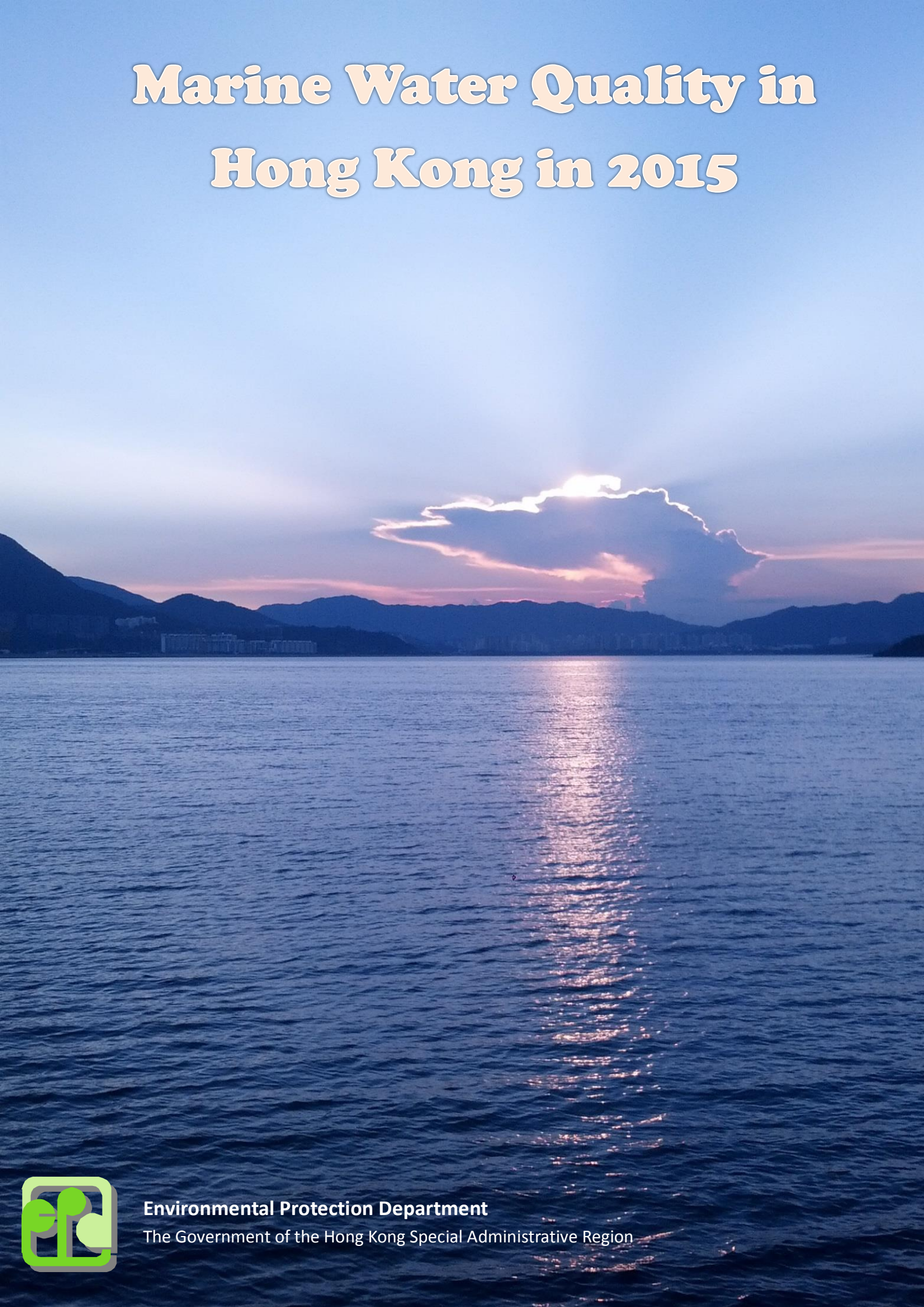
Marine Water Quality in Hong Kong in 2015



Environmental Protection Department
The Government of the Hong Kong Special Administrative Region

Mission

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

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Introduction

The Hong Kong Special Administrative Region (HKSAR) has a land area of 1,106km^2 and 1,649km^2 of marine waters. It has long coastlines, including 468km in the Kowloon Peninsula and New Territories and 733km in Hong Kong Island, Lantau Island and other small islands. Excluding Hong Kong Island and Lantau Island, there are 261 islands in the territory, each with an area greater than 500m^2. Its coastal waters support a variety of marine life.

Map of Hong Kong water showing different beneficial uses

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:

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

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

EPD's marine monitoring vessel

"Dr. Catherine Lam"

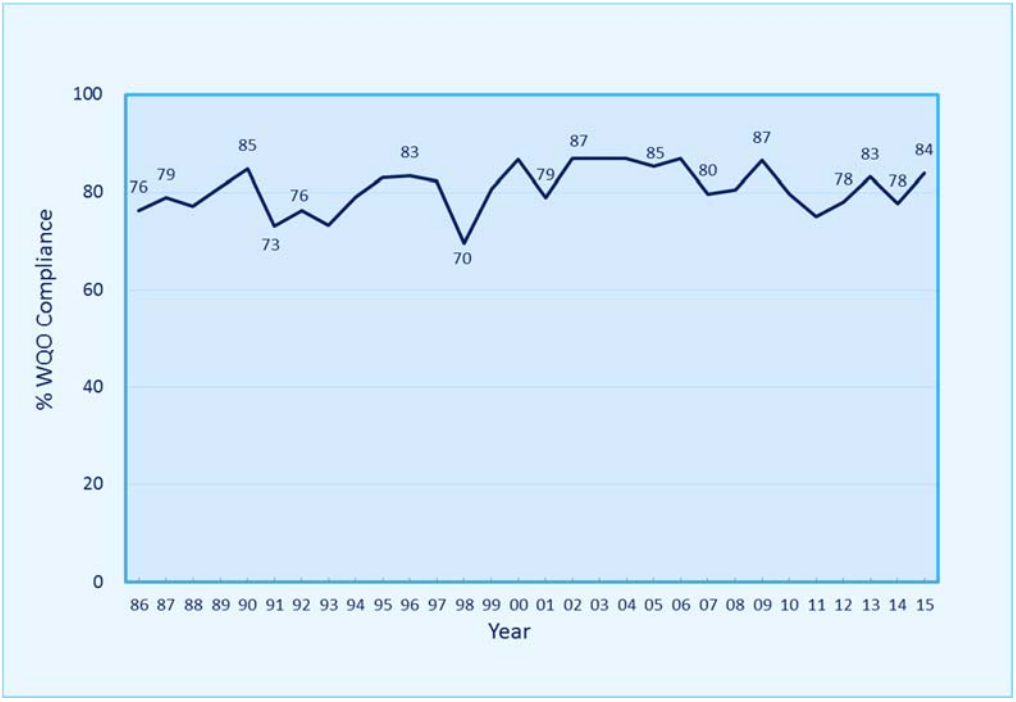
The EPD has a dedicated marine monitoring vessel "*Dr. Catherine Lam*". It is equipped with an advanced conductivity-temperature-depth (CTD) profiler linked to a computer-controlled rosette water sampler which takes field measurements and collects water samples simultaneously. Marine sediments are collected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

Water sampling by computer-controlled rosette water sampler

The State of Hong Kong Marine Waters in 2015

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

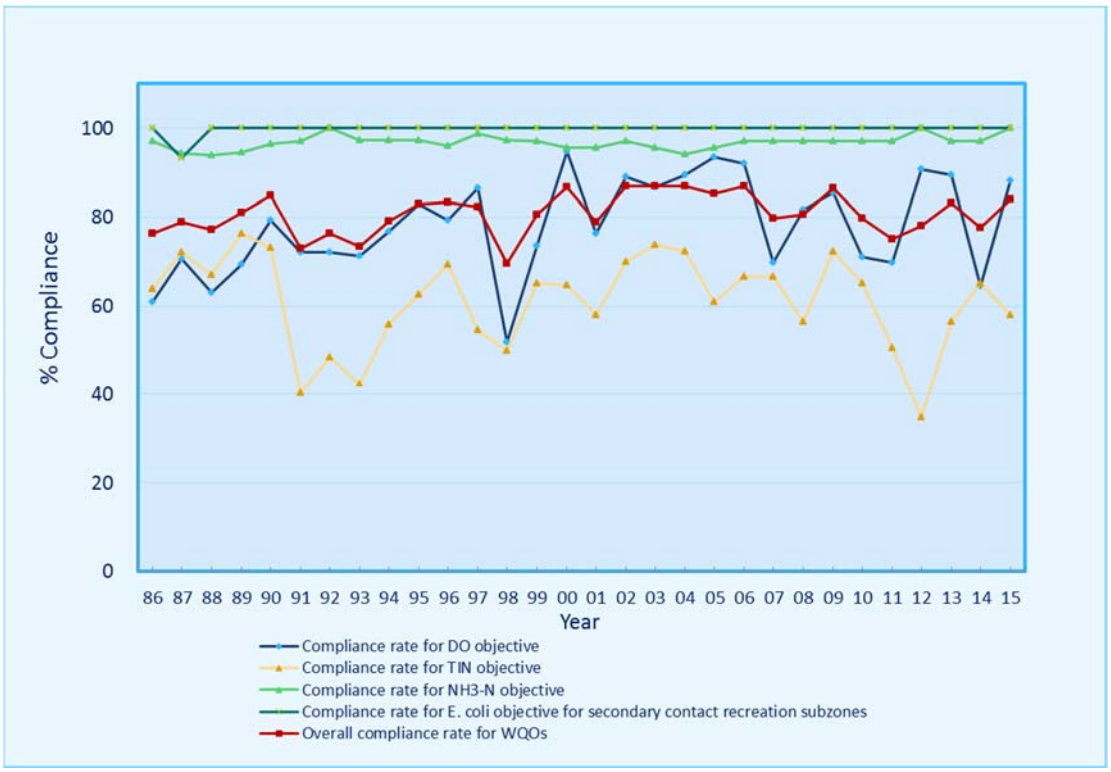
The overall marine water quality compliance with the WQOs in Hong Kong was 84% in 2015, compared with 78% in 2014 and 83% in 2013.



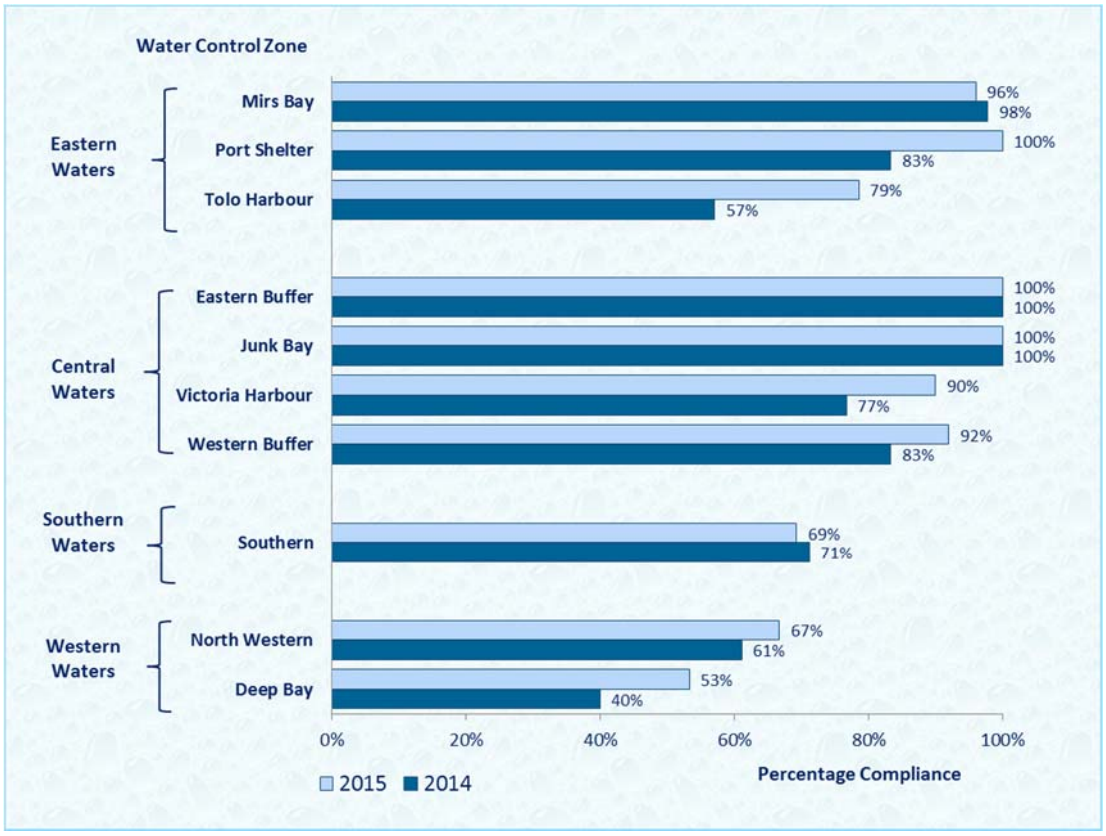
Overall compliance with the marine Water Quality Objectives
in Hong Kong, 1986-2015

A higher overall WQO compliance rate in 2015 compared with 2014 was mainly due to the higher compliance rate with the dissolved oxygen (DO) objective from 64.5% in 2014 to 88.2% in 2015. On the other hand, the compliance rate with the total inorganic nitrogen (TIN) objective decreased from 65.2% in 2014 to 58.0% in 2015, comparable to 56.5% in 2013.

Territory-wide, six Water Control Zones (WCZs) (i.e Tolo Harbour & Channel, Port Shelter, Victoria Harbour, Western Buffer, North Western, Deep Bay WCZs) have higher overall compliance rate, two WCZs (i.e. Mirs Bay and Southern WCZs) have lower overall compliance rate, and for the remaining two WCZs (i.e. Eastern Buffer and Junk Bay WCZs) the overall compliance rate remains unchanged at 100%.



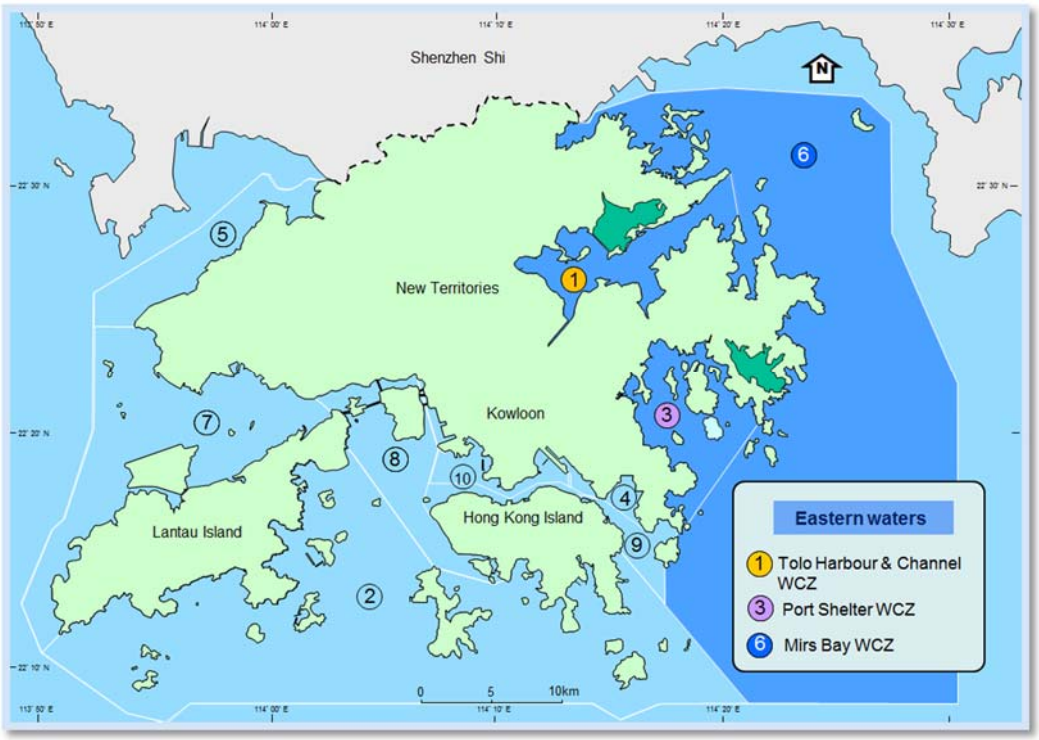
Overall compliance rate with the WQOs and the compliance rates
for the four objectives in Hong Kong, 1986-2015



Overall level of compliance with the Water Quality Objectives
in the ten Water Control Zones in 2014 and 2015

The improvement of overall compliance rate in the Tolo Harbour & Channel, Port Shelter, Victoria Harbour, Western Buffer and North Western WCZs in 2015 was mainly due to higher compliance rate with the DO objective. The improvement of overall compliance rate in Deep Bay was due to higher compliance with the NH_3-N objective. On the other hand, the slightly lower compliance rate for the Mirs Bay and Southern WCZs in 2015 compared with 2014 was mainly due to a slight decrease in compliance with the DO objective and the TIN objective respectively.

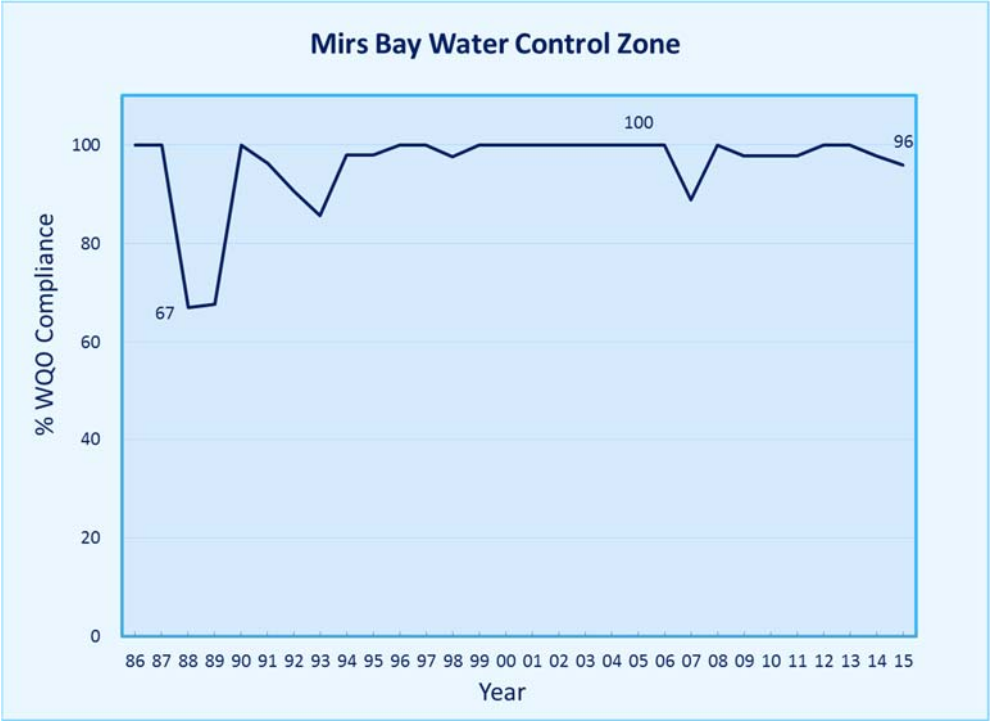
Eastern Waters



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

Sai Wan in Port Shelter WCZ

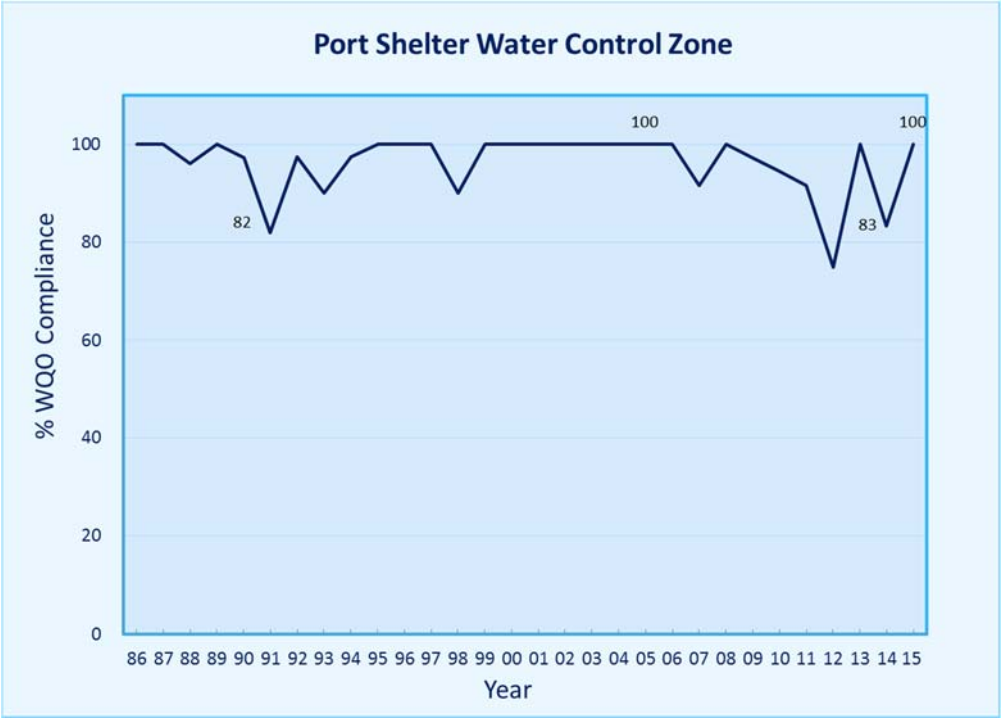
Mirs Bay Water Control Zone



In 2015, the overall WQO compliance rate of the Mirs Bay WCZ was 96%. The water quality of the Mirs Bay WCZ was good in 2015 with high DO and low TIN levels. Moreover, the Mirs Bay WCZ also complied with the bacteriological WQO of ≤ 610 *E. coli* cfu / 100 mL (annual geometric mean) for secondary contact recreation.

Long Harbour in Mirs Bay WCZ

Port Shelter Water Control Zone



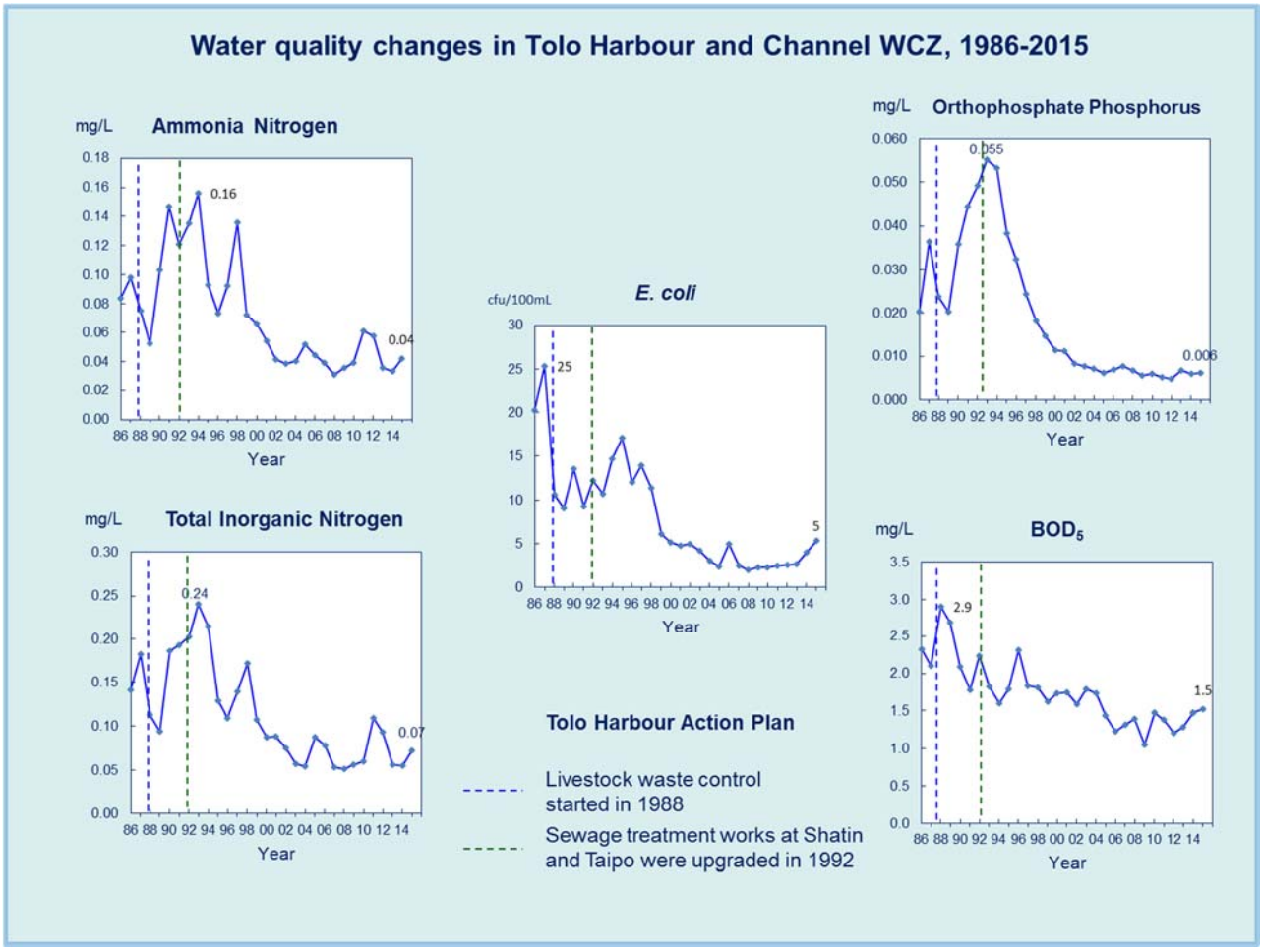
Port Shelter is a popular area for various water sports activities, including swimming, yachting, water-skiing and diving.

In 2015, the water quality of the Port Shelter WCZ was good and the overall WQO compliance rate was 100%, with full compliance with the WQOs for *E. coli*, DO, TIN and NH_3-N.

The six gazetted beaches, which attracted 1.3 million visitors during the 2015 bathing season, complied with the water quality objective for swimming in 2015.

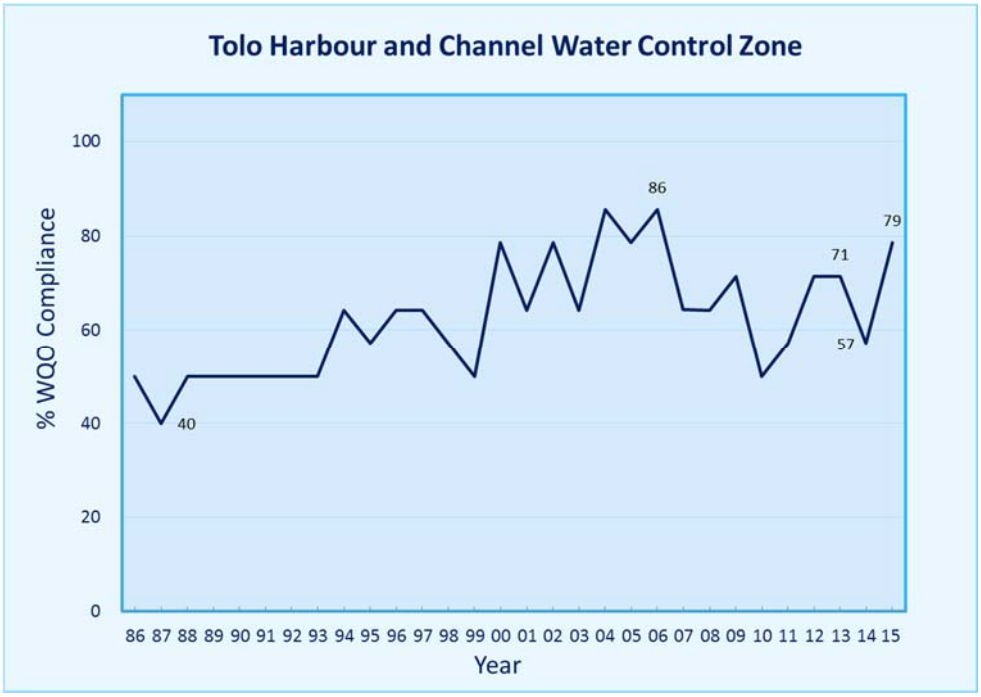
Tolo Harbour and Channel Water Control Zone

Since the implementation of the Tolo Harbour Action Plan in the mid-80s, which includes the control of livestock waste, the improvement of sewage treatment facilities, the export of treated effluent outside Tolo Harbour and the extension of village sewerage, there has been a steady improvement in water quality in Tolo Harbour in the past decade including a decrease in the levels of 5-day Biochemical Oxygen Demand (BOD_5), *E. coli*, total inorganic nitrogen, ammonia nitrogen and orthophosphate phosphorus. The long term data as shown in the figures below indicate the decreasing trend of organic and nutrient loading. Moreover, Tolo Harbour is also able to comply with the bacteriological WQO of ≤ 610 *E. coli* cfu / 100 mL (annual geometric mean) for secondary contact recreation.



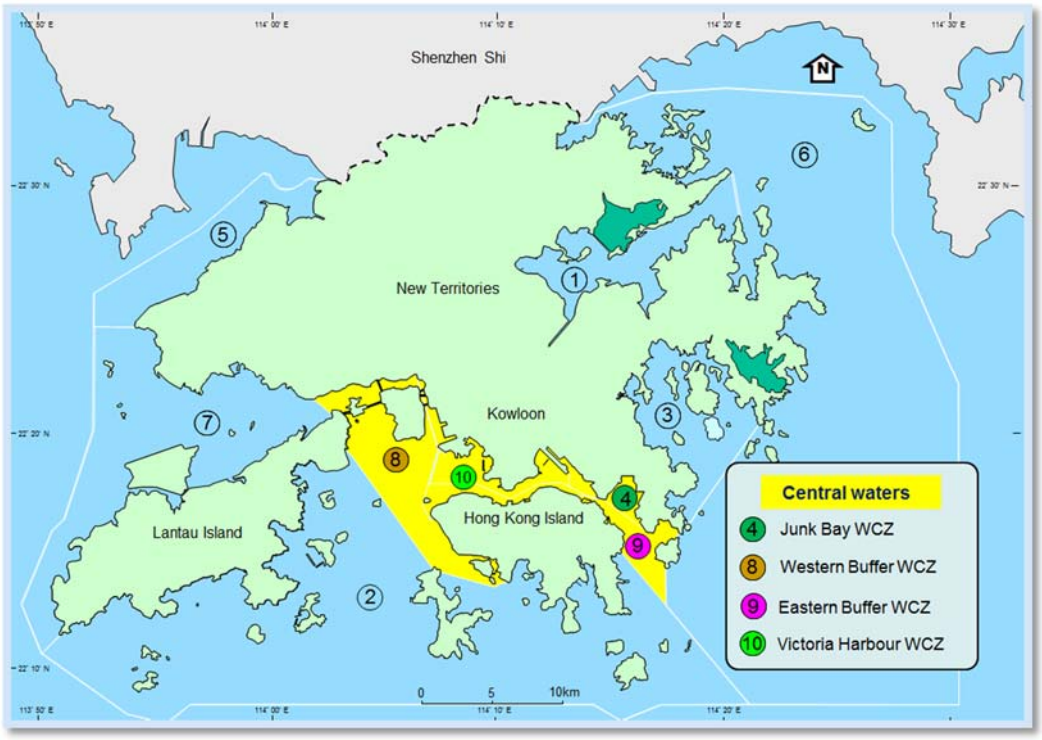
The 2015 overall WQO compliance rate of the Tolo Harbour and Channel WCZ was 79% with a compliance rate with the DO objective at 57%. Since Tolo Harbour is a shallow semi-enclosed water body with low water exchange rate with Mirs Bay, the harbour's essentially landlocked

situation often leads to stratification of the water column and lower bottom DO levels particularly during the hot summer months, hence resulting in non-compliance with the DO objective in the summer months.



Tolo Harbour and Channel WCZ

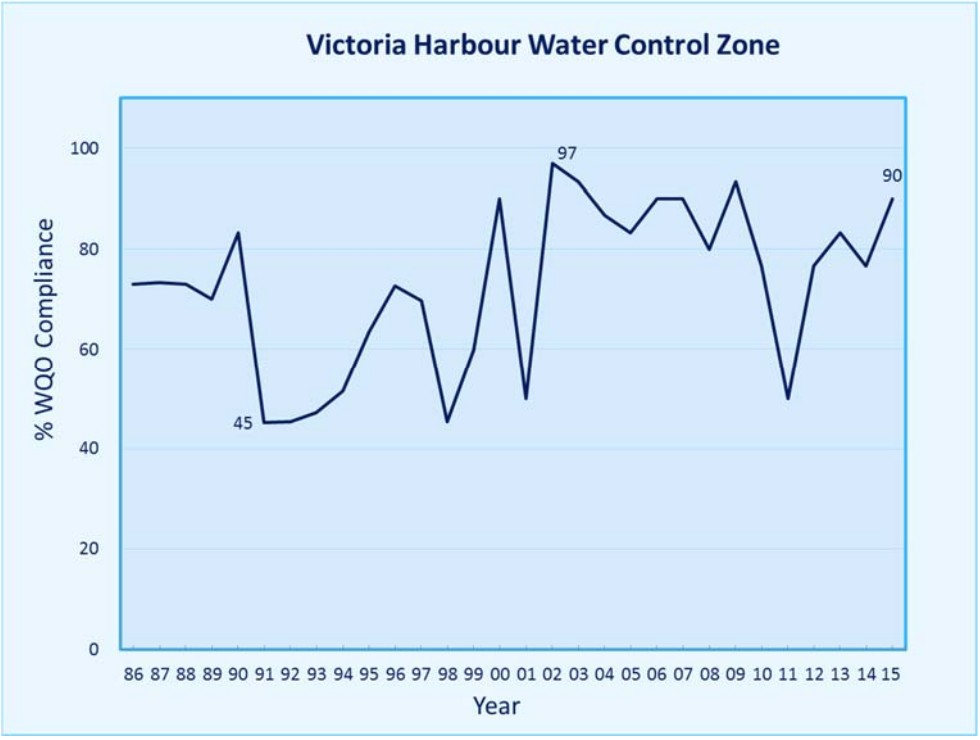
Central Waters



The central waters of Hong Kong, including the Victoria Harbour, Eastern Buffer, Western Buffer and Junk Bay WCZs, are important navigational channels and port areas.

After the commissioning of the Stonecutters Island Sewage Treatment Works (SCISTW) under the Harbour Area Treatment Scheme (HATS) Stage 1 in end 2001, about 75% of the sewage around Victoria Harbour 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. Further improvement in water quality is expected and early sign of improvement has been observed in terms of *E. coli* level which has decreased by 74% after the commissioning of HATS Stage 2A in end 2015, as the remaining 25% of sewage from the middle and western sides of Victoria Harbour is diverted to the SCISTW for treatment.

Victoria Harbour Water Control Zone

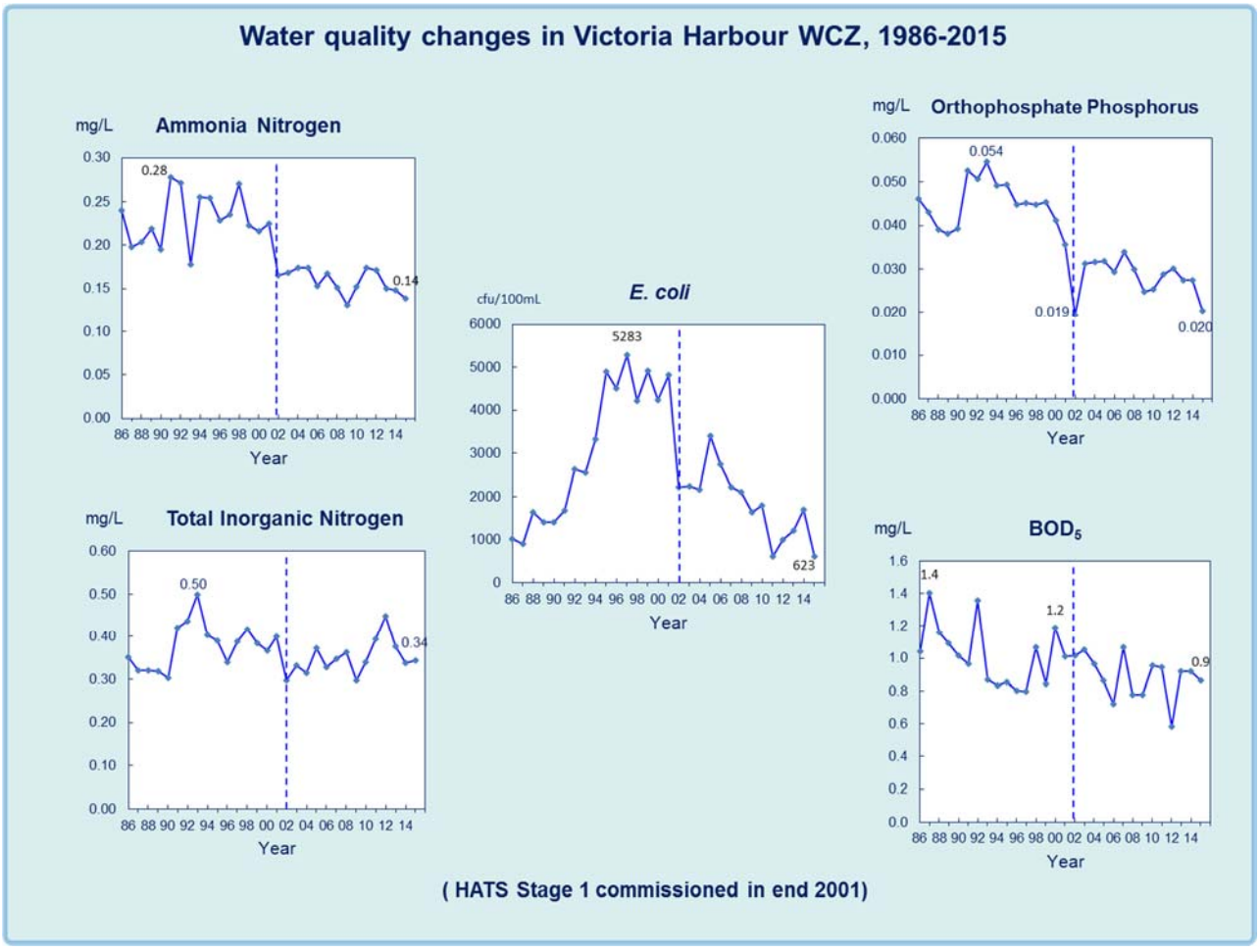


The overall WQO compliance rate of the Victoria Harbour WCZ in 2015 was 90%. Compliance with the DO objective was 100%, while compliance rate with the TIN objective decreased from 90% in 2014 to 70% in 2015. The overall annual average level of TIN in Victoria Harbour increased from 2009 and reached 0.449 mg/L in 2012, then dropped to 0.337 mg/L in 2014 with a slight rise to 0.344 mg/L in 2015.

Victoria Harbour

The TIN level in the Victoria Harbour WCZ could be affected by the year-to-year normal range of fluctuation of the discharge from the Tolo Harbour Effluent Export Scheme and surface run-off, the effluent discharged from the preliminary treatment plants located between North Point and Central before the commissioning of HATS Stage 2A, as well as the higher background TIN level under the influence of Pearl River discharge, as reflected in the relatively high TIN level in many stations in the Northwestern and Southern WCZs.

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



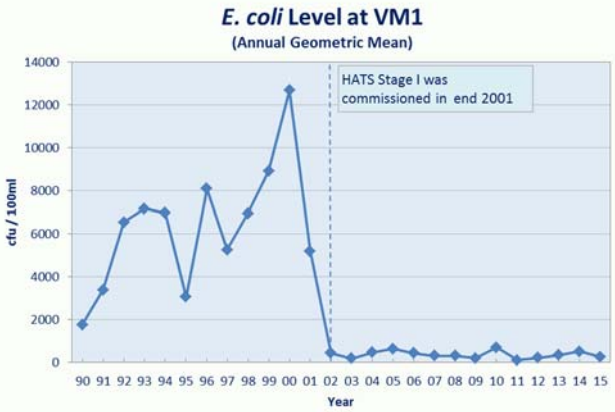
The *E. coli* level in the eastern side of Victoria Harbour has markedly improved since HATS Stage I was commissioned in end 2001. The Cross Harbour Swim, suspended from 1979 because of poor water quality, has resumed since 2011 in the eastern side of the harbour.

Cross Harbour Swim in Eastern Side of Victoria Harbour

Since 2002, *E. coli* level in the eastern part of Victoria Harbour has markedly improved.

Five annual events had been organised:

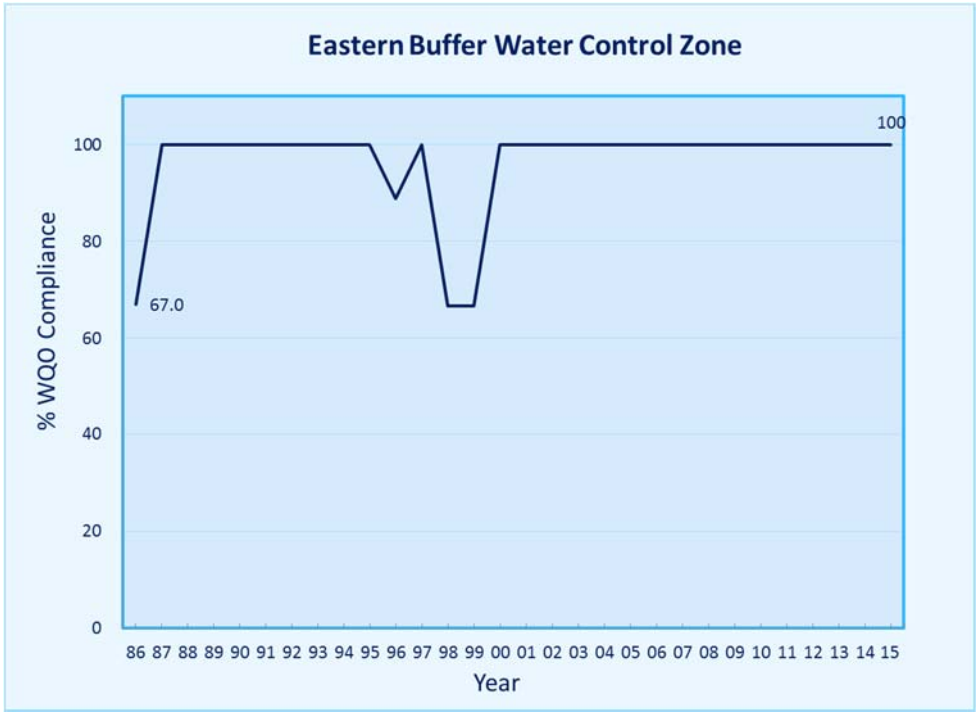
- October 2011
- October 2012
- October 2013
- October 2014
- October 2015

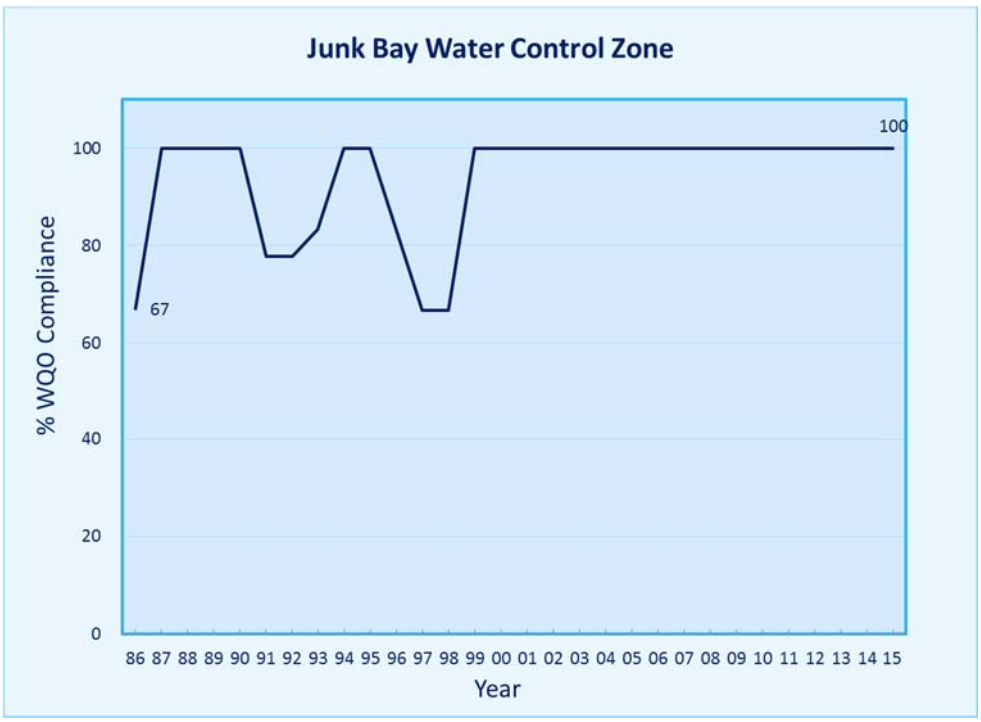


About 2500 participants took part in the 2015 Cross Harbour Swim

Eastern Buffer and Junk Bay Water Control Zones

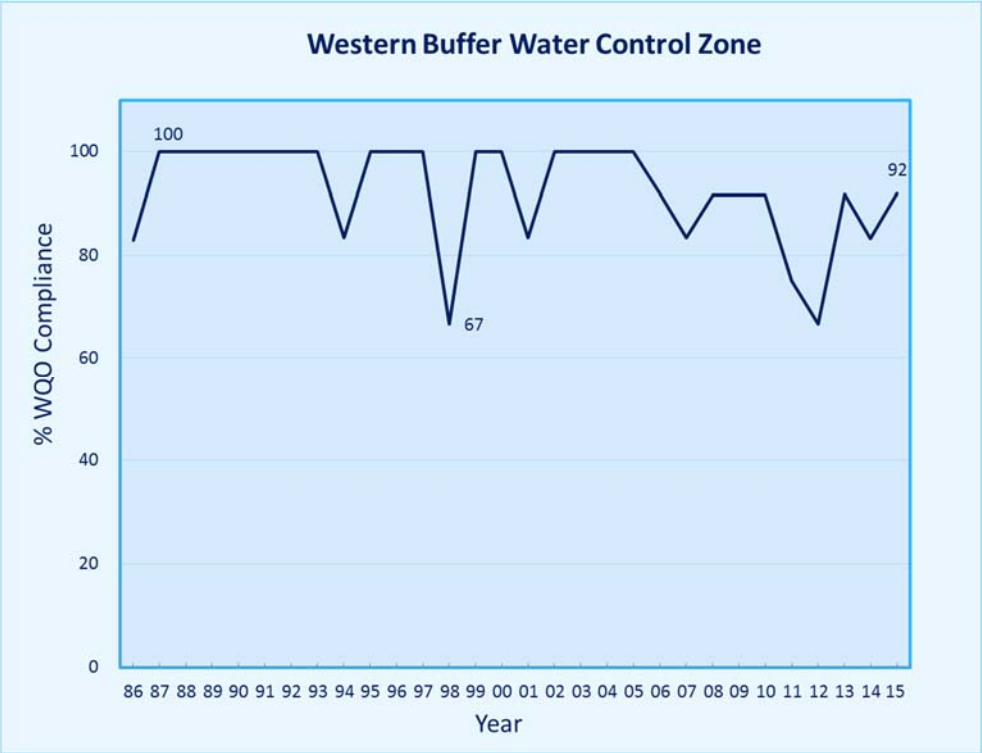
Both the Eastern Buffer and Junk Bay WCZs have achieved full compliance (100%) with the WQOs in 2015. Indeed, since the implementation of HATS Stage 1 in end 2001 by which all sewage generated from Junk Bay (Tseung Kwan O), the Kowloon Peninsula and the eastern part of Hong Kong Island (Chai Wan) was diverted and treated at the SCISTW, the water quality of these two WCZs has improved markedly with increasing DO and decreasing nutrient and bacterial levels.



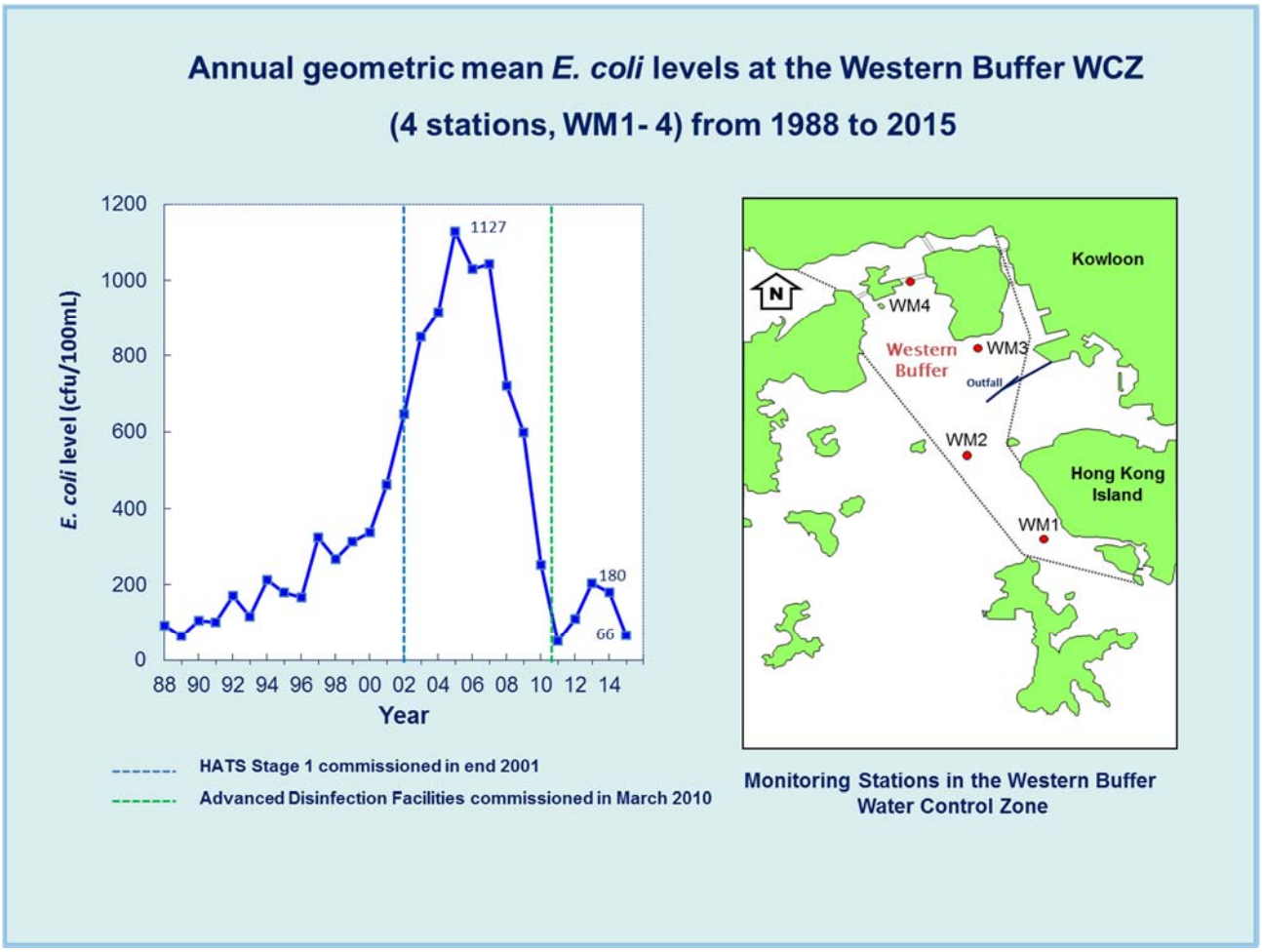


Western Buffer Water Control Zone

The Western Buffer WCZ achieved 92% overall compliance with the WQOs in 2015, with full compliance with the WQOs for TIN and NH_3-N. The overall annual average level of TIN was 0.32 mg/L in 2015, as compared with 0.25 mg/L, 0.33 mg/L and 0.38 mg/L in 2014, 2013 and 2012 respectively. Similar to the Victoria Harbour WCZ, the fluctuation of TIN levels in the Western Buffer WCZ in recent years could be influenced by the discharges of Pearl River, the year to year fluctuation of surface run-off, as well as the discharges from the SCISTW, and the five preliminary treatment plants located at Sandy Bay, Cyberport, Wah Fu, Ap Lei Chau and Aberdeen before the commissioning of the HATS Stage 2A.

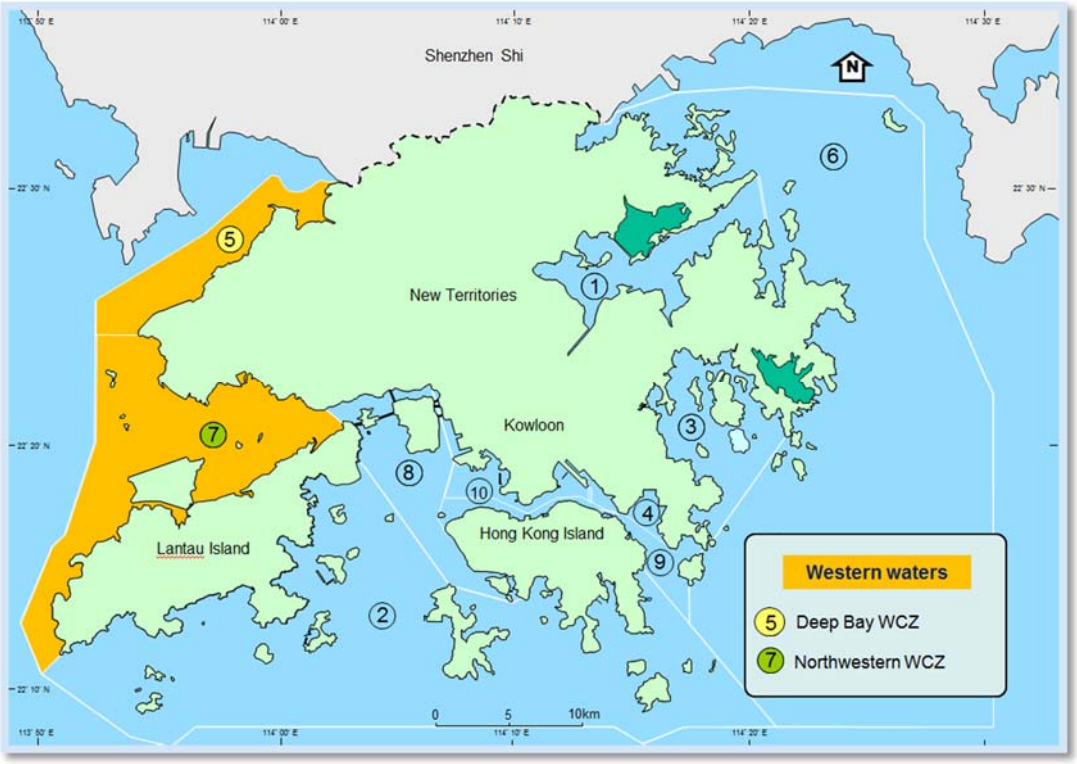


On the other hand, since the commissioning of the Advance Disinfection Facilities at the SCISTW in March 2010, the *E. coli* level in the WCZ decreased by over 90% in 2011, as compared with the pre-commissioning period of 2009.



There are eight gazetted beaches located in Tsuen Wan District of this WCZ. In 2015, all eight gazetted beaches complied with the water quality objective for swimming, the sixth consecutive year since 2010.

Western Waters



The Deep Bay and North Western WCZs are located to the west of Hong Kong. Other than local discharges, both WCZs are 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. 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).

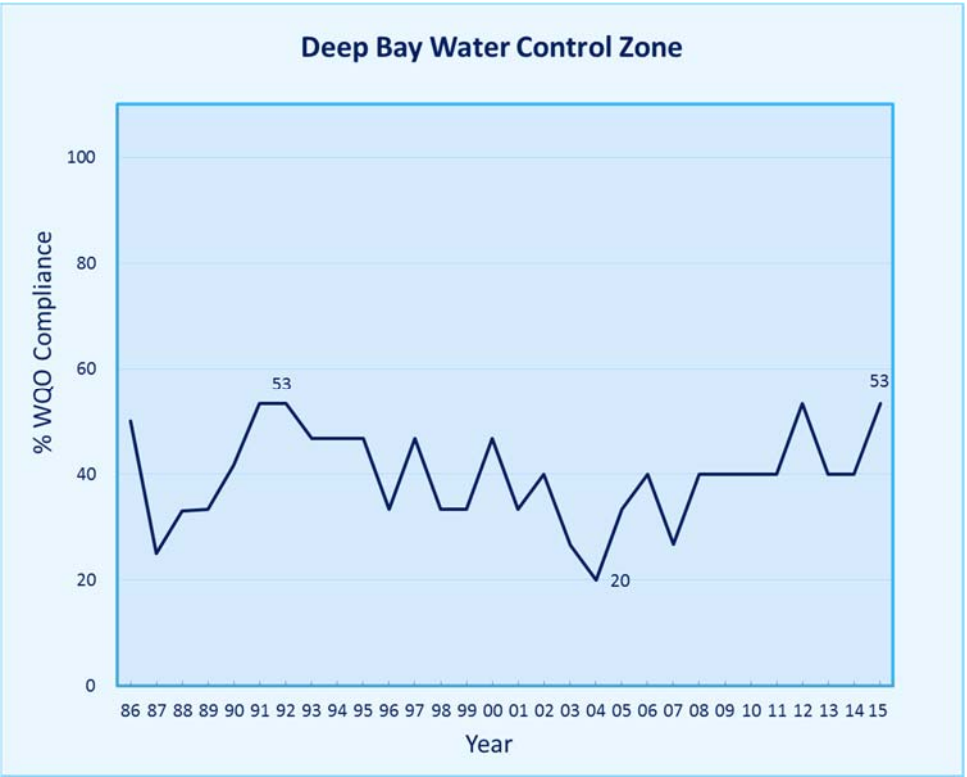
Mai Po in Deep Bay WCZ

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

North Western WCZ

Deep Bay Water Control Zone

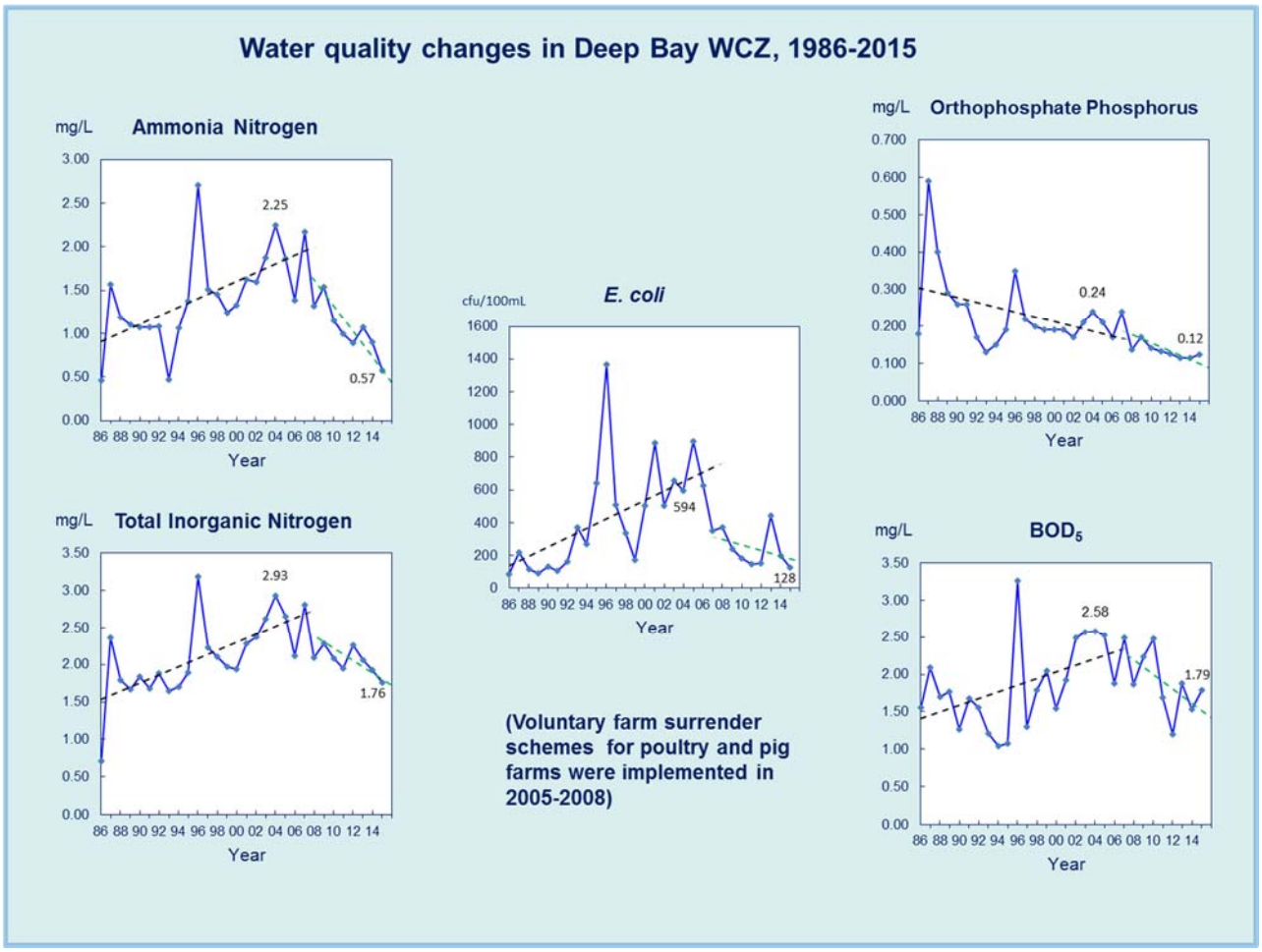
Deep Bay is shallow with depths varying from 2m at DM1 to 8m at DM5 and its sediment laden water body is impacted by pollution from both Hong Kong and Shenzhen including discharges from Shenzhen River as well as unsewered villages. The inner Deep Bay is most affected by the discharges from Shenzhen River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



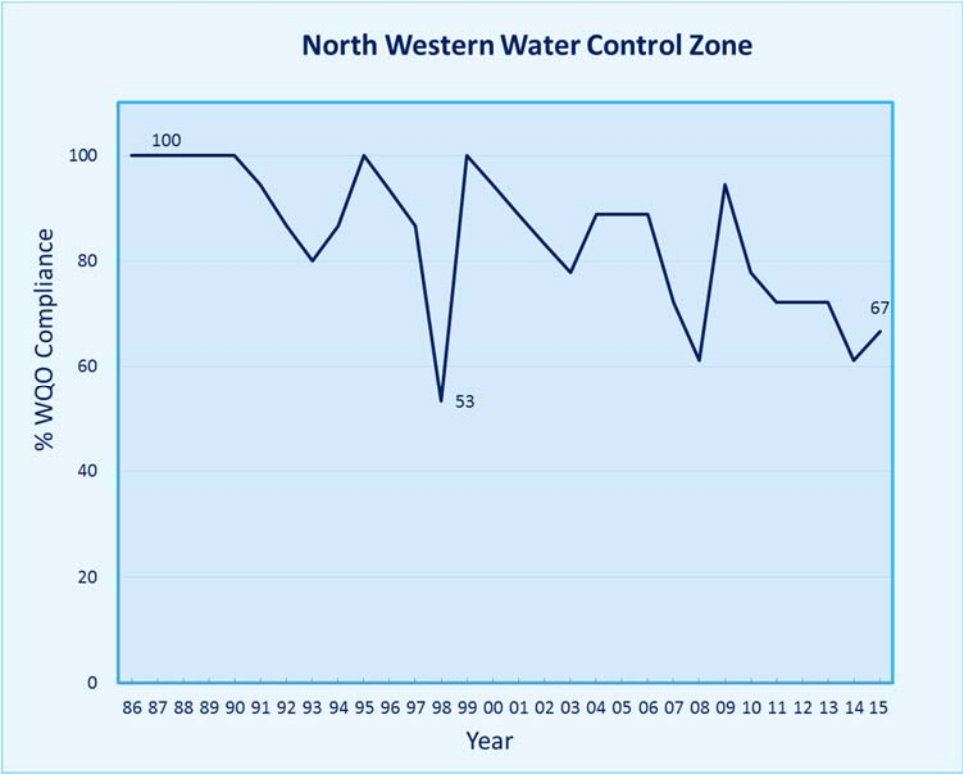
The WQO compliance rate of the Deep Bay WCZ varied between 40-53% from 2008 and was 53% in 2015.

Similar to the previous years, the Deep Bay WCZ had relatively high nutrient levels in 2015. The TIN level in the Deep Bay inner subzone (1.4 – 2.8 mg/L) and Deep Bay outer subzone (1.1 – 1.3 mg/L) was higher than the respective TIN objective of 0.7 mg/L and 0.5 mg/L. Non-compliance with the DO objective was also observed at two of the three stations in the Deep Bay inner subzone (DM1 and DM2). The NH_3-N objective was fully complied with in 2015.

While the TIN level in Deep Bay is still high, as a result of the collaboration with our Shenzhen counterpart in reducing pollution load, and the voluntary farm surrender schemes for poultry and pig farms implemented in 2005-2008, we have observed some sign of water quality improvement since the mid-2000s. The declining water quality trend observed during the period 1986-2007 was reversed after 2007. A comparison of the monitoring results collected between 1997-2006 and 2007-2015 suggests that the water quality of Deep Bay has improved in terms of reduction in organic loading (i.e. BOD_5), nutrients (e.g. ammonia nitrogen, TIN and orthophosphate) and bacterial levels.

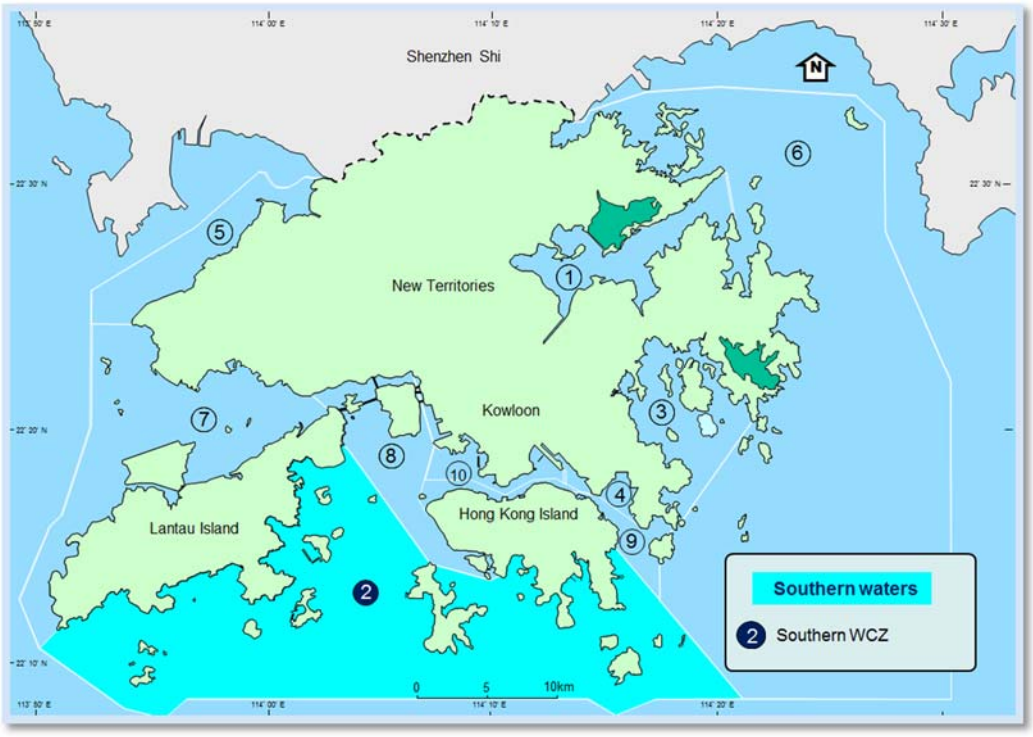


North Western Water Control Zone



In 2015, the North Western WCZ attained an overall WQO compliance rate of 67%. Compliance with the NH_3-N and TIN objectives in this WCZ was 100% and 17% respectively. The higher levels of TIN (annual mean 0.45 - 0.77 mg/L) might be associated with the higher background level of the discharges from Pearl River, and some local discharges and surface run-off from the Northwest New Territories as well as North Lantau.

Southern Waters

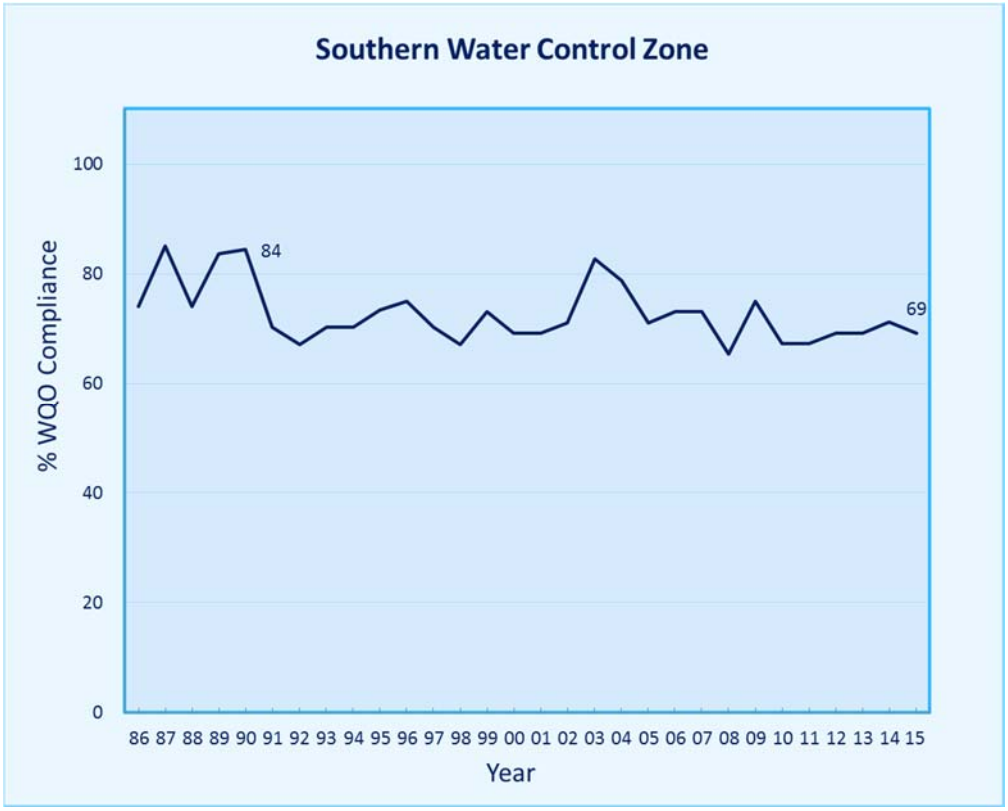


The southern waters consist of only one water control zone. The Southern WCZ stretches from the south of Hong Kong Island to Lantau Island and faces the South China Sea. The western part of the WCZ is influenced seasonally by the Pearl River flow and the effect diminishes gradually towards the east.

