1 Introduction

1.0.1 The consultancy study on the Review and Development of Marine Water Quality Objectives (WQOs) was initiated in October 2008, and we have completed an initial review about the existing WQOs, conditions of our marine environment, and overseas practices.

1.0.2 This WQO review is important in a number of aspects such as beneficial uses of marine waters, marine water quality management, marine conservation, coastal development, environmental impact assessment, and pollution control in Hong Kong. We would like to hear your views and concerns at this early stage, so as to identify a set of WQOs appropriate for Hong Kong in the decades to come.

1.0.3 The objective, need and initial issues of the WQO review have been outlined in the "First Stage Public Engagement Document". The purpose of this Technical Note is to provide more in-depth technical details about the initial review.

2 Characterization of marine waters in Hong Kong

2.0.1 Based on the fundamental differences in hydrographic conditions along the estuarine-oceanic transition gradient, water circulation, water depth, the bathymetric condition, potential pollution sources levels of contaminants, the major delineation of marine biota and the occurrence of various sensitive receivers, it is considered useful to divide the waters of Hong Kong into 7 water bodies (Figure 2.1). The following provides a narrative summary on the beneficial uses and sensitive receivers; physical, chemical and biological characteristics of these 7 water bodies.

2.1 Beneficial uses and sensitive receivers

2.1.1 Typical beneficial uses and sensitive receivers in our marine waters are summarized below and Table 2.1. Their distributions are shown in Figure 2.2:

(a) Sites of special scientific interest (SSSI),
(b) Sites/species of high conservation values (e.g., corals, seagrass, mangroves and marine mammals)
(c) Marine parks and marine reserve
(d) Nursery and spawning grounds
(e) Mariculture zones and oyster culture grounds
(f) Habitats of ecologically important species (e.g., keystone species)
(g) Bathing beaches and secondary contact recreation
(h) Seawater intakes for flushing and cooling
(i) Navigation
(j) Effluent disposal
(k) Spoil disposal, and marine fill borrowing

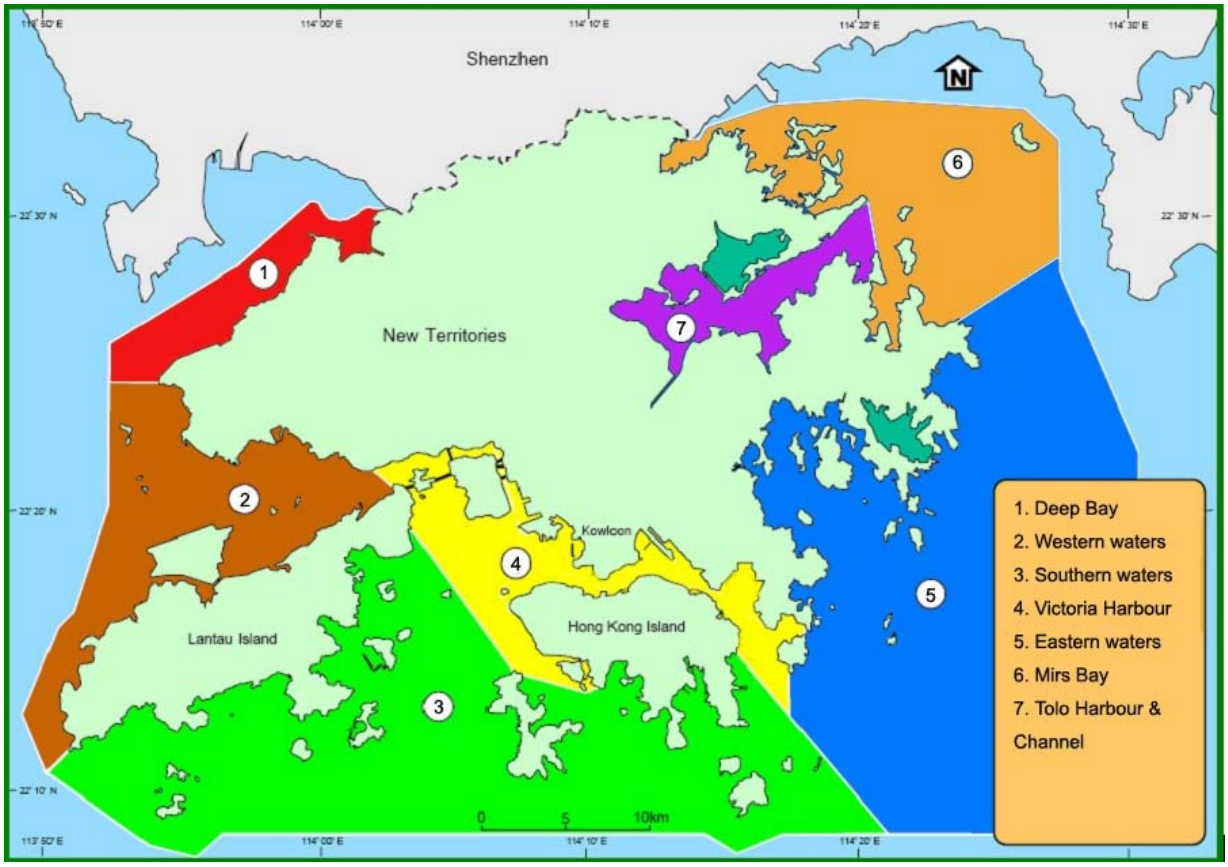

Figure 2.1 Seven water bodies for characterization of marine waters of Hong Kong

Figure 2.2 Different habitats for aquatic life and various beneficial uses in the marine waters of Hong Kong

Table 2.1 Summary on present beneficial uses and sensitive receivers in the 7 water bodies of Hong Kong

Characteristics	Water bodies (see Figure 2.1 and notes at the end of this table)						
	1	2	3	4	5	6	7
	Deep Bay	Western waters	Southern waters	*Victoria Harbour (& Junk Bay	Eastern waters	Mirs Bay	Tolo Harbour & Channel
Current beneficial uses							
Nature reserves and Site of special scientific interest	✓	✓	✓		✓	✓	✓
Maintenance of natural ecosystems and wildlife	✓	✓	✓	✓	✓	✓	✓
Production of fish, crustaceans and shellfish for human consumption	✓	✓	✓	✓	✓	✓	✓
Bathing, diving and primary contact recreation	✓	✓	✓	✓	✓	✓	✓
Boating, fishing and secondary contact recreation	✓	✓	✓	✓	✓	✓	✓
Aesthetic enjoyment	✓	✓	✓	✓	✓	✓	✓
Industrial and domestic water supply	✓	✓	✓	✓	✓		✓
Supply of flushing water		✓	✓	✓	✓		✓
Seawater intakes	Nil	Yes (3 proposed seawater pumping stations (SW P/Ss) and 1 existing SW P/S)	Nil	Yes (1 proposed SW P/S) and 16 existing SW P/Ss)	1 proposed SW P/S	Nil	2 existing SW P/Ss
Navigation and shipping		✓	✓	✓	✓	✓	✓
Typhoon shelters		✓	✓	✓	✓		✓
Reception and dilution of effluents	✓	✓	✓	✓	✓		✓

Characteristics	Water bodies (see Figure 2.1 and notes at the end of this table)						
	1	2	3	4	5	6	7
	Deep Bay	Western waters	Southern waters	*Victoria Harbour (& Junk Bay	Eastern waters	Mirs Bay	Tolo Harbour & Channel
Sensitive Receivers							
Sites of special scientific interest	Tsim Bei Tsui Egretry, Tsim Bei Tsui, Inner Deep Bay, Pak Nai, Mai Po Marshes	Nil	Sham Wan, Shek O Headland, San Tau Beach, Tai Tam Harbour (inner bay)	Nil	Tai Long Bay, Pak Sha Wan Peninsula, Ninepin Group	A Chau, Lai Chi Wo Beach, Port Island, Yim Tso Ha Egretry	Kei Ling Ha, Ting Kok
Marine Parks/Reserve	Nil	1 (Sha Chau and Lung Kwu Chau Marine Park)	1 (Cape d'Aguilar Marine Reserve)	Nil	Nil	2 (Yan Chau Tong Marine Park, Tung Ping Chau Marine Park)	1 (Hoi Ha Wan Marine Park)
Marine mammals	Chinese white dolphin (++)	Chinese white dolphin (++++)	Chinese white dolphin (++) and black finless porpoise (++)	Chinese white dolphin (+)	Black finless porpoise (+)	Black finless porpoise (+)	Nil
Spawning and nursery grounds	Nil	Fishes	Fishes, shrimps, Mantis shrimps, Crabs	Nil	Fishes	Fishes	Nil
Mariculture	1 oyster farming area	Nil	4 fish culture zones	2 fish culture zones	7 fish culture zones	9 fish culture zones	4 fish culture zones
Corals	Nil	Nil	14 sites	Nil	12 sites	6 sites	5 sites
Mangroves	6 sites	6 sites	4 sites	Nil	8 sites	9 sites	10 sites
Seagrasses	6 sites	3 sites	Nil	Nil	2 sites	6 sites	Nil
Bathing beaches	Nil	6 gazetted beaches	21 gazetted beaches	8 gazetted beaches	6 gazetted beaches	Nil	Nil
Secondary recreational uses	Yes (+)	Yes (+)	Yes (++)	Yes (+)	Yes (+++)	Yes (+++)	Yes (+++++)

Notes:

(+) denotes the relative abundance of the respective sensitive receivers in each water body.

