Marine Water Quality in Hong Kong in 2010

Environmental Protection Department

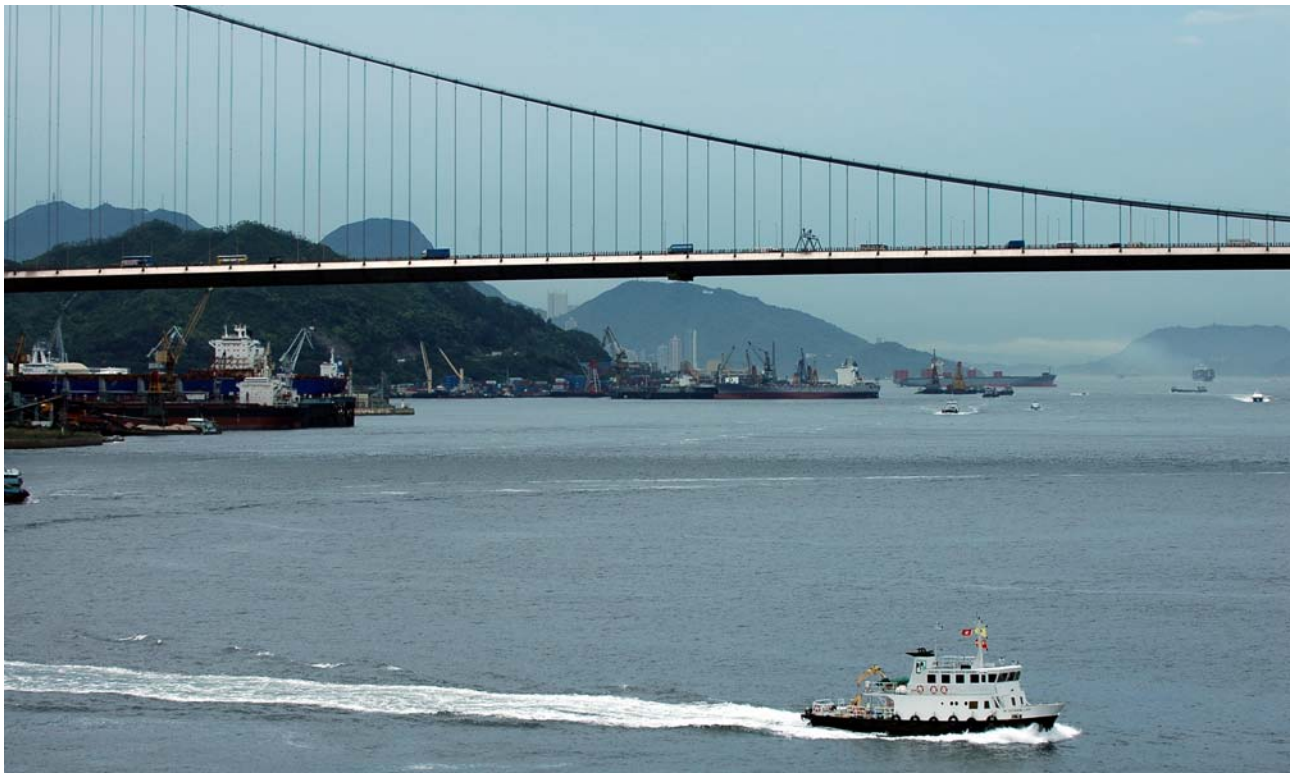
The Government of the Hong Kong Special Administrative

同心耕耘廿五載　共創綠色新世代

25 Years of Sustained Effort for a Greener Future

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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History of Marine Monitoring Programme

The marine monitoring programme was introduced in 1986 when the Environmental Protection Department (EPD) was formally established to monitor water pollution in the territory and to assess the marine water quality.

In the past 25 years, the monitoring programme has accumulated a sizable database on the quality of Hong Kong's marine water and sediments. In addition to the assessment of water quality, EPD has used the database to provide background information for various local and strategic planning studies, to design and assess the effectiveness of the mitigation measures, and to predict future changes and challenges to Hong Kong's waters. The programme has proved itself to be a crucial management tool of our sensitive marine environment.

The EPD publishes a water quality report annually. The water quality information is also uploaded onto the departmental website for public access.
(http://www.epd.gov.hk/epd/english/environmentinhk/water/marine_quality/mwq_home.html)

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Introduction

The Hong Kong Special Administrative Region (HKSAR) has a land area of 1,104km^2 and 1,651km^2 of marine waters. It has long coastlines, including 461km in Kowloon Peninsula and New Territories and 728km in Hong Kong Island, Lantau Island and other small islands. There are more than 260 islands in the territory, each with an area greater than 500m^2. 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:

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

Every month, the EPD monitors the marine water quality at 76 monitoring stations and collected and examined phytoplankton samples from 25 stations. We also monitor the water quality of 17 typhoon shelters, marinas, and dockyard(s) across Hong Kong bimonthly. In addition, sediment samples were collected and analyzed at 60 stations, including the 17 typhoon shelters, marinas, and dockyard(s) 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

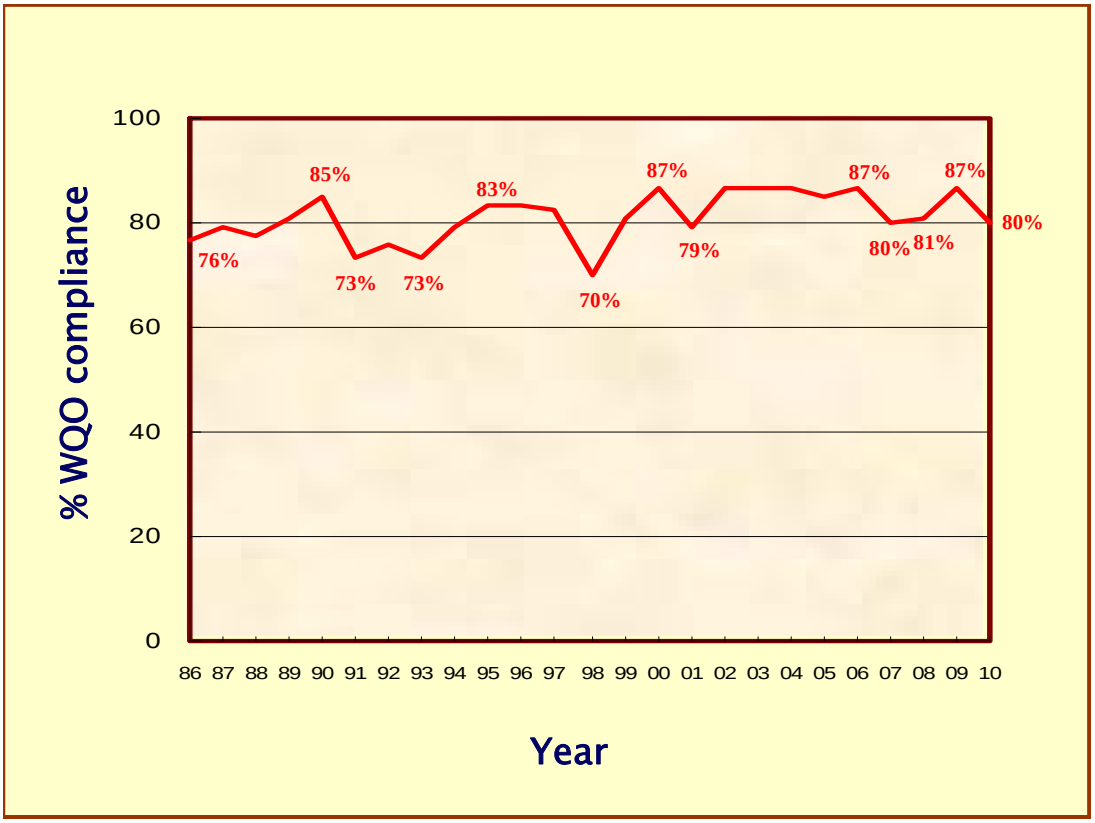
water sampler which takes field measurements and collects water samples simultaneously. Marine sediments are collected using bottom sediment grabs. The water and sediment samples are analysed by the EPD's laboratories and the Government Laboratory for over 80 physical, chemical and biological parameters.

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

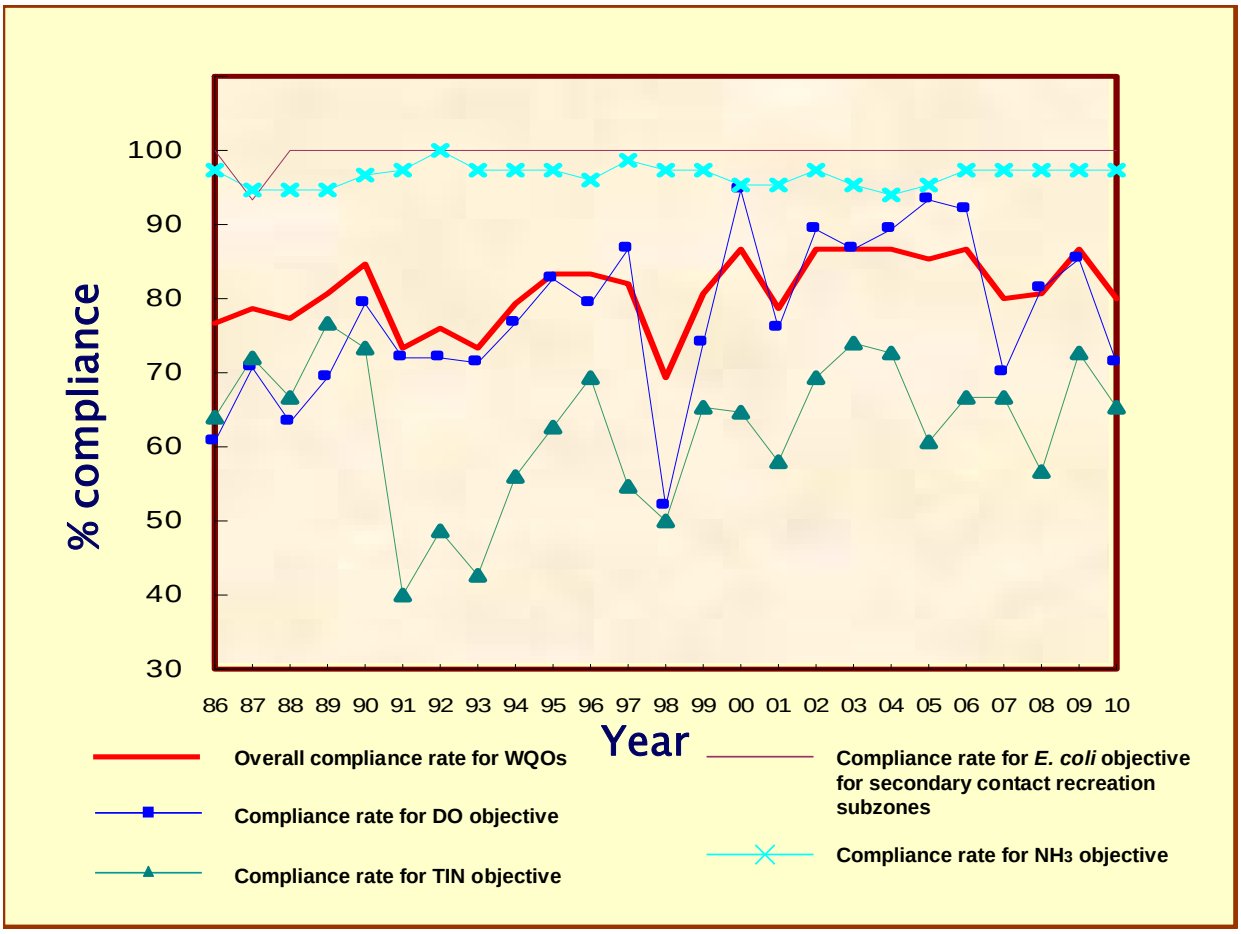
The State of Hong Kong Marine Waters in 2010

The overall WQO compliance rate of the whole territory is based on the combined individual compliance rates of all stations for the four important marine WQOs, namely Dissolved Oxygen (DO), Total Inorganic Nitrogen (TIN), Unionised Ammonia (NH_3) and *E. coli* bacteria.

The overall WQO compliance rate for 2010 was 80%, lower than that in 2009 (87%) but similar to that in 2007 (80%) and 2008 (81%).



Overall compliance with the marine Water Quality Objectives in Hong Kong, 1986-2010



The overall compliance rate with the WQOs and the compliance rates for the four objectives in Hong Kong, 1986-2010

The overall WQO compliance rate was lower in 2010 as compared with 2009, mainly due to a lower compliance rate with the dissolved oxygen (DO) objective (71% in 2010 as compared with 86% in 2009), as well as a lower compliance rate with the total inorganic nitrogen (TIN) objective (65% in 2010 as compared with 73% in 2009).

The dissolved oxygen levels in a water body can be affected by organic pollution, which reduces the level due to oxygen consumption, and natural factors such as temperature and water column stratification. High temperature would reduce the solubility of oxygen in the water column, hence lower DO level in hot weather. According to Hong Kong Observatory's weather report in 2010, July was hotter than usual with 8 very hot days with daily temperature of 33 degrees or above, and this could be a key factor for the lower compliance rates with the DO objective as observed in the Tolo Harbour and Channel Water Control Zone (WCZ) and Victoria Harbour WCZ in 2010.

Regarding stratification of the water column, its formation is a consequence of water masses with different densities. Water density is strongly influenced by temperature and salinity; with less

dense, warmer surface waters floating on top of denser, colder waters. Water is unable to mix across the boundary between the surface layer and lower layer, but wind, upwelling, down-welling and storms help move water across the boundary. For semi-enclosed water body such as Tolo Harbour, which is protected from the wind by surrounding topography or land masses, the water column is readily "stratified" and separated into distinct top and bottom layers during the hot summer months, or during periods of heavy rainfall when the warmer surface runoff, which is less saline and lighter than sea water, drains into the sea.

Under situation of either high temperature, as encountered in 2010 during the hot summer months, or heavy rainfalls, the oxygen levels at the deeper waters would gradually reduce because there is no replenishment of oxygen from the upper water layer after the oxygen is consumed by the bottom-dwelling organisms. Regarding the rain record in 2010, while the first half of the year was relatively dry with the total rainfall about 16% below normal, heavier rainfall was recorded during the summer period due to the heavy rain episodes in July and the typhoon-related torrential rainfall in the summer between July and September. For example, the rainfall in September has a record high level of 593.1 millimetres, as compared with the normal figure of 287.5 millimetres.

The compliance rates with TIN objective in the Northwestern WCZ decreased from 83.3% in 2009 to 33.3% in 2010 which resulted in the 78% overall compliance in 2010. High levels of TIN (0.7-1.1mg/L) in the Northwestern WCZ were recorded in June to September of 2010, resulting in the overall annual average of TIN level in this WCZ to exceed 0.4 mg/L (the TIN objective for this WCZ). The higher levels of TIN recorded in the northwestern waters of Hong Kong in the summer months might be associated with the higher background level of the Pearl River Delta, since heavy rainfalls occurred in the Pearl River Delta area in the same period.

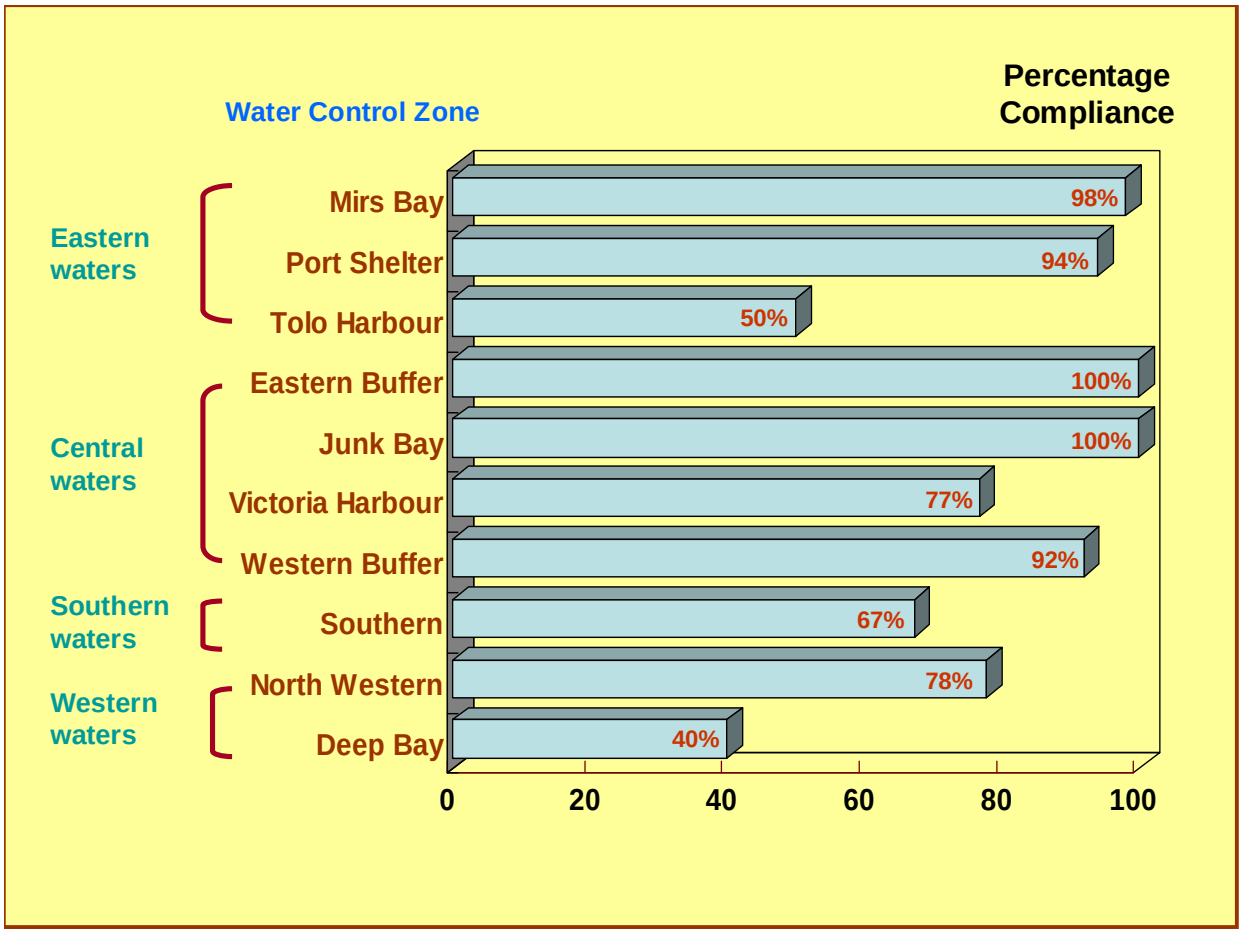
In the Victoria Harbour WCZ, the 2010 compliance rate was 77% compared with 93% in 2009. The lower compliance rate was mainly due to the non-compliance with DO objective at 6 stations in Victoria Harbour (VM1, 4, 5, 6, 12 and 15) in the summer months of 2010. Similar to the Tolo Harbour WCZ, the low DO situation was likely related to the unusually hot and wet weather during July to September. The *E. coli* level in the general western Victoria Harbour area decreased by 47%-68% compared with that in 2009 which could be attributed to the commissioning of the Advance Disinfection Facilities (ADF) at the Stonecutters Island Sewage Treatment Works (SCISTW) in March 2010. However, no decrease in *E. coli* level was observed in central Victoria Harbour (from North Point to Sai Wan) because the discharges from the four remaining sewage screening plants on the north side of Hong Kong Island have not yet been intercepted for treatment at the SCISTW.

The overall compliance rates in the Eastern Buffer, Junk Bay and Western Buffer WCZs were 100%, 100% and 92% respectively in 2010 which were the same as in 2009. The full compliance achieved in the Eastern Buffer and Junk Bay WCZs has been maintained since 2002 when the HATS Stage 1 was commissioned.

The overall WQO compliance rate in Deep Bay was 40% in 2010, same as in 2009. The TIN levels in Inner Deep Bay (DM1, DM2 and DM3) were largely similar to those in 2009 (i.e. 3.8, 3.0 and 1.5 mg/L) and exceeded the Water Quality Objective of 0.7 mg/L. The TIN levels in Outer Deep Bay remained largely stable since 2002 at 1.0-1.2 mg/L.

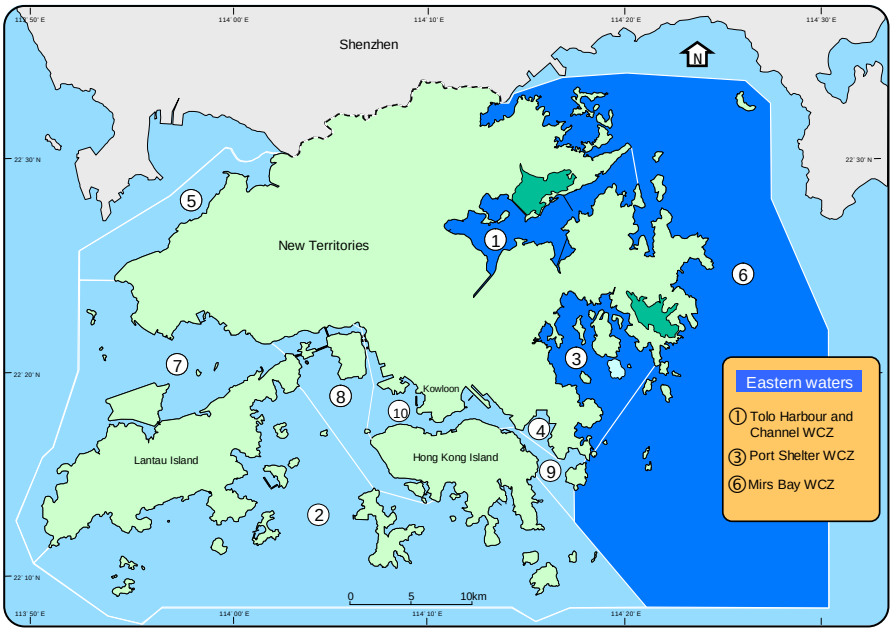
The compliance rates in Port Shelter and Mirs Bay in 2010 were 94% and 98% respectively and largely similar to those in 2009.

The compliance rate in the Southern WCZ in 2010 was 67% and slightly lower than that in 2009 (75%). Similar to Northwestern WCZ, the decrease in compliance rate was mainly due to the higher TIN levels recorded in the wet and hot summer months in 2010.



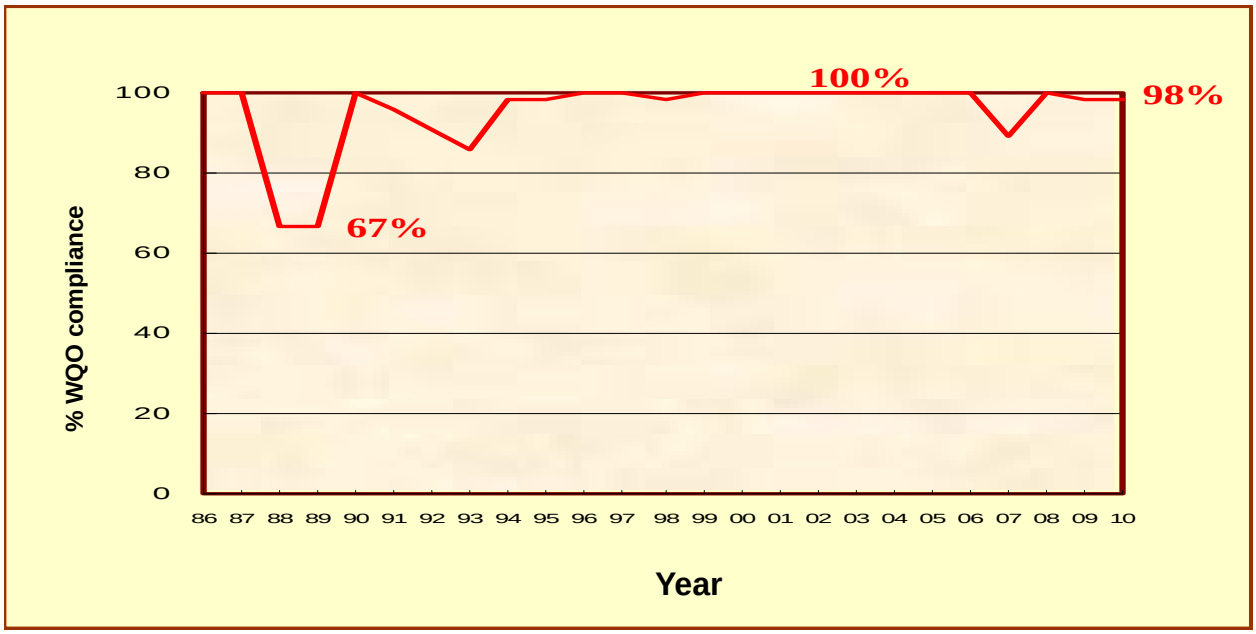
Level of compliance with the Water Quality Objectives in the ten Water Control Zones in 2010

Eastern Waters



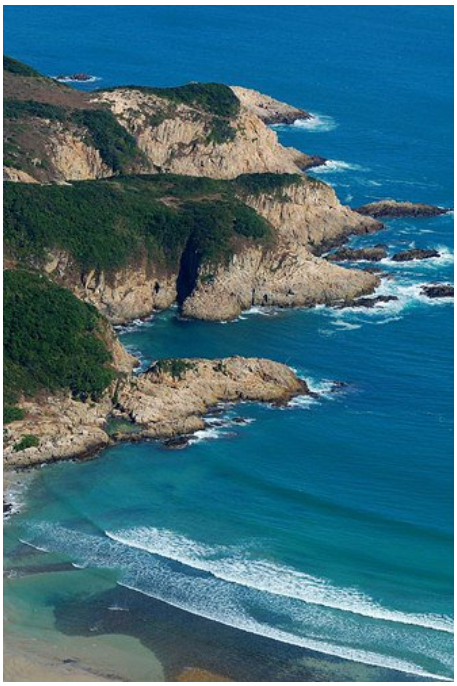
The eastern waters cover an area of 900 km^2 which comprises Mirs Bay, Port Shelter and Tolo Harbour & Channel Water Control Zones (WCZs). These waterbodies have beautiful coastlines and good water quality in general which support a diversity of marine life. Moreover, there are six gazetted beaches (Kiu Tsui, Hap Mun Bay, Trio, Silverstrand, Clear Water Bay First and Clear Water Bay Second Beaches) 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.

Mirs Bay Water Control Zone



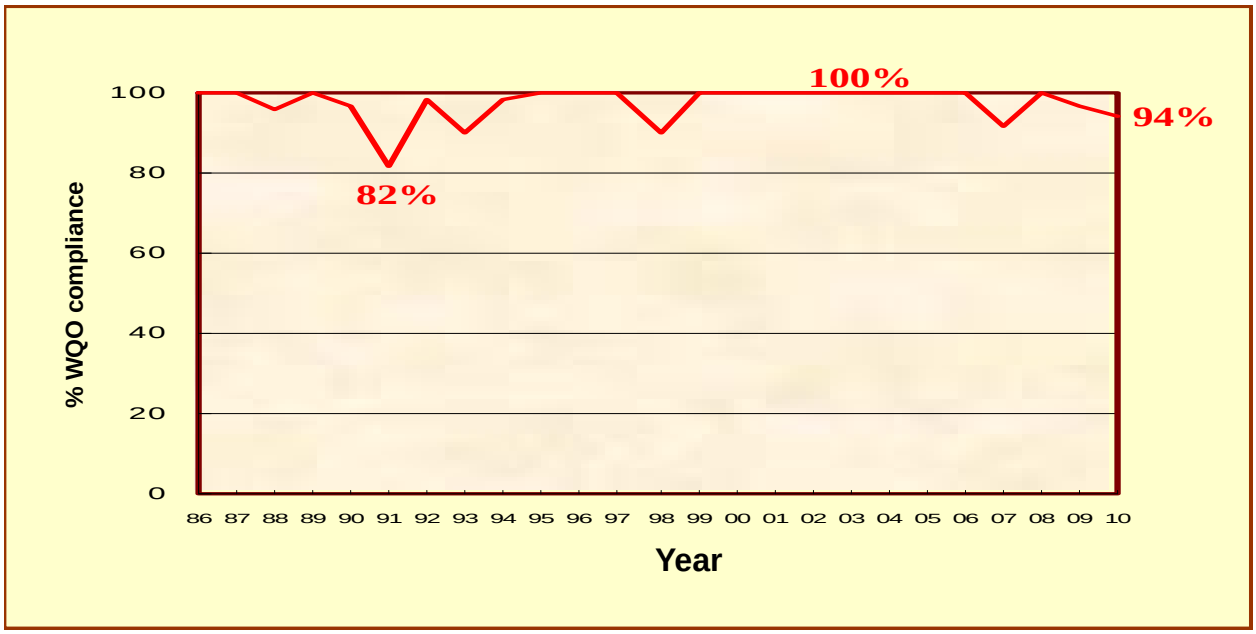
The overall WQO compliance rate of the Mirs Bay WCZ was 98% in 2010, the same as in 2009. The water quality of the Mirs Bay WCZ was generally good in 2010 with high DO as well as low nutrient and bacteria counts which fully met their respective WQO. The only recorded non-compliance with WQOs was due to the low oxygen levels recorded at the sea bottom in July and August at station MM4 located in the middle of inner Mirs Bay when the water was thermally stratified.

Good water quality in Mirs Bay supports a diversity of marine life



The beautiful and scenic Sai Wan

Port Shelter Water Control Zone

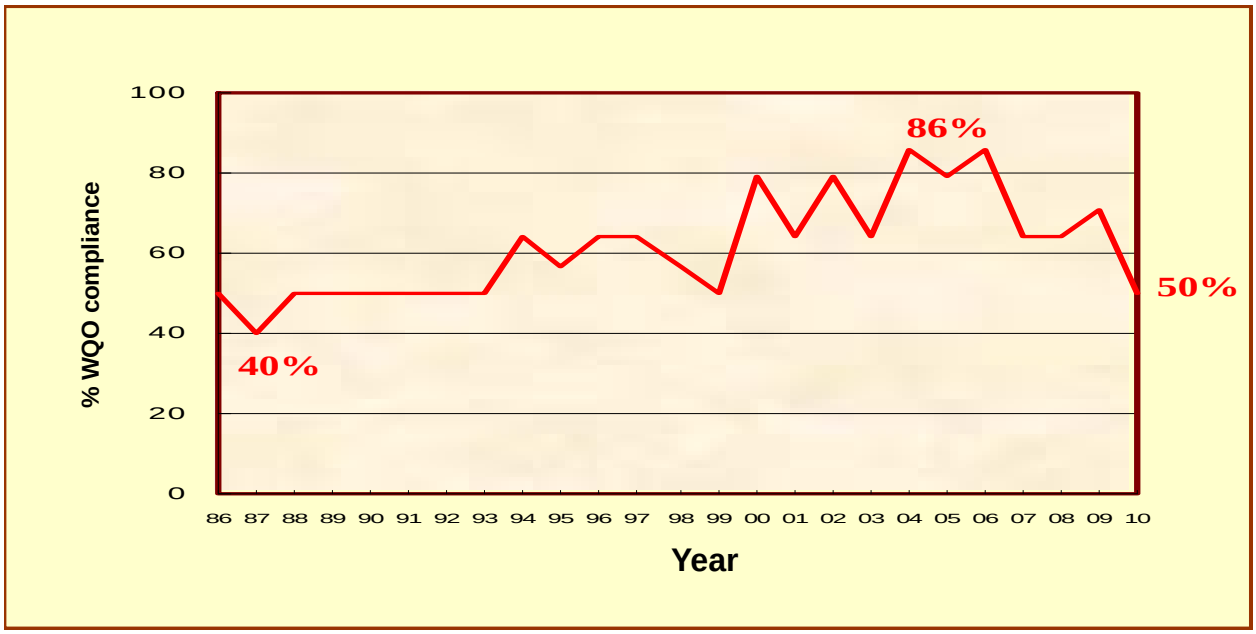


In 2010, the water quality in the Port Shelter WCZ was amongst the best in the territory with high DO and low levels of nutrients and *E. coli*. Similar to Mirs Bay, the 2010 WQO compliance of the Port Shelter WCZ was 94%. The non-compliance with DO objective was due to the low oxygen levels recorded at the sea bottom in August and September at stations PM7 and PM9 located near Shelter Island and the middle of Rocky Harbour respectively when the water was thermally stratified in the summer. As always, Port Shelter has excellent water quality and it attracts a lot of visitors who enjoy various water sport activities, including swimming, yachting, water skiing and diving every year. The six gazetted beaches in Port Shelter were visited by over 1.5 million visitors during the 2010 bathing season.

Trio Beach in Port Shelter is one of the beaches with good water quality

Silverstrand Beach is one of the popular bathing beaches in Port Shelter which opens all year round

Tolo Harbour and Channel Water Control Zone

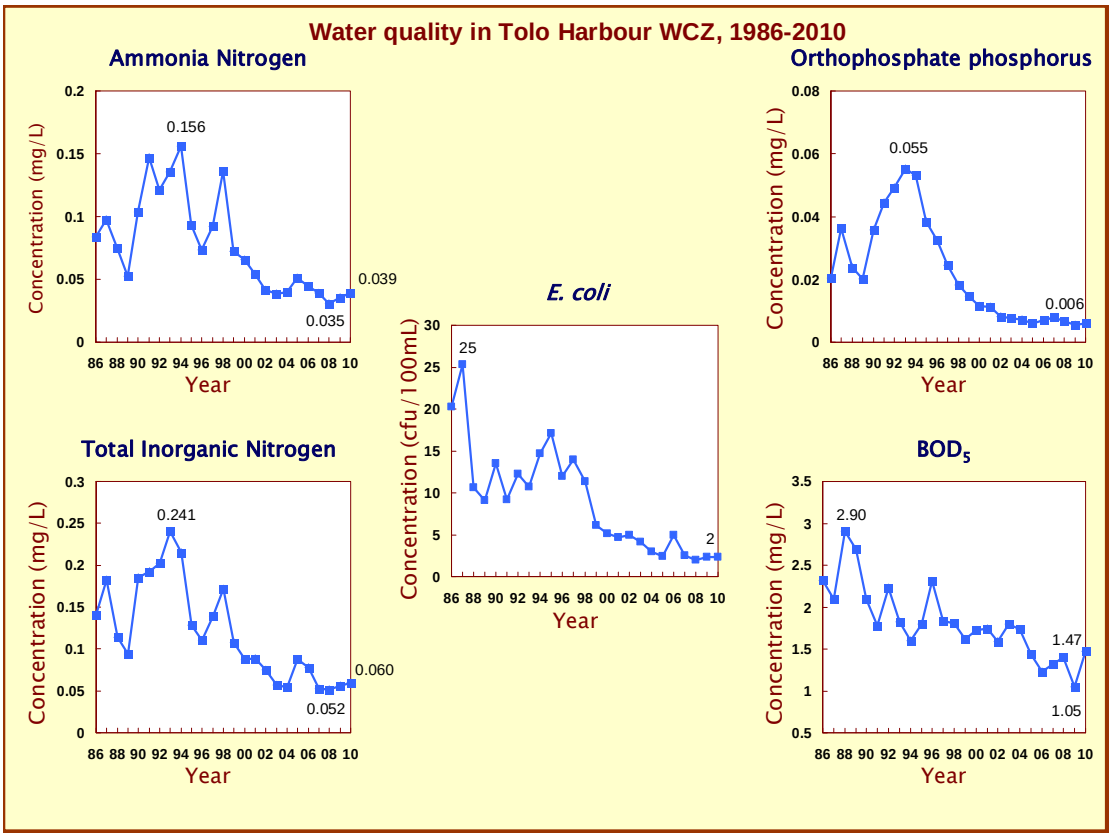


A 50% overall compliance rate with the WQO in 2010 was noted in Tolo Harbour due to the low DO levels in the water column from July to September. We have reviewed the data of the other key water quality parameters monitored by the EPD during these summer months and do not find any deterioration of water quality due to pollution. The long term data as shown in the figures below also shows a decreasing trend of organic or nutrient loading. Moreover, Tolo Harbour is also able to comply with the bacteriological WQO of 610 cfu per 100 mL (annual geometric mean).

As such the low DO situation was not caused by organic pollution but might be related to the unusually hot weather in 2010. Since Tolo Harbour is a semi-enclosed water body, the heavy rainfall from July to September would also intensify the stratification of the water column, which would reduce the mixing of the bottom layer with the upper layer of the water column and lead to low DO or anoxic condition of the bottom layer. Coupled with the stringent WQO for DO, which requires that all (i.e. 100%) samples[1] collected in the harbour during the year must meet the relevant objectives, it was observed that out of the 7 stations, 5 stations in the harbour and buffer subzones (as compared with only 2 stations in 2009) failed to meet the WQO for bottom DO, hence

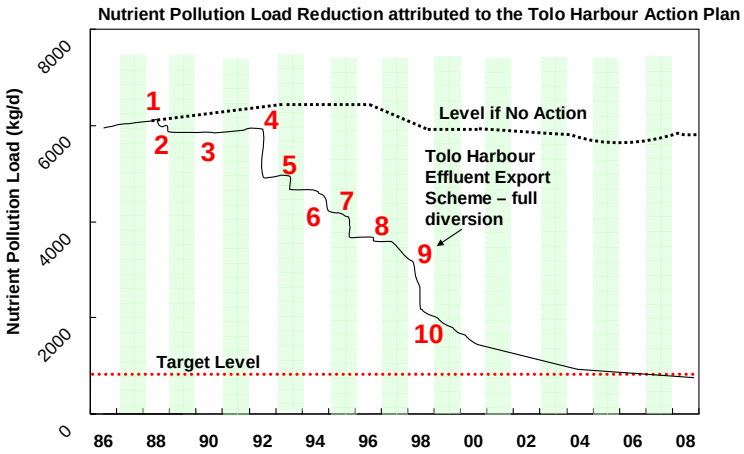
[1] The DO WQO for Tolo Harbour WCZ is more stringent, since for other WCZs, the WQO specifies that 90% of the samples should meet a minimum DO level and hence allowance is made for some samples during the year in not meeting the minimum DO level; whereas in the case of Tolo Harbour WCZ, the WQO specifies 100% of the samples, and hence all samples must achieve the minimum DO level. For example, if only one of the 12 samples during the year for Station A is unable to achieve the minimum DO level, Station A will still be regarded as non-compliant with the WQO.

a lower compliance rate of 50%[2] as compared with 64%, 64% and 71 % in 2007, 2008 and 2009 respectively.



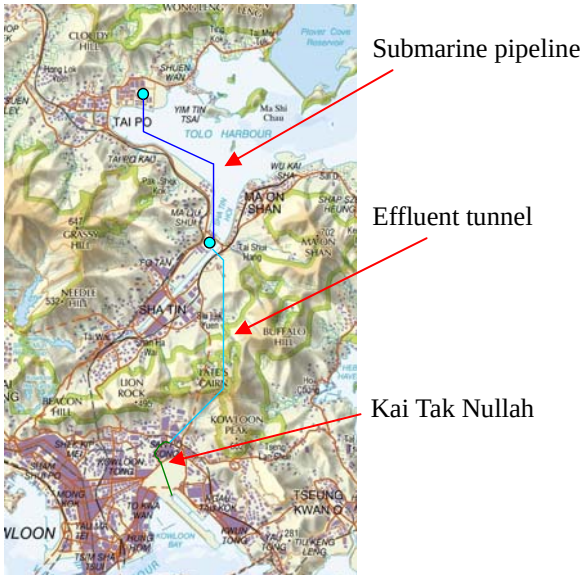
[2] The 50% overall water quality compliance rate in Tolo Harbour in 2010 was due to the "zero" DO compliance rate recorded that year where none of the monitoring stations in the harbour and buffer subzones could comply with the bottom DO WQO, a rare phenomenon that only happened once in 1999 during the last 15 years. The exceptionally low DO in Tolo Harbour water in 2010 is unlikely due to pollution-because (1) the Tolo Harbour catchment areas are mostly connected to public sewers; (2) the collected sewage is treated at two secondary sewage treatment works, and the treated effluent is discharged outside the Tolo Harbour WCZ, (3) there is no report of major emergency discharge of untreated sewage from the sewage treatment works into the Tolo Harbour WCZ, and (4) the EPD's monitoring data does not indicate any deterioration of water quality in terms of other key parameters.

Other than low bottom DO, the water quality of the Tolo Harbour and Channel WCZ continued to improve since the implementation of the Tolo Harbour Action Plan in the mid-80s.



Tolo Harbour Action Plan
1 Livestock waste control measures were in place
2 Livestock keeping was prohibited in the harbour catchment area
3 Control of wastewater at the Tolo Harbour Water Control Zone begun
4 Sewage treatment works at Shatin and Taipo upgraded
5 Interim measures, i.e. dry weather flow interceptors provided at the villages facing immediate pollution problems
6 Restoration of Shuen Wan Landfill at Tai Po
7 Effluent from Shatin Sewage Treatment Works was partially diverted for discharge in the better flushed Victoria Harbour
8 Effluent from Taipo Sewage Treatment Works was partially diverted for discharge in the better flushed Victoria Harbour
9 Full diversion of effluent from both Taipo and Shatin Sewage Treatment Works to Victoria Harbour
10 Extend the public sewer network to the rural areas in Tolo Harbour catchment area

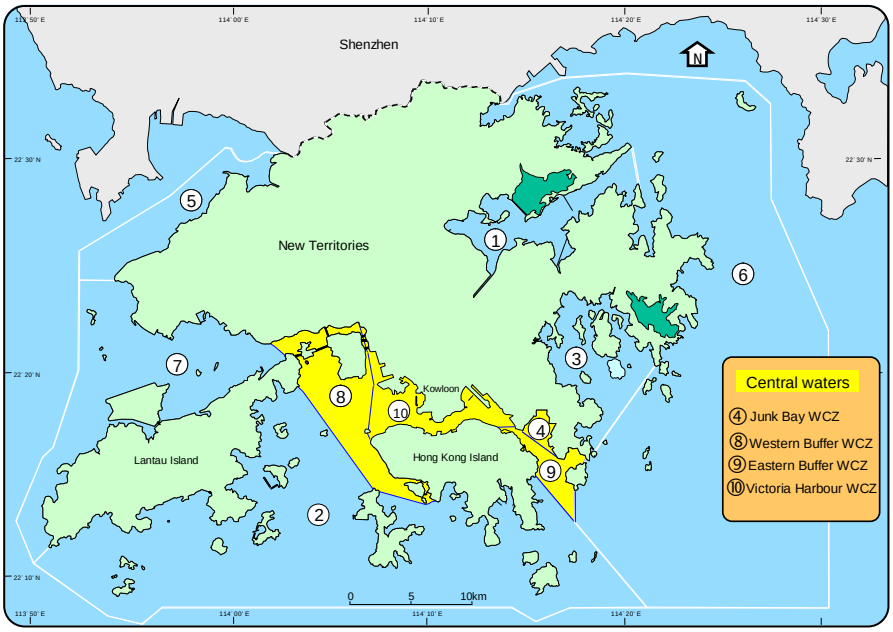
The Action Plan includes the control of livestock waste, improvement of sewage treatment facilities, export of treated effluent outside of the Tolo Harbour to Kai Tak Nullah in Victoria Harbour and extension of village sewerage in the catchment area. As a result of Government's effort, an improvement of water quality (i.e. decrease in 5-day Biochemical Oxygen Demand, *E. coli*, nitrogen and orthophosphate phosphorus measurements) was observed in Tolo Harbour in the past decade.



Flow diagram of Tolo Harbour Effluent Export Scheme

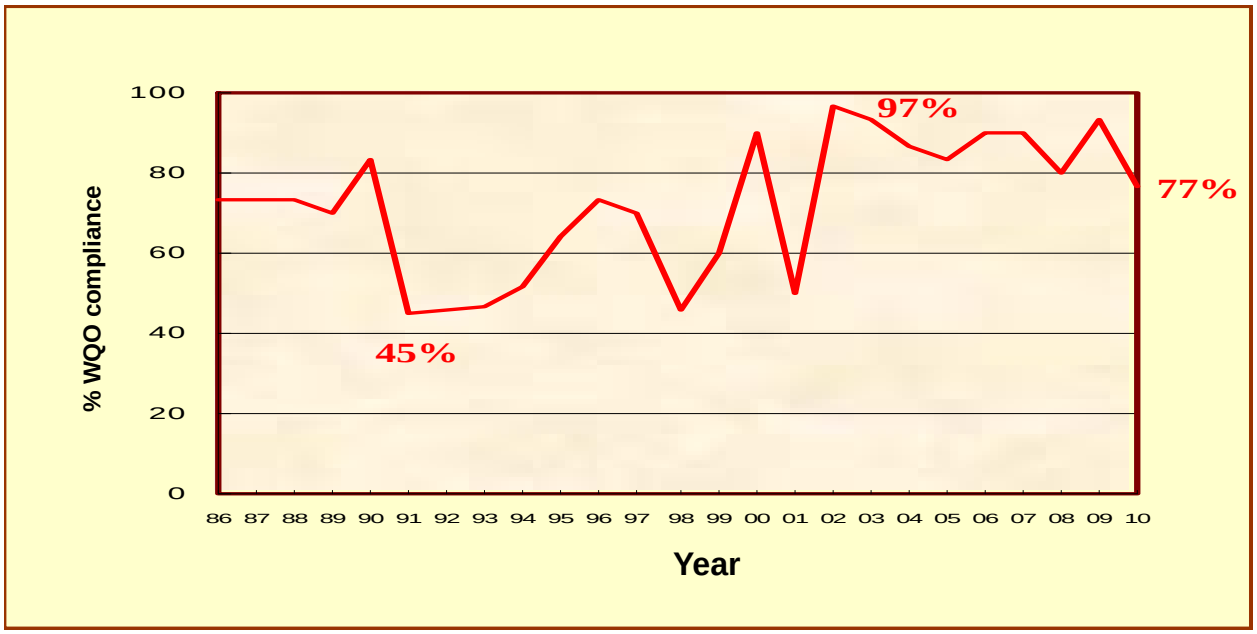
Tolo Harbour is one of the most popular place for wind surfing and boating

Central Waters



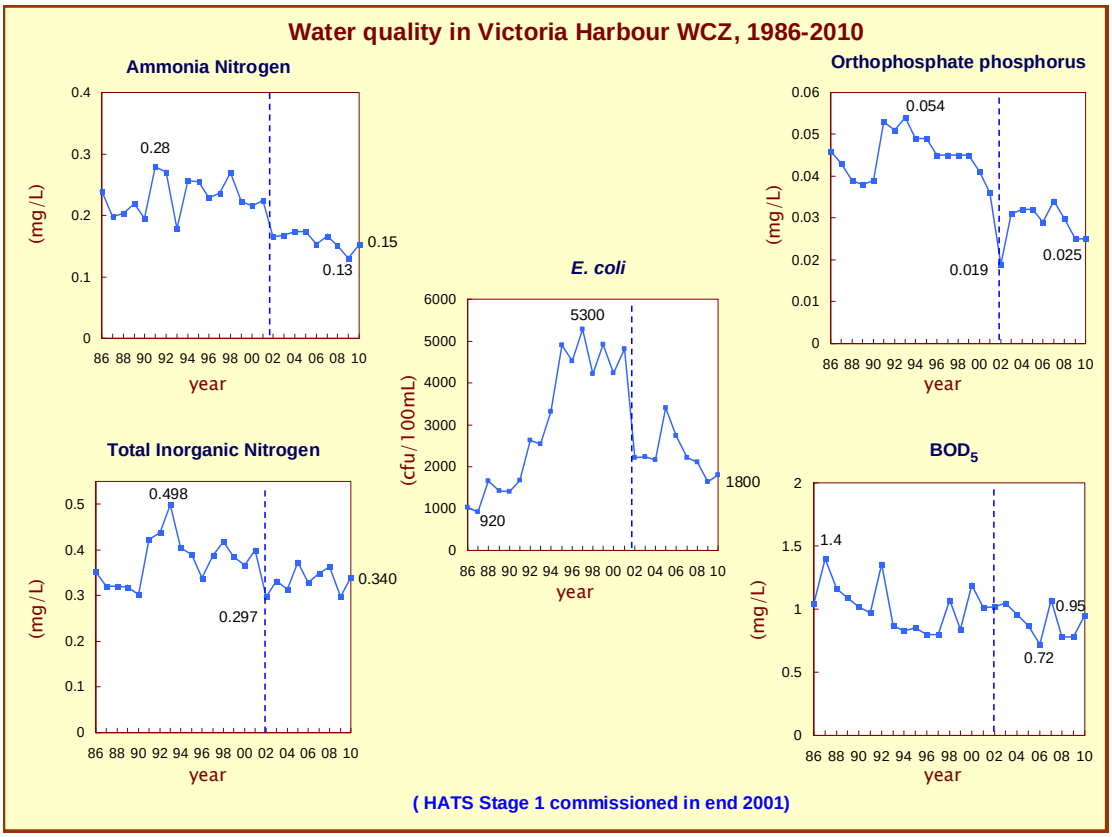
The central waters of Hong Kong, including the Victoria Harbour, Eastern Buffer, Western Buffer and Junk Bay WCZs, are important navigational channels and port areas. After the commissioning of the Stonecutters Island Sewage Treatment Works (SCISTW) under the Harbour Area Treatment Scheme (HATS) Stage 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 Water Control Zone



In the Victoria Harbour WCZ, the 2010 compliance rate was 77% as compared with 93% in 2009. The lower WQO compliance rate was mainly due to non-compliance with the DO WQO. Based on EPD's monitoring data, non-compliance with the DO objective was observed at 6 stations during the hot and wet summer months, as compared with non-compliance at fewer stations in previous years.

As illustrated in the below figure, the key parameters monitored by the EPD indicated that the water quality of the harbour has actually been on an improving trend, and since the full commissioning of the Advance Disinfection Facilities (ADF) at the Stonecutters Island Sewage Treatment Works (SCISTW) in March 2010, the *E. coli* level in the western Victoria Harbour area decreased by about 60%.



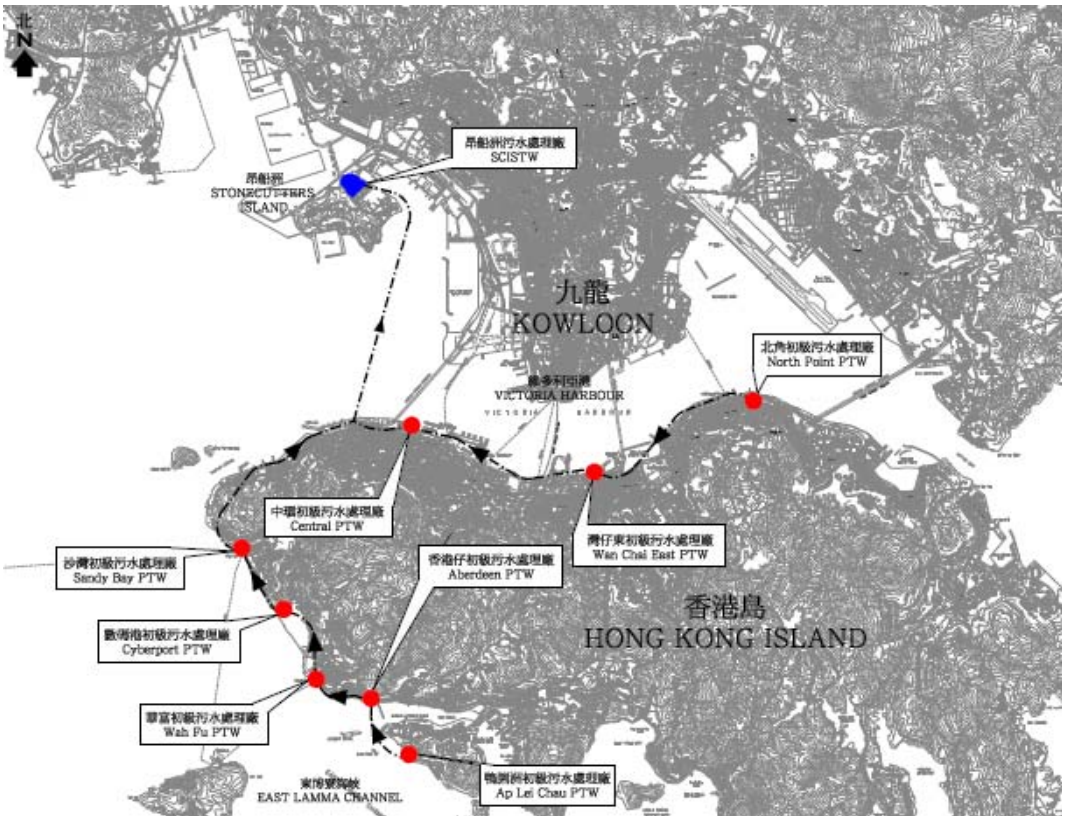
In general, the water quality improvements in eastern Victoria Harbour have been maintained since the commissioning of HATS Stage 1 in 2002 which now collects 1.4 million cubic metres of sewage generated daily in Kowloon and north-eastern Hong Kong Island via deep tunnels to the SCISTW for centralised treatment before disposal. In addition, the *E. coli* levels in western Victoria Harbour decreased by 47%-68% comparing with those in 2009 which could be attributed to the commissioning of the Advance Disinfection Facilities (ADF) at the SCISTW in March 2010.

Victoria Harbour is Hong Kong's most precious natural asset

There was an apparent increase in the annual geometric mean *E. coli* level in central Victoria Harbour (from North Point to Central) in 2010 compared with that in 2009. Detailed investigations were conducted by the relevant departments including EPD, DSD and CEDD and subsequently revealed that these were neither unusual activities nor major pollution sources that could contribute to the observed *E. coli* increase. The annual geometric mean *E. coli* level was generally within the range of natural fluctuation as observed over the last several years (2700 to 4900 cfu/100mL from 2002 to 2010).

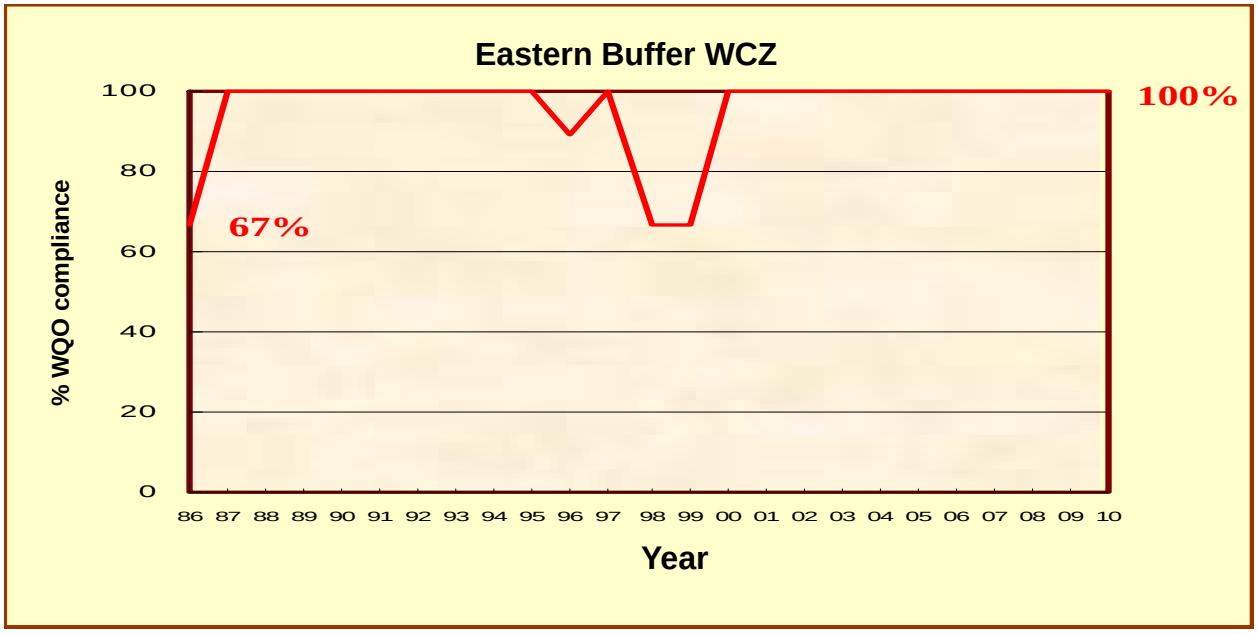
Victoria Harbour at dawn

At present, screened sewage discharged from the four remaining sewage screening plants in the middle and western part of Hong Kong Island are still contributing relatively high levels of *E. coli* in water at central Victoria Harbour. To further improve the water quality of Victoria Harbour, the construction of HATS Stage 2A has proceeded and Stage 2A is aimed to be commissioned by end 2014. It will collect and provide chemical treatment to the remaining 25% of the untreated sewage currently generated daily from North Point to Ap Lei Chau in the middle and western parts of Hong Kong Island.

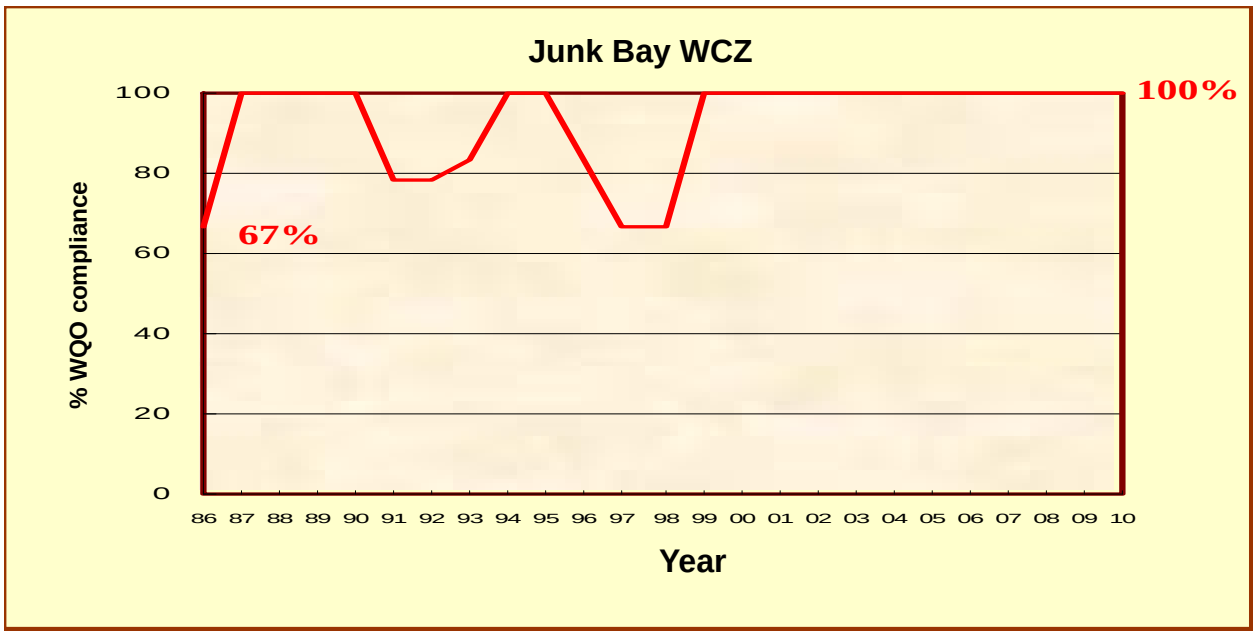


Details of the new sewage collection networks under the HATS Stage 2A

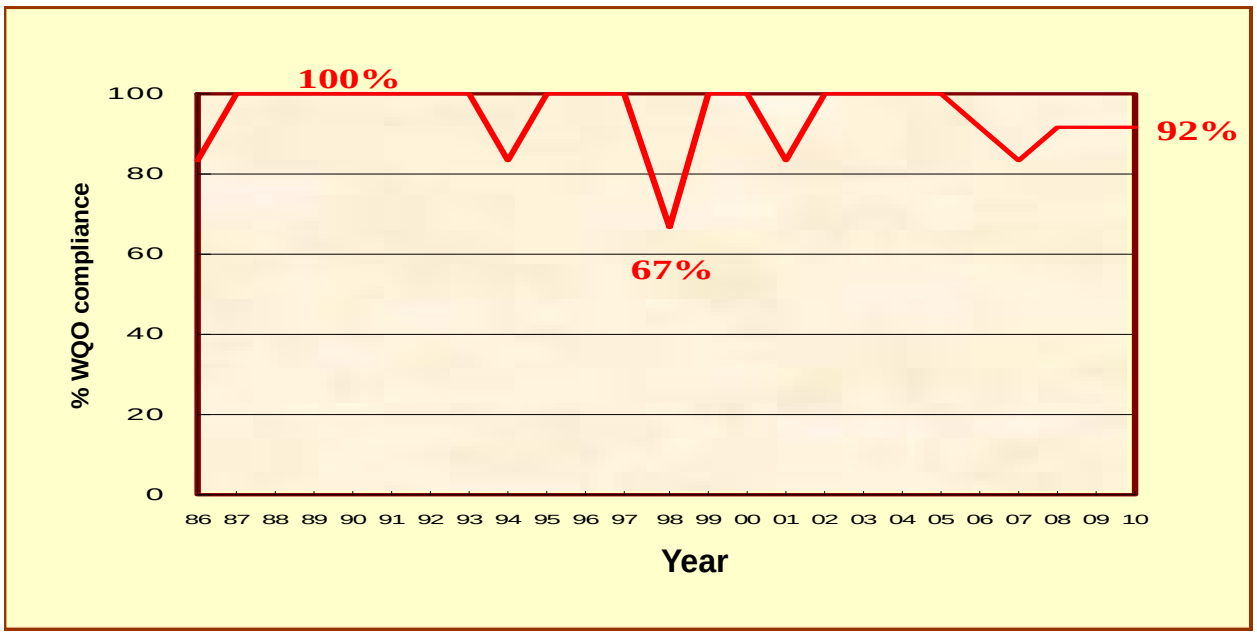
Eastern Buffer and Junk Bay Water Control Zones



Since the implementation of the 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 nutrients and *E. coli* levels. In 2010, the Eastern Buffer and Junk Bay WCZs achieved full compliance (100%) with the WQOs. The annual geometric mean *E. coli* levels in these waters in 2010 were below 50 cfu/100mL.

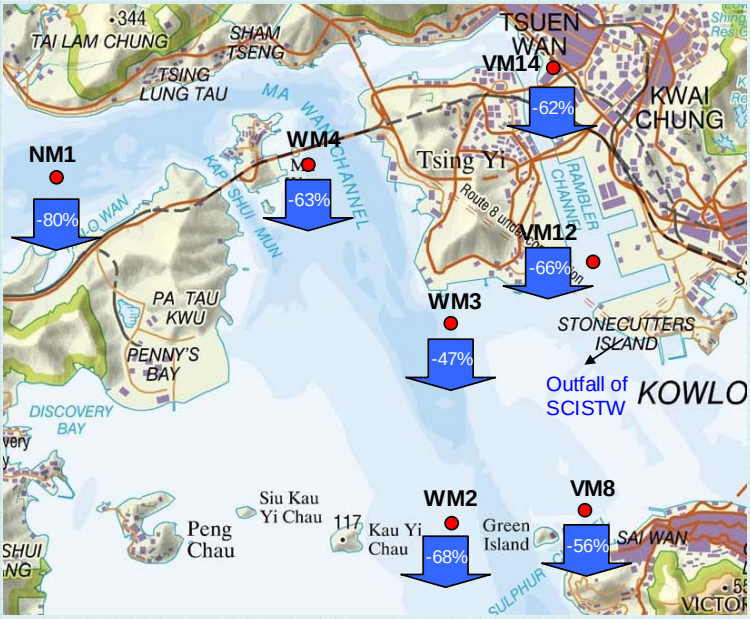


Western Buffer Water Control Zone



The Western Buffer WCZ achieved a 92% overall compliance with the WQOs in 2010, same as in 2009. It should be noted that the *E. coli* levels in western Victoria Harbour decreased by 40%-70% compared with those in 2009 since the commissioning of the Advance Disinfection Facilities (ADF) at the SCISTW in March 2010. The annual geometric mean *E. coli* level at this WCZ was reduced from 600 cfu/100mL in 2009 to 250 cfu/100mL in 2010.

Reduction of *E. coli* levels after the commissioning of the Advance Disinfection Facilities in March 2010



- The commissioning of HATS Stage 1 in late 2001 has brought marked improvement in the water quality of Victoria Harbour. However, the treated but un-disinfected effluent discharged from the Stonecutters Island Sewage Treatment Works (SCISTW) also led to an increase in *E. coli* in the western harbour and some Tsuen Wan beaches.

- The Advance Disinfection Facilities were installed at the SCISTW and commissioned in March 2010.

- After the commissioning of the Advance Disinfection Facilities, *E. coli* levels reduced by 47%-80% in the western harbour and along the Tsuen Wan shoreline.

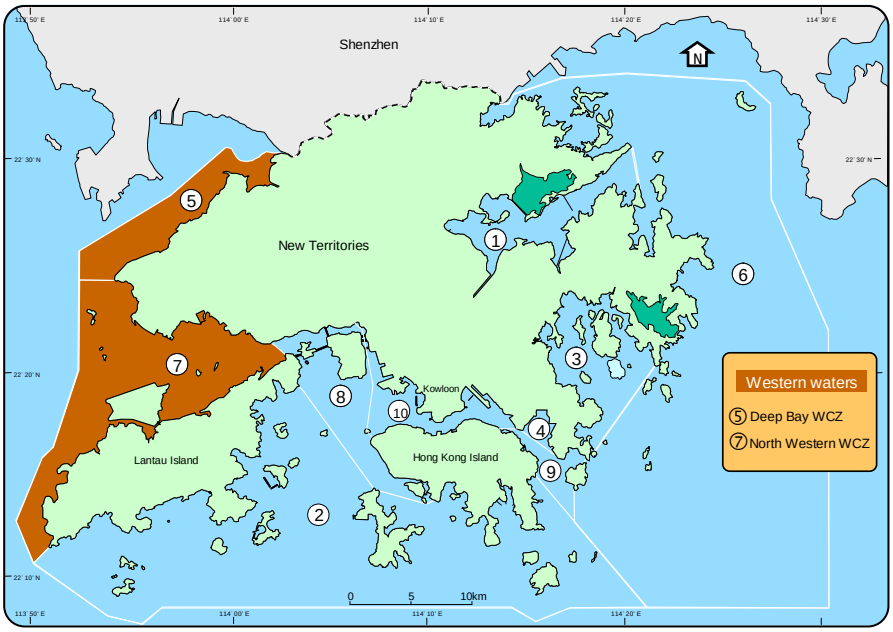
The key elements of the advance disinfection facilities (ADF) include:

Chlorination system

Dechlorination system

Chemical storage tanks

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.

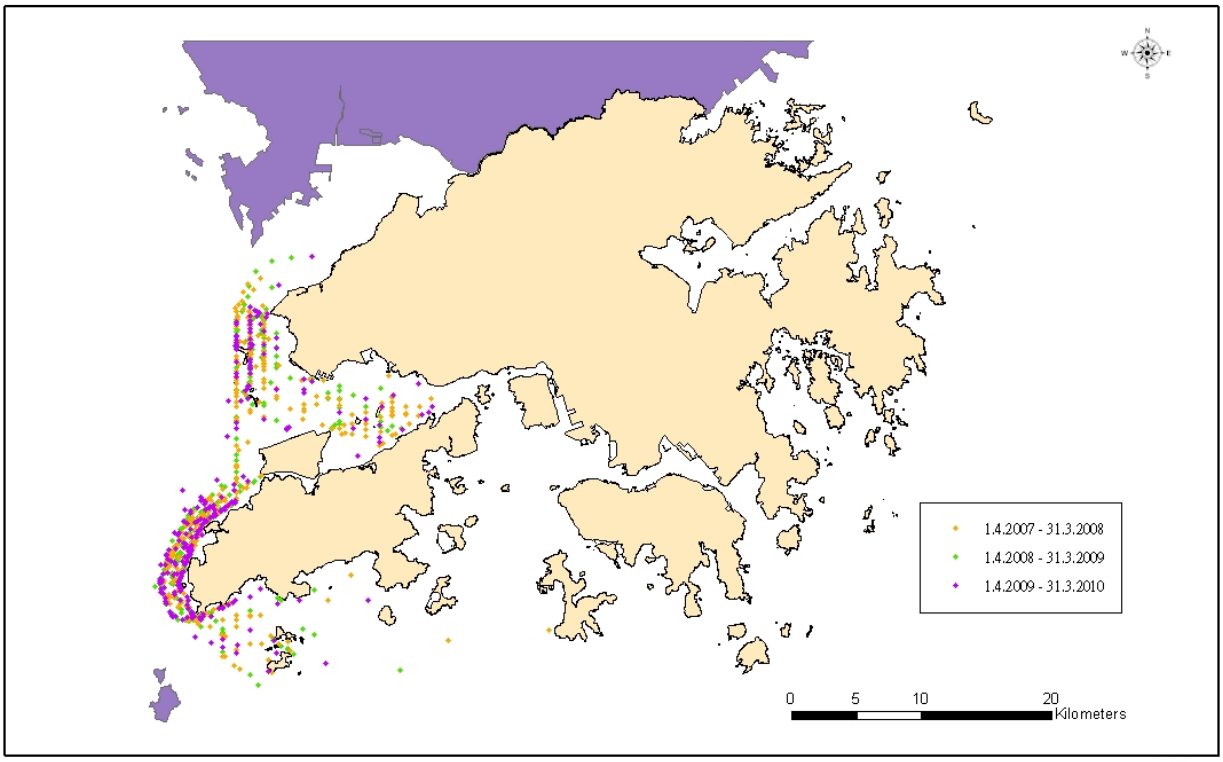
The Deep Bay WCZ includes the ecologically sensitive Mai Po and Inner Deep Bay Ramsar site, and areas of oyster culture. The Ramsar Site inside Deep Bay supports a high diversity of birds. About 300 species, representing about 70% of the Hong Kong avian fauna, have been recorded there. The site regularly 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).

Some common birds in Deep Bay

Cattle egret and White egrets

Black-faced Spoonbills

The North Western WCZ is also the home of the Chinese white dolphins, which are commonly spotted in areas around Lantau Island, Tuen Mun, Sha Chau and Lung Kwu Chau where the salinity is influenced seasonally by freshwater input from the Pearl River.

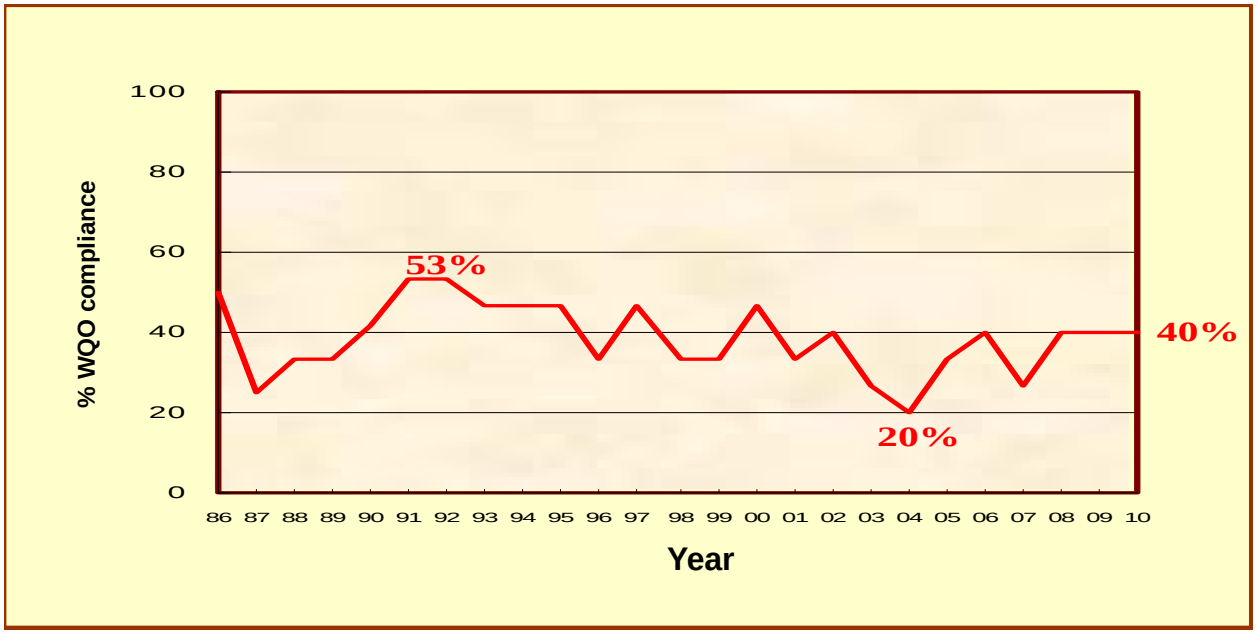


Distribution of Chinese white dolphins (2007 - 10)

Source : The Agriculture, Fisheries and Conservation Department

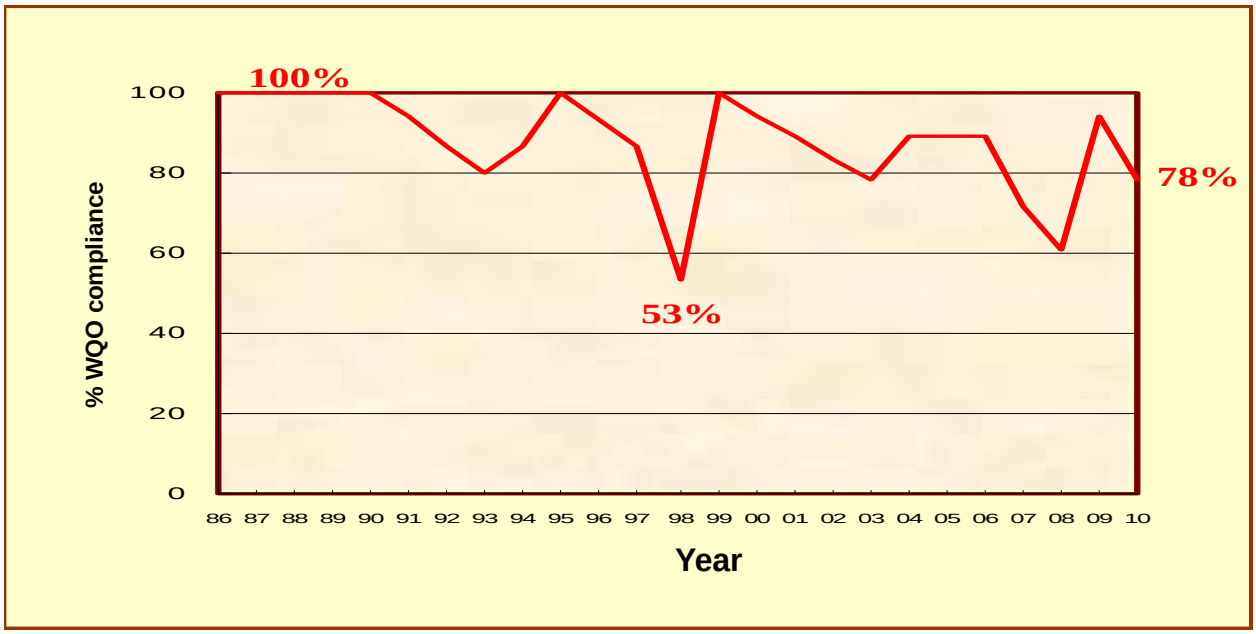
Deep Bay Water Control Zone

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 Deep Bay WCZ has the poorest water quality in the territory with high concentrations of organic and inorganic pollutants and low levels of DO. Same as in 2008 and 2009, the WQO compliance in the Deep Bay WCZ in 2010 was 40%. The inner bay was most affected by the discharges from Shenzhen River as well as Kam Tin River, Yuen Long Creek and Tin Shui Wai Nullah from Hong Kong side. While three of the monitoring stations in the outer bay met the WQOs for DO and NH_3, none of the 5 stations in the Deep Bay WCZ met the TIN objective. Similar to the previous years, the 2010 nitrogen levels in inner (inner subzone) Deep Bay (1.5 – 3.8 mg/L) and outer (outer subzone) Deep Bay (1.0 – 1.2 mg/L) were much higher compared with their respective TIN objectives for inner subzone (0.7 mg/L) and outer subzone (0.5 mg/L).