Southern Water Control Zone

The Southern WCZ attained an overall 69% compliance with the WQOs in 2015. All 16 stations in the WCZ fully complied with the DO and NH_3-N objectives, but due to the higher background level of the Pearl River flow, all stations did not meet the TIN objective of 0.1mg/L.

The Southern WCZ also covers a number of secondary contact recreation subzones which are mainly located along the coast in Southern District (Hong Kong Island) and the outlying islands. In 2015, full compliance (100%) with the *E. coli* objective was attained in the secondary contact recreation subzones.



There are 21 gazetted beaches located in this WCZ: 12 on Hong Kong Island, 5 on Lantau Island, 2 on Lamma Island and 2 on Cheung Chau. In 2015, all 21 gazetted beaches in the southern waters complied with the water quality objective for swimming.

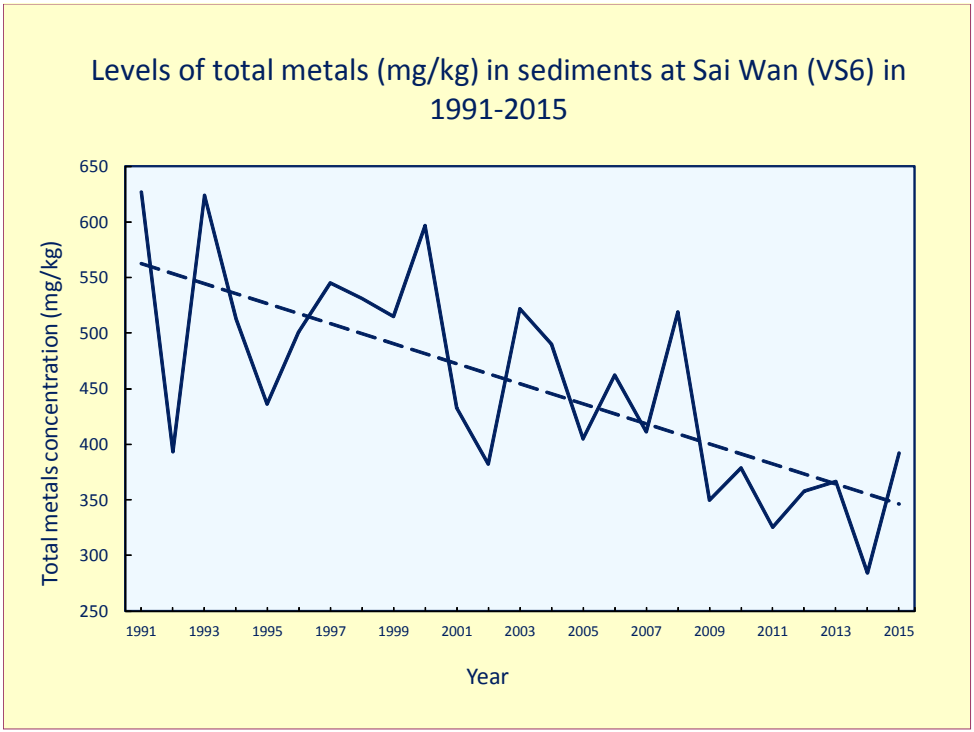
Southern WCZ

Sediment Quality and Levels of Toxic Substances in Hong Kong

Sediment sampling

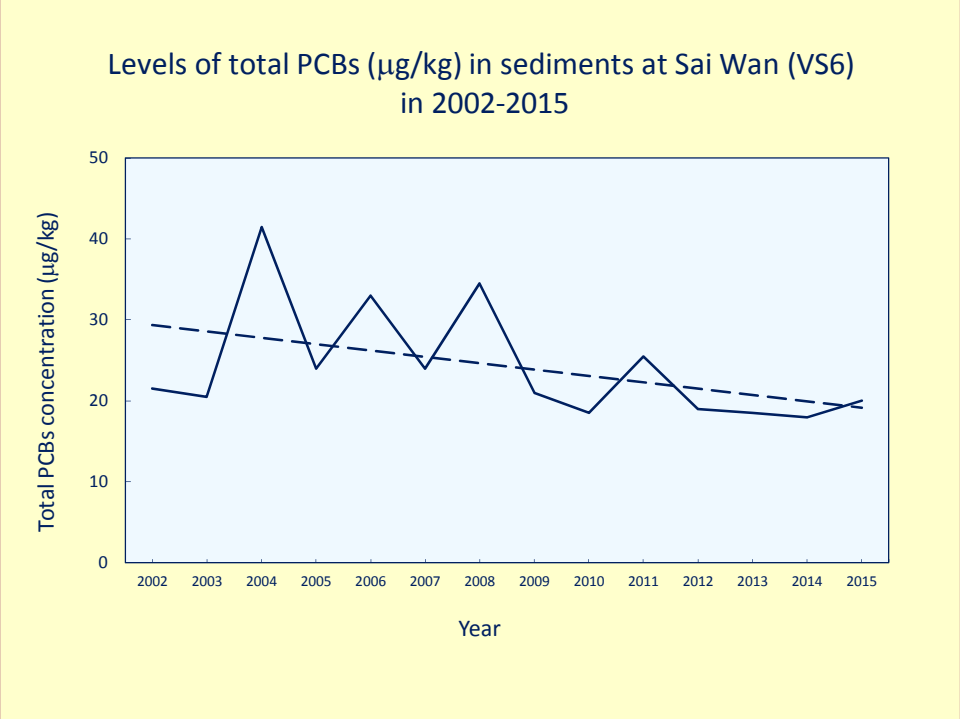
Sea bottom sediments are the ultimate sink of pollutants in the marine environment, and are also home to a wide variety of benthic organisms. The quality of marine sediments can therefore reflect the health of the marine environment as a whole.

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



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

With regard to trace organic pollutants such as polychlorinated biphenyls (PCBs), they were generally present at low concentrations except for one station in western Victoria Harbour (VS6). The higher levels of PCB at VS6 could be related to the discharges from industries in the past as well as contamination from the waste incineration facility in Kennedy Town which ceased operation in 1993 and was demolished in 2007. Similar to metals, a gradual decreasing trend of total PCBs in sediments could also be observed at VS6 since 2002.



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

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

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

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

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

Typhoon Shelters in Hong Kong

Kwun Tong Typhoon Shelter

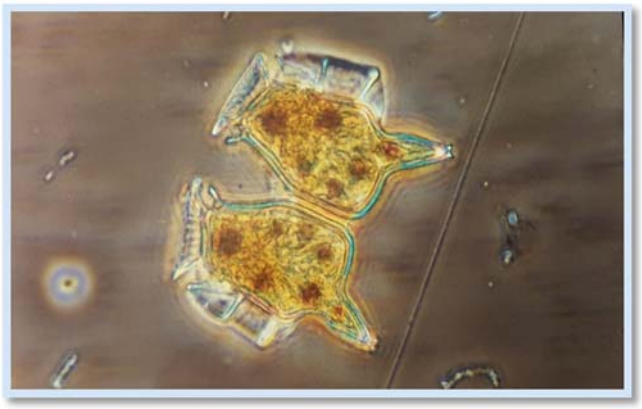
Typhoon shelters in Hong Kong are used by small to medium vessels as protection against strong winds and rough sea conditions particularly during the typhoon season. For this reason, typhoon shelters are often semi-enclosed water bodies and vulnerable to pollution from both land and sea. Hong Kong has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

In 2015, the EPD monitored the water quality of the 17 typhoon shelters, marinas and dockyard around Hong Kong. Similar to 2014, the 3 typhoon shelters located in Sai Kung, namely Yim Tin Tsai TS, Hebe Haven TS and Sai Kung TS also had lower TIN levels (0.06 – 0.08 mg/L) and *E. coli* counts (2 – 60 cfu/100mL). In general, the water quality of typhoon shelters in Victoria Harbour, i.e. Kwun Tong TS, Causeway Bay TS and New Yau Ma Tei TS, was higher in TIN levels (0.43 – 0.85 mg/L) and *E. coli* counts (1000 – 6800 cfu/100mL) compared with those located farther away from the urban areas, such as Tuen Mun TS, Cheung Chau TS, Hei Ling Chau TS and Aberdeen TS (TIN levels: 0.18 – 0.67 mg/L; *E. coli* counts: 2 – 1600 cfu/100mL). Nevertheless, the water quality of all typhoon shelters in Hong Kong as a whole was improving in general during the last decade.

Regarding sediment quality, the sediments of some typhoon shelters located in Victoria Harbour were often contaminated by heavy metals due to historical discharges from the nearby industries. During the period from 2011-2015, the sediment in Kwun Tong TS recorded the highest levels of total heavy metals (i.e. cadmium, chromium, copper, mercury, nickel, lead, silver and zinc) amongst the typhoon shelters in Hong Kong.

For trace organic pollutants, To Kwa Wan TS had the highest level of polyaromatic hydrocarbons (PAHs) as compared with other typhoon shelters in 2015. 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



Dinophysis caudate (Dinoflagellate)

It is known that over-enrichment of a water body with nutrients such as nitrogen and phosphorus can encourage the growth of phytoplankton. Under suitable environmental conditions (including nutrients, water temperature, sunlight and wind speed), phytoplankton can reproduce quickly and very high numbers of phytoplankton cells may be found in a water body. This phenomenon is called algal bloom, also known as red tide. Some algal blooms are associated with the production of toxins that have harmful effects on fish and shellfish. Some non-toxic blooms may cause harm through their accumulated biomass which can affect co-occurring organisms. These events are known as Harmful Algal Blooms (HABs). Red tides can also deplete oxygen in the water when the dead algae decompose and cause massive fish kills. Phytoplankton monitoring therefore forms an essential part of water quality management.

The EPD conducts monitoring of phytoplankton at 25 stations covering 9 Water Control Zones (WCZs) in Hong Kong marine waters. Monthly samples are collected and analyzed. Changes and trends in phytoplankton with regard to their composition and densities are identified. A total of 82 phytoplankton species were recorded in Hong Kong waters in 2015. Of these, 46 were diatoms (56%), 24 were dinoflagellates (29%) and 12 were from other minor algal groups (15%). Of the samples examined in 2015, diatoms constituted the largest component of phytoplankton in all the WCZs in terms of species number. In terms of cell density, diatoms formed the largest component of phytoplankton in most WCZs (i.e. Tolo Harbour and Channel WCZ, Eastern Buffer WCZ, Victoria Harbour WCZ, Southern WCZ and Western Buffer WCZ), indicating that the water quality in these areas remains good with diatom as the dominant group. The most dominant diatoms were *Thalassiosira* spp. which constituted 19-79% of the diatom population in these WCZs. The most abundant dinoflagellates were *Gymnodinium* spp. comprising 13-49% of the dinoflagellate population in each WCZ. In 2015, the total phytoplankton densities were generally higher at the stations in the Tolo Harbour and Channel and Southern WCZs than those in the other WCZs. The densities of diatoms, dinoflagellates and other minor phytoplankton group followed a similar pattern as the total phytoplankton density.

Red tides and algal blooms are natural phenomena which occur seasonally in both polluted and unpolluted waters. In Hong Kong, red tides occur more commonly in semi-enclosed bays (e.g.

Tolo Harbour) with low tidal flushing rate. A total of 898 red tides were recorded in Hong Kong waters between 1980 and 2015. Locally, red tides occur more frequently in the eastern (72%) and southern (18%) waters. From 1980 to 2015, some 349 (39%) of the 898 red tides occurred in the Tolo Harbour and Channel WCZ, 153 (17%) in the Mirs Bay WCZ, 158 (18%) in the Southern WCZ and 142 (16%) in the Port Shelter WCZ. The most common red tide species in Hong Kong waters was the dinoflagellate *Noctiluca scintillans,* which accounted for 31% of the reported red tides between 1980 and 2015. Historically, red tides increased significantly in the 80s and reached a peak in 1988, when a total of 88 incidents were reported. Since the mid 90s, red tides fluctuated between 8 and 45 incidents per year. In 2015, a total of 9 red tides were recorded in Hong Kong waters. Of these, 2 occurred in the Mirs Bay WCZ, 2 in Tolo Harbour and Channel, 2 in Port Shelter, 2 in Southern and one in North Western. These incidents involved 8 red tide species and their distribution is set out below. Most of them are non-toxic species commonly found in Hong Kong waters. However, *Pseudo-nitzschia pungens* is a suspected toxic species which are associated with the production of toxins of ASP (Amnesic Shellfish Poisoning) that have harmful effects on fish and shellfish. *Trichodesmium erythraeum* is also a suspected toxic species containing microcystin that can contaminate fish and shellfish. One fish kill was recorded in Hong Kong waters (Yim Tin Tsai Fish Culture Zone) in 2015. The fish kill was caused by *Karenia mikimotoi*.

Distribution of red tide species in 2015

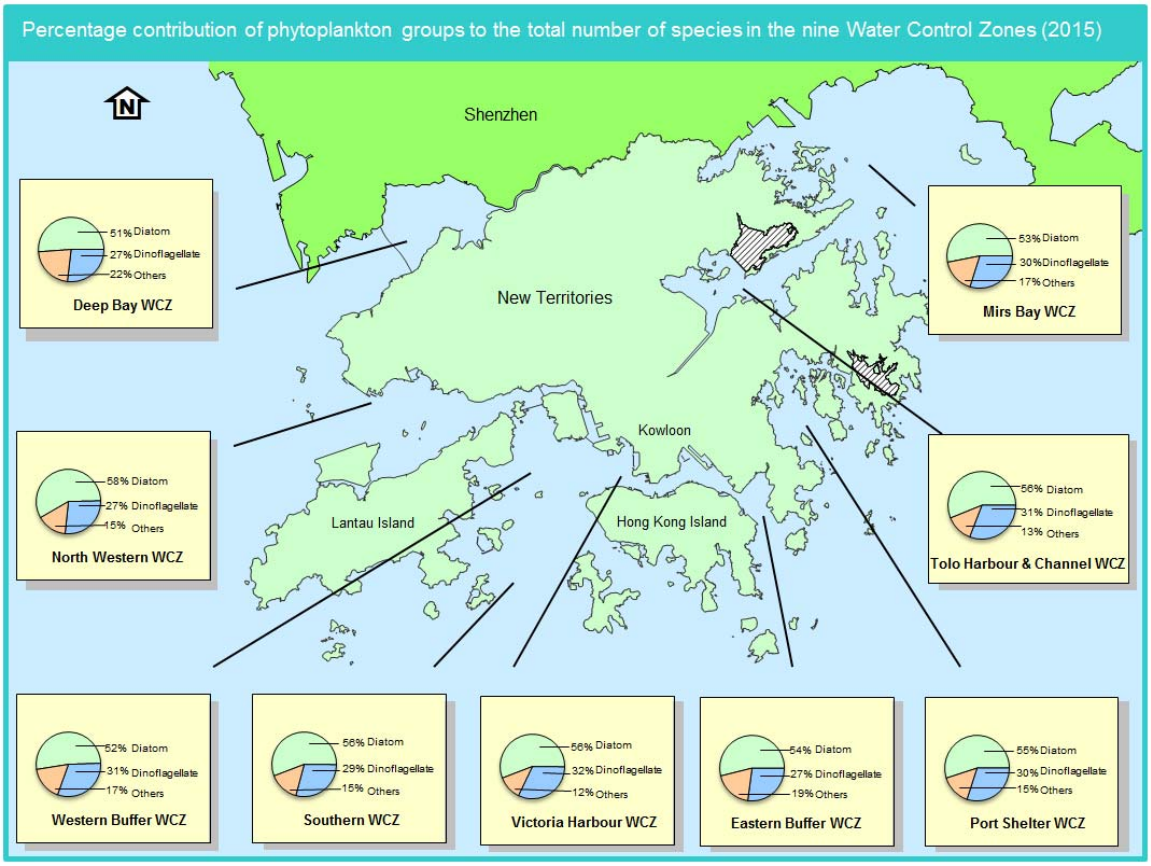
Mirs Bay WCZ
Mesodinium rubrum
Gyrodinium impudicum

Tolo Harbour & Channel WCZ
Heterocapsa circularisquama
Karenia mikimotoi

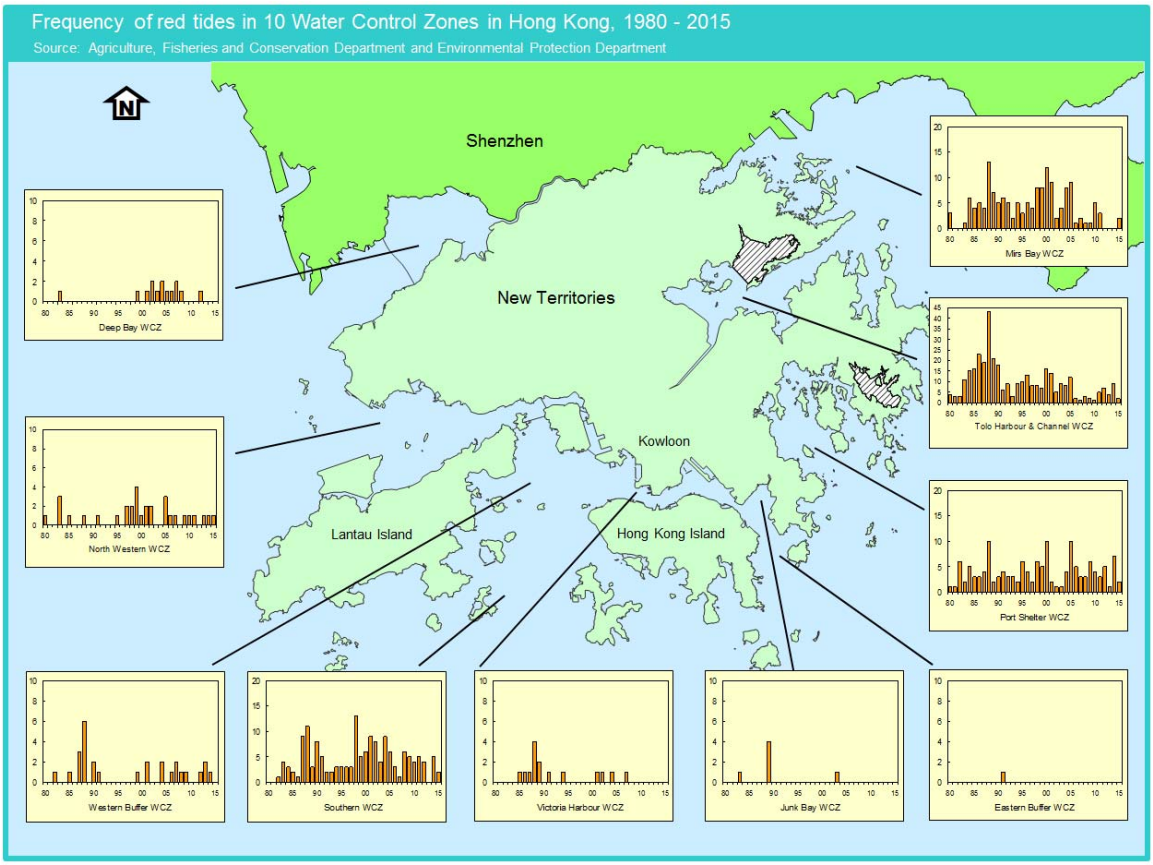
Port Shelter WCZ
Gonyaulax polygramma
Trichodesmium erythraeum

Southern WCZ
Noctiluca scintillans
Pseudo-nitzchia pungens

North Western WCZ
Noctiluca scintillans

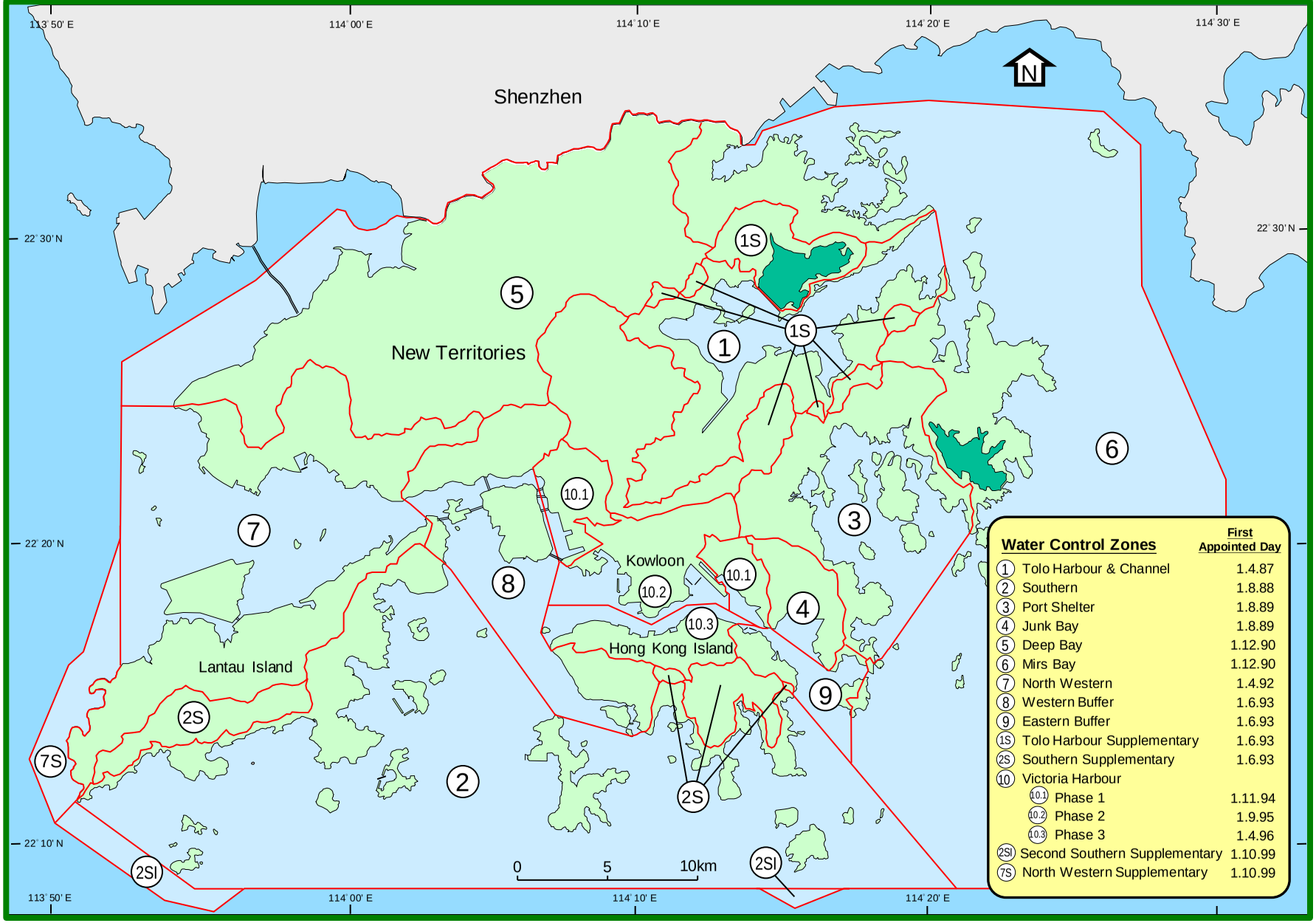


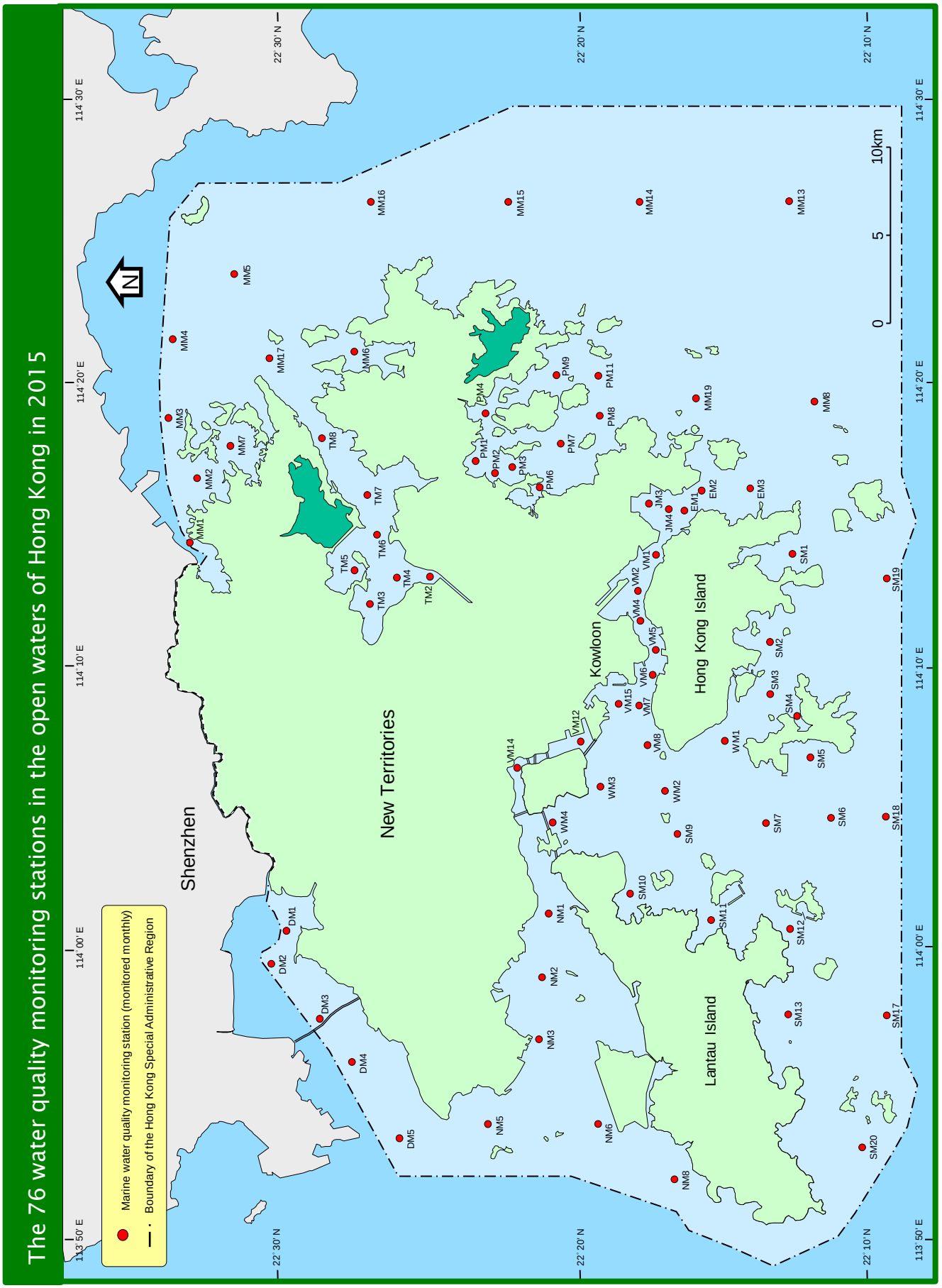
Note : Others refer to minor phytoplankton groups which mainly include *Cyanophyta* and *Chrysophyta*.

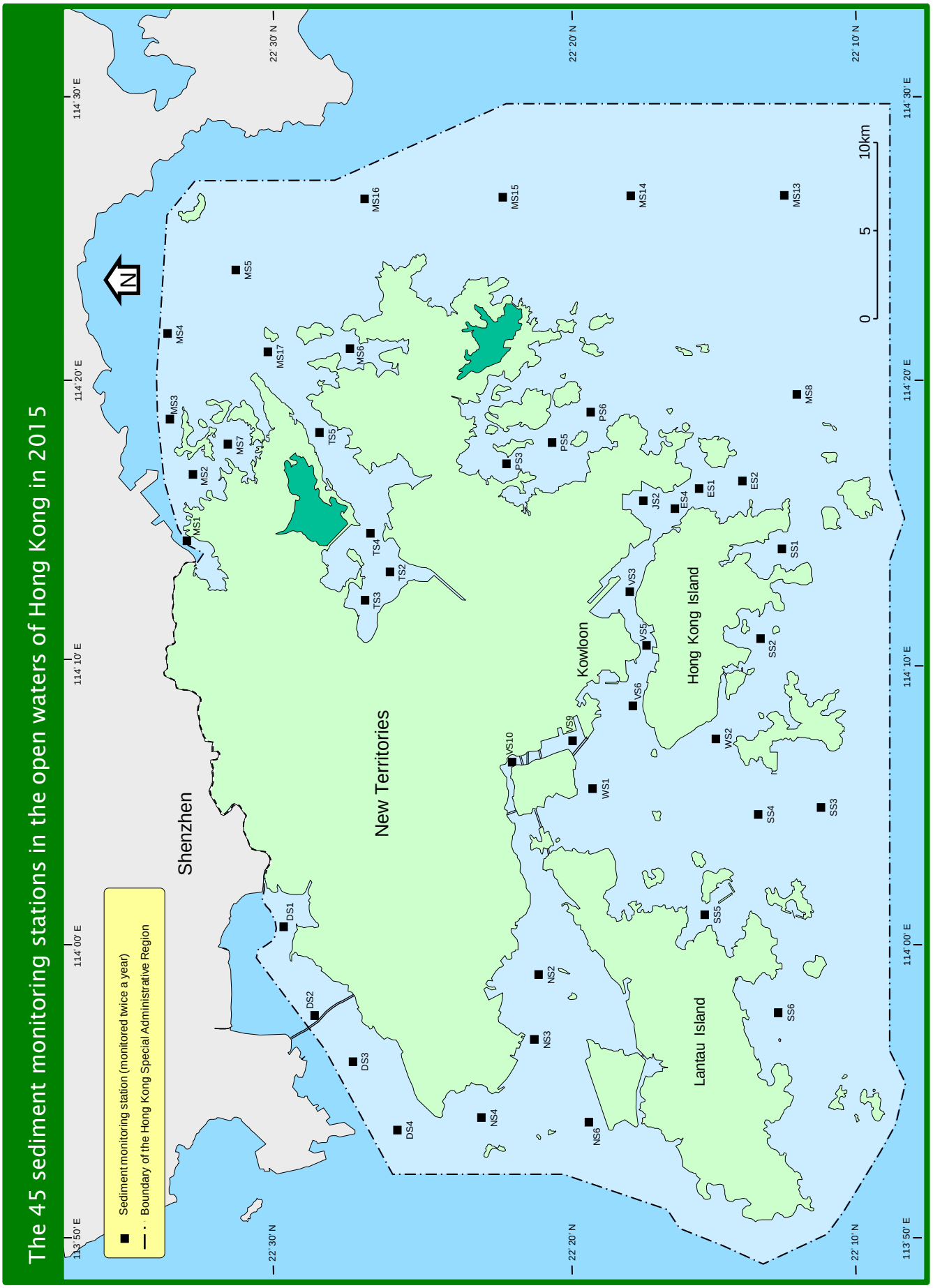


The Water Control Zones in Hong Kong

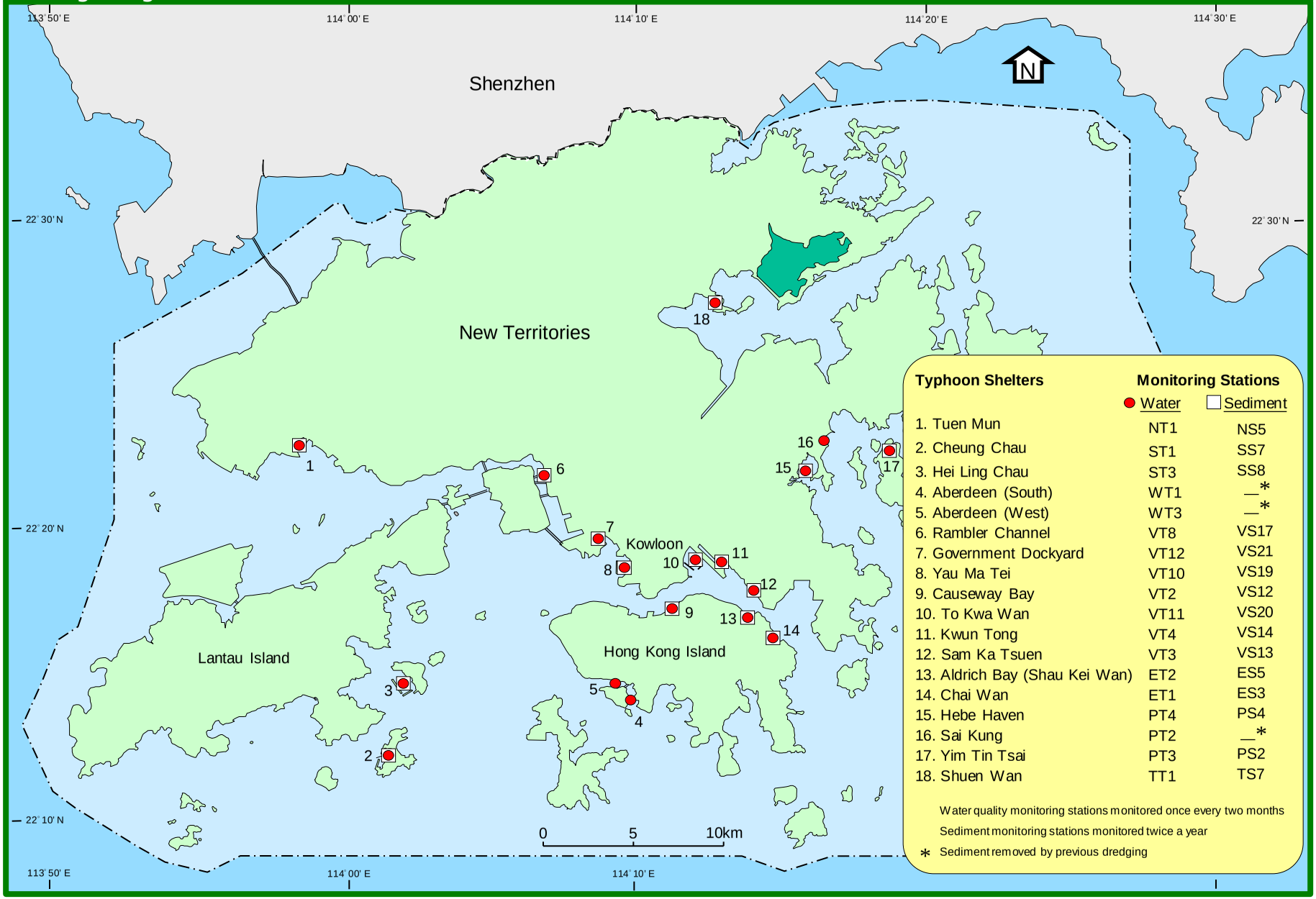
(Source: Environment Bureau– Plan No. WP/WP4/75, Oct 1999)




The 76 water quality monitoring stations in the open waters of Hong Kong in 2015
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
DM1
DM2
DM3
DM4
DM5
MM1
MM2
MM3
MM4
MM5
MM6
MM7
MM8
MM13
MM14
MM15
MM16
MM17
MM19
NM1
NM2
NM3
NM5
NM6
NM8
PM1
PM2
PM3
PM4
PM6
PM7
PM8
PM9
PM11
SM1
SM2
SM3
SM4
SM5
SM6
SM7
SM9
SM10
SM11
SM12
SM13
SM17
SM18
SM19
SM20
TM2
TM3
TM4
TM5
TM6
TM7
TM8
VM1
VM2
VM4
VM5
VM6
VM7
VM8
VM12
VM14
VM15
WM1
WM2
WM3
WM4
JM3
JM4
EM1
EM2
EM3


The 45 sediment monitoring stations in the open waters of Hong Kong in 2015
Sediment monitoring station (monitored twice a year)
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MS1
MS2
MS3
MS4
MS5
MS6
MS7
MS8
MS13
MS14
MS15
MS16
MS17
TS2
TS3
TS4
TS5
PS3
PS5
PS6
JS2
ES1
ES2
ES4
SS1
SS2
SS3
SS4
SS5
SS6
VS3
VS5
VS6
VS9
VS10
WS1
WS2
DS1
DS2
DS3
DS4
NS2
NS3
NS4
NS6
0
5
10km
N
114° 30' E
114° 20' E
114° 10' E
114° 00' E
113° 50' E
22° 30' N
22° 20' N
22° 10' N

The 18 water quality monitoring stations and 15 sediment monitoring stations in the typhoon shelters of Hong Kong in 2015



Typhoon Shelters	Monitoring Stations	
	Water	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

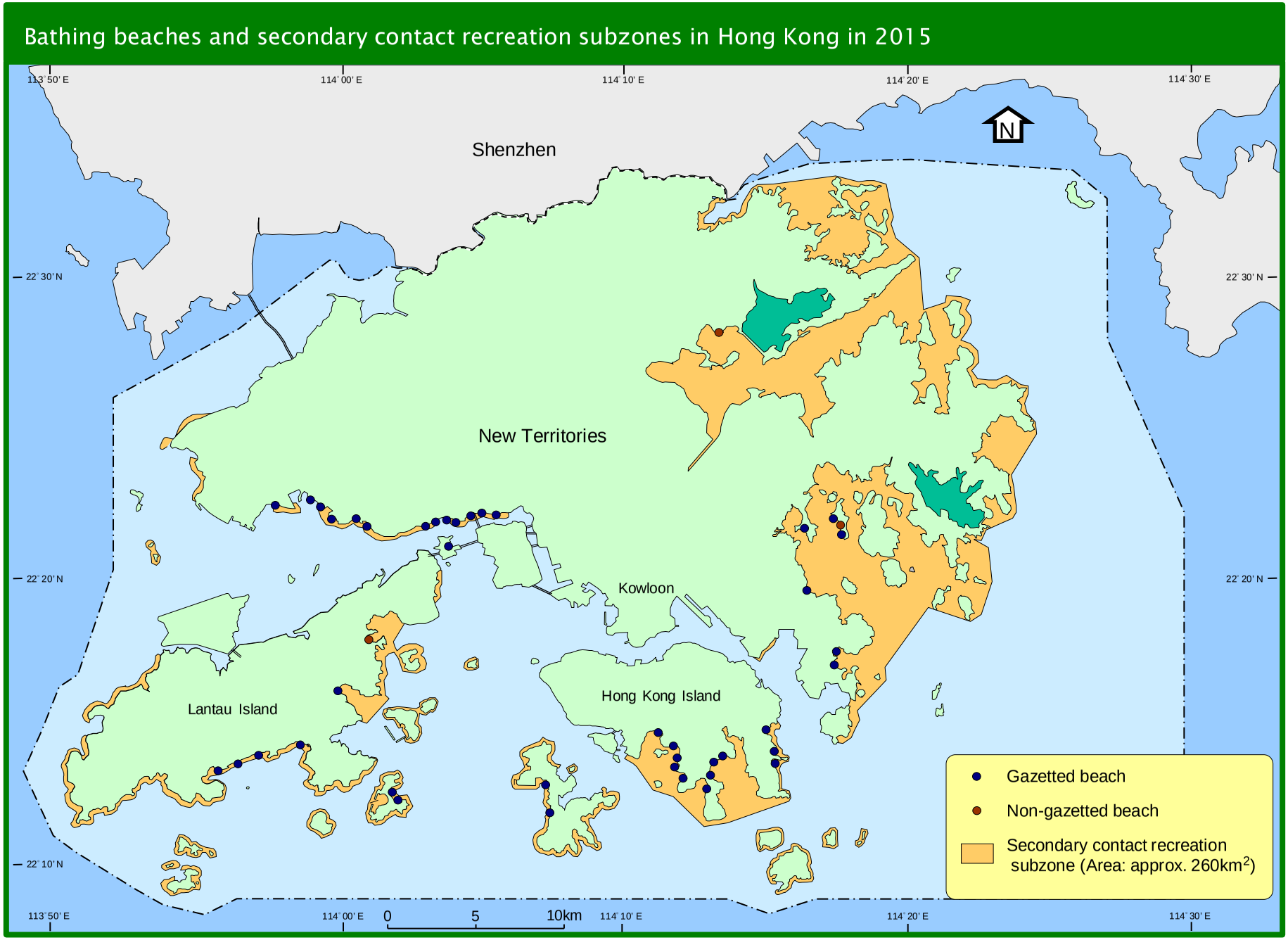
* Sediment removed by previous dredging

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

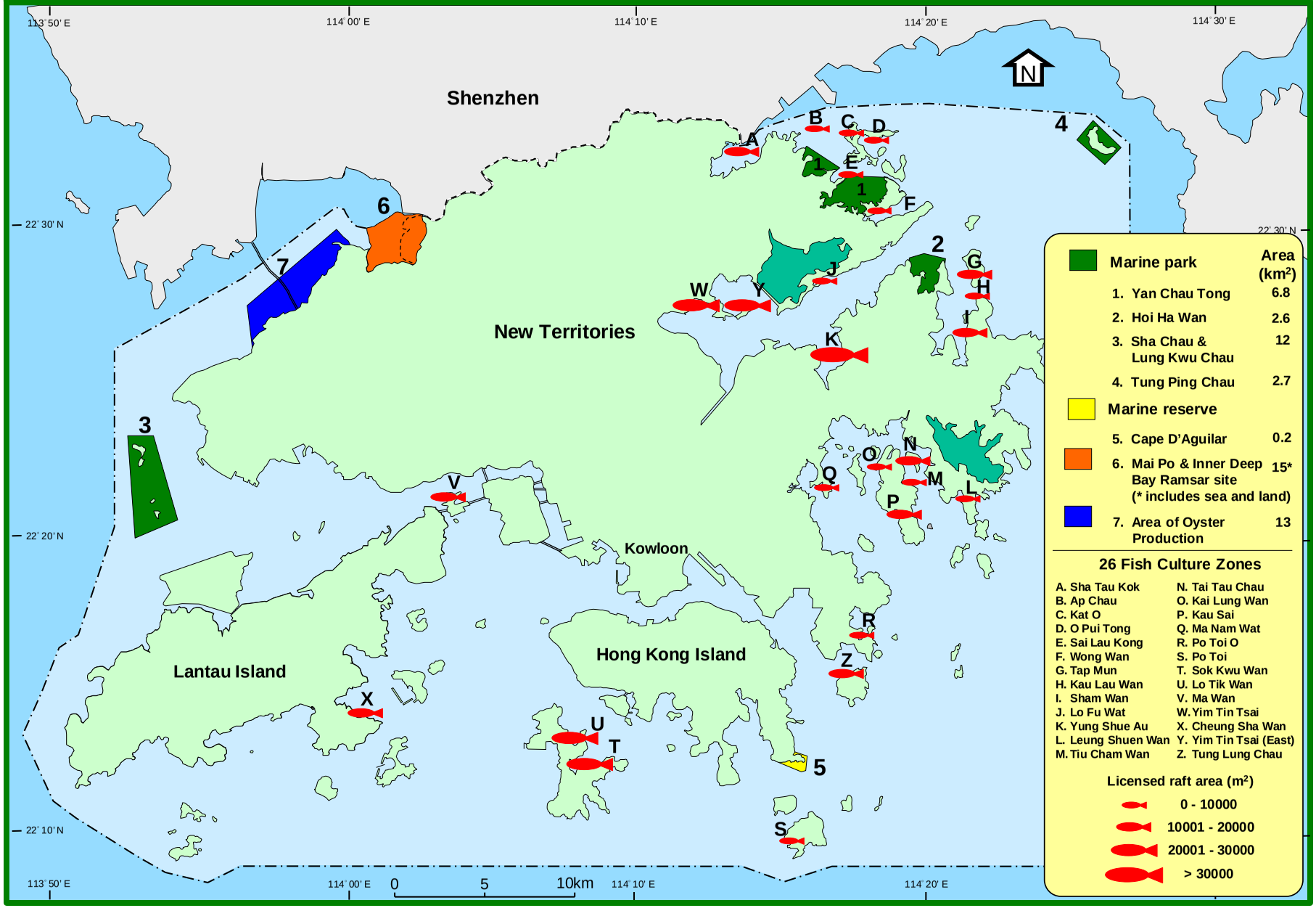
Note : 1. All locations are based on WGS84 datum

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

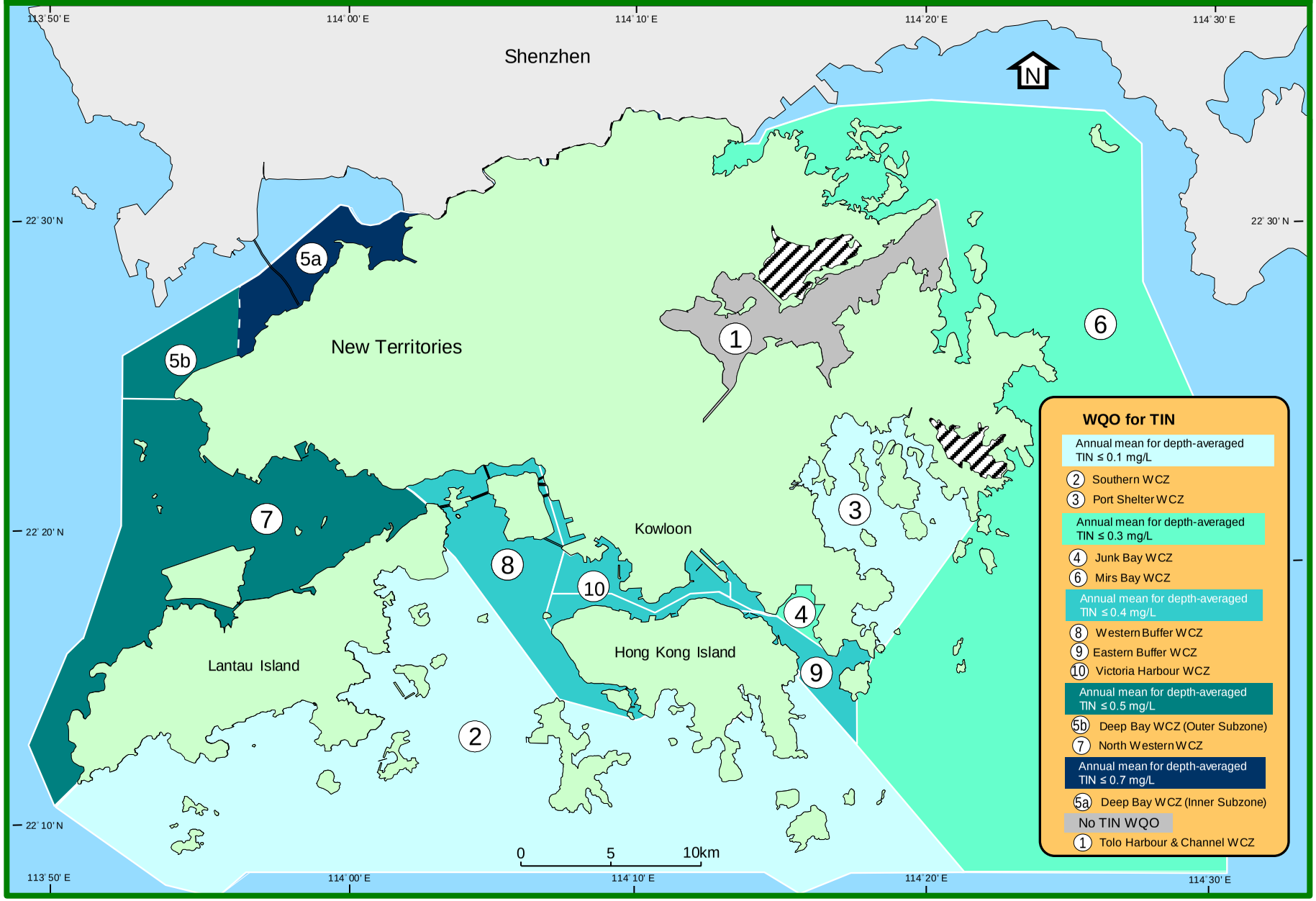

Bathing beaches and secondary contact recreation subzones in Hong Kong in 2015
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E
N
Shenzhen
22° 30' N
New Territories
22° 20' N
Kowloon
Lantau Island
Hong Kong Island
22° 10' N
0
5
10km
Gazetted beach
Non-gazetted beach
Secondary contact recreation subzone (Area: approx. 260km2)

Fish and shellfish culture zones and marine conservation sites in Hong Kong in 2015

(source: Agriculture, Fisheries and Conservation Department)



Water Quality Objective (WQO) for Total Inorganic Nitrogen (TIN) in the ten Water Control Zones



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 Harbour & Channel WCZ, Southern WCZ, Port Shelter WCZ, Mirs Bay WCZ, Deep Bay WCZ, North Western WCZ, Western Buffer WCZ
	Annual geometric mean not to exceed 610 cfu/100mL	Fish culture subzones in Tolo Harbour & Channel WCZ, Southern WCZ, Port Shelter WCZ, Junk Bay WCZ, Mirs Bay WCZ, Deep Bay WCZ, Eastern Buffer WCZ, Western Buffer WCZ
pH	To be in the range 6.5 - 8.5, change due to waste discharge not to exceed 0.2	Marine waters of all WCZs except Tolo Harbour & Channel WCZ
	Change due to waste discharge not to be greater than ±0.5	Harbour Subzone in Tolo Harbour & Channel WCZ
	Change due to waste discharge not to be greater than ±0.3	Buffer Subzone in Tolo Harbour & Channel WCZ
	Change due to waste discharge not to be greater than ±0.1	Channel Subzone in Tolo Harbour & Channel WCZ
Salinity	Change due to waste discharge not to exceed 10% of natural ambient level	All WCZs (Whole zone) except Tolo Harbour & Channel WCZ
	Change due to waste discharge not to be greater than ±3ppt	Tolo Harbour & Channel WCZ
Temperature	Change due to waste discharge not to exceed 2℃	All WCZs (Whole zone) except Tolo Harbour & Channel WCZ
	Change due to waste discharge not to exceed 1℃	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 22ed 2540D (weighing)	GL[18]
	Volatile Suspended Solids[3]	mg/L	0.5	S,M,B	In-house method GL-PH-23 based on APHA 22ed 2540E (weighing)	GL
Aggregate Organic Constituents	5-day Biochemical Oxygen Demand (BOD_5)[4]	mg/L	0.1	S,M,B	In-house method based on APHA 20ed 5210B	EML/EPD[16]
Nutrients and Inorganic Constituents	Ammonia Nitrogen[5]	mg/L	0.005	S,M,B	In-house method GL-IN-15 based on ASTM D3590-11 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 22ed 4500-NO_2^- B (FIA)	GL
	Nitrate Nitrogen[5]	mg/L	0.002	S,M,B	In-house method GL-IN-18 based on APHA 22ed 4500-NO_3^- 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 D3590-11 B (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 APHA 22ed 4500-P G (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)	GL
	Silica (as SiO_2) (soluble) [5]	mg/L	0.05	S,M,B	In-house method GL-IN-17 based on APHA 22ed 4500-SiO_2 F (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

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 (combustion - IR)	GL
Nutrients and Inorganic Constituents [3]	Ammonia Nitrogen (NH_4-N)	mg/kg	0.05	In-house method GL-IN-19 based on ASTM D3590-11 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 D3590-11 B (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)	GL
	Total Sulphide	mg/kg	0.2	In-house method GL-IN-45 based on APHA 20ed 4500-S^{2-} A&D (spectrophotometric)	GL
	Total Cyanide	mg/kg	0.1	In-house method GL-IN-44 based on APHA 20ed 4500-CN^- A&E (distillation and amperometric)	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 2015

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 (°C)		24.4 (17.2 - 29.9)	24.1 (17.0 - 29.4)	23.9 (17.0 - 29.4)	23.4 (16.7 - 28.8)	23.5 (16.8 - 29.1)	23.2 (16.7 - 28.7)	23.2 (16.7 - 28.7)
Salinity		31.7 (26.1 - 33.2)	32.1 (27.4 - 33.3)	32.4 (28.9 - 33.4)	32.7 (30.3 - 33.8)	32.5 (29.4 - 33.7)	32.7 (30.2 - 33.9)	32.8 (30.9 - 33.9)
Dissolved Oxygen (mg/L)		6.8 (5.7 - 7.9)	6.3 (3.5 - 8.0)	5.9 (4.3 - 7.5)	5.9 (4.2 - 7.7)	6.0 (3.5 - 8.0)	5.8 (3.7 - 8.5)	6.0 (3.8 - 8.4)
	Bottom	6.4 (3.4 - 7.8)	5.5 (1.0 - 7.7)	4.8 (0.3 - 7.8)	5.2 (1.6 - 8.0)	5.2 (0.8 - 8.2)	5.2 (1.9 - 8.4)	5.0 (2.1 - 7.8)
Dissolved Oxygen (% Saturation)		98 (86 - 118)	89 (53 - 103)	84 (66 - 97)	83 (64 - 96)	84 (53 - 103)	81 (55 - 105)	84 (56 - 108)
	Bottom	90 (51 - 111)	76 (15 - 98)	67 (5 - 98)	72 (22 - 99)	72 (12 - 103)	71 (26 - 104)	68 (29 - 97)
pH		8.1 (7.9 - 8.3)	8.1 (7.9 - 8.3)	8.1 (7.9 - 8.3)	8.1 (7.8 - 8.3)	8.1 (7.9 - 8.3)	8.1 (7.8 - 8.3)	8.1 (7.8 - 8.3)
Secchi Disc Depth (m)		2.5 (2.0 - 3.0)	3.0 (2.2 - 5.0)	3.3 (2.4 - 5.0)	3.3 (2.0 - 5.0)	3.0 (2.0 - 4.0)	3.1 (2.0 - 5.0)	3.5 (2.0 - 5.1)
Turbidity (NTU)		2.7 (1.1 - 4.9)	2.3 (0.7 - 4.0)	2.2 (0.5 - 4.6)	2.8 (0.6 - 6.5)	3.3 (0.6 - 10.1)	3.4 (1.0 - 8.4)	2.6 (0.8 - 5.0)
Suspended Solids (mg/L)		3.6 (1.5 - 9.4)	3.8 (1.1 - 14.5)	3.9 (1.1 - 16.3)	2.5 (0.9 - 7.2)	4.3 (1.2 - 13.3)	3.2 (0.8 - 5.9)	2.9 (0.9 - 7.5)
5-day Biochemical Oxygen Demand (mg/L)		1.3 (0.5 - 2.1)	1.1 (0.6 - 1.7)	1.1 (0.2 - 1.7)	0.8 (0.2 - 1.7)	1.2 (0.3 - 3.4)	0.8 (0.3 - 1.8)	0.8 (0.2 - 1.6)
Ammonia Nitrogen (mg/L)		0.037 (0.015 - 0.067)	0.036 (0.013 - 0.062)	0.042 (0.014 - 0.113)	0.031 (0.015 - 0.060)	0.032 (0.014 - 0.046)	0.031 (0.017 - 0.055)	0.027 (0.013 - 0.050)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.004)	0.002 (<0.001 - 0.004)	0.002 (<0.001 - 0.006)	0.001 (<0.001 - 0.003)	0.002 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.002)
Nitrite Nitrogen (mg/L)		0.015 (<0.002 - 0.054)	0.012 (<0.002 - 0.049)	0.015 (0.002 - 0.058)	0.011 (<0.002 - 0.037)	0.013 (<0.002 - 0.040)	0.013 (<0.002 - 0.040)	0.011 (<0.002 - 0.036)
Nitrate Nitrogen (mg/L)		0.060 (<0.002 - 0.193)	0.034 (<0.002 - 0.155)	0.031 (<0.002 - 0.160)	0.028 (<0.002 - 0.122)	0.036 (<0.002 - 0.149)	0.033 (<0.002 - 0.157)	0.031 (<0.002 - 0.085)
Total Inorganic Nitrogen (mg/L)		0.11 (0.03 - 0.24)	0.08 (0.02 - 0.19)	0.09 (0.02 - 0.20)	0.07 (0.02 - 0.16)	0.08 (0.03 - 0.19)	0.08 (0.03 - 0.19)	0.07 (0.02 - 0.13)
Total Kjeldahl Nitrogen (mg/L)		0.31 (0.18 - 0.46)	0.32 (0.14 - 0.55)	0.28 (0.22 - 0.42)	0.28 (0.17 - 0.48)	0.26 (0.13 - 0.40)	0.29 (0.16 - 0.49)	0.26 (0.15 - 0.43)
Total Nitrogen (mg/L)		0.39 (0.19 - 0.57)	0.36 (0.14 - 0.59)	0.33 (0.23 - 0.47)	0.32 (0.17 - 0.53)	0.31 (0.14 - 0.46)	0.34 (0.18 - 0.54)	0.30 (0.15 - 0.47)
Orthophosphate Phosphorus (mg/L)		0.006 (0.004 - 0.011)	0.007 (0.004 - 0.016)	0.008 (0.003 - 0.020)	0.007 (0.003 - 0.018)	0.008 (0.004 - 0.021)	0.007 (0.002 - 0.015)	0.007 (0.005 - 0.014)
Total Phosphorus (mg/L)		0.04 (<0.02 - 0.11)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.09)	0.04 (<0.02 - 0.06)	0.04 (<0.02 - 0.09)	0.04 (<0.02 - 0.07)
Silica (as SiO_2) (mg/L)		0.61 (0.22 - 1.28)	0.60 (0.12 - 1.34)	0.70 (0.18 - 1.38)	0.66 (0.17 - 1.45)	0.69 (0.19 - 1.61)	0.68 (0.19 - 1.39)	0.66 (0.20 - 1.38)
Chlorophyll-a (µg/L)		5.3 (1.1 - 11.6)	3.5 (0.9 - 7.1)	3.2 (0.4 - 7.7)	2.2 (0.9 - 6.1)	1.9 (0.6 - 3.6)	2.3 (0.5 - 6.5)	2.3 (<0.2 - 6.2)
E.coli (count/100mL)		6 (1 - 93)	2 (<1 - 8)	1 (<1 - 9)	1 (<1 - 1)	1 (<1 - 4)	1 (<1 - 2)	1 (<1 - 1)
Faecal Coliforms (count/100mL)		11 (1 - 300)	3 (<1 - 48)	2 (<1 - 25)	2 (<1 - 15)	2 (<1 - 32)	2 (<1 - 6)	2 (<1 - 14)

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 2015 (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 (°C)		22.6 (16.2 - 28.0)	22.6 (16.4 - 28.1)	22.8 (16.2 - 27.6)	22.7 (16.1 - 27.7)	22.7 (16.0 - 27.7)	22.9 (16.3 - 28.1)	23.6 (16.6 - 28.8)
Salinity		33.2 (31.8 - 34.1)	33.0 (31.7 - 34.0)	33.1 (31.7 - 34.6)	33.2 (31.6 - 34.2)	33.2 (31.7 - 34.3)	33.2 (31.8 - 34.0)	32.5 (29.2 - 33.6)
Dissolved Oxygen (mg/L)		5.9 (4.0 - 8.0)	6.2 (4.2 - 8.0)	6.3 (5.1 - 8.0)	6.3 (4.6 - 8.1)	6.2 (4.3 - 7.8)	6.2 (4.0 - 7.9)	6.0 (4.2 - 8.0)
	Bottom	5.4 (2.7 - 7.9)	5.7 (3.0 - 7.9)	5.8 (3.5 - 7.9)	5.7 (3.1 - 8.0)	5.7 (3.0 - 7.8)	5.4 (2.3 - 7.9)	5.4 (1.3 - 8.0)
Dissolved Oxygen (% Saturation)		83 (58 - 99)	86 (60 - 99)	89 (73 - 99)	88 (66 - 100)	87 (64 - 97)	87 (61 - 109)	84 (62 - 100)
	Bottom	75 (38 - 97)	78 (42 - 99)	80 (49 - 98)	79 (45 - 98)	78 (42 - 96)	75 (32 - 97)	75 (19 - 100)
pH		8.0 (7.8 - 8.4)	8.0 (7.8 - 8.3)	8.0 (7.8 - 8.4)	8.0 (7.8 - 8.3)	8.0 (7.8 - 8.3)	7.9 (7.7 - 8.4)	8.0 (7.8 - 8.3)
Secchi Disc Depth (m)		3.5 (1.8 - 6.0)	3.5 (2.0 - 5.0)	3.7 (1.5 - 5.4)	3.9 (2.1 - 5.0)	4.0 (1.6 - 6.1)	5.0 (3.0 - 10.0)	3.5 (2.5 - 4.5)
Turbidity (NTU)		3.4 (1.1 - 6.3)	3.8 (0.8 - 6.4)	3.7 (1.4 - 11.3)	3.9 (1.1 - 9.7)	3.7 (1.2 - 14.2)	3.2 (0.9 - 7.0)	2.0 (0.8 - 3.0)
Suspended Solids (mg/L)		4.5 (1.1 - 20.0)	5.7 (1.1 - 23.7)	5.4 (0.8 - 28.0)	6.2 (1.5 - 32.7)	5.3 (1.6 - 25.3)	5.2 (1.1 - 28.7)	3.0 (0.9 - 11.7)
5-day Biochemical Oxygen Demand (mg/L)		0.5 (0.1 - 0.8)	0.5 (0.1 - 1.6)	0.5 (0.1 - 1.7)	0.6 (0.1 - 1.9)	0.5 (0.2 - 1.4)	0.5 (0.1 - 0.9)	1.1 (0.3 - 2.9)
Ammonia Nitrogen (mg/L)		0.021 (0.015 - 0.031)	0.019 (0.014 - 0.032)	0.018 (0.011 - 0.026)	0.027 (0.012 - 0.100)	0.019 (0.013 - 0.024)	0.020 (0.010 - 0.034)	0.032 (0.015 - 0.060)
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)	<0.001 (<0.001 - 0.001)	<0.001 (<0.001 - 0.002)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)		0.015 (0.004 - 0.035)	0.018 (0.003 - 0.036)	0.013 (0.003 - 0.038)	0.013 (0.003 - 0.040)	0.013 (0.003 - 0.037)	0.012 (0.002 - 0.036)	0.010 (0.003 - 0.028)
Nitrate Nitrogen (mg/L)		0.042 (0.004 - 0.094)	0.047 (0.002 - 0.110)	0.039 (<0.002 - 0.115)	0.036 (0.003 - 0.103)	0.033 (0.003 - 0.103)	0.025 (0.003 - 0.079)	0.026 (<0.002 - 0.130)
Total Inorganic Nitrogen (mg/L)		0.08 (0.03 - 0.13)	0.08 (0.02 - 0.14)	0.07 (0.02 - 0.15)	0.08 (0.02 - 0.21)	0.06 (0.02 - 0.14)	0.06 (0.02 - 0.11)	0.07 (0.02 - 0.17)
Total Kjeldahl Nitrogen (mg/L)		0.19 (0.08 - 0.33)	0.20 (0.12 - 0.27)	0.20 (0.08 - 0.30)	0.23 (0.06 - 0.45)	0.20 (<0.05 - 0.32)	0.20 (0.06 - 0.30)	0.29 (0.17 - 0.43)
Total Nitrogen (mg/L)		0.25 (0.10 - 0.36)	0.27 (0.13 - 0.36)	0.25 (0.08 - 0.39)	0.28 (0.06 - 0.56)	0.24 (0.06 - 0.36)	0.24 (0.07 - 0.34)	0.33 (0.18 - 0.46)
Orthophosphate Phosphorus (mg/L)		0.009 (0.005 - 0.015)	0.008 (0.005 - 0.015)	0.007 (0.005 - 0.012)	0.008 (0.005 - 0.013)	0.008 (0.005 - 0.013)	0.008 (0.005 - 0.015)	0.008 (0.002 - 0.019)
Total Phosphorus (mg/L)		0.04 (<0.02 - 0.09)	0.04 (<0.02 - 0.08)	0.03 (<0.02 - 0.07)	0.04 (<0.02 - 0.07)	0.04 (<0.02 - 0.07)	0.04 (<0.02 - 0.07)	0.04 (<0.02 - 0.08)
Silica (as SiO_2) (mg/L)		0.67 (0.20 - 1.11)	0.66 (0.17 - 1.27)	0.54 (0.14 - 0.96)	0.59 (0.16 - 1.13)	0.60 (0.11 - 1.13)	0.61 (0.11 - 1.05)	0.68 (0.22 - 1.51)
Chlorophyll-a (µg/L)		1.7 (0.9 - 4.9)	1.9 (0.4 - 7.7)	1.8 (0.4 - 7.0)	2.0 (0.7 - 5.5)	1.2 (0.4 - 2.4)	1.3 (0.4 - 2.1)	3.7 (0.8 - 14.4)
E.coli (count/100mL)		1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 3)
Faecal Coliforms (count/100mL)		1 (<1 - 2)	1 (<1 - 4)	1 (<1 - 2)	1 (<1 - 3)	1 (<1 - 1)	1 (<1 - 2)	3 (1 - 41)

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 2015

Parameter		Inner Port Shelter				Hebe Haven
		PM1	PM2	PM3	PM4	PM6
Number of samples		12	12	12	12	12
Temperature (°C)		24.2 (16.9 - 29.5)	24.0 (16.9 - 28.8)	23.7 (16.9 - 29.1)	24.0 (16.9 - 28.6)	23.8 (17.0 - 29.4)
Salinity		32.5 (29.8 - 33.6)	32.5 (30.8 - 33.5)	32.7 (31.6 - 33.4)	32.5 (30.2 - 33.7)	32.7 (31.7 - 33.7)
Dissolved Oxygen (mg/L)		6.5 (4.4 - 8.4)	6.5 (4.2 - 8.3)	6.2 (3.2 - 8.3)	6.3 (4.8 - 8.1)	6.1 (3.5 - 7.6)
	Bottom	6.4 (2.2 - 8.8)	6.4 (2.4 - 8.3)	5.9 (1.1 - 8.2)	6.4 (3.5 - 8.7)	5.6 (1.9 - 7.6)
Dissolved Oxygen (% Saturation)		92 (65 - 115)	92 (63 - 110)	88 (47 - 104)	89 (71 - 102)	86 (51 - 98)
	Bottom	91 (32 - 115)	90 (35 - 109)	82 (15 - 102)	90 (52 - 109)	78 (27 - 99)
pH		8.0 (7.7 - 8.3)	7.9 (7.6 - 8.3)	7.9 (7.7 - 8.3)	7.9 (7.7 - 8.3)	7.9 (7.8 - 8.3)
Secchi Disc Depth (m)		3.8 (2.5 - 5.0)	3.6 (2.5 - 5.0)	4.0 (3.0 - 7.0)	3.5 (3.0 - 4.0)	3.7 (2.5 - 5.5)
Turbidity (NTU)		2.8 (0.7 - 8.3)	2.9 (0.7 - 9.7)	2.7 (0.9 - 7.7)	3.3 (1.1 - 7.8)	2.9 (0.9 - 6.3)
Suspended Solids (mg/L)		2.3 (1.1 - 6.7)	2.3 (0.7 - 5.0)	1.9 (0.8 - 4.6)	3.3 (1.1 - 13.7)	2.6 (1.1 - 5.4)
5-day Biochemical Oxygen Demand (mg/L)		1.0 (0.2 - 1.8)	0.8 (0.2 - 1.8)	0.8 (0.2 - 1.7)	1.1 (0.2 - 4.3)	0.7 (<0.1 - 1.4)
Ammonia Nitrogen (mg/L)		0.039 (0.011 - 0.075)	0.035 (0.016 - 0.065)	0.034 (0.019 - 0.058)	0.039 (0.012 - 0.058)	0.036 (0.014 - 0.063)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.004)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.002)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)		0.008 (<0.002 - 0.054)	0.009 (<0.002 - 0.061)	0.010 (<0.002 - 0.064)	0.006 (<0.002 - 0.032)	0.008 (<0.002 - 0.048)
Nitrate Nitrogen (mg/L)		0.018 (<0.002 - 0.067)	0.021 (<0.002 - 0.068)	0.021 (<0.002 - 0.071)	0.015 (<0.002 - 0.061)	0.024 (<0.002 - 0.065)
Total Inorganic Nitrogen (mg/L)		0.07 (0.02 - 0.17)	0.07 (0.02 - 0.17)	0.07 (0.03 - 0.15)	0.06 (0.02 - 0.15)	0.07 (0.02 - 0.15)
Total Kjeldahl Nitrogen (mg/L)		0.28 (0.18 - 0.50)	0.31 (0.19 - 0.61)	0.29 (0.16 - 0.50)	0.27 (0.18 - 0.42)	0.27 (0.17 - 0.43)
Total Nitrogen (mg/L)		0.31 (0.18 - 0.50)	0.34 (0.20 - 0.61)	0.32 (0.19 - 0.50)	0.30 (0.20 - 0.43)	0.31 (0.17 - 0.43)
Orthophosphate Phosphorus (mg/L)		0.006 (0.004 - 0.010)	0.007 (0.004 - 0.011)	0.007 (0.004 - 0.015)	0.006 (0.004 - 0.010)	0.006 (0.004 - 0.012)
Total Phosphorus (mg/L)		0.03 (<0.02 - 0.07)	0.03 (<0.02 - 0.07)	0.04 (<0.02 - 0.11)	0.03 (<0.02 - 0.09)	0.03 (<0.02 - 0.07)
Silica (as SiO_2) (mg/L)		0.64 (0.09 - 1.40)	0.61 (0.07 - 1.21)	0.64 (0.24 - 1.22)	0.66 (0.30 - 1.06)	0.59 (0.19 - 0.98)
Chlorophyll-*a* (µg/L)		2.8 (1.4 - 6.1)	2.3 (1.1 - 3.7)	1.7 (0.7 - 2.7)	3.3 (1.0 - 10.5)	2.7 (0.8 - 4.4)
E.coli (count/100mL)		1 (<1 - 3)	3 (1 - 16)	2 (<1 - 5)	1 (<1 - 3)	2 (<1 - 9)
Faecal Coliforms (count/100mL)		4 (<1 - 32)	14 (1 - 80)	4 (<1 - 57)	3 (<1 - 40)	3 (1 - 23)

