Marine Water Quality in Hong Kong in 2022

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

Our 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.

Acknowledgements

We acknowledge the following parties for their contribution to this report: Government Laboratory for undertaking chemical analyses of water and sediment samples; Marine Department for managing and operating the monitoring vessel *Dr. Catherine Lam* in conducting field sampling and measurement; Agriculture, Fisheries and Conservation Department for providing photos and information on marine parks, fish culture zones and red tides; Lands Department for providing information on geography and aerial photography of Hong Kong.

Abbreviations / 簡稱

Advance Disinfection Facilities	ADF	前期消毒設施
Ammonia Nitrogen	NH_4-N	氨氮
Conductivity-temperature-depth	CTD /溫鹽深	溫度、鹽度、深度
Dissolved Oxygen	DO	溶解氧
Environmental Protection Department	EPD / 環保署	環境保護署
Escherichia coli	*E. coli*	大腸桿菌
Harbour Area Treatment Scheme	HATS	淨化海港計劃
Orthophosphate phosphorus	PO_4-P	正磷酸鹽磷
Sewage Treatment Works	STW	污水處理廠
Stonecutters Island Sewage Treatment Works	SCISTW	昂船洲污水處理廠
Total Inorganic Nitrogen	TIN	總無機氮
Unionised Ammonia Nitrogen	NH_3-N	非離子化氨氮
Water Control Zone	WCZ	水質管制區
Water Quality Objective	WQO	水質指標
5-day Biochemical Oxygen Demand	BOD_5	五天生化需氧量

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1. Introduction

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

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

On a monthly basis, the EPD monitors the marine water quality at 76 monitoring stations in open waters, and collects and examines phytoplankton samples from 26 of these stations. We also monitor, at bimonthly intervals, the water quality of 18 monitoring stations located in sheltered waters, including 14 typhoon shelters, three sheltered anchorages and the Government Dockyard. In addition, sediment samples are collected twice a year from 60 monitoring stations for analyses, including 45 stations in open waters and 15 stations in sheltered waters.

Most of the field work at these monitoring stations is conducted on board of *MV Dr. Catherine Lam* – EPD's marine monitoring vessel. An advanced conductivity-temperature-depth (CTD) profiler linked to a computer-controlled rosette water sampler is set up on the vessel to allow simultaneous depth profiling of *in situ* measurements and water sampling at specified depths. Marine sediments are collected by using a Van Veen sediment grab sampler. The water and sediment samples are analysed by the Government Laboratory and EPD's laboratory for over 80 physical, chemical and biological parameters. Details of the water quality and sediment parameters, their analytical methods as well as information of monitoring stations and WQOs are given in Appendix A.

2. The State of Hong Kong Marine Waters in 2022

2.1 Overall Compliance Rate of Marine Water Quality Objectives (WQOs)

The overall marine WQO compliance rate[1] for Hong Kong was 86% in 2022 (see Figure 1). The compliance rates for the four key WQO parameters and the overall WQO compliance rates for the ten water control zones (WCZs) are shown in Figures 2