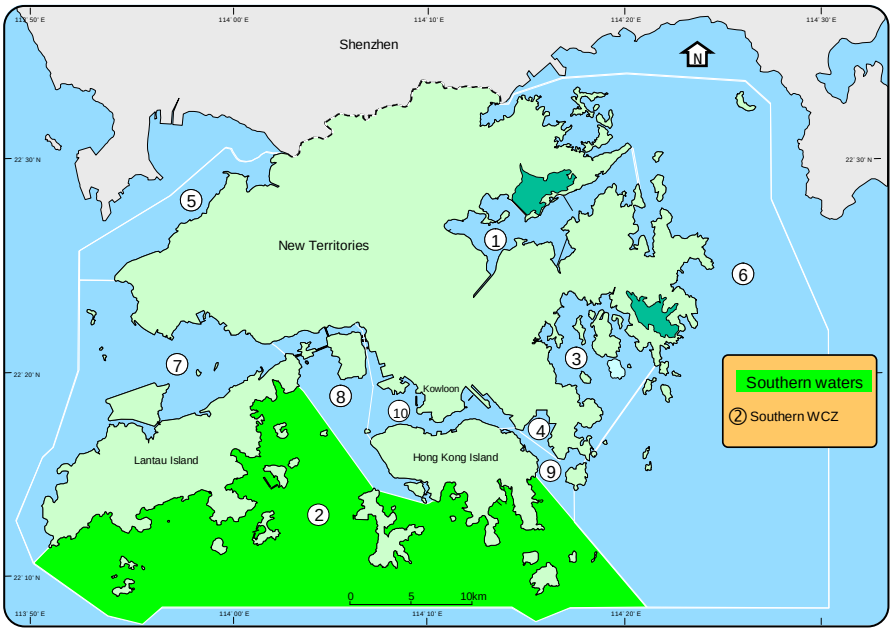
North Western Water Control Zone



Although all stations in the North Western WCZ fully complied with the DO and NH_3 objectives, t his WCZ only attained an overall WQO compliance rate of 78% in 2010 and was lower compared with that in 2009 (94%). The main reason of this lower overall compliance rate was due to the high levels of TIN (0.7-1.1 mg/L) recorded in June to September of 2010 which led to high non-compliance rate with the TIN objective in this WCZ (i.e. in excess of 0.4 mg/L). The higher levels of TIN recorded in the northwestern waters might be associated with the higher background level of the Pearl River Delta since more nutrients are released due to surface runoffs during heavy rainfalls as observed in the Pearl River Delta area during the 2010 hot and wet summer months.

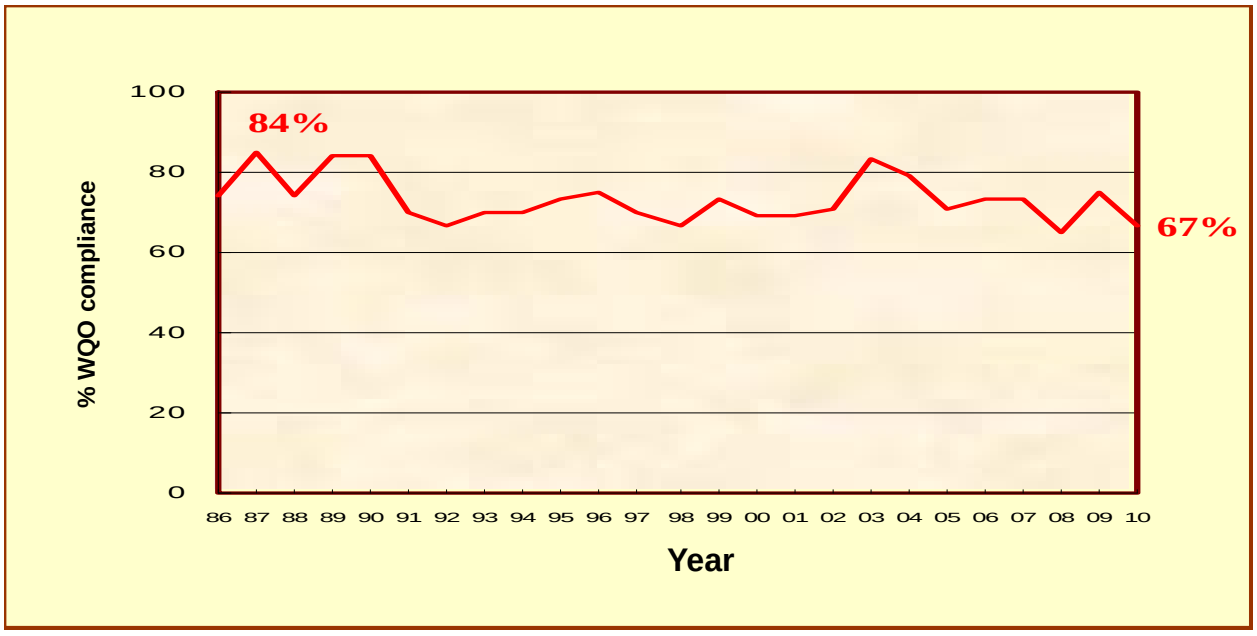
Sha Chau and Lung Kwu Chau Marine Park in the North Western WCZ is one of the five marine parks/reserve in Hong Kong

Southern Waters



Southern Waters consists 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



In 2010, the Southern WCZ attained an overall 67% compliance with the WQOs, slightly lower than that in 2009 (75%) but higher compared with 2008 (65%). Although full compliance (100%) with the WQOs for unionised ammonia (NH_3) and *E. coli* was achieved in 2010, there was a decrease in TIN compliance rate due to the higher TIN levels recorded mainly in the summer months from June to September. Similar to the North Western WCZ, the higher levels of TIN recorded in the southern water during the 2010 summer months could be related to the heavy rainfalls recorded in the Pearl River Delta area in the same period.

The secondary contact recreation subzones of the Southern WCZ are mainly located along the coastal waters in the Southern District (Hong Kong Island) and outlying islands. They cover an area of approximately 67 km^2, which is about 26% of the total secondary contact recreation subzone areas of Hong Kong. In 2010, full compliance (100%) with the *E. coli* objective was attained in the secondary contact recreation subzones.

There are also 21 gazetted beaches located in this WCZ : Hong Kong Island (12), Lantau Island (5), Lamma Island (2) and Cheung Chau (2). In 2010, all 21 gazetted beaches in southern water complied with the water quality objective for swimming and most beaches (except two) ranked “Good” during the bathing season from March to October.

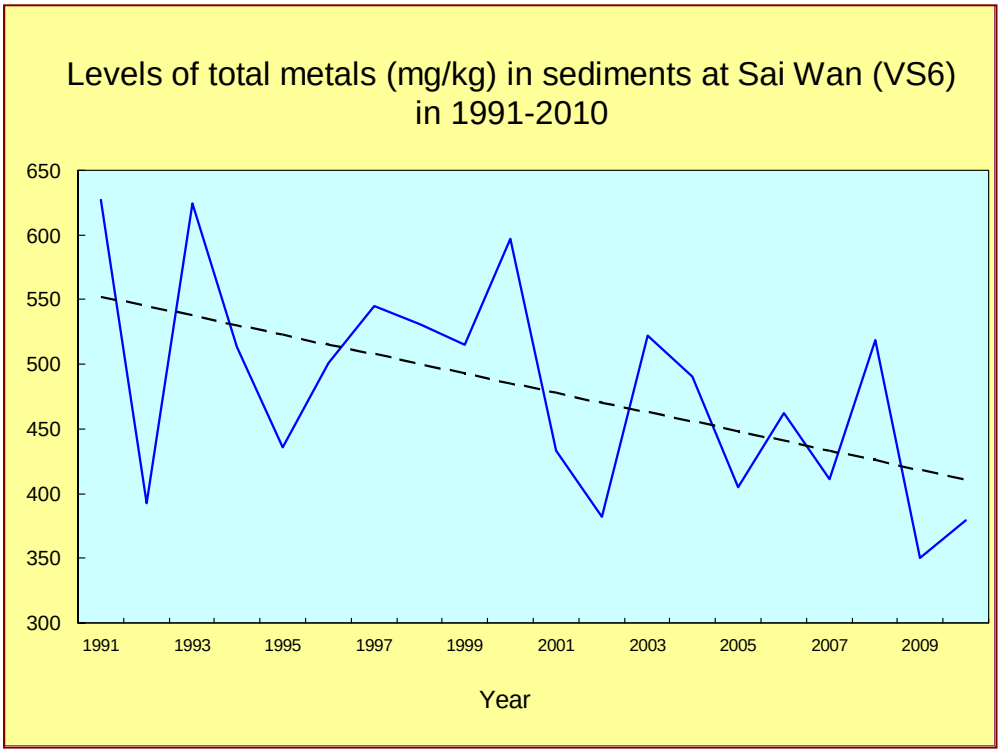
Repulse Bay Beach is one of the most popular beaches in Hong Kong

Sediment Quality in Hong Kong

Sediment samples collected by grab sampler

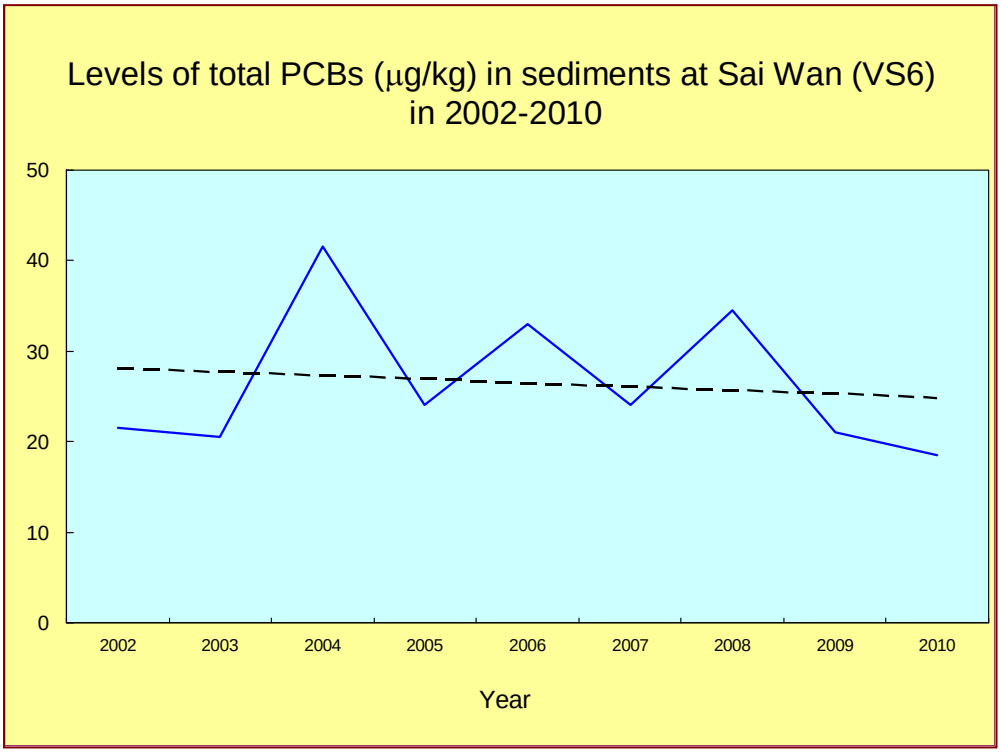
Sea bottom sediments are the ultimate sink of pollutants in the marine environment, and are also home to a wide variety of benthic organisms. The quality of marine sediments can therefore be used to reflect the health of the marine environment as a whole.

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 effort in enforcing relevant pollution control ordinances, i.e. Water Pollution Control Ordinance and Waste Disposal Ordinances, and the removal of various industrial pollution sources, a general decreasing trend of total metals in sediment was observed at stations in the Harbour such as VS6 since 1991.

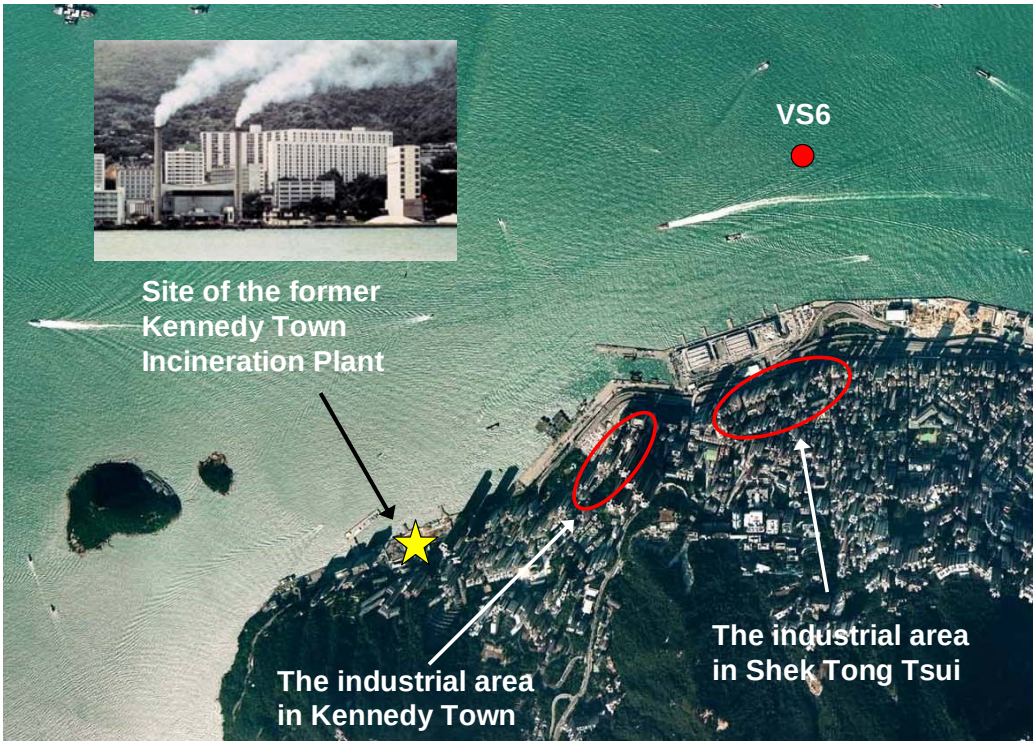


Note : Total metals include cadmium, chromium, copper, mercury, nickel, lead, silver and zinc

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 decreasing trend of total PCBs in sediment could also be observed at VS6 in recent years, although rather slowly.



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



Map showing the site of former Kennedy Town Incineration Plant, industrial areas in Kennedy Town and Shek Tong Tsui, and a sediment monitoring station (VS6)

Typhoon Shelters in Hong Kong

Causeway Bay Typhoon Shelter in Hong Kong Island

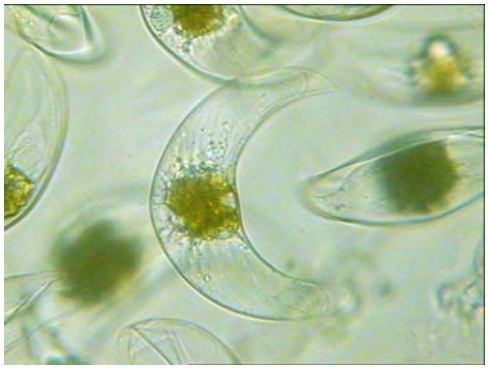
Typhoon shelters in Hong Kong are used by small to medium vessels as protection against strong winds and rough sea conditions particularly during typhoon season. For this reason, typhoon shelters are often semi-enclosed water bodies and vulnerable to pollution from both land and sea. Hong Kong has 17 typhoon shelters (TSs), marinas and dockyard(s). Some of these are located adjacent to populated residential and/or industrial areas, i.e. Causeway Bay TS and Kwun Tong TS. Others are located in outlying islands or far away from urban areas, i.e. Hei Ling Chau TS and Hebe Haven TS.

In 2010, the EPD monitored the water quality of 17 typhoon shelters (TSs), marinas and dockyard(s) around Hong Kong. Among these typhoon shelters, the three located in Sai Kung, namely Yim Tin Tsai TS, Hebe Haven TS and Sai Kung TS had the lowest TIN levels (0.04 - 0.06 mg/L) and *E. coli* counts (1 - 13 cfu/100mL). In general, the water quality of typhoon shelters in Victoria Harbour, i.e. Kwun Tong, Causeway Bay and New Yau Ma Tei TSs was poorer in terms of TIN levels (0.41 – 1.03 mg/L) and *E. coli* counts (820-2800 cfu/100mL) compared with those located in outlying islands which were far away from the urban areas.

Regarding sediment quality, Yim Tin Tsai TS in Sai Kung also had the lowest levels of heavy metals amongst the 15 typhoon shelters sampled. Due to historical discharges from the nearby industries, the sediments of typhoon shelters located in Victoria Harbour were often contaminated by heavy metals. During the period from 2006-2010, 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) compared with other typhoon shelters in 2010. 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

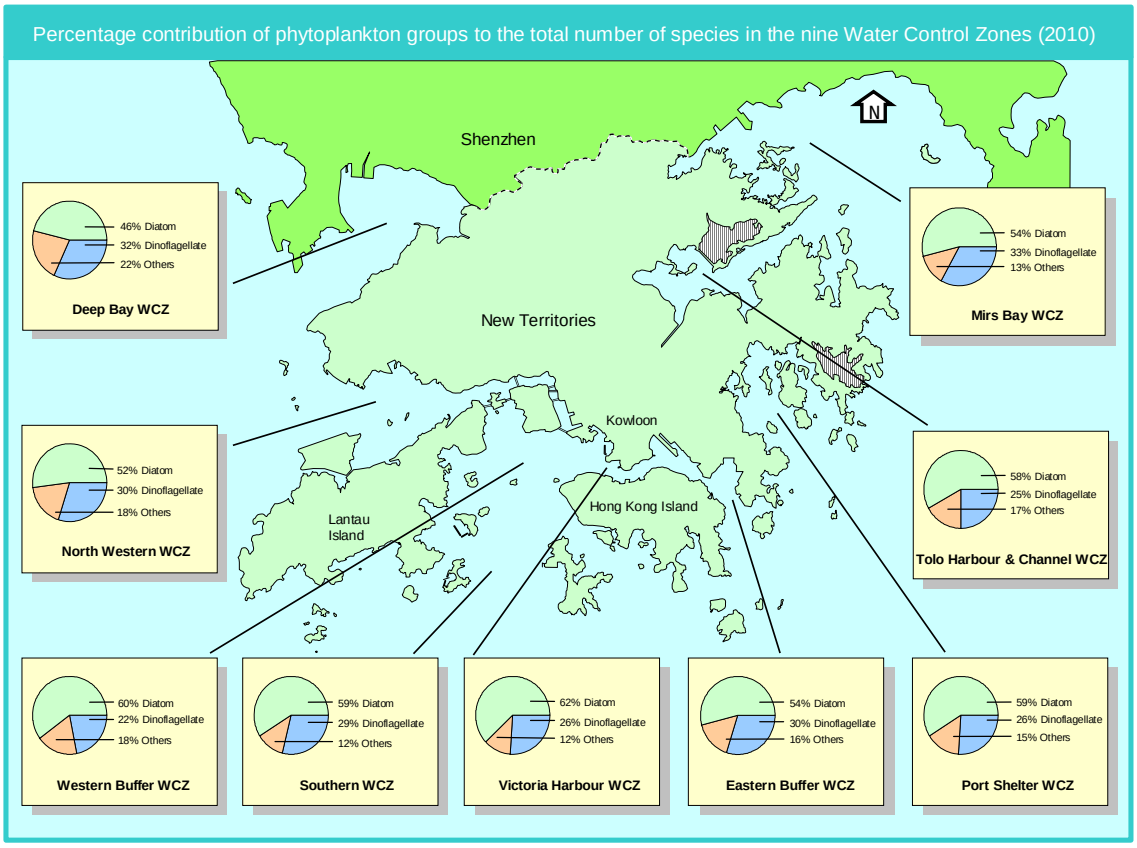


Pyrocystis lunula
under light microscope

Red tide is a common name for a phenomenon also known as Harmful Algal Bloom (HAB), an event in which some micro-algae (e.g. phytoplankton) accumulate rapidly in a water body and result in discoloration of the surface water. It is more commonly found in coastal areas. Usually, high concentration of nutrients (e.g. nitrogen, phosphorus and silica) can stimulate excessive algal growth. The enhanced algal growth may exhaust dissolved oxygen in the water when dead algae decompose and suffocate other organisms (e.g. fish kills). Some phytoplankton species may also produce toxins and poison other marine life and cultured fish. Phytoplankton and red tide monitoring therefore forms an essential part of water quality management.

EPD conducts monitoring of phytoplankton at 25 stations covering nine Water Control Zones (WCZs) in the territory. Monthly samples are analyzed, and trends and changes in phytoplankton composition and densities are examined.

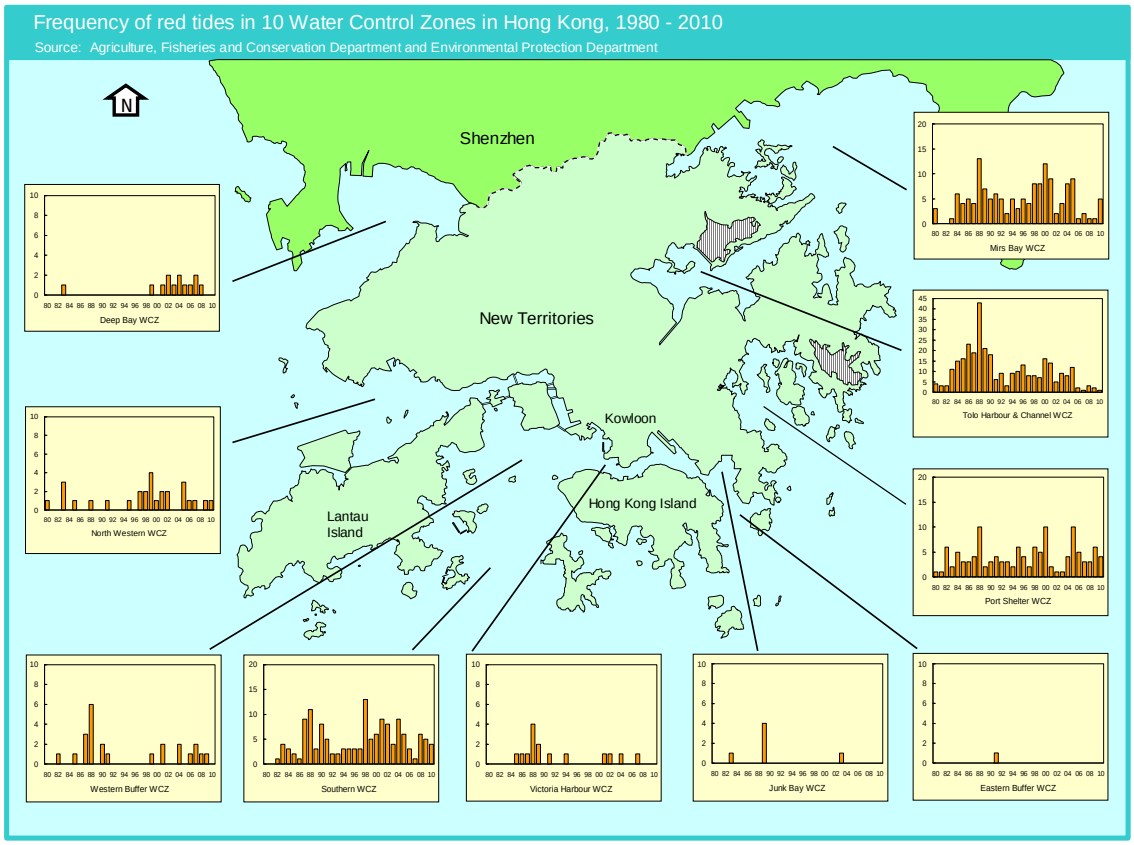
A total of 94 phytoplankton species was recorded in Hong Kong waters in 2010. Of these, 55 were diatoms (58%), 26 were dinoflagellates (28%) and 13 were from other minor algal groups (14%). Of the samples examined in 2010, diatoms constituted the largest component of phytoplankton in term of both species number and cell density. The most dominant diatom species was *Skeletonema costatum* which constituted 14-81% of the diatom population in the Mirs Bay, Southern, Deep Bay, Western Buffer, Victoria Harbour and North Western WCZs. The most abundant dinoflagellate species were *Gymnodinium spp.* comprising 16-53% of the dinoflagellate populations in all the WCZs. In 2010, phytoplankton densities were generally higher in Tolo Harbour & Channel and at a station in North Western (i.e. NM1) compared with those in other WCZs.



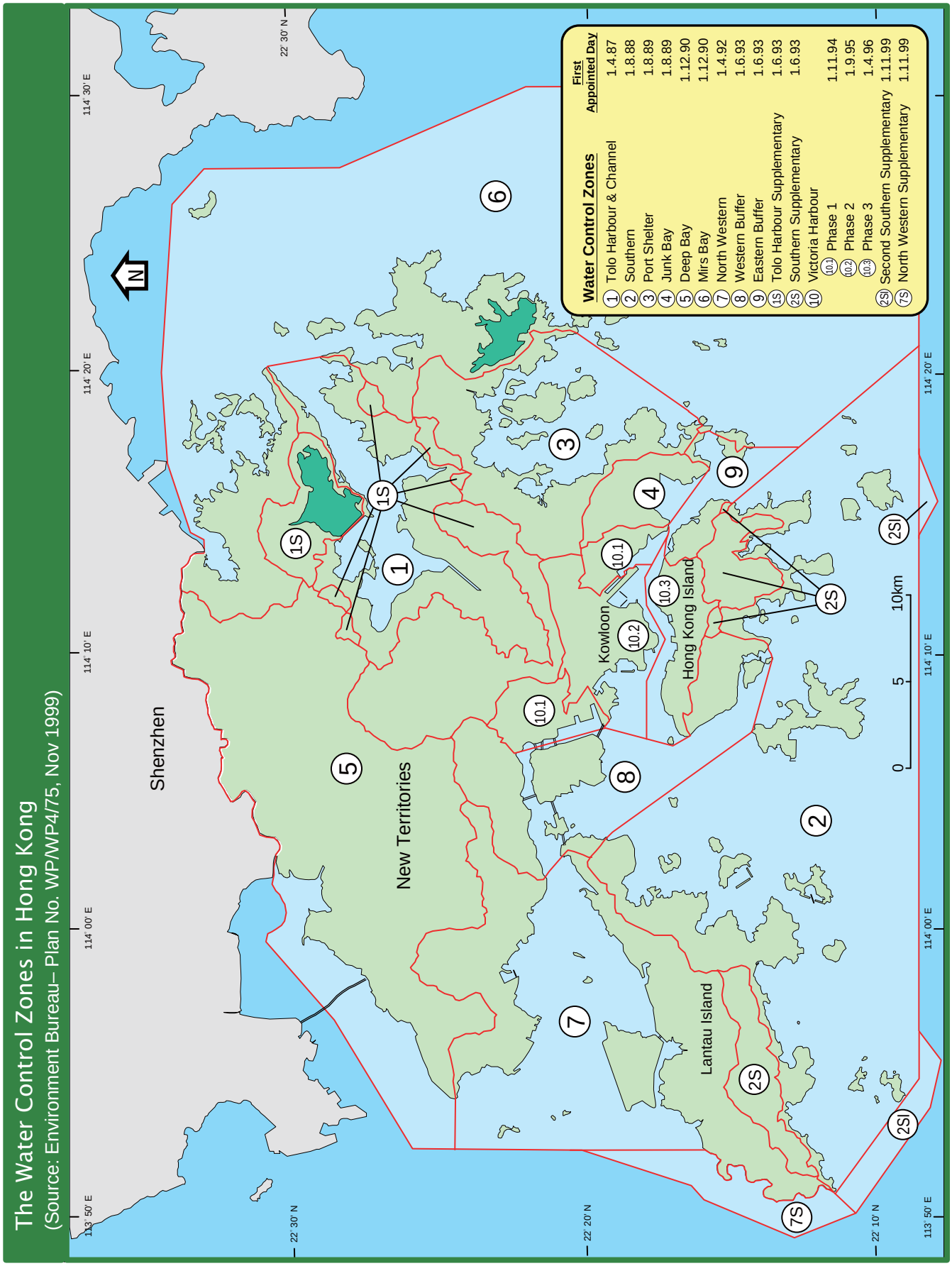
Note : Others refer to minor phytoplankton groups which mainly include Cyanophyta and Chrysophyta.

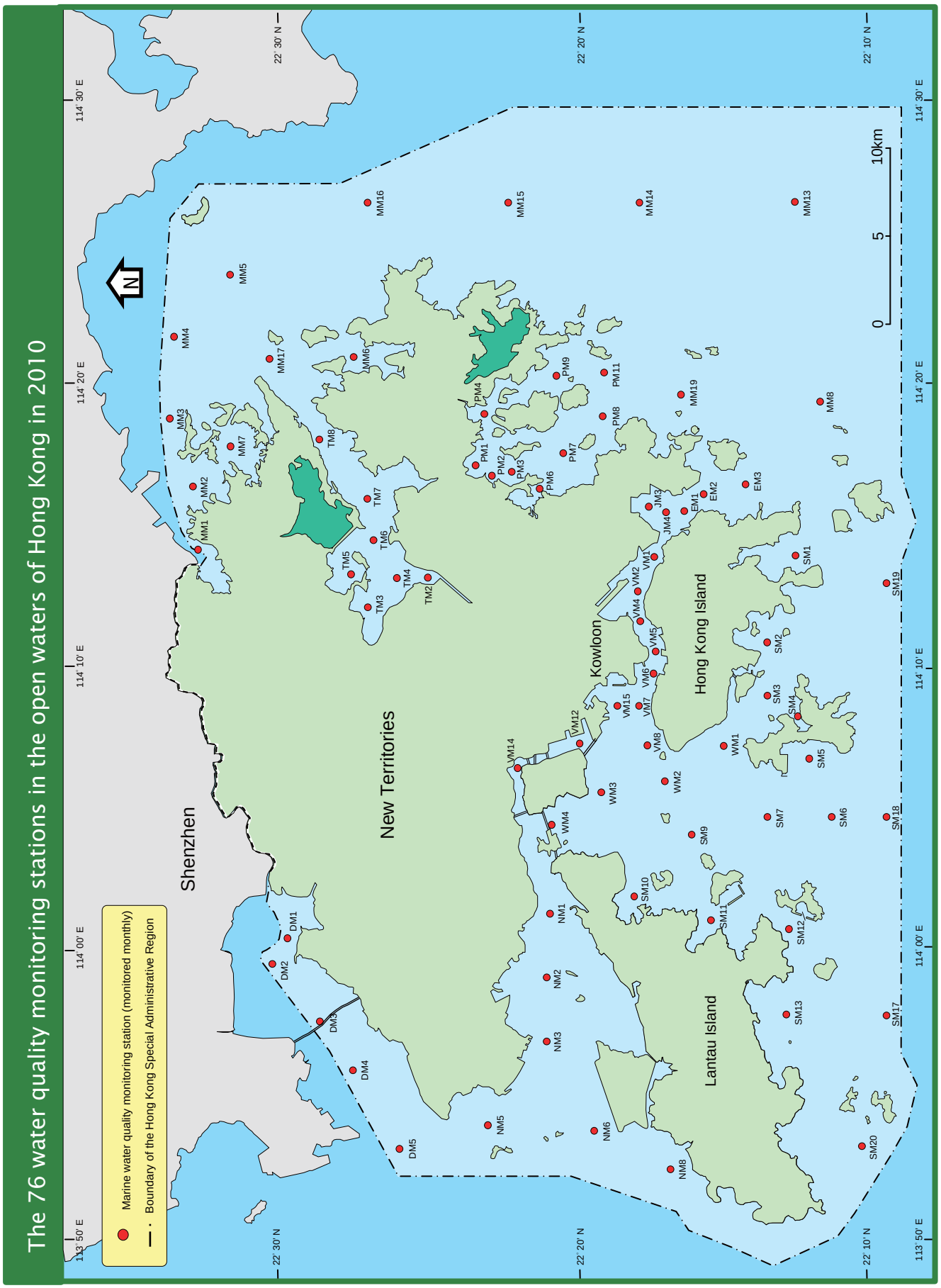
Red tides and algal blooms are phenomena which can occur seasonally in both polluted and unpolluted waters. In general, red tides occur more commonly in semi-enclosed bays with low tidal flushing and under favorable environmental conditions. A total of 823 red tides incidents was recorded in Hong Kong waters between 1980 and 2010. Locally, red tides occur more frequently in the eastern (72%) and southern (17%) waters. From 1980 to 2010, some 322 of 823 red tides incidents (39%) occurred in the Tolo Harbour and Channel WCZ, and 148 (18%) in the Mirs Bay

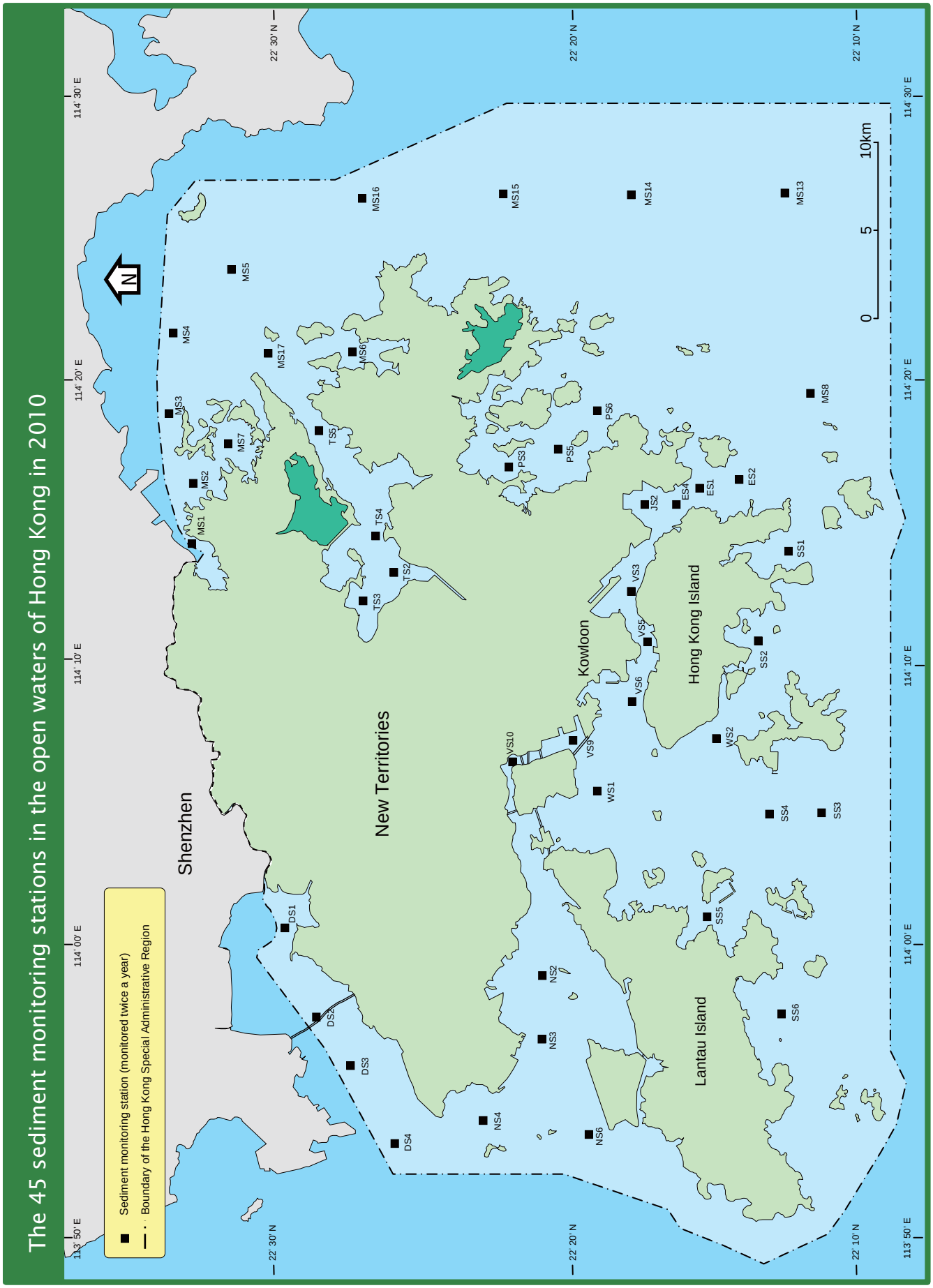
WCZ, 124 (15%) in the Port Shelter WCZ and 142 (17%) in the Southern WCZ, respectively. The most common red tide species in Hong Kong waters was the dinoflagellate *Noctiluca scintillans*, which accounted for about 29% of the reported red tides incidents between 1980 and 2010. Historically, red tides increased significantly in the 80s and reached a peak in 1988, when a total of 88 incidents were reported. Since mid 90s, red tides fluctuated between 10 and 45 incidents per year. In 2010, a total of 15 red tides incidents were recorded in Hong Kong waters. Of these, 5 occurred in Mirs Bay, 4 in Southern waters and 4 in Port Shelter; whereas only one in Tolo Harbour and North Western, respectively. These incidents involved 8 red tide species, i.e. *Noctiluca scintillans*, *Thalassiosira tealata*, *Phaeocytis globosa*, *Mesodinium rubrum*, *Scrippsiella trochoidea*, *Akashiwo sanguinea*, *Karenia mikimotoi* and *Chaetoceros salsugineum*. They are non-toxic species commonly found in Hong Kong waters. However, *Phaeocytis globosa* and *Karenia mikimotoi* are harmful species which can cause fish kill based on overseas studies. No fish kill was recorded in Hong Kong waters in 2010.



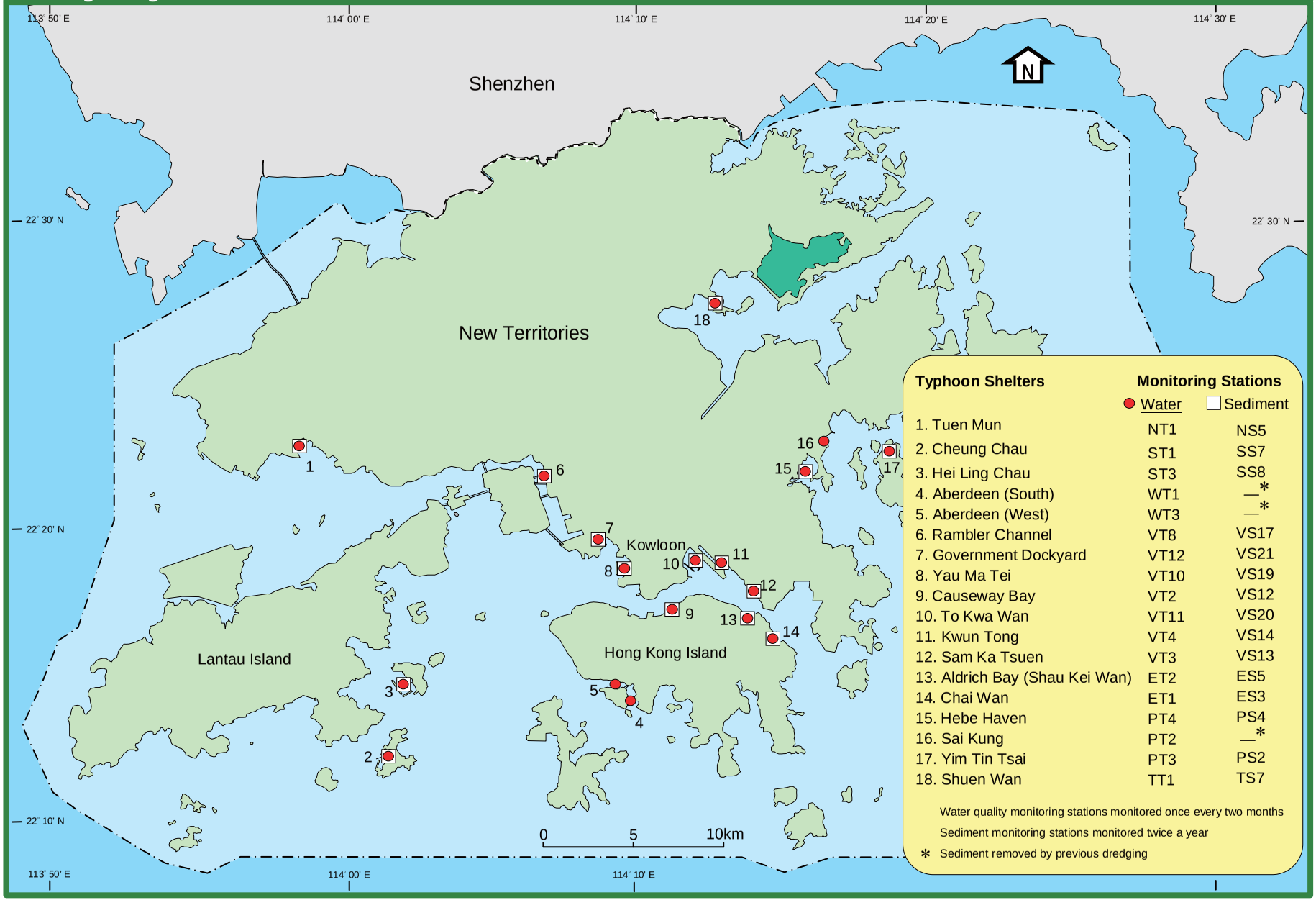
Appendices


The Water Control Zones in Hong Kong
(Source: Environment Bureau– Plan No. WP/WP4/75, Nov 1999)
Water Control Zones
First Appointed Day
1 Tolo Harbour & Channel 1.4.87
2 Southern 1.8.88
3 Port Shelter 1.8.89
4 Junk Bay 1.8.89
5 Deep Bay 1.12.90
6 Mirs Bay 1.12.90
7 North Western 1.4.92
8 Western Buffer 1.6.93
9 Eastern Buffer 1.6.93
1S Tolo Harbour Supplementary 1.6.93
2S Southern Supplementary 1.6.93
10 Victoria Harbour
10.1 Phase 1 1.11.94
10.2 Phase 2 1.9.95
10.3 Phase 3 1.4.96
2SI Second Southern Supplementary 1.11.99
7S North Western Supplementary 1.11.99
N
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
0
5
10km
22° 30' N
22° 20' N
22° 10' N
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E


The 76 water quality monitoring stations in the open waters of Hong Kong in 2010
Marine water quality monitoring station (monitored monthly)
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
N
0
5
10km
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E
22° 30' N
22° 20' N
22° 10' N


The 45 sediment monitoring stations in the open waters of Hong Kong in 2010
Sediment monitoring station (monitored twice a year)
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
N
0
5
10km
114° 30' E
114° 20' E
114° 10' E
114° 00' E
113° 50' E
22° 30' N
22° 20' N
22° 10' N
MS1
MS2
MS3
MS4
MS5
MS6
MS7
MS8
MS13
MS14
MS15
MS16
MS17
TS2
TS3
TS4
TS5
PS3
PS5
PS6
ES1
ES2
ES4
JS2
SS1
SS2
SS3
SS4
SS5
SS6
VS3
VS5
VS6
VS9
VS10
WS1
WS2
DS1
DS2
DS3
DS4
NS2
NS3
NS4
NS6

The 18 water quality monitoring stations and 15 sediment monitoring stations in the typhoon shelters of Hong Kong in 2010



Typhoon Shelters	Monitoring Stations: Water	Monitoring Stations: Sediment
1. Tuen Mun	NT1	NS5
2. Cheung Chau	ST1	SS7
3. Hei Ling Chau	ST3	SS8
4. Aberdeen (South)	WT1	—*
5. Aberdeen (West)	WT3	—*
6. Rambler Channel	VT8	VS17
7. Government Dockyard	VT12	VS21
8. Yau Ma Tei	VT10	VS19
9. Causeway Bay	VT2	VS12
10. To Kwa Wan	VT11	VS20
11. Kwun Tong	VT4	VS14
12. Sam Ka Tsuen	VT3	VS13
13. Aldrich Bay (Shau Kei Wan)	ET2	ES5
14. Chai Wan	ET1	ES3
15. Hebe Haven	PT4	PS4
16. Sai Kung	PT2	—*
17. Yim Tin Tsai	PT3	PS2
18. Shuen Wan	TT1	TS7

Water quality monitoring stations monitored once every two months

Sediment monitoring stations monitored twice a year

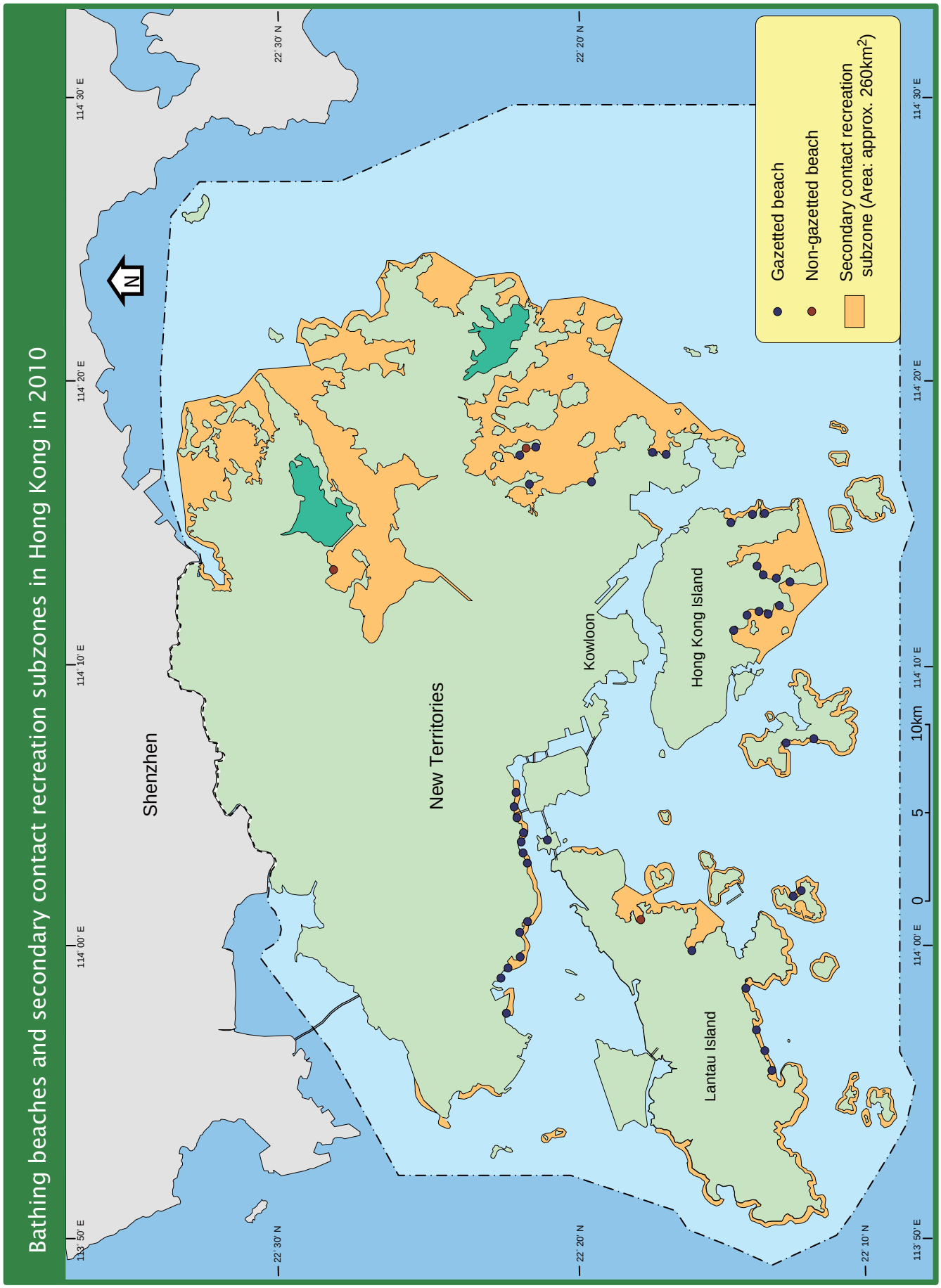
* Sediment removed by previous dredging

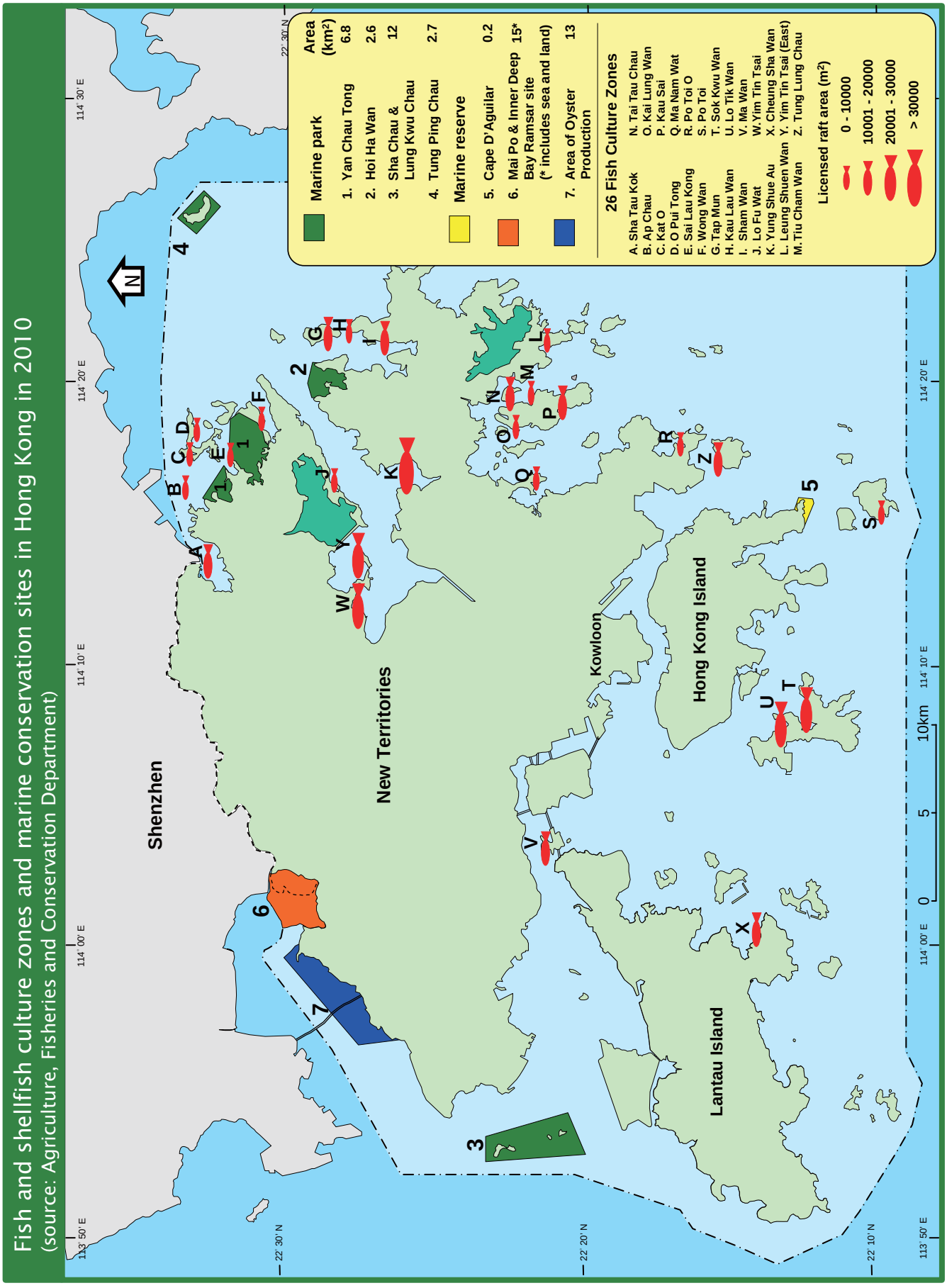
Location of marine water and sediment monitoring stations

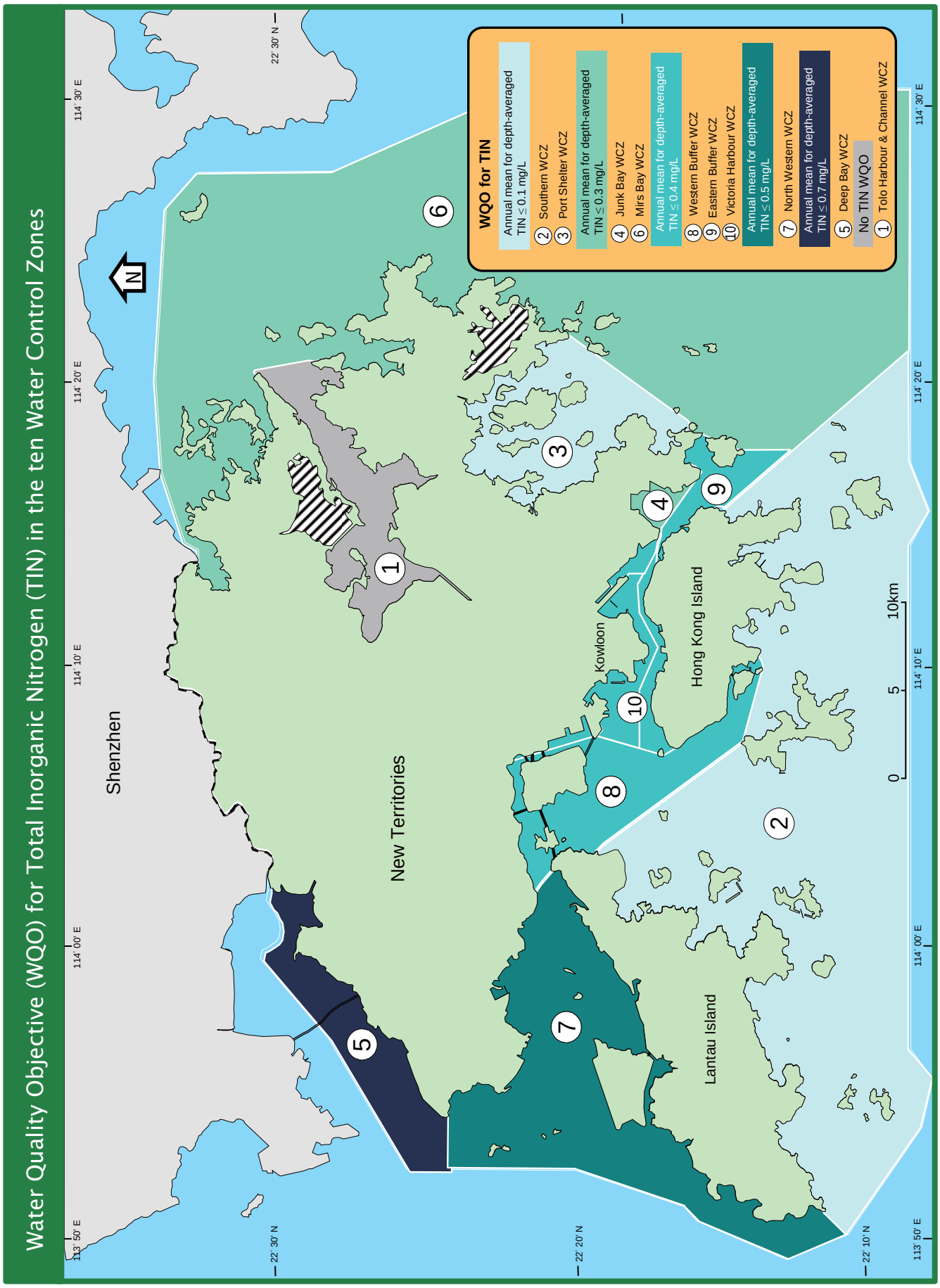
Water Control Zone	Station		Location		Depth (m)
	Water	Sediment	Latitude	Longitude	approx.
Tolo Harbour and Channel	TM2		22° 24.744' N	114° 13.085' E	4
	TM3	TS3	22° 26.857' N	114° 12.181' E	7
	TM4	TS2	22° 25.964' N	114° 13.176' E	8
	TM5		22° 27.426' N	114° 13.456' E	4
	TM6	TS4	22° 26.631' N	114° 14.506' 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
Mirs Bay	MM1	MS1	22° 32.984' N	114° 14.271' E	6
	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
	MM17	MS17	22° 30.192' N	114° 20.960' E	17
	MM19		22° 15.921' N	114° 19.411' E	28
Western Buffer	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
	*WT1		22° 14.494' N	114° 9.737' E	7
	*WT3		22° 14.811' N	114° 8.918' E	10
Eastern Buffer	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
	*ET2	*ES5	22° 17.078' N	114° 13.783' E	12
Victoria Harbour	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 aremarked with an asterisk *


Bathing beaches and secondary contact recreation subzones in Hong Kong in 2010
Gazetted beach
Non-gazetted beach
Secondary contact recreation subzone (Area: approx. 260km²)
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
N
0
5
10km
22° 30' N
22° 20' N
22° 10' N
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E


Fish and shellfish culture zones and marine conservation sites in Hong Kong in 2010
(source: Agriculture, Fisheries and Conservation Department)
Marine park
Area (km²)
1. Yan Chau Tong 6.8
2. Hoi Ha Wan 2.6
3. Sha Chau & Lung Kwu Chau 12
4. Tung Ping Chau 2.7
Marine reserve
5. Cape D'Aguilar 0.2
6. Mai Po & Inner Deep Bay Ramsar site (* includes sea and land) 15*
7. Area of Oyster Production 13
26 Fish Culture Zones
A. Sha Tau Kok
B. Ap Chau
C. Kat O
D. O Pui Tong
E. Sai Lau Kong
F. Wong Wan
G. Tap Mun
H. Kau Lau Wan
I. Sham Wan
J. Lo Fu Wat
K. Yung Shue Au
L. Leung Shuen Wan
M. Tiu Cham Wan
N. Tai Tau Chau
O. Kai Lung Wan
P. Kau Sai
Q. Ma Nam Wat
R. Po Toi O
S. Po Toi
T. Sok Kwu Wan
U. Lo Tik Wan
V. Ma Wan
W. Yim Tin Tsai
X. Cheung Sha Wan
Y. Yim Tin Tsai (East)
Z. Tung Lung Chau
Licensed raft area (m²)
0 - 10000
10001 - 20000
20001 - 30000
> 30000
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
N
0
5
10km
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E
22° 30' N
22° 20' N
22° 10' N


Water Quality Objective (WQO) for Total Inorganic Nitrogen (TIN) in the ten Water Control Zones
WQO for TIN
Annual mean for depth-averaged TIN ≤ 0.1 mg/L
2 Southern WCZ
3 Port Shelter WCZ
Annual mean for depth-averaged TIN ≤ 0.3 mg/L
4 Junk Bay WCZ
6 Mirs Bay WCZ
Annual mean for depth-averaged TIN ≤ 0.4 mg/L
8 Western Buffer WCZ
9 Eastern Buffer WCZ
10 Victoria Harbour WCZ
Annual mean for depth-averaged TIN ≤ 0.5 mg/L
7 North Western WCZ
Annual mean for depth-averaged TIN ≤ 0.7 mg/L
5 Deep Bay WCZ
No TIN WQO
1 Tolo Harbour & Channel WCZ
N
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
0
5
10km
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E
22° 30' N
22° 20' N
22° 10' N

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
E. coli	Annual geometric mean not to exceed 610 cfu/100mL	Secondary contact recreation subzones in Tolo Habour & 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 Habour & Channel WCZ, Southern WCZ, Port Shelter WCZ, Junk Bay, 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%	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-*a*	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 Sediments[1]

Contaminants	Lower Chemical Exceedance Level (LCEL)	Upper Chemical Exceedance Level (UCEL)
Metals *(mg/kg dry weight)*		
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 *(mg/kg dry weight)*		
Arsenic (As)	12	42
Organic-PAHs *(µg/kg dry weight)*		
Low Molecular Weight PAHs[3]	550	3160
High Molecular Weight PAHs[4]	1700	9600
Organic-non-PAHs *(µg/kg dry weight)*		
Total PCBs	23	180
Organometallics *(mg TBT/L in Interstitial water)*		
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 elelectrode), 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 (electrodemetric), 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 18ed. 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-NO2- B (FIA)	GL
	Nitrate Nitrogen[5]	mg/L	0.002	S,M,B	In-house method GL-IN-18 based on APHA 20ed. 4500-NO3- 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-SiO2 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
	Escherichia coli (*E. coli*)[7]	cfu/100mL	1	S,M,B	In-house method, membrane filtration with CHROMagar Liquid *E. coli* -coliform culture[14]	EML/EPD
	Faecal Coliforms[7]	cfu/100mL	1	S,M,B	In-house method, membrane filtration with CHROMagar Liquid *E. coli* -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 E. coli 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 Vervollkommung 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 sediment[1] 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 (electrodemetric)	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
	Polyaromatic 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(*b*)fluoranthene	µg/kg	1	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(*ghi*)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 2010

Parameter		Starling Inlet	Crooked Island		Port Island	Mirs Bay North		
		MM1	MM2	MM7	MM17	MM3	MM4	MM5
Number of samples		12	12	12	12	12	12	12
Temperature (℃)		23.8 (17.4 - 29.3)	23.6 (17.6 - 28.9)	23.4 (17.4 - 29.0)	22.9 (17.2 - 28.2)	23.1 (17.4 - 27.9)	22.9 (17.2 - 27.5)	22.8 (17.3 - 27.5)
Salinity		31.5 (29.9 - 32.9)	31.9 (30.3 - 33.1)	32.1 (30.4 - 33.1)	31.9 (28.7 - 33.3)	32.2 (30.5 - 33.2)	32.3 (30.7 - 33.4)	32.3 (30.7 - 33.4)
Dissolved Oxygen (mg/L)		6.7 (5.1 - 8.9)	6.7 (4.6 - 8.1)	6.3 (2.4 - 8.5)	6.3 (3.7 - 7.8)	6.4 (4.2 - 7.8)	6.3 (3.9 - 8.1)	6.4 (3.2 - 8.2)
	Bottom	5.9 (1.7 - 7.3)	5.9 (1.2 - 7.4)	5.4 (0.2 - 7.6)	5.5 (1.2 - 7.8)	5.6 (1.7 - 7.4)	5.5 (1.8 - 7.7)	5.5 (1.8 - 7.8)
Dissolved Oxygen (% Saturation)		95 (77 - 136)	94 (72 - 123)	88 (38 - 130)	87 (56 - 99)	90 (64 - 99)	88 (60 - 103)	89 (48 - 105)
	Bottom	83 (26 - 102)	82 (17 - 105)	75 (3 - 101)	75 (17 - 98)	76 (24 - 95)	74 (26 - 98)	75 (26 - 99)
pH		8.0 (7.6 - 8.5)	8.0 (7.7 - 8.4)	8.0 (7.7 - 8.4)	8.0 (7.7 - 8.3)	8.0 (7.7 - 8.4)	8.0 (7.7 - 8.3)	8.0 (7.7 - 8.3)
Secchi Disc Depth (m)		2.4 (1.9 - 3.5)	2.7 (1.8 - 4.1)	3.5 (1.8 - 4.5)	3.8 (2.2 - 5.6)	2.8 (1.8 - 3.6)	3.1 (1.9 - 5.8)	3.5 (2.2 - 5.8)
Turbidity (NTU)		3.4 (1.2 - 8.1)	2.2 (0.6 - 7.6)	3.1 (0.5 - 17.5)	2.3 (0.4 - 10.4)	3.2 (1.0 - 9.8)	2.6 (0.6 - 7.0)	2.2 (0.4 - 7.8)
Suspended Solids (mg/L)		4.1 (1.3 - 7.6)	2.3 (1.1 - 3.8)	2.4 (0.9 - 8.4)	1.8 (0.8 - 2.9)	3.2 (1.4 - 5.3)	2.8 (1.1 - 7.5)	1.6 (0.7 - 3.4)
5-day Biochemical Oxygen Demand (mg/L)		1.4 (0.5 - 4.0)	1.2 (0.6 - 2.6)	1.0 (0.5 - 2.1)	0.7 (0.5 - 1.3)	0.8 (0.2 - 1.7)	0.6 (0.4 - 1.0)	0.7 (0.4 - 1.1)
Ammonia Nitrogen (mg/L)		0.060 (0.017 - 0.110)	0.043 (0.007 - 0.089)	0.039 (0.009 - 0.084)	0.026 (0.014 - 0.048)	0.032 (0.019 - 0.048)	0.025 (0.015 - 0.050)	0.024 (0.014 - 0.042)
Unionised Ammonia (mg/L)		0.003 (<0.001 - 0.008)	0.002 (<0.001 - 0.009)	0.002 (<0.001 - 0.007)	0.001 (<0.001 - 0.004)	0.002 (<0.001 - 0.004)	0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)		0.007 (<0.002 - 0.016)	0.006 (<0.002 - 0.015)	0.004 (<0.002 - 0.015)	0.006 (<0.002 - 0.019)	0.005 (<0.002 - 0.013)	0.006 (<0.002 - 0.015)	0.006 (0.002 - 0.010)
Nitrate Nitrogen (mg/L)		0.064 (0.005 - 0.139)	0.027 (0.004 - 0.073)	0.018 (0.005 - 0.038)	0.019 (0.005 - 0.047)	0.019 (0.009 - 0.046)	0.022 (0.008 - 0.045)	0.023 (0.004 - 0.049)
Total Inorganic Nitrogen (mg/L)		0.13 (0.02 - 0.24)	0.08 (0.01 - 0.12)	0.06 (0.02 - 0.11)	0.05 (0.03 - 0.08)	0.06 (0.04 - 0.07)	0.05 (0.03 - 0.09)	0.05 (0.03 - 0.08)
Total Kjeldahl Nitrogen (mg/L)		0.24 (0.17 - 0.40)	0.20 (0.13 - 0.32)	0.17 (0.11 - 0.27)	0.15 (0.11 - 0.21)	0.16 (0.09 - 0.23)	0.15 (0.10 - 0.22)	0.13 (0.08 - 0.20)
Total Nitrogen (mg/L)		0.31 (0.20 - 0.40)	0.24 (0.16 - 0.35)	0.19 (0.15 - 0.30)	0.17 (0.12 - 0.24)	0.19 (0.11 - 0.25)	0.18 (0.12 - 0.26)	0.16 (0.09 - 0.23)
Orthophosphate Phosphorus (mg/L)		0.008 (<0.002 - 0.016)	0.006 (0.003 - 0.011)	0.007 (0.003 - 0.013)	0.007 (0.003 - 0.016)	0.006 (0.004 - 0.009)	0.006 (0.002 - 0.009)	0.006 (0.003 - 0.011)
Total Phosphorus (mg/L)		0.03 (<0.02 - 0.06)	0.03 (<0.02 - 0.04)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.04)	0.02 (<0.02 - 0.02)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)
Silica (as SiO_2) (mg/L)		0.67 (0.22 - 1.07)	0.56 (0.30 - 0.84)	0.65 (0.30 - 1.45)	0.66 (0.19 - 1.36)	0.55 (0.16 - 0.95)	0.61 (0.21 - 1.10)	0.58 (0.18 - 0.97)
Chlorophyll-*a* (μg/L)		8.9 (0.5 - 30.0)	5.4 (0.7 - 20.6)	3.3 (1.1 - 7.0)	1.9 (0.7 - 3.9)	3.0 (0.7 - 8.6)	2.1 (0.5 - 3.3)	1.8 (0.6 - 3.7)
E.coli (count/100mL)		67 (6 - 450)	2 (<1 - 110)	1 (<1 - 2)	1 (<1 - 2)	1 (<1 - 4)	1 (<1 - 1)	1 (<1 - 1)
Faecal Coliforms (count/100mL)		140 (18 - 1200)	4 (<1 - 130)	2 (<1 - 23)	2 (<1 - 120)	2 (<1 - 54)	2 (<1 - 120)	2 (<1 - 680)

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 2010 (continued)

Parameter		Ninepin Group MM19	Waglan Isalnd MM8	Mirs Bay (South) MM13	Mirs Bay (Central) MM14	Mirs Bay (Central) MM15	Mirs Bay (Central) MM16	Long Harbour MM6
Number of samples		12	12	12	12	12	12	12
Temperature (℃)		22.3 (17.1 - 27.5)	22.4 (17.3 - 27.4)	22.7 (17.2 - 27.3)	22.4 (16.7 - 27.4)	22.4 (16.7 - 27.4)	22.7 (16.9 - 27.5)	23.1 (17.1 - 28.8)
Salinity		32.9 (31.5 - 33.9)	32.9 (32.0 - 34.0)	33.0 (31.7 - 34.1)	33.0 (31.3 - 33.9)	33.0 (31.2 - 33.9)	32.8 (31.0 - 33.7)	31.8 (27.3 - 33.4)
Dissolved Oxygen (mg/L)		6.4 (3.8 - 8.2)	6.3 (4.1 - 8.1)	6.5 (4.6 - 8.2)	6.3 (4.1 - 8.2)	6.3 (3.8 - 8.1)	6.4 (4.4 - 8.1)	6.5 (4.0 - 8.3)
	Bottom	5.8 (2.5 - 7.9)	5.8 (2.9 - 8.0)	5.9 (3.8 - 8.0)	5.9 (2.8 - 8.1)	5.8 (2.3 - 8.0)	5.8 (1.8 - 7.9)	5.9 (0.2 - 8.1)
Dissolved Oxygen (% Saturation)		88 (54 - 103)	87 (59 - 104)	91 (67 - 104)	87 (61 - 102)	88 (56 - 103)	89 (66 - 107)	90 (62 - 113)
	Bottom	78 (36 - 99)	80 (41 - 102)	82 (53 - 102)	81 (39 - 102)	79 (32 - 100)	79 (25 - 102)	82 (3 - 108)
pH		8.0 (7.7 - 8.2)	8.0 (7.7 - 8.2)	8.0 (7.7 - 8.2)	8.0 (7.7 - 8.3)	8.0 (7.7 - 8.2)	8.0 (7.7 - 8.2)	8.0 (7.7 - 8.3)
Secchi Disc Depth (m)		3.2 (2.0 - 4.5)	3.5 (2.7 - 5.5)	3.6 (2.5 - 5.0)	3.7 (2.4 - 5.7)	4.0 (2.6 - 6.9)	4.0 (2.9 - 5.5)	3.4 (1.9 - 4.3)
Turbidity (NTU)		4.5 (1.0 - 20.4)	3.6 (1.3 - 6.4)	3.7 (1.4 - 7.5)	3.0 (1.2 - 5.9)	3.4 (1.1 - 8.3)	2.7 (0.6 - 6.7)	1.9 (0.6 - 7.2)
Suspended Solids (mg/L)		2.3 (0.8 - 5.4)	2.7 (1.1 - 5.5)	2.9 (1.0 - 6.3)	2.0 (1.0 - 4.9)	2.4 (1.0 - 7.2)	2.0 (0.7 - 5.4)	1.9 (0.6 - 4.3)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (0.4 - 1.2)	0.4 (0.2 - 0.8)	0.4 (0.1 - 0.9)	0.5 (<0.1 - 0.9)	0.5 (<0.1 - 0.9)	0.6 (0.3 - 0.9)	0.9 (0.4 - 2.2)
Ammonia Nitrogen (mg/L)		0.021 (0.011 - 0.035)	0.017 (0.006 - 0.028)	0.015 (0.009 - 0.031)	0.019 (0.007 - 0.035)	0.018 (0.007 - 0.031)	0.019 (<0.005 - 0.040)	0.026 (0.013 - 0.036)
Unionised Ammonia (mg/L)		<0.001 (<0.001 - 0.002)	<0.001 (<0.001 - 0.002)	<0.001 (<0.001 - 0.003)	<0.001 (<0.001 - 0.003)	<0.001 (<0.001 - 0.003)	<0.001 (<0.001 - 0.002)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)		0.012 (0.002 - 0.019)	0.013 (0.003 - 0.029)	0.011 (<0.002 - 0.021)	0.012 (<0.002 - 0.024)	0.011 (<0.002 - 0.020)	0.009 (<0.002 - 0.014)	0.004 (<0.002 - 0.010)
Nitrate Nitrogen (mg/L)		0.057 (0.007 - 0.150)	0.064 (0.004 - 0.157)	0.053 (0.003 - 0.143)	0.052 (0.002 - 0.127)	0.049 (<0.002 - 0.127)	0.037 (0.002 - 0.074)	0.015 (0.005 - 0.025)
Total Inorganic Nitrogen (mg/L)		0.09 (0.03 - 0.19)	0.09 (0.02 - 0.19)	0.08 (0.02 - 0.17)	0.08 (0.02 - 0.17)	0.08 (0.02 - 0.17)	0.07 (0.01 - 0.11)	0.04 (0.02 - 0.06)
Total Kjeldahl Nitrogen (mg/L)		0.13 (0.09 - 0.19)	0.12 (0.10 - 0.19)	0.13 (0.08 - 0.20)	0.13 (0.09 - 0.21)	0.12 (0.09 - 0.19)	0.13 (0.09 - 0.21)	0.14 (0.08 - 0.20)
Total Nitrogen (mg/L)		0.20 (0.14 - 0.34)	0.20 (0.12 - 0.36)	0.19 (0.12 - 0.35)	0.19 (0.12 - 0.34)	0.18 (0.10 - 0.29)	0.18 (0.11 - 0.28)	0.16 (0.09 - 0.22)
Orthophosphate Phosphorus (mg/L)		0.010 (0.005 - 0.026)	0.009 (0.004 - 0.018)	0.008 (0.004 - 0.019)	0.009 (0.004 - 0.024)	0.009 (0.004 - 0.022)	0.007 (0.003 - 0.011)	0.006 (0.003 - 0.012)
Total Phosphorus (mg/L)		0.02 (<0.02 - 0.04)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.04)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.02)	0.02 (<0.02 - 0.03)
Silica (as SiO_2) (mg/L)		0.66 (0.20 - 1.50)	0.66 (0.22 - 1.57)	0.54 (0.20 - 1.53)	0.60 (0.22 - 1.47)	0.63 (0.17 - 1.30)	0.59 (0.27 - 1.17)	0.57 (0.14 - 1.33)
Chlorophyll-*a* (μg/L)		1.8 (0.8 - 4.3)	2.3 (0.7 - 6.4)	2.0 (0.6 - 5.7)	1.7 (0.9 - 2.6)	1.5 (0.7 - 3.7)	1.5 (0.6 - 2.9)	3.0 (0.7 - 7.1)
E.coli (count/100mL)		1 (<1 - 2)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 9)
Faecal Coliforms (count/100mL)		2 (<1 - 9)	1 (<1 - 3)	1 (<1 - 3)	1 (<1 - 2)	1 (<1 - 2)	1 (<1 - 2)	2 (<1 - 560)

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 2010

Parameter		Inner Port Shelter PM1	PM2	PM3	PM4	Hebe Haven PM6
Number of samples		12	12	12	12	12
Temperature (℃)		23.8 (15.9 - 30.4)	23.9 (16.5 - 30.7)	23.8 (16.5 - 30.8)	23.8 (15.9 - 30.6)	23.6 (16.4 - 29.6)
Salinity		31.8 (28.8 - 33.6)	31.8 (28.6 - 33.5)	31.9 (29.5 - 33.7)	31.8 (28.8 - 33.5)	32.0 (30.2 - 33.5)
Dissolved Oxygen (mg/L)		6.9 (4.6 - 9.6)	6.4 (4.8 - 8.3)	6.2 (3.7 - 7.8)	6.8 (4.4 - 9.0)	6.4 (4.3 - 8.1)
	Bottom	6.5 (1.4 - 8.7)	6.4 (2.6 - 7.8)	5.7 (0.2 - 7.5)	6.8 (4.9 - 8.6)	5.8 (1.1 - 7.5)
Dissolved Oxygen (% Saturation)		97 (70 - 123)	90 (70 - 106)	87 (58 - 110)	96 (67 - 116)	90 (65 - 108)
	Bottom	91 (21 - 116)	90 (39 - 112)	80 (3 - 108)	96 (74 - 116)	81 (17 - 106)
pH		8.0 (7.7 - 8.4)	8.0 (7.6 - 8.4)	8.0 (7.6 - 8.4)	8.0 (7.7 - 8.4)	8.0 (7.7 - 8.3)
Secchi Disc Depth (m)		3.2 (2.0 - 5.0)	3.5 (2.6 - 5.8)	3.6 (2.1 - 6.2)	3.4 (1.8 - 4.7)	3.7 (2.4 - 5.0)
Turbidity (NTU)		1.6 (0.5 - 4.7)	1.7 (0.5 - 5.1)	1.6 (0.5 - 4.6)	2.8 (0.8 - 14.3)	1.6 (0.5 - 4.7)
Suspended Solids (mg/L)		1.3 (0.7 - 2.4)	1.4 (0.7 - 2.4)	1.2 (0.5 - 2.5)	1.8 (0.7 - 4.2)	1.5 (0.7 - 2.5)
5-day Biochemical Oxygen Demand (mg/L)		1.0 (0.3 - 2.9)	0.8 (0.2 - 1.4)	0.7 (0.2 - 1.1)	0.9 (0.3 - 1.6)	0.7 (0.3 - 1.1)
Ammonia Nitrogen (mg/L)		0.023 (0.006 - 0.052)	0.026 (0.011 - 0.045)	0.024 (0.006 - 0.054)	0.021 (0.009 - 0.033)	0.027 (0.009 - 0.046)
Unionised Ammonia (mg/L)		0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)		0.009 (<0.002 - 0.043)	0.010 (<0.002 - 0.051)	0.010 (<0.002 - 0.051)	0.008 (<0.002 - 0.044)	0.009 (<0.002 - 0.044)
Nitrate Nitrogen (mg/L)		0.024 (0.002 - 0.088)	0.030 (0.004 - 0.099)	0.025 (0.004 - 0.083)	0.025 (0.003 - 0.100)	0.028 (0.003 - 0.092)
Total Inorganic Nitrogen (mg/L)		0.06 (0.02 - 0.14)	0.07 (0.02 - 0.15)	0.06 (0.02 - 0.14)	0.05 (0.02 - 0.15)	0.06 (0.02 - 0.15)
Total Kjeldahl Nitrogen (mg/L)		0.16 (0.08 - 0.23)	0.16 (0.10 - 0.24)	0.16 (0.07 - 0.26)	0.15 (0.07 - 0.26)	0.16 (0.07 - 0.24)
Total Nitrogen (mg/L)		0.19 (0.10 - 0.28)	0.20 (0.12 - 0.29)	0.20 (0.11 - 0.27)	0.19 (0.12 - 0.28)	0.20 (0.13 - 0.26)
Orthophosphate Phosphorus (mg/L)		0.005 (<0.002 - 0.012)	0.005 (<0.002 - 0.013)	0.005 (<0.002 - 0.012)	0.006 (<0.002 - 0.014)	0.007 (<0.002 - 0.016)
Total Phosphorus (mg/L)		0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.02)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)
Silica (as SiO_2) (mg/L)		0.57 (0.07 - 1.27)	0.61 (0.09 - 1.30)	0.59 (0.10 - 1.27)	0.56 (0.07 - 1.20)	0.58 (0.10 - 1.27)
Chlorophyll-a (μg/L)		3.5 (0.8 - 11.8)	3.3 (0.8 - 10.1)	2.2 (0.8 - 4.5)	2.8 (1.3 - 7.4)	3.1 (0.5 - 5.9)
E.coli (count/100mL)		2 (<1 - 8)	4 (<1 - 41)	1 (<1 - 3)	1 (<1 - 4)	2 (<1 - 4)
Faecal Coliforms (count/100mL)		3 (1 - 21)	26 (4 - 190)	3 (<1 - 57)	2 (<1 - 8)	4 (1 - 9)