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 2015 (continued)

Parameter		Outer Port Shelter PM7	Outer Port Shelter PM8	Rocky Harbour PM9	Bluff Island PM11
Number of samples		12	12	12	12
Temperature (°C)		23.4 (16.9 - 27.9)	23.1 (16.7 - 27.6)	23.3 (16.6 - 28.3)	23.1 (16.5 - 28.0)
Salinity		32.9 (31.8 - 33.6)	32.9 (31.8 - 33.6)	32.9 (31.8 - 33.6)	33.0 (31.8 - 33.7)
Dissolved Oxygen (mg/L)		6.3 (4.0 - 8.3)	6.3 (3.7 - 8.1)	6.4 (4.1 - 8.7)	6.3 (4.1 - 8.1)
	Bottom	5.6 (1.6 - 8.2)	5.6 (2.2 - 7.8)	6.1 (1.7 - 8.5)	6.0 (3.4 - 8.2)
Dissolved Oxygen (% Saturation)		89 (59 - 104)	89 (55 - 101)	90 (61 - 108)	89 (61 - 101)
	Bottom	78 (23 - 103)	78 (31 - 97)	85 (24 - 106)	83 (48 - 102)
pH		8.0 (7.8 - 8.3)	8.0 (7.8 - 8.3)	8.0 (7.8 - 8.3)	8.0 (7.8 - 8.3)
Secchi Disc Depth (m)		4.7 (3.0 - 7.0)	4.8 (2.5 - 7.0)	4.9 (3.0 - 9.0)	5.3 (2.5 - 10.0)
Turbidity (NTU)		2.7 (0.9 - 5.1)	2.9 (0.8 - 5.9)	2.7 (0.6 - 6.9)	2.8 (0.7 - 6.6)
Suspended Solids (mg/L)		1.9 (<0.5 - 4.4)	2.0 (0.6 - 5.8)	1.9 (0.7 - 4.9)	2.3 (0.7 - 7.1)
5-day Biochemical Oxygen Demand (mg/L)		0.6 (<0.1 - 1.4)	0.5 (<0.1 - 1.1)	0.6 (<0.1 - 1.3)	0.5 (<0.1 - 1.0)
Ammonia Nitrogen (mg/L)		0.028 (0.014 - 0.042)	0.027 (0.011 - 0.040)	0.029 (0.016 - 0.042)	0.025 (0.013 - 0.033)
Unionised Ammonia (mg/L)		0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.002)
Nitrite Nitrogen (mg/L)		0.012 (<0.002 - 0.044)	0.011 (0.002 - 0.031)	0.011 (<0.002 - 0.043)	0.013 (<0.002 - 0.042)
Nitrate Nitrogen (mg/L)		0.026 (0.002 - 0.066)	0.031 (0.003 - 0.075)	0.027 (<0.002 - 0.066)	0.033 (0.002 - 0.085)
Total Inorganic Nitrogen (mg/L)		0.07 (0.03 - 0.12)	0.07 (0.03 - 0.11)	0.07 (0.03 - 0.12)	0.07 (0.03 - 0.12)
Total Kjeldahl Nitrogen (mg/L)		0.27 (0.14 - 0.55)	0.24 (0.13 - 0.42)	0.26 (0.15 - 0.59)	0.26 (0.13 - 0.58)
Total Nitrogen (mg/L)		0.31 (0.15 - 0.55)	0.28 (0.14 - 0.43)	0.30 (0.17 - 0.59)	0.31 (0.17 - 0.58)
Orthophosphate Phosphorus (mg/L)		0.008 (0.004 - 0.016)	0.008 (0.004 - 0.017)	0.008 (0.004 - 0.015)	0.008 (0.004 - 0.015)
Total Phosphorus (mg/L)		0.03 (<0.02 - 0.07)	0.03 (<0.02 - 0.06)	0.03 (<0.02 - 0.08)	0.03 (<0.02 - 0.06)
Silica (as SiO_2) (mg/L)		0.63 (0.18 - 1.23)	0.65 (0.22 - 1.30)	0.66 (0.23 - 1.26)	0.64 (0.18 - 1.13)
Chlorophyll-*a* (μg/L)		1.6 (0.3 - 3.7)	1.6 (0.9 - 3.0)	1.5 (0.7 - 2.3)	1.5 (0.7 - 2.6)
E.coli (count/100mL)		1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)
Faecal Coliforms (count/100mL)		1 (<1 - 5)	1 (<1 - 3)	1 (<1 - 3)	1 (<1 - 6)

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

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

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Tolo Harbour WCZ in 2015

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 (°C)		24.5 (17.5 - 29.7)	24.7 (17.3 - 29.9)	24.4 (17.2 - 29.5)	24.8 (17.5 - 29.9)	24.0 (17.1 - 28.8)	24.1 (17.1 - 28.8)	23.4 (16.8 - 28.5)
Salinity		30.1 (24.4 - 32.5)	31.0 (25.9 - 32.5)	31.2 (27.5 - 32.7)	31.2 (27.6 - 32.9)	31.8 (28.9 - 33.3)	32.0 (29.4 - 33.4)	32.6 (31.0 - 33.7)
Dissolved Oxygen (mg/L)		6.6 (4.8 - 8.8)	7.0 (5.6 - 8.9)	6.6 (4.4 - 8.7)	6.7 (5.1 - 8.6)	6.1 (4.7 - 7.5)	6.3 (5.0 - 8.1)	5.8 (3.0 - 7.9)
	Bottom	7.1 (2.5- 9.3)	6.3 (4.0 - 9.0)	5.4 (3.2 - 8.1)	7.1 (5.8 - 9.3)	5.3 (1.7 - 8.1)	5.4 (2.8 - 8.1)	4.7 (0.8- 8.0)
Dissolved Oxygen (% Saturation)		93 (70 - 111)	99 (80 - 119)	93 (63 - 115)	96 (75 - 112)	86 (69 - 94)	88 (74 - 102)	81 (46 - 99)
	Bottom	100 (38 - 124)	89 (62 - 120)	76 (42 - 103)	101 (85 - 120)	74 (25 - 101)	76 (42 - 101)	64 (11 - 100)
pH		8.0 (7.7 - 8.3)	8.1 (7.8 - 8.3)	8.0 (7.8 - 8.3)	8.0 (7.8 - 8.3)	8.0 (7.8 - 8.3)	8.0 (7.8 - 8.2)	8.0 (7.8 - 8.2)
Secchi Disc Depth (m)		2.5 (2.0 - 3.2)	2.5 (1.2 - 4.0)	3.0 (2.0 - 5.0)	2.5 (1.8 - 3.5)	2.9 (2.0 - 5.0)	3.2 (2.2 - 6.0)	3.6 (2.4 - 6.0)
Turbidity (NTU)		3.0 (1.2 - 5.8)	3.0 (1.2 - 6.3)	2.9 (1.2 - 5.6)	3.1 (1.4 - 4.8)	2.9 (1.2 - 5.3)	2.7 (1.0 - 5.4)	3.2 (1.2 - 8.9)
Suspended Solids (mg/L)		4.6 (0.9 - 14.7)	3.5 (1.2 - 6.8)	3.8 (1.1 - 9.6)	5.0 (1.3 - 15.6)	2.5 (1.2 - 4.0)	3.3 (1.0 - 5.5)	3.5 (0.9 - 10.6)
5-day Biochemical Oxygen Demand (mg/L)		1.8 (1.0 - 3.2)	1.8 (1.0 - 3.2)	1.6 (0.7 - 2.7)	1.9 (0.9 - 5.2)	1.3 (0.8 - 2.1)	1.2 (0.7 - 2.3)	1.1 (0.6 - 2.3)
Ammonia Nitrogen (mg/L)		0.050 (0.007 - 0.135)	0.047 (0.007 - 0.108)	0.045 (0.006 - 0.106)	0.037 (0.009 - 0.085)	0.041 (0.009 - 0.083)	0.038 (0.010 - 0.077)	0.037 (0.014 - 0.065)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.006)	0.002 (<0.001 - 0.005)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)		0.005 (<0.002 - 0.012)	0.006 (<0.002 - 0.028)	0.006 (<0.002 - 0.020)	0.004 (<0.002 - 0.008)	0.008 (<0.002 - 0.053)	0.007 (<0.002 - 0.036)	0.011 (0.002 - 0.040)
Nitrate Nitrogen (mg/L)		0.041 (<0.002 - 0.145)	0.028 (<0.002 - 0.157)	0.021 (<0.002 - 0.123)	0.022 (<0.002 - 0.130)	0.016 (<0.002 - 0.111)	0.015 (<0.002 - 0.123)	0.025 (<0.002 - 0.094)
Total Inorganic Nitrogen (mg/L)		0.10 (0.01 - 0.28)	0.08 (0.01 - 0.22)	0.07 (0.01 - 0.16)	0.06 (0.01 - 0.17)	0.06 (0.01 - 0.16)	0.06 (0.01 - 0.17)	0.07 (0.02 - 0.15)
Total Kjeldahl Nitrogen (mg/L)		0.44 (0.24 - 0.94)	0.39 (0.25 - 0.66)	0.36 (0.24 - 0.60)	0.36 (0.18 - 0.67)	0.33 (0.22 - 0.66)	0.32 (0.20 - 0.50)	0.32 (0.17 - 0.74)
Total Nitrogen (mg/L)		0.48 (0.24 - 0.99)	0.42 (0.26 - 0.68)	0.38 (0.24 - 0.63)	0.39 (0.18 - 0.69)	0.35 (0.22 - 0.67)	0.34 (0.20 - 0.53)	0.36 (0.23 - 0.77)
Orthophosphate Phosphorus (mg/L)		0.006 (0.004 - 0.015)	0.005 (0.004 - 0.010)	0.006 (0.003 - 0.009)	0.005 (0.003 - 0.008)	0.006 (0.003 - 0.019)	0.006 (0.003 - 0.017)	0.008 (0.005 - 0.019)
Total Phosphorus (mg/L)		0.04 (<0.02 - 0.07)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.07)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.08)	0.05 (0.02 - 0.09)
Silica (as SiO_2) (mg/L)		1.16 (0.62 - 2.70)	0.87 (0.40 - 1.17)	0.91 (0.21 - 1.50)	0.92 (0.31 - 1.60)	0.82 (0.23 - 1.22)	0.73 (0.20 - 1.18)	0.77 (0.38 - 1.53)
Chlorophyll-a (µg/L)		6.5 (2.2 - 12.0)	7.3 (1.9 - 14.0)	5.6 (1.4 - 12.0)	5.8 (1.9 - 14.5)	4.7 (1.6 - 12.1)	4.5 (1.0 - 10.0)	3.4 (1.2 - 9.9)
E.coli (count/100mL)		42 (<1 - 1500)	18 (<1 - 790)	7 (<1 - 230)	4 (<1 - 180)	3 (<1 - 46)	2 (<1 - 23)	1 (<1 - 3)
Faecal Coliforms (count/100mL)		260 (7 - 8200)	66 (1 - 3200)	24 (1 - 1200)	16 (2 - 660)	13 (<1 - 440)	6 (1 - 200)	2 (<1 - 19)

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 2015

Parameter		Hong Kong Island (South)			East Lamma Channel	
		SM1	SM2	SM19	SM3	SM4
Number of samples		12	12	12	12	12
Temperature (°C)		23.1 (17.4 - 28.2)	23.3 (17.7 - 28.2)	23.2 (17.3 - 28.2)	23.3 (17.6 - 28.2)	23.4 (17.7 - 28.1)
Salinity		32.5 (30.4 - 33.7)	32.2 (30.9 - 33.7)	32.5 (29.9 - 33.8)	32.3 (30.4 - 33.6)	31.8 (28.4 - 33.6)
Dissolved Oxygen (mg/L)		6.3 (4.5 - 7.7)	6.3 (4.7 - 7.5)	6.4 (4.8 - 7.6)	6.0 (4.0 - 7.7)	6.1 (4.6 - 7.3)
	Bottom	5.9 (2.4 - 7.7)	5.8 (2.5 - 7.8)	5.8 (3.0 - 7.7)	5.6 (2.4 - 7.9)	5.7 (2.7 - 7.8)
Dissolved Oxygen (% Saturation)		88 (65 - 98)	88 (68 - 97)	90 (69 - 100)	84 (58 - 99)	86 (67 - 95)
	Bottom	81 (35 - 98)	80 (36 - 99)	80 (42 - 98)	77 (34 - 101)	80 (39 - 99)
pH		8.0 (7.7 - 8.4)	7.9 (7.7 - 8.3)	8.0 (7.8 - 8.4)	7.9 (7.7 - 8.3)	7.9 (7.7 - 8.3)
Secchi Disc Depth (m)		3.3 (2.1 - 4.8)	3.2 (1.9 - 5.6)	3.4 (2.8 - 5.1)	3.3 (2.5 - 5.5)	3.1 (1.9 - 5.3)
Turbidity (NTU)		3.2 (0.7 - 5.3)	3.3 (1.1 - 5.7)	4.0 (0.9 - 6.9)	3.3 (0.9 - 6.3)	3.3 (1.1 - 4.9)
Suspended Solids (mg/L)		4.0 (0.8 - 12.8)	4.5 (1.4 - 17.8)	4.9 (1.0 - 16.5)	2.7 (1.1 - 4.3)	4.6 (1.3 - 21.0)
5-day Biochemical Oxygen Demand (mg/L)		0.8 (0.1 - 3.0)	1.0 (0.1 - 4.8)	0.4 (<0.1 - 1.2)	0.6 (0.2 - 1.1)	0.9 (0.2 - 3.5)
Ammonia Nitrogen (mg/L)		0.034 (0.019 - 0.050)	0.043 (0.021 - 0.068)	0.028 (0.018 - 0.039)	0.052 (0.021 - 0.096)	0.062 (0.020 - 0.110)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.006)	0.002 (<0.001 - 0.006)	0.001 (<0.001 - 0.004)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.007)
Nitrite Nitrogen (mg/L)		0.017 (0.004 - 0.037)	0.023 (0.004 - 0.067)	0.020 (0.004 - 0.062)	0.028 (0.005 - 0.100)	0.034 (0.006 - 0.110)
Nitrate Nitrogen (mg/L)		0.075 (0.006 - 0.187)	0.089 (0.013 - 0.223)	0.087 (0.003 - 0.284)	0.096 (0.015 - 0.220)	0.124 (0.038 - 0.280)
Total Inorganic Nitrogen (mg/L)		0.13 (0.05 - 0.26)	0.15 (0.07 - 0.29)	0.13 (0.04 - 0.36)	0.18 (0.06 - 0.28)	0.22 (0.10 - 0.39)
Total Kjeldahl Nitrogen (mg/L)		0.24 (0.15 - 0.47)	0.28 (0.17 - 0.55)	0.29 (0.16 - 0.54)	0.28 (0.14 - 0.52)	0.31 (0.19 - 0.54)
Total Nitrogen (mg/L)		0.33 (0.19 - 0.55)	0.39 (0.22 - 0.67)	0.39 (0.18 - 0.59)	0.41 (0.21 - 0.55)	0.47 (0.26 - 0.65)
Orthophosphate Phosphorus (mg/L)		0.008 (0.004 - 0.013)	0.009 (0.003 - 0.017)	0.008 (0.005 - 0.015)	0.010 (0.005 - 0.018)	0.012 (0.003 - 0.021)
Total Phosphorus (mg/L)		0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.07)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.09)	0.04 (<0.02 - 0.11)
Silica (as SiO_2) (mg/L)		0.73 (0.11 - 1.90)	0.80 (0.13 - 1.87)	0.78 (0.12 - 1.93)	0.88 (0.13 - 2.20)	0.98 (0.19 - 2.30)
Chlorophyll-a (µg/L)		2.7 (0.7 - 11.2)	3.2 (1.0 - 12.6)	3.0 (0.7 - 15.2)	3.5 (0.9 - 10.9)	3.2 (1.0 - 15.5)
E.coli (count/100mL)		2 (<1 - 14)	26 (<1 - 150)	1 (<1 - 4)	35 (6 - 290)	12 (2 - 230)
Faecal Coliforms (count/100mL)		3 (<1 - 41)	48 (<1 - 220)	2 (<1 - 22)	68 (9 - 450)	23 (2 - 350)

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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 Southern WCZ in 2015 (continued)

Parameter		West Lamma Channel				
		SM5	SM6	SM7	SM9	SM18
Number of samples		12	12	12	12	12
Temperature (°C)		24.0 (17.7 - 28.3)	23.5 (17.6 - 28.2)	23.8 (18.0 - 28.1)	24.0 (17.0 - 28.0)	23.3 (17.5 - 28.1)
Salinity		31.3 (24.4 - 33.6)	31.5 (28.2 - 33.4)	30.3 (25.2 - 33.2)	29.8 (23.4 - 32.1)	31.9 (27.6 - 33.5)
Dissolved Oxygen (mg/L)		6.8 (5.3 - 9.4)	6.4 (4.7 - 7.8)	6.2 (5.0 - 8.0)	6.1 (4.2 - 8.7)	6.3 (4.3 - 7.8)
	Bottom	5.9 (2.6 - 7.8)	5.6 (1.0 - 7.7)	5.7 (2.7 - 8.6)	5.5 (2.6 - 8.3)	5.5 (2.4 - 7.8)
Dissolved Oxygen (% Saturation)		96 (81 - 137)	90 (68 - 109)	87 (75 - 102)	85 (62 - 109)	88 (62 - 101)
	Bottom	83 (37 - 99)	77 (14 - 101)	79 (39 - 110)	76 (38 - 103)	76 (34 - 98)
pH		8.0 (7.8 - 8.6)	8.0 (7.8 - 8.4)	7.9 (7.8 - 8.2)	7.9 (7.7 - 8.1)	8.0 (7.8 - 8.4)
Secchi Disc Depth (m)		2.9 (1.6 - 4.8)	2.9 (1.7 - 5.2)	2.8 (2.0 - 5.1)	2.9 (2.0 - 4.2)	3.0 (1.8 - 4.1)
Turbidity (NTU)		4.6 (1.1 - 8.7)	3.9 (1.1 - 6.7)	4.1 (1.5 - 7.0)	5.4 (1.4 - 20.6)	4.7 (0.8 - 7.6)
Suspended Solids (mg/L)		6.1 (1.3 - 21.3)	6.5 (1.4 - 20.1)	5.9 (1.7 - 15.7)	5.4 (1.6 - 22.7)	5.1 (1.3 - 14.3)
5-day Biochemical Oxygen Demand (mg/L)		0.9 (0.1 - 2.6)	0.8 (0.2 - 1.7)	1.1 (0.1 - 2.8)	1.0 (0.3 - 2.2)	0.6 (0.1 - 1.3)
Ammonia Nitrogen (mg/L)		0.041 (0.013 - 0.062)	0.045 (0.019 - 0.076)	0.083 (0.019 - 0.183)	0.108 (0.027 - 0.180)	0.034 (0.013 - 0.056)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.010)	0.002 (<0.001 - 0.006)	0.003 (<0.001 - 0.007)	0.003 (<0.001 - 0.007)	0.002 (<0.001 - 0.005)
Nitrite Nitrogen (mg/L)		0.029 (0.006 - 0.092)	0.032 (0.006 - 0.089)	0.052 (0.009 - 0.173)	0.045 (0.012 - 0.160)	0.026 (0.005 - 0.064)
Nitrate Nitrogen (mg/L)		0.127 (0.024 - 0.403)	0.138 (0.019 - 0.340)	0.225 (0.060 - 0.610)	0.236 (0.089 - 0.470)	0.112 (0.009 - 0.365)
Total Inorganic Nitrogen (mg/L)		0.20 (0.08 - 0.54)	0.21 (0.08 - 0.44)	0.36 (0.11 - 0.77)	0.39 (0.24 - 0.54)	0.17 (0.06 - 0.42)
Total Kjeldahl Nitrogen (mg/L)		0.31 (0.19 - 0.52)	0.32 (0.17 - 0.66)	0.35 (0.24 - 0.68)	0.36 (0.22 - 0.52)	0.28 (0.17 - 0.48)
Total Nitrogen (mg/L)		0.46 (0.25 - 0.79)	0.49 (0.22 - 0.84)	0.63 (0.35 - 0.98)	0.64 (0.44 - 0.82)	0.42 (0.20 - 0.64)
Orthophosphate Phosphorus (mg/L)		0.009 (0.003 - 0.014)	0.011 (0.002 - 0.019)	0.015 (0.003 - 0.033)	0.019 (0.010 - 0.035)	0.009 (0.004 - 0.017)
Total Phosphorus (mg/L)		0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.07)	0.05 (0.02 - 0.09)	0.05 (0.03 - 0.09)	0.04 (<0.02 - 0.09)
Silica (as SiO_2) (mg/L)		0.92 (0.22 - 2.47)	1.04 (0.23 - 2.87)	1.35 (0.13 - 3.77)	1.30 (0.14 - 2.83)	0.95 (0.19 - 2.43)
Chlorophyll-a (µg/L)		5.4 (1.1 - 31.5)	4.5 (0.7 - 19.5)	5.3 (1.0 - 24.3)	5.7 (1.0 - 17.7)	3.0 (0.6 - 13.1)
E.coli (count/100mL)		1 (<1 - 2)	1 (<1 - 6)	3 (<1 - 23)	11 (1 - 210)	1 (<1 - 1)
Faecal Coliforms (count/100mL)		2 (<1 - 6)	2 (<1 - 16)	7 (1 - 67)	25 (2 - 340)	1 (<1 - 2)

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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 Southern WCZ in 2015 (continued)

Parameter		Lantau Island (East)		Lantau Island (South)			Soko Islands
		SM10	SM11	SM12	SM13	SM17	SM20
Number of samples		12	12	12	12	12	12
Temperature (°C)		24.0 (16.9 - 28.4)	24.0 (17.0 - 28.6)	24.1 (16.8 - 28.9)	24.2 (16.8 - 29.2)	23.6 (16.4 - 27.7)	23.8 (16.5 - 28.6)
Salinity		29.7 (23.2 - 32.6)	29.9 (22.7 - 32.6)	30.0 (20.3 - 32.9)	29.7 (18.7 - 33.0)	30.9 (23.5 - 33.3)	30.1 (22.8 - 33.1)
Dissolved Oxygen (mg/L)		6.5 (5.2 - 8.5)	6.8 (5.3 - 9.3)	7.0 (5.4 - 8.5)	7.1 (5.7 - 9.2)	6.8 (4.7 - 8.4)	6.6 (4.6 - 8.6)
	Bottom	7.0 (5.2 - 9.2)	6.4 (3.2 - 9.9)	6.4 (2.4 - 8.4)	6.9 (4.0 - 9.7)	5.7 (2.1 - 8.4)	6.1 (3.0 - 8.7)
Dissolved Oxygen (% Saturation)		91 (74 - 124)	96 (75 - 117)	99 (80 - 125)	100 (85 - 133)	96 (69 - 126)	93 (66 - 107)
	Bottom	98 (76 - 118)	90 (46 - 123)	90 (35 - 108)	96 (58 - 142)	79 (30 - 104)	85 (43 - 108)
pH		7.9 (7.7 - 8.3)	8.0 (7.7 - 8.4)	8.0 (7.7 - 8.5)	8.0 (7.7 - 8.4)	8.0 (7.7 - 8.5)	8.0 (7.8 - 8.5)
Secchi Disc Depth (m)		2.2 (1.8 - 3.6)	2.5 (1.5 - 4.5)	2.5 (1.9 - 3.0)	2.6 (1.7 - 4.1)	3.0 (1.5 - 6.0)	2.6 (2.0 - 3.5)
Turbidity (NTU)		5.5 (2.6 - 11.4)	4.4 (1.8 - 7.9)	5.8 (2.0 - 20.9)	4.3 (1.4 - 7.9)	3.6 (1.5 - 7.4)	5.2 (2.1 - 8.7)
Suspended Solids (mg/L)		4.9 (2.0 - 9.1)	6.0 (2.4 - 13.1)	7.2 (1.4 - 25.0)	4.8 (2.3 - 10.4)	3.3 (1.3 - 7.2)	6.2 (1.8 - 14.5)
5-day Biochemical Oxygen Demand (mg/L)		1.3 (0.4 - 3.0)	1.5 (0.5 - 3.5)	1.3 (0.3 - 2.2)	1.4 (0.4 - 2.6)	0.9 (0.4 - 2.0)	1.0 (0.4 - 1.9)
Ammonia Nitrogen (mg/L)		0.084 (0.025 - 0.160)	0.070 (0.021 - 0.137)	0.058 (0.022 - 0.091)	0.054 (0.024 - 0.086)	0.037 (0.020 - 0.069)	0.042 (0.021 - 0.076)
Unionised Ammonia (mg/L)		0.003 (0.001 - 0.007)	0.003 (<0.001 - 0.006)	0.003 (<0.001 - 0.006)	0.003 (<0.001 - 0.007)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.005)
Nitrite Nitrogen (mg/L)		0.036 (0.009 - 0.073)	0.033 (0.005 - 0.071)	0.032 (0.006 - 0.069)	0.032 (0.006 - 0.069)	0.026 (0.005 - 0.058)	0.033 (0.007 - 0.069)
Nitrate Nitrogen (mg/L)		0.212 (0.065 - 0.390)	0.193 (0.033 - 0.457)	0.181 (0.049 - 0.513)	0.185 (0.042 - 0.547)	0.149 (0.010 - 0.483)	0.181 (0.037 - 0.550)
Total Inorganic Nitrogen (mg/L)		0.33 (0.14 - 0.57)	0.30 (0.08 - 0.50)	0.27 (0.09 - 0.58)	0.27 (0.10 - 0.64)	0.21 (0.06 - 0.53)	0.26 (0.09 - 0.61)
Total Kjeldahl Nitrogen (mg/L)		0.38 (0.22 - 0.50)	0.40 (0.22 - 0.59)	0.38 (0.13 - 0.68)	0.37 (0.13 - 0.63)	0.34 (0.16 - 0.64)	0.33 (0.11 - 0.71)
Total Nitrogen (mg/L)		0.63 (0.41 - 0.82)	0.62 (0.37 - 0.87)	0.60 (0.31 - 0.95)	0.59 (0.28 - 1.18)	0.52 (0.32 - 0.84)	0.54 (0.25 - 0.85)
Orthophosphate Phosphorus (mg/L)		0.014 (0.006 - 0.026)	0.013 (0.003 - 0.025)	0.010 (0.002 - 0.021)	0.010 (0.003 - 0.019)	0.007 (0.004 - 0.012)	0.009 (0.003 - 0.015)
Total Phosphorus (mg/L)		0.05 (0.02 - 0.07)	0.04 (0.02 - 0.08)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.09)	0.04 (<0.02 - 0.07)	0.04 (<0.02 - 0.06)
Silica (as SiO_2) (mg/L)		1.04 (0.13 - 2.20)	0.93 (0.06 - 2.10)	0.91 (0.12 - 2.37)	1.03 (0.26 - 2.47)	0.83 (0.13 - 2.43)	1.10 (0.12 - 3.07)
Chlorophyll-*a* (µg/L)		8.9 (1.1 - 25.0)	10.0 (1.2 - 25.7)	8.9 (1.3 - 22.7)	7.2 (1.1 - 20.3)	6.1 (0.8 - 14.0)	5.0 (1.1 - 11.1)
E.coli (count/100mL)		3 (<1 - 20)	2 (<1 - 14)	38 (10 - 170)	3 (<1 - 34)	1 (<1 - 2)	1 (<1 - 4)
Faecal Coliforms (count/100mL)		8 (1 - 220)	5 (<1 - 90)	93 (27 - 300)	6 (1 - 77)	2 (<1 - 6)	2 (<1 - 22)

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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 2015

Parameter		Victoria Harbour (East)		Victoria Harbour (Central)		
		VM1	VM2	VM4	VM5	VM6
Number of samples		12	12	12	12	12
Temperature (°C)		22.9 (16.6 - 28.6)	23.1 (16.6 - 28.6)	23.3 (16.6 - 28.7)	23.5 (16.8 - 28.8)	23.5 (16.9 - 28.8)
Salinity		32.7 (31.3 - 33.3)	32.4 (31.1 - 33.4)	32.0 (30.2 - 33.2)	31.5 (28.4 - 33.0)	31.5 (28.8 - 32.9)
Dissolved Oxygen (mg/L)		5.4 (3.7 - 6.9)	5.6 (4.1 - 7.2)	5.4 (3.4 - 7.0)	5.3 (3.4 - 6.5)	5.2 (3.3 - 6.5)
	Bottom	5.3 (3.2 - 7.3)	5.4 (3.1 - 7.2)	5.3 (3.0 - 7.1)	5.1 (2.5 - 6.6)	4.9 (2.0 - 6.7)
Dissolved Oxygen (% Saturation)		76 (54 - 88)	78 (60 - 92)	76 (50 - 88)	75 (49 - 83)	73 (49 - 85)
	Bottom	74 (45 - 93)	75 (44 - 93)	74 (42 - 91)	71 (36 - 85)	69 (29 - 89)
pH		7.8 (7.7 - 8.4)	7.8 (7.7 - 8.2)	7.8 (7.6 - 8.1)	7.8 (7.6 - 8.1)	7.8 (7.6 - 8.1)
Secchi Disc Depth (m)		3.2 (2.2 - 5.0)	3.1 (1.6 - 3.8)	2.9 (1.6 - 3.6)	2.6 (1.5 - 3.1)	2.6 (1.5 - 3.1)
Turbidity (NTU)		4.5 (1.5 - 6.7)	4.0 (1.5 - 7.2)	4.2 (2.1 - 7.5)	4.2 (2.3 - 6.7)	4.3 (2.5 - 7.1)
Suspended Solids (mg/L)		4.5 (1.6 - 9.8)	4.8 (0.9 - 13.0)	5.4 (1.1 - 16.3)	5.2 (0.9 - 14.7)	5.2 (1.0 - 13.9)
5-day Biochemical Oxygen Demand (mg/L)		0.8 (0.2 - 2.4)	0.9 (0.2 - 2.3)	0.9 (0.2 - 2.3)	1.3 (0.1 - 2.3)	1.0 (0.3 - 1.7)
Ammonia Nitrogen (mg/L)		0.081 (0.046 - 0.140)	0.092 (0.046 - 0.123)	0.114 (0.074 - 0.187)	0.150 (0.099 - 0.233)	0.156 (0.102 - 0.257)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.007)	0.003 (<0.001 - 0.008)	0.003 (0.001 - 0.009)	0.004 (0.002 - 0.012)	0.004 (0.002 - 0.009)
Nitrite Nitrogen (mg/L)		0.022 (0.003 - 0.069)	0.023 (0.002 - 0.068)	0.027 (0.005 - 0.076)	0.030 (0.006 - 0.089)	0.031 (0.007 - 0.095)
Nitrate Nitrogen (mg/L)		0.091 (0.049 - 0.174)	0.103 (0.039 - 0.157)	0.129 (0.064 - 0.237)	0.161 (0.072 - 0.340)	0.160 (0.074 - 0.333)
Total Inorganic Nitrogen (mg/L)		0.19 (0.10 - 0.30)	0.22 (0.09 - 0.27)	0.27 (0.14 - 0.37)	0.34 (0.18 - 0.49)	0.35 (0.19 - 0.49)
Total Kjeldahl Nitrogen (mg/L)		0.37 (0.17 - 0.96)	0.34 (0.25 - 0.50)	0.42 (0.28 - 0.73)	0.46 (0.29 - 0.82)	0.43 (0.33 - 0.59)
Total Nitrogen (mg/L)		0.49 (0.26 - 1.02)	0.47 (0.29 - 0.62)	0.58 (0.40 - 0.82)	0.65 (0.39 - 0.91)	0.62 (0.43 - 0.76)
Orthophosphate Phosphorus (mg/L)		0.015 (0.004 - 0.027)	0.017 (0.006 - 0.034)	0.019 (0.007 - 0.031)	0.023 (0.005 - 0.038)	0.024 (0.007 - 0.042)
Total Phosphorus (mg/L)		0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.07)	0.05 (0.02 - 0.07)	0.05 (0.03 - 0.08)	0.05 (0.03 - 0.08)
Silica (as SiO_2) (mg/L)		0.65 (0.17 - 1.27)	0.65 (0.19 - 1.23)	0.75 (0.22 - 1.50)	0.84 (0.22 - 1.60)	0.88 (0.17 - 1.73)
Chlorophyll-a (µg/L)		3.2 (0.9 - 10.5)	3.4 (0.5 - 11.5)	3.7 (0.2 - 13.3)	4.4 (0.3 - 17.3)	3.6 (0.5 - 15.7)
E.coli (count/100mL)		260 (64 - 2600)	450 (75 - 4800)	1500 (170 - 7400)	3100 (80 - 52000)	1900 (140 - 9100)
Faecal Coliforms (count/100mL)		550 (150 - 7900)	980 (160 - 11000)	3000 (320 - 9600)	7500 (180 - 93000)	4400 (400 - 16000)

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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 2015 (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 (°C)		23.9 (17.0 - 28.8)	23.8 (17.0 - 28.6)	23.6 (16.9 - 28.2)	23.8 (17.2 - 28.3)	24.2 (17.3 - 28.2)
Salinity		31.1 (27.8 - 32.6)	31.2 (27.6 - 32.6)	31.4 (28.7 - 32.7)	30.7 (26.9 - 32.3)	29.2 (21.4 - 31.7)
Dissolved Oxygen (mg/L)		5.3 (3.7 - 6.1)	5.7 (3.9 - 7.2)	5.4 (3.5 - 6.7)	5.3 (4.1 - 6.8)	5.5 (4.0 - 6.7)
	Bottom	5.0 (3.4 - 6.2)	5.4 (3.3 - 7.4)	5.1 (2.4 - 6.7)	5.1 (3.7 - 7.1)	5.5 (3.6 - 7.2)
Dissolved Oxygen (% Saturation)		74 (54 - 85)	80 (56 - 92)	76 (50 - 89)	74 (60 - 87)	78 (58 - 87)
	Bottom	70 (49 - 85)	75 (47 - 95)	71 (35 - 86)	72 (53 - 91)	77 (53 - 92)
pH		7.8 (7.6 - 8.1)	7.8 (7.7 - 8.1)	7.8 (7.6 - 8.1)	7.8 (7.6 - 8.1)	7.8 (7.6 - 8.1)
Secchi Disc Depth (m)		2.9 (1.5 - 4.0)	2.9 (1.4 - 3.5)	2.5 (2.1 - 3.1)	2.7 (1.9 - 4.0)	2.5 (1.6 - 3.5)
Turbidity (NTU)		4.6 (2.2 - 8.8)	5.5 (1.9 - 10.5)	4.5 (2.7 - 8.1)	5.7 (2.7 - 10.3)	5.3 (2.7 - 9.5)
Suspended Solids (mg/L)		6.0 (1.8 - 17.7)	6.4 (1.9 - 16.3)	6.2 (1.1 - 18.7)	8.1 (3.1 - 26.3)	7.4 (1.8 - 21.7)
5-day Biochemical Oxygen Demand (mg/L)		1.0 (0.5 - 1.4)	0.8 (0.4 - 1.2)	0.9 (0.4 - 2.2)	0.6 (0.3 - 1.1)	0.6 (0.2 - 1.2)
Ammonia Nitrogen (mg/L)		0.208 (0.088 - 0.310)	0.134 (0.039 - 0.220)	0.158 (0.090 - 0.287)	0.163 (0.089 - 0.250)	0.127 (0.024 - 0.200)
Unionised Ammonia (mg/L)		0.006 (0.002 - 0.013)	0.004 (0.001 - 0.010)	0.004 (0.001 - 0.012)	0.005 (0.002 - 0.009)	0.004 (<0.001 - 0.008)
Nitrite Nitrogen (mg/L)		0.035 (0.016 - 0.106)	0.036 (0.013 - 0.104)	0.032 (0.007 - 0.107)	0.043 (0.015 - 0.140)	0.054 (0.014 - 0.167)
Nitrate Nitrogen (mg/L)		0.188 (0.067 - 0.437)	0.183 (0.065 - 0.480)	0.164 (0.083 - 0.347)	0.214 (0.100 - 0.523)	0.329 (0.100 - 1.100)
Total Inorganic Nitrogen (mg/L)		0.43 (0.25 - 0.57)	0.35 (0.19 - 0.60)	0.35 (0.18 - 0.48)	0.42 (0.31 - 0.66)	0.51 (0.28 - 1.21)
Total Kjeldahl Nitrogen (mg/L)		0.52 (0.29 - 0.92)	0.39 (0.24 - 0.64)	0.45 (0.31 - 0.78)	0.40 (0.29 - 0.64)	0.36 (0.27 - 0.44)
Total Nitrogen (mg/L)		0.74 (0.55 - 1.00)	0.61 (0.39 - 0.82)	0.65 (0.43 - 1.02)	0.66 (0.46 - 0.93)	0.75 (0.50 - 1.47)
Orthophosphate Phosphorus (mg/L)		0.023 (0.004 - 0.039)	0.017 (0.006 - 0.035)	0.023 (0.004 - 0.042)	0.021 (0.005 - 0.039)	0.021 (0.004 - 0.040)
Total Phosphorus (mg/L)		0.06 (0.04 - 0.08)	0.04 (0.03 - 0.07)	0.06 (0.03 - 0.11)	0.05 (0.04 - 0.08)	0.05 (0.03 - 0.08)
Silica (as SiO_2) (mg/L)		1.04 (0.24 - 1.90)	1.07 (0.18 - 2.17)	0.87 (0.21 - 1.97)	1.29 (0.14 - 2.67)	1.79 (0.13 - 5.77)
Chlorophyll-a (µg/L)		3.9 (0.8 - 12.7)	3.6 (1.0 - 8.7)	4.3 (0.5 - 15.3)	2.6 (1.0 - 6.7)	2.9 (0.7 - 11.4)
E.coli (count/100mL)		1000 (150 - 4400)	220 (13 - 5100)	610 (120 - 2500)	300 (47 - 2800)	210 (30 - 1800)
Faecal Coliforms (count/100mL)		2400 (350 - 9900)	470 (38 - 8500)	1600 (480 - 4100)	780 (100 - 5800)	520 (63 - 5600)

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

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

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Eastern Buffer WCZ in 2015

Parameter	Chai Wan	Tathong Channel	
	EM1	EM2	EM3
Number of samples	12	12	12
Temperature (°C)	22.8 (16.7 - 28.1)	22.7 (16.7 - 28.0)	22.8 (16.7 - 28.0)
Salinity	32.8 (31.9 - 33.5)	32.9 (31.8 - 33.7)	33.0 (31.9 - 33.7)
Dissolved Oxygen (mg/L)	6.2 (4.1 - 8.0)	6.1 (4.1 - 8.0)	6.4 (4.3 - 8.1)
Bottom	6.0 (3.6 - 8.1)	5.9 (3.5 - 8.1)	6.0 (3.8 - 8.2)
Dissolved Oxygen (% Saturation)	87 (58 - 102)	86 (58 - 102)	89 (62 - 103)
Bottom	84 (51 - 103)	82 (49 - 103)	84 (53 - 104)
pH	8.0 (7.8 - 8.3)	8.0 (7.8 - 8.3)	8.0 (7.8 - 8.3)
Secchi Disc Depth (m)	3.3 (1.5 - 5.0)	3.6 (2.0 - 5.2)	3.5 (1.8 - 5.2)
Turbidity (NTU)	3.5 (1.0 - 9.9)	3.3 (0.8 - 6.8)	3.4 (1.1 - 6.0)
Suspended Solids (mg/L)	3.6 (0.9 - 14.7)	3.9 (1.1 - 14.0)	4.4 (0.9 - 14.0)
5-day Biochemical Oxygen Demand (mg/L)	0.7 (0.3 - 1.3)	0.8 (0.3 - 2.4)	0.7 (0.3 - 1.4)
Ammonia Nitrogen (mg/L)	0.050 (0.011 - 0.220)	0.041 (0.007 - 0.156)	0.032 (0.008 - 0.118)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.012)	0.002 (<0.001 - 0.009)	0.001 (<0.001 - 0.007)
Nitrite Nitrogen (mg/L)	0.024 (0.004 - 0.086)	0.021 (0.003 - 0.079)	0.019 (0.003 - 0.064)
Nitrate Nitrogen (mg/L)	0.058 (0.020 - 0.126)	0.053 (0.011 - 0.095)	0.039 (0.003 - 0.094)
Total Inorganic Nitrogen (mg/L)	0.13 (0.07 - 0.37)	0.12 (0.04 - 0.26)	0.09 (0.04 - 0.19)
Total Kjeldahl Nitrogen (mg/L)	0.30 (0.09 - 0.88)	0.28 (0.11 - 0.76)	0.26 (0.10 - 0.71)
Total Nitrogen (mg/L)	0.39 (0.16 - 1.03)	0.35 (0.14 - 0.87)	0.32 (0.13 - 0.78)
Orthophosphate Phosphorus (mg/L)	0.011 (0.005 - 0.030)	0.010 (0.005 - 0.023)	0.009 (0.005 - 0.018)
Total Phosphorus (mg/L)	0.04 (<0.02 - 0.09)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.07)
Silica (as SiO_2) (mg/L)	0.65 (0.16 - 1.50)	0.63 (0.14 - 1.33)	0.60 (0.15 - 1.23)
Chlorophyll-*a* (µg/L)	3.0 (0.9 - 13.5)	2.3 (0.9 - 8.2)	1.9 (0.7 - 4.7)
E.coli (count/100mL)	24 (4 - 170)	10 (1 - 86)	2 (1 - 27)
Faecal Coliforms (count/100mL)	57 (6 - 620)	22 (2 - 180)	4 (1 - 74)

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

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

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Western Buffer WCZ in 2015

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 (°C)		23.2 (16.9 - 28.2)	23.8 (17.0 - 28.3)	23.6 (17.1 - 28.3)	23.6 (17.2 - 28.2)
Salinity		32.1 (30.7 - 33.4)	30.8 (27.5 - 32.7)	31.4 (29.4 - 32.4)	31.0 (28.1 - 32.4)
Dissolved Oxygen (mg/L)		5.8 (3.4 - 7.7)	5.9 (4.1 - 7.6)	5.5 (3.8 - 7.3)	5.4 (3.5 - 7.2)
	Bottom	5.3 (2.7 - 7.9)	5.8 (3.5 - 7.8)	5.3 (2.6 - 7.6)	5.3 (2.5 - 7.6)
Dissolved Oxygen (% Saturation)		81 (49 - 96)	83 (59 - 95)	77 (55 - 92)	75 (51 - 91)
	Bottom	74 (38 - 102)	81 (51 - 97)	74 (38 - 96)	74 (36 - 98)
pH		7.9 (7.5 - 8.2)	7.9 (7.7 - 8.2)	7.9 (7.7 - 8.2)	7.9 (7.7 - 8.2)
Secchi Disc Depth (m)		3.0 (2.0 - 5.0)	3.0 (2.0 - 4.0)	2.7 (2.0 - 3.5)	2.6 (1.6 - 3.0)
Turbidity (NTU)		5.0 (1.4 - 10.3)	4.6 (1.5 - 8.5)	5.7 (2.4 - 11.3)	6.2 (2.7 - 15.5)
Suspended Solids (mg/L)		6.0 (1.7 - 17.0)	5.3 (1.1 - 14.1)	5.5 (2.6 - 12.3)	6.8 (2.1 - 13.8)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (0.4 - 1.2)	0.7 (0.4 - 1.1)	0.7 (0.3 - 1.4)	0.6 (0.2 - 1.2)
Ammonia Nitrogen (mg/L)		0.060 (0.034 - 0.103)	0.102 (0.025 - 0.160)	0.140 (0.086 - 0.203)	0.112 (0.026 - 0.187)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.004)	0.003 (<0.001 - 0.007)	0.004 (0.002 - 0.008)	0.004 (0.001 - 0.008)
Nitrite Nitrogen (mg/L)		0.031 (0.005 - 0.123)	0.043 (0.010 - 0.160)	0.039 (0.014 - 0.133)	0.044 (0.015 - 0.160)
Nitrate Nitrogen (mg/L)		0.104 (0.013 - 0.311)	0.209 (0.072 - 0.573)	0.166 (0.070 - 0.383)	0.207 (0.089 - 0.603)
Total Inorganic Nitrogen (mg/L)		0.20 (0.07 - 0.39)	0.35 (0.18 - 0.68)	0.35 (0.21 - 0.52)	0.36 (0.23 - 0.70)
Total Kjeldahl Nitrogen (mg/L)		0.27 (0.14 - 0.39)	0.34 (0.21 - 0.53)	0.36 (0.25 - 0.49)	0.34 (0.21 - 0.46)
Total Nitrogen (mg/L)		0.41 (0.21 - 0.58)	0.59 (0.35 - 0.91)	0.57 (0.38 - 0.73)	0.59 (0.35 - 0.93)
Orthophosphate Phosphorus (mg/L)		0.012 (0.004 - 0.022)	0.017 (0.005 - 0.032)	0.018 (0.005 - 0.036)	0.018 (0.005 - 0.032)
Total Phosphorus (mg/L)		0.04 (0.02 - 0.08)	0.05 (0.03 - 0.08)	0.04 (0.03 - 0.08)	0.04 (0.03 - 0.07)
Silica (as SiO_2) (mg/L)		0.87 (0.16 - 1.93)	1.20 (0.14 - 2.70)	1.10 (0.13 - 2.00)	1.28 (0.13 - 3.20)
Chlorophyll-*a* (µg/L)		2.9 (0.9 - 8.6)	3.1 (0.7 - 9.3)	3.0 (0.6 - 11.4)	2.2 (0.8 - 8.5)
E.coli (count/100mL)		29 (5 - 140)	37 (8 - 230)	220 (26 - 2400)	77 (26 - 170)
Faecal Coliforms (count/100mL)		55 (8 - 240)	83 (10 - 530)	460 (52 - 4900)	150 (69 - 360)

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

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

3. Data in brackets indicate the ranges.

Summary of water quality statistics for the Junk Bay WCZ in 2015

Parameter	Junk Bay	
	JM3	JM4
Number of samples	12	12
Temperature (°C)	22.8 (16.7 - 28.1)	22.7 (16.6 - 28.0)
Salinity	32.7 (31.4 - 33.4)	32.9 (31.9 - 33.6)
Dissolved Oxygen (mg/L)	6.0 (4.8 - 7.7)	6.1 (4.0 - 8.1)
Bottom	5.8 (4.0 - 7.8)	6.0 (3.7 - 8.0)
Dissolved Oxygen (% Saturation)	84 (73 - 98)	85 (57 - 103)
Bottom	81 (56 - 99)	83 (52 - 102)
pH	7.9 (7.7 - 8.2)	7.9 (7.8 - 8.2)
Secchi Disc Depth (m)	3.2 (1.9 - 5.0)	3.3 (2.0 - 4.5)
Turbidity (NTU)	3.6 (0.8 - 7.9)	3.2 (1.0 - 5.2)
Suspended Solids (mg/L)	4.9 (0.8 - 18.0)	4.7 (0.9 - 18.3)
5-day Biochemical Oxygen Demand (mg/L)	0.8 (0.3 - 1.5)	0.7 (0.2 - 1.7)
Ammonia Nitrogen (mg/L)	0.062 (0.009 - 0.170)	0.051 (0.008 - 0.160)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.010)	0.002 (<0.001 - 0.010)
Nitrite Nitrogen (mg/L)	0.026 (0.004 - 0.100)	0.023 (0.004 - 0.089)
Nitrate Nitrogen (mg/L)	0.073 (0.012 - 0.120)	0.060 (0.011 - 0.107)
Total Inorganic Nitrogen (mg/L)	0.16 (0.08 - 0.27)	0.13 (0.07 - 0.26)
Total Kjeldahl Nitrogen (mg/L)	0.29 (0.17 - 0.62)	0.33 (0.12 - 1.02)
Total Nitrogen (mg/L)	0.39 (0.24 - 0.72)	0.42 (0.19 - 1.13)
Orthophosphate Phosphorus (mg/L)	0.014 (0.007 - 0.028)	0.012 (0.006 - 0.027)
Total Phosphorus (mg/L)	0.04 (0.02 - 0.10)	0.04 (<0.02 - 0.09)
Silica (as SiO_2) (mg/L)	0.68 (0.19 - 1.50)	0.66 (0.17 - 1.40)
Chlorophyll-*a* (µg/L)	2.8 (0.8 - 8.2)	3.1 (1.1 - 12.4)
E.coli (count/100mL)	68 (19 - 210)	34 (3 - 150)
Faecal Coliforms (count/100mL)	160 (74 - 440)	71 (4 - 340)

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 2015

Parameter		Inner Deep Bay			Outer Deep Bay	
		DM1	DM2	DM3	DM4	DM5
Number of samples		12	12	12	12	12
Temperature (°C)		25.4 (15.8 - 31.7)	25.2 (16.0 - 31.3)	25.2 (16.5 - 31.0)	25.0 (17.2 - 30.1)	24.7 (17.2 - 30.1)
Salinity		15.2 (4.3 - 20.9)	16.6 (4.2 - 24.8)	20.2 (8.1 - 27.9)	21.5 (9.9 - 29.7)	23.8 (7.9 - 30.8)
Dissolved Oxygen (mg/L)		4.5 (3.0 - 6.9)	5.1 (2.9 - 7.0)	5.5 (4.0 - 7.3)	5.8 (4.4 - 7.2)	6.0 (4.2 - 7.2)
	Bottom	N.M.	N.M.	N.M.	5.8 (4.2 - 7.2)	5.8 (3.8 - 7.2)
Dissolved Oxygen (% Saturation)		60 (39 - 83)	67 (41 - 92)	75 (56 - 103)	79 (62 - 90)	81 (60 - 91)
	Bottom	N.M.	N.M.	N.M.	78 (60 - 89)	79 (54 - 91)
pH		7.2 (6.8 - 7.7)	7.5 (7.3 - 7.7)	7.7 (7.4 - 7.9)	7.7 (7.6 - 7.9)	7.8 (7.6 - 8.0)
Secchi Disc Depth (m)		0.9 (0.2 - 1.5)	1.0 (0.7 - 2.0)	1.2 (0.7 - 2.0)	1.6 (1.0 - 2.3)	1.8 (1.3 - 2.5)
Turbidity (NTU)		27.9 (10.4 - 81.3)	20.0 (12.7 - 41.0)	8.9 (3.5 - 25.2)	4.9 (2.4 - 13.3)	4.2 (2.4 - 8.0)
Suspended Solids (mg/L)		44.1 (13.0 - 150.0)	33.3 (14.0 - 61.0)	11.6 (4.4 - 28.0)	8.0 (2.7 - 15.0)	7.3 (2.7 - 18.7)
5-day Biochemical Oxygen Demand (mg/L)		3.4 (1.6 - 7.1)	2.8 (1.2 - 5.7)	1.2 (0.6 - 2.8)	0.8 (0.5 - 1.8)	0.8 (0.5 - 2.2)
Ammonia Nitrogen (mg/L)		1.340 (0.440 - 3.000)	0.913 (0.280 - 1.800)	0.256 (0.096 - 0.560)	0.202 (0.045 - 0.415)	0.158 (0.035 - 0.287)
Unionised Ammonia (mg/L)		0.016 (0.003 - 0.074)	0.019 (0.003 - 0.076)	0.006 (0.002 - 0.013)	0.005 (0.002 - 0.009)	0.005 (0.002 - 0.009)
Nitrite Nitrogen (mg/L)		0.432 (0.130 - 0.890)	0.366 (0.054 - 1.000)	0.211 (0.053 - 0.390)	0.149 (0.036 - 0.315)	0.115 (0.024 - 0.253)
Nitrate Nitrogen (mg/L)		1.069 (0.500 - 2.200)	0.940 (0.470 - 1.500)	0.943 (0.510 - 1.900)	0.903 (0.300 - 1.850)	0.795 (0.223 - 1.930)
Total Inorganic Nitrogen (mg/L)		2.84 (1.91 - 4.13)	2.22 (1.43 - 3.17)	1.41 (0.91 - 2.56)	1.25 (0.63 - 2.41)	1.07 (0.49 - 2.05)
Total Kjeldahl Nitrogen (mg/L)		2.38 (0.88 - 4.00)	1.67 (0.66 - 3.20)	0.61 (0.41 - 0.93)	0.52 (0.31 - 0.87)	0.44 (0.29 - 0.66)
Total Nitrogen (mg/L)		3.88 (2.28 - 5.13)	2.98 (1.81 - 4.67)	1.76 (1.19 - 2.94)	1.57 (1.05 - 3.01)	1.35 (0.91 - 2.43)
Orthophosphate Phosphorus (mg/L)		0.236 (0.150 - 0.310)	0.200 (0.100 - 0.350)	0.086 (0.035 - 0.130)	0.052 (0.029 - 0.074)	0.040 (0.021 - 0.067)
Total Phosphorus (mg/L)		0.37 (0.23 - 0.58)	0.30 (0.14 - 0.56)	0.16 (0.08 - 0.26)	0.11 (0.06 - 0.20)	0.09 (0.04 - 0.26)
Silica (as SiO_2) (mg/L)		8.74 (5.10 - 14.00)	7.36 (2.60 - 16.00)	4.68 (1.70 - 9.60)	4.10 (1.10 - 9.05)	3.71 (0.93 - 10.60)
Chlorophyll-*a* (µg/L)		15.2 (4.1 - 56.0)	12.6 (2.1 - 52.0)	4.7 (1.4 - 25.0)	2.3 (0.9 - 4.6)	2.6 (0.6 - 8.7)
E.coli (count/100mL)		1800 (90 - 180000)	340 (16 - 12000)	23 (2 - 590)	27 (1 - 450)	92 (19 - 660)
Faecal Coliforms (count/100mL)		3400 (170 - 200000)	790 (62 - 20000)	54 (6 - 1000)	61 (1 - 670)	190 (50 - 1000)

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 the North Western WCZ in 2015

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 (°C)		23.7 (16.9 - 27.4)	24.0 (16.9 - 27.8)	24.2 (17.0 - 27.7)	24.3 (16.9 - 28.0)	24.4 (16.6 - 28.7)	24.2 (16.6 - 28.6)
Salinity		29.9 (25.2 - 31.7)	28.1 (18.9 - 31.3)	27.9 (21.0 - 31.3)	26.3 (21.2 - 31.0)	25.5 (14.3 - 31.4)	27.8 (14.0 - 32.8)
Dissolved Oxygen (mg/L)		5.4 (3.7 - 7.2)	5.7 (4.3 - 7.4)	5.6 (4.3 - 7.3)	5.7 (4.1 - 7.5)	6.1 (4.9 - 7.9)	6.2 (4.8 - 8.2)
	Bottom	5.2 (2.5 - 7.3)	5.4 (3.2 - 7.3)	5.3 (3.0 - 7.4)	5.4 (2.9 - 7.5)	5.9 (3.9 - 8.0)	6.0 (3.3 - 8.3)
Dissolved Oxygen (% Saturation)		75 (53 - 90)	79 (62 - 92)	78 (62 - 91)	78 (57 - 93)	84 (70 - 98)	87 (70 - 102)
	Bottom	72 (36 - 92)	75 (46 - 91)	74 (44 - 91)	74 (42 - 93)	81 (56 - 99)	83 (48 - 103)
pH		7.8 (7.7 - 8.0)	7.8 (7.6 - 8.0)	7.8 (7.6 - 8.0)	7.8 (7.6 - 8.0)	7.8 (7.6 - 8.0)	7.9 (7.7 - 8.1)
Secchi Disc Depth (m)		2.5 (1.6 - 3.5)	2.4 (1.3 - 3.8)	2.2 (1.5 - 3.0)	2.2 (1.2 - 3.0)	2.1 (1.0 - 3.0)	1.9 (1.1 - 2.5)
Turbidity (NTU)		6.0 (3.3 - 10.5)	5.5 (2.9 - 11.4)	7.5 (3.2 - 13.9)	6.7 (3.7 - 9.3)	6.8 (4.0 - 9.9)	8.5 (5.6 - 13.8)
Suspended Solids (mg/L)		8.0 (1.3 - 22.0)	6.6 (2.7 - 20.3)	10.8 (4.2 - 30.3)	8.6 (4.5 - 20.4)	9.2 (2.4 - 18.3)	12.8 (3.5 - 22.3)
5-day Biochemical Oxygen Demand (mg/L)		0.6 (<0.1 - 2.6)	0.8 (<0.1 - 2.8)	0.8 (<0.1 - 2.8)	0.6 (<0.1 - 2.2)	0.8 (<0.1 - 3.0)	0.7 (<0.1 - 1.8)
Ammonia Nitrogen (mg/L)		0.107 (0.016 - 0.177)	0.106 (0.014 - 0.180)	0.110 (0.013 - 0.203)	0.115 (0.013 - 0.207)	0.087 (0.011 - 0.177)	0.047 (0.020 - 0.140)
Unionised Ammonia (mg/L)		0.003 (<0.001 - 0.006)	0.003 (<0.001 - 0.009)	0.003 (<0.001 - 0.008)	0.003 (<0.001 - 0.009)	0.002 (<0.001 - 0.009)	0.002 (<0.001 - 0.008)
Nitrite Nitrogen (mg/L)		0.052 (0.016 - 0.130)	0.066 (0.017 - 0.131)	0.070 (0.018 - 0.153)	0.091 (0.020 - 0.270)	0.082 (0.014 - 0.203)	0.056 (0.007 - 0.140)
Nitrate Nitrogen (mg/L)		0.286 (0.127 - 0.723)	0.421 (0.133 - 1.230)	0.429 (0.137 - 0.963)	0.557 (0.153 - 1.090)	0.597 (0.130 - 1.430)	0.406 (0.026 - 1.600)
Total Inorganic Nitrogen (mg/L)		0.44 (0.27 - 0.84)	0.59 (0.29 - 1.36)	0.61 (0.31 - 1.09)	0.76 (0.33 - 1.23)	0.77 (0.27 - 1.55)	0.51 (0.09 - 1.69)
Total Kjeldahl Nitrogen (mg/L)		0.37 (0.18 - 0.59)	0.37 (0.15 - 0.69)	0.38 (0.19 - 0.80)	0.38 (0.19 - 0.60)	0.33 (0.18 - 0.51)	0.29 (0.12 - 0.52)
Total Nitrogen (mg/L)		0.71 (0.56 - 1.06)	0.86 (0.52 - 1.61)	0.88 (0.55 - 1.28)	1.03 (0.64 - 1.46)	1.01 (0.50 - 1.86)	0.75 (0.30 - 2.01)
Orthophosphate Phosphorus (mg/L)		0.022 (0.008 - 0.031)	0.024 (0.013 - 0.039)	0.025 (0.011 - 0.040)	0.028 (0.011 - 0.047)	0.025 (0.007 - 0.050)	0.017 (0.006 - 0.038)
Total Phosphorus (mg/L)		0.05 (0.03 - 0.07)	0.05 (0.03 - 0.08)	0.06 (0.04 - 0.09)	0.06 (0.03 - 0.10)	0.06 (0.03 - 0.11)	0.05 (<0.02 - 0.10)
Silica (as SiO_2) (mg/L)		1.58 (0.24 - 3.83)	2.18 (0.27 - 6.87)	2.17 (0.29 - 5.30)	2.70 (0.39 - 6.03)	2.86 (0.57 - 7.77)	2.24 (0.25 - 8.80)
Chlorophyll-*a* (µg/L)		1.6 (0.4 - 4.6)	1.8 (0.4 - 5.8)	1.7 (0.7 - 4.1)	1.5 (0.5 - 2.9)	1.9 (0.9 - 4.4)	2.4 (0.7 - 6.2)
E.coli (count/100mL)		97 (7 - 510)	31 (2 - 220)	59 (10 - 220)	130 (42 - 1000)	19 (7 - 140)	3 (<1 - 27)
Faecal Coliforms (count/100mL)		200 (48 - 650)	70 (4 - 340)	130 (23 - 580)	260 (89 - 2900)	43 (17 - 210)	6 (1 - 53)

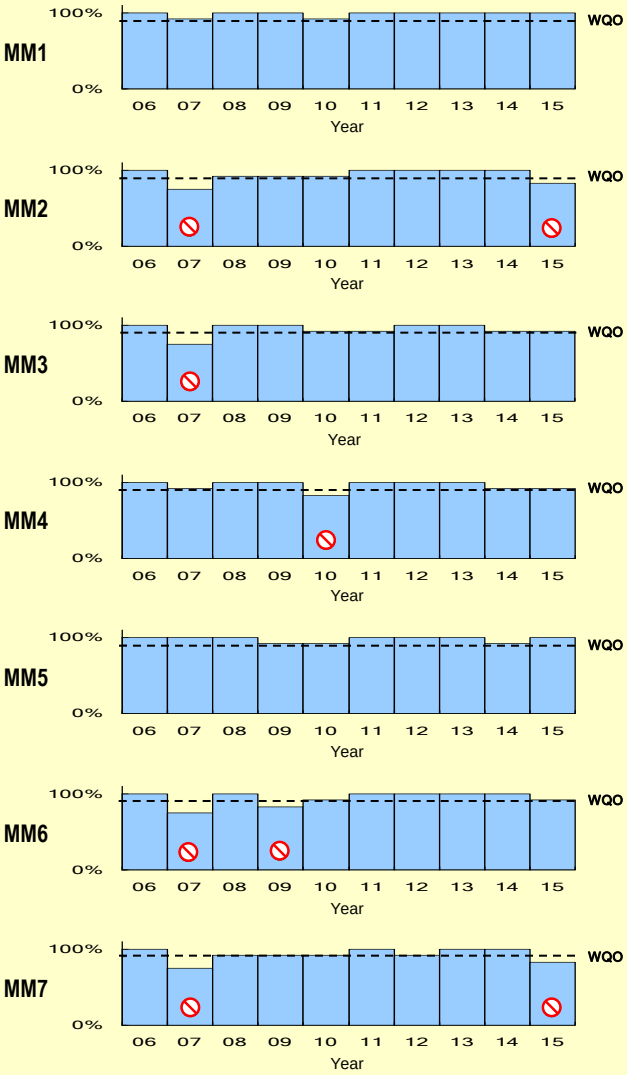
Note : 1. Unless otherwise specified, data presented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B).

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

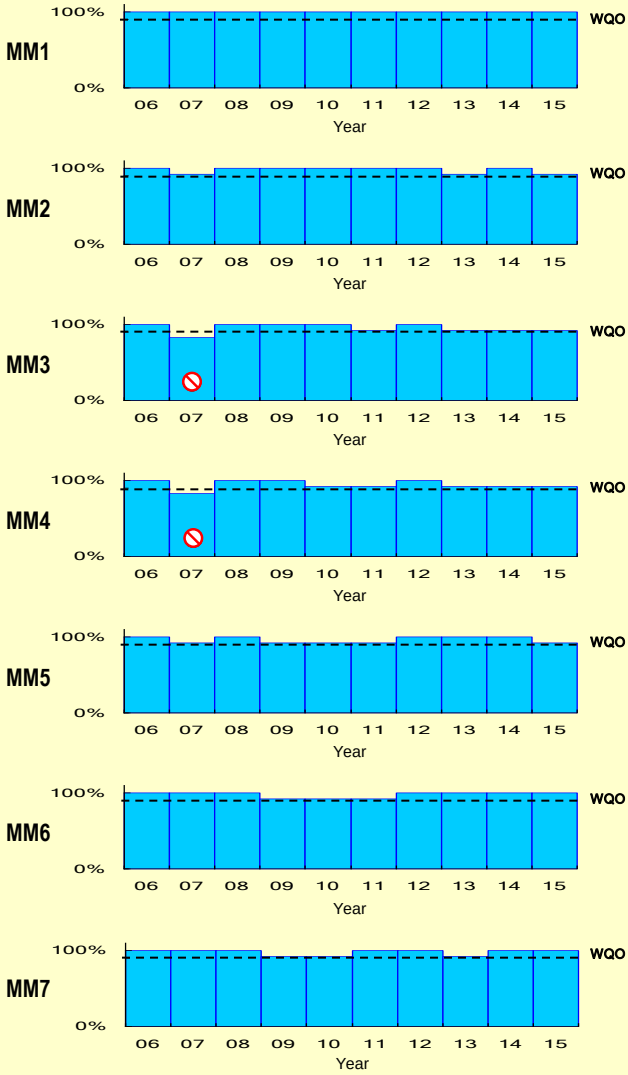
3. Data in brackets indicate the ranges.

