2. Water Quality

2.1. Overview of Existing Information

The water quality environment in the Pearl River Estuary is influenced by the seasonal change of river water discharge and tidal change (Wu, 1995). Changes in salinity and SS have particularly wide ranges.

2.1.1. Salinity

The influence of river water and tide directly affects salinity. In the upper layer, salinity ranges widely, from approximately 0 to 25 (Huang et al., 1997). Salinity of less than 10 is distributed widely in the estuary throughout the rainy season.

Salinity in the lower layer also ranges widely, from approximately 0 to 30. The lower layer is more strongly influenced by tides than the upper layer. Therefore, daily changes of the salinity are greatest during the spring tide. The salinity contour shows a great inclination from north towards the south in the rainy season. The contour shows similar distribution in the dry season, but the inclination is lower.

2.1.2. SS

Water of the Pearl River has a high SS concentration, due to a large amount of heavy soil particles. This is similar to other major river in China.

The range of SS concentration in the upper layer of the estuary is approximately 0 to 200 mg/L. The horizontal distribution tends to decline in relation to the distance from the river mouth (i.e. decline towards the outside of the estuary). Therefore, the highest contour line of SS appears at the northwestern part of the estuary, where four outlets, Humen, Jiaomen, Hengmen, and Hongquimen inflow, and it is shaped in stripes heading towards south, i.e. to the mouth of the estuary.

The range of SS concentrations in the middle and the lower layer are almost the same as in the upper layer. The distribution of SS concentrations seems to be mainly related to river discharges rather than tidal change.

2.1.3. Organic matter

TOC and COD_{Mn} are used as indices for organic matter. COD_{Mn} ranges from 1 to 3 mg/L (Long et al., 2000; Wang et al., 1987; Zhou, 1994; Zhang, 1995). It shows a significantly high value around the mouths of the Pearl River system.

Zooplankton and phytoplankton are also components of organic matter, not found in significant quantity in the river water. Judging from the quantities of Chlorophyll-a or phytoplankton present in the estuary, their bloom seems to occur not in the inner bay, but in the outer sea. Organic matter produced within the estuary settles in the bottom layer but is eventually carried away to the outer sea without accumulation.

2.1.4. Nutrients

There are high concentrations of nitrate and silicate in the river water in the Pearl River Estuary. Nitrate ranges from 0.5 to 2.0 mg/L and silicate from 1 to 10 mg/L (Zhou, 1994; Peng et al., 1993; Huang et al., 1997; Jiang et al., 1995).

In contrast, these substances are not in such high concentrations in the offshore water. Therefore, the concentrations of these substances in the river and in offshore water are in contrast.

Phosphorus is also one of the major of nutrients in the estuary. Although its distribution pattern is similar to nitrate and silicate, it does not show any relationship with salinity distribution.

From the view-point of primary production, the concentrations of both nitrogen and phosphorus are very high, although phosphorus is often limited by amount of algal multiplication.

2.1.5. Heavy metals

Small amounts of the heavy metals, Pb, Cd, Hg, Cu, Zn, and As, have been detected in the estuary (Zhou, 1994; Wang et al., 1987). However, judging from the data, they do not seem to influence human health significantly, because:

- numerical values are within the acceptable level; and
- SS is so high in the estuary that those substances are easy to detect because of their terrestrial origin.

Measurements of heavy metals in plankton and fish have been carried out as an indicator for heavy metal pollution.

2.1.6. Oil contents

The analytical method that the Chinese use to measure oil contents is not intended for specified oils, but for all oil contents and organic matters extracted in an organic solvent (i.e. n-Hexane). According to previous survey results, oil contents in the estuary are usually only detected at very low levels, except in the case of oil accidents.

It is necessary to consider that the reported results of oil contents are often from samples collected from the layer one meter below the surface, according to the Chinese regulation. This sampling method does not seem suitable to accurately identify the pollutant condition of oil contents; specific sampling methods for oil contents should be reviewed and established.

2.1.7. Environmental Problems in the Study Area

(1) Dredging

Because of the significant amount of SS, silt, sand inflows and sedimentation in the estuary, the bottom mud is accumulating rapidly. Therefore, dredging is required to maintain navigation channels on a regular basis. Two major channels lead directly from Humen to the mouth of the estuary.

The depth of the channel in the vicinity of Humen is approximately 25 m and is deeper than other areas. In this local deep area, there is a possibility that some water quality problems may happen, such as low temperature, poor oxygen, etc. These may result in a biological disturbance that reduces the abundance of organisms, decomposition of bottom sediment, and occurrence of deoxidized substances, such as NH_4-N and H_2S.

(2) Reclamation

Because of the shallow depth in the coastal area, especially in the western coast, an extensive mud flat area appears at low tide, and a reclamation plan for the area is underway.

Although reclamation projects that consider the environment have been carried out, some impacts on the ecosystem are unavoidable. The risk of reducing the abundance of organisms, especially endangered species, needs to be minimized and close attention must be paid to develop strategies to ensure this. Tidal flats are important as a feeding or resting area for many creatures, including migratory birds that are not permanent inhabitants. In addition, they play an important role in improving water quality, such as by promoting DO supply and the decomposition of organic matter.

2.2. The Water Quality Monitoring Program

The results of two water monitoring surveys over two seasons in the Pearl River Estuary were compared to see whether the water complied with the 'Chinese Environmental Standard for Seawater'. The results indicated potential water quality issues in pH, DO, COD, SS, I-N, PO_4-P, oils, Pb and Zn (See Tables 2.2.1 and 2.2.2). In particular, I-N and PO_4-P exceeded the limit significantly. Water pollution, indicated by COD, was also significant among the urban coastal areas. The most polluted areas were Shenzhen Bay and the upper bay. The extent of the pollution in Shenzhen Bay was also significant, particularly in terms of PO_4-P.

River-origin pollutants, especially NO_3-N and COD, were transported towards the bay mouth while being diluted and/or diffused by the great quantity of river discharge of four outlets (Humen, Jaomen, Hongquimen, and Hengmen) and high speed tidal currents. However, in Shenzhen Bay or in the upper bay area, topographically close to land, nutrients and COD were in high concentrations due to pollutant load being directly discharged from the urban area.

The high SS concentration was mainly caused by re-suspension induced by high speed tidal currents. Thus it was often observed at the bottom layer. Such high SS water mass sometimes even reached the surface in shallow depth areas where high current speed dominated.

The following section describes the status of each pollution item.

2.2.1. Salinity

In the rainy season, almost the entire estuary area, from the upper bay down to the bay mouth, was influenced by freshwater because of the great discharge from the Pearl River. In the dry and transient season, the low salinity area was limited to the upper bay or river mouths only, because of less discharge from the River.

The horizontal distribution pattern of salinity is summarized as follows:

- rainy season - low at the upper bay and high at the bay mouth;
- dry and transient seasons - low at the western and high at the eastern part.

During the spring tide, vertical mixing by high-speed tidal currents occurred in all layers, especially in shallow depth survey points. Conversely, during the neap tide, when there is less influence of the tidal current, salinity showed a stronger gradient and stratification formed. In the rainy season, in particular, strong stratification of salinity formed over almost the entire estuary.

At the western part of bay mouth, where the weak stratification formed in all seasons, salinity of each layer in the neap tide was lower than in the spring tide. At the eastern part of bay mouth, stratification formed in the rainy season, particularly during the neap tide. (See Table 2.2.3).