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 2010 (continued)

Parameter		Outer Port Shelter PM7	Outer Port Shelter PM8	Rocky Harbour PM9	Bluff Island PM11
Number of samples		12	12	12	12
Temperature (℃)		23.1 (16.5 - 27.9)	22.9 (16.8 - 27.2)	23.0 (16.1 - 27.5)	22.7 (16.7 - 27.1)
Salinity		32.4 (31.0 - 33.6)	32.6 (31.2 - 33.7)	32.5 (30.4 - 33.7)	32.7 (31.4 - 33.8)
Dissolved Oxygen (mg/L)		6.4 (3.8 - 8.2)	6.4 (4.6 - 7.9)	6.5 (4.5 - 8.1)	6.4 (4.4 - 7.9)
	Bottom	5.4 (0.3 - 7.6)	5.7 (1.6 - 7.6)	5.7 (0.7 - 8.0)	5.6 (1.4 - 7.7)
Dissolved Oxygen (% Saturation)		89 (58 - 108)	90 (68 - 104)	90 (69 - 106)	90 (65 - 103)
	Bottom	74 (4 - 98)	78 (22 - 98)	78 (10 - 102)	76 (19 - 99)
pH		8.0 (7.7 - 8.2)	8.0 (7.7 - 8.2)	8.0 (7.7 - 8.3)	8.0 (7.7 - 8.2)
Secchi Disc Depth (m)		4.6 (1.8 - 7.4)	4.6 (1.8 - 7.1)	3.8 (2.6 - 6.5)	4.0 (2.8 - 7.0)
Turbidity (NTU)		1.5 (0.5 - 4.5)	1.9 (0.9 - 4.6)	1.8 (0.6 - 5.2)	2.0 (0.7 - 5.0)
Suspended Solids (mg/L)		1.2 (<0.5 - 2.4)	1.6 (0.6 - 3.3)	1.5 (0.7 - 2.4)	1.6 (0.8 - 3.1)
5-day Biochemical Oxygen Demand (mg/L)		0.6 (0.2 - 1.0)	0.6 (0.3 - 1.0)	0.7 (0.4 - 1.0)	0.5 (0.2 - 1.0)
Ammonia Nitrogen (mg/L)		0.023 (0.007 - 0.038)	0.021 (<0.005 - 0.035)	0.021 (<0.005 - 0.038)	0.019 (<0.005 - 0.032)
Unionised Ammonia (mg/L)		0.001 (<0.001 - 0.002)	<0.001 (<0.001 - 0.002)	0.001 (<0.001 - 0.002)	<0.001 (<0.001 - 0.002)
Nitrite Nitrogen (mg/L)		0.008 (<0.002 - 0.043)	0.009 (<0.002 - 0.036)	0.009 (<0.002 - 0.045)	0.009 (<0.002 - 0.033)
Nitrate Nitrogen (mg/L)		0.027 (0.004 - 0.092)	0.037 (0.004 - 0.081)	0.030 (0.003 - 0.093)	0.037 (0.003 - 0.089)
Total Inorganic Nitrogen (mg/L)		0.06 (0.02 - 0.13)	0.07 (0.02 - 0.12)	0.06 (0.02 - 0.13)	0.06 (0.02 - 0.11)
Total Kjeldahl Nitrogen (mg/L)		0.14 (0.07 - 0.24)	0.13 (0.07 - 0.21)	0.13 (0.07 - 0.23)	0.14 (0.07 - 0.23)
Total Nitrogen (mg/L)		0.18 (0.12 - 0.27)	0.17 (0.10 - 0.27)	0.17 (0.10 - 0.25)	0.19 (0.10 - 0.30)
Orthophosphate Phosphorus (mg/L)		0.007 (0.004 - 0.016)	0.007 (0.004 - 0.010)	0.006 (0.003 - 0.010)	0.007 (0.004 - 0.012)
Total Phosphorus (mg/L)		0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.02)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)
Silica (as SiO_2) (mg/L)		0.56 (0.16 - 0.94)	0.57 (0.24 - 1.10)	0.60 (0.25 - 1.18)	0.60 (0.22 - 1.18)
Chlorophyll-*a* (μg/L)		2.6 (0.5 - 7.5)	2.0 (1.0 - 3.5)	2.4 (1.0 - 5.3)	2.3 (0.5 - 6.6)
E.coli (count/100mL)		1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)
Faecal Coliforms (count/100mL)		1 (<1 - 1)	1 (<1 - 2)	1 (<1 - 1)	1 (<1 - 1)

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 2010

Parameter		Harbour Subzone			Buffer Subzone		Channel Subzone	
		TM2	TM3	TM4	TM5	TM6	TM7	TM8
Number of samples		12	12	12	12	12	12	12
Temperature (℃)		23.9 (16.3 - 30.7)	24.1 (16.9 - 30.4)	23.8 (16.3 - 30.3)	24.1 (17.5 - 30.7)	23.5 (16.1 - 29.7)	23.5 (16.2 - 30.0)	23.2 (16.4 - 30.4)
Salinity		30.5 (24.7 - 32.4)	31.0 (27.9 - 32.4)	31.1 (27.7 - 32.5)	31.1 (27.4 - 32.4)	31.6 (30.1 - 32.8)	31.6 (28.7 - 33.1)	32.0 (29.0 - 33.1)
Dissolved Oxygen (mg/L)		6.7 (4.5 - 8.5)	6.7 (5.1 - 8.4)	6.8 (5.0 - 8.2)	6.6 (5.4 - 8.0)	6.1 (4.1 - 7.9)	6.4 (4.9 - 7.6)	5.9 (3.4 - 7.4)
	Bottom	6.7 (2.8 - 8.5)	5.0 (0.2 - 7.4)	6.0 (1.5 - 7.4)	5.0 (0.1 - 7.8)	5.2 (1.4 - 7.4)	5.5 (2.4 - 9.4)	5.3 (2.8 - 7.6)
Dissolved Oxygen (% Saturation)		94 (68 - 126)	95 (73 - 125)	96 (78 - 122)	93 (80 - 120)	86 (64 - 115)	91 (76 - 105)	83 (52 - 96)
	Bottom	94 (43 - 119)	68 (3 - 94)	83 (23 - 107)	68 (2 - 98)	73 (21 - 109)	76 (34 - 117)	73 (42 - 106)
pH		8.0 (7.7 - 8.5)	8.1 (7.7 - 8.4)	8.1 (7.7 - 8.3)	8.1 (7.7 - 8.5)	8.0 (7.7 - 8.3)	8.1 (7.7 - 8.4)	8.0 (7.7 - 8.3)
Secchi Disc Depth (m)		2.6 (1.3 - 4.0)	2.4 (1.5 - 3.7)	2.6 (1.5 - 4.2)	2.7 (1.2 - 4.0)	2.5 (1.5 - 3.5)	2.7 (2.0 - 3.8)	3.1 (2.5 - 4.6)
Turbidity (NTU)		2.1 (0.9 - 5.9)	3.6 (1.1 - 13.1)	2.0 (0.9 - 6.7)	2.1 (0.6 - 6.5)	2.4 (1.0 - 6.5)	2.0 (0.6 - 6.9)	2.5 (0.9 - 7.1)
Suspended Solids (mg/L)		1.9 (0.9 - 3.3)	2.1 (0.8 - 4.3)	1.7 (0.5 - 2.7)	1.6 (0.8 - 3.2)	2.2 (1.0 - 5.4)	1.5 (<0.5 - 2.9)	1.8 (0.9 - 3.6)
5-day Biochemical Oxygen Demand (mg/L)		1.7 (0.8 - 2.6)	1.9 (0.8 - 3.0)	1.6 (0.6 - 2.3)	1.7 (0.6 - 2.3)	1.3 (0.8 - 2.6)	1.3 (0.6 - 2.0)	0.8 (0.5 - 1.4)
Ammonia Nitrogen (mg/L)		0.049 (0.014 - 0.115)	0.046 (0.015 - 0.113)	0.039 (0.008 - 0.103)	0.039 (0.010 - 0.090)	0.039 (0.019 - 0.070)	0.028 (0.009 - 0.067)	0.032 (0.009 - 0.053)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.006)	0.003 (<0.001 - 0.007)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.010)	0.001 (<0.001 - 0.005)	0.001 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)		0.005 (<0.002 - 0.019)	0.004 (<0.002 - 0.015)	0.004 (<0.002 - 0.019)	0.003 (<0.002 - 0.007)	0.007 (<0.002 - 0.021)	0.005 (<0.002 - 0.020)	0.011 (<0.002 - 0.029)
Nitrate Nitrogen (mg/L)		0.026 (<0.002 - 0.060)	0.014 (<0.002 - 0.055)	0.014 (<0.002 - 0.057)	0.012 (<0.002 - 0.041)	0.013 (<0.002 - 0.051)	0.012 (<0.002 - 0.050)	0.016 (0.003 - 0.054)
Total Inorganic Nitrogen (mg/L)		0.08 (0.02 - 0.15)	0.06 (0.02 - 0.15)	0.06 (0.01 - 0.13)	0.05 (0.01 - 0.14)	0.06 (0.03 - 0.11)	0.05 (0.01 - 0.11)	0.06 (0.03 - 0.10)
Total Kjeldahl Nitrogen (mg/L)		0.24 (0.17 - 0.32)	0.25 (0.17 - 0.35)	0.23 (0.13 - 0.34)	0.21 (0.12 - 0.30)	0.22 (0.14 - 0.32)	0.19 (0.12 - 0.27)	0.17 (0.11 - 0.23)
Total Nitrogen (mg/L)		0.27 (0.17 - 0.33)	0.26 (0.17 - 0.36)	0.25 (0.14 - 0.34)	0.22 (0.12 - 0.30)	0.24 (0.15 - 0.33)	0.21 (0.12 - 0.29)	0.20 (0.13 - 0.30)
Orthophosphate Phosphorus (mg/L)		0.006 (<0.002 - 0.014)	0.006 (<0.002 - 0.017)	0.005 (<0.002 - 0.012)	0.005 (0.002 - 0.016)	0.008 (0.003 - 0.039)	0.006 (0.003 - 0.027)	0.007 (0.003 - 0.017)
Total Phosphorus (mg/L)		0.03 (<0.02 - 0.04)	0.03 (<0.02 - 0.04)	0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.04)	0.03 (<0.02 - 0.07)	0.02 (<0.02 - 0.05)	0.02 (<0.02 - 0.04)
Silica (as SiO_2) (mg/L)		0.85 (0.07 - 2.00)	0.67 (0.05 - 1.93)	0.64 (0.05 - 1.77)	0.66 (0.06 - 1.90)	0.79 (0.27 - 1.57)	0.62 (0.10 - 1.57)	0.78 (0.40 - 1.43)
Chlorophyll-*a* (μg/L)		6.1 (0.4 - 20.5)	8.0 (0.6 - 18.3)	6.1 (0.5 - 15.3)	5.5 (0.4 - 11.0)	5.5 (0.3 - 19.3)	4.6 (0.2 - 11.6)	2.6 (0.5 - 4.8)
E.coli (count/100mL)		10 (1 - 390)	4 (1 - 28)	4 (<1 - 120)	2 (<1 - 14)	1 (<1 - 4)	1 (<1 - 2)	1 (<1 - 2)
Faecal Coliforms (count/100mL)		85 (3 - 700)	18 (1 - 160)	24 (1 - 480)	9 (1 - 100)	5 (1 - 39)	2 (<1 - 34)	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 2010

Parameter		Hong Kong Island (South) SM1	SM2	SM19	East Lamma Channel SM3	SM4
Number of samples		12	12	12	12	12
Temperature (℃)		22.7 (16.9 - 27.9)	22.7 (17.2 - 26.9)	22.5 (16.8 - 26.2)	22.5 (17.4 - 26.3)	22.9 (17.6 - 27.6)
Salinity		32.4 (30.6 - 33.8)	32.3 (30.0 - 33.9)	32.6 (29.6 - 33.9)	32.5 (30.5 - 33.9)	31.8 (28.9 - 33.8)
Dissolved Oxygen (mg/L)		6.8 (4.6 - 8.3)	6.5 (4.5 - 8.0)	6.6 (4.8 - 8.4)	6.3 (3.8 - 8.8)	6.3 (4.5 - 8.0)
	Bottom	6.4 (2.0 - 8.2)	6.2 (2.4 - 8.0)	6.1 (2.4 - 8.2)	6.1 (2.1 - 10.2)	6.5 (4.0 - 8.4)
Dissolved Oxygen (% Saturation)		94 (68 - 108)	91 (66 - 105)	92 (71 - 110)	87 (55 - 114)	87 (66 - 103)
	Bottom	89 (29 - 103)	85 (35 - 103)	84 (34 - 103)	83 (30 - 133)	90 (59 - 110)
pH		8.0 (7.8 - 8.4)	8.0 (7.7 - 8.3)	8.0 (7.8 - 8.3)	8.0 (7.7 - 8.2)	8.0 (7.7 - 8.2)
Secchi Disc Depth (m)		3.1 (2.0 - 4.6)	2.9 (1.7 - 4.6)	3.2 (2.0 - 5.5)	2.7 (1.6 - 4.5)	2.8 (1.9 - 4.2)
Turbidity (NTU)		3.1 (0.7 - 11.7)	4.6 (0.9 - 11.8)	4.1 (1.3 - 13.1)	4.5 (1.0 - 10.1)	3.1 (0.9 - 9.8)
Suspended Solids (mg/L)		2.7 (0.7 - 4.9)	4.6 (1.1 - 14.3)	3.9 (1.5 - 11.0)	4.1 (1.2 - 10.9)	2.8 (1.1 - 5.5)
5-day Biochemical Oxygen Demand (mg/L)		0.8 (0.3 - 2.0)	0.8 (0.4 - 2.1)	0.7 (0.1 - 2.2)	0.8 (0.5 - 2.0)	0.9 (0.3 - 2.2)
Ammonia Nitrogen (mg/L)		0.022 (0.010 - 0.043)	0.031 (0.017 - 0.055)	0.019 (0.010 - 0.042)	0.038 (0.013 - 0.070)	0.062 (0.013 - 0.110)
Unionised Ammonia (mg/L)		0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.004)	<0.001 (<0.001 - 0.002)	0.001 (<0.001 - 0.004)	0.002 (<0.001 - 0.005)
Nitrite Nitrogen (mg/L)		0.012 (<0.002 - 0.032)	0.025 (0.003 - 0.081)	0.014 (<0.002 - 0.025)	0.027 (0.005 - 0.070)	0.043 (0.006 - 0.204)
Nitrate Nitrogen (mg/L)		0.056 (0.005 - 0.190)	0.098 (0.016 - 0.393)	0.066 (0.005 - 0.203)	0.097 (0.016 - 0.363)	0.151 (0.027 - 0.763)
Total Inorganic Nitrogen (mg/L)		0.09 (0.02 - 0.23)	0.15 (0.04 - 0.52)	0.10 (0.03 - 0.24)	0.16 (0.05 - 0.48)	0.26 (0.08 - 1.04)
Total Kjeldahl Nitrogen (mg/L)		0.13 (0.09 - 0.21)	0.13 (0.09 - 0.20)	0.13 (0.08 - 0.20)	0.16 (0.09 - 0.26)	0.17 (0.09 - 0.34)
Total Nitrogen (mg/L)		0.20 (0.11 - 0.33)	0.25 (0.12 - 0.67)	0.21 (0.12 - 0.33)	0.28 (0.15 - 0.64)	0.37 (0.17 - 1.18)
Orthophosphate Phosphorus (mg/L)		0.007 (0.003 - 0.015)	0.013 (0.003 - 0.032)	0.007 (0.004 - 0.015)	0.014 (0.003 - 0.035)	0.018 (0.004 - 0.034)
Total Phosphorus (mg/L)		0.02 (<0.02 - 0.02)	0.02 (<0.02 - 0.04)	0.02 (<0.02 - 0.03)	0.03 (<0.02 - 0.05)	0.03 (<0.02 - 0.05)
Silica (as SiO_2) (mg/L)		0.55 (0.17 - 1.27)	0.67 (0.19 - 1.37)	0.61 (0.21 - 1.30)	0.71 (0.21 - 1.43)	0.81 (0.20 - 1.93)
Chlorophyll-a (μg/L)		2.3 (0.6 - 6.5)	2.6 (0.6 - 5.5)	2.0 (0.5 - 4.5)	2.5 (0.5 - 4.9)	2.7 (0.7 - 6.3)
E.coli (count/100mL)		1 (<1 - 1)	57 (5 - 210)	1 (<1 - 2)	23 (3 - 270)	13 (2 - 440)
Faecal Coliforms (count/100mL)		2 (1 - 4)	99 (9 - 400)	2 (<1 - 8)	49 (7 - 560)	30 (7 - 1100)

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 2010 (continued)

Parameter		West Lamma Channel				
		SM5	SM6	SM7	SM9	SM18
Number of samples		12	12	12	12	12
Temperature (℃)		23.2 (17.2 - 29.1)	23.0 (17.2 - 28.2)	23.3 (17.5 - 28.7)	23.4 (17.2 - 27.7)	22.8 (17.1 - 27.7)
Salinity		31.9 (26.8 - 33.9)	31.8 (28.4 - 34.0)	30.9 (21.7 - 33.5)	29.9 (23.0 - 32.9)	32.2 (28.4 - 34.0)
Dissolved Oxygen (mg/L)		6.7 (5.4 - 8.4)	6.8 (4.6 - 8.2)	6.8 (4.7 - 8.4)	6.1 (4.1 - 7.9)	6.7 (4.5 - 8.5)
	Bottom	5.5 (2.3 - 7.9)	7.2 (6.1 - 8.6)	6.9 (6.0 - 7.7)	6.3 (<0.1 - 8.5)	5.9 (1.1 - 8.2)
Dissolved Oxygen (% Saturation)		94 (81 - 110)	94 (68 - 106)	94 (70 - 111)	84 (61 - 100)	93 (69 - 112)
	Bottom	76 (33 - 99)	101 (86 - 128)	96 (87 - 115)	87 (1 - 123)	80 (16 - 107)
pH		8.0 (7.7 - 8.3)	8.0 (7.7 - 8.3)	8.0 (7.6 - 8.2)	7.9 (7.6 - 8.1)	8.0 (7.8 - 8.3)
Secchi Disc Depth (m)		2.6 (1.5 - 3.8)	2.6 (1.8 - 3.8)	2.5 (1.0 - 3.2)	2.4 (1.3 - 3.5)	2.9 (1.8 - 4.5)
Turbidity (NTU)		5.5 (1.1 - 13.5)	4.1 (0.7 - 11.8)	5.1 (1.0 - 9.5)	5.0 (1.7 - 8.5)	4.1 (0.8 - 11.3)
Suspended Solids (mg/L)		5.6 (1.4 - 20.7)	4.2 (1.3 - 11.0)	5.9 (1.8 - 11.1)	5.8 (1.6 - 11.1)	3.8 (0.9 - 9.5)
5-day Biochemical Oxygen Demand (mg/L)		1.0 (0.5 - 2.5)	1.1 (0.5 - 2.5)	1.1 (0.5 - 3.1)	0.8 (0.2 - 1.5)	0.8 (0.1 - 2.3)
Ammonia Nitrogen (mg/L)		0.026 (0.015 - 0.053)	0.028 (0.016 - 0.041)	0.056 (0.019 - 0.187)	0.104 (0.036 - 0.217)	0.022 (0.009 - 0.042)
Unionised Ammonia (mg/L)		0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.002 (<0.001 - 0.004)	0.003 (0.001 - 0.010)	0.001 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)		0.022 (0.003 - 0.047)	0.024 (0.007 - 0.046)	0.038 (0.009 - 0.076)	0.052 (0.012 - 0.118)	0.018 (<0.002 - 0.047)
Nitrate Nitrogen (mg/L)		0.087 (0.016 - 0.290)	0.097 (0.005 - 0.300)	0.150 (0.033 - 0.467)	0.219 (0.072 - 0.540)	0.076 (0.004 - 0.270)
Total Inorganic Nitrogen (mg/L)		0.14 (0.04 - 0.34)	0.15 (0.03 - 0.36)	0.24 (0.10 - 0.55)	0.38 (0.18 - 0.70)	0.12 (0.03 - 0.30)
Total Kjeldahl Nitrogen (mg/L)		0.14 (0.10 - 0.21)	0.16 (0.10 - 0.22)	0.18 (0.10 - 0.27)	0.26 (0.18 - 0.35)	0.13 (0.07 - 0.21)
Total Nitrogen (mg/L)		0.24 (0.12 - 0.47)	0.28 (0.14 - 0.48)	0.37 (0.18 - 0.68)	0.53 (0.32 - 0.84)	0.22 (0.10 - 0.43)
Orthophosphate Phosphorus (mg/L)		0.009 (0.003 - 0.015)	0.009 (0.003 - 0.016)	0.014 (0.003 - 0.027)	0.019 (0.004 - 0.037)	0.009 (0.003 - 0.016)
Total Phosphorus (mg/L)		0.02 (<0.02 - 0.03)	0.02 (<0.02 - 0.03)	0.03 (<0.02 - 0.04)	0.04 (0.03 - 0.05)	0.02 (<0.02 - 0.03)
Silica (as SiO_2) (mg/L)		0.71 (0.18 - 1.60)	0.72 (0.17 - 1.67)	0.94 (0.39 - 2.40)	1.30 (0.52 - 3.13)	0.70 (0.17 - 1.54)
Chlorophyll-a (μg/L)		2.9 (0.5 - 7.8)	4.0 (0.5 - 11.3)	5.0 (0.8 - 14.7)	5.3 (0.9 - 23.8)	2.7 (0.5 - 8.0)
E.coli (count/100mL)		2 (<1 - 16)	2 (<1 - 11)	3 (<1 - 130)	19 (1 - 120)	1 (<1 - 1)
Faecal Coliforms (count/100mL)		3 (1 - 21)	2 (1 - 45)	7 (<1 - 470)	42 (2 - 280)	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 2010 (continued)

Parameter		Lantau Island (East) SM10	Lantau Island (East) SM11	Lantau Island (South) SM12	Lantau Island (South) SM13	Lantau Island (South) SM17	Soko Islands SM20
Number of samples		12	12	12	12	12	12
Temperature (℃)		23.8 (17.0 - 28.5)	23.8 (16.9 - 28.6)	23.7 (16.7 - 28.6)	23.9 (17.0 - 29.3)	23.2 (16.9 - 27.8)	23.1 (17.2 - 28.2)
Salinity		30.0 (25.9 - 33.1)	30.0 (24.7 - 33.1)	29.9 (23.1 - 33.4)	29.5 (21.7 - 33.6)	31.1 (24.9 - 34.0)	30.3 (18.1 - 33.8)
Dissolved Oxygen (mg/L)		6.7 (3.5 - 8.6)	6.9 (3.4 - 9.2)	7.0 (5.4 - 8.6)	7.2 (5.1 - 8.5)	6.4 (4.0 - 7.9)	5.9 (2.2 - 7.9)
	Bottom	6.6 (2.0 - 9.8)	5.9 (0.5 - 7.9)	6.5 (4.7 - 7.9)	6.7 (5.2 - 8.1)	5.6 (2.1 - 7.8)	5.8 (1.9 - 8.0)
Dissolved Oxygen (% Saturation)		94 (52 - 129)	97 (52 - 138)	98 (81 - 129)	101 (74 - 127)	89 (59 - 105)	81 (32 - 105)
	Bottom	93 (29 - 146)	82 (8 - 109)	91 (71 - 109)	94 (76 - 121)	77 (30 - 102)	79 (28 - 104)
pH		7.9 (7.6 - 8.3)	7.9 (7.7 - 8.3)	8.0 (7.7 - 8.3)	8.0 (7.7 - 8.4)	7.9 (7.7 - 8.2)	7.9 (7.7 - 8.3)
Secchi Disc Depth (m)		2.0 (1.5 - 3.0)	2.1 (1.5 - 3.1)	2.1 (1.1 - 3.5)	2.3 (1.5 - 3.6)	2.5 (1.8 - 4.0)	2.2 (1.0 - 3.8)
Turbidity (NTU)		5.1 (2.4 - 11.3)	5.1 (2.1 - 11.2)	5.0 (1.8 - 9.5)	4.9 (2.3 - 10.9)	4.9 (1.9 - 12.8)	8.2 (3.2 - 15.7)
Suspended Solids (mg/L)		5.5 (2.1 - 11.5)	6.2 (2.0 - 12.3)	6.5 (1.5 - 14.2)	5.5 (1.7 - 13.3)	4.6 (1.7 - 11.7)	10.2 (3.9 - 20.2)
5-day Biochemical Oxygen Demand (mg/L)		1.3 (0.5 - 3.4)	1.2 (0.3 - 2.5)	1.1 (0.4 - 2.2)	1.1 (0.3 - 2.5)	0.7 (0.5 - 1.3)	0.7 (0.4 - 1.1)
Ammonia Nitrogen (mg/L)		0.092 (0.020 - 0.185)	0.086 (0.035 - 0.187)	0.070 (0.030 - 0.163)	0.043 (0.015 - 0.117)	0.038 (0.010 - 0.140)	0.029 (0.008 - 0.073)
Unionised Ammonia (mg/L)		0.003 (<0.001 - 0.007)	0.003 (<0.001 - 0.005)	0.003 (<0.001 - 0.009)	0.002 (<0.001 - 0.005)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)		0.045 (0.009 - 0.072)	0.043 (0.008 - 0.085)	0.038 (0.006 - 0.088)	0.039 (0.006 - 0.091)	0.029 (<0.002 - 0.074)	0.042 (0.003 - 0.203)
Nitrate Nitrogen (mg/L)		0.195 (0.063 - 0.375)	0.192 (0.055 - 0.367)	0.178 (0.029 - 0.477)	0.183 (0.030 - 0.503)	0.132 (<0.002 - 0.372)	0.187 (0.008 - 0.620)
Total Inorganic Nitrogen (mg/L)		0.33 (0.15 - 0.48)	0.32 (0.13 - 0.47)	0.29 (0.07 - 0.61)	0.27 (0.07 - 0.63)	0.20 (0.02 - 0.46)	0.26 (0.04 - 0.84)
Total Kjeldahl Nitrogen (mg/L)		0.25 (0.20 - 0.38)	0.25 (0.19 - 0.35)	0.22 (0.13 - 0.32)	0.19 (0.12 - 0.33)	0.17 (0.10 - 0.27)	0.16 (0.11 - 0.22)
Total Nitrogen (mg/L)		0.49 (0.28 - 0.69)	0.49 (0.25 - 0.74)	0.44 (0.20 - 0.78)	0.41 (0.21 - 0.78)	0.33 (0.13 - 0.57)	0.39 (0.17 - 1.00)
Orthophosphate Phosphorus (mg/L)		0.016 (<0.002 - 0.041)	0.015 (<0.002 - 0.038)	0.013 (0.003 - 0.030)	0.012 (0.003 - 0.039)	0.012 (0.005 - 0.030)	0.013 (0.004 - 0.032)
Total Phosphorus (mg/L)		0.03 (0.03 - 0.06)	0.03 (0.02 - 0.05)	0.03 (<0.02 - 0.04)	0.03 (<0.02 - 0.05)	0.03 (<0.02 - 0.04)	0.03 (<0.02 - 0.06)
Silica (as SiO_2) (mg/L)		0.95 (0.54 - 2.10)	0.88 (0.48 - 1.77)	0.90 (0.21 - 2.00)	0.87 (0.24 - 2.37)	0.85 (0.24 - 2.33)	1.16 (0.34 - 3.13)
Chlorophyll-a (μg/L)		10.5 (1.4 - 41.5)	9.9 (1.1 - 33.0)	7.9 (1.3 - 27.3)	7.0 (1.3 - 31.7)	3.4 (0.9 - 14.1)	3.2 (1.1 - 8.0)
E.coli (count/100mL)		5 (1 - 120)	2 (<1 - 9)	43 (1 - 840)	2 (<1 - 24)	1 (<1 - 4)	1 (<1 - 9)
Faecal Coliforms (count/100mL)		14 (2 - 390)	5 (1 - 38)	93 (2 - 2100)	4 (1 - 55)	2 (<1 - 5)	2 (<1 - 27)

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 2010

Parameter		Victoria Harbour (East) VM1	Victoria Harbour (East) VM2	Victoria Harbour (Central) VM4	Victoria Harbour (Central) VM5	Victoria Harbour (Central) VM6
Number of samples		12	12	12	12	12
Temperature (℃)		22.8 (16.5 - 27.3)	23.0 (16.5 - 27.3)	23.3 (16.6 - 27.8)	23.3 (16.5 - 27.7)	23.2 (16.6 - 27.7)
Salinity		32.0 (29.2 - 33.6)	31.7 (29.1 - 33.7)	31.2 (27.4 - 33.7)	31.0 (26.5 - 33.4)	31.4 (28.8 - 33.4)
Dissolved Oxygen (mg/L)		5.6 (3.3 - 7.6)	5.4 (3.5 - 6.7)	5.5 (3.4 - 7.1)	5.3 (3.6 - 6.4)	5.2 (3.6 - 6.5)
	Bottom	4.8 (1.1 - 6.3)	4.8 (1.2 - 6.4)	5.1 (3.2 - 7.0)	5.7 (1.7 - 8.1)	4.2 (1.9 - 5.2)
Dissolved Oxygen (% Saturation)		77 (49 - 95)	74 (53 - 90)	77 (52 - 105)	74 (54 - 94)	73 (54 - 95)
	Bottom	67 (16 - 84)	67 (17 - 93)	71 (47 - 92)	78 (25 - 112)	58 (28 - 76)
pH		7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.3)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)
Secchi Disc Depth (m)		3.0 (1.9 - 4.1)	2.9 (2.0 - 4.6)	2.7 (1.8 - 3.9)	2.4 (1.2 - 3.1)	2.7 (1.0 - 5.2)
Turbidity (NTU)		4.0 (1.5 - 12.1)	3.2 (1.1 - 5.9)	3.2 (1.2 - 5.7)	3.5 (1.2 - 5.6)	3.1 (1.0 - 5.5)
Suspended Solids (mg/L)		4.0 (1.4 - 8.1)	3.6 (0.9 - 7.6)	3.7 (1.4 - 8.6)	4.1 (1.1 - 9.0)	3.5 (1.0 - 6.9)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (<0.1 - 1.2)	0.9 (<0.1 - 1.6)	0.9 (<0.1 - 2.3)	1.6 (0.4 - 3.9)	1.0 (0.6 - 1.7)
Ammonia Nitrogen (mg/L)		0.083 (0.042 - 0.187)	0.120 (0.063 - 0.197)	0.145 (0.064 - 0.293)	0.184 (0.113 - 0.343)	0.177 (0.109 - 0.310)
Unionised Ammonia (mg/L)		0.003 (<0.001 - 0.010)	0.004 (<0.001 - 0.011)	0.005 (<0.001 - 0.015)	0.007 (0.002 - 0.019)	0.006 (0.002 - 0.018)
Nitrite Nitrogen (mg/L)		0.024 (0.008 - 0.055)	0.027 (0.007 - 0.053)	0.030 (0.008 - 0.053)	0.032 (0.009 - 0.054)	0.031 (0.009 - 0.053)
Nitrate Nitrogen (mg/L)		0.097 (0.027 - 0.203)	0.123 (0.029 - 0.257)	0.135 (0.027 - 0.287)	0.145 (0.045 - 0.307)	0.141 (0.051 - 0.270)
Total Inorganic Nitrogen (mg/L)		0.20 (0.09 - 0.32)	0.27 (0.10 - 0.40)	0.31 (0.10 - 0.49)	0.36 (0.17 - 0.55)	0.35 (0.19 - 0.51)
Total Kjeldahl Nitrogen (mg/L)		0.21 (0.12 - 0.32)	0.25 (0.15 - 0.32)	0.29 (0.16 - 0.45)	0.36 (0.24 - 0.52)	0.32 (0.23 - 0.47)
Total Nitrogen (mg/L)		0.33 (0.16 - 0.45)	0.40 (0.19 - 0.59)	0.46 (0.20 - 0.64)	0.53 (0.30 - 0.82)	0.49 (0.30 - 0.67)
Orthophosphate Phosphorus (mg/L)		0.020 (0.010 - 0.036)	0.024 (0.011 - 0.039)	0.025 (0.005 - 0.045)	0.029 (0.013 - 0.046)	0.030 (0.017 - 0.048)
Total Phosphorus (mg/L)		0.03 (0.02 - 0.06)	0.04 (0.02 - 0.05)	0.04 (0.03 - 0.07)	0.05 (0.03 - 0.07)	0.05 (0.03 - 0.06)
Silica (as SiO_2) (mg/L)		0.74 (0.25 - 1.30)	0.79 (0.22 - 1.50)	0.83 (0.20 - 1.70)	0.90 (0.22 - 1.77)	0.91 (0.36 - 1.80)
Chlorophyll-a (μg/L)		2.8 (0.5 - 12.2)	3.3 (0.5 - 15.4)	4.3 (0.3 - 27.0)	3.9 (0.4 - 18.5)	3.3 (0.3 - 15.6)
E.coli (count/100mL)		710 (180 - 4400)	2000 (420 - 17000)	3100 (520 - 26000)	8400 (2400 - 26000)	4400 (550 - 13000)
Faecal Coliforms (count/100mL)		1600 (410 - 9400)	4500 (680 - 27000)	6500 (1500 - 41000)	21000 (5100 - 59000)	11000 (1300 - 29000)

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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.

Summary of water quality statistics of the Victoria Harbour WCZ in 2010 (continued)

Parameter		Victoria Harbour (West) VM7	Victoria Harbour (West) VM8	Stonecutters Island VM15	Rambler Channel VM12	Rambler Channel VM14
Number of samples		12	12	12	12	12
Temperature (℃)		23.0 (17.9 - 27.2)	23.0 (18.1 - 26.9)	23.4 (16.8 - 27.6)	22.9 (18.3 - 26.3)	23.3 (18.4 - 27.5)
Salinity		31.2 (26.1 - 33.3)	31.2 (25.8 - 33.4)	31.0 (26.7 - 33.5)	31.3 (28.6 - 33.1)	29.8 (22.5 - 33.0)
Dissolved Oxygen (mg/L)		5.8 (4.5 - 7.5)	6.3 (4.1 - 9.0)	5.5 (3.9 - 6.3)	5.6 (3.5 - 8.2)	6.2 (4.3 - 9.0)
	Bottom	5.6 (3.4 - 7.0)	4.2 (2.6 - 5.2)	4.8 (1.3 - 6.4)	5.0 (1.7 - 6.9)	5.2 (1.3 - 6.9)
Dissolved Oxygen (% Saturation)		81 (66 - 108)	88 (60 - 125)	77 (58 - 90)	77 (51 - 114)	86 (62 - 125)
	Bottom	79 (51 - 104)	58 (39 - 76)	67 (19 - 90)	69 (25 - 90)	72 (19 - 95)
pH		7.9 (7.6 - 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)
Secchi Disc Depth (m)		2.7 (1.7 - 4.0)	2.5 (1.5 - 4.0)	2.4 (1.2 - 3.6)	2.3 (1.6 - 3.0)	2.3 (1.3 - 4.2)
Turbidity (NTU)		3.5 (1.0 - 6.6)	5.2 (1.2 - 19.1)	3.7 (1.3 - 7.5)	6.8 (1.6 - 22.8)	4.7 (1.1 - 7.8)
Suspended Solids (mg/L)		3.8 (1.6 - 5.6)	5.2 (1.5 - 11.9)	4.2 (1.3 - 8.7)	8.8 (2.4 - 27.3)	5.9 (1.8 - 11.7)
5-day Biochemical Oxygen Demand (mg/L)		1.0 (0.5 - 1.8)	1.0 (0.5 - 1.7)	0.9 (0.5 - 2.0)	0.8 (0.2 - 1.6)	0.9 (0.2 - 2.1)
Ammonia Nitrogen (mg/L)		0.163 (0.090 - 0.293)	0.158 (0.047 - 0.277)	0.199 (0.114 - 0.333)	0.158 (0.026 - 0.270)	0.137 (0.044 - 0.227)
Unionised Ammonia (mg/L)		0.005 (0.002 - 0.014)	0.005 (0.001 - 0.009)	0.007 (0.002 - 0.021)	0.004 (0.001 - 0.010)	0.004 (0.001 - 0.008)
Nitrite Nitrogen (mg/L)		0.034 (0.016 - 0.078)	0.039 (0.009 - 0.083)	0.034 (0.012 - 0.057)	0.040 (0.013 - 0.080)	0.051 (0.014 - 0.117)
Nitrate Nitrogen (mg/L)		0.157 (0.068 - 0.347)	0.171 (0.047 - 0.530)	0.147 (0.046 - 0.307)	0.186 (0.066 - 0.483)	0.228 (0.077 - 0.533)
Total Inorganic Nitrogen (mg/L)		0.35 (0.20 - 0.49)	0.37 (0.21 - 0.66)	0.38 (0.18 - 0.62)	0.38 (0.25 - 0.58)	0.42 (0.22 - 0.69)
Total Kjeldahl Nitrogen (mg/L)		0.35 (0.25 - 0.48)	0.31 (0.19 - 0.42)	0.34 (0.23 - 0.47)	0.30 (0.16 - 0.44)	0.28 (0.16 - 0.37)
Total Nitrogen (mg/L)		0.55 (0.45 - 0.65)	0.52 (0.27 - 0.92)	0.53 (0.29 - 0.73)	0.53 (0.32 - 0.79)	0.55 (0.27 - 0.83)
Orthophosphate Phosphorus (mg/L)		0.025 (0.008 - 0.039)	0.022 (0.007 - 0.039)	0.031 (0.016 - 0.046)	0.024 (0.006 - 0.039)	0.022 (0.004 - 0.036)
Total Phosphorus (mg/L)		0.05 (0.04 - 0.06)	0.04 (0.03 - 0.05)	0.05 (0.04 - 0.06)	0.04 (0.03 - 0.06)	0.04 (0.02 - 0.06)
Silica (as SiO_2) (mg/L)		0.81 (0.13 - 2.13)	0.92 (0.09 - 2.80)	0.93 (0.16 - 1.87)	1.05 (0.10 - 2.47)	1.07 (0.08 - 2.20)
Chlorophyll-a (μg/L)		5.0 (0.4 - 13.7)	6.9 (0.5 - 30.3)	4.1 (0.2 - 21.8)	6.1 (0.5 - 32.0)	6.4 (0.5 - 23.7)
E.coli (count/100mL)		2800 (520 - 16000)	1600 (190 - 5600)	1800 (430 - 5900)	760 (150 - 3700)	340 (36 - 2500)
Faecal Coliforms (count/100mL)		6100 (1000 - 28000)	3500 (400 - 13000)	4600 (880 - 28000)	1800 (350 - 11000)	830 (110 - 5200)

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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.

Summary of water quality statistics for the Eastern Buffer WCZ in 2010

Parameter		Chai Wan	Tathong Channel	
		EM1	EM2	EM3
Number of samples		12	12	12
Temperature (℃)		22.4 (16.5 - 27.5)	22.4 (16.4 - 27.7)	22.2 (16.5 - 27.6)
Salinity		32.6 (30.8 - 33.9)	32.7 (30.9 - 33.9)	32.9 (31.0 - 33.9)
Dissolved Oxygen (mg/L)		6.3 (4.2 - 7.7)	6.3 (4.5 - 8.0)	6.4 (4.2 - 8.2)
	Bottom	5.9 (3.0 - 8.0)	6.0 (3.1 - 8.0)	6.1 (2.5 - 8.1)
Dissolved Oxygen (% Saturation)		88 (64 - 98)	87 (69 - 101)	88 (63 - 103)
	Bottom	81 (44 - 100)	83 (45 - 101)	84 (36 - 102)
pH		7.9 (7.6 - 8.2)	8.0 (7.7 - 8.1)	8.0 (7.7 - 8.2)
Secchi Disc Depth (m)		2.9 (1.8 - 4.5)	3.0 (1.9 - 4.5)	2.7 (2.0 - 3.5)
Turbidity (NTU)		3.5 (1.4 - 7.2)	3.6 (1.0 - 6.8)	3.7 (1.5 - 7.5)
Suspended Solids (mg/L)		3.2 (1.0 - 7.5)	3.2 (1.3 - 7.7)	3.1 (1.4 - 6.5)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (0.2 - 1.7)	0.5 (0.1 - 1.0)	0.5 (<0.1 - 0.8)
Ammonia Nitrogen (mg/L)		0.051 (0.012 - 0.101)	0.041 (0.009 - 0.099)	0.030 (0.012 - 0.051)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.006)	0.002 (<0.001 - 0.005)	0.001 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)		0.018 (0.005 - 0.047)	0.018 (0.005 - 0.044)	0.016 (0.004 - 0.039)
Nitrate Nitrogen (mg/L)		0.058 (0.007 - 0.113)	0.054 (0.006 - 0.108)	0.047 (0.003 - 0.103)
Total Inorganic Nitrogen (mg/L)		0.13 (0.03 - 0.23)	0.11 (0.03 - 0.22)	0.09 (0.04 - 0.16)
Total Kjeldahl Nitrogen (mg/L)		0.16 (0.09 - 0.31)	0.13 (0.08 - 0.25)	0.12 (0.07 - 0.18)
Total Nitrogen (mg/L)		0.24 (0.12 - 0.41)	0.21 (0.12 - 0.37)	0.18 (0.11 - 0.28)
Orthophosphate Phosphorus (mg/L)		0.013 (0.003 - 0.029)	0.013 (0.004 - 0.027)	0.012 (0.004 - 0.030)
Total Phosphorus (mg/L)		0.03 (<0.02 - 0.04)	0.03 (<0.02 - 0.05)	0.03 (<0.02 - 0.05)
Silica (as SiO_2) (mg/L)		0.61 (0.15 - 0.85)	0.61 (0.25 - 0.94)	0.61 (0.23 - 1.00)
Chlorophyll-*a* (μg/L)		4.8 (0.5 - 24.3)	1.9 (0.5 - 9.5)	1.4 (0.4 - 3.9)
E.coli (count/100mL)		25 (1 - 330)	15 (1 - 180)	3 (<1 - 26)
Faecal Coliforms (count/100mL)		61 (7 - 1400)	33 (2 - 1100)	6 (1 - 110)

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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.

Summary of water quality statistics for the Western Buffer WCZ in 2010

Parameter		Hong Kong Island (West) WM1	Hong Kong Island (West) WM2	Tsing Yi (South) WM3	Tsing Yi (West) WM4
Number of samples		12	12	12	12
Temperature (℃)		22.5 (18.0 - 26.2)	22.9 (18.2 - 26.6)	22.7 (18.2 - 26.2)	22.8 (18.2 - 26.3)
Salinity		32.3 (29.5 - 33.7)	31.3 (26.0 - 33.5)	31.7 (28.7 - 33.4)	31.2 (26.2 - 33.2)
Dissolved Oxygen (mg/L)		6.3 (3.6 - 8.7)	6.4 (4.1 - 9.1)	6.0 (3.1 - 8.5)	5.9 (3.4 - 8.3)
	Bottom	5.5 (1.8 - 7.7)	6.3 (4.1 - 7.4)	6.4 (4.7 - 7.3)	<0.1 (<0.1 - <0.1)
Dissolved Oxygen (% Saturation)		88 (52 - 115)	88 (60 - 126)	82 (46 - 118)	81 (50 - 115)
	Bottom	75 (26 - 107)	87 (61 - 104)	88 (69 - 101)	<1 (<1 - <1)
pH		8.0 (7.7 - 8.2)	7.9 (7.7 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)
Secchi Disc Depth (m)		3.0 (2.0 - 4.8)	2.7 (1.8 - 4.5)	2.5 (1.9 - 3.5)	2.3 (1.3 - 3.8)
Turbidity (NTU)		4.3 (1.4 - 10.0)	4.2 (0.9 - 12.6)	4.5 (1.4 - 7.7)	4.9 (1.2 - 8.4)
Suspended Solids (mg/L)		4.3 (1.4 - 8.1)	4.8 (1.7 - 17.6)	5.2 (2.1 - 11.5)	6.0 (1.4 - 11.8)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (0.3 - 1.2)	0.8 (0.2 - 1.6)	0.8 (0.4 - 1.7)	0.7 (0.2 - 1.5)
Ammonia Nitrogen (mg/L)		0.054 (0.022 - 0.103)	0.108 (0.038 - 0.227)	0.133 (0.009 - 0.303)	0.106 (0.018 - 0.213)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.003)	0.003 (0.001 - 0.006)	0.004 (<0.001 - 0.006)	0.003 (0.001 - 0.006)
Nitrite Nitrogen (mg/L)		0.025 (0.006 - 0.059)	0.037 (0.009 - 0.089)	0.033 (0.011 - 0.076)	0.038 (0.012 - 0.080)
Nitrate Nitrogen (mg/L)		0.103 (0.026 - 0.320)	0.158 (0.044 - 0.440)	0.142 (0.052 - 0.277)	0.167 (0.073 - 0.343)
Total Inorganic Nitrogen (mg/L)		0.18 (0.06 - 0.41)	0.30 (0.09 - 0.55)	0.31 (0.18 - 0.46)	0.31 (0.20 - 0.44)
Total Kjeldahl Nitrogen (mg/L)		0.17 (0.11 - 0.25)	0.25 (0.16 - 0.37)	0.29 (0.16 - 0.45)	0.23 (0.10 - 0.33)
Total Nitrogen (mg/L)		0.29 (0.18 - 0.62)	0.45 (0.25 - 0.80)	0.46 (0.33 - 0.59)	0.44 (0.28 - 0.56)
Orthophosphate Phosphorus (mg/L)		0.012 (0.007 - 0.020)	0.017 (0.006 - 0.036)	0.021 (0.008 - 0.040)	0.020 (0.008 - 0.032)
Total Phosphorus (mg/L)		0.02 (<0.02 - 0.03)	0.03 (0.02 - 0.05)	0.04 (0.03 - 0.06)	0.04 (0.02 - 0.05)
Silica (as SiO_2) (mg/L)		0.81 (0.17 - 1.93)	0.95 (0.09 - 2.67)	0.89 (0.13 - 1.83)	0.97 (0.12 - 2.07)
Chlorophyll-*a* (μg/L)		3.7 (0.7 - 12.2)	6.0 (0.6 - 22.3)	4.2 (0.6 - 14.2)	4.7 (0.5 - 15.0)
E.coli (count/100mL)		85 (4 - 1200)	300 (16 - 3200)	790 (230 - 2900)	200 (54 - 960)
Faecal Coliforms (count/100mL)		150 (6 - 1800)	590 (38 - 6000)	1700 (390 - 7100)	390 (91 - 2100)

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3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Junk Bay WCZ in 2010

Parameter		Junk Bay JM3	Junk Bay JM4
Number of samples		12	12
Temperature (℃)		22.5 (16.3 - 28.7)	22.4 (16.3 - 27.6)
Salinity		32.4 (30.8 - 33.8)	32.6 (30.9 - 33.9)
Dissolved Oxygen (mg/L)		6.2 (4.9 - 7.6)	6.3 (4.5 - 7.9)
	Bottom	6.0 (3.9 - 7.7)	5.9 (2.9 - 8.0)
Dissolved Oxygen (% Saturation)		86 (71 - 96)	87 (68 - 100)
	Bottom	82 (56 - 98)	81 (42 - 100)
pH		7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)
Secchi Disc Depth (m)		2.9 (1.8 - 4.2)	3.0 (1.8 - 5.6)
Turbidity (NTU)		2.8 (0.7 - 6.4)	3.2 (1.3 - 7.2)
Suspended Solids (mg/L)		2.5 (0.8 - 4.6)	2.8 (1.7 - 5.3)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (0.3 - 1.5)	0.6 (0.1 - 1.5)
Ammonia Nitrogen (mg/L)		0.058 (0.027 - 0.097)	0.047 (0.020 - 0.082)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.006)	0.002 (<0.001 - 0.005)
Nitrite Nitrogen (mg/L)		0.021 (0.006 - 0.051)	0.019 (0.005 - 0.048)
Nitrate Nitrogen (mg/L)		0.068 (0.017 - 0.111)	0.056 (0.007 - 0.099)
Total Inorganic Nitrogen (mg/L)		0.15 (0.07 - 0.20)	0.12 (0.04 - 0.19)
Total Kjeldahl Nitrogen (mg/L)		0.18 (0.10 - 0.26)	0.16 (0.10 - 0.22)
Total Nitrogen (mg/L)		0.27 (0.14 - 0.35)	0.23 (0.12 - 0.32)
Orthophosphate Phosphorus (mg/L)		0.014 (0.006 - 0.019)	0.012 (0.004 - 0.023)
Total Phosphorus (mg/L)		0.03 (<0.02 - 0.05)	0.03 (<0.02 - 0.05)
Silica (as SiO_2) (mg/L)		0.63 (0.15 - 0.97)	0.61 (0.13 - 0.89)
Chlorophyll-a (μg/L)		3.9 (0.5 - 21.4)	3.3 (0.5 - 14.3)
E.coli (count/100mL)		46 (5 - 140)	30 (4 - 240)
Faecal Coliforms (count/100mL)		110 (10 - 400)	66 (12 - 720)

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 2010

Parameter		Inner Deep Bay DM1	DM2	DM3	Outer Deep Bay DM4	DM5
Number of samples		12	12	12	12	12
Temperature (℃)		25.1 (15.6 - 31.0)	25.1 (16.2 - 31.1)	24.8 (16.6 - 30.7)	24.6 (17.2 - 30.1)	24.3 (17.4 - 29.3)
Salinity		17.2 (10.7 - 22.1)	19.0 (12.0 - 25.7)	21.4 (13.5 - 27.8)	22.5 (15.6 - 29.7)	25.6 (19.4 - 31.7)
Dissolved Oxygen (mg/L)		4.2 (2.5 - 5.9)	4.9 (3.5 - 6.9)	6.2 (4.3 - 8.0)	5.9 (4.1 - 7.3)	5.9 (4.4 - 7.3)
	Bottom	N.M.	N.M.	N.M.	5.7 (3.8 - 7.2)	5.7 (4.0 - 7.3)
Dissolved Oxygen (% Saturation)		56 (37 - 72)	66 (47 - 95)	85 (62 - 118)	80 (59 - 91)	81 (64 - 92)
	Bottom	N.M.	N.M.	N.M.	78 (56 - 89)	79 (58 - 92)
pH		7.3 (7.1 - 7.5)	7.5 (7.3 - 7.7)	7.7 (7.5 - 8.0)	7.7 (7.6 - 7.9)	7.8 (7.5 - 8.0)
Secchi Disc Depth (m)		0.5 (0.1 - 2.0)	0.6 (0.1 - 3.0)	0.8 (0.1 - 3.0)	1.1 (0.5 - 4.0)	1.5 (0.7 - 8.0)
Turbidity (NTU)		37.3 (21.0 - 115.0)	29.3 (13.0 - 62.4)	16.0 (13.3 - 20.9)	15.1 (9.4 - 21.0)	13.5 (10.5 - 17.7)
Suspended Solids (mg/L)		34.3 (14.0 - 130.0)	23.8 (7.5 - 61.0)	10.0 (5.1 - 19.0)	7.9 (4.3 - 14.5)	5.8 (3.5 - 7.8)
5-day Biochemical Oxygen Demand (mg/L)		4.4 (1.5 - 20.0)	4.2 (1.4 - 21.0)	2.2 (0.4 - 12.0)	0.9 (0.4 - 1.6)	0.8 (0.5 - 1.1)
Ammonia Nitrogen (mg/L)		2.830 (0.580 - 5.600)	1.930 (0.420 - 4.200)	0.436 (0.056 - 1.400)	0.305 (0.070 - 0.585)	0.236 (0.056 - 0.547)
Unionised Ammonia (mg/L)		0.025 (0.014 - 0.052)	0.025 (0.010 - 0.041)	0.009 (0.004 - 0.014)	0.007 (0.004 - 0.009)	0.006 (0.002 - 0.009)
Nitrite Nitrogen (mg/L)		0.348 (0.210 - 0.500)	0.348 (0.220 - 0.500)	0.218 (0.160 - 0.420)	0.186 (0.096 - 0.390)	0.142 (0.037 - 0.297)
Nitrate Nitrogen (mg/L)		0.628 (0.340 - 0.910)	0.687 (0.410 - 1.200)	0.803 (0.410 - 1.500)	0.732 (0.345 - 1.250)	0.580 (0.167 - 0.920)
Total Inorganic Nitrogen (mg/L)		3.81 (1.74 - 6.23)	2.97 (1.65 - 5.40)	1.46 (1.02 - 2.05)	1.22 (0.72 - 1.76)	0.96 (0.47 - 1.46)
Total Kjeldahl Nitrogen (mg/L)		3.24 (0.83 - 6.00)	2.33 (0.84 - 4.50)	0.65 (0.29 - 1.60)	0.49 (0.33 - 0.68)	0.41 (0.25 - 0.64)
Total Nitrogen (mg/L)		4.22 (1.99 - 6.63)	3.36 (2.14 - 5.70)	1.68 (1.15 - 2.45)	1.40 (0.87 - 1.98)	1.13 (0.62 - 1.58)
Orthophosphate Phosphorus (mg/L)		0.301 (0.190 - 0.410)	0.236 (0.100 - 0.370)	0.079 (0.026 - 0.140)	0.052 (0.029 - 0.064)	0.041 (0.031 - 0.053)
Total Phosphorus (mg/L)		0.38 (0.22 - 0.51)	0.30 (0.17 - 0.45)	0.11 (0.07 - 0.19)	0.08 (0.05 - 0.12)	0.07 (0.05 - 0.10)
Silica (as SiO_2) (mg/L)		6.34 (4.10 - 10.00)	5.19 (2.50 - 8.00)	3.62 (2.30 - 5.10)	3.24 (1.75 - 4.50)	2.59 (0.99 - 3.93)
Chlorophyll-*a* (μg/L)		4.6 (1.1 - 12.0)	6.1 (1.0 - 18.0)	5.1 (0.9 - 23.0)	2.8 (1.1 - 9.5)	2.5 (0.7 - 8.4)
E.coli (count/100mL)		1300 (100 - 24000)	480 (46 - 15000)	26 (1 - 130)	78 (32 - 200)	170 (28 - 450)
Faecal Coliforms (count/100mL)		2700 (330 - 31000)	950 (130 - 38000)	67 (3 - 210)	160 (76 - 310)	390 (120 - 1100)

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. NM - not measured.

Summary of water quality statistics for the North Western WCZ in 2010

Parameter		Lantau Island (North) NM1	Pearl Island NM2	Pillar Point NM3	Urmston Road NM5	Chek Lap Kok (North) NM6	Chek Lap Kok (West) NM8
Number of samples		12	12	12	12	12	12
Temperature (℃)		23.0 (16.8 - 27.0)	23.3 (16.8 - 28.7)	23.1 (16.7 - 27.4)	23.4 (16.5 - 27.8)	23.6 (15.7 - 30.0)	23.6 (15.9 - 30.1)
Salinity		30.0 (25.1 - 33.0)	28.8 (20.6 - 32.9)	29.5 (25.9 - 32.4)	28.0 (22.9 - 32.1)	26.3 (13.9 - 32.6)	27.1 (14.3 - 33.6)
Dissolved Oxygen (mg/L)		6.1 (3.6 - 9.2)	6.4 (4.0 - 9.9)	6.2 (4.3 - 8.9)	6.0 (3.5 - 8.4)	7.1 (4.7 - 10.4)	7.6 (5.1 - 10.8)
	Bottom	6.0 (2.0 - 14.2)	5.8 (3.8 - 8.6)	5.6 (2.4 - 7.7)	5.4 (2.2 - 7.3)	7.0 (5.0 - 9.9)	7.1 (5.3 - 10.1)
Dissolved Oxygen (% Saturation)		84 (52 - 121)	87 (58 - 137)	85 (63 - 123)	82 (50 - 114)	97 (66 - 140)	105 (73 - 154)
	Bottom	81 (29 - 187)	80 (55 - 119)	76 (34 - 106)	74 (31 - 98)	96 (72 - 134)	98 (75 - 141)
pH		7.9 (7.6 - 8.3)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)	7.9 (7.6 - 8.2)	8.0 (7.7 - 8.5)	8.1 (7.7 - 8.5)
Secchi Disc Depth (m)		5.1 (1.0 - 34.0)	2.2 (1.4 - 3.5)	2.2 (1.5 - 4.0)	1.8 (0.8 - 2.5)	1.9 (1.0 - 2.6)	1.8 (0.6 - 2.9)
Turbidity (NTU)		7.2 (1.4 - 15.1)	5.7 (1.5 - 13.2)	6.6 (1.4 - 16.6)	8.8 (3.7 - 17.1)	9.1 (1.6 - 18.0)	11.1 (1.5 - 28.6)
Suspended Solids (mg/L)		8.0 (2.0 - 21.2)	5.6 (1.5 - 10.4)	6.6 (2.9 - 14.0)	8.7 (2.6 - 15.4)	9.7 (1.9 - 23.0)	12.8 (1.9 - 43.0)
5-day Biochemical Oxygen Demand (mg/L)		0.8 (0.2 - 2.3)	0.9 (0.3 - 2.3)	0.8 (0.4 - 1.6)	0.7 (0.4 - 1.7)	1.0 (0.3 - 2.5)	1.1 (0.1 - 3.4)
Ammonia Nitrogen (mg/L)		0.116 (0.031 - 0.197)	0.113 (0.035 - 0.210)	0.113 (0.040 - 0.210)	0.134 (0.067 - 0.257)	0.069 (0.021 - 0.160)	0.046 (0.011 - 0.100)
Unionised Ammonia (mg/L)		0.004 (0.001 - 0.008)	0.004 (0.001 - 0.008)	0.004 (0.002 - 0.007)	0.004 (0.001 - 0.007)	0.003 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)
Nitrite Nitrogen (mg/L)		0.054 (0.011 - 0.165)	0.073 (0.011 - 0.227)	0.064 (0.021 - 0.156)	0.087 (0.024 - 0.233)	0.103 (0.018 - 0.373)	0.084 (0.004 - 0.357)
Nitrate Nitrogen (mg/L)		0.243 (0.066 - 0.530)	0.318 (0.068 - 0.740)	0.275 (0.113 - 0.487)	0.386 (0.120 - 0.770)	0.459 (0.098 - 1.270)	0.378 (0.030 - 1.300)
Total Inorganic Nitrogen (mg/L)		0.41 (0.23 - 0.73)	0.50 (0.23 - 0.92)	0.45 (0.27 - 0.66)	0.61 (0.29 - 1.06)	0.63 (0.19 - 1.66)	0.51 (0.08 - 1.67)
Total Kjeldahl Nitrogen (mg/L)		0.28 (0.17 - 0.37)	0.27 (0.17 - 0.38)	0.26 (0.18 - 0.37)	0.30 (0.20 - 0.41)	0.27 (0.17 - 0.45)	0.23 (0.13 - 0.45)
Total Nitrogen (mg/L)		0.58 (0.32 - 0.91)	0.66 (0.35 - 1.11)	0.60 (0.35 - 0.83)	0.78 (0.40 - 1.33)	0.83 (0.30 - 1.85)	0.69 (0.16 - 1.88)
Orthophosphate Phosphorus (mg/L)		0.021 (0.007 - 0.031)	0.021 (0.005 - 0.030)	0.021 (0.006 - 0.030)	0.026 (0.010 - 0.041)	0.016 (0.009 - 0.032)	0.012 (0.005 - 0.037)
Total Phosphorus (mg/L)		0.04 (0.03 - 0.06)	0.04 (0.02 - 0.05)	0.04 (0.03 - 0.06)	0.05 (0.04 - 0.07)	0.04 (0.03 - 0.06)	0.04 (0.02 - 0.05)
Silica (as SiO_2) (mg/L)		1.10 (0.16 - 2.87)	1.30 (0.26 - 3.50)	1.21 (0.17 - 2.77)	1.66 (0.67 - 4.13)	1.67 (0.10 - 5.80)	1.49 (0.15 - 5.97)
Chlorophyll-*a* (μg/L)		5.3 (0.5 - 22.4)	7.3 (0.7 - 33.9)	5.7 (0.7 - 19.3)	5.2 (0.9 - 19.1)	10.0 (1.2 - 41.0)	9.0 (0.8 - 44.3)
E.coli (count/100mL)		90 (13 - 1200)	65 (10 - 360)	250 (49 - 1400)	670 (190 - 2400)	31 (2 - 120)	2 (<1 - 12)
Faecal Coliforms (count/100mL)		250 (46 - 4900)	150 (26 - 610)	620 (140 - 4600)	1600 (610 - 7300)	71 (8 - 360)	5 (1 - 42)

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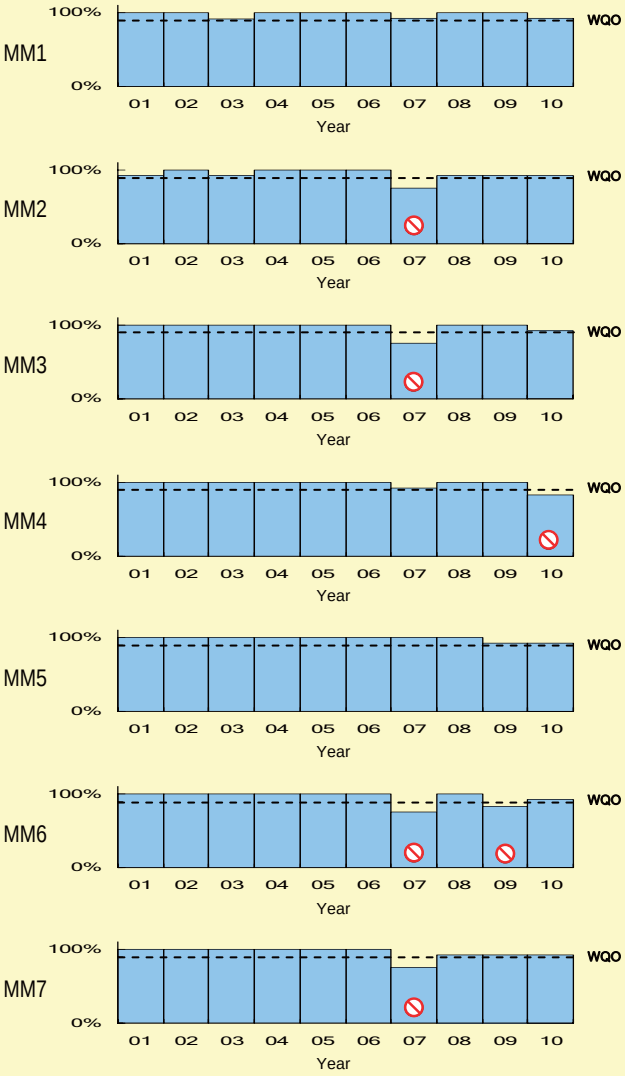
2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

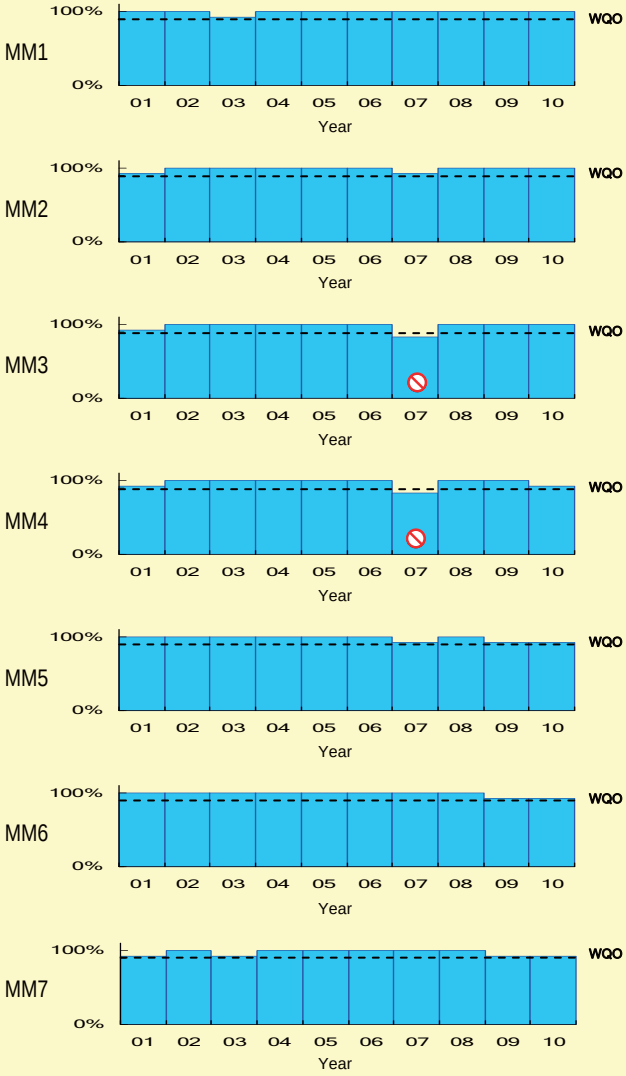
3. Data in brackets indicate the ranges.