1. The delineation of water bodies is based on the hydgrographic and bathymetric conditions, potential pollution sources, levels of contaminants, location of marine biota and sensitive receivers. *Victoria Harbour covers the coastal waters of Tsing Yi, the harbour, Junk Bay and east of Tung Lung Chau. Eastern waters zone covers the southern part of Mirs Bay and Port Shelter. Mirs Bay confines to the Mirs Bay waters and extends as far as Shek Ngau Chau and Wong Mau Chau.

2. Environmental Protection Department. Justification of Ecological Value Assigned to Sites of Special Scientific Interest (SSSI) (http://www.epd.gov.hk/epd/textonly/english/environmentinhk/eia_planning/sea/terr_table74a.html)
3. Shin et al. (2004)
4. Leung (1999)
5. CITYU (1999)
6. Leung and Leung (2000)
7. Taylor (1994)
8. Leung and Morton (2000)
9. Blackmore and Rainbow (2000)
10. Leung (1992)
11. Shin (1985)
12. Taylor and Shin (1989)
13. Taylor (1992)
14. Binnie (1995a)
15. ERM (1998)

2.2 General hydrography, water quality and major biological communities

2.2.1 The general hydrography and water quality of various water bodies in Hong Kong are well understood. Overall in Hong Kong marine waters, the hydrographical conditions exhibit a gradual transition from a sheltered, estuarine environment in the west, to an exposed, oceanic environment in the east, with a transition zone in the middle receiving heavier pollution loading from the urbanized area fringing Victoria Harbour. Table 2.2 provides a summary and comparison on the major physical conditions and water quality (salinity, temperature, nutrients, current, bathymetry, suspended solids, bacteria), and pollution sources in different parts of Hong Kong waters (Data compiled from EPD's monitoring programme 2003-2007; http://epic.epd.gov.hk/ca/uid/marinehistorical). Except where specifically mentioned, median values are given to provide a general indication and comparison. A synopsis of key points, which are relevant to the present review study, is provided in the following sub-sections.

2.2.2 An analysis of nutrient levels in different parts of Hong Kong waters shows the following:

- Highest levels of total nitrogen (1.53 mg/L), total phosphorus (0.13 mg/L), unionized ammonia (0.017 mg/L), and total inorganic nitrogen (1.36 mg/L) are found in Deep Bay, followed in decreasing order by western and southern waters, clearly demonstrating the influence of Pearl River discharge, especially during the summer when the Pearl River discharge is at its peak. The relatively high levels of nutrients in Deep Bay may also be ascribed to the fact that it is a semi-enclosed bay with low flushing capacity.
- In Victoria Harbour where sewage is discharged, total nitrogen (0.18 mg/L), total phosphorus (0.02 mg/L), unionized ammonia (0.001 mg/L) and total inorganic nitrogen (0.095 mg/L) concentrations are also high.
- Eastern waters and Mirs Bay are relatively nutrient poor since these waters are bathed by oceanic waters and far away from both the Pearl River and sewage discharges.
- Level of total nitrogen in Tolo Habour and Channel (0.22 mg/L) is generally higher than that in Mirs Bay (0.17 mg/L) and Eastern waters (0.14 mg/L).

2.2.3 Phytoplankton biomass in Hong Kong waters is regulated by a combination of physico-chemical and biological factors that are related to the seasonal influence of the Pearl River discharge and oceanic waters, sewage effluent inputs, and strong hydrodynamic mixing from southwest monsoon winds in summer and the northeast monsoon winds in winter.

2.2.4 High levels of *E. coli* are found in Victoria Harbour, indicating faecal pollution caused by sewage discharge into the Harbour. Levels of *E. coli* in inner Deep Bay were also high, followed by western waters, indicating faecal pollution also presented in inner Deep Bay. *E. coli* counts are generally low in southern waters, Mirs Bay and Tolo Harbour and Channel, and the lowest levels are found in eastern waters.

2.2.5 EPD's water quality monitoring data show that the 2008 overall WQO compliance rate of the whole territory achieved 81%, approximately same as that in 2007 (80%). The rate is based on the combined individual compliance rates of all stations in the territory

for the four important marine WQOs, namely DO, TIN, unionized NH_3 and *E. coli* bacteria. Figure 2.3 shows the annual WQO compliance rates in Hong Kong and the water quality trends for NH_3-N, TIN, *E. coli*, BOD_5 and orthophosphate phosphorus from 1986 to 2008.

2.2.6 Figure 2.4 – 2.6 show the water quality trends of Deep Bay, Tolo Harbour and Victoria Harbour from 1986-2008. The inner Deep Bay has relatively poor water quality, with low WQO compliance in terms of DO, TIN and unionized NH_3. With the implementation of the Tolo Habour Action Plan and other pollution control measure, there is a gradual recovery of the water environment in Tolo Harbour. The HATS Stage 1 led to a general improvement of water quality in the eastern Victoria Harbour, whereas the western harbour area around the Stonecutters Island Sewage Treatment Works outfall continued to have elevated levels of *E. coli* bacteria.

2.2.7 The EPD conducts long-term monitoring of phytoplankton monthly at 25 stations covering nine WCZs. An analysis of the monitoring data collected during the period 1991-2006 (CITYU, 2008) recorded a total of 235 species (121 diatoms, 82 dinoflagellates and 32 others). Results showed that Deep Bay, Tolo Harbour, Victoria Harbour, Mirs Bay and Port Shelter frequently showed distinct differences in phytoplankton composition as compared to other sampling stations from 1991 to 2006. The major spatial assemblages of phytoplankton community were, to a large extent, defined by geographical areas. In general, the following spatial pattern was delineated: Tolo Harbour and Channel, Port Shelter and Mirs Bay, Victoria Harbour, southern waters, and northwestern waters and Deep Bay.

2.2.8 In terms of phytoplankton cell density, Tolo Harbour and Channel are relatively higher (>3,000 cell/mL), compared with Mirs Bay (2,001-2,500 cells/mL) and other water bodies in Hong Kong (1,001-2,000 cells/mL).

2.2.9 Algal blooms including red tides are phenomena occasionally associated with nutrients enrichment of waters. In Hong Kong, red tides occurred more frequently in the eastern and southern waters than in Deep Bay where the waters are comparatively nutrients rich. Figure 2.7 shows the number of red tides incidents in Deep Bay, southern waters, Port Shelter, Tolo Harbour and Mirs Bay. Despite the high levels of TIN in Deep Bay and southern waters, other factors seem to be dominating and other site-specific conditions, e.g. water currents, water temperature, salinity, light intensity, etc., sometimes play a more important role in the phenomena.

2.2.10 Hong Kong's infaunal benthos are largely homogeneous (Shin et al., 2004), with exceptions for places such as in Victoria Harbour, Tolo Harbour and Channel, Deep Bay and Urmston Road, and Tai Long Wan (Sai Kung). Polychaete annelids, crustaceans and bivalves are the most abundant animal groups. Seasonal variations are minimal.

2.2.11 A study undertaken by EPD (CITYU, 2006) on the epibenthos of Hong Kong waters revealed that the highest species number is found in eastern waters, followed by southern waters, western waters, Deep Bay, Mirs Bay, Tolo and Victoria Harbour. The dominant epibenthic species are sea pens, gastropods, bivalves, shrimps, mantis shrimps and crabs. Separate epifaunal communities can be found in Deep Bay, western waters and northeastern waters. The epifauna in southern, eastern and Tathong Channel waters also form a distinct community.