Table 2.2.3 Water Quality (Salinity)

Area / Layer (Season / Tide)		Rainy		Dry		Transient
		Spring Tide	Neap Tide	Spring Tide	Neap Tide	Neap Tide
Average of Survey Area	Upper	11.13	6.26	24.05	21.93	20.28
	Bottom	18.12	19.41	25.15	25.99	25.60
Bay Head (P01)	Upper	0.15	0.53	10.73	14.20	5.88
	Bottom	0.20	15.12	14.42	23.09	20.78
River Mouth (P04)	Upper	0.13	0.11	0.25	0.22	0.28
	Bottom	0.13	0.11	1.54	4.82	13.13
Shenzhen Bay (P10)	Upper	6.60	11.30	25.96	26.17	24.52
	Bottom	6.61	12.54	25.96	27.88	25.17
Central Bay (P11)	Upper	8.42	2.94	27.64	22.28	22.26
	Bottom	22.90	25.79	28.56	30.75	28.64
Western part of Bay Mouth (P24)	Upper	24.32	11.16	25.98	21.23	20.09
	Bottom	31.31	22.05	30.11	25.72	24.50
Eastern part of Bay Mouth (P18)	Upper	23.73	13.45	32.03	32.47	30.41
	Bottom	33.29	33.76	32.15	32.49	31.25

2.2.2. DO (Dissolved Oxygen)

The DO concentration was low in the upper layer in the rainy season, and a mild DO concentration gradient formed vertically. However, this did not indicate an anaerobic condition for the bottom layer. The horizontal distribution showed a low concentration in the eastern part of the bay mouth.
In the dry and transient seasons, DO was almost saturated in all layers over the entire estuary, except in the Shenzhen Bay where the DO concentration was lower. A vertical concentration gradient of DO was not clear.

2.2.3. COD (Chemical Oxygen Demand)

The COD in the entire estuary was high in the rainy season, and low in the dry and transient seasons. During the neap tide in the rainy season, the COD of the upper layer was high, but in the other seasons, such vertical distributions were not clear.

The COD was high in Shenzhen Bay, the upper bay and the river mouths. The trend was most significant in the rainy season. Conversely, in the bay mouth, the COD was generally low, except for a slightly higher level in the upper layer, influenced by river discharge or phytoplankton during the neap tide in the rainy season.

In the dry season, the COD was generally lower than that in the rainy season. A vertical gradient of COD was not observed (See Figure 2.2.2 and Table 2.2.4).

Table 2.2.4 Water Quality (COD)

(Unit: mg/L)

Season / Tide / Area / Layer		Rainy		Dry		Transient
		Spring Tide	Neap Tide	Spring Tide	Neap Tide	Neap Tide
Average of Survey Area	Upper	1.8	2.0	1.1	0.9	1.1
	Bottom	1.7	1.4	1.1	0.8	1.0
Bay Head (PO1)	Upper	3.6	2.2	1.3	1.3	1.7
	Bottom	3.4	1.9	1.3	0.7	1.1
River Mouth (PO4)	Upper	1.6	1.3	1.1	1.1	1.5
	Bottom	1.6	1.6	1.2	1.2	1.7
Shenzhen Bay (P10)	Upper	4.8	4.8	2.2	1.4	1.1
	Bottom	3.8	3.6	2.1	1.2	1.9
Central Bay (P11)	Upper	1.5	1.6	1.1	0.8	1.1
	Bottom	1.9	1.0	1.3	0.6	0.5
Western part of Bay Mouth (P24)	Upper	0.9	1.8	0.7	1.1	0.2
	Bottom	0.7	1.0	0.6	1.1	0.6
Eastern part of Bay Mouth (P18)	Upper	0.7	1.6	0.4	0.3	0.6
	Bottom	0.4	0.5	0.4	0.3	0.9

2.2.4. SS (Suspended Solid)

The high SS concentration in the estuary was mainly caused by the re-suspension of particles induced by high speed tidal currents and river discharge. Thus, high SS concentration was often observed in the bottom layer. A water mass with a high SS concentration sometimes even reached even to the surface in shallow depth areas, where high-speed currents were dominant. As a result, SS concentration during the spring tide was higher than that during the neap tide.

SS concentration was comparatively low in Shenzhen Bay and the eastern part of the upper bay. Tidal current had a small influence in these areas, because of the closeness of Shenzhen Bay and the deeper water depths in the eastern part of the upper bay (See Figure 2.2.3 and Table 2.2.5).

Table 2.2.5 Water Quality (SS)

(Unit: mg/L)

Area / Layer \ Season / Tide		Rainy		Dry		Transient
		Spring Tide	Neap Tide	Spring Tide	Neap Tide	Neap Tide
Average of Survey Area	Upper	47	22	43	31	9
	Bottom	83	29	60	38	16
Bay Head (PO1)	Upper	62	27	27	11	23
	Bottom	120	57	187	96	19
River Mouth (PO4)	Upper	32	42	25	15	16
	Bottom	66	46	37	23	15
Shenzhen Bay (P10)	Upper	38	8	14	8	37
	Bottom	54	26	10	15	24
Central Bay (P11)	Upper	54	20	124	6	7
	Bottom	155	31	194	16	14
Western part of Bay Mouth (P24)	Upper	17	1	335	5	7
	Bottom	114	6	320	6	7
Eastern part of Bay Mouth (P18)	Upper	10	6	13	6	4
	Bottom	8	12	16	7	3

2.2.5. T-N (Total Nitrogen)

T-N concentration in the entire estuary was the highest in the rainy season and the lowest in the transient season. During the spring tide in the rainy season, T-N concentration in upper layer was higher than that in the bottom layer, but in the other tides and seasons, the difference between the upper and bottom layer was low.

In the bay head and the river mouth, T-N concentration was high compared with the other area in the rainy season. In the eastern part of bay mouth, it was lower than that in the other area in all seasons, especially, in the dry and transient seasons.

Since T-N mainly consisted of NO_3-N in the Pearl River Estuary, the seasonal and spatial distributions were similar with each other. (See Figure 2.2.4 and Table 2.2.6).

Table 2.2.6 Water Quality (T-N)

(Unit: mg/L)

Season / Tide Area / Layer		Rainy		Dry		Transient
		Spring Tide	Neap Tide	Spring Tide	Neap Tide	Neap Tide
Average of Survey Area	Upper	1.52	2.13	0.89	0.97	0.77
	Bottom	1.42	1.47	0.87	0.82	0.63
Bay Head (PO1)	Upper	2.46	2.39	1.13	1.22	1.11
	Bottom	2.30	1.95	1.10	0.88	0.79
River Mouth (PO4)	Upper	2.43	2.22	0.99	1.14	0.91
	Bottom	3.19	2.08	1.03	1.12	1.03
Shenzhen Bay (P10)	Upper	1.26	1.84	2.21	1.26	0.82
	Bottom	1.00	2.05	2.53	1.11	0.93
Central Bay (P11)	Upper	1.62	2.15	0.71	0.88	0.76
	Bottom	1.50	0.90	0.76	0.53	0.47
Western part of Bay Mouth (P24)	Upper	1.66	1.86	0.56	1.23	0.76
	Bottom	1.06	1.20	0.69	0.65	0.66
Eastern part of Bay Mouth (P18)	Upper	1.28	1.03	0.23	0.34	0.25
	Bottom	0.85	0.26	0.25	0.30	0.19

2.2.6. T-P (Total Phosphorus)

T-P concentration in the entire estuary was higher in the dry. In Shenzhen Bay, it was notably high in all seasons, except during the spring tide in the rainy season.

The horizontal distribution of T-N showed comparatively high levels in the central bay and the western part of bay mouth during the spring tide in the rainy and dry seasons. During the neap tide, it was low in the same area. In the eastern part of bay mouth, it was low compared with the other area in the all seasons, especially, in the transient season.