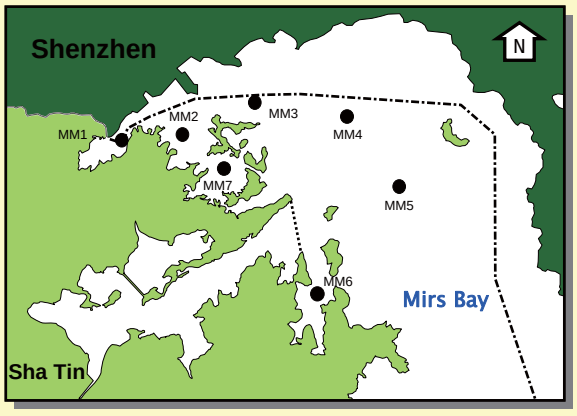
Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)



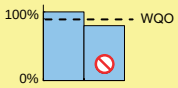


Dissolved Oxygen (DO)

1. Bottom

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

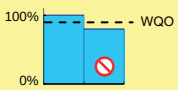
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

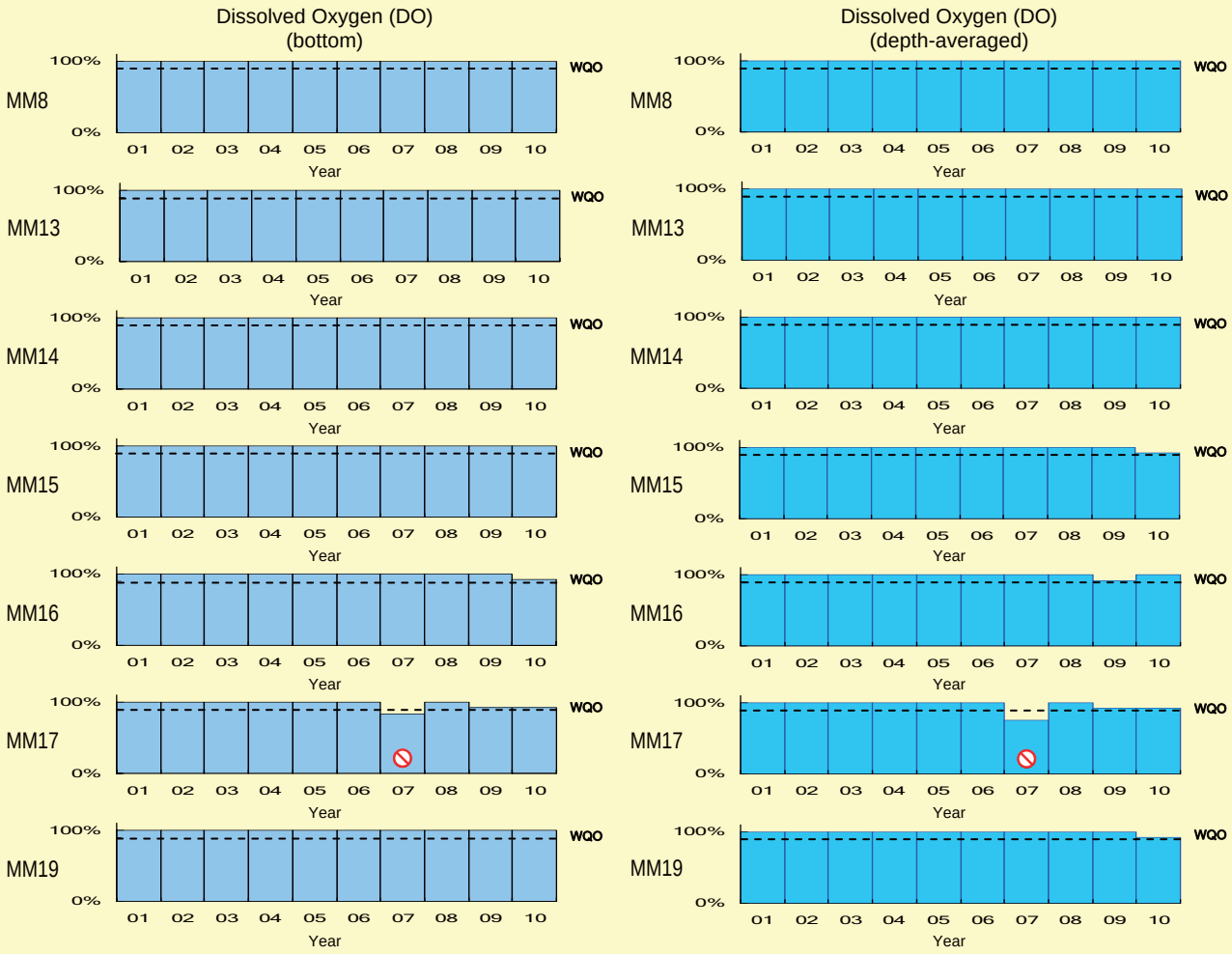
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

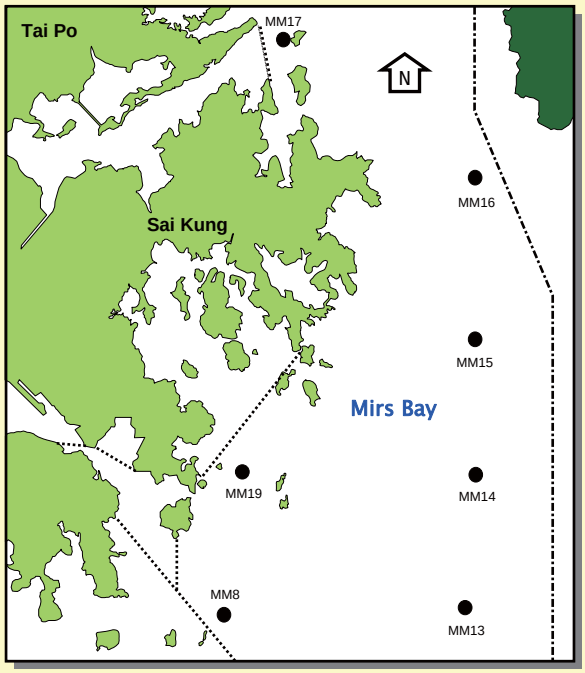
% sample with depth-averaged DO ≥ 4 mg/L



Non-compliance

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





Dissolved Oxygen (DO)

1. Bottom

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

% sample with bottom DO ≥ 2 mg/L

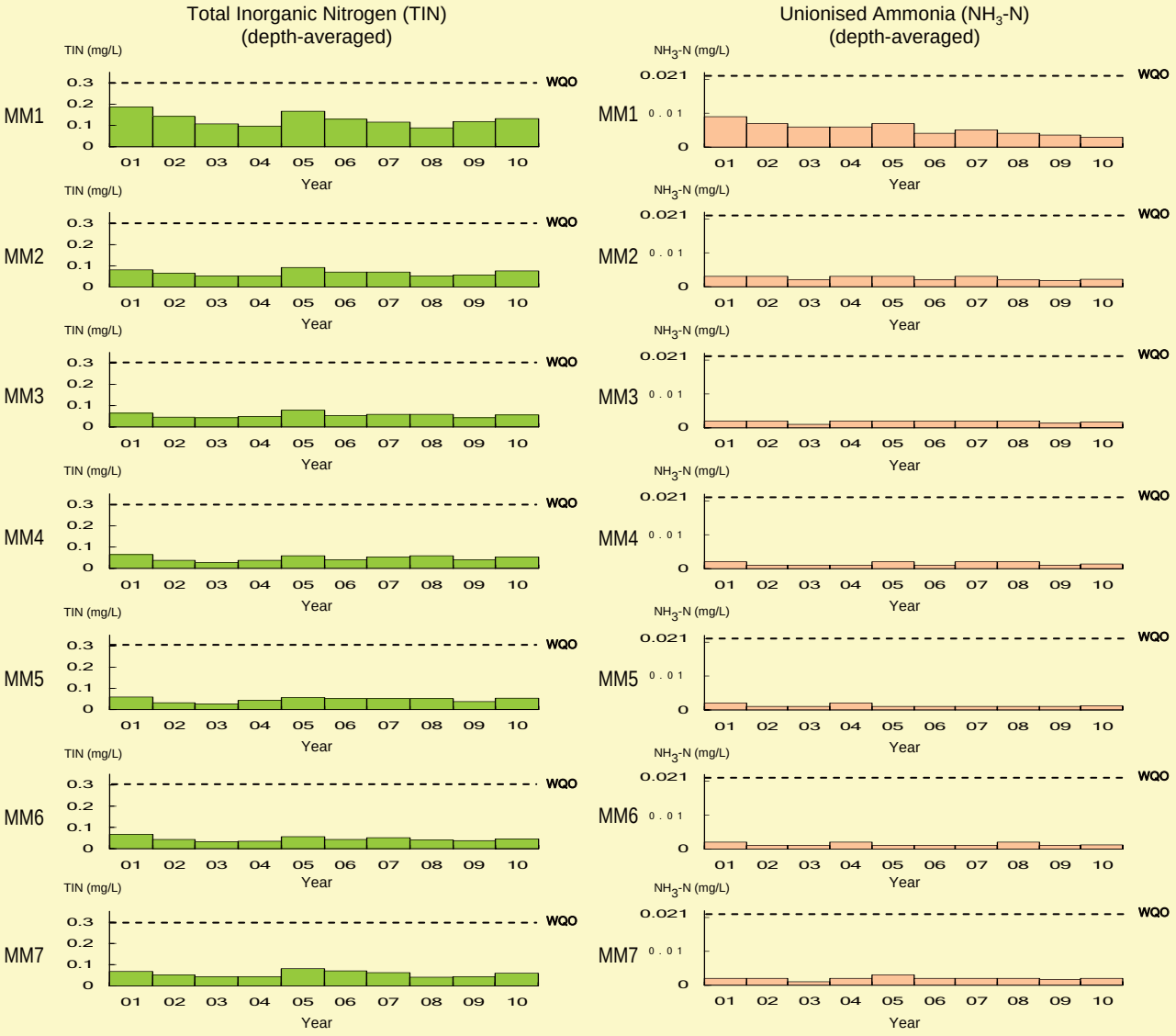
2. Depth-averaged

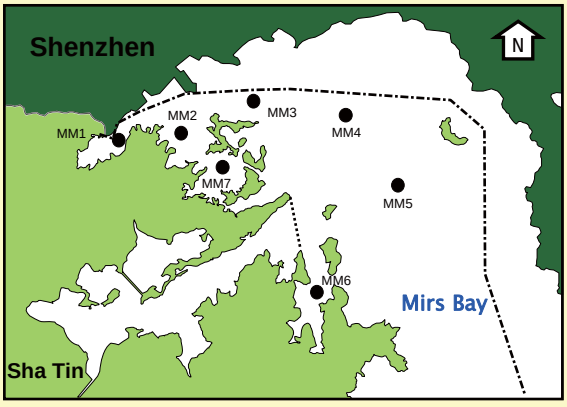
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

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

Non-compliance

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

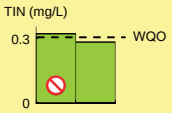




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

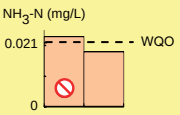


Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

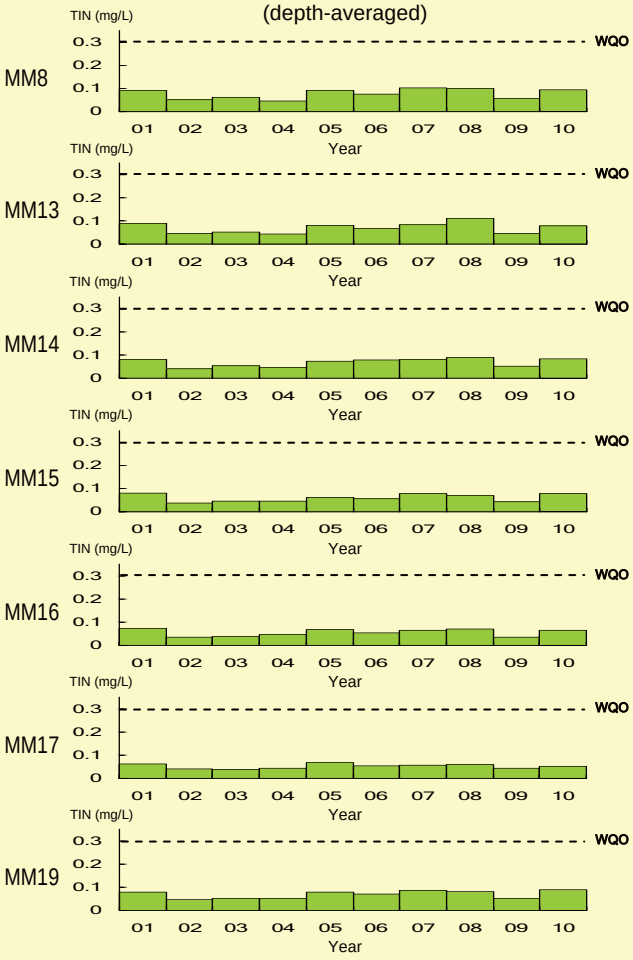
annual mean for depth-averaged NH_3-N

Non-compliance

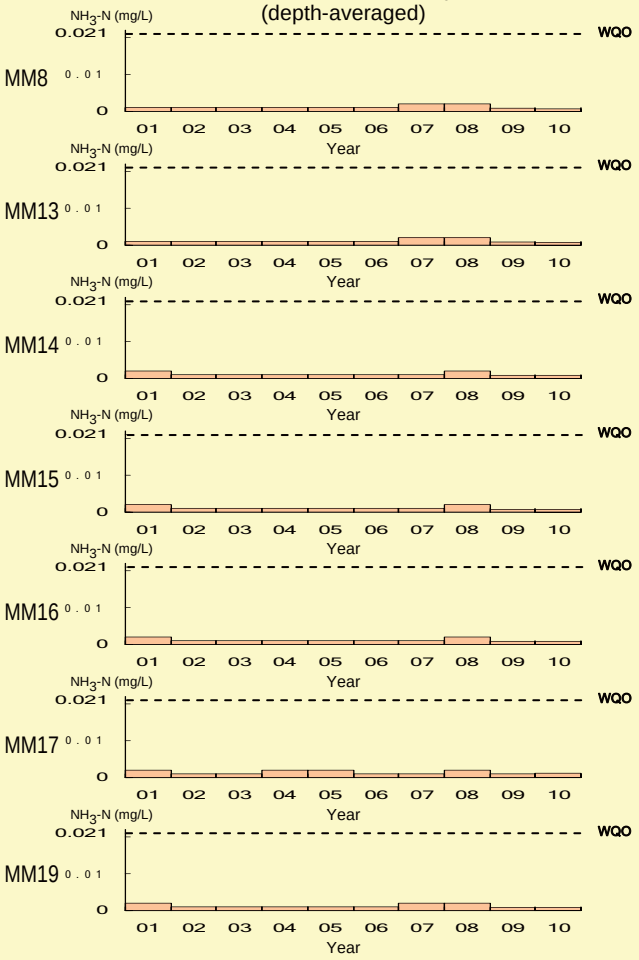


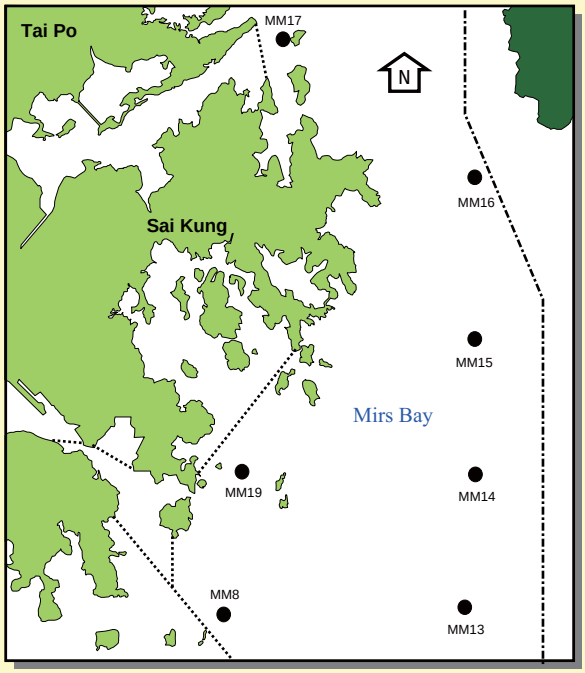
Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)



Unionised Ammonia (NH_3-N) (depth-averaged)

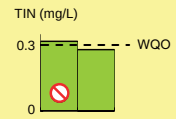




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN



Unionised Ammonia (NH_3-N)

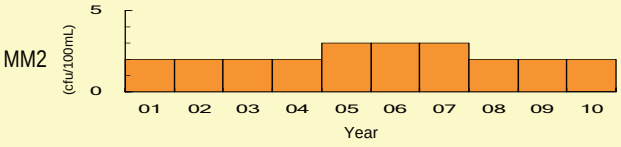
WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

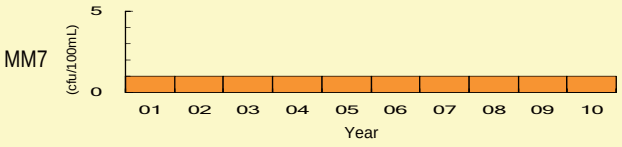
annual mean for depth-averaged NH_3-N

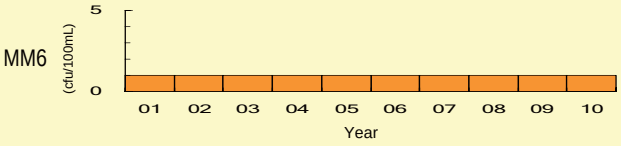
Non-compliance

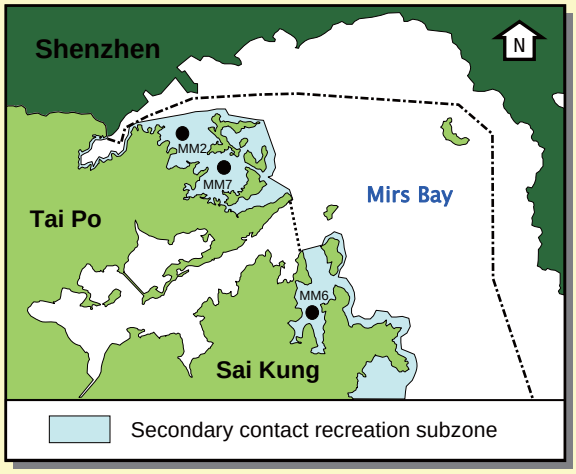
Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

E. coli
(annual geometric mean)



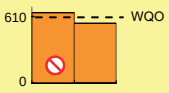






E. coli

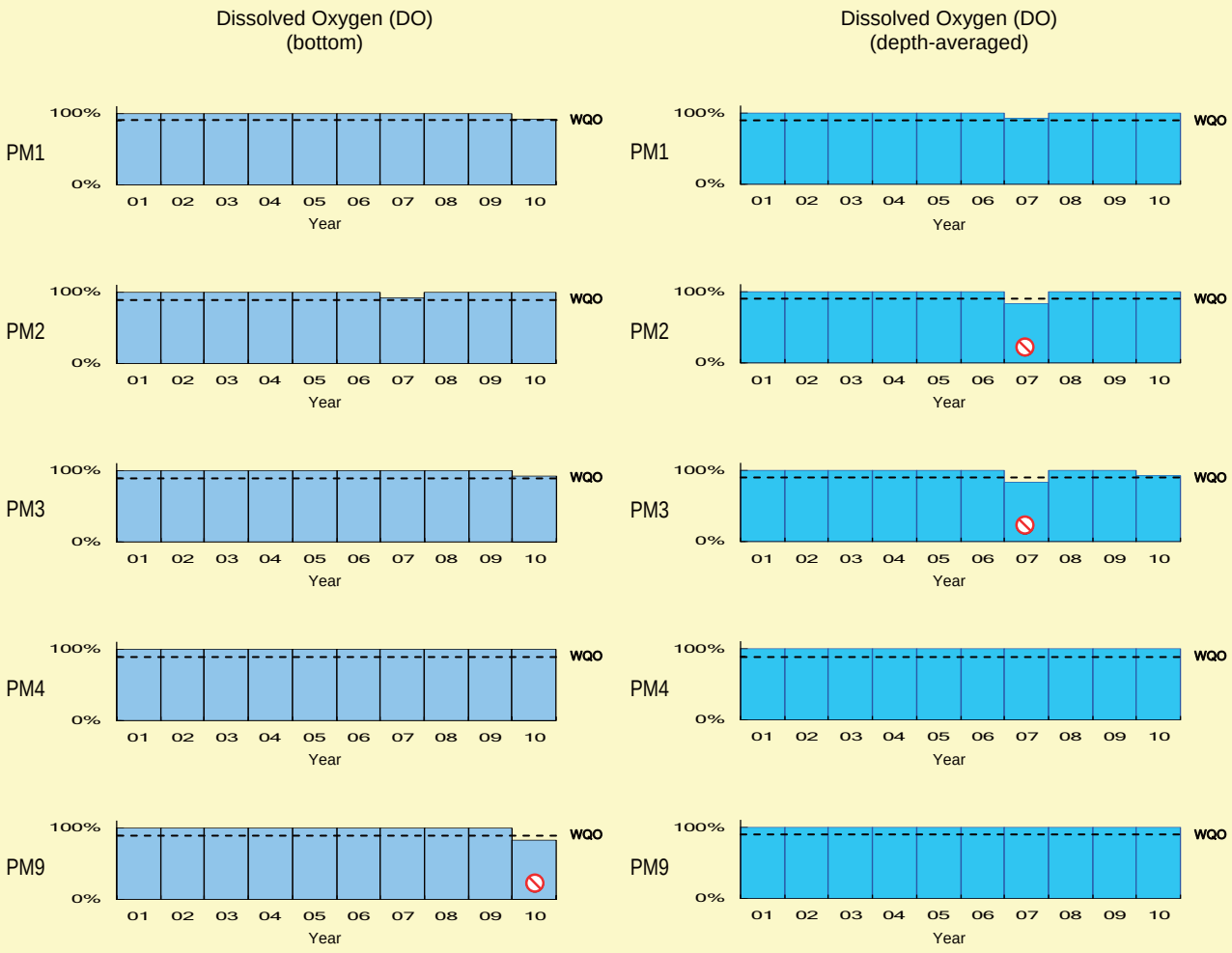
WQO for secondary contact recreation subzones :
annual geometric mean for depth averaged
E. coli ≤ 610 cfu/100mL

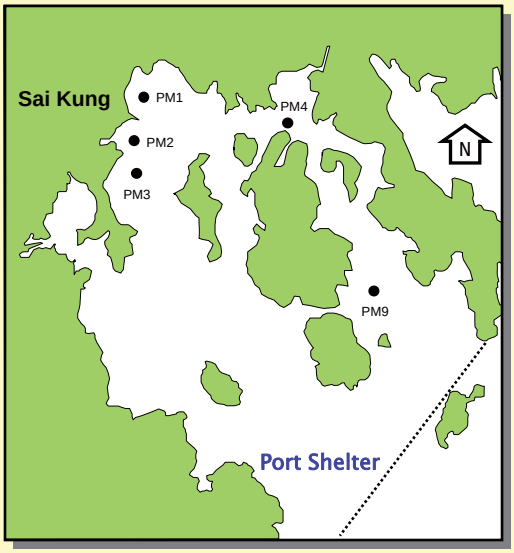


annual geometric mean for depth averaged
E. coli (cfu/100mL)

Non-compliance

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





Dissolved Oxygen (DO)

1. Bottom

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

% sample with bottom DO ≥ 2 mg/L

2. Depth-averaged

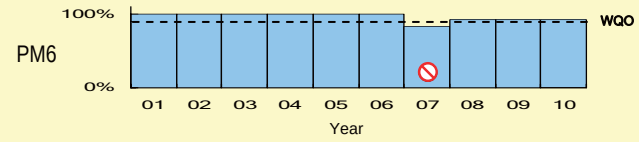
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

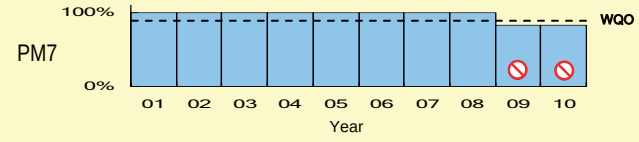
% sample with depth-averaged DO ≥ 4 mg/L

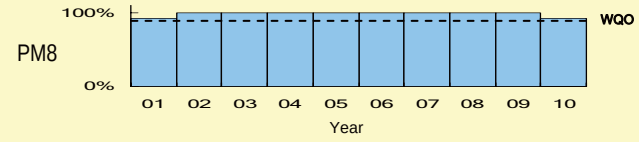
Non-compliance

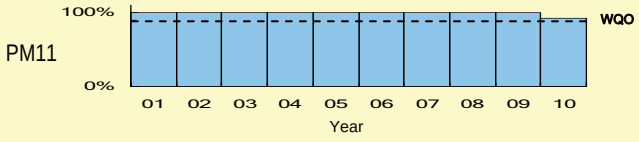
Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)

Dissolved Oxygen (DO) (bottom)

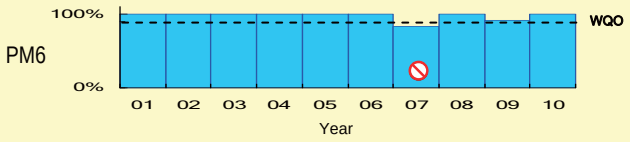


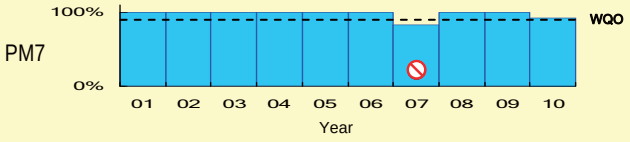


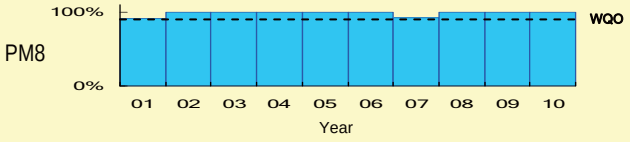


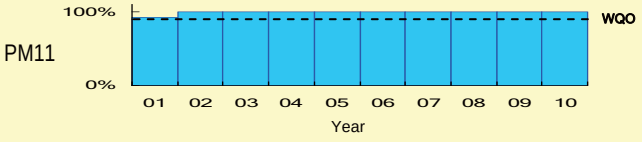


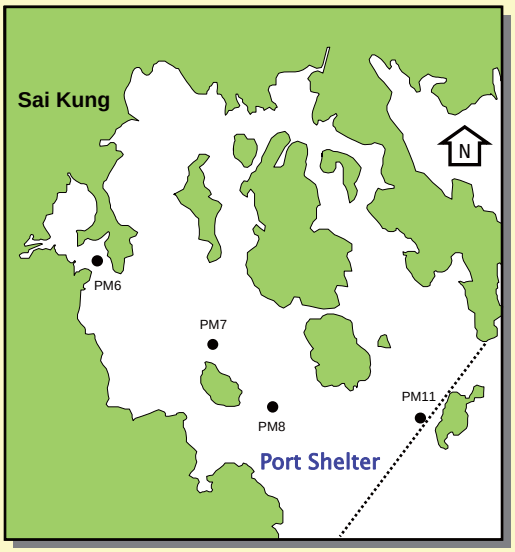
Dissolved Oxygen (DO) (depth-averaged)









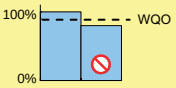


Dissolved Oxygen (DO)

1. Bottom

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

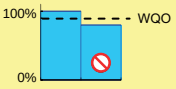
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

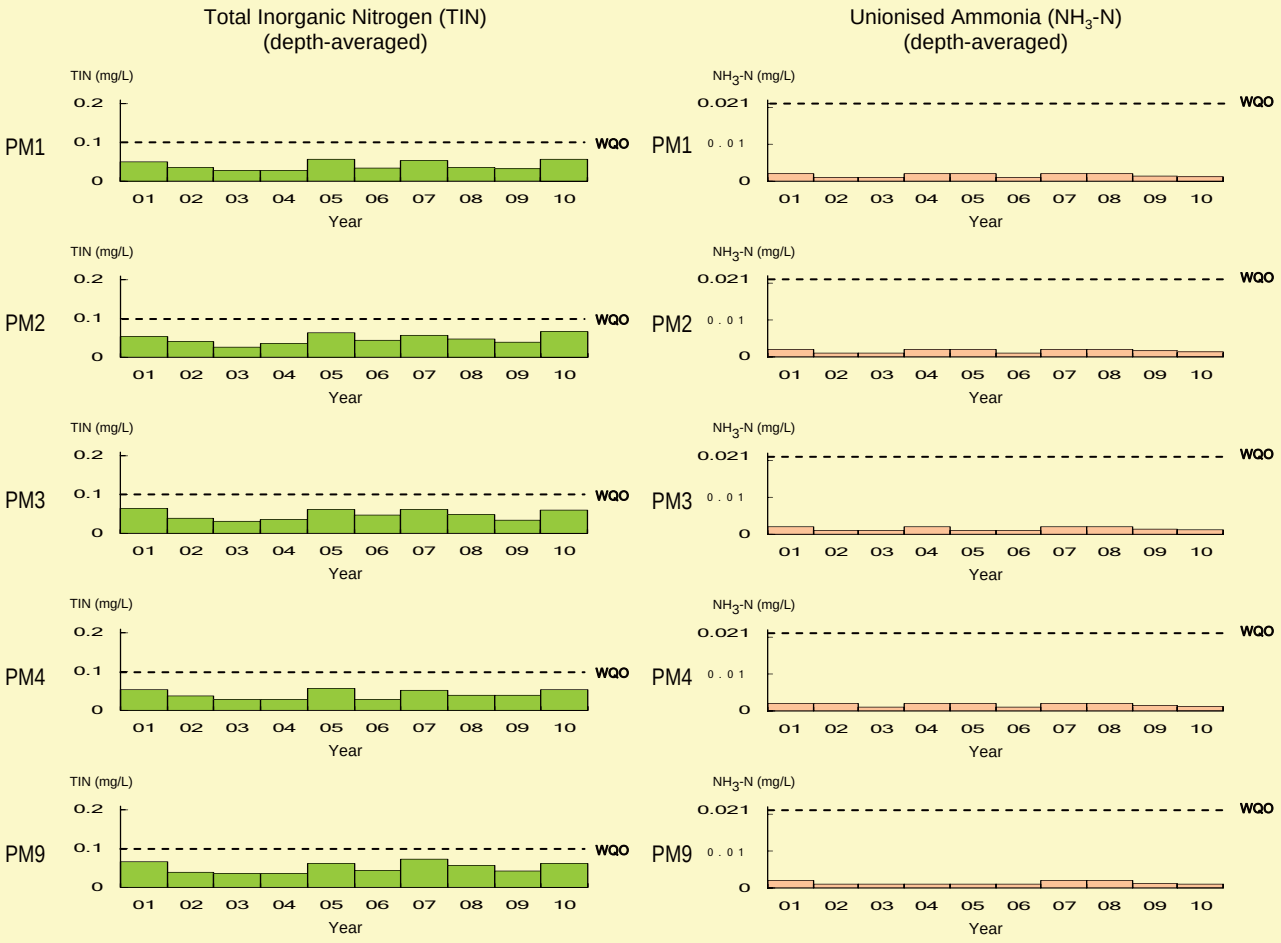
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

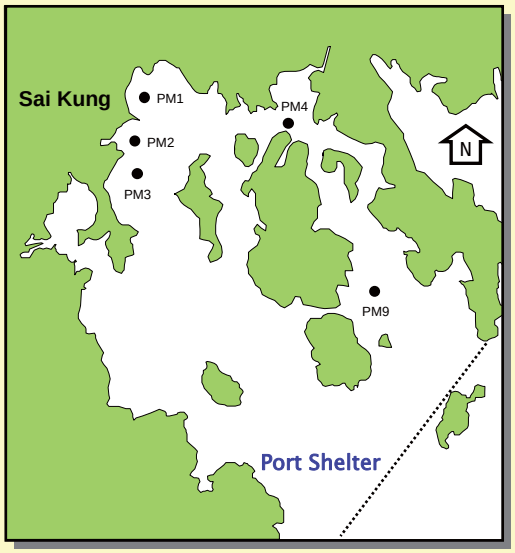
% sample with depth-averaged DO ≥ 4 mg/L

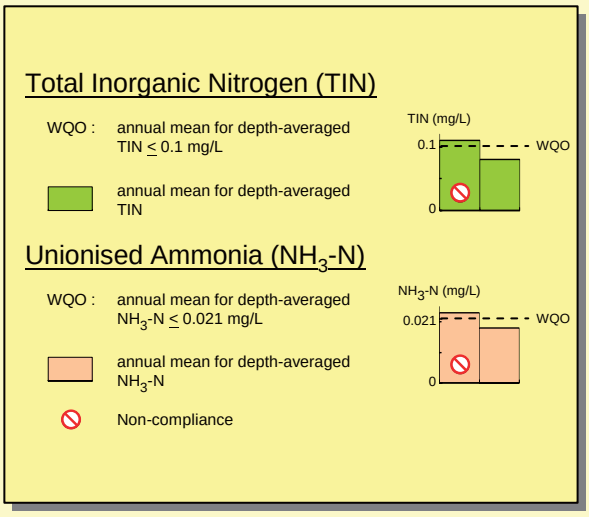


Non-compliance

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



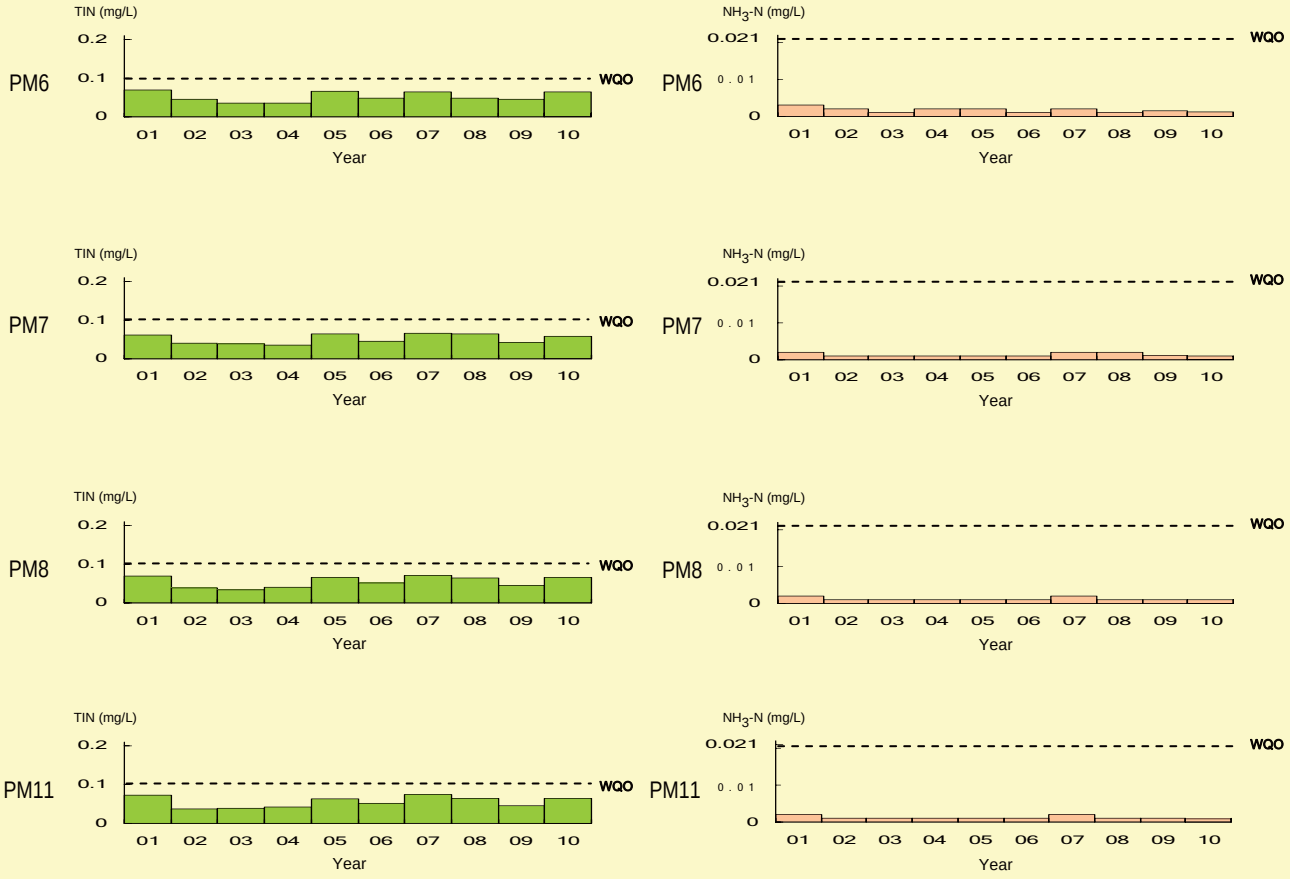


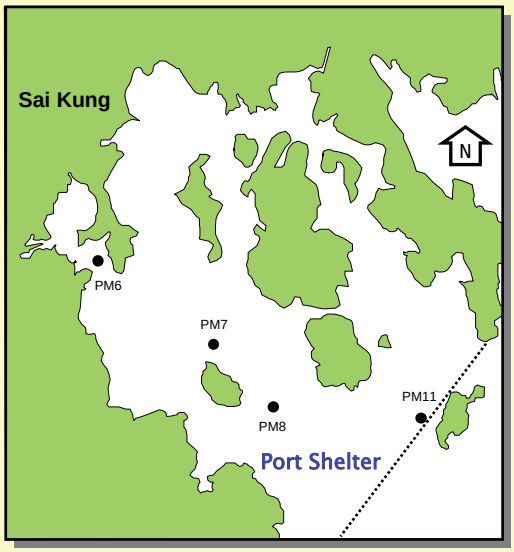


Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)

Unionised Ammonia (NH_3-N) (depth-averaged)

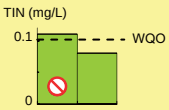




Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN ≤ 0.1 mg/L

annual mean for depth-averaged TIN

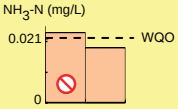


Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

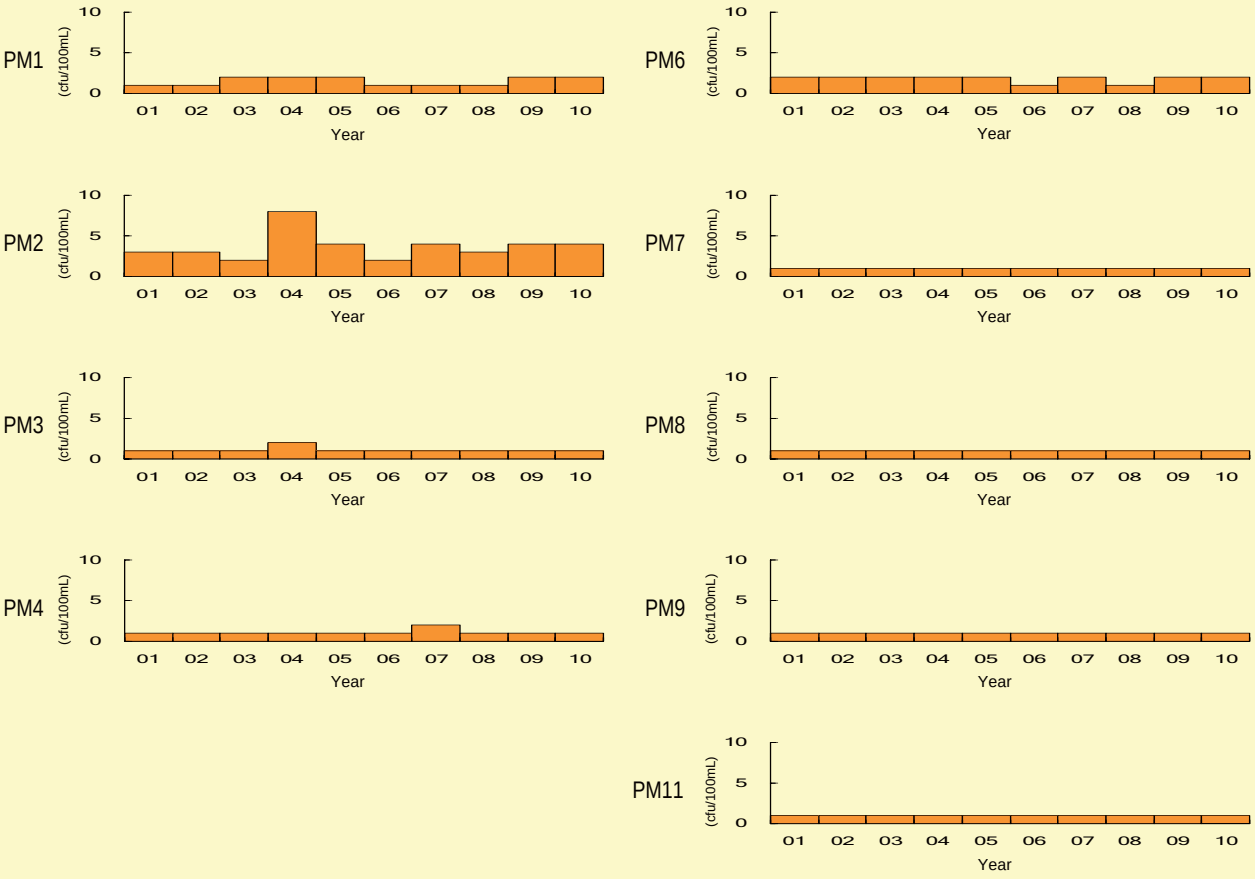
annual mean for depth-averaged NH_3-N

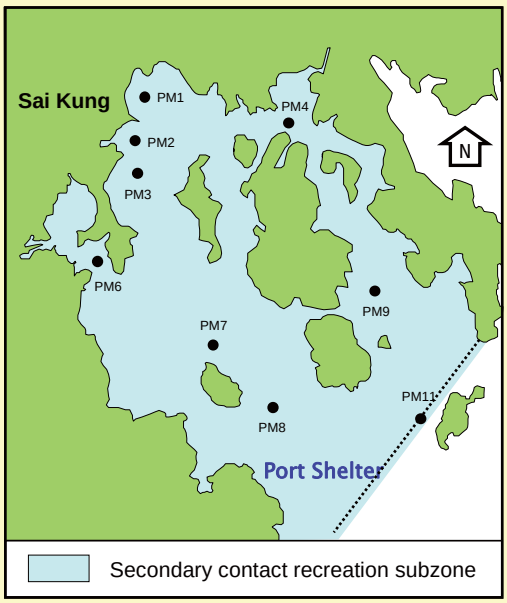
Non-compliance

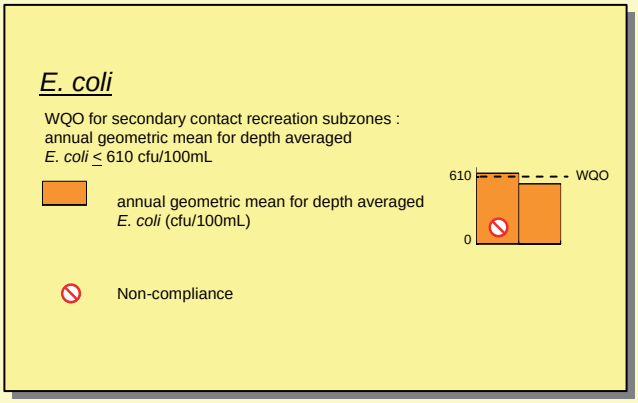


Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)

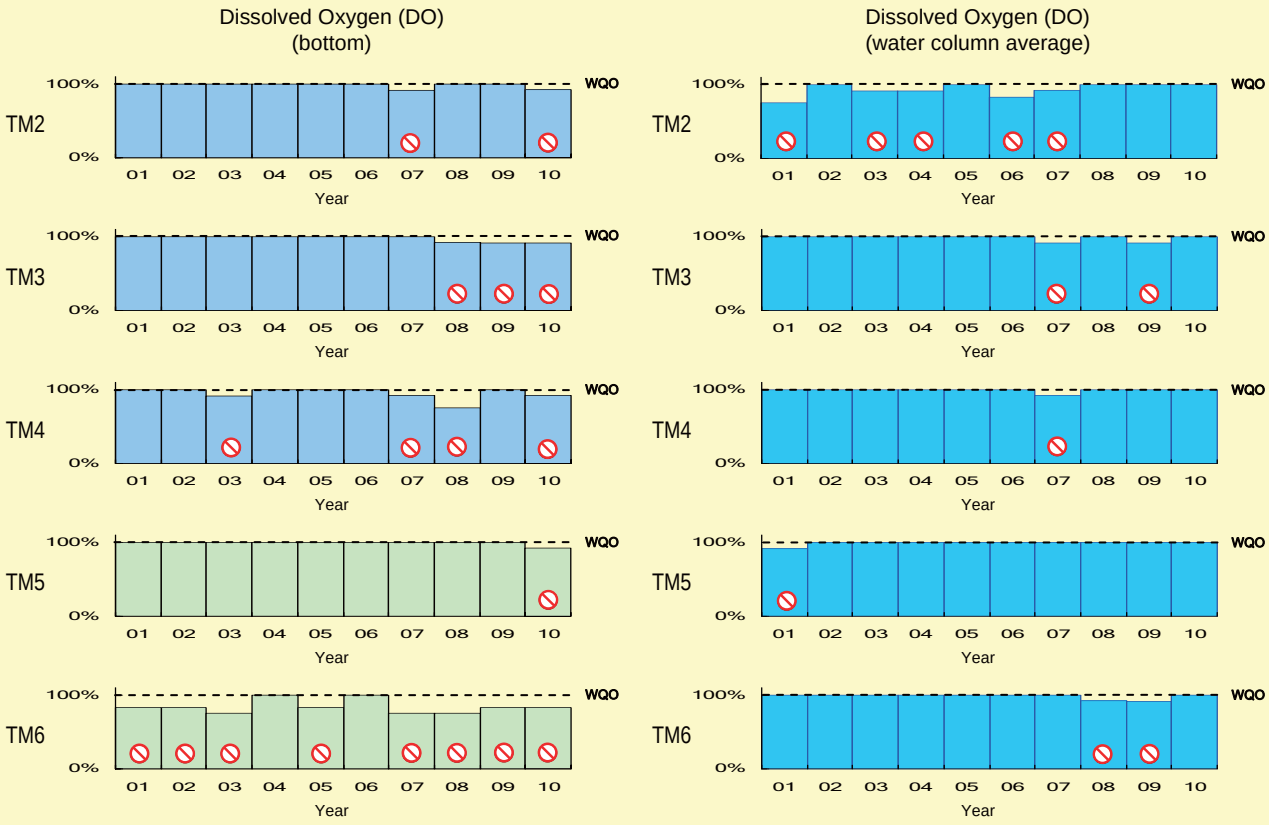
E. coli
(annual geometric mean)

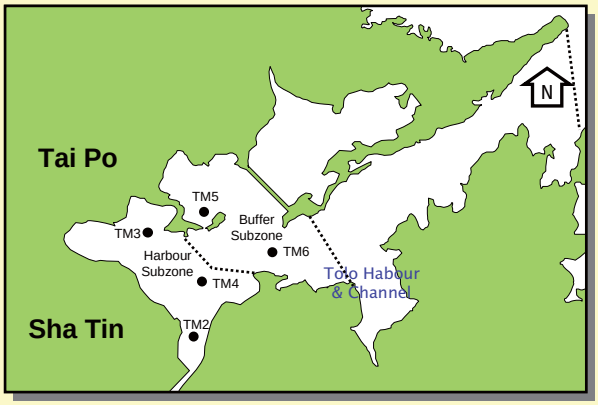






Levels of compliance with key Water Quality Objectives in the Tolo Harbour and Channel WCZ





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)

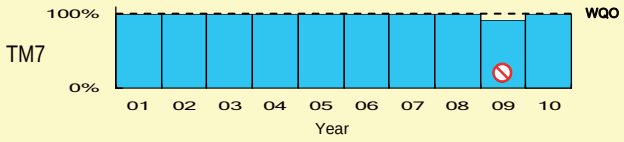
WQO : 100% sample with water column average DO ≥ 4 mg/L

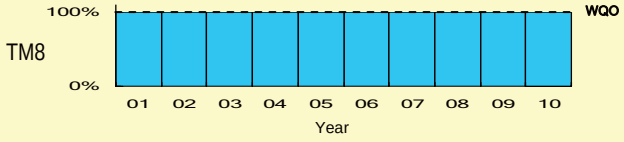
% sample with water column average DO ≥ 4 mg/L

Non-compliance

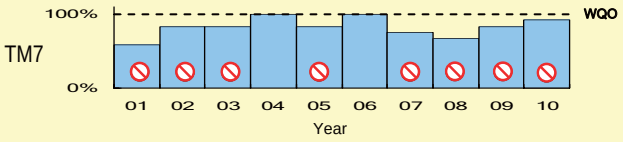
Levels of compliance with key Water Quality Objectives in the Tolo Harbour and Channel WCZ (continued)

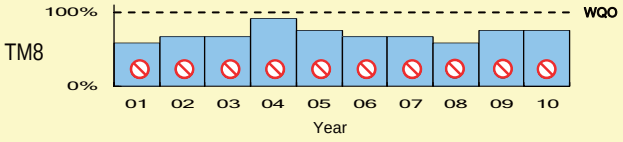
Dissolved Oxygen (DO)
(surface)



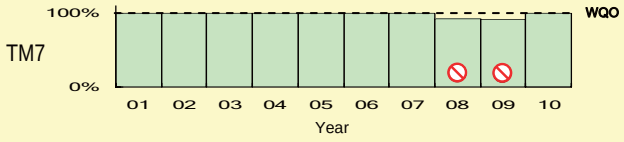


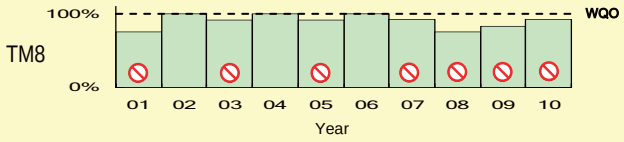
Dissolved Oxygen (DO)
(bottom)





Dissolved Oxygen (DO)
(middle)





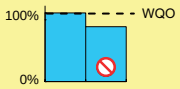
Dissolved Oxygen (DO)

Channel Subzone (TM7 - TM8)

1. Surface

WQO : 100% sample with surface DO ≥ 4 mg/L

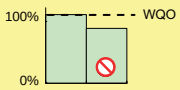
% sample with surface DO ≥ 4 mg/L



2. Middle

WQO : 100% sample with middle DO ≥ 4 mg/L

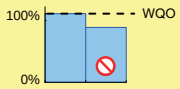
% sample with middle DO ≥ 4 mg/L



3. Bottom

WQO : 100% sample with bottom DO ≥ 4 mg/L

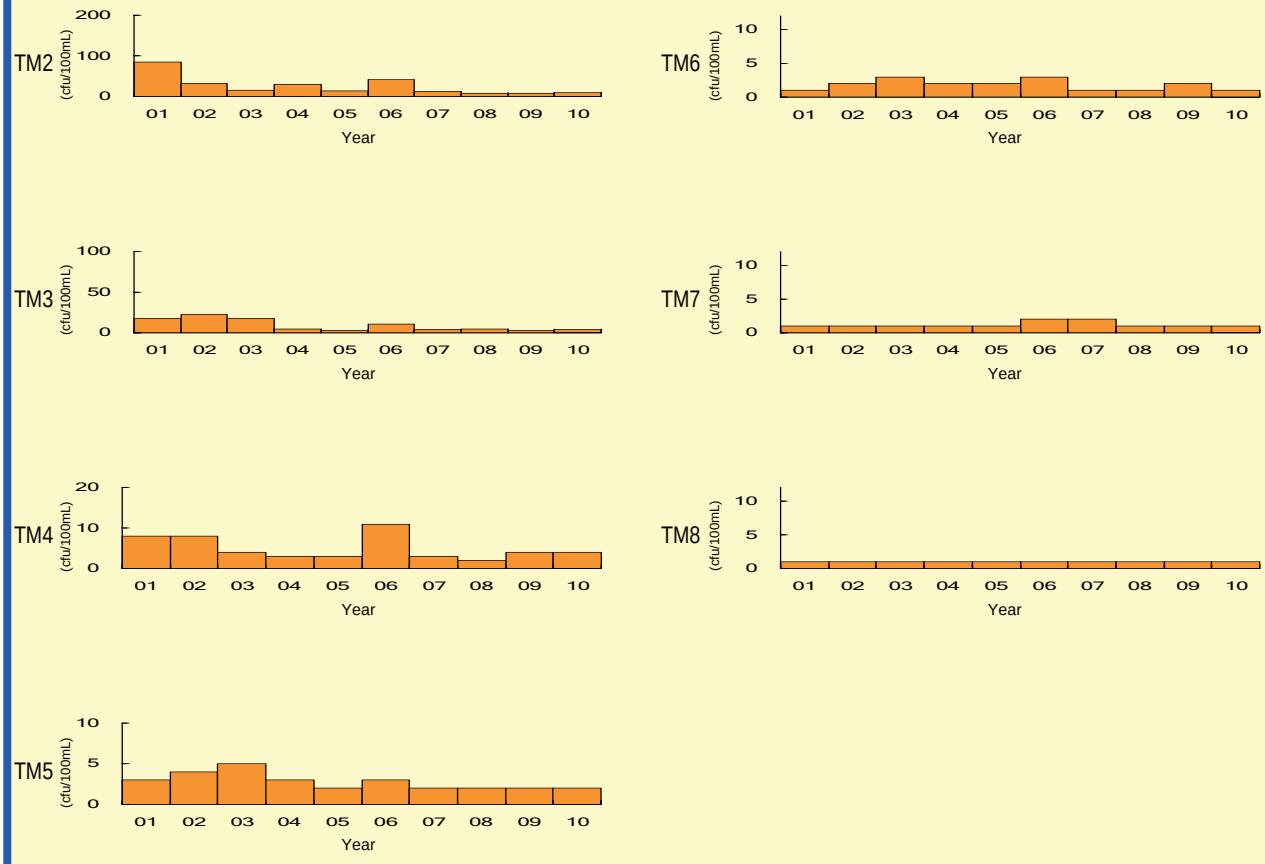
% sample with bottom DO ≥ 4 mg/L

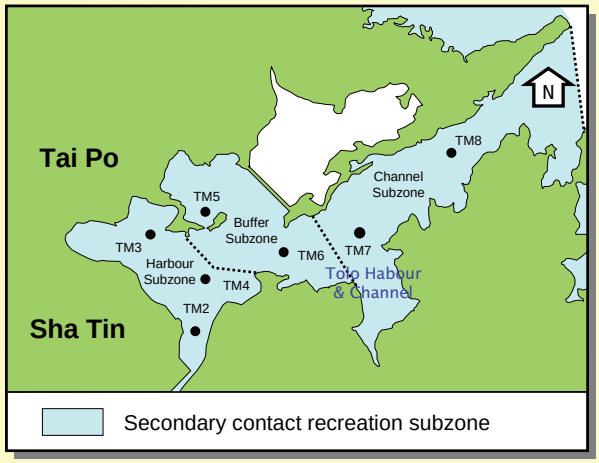


Non-compliance

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

E. coli
(annual geometric mean)



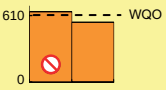


E. coli

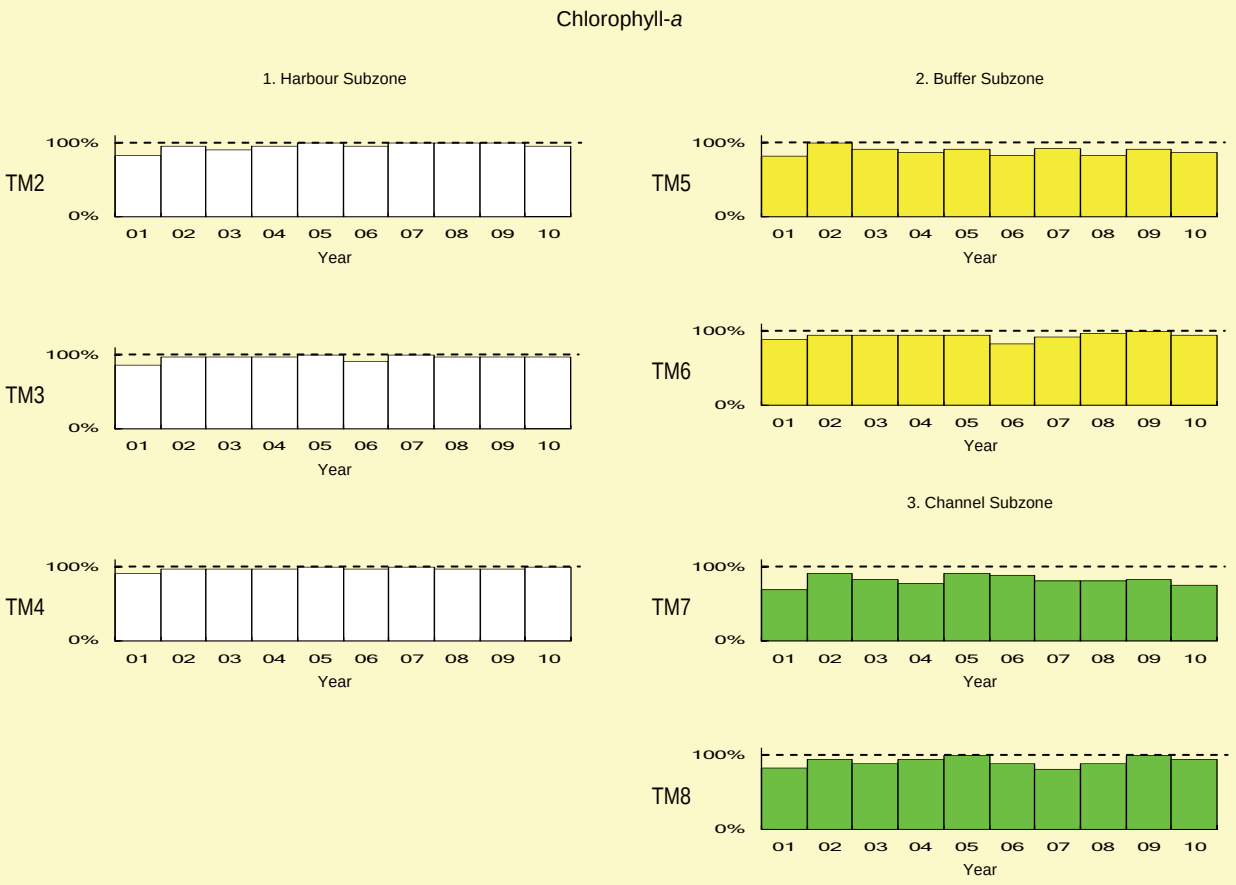
WQO for secondary contact recreation subzones :
annual geometric mean for depth averaged
E. coli ≤ 610 cfu/100mL

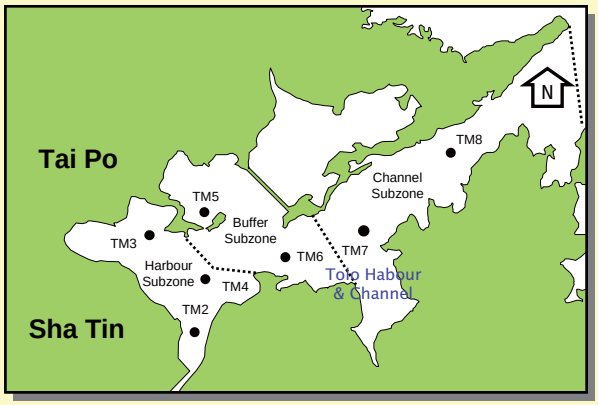
annual geometric mean for depth averaged *E. coli* (cfu/100mL)

Non-compliance



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





Chlorophyll-*a*

1. Harbour Subzone

% 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

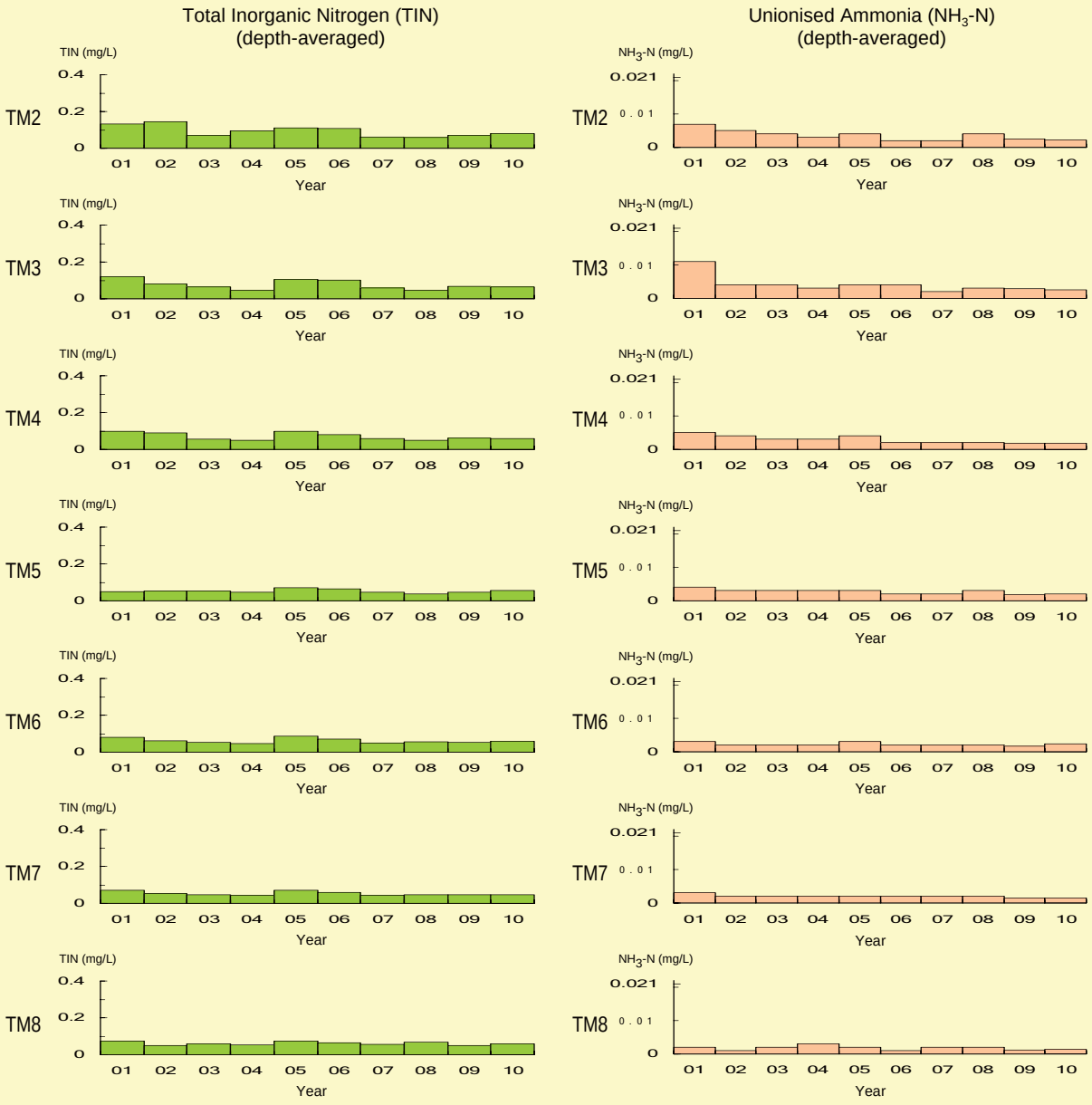
WQO : Chlorophyll-*a* ≤ 10 μg/L

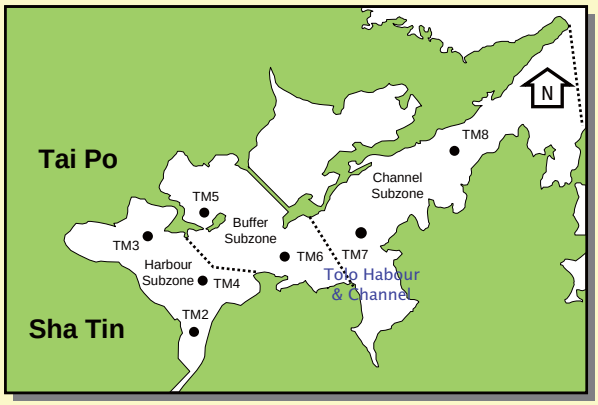
3. Channel Subzone

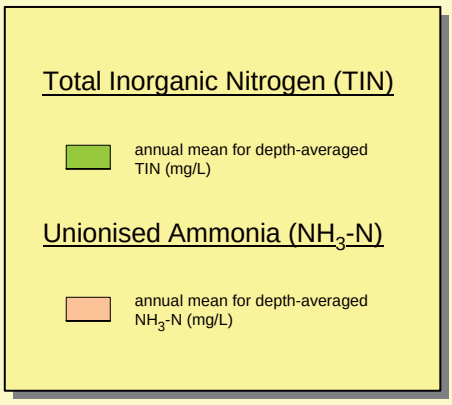
% sample (S, M, B) with Chlorophyll-*a* ≤ 6 μg/L

WQO : Chlorophyll-*a* ≤ 6 μg/L

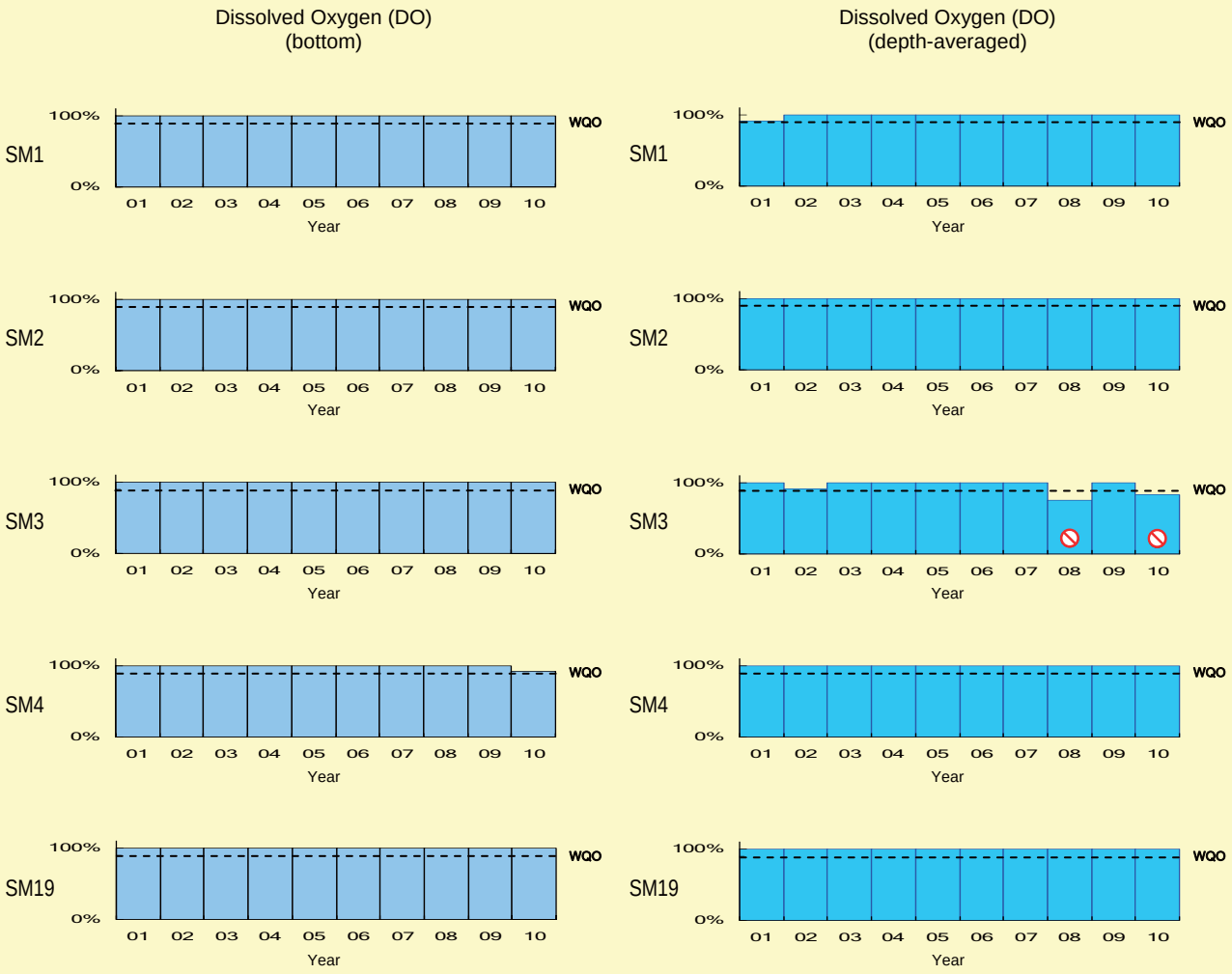
Levels of total inorganic nitrogen and unionised ammonia in the Tolo Harbour and Channel WCZ

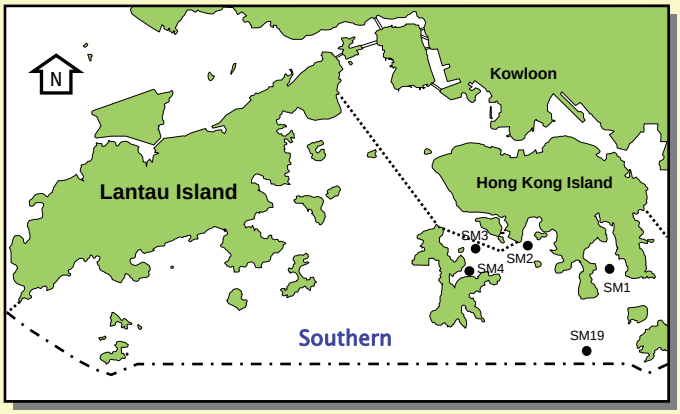






Levels of compliance with key Water Quality Objectives in the Southern WCZ





Dissolved Oxygen (DO)

1. Bottom

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

% sample with bottom DO ≥ 2 mg/L

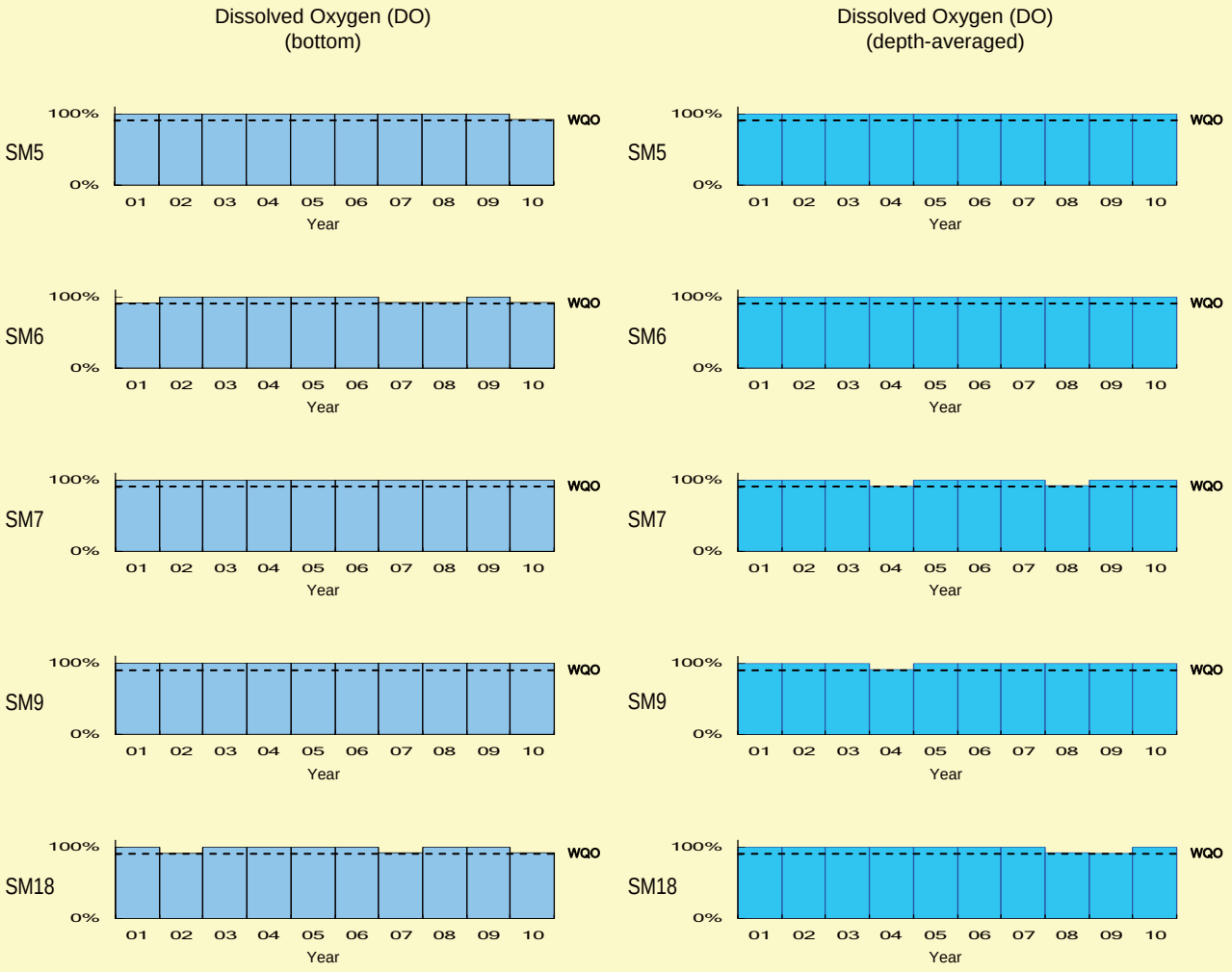
2. Depth-averaged

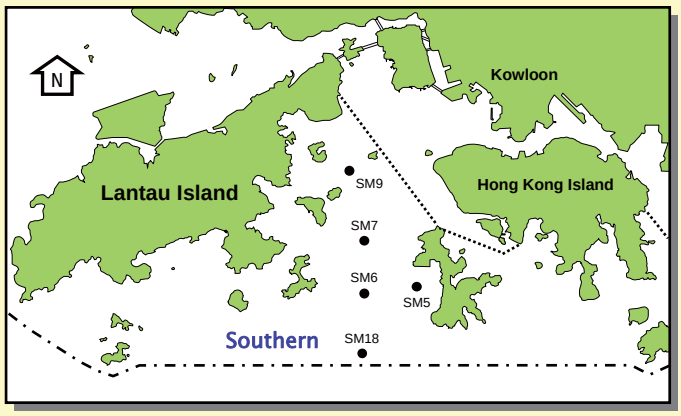
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

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

Non-compliance

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





Dissolved Oxygen (DO)

1. Bottom

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

% sample with bottom DO ≥ 2 mg/L

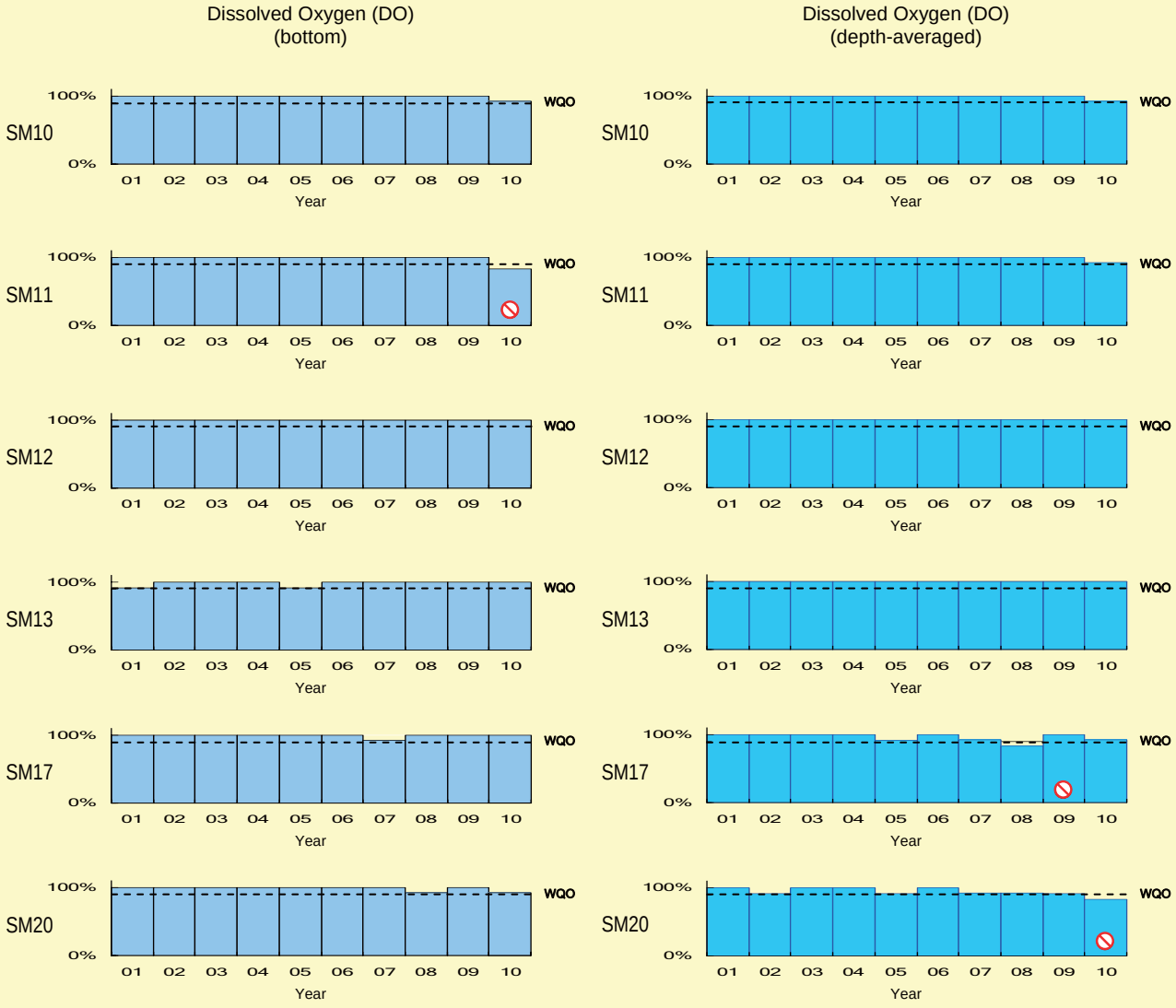
2. Depth-averaged

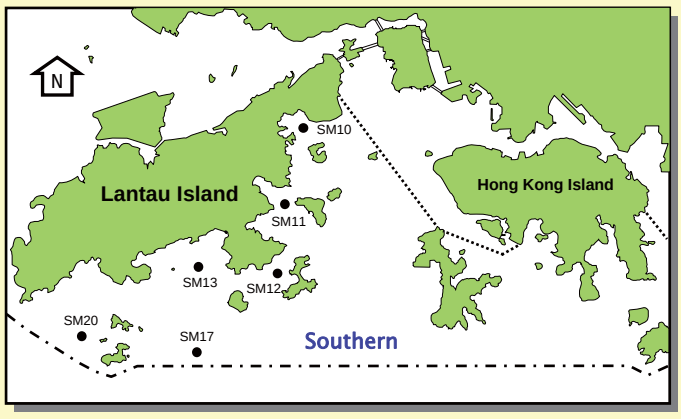
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

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

Non-compliance

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





Dissolved Oxygen (DO)

1. Bottom

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

% sample with bottom DO ≥ 2 mg/L

2. Depth-averaged

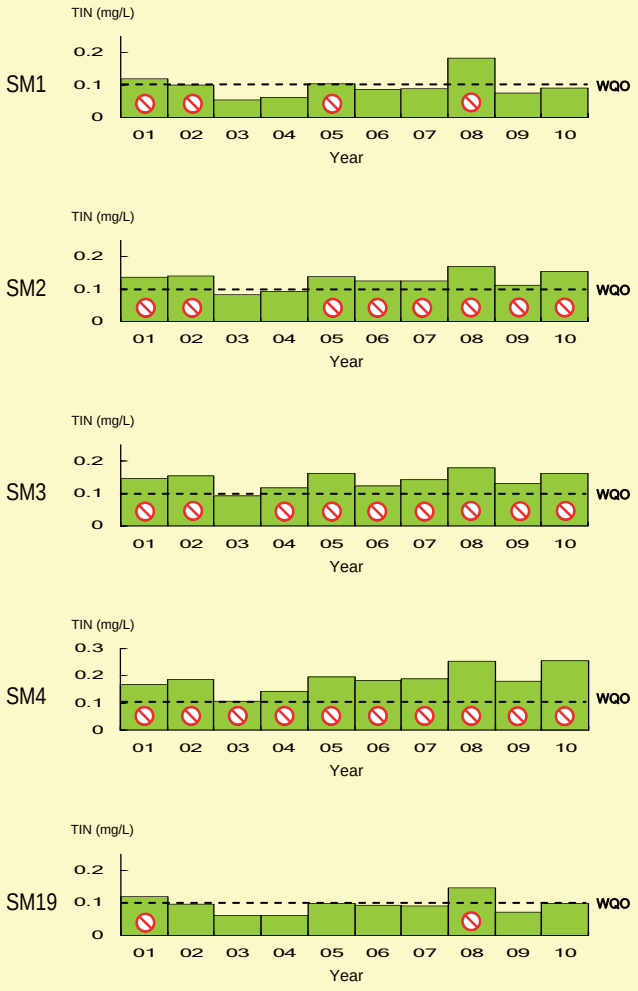
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

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

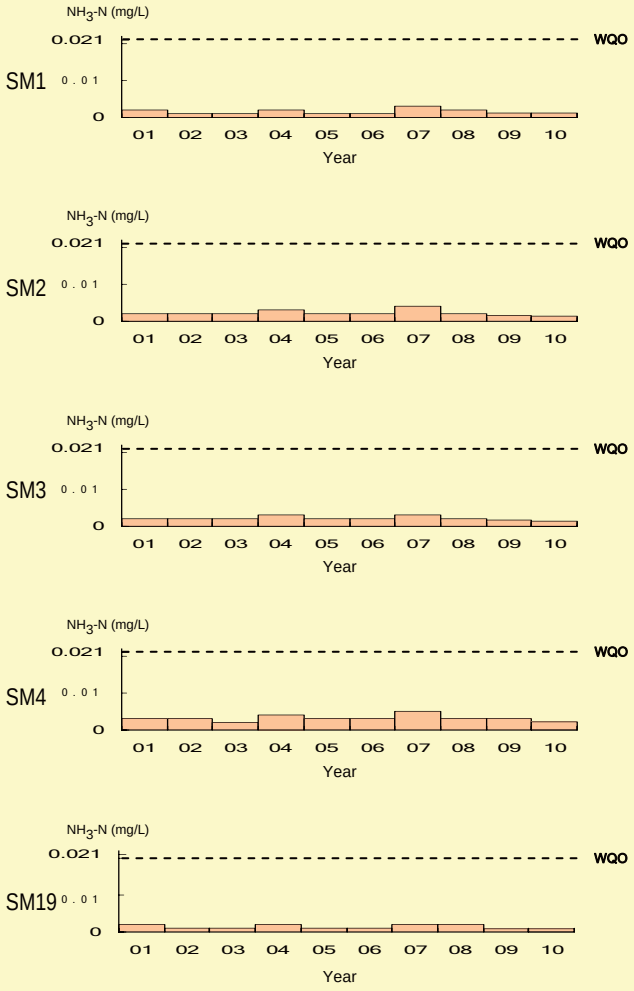
Non-compliance

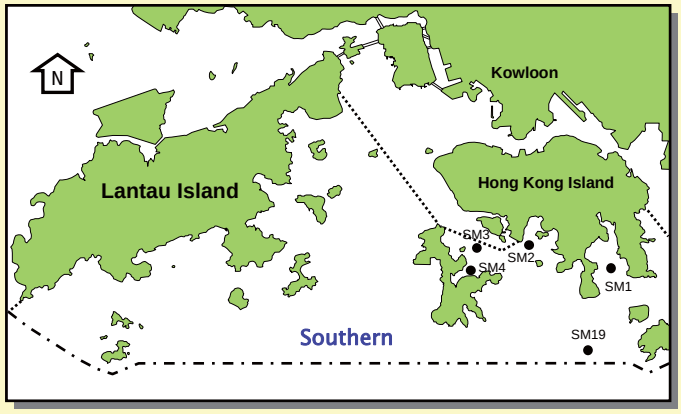
Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)



Unionised Ammonia (NH_3-N) (depth-averaged)

