:30 - 15:00  
 Station: 10  
 Location: 22°49'51.9" S, 43°09'12.3" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 26.0 °C (14:52)  
 Wind force: -  
 Water color: Greenish brown  
 Secchi-disk reading: 1.3 m  
 Water depth: 26.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.6	32.7	5.8	87	8.58	21.44
1.0	25.3	32.7	5.8	87	-	21.53
2.0	25.2	32.7	5.1	77	-	21.58
3.0	25.0	32.8	4.9	73	-	21.70
4.0	25.0	32.9	4.8	72	-	21.77
5.0	24.8	32.9	4.5	66	8.26	21.83
10.0	24.4	33.8	3.9	57	-	22.63
15.0	24.1	34.3	4.4	64	-	23.09
20.0	24.0	34.3	4.4	66	-	23.12
25.0	23.9	34.4	4.5	67	8.24	23.23

Table APP 1.2-2(7) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 15:50 - 16:0  
 Station: 8  
 Location: 22°50'02.0" S, 43°14'12.7" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 26.0 °C (15:55)  
 Wind force: -  
 Wind direction: -  
 Water color: Dark brown  
 Secchi-disk reading: 1.4 m  
 Water depth: 8.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	26.0	30.3	3.7	55	8.17	20.35
1.0	26.0	30.8	3.4	50	-	20.65
2.0	25.8	31.3	2.6	39	8.16	21.41
3.0	25.6	31.7	1.8	27	-	21.87
4.0	25.5	32.1	1.8	27	-	22.30
5.0	25.4	32.3	2.0	30	-	22.53
6.0	25.4	32.4	2.4	36	-	22.63
7.0	25.3	32.5	2.2	32	-	22.76
8.0	25.3	32.5	1.9	29	8.09	22.76

Table APP 1.2-2(10) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 17:25 - 17:40  
 Station: 11  
 Location: 22°48'44.1" S, 43°06'20.5" W  
 Weather on the previous day: Clear  
 Weather on the day: Cloudy  
 Water color: Greenish brown  
 Secchi-disk reading: 1.3 m  
 Water depth: 5.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.0	30.7	5.8	85	8.22	20.12
0.5	25.0	30.7	5.6	83	-	20.13
1.0	25.0	30.8	5.5	81	-	20.20
2.0	25.0	30.7	5.5	80	-	20.13
3.0	25.0	30.7	5.4	79	-	20.13
4.0	24.8	30.8	5.2	76	8.21	20.28
4.5	24.8	30.8	5.0	74	-	20.28

Table APP 1.2-2(11) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 16:45 - 17:00  
 Station: 12  
 Location: 22°47'49.1" S, 43°07'51.9" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: -  
 Wind force: -  
 Wind direction: -  
 Water color: Greenish brown  
 Secchi-disk reading: 1.2 m  
 Water depth: 17.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)		pH	Sigma-t
0.0	25.4	30.3	8.6	127	8.52	19.71
0.5	25.5	30.3	8.8	130	-	19.69
1.0	25.5	30.2	8.7	128	-	19.60
3.0	24.9	30.5	8.3	122	-	20.01
5.0	24.4	31.3	3.9	57	8.20	20.75
7.0	24.1	31.5	3.3	59	-	20.99
10.0	24.1	31.6	3.3	59	-	21.07
15.0	23.9	32.0	3.6	52	-	21.43
16.0	23.9	32.1	3.8	56	8.14	21.50
17.0	23.9	32.0	3.8	56	-	21.43

Table APP 1.2-2(14) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 15:30 - 15:50  
 Station: 15  
 Location: 22°46'17.2" S, 43°05'43.5" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: -  
 Wind force: 5 - 6 m/s  
 Wind direction: -  
 Water color: Brownish dark green  
 Secchi-disk reading: 1.2 m  
 Water depth: 10.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)		pH	Sigma-t
0.0	25.4	30.1	9.3	137	8.53	19.56
0.5	25.3	30.1	9.0	133	-	19.59
1.0	25.3	30.1	8.8	130	-	19.59
2.0	25.2	30.2	8.0	118	-	19.69
2.5	25.2	30.3	7.4	109	-	19.77
3.0	25.1	30.5	4.5	65	8.25	19.95
5.0	24.3	31.3	3.1	45	-	20.79
7.0	24.3	31.4	2.9	43	8.08	20.86
9.0	24.3	26.2	2.6	37	-	16.96

Table APP 1.2-2(12) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 14:30 - 14:55  
 Station: 13  
 Location: 22°47'00.0" S, 43°15'00.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 29.5 °C (14:22)  
 Wind force: 7 m/s  
 Wind direction: SW  
 Water color: Brown  
 Secchi-disk reading: 0.5 m  
 Water depth: 2.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)		pH	Sigma-t
0.0	26.8	26.3	11.5	169	9.61	16.30
0.5	26.7	26.2	11.0	162	-	16.25
1.0	26.7	26.2	10.6	156	-	16.25
1.5	26.6	30.5	10.4	156	9.26	19.49
2.0	25.1	31.5	2.3	35	-	20.69

Table APP 1.2-2(15) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 14:15 - 14:45  
 Station: 16  
 Location: 22°48'44.1" S, 43°06'20.5" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 27.2 °C (14:20)  
 Wind force: 8 m/s  
 Wind direction: SW  
 Water color: Greenish brown  
 Secchi-disk reading: 0.9 m  
 Water depth: 4.3 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)		pH	Sigma-t
0.0	26.2	28.6	13.9	205	8.53	18.19
0.5	26.2	28.7	12.7	187	-	18.27
1.0	26.1	28.8	10.7	158	-	18.37
1.3	26.1	28.9	-	-	-	18.45
1.5	25.0	29.9	6.6	96	-	19.53
2.0	25.1	30.1	4.6	63	-	19.65
2.5	25.0	30.5	3.6	53	-	19.98
3.0	24.8	30.7	3.2	47	-	20.19
3.3	24.8	30.7	2.9	43	8.16	20.19
4.0	24.7	30.7	2.9	42	-	20.22

Table APP 1.2-2(13) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 15:30 - 15:50  
 Station: 14  
 Location: 22°46'00.0" S, 43°12'00.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 29.0 °C (15:28)  
 Wind force: 5 m/s  
 Wind direction: E  
 Water color: Greenish brown  
 Secchi-disk reading: 0.7 m  
 Water depth: 6.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)		pH	Sigma-t
0.0	25.9	30.9	11.8	175	9.76	20.00
0.5	25.8	31.0	11.1	165	-	20.11
1.0	25.8	31.0	10.5	156	-	20.11
1.5	25.6	31.1	9.7	144	-	20.25
2.0	25.0	32.4	5.4	80	-	21.40
2.5	24.5	32.7	3.5	51	-	21.78
3.0	24.4	32.7	3.2	46	8.90	21.81
3.5	24.3	32.8	2.7	39	-	21.91
4.0	24.2	32.9	2.5	37	-	22.02
4.5	24.3	32.9	2.5	37	-	21.99

Table APP 1.2-2(16) Field Record of the First Simultaneous Survey (Spring Tide - High Tide)

Date: May 18, 1992 Time: 16:55 - 17:15  
 Station: 17  
 Location: 22°47'00.0" S, 43°07'00.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 26.0 °C (16:56)  
 Wind force: 5 - 6 m/s  
 Wind direction: SW  
 Water color: Greenish brown  
 Secchi-disk reading: 0.9 m  
 Water depth: 5.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)		pH	Sigma-t
0.0	25.0	31.9	8.8	131	9.52	21.03
0.5	25.1	31.9	7.7	114	-	21.00
1.0	25.0	31.9	7.4	110	-	21.03
1.5	25.0	31.9	6.9	102	-	21.03
2.0	25.0	32.0	6.8	100	-	21.10
2.5	25.0	32.0	6.9	102	-	21.10
3.0	24.9	32.1	5.7	84	-	21.21
3.5	24.9	32.1	5.1	75	-	21.21
4.0	24.9	32.1	5.0	74	-	21.21
4.5	24.8	32.2	4.4	65	9.41	21.31

Table APP 1.2-2(17) Field Record of the First Simultaneous Survey  
(Spring Tide - High Tide)

Date: May 18, 1992 Time: 16:10 - 16:30  
 Station: 18  
 Location: 22°44'00.0" S, 43°10'00.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 28.5 °C (16:12)  
 Wind force: 3 m/s  
 Wind direction: SW  
 Water color: Greenish brown  
 Secchi-disk reading: 1.0 m  
 Water depth: 4.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.6	31.5	8.0	119	9.61	20.55
0.6	25.6	31.5	9.2	137	-	20.55
1.0	25.6	31.5	7.9	117	-	20.55
1.5	25.6	31.5	7.6	113	9.26	20.55
2.0	25.6	31.5	6.9	103	-	20.55
2.5	25.5	31.8	6.5	97	-	20.65
3.0	25.5	31.8	5.9	68	-	20.65
3.5	25.4	31.7	5.8	87	-	20.76
4.0	25.4	32.0	4.8	72	-	20.98

Table APP 1.2-3(1) Field Record of the Second Simultaneous Survey  
(Neap Tide - High Tide)

Date: June 8, 1992 Time: 11:00 - 11:22  
 Station: 1  
 Location: 22°54'58.9" S, 43°09'29.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 28.0 °C (11:20)  
 Wind force: 1 m/s  
 Wind direction: N  
 Water color: Green  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 7.0 m  
 Water depth: 50.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.89	34.96	9.6	144	8.42	19.64
1.0	24.95	34.96	9.4	142	-	19.62
2.0	24.66	34.94	9.6	143	-	19.70
3.0	24.37	34.93	9.3	138	-	19.79
4.0	24.22	34.94	9.2	136	-	19.83
5.0	24.11	34.98	9.5	134	8.24	19.87
6.0	24.02	34.98	8.9	132	-	19.89
8.0	23.84	35.11	7.8	115	-	19.94
10.0	23.63	35.17	7.4	110	-	19.99
15.0	23.59	35.26	7.0	104	-	20.02
20.0	23.37	35.29	7.0	103	-	20.08
25.0	23.27	35.42	6.8	101	8.15	20.11
30.0	23.24	35.46	6.6	97	-	20.12
35.0	23.01	35.49	6.5	95	-	20.18
40.0	22.68	35.57	5.9	85	-	20.27
45.0	22.09	35.65	5.6	81	-	20.44
49.0	21.71	35.70	5.4	77	8.11	20.54

Table APP 1.2-3(2) Field Record of the Second Simultaneous Survey  
(Neap Tide - High Tide)

Date: June 8, 1992 Time: 09:55 - 10:10  
 Station: 2  
 Location: 22°58'27.8" S, 43°08'02.4" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 26.5 °C (10:10)  
 Wind force: -  
 Wind direction: -  
 Water color: Green  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 7.5 m  
 Water depth: 19.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	23.91	34.76	7.2	107	8.13	19.92
1.0	23.91	34.76	7.2	107	-	19.92
2.0	23.92	34.76	7.3	108	-	19.92
3.0	23.91	34.78	7.1	105	-	19.92
4.0	23.89	34.76	7.1	105	-	19.93
5.0	23.88	34.76	7.0	104	8.01	19.93
6.0	23.85	34.79	7.1	105	-	19.94
8.0	23.56	35.13	7.0	103	-	20.02
10.0	23.49	35.18	7.0	103	-	20.04
12.0	23.45	35.20	6.8	100	-	20.06
14.0	23.23	35.32	6.6	97	-	20.12
16.0	23.20	35.34	6.4	93	-	20.13
18.0	23.19	35.36	6.4	94	8.08	20.13

Table APP 1.2-3(3) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 08:55 - 09:10  
 Station: 3  
 Location: 22°55' 48.3" S, 43°08' 40.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 26.5 °C(09:04)  
 Wind force: 2 m/s  
 Wind direction: NNW  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 3.5 m  
 Water depth: 32.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.48	33.77	6.7	99	8.12	19.76
0.5	24.44	33.81	6.6	98	-	19.77
1.0	24.37	33.86	6.5	96	-	19.78
2.0	24.20	34.10	6.6	97	-	19.84
3.0	24.14	34.10	6.4	95	-	19.86
4.0	24.10	34.17	6.2	92	-	19.87
5.0	24.03	34.31	6.4	95	7.94	19.89
6.0	23.87	34.59	6.4	95	-	19.93
8.0	23.81	34.70	6.6	97	-	19.95
10.0	23.72	34.84	6.5	96	-	19.98
15.0	23.69	34.89	6.4	94	-	19.99
20.0	23.68	34.90	6.4	94	-	19.99
25.0	23.65	34.94	6.2	92	-	20.00
31.0	23.65	34.94	6.5	95	8.07	20.00

Table APP 1.2-3(5) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 07:40 - 07:55  
 Station: 5  
 Location: 22°54' 15.6" S, 43°09' 03.3" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: -  
 Wind force: 1 m/s  
 Wind direction: NNW  
 Water color: Brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 2.2 m  
 Water depth: 36.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.50	33.71	7.2	106	7.55	22.53
1.0	24.44	33.75	6.3	93	-	22.59
2.0	24.36	33.91	7.1	105	-	22.72
3.0	24.24	33.93	7.2	107	-	22.78
3.5	24.31	33.97	7.0	103	-	22.78
5.0	24.30	34.00	7.2	107	7.50	22.81
6.0	24.28	34.04	7.2	107	-	22.85
8.0	24.13	34.22	7.6	112	-	23.03
10.0	23.90	34.50	7.6	113	7.70	23.30
15.0	23.79	34.81	7.5	110	-	23.57
20.0	23.72	34.86	7.5	111	-	23.63
25.0	23.72	34.86	7.4	109	-	23.63
30.0	23.72	34.86	7.4	109	-	23.63
35.0	23.72	34.86	7.3	107	-	23.63

Table APP 1.2-3(4) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 08:10 - 08:40  
 Station: 4  
 Location: 22°56' 25.5" S, 43°10' 02.1" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 24.0 °C (07:25)  
 Water color: Brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 2.0 m  
 Water depth: 12.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.34	34.08	6.5	96	8.14	19.80
1.0	24.33	34.09	6.4	95	-	19.80
2.0	24.30	34.13	6.1	90	-	19.81
3.0	24.12	30.00	5.1	74	8.04	19.86
4.0	24.10	34.38	5.7	85	-	19.87
5.0	24.07	34.41	5.6	83	-	19.88
6.0	24.05	34.43	6.4	95	-	19.88
8.0	24.01	34.48	6.6	97	-	19.89
10.0	23.99	34.50	6.4	94	-	19.90
11.0	23.95	34.54	4.9	73	8.03	19.91

Table APP 1.2-3(6) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 07:15 - 07:50  
 Station: 6  
 Location: 22°52' 06.0" S, 43°09' 34.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 24.0 °C (07:25)  
 Wind force: Light wind  
 Wind direction: N  
 Water color: Greenish brown  
 Garbage: No  
 Oil: Yes  
 Secchi-disk reading: 1.5 m  
 Water depth: 22.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.6	33.1	6.0	88	8.01	22.04
1.0	24.6	33.6	-	-	-	22.42
2.5	24.1	34.3	5.7	84	-	23.09
5.0	23.9	34.7	5.2	76	8.00	23.48
7.5	23.9	34.8	5.4	75	-	23.53
10.0	23.8	35.0	5.4	75	8.00	23.71
15.0	23.0	35.0	5.4	74	-	23.94
20.0	23.7	35.0	5.4	75	-	23.74
21.0	23.7	35.0	5.0	74	8.02	23.74