The N/P ratio was changeable, depending on the T-N levels. The ratios, calculated from the T-N and T-P values, were 32 in the rainy season and 11 in the dry season. The ratio in the rainy season was about three times greater than that in dry season, which is a remarkable (See Figure 2.2.5, Figure 2.2.6, and Table 2.2.7).

Table 2.2.7 Water Quality (T-P)

(Unit: mg/L)

Area / Layer	Season / Tide	Rainy		Dry		Transient
		Spring Tide	Neap Tide	Spring Tide	Neap Tide	Neap Tide
Average of Survey Area	Upper	0.073	0.063	0.082	0.097	0.040
	Bottom	0.071	0.064	0.084	0.097	0.050
Bay Head (PO1)	Upper	0.058	0.046	0.075	0.090	0.060
	Bottom	0.084	0.076	0.087	0.108	0.034
River Mouth (PO4)	Upper	0.050	0.045	0.063	0.103	0.043
	Bottom	0.059	0.044	0.104	0.115	0.053
Shenzhen Bay (P10)	Upper	0.151	0.476	0.612	0.567	0.430
	Bottom	0.091	0.327	0.614	0.410	0.417
Central Bay (P11)	Upper	0.087	0.044	0.086	0.061	0.033
	Bottom	0.105	0.061	0.095	0.066	0.026
Western part of Bay Mouth (P24)	Upper	0.051	0.039	0.091	0.057	0.021
	Bottom	0.072	0.045	0.095	0.044	0.016
Eastern part of Bay Mouth (P18)	Upper	0.032	0.034	0.030	0.044	0.006
	Bottom	0.036	0.036	0.034	0.040	0.010

2.2.7. Oil Contents

The oil concentration was slightly higher in Shenzhen Bay and the upper bay than in other areas in both seasons (See Table 2.2.8).

2.2.8. Pb, Zn

Distribution patterns of Pb and Zn concentration did not show any significant characteristics. However, some survey points exceeded the Class 1 Standard for water quality for these metals (Pb: 1 μg/L, Zn: 20 μg/L), especially in the western part of the bay mouth (See Table 2.2.9 and 2.2.10).

Table 2.2.1 Environmental Standard for Sea Water in People's Republic of China
(GB 3097-1997)

No.	Items	Unit	Class 1[*1)]	Class 2[*2)]	Class 3[*3)]	Class 4[*4)]
1	Floating Matter	-	*5)			*6)
2	Color, Smell, and Taste	-	*7)			*8)
3	Suspended Solid (SS) [*9)]	mg/L	10	100		150
4	Coliforms	Ind/L	*10)			-
5	E.coli	Ind//L	*10)			-
6	Pathogenic Organisms	-	*11)			
7	Temperature[*12)]	℃	2 (1)[*13)]		4	
8	PH	-	7.8-8.5		6.8-8.8	
9	Dissolved Oxygen (DO)	mg/L	6	5	4	3
10	Chemical Oxygen Demand (COD)	mg/L	2	3	4	5
11	Biochemical Oxygen Demand (BOD)	mg/L	1	3	4	5
12	Inorganic Nitrogen (I-N)	mg/L	0.20	0.30	0.40	0.50
13	Nonionic Anmonium	mg/L	0.020			
14	Inorganic Phosphorus (PO_4-P)	mg/L	0.015	0.030		0.045
15	Mercury (Hg)	mg/L	0.00005	0.0002		0.0005
16	Cadmium (Cd)	mg/L	0.001	0.005	0.010	
17	Lead (Pb)	mg/L	0.001	0.005	0.010	0.050
18	Chromium (VI) (Cr (VI))	mg/L	0.005	0.010	0.020	0.050
19	Total Chromium (T-Cr)	mg/L	0.05	0.10	0.20	0.50
20	Arsenic (As)	mg/L	0.020	0.030	0.050	
21	Cupper (Cu)	mg/L	0.005	0.010	0.050	
22	Zinc (Zn)	mg/L	0.020	0.050	0.10	0.50
23	Selenium (Se)	mg/L	0.010	0.020		0.050
24	Nickel (Ni)	mg/L	0.005	0.010	0.020	0.050
25	Cyanide (CN)	mg/L	0.005		0.10	0.20
26	Sulfide (S)	mg/L	0.02	0.05	0.10	0.25
27	Volatile Phenol	mg/L	0.005		0.010	0.050
28	Oil Contents	mg/L	0.05		0.30	0.50
29	Chlorobenzen	mg/L	0.001	0.002	0.003	0.005
30	DDT	mg/L	0.00005	0.0001		
31	Parathion	mg/L	0.0005	0.001		
32	Parathion-methyl	mg/L	0.0005	0.001		
33	Benz-(a)-pyrene	mg/L	0.0025			
34	Anionic Surface Active Agent	mg/L	0.03	0.10		
35	Radioactive Nucleon	Bq/L	^{60}Co-0.03, ^{90}Sr-4, ^{106}Rn-0.2, ^{134}Cs-0.6, ^{137}Cs-			

*1) Class 1: The marine fishery waters, conservation of marine nature and scarce organisms.
*2) Class 2: Fishery cultivation area, sea bathing beach, food industrial water.
*3) Class 3: The general industrial water area and sightseeing area
*4) Class 4: Port/harbor area and the other development/construction area.
*5) Not appeared oil-film, floating particles, and the other matter.
*6) Not appeared the obvious oil-film, floating particles, and the other matter.
*7) Color, Smell, and Taste are not unusual for Sea-water and Sea-products.
*8) Color, Smell, and Taste are not unusual for Sea-water.
*9) As artificial activity additional.
*10) In the shell-farm for human-eating.
*11) As going up by artificial activity.
*12) In summer.
*13) No detection in shellfish's cultivation area for eating raw.

Table 2.2.2 Corresponding Percentage of Water Quality to the Environmental Standard for Sea Water in People's Republic of China

(Unit:%)