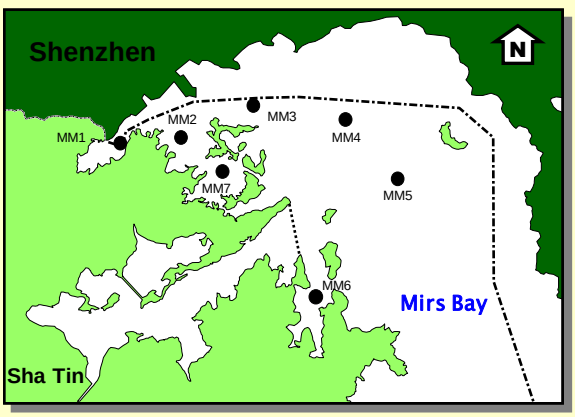
Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ

Dissolved Oxygen (DO) (bottom)



Dissolved Oxygen (DO) (depth-averaged)



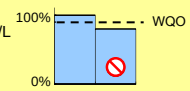


Dissolved Oxygen (DO)

1. Bottom

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

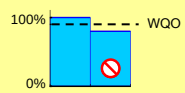
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

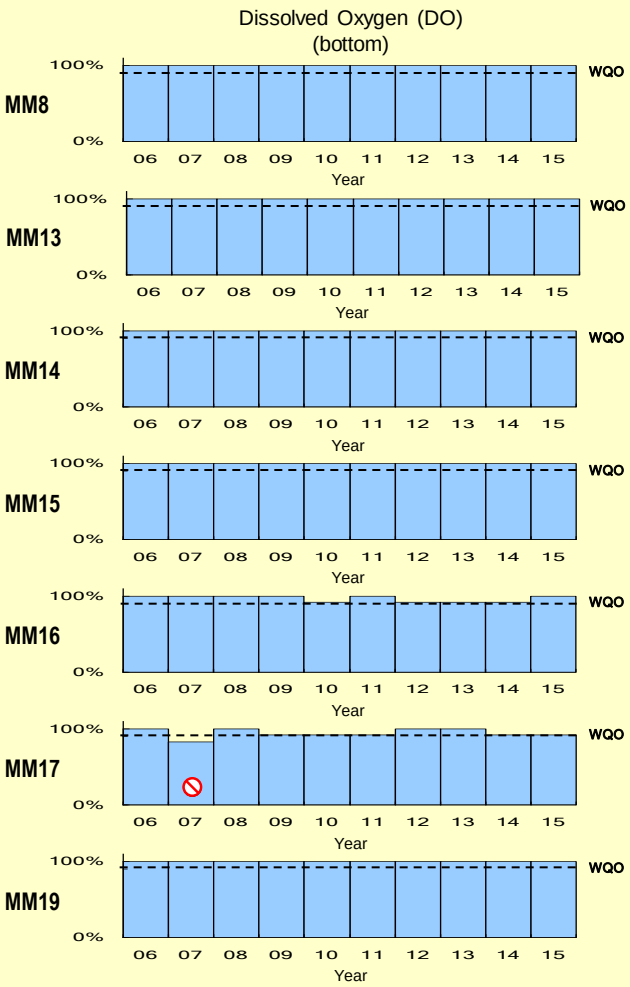
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

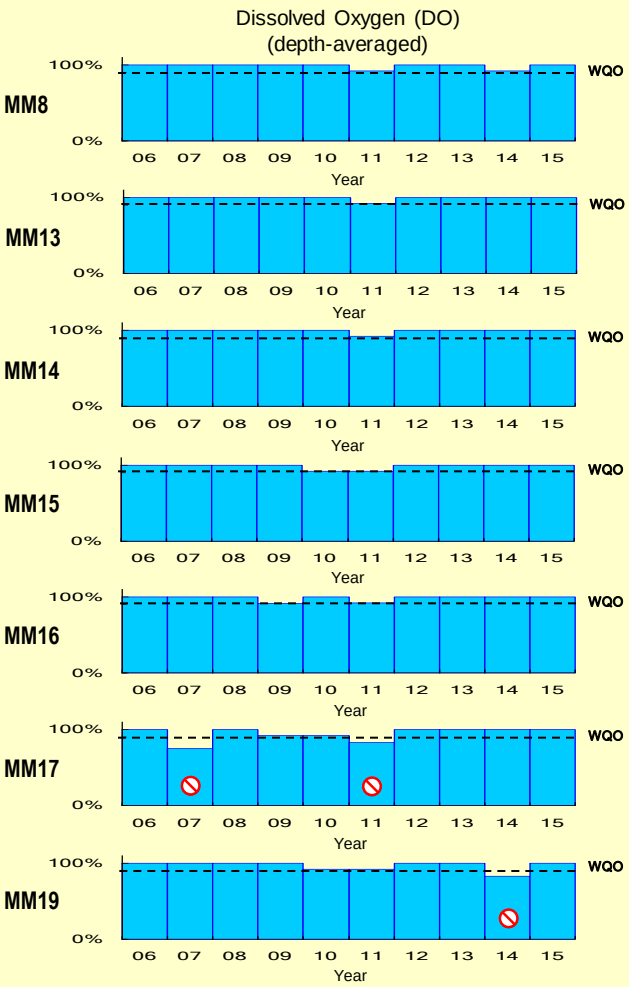
% sample with depth-averaged DO ≥ 4 mg/L

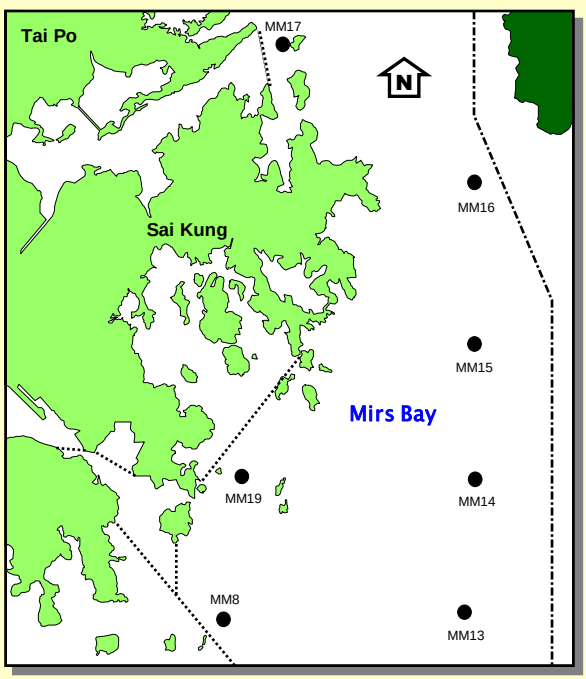


Non-compliance

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

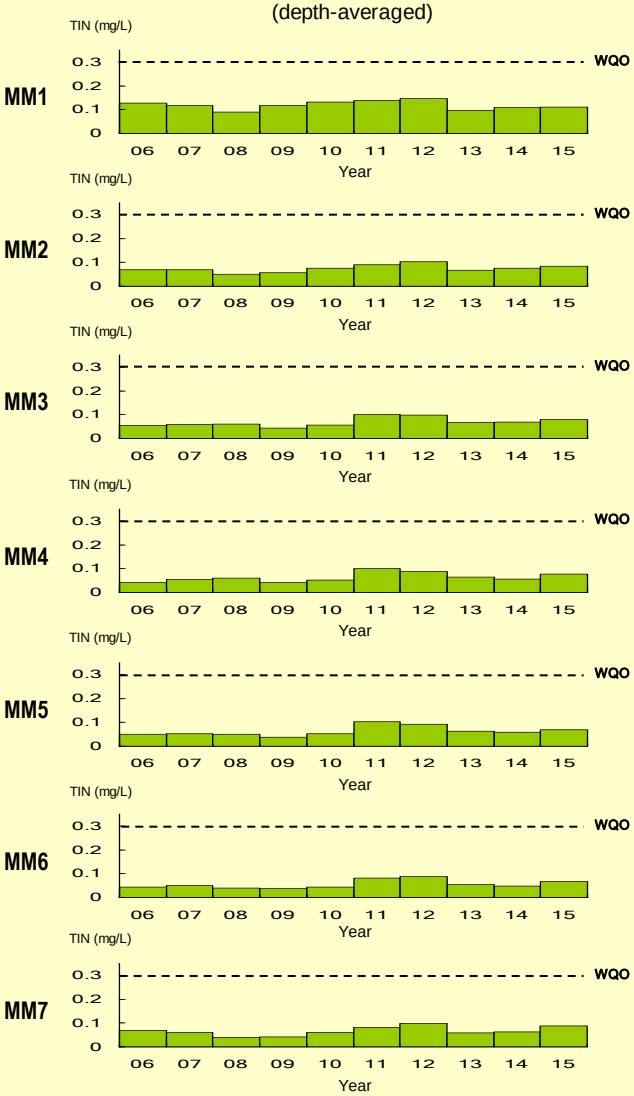
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

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

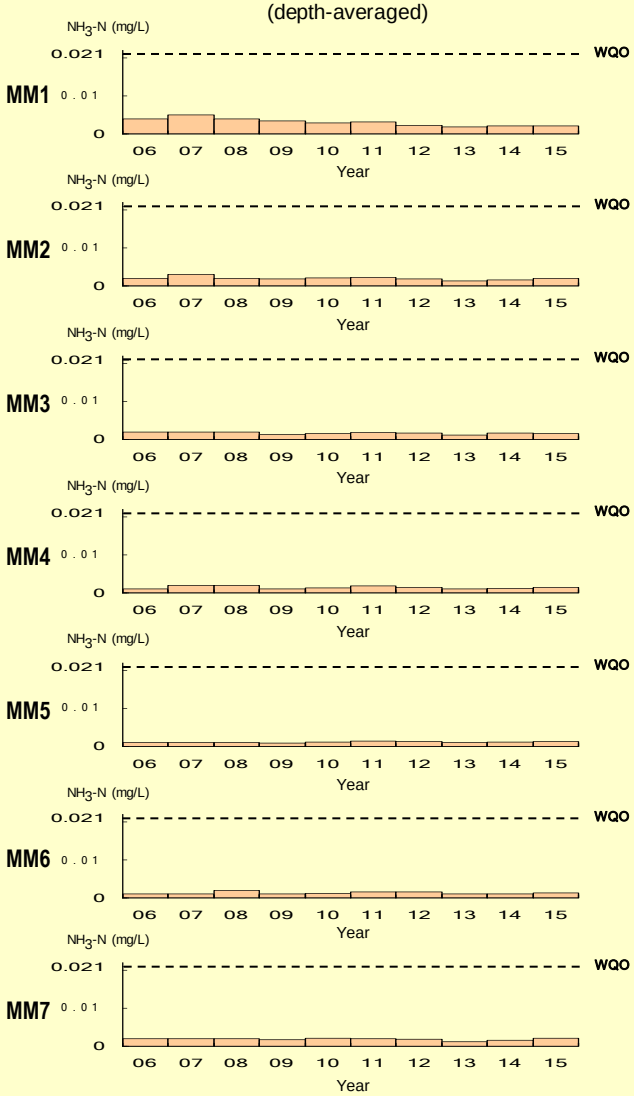
Non-compliance

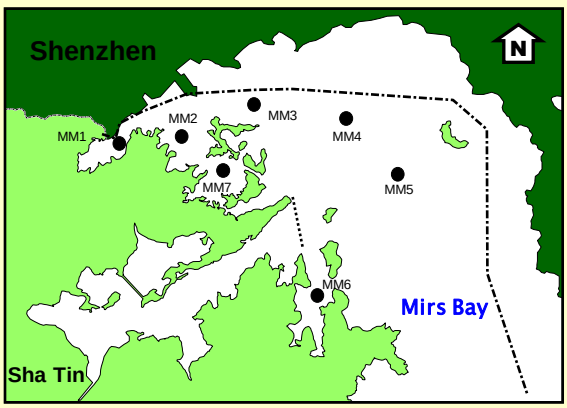
Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)



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

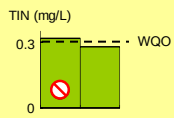




Total Inorganic Nitrogen (TIN)

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

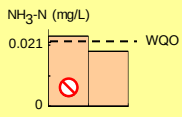
annual mean for depth-averaged TIN



Unionised Ammonia (NH_3-N)

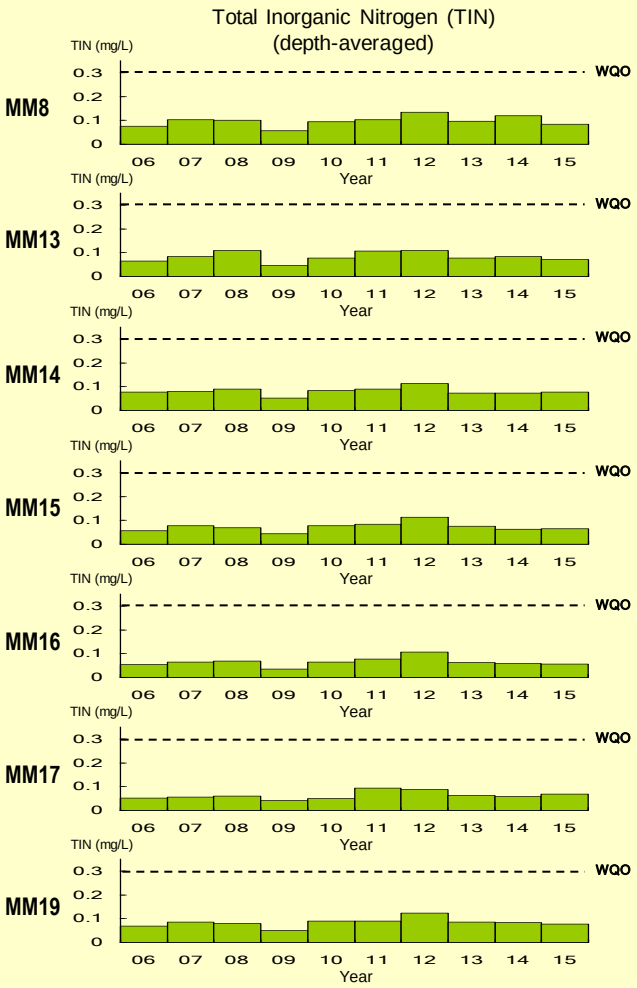
WQO: annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

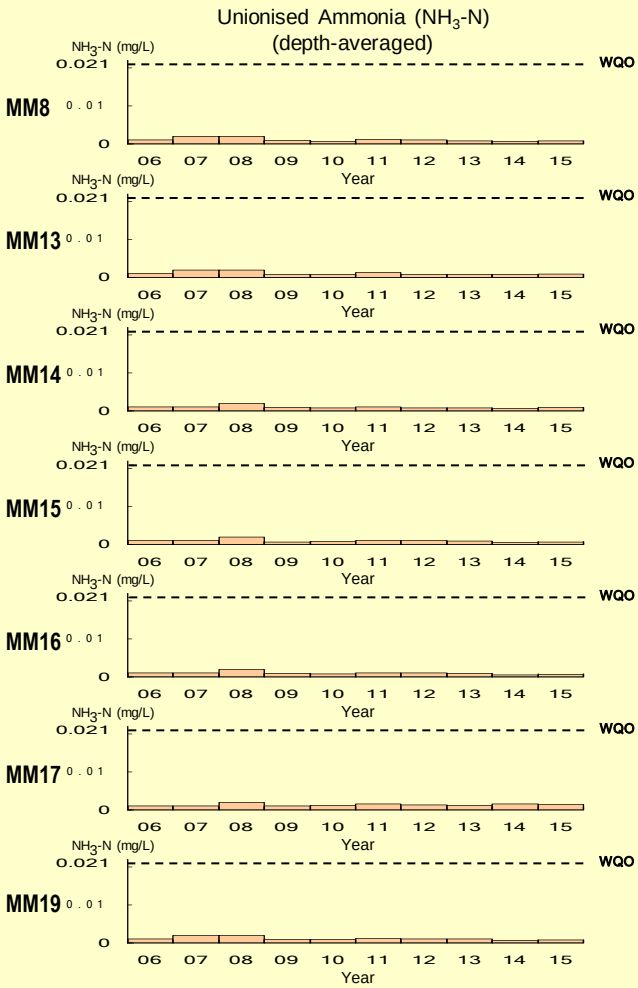
annual mean for depth-averaged NH_3-N

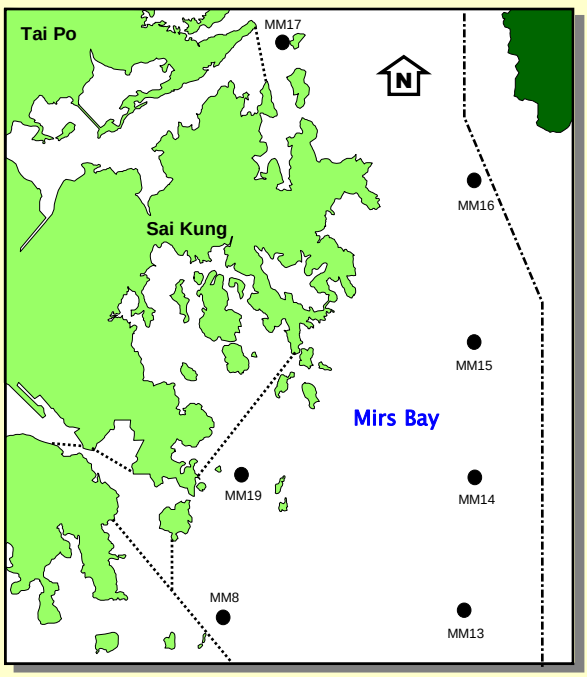


Non-compliance

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



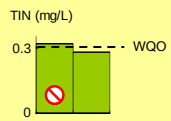




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

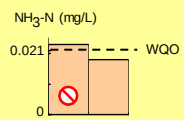


Unionised Ammonia (NH_3-N)

WQO : annual mean for depth-averaged NH_3-N $\leq$ 0.021 mg/L

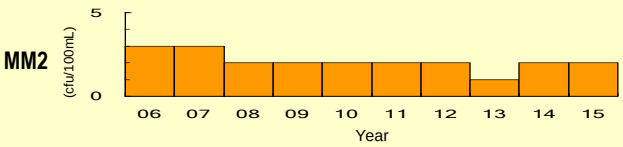
annual mean for depth-averaged NH_3-N

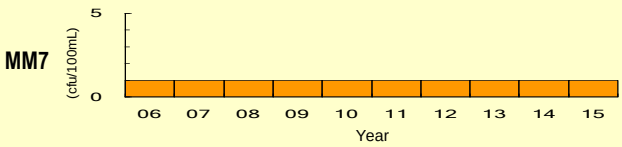
Non-compliance

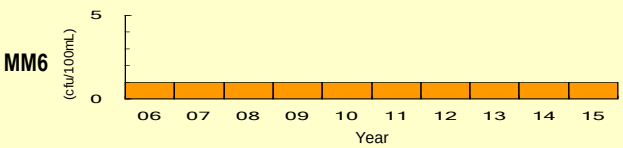


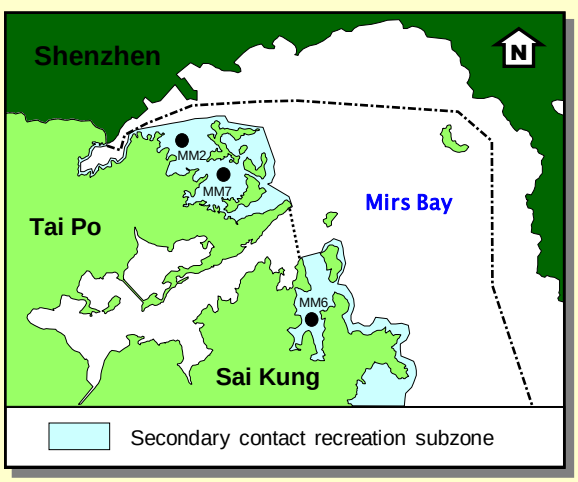
Levels of compliance with key Water Quality Objectives in the Mirs Bay WCZ (continued)

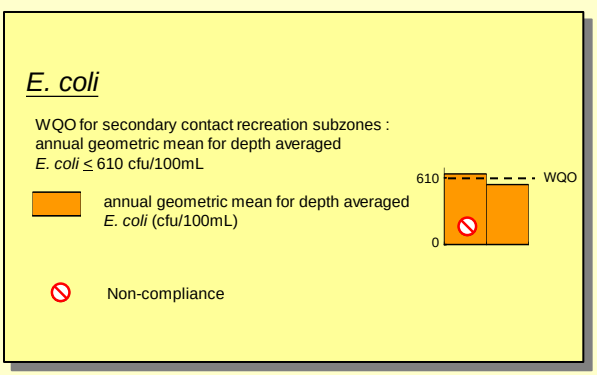
E. coli
(annual geometric mean)



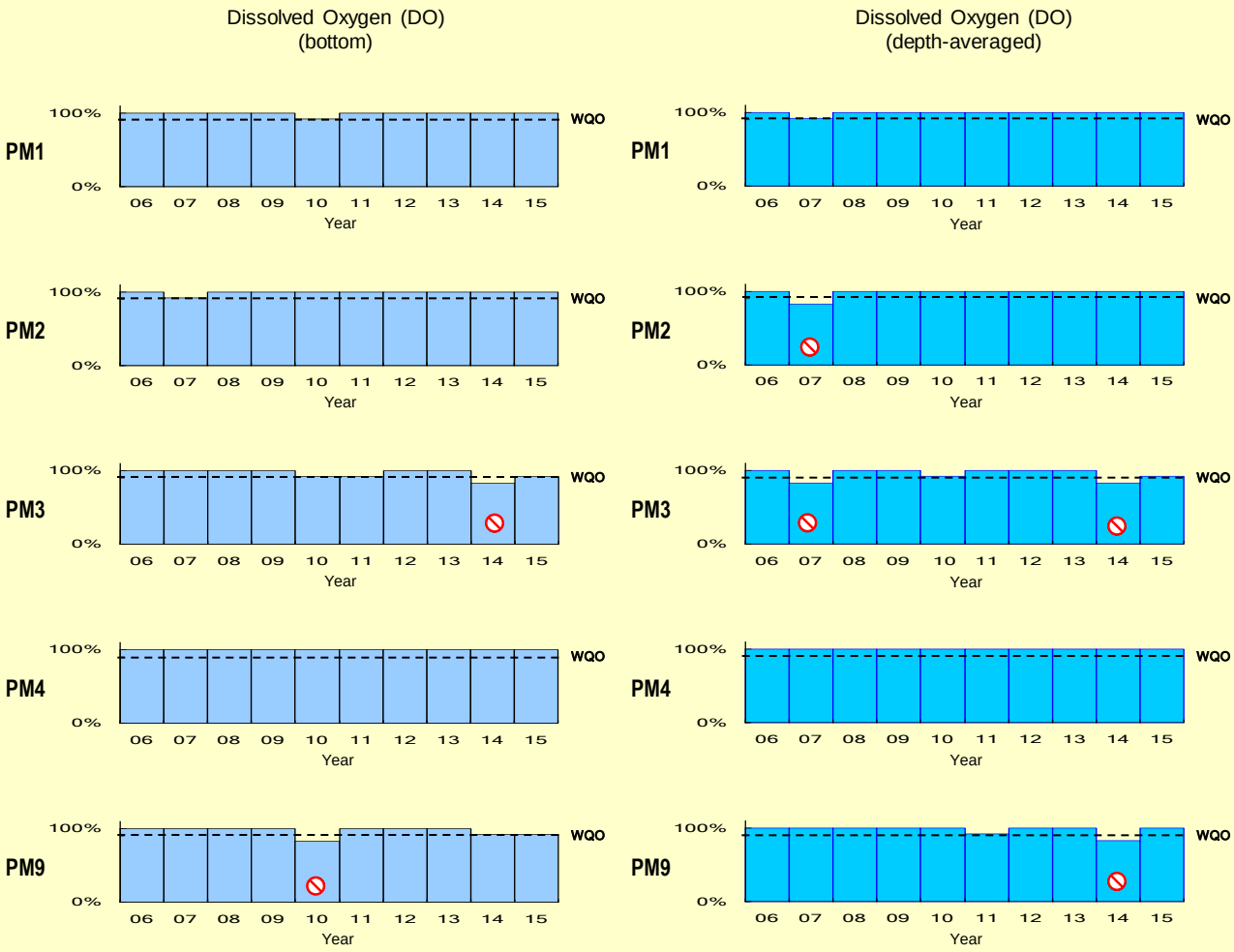


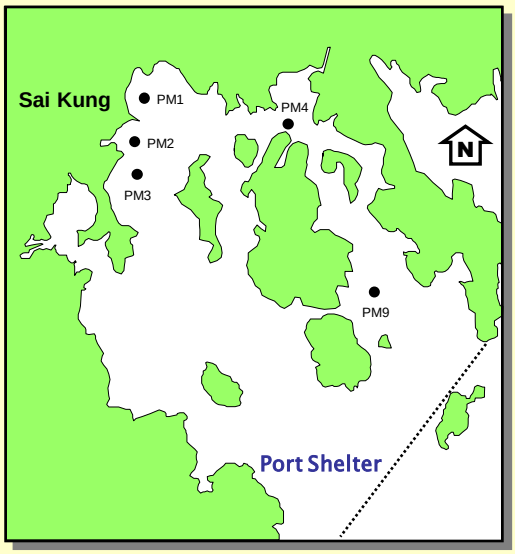






Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ





Dissolved Oxygen (DO)

1. Bottom

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

% sample with bottom DO ≥ 2 mg/L

2. Depth-averaged

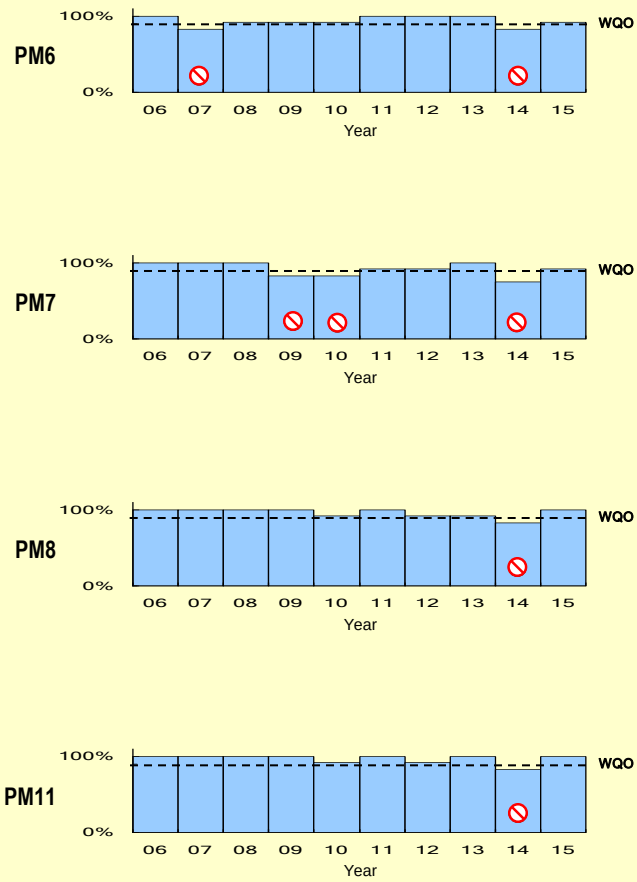
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

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

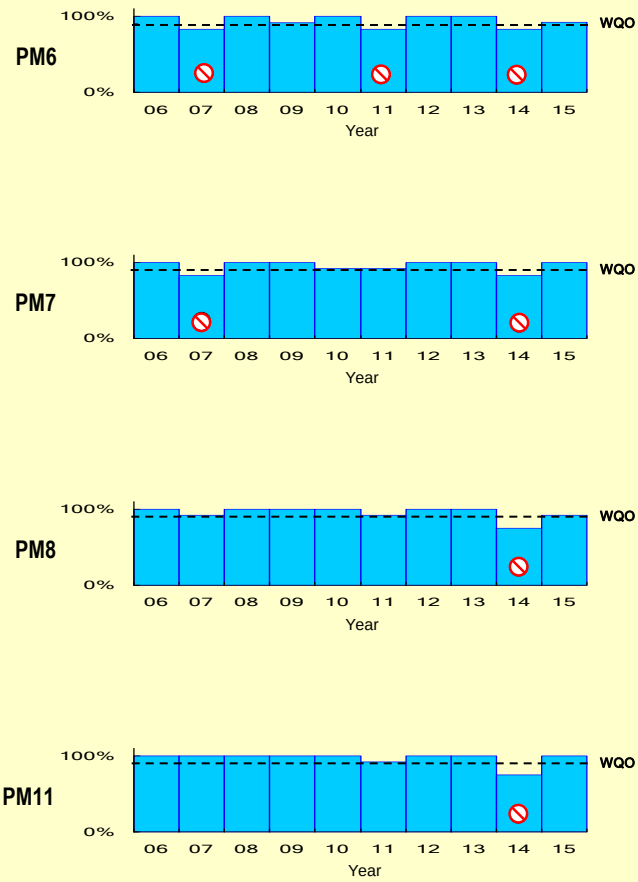
Non-compliance

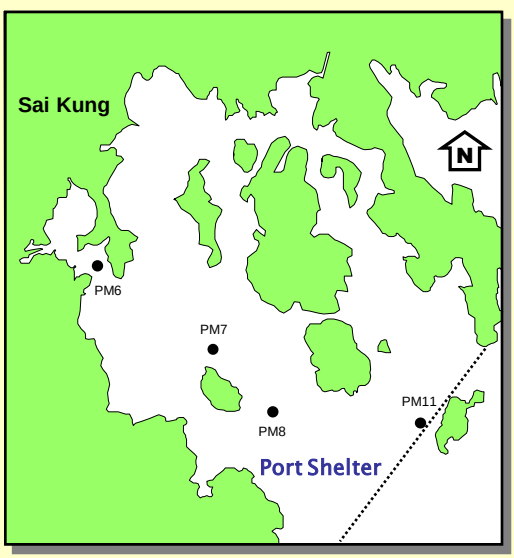
Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)



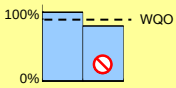


Dissolved Oxygen (DO)

1. Bottom

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

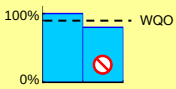
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

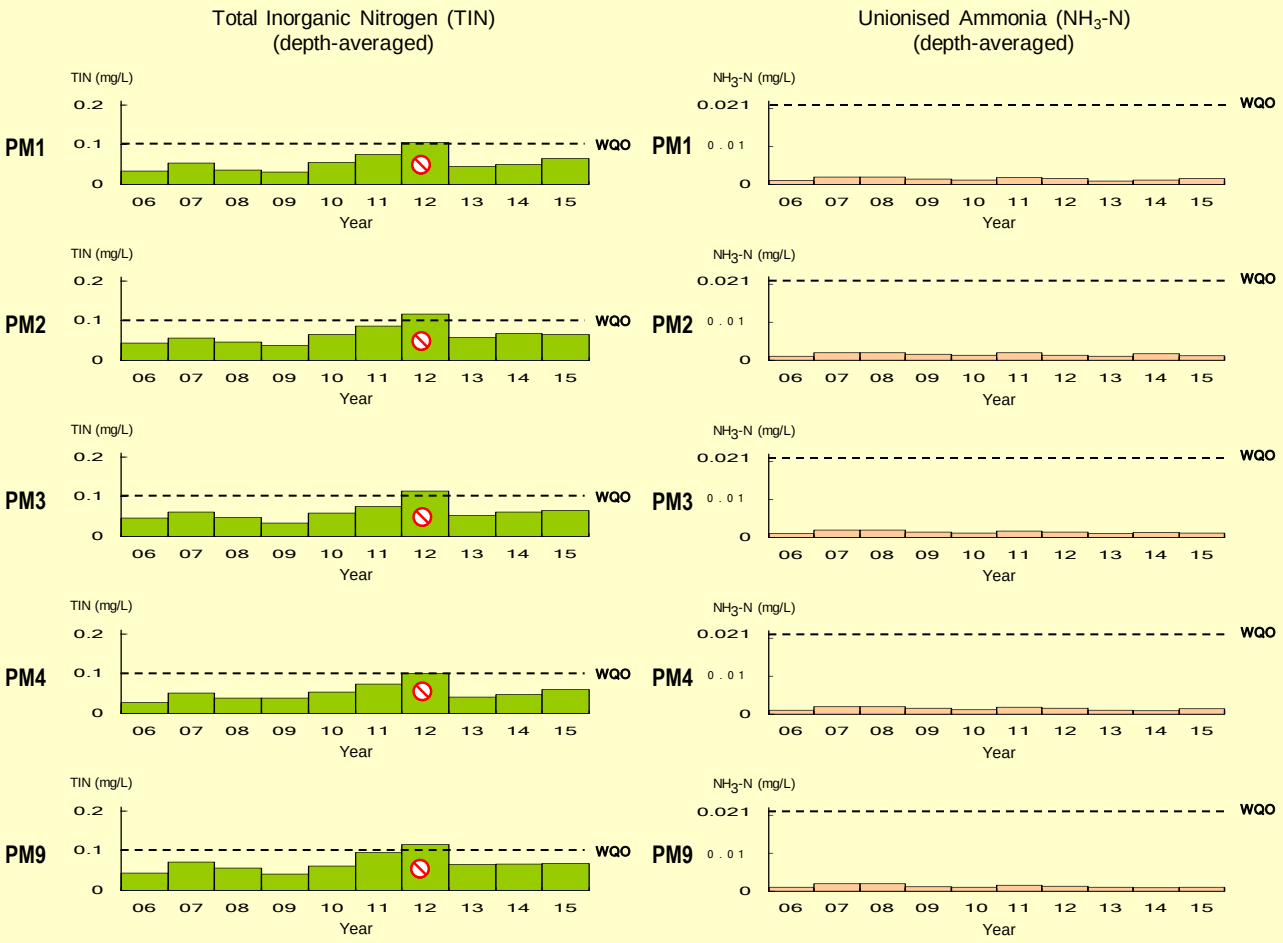
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

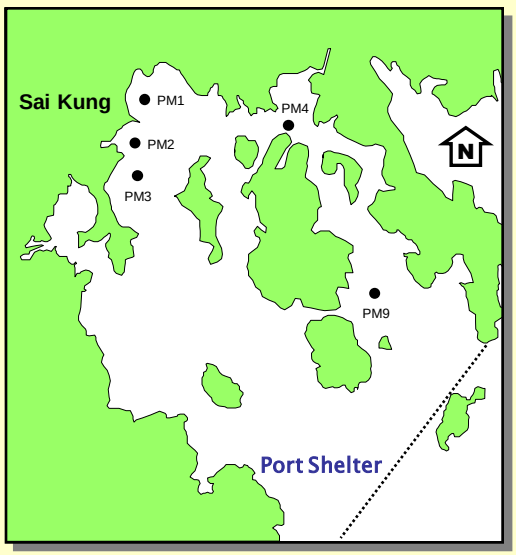
% sample with depth-averaged DO ≥ 4 mg/L



Non-compliance

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

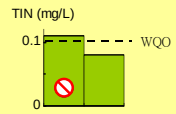




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

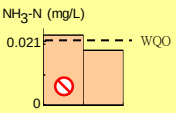


Unionised Ammonia (NH_3-N)

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

annual mean for depth-averaged NH_3-N

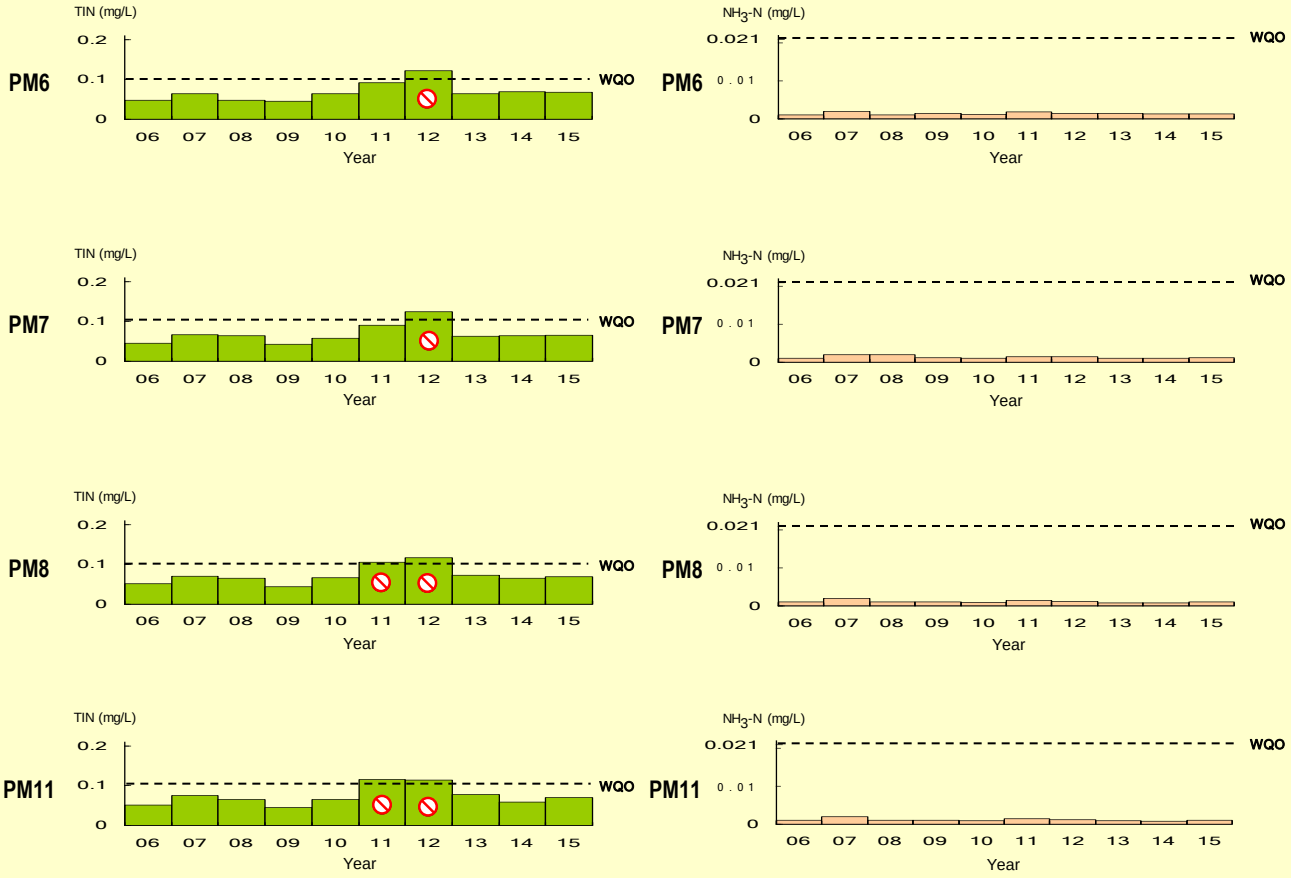
Non-compliance

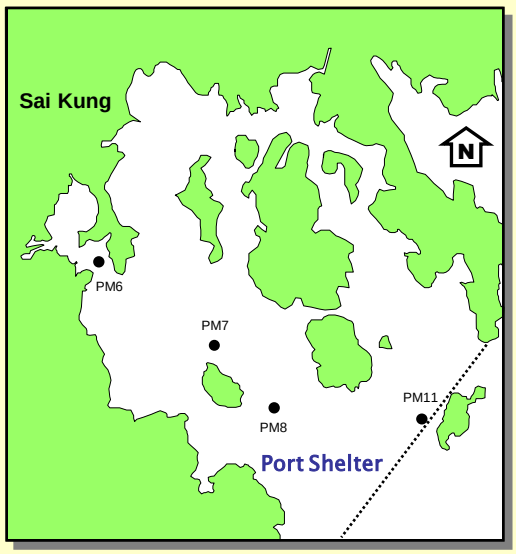


Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)

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

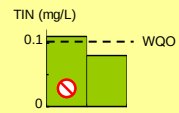




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

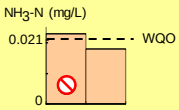


Unionised Ammonia (NH_3-N)

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

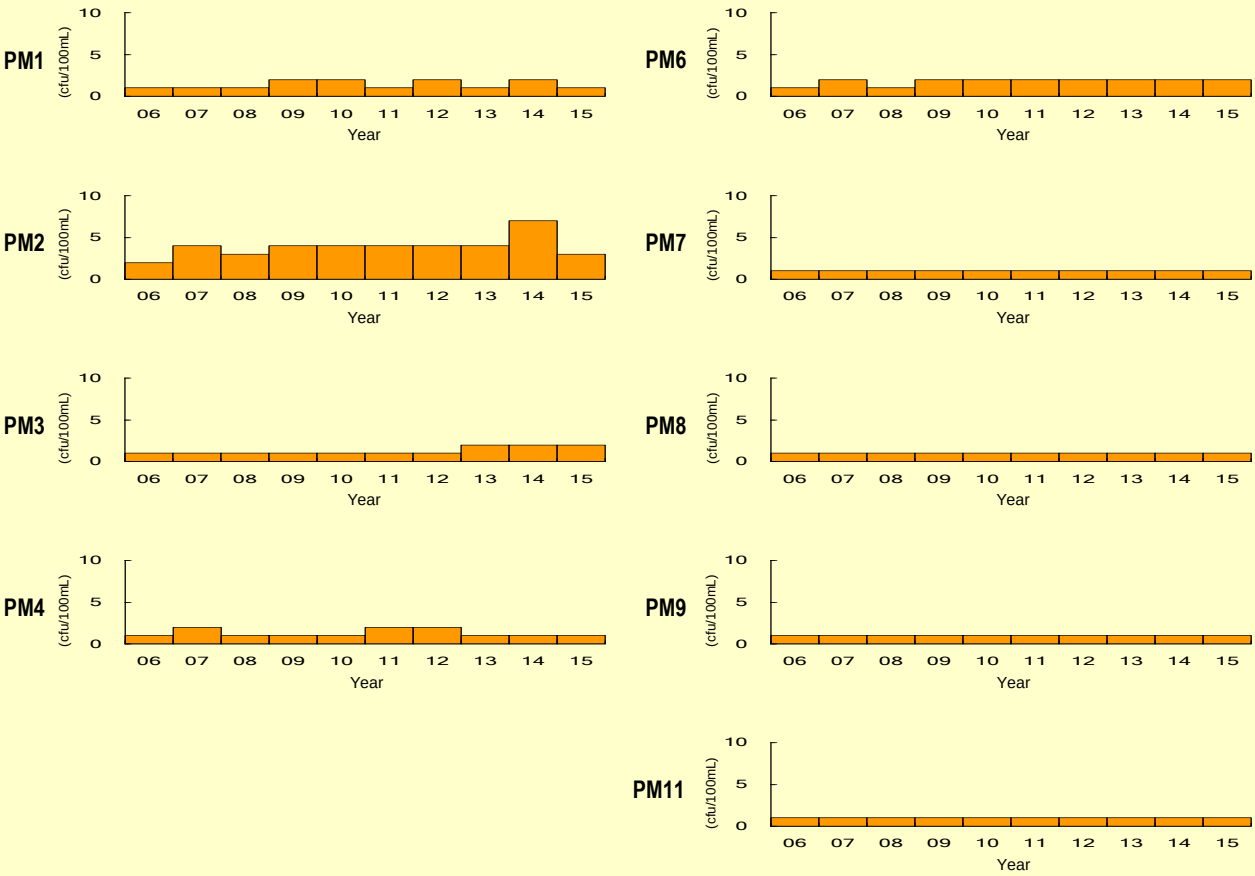
annual mean for depth-averaged NH_3-N

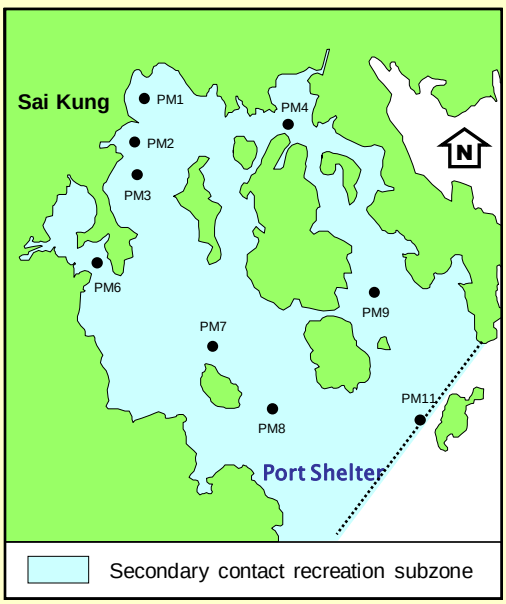
Non-compliance

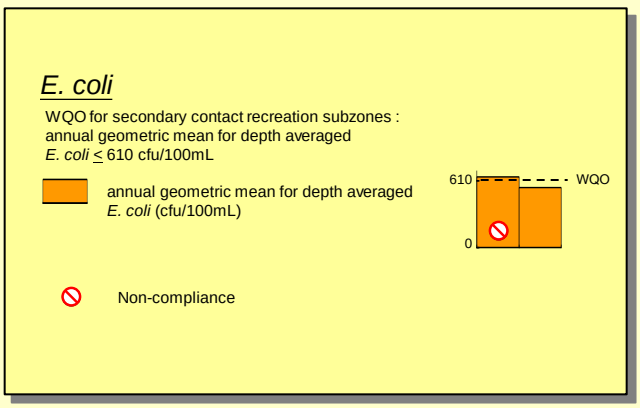


Levels of compliance with key Water Quality Objectives in the Port Shelter WCZ (continued)

E. coli
(annual geometric mean)

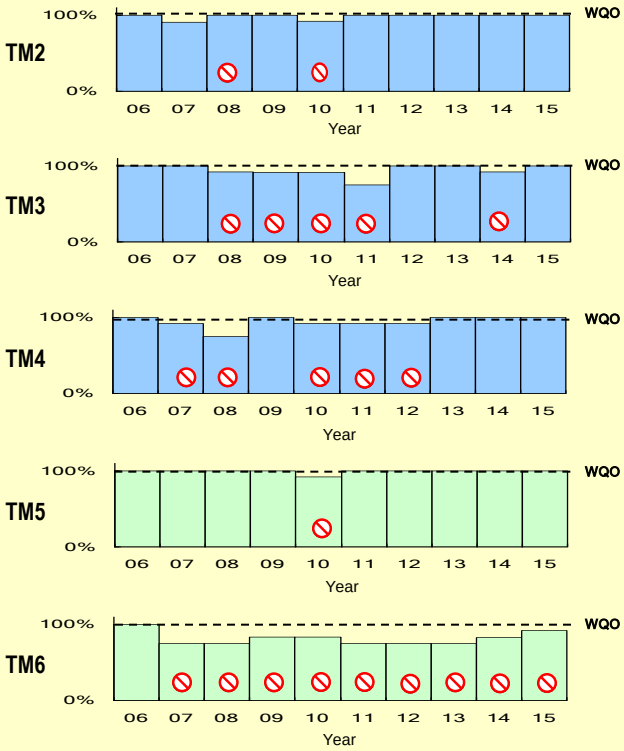




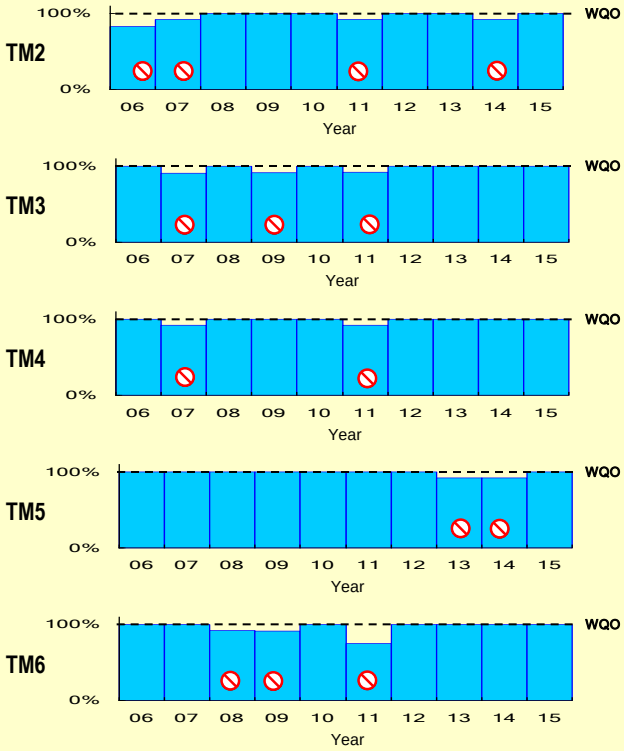


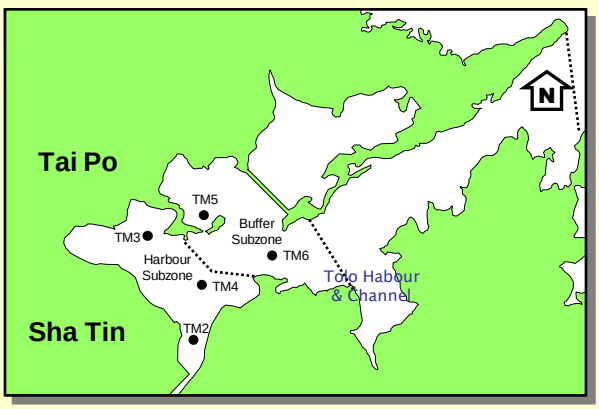
Levels of compliance with key Water Quality Objectives in the Tolo Harbour and Channel WCZ

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(water column average)





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

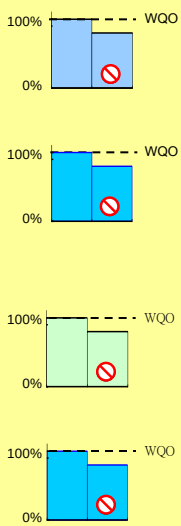
% sample with bottom DO ≥ 3 mg/L

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

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

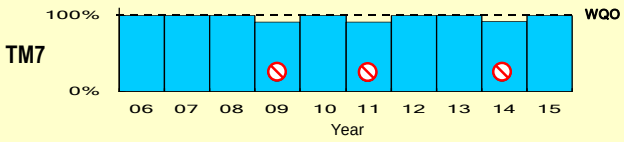
% sample with water column average DO ≥ 4 mg/L

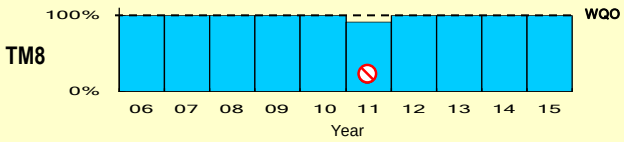
Non-compliance



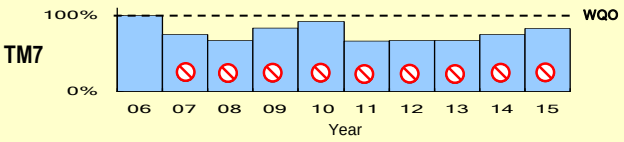
Levels of compliance with key Water Quality Objectives in the Tolo Harbour and Channel WCZ (continued)

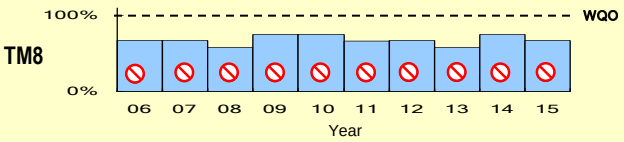
Dissolved Oxygen (DO)
(surface)



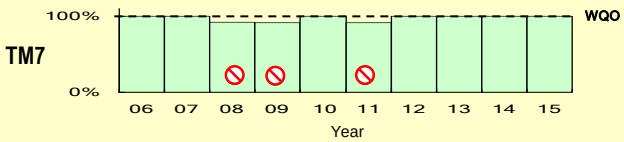


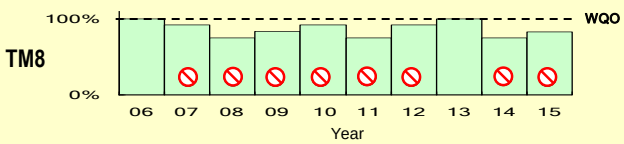
Dissolved Oxygen (DO)
(bottom)

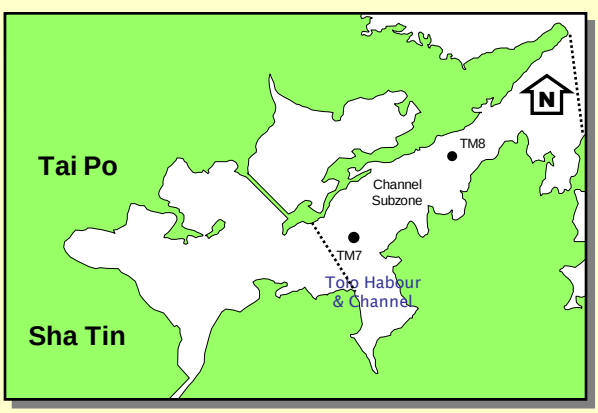




Dissolved Oxygen (DO)
(middle)







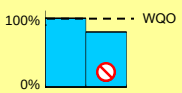
Dissolved Oxygen (DO)

Channel Subzone (TM7 - TM8)

1. Surface

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

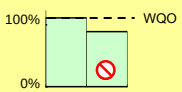
% sample with surface DO ≥ 4 mg/L



2. Middle

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

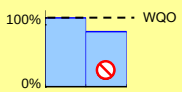
% sample with middle DO ≥ 4 mg/L



3. Bottom

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

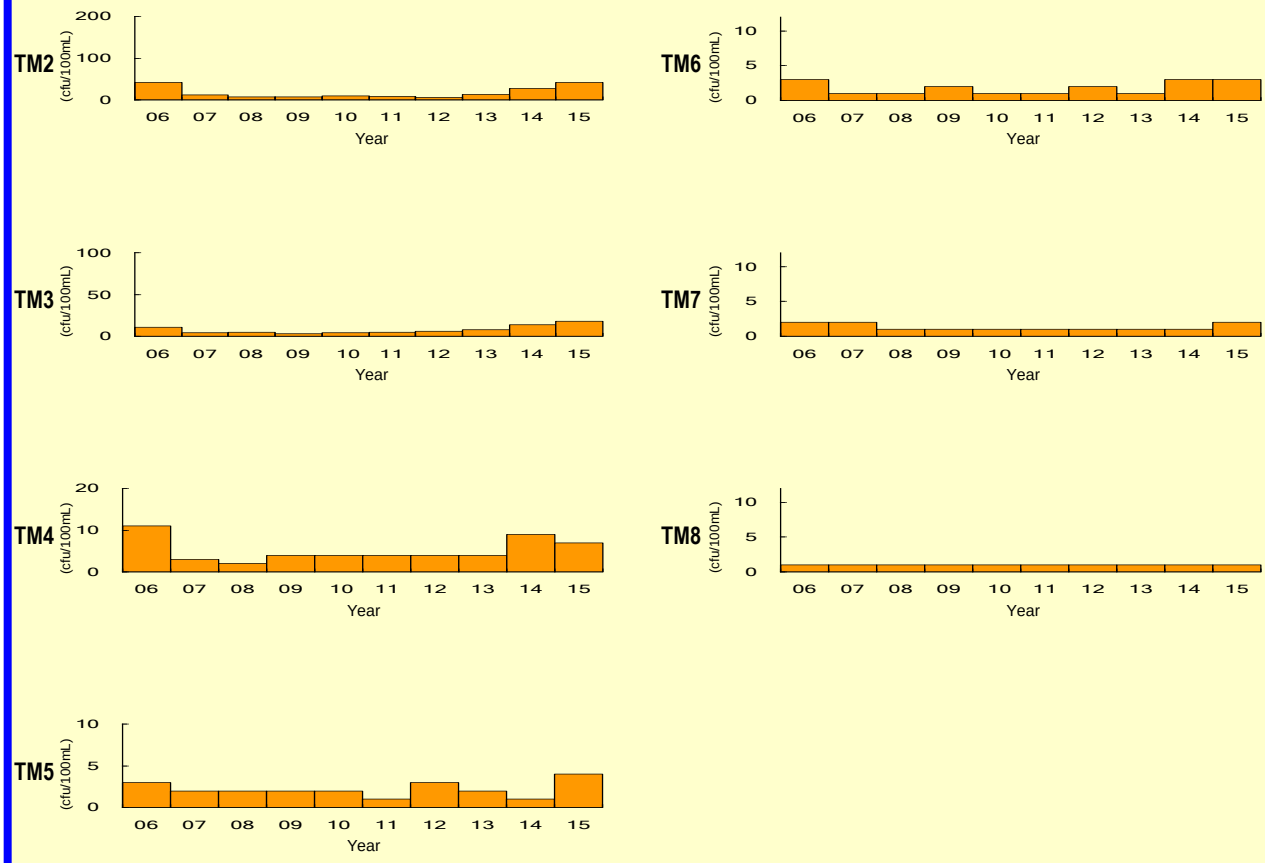
% sample with bottom DO ≥ 4 mg/L

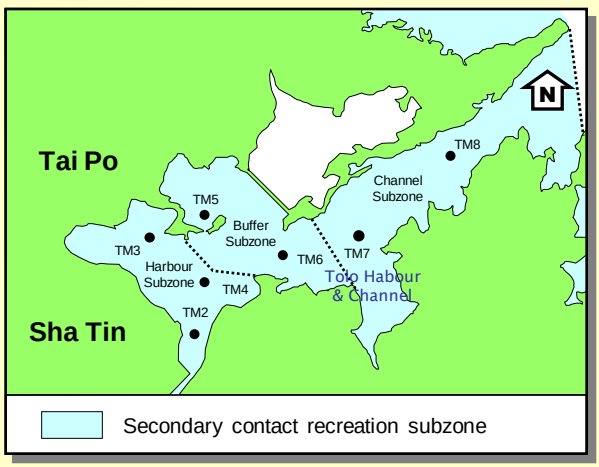


Non-compliance

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

E. coli
(annual geometric mean)



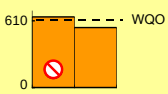


E. coli

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)

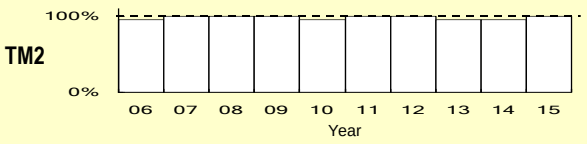
Non-compliance

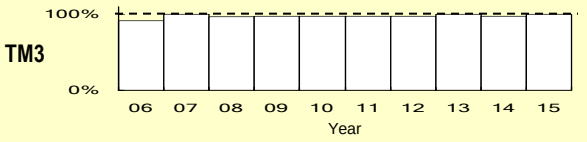


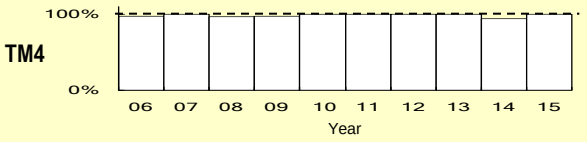
Levels of chlorophyll-*a* in the Tolo Harbour and Channel WCZ

Chlorophyll-*a*

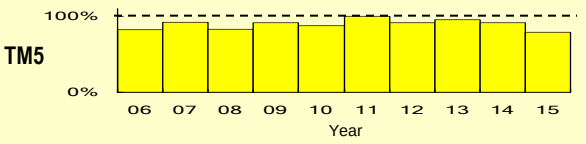
1. Harbour Subzone

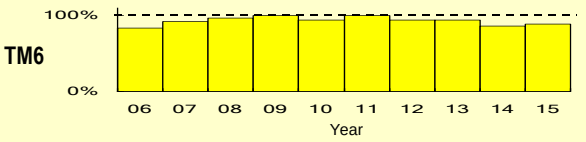




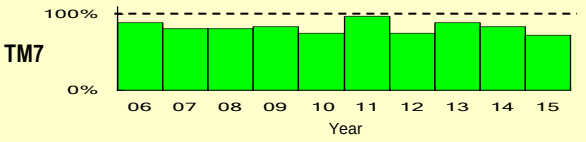


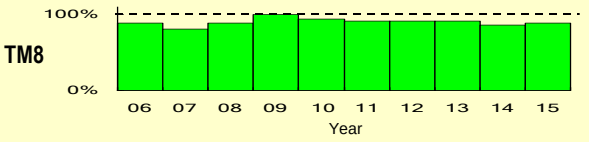
2. Buffer Subzone

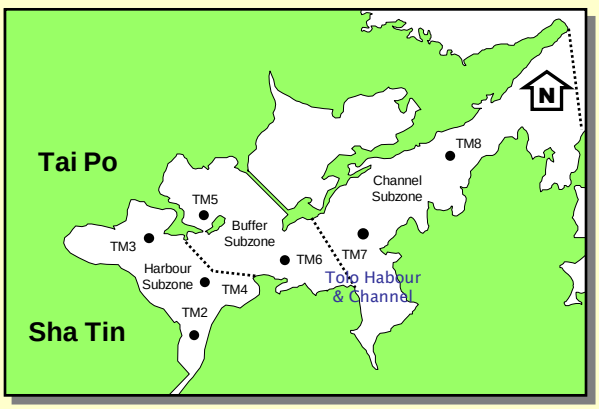




3. Channel Subzone







Chlorophyll-*a*

1. Harbour Subzone

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

WQO : Chlorophyll-*a* ≤ 20 μg/L

2. Buffer Subzone

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

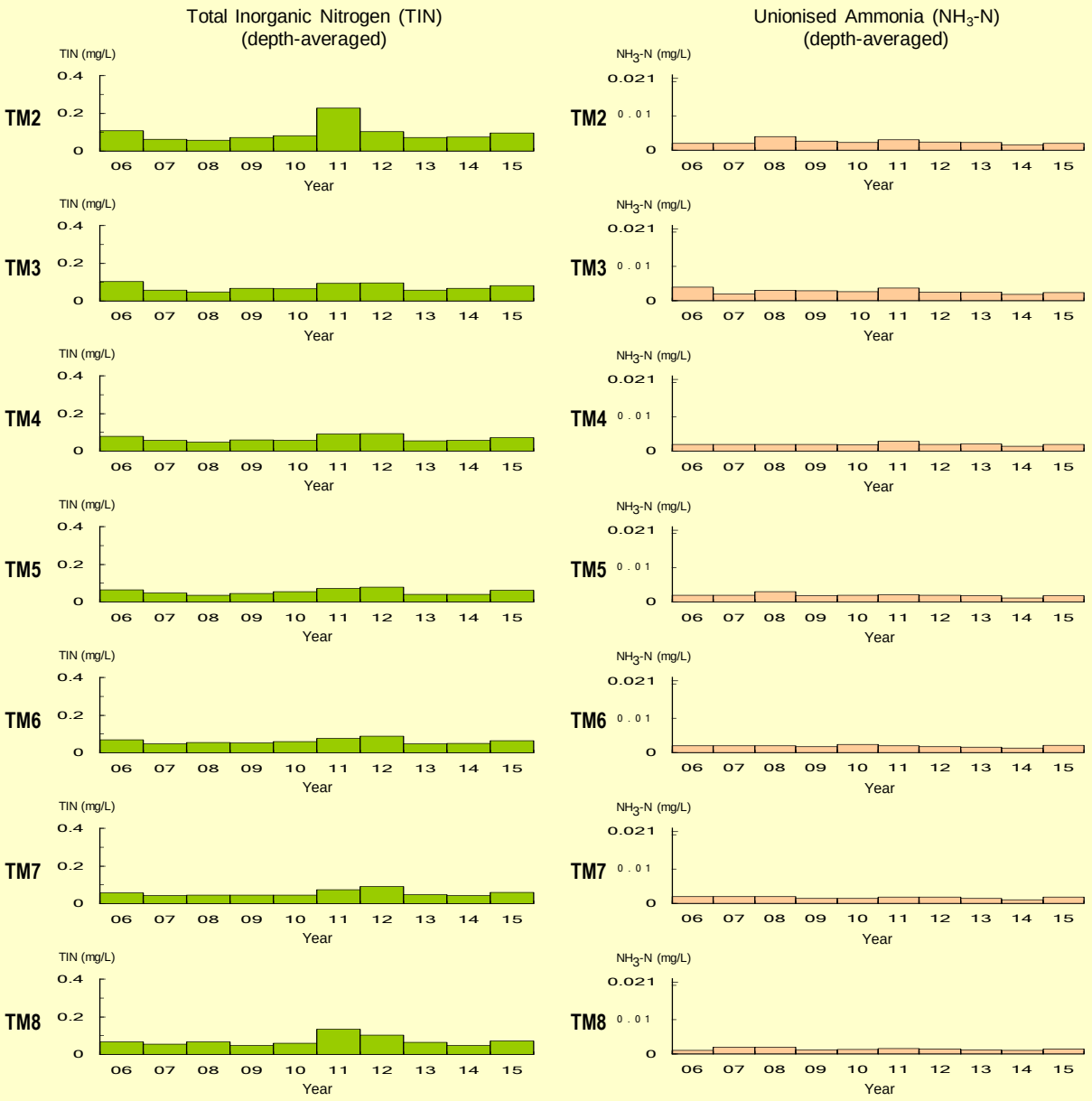
WQO : Chlorophyll-*a* ≤ 10 μg/L

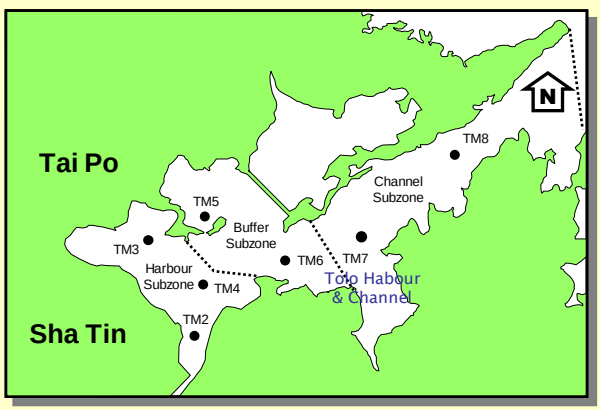
3. Channel Subzone

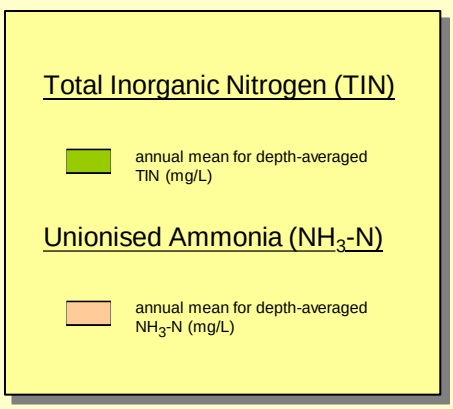
% sample (S, M, B) with Chlorophyll-*a* ≤ 6 μg/L

WQO : Chlorophyll-*a* ≤ 6 μg/L

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



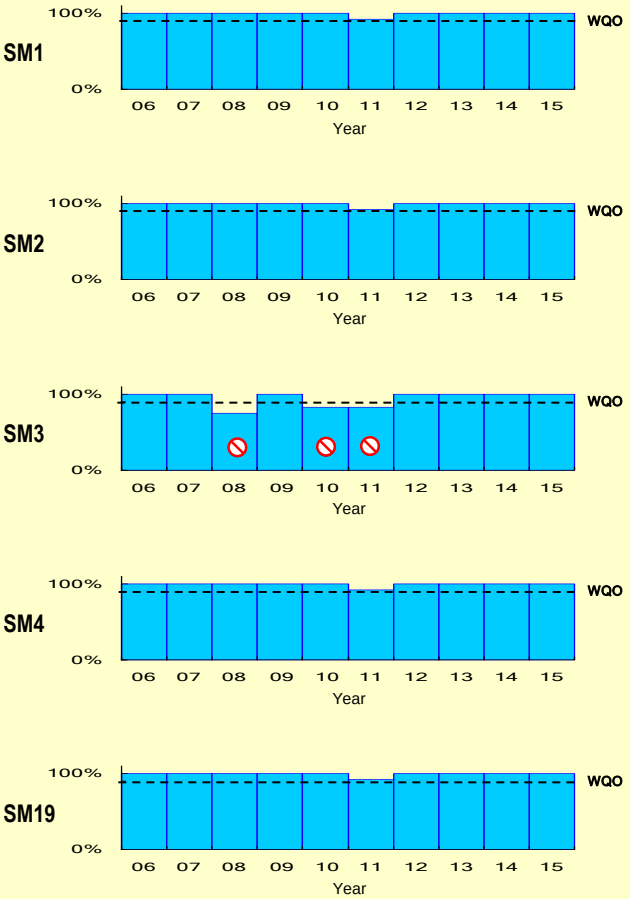


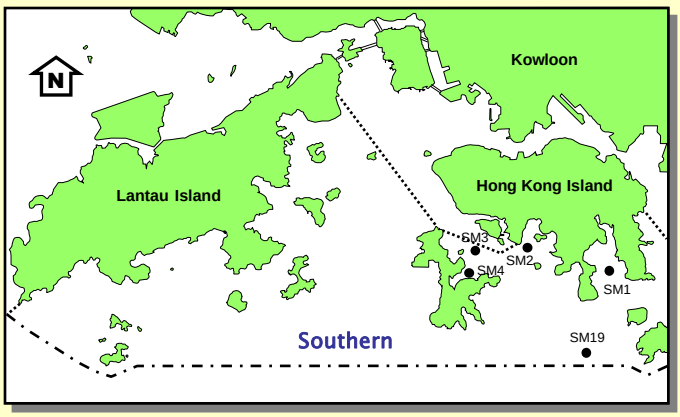


Levels of compliance with key Water Quality Objectives in the Southern WCZ

Dissolved Oxygen (DO) (bottom)

Dissolved Oxygen (DO) (depth-averaged)



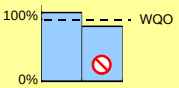


Dissolved Oxygen (DO)

1. Bottom

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

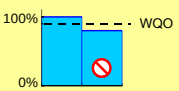
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

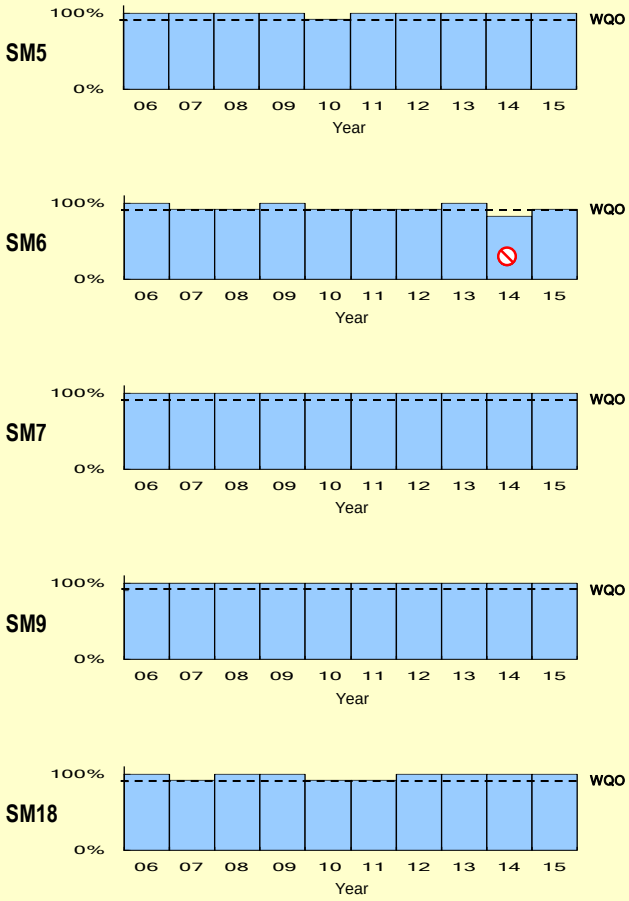
% sample with depth-averaged DO ≥ 4 mg/L



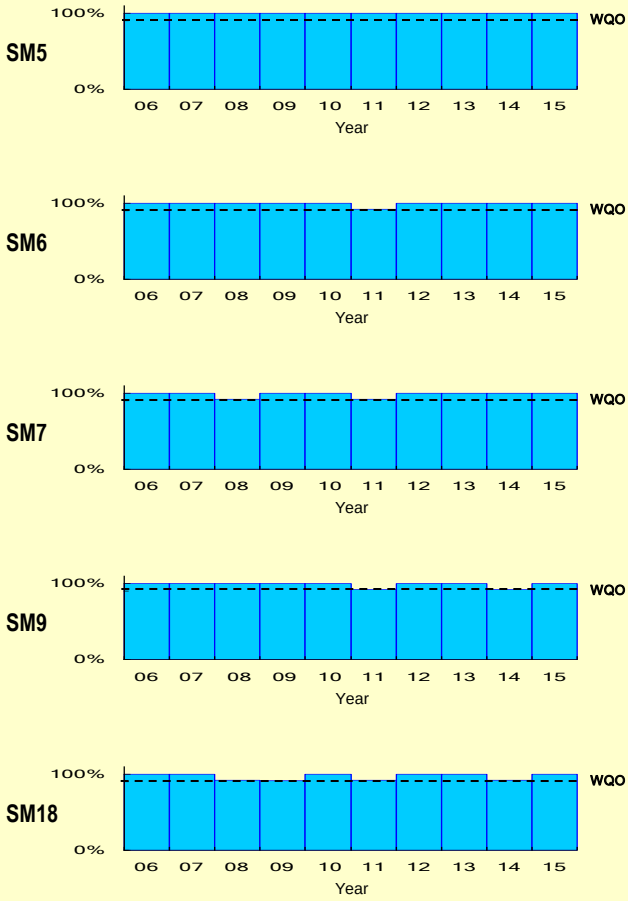
Non-compliance

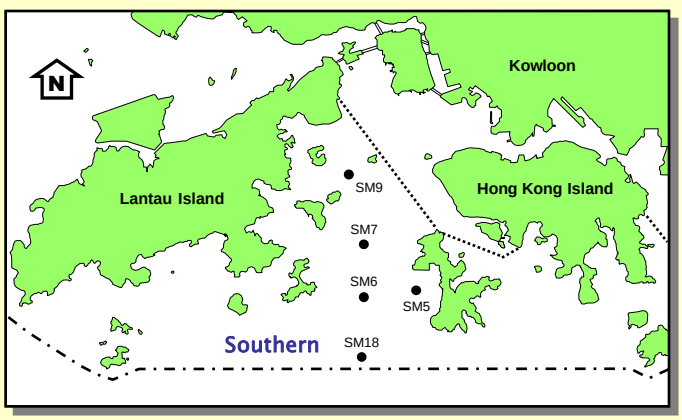
Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

Dissolved Oxygen (DO) (bottom)



Dissolved Oxygen (DO) (depth-averaged)



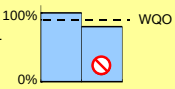


Dissolved Oxygen (DO)

1. Bottom

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

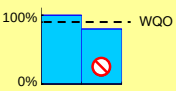
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