Table APP 1.2-3(7) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 08:10 - 08:30  
 Station: 7  
 Location: 22°52'00.0" S, 43°12'00.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 30.0 °C (08:15)  
 Wind force: Light wind  
 Wind direction: N  
 Water color: Brownish green  
 Garbage: Yes  
 Oil: Yes  
 Secchi-disk reading: 0.8 m  
 Water depth: 8.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.3	30.1	3.0	45	7.81	19.59
0.5	25.3	32.0	-	-	-	21.01
1.0	25.1	32.9	3.5	52	-	21.74
2.0	25.0	33.1	4.3	64	-	21.92
3.0	24.9	33.4	4.8	71	8.05	22.18
4.0	24.7	33.6	4.0	59	-	22.39
5.0	24.5	33.8	2.5	37	-	22.60
6.0	24.4	33.9	2.1	32	-	22.70
7.0	24.3	33.3	2.1	32	7.88	22.28

Table APP 1.2-3(9) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 09:26 - 09:45  
 Station: 9  
 Location: 22°49'36" S, 43°12'27" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 31.0 °C (09:32)  
 Wind force: Light wind  
 Water color: Brownish green  
 Garbage: Yes  
 Oil: No  
 Secchi-disk reading: 1.1 m  
 Water depth: 6.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.7	31.2	6.1	91	7.98	20.29
1.0	25.6	31.4	5.9	88	-	20.47
2.0	25.7	32.4	5.7	86	-	21.19
3.0	25.3	33.1	5.1	76	-	21.83
4.0	24.8	33.5	4.3	64	-	22.28
5.0	24.7	33.6	3.5	52	7.93	22.39

Table APP 1.2-3(8) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 08:55 - 09:10  
 Station: 8  
 Location: 22°50'12.0" S, 43°14'19.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 28.0 °C (09:04)  
 Wind force: -  
 Wind direction: -  
 Water color: Brownish green  
 Garbage: Yes  
 Oil: No  
 Secchi-disk reading: 1.4 m  
 Water depth: 8.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.5	31.3	1.8	27	7.71	20.42
1.0	25.5	31.2	1.5	22	-	20.35
2.0	25.5	31.3	1.3	20	7.73	20.42
3.0	25.5	31.4	1.3	19	-	20.50
4.0	25.5	31.4	1.3	19	-	20.50
5.0	25.4	31.9	1.3	19	-	20.90
6.0	25.2	32.3	1.2	19	-	21.26
6.5	25.3	32.2	-	-	-	21.16
7.0	24.9	33.3	1.6	23	7.79	22.10

Table APP 1.2-3(10) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 10:05 - 10:25  
 Station: 10  
 Location: 22°50'04" S, 43°09'08" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 26.0 °C (10:22)  
 Wind force: Light wind  
 Wind direction: N  
 Water color: Brownish green  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.2 m  
 Water depth: 24.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t	DO (reading)
			(mg/l)	(%)			
0.0	25.4	32.9	8.3	124	8.26	21.65	10.0
1.0	-	-	-	-	-	-	9.7
2.5	24.9	33.4	7.0	105	-	22.18	8.5
4.0	-	-	-	-	-	-	5.8
5.0	24.4	34.1	4.5	67	8.04	22.85	5.5
7.5	24.0	34.5	4.0	59	-	23.27	4.9
10.0	24.0	34.7	4.0	59	-	23.43	4.9
15.0	23.8	34.8	4.0	59	-	23.56	4.9
20.0	23.7	35.0	4.2	62	-	23.74	5.1
23.0	23.7	35.1	4.2	62	8.07	23.82	5.1

Table APP 1.2-3(11) Field Record of the Second Simultaneous Survey  
(Neap Tide - High Tide)

Date: June 8, 1992 Time: 08:00 - 08:20  
 Station: 11  
 Location: 22°48'58.1" S, 43°08'04.7" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 25.3 °C (07:10)  
 Wind force: 1 m/s  
 Wind direction: N  
 Water color: Brown  
 Garbage: Yes  
 Oil: No  
 Secchi-disk reading: 1.1 m  
 Water depth: 3.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.5	28.6	9.3	136	8.17	18.41
0.5	25.4	28.8	8.5	124	-	18.59
1.0	25.3	29.4	7.4	106	-	19.06
1.5	25.2	29.5	7.1	104	-	19.17
2.0	25.1	29.9	6.5	95	-	19.50
2.5	24.9	30.1	6.6	96	8.09	19.71
3.0	24.9	30.1	5.9	86	-	19.71
3.3	24.9	30.2	5.9	86	-	19.78

Table APP 1.2-3(13) Field Record of the Second Simultaneous Survey  
(Neap Tide - High Tide)

Date: June 8, 1992 Time: 10:09 - 10:20  
 Station: 13  
 Location: 22°47'08.4" S, 43°15'02.5" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 30.5 °C (10:11)  
 Wind force: 2 m/s  
 Wind direction: NE  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 0.8 m  
 Water depth: 1.8 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	28.6	27.1	7.9	120	8.04	16.95
0.5	28.4	28.0	7.0	106	-	17.68
1.0	25.2	32.2	2.8	42	-	21.19
1.5	24.7	32.7	1.5	22	7.95	21.71

Table APP 1.2-3(12) Field Record of the Second Simultaneous Survey  
(Neap Tide - High Tide)

Date: June 8, 1992 Time: 08:40 - 09:00  
 Station: 12  
 Location: 22°47'56.2" S, 43°08'02.9" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 28.0 °C (08:50)  
 Wind force: 1 m/s  
 Wind direction: NEN  
 Water color: Brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.9 m  
 Water depth: 17.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.7	30.5	7.9	115	8.12	20.07
0.5	24.7	30.6	7.5	110	-	20.14
1.0	24.7	30.7	7.5	110	-	20.22
1.5	24.6	30.7	7.8	114	-	20.25
2.0	24.6	30.8	7.7	112	-	20.32
4.0	-	-	7.3	-	-	-
5.0	24.5	31.3	6.3	92	8.05	20.72
8.0	24.2	31.6	-	-	-	21.04
10.0	24.0	32.0	-	-	-	21.40
15.0	23.9	32.2	-	-	-	21.58
16.0	23.8	32.3	4.5	55	8.02	21.68

Table APP 1.2-3(14) Field Record of the Second Simultaneous Survey  
(Neap Tide - High Tide)

Date: June 8, 1992 Time: 09:35 - 09:40  
 Station: 14  
 Location: (22°46'12.9" S, 43°12'05.5" W)  
 Weather on the previous day: Clear  
 Weather on the day: clear  
 Air temperature: 29.5 °C (09:27)  
 Wind force: 1 m/s  
 Wind direction: NE  
 Water color: Brown  
 Garbage: No  
 Oil: NO  
 Secchi-disk reading: 0.8 m  
 Water depth: 5.6 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	28.0	28.1	11.7	171	8.44	17.87
0.5	25.9	29.1	10.3	153	-	18.65
1.0	25.2	32.8	5.2	78	-	21.51
1.5	24.7	33.0	4.2	63	-	21.96
2.0	24.6	33.4	4.1	61	-	22.29
2.5	24.5	33.5	3.6	54	8.22	22.40
3.0	24.5	33.6	3.4	50	-	22.47
3.5	24.5	33.6	3.3	49	-	22.47
4.0	24.4	33.6	3.3	49	-	22.50
4.5	24.4	33.6	-	-	-	22.50



Table APP 1.2-3(16) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 09:25 - 09:40  
 Station: 15  
 Location: 22°46'00.4" S, 43°05'32.4" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 29.5 °C (09:27)  
 Wind force: 0.5 m/s  
 Wind direction: 1 m/s  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.5 m  
 Water depth: 8.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.1	29.6	8.5	126	8.17	19.27
0.5	25.2	29.6	8.5	124	-	19.24
1.0	25.1	29.8	8.4	123	-	19.42
1.5	24.9	29.9	8.3	121	-	19.56
2.0	24.9	30.7	7.2	105	-	20.16
3.0	24.6	31.0	6.6	96	8.11	20.48
4.0	24.6	31.3	5.6	80	-	20.70
5.0	24.4	31.3	-	-	-	20.76
6.0	24.4	31.5	-	-	-	20.91
7.0	24.5	31.6	4.6	62	8.01	20.96
7.5	24.2	31.6	-	-	-	21.05

Table APP 1.2-3(17) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 07:45 - 08:15  
 Station: 17  
 Location: 22°43'59.6" S, 43°07'01.8" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 25.0 °C (07:45)  
 Wind force: Light wind  
 Wind direction: NE  
 Water color: Brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.2 m  
 Water depth: 5.3 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	24.6	31.6	7.8	114	8.50	20.93
0.5	24.4	31.1	7.5	108	-	20.61
1.0	24.5	31.9	7.3	107	-	21.11
1.5	24.4	31.9	7.1	103	-	21.22
2.0	24.4	32.1	6.9	101	-	21.37
2.5	24.2	32.3	6.4	94	-	21.58
3.0	24.2	32.9	4.9	72	-	22.03
3.5	24.1	33.3	3.0	44	-	22.36
4.0	-	33.4	-	-	7.83	-

Table APP 1.2-3(16) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 10:05 - 10:20  
 Station: 16  
 Location: (22°43'27.9" S, 43°05'03.4" W)  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 29.5 °C (10:10)  
 Wind force: 1 - 2 m/s  
 Wind direction: NE  
 Water color: Brownish green  
 Garbage: Yes  
 Oil: No  
 Secchi-disk reading: 1.4 m  
 Water depth: 4.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.4	29.7	7.1	104	8.23	19.26
0.5	25.4	29.9	7.0	103	-	19.41
1.0	25.4	30.1	7.1	105	-	19.56
1.5	24.8	30.5	5.0	74	-	20.04
2.0	24.8	31.0	4.3	64	-	20.42
2.5	24.8	31.0	3.9	58	-	20.48
3.0	24.8	31.0	3.4	50	-	20.48
3.5	-	-	-	-	8.01	-
4.0	24.5	31.0	3.1	46	-	20.51

Table APP 1.2-3(18) Field Record of the Second Simultaneous Survey (Neap Tide - High Tide)

Date: June 8, 1992 Time: 08:45 - 09:05  
 Station: 18  
 Location: 22°44'02.7" S, 43°09'59.7" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 28.0 °C (08:50)  
 Wind force: 0 m/s  
 Wind direction: NE  
 Water color: Brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 0.9 m  
 Water depth: 4.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.3	30.6	9.1	134	8.49	19.97
0.5	25.1	31.0	8.8	130	-	20.33
1.0	25.3	31.7	6.3	93	-	20.60
1.5	25.2	32.2	5.5	82	-	21.20
2.0	24.8	32.8	3.9	58	-	21.78
2.5	24.7	32.9	2.2	33	-	21.88
3.0	24.4	33.1	1.7	25	-	22.12
3.5	24.3	33.3	1.2	18	7.70	22.30

Table APP 1.2-4(1) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 13:25 - 13:40  
 Station: 2  
 Location: 22°58' 39.7" S, 43°08' 23.2" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 28.0 °C (13:40)  
 Wind force: -  
 Wind direction: -  
 Water color: Greenish brown  
 Garbage: Yes  
 Oil: No  
 Secchi-disk reading: 5.0 m  
 Water depth: 18.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.41	34.08	6.6	99	7.84	19.48
1.0	24.19	34.48	6.2	94	-	19.84
2.0	24.01	34.59	6.1	90	-	19.89
3.0	23.85	34.77	6.0	88	-	19.94
4.0	23.85	34.77	5.9	88	-	19.94
5.0	23.86	34.82	6.0	89	7.92	19.94
6.0	23.82	34.86	6.0	88	-	19.95
7.0	23.79	34.97	6.2	92	-	19.96
10.0	23.66	35.08	6.1	91	-	20.00
12.0	23.45	35.21	5.7	84	-	20.06
14.0	23.35	35.26	5.8	85	-	20.08
16.0	23.24	35.33	5.2	77	-	20.12
17.0	23.14	35.33	5.2	77	7.79	20.14

Table APP 1.2-4(3) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 14:35 - 14:45  
 Station: 4  
 Location: 22°56' 24.8" S, 43°10' 01.4" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 30.5 °C (14:35)  
 Wind force: -  
 Wind direction: -  
 Water color: Dark brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 0.4 m  
 Water depth: 10.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	25.58	33.92	16.5	249	8.55	19.43
1.0	25.21	33.94	10.2	153	-	19.54
2.0	24.86	34.11	10.8	161	-	19.54
3.0	24.53	34.18	8.9	132	8.20	19.54
4.0	24.40	34.18	7.4	110	-	19.54
5.0	24.22	34.33	5.3	78	-	19.82
6.0	24.11	34.40	5.4	80	-	19.87
8.0	24.06	34.44	6.2	91	-	19.88
9.0	21.08	34.42	6.0	90	8.09	20.71

Table APP 1.2-4(2) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 14:10 - 14:20  
 Station: 3  
 Location: 22°55' 39.8" S, 43°08' 32.3" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 28.0 °C (14:10)  
 Wind force: -  
 Wind direction: -  
 Water color: Brown  
 Garbage: Yes  
 Oil: Yes  
 Secchi-disk reading: 1.6 m  
 Water depth: 33.5 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	26.10	33.30	12.0	186	8.06	19.27
1.0	24.90	33.34	10.9	162	-	19.63
2.0	24.56	33.68	7.4	110	-	19.73
3.0	24.45	33.77	6.3	93	-	19.77
4.0	24.40	33.87	6.3	93	-	19.78
5.0	24.34	33.95	6.2	91	7.48	19.80
6.0	24.29	34.09	6.3	93	-	19.81
8.0	24.19	34.22	6.7	99	-	19.84
10.0	24.16	34.32	6.7	100	-	19.85
15.0	23.90	34.62	6.8	100	-	19.93
20.0	23.86	34.65	6.8	100	-	19.94
25.0	23.74	34.82	6.5	95	-	19.97
30.0	23.70	34.89	6.5	95	-	19.98
32.5	23.69	34.90	6.4	94	7.63	19.99

Table APP 1.2-4(4) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 15:10 - 15:20  
 Station: 5  
 Location: 22°54' 34.5" S, 43°08' 56.7" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 28.0 °C (15:15)  
 Wind force: -  
 Wind direction: -  
 Water color: Dark brown  
 Garbage: No  
 Oil: Yes  
 Secchi-disk reading: 0.8 m  
 Water depth: 35.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	26.70	32.79	19.8	301	8.38	21.16
1.0	25.51	32.79	16.7	250	-	21.52
2.0	25.40	32.92	11.8	176	-	21.67
3.0	25.31	32.96	10.9	163	-	21.72
4.0	24.89	33.23	8.4	125	-	22.05
5.0	24.63	33.48	5.1	76	8.10	22.32
6.0	24.50	33.75	6.4	95	-	22.56
8.0	24.24	34.08	6.9	96	-	22.89
10.0	24.11	34.33	6.7	100	8.06	23.11
15.0	23.88	34.65	7.0	103	-	23.42
20.0	23.79	34.78	7.4	109	-	23.55
25.0	23.75	34.82	6.8	100	-	23.59
30.0	23.72	34.85	7.0	103	-	23.62
34.0	23.71	34.88	6.9	106	8.02	23.65

