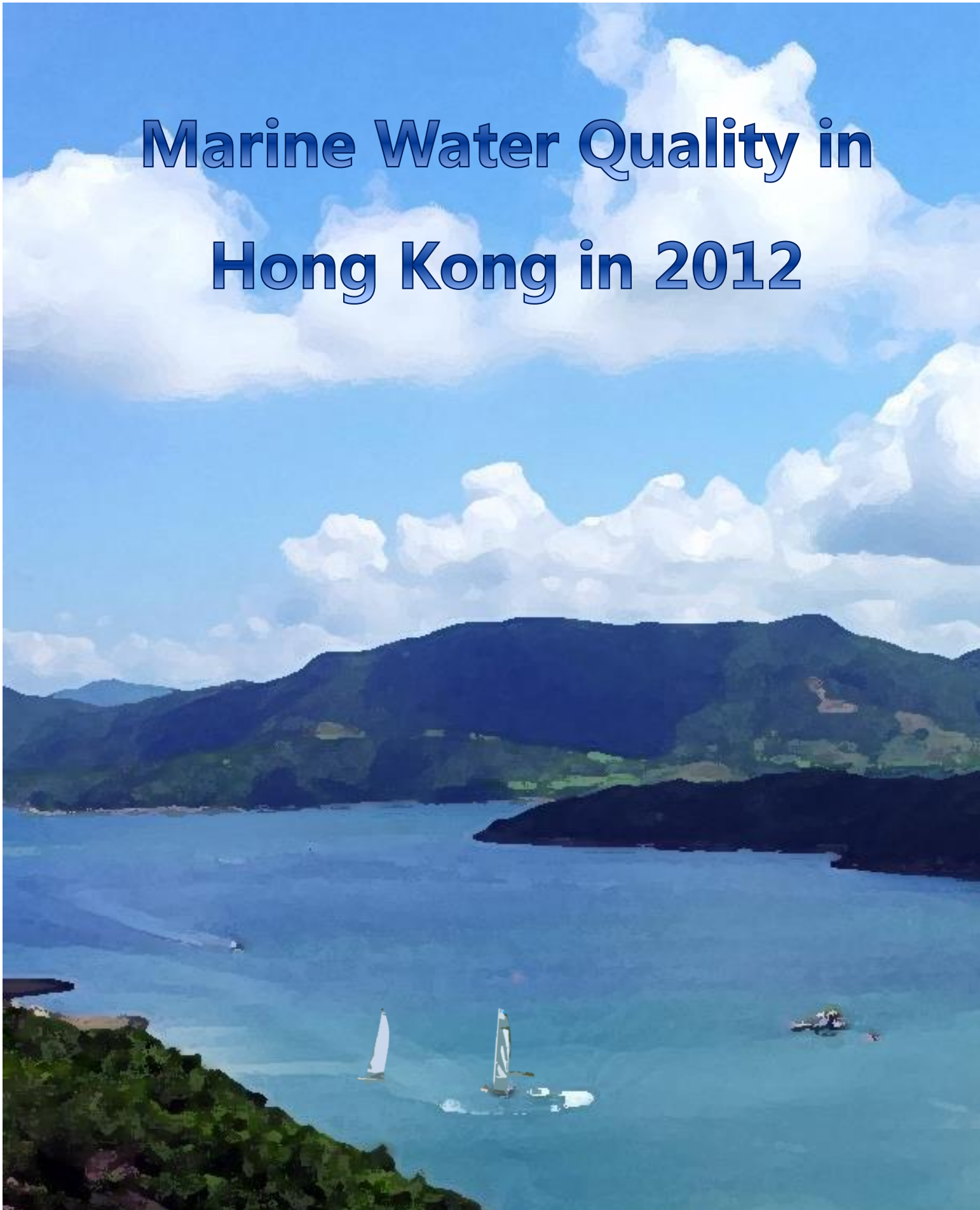


Marine Water Quality in Hong Kong in 2012



Environmental Protection Department

The Government of the Hong Kong Special Administrative Region



Mission

To conduct a comprehensive and scientific monitoring programme that helps safeguard the health of Hong Kong's marine environment and achieve the Water Quality Objectives.



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Introduction

The Hong Kong Special Administrative Region (HKSAR) has a land area of 1,104km² and 1,651km² of marine waters. It has long coastlines, including 462km in the Kowloon Peninsula and New Territories and 727km in Hong Kong Island, Lantau Island and other small islands. Excluding Hong Kong Island and Lantau Island, there are 261 islands in the territory, each with an area greater than 500m². Its coastal waters support a variety of marine life.





To protect the marine environment of Hong Kong, the Environmental Protection Department (EPD) has initiated a comprehensive marine water quality monitoring programme since 1986. The aims and objectives of the programme are to:

- o indicate the state of coastal waters;
- o reveal long-term changes in water quality;
- o provide a basis for planning water pollution control strategies; and
- o assess compliance with the key statutory Water Quality Objectives (WQOs).

Every month, the EPD monitors the marine water quality at 76 monitoring stations and collects and examines phytoplankton samples from 25 of the stations. We also monitor the water quality of 17 typhoon shelters, marinas, and dockyard across Hong Kong bimonthly. In addition, sediment samples are collected and analyzed at 60 stations, covering the 17 typhoon shelters, marinas, and dockyard, twice a year.

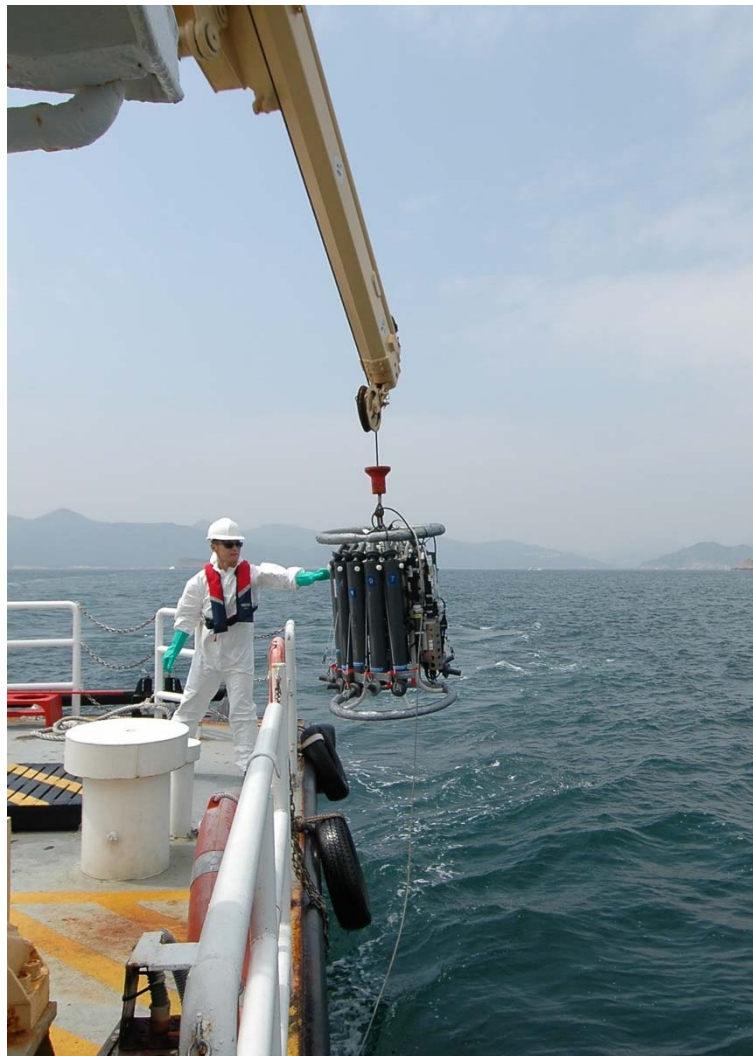


EPD's marine monitoring vessel

"Dr. Catherine Lam"



The EPD has a dedicated marine monitoring vessel “*Dr. Catherine Lam*”. It is equipped with an advanced conductivity-temperature-depth (CTD) profiler linked to a computer-controlled rosette water sampler which takes field measurements and collects water samples simultaneously. Marine sediments are collected using a Van Veen sediment grab sampler. The water and sediment samples are analysed by EPD’s laboratory and the Government Laboratory on over 80 physical, chemical and biological parameters.



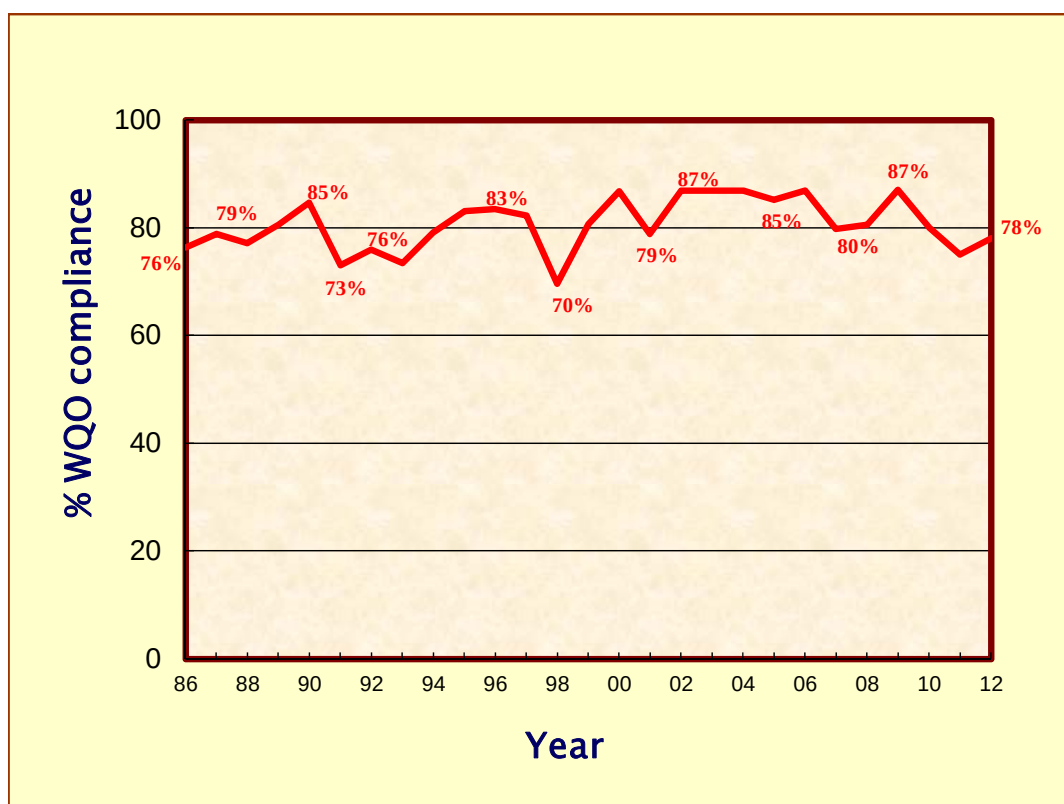
EPD’s staff and the computer-controlled rosette water sampler



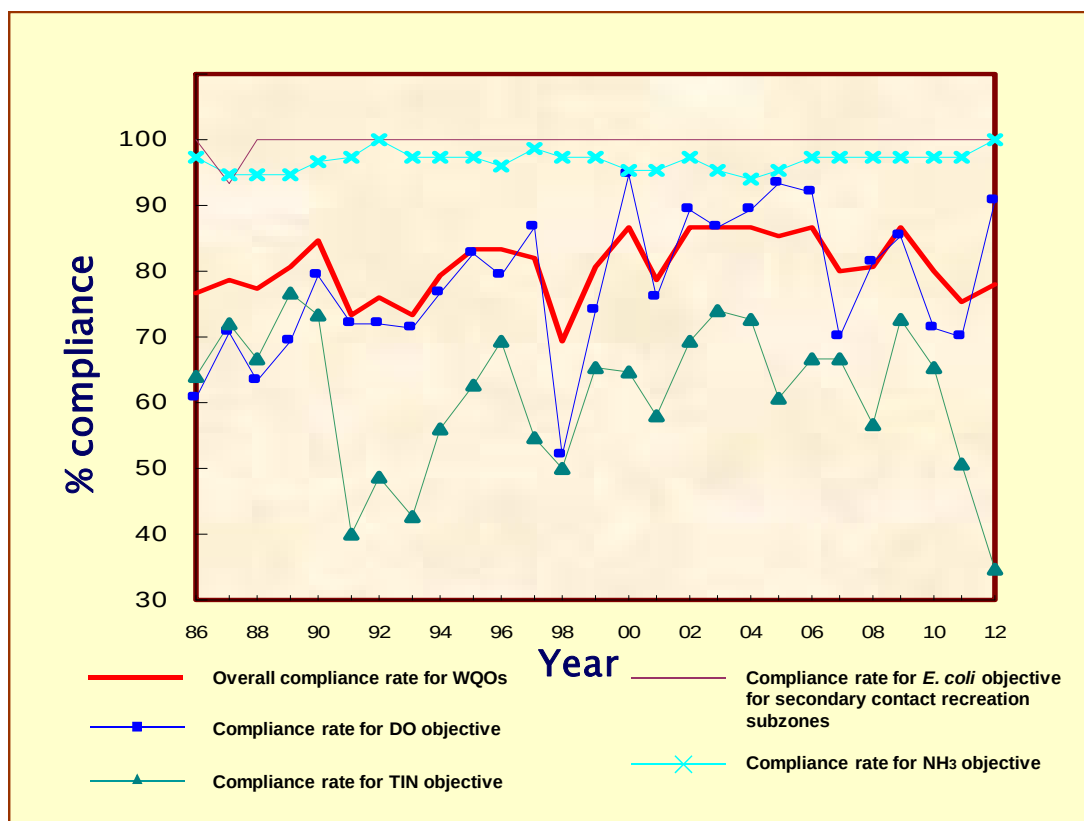
The State of Hong Kong Marine Waters in 2012

The overall WQO compliance rate of the whole territory is based on the combined individual compliance rates of all stations with the marine WQOs for four key parameters namely Dissolved Oxygen (DO), Total Inorganic Nitrogen (TIN), Unionised Ammonia (NH₃) and *E. coli* bacteria.

The overall marine water quality compliance with the WQOs in Hong Kong was 78% in 2012, compared with 75% in 2011.



Overall compliance with the marine Water Quality Objectives
in Hong Kong, 1986-2012



Overall compliance rate with the WQOs and the compliance rates for the four objectives in Hong Kong, 1986-2012

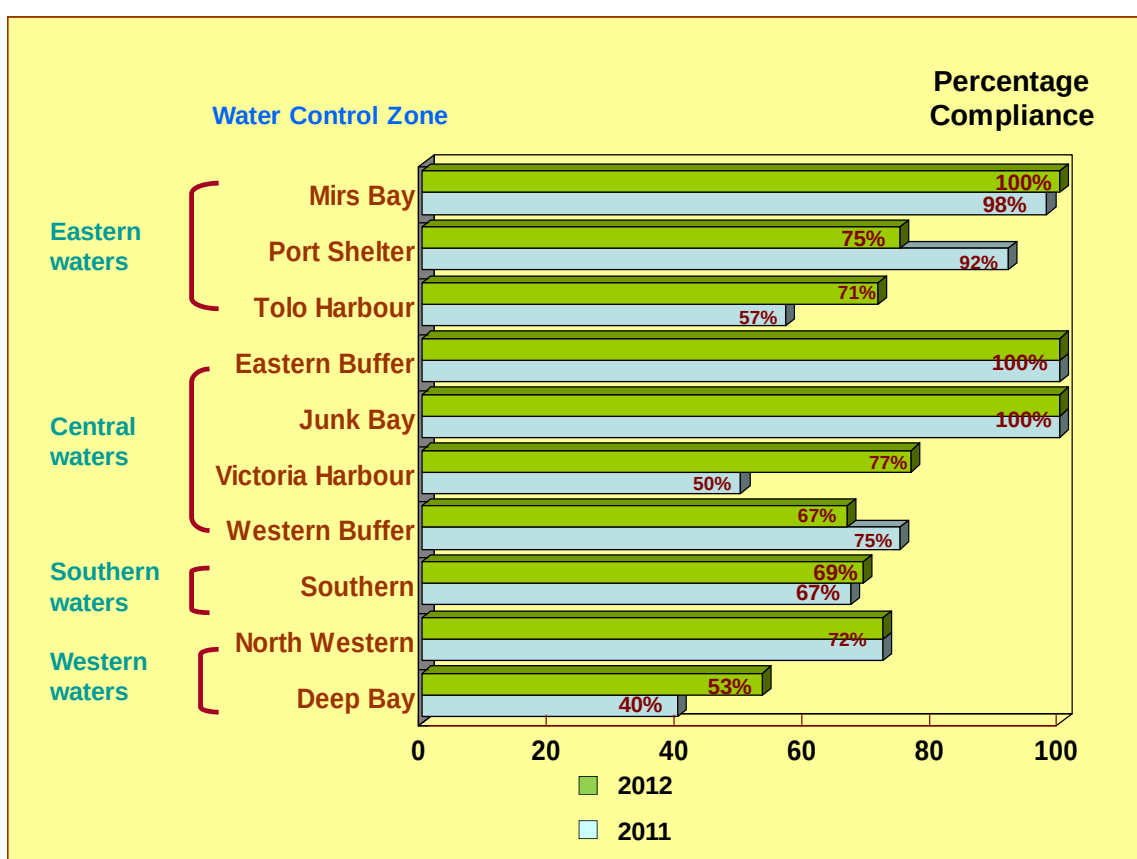
A higher overall WQO compliance rate in 2012 compared with 2011 was mainly due to the improvement in compliance rates with the DO objective from 69.7% to 90.8% and the NH₃-N objective from 97.1% to 100% during the period. Nevertheless, the compliance rate with the TIN objective was only 34.8% in 2012 compared with 50.7% in 2011.

Territory-wise speaking, five Water Control Zones (WCZs) (i.e. Victoria Harbour, Southern, Deep Bay, Tolo Harbour and Mirs Bay WCZs) have higher overall compliance rate, two WCZs (i.e. Western Buffer, Port Shelter WCZs) have lower overall compliance rate, and for the remaining three WCZs (e.g. North Western, Junk Bay and Eastern Buffer WCZs) the overall compliance rate remain unchanged. The improvement of overall compliance rate in the Victoria Harbour, Southern, Tolo Harbour and Mirs Bay WCZs in 2012 was mainly due to higher compliance rates with the DO objective. For the Deep Bay WCZ, the improvement was due to a higher compliance rate with the NH₃-N objective.

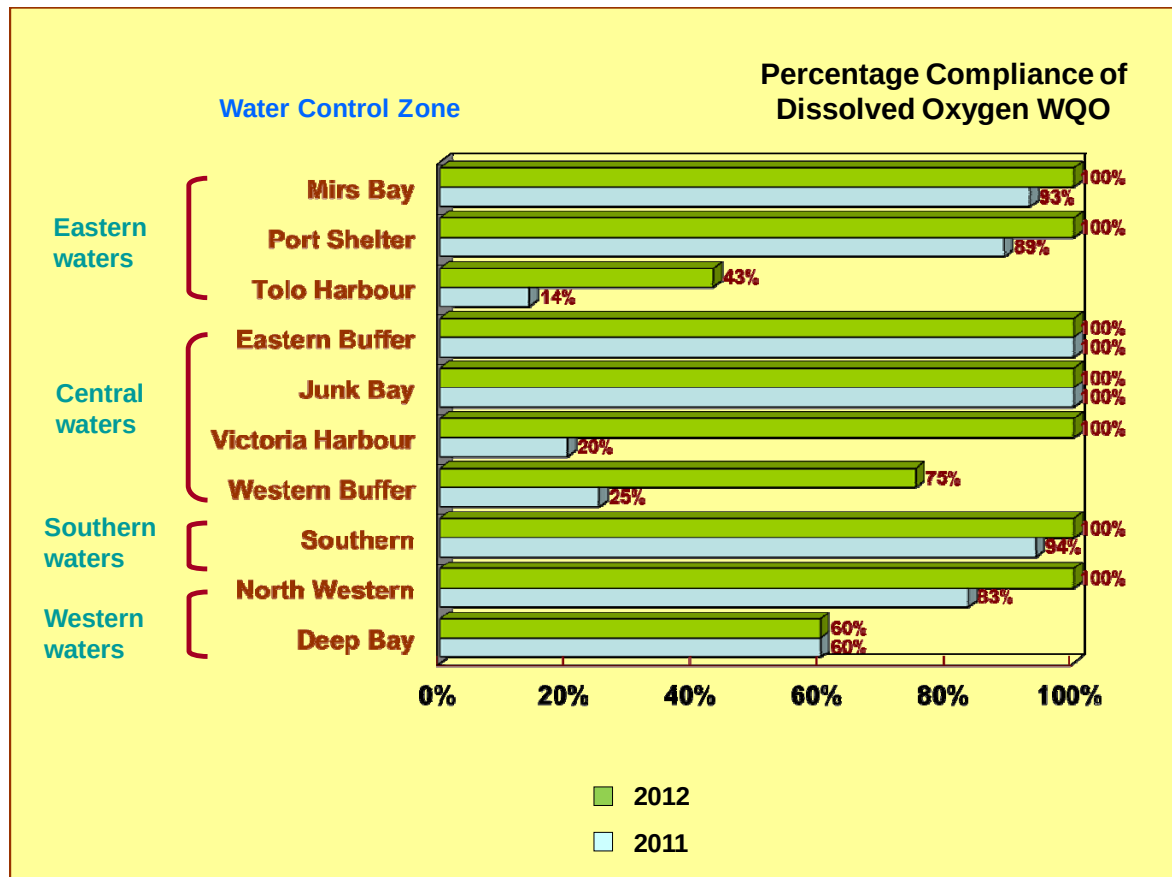


On the other hand, the drop in the overall compliance rate in the Western Buffer WCZ was mainly due to an increase in the total inorganic nitrogen (TIN) level at three monitoring stations which marginally failed to meet the TIN objective of 0.4 mg/L in 2012, while all four stations complied with the TIN objective in 2011. The increase in TIN level could be due to a higher background TIN level under the influence of Pearl River discharge, as reflected in the TIN level in many stations in the North Western and Southern WCZs; as well as the gradual increase in the flow from the four preliminary treatment plants located between North Point and Central during the period.

Similarly, there was a drop in the overall WQO compliance rate in the Port Shelter WCZ because all nine stations failed to meet the very stringent TIN objective of 0.1 mg/L in 2012, while only two stations failed to do so in 2011. The increase in TIN level could be due to a higher background TIN level in the eastern waters of Hong Kong brought about by an increase in shipping and port activities in the region.



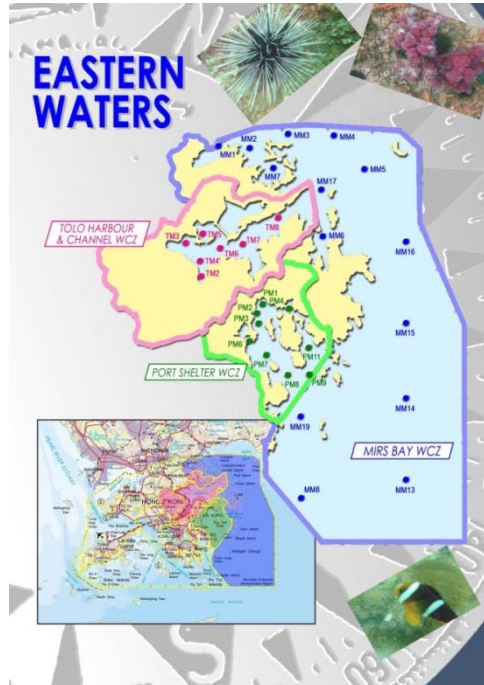
Level of compliance with the Water Quality Objectives in the ten Water Control Zones in 2011 and 2012



Level of compliance with the Dissolved Oxygen Water Quality Objective
in the ten Water Control Zones in 2011 and 2012



Eastern Waters



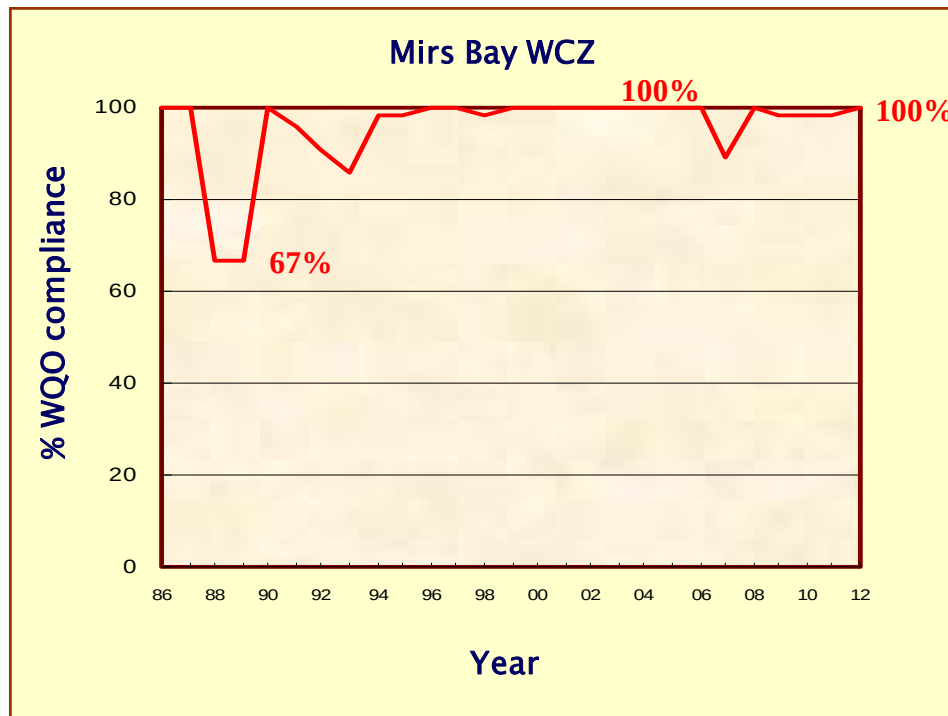
The eastern waters cover an area of 900 km² which comprises the Mirs Bay, Port Shelter and Tolo Harbour and Channel WCZs. These waterbodies have beautiful coastlines and good water quality in general which support a diversity of marine life. Moreover, there are six gazetted beaches (Kiu Tsui, Hap Mun Bay, Trio, Silverstrand, Clear Water Bay First and Clear Water Bay Second) in Port Shelter, three marine parks (Yan Chau Tong, Hoi Ha Wan and Tung Ping Chau), 21 fish culture zones and a number of secondary contact recreation subzones located within these three WCZs.



Po Kwu Wan in Port Shelter WCZ



Mirs Bay Water Control Zone



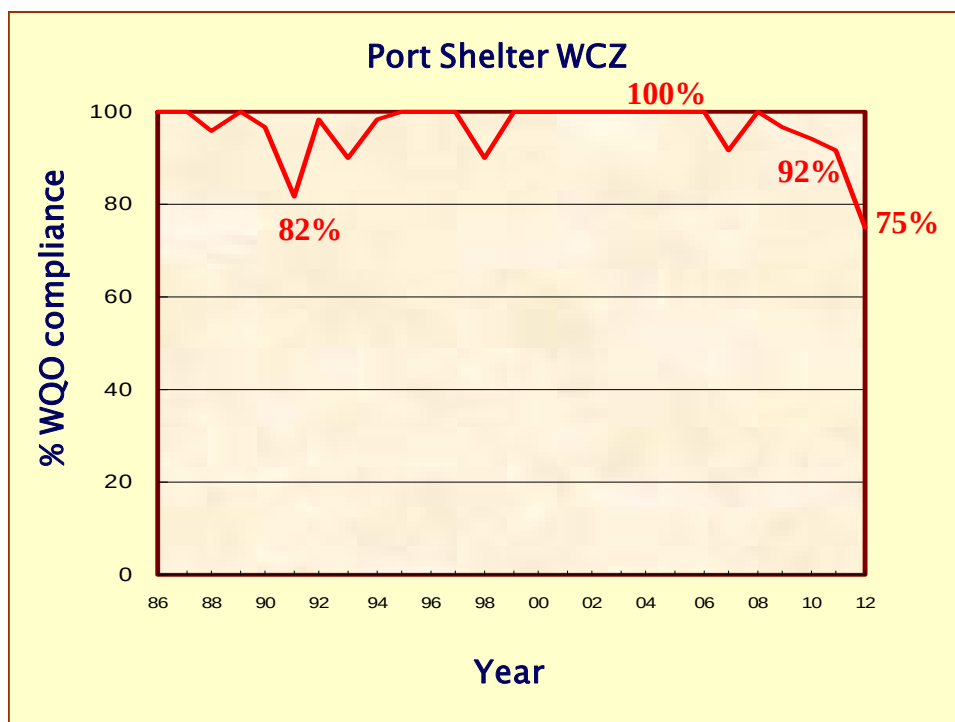
In 2012, the overall WQO compliance rate of the Mirs Bay WCZ was 100%. Despite an increasing trend in TIN in recent years, the water quality of the Mirs Bay WCZ was generally good in 2012 with high DO. Both the DO and TIN levels also fully met the respective WQO. Moreover, the Mirs Bay WCZ also complied with the bacteriological WQO of ≤ 610 *E. coli* cfu / 100 mL (annual geometric mean) for secondary contact recreation.



The very popular Sai Wan in Mirs Bay WCZ



Port Shelter Water Control Zone



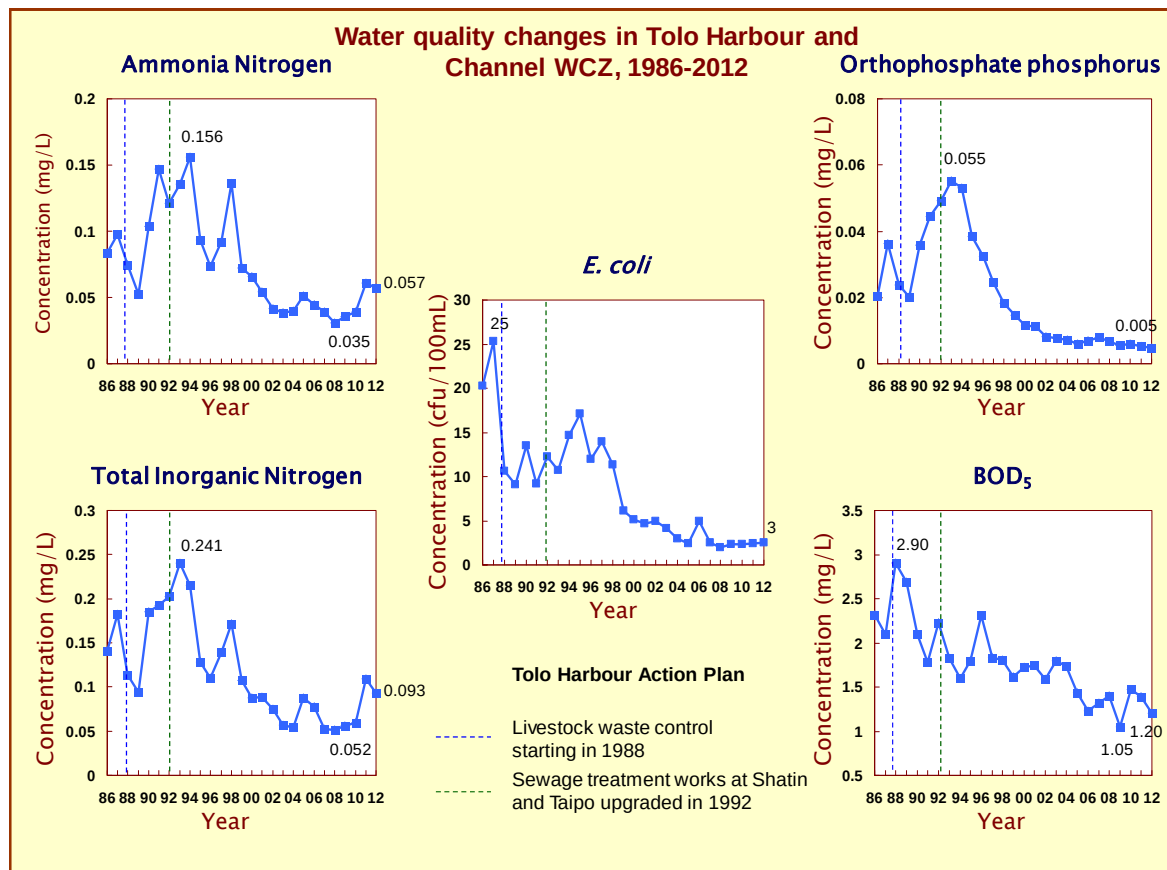
Port Shelter attracts a lot of visitors who enjoy various water sports activities, including swimming, yachting, water-skiing and diving, every year. The six gazetted beaches attracted 1.34 million visitors during the 2012 bathing season.

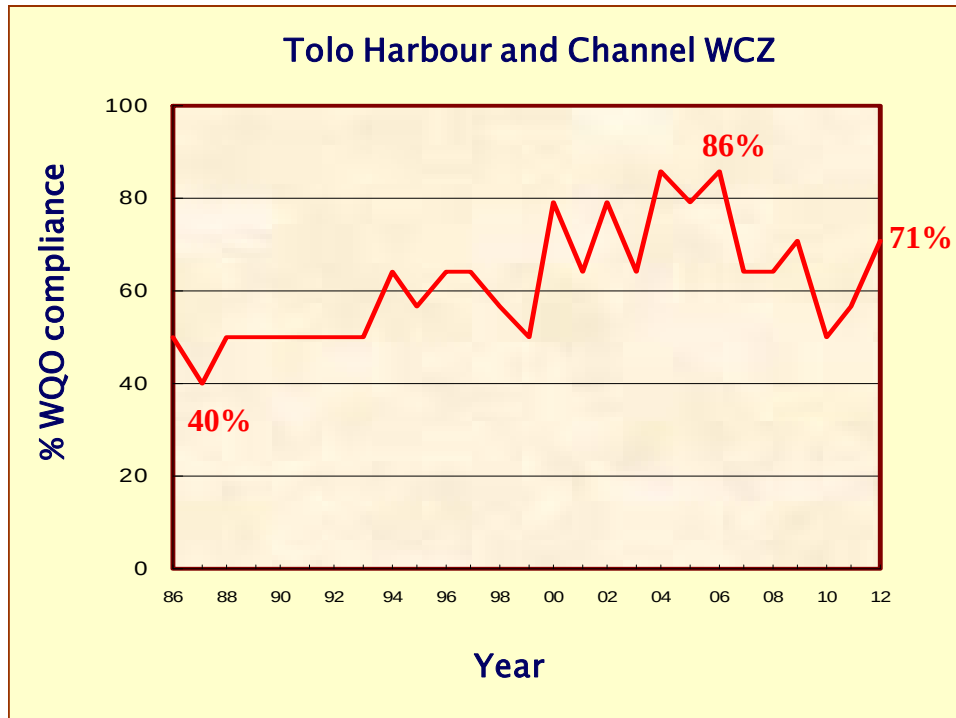
In 2012, the levels of DO and *E. coli* in the Port Shelter WCZ were satisfactory as in previous years. However, the 2012 WQO compliance rate of the Port Shelter WCZ was only 75% compared with 92% in 2011. The lower compliance rate was because all nine stations failed to meet the very stringent TIN objective of 0.1 mg/L in 2012, while only two stations failed to do so in 2011. The average TIN level of the WCZ was 0.115 mg/L in 2012, compared to 0.090 mg/L in 2011. Because a similar pattern of TIN elevation was noted at both the inner and outer parts of the Port Shelter WCZ as well as the entire Mirs Bay and Eastern Buffer WCZs, we would observe that the elevated TIN level in recent years is a regional phenomenon which could be related to the increase in shipping activities to and from the Yantian International Container Terminal (YICT) on the Mainland side in northern Mirs Bay.



Tolo Harbour and Channel Water Control Zone

Since the implementation of the Tolo Harbour Action Plan in the mid-80s, which includes the control of livestock wastes, the improvement of sewage treatment facilities, the export of treated effluent outside Tolo Harbour and the extension of village sewerage, there has been a steady improvement in water quality in Tolo Harbour in the past decade including a decrease in the levels of 5-day Biochemical Oxygen Demand (BOD₅), *E. coli*, nitrogen and orthophosphate phosphorus. The long term data as shown in the figures below indicated the decreasing trend of organic and nutrient loading. Moreover, Tolo Harbour is also able to comply with the bacteriological WQO of ≤ 610 *E. coli* cfu / 100 mL (annual geometric mean) for secondary contact recreation.





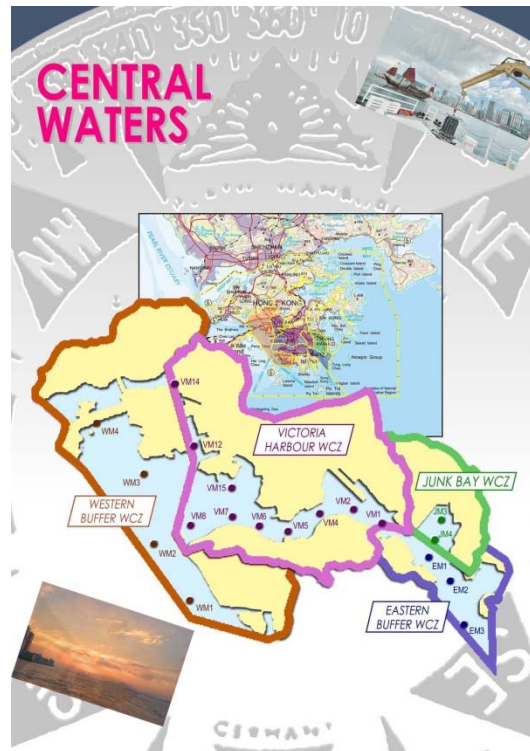
The 2012 overall WQO compliance rate of the Tolo Harbour and Channel WCZ was 71% and was higher than that in 2011 due to the increase in compliance rate with the DO objective from 14% to 43% in the same period. Since Tolo Harbour is a shallow semi-enclosed water body with low water exchange rate with Mirs Bay, the harbour's essentially landlocked situation often leads to stratification of the water column and lower bottom DO levels particularly during the hot summer months, hence resulting in non-compliance with the DO objective in the summer months.



Lo Fu Wat in Tolo Harbour and Channel WCZ



Central Waters



The central waters of Hong Kong, including the Victoria Harbour, Eastern Buffer, Western Buffer and Junk Bay WCZs, are important navigational channels and port areas. After the commissioning of the Stonecutters Island Sewage Treatment Works (SCISTW) under the Harbour Area Treatment Scheme (HATS) Stage 1 in 2002, about 75% of the sewage around Victoria Harbour now receives chemically enhanced primary treatment, resulting in a 70% reduction of the pollution load (in terms of organic pollutants) into the harbour. This also leads to an improvement of water quality in the harbour which can be observed particularly in the Eastern Buffer and Junk Bay WCZs.

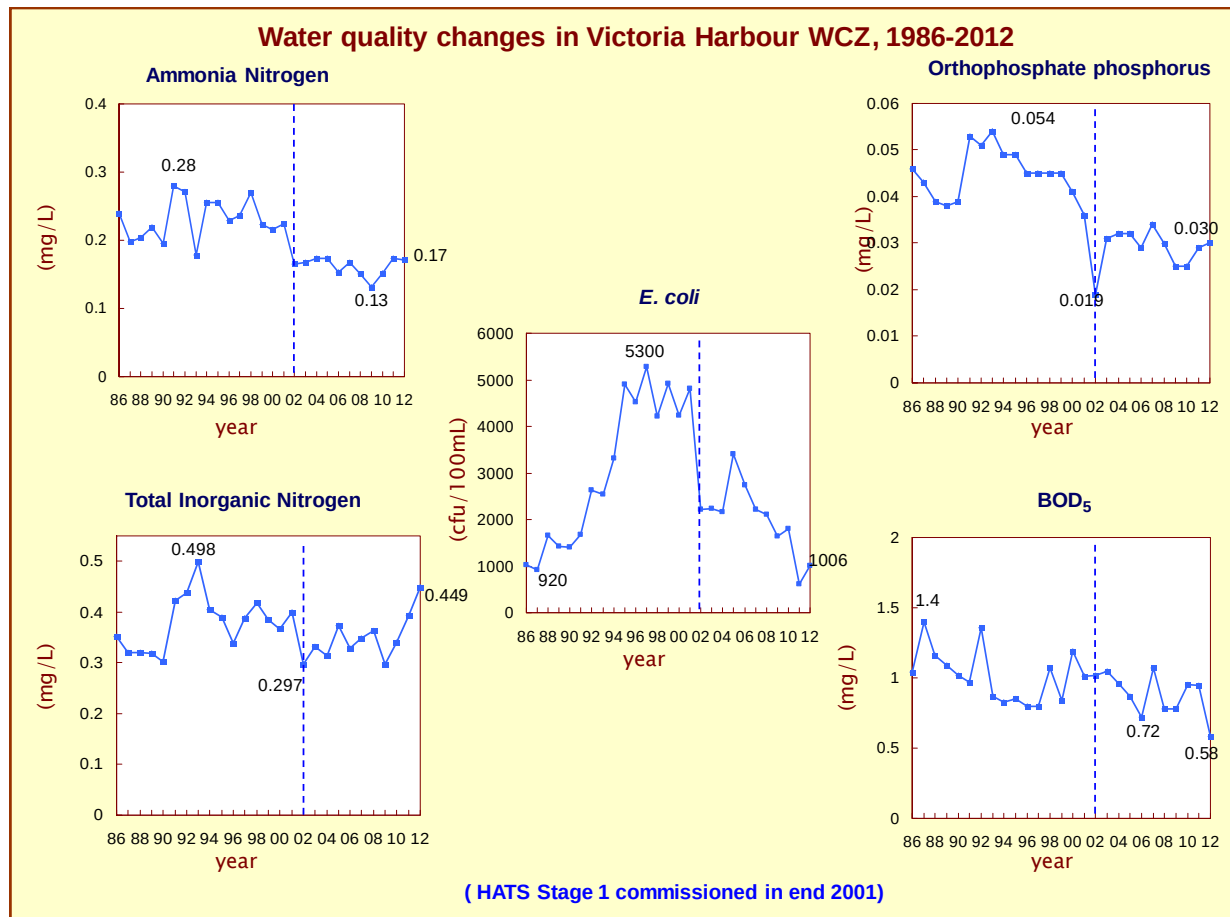


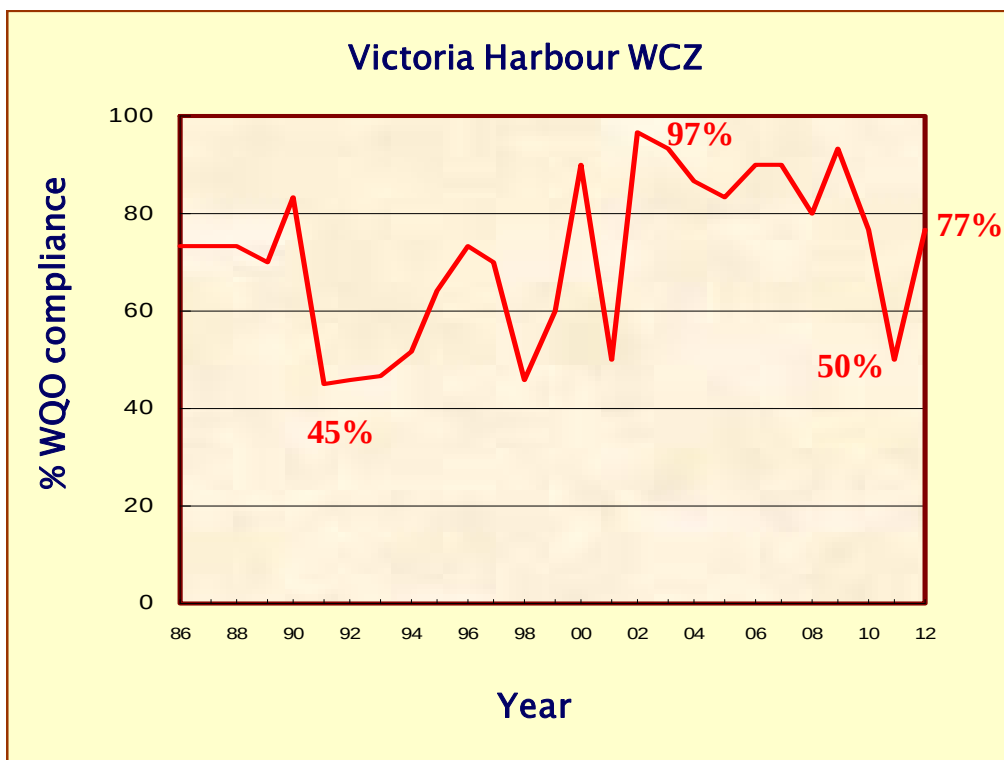
Victoria Harbour



Victoria Harbour Water Control Zone

The figure below illustrates the long term trend of some important water quality parameters in Victoria Harbour since 1986 and after the implementation of the HATS Stage 1 in end 2001.





The overall WQO compliance rate of the WCZ was 77%, as compared with 50% in 2011. Increase in the compliance rate in 2012 was resulted from the improvement in compliance with the DO objective. All the open water stations in the Victoria Harbour WCZ achieved 100% compliance with the DO objective in 2012.

Compliance with the TIN objective in 2012 remained at 30% as in 2011. Same as in 2011, non-compliance are mainly observed at stations in the central and western parts of the Harbour (VM5, 6, 7, 8, 12, 14 and 15). The overall annual average level of TIN in Victoria Harbour increased from 0.39 mg/L in 2011 to 0.45 mg/L in 2012. The increase in TIN level could be due to a higher background TIN level under the influence of Pearl River discharge, as reflected in the increase in TIN level in many stations in the Northwestern and Southern WCZs, the year-to-year normal range of fluctuation of the discharge from the Tolo Harbour Effluent Export Scheme and surface run-off, as well as the gradual increase in effluent discharged from the four preliminary treatment plants located between North Point and Central during the period.

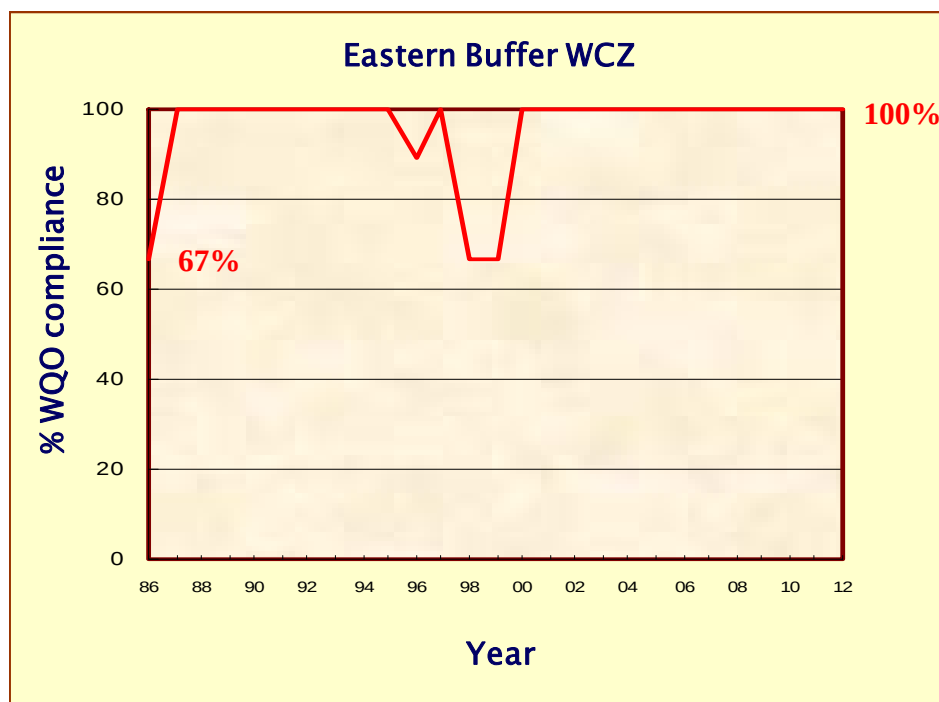
At present, sewage discharged from the four remaining preliminary treatment plants in the middle and western parts of Hong Kong Island are still contributing to the relatively high levels of *E. coli* in central Victoria Harbour. To further improve the water quality of Victoria Harbour, the construction of HATS Stage 2A has proceeded with a view to completion by end 2014

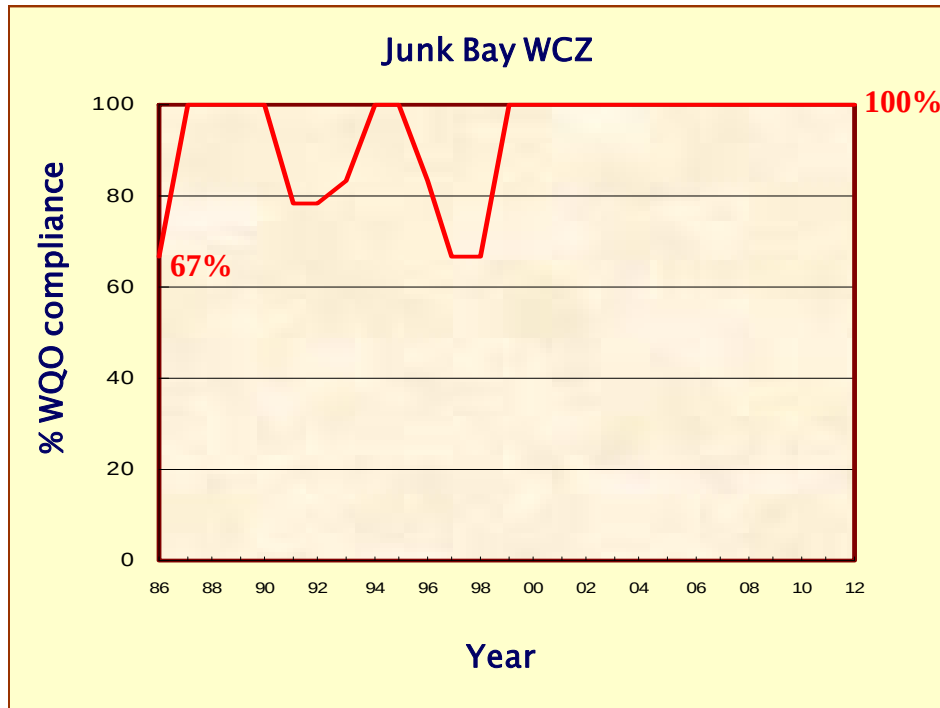


(<http://www.cleanharbour.gov.hk/english/index.html>). Upon commissioning, sewage tunnels will collect the remaining 25% of the sewage currently generated daily from North Point to Ap Lei Chau in the middle and western parts of Hong Kong Island, and convey the sewage to the SCISTW for treatment.

Eastern Buffer and Junk Bay Water Control Zones

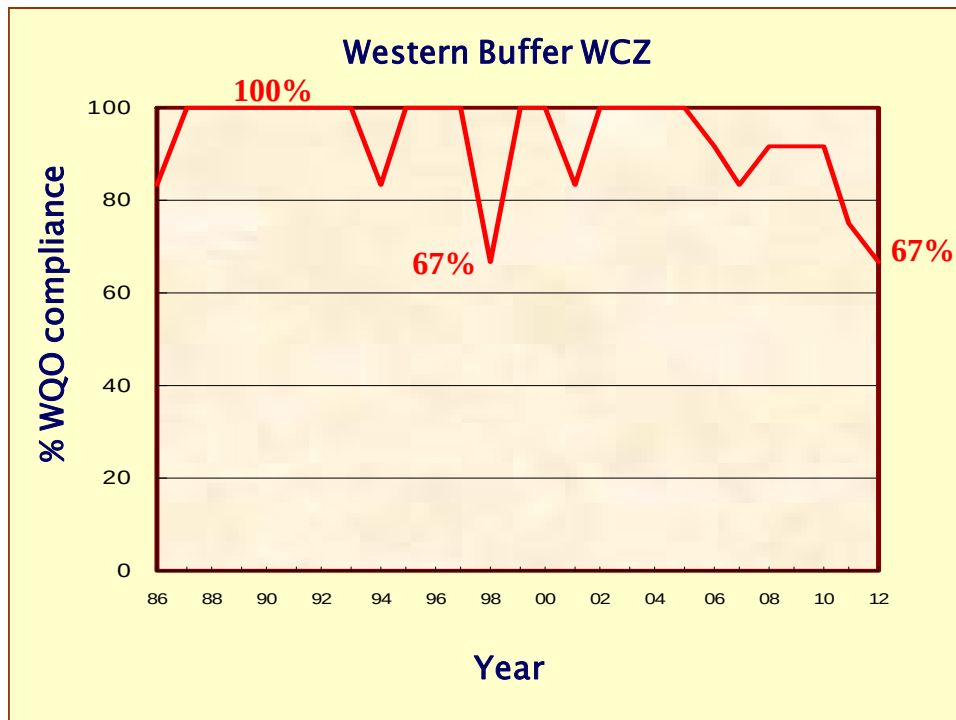
Both the Eastern Buffer and Junk Bay WCZs have achieved full compliance (100%) with the WQOs in 2012. Indeed, since the implementation of HATS Stage 1 in 2002 by which all sewage generated from Junk Bay (Tseung Kwan O), the Kowloon Peninsula and east of Hong Kong Island (Chai Wan) was diverted and treated at the SCISTW, the water quality of these two WCZs has improved markedly with increasing DO and decreasing nutrient and bacterial levels.



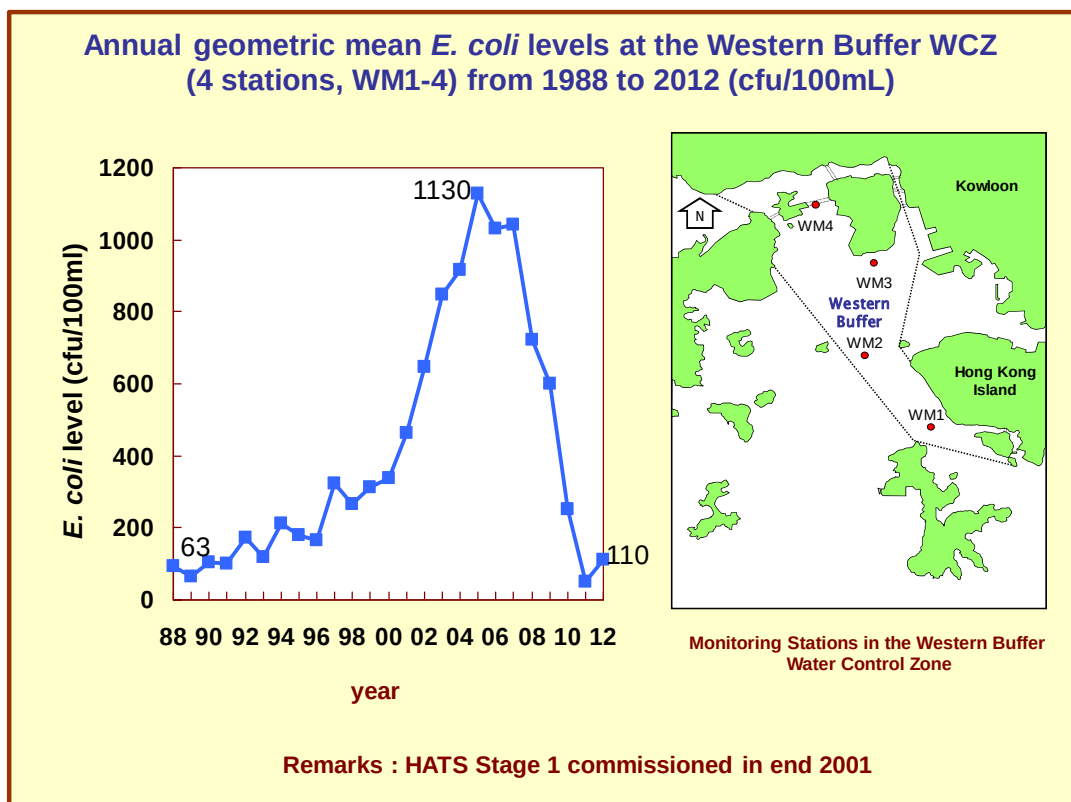


Western Buffer Water Control Zone

The Western Buffer WCZ achieved a 67% overall compliance with the WQOs in 2012, lower than the 75% in 2011. While compliance with the DO objective improved from 25% in 2011 to 75% in 2012, compliance with the TIN objective fell from 100% in 2011 to 25% in 2012 resulting in a lower overall compliance rate in 2012. The low compliance with the TIN objective was due to marginal exceedance of the TIN WQO of 0.4mg/L at three stations WM2, WM3 and WM4 (ranging from 0.401 to 0.426 mg/L) out of four stations. Similar to the Victoria Harbour WCZ, the increase in TIN level in recent years could be due to a higher background TIN level under the influence of Pearl River discharge, the year to year fluctuation of surface run-off, as well as the gradual increase in discharges from the four preliminary treatment plants located between North Point and Central during the period.

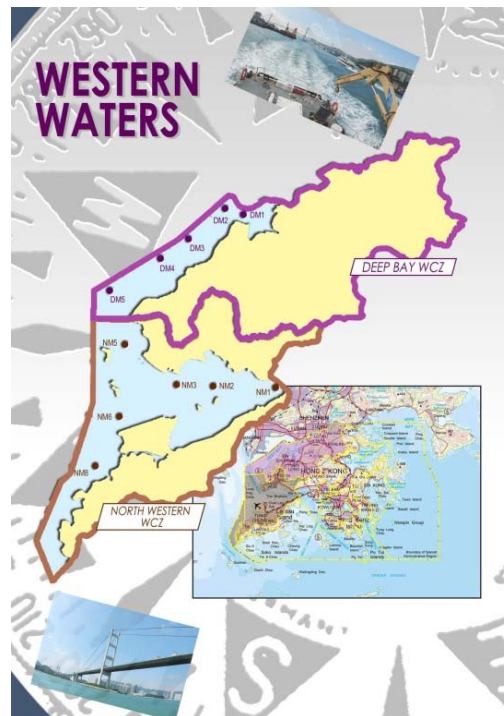


On the other hand, since the commissioning of the Advance Disinfection Facilities in March 2010, the *E. coli* level in the WCZ decreased by over 90% in 2011, as compared with the pre-commissioning period of 2009.





Western Waters



The Deep Bay and North Western WCZs are located to the west of Hong Kong. Other than local discharge, both WCZs were influenced by the discharges from Pearl River during the wet season. The Deep Bay WCZ also receives discharges from Shenzhen River all year round.

The Deep Bay WCZ includes the ecologically sensitive Mai Po and Inner Deep Bay Ramsar site, and areas of oyster culture. The Ramsar Site inside Deep Bay supports a high diversity of birds. About 300 species, representing about 70% of the Hong Kong avian fauna, have been recorded there. The site regularly supports over 100,000 waterbirds for the whole year and some 50,000 waterbirds in mid-winter. It is an important feeding and resting ground for wintering and migratory birds, including a number of globally threatened species (e.g. Black-faced Spoonbill, Saunders's Gull and Imperial Eagle).



Nam Sang Wai in Inner Deep Bay WCZ



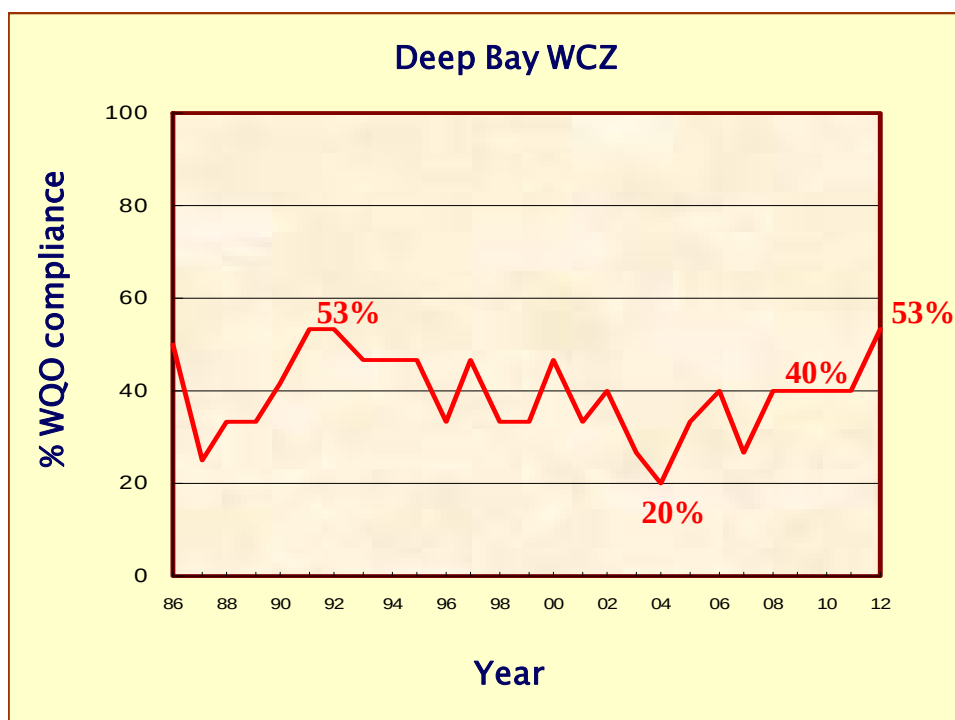
The North Western WCZ is the water body where Chinese white dolphins are commonly spotted in areas around Lantau Island, Tuen Mun, Sha Chau and Lung Kwu Chau. Sha Chau and Lung Kwu Chau Marine Park is also the only marine park located in the western waters of Hong Kong.



North Western Waters

Deep Bay Water Control Zone

Deep Bay is shallow with depths varying from 2m at DM1 to 8m at DM5 and its sediment laden water body is impacted by pollution from both Hong Kong and Shenzhen including discharges from Shenzhen River as well as some local unsewered villages. The inner Deep Bay was most affected by the discharges from Shenzhen River as well as Kam Tin River, Yuen Long Creek and Tin Shui Wai Nullah.

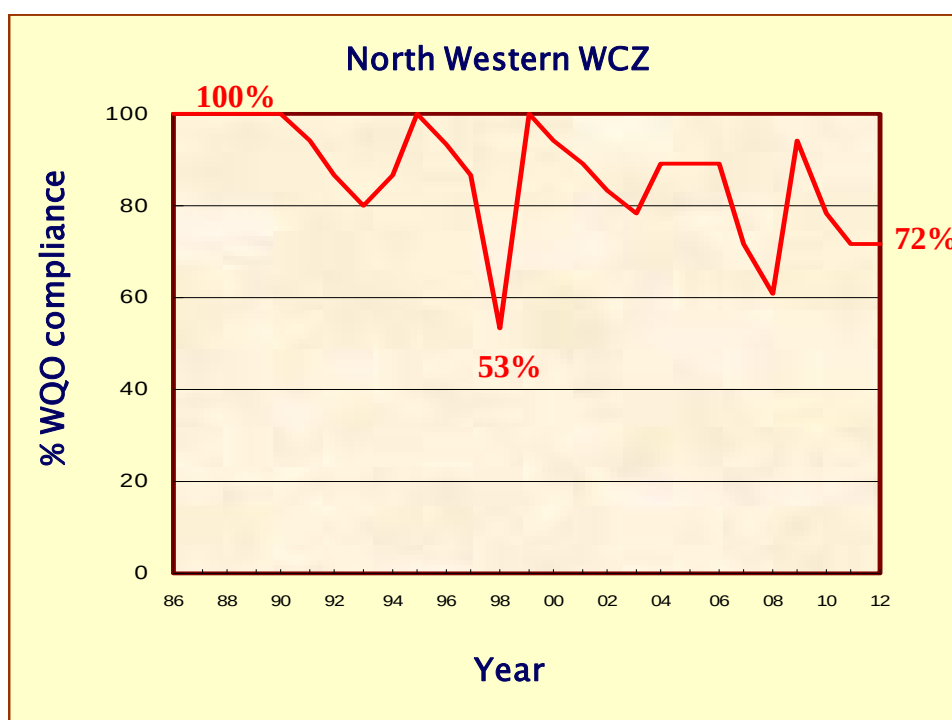




The Deep Bay WCZ has high concentrations of organic and inorganic pollutants and low levels of DO. The WQO compliance in the Deep Bay WCZ in 2012 was 53% compared with 40% recorded in the previous four years due to the decrease in the level of unionized ammonia from 0.013 mg/L to 0.009 mg/L which led to an increase in compliance with the unionized ammonia WQO from 60% to 100%.

Similar to the previous years, none of the five stations in the Deep Bay WCZ met the TIN objective in 2012. The TIN level in the Deep Bay inner subzone (1.8 – 3.6 mg/L) and Deep Bay outer subzone (1.1 – 1.5 mg/L) was higher than the respective TIN objective of 0.7 mg/L and 0.5 mg/L. In addition, two out of the three stations in Inner Deep Bay (DM1 and DM3) also did not comply with the DO objective.

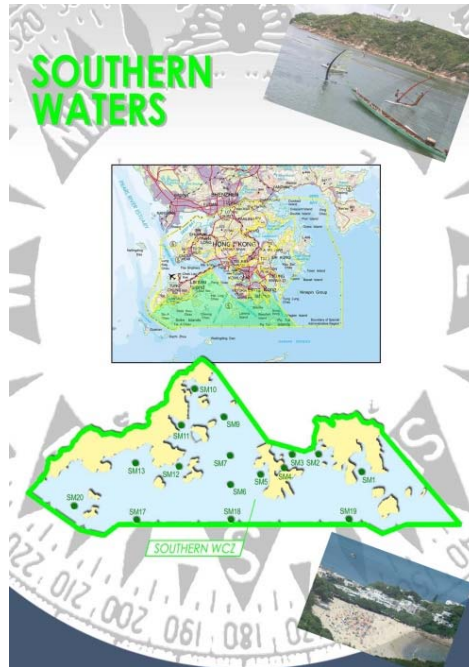
North Western Water Control Zone



In 2012, the North Western WCZ attained an overall WQO compliance rate of 72%, same as that in 2011. All stations in the WCZ fully complied with the unionised ammonia and DO objectives. Apart from NM1, all the other five stations in this WCZ did not comply with the TIN objective. The higher levels of TIN at these five stations (annual means 0.56-0.85 mg/L) might be associated with the higher background level of the discharge from Pearl River, and some local discharges and surface run-off from the Northwest New Territories as well as north Lantau.

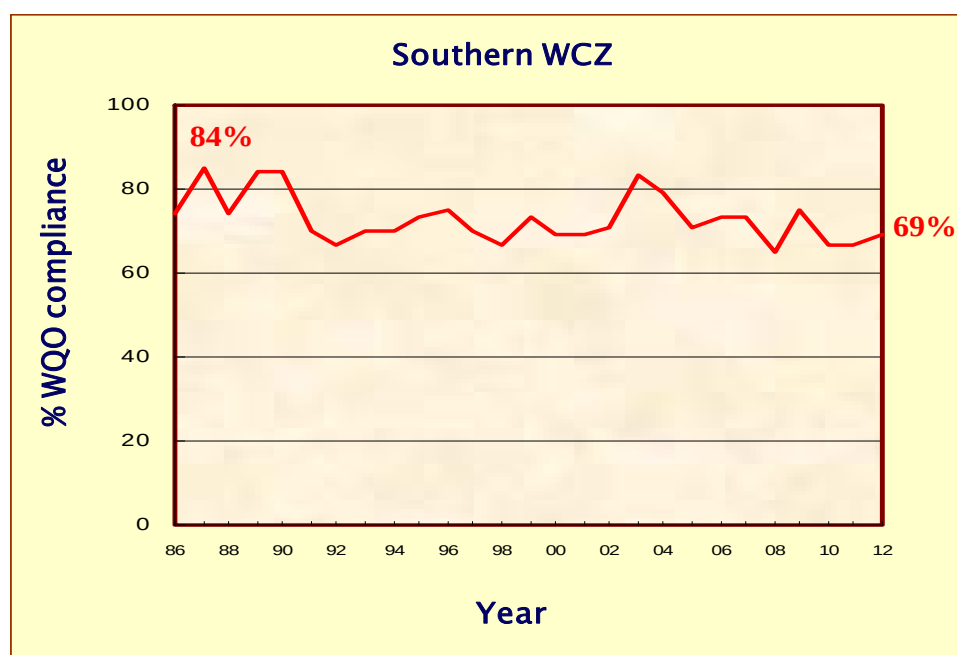


Southern Waters



The southern waters consist of only one water control zone. The Southern WCZ stretches from Hong Kong Island south to Lantau Island and faces the South China Sea. The western part of the WCZ is influenced seasonally by the Pearl River flow and the effect diminishes gradually towards the eastern direction.

Southern Water Control Zone





Similar to 2011, the Southern WCZ attained an overall 69% compliance with the WQOs in 2012. All 16 stations in the WCZ fully complied with the DO and unionized ammonia objectives but failed to comply with the TIN objective, which could be related to the higher background level of the Pearl River flow.

The Southern WCZ also covers a number of secondary contact recreation subzones which are mainly located along the coast in Southern District (Hong Kong Island) and the outlying islands. The secondary contact recreation subzones cover an area of approximately 67 km², about 26% of the total area of the secondary contact recreation subzones of Hong Kong. In 2012, full compliance (100%) with the *E. coli* objective was attained in the secondary contact recreation subzones.



East Lamma Channel

There are 21 gazetted beaches located in this WCZ : twelve on Hong Kong Island, five on Lantau Island, two on Lamma Island and two on Cheung Chau. In 2012, all 21 gazetted beaches in the southern waters complied with the water quality objective for swimming and most beaches (except the Silvermine Bay Beach on Lantau Island and the Big Wave Bay Beach, the Rocky Bay Beach and the Stanley Main Beach on Hong Kong Island) were ranked as “Good” during the bathing season from March to October.



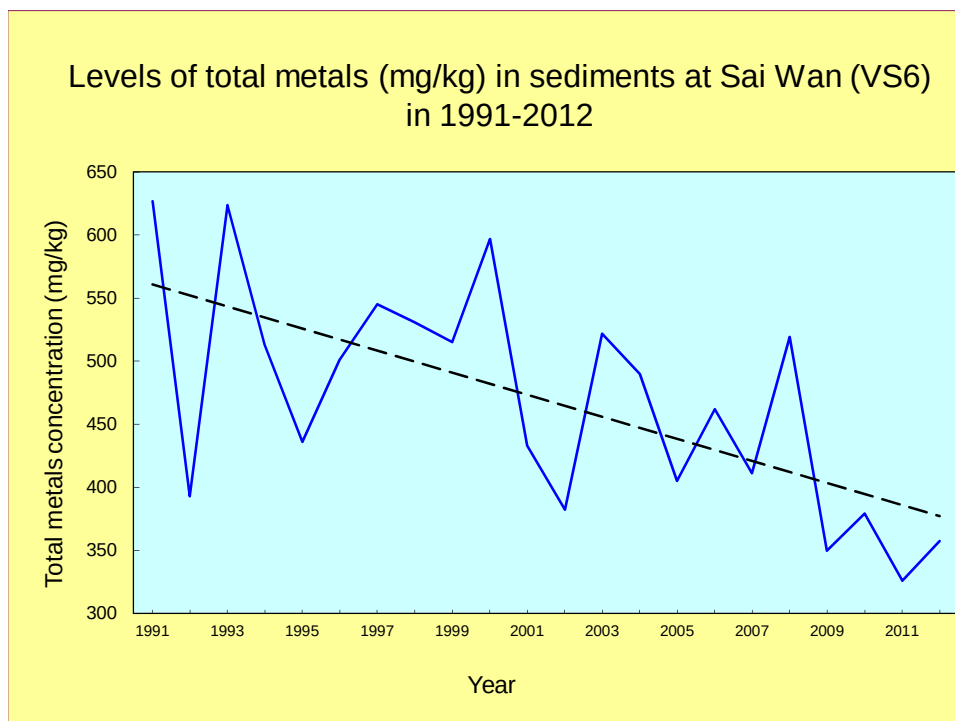
Sediment Quality and Levels of Toxic Substances in Hong Kong

Sea bottom sediments are the ultimate sink of pollutants in the marine environment, and are also home to a wide variety of benthic organisms. The quality of marine sediments can therefore reflect the health of the marine environment as a whole.

Since the implementation of the marine monitoring programme in 1986, elevated levels of selected heavy metals, in particular copper and silver, could often be detected in the sediments of Victoria Harbour and Tsuen Wan Bay. This was attributed to previous industrial pollution sources in the 60s to 80s before pollution control legislation was introduced. Nevertheless, through EPD's efforts in enforcing relevant pollution control ordinances, i.e. the Water Pollution Control Ordinance and Waste Disposal Ordinance, and the removal of various industrial pollution sources, we observe a general decreasing trend of total metals in sediments at stations in Victoria Harbour such as VS6 since 1991.