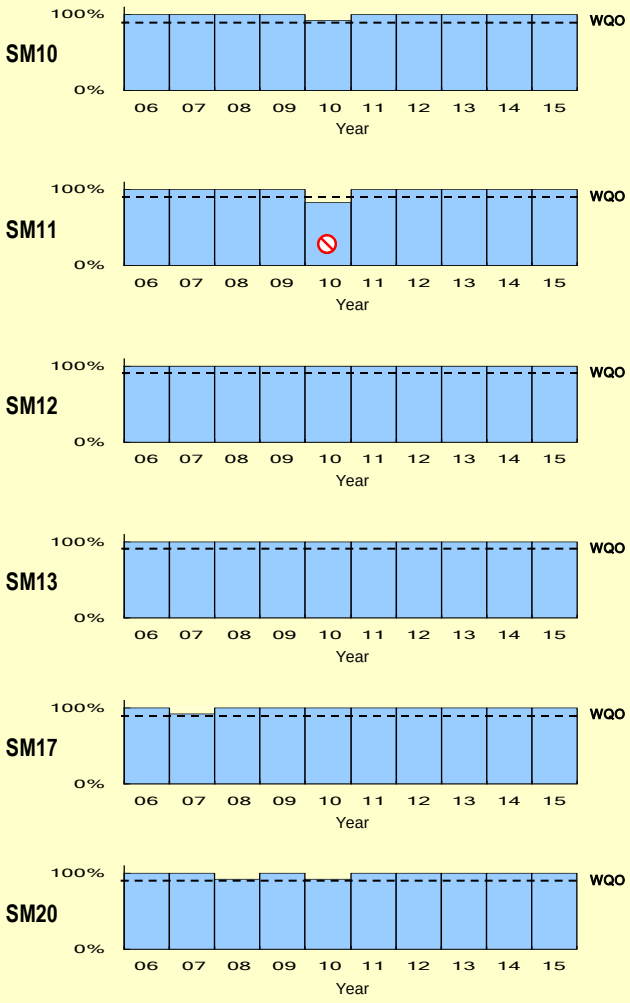
% sample with depth-averaged DO ≥ 4 mg/L



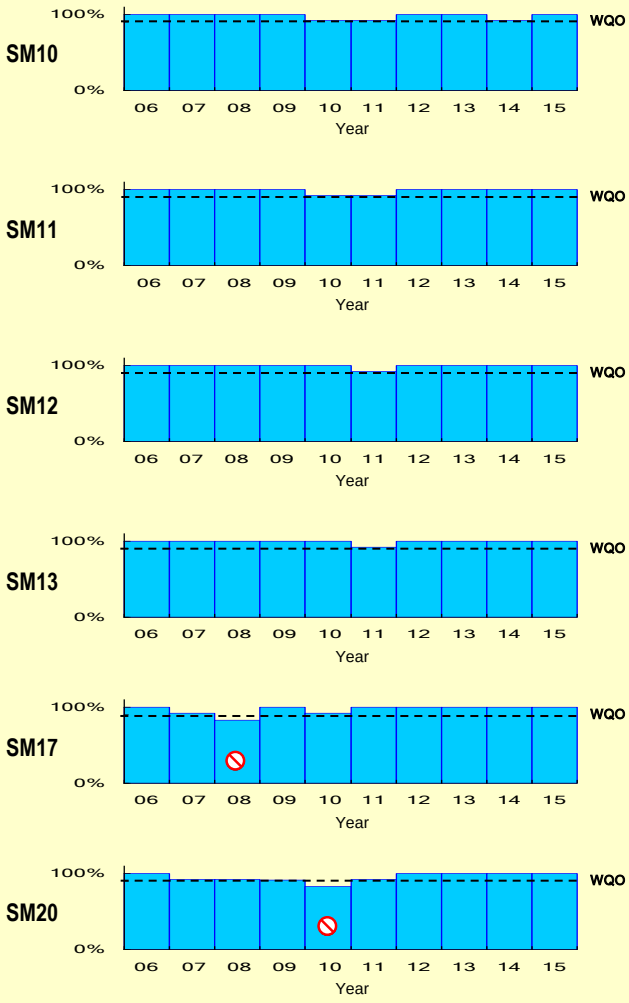
Non-compliance

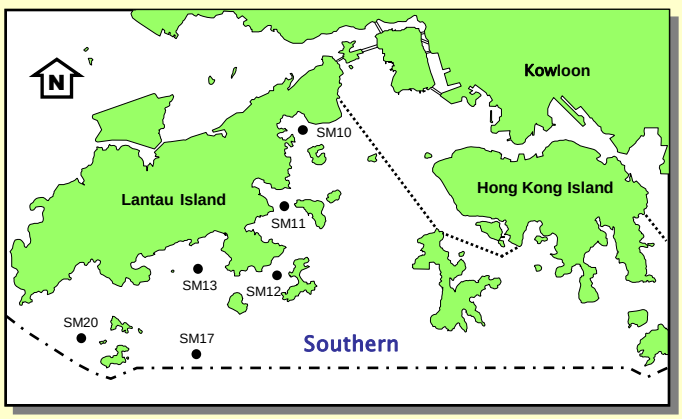
Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

Dissolved Oxygen (DO) (bottom)



Dissolved Oxygen (DO) (depth-averaged)



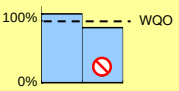


Dissolved Oxygen (DO)

1. Bottom

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

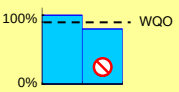
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

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

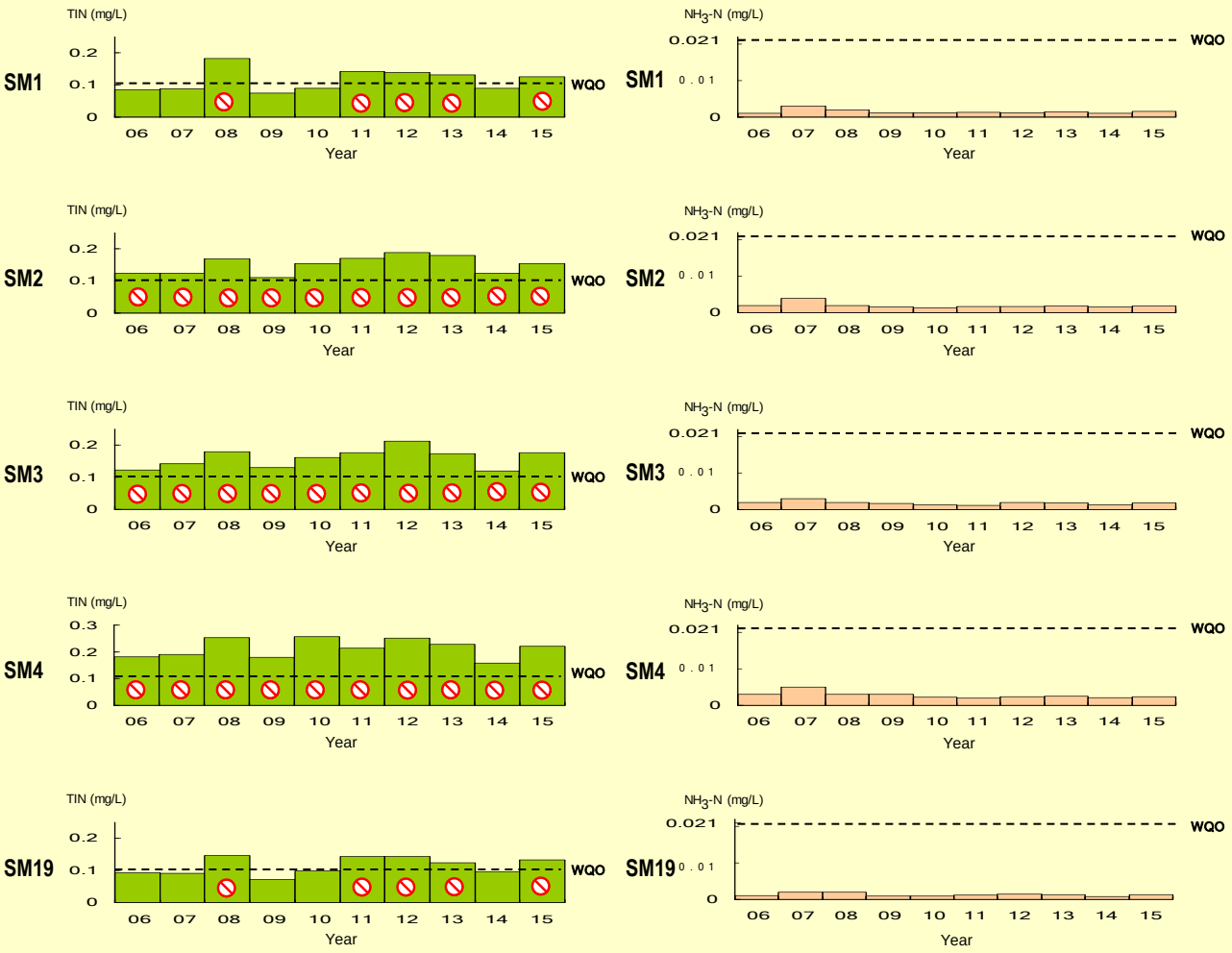


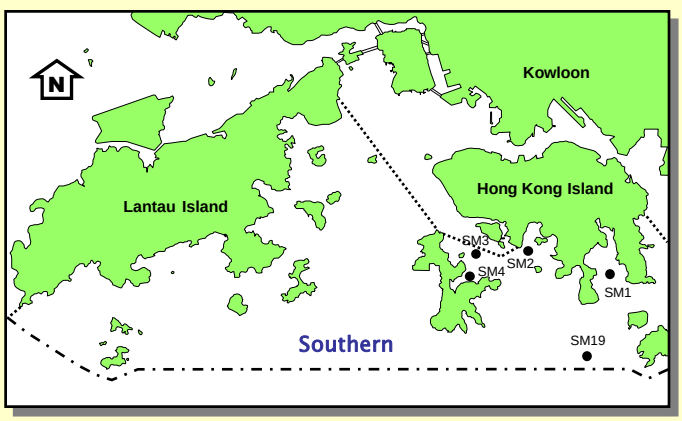
Non-compliance

Levels of compliance with key Water Quality Objectives in the 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

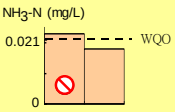
annual mean for depth-averaged TIN

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

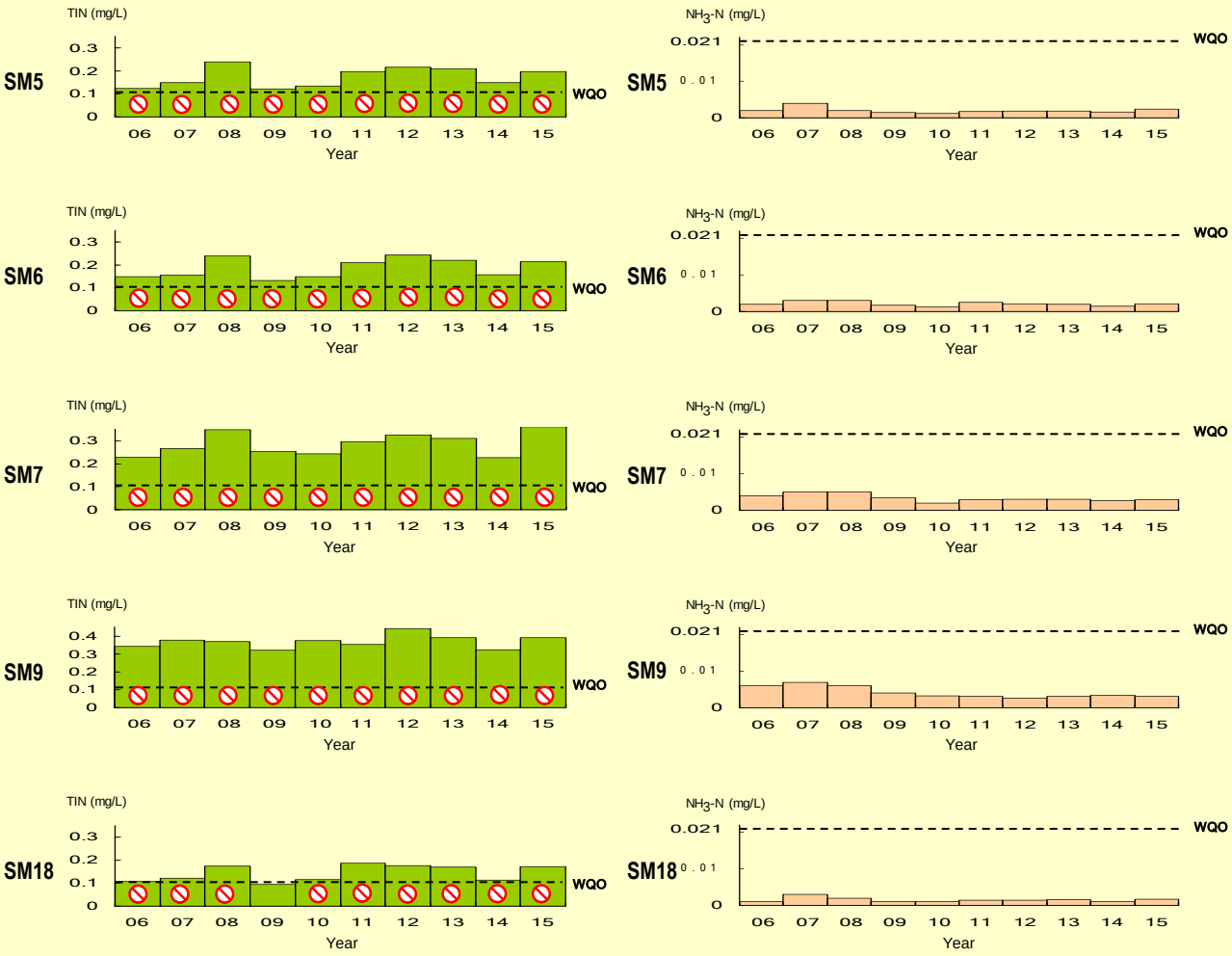
Non-compliance

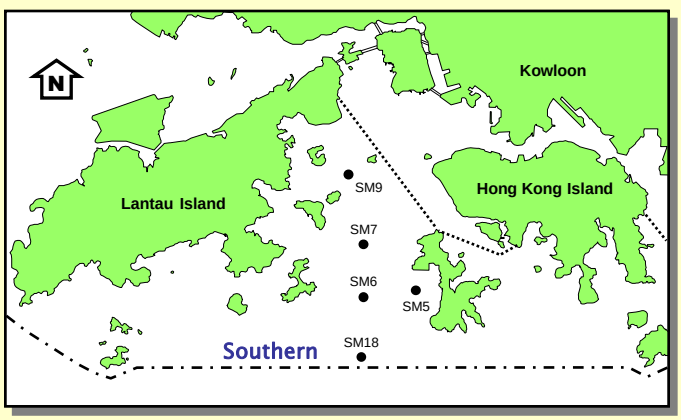


Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

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

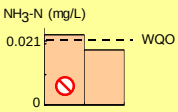
annual mean for depth-averaged TIN

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

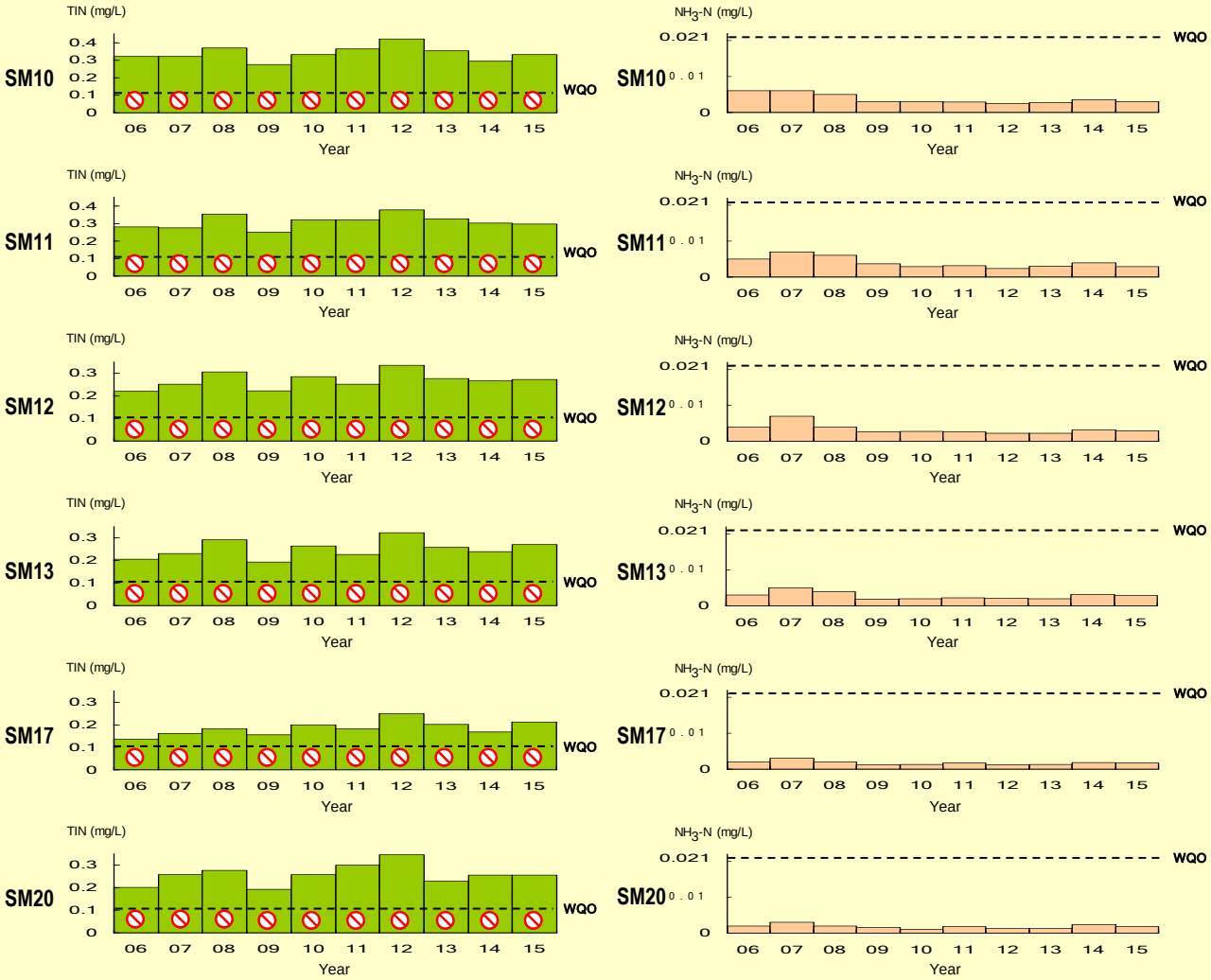
Non-compliance

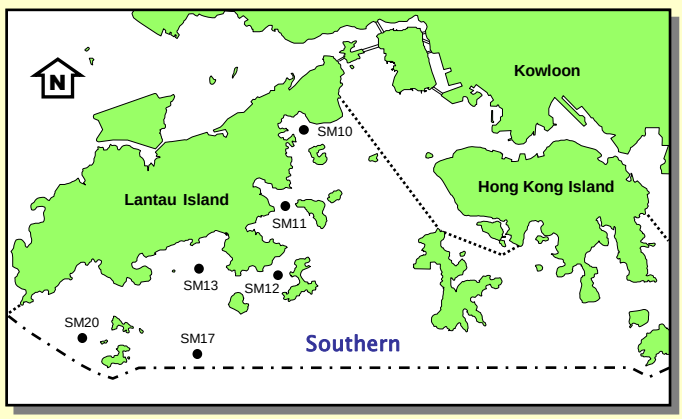


Levels of compliance with key Water Quality Objectives in the Southern WCZ (continued)

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

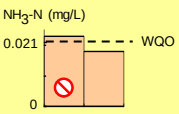
annual mean for depth-averaged TIN

Unionised Ammonia (NH_3-N)

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

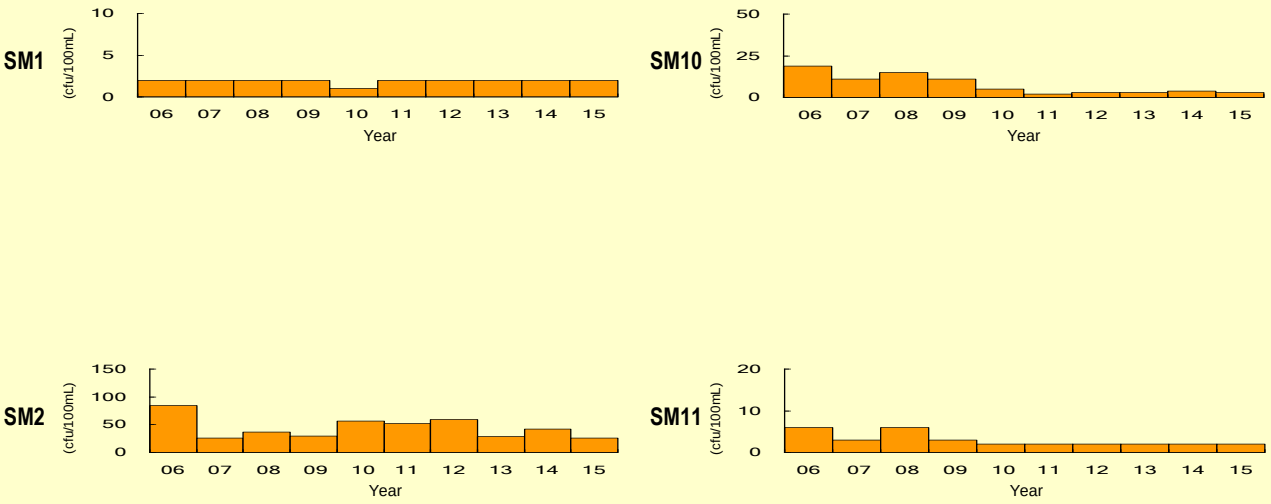
annual mean for depth-averaged NH_3-N

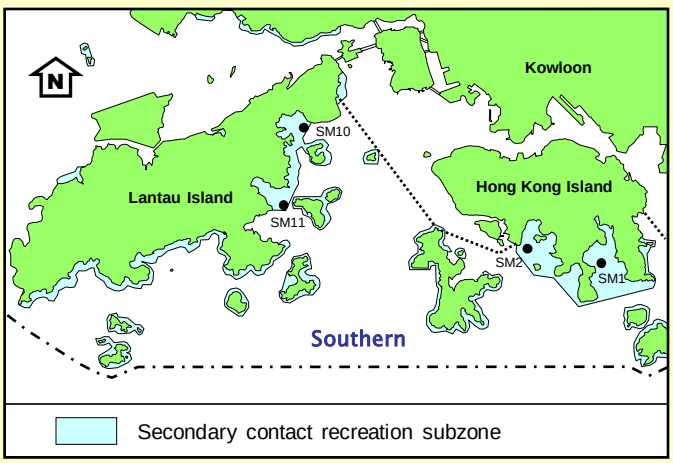
Non-compliance



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

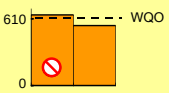
E. coli
(annual geometric mean)





E. coli

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

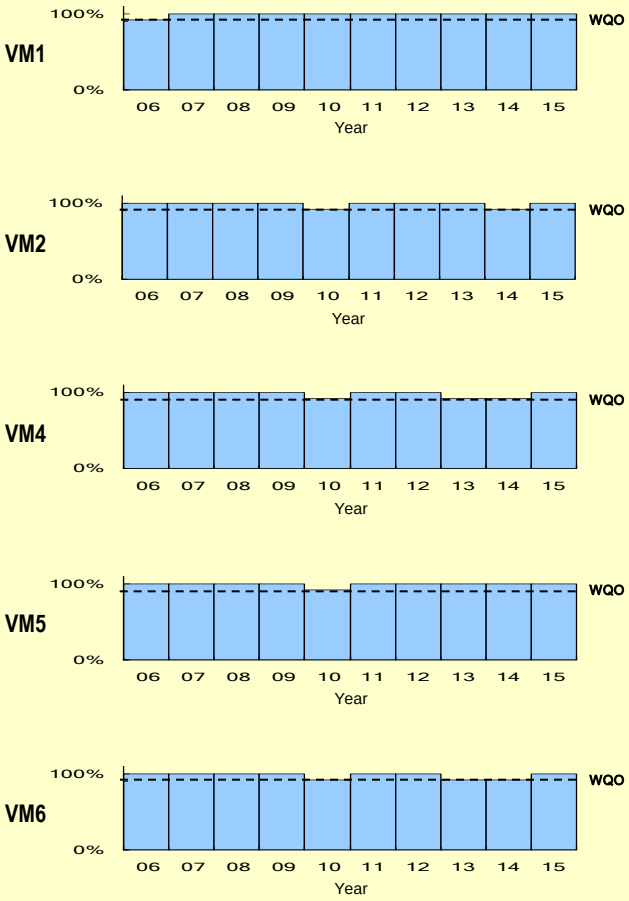


annual geometric mean for depth averaged *E. coli* (cfu/100mL)

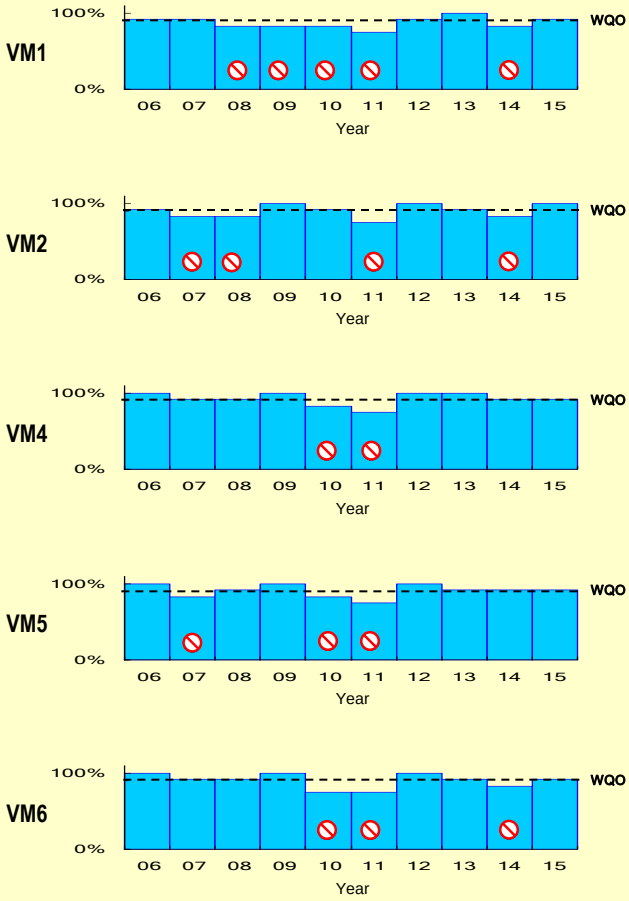
Non-compliance

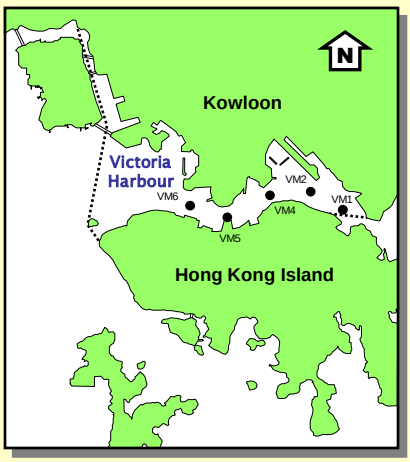
Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ

Dissolved Oxygen (DO) (bottom)



Dissolved Oxygen (DO) (depth-averaged)



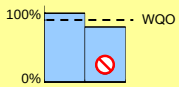


Dissolved Oxygen (DO)

1. Bottom

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

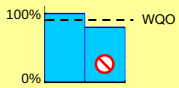
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

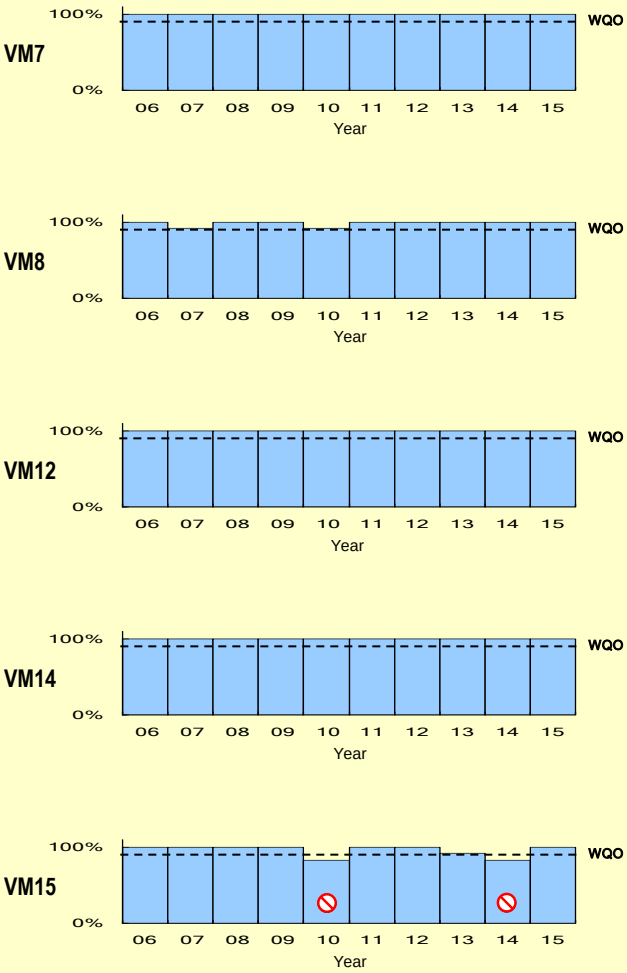
% sample with depth-averaged DO ≥ 4 mg/L



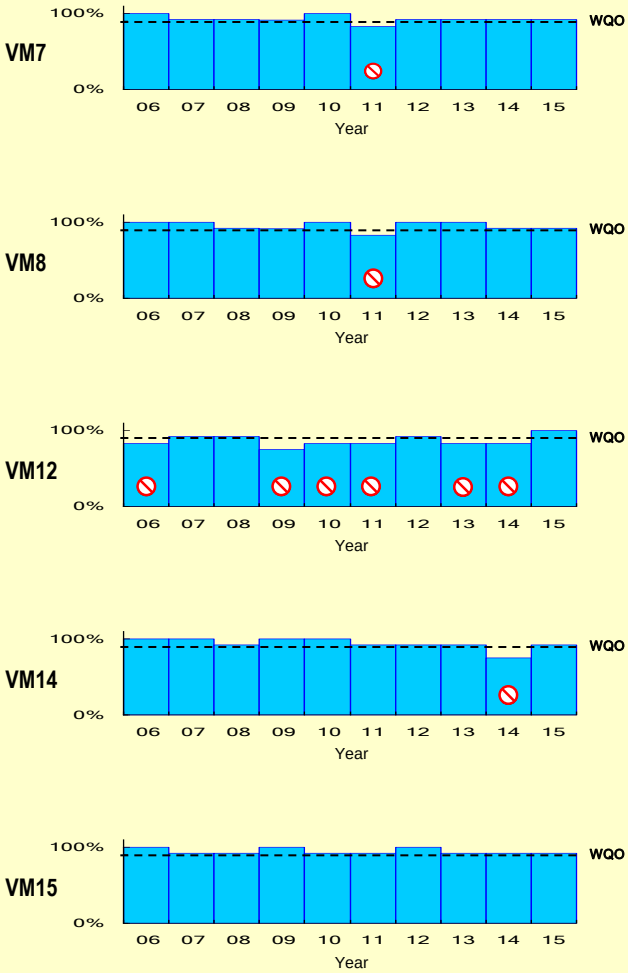
Non-compliance

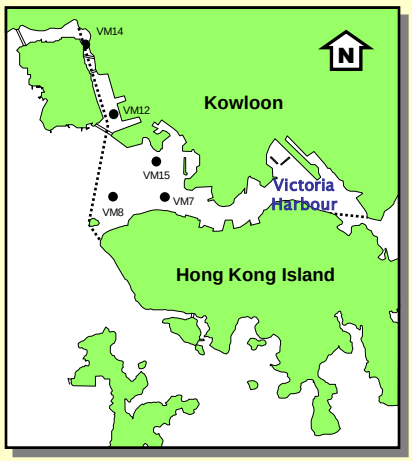
Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ (continued)

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

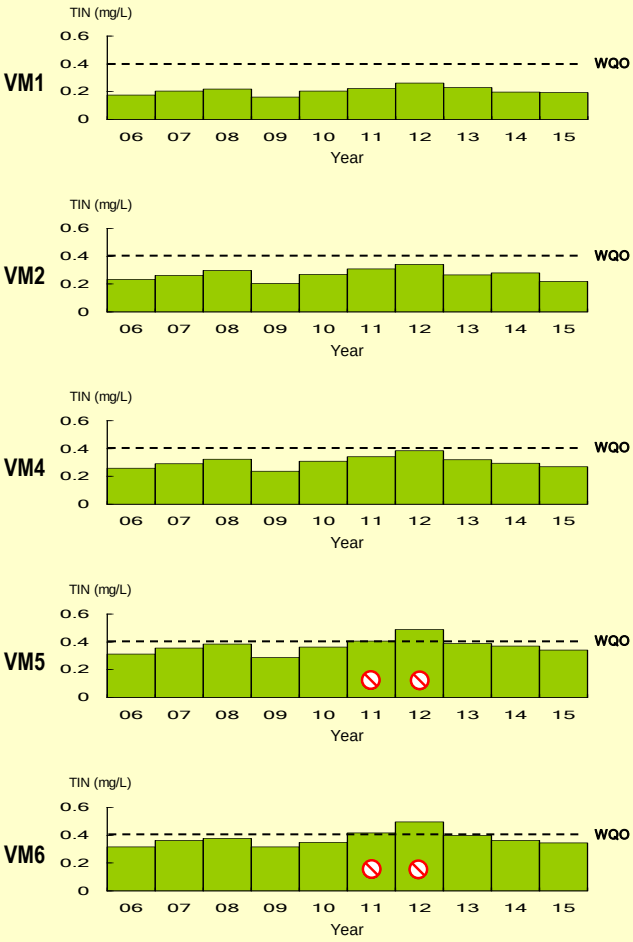
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

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

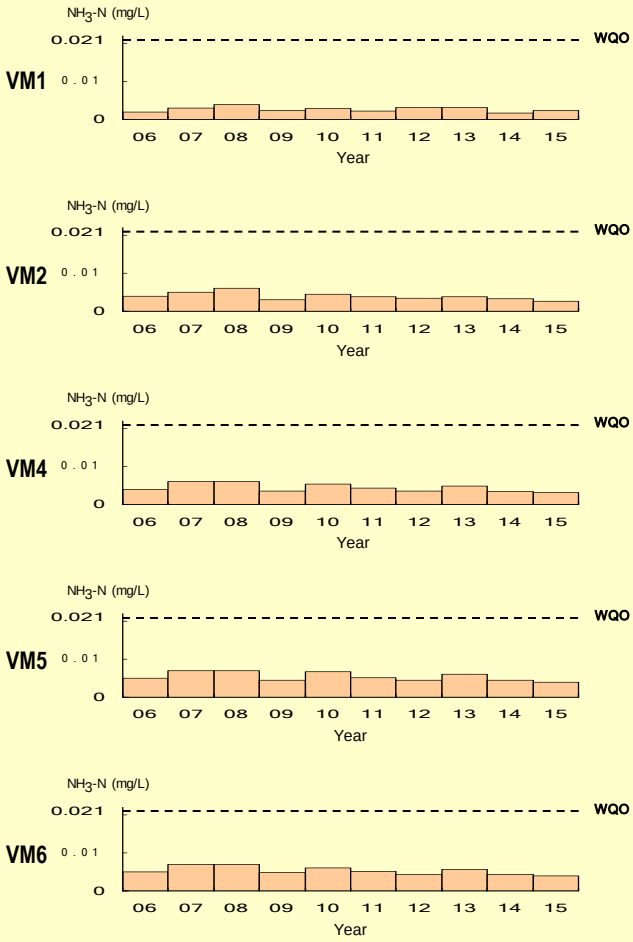
Non-compliance

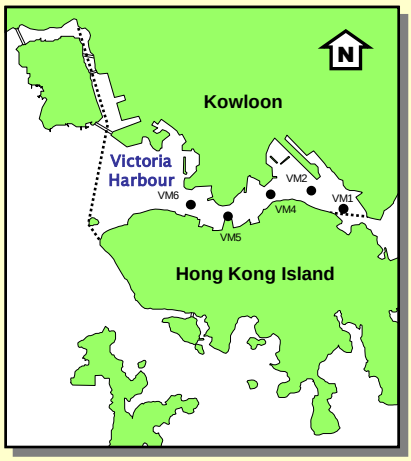
Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ (continued)

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

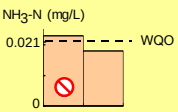
annual mean for depth-averaged TIN

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

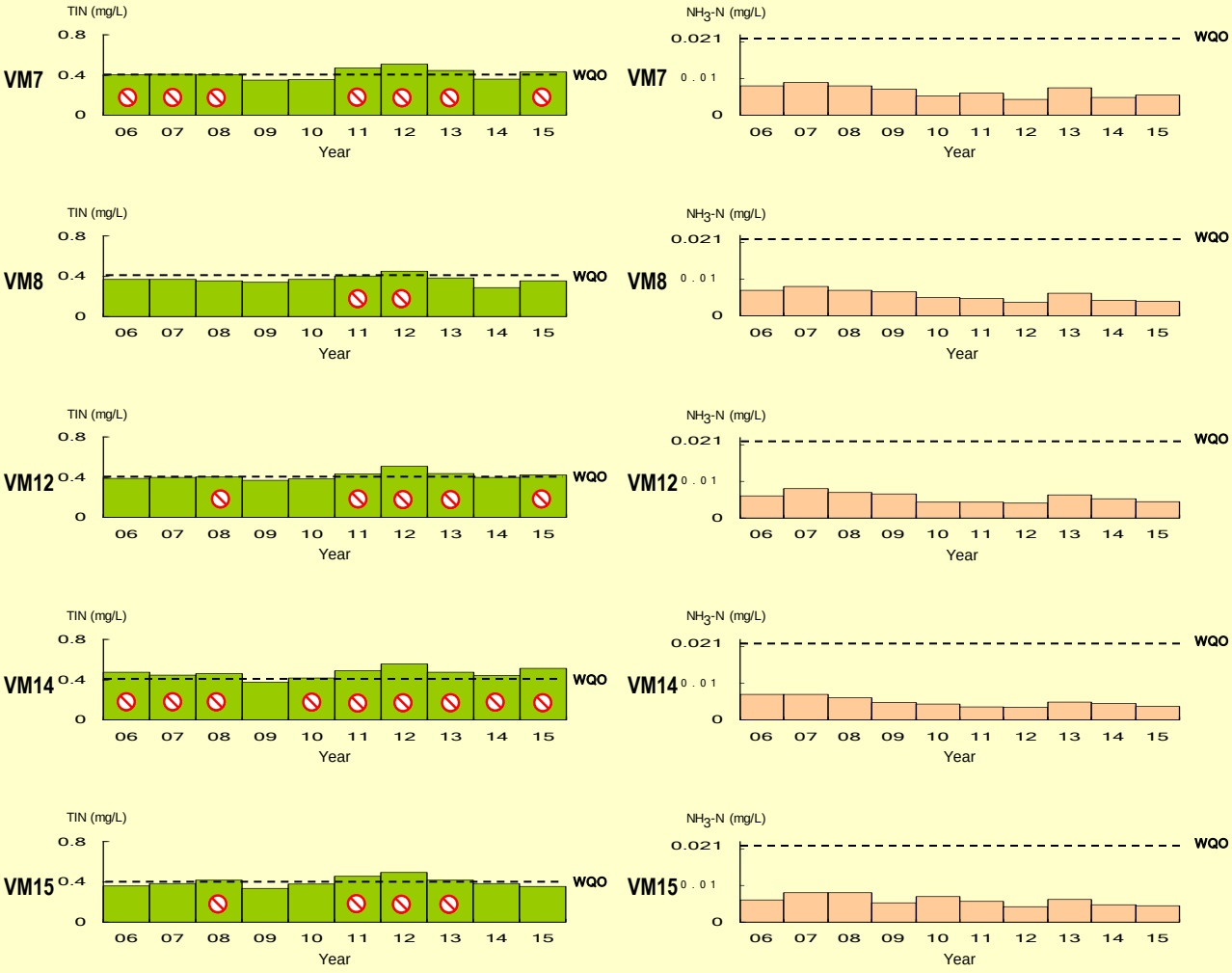
Non-compliance

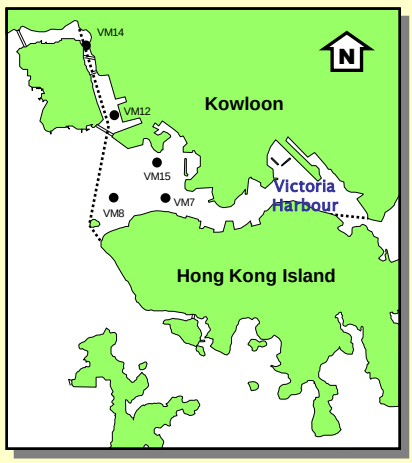


Levels of compliance with key Water Quality Objectives in the Victoria Harbour WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)

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

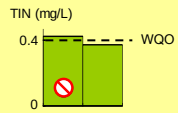




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

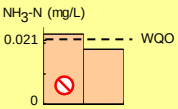


Unionised Ammonia (NH_3-N)

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

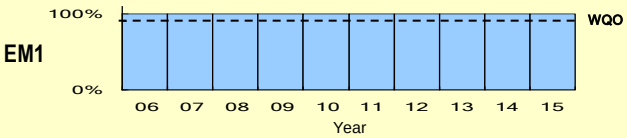
annual mean for depth-averaged NH_3-N

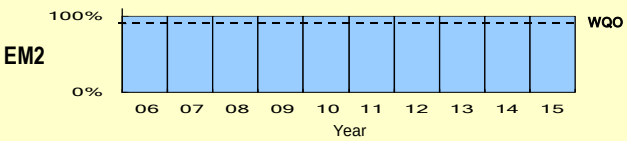
Non-compliance

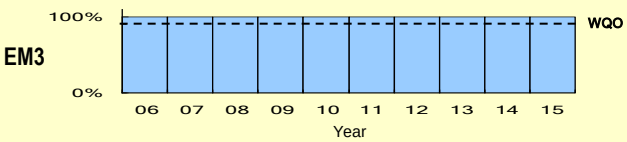


Levels of compliance with key Water Quality Objectives in the Eastern Buffer WCZ

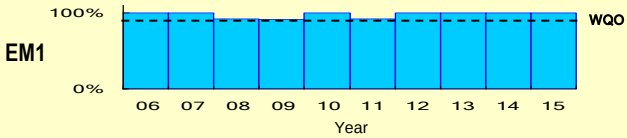
Dissolved Oxygen (DO) (bottom)

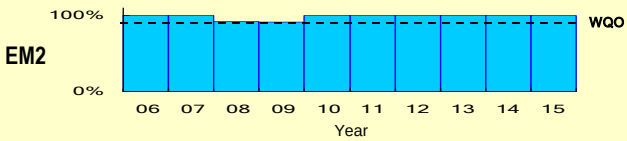


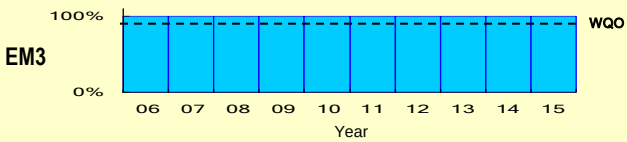


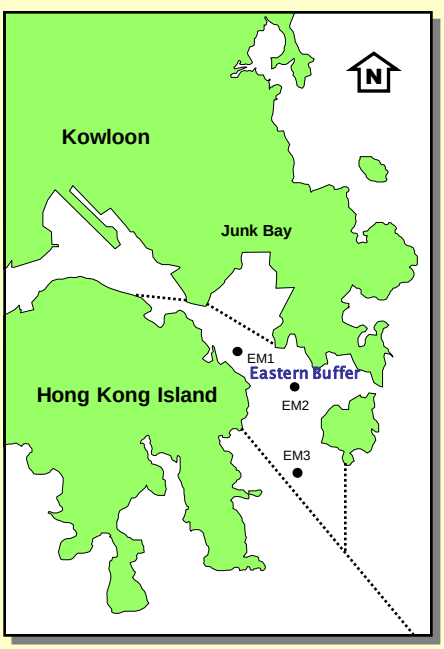


Dissolved Oxygen (DO) (depth-averaged)







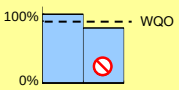


Dissolved Oxygen (DO)

1. Bottom

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

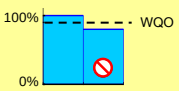
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

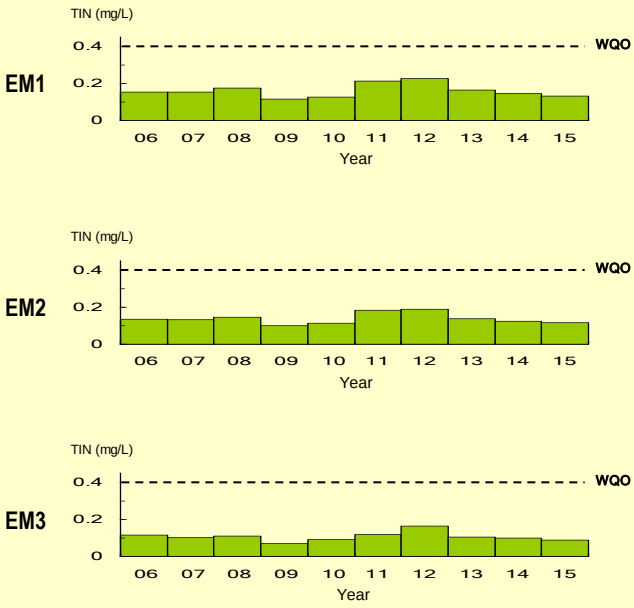
% sample with depth-averaged DO ≥ 4 mg/L



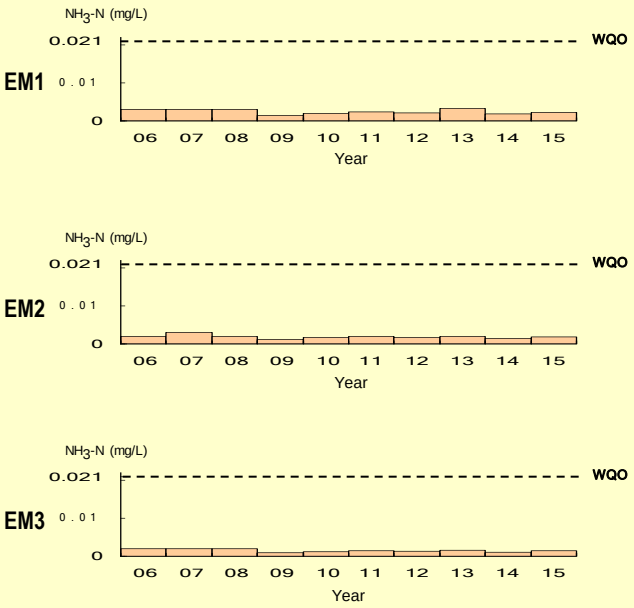
Non-compliance

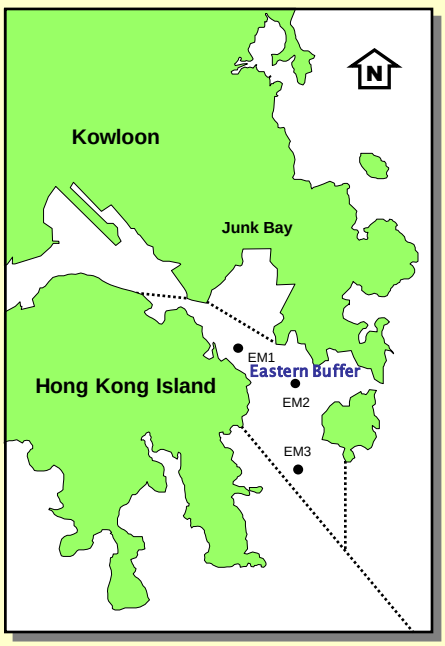
Levels of compliance with key Water Quality Objectives in the Eastern Buffer WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)



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

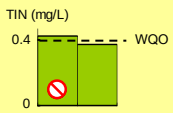




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

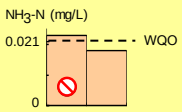


Unionised Ammonia (NH_3-N)

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

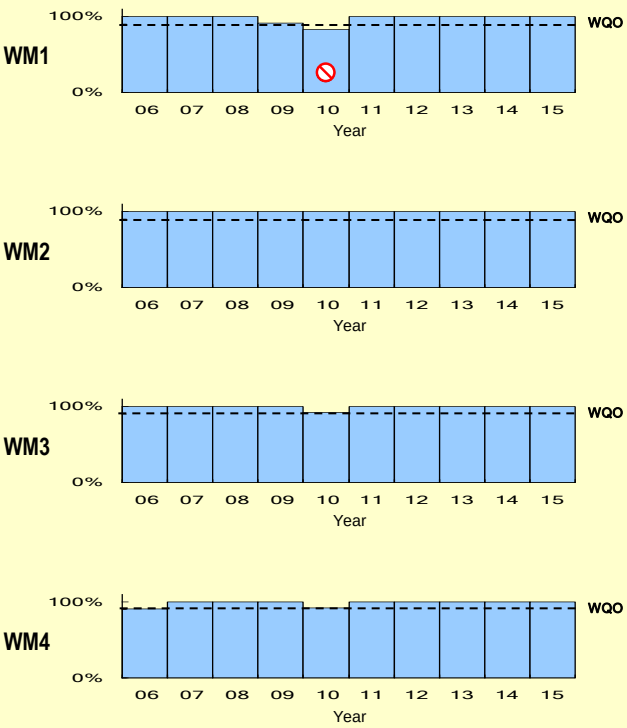
annual mean for depth-averaged NH_3-N

Non-compliance

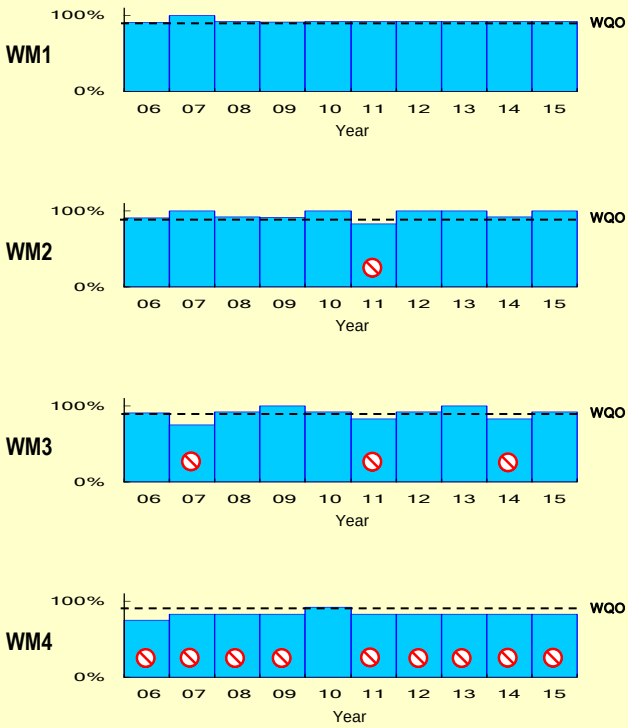


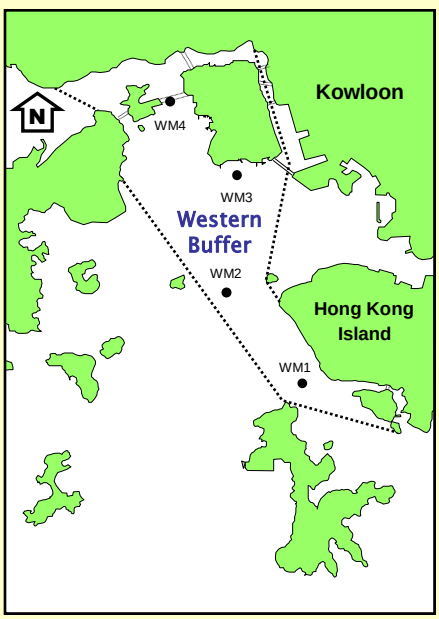
Levels of compliance with key Water Quality Objectives in the Western Buffer WCZ

Dissolved Oxygen (DO) (bottom)



Dissolved Oxygen (DO) (depth-averaged)



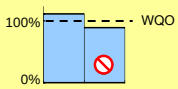


Dissolved Oxygen (DO)

1. Bottom

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

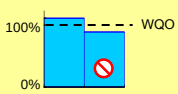
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

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

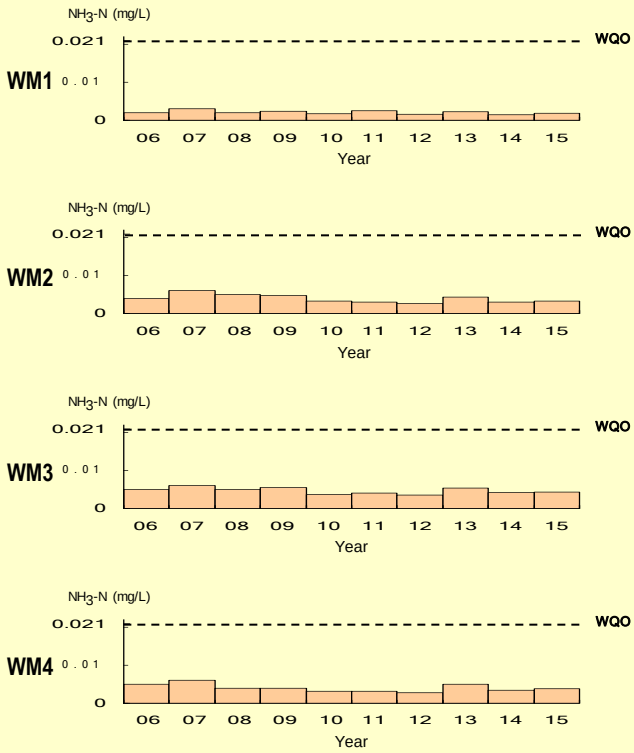


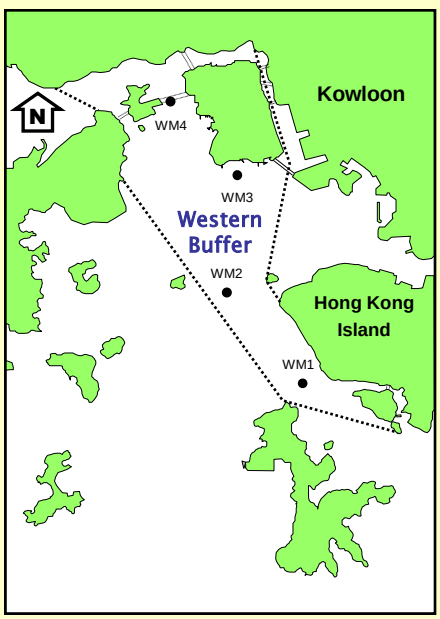
Non-compliance

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

Total Inorganic Nitrogen (TIN) (depth-averaged)

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

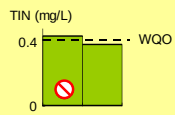




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

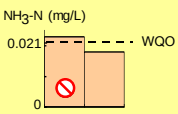


Unionised Ammonia (NH_3-N)

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

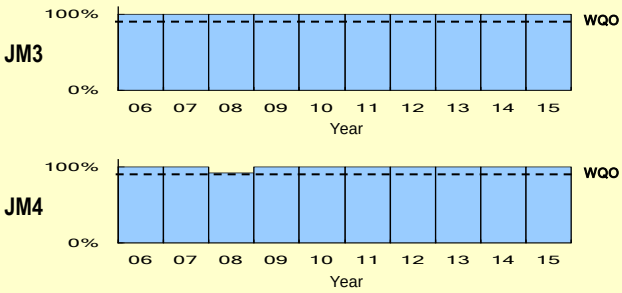
annual mean for depth-averaged NH_3-N

Non-compliance

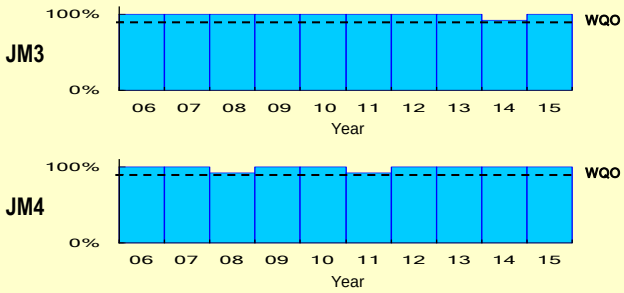


Levels of compliance with key Water Quality Objectives in the Junk Bay WCZ

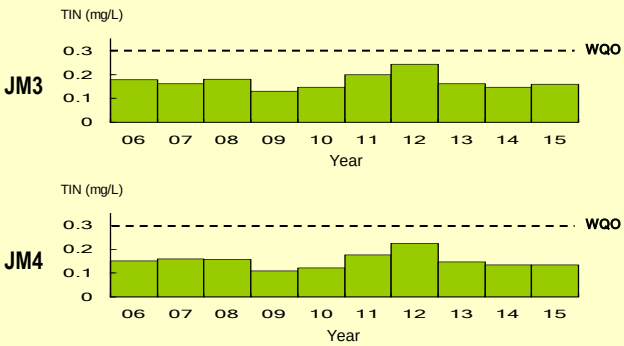
Dissolved Oxygen (DO)
(bottom)



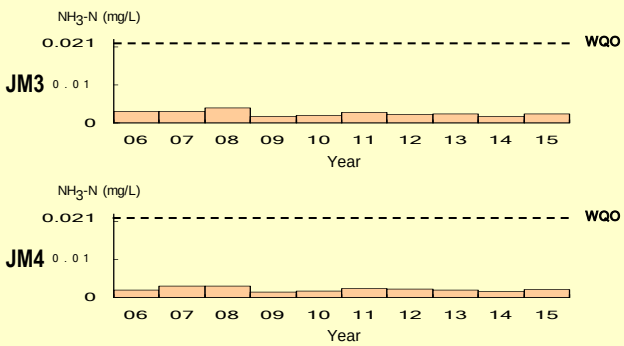
Dissolved Oxygen (DO)
(depth-averaged)

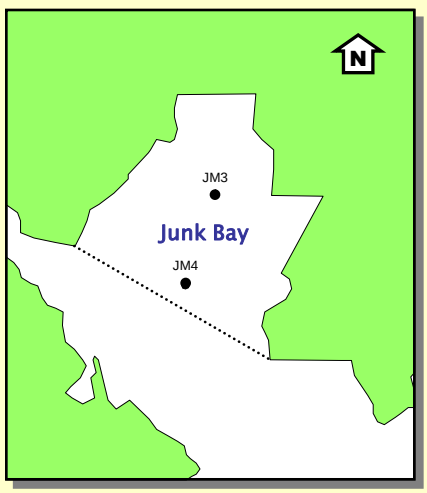


Total Inorganic Nitrogen (TIN)
(depth-averaged)



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



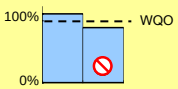


Dissolved Oxygen (DO)

1. Bottom

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

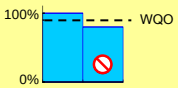
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

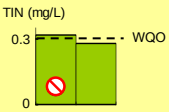
% sample with depth-averaged DO ≥ 4 mg/L



Total Inorganic Nitrogen (TIN)

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

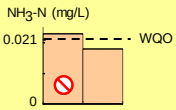
annual mean for depth-averaged TIN



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

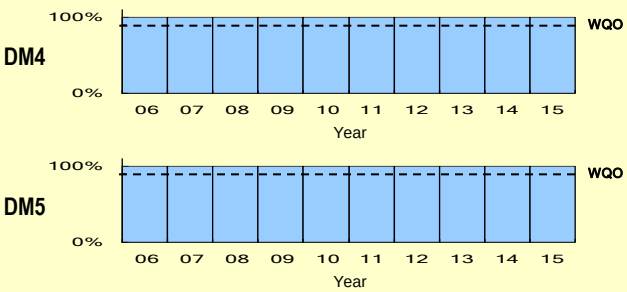
Levels of compliance with key Water Quality Objectives in the Deep Bay WCZ

Dissolved Oxygen (DO)
(bottom)

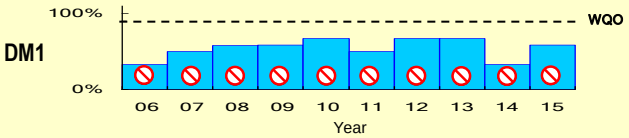
DM1 DO (bottom) not measured, water depth ≤ 3m

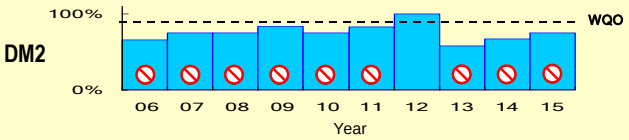
DM2 DO (bottom) not measured, water depth ≤ 3m

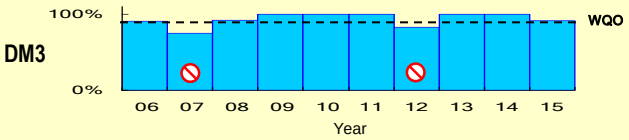
DM3 DO (bottom) not measured, water depth ≤ 3m

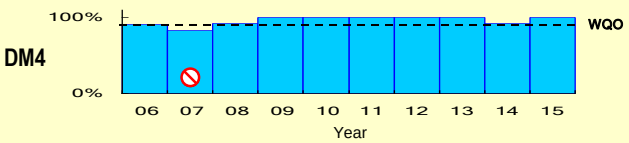


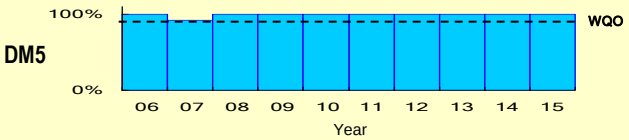
Dissolved Oxygen (DO)
(depth-averaged)

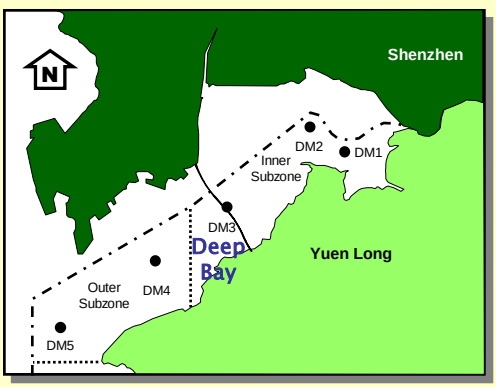










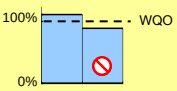


Dissolved Oxygen (DO)

1. Bottom

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

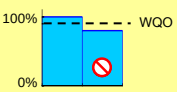
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

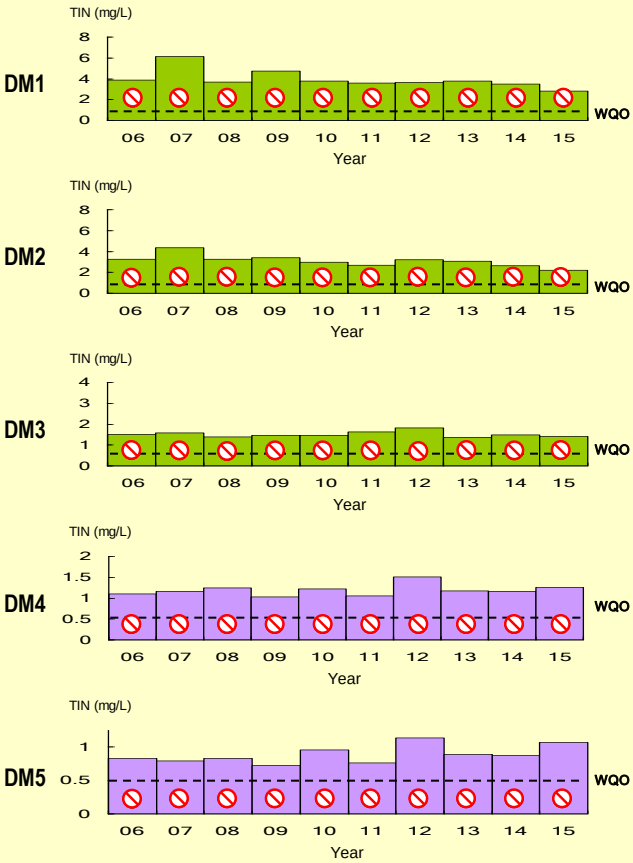
% sample with depth-averaged DO ≥ 4 mg/L



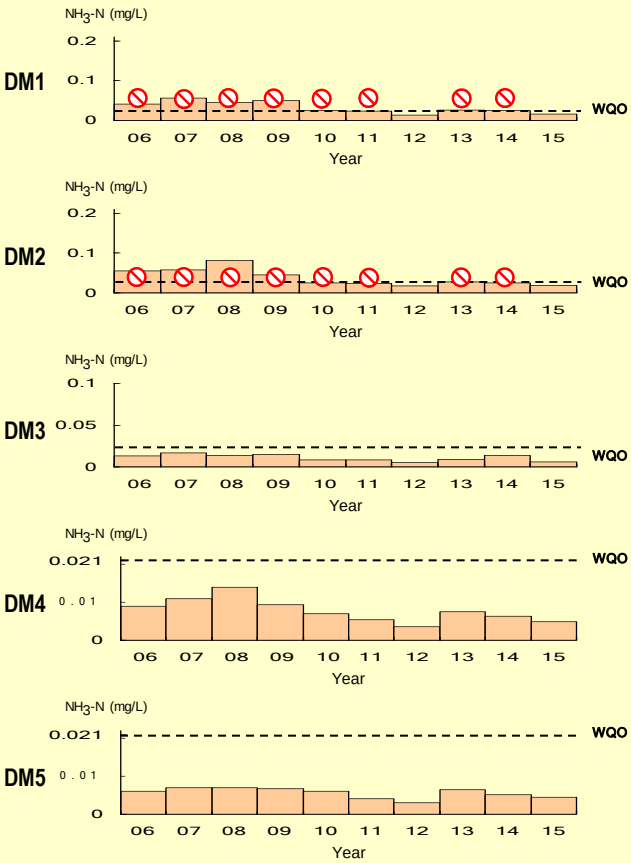
Non-compliance

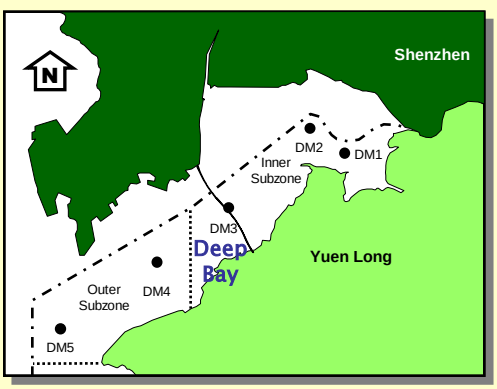
Levels of compliance with key Water Quality Objectives in the Deep Bay WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)



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



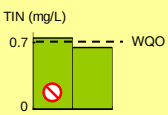


Total Inorganic Nitrogen (TIN)

Inner Subzone (DM1 - DM3)

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

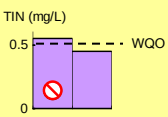
annual mean for depth-averaged TIN



Outer Subzone (DM4 - DM5)

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

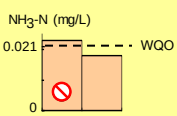
annual mean for depth-averaged TIN



Unionised Ammonia (NH_3-N)

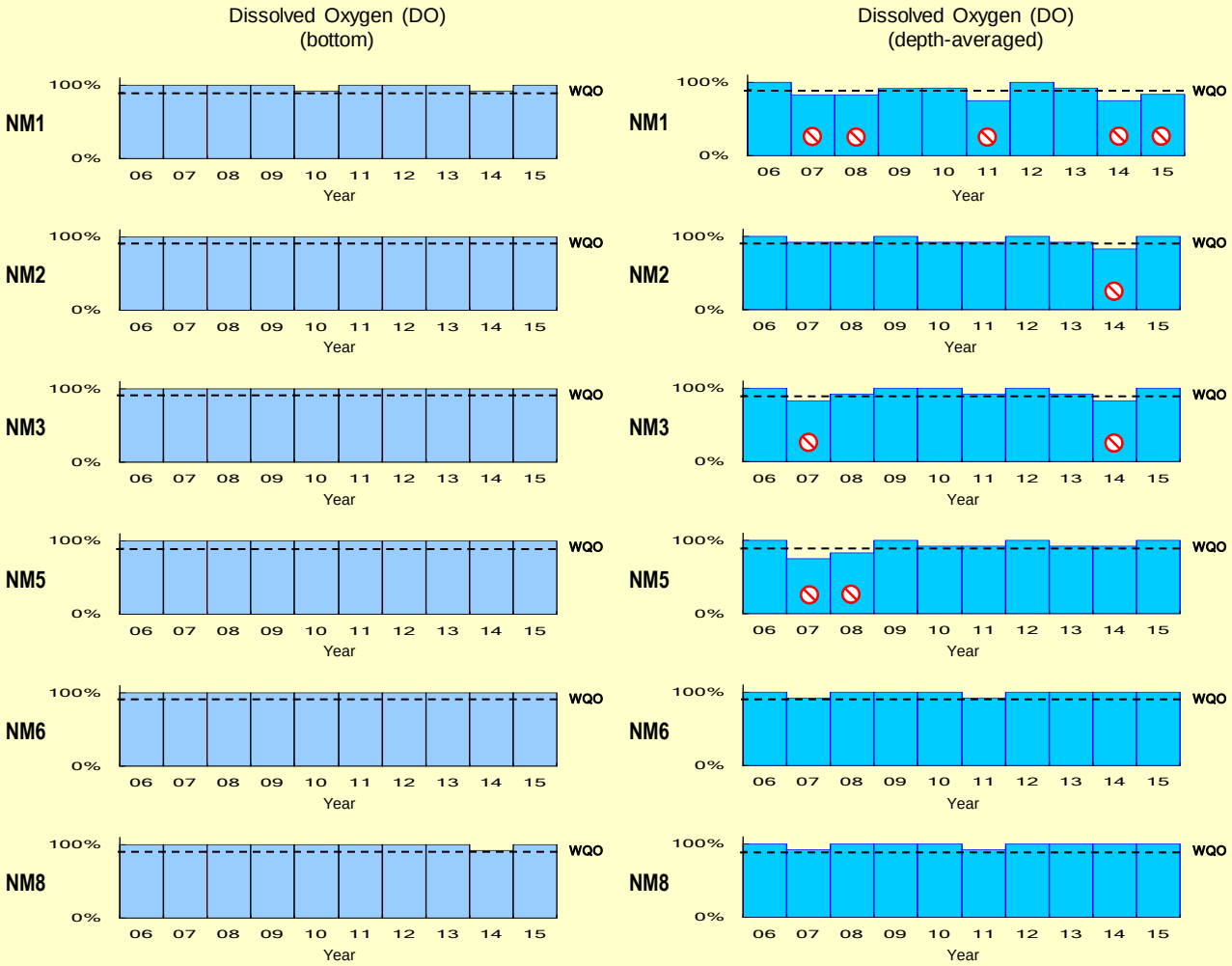
WQO: annual mean for depth-averaged NH_3-N ≤ 0.021 mg/L