Table APP 1.2-4(5) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 15:30 - 15:45  
 Station: 6  
 Location: 22°52'02.0" S, 43°09'34.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 31.5 °C (15:40)  
 Wind force: -  
 Wind direction: -  
 Water color: Brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.0 m  
 Water depth: 22.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)	DO (%)	pH	Sigma-t
0.0	27.0	33.1	2.0	31	8.65	21.30
2.5	25.0	33.6	1.2	18	-	22.30
5.0	24.8	33.8	1.1	16	8.16	22.51
7.5	24.6	34.0	1.0	15	-	22.72
10.0	24.2	34.4	0.8	12	8.07	23.14
15.0	23.8	35.0	0.9	13	-	23.71
20.0	23.7	35.1	0.9	13	-	23.82
21.0	23.7	32.2	0.9	13	8.13	21.64

Table APP 1.2-4(6) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 15:08 - 15:20  
 Station: 7  
 Location: 22°52'00.7" S, 43°11'55.6" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 32.0 °C (15:12)  
 Wind force: -  
 Wind direction: -  
 Water color: Brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.1 m  
 Water depth: 7.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)	DO (%)	pH	Sigma-t
0.0	26.8	31.8	2.1	32	8.36	20.39
1.0	26.4	32.0	1.8	26	-	20.67
1.5	25.0	33.2	-	-	-	22.00
2.0	25.0	33.3	1.0	15	-	22.07
3.0	24.6	33.7	0.8	12	8.01	22.49
4.0	24.3	34.0	0.7	10	-	22.81
5.0	24.3	34.1	0.6	9	-	22.88
6.0	24.3	34.1	0.5	7	7.96	22.88

Table APP 1.2-4(7) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 14:35 - 14:50  
 Station: 8  
 Location: 22°50'12.0" S, 43°14'19.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Slightly cloudy  
 Air temperature: 32.0 °C (14:42)  
 Wind force: Brownish green  
 Wind direction: -  
 Water color: -  
 Garbage: Yes  
 Oil: No  
 Secchi-disk reading: 1.0 m  
 Water depth: 7.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)	DO (%)	pH	Sigma-t
0.0	28.2	27.3	2.3	35	8.36	16.60
0.5	26.6	28.8	1.3	19	-	18.22
1.0	26.2	29.4	0.5	8	-	18.79
2.0	25.7	31.1	0.3	5	7.76	20.21
3.0	25.6	31.3	0.3	5	-	20.39
4.0	25.5	31.6	0.4	6	-	20.65
5.0	25.4	32.0	0.5	7	-	20.98
6.0	25.3	32.4	0.5	7	7.84	21.31

Table APP 1.2-4(8) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 14:13 - 14:23  
 Station: 9  
 Location: 22°49'35.6" S, 43°12'27.3" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 33.0 °C (14:18)  
 Water color: Brownish green  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.2 m  
 Water depth: 6.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)	DO (%)	pH	Sigma-t
0.0	27.0	31.3	2.8	42	8.02	19.96
1.0	26.8	31.3	2.0	30	-	20.02
2.0	25.7	32.0	1.5	22	-	20.89
3.0	25.2	33.1	1.5	22	-	21.86
4.0	25.0	33.5	1.4	21	-	22.22
5.0	24.7	33.7	0.9	13	7.91	22.46

Table APP 1.2-4(9) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 13:35 - 13:54  
 Station: 10  
 Location: 22°50'04" S, 43°09'08" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 33.0 °C (13:50)  
 Wind force: Light wind  
 Wind direction: NE  
 Water color: Dark brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.5 m  
 Water depth: 21.0 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)	DO (%)	pH	Sigma-t	DO (reading)
0.0	26.0	33.1	5.8	88	8.68	21.62	7.0
0.5	-	-	-	-	-	-	4.2
1.0	-	-	-	-	-	-	3.6
2.0	-	-	-	-	-	-	2.7
2.5	24.7	33.7	2.6	38	-	22.46	3.1
3.0	-	-	-	-	-	-	2.4
4.0	-	-	-	-	-	-	2.3
5.0	24.5	34.0	2.0	29	8.07	22.75	2.4
7.5	24.0	34.7	1.8	27	-	23.43	2.2
10.0	23.9	34.9	1.8	27	-	23.61	2.2
15.0	23.8	35.0	2.0	29	-	23.71	2.4
20.0	23.7	35.0	2.0	29	8.08	23.74	2.4

Table APP 1.2-4(10) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 15:15 - 15:30  
 Station: 11  
 Location: 22°48'59.2" S, 43°06'06.8" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.0 m  
 Water depth: 2.7 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO (mg/l)	DO (%)	pH	Sigma-t
0.0	28.1	30.2	9.0	138	8.36	18.78
0.5	26.8	30.0	9.9	149	-	19.05
1.0	26.3	30.1	9.8	146	-	19.28
1.5	25.9	30.1	8.7	129	-	19.40
2.0	25.8	30.1	8.2	121	-	19.44
2.5	25.8	30.2	8.4	124	8.36	19.51

Table APP 1.2-4(11) Field Record of the Second Simultaneous Survey  
(Neap Tide - Low Tide)

Date: June 8, 1992 Time: 14:35 - 14:55  
 Station: 12  
 Location: 22°47'30.0" S, 43°07'55.4" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.6 m  
 Water depth: 16.1 m

Depth (m)	Temp. (°C)	Salinity (%)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	27.8	30.6	11.4	174	8.45	19.18
0.5	27.1	30.6	10.8	163	-	19.40
1.0	25.6	30.8	7.3	108	-	20.02
1.5	24.9	30.9	5.5	81	-	20.31
2.0	-	-	5.4	66	-	-
3.0	24.9	31.3	5.4	79	-	20.61
4.0	-	-	5.2	-	-	-
5.0	24.8	31.3	5.5	81	-	20.64
8.0	24.3	32.0	-	-	-	21.31
10.0	24.2	32.2	-	-	-	21.49
15.0	23.8	32.5	4.1	60	8.06	21.83
15.5	23.9	32.6	-	-	-	21.88

Table APP 1.2-4(14) Field Record of the Second Simultaneous Survey  
(Neap Tide - Low Tide)

Date: June 8, 1992 Time: 14:00 - 14:15  
 Station: 15  
 Location: 22°46'02.7" S, 43°06'32.8" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 34.0 °C(14:08)  
 Wind force: 0 m/s  
 Wind direction: NE  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.8 m  
 Water depth: 8.0 m

Depth (m)	Temp. (°C)	Salinity (%)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	26.8	29.6	8.5	127	8.30	18.75
0.5	26.0	29.5	7.5	111	-	18.92
1.0	25.4	30.1	6.0	88	-	19.56
1.5	-	-	5.8	71	-	-
2.0	24.9	30.8	5.0	73	-	20.24
3.0	24.6	31.3	4.6	67	8.09	20.70
5.0	24.3	31.6	3.8	55	-	21.02
6.0	24.2	31.8	-	-	-	21.20
7.0	24.1	31.9	3.8	55	8.00	21.30

Table APP 1.2-4(12) Field Record of the Second Simultaneous Survey  
(Neap Tide - Low Tide)

Date: June 8, 1992 Time: 13:22 - 13:37  
 Station: 13  
 Location: 22°44'10.5" S, 43°14'58.6" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 24.0 °C (13:25)  
 Wind force: 3 m/s  
 Wind direction: NW  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 0.7 m  
 Water depth: 1.6 m

Depth (m)	Temp. (°C)	Salinity (%)	DO		pH	Sigma-t	DO (reading)
			(mg/l)	(%)			
0.0	28.0	26.8	14.1	212	8.82	16.29	16.4
0.5	28.0	-	-	-	-	-	14.4
1.0	25.4	-	-	-	8.81	-	13.2
1.5	25.4	-	-	-	-	-	3.9

Table APP 1.2-4(15) Field Record of the Second Simultaneous Survey  
(Neap Tide - Low Tide)

Date: June 8, 1992 Time: 13:25 - 13:40  
 Station: 16  
 Location: 22°43'46.6" S, 43°05'02.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 33.0 °C (13:30)  
 Wind force: 0 m/s  
 Wind direction: NE  
 Water color: Dark brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.1 m  
 Water depth: 4.5 m

Depth (m)	Temp. (°C)	Salinity (%)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	27.7	28.9	6.9	134	8.30	17.93
0.5	26.6	29.4	11.7	175	-	18.66
1.0	25.7	30.2	11.5	170	-	19.54
1.5	25.1	30.5	6.3	93	-	19.95
2.0	24.6	30.9	3.7	54	-	20.40
2.5	24.7	31.0	3.4	50	-	20.45
3.0	24.6	31.1	3.3	48	-	20.55
3.5	24.5	31.1	2.9	42	8.02	20.58
4.0	24.5	31.2	2.4	35	-	20.68

Table APP 1.2-4(13) Field Record of the Second Simultaneous Survey  
(Neap Tide - Low Tide)

Date: June 8, 1992 Time: 13:55 - 14:08  
 Station: 14  
 Location: 22°45'56.9" S, 43°12'01.9" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 34.0 °C(14:08)  
 Wind force: 1 m/s  
 Wind direction: NE  
 Water color: Brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 0.6 m  
 Water depth: 4.7 m

Depth (m)	Temp. (°C)	Salinity (%)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	27.7	29.0	20.1	306	8.14	18.01
0.5	27.7	29.0	18.7	252	-	18.01
1.0	26.6	30.2	12.0	180	-	19.26
1.5	25.7	31.4	6.4	95	-	20.45
2.0	25.1	32.3	4.4	65	8.07	21.31
2.5	24.7	33.0	3.4	50	-	21.96
3.0	24.6	33.3	3.1	45	-	22.22
3.5	24.5	33.5	2.8	42	-	22.40
4.0	24.5	33.6	-	-	8.71	22.47
4.5	24.4	28.4	-	-	-	-

Table APP 1.2-4(16) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 15:10 - 15:20  
 Station: 17  
 Location: 22°47'02.4" S, 43°07'02.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 34.0 °C (15:12)  
 Wind force: 1 m/s  
 Wind direction: NE  
 Water color: Brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 1.0 m  
 Water depth: 4.8 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	27.7	31.7	8.1	118	8.32	20.05
0.5	26.6	31.8	8.7	127	-	20.47
1.0	25.6	32.1	9.7	142	-	21.01
1.5	25.1	32.1	5.7	84	-	21.16
2.0	24.9	32.4	4.4	65	-	21.45
2.5	24.8	32.6	3.7	54	-	21.63
3.0	24.6	33.0	3.3	48	-	21.99
3.5	24.4	33.3	2.5	37	-	22.27
4.0	24.3	33.5	-	-	7.36	22.46

Table APP 1.2-4(17) Field Record of the Second Simultaneous Survey (Neap Tide - Low Tide)

Date: June 8, 1992 Time: 16:12 - 16:32  
 Station: 18  
 Location: 22°44'00.0" S, 43°10'00" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 28.5 °C (16:12)  
 Wind force: 3 m/s  
 Wind direction: SW  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No  
 Secchi-disk reading: 0.6 m  
 Water depth: 3.8 m

Depth (m)	Temp. (°C)	Salinity (‰)	DO		pH	Sigma-t
			(mg/l)	(%)		
0.0	28.1	30.6	16.4	251	9.69	19.09
0.5	28.1	30.3	14.5	222	-	18.86
1.0	28.0	30.4	15.2	232	-	18.97
1.5	26.2	31.2	7.8	115	-	20.14
2.0	25.4	31.8	3.9	58	-	20.84
2.5	25.0	32.5	3.2	47	-	21.49
3.0	24.5	32.9	1.7	25	-	21.94
3.5	24.4	33.2	-	-	8.04	22.20

Table APP 1.2-5(1) Field Record of the Third Simultaneous Survey (Spring Tide - Low Tide)

Date: November 10, 1992 Time: 09:20-09:40  
 Station: 1  
 Location: 22°04'30.0" S, 43°05'01.0" W  
 Air temperature: 24.5 °C(09:20)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 2 m/s  
 Wind direction: SSE  
 Secchi-disk reading: 8.5 m  
 Water depth: 49.7 m  
 Water color: Green  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	EC (mS/cm)	Sigma-t
			(mg/l)	(%)			
0.0	22.95	7.46	8.1	117	34.45	-	23.55
1.0	22.94	-	8.1	117	34.46	-	23.56
2.0	22.93	-	8.1	117	34.36	-	23.49
3.0	22.92	-	8.4	122	34.37	-	23.50
4.0	22.85	-	8.5	123	34.44	-	23.57
5.0	22.82	8.09	8.6	124	34.43	-	23.58
6.0	22.77	-	8.6	124	34.44	-	23.60
8.0	22.76	-	8.7	126	34.43	-	23.59
10.0	22.75	-	8.9	128	34.43	-	23.60
12.0	22.70	-	8.8	127	34.43	-	23.61
14.0	21.99	-	8.8	125	34.62	-	23.95
15.0	21.97	-	8.7	124	34.62	-	23.96
16.0	21.94	-	8.6	123	34.64	-	23.98
18.0	21.91	-	8.6	123	34.64	-	23.99
20.0	21.64	-	8.6	122	34.82	-	24.20
25.0	21.09	8.08	8.1	114	34.99	-	24.48
30.0	19.39	-	7.5	104	35.27	-	25.15
33.0	17.94	-	6.6	88	35.38	-	25.60
35.0	17.07	-	6.7	89	35.33	-	24.77
40.0	16.41	-	6.2	81	35.51	-	26.07
45.0	16.00	-	5.9	76	35.51	-	26.16
49.0	15.20	7.95	5.7	73	35.49	-	26.33

Table APP 1.2-5(2) Third Simultaneous Survey (Spring Tide - Low Tide)

Date: November 10, 1992 Time: 10:45-10:55  
 Station: 2  
 Location: 22°58'29.2" S, 43°07'59.1" W  
 Air temperature: 25.94 °C(10:45)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 1 m/s  
 Wind direction: S  
 Secchi-disk reading: 1.8 m  
 Water depth: 17.0 m  
 Water color: Brownish green  
 Garbage: Yes  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	EC (mS/cm)	Sigma-t
			(mg/l)	(%)			
0.0	23.45	7.95	6.4	93	31.24	-	20.99
1.0	22.68	-	5.9	87	32.16	-	21.91
1.5	22.93	-	6.1	90	32.49	-	22.08
2.0	22.52	-	6.5	95	32.90	-	22.51
3.0	22.35	-	6.4	94	33.20	-	22.78
4.0	22.32	-	6.5	92	33.34	-	22.89
5.0	22.31	7.99	6.5	92	33.38	-	22.93
6.0	22.30	-	6.5	93	33.42	-	22.96
8.0	22.30	-	6.6	94	33.43	-	22.97
10.0	22.33	-	6.9	99	33.41	-	22.94
12.0	22.41	-	7.3	105	33.83	-	23.24
14.0	22.45	-	7.8	112	34.04	-	23.02
15.0	22.47	-	8.3	119	34.38	-	23.02
16.0	22.47	8.14	8.3	119	34.38	-	23.03

Table APP 1.2-5(3)

Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 11:20-11:37  
 Station: 3  
 Location: 22°55' 53.6" S, 43°08' 34.9" W  
 Air temperature: 26.83 °C(11:20)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 2-3 m/s  
 Wind direction: S  
 Secchi-disk reading: 1.5 m  
 Water depth: 45.0 m  
 Water color: Brown  
 Garbage: Yes  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	EC (mS/cm)	Sigma-t
0.0	24.30	8.09	7.7	107	29.59	19.50
0.5	23.90	-	7.1	103	30.87	20.58
1.0	23.08	-	6.7	96	30.95	20.88
2.0	22.83	-	6.6	94	31.37	21.26
3.0	22.73	-	6.6	94	31.51	21.40
3.5	22.40	-	6.4	91	32.28	22.07
4.0	22.46	-	6.4	91	32.97	22.58
5.0	22.39	8.00	6.5	92	32.98	22.60
6.0	22.40	-	6.5	92	33.01	22.62
7.0	22.37	-	6.6	94	33.25	22.81
8.0	22.42	-	6.6	94	33.01	22.62
10.0	22.40	-	6.9	98	32.98	22.60
12.0	22.36	-	7.1	98	33.40	22.93
14.0	22.37	-	7.0	101	33.43	22.95
15.0	22.39	-	7.2	100	33.35	22.88
16.0	22.37	-	7.3	103	33.40	22.93
18.0	22.36	-	7.4	104	33.46	22.97
20.0	22.36	-	7.4	105	33.39	22.92
25.0	22.37	-	7.4	105	33.40	22.93
30.0	22.37	-	7.4	105	33.42	22.94
35.0	22.33	-	7.4	106	33.60	23.09
40.0	22.28	-	7.4	106	33.69	23.17
44.0	22.31	8.06	7.4	106	33.51	23.03

Table APP 1.2-5(5)

Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 12:33-12:50  
 Station: 5  
 Location: 22°54' 07.3" S, 43°08' 54.0" W  
 Air temperature: 25.56 °C(12:33)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 2 m/s  
 Wind direction: SS  
 Secchi-disk reading: 1.2 m  
 Water depth: 37.8 m  
 Water color: Brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	EC (mS/cm)	Sigma-t
0.0	23.44	8.03	6.6	95	30.24	20.24
1.0	23.38	-	6.0	86	30.89	20.75
1.5	22.81	-	5.6	80	30.97	20.97
2.0	22.82	-	5.6	80	30.98	20.97
3.0	22.54	-	6.0	85	31.64	21.55
4.0	22.51	-	6.1	86	31.98	21.81
5.0	22.52	8.01	5.9	84	31.99	21.82
6.0	22.52	-	5.9	84	32.09	21.89
8.0	22.47	-	6.0	85	32.17	21.97
10.0	22.45	8.02	6.1	87	32.38	22.13
12.0	22.22	-	6.0	85	32.63	22.42
14.0	22.19	-	6.2	88	32.80	22.52
15.0	22.14	-	6.2	88	32.97	22.67
16.0	22.14	-	6.2	88	33.03	22.71
18.0	22.14	-	6.4	92	33.13	22.79
20.0	22.14	-	6.4	90	33.13	22.79
25.0	22.13	-	6.8	98	33.47	23.05
30.0	22.13	-	6.8	96	33.44	23.02
35.0	22.18	-	6.8	98	33.57	23.11
37.0	22.19	8.07	6.9	99	33.57	23.10

Table APP 1.2-5(4)

Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 12:00-12:10  
 Station: 4  
 Location: 22°56' 21.2" S, 43°09' 59.3" W  
 Air temperature: 26.8 °C(12:00)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 2-3 m/s  
 Wind direction: SW  
 Secchi-disk reading: 0.8 m  
 Water depth: 11.0 m  
 Water color: Brown  
 Garbage: No  
 Oil: Yes

Depth(m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	EC (mS/cm)	Sigma-t
0.0	25.10	8.09	8.8	128	29.70	19.35
0.5	23.14	-	6.4	92	31.67	21.40
1.0	22.92	-	6.6	94	31.87	21.62
2.0	22.93	-	6.4	91	31.64	21.44
3.0	22.98	8.02	6.6	94	31.59	21.39
4.0	22.80	-	6.3	89	31.88	21.66
4.5	22.74	-	5.9	84	31.94	21.72
5.0	22.28	-	5.3	75	32.83	22.53
6.0	22.00	-	4.9	69	33.32	22.97
7.0	21.93	8.00	4.7	67	33.35	23.01
8.0	21.92	-	4.8	68	33.41	23.06
9.0	21.92	-	4.8	68	33.43	23.07
10.0	21.92	7.98	4.8	68	33.47	23.10

Table APP 1.2-5(6)

Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 08:20-08:45  
 Station: 6  
 Location: 22°52' 04.0" S, 43°00' 05.4" W  
 Air temperature: 23.7 °C(08:20)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 0-1 m/s  
 Wind direction: SW  
 Secchi-disk reading: 1.0 m  
 Water depth: 19.5 m  
 Water color: Brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	EC (mS/cm)	Sigma-t
0.0	24.50	-	9.5	132	22.16	34.11
0.5	23.88	-	7.6	106	24.48	38.52
1.0	23.65	-	7.1	100	27.18	41.39
1.5	23.68	-	6.3	90	28.51	43.01
2.0	23.52	-	6.1	77	28.91	43.41
2.5	23.27	-	5.4	77	29.61	44.13
3.0	23.15	-	5.5	79	29.97	44.14
4.0	22.95	-	5.8	82	29.74	44.03
5.0	22.84	-	5.6	79	30.05	44.35
7.0	22.23	-	4.1	58	30.85	44.97
9.0	21.96	-	3.8	50	31.84	45.98
13.0	21.61	-	3.0	43	32.75	46.78
17.0	21.80	-	3.9	55	33.30	47.54

Table APP 1.2-5(7) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 09:53-10:10  
 Station: 7  
 Location: 22°51'59.1" S, 43°11'59.2" W  
 Air temperature: 24.0 °C(09:55)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 0-1 m/s  
 Wind direction: SW  
 Secchi-disk reading: -  
 Water depth: 7.1 m  
 Water color: Brown  
 Garbage: No  
 Oil: Yes

Depth(m)	Temp. (°C)	pH	DO		Salinity (‰)	EC (mS/cm)	Sigma-t
			(mg/l)	(%)			
0.0	24.18	-	5.4	78	29.16	44.30	19.22
0.5	23.88	-	5.0	72	29.43	44.33	19.50
1.0	23.85	-	4.7	87	29.15	44.31	19.30
1.5	23.33	-	4.4	63	30.40	45.31	20.39
2.0	22.69	-	2.7	38	31.34	45.85	21.28
2.5	22.65	-	2.7	38	31.33	45.85	21.28
3.0	22.59	-	2.7	38	31.62	45.98	21.52
4.0	22.18	-	3.4	49	32.21	46.55	22.08
5.0	22.13	-	3.6	50	32.36	46.71	22.21
6.0	22.08	-	3.6	51	32.55	46.91	22.36
6.5	21.93	-	3.6	51	32.64	46.91	22.47

Table APP 1.2-5(9) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 10:35-10:45  
 Station: 9  
 Location: 22°49'28.8" S, 43°14'35.4" W  
 Air temperature: 27.2 °C(10:40)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 0-1 m/s  
 Wind direction: SW  
 Secchi-disk reading: 0.6 m  
 Water depth: 3.6 m  
 Water color: Brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO		Salinity (‰)	EC (mS/cm)	Sigma-t
			(mg/l)	(%)			
0.0	25.09	-	6.37	91	26.47	41.38	16.93
0.5	25.11	-	5.94	85	26.45	41.35	16.91
1.0	24.99	-	5.35	77	26.49	41.35	16.98
1.5	24.83	-	4.28	61	26.54	41.29	17.06
2.0	24.08	-	1.86	27	29.09	42.70	18.44
2.5	23.76	-	1.86	26	29.78	43.65	19.05
3.0	23.48	-	2.05	29	29.98	44.81	20.03
3.5	22.90	-	1.07	15	30.79	45.60	20.81

Table APP 1.2-5(8) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 11:03-11:21  
 Station: 8  
 Location: 22°50'04.3" S, 43°14'21.9" W  
 Air temperature: 25.0 °C(11:05)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 2-3 m/s  
 Wind direction: SW  
 Secchi-disk reading: 0.9 m  
 Water depth: 9.2 m  
 Water color: Brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO		Salinity (‰)	EC (mS/cm)	Sigma-t
			(mg/l)	(%)			
0.0	25.75	-	6.58	94	24.25	38.72	15.08
0.5	24.62	-	2.26	32	26.10	40.48	16.82
1.0	24.45	-	2.10	30	26.92	41.52	17.46
1.5	24.37	-	2.16	31	27.59	42.50	17.98
2.0	24.33	-	2.58	37	27.84	42.61	18.18
2.5	24.06	-	1.82	26	28.63	43.54	18.85
3.0	24.03	-	1.76	25	28.71	43.62	18.92
4.0	23.92	-	1.53	22	28.84	43.69	19.05
5.0	23.72	-	1.22	17	29.25	44.05	19.41
6.0	23.08	-	1.16	18	30.57	45.14	20.59
7.0	23.04	-	0.96	14	30.50	45.25	20.62
8.0	23.04	-	0.87	12	30.57	45.21	20.60

Table APP 1.2-5(10) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 09:10-09:35  
 Station: 10  
 Location: 22°50'00.3" S, 43°09'10.3" W  
 Air temperature: 24.1 °C(09:10)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 1-2 m/s  
 Wind direction: SW  
 Secchi-disk reading: 0.7 m  
 Water depth: 22.5 m  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO		Salinity (‰)	EC (mS/cm)	Sigma-t
			(mg/l)	(%)			
0.0	25.15	-	9.60	135	23.50	36.27	14.69
0.5	24.11	-	7.71	108	25.13	39.39	16.21
1.0	23.71	-	6.62	94	28.25	42.75	18.67
1.5	23.32	-	5.88	83	29.39	43.97	19.63
2.0	23.19	-	5.56	79	29.63	44.11	19.85
2.5	22.90	-	4.75	67	30.32	44.76	20.45
3.0	22.97	-	4.70	67	30.38	44.83	20.48
5.0	21.71	-	3.28	46	32.98	45.79	22.79
7.0	21.55	-	3.07	43	32.63	46.52	22.57
9.0	21.43	-	2.80	39	32.95	46.78	22.85
11.0	21.38	-	2.77	39	33.04	46.83	22.93
13.0	21.28	-	2.67	38	33.18	46.92	23.06
15.0	21.36	-	2.72	38	33.28	47.14	23.11
17.0	21.40	-	3.03	43	33.31	47.30	23.13
18.0	21.49	-	3.03	43	33.34	47.28	23.12

Table APP 1.2-5(11) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 09:00-09:15  
 Station: 11  
 Location: 22°48'59.9" S, 43°06'09.5" W  
 Air temperature: 26.1°C (09:00)  
 Wind force: 0-1 m/s  
 Wind direction: SW  
 Water color: Brown  
 Secchi-disk reading: 0.8 m  
 Water depth: 2.6 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	Sigma-t
			(mg/l)	(%)		
0.0	25.3	8.51	-	-	14.5	7.95
0.5	25.1	-	-	-	15.4	8.67
1.0	25.1	-	-	-	16.2	9.27
1.5	25.1	-	-	-	17.9	10.53
1.6	-	8.18	-	-	-	-
2.0	23.6	-	-	-	25.9	16.93
2.5	23.0	-	-	-	27.1	18.00

Table APP 1.2-5(12) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 10:00-10:15  
 Station: 12  
 Location: 22°47'22.4" S, 43°07'45.0" W  
 Wind force: 0-1 m/s  
 Wind direction: SW  
 Water color: Brown  
 Secchi-disk reading: 0.9 m  
 Water depth: 14.5 m  
 Garbage: Yes, a little  
 Oil: Yes, a little

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	Sigma-t
			(mg/l)	(%)		
0.0	26.1	8.95	-	-	21.2	12.70
0.5	26.2	-	-	-	21.2	12.67
1.0	26.1	-	-	-	21.1	12.63
1.5	25.7	-	-	-	23.7	14.68
2.0	25.0	-	-	-	25.3	16.08
3.0	24.1	-	-	-	26.6	17.32
5.0	22.0	8.23	-	-	30.8	21.06
7.0	21.9	-	-	-	31.1	21.32
10.0	21.7	-	-	-	31.3	21.52
13.5	21.4	8.12	-	-	32.0	22.14
14.0	21.4	-	-	-	32.1	22.21

Table APP 1.2-5(13) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 11:10-11:25  
 Station: 13  
 Location: 29.2°C (11:10)  
 Wind force: 0 m/s  
 Water color: Dark brown or black  
 Secchi-disk reading: 0.2 m  
 Water depth: 2.5 m  
 Garbage: No  
 Oil: Yes

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	Sigma-t
			(mg/l)	(%)		
0.0	25.5	7.65	0.6	9	23.0	14.22
0.5	25.2	-	1.0	15	23.2	14.45
1.0	24.5	-	1.5	21	23.5	14.88
1.5	24.0	7.77	1.6	22	24.0	15.40
2.0	23.4	-	1.1	18	25.0	16.31
2.5	23.3	-	0.7	10	25.7	16.87

Table APP 1.2-5(14) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 10:40-11:00  
 Station: 14  
 Location: 29.5°C (10:40)  
 Wind force: Non  
 Wind direction: -  
 Water color: Brown  
 Secchi-disk reading: 0.4 m  
 Water depth: 4.0 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	Sigma-t
			(mg/l)	(%)		
0.0	25.6	8.32	12.8	180	22.4	13.74
0.5	25.3	-	8.9	126	24.2	15.17
1.0	25.2	-	8.2	114	24.4	15.35
1.5	25.2	-	7.8	111	24.8	15.85
2.0	25.0	-	6.8	96	25.1	15.93
2.5	24.2	-	3.7	52	26.7	17.36
3.0	23.2	8.28	2.4	35	29.3	19.60
3.5	22.7	-	2.3	32	30.1	20.34

Table APP 1.2-5(15) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 10:45-11:00  
 Station: 15  
 Location: 22°45'58.8" S, 43°05'32.0"  
 Weather on the previous day: Cloudy  
 Weather on the day: Cloudy  
 Wind force: 1-2 m/s  
 Wind direction: SW  
 Water color: Dark brown  
 Secchi-disk reading: 0.5 m  
 Water depth: 7.3 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	Sigma-t
			(mg/l)	(%)		
0.0	25.6	8.59	-	-	8.7	3.57
0.5	25.6	-	-	-	11.8	5.86
1.0	25.2	-	-	-	21.8	13.41
1.5	25.0	-	-	-	22.3	13.84
2.0	24.3	-	-	-	25.5	16.43
3.0	22.9	8.35	-	-	28.3	18.93
4.0	22.7	-	-	-	29.1	19.59
5.0	22.3	-	-	-	29.9	20.30
6.0	21.9	-	-	-	30.9	21.17
6.3	21.9	8.21	-	-	30.9	21.17

Table APP 1.2-5(16) Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 11:30-11:45  
 Station: 16  
 Location: 22°43'25.8" S, 43°04'44.9" W  
 Weather on the previous day: Cloudy  
 Weather on the day: Cloudy  
 Air temperature: -  
 Wind force: 1-2 m/s  
 Wind direction: SW  
 Water color: Brown  
 Secchi-disk reading: 0.6 m  
 Water depth: 3.5 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	Sigma-t
			(mg/l)	(%)		
0.0	25.7	7.32	-	-	13.3	6.95
0.5	25.3	-	-	-	14.9	8.25
1.0	25.4	-	-	-	19.5	11.64
1.5	24.6	-	-	-	22.5	14.10
2.0	23.4	-	-	-	27.2	17.96
2.5	22.7	8.24	-	-	28.6	19.21
3.0	22.8	-	-	-	29.6	19.99
3.3	22.5	-	-	-	29.5	19.95