Sediment sampling

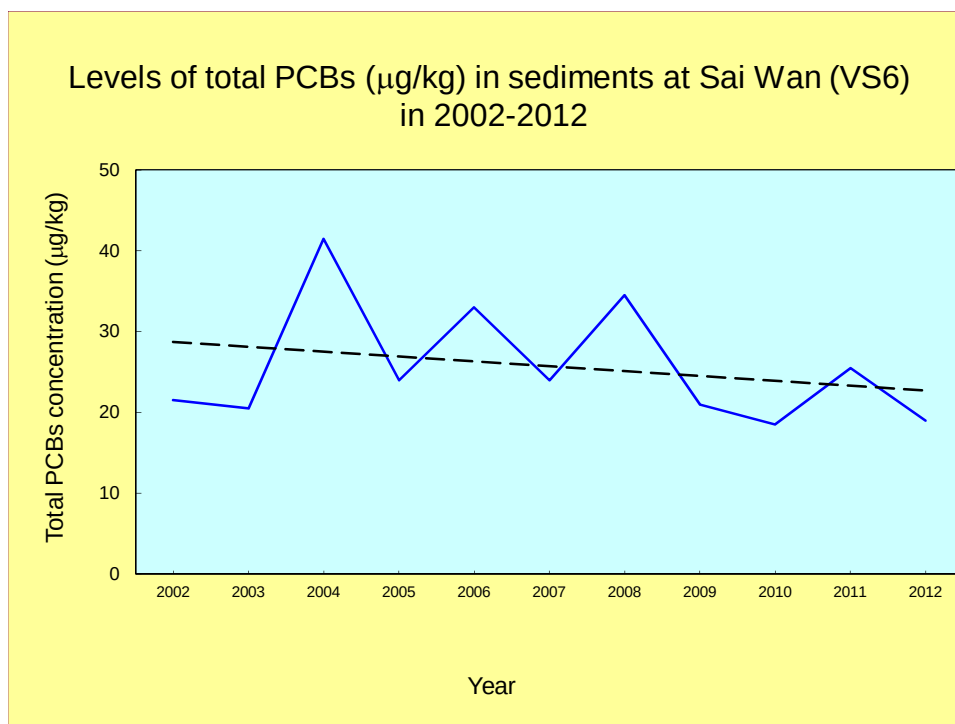


Note : Total metals include cadmium, chromium, copper, mercury, nickel, lead, silver and zinc

With regard to trace organic pollutants such as polychlorinated biphenyls (PCBs), they were generally present at low concentrations except for one station in western Victoria Harbour (VS6).



The higher levels of PCB at VS6 could be related to the discharges from industries in the past as well as contamination from the waste incineration facility in Kennedy Town which ceased operation in 1993 and was demolished in 2007. Similar to metals, a gradual decreasing trend of total PCBs in sediment could also be observed at VS6 since 2002.



Note : Total PCBs were calculated based on the definition in the 2002 Technical Circular 'ETWB (W) No. 34/2002 Management of Dredged / Excavated Sediment'

The EPD has been conducting a toxic substances monitoring programme since 2004 based on three-year cycles. The first two years of the cycle (i.e. 2004-2005, 2007-2008 and 2010-2011) would focus on samples collected from the natural marine environment, i.e. water, sediment, biota and the third year (i.e. 2006, 2009 and 2012) on potential pollution sources as well as rivers. For the first two years of each cycle, 10 marine water and 10 sediment as well as a number of marine biota samples were collected from different locations throughout the territory. The data collected from the three cycles mentioned above would serve as baseline information for long-term comparison.

The results so far show that the levels of toxic substances in the Hong Kong marine environment were generally low as compared with other areas of the Pearl River Estuary, and were largely within the range reported for coastal waters of the Mainland and other countries. In general, the levels of toxic substances in marine water, sediment and biota met local and international standards i.e. USA, Canada, European Union, Australia and Japan for the protection of marine life and human health.



Nevertheless, elevated levels of some chemicals such as heavy metals were found in marine sediments at some localised “hot spots” areas associated with historical pollution, as well as nonylphenol in sediment at areas near the discharge points of the preliminary treatment plants in central Victoria Harbour. The details of the programme and the summary of the major findings can be found at the following link:

<http://wqrc.epd.gov.hk/en/water-quality/toxic.aspx>



Typhoon Shelters in Hong Kong

Typhoon shelters in Hong Kong are used by small to medium vessels as protection against strong winds and rough sea conditions particularly during the typhoon season. For this reason, typhoon shelters are often semi-enclosed water bodies and vulnerable to pollution from both land and sea. Hong Kong has 17 typhoon shelters (TSs), marinas and dockyard. Some of these are located adjacent to populated residential and/or industrial areas, e.g. Causeway Bay TS and Kwun Tong TS. Others are located in outlying islands or far away from the urban areas, e.g. Cheung Chau TS and Shuen Wan TS. In general, the water quality of all typhoon shelters in Hong Kong was improving in the last decade.



Sam Ka Tsuen Typhoon Shelter

In 2012, the EPD monitored the water quality of the 17 typhoon shelters, marinas and dockyard around Hong Kong. Similar to 2011, the three typhoon shelters located in Sai Kung, namely Yim Tin Tsai TS, Hebe Haven TS and Sai Kung TS had relatively low TIN levels (0.13 - 0.19 mg/L) and *E. coli* counts (2 - 28 cfu/100mL) in 2012. In addition, the water quality of typhoon shelters in Victoria Harbour in 2012, i.e. Kwun Tong TS, Causeway Bay TS and New Yau Ma Tei TS, was also generally poorer in terms of TIN levels (0.54 – 1.40 mg/L) and *E. coli* counts (642 - 2688 cfu/100mL) compared with those mentioned above located farther away from the urban areas.

Regarding sediment quality, the sediments of some typhoon shelters located in Victoria Harbour were often contaminated by heavy metals due to historical discharges from the nearby industries. During the period from 2008-2012, the sediment in Kwun Tong TS recorded the highest levels of total heavy metals (i.e. cadmium, chromium, copper, mercury, nickel, lead, silver and zinc) amongst the typhoon shelters in Hong Kong.

For trace organic pollutants, To Kwa Wan TS had the highest level of polyaromatic hydrocarbons (PAHs) as compared with other typhoon shelters in 2012. The presence of PAHs in To Kwa Wan TS could be attributed to contamination from the old industrial areas in San Po Kong and possibly the old Kai Tak Airport which ceased operation in July 1998.



Phytoplankton and Red Tides in Hong Kong



Phytoplankton identification under light microscope

Phytoplankton requires sunlight and nutrients such as nitrogen, phosphorus, and silica to live and grow. Under favourable environmental condition, phytoplankton can reproduce very quickly and very high numbers of phytoplankton cells may be found in a water body. This phenomenon is called algal bloom, also known as red tide. Some blooms can produce toxins that have harmful effects on fish and shellfish. Some non-toxic blooms may cause harm through their accumulated biomass which

can affect co-occurring organisms. These events are sometimes known as Harmful Algal Blooms (HABs) or Nuisance Algal Blooms (NABs). Apart from nutrient enrichment and sunlight, red tide formation can also be affected by temperature, wind, etc. Red tides can deplete oxygen in the water when the dead algae decompose and cause massive fish kills. Phytoplankton and red tide monitoring therefore forms an essential part of marine water quality management.

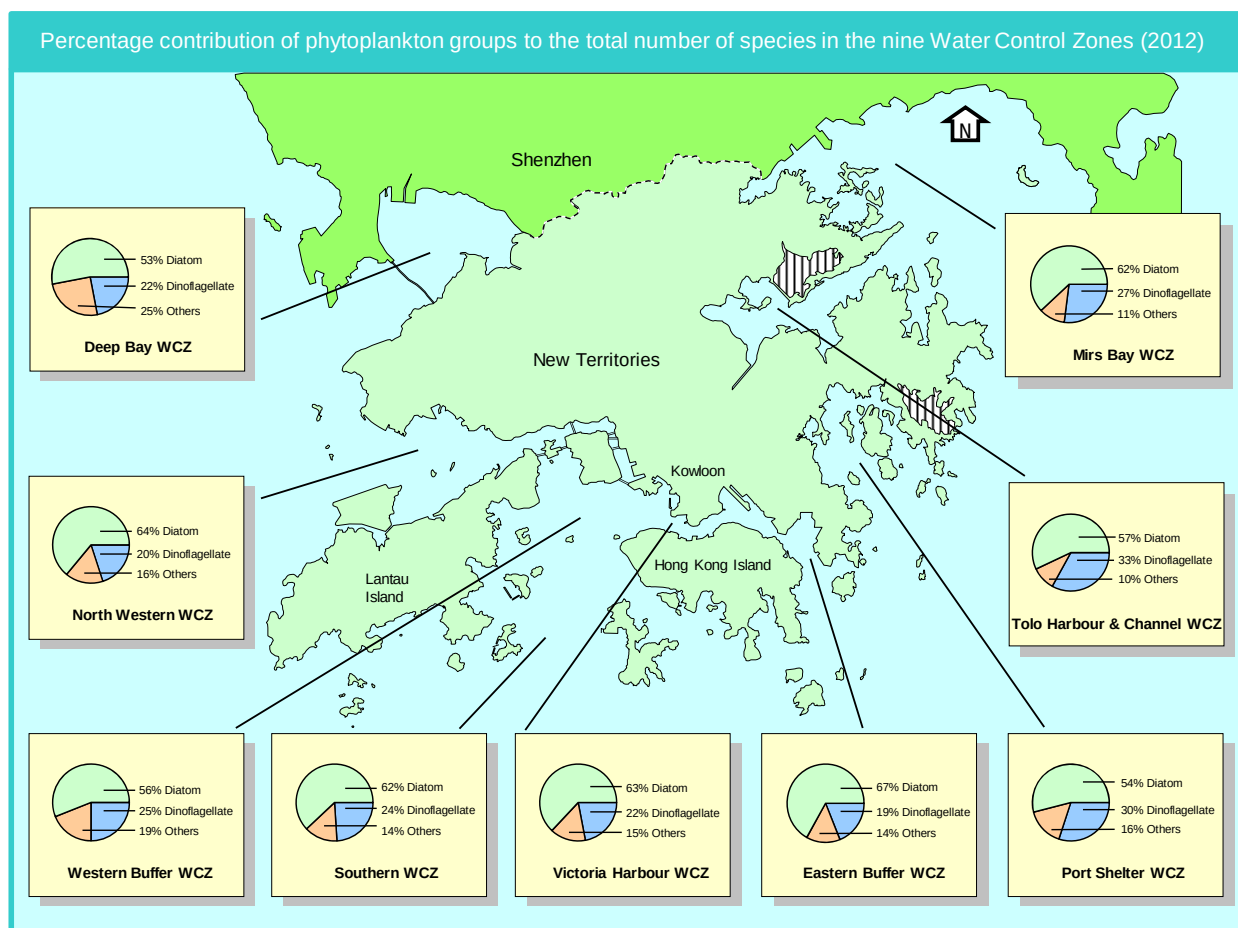
The EPD conducts monitoring of phytoplankton at 25 stations covering nine Water Control Zones (WCZs) in Hong Kong marine waters. Monthly samples are collected and analyzed. Changes and trends in phytoplankton with regard to their composition and densities are identified.

A total of 103 phytoplankton species was recorded in Hong Kong waters in 2012. Of these, 60 were diatoms (58%), 30 were dinoflagellates (29%) and 13 were from other minor algal groups (13%). Of the samples examined in 2012, diatoms constituted the largest component of phytoplankton in terms of both species richness and cell density. The most dominant diatom species were *Skeletonema costatum* which constituted 25-71% of the diatom population in the Eastern Buffer, Victoria Harbour, Southern, North Western and Western Buffer WCZs. The most abundant dinoflagellate species were *Gymnodinium spp.* comprising 21-62% of the dinoflagellate populations in all the WCZs. In 2012, phytoplankton densities were generally higher at some stations in the Tolo Harbour & Channel and Southern WCZs than those in the other WCZs.

Red tides are phenomena which can occur seasonally in both polluted and unpolluted waters. In Hong Kong, red tides occur more commonly in semi-enclosed water bodies (e.g. Tolo Harbour) with low tidal flushing rate. A total of 858 red tides were recorded in Hong Kong waters between



1980 and 2012. Locally, red tides occur more frequently in the eastern (72%) and southern (18%) waters. From 1980 to 2012, some 334 (39%) of the 858 red tides occurred in the Tolo Harbour and Channel WCZ, 151 (18%) in the Mirs Bay WCZ, 151 (18%) in the Southern WCZ and 132 (15%) in the Port Shelter WCZ. The most common red tide species in Hong Kong waters was the dinoflagellate *Noctiluca scintillans*, which accounted for approximately 29% of the reported red tides cases between 1980 and 2012. Historically, red tides increased significantly in the 80s and reached a peak in 1988, when a total of 88 incidents were reported. Since the mid-90s, red tides fluctuated between 10 and 45 incidents per year. In 2012, a total of 18 red tides were recorded in Hong Kong waters. Of these, seven occurred in the Tolo Harbour & Channel, five in Port Shelter, four in Southern Waters, one in Deep Bay and one in Western Buffer. These incidents involved 14 red tide species and their distribution is set out below. Most of them are non-toxic species commonly found in Hong Kong waters. The species *Chattonella marina* can cause fish kills based on local experience. However, no fish kill was recorded in Hong Kong waters in 2012.



Note : Others refer to minor phytoplankton groups which mainly include Cyanophyta and Chrysophyta.



Distribution of red tide species in 2012

Tolo Harbour & Channel WCZ

Dunaliella spp.

Heterosigma akashiwo

Neoceratium furca

Noctiluca scintillans

Scrippsiella trochoidea

Southern WCZ

Akashiwo sanguinea

Mesodinium rubrum

Pseudo-nitzschia delicatissima

Skeletonema costatum

Port Shelter WCZ

Chattonella marina

Dictyocha speculum

Neoceratium furca

Neoceratium tripos

Noctiluca scintillans

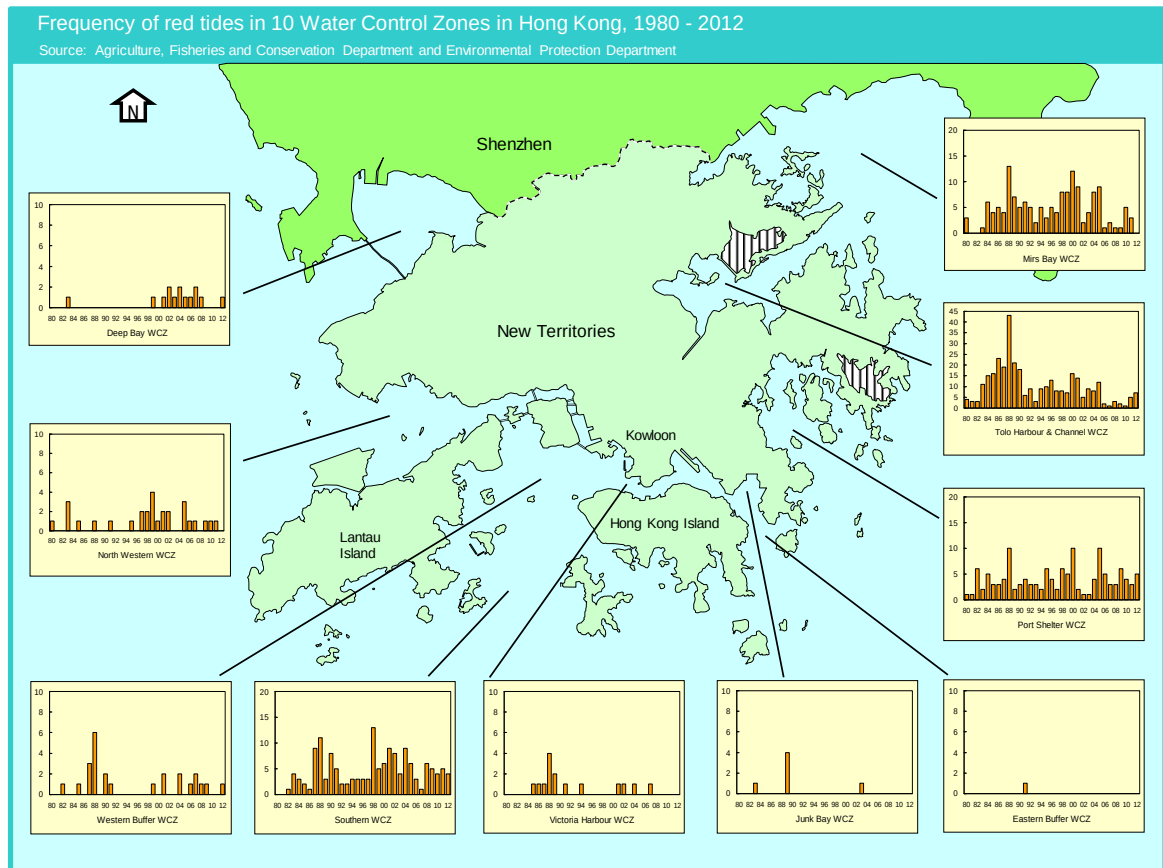
Pseudo-nitzschia delicatissima

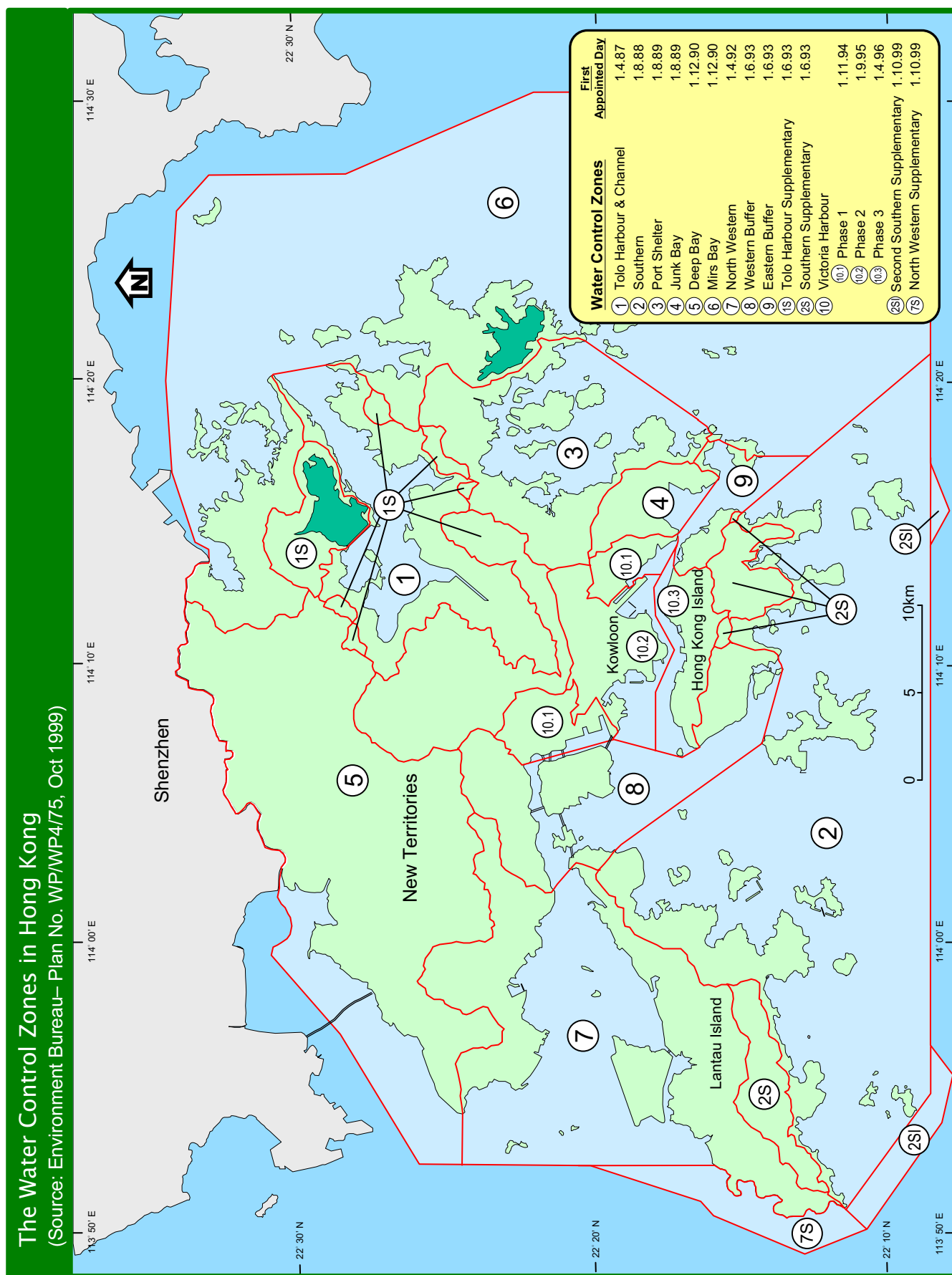
Deep Bay WCZ

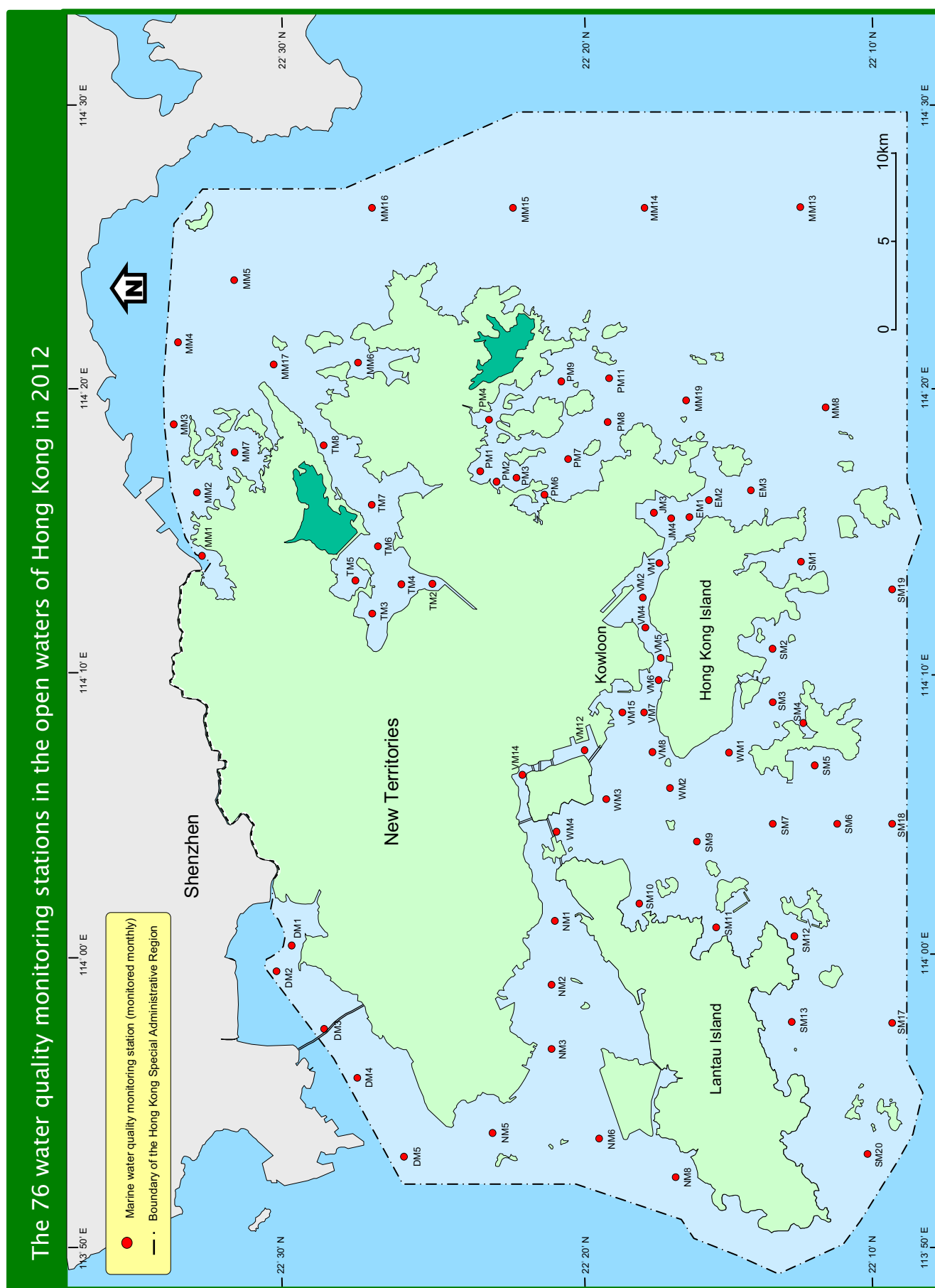
Protopolykrikos distortus

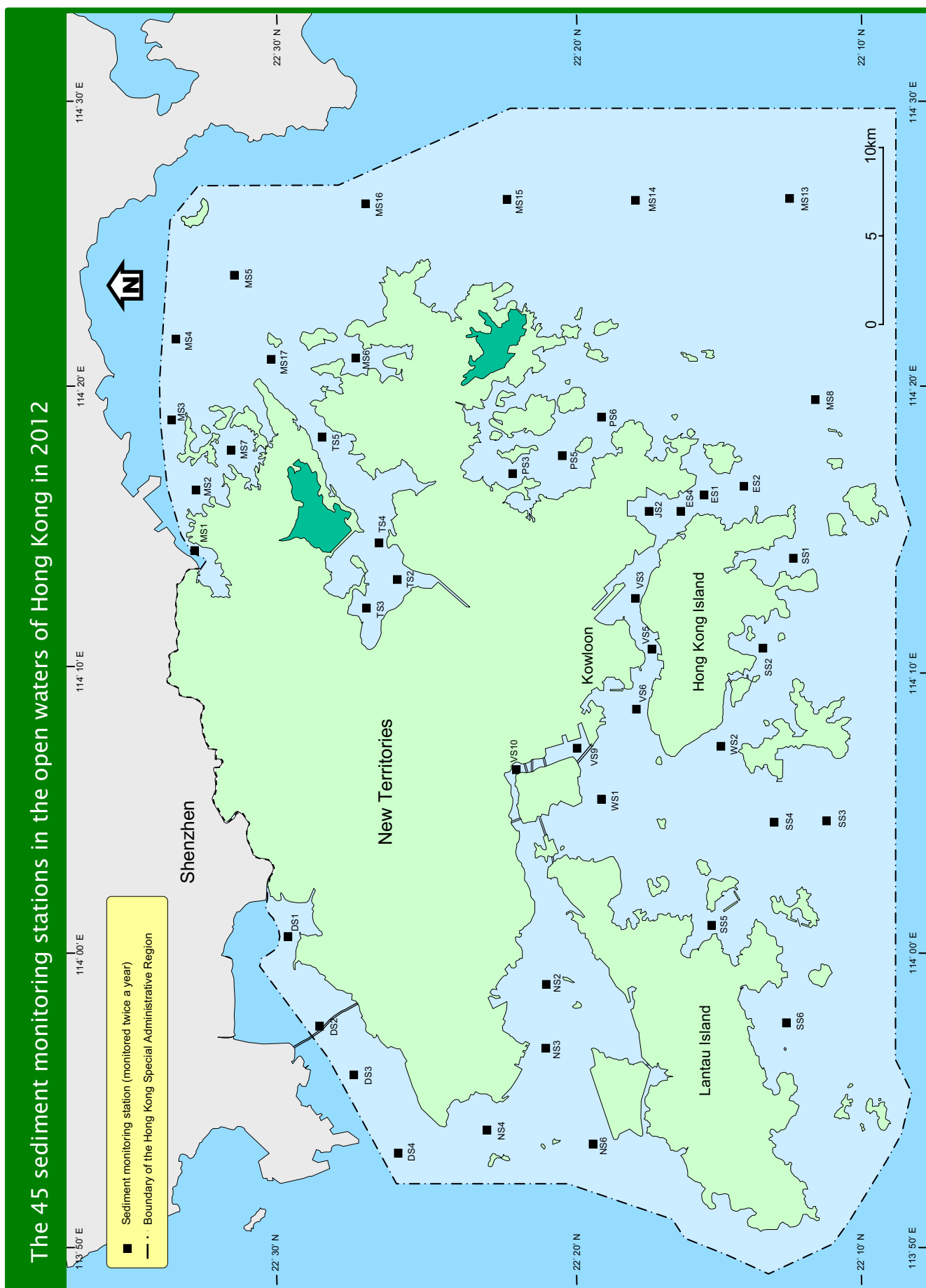
Western Buffer WCZ

Thalassiosira pseudonana

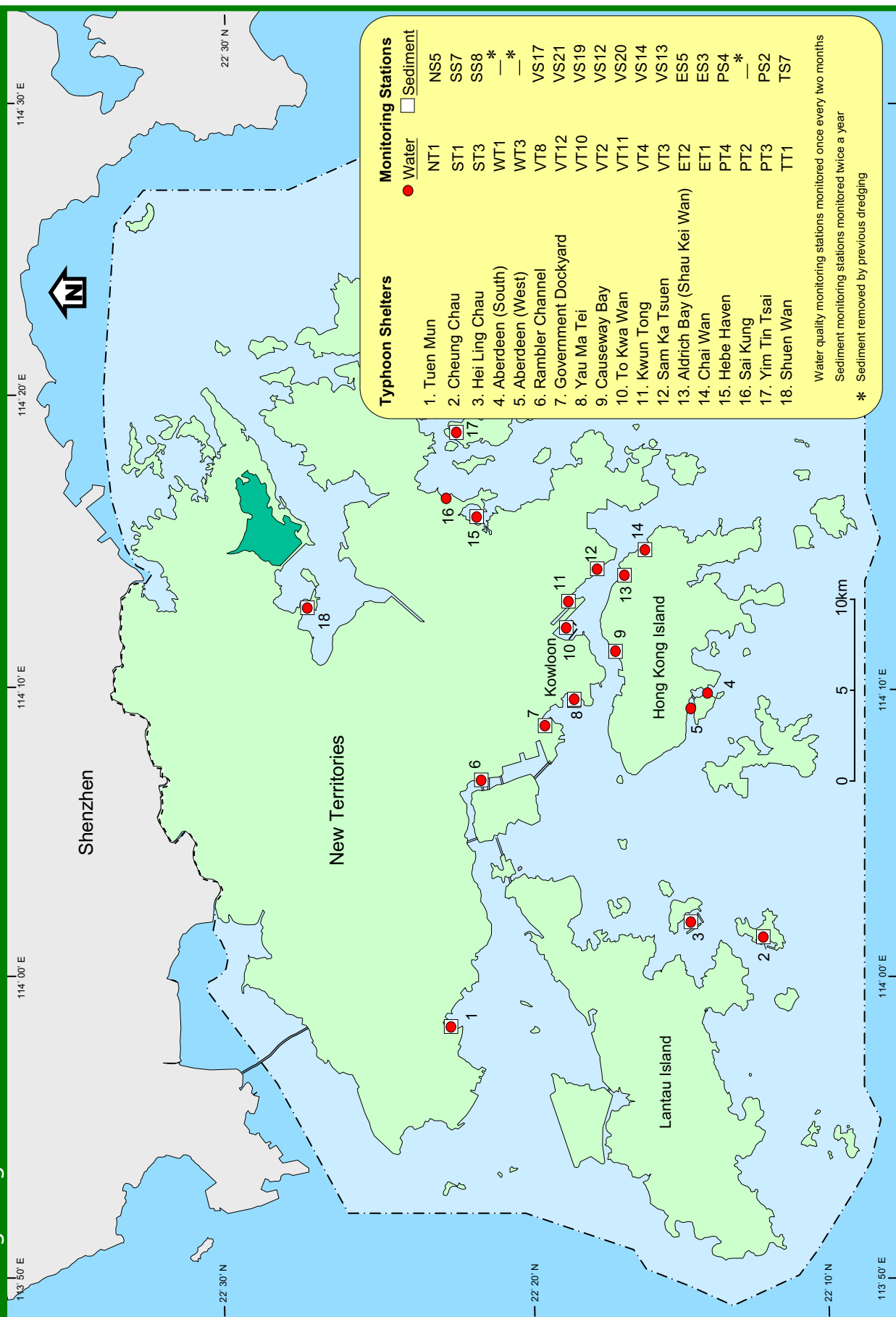








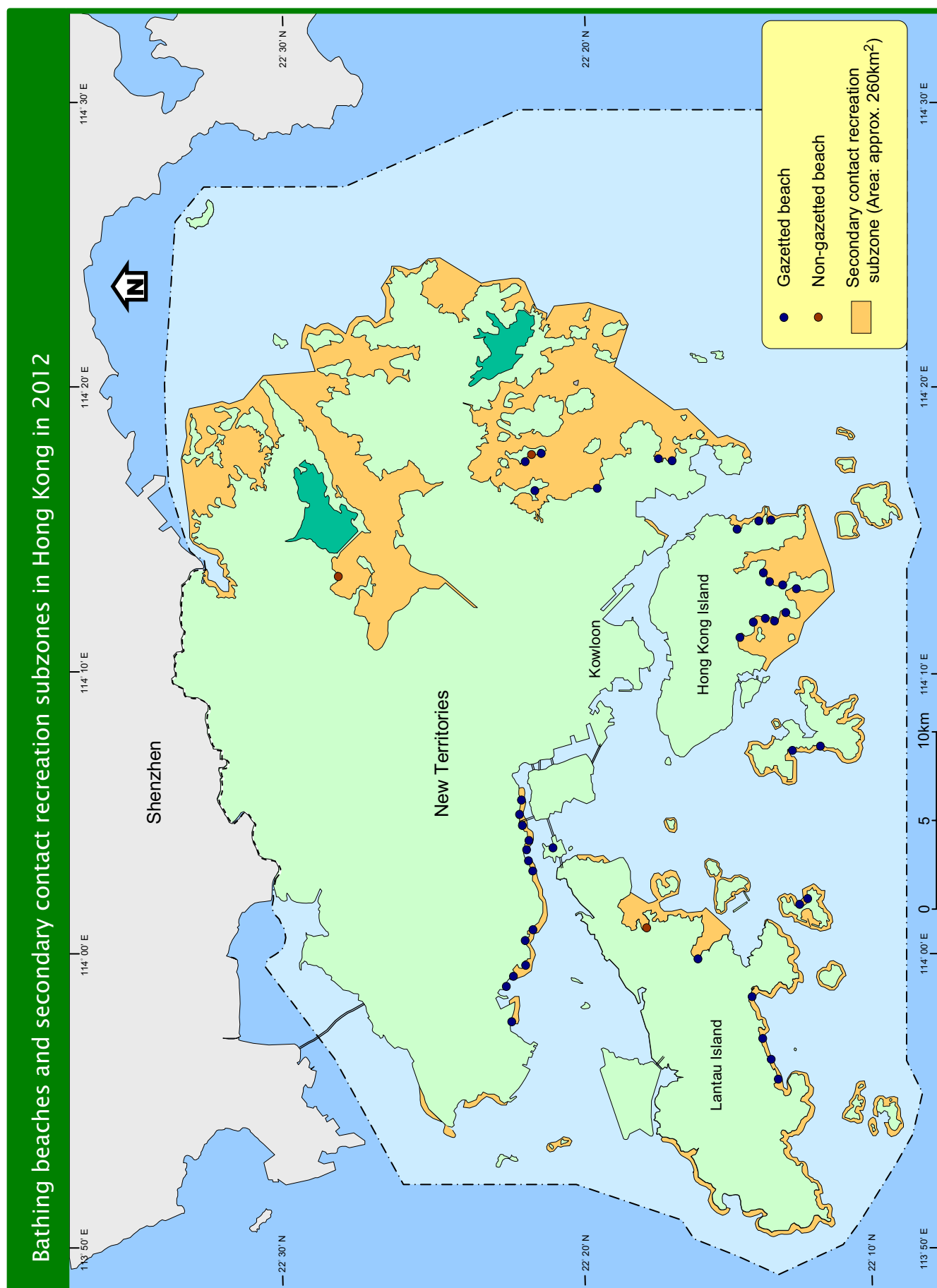
The 18 water quality monitoring stations and 15 sediment monitoring stations in the typhoon shelters of Hong Kong in 2012

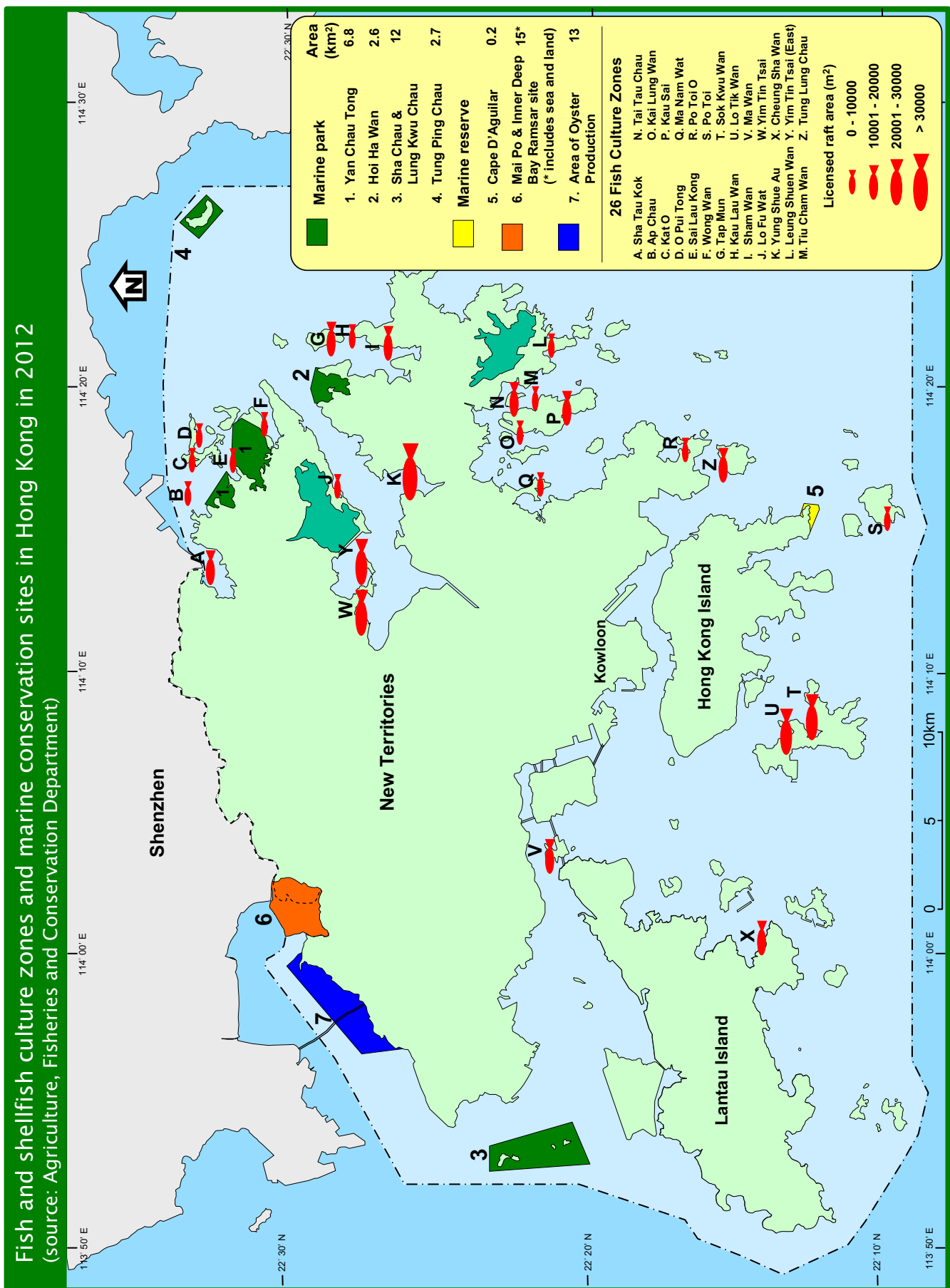


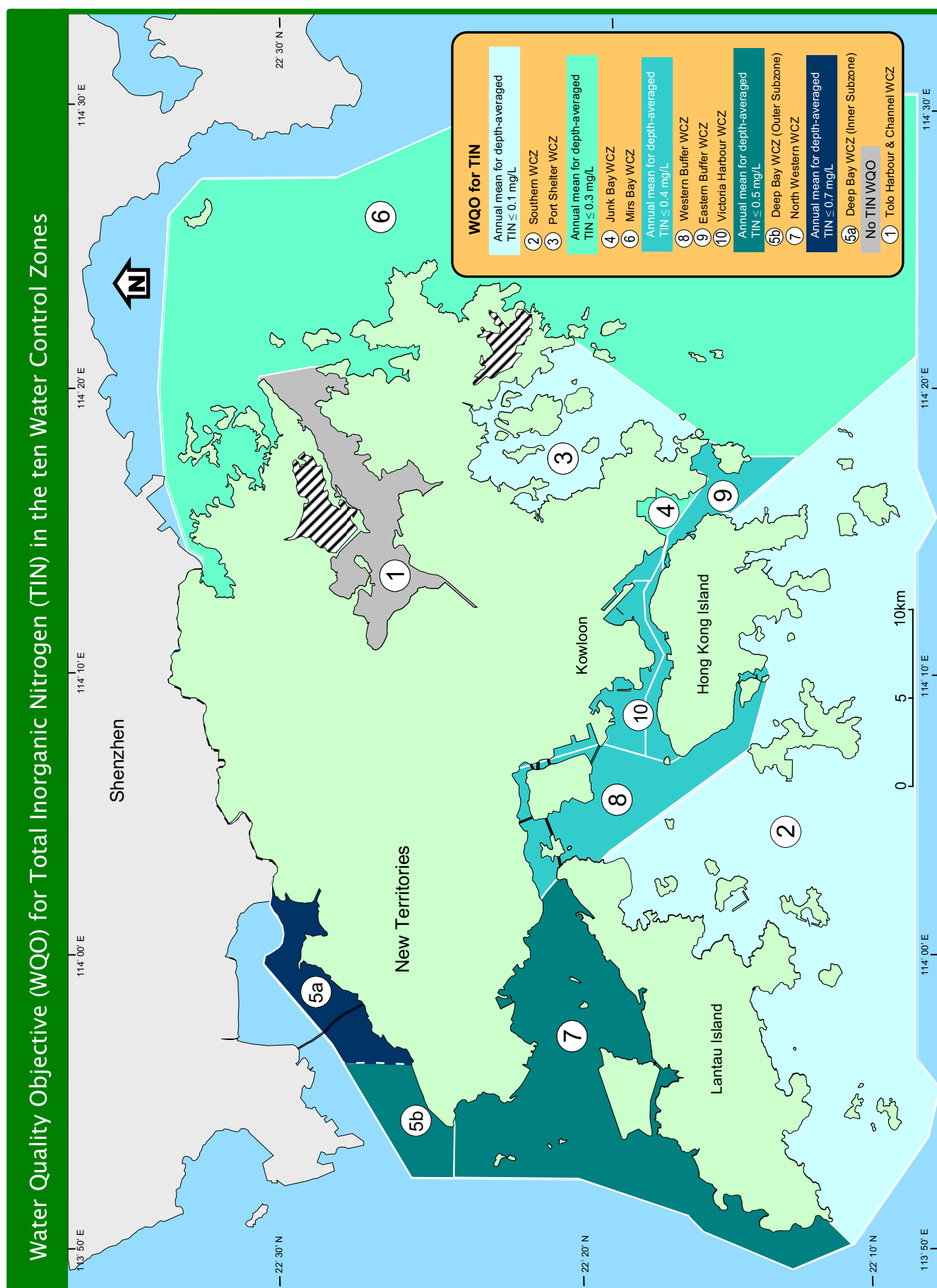
Location of marine water and sediment monitoring stations						
Water Control Zone	Station		Location		Depth (m)	
	Water	Sediment	Latitude	Longitude	approx.	
Tolo Harbour and Channel	TM2		22° 24.744' N	114° 13.085' E	4	
	TM3	TS3	22° 26.857' N	114° 12.181' E	7	
	TM4	TS2	22° 25.964' N	114° 13.176' E	8	
	TM5		22° 27.426' N	114° 13.456' E	4	
	TM6	TS4	22° 26.631' N	114° 14.506' E	12	
	TM7		22° 26.907' N	114° 16.057' E	11	
	TM8	TS5	22° 28.392' N	114° 18.003' E	22	
	*TT1	*TS7	22° 27.270' N	114° 12.717' E	6	
Southern Water	SM1	SS1	22° 12.738' N	114° 13.885' E	14	
	SM2	SS2	22° 13.447' N	114° 10.691' E	14	
	SM3		22° 13.527' N	114° 8.980' E	33	
	SM4		22° 12.758' N	114° 8.315' E	11	
	SM5		22° 12.141' N	114° 6.728' E	8	
	SM6	SS3	22° 11.500' N	114° 4.743' E	14	
	SM7	SS4	22° 13.740' N	114° 4.473' E	8	
	SM9		22° 16.420' N	114° 4.024' E	8	
	SM10		22° 18.125' N	114° 1.919' E	5	
	SM11	SS5	22° 15.443' N	114° 1.078' E	8	
	SM12		22° 12.861' N	114° 0.869' E	7	
	SM13	SS6	22° 12.957' N	113° 57.724' E	6	
	SM17		22° 9.211' N	113° 57.727' E	12	
	SM18		22° 9.211' N	114° 4.746' E	21	
	SM19		22° 9.211' N	114° 13.077' E	24	
	SM20		22° 10.448' N	113° 52.932' E	7	
	*ST1	*SS7	22° 12.517' N	114° 1.493' E	5	
	*ST3	*SS8	22° 14.734' N	114° 1.928' E	6	
Port Shelter	PM1		22° 23.242' N	114° 17.145' E	6	
	PM2		22° 22.643' N	114° 16.687' E	8	
	PM3	PS3	22° 22.156' N	114° 16.910' E	13	
	PM4		22° 22.940' N	114° 18.819' E	6	
	PM6		22° 21.102' N	114° 16.213' E	11	
	PM7	PS5	22° 20.453' N	114° 17.703' E	17	
	PM8	PS6	22° 19.168' N	114° 18.745' E	20	
	PM9		22° 20.529' N	114° 20.196' E	15	
	PM11		22° 19.240' N	114° 20.163' E	21	
	*PT2		22° 22.798' N	114° 16.540' E	3	
	*PT3	*PS2	22° 22.790' N	114° 18.400' E	6	
	*PT4	*PS4	22° 21.728' N	114° 15.879' E	5	
Junk Bay	JM3	JS2	22° 17.490' N	114° 15.657' E	10	
	JM4		22° 16.873' N	114° 15.378' E	16	
Deep Bay	DM1	DS1	22° 29.769' N	114° 0.644' E	2	
	DM2		22° 30.454' N	113° 59.549' E	2	
	DM3	DS2	22° 28.600' N	113° 57.551' E	3	
	DM4	DS3	22° 27.335' N	113° 55.937' E	4	
	DM5	DS4	22° 25.561' N	113° 53.388' E	8	
North Western	NM1		22° 20.877' N	114° 1.286' E	34	
	NM2	NS2	22° 21.130' N	113° 58.815' E	11	
	NM3	NS3	22° 21.324' N	113° 56.783' E	14	
	NM5	NS4	22° 23.051' N	113° 53.972' E	20	
	NM6	NS6	22° 19.281' N	113° 53.908' E	5	
	NM8		22° 16.695' N	113° 51.886' E	8	
	*NT1	*NS5	22° 22.475' N	113° 58.353' E	4	
	MM1	MS1	22° 32.984' N	114° 14.271' E	6	
Mirs Bay	MM2	MS2	22° 32.626' N	114° 16.648' E	11	
	MM3	MS3	22° 33.714' N	114° 18.615' E	16	
	MM4	MS4	22° 33.817' N	114° 21.483' E	18	
	MM5	MS5	22° 31.233' N	114° 23.633' E	20	
	MM6	MS6	22° 27.334' N	114° 20.997' E	12	
	MM7	MS7	22° 31.409' N	114° 17.824' E	13	
	MM8	MS8	22° 12.021' N	114° 19.345' E	31	
	MM13	MS13	22° 13.000' N	114° 26.920' E	28	
	MM14	MS14	22° 17.560' N	114° 26.920' E	25	
	MM15	MS15	22° 22.120' N	114° 26.920' E	24	
	MM16	MS16	22° 26.670' N	114° 26.920' E	22	
Western Buffer	MM17	MS17	22° 30.192' N	114° 20.960' E	17	
	MM19		22° 15.921' N	114° 19.411' E	28	
	WM1	WS2	22° 15.044' N	114° 7.363' E	35	
	WM2		22° 17.074' N	114° 5.730' E	13	
	WM3	WS1	22° 19.203' N	114° 5.826' E	20	
	WM4		22° 20.940' N	114° 4.256' E	26	
Eastern Buffer	*WT1		22° 14.494' N	114° 9.737' E	7	
	*WT3		22° 14.811' N	114° 8.918' E	10	
	EM1	ES4	22° 16.506' N	114° 15.335' E	16	
	EM2	ES1	22° 15.732' N	114° 15.971' E	21	
	EM3	ES2	22° 14.237' N	114° 16.144' E	21	
	*ET1	*ES3	22° 16.203' N	114° 14.624' E	6	
Victoria Harbour	*ET2	*ES5	22° 17.078' N	114° 13.783' E	12	
	VM1		22° 17.280' N	114° 13.839' E	38	
	VM2		22° 17.862' N	114° 12.619' E	12	
		VS3	22° 17.631' N	114° 12.526' E	8	
	VM4		22° 17.860' N	114° 11.654' E	12	
	VM5		22° 17.266' N	114° 10.510' E	11	
		VS5	22° 17.077' N	114° 10.600' E	8	
	VM6		22° 17.371' N	114° 9.665' E	14	
	VM7	VS6	22° 17.771' N	114° 8.416' E	10	
	VM8		22° 17.564' N	114° 7.175' E	11	
	VM12	VS9	22° 19.757' N	114° 7.278' E	14	
	VM14	VS10	22° 21.935' N	114° 6.527' E	11	
	VM15		22° 18.579' N	114° 8.539' E	13	
	*VT2	*VS12	22° 17.194' N	114° 11.304' E	5	
	*VT3	*VS13	22° 17.448' N	114° 14.250' E	5	
	*VT4	*VS14	22° 18.734' N	114° 12.814' E	6	
	*VT8	*VS17	22° 21.360' N	114° 6.867' E	5	
	*VT10	*VS19	22° 18.590' N	114° 9.430' E	5	
	*VT11	*VS20	22° 18.981' N	114° 11.814' E	6	
	*VT12	*VS21	22° 19.429' N	114° 8.587' E	5	

Note : 1. All locations are based on WGS84 datum

2. Water quality and sediment monitoring stations in typhoon shelters are marked with an asterisk *







Summary of Water Quality Objectives (WQOs) for marine waters of Hong Kong		
Parameter	Water Quality Objective	Water Control Zone (WCZ) / Part(s) of zone / Subzone to which the WQO applies
Aesthetic Appearance	There should be no objectionable odours or discolouration of the water Tarry residues, floating wood, articles made of glass, plastic, rubber or of any other substances should be absent Mineral oil should not be visible on the surface. Surfactants should not give rise to a lasting foam. There should be no recognisable sewage-derived debris. Floating, submerged and semi-submerged objects of a size likely to interfere with the free movement of vessels, or cause damage to vessels, should be absent. The waters should not contain substances which settle to form objectionable deposits.	All WCZs (whole zone)
Dissolved Oxygen (bottom)	Not less than 2 mg/L for 90% of samples ;	Marine waters of all WCZs except Tolo Harbour & Channel WCZ
Dissolved Oxygen (Depth-averaged)	Not less than 4 mg/L for 90% of samples ;	Marine waters of all WCZs except Tolo Harbour & Channel WCZ
Dissolved Oxygen (bottom)	Not less than 2mg/L	Harbour Subzone in Tolo Harbour & Channel WCZ
	Not less than 3mg/L	Buffer Subzone in Tolo Harbour & Channel WCZ
	Not less than 4mg/L	Channel Subzone in Tolo Harbour & Channel WCZ
Dissolved Oxygen (surface to 2m above bottom)	Not less than 4mg/L	Harbour Subzone and Buffer Subzone in Tolo Harbour & Channel WCZ
Dissolved Oxygen (all depths)	Not less than 4mg/L	Channel Subzone in Tolo Harbour & Channel WCZ
Nutrients	Annual mean depth-averaged total inorganic nitrogen not to exceed 0.1 mg/L	Marine waters of Southern WCZ and Port Shelter WCZ
	Annual mean depth-averaged total inorganic nitrogen not to exceed 0.3 mg/L	Marine waters of Mirs Bay WCZ, Junk Bay WCZ, North Western WCZ (Castle Peak Subzone)
	Annual mean depth-averaged total inorganic nitrogen not to exceed 0.4 mg/L	Marine waters of Eastern Buffer WCZ, Western Buffer WCZ, Victoria Harbour WCZ
	Annual mean depth-averaged total inorganic nitrogen not to exceed 0.5 mg/L	Marine waters of Deep Bay WCZ (Outer Subzone) and North Western WCZ (Whole zone except Castle Peak Subzone)
	Annual mean depth-averaged total inorganic nitrogen not to exceed 0.7 mg/L	Marine waters of Deep Bay WCZ (Inner Subzone)
Unionised ammonia	Annual mean not to exceed 0.021 mg/L	All WCZs (whole zone) except Tolo Harbour & Channel WCZ
<i>E. coli</i>	Annual geometric mean not to exceed 610 cfu/100mL	Secondary contact recreation subzones in Tolo Harbour & Channel WCZ, Southern WCZ, Port Shelter WCZ, Mirs Bay WCZ, Deep Bay WCZ, North Western WCZ, Western Buffer WCZ
	Annual geometric mean not to exceed 610 cfu/100mL	Fish culture subzones in Tolo Harbour & Channel WCZ, Southern WCZ, Port Shelter WCZ, Junk Bay WCZ, Mirs Bay WCZ, Deep Bay WCZ, Eastern Buffer WCZ, Western Buffer WCZ
pH	To be in the range 6.5 – 8.5, change due to waste discharge not to exceed 0.2	Marine waters of all WCZs except Tolo Harbour & Channel WCZ
	Change due to waste discharge not to be greater than ± 0.5	Harbour Subzone in Tolo Harbour & Channel WCZ
	Change due to waste discharge not to be greater than ± 0.3	Buffer Subzone in Tolo Harbour & Channel WCZ
	Change due to waste discharge not to be greater than ± 0.1	Channel Subzone in Tolo Harbour & Channel WCZ
Salinity	Change due to waste discharge not to exceed 10% of natural ambient level	All WCZs (Whole zone) except Tolo Harbour & Channel WCZ
	Change due to waste discharge not to be greater than ± 3 ppt	Tolo Harbour & Channel WCZ
Temperature	Change due to waste discharge not to exceed 2°C	All WCZs (Whole zone) except Tolo Harbour & Channel WCZ
	Change due to waste discharge not to exceed 1°C	Tolo Harbour & Channel WCZ
Suspended solids	Waste discharge not to raise the natural ambient level by 30% nor cause the accumulation of suspended solids which may adversely affect aquatic communities	Marine waters of all WCZs except Tolo Harbour & Channel WCZ
Toxicants	Not to be present at levels producing significant toxic effect	All WCZs (Whole zone)
Chlorophyll- <i>a</i>	Not to exceed 20mg/m ³ (µg/L) calculated as running arithmetic mean of 5 daily measurements for any location and depth	Harbour Subzone in Tolo Harbour & Channel WCZ
	Not to exceed 10mg/m ³ (µg/L) calculated as running arithmetic mean of 5 daily measurements for any location and depth	Buffer Subzone in Tolo Harbour & Channel WCZ
	Not to exceed 6mg/m ³ (µg/L) calculated as running arithmetic mean of 5 daily measurements for any location and depth	Channel Subzone in Tolo Harbour & Channel WCZ

Sediment Quality Criteria for the Classification of Sediments¹

Contaminants	Lower Chemical Exceedance Level (LCEL)	Upper Chemical Exceedance Level (UCEL)
Metals (<i>mg/kg dry weight</i>)		
Cadmium (Cd)	1.5	4
Chromium (Cr)	80	160
Copper (Cu)	65	110
Mercury (Hg)	0.5	1
Nickel (Ni) ²	40	40
Lead (Pb)	75	110
Silver (Ag)	1	2
Zinc (Zn)	200	270
Metalloid (<i>mg/kg dry weight</i>)		
Arsenic (As)	12	42
Organic-PAHs (<i>µg/kg dry weight</i>)		
Low Molecular Weight PAHs ³	550	3160
High Molecular Weight PAHs ⁴	1700	9600
Organic-non-PAHs (<i>µg/kg dry weight</i>)		
Total PCBs	23	180
Organometallics (<i>mg TBT/L in Interstitial water</i>)		
Tributyltin ²	0.15	0.15

Footnote: 1 The table is extracted from Appendix A of WBTC (W) No. 34/2002 Management of Dredged / Excavated Sediment (<http://www.devb-wb.gov.hk>).

2 When the LCEL and UCEL for a contaminant are the same, the contaminant level is considered to have exceeded UCEL if it is greater than the value shown.

3 Low molecular weight PAHs include acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene.

4 High molecular weight PAHs include benzo[a]anthracene, benzo[a]pyrene, chrysene, dibenzo[a,h]anthracene, fluoranthene, pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, indeno[1,2,3-c,d]pyrene and benzo[g,h,i]perylene.

5 Total PCBs include 18 congeners: PCB 8, 18, 28, 44, 52, 66, 77, 101, 105, 118, 126, 128, 138, 153, 169, 170, 180, 187.

Summary of marine water quality parameters						
	Parameter	Unit	Reporting Limit	Sampling Depth	Standard Method / Techniques used ²⁰	Analysed by
Physical and Aggregate Properties	Temperature ¹	°C	0.1	Depth Profiling ¹⁰	Instrumental (thermistor), SEACAT19+ CTD and Water Quality Profiler	MMT/EPD ¹⁵
	Salinity ^{1,8}	-	0.1	Depth Profiling	Instrumental (electrical conductivity), SEACAT19+ CTD and Water Quality Profiler	MMT/EPD
	Dissolved Oxygen ¹	mg/L % saturation ⁹	0.1 1	Depth Profiling	Instrumental (membrane electrode), SBE23Y dissolved oxygen sensor linked to SEACAT19+ CTD and Water Quality Profiler	MMT/EPD
	Turbidity ²	NTU	0.1	Depth Profiling	Instrumental (nephelometric / infrared back scattering), OBS-3 turbidity sensor linked to SEACAT 19+ CTD and Water Quality Profiler	MMT/EPD
	pH ¹	-	0.1	Depth Profiling	Instrumental (electrodeometric), SBE18 pH sensor linked to SEACAT19 + CTD and Water Quality Profiler	MMT/EPD
	Secchi Disc Depth ²	m	0.1	---	Manual	MMT/EPD
	Suspended Solids ²	mg/L	0.5	S,M,B ¹¹	In-house method GL-PH-23 based on APHA 20ed. 2540D (weighing)	GL ¹⁸
	Volatile Suspended Solids ³	mg/L	0.5	S,M,B	In-house method GL-PH-23 based on APHA 20ed. 2540E (weighing)	GL
Aggregate Organic Constituents	5-day Biochemical Oxygen Demand (BOD ₅) ⁴	mg/L	0.1	S,M,B	In-house method based on APHA 20ed. 5210B	EML/EPD ¹⁶
Nutrients and Inorganic Constituents	Ammonia Nitrogen ⁵	mg/L	0.005	S,M,B	In-house method GL-IN-15 based on ASTM D3590-89 B (FIA)	GL
	Unionised Ammonia ⁵	mg/L	0.001	S,M,B	By calculation ¹²	MMT/EPD
	Nitrite Nitrogen ⁵	mg/L	0.002	S,M,B	In-house method GL-IN-18 based on APHA 20ed. 4500-NO ₂ -B (FIA)	GL
	Nitrate Nitrogen ⁵	mg/L	0.002	S,M,B	In-house method GL-IN-18 based on APHA 20ed. 4500-NO ₃ -F & I (FIA)	GL
	Total Inorganic Nitrogen ⁵	mg/L	0.01	S,M,B	By calculation ¹³	MMT/EPD
	Total Kjeldahl Nitrogen ⁵ (soluble; soluble & particulate)	mg/L	0.05	S,M,B	In-house methods GL-IN-14 and GL-IN-15 respectively based on ASTM D3590-89 B (FIA) and APHA 20ed 4500-N A&D (FIA)	GL
	Total Nitrogen ⁵	mg/L	0.05	S,M,B	By calculation ¹³	MMT/EPD
	Orthophosphate Phosphorus ⁵	mg/L	0.002	S,M,B	In-house method GL-IN-16 based on ASTM D515-88 A (FIA)	GL
	Total Phosphorus ⁵ (soluble; soluble & particulate)	mg/L	0.02	S,M,B	In-house methods GL-IN-14 and GL-IN-16 respectively based on ASTM D515-88 B (FIA) and APHA 20ed 4500-P G (FIA)	GL
	Silica (as SiO ₂) (soluble) ⁵	mg/L	0.05	S,M,B	In-house method GL-IN-17 based on APHA 20ed. 4500-SiO ₂ C&E (FIA)	GL
Biological and Microbiological Examination	Chlorophyll-a ⁶	µg/L	0.2	S,M,B	In-house method GL-OR-34 based on APHA 20ed. 10200H 2 (spectrophotometric)	GL
	<i>Escherichia coli</i> (<i>E. coli</i>) ⁷	cfu/100mL	1	S,M,B	In-house method, membrane filtration with CHROMagar Liquid <i>E. coli</i> -coliform culture ¹⁴	EML/EPD
	Faecal Coliforms ⁷	cfu/100mL	1	S,M,B	In-house method, membrane filtration with CHROMagar Liquid <i>E. coli</i> -coliform culture ¹⁴	EML/EPD
	Phytoplankton	cell/mL	1	S	In-house method, 10 ml settled sub-sample using plankton chamber and inverted microscope ¹⁹	WSL/EPD ¹⁷
Note: 1 Indicate general oceanographic conditions of marine water 2 Low transparency and light penetration would affect aesthetic value and photosynthesis in marine water 3 Indicate the amount of particulate organic matters in marine water 4 Indicate the amount of organic pollutants in marine water 5 Major nutrients (nitrogen, phosphorus, silica) promoting algal growth in marine water 6 Indicate the amount of algal biomass in marine water 7 Sewage bacteria indicate the extent of faecal pollution in marine water 8 Measuring and reporting of Salinity (S) are based on the Practical Salinity Scale and International Equation of State of Seawater (UNESCO Technical Papers in Marine Science No. 30 (1981) ; No. 36 (1981) and No. 45 (1985)) 9 Percent saturation of dissolved oxygen is calculated from dissolved oxygen in mg/L based on Weiss R.F. (1970); The solubility of nitrogen, oxygen and argon in water and seawater. Deep Sea Res. Vol. 17, pp.721-735 10 Depth profiling – continuous measurements at downcast are processed and presented at 1m intervals from 1m below the surface to 1m above the seabed 11 If water depth is 6m or above, sampling is taken at three depths during upcast: S – 1m below water surface; M – mid-depth of water column; B – 1m above seabed. If water depth is 4 to 5 m, "M" is skipped; If water depth is 3m or less, "M" and "B" are skipped. 12 i) Bower C.E. and Bidwell J.P. (1978), Ionization of ammonia in seawater: Effect of temperature, pH and salinity. J. Fish. Res. Board Can. Vol.35, pp.1012-1016; ii) K., Russo R.C. & et. al. (1975), Aqueous ammonia equilibrium calculations: effect of pH and temperature. J. Fish. Res. Board Can. Vol.32, pp.2379-2383 13 Total Inorganic Nitrogen = Ammonia Nitrogen + Nitrite Nitrogen + Nitrate Nitrogen ; Total Nitrogen = Total Kjeldahl Nitrogen (soluble & particulate) + Nitrite Nitrogen + Nitrate Nitrogen 14 i) DoE, DHSS & PHLS (1983); The Bacteriological Examination of Drinking Water Supplies 1982, Sec.7.8 & 7.9; ii) B.S.W. Ho and T.Y. Tam (1997), Enumeration of <i>E. coli</i> in environmental waters and wastewater using a chromogenic medium. Wat. Sci. Tech.Vol.35, No.11-12, pp.409-413; method adopted in 1997. 15 MMT/EPD – Marine Monitoring Team, Water Policy and Science Group, Environmental Protection Department. 16 EML/EPD – Environmental Microbiology Laboratory, Water Policy and Science Group, Environmental Protection Department. 17 WSL/EPD – Water Sciences Laboratory, Water Policy and Science Group, Environmental Protection Department 18 GL – Government Laboratory. 19 i) Lund, J.H., Kipling, C. and Le Cren, E.D. 1958. The inverted microscope method of estimating algal numbers, and the statistical basis of estimations by counting. Hydrobiologia Vol. 11, pp. 143-170. ii) Utermohl, H. 1958. Zur Vervollkommnung der Quantitativen Phytoplankton-Methodik. Mitt. Inter. Verein. Lim. Vol. 9, pp. 1-38. 20 Mention of brand names and commercial products does not constitute or imply endorsement or recommendation by the Environmental Protection Department.						

Summary of marine sediment¹ parameters

	Parameter	Unit ²	Reporting Limit	Standard Method / Techniques used ⁸	Analysed by
Physical and Aggregate Properties	Particle Size Fractionation	% w/w	1	In-house method, sieving and weighing : 8 fractions : >4000 µm, <4000µm, <2000µm, <1000µm, <500µm, <250µm, <125µm and <63µm	MMT/EPD ⁶
	Electrochemical Potential ⁴	mV	1	Instrumental, Orion Model 250A pH/Redox Meter (electrodeometric)	MMT/EPD
	Total Solids (TS) ³	% w/w	0.1	In-house method GL-PH-22 based on APHA 20ed 2540G (weighing)	GL ⁷
	Total Volatile Solids (TVS) ³	% TS	0.1	In-house method GL-PH-22 based on APHA 20ed 2540G (weighing)	GL
	Dry Wet Ratio	-	0.01	In-house method GL-PH-22 based on APHA 20ed 2540G (weighing)	GL
Aggregate Organic Constituents ³	Chemical Oxygen Demand (COD)	mg/kg	2	In-house method GL-OR-47 based on ASTM D1252-00 A (open reflux)	GL
	Total Carbon (TC)	% w/w	0.1	In-house method GL-OR-33 based on APHA 20ed 5310 B (FIA)	GL
Nutrients and Inorganic Constituents ³	Ammonia Nitrogen (NH ₄ -N)	mg/kg	0.05	In-house method GL-IN-15 based on ASTM D3590-89 B (FIA)	GL
	Total Kjeldahl Nitrogen (TKN)	mg/kg	0.5	In-house methods GL-IN-14 and GL-IN-15 respectively based on ASTM D3590-89 B (FIA) and APHA 20ed 4500-N A&D (FIA)	GL
	Total Phosphorus	mg/kg	0.2	In-house methods GL-IN-14 and GL-IN-16 respectively based on ASTM D515-88 B (FIA) and APHA 20ed 4500-P G (FIA)	GL
	Total Sulphide	mg/kg	0.2	In-house method GL-IN-45 based on APHA 20ed 4500-S ² - D (FIA)	GL
	Total Cyanide	mg/kg	0.1	In-house method GL-IN-44 based on APHA, 20ed., 4500 CN -A&E (distillation and colorimetric)	GL
Metals & Metalloids ⁵	Aluminium (Al)	mg/kg	1	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Arsenic (As)	mg/kg	0.1	In-house methods GL-TE-64 and GL-TE-66 based on USEPA method 6020 (ICP-MS)	GL
	Barium (Ba)	mg/kg	0.2	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Boron (B)	mg/kg	5	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Cadmium (Cd)	mg/kg	0.1	In-house method GL-TE-64 based on USEPA method 6020 (ICP-MS)	GL
	Chromium (Cr)	mg/kg	0.2	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Copper (Cu)	mg/kg	0.2	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Iron (Fe)	mg/kg	5	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Lead (Pb)	mg/kg	0.2	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Manganese (Mn)	mg/kg	1	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Mercury (Hg)	mg/kg	0.05	In-house methods GL-TE-64 and GL-TE-66 based on USEPA method 6020 (ICP-MS)	GL
	Nickel (Ni)	mg/kg	0.2	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Silver (Ag)	mg/kg	0.2	In-house method GL-TE-64 based on USEPA method 6020 (ICP-MS)	GL
	Vanadium (V)	mg/kg	0.1	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
	Zinc (Zn)	mg/kg	0.2	In-house methods GL-TE-60 and GL-TE-64 respectively based on USEPA methods 6010B (ICP-AES) and 6020 (ICP-MS)	GL
Trace Organic Compounds	Polychlorinated Biphenyls (PCBs)				
	18 PCB congeners : PCB 8, 18, 28, 44, 52, 66, 77, 101, 105, 118, 126, 128, 138, 153, 169, 170, 180, 187	µg/kg	2	In-house method GL-OR-25 based on Reference Method for the Analysis of Polychlorinated Biphenyls, Environmental Protection Series: Report EPS 1/RM/31, March 1997, Environment Canada (GC-MS)	GL
	Polycyclic Aromatic Hydrocarbons (PAHs)				
	- Acenaphthene	µg/kg	50	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Acenaphthylene	µg/kg	50	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Naphthalene	µg/kg	60	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Fluorene	µg/kg	10	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Phenanthrene	µg/kg	5	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Anthracene	µg/kg	5	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Fluoranthene	µg/kg	5	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Pyrene	µg/kg	5	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Benzo(a)anthracene	µg/kg	3	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Chrysene	µg/kg	5	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Benzo(k)fluoranthene	µg/kg	1	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Benzo(a)pyrene	µg/kg	1	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Dibenzo(a,h)anthracene	µg/kg	5	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Benzo(g,h,i)perylene	µg/kg	1	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL
	- Indeno(1,2,3-cd)pyrene	µg/kg	5	In-house method GL-OR-15 based on USEPA method 610, 1984 (UV-FLUO)	GL

Note: 1 Birge-Ekman (0.023sq.m) grab / Van Veen (0.1sq.m) grab / Smith-McIntyre (0.1sq.m) grab is employed to collect sediment samples from the top 10cm of seabed.

2 All parameters are reported on a dry weight basis unless otherwise stated.

3 Determinants are reported on a wet weight basis.

4 Electrochemical potential (Eh) is measured "on-site" at 3cm below the surface of freshly collected sediment samples (Reference : Handbook of Techniques for Aquatic Sediment Sampling. By A. Mudrock & S.D. MacKnight, 1994, CRC Press).

5 Digestion procedure for metals and metalloids in sediment follows Government Laboratory's in-house method GL-TE-51.

6 MMT/EPD – Marine Monitoring Team, Water Policy and Science Group, Environmental Protection Department.

7 GL – Government Laboratory.

8 Mention of brand names and commercial products does not constitute or imply endorsement or recommendation by the Environmental Protection Department.