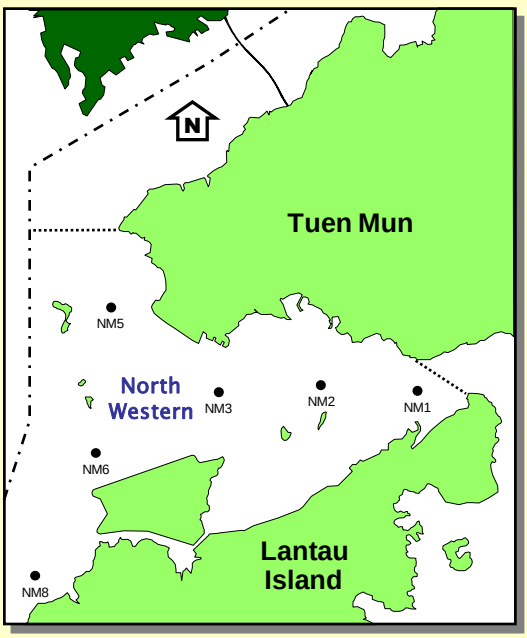
annual mean for depth-averaged NH_3-N



Non-compliance

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





Dissolved Oxygen (DO)

1. Bottom

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

% sample with bottom DO ≥ 2 mg/L

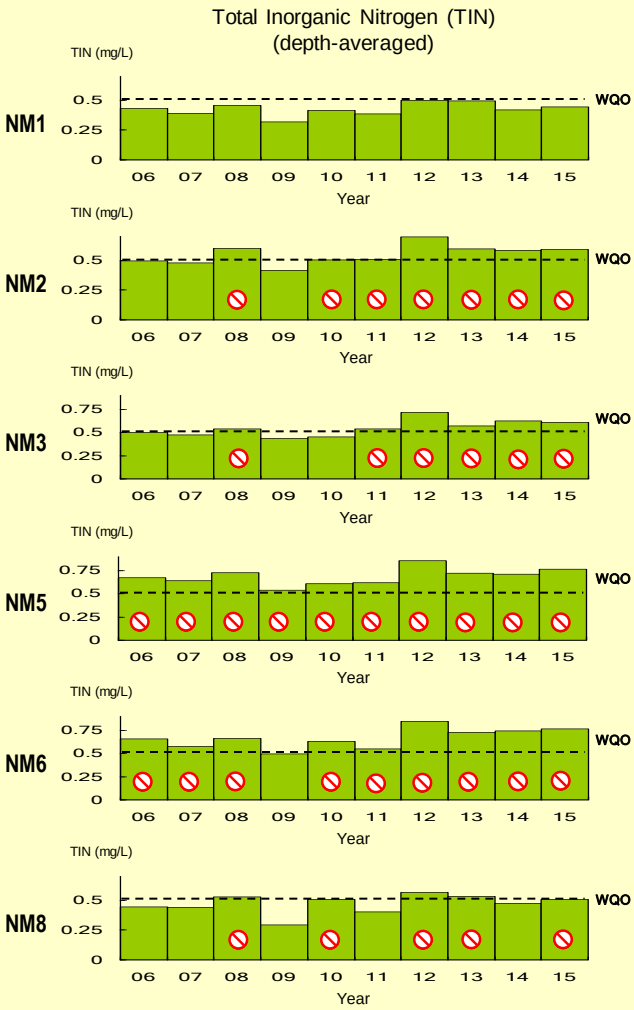
2. Depth-averaged

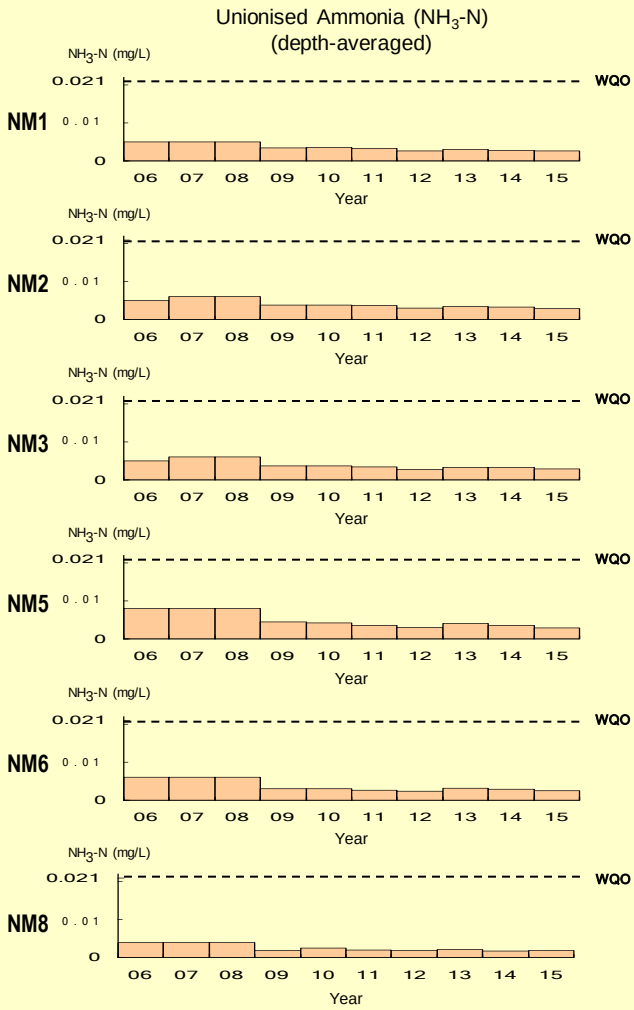
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

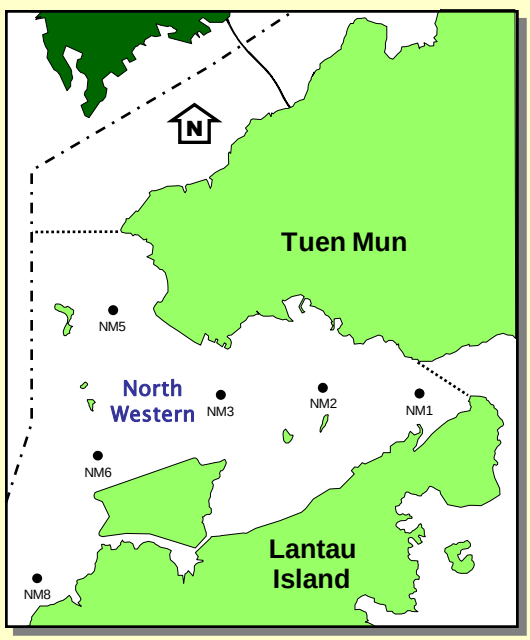
% sample with depth-averaged DO ≥ 4 mg/L

Non-compliance

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



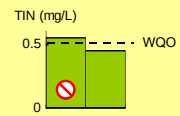




Total Inorganic Nitrogen (TIN)

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

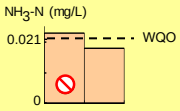
annual mean for depth-averaged TIN



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, 1991–2015

Monitoring Station		MM1	MM2	MM3	MM4	MM5	MM6	MM7
Monitoring Period		1991 – 2015	1991 – 2015	1991 – 2015	1991 – 2015	1991 – 2015	1991 – 2015	1991 – 2015
Parameter	Water Depth							
Temperature (°C)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	↗	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Salinity	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	↘	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
pH	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘
	Bottom	-	↘	↘	↘	-	↘	↘
	Average	↘	↘	↘	↘	-	↘	↘
Secchi disc depth (m)		↗	↘	↘	↘	↘	-	↘
Turbidity (NTU)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Suspended Solids (mg/L)	Surface	-	↗	↗	-	-	-	-
	Middle	-	↗	↗	↗	↗	-	↗
	Bottom	↘	-	↗	↗	-	-	↗
	Average	↘	-	↗	↗	-	-	↗
Total volatile solids (mg/L)	Surface	-	↗	↗	-	-	-	↗
	Middle	-	↗	↗	-	-	-	↗
	Bottom	-	-	↗	-	-	-	↗
	Average	-	-	↗	-	↗	-	↗
5-day Biochemical Oxygen Demand (mg/L)	Surface	↘	-	-	-	-	↘	-
	Middle	↘	-	-	-	-	-	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	-	-	-	-	↘	-
Ammonia nitrogen (mg/L)	Surface	↘	-	-	-	-	-	-
	Middle	↘	-	-	-	-	-	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	-	-	-	-	-	-
Unionised Ammonia (mg/L)	Surface	↘	↘	↘	-	-	-	-
	Middle	↘	-	-	-	-	↘	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	↘	↘	-	-	↘	-
Nitrite nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	↗	-	-	-	-	-	-
	Average	↗	-	↗	-	-	-	-
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	-	↗	-	-
	Middle	↗	↗	↗	↗	↗	-	-
	Bottom	↗	↗	↗	-	-	-	↗
	Average	↗	↗	↗	-	↗	-	-
Total inorganic nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Total Kjeldahl nitrogen (mg/L)	Surface	↘	-	-	-	-	-	-
	Middle	↘	-	-	-	-	-	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	-	-	-	-	-	-
Total nitrogen (mg/L)	Surface	↘	-	-	-	-	-	-
	Middle	↘	-	-	-	-	-	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	-	-	-	-	-	-
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	-	-	-	-	-	-
	Middle	↘	-	-	-	-	-	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	↘	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-	-	-	↘
	Middle	-	-	-	-	-	-	↘
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Chlorophyll-*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 – 2015 (continued)

Monitoring Station		MM8	MM13	MM14	MM15	MM16	MM17	MM19
Monitoring Period		1991 – 2015	1991 – 2015	1994 – 2015	1994 – 2015	1994 – 2015	1986 – 2015	2001 – 2015
Parameter	Water Depth							
Temperature (°C)	Surface	↗	-	-	-	-	-	-
	Middle	-	-	-	-	-	↗	-
	Bottom	-	-	-	-	-	↗	-
	Average	-	-	-	-	-	↗	-
Salinity	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-	-	↘	-
	Middle	↘	-	-	-	-	-	-
	Bottom	↘	-	-	-	↘	-	-
	Average	↘	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	↗	-	-	-	-	↘	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	↗	-	-	↘	↗	-
	Average	-	-	-	-	-	-	-
pH	Surface	-	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		-	↘	↘	-	-	↘	-
Turbidity (NTU)	Surface	-	-	-	-	-	-	↘
	Middle	-	-	-	-	-	-	↘
	Bottom	-	-	↘	↘	-	-	↘
	Average	-	-	-	-	-	-	↘
Suspended Solids (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	↘	-	-	-	-	-
	Bottom	-	-	-	-	-	↘	↘
	Average	-	-	-	-	-	↘	↘
Total volatile solids (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	-	-	-	↘	-
	Middle	↘	↘	-	-	-	↘	-
	Bottom	↘	↘	↘	↘	-	↘	↘
	Average	↘	↘	-	-	-	-	↘
Ammonia nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Unionised Ammonia (mg/L)	Surface	-	-	-	-	↘	-	-
	Middle	↘	-	-	-	-	-	-
	Bottom	↘	↘	-	-	↘	-	-
	Average	↘	↘	-	-	↘	-	-
Nitrite nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	↗	-	-	-	-	-	-
	Average	↗	↗	↗	-	-	-	-
Nitrate nitrogen (mg/L)	Surface	-	-	-	-	-	-	↗
	Middle	-	-	-	-	-	-	↗
	Bottom	↗	-	-	-	-	↗	↗
	Average	↗	-	-	↗	-	-	↗
Total inorganic nitrogen (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	↗	↗
	Average	-	-	-	-	-	-	-
Total Kjeldahl nitrogen (mg/L)	Surface	-	-	-	-	-	↘	↗
	Middle	-	-	-	-	-	↘	↗
	Bottom	-	-	-	-	-	↘	↗
	Average	-	-	-	-	-	↘	↗
Total nitrogen (mg/L)	Surface	-	-	-	-	-	↘	↗
	Middle	-	-	-	-	-	↘	↗
	Bottom	-	-	-	-	-	↘	↗
	Average	-	-	-	-	-	↘	↗
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	↘	-	-
	Bottom	↘	↘	-	↘	↘	-	-
	Average	↘	↘	↘	↘	↘	-	-
Total phosphorus (mg/L)	Surface	-	-	-	-	-	↘	-
	Middle	-	-	-	-	-	↘	-
	Bottom	-	-	-	-	-	↘	-
	Average	↘	↘	-	-	-	↘	-
Silica (mg/L)	Surface	-	↘	-	-	-	↘	-
	Middle	-	-	-	-	-	↘	-
	Bottom	-	-	-	-	-	↘	↗
	Average	-	-	-	-	-	↘	↗
Chlorophyll-*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 – 2015

Monitoring Station		PM1	PM2	PM3	PM4	PM6	PM7	PM8	PM9	PM11
Monitoring Period		1986 – 2015	1986 – 2015	1986 – 2015	1986 – 2015	1986 – 2015	1986 – 2015	1986 – 2015	1986 – 2015	1993 – 2015
Parameter	Water Depth									
Temperature (°C)	Surface	–	–	–	–	↗	–	↗	–	–
	Middle	↗	–	↗	–	↗	↗	↗	↗	–
	Bottom	↗	↗	↗	↗	↗	↗	↗	↗	–
	Average	↗	–	↗	↗	↗	↗	↗	↗	–
Salinity	Surface	–	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–	–
Dissolved Oxygen (mg/L)	Surface	–	–	↘	↘	↘	–	–	↘	–
	Middle	–	–	–	–	–	–	–	–	–
	Bottom	↗	↗	–	↗	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–	–
Dissolved Oxygen (%)	Surface	–	–	–	–	–	–	–	–	–
	Middle	↗	↗	↗	–	↗	↗	↗	–	–
	Bottom	↗	↗	↗	↗	–	–	–	↗	–
	Average	↗	–	–	–	–	–	–	–	–
pH	Surface	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	–	–	↗	–	–	–	–
Turbidity (NTU)	Surface	–	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–	–
Suspended Solids (mg/L)	Surface	–	↘	↘	–	↘	↘	↘	↘	–
	Middle	↘	↘	↘	↘	↘	–	↘	↘	–
	Bottom	↘	↘	–	↘	–	–	–	–	–
	Average	↘	↘	↘	↘	↘	↘	–	–	–
Total volatile solids (mg/L)	Surface	–	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–	–
5-day Biochemical Oxygen Demand (mg/L)	Surface	–	↘	–	–	↘	↘	–	–	–
	Middle	–	–	–	–	↘	–	↘	–	–
	Bottom	–	↘	–	–	↘	↘	↘	↘	↘
	Average	–	↘	–	–	↘	↘	↘	–	–
Ammonia nitrogen (mg/L)	Surface	–	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–	–
Unionised Ammonia (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	–
	Middle	↘	↘	–	–	↘	–	–	–	↘
	Bottom	↘	↘	↘	–	↘	–	↘	–	↘
	Average	↘	↘	↘	↘	↘	–	↘	↘	↘
Nitrite nitrogen (mg/L)	Surface	–	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	↗	–	↗
	Average	–	–	–	–	–	–	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	–	–	–	–	–	–	–	↗	↗
	Middle	–	–	–	–	–	–	↗	↗	↗
	Bottom	–	–	–	–	–	↗	↗	↗	↗
	Average	–	–	–	–	–	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	–	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	↗	↗	↗	↗
	Average	–	–	–	–	–	–	↗	–	–
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	–
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	–
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	–
	Average	↘	↘	↘	↘	↘	↘	↘	↘	–
Total nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	–
	Middle	↘	↘	–	–	↘	↘	↘	↘	–
	Bottom	↘	↘	↘	↘	↘	–	–	↘	–
	Average	↘	↘	↘	↘	↘	–	↘	↘	–
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	–	–	–	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	–	↘	↘	–	↘	–	–	–	–
	Middle	↘	↘	–	–	↘	–	–	–	–
	Bottom	↘	↘	↘	↘	↘	–	–	–	–
	Average	↘	↘	↘	↘	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	–	–	–	–	–	–	↘	–	–
	Middle	↘	↘	↘	–	–	↘	↘	↘	–
	Bottom	↘	↘	–	↘	–	–	–	–	–
	Average	↘	↘	–	↘	–	–	–	–	–
Chlorophyll-*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 – 2015

Monitoring Station		TM2	TM3	TM4	TM5	TM6	TM7	TM8
Monitoring Period		1986 – 2015	1986 – 2015	1986 – 2015	1988 – 2015	1986 – 2015	1988 – 2015	1986 – 2015
Parameter	Water Depth							
Temperature (°C)	Surface	↗	↗	↗	↗	↗	↗	↗
	Middle	NA	↗	↗	NA	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗
Salinity	Surface	↗	-	↗	-	-	↗	↗
	Middle	NA	-	-	NA	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	↗	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	↘	↘	↘	↘	↘	↘
	Middle	NA	↗	-	NA	↗	-	-
	Bottom	↗	↗	↗	↗	↗	↗	-
	Average	↗	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	-	↘	↘	↘	↘	↘	↘
	Middle	NA	↗	-	NA	↗	-	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗
	Average	↗	-	-	-	-	-	-
pH	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗	-
Turbidity (NTU)	Surface	-	-	-	-	-	-	-
	Middle	NA	-	-	NA	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	-	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	↘
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	↘	↘	↘	↘	↘	↘	-
Unionised Ammonia (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	↘
Nitrite nitrogen (mg/L)	Surface	↘	↘	-	-	-	-	-
	Middle	NA	↘	↘	NA	↘	-	-
	Bottom	↘	↘	↘	-	↘	↘	-
	Average	↘	↘	↘	-	↘	↘	-
Nitrate nitrogen (mg/L)	Surface	↘	↘	↘	-	↘	-	-
	Middle	NA	↘	↘	NA	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	-
Total inorganic nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	-
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Total nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-	-	-	-
	Middle	NA	-	-	NA	-	↘	↘
	Bottom	-	↘	-	-	-	↘	-
	Average	-	-	-	-	-	-	-
Chlorophyll-*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 – 2015

Monitoring Station		SM1	SM2	SM3	SM4	SM5	SM6	SM7	SM9
Monitoring Period		1986 I 2015	1986 I 2015	1986 I 2015	1986 I 2015	1986 I 2015	1986 I 2015	1986 I 2015	1988 I 2015
Parameter	Water Depth								
Temperature (°C)	Surface	–	–	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	–	↗	↗	↗	↗	↗
	Bottom	–	–	↗	↗	↗	↗	↗	↗
	Average	↗	–	↗	↗	↗	↗	↗	↗
Salinity	Surface	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–
Dissolved Oxygen (mg/L)	Surface	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	↗
	Bottom	–	–	–	–	–	–	–	–
	Average	–	–	↘	–	–	–	–	–
Dissolved Oxygen (%)	Surface	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	↗
	Bottom	–	–	–	–	–	–	–	↗
	Average	–	–	–	–	–	–	–	↗
pH	Surface	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		–	↗	↗	↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	↘
	Average	–	–	–	–	–	–	–	–
Suspended Solids (mg/L)	Surface	–	–	↘	↘	–	–	–	↘
	Middle	–	–	–	↘	–	–	–	↘
	Bottom	–	–	–	↘	–	–	–	↘
	Average	–	–	–	↘	–	–	–	↘
Total volatile solids (mg/L)	Surface	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–
5-day Biochemical Oxygen Demand (mg/L)	Surface	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–
Ammonia nitrogen (mg/L)	Surface	–	–	↗	↗	–	–	–	–
	Middle	–	–	–	↗	–	–	–	↗
	Bottom	–	–	–	–	–	–	–	↗
	Average	–	–	–	↗	–	–	–	–
Unionised Ammonia (mg/L)	Surface	↘	↘	–	–	–	–	–	–
	Middle	↘	↘	↘	–	–	–	–	–
	Bottom	↘	↘	–	–	–	–	–	–
	Average	↘	↘	–	–	–	–	–	–
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗	↗	↗	↗
	Bottom	–	↗	–	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗	–	↗	↗
	Bottom	↗	↗	–	↗	↗	–	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	–	–	↗	↗
	Bottom	–	↗	↗	↗	↗	–	↗	↗
	Average	↗	↗	↗	↗	↗	–	↗	↗
Total Kjeldahl nitrogen (mg/L)	Surface	–	↘	–	↘	–	–	↘	–
	Middle	–	–	–	–	–	–	–	–
	Bottom	↘	↘	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–
Total nitrogen (mg/L)	Surface	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	–	↘	–	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	–	–	–	–	–	–	↘	↘
	Middle	–	–	↘	↘	–	–	↘	↘
	Bottom	–	–	–	↘	–	–	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	–	–	–	–	–	–	–	–
	Middle	–	–	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–	–	–
	Average	–	–	–	–	–	–	–	–
Chlorophyll-*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 – 2015 (continued)

Monitoring Station		SM10	SM11	SM12	SM13	SM17	SM18	SM19	SM20
Monitoring Period		1986 – 2015	1986 – 2015	1986 – 2015	1986 – 2015	1989 – 2015	1989 – 2015	1989 – 2015	1999 – 2015
Parameter	Water Depth								
Temperature (°C)	Surface	↗	↗	↗	↗	↗	↗	-	-
	Middle	NA	↗	↗	↗	↗	↗	-	-
	Bottom	↗	↗	↗	↗	↗	-	-	-
	Average	↗	↗	↗	↗	↗	↗	-	-
Salinity	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	↗	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
pH	Surface	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗	-	↗
Turbidity (NTU)	Surface	-	-	-	-	-	-	-	↗
	Middle	NA	-	-	-	-	-	-	↗
	Bottom	-	-	-	-	-	-	-	↗
	Average	-	-	-	-	-	-	-	↗
Suspended Solids (mg/L)	Surface	↘	↘	-	-	-	↘	-	↘
	Middle	NA	-	-	-	↘	↘	-	↘
	Bottom	↘	-	-	-	-	-	-	↘
	Average	↘	↘	-	-	↘	-	-	↘
Total volatile solids (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	↘	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Ammonia nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	↗	-	-	-	-	-	-
	Average	-	↗	-	-	-	-	-	-
Unionised Ammonia (mg/L)	Surface	-	-	-	↘	↘	-	-	-
	Middle	NA	-	-	-	↘	-	↘	-
	Bottom	-	-	-	-	↘	-	↘	-
	Average	-	-	-	-	↘	-	↘	-
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗	↗	↗
	Middle	NA	↗	↗	↗	↗	-	↗	↗
	Bottom	↗	↗	↗	↗	↗	-	↗	↗
	Average	↗	↗	↗	↗	↗	-	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗	↗	↗
	Middle	NA	↗	↗	↗	↗	-	↗	-
	Bottom	↗	↗	↗	↗	-	-	↗	-
	Average	↗	↗	↗	↗	↗	-	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	-	-	↗
	Middle	NA	↗	↗	↗	↗	-	-	↗
	Bottom	↗	↗	↗	↗	-	-	-	↗
	Average	↗	↗	↗	↗	↗	-	-	↗
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	-	-	-	-	-	↗
	Middle	NA	-	-	-	-	-	-	↗
	Bottom	-	-	-	-	-	-	-	↗
	Average	↘	-	-	-	-	-	-	↗
Total nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	↗
	Middle	NA	-	-	-	-	-	-	↗
	Bottom	-	-	-	-	-	-	-	↗
	Average	-	-	-	-	-	-	-	↗
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	-
	Middle	NA	↘	↘	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	↘	-
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	-	-	-	-
	Middle	NA	↘	↘	↘	-	-	-	-
	Bottom	↘	↘	↘	↘	↘	-	-	-
	Average	↘	↘	↘	↘	↘	↘	↘	-
Silica (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	↘	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Chlorophyll-*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 – 2015

Monitoring Station		VM1	VM2	VM4	VM5	VM6
Monitoring Period		1988 – 2015	1988 – 2015	1988 – 2015	1986 – 2015	1988 – 2015
Parameter	Water Depth					
Temperature (°C)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-
	Middle	↗	-	-	-	-
	Bottom	↗	-	-	-	-
	Average	↗	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Dissolved Oxygen (%)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
pH	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	-
	Average	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	-	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Total volatile solids (mg/L)	Surface	↘	↘	↘	-	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	-	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
5-day Biochemical Oxygen Demand (mg/L)	Surface	↘	↘	↘	-	-
	Middle	↘	↘	↘	-	-
	Bottom	↘	↘	↘	-	-
	Average	↘	↘	↘	-	-
Ammonia nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Nitrite nitrogen (mg/L)	Surface	-	-	-	↗	↗
	Middle	-	-	-	↗	-
	Bottom	↘	-	-	-	-
	Average	-	-	-	-	-
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	-	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↘	↘	-	-	-
	Middle	↘	↘	↘	-	-
	Bottom	↘	↘	↘	-	↘
	Average	↘	↘	↘	-	-
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Total nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-	-
	Middle	↘	-	-	-	-
	Bottom	-	↘	-	-	-
	Average	-	-	-	-	-
Chlorophyll-*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 – 2015 (continued)

Monitoring Station		VM7	VM8	VM12	VM14	VM15
Monitoring Period		1986 – 2015	1986 – 2015	1986 – 2015	1986 – 2015	1993 – 2015
Parameter	Water Depth					
Temperature (°C)	Surface	↗	↗	↗	↗	-
	Middle	↗	↗	↗	↗	-
	Bottom	↗	↗	↗	↗	-
	Average	↗	↗	↗	↗	-
Salinity	Surface	-	-	-	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	-
	Average	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	-	↗	-	↗
	Middle	↗	-	↗	↗	↗
	Bottom	↗	-	↗	↗	↗
	Average	↗	-	↗	↗	↗
Dissolved Oxygen (%)	Surface	↗	-	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	-	↗	↗	↗
pH	Surface	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	-
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	-
	Average	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	-	↘	↘
	Middle	↘	↘	-	↘	↘
	Bottom	↘	↘	-	↘	↘
	Average	↘	↘	-	↘	↘
Total volatile solids (mg/L)	Surface	↘	↘	-	↘	↘
	Middle	↘	↘	-	↘	↘
	Bottom	↘	↘	-	↘	↘
	Average	↘	↘	-	↘	↘
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	↘	↘	-
	Middle	-	-	↘	↘	-
	Bottom	-	-	↘	↘	-
	Average	-	-	↘	↘	-
Ammonia nitrogen (mg/L)	Surface	↘	↗	↘	↘	↘
	Middle	↘	↗	↘	↘	↘
	Bottom	↘	-	↘	-	↘
	Average	↘	↗	↘	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	-	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	-
	Bottom	↗	↗	-	↗	↗
	Average	↗	↗	↗	↗	-
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	-	↗	-	-	-
	Middle	-	↗	-	↗	↘
	Bottom	-	↗	-	↗	↘
	Average	-	↗	-	-	-
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Total nitrogen (mg/L)	Surface	↘	-	↘	↘	↘
	Middle	↘	-	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	-
	Average	-	-	-	-	-
Chlorophyll-*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 – 2015

Monitoring Station		EM1	EM2	EM3
Monitoring Period		1986 I 2015	1986 I 2015	1988 I 2015
Parameter	Water Depth			
Temperature (°C)	Surface	↗	↗	↗
	Middle	↗	↗	↗
	Bottom	↗	↗	↗
	Average	↗	↗	↗
Salinity	Surface	-	-	-
	Middle	-	-	-
	Bottom	-	-	-
	Average	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	-	-
	Middle	↗	↗	-
	Bottom	↗	-	-
	Average	↗	-	-
Dissolved Oxygen (%)	Surface	↗	↗	-
	Middle	↗	↗	-
	Bottom	↗	↗	-
	Average	↗	↗	-
pH	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Secchi disc depth (m)		↗	-	-
Turbidity (NTU)	Surface	-	-	-
	Middle	-	-	-
	Bottom	-	-	-
	Average	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	-
	Middle	↘	↘	↘
	Bottom	↘	-	-
	Average	↘	↘	-
Total volatile solids (mg/L)	Surface	↘	-	-
	Middle	↘	-	-
	Bottom	↘	-	-
	Average	↘	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	↘	-	-
	Middle	↘	↘	-
	Bottom	↘	-	-
	Average	↘	-	-
Ammonia nitrogen (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	-
	Average	↘	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Nitrite nitrogen (mg/L)	Surface	-	↘	-
	Middle	↘	↘	-
	Bottom	↘	-	-
	Average	↘	↘	-
Nitrate nitrogen (mg/L)	Surface	-	-	-
	Middle	-	-	-
	Bottom	-	-	-
	Average	-	-	-
Total inorganic nitrogen (mg/L)	Surface	↘	↘	-
	Middle	↘	↘	-
	Bottom	↘	↘	-
	Average	↘	↘	-
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Total nitrogen (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘
	Middle	↘	↘	↘
	Bottom	↘	↘	↘
	Average	↘	↘	↘
Silica (mg/L)	Surface	↘	↘	↘
	Middle	-	-	-
	Bottom	-	-	-
	Average	-	-	-
Chlorophyll-*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 – 2015

Monitoring Station		WM1	WM2	WM3	WM4
Monitoring Period		1988 – 2015	1988 – 2015	1986 – 2015	1986 – 2015
Parameter	Water Depth				
Temperature (°C)	Surface	↗	↗	↗	↗
	Middle	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗
	Average	↗	↗	↗	↗
Salinity	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	↗	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	↘
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	-	↘
	Middle	-	-	↗	-
	Bottom	-	↗	-	-
	Average	-	-	-	-
pH	Surface	↘	↘	↘	↘
	Middle	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘
	Average	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	↘	↘
	Middle	-	↘	↘	-
	Bottom	↗	↘	-	-
	Average	-	↘	↘	-
Total volatile solids (mg/L)	Surface	-	-	↘	↘
	Middle	-	-	↘	↘
	Bottom	-	-	-	-
	Average	-	-	↘	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	-	-	-	-
Ammonia nitrogen (mg/L)	Surface	-	↗	-	↗
	Middle	-	↗	-	↗
	Bottom	↘	-	-	-
	Average	-	↗	-	↗
Unionised Ammonia (mg/L)	Surface	-	-	-	-
	Middle	↘	-	↘	-
	Bottom	↘	-	↘	↘
	Average	↘	-	↘	-
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗
	Middle	-	↗	↗	↗
	Bottom	-	↗	-	-
	Average	↗	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗
	Middle	-	↗	↗	↗
	Bottom	-	↗	↗	↗
	Average	-	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↗	↗	↗	↗
	Middle	-	↗	↗	↗
	Bottom	-	↗	-	↗
	Average	-	↗	↗	↗
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘	↘	↘
	Middle	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘
	Average	↘	↘	↘	↘
Total nitrogen (mg/L)	Surface	-	-	-	-
	Middle	↘	-	-	-
	Bottom	↘	-	↘	↘
	Average	↘	-	↘	-
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	-
	Middle	↘	-	↘	↘
	Bottom	↘	↘	↘	↘
	Average	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘	↘	↘
	Middle	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘
	Average	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	-	-	-	-
Chlorophyll-*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 – 2015

Monitoring Station		JM3	JM4
Monitoring Period		1986 I 2015	1986 I 2015
Parameter	Water Depth		
Temperature (°C)	Surface	↗	↗
	Middle	↗	↗
	Bottom	↗	↗
	Average	↗	↗
Salinity	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
Dissolved Oxygen (mg/L)	Surface	-	-
	Middle	↗	↗
	Bottom	↗	↗
	Average	↗	↗
Dissolved Oxygen (%)	Surface	↗	↗
	Middle	↗	↗
	Bottom	↗	↗
	Average	↗	↗
pH	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Secchi disc depth (m)		↗	↗
Turbidity (NTU)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
Suspended Solids (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	-	-
	Average	↘	↘
Total volatile solids (mg/L)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	-	-
	Middle	-	-
	Bottom	↘	↘
	Average	-	-
Ammonia nitrogen (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Unionised Ammonia (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Nitrite nitrogen (mg/L)	Surface	-	-
	Middle	-	↘
	Bottom	-	-
	Average	-	-
Nitrate nitrogen (mg/L)	Surface	-	↗
	Middle	↗	↗
	Bottom	↗	-
	Average	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Total Kjeldahl nitrogen (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Total nitrogen (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Orthophosphate phosphorus (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Total phosphorus (mg/L)	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Silica (mg/L)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
Chlorophyll-*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 – 2015

Monitoring Station		DM1	DM2	DM3	DM4	DM5
Monitoring Period		1986 I 2015	1986 I 2015	1986 I 2015	1986 I 2015	1991 I 2015
Parameter	Water Depth					
Temperature (°C)	Surface	↗	↗	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	↗	↗	↗	↗	↗
Salinity	Surface	↘	↘	-	-	-
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	↘
	Average	↘	↘	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	↘	↘	↘	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	↘	-
	Average	-	↘	↘	↘	-
Dissolved Oxygen (%)	Surface	-	↘	↘	↘	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	↘	-
	Average	-	↘	↘	↘	-
pH	Surface	↘	↘	↘	↘	↘
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	↘
	Average	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	-	-	-	-
Turbidity (NTU)	Surface	-	-	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	↘
	Average	-	-	-	-	-
Suspended Solids (mg/L)	Surface	-	-	-	-	↘
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	-	↘
	Average	-	-	-	-	↘
Total volatile solids (mg/L)	Surface	-	↗	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	-	↗	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	↗	↗	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	↗	↗	-	-	-
Ammonia nitrogen (mg/L)	Surface	-	-	-	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	-	-	-	↗	↗
Unionised Ammonia (mg/L)	Surface	↘	-	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	↘	-	-	-	-
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	↗	↗	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	-	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	↗	-	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	-	-	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	-	-	↗	↗	↗
Total Kjeldahl nitrogen (mg/L)	Surface	-	-	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	-	-	-	-	-
Total nitrogen (mg/L)	Surface	-	-	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	-	-	↗	↗	↗
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	-	↗	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	↘	↘	-	-	-
Total phosphorus (mg/L)	Surface	↘	↘	↘	-	↘
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	↘
	Average	↘	↘	↘	↘	↘
Silica (mg/L)	Surface	↗	↗	-	-	-
	Middle	NA	NA	NA	NA	-
	Bottom	NA	NA	NA	-	-
	Average	↗	↗	-	-	-
Chlorophyll-*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 – 2015

Monitoring Station		NM1	NM2	NM3	NM5	NM6	NM8
Monitoring Period		1988 – 2015	1986 – 2015	1986 – 2015	1988 – 2015	1991 – 2015	1999 – 2015
Parameter	Water Depth						
Temperature (°C)	Surface	–	↗	↗	↗	–	–
	Middle	–	–	↗	↗	↗	–
	Bottom	–	–	↗	–	↗	–
	Average	–	–	↗	↗	↗	–
Salinity	Surface	–	–	–	–	–	–
	Middle	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–
	Average	–	–	–	–	–	–
Dissolved Oxygen (mg/L)	Surface	–	–	–	↘	–	–
	Middle	–	–	–	–	–	–
	Bottom	–	–	–	↘	–	–
	Average	–	–	–	↘	–	–
Dissolved Oxygen (%)	Surface	–	–	–	↘	–	–
	Middle	–	–	–	–	–	–
	Bottom	–	–	–	–	–	–
	Average	–	–	–	↘	–	–
pH	Surface	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	–	–	–	–	–	↘
	Middle	–	↘	–	–	–	↘
	Bottom	–	↘	–	–	–	↘
	Average	–	–	–	–	–	↘
Suspended Solids (mg/L)	Surface	↘	–	–	↘	↘	–
	Middle	–	↘	↘	–	–	↘
	Bottom	–	↘	↘	–	↘	–
	Average	–	↘	↘	–	↘	–
Total volatile solids (mg/L)	Surface	–	–	–	–	–	–
	Middle	–	–	–	–	–	–
	Bottom	–	↘	–	–	–	–
	Average	–	↘	–	–	–	–
5-day Biochemical Oxygen Demand (mg/L)	Surface	–	↘	–	–	–	–
	Middle	–	–	–	–	–	–
	Bottom	–	↘	–	–	–	–
	Average	–	↘	–	–	–	–
Ammonia nitrogen (mg/L)	Surface	↗	↗	↗	–	–	–
	Middle	↗	↗	↗	↗	–	–
	Bottom	↗	↗	↗	↗	–	–
	Average	↗	↗	↗	–	–	–
Unionised Ammonia (mg/L)	Surface	↘	–	–	–	–	–
	Middle	↘	–	–	–	–	–
	Bottom	↘	–	–	–	–	–
	Average	↘	–	–	–	–	–
Nitrite nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗	–
	Bottom	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗
Nitrate nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	–
	Average	↗	↗	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗	–
	Bottom	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	–
Total Kjeldahl nitrogen (mg/L)	Surface	–	–	↘	–	–	–
	Middle	–	–	–	–	–	–
	Bottom	↘	↘	↘	–	–	↗
	Average	–	–	–	–	–	–
Total nitrogen (mg/L)	Surface	–	–	–	↗	–	↗
	Middle	–	↗	–	–	–	↗
	Bottom	–	–	–	–	–	↗
	Average	–	–	–	–	–	↗
Orthophosphate phosphorus (mg/L)	Surface	↘	–	–	–	↘	–
	Middle	–	–	–	–	↘	–
	Bottom	↘	↘	–	–	↘	–
	Average	↘	↘	–	–	↘	–
Total phosphorus (mg/L)	Surface	↘	–	–	–	↘	–
	Middle	–	–	–	↘	↘	–
	Bottom	↘	↘	↘	↘	↘	–
	Average	↘	↘	↘	↘	↘	–
Silica (mg/L)	Surface	–	–	–	–	–	–
	Middle	–	↗	–	–	–	–
	Bottom	–	–	–	–	–	–
	Average	–	–	–	–	–	–
Chlorophyll-*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, 2011 - 2015

	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 <63µm (%w/w)	70 (57 - 83)	84 (71 - 94)	71 (54 - 88)	90 (84 - 96)	73 (54 - 95)	79 (62 - 88)	76 (66 - 87)	85 (62 - 95)
Electrochemical Potential (mV)	-300 (-408 - -179)	-314 (-418 - -165)	-293 (-419 - -128)	-333 (-444 - -239)	-246 (-433 - -82)	-265 (-443 - -91)	-247 (-419 - -92)	-249 (-424 - -112)
Total Solids (%w/w)	38 (31 - 47)	33 (28 - 43)	38 (31 - 45)	30 (28 - 33)	58 (53 - 60)	49 (45 - 54)	49 (40 - 54)	45 (42 - 51)
Total Volatile Soilds (%w/w)	9.2 (6.8 - 11.0)	9.3 (6.2 - 11.0)	9.2 (7.1 - 11.0)	10.6 (9.7 - 12.0)	5.4 (3.9 - 6.5)	6.7 (5.9 - 7.2)	6.5 (5.6 - 7.5)	7.0 (6.0 - 9.5)
Chemical Oxygen Demand (mg/kg)	20800 (18000 - 24000)	18200 (15000 - 21000)	16700 (15000 - 18000)	17000 (13000 - 21000)	9250 (7700 - 11000)	11490 (9100 - 15000)	12120 (9400 - 14000)	11560 (9600 - 14000)
Total Carbon (%w/w)	0.8 (0.6 - 1.2)	0.6 (0.6 - 0.8)	0.9 (0.8 - 1.2)	0.9 (0.8 - 1.0)	0.9 (0.8 - 1.0)	0.7 (0.6 - 0.9)	0.8 (0.6 - 1.0)	0.7 (0.6 - 1.1)
Ammonical Nitrogen (mg/kg)	6.08 (1.70 - 12.00)	4.42 (<0.05 - 8.20)	6.41 (1.30 - 14.00)	12.81 (7.90 - 25.00)	5.90 (0.26 - 16.00)	3.91 (1.50 - 7.50)	4.11 (<0.05 - 8.90)	3.80 (1.50 - 8.80)
Total Kjeldahl Nitrogen (mg/kg)	590 (440 - 780)	560 (440 - 690)	620 (400 - 740)	770 (620 - 940)	420 (340 - 500)	520 (360 - 600)	460 (360 - 530)	510 (440 - 610)
Total Phosphorus (mg/kg)	170 (150 - 210)	160 (140 - 190)	180 (140 - 220)	210 (180 - 250)	240 (200 - 290)	230 (170 - 270)	230 (150 - 260)	220 (190 - 250)
Total Sulphide (mg/kg)	130 (1 - 330)	95 (17 - 160)	120 (20 - 270)	110 (42 - 190)	26 (3 - 65)	29 (1 - 65)	29 (11 - 55)	25 (0 - 63)
Total Cyanide (mg/kg)	0.2 (0.1 - 0.2)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.3)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)
Arsenic (mg/kg)	9.3 (7.4 - 11.0)	9.6 (6.6 - 11.0)	8.2 (6.0 - 11.0)	6.0 (5.3 - 6.9)	6.6 (5.9 - 7.0)	8.3 (6.6 - 10.0)	6.8 (4.7 - 8.4)	7.8 (6.2 - 9.9)
Cadmium (mg/kg)	0.6 (0.3 - 0.9)	0.6 (0.5 - 0.8)	0.4 (0.2 - 0.5)	0.3 (0.2 - 0.4)	<0.1 (<0.1 - <0.1)	0.1 (<0.1 - 0.1)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)
Chromium (mg/kg)	23 (15 - 27)	24 (14 - 29)	22 (16 - 27)	33 (26 - 37)	21 (18 - 23)	29 (27 - 32)	29 (21 - 39)	34 (26 - 39)
Copper (mg/kg)	33 (19 - 41)	37 (21 - 49)	22 (14 - 35)	21 (18 - 29)	9 (8 - 11)	18 (15 - 21)	16 (12 - 25)	29 (18 - 35)
Lead (mg/kg)	79 (46 - 96)	86 (50 - 110)	60 (36 - 91)	48 (35 - 54)	25 (22 - 28)	32 (20 - 37)	32 (20 - 46)	39 (25 - 46)
Mercury (mg/kg)	0.10 (<0.05 - 0.38)	0.09 (<0.05 - 0.30)	0.08 (<0.05 - 0.30)	0.08 (<0.05 - 0.30)	0.06 (<0.05 - 0.07)	0.09 (0.05 - 0.13)	0.10 (0.06 - 0.17)	0.13 (0.09 - 0.21)
Nickel (mg/kg)	14 (9 - 16)	14 (9 - 18)	15 (11 - 17)	23 (20 - 26)	15 (14 - 17)	19 (17 - 22)	19 (15 - 26)	21 (17 - 24)
Silver (mg/kg)	0.4 (0.2 - 0.6)	0.5 (0.3 - 0.8)	0.2 (<0.2 - 0.3)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - <0.2)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - <0.2)	0.3 (<0.2 - 0.4)
Zinc (mg/kg)	220 (130 - 270)	270 (180 - 360)	140 (110 - 160)	130 (100 - 140)	61 (51 - 68)	90 (82 - 98)	83 (67 - 120)	110 (92 - 120)
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]	100 (90 - 170)	110 (90 - 240)	100 (90 - 110)	110 (90 - 160)	100 (90 - 180)	100 (90 - 150)	110 (94 - 160)	110 (94 - 160)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	53 (16 - 95)	47 (28 - 84)	46 (17 - 110)	63 (41 - 110)	51 (20 - 230)	92 (27 - 280)	68 (26 - 130)	120 (46 - 210)

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, 2011 – 2015

	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 <63μm (%w/w)	93 (82 - 97)	64 (52 - 86)	92 (80 - 99)	57 (36 - 78)	70 (52 - 86)	81 (44 - 95)	58 (34 - 81)
Electrochemical Potential (mV)	-256 (-408 - -88)	-219 (-379 - -73)	-244 (-395 - -75)	-287 (-401 - -92)	-278 (-420 - -52)	-294 (-396 - -129)	-300 (-398 - -93)
Total Solids (%w/w)	39 (33 - 43)	64 (59 - 68)	42 (40 - 48)	50 (43 - 61)	50 (47 - 55)	48 (40 - 61)	55 (48 - 63)
Total Volatile Soilds (%w/w)	7.5 (5.9 - 8.5)	3.7 (3.4 - 4.3)	7.4 (5.8 - 9.9)	5.8 (3.3 - 7.1)	6.7 (5.6 - 8.4)	6.8 (4.9 - 9.2)	5.7 (4.0 - 8.2)
Chemical Oxygen Demand (mg/kg)	12580 (9800 - 17000)	8750 (5900 - 18000)	13190 (8900 - 17000)	17000 (11000 - 21000)	14200 (12000 - 16000)	10920 (9300 - 13000)	11740 (7400 - 15000)
Total Carbon (%w/w)	0.6 (0.5 - 0.7)	0.5 (0.4 - 0.5)	0.7 (0.6 - 0.8)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.9)	0.7 (0.4 - 1.2)
Ammonical Nitrogen (mg/kg)	9.35 (0.79 - 13.00)	6.22 (0.46 - 13.00)	4.22 (0.14 - 9.00)	50.68 (1.10 - 260.00)	3.83 (0.13 - 13.00)	4.14 (0.22 - 23.00)	3.93 (0.23 - 9.20)
Total Kjeldahl Nitrogen (mg/kg)	560 (390 - 660)	360 (280 - 710)	570 (430 - 660)	580 (430 - 780)	430 (270 - 560)	430 (280 - 590)	340 (110 - 560)
Total Phosphorus (mg/kg)	200 (150 - 230)	200 (170 - 240)	210 (180 - 230)	300 (200 - 370)	260 (140 - 370)	240 (160 - 310)	190 (60 - 270)
Total Sulphide (mg/kg)	43 (6 - 93)	4 (1 - 7)	45 (15 - 81)	160 (14 - 360)	16 (3 - 39)	18 (8 - 30)	13 (1 - 59)
Total Cyanide (mg/kg)	0.2 (<0.1 - 0.2)	<0.1 (<0.1 - <0.1)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.2 (<0.1 - 0.3)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)
Arsenic (mg/kg)	7.2 (5.8 - 8.0)	5.7 (4.4 - 9.0)	7.5 (6.8 - 8.6)	8.8 (6.1 - 12.0)	13.6 (10.0 - 17.0)	11.5 (8.8 - 14.0)	10.0 (6.6 - 15.0)
Cadmium (mg/kg)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	0.1 (0.1 - 0.2)	0.3 (0.2 - 0.4)	0.2 (0.1 - 0.6)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)
Chromium (mg/kg)	37 (25 - 45)	20 (17 - 29)	41 (29 - 47)	38 (21 - 54)	39 (28 - 45)	37 (27 - 44)	29 (17 - 38)
Copper (mg/kg)	34 (26 - 44)	10 (7 - 14)	69 (55 - 78)	55 (22 - 73)	44 (28 - 73)	43 (25 - 61)	29 (13 - 53)
Lead (mg/kg)	47 (32 - 53)	23 (19 - 36)	46 (31 - 55)	44 (27 - 60)	58 (37 - 120)	43 (29 - 59)	35 (23 - 46)
Mercury (mg/kg)	0.14 (0.11 - 0.16)	0.06 (<0.05 - 0.11)	0.22 (0.18 - 0.25)	0.13 (0.07 - 0.26)	0.13 (0.09 - 0.19)	0.11 (0.06 - 0.14)	0.08 (<0.05 - 0.13)
Nickel (mg/kg)	22 (17 - 26)	12 (11 - 19)	20 (15 - 23)	21 (13 - 29)	22 (16 - 29)	23 (17 - 28)	18 (11 - 25)
Silver (mg/kg)	0.4 (0.2 - 0.5)	<0.2 (<0.2 - <0.2)	1.2 (0.9 - 1.6)	0.6 (0.3 - 0.9)	0.4 (<0.2 - 1.1)	0.3 (<0.2 - 0.5)	0.2 (<0.2 - 0.3)
Zinc (mg/kg)	130 (85 - 150)	57 (46 - 99)	140 (97 - 160)	210 (100 - 310)	160 (110 - 270)	120 (87 - 150)	97 (64 - 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)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4] [6]	120 (90 - 200)	100 (90 - 160)	150 (96 - 350)	110 (95 - 130)	110 (90 - 150)	100 (90 - 120)	110 (90 - 210)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	94 (51 - 190)	30 (19 - 92)	300 (130 - 410)	190 (76 - 690)	80 (23 - 120)	80 (36 - 140)	54 (20 - 93)

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, 2011 - 2015

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 <63µm (%w/w)	84 (12 - 96)	62 (26 - 81)	72 (48 - 90)	91 (82 - 99)	93 (85 - 99)	92 (86 - 98)	91 (80 - 98)	69 (13 - 91)
Electrochemical Potential (mV)	-283 (-399 - -96)	-280 (-407 - -86)	-272 (-400 - -86)	-234 (-395 - -106)	-265 (-399 - -105)	-324 (-396 - -235)	-217 (-388 - -85)	-229 (-395 - -95)
Total Solids (%w/w)	35 (32 - 40)	48 (41 - 58)	48 (38 - 55)	38 (36 - 42)	33 (30 - 36)	30 (26 - 34)	34 (29 - 41)	46 (36 - 61)
Total Volatile Soilds (%w/w)	11.6 (10.0 - 13.0)	8.6 (6.0 - 11.0)	8.6 (6.5 - 10.0)	7.6 (6.7 - 8.4)	8.8 (7.6 - 10.0)	10.8 (9.0 - 15.0)	9.5 (8.4 - 11.0)	7.2 (3.1 - 8.9)
Chemical Oxygen Demand (mg/kg)	16000 (10000 - 19000)	11150 (7400 - 17000)	11460 (9600 - 14000)	13900 (11000 - 17000)	14600 (11000 - 18000)	15300 (13000 - 21000)	12840 (8400 - 16000)	12500 (10000 - 14000)
Total Carbon (%w/w)	1.1 (1.0 - 1.3)	1.5 (1.1 - 2.1)	1.3 (0.9 - 1.6)	0.6 (<0.1 - 0.8)	0.7 (0.6 - 0.8)	0.8 (0.7 - 1.0)	0.8 (0.6 - 1.1)	0.8 (0.6 - 1.3)
Ammonical Nitrogen (mg/kg)	7.07 (1.90 - 12.00)	6.25 (2.70 - 9.50)	12.12 (0.40 - 60.00)	6.89 (0.13 - 10.00)	8.78 (1.50 - 14.00)	9.94 (7.30 - 13.00)	8.19 (2.20 - 11.00)	10.31 (2.60 - 25.00)
Total Kjeldahl Nitrogen (mg/kg)	680 (310 - 850)	610 (400 - 710)	660 (450 - 770)	570 (460 - 620)	650 (500 - 770)	710 (640 - 800)	710 (580 - 880)	500 (250 - 610)
Total Phosphorus (mg/kg)	200 (160 - 240)	210 (180 - 280)	240 (190 - 280)	190 (170 - 200)	190 (160 - 210)	200 (170 - 240)	210 (190 - 280)	180 (100 - 220)
Total Sulphide (mg/kg)	35 (10 - 69)	22 (2 - 35)	37 (4 - 98)	42 (3 - 88)	55 (1 - 150)	66 (1 - 180)	38 (1 - 88)	51 (1 - 170)
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 - 0.2)	0.2 (0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.3)
Arsenic (mg/kg)	5.4 (3.6 - 6.0)	4.8 (3.2 - 6.1)	5.8 (5.2 - 7.2)	8.3 (7.1 - 9.5)	7.3 (6.0 - 8.6)	6.8 (5.8 - 7.8)	6.2 (5.1 - 7.0)	5.5 (3.8 - 6.4)
Cadmium (mg/kg)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	0.2 (0.1 - 0.3)	0.3 (0.1 - 0.4)	0.3 (0.2 - 0.5)	<0.1 (<0.1 - 0.1)	<0.1 (<0.1 - <0.1)
Chromium (mg/kg)	25 (16 - 28)	22 (14 - 31)	24 (20 - 28)	29 (19 - 36)	33 (27 - 39)	32 (27 - 36)	32 (26 - 35)	25 (21 - 33)
Copper (mg/kg)	20 (10 - 26)	11 (6 - 16)	11 (9 - 14)	23 (17 - 28)	22 (19 - 25)	21 (13 - 26)	15 (12 - 17)	10 (7 - 14)
Lead (mg/kg)	35 (21 - 44)	28 (18 - 38)	31 (24 - 40)	45 (34 - 54)	46 (34 - 50)	40 (27 - 45)	42 (34 - 46)	27 (20 - 33)
Mercury (mg/kg)	0.08 (0.06 - 0.10)	0.05 (<0.05 - 0.06)	0.05 (<0.05 - 0.06)	0.06 (<0.05 - 0.07)	0.06 (<0.05 - 0.07)	0.07 (0.05 - 0.10)	0.05 (<0.05 - 0.06)	<0.05 (<0.05 - <0.05)
Nickel (mg/kg)	16 (11 - 19)	16 (10 - 21)	17 (15 - 21)	17 (12 - 20)	22 (18 - 25)	22 (18 - 25)	22 (18 - 25)	17 (13 - 21)
Silver (mg/kg)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - 0.2)	<0.2 (<0.2 - <0.2)	0.5 (0.3 - 0.8)	0.3 (0.2 - 0.4)	0.2 (<0.2 - 0.3)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - <0.2)
Zinc (mg/kg)	91 (55 - 120)	69 (43 - 110)	71 (51 - 100)	100 (69 - 130)	110 (87 - 130)	96 (82 - 110)	94 (75 - 110)	66 (52 - 89)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4]	130 (90 - 230)	100 (90 - 150)	120 (90 - 200)	120 (90 - 200)	140 (90 - 350)	130 (90 - 220)	120 (90 - 180)	100 (90 - 130)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	73 (32 - 160)	38 (18 - 78)	45 (18 - 91)	52 (29 - 90)	56 (32 - 88)	66 (31 - 110)	47 (31 - 92)	33 (18 - 65)

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, 2011 - 2015

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 <63µm (%w/w)	83 (18 - 95)	86 (77 - 94)	93 (83 - 97)	87 (52 - 97)	92 (83 - 97)	90 (75 - 99)	90 (86 - 98)	78 (64 - 95)
Electrochemical Potential (mV)	-212 (-392 - -68)	-194 (-383 - -95)	-261 (-375 - -115)	-202 (-366 - -79)	-223 (-360 - -110)	-219 (-389 - -112)	-224 (-384 - -106)	-210 (-380 - -99)
Total Solids (%w/w)	39 (34 - 53)	41 (35 - 45)	31 (28 - 36)	46 (38 - 51)	49 (44 - 53)	51 (48 - 53)	51 (44 - 54)	54 (49 - 57)
Total Volatile Soilds (%w/w)	8.1 (5.6 - 9.4)	7.9 (6.6 - 10.0)	10.6 (9.3 - 12.0)	6.6 (5.8 - 7.4)	6.4 (5.7 - 7.7)	5.9 (5.1 - 6.7)	6.0 (5.4 - 6.7)	6.0 (5.4 - 6.8)
Chemical Oxygen Demand (mg/kg)	12100 (10000 - 14000)	12050 (9500 - 14000)	14900 (12000 - 17000)	10130 (8600 - 12000)	8500 (6400 - 10000)	8090 (5200 - 9600)	8140 (5700 - 10000)	8730 (6300 - 11000)
Total Carbon (%w/w)	0.7 (0.7 - 0.9)	0.7 (0.6 - 0.8)	0.9 (0.7 - 1.2)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.6)	0.6 (0.5 - 0.7)	0.7 (0.6 - 0.8)
Ammonical Nitrogen (mg/kg)	5.73 (0.21 - 8.80)	5.97 (2.20 - 12.00)	9.17 (5.70 - 11.00)	3.52 (1.60 - 7.30)	2.52 (0.68 - 9.30)	2.66 (0.74 - 6.30)	3.35 (1.20 - 7.60)	3.84 (2.00 - 7.70)
Total Kjeldahl Nitrogen (mg/kg)	640 (500 - 730)	600 (450 - 670)	740 (680 - 810)	500 (400 - 550)	480 (320 - 550)	490 (380 - 550)	500 (420 - 560)	470 (350 - 540)
Total Phosphorus (mg/kg)	210 (190 - 240)	210 (180 - 240)	210 (190 - 220)	220 (190 - 240)	240 (160 - 260)	240 (190 - 270)	250 (210 - 270)	240 (160 - 280)
Total Sulphide (mg/kg)	16 (3 - 51)	21 (4 - 66)	44 (3 - 83)	14 (6 - 30)	8 (2 - 14)	10 (2 - 35)	8 (2 - 19)	10 (4 - 23)
Total Cyanide (mg/kg)	0.1 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)	<0.1 (<0.1 - 0.1)	0.1 (<0.1 - 0.2)	<0.1 (<0.1 - 0.1)
Arsenic (mg/kg)	6.8 (6.1 - 7.8)	6.7 (6.0 - 7.3)	5.9 (5.2 - 6.5)	7.3 (6.6 - 7.9)	7.7 (6.3 - 8.7)	7.3 (5.6 - 8.7)	6.8 (4.9 - 8.1)	6.8 (5.2 - 9.9)
Cadmium (mg/kg)	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)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)
Chromium (mg/kg)	33 (29 - 38)	28 (24 - 31)	31 (28 - 35)	32 (28 - 33)	30 (24 - 34)	29 (19 - 33)	28 (19 - 35)	26 (18 - 40)
Copper (mg/kg)	14 (10 - 16)	13 (10 - 16)	17 (14 - 20)	13 (10 - 18)	12 (9 - 17)	11 (6 - 16)	10 (7 - 16)	9 (6 - 14)
Lead (mg/kg)	35 (29 - 39)	36 (26 - 41)	40 (32 - 45)	33 (30 - 37)	31 (25 - 35)	30 (21 - 34)	29 (22 - 33)	29 (22 - 35)
Mercury (mg/kg)	0.05 (<0.05 - 0.06)	0.05 (<0.05 - 0.06)	0.06 (<0.05 - 0.08)	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)	22 (18 - 24)	21 (17 - 24)	22 (19 - 25)	22 (20 - 24)	22 (19 - 23)	20 (14 - 23)	20 (13 - 24)	18 (12 - 28)
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)	83 (71 - 100)	82 (66 - 92)	100 (92 - 120)	79 (72 - 89)	77 (62 - 86)	72 (52 - 83)	68 (50 - 75)	63 (48 - 77)
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]	130 (90 - 250)	93 (90 - 100)	110 (90 - 140)	130 (90 - 260)	140 (90 - 330)	110 (90 - 200)	120 (90 - 220)	110 (90 - 160)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	49 (30 - 100)	35 (26 - 56)	55 (29 - 85)	70 (27 - 310)	44 (27 - 91)	30 (17 - 49)	32 (20 - 67)	30 (18 - 53)

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

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

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, 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, 2011 – 2015

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 <63µm (%w/w)	57 (18 - 89)	53 (20 - 85)	54 (13 - 88)	66 (29 - 90)	75 (62 - 84)	87 (78 - 97)
Electrochemical Potential (mV)	-204 (-380 - -80)	-236 (-390 - -111)	-271 (-428 - -83)	-235 (-380 - -81)	-274 (-398 - -135)	-232 (-347 - -88)
Total Solids (%w/w)	50 (39 - 65)	53 (40 - 63)	55 (43 - 65)	57 (42 - 70)	47 (44 - 51)	45 (43 - 48)
Total Volatile Soilds (%w/w)	6.4 (4.8 - 9.2)	6.4 (4.9 - 9.6)	5.7 (4.2 - 7.1)	5.0 (3.0 - 7.2)	6.7 (6.2 - 7.3)	6.7 (5.9 - 7.6)
Chemical Oxygen Demand (mg/kg)	10890 (9000 - 12000)	11840 (9400 - 14000)	12610 (9100 - 17000)	11160 (8600 - 14000)	13900 (12000 - 17000)	11940 (9400 - 15000)
Total Carbon (%w/w)	0.9 (0.5 - 1.3)	0.8 (0.5 - 1.2)	0.6 (<0.1 - 0.8)	0.7 (0.4 - 1.2)	0.8 (0.7 - 0.9)	0.6 (0.5 - 0.7)
Ammonical Nitrogen (mg/kg)	5.57 (0.92 - 13.00)	7.82 (0.07 - 31.00)	3.48 (1.20 - 7.90)	10.47 (0.07 - 76.00)	7.95 (1.50 - 15.00)	5.57 (0.69 - 12.00)
Total Kjeldahl Nitrogen (mg/kg)	390 (300 - 580)	410 (250 - 570)	380 (260 - 600)	370 (180 - 510)	500 (400 - 590)	520 (430 - 620)
Total Phosphorus (mg/kg)	200 (150 - 230)	210 (160 - 260)	200 (140 - 260)	190 (100 - 260)	210 (180 - 250)	210 (180 - 240)
Total Sulphide (mg/kg)	37 (1 - 190)	39 (0 - 130)	64 (5 - 220)	21 (0 - 51)	100 (4 - 160)	31 (5 - 72)
Total Cyanide (mg/kg)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)
Arsenic (mg/kg)	8.2 (4.5 - 11.0)	10.5 (7.7 - 14.0)	10.3 (7.8 - 13.0)	12.0 (7.1 - 17.0)	8.0 (6.8 - 8.8)	7.8 (7.1 - 8.9)
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 - 0.2)	0.1 (<0.1 - 0.1)	<0.1 (<0.1 - <0.1)
Chromium (mg/kg)	29 (14 - 37)	30 (19 - 38)	29 (23 - 36)	28 (17 - 40)	35 (25 - 58)	34 (27 - 40)
Copper (mg/kg)	29 (13 - 46)	26 (13 - 38)	27 (17 - 38)	19 (9 - 34)	46 (31 - 62)	26 (18 - 33)
Lead (mg/kg)	34 (20 - 45)	36 (26 - 47)	35 (29 - 40)	33 (20 - 43)	36 (29 - 40)	35 (24 - 41)
Mercury (mg/kg)	0.11 (<0.05 - 0.16)	0.11 (0.07 - 0.15)	0.09 (0.06 - 0.12)	0.08 (<0.05 - 0.13)	0.22 (0.10 - 0.88)	0.13 (0.07 - 0.47)
Nickel (mg/kg)	17 (9 - 22)	18 (11 - 23)	17 (13 - 23)	17 (11 - 23)	18 (14 - 22)	21 (17 - 25)
Silver (mg/kg)	0.3 (<0.2 - 0.5)	0.3 (<0.2 - 0.4)	0.2 (<0.2 - 0.3)	<0.2 (<0.2 - 0.2)	0.6 (0.4 - 0.8)	0.3 (<0.2 - 0.3)
Zinc (mg/kg)	98 (50 - 120)	93 (63 - 120)	98 (83 - 110)	80 (42 - 110)	110 (83 - 130)	100 (79 - 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]	120 (90 - 340)	140 (90 - 500)	120 (90 - 240)	100 (90 - 150)	110 (90 - 170)	110 (90 - 180)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	77 (36 - 150)	160 (41 - 690)	86 (24 - 130)	40 (17 - 64)	230 (100 - 570)	87 (24 - 220)

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

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

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

4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, 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, 2011 – 2015

	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 <63µm (%w/w)	58 (33 - 94)	67 (41 - 94)	53 (31 - 90)	67 (34 - 83)	86 (69 - 97)	69 (32 - 97)	68 (31 - 87)	73 (37 - 88)
Electrochemical Potential (mV)	-230 (-381 - -63)	-221 (-380 - -83)	-236 (-389 - -75)	-303 (-463 - -218)	-348 (-438 - -260)	-297 (-392 - -150)	-272 (-382 - -123)	-255 (-350 - -121)
Total Solids (%w/w)	59 (50 - 69)	54 (41 - 63)	58 (47 - 66)	47 (38 - 60)	40 (33 - 44)	48 (37 - 60)	46 (40 - 56)	42 (36 - 52)
Total Volatile Soilds (%w/w)	5.7 (3.7 - 9.0)	6.2 (4.1 - 8.5)	5.6 (3.7 - 8.1)	6.7 (4.8 - 8.6)	8.2 (6.7 - 8.9)	7.5 (4.2 - 9.6)	6.3 (5.1 - 7.9)	7.4 (6.2 - 8.5)
Chemical Oxygen Demand (mg/kg)	9790 (7200 - 14000)	9190 (7100 - 13000)	12530 (9300 - 24000)	17300 (12000 - 20000)	20600 (16000 - 23000)	16400 (12000 - 19000)	14800 (12000 - 18000)	16300 (12000 - 23000)
Total Carbon (%w/w)	1.2 (0.8 - 1.6)	0.8 (0.7 - 1.0)	1.1 (0.8 - 2.2)	0.8 (0.6 - 0.9)	0.9 (0.6 - 1.2)	1.0 (0.6 - 1.9)	0.7 (0.5 - 0.8)	0.8 (0.5 - 1.3)
Ammonical Nitrogen (mg/kg)	4.38 (0.22 - 14.00)	5.49 (<0.05 - 19.00)	6.38 (0.80 - 12.00)	14.76 (0.89 - 58.00)	29.13 (8.10 - 70.00)	9.88 (0.11 - 18.00)	9.22 (2.90 - 23.00)	4.76 (0.37 - 17.00)
Total Kjeldahl Nitrogen (mg/kg)	400 (220 - 460)	480 (350 - 650)	470 (290 - 560)	550 (400 - 700)	750 (570 - 1200)	540 (390 - 700)	460 (250 - 550)	490 (400 - 600)
Total Phosphorus (mg/kg)	190 (110 - 230)	220 (190 - 240)	200 (120 - 240)	200 (160 - 250)	220 (170 - 250)	230 (180 - 280)	200 (130 - 260)	200 (180 - 250)
Total Sulphide (mg/kg)	35 (13 - 94)	29 (3 - 78)	110 (10 - 620)	250 (12 - 460)	380 (210 - 620)	230 (110 - 340)	120 (4 - 250)	66 (5 - 180)
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 - 0.2)	0.2 (<0.1 - 0.3)	0.2 (<0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.4)
Arsenic (mg/kg)	5.2 (3.6 - 6.4)	6.1 (4.5 - 9.5)	6.0 (4.2 - 7.6)	7.2 (4.3 - 8.8)	7.9 (6.9 - 8.7)	7.6 (6.0 - 9.1)	7.0 (4.4 - 8.8)	8.2 (6.6 - 9.5)
Cadmium (mg/kg)	<0.1 (<0.1 - <0.1)	<0.1 (<0.1 - <0.1)	0.1 (<0.1 - 0.4)	0.3 (0.2 - 0.5)	0.7 (0.4 - 0.9)	0.3 (<0.1 - 0.4)	0.2 (<0.1 - 0.2)	0.4 (0.2 - 0.9)
Chromium (mg/kg)	21 (14 - 30)	27 (19 - 49)	32 (24 - 40)	38 (21 - 51)	50 (38 - 61)	35 (24 - 45)	36 (28 - 45)	57 (43 - 67)
Copper (mg/kg)	24 (15 - 36)	17 (12 - 32)	57 (39 - 100)	99 (52 - 160)	140 (110 - 190)	75 (28 - 100)	54 (10 - 79)	130 (110 - 170)
Lead (mg/kg)	26 (15 - 35)	27 (18 - 42)	35 (25 - 61)	46 (29 - 59)	64 (55 - 72)	62 (29 - 100)	34 (25 - 41)	55 (37 - 78)
Mercury (mg/kg)	0.11 (0.08 - 0.21)	0.08 (<0.05 - 0.13)	0.21 (0.09 - 0.50)	0.32 (0.14 - 0.52)	0.45 (0.34 - 0.52)	0.61 (0.18 - 2.00)	0.22 (<0.05 - 0.86)	0.23 (0.09 - 0.75)
Nickel (mg/kg)	13 (9 - 18)	18 (12 - 31)	16 (13 - 21)	18 (10 - 24)	23 (18 - 28)	17 (13 - 23)	20 (14 - 24)	24 (17 - 28)
Silver (mg/kg)	0.4 (0.2 - 0.6)	0.2 (<0.2 - 0.4)	1.4 (0.6 - 4.2)	2.4 (1.1 - 4.1)	4.1 (2.4 - 7.9)	1.5 (0.3 - 2.2)	1.0 (<0.2 - 1.3)	2.8 (1.9 - 5.6)
Zinc (mg/kg)	65 (48 - 87)	71 (48 - 110)	110 (69 - 260)	150 (85 - 200)	260 (200 - 330)	150 (91 - 200)	120 (67 - 140)	180 (140 - 250)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 19)	18 (18 - 19)	21 (18 - 29)	20 (18 - 33)	18 (18 - 19)	18 (18 - 20)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4]	110 (90 - 190)	100 (90 - 150)	130 (90 - 250)	160 (93 - 430)	150 (100 - 240)	230 (110 - 700)	110 (93 - 170)	130 (94 - 250)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	140 (48 - 270)	74 (38 - 190)	410 (110 - 1800)	1000 (180 - 3300)	690 (500 - 1000)	1300 (180 - 3200)	160 (31 - 240)	310 (94 - 730)

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.