Table APP 1.2-5(17)

Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 09:00-09:30  
 Station: 17  
 Location:  
 Weather on the day: Cloudy  
 Air temperature: 25.1 °C(09:00)  
 Wind force: 1-2 m/s  
 Wind direction: SW  
 Water color: Brown  
 Secchi-disk reading: 0.6 m  
 Water depth: 3.5 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	Sigma-t
			(mg/l)	(%)		
0.0	25.1	8.40	9.0	126	22.7	14.11
0.5	25.2	-	9.6	133	21.4	13.11
1.0	24.7	-	8.3	117	23.3	14.67
1.5	24.4	-	7.2	101	25.0	16.03
2.0	24.1	-	6.1	86	26.0	16.67
2.5	23.4	-	4.4	61	27.2	17.96
3.0	22.6	8.14	3.0	43	29.3	19.77
3.5	22.4	-	2.5	35	30.2	20.50
4.0	22.2	-	2.3	32	30.4	20.71

Table APP 1.2-5(18)

Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 10:03-10:15  
 Station: 18  
 Location:  
 Weather on the previous day: Cloudy  
 Weather on the day: Slightly cloudy  
 Air temperature: 28.0 °C(10:03)  
 Wind force: 1-2 m/s  
 Wind direction: SW  
 Water color: Brown  
 Secchi-disk reading: 0.4 m  
 Water depth: 3.0 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	Sigma-t
			(mg/l)	(%)		
0.0	26.0	8.34	10.0	143	23.0	14.07
0.5	25.6	-	4.8	68	23.6	14.64
1.0	25.1	-	4.8	68	25.2	15.98
1.5	24.5	-	5.2	75	26.3	16.98
2.0	24.1	8.14	4.4	63	27.7	18.14
2.5	23.6	-	3.0	42	28.9	19.19
3.0	22.8	-	1.9	27	30.1	20.31

Table APP 1.2-5(19)

Third Simultaneous Survey  
(Spring Tide - Low Tide)

Date: November 10, 1992 Time: 11:36-11:50  
 Station: 19  
 Location: 22°49'38.6" S, 43°15'39.4" W  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Air temperature: 24.7 °C(11:38)  
 Wind force: 0-1 m/s  
 Wind direction: SW  
 Water color: Brown  
 Secchi-disk reading: 0.7 m  
 Water depth: 7.7 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (‰)	EC (mS/cm)	Sigma-t
			(mg/l)	(%)			
0.0	25.64	-	7.28	103	23.21	37.29	14.33
0.5	25.40	-	5.56	79	23.33	37.40	14.50
1.0	24.91	-	3.08	44	24.32	38.81	15.38
1.5	24.84	-	2.95	42	24.41	38.30	15.46
2.0	24.70	-	1.94	27	24.78	38.68	15.78
2.5	24.55	-	1.08	15	25.80	39.69	16.69
3.0	24.65	-	0.95	13	24.91	38.69	15.89
3.5	24.41	-	0.83	12	27.03	41.67	17.55
4.0	24.38	-	0.98	14	27.33	41.98	17.78
5.0	24.33	-	1.02	15	27.61	42.36	18.01
6.0	24.31	-	1.01	14	27.69	42.45	18.07
7.0	24.29	-	0.98	14	27.80	42.59	18.16

Table APP 1.2-6(1) Field Record of the Third Simultaneous Survey (Spring Tide - High Tide)

Date: November 10, 1992 Time: 14:20-14:30  
 Station: 2  
 Location: 22°53'34.5" S, 43°08'01.0" W  
 Air temperature: 23.39°C(14:20)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 0-1 m/s  
 Wind direction: SSE  
 Secchi-disk reading: 3.5 m  
 Water depth: 18.0 m  
 Water color: Greenish brown  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO (mg/l)	(%)	Salinity (%)	EC (mS/cm)	Sigma-t
0.0	23.44	7.99	6.5	94	33.24	-	22.50
1.0	22.55	-	6.5	93	33.74	-	23.13
2.0	22.57	-	6.8	97	33.82	-	23.19
3.0	22.59	-	7.1	102	33.91	-	23.25
4.0	22.61	-	7.3	104	33.92	-	23.25
5.0	22.63	8.00	7.3	104	33.93	-	23.25
6.0	22.66	-	7.3	106	33.96	-	23.27
8.0	22.91	-	7.9	114	34.24	-	23.41
10.0	22.80	-	8.1	117	34.33	-	23.51
12.0	22.15	-	7.8	112	34.45	-	23.78
14.0	22.04	-	7.9	113	34.48	-	23.83
15.0	22.02	-	7.9	113	34.49	-	23.85
16.0	22.02	-	8.0	114	34.49	-	23.85
17.0	22.01	8.09	8.0	114	34.49	-	23.85

Table APP 1.2-6(3) Third Simultaneous Survey (Spring Tide - High Tide)

Date: November 10, 1992 Time: 15:17-15:25  
 Station: 4  
 Location: 22°56'20.8" S, 43°09'55.8" W  
 Air temperature: 23.6 °C(15:17)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 5-6 m/s  
 Wind direction: SW  
 Secchi-disk reading: 1.5 m  
 Water depth: 11.5 m  
 Water color: Brownish green  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	(%)	Salinity (%)	EC (mS/cm)	Sigma-t
0.0	23.77	7.99	7.0	100	31.25	-	20.90
1.0	23.72	-	7.5	101	31.26	-	20.93
2.0	23.20	-	6.8	97	31.75	-	21.44
2.5	22.83	-	5.7	82	32.11	-	21.82
3.0	22.50	8.02	5.7	80	32.38	-	22.12
4.0	22.44	-	5.4	77	32.43	-	22.17
5.0	22.44	-	5.6	80	32.68	-	22.36
6.0	22.39	-	5.6	79	32.81	-	22.47
7.0	22.25	8.05	5.2	74	32.91	-	22.59
8.0	22.21	-	5.1	72	32.98	-	22.65
8.5	22.00	-	4.9	69	33.01	-	22.73
9.0	22.13	-	4.5	65	33.29	-	22.91
10.0	21.94	-	4.5	64	33.34	-	23.00
11.0	21.92	8.03	4.5	64	33.37	-	23.03

Table APP 1.2-6(2) Third Simultaneous Survey (Spring Tide - High Tide)

Date: November 10, 1992 Time: 14:50-15:07  
 Station: 3  
 Location: 22°55'51.8" S, 43°08'33.4" W  
 Air temperature: 23.8 °C(14:50)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 5-6 m/s  
 Wind direction: SSE  
 Secchi-disk reading: 3.0 m  
 Water depth: 45.0 m  
 Water color: Brownish green  
 Garbage: Yes  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	(%)	Salinity (%)	EC (mS/cm)	Sigma-t
0.0	22.63	7.99	6.8	97	32.29	-	22.01
1.0	22.83	-	6.5	93	33.15	-	22.61
2.0	22.74	-	6.5	93	33.29	-	22.74
3.0	22.71	-	6.9	98	33.32	-	22.77
4.0	22.68	-	6.9	98	33.48	-	22.90
5.0	22.74	8.04	7.0	101	33.38	-	22.81
6.0	22.71	-	7.0	101	33.26	-	22.72
8.0	22.66	-	6.9	100	33.42	-	22.86
10.0	22.66	-	7.0	101	33.49	-	22.91
12.0	22.68	-	7.3	104	33.44	-	22.87
14.0	22.71	-	7.4	106	33.45	-	22.87
15.0	22.67	-	7.4	106	33.55	-	22.95
16.0	22.65	-	7.4	107	33.54	-	22.95
18.0	22.71	-	7.4	107	33.36	-	22.80
20.0	22.74	-	7.5	108	33.38	-	22.81
25.0	22.65	-	7.5	108	33.50	-	22.92
30.0	22.65	-	7.4	107	33.58	-	22.98
35.0	22.59	-	7.3	105	33.85	-	23.20
40.0	22.57	-	7.4	107	33.89	-	23.24
44.0	22.57	7.70	7.3	105	33.90	-	23.25

Table APP 1.2-6(4) Third Simultaneous Survey (Spring Tide - High Tide)

Date: November 10, 1992 Time: 15:46-16:03  
 Station: 5  
 Location: 22°54'07.5" S, 43°08'52.4" W  
 Air temperature: 23.71 °C(15:46)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 6 m/s  
 Wind direction: SW  
 Secchi-disk reading: 1.6 m  
 Water depth: 38.5 m  
 Water color: Brownish green  
 Garbage: Yes  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	(%)	Salinity (%)	EC (mS/cm)	Sigma-t
0.0	23.22	7.97	6.6	96	32.11	-	21.71
1.0	23.15	-	8.2	118	32.18	-	21.78
2.0	22.78	-	7.9	113	32.65	-	22.24
3.0	22.74	-	8.9	128	32.89	-	22.44
4.0	22.71	-	7.0	101	32.98	-	22.51
5.0	22.65	8.02	6.5	94	32.98	-	22.53
6.0	22.54	-	6.6	95	33.14	-	22.68
8.0	22.41	-	6.3	90	33.07	-	22.67
10.0	22.42	8.05	6.4	91	33.10	-	22.68
12.0	22.43	-	6.5	93	33.50	-	22.98
14.0	22.45	-	6.7	96	33.56	-	23.02
15.0	22.45	-	6.7	96	33.56	-	23.02
16.0	22.46	-	6.7	97	33.57	-	23.03
18.0	22.49	-	6.9	99	33.59	-	23.04
20.0	22.49	-	7.1	102	33.60	-	23.04
25.0	22.47	-	7.2	104	33.91	-	23.28
30.0	22.47	-	7.4	106	33.94	-	23.31
35.0	22.45	-	6.7	96	33.92	-	23.30
37.5	22.46	-	7.5	108	33.92	-	23.29
38.0	-	8.08	-	-	-	-	-

Table APP 1.2-6(5) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 14:28-14:45  
 Station: 6  
 Location: 22°52'01.6" S, 43°08'59.8" W  
 Air temperature: 24.8 °C(14:30)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 2-3 m/s  
 Wind direction: SW  
 Secchi-disk reading: 1.5 m  
 Water depth: 19.8 m  
 Water color: Brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	EC (mS/cm)	Sigma-t
0.0	23.31	-	6.0	86	30.78	45.71
0.5	23.31	-	6.1	87	30.81	45.76
1.0	23.27	-	6.0	86	30.81	45.77
1.5	23.23	-	5.9	85	30.86	45.76
2.0	23.16	-	5.9	84	30.85	45.76
2.5	23.11	-	5.7	81	30.93	45.77
3.0	23.07	-	5.8	80	30.96	45.77
4.0	22.93	-	4.9	69	31.54	46.22
5.0	22.54	-	5.0	69	32.26	46.89
6.0	22.40	-	4.9	69	32.36	46.92
7.0	22.36	-	4.9	69	32.40	46.99
9.0	22.37	-	4.5	64	33.37	47.69
11.0	22.01	-	4.7	67	33.46	47.98
13.0	22.00	-	4.5	64	33.51	48.03
15.0	22.00	-	4.6	66	33.52	48.07
17.0	22.00	-	4.5	65	33.53	48.09
18.0	22.00	-	4.5	64	33.55	48.12

Table APP 1.2-6(6) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 16:54-17:15  
 Station: 7  
 Location: 22°51'59.7" S, 43°12'00.1" W  
 Air temperature: 24.5 °C(16:55)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 0-2 m/s  
 Wind direction: SW  
 Secchi-disk reading: 0.9 m  
 Water depth: 8.0 m  
 Water color: Brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	EC (mS/cm)	Sigma-t
0.0	24.33	-	8.9	129	29.01	44.33
0.5	24.31	-	9.1	125	29.03	44.35
1.0	24.31	-	8.6	124	29.05	44.36
1.5	24.22	-	8.2	118	29.23	44.50
2.0	24.06	-	8.5	94	29.73	45.04
2.5	24.02	-	6.1	88	29.84	45.11
3.0	23.74	-	4.7	67	30.49	45.60
4.0	23.26	-	4.3	61	30.70	45.59
5.0	23.00	-	3.9	55	31.05	45.76
6.0	22.37	-	2.8	40	31.92	46.35
7.0	22.25	-	2.7	39	32.09	46.47
8.0	21.89	-	2.0	28	28.09	41.11

Table APP 1.2-6(7) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 16:12-16:30  
 Station: 8  
 Location: 22°50'04.5" S, 43°14'19.3" W  
 Air temperature: 23.8 °C(16:17)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 3-4 m/s  
 Wind direction: SW  
 Secchi-disk reading: -  
 Water depth: 8.8 m  
 Water color: Brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	EC (mS/cm)	Sigma-t
0.0	24.94	-	6.73	83	27.39	42.58
0.5	24.94	-	6.52	80	27.44	42.59
1.0	24.92	-	6.51	80	27.41	42.59
1.5	24.93	-	6.61	81	27.39	42.57
2.0	24.91	-	6.48	80	27.46	42.61
2.5	24.62	-	4.89	60	28.00	43.21
3.0	24.27	-	4.35	53	29.36	43.85
4.0	24.01	-	3.63	44	29.38	44.53
5.0	23.98	-	3.66	44	29.55	44.83
6.0	24.02	-	3.60	44	29.71	44.94
7.0	24.04	-	3.58	43	29.91	45.23
8.0	23.17	-	2.25	27	30.57	45.25
8.5	22.88	-	1.36	16	30.30	45.40

Table APP 1.2-6(8) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 15:44-15:55  
 Station: 9  
 Location: 22°49'30.0" S, 43°12'31.1" W  
 Air temperature: 23.5 °C(15:45)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 3-4 m/s  
 Wind direction: SW  
 Secchi-disk reading: 1.0 m  
 Water depth: 5.5 m  
 Water color: Brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	EC (mS/cm)	Sigma-t
0.0	25.36	-	7.95	116	27.94	43.68
0.5	25.19	-	7.57	110	28.01	43.82
1.0	25.31	-	7.48	109	28.00	43.80
1.5	25.19	-	7.46	108	28.21	43.83
2.0	25.04	-	6.87	100	28.33	43.96
2.5	24.75	-	4.43	64	28.99	44.53
3.0	24.13	-	4.52	65	29.54	44.66
3.5	23.70	-	3.22	46	29.87	44.80
4.0	23.08	-	2.46	35	30.53	45.34
4.5	22.69	-	2.11	30	31.17	45.73
5.0	22.56	-	1.81	26	31.41	45.85
5.5	22.48	-	1.35	19	31.50	45.91

Table APP 1.2-6(9) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 15:00-15:16  
 Station: 10  
 Location: 22°49' 58.0" S, 43°03' 01.8" W  
 Air temperature: 24.0 °C(15:00)  
 Weather on the previous day: Cloudy and slightly rain  
 Weather on the day: Cloudy  
 Wind force: 2-3 m/s  
 Wind direction: SW  
 Secchi-disk reading: 0.9 m  
 Water depth: 22.8 m  
 Water color: Brown  
 Garbage: No  
 Oil: No