2.2.12 The 13-month fisheries resource survey commissioned by AFCD in 1997 (ERM, 1998) provided a comprehensive and quantitative analysis as well as spatial and temporal comparison on both demersal and pelagic fish populations in the entire Hong Kong waters. The survey data showed that the highest species number of demersal fish was found in Deep Bay, followed by Double Haven and Sharp Island, Lung Kwu Chau and Lamma. Lowest species number is found in inner and outer Tolo Harbour and Mirs Bay. For pelagic fish, a total of 91 species of fish were reported from AFCD's gillnet survey (ERM, 1998). The largest number of fish species was captured at the Ninepins, and low numbers were recorded at Double Haven, Inner Tolo Harbour, Kat O, and Peng Chau.

2.2.13 In general, the following spatial difference in demersal species composition is evident:

- **Deep Bay**: Largest catches were Sciaenidae (croakers).
- **Southern and western waters** (Stanley, South Lamma, South Cheung Chau, Sokos, South Lantau, Lamma, Brothers and Lung Kwu Chau): Siganidae (rabbit fish), Sciaenidae (croaker), Gobiidae (Goby), and Apogonidae (cardinal fish) were common.
- **Eastern waters** (Basalt, Ninepines, Waglan): Apogonidae (cardinal fish) and Sciaenidae (croaker) were most abundant.
- **Northeastern waters** (Double Haven, Outer Tolo, Inner Tolo, Long Harbour, Mirs Bay and Sharp Island): Siganidae (rabbit fish) and Gobiidae (goby) predominated.

Table 2.2 Summary on physical characteristics and water quality of the 7 water bodies of Hong Kong

Characteristics	Water bodies (see Figure 2.1 and notes at the end of this table)						
	1	2	3	4	5	6	7
	Deep Bay	**Western waters**	**Southern waters**	**Victoria Harbour**	**Eastern waters**	**Mirs Bay**	**Tolo Harbour & Channel**
Physical Characteristics (Data are presented as median followed by the minimum and maximum values, as appropriate)							
Water circulation	Moderate (average tidal speed: 0.3-0.5 m/s in dry season, 0.6-0.9 m/s in wet season ; max: 1 m/s; flushing time: 23.4 days in inner bay; 2.5 days in outer bay)	Moderate (average tidal speed: 0.25 m/s; max: 0.79 m/s)	Moderate (average tidal speed: 0.15 m/s; max: 0.54 m/s)	Good (average tidal speed: 0.35 m/s; max: 0.88 m/s; flushing time: 1.5 – 2.5 days in the wet season and 5 – 7 days in the dry season)	Moderate (average tidal speed: 0.11 ms/ max: 0.34 m/s)	Moderate (average tidal speed: 0.19 m/s; max: 0.4 m/s)	Poor (average tidal speed: 0.01 m/s; max: 0.24 m/s; flushing time in inner Tolo Harbour: 38 days in the dry season and 14.4 days in the wet season)
Bathymetry	Shallow (1- 5 m)	4 – 40 m	15 – 46 m	8 – 40 m	15 – 25 m	6 – 75 m	Shallow in harbour (4 m), moderate in channel (16 m)
Stratification	No	Yes	Yes	Yes	Yes	Yes	No in harbour; Yes in channel
Temperature (ºC)	25.3 13.0 32.4	24.5 15.1 31.3	24.4 15.3 30.0	24.1 15.5 30.4	23.2 14.8 32.0	23.7 15.1 31.7	24.4 13.0 31.3
Salinity (‰) (median)	25.2	31.3	32.8	32.9	33.2	32.9	32.4
pH	7.8 6.5 9.3	8.0 7.3 8.6	8.2 7.0 9.1	7.9 7.8 7.9	8.2 7.2 8.8	8.2 7.4 8.9	8.2 6.8 8.8
Chlorophyll-*a* (μg/L)	2.2 0.2 260.0	1.9 0.2 42.0	1.9 0.2 55.0	1.8 0.8 2.7	1.6 0.2 39.0	2.0 0.2 53.0	4.1 0.3 95.0
Suspended Solids (mg/L)	13.0 2.2 230.0	7.4 0.9 150.0	4.6 0.5 210.0	7.2 2.6 110.0	1.6 0.5 210.0	2.0 0.5 79.0	1.8 0.5 170.0

Characteristics	Water bodies (see Figure 2.1 and notes at the end of this table)						
	1	2	3	4	5	6	7
	Deep Bay	**Western waters**	**Southern waters**	**Victoria Harbour**	**Eastern waters**	**Mirs Bay**	**Tolo Harbour & Channel**
Dissolved oxygen (mg/L, depth average)	5.4	6.2	6.6	6.6	6.5	6.6	6.5
	0.2	2.1	1.6	5.3	1.1	0.5	1.0
	12.9	10.3	11.6	7.1	10.7	12.7	11.2
Dissolved oxygen (mg/L, bottom)	5.6	6.1	6.4	5.55	6.4	6.45	6.3
	2.7	2.1	1.6	1.3	1.1	0.5	1
	10.2	10	11.6	10.9	9.2	12.7	11
Nutrients (Data are presented as median followed by the minimum and maximum values)							
Total Nitrogen (mg/L)	1.53	0.53	0.27	0.18	0.14	0.17	0.22
	0.01	0.12	0.05	0.09	0.05	0.05	0.08
	15.02	2.54	1.46	0.51	0.80	1.21	1.51
Unionized Ammonia (mg/L)	0.017	0.005	0.002	0.001	0.001	0.001	0.002
	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.760	0.047	0.034	0.005	0.020	0.048	0.053
Total Inorganic Nitrogen (mg/L)	1.360	0.390	0.140	0.095	0.040	0.040	0.050
	0.230	0.010	0.010	0.020	0.010	0.010	0.010
	10.020	2.300	1.210	0.290	0.620	0.580	0.420
Total Phosphorus (mg/L)	0.130	0.040	0.030	0.020	0.020	0.020	0.020
	0.030	0.020	0.020	0.020	0.020	0.020	0.020
	1.300	0.220	0.160	0.060	0.130	0.200	0.300
Orthophosphate Phosphorus (mg/L)	0.094	0.024	0.010	0.012	0.007	0.006	0.006
	0.005	0.002	0.002	0.006	0.002	0.002	0.002
	0.880	0.087	0.040	0.029	0.045	0.120	0.057
Silica (mg/L as SiO_2)	3.40	1.20	0.68	0.48	0.53	0.49	0.66
	0.05	0.05	0.05	0.37	0.05	0.05	0.05
	12.00	8.90	6.20	0.62	3.20	3.00	3.00
Bacteria (Data are presented as median followed by the minimum and maximum values)							
Escherichia coli (cfu/100 ml)	515	300	3	310	1	1	1
	2	1	1	1	1	1	1
	360000	23000	11000	21000	1300	4600	3200

Characteristics	Water bodies (see Figure 2.1 and notes at the end of this table)						
	1	2	3	4	5	6	7
	Deep Bay	**Western waters**	**Southern waters**	**Victoria Harbour**	**Eastern waters**	**Mirs Bay**	**Tolo Harbour & Channel**
Major sources of pollution							
Major sources of pollution	Shenzhen River, Yuen Long Creek, Xin Zhou River, Pearl River	Treated effluents from Stonecutters Island STWs, San Wai and Pillar Point STWs.	Influenced by the discharge from the Pearl River	Treated effluents from Stonecutters Island STW, and Sha Tin and Tai Po STWs, and urban non-point sources	Non-point sources from runoff and waste from mariculture	Non-point sources from runoff and waste from mariculture	Non-point sources from runoff and waste from mariculture, Emergency discharges from Sha Tin and Tai Po STWs during heavy rain

Notes:

1. Pollution level (median values) was derived from EPD's water quality monitoring data from 2003-2007. (Data compiled from EPD's monitoring programme; http://epic.epd.gov.hk/ca/uid/marinehistorical).
2. The delineation of water bodies is based on the hydgrographic and bathymetric conditions, potential pollution sources, levels of contaminants, location of marine biota and sensitive receivers. *Victoria Harbour covers the coastal waters of Tsing Yi, the harbour, Junk Bay and east of Tung Lung Chau. Eastern waters zone covers the southern part of Mirs Bay and Port Shelter. Mirs Bay confines to the Mirs Bay waters and extends as far as Shek Ngau Chau and Wong Mau Chau.
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7. Leung and Leung (2000)
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9. Leung and Morton (2000)
10. Blackmore and Rainbow (2000)
11. Leung (1992)
12. Shin (1985)
13. Taylor and Shin (1989)
14. Taylor (1992)
15. Binnie (1995a)
16. ERM (1998)
17. SEPB and EPD (2008)
18. Qian (2003)