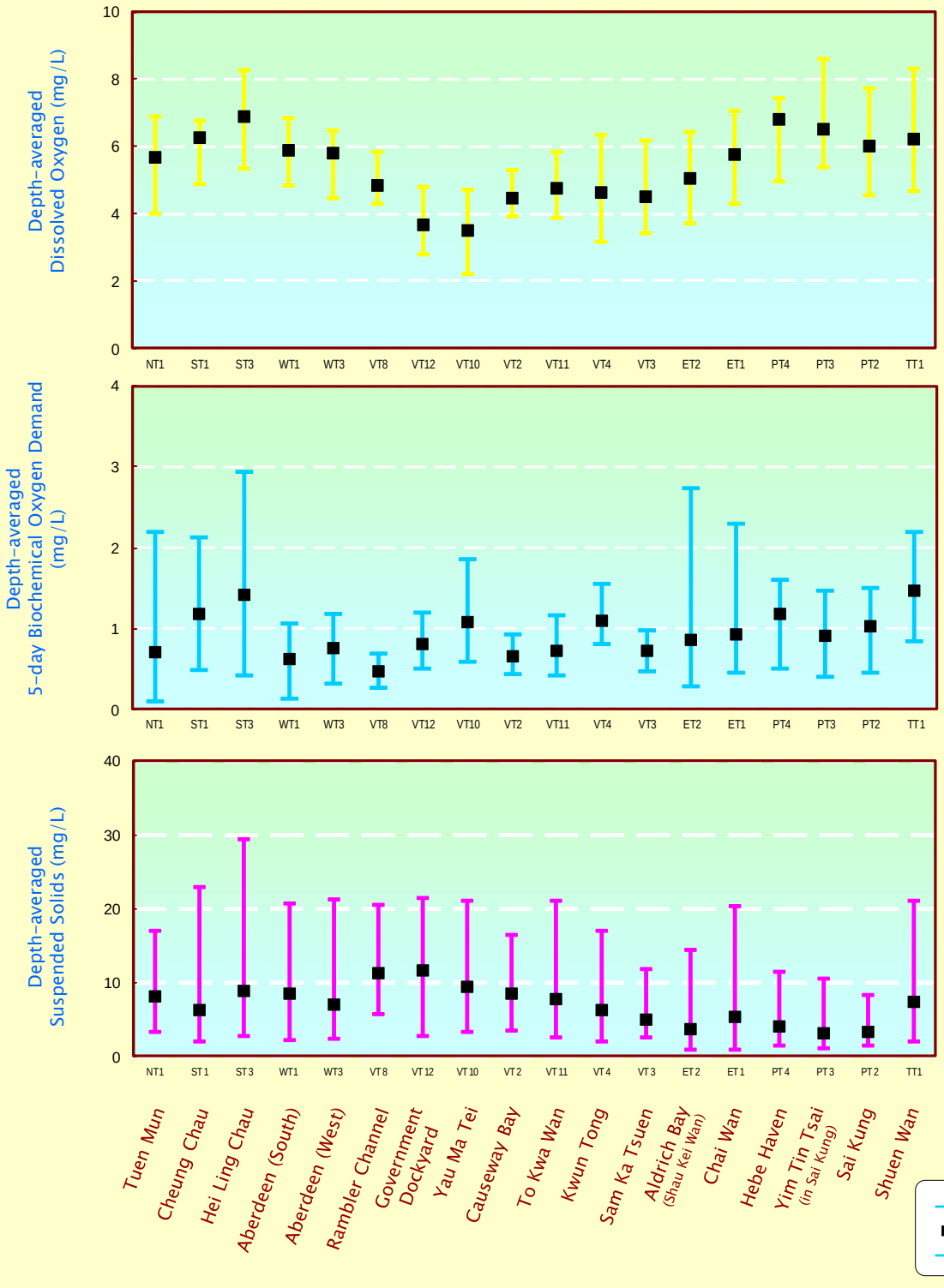
3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

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

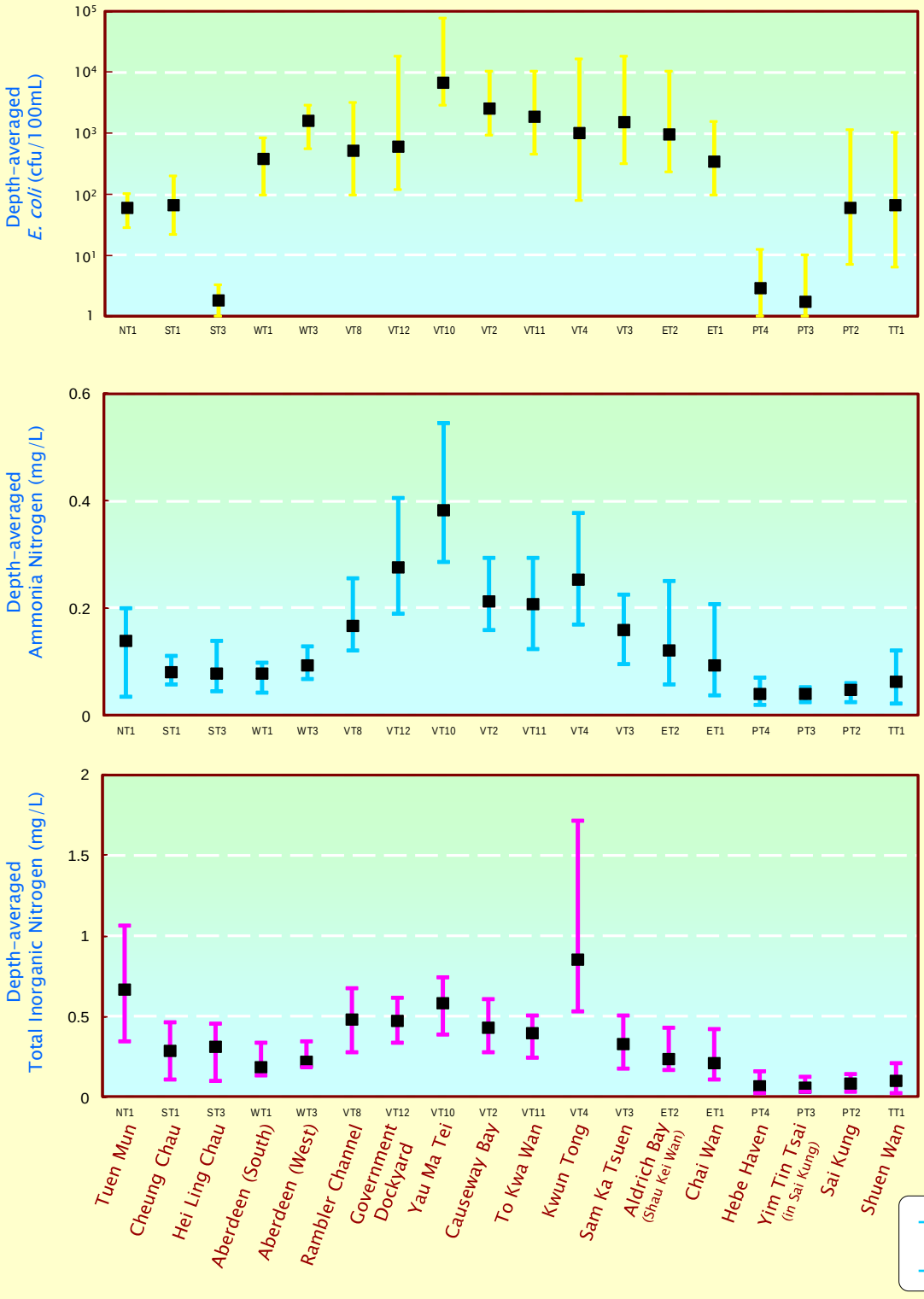
5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

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.

Water quality of typhoon shelters in Hong Kong in 2015



Water quality of typhoon shelters in Hong Kong in 2015 (continued)



Results of the Seasonal Kendall Test for water quality trends in typhoon shelters, 1986 – 2015

Monitoring Station		NT1	ST1	ST3	WT3	WT1	VT8	VT10	VT2	VT11
Monitoring Period		1986 I 2015	1986 I 2015	2000 I 2015	1986 I 2015	1986 I 2015	1986 I 2015	1993 I 2015	1986 I 2015	1994 I 2015
Parameter	Water Depth									
Temperature (°C)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Salinity	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
pH	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	↘	-	-	NA	NA	NA	-
	Bottom	NA	-	↘	-	-	-	-	-	-
	Average	-	-	↘	-	-	-	-	-	↘
Secchi disc depth (m)		-	↗	↗	↗	-	-	-	-	-
Turbidity (NTU)	Surface	↘	↘	↘	-	-	↘	↘	↘	↘
	Middle	NA	↘	↘	-	-	NA	NA	NA	-
	Bottom	NA	↘	↘	-	-	↘	↘	↘	↘
	Average	↘	↘	↘	-	-	↘	↘	↘	↘
Suspended Solids (mg/L)	Surface	-	↘	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Total volatile solids (mg/L)	Surface	↘	-	-	-	-	-	-	↘	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	↘	-	-	-	-	↘	-	-
	Average	↘	-	-	-	-	-	↘	↘	-
5-day Biochemical Oxygen Demand	Surface	-	-	-	-	-	↘	-	↘	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	↘	-
	Average	-	-	-	-	-	↘	-	↘	-
Ammonia nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Unionised Ammonia(mg/L)	Surface	-	↘	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	↘	↘	-	-	-	-	-	-
	Average	-	-	↘	-	-	-	-	-	-
Nitrite nitrogen (mg/L)	Surface	-	-	↗	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	↗	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Nitrate nitrogen (mg/L)	Surface	↗	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	↗	-	-	-	-	-	-
	Average	↗	-	↗	-	-	-	-	-	-
Total inorganic nitrogen (mg/L)	Surface	↗	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	↗	-	-	-	-	-	-	-	-
Total Kjeldahl nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Total nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Orthophosphate phosphorus (mg/L)	Surface	-	-	-	-	-	-	-	↘	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	↘	-
	Average	-	-	-	-	-	-	-	↘	-
Total phosphorus (mg/L)	Surface	-	-	-	-	-	-	-	↘	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	↘	-
Silica (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Chlorophyll-*a* (µg/L)	Surface	-	-	-	-	-	↘	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	↘	-	-	-
E. coli (cfu/100mL)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Faecal coliforms (cfu/100mL)	Surface	-	-	-	-	-	-	-	↘	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	NA	-	-	-	-	-	-	↘	-
	Average	-	-	-	-	-	-	-	↘	-

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

Results of the Seasonal Kendall Test for water quality trends in typhoon shelters, 1986 – 2015 (continued)

Monitoring Station		VT12	VT4	VT3	ET2	ET1	PT4	PT3	PT2	TT1
Monitoring Period		2000 I 2015	1987 I 2015	1986 I 2015	1993 I 2015	1986 I 2015	1986 I 2015	1986 I 2015	1986 I 2015	1986 I 2015
Parameter	Water Depth									
Temperature (°C)	Surface	-	-	-	↘	↘	-	-	-	-
	Middle	NA	-	NA	-	↘	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	↘	-	-	-	-
Salinity	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	↘
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	↗	-	NA	-
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (%)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	↗	-	NA	-
	Average	-	-	-	-	-	-	-	-	-
pH	Surface	-	-	-	-	-	-	-	↘	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	-	↘	-
Secchi disc depth (m)		-	↗	-	↗	↗	-	-	-	-
Turbidity (NTU)	Surface	↘	↘	↘	-	-	↘	↘	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	↘	↘	↘	↘	↘	-	↘	NA	-
	Average	↘	↘	↘	-	-	↘	↘	-	-
Suspended Solids (mg/L)	Surface	-	-	-	↘	-	-	-	-	-
	Middle	NA	↘	NA	↘	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	-	-	-
Total volatile solids (mg/L)	Surface	↘	-	↘	-	-	-	-	-	-
	Middle	NA	-	NA	↘	-	NA	-	NA	-
	Bottom	-	-	↘	-	-	-	-	NA	-
	Average	↘	-	↘	↘	↘	-	-	-	-
5-day Biochemical Oxygen Demand	Surface	-	↘	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	↗
	Average	-	↘	-	-	-	-	-	-	-
Ammonia nitrogen (mg/L)	Surface	-	↘	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	-	-	-
Unionised Ammonia(mg/L)	Surface	-	↘	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	↘	-	-	-	-	-	-	-
Nitrite nitrogen (mg/L)	Surface	-	↘	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	-	-	-
Nitrate nitrogen (mg/L)	Surface	-	↗	-	-	-	-	-	-	-
	Middle	NA	↗	NA	-	-	NA	-	NA	-
	Bottom	-	↗	-	-	-	-	-	NA	-
	Average	-	↗	-	-	-	-	-	-	-
Total inorganic nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	↗	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	-	-	-
Total Kjeldahl nitrogen (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	↗	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	↗	-	-
Total nitrogen (mg/L)	Surface	-	-	-	-	-	↗	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	↗	-	-
Orthophosphate phosphorus (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	↘	-	-	-	NA	-
	Average	-	-	-	↘	-	-	-	-	↘
Total phosphorus (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	-	-	-
Silica (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	-	-	-
Chlorophyll-*a* (µg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	-	-	-	-	-	-	NA	-
	Average	-	-	-	-	-	-	-	-	-
E. coli (cfu/100mL)	Surface	-	↘	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	↘	-	-	-	-	-	NA	-
	Average	-	↘	-	-	-	-	-	-	-
Faecal coliforms (cfu/100mL)	Surface	-	↘	-	-	-	-	-	-	-
	Middle	NA	-	NA	-	-	NA	-	NA	-
	Bottom	-	↘	-	-	-	-	-	NA	-
	Average	-	↘	-	-	-	-	-	-	-

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

Summary of water quality statistics for typhoon shelters in 2015

Parameter		Tuen Mun NT1	Cheung Chau ST1	Hei Ling Chau ST3	Aberdeen (South) WT1	Aberdeen (West) WT3	Rambler Channel VT8
Number of samples		**6**	**6**	**6**	**6**	**6**	**6**
Temperature (°C)		24.5 (17.6 - 29.3)	24.4 (18.2 - 28.9)	24.2 (18.2 - 28.4)	23.9 (18.0 - 27.8)	23.8 (18.0 - 27.6)	23.8 (17.7 - 27.8)
Salinity		26.2 (18.0 - 30.8)	30.1 (25.0 - 32.6)	29.8 (24.5 - 32.1)	32.1 (30.2 - 32.9)	31.8 (29.9 - 32.7)	29.4 (25.8 - 31.8)
Dissolved Oxygen (mg/L)		5.7 (4.0 - 6.9)	6.3 (4.9 - 6.8)	6.9 (5.4 - 8.3)	5.9 (4.9 - 6.8)	5.8 (4.5 - 6.5)	4.8 (4.3 - 5.8)
	Bottom	N.M.	5.8 (4.2 - 7.1)	6.6 (5.3 - 9.3)	6.0 (4.9 - 7.6)	5.7 (4.6 - 7.2)	5.3 (4.5 - 6.5)
Dissolved Oxygen (% Saturation)		79 (51 - 99)	89 (72 - 100)	97 (79 - 120)	83 (74 - 89)	82 (68 - 91)	67 (62 - 74)
	Bottom	N.M.	82 (62 - 91)	92 (77 - 119)	84 (75 - 97)	80 (68 - 92)	74 (64 - 84)
pH		7.8 (7.7 - 8.0)	8.0 (7.7 - 8.2)	8.0 (7.7 - 8.3)	7.9 (7.8 - 8.2)	7.9 (7.7 - 8.2)	7.8 (7.7 - 8.0)
Secchi Disc Depth (m)		1.9 (1.2 - 2.7)	2.4 (2.0 - 3.0)	2.4 (1.8 - 3.5)	3.0 (1.8 - 5.0)	2.8 (1.8 - 4.0)	1.7 (1.5 - 2.1)
Turbidity (NTU)		5 (3.7 - 7.5)	5.2 (3.2 - 8.5)	5.1 (2.9 - 10.4)	4.5 (1.6 - 7.5)	4.5 (1.8 - 7.4)	6.6 (4.1 - 10.5)
Suspended Solids (mg/L)		8.1 (3.2 - 17.0)	6.2 (1.9 - 23.0)	8.9 (2.7 - 29.3)	8.5 (2.2 - 20.7)	6.9 (2.3 - 21.3)	11.2 (5.6 - 20.5)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (<0.1 - 2.2)	1.2 (0.5 - 2.1)	1.4 (0.4 - 2.9)	0.6 (0.1 - 1.1)	0.8 (0.3 - 1.2)	0.5 (0.3 - 0.7)
Ammonia Nitrogen (mg/L)		0.14 (0.034 - 0.200)	0.08 (0.059 - 0.110)	0.08 (0.045 - 0.140)	0.08 (0.044 - 0.098)	0.09 (0.067 - 0.130)	0.17 (0.120 - 0.255)
Unionised Ammonia (mg/L)		0.004 (0.003 - 0.009)	0.004 (0.002 - 0.006)	0.003 (0.001 - 0.005)	0.003 (0.001 - 0.006)	0.004 (0.001 - 0.006)	0.005 (0.002 - 0.007)
Nitrite Nitrogen (mg/L)		0.060 (0.017 - 0.088)	0.028 (0.007 - 0.050)	0.036 (0.007 - 0.072)	0.018 (0.007 - 0.044)	0.023 (0.009 - 0.053)	0.055 (0.014 - 0.120)
Nitrate Nitrogen (mg/L)		0.472 (0.150 - 0.950)	0.175 (0.045 - 0.360)	0.200 (0.045 - 0.343)	0.087 (0.037 - 0.210)	0.102 (0.045 - 0.223)	0.257 (0.120 - 0.425)
Total Inorganic Nitrogen (mg/L)		0.67 (0.35 - 1.06)	0.28 (0.11 - 0.47)	0.31 (0.10 - 0.46)	0.18 (0.14 - 0.33)	0.22 (0.18 - 0.34)	0.48 (0.28 - 0.68)
Total Kjeldahl Nitrogen (mg/L)		0.45 (0.21 - 0.79)	0.32 (0.27 - 0.40)	0.33 (0.30 - 0.39)	0.26 (0.09 - 0.46)	0.28 (0.12 - 0.48)	0.38 (0.32 - 0.42)
Total Nitrogen (mg/L)		0.98 (0.56 - 1.25)	0.52 (0.34 - 0.70)	0.57 (0.37 - 0.71)	0.37 (0.19 - 0.51)	0.41 (0.24 - 0.53)	0.69 (0.51 - 0.86)
Orthophosphate Phosphorus (mg/L)		0.024 (0.005 - 0.036)	0.012 (0.002 - 0.024)	0.013 (0.003 - 0.027)	0.011 (0.002 - 0.017)	0.011 (0.003 - 0.020)	0.023 (0.015 - 0.039)
Total Phosphorus (mg/L)		0.06 (0.03 - 0.12)	0.04 (0.02 - 0.10)	0.05 (0.02 - 0.14)	0.03 (0.02 - 0.06)	0.03 (0.02 - 0.07)	0.06 (0.04 - 0.08)
Silica (as SiO_2) (mg/L)		2.02 (0.38 - 5.70)	0.94 (0.17 - 1.93)	0.93 (0.08 - 2.00)	0.68 (0.39 - 1.13)	0.73 (0.36 - 1.20)	1.48 (0.50 - 3.00)
Chlorophyll-*a* (µg/L)		3.4 (1.0 - 9.9)	6.6 (1.2 - 16.0)	9.5 (1.7 - 23.3)	2.8 (1.0 - 6.8)	2.9 (0.5 - 6.5)	1.0 (0.3 - 1.8)
E.coli (count/100mL)		59 (28 - 100)	65 (21 - 200)	2 (<1 - 3)	380 (97 - 840)	1600 (550 - 2800)	520 (97 - 3200)
Faecal Coliforms (count/100mL)		380 (160 - 1000)	210 (74 - 360)	3 (1 - 7)	970 (310 - 2100)	3000 (1100 - 5300)	1800 (310 - 13000)

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 2015 (continued)

Parameter		Government Dockyard VT12	Yau Ma Tei VT10	Causeway Bay VT2	To Kwa Wan VT11	Kwun Tong VT4	Sam Ka Tsuen VT3
Number of samples		6	6	6	6	6	6
Temperature (°C)		23.9 (17.8 - 28.0)	23.7 (17.5 - 27.9)	23.7 (17.3 - 27.8)	23.5 (17.1 - 27.8)	23.9 (17.7 - 28.0)	23.5 (17.2 - 27.9)
Salinity		29.9 (23.9 - 32.0)	29.7 (23.3 - 32.3)	30.2 (25.7 - 32.3)	30.9 (26.9 - 32.5)	29.4 (26.5 - 31.3)	31.0 (26.2 - 32.7)
Dissolved Oxygen (mg/L)		3.7 (2.8 - 4.8)	3.5 (2.2 - 4.7)	4.5 (3.9 - 5.3)	4.8 (3.9 - 5.9)	4.6 (3.2 - 6.3)	4.5 (3.4 - 6.2)
	Bottom	3.9 (2.9 - 5.4)	3.7 (2.3 - 4.9)	4.6 (3.8 - 5.7)	5.0 (3.8 - 6.4)	4.6 (3.3 - 6.5)	4.9 (3.7 - 6.4)
Dissolved Oxygen (% Saturation)		51 (40 - 62)	49 (33 - 61)	62 (57 - 68)	66 (56 - 73)	64 (46 - 81)	62 (52 - 78)
	Bottom	54 (43 - 70)	51 (34 - 63)	64 (58 - 73)	69 (56 - 83)	65 (49 - 83)	68 (56 - 82)
pH		7.7 (7.5 - 7.9)	7.7 (7.6 - 7.8)	7.8 (7.6 - 8.0)	7.8 (7.7 - 8.0)	7.7 (7.4 - 7.8)	7.8 (7.6 - 7.9)
Secchi Disc Depth (m)		1.7 (1.2 - 2.2)	1.8 (1.3 - 2.2)	2.1 (1.8 - 2.5)	2.1 (1.6 - 2.6)	2.5 (1.8 - 3.3)	2.3 (1.8 - 3.0)
Turbidity (NTU)		6.8 (3.7 - 9.3)	6.1 (3.1 - 11.7)	5.4 (4.0 - 8.4)	5.0 (3.3 - 7.3)	4.0 (1.4 - 6.1)	4.8 (3.3 - 6.7)
Suspended Solids (mg/L)		11.6 (2.7 - 21.5)	9.5 (3.2 - 21.0)	8.4 (3.5 - 16.5)	7.7 (2.6 - 21.0)	6.2 (1.9 - 17.0)	5.0 (2.6 - 11.8)
5-day Biochemical Oxygen Demand (mg/L)		0.8 (0.5 - 1.2)	1.1 (0.6 - 1.9)	0.7 (0.4 - 0.9)	0.7 (0.4 - 1.2)	1.1 (0.8 - 1.6)	0.7 (0.5 - 1.0)
Ammonia Nitrogen (mg/L)		0.28 (0.190 - 0.405)	0.38 (0.285 - 0.545)	0.21 (0.160 - 0.295)	0.21 (0.123 - 0.293)	0.25 (0.170 - 0.377)	0.16 (0.097 - 0.225)
Unionised Ammonia (mg/L)		0.006 (0.002 - 0.011)	0.008 (0.003 - 0.014)	0.006 (0.002 - 0.012)	0.007 (0.002 - 0.013)	0.006 (0.002 - 0.011)	0.005 (0.001 - 0.009)
Nitrite Nitrogen (mg/L)		0.029 (0.015 - 0.048)	0.036 (0.015 - 0.069)	0.033 (0.011 - 0.069)	0.030 (0.011 - 0.066)	0.055 (0.029 - 0.101)	0.027 (0.008 - 0.064)
Nitrate Nitrogen (mg/L)		0.164 (0.099 - 0.275)	0.166 (0.084 - 0.295)	0.189 (0.100 - 0.315)	0.157 (0.094 - 0.217)	0.545 (0.313 - 1.240)	0.144 (0.065 - 0.235)
Total Inorganic Nitrogen (mg/L)		0.47 (0.34 - 0.61)	0.58 (0.39 - 0.75)	0.43 (0.28 - 0.61)	0.40 (0.24 - 0.51)	0.85 (0.53 - 1.72)	0.33 (0.18 - 0.50)
Total Kjeldahl Nitrogen (mg/L)		0.63 (0.48 - 0.93)	0.69 (0.56 - 1.03)	0.50 (0.42 - 0.76)	0.47 (0.37 - 0.71)	0.57 (0.37 - 0.90)	0.44 (0.31 - 0.68)
Total Nitrogen (mg/L)		0.82 (0.63 - 1.07)	0.89 (0.66 - 1.17)	0.72 (0.55 - 0.94)	0.65 (0.53 - 0.87)	1.17 (0.72 - 2.24)	0.61 (0.46 - 0.82)
Orthophosphate Phosphorus (mg/L)		0.038 (0.025 - 0.043)	0.036 (0.022 - 0.045)	0.030 (0.023 - 0.046)	0.033 (0.024 - 0.043)	0.172 (0.063 - 0.417)	0.029 (0.018 - 0.044)
Total Phosphorus (mg/L)		0.08 (0.07 - 0.11)	0.09 (0.07 - 0.12)	0.07 (0.05 - 0.10)	0.07 (0.05 - 0.09)	0.23 (0.09 - 0.56)	0.07 (0.04 - 0.10)
Silica (as SiO_2) (mg/L)		1.18 (0.57 - 1.95)	1.21 (0.66 - 2.10)	1.33 (0.64 - 2.65)	1.11 (0.48 - 2.20)	1.68 (0.89 - 3.77)	1.06 (0.47 - 2.05)
Chlorophyll-*a* (µg/L)		2.2 (0.6 - 4.1)	1.8 (0.3 - 5.6)	0.8 (0.4 - 1.1)	1.3 (0.4 - 2.3)	4.1 (0.5 - 6.8)	1.0 (0.2 - 2.1)
E.coli (count/100mL)		610 (120 - 18000)	6800 (2800 - 77000)	2600 (900 - 10000)	1900 (440 - 10000)	1000 (77 - 16000)	1500 (310 - 18000)
Faecal Coliforms (count/100mL)		1800 (300 - 66000)	17000 (4500 - 240000)	9800 (3100 - 44000)	4100 (790 - 27000)	3600 (500 - 53000)	3900 (1000 - 77000)

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 2015 (continued)

Parameter		Aldrich Bay (Shau Kei Wan) ET2	Chai Wan ET1	Hebe Haven PT4	Yim Tin Tsai PT3	Sai Kung PT2	Shuen Wan TT1
Number of samples		6	6	6	6	6	6
Temperature (°C)		22.8 (17.8 - 28.0)	23.0 (17.7 - 28.1)	24.8 (17.2 - 30.1)	24.2 (16.7 - 28.8)	24.5 (17.0 - 29.3)	25.0 (17.5 - 29.9)
Salinity		32.3 (31.5 - 32.8)	32.2 (31.5 - 32.8)	32.3 (31.6 - 33.0)	32.8 (31.8 - 33.4)	32.5 (31.6 - 33.1)	31.1 (27.1 - 32.4)
Dissolved Oxygen (mg/L)		5.0 (3.7 - 6.4)	5.7 (4.3 - 7.1)	6.8 (5.0 - 7.5)	6.5 (5.4 - 8.6)	6.0 (4.6 - 7.7)	6.2 (4.7 - 8.3)
	Bottom	5.1 (3.7 - 6.6)	5.8 (4.1 - 7.2)	7.2 (6.1 - 7.8)	6.8 (5.6 - 8.8)	N.M. N.M.	6.1 (3.3 - 9.6)
Dissolved Oxygen (% Saturation)		70 (56 - 82)	80 (65 - 90)	98 (78 - 111)	93 (83 - 108)	86 (71 - 101)	89 (67 - 111)
	Bottom	71 (53 - 85)	81 (63 - 92)	104 (90 - 118)	96 (86 - 109)	N.M. N.M.	87 (49 - 129)
pH		7.8 (7.6 - 8.0)	7.9 (7.8 - 8.2)	8.0 (7.7 - 8.3)	8.0 (7.8 - 8.3)	7.9 (7.6 - 8.1)	8.1 (7.8 - 8.3)
Secchi Disc Depth (m)		3.6 (2.5 - 4.3)	3.1 (2.0 - 4.1)	3.0 (2.5 - 3.5)	3.2 (2.7 - 3.8)	2.4 (2.0 - 3.0)	2.8 (1.7 - 3.5)
Turbidity (NTU)		2.8 (1.1 - 4.6)	2.9 (1.2 - 4.7)	3.1 (1.3 - 6.2)	3.5 (1.0 - 9.3)	4.1 (2.2 - 11.1)	3.4 (1.7 - 4.9)
Suspended Solids (mg/L)		3.6 (0.9 - 14.3)	5.3 (0.8 - 20.3)	4.0 (1.4 - 11.5)	3.0 (1.1 - 10.4)	3.2 (1.5 - 8.3)	7.3 (1.9 - 21.0)
5-day Biochemical Oxygen Demand (mg/L)		0.9 (0.3 - 2.7)	0.9 (0.5 - 2.3)	1.2 (0.5 - 1.6)	0.9 (0.4 - 1.5)	1.0 (0.5 - 1.5)	1.5 (0.8 - 2.2)
Ammonia Nitrogen (mg/L)		0.12 (0.057 - 0.250)	0.09 (0.038 - 0.207)	0.04 (0.019 - 0.072)	0.04 (0.025 - 0.053)	0.05 (0.026 - 0.060)	0.06 (0.022 - 0.120)
Unionised Ammonia (mg/L)		0.004 (<0.001 - 0.008)	0.004 (<0.001 - 0.010)	0.002 (<0.001 - 0.003)	0.002 (<0.001 - 0.003)	0.002 (<0.001 - 0.004)	0.003 (0.002 - 0.006)
Nitrite Nitrogen (mg/L)		0.022 (0.007 - 0.048)	0.018 (0.006 - 0.037)	0.004 (<0.002 - 0.009)	0.003 (<0.002 - 0.007)	0.004 (<0.002 - 0.009)	0.008 (<0.002 - 0.033)
Nitrate Nitrogen (mg/L)		0.091 (0.064 - 0.154)	0.095 (0.039 - 0.193)	0.025 (<0.002 - 0.088)	0.015 (<0.002 - 0.065)	0.028 (<0.002 - 0.089)	0.025 (<0.002 - 0.082)
Total Inorganic Nitrogen (mg/L)		0.24 (0.16 - 0.43)	0.21 (0.11 - 0.42)	0.07 (0.02 - 0.16)	0.06 (0.03 - 0.12)	0.08 (0.03 - 0.14)	0.10 (0.03 - 0.21)
Total Kjeldahl Nitrogen (mg/L)		0.34 (0.14 - 0.69)	0.29 (0.10 - 0.57)	0.29 (0.22 - 0.39)	0.26 (0.21 - 0.31)	0.26 (0.22 - 0.30)	0.44 (0.23 - 0.57)
Total Nitrogen (mg/L)		0.45 (0.26 - 0.87)	0.40 (0.20 - 0.78)	0.31 (0.22 - 0.39)	0.28 (0.21 - 0.39)	0.29 (0.24 - 0.40)	0.47 (0.24 - 0.63)
Orthophosphate Phosphorus (mg/L)		0.019 (0.005 - 0.041)	0.014 (0.005 - 0.038)	0.006 (0.004 - 0.009)	0.006 (0.005 - 0.009)	0.007 (0.005 - 0.010)	0.006 (0.004 - 0.010)
Total Phosphorus (mg/L)		0.04 (0.03 - 0.09)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.08)	0.04 (<0.02 - 0.09)	0.04 (<0.02 - 0.07)
Silica (as SiO_2) (mg/L)		0.81 (0.27 - 1.73)	0.68 (0.26 - 1.70)	0.45 (0.06 - 0.84)	0.54 (0.25 - 0.75)	0.59 (0.12 - 0.86)	0.90 (0.36 - 1.23)
Chlorophyll-*a* (µg/L)		1.5 (0.8 - 2.1)	2.1 (1.1 - 2.9)	4.3 (1.6 - 8.7)	2.9 (1.4 - 6.1)	2.4 (0.9 - 3.9)	4.9 (1.8 - 11.4)
E.coli (count/100mL)		960 (230 - 10000)	350 (97 - 1500)	3 (<1 - 12)	2 (<1 - 10)	60 (7 - 1100)	66 (6 - 1000)
Faecal Coliforms (count/100mL)		2100 (400 - 30000)	1100 (110 - 9500)	8 (1 - 37)	3 (<1 - 11)	230 (44 - 4700)	180 (20 - 2600)

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 statistics of bottom sediment quality of typhoon shelters, 2011- 2015

Parameter	Tuen Mun NS5	Cheung Chau SS7	Hei Ling Chau SS8	Rambler Channel VS17	Government Dockyard VS21	Yau Ma Tei VS19	Causeway Bay VS12
Number of samples	10	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	74 (53 - 90)	89 (65 - 98)	96 (92 - 98)	80 (50 - 99)	79 (3 - 98)	83 (55 - 92)	74 (26 - 99)
Electrochemical Potential (mV)	-285 (-386 - -92)	-289 (-465 - -74)	-265 (-403 - -79)	-292 (-376 - -169)	-326 (-396 - -230)	-362 (-407 - -259)	-316 (-389 - -193)
Total Solids (%w/w)	44 (36 - 53)	36 (28 - 48)	36 (32 - 40)	41 (37 - 50)	37 (30 - 46)	52 (47 - 59)	50 (36 - 68)
Total Volatile Soilds (%w/w)	7.2 (5.5 - 9.2)	7.6 (6.2 - 11.0)	7.8 (6.4 - 8.7)	7.9 (6.3 - 9.0)	7.4 (6.4 - 9.2)	6.4 (5.2 - 7.6)	6.7 (3.8 - 9.2)
Chemical Oxygen Demand (mg/kg)	16600 (13000 - 27000)	15000 (13000 - 18000)	10950 (8900 - 14000)	19500 (16000 - 24000)	15200 (13000 - 20000)	14200 (12000 - 20000)	17900 (10000 - 24000)
Total Carbon (%w/w)	0.7 (0.5 - 0.9)	0.6 (0.5 - 0.9)	0.5 (0.4 - 0.5)	0.9 (0.7 - 1.2)	0.5 (0.4 - 0.6)	0.9 (0.8 - 1.4)	1.1 (0.6 - 2.0)
Ammonical Nitrogen (mg/kg)	10.2 (2.2 - 27.0)	9.4 (1.3 - 23.0)	8.4 (0.7 - 18.0)	5.5 (0.2 - 12.0)	10.5 (2.7 - 22.0)	19.0 (4.1 - 32.0)	18.2 (1.9 - 65.0)
Total Kjeldahl Nitrogen (mg/kg)	470 (270 - 580)	510 (430 - 680)	530 (390 - 650)	560 (430 - 710)	440 (350 - 520)	480 (350 - 590)	510 (300 - 750)
Total Phosphorus (mg/kg)	220 (150 - 290)	220 (170 - 420)	180 (150 - 230)	220 (170 - 260)	180 (160 - 190)	240 (170 - 360)	200 (130 - 310)
Total Sulphide (mg/kg)	110 (13 - 340)	90 (0 - 330)	68 (1 - 390)	240 (54 - 430)	120 (10 - 350)	110 (3 - 180)	170 (41 - 410)
Total Cyanide (mg/kg)	0.2 (<0.1 - 0.3)	0.2 (0.1 - 0.2)	0.1 (<0.1 - 0.2)	0.3 (0.1 - 0.5)	0.1 (<0.1 - 0.2)	0.1 (<0.1 - 0.2)	0.2 (<0.1 - 0.2)
Arsenic (mg/kg)	8.6 (7.2 - 10.0)	7 (5.9 - 8.8)	6.8 (5.7 - 7.6)	8.8 (6.7 - 10.0)	7.3 (4.3 - 8.3)	5.1 (4.2 - 6.1)	6.7 (3.8 - 9.0)
Cadmium (mg/kg)	0.3 (0.2 - 0.6)	0.1 (<0.1 - 0.2)	<0.1 (<0.1 - <0.1)	0.8 (0.4 - 1.8)	0.4 (0.3 - 0.5)	0.3 (0.1 - 0.6)	0.4 (0.1 - 0.9)
Chromium (mg/kg)	32 (28 - 38)	44 (31 - 60)	37 (32 - 43)	130 (69 - 330)	43 (28 - 48)	33 (22 - 42)	37 (17 - 64)
Copper (mg/kg)	48 (31 - 67)	85 (56 - 130)	33 (28 - 37)	230 (150 - 730)	140 (89 - 190)	69 (35 - 100)	110 (37 - 230)
Lead (mg/kg)	46 (27 - 69)	64 (33 - 230)	45 (39 - 50)	74 (54 - 92)	47 (33 - 54)	40 (24 - 82)	61 (27 - 120)
Mercury (mg/kg)	0.1 (0.07 - 0.17)	0.15 (0.10 - 0.23)	0.12 (0.10 - 0.13)	0.23 (0.16 - 0.33)	0.21 (0.17 - 0.27)	0.16 (<0.05 - 0.22)	0.54 (0.19 - 0.69)
Nickel (mg/kg)	18 (14 - 23)	20 (15 - 24)	23 (20 - 25)	47 (24 - 160)	22 (19 - 24)	19 (15 - 22)	17 (7 - 25)
Silver (mg/kg)	1.5 (0.7 - 3.2)	0.3 (<0.2 - 0.4)	0.4 (0.2 - 0.5)	4.3 (2.6 - 12.0)	1.4 (1.0 - 1.6)	1.0 (0.5 - 1.8)	2 (0.4 - 4.9)
Zinc (mg/kg)	160 (110 - 260)	150 (110 - 170)	130 (120 - 130)	280 (210 - 400)	190 (110 - 250)	160 (110 - 300)	180 (71 - 310)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 21)	18 (18 - 18)	36 (19 - 76)	20 (18 - 29)	18 (18 - 20)	73 (18 - 400)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4][6]	150 (90 - 340)	110 (90 - 190)	110 (90 - 190)	190 (96 - 510)	130 (96 - 280)	120 (90 - 170)	180 (94 - 290)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5][6]	260 (76 - 970)	220 (100 - 650)	82 (59 - 110)	1600 (260 - 5400)	240 (110 - 490)	200 (120 - 330)	730 (250 - 2100)

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, 2011- 2015 (continued)

Parameter	To Kwa Wan VS20	Kwun Tong VS14	Sam Ka Tsuen VS13	Aldrich Bay (Shau Kei ES5	Chai Wan ES3	Hebe Haven PS4	Yim Tin Tsai PS2	Shuen Wan TS7
Number of samples	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
Particle Size Fractionation <63µm (% w/w)	80 (58 - 99)	79 (52 - 92)	81 (60 - 89)	92 (81 - 99)	89 (83 - 96)	89 (75 - 95)	76 (33 - 91)	74 (45 - 100)
Electrochemical Potential (mV)	-350 (-398 - -316)	-340 (-394 - -223)	-326 (-457 - -164)	-356 (-400 - -289)	-311 (-389 - -233)	-294 (-396 - -151)	-265 (-398 - -86)	-322 (-451 - -201)
Total Solids (% w/w)	42 (36 - 48)	34 (28 - 40)	38 (35 - 41)	30 (25 - 37)	38 (35 - 44)	42 (36 - 46)	48 (40 - 72)	39 (28 - 49)
Total Volatile Soilds (% w/w)	9.9 (8.1 - 16.0)	10.3 (8.5 - 12.0)	9.6 (8.6 - 11.0)	9.2 (8.1 - 10.0)	8.0 (6.7 - 9.0)	9.4 (8.2 - 10.0)	9.6 (5.8 - 12.0)	8.2 (5.5 - 11.0)
Chemical Oxygen Demand (mg/kg)	27800 (21000 - 41000)	22400 (16000 - 32000)	22800 (17000 - 27000)	17100 (12000 - 22000)	20100 (16000 - 23000)	22000 (19000 - 24000)	15440 (9400 - 19000)	22700 (19000 - 29000)
Total Carbon (% w/w)	1.4 (0.7 - 2.8)	1.0 (0.7 - 1.8)	1.0 (0.7 - 1.3)	0.7 (0.5 - 0.9)	0.9 (0.8 - 1.0)	1.0 (0.7 - 1.3)	2.0 (0.9 - 6.0)	0.8 (0.6 - 1.0)
Ammonical Nitrogen (mg/kg)	14.2 (2.0 - 34.0)	22.0 (5.8 - 43.0)	15.9 (1.4 - 74.0)	28.8 (16.0 - 37.0)	3.8 (0.3 - 10.0)	6.5 (0.3 - 22.0)	9.3 (4.1 - 23.0)	8.4 (3.6 - 15.0)
Total Kjeldahl Nitrogen (mg/kg)	650 (560 - 760)	700 (500 - 1200)	640 (380 - 760)	570 (470 - 620)	580 (520 - 660)	750 (620 - 1000)	610 (170 - 950)	630 (490 - 780)
Total Phosphorus (mg/kg)	250 (210 - 340)	240 (190 - 420)	330 (170 - 670)	190 (150 - 230)	210 (190 - 240)	210 (170 - 250)	170 (79 - 260)	220 (170 - 320)
Total Sulphide (mg/kg)	210 (44 - 350)	400 (0 - 860)	410 (120 - 970)	550 (200 - 730)	190 (20 - 350)	61 (23 - 140)	35 (8 - 83)	130 (45 - 340)
Total Cyanide (mg/kg)	0.2 (<0.1 - 0.3)	0.3 (<0.1 - 0.5)	0.2 (<0.1 - 0.4)	0.2 (<0.1 - 0.2)	0.2 (<0.1 - 0.2)	0.2 (0.1 - 0.3)	0.1 (<0.1 - 0.2)	0.3 (<0.1 - 0.5)
Arsenic (mg/kg)	8.8 (7.2 - 14.0)	7.1 (5.7 - 8.8)	7.7 (6.7 - 10.0)	7.6 (6.7 - 8.8)	9.3 (7.5 - 10.0)	8.2 (6.4 - 10.0)	4.6 (3.5 - 5.9)	9.2 (7.1 - 11.0)
Cadmium (mg/kg)	1.0 (0.7 - 1.4)	2.6 (1.2 - 4.9)	0.8 (0.4 - 1.0)	0.4 (0.4 - 0.5)	0.5 (0.3 - 0.8)	0.1 (<0.1 - 0.2)	<0.1 (<0.1 - <0.1)	0.4 (0.3 - 0.6)
Chromium (mg/kg)	95 (67 - 140)	250 (130 - 510)	61 (46 - 110)	53 (46 - 68)	81 (58 - 100)	24 (17 - 27)	16 (13 - 20)	23 (16 - 33)
Copper (mg/kg)	620 (380 - 1100)	1700 (810 - 4300)	170 (120 - 270)	210 (150 - 270)	230 (140 - 280)	48 (24 - 61)	14 (11 - 17)	110 (55 - 150)
Lead (mg/kg)	130 (75 - 400)	130 (88 - 170)	86 (61 - 97)	65 (55 - 79)	85 (61 - 100)	38 (23 - 45)	29 (20 - 37)	93 (55 - 110)
Mercury (mg/kg)	1.21 (0.89 - 1.60)	0.82 (0.57 - 1.40)	1.07 (0.41 - 2.10)	0.25 (0.17 - 0.29)	0.39 (0.28 - 0.53)	0.14 (0.09 - 0.16)	0.06 (<0.05 - 0.07)	0.27 (0.07 - 1.50)
Nickel (mg/kg)	32 (20 - 51)	69 (37 - 160)	20 (16 - 31)	24 (20 - 31)	25 (17 - 30)	8 (5 - 10)	13 (9 - 21)	11 (7 - 13)
Silver (mg/kg)	4.6 (3.2 - 5.8)	7.8 (4.5 - 15.0)	2.3 (1.8 - 2.8)	4.8 (1.8 - 8.0)	13.0 (6.0 - 23.0)	0.3 (0.2 - 0.3)	0.2 (<0.2 - 0.3)	0.4 (0.2 - 0.5)
Zinc (mg/kg)	350 (250 - 980)	420 (310 - 640)	340 (280 - 490)	280 (230 - 350)	330 (240 - 460)	140 (81 - 170)	69 (53 - 90)	270 (220 - 450)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	100 (56 - 130)	170 (92 - 380)	41 (29 - 66)	20 (18 - 31)	35 (23 - 51)	18 (18 - 18)	18 (18 - 18)	19 (18 - 25)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4] [6]	48000 (1000 - 120000)	210 (96 - 400)	190 (100 - 430)	180 (95 - 340)	180 (100 - 270)	140 (97 - 340)	130 (90 - 400)	120 (90 - 190)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	520000 (9300 - 1200000)	1200 (790 - 2100)	840 (540 - 1400)	650 (220 - 1200)	600 (310 - 970)	110 (71 - 150)	54 (21 - 88)	130 (77 - 210)

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

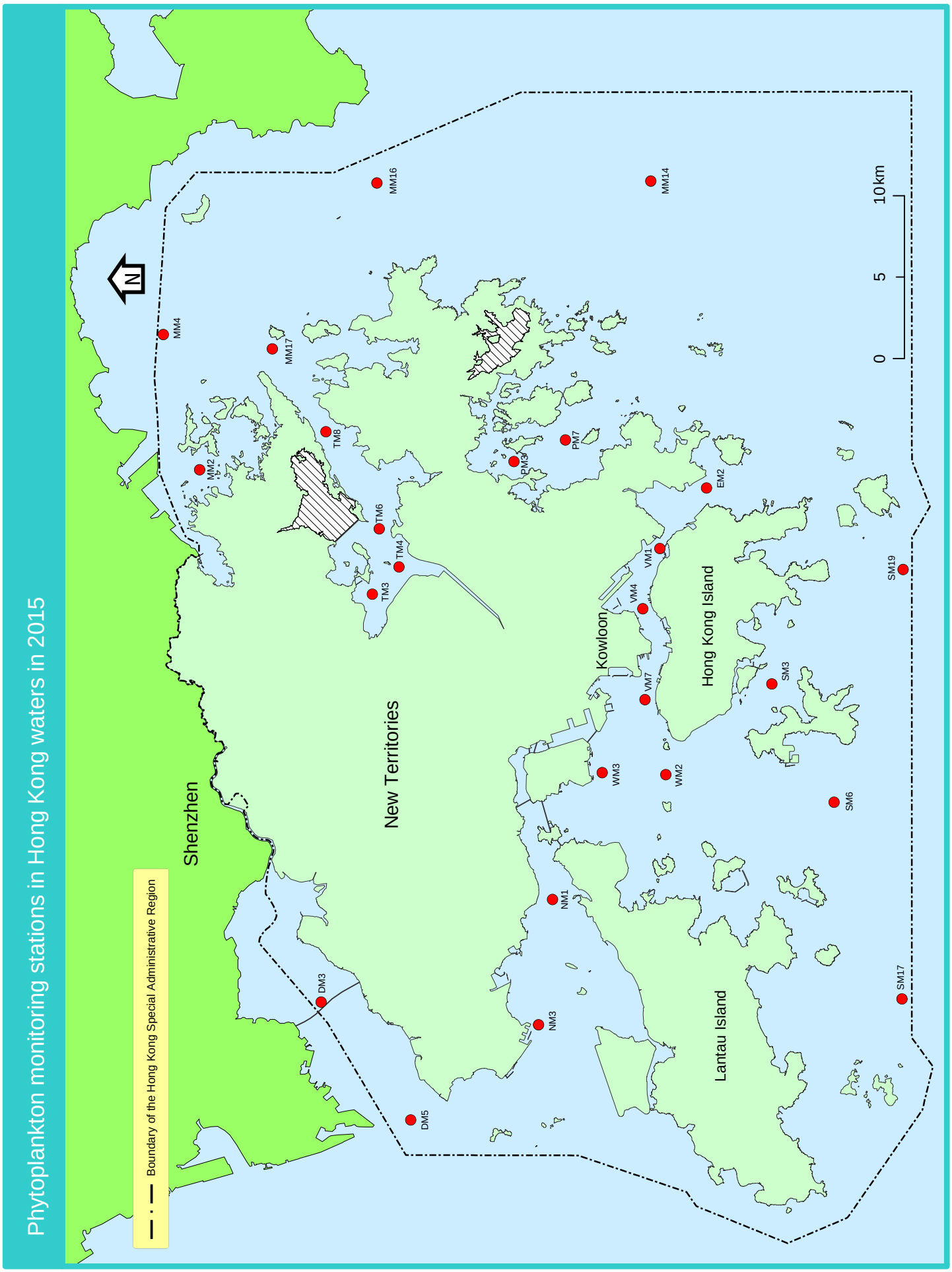
2 All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.

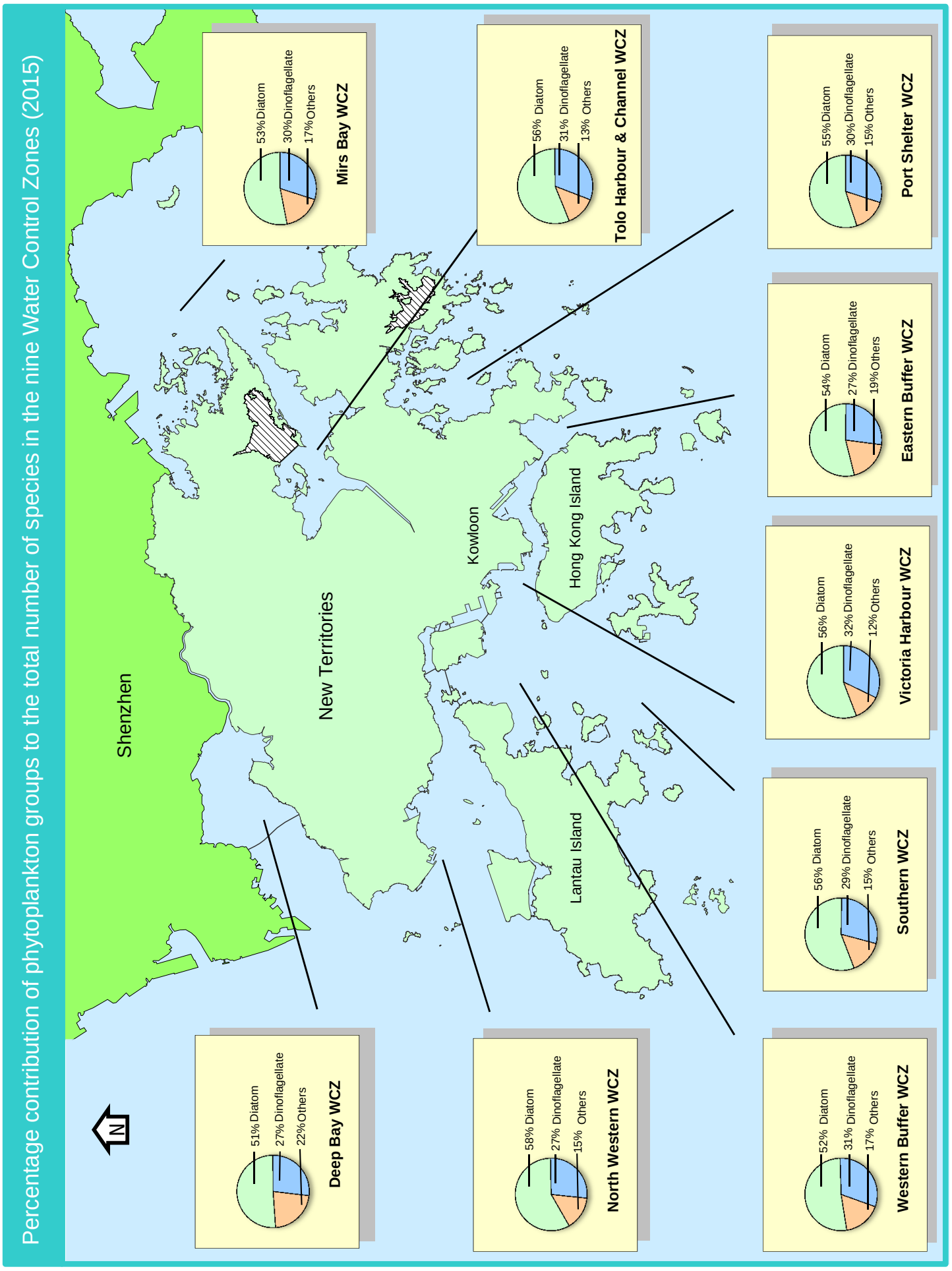
3 Total PCBs results are derived from the summation of 18 congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

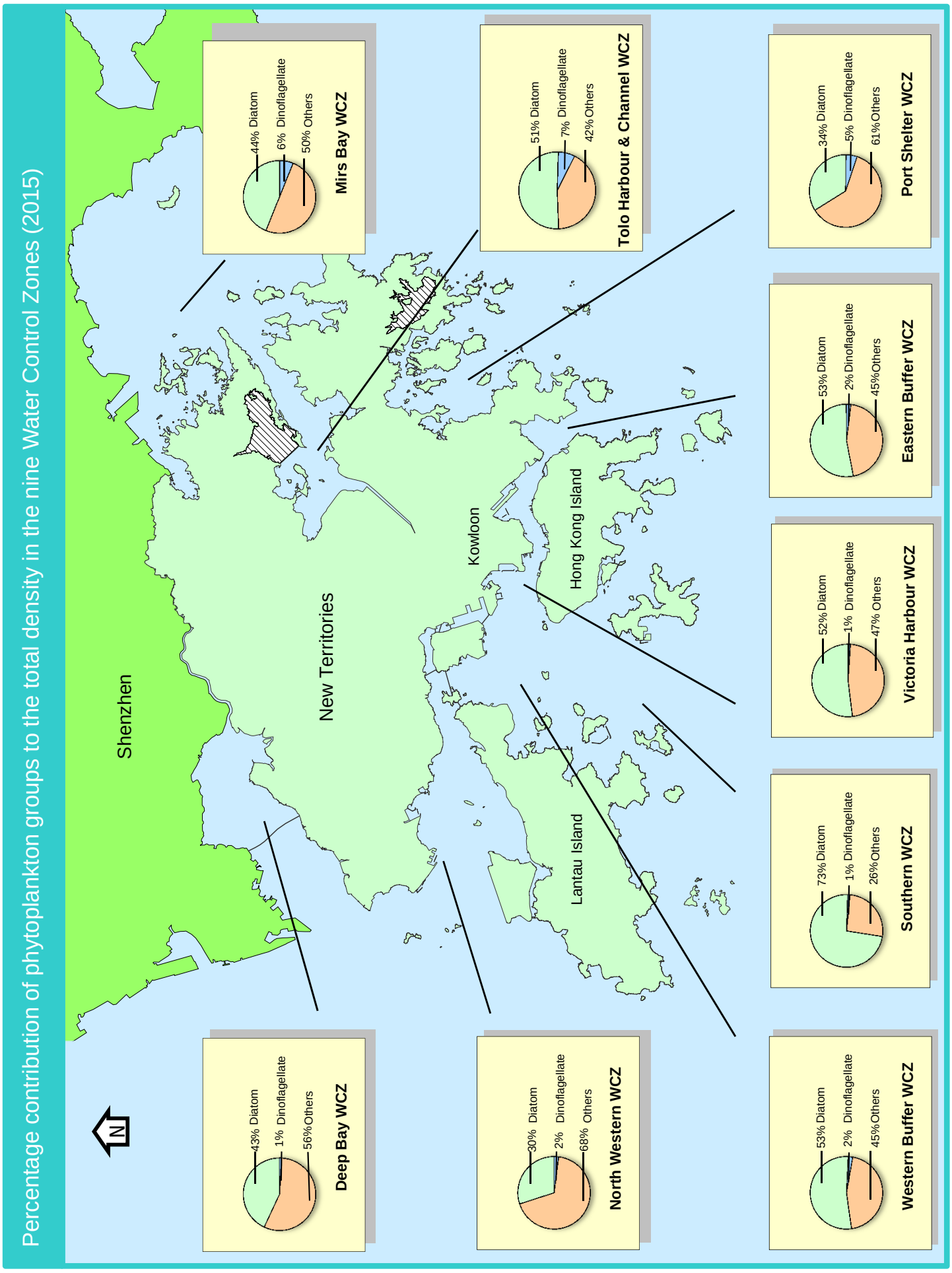
4 Low molecular weight polyaromatic hydrocarbons (PAHs) include 6 congeners of molecular weight below 200, namely : Acenaphthene, Acenaphthylene, Anthracene, Flourene, Naphthalene and Phenanthrene.

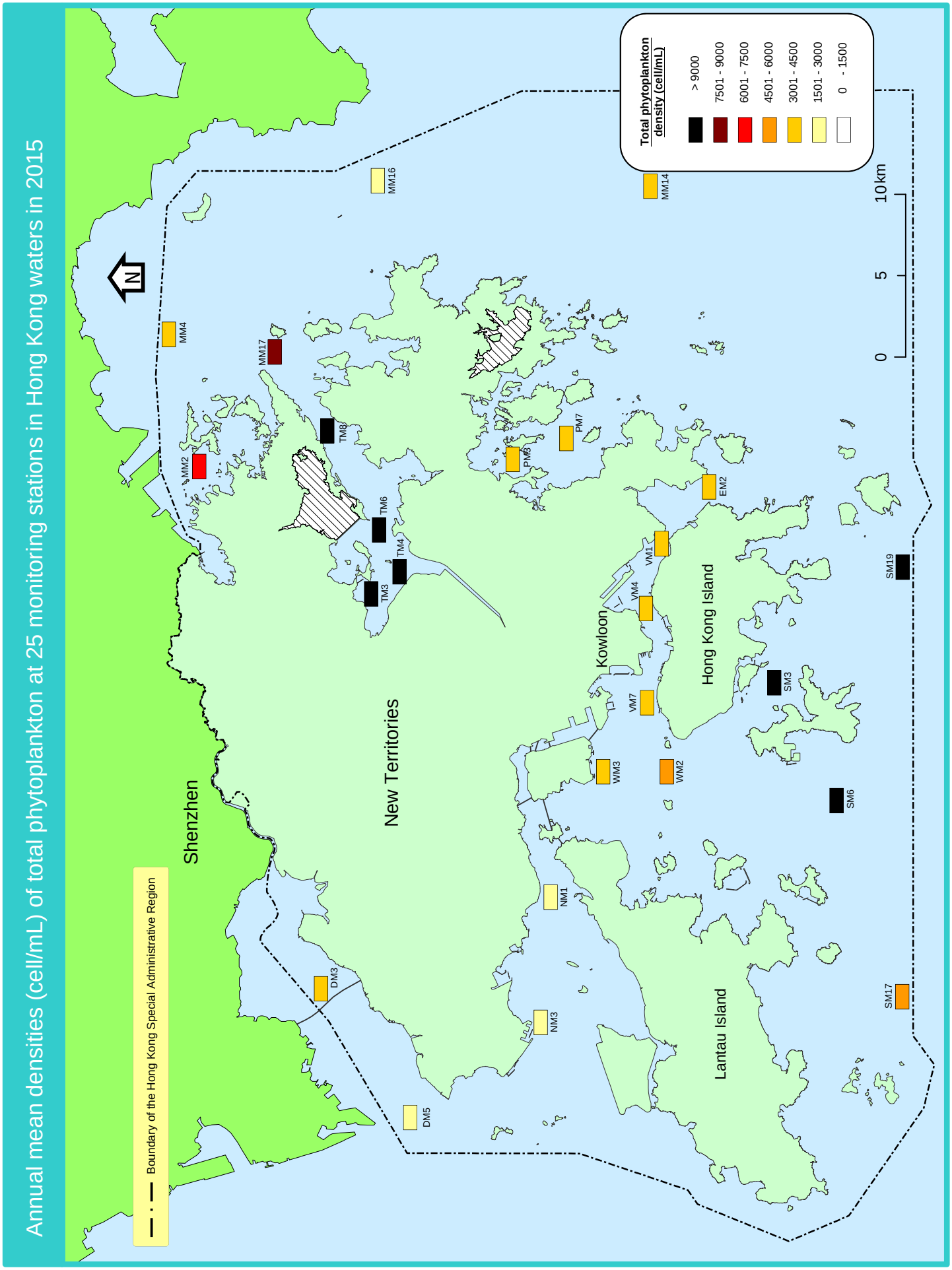
5 High molecular weight polyaromatic hydrocarbons (PAHs) include 10 congeners of molecular weight above 200, namely : Fluoranthene,
Pyrene, Benzo(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene and Indeno(1,2,3-cd)pyrene.

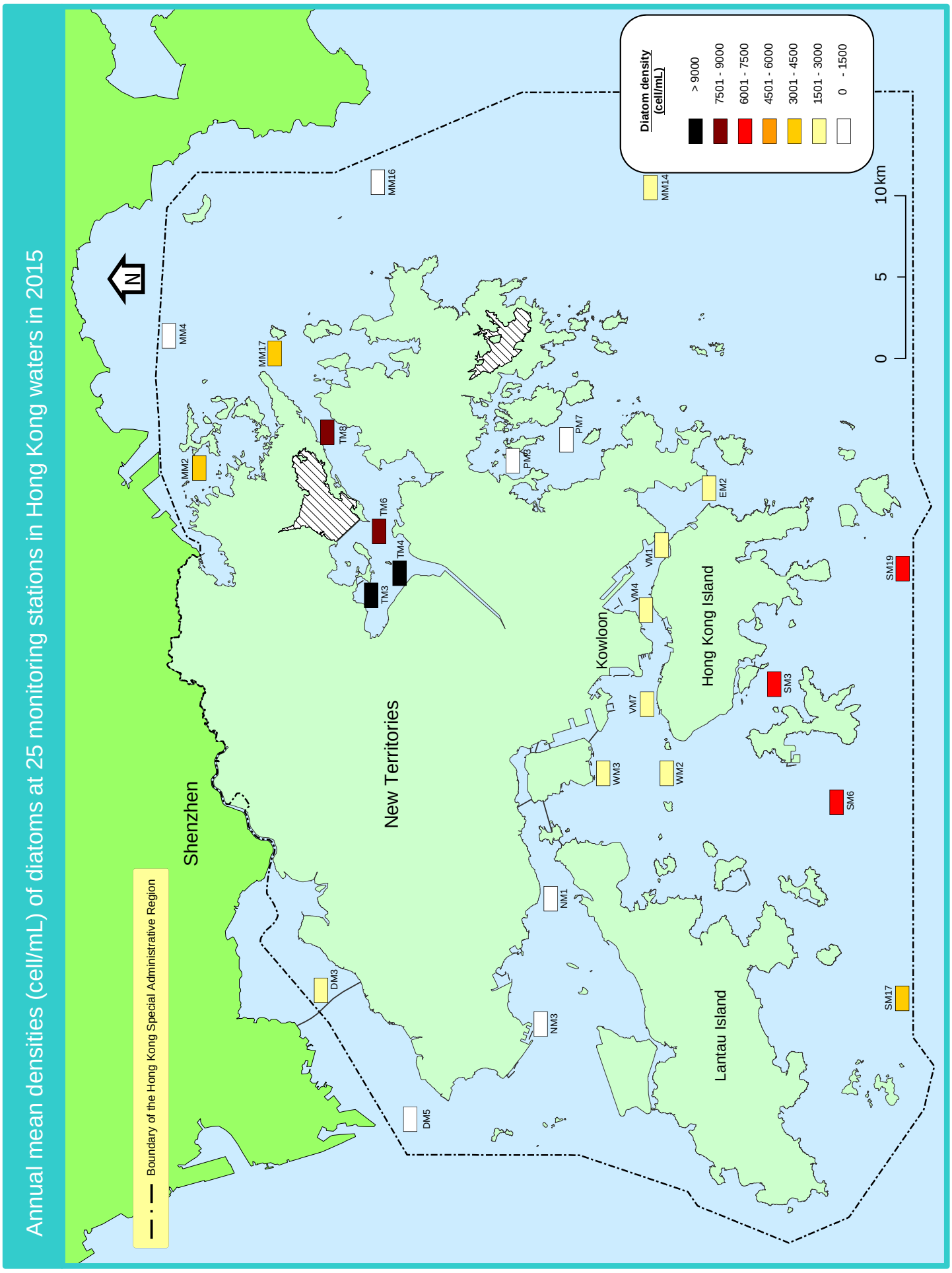
6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

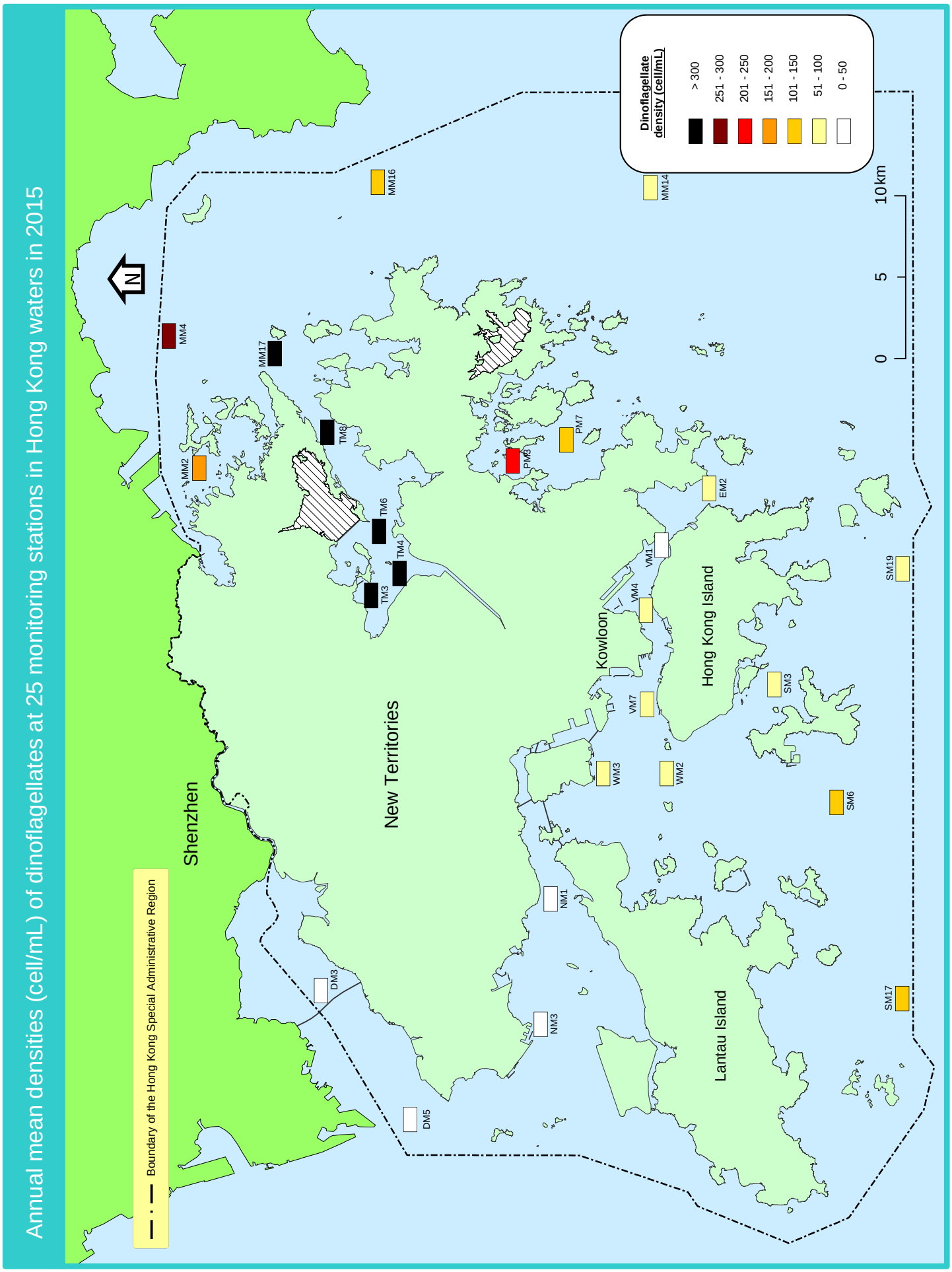

Phytoplankton monitoring stations in Hong Kong waters in 2015
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
N
0
5
10 km
MM16
MM14
MM4
MM17
MM2
TM8
TM6
TM4
TM3
PM7
PM3
EM2
VM1
VM4
VM7
SM19
SM3
WM3
WM2
SM6
NM1
NM3
DM3
DM5
SM17

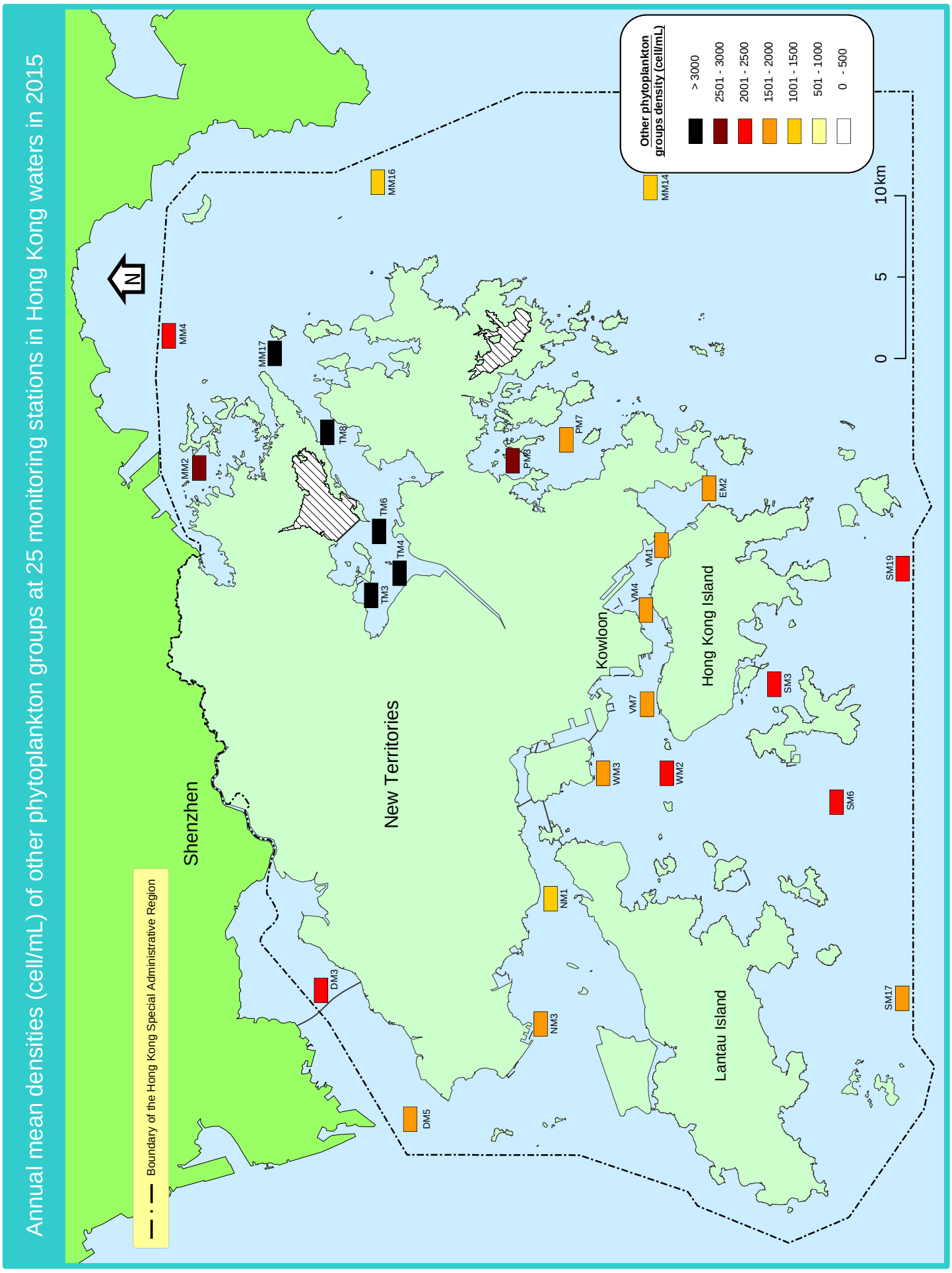

Percentage contribution of phytoplankton groups to the total number of species in the nine Water Control Zones (2015)
N
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
Mirs Bay WCZ
53% Diatom
30% Dinoflagellate
17% Others
Tolo Harbour & Channel WCZ
56% Diatom
31% Dinoflagellate
13% Others
Port Shelter WCZ
55% Diatom
30% Dinoflagellate
15% Others
Eastern Buffer WCZ
54% Diatom
27% Dinoflagellate
19% Others
Victoria Harbour WCZ
56% Diatom
32% Dinoflagellate
12% Others
Southern WCZ
56% Diatom
29% Dinoflagellate
15% Others
Western Buffer WCZ
52% Diatom
31% Dinoflagellate
17% Others
North Western WCZ
58% Diatom
27% Dinoflagellate
15% Others
Deep Bay WCZ
51% Diatom
27% Dinoflagellate
22% Others