<table>
<tr><th rowspan="2">Items</th><th rowspan="2">Season</th><th colspan="5">Classificstion</th></tr>
<tr><th>Class 1</th><th>Class 2</th><th>Class 3</th><th>Class 4</th><th>Others</th></tr>
<tr><td rowspan="2">p H</td><td>Rainy</td><td colspan="2">55</td><td colspan="2">46</td><td>0</td></tr>
<tr><td>Dry</td><td colspan="2">91</td><td colspan="2">9</td><td>0</td></tr>
<tr><td rowspan="2">DO</td><td>Rainy</td><td>24</td><td>36</td><td>22</td><td>17</td><td>2</td></tr>
<tr><td>Dry</td><td>97</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td rowspan="2">COD</td><td>Rainy</td><td>80</td><td>13</td><td>6</td><td>1</td><td>0</td></tr>
<tr><td>Dry</td><td>97</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td rowspan="2">BOD_5</td><td>Rainy</td><td>75</td><td>25</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>Dry</td><td>95</td><td>5</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td rowspan="2">Hg</td><td>Rainy</td><td>100</td><td colspan="2">0</td><td>0</td><td>0</td></tr>
<tr><td>Dry</td><td>100</td><td colspan="2">0</td><td>0</td><td>0</td></tr>
<tr><td rowspan="2">Cu</td><td>Rainy</td><td>100</td><td>0</td><td colspan="2">0</td><td>0</td></tr>
<tr><td>Dry</td><td>100</td><td>0</td><td colspan="2">0</td><td>0</td></tr>
<tr><td rowspan="2">Zn</td><td>Rainy</td><td>48</td><td>51</td><td>2</td><td>0</td><td>0</td></tr>
<tr><td>Dry</td><td>24</td><td>76</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td rowspan="2">Pb</td><td>Rainy</td><td>52</td><td>49</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Dry</td><td>43</td><td>57</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td rowspan="2">Cd</td><td>Rainy</td><td>100</td><td>0</td><td colspan="2">0</td><td>0</td></tr>
<tr><td>Dry</td><td>100</td><td>0</td><td colspan="2">0</td><td>0</td></tr>
<tr><td rowspan="2">As</td><td>Rainy</td><td>100</td><td>0</td><td colspan="2">0</td><td>0</td></tr>
<tr><td>Dry</td><td>100</td><td>0</td><td colspan="2">0</td><td>0</td></tr>
<tr><td rowspan="2">SS</td><td>Rainy</td><td>85</td><td colspan="2">9</td><td>0</td><td>6</td></tr>
<tr><td>Dry</td><td>22</td><td colspan="2">65</td><td>10</td><td>3</td></tr>
<tr><td rowspan="2">IN</td><td>Rainy</td><td>2</td><td>4</td><td>7</td><td>5</td><td>83</td></tr>
<tr><td>Dry</td><td>19</td><td>9</td><td>12</td><td>17</td><td>43</td></tr>
<tr><td rowspan="2">PO_4-P</td><td>Rainy</td><td>13</td><td colspan="2">32</td><td>41</td><td>15</td></tr>
<tr><td>Dry</td><td>9</td><td colspan="2">29</td><td>24</td><td>39</td></tr>
<tr><td rowspan="2">Oils</td><td>Rainy</td><td>96</td><td>4</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Dry</td><td>92</td><td>8</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Table 2.2.8　Water Quality (Oils Contents)

(Unit:mg/L)

Season/Tide Area	Rainy Season		Dry Season	
	Spring Tide	Neap Tide	Spring Tide	Neap Tide
Bay head(P01)	0.02	0.05	0.05	0.05
River mouth(P04)	0.02	0.02	0.03	0.03
Shenzhen Bay(P10)	0.07	0.04	0.08	0.05
Bay center(P11)	0.02	0.04	0.03	0.03
Western part of bay mouth(P24)	0.01	0.02	0.02	0.03
Eastern part of bay mouth(P22)	0.02	0.02	0.02	0.02

Table 2.2.9　Water Quality (Pb)

(Unit:mg/m^3)

Area/Layer	Season/Tide	Rainy Season		Dry Season	
		Spring Tide	Neap Tide	Spring Tide	Neap Tide
Bay head(P01)	Upper	1.11	0.53	1.94	1.42
	Bottom	1.22	0.79	2.21	1.81
River mouth(P04)	Upper	0.76	1.01	1.26	0.95
	Bottom	0.90	1.20	1.83	0.95
Shenzhen Bay(P10)	Upper	1.13	1.36	0.73	1.40
	Bottom	4.14	1.26	1.35	0.95
Bay center(P11)	Upper	0.92	2.11	0.80	3.42
	Bottom	0.54	1.71	0.67	1.90
Western part of bay mouth(P24)	Upper	1.25	4.21	0.81	3.61
	Bottom	0.85	2.92	1.28	3.86
Eastern part of bay mouth(P22)	Upper	0.20	1.75	0.97	2.54
	Bottom	0.41	1.03	0.77	2.40

Table 2.2.10　Water Quality (Zn)

(Unit:mg/m^3)

Area/Layer	Season/Tide	Rainy Season		Dry Season	
		Spring Tide	Neap Tide	Spring Tide	Neap Tide
Bay head(P01)	Upper	20.3	15.4	35.0	27.6
	Bottom	27.8	24.1	37.2	31.8
River mouth(P04)	Upper	34.8	10.4	30.3	3.3
	Bottom	31.5	7.8	37.2	6.9
Shenzhen Bay(P10)	Upper	25.4	17.9	27.2	28.5
	Bottom	32.0	14.2	29.7	38.7
Bay center(P11)	Upper	26.2	8.9	29.4	17.5
	Bottom	32.1	12.9	27.4	22.8
Western part of bay mouth(P24)	Upper	59.3	10.8	48.9	21.3
	Bottom	43.5	4.6	48.5	19.6
Eastern part of bay mouth(P22)	Upper	39.6	9.3	24.7	17.7
	Bottom	12.9	4.6	23.8	15.6

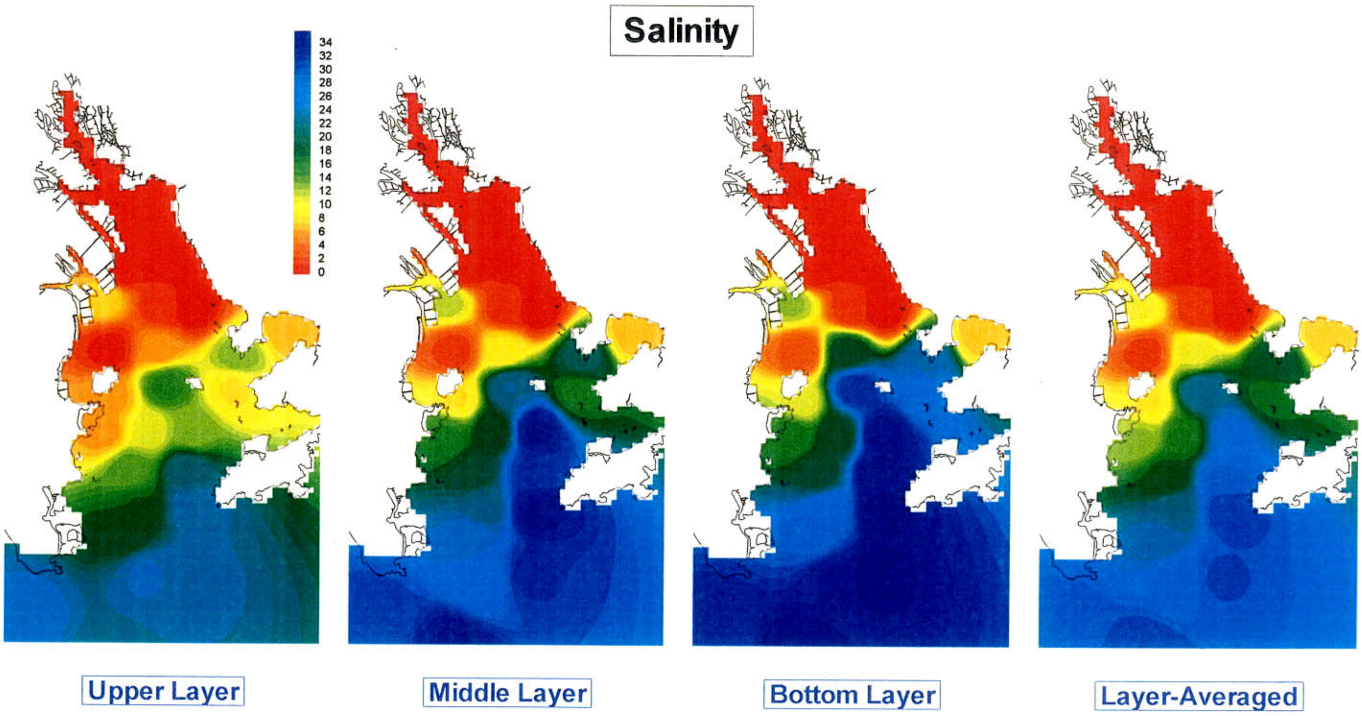

Figure 2.2.1 (1) Rainy Season Water Quality Survey Results (Graphic Rendition by Interpolation)