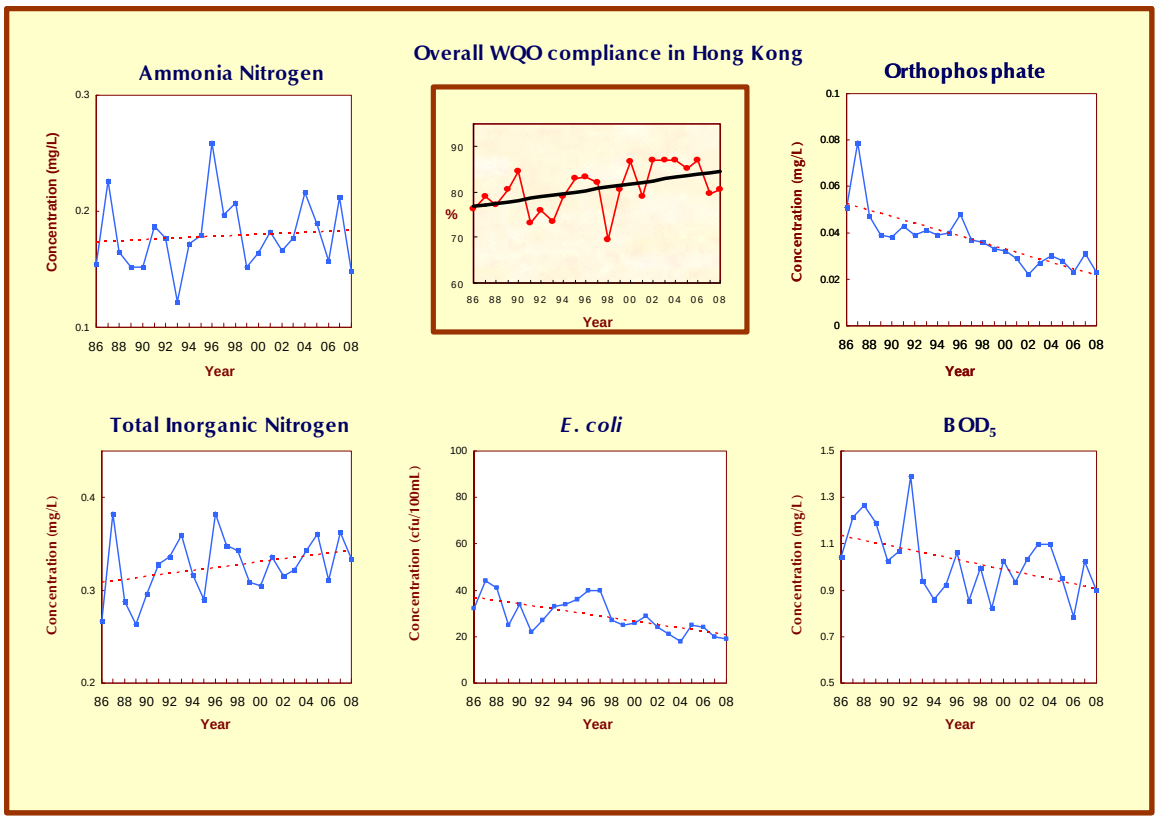

Figure 2.3 Water Quality Changes in Hong Kong, 1986 - 2008

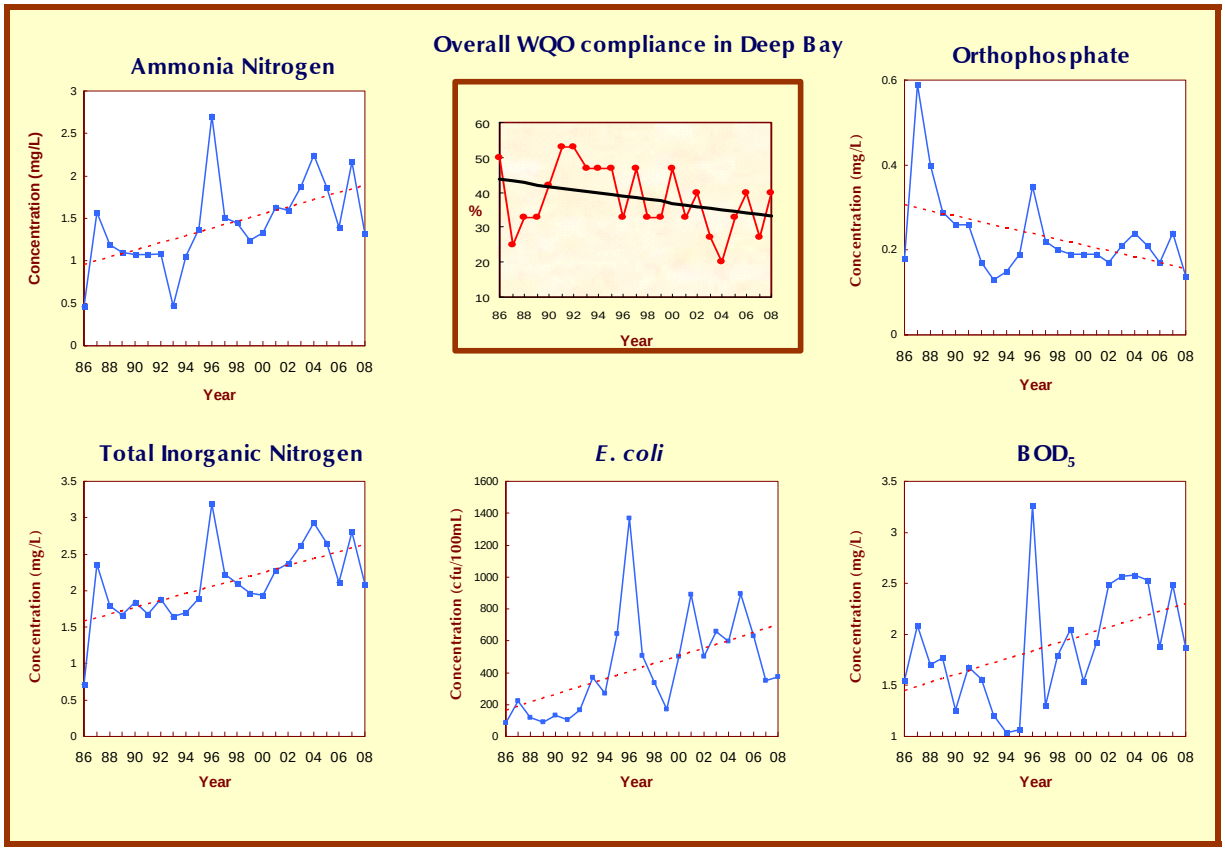

Figure 2.4 Water Quality Changes in the Deep Bay Water Control Zone, 1986 – 2008

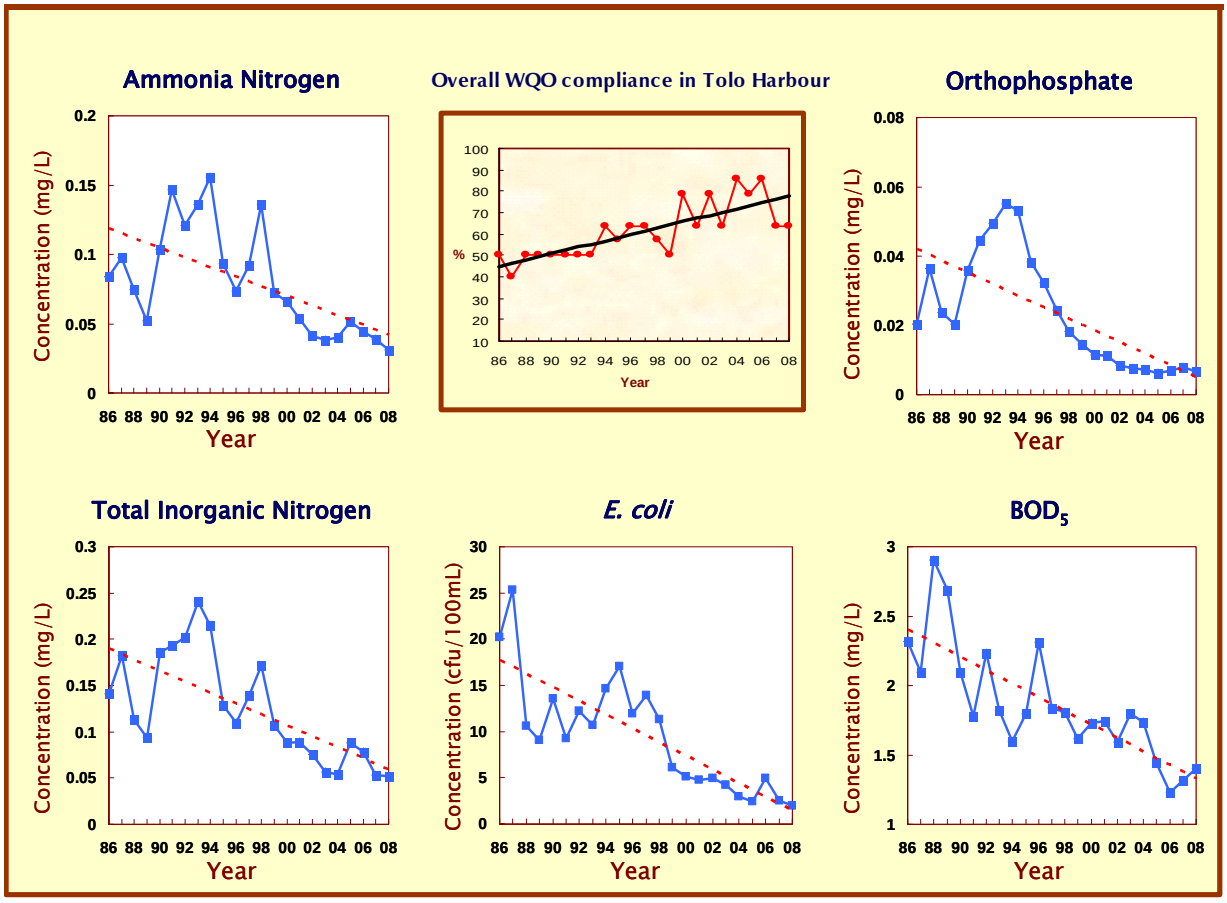

Figure 2.5 Water Quality Changes in the Tolo Harbour and Channel Water Control Zone, 1986 – 2008

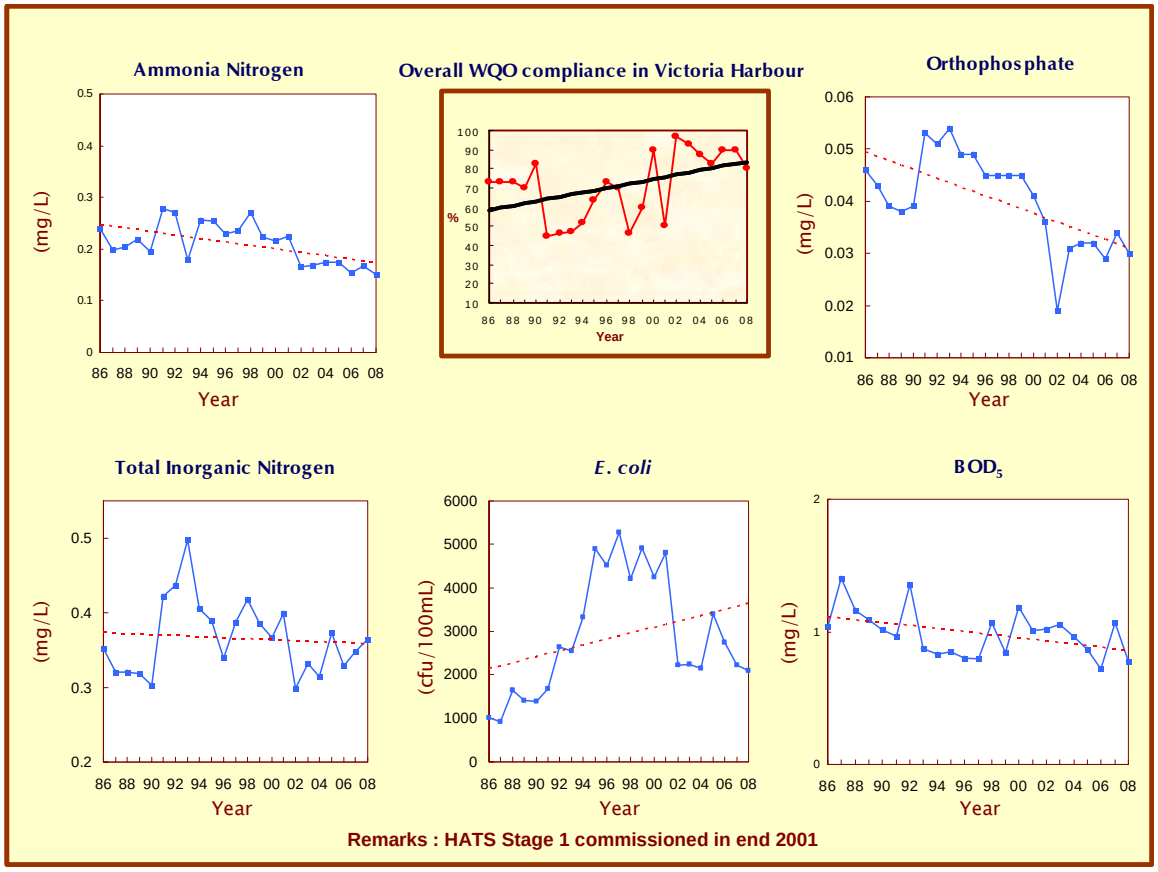

Figure 2.6 Water Quality Changes in the Victoria Harbour Water Control Zone, 1986 - 2008