Summary of water quality statistics for the Mirs Bay WCZ in 2012

Parameter	Starling nlet MM1	Crooked sland MM2	Port sland MM7	MM17	MM3	Mirs Bay North MM4	MM5
Number of samples	12	12	12	12	12	12	12
Temperature (°C)	23.8 (16.2 - 28.7)	23.5 (16.0 - 28.7)	23.3 (16.1 - 28.9)	23.0 (15.9 - 28.3)	23.1 (15.9 - 28.2)	23.0 (15.9 - 28.2)	23.0 (16.0 - 27.8)
Salinity	31.2 (30.0 - 32.3)	31.5 (30.2 - 32.5)	31.6 (30.5 - 32.6)	31.9 (31.0 - 33.0)	31.8 (30.6 - 32.8)	31.9 (30.7 - 33.0)	32.0 (31.1 - 33.1)
Dissolved Oxygen (mg/L)	7.2 (5.9 - 8.7)	7.2 (4.7 - 9.3)	7.1 (4.9 - 9.4)	7.1 (5.5 - 9.1)	7.1 (4.9 - 9.7)	7.2 (5.6 - 9.4)	7.1 (4.6 - 9.3)
Bottom	6.7 (4.2 - 8.6)	6.2 (2.7 - 8.5)	6.0 (1.4 - 9.2)	6.2 (3.4 - 9.0)	6.0 (2.6 - 8.8)	6.2 (3.1 - 8.4)	5.8 (2.3 - 8.6)
Dissolved Oxygen (% Saturation)	101 (88 - 117)	101 (72 - 118)	100 (75 - 116)	99 (81 - 113)	99 (75 - 121)	100 (83 - 118)	98 (71 - 120)
Bottom	94 (61 - 110)	86 (38 - 106)	82 (19 - 113)	85 (47 - 111)	82 (40 - 108)	84 (44 - 104)	80 (34 - 106)
pH	7.9 (7.7 - 8.3)	7.9 (7.6 - 8.4)	7.9 (7.5 - 8.3)	7.9 (7.6 - 8.3)	7.9 (7.6 - 8.3)	7.9 (7.6 - 8.3)	7.9 (7.6 - 8.3)
Secchi Disc Depth (m)	2.2 (1.9 - 3.0)	2.4 (2.0 - 3.0)	3.2 (2.0 - 7.5)	3.8 (2.4 - 8.0)	3.0 (1.8 - 5.0)	3.5 (2.0 - 8.5)	4.0 (2.0 - 11.0)
Turbidity (NTU)	2.4 (1.4 - 4.1)	1.9 (0.9 - 3.9)	1.2 (0.4 - 2.0)	1.3 (0.2 - 2.4)	2.3 (0.8 - 3.3)	1.9 (0.4 - 4.9)	3.1 (0.5 - 17.8)
Suspended Solids (mg/L)	3.6 (1.6 - 6.3)	2.5 (1.4 - 3.9)	1.8 (0.7 - 2.8)	1.7 (0.5 - 3.3)	2.7 (1.3 - 4.5)	2.8 (0.7 - 6.9)	2.0 (0.6 - 3.8)
5-day Biochemical Oxygen Demand (mg/L)	1.0 (0.2 - 2.0)	0.8 (0.3 - 1.2)	0.8 (0.2 - 1.8)	0.6 (0.2 - 1.3)	0.7 (0.3 - 1.2)	0.7 (0.3 - 2.1)	0.6 (<0.1 - 1.6)
Ammonia Nitrogen (mg/L)	0.061 (0.027 - 0.108)	0.049 (0.021 - 0.083)	0.052 (0.016 - 0.099)	0.040 (0.020 - 0.068)	0.047 (0.014 - 0.088)	0.039 (0.019 - 0.067)	0.039 (0.017 - 0.075)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.006)	0.002 (<0.001 - 0.006)	0.002 (<0.001 - 0.006)	0.001 (<0.001 - 0.004)	0.002 (<0.001 - 0.005)	0.001 (<0.001 - 0.005)	0.001 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)	0.010 (<0.002 - 0.030)	0.009 (0.002 - 0.024)	0.008 (<0.002 - 0.016)	0.009 (0.002 - 0.023)	0.010 (0.002 - 0.035)	0.009 (<0.002 - 0.019)	0.009 (<0.002 - 0.023)
Nitrate Nitrogen (mg/L)	0.074 (0.006 - 0.253)	0.045 (0.004 - 0.121)	0.040 (0.004 - 0.126)	0.039 (0.004 - 0.122)	0.042 (0.006 - 0.123)	0.040 (0.004 - 0.120)	0.044 (0.005 - 0.132)
Total Inorganic Nitrogen (mg/L)	0.15 (0.04 - 0.35)	0.10 (0.03 - 0.20)	0.10 (0.02 - 0.19)	0.09 (0.03 - 0.18)	0.10 (0.03 - 0.18)	0.09 (0.03 - 0.17)	0.09 (0.03 - 0.19)
Total Kjeldahl Nitrogen (mg/L)	0.24 (0.17 - 0.31)	0.23 (0.17 - 0.39)	0.21 (0.16 - 0.28)	0.19 (0.14 - 0.24)	0.22 (0.16 - 0.49)	0.19 (0.14 - 0.32)	0.18 (0.13 - 0.26)
Total Nitrogen (mg/L)	0.33 (0.21 - 0.53)	0.29 (0.19 - 0.44)	0.25 (0.18 - 0.42)	0.24 (0.15 - 0.37)	0.27 (0.18 - 0.55)	0.24 (0.16 - 0.39)	0.23 (0.16 - 0.37)
Orthophosphate Phosphorus (mg/L)	0.007 (0.002 - 0.015)	0.006 (0.002 - 0.008)	0.006 (0.003 - 0.011)	0.006 (0.004 - 0.009)	0.007 (0.003 - 0.011)	0.006 (0.003 - 0.010)	0.007 (0.003 - 0.012)
Total Phosphorus (mg/L)	0.03 (0.02 - 0.04)	0.03 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)	0.03 (0.02 - 0.03)	0.03 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)
Silica (as SiO ₂) (mg/L)	0.68 (0.20 - 1.63)	0.54 (0.16 - 1.10)	0.58 (0.07 - 1.34)	0.56 (0.10 - 0.90)	0.57 (0.10 - 1.03)	0.53 (0.16 - 1.04)	0.58 (0.20 - 0.97)
Chlorophyll-a (µg/L)	5.8 (0.5 - 14.3)	4.0 (1.2 - 6.9)	3.5 (0.6 - 7.1)	3.2 (0.5 - 9.2)	3.2 (0.8 - 8.0)	3.3 (0.8 - 10.0)	2.6 (0.3 - 8.6)
<i>E. coli</i> (count/100mL)	18 (2 - 120)	2 (<1 - 7)	1 (<1 - 2)	1 (<1 - 1)	1 (<1 - 4)	1 (<1 - 1)	1 (<1 - 1)
Faecal Coliforms (count/100mL)	37 (4 - 220)	3 (<1 - 55)	1 (<1 - 6)	2 (<1 - 16)	2 (<1 - 15)	2 (<1 - 11)	2 (<1 - 8)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Mirs Bay WCZ in 2012 (continued)

Parameter	Ninepin Group MM19	Waglan salnd MM8	Mirs Bay (South) MM13	Mirs Bay (Central)			Long Harbour MM
Number of samples	12	12	12	12	12	12	12
Temperature (°C)	22.6 (15.6 - 27.5)	22.8 (15.9 - 27.3)	23.1 (15.5 - 27.3)	22.8 (15.3 - 27.5)	22.7 (15.5 - 27.7)	22.8 (15.5 - 27.4)	23.0 (15.8 - 28.3)
Salinity	32.5 (31.5 - 33.6)	32.3 (30.5 - 33.2)	32.6 (30.8 - 33.7)	32.6 (31.3 - 33.6)	32.5 (31.3 - 33.6)	32.3 (31.2 - 33.2)	31.7 (30.5 - 32.8)
Dissolved Oxygen (mg/L)	6.8 (4.8 - 8.3)	6.8 (4.7 - 8.2)	6.8 (4.8 - 8.3)	6.8 (4.7 - 8.2)	7.0 (4.8 - 8.2)	7.0 (4.6 - 9.7)	7.2 (4.7 - 9.0)
Bottom	6.2 (2.2 - 8.0)	6.2 (2.4 - 7.8)	6.3 (2.2 - 7.9)	6.4 (3.8 - 8.0)	6.5 (3.9 - 8.0)	6.0 (0.5 - 8.0)	6.4 (2.4 - 8.8)
Dissolved Oxygen (% Saturation)	95 (71 - 112)	95 (69 - 113)	96 (71 - 117)	96 (70 - 113)	98 (71 - 115)	97 (71 - 123)	99 (69 - 117)
Bottom	85 (32 - 108)	85 (35 - 108)	86 (32 - 112)	88 (55 - 111)	90 (55 - 110)	82 (8 - 106)	88 (34 - 109)
pH	7.9 (7.5 - 8.1)	7.9 (7.6 - 8.1)	7.9 (7.6 - 8.1)	7.9 (7.5 - 8.2)	7.9 (7.5 - 8.2)	7.8 (7.5 - 8.1)	7.9 (7.5 - 8.3)
Secchi Disc Depth (m)	3.6 (2.0 - 7.0)	3.6 (2.4 - 7.0)	3.5 (2.7 - 6.0)	3.5 (2.0 - 6.0)	4.1 (2.5 - 6.0)	4.0 (2.0 - 6.0)	3.9 (2.5 - 8.3)
Turbidity (NTU)	2.2 (1.2 - 3.9)	3.0 (1.2 - 6.5)	2.4 (1.4 - 4.4)	2.8 (1.1 - 8.9)	2.2 (0.5 - 5.5)	2.2 (0.7 - 3.3)	1.3 (0.4 - 3.4)
Suspended Solids (mg/L)	2.5 (0.9 - 4.7)	3.0 (0.9 - 6.5)	2.5 (1.3 - 4.1)	3.1 (0.8 - 10.5)	2.3 (0.6 - 5.8)	2.5 (0.8 - 3.8)	1.9 (0.6 - 5.7)
5-day Biochemical Oxygen Demand (mg/L)	0.4 (0.2 - 0.9)	0.4 (<0.1 - 0.7)	0.3 (<0.1 - 0.6)	0.4 (<0.1 - 0.9)	0.3 (<0.1 - 0.9)	0.5 (<0.1 - 1.3)	0.7 (0.1 - 1.5)
Ammonia Nitrogen (mg/L)	0.035 (0.018 - 0.065)	0.032 (0.014 - 0.061)	0.027 (0.011 - 0.055)	0.027 (0.007 - 0.057)	0.034 (0.014 - 0.068)	0.034 (0.015 - 0.063)	0.047 (0.023 - 0.091)
Unionised Ammonia (mg/L)	0.001 (<0.001 - 0.003)	<0.001 (<0.001 - 0.003)	<0.001 (<0.001 - 0.002)	<0.001 (<0.001 - 0.002)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.002)	0.002 (<0.001 - 0.005)
Nitrite Nitrogen (mg/L)	0.013 (0.003 - 0.040)	0.014 (0.003 - 0.029)	0.011 (<0.002 - 0.029)	0.012 (<0.002 - 0.033)	0.009 (0.002 - 0.028)	0.009 (0.002 - 0.023)	0.008 (0.002 - 0.032)
Nitrate Nitrogen (mg/L)	0.076 (0.007 - 0.227)	0.090 (0.011 - 0.223)	0.070 (0.003 - 0.233)	0.074 (0.007 - 0.260)	0.072 (0.006 - 0.250)	0.063 (0.006 - 0.230)	0.033 (0.004 - 0.106)
Total Inorganic Nitrogen (mg/L)	0.12 (0.04 - 0.27)	0.14 (0.05 - 0.26)	0.11 (0.03 - 0.27)	0.11 (0.04 - 0.28)	0.11 (0.03 - 0.28)	0.11 (0.03 - 0.26)	0.09 (0.03 - 0.17)
Total Kjeldahl Nitrogen (mg/L)	0.16 (0.08 - 0.28)	0.16 (0.09 - 0.25)	0.16 (0.07 - 0.26)	0.16 (0.08 - 0.29)	0.15 (0.08 - 0.25)	0.18 (0.12 - 0.36)	0.19 (0.13 - 0.27)
Total Nitrogen (mg/L)	0.25 (0.15 - 0.38)	0.26 (0.13 - 0.37)	0.24 (0.08 - 0.40)	0.25 (0.11 - 0.38)	0.24 (0.09 - 0.39)	0.25 (0.14 - 0.44)	0.23 (0.16 - 0.39)
Orthophosphate Phosphorus (mg/L)	0.009 (0.005 - 0.014)	0.009 (0.004 - 0.017)	0.008 (0.003 - 0.018)	0.009 (0.003 - 0.021)	0.009 (0.003 - 0.017)	0.008 (0.004 - 0.016)	0.006 (0.003 - 0.010)
Total Phosphorus (mg/L)	0.03 (<0.02 - 0.03)	0.03 (<0.02 - 0.03)	0.03 (<0.02 - 0.03)	0.03 (<0.02 - 0.04)	0.03 (<0.02 - 0.09)	0.03 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)
Silica (as SiO ₂) (mg/L)	0.69 (0.24 - 1.13)	0.71 (0.22 - 1.17)	0.58 (0.14 - 1.10)	0.67 (0.17 - 1.37)	0.67 (0.22 - 1.37)	0.70 (0.28 - 1.24)	0.62 (0.09 - 1.05)
Chlorophyll-a (µg/L)	1.6 (0.9 - 2.6)	1.8 (0.6 - 4.2)	1.3 (0.5 - 3.3)	1.4 (0.5 - 3.4)	1.4 (0.4 - 3.7)	2.0 (0.5 - 6.9)	2.9 (0.6 - 8.5)
<i>E. coli</i> (count/100mL)	1 (<1 - 1)	1 (<1 - 2)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)
Faecal Coliforms (count/100mL)	1 (<1 - 2)	1 (<1 - 4)	1 (<1 - 1)	1 (<1 - 2)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 6)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Port Shelter WCZ in 2012

Parameter	Inner Port Shelter				Hebe Haven
	PM1	PM2	PM3	PM4	PM
Number of samples	12	12	12	12	12
Temperature (°C)	23.5 (15.5 - 28.7)	23.3 (15.7 - 28.6)	23.1 (15.7 - 28.0)	23.5 (15.7 - 28.7)	23.3 (15.7 - 28.3)
Salinity	31.4 (28.8 - 32.9)	31.4 (28.2 - 32.9)	31.7 (29.8 - 32.9)	31.4 (28.7 - 33.0)	31.5 (30.4 - 32.8)
Dissolved Oxygen (mg/L)	7.4 (5.2 - 9.7)	7.1 (5.1 - 8.8)	7.0 (4.5 - 8.8)	7.4 (5.5 - 9.1)	7.3 (5.5 - 9.5)
Bottom	6.9 (3.6 - 9.6)	6.6 (3.0 - 8.3)	6.2 (2.6 - 7.7)	7.2 (5.4 - 9.2)	6.5 (3.4 - 8.6)
Dissolved Oxygen (% Saturation)	103 (79 - 140)	99 (78 - 127)	98 (68 - 129)	104 (84 - 134)	101 (84 - 134)
Bottom	96 (54 - 126)	90 (46 - 107)	85 (39 - 107)	100 (81 - 130)	89 (51 - 119)
pH	7.9 (7.6 - 8.2)	7.8 (7.6 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)
Secchi Disc Depth (m)	2.9 (1.3 - 4.0)	3.2 (1.8 - 4.0)	3.2 (2.0 - 4.0)	3.1 (2.0 - 4.0)	3.0 (1.2 - 4.0)
Turbidity (NTU)	1.5 (0.7 - 3.4)	1.5 (0.7 - 2.5)	1.6 (0.6 - 3.0)	1.7 (0.7 - 3.8)	1.4 (0.5 - 2.4)
Suspended Solids (mg/L)	1.6 (0.8 - 2.5)	1.7 (0.7 - 2.7)	1.6 (0.7 - 3.3)	2.0 (1.0 - 4.3)	1.5 (1.0 - 2.5)
5-day Biochemical Oxygen Demand (mg/L)	0.7 (<0.1 - 1.6)	0.5 (<0.1 - 1.1)	0.5 (<0.1 - 1.0)	0.5 (0.1 - 0.9)	0.4 (<0.1 - 1.0)
Ammonia Nitrogen (mg/L)	0.049 (0.019 - 0.106)	0.044 (0.025 - 0.075)	0.046 (0.023 - 0.077)	0.046 (0.023 - 0.097)	0.048 (0.024 - 0.077)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.002 (<0.001 - 0.004)	0.002 (<0.001 - 0.003)	0.002 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)	0.006 (<0.002 - 0.022)	0.008 (<0.002 - 0.022)	0.009 (0.003 - 0.022)	0.006 (<0.002 - 0.018)	0.008 (0.003 - 0.017)
Nitrate Nitrogen (mg/L)	0.051 (<0.002 - 0.180)	0.065 (0.007 - 0.197)	0.060 (0.006 - 0.190)	0.048 (0.002 - 0.177)	0.066 (0.004 - 0.217)
Total Inorganic Nitrogen (mg/L)	0.11 (0.03 - 0.23)	0.12 (0.05 - 0.25)	0.11 (0.04 - 0.24)	0.10 (0.03 - 0.21)	0.12 (0.04 - 0.26)
Total Kjeldahl Nitrogen (mg/L)	0.19 (0.10 - 0.27)	0.18 (0.12 - 0.24)	0.19 (0.12 - 0.27)	0.17 (0.12 - 0.24)	0.18 (0.11 - 0.27)
Total Nitrogen (mg/L)	0.24 (0.11 - 0.34)	0.25 (0.15 - 0.35)	0.26 (0.14 - 0.38)	0.23 (0.13 - 0.33)	0.25 (0.12 - 0.37)
Orthophosphate Phosphorus (mg/L)	0.007 (0.002 - 0.013)	0.008 (0.002 - 0.018)	0.008 (0.003 - 0.017)	0.007 (0.003 - 0.014)	0.008 (0.002 - 0.017)
Total Phosphorus (mg/L)	0.03 (<0.02 - 0.05)	0.03 (<0.02 - 0.10)	0.03 (<0.02 - 0.08)	0.02 (<0.02 - 0.04)	0.03 (<0.02 - 0.03)
Silica (as SiO ₂) (mg/L)	0.78 (0.30 - 1.27)	0.78 (0.15 - 1.30)	0.68 (0.15 - 1.20)	0.75 (0.24 - 1.30)	0.74 (0.14 - 1.23)
Chlorophyll-a (µg/L)	2.6 (0.3 - 6.8)	2.0 (0.4 - 5.3)	1.7 (0.3 - 4.2)	2.5 (0.2 - 9.7)	2.2 (0.3 - 4.3)
<i>E. coli</i> (count/100mL)	2 (<1 - 89)	4 (<1 - 100)	1 (<1 - 9)	2 (<1 - 25)	2 (<1 - 15)
Faecal Coliforms (count/100mL)	3 (<1 - 590)	21 (<1 - 730)	2 (<1 - 130)	3 (<1 - 300)	4 (<1 - 120)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics of the Port Shelter WCZ in 2012 (continued)

Parameter	Outer Port Shelter		Rocky Harbour	Bluff Island
	PM7	PM8	PM9	PM11
Number of samples	12	12	12	12
Temperature (°C)	22.9 (15.5 - 28.0)	22.9 (15.3 - 27.9)	22.9 (15.6 - 27.9)	22.9 (15.3 - 27.8)
Salinity	31.9 (30.3 - 33.0)	32.1 (30.9 - 33.1)	32.0 (31.2 - 33.1)	32.2 (31.1 - 33.1)
Dissolved Oxygen (mg/L)	7.1 (4.6 - 9.8)	7.2 (4.3 - 9.8)	7.3 (5.4 - 9.6)	7.1 (4.9 - 8.8)
Bottom	6.2 (1.6 - 9.4)	6.6 (1.7 - 9.5)	6.6 (3.0 - 8.3)	6.4 (1.4 - 8.3)
Dissolved Oxygen (% Saturation)	99 (70 - 120)	101 (65 - 121)	101 (82 - 134)	99 (74 - 123)
Bottom	84 (23 - 113)	91 (25 - 115)	90 (45 - 103)	89 (21 - 102)
pH	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)
Secchi Disc Depth (m)	4.2 (1.8 - 6.0)	4.3 (1.8 - 6.4)	4.0 (2.3 - 6.0)	3.9 (1.9 - 5.5)
Turbidity (NTU)	1.5 (0.5 - 3.2)	2.1 (0.4 - 4.8)	1.4 (0.4 - 3.3)	1.8 (0.9 - 5.0)
Suspended Solids (mg/L)	1.4 (0.7 - 2.6)	1.6 (0.5 - 4.9)	1.4 (0.7 - 3.2)	1.6 (0.8 - 4.7)
5-day Biochemical Oxygen Demand (mg/L)	0.3 (<0.1 - 0.6)	0.3 (<0.1 - 0.5)	0.4 (<0.1 - 0.8)	0.3 (<0.1 - 0.8)
Ammonia Nitrogen (mg/L)	0.045 (0.023 - 0.081)	0.035 (0.010 - 0.057)	0.041 (0.024 - 0.073)	0.035 (0.011 - 0.061)
Unionised Ammonia (mg/L)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)	0.010 (0.002 - 0.017)	0.012 (<0.002 - 0.025)	0.009 (0.002 - 0.019)	0.010 (0.003 - 0.018)
Nitrate Nitrogen (mg/L)	0.069 (0.007 - 0.220)	0.071 (0.007 - 0.237)	0.067 (0.005 - 0.227)	0.070 (0.007 - 0.240)
Total Inorganic Nitrogen (mg/L)	0.13 (0.03 - 0.26)	0.12 (0.03 - 0.26)	0.12 (0.04 - 0.28)	0.12 (0.04 - 0.27)
Total Kjeldahl Nitrogen (mg/L)	0.17 (0.12 - 0.23)	0.15 (0.09 - 0.25)	0.15 (0.09 - 0.24)	0.15 (0.09 - 0.22)
Total Nitrogen (mg/L)	0.25 (0.15 - 0.37)	0.23 (0.11 - 0.36)	0.23 (0.12 - 0.35)	0.23 (0.12 - 0.35)
Orthophosphate Phosphorus (mg/L)	0.009 (0.003 - 0.016)	0.009 (0.004 - 0.019)	0.008 (0.003 - 0.017)	0.009 (0.004 - 0.018)
Total Phosphorus (mg/L)	0.02 (<0.02 - 0.04)	0.02 (<0.02 - 0.04)	0.03 (<0.02 - 0.03)	0.03 (<0.02 - 0.08)
Silica (as SiO ₂) (mg/L)	0.70 (0.37 - 1.08)	0.63 (0.26 - 1.17)	0.64 (0.33 - 1.20)	0.63 (0.30 - 1.17)
Chlorophyll-a (µg/L)	1.3 (0.4 - 2.4)	1.2 (0.5 - 2.3)	1.3 (0.3 - 3.1)	1.2 (0.5 - 2.3)
<i>E. coli</i> (count/100mL)	1 (<1 - 7)	1 (<1 - 5)	1 (<1 - 3)	1 (<1 - 2)
Faecal Coliforms (count/100mL)	2 (<1 - 49)	1 (<1 - 29)	1 (<1 - 18)	1 (<1 - 17)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Tolo Harbour WCZ in 2012

Parameter	Harbour Sub one			Buffer Sub one		Channel Sub one	
	TM2	TM3	TM4	TM5	TM	TM7	TM8
Number of samples	12	12	12	12	12	12	12
Temperature (°C)	24.1 (15.4 - 29.1)	24.0 (15.2 - 29.1)	23.7 (15.4 - 28.7)	24.3 (15.5 - 29.1)	23.2 (15.8 - 28.3)	23.2 (15.7 - 28.0)	22.7 (15.6 - 27.5)
Salinity	30.4 (29.1 - 31.6)	30.8 (29.7 - 32.1)	30.8 (29.8 - 32.1)	30.8 (29.6 - 32.0)	31.3 (30.6 - 32.8)	31.5 (30.6 - 32.7)	31.9 (31.1 - 33.0)
Dissolved Oxygen (mg/L)	7.9 (4.9 - 11.2)	7.6 (6.3 - 10.6)	7.1 (4.8 - 10.4)	7.5 (5.9 - 10.5)	6.6 (4.1 - 9.4)	6.8 (4.6 - 9.2)	6.3 (4.1 - 8.3)
Bottom	7.7 (4.3 - 11.2)	6.4 (2.3 - 10.2)	5.1 (1.8 - 9.7)	7.3 (5.3 - 10.9)	5.0 (1.7 - 7.5)	5.1 (1.3 - 7.9)	4.8 (0.6 - 7.7)
Dissolved Oxygen (% Saturation)	111 (75 - 170)	108 (82 - 161)	99 (73 - 134)	106 (88 - 138)	91 (62 - 119)	94 (71 - 123)	87 (62 - 103)
Bottom	108 (67 - 169)	89 (34 - 143)	70 (26 - 121)	103 (80 - 141)	68 (24 - 101)	69 (18 - 104)	65 (8 - 97)
pH	7.9 (7.7 - 8.1)	7.9 (7.6 - 8.3)	7.9 (7.5 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.5 - 8.2)	7.9 (7.5 - 8.2)	7.9 (7.5 - 8.1)
Secchi Disc Depth (m)	2.7 (2.0 - 3.4)	2.7 (2.0 - 4.8)	3.0 (2.0 - 5.0)	2.8 (2.0 - 3.6)	3.0 (2.0 - 4.3)	3.4 (2.0 - 5.0)	4.0 (2.5 - 5.8)
Turbidity (NTU)	1.1 (0.7 - 1.9)	1.2 (0.6 - 2.9)	1.2 (0.5 - 2.4)	2.0 (0.8 - 4.2)	1.2 (0.5 - 2.7)	1.1 (0.5 - 2.0)	1.5 (0.5 - 3.2)
Suspended Solids (mg/L)	1.8 (0.8 - 2.5)	1.6 (0.8 - 2.5)	1.5 (0.8 - 3.2)	3.8 (0.8 - 14.7)	1.6 (0.7 - 3.0)	1.6 (0.8 - 3.5)	1.5 (0.8 - 2.5)
5-day Biochemical Oxygen Demand (mg/L)	1.5 (0.7 - 2.5)	1.6 (0.9 - 2.6)	1.3 (0.7 - 2.0)	1.5 (0.5 - 2.9)	1.1 (0.5 - 1.8)	1.0 (0.3 - 1.9)	0.6 (0.3 - 0.9)
Ammonia Nitrogen (mg/L)	0.063 (0.026 - 0.105)	0.063 (0.030 - 0.109)	0.059 (0.028 - 0.094)	0.055 (0.021 - 0.100)	0.054 (0.023 - 0.100)	0.056 (0.022 - 0.089)	0.052 (0.014 - 0.082)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.006)	0.002 (<0.001 - 0.004)	0.002 (<0.001 - 0.004)	0.002 (<0.001 - 0.003)	0.002 (<0.001 - 0.003)	0.002 (<0.001 - 0.002)
Nitrite Nitrogen (mg/L)	0.011 (<0.002 - 0.059)	0.010 (<0.002 - 0.039)	0.013 (<0.002 - 0.062)	0.008 (<0.002 - 0.042)	0.010 (<0.002 - 0.040)	0.011 (<0.002 - 0.041)	0.011 (0.003 - 0.034)
Nitrate Nitrogen (mg/L)	0.029 (<0.002 - 0.089)	0.024 (0.002 - 0.077)	0.023 (0.005 - 0.067)	0.017 (<0.002 - 0.069)	0.023 (0.004 - 0.065)	0.023 (0.004 - 0.074)	0.040 (0.008 - 0.107)
Total Inorganic Nitrogen (mg/L)	0.10 (0.03 - 0.22)	0.10 (0.04 - 0.16)	0.09 (0.04 - 0.15)	0.08 (0.03 - 0.15)	0.09 (0.04 - 0.13)	0.09 (0.05 - 0.14)	0.10 (0.05 - 0.17)
Total Kjeldahl Nitrogen (mg/L)	0.27 (0.20 - 0.35)	0.27 (0.22 - 0.38)	0.26 (0.15 - 0.35)	0.26 (0.21 - 0.30)	0.23 (0.15 - 0.36)	0.23 (0.19 - 0.27)	0.20 (0.14 - 0.26)
Total Nitrogen (mg/L)	0.31 (0.23 - 0.39)	0.31 (0.25 - 0.43)	0.29 (0.23 - 0.40)	0.29 (0.23 - 0.37)	0.27 (0.20 - 0.45)	0.26 (0.22 - 0.30)	0.25 (0.17 - 0.32)
Orthophosphate Phosphorus (mg/L)	0.004 (0.002 - 0.007)	0.004 (<0.002 - 0.006)	0.004 (0.002 - 0.006)	0.004 (0.003 - 0.006)	0.005 (0.003 - 0.008)	0.005 (0.003 - 0.009)	0.008 (0.004 - 0.014)
Total Phosphorus (mg/L)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)	0.03 (<0.02 - 0.04)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.04)	0.03 (0.02 - 0.03)
Silica (as SiO ₂) (mg/L)	0.85 (0.17 - 2.00)	0.74 (0.37 - 1.60)	0.92 (0.34 - 1.67)	0.80 (0.12 - 1.60)	0.86 (0.33 - 1.53)	0.88 (0.28 - 1.40)	0.92 (0.44 - 1.37)
Chlorophyll-a (µg/L)	6.8 (0.8 - 15.0)	6.6 (1.4 - 11.2)	5.7 (1.2 - 11.2)	5.7 (1.3 - 10.9)	4.3 (1.0 - 10.2)	4.3 (0.8 - 8.4)	2.7 (1.2 - 5.3)
<i>E.coli</i> (count/100mL)	6 (1 - 45)	6 (<1 - 830)	4 (1 - 18)	3 (<1 - 26)	2 (<1 - 11)	1 (<1 - 2)	1 (<1 - 1)
Faecal Coliforms (count/100mL)	48 (2 - 620)	24 (2 - 3600)	17 (2 - 140)	8 (1 - 78)	4 (1 - 45)	2 (<1 - 3)	1 (<1 - 2)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Southern WCZ in 2012

Parameter	Hong Kong island (South)			East Lamma Channel	
	SM1	SM2	SM19	SM3	SM4
Number of samples	12	12	12	12	12
Temperature (°C)	23.0 (15.3 - 28.1)	23.1 (15.7 - 27.9)	23.0 (15.2 - 27.8)	22.9 (15.9 - 28.0)	23.3 (16.2 - 28.2)
Salinity	32.0 (30.1 - 33.2)	31.6 (29.5 - 33.0)	32.0 (30.5 - 33.3)	31.7 (30.4 - 32.9)	31.2 (27.6 - 32.8)
Dissolved Oxygen (mg/L)	7.2 (5.4 - 8.6)	6.9 (5.1 - 8.5)	7.1 (5.3 - 8.4)	6.7 (4.3 - 8.4)	6.9 (4.5 - 9.0)
Bottom	6.8 (4.1 - 8.5)	6.5 (3.2 - 8.4)	6.5 (3.7 - 8.3)	6.3 (3.6 - 8.5)	6.6 (2.6 - 8.7)
Dissolved Oxygen (% Saturation)	100 (79 - 117)	96 (77 - 114)	98 (78 - 116)	92 (65 - 113)	95 (66 - 113)
Bottom	94 (61 - 113)	90 (46 - 114)	90 (54 - 115)	87 (50 - 114)	91 (37 - 114)
pH	7.9 (7.6 - 8.3)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)	7.8 (7.5 - 8.2)	7.8 (7.5 - 8.2)
Secchi Disc Depth (m)	2.8 (1.6 - 4.5)	2.6 (1.8 - 3.0)	2.8 (1.9 - 4.2)	2.9 (2.0 - 4.2)	2.7 (1.9 - 3.8)
Turbidity (NTU)	2.2 (<0.1 - 4.8)	3.7 (0.8 - 7.7)	3.0 (<0.1 - 6.4)	3.0 (2.2 - 4.3)	2.2 (0.8 - 3.5)
Suspended Solids (mg/L)	3.0 (1.2 - 7.5)	5.8 (1.0 - 12.9)	3.4 (1.4 - 7.0)	3.7 (2.2 - 7.0)	3.0 (0.9 - 4.5)
5-day Biochemical Oxygen Demand (mg/L)	0.5 (0.1 - 1.1)	0.5 (0.1 - 1.2)	0.4 (<0.1 - 1.2)	0.5 (0.1 - 1.6)	0.5 (0.2 - 1.0)
Ammonia Nitrogen (mg/L)	0.037 (0.011 - 0.069)	0.051 (0.010 - 0.084)	0.036 (0.005 - 0.086)	0.063 (0.011 - 0.107)	0.074 (0.010 - 0.123)
Unionised Ammonia (mg/L)	0.001 (<0.001 - 0.003)	0.002 (<0.001 - 0.006)	0.001 (<0.001 - 0.006)	0.002 (<0.001 - 0.007)	0.002 (<0.001 - 0.009)
Nitrite Nitrogen (mg/L)	0.015 (0.003 - 0.031)	0.025 (0.007 - 0.057)	0.016 (0.003 - 0.032)	0.028 (0.008 - 0.069)	0.030 (0.008 - 0.071)
Nitrate Nitrogen (mg/L)	0.087 (0.013 - 0.243)	0.114 (0.028 - 0.230)	0.091 (0.012 - 0.253)	0.121 (0.038 - 0.223)	0.148 (0.040 - 0.330)
Total Inorganic Nitrogen (mg/L)	0.14 (0.04 - 0.28)	0.19 (0.09 - 0.33)	0.14 (0.04 - 0.29)	0.21 (0.11 - 0.31)	0.25 (0.11 - 0.47)
Total Kjeldahl Nitrogen (mg/L)	0.16 (0.10 - 0.21)	0.19 (0.14 - 0.27)	0.17 (0.09 - 0.23)	0.21 (0.15 - 0.29)	0.23 (0.13 - 0.40)
Total Nitrogen (mg/L)	0.26 (0.15 - 0.37)	0.33 (0.21 - 0.45)	0.28 (0.16 - 0.38)	0.36 (0.24 - 0.42)	0.40 (0.21 - 0.57)
Orthophosphate Phosphorus (mg/L)	0.008 (0.003 - 0.021)	0.010 (0.004 - 0.023)	0.009 (0.004 - 0.021)	0.013 (0.006 - 0.024)	0.013 (0.006 - 0.030)
Total Phosphorus (mg/L)	0.03 (<0.02 - 0.03)	0.03 (<0.02 - 0.04)	0.03 (<0.02 - 0.03)	0.03 (<0.02 - 0.04)	0.03 (<0.02 - 0.05)
Silica (as SiO ₂) (mg/L)	0.61 (0.10 - 1.20)	0.76 (0.21 - 1.20)	0.65 (0.12 - 1.20)	0.85 (0.31 - 1.37)	0.82 (0.30 - 1.47)
Chlorophyll-a (µg/L)	2.7 (0.6 - 6.8)	2.7 (0.6 - 7.9)	2.3 (0.5 - 5.6)	2.1 (0.6 - 5.4)	3.0 (0.3 - 11.5)
<i>E. coli</i> (count/100mL)	2 (1 - 10)	59 (3 - 330)	1 (<1 - 3)	40 (6 - 220)	16 (1 - 3100)
Faecal Coliforms (count/100mL)	3 (1 - 13)	110 (15 - 540)	2 (1 - 6)	68 (15 - 330)	31 (2 - 4300)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Southern WCZ in 2012 (continued)

Parameter	West Lamma Channel				
	SM5	SM	SM7	SM9	SM18
Number of samples	12	12	12	12	12
Temperature (°C)	23.5 (15.8 - 28.4)	23.2 (15.8 - 28.2)	23.6 (16.0 - 28.3)	23.6 (16.3 - 28.4)	23.1 (15.3 - 28.1)
Salinity	31.0 (26.2 - 33.1)	31.1 (26.6 - 33.1)	30.4 (26.4 - 32.5)	29.6 (23.3 - 33.0)	31.6 (29.0 - 33.1)
Dissolved Oxygen (mg/L)	7.3 (5.6 - 8.8)	7.0 (5.0 - 8.7)	7.1 (5.0 - 9.7)	7.1 (5.3 - 9.4)	7.1 (5.6 - 8.9)
Bottom	6.7 (3.5 - 8.6)	6.2 (1.7 - 8.6)	6.4 (2.6 - 9.4)	6.7 (4.5 - 8.4)	6.3 (2.8 - 8.5)
Dissolved Oxygen (% Saturation)	102 (86 - 118)	97 (75 - 117)	98 (76 - 122)	99 (80 - 134)	99 (83 - 121)
Bottom	93 (52 - 114)	86 (24 - 115)	88 (39 - 118)	92 (67 - 119)	87 (39 - 115)
pH	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.1)	7.8 (7.5 - 8.1)	7.9 (7.6 - 8.2)
Secchi Disc Depth (m)	2.3 (1.6 - 3.6)	2.4 (1.8 - 3.8)	2.3 (1.6 - 3.1)	2.2 (1.7 - 2.9)	2.6 (1.9 - 3.9)
Turbidity (NTU)	3.6 (0.9 - 8.1)	3.8 (1.3 - 6.8)	4.3 (2.6 - 8.0)	5.5 (0.9 - 14.3)	3.2 (0.2 - 6.2)
Suspended Solids (mg/L)	4.7 (1.3 - 9.4)	5.4 (1.3 - 9.6)	6.1 (3.4 - 12.2)	6.4 (2.0 - 18.0)	4.1 (1.3 - 7.7)
5-day Biochemical Oxygen Demand (mg/L)	0.5 (0.1 - 1.4)	0.5 (0.2 - 1.3)	0.6 (0.2 - 1.8)	0.6 (<0.1 - 1.4)	0.5 (<0.1 - 1.0)
Ammonia Nitrogen (mg/L)	0.047 (0.011 - 0.095)	0.057 (0.027 - 0.123)	0.089 (0.030 - 0.133)	0.112 (0.026 - 0.227)	0.044 (0.006 - 0.104)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)	0.003 (<0.001 - 0.009)	0.003 (<0.001 - 0.005)	0.001 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)	0.027 (0.008 - 0.058)	0.031 (0.006 - 0.076)	0.038 (0.008 - 0.094)	0.050 (0.013 - 0.107)	0.021 (0.006 - 0.043)
Nitrate Nitrogen (mg/L)	0.141 (0.036 - 0.407)	0.154 (0.047 - 0.427)	0.197 (0.109 - 0.430)	0.281 (0.086 - 0.657)	0.111 (0.018 - 0.255)
Total Inorganic Nitrogen (mg/L)	0.22 (0.10 - 0.52)	0.24 (0.10 - 0.60)	0.32 (0.15 - 0.59)	0.44 (0.23 - 0.80)	0.18 (0.06 - 0.38)
Total Kjeldahl Nitrogen (mg/L)	0.19 (0.11 - 0.31)	0.22 (0.13 - 0.30)	0.25 (0.13 - 0.31)	0.33 (0.25 - 0.43)	0.17 (0.09 - 0.22)
Total Nitrogen (mg/L)	0.36 (0.19 - 0.62)	0.40 (0.29 - 0.70)	0.49 (0.32 - 0.67)	0.66 (0.40 - 1.01)	0.30 (0.18 - 0.47)
Orthophosphate Phosphorus (mg/L)	0.010 (0.003 - 0.021)	0.012 (0.005 - 0.021)	0.015 (0.005 - 0.027)	0.021 (0.003 - 0.036)	0.009 (0.005 - 0.021)
Total Phosphorus (mg/L)	0.03 (<0.02 - 0.04)	0.03 (0.02 - 0.05)	0.04 (0.02 - 0.06)	0.04 (0.02 - 0.06)	0.03 (<0.02 - 0.03)
Silica (as SiO ₂) (mg/L)	0.79 (0.20 - 1.47)	0.91 (0.35 - 1.80)	1.00 (0.13 - 1.73)	1.18 (0.46 - 2.23)	0.76 (0.19 - 1.38)
Chlorophyll-a (µg/L)	4.0 (0.8 - 14.1)	3.6 (0.8 - 16.0)	4.7 (0.6 - 17.0)	6.1 (0.4 - 20.7)	2.5 (0.6 - 6.7)
<i>E. coli</i> (count/100mL)	1 (<1 - 3)	1 (<1 - 1)	5 (1 - 460)	15 (2 - 150)	1 (<1 - 1)
Faecal Coliforms (count/100mL)	2 (<1 - 12)	2 (<1 - 3)	10 (1 - 640)	32 (5 - 320)	1 (<1 - 5)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Southern WCZ in 2012 (continued)

Parameter	Lantau sland (East)		Lantau sland (South)			Soko slands
	SM10	SM11	SM12	SM13	SM17	SM20
Number of samples	12	12	12	12	12	12
Temperature (°C)	23.9 (16.5 - 29.3)	23.8 (16.4 - 29.8)	23.7 (16.0 - 29.3)	23.8 (16.0 - 29.2)	23.4 (15.5 - 29.4)	23.5 (15.8 - 29.2)
Salinity	29.1 (22.9 - 32.6)	29.3 (23.0 - 32.6)	29.4 (22.0 - 32.6)	29.5 (22.7 - 33.0)	30.4 (24.3 - 33.0)	29.4 (21.1 - 33.2)
Dissolved Oxygen (mg/L)	8.0 (6.2 - 10.6)	8.2 (6.4 - 11.6)	8.0 (6.4 - 10.3)	7.8 (5.4 - 10.7)	7.6 (6.1 - 9.3)	7.3 (5.4 - 8.7)
Bottom	8.0 (6.2 - 10.8)	7.8 (6.3 - 10.1)	7.5 (5.4 - 9.6)	7.4 (4.8 - 11.3)	6.8 (3.1 - 9.0)	6.7 (3.5 - 8.7)
Dissolved Oxygen (% Saturation)	111 (89 - 151)	114 (91 - 172)	112 (93 - 149)	109 (83 - 155)	105 (88 - 133)	101 (80 - 122)
Bottom	112 (90 - 156)	108 (91 - 145)	105 (82 - 138)	102 (72 - 162)	93 (46 - 116)	93 (51 - 116)
pH	7.9 (7.5 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.1)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)
Secchi Disc Depth (m)	2.1 (1.5 - 2.6)	2.1 (1.1 - 3.0)	2.1 (1.7 - 3.1)	2.3 (1.6 - 3.0)	2.5 (2.0 - 3.1)	2.2 (1.8 - 2.8)
Turbidity (NTU)	5.7 (1.3 - 16.6)	5.6 (1.1 - 12.3)	6.2 (1.1 - 18.8)	5.9 (1.2 - 18.7)	5.0 (0.5 - 18.7)	6.2 (1.7 - 22.3)
Suspended Solids (mg/L)	7.2 (2.1 - 18.5)	6.3 (2.2 - 11.7)	7.3 (2.1 - 14.4)	6.8 (2.0 - 19.0)	4.8 (1.7 - 12.0)	6.6 (2.3 - 20.7)
5-day Biochemical Oxygen Demand (mg/L)	0.8 (<0.1 - 2.0)	0.9 (<0.1 - 2.5)	0.8 (<0.1 - 2.3)	0.7 (<0.1 - 1.9)	0.5 (<0.1 - 1.2)	0.6 (<0.1 - 1.3)
Ammonia Nitrogen (mg/L)	0.091 (0.037 - 0.205)	0.081 (0.023 - 0.177)	0.064 (0.030 - 0.157)	0.056 (0.020 - 0.153)	0.035 (0.013 - 0.079)	0.043 (0.014 - 0.127)
Unionised Ammonia (mg/L)	0.003 (0.001 - 0.007)	0.002 (0.001 - 0.006)	0.002 (<0.001 - 0.007)	0.002 (<0.001 - 0.008)	0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)	0.048 (0.008 - 0.100)	0.045 (0.007 - 0.092)	0.042 (0.007 - 0.086)	0.040 (0.008 - 0.081)	0.028 (0.007 - 0.061)	0.038 (0.009 - 0.074)
Nitrate Nitrogen (mg/L)	0.282 (0.092 - 0.855)	0.251 (0.098 - 0.717)	0.230 (0.100 - 0.563)	0.228 (0.081 - 0.547)	0.186 (0.018 - 0.460)	0.266 (0.050 - 0.707)
Total Inorganic Nitrogen (mg/L)	0.42 (0.14 - 1.00)	0.38 (0.15 - 0.87)	0.34 (0.16 - 0.70)	0.32 (0.18 - 0.66)	0.25 (0.07 - 0.58)	0.35 (0.13 - 0.78)
Total Kjeldahl Nitrogen (mg/L)	0.30 (0.23 - 0.37)	0.29 (0.21 - 0.38)	0.26 (0.19 - 0.33)	0.23 (0.13 - 0.31)	0.20 (0.15 - 0.28)	0.25 (0.16 - 0.59)
Total Nitrogen (mg/L)	0.63 (0.33 - 1.23)	0.59 (0.37 - 1.06)	0.53 (0.41 - 0.83)	0.50 (0.28 - 0.84)	0.42 (0.24 - 0.75)	0.55 (0.29 - 0.98)
Orthophosphate Phosphorus (mg/L)	0.018 (0.004 - 0.033)	0.016 (0.003 - 0.031)	0.014 (0.003 - 0.032)	0.013 (0.003 - 0.022)	0.010 (0.003 - 0.020)	0.012 (0.003 - 0.020)
Total Phosphorus (mg/L)	0.04 (0.03 - 0.05)	0.03 (0.02 - 0.05)	0.03 (<0.02 - 0.05)	0.03 (0.02 - 0.05)	0.03 (<0.02 - 0.06)	0.04 (<0.02 - 0.10)
Silica (as SiO ₂) (mg/L)	1.02 (<0.05 - 2.15)	0.95 (0.06 - 1.40)	0.98 (0.09 - 2.00)	1.11 (0.34 - 2.23)	0.92 (0.30 - 2.20)	1.37 (0.47 - 3.60)
Chlorophyll-a (µg/L)	8.3 (0.7 - 19.5)	8.8 (0.7 - 28.3)	6.1 (0.9 - 15.9)	4.5 (0.9 - 13.1)	4.1 (0.6 - 11.7)	3.1 (0.7 - 6.4)
<i>E. coli</i> (count/100mL)	3 (<1 - 14)	2 (<1 - 13)	18 (2 - 990)	3 (<1 - 44)	1 (<1 - 3)	1 (<1 - 1)
Faecal Coliforms (count/100mL)	7 (1 - 26)	3 (<1 - 28)	38 (6 - 1500)	4 (1 - 71)	2 (<1 - 4)	1 (<1 - 3)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics of the Victoria Harbour WCZ in 2012

Parameter	Victoria Harbour (East)		Victoria Harbour (Central)		
	VM1	VM2	VM4	VM5	VM
Number of samples	12	12	12	12	12
Temperature (°C)	23.2 (16.1 - 27.7)	23.4 (16.1 - 28.8)	23.4 (16.2 - 28.8)	23.6 (16.3 - 28.9)	23.6 (16.3 - 28.9)
Salinity	31.8 (30.8 - 32.9)	31.3 (29.1 - 32.8)	31.0 (28.9 - 32.8)	30.3 (27.2 - 32.6)	30.3 (26.7 - 32.6)
Dissolved Oxygen (mg/L)	6.3 (3.9 - 7.8)	6.2 (4.3 - 7.7)	5.9 (4.3 - 7.6)	5.9 (4.3 - 6.9)	5.8 (4.4 - 6.9)
Bottom	6.3 (3.9 - 8.0)	6.1 (3.3 - 7.9)	5.8 (3.1 - 7.5)	5.6 (4.0 - 7.0)	5.5 (3.7 - 6.9)
Dissolved Oxygen (% Saturation)	88 (59 - 108)	85 (65 - 104)	83 (63 - 96)	81 (65 - 97)	81 (66 - 97)
Bottom	88 (59 - 110)	85 (49 - 108)	81 (48 - 100)	78 (61 - 92)	77 (57 - 90)
pH	7.8 (7.5 - 8.3)	7.7 (7.4 - 8.0)	7.7 (7.4 - 7.9)	7.7 (7.4 - 7.9)	7.7 (7.4 - 7.9)
Secchi Disc Depth (m)	3.3 (2.0 - 5.5)	2.9 (2.0 - 3.9)	2.9 (2.0 - 4.0)	2.6 (2.0 - 4.0)	2.6 (1.9 - 4.0)
Turbidity (NTU)	3.9 (1.1 - 9.0)	3.5 (0.8 - 9.5)	3.6 (1.2 - 8.9)	3.7 (1.4 - 11.2)	3.9 (1.6 - 12.8)
Suspended Solids (mg/L)	3.8 (1.2 - 6.6)	3.5 (1.2 - 7.8)	3.5 (1.4 - 8.0)	4.0 (1.1 - 7.6)	4.0 (2.1 - 9.6)
5-day Biochemical Oxygen Demand (mg/L)	0.4 (<0.1 - 0.7)	0.5 (0.1 - 1.3)	0.5 (0.2 - 1.2)	1.2 (0.2 - 2.7)	0.7 (0.2 - 1.8)
Ammonia Nitrogen (mg/L)	0.093 (0.043 - 0.194)	0.132 (0.055 - 0.263)	0.151 (0.078 - 0.257)	0.205 (0.143 - 0.260)	0.202 (0.133 - 0.270)
Unionised Ammonia (mg/L)	0.003 (<0.001 - 0.011)	0.003 (<0.001 - 0.010)	0.004 (<0.001 - 0.010)	0.004 (0.001 - 0.011)	0.004 (0.001 - 0.010)
Nitrite Nitrogen (mg/L)	0.023 (0.006 - 0.051)	0.028 (0.008 - 0.060)	0.029 (0.011 - 0.054)	0.034 (0.015 - 0.063)	0.036 (0.016 - 0.059)
Nitrate Nitrogen (mg/L)	0.147 (0.050 - 0.301)	0.183 (0.065 - 0.357)	0.202 (0.086 - 0.433)	0.249 (0.097 - 0.630)	0.258 (0.107 - 0.643)
Total Inorganic Nitrogen (mg/L)	0.26 (0.15 - 0.53)	0.34 (0.18 - 0.64)	0.38 (0.23 - 0.73)	0.49 (0.32 - 0.95)	0.50 (0.33 - 0.95)
Total Kjeldahl Nitrogen (mg/L)	0.24 (0.15 - 0.36)	0.29 (0.18 - 0.55)	0.33 (0.19 - 0.50)	0.44 (0.33 - 0.53)	0.41 (0.30 - 0.49)
Total Nitrogen (mg/L)	0.41 (0.24 - 0.65)	0.50 (0.31 - 0.85)	0.56 (0.35 - 0.91)	0.72 (0.51 - 1.13)	0.70 (0.51 - 1.12)
Orthophosphate Phosphorus (mg/L)	0.020 (0.012 - 0.036)	0.025 (0.013 - 0.037)	0.030 (0.021 - 0.036)	0.033 (0.018 - 0.052)	0.034 (0.018 - 0.049)
Total Phosphorus (mg/L)	0.03 (0.02 - 0.04)	0.04 (0.03 - 0.06)	0.05 (0.03 - 0.06)	0.06 (0.04 - 0.08)	0.05 (0.04 - 0.07)
Silica (as SiO ₂) (mg/L)	1.06 (0.45 - 1.57)	1.13 (0.51 - 1.67)	1.21 (0.65 - 1.87)	1.37 (0.77 - 2.23)	1.40 (0.79 - 2.27)
Chlorophyll-a (µg/L)	1.3 (0.2 - 2.8)	1.9 (0.5 - 9.3)	1.9 (0.2 - 9.7)	2.7 (0.4 - 16.3)	2.0 (0.4 - 11.6)
<i>E. coli</i> (count/100mL)	230 (24 - 1400)	800 (73 - 5800)	3100 (1300 - 17000)	5300 (650 - 71000)	3300 (640 - 26000)
Faecal Coliforms (count/100mL)	480 (32 - 3500)	1600 (120 - 14000)	5700 (2400 - 23000)	12000 (1100 - 190000)	6600 (1700 - 40000)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics of the Victoria Harbour WCZ in 2012 (continued)

Parameter	Victoria Harbour (West)		Stonecutters Island	Rambler Channel	
	VM7	VM8	VM15	VM12	VM14
Number of samples	12	12	12	12	12
Temperature (°C)	23.2 (15.2 - 28.3)	23.2 (15.4 - 28.3)	23.7 (16.2 - 28.7)	23.3 (15.9 - 28.3)	23.5 (16.0 - 28.5)
Salinity	30.1 (24.9 - 32.7)	30.2 (24.6 - 32.9)	30.4 (27.4 - 32.6)	30.0 (26.0 - 32.6)	28.9 (21.2 - 32.5)
Dissolved Oxygen (mg/L)	6.1 (3.8 - 8.5)	6.6 (4.5 - 9.0)	5.7 (4.2 - 7.4)	6.0 (3.8 - 8.4)	6.2 (3.6 - 8.1)
Bottom	5.9 (3.6 - 8.6)	6.3 (4.4 - 9.2)	5.5 (3.9 - 7.0)	6.0 (3.5 - 8.4)	6.2 (3.3 - 8.1)
Dissolved Oxygen (% Saturation)	84 (58 - 121)	90 (66 - 109)	80 (63 - 101)	83 (57 - 103)	85 (53 - 113)
Bottom	82 (55 - 104)	87 (66 - 111)	76 (57 - 95)	82 (53 - 103)	85 (49 - 111)
pH	7.7 (7.4 - 7.9)	7.8 (7.5 - 7.9)	7.6 (7.4 - 7.9)	7.7 (7.4 - 7.9)	7.7 (7.4 - 7.9)
Secchi Disc Depth (m)	2.6 (2.0 - 4.0)	2.6 (2.0 - 3.0)	2.6 (2.0 - 4.0)	2.4 (1.8 - 3.5)	2.4 (2.0 - 3.5)
Turbidity (NTU)	12.8 (2.1 - 96.7)	11.4 (2.4 - 91.7)	4.8 (2.0 - 12.0)	14.6 (3.0 - 109.0)	13.1 (2.2 - 104.0)
Suspended Solids (mg/L)	4.0 (2.3 - 7.5)	6.3 (2.4 - 30.3)	6.8 (1.8 - 34.3)	8.3 (2.5 - 16.0)	5.8 (2.1 - 13.3)
5-day Biochemical Oxygen Demand (mg/L)	0.6 (0.2 - 1.1)	0.6 (0.2 - 1.1)	0.5 (0.1 - 1.2)	0.4 (<0.1 - 1.0)	0.4 (<0.1 - 1.0)
Ammonia Nitrogen (mg/L)	0.206 (0.103 - 0.323)	0.159 (0.096 - 0.243)	0.212 (0.157 - 0.337)	0.190 (0.113 - 0.247)	0.159 (0.075 - 0.273)
Unionised Ammonia (mg/L)	0.004 (0.002 - 0.010)	0.004 (0.002 - 0.006)	0.004 (0.001 - 0.008)	0.004 (0.002 - 0.007)	0.003 (0.001 - 0.006)
Nitrite Nitrogen (mg/L)	0.040 (0.014 - 0.067)	0.045 (0.012 - 0.090)	0.034 (0.018 - 0.057)	0.048 (0.015 - 0.087)	0.057 (0.016 - 0.110)
Nitrate Nitrogen (mg/L)	0.260 (0.100 - 0.690)	0.248 (0.079 - 0.627)	0.247 (0.107 - 0.580)	0.270 (0.097 - 0.620)	0.342 (0.123 - 0.840)
Total Inorganic Nitrogen (mg/L)	0.51 (0.31 - 0.92)	0.45 (0.30 - 0.87)	0.49 (0.35 - 0.90)	0.51 (0.34 - 0.85)	0.56 (0.32 - 1.08)
Total Kjeldahl Nitrogen (mg/L)	0.41 (0.24 - 0.58)	0.33 (0.24 - 0.43)	0.40 (0.31 - 0.51)	0.36 (0.25 - 0.49)	0.33 (0.23 - 0.50)
Total Nitrogen (mg/L)	0.71 (0.45 - 1.15)	0.63 (0.40 - 1.08)	0.68 (0.50 - 1.08)	0.68 (0.50 - 1.02)	0.73 (0.49 - 1.28)
Orthophosphate Phosphorus (mg/L)	0.034 (0.010 - 0.048)	0.027 (0.017 - 0.034)	0.035 (0.021 - 0.052)	0.032 (0.015 - 0.044)	0.030 (0.019 - 0.045)
Total Phosphorus (mg/L)	0.05 (0.04 - 0.07)	0.04 (0.03 - 0.06)	0.05 (0.04 - 0.07)	0.05 (0.04 - 0.07)	0.05 (0.03 - 0.06)
Silica (as SiO ₂) (mg/L)	1.41 (0.67 - 2.70)	1.37 (0.60 - 2.60)	1.41 (0.92 - 2.20)	1.45 (0.90 - 2.47)	1.70 (0.83 - 4.10)
Chlorophyll-a (µg/L)	1.9 (0.3 - 9.3)	1.9 (0.4 - 7.1)	2.0 (0.4 - 9.8)	1.3 (0.4 - 3.5)	1.4 (0.4 - 4.2)
<i>E. coli</i> (count/100mL)	2000 (83 - 14000)	630 (67 - 12000)	570 (89 - 2200)	410 (75 - 2100)	360 (51 - 5200)
Faecal Coliforms (count/100mL)	4400 (130 - 31000)	1300 (95 - 21000)	1300 (200 - 4900)	910 (110 - 5200)	780 (160 - 8900)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Eastern Buffer WCZ in 2012

Parameter	Chai Wan	Tathong Channel	
	EM1	EM2	EM3
Number of samples	12	12	12
Temperature (°C)	23.0 (15.0 - 28.4)	22.9 (14.9 - 28.7)	22.8 (14.9 - 28.1)
Salinity	31.7 (30.3 - 32.9)	31.8 (30.3 - 33.0)	32.1 (31.0 - 33.1)
Dissolved Oxygen (mg/L)	6.7 (4.5 - 9.7)	7.0 (4.2 - 9.7)	7.0 (4.5 - 9.7)
Bottom	6.7 (4.3 - 9.6)	6.8 (3.5 - 9.7)	6.6 (3.2 - 9.7)
Dissolved Oxygen (% Saturation)	93 (67 - 116)	97 (62 - 116)	97 (67 - 116)
Bottom	93 (64 - 115)	93 (51 - 116)	91 (48 - 116)
pH	7.8 (7.5 - 8.1)	7.8 (7.5 - 8.1)	7.9 (7.5 - 8.1)
Secchi Disc Depth (m)	3.4 (2.4 - 4.1)	3.2 (2.0 - 4.2)	3.3 (2.4 - 4.5)
Turbidity (NTU)	3.8 (0.7 - 20.8)	4.8 (1.0 - 26.7)	6.7 (1.4 - 50.5)
Suspended Solids (mg/L)	2.9 (0.8 - 6.8)	3.0 (1.2 - 7.8)	2.3 (1.3 - 3.9)
5-day Biochemical Oxygen Demand (mg/L)	0.5 (0.2 - 0.9)	0.5 (0.2 - 1.0)	0.4 (0.2 - 0.8)
Ammonia Nitrogen (mg/L)	0.073 (0.018 - 0.117)	0.054 (0.015 - 0.099)	0.043 (0.010 - 0.092)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.006)	0.002 (<0.001 - 0.005)	0.001 (<0.001 - 0.005)
Nitrite Nitrogen (mg/L)	0.020 (0.004 - 0.055)	0.019 (0.003 - 0.048)	0.016 (0.003 - 0.038)
Nitrate Nitrogen (mg/L)	0.132 (0.030 - 0.280)	0.116 (0.029 - 0.273)	0.106 (0.018 - 0.257)
Total Inorganic Nitrogen (mg/L)	0.23 (0.14 - 0.32)	0.19 (0.09 - 0.31)	0.17 (0.06 - 0.28)
Total Kjeldahl Nitrogen (mg/L)	0.20 (0.10 - 0.33)	0.18 (0.10 - 0.28)	0.17 (0.10 - 0.27)
Total Nitrogen (mg/L)	0.35 (0.18 - 0.46)	0.32 (0.16 - 0.41)	0.29 (0.12 - 0.38)
Orthophosphate Phosphorus (mg/L)	0.017 (0.009 - 0.028)	0.013 (0.006 - 0.023)	0.011 (0.006 - 0.021)
Total Phosphorus (mg/L)	0.03 (0.02 - 0.04)	0.03 (<0.02 - 0.04)	0.03 (<0.02 - 0.04)
Silica (as SiO ₂) (mg/L)	0.89 (0.39 - 1.30)	0.81 (0.37 - 1.30)	0.77 (0.31 - 1.20)
Chlorophyll-a (µg/L)	1.6 (0.4 - 4.8)	1.8 (0.5 - 5.6)	1.6 (0.5 - 4.3)
<i>E. coli</i> (count/100mL)	57 (1 - 550)	18 (1 - 140)	4 (1 - 35)
Faecal Coliforms (count/100mL)	140 (2 - 770)	40 (3 - 300)	9 (1 - 78)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Western Buffer WCZ in 2012

Parameter	Hong Kong island (West)		Tsing Yi (South)	Tsing Yi (West)
	WM1	WM2	WM3	WM4
Number of samples	12	12	12	12
Temperature (°C)	22.9 (15.4 - 27.6)	23.1 (15.5 - 28.3)	23.1 (15.7 - 27.9)	23.1 (15.8 - 28.1)
Salinity	31.2 (28.2 - 33.1)	30.4 (26.5 - 33.0)	30.8 (28.5 - 32.9)	30.4 (26.8 - 32.7)
Dissolved Oxygen (mg/L)	6.8 (3.6 - 9.5)	6.7 (4.4 - 9.0)	6.4 (3.9 - 8.6)	6.3 (3.7 - 8.8)
Bottom	6.5 (2.1 - 9.6)	6.7 (4.2 - 9.0)	6.4 (3.3 - 9.0)	6.2 (3.3 - 8.8)
Dissolved Oxygen (% Saturation)	94 (53 - 126)	92 (66 - 110)	88 (58 - 106)	87 (55 - 107)
Bottom	88 (31 - 115)	92 (64 - 111)	88 (49 - 109)	85 (49 - 107)
pH	7.8 (7.5 - 8.0)	7.8 (7.5 - 7.9)	7.8 (7.5 - 7.9)	7.8 (7.4 - 7.9)
Secchi Disc Depth (m)	2.7 (2.0 - 3.5)	2.6 (1.5 - 4.0)	2.4 (1.9 - 4.0)	2.6 (2.0 - 4.0)
Turbidity (NTU)	12.5 (2.0 - 98.1)	11.4 (1.5 - 97.4)	14.4 (2.3 - 110.0)	12.5 (1.6 - 99.9)
Suspended Solids (mg/L)	6.0 (2.1 - 11.3)	3.9 (1.9 - 7.2)	6.5 (2.7 - 14.3)	5.3 (1.7 - 10.4)
5-day Biochemical Oxygen Demand (mg/L)	0.4 (<0.1 - 1.2)	0.4 (0.1 - 0.7)	0.5 (<0.1 - 0.9)	0.4 (0.2 - 0.6)
Ammonia Nitrogen (mg/L)	0.062 (0.027 - 0.107)	0.114 (0.058 - 0.213)	0.149 (0.074 - 0.247)	0.128 (0.066 - 0.207)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.004)	0.003 (<0.001 - 0.005)	0.004 (0.001 - 0.007)	0.003 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)	0.033 (0.007 - 0.071)	0.049 (0.014 - 0.102)	0.042 (0.014 - 0.086)	0.049 (0.015 - 0.117)
Nitrate Nitrogen (mg/L)	0.170 (0.044 - 0.403)	0.249 (0.080 - 0.560)	0.211 (0.078 - 0.410)	0.250 (0.095 - 0.473)
Total Inorganic Nitrogen (mg/L)	0.27 (0.14 - 0.50)	0.41 (0.20 - 0.74)	0.40 (0.26 - 0.58)	0.43 (0.26 - 0.65)
Total Kjeldahl Nitrogen (mg/L)	0.20 (0.14 - 0.28)	0.28 (0.20 - 0.43)	0.32 (0.23 - 0.43)	0.27 (0.17 - 0.34)
Total Nitrogen (mg/L)	0.40 (0.22 - 0.66)	0.58 (0.33 - 0.89)	0.57 (0.39 - 0.77)	0.57 (0.41 - 0.80)
Orthophosphate Phosphorus (mg/L)	0.015 (0.004 - 0.030)	0.023 (0.007 - 0.039)	0.025 (0.011 - 0.043)	0.024 (0.002 - 0.039)
Total Phosphorus (mg/L)	0.03 (0.02 - 0.05)	0.04 (0.03 - 0.05)	0.04 (0.03 - 0.07)	0.05 (0.03 - 0.09)
Silica (as SiO ₂) (mg/L)	1.02 (0.46 - 1.60)	1.33 (0.77 - 2.23)	1.26 (0.80 - 1.97)	1.36 (0.89 - 2.20)
Chlorophyll-a (µg/L)	1.9 (0.5 - 7.9)	1.6 (0.3 - 4.8)	1.1 (0.3 - 3.5)	1.0 (0.3 - 3.6)
<i>E. coli</i> (count/100mL)	71 (7 - 990)	130 (8 - 6300)	230 (42 - 2100)	68 (14 - 340)
Faecal Coliforms (count/100mL)	140 (15 - 1300)	240 (14 - 11000)	460 (95 - 5500)	130 (20 - 730)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Junk Bay WCZ in 2012

Parameter	Junk Bay	
	M3	M4
Number of samples	12	12
Temperature (°C)	23.1 (15.0 - 28.5)	23.0 (14.8 - 28.5)
Salinity	31.5 (29.6 - 33.0)	31.7 (30.1 - 32.9)
Dissolved Oxygen (mg/L)	6.9 (4.2 - 9.6)	6.9 (4.3 - 9.7)
Bottom	6.8 (4.0 - 9.7)	6.8 (4.2 - 9.7)
Dissolved Oxygen (% Saturation)	95 (63 - 116)	94 (63 - 116)
Bottom	93 (59 - 115)	93 (62 - 115)
pH	7.8 (7.6 - 8.0)	7.8 (7.6 - 8.0)
Secchi Disc Depth (m)	3.3 (1.9 - 4.5)	3.3 (2.0 - 4.2)
Turbidity (NTU)	6.2 (1.0 - 52.7)	6.7 (0.6 - 52.7)
Suspended Solids (mg/L)	2.2 (1.1 - 5.2)	2.9 (0.7 - 6.3)
5-day Biochemical Oxygen Demand (mg/L)	0.5 (0.2 - 0.9)	0.4 (<0.1 - 0.8)
Ammonia Nitrogen (mg/L)	0.075 (0.024 - 0.157)	0.071 (0.018 - 0.150)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.008)	0.002 (<0.001 - 0.008)
Nitrite Nitrogen (mg/L)	0.022 (0.005 - 0.058)	0.021 (0.004 - 0.056)
Nitrate Nitrogen (mg/L)	0.146 (0.035 - 0.287)	0.132 (0.031 - 0.280)
Total Inorganic Nitrogen (mg/L)	0.24 (0.12 - 0.33)	0.22 (0.12 - 0.32)
Total Kjeldahl Nitrogen (mg/L)	0.22 (0.11 - 0.37)	0.23 (0.13 - 0.38)
Total Nitrogen (mg/L)	0.39 (0.15 - 0.52)	0.38 (0.17 - 0.53)
Orthophosphate Phosphorus (mg/L)	0.017 (0.005 - 0.025)	0.017 (0.008 - 0.024)
Total Phosphorus (mg/L)	0.03 (<0.02 - 0.04)	0.03 (<0.02 - 0.04)
Silica (as SiO ₂) (mg/L)	0.87 (0.46 - 1.30)	0.86 (0.44 - 1.30)
Chlorophyll-a (µg/L)	2.2 (0.4 - 9.0)	1.8 (0.4 - 5.8)
<i>E. coli</i> (count/100mL)	57 (9 - 320)	62 (1 - 200)
Faecal Coliforms (count/100mL)	130 (15 - 1000)	150 (4 - 960)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Deep Bay WCZ in 2012

Parameter	Inner Deep Bay			Outer Deep Bay	
	DM1	DM2	DM3	DM4	DM5
Number of samples	12	12	12	12	12
Temperature (°C)	24.9 (15.3 - 31.4)	25.0 (15.3 - 32.0)	24.8 (15.9 - 31.6)	24.7 (15.9 - 30.9)	24.3 (16.5 - 29.2)
Salinity	15.5 (0.7 - 23.1)	16.9 (1.8 - 24.1)	19.8 (6.5 - 28.1)	20.7 (9.2 - 29.8)	23.9 (12.9 - 31.1)
Dissolved Oxygen (mg/L)	4.9 (2.5 - 6.8)	5.6 (4.0 - 7.3)	6.1 (3.6 - 7.6)	6.6 (4.3 - 8.3)	6.4 (4.4 - 7.9)
Bottom	NM	NM	NM	6.5 (4.3 - 8.1)	6.1 (3.3 - 7.6)
Dissolved Oxygen (% Saturation)	64 (33 - 91)	74 (58 - 93)	82 (51 - 104)	88 (64 - 117)	87 (65 - 111)
Bottom	NM	NM	NM	88 (63 - 114)	83 (48 - 101)
pH	7.1 (6.9 - 7.4)	7.2 (7.1 - 7.5)	7.4 (7.2 - 7.7)	7.5 (6.8 - 7.7)	7.6 (7.4 - 7.8)
Secchi Disc Depth (m)	0.8 (0.5 - 1.2)	0.9 (0.5 - 1.2)	1.1 (0.9 - 1.5)	1.3 (1.0 - 1.5)	1.4 (1.0 - 1.6)
Turbidity (NTU)	34.2 (13.1 - 70.6)	21.5 (4.8 - 61.3)	8.9 (2.7 - 20.2)	8.6 (2.2 - 15.0)	9.6 (1.7 - 25.2)
Suspended Solids (mg/L)	49.8 (11.0 - 140.0)	24.9 (6.5 - 85.0)	8.9 (3.0 - 18.0)	11.5 (2.5 - 32.0)	8.6 (1.8 - 22.0)
5-day Biochemical Oxygen Demand (mg/L)	2.5 (0.6 - 4.8)	1.5 (0.4 - 4.1)	0.9 (0.3 - 1.8)	0.6 (0.2 - 1.3)	0.5 (0.1 - 1.2)
Ammonia Nitrogen (mg/L)	1.940 (0.840 - 5.600)	1.640 (0.630 - 7.000)	0.433 (0.100 - 1.100)	0.256 (0.070 - 0.560)	0.185 (0.065 - 0.437)
Unionised Ammonia (mg/L)	0.014 (0.004 - 0.038)	0.017 (0.003 - 0.075)	0.006 (0.002 - 0.019)	0.004 (0.002 - 0.007)	0.003 (0.001 - 0.006)
Nitrite Nitrogen (mg/L)	0.489 (0.300 - 0.770)	0.420 (0.220 - 0.710)	0.243 (0.097 - 0.540)	0.183 (0.043 - 0.355)	0.129 (0.017 - 0.280)
Nitrate Nitrogen (mg/L)	1.190 (0.840 - 1.600)	1.170 (0.890 - 1.500)	1.140 (0.630 - 2.100)	1.060 (0.365 - 1.950)	0.824 (0.260 - 1.570)
Total Inorganic Nitrogen (mg/L)	3.62 (2.25 - 7.21)	3.23 (1.98 - 8.64)	1.81 (1.12 - 3.12)	1.50 (0.71 - 2.76)	1.14 (0.38 - 2.16)
Total Kjeldahl Nitrogen (mg/L)	2.78 (1.20 - 9.80)	2.15 (0.96 - 8.70)	0.70 (0.32 - 1.60)	0.48 (0.25 - 0.85)	0.42 (0.25 - 0.74)
Total Nitrogen (mg/L)	4.47 (2.61 - 11.40)	3.73 (2.31 - 10.30)	2.07 (1.31 - 3.41)	1.72 (0.91 - 3.04)	1.37 (0.56 - 2.36)
Orthophosphate Phosphorus (mg/L)	0.238 (0.180 - 0.370)	0.206 (0.140 - 0.380)	0.099 (0.053 - 0.280)	0.050 (0.026 - 0.089)	0.036 (0.020 - 0.046)
Total Phosphorus (mg/L)	0.34 (0.23 - 0.62)	0.26 (0.17 - 0.52)	0.13 (0.08 - 0.32)	0.07 (0.05 - 0.12)	0.07 (0.05 - 0.22)
Silica (as SiO ₂) (mg/L)	7.85 (3.40 - 17.00)	7.43 (3.00 - 16.00)	4.94 (1.90 - 12.00)	4.14 (1.30 - 8.55)	3.26 (1.03 - 6.73)
Chlorophyll-a (µg/L)	4.8 (1.0 - 27.0)	5.3 (1.0 - 31.0)	4.0 (0.4 - 11.0)	2.5 (0.4 - 6.7)	2.1 (0.5 - 6.8)
<i>E. coli</i> (count/100mL)	830 (61 - 56000)	260 (12 - 25000)	27 (2 - 80)	55 (1 - 420)	290 (120 - 810)
Faecal Coliforms (count/100mL)	1500 (120 - 91000)	440 (25 - 33000)	56 (5 - 260)	120 (6 - 580)	530 (230 - 1400)

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2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