Depth(m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	EC (mS/cm)	Sigma-t	
0.0	24.08	-	8.16	116	27.98	42.69	18.36
0.5	24.09	-	8.15	116	27.98	42.67	18.35
1.0	24.09	-	7.77	111	27.95	42.64	18.33
1.5	24.00	-	6.98	99	28.13	42.85	18.49
2.0	23.86	-	7.24	103	28.36	43.46	18.71
2.5	23.62	-	5.75	82	29.15	43.51	19.37
3.0	23.48	-	5.15	73	29.57	44.30	19.72
4.0	23.05	-	4.92	70	29.90	44.42	20.09
5.0	22.96	-	4.77	68	30.14	44.61	20.30
6.0	22.76	-	3.56	50	30.48	44.78	20.61
7.0	22.04	-	3.35	47	31.83	46.04	21.83
8.0	21.90	-	3.52	50	32.07	36.67	22.05
9.0	22.04	-	3.78	54	32.71	47.13	22.50
10.0	22.08	-	4.13	59	32.83	47.31	22.58
11.0	22.07	-	3.98	57	32.92	47.30	22.65
12.0	22.00	-	4.01	57	33.00	47.42	22.73
13.0	21.90	-	3.91	55	33.10	47.51	22.83
14.0	21.80	-	3.81	54	33.30	47.61	23.01
15.0	21.80	-	3.94	56	33.34	47.64	23.04
16.0	21.80	-	3.86	55	33.36	47.65	23.05
17.0	21.80	-	3.88	55	33.35	47.65	23.05
18.0	21.60	-	3.21	46	33.34	47.65	23.04

Table APP 1.2-6(10) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 14:25-14:40  
 Station: 11  
 Location: 22°53' 16.2" S, 43°10' 05.0" W  
 Air temperature: 28.1°C (14:30)  
 Wind force: 0-1 m/s  
 Wind direction: SW  
 Water color: Brownish green  
 Secchi-disk reading: 0.5 m  
 Water depth: 3.3 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	Sigma-t
0.0	26.2	9.09	-	19.3	11.26
0.5	25.7	-	-	19.5	11.55
1.0	25.5	-	-	19.6	11.68
1.5	25.1	-	-	20.7	12.62
2.0	24.5	-	-	23.6	14.96
2.3	23.4	8.36	-	24.4	15.86
3.0	22.6	-	-	25.4	16.83

Table APP 1.2-6(11) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 14:55-15:10  
 Station: 12  
 Location: 22°47' 07.1" S, 43°07' 43.8" W  
 Wind force: 1-2 m/s  
 Wind direction: SW  
 Water color: Brown  
 Secchi-disk reading: 0.6 m  
 Water depth: 15.0 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	Sigma-t
0.0	25.3	8.84	-	23.2	14.43
0.5	25.2	-	-	23.3	14.53
1.0	24.8	-	-	25.3	16.14
2.0	23.3	-	-	27.3	18.07
3.0	23.1	-	-	28.9	19.33
5.0	22.3	8.34	-	30.3	20.60
7.0	22.0	-	-	31.0	21.22
10.0	21.5	-	-	31.9	22.03
12.0	21.4	-	-	32.2	22.29
13.0	21.4	-	-	32.3	22.36
14.0	21.4	8.27	-	32.4	22.44

Table APP 1.2-6(12) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 14:00-14:12  
 Station: 13  
 Location:  
 Air temperature: 29.2°C (14:00)  
 Wind force: Non  
 Wind direction: -  
 Water color: Dark brown  
 Secchi-disk reading: 0.3 m  
 Water depth: 2.0 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	Sigma-t	
0.0	27.5	8.73	15.9	228	19.7	11.17
0.5	26.7	-	12.6	178	20.6	12.08
1.0	24.9	-	1.3	18	23.8	14.99
1.5	24.5	8.06	1.7	24	25.2	16.15
2.0	24.2	-	1.3	18	26.0	16.84

Table APP 1.2-6(13) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 14:30-14:42  
 Station: 14  
 Location:  
 Air temperature: 28.5°C (14:30)  
 Wind force: 1-2 m/s  
 Wind direction: SW  
 Water color: Brownish green  
 Secchi-disk reading: 0.4 m  
 Water depth: 5.5 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO (mg/l)	Salinity (‰)	Sigma-t	
0.0	26.2	8.86	15.1	216	22.8	13.86
0.5	26.0	-	13.2	109	23.4	14.37
1.0	24.7	-	6.2	88	26.0	16.69
1.5	24.2	-	4.8	68	26.8	17.44
2.0	23.8	-	4.1	58	27.7	18.23
2.5	23.3	8.19	3.7	53	29.4	19.65
3.0	22.8	-	2.5	36	30.7	20.82
3.5	22.0	-	2.3	32	31.2	21.37
4.0	21.9	8.04	2.2	30	31.2	21.39

Table APP 1.2-6(14) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 15:40-15:55  
 Station: 15  
 Location: 22°45'58.2" S, 43°05'29.8" W  
 Weather on the previous day: Cloudy  
 Weather on the day: Cloudy  
 Air temperature: 27.3 °C(15:40)  
 Wind force: 2-3 m/s  
 Wind direction: SW  
 Water color: Dark brown  
 Secchi-disk reading: 0.8 m  
 Water depth: 8.0 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (%)	Sigma-t
			(mg/l)	(%)		
0.0	26.8	9.03	-	-	17.2	9.52
0.5	26.1	-	-	-	18.6	10.77
1.0	25.0	-	-	-	22.0	13.62
1.5	24.0	-	-	-	25.2	16.29
2.0	23.2	-	-	-	28.4	18.92
3.0	22.1	8.37	-	-	30.5	20.81
5.0	21.8	-	-	-	31.5	21.65
6.0	21.5	-	-	-	31.7	21.88
7.0	21.5	8.29	-	-	31.8	21.96
7.5	21.5	-	-	-	31.8	21.96

Table APP 1.2-6(16) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 15:25-15:37  
 Station: 17  
 Location:  
 Weather on the day: Cloudy  
 Air temperature: 28.0 °C(15:25)  
 Wind force: 1-2 m/s  
 Wind direction: SW  
 Water color: Greenish brown  
 Secchi-disk reading: 0.4 m  
 Water depth: 5.5 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (%)	Sigma-t
			(mg/l)	(%)		
0.0	26.5	8.83	14.6	208	21.3	12.68
0.5	26.1	-	14.3	202	21.2	12.70
1.0	25.0	-	10.5	149	24.8	15.71
1.5	25.2	-	5.9	84	24.2	15.20
2.0	23.8	-	4.1	58	28.4	18.75
2.5	23.2	-	3.5	49	28.9	19.30
3.0	23.1	-	3.5	49	29.0	19.40
3.5	22.6	-	2.4	33	30.0	20.30
4.0	22.5	8.07	1.9	27	30.0	20.32

Table APP 1.2-6(15) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 16:20-16:35  
 Station: 16  
 Location: 22°43'23.4" S, 43°05'05.7" W  
 Weather on the previous day: Cloudy  
 Weather on the day: Cloudy  
 Air temperature:  
 Wind force: 2-3 m/s  
 Wind direction: SW  
 Water color: Brown  
 Secchi-disk reading: 0.8 m  
 Water depth: 5.0 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (%)	Sigma-t
			(mg/l)	(%)		
0.0	27.7	8.96	-	-	13.1	6.22
0.5	26.8	-	-	-	19.6	11.30
1.0	24.9	-	-	-	22.7	14.17
1.5	24.2	-	-	-	24.8	15.94
2.0	23.4	-	-	-	27.5	18.19
3.0	22.9	-	-	-	28.5	19.08
4.0	22.6	8.24	-	-	29.8	20.14
4.5	22.3	-	-	-	30.1	20.45

Table APP 1.2-6(17) Third Simultaneous Survey  
(Spring Tide - High Tide)

Date: November 10, 1992 Time: 15:00-15:10  
 Station: 18  
 Location:  
 Weather on the previous day: Cloudy  
 Weather on the day: Cloudy  
 Air temperature: 28.2 °C(15:00)  
 Wind force: 1-2 m/s  
 Wind direction: SW  
 Water color: Brownish green  
 Secchi-disk reading: 0.4 m  
 Water depth: 4.0 m  
 Garbage: No  
 Oil: No

Depth (m)	Temp. (°C)	pH	DO		Salinity (%)	Sigma-t
			(mg/l)	(%)		
0.0	26.7	8.91	14.8	213	23.0	13.86
0.5	26.9	-	12.8	185	23.3	14.02
1.0	26.0	-	6.0	88	26.8	16.91
1.5	24.3	-	5.2	88	26.8	17.41
2.0	24.2	-	5.3	75	26.9	17.51
2.5	24.2	-	3.7	52	28.0	18.34
3.0	23.2	8.07	1.9	28	30.0	20.13
3.5	22.7	-	1.8	26	30.2	20.42
4.0	22.6	-	1.6	26	30.2	20.45

Table APP 1.5-1(1)

Physical Characteristics  
near the Mouth of the Bay-1Date: May 17, 1992  
Time: 09:40Station: A  
Location: 22°56'02.4" S  
43°08'36.8" W

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	DO(mg/l)	Sigma-t
0.0	25.00	32.25	49.46	8.7	21.29
1.0	24.91	32.49	49.53	8.0	21.50
2.0	24.55	32.95	49.84	7.1	21.95
3.0	24.54	33.18	50.15	6.6	22.13
4.0	24.54	33.42	50.26	6.5	22.31
5.0	24.26	33.58	50.37	6.4	22.51
6.0	24.29	33.73	50.49	6.6	22.62
7.0	24.20	33.66	50.45	6.6	22.59
8.0	24.19	33.71	50.46	6.9	22.63
9.0	24.14	33.75	50.51	6.9	22.68
10.0	24.13	33.74	50.49	7.0	22.67
11.0	24.12	33.78	50.52	7.0	22.71
12.0	24.11	33.81	50.52	7.8	22.73
13.0	24.10	33.81	50.54	7.9	22.73
14.0	24.09	33.84	50.57	7.7	22.76
15.0	24.08	33.90	50.60	7.7	22.81
16.0	24.01	34.04	50.76	7.6	22.93
17.0	24.00	34.08	50.81	7.6	22.97
18.0	23.98	34.13	50.84	7.7	23.01
19.0	23.96	34.24	50.95	7.8	23.10
20.0	23.90	34.37	51.09	7.9	23.22

Date: May 17, 1992  
Time: 11:00Station: A'  
Location: 22°56'02.4" S  
43°08'36.8" W

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	DO(mg/l)	Sigma-t
0.0	24.60	33.45	50.62	7.4	22.31
2.0	23.93	34.28	50.98	6.0	23.14
4.0	23.92	34.28	50.98	5.7	23.14
6.0	23.89	34.33	50.99	5.6	23.19
8.0	23.86	34.34	50.07	5.6	23.20
8.7	23.86	34.39	50.04	5.6	23.24
9.2	23.85	34.41	50.10	5.5	23.26

Date: May 17, 1992  
Time: 12:00  
Station: B

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	DO(mg/l)	Sigma-t
0.0	25.10	32.57	49.92	9.1	21.50
2.0	24.39	33.32	50.20	0.0	22.27
4.0	24.21	33.78	50.56	6.4	22.67
6.0	23.92	34.16	50.99	5.9	23.04
8.0	23.85	34.39	51.01	5.7	23.24
10.0	23.82	34.44	51.10	5.6	23.28
12.0	23.81	34.78	51.10	5.6	23.54
14.0	23.81	34.45	51.12	5.7	23.29
16.0	23.81	34.44	51.10	5.8	23.29
18.0	23.85	34.46	51.10	5.7	23.29
20.0	23.88	34.43	51.09	5.9	23.26
22.0	23.80	34.46	51.10	6.2	23.30
24.0	23.81	34.46	51.10	5.9	23.30
26.0	23.81	34.46	51.10	5.7	23.30
28.0	23.82	34.46	51.10	5.6	23.30
30.0	23.82	34.42	51.07	5.5	23.27
32.0	23.86	34.39	51.06	5.6	23.23
34.0	23.86	34.39	51.06	5.5	23.23
36.0	23.85	34.41	51.08	5.4	23.25
38.0	23.82	34.44	51.09	5.5	23.28
40.0	23.81	34.46	51.10	5.5	23.30

Date: May 17, 1992  
Time: 15:30  
Station: D

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	DO(mg/l)	Sigma-t
2	24.20	34.02	50.90	-	22.85
4	24.06	34.25	50.98	-	23.07
6	24.07	34.23	51.02	-	23.05
8	24.07	34.24	51.12	-	23.06
10	24.05	34.31	51.13	-	23.12
12	24.00	34.63	51.57	-	23.37
14	23.91	34.76	51.60	-	23.50
16	23.92	34.74	51.60	-	23.48
18	23.96	34.72	51.60	-	23.45
20	23.90	34.75	51.60	-	23.49
22	23.89	34.76	51.59	-	23.50
24	23.64	34.94	51.48	-	23.71

Date: May 17, 1992  
Time: 17:00  
Station: E

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	DO(mg/l)	Sigma-t
0	23.71	34.68	51.29	-	23.50
2	23.72	34.69	51.32	-	23.50
4	23.72	34.69	51.32	-	23.50
6	23.72	34.69	51.32	-	23.50
8	23.74	34.68	51.32	-	23.49
10	23.74	34.68	51.32	-	23.49
12	23.74	34.68	51.32	-	23.49
14	23.74	34.68	51.32	-	23.49
16	23.74	34.68	51.32	-	23.49
18	23.74	34.68	51.32	-	23.49

Date: May 17, 1992  
Time: 14:00  
Station: C

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	DO(mg/l)	Sigma-t
0.0	23.82	34.49	51.16	8.9	23.32
2.0	23.78	34.67	51.35	7.7	23.47
4.0	23.78	34.67	51.37	7.1	23.47
6.0	23.77	34.69	51.37	7.0	23.49
8.0	23.77	34.68	51.37	7.0	23.48
9.4	23.77	34.69	51.38	7.1	23.49
11.2	23.76	34.70	51.38	7.1	23.50
13.2	23.77	34.69	51.37	7.0	23.49
15.0	23.77	34.70	51.38	7.1	23.49
16.9	23.76	34.72	51.38	7.0	23.51
18.8	23.76	34.72	51.40	7.0	23.51
20.7	23.78	34.72	51.38	7.0	23.51
22.6	23.76	34.24	51.85	8.9	23.16

Table APP 1.5-1(2) Physical Characteristics near the Mouth of the Bay-2

Date: November 11, 1992  
 Station: St. F-1  
 Location: 22°56' 15.2' S, 43°08' 49.5' W  
 Time: 09:00-09:06  
 Water depth: 22.3 m  
 Weather: Clear  
 Wind force: 0-1 m/s  
 Air temperature: 23.53 °C(09:30)

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	Sigma-t
0.0	22.63	32.37	47.95	22.07
1.0	22.81	32.88	48.06	22.46
2.0	22.60	33.22	48.21	22.72
3.0	22.56	33.34	48.40	22.82
4.0	22.55	33.42	48.46	22.88
5.0	22.53	33.53	48.59	22.97
6.0	22.52	33.53	48.57	22.97
7.0	22.52	33.64	48.71	23.06
8.0	22.50	33.64	48.71	23.06
9.0	22.50	33.64	48.71	23.06
10.0	22.50	33.63	48.70	23.06
11.0	22.51	33.63	48.70	23.05
12.0	22.49	33.67	48.73	23.09
13.0	22.50	33.66	48.73	23.08
14.0	22.50	33.66	48.73	23.08
15.0	22.50	33.67	48.73	23.09
16.0	22.50	33.67	48.74	23.09
17.0	22.50	33.67	48.74	23.09
18.0	22.50	33.67	48.74	23.09
19.0	22.49	33.71	48.78	23.12
20.0	22.47	33.73	48.79	23.14
21.0	22.49	33.74	48.79	23.14
22.0	22.44	33.78	48.84	23.19