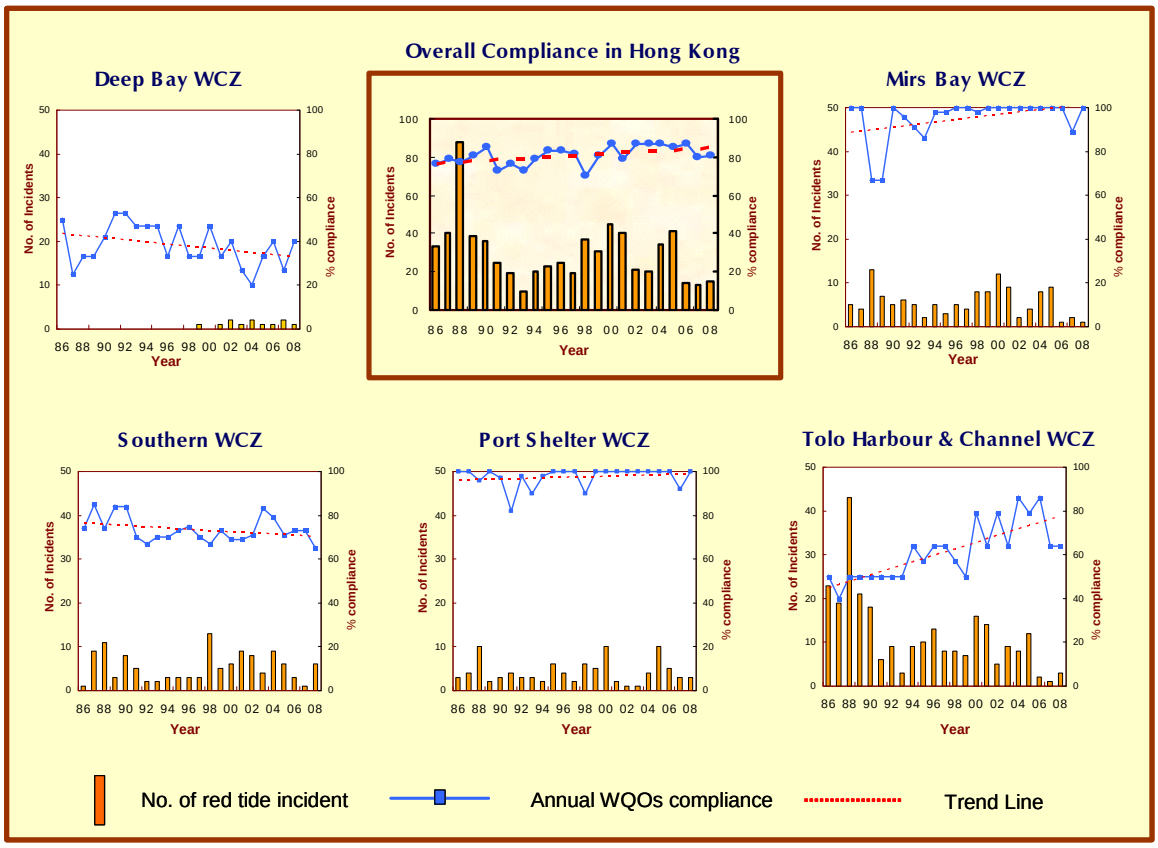

Figure 2.7 Red Tide Incidents and WQO Compliance in Hong Kong Waters, 1986 - 2008

2.3 Characterization of pollution sources and levels

2.3.1 In Hong Kong, the major pollution sources come from more than 2 million m^3 of sewage effluent daily discharged by the population of some 7 million people (Xu et al., 2008) through 25 major sewage treatment works scattered throughout Hong Kong.