4. NM – not measured.

Summary of water quality statistics for the North Western WCZ in 2012

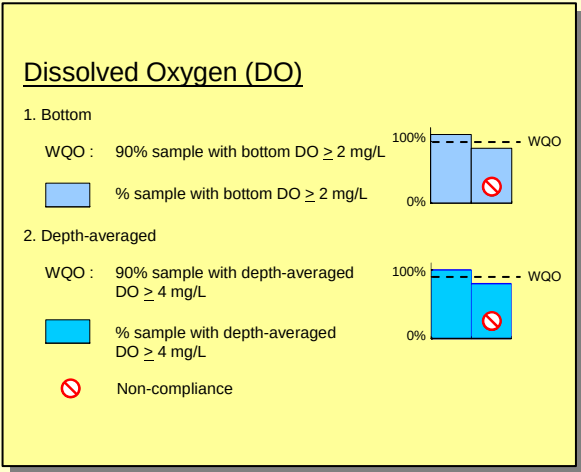
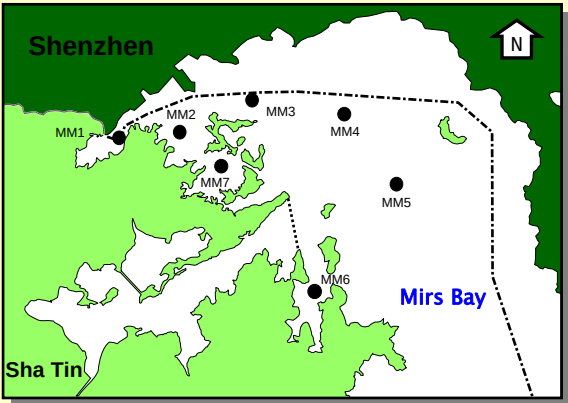
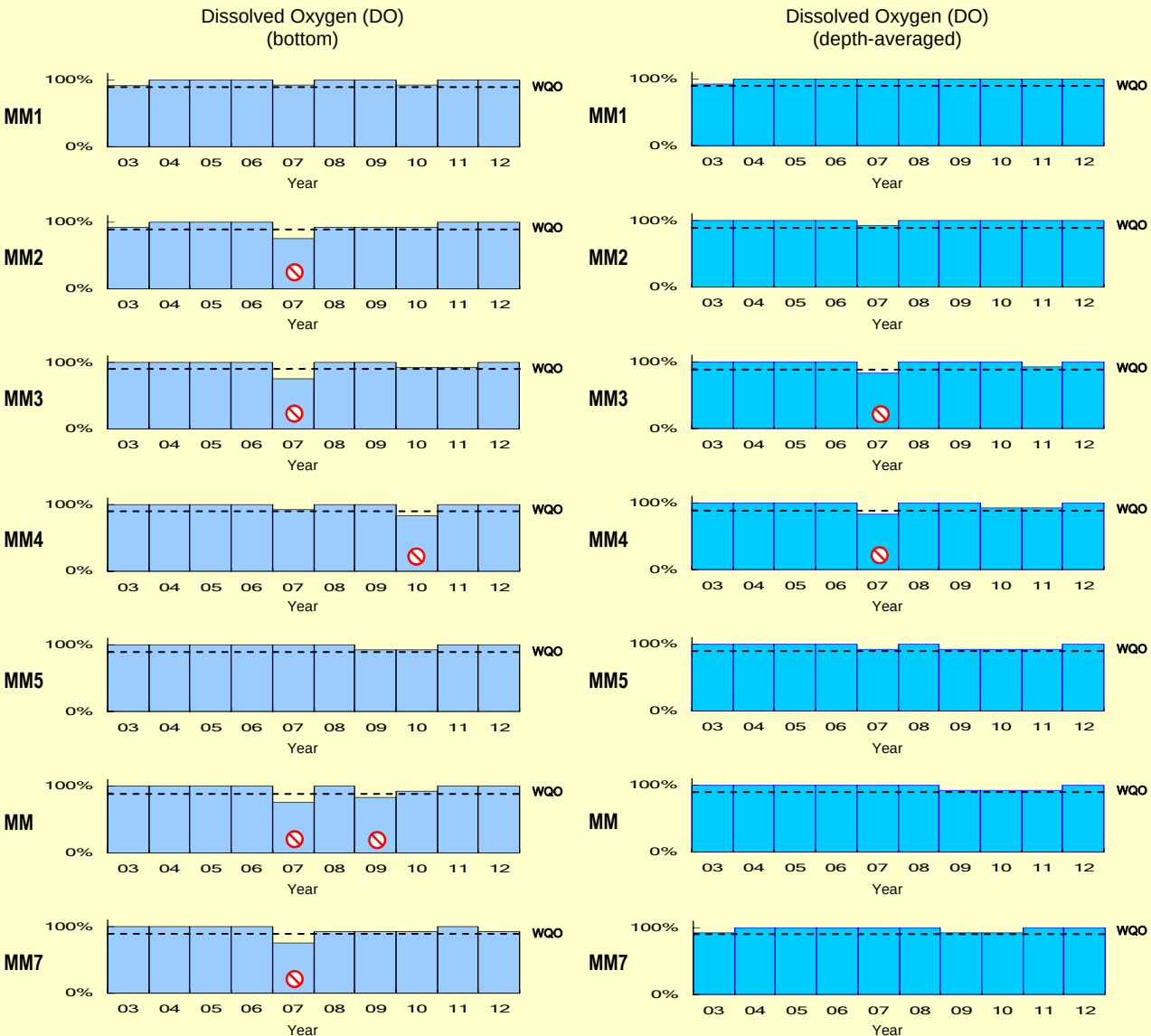
Parameter	Lantau Island (North) NM1	Pearl Island NM2	Pillar Point NM3	rmston Road NM5	Chek Lap Kok (North) NM	(West) NM8
Number of samples	12	12	12	12	12	12
Temperature (°C)	23.8 (16.2 - 28.8)	24.4 (16.2 - 29.5)	24.2 (16.2 - 29.0)	24.3 (16.4 - 29.4)	24.4 (16.4 - 29.8)	24.2 (16.3 - 30.0)
Salinity	29.2 (23.5 - 31.9)	26.8 (13.5 - 31.5)	27.5 (20.4 - 31.5)	26.3 (20.4 - 31.5)	24.9 (9.1 - 31.6)	26.9 (7.4 - 32.1)
Dissolved Oxygen (mg/L)	6.1 (4.8 - 7.6)	6.8 (6.0 - 7.6)	6.3 (4.6 - 7.5)	6.2 (4.4 - 7.6)	7.2 (5.9 - 8.8)	7.4 (4.5 - 11.5)
Bottom	5.4 (2.2 - 7.2)	6.2 (4.3 - 7.3)	5.8 (3.4 - 7.5)	5.5 (2.3 - 7.5)	6.9 (5.2 - 8.3)	6.8 (2.6 - 10.6)
Dissolved Oxygen (% Saturation)	85 (71 - 96)	95 (86 - 111)	87 (68 - 99)	86 (64 - 99)	99 (86 - 122)	102 (65 - 159)
Bottom	75 (32 - 91)	86 (64 - 98)	80 (49 - 97)	76 (34 - 95)	95 (75 - 111)	94 (39 - 145)
pH	7.7 (7.5 - 8.0)	7.7 (7.5 - 8.1)	7.7 (7.5 - 8.0)	7.7 (7.5 - 8.0)	7.8 (7.6 - 8.1)	7.9 (7.6 - 8.1)
Secchi Disc Depth (m)	2.4 (1.6 - 4.0)	2.2 (1.3 - 3.5)	2.2 (1.4 - 3.6)	1.9 (1.4 - 2.6)	2.0 (1.4 - 2.7)	2.0 (1.0 - 2.5)
Turbidity (NTU)	4.2 (1.4 - 7.4)	3.5 (1.6 - 6.4)	4.5 (1.6 - 6.9)	7.1 (2.0 - 10.9)	5.6 (2.7 - 10.6)	6.9 (3.0 - 14.5)
Suspended Solids (mg/L)	5.1 (1.5 - 9.2)	4.0 (1.6 - 6.3)	5.5 (1.8 - 9.9)	7.9 (2.0 - 12.7)	6.2 (2.5 - 12.5)	7.7 (3.4 - 18.8)
5-day Biochemical Oxygen Demand (mg/L)	0.6 (0.1 - 1.3)	0.7 (0.2 - 1.9)	0.7 (0.2 - 1.7)	0.7 (0.3 - 1.3)	0.7 (<0.1 - 2.1)	0.6 (<0.1 - 1.4)
Ammonia Nitrogen (mg/L)	0.122 (0.031 - 0.213)	0.140 (0.047 - 0.317)	0.145 (0.045 - 0.350)	0.160 (0.044 - 0.373)	0.101 (0.017 - 0.337)	0.063 (0.015 - 0.173)
Unionised Ammonia (mg/L)	0.003 (<0.001 - 0.004)	0.003 (0.001 - 0.004)	0.003 (0.001 - 0.004)	0.003 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)	0.058 (0.017 - 0.137)	0.073 (0.017 - 0.150)	0.078 (0.019 - 0.160)	0.098 (0.022 - 0.243)	0.094 (0.021 - 0.253)	0.055 (0.017 - 0.102)
Nitrate Nitrogen (mg/L)	0.319 (0.153 - 0.723)	0.484 (0.167 - 1.330)	0.493 (0.210 - 1.160)	0.598 (0.260 - 1.140)	0.650 (0.220 - 1.630)	0.447 (0.081 - 1.530)
Total Inorganic Nitrogen (mg/L)	0.50 (0.32 - 0.79)	0.70 (0.32 - 1.44)	0.72 (0.39 - 1.48)	0.86 (0.44 - 1.59)	0.85 (0.29 - 1.87)	0.57 (0.18 - 1.59)
Total Kjeldahl Nitrogen (mg/L)	0.29 (0.24 - 0.36)	0.32 (0.23 - 0.47)	0.34 (0.23 - 0.63)	0.36 (0.29 - 0.58)	0.28 (0.11 - 0.52)	0.24 (0.11 - 0.44)
Total Nitrogen (mg/L)	0.67 (0.51 - 1.04)	0.87 (0.49 - 1.67)	0.91 (0.51 - 1.76)	1.05 (0.59 - 1.80)	1.02 (0.35 - 2.04)	0.74 (0.34 - 2.01)
Orthophosphate Phosphorus (mg/L)	0.024 (0.012 - 0.037)	0.025 (0.005 - 0.038)	0.026 (0.010 - 0.038)	0.030 (0.016 - 0.042)	0.022 (0.006 - 0.037)	0.015 (0.008 - 0.021)
Total Phosphorus (mg/L)	0.04 (0.03 - 0.05)	0.04 (0.03 - 0.05)	0.05 (0.03 - 0.06)	0.05 (0.04 - 0.07)	0.04 (0.03 - 0.06)	0.03 (0.02 - 0.05)
Silica (as SiO ₂) (mg/L)	1.49 (0.75 - 3.80)	2.00 (0.71 - 6.60)	2.03 (0.74 - 5.80)	2.41 (0.97 - 5.77)	2.58 (0.76 - 8.37)	2.06 (0.70 - 7.70)
Chlorophyll-a (µg/L)	2.6 (0.5 - 9.6)	3.6 (0.4 - 14.3)	2.4 (0.7 - 7.8)	2.3 (0.3 - 6.7)	4.3 (0.9 - 17.3)	5.0 (1.0 - 23.7)
<i>E.coli</i> (count/100mL)	34 (8 - 160)	69 (5 - 1600)	180 (30 - 1400)	670 (150 - 2300)	13 (2 - 230)	2 (<1 - 32)
Faecal Coliforms (count/100mL)	58 (10 - 290)	140 (7 - 3200)	390 (39 - 3200)	1400 (240 - 6600)	26 (2 - 330)	4 (1 - 69)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

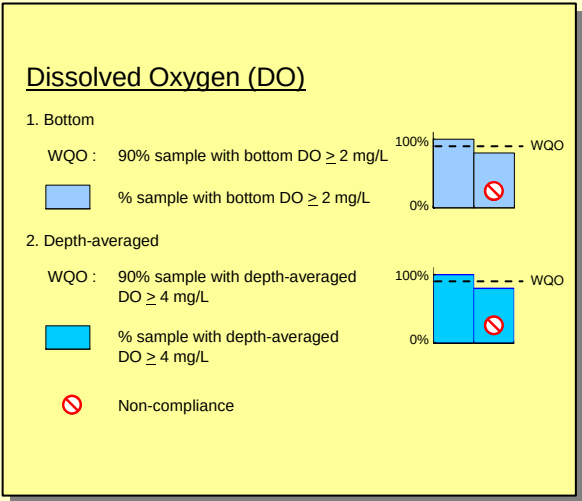
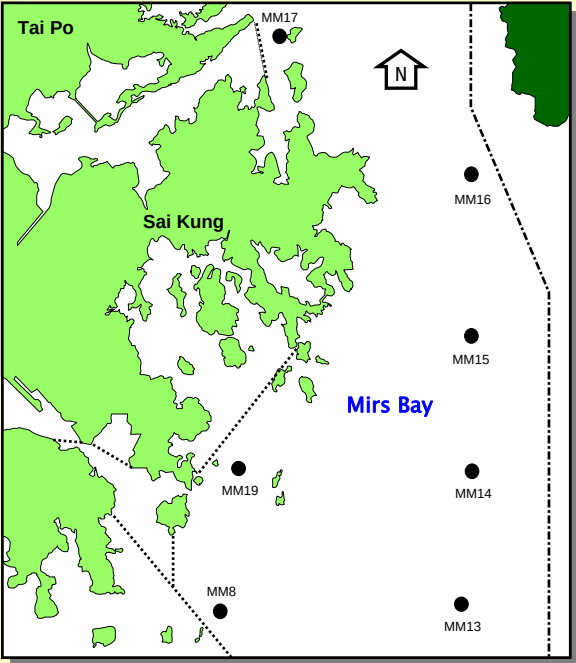
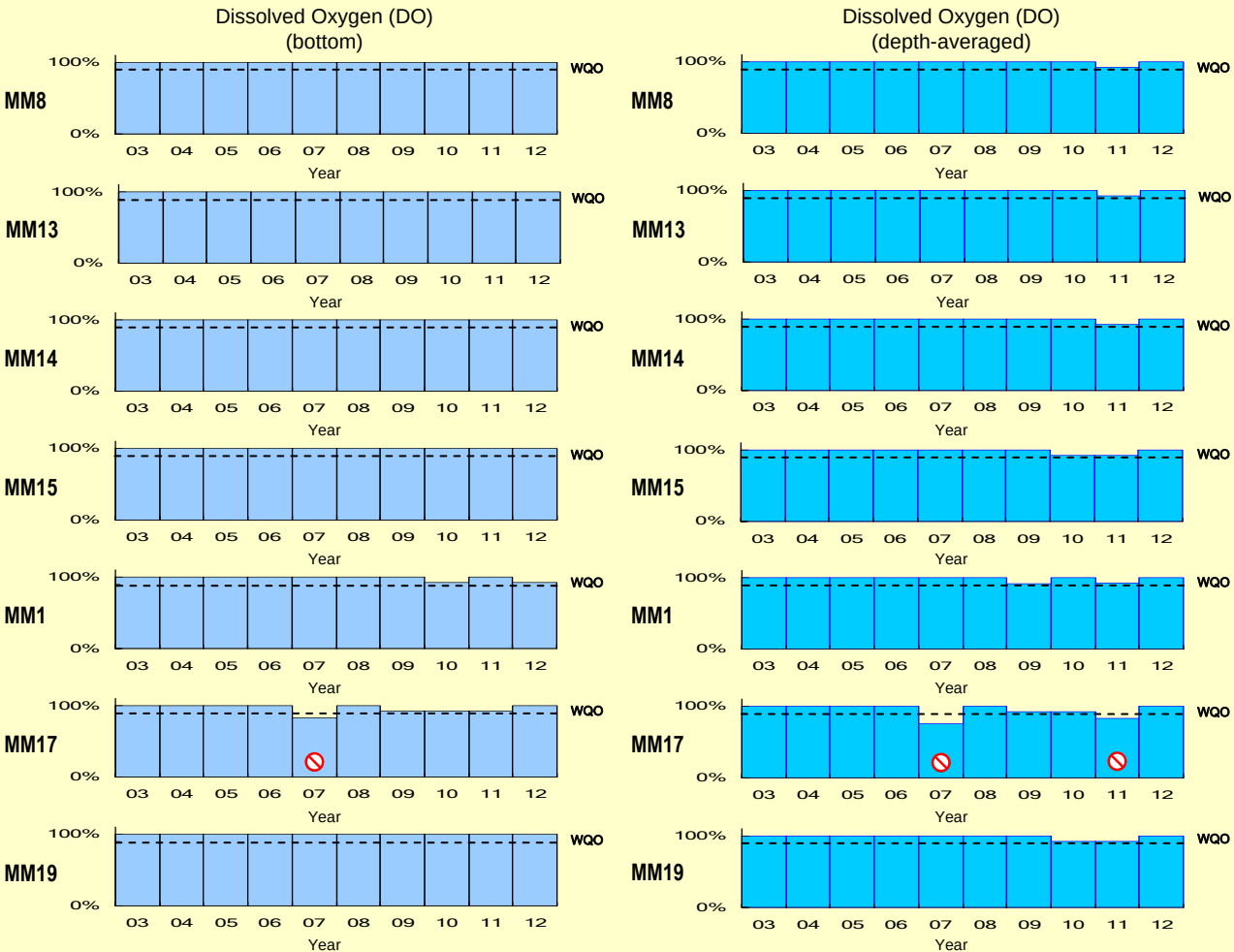
2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

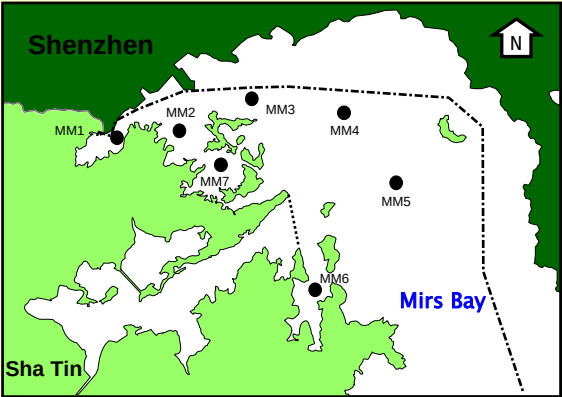
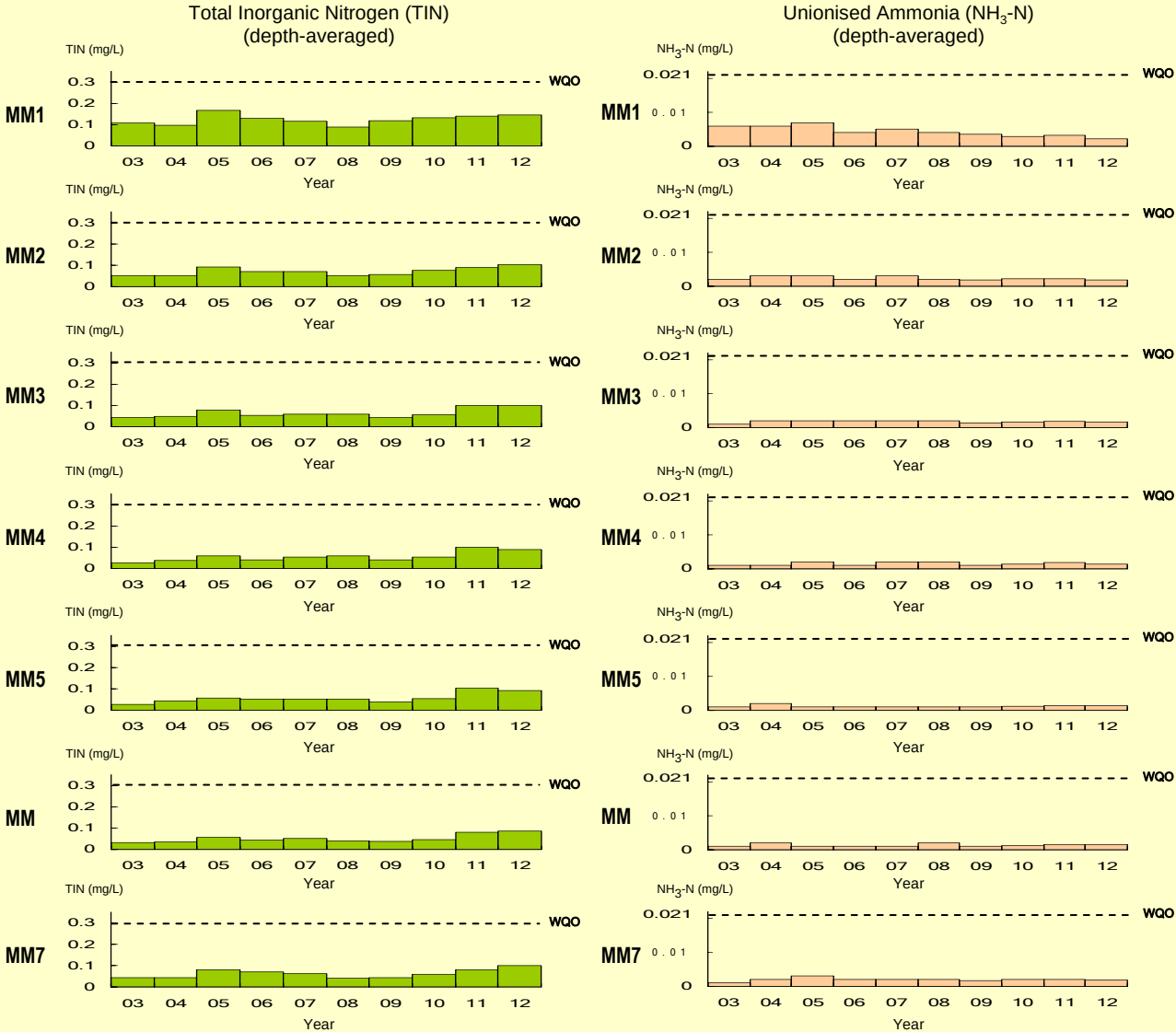
Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ



Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)



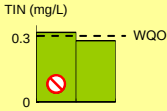
Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)



Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN ≤ 0.3 mg/L

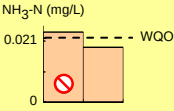
■ annual mean for depth-averaged TIN



Unionised Ammonia (NH₃-N)

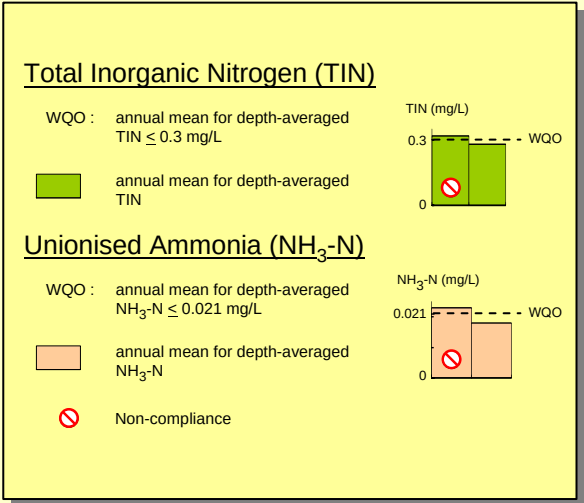
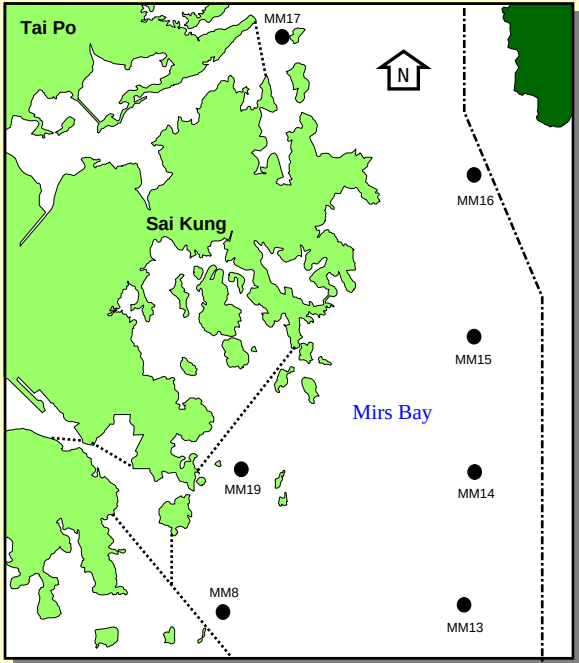
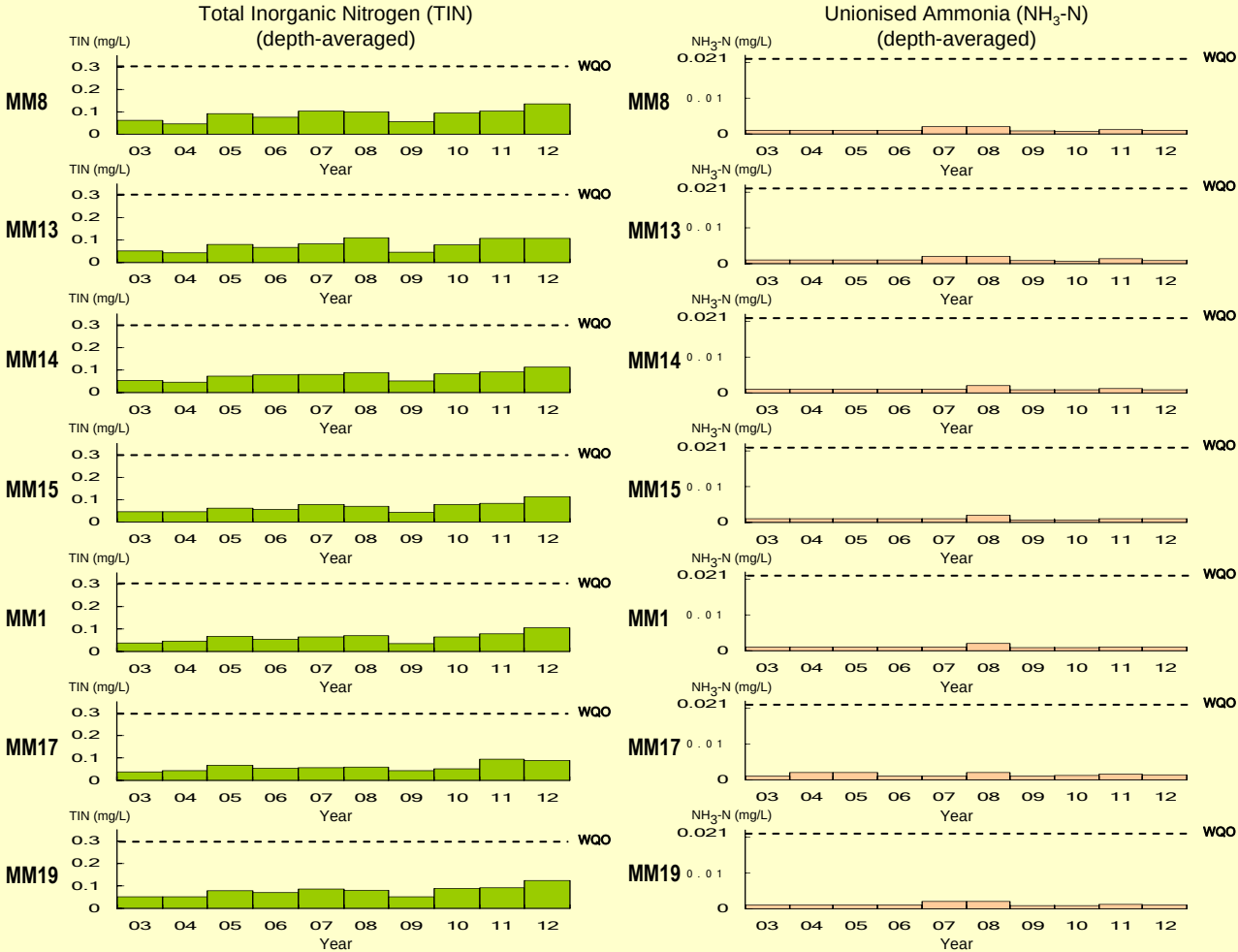
WQO : annual mean for depth-averaged NH₃-N ≤ 0.021 mg/L

■ annual mean for depth-averaged NH₃-N



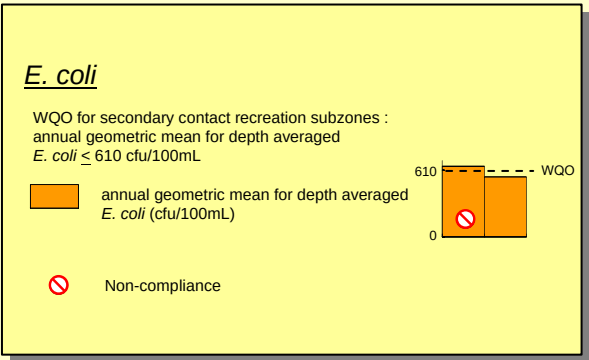
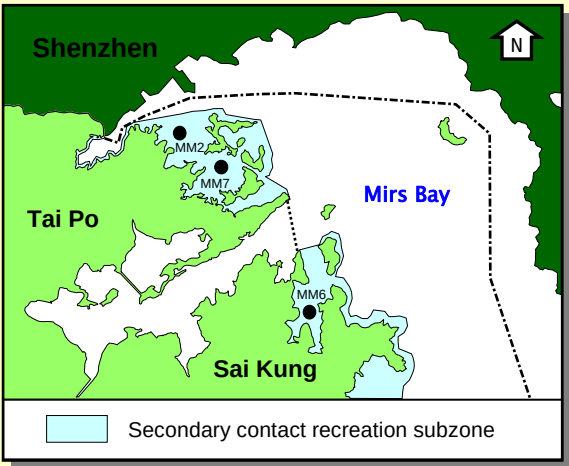
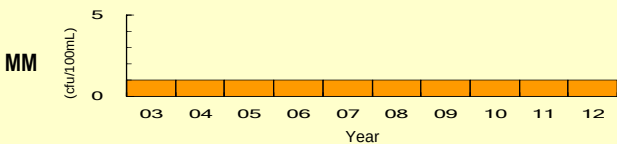
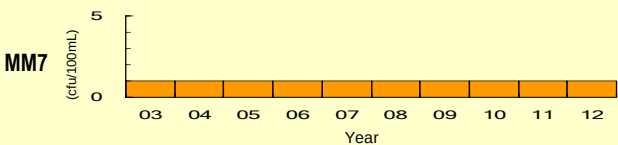
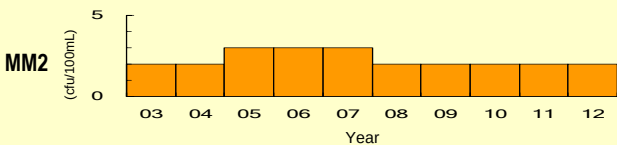
⊘ Non-compliance

Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

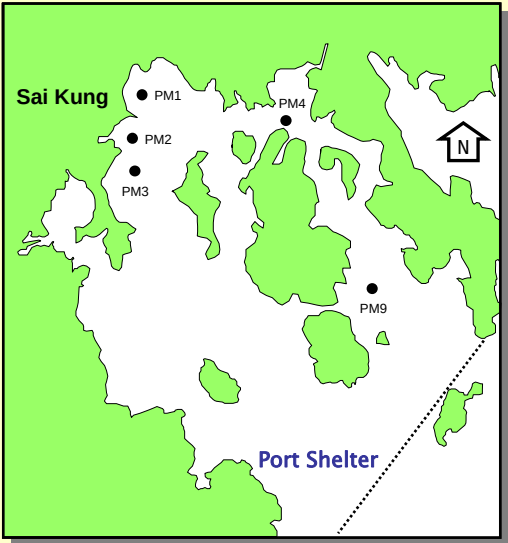
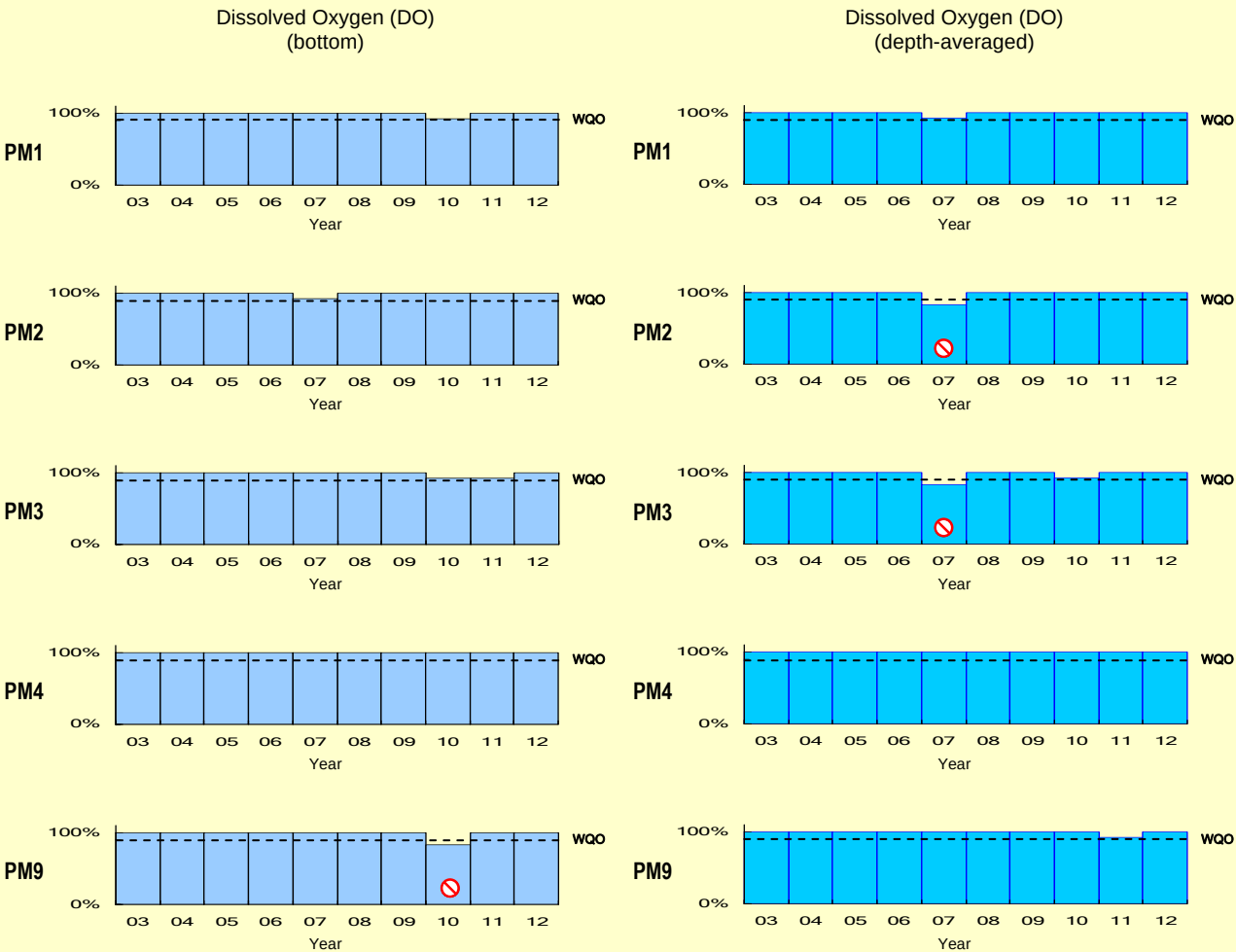


Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

E. coli
(annual geometric mean)



Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ

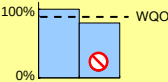


Dissolved Oxygen (DO)

1. Bottom

WQO : 90% sample with bottom DO $\geq$ 2 mg/L

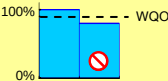
% sample with bottom DO $\geq$ 2 mg/L



2. Depth-averaged

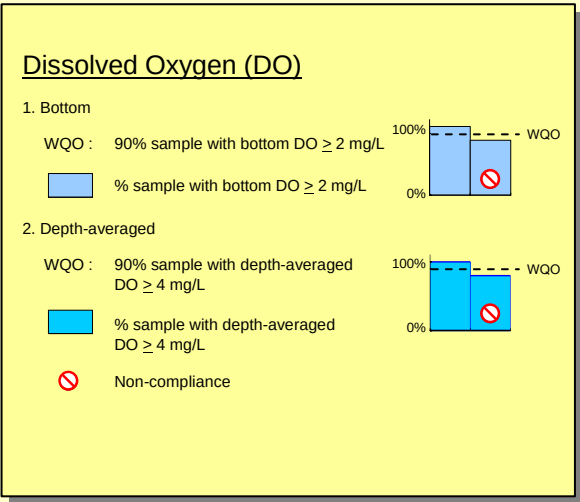
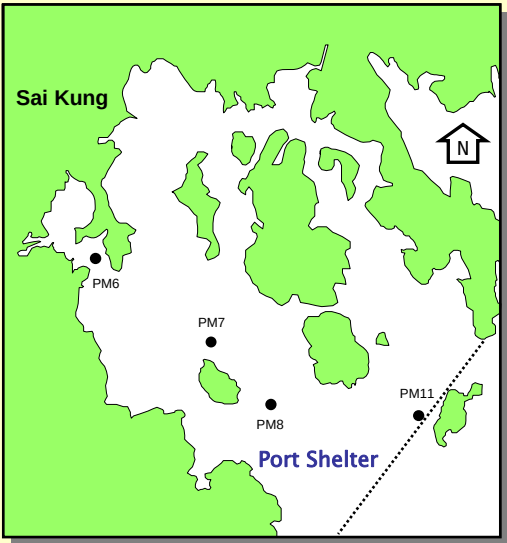
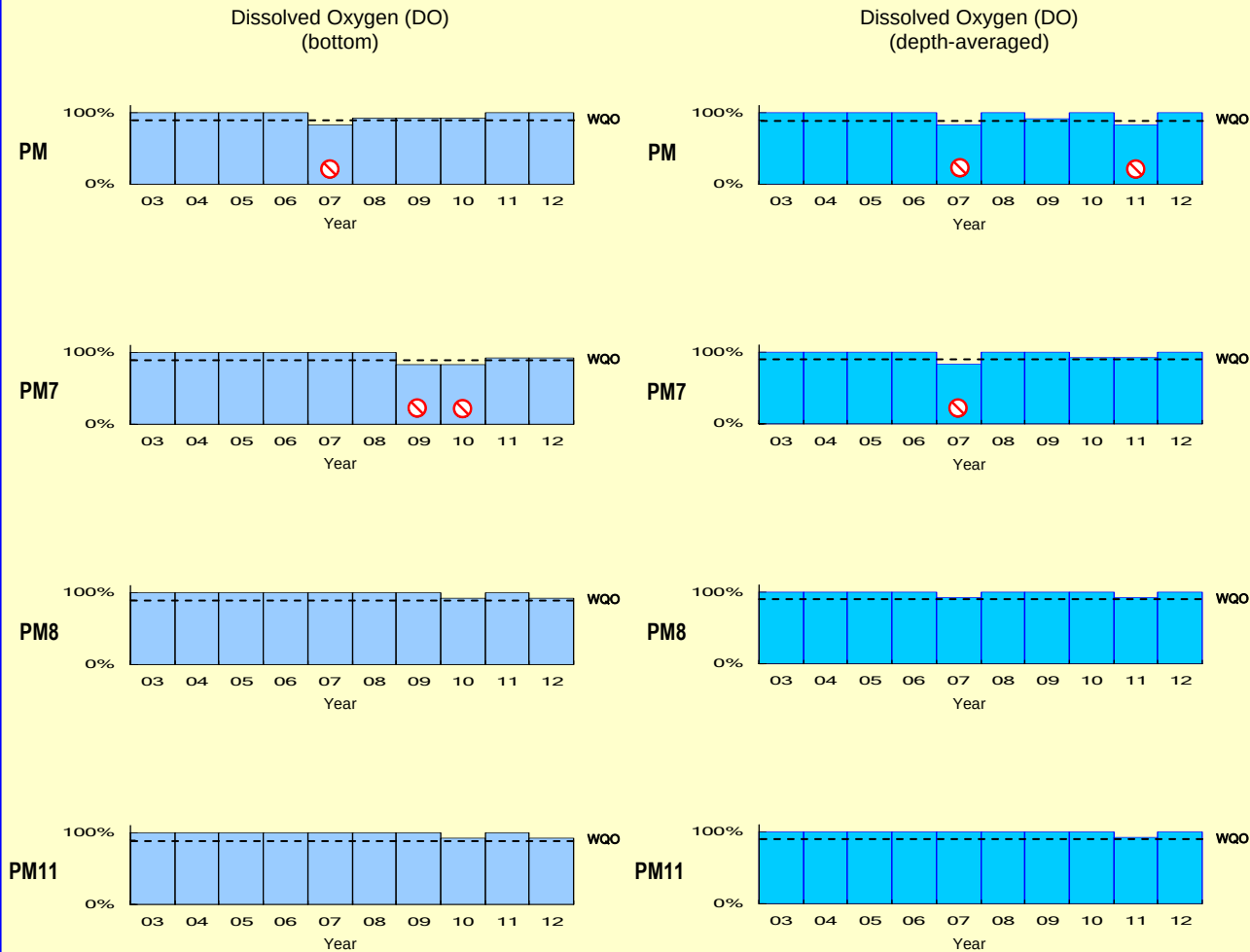
WQO : 90% sample with depth-averaged DO $\geq$ 4 mg/L

% sample with depth-averaged DO $\geq$ 4 mg/L

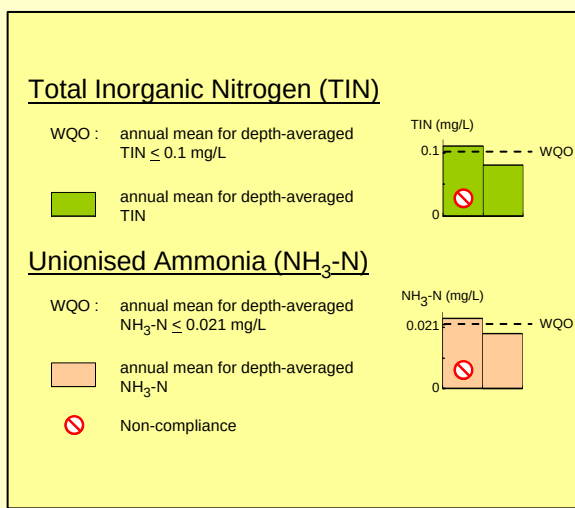
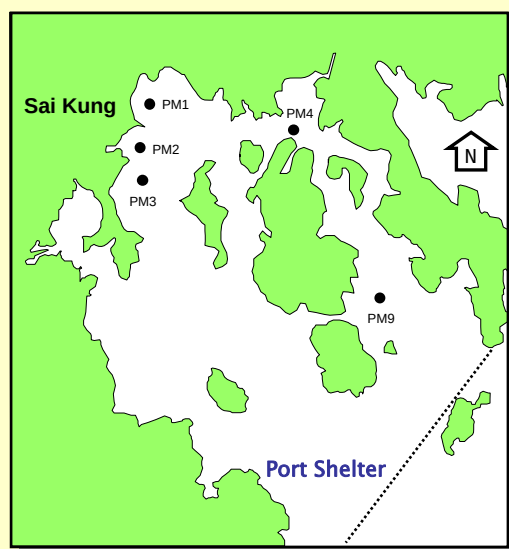
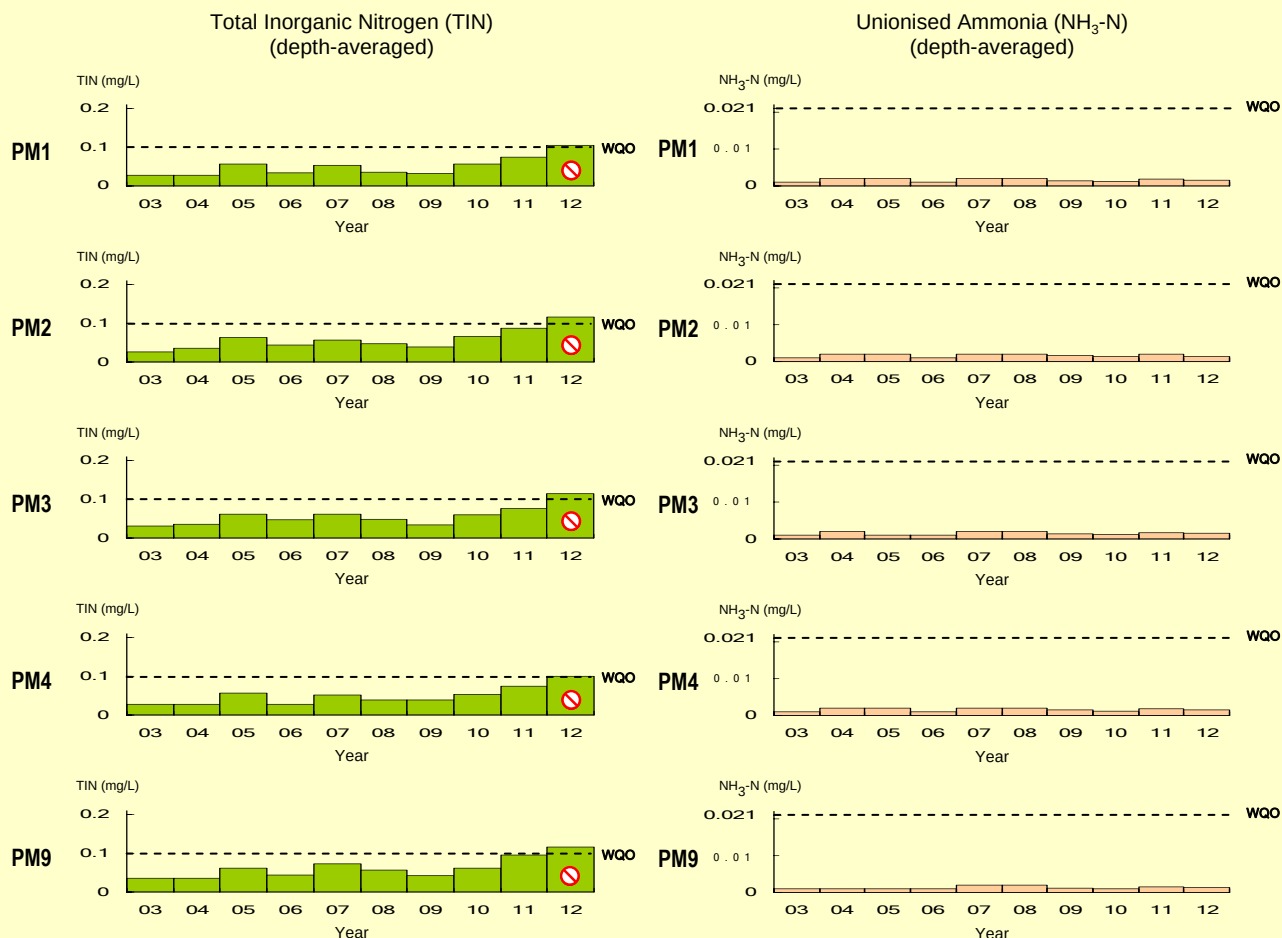


Non-compliance

Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)



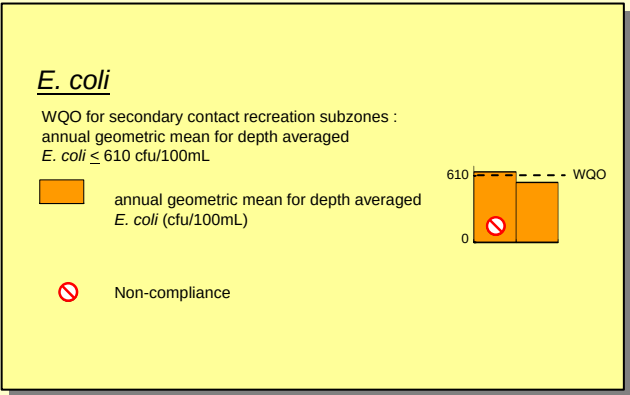
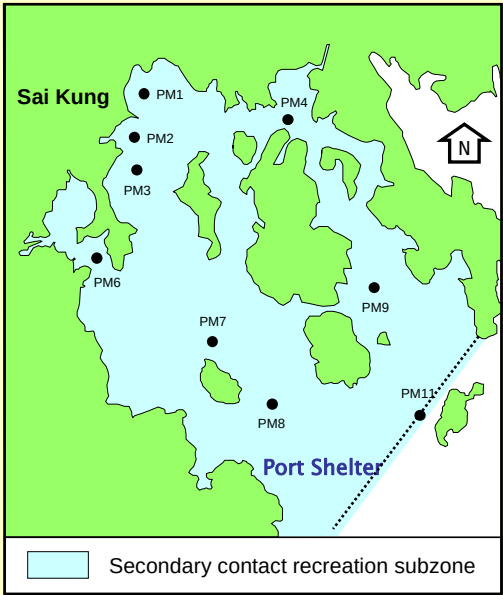
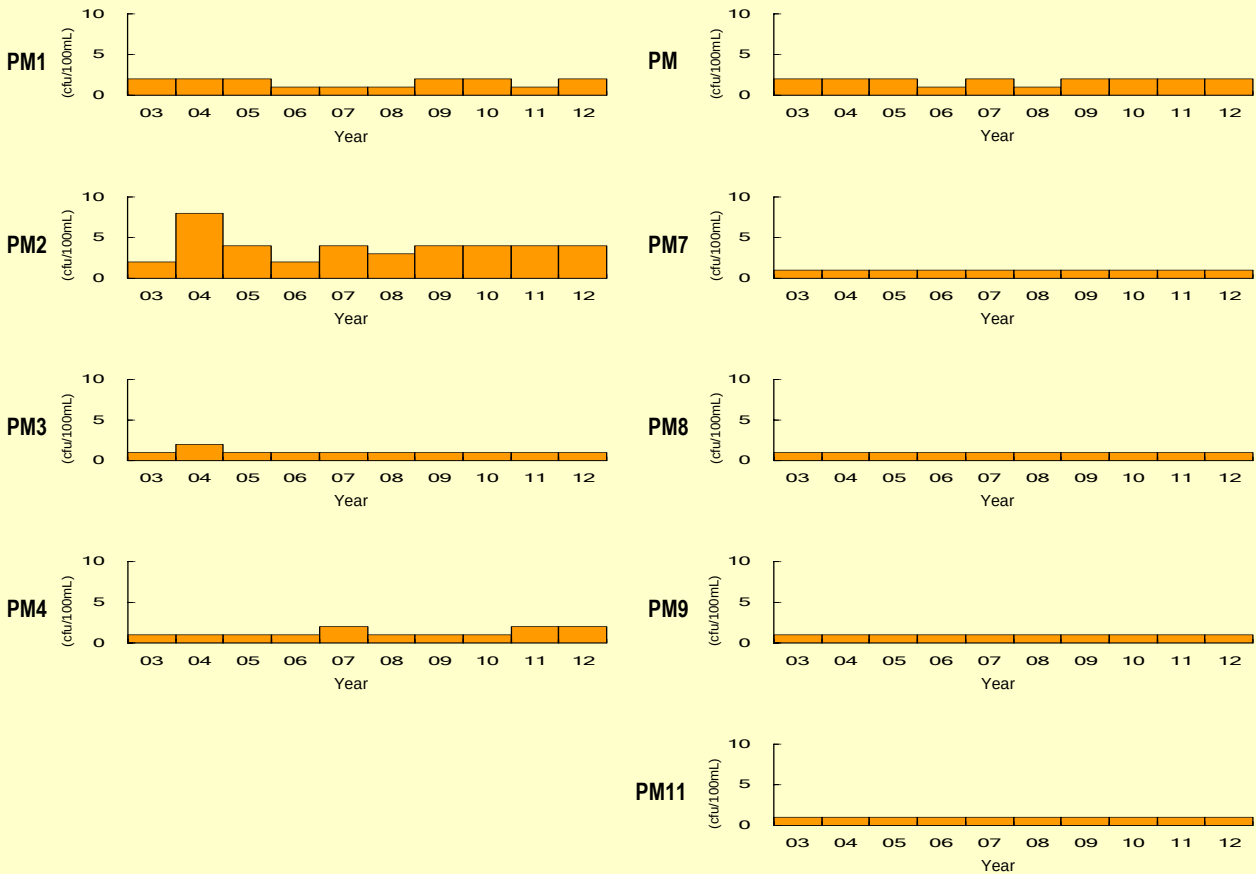
Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ
(continued)



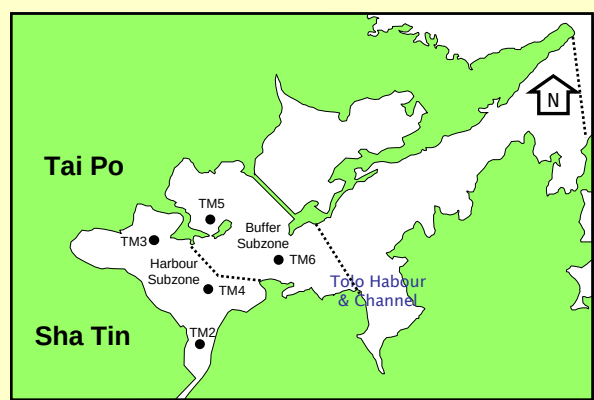
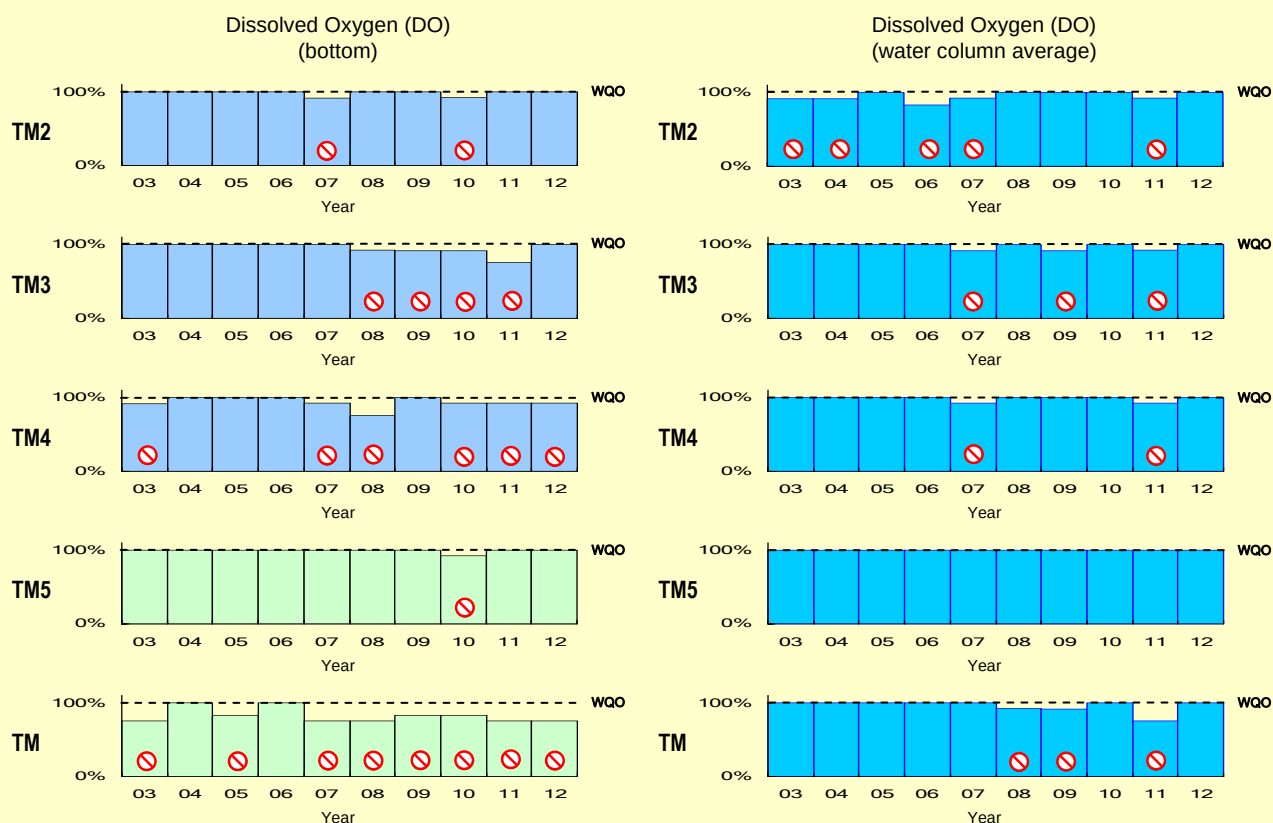
Bar chart showing $\text{NH}_3\text{-N}$ (mg/L) for WQO and a redacted value. The WQO bar is at 0.021 mg/L. The redacted bar is slightly lower. A red prohibition sign is over the redacted bar.

Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)

E. coli
(annual geometric mean)



Levels of compliance with key Water Quality Objectives in the Tolo Harbour and Channel WCZ



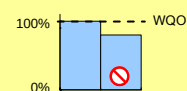
Dissolved Oxygen (DO)

Harbour Subzone (TM2 - TM4)

1. Bottom

WQO : 100% sample with bottom DO ≥ 2 mg/L

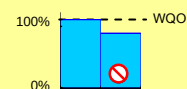
% sample with bottom DO ≥ 2 mg/L



2. Water column average (surface to 2m above bottom)

WQO : 100% sample with water column average DO ≥ 4 mg/L

% sample with water column average DO ≥ 4 mg/L

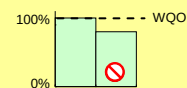


Buffer Subzone (TM5 - TM6)

1. Bottom

WQO : 100% sample with bottom DO ≥ 3 mg/L

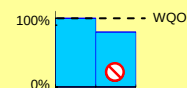
% sample with bottom DO ≥ 3 mg/L



2. Water column average (surface to 2m above bottom)

WQO : 100% sample with water column average DO ≥ 4 mg/L

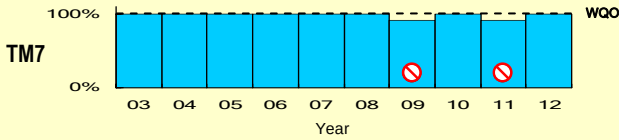
% sample with water column average DO ≥ 4 mg/L



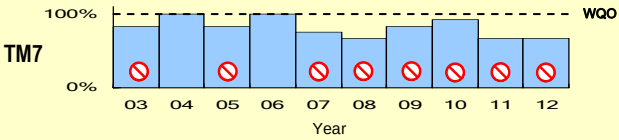
Non-compliance

Levels of compliance with key Water Quality Objectives in the Tolo Harbour and Channel WCZ (continued)

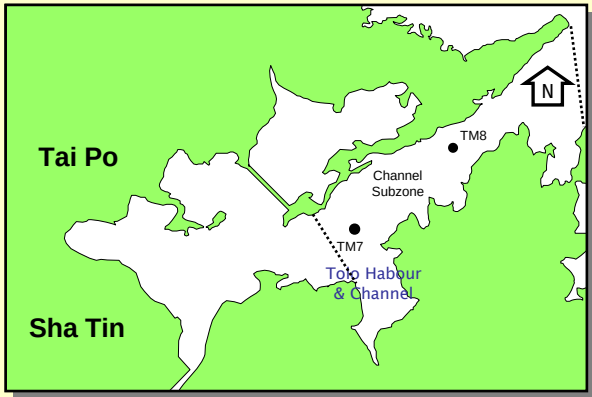
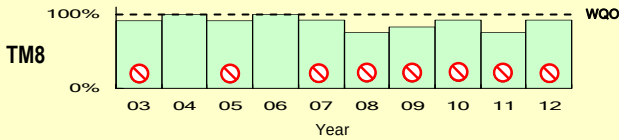
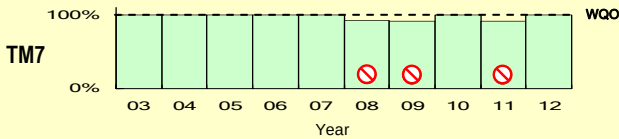
Dissolved Oxygen (DO)
(surface)



Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(middle)



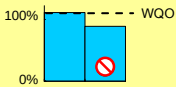
Dissolved Oxygen (DO)

Channel Subzone (TM7 - TM8)

1. Surface

WQO : 100% sample with surface DO $\geq$ 4 mg/L

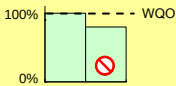
% sample with surface DO $\geq$ 4 mg/L



2. Middle

WQO : 100% sample with middle DO $\geq$ 4 mg/L

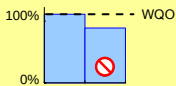
% sample with middle DO $\geq$ 4 mg/L



3. Bottom

WQO : 100% sample with bottom DO $\geq$ 4 mg/L

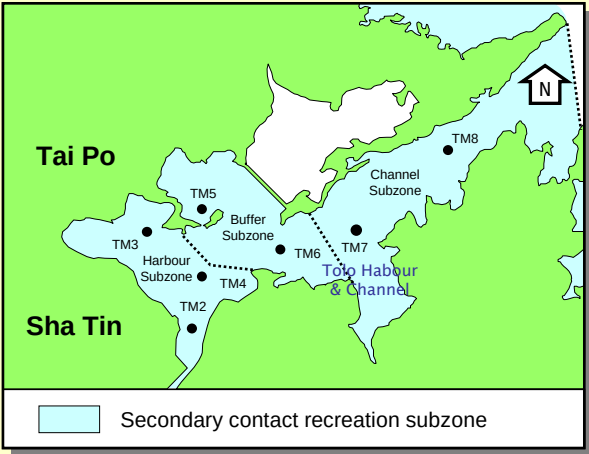
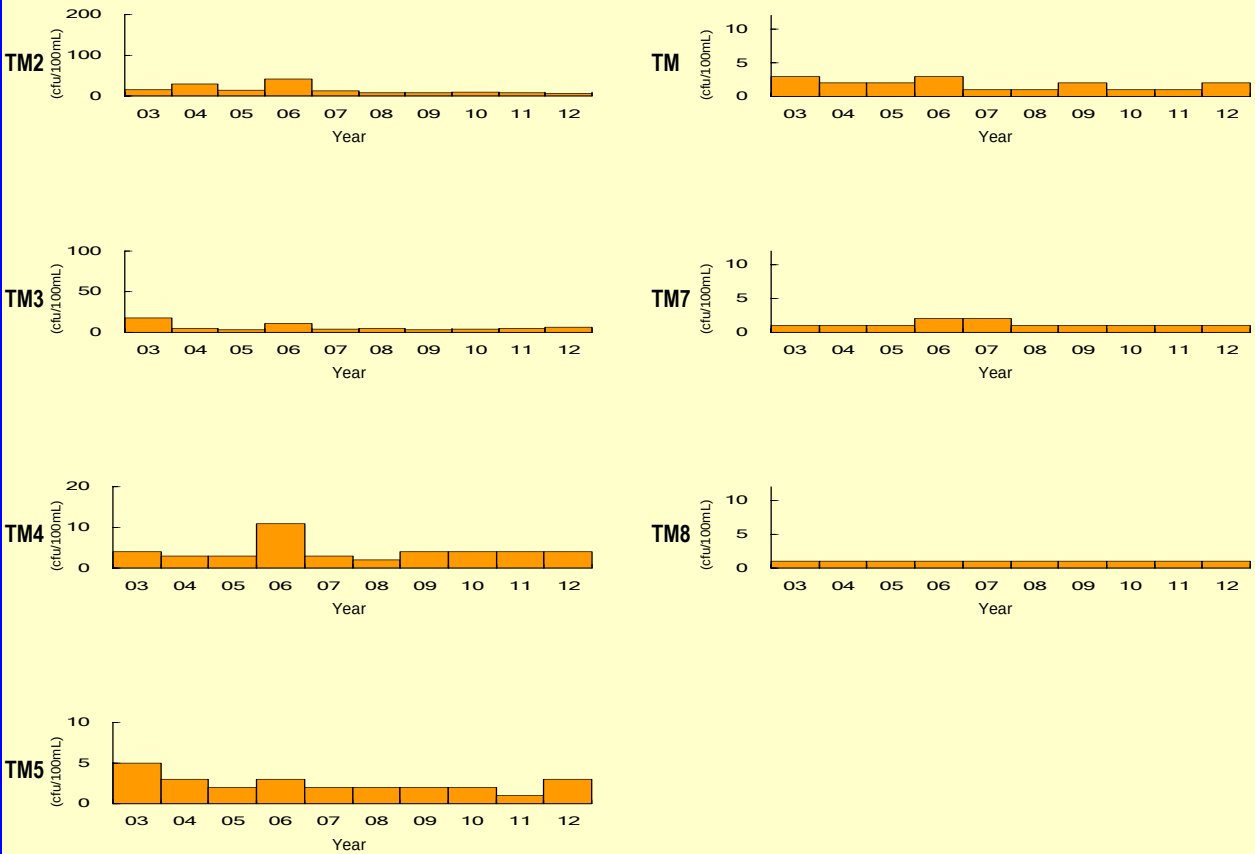
% sample with bottom DO $\geq$ 4 mg/L



Non-compliance

Levels of compliance with key Water Quality Objectives in the Tolo Harbour and Channel WCZ (continued)

E. coli
(annual geometric mean)



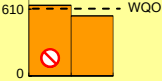
E. coli

WQO for secondary contact recreation subzones :
annual geometric mean for depth averaged
E. coli ≤ 610 cfu/100mL

annual geometric mean for depth averaged
E. coli (cfu/100mL)



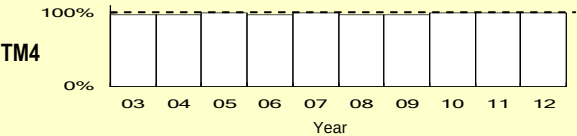
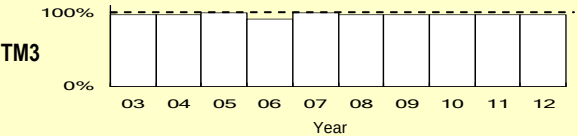
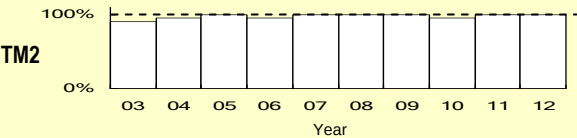
Non-compliance



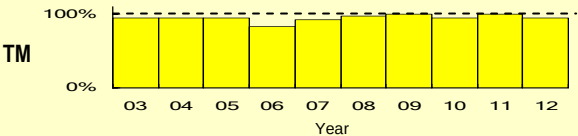
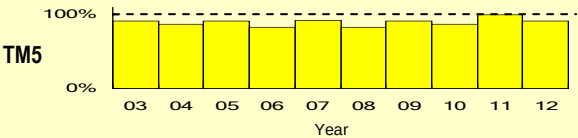
Levels of chlorophyll-a in the Tolo Harbour and Channel WCZ

Chlorophyll-a

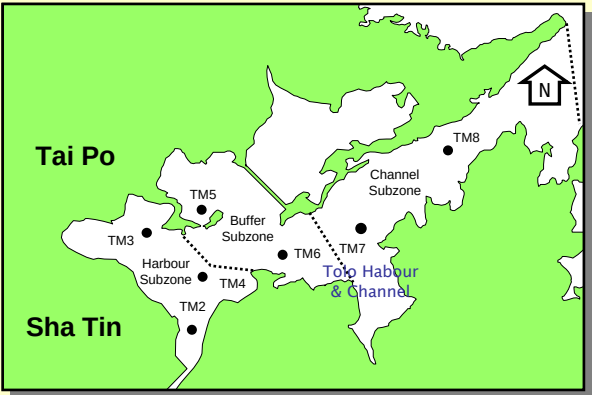
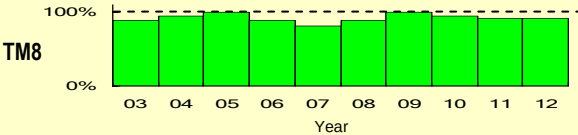
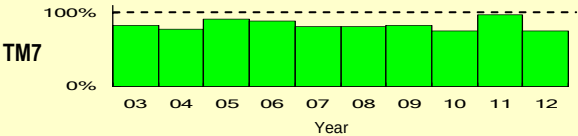
1. Harbour Subzone



2. Buffer Subzone



3. Channel Subzone



Chlorophyll-a

1. Harbour Subzone

% sample (S, M, B) with Chlorophyll-a ≤ 20 µg/L
WQO : Chlorophyll-a ≤ 20 µg/L

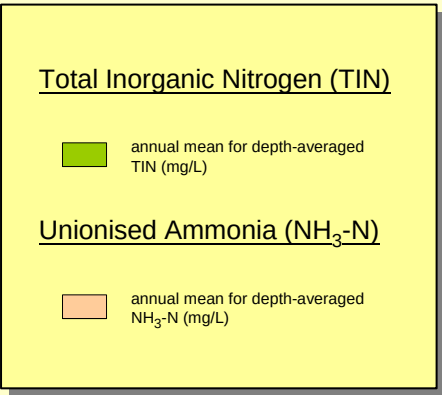
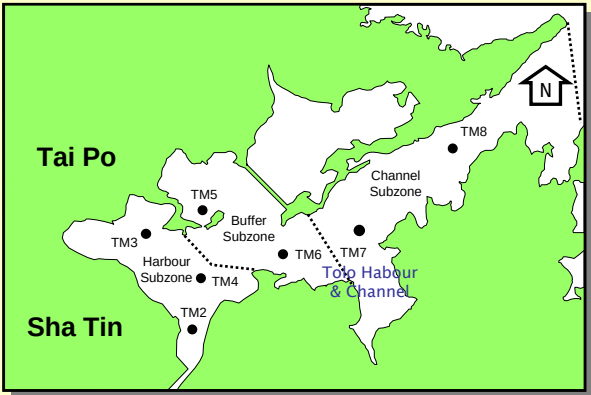
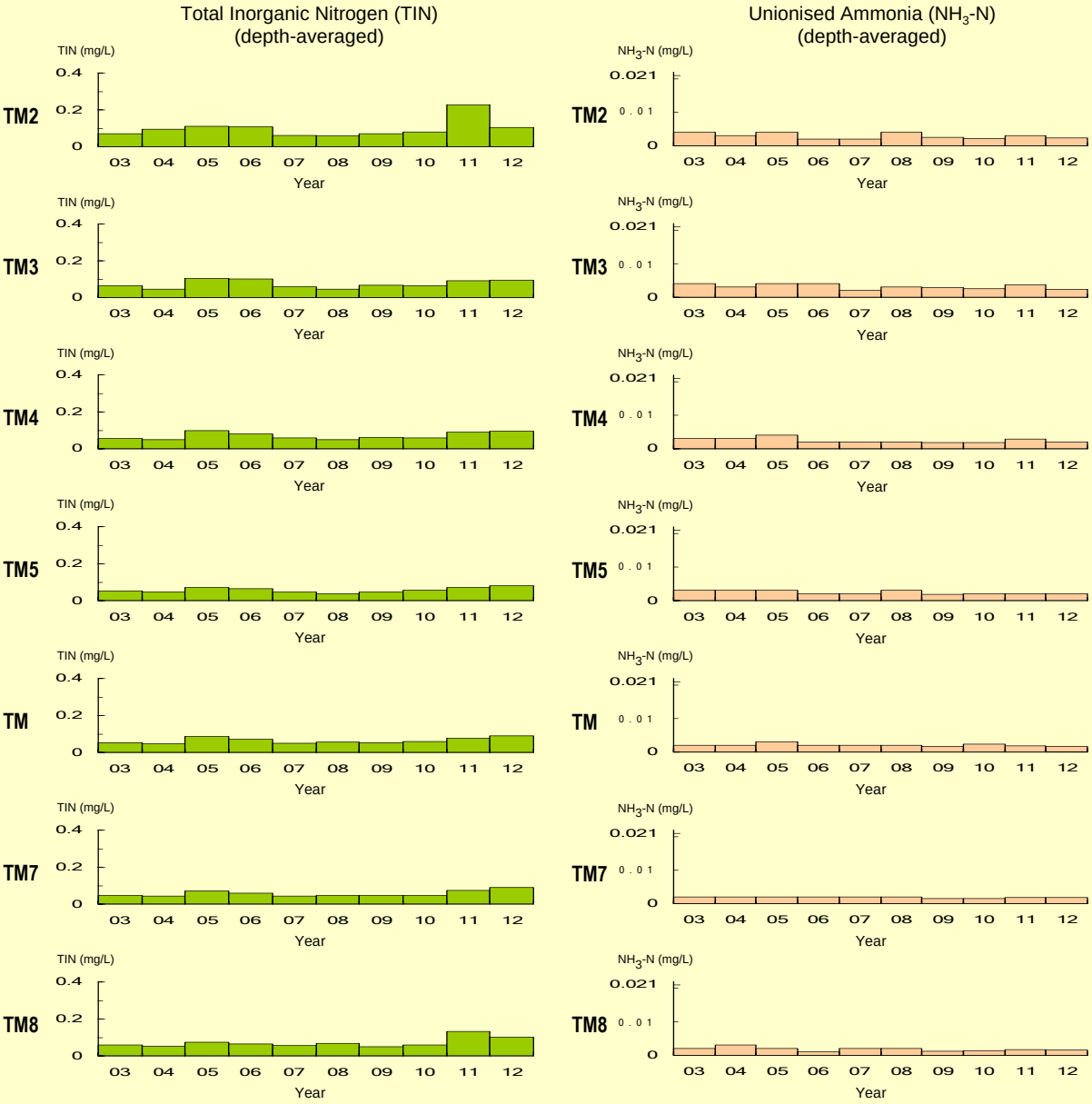
2. Buffer Subzone