Station: St. F-1  
 Time: 10:00-10:10  
 Air temperature: 25.70 °C(10:00)

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	Sigma-t
0.0	23.07	31.63	46.62	21.39
1.0	22.83	31.99	46.92	21.73
2.0	22.76	32.19	47.09	21.90
3.0	22.68	32.37	47.29	22.06
4.0	22.66	32.47	47.32	22.14
5.0	22.65	32.52	47.36	22.18
6.0	22.62	32.74	47.37	22.35
7.0	22.57	32.84	47.92	22.44
8.0	22.52	33.33	48.26	22.82
9.0	22.51	33.50	48.56	22.95
10.0	22.51	33.50	48.54	22.95
11.0	22.51	33.56	48.62	23.00
12.0	22.51	33.58	48.65	23.01
13.0	22.50	33.59	48.70	23.03
14.0	22.50	33.63	48.68	23.06
15.0	22.49	33.68	48.74	23.10
16.0	22.49	33.68	48.74	23.10
17.0	22.49	33.68	48.74	23.10
18.0	22.49	33.68	48.74	23.10
19.0	22.49	33.68	48.74	23.10
20.0	22.49	33.68	48.74	23.10
21.0	22.46	33.69	48.74	23.11

Station: St. F-2  
 Location: 22°56' 12.9' S, 43°08' 46.3' W  
 Time: 11:00-11:10  
 Water depth: 27.4 m  
 Air temperature: 27.4 °C(11:00)

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	Sigma-t
0.0	24.22	30.44	46.11	20.16
1.0	23.05	31.48	46.68	21.28
2.0	22.83	32.06	46.98	21.78
3.0	22.83	32.24	47.29	21.92
4.0	22.81	32.52	47.59	22.13
5.0	22.75	32.68	47.70	22.27
6.0	22.72	32.70	47.70	22.29
7.0	22.64	32.78	47.73	22.38
8.0	22.65	32.76	47.73	22.36
9.0	22.62	32.85	47.87	22.43
10.0	22.56	33.13	48.12	22.66
11.0	22.55	33.20	48.28	22.72
12.0	22.54	33.27	48.29	22.77
13.0	22.54	33.28	48.28	22.78
14.0	22.53	33.29	48.30	22.79
15.0	22.53	33.32	48.42	22.81
16.0	22.52	33.37	48.43	22.85
17.0	22.51	33.42	48.44	22.89
18.0	22.51	33.43	48.44	22.90
19.0	22.51	33.44	48.44	22.91
20.0	22.51	33.44	48.44	22.91
21.0	22.52	33.44	48.44	22.91
22.0	22.52	33.45	48.45	22.91
23.0	22.51	33.52	48.52	22.97
24.0	22.50	33.56	48.56	23.00
25.0	22.50	33.56	48.56	23.00
26.0	22.49	33.60	48.60	23.04
27.0	22.49	33.63	48.63	23.06

Station: St. F-1  
 Time: 09:30-09:38

Depth(m)	Temp.(°C)	Salinity(%)	EC(mS/cm)	Sigma-t
0.0	22.75	32.71	47.76	22.29
1.0	22.66	32.92	47.89	22.48
2.0	22.51	33.51	48.54	22.96
3.0	22.50	33.52	48.54	22.97
4.0	22.50	33.51	48.56	22.97
5.0	22.50	33.51	48.56	22.97
6.0	22.49	33.57	48.60	23.01
7.0	22.49	33.58	48.62	23.02
8.0	22.49	33.58	48.60	23.02
9.0	22.49	33.57	48.62	23.01
10.0	22.50	33.57	48.62	23.01
11.0	22.50	33.58	48.65	23.02
12.0	22.49	33.61	48.67	23.04
13.0	22.49	33.64	48.71	23.07
14.0	22.49	33.65	48.71	23.07
15.0	22.46	33.67	48.73	23.10
16.0	22.46	33.67	48.73	23.10
17.0	22.47	33.66	48.71	23.09
18.0	22.47	33.65	48.71	23.08
19.0	22.47	33.67	48.71	23.09
20.0	22.47	33.67	48.73	23.09
21.0	22.46	33.67	48.71	23.10
22.0	22.45	33.71	48.79	23.13

Table APP 1.5-1(3) Physical Characteristics near the Mouth of the Bay-2

Station: St. F-2				
Time: 12:00-12:10				
Depth(m)	Temp.(°C)	Salinity(‰)	EC(mS/cm)	Sigma-t
0.0	23.27	32.72	47.79	22.15
0.5	22.61	33.21	43.21	22.71
1.0	22.58	33.22	43.21	22.73
2.0	22.54	33.19	43.18	22.71
3.0	22.58	33.21	43.17	22.72
4.0	22.54	33.20	43.28	22.72
5.0	22.54	33.19	43.18	22.71
6.0	22.54	33.20	43.17	22.72
7.0	22.54	33.20	43.17	22.72
8.0	22.54	33.20	43.18	22.72
9.0	22.54	33.20	43.18	22.72
10.0	22.55	33.18	43.22	22.70
11.0	22.55	33.16	43.14	22.69
12.0	22.55	33.16	43.15	22.69
13.0	22.55	33.16	43.14	22.69
14.0	22.55	33.16	43.12	22.69
15.0	22.55	33.14	43.14	22.67
16.0	22.54	33.18	43.18	22.71
17.0	22.52	33.34	43.34	22.83
18.0	22.52	33.34	43.35	22.83
19.0	22.52	33.38	43.37	22.86
20.0	22.51	33.39	43.39	22.87
21.0	22.51	33.32	43.40	22.82
22.0	22.51	33.39	43.40	22.87
23.0	22.51	33.48	43.40	22.94
24.0	22.50	33.67	43.67	23.01
25.0	22.43	33.66	43.67	23.10
26.0	22.43	33.69	43.70	23.12
27.0	22.41	33.7	43.71	23.13

Station: St. F-2				
Time: 13:10-13:18				
Depth(m)	Temp.(°C)	Salinity(‰)	EC(mS/cm)	Sigma-t
0.0	25.33	29.61	46.00	19.21
1.0	24.73	29.84	45.78	19.56
2.0	22.97	31.13	45.87	21.04
3.0	22.56	31.83	46.42	21.68
4.0	22.61	31.89	46.53	21.71
5.0	22.63	32.59	47.48	22.24
6.0	22.62	32.60	47.48	22.25
7.0	22.62	32.61	47.50	22.25
8.0	22.56	33.10	48.18	22.64
9.0	22.54	33.27	48.28	22.77
10.0	22.54	33.30	48.23	22.80
11.0	22.53	33.33	48.35	22.82
12.0	22.52	33.42	48.43	22.89
13.0	22.51	33.52	48.57	22.97
14.0	22.50	33.54	48.57	22.99
15.0	22.50	33.57	48.62	23.01
16.0	22.49	33.58	48.64	23.02
17.0	22.50	33.59	48.64	23.03
18.0	22.47	33.61	48.65	23.05
19.0	22.47	33.61	48.65	23.05
20.0	22.49	33.61	48.65	23.04
21.0	22.48	33.61	48.65	23.05
22.0	22.46	33.61	48.65	23.05

Station: St. F-2  
Time: 14:00-14:10

Depth(m)	Temp.(°C)	Salinity(‰)	EC(mS/cm)	Sigma-t
0.0	23.04	32.71	48.15	22.21
1.0	23.01	32.68	48.06	22.20
2.0	23.06	32.67	48.06	22.17
3.0	23.09	32.74	48.12	22.22
4.0	22.94	32.85	48.12	22.34
5.0	22.99	32.90	48.17	22.37
6.0	22.89	32.89	48.20	22.39
7.0	22.84	32.99	48.18	22.48
8.0	22.82	33.03	48.31	22.51
9.0	22.20	32.92	48.20	22.60
10.0	22.80	32.95	48.22	22.46
11.0	22.55	32.95	48.18	22.53
12.0	22.88	32.92	48.25	22.41
13.0	22.53	33.42	48.46	22.69
14.0	22.64	33.24	48.36	22.72
15.0	22.53	33.17	48.40	22.70
16.0	22.62	33.35	48.39	22.81
17.0	22.52	33.48	48.51	22.94
18.0	22.49	33.52	48.54	22.98
19.0	22.49	33.51	48.54	22.97
20.0	22.47	33.54	48.54	23.00
21.0	22.49	33.53	48.56	22.98
22.0	22.47	33.54	48.54	23.00

Station: St. F-2  
Time: 15:00-15:10

Depth(m)	Temp.(°C)	Salinity(‰)	EC(mS/cm)	Sigma-t
0.0	23.16	33.17	48.74	22.52
1.0	23.12	33.18	48.76	22.54
2.0	23.12	33.20	48.74	22.55
3.0	23.11	33.19	48.74	22.55
4.0	23.07	33.24	48.76	22.60
5.0	23.08	33.22	48.74	22.58
6.0	23.07	33.22	48.78	22.58
7.0	23.05	33.23	48.76	22.60
8.0	23.07	33.25	48.74	22.61
9.0	23.04	32.29	48.76	21.89
10.0	23.03	32.30	48.23	21.90
11.0	23.03	32.30	48.82	21.90
12.0	23.03	32.33	48.84	21.93
13.0	23.03	33.35	48.82	22.69
14.0	23.01	33.36	48.85	22.71
15.0	22.99	33.35	48.85	22.70
16.0	22.88	33.42	48.89	22.79
17.0	22.78	33.46	48.79	22.85
18.0	22.81	33.46	48.76	22.84
19.0	22.76	33.47	48.76	22.86
20.0	22.77	33.49	48.81	22.87
21.0	22.77	33.50	48.81	22.88
22.0	22.80	33.50	48.79	22.87



Table APP 1.7-1(1)

## Field Record of the Preliminary Survey-1

Date: April 23, 1992 Time: 09:20-10:07  
 Station: PI-1 Location: 22°54'58.9" S, 43°08'29.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 24.9 °C (09:27)  
 Light intensity at 0 m: 15000 lux (no. 5 filter), 2600 uE  
 1 % light intensity water depth: 4.6 m  
 Water color: Greenish brown  
 Secchi-disk reading: 2.6 m  
 Water depth: 15.5m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l) (%)	pH	Sigma-t
0.0	24.24	33.45	50.20	4.5	67	22.469
1.0	23.90	33.80	50.34	4.4	85	22.838
2.0	23.82	34.00	50.52	4.6	88	23.016
5.0	23.75	34.50	51.07	4.9	73	23.420
7.0	23.74	34.58	51.18	5.0	74	23.484
10.0	23.69	34.71	51.31	5.0	74	23.599
15.0	23.78	34.71	51.51	5.0	74	23.572

Table APP 1.7-1(2)

## Preliminary Survey - 1

Date: April 23, 1992 Time: 10:20-10:35  
 Station: PI-2 Location: 22°55'00.1" S, 43°08'25.3" W  
 Water color: Greenish dark brown  
 Secchi-disk reading: 0.8 m  
 Water depth: 21.9 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l) (%)	pH	Sigma-t
0.0	24.95	33.21	50.59	9.8	121	22.072
1.0	24.47	33.30	50.23	7.5	92	22.285
3.0	24.09	33.68	50.42	6.8	82	22.690
5.0	24.00	33.98	50.67	5.1	62	22.947
7.0	23.79	34.34	50.92	5.1	62	23.285
10.0	23.76	34.38	50.96	5.2	63	23.325
15.0	23.68	34.54	51.08	5.3	64	23.468
20.0	23.60	34.74	51.27	5.7	69	23.648

Table APP 1.7-1(3)

## Preliminary Survey - 1

Date: April 23, 1992 Time: 10:50-11:08  
 Station: PI-3 Location: 22°54'51.4" S, 43°08'57.4" W  
 Light intensity at 0 m: 17000 lux (no.5 filter), 2500 uE  
 1 % light intensity water depth: 5.2 m  
 Water color: Greenish brown  
 Secchi-disk reading: 2.5 m  
 Water depth: 6.2 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l) (%)	pH	Sigma-t
0.0	25.57	33.67	51.67	8.1	122	22.234
1.0	24.80	33.94	51.41	7.1	106	22.676
2.0	24.34	33.98	51.10	5.8	87	22.848
3.0	24.38	34.12	51.24	4.8	71	22.941
4.0	24.06	34.23	51.09	4.5	67	23.121
5.0	23.80	34.34	50.98	3.7	54	23.282
5.3	23.46	34.57	-	0.2	2	23.559
5.5	23.46	34.58	-	0.2	2	23.567
6.0	23.41	34.58	50.85	0.1	1	23.581

Table APP 1.7-1(4)

## Preliminary Survey - 1

Date: April 23, 1992 Time: 11:27-11:40  
 Station: PI-4 Location: 22°56'09.4" S, 43°08'11.8" W  
 Water color: Greenish brown  
 Secchi-disk reading: 1.4 m  
 Water depth: 30.8 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l) (%)	pH	Sigma-t
0.0	25.24	33.55	51.37	7.9	119	22.244
1.0	25.10	33.48	51.21	7.9	117	22.241
3.0	24.20	33.79	50.62	6.9	102	22.742
4.0	24.24	33.71	50.56	6.4	95	22.669
5.0	24.01	33.94	50.63	5.1	75	22.913
7.0	23.86	34.24	51.00	5.0	74	23.188
10.0	23.88	34.54	51.26	5.2	76	23.412
15.0	23.78	34.73	51.18	5.1	75	23.588
20.0	23.76	34.73	51.58	5.4	80	23.594
25.0	23.70	34.76	51.58	5.3	78	23.534
30.0	23.67	34.72	51.29	5.1	74	30.543

Table APP 1.7-1(5)

## Preliminary Survey - 1

Date: April 23, 1992 Time: 13:55-13:15  
 Station: PI-5 Location: 22°55'54.9" S, 43°08'34.5" W  
 Water color: Brown (transparent)  
 Secchi-disk reading: 1.3 m  
 Water depth: 30.5 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	DO (%)	pH	Sigma-t
0.0	25.06	33.33	50.85	9.0	133	8.01	22.130
0.7	25.09	33.33	50.88	-	-	-	22.121
2.0	24.83	33.36	50.82	5.4	93	-	22.223
2.1	24.24	33.64	50.45	-	-	-	22.615
2.8	23.77	33.68	51.57	4.9	71	-	22.785
3.0	24.11	33.90	50.69	5.0	73	-	22.853
3.5	24.29	33.91	50.67	-	-	7.86	22.807
5.0	24.02	34.04	50.79	5.0	73	-	22.987
7.1	23.87	34.21	50.85	-	-	-	23.162
9.8	23.90	34.23	50.85	4.8	70	7.87	23.188
10.6	23.82	34.51	51.18	-	-	-	23.407
14.5	23.80	34.66	51.34	5.1	74	-	23.528
18.8	23.74	34.74	51.41	-	-	-	23.607
19.8	23.68	34.77	51.48	4.9	78	-	23.648
25.0	23.65	34.81	51.41	-	-	-	23.698