2.3.2 The review of the Deep Bay Water Pollution Control Joint Implementation Programme.(HKGJWG 2008) reported that the water quality of the outer Deep Bay is strongly influenced by the Pearl Estuary flow where more than 50% of the nutrients input, in terms of nitrogen and phosphorus, are contributed by non-Bay sources. The influence of the Pearl Estuary flow diminishes towards the inner bay area. Figure 2.8 shows the nutrient contributions by the Pearl Estuary flow to Deep Bay.

2.3.3 For toxic substances, direct discharges of these pollutants by the local industry are currently uncommon due to relocation of the industry to the Mainland since early 1980s'. Chau (2006) concluded that the local source of organochlorines is not significant. The recent study of Kueh and Lam (2008) also pointed out that air deposition or regional pollution, rather than local discharges, are the major contributor to the dioxins/furans, dioxin-like PCBs, PAHs and PCBs found in the local marine environment.

2.3.4 EPD commissioned in 2004 a long-term programme for monitoring toxic substances (Figure 2.9) in the marine environment, focusing on chemicals of potential ecological and health concern identified from the EPD's study on Toxic Substance Pollution in Hong Kong (EPD 2003). Figures 2.10 - 2.15 show the graphical presentation of the data on marine water, sediments and biota collected in 2004-2006. Twenty-four priority chemicals were measured, including dioxins/furans, dioxin-like PCBs, Total PCBs, PAHs, DDTs, HCHs, TBTs, phenol, nonylphenol (NP), NP ethoxylates, PBDEs and metals. Results indicated that toxic substances in Hong Kong marine environment were within the range reported for the coastal waters in China and other regions, but were generally low compared with the Pearl River Estuary (Kueh and Lam 2008).

2.3.5 Yang et al. (2006) reported wide distribution of organo-tin compounds, dioxins/furans, PAHs and nonylphenol ethoxylates in the local marine waters but they concluded that the levels of which were not of toxicological concern. Potential ecological risk on benthic communities was however, found in several "hot spots" such as Victoria Harbour, Deep Bay, and Tolo Harbour and Channel. However, they considered that sediments accumulated from local sewage effluents in the past decades were the major sources of most heavy metals and trace organics, whereas air deposition is only a relatively minor contributor of toxic organic compounds to the local marine environment.

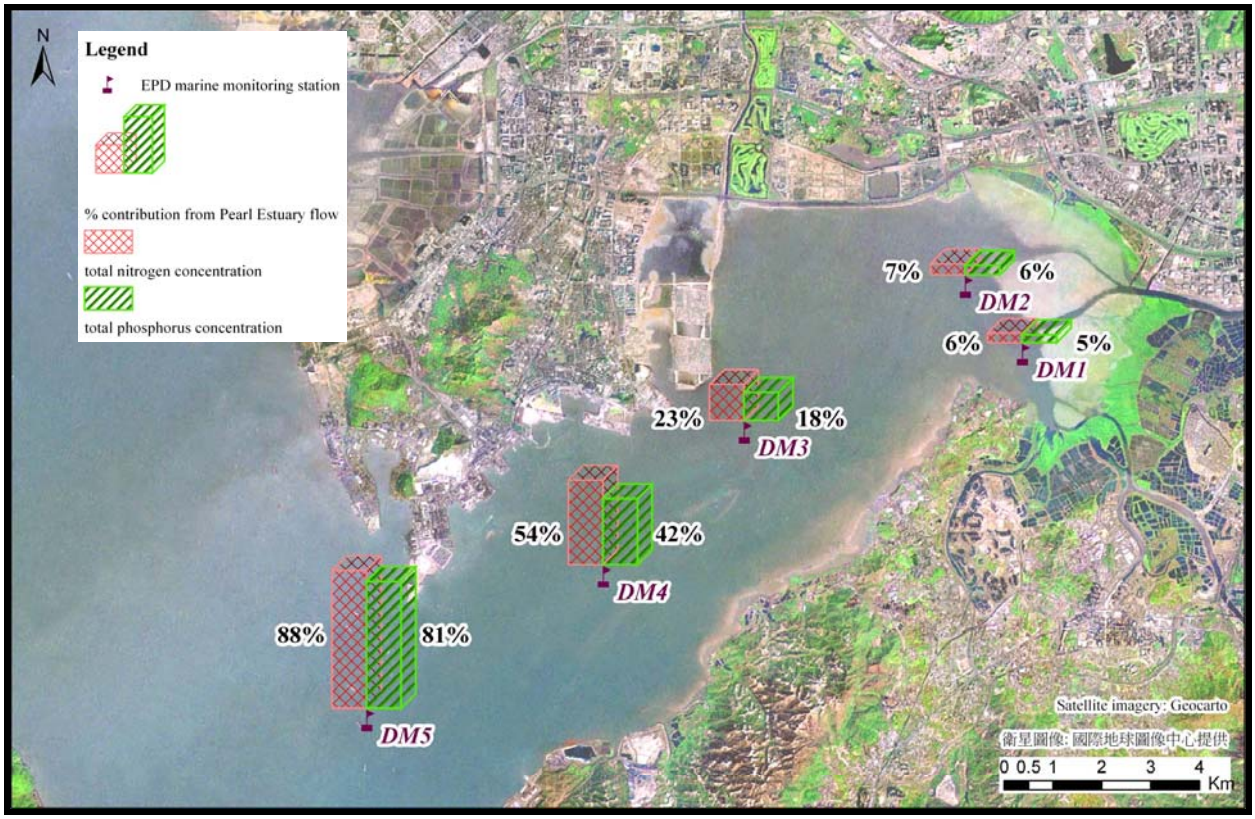

Figure 2.8 Influence of Pearl Estuary Flow on Deep Bay Water Quality

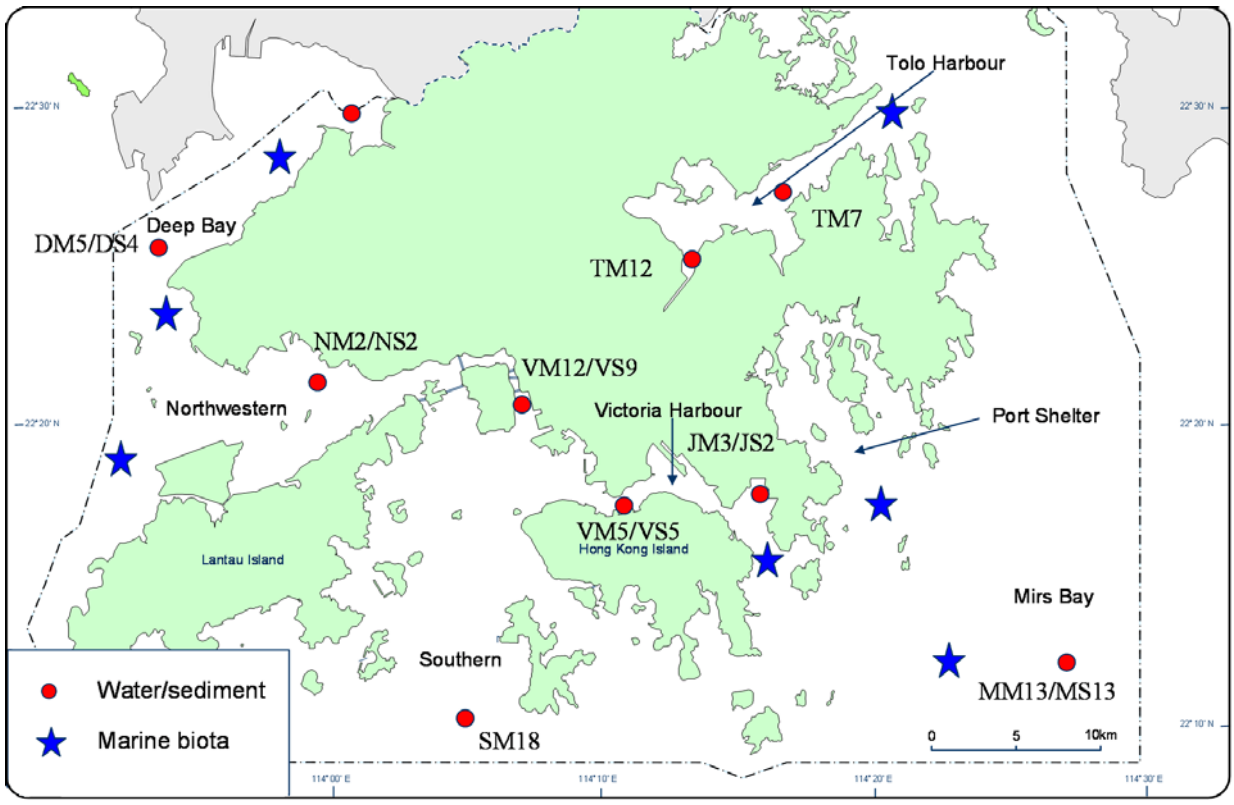

Figure 2.9 Sampling Locations for the Marine Environment under EPD's Toxic Substances Monitoring Programme