% sample (S, M, B) with Chlorophyll-a ≤ 10 µg/L
WQO : Chlorophyll-a ≤ 10 µg/L

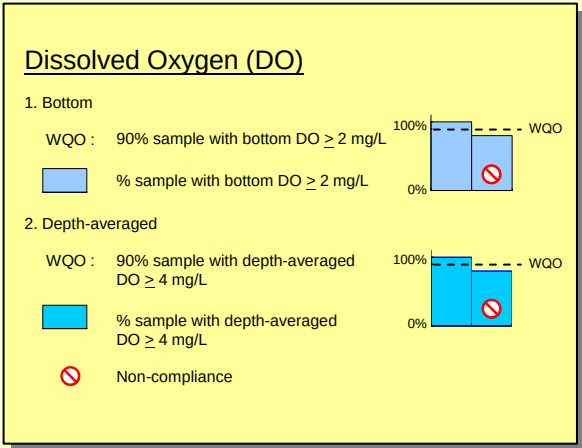
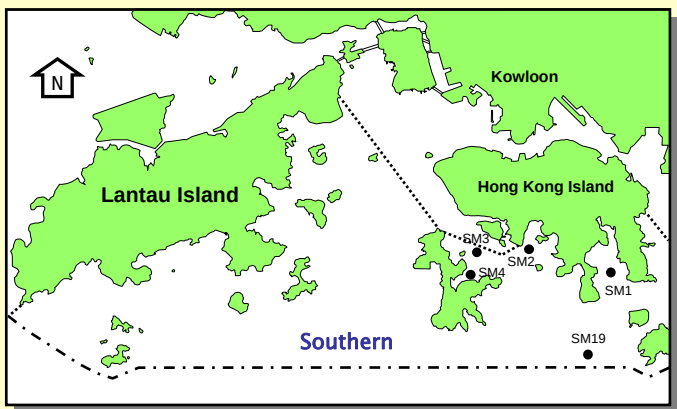
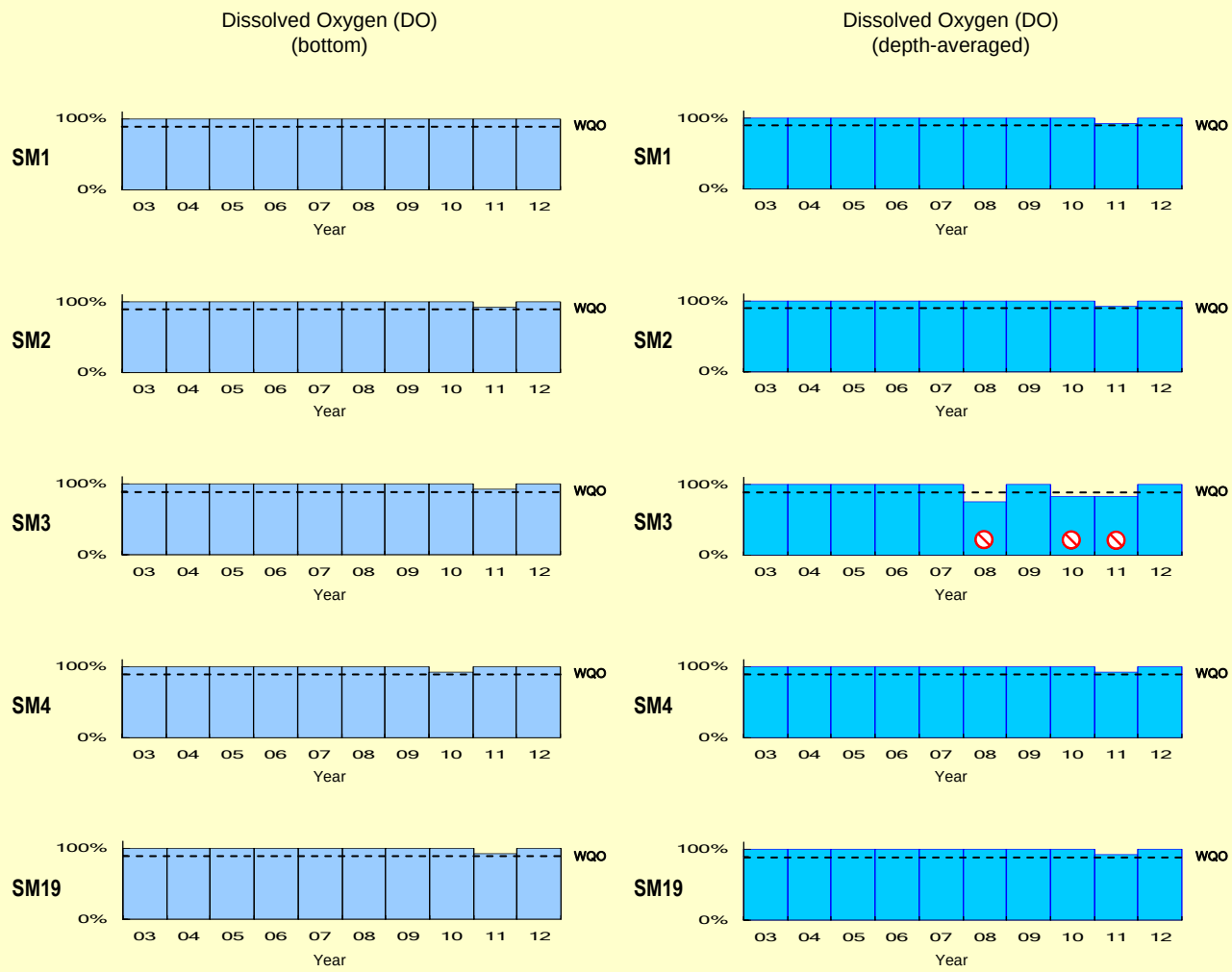
3. Channel Subzone

% sample (S, M, B) with Chlorophyll-a ≤ 6 µg/L
WQO : Chlorophyll-a ≤ 6 µg/L

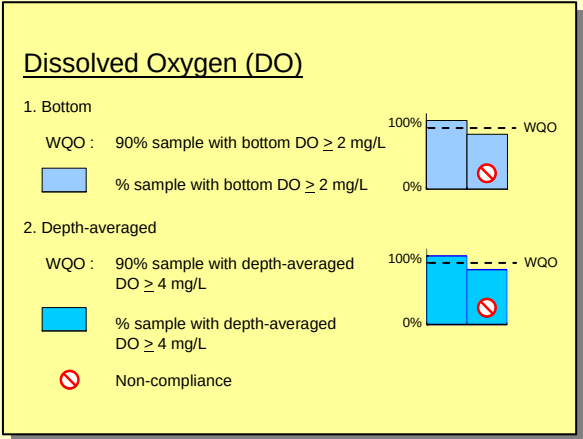
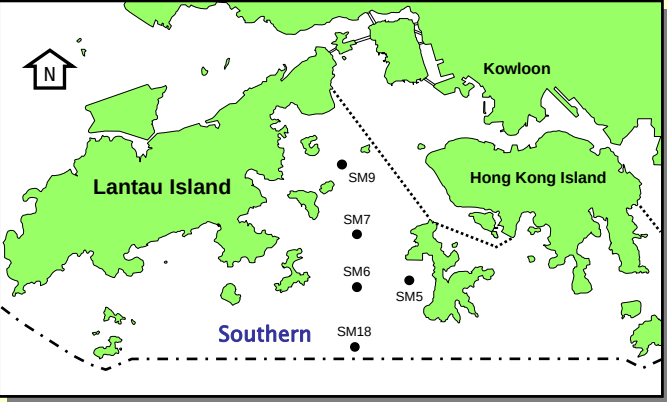
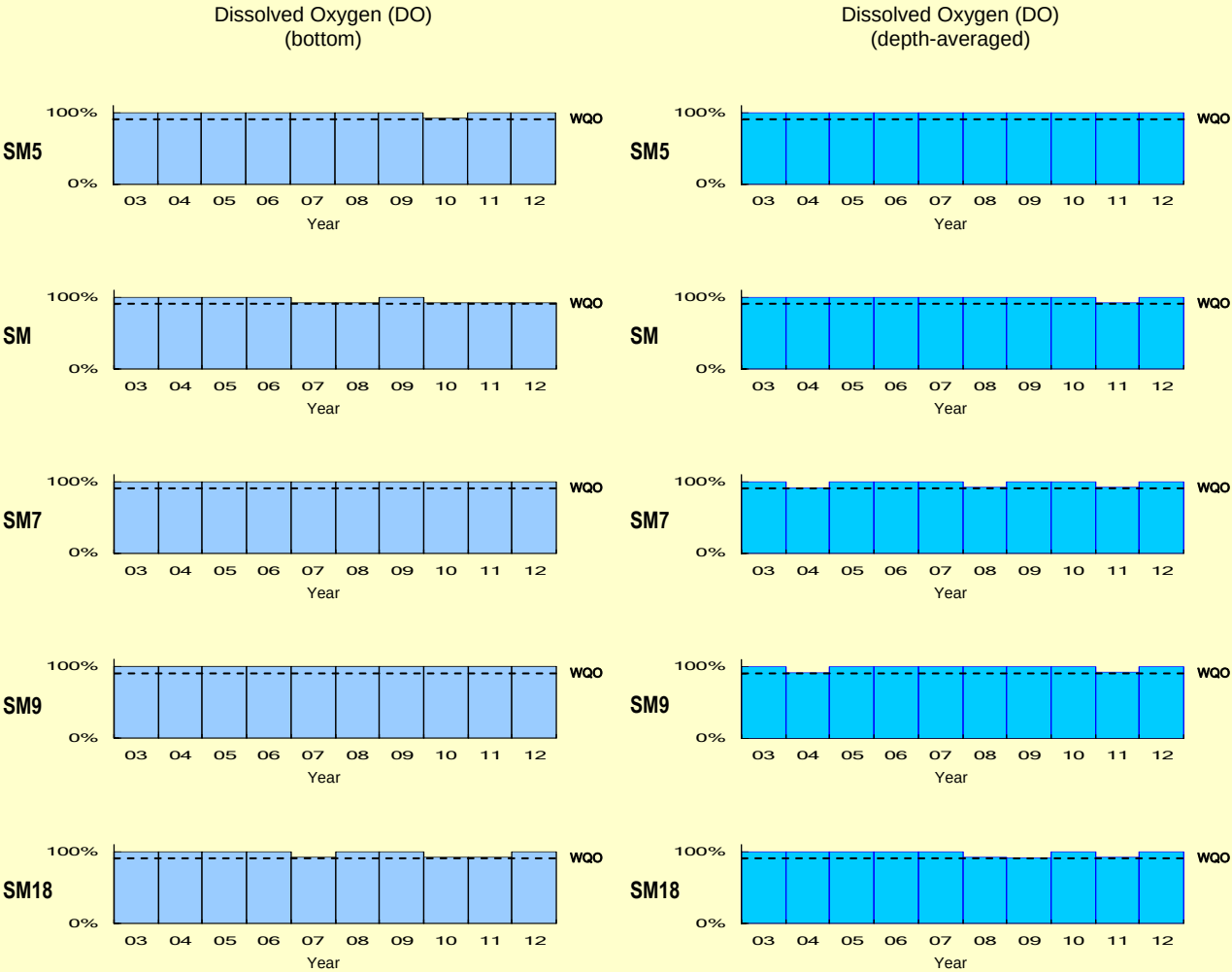
Levels of total inorganic nitrogen and unionised ammonia in the Tolo Harbour and Channel WCZ



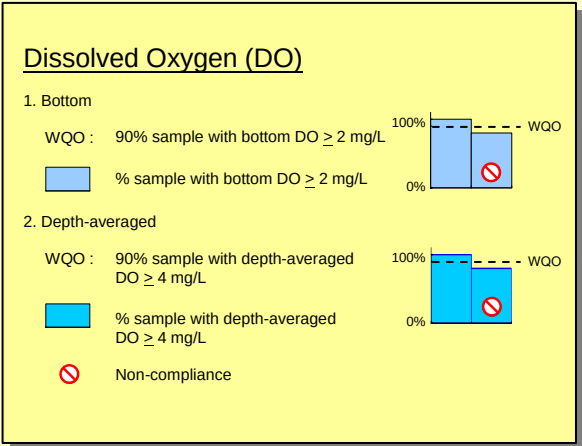
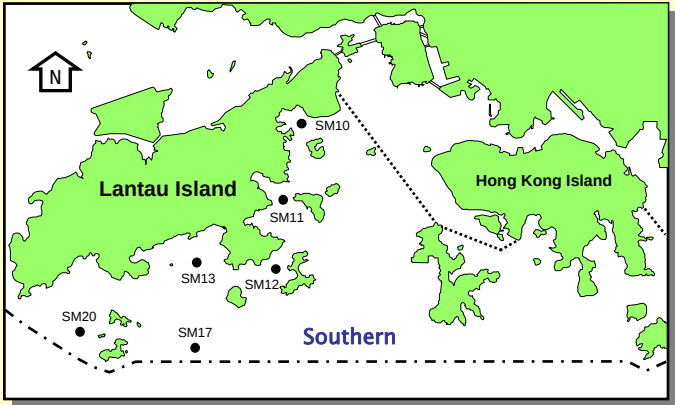
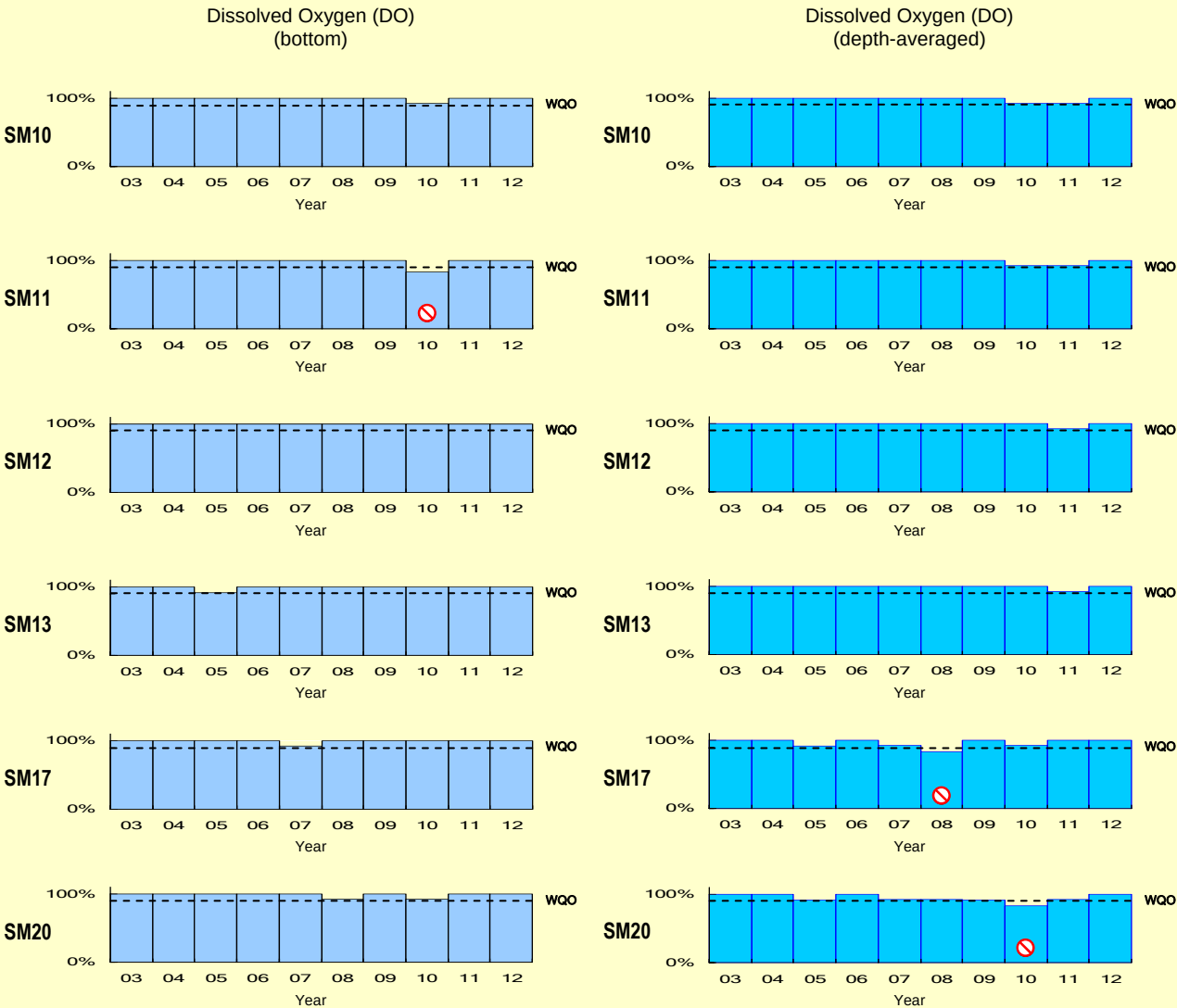
Levels of compliance with key Water Quality Objectives in the Southern WCZ



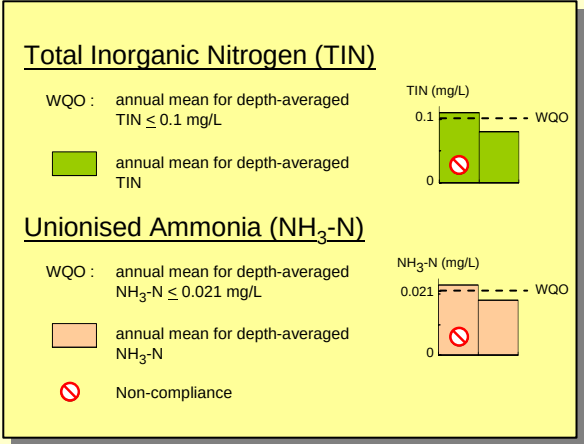
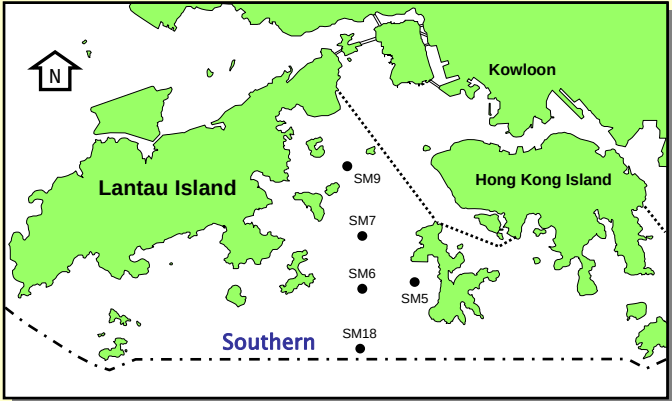
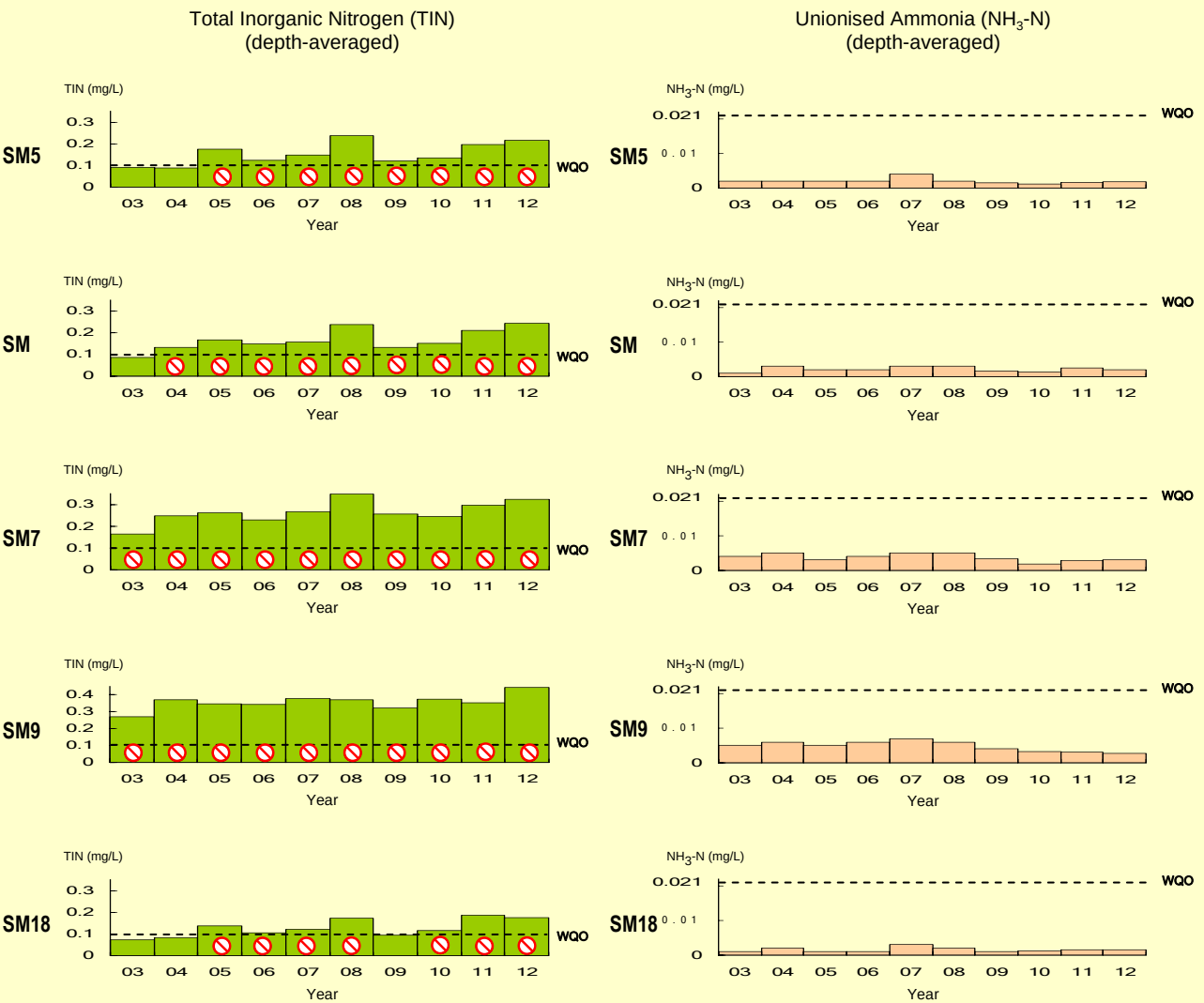
Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)



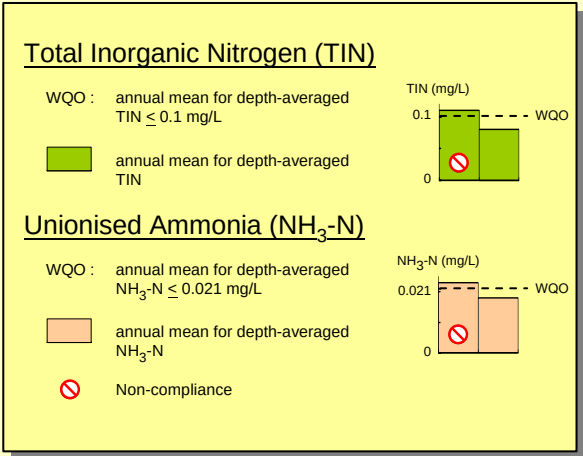
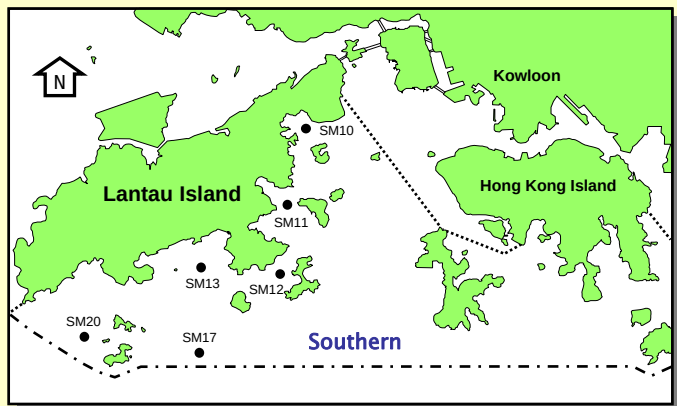
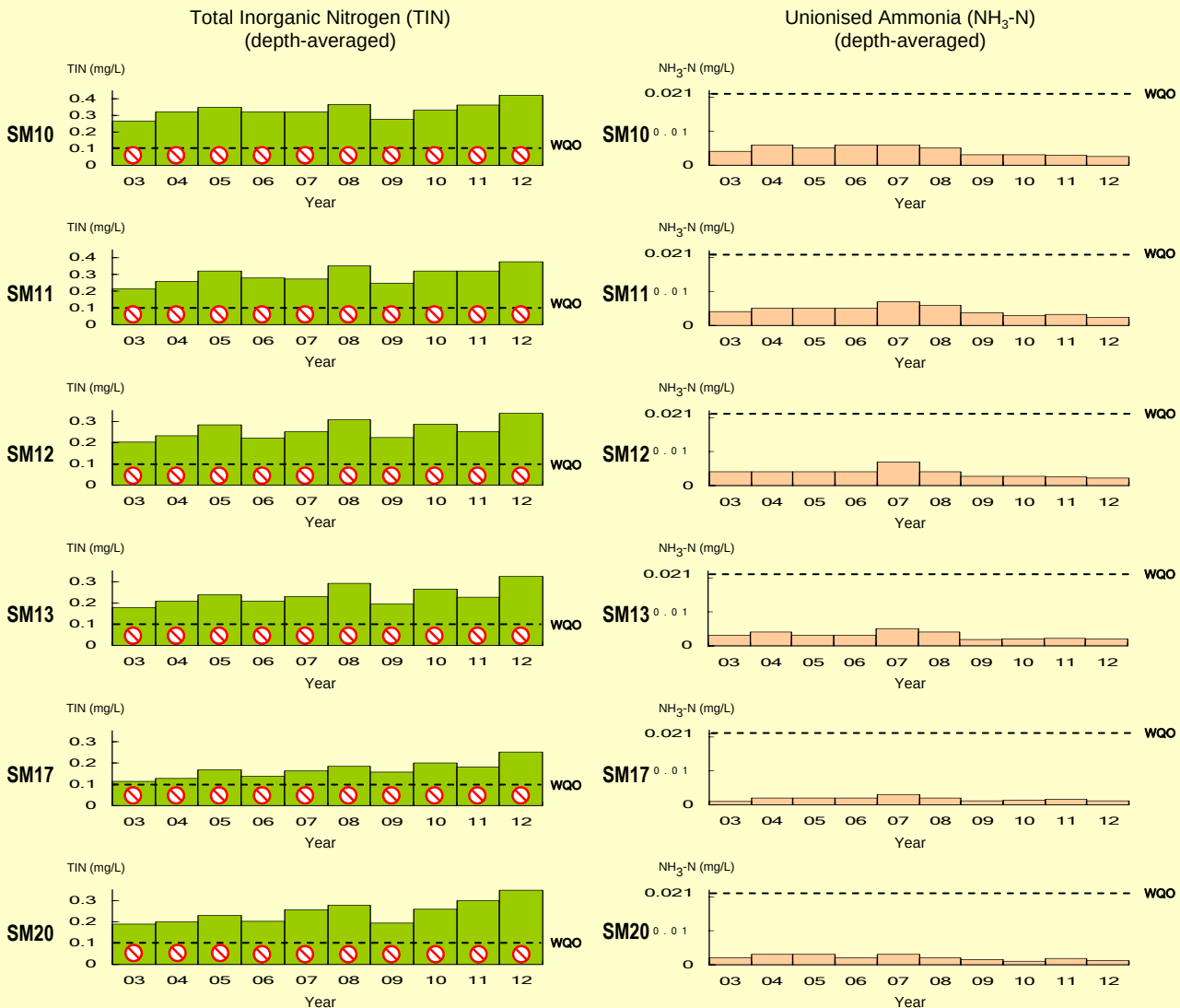
Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)



Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

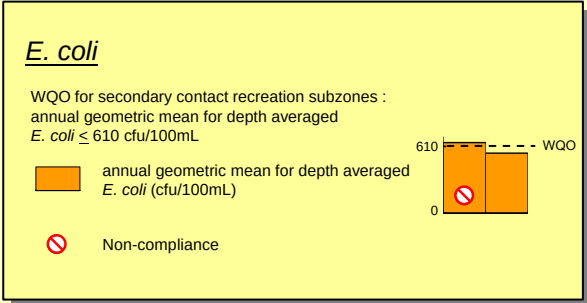
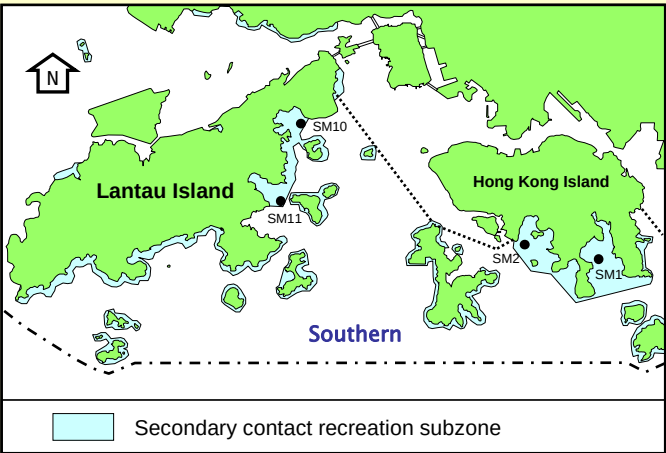
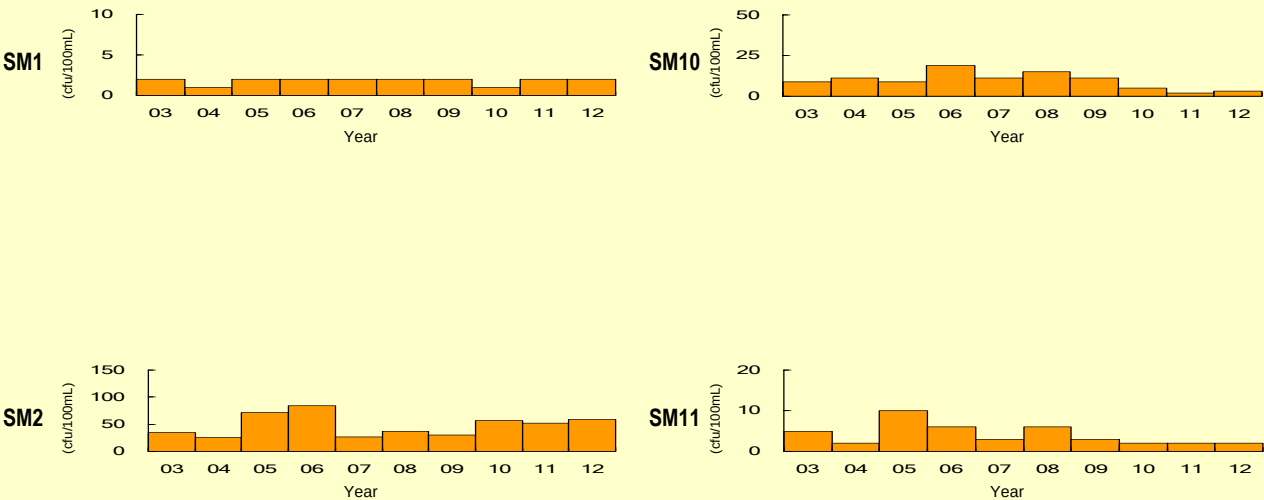


Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

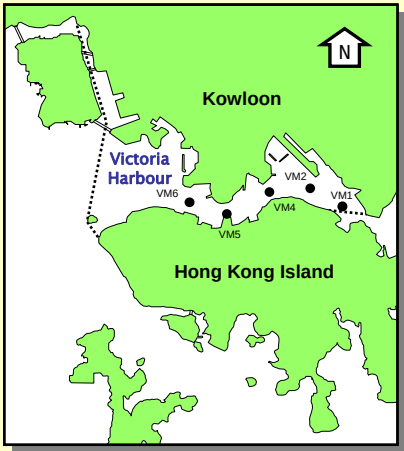
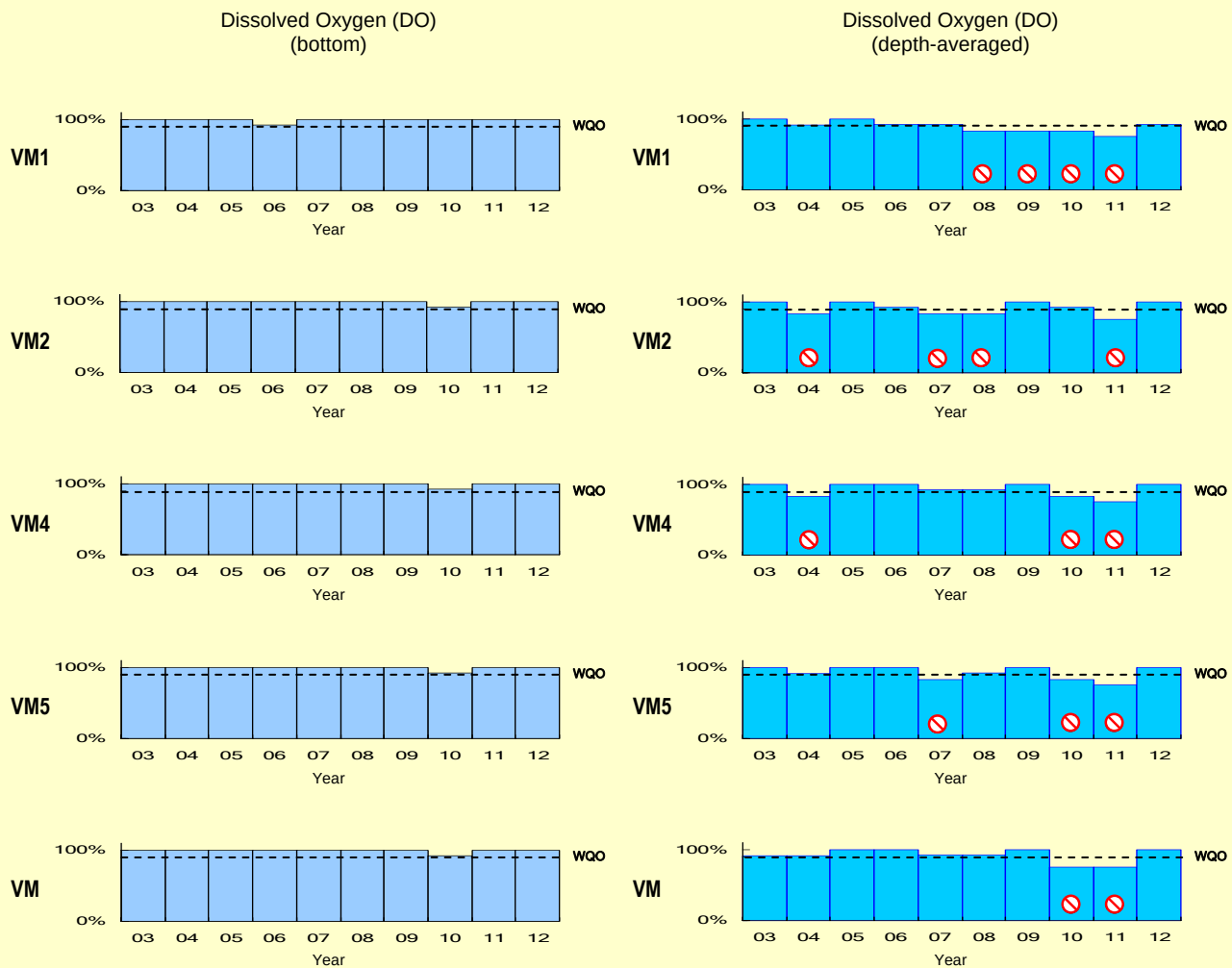


Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

E. coli
(annual geometric mean)



Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ

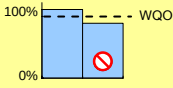


Dissolved Oxygen (DO)

1. Bottom

WQO : 90% sample with bottom DO $\geq$ 2 mg/L

% sample with bottom DO $\geq$ 2 mg/L

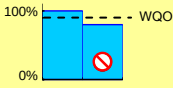


2. Depth-averaged

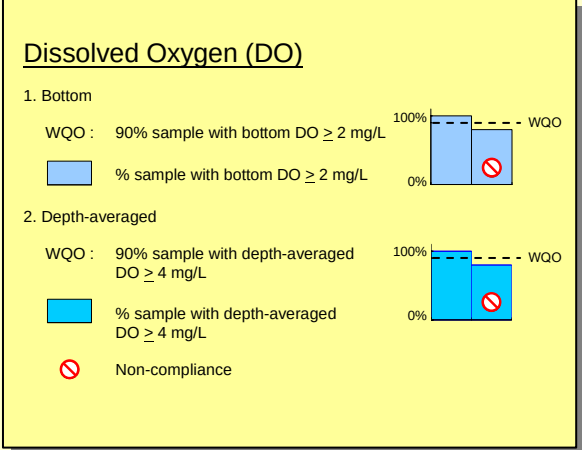
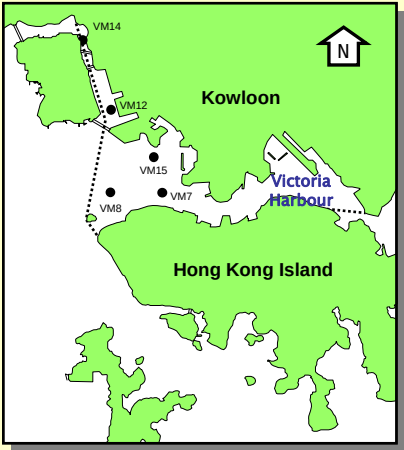
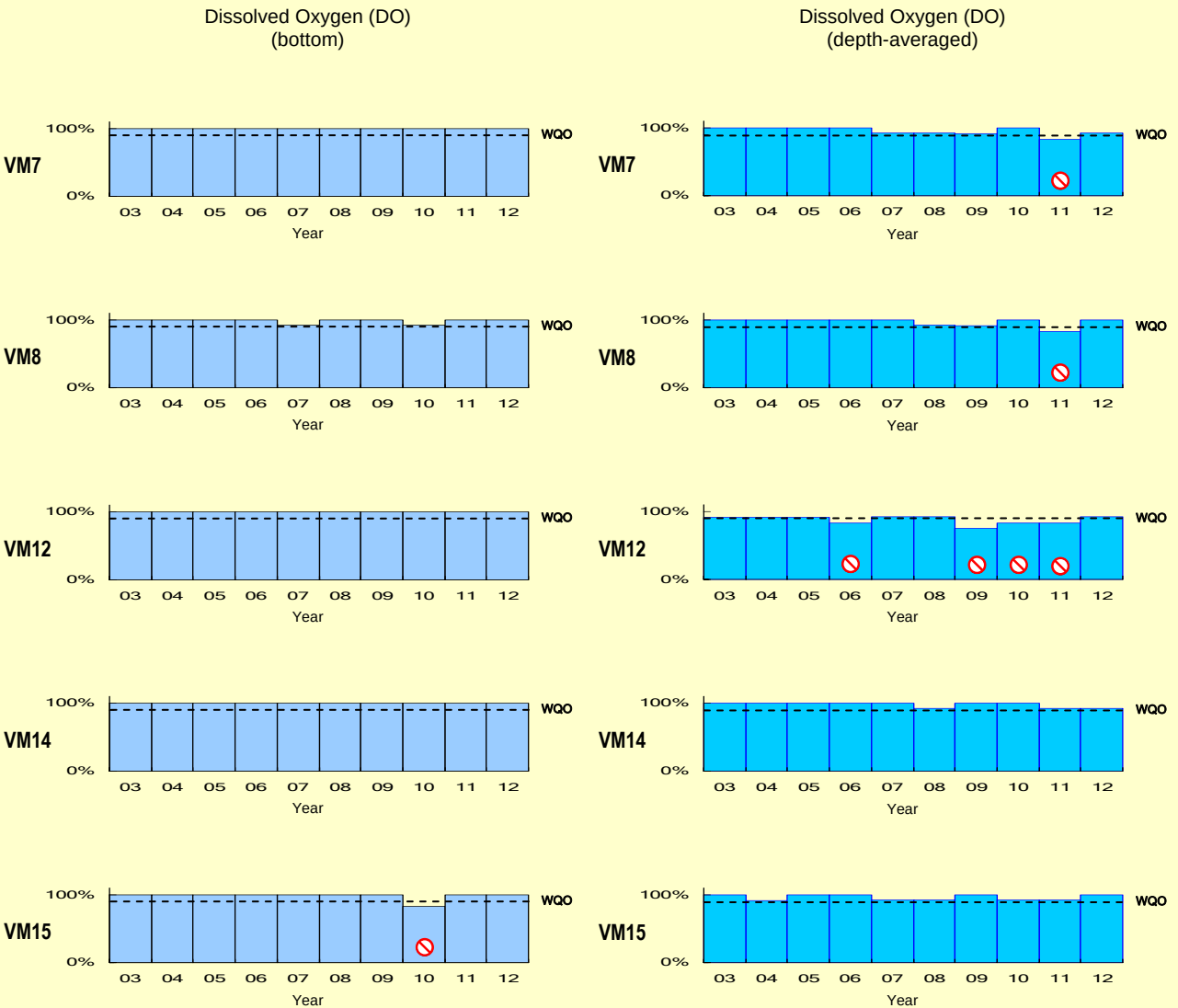
WQO : 90% sample with depth-averaged DO $\geq$ 4 mg/L

% sample with depth-averaged DO $\geq$ 4 mg/L

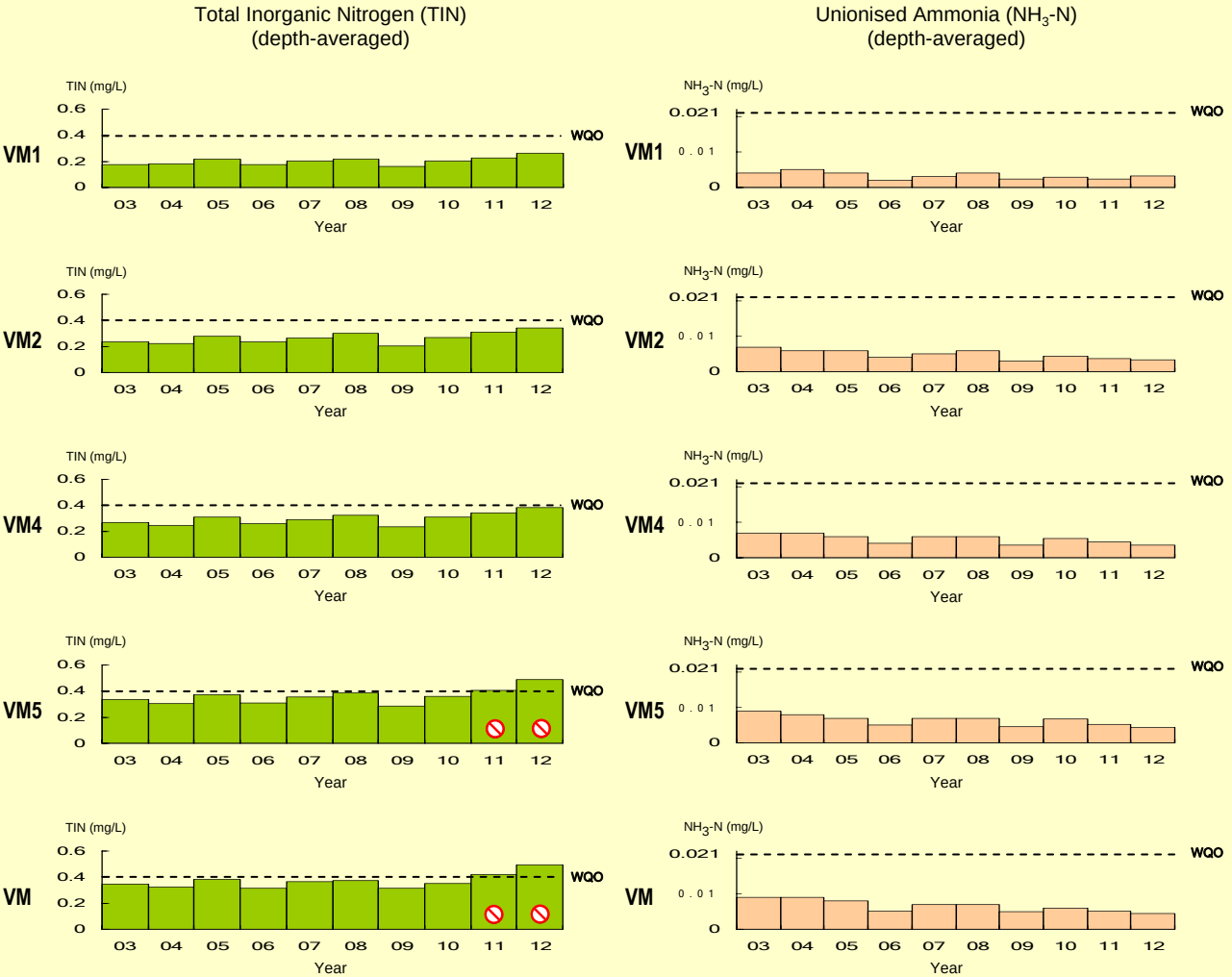
Non-compliance



Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ (continued)



Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ (continued)



TIN (mg/L)

0.6

0.4

0.2

0

03

04

05

06

07

08

09

10

11

12

Year

WQO

VM5

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

NH₃-N (mg/L)

0.021

0.01

0

03

04

05

06

07

08

09

10

11

12

Year

WQO

VM5

0.005

0.005

0.005

0.005

0.005

0.005

0.005

0.005

0.005

0.005

0.005

0.005

TIN (mg/L)

0.6

0.4

0.2

0

03

04

05

06

07

08

09

10

11

12

Year

WQO

VM

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

0.2

NH₃-N (mg/L)

0.021

0.01

0

03

04

05

06

07

08

09

10

11

12

Year

WQO

VM

0.005

0.005

0.005

0.005

0.005

0.005

0.005

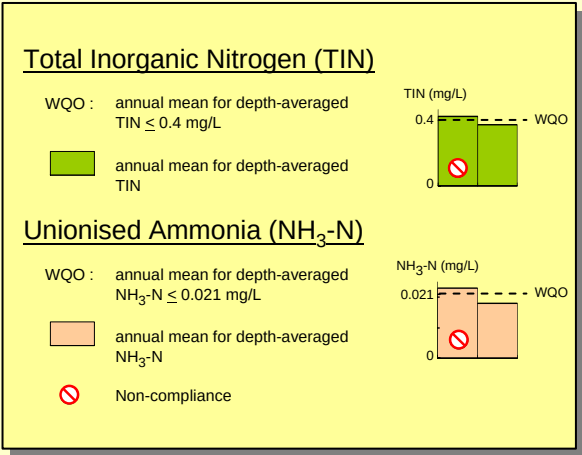
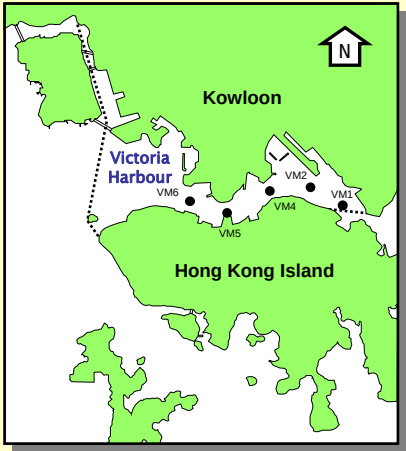
0.005

0.005

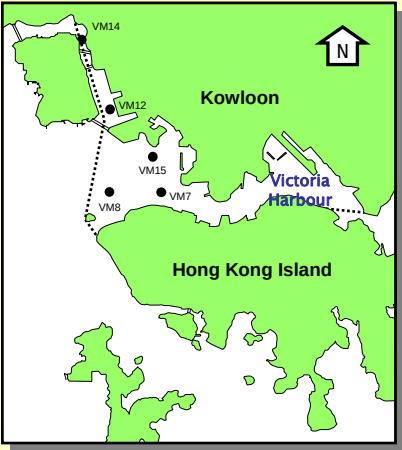
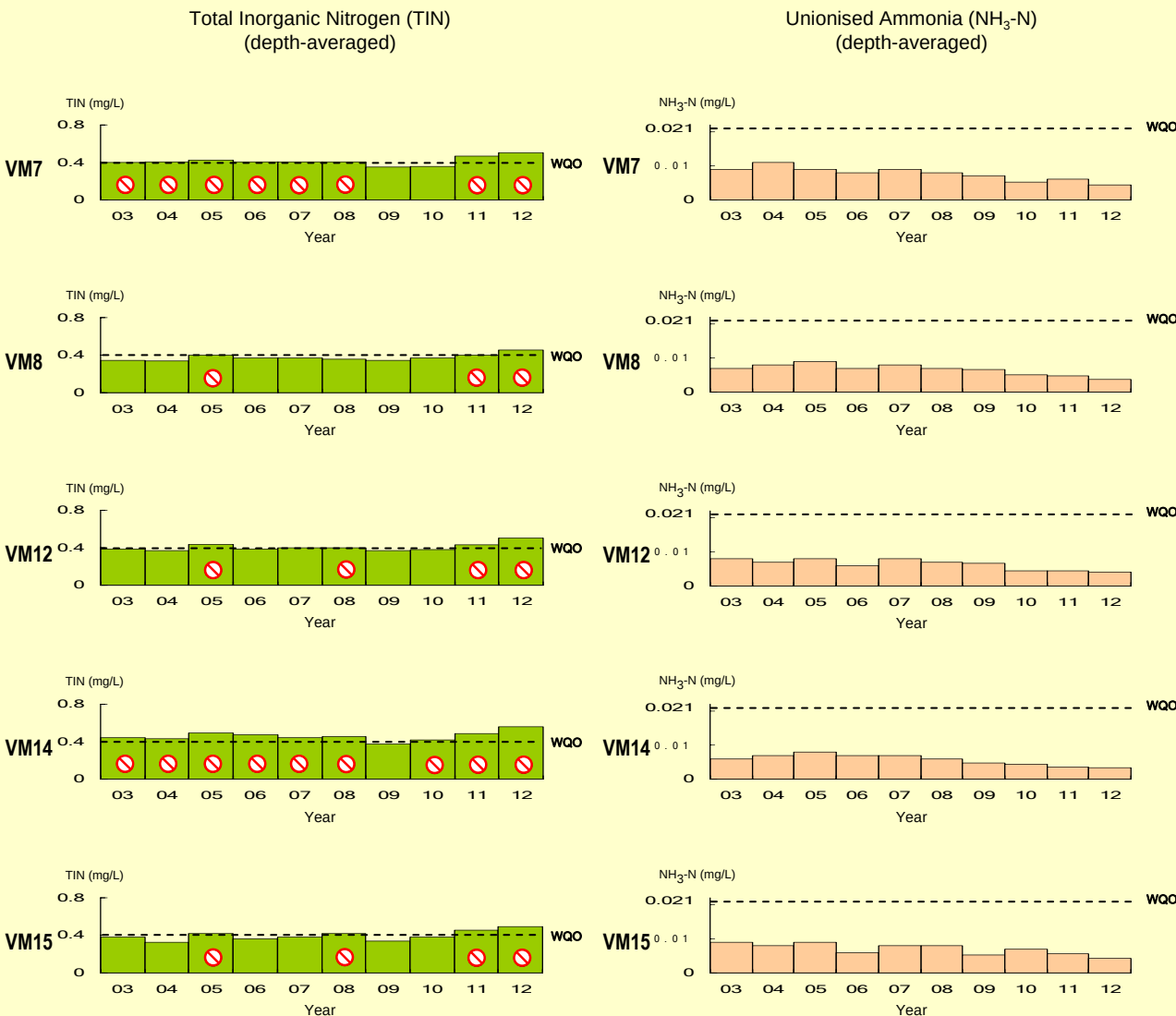
0.005

0.005

0.005



Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ (continued)

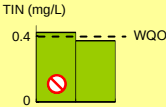


Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged
TIN ≤ 0.4 mg/L



annual mean for depth-averaged
TIN

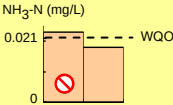


Unionised Ammonia (NH₃-N)

WQO : annual mean for depth-averaged
NH₃-N ≤ 0.021 mg/L

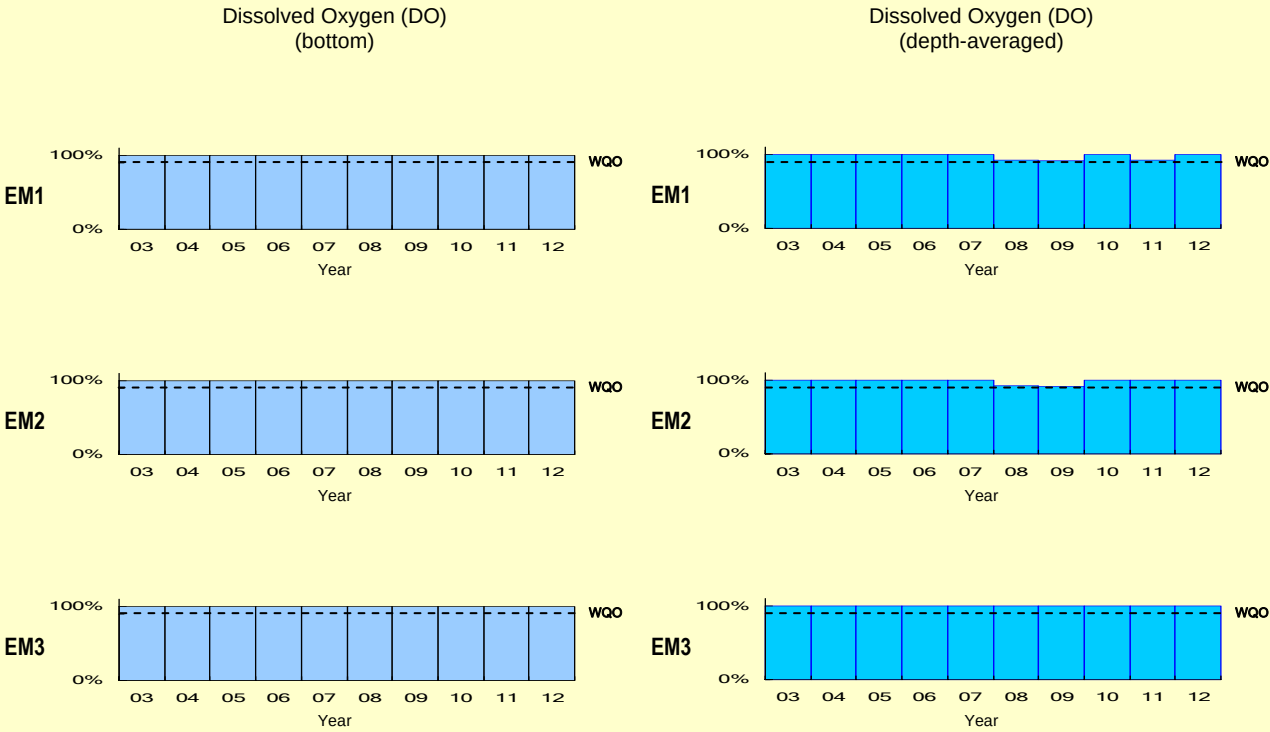


annual mean for depth-averaged
NH₃-N

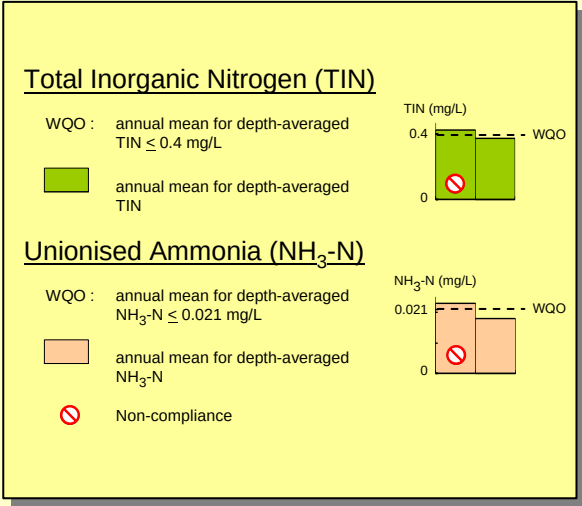
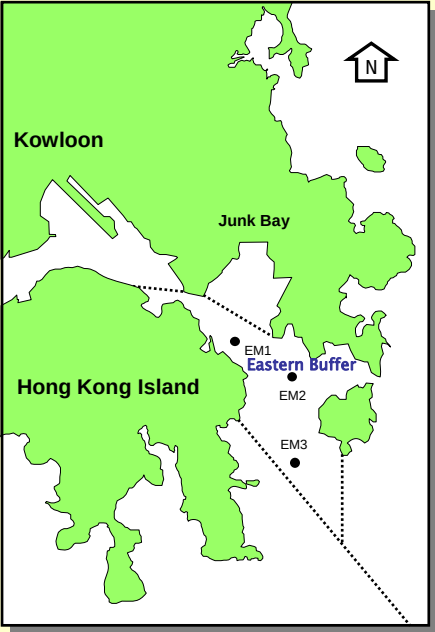
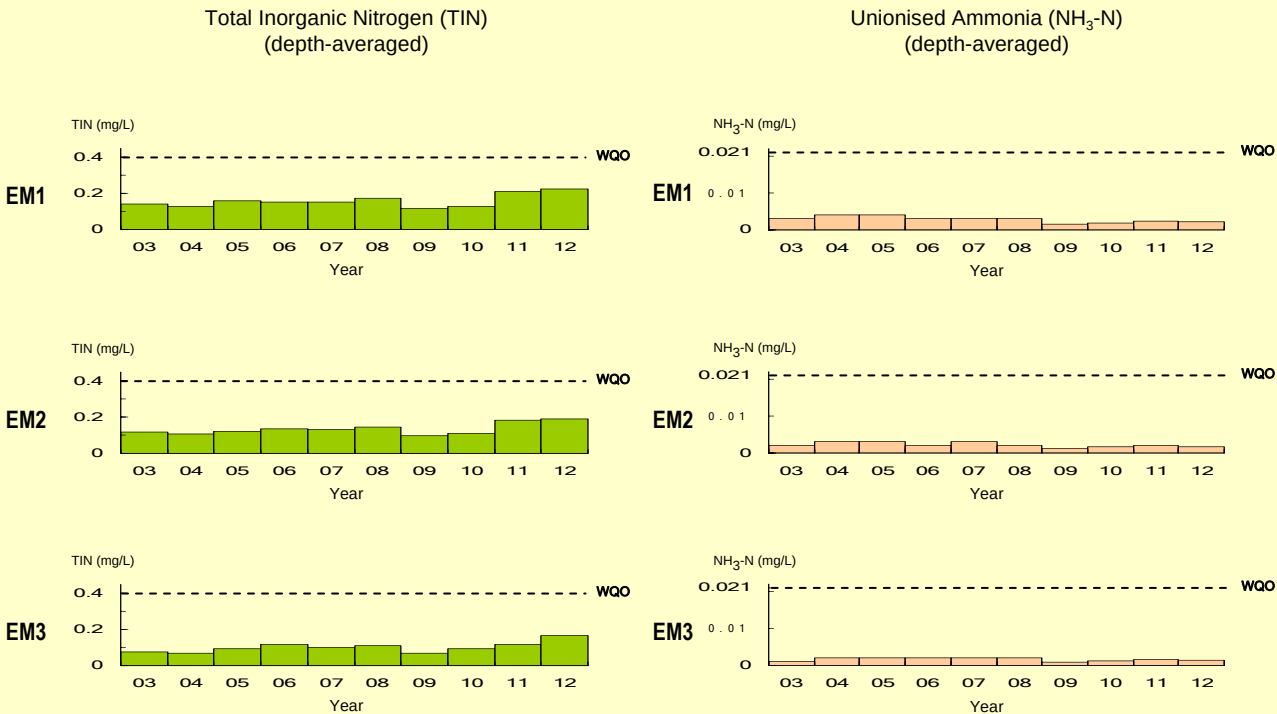


Non-compliance

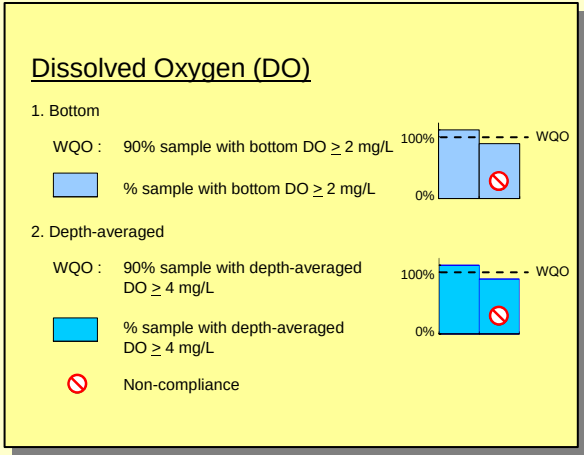
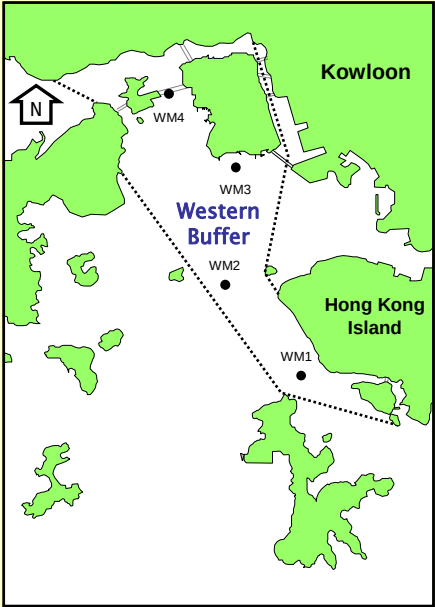
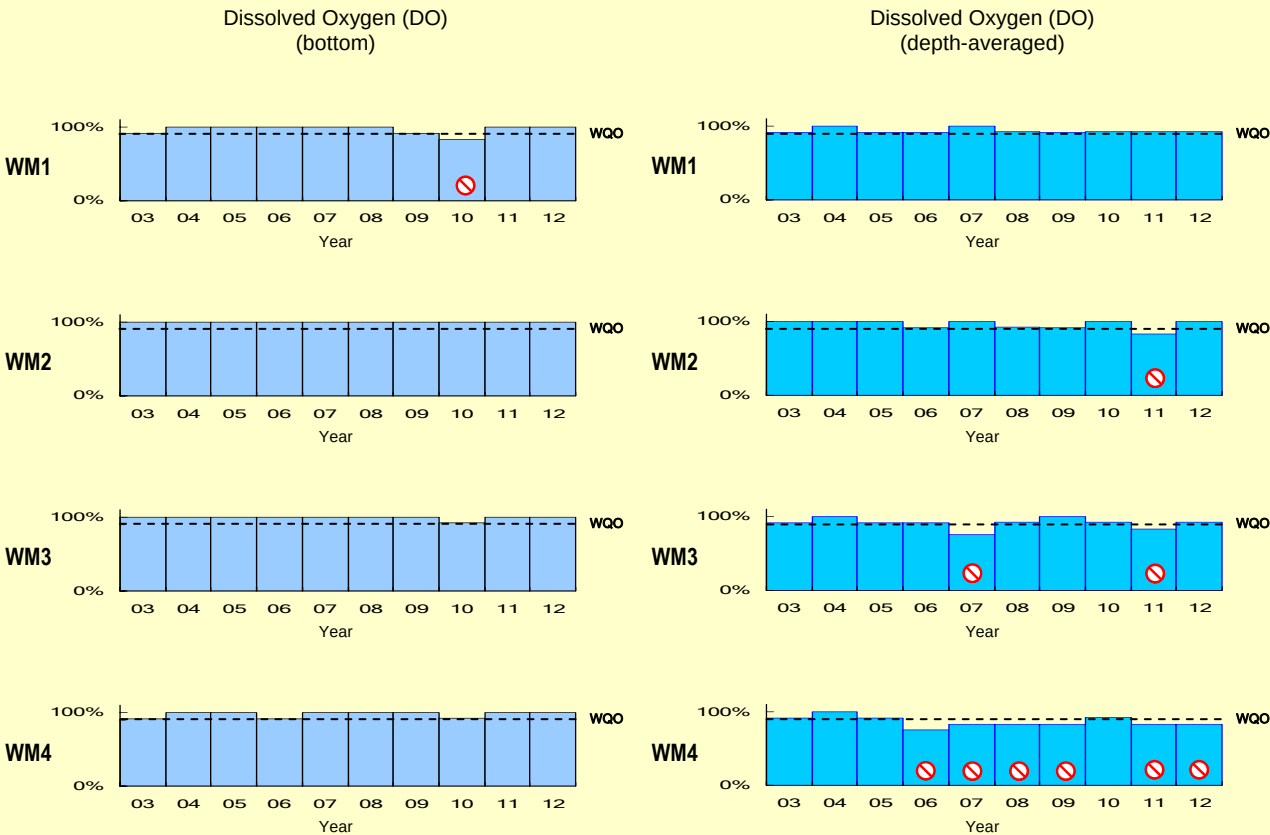
Levels of compliance with key Water Quality Objectives in the Eastern Buffer WCZ



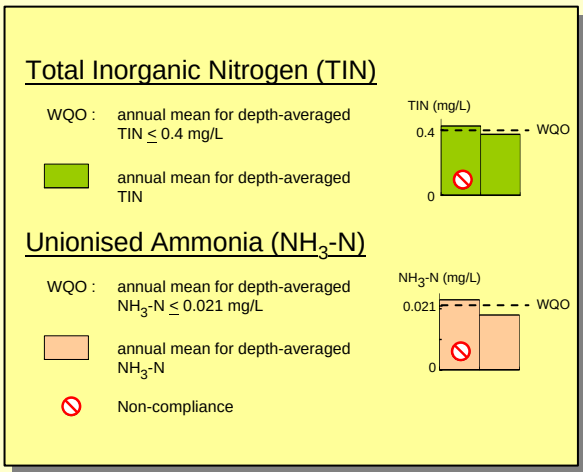
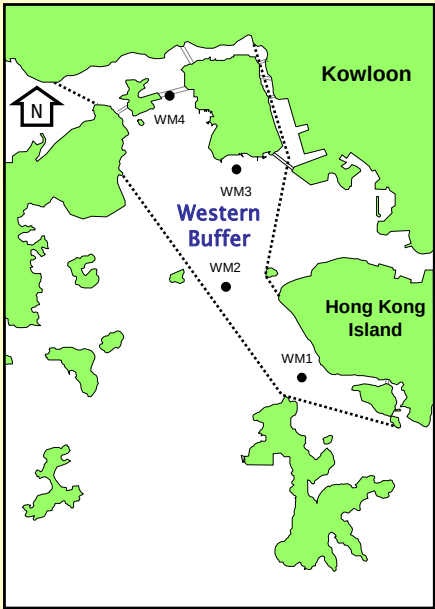
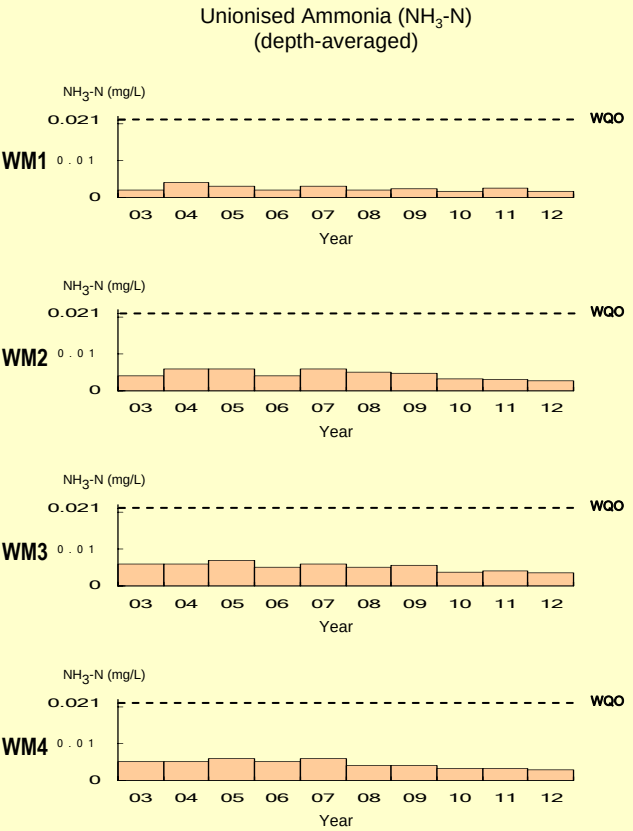
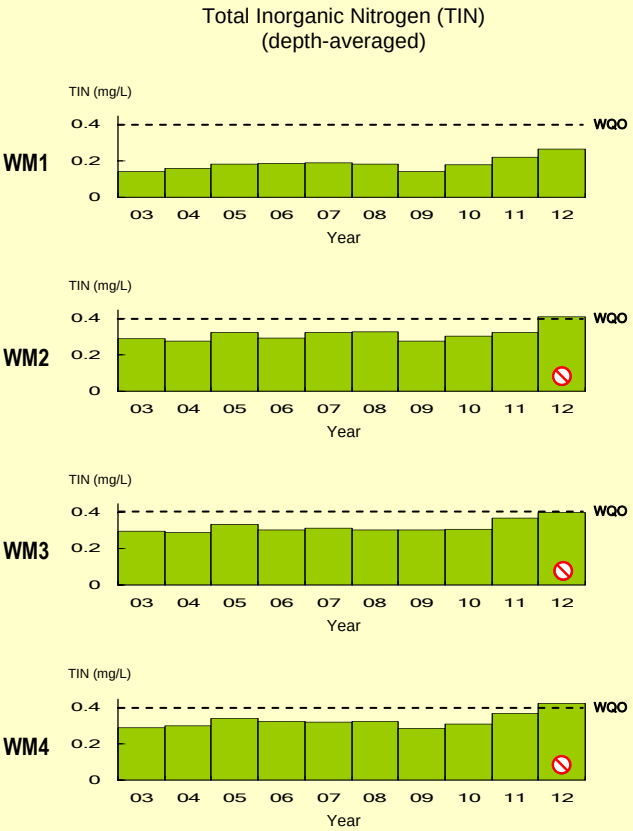
Levels of compliance with key Water Quality Objectives in the Eastern Buffer WCZ (continued)



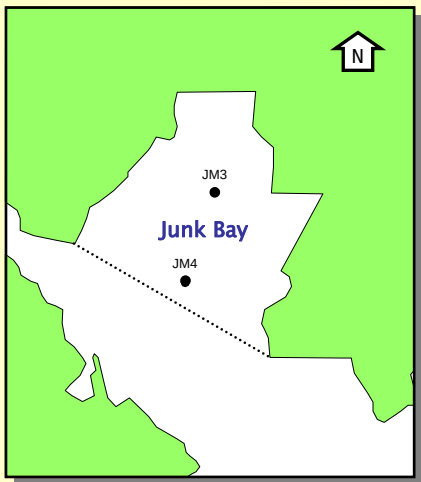
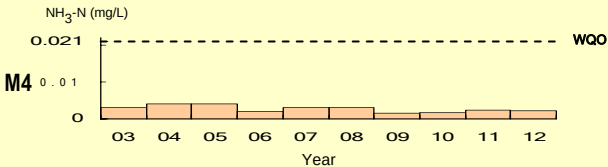
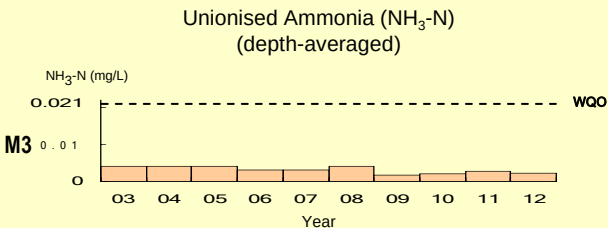
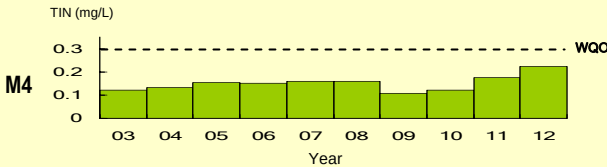
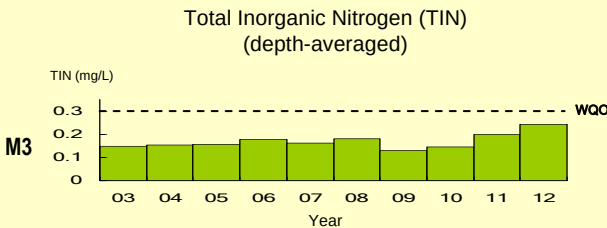
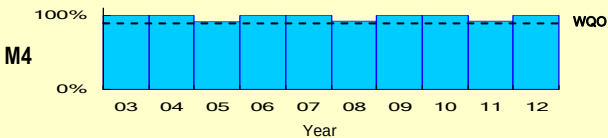
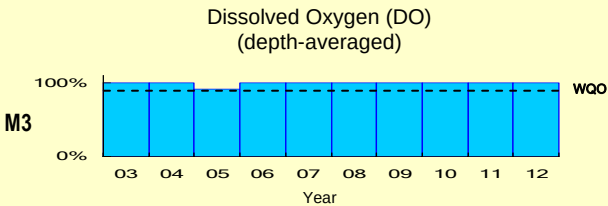
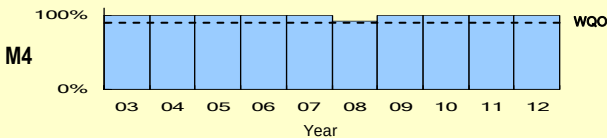
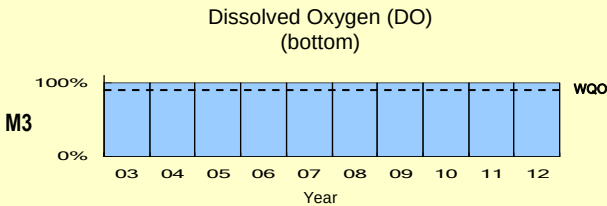
Levels of compliance with key Water Quality Objectives in the Western Buffer WCZ