Spring Tide : July 31 - August 3, 2000

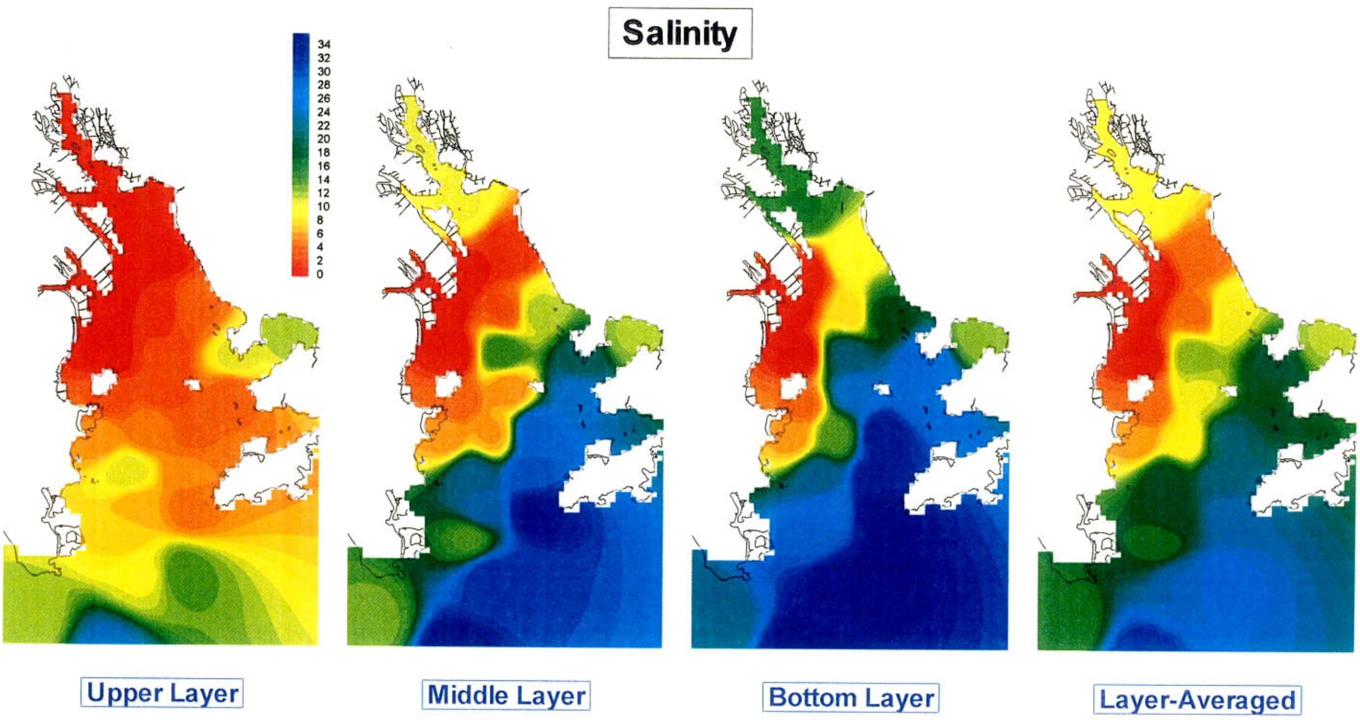

Figure 2.2.1 (2) Rainy Season Water Quality Survey Results (Graphic Rendition by Interpolation)

Neap Tide : August 6 - 9, 2000

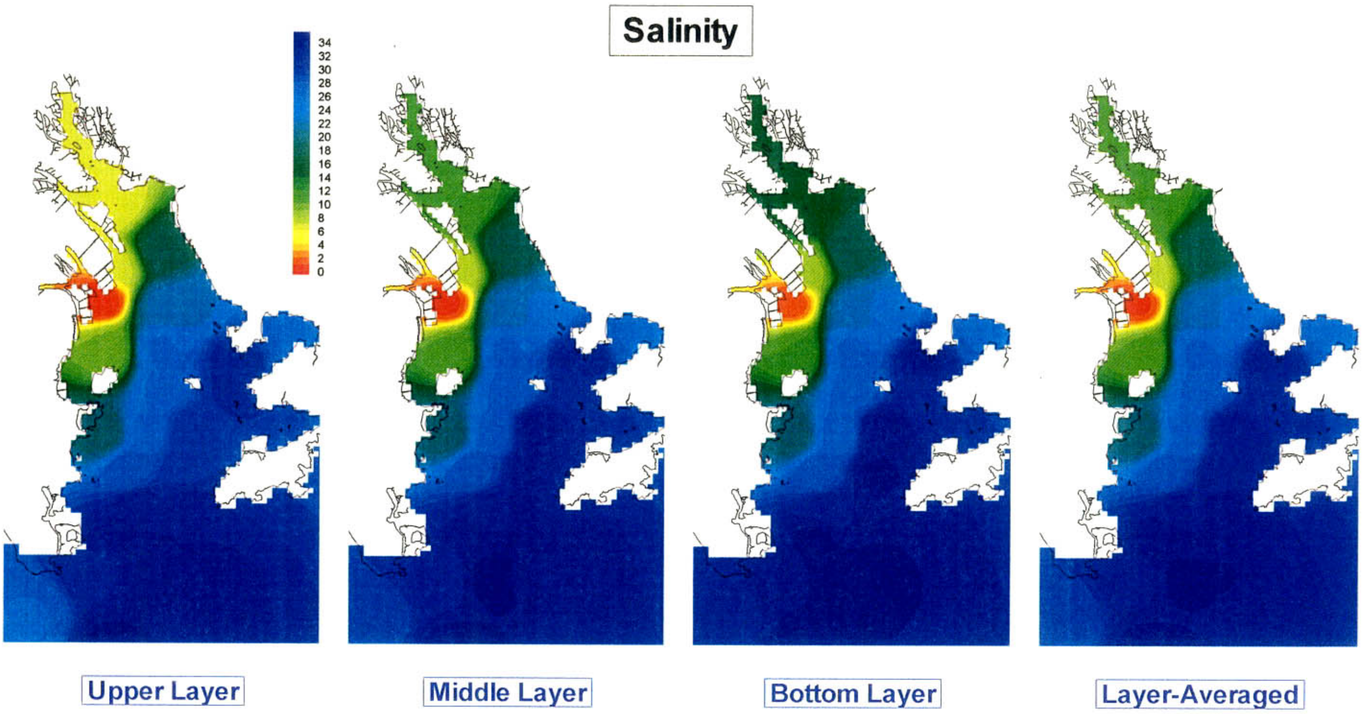

Figure 2.2.1 (3) Dry Season Water Quality Survey Results (Graphic Rendition by Interpolation)