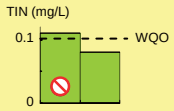




Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN ≤ 0.1 mg/L

annual mean for depth-averaged TIN

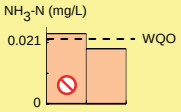


Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

annual mean for depth-averaged NH_3-N

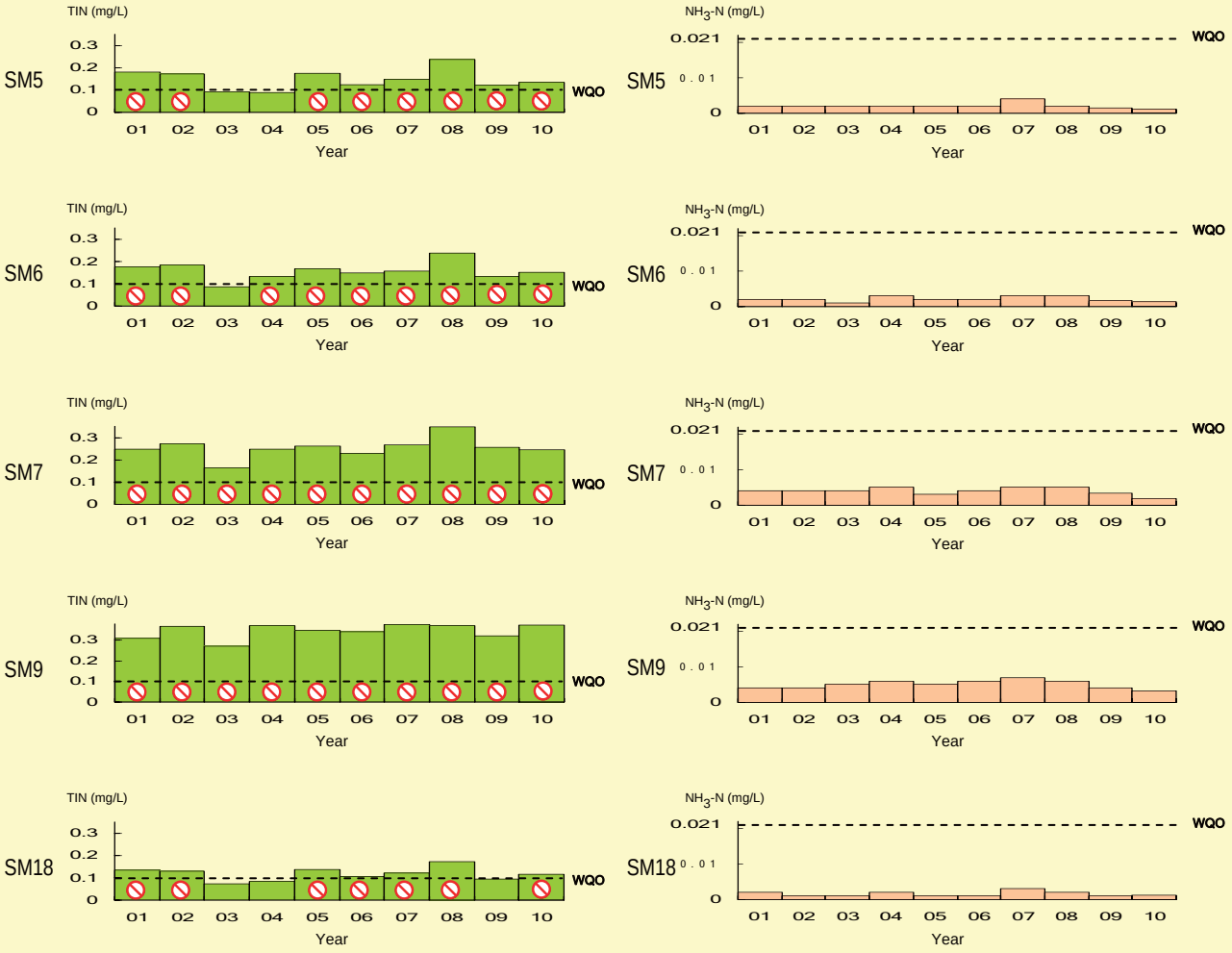
Non-compliance

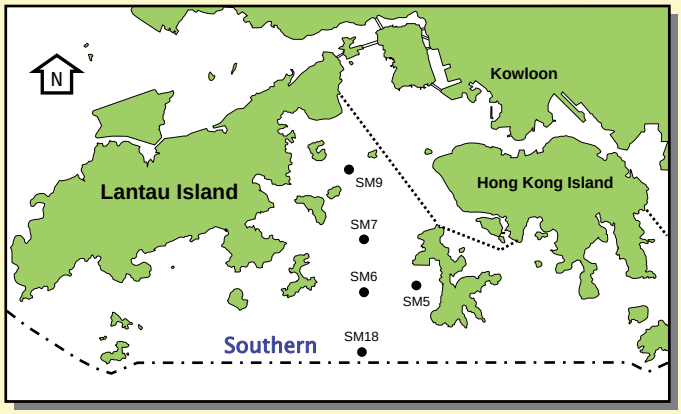


Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)

Unionised Ammonia (NH_3-N) (depth-averaged)

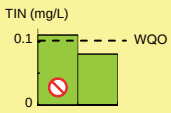




Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN ≤ 0.1 mg/L

annual mean for depth-averaged TIN

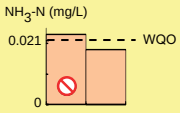


Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

annual mean for depth-averaged NH_3-N

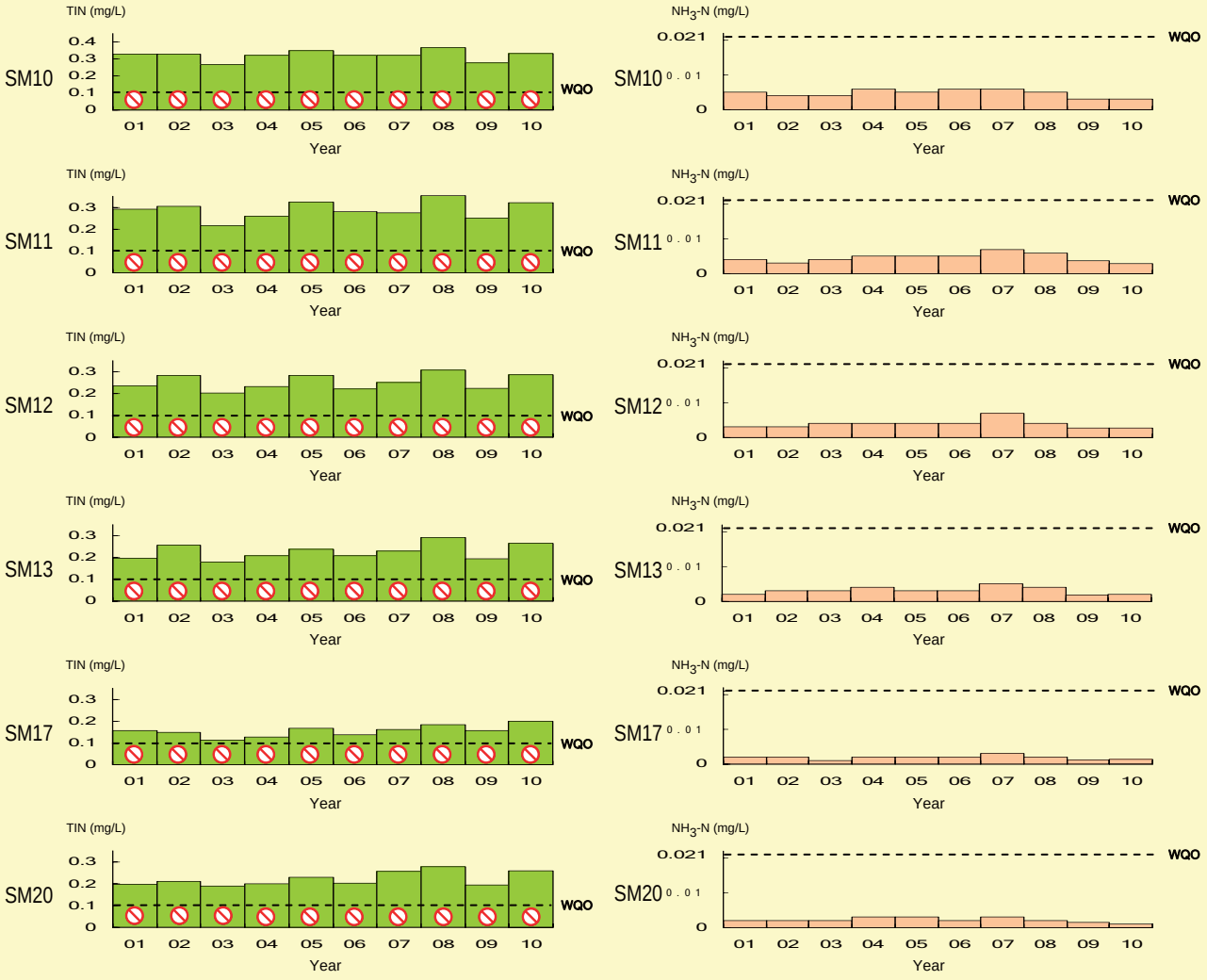
Non-compliance

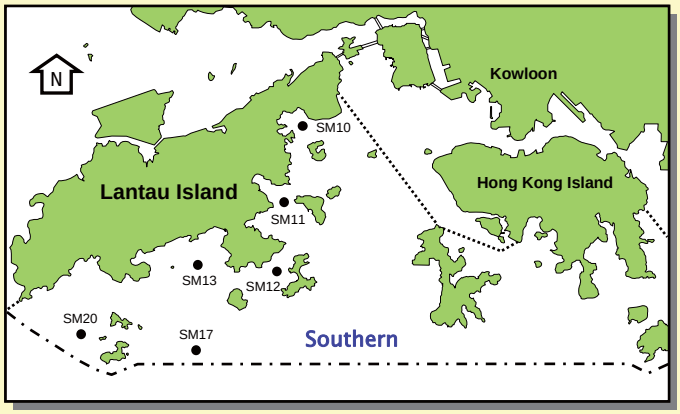


Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)

Unionised Ammonia (NH_3-N) (depth-averaged)

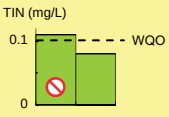




Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN ≤ 0.1 mg/L

annual mean for depth-averaged TIN

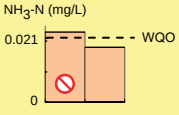


Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

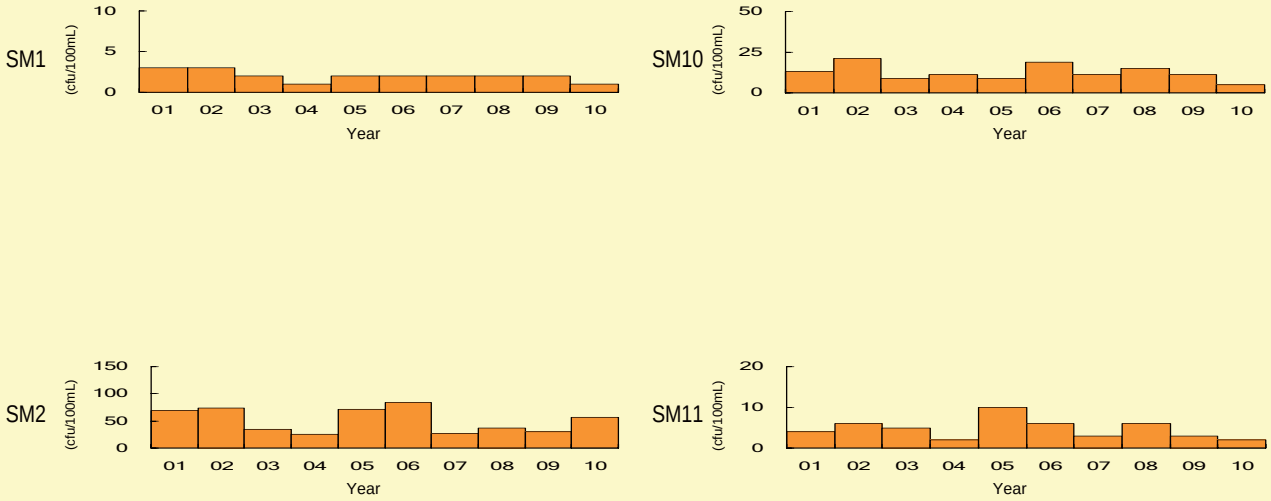
annual mean for depth-averaged NH_3-N

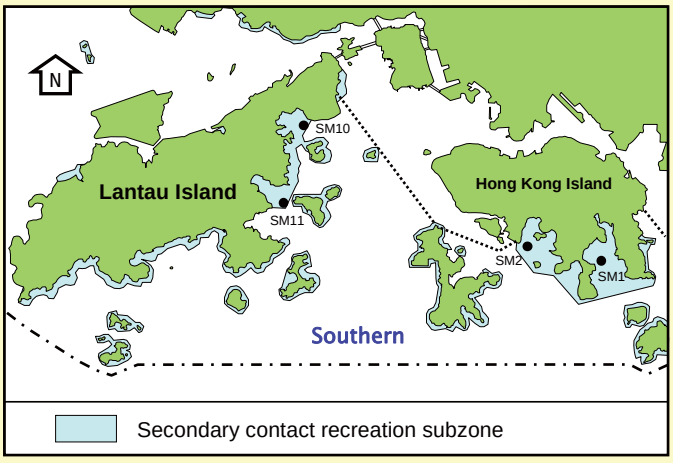
Non-compliance



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

E. coli
(annual geometric mean)



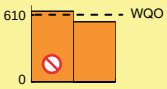


E. coli

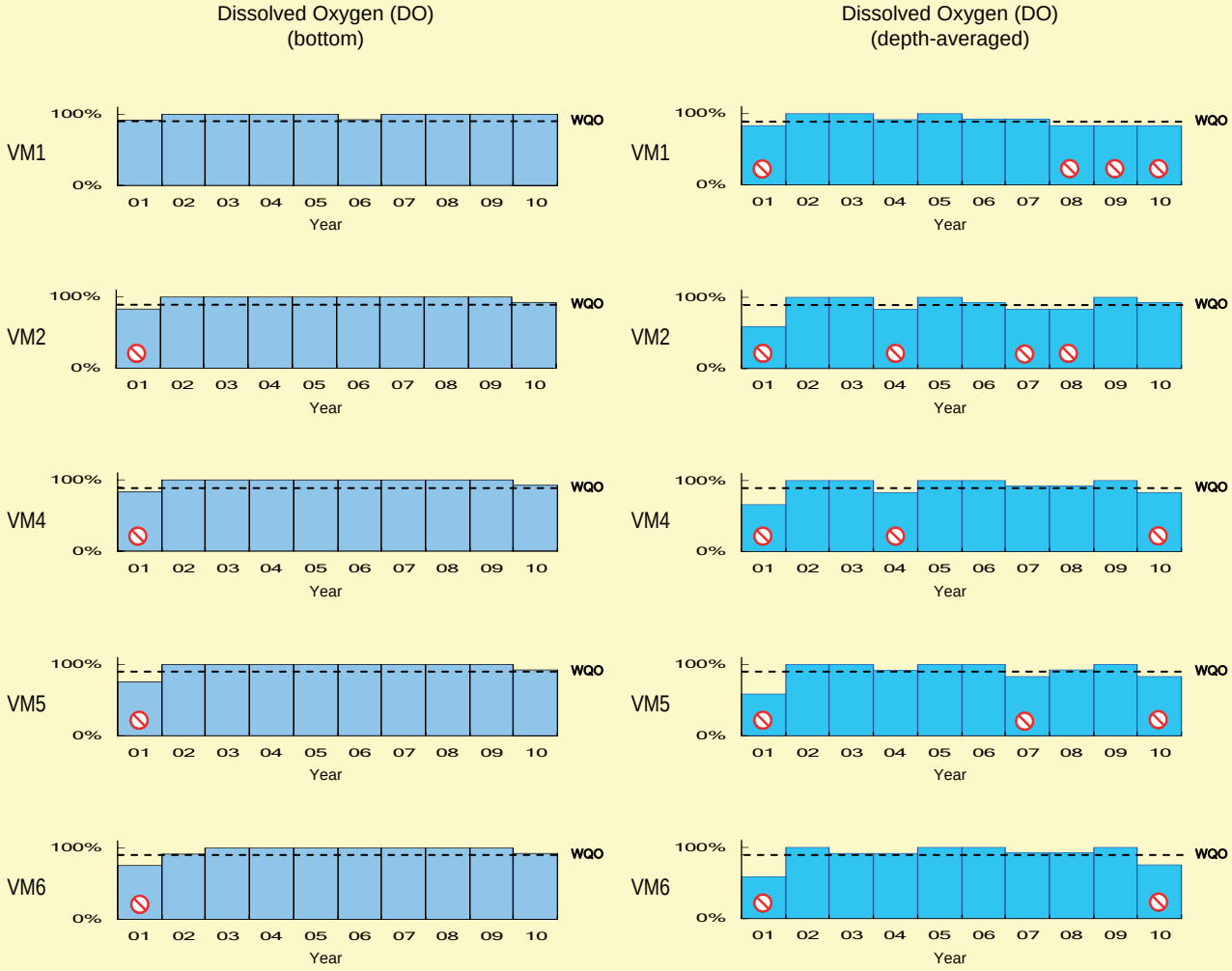
WQO for secondary contact recreation subzones :
annual geometric mean for depth averaged
E. coli ≤ 610 cfu/100mL

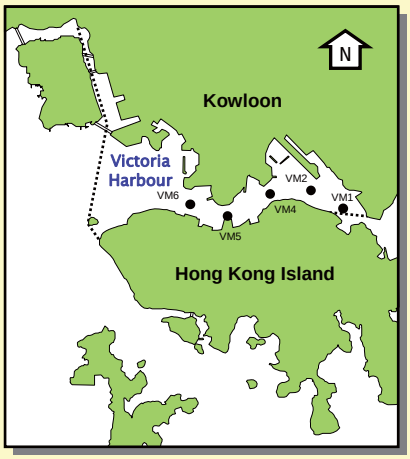
annual geometric mean for depth averaged *E. coli* (cfu/100mL)

Non-compliance



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





Dissolved Oxygen (DO)

1. Bottom

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

% sample with bottom DO ≥ 2 mg/L

2. Depth-averaged

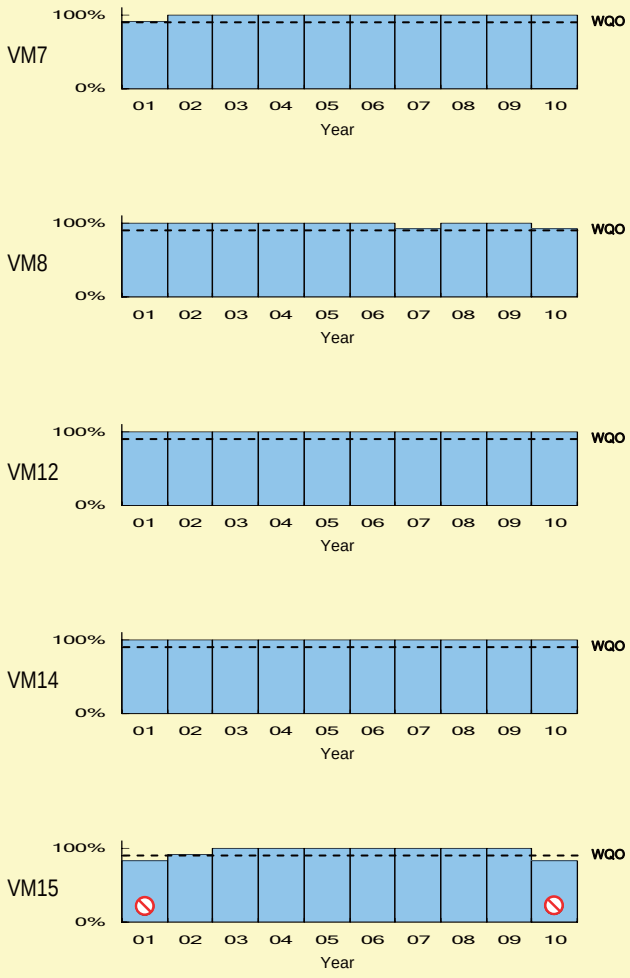
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

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

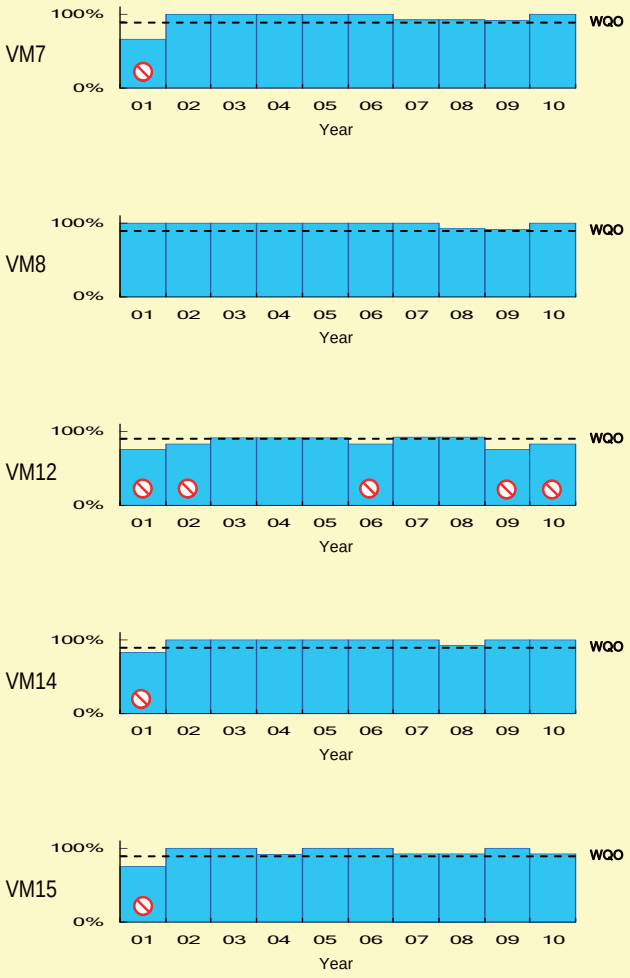
Non-compliance

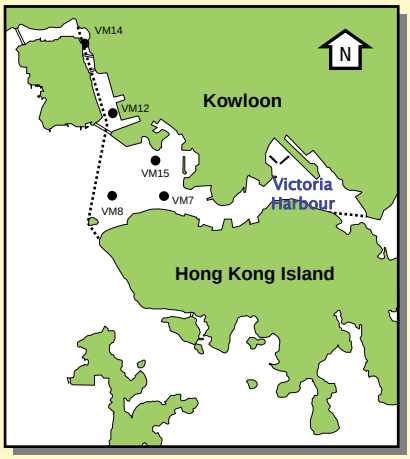
Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ (continued)

Dissolved Oxygen (DO) (bottom)



Dissolved Oxygen (DO) (depth-averaged)



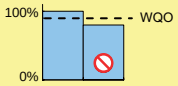


Dissolved Oxygen (DO)

1. Bottom

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

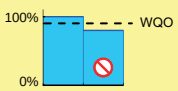
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

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

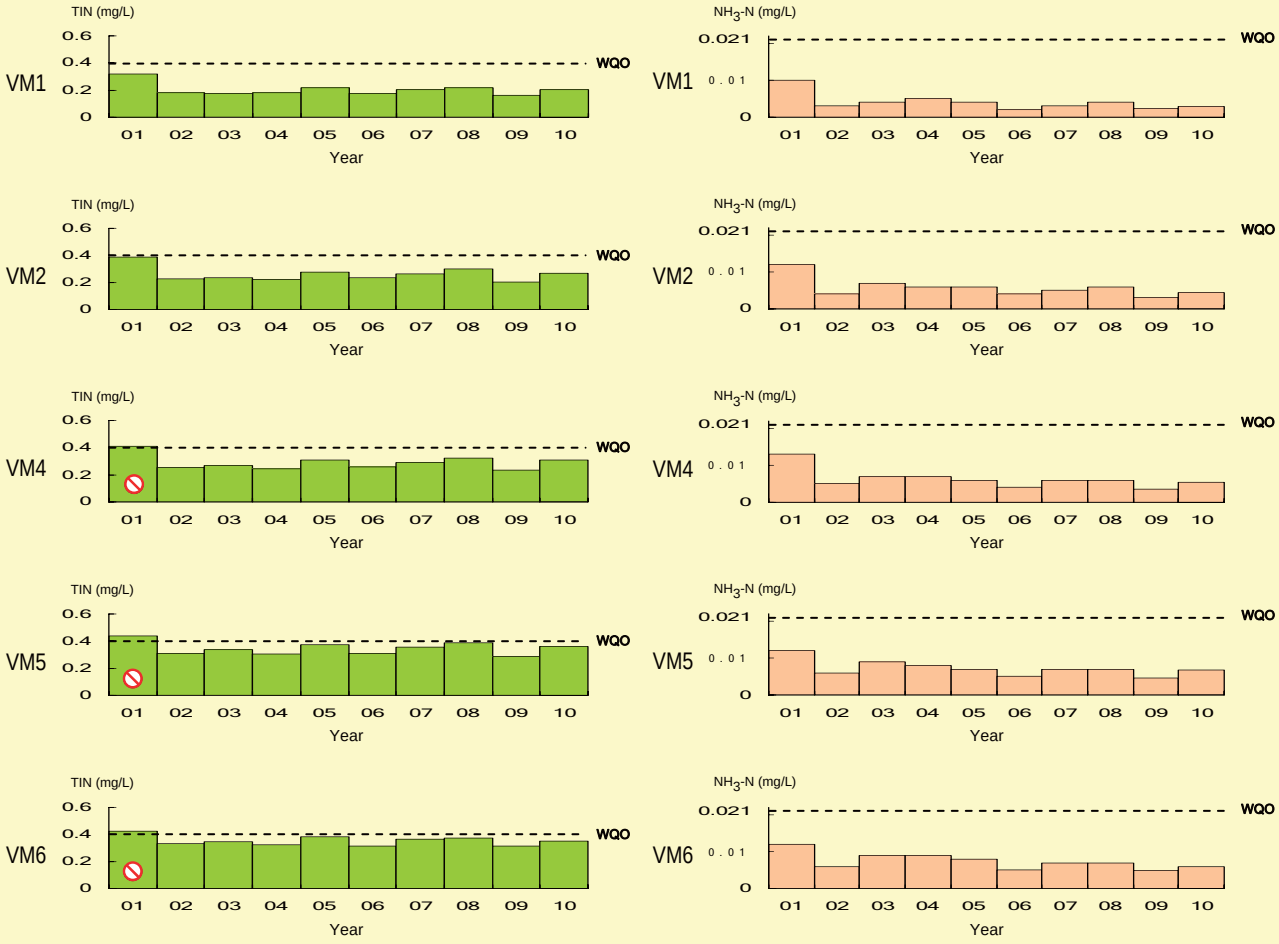


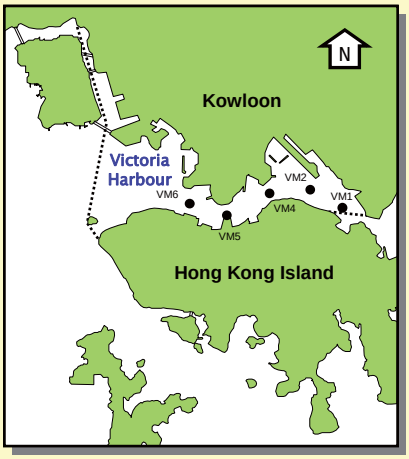
Non-compliance

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

Total Inorganic Nitrogen (TIN) (depth-averaged)

Unionised Ammonia (NH_3-N) (depth-averaged)





Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

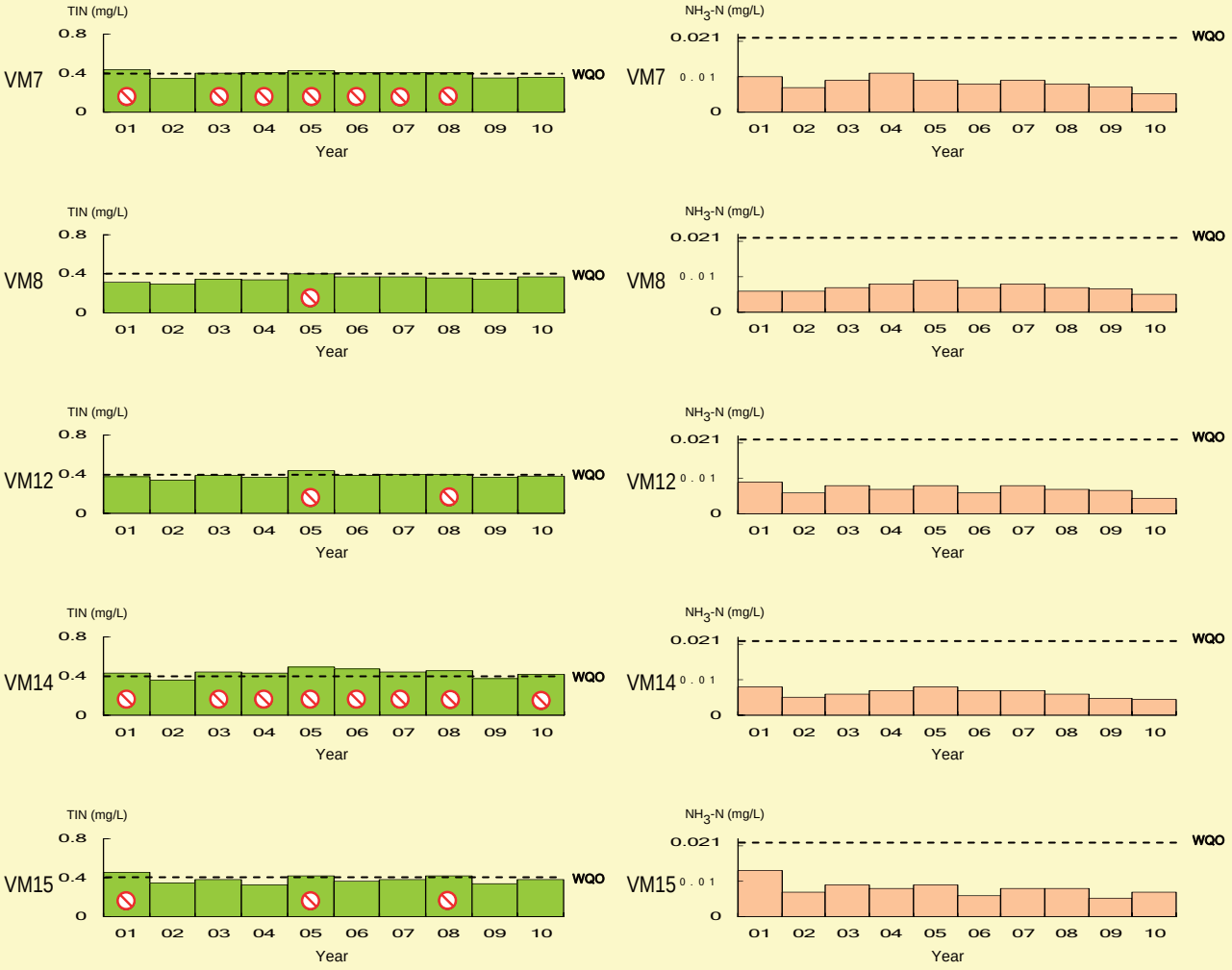
annual mean for depth-averaged NH_3-N

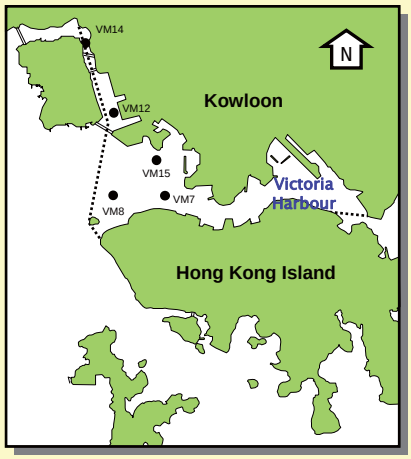
Non-compliance

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

Total Inorganic Nitrogen (TIN) (depth-averaged)

Unionised Ammonia (NH_3-N) (depth-averaged)

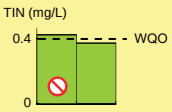




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

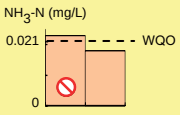


Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

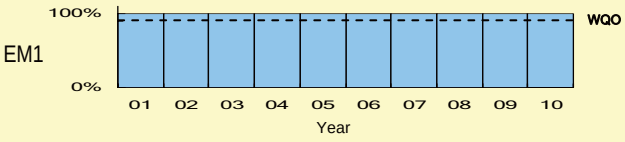
annual mean for depth-averaged NH_3-N

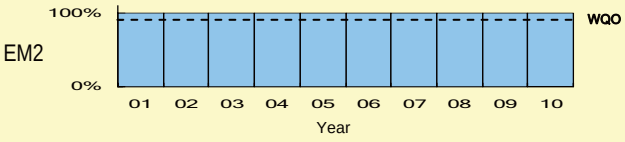
Non-compliance

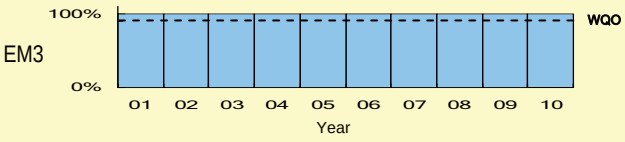


Levels of compliance with key Water Quality Objectives in the Eastern Buffer WCZ

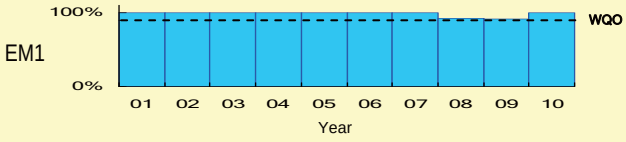
Dissolved Oxygen (DO)
(bottom)

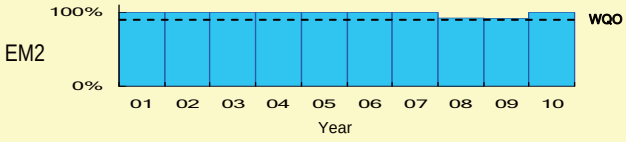


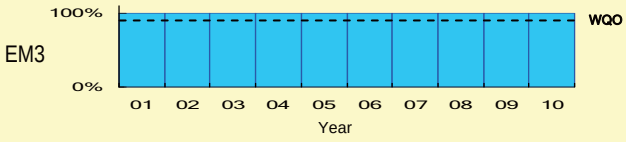


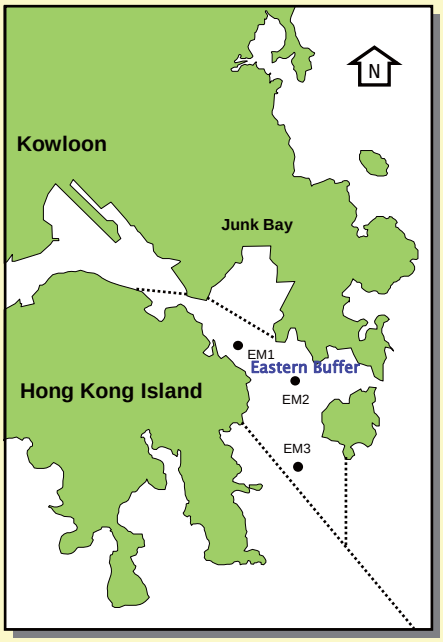


Dissolved Oxygen (DO)
(depth-averaged)







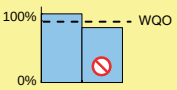


Dissolved Oxygen (DO)

1. Bottom

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

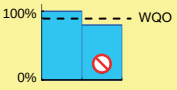
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

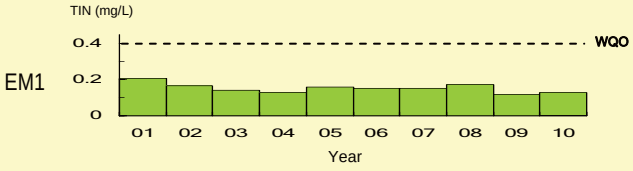
% sample with depth-averaged DO ≥ 4 mg/L

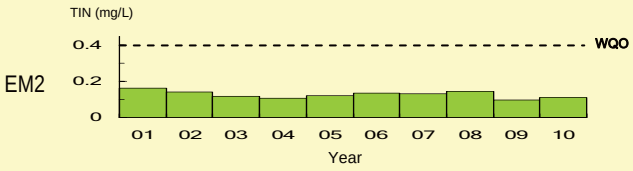


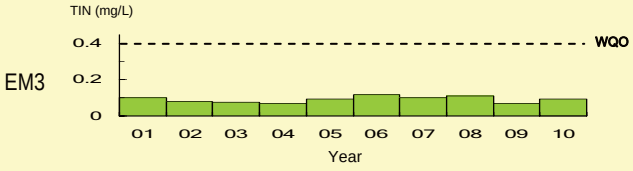
Non-compliance

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

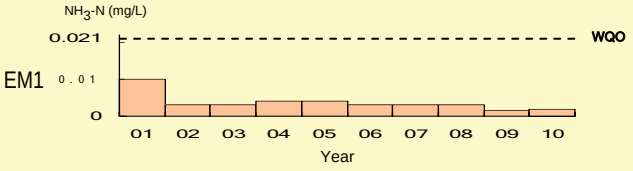
Total Inorganic Nitrogen (TIN)
(depth-averaged)

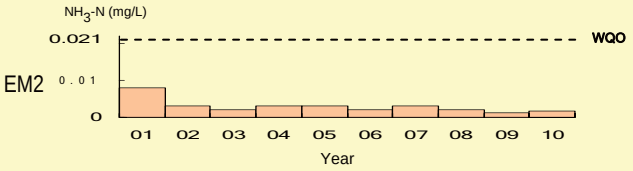


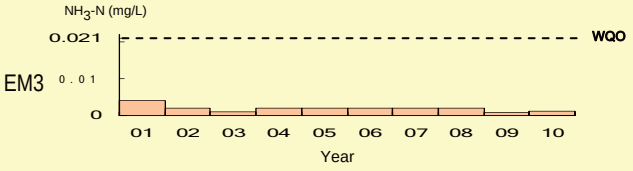


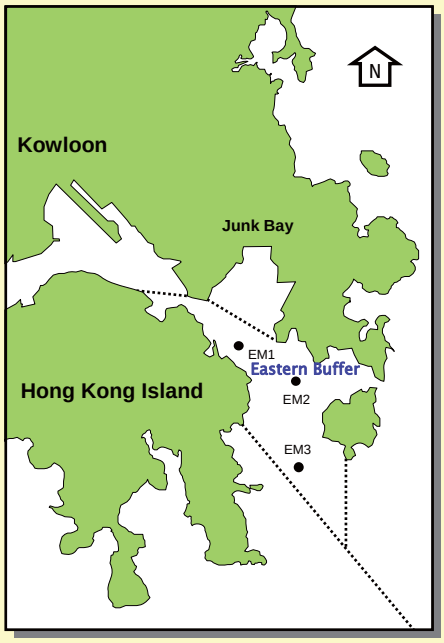


Unionised Ammonia (NH_3-N)
(depth-averaged)





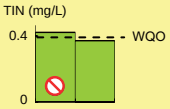




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

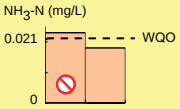


Unionised Ammonia (NH_3-N)

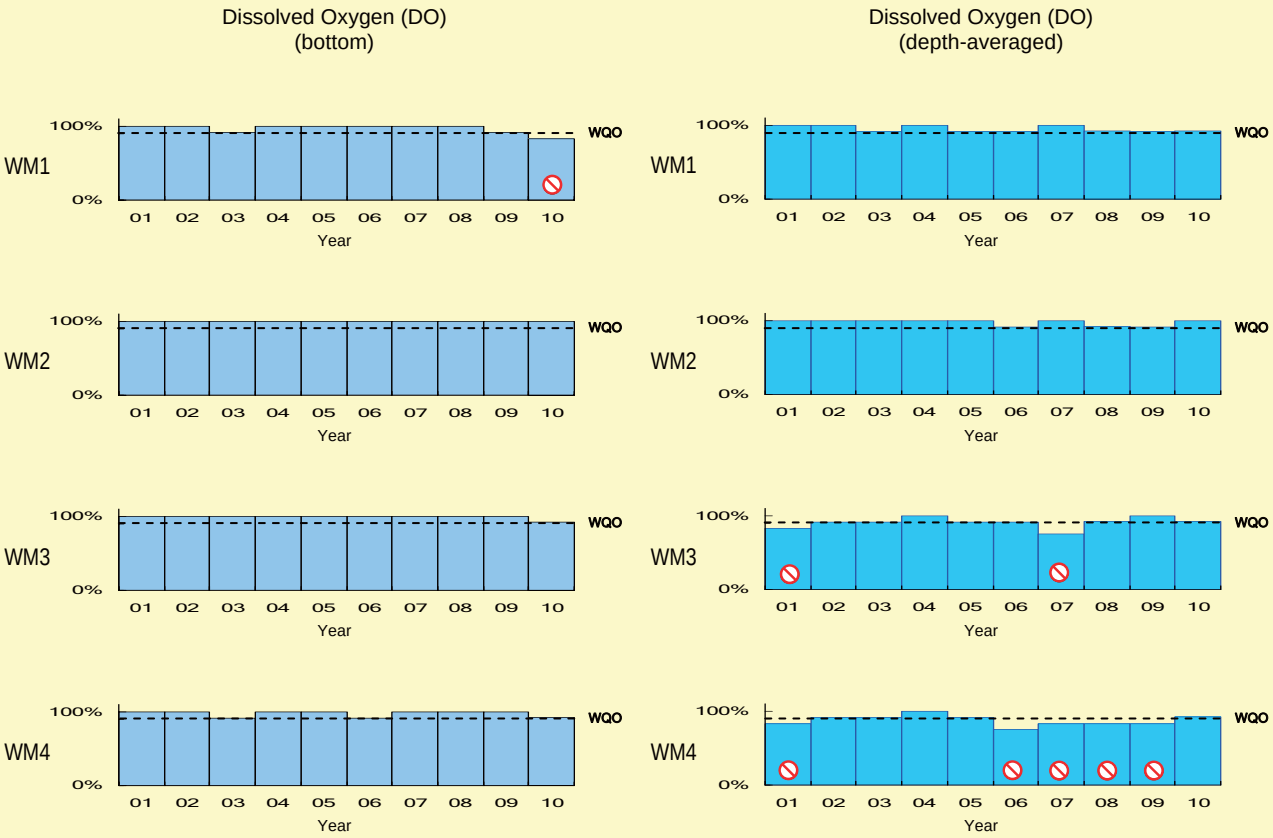
WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

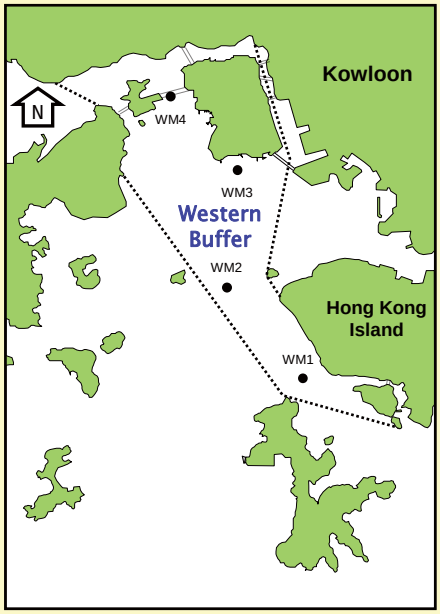
annual mean for depth-averaged NH_3-N

Non-compliance



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



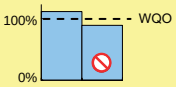


Dissolved Oxygen (DO)

1. Bottom

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

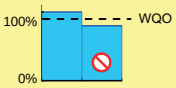
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

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

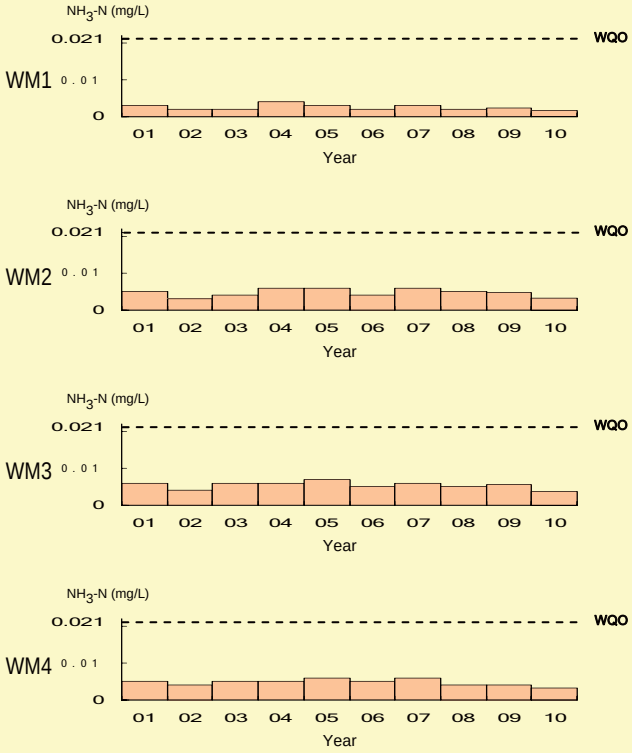


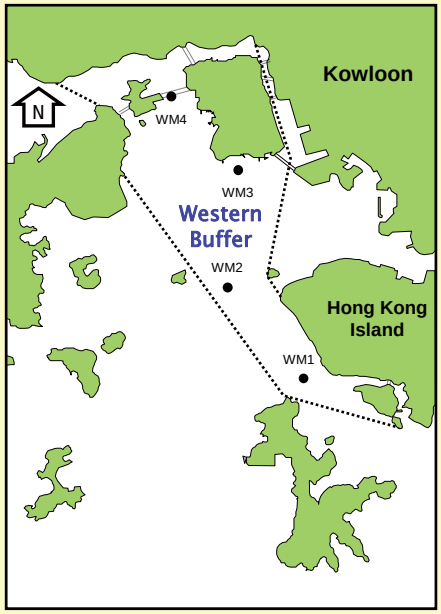
Non-compliance

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

Total Inorganic Nitrogen (TIN) (depth-averaged)

Unionised Ammonia (NH_3-N) (depth-averaged)

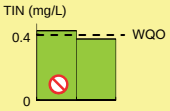




Total Inorganic Nitrogen (TIN)

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

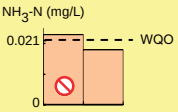
annual mean for depth-averaged TIN



Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

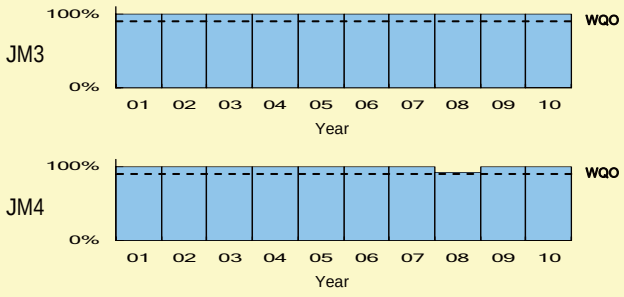
annual mean for depth-averaged NH_3-N



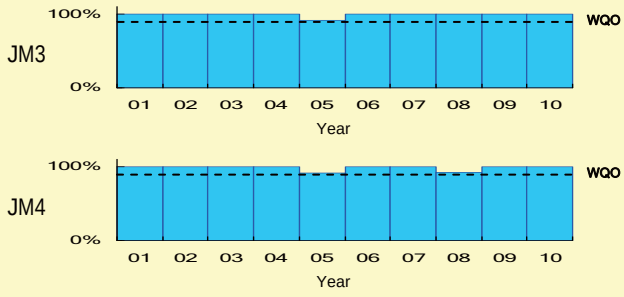
Non-compliance

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

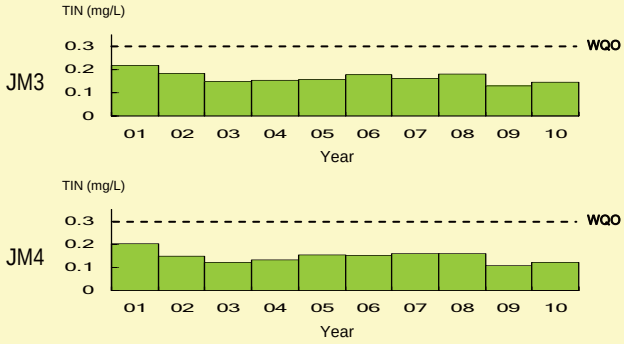
Dissolved Oxygen (DO)
(bottom)



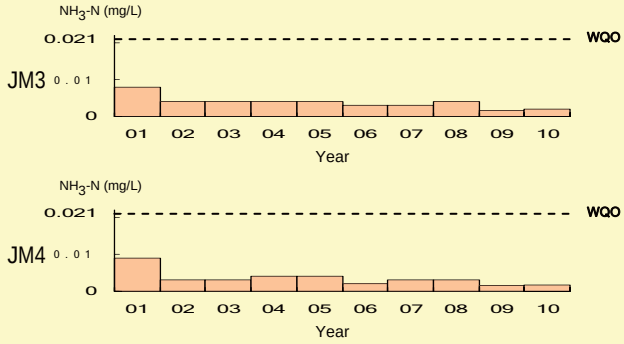
Dissolved Oxygen (DO)
(depth-averaged)

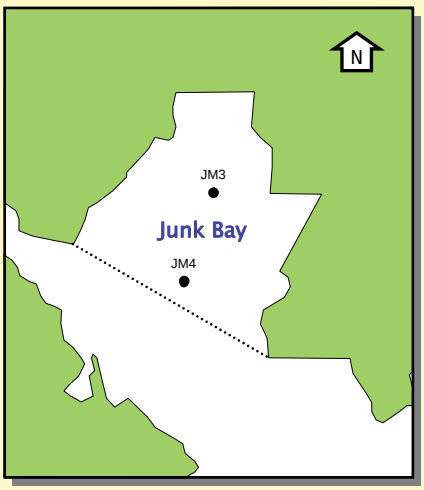


Total Inorganic Nitrogen (TIN)
(depth-averaged)



Unionised Ammonia (NH_3-N)
(depth-averaged)



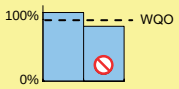


Dissolved Oxygen (DO)

1. Bottom

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

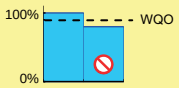
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

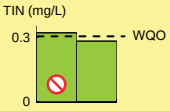
% sample with depth-averaged DO ≥ 4 mg/L



Total Inorganic Nitrogen (TIN)

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

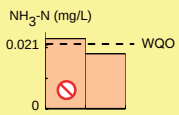
annual mean for depth-averaged TIN



Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

annual mean for depth-averaged NH_3-N



Non-compliance

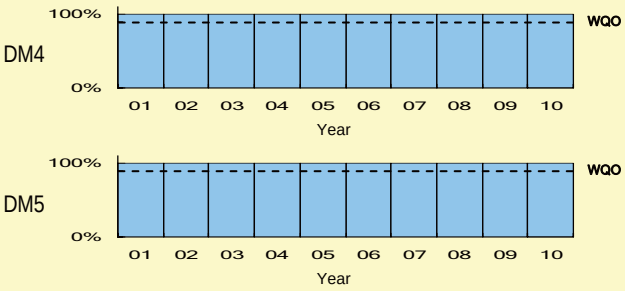
Levels of compliance with key Water Quality Objectives in the Deep Bay WCZ

Dissolved Oxygen (DO)
(bottom)

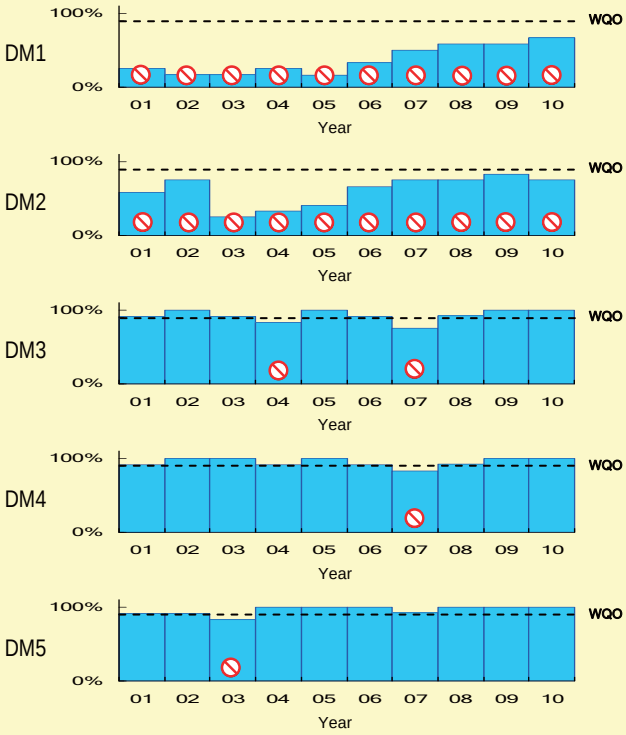
DM1 DO (bottom) not measured, water depth ≤ 3m

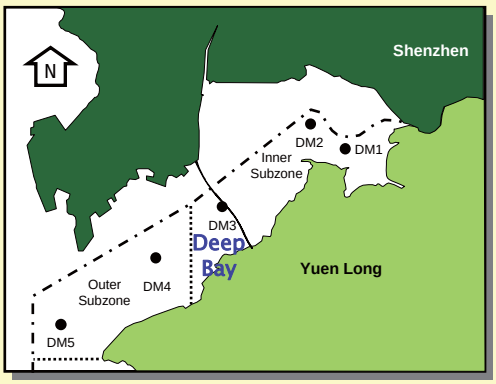
DM2 DO (bottom) not measured, water depth ≤ 3m

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



Dissolved Oxygen (DO)
(depth-averaged)



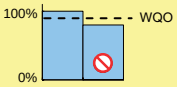


Dissolved Oxygen (DO)

1. Bottom

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

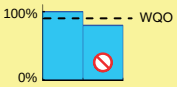
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

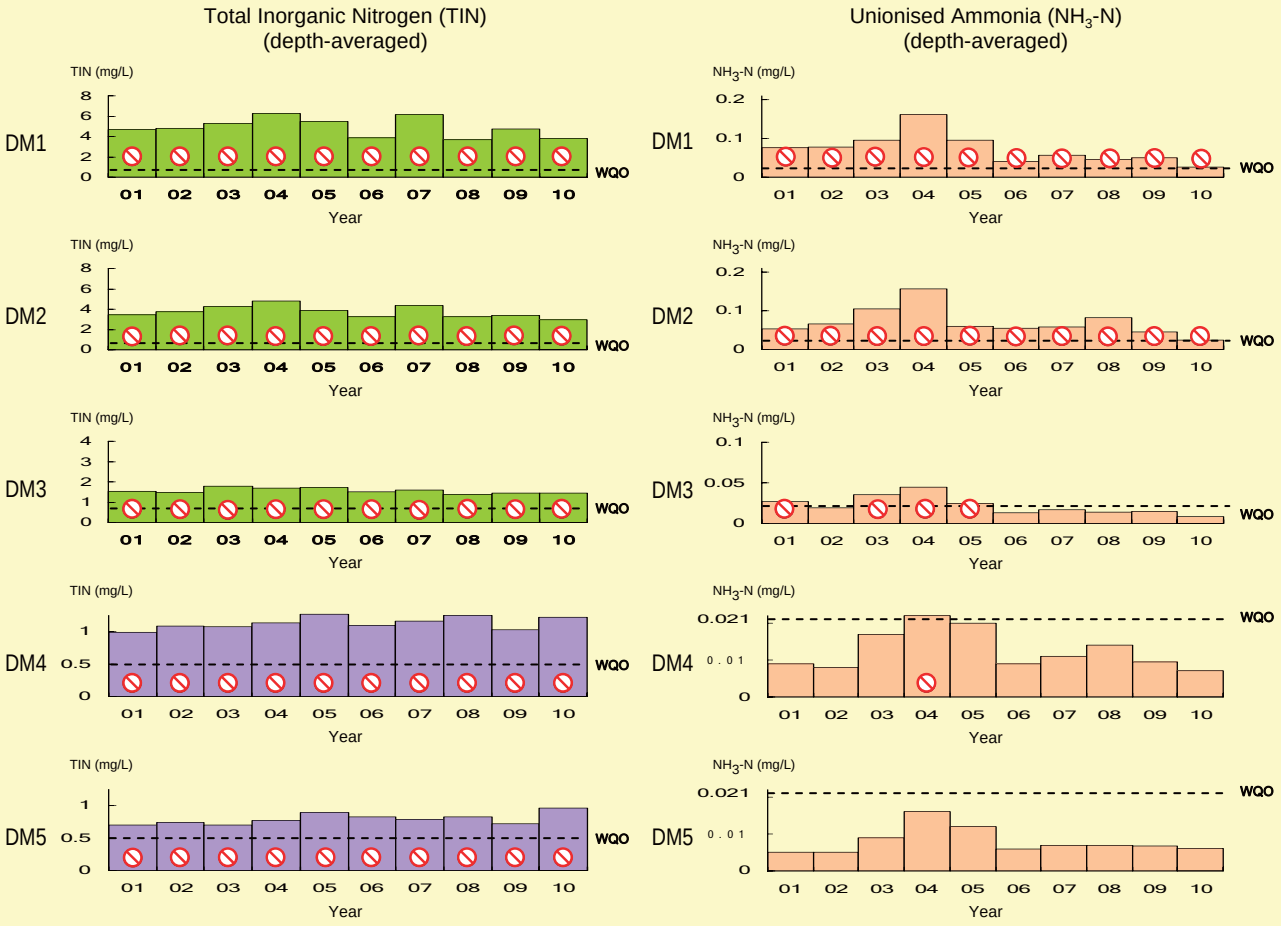
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

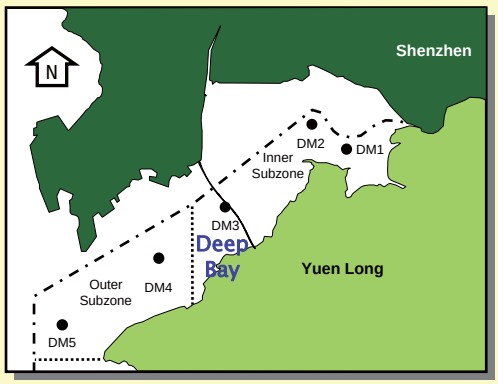
% sample with depth-averaged DO ≥ 4 mg/L



Non-compliance

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



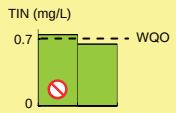


Total Inorganic Nitrogen (TIN)

Inner Subzone (DM1 - DM3)

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

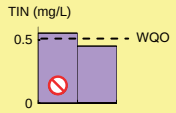
annual mean for depth-averaged TIN



Outer Subzone (DM4 - DM5)

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

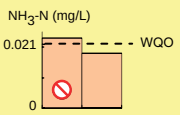
annual mean for depth-averaged TIN



Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

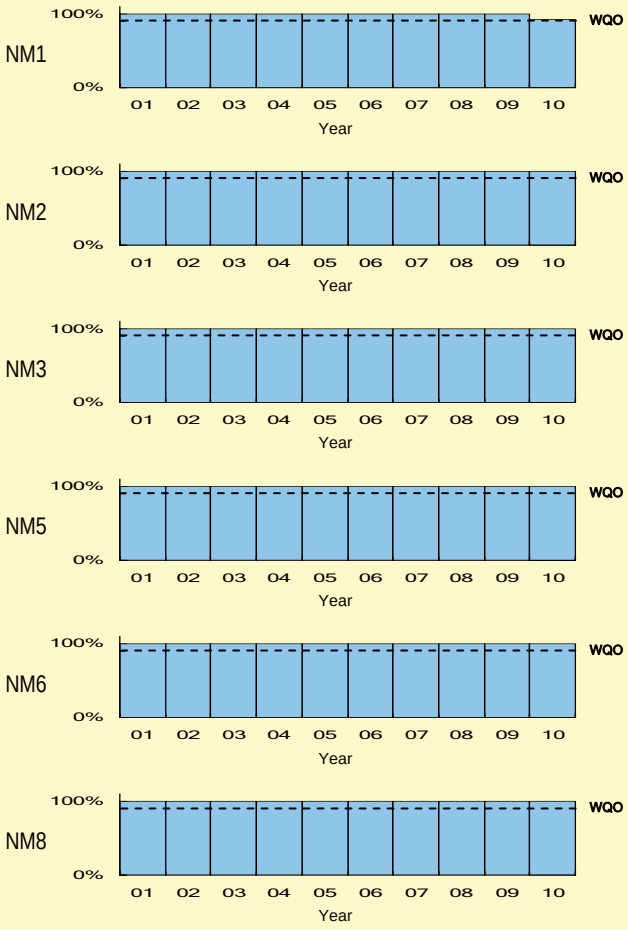
annual mean for depth-averaged NH_3-N



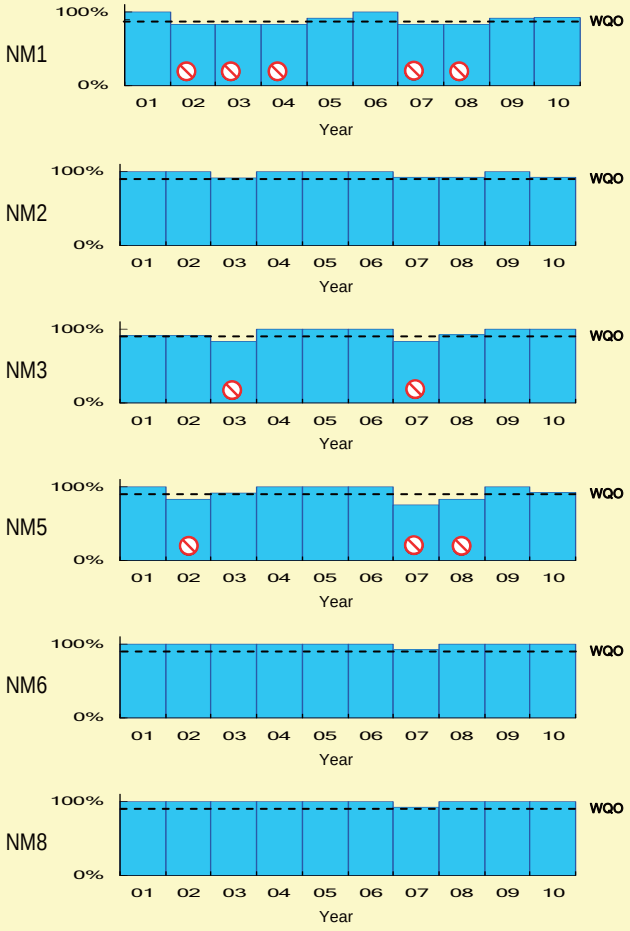
Non-compliance

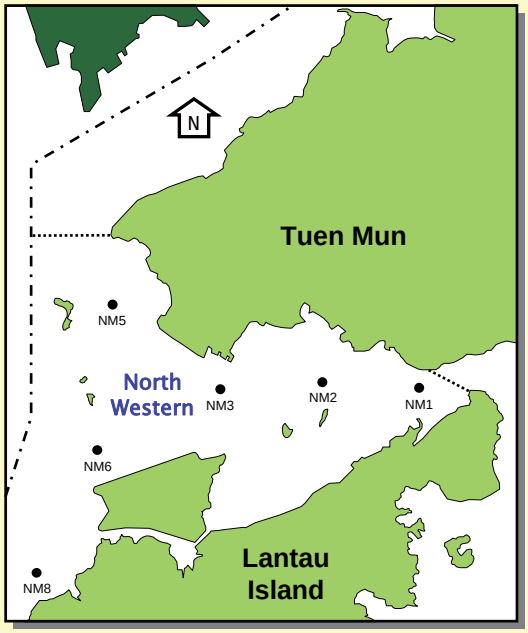
Levels of compliance with key Water Quality Objectives in the North Western WCZ

Dissolved Oxygen (DO) (bottom)



Dissolved Oxygen (DO) (depth-averaged)



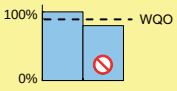


Dissolved Oxygen (DO)

1. Bottom

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

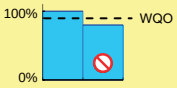
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

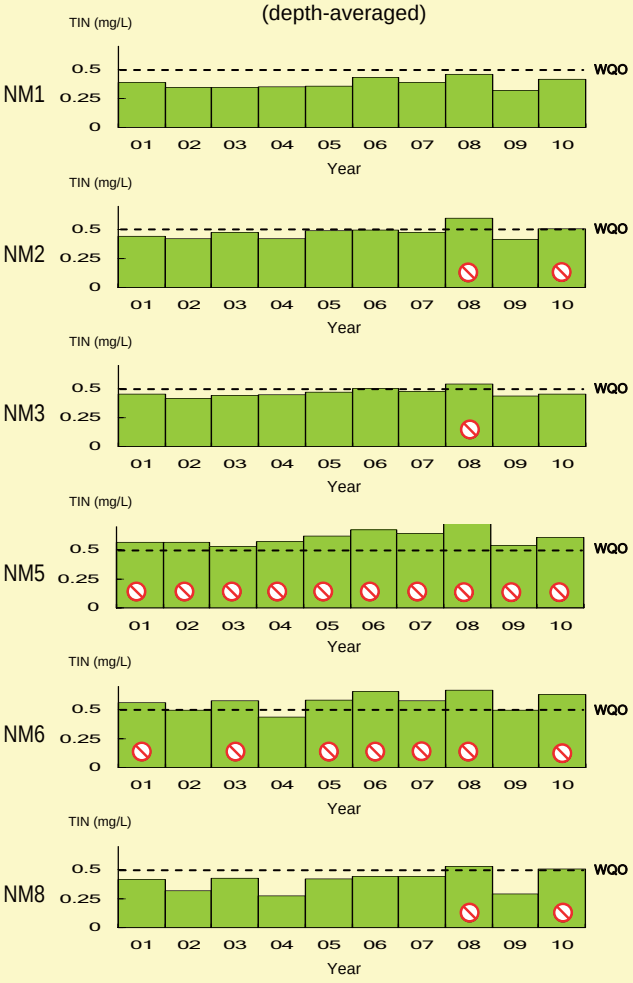
% sample with depth-averaged DO ≥ 4 mg/L



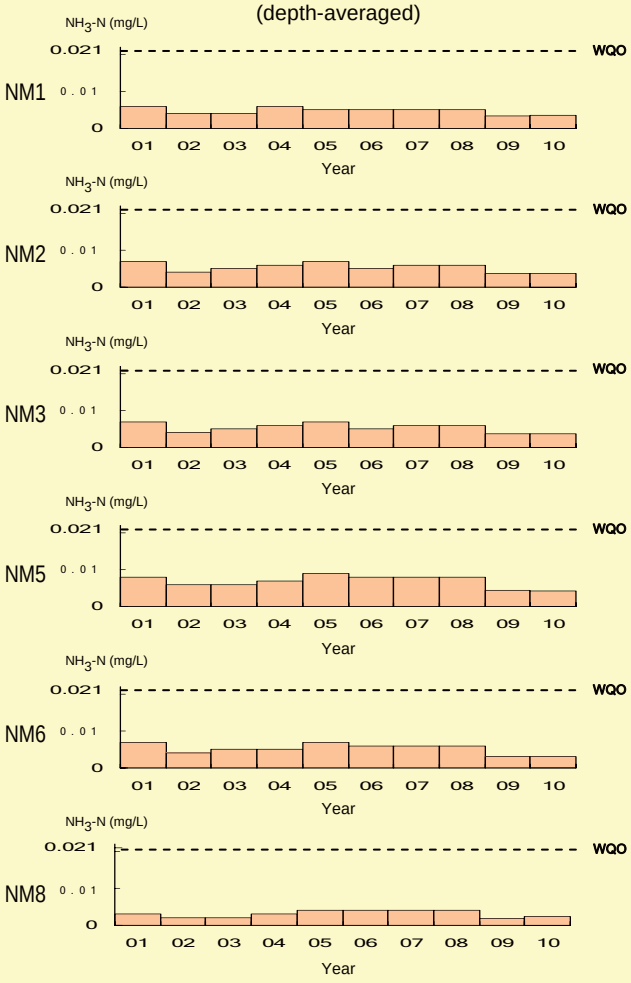
Non-compliance

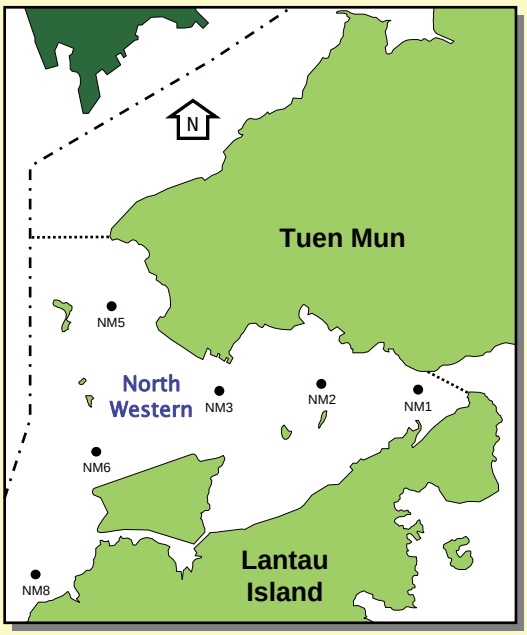
Levels of compliance with key Water Quality Objectives in the North Western WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)



Unionised Ammonia (NH_3-N) (depth-averaged)





Total Inorganic Nitrogen (TIN)

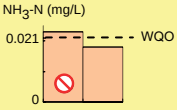
WQO : annual mean for depth-averaged TIN ≤ 0.5 mg/L

annual mean for depth-averaged TIN

Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

annual mean for depth-averaged NH_3-N



Non-compliance

Results of the Seasonal Kendall Test for water quality trends in the Mirs Bay WCZ, 1991 – 2010

Monitoring Station		MM1	MM2	MM3	MM4	MM5	MM6	MM7
Monitoring Period		1991 I 2010	1991 I 2010	1991 I 2010	1991 I 2010	1991 I 2010	1991 I 2010	1991 I 2010
Parameter	Water Depth							
Temperature (℃)	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	↘	-	-	-	-	↘	-
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-*a* (μg/L)	Surface	-	↗	↗	↗	↗	-	↗
	Middle	↗	↗	↗	↗	↗	↗	↗
	Bottom	↗	↗	-	-	-	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗
E. coli (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 – 2010 (continued)

Monitoring Station		MM8	MM13	MM14	MM15	MM16	MM17	MM19
Monitoring Period		1991 – 2010	1991 – 2010	1994 – 2010	1994 – 2010	1994 – 2010	1986 – 2010	2001 – 2010
Parameter	Water Depth							
Temperature (℃)	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	↘	-	-	-	-	-	-
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-*a* (μg/L)	Surface	↗	↗	-	-	-	↗	-
	Middle	↗	-	-	-	-	↗	-
	Bottom	↗	-	-	-	-	↗	-
	Average	↗	↗	-	-	-	↗	-
E. coli (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 – 2010

Monitoring Station		PM1	PM2	PM3	PM4	PM6	PM7	PM8	PM9	PM11
Monitoring Period		1986 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1993 – 2010
Parameter	Water Depth									
Temperature (℃)	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	-	-	-	-	↘	-	-	-	-
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-*a* (μg/L)	Surface	↗	-	↗	↗	-	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	-	↗	↗	↗	-
	Bottom	↗	↗	↗	↗	-	↗	↗	↗	-
	Average	↗	-	↗	↗	-	↗	↗	↗	-
E. coli (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 Habour and Channel WCZ, 1986 – 2010

Monitoring Station		TM2	TM3	TM4	TM5	TM6	TM7	TM8
Monitoring Period		1986 I 2010	1986 I 2010	1986 I 2010	1988 I 2010	1986 I 2010	1988 I 2010	1986 I 2010
Parameter	Water Depth							
Temperature (℃)	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	↘	↘	↘	↘	↘	↘	-
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-*a* (μg/L)	Surface	↘	-	↘	-	↘	-	-
	Middle	NA	-	-	NA	-	-	-
	Bottom	-	-	-	-	-	↗	↗
	Average	↘	-	↘	-	-	-	-
E. coli (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 – 2010

Monitoring Station		SM1	SM2	SM3	SM4	SM5	SM6	SM7	SM9
Monitoring Period		1986 I 2010	1986 I 2010	1986 I 2010	1986 I 2010	1986 I 2010	1986 I 2010	1986 I 2010	1988 I 2010
Parameter	Water Depth								
Temperature (℃)	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	-	-	-	-	-	-	-	↗
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-*a* (μg/L)	Surface	-	-	↗	-	-	-	↗	↗
	Middle	-	-	-	-	-	-	↗	↗
	Bottom	-	-	-	-	-	-	↗	↗
	Average	-	-	-	-	-	-	↗	↗
E. coli (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 – 2010 (continued)

Monitoring Station		SM10	SM11	SM12	SM13	SM17	SM18	SM19	SM20
Monitoring Period		1986 I 2010	1986 I 2010	1986 I 2010	1986 I 2010	1989 I 2010	1989 I 2010	1989 I 2010	1999 I 2010
Parameter	Water Depth								
Temperature (℃)	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	-	↗	-	-	-	-	-	-
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-*a* (μg/L)	Surface	↗	↗	↗	↗	↗	-	↗	-
	Middle	NA	-	↗	↗	-	-	-	-
	Bottom	↗	-	-	-	↗	-	-	-
	Average	↗	-	↗	↗	-	-	-	-
E. coli (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 – 2010

Monitoring Station		VM1	VM2	VM4	VM5	VM6
Monitoring Period		1988 I 2010	1988 I 2010	1988 I 2010	1986 I 2010	1988 I 2010
Parameter	Water Depth					
Temperature (℃)	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	↘	↘	↘	↘	↘
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-*a* (μg/L)	Surface	-	↗	↗	-	-
	Middle	-	↗	↗	↗	↗
	Bottom	-	↗	↗	↗	-
	Average	-	↗	↗	↗	↗
E. coli (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 – 2010 (continued)

Monitoring Station		VM7	VM8	VM12	VM14	VM15
Monitoring Period		1986 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1993 – 2010
Parameter	Water Depth					
Temperature (℃)	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	↘	↗	↘	↘	↘
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-*a* (μg/L)	Surface	-	-	-	↗	↗
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	↗
	Average	-	-	-	↗	↗
E. coli (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 – 2010

Monitoring Station		EM1	EM2	EM3
Monitoring Period		1986 I 2010	1986 I 2010	1988 I 2010
Parameter	Water Depth			
Temperature (℃)	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	↘	↘	↘
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-*a* (μg/L)	Surface	-	-	-
	Middle	-	-	-
	Bottom	-	-	-
	Average	-	-	-
E. coli (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 – 2010

Monitoring Station		WM1	WM2	WM3	WM4
Monitoring Period		1988 I 2010	1988 I 2010	1986 I 2010	1986 I 2010
Parameter	Water Depth				
Temperature (℃)	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	-	↗	-	-
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-*a* (μg/L)	Surface	↗	↗	↗	↗
	Middle	-	↗	↗	↗
	Bottom	↗	↗	↗	↗
	Average	↗	↗	↗	↗
E. coli (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 – 2010

Monitoring Station		JM3	JM4
Monitoring Period		1986 I 2010	1986 I 2010
Parameter	Water Depth		
Temperature (℃)	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	↘	↘
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-*a* (μg/L)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
E. coli (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 – 2010

Monitoring Station		DM1	DM2	DM3	DM4	DM5
Monitoring Period		1986 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1991 – 2010
Parameter	Water Depth					
Temperature (℃)	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	↗	↗	↗	↗	↗
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-*a* (μg/L)	Surface	-	↗	-	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	-	↗	-	-	↗
E. coli (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 – 2010

Monitoring Station		NM1	NM2	NM3	NM5	NM6	NM8
Monitoring Period		1988 – 2010	1986 – 2010	1986 – 2010	1988 – 2010	1991 – 2010	1999 – 2010
Parameter	Water Depth						
Temperature (℃)	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	↗	↗	↗	↗	-	-
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-*a* (μg/L)	Surface	-	-	↗	↗	↗	-
	Middle	-	-	↗	↗	↗	-
	Bottom	-	-	↗	↗	↗	-
	Average	-	-	↗	↗	↗	↗
E. coli (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, 2006 - 2010