Levels of compliance with key Water Quality Objectives in the Western Buffer WCZ (continued)



Levels of compliance with key Water Quality Objectives in the Junk Bay WCZ

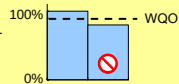


Dissolved Oxygen (DO)

1. Bottom

WQO : 90% sample with bottom DO $\geq$ 2 mg/L

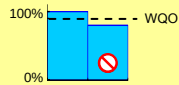
% sample with bottom DO $\geq$ 2 mg/L



2. Depth-averaged

WQO : 90% sample with depth-averaged DO $\geq$ 4 mg/L

% sample with depth-averaged DO $\geq$ 4 mg/L



Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN $\leq$ 0.3 mg/L

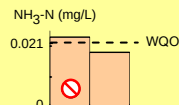
annual mean for depth-averaged TIN



Unionised Ammonia (NH₃-N)

WQO : annual mean for depth-averaged NH₃-N $\leq$ 0.021 mg/L

annual mean for depth-averaged NH₃-N



Non-compliance

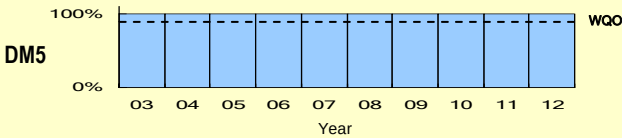
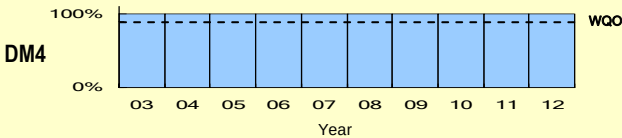
Levels of compliance with key Water Quality Objectives in the Deep Bay WCZ

Dissolved Oxygen (DO)
(bottom)

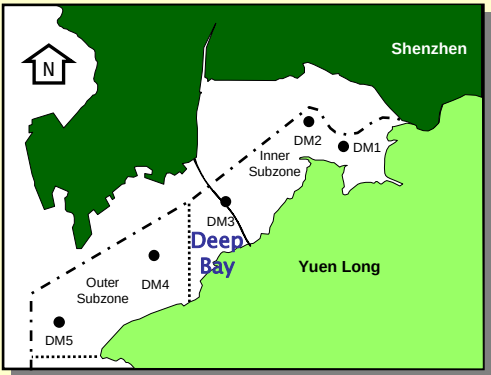
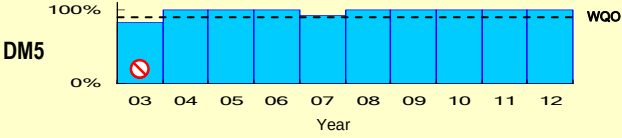
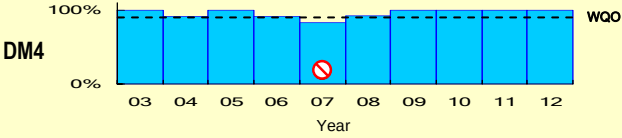
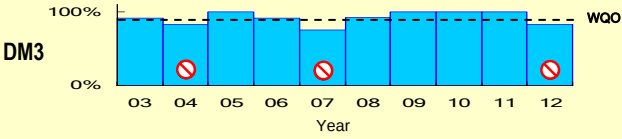
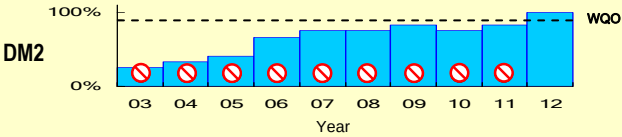
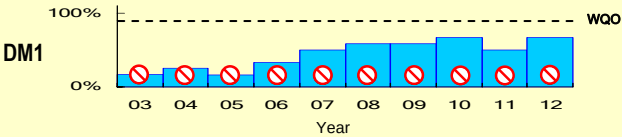
DM1 DO (bottom) not measured water depth ≤ 3m

DM2 DO (bottom) not measured water depth ≤ 3m

DM3 DO (bottom) not measured water depth ≤ 3m



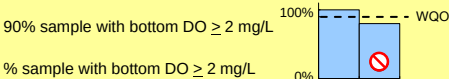
Dissolved Oxygen (DO)
(depth-averaged)



Dissolved Oxygen (DO)

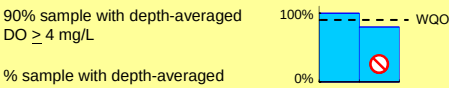
1. Bottom

WQO : 90% sample with bottom DO ≥ 2 mg/L



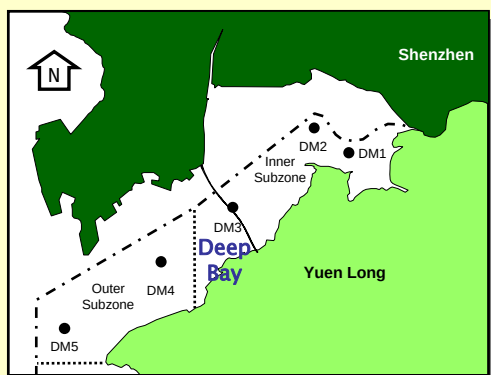
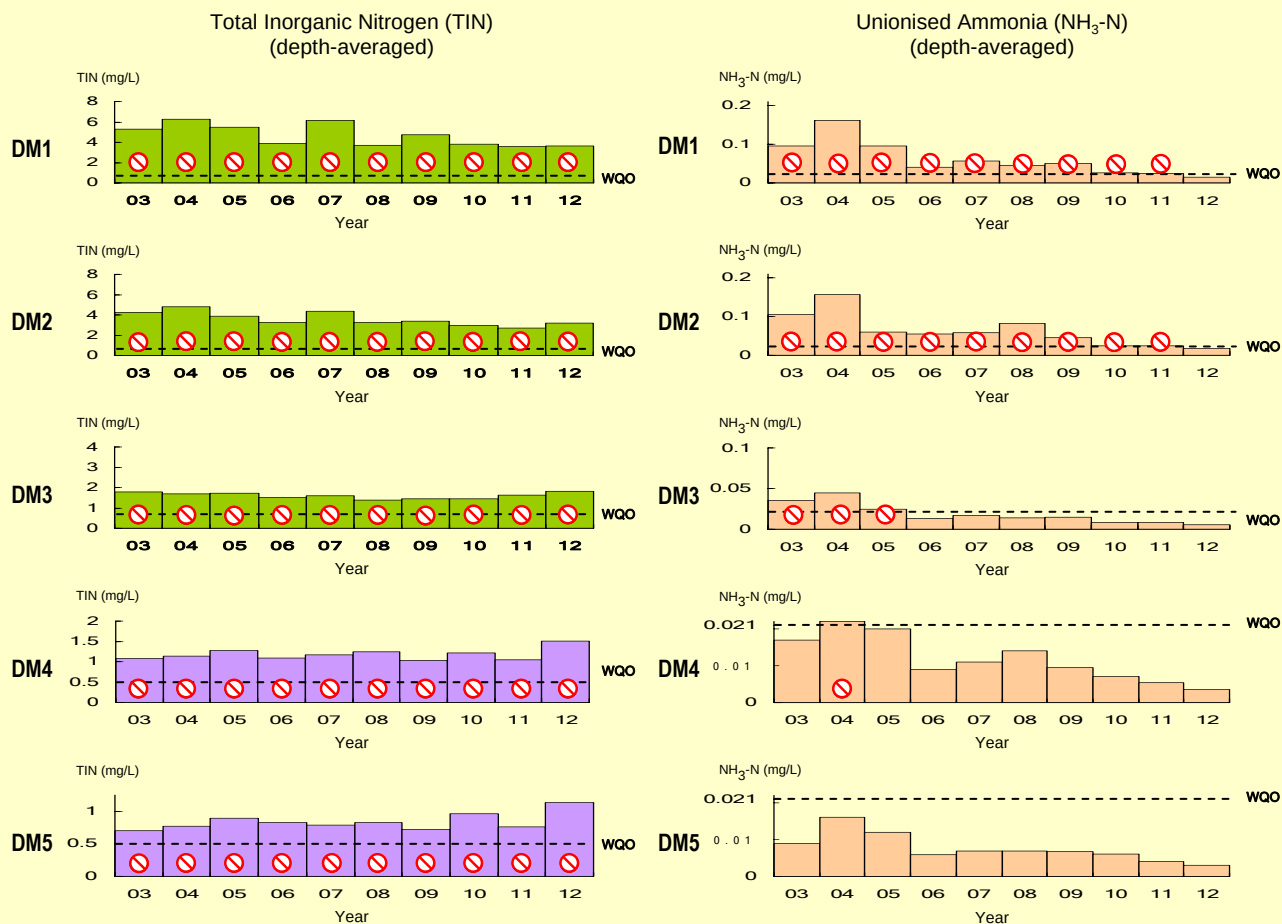
2. Depth-averaged

WQO : 90% sample with depth-averaged DO ≥ 4 mg/L



Non-compliance

Levels of compliance with key Water Quality Objectives in the Deep Bay WCZ (continued)

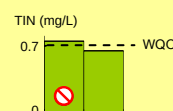


Total Inorganic Nitrogen (TIN)

Inner Subzone (DM1 - DM3)

WQO : annual mean for depth-averaged TIN ≤ 0.7 mg/L

annual mean for depth-averaged TIN



Outer Subzone (DM4 - DM5)

WQO : annual mean for depth-averaged TIN ≤ 0.5 mg/L

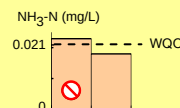
annual mean for depth-averaged TIN



Unionised Ammonia (NH₃-N)

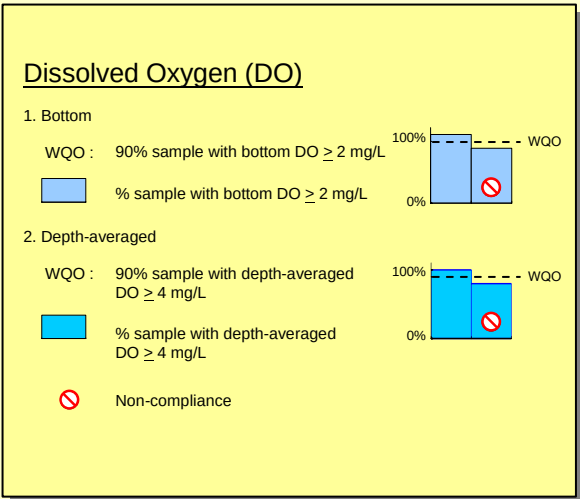
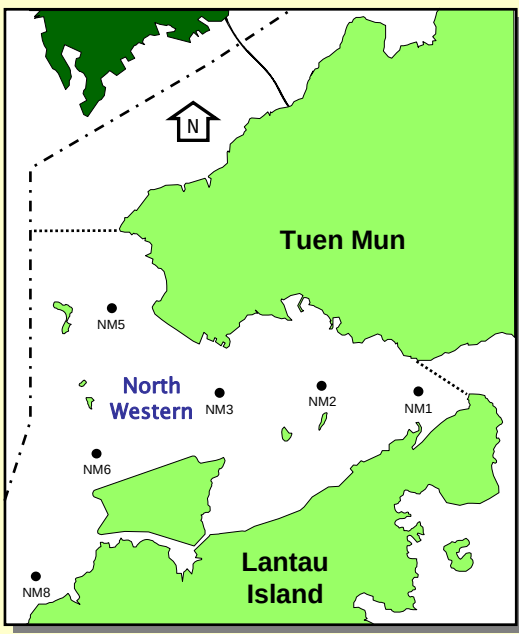
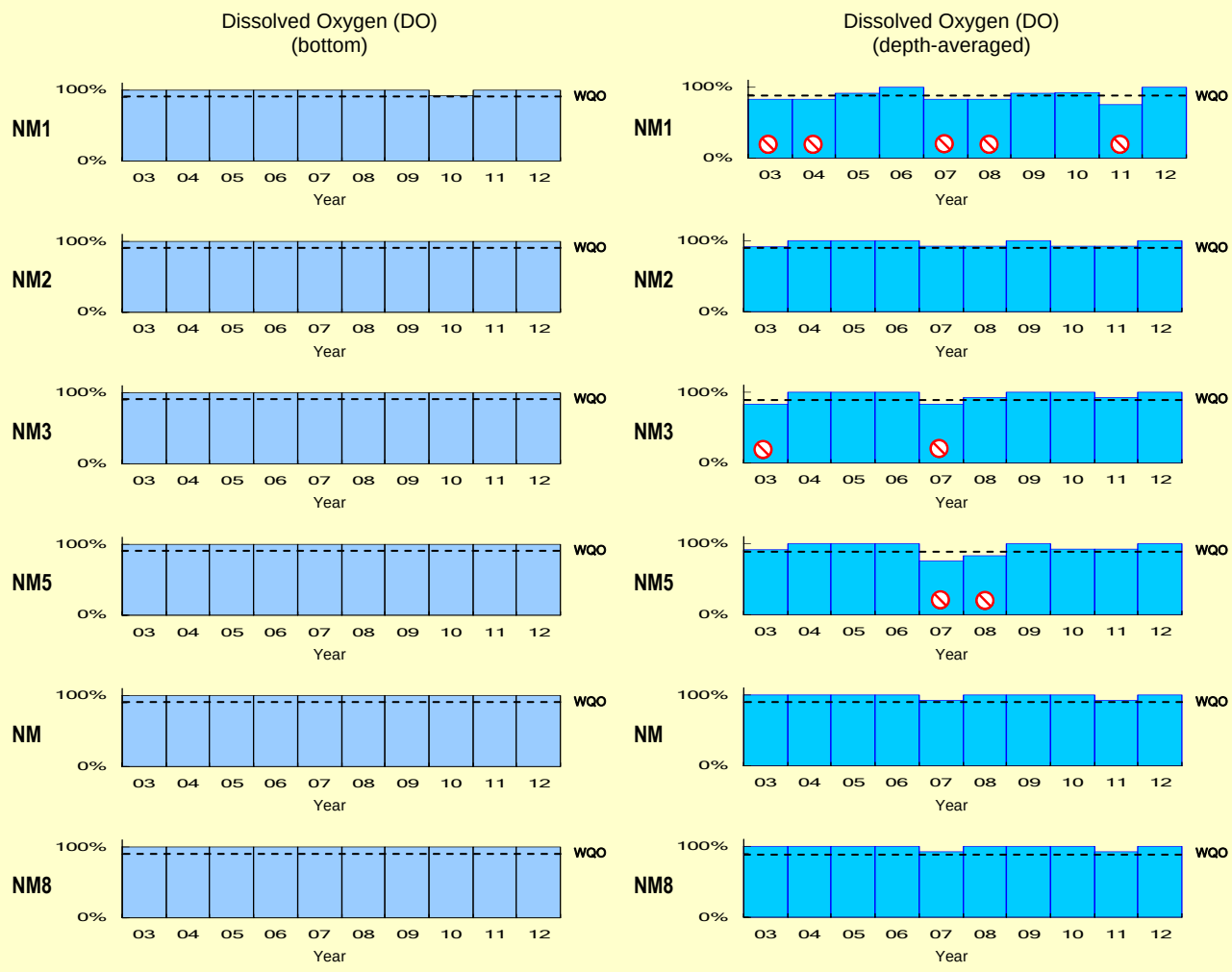
WQO : annual mean for depth-averaged NH₃-N ≤ 0.021 mg/L

annual mean for depth-averaged NH₃-N

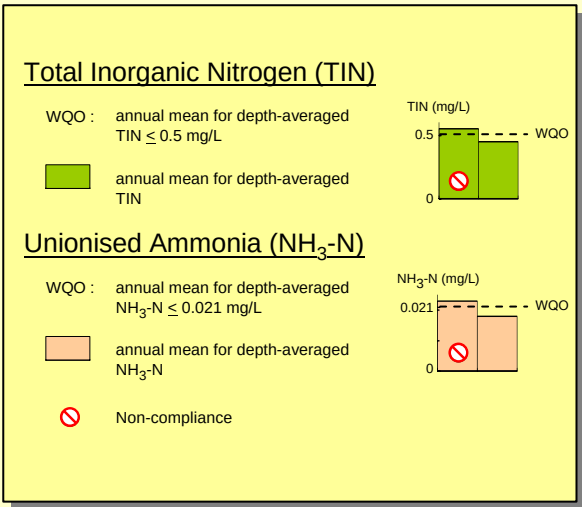
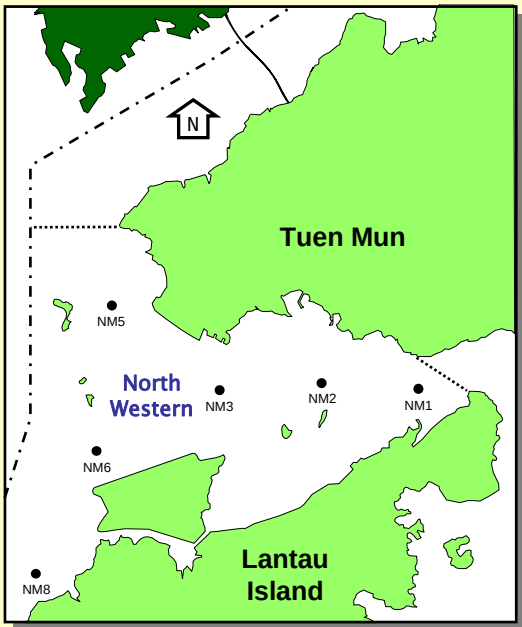
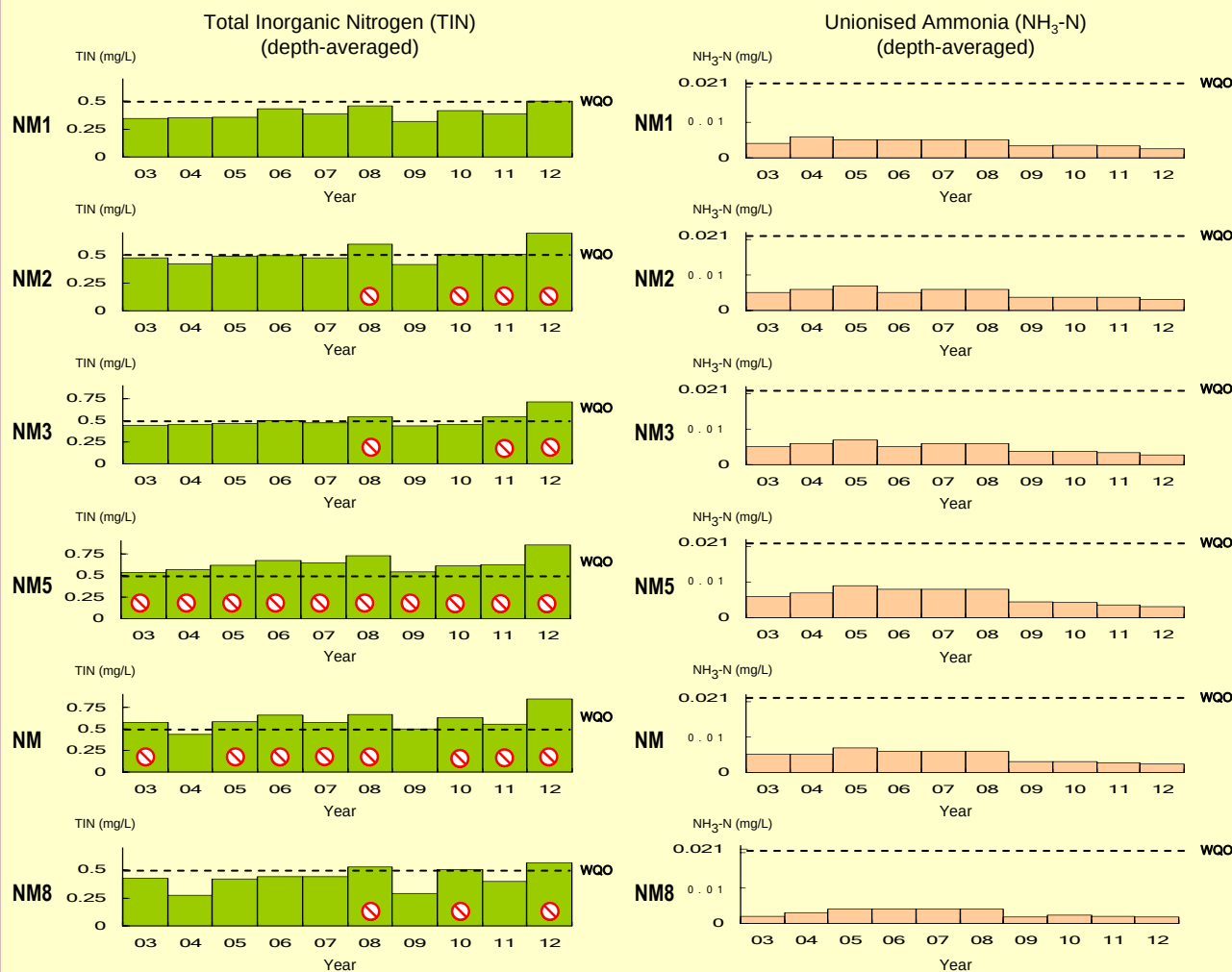


Non-compliance

Levels of compliance with key Water Quality Objectives in the North Western WCZ



Levels of compliance with key Water Quality Objectives in the North Western WCZ (continued)



Results of the Seasonal Kendall Test for water quality trends in the Mirs Bay WCZ, 1991 – 2012

Monitoring Station		MM1	MM2	MM3	MM4	MM5	MM6	MM7
Monitoring Period		1991 2012	1991 2012	1991 2012	1991 2012	1991 2012	1991 2012	1991 2012
Parameter	Water Depth							
Temperature (°C)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Salinity	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
pH	Surface	↓	↓	↓	↓	↓	↓	-
	Middle	-	-	-	↓	-	↓	-
	Bottom	-	-	-	-	-	↓	-
	Average	-	-	-	-	-	-	-
Secchi disc depth (m)		↑	↓	↓	↓	↓	-	↓
Turbidity (NTU)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Suspended Solids (mg/L)	Surface	-	↑	↑	↑	-	-	-
	Middle	-	↑	↑	↑	-	-	↑
	Bottom	-	↑	↑	↑	-	-	↑
	Average	-	↑	↑	↑	-	-	↑
Volatile suspended solids (mg/L)	Surface	-	↑	↑	-	-	-	↑
	Middle	-	↑	↑	-	-	-	↑
	Bottom	-	↑	↑	-	-	-	↑
	Average	-	↑	↑	-	↑	-	↑
5-day Biochemical Oxygen Demand (mg/L)	Surface	↓	-	-	-	-	↓	-
	Middle	↓	-	-	-	-	-	-
	Bottom	↓	-	-	-	-	-	-
	Average	↓	-	-	-	-	↓	-
Ammonia nitrogen (mg/L)	Surface	↓	-	-	-	-	-	-
	Middle	↓	-	-	-	-	-	-
	Bottom	↓	-	-	-	-	-	-
	Average	↓	-	-	-	-	-	-
Unionised Ammonia (mg/L)	Surface	↓	↓	↓	-	-	↓	-
	Middle	↓	-	-	-	-	-	-
	Bottom	↓	-	-	-	-	-	-
	Average	↓	-	-	-	-	-	-
Nitrite nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	↑	-	-	-	-	-	-
Nitrate nitrogen (mg/L)	Surface	↑	↑	↑	↑	↑	-	-
	Middle	↑	↑	↑	-	-	-	-
	Bottom	↑	↑	↑	-	-	-	-
	Average	↑	↑	↑	-	-	-	-
Total inorganic nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Total Kjeldahl nitrogen (mg/L)	Surface	↓	-	-	-	-	-	-
	Middle	↓	-	-	-	-	-	-
	Bottom	↓	-	-	-	-	-	-
	Average	↓	-	-	-	-	-	-
Total nitrogen (mg/L)	Surface	↓	-	-	-	-	-	-
	Middle	↓	-	-	-	-	-	-
	Bottom	↓	-	-	-	-	-	-
	Average	↓	-	-	-	-	-	-
Orthophosphate phosphorus (mg/L)	Surface	↓	↓	↓	↓	↓	↓	↓
	Middle	↓	↓	↓	↓	↓	↓	↓
	Bottom	↓	↓	↓	↓	↓	↓	↓
	Average	↓	↓	↓	↓	↓	↓	↓
Total phosphorus (mg/L)	Surface	↓	↓	↓	↓	↓	↓	↓
	Middle	↓	↓	↓	↓	↓	↓	↓
	Bottom	↓	↓	↓	↓	↓	↓	↓
	Average	↓	↓	↓	↓	↓	↓	↓
Silica (mg/L)	Surface	↓	↓	↓	↓	↓	↓	↓
	Middle	↓	↓	↓	↓	↓	↓	↓
	Bottom	↓	↓	↓	↓	↓	↓	↓
	Average	↓	↓	↓	↓	↓	↓	↓
Chlorophyll- <i>a</i> (µg/L)	Surface	-	↑	↑	↑	↑	↑	↑
	Middle	-	↑	↑	↑	↑	↑	↑
	Bottom	-	↑	↑	↑	↑	↑	↑
	Average	-	↑	↑	↑	↑	↑	↑
<i>E. coli</i> (cfu/100mL)	Surface	↓	-	-	-	-	-	-
	Middle	↓	-	-	-	-	-	-
	Bottom	↓	-	-	-	-	-	-
	Average	↓	-	-	-	-	-	-
Faecal coliforms (cfu/100mL)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	↓	-
	Average	-	-	-	-	-	-	-

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↑ significant increase

4. ↓ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Mirs Bay WCZ, 1986 – 2012 (continued)

Monitoring Station		MM8	MM13	MM14	MM15	MM16	MM17	MM19
Monitoring Period		1991 2012	1991 2012	1994 2012	1994 2012	1994 2012	1986 2012	2001 2012
Parameter	Water Depth							
Temperature (°C)	Surface	↗	-	-	-	-	-	-
	Middle	-	-	-	-	-	↗	-
	Bottom	-	-	-	-	-	↗	-
	Average	-	-	-	-	-	↗	-
Salinity	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	-	-	-	-	-	-
	Middle	↘	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	↗	-	-	-	-	-	-
	Middle	-	↗	-	-	-	↗	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
pH	Surface	-	-	↘	↘	↘	↘	↘
	Middle	-	-	↘	↘	↘	↘	↘
	Bottom	-	-	↘	↘	↘	↘	↘
	Average	-	-	↘	↘	↘	↘	↘
Secchi disc depth (m)		-	↘	↘	↘	↘	↘	↘
Turbidity (NTU)	Surface	-	-	-	-	-	↗	↘
	Middle	-	-	-	-	-	-	↘
	Bottom	-	-	-	-	-	-	↘
	Average	-	-	-	-	-	-	↘
Suspended Solids (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	↗	-	-	-	-	-	↘
	Average	-	-	-	-	-	↘	↘
Volatile suspended solids (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	↗	-	-	-	-
	Average	↗	-	↗	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	↘	↘	-	-	-	↘	-
	Middle	↘	↘	-	-	-	↘	-
	Bottom	↘	-	-	-	-	↘	-
	Average	↘	-	-	-	-	↘	-
Ammonia nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	↗
	Average	-	-	-	-	-	-	↗
Unionised Ammonia (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Nitrite nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Nitrate nitrogen (mg/L)	Surface	-	-	-	-	-	-	↗
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	↗	↗	↗	↗	-
	Average	-	-	↗	↗	↗	↗	-
Total inorganic nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	↗	-
	Average	-	-	-	-	-	↗	-
Total Kjeldahl nitrogen (mg/L)	Surface	-	-	-	-	-	↘	↗
	Middle	↘	↘	-	-	-	↘	↗
	Bottom	-	-	-	-	-	↘	↗
	Average	↘	↘	-	-	-	↘	↗
Total nitrogen (mg/L)	Surface	-	-	-	-	-	↘	↗
	Middle	-	↘	-	-	-	↘	↗
	Bottom	-	-	-	-	-	↘	↗
	Average	-	↘	-	-	-	↘	↗
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	-
Total phosphorus (mg/L)	Surface	↘	↘	-	-	-	↘	-
	Middle	↘	↘	-	-	-	↘	-
	Bottom	↘	↘	-	-	-	↘	-
	Average	↘	↘	-	-	-	↘	-
Silica (mg/L)	Surface	-	↘	-	-	↘	↘	-
	Middle	-	↘	-	-	-	↘	-
	Bottom	-	↘	-	-	-	↘	-
	Average	-	↘	-	-	-	↘	-
Chlorophyll- <i>a</i> (µg/L)	Surface	↗	-	↘	-	-	↗	-
	Middle	-	-	↘	-	-	↗	-
	Bottom	-	-	-	-	-	↗	-
	Average	-	-	-	-	-	↗	-
<i>E. coli</i> (cfu/100mL)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Faecal coliforms (cfu/100mL)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↗ significant increase

4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Port Shelter WCZ, 1986 – 2012

Monitoring Station		PM1	PM2	PM3	PM4	PM6	PM7	PM8	PM9	PM11
Monitoring Period		1986 I 2012	1986 I 2012	1986 I 2012	1986 I 2012	1986 I 2012	1986 I 2012	1986 I 2012	1986 I 2012	1993 I 2012
Parameter	Water Depth									
Temperature (°C)	Surface	-	-	-	-	↗	↗	↗	↗	-
	Middle	↗		↗		↗	↗	↗	↗	-
	Bottom	↗	↗	↗	↗	↗	↗	↗	↗	-
	Average	↗	-	↗	↗	↗	↗	↗	↗	-
Salinity	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	↗	-	-	↗	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	-	-	-	-	-	-	-
	Middle	↗	↗	↗	↗	↗	↗	-	-	-
	Bottom	↗	↗	↗	↗	-	-	-	-	-
	Average	↗		↗		-	-	-	-	-
pH	Surface	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗			↗			↘	
Turbidity (NTU)	Surface	-	-	↗	↗	-	↗	↗	↗	-
	Middle	-	-			-	-	-	-	-
	Bottom	-	-	↗	-	-	↗	↗	↗	-
	Average	-	-	↗		-	↗	↗	↗	-
Suspended Solids (mg/L)	Surface	-	↘	↘	↘	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	↘	↘	-
Volatile suspended solids (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-	↗
	Average	-	-	-	-	-	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	↘	-	-	↘	-	-	-	-
	Middle	-		-	-	↘	-	-	-	↘
	Bottom	-	↘	-	-	↘	-	-	↘	↘
	Average	-	↘	-	-	↘	-	-	↘	↘
Ammonia nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Unionised Ammonia (mg/L)	Surface	↘	↘	-	-	↘	-	-	-	↘
	Middle	↘	↘	-	-	↘	-	-	-	↘
	Bottom	↘	↘	-	-	↘	-	-	-	↘
	Average	↘	↘	-	-	↘	-	-	-	↘
Nitrite nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-	↗
	Average	-	-	-	-	-	-	-	-	↗
Nitrate nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	↗	↗	↗	↗
	Average	-	-	-	-	-	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	↗	↗	↗	↗
	Average	-	-	-	-	-	↗	↗	↗	↗
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	↘	↘	-
Total nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	↘	↘	-
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	↘	↘	-
Silica (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘	↘
Chlorophyll- <i>a</i> (µg/L)	Surface	↗	↗	↗	↗	-	↗	↗	↗	-
	Middle	↗	↗	↗	↗	-	↗	↗	↗	-
	Bottom	↗	↗	↗	↗	-	↗	↗	↗	-
	Average	↗	↗	↗	↗	-	↗	↗	↗	-
<i>E. coli</i> (cfu/100mL)	Surface	-	↘	-	-	↘	-	-	-	-
	Middle	-	↘	-	-	↘	-	-	-	-
	Bottom	-	↘	-	-	↘	-	-	-	-
	Average	-	↘	-	-	↘	-	-	-	-
Faecal coliforms (cfu/100mL)	Surface	-	-	-	-	↘	-	-	-	-
	Middle	-	-	-	-	↘	-	-	-	-
	Bottom	-	↘	-	-	↘	-	-	-	-
	Average	↘	-	-	-	↘	-	-	-	-

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↗ significant increase

4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Tolo Harbour and Channel WCZ, 1986 – 2012

Monitoring Station		TM2	TM3	TM4	TM5	TM6	TM7	TM8
Monitoring Period		1986 I 2012	1986 I 2012	1986 I 2012	1988 I 2012	1986 I 2012	1988 I 2012	1986 I 2012
Parameter	Water Depth							
Temperature (°C)	Surface	↗	↗	↗	↗	↗	↗	↗
	Middle	NA	↗	↗	NA	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗
Salinity	Surface	↗	-	-	↗	-	↗	↗
	Middle	NA	-	-	NA	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	↗	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↗	↗	↗	-	↗	↗	-
	Average	↗	↗	↗	-	↗	↗	-
Dissolved Oxygen (%)	Surface	-	↘	↘	↘	↘	↘	↘
	Middle	NA	-	-	NA	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗
pH	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗	-
Turbidity (NTU)	Surface	-	-	-	-	-	-	-
	Middle	NA	-	-	NA	-	-	-
	Bottom	-	-	-	-	-	-	↗
	Average	-	-	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Volatile suspended solids (mg/L)	Surface	↘	↘	↘	-	↘	-	↘
	Middle	NA	↘	↘	NA	↘	-	↘
	Bottom	↘	↘	↘	↘	↘	-	↘
	Average	↘	↘	↘	-	↘	-	↘
5-day Biochemical Oxygen Demand (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Ammonia nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Nitrite nitrogen (mg/L)	Surface	↘	↘	↘	-	↘	-	↘
	Middle	NA	↘	↘	NA	↘	-	↘
	Bottom	↘	↘	↘	-	↘	↘	↘
	Average	↘	↘	↘	-	↘	↘	↘
Nitrate nitrogen (mg/L)	Surface	↘	↘	↘	-	↘	-	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Total inorganic nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Total nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-	-	-	↘
	Middle	NA	-	-	NA	-	↘	↘
	Bottom	-	-	-	-	-	↘	-
	Average	-	-	-	-	-	↘	-
Chlorophyll- <i>a</i> (µg/L)	Surface	↘	↘	↘	↘	↘	-	-
	Middle	NA	-	-	NA	-	-	-
	Bottom	-	-	-	-	-	↗	↗
	Average	↘	-	↘	-	-	-	-
<i>E. coli</i> (cfu/100mL)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Faecal coliforms (cfu/100mL)	Surface	↘	-	↘	-	↘	-	-
	Middle	NA	↘	↘	NA	↘	-	-
	Bottom	↘	↘	↘	-	↘	-	-
	Average	↘	↘	↘	-	↘	↘	-

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$
 2. - indicates no significant trend
 3. NA (Not Applicable) indicates the measurement was not made due to shallow water
 4. ↗ significant increase
 5. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Southern WCZ, 1986 – 2012

Monitoring Station		SM1	SM2	SM3	SM4	SM5	SM6	SM7	SM9
Monitoring Period		1986 2012	1986 2012	1986 2012	1986 2012	1986 2012	1986 2012	1986 2012	1988 2012
Parameter	Water Depth								
Temperature (°C)	Surface	-	-	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	-	↗	↗	↗	↗	↗
	Bottom	-	-	↗	↗	↗	↗	↗	↗
	Average	-	-	-	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	↗
	Average	-	-	-	-	-	-	-	↗
pH	Surface	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)								↘	↘
Turbidity (NTU)	Surface	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Suspended Solids (mg/L)	Surface	-	-	-	↘	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	↗	-	↘
	Average	-	-	-	-	-	-	-	↘
Volatile suspended solids (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Ammonia nitrogen (mg/L)	Surface	-	-	-	↗	-	-	-	↗
	Middle	-	-	-	↗	-	-	↗	↗
	Bottom	-	-	-	↗	-	-	↗	↗
	Average	-	-	-	↗	-	-	↗	↗
Unionised Ammonia (mg/L)	Surface	↘	-	-	-	-	-	-	-
	Middle	↘	-	-	-	-	-	-	-
	Bottom	↘	-	-	-	-	-	-	-
	Average	↘	↘	-	-	-	-	-	-
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗	↗	↗
	Middle	-	↗	↗	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↗	↗	↗	↗	-	-	↗	↗
	Middle	-	↗	↗	↗	-	-	↗	↗
	Bottom	-	↗	↗	↗	↗	-	↗	↗
	Average	↗	↗	↗	↗	↗	-	↗	↗
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	↘	-
Total nitrogen (mg/L)	Surface	↘	-	↘	-	-	-	-	-
	Middle	↘	↘	↘	-	-	-	-	-
	Bottom	↘	↘	↘	-	-	-	-	-
	Average	↘	↘	↘	-	-	-	-	-
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	-	↘	↘	↘	↘
	Middle	-	↘	↘	-	↘	↘	↘	↘
	Bottom	↘	↘	↘	-	↘	↘	↘	↘
	Average	↘	↘	↘	-	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	-	-	-	-	-	-	-	↗
	Middle	-	-	-	-	-	-	-	↗
	Bottom	-	-	-	-	-	-	-	↗
	Average	-	-	-	-	-	-	-	↗
<i>E. coli</i> (cfu/100mL)	Surface	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	↘	-	-	-	-	-	-	-
Faecal coliforms (cfu/100mL)	Surface	-	↗	↗	↗	-	-	-	-
	Middle	-	-	↗	↗	-	-	-	-
	Bottom	-	-	↗	↗	-	-	↗	-
	Average	-	↗	-	↗	↗	-	-	-

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↗ significant increase

4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Southern WCZ, 1986 – 2012 (continued)

Monitoring Station		SM10	SM11	SM12	SM13	SM17	SM18	SM19	SM20
Monitoring Period		1986 I 2012	1986 I 2012	1986 I 2012	1986 I 2012	1989 I 2012	1989 I 2012	1989 I 2012	1999 I 2012
Parameter	Water Depth								
Temperature (°C)	Surface	↗	↗	↗	↗	↗	↗	-	-
	Middle	NA	↗	↗	↗	↗	↗	-	-
	Bottom	↗	↗	↗	↗	↗	↗	-	-
	Average	↗	↗	↗	↗	↗	↗	-	-
Salinity	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	↗	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
pH	Surface	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	-	-	-	-	-	-	↗
Turbidity (NTU)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	↘
	Average	-	-	-	-	-	-	-	↘
Suspended Solids (mg/L)	Surface	-	-	-	-	↘	↘	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	↘
	Average	-	-	-	-	-	-	-	↘
Volatile suspended solids (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	↘	↘	↘	-	-	-	-
	Average	-	-	↘	↘	-	-	-	-
Ammonia nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	↗	-	-	-	-	-	-
	Bottom	↗	↗	↗	-	-	-	-	-
	Average	↗	↗	↗	-	-	-	-	-
Unionised Ammonia (mg/L)	Surface	-	-	-	-	↘	-	-	-
	Middle	NA	-	-	-	↘	-	-	-
	Bottom	-	-	-	-	↘	-	-	-
	Average	-	-	-	-	↘	-	-	-
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗	-	↗
	Middle	NA	↗	↗	↗	↗	-	↗	↗
	Bottom	↗	↗	↗	↗	↗	-	↗	↗
	Average	↗	↗	↗	↗	↗	-	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	-	-	↗
	Middle	NA	↗	↗	↗	↗	-	↗	↗
	Bottom	↗	↗	↗	↗	↗	-	↗	↗
	Average	↗	↗	↗	↗	↗	-	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	-	-	↗
	Middle	NA	↗	↗	↗	↗	-	-	↗
	Bottom	↗	↗	↗	↗	↗	-	-	↗
	Average	↗	↗	↗	↗	↗	-	-	↗
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	-	↘	-	↘
	Middle	NA	↘	↘	↘	-	↘	-	↘
	Bottom	↘	↘	↘	↘	-	↘	-	↘
	Average	↘	↘	↘	↘	-	↘	-	↘
Total nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	↗
	Middle	NA	-	-	-	-	-	-	↗
	Bottom	-	-	-	-	-	-	-	↗
	Average	-	-	-	-	-	-	-	↗
Orthophosphate phosphorus (mg/L)	Surface	↘	-	↘	↘	↘	↘	↘	-
	Middle	NA	-	↘	↘	↘	↘	↘	-
	Bottom	↘	-	↘	↘	↘	↘	↘	-
	Average	↘	-	↘	↘	↘	↘	↘	-
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	-
	Middle	NA	↘	↘	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	↘	-
Silica (mg/L)	Surface	-	-	-	-	-	↘	-	-
	Middle	NA	-	-	-	-	↘	-	-
	Bottom	-	-	-	-	-	↘	-	-
	Average	-	-	-	-	-	↘	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	↗	↗	↗	↗	-	-	-	-
	Middle	NA	-	↗	↗	-	-	-	↘
	Bottom	↗	-	↗	↗	↗	-	-	-
	Average	↗	-	↗	↗	-	-	-	-
<i>E. coli</i> (cfu/100mL)	Surface	↘	↘	-	-	-	-	-	-
	Middle	NA	↘	-	-	-	-	-	-
	Bottom	↘	↘	-	-	-	-	-	-
	Average	↘	↘	-	-	-	-	-	-
Faecal coliforms (cfu/100mL)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	↘	↗	↗	-	-	-	-
	Average	-	-	-	↗	-	-	-	-

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. NA (Not Applicable) indicates the measurement was not made due to shallow water

4. ↗ significant increase

5. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Victoria Harbour WCZ, 1986 – 2012

Monitoring Station		VM1	VM2	VM4	VM5	VM6
Monitoring Period		1988 I 2012	1988 I 2012	1988 I 2012	1986 I 2012	1988 I 2012
Parameter	Water Depth					
Temperature (°C)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-
	Middle	↗	-	-	-	-
	Bottom	↗	-	-	-	-
	Average	↗	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Dissolved Oxygen (%)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
pH	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	-
	Average	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	-	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Volatile suspended solids (mg/L)	Surface	↘	↘	↘	-	↘
	Middle	↘	↘	↘	-	↘
	Bottom	-	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
5-day Biochemical Oxygen Demand (mg/L)	Surface	↘	↘	↘	-	-
	Middle	↘	↘	↘	-	-
	Bottom	↘	↘	↘	-	-
	Average	↘	↘	↘	-	-
Ammonia nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Nitrite nitrogen (mg/L)	Surface	-	-	-	↗	↗
	Middle	↘	-	-	↗	-
	Bottom	↘	-	-	↗	-
	Average	↘	-	-	↗	-
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	-	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↘	↘	↘	-	-
	Middle	↘	↘	↘	-	-
	Bottom	↘	↘	↘	-	-
	Average	↘	↘	↘	-	-
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Total nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-	-
	Middle	↘	-	-	-	-
	Bottom	↘	-	-	-	-
	Average	↘	-	-	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	-	-	↗	-	-
	Middle	-	↗	↗	-	-
	Bottom	-	↗	↗	-	-
	Average	-	↗	↗	-	-
<i>E. coli</i> (cfu/100mL)	Surface	↘	↘	↘	↗	-
	Middle	↘	↘	↘	↗	-
	Bottom	↘	↘	↘	↗	-
	Average	↘	↘	↘	↗	-
Faecal coliforms (cfu/100mL)	Surface	↘	↘	-	↗	↗
	Middle	↘	↘	-	↗	↗
	Bottom	↘	↘	-	↗	↗
	Average	↘	↘	-	↗	↗

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↗ significant increase

4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Victoria Harbour WCZ, 1986 – 2012 (continued)

Monitoring Station		VM7	VM8	VM12	VM14	VM15
Monitoring Period		1986 1 2012	1986 1 2012	1986 1 2012	1986 1 2012	1993 1 2012
Parameter	Water Depth					
Temperature (°C)	Surface	↗	↗	↗	↗	-
	Middle	↗	↗	↗	↗	-
	Bottom	↗	↗	↗	↗	-
	Average	↗	↗	↗	↗	-
Salinity	Surface	-	-	-	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	-
	Average	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	-	↗	↗	↗
	Middle	↗	-	↗	↗	↗
	Bottom	↗	-	↗	↗	↗
	Average	↗	-	↗	↗	↗
Dissolved Oxygen (%)	Surface	↗	-	↗	↗	↗
	Middle	↗	-	↗	↗	↗
	Bottom	↗	-	↗	↗	↗
	Average	↗	-	↗	↗	↗
pH	Surface	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	-
Secchi disc depth (m)		↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	↗	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	-
	Average	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	-	-	↘
	Middle	↘	↘	-	-	↘
	Bottom	↘	↘	-	-	↘
	Average	↘	↘	-	-	↘
Volatile suspended solids (mg/L)	Surface	↘	↘	-	↘	-
	Middle	↘	↘	-	↘	-
	Bottom	↘	↘	-	↘	-
	Average	↘	↘	-	↘	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	↘	↘	-
	Middle	-	-	↘	↘	-
	Bottom	-	-	↘	↘	-
	Average	-	-	↘	↘	-
Ammonia nitrogen (mg/L)	Surface	↘	↗	↘	↘	↘
	Middle	↘	↗	↘	↘	↘
	Bottom	↘	↗	↘	↘	↘
	Average	↘	↗	↘	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	-	↘	↘	-
	Middle	↘	-	↘	↘	-
	Bottom	↘	-	↘	↘	-
	Average	↘	-	↘	↘	-
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	-	↗	-	↗	-
	Middle	-	↗	-	↗	-
	Bottom	-	↗	-	↗	↘
	Average	-	↗	-	↗	↘
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Total nitrogen (mg/L)	Surface	↘	-	↘	↘	↘
	Middle	↘	-	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	-	↘	↘	↘
	Middle	↘	-	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	↘	-
	Middle	-	-	-	↘	-
	Bottom	-	-	-	↘	-
	Average	-	-	-	↘	-
Chlorophyll- <i>a</i> (µg/L)	Surface	-	-	-	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	-
	Average	-	-	-	-	-
<i>E. coli</i> (cfu/100mL)	Surface	↗	↗	-	↘	↘
	Middle	↗	↗	-	↘	↘
	Bottom	↗	↗	-	↘	↘
	Average	↗	↗	-	↘	↘
Faecal coliforms (cfu/100mL)	Surface	↗	↗	-	↘	-
	Middle	↗	↗	-	↘	-
	Bottom	↗	↗	-	↘	-
	Average	↗	↗	-	↘	-

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↗ significant increase

4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Eastern Buffer WCZ, 1986 – 2012

Monitoring Station		EM1	EM2	EM3
Monitoring Period		1986 I 2012	1986 I 2012	1988 I 2012
Parameter	Water Depth			
Temperature (°C)	Surface	↗	↗	↗
	Middle	↗	↗	↗
	Bottom	↗	↗	↗
	Average	↗	↗	↗
Salinity	Surface	-	-	-
	Middle	-	-	-
	Bottom	-	-	-
	Average	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	-	-
	Middle	↗	-	-
	Bottom	-	-	-
	Average	↗	-	-
Dissolved Oxygen (%)	Surface	↗	↗	-
	Middle	↗	↗	-
	Bottom	↗	↗	-
	Average	↗	↗	-
pH	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Secchi disc depth (m)		↗	↘	↘
Turbidity (NTU)	Surface	-	↗	↗
	Middle	-	-	↗
	Bottom	-	↗	↗
	Average	-	↗	↗
Suspended Solids (mg/L)	Surface	↘	↘	-
	Middle	↘	-	-
	Bottom	↘	-	-
	Average	↘	-	-
Volatile suspended solids (mg/L)	Surface	↘	-	-
	Middle	↘	-	-
	Bottom	↘	-	-
	Average	↘	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	↘	-	-
	Middle	↘	↘	-
	Bottom	↘	-	↘
	Average	↘	↘	↘
Ammonia nitrogen (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Nitrite nitrogen (mg/L)	Surface	-	-	-
	Middle	↘	-	-
	Bottom	↘	-	-
	Average	↘	-	-
Nitrate nitrogen (mg/L)	Surface	-	-	-
	Middle	-	-	-
	Bottom	-	-	-
	Average	-	-	-
Total inorganic nitrogen (mg/L)	Surface	↘	↘	-
	Middle	↘	↘	-
	Bottom	↘	↘	-
	Average	↘	↘	-
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Total nitrogen (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Silica (mg/L)	Surface	-	-	-
	Middle	-	-	-
	Bottom	-	-	-
	Average	-	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	-	-	-
	Middle	-	-	-
	Bottom	-	-	-
	Average	-	-	-
<i>E. coli</i> (cfu/100mL)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Faecal coliforms (cfu/100mL)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↗ significant increase

4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Western Buffer WCZ, 1986 – 2012

Monitoring Station		WM1	WM2	WM3	WM4
Monitoring Period		1988 I 2012	1988 I 2012	1986 I 2012	1986 I 2012
Parameter	Water Depth				
Temperature (°C)	Surface	↗	↗	↗	↗
	Middle	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗
	Average	↗	↗	↗	↗
Salinity	Surface	↗	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	↗	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	↗	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	-	-	-	-
pH	Surface	↘	↘	↘	↘
	Middle	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘
	Average	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	↗	-	-	-
	Average	-	-	-	-
Suspended Solids (mg/L)	Surface	-	-	↘	↘
	Middle	-	-	-	-
	Bottom	↗	-	-	-
	Average	-	-	-	-
Volatile suspended solids (mg/L)	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	↗	-	-	-
	Average	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	-	-	-	-
Ammonia nitrogen (mg/L)	Surface	-	↗	-	↗
	Middle	-	↗	-	↗
	Bottom	-	↗	-	↗
	Average	-	↗	-	↗
Unionised Ammonia (mg/L)	Surface	↘	-	-	-
	Middle	↘	-	-	-
	Bottom	↘	-	↘	↘
	Average	↘	-	↘	↘
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗
	Middle	-	↗	-	↗
	Bottom	-	↗	-	↗
	Average	↗	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗
	Middle	-	↗	↗	↗
	Bottom	-	↗	↗	↗
	Average	-	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↗	↗	↗	↗
	Middle	-	↗	-	↗
	Bottom	-	↗	-	↗
	Average	-	↗	↗	↗
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘
	Middle	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘
	Average	↘	↘	↘	↘
Total nitrogen (mg/L)	Surface	-	-	-	-
	Middle	↘	-	↘	↘
	Bottom	↘	-	↘	↘
	Average	↘	-	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	-	↘	↘
	Middle	↘	-	↘	↘
	Bottom	↘	-	↘	↘
	Average	↘	-	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘
	Middle	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘
	Average	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	-	-	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	-	-	-	↗
	Middle	-	-	-	-
	Bottom	↗	-	-	-
	Average	-	-	-	-
<i>E. coli</i> (cfu/100mL)	Surface	-	↗	↗	↗
	Middle	-	↗	↗	↗
	Bottom	-	↗	↗	↗
	Average	-	↗	↗	↗
Faecal coliforms (cfu/100mL)	Surface	-	↗	↗	↗
	Middle	-	↗	↗	↗
	Bottom	-	↗	↗	↗
	Average	-	↗	↗	↗

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↗ significant increase

4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Junk Bay WCZ, 1986 – 2012

Monitoring Station		JM3	JM4
Monitoring Period		1986 I 2012	1986 I 2012
Parameter	Water Depth		
Temperature (°C)	Surface	↗	↗
	Middle	↗	↗
	Bottom	↗	↗
	Average	↗	↗
Salinity	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
Dissolved Oxygen (mg/L)	Surface	-	-
	Middle	↗	↗
	Bottom	↗	-
	Average	↗	-
Dissolved Oxygen (%)	Surface	↗	↗
	Middle	↗	↗
	Bottom	↗	↗
	Average	↗	↗
pH	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Secchi disc depth (m)		-	-
Turbidity (NTU)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	↗
Suspended Solids (mg/L)	Surface	↘	↘
	Middle	-	-
	Bottom	-	-
	Average	↘	-
Volatile suspended solids (mg/L)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Ammonia nitrogen (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Nitrite nitrogen (mg/L)	Surface	-	-
	Middle	-	-
	Bottom	-	↘
	Average	-	-
Nitrate nitrogen (mg/L)	Surface	-	↗
	Middle	↗	-
	Bottom	-	-
	Average	-	-
Total inorganic nitrogen (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Total nitrogen (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Silica (mg/L)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
<i>E. coli</i> (cfu/100mL)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Faecal coliforms (cfu/100mL)	Surface	-	-
	Middle	-	↘
	Bottom	↘	↘
	Average	-	↘

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↗ significant increase

4. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the Deep Bay WCZ, 1986 – 2012

Monitoring Station		DM1	DM2	DM3	DM4	DM5
Monitoring Period		1986 I 2012	1986 I 2012	1986 I 2012	1986 I 2012	1991 I 2012
Parameter	Water Depth					
Temperature (°C)	Surface	↗	↗	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	↗	↗	↗	↗	↗
Salinity	Surface	↘	↘	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	↘
	Average	↘	↘	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	↘	↘	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	↘	-
	Average	-	-	↘	↘	-
Dissolved Oxygen (%)	Surface	-	-	↘	↘	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	-	-	↘	↘	-
pH	Surface	↘	↘	↘	↘	↘
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	↘
	Average	↘	↘	↘	↘	↘
Secchi disc depth (m)		-	-	-	-	-
Turbidity (NTU)	Surface	-	-	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	-	-	-	-	-
Suspended Solids (mg/L)	Surface	-	-	-	-	↘
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	↘
	Average	-	-	-	-	↘
Volatile suspended solids (mg/L)	Surface	-	-	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	-	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	↗	↗	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	↗	↗	-	-	-
Ammonia nitrogen (mg/L)	Surface	-	↗	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	-	↗	↗	↗	↗
Unionised Ammonia (mg/L)	Surface	-	-	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	-	-	-	-	-
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	↗	↗	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	-	-	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	-	-	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	↗	↗	↗	↗	↗
Total Kjeldahl nitrogen (mg/L)	Surface	-	↗	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	-	↗	-	-	-
Total nitrogen (mg/L)	Surface	-	↗	↗	↗	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	↗	-
	Average	-	↗	↗	↗	-
Orthophosphate phosphorus (mg/L)	Surface	↘	-	-	↗	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	↗	-
	Average	↘	-	-	-	-
Total phosphorus (mg/L)	Surface	↘	↘	↘	-	↘
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	↘
	Average	↘	↘	↘	-	↘
Silica (mg/L)	Surface	-	-	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	-	-	-	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	-	↗	-	-	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	-	↗	↗	-	↗
<i>E. coli</i> (cfu/100mL)	Surface	-	-	-	↗	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	↗	-
	Average	-	-	-	↗	-
Faecal coliforms (cfu/100mL)	Surface	-	-	-	↗	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	↗	↗
	Average	-	-	-	↗	-

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. NA (Not Applicable) indicates the measurement was not made due to shallow water

4. ↗ significant increase

5. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in the North Western WCZ, 1986 – 2012

Monitoring Station		NM1	NM2	NM3	NM5	NM6	NM8
Monitoring Period		1988 1 2012	1986 1 2012	1986 1 2012	1988 1 2012	1991 1 2012	1999 1 2012
Parameter	Water Depth						
Temperature (°C)	Surface	-	-	-	-	-	-
	Middle	-	-	↗	↗	-	-
	Bottom	-	-	-	-	-	-
	Average	-	-	↗	↗	-	-
Salinity	Surface	-	-	-	-	-	-
	Middle	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-
	Average	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-	-	↗
	Middle	-	-	-	↘	-	-
	Bottom	-	-	-	-	-	-
	Average	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	-	-	-	↗
	Middle	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-
	Average	-	-	-	-	-	-
pH	Surface	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-	-	↘
	Middle	-	-	-	-	-	↘
	Bottom	-	-	-	-	-	↘
	Average	-	-	-	-	-	↘
Suspended Solids (mg/L)	Surface	-	-	↘	↘	-	-
	Middle	-	↘	↘	-	-	-
	Bottom	-	↘	↘	-	-	-
	Average	-	↘	↘	-	-	-
Volatile suspended solids (mg/L)	Surface	-	-	-	-	-	-
	Middle	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-
	Average	-	-	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	-	-	-	-
	Middle	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-
	Average	-	-	-	-	-	-
Ammonia nitrogen (mg/L)	Surface	↗	↗	↗	↗	-	-
	Middle	↗	↗	↗	↗	-	-
	Bottom	↗	↗	↗	↗	-	-
	Average	↗	↗	↗	↗	-	-
Unionised Ammonia (mg/L)	Surface	-	-	-	-	-	-
	Middle	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-
	Average	-	-	-	-	-	-
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗	-
	Bottom	↗	↗	↗	↗	↗	-
	Average	↗	↗	↗	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	-
	Middle	-	↗	↗	↗	-	-
	Bottom	-	↗	↗	↗	-	-
	Average	-	↗	↗	↗	-	-
Total inorganic nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	-
	Middle	↗	↗	↗	↗	↗	-
	Bottom	↗	↗	↗	↗	↗	-
	Average	↗	↗	↗	↗	↗	-
Total Kjeldahl nitrogen (mg/L)	Surface	-	↘	↘	-	↘	-
	Middle	↘	↘	↘	-	-	-
	Bottom	↘	↘	↘	-	-	-
	Average	↘	↘	↘	-	↘	-
Total nitrogen (mg/L)	Surface	-	-	-	-	-	-
	Middle	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-
	Average	-	-	-	-	-	-
Orthophosphate phosphorus (mg/L)	Surface	↘	-	-	-	↘	-
	Middle	-	-	-	-	↘	-
	Bottom	-	-	-	-	↘	-
	Average	↘	-	-	-	↘	-
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	-
Silica (mg/L)	Surface	-	-	-	-	-	-
	Middle	-	-	-	-	-	-
	Bottom	-	-	-	↘	-	-
	Average	-	-	-	-	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	-	-	↗	-	↗	-
	Middle	-	-	↗	↗	↗	-
	Bottom	-	-	↗	↗	↗	-
	Average	-	-	↗	↗	↗	-
<i>E. coli</i> (cfu/100mL)	Surface	-	-	↘	↗	-	-
	Middle	-	-	-	↗	-	-
	Bottom	-	-	-	↗	-	-
	Average	-	-	-	↗	-	-
Faecal coliforms (cfu/100mL)	Surface	-	-	-	↗	-	↘
	Middle	-	-	-	↗	-	-
	Bottom	-	-	-	↗	-	-
	Average	-	-	-	↗	-	↘

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$

2. - indicates no significant trend

3. ↗ significant increase

4. ↘ significant decrease

Summary statistics for bottom sediment quality in the Tolo Harbour and Channel and Southern WCZs, 2008 – 2012

Parameter	Tolo Harbour and Channel				Hong Kong Island		West Lamma Channel	
	Harbour	Subzone	Buffer Subzone	Channel Subzone	(South)		SS3	SS4
	TS2	TS3	TS4	TS5	SS1	SS2		
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	70 (59 - 81)	81 (71 - 98)	65 (53 - 79)	89 (80 - 97)	74 (63 - 93)	80 (62 - 94)	75 (66 - 83)	90 (73 - 98)
Electrochemical Potential (mV)	-275 (-352 - -185)	-275 (-348 - -165)	-275 (-376 - -190)	-324 (-380 - -262)	-192 (-382 - -82)	-200 (-362 - -88)	-189 (-366 - -64)	-183 (-385 - -68)
Total Solids (%w/w)	37 (32 - 47)	35 (29 - 43)	40 (30 - 61)	31 (28 - 37)	57 (47 - 62)	50 (46 - 60)	50 (40 - 54)	46 (42 - 55)
Total Volatile Solids (%w/w)	8.5 (6.8 - 10.0)	8.2 (6.2 - 9.9)	8.2 (4.7 - 10.0)	9.8 (9.4 - 10.0)	5.2 (3.9 - 6.2)	6.2 (5.4 - 6.7)	6.4 (5.6 - 8.5)	6.2 (4.9 - 7.1)
Chemical Oxygen Demand (mg/kg)	20200 (17000 - 24000)	19000 (15000 - 23000)	17200 (14000 - 20000)	16900 (15000 - 19000)	9470 (7700 - 12000)	11680 (9800 - 14000)	14220 (9400 - 18000)	13600 (11000 - 16000)
Total Carbon (%w/w)	0.8 (0.7 - 1.1)	0.7 (0.6 - 0.8)	1.0 (0.8 - 1.3)	0.8 (0.7 - 1.0)	0.9 (0.7 - 1.0)	0.7 (0.6 - 0.9)	0.9 (0.6 - 1.1)	0.6 (0.6 - 0.7)
Ammonical Nitrogen (mg/kg)	6.5 (1.0 - 13.0)	2.9 (<0.1 - 7.5)	6.5 (1.7 - 14.0)	12.8 (7.9 - 25.0)	6.2 (2.2 - 15.0)	4.3 (0.1 - 7.5)	5.0 (0.8 - 11.0)	3.3 (1.0 - 8.8)
Total Kjeldahl Nitrogen (mg/kg)	560 (420 - 690)	530 (350 - 630)	610 (400 - 740)	710 (610 - 850)	400 (340 - 440)	470 (360 - 600)	400 (320 - 470)	480 (380 - 710)
Total Phosphorus (mg/kg)	170 (140 - 190)	160 (140 - 190)	170 (130 - 190)	200 (180 - 230)	230 (180 - 290)	220 (170 - 290)	210 (150 - 240)	210 (190 - 290)
Total Sulphide (mg/kg)	85 (11 - 290)	65 (10 - 160)	99 (17 - 270)	88 (24 - 170)	11 (5 - 26)	19 (1 - 46)	19 (3 - 55)	20 (0 - 73)
Total Cyanide (mg/kg)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.2)	<0.1 (<0.1 - 0.1)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)
Arsenic (mg/kg)	8.4 (5.9 - 10.0)	9.2 (6.6 - 11.0)	7.2 (5.7 - 9.2)	6.1 (5.3 - 6.6)	6.7 (6.1 - 7.9)	8.4 (6.8 - 9.5)	7.0 (4.7 - 8.4)	8.0 (6.9 - 9.9)
Cadmium (mg/kg)	0.5 (0.2 - 0.7)	0.6 (0.3 - 0.7)	0.4 (0.2 - 0.5)	0.3 (0.2 - 0.3)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)
Chromium (mg/kg)	23 (15 - 27)	22 (14 - 29)	21 (16 - 24)	33 (31 - 37)	22 (18 - 28)	31 (27 - 38)	30 (21 - 39)	37 (32 - 47)
Copper (mg/kg)	28 (15 - 39)	31 (21 - 47)	20 (15 - 27)	20 (17 - 22)	10 (9 - 11)	19 (16 - 22)	17 (12 - 25)	30 (26 - 35)
Lead (mg/kg)	78 (66 - 92)	86 (76 - 99)	57 (43 - 68)	50 (46 - 54)	26 (22 - 28)	33 (30 - 37)	33 (28 - 46)	41 (32 - 46)
Mercury (mg/kg)	0.07 (0.05 - 0.10)	0.06 (0.05 - 0.10)	0.06 (0.05 - 0.07)	0.06 (0.05 - 0.08)	0.05 (0.05 - 0.06)	0.08 (0.06 - 0.13)	0.09 (0.06 - 0.17)	0.12 (0.10 - 0.13)
Nickel (mg/kg)	14 (9 - 17)	13 (9 - 18)	14 (11 - 17)	24 (19 - 26)	16 (14 - 17)	20 (18 - 22)	20 (15 - 26)	22 (19 - 24)
Silver (mg/kg)	0.4 (0.2 - 0.6)	0.4 (0.3 - 0.5)	0.2 (0.2 - 0.3)	0.2 (0.2 - 0.3)	<0.2 (<0.2 - 0.2)	0.2 (0.2 - 0.3)	<0.2 (<0.2 - 0.2)	0.4 (0.3 - 0.4)
Zinc (mg/kg)	180 (130 - 270)	230 (140 - 330)	130 (82 - 150)	120 (110 - 140)	63 (51 - 80)	91 (77 - 110)	82 (67 - 120)	110 (94 - 140)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) ⁽³⁾	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ⁽⁴⁾	91 (90 - 94)	92 (90 - 100)	95 (90 - 110)	98 (90 - 140)	94 (90 - 120)	100 (90 - 150)	96 (90 - 110)	98 (90 - 160)
High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ^{(5) (6)}	47 (16 - 63)	47 (31 - 69)	43 (24 - 65)	58 (47 - 72)	61 (25 - 230)	100 (38 - 280)	66 (22 - 130)	100 (57 - 160)

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

Summary statistics for bottom sediment quality in the Southern, Junk Bay and Deep Bay WCZs, 2008 – 2012

Parameter	Lantau Island		Junk Bay	Inner Deep Bay		Outer Deep Bay	
	(East) SS5	(South) SS6	JS2	DS1	DS2	DS3	DS4
Number of samples	10	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	91 (85 - 96)	71 (52 - 87)	87 (68 - 96)	53 (18 - 94)	64 (17 - 82)	75 (44 - 95)	62 (40 - 81)
Electrochemical Potential (mV)	-166 (-258 - -88)	-129 (-270 - -71)	-156 (-265 - -75)	-219 (-268 - -92)	-177 (-228 - -52)	-244 (-396 - -115)	-218 (-370 - -93)
Total Solids (%w/w)	40 (38 - 43)	64 (60 - 66)	43 (40 - 51)	52 (47 - 61)	47 (41 - 55)	49 (42 - 67)	53 (48 - 63)
Total Volatile Solids (%w/w)	7.1 (5.9 - 7.7)	3.6 (3.2 - 4.2)	6.6 (5.7 - 7.7)	5.4 (3.3 - 7.1)	6.5 (5.0 - 8.5)	6.3 (3.2 - 8.1)	5.8 (4.9 - 6.7)
Chemical Oxygen Demand (mg/kg)	13500 (11000 - 17000)	8600 (5900 - 18000)	14600 (11000 - 18000)	19700 (13000 - 24000)	17100 (13000 - 22000)	12080 (9900 - 16000)	12500 (10000 - 15000)
Total Carbon (%w/w)	0.6 (0.5 - 0.7)	0.5 (0.4 - 0.6)	0.7 (0.6 - 0.8)	0.7 (0.5 - 0.8)	0.7 (0.5 - 1.3)	0.6 (0.4 - 0.9)	0.6 (0.4 - 0.9)
Ammonical Nitrogen (mg/kg)	7.8 (0.1 - 15.0)	3.7 (1.2 - 9.4)	4.0 (0.1 - 8.2)	71.5 (12.0 - 260.0)	9.8 (0.1 - 42.0)	4.3 (0.1 - 23.0)	5.9 (0.1 - 14.0)
Total Kjeldahl Nitrogen (mg/kg)	490 (300 - 580)	320 (270 - 500)	480 (320 - 600)	500 (320 - 780)	410 (260 - 680)	350 (160 - 490)	300 (110 - 490)
Total Phosphorus (mg/kg)	190 (130 - 220)	200 (180 - 240)	190 (150 - 230)	300 (230 - 360)	270 (120 - 490)	210 (100 - 280)	170 (60 - 220)
Total Sulphide (mg/kg)	32 (2 - 93)	3 (1 - 7)	30 (2 - 81)	220 (1 - 380)	88 (1 - 360)	11 (0 - 39)	25 (1 - 140)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.3)	0.2 (0.1 - 0.2)	0.3 (0.2 - 0.4)	0.2 (0.1 - 0.4)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.2)
Arsenic (mg/kg)	7.5 (6.6 - 8.0)	5.3 (4.4 - 6.0)	7.7 (7.0 - 8.5)	9.0 (7.0 - 12.0)	11.6 (8.6 - 15.0)	11.1 (5.5 - 14.0)	11.7 (9.7 - 15.0)
Cadmium (mg/kg)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	0.1 (0.1 - 0.2)	0.3 (0.2 - 0.5)	0.3 (0.1 - 0.6)	0.1 (0.1 - 0.2)	<0.1 (<0.1 - 0.1)
Chromium (mg/kg)	41 (36 - 45)	20 (17 - 23)	44 (39 - 49)	43 (30 - 57)	43 (28 - 79)	37 (22 - 51)	36 (29 - 49)
Copper (mg/kg)	36 (33 - 39)	10 (8 - 12)	82 (73 - 97)	67 (46 - 90)	55 (28 - 100)	64 (27 - 230)	35 (10 - 65)
Lead (mg/kg)	50 (42 - 53)	24 (20 - 27)	49 (41 - 55)	50 (38 - 61)	50 (32 - 84)	44 (32 - 59)	41 (27 - 51)
Mercury (mg/kg)	0.15 (0.13 - 0.16)	0.07 (0.05 - 0.18)	0.23 (0.17 - 0.29)	0.14 (0.08 - 0.24)	0.15 (0.09 - 0.26)	0.10 (0.05 - 0.14)	0.09 (0.05 - 0.14)
Nickel (mg/kg)	25 (22 - 26)	13 (11 - 15)	22 (19 - 24)	25 (18 - 39)	24 (16 - 37)	23 (12 - 32)	20 (16 - 29)
Silver (mg/kg)	0.5 (0.4 - 0.5)	<0.2 (<0.2 - 0.2)	1.7 (1.4 - 2.0)	0.8 (0.4 - 1.6)	0.6 (0.2 - 1.6)	0.3 (0.2 - 0.6)	0.3 (0.2 - 0.4)
Zinc (mg/kg)	130 (120 - 150)	55 (44 - 63)	140 (110 - 150)	220 (150 - 280)	190 (100 - 420)	120 (65 - 150)	100 (63 - 140)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) ⁽³⁾	18 (18 - 18)	18 (18 - 18)	18 (18 - 20)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ⁽⁴⁾	93 (90 - 100)	91 (90 - 97)	98 (90 - 110)	160 (90 - 540)	97 (90 - 120)	93 (90 - 99)	95 (90 - 100)
High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ^{(5) (6)}	95 (70 - 190)	22 (20 - 29)	310 (160 - 430)	780 (100 - 4100)	150 (23 - 360)	76 (34 - 130)	58 (17 - 93)

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

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3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

Summary statistics for bottom sediment quality in the Port Shelter and Mirs Bay WCZs, 2008 – 2012