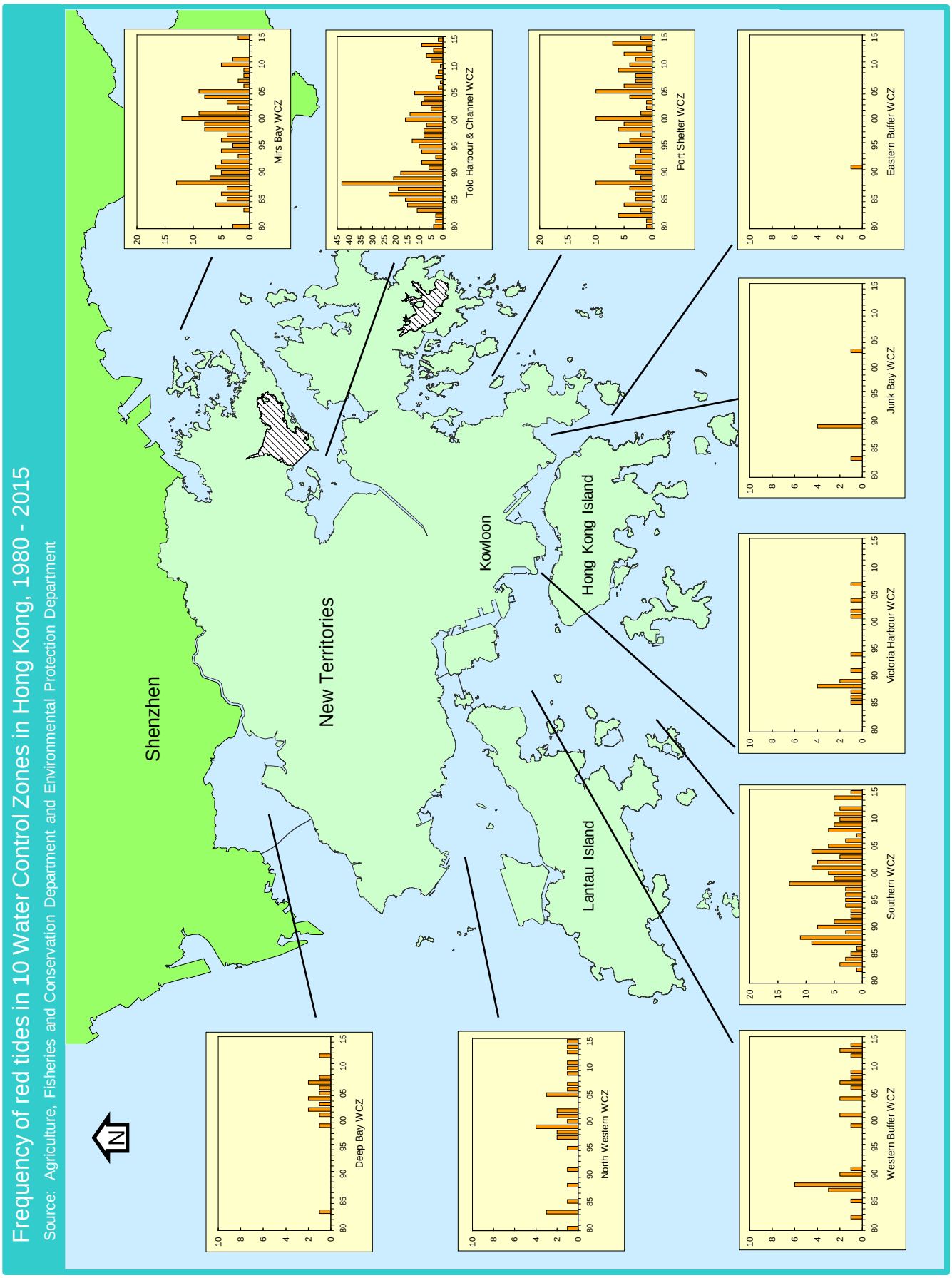

Percentage contribution of phytoplankton groups to the total density in the nine Water Control Zones (2015)
N
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
Mirs Bay WCZ
44% Diatom
6% Dinoflagellate
50% Others
Tolo Harbour & Channel WCZ
51% Diatom
7% Dinoflagellate
42% Others
Port Shelter WCZ
34% Diatom
5% Dinoflagellate
61% Others
Eastern Buffer WCZ
53% Diatom
2% Dinoflagellate
45% Others
Victoria Harbour WCZ
52% Diatom
1% Dinoflagellate
47% Others
Southern WCZ
73% Diatom
1% Dinoflagellate
26% Others
Western Buffer WCZ
53% Diatom
2% Dinoflagellate
45% Others
North Western WCZ
30% Diatom
2% Dinoflagellate
68% Others
Deep Bay WCZ
43% Diatom
1% Dinoflagellate
56% Others


Annual mean densities (cell/mL) of total phytoplankton at 25 monitoring stations in Hong Kong waters in 2015
Total phytoplankton density (cell/mL)
> 9000
7501 - 9000
6001 - 7500
4501 - 6000
3001 - 4500
1501 - 3000
0 - 1500
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
N
0
5
10 km
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 diatoms at 25 monitoring stations in Hong Kong waters in 2015
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
MM4
MM17
MM2
MM16
MM14
TM8
TM6
TM4
TM3
PM7
PM3
EM2
VM1
VM4
VM7
WM3
WM2
SM19
SM3
SM6
NM1
NM3
DM3
DM5
SM17


Annual mean densities (cell/mL) of dinoflagellates at 25 monitoring stations in Hong Kong waters in 2015
Dinoflagellate density (cell/mL)
> 300
251 - 300
201 - 250
151 - 200
101 - 150
51 - 100
0 - 50
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
N
0
5
10km
MM4
MM17
MM16
MM14
MM2
TM8
TM6
TM4
TM3
PM7
PM3
EM2
VM1
VM4
VM7
WM3
WM2
SM3
SM6
SM19
SM17
NM1
NM3
DM3
DM5

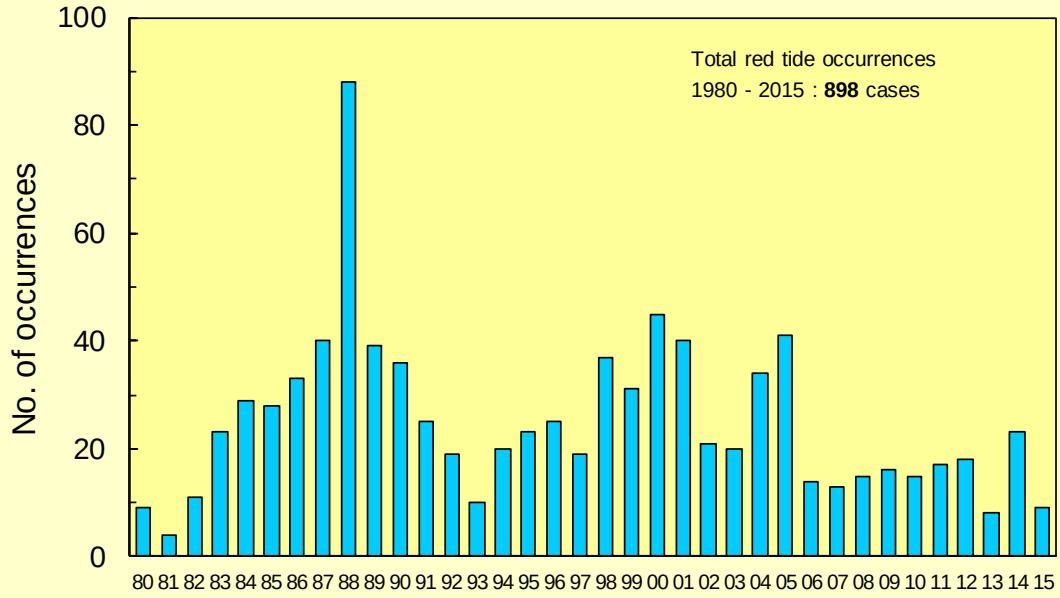

Annual mean densities (cell/mL) of other phytoplankton groups at 25 monitoring stations in Hong Kong waters in 2015
Other phytoplankton groups density (cell/mL)
> 3000
2501 - 3000
2001 - 2500
1501 - 2000
1001 - 1500
501 - 1000
0 - 500
Boundary of the Hong Kong Special Administrative Region
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
N
0
5
10km
MM4
MM17
MM16
MM14
MM2
TM8
TM6
TM4
TM3
PM7
PM3
EM2
VM1
VM4
VM7
WM3
WM2
SM3
SM6
SM19
SM17
NM1
NM3
DM3
DM5


Frequency of red tides in 10 Water Control Zones in Hong Kong, 1980 - 2015
Source: Agriculture, Fisheries and Conservation Department and Environmental Protection Department
N
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
Mirs Bay WCZ
Tolo Harbour & Channel WCZ
Port Shelter WCZ
Eastern Buffer WCZ
Junk Bay WCZ
Victoria Harbour WCZ
Southern WCZ
Western Buffer WCZ
North Western WCZ
Deep Bay WCZ

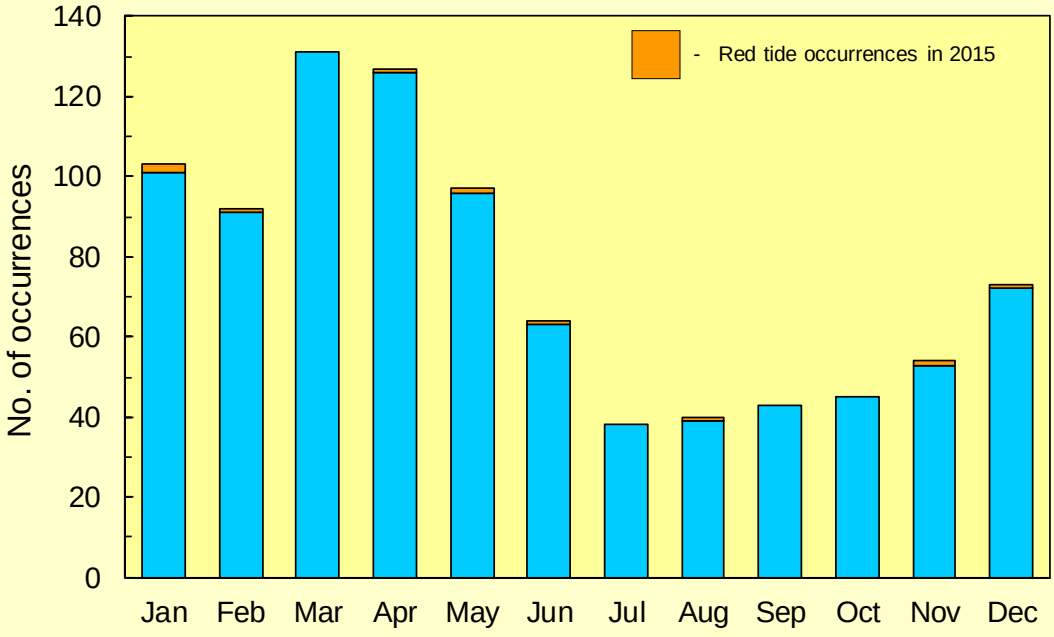
Occurrence of red tides in Hong Kong waters, 1980 – 2015

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

Yearly Distribution

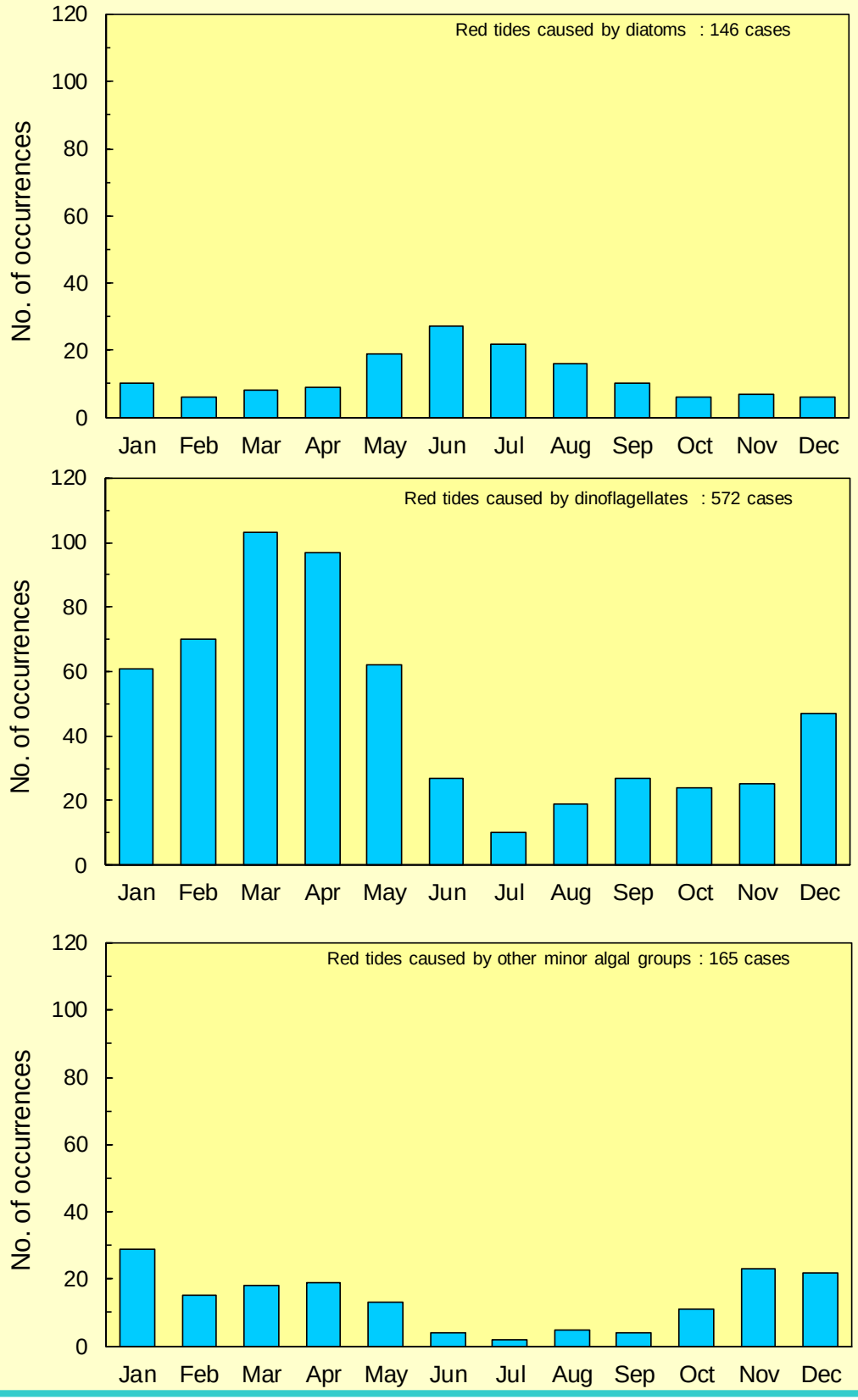


Monthly Distribution



Seasonal occurrence of red tides caused by different phytoplankton groups in Hong Kong, 1980 – 2015

(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 2015.

Species	% Abundance[1]	Frequency[2]
Tolo Harbour & Channel		
Diatoms		
Thalassiosira spp.	22.33	12
Skeletonema costatum	21.36	8
Chaetoceros spp.	15.66	10
Dinoflagellates		
Scrippsiella spp.	76.52	9
Gymnodinium spp.	13.17	12
Karenia mikimotoi	3.14	10
Others		
small flagellates	87.67	12
Plagioselmis prolonga	9.72	12
Teleaulax acuta	2.41	12
Mirs Bay		
Diatoms		
Pseudo-nitzschia spp.	21.17	12
Thalassiosira spp.	19.24	12
Dactyliosolen fragilissimus	17.14	8
Dinoflagellates		
Scrippsiella spp.	73.23	12
Gymnodinium spp.	13.25	12
Karenia mikimotoi	3.29	9
Others		
small flagellates	81.14	12
Plagioselmis prolonga	12.32	12
Teleaulax acuta	6.31	12
Eastern Buffer		
Diatoms		
Dactyliosolen fragilissimus	24.78	4
Pseudo-nitzschia spp.	24.45	8
Chaetoceros spp.	23.68	10
Dinoflagellates		
Gymnodinium spp.	33.64	11
Scrippsiella spp.	26.29	4
Karenia mikimotoi	14.60	4
Others		
small flagellates	80.19	12
Plagioselmis prolonga	13.92	12
Teleaulax acuta	5.36	10
Port Shelter		
Diatoms		
Skeletonema costatum	25.02	9
Chaetoceros spp.	19.37	11
Pseudo-nitzschia spp.	16.98	11
Dinoflagellates		
Gymnodinium spp.	38.05	12
Scrippsiella spp.	20.70	12
Gonyaulax spp.	7.86	1
Others		
small flagellates	81.43	12
Plagioselmis prolonga	13.42	12
Teleaulax acuta	4.62	12
Victoria Harbour		
Diatoms		
Pseudo-nitzschia spp.	26.20	12
Chaetoceros spp.	24.99	12
Thalassiosira spp.	18.63	12
Dinoflagellates		
Gymnodinium spp.	32.27	12
Scrippsiella spp.	23.60	9
Karenia mikimotoi	9.93	7
Others		
small flagellates	80.60	12
Plagioselmis prolonga	13.03	12
Teleaulax acuta	6.09	12
Southern		
Diatoms		
Thalassiosira spp.	59.29	12
Chaetoceros spp.	19.89	12
Leptocylindrus danicus	6.58	8
Dinoflagellates		
Gymnodinium spp.	32.56	12
Protoperidinium bipes	26.99	5
Scrippsiella spp.	13.11	10
Others		
small flagellates	85.51	12
Plagioselmis prolonga	10.23	12
Teleaulax acuta	3.90	12
North Western		
Diatoms		
Skeletonema costatum	36.03	9
Thalassiosira spp.	27.32	12
Chaetoceros spp.	22.86	10
Dinoflagellates		
Gymnodinium spp.	48.87	12
Scrippsiella spp.	23.93	7
Protoperidinium spp.	6.14	5
Others		
small flagellates	75.95	12
Plagioselmis prolonga	15.31	12
Teleaulax acuta	8.05	12
Western Buffer		
Diatoms		
Thalassiosira spp.	47.06	12
Chaetoceros spp.	23.40	9
Pseudo-nitzschia spp.	12.62	12
Dinoflagellates		
Gymnodinium spp.	32.69	12
Scrippsiella spp.	27.99	9
Protoperidinium bipes	9.63	4
Others		
small flagellates	70.14	12
Plagioselmis prolonga	18.94	12
Teleaulax acuta	10.38	12
Deep Bay		
Diatoms		
Thalassiosira spp.	78.65	12
Chaetoceros spp.	8.55	9
Skeletonema costatum	7.95	10
Dinoflagellates		
Scrippsiella spp.	43.95	6
Gymnodinium spp.	32.46	10
Protoperidinium spp.	9.61	6
Others		
small flagellates	72.47	12
Plagioselmis prolonga	13.99	12
Teleaulax acuta	12.62	12

[1] % of species/group in diatoms, dinoflagellates and other phytoplankton

[2] Number of occurrences out of 12 sampling occasions.

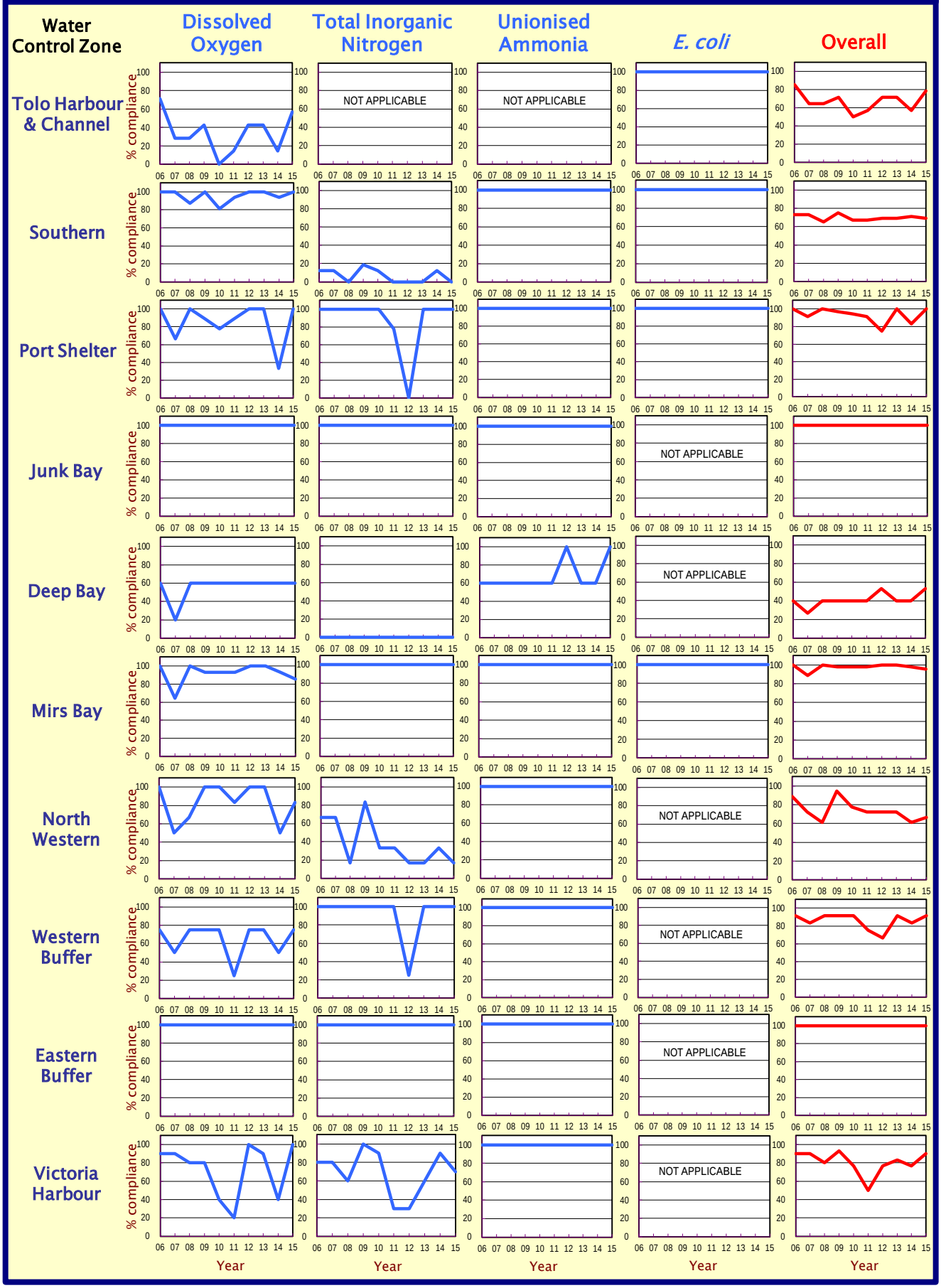
Occurrence and distribution of red tide species in different Water Control Zones (WCZs), 1980 - 2015

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	68	69		62			60	7	9		275
Skeletonema costatum	23	3		1	3	9	13	3	10	2	67
Mesodinium rubrum	8	10		11	1		18	7	3	2	60
Gonyaulax polygramma	23	8		17			6	1			55
Prorocentrum minimum	45	1							1		47
Neoceratium furca	17	7		14							38
Prorocentrum triestinum	33										33
Heterosigma akashiwo	18	2					1	5		1	27
Scrippsiella trochoidea	18	5		3			1				27
Heterocapsa circularisquama	14	3									17
Prorocentrum sigmoides	14	1		1							16
Trichodesmium erythraeum		6		6			3				15
Akashiwo sanguinea	4	3		1			3	2		1	14
Prorocentrum dentatum	8	4		1			1				14
Phaeocystis globosa	1	1		1			9			1	13
Karenia mikimotoi	7	2		3							12
Thalassiosira nordenskioeldii	2	3				1	4		2		12
Cochlodinium cf. geminatum	2			2			1	3	1	2	11
Prorocentrum micans	4	4		1		1	1				11
Leptocylindrus minimus	10										10
Thalassiosira pseudonana	7	1							1		9
Chroomanas 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
Dictyocha speculum		2		3			1				6
Gyrodinium instriatum						1	1	2	1	1	6
Chattonella marina	3	1		1							5
Haematococcus pluvialis	5										5
Pseudo-nitzschia pungens	1					2	1		1		5
Teleaulax acuta	5										5
Thalassiosira spp.	2				1		2				5
Eutreptiella spp.	4										4
Leptocylindrus danicus	3	1									4
Pseudo-nitzschia delicatissima				1			2		1		4
Pseudo-nitzschia pseudodelicatissima	1						2		1		4
Chaetoceros curvisetus			1		1		1				3
Chaetoceros socialis	1						2				3
Chattonella ovata		2		1							3
Cochlodinium polykrikoides				1			2				3
Eucampia zodiacus							2	1			3
Gymnodinium simplex	3										3
Heterocapsa rotundata	2							1			3
Karenia longicanalis	1	1					1				3
Prorocentrum balticum	1	1		1							3
Trichodesmium spp.		1		1			1				3
Alexandrium catenella		1			1						2
Alexandrium tamarense				2							2
Cerataulina pelagica	2										2
Chaetoceros pseudocurvisetus	1						1				2
Chaetoceros salsugineum		1					1				2
Chattonella spp.	1						1				2
Dunaliella spp.	2										2
Fibrocapsa japonica				1			1				2
Guinardia delicatula	1						1				2
Gymnodinium spp. X				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
Chaetoceros spp. 0105	1										1
Chaetoceros tenuissimus		1									1
Chattonella spp. 0310	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
Dactyliosolen phuketensis							1				1
Guinardia striata	1										1
Gymnodinium spp.		1									1
Gyrodinium impudicum		1									1
Gyrodinium spirale							1				1
Hermesinum adriaticum		1									1
Karenia papilionacea				1							1
Karlodinium veneficum		1									1
Leptocylindrus spp.							1				1
Navicula spp.										1	1
Neoceratium tripos				1							1
Odontella mobiliensis	1										1
Odontella sinensis	1										1
Pedinomonadaceae spp.	1										1
Peridinium quinquecorne	1										1
Takayama pulchella	1										1
Thalassomonas spp.	1										1
Trichodesmium thiebautii							1				1
Total : 90 species	415	154	1	145	7	14	157	32	31	13	969

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

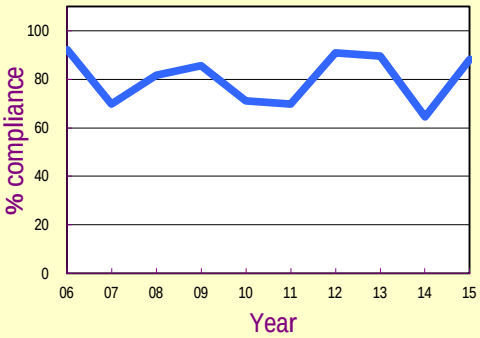
Source: Agriculture, Fisheries and Conservation Department and Environmental Protection Department

Level of compliance with key marine Water Quality Objectives for 10 Water Control Zones in Hong Kong, 2006 – 2015

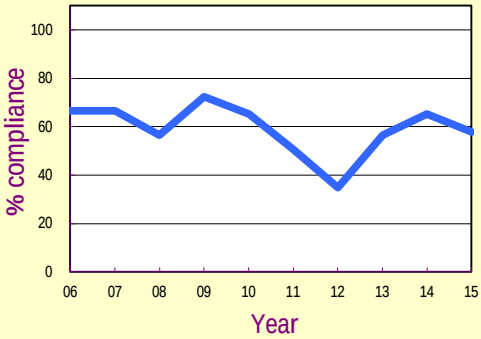


Level of compliance with key marine Water Quality Objectives in Hong Kong, 2006 – 2015

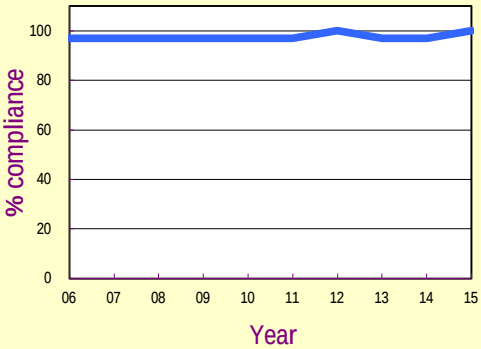
Dissolved Oxygen



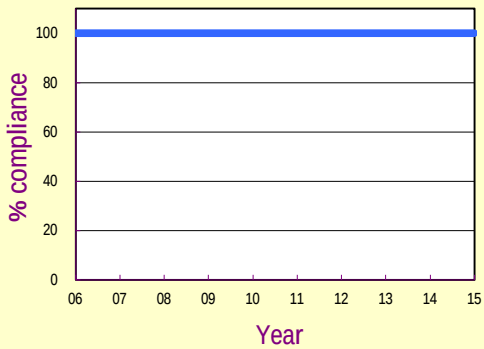
Total Inorganic Nitrogen



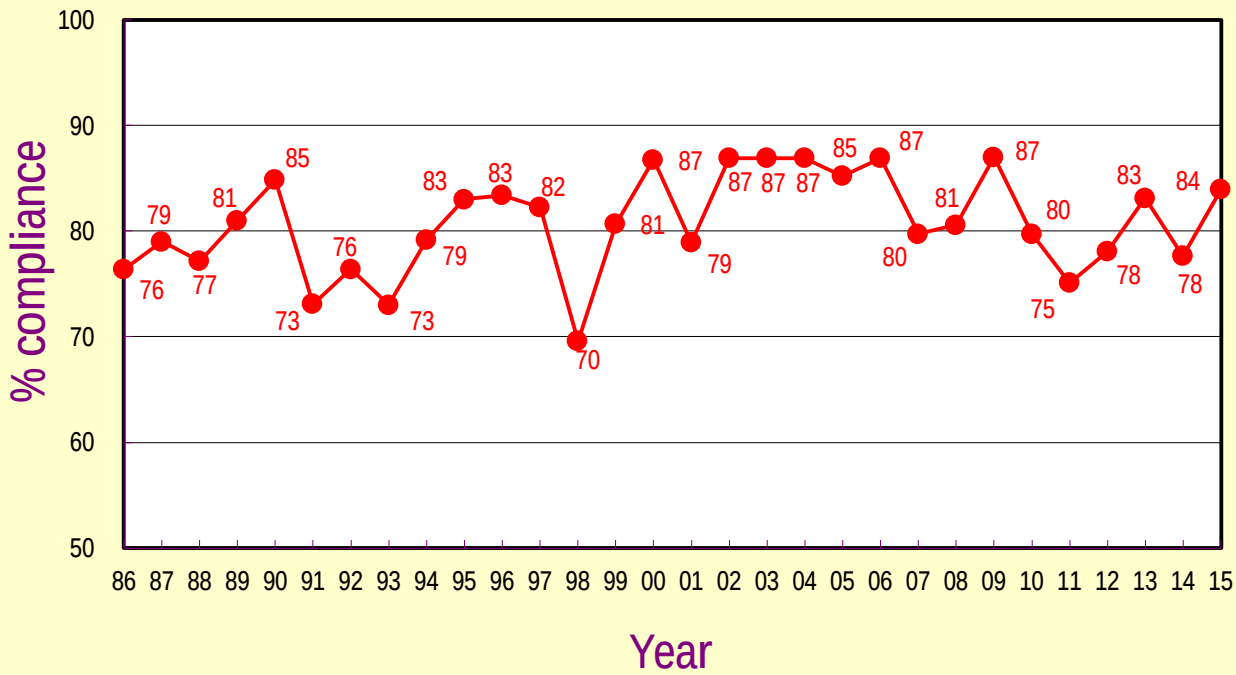
Unionised Ammonia

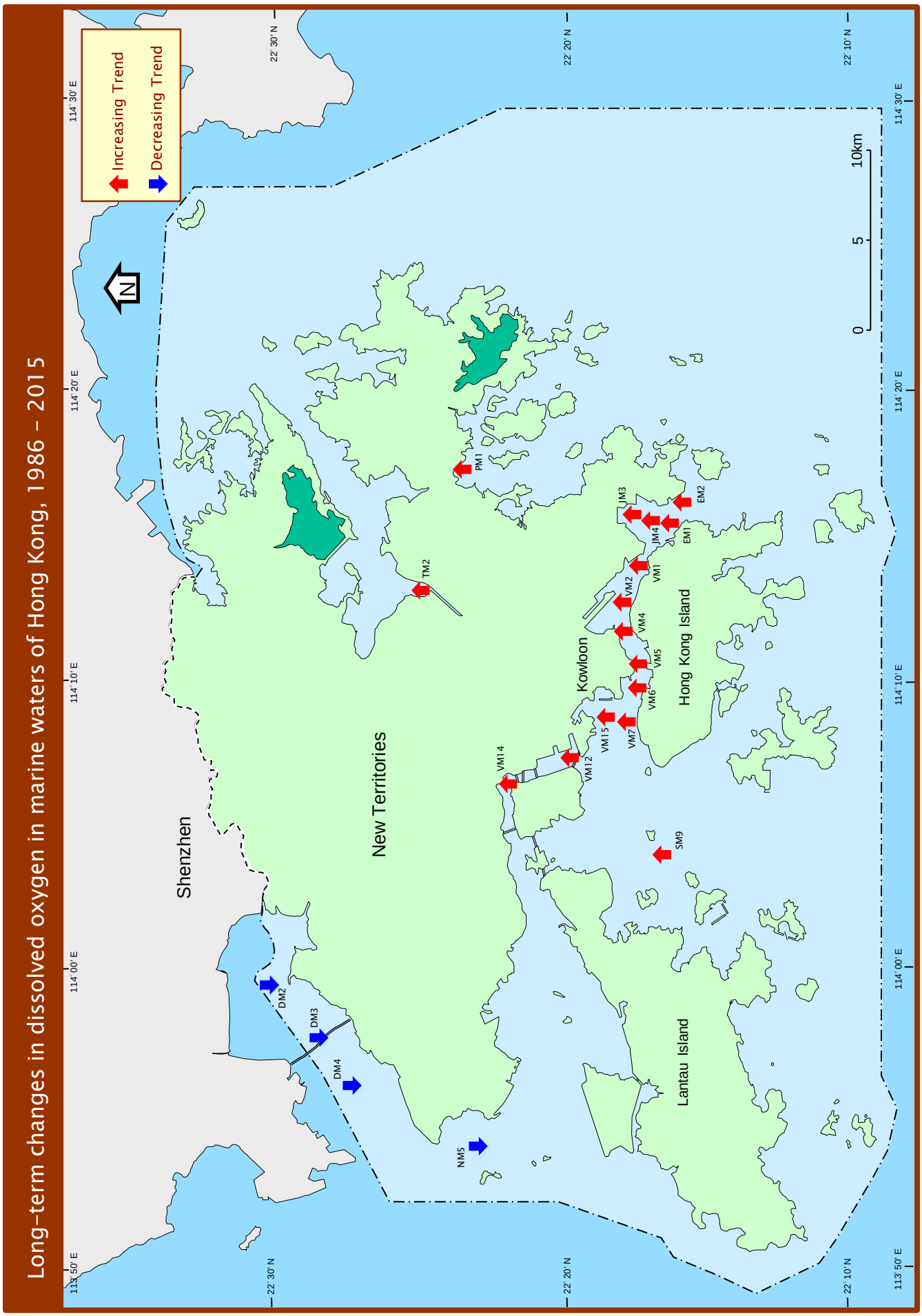


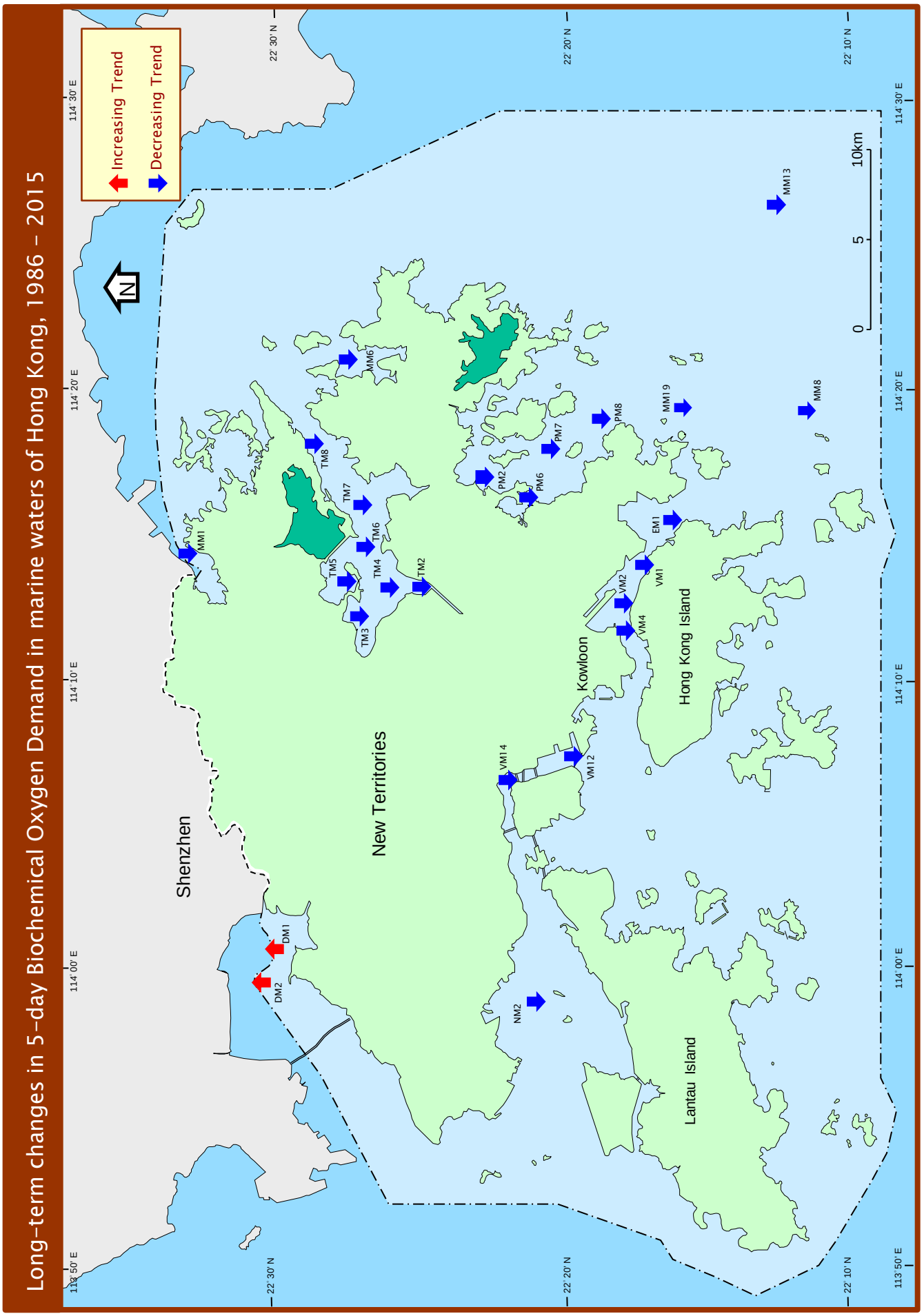
E. coli

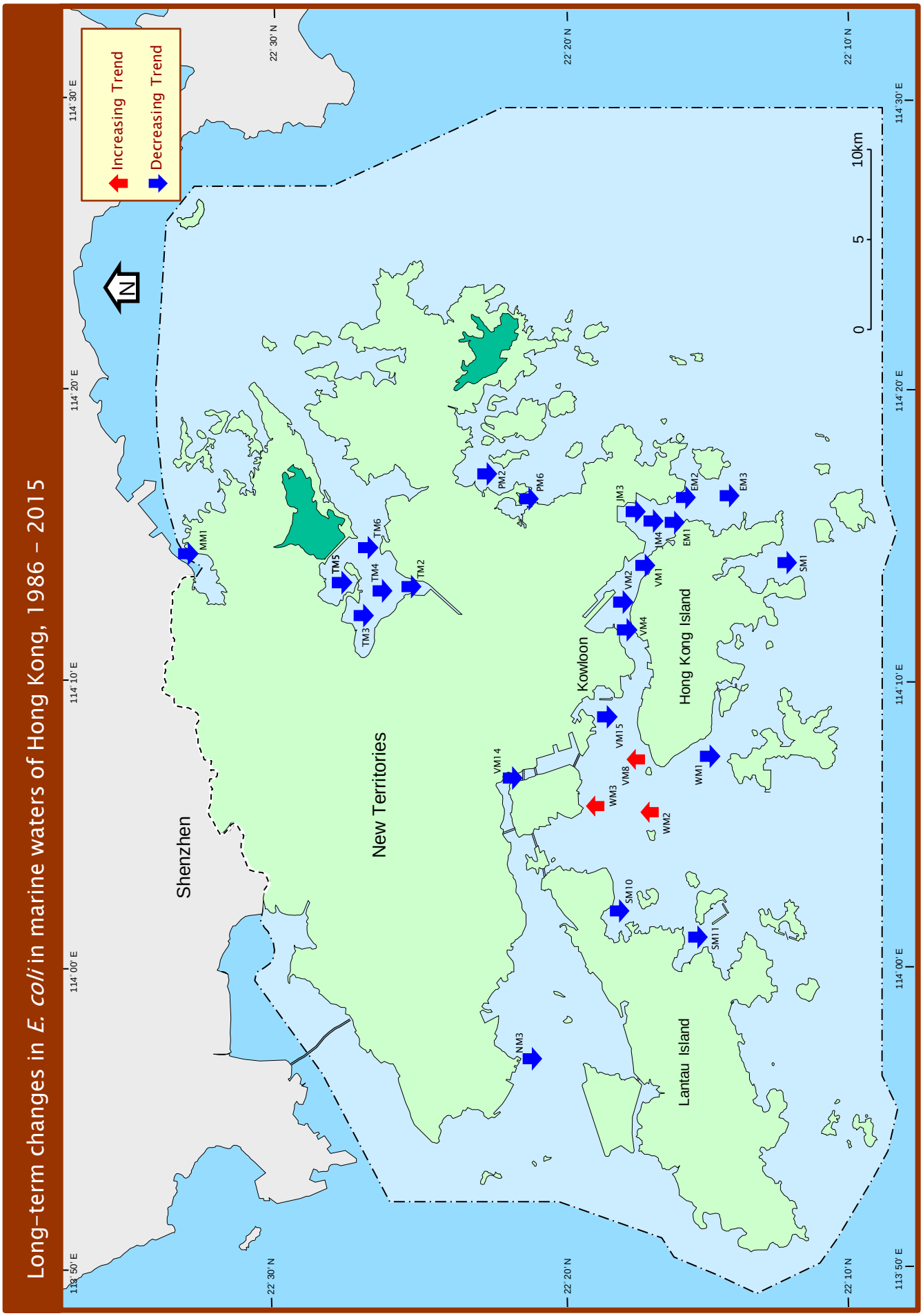


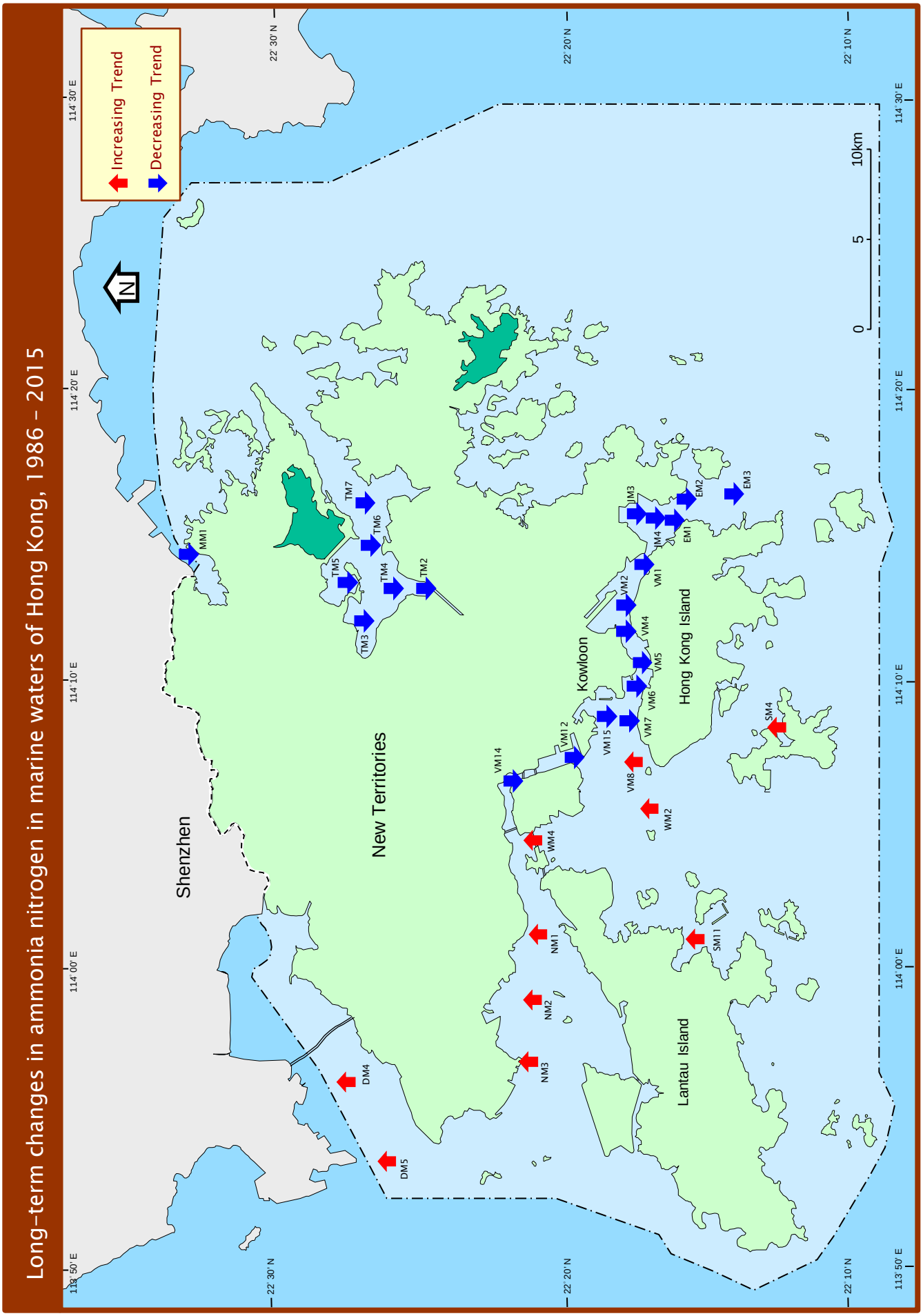
Overall level of compliance with key marine Water Quality Objectives in Hong Kong, 1986 – 2015



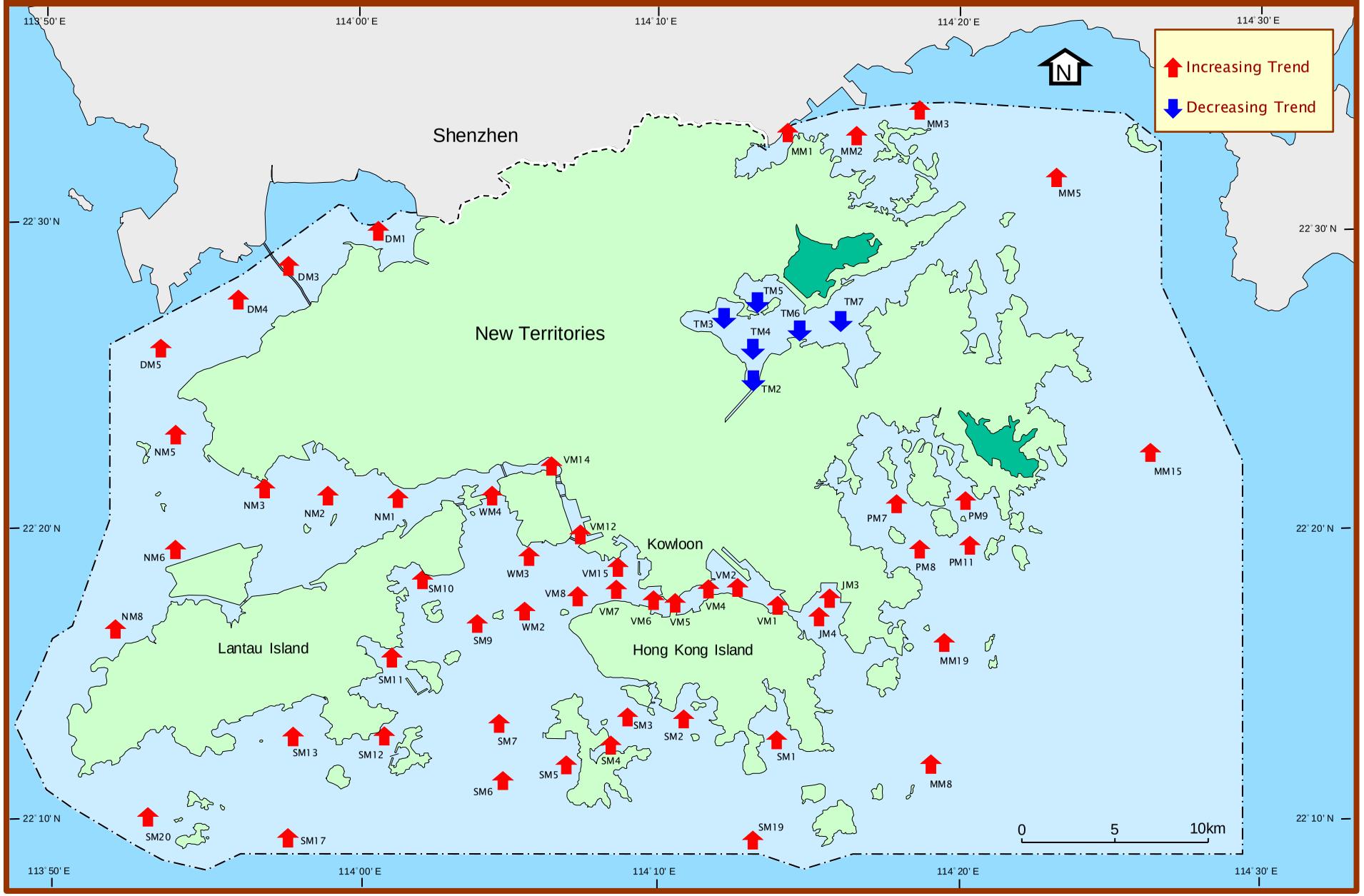

Long-term changes in dissolved oxygen in marine waters of Hong Kong, 1986 – 2015
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
PM1
TM2
JM3
JM4
EM1
EM2
VM1
VM2
VM4
VM5
VM6
VM7
VM15
VM12
VM14
SM9
DM2
DM3
DM4
NM5
114° 30' E
114° 20' E
114° 10' E
114° 00' E
113° 50' E
22° 30' N
22° 20' N
22° 10' N

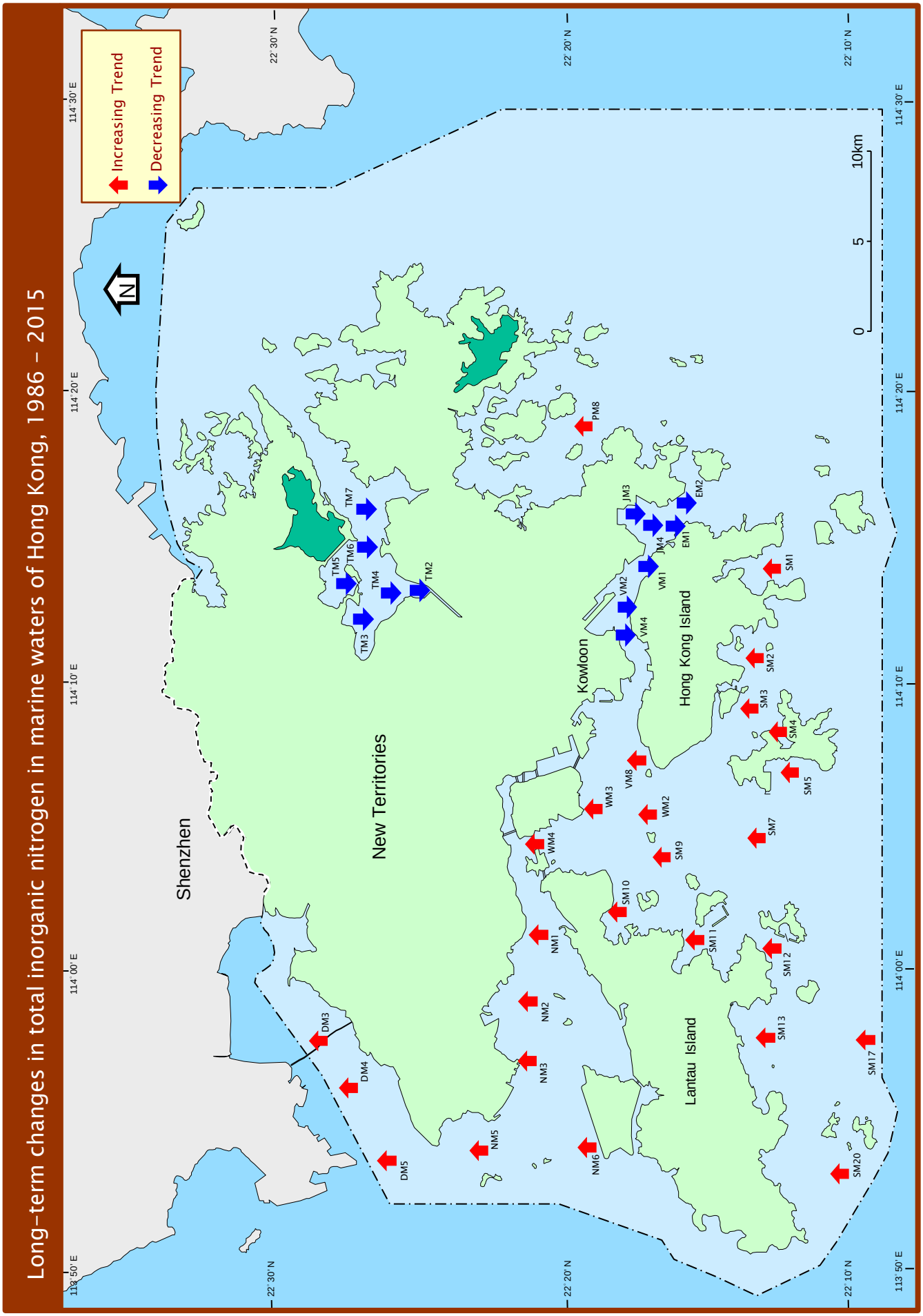

Long-term changes in 5-day Biochemical Oxygen Demand in marine waters of Hong Kong, 1986 – 2015
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM1
TM8
TM7
TM6
MM6
TM5
TM4
TM3
TM2
PM2
PM6
PM7
PM8
MM9
MM8
MM13
EM1
VM1
VM2
VM4
VM14
VM12
NM2
DM1
DM2
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 *E. coli* in marine waters of Hong Kong, 1986 – 2015
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM1
TM2
TM3
TM4
TM5
TM6
PM2
PM6
JM3
JM4
EM1
EM2
EM3
SM1
VM1
VM2
VM4
VM8
VM14
VM15
WM1
WM2
WM3
SM10
SM11
NM3
114° 30' E
114° 20' E
114° 10' E
114° 00' E
113° 50' E
22° 30' N
22° 20' N
22° 10' N

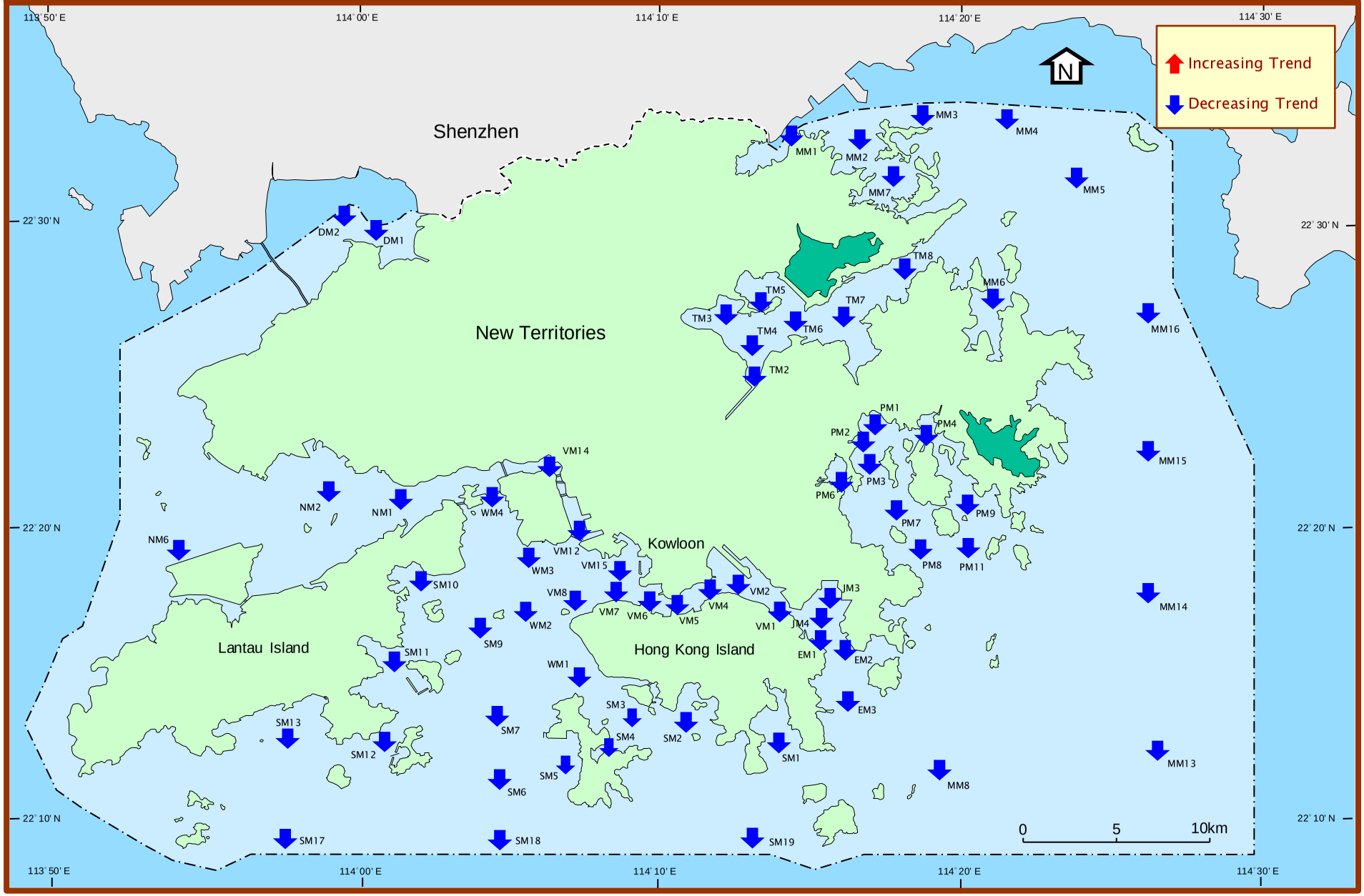

Long-term changes in ammonia nitrogen in marine waters of Hong Kong, 1986 - 2015

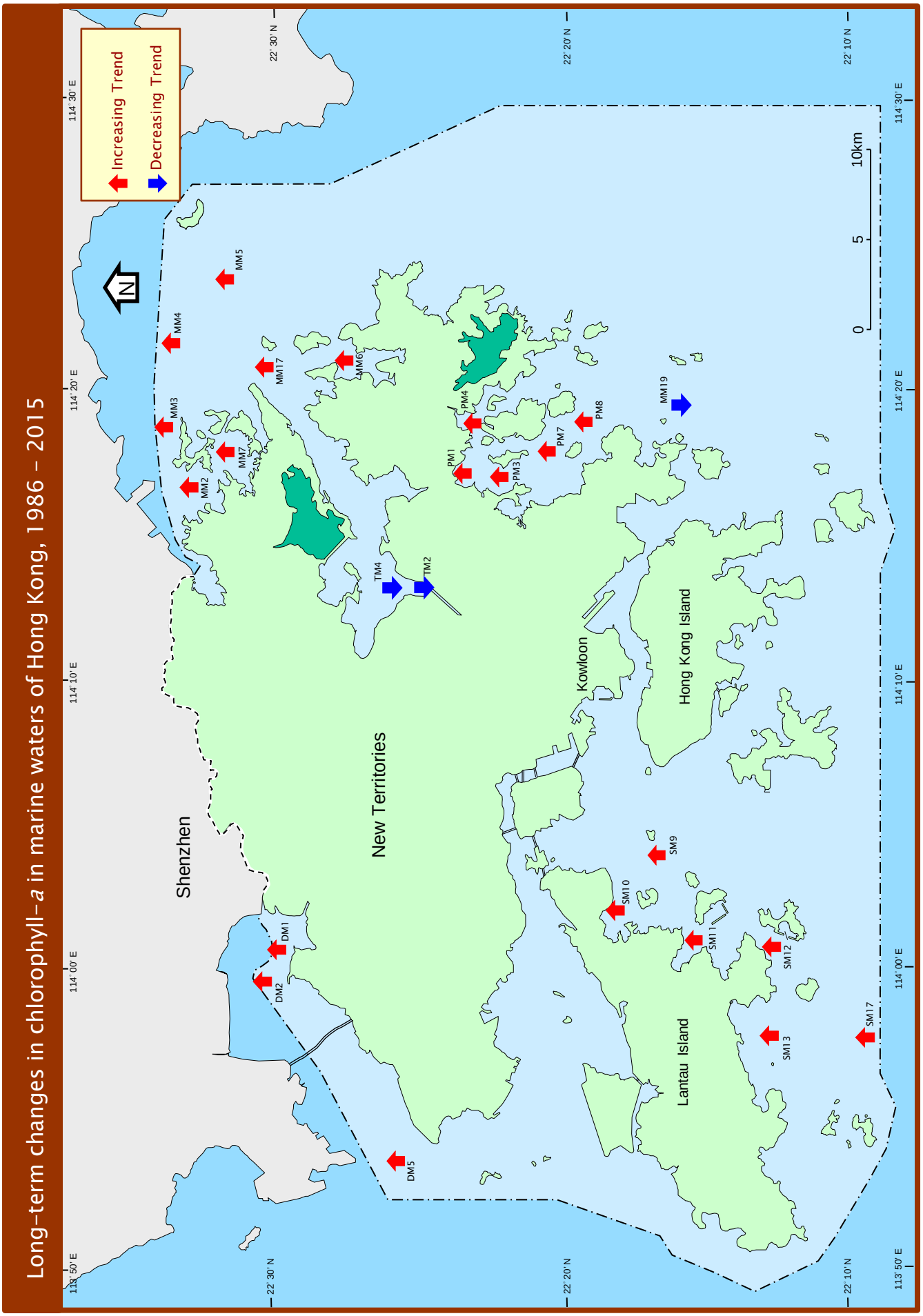
Long-term changes in nitrate nitrogen in marine waters of Hong Kong, 1986 – 2015

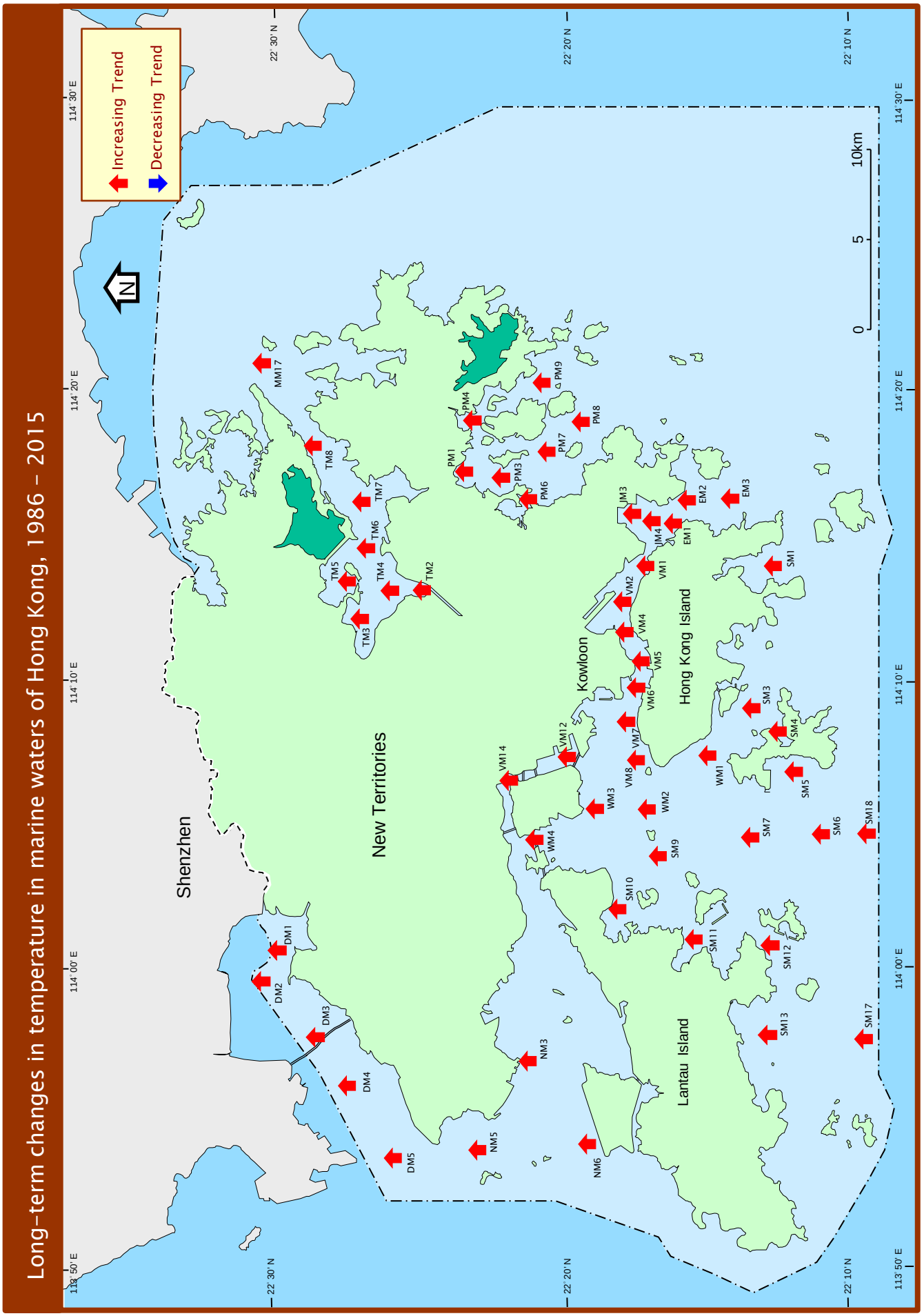



Long-term changes in total inorganic nitrogen in marine waters of Hong Kong, 1986 – 2015
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
TM7
TM6
TM5
TM4
TM3
TM2
PM8
JM3
JM4
EM1
EM2
VM1
VM2
VM4
VM8
SM1
SM2
SM3
SM4
SM5
SM7
SM9
WM2
WM3
WM4
SM10
SM11
SM12
SM13
SM17
SM20
NM1
NM2
NM3
NM5
NM6
DM3
DM4
DM5
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 orthophosphate phosphorus in marine waters of Hong Kong, 1986 – 2015




Long-term changes in chlorophyll-*a* in marine waters of Hong Kong, 1986 – 2015
Increasing Trend
Decreasing Trend
N
0
5
10km
Shenzhen
New Territories
Kowloon
Hong Kong Island
Lantau Island
MM5
MM4
MM3
MM2
MM7
MM17
MM6
MM19
PM1
PM4
PM3
PM7
PM8
TM4
TM2
SM9
SM10
SM11
SM12
SM13
SM17
DM1
DM2
DM5
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 temperature in marine waters of Hong Kong, 1986 – 2015
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
TM3
TM2
PM9
PM8
PM7
PM6
PM4
PM3
PM1
IM3
IM4
EM1
EM2
EM3
VM1
VM2
VM4
VM5
VM6
VM7
VM8
VM12
VM14
WM1
WM2
WM3
WM4
SM1
SM3
SM4
SM5
SM6
SM7
SM9
SM10
SM11
SM12
SM13
SM17
SM18
DM1
DM2
DM3
DM4
DM5
NM3
NM5
NM6