	Tolo Harbour and Channel				Hong Kong Island (South)		West Lamma Channel	
	Harbour Subzone		Buffer Subzone	Channel Subzone				
Parameter	TS2	TS3	TS4	TS5	SS1	SS2	SS3	SS4
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63 μm (%w/w)	73 (58 - 88)	82 (65 - 98)	65 (53 - 80)	89 (80 - 97)	72 (59 - 93)	80 (62 - 94)	76 (66 - 92)	84 (68 - 98)
Electrochemical Potential (mV)	-302 ((-354) - (-241))	-304 ((-352) - (-258))	-308 ((-359) - (-231))	-334 ((-380) - (-262))	-152 ((-263) - (-91))	-162 ((-279) - (-88))	-165 ((-265) - (-64))	-153 ((-246) - (-68))
Total Solids (%w/w)	36 (32 - 40)	34 (29 - 43)	39 (30 - 61)	31 (28 - 37)	58 (47 - 63)	49 (45 - 60)	52 (45 - 54)	47 (42 - 55)
Total Volatile Soilds (%w/w)	9.0 (7.7 - 10.0)	9.1 (7.2 - 11.0)	8.5 (4.7 - 11.0)	9.9 (8.4 - 12.0)	5.6 (4.9 - 7.0)	6.6 (5.4 - 8.6)	6.7 (5.8 - 8.5)	6.4 (4.9 - 9.3)
Chemical Oxygen Demand (mg/kg)	22000 (17000 - 27000)	22000 (19000 - 25000)	19000 (14000 - 22000)	19000 (15000 - 24000)	10000 (8900 - 12000)	12000 (10000 - 14000)	16000 (14000 - 18000)	15000 (14000 - 16000)
Total Carbon (%w/w)	0.9 (0.7 - 1.1)	0.7 (0.6 - 0.8)	1.0 (0.8 - 1.3)	0.8 (0.7 - 0.9)	0.9 (0.7 - 1.0)	0.7 (0.6 - 0.9)	0.9 (0.7 - 1.1)	0.7 (0.5 - 1.3)
Ammonical Nitrogen (mg/kg)	7.30 (1.00 - 13.00)	3.50 (<0.05 - 7.20)	8.70 (3.20 - 15.00)	12.00 (7.60 - 21.00)	6.30 (2.20 - 15.00)	4.60 (0.05 - 6.80)	4.70 (0.75 - 11.00)	3.10 (0.97 - 6.50)
Total Kjeldahl Nitrogen (mg/kg)	570 (420 - 700)	530 (350 - 630)	620 (400 - 810)	740 (590 - 870)	370 (210 - 440)	450 (290 - 600)	380 (320 - 430)	430 (260 - 710)
Total Phosphorus (mg/kg)	170 (140 - 200)	160 (140 - 180)	170 (130 - 190)	200 (160 - 230)	210 (110 - 290)	220 (160 - 290)	210 (170 - 230)	200 (150 - 290)
Total Sulphide (mg/kg)	80 (8 - 220)	81 (10 - 240)	86 (11 - 220)	64 (21 - 140)	10 (5 - 22)	26 (1 - 86)	10 (3 - 34)	20 (2 - 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)	8.5 (5.9 - 10.0)	9.2 (7.4 - 11.0)	7.3 (5.7 - 8.0)	5.9 (5.3 - 6.6)	6.7 (6.2 - 7.9)	8.4 (7.8 - 9.5)	6.9 (5.8 - 7.9)	7.6 (6.1 - 8.9)
Cadmium (mg/kg)	0.6 (0.2 - 0.8)	0.6 (0.3 - 0.7)	0.4 (0.2 - 0.6)	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)	25 (19 - 29)	23 (20 - 27)	24 (19 - 33)	33 (31 - 36)	24 (20 - 28)	32 (27 - 38)	30 (25 - 37)	36 (30 - 47)
Copper (mg/kg)	35 (15 - 50)	38 (24 - 59)	23 (15 - 36)	21 (17 - 25)	10 (7 - 13)	20 (17 - 23)	17 (14 - 20)	29 (18 - 38)
Lead (mg/kg)	81 (66 - 96)	92 (77 - 100)	62 (47 - 79)	50 (46 - 57)	26 (22 - 31)	35 (30 - 41)	33 (28 - 38)	39 (32 - 44)
Mercury (mg/kg)	0.08 (0.05 - 0.12)	0.07 (0.05 - 0.11)	0.06 (0.05 - 0.10)	0.06 (0.05 - 0.09)	0.05 (0.05 - 0.06)	0.09 (0.07 - 0.13)	0.09 (0.07 - 0.15)	0.12 (0.08 - 0.20)
Nickel (mg/kg)	16 (12 - 22)	15 (12 - 20)	16 (11 - 24)	25 (19 - 31)	17 (14 - 21)	22 (19 - 26)	21 (17 - 25)	22 (19 - 26)
Silver (mg/kg)	0.4 (0.2 - 0.6)	0.5 (0.3 - 0.7)	0.2 (0.2 - 0.3)	<0.2 (0.2 - <0.2)	<0.2 (0.2 - <0.2)	0.2 (0.2 - 0.3)	<0.2 (0.2 - <0.2)	0.4 (0.2 - 0.4)
Zinc (mg/kg)	230 (130 - 320)	250 (140 - 370)	150 (82 - 200)	130 (110 - 150)	68 (55 - 81)	98 (77 - 110)	86 (68 - 100)	110 (88 - 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 Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4]	90 (90 - 90)	90 (90 - 94)	91 (90 - 98)	90 (90 - 90)	90 (90 - 95)	90 (90 - 95)	93 (90 - 110)	92 (90 - 110)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	45 (24 - 58)	49 (26 - 85)	39 (24 - 65)	53 (28 - 72)	43 (25 - 85)	76 (34 - 210)	55 (22 - 120)	95 (40 - 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, Flourene, 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, 2006 – 2010

	Lantau Island		Junk Bay	Inner Deep Bay		Outer Deep Bay	
Parameter	(East) SS5	(South) SS6	JS2	DS1	DS2	DS3	DS4
Number of samples	10	10	10	10	10	10	10
Particle Size Fractionation <63 μm (%w/w)	93 (85 - 99)	66 (51 - 87)	85 (68 - 96)	63 (18 - 94)	63 (17 - 82)	81 (47 - 95)	62 (39 - 80)
Electrochemical Potential (mV)	-186 ((-258) - (-110))	-133 ((-270) - (-62))	-171 ((-265) - (-115))	-230 ((-298) - (-143))	-198 ((-267) - (-108))	-194 ((-350) - (-88))	-179 ((-334) - (-104))
Total Solids (%w/w)	39 (37 - 40)	63 (55 - 66)	44 (40 - 51)	51 (37 - 59)	48 (41 - 53)	48 (42 - 67)	57 (50 - 67)
Total Volatile Soilds (%w/w)	7.7 (6.8 - 9.9)	3.9 (3.2 - 4.6)	6.6 (5.6 - 9.5)	6.0 (4.3 - 8.8)	6.4 (5.0 - 8.5)	6.7 (3.2 - 9.8)	5.6 (4.0 - 8.1)
Chemical Oxygen Demand (mg/kg)	14000 (13000 - 16000)	8600 (7200 - 11000)	16000 (13000 - 19000)	22000 (16000 - 29000)	19000 (16000 - 22000)	14000 (9900 - 17000)	14000 (10000 - 17000)
Total Carbon (%w/w)	0.6 (0.5 - 0.6)	0.5 (0.4 - 0.6)	0.7 (0.6 - 0.8)	0.7 (0.6 - 1.2)	0.8 (0.6 - 1.3)	0.5 (0.4 - 0.7)	0.6 (0.4 - 0.9)
Ammonical Nitrogen (mg/kg)	8.50 (0.05 - 15.00)	5.20 (1.20 - 10.00)	4.00 (0.22 - 8.60)	110.00 (28.00 - 600.00)	11.00 (0.13 - 42.00)	1.50 (<0.05 - 4.50)	6.00 (0.06 - 15.00)
Total Kjeldahl Nitrogen (mg/kg)	480 (300 - 580)	310 (190 - 500)	460 (320 - 550)	570 (320 - 1700)	460 (260 - 700)	300 (160 - 450)	270 (100 - 490)
Total Phosphorus (mg/kg)	190 (130 - 220)	190 (130 - 240)	190 (150 - 210)	310 (210 - 530)	290 (120 - 490)	190 (100 - 280)	160 (70 - 220)
Total Sulphide (mg/kg)	39 (2 - 150)	3 (1 - 13)	31 (2 - 160)	340 (1 - 960)	160 (1 - 570)	31 (0 - 120)	20 (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 (0.1 - 0.5)	0.2 (0.1 - 0.4)	0.2 (0.1 - 0.3)	0.1 (0.1 - 0.2)
Arsenic (mg/kg)	7.5 (6.6 - 8.3)	5.4 (4.4 - 6.0)	7.5 (6.7 - 8.5)	9.8 (7.1 - 13.0)	11.0 (8.6 - 13.0)	12.0 (5.5 - 15.0)	12.0 (8.8 - 15.0)
Cadmium (mg/kg)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	0.1 (0.1 - 0.2)	0.4 (0.2 - 0.7)	0.4 (0.2 - 0.6)	0.2 (0.1 - 0.3)	<0.1 (0.1 - <0.1)
Chromium (mg/kg)	42 (38 - 45)	21 (17 - 23)	45 (39 - 49)	46 (35 - 66)	45 (28 - 79)	41 (22 - 53)	33 (16 - 49)
Copper (mg/kg)	37 (33 - 42)	10 (8 - 13)	89 (73 - 100)	84 (47 - 210)	65 (29 - 100)	73 (27 - 230)	27 (9 - 65)
Lead (mg/kg)	51 (42 - 56)	23 (20 - 28)	50 (41 - 54)	55 (42 - 84)	51 (32 - 84)	48 (32 - 61)	41 (27 - 58)
Mercury (mg/kg)	0.16 (0.14 - 0.20)	0.07 (0.05 - 0.18)	0.25 (0.17 - 0.41)	0.19 (0.08 - 0.40)	0.16 (0.12 - 0.26)	0.12 (0.05 - 0.16)	0.07 (0.05 - 0.14)
Nickel (mg/kg)	27 (24 - 32)	13 (11 - 17)	24 (19 - 31)	39 (19 - 140)	27 (17 - 37)	27 (12 - 35)	20 (15 - 29)
Silver (mg/kg)	0.5 (0.4 - 0.6)	<0.2 (0.2 - <0.2)	1.9 (1.6 - 2.1)	1.0 (0.4 - 2.9)	0.7 (0.3 - 1.6)	0.4 (0.2 - 0.7)	0.3 (0.2 - 0.4)
Zinc (mg/kg)	140 (120 - 160)	57 (44 - 73)	140 (110 - 160)	260 (150 - 560)	210 (100 - 420)	140 (65 - 200)	95 (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 Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4]	91 (90 - 94)	90 (90 - 90)	98 (90 - 110)	200 (90 - 540)	96 (90 - 120)	93 (90 - 99)	91 (90 - 95)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	78 (63 - 100)	23 (20 - 29)	260 (90 - 430)	800 (73 - 4100)	160 (81 - 360)	97 (34 - 280)	45 (16 - 71)

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, Flourene, 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, 2006 – 2010

Parameter	Inner Port Shelter	Outer Port Shelter		Starling Inlet	Crooked Island		Port Island	Mirs Bay (North)
	PS3	PS5	PS6	MS1	MS2	MS7	MS17	MS3
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63 μm (%w/w)	87 (58 - 96)	62 (24 - 92)	79 (66 - 91)	85 (64 - 93)	85 (21 - 99)	91 (83 - 99)	89 (77 - 95)	87 (78 - 96)
Electrochemical Potential (mV)	-202 ((-294) - (-39))	-127 ((-240) - (-21))	-144 ((-252) - (-65))	-254 ((-346) - (-121))	-287 ((-368) - (-109))	-337 ((-368) - (-306))	-221 ((-295) - (-63))	-217 ((-327) - (-113))
Total Solids (%w/w)	37 (33 - 41)	52 (38 - 63)	51 (46 - 55)	41 (36 - 45)	32 (31 - 34)	30 (27 - 35)	35 (33 - 39)	45 (38 - 58)
Total Volatile Soilds (%w/w)	11.0 (8.5 - 14.0)	7.8 (4.7 - 10.0)	7.9 (6.4 - 11.0)	7.5 (6.4 - 11.0)	9.1 (7.5 - 15.0)	10.0 (8.9 - 15.0)	9.3 (7.8 - 15.0)	7.6 (4.0 - 12.0)
Chemical Oxygen Demand (mg/kg)	18000 (14000 - 20000)	12000 (9900 - 14000)	13000 (11000 - 15000)	17000 (14000 - 23000)	16000 (13000 - 20000)	17000 (16000 - 20000)	16000 (15000 - 19000)	14000 (9900 - 19000)
Total Carbon (%w/w)	1.2 (1.0 - 1.4)	1.9 (0.9 - 3.7)	1.3 (1.1 - 1.5)	0.7 (0.6 - 0.8)	0.6 (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)	5.10 (0.10 - 11.00)	6.40 (1.30 - 11.00)	6.40 (2.40 - 9.10)	6.80 (0.13 - 15.00)	11.00 (0.07 - 20.00)	9.60 (4.80 - 14.00)	5.20 (0.23 - 10.00)	4.80 (0.05 - 10.00)
Total Kjeldahl Nitrogen (mg/kg)	540 (280 - 680)	400 (210 - 680)	430 (210 - 580)	420 (290 - 510)	580 (460 - 670)	600 (340 - 730)	640 (590 - 720)	430 (290 - 510)
Total Phosphorus (mg/kg)	170 (87 - 210)	160 (83 - 210)	180 (89 - 230)	150 (95 - 180)	180 (150 - 190)	180 (140 - 210)	200 (180 - 220)	150 (110 - 170)
Total Sulphide (mg/kg)	16 (4 - 41)	6 (1 - 14)	7 (1 - 24)	53 (11 - 130)	49 (8 - 160)	23 (2 - 96)	20 (1 - 84)	13 (2 - 25)
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)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)
Arsenic (mg/kg)	5.8 (4.8 - 6.3)	4.1 (0.2 - 5.6)	5.8 (5.2 - 6.5)	8.2 (6.9 - 9.2)	6.8 (5.7 - 7.9)	6.6 (5.8 - 7.6)	6.4 (5.6 - 7.3)	6.3 (5.0 - 7.3)
Cadmium (mg/kg)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	0.3 (0.2 - 0.5)	0.3 (0.1 - 0.3)	0.2 (0.1 - 0.5)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)
Chromium (mg/kg)	27 (20 - 34)	22 (13 - 31)	25 (21 - 30)	29 (25 - 35)	36 (33 - 39)	35 (31 - 39)	34 (29 - 38)	29 (19 - 35)
Copper (mg/kg)	21 (16 - 26)	11 (6 - 16)	11 (9 - 14)	32 (23 - 42)	21 (14 - 23)	20 (16 - 23)	17 (15 - 19)	13 (10 - 17)
Lead (mg/kg)	36 (30 - 41)	27 (15 - 38)	30 (26 - 35)	48 (41 - 56)	46 (39 - 51)	44 (38 - 51)	46 (40 - 50)	35 (24 - 42)
Mercury (mg/kg)	0.08 (0.07 - 0.11)	<0.05 (0.05 - <0.05)	<0.05 (0.05 - <0.05)	0.07 (0.06 - 0.10)	0.05 (0.05 - 0.06)	0.06 (0.06 - 0.07)	0.06 (0.05 - 0.07)	0.06 (0.05 - 0.13)
Nickel (mg/kg)	18 (15 - 23)	17 (9 - 24)	19 (15 - 24)	18 (16 - 24)	24 (21 - 27)	24 (22 - 27)	26 (21 - 30)	20 (13 - 24)
Silver (mg/kg)	0.2 (0.2 - 0.3)	<0.2 (0.2 - <0.2)	<0.2 (0.2 - <0.2)	1.1 (0.6 - 1.4)	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)	97 (73 - 130)	68 (29 - 93)	73 (53 - 90)	110 (88 - 140)	110 (92 - 120)	100 (82 - 120)	100 (87 - 120)	78 (51 - 96)
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 Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4]	90 (90 - 90)	90 (90 - 94)	90 (90 - 94)	91 (90 - 100)	90 (90 - 90)	91 (90 - 100)	90 (90 - 90)	91 (90 - 97)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	54 (24 - 82)	27 (17 - 34)	25 (20 - 40)	53 (28 - 190)	38 (25 - 51)	61 (28 - 170)	36 (29 - 44)	28 (19 - 67)

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, Flourene, 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, 2006 - 2010

Parameter	Mirs Bay (North) MS4	Mirs Bay (North) MS5	Long Harbour MS6	Waglan Island MS8	Mirs Bay (South) MS13	Mirs Bay (Central) MS14	Mirs Bay (Central) MS15	Mirs Bay (Central) MS16
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63 μm (%w/w)	88 (69 - 97)	86 (79 - 95)	92 (81 - 98)	94 (90 - 97)	93 (82 - 99)	92 (84 - 96)	90 (82 - 97)	86 (76 - 96)
Electrochemical Potential (mV)	-184 ((-267) - (-82))	-177 ((-253) - (-95))	-228 ((-300) - (-91))	-165 ((-249) - (-92))	-157 ((-208) - (-59))	-164 ((-250) - (-88))	-151 ((-260) - (-108))	-160 ((-267) - (-103))
Total Solids (%w/w)	38 (33 - 41)	42 (36 - 47)	34 (33 - 39)	47 (44 - 48)	50 (42 - 54)	50 (46 - 56)	50 (43 - 57)	55 (49 - 61)
Total Volatile Soilds (%w/w)	8.3 (6.3 - 13.0)	7.7 (6.6 - 12.0)	10.0 (9.0 - 16.0)	6.5 (5.6 - 8.9)	6.3 (5.7 - 8.4)	6.1 (4.9 - 8.7)	6.3 (5.5 - 8.8)	5.8 (4.7 - 8.0)
Chemical Oxygen Demand (mg/kg)	15000 (12000 - 18000)	14000 (10000 - 17000)	18000 (15000 - 21000)	12000 (9800 - 18000)	11000 (8100 - 18000)	11000 (8500 - 18000)	11000 (8100 - 21000)	12000 (7900 - 27000)
Total Carbon (%w/w)	0.7 (0.6 - 0.8)	0.7 (0.6 - 0.8)	0.9 (0.7 - 1.0)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.6)	0.5 (0.5 - 0.6)	0.5 (0.5 - 0.6)	0.6 (0.6 - 0.7)
Ammonical Nitrogen (mg/kg)	6.70 (0.85 - 22.00)	4.50 (0.05 - 9.60)	7.50 (4.70 - 10.00)	2.40 (0.35 - 6.90)	1.90 (0.70 - 3.10)	1.90 (0.12 - 4.00)	2.50 (0.18 - 4.30)	3.00 (0.86 - 5.70)
Total Kjeldahl Nitrogen (mg/kg)	520 (430 - 670)	530 (390 - 650)	680 (580 - 800)	420 (270 - 480)	360 (200 - 530)	400 (200 - 510)	440 (310 - 500)	390 (240 - 540)
Total Phosphorus (mg/kg)	180 (150 - 210)	190 (160 - 210)	210 (180 - 240)	200 (150 - 240)	200 (98 - 260)	210 (130 - 250)	230 (180 - 250)	220 (170 - 260)
Total Sulphide (mg/kg)	13 (1 - 67)	11 (1 - 24)	18 (2 - 72)	6 (1 - 21)	42 (0 - 390)	4 (1 - 7)	8 (1 - 20)	6 (1 - 13)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.3)	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 - 0.2)	0.1 (0.1 - 0.2)	<0.1 (0.1 - <0.1)
Arsenic (mg/kg)	6.3 (5.5 - 6.9)	6.3 (5.4 - 6.9)	6.1 (5.4 - 6.9)	6.4 (5.4 - 7.1)	6.9 (5.7 - 8.1)	6.9 (5.7 - 8.3)	6.1 (5.2 - 6.8)	6.3 (5.3 - 7.0)
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)	35 (30 - 39)	30 (25 - 35)	33 (30 - 39)	31 (25 - 35)	31 (27 - 37)	31 (28 - 34)	28 (24 - 32)	27 (21 - 33)
Copper (mg/kg)	15 (12 - 17)	13 (10 - 15)	18 (16 - 19)	12 (8 - 16)	12 (10 - 14)	11 (9 - 13)	10 (8 - 12)	9 (7 - 12)
Lead (mg/kg)	39 (34 - 45)	40 (31 - 47)	43 (39 - 49)	33 (29 - 42)	32 (27 - 38)	32 (29 - 36)	30 (23 - 33)	31 (26 - 35)
Mercury (mg/kg)	0.05 (0.05 - 0.07)	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)	26 (21 - 32)	23 (18 - 27)	24 (21 - 27)	23 (18 - 29)	24 (20 - 27)	23 (19 - 27)	22 (17 - 28)	21 (17 - 24)
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)	93 (73 - 110)	87 (64 - 100)	110 (89 - 150)	82 (64 - 100)	82 (71 - 94)	81 (66 - 92)	73 (64 - 95)	73 (55 - 84)
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 Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4]	90 (90 - 90)	90 (90 - 90)	90 (90 - 90)	98 (90 - 160)	91 (90 - 95)	91 (90 - 97)	95 (90 - 140)	94 (90 - 120)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	34 (28 - 57)	31 (19 - 63)	55 (41 - 74)	32 (17 - 67)	32 (19 - 59)	23 (18 - 40)	25 (19 - 51)	29 (17 - 91)

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, Flourene, 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 North Western and Western Buffer WCZs, 2006 – 2010

Parameter	Pearl Island NS2	Pillar Point NS3	Urmston Road NS4	Chek Lap Kok (North) NS6	Tsing Yi (South) WS1	Hong Kong Island (West) WS2
Number of samples	10	10	10	10	10	10
Particle Size Fractionation <63 μm (%w/w)	65 (35 - 90)	72 (34 - 96)	49 (14 - 95)	51 (26 - 69)	68 (39 - 90)	82 (68 - 93)
Electrochemical Potential (mV)	-172 ((-338) - (-57))	-189 ((-340) - (-42))	-220 ((-403) - (-133))	-172 ((-320) - (-57))	-190 ((-245) - (-88))	-150 ((-233) - (-58))
Total Solids (%w/w)	53 (45 - 59)	53 (43 - 70)	59 (44 - 68)	63 (52 - 71)	49 (43 - 63)	46 (43 - 49)
Total Volatile Soilds (%w/w)	6.2 (5.6 - 7.5)	6.2 (3.1 - 7.5)	5.3 (4.4 - 6.5)	4.2 (2.9 - 6.0)	6.2 (4.6 - 7.7)	6.2 (5.1 - 8.4)
Chemical Oxygen Demand (mg/kg)	13000 (11000 - 15000)	15000 (9700 - 23000)	14000 (11000 - 17000)	12000 (11000 - 15000)	17000 (13000 - 20000)	15000 (13000 - 21000)
Total Carbon (%w/w)	0.8 (0.5 - 1.2)	0.7 (0.5 - 1.0)	0.7 (0.5 - 0.9)	0.5 (0.3 - 0.8)	0.8 (0.6 - 1.1)	0.6 (0.5 - 0.7)
Ammonical Nitrogen (mg/kg)	3.20 (0.05 - 9.30)	5.80 (0.05 - 21.00)	8.70 (0.11 - 22.00)	2.80 (0.05 - 10.00)	6.90 (0.17 - 18.00)	1.80 (0.05 - 3.60)
Total Kjeldahl Nitrogen (mg/kg)	350 (260 - 520)	340 (170 - 430)	300 (110 - 440)	240 (130 - 310)	400 (290 - 480)	380 (260 - 450)
Total Phosphorus (mg/kg)	190 (130 - 290)	190 (130 - 220)	180 (77 - 230)	130 (110 - 160)	190 (130 - 260)	170 (140 - 190)
Total Sulphide (mg/kg)	15 (1 - 38)	37 (2 - 110)	20 (2 - 54)	8 (0 - 47)	69 (7 - 150)	13 (3 - 41)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.3)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.2)	0.1 (0.1 - 0.2)
Arsenic (mg/kg)	8.5 (6.8 - 10.0)	11.0 (8.3 - 14.0)	10.0 (8.2 - 15.0)	9.2 (7.1 - 13.0)	7.7 (3.8 - 9.4)	8.8 (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 (24 - 41)	33 (20 - 44)	29 (22 - 47)	25 (16 - 35)	35 (17 - 42)	35 (32 - 40)
Copper (mg/kg)	35 (26 - 49)	31 (18 - 48)	28 (12 - 51)	15 (9 - 21)	52 (13 - 68)	25 (17 - 30)
Lead (mg/kg)	37 (31 - 45)	39 (27 - 51)	37 (31 - 53)	29 (16 - 47)	39 (24 - 47)	36 (30 - 43)
Mercury (mg/kg)	0.09 (0.08 - 0.12)	0.10 (0.06 - 0.16)	0.08 (0.06 - 0.14)	0.06 (0.05 - 0.10)	0.14 (0.06 - 0.19)	0.09 (0.05 - 0.14)
Nickel (mg/kg)	19 (15 - 23)	20 (11 - 26)	18 (13 - 27)	16 (8 - 23)	20 (9 - 24)	23 (19 - 26)
Silver (mg/kg)	0.4 (0.3 - 0.5)	0.3 (0.2 - 0.5)	0.3 (0.2 - 0.4)	<0.2 (0.2 - <0.2)	1.1 (0.2 - 1.7)	0.3 (0.2 - 0.5)
Zinc (mg/kg)	100 (88 - 120)	99 (62 - 130)	100 (78 - 130)	68 (32 - 99)	110 (53 - 140)	99 (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 Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4]	91 (90 - 94)	91 (90 - 96)	92 (90 - 100)	90 (90 - 90)	94 (90 - 100)	91 (90 - 95)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	74 (26 - 150)	62 (24 - 110)	58 (24 - 100)	24 (17 - 39)	170 (77 - 280)	62 (38 - 120)

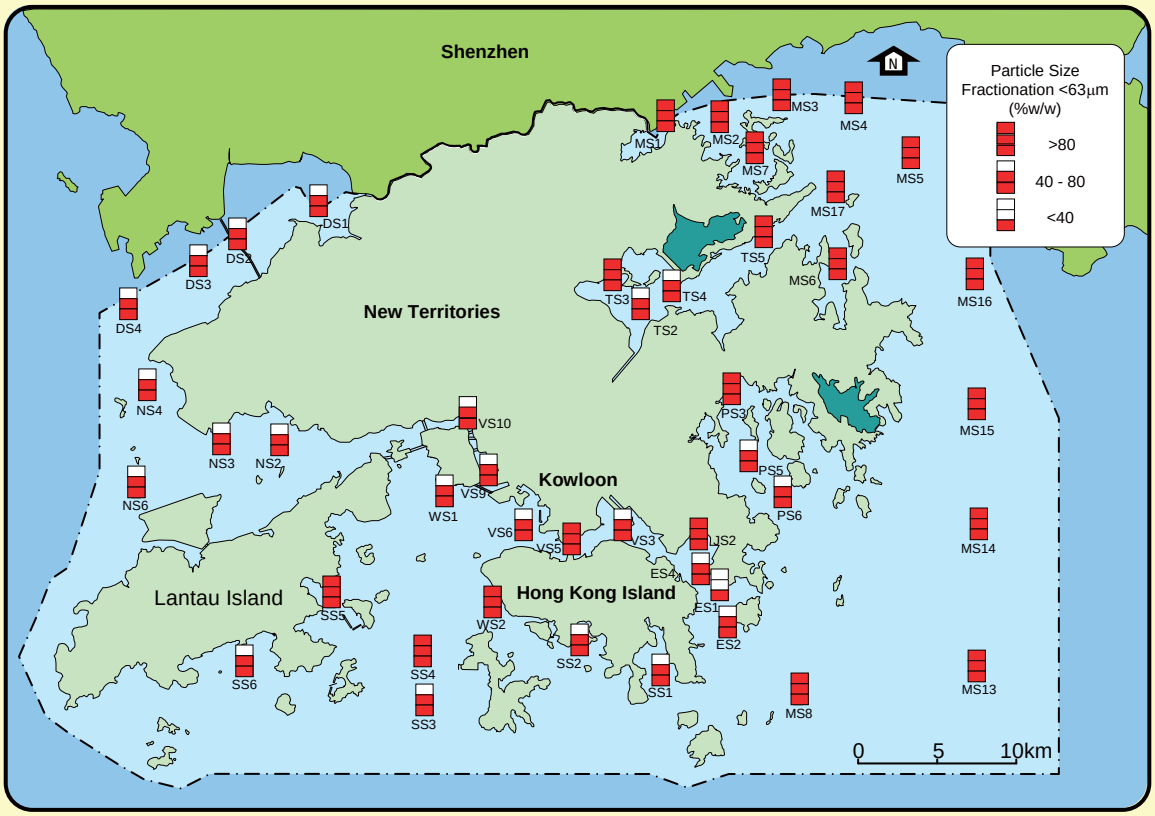
Note:
1. Data presented are arithmetic means ; data in brackets indicate ranges.
2. All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.
3. Total PCBs results are derived from the summation of 18 congeners. If the concentration 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, Flourene, 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, 2006 – 2010

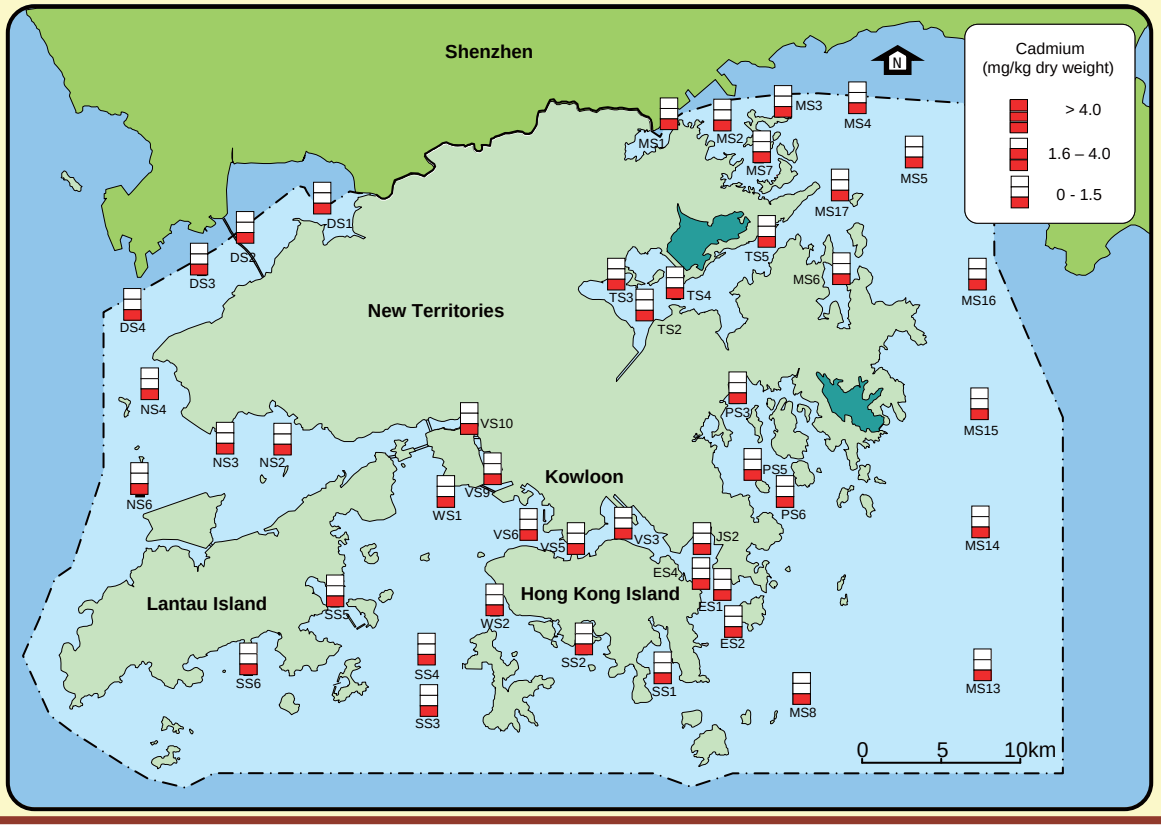
	Eastern Buffer			Victoria Harbour			Rambler Channel	
	Chai Wan	Tathong Channel		(East)	(Central)	(West)		
Parameter	ES1	ES2	ES4	VS3	VS5	VS6	VS9	VS10
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63 μm (%w/w)	46 (21 - 65)	77 (50 - 98)	55 (24 - 91)	70 (20 - 91)	82 (51 - 95)	55 (25 - 77)	74 (53 - 88)	71 (18 - 92)
Electrochemical Potential (mV)	-172 ((-230) - (-128))	-151 ((-222) - (-102))	-162 ((-198) - (-134))	-266 ((-343) - (-183))	-353 ((-386) - (-312))	-283 ((-381) - (-169))	-167 ((-224) - (-80))	-227 ((-329) - (-78))
Total Solids (%w/w)	64 (54 - 70)	55 (38 - 66)	59 (45 - 69)	45 (38 - 63)	39 (33 - 50)	53 (37 - 64)	49 (42 - 54)	45 (37 - 66)
Total Volatile Soilds (%w/w)	4.8 (4.1 - 6.6)	5.6 (3.5 - 7.9)	5.2 (3.7 - 6.5)	6.7 (4.1 - 9.6)	8.4 (6.3 - 10.0)	7.5 (4.1 - 12.0)	6.0 (5.3 - 6.9)	7.1 (4.1 - 9.4)
Chemical Oxygen Demand (mg/kg)	10000 (8700 - 13000)	11000 (6700 - 15000)	13000 (11000 - 15000)	21000 (15000 - 26000)	26000 (20000 - 30000)	22000 (16000 - 32000)	15000 (11000 - 17000)	19000 (15000 - 30000)
Total Carbon (%w/w)	1.3 (0.9 - 1.6)	0.8 (0.6 - 1.2)	0.9 (0.7 - 1.3)	0.7 (0.6 - 0.8)	0.9 (0.7 - 1.4)	1.2 (0.7 - 1.5)	0.8 (0.6 - 1.3)	0.8 (0.5 - 1.5)
Ammonical Nitrogen (mg/kg)	4.30 (2.20 - 9.30)	3.60 (0.45 - 13.00)	4.30 (0.30 - 8.50)	7.90 (0.05 - 17.00)	20.00 (7.20 - 36.00)	10.00 (2.50 - 28.00)	9.40 (0.05 - 24.00)	5.40 (0.05 - 22.00)
Total Kjeldahl Nitrogen (mg/kg)	300 (190 - 420)	370 (210 - 590)	380 (200 - 530)	570 (350 - 1200)	620 (430 - 940)	420 (170 - 560)	310 (130 - 530)	440 (300 - 650)
Total Phosphorus (mg/kg)	160 (96 - 200)	180 (140 - 220)	160 (88 - 230)	210 (130 - 430)	200 (160 - 240)	210 (110 - 260)	150 (65 - 220)	190 (140 - 250)
Total Sulphide (mg/kg)	18 (1 - 67)	10 (1 - 41)	23 (1 - 78)	64 (2 - 160)	200 (8 - 470)	140 (11 - 320)	33 (1 - 240)	67 (1 - 190)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.2)	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)	4.7 (3.6 - 6.2)	6.2 (4.4 - 8.9)	4.5 (3.4 - 6.3)	7.7 (5.3 - 11.0)	7.5 (6.5 - 8.7)	9.2 (5.5 - 16.0)	5.6 (3.0 - 8.1)	7.8 (4.6 - 9.9)
Cadmium (mg/kg)	<0.1 (0.1 - <0.1)	0.1 (0.1 - 0.2)	<0.1 (0.1 - <0.1)	0.4 (0.2 - 0.6)	0.7 (0.4 - 0.9)	0.4 (0.2 - 0.6)	0.2 (0.1 - 0.3)	0.5 (0.1 - 1.0)
Chromium (mg/kg)	21 (16 - 29)	26 (17 - 41)	26 (21 - 38)	42 (18 - 59)	55 (42 - 68)	35 (17 - 49)	36 (28 - 43)	67 (27 - 91)
Copper (mg/kg)	26 (21 - 29)	22 (9 - 54)	45 (32 - 56)	110 (40 - 170)	160 (120 - 220)	91 (55 - 120)	65 (8 - 230)	170 (65 - 240)
Lead (mg/kg)	26 (22 - 32)	29 (18 - 50)	30 (23 - 41)	55 (42 - 66)	66 (55 - 79)	83 (50 - 140)	32 (23 - 42)	62 (38 - 99)
Mercury (mg/kg)	0.10 (0.07 - 0.14)	0.08 (0.05 - 0.17)	0.16 (0.10 - 0.36)	0.41 (0.13 - 0.99)	0.48 (0.35 - 0.63)	0.58 (0.26 - 1.20)	0.12 (0.05 - 0.20)	0.21 (0.13 - 0.28)
Nickel (mg/kg)	13 (10 - 17)	18 (12 - 27)	15 (11 - 21)	19 (10 - 27)	24 (19 - 29)	17 (10 - 25)	22 (19 - 28)	29 (12 - 38)
Silver (mg/kg)	0.5 (0.4 - 0.7)	0.3 (0.2 - 0.6)	1.0 (0.8 - 1.2)	3.9 (1.3 - 6.0)	6.0 (3.6 - 9.0)	2.6 (1.1 - 4.0)	0.9 (0.2 - 1.8)	3.7 (1.3 - 5.0)
Zinc (mg/kg)	67 (59 - 79)	77 (40 - 120)	83 (72 - 110)	180 (85 - 250)	270 (190 - 300)	200 (140 - 250)	100 (71 - 140)	200 (90 - 350)
Total Polychlorinated Biphenyls (PCBs) (μg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	19 (18 - 22)	19 (18 - 23)	26 (18 - 49)	18 (18 - 18)	20 (18 - 29)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4]	100 (90 - 210)	92 (90 - 100)	100 (90 - 170)	110 (90 - 140)	130 (100 - 210)	240 (110 - 410)	93 (90 - 100)	100 (90 - 140)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	170 (45 - 840)	72 (24 - 300)	340 (62 - 1700)	500 (90 - 930)	710 (350 - 1100)	2300 (360 - 6200)	92 (18 - 200)	330 (52 - 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, Flourene, 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.

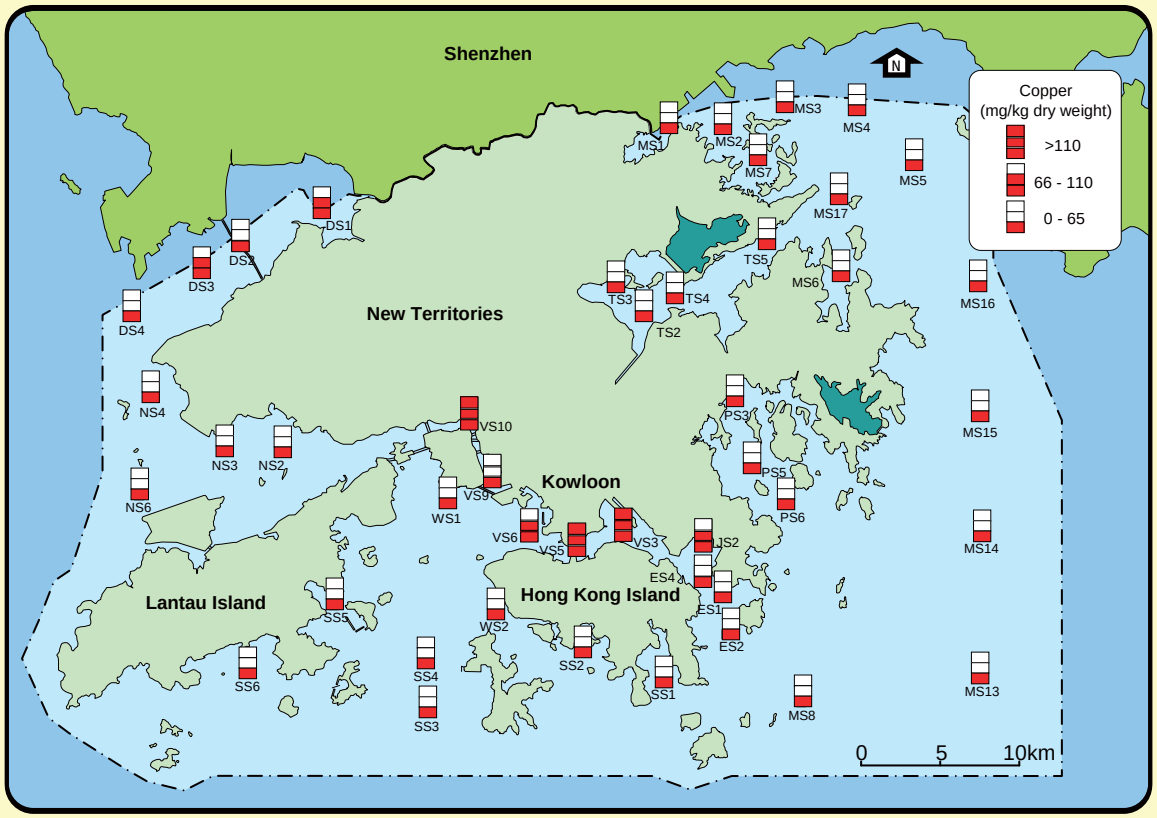
Mean particle size fractionation <63 µm levels in marine sediments in Hong Kong, 2006 – 2010



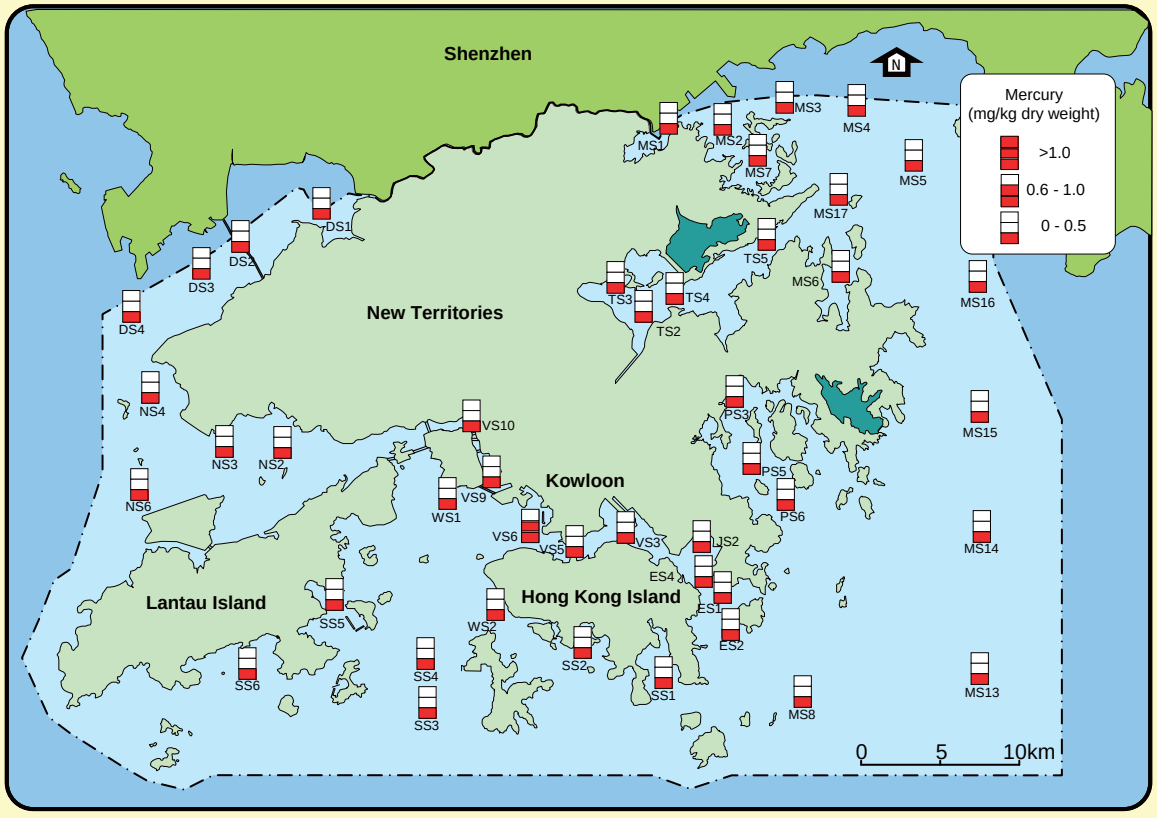
Mean cadmium levels in marine sediments in Hong Kong, 2006 – 2010



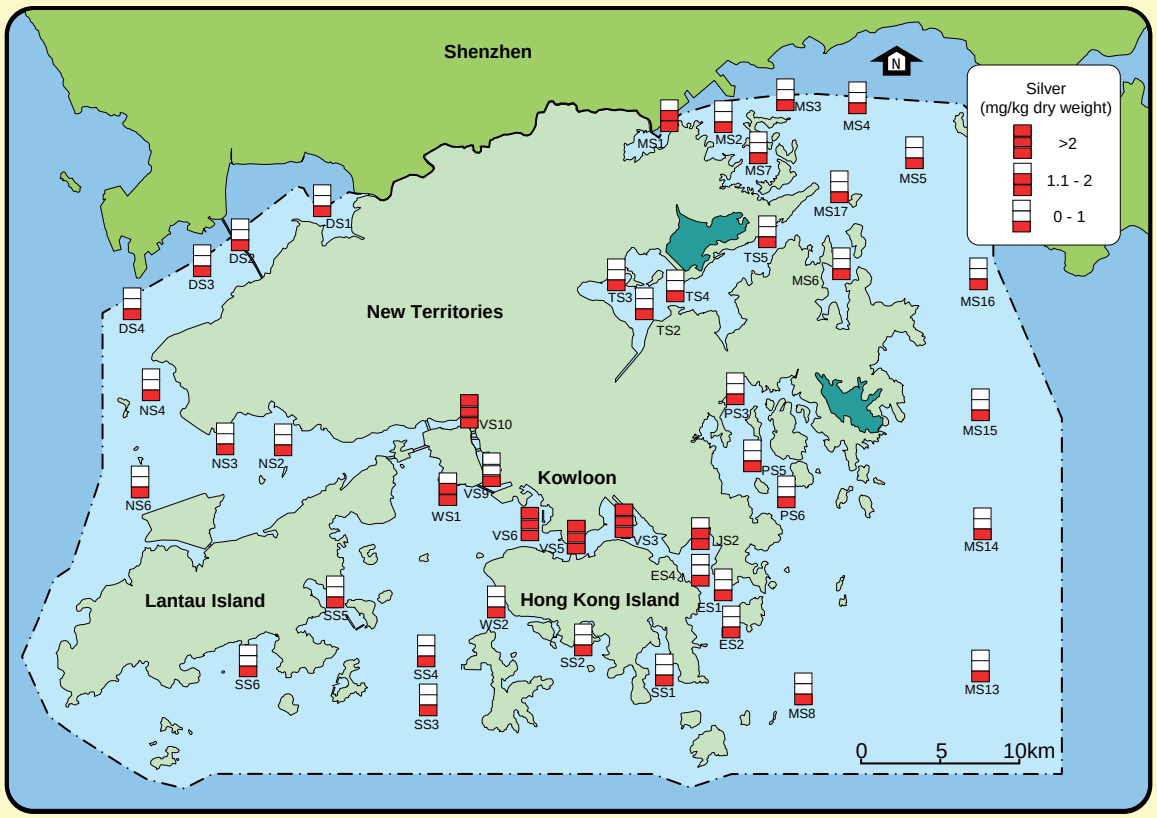
Mean copper levels in marine sediments in Hong Kong, 2006 – 2010



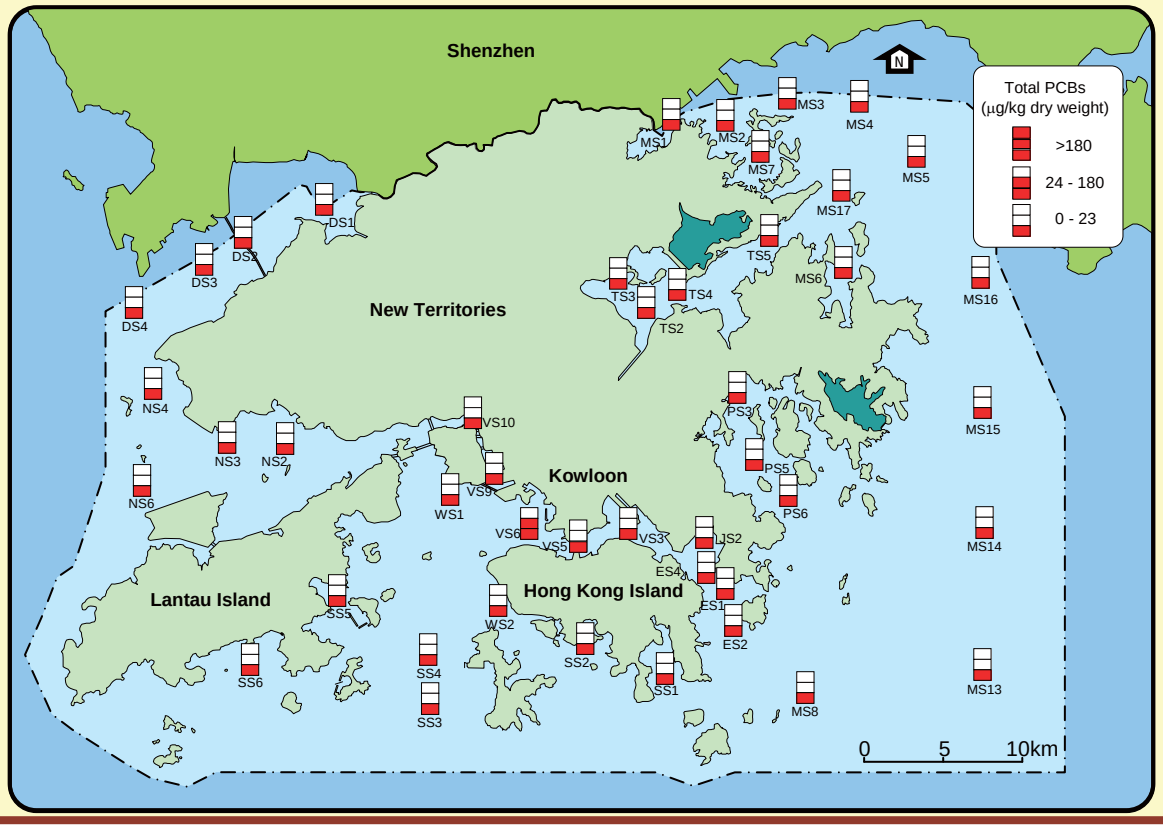
Mean mercury levels in marine sediments in Hong Kong, 2006 – 2010



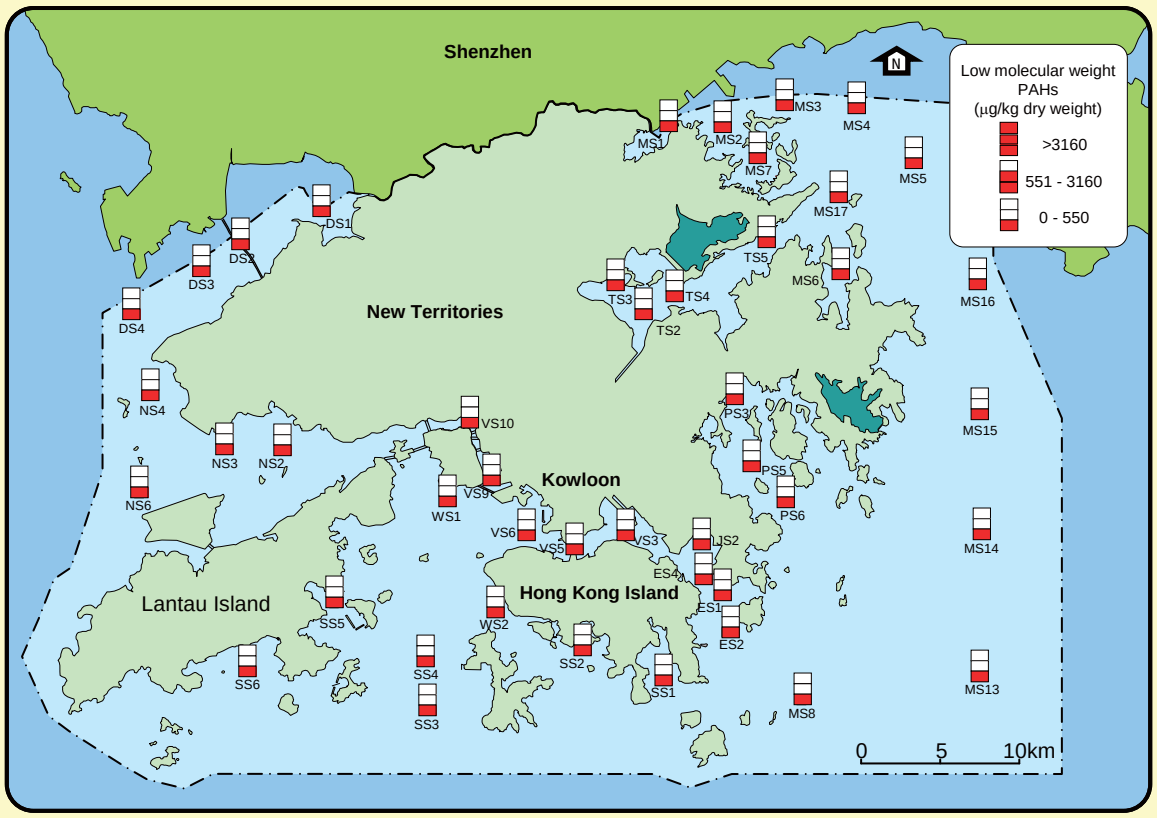
Mean silver levels in marine sediments in Hong Kong, 2006 – 2010



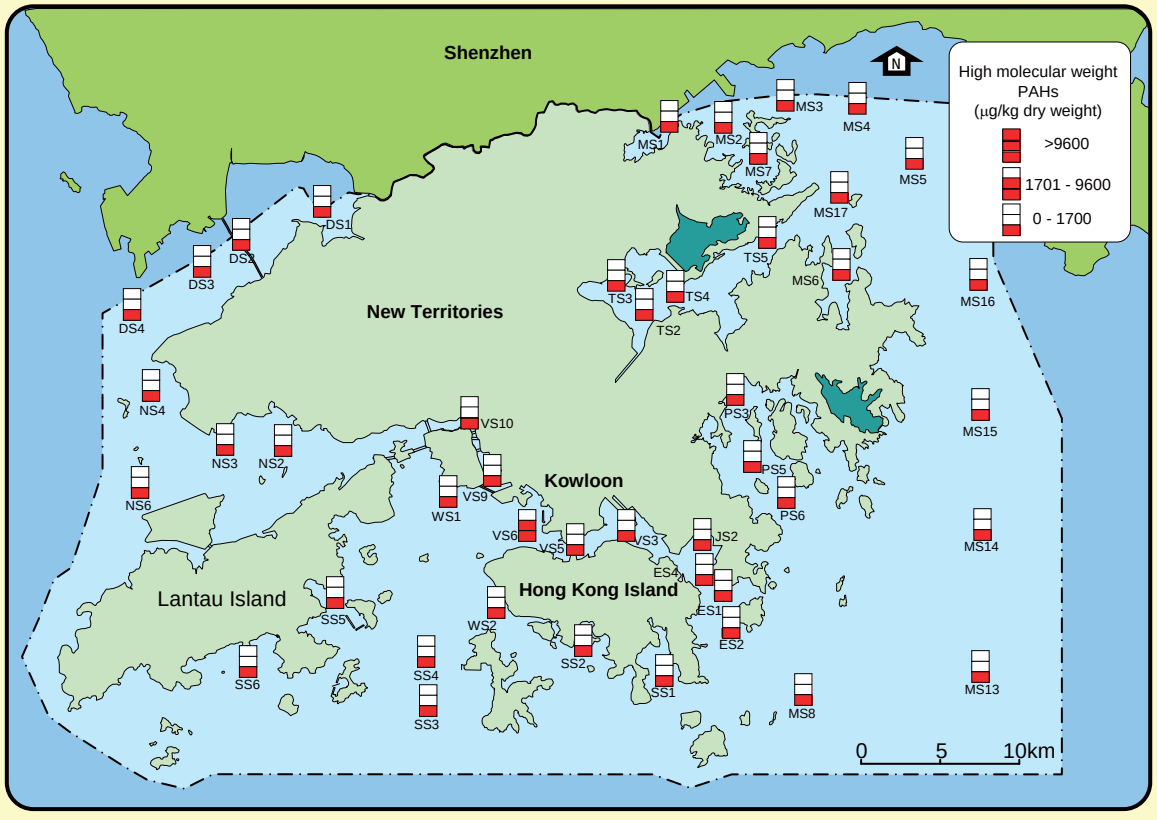
Mean total polychlorinated biphenyls (PCBs) levels in marine sediments in Hong Kong, 2006 – 2010



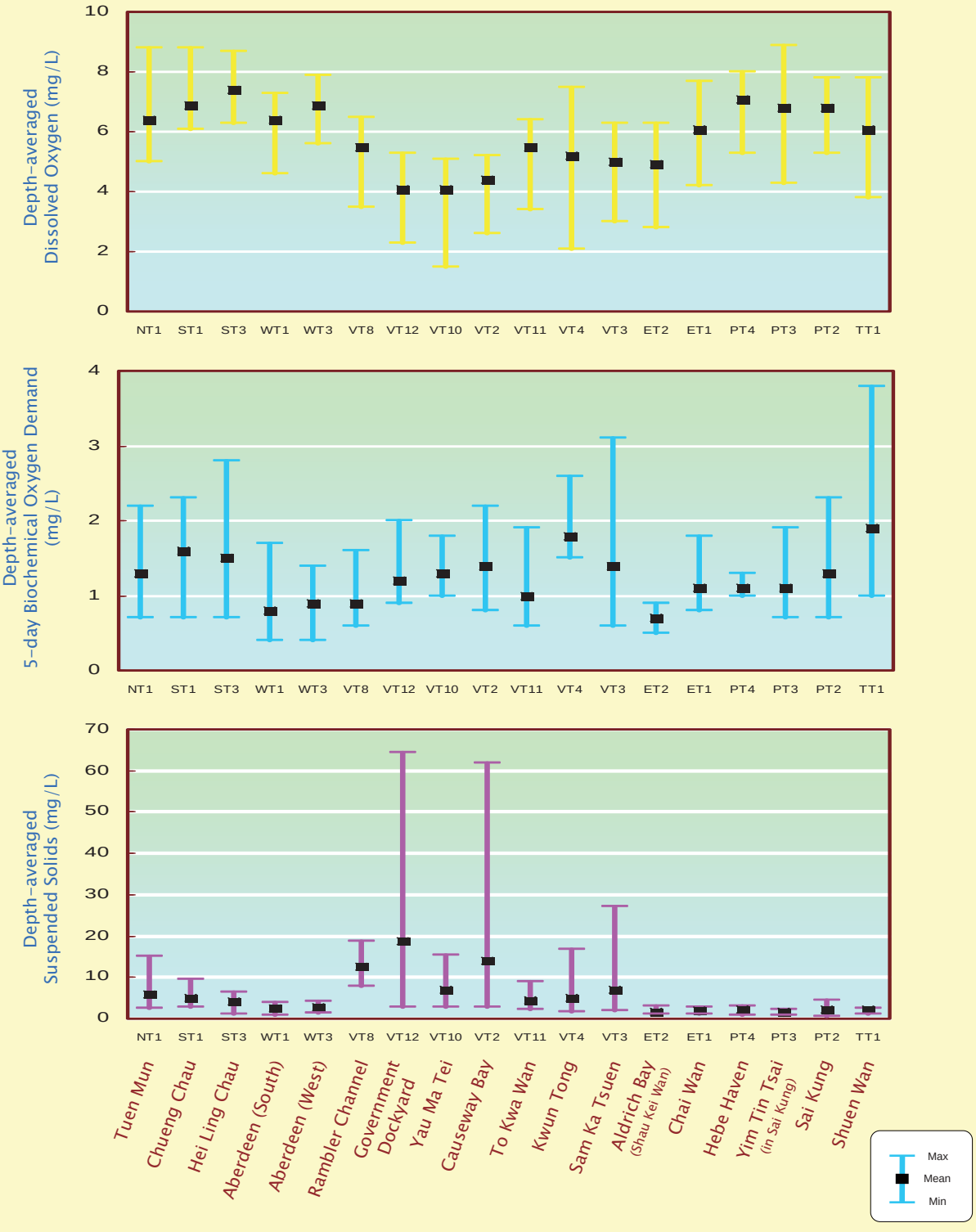
Mean low molecular weight polycyclic aromatic hydrocarbons (PAHs) levels in marine sediments in Hong Kong, 2006 – 2010



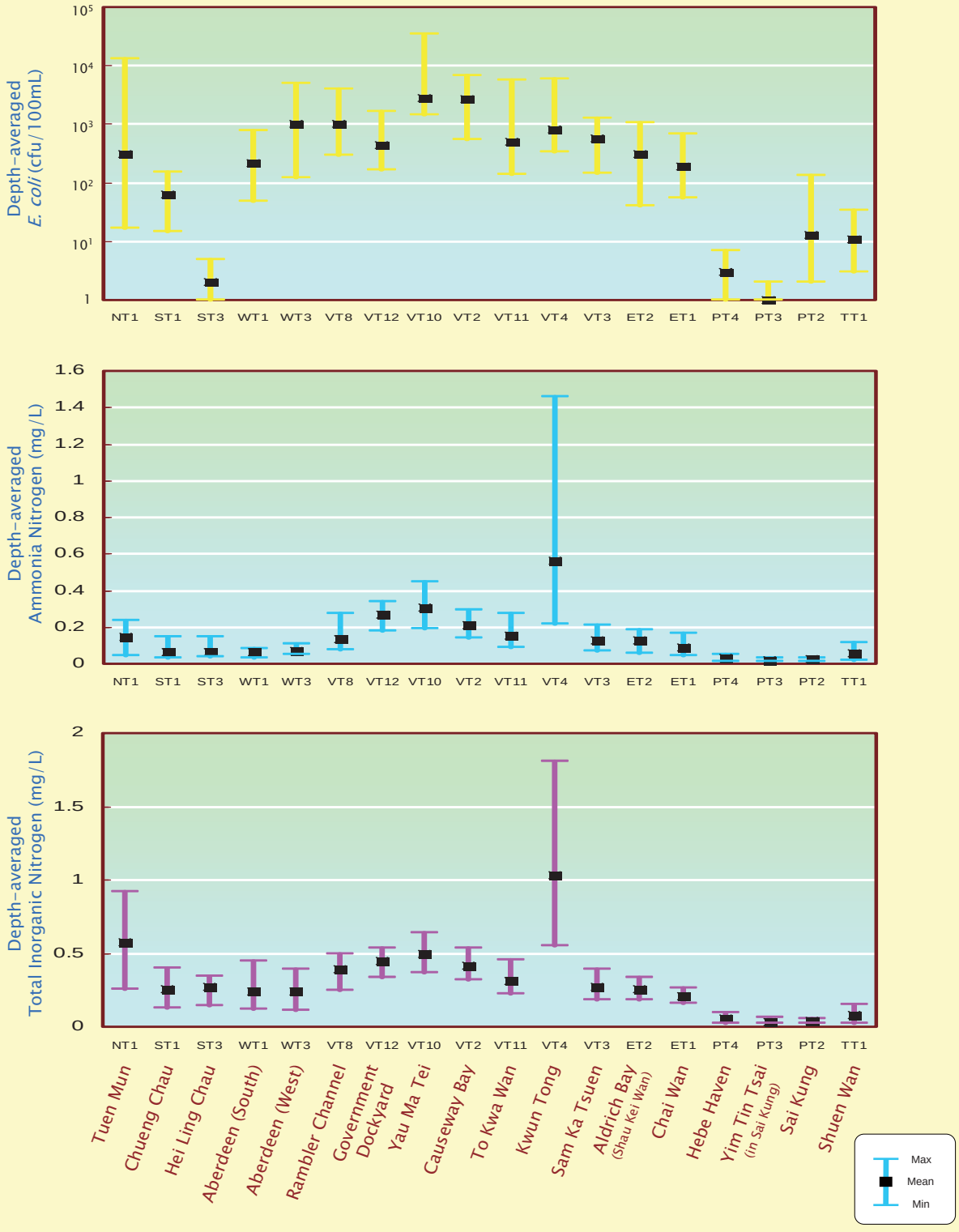
Mean high molecular weight polycyclic aromatic hydrocarbons (PAHs) levels in marine sediments in Hong Kong, 2006 – 2010



Water quality of typhoon shelters in Hong Kong in 2010



Water quality of typhoon shelters in Hong Kong in 2010 (continued)



Results of the Seasonal Kendall Test for water quality trends in typhoon shelters, 1986 – 2010

Monitoring Station		NT1	ST1	ST3	WT3	WT1	VT8	VT10	VT2	VT11
Monitoring Period		1986 – 2010	1986 – 2010	2000 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1993 – 2010	1986 – 2010	1994 – 2010
Parameter	Water Depth									
Temperature (℃)	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	↘	-	-	-	-	-	↘	-	-
Total volatile 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	↘	-	-	-	-	↘	↘	↘	↘
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-*a* (μg/L)	Surface	↗	-	-	-	-	↗	↗	↗	-
	Middle	NA	-	-	-	-	↗	↗	-	-
	Bottom	NA	-	-	↗	-	↗	↗	↗	↗
	Average	↗	-	-	↗	-	↗	↗	↗	-
E. coli (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 wate
4. ↗ significant increase
5. ↘ significant decrease

Results of the Seasonal Kendall Test for water quality trends in typhoon shelters, 1986 – 2010 (continued)

Monitoring Station		VT12	VT4	VT3	ET2	ET1	PT4	PT2	PT3	TT1
Monitoring Period		2000 – 2010	1987 – 2010	1986 – 2010	1993 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1986 – 2010	1986 – 2010
Parameter	Water Depth									
Temperature (℃)	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	-	↘	↘	↘	-	-	-	-	↘
Total volatile 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	↘	↘	↘	↘	-	↘	↘	-	↘
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-*a* (μg/L)	Surface	-	↗	↗	-	-	-	-	-	↘
	Middle	-	↗	-	-	-	NA	NA	-	↘
	Bottom	↗	↗	↗	-	-	-	-	-	-
	Average	-	↗	↗	-	-	-	-	-	↘
E. coli (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 wate
4. ↗ significant increase
5. ↘ significant decrease

Summary of water quality statistics for typhoon shelters in 2010

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 (℃)		23.8 (17.2 - 29.1)	23.7 (16.7 - 29.5)	23.5 (16.8 - 28.3)	23.0 (18.3 - 27.8)	22.8 (18.4 - 27.3)	23.5 (18.2 - 27.3)
Salinity		26.0 (17.4 - 32.3)	29.7 (22.2 - 33.1)	30.2 (26.0 - 33.1)	30.9 (25.0 - 33.4)	30.7 (24.5 - 33.1)	30.3 (27.7 - 32.0)
Dissolved Oxygen (mg/L)		6.4 (5.0 - 8.8)	6.9 (6.1 - 8.8)	7.4 (6.3 - 8.7)	6.4 (4.6 - 7.3)	6.9 (5.6 - 7.9)	5.5 (3.5 - 6.5)
	Bottom	N.M.	5.7 (0.8 - 7.8)	6.0 (0.8 - 7.8)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	5.4 (1.8 - 7.7)
Dissolved Oxygen (% Saturation)		88 (63 - 119)	98 (85 - 132)	104 (84 - 129)	88 (68 - 102)	96 (83 - 115)	77 (52 - 88)
	Bottom	N.M.	80 (13 - 115)	84 (12 - 115)	<1 (<1 - <1)	<1 (<1 - <1)	74 (25 - 105)
pH		8.0 (7.7 - 8.2)	8.0 (7.7 - 8.3)	8.0 (7.8 - 8.3)	8.0 (7.7 - 8.2)	7.9 (7.7 - 8.2)	7.8 (7.6 - 8.0)
Secchi Disc Depth (m)		1.8 (0.5 - 2.6)	2.0 (1.5 - 2.6)	2.0 (1.7 - 2.2)	3.0 (2.5 - 4.0)	2.8 (2.2 - 3.8)	1.7 (1.0 - 2.0)
Turbidity (NTU)		5.8 (1.8 - 12.6)	4.5 (1.9 - 8.1)	4.1 (0.9 - 8.5)	3.6 (1.0 - 12.8)	3.6 (1.2 - 11.4)	9.5 (5.4 - 18.8)
Suspended Solids (mg/L)		5.9 (2.4 - 15.0)	5.1 (2.7 - 9.4)	4.2 (1.0 - 6.5)	2.5 (0.9 - 3.9)	2.8 (1.3 - 4.3)	12.6 (7.7 - 18.7)
5-day Biochemical Oxygen Demand (mg/L)		1.3 (0.7 - 2.2)	1.6 (0.7 - 2.3)	1.5 (0.7 - 2.8)	0.8 (0.4 - 1.7)	0.9 (0.4 - 1.4)	0.9 (0.6 - 1.6)
Ammonia Nitrogen (mg/L)		0.147 (0.048 - 0.240)	0.067 (0.034 - 0.150)	0.062 (0.036 - 0.147)	0.064 (0.033 - 0.082)	0.069 (0.050 - 0.110)	0.135 (0.077 - 0.277)
Unionised Ammonia (mg/L)		0.006 (0.002 - 0.012)	0.003 (0.001 - 0.006)	0.002 (<0.001 - 0.003)	0.002 (0.001 - 0.004)	0.003 (0.001 - 0.005)	0.004 (0.002 - 0.004)
Nitrite Nitrogen (mg/L)		0.085 (0.019 - 0.220)	0.034 (0.007 - 0.069)	0.040 (0.009 - 0.084)	0.025 (0.012 - 0.058)	0.026 (0.012 - 0.053)	0.049 (0.025 - 0.066)
Nitrate Nitrogen (mg/L)		0.343 (0.110 - 0.650)	0.159 (0.051 - 0.330)	0.168 (0.059 - 0.257)	0.152 (0.050 - 0.357)	0.143 (0.049 - 0.280)	0.206 (0.077 - 0.340)
Total Inorganic Nitrogen (mg/L)		0.58 (0.26 - 0.92)	0.26 (0.13 - 0.40)	0.27 (0.14 - 0.34)	0.24 (0.12 - 0.45)	0.24 (0.11 - 0.39)	0.39 (0.25 - 0.49)
Total Kjeldahl Nitrogen (mg/L)		0.35 (0.22 - 0.49)	0.24 (0.18 - 0.37)	0.24 (0.19 - 0.36)	0.20 (0.18 - 0.21)	0.21 (0.17 - 0.29)	0.34 (0.22 - 0.56)
Total Nitrogen (mg/L)		0.78 (0.35 - 1.14)	0.44 (0.23 - 0.57)	0.45 (0.26 - 0.52)	0.38 (0.25 - 0.63)	0.38 (0.23 - 0.53)	0.60 (0.52 - 0.71)
Orthophosphate Phosphorus (mg/L)		0.024 (0.004 - 0.057)	0.013 (0.003 - 0.026)	0.012 (0.004 - 0.025)	0.012 (0.004 - 0.020)	0.012 (0.004 - 0.021)	0.025 (0.009 - 0.040)
Total Phosphorus (mg/L)		0.04 (0.03 - 0.08)	0.03 (0.02 - 0.04)	0.03 (0.02 - 0.04)	0.03 (0.02 - 0.03)	0.02 (0.02 - 0.03)	0.04 (0.04 - 0.05)
Silica (as SiO_2) (mg/L)		1.52 (0.52 - 3.30)	0.68 (0.09 - 1.47)	0.62 (0.36 - 0.88)	0.89 (0.28 - 1.70)	0.85 (0.23 - 1.60)	1.02 (0.47 - 1.35)
Chlorophyll-a (μg/L)		7.7 (0.8 - 22.0)	10.0 (0.9 - 27.0)	8.9 (1.1 - 22.3)	4.3 (1.1 - 18.3)	3.9 (0.6 - 10.9)	5.7 (0.6 - 25.3)
E.coli (count/100mL)		320 (17 - 13000)	63 (15 - 150)	2 (<1 - 5)	220 (49 - 780)	1000 (120 - 5000)	1000 (290 - 4100)
Faecal Coliforms (count/100mL)		1900 (99 - 61000)	220 (32 - 530)	3 (1 - 13)	540 (190 - 1300)	2200 (220 - 11000)	2400 (640 - 11000)

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 2010

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 (℃)		23.9 (18.3 - 27.9)	23.6 (18.2 - 27.9)	23.5 (18.0 - 27.6)	23.3 (17.8 - 27.6)	23.8 (18.3 - 28.3)	23.4 (18.0 - 27.8)
Salinity		30.7 (29.0 - 31.8)	30.8 (29.1 - 31.8)	30.9 (29.2 - 31.8)	31.5 (29.9 - 32.2)	29.4 (22.9 - 31.6)	31.5 (29.8 - 32.5)
Dissolved Oxygen (mg/L)		4.1 (2.3 - 5.3)	4.1 (1.6 - 5.1)	4.4 (2.6 - 5.2)	5.5 (3.4 - 6.4)	5.2 (2.1 - 7.5)	5.0 (3.0 - 6.3)
	Bottom	4.8 (2.0 - 5.9)	4.5 (3.1 - 5.6)	5.7 (3.9 - 6.7)	5.3 (3.3 - 6.4)	5.9 (2.6 - 8.4)	5.8 (1.6 - 9.8)
Dissolved Oxygen (% Saturation)		57 (35 - 78)	57 (23 - 75)	61 (39 - 74)	77 (51 - 93)	73 (31 - 109)	69 (46 - 88)
	Bottom	67 (30 - 87)	63 (46 - 74)	79 (57 - 88)	73 (49 - 91)	81 (37 - 117)	80 (24 - 129)
pH		7.7 (7.5 - 7.8)	7.7 (7.5 - 7.8)	7.8 (7.6 - 7.9)	7.8 (7.6 - 7.9)	7.8 (7.5 - 8.0)	7.8 (7.6 - 8.0)
Secchi Disc Depth (m)		1.8 (1.3 - 3.0)	1.8 (1.0 - 2.7)	5.3 (1.7 - 20.0)	2.5 (2.0 - 3.3)	1.7 (1.5 - 2.1)	2.6 (2.0 - 3.5)
Turbidity (NTU)		10.3 (2.3 - 23.6)	5.9 (1.3 - 13.6)	8.1 (2.5 - 24.5)	4.7 (1.4 - 14.1)	4.5 (1.7 - 13.8)	5.1 (1.3 - 14.4)
Suspended Solids (mg/L)		18.8 (2.8 - 64.5)	6.9 (2.8 - 15.5)	14.1 (2.9 - 62.0)	4.5 (2.1 - 8.9)	5.0 (1.6 - 16.7)	6.9 (1.9 - 27.2)
5-day Biochemical Oxygen Demand (mg/L)		1.2 (0.9 - 2.0)	1.3 (1.0 - 1.8)	1.4 (0.8 - 2.2)	1.0 (0.6 - 1.9)	1.8 (1.5 - 2.6)	1.4 (0.6 - 3.1)
Ammonia Nitrogen (mg/L)		0.268 (0.180 - 0.340)	0.309 (0.193 - 0.450)	0.214 (0.140 - 0.295)	0.155 (0.087 - 0.273)	0.562 (0.217 - 1.460)	0.126 (0.068 - 0.210)
Unionised Ammonia (mg/L)		0.005 (0.003 - 0.009)	0.006 (0.003 - 0.011)	0.005 (0.003 - 0.009)	0.004 (0.002 - 0.008)	0.011 (0.005 - 0.022)	0.003 (0.002 - 0.007)
Nitrite Nitrogen (mg/L)		0.036 (0.020 - 0.050)	0.038 (0.023 - 0.050)	0.035 (0.022 - 0.050)	0.031 (0.019 - 0.053)	0.074 (0.032 - 0.137)	0.029 (0.017 - 0.051)
Nitrate Nitrogen (mg/L)		0.147 (0.093 - 0.200)	0.147 (0.097 - 0.200)	0.164 (0.120 - 0.205)	0.127 (0.087 - 0.170)	0.398 (0.213 - 0.820)	0.121 (0.085 - 0.180)
Total Inorganic Nitrogen (mg/L)		0.45 (0.34 - 0.54)	0.49 (0.37 - 0.64)	0.41 (0.32 - 0.54)	0.31 (0.22 - 0.45)	1.03 (0.55 - 1.81)	0.28 (0.19 - 0.39)
Total Kjeldahl Nitrogen (mg/L)		0.49 (0.38 - 0.67)	0.50 (0.41 - 0.66)	0.45 (0.30 - 0.66)	0.31 (0.22 - 0.48)	0.76 (0.39 - 1.63)	0.29 (0.19 - 0.40)
Total Nitrogen (mg/L)		0.67 (0.54 - 0.82)	0.68 (0.59 - 0.85)	0.65 (0.47 - 0.90)	0.47 (0.36 - 0.66)	1.23 (0.69 - 1.98)	0.44 (0.32 - 0.58)
Orthophosphate Phosphorus (mg/L)		0.041 (0.029 - 0.051)	0.040 (0.024 - 0.051)	0.032 (0.018 - 0.043)	0.027 (0.013 - 0.041)	0.140 (0.080 - 0.186)	0.026 (0.014 - 0.037)
Total Phosphorus (mg/L)		0.07 (0.06 - 0.12)	0.06 (0.04 - 0.07)	0.06 (0.04 - 0.11)	0.04 (0.03 - 0.06)	0.17 (0.10 - 0.22)	0.04 (0.03 - 0.06)
Silica (as SiO_2) (mg/L)		0.86 (0.14 - 1.50)	0.83 (0.12 - 1.23)	0.88 (0.11 - 1.25)	0.66 (0.07 - 1.10)	1.18 (0.64 - 2.07)	0.70 (0.07 - 1.13)
Chlorophyll-a (μg/L)		7.3 (0.9 - 16.0)	6.6 (0.8 - 21.3)	5.2 (0.8 - 20.0)	6.5 (0.9 - 22.0)	13.9 (1.0 - 26.7)	5.1 (1.0 - 18.0)
E.coli (count/100mL)		440 (160 - 1600)	2800 (1500 - 35000)	2700 (540 - 6700)	510 (140 - 5600)	820 (330 - 6000)	560 (140 - 1300)
Faecal Coliforms (count/100mL)		1100 (390 - 4100)	7400 (2700 - 71000)	8200 (1200 - 26000)	1200 (310 - 9000)	1900 (530 - 12000)	1600 (690 - 2800)