	Inner Port Shelter	Outer Port Shelter	Starling Inlet	Crooked Island	Port Island	Mirs Bay		
Parameter	PS3	PS5	PS6	MS1	MS2	MS7	MS17	(North) MS3
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63μm (%w/w)	87 (58 - 95)	57 (24 - 89)	74 (48 - 91)	87 (64 - 97)	93 (85 - 99)	93 (83 - 98)	89 (80 - 94)	71 (13 - 90)
Electrochemical Potential (mV)	-219 (-311 - -39)	-178 (-381 - -21)	-195 (-378 - -65)	-223 (-367 - -106)	-229 (-367 - -105)	-315 (-364 - -266)	-183 (-275 - -63)	-191 (-371 - -95)
Total Solids (%w/w)	37 (35 - 41)	50 (39 - 63)	50 (38 - 55)	39 (36 - 45)	33 (32 - 36)	29 (27 - 35)	35 (29 - 41)	49 (38 - 61)
Total Volatile Solids (%w/w)	10.7 (8.5 - 12.0)	7.7 (4.7 - 10.0)	7.5 (6.4 - 9.4)	7.2 (6.4 - 7.8)	8.1 (7.5 - 8.9)	9.6 (8.9 - 11.0)	8.7 (7.8 - 10.0)	6.1 (3.1 - 8.8)
Chemical Oxygen Demand (mg/kg)	16900 (14000 - 20000)	11490 (9900 - 14000)	12000 (10000 - 14000)	14200 (11000 - 17000)	14400 (11000 - 16000)	15800 (13000 - 19000)	14800 (12000 - 18000)	11890 (9900 - 16000)
Total Carbon (%w/w)	1.2 (1.0 - 1.4)	1.9 (1.0 - 3.7)	1.3 (0.9 - 1.6)	0.7 (0.5 - 0.8)	0.7 (0.5 - 0.8)	0.7 (0.6 - 0.9)	0.8 (0.6 - 1.0)	0.7 (0.5 - 1.1)
Ammonical Nitrogen (mg/kg)	5.6 (0.1 - 11.0)	7.2 (2.4 - 11.0)	12.4 (0.4 - 60.0)	5.7 (0.1 - 12.0)	8.4 (0.1 - 20.0)	9.4 (4.8 - 14.0)	5.4 (0.2 - 11.0)	7.1 (1.4 - 25.0)
Total Kjeldahl Nitrogen (mg/kg)	630 (410 - 850)	500 (320 - 700)	530 (400 - 740)	480 (350 - 620)	560 (460 - 630)	630 (530 - 710)	640 (580 - 740)	430 (250 - 510)
Total Phosphorus (mg/kg)	190 (130 - 220)	180 (120 - 210)	210 (180 - 230)	170 (140 - 190)	180 (150 - 200)	190 (180 - 210)	200 (190 - 220)	160 (100 - 200)
Total Sulphide (mg/kg)	18 (4 - 41)	14 (1 - 35)	19 (1 - 98)	37 (11 - 87)	31 (1 - 69)	35 (2 - 96)	22 (1 - 88)	20 (2 - 54)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	<0.1 (<0.1 - 0.1)	0.2 (0.1 - 0.2)	0.2 (0.1 - 0.2)	0.2 (0.1 - 0.2)	0.2 (0.1 - 0.2)	0.1 (0.1 - 0.2)
Arsenic (mg/kg)	5.8 (4.8 - 6.3)	4.2 (0.2 - 5.6)	5.8 (5.6 - 6.5)	8.1 (6.9 - 8.9)	7.2 (5.7 - 7.9)	6.6 (5.8 - 7.4)	6.4 (5.7 - 7.0)	5.8 (3.8 - 7.3)
Cadmium (mg/kg)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	0.2 (0.1 - 0.4)	0.3 (0.1 - 0.4)	0.3 (0.1 - 0.5)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)
Chromium (mg/kg)	27 (22 - 34)	22 (13 - 31)	24 (20 - 30)	27 (19 - 32)	35 (27 - 39)	35 (32 - 39)	34 (30 - 38)	27 (19 - 35)
Copper (mg/kg)	21 (12 - 26)	11 (6 - 15)	11 (9 - 14)	26 (17 - 39)	22 (19 - 23)	20 (16 - 26)	16 (14 - 19)	12 (7 - 17)
Lead (mg/kg)	36 (31 - 44)	27 (15 - 34)	30 (26 - 35)	45 (34 - 52)	46 (39 - 51)	43 (38 - 48)	43 (40 - 47)	32 (24 - 42)
Mercury (mg/kg)	0.08 (0.06 - 0.10)	0.05 (0.05 - 0.06)	<0.05 (<0.05 - 0.05)	0.07 (0.06 - 0.08)	0.06 (0.05 - 0.07)	0.07 (0.06 - 0.09)	0.06 (0.05 - 0.07)	0.06 (0.05 - 0.13)
Nickel (mg/kg)	18 (15 - 21)	16 (9 - 20)	18 (15 - 21)	17 (12 - 20)	23 (18 - 25)	23 (21 - 27)	24 (22 - 28)	18 (13 - 23)
Silver (mg/kg)	0.2 (0.2 - 0.3)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - 0.2)	0.8 (0.4 - 1.3)	0.3 (0.2 - 0.5)	0.2 (0.2 - 0.3)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - 0.2)
Zinc (mg/kg)	91 (69 - 130)	64 (29 - 92)	65 (51 - 82)	95 (69 - 110)	100 (87 - 120)	97 (82 - 120)	94 (87 - 110)	68 (51 - 89)
Total Polychlorinated Biphenyls (PCBs) (μg/kg) ⁽³⁾	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (μg/kg) ⁽⁴⁾	99 (90 - 140)	94 (90 - 110)	96 (90 - 130)	97 (90 - 140)	92 (90 - 100)	100 (90 - 160)	95 (90 - 110)	94 (90 - 100)
High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (μg/kg) ^{(5) (6)}	58 (35 - 82)	29 (19 - 36)	27 (20 - 40)	57 (28 - 190)	41 (31 - 51)	69 (28 - 170)	41 (31 - 65)	29 (18 - 67)

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3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

Summary statistics for bottom sediment quality in the Mirs Bay WCZ, 2008 – 2012

Parameter	Mirs Bay (North)		Long Harbour	Waglan Island	Mirs Bay (South)	Mirs Bay (Central)		
	MS4	MS5	MS6	MS8	MS13	MS14	MS15	MS16
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63 μ m (%w/w)	87 (69 - 97)	85 (80 - 90)	93 (87 - 98)	92 (74 - 97)	92 (82 - 99)	92 (84 - 96)	92 (87 - 97)	84 (64 - 96)
Electrochemical Potential (mV)	-174 (-267 - -82)	-149 (-250 - -95)	-226 (-300 - -91)	-163 (-283 - -92)	-161 (-291 - -59)	-162 (-270 - -88)	-153 (-244 - -106)	-152 (-267 - -99)
Total Solids (%w/w)	38 (33 - 42)	43 (41 - 47)	33 (30 - 35)	46 (38 - 51)	50 (46 - 52)	50 (46 - 52)	49 (44 - 53)	55 (49 - 61)
Total Volatile Solids (%w/w)	7.6 (6.3 - 8.6)	6.9 (6.6 - 8.0)	9.7 (9.0 - 12.0)	6.4 (5.6 - 7.1)	6.1 (5.7 - 6.8)	5.7 (4.9 - 6.3)	6.0 (5.4 - 6.7)	5.6 (4.7 - 6.5)
Chemical Oxygen Demand (mg/kg)	13400 (11000 - 16000)	12400 (10000 - 14000)	15200 (12000 - 17000)	10050 (8800 - 12000)	9020 (7800 - 10000)	8900 (7700 - 10000)	8620 (7300 - 10000)	9050 (7800 - 11000)
Total Carbon (%w/w)	0.7 (0.6 - 0.8)	0.7 (0.6 - 0.8)	0.9 (0.7 - 1.2)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.6)	0.5 (0.5 - 0.6)	0.6 (0.5 - 0.6)	0.7 (0.6 - 0.8)
Ammonical Nitrogen (mg/kg)	5.6 (0.2 - 22.0)	4.9 (0.1 - 9.6)	7.7 (4.7 - 10.0)	3.4 (1.2 - 7.3)	1.7 (0.7 - 3.1)	1.7 (0.1 - 4.0)	2.7 (0.2 - 5.4)	3.4 (1.9 - 5.7)
Total Kjeldahl Nitrogen (mg/kg)	530 (430 - 680)	510 (390 - 630)	680 (580 - 770)	440 (350 - 550)	390 (240 - 540)	410 (230 - 510)	460 (410 - 500)	390 (240 - 540)
Total Phosphorus (mg/kg)	180 (150 - 200)	190 (160 - 220)	210 (190 - 230)	200 (170 - 230)	210 (130 - 250)	210 (130 - 240)	230 (210 - 250)	210 (160 - 250)
Total Sulphide (mg/kg)	11 (2 - 28)	11 (1 - 24)	18 (2 - 63)	9 (1 - 30)	44 (0 - 390)	5 (1 - 13)	7 (1 - 17)	8 (1 - 16)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.3)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	<0.1 (<0.1 - 0.1)
Arsenic (mg/kg)	6.4 (5.5 - 7.1)	6.5 (6.1 - 7.2)	6.1 (5.2 - 6.9)	6.8 (5.4 - 7.9)	7.3 (6.3 - 8.3)	7.0 (6.4 - 8.3)	6.3 (5.2 - 7.3)	6.2 (5.3 - 7.2)
Cadmium (mg/kg)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	0.1 (0.1 - 0.2)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)
Chromium (mg/kg)	33 (30 - 38)	29 (24 - 32)	32 (29 - 36)	31 (25 - 35)	31 (27 - 34)	30 (27 - 34)	28 (25 - 30)	27 (21 - 33)
Copper (mg/kg)	14 (10 - 16)	12 (10 - 14)	17 (14 - 19)	12 (8 - 15)	11 (9 - 12)	10 (7 - 13)	10 (7 - 12)	9 (6 - 12)
Lead (mg/kg)	37 (34 - 44)	39 (31 - 45)	42 (39 - 47)	33 (29 - 37)	32 (29 - 33)	32 (29 - 34)	30 (23 - 33)	30 (26 - 35)
Mercury (mg/kg)	0.05 (0.05 - 0.06)	0.05 (0.05 - 0.06)	0.07 (0.05 - 0.11)	0.05 (0.05 - 0.06)	0.05 (0.05 - 0.07)	<0.05 (<0.05 - 0.05)	<0.05 (<0.05 - 0.05)	<0.05 (<0.05 - 0.05)
Nickel (mg/kg)	23 (21 - 27)	21 (17 - 24)	23 (21 - 26)	22 (18 - 26)	23 (20 - 27)	22 (19 - 26)	20 (17 - 24)	20 (17 - 22)
Silver (mg/kg)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - 0.2)
Zinc (mg/kg)	82 (73 - 92)	79 (64 - 100)	97 (89 - 110)	77 (64 - 89)	77 (71 - 84)	74 (66 - 87)	69 (64 - 75)	67 (55 - 84)
Total Polychlorinated Biphenyls (PCBs) (μ g/kg) ⁽³⁾	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (μ g/kg) ⁽⁴⁾	94 (90 - 110)	91 (90 - 100)	95 (90 - 120)	99 (90 - 160)	94 (90 - 120)	91 (90 - 97)	96 (90 - 140)	94 (90 - 120)
High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (μ g/kg) ^{(5) (6)}	33 (28 - 42)	29 (19 - 38)	52 (29 - 70)	36 (17 - 67)	38 (19 - 59)	26 (19 - 40)	27 (19 - 51)	30 (17 - 91)

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4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

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6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

Summary statistics for bottom sediment quality in the North Western and Western Buffer W CZs, 2008 – 2012

	Pearl Island	Pillar Point	Urmston Road	Chek Lap Kok (North)	Tsing Yi (South)	Hong Kong Island (West)
Parameter	NS2	NS3	NS4	NS6	WS1	WS2
Number of samples	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	69 (44 - 90)	71 (20 - 96)	62 (31 - 95)	57 (26 - 86)	72 (39 - 90)	88 (74 - 97)
Electrochemical Potential (mV)	-188 (-380 - -57)	-206 (-390 - -42)	-235 (-403 - -83)	-182 (-372 - -57)	-204 (-327 - -88)	-160 (-338 - -58)
Total Solids (%w/w)	50 (41 - 58)	50 (43 - 59)	57 (44 - 68)	60 (52 - 71)	48 (43 - 63)	45 (43 - 49)
Total Volatile Solids (%w/w)	5.9 (4.9 - 6.5)	6.4 (4.9 - 7.2)	5.3 (4.2 - 6.6)	4.4 (2.9 - 5.6)	6.0 (4.6 - 6.7)	5.9 (5.1 - 6.9)
Chemical Oxygen Demand (mg/kg)	11890 (9900 - 14000)	13340 (9400 - 17000)	13100 (11000 - 17000)	12300 (10000 - 15000)	14700 (12000 - 18000)	13540 (9400 - 21000)
Total Carbon (%w/w)	0.8 (0.5 - 1.2)	0.8 (0.5 - 1.2)	0.7 (0.5 - 0.9)	0.6 (0.3 - 1.2)	0.7 (0.6 - 0.9)	0.6 (0.5 - 0.6)
Ammonical Nitrogen (mg/kg)	3.7 (0.1 - 9.3)	7.5 (0.1 - 21.0)	5.6 (0.1 - 22.0)	3.5 (0.1 - 17.0)	8.4 (0.2 - 18.0)	2.8 (0.1 - 6.2)
Total Kjeldahl Nitrogen (mg/kg)	360 (290 - 440)	350 (170 - 470)	310 (110 - 440)	270 (180 - 490)	430 (340 - 560)	420 (270 - 570)
Total Phosphorus (mg/kg)	180 (150 - 230)	180 (140 - 220)	170 (77 - 230)	140 (100 - 260)	190 (160 - 210)	180 (140 - 220)
Total Sulphide (mg/kg)	23 (2 - 51)	49 (0 - 130)	52 (2 - 220)	10 (0 - 44)	71 (4 - 160)	18 (4 - 63)
Total Cyanide (mg/kg)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.2)	0.2 (0.1 - 0.2)
Arsenic (mg/kg)	8.3 (4.5 - 10.0)	11.5 (8.3 - 14.0)	10.3 (8.1 - 15.0)	10.0 (7.1 - 13.0)	7.8 (3.8 - 8.9)	8.5 (6.9 - 12.0)
Cadmium (mg/kg)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	0.1 (0.1 - 0.2)	<0.1 (<0.1 - 0.1)
Chromium (mg/kg)	31 (14 - 41)	35 (22 - 44)	29 (22 - 47)	26 (16 - 35)	36 (17 - 58)	35 (31 - 40)
Copper (mg/kg)	34 (13 - 49)	32 (13 - 48)	26 (12 - 51)	14 (9 - 24)	48 (13 - 68)	26 (17 - 33)
Lead (mg/kg)	37 (20 - 45)	42 (31 - 51)	37 (29 - 53)	31 (16 - 47)	37 (24 - 46)	37 (30 - 41)
Mercury (mg/kg)	0.09 (0.05 - 0.13)	0.11 (0.07 - 0.16)	0.09 (0.06 - 0.14)	0.06 (0.05 - 0.10)	0.14 (0.06 - 0.21)	0.10 (0.05 - 0.14)
Nickel (mg/kg)	18 (9 - 23)	21 (15 - 26)	17 (13 - 27)	17 (8 - 23)	19 (9 - 24)	22 (19 - 25)
Silver (mg/kg)	0.4 (0.2 - 0.5)	0.3 (0.2 - 0.5)	0.2 (0.2 - 0.4)	<0.2 (<0.2 - 0.2)	0.8 (0.2 - 1.3)	0.3 (0.2 - 0.4)
Zinc (mg/kg)	100 (50 - 120)	100 (63 - 130)	96 (78 - 130)	71 (32 - 99)	110 (53 - 140)	97 (77 - 110)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) ⁽³⁾	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ⁽⁴⁾	91 (90 - 96)	93 (90 - 100)	93 (90 - 100)	91 (90 - 96)	99 (90 - 130)	95 (90 - 120)
High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ^{(5) (6)}	85 (26 - 150)	86 (24 - 170)	72 (24 - 130)	26 (17 - 50)	210 (77 - 570)	89 (54 - 220)

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

Summary statistics for bottom sediment quality in the Eastern Buffer and Victoria Harbour WCZs, 2008 – 2012

Parameter	Eastern Buffer			Victoria Harbour			Rambler Channel	
	Chai Wan ES1	Tathong Channel ES2	ES4	(East) VS3	(Central) VS5	(West) VS6	VS9	VS10
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	55 (33 - 76)	63 (41 - 93)	60 (31 - 91)	68 (38 - 91)	84 (51 - 97)	60 (35 - 86)	76 (53 - 87)	78 (48 - 92)
Electrochemical Potential (mV)	-157 (-230 - -63)	-135 (-222 - -83)	-158 (-289 - -75)	-255 (-305 - -222)	-340 (-365 - -260)	-276 (-369 - -175)	-194 (-319 - -110)	-234 (-350 - -78)
Total Solids (%w/w)	60 (50 - 68)	59 (43 - 66)	56 (45 - 67)	46 (41 - 60)	38 (33 - 50)	53 (37 - 64)	46 (41 - 52)	41 (37 - 46)
Total Volatile Solids (%w/w)	5.1 (3.7 - 6.6)	4.9 (3.5 - 6.7)	5.4 (3.7 - 6.5)	6.1 (4.8 - 7.1)	8.2 (6.3 - 10.0)	7.2 (4.1 - 12.0)	6.1 (5.1 - 7.0)	7.7 (6.7 - 9.4)
Chemical Oxygen Demand (mg/kg)	10830 (9100 - 14000)	9660 (6700 - 14000)	13100 (10000 - 24000)	18200 (12000 - 22000)	23000 (19000 - 27000)	18300 (12000 - 24000)	13800 (11000 - 16000)	18500 (12000 - 30000)
Total Carbon (%w/w)	1.2 (0.8 - 1.5)	0.8 (0.6 - 1.2)	1.1 (0.7 - 2.2)	0.7 (0.6 - 0.8)	0.9 (0.7 - 1.4)	1.1 (0.7 - 1.9)	0.7 (0.5 - 1.3)	0.9 (0.5 - 1.3)
Ammonical Nitrogen (mg/kg)	3.7 (0.3 - 9.3)	4.3 (0.1 - 19.0)	4.7 (0.8 - 12.0)	6.0 (0.1 - 17.0)	24.4 (7.2 - 70.0)	8.6 (2.5 - 18.0)	12.9 (2.8 - 24.0)	4.6 (0.4 - 22.0)
Total Kjeldahl Nitrogen (mg/kg)	340 (220 - 450)	370 (280 - 460)	420 (290 - 530)	500 (400 - 610)	640 (430 - 780)	440 (330 - 570)	380 (210 - 530)	500 (410 - 650)
Total Phosphorus (mg/kg)	160 (96 - 210)	190 (150 - 210)	180 (120 - 230)	190 (160 - 260)	200 (160 - 240)	220 (180 - 260)	170 (97 - 220)	200 (180 - 250)
Total Sulphide (mg/kg)	19 (1 - 67)	7 (1 - 27)	86 (1 - 620)	100 (2 - 300)	310 (8 - 620)	150 (11 - 320)	98 (1 - 250)	84 (1 - 190)
Total Cyanide (mg/kg)	<0.1 (<0.1 - 0.1)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.6)	0.2 (0.1 - 0.3)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.4)
Arsenic (mg/kg)	5.4 (4.3 - 6.2)	5.9 (4.4 - 8.9)	5.2 (3.4 - 6.5)	7.3 (4.3 - 11.0)	7.4 (6.5 - 8.4)	8.9 (6.0 - 16.0)	6.7 (3.4 - 8.4)	8.3 (6.6 - 9.9)
Cadmium (mg/kg)	<0.1 (<0.1 - 0.1)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.4)	0.3 (0.2 - 0.5)	0.7 (0.4 - 0.9)	0.4 (0.2 - 0.6)	0.2 (0.1 - 0.3)	0.6 (0.2 - 1.0)
Chromium (mg/kg)	24 (19 - 30)	23 (17 - 40)	30 (24 - 39)	36 (19 - 51)	52 (42 - 64)	33 (25 - 43)	38 (29 - 43)	68 (48 - 91)
Copper (mg/kg)	27 (21 - 36)	17 (9 - 54)	50 (32 - 100)	89 (40 - 160)	140 (120 - 190)	82 (55 - 110)	56 (14 - 81)	160 (110 - 240)
Lead (mg/kg)	28 (23 - 35)	25 (18 - 40)	35 (26 - 61)	47 (29 - 66)	67 (56 - 79)	79 (37 - 140)	35 (25 - 42)	66 (45 - 99)
Mercury (mg/kg)	0.11 (0.08 - 0.21)	0.07 (0.05 - 0.17)	0.22 (0.12 - 0.50)	0.34 (0.13 - 0.99)	0.44 (0.34 - 0.53)	0.55 (0.20 - 0.97)	0.15 (0.05 - 0.21)	0.20 (0.11 - 0.28)
Nickel (mg/kg)	14 (11 - 18)	15 (12 - 27)	16 (13 - 21)	17 (10 - 23)	23 (19 - 28)	16 (12 - 23)	21 (19 - 24)	29 (22 - 36)
Silver (mg/kg)	0.5 (0.4 - 0.6)	0.2 (0.2 - 0.4)	1.3 (0.7 - 4.2)	3.0 (1.1 - 5.6)	5.0 (3.6 - 7.9)	2.1 (1.2 - 4.0)	1.1 (0.2 - 1.8)	3.8 (2.1 - 5.6)
Zinc (mg/kg)	69 (56 - 87)	64 (40 - 120)	100 (69 - 260)	150 (85 - 210)	260 (190 - 330)	170 (110 - 250)	110 (71 - 140)	220 (140 - 350)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) ⁽³⁾	18 (18 - 18)	18 (18 - 18)	18 (18 - 19)	18 (18 - 20)	20 (18 - 29)	24 (18 - 49)	18 (18 - 19)	20 (18 - 29)
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ⁽⁴⁾	110 (90 - 210)	93 (90 - 100)	110 (90 - 170)	110 (93 - 140)	140 (100 - 210)	270 (110 - 700)	98 (90 - 130)	110 (90 - 140)
High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ^{(5) (6)}	200 (58 - 840)	75 (25 - 300)	570 (110 - 1800)	570 (180 - 960)	810 (600 - 1100)	2200 (180 - 6200)	140 (19 - 240)	450 (170 - 1400)

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

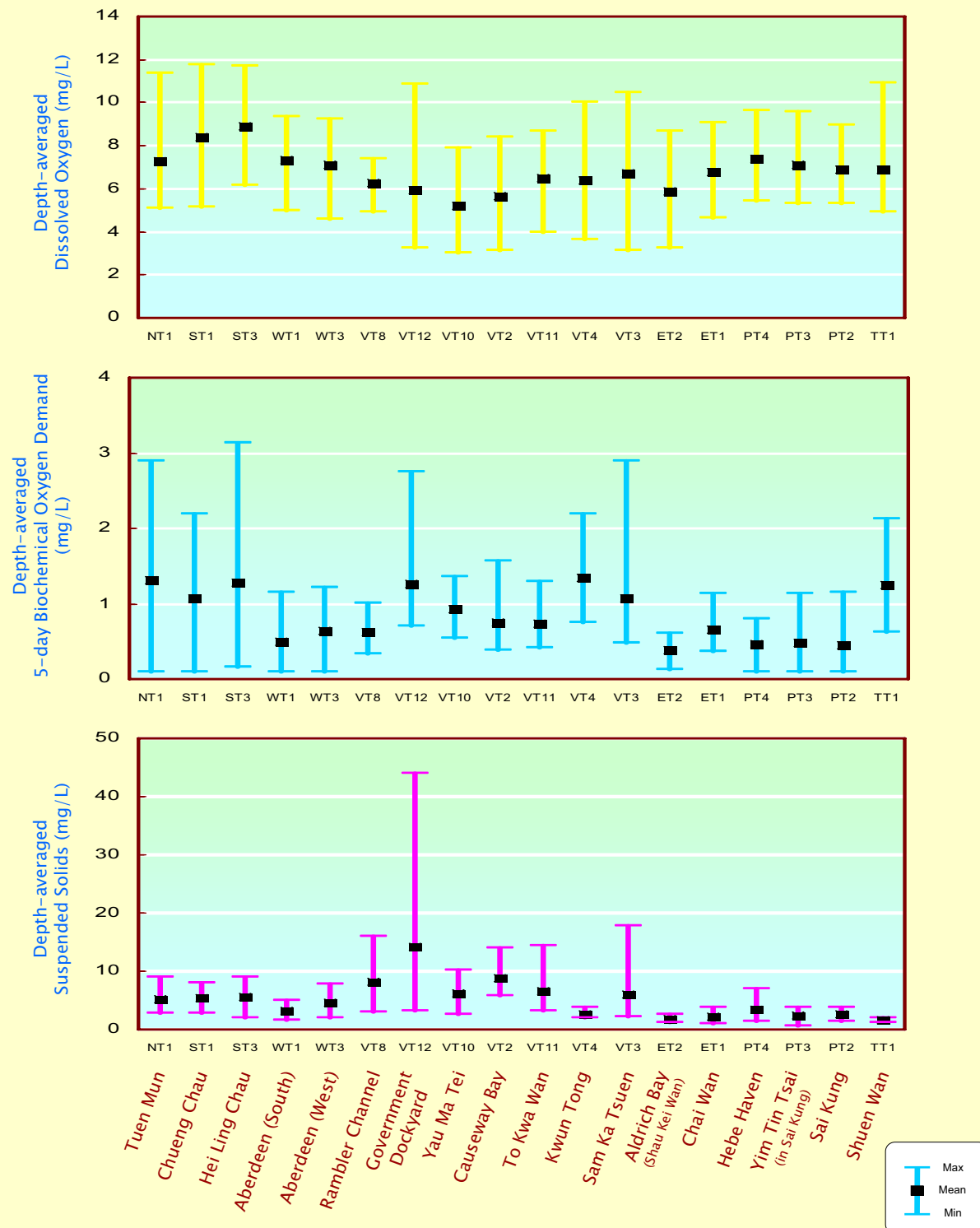
3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

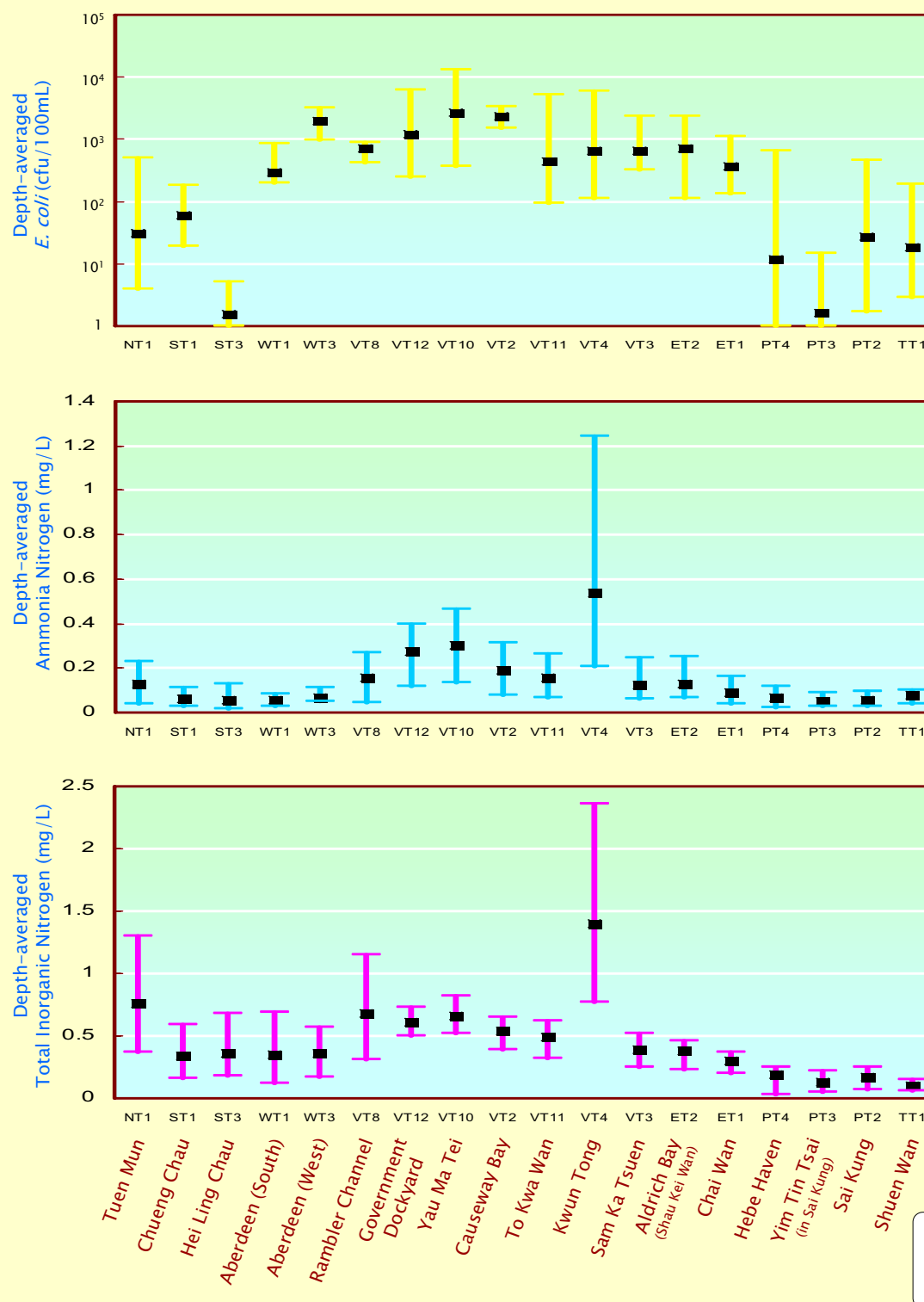
5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

Water quality of typhoon shelters in Hong Kong in 2012



Water quality of typhoon shelters in Hong Kong in 2012 (continued)



Results of the Seasonal Kendall Test for water quality trends in typhoon shelters, 1986 – 2012										
Monitoring Station		NT1	ST1	ST3	WT3	WT1	VT8	VT10	VT2	VT11
		1986	1986	2000	1986	1986	1986	1993	1986	1994
Monitoring Period		I	I	I	I	I	I	I	I	I
		2012	2012	2012	2012	2012	2012	2012	2012	2012
Parameter	Water Depth									
Temperature (°C)	Surface	-	-	-	-	-	↗	-	-	-
	Middle	NA	-	-	-	-	↗	↗	-	-
	Bottom	NA	-	-	-	-	↗	-	-	-
	Average	↗	↗	-	-	-	↗	-	-	-
Salinity	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	-	-	-	↗	↗	-	↗	↗
	Middle	NA	-	↗	-	↗	↗	↗	↗	↗
	Bottom	NA	-	-	-	↗	↗	↗	↗	↗
	Average	↗	-	-	-	↗	↗	↗	↗	↗
Dissolved Oxygen (%)	Surface	↗	-	-	↗	↗	↗	-	↗	↗
	Middle	NA	↗	-	-	↗	↗	↗	↗	↗
	Bottom	NA	-	-	↗	↗	↗	↗	↗	↗
	Average	↗	-	-	↗	↗	↗	↗	↗	↗
pH	Surface	-	↘	↘	↘	↘	-	-	-	-
	Middle	NA	↘	↘	↘	↘	-	-	-	-
	Bottom	NA	↘	↘	↘	↘	-	-	-	-
	Average	-	↘	↘	↘	↘	-	-	-	-
Secchi disc depth (m)		↗	↗	-	↗	↗	↗	↗	↗	-
Turbidity (NTU)	Surface	-	-	↘	-	-	↗	-	↗	-
	Middle	NA	↘	↘	-	-	-	-	↗	-
	Bottom	NA	↘	↘	-	-	-	-	↗	-
	Average	-	↘	↘	-	-	↗	-	↗	-
Suspended Solids (mg/L)	Surface	↘	-	-	-	↘	-	↘	-	↘
	Middle	NA	-	-	-	↘	-	↘	-	↘
	Bottom	NA	-	-	-	↘	-	↘	-	↘
	Average	↘	-	-	-	↘	-	↘	-	↘
Volatile suspended solids (mg/L)	Surface	↘	-	-	↘	↘	-	-	-	-
	Middle	NA	-	↗	-	↘	-	↘	-	-
	Bottom	NA	-	-	-	↘	-	-	-	-
	Average	↘	-	-	↘	↘	-	↘	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	-	-	↘	-	-	↘	-
	Middle	NA	-	-	-	↘	-	-	↘	-
	Bottom	NA	-	-	-	↘	-	-	↘	-
	Average	-	-	-	-	↘	-	-	↘	-
Ammonia nitrogen (mg/L)	Surface	↘	-	-	-	↘	↘	↘	↘	↘
	Middle	NA	-	-	-	-	↘	↘	↘	↘
	Bottom	NA	-	-	-	-	↘	↘	↘	↘
	Average	↘	-	-	-	-	↘	↘	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	↘	↘	↘	↘	-	-	↘	↘
	Middle	NA	-	↘	↘	↘	-	-	↘	↘
	Bottom	NA	↘	↘	↘	↘	-	-	↘	↘
	Average	↘	↘	↘	↘	↘	-	-	↘	↘
Nitrite nitrogen (mg/L)	Surface	↗	-	-	-	-	↗	-	-	↗
	Middle	NA	-	-	-	-	↗	↗	-	↗
	Bottom	NA	-	-	-	-	↗	-	-	↗
	Average	↗	-	-	-	-	↗	-	-	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	-	-	↗	↗	↗	↗
	Middle	NA	-	-	-	-	↗	↗	↗	↗
	Bottom	NA	↗	↗	-	-	↗	↗	↗	↗
	Average	↗	↗	↗	-	-	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	-	-	-	-	-	-	↘	-	-
	Middle	NA	-	-	-	-	-	↘	-	-
	Bottom	NA	-	-	-	-	-	↘	-	-
	Average	-	-	-	-	-	-	↘	-	-
Total Kjeldahl nitrogen (mg/L)	Surface	↘	-	-	-	-	↘	↘	↘	↘
	Middle	NA	-	-	-	-	↘	↘	↘	↘
	Bottom	NA	-	-	-	-	↘	↘	↘	↘
	Average	↘	-	-	-	-	↘	↘	↘	↘
Total nitrogen (mg/L)	Surface	-	-	↗	-	-	↘	↘	↘	↘
	Middle	NA	-	-	-	-	↘	↘	↘	↘
	Bottom	NA	-	-	-	-	↘	↘	↘	↘
	Average	-	-	↗	-	-	↘	↘	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	-	-	-	-	↘	↘	↘	↘
	Middle	NA	↘	-	-	-	↘	↘	↘	↘
	Bottom	NA	-	↘	-	-	↘	↘	↘	↘
	Average	↘	-	↘	-	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	-	-	-	-	↘	↘	↘	↘
	Middle	NA	-	-	-	-	↘	↘	↘	↘
	Bottom	NA	-	-	-	-	↘	↘	↘	↘
	Average	↘	-	-	-	-	↘	↘	↘	↘
Silica (mg/L)	Surface	↘	-	-	-	-	-	↘	-	-
	Middle	NA	-	-	-	-	-	↘	-	-
	Bottom	NA	-	-	-	-	-	↘	-	-
	Average	↘	-	-	-	-	-	↘	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	↗	-	-	-	-	↗	-	-	-
	Middle	NA	-	-	-	-	-	↗	-	-
	Bottom	NA	-	-	-	-	↗	↗	-	-
	Average	↗	-	-	-	-	↗	↗	-	-
<i>E. coli</i> (cfu/100mL)	Surface	↘	-	-	-	↘	-	↘	↘	↘
	Middle	NA	↘	↘	-	↘	-	↘	↘	↘
	Bottom	NA	↘	-	-	-	-	↘	↘	↘
	Average	↘	-	-	-	↘	-	↘	↘	↘
Faecal coliforms (cfu/100mL)	Surface	↘	-	↘	-	↘	-	-	↘	-
	Middle	NA	-	↘	-	-	-	-	↘	-
	Bottom	NA	-	-	-	-	-	-	↘	-
	Average	↘	-	↘	-	-	-	-	↘	-

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$
 2. - indicates no significant trend
 3. NA (Not Applicable) indicates the measurement was not made due to shallow water
 4. ↗ significant increase
 5. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in typhoon shelters, 1986 – 2012 (continued)										
Monitoring Station		VT12	VT4	VT3	ET2	ET1	PT4	PT3	PT2	TT1
		2000	1987	1986	1993	1986	1986	1986	1986	1986
Monitoring Period		I	I	I	I	I	I	I	I	I
		2012	2012	2012	2012	2012	2012	2012	2012	2012
Parameter	Water Depth									
Temperature (°C)	Surface	-	-	↗	-	↗	-	-	-	↗
	Middle	-	-	-	-	↗	NA	-	NA	-
	Bottom	-	-	↗	-	↗	↗	↗	-	-
	Average	-	-	↗	-	↗	-	↗	-	-
Salinity	Surface	-	-	-	-	-	-	-	-	-
	Middle	↘	-	-	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	↗	↗	↗	-	-	-	↗	↘
	Middle	-	↗	↗	↗	-	NA	-	NA	-
	Bottom	-	↗	↗	↗	-	-	-	-	-
	Average	-	↗	↗	↗	-	-	-	↗	-
Dissolved Oxygen (%)	Surface	-	↗	↗	↗	-	-	-	↗	↘
	Middle	-	↗	↗	↗	↗	NA	-	NA	-
	Bottom	-	↗	↗	↗	↗	-	-	-	-
	Average	-	↗	↗	↗	-	-	-	↗	-
pH	Surface	-	-	-	-	↘	↘	↘	↘	↘
	Middle	-	↗	-	↘	↘	NA	↘	NA	↘
	Bottom	-	-	-	↘	↘	↘	↘	↘	↘
	Average	-	-	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		-	↗	↗	↗	↗	↗	-	↗	↗
Turbidity (NTU)	Surface	↘	-	-	-	-	-	-	-	-
	Middle	-	-	↗	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	↘	-
Suspended Solids (mg/L)	Surface	-	↘	↘	↘	-	-	-	-	↘
	Middle	-	↘	↘	↘	-	NA	-	NA	↘
	Bottom	-	↘	↘	-	↘	-	-	-	↘
	Average	-	↘	↘	↘	-	-	-	-	↘
Volatile suspended solids (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	↘	↘	-	-	NA	-	NA	↘
	Bottom	-	↘	-	-	-	-	-	-	↘
	Average	-	↘	-	-	-	-	-	-	↘
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	↘	↘	↘	-	↘	-	↘	↘
	Middle	-	↘	↘	↘	-	NA	-	NA	↘
	Bottom	-	↘	↘	↘	-	-	-	-	↘
	Average	↗	↘	↘	↘	-	↘	-	↘	↘
Ammonia nitrogen (mg/L)	Surface	-	↘	↘	↘	-	-	-	-	↘
	Middle	-	↘	↘	↘	-	NA	-	NA	-
	Bottom	-	↘	↘	↘	-	-	-	-	↘
	Average	-	↘	↘	↘	-	-	-	-	↘
Unionised Ammonia (mg/L)	Surface	↘	↘	↘	↘	-	↘	-	↘	↘
	Middle	↘	↘	↘	↘	-	NA	-	NA	↘
	Bottom	↘	↘	↘	↘	-	↘	-	-	↘
	Average	↘	↘	↘	↘	-	↘	-	↘	↘
Nitrite nitrogen (mg/L)	Surface	-	↗	-	-	-	-	-	-	-
	Middle	-	↗	-	-	-	NA	-	NA	-
	Bottom	-	↗	-	-	-	-	-	-	-
	Average	-	↗	-	-	-	-	-	-	-
Nitrate nitrogen (mg/L)	Surface	-	↗	↗	-	-	-	-	-	-
	Middle	↗	↗	↗	-	-	NA	↗	NA	-
	Bottom	-	↗	-	-	-	-	-	-	-
	Average	-	↗	↗	-	-	-	-	-	-
Total inorganic nitrogen (mg/L)	Surface	-	-	↘	↘	-	-	-	-	↘
	Middle	-	↘	↘	↘	-	NA	-	NA	-
	Bottom	-	↘	↘	↘	-	-	-	-	↘
	Average	-	↘	↘	↘	-	-	-	-	↘
Total Kjeldahl nitrogen (mg/L)	Surface	-	↘	↘	↘	-	↘	-	-	↘
	Middle	-	↘	↘	↘	-	NA	↗	NA	↘
	Bottom	-	↘	↘	↘	-	↘	↗	-	↘
	Average	-	↘	↘	↘	-	↘	-	-	↘
Total nitrogen (mg/L)	Surface	-	↘	↘	↘	-	↘	↗	-	↘
	Middle	-	↘	↘	↘	-	NA	↗	NA	↘
	Bottom	-	↘	↘	↘	-	↘	↗	-	↘
	Average	-	↘	↘	↘	-	↘	-	-	↘
Orthophosphate phosphorus (mg/L)	Surface	-	↗	↘	↘	-	-	-	-	↘
	Middle	-	↘	↘	↘	-	NA	-	NA	↘
	Bottom	-	↘	↘	↘	-	-	↘	-	↘
	Average	-	-	↘	↘	-	↘	-	-	↘
Total phosphorus (mg/L)	Surface	-	-	↘	↘	↘	↘	-	-	↘
	Middle	-	↘	↘	↘	↘	NA	-	NA	↘
	Bottom	-	↘	↘	↘	↘	↘	-	-	↘
	Average	-	↘	↘	↘	↘	↘	-	-	↘
Silica (mg/L)	Surface	-	-	-	↘	-	↗	-	-	-
	Middle	-	↘	-	↘	-	NA	-	NA	-
	Bottom	-	↘	-	↘	-	-	-	-	-
	Average	-	↘	-	↘	-	-	-	-	-
Chlorophyll- <i>a</i> (µg/L)	Surface	-	↗	↗	-	-	-	-	-	↘
	Middle	-	↗	-	-	-	NA	-	NA	-
	Bottom	↗	↗	↗	-	-	-	-	-	-
	Average	↗	↗	↗	-	-	-	-	-	↘
<i>E. coli</i> (cfu/100mL)	Surface	-	↘	↘	↘	-	↘	-	↘	↘
	Middle	-	↘	↘	↘	-	NA	-	NA	↘
	Bottom	-	↘	↘	↘	-	↘	-	↘	↘
	Average	-	↘	↘	↘	-	↘	-	↘	↘
Faecal coliforms (cfu/100mL)	Surface	-	↘	↘	↘	-	-	-	↘	↘
	Middle	-	↘	↘	↘	-	NA	-	NA	↘
	Bottom	↘	↘	↘	↘	-	↘	-	↘	↘
	Average	-	↘	↘	↘	-	↘	-	↘	↘

Note: 1. Results of the Seasonal Kendall Test statistically significant at $p < 0.05$
 2. - indicates no significant trend
 3. NA (Not Applicable) indicates the measurement was not made due to shallow water
 4. ↗ significant increase
 5. ↘ significant decrease

Summary of water quality statistics for typhoon shelters in 2012

Parameter	Tuen Mun NT1	Cheung Chau ST1	Hei Ling Chau ST3	Aberdeen (South) WT1	Aberdeen (West) WT3	Rambler Channel VT8
Number of samples	6	6	6	6	6	6
Temperature (°C)	25.0 (17.1 - 30.3)	24.1 (16.9 - 29.7)	24.2 (16.9 - 29.7)	23.0 (15.3 - 28.5)	22.9 (15.2 - 28.6)	23.8 (17.4 - 28.6)
Salinity	24.1 (10.3 - 31.2)	28.7 (21.8 - 32.4)	28.6 (23.4 - 32.2)	29.8 (26.4 - 32.7)	29.9 (27.4 - 32.5)	27.6 (18.2 - 32.0)
Dissolved Oxygen (mg/L)	7.3 (5.1 - 11.4)	8.4 (5.2 - 11.8)	8.9 (6.2 - 11.7)	7.4 (5.0 - 9.3)	7.1 (4.6 - 9.2)	6.3 (4.9 - 7.4)
Bottom	N.M.	8.1 (5.9 - 10.7)	8.7 (6.3 - 11.3)	7.2 (5.0 - 9.0)	6.5 (4.4 - 9.0)	6.1 (4.2 - 7.3)
Dissolved Oxygen (% Saturation)	101 (77 - 160)	118 (75 - 173)	125 (90 - 173)	101 (76 - 133)	97 (70 - 131)	87 (74 - 105)
Bottom	N.M.	113 (86 - 158)	121 (92 - 163)	99 (75 - 122)	89 (67 - 108)	84 (62 - 103)
pH	7.8 (7.6 - 8.3)	7.9 (7.5 - 8.2)	7.9 (7.6 - 8.2)	7.8 (7.6 - 8.0)	7.8 (7.6 - 7.9)	7.6 (7.4 - 7.8)
Secchi Disc Depth (m)	1.9 (1.5 - 2.0)	2.1 (1.8 - 3.1)	2.1 (1.8 - 2.9)	2.8 (2.0 - 3.5)	2.7 (2.0 - 3.0)	2.1 (1.6 - 3.0)
Turbidity (NTU)	3.2 (2.1 - 5.2)	4.9 (2.1 - 11.7)	4.8 (1.0 - 10.9)	15.5 (1.4 - 81.2)	16.1 (1.8 - 80.0)	7.6 (2.1 - 19.4)
Suspended Solids (mg/L)	5.2 (2.9 - 9.1)	5.4 (2.8 - 8.0)	5.5 (2.1 - 9.1)	3.3 (1.6 - 4.9)	4.6 (2.0 - 7.9)	8.2 (3.0 - 16.0)
5-day Biochemical Oxygen Demand (mg/L)	1.3 (<0.1 - 2.9)	1.1 (<0.1 - 2.2)	1.3 (0.2 - 3.1)	0.5 (<0.1 - 1.1)	0.6 (<0.1 - 1.2)	0.6 (0.3 - 1.0)
Ammonia Nitrogen (mg/L)	0.131 (0.042 - 0.230)	0.063 (0.028 - 0.110)	0.056 (0.017 - 0.127)	0.055 (0.026 - 0.086)	0.070 (0.050 - 0.113)	0.155 (0.047 - 0.270)
Unionised Ammonia (mg/L)	0.004 (0.002 - 0.006)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.006)	0.003 (0.001 - 0.005)
Nitrite Nitrogen (mg/L)	0.068 (0.021 - 0.120)	0.036 (0.007 - 0.067)	0.043 (0.008 - 0.088)	0.035 (0.009 - 0.061)	0.037 (0.011 - 0.063)	0.063 (0.021 - 0.105)
Nitrate Nitrogen (mg/L)	0.560 (0.180 - 1.200)	0.238 (0.089 - 0.457)	0.257 (0.117 - 0.550)	0.256 (0.038 - 0.570)	0.253 (0.050 - 0.460)	0.468 (0.115 - 1.050)
Total Inorganic Nitrogen (mg/L)	0.76 (0.37 - 1.31)	0.34 (0.16 - 0.60)	0.36 (0.18 - 0.68)	0.35 (0.13 - 0.69)	0.36 (0.18 - 0.58)	0.69 (0.31 - 1.15)
Total Kjeldahl Nitrogen (mg/L)	0.34 (0.24 - 0.46)	0.28 (0.22 - 0.40)	0.29 (0.22 - 0.46)	0.21 (0.08 - 0.28)	0.24 (0.11 - 0.32)	0.32 (0.22 - 0.44)
Total Nitrogen (mg/L)	0.97 (0.54 - 1.60)	0.55 (0.38 - 0.86)	0.59 (0.41 - 0.86)	0.50 (0.28 - 0.89)	0.53 (0.32 - 0.80)	0.85 (0.46 - 1.32)
Orthophosphate Phosphorus (mg/L)	0.021 (0.003 - 0.035)	0.012 (0.003 - 0.030)	0.012 (0.003 - 0.030)	0.013 (0.003 - 0.029)	0.017 (0.006 - 0.031)	0.032 (0.017 - 0.047)
Total Phosphorus (mg/L)	0.04 (0.02 - 0.07)	0.03 (0.02 - 0.04)	0.03 (0.02 - 0.05)	0.03 (0.03 - 0.04)	0.04 (0.03 - 0.04)	0.05 (0.04 - 0.06)
Silica (as SiO ₂) (mg/L)	2.05 (0.22 - 5.70)	0.72 (0.10 - 1.14)	0.68 (0.06 - 1.17)	0.98 (0.53 - 1.37)	1.13 (0.65 - 1.40)	2.03 (1.20 - 4.70)
Chlorophyll-a (µg/L)	10.7 (2.8 - 26.0)	11.3 (1.1 - 26.0)	12.6 (1.5 - 23.3)	4.9 (0.6 - 16.9)	4.2 (0.6 - 12.2)	3.4 (0.8 - 9.0)
E.coli (count/100mL)	31 (4 - 500)	60 (20 - 180)	2 (<1 - 5)	300 (200 - 850)	2000 (970 - 3200)	710 (430 - 890)
Faecal Coliforms (count/100mL)	240 (17 - 5500)	150 (60 - 340)	2 (1 - 13)	670 (250 - 2000)	3500 (2000 - 6100)	1600 (1100 - 2300)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

4. N.M. – not measured

Summary of water quality statistics for typhoon shelters in 2012

Parameter	Government Dockyard VT12	Yau Ma Tei VT10	Causeway Bay VT2	To Kwa Wan VT11	Kwun Tong VT4	Sam Ka Tsuen VT3
Number of samples	6	6	6	6	6	6
Temperature (°C)	23.9 (17.1 - 29.3)	23.7 (16.9 - 28.6)	23.4 (16.4 - 28.3)	23.2 (16.2 - 28.1)	23.6 (16.8 - 28.5)	23.3 (16.1 - 28.5)
Salinity	28.9 (23.5 - 31.8)	28.8 (22.5 - 31.9)	29.0 (23.3 - 32.0)	29.5 (23.7 - 32.3)	28.2 (24.4 - 31.1)	29.7 (24.4 - 32.3)
Dissolved Oxygen (mg/L)	5.9 (3.2 - 10.9)	5.2 (3.0 - 7.9)	5.7 (3.1 - 8.4)	6.5 (4.0 - 8.7)	6.4 (3.7 - 10.0)	6.7 (3.1 - 10.5)
Bottom	5.8 (3.1 - 10.4)	5.2 (3.0 - 7.4)	5.6 (3.3 - 7.4)	6.6 (3.9 - 8.2)	6.0 (3.1 - 8.0)	6.8 (4.3 - 8.9)
Dissolved Oxygen (% Saturation)	84 (49 - 162)	72 (46 - 116)	78 (47 - 123)	90 (60 - 127)	88 (55 - 148)	93 (47 - 154)
Bottom	82 (47 - 155)	72 (46 - 108)	77 (50 - 108)	90 (59 - 119)	83 (48 - 118)	94 (65 - 131)
pH	7.6 (7.3 - 7.8)	7.5 (7.2 - 7.7)	7.6 (7.4 - 7.7)	7.7 (7.4 - 7.8)	7.6 (7.3 - 7.7)	7.7 (7.5 - 7.8)
Secchi Disc Depth (m)	2.1 (1.5 - 3.0)	2.2 (1.5 - 4.0)	2.1 (1.5 - 3.0)	2.6 (2.0 - 4.0)	2.3 (1.5 - 3.5)	2.4 (1.7 - 3.0)
Turbidity (NTU)	8.2 (1.7 - 26.0)	4.2 (1.8 - 7.1)	5.5 (3.7 - 8.3)	3.7 (1.6 - 6.1)	1.9 (1.6 - 2.5)	3.6 (1.6 - 9.4)
Suspended Solids (mg/L)	14.3 (3.2 - 43.9)	6.2 (2.6 - 10.3)	8.7 (5.8 - 14.0)	6.7 (3.2 - 14.5)	2.6 (1.9 - 3.8)	6.0 (2.2 - 17.9)
5-day Biochemical Oxygen Demand (mg/L)	1.3 (0.7 - 2.8)	0.9 (0.6 - 1.4)	0.8 (0.4 - 1.6)	0.7 (0.4 - 1.3)	1.3 (0.8 - 2.2)	1.1 (0.5 - 2.9)
Ammonia Nitrogen (mg/L)	0.274 (0.120 - 0.395)	0.303 (0.134 - 0.465)	0.192 (0.079 - 0.315)	0.155 (0.065 - 0.263)	0.539 (0.205 - 1.240)	0.122 (0.059 - 0.245)
Unionised Ammonia (mg/L)	0.005 (0.002 - 0.012)	0.005 (0.001 - 0.011)	0.004 (0.001 - 0.009)	0.003 (0.001 - 0.009)	0.007 (0.002 - 0.015)	0.003 (<0.001 - 0.009)
Nitrite Nitrogen (mg/L)	0.042 (0.030 - 0.053)	0.043 (0.026 - 0.057)	0.039 (0.018 - 0.057)	0.039 (0.014 - 0.060)	0.110 (0.047 - 0.210)	0.036 (0.014 - 0.060)
Nitrate Nitrogen (mg/L)	0.292 (0.135 - 0.400)	0.317 (0.110 - 0.583)	0.312 (0.115 - 0.520)	0.292 (0.100 - 0.510)	0.748 (0.430 - 1.380)	0.237 (0.075 - 0.360)
Total Inorganic Nitrogen (mg/L)	0.61 (0.50 - 0.73)	0.66 (0.52 - 0.82)	0.54 (0.39 - 0.65)	0.49 (0.32 - 0.62)	1.40 (0.77 - 2.36)	0.39 (0.26 - 0.52)
Total Kjeldahl Nitrogen (mg/L)	0.55 (0.42 - 0.65)	0.54 (0.35 - 0.75)	0.40 (0.33 - 0.53)	0.34 (0.27 - 0.47)	0.84 (0.46 - 1.51)	0.33 (0.23 - 0.50)
Total Nitrogen (mg/L)	0.88 (0.72 - 0.99)	0.90 (0.75 - 1.10)	0.75 (0.56 - 0.96)	0.67 (0.55 - 0.84)	1.69 (1.01 - 2.63)	0.60 (0.42 - 0.91)
Orthophosphate Phosphorus (mg/L)	0.041 (0.008 - 0.063)	0.042 (0.014 - 0.067)	0.032 (0.008 - 0.045)	0.029 (0.007 - 0.043)	0.190 (0.103 - 0.264)	0.024 (0.008 - 0.037)
Total Phosphorus (mg/L)	0.08 (0.04 - 0.10)	0.08 (0.05 - 0.12)	0.06 (0.04 - 0.08)	0.05 (0.04 - 0.08)	0.22 (0.13 - 0.31)	0.05 (0.03 - 0.07)
Silica (as SiO ₂) (mg/L)	1.23 (0.38 - 1.55)	1.37 (0.47 - 2.20)	1.42 (0.59 - 1.90)	1.16 (0.40 - 1.90)	1.50 (0.81 - 2.47)	0.99 (0.29 - 1.30)
Chlorophyll-a (µg/L)	10.2 (0.7 - 33.0)	6.3 (0.3 - 21.0)	6.1 (0.3 - 26.0)	7.3 (0.3 - 25.7)	10.7 (0.3 - 22.5)	8.7 (0.4 - 38.0)
E.coli (count/100mL)	1200 (250 - 6300)	2700 (360 - 13000)	2300 (1500 - 3400)	450 (94 - 5200)	640 (110 - 5800)	650 (320 - 2400)
Faecal Coliforms (count/100mL)	2100 (470 - 16000)	5900 (1100 - 23000)	7200 (4800 - 14000)	1000 (230 - 7400)	1500 (170 - 22000)	1700 (830 - 3400)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary of water quality statistics for typhoon shelters in 2012

Parameter	Aldrich Bay (Shau Kei Wan) ET2	Chai Wan ET1	Hebe Haven PT4	Yim Tin Tsai PT3	Sai Kung PT2	Shuen Wan TT1
Number of samples	6	6	6	6	6	6
Temperature (°C)	22.7 (15.1 - 28.1)	22.9 (15.2 - 28.6)	23.1 (15.8 - 28.1)	22.9 (15.7 - 27.8)	22.9 (15.9 - 28.0)	24.2 (15.3 - 29.1)
Salinity	30.8 (30.1 - 32.3)	30.8 (29.7 - 32.3)	29.7 (23.8 - 32.5)	30.8 (27.9 - 33.0)	30.6 (26.8 - 32.8)	30.9 (29.9 - 31.8)
Dissolved Oxygen (mg/L)	5.9 (3.2 - 8.7)	6.8 (4.6 - 9.1)	7.4 (5.4 - 9.7)	7.1 (5.3 - 9.6)	6.9 (5.3 - 9.0)	6.9 (5.0 - 10.9)
Bottom	5.7 (2.3 - 8.8)	6.7 (4.7 - 9.1)	7.2 (5.5 - 9.2)	6.9 (5.1 - 8.1)	7.2 (6.0 - 8.6)	5.4 (2.7 - 10.9)
Dissolved Oxygen (% Saturation)	79 (49 - 104)	93 (71 - 109)	102 (80 - 138)	98 (81 - 144)	95 (81 - 133)	97 (72 - 142)
Bottom	77 (35 - 105)	91 (72 - 109)	99 (81 - 133)	95 (76 - 114)	98 (89 - 126)	74 (40 - 140)
pH	7.7 (7.4 - 8.0)	7.8 (7.5 - 8.0)	7.8 (7.3 - 8.2)	7.8 (7.6 - 8.2)	7.8 (7.6 - 8.1)	7.9 (7.6 - 8.2)
Secchi Disc Depth (m)	3.6 (3.0 - 4.2)	3.0 (2.0 - 3.7)	2.3 (1.3 - 3.0)	2.6 (1.5 - 4.0)	2.5 (1.8 - 3.0)	2.8 (2.0 - 4.0)
Turbidity (NTU)	10.2 (0.9 - 53.8)	3.9 (1.2 - 14.3)	2.6 (1.2 - 7.3)	2.4 (0.7 - 6.3)	2.7 (0.9 - 6.9)	1.1 (0.7 - 1.7)
Suspended Solids (mg/L)	1.8 (1.3 - 2.6)	2.1 (1.1 - 3.9)	3.4 (1.4 - 7.0)	2.4 (0.7 - 3.7)	2.6 (1.5 - 3.9)	1.7 (1.2 - 2.1)
5-day Biochemical Oxygen Demand (mg/L)	0.4 (0.1 - 0.6)	0.7 (0.4 - 1.1)	0.5 (<0.1 - 0.8)	0.5 (<0.1 - 1.1)	0.5 (<0.1 - 1.2)	1.3 (0.6 - 2.1)
Ammonia Nitrogen (mg/L)	0.127 (0.066 - 0.250)	0.087 (0.037 - 0.163)	0.070 (0.023 - 0.120)	0.051 (0.029 - 0.092)	0.054 (0.028 - 0.095)	0.077 (0.042 - 0.103)
Unionised Ammonia (mg/L)	0.003 (0.001 - 0.009)	0.003 (<0.001 - 0.008)	0.002 (<0.001 - 0.003)	0.002 (<0.001 - 0.003)	0.002 (<0.001 - 0.003)	0.003 (<0.001 - 0.007)
Nitrite Nitrogen (mg/L)	0.030 (0.015 - 0.053)	0.025 (0.012 - 0.046)	0.009 (0.003 - 0.014)	0.006 (<0.002 - 0.012)	0.009 (0.005 - 0.014)	0.005 (<0.002 - 0.011)
Nitrate Nitrogen (mg/L)	0.218 (0.082 - 0.297)	0.190 (0.079 - 0.300)	0.111 (0.007 - 0.210)	0.074 (0.011 - 0.180)	0.112 (0.028 - 0.205)	0.023 (0.012 - 0.043)
Total Inorganic Nitrogen (mg/L)	0.38 (0.23 - 0.46)	0.30 (0.20 - 0.37)	0.19 (0.03 - 0.26)	0.13 (0.05 - 0.22)	0.18 (0.08 - 0.25)	0.10 (0.06 - 0.15)
Total Kjeldahl Nitrogen (mg/L)	0.32 (0.25 - 0.46)	0.27 (0.24 - 0.34)	0.23 (0.13 - 0.30)	0.21 (0.12 - 0.29)	0.19 (0.12 - 0.24)	0.30 (0.26 - 0.36)
Total Nitrogen (mg/L)	0.57 (0.47 - 0.67)	0.49 (0.40 - 0.57)	0.35 (0.28 - 0.48)	0.30 (0.22 - 0.39)	0.31 (0.18 - 0.41)	0.33 (0.29 - 0.39)
Orthophosphate Phosphorus (mg/L)	0.030 (0.021 - 0.035)	0.020 (0.012 - 0.029)	0.012 (<0.002 - 0.018)	0.008 (0.003 - 0.014)	0.011 (0.004 - 0.019)	0.007 (0.002 - 0.010)
Total Phosphorus (mg/L)	0.04 (0.04 - 0.06)	0.04 (0.03 - 0.04)	0.03 (<0.02 - 0.05)	0.03 (0.02 - 0.04)	0.03 (0.02 - 0.04)	0.03 (0.02 - 0.03)
Silica (as SiO ₂) (mg/L)	1.26 (1.03 - 1.40)	1.00 (0.64 - 1.40)	1.17 (0.22 - 2.63)	0.90 (0.16 - 1.48)	1.04 (0.14 - 1.85)	0.76 (0.23 - 1.60)
Chlorophyll-a (μ g/L)	1.2 (0.2 - 2.9)	3.2 (0.5 - 9.3)	4.0 (<0.2 - 11.5)	2.8 (0.4 - 8.5)	2.4 (0.4 - 6.3)	6.8 (1.5 - 10.4)
E.coli (count/100mL)	710 (110 - 2300)	380 (140 - 1100)	12 (<1 - 660)	2 (<1 - 15)	28 (2 - 450)	19 (3 - 190)
Faecal Coliforms (count/100mL)	1500 (270 - 6400)	930 (360 - 4300)	44 (<1 - 3200)	4 (1 - 340)	150 (2 - 3500)	62 (30 - 530)

Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

Summary statistics of bottom sediment quality of typhoon shelters, 2008– 2012

Parameter	Tuen Mun NS5	Cheung Chau SS7	Hei Ling Chau SS8	Rambler Channel VS17	Government Dockyard VS21	Yau Ma Tei VS19	Causeway Bay VS12
Number of samples	10	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	77 (68 - 92)	89 (66 - 97)	96 (91 - 99)	78 (47 - 99)	93 (80 - 99)	75 (55 - 92)	87 (66 - 99)
Electrochemical Potential (mV)	-252 (-366 - -92)	-195 (-302 - -74)	-187 (-287 - -79)	-256 (-329 - -144)	-285 (-356 - -162)	-316 (-378 - -106)	-295 (-388 - -193)
Total Solids (%w/w)	46 (38 - 53)	41 (29 - 50)	36 (32 - 40)	42 (36 - 57)	36 (30 - 39)	51 (45 - 59)	41 (33 - 58)
Total Volatile Solids (%w/w)	6.5 (5.5 - 7.3)	6.4 (5.4 - 7.4)	7.4 (6.4 - 8.4)	7.2 (4.6 - 8.3)	6.9 (6.2 - 8.1)	6.3 (5.2 - 7.5)	7.9 (4.5 - 9.4)
Chemical Oxygen Demand (mg/kg)	18200 (14000 - 22000)	15300 (12000 - 23000)	11760 (9600 - 14000)	19700 (18000 - 23000)	15000 (13000 - 17000)	15000 (13000 - 19000)	22200 (10000 - 27000)
Total Carbon (%w/w)	0.8 (0.7 - 1.0)	0.7 (0.5 - 1.1)	0.5 (0.5 - 0.6)	1.0 (0.8 - 1.3)	0.5 (0.5 - 0.6)	1.0 (0.7 - 1.4)	0.9 (0.6 - 1.1)
Ammonical Nitrogen (mg/kg)	11.2 (1.6 - 27.0)	6.7 (1.3 - 15.0)	6.1 (1.0 - 16.0)	8.3 (0.5 - 19.0)	8.0 (3.6 - 22.0)	18.8 (4.1 - 47.0)	14.3 (1.9 - 39.0)
Total Kjeldahl Nitrogen (mg/kg)	410 (270 - 500)	460 (370 - 520)	560 (390 - 1000)	490 (340 - 610)	400 (340 - 520)	400 (210 - 530)	550 (300 - 720)
Total Phosphorus (mg/kg)	200 (150 - 240)	250 (170 - 440)	190 (150 - 340)	210 (150 - 260)	190 (170 - 200)	190 (110 - 250)	200 (150 - 250)
Total Sulphide (mg/kg)	91 (13 - 220)	44 (0 - 100)	59 (2 - 390)	260 (23 - 540)	98 (7 - 350)	140 (18 - 350)	140 (23 - 290)
Total Cyanide (mg/kg)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.4)	0.3 (0.2 - 0.5)	0.2 (0.1 - 0.5)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.2)
Arsenic (mg/kg)	10.5 (7.3 - 28.0)	7.5 (6.3 - 9.3)	6.9 (5.7 - 7.9)	9.0 (7.9 - 10.0)	8.0 (7.0 - 9.0)	5.2 (4.4 - 6.4)	7.4 (5.2 - 9.0)
Cadmium (mg/kg)	0.3 (0.2 - 0.4)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	0.7 (0.6 - 1.0)	0.3 (0.3 - 0.4)	0.3 (0.1 - 0.5)	0.7 (0.1 - 1.0)
Chromium (mg/kg)	34 (28 - 42)	45 (39 - 56)	39 (33 - 48)	120 (85 - 150)	46 (42 - 50)	32 (22 - 39)	54 (23 - 66)
Copper (mg/kg)	50 (31 - 65)	80 (56 - 100)	34 (30 - 39)	210 (150 - 280)	150 (130 - 190)	68 (35 - 100)	180 (38 - 250)
Lead (mg/kg)	48 (38 - 66)	49 (42 - 58)	48 (42 - 57)	79 (62 - 92)	51 (47 - 55)	53 (28 - 110)	75 (46 - 120)
Mercury (mg/kg)	0.09 (0.07 - 0.12)	0.17 (0.12 - 0.28)	0.12 (0.09 - 0.15)	0.22 (0.14 - 0.27)	0.19 (0.15 - 0.24)	0.17 (0.11 - 0.23)	0.63 (0.28 - 0.84)
Nickel (mg/kg)	22 (15 - 47)	20 (13 - 24)	24 (21 - 26)	41 (31 - 51)	24 (22 - 28)	20 (15 - 23)	23 (13 - 28)
Silver (mg/kg)	1.9 (1.0 - 2.9)	0.3 (0.2 - 0.4)	0.5 (0.4 - 0.6)	4.0 (2.9 - 4.9)	1.7 (1.4 - 1.9)	1.1 (0.5 - 1.9)	4.2 (0.4 - 7.4)
Zinc (mg/kg)	160 (110 - 220)	130 (110 - 150)	130 (100 - 150)	290 (200 - 350)	220 (200 - 250)	150 (98 - 200)	250 (110 - 340)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) ⁽³⁾	18 (18 - 18)	19 (18 - 22)	18 (18 - 18)	45 (33 - 76)	19 (18 - 24)	18 (18 - 20)	42 (18 - 80)
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ⁽⁴⁾	96 (90 - 120)	100 (90 - 130)	96 (90 - 110)	260 (110 - 1100)	98 (90 - 120)	110 (90 - 140)	120 (94 - 170)
High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ^{(5) (6)}	220 (22 - 970)	240 (120 - 590)	87 (62 - 110)	2200 (700 - 5600)	240 (120 - 490)	430 (140 - 940)	710 (250 - 1000)

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

Summary statistics of bottom sediment quality of typhoon shelters, 2008– 2012 (continued)

Parameter	To Kwa Wan VS20	Kwun Tong VS14	Sam Ka Tsuen VS13	Aldrich Bay (Shau Kei Wan) ES5	Chai Wan ES3	Hebe Haven PS4	Yim Tin Tsai PS2	Shuen Wan TS7
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63µm (% w/w)	80 (55 - 99)	82 (65 - 92)	82 (60 - 88)	88 (81 - 94)	90 (85 - 96)	88 (81 - 97)	74 (28 - 92)	70 (46 - 90)
Electrochemical Potential (mV)	-303 (-374 - -65)	-349 (-383 - -252)	-276 (-353 - -84)	-360 (-399 - -320)	-272 (-356 - -136)	-203 (-361 - -21)	-197 (-307 - -30)	-298 (-375 - -220)
Total Solids (% w/w)	45 (36 - 54)	34 (28 - 42)	39 (37 - 42)	32 (28 - 37)	41 (35 - 49)	40 (36 - 43)	49 (43 - 65)	40 (23 - 52)
Total Volatile Solids (% w/w)	7.8 (5.2 - 11.0)	10.2 (8.4 - 11.0)	9.4 (8.6 - 11.0)	8.9 (7.8 - 10.0)	7.6 (5.7 - 8.7)	8.9 (7.8 - 10.0)	9.0 (5.5 - 10.0)	7.6 (5.5 - 12.0)
Chemical Oxygen Demand (mg/kg)	24400 (18000 - 35000)	26300 (16000 - 39000)	24600 (22000 - 28000)	19200 (14000 - 22000)	22500 (16000 - 30000)	22500 (19000 - 24000)	16200 (11000 - 18000)	22300 (19000 - 28000)
Total Carbon (% w/w)	1.2 (0.8 - 2.0)	1.0 (0.8 - 1.5)	0.9 (0.7 - 1.3)	0.8 (0.7 - 1.1)	0.9 (0.8 - 1.0)	0.9 (0.7 - 1.2)	2.0 (1.3 - 4.3)	0.8 (0.7 - 1.0)
Ammonical Nitrogen (mg/kg)	13.9 (2.5 - 34.0)	33.0 (9.9 - 76.0)	7.8 (0.5 - 16.0)	28.1 (16.0 - 37.0)	3.3 (0.3 - 6.2)	6.2 (0.3 - 22.0)	7.9 (3.4 - 13.0)	6.6 (2.5 - 15.0)
Total Kjeldahl Nitrogen (mg/kg)	540 (460 - 670)	630 (470 - 720)	600 (530 - 760)	610 (530 - 730)	520 (410 - 630)	640 (580 - 740)	460 (170 - 610)	630 (490 - 840)
Total Phosphorus (mg/kg)	220 (190 - 240)	210 (160 - 240)	330 (240 - 670)	210 (170 - 280)	240 (180 - 400)	190 (170 - 220)	140 (91 - 190)	220 (170 - 360)
Total Sulphide (mg/kg)	140 (58 - 270)	540 (110 - 840)	310 (5 - 970)	470 (59 - 720)	120 (18 - 320)	41 (2 - 140)	16 (1 - 57)	130 (50 - 340)
Total Cyanide (mg/kg)	0.2 (0.1 - 0.3)	0.3 (0.1 - 0.4)	0.3 (0.1 - 0.5)	0.2 (0.1 - 0.2)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	<0.1 (<0.1 - 0.1)	0.3 (0.1 - 0.5)
Arsenic (mg/kg)	7.9 (6.9 - 8.6)	6.7 (5.4 - 8.4)	7.9 (6.7 - 10.0)	7.5 (6.1 - 9.0)	9.4 (8.0 - 10.0)	8.3 (6.4 - 9.1)	4.2 (2.6 - 5.7)	8.7 (6.6 - 11.0)
Cadmium (mg/kg)	0.8 (0.4 - 1.5)	2.4 (1.2 - 5.0)	0.9 (0.7 - 1.0)	0.5 (0.4 - 1.1)	0.6 (0.3 - 0.8)	0.2 (0.1 - 0.2)	<0.1 (<0.1 - 0.1)	0.4 (0.2 - 0.8)
Chromium (mg/kg)	82 (53 - 110)	230 (100 - 570)	72 (50 - 110)	57 (48 - 66)	96 (77 - 120)	27 (22 - 33)	17 (8 - 20)	20 (14 - 28)
Copper (mg/kg)	510 (240 - 960)	1600 (720 - 4200)	210 (160 - 270)	270 (190 - 420)	260 (220 - 320)	49 (37 - 61)	17 (7 - 34)	160 (55 - 680)
Lead (mg/kg)	100 (60 - 220)	130 (81 - 400)	97 (88 - 110)	72 (63 - 82)	91 (69 - 130)	39 (36 - 45)	30 (13 - 37)	93 (71 - 120)
Mercury (mg/kg)	1.04 (0.50 - 1.70)	0.73 (0.41 - 1.40)	0.92 (0.61 - 2.10)	0.27 (0.24 - 0.31)	0.46 (0.32 - 0.65)	0.13 (0.09 - 0.16)	0.05 (0.05 - 0.07)	0.13 (0.05 - 0.19)
Nickel (mg/kg)	29 (19 - 44)	65 (31 - 170)	23 (16 - 31)	25 (23 - 28)	29 (23 - 40)	9 (7 - 10)	12 (6 - 14)	10 (7 - 14)
Silver (mg/kg)	4.5 (3.1 - 5.8)	7.7 (4.8 - 13.0)	2.7 (2.2 - 3.3)	7.0 (4.6 - 9.0)	15.9 (5.2 - 29.0)	0.3 (0.2 - 0.3)	<0.2 (<0.2 - 0.2)	0.4 (0.2 - 0.6)
Zinc (mg/kg)	250 (150 - 380)	410 (270 - 620)	350 (280 - 490)	330 (260 - 400)	340 (270 - 440)	140 (120 - 170)	69 (28 - 80)	280 (180 - 450)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) ⁽³⁾	80 (31 - 130)	140 (63 - 370)	44 (33 - 66)	23 (18 - 31)	41 (29 - 56)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ⁽⁴⁾⁽⁶⁾	19000 (560 - 66000)	170 (98 - 300)	140 (100 - 220)	120 (94 - 160)	130 (100 - 170)	100 (90 - 160)	110 (90 - 160)	92 (90 - 95)
High Molecular Weight Polycyclic Aromatic Hydrocarbons (PAHs) (µg/kg) ⁽⁵⁾⁽⁶⁾	270000 (7700 - 1100000)	1200 (560 - 1900)	910 (540 - 1400)	800 (220 - 1500)	610 (330 - 1000)	84 (60 - 150)	91 (21 - 540)	120 (61 - 240)

Note: 1 Data presented are arithmetic means ; data in brackets indicate ranges.