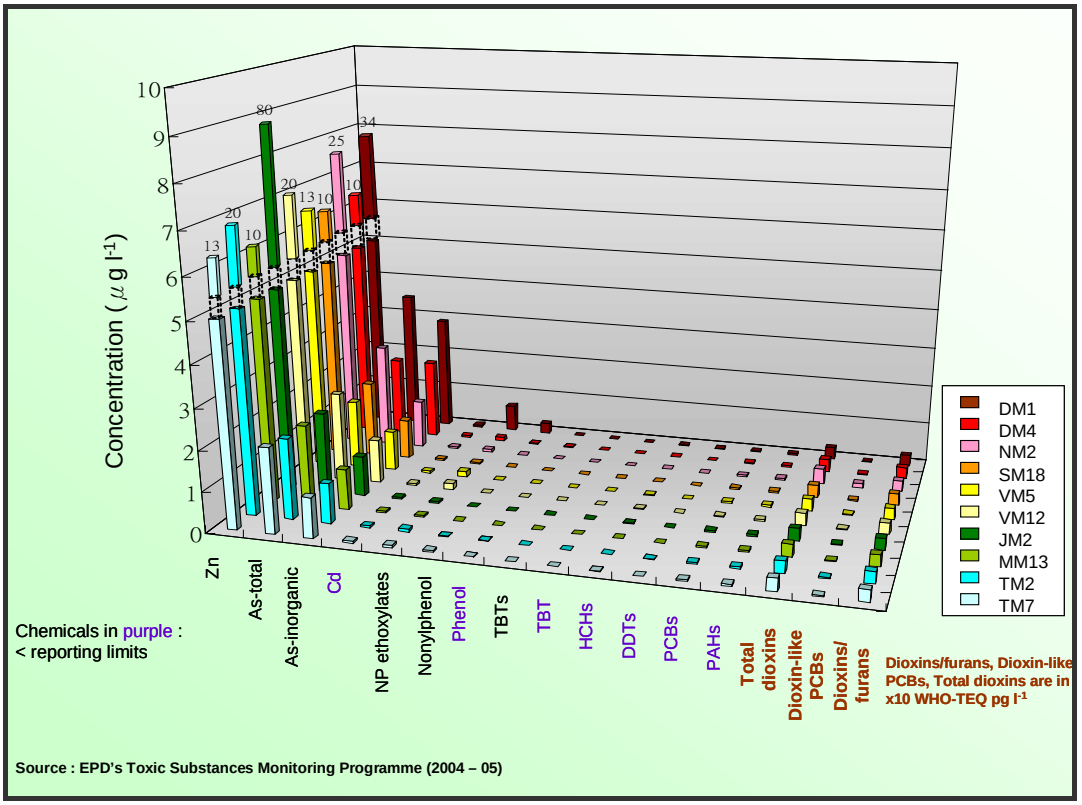

Figure 2.10 Levels of Toxic Substances in Hong Kong's Marine Water

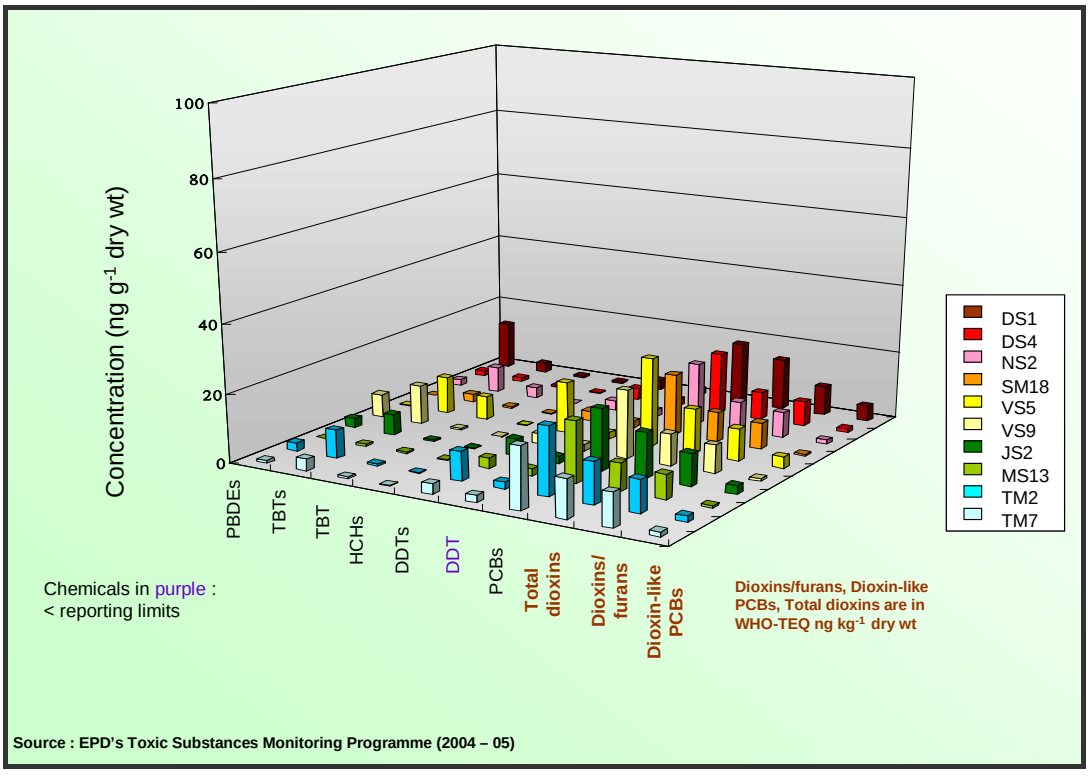

Figure 2.11 Levels of Trace Organic Compounds in Hong Kong's Marine Sediments

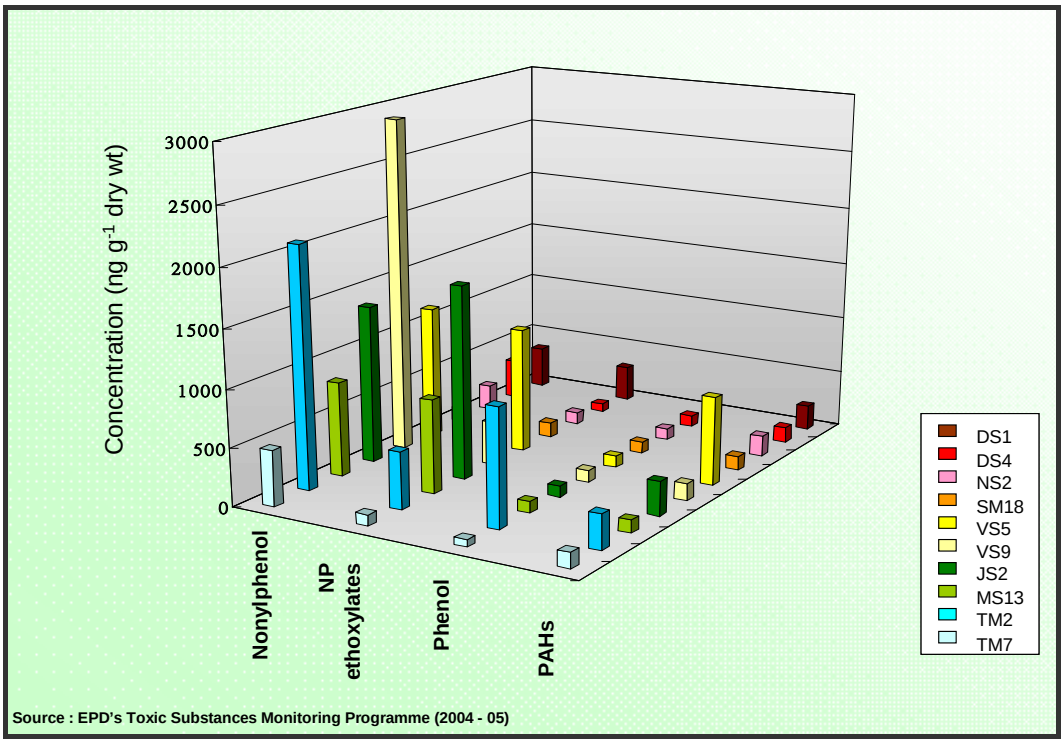

Figure 2.12 Levels of Organic Compounds in Hong Kong's Marine Sediments

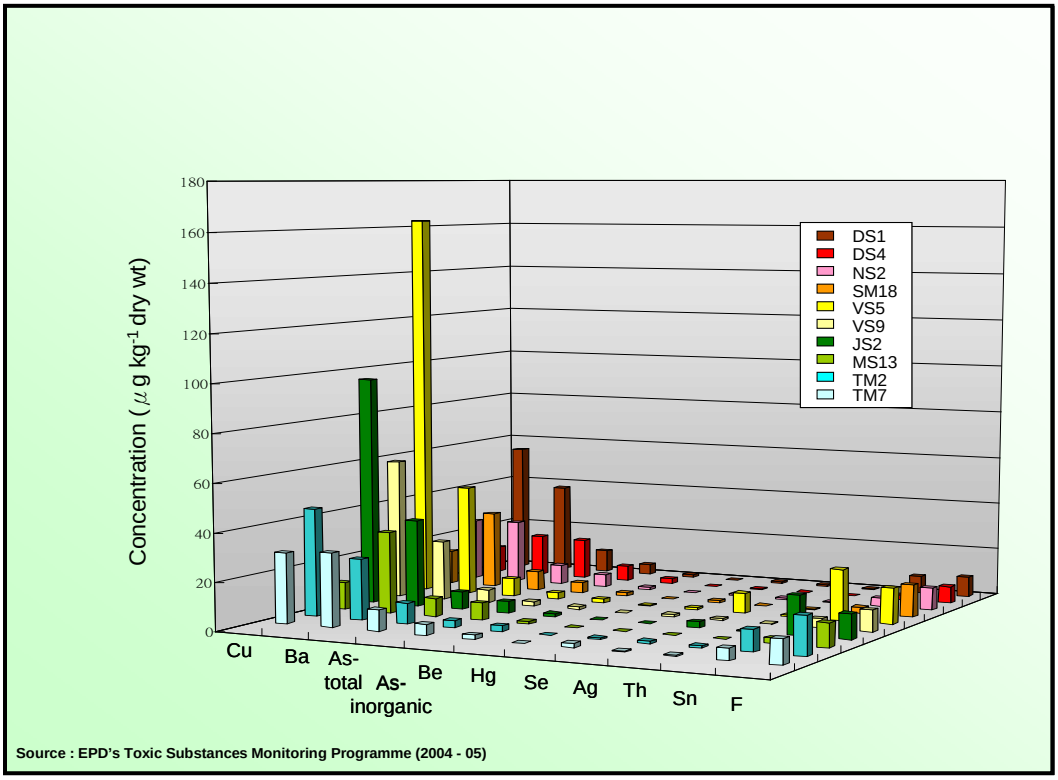