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 2010

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 (℃)		22.4 (17.5 - 27.2)	22.9 (17.6 - 28.7)	24.1 (17.9 - 31.3)	24.0 (18.1 - 30.7)	24.2 (18.3 - 31.1)	24.2 (17.7 - 30.6)
Salinity		32.2 (31.1 - 33.1)	32.0 (30.7 - 33.1)	31.3 (28.7 - 32.8)	32.0 (30.2 - 33.4)	31.9 (29.9 - 33.1)	30.9 (28.1 - 32.2)
Dissolved Oxygen (mg/L)		4.9 (2.8 - 6.3)	6.1 (4.2 - 7.7)	7.1 (5.3 - 8.0)	6.8 (4.3 - 8.9)	6.9 (5.3 - 7.8)	6.1 (3.8 - 7.8)
	Bottom	4.4 (1.3 - 6.6)	5.9 (4.4 - 6.8)	6.9 (5.5 - 8.0)	6.7 (4.0 - 8.7)	6.9 (4.7 - 7.9)	5.9 (3.5 - 8.1)
Dissolved Oxygen (% Saturation)		67 (42 - 81)	85 (65 - 113)	100 (84 - 114)	95 (68 - 115)	97 (84 - 105)	86 (59 - 116)
	Bottom	60 (20 - 83)	83 (67 - 94)	98 (88 - 104)	94 (63 - 114)	97 (75 - 107)	81 (50 - 112)
pH		7.7 (7.5 - 7.9)	7.9 (7.6 - 8.1)	8.0 (7.8 - 8.2)	8.0 (7.7 - 8.2)	8.0 (7.7 - 8.3)	8.0 (7.7 - 8.3)
Secchi Disc Depth (m)		3.8 (2.1 - 6.5)	2.8 (1.8 - 3.5)	2.9 (2.3 - 3.3)	3.1 (2.2 - 4.0)	2.5 (2.0 - 3.3)	2.7 (1.6 - 4.5)
Turbidity (NTU)		2.2 (0.6 - 6.1)	2.5 (0.8 - 6.8)	2.1 (1.1 - 5.0)	1.9 (1.3 - 4.8)	2.2 (1.0 - 4.8)	2.4 (0.8 - 7.8)
Suspended Solids (mg/L)		1.8 (1.0 - 3.1)	2.0 (1.2 - 2.9)	2.1 (0.9 - 3.1)	1.7 (0.9 - 2.2)	2.2 (0.7 - 4.6)	2.2 (1.1 - 2.6)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (0.5 - 0.9)	1.1 (0.8 - 1.8)	1.1 (1.0 - 1.3)	1.1 (0.7 - 1.9)	1.3 (0.7 - 2.3)	1.9 (1.0 - 3.8)
Ammonia Nitrogen (mg/L)		0.125 (0.057 - 0.187)	0.092 (0.046 - 0.167)	0.033 (0.016 - 0.050)	0.021 (0.012 - 0.032)	0.023 (0.015 - 0.031)	0.058 (0.017 - 0.113)
Unionised Ammonia (mg/L)		0.003 (0.001 - 0.006)	0.003 (0.001 - 0.007)	0.002 (<0.001 - 0.004)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.004)	0.002 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)		0.026 (0.014 - 0.053)	0.022 (0.014 - 0.044)	0.003 (<0.002 - 0.004)	0.002 (<0.002 - 0.002)	0.002 (<0.002 - 0.003)	0.006 (<0.002 - 0.021)
Nitrate Nitrogen (mg/L)		0.109 (0.076 - 0.137)	0.094 (0.072 - 0.130)	0.022 (0.003 - 0.045)	0.013 (<0.002 - 0.034)	0.013 (0.003 - 0.023)	0.018 (<0.002 - 0.035)
Total Inorganic Nitrogen (mg/L)		0.26 (0.19 - 0.33)	0.21 (0.16 - 0.27)	0.06 (0.02 - 0.10)	0.04 (0.02 - 0.07)	0.04 (0.02 - 0.06)	0.08 (0.02 - 0.15)
Total Kjeldahl Nitrogen (mg/L)		0.26 (0.16 - 0.33)	0.24 (0.16 - 0.31)	0.19 (0.12 - 0.28)	0.17 (0.11 - 0.26)	0.18 (0.13 - 0.24)	0.26 (0.22 - 0.31)
Total Nitrogen (mg/L)		0.39 (0.29 - 0.48)	0.36 (0.28 - 0.46)	0.22 (0.13 - 0.32)	0.19 (0.12 - 0.27)	0.19 (0.14 - 0.26)	0.28 (0.24 - 0.36)
Orthophosphate Phosphorus (mg/L)		0.027 (0.015 - 0.036)	0.019 (0.011 - 0.034)	0.008 (<0.002 - 0.021)	0.005 (<0.002 - 0.009)	0.006 (0.002 - 0.015)	0.006 (<0.002 - 0.011)
Total Phosphorus (mg/L)		0.04 (0.03 - 0.05)	0.04 (0.03 - 0.06)	0.03 (<0.02 - 0.04)	0.02 (<0.02 - 0.02)	0.02 (<0.02 - 0.03)	0.03 (0.02 - 0.04)
Silica (as SiO_2) (mg/L)		0.84 (0.44 - 1.14)	0.61 (0.15 - 0.88)	0.46 (0.07 - 0.73)	0.47 (0.10 - 0.99)	0.49 (0.11 - 0.80)	0.74 (0.13 - 1.60)
Chlorophyll-a (μg/L)		3.1 (0.4 - 11.6)	6.2 (0.9 - 14.2)	4.4 (2.5 - 8.2)	3.4 (1.5 - 9.8)	3.9 (1.2 - 7.9)	6.4 (1.0 - 13.7)
E.coli (count/100mL)		310 (41 - 1000)	190 (56 - 680)	3 (<1 - 7)	1 (<1 - 2)	13 (2 - 130)	11 (3 - 34)
Faecal Coliforms (count/100mL)		640 (80 - 3400)	460 (110 - 1100)	11 (<1 - 50)	1 (1 - 3)	110 (21 - 880)	41 (18 - 82)

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, 2006- 2010

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 <63 μm (%w/w)	76 (51 - 94)	85 (66 - 94)	95 (91 - 99)	71 (47 - 89)	93 (83 - 99)	72 (60 - 88)	82 (65 - 97)
Electrochemical Potential (mV)	-262 ((-353) - (-173))	-224 ((-310) - (-150))	-207 ((-287) - (-81))	-257 ((-366) - (-144))	-285 ((-350) - (-162))	-326 ((-397) - (-106))	-331 ((-388) - (-209))
Total Solids (%w/w)	46 (36 - 56)	42 (38 - 50)	36 (33 - 40)	45 (36 - 57)	38 (36 - 46)	48 (40 - 54)	39 (33 - 51)
Total Volatile Soilds (%w/w)	7.0 (6.2 - 9.2)	6.6 (5.4 - 8.8)	8.0 (6.7 - 11.0)	6.9 (4.6 - 8.3)	6.9 (6.0 - 9.6)	6.7 (5.8 - 8.6)	8.7 (5.9 - 11.0)
Chemical Oxygen Demand (mg/kg)	20000 (17000 - 25000)	17000 (12000 - 23000)	13000 (10000 - 15000)	22000 (16000 - 31000)	16000 (11000 - 19000)	18000 (13000 - 24000)	28000 (21000 - 36000)
Total Carbon (%w/w)	0.8 (0.6 - 1.0)	0.7 (0.6 - 1.1)	0.5 (0.5 - 0.6)	1.0 (0.8 - 1.3)	0.5 (0.5 - 0.6)	0.9 (0.7 - 1.2)	0.9 (0.8 - 1.1)
Ammonical Nitrogen (mg/kg)	8.50 (0.91 - 21.00)	8.70 (3.30 - 21.00)	5.40 (1.00 - 11.00)	8.40 (0.24 - 20.00)	5.70 (3.60 - 8.70)	25.00 (5.40 - 47.00)	22.00 (4.80 - 39.00)
Total Kjeldahl Nitrogen (mg/kg)	430 (230 - 620)	450 (330 - 540)	510 (300 - 1000)	440 (330 - 540)	360 (290 - 410)	430 (210 - 600)	640 (520 - 780)
Total Phosphorus (mg/kg)	220 (150 - 300)	250 (170 - 440)	180 (140 - 340)	190 (150 - 220)	190 (150 - 210)	200 (110 - 240)	220 (190 - 260)
Total Sulphide (mg/kg)	150 (19 - 750)	66 (14 - 250)	42 (2 - 150)	190 (23 - 540)	33 (3 - 110)	150 (18 - 380)	150 (23 - 300)
Total Cyanide (mg/kg)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.1 (0.1 - 0.4)	0.3 (0.1 - 0.5)	0.2 (0.1 - 0.5)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.3)
Arsenic (mg/kg)	10.0 (5.8 - 28.0)	8.0 (6.7 - 9.3)	7.0 (5.8 - 7.9)	8.6 (7.2 - 9.8)	8.0 (7.0 - 9.1)	5.5 (4.4 - 6.7)	8.1 (6.1 - 9.2)
Cadmium (mg/kg)	0.3 (0.2 - 0.7)	0.1 (0.1 - 0.2)	<0.1 (0.1 - <0.1)	0.7 (0.5 - 1.0)	0.3 (0.1 - 0.4)	0.3 (0.1 - 0.6)	0.9 (0.6 - 1.2)
Chromium (mg/kg)	36 (22 - 53)	50 (39 - 61)	41 (33 - 48)	130 (85 - 170)	47 (43 - 53)	36 (27 - 44)	64 (50 - 76)
Copper (mg/kg)	54 (31 - 72)	95 (57 - 130)	37 (30 - 43)	230 (150 - 310)	140 (24 - 170)	79 (36 - 130)	250 (180 - 310)
Lead (mg/kg)	57 (38 - 85)	51 (45 - 57)	50 (42 - 58)	84 (65 - 140)	50 (28 - 57)	54 (29 - 110)	81 (59 - 110)
Mercury (mg/kg)	0.09 (0.05 - 0.12)	0.19 (0.13 - 0.28)	0.13 (0.09 - 0.15)	0.21 (0.14 - 0.27)	0.17 (0.05 - 0.23)	0.22 (0.13 - 0.44)	0.76 (0.54 - 1.30)
Nickel (mg/kg)	22 (14 - 47)	21 (13 - 24)	26 (21 - 32)	46 (31 - 74)	27 (22 - 36)	22 (17 - 28)	27 (18 - 34)
Silver (mg/kg)	2.8 (0.6 - 11.0)	0.4 (0.2 - 0.4)	0.5 (0.4 - 0.7)	4.5 (2.9 - 6.6)	1.7 (0.3 - 2.1)	1.5 (0.8 - 2.5)	6.5 (3.5 - 10.0)
Zinc (mg/kg)	180 (120 - 300)	150 (110 - 230)	140 (100 - 160)	280 (200 - 350)	210 (110 - 240)	180 (98 - 320)	320 (190 - 450)
Total Polychlorinated Biphenyls (PCBs) (μg/kg) [3]	18 (18 - 18)	18 (18 - 22)	18 (18 - 18)	46 (28 - 71)	20 (18 - 24)	19 (18 - 20)	38 (27 - 51)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4]	96 (90 - 110)	95 (90 - 110)	92 (90 - 99)	220 (100 - 1100)	95 (90 - 100)	110 (90 - 140)	130 (110 - 170)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	220 (22 - 530)	220 (130 - 590)	78 (62 - 100)	1600 (480 - 5600)	180 (21 - 280)	500 (190 - 940)	790 (640 - 1000)

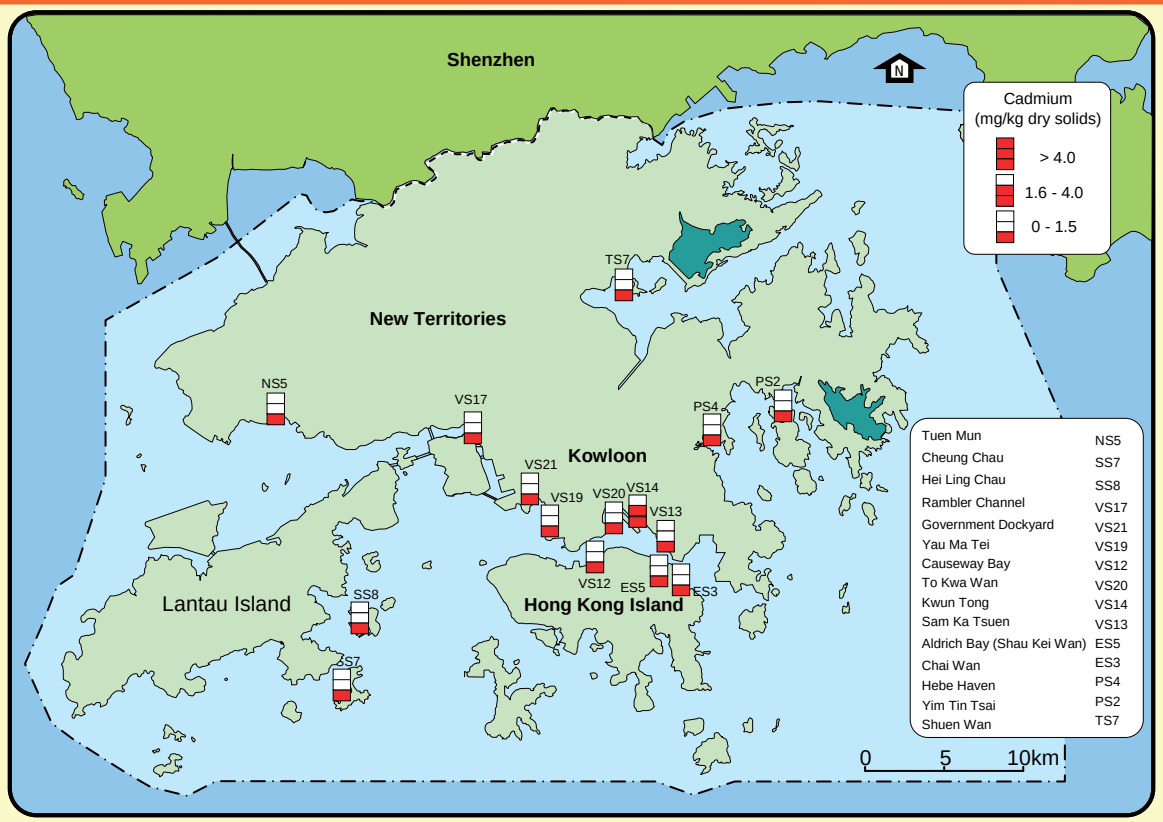
Note:
1. Data presented are arithmetic means ; data in brackets indicate ranges.
2. All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.
3. Total PCBs results are derived from the summation of 18 congeners. If the concentration 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, Flourene, 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, 2006- 2010 (continued)

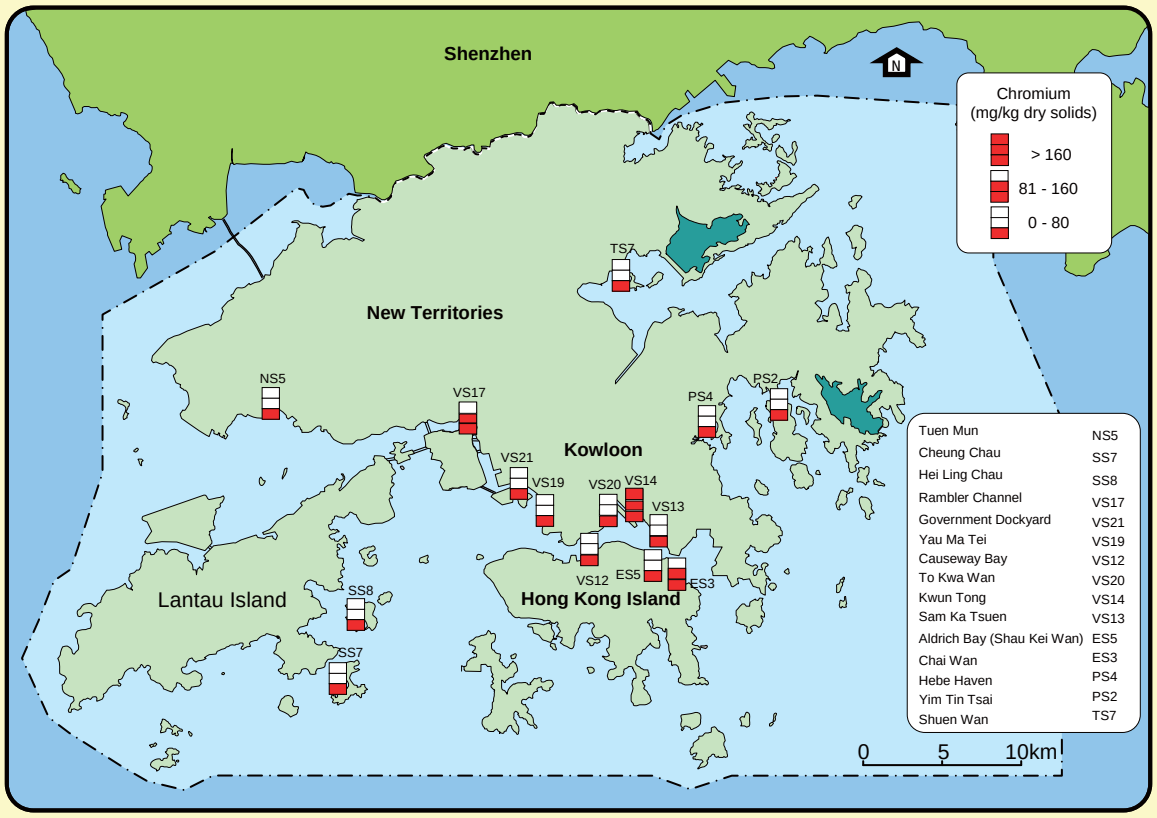
Parameter	To Kwa Wan VS20	Kwun Tong VS14	Sam Ka Tsuen VS13	Aldrich Bay (Shau Kei Wan) ES5	Chai Wan ES3	Hebe Haven PS4	Yim Tin Tsai PS2	Shuen Wan TS7
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63 μm (%w/w)	68 (45 - 85)	73 (50 - 92)	84 (76 - 90)	90 (84 - 97)	89 (80 - 96)	88 (81 - 97)	79 (28 - 93)	66 (46 - 90)
Electrochemical Potential (mV)	-314 ((-378) - (-65))	-357 ((-397) - (-252))	-242 ((-377) - (-56))	-378 ((-410) - (-345))	-293 ((-356) - (-136))	-191 ((-281) - (-21))	-181 ((-326) - (-30))	-318 ((-375) - (-220))
Total Solids (%w/w)	49 ((45 - 54))	37 ((27 - 45))	40 ((37 - 43))	31 ((27 - 35))	42 ((36 - 49))	40 ((37 - 43))	49 ((34 - 65))	37 ((23 - 52))
Total Volatile Soilds (%w/w)	7.2 (5.2 - 11.0)	9.7 (7.0 - 11.0)	9.6 (8.6 - 12.0)	9.5 (7.8 - 11.0)	8.0 (5.7 - 8.9)	9.2 (7.8 - 13.0)	9.8 (5.5 - 15.0)	8.3 (6.0 - 12.0)
Chemical Oxygen Demand (mg/kg)	29000 (18000 - 44000)	31000 (24000 - 41000)	26000 (21000 - 30000)	22000 (17000 - 31000)	26000 (18000 - 30000)	23000 (17000 - 26000)	17000 (11000 - 22000)	25000 (19000 - 30000)
Total Carbon (%w/w)	1.2 (0.8 - 2.0)	1.0 (0.7 - 1.5)	0.9 (0.8 - 1.2)	0.8 (0.7 - 1.1)	0.9 (0.7 - 1.0)	0.9 (0.7 - 1.1)	2.0 (0.9 - 4.3)	0.8 (0.7 - 1.0)
Ammonical Nitrogen (mg/kg)	16.00 (6.70 - 34.00)	32.00 (11.00 - 76.00)	8.80 (0.51 - 19.00)	28.00 (4.20 - 37.00)	2.70 (0.31 - 6.20)	4.40 (1.50 - 7.50)	9.10 (1.70 - 22.00)	7.00 (2.50 - 12.00)
Total Kjeldahl Nitrogen (mg/kg)	490 (420 - 550)	610 (410 - 720)	580 (530 - 630)	610 (480 - 730)	490 (400 - 630)	550 (290 - 670)	490 (280 - 850)	660 (520 - 890)
Total Phosphorus (mg/kg)	200 (170 - 240)	200 (160 - 240)	270 (220 - 340)	200 (170 - 280)	240 (180 - 400)	180 (120 - 220)	150 (77 - 200)	250 (170 - 430)
Total Sulphide (mg/kg)	120 (12 - 360)	500 (25 - 1300)	110 (5 - 380)	510 (59 - 1200)	140 (18 - 320)	21 (2 - 51)	17 (1 - 110)	230 (53 - 1300)
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 - 0.3)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	<0.1 (0.1 - <0.1)	0.2 (0.1 - 0.5)
Arsenic (mg/kg)	7.6 (6.0 - 8.7)	6.3 (5.4 - 8.4)	7.7 (6.4 - 8.5)	7.9 (6.1 - 10.0)	9.2 (8.0 - 10.0)	8.2 (7.3 - 9.1)	4.0 (2.6 - 5.6)	9.1 (6.6 - 12.0)
Cadmium (mg/kg)	0.8 (0.4 - 1.5)	2.3 (1.2 - 5.0)	0.9 (0.7 - 1.0)	0.6 (0.4 - 1.1)	0.6 (0.3 - 0.8)	0.2 (0.1 - 0.3)	<0.1 (0.1 - <0.1)	0.5 (0.2 - 0.8)
Chromium (mg/kg)	80 (53 - 110)	240 (100 - 570)	64 (44 - 100)	59 (55 - 66)	99 (75 - 120)	28 (23 - 33)	17 (8 - 23)	23 (14 - 33)
Copper (mg/kg)	570 (240 - 960)	1700 (720 - 4200)	200 (160 - 240)	310 (210 - 430)	280 (220 - 330)	52 (37 - 61)	19 (7 - 34)	190 (65 - 680)
Lead (mg/kg)	100 (60 - 220)	130 (75 - 400)	100 (85 - 120)	76 (68 - 83)	87 (68 - 130)	39 (36 - 43)	31 (13 - 38)	98 (71 - 120)
Mercury (mg/kg)	1.10 (0.50 - 2.20)	0.67 (0.41 - 1.40)	0.81 (0.61 - 1.20)	0.32 (0.24 - 0.61)	0.49 (0.34 - 0.65)	0.12 (0.09 - 0.16)	0.06 (0.05 - 0.07)	0.14 (0.05 - 0.27)
Nickel (mg/kg)	32 (19 - 45)	71 (31 - 170)	22 (17 - 29)	27 (24 - 30)	30 (22 - 40)	9 (7 - 11)	12 (6 - 18)	12 (7 - 20)
Silver (mg/kg)	4.4 (3.1 - 5.8)	7.7 (4.8 - 13.0)	2.7 (2.4 - 3.3)	7.6 (5.7 - 9.0)	18.0 (5.2 - 30.0)	0.3 (0.3 - 0.3)	<0.2 (0.2 - <0.2)	0.5 (0.2 - 0.7)
Zinc (mg/kg)	240 (150 - 380)	400 (270 - 620)	350 (280 - 390)	370 (280 - 550)	330 (250 - 440)	150 (130 - 170)	76 (28 - 110)	330 (180 - 470)
Total Polychlorinated Biphenyls (PCBs) (μg/kg) [3]	76 (31 - 140)	180 (63 - 470)	50 (33 - 110)	24 (18 - 29)	47 (29 - 71)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4]	13000 (560 - 42000)	150 (98 - 300)	130 (100 - 220)	110 (94 - 160)	120 (100 - 170)	92 (90 - 110)	100 (90 - 160)	91 (90 - 96)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	110000 (7700 - 290000)	1100 (560 - 1900)	700 (410 - 1200)	750 (370 - 1500)	550 (270 - 1000)	73 (37 - 150)	87 (21 - 540)	140 (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, Flourene, 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.

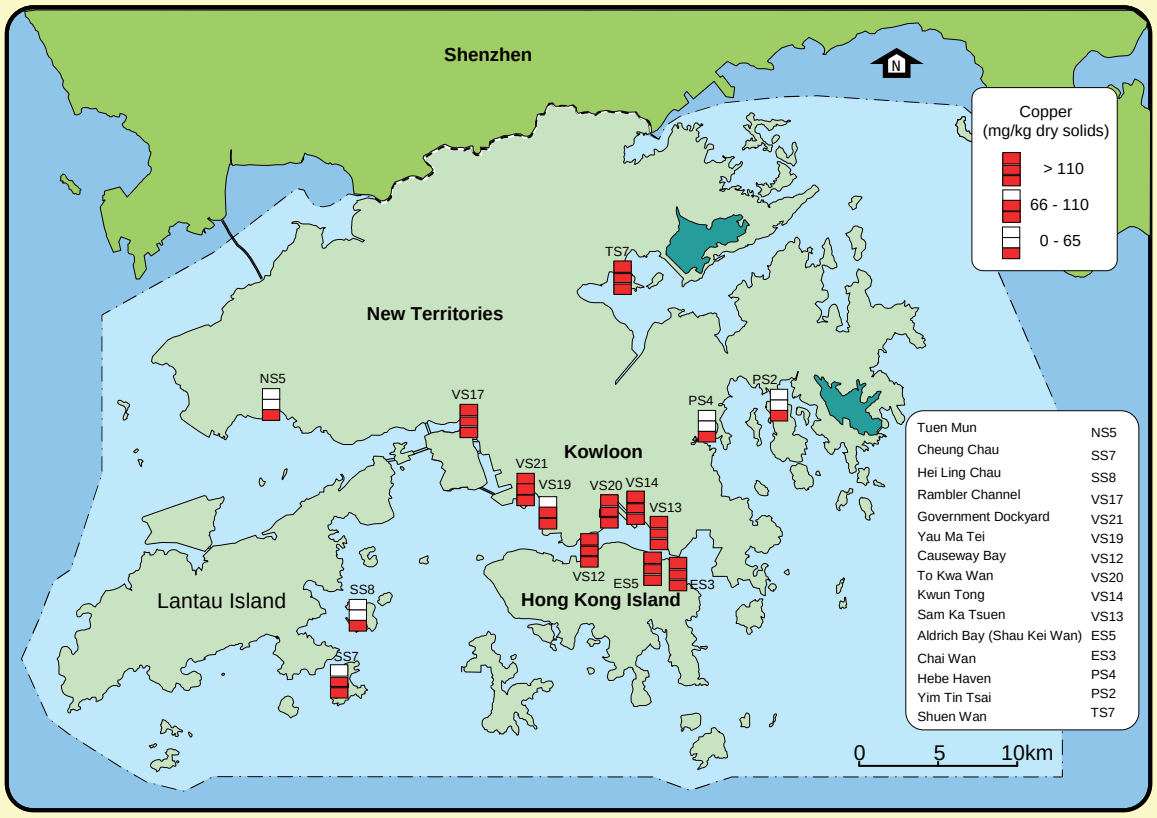
Mean cadmium levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



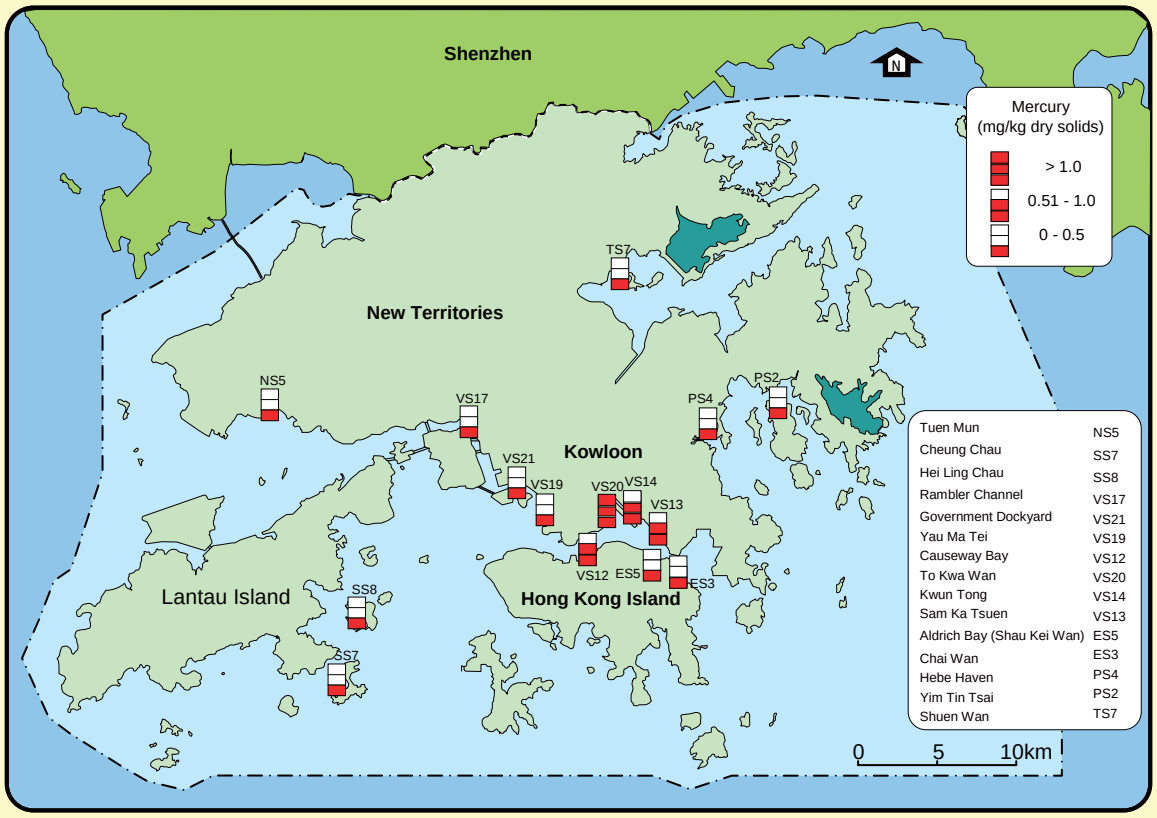
Mean chromium levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



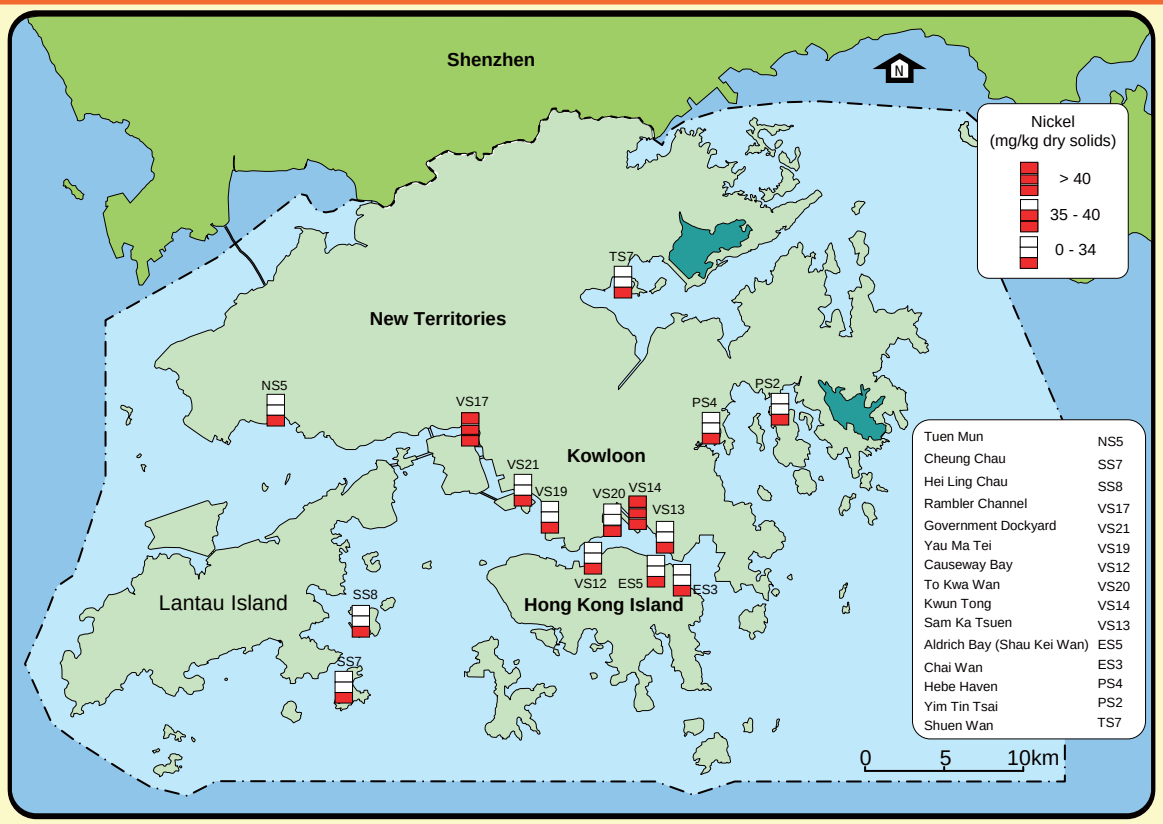
Mean copper levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



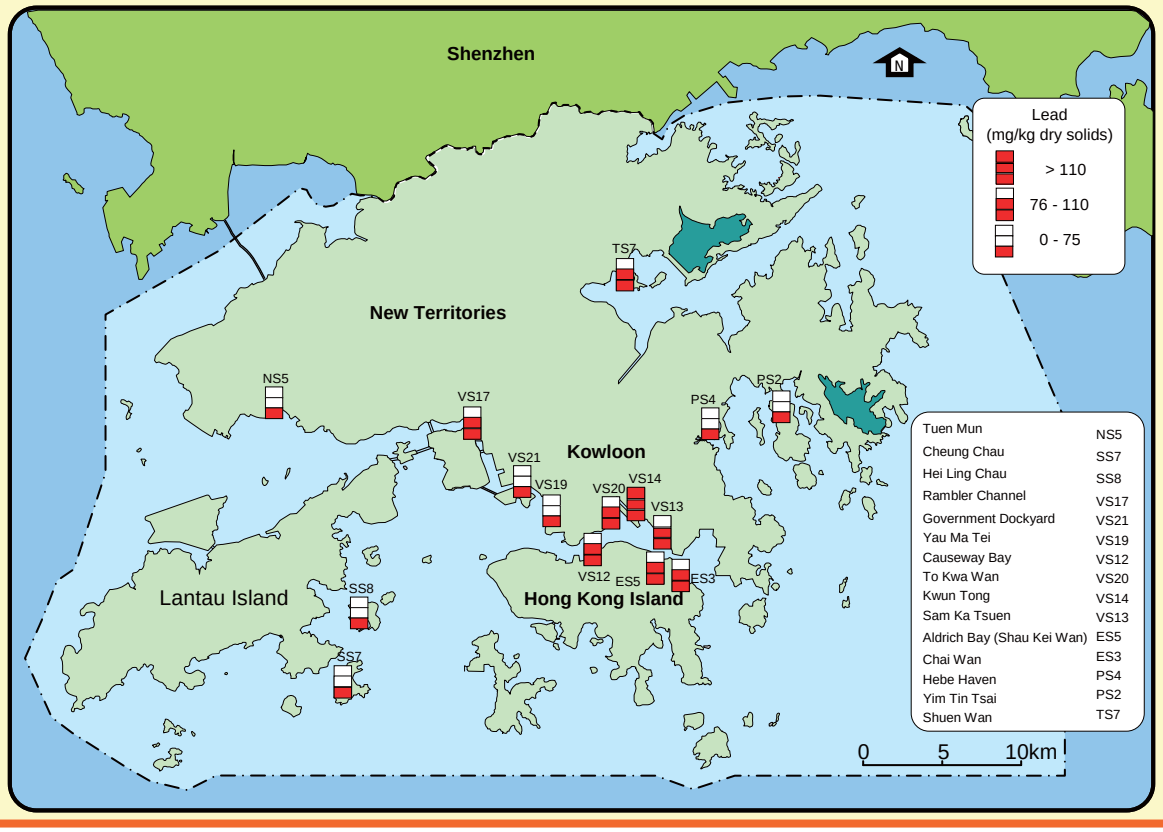
Mean mercury levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



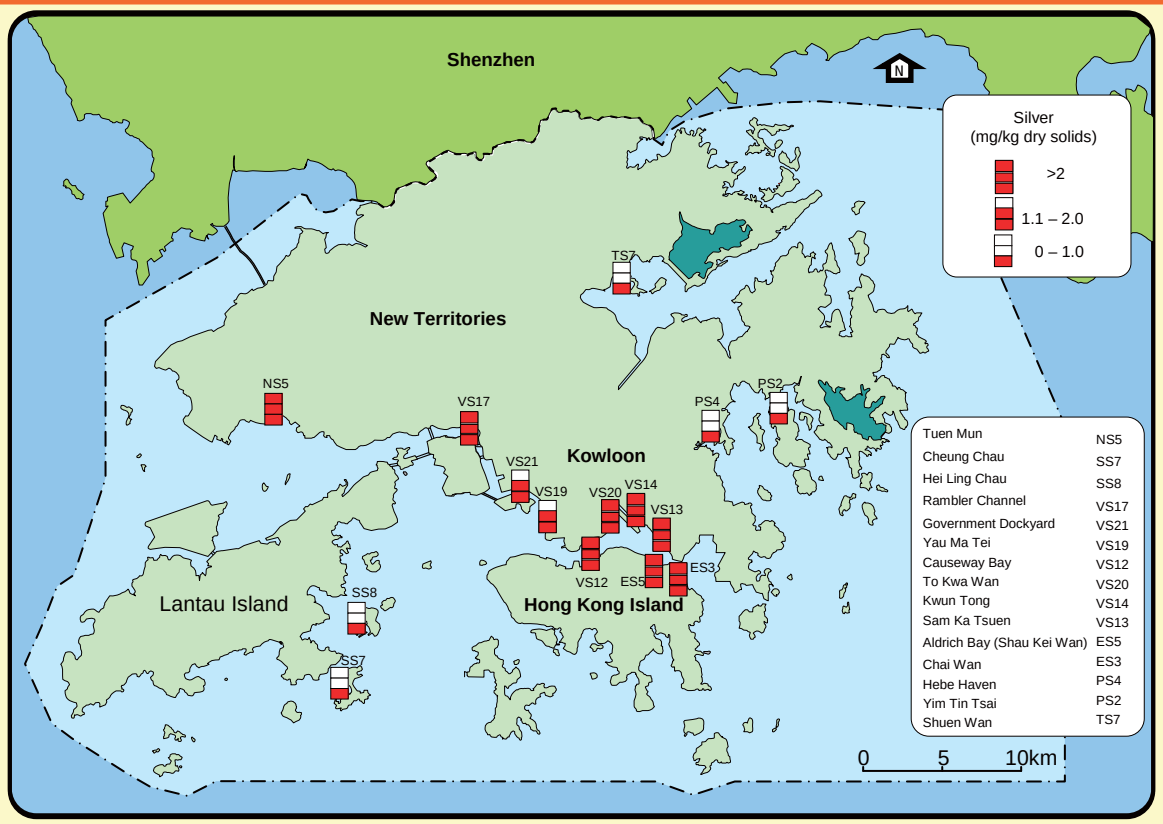
Mean nickel levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



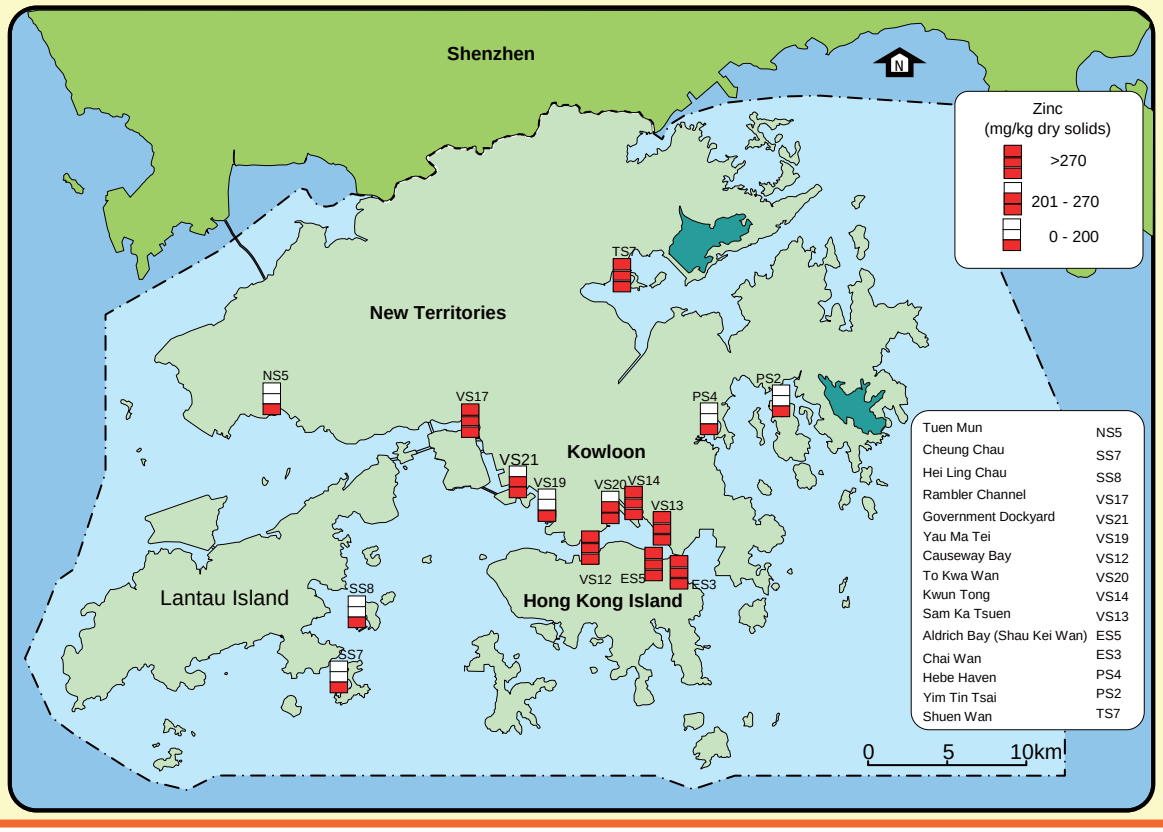
Mean Lead levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



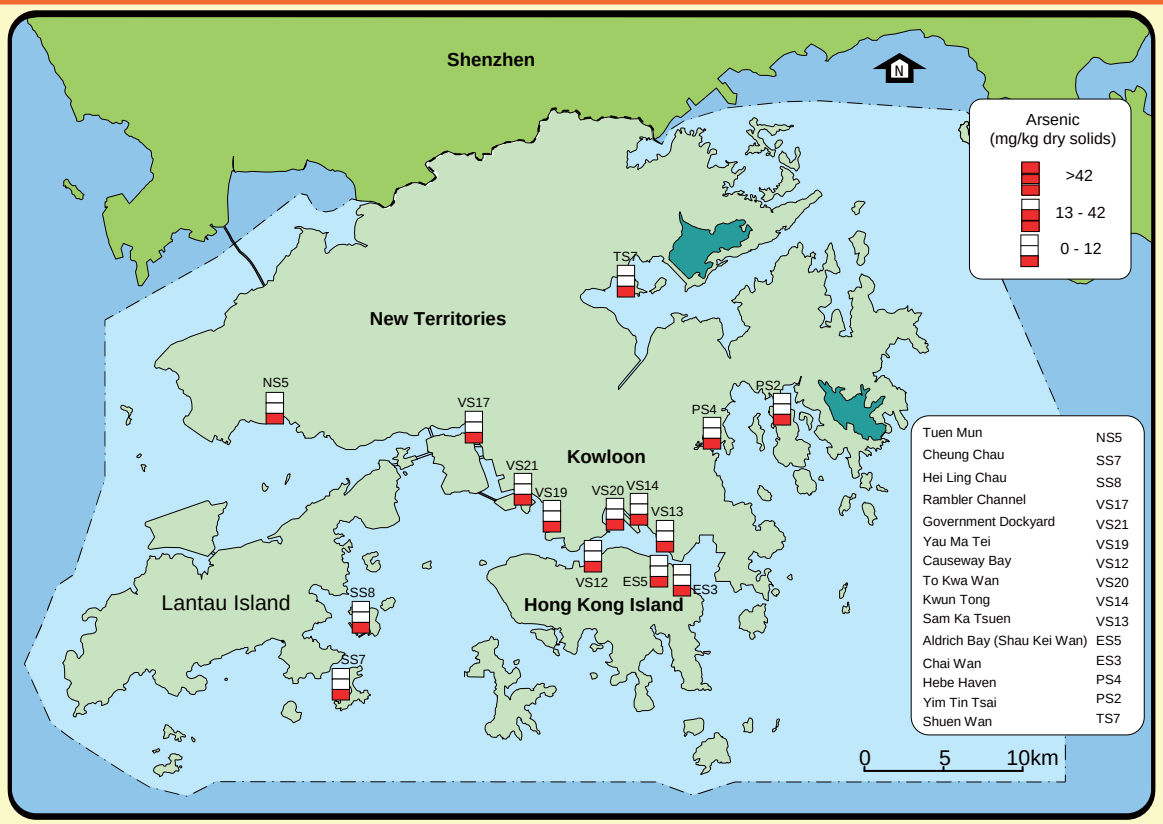
Mean silver levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



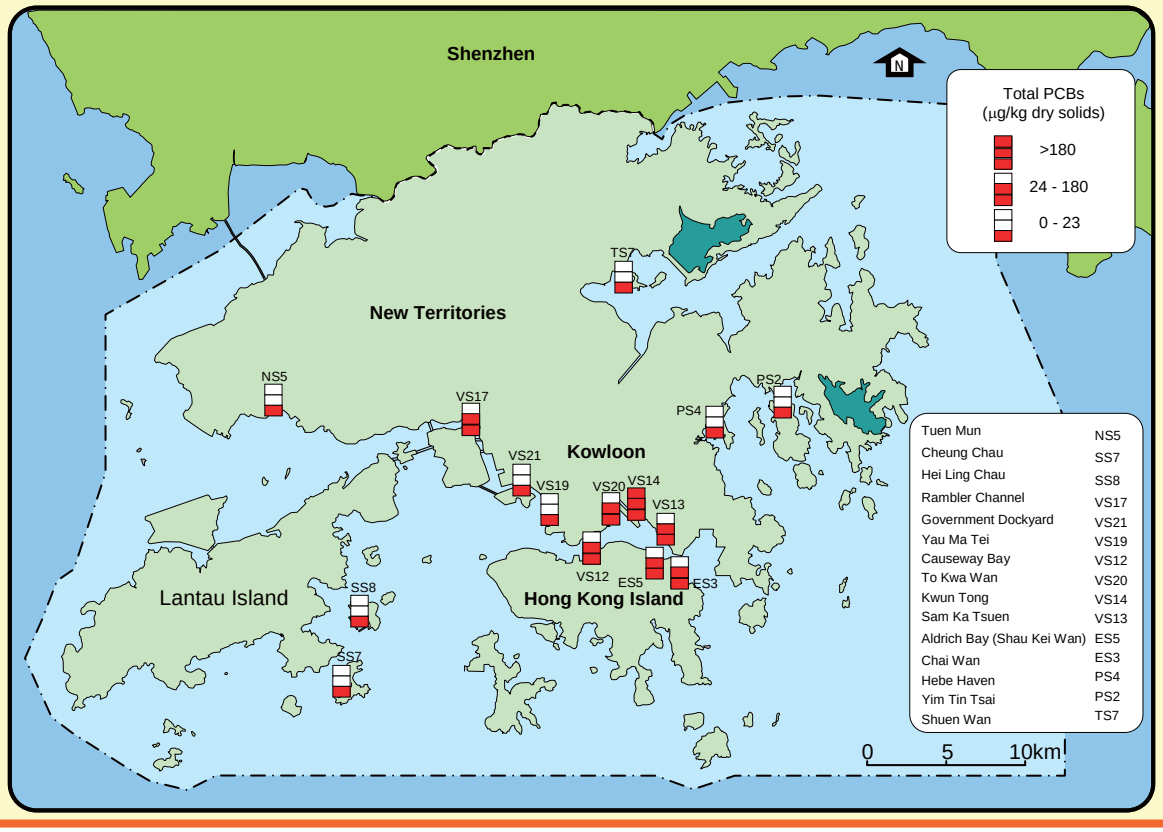
Mean zinc levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



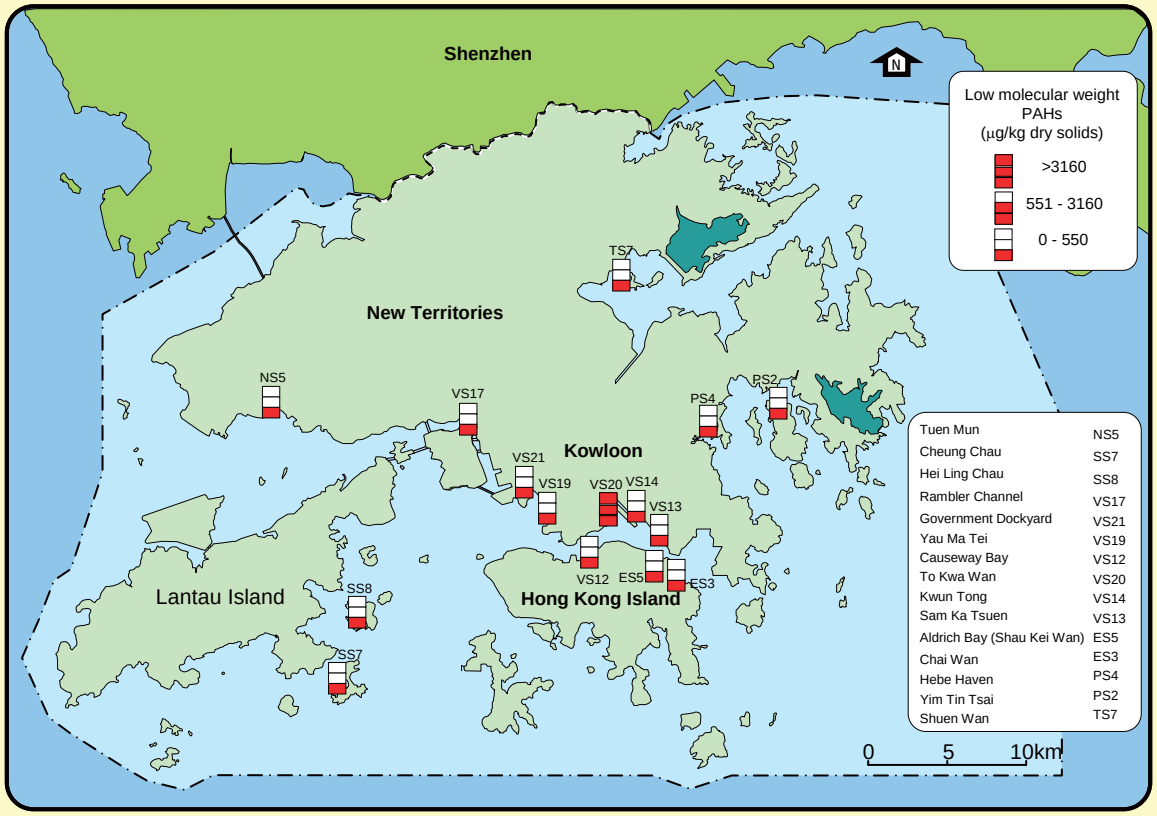
Mean arsenic levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



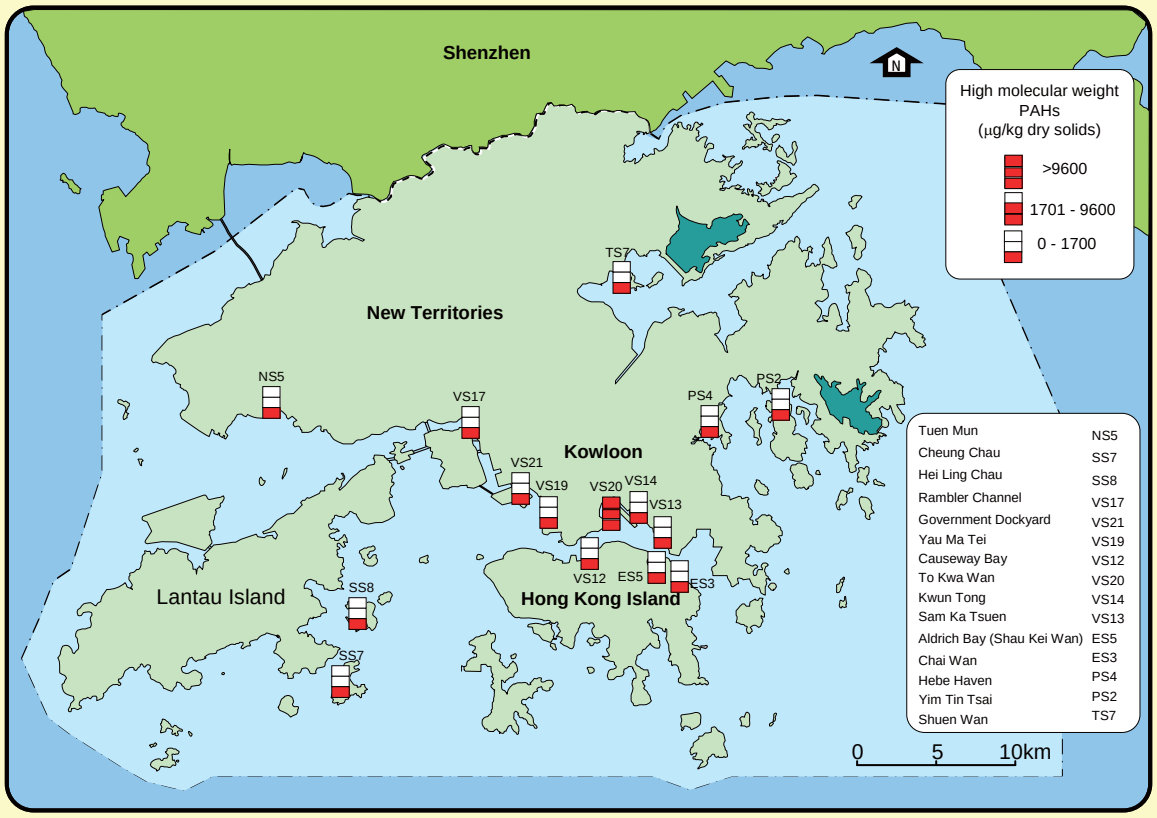
Mean total polychlorinated biphenyls (PCBs) levels in typhoon shelter sediments in Hong Kong, 2006 – 2010

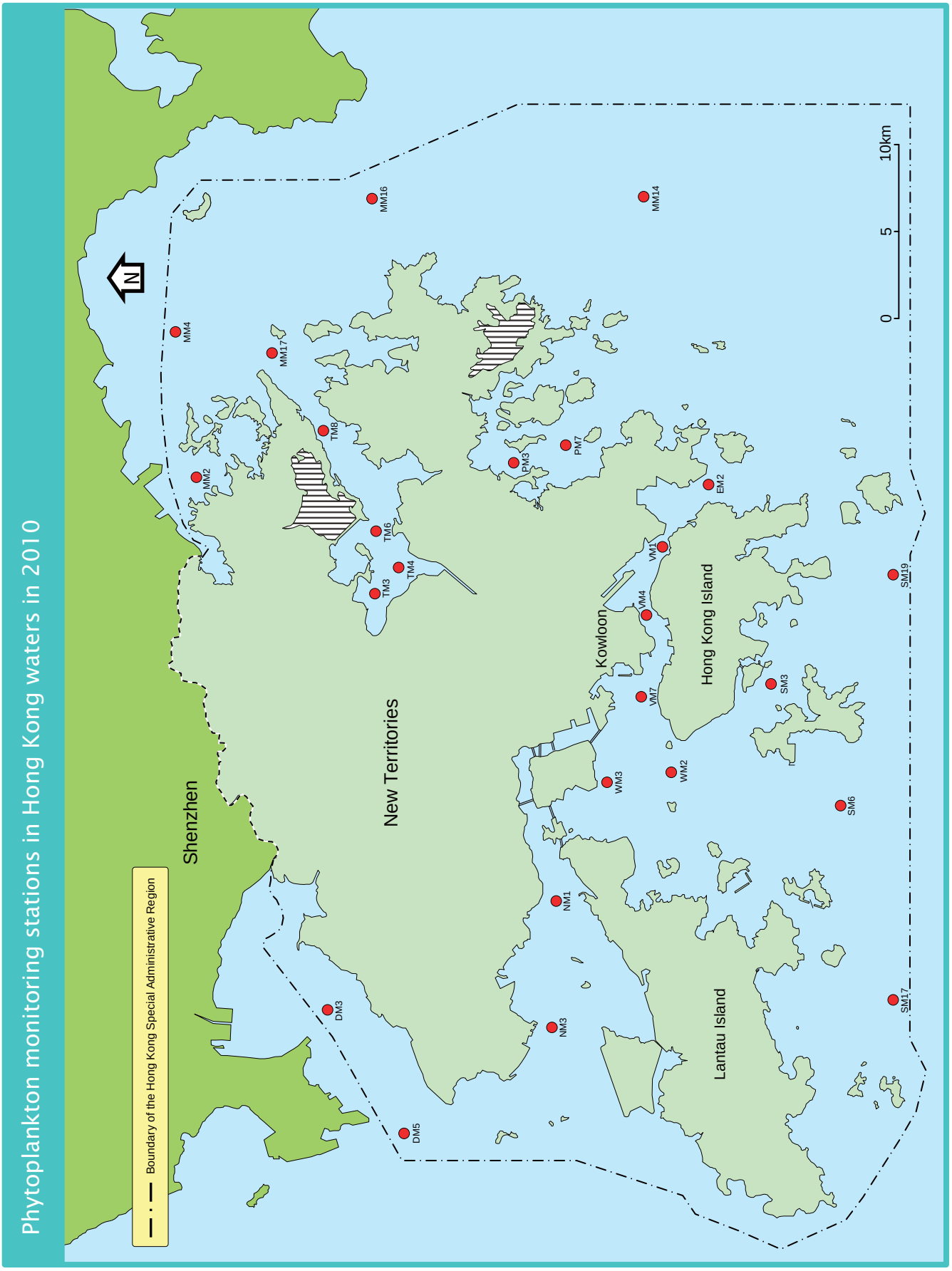


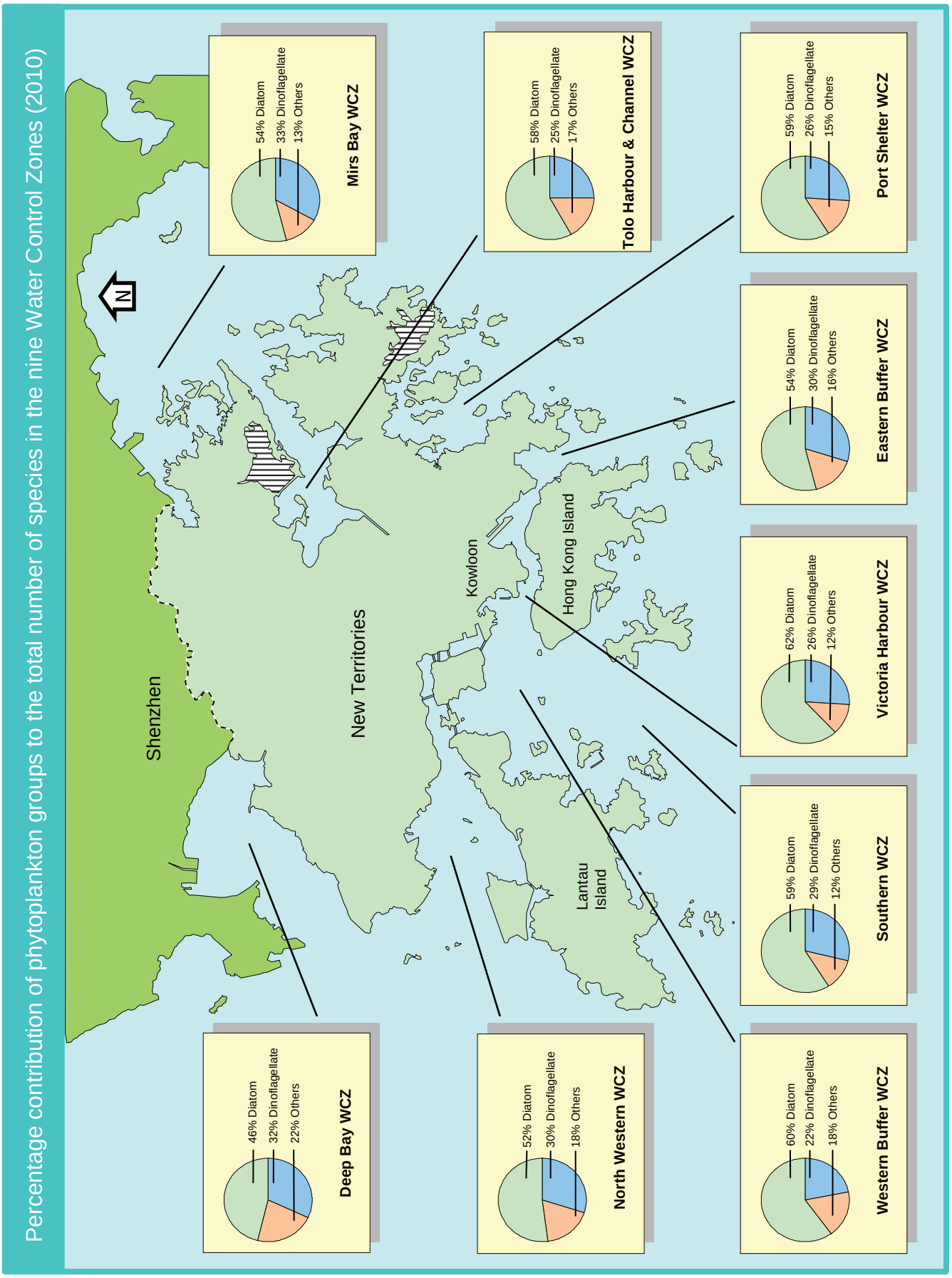
Mean low molecular weight polycyclic aromatic hydrocarbons (PAHs) levels in typhoon shelter sediments in Hong Kong, 2006 – 2010



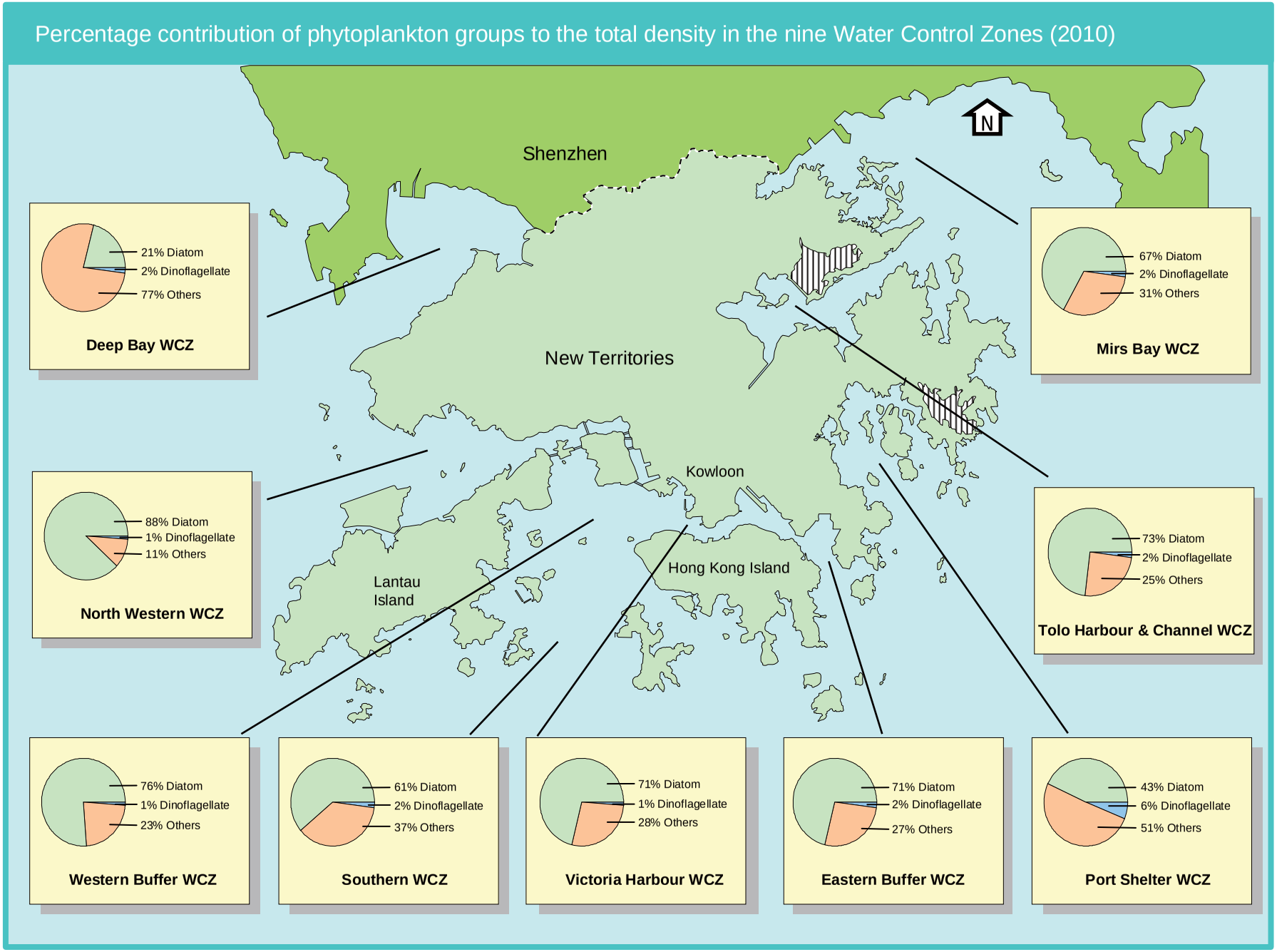
Mean high molecular weight polycyclic aromatic hydrocarbons (PAHs) levels in typhoon shelter sediments in Hong Kong, 2006 – 2010

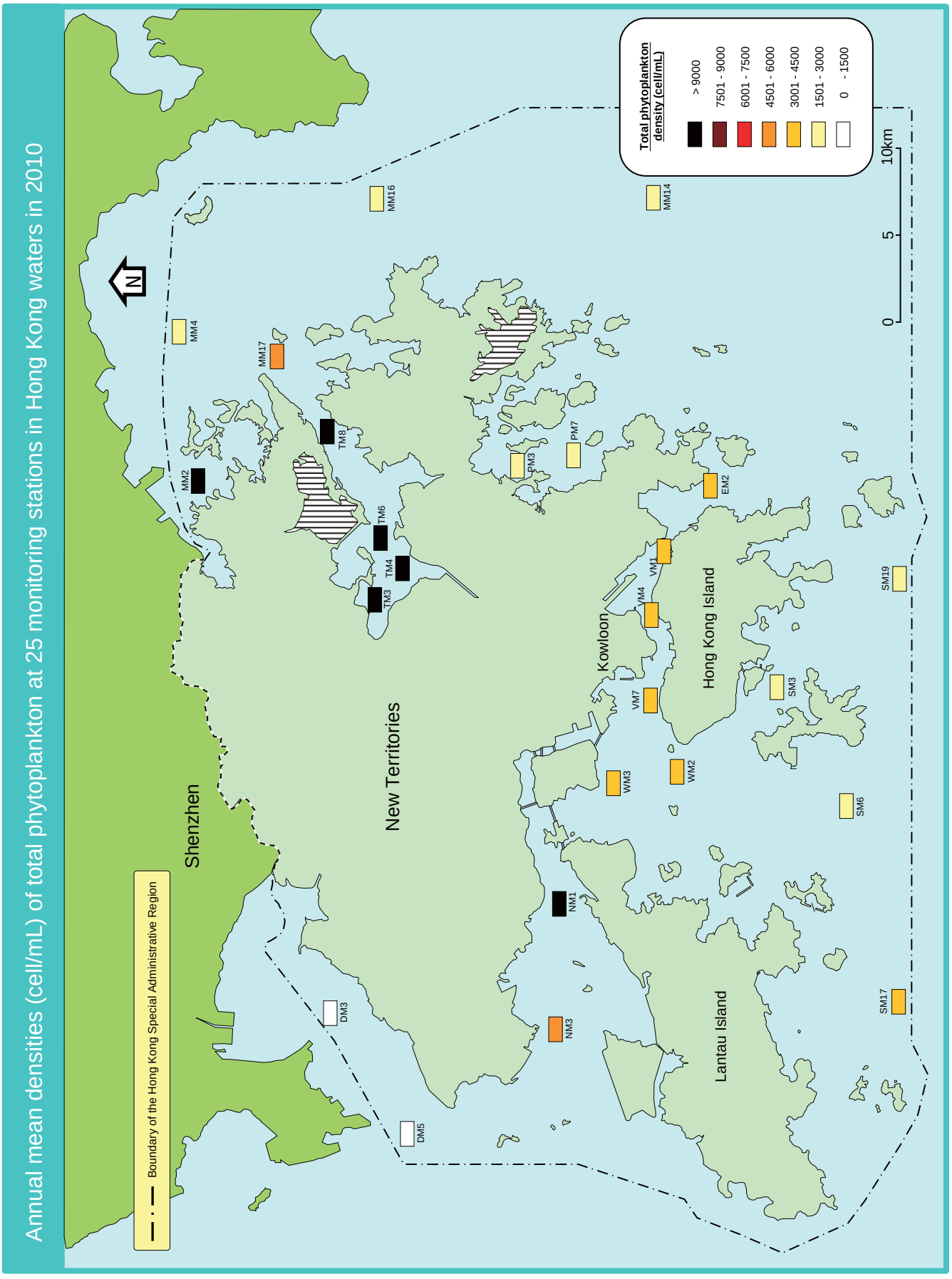


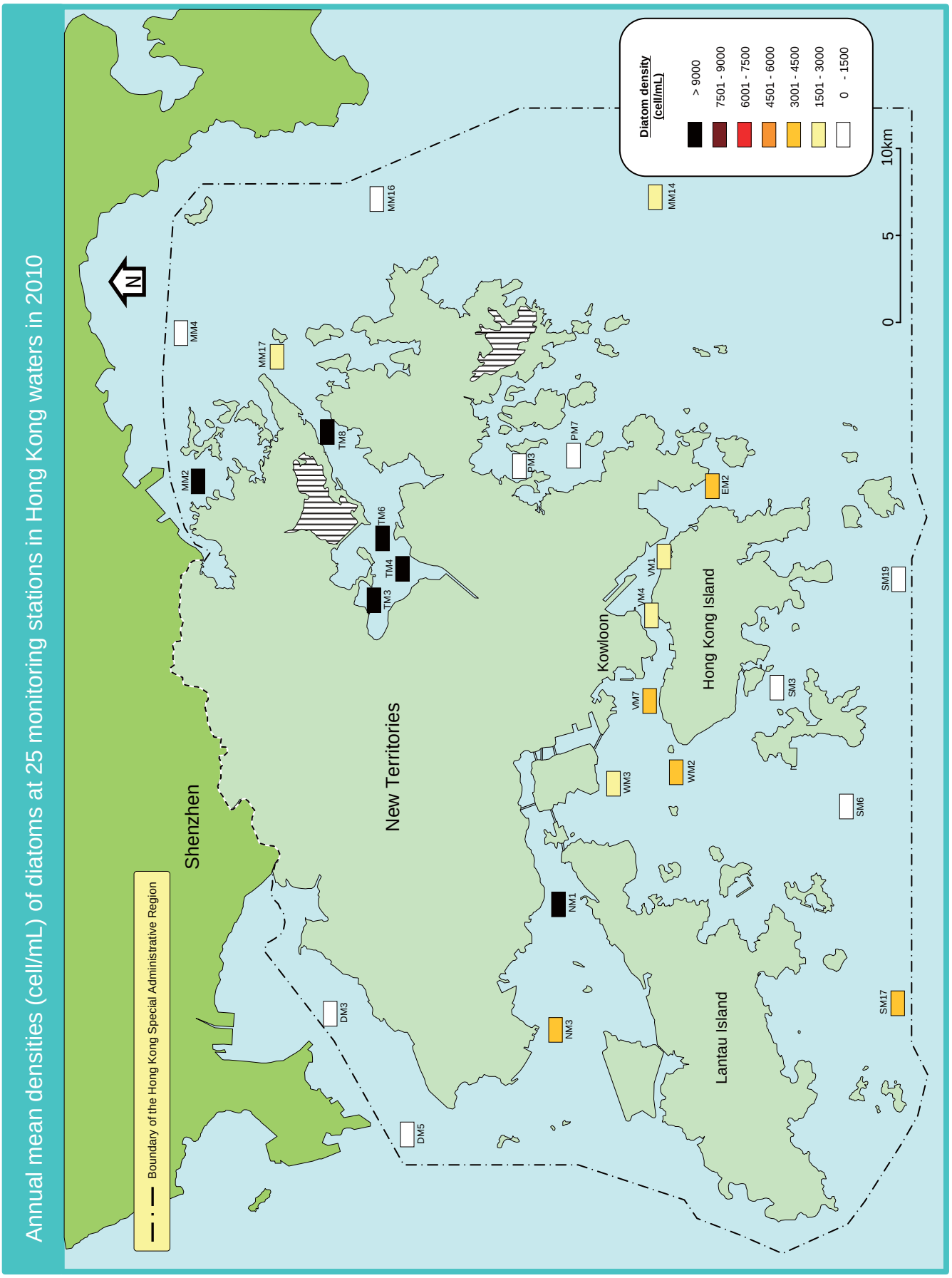

Phytoplankton monitoring stations in Hong Kong waters in 2010
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
N
0
5
10km
MM2
MM4
MM14
MM16
MM17
TM3
TM4
TM6
TM8
PM3
PM7
EM2
VM1
VM4
VM7
WM2
WM3
SM3
SM6
SM17
SM19
NM1
NM3
DM3
DM5