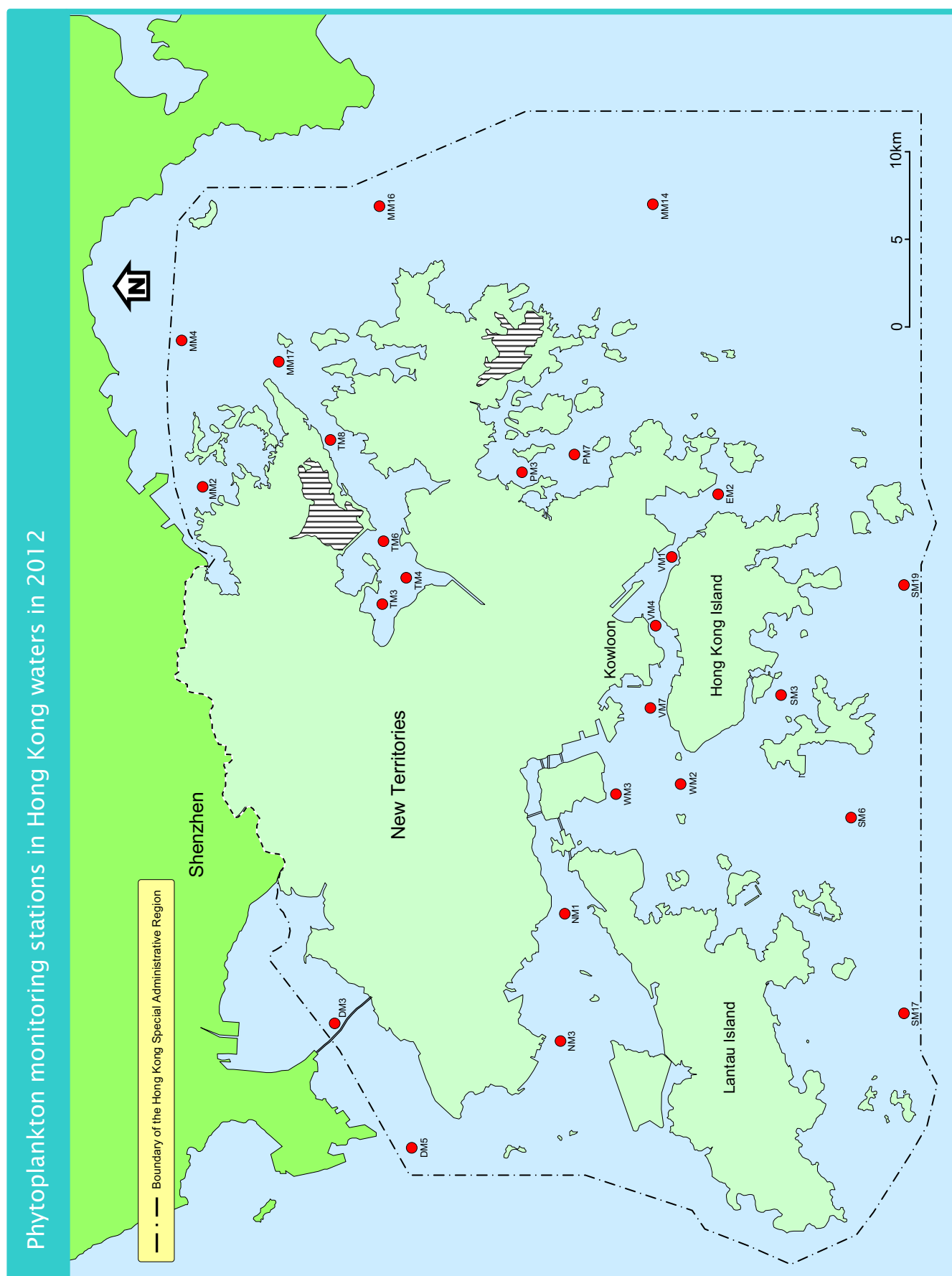
2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

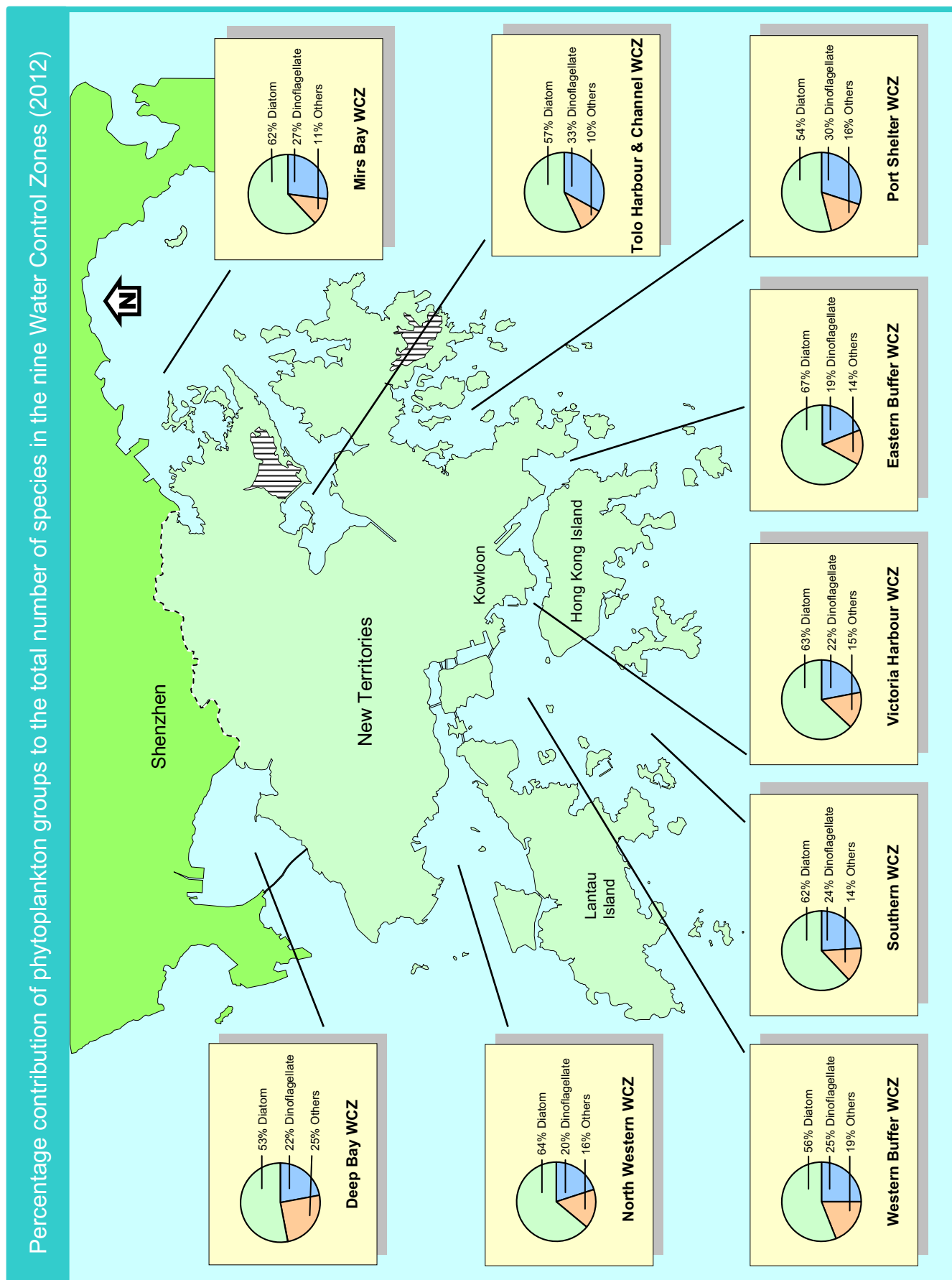
3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

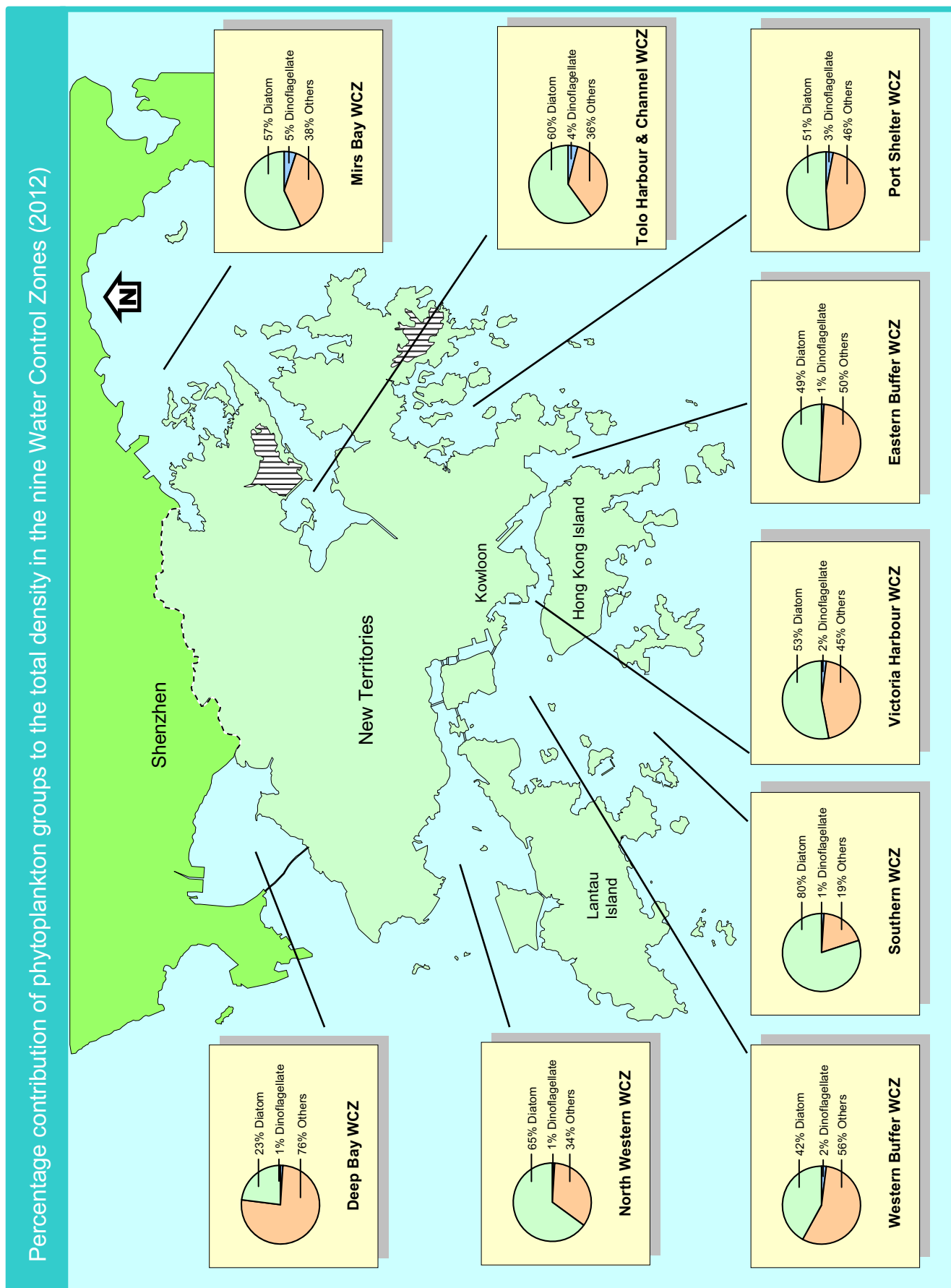
4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Fluorene, Naphthalene and Phenanthrene.

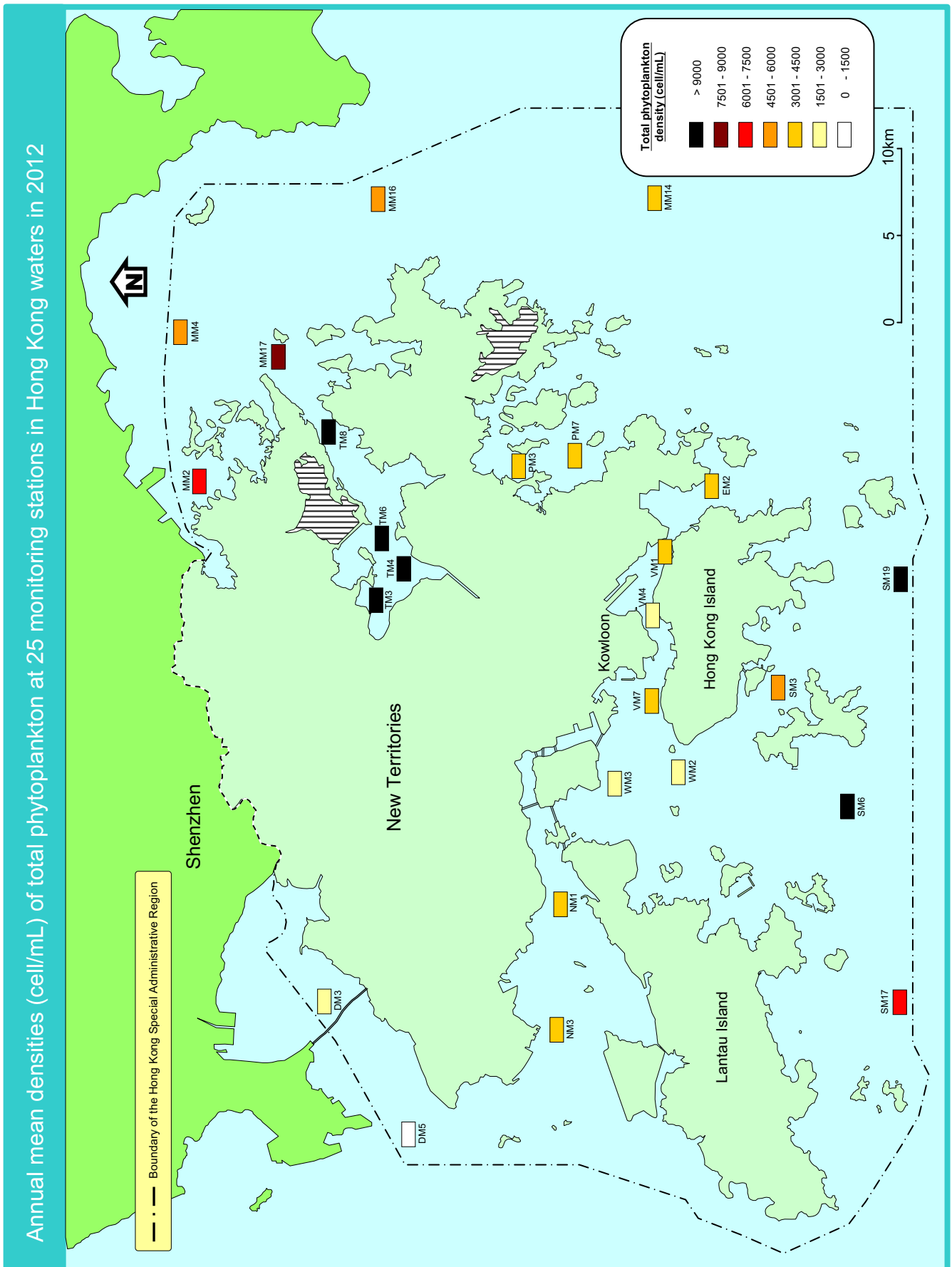
5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

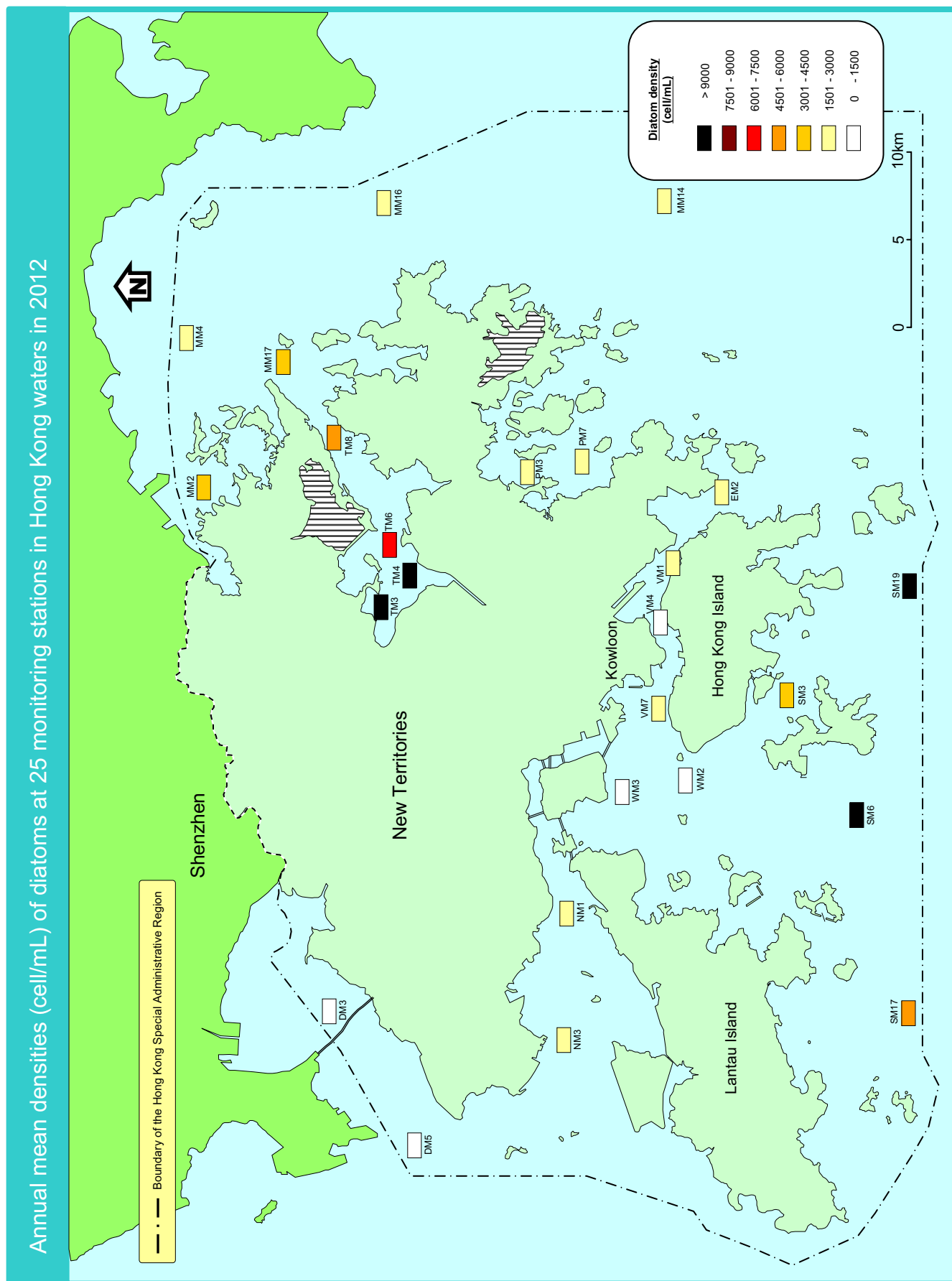
6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

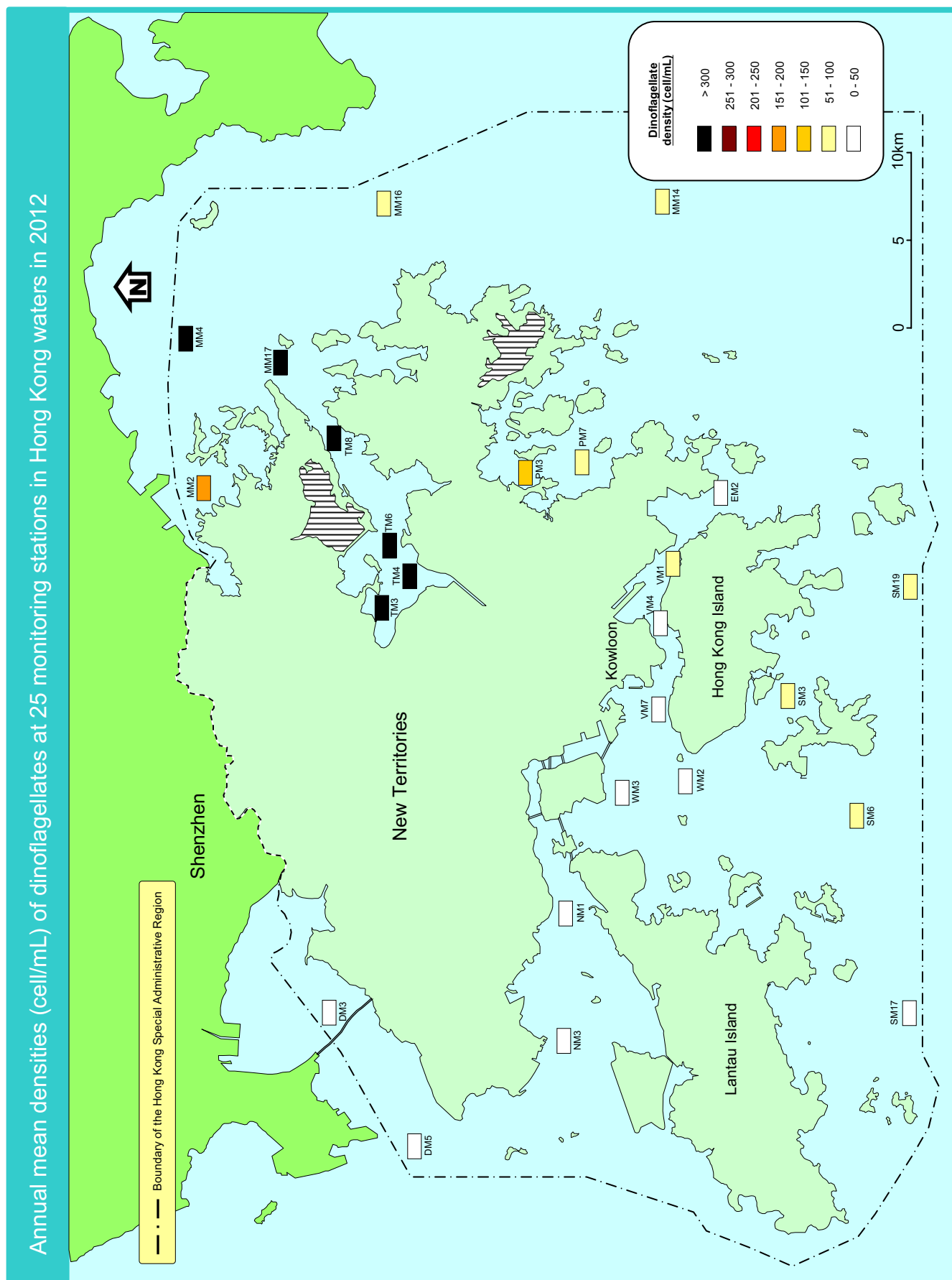


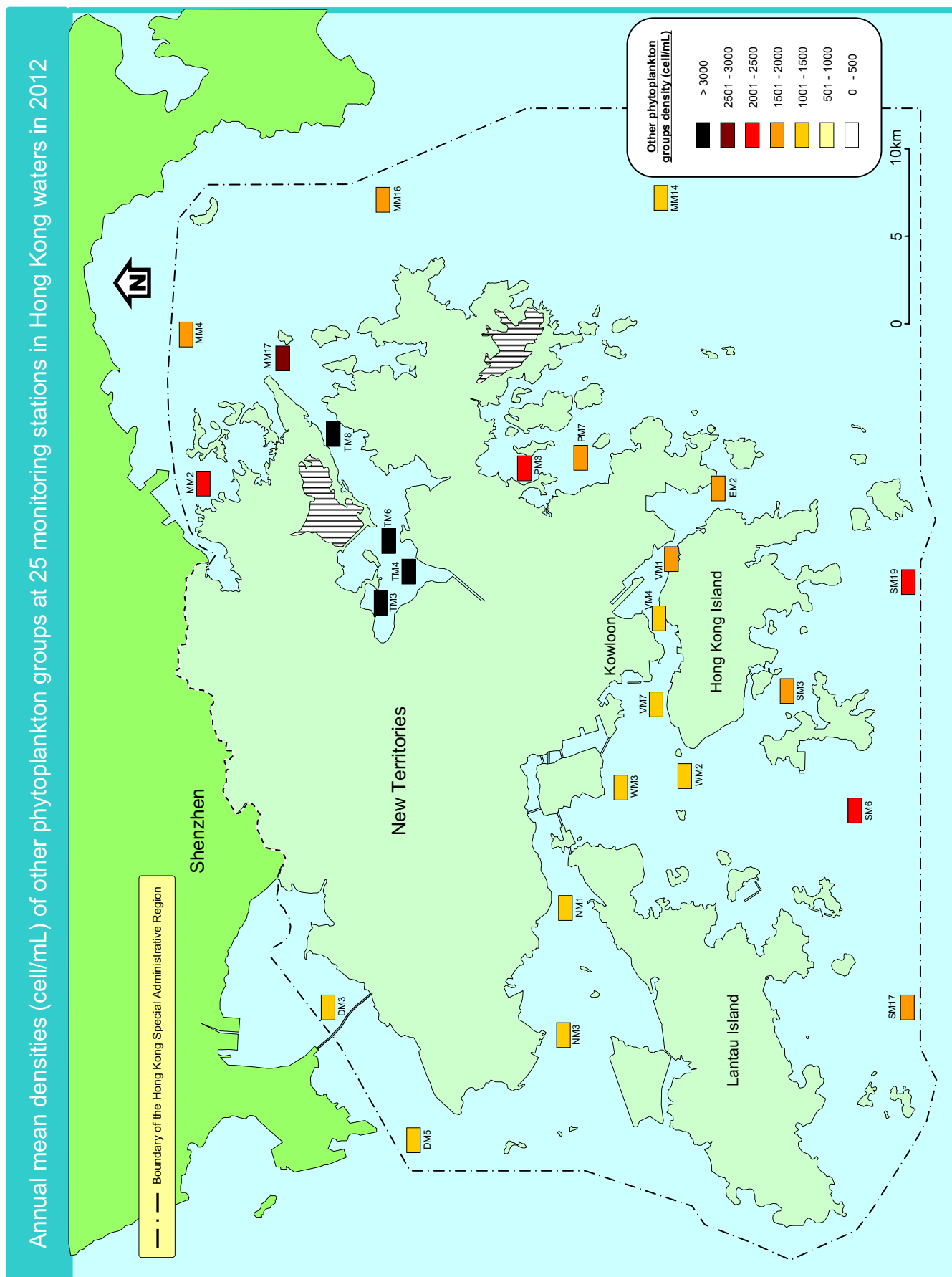






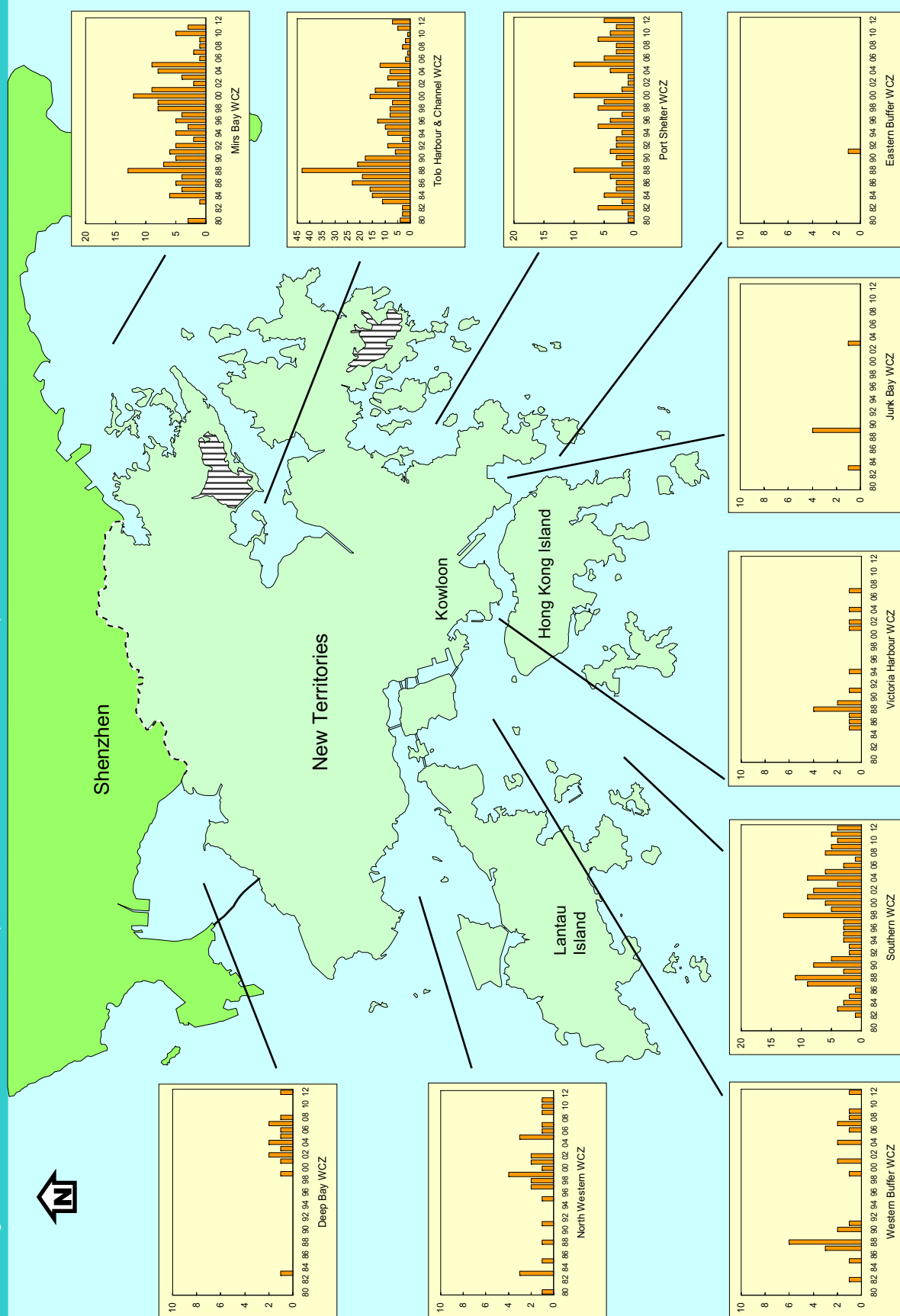






Frequency of red tides in 10 Water Control Zones in Hong Kong, 1980 - 2012

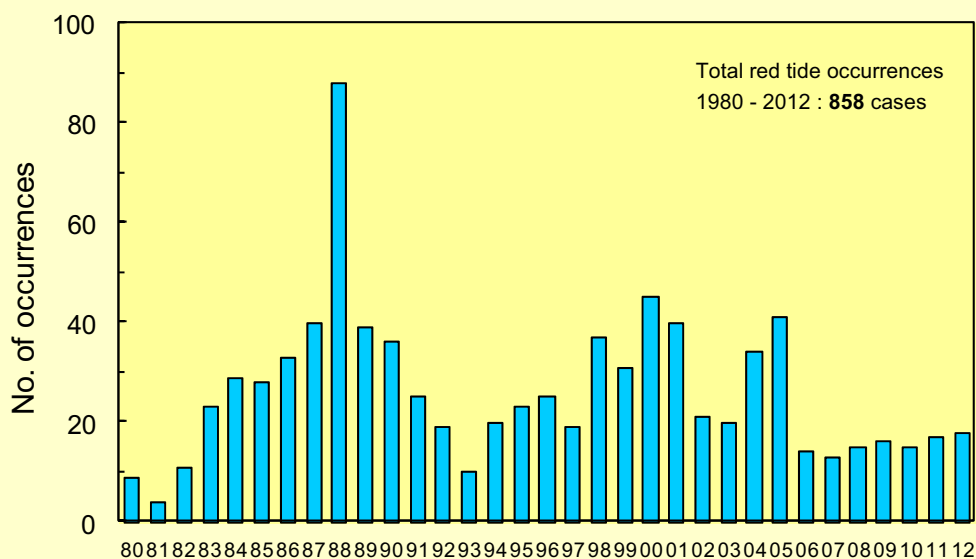
Source: Agriculture, Fisheries and Conservation Department and Environmental Protection Department



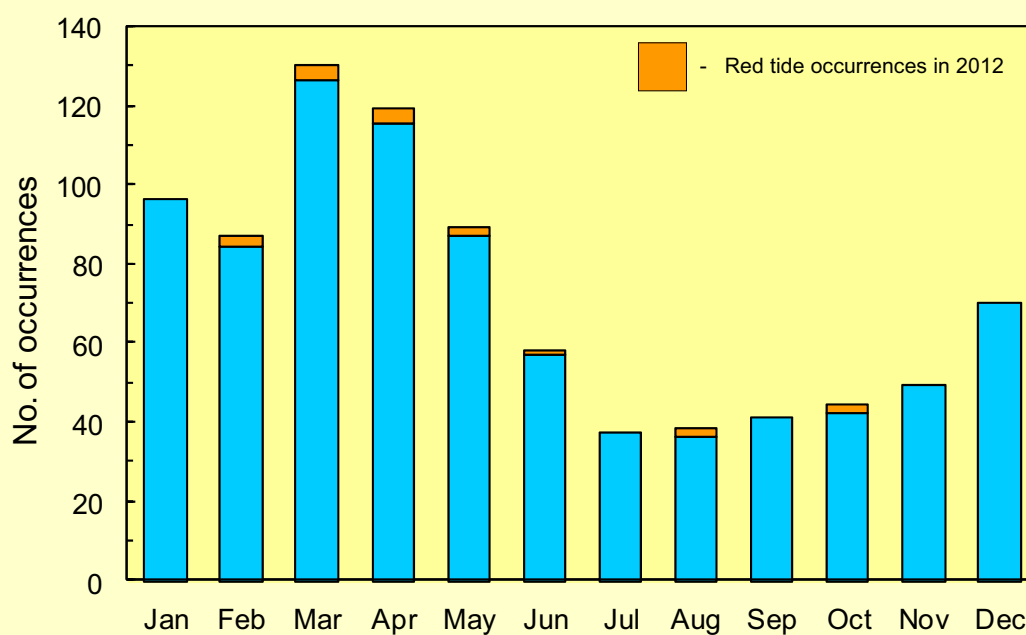
Occurrence of red tides in Hong Kong waters, 1980 – 2012

(Sources: Agriculture, Fisheries and Conservation Department and Environmental Protection Department)

Yearly Distribution

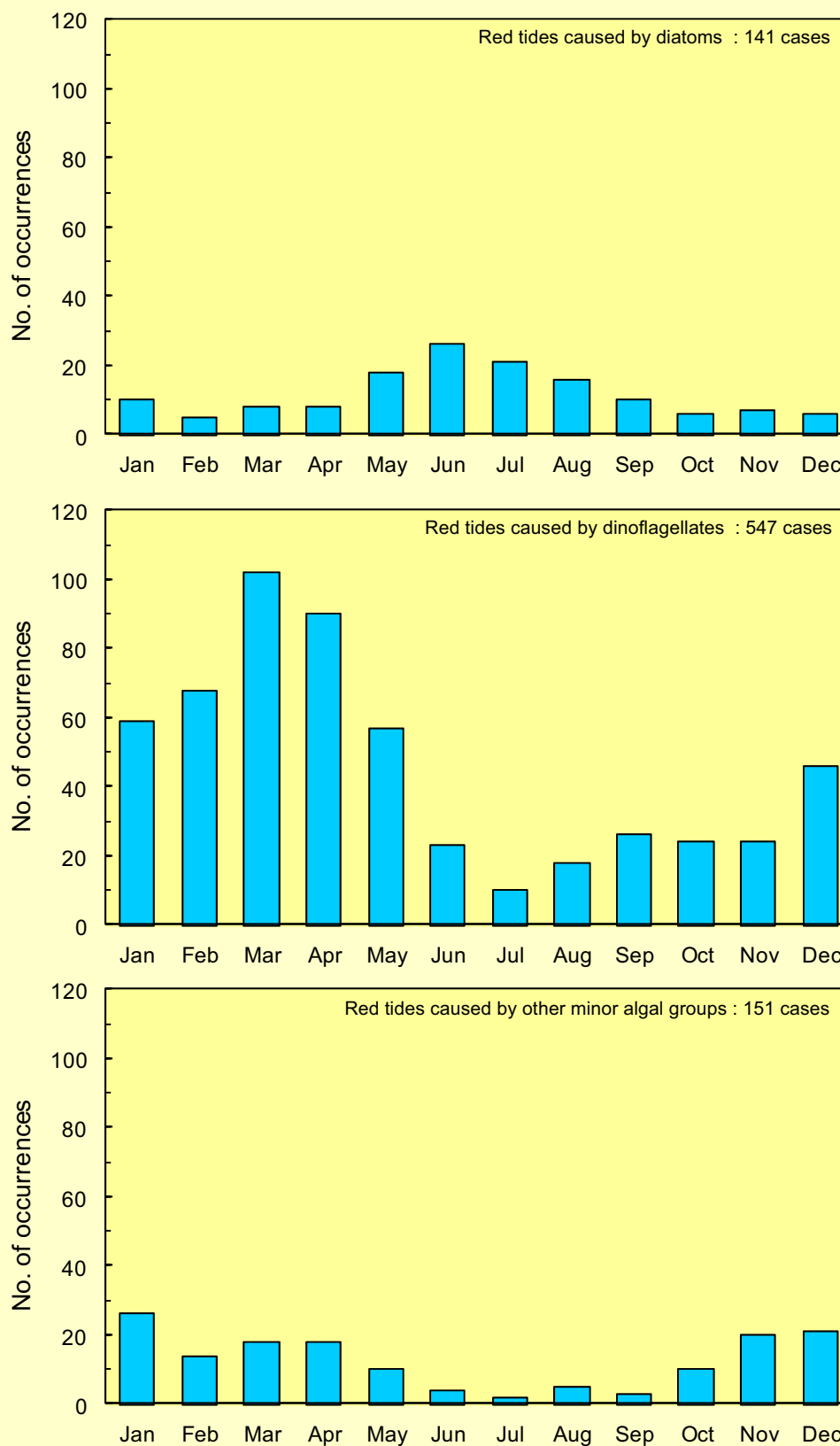


Monthly Distribution



Seasonal occurrence of red tides caused by different phytoplankton groups in Hong Kong, 1980 – 2012

(Sources: Agriculture, Fisheries and Conservation Department and Environmental Protection Department)



Abundance and frequency of the dominant phytoplankton species in different Water Control Zones (WCZs) in 2012.

Species	% Abundance ¹	Frequency ²	Species	% Abundance ¹	Frequency ²	Species	% Abundance ¹	Frequency ²
Tolo Harbour & Channel								
Diatoms			Port Shelter			North Western		
<i>Chaetoceros</i> spp.	35.9	11	Diatoms			Diatoms		
<i>Leptocylindrus danicus</i>	17.9	8	<i>Chaetoceros</i> spp.	44.1	12	<i>Skeletonema costatum</i>	50.5	9
<i>Dactylosolen fragilissimus</i>	12.3	9	<i>Thalassiosira</i> spp.	26.1	12	<i>Thalassiosira</i> spp.	21.4	12
Dinoflagellates			<i>Pseudo-nitzschia</i> spp.	18.4	10	<i>Chaetoceros</i> spp.	12.8	7
<i>Scrippsiella</i> spp.	48.6	9	Dinoflagellates			Dinoflagellates		
<i>Gymnodinium</i> spp.	21.1	12	<i>Gymnodinium</i> spp.	49.5	11	<i>Gymnodinium</i> spp.	58.1	9
<i>Scrippsiella trochoidea</i>	10.2	5	<i>Scrippsiella</i> spp.	18.5	9	<i>Scrippsiella</i> spp.	17.5	7
Others			<i>Amphidinium</i> spp.	15.9	9	<i>Amphidinium</i> spp.	11.1	8
small flagellates	91.2	12	Others			Others		
<i>Plagioselmis prolonga</i>	6.7	12	small flagellates	88.4	12	small flagellates	79.5	12
<i>Teleaulax acuta</i>	1.5	12	<i>Plagioselmis prolonga</i>	9.7	12	<i>Plagioselmis prolonga</i>	14.8	12
			<i>Teleaulax acuta</i>	1.3	12	<i>Teleaulax acuta</i>	5.0	12
Mir's Bay								
Diatoms			Victoria Harbour			Western Buffer		
<i>Chaetoceros</i> spp.	24.1	12	Diatoms			Diatoms		
<i>Pseudo-nitzschia</i> spp.	19.1	12	<i>Skeletonema costatum</i>	45.5	11	<i>Skeletonema costatum</i>	70.1	10
<i>Dactylosolen fragilissimus</i>	11.6	8	<i>Thalassiosira</i> spp.	25.0	12	<i>Thalassiosira</i> spp.	11.9	12
Dinoflagellates			<i>Chaetoceros</i> spp.	11.7	11	<i>Chaetoceros</i> spp.	6.9	9
<i>Gymnodinium</i> spp.	50.5	12	Dinoflagellates			Dinoflagellates		
<i>Scrippsiella</i> spp.	19.2	11	<i>Gymnodinium</i> spp.	55.5	10	<i>Gymnodinium</i> spp.	53.0	12
<i>Scrippsiella trochoidea</i>	14.0	3	<i>Amphidinium</i> spp.	13.8	9	<i>Amphidinium</i> spp.	24.1	10
Others			<i>Gyrodinium fusiforme</i>	11.7	9	<i>Scrippsiella</i> spp.	14.5	4
small flagellates	89.4	12	Others			Others		
<i>Plagioselmis prolonga</i>	8.0	12	small flagellates	85.6	12	small flagellates	84.5	12
<i>Teleaulax acuta</i>	1.7	12	<i>Plagioselmis prolonga</i>	10.3	12	<i>Plagioselmis prolonga</i>	10.1	12
			<i>Teleaulax acuta</i>	3.6	11	<i>Teleaulax acuta</i>	5.0	10
Eastern Buffer								
Diatoms			Southern			Deep Bay		
<i>Thalassiosira</i> spp.	26.5	12	Diatoms			Diatoms		
<i>Skeletonema costatum</i>	25.0	8	<i>Skeletonema costatum</i>	47.6	10	<i>Thalassiosira</i> spp.	55.3	12
<i>Pseudo-nitzschia</i> spp.	14.7	11	<i>Pseudo-nitzschia</i> spp.	19.3	11	<i>Pleurosigma</i> spp.	14.8	4
Dinoflagellates			<i>Chaetoceros</i> spp.	10.1	11	<i>Skeletonema costatum</i>	6.9	9
<i>Gymnodinium</i> spp.	54.7	9	Dinoflagellates			Dinoflagellates		
<i>Amphidinium</i> spp.	19.6	7	<i>Gymnodinium</i> spp.	60.3	12	<i>Gymnodinium</i> spp.	61.7	10
<i>Scrippsiella</i> spp.	12.1	5	<i>Amphidinium</i> spp.	20.9	11	<i>Scrippsiella</i> spp.	15.6	4
Others			<i>Scrippsiella</i> spp.	9.6	9	<i>Amphidinium</i> spp.	10.3	4
small flagellates	88.9	12	Others			Others		
<i>Plagioselmis prolonga</i>	8.3	12	small flagellates	89.8	12	small flagellates	70.4	12
<i>Teleaulax acuta</i>	2.6	12	<i>Plagioselmis prolonga</i>	7.1	12	<i>Plagioselmis prolonga</i>	17.4	12
			<i>Teleaulax acuta</i>	2.8	12	<i>Teleaulax acuta</i>	10.3	12

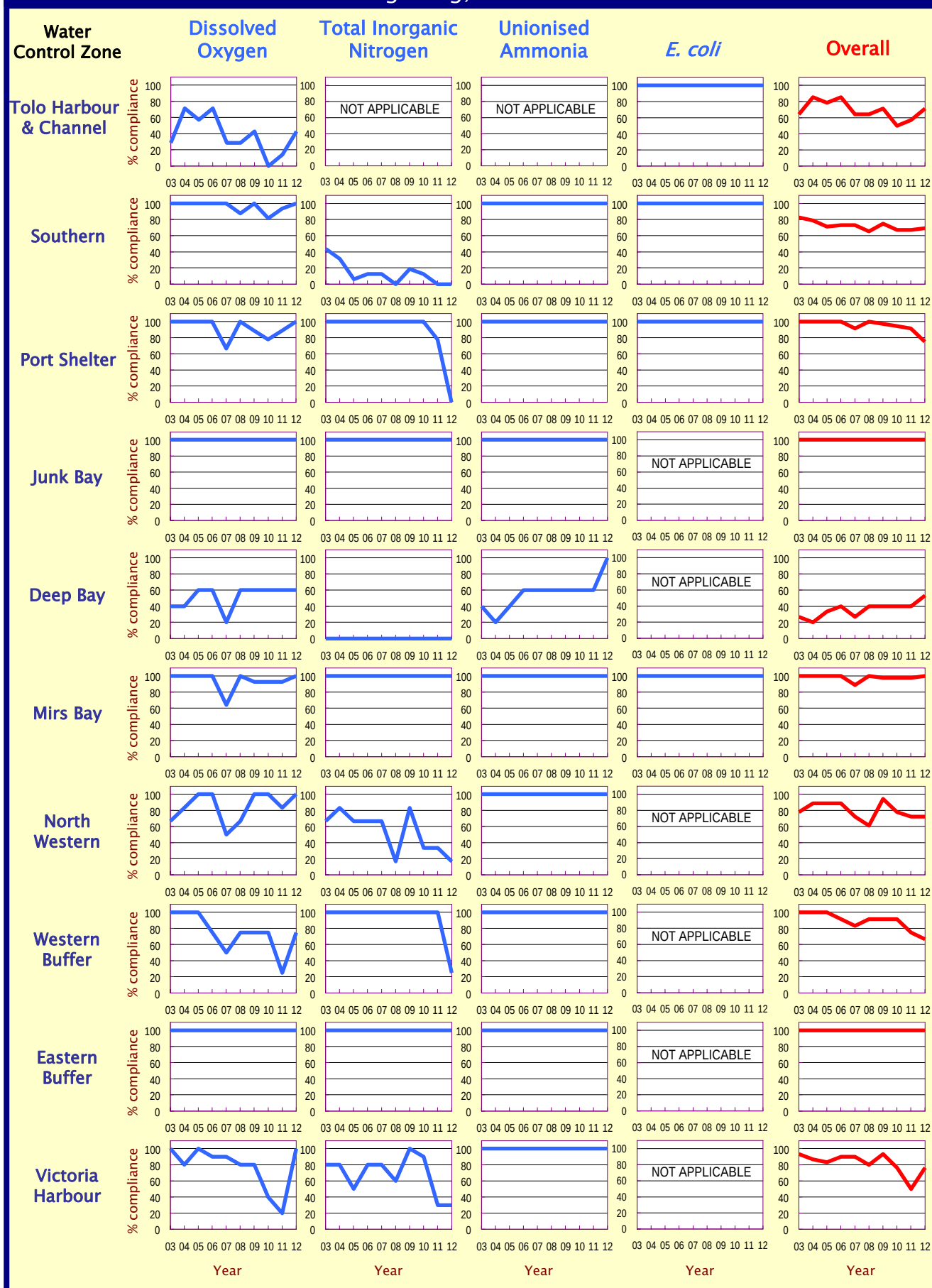
¹ % of species/group in diatoms, dinoflagellates and other phytoplankton² Number of occurrences out of 12 sampling occasions.

Occurrence and distribution of red tide species in different Water Control Zones (WCZs), 1980 - 2012												
Species	Tolo Harbour & Channel	Mirs Bay	Eastern Buffer	Port Shelter	Number of occurrences				North Western	Western Buffer	Deep Bay	Total
	WCZ	WCZ	WCZ	WCZ	Junk Bay WCZ	Victoria Harbour WCZ	Southern Waters WCZ	WCZ	WCZ	WCZ		
<i>Noctiluca scintillans</i>	66	69		59				58	6	7		265
<i>Skeletonema costatum</i>	23	3		1	3	9		13	3	9	2	66
<i>Mesodinium rubrum</i>	8	9		10	1			18	7	3	2	58
<i>Gonyaulax polygramma</i>	21	8		15				6	1			51
<i>Prorocentrum minimum</i>	44	1										45
<i>Neoceratium furca</i>	16	7		14								37
<i>Prorocentrum triestinum</i>	33											33
<i>Scrippsiella trochoidea</i>	16	5		3				1				25
<i>Heterosigma akashiwo</i>	16	2							3		1	22
<i>Heterocapsa circularisquama</i>	13	3										16
<i>Prorocentrum sigmoides</i>	14	1		1								16
<i>Prorocentrum dentatum</i>	8	4		1				1				14
<i>Trichodesmium erythraeum</i>		6		5				3				14
<i>Akashiwo sanguinea</i>	3	3		1				2	2		1	12
<i>Thalassiosira nordenskiöldii</i>	2	3				1		4		2		12
<i>Karenia mikimotoi</i>	6	2		3								11
<i>Phaeocystis globosa</i>		1						9			1	11
<i>Prorocentrum micans</i>	4	4		1		1		1				11
<i>Leptocylindrus minimus</i>	10											10
<i>Cryptomonas</i> spp.	8											8
<i>Dactylosolen fragilissimus</i>	6	1		1								8
<i>Karenia digitata</i>	1	3		2				2				8
<i>Thalassiosira mala</i>	6							2				8
<i>Chaetoceros</i> spp.	6			1								7
<i>Plagioselmis prolunga</i>	7											7
<i>Thalassiosira proschkiniae</i>	6	1										7
<i>Cochlodinium</i> spp.	2								2	1	1	6
<i>Dictyocha speculum</i>		2		3				1				6
<i>Gyrodinium instriatum</i>						1		1	2	1	1	6
<i>Thalassiosira</i> spp.	2				1			2				5
<i>Chattonella marina</i>	2	1		1								4
<i>Eutreptiella</i> spp.	4											4
<i>Haematococcus pluvialis</i>	4											4
<i>Leptocylindrus danicus</i>	3	1										4
<i>Pseudo-nitzschia pseudodelicatissima</i>	1							2		1		4
<i>Chaetoceros curvisetus</i>			1		1			1				3
<i>Chaetoceros socialis</i>	1							2				3
<i>Chattonella ovata</i>		2		1								3
<i>Cochlodinium polykrikoides</i>				1				2				3
<i>Gymnodinium simplex</i>	3											3
<i>Karenia longicanalis</i>	1	1						1				3
<i>Prorocentrum balticum</i>	1	1		1								3
<i>Protopolykrokos distortus</i>								1	1		1	3
<i>Pseudo-nitzschia seriata</i>	1					2						3
<i>Teleaulax acuta</i>	3											3
<i>Trichodesmium</i> spp.		1		1				1				3
<i>Alexandrium catenella</i>		1			1							2
<i>Alexandrium tamarense</i>				2								2
<i>Cerataulina pelagica</i>	2											2
<i>Chaetoceros salsugineum</i>		1						1				2
<i>Chattonella</i> spp.	1							1				2
<i>Dunaliella</i> spp.	2											2
<i>Eucampia zodiacus</i>								1	1			2
<i>Fibrocapsa japonica</i>				1				1				2
<i>Gymnodinium</i> spp. X				2								2
<i>Heterocapsa rotundata</i>	2											2
<i>Nitzschia longissima</i>	1							1				2
<i>Prorocentrum</i> spp.	1	1										2
<i>Pseudo-nitzschia delicatissima</i>				1				1				2
<i>Pseudo-nitzschia</i> spp.								2				2
<i>Thalassiosira tealata</i>								2				2
<i>Thalassiosira weissflogii</i>											2	2
<i>Chaetoceros pseudocrinitus</i>	1											1
<i>Chaetoceros pseudocurvisetus</i>								1				1
<i>Chaetoceros</i> spp.0105	1											1
<i>Chaetoceros tenuissimus</i>		1										1
<i>Chlamydomonas</i> spp.	1											1
<i>Chlamydomonas uva-maris</i>	1											1
<i>Cyclotella caspia</i>	1											1
<i>Cyclotella</i> spp.	1											1
<i>Cylindrotheca closterium</i>	1											1
<i>Cyttarocyllis</i> spp.				1								1
<i>Guinardia delicatula</i>	1											1
<i>Guinardia striata</i>	1											1
<i>Gymnodinium</i> spp.		1										1
<i>Gyrodinium spirale</i>								1				1
<i>Hemesinum adriaticum</i>		1										1
<i>Karenia papilionacea</i>				1								1
<i>Karlodinium micrum</i>		1										1
<i>Katodinium rotundatum</i>									1			1
<i>Leptocylindrus</i> spp.								1				1
<i>Navicula</i> spp.											1	1
<i>Neoceratium tripos</i>				1								1
<i>Odontella mobiliensis</i>	1											1
<i>Odontella sinensis</i>	1											1
<i>Pedinomonadaceae</i> spp.	1											1
<i>Protoperidinium quinquecorne</i>	1											1
<i>Takayama pulchella</i>	1											1
<i>Thalassiosira pseudonana</i>										1		1
<i>Thalassomonas</i> spp.	1											1
<i>Trichodesmium thiebautii</i>								1				1
Total : 91 species	395	152	1	135	7	14		148	29	25	13	919
Note: a red tide incident may involve more than one causative species.												
Source: Agriculture, Fisheries and Conservation Department and Environmental Protection Department												

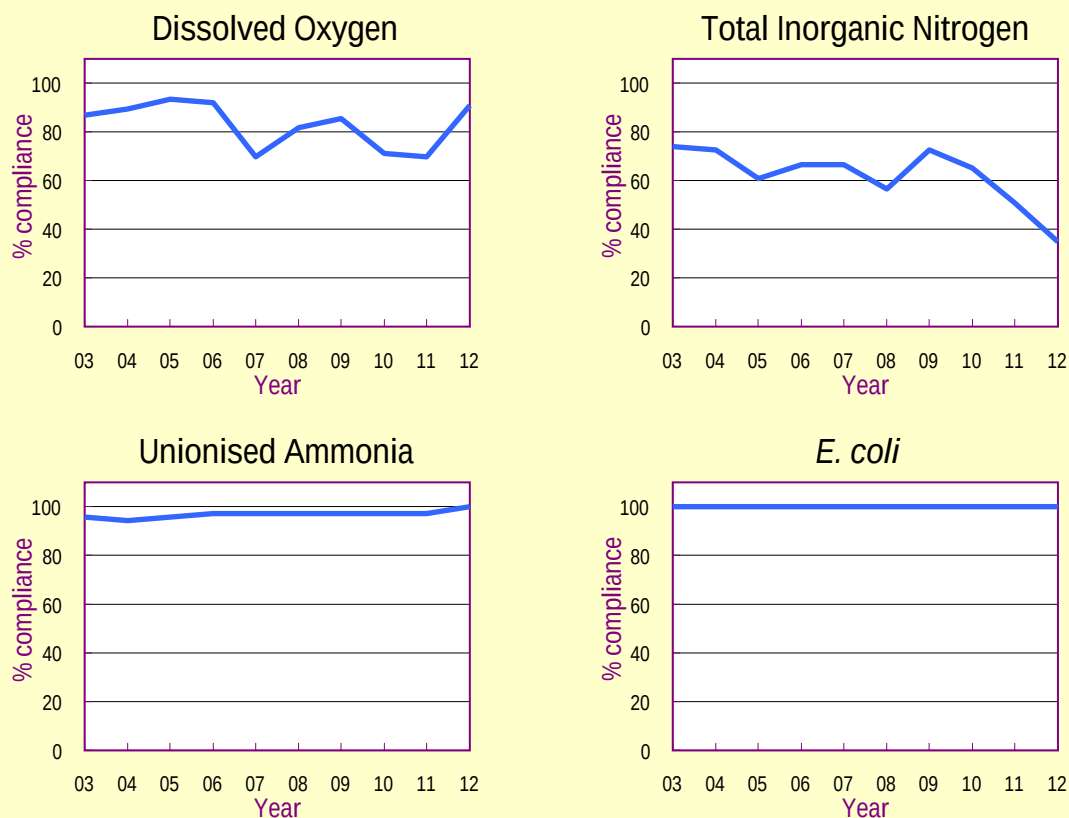
Note : a red tide incident may involve more than one causative species.

Source: Agriculture, Fisheries and Conservation Department and Environmental Protection Department

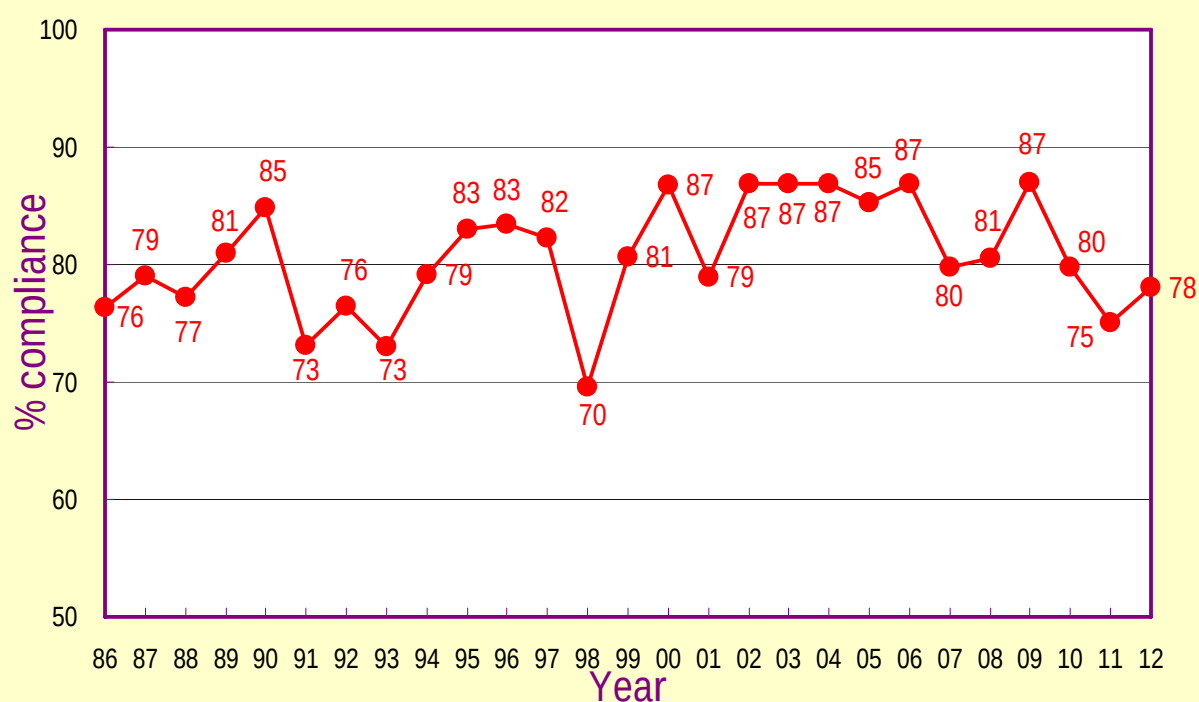
Level of compliance with key marine Water Quality Objectives for 10 Water Control Zones in Hong Kong, 2003 – 2012



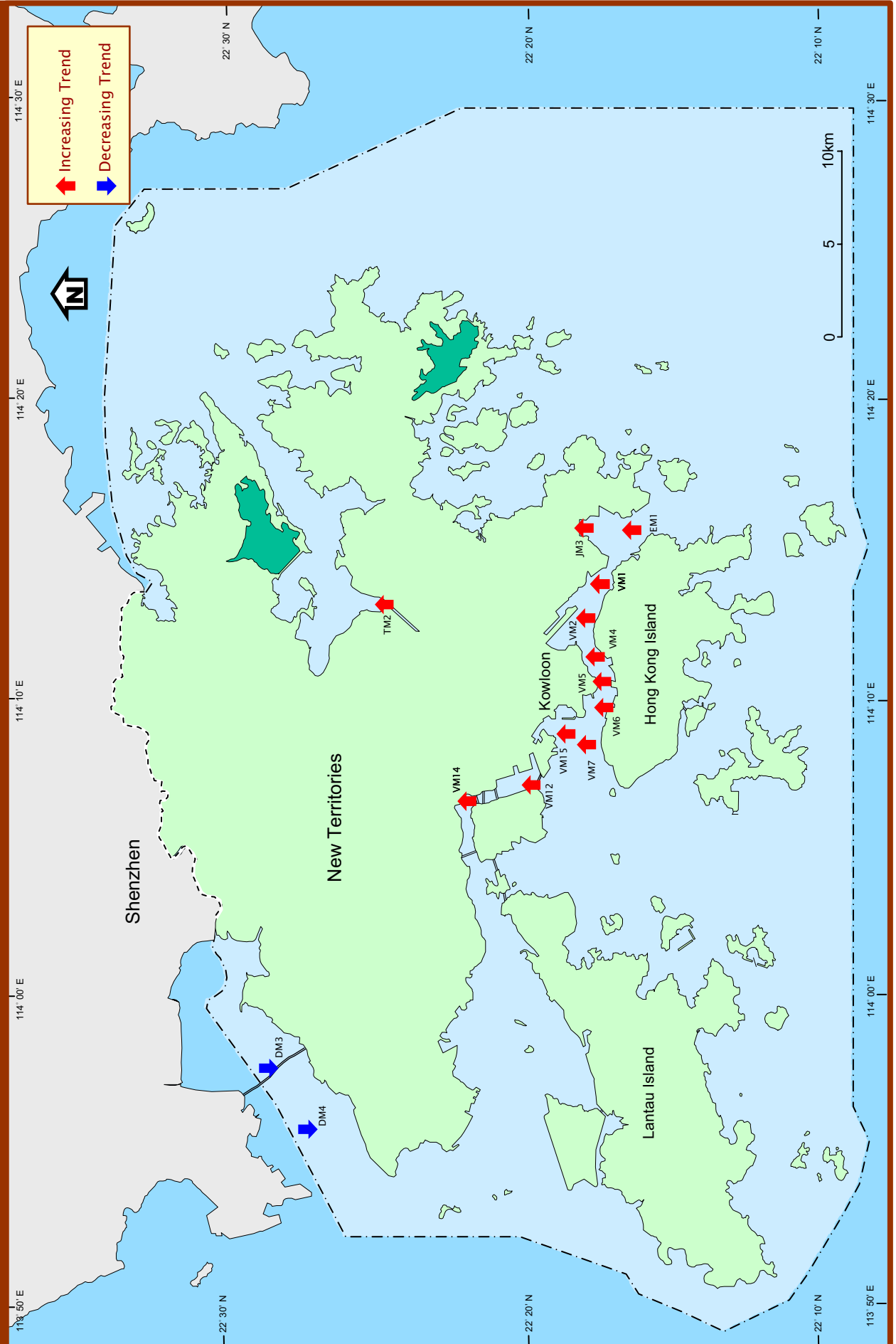
Level of compliance with key marine Water Quality Objectives in Hong Kong, 2003 – 2012

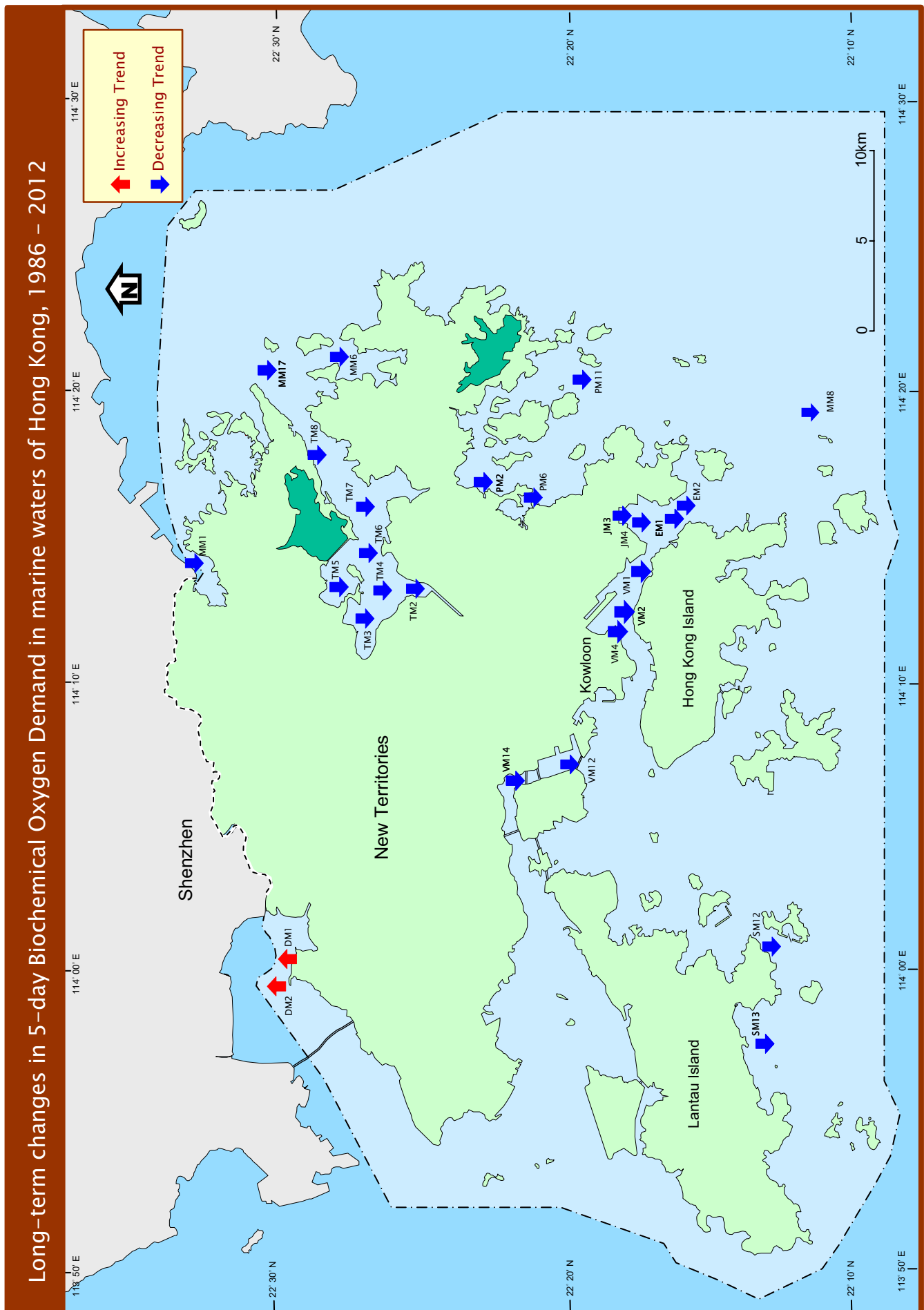


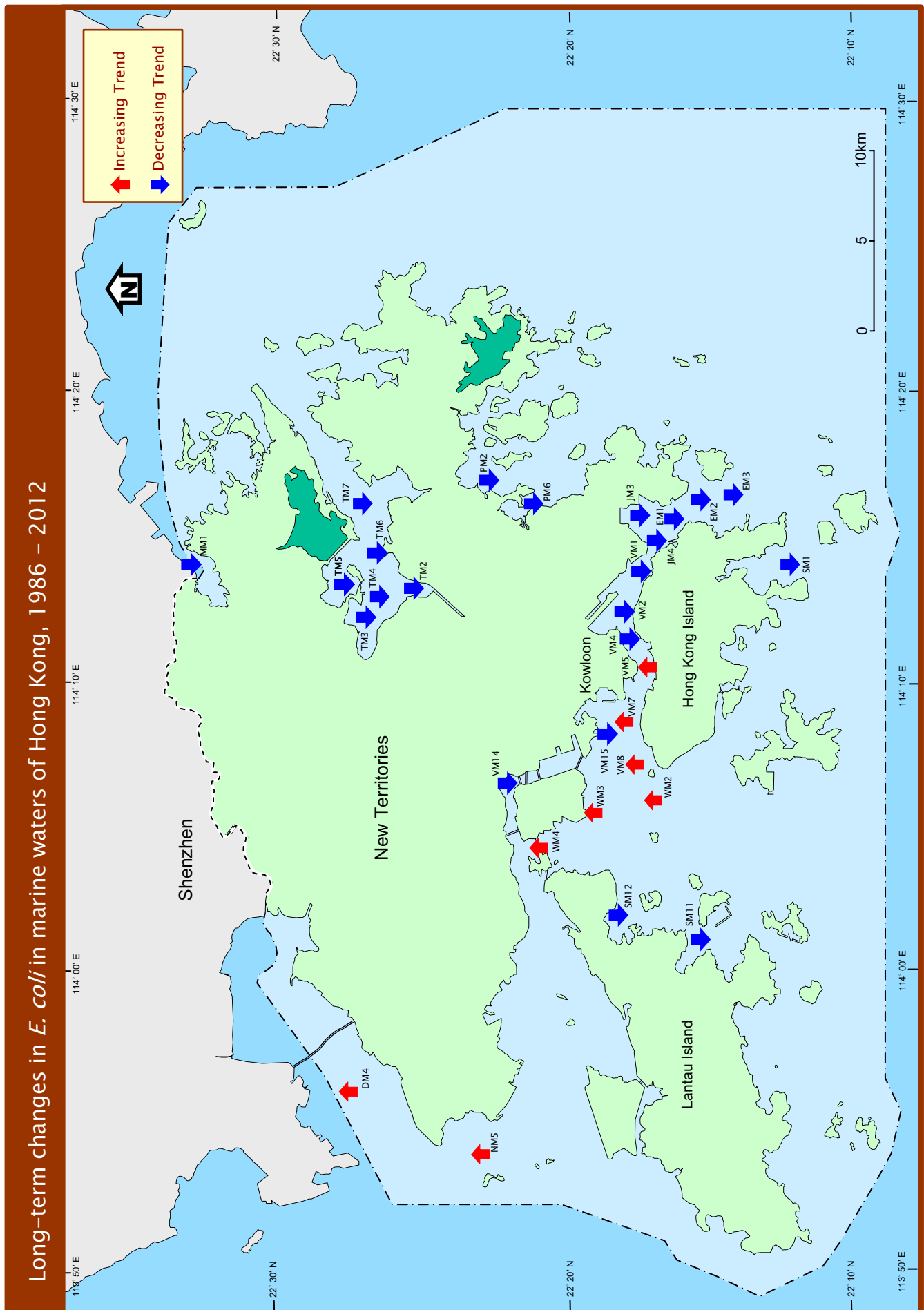
Overall level of compliance with key marine Water Quality Objectives in Hong Kong, 1986 – 2012

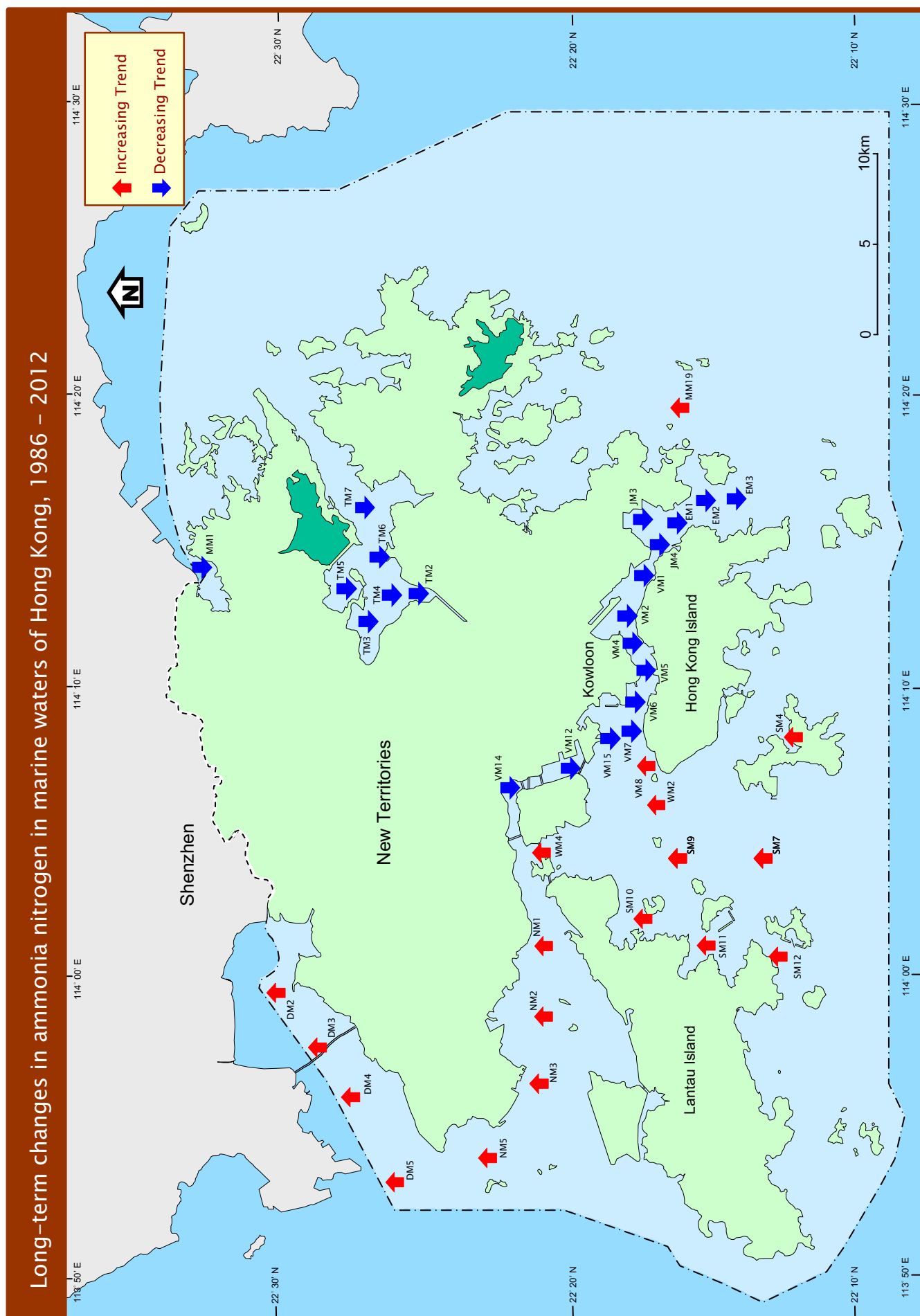


Long-term changes in dissolved oxygen in marine waters of Hong Kong, 1986 – 2012









Long-term changes in nitrate nitrogen in marine waters of Hong Kong, 1986 – 2012