Spring Tide : December 9 - 14, 2000

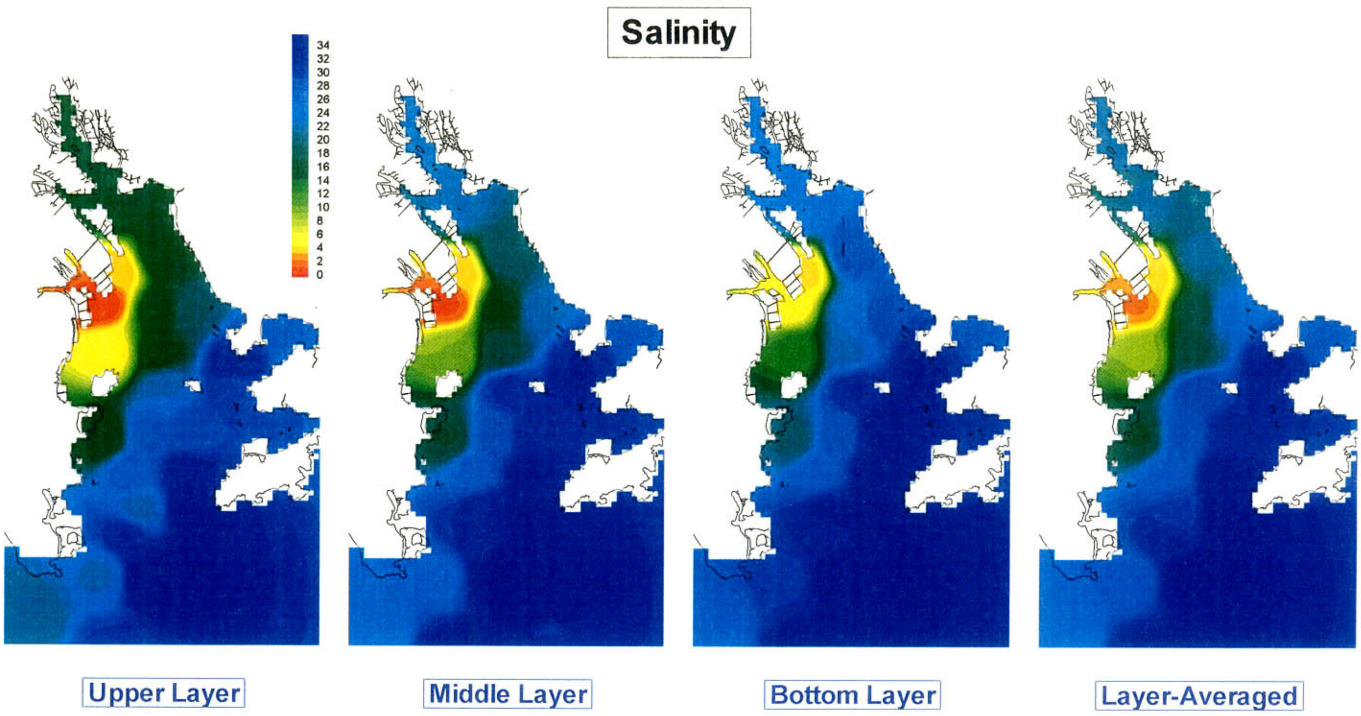

Figure 2.2.1 (4) Dry Season Water Quality Survey Results (Graphic Rendition by Interpolation)

Neap Tide : December 4 - 8, 2000

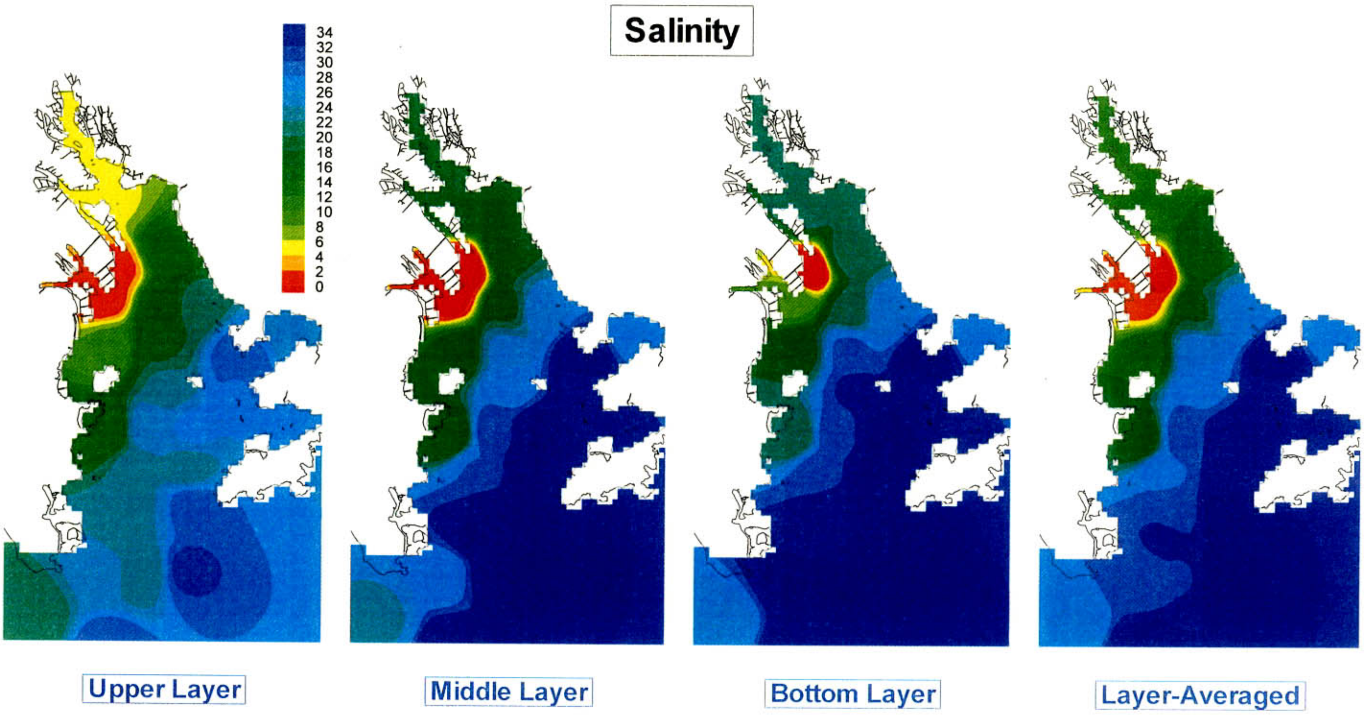

Figure 2.2.1 (5) Transient Season Water Quality Survey Results (Nonlinear Rendition by Interpolation)
Neap Tide : March 4 - 6, 2001