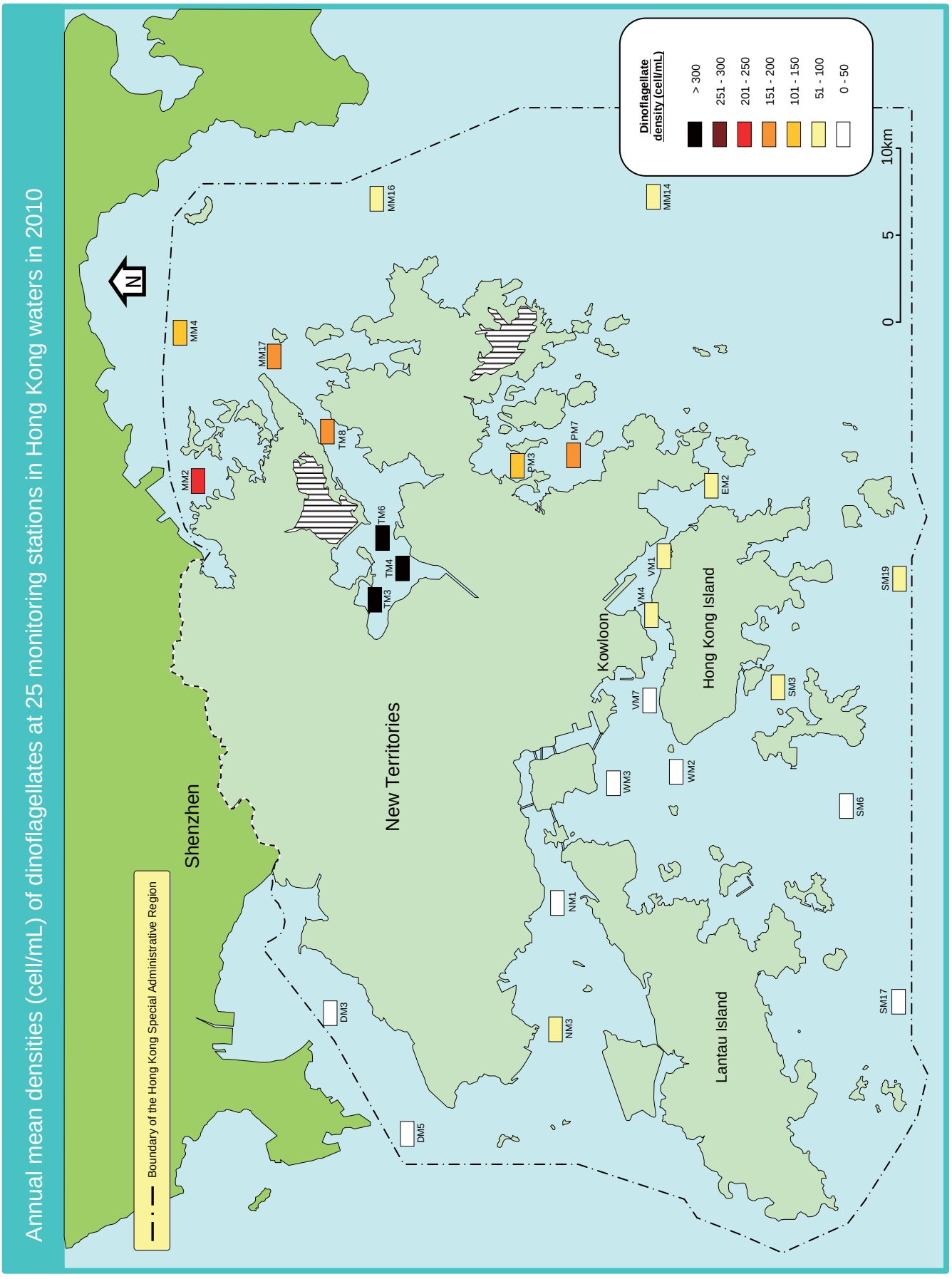

Percentage contribution of phytoplankton groups to the total number of species in the nine Water Control Zones (2010)
N
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
Mirs Bay WCZ
54% Diatom
33% Dinoflagellate
13% Others
Tolo Harbour & Channel WCZ
58% Diatom
25% Dinoflagellate
17% Others
Port Shelter WCZ
59% Diatom
26% Dinoflagellate
15% Others
Eastern Buffer WCZ
54% Diatom
30% Dinoflagellate
16% Others
Victoria Harbour WCZ
62% Diatom
26% Dinoflagellate
12% Others
Southern WCZ
59% Diatom
29% Dinoflagellate
12% Others
Western Buffer WCZ
60% Diatom
22% Dinoflagellate
18% Others
North Western WCZ
52% Diatom
30% Dinoflagellate
18% Others
Deep Bay WCZ
46% Diatom
32% Dinoflagellate
22% Others

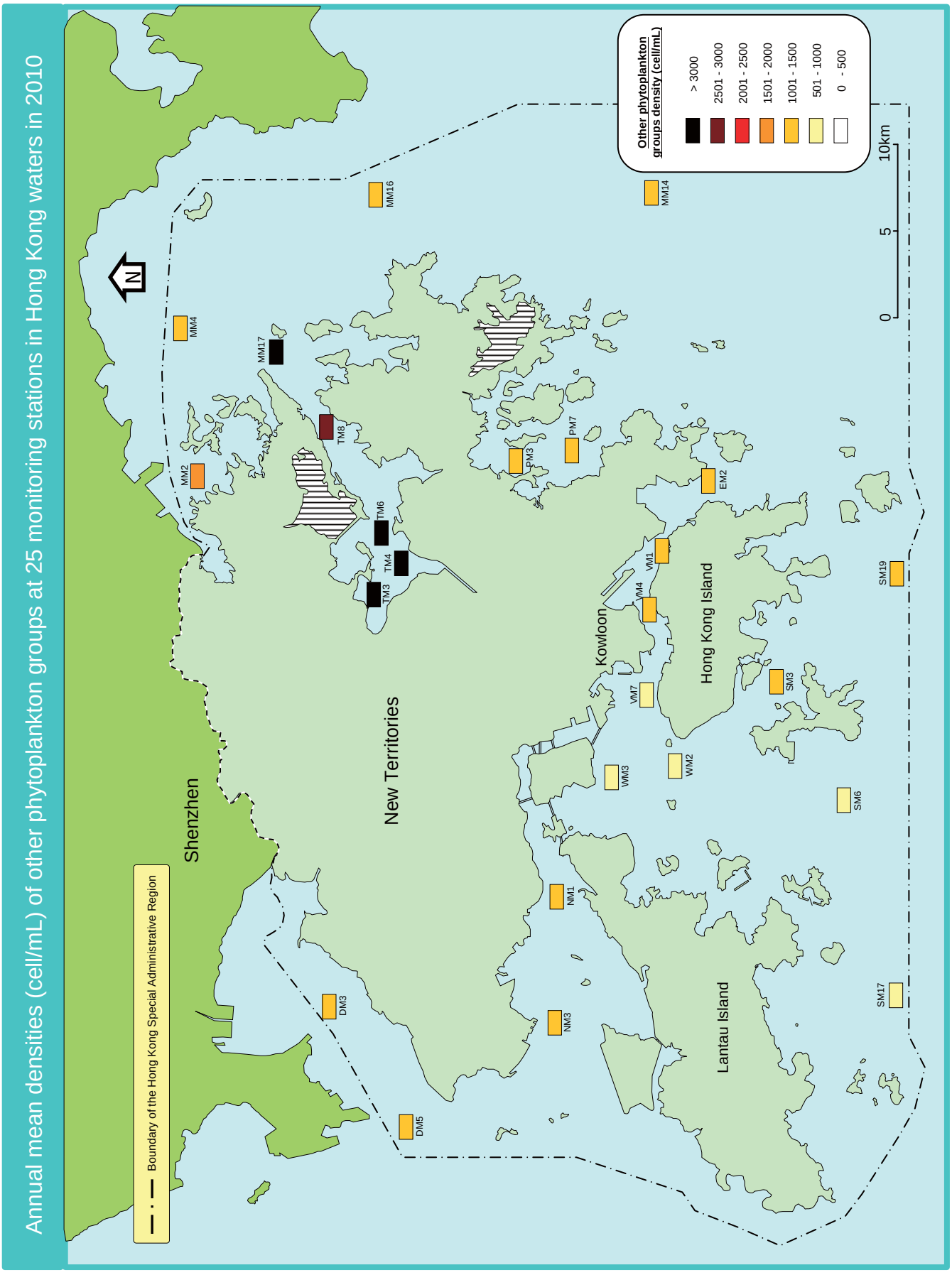
Percentage contribution of phytoplankton groups to the total density in the nine Water Control Zones (2010)

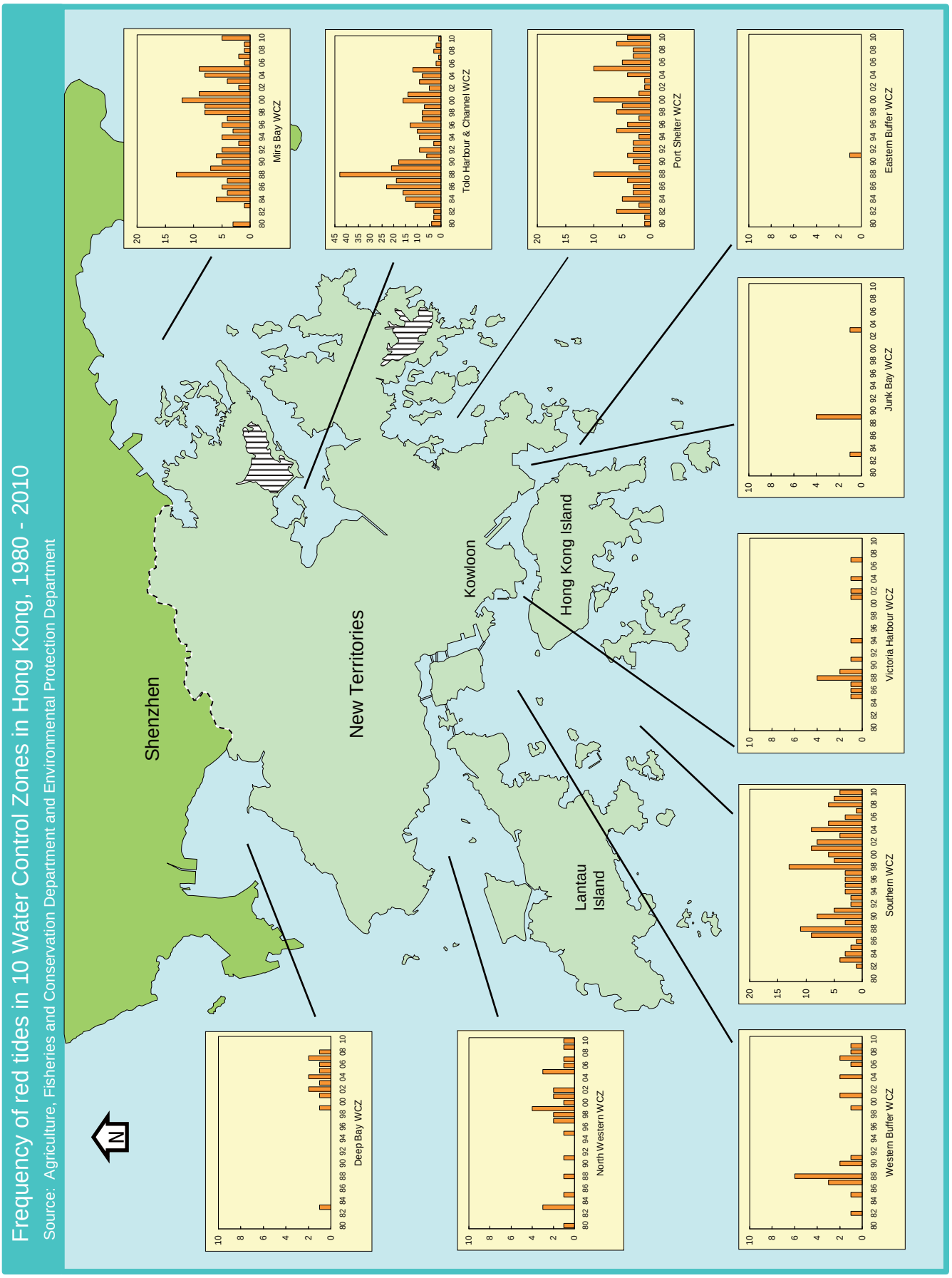



Annual mean densities (cell/mL) of total phytoplankton at 25 monitoring stations in Hong Kong waters in 2010
Total phytoplankton density (cell/mL)
> 9000
7501 - 9000
6001 - 7500
4501 - 6000
3001 - 4500
1501 - 3000
0 - 1500
0
5
10km
N
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM2
MM4
MM16
MM17
MM14
TM3
TM4
TM6
TM8
PM3
PM7
EM2
VM1
VM4
VM7
WM2
WM3
SM3
SM6
SM19
SM17
NM1
NM3
DM3
DM5


Annual mean densities (cell/mL) of diatoms at 25 monitoring stations in Hong Kong waters in 2010
Diatom density (cell/mL)
> 9000
7501 - 9000
6001 - 7500
4501 - 6000
3001 - 4500
1501 - 3000
0 - 1500
0
5
10km
N
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM2
MM4
MM16
MM17
MM14
TM3
TM4
TM6
TM8
PM3
PM7
EM2
VM1
VM4
VM7
WM2
WM3
SM3
SM6
SM17
SM19
NM1
NM3
DM3
DM5


Annual mean densities (cell/mL) of dinoflagellates at 25 monitoring stations in Hong Kong waters in 2010
Dinoflagellate density (cell/mL)
> 300
251 - 300
201 - 250
151 - 200
101 - 150
51 - 100
0 - 50
0
5
10km
N
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM16
MM14
MM4
MM17
MM2
TM8
TM6
TM4
TM3
PM7
PM3
EM2
VM1
VM4
VM7
SM19
SM3
WM3
WM2
SM6
NM1
NM3
DM3
DM5
SM17

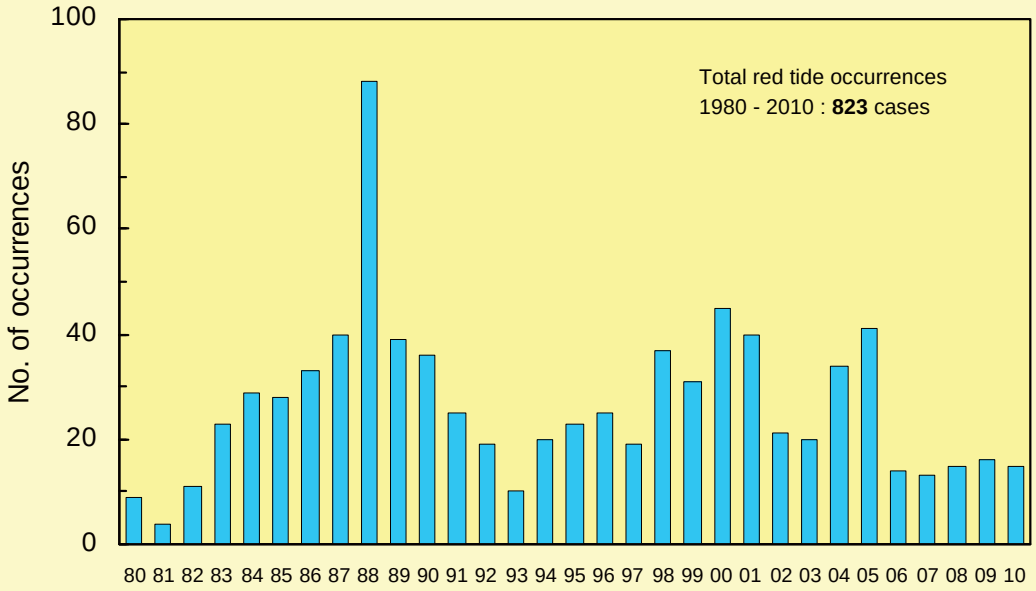

Annual mean densities (cell/mL) of other phytoplankton groups at 25 monitoring stations in Hong Kong waters in 2010
Other phytoplankton groups density (cell/mL)
> 3000
2501 - 3000
2001 - 2500
1501 - 2000
1001 - 1500
501 - 1000
0 - 500
0
5
10km
N
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM16
MM14
MM4
MM17
MM2
TM8
TM6
TM4
TM3
PM7
PM3
EM2
VM1
VM4
VM7
WM3
WM2
SM19
SM3
SM6
NM1
NM3
DM3
DM5
SM17


Frequency of red tides in 10 Water Control Zones in Hong Kong, 1980 - 2010
Source: Agriculture, Fisheries and Conservation Department and Environmental Protection Department
N
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
Deep Bay WCZ
North Western WCZ
Western Buffer WCZ
Southern WCZ
Victoria Harbour WCZ
Junk Bay WCZ
Eastern Buffer WCZ
Port Shelter WCZ
Tolo Harbour & Channel WCZ
Mirs Bay WCZ

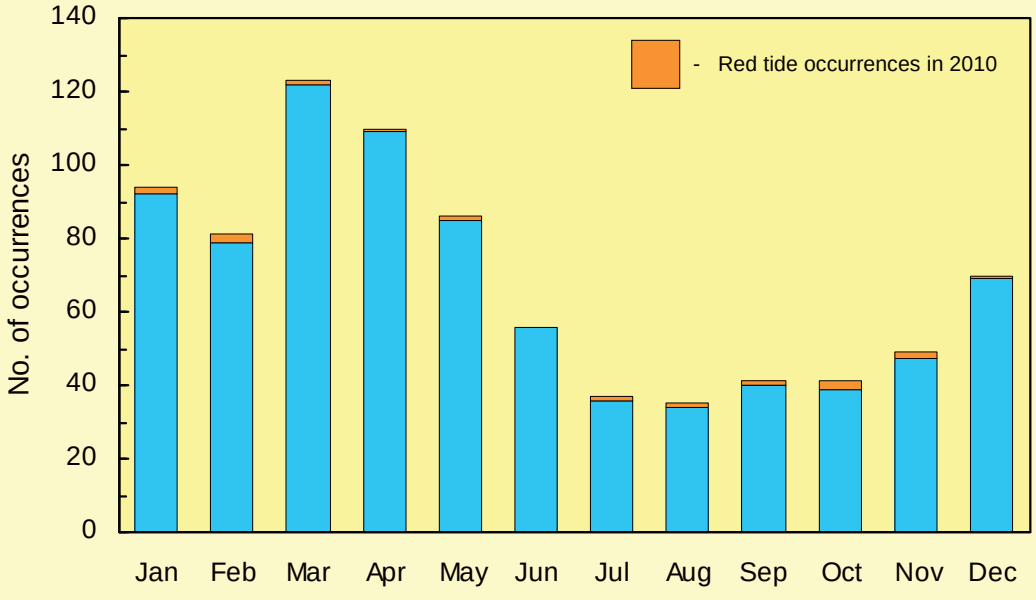
Occurrence of red tides in Hong Kong waters, 1980 – 2010

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

Yearly Distribution

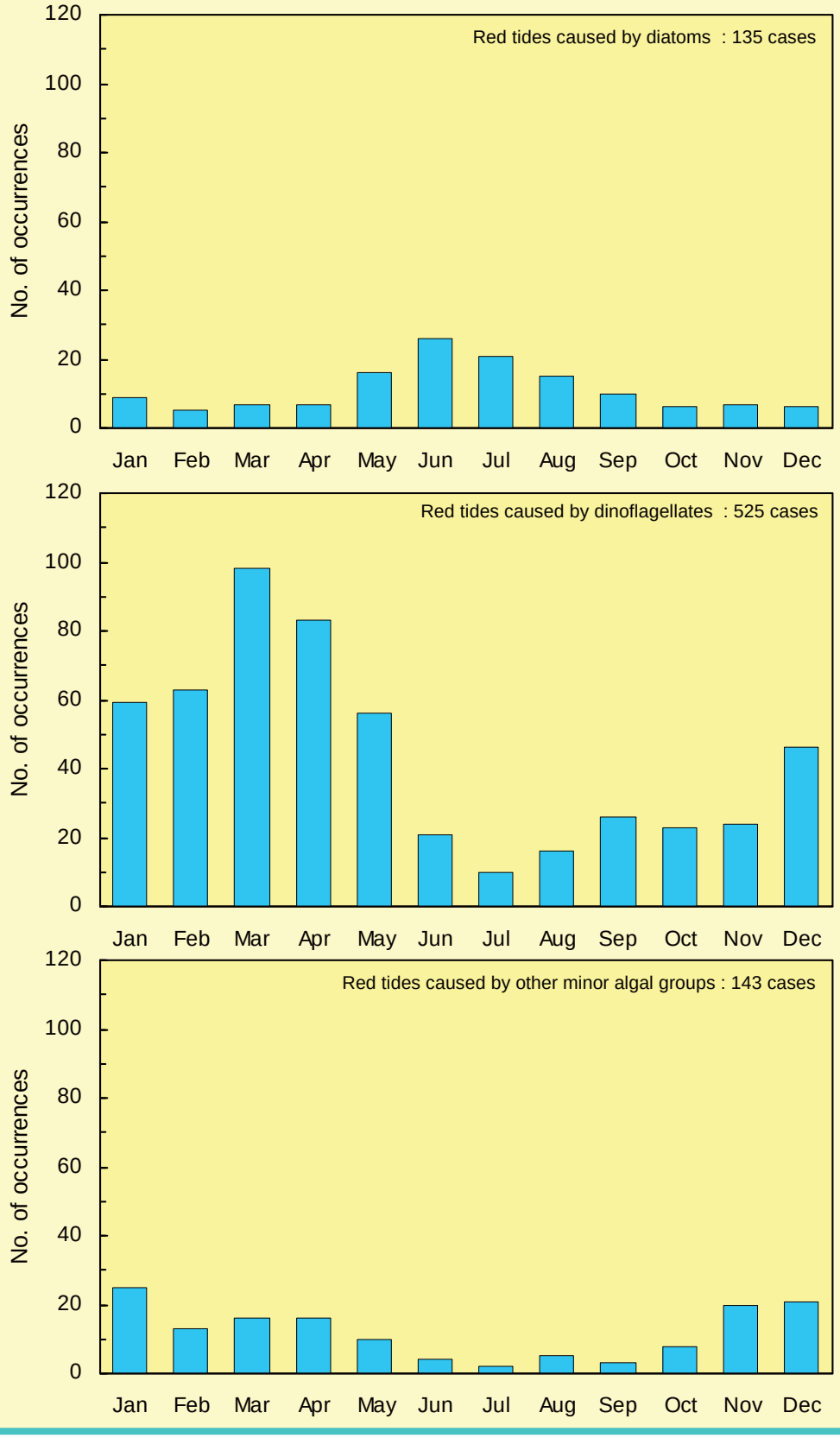


Monthly Distribution



Seasonal occurrence of red tides caused by different phytoplankton groups in Hong Kong, 1980 – 2010

(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 2010.

Species	% Abundance[1]	Frequency[2]	Species	% Abundance[1]	Frequency[2]	Species	% Abundance[1]	Frequency[2]
Tolo Harbour & Channel			**Port Shelter**			**North Western**		
Diatoms			Diatoms			Diatoms		
Leptocylindrus danicus	30.2	8	*Pseudo-nitzschia spp.*	33.2	10	*Skeletonema costatum*	81.2	11
Pseudo-nitzschia spp.	20.1	12	*Chaetoceros spp.*	32.4	12	*Chaetoceros spp.*	8.6	8
Chaetoceros spp.	18.5	12	*Thalassiosira spp.*	8.8	12	*Thalassiosira spp.*	7.8	12
Dinoflagellates			Dinoflagellates			Dinoflagellates		
Scrippsiella spp.	41.8	10	*Scrippsiella spp.*	30.3	10	*Gymnodinium spp.*	50.6	12
Gymnodinium spp.	22.0	12	*Karenia papilionacea*	18.3	4	*Amphidinium spp.*	18.8	7
Scrippsiella trochoidea	12.5	4	*Gymnodinium spp.*	16.3	10	*Scrippsiella spp.*	10.6	6
Others			Others			Others		
small flagellates	92.0	12	*small flagellates*	85.4	12	*small flagellates*	77.7	12
Plagioselmis prolonga	5.1	12	*Plagioselmis prolonga*	11.1	12	*Plagioselmis prolonga*	16.4	12
Teleaulax acuta	2.3	12	*Teleaulax acuta*	2.9	10	*Teleaulax acuta*	3.8	12
Mirs Bay			**Victoria Harbour**			**Western Buffer**		
Diatoms			Diatoms			Diatoms		
Chaetoceros spp.	34.4	12	*Skeletonema costatum*	49.1	10	*Thalassiosira spp.*	50.8	12
Pseudo-nitzschia spp.	16.9	12	*Thalassiosira spp.*	24.9	12	*Skeletonema costatum*	32.6	10
Skeletonema costatum	13.8	11	*Chaetoceros spp.*	12.9	11	*Chaetoceros spp.*	8.5	11
Dinoflagellates			Dinoflagellates			Dinoflagellates		
Gymnodinium spp.	38.7	12	*Gymnodinium spp.*	42.8	12	*Gymnodinium spp.*	41.7	12
Scrippsiella spp.	18.1	11	*Gyrodinium fusiforme*	20.3	12	*Amphidinium spp.*	24.6	8
Gyrodinium fusiforme	10.6	12	*Amphidinium spp.*	14.1	9	*Gyrodinium fusiforme*	11.00	8
Others			Others			Others		
small flagellates	83.8	12	*small flagellates*	84.7	12	*small flagellates*	81.2	12
Plagioselmis prolonga	12.0	12	*Plagioselmis prolonga*	11.7	12	*Plagioselmis prolonga*	12.7	12
Teleaulax acuta	3.6	12	*Teleaulax acuta*	2.9	12	*Teleaulax acuta*	4.7	12
Eastern Buffer			**Southern**			**Deep Bay**		
Diatoms			Diatoms			Diatoms		
Pseudo-nitzschia spp.	40.5	9	*Chaetoceros spp.*	36.9	11	*Thalassiosira spp.*	36.8	12
Thalassiosira spp.	23.9	11	*Pseudo-nitzschia spp.*	20.2	12	*Skeletonema costatum*	32.5	10
Chaetoceros spp.	23.5	8	*Skeletonema costatum*	19.2	10	*Chaetoceros spp.*	9.0	7
Dinoflagellates			Dinoflagellates			Dinoflagellates		
Gymnodinium spp.	37.5	10	*Gymnodinium spp.*	53.2	12	*Gymnodinium spp.*	30.5	9
Amphidinium spp.	19.4	8	*Amphidinium spp.*	16.7	11	*Scrippsiella spp.*	18.2	5
Prorocentrum minimum	13.5	2	*Scrippsiella spp.*	11.7	7	*Amphidinium spp.*	14.6	4
Others			Others			Others		
small flagellates	82.0	12	*small flagellates*	83.8	12	*small flagellates*	58.9	12
Plagioselmis prolonga	13.4	12	*Plagioselmis prolonga*	13.3	12	*Plagioselmis prolonga*	28.4	12
Teleaulax acuta	3.9	10	*Teleaulax acuta*	2.3	12	*Teleaulax acuta*	9.1	12

[1] % of species/group in diatoms, dinoflagellates and other phytoplankton
[2] Number of occurrences out of 12 sampling occasions.

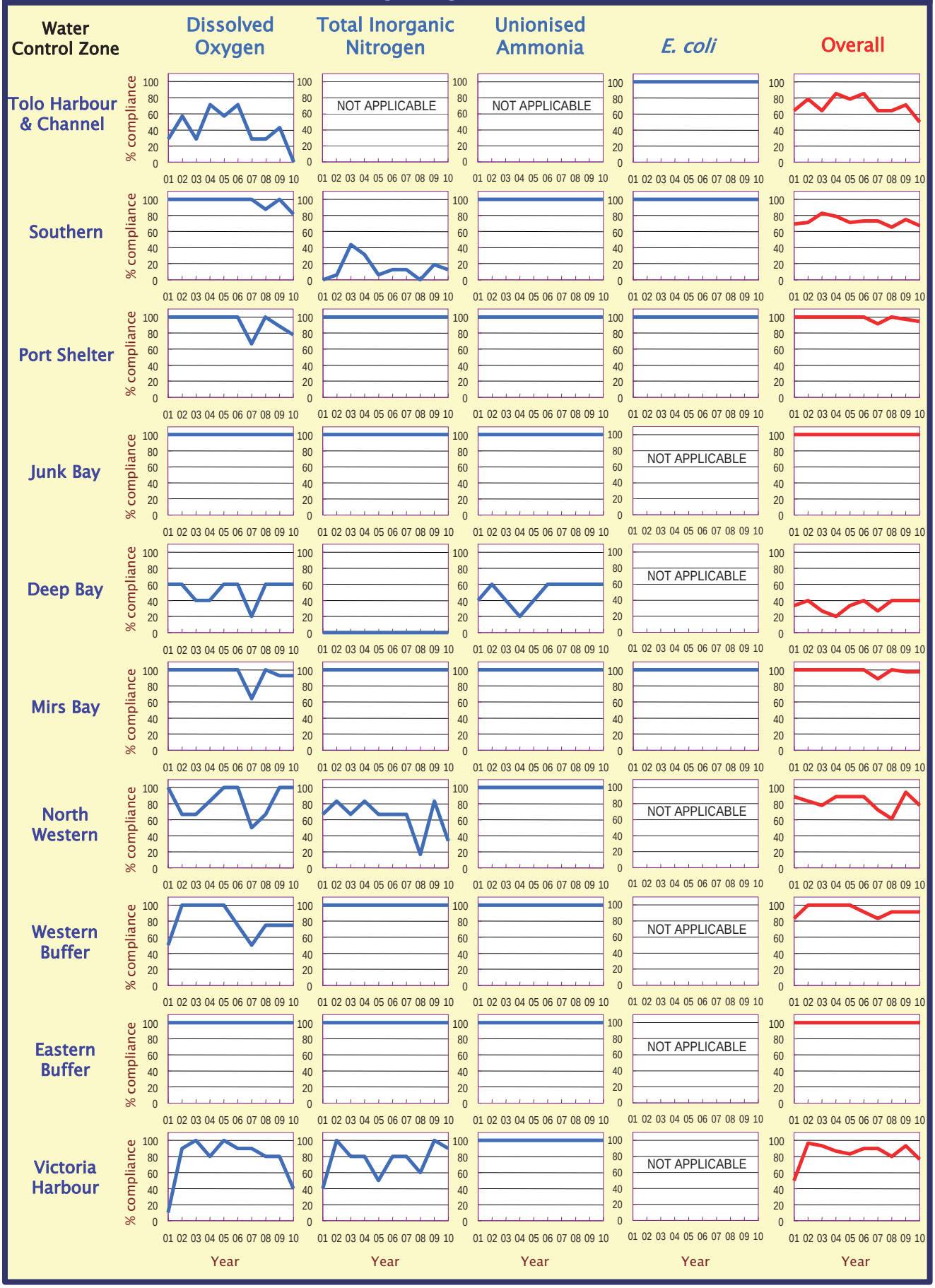
Occurrence and distribution of red tide species in different Water Control Zones (WCZs), 1980 -2010

Species	Number of occurrences										
	Tolo Harbour & Channel WCZ	Mirs Bay WCZ	Eastern Buffer WCZ	Port Shelter WCZ	Junk Bay WCZ	Victoria Harbour WCZ	Southern Waters WCZ	North Western WCZ	Western Buffer WCZ	Deep Bay WCZ	Total
Noctiluca scintillans	62	68		57			57	5	7		256
Skeletonema costatum	23	3		1	3	9	12	3	9	2	65
Mesodinium rubrum	8	8		10	1		17	7	2	2	55
Gonyaulax polygramma	21	8		14			6	1			50
Prorocentrum minimum	44	1									45
Ceratium furca	15	7		13							35
Prorocentrum triestinum	33										33
Scrippsiella trochoidea	15	5		3			1				24
Heterosigma akashiwo	15	2						3		1	21
Heterocapsa circularisquama	13	3									16
Prorocentrum sigmoides	14	1		1							16
Prorocentrum dentatum	8	4		1			1				14
Trichodesmium erythraeum		6		5			3				14
Thalassiosira nordenskioeldii	2	3				1	4		2		12
Karenia mikimotoi	6	2		3							11
Prorocentrum micans	4	4		1		1	1				11
Leptocylindrus minimus	10										10
Phaeocystis globosa		1					8			1	10
Akashiwo sanguinea	2	3						2		1	8
Cryptomonas spp.	8										8
Dactyliosolen fragilissimus	6	1		1							8
Karenia digitata	1	3		2			2				8
Thalassiosira mala	6						2				8
Chaetoceros spp.	6			1							7
Plagioselmis prolonga	7										7
Thalassiosira proschkinae	6	1									7
Cochlodinium spp.	2							2	1	1	6
Gyrodinium instriatum						1	1	2	1	1	6
Dictyocha speculum		2		2			1				5
Thalassiosira spp.	2				1		2				5
Eutreptiella spp.	4										4
Haematococcus pluvialis	4										4
Leptocylindrus danicus	3	1									4
Pseudo-nitzschia pseudodelicatissima	1						2		1		4
Chaetoceros curvisetus			1		1		1				3
Chattonella marina	2	1									3
Chattonella ovata		2		1							3
Gymnodinium simplex	3										3
Karenia longicanalis	1	1					1				3
Prorocentrum balticum	1	1		1							3
Pseudo-nitzschia seriata	1					2					3
Teleaulax acuta	3										3
Trichodesmium spp.		1		1			1				3
Alexandrium tamarense				2							2
Cerataulina pelagica	2										2
Chaetoceros socialis							2				2
Chattonella spp.	1						1				2
Cochlodinium polykrikoides							2				2
Eucampia zodiacus							1	1			2
Fibrocapsa japonica				1			1				2
Gymnodinium spp. X				2							2
Heterocapsa rotundata	2										2
Nitzschia longissima	1						1				2
Prorocentrum spp.	1	1									2
Pseudo-nitzschia spp.							2				2
Thalassiosira tealata							2				2
Thalassiosira weissflogii										2	2
Alexandrium catenella					1						1
Chaetoceros pseudocrinitus	1										1
Chaetoceros pseudocurvisetus							1				1
Chaetoceros salsugineum		1									1
Chaetoceros spp.0105	1										1
Chaetoceros tenuissimus		1									1
Chlamydomonas spp.	1										1
Chlamydomonas uva-maris	1										1
Cyclotella caspia	1										1
Cyclotella spp.	1										1
Cylindrotheca closterium	1										1
Cyttarocylis spp.				1							1
Guinardia delicatula	1										1
Guinardia striata	1										1
Gymnodinium spp.		1									1
Gyrodinium spirale							1				1
Hermesinum adriaticum		1									1
Karenia papilionacea				1							1
Karlodinium micrum		1									1
Katodinium rotundatum								1			1
Leptocylindrus spp.							1				1
Navicula spp.										1	1
Odontella mobiliensis	1										1
Odontella sinensis	1										1
Pedinomonadaceae spp.	1										1
Protoperidinium quinquecorne	1										1
Protopolykrokos distortus								1			1
Thalassomonas spp.	1										1
Trichodesmium thiebautii							1				1
Total : 86 species	383	149	1	125	7	14	139	28	23	12	881

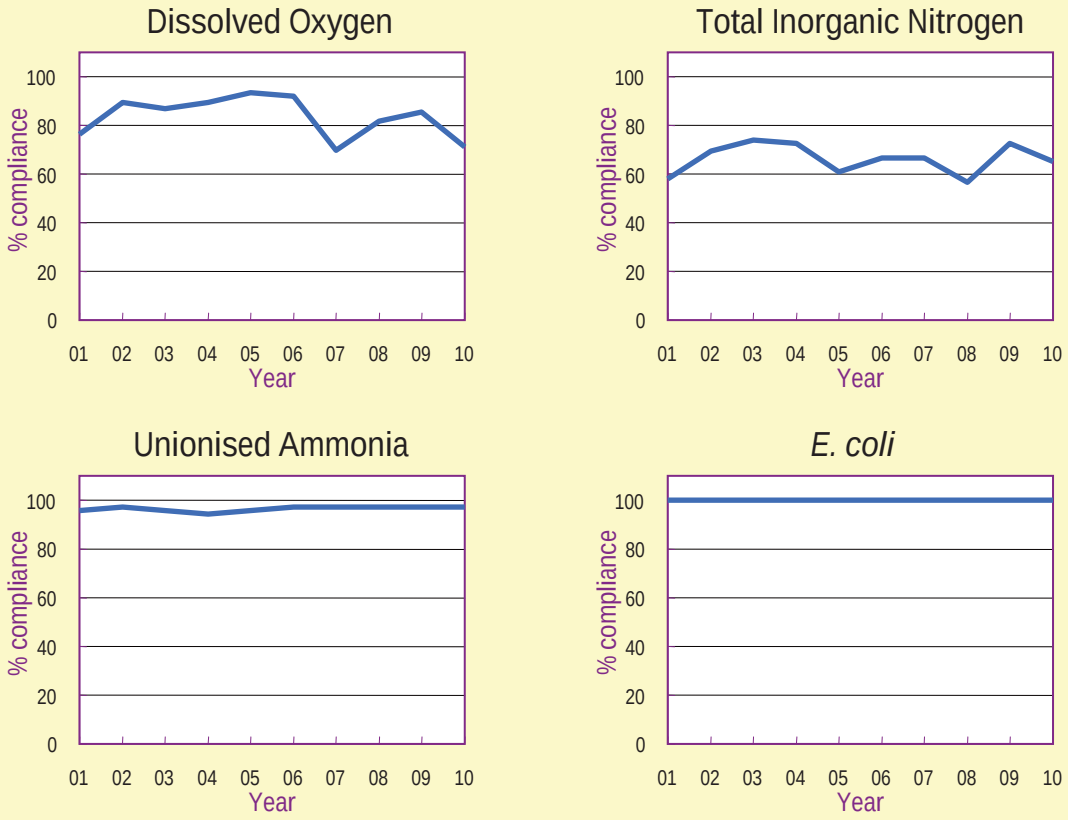
Note: a red tide incident may involve more than one causative species.

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

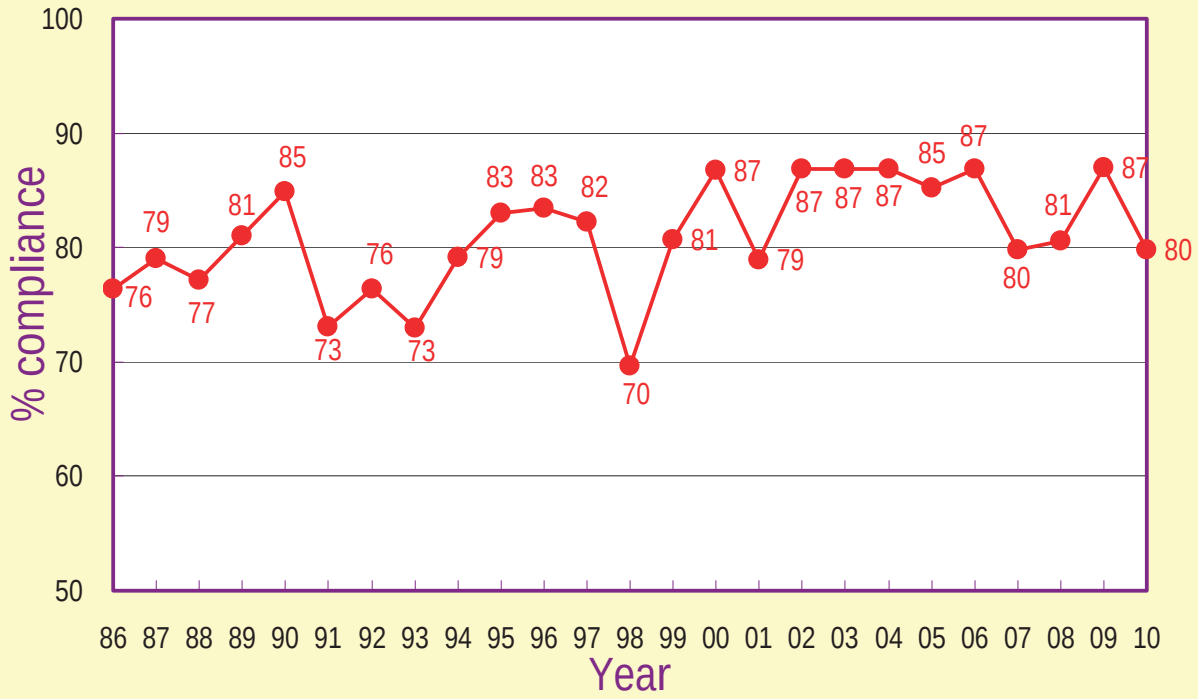
Level of compliance with key marine Water Quality Objectives for 10 Water Control Zones in Hong Kong, 2001 – 2010

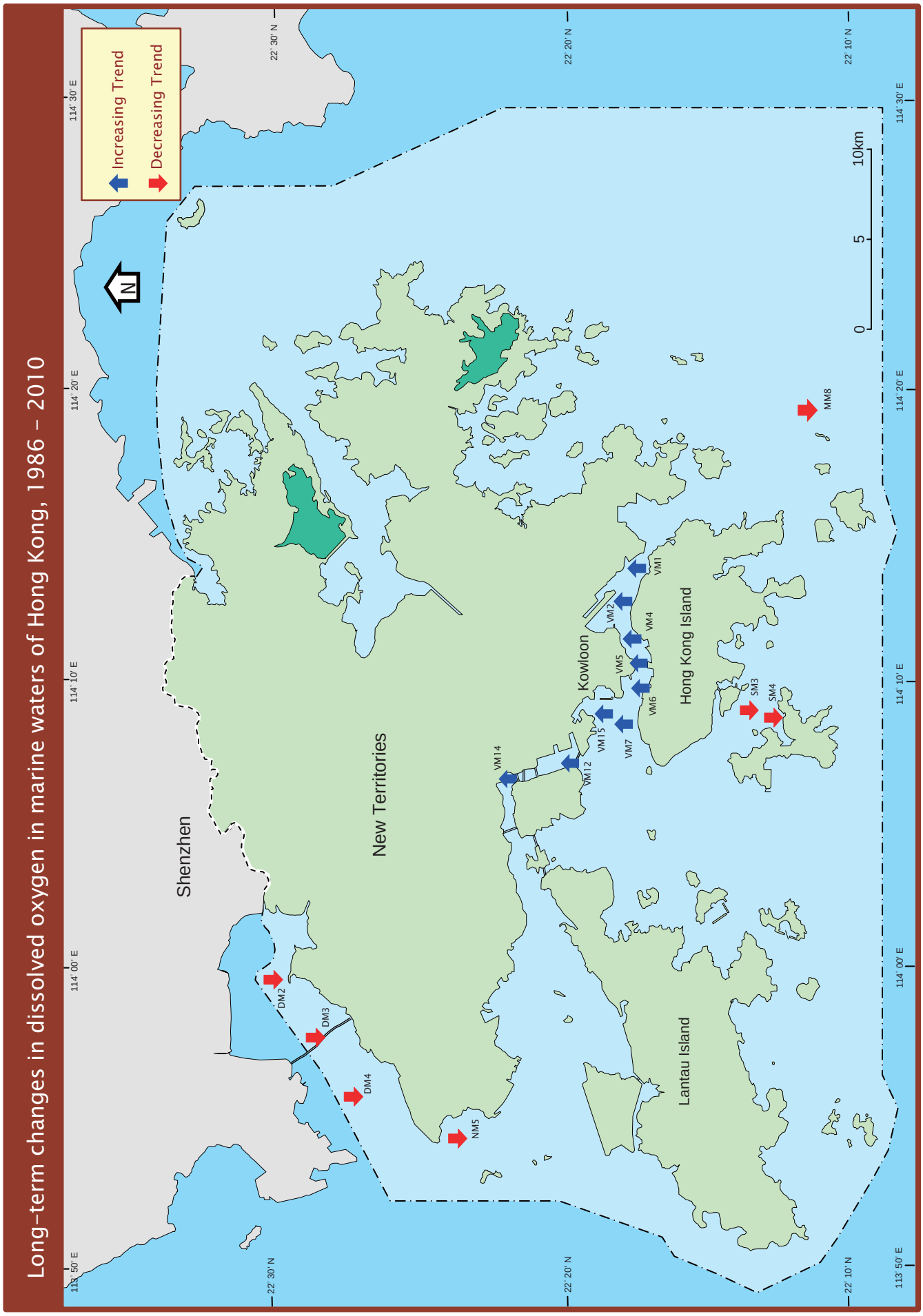


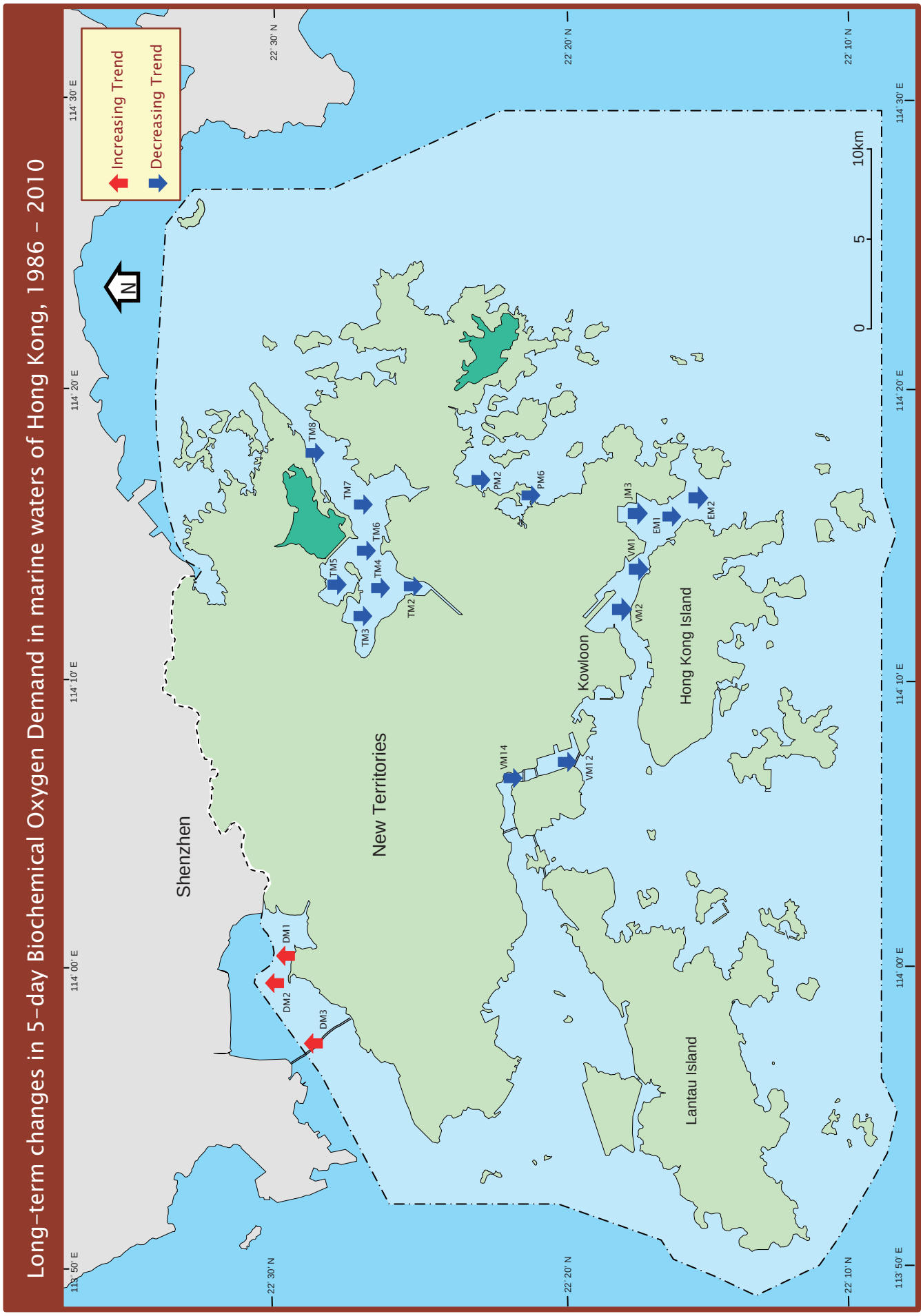
Level of compliance with key marine Water Quality Objectives in Hong Kong, 2001 – 2010

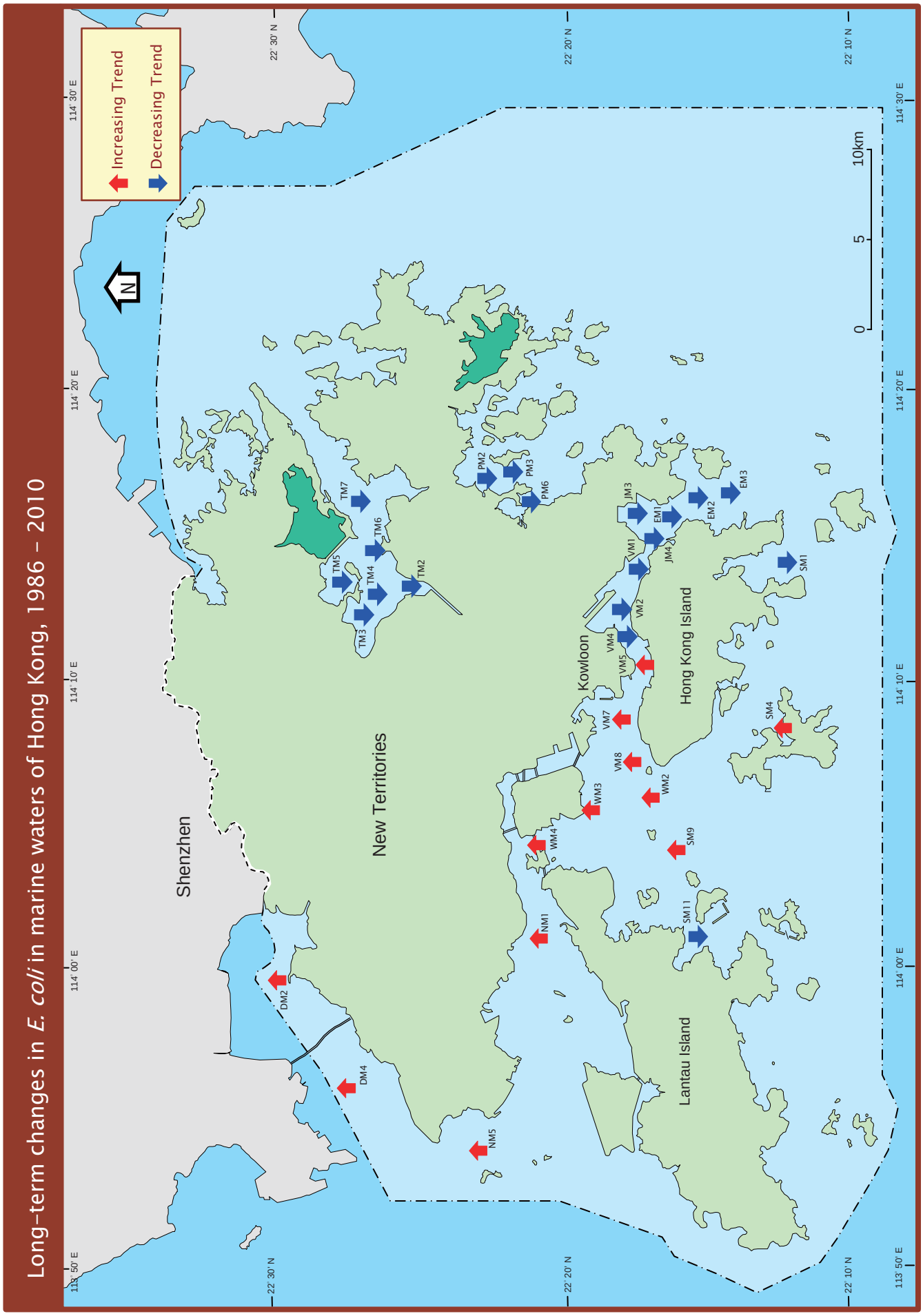


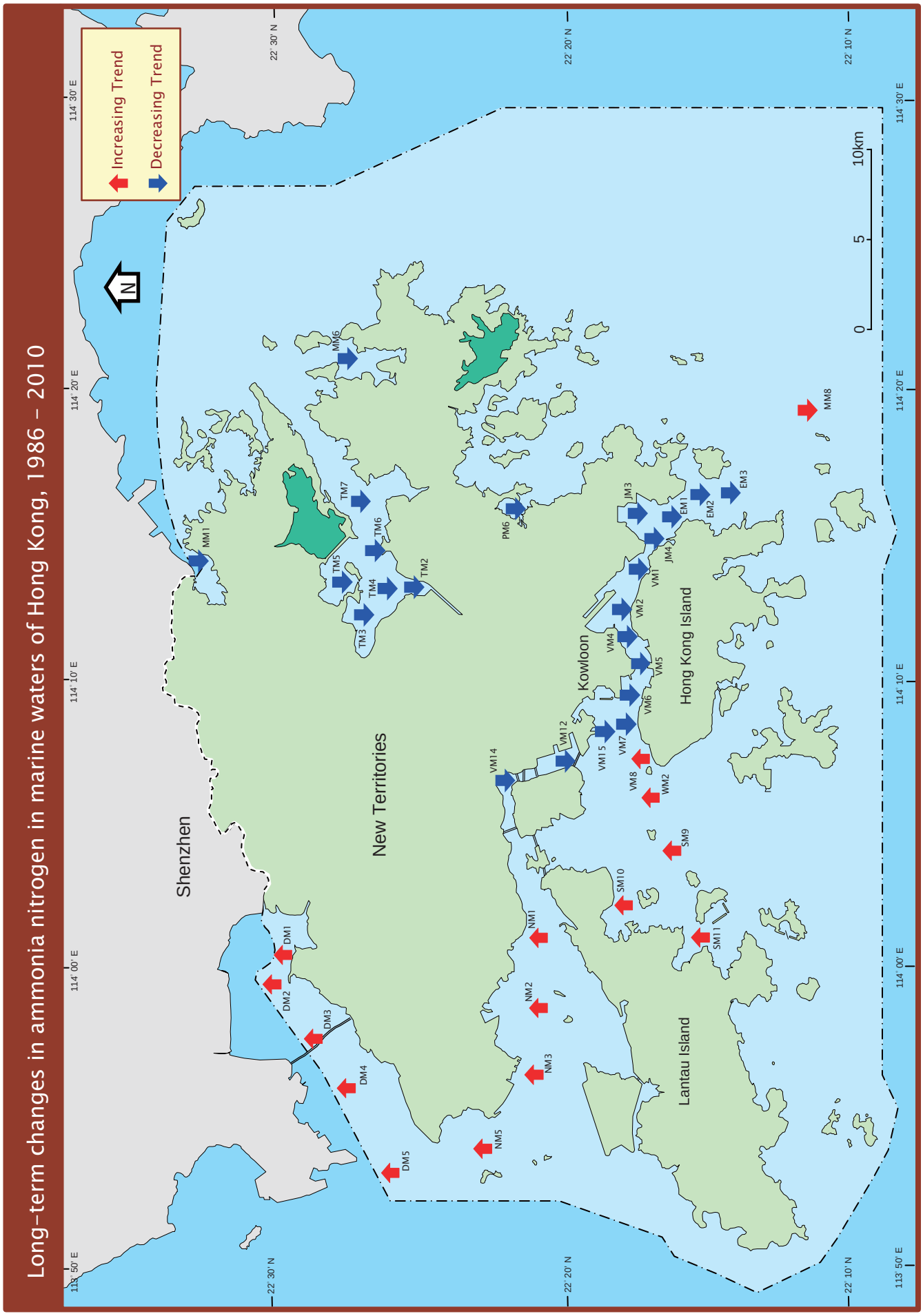
Overall level of compliance with key marine Water Quality Objectives in Hong Kong, 1986 – 2010

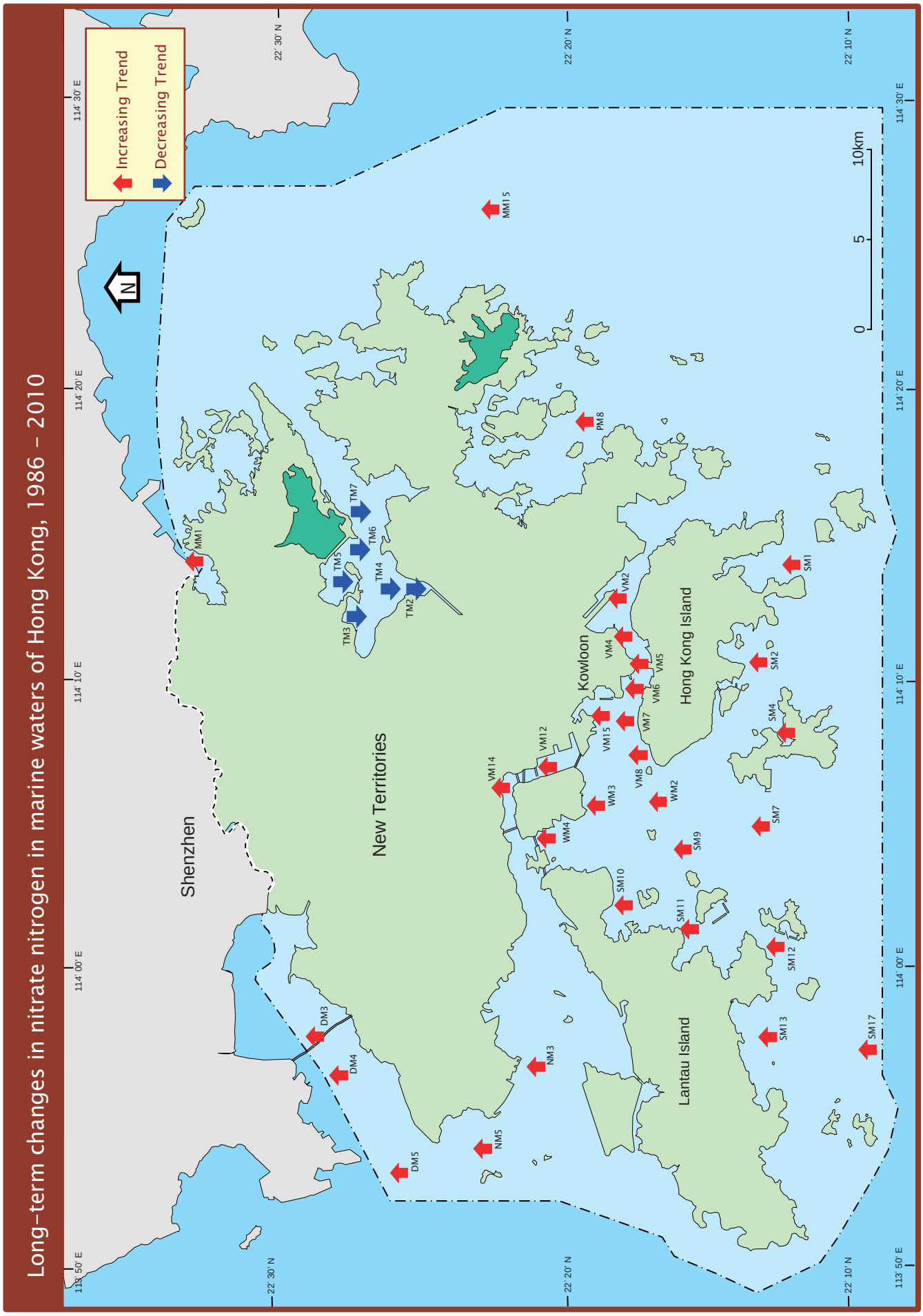


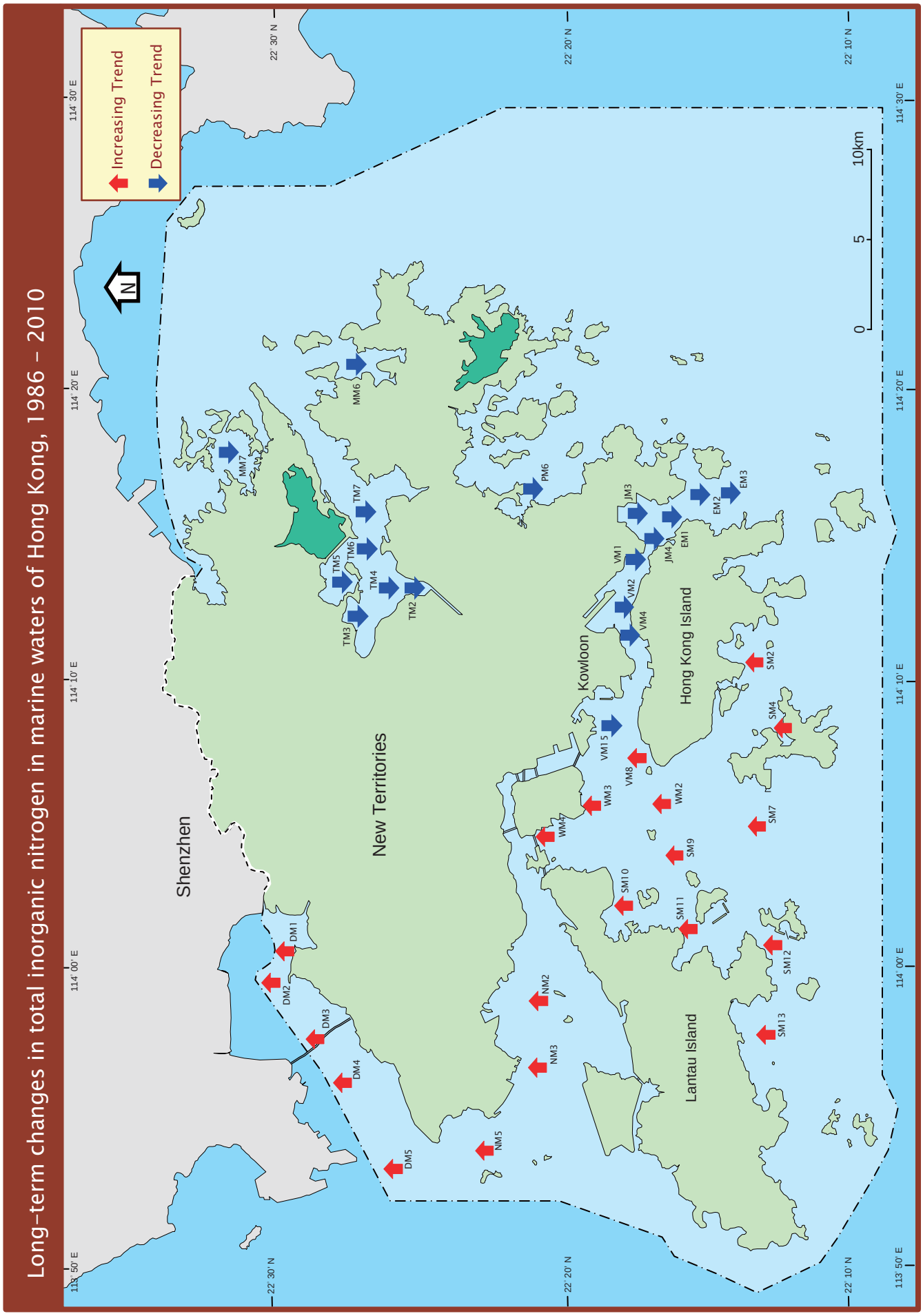

Long-term changes in dissolved oxygen in marine waters of Hong Kong, 1986 – 2010
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
VM1
VM2
VM4
VM5
VM6
VM7
VM12
VM14
VM15
SM3
SM4
MM8
DM2
DM3
DM4
NM5
114° 30' E
114° 20' E
114° 10' E
114° 00' E
113° 50' E
22° 30' N
22° 20' N
22° 10' N

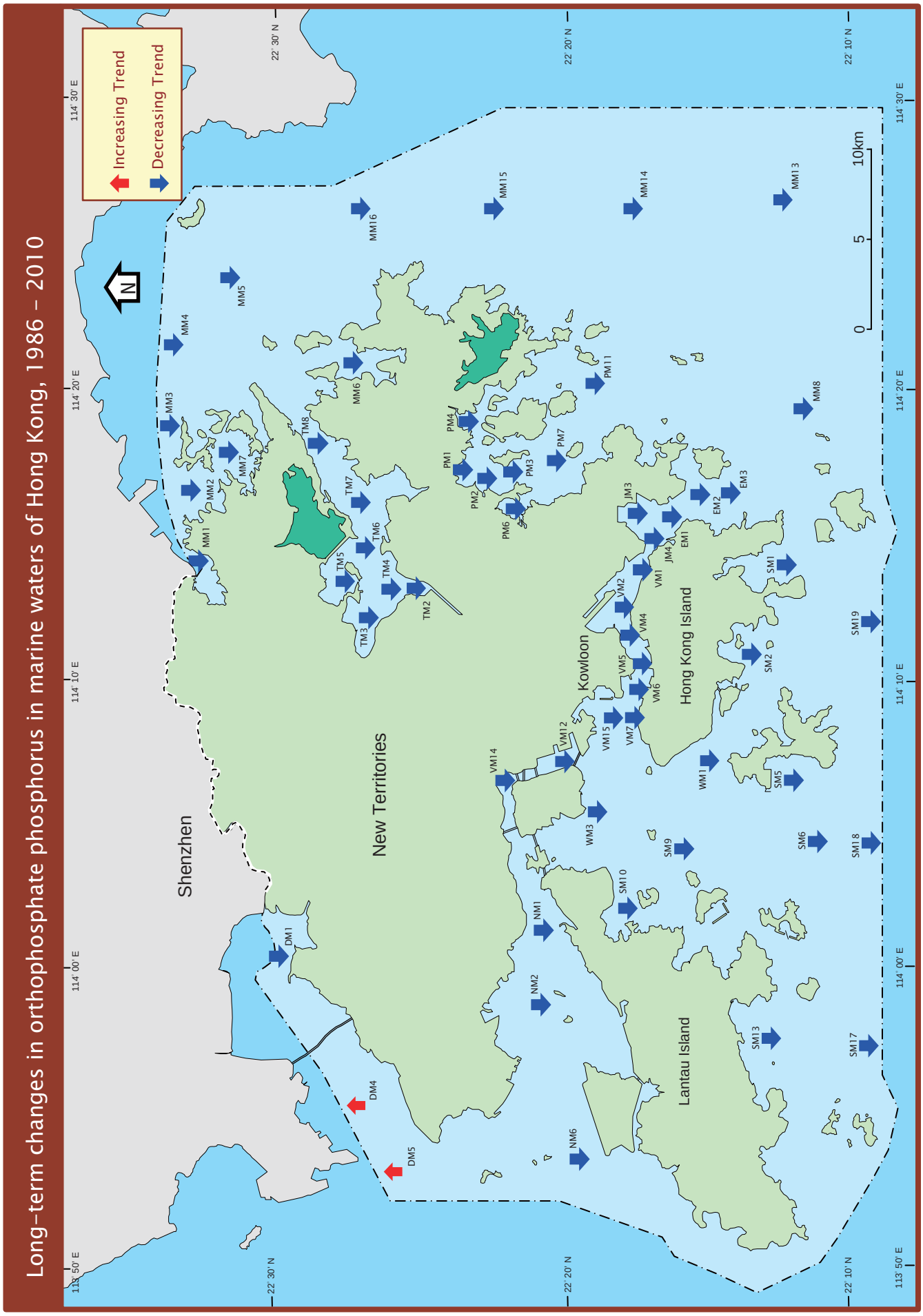

Long-term changes in 5-day Biochemical Oxygen Demand in marine waters of Hong Kong, 1986 – 2010
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
TM8
TM7
TM6
TM5
TM4
TM3
TM2
PM2
PM6
JM3
EM1
EM2
VM1
VM2
VM14
VM12
DM1
DM2
DM3
22° 30' N
22° 20' N
22° 10' N
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E

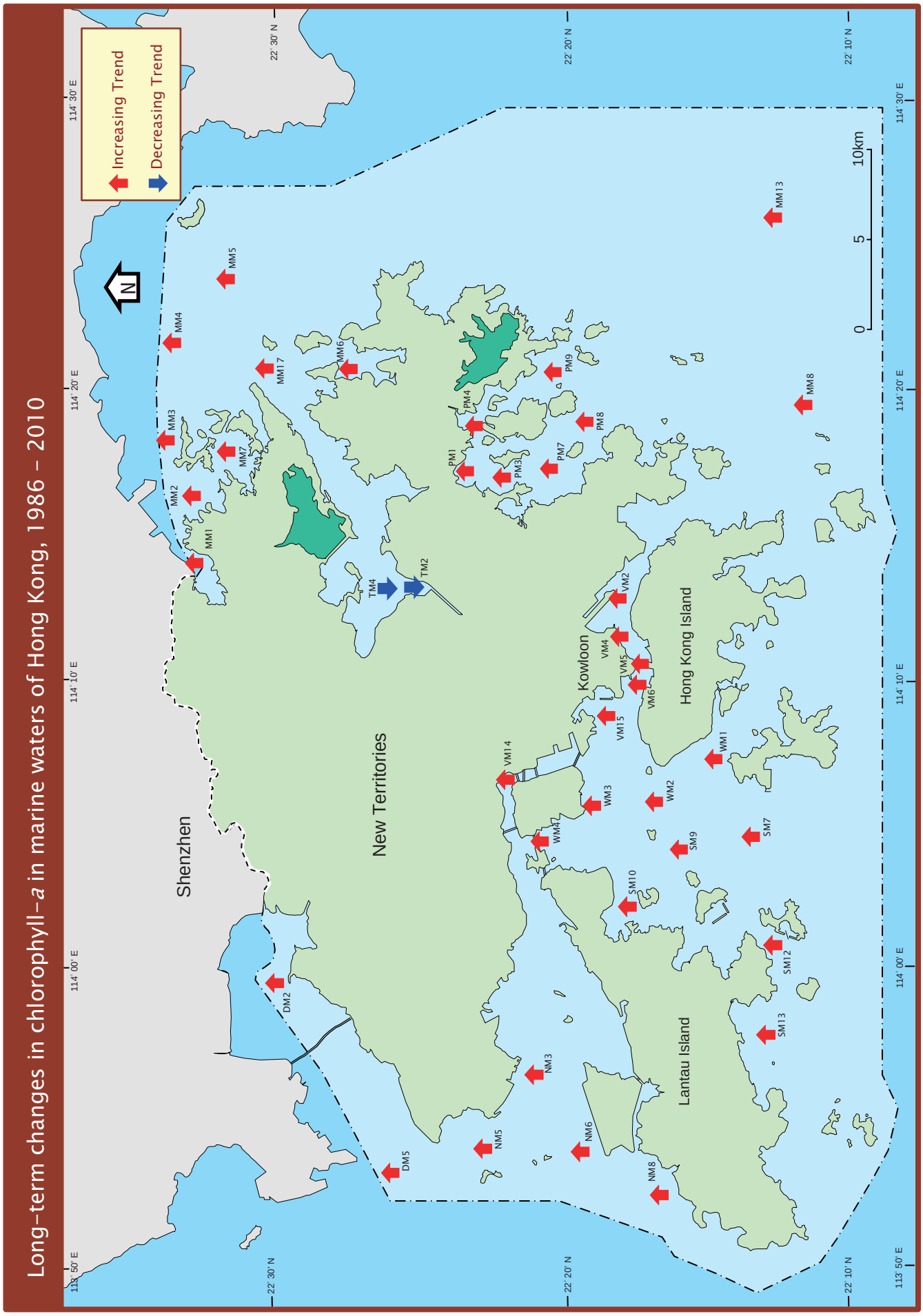

Long-term changes in *E. coli* in marine waters of Hong Kong, 1986 – 2010
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
TM7
TM6
TM5
TM4
TM3
TM2
PM2
PM3
PM6
JM3
EM1
EM2
EM3
JM4
VM1
VM2
VM4
VM5
VM7
VM8
SM1
SM4
WM2
WM3
WM4
SM9
SM11
NM1
NM5
DM2
DM4
22° 30' N
22° 20' N
22° 10' N
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E

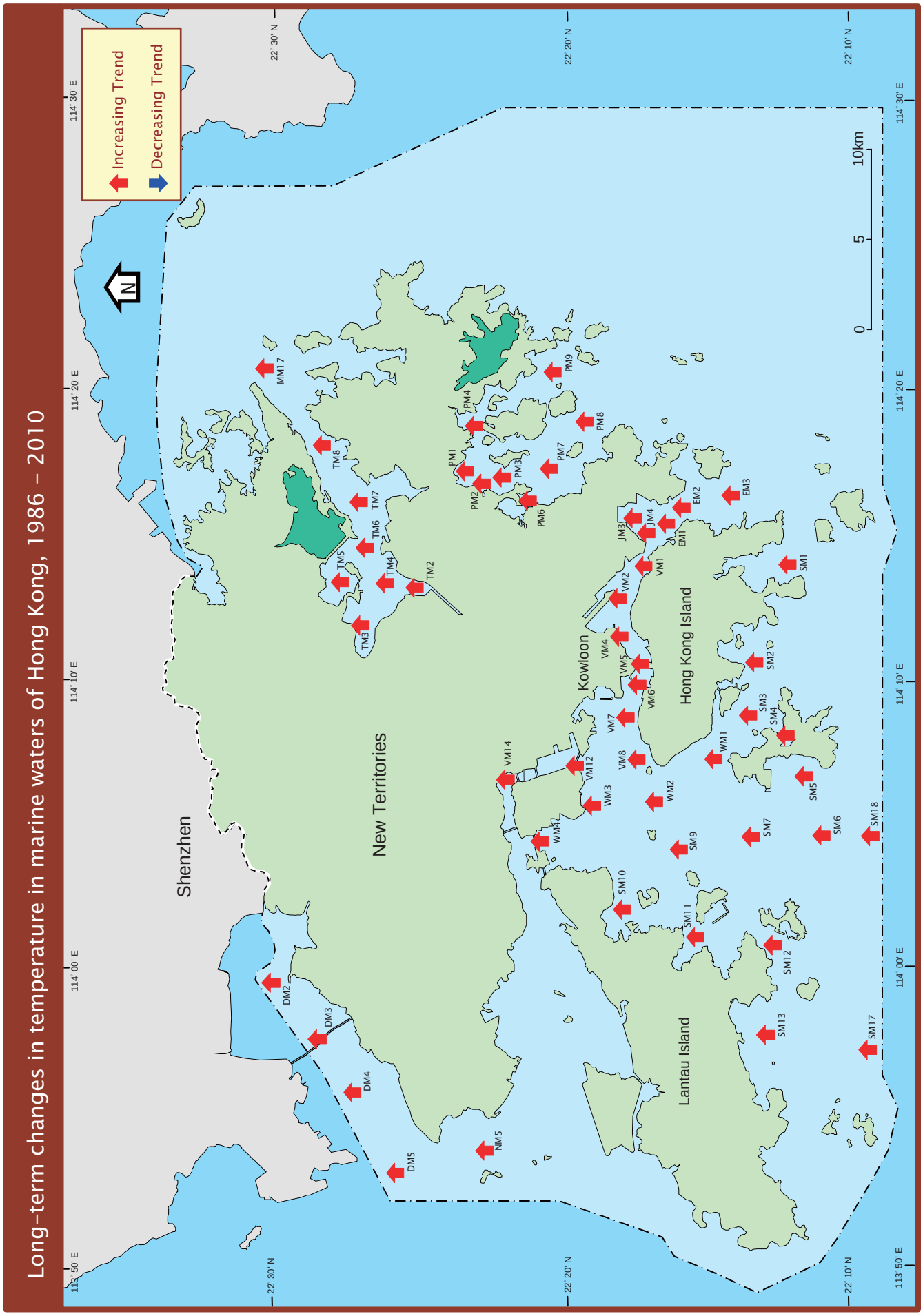

Long-term changes in ammonia nitrogen in marine waters of Hong Kong, 1986 – 2010
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM1
MM6
MM8
TM2
TM3
TM4
TM5
TM6
TM7
PM6
JM3
JM4
EM1
EM2
EM3
VM1
VM2
VM4
VM5
VM6
VM7
VM8
VM12
VM14
WM2
SM9
SM10
SM11
NM1
NM2
NM3
NM5
DM1
DM2
DM3
DM4
DM5
22° 30' N
22° 20' N
22° 10' N
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E


Long-term changes in nitrate nitrogen in marine waters of Hong Kong, 1986 – 2010
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM1
MM5
PM8
TM2
TM3
TM4
TM5
TM6
TM7
VM2
VM3
VM4
VM5
VM6
VM7
VM8
VM12
VM14
VM15
WM2
WM3
WM4
SM1
SM2
SM4
SM7
SM9
SM10
SM11
SM12
SM13
SM17
DM3
DM4
DM5
NM3
NM5
114° 30' E
114° 20' E
114° 10' E
114° 00' E
113° 50' E
22° 30' N
22° 20' N
22° 10' N


Long–term changes in total inorganic nitrogen in marine waters of Hong Kong, 1986 – 2010
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
DM1
DM2
DM3
DM4
DM5
NM2
NM3
NM5
TM2
TM3
TM4
TM5
TM6
TM7
MM6
MM7
PM6
JM3
JM4
EM1
EM2
EM3
VM1
VM2
VM4
VM15
VM8
WM3
WM4
WM2
SM2
SM4
SM7
SM9
SM10
SM11
SM12
SM13
22° 30' N
22° 20' N
22° 10' N
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E


Long-term changes in orthophosphate phosphorus in marine waters of Hong Kong, 1986 – 2010
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
114° 30' E
114° 20' E
114° 10' E
114° 00' E
113° 50' E
22° 30' N
22° 20' N
22° 10' N


Long-term changes in chlorophyll-*a* in marine waters of Hong Kong, 1986 – 2010
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM1
MM2
MM3
MM4
MM5
MM6
MM7
MM8
MM13
MM17
TM2
TM4
PM1
PM3
PM4
PM7
PM8
PM9
VM1
VM2
VM4
VM5
VM6
VM14
VM15
WM1
WM2
WM3
WM4
SM7
SM9
SM10
SM12
SM13
NM3
NM5
NM6
NM8
DM2
DM5
22° 30' N
22° 20' N
22° 10' N
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E


Long-term changes in temperature in marine waters of Hong Kong, 1986 – 2010
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
114° 30' E
114° 20' E
114° 10' E
114° 00' E
113° 50' E
22° 30' N
22° 20' N
22° 10' N
MM17
TM8
TM7
TM6
TM5
TM4
TM2
TM3
PM9
PM8
PM4
PM7
PM1
PM3
PM2
PM6
JM3
JM4
EM2
EM3
EM1
VM1
VM2
VM4
VM5
VM6
VM7
VM8
VM12
VM14
WM3
WM4
WM2
WM1
SM1
SM2
SM3
SM4
SM5
SM6
SM7
SM9
SM10
SM11
SM12
SM13
SM18
SM17
DM2
DM3
DM4
DM5
NM5