Figure 2.13 Levels of Metal and Inorganic Compounds in Hong Kong's Marine Sediments

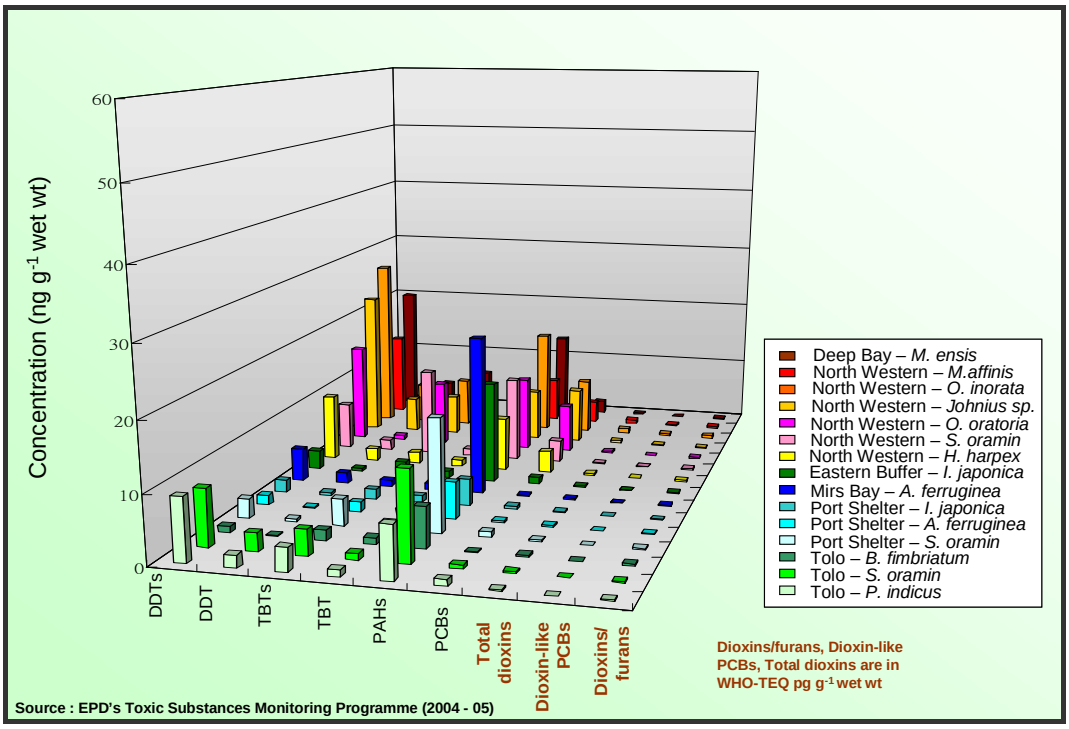

Figure 2.14 Levels of Trace Organic Compounds in Marine Biota collected from Hong Kong

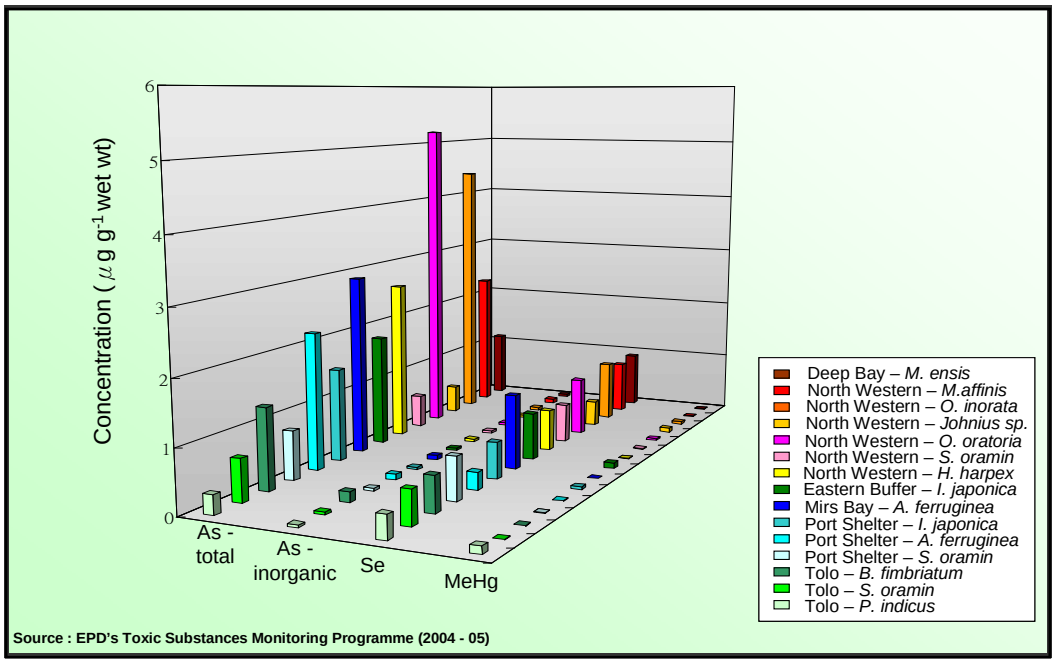

Figure 2.15 Levels of Metal and Metallic Compounds in Marine Biota collected from Hong Kong