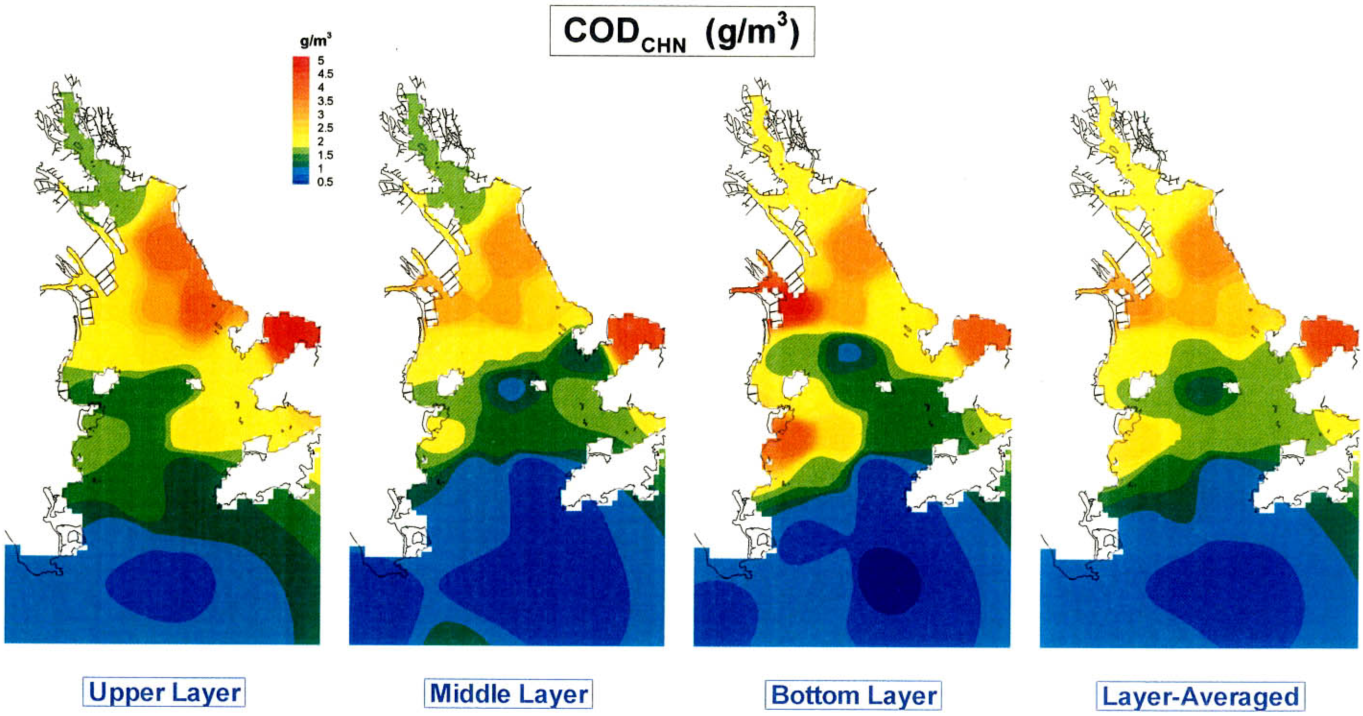

Figure 2.2.2 (1) Rainy Season Water Quality Survey Results (Graphic Rendition by Interpolation)

Spring Tide : July 31 - August 3, 2000

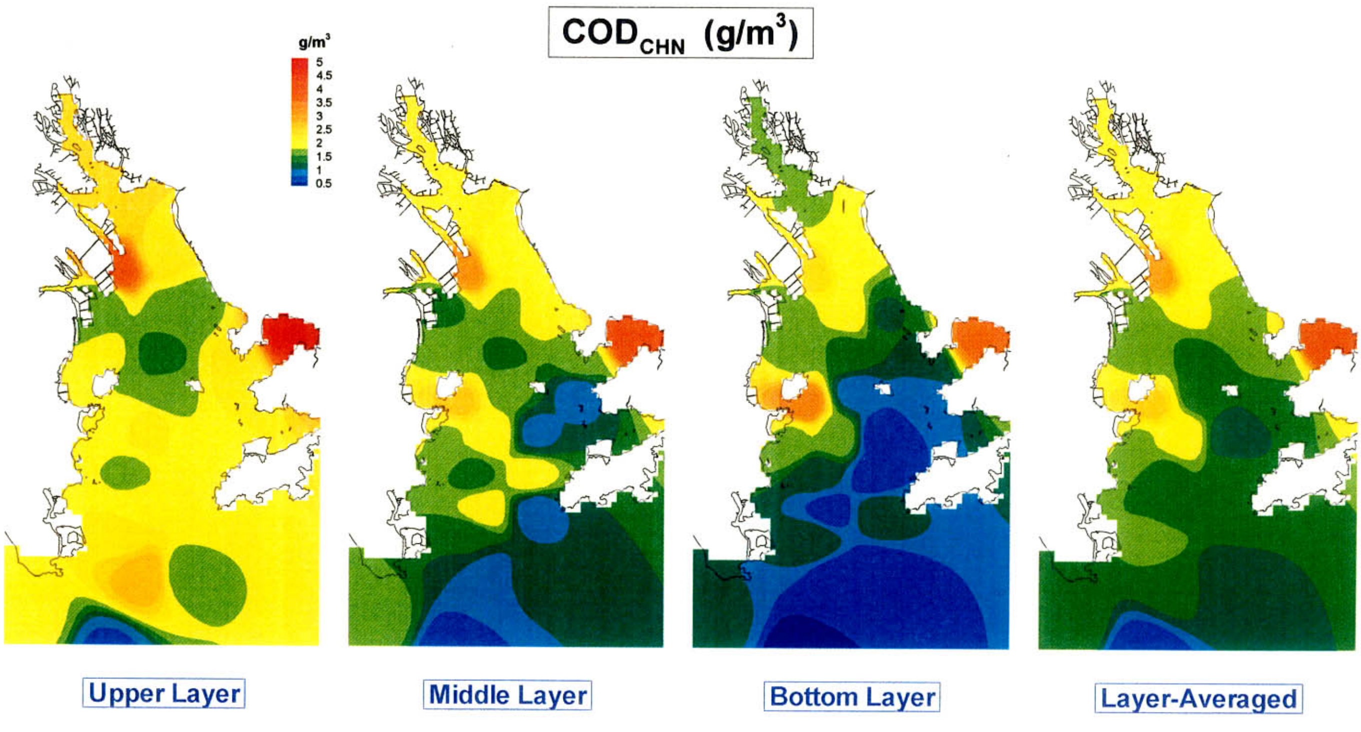

Figure 2.2.2 (2) Rainy Season Water Quality Survey Results (Graphic Rendition by Interpolation)

Neap Tide : August 6 - 9, 2000

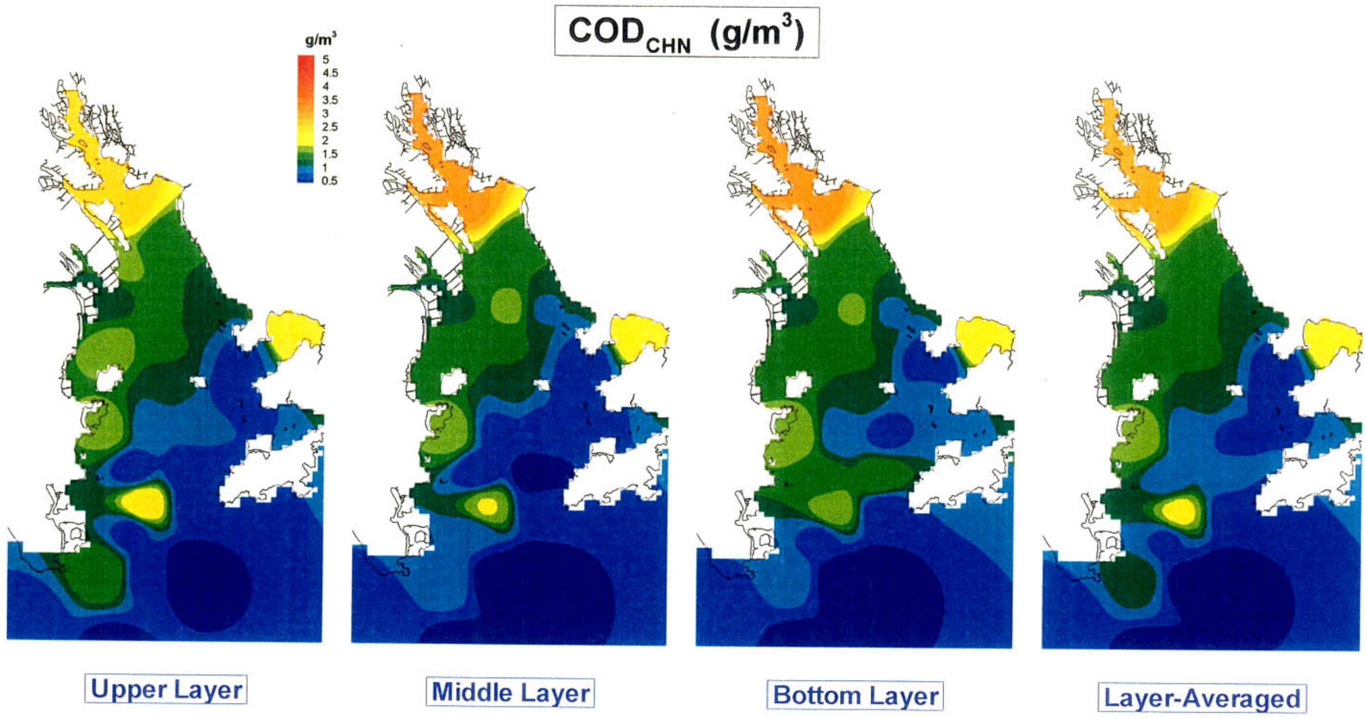

Figure 2.2.2 (3) Dry Season Water Quality Survey Results (Graphic Rendition by Interpolation)