Table APP 1.7-1(7)

## Preliminary Survey - 1

Date: April 23, 1992 Time: 15:00-15:12  
 Station: PI-7 Location: 22°53'19.6" S, 43°09'11.9" W  
 Wind force: 4 m/s  
 Wind direction: South  
 Water color: Brown  
 Secchi-disk reading: 1.4 m  
 Water depth: 33.0 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	DO (%)	pH	Sigma-t
0.0	25.07	33.19	50.74	8.0	119	7.98	22.020
1.0	25.16	33.19	50.73	7.9	118	-	21.983
2.0	25.14	33.19	50.76	7.8	115	-	21.988
3.0	25.03	33.23	50.65	6.7	99	-	22.063
4.0	24.37	33.58	50.51	4.7	88	-	22.530
5.0	24.24	33.71	50.54	4.3	83	-	22.669
10.0	23.85	34.26	50.88	4.2	82	-	23.206
15.0	23.06	34.68	51.24	4.3	82	-	23.760
20.0	23.57	34.72	51.20	4.9	71	-	23.642
25.0	23.51	34.75	51.18	4.7	69	-	23.683
30.0	23.46	34.74	51.12	4.7	67	-	23.690

Table APP 1.7-1(6)

## Preliminary Survey - 1

Date: April 23, 1992 Time: 14:38-14:55  
 Station: PI-6 Location: 22°53'50.6" S, 43°09'42.5" W  
 Light intensity at 0 m: 10000 lux, 2100 uE  
 1% light intensity water depth: 2.4 m  
 Water color: Brown (transparent)  
 Secchi-disk reading: 1.2 m  
 Water depth: 17.0 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	DO (%)	pH	Sigma-t
0.0	25.34	33.14	50.90	10.3	153	-	21.889
1.0	25.34	33.17	50.93	10.4	154	-	21.922
3.0	24.84	33.27	50.63	9.5	140	-	22.151
4.0	24.41	33.45	50.37	5.5	81	-	22.418
5.0	24.39	33.46	50.35	5.5	81	-	22.432
7.0	23.84	34.21	50.73	4.1	59	-	23.171
10.0	23.69	34.66	51.27	4.6	66	-	23.561
15.0	23.61	34.79	51.35	5.0	72	-	23.684

Table APP 1.7-1(8)

## Preliminary Survey - 1

Date: April 23, 1992 Time: 16:20-16:32  
 Station: PI-8 Location: 22°53'16.2" S, 43°10'05.0" W  
 Water color: Brown  
 Secchi-disk reading: 1.2 m  
 Water depth: 13.0m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	DO (%)	pH	Sigma-t
0.0	25.51	33.31	51.24	9.2	138	8.01	21.931
1.0	25.48	33.32	51.15	9.3	139	-	21.948
2.0	25.23	33.32	51.06	9.3	139	-	22.025
3.0	24.33	33.58	50.45	8.7	132	-	22.478
3.5	24.24	33.71	50.51	7.8	114	-	22.617
4.0	24.08	33.86	50.60	6.0	89	-	22.778
5.0	23.93	34.03	50.67	3.9	57	-	22.951
7.0	23.81	34.27	50.77	3.6	54	-	23.167
10.0	23.70	34.33	50.90	3.6	54	-	23.245
12.0	23.61	34.54	51.01	3.7	55	-	23.423

Table APP 1.7-1(11) Preliminary Survey - 1

Date: April 23, 1992 Time: 16:12-16:16  
 Station: P1-11 Location: 22°51'57.4" S, 43°10'57.3" W  
 Water color: Grayish green brown (not transparent)  
 Secchi-disk reading: 1.5 m  
 Water depth: 8.1 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	(%)	pH	Sigma-t
0.0	25.63	32.88	50.81	4.7	71	7.84	21.572
1.0	25.63	32.88	50.82	4.7	71	-	21.572
2.0	25.63	32.88	50.81	4.6	70	-	21.572
3.0	25.44	33.01	50.76	4.4	68	-	21.728
4.0	24.48	33.41	50.54	3.3	50	-	22.320
4.5	24.29	33.85	50.48	3.2	48	-	22.557
5.0	24.06	33.79	50.48	2.1	31	-	22.731
7.0	24.02	33.83	50.49	1.7	26	-	22.773

Table APP 1.7-1(12) Preliminary Survey - 1

Date: April 23, 1992 Time: 16:20-16:30  
 Station: P1-12 Location: 22°51'56.6" S, 43°11'57.7" W  
 Water color: Grayish green brown  
 Secchi-disk reading: 1.4 m  
 Water depth: 9.1 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	(%)	pH	Sigma-t
0.0	25.22	33.26	50.92	8.3	124	7.84	21.983
1.0	25.24	33.24	50.92	8.4	125	-	21.962
2.0	25.24	33.25	50.93	8.4	125	-	21.969
3.0	25.22	33.37	50.71	7.4	110	-	22.068
3.5	24.51	33.49	51.00	6.5	97	-	22.371
4.0	24.39	33.56	50.49	5.0	74	-	22.463
4.5	24.26	33.63	50.49	4.3	63	-	22.551
5.0	24.16	33.74	50.51	3.6	54	-	22.664
7.0	23.87	34.01	50.49	3.0	44	-	22.953
8.0	23.65	34.31	50.63	2.4	35	-	23.244

Table APP 1.7-1(9) Preliminary Survey - 1

Date: April 23, 1992 Time: 15:40-15:50  
 Station: P1-9 Location: 22°53'01.6" S, 43°11'31.0" W  
 Water color: Grayish green brown  
 Secchi-disk reading: 1.6 m  
 Water depth: 8.0 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	(%)	pH	Sigma-t
0.0	25.09	33.09	50.56	4.6	72	8.01	21.895
1.0	25.06	33.09	50.56	4.6	72	-	21.904
2.0	25.04	33.12	50.54	4.6	68	-	21.933
3.0	24.78	33.30	50.54	4.4	65	-	22.147
3.5	24.71	33.34	50.51	4.0	59	-	22.198
4.0	24.47	33.47	50.51	3.1	46	-	22.368
4.5	24.39	33.56	50.46	2.7	40	-	22.480
5.0	24.21	33.69	50.49	1.9	28	-	22.611
7.0	23.88	33.46	50.54	1.7	24	-	22.536

Table APP 1.7-1(10) Preliminary Survey - 1

Date: April 23, 1992 Time: 15:55-16:05  
 Station: P1-10 Location: 22°52'53.5" S, 43°12'03.1" W  
 Water color: Grayish green brown  
 Secchi-disk reading: 1.3 m  
 Water depth: 4.0 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	(%)	pH	Sigma-t
0.0	25.91	32.75	50.93	4.6	69	7.61	21.387
0.5	25.95	32.77	50.98	4.6	68	-	21.390
1.0	25.95	32.77	50.99	4.6	68	-	21.390
1.5	25.94	32.78	50.98	4.5	68	-	21.401
2.0	25.94	32.76	50.96	4.6	69	-	21.386
2.5	25.95	32.76	50.95	4.4	66	-	21.392
3.0	25.96	32.74	50.95	4.3	65	-	21.384
3.5	25.97	32.71	50.92	4.3	65	-	21.339

Table APP 1.7-1(13) Preliminary Survey - 1

Date: April 23, 1992 Time: 16:43-16:50  
 Station: P1-13 Location: 22°52'02.2" S, 43°09'36.7" W  
 Water color: Grayish green brown  
 Secchi-disk reading: 1.4 m  
 Water depth: 21.0 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	pH	Sigma-t
0.0	24.91	33.27	50.62	6.9	102	8.01
3.0	24.88	33.28	50.62	6.0	89	-
5.0	24.00	34.03	50.71	3.8	56	-
7.0	23.92	34.10	50.71	3.7	55	-
8.7	23.71	34.38	50.92	4.0	59	-
13.0	23.56	34.66	51.10	4.1	60	-
15.6	23.51	34.70	51.12	4.0	59	-

Table APP 1.7-1(15) Preliminary Survey - 1

Date: April 24, 1992 Time: 10:57-11:08  
 Station: P1-15 Location: 22°57'38.5" S, 43°07'03.5" W  
 Water color: Greenish dark brown  
 Secchi-disk reading: 3.0 m  
 Water depth: 18.1 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	pH	Sigma-t
0.0	24.63	34.26	51.46	6.1	91	7.92
1.0	24.47	34.42	51.41	5.9	88	-
3.0	24.02	34.80	51.51	5.8	86	-
4.0	24.01	34.66	51.59	5.7	85	-
5.0	24.00	34.66	51.60	5.7	85	-
10.0	23.66	34.98	51.51	5.7	84	-
11.0	23.43	35.03	51.40	-	-	-
12.0	22.61	35.35	50.87	-	-	-
15.0	21.31	35.42	49.78	5.9	85	-
18.0	21.25	35.42	49.70	5.9	84	-

Table APP 1.7-1(14) Preliminary Survey - 1

Date: April 24, 1992 Time: 10:07-10:30  
 Station: P1-14 Location: 22°58'03.5" S, 43°03'55.0" W  
 Weather on the previous day: Clear  
 Weather on the day: Clear  
 Air temperature: 27.2 °C (13:30)  
 Wind force: 3 m/s  
 Wind direction: SSE  
 Light intensity on the surface: 25500 lux (no.5 filter)  
 Light intensity at 0 m: 15000 lux  
 1% light intensity water depth: 3.1 m  
 Water color: Dark greenish brown  
 Secchi-disk reading: 13.6 m  
 Water depth: 18.5 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	pH	Sigma-t
0.0	24.79	34.87	52.66	6.8	102	7.95
1.0	24.76	34.87	52.66	6.8	102	-
3.0	24.50	34.92	52.43	6.9	103	-
5.0	24.42	34.99	52.37	6.7	100	7.96
10.0	23.92	35.23	51.16	6.5	97	7.93
15.0	20.46	35.48	49.06	5.8	82	-
18.0	20.33	35.50	48.85	5.7	80	8.02

Table APP 1.7-1(16) Preliminary Survey - 1

Date: April 24, 1992 Time: 11:20-11:26  
 Station: P1-16 Location: 22°58'07.0" S, 43°08'29.8" W  
 Water color: Dark green  
 Secchi-disk reading: 3.6 m  
 Water depth: 16.5 m

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	pH	Sigma-t
0.0	24.49	34.31	51.85	5.8	86	7.92
1.0	24.57	34.36	51.71	5.8	86	-
2.0	24.05	34.50	51.45	-	-	-
3.0	23.98	34.60	51.46	5.5	81	-
4.0	23.96	34.60	51.45	5.5	81	-
5.0	23.95	34.67	51.46	5.5	81	-
7.0	23.78	34.79	51.51	5.6	82	-
10.0	23.20	35.15	51.45	5.6	83	-
13.0	23.14	35.35	49.79	5.9	86	-
14.0	20.22	35.47	48.70	-	-	-
15.0	20.13	35.51	48.65	5.8	81	-
16.0	20.14	35.49	48.65	5.7	79	-

Table APP 1.7-1(17) Preliminary Survey - 1

Date: April 24, 1992  
 Station: PI-17  
 Water color: Greenish brown (transparent)  
 Secchi-disk reading: 3.0 m  
 Water depth: 32.0 m

Time: 11:45-12:05  
 Location: 22°57'02.9" S, 43°08'48.0" W

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	pH	Sigma-t
0.0	25.06	33.92	51.63	6.4	96	22.528
1.0	24.63	34.19	51.48	6.3	94	22.862
2.0	24.31	34.23	51.38	5.8	87	22.988
3.0	24.13	34.47	51.43	5.8	83	23.223
4.0	24.08	34.52	51.45	5.4	80	23.275
5.0	24.00	34.60	51.45	5.3	79	23.359
7.0	23.97	34.61	51.46	5.2	78	23.376
10.0	23.68	34.77	51.38	5.4	80	23.582
13.0	23.54	34.94	51.27	5.6	82	23.752
14.0	23.54	34.94	51.27	5.6	82	23.752
15.0	22.52	35.02	50.59	5.8	84	24.108
20.0	21.64	35.23	49.98	5.8	83	24.515
25.0	19.76	35.48	48.26	5.7	79	25.212
30.0	19.50	35.54	48.04	5.7	78	25.326

Table APP 1.7-1(19) Preliminary Survey - 1

Date: April 24, 1992  
 Station: PI-19  
 Weather on the day: Cloudy and windy  
 Air temperature: 27.2 °C (13:30)  
 Wind force: 7 m/s  
 Wind direction: SSE  
 Water color: Brown  
 Secchi-disk reading: 1.5 m  
 Water depth: 26.0 m

Time: 13:27-13:37  
 Location: 22°54'10.3" S, 43°08'25.5" W

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	pH	Sigma-t
0.0	25.73	33.11	51.21	9.7	146	21.713
1.0	25.75	33.10	51.26	9.6	145	21.700
2.0	24.76	33.21	51.92	7.7	114	22.085
3.0	24.90	33.33	50.76	6.9	102	22.133
4.0	24.76	33.38	50.63	5.9	87	22.213
5.0	24.67	33.42	50.62	5.4	80	22.270
7.0	24.51	33.90	51.07	5.1	76	22.680
10.0	23.77	34.66	51.31	4.6	68	23.473
15.0	23.68	34.70	51.30	4.5	66	23.529
20.0	23.66	34.74	51.31	4.4	65	23.566
25.0	23.60	34.75	51.23	4.3	63	23.591

Table APP 1.7-1(18) Preliminary Survey - 1

Date: April 24, 1992  
 Station: PI-18  
 Water color: Light greenish brown (oily), bubbles  
 Secchi-disk reading: 2.0 m  
 Water depth: 12.0 m

Time: 12:10-12:20  
 Location: 22°56'24.5" S, 43°10'01.1" W

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	pH	sigma-t
0.0	25.43	34.02	52.12	6.3	96	22.489
1.0	25.31	33.98	51.96	6.2	93	22.481
2.0	24.55	34.11	51.40	6.3	94	22.826
3.0	24.35	34.21	51.27	6.4	95	22.961
4.0	24.18	34.28	51.26	5.3	79	23.072
5.0	23.92	34.42	51.16	4.4	64	23.247
7.0	23.58	34.58	50.99	3.9	57	23.468
10.0	23.22	34.75	50.90	2.0	30	23.702
11.0	23.14	34.81	50.87	1.7	26	23.771

Table APP 1.7-1(20) Preliminary Survey - 1

Date: April 24, 1992  
 Station: PI-20  
 Water color: Greenish brown  
 Secchi-disk reading: 1.5 m  
 Water depth: 8.0 m

Time: 13:46-13:55  
 Location: 22°53'01.1" S, 43°08'25.59" W

Depth (m)	Temp. (°C)	Salinity (%)	EC (mS/cm)	DO (mg/l)	pH	Sigma-t
0.0	26.18	32.71	51.12	10.3	156	21.273
1.0	26.19	32.74	51.09	10.1	153	21.292
2.0	24.81	33.18	50.42	6.0	89	22.046
3.0	24.76	33.27	50.48	5.3	79	22.130
3.5	24.78	33.32	50.59	-	-	22.162
4.0	24.60	33.50	50.60	4.9	72	22.352
5.0	24.49	33.59	50.65	4.2	62	22.452
7.0	24.24	33.66	50.70	3.7	55	22.730