Spring Tide : December 9 - 14, 2000

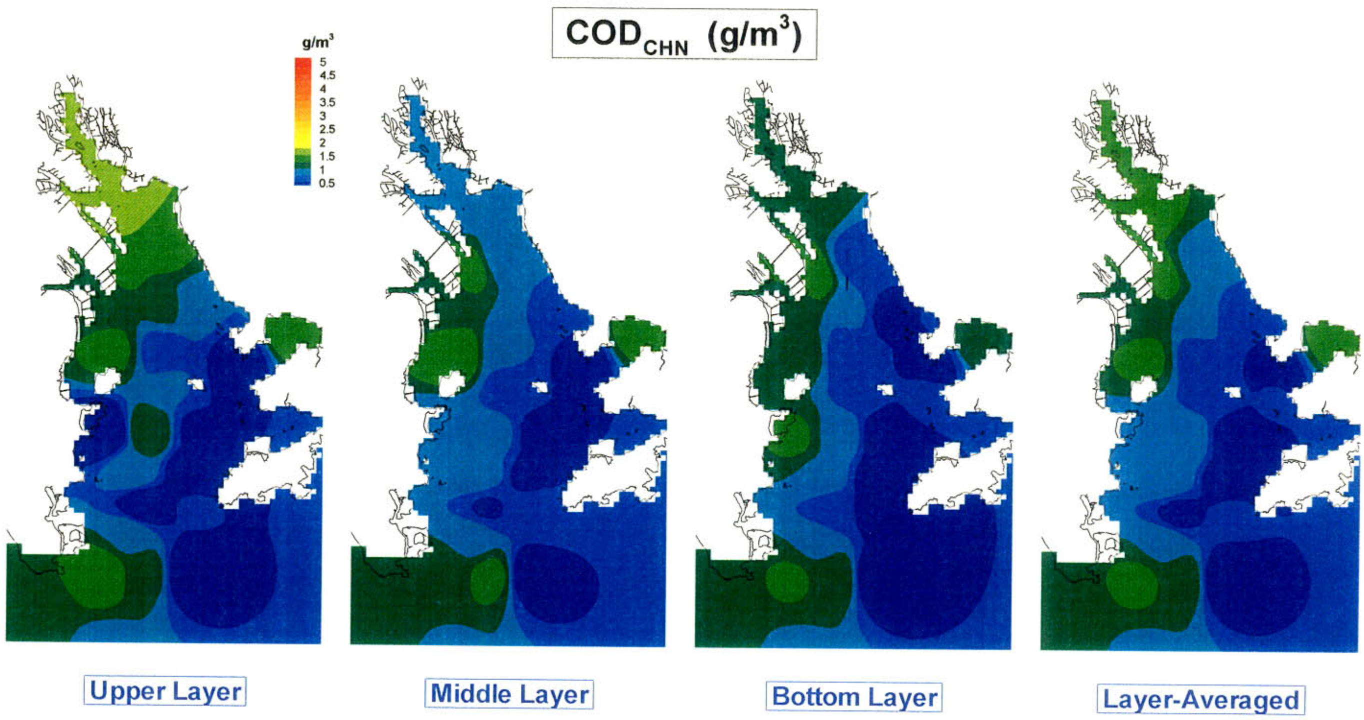

Figure 2.2.2 (4) Dry Season Water Quality Survey Results (Graphic Rendition by Interpolation)

Neap Tide : December 4 - 8, 2000

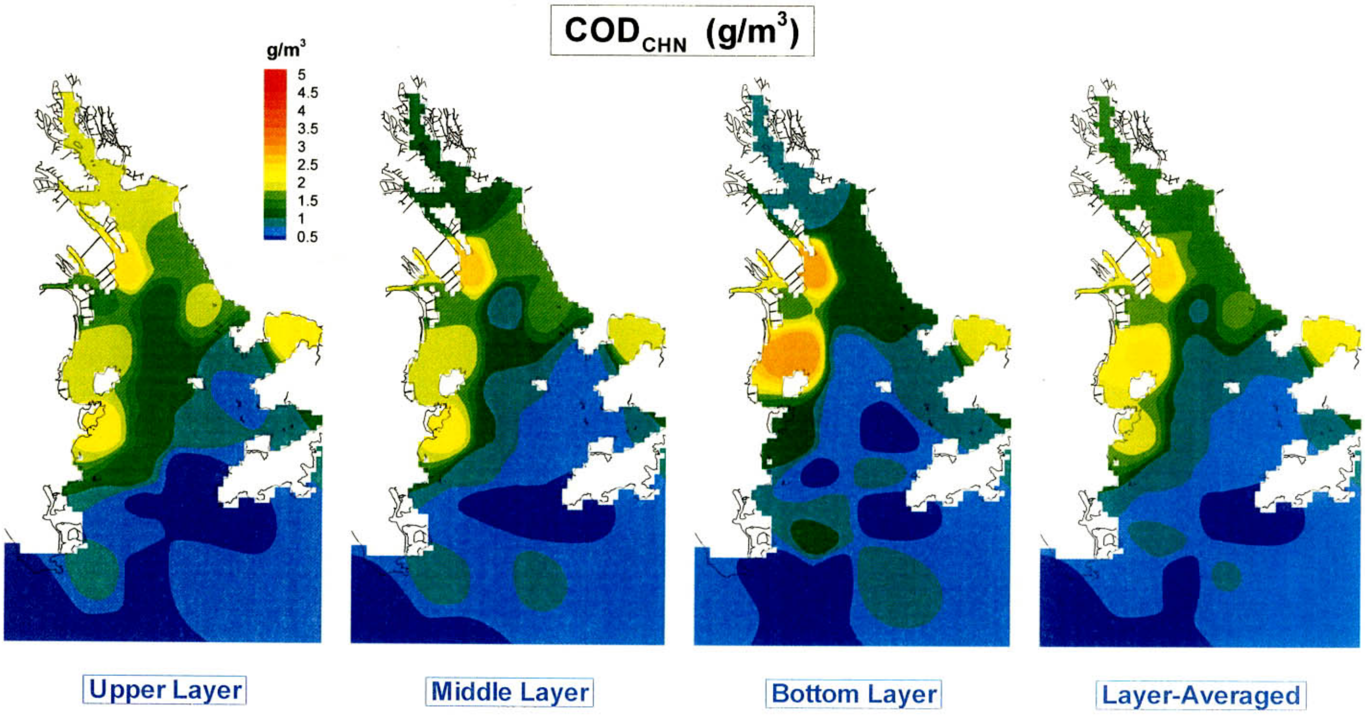

Figure 2.2.2 (5) Transient Season Water Quality Survey Results (Nonlinear Rendition by Interpolation)

Neap Tide : March 4 - 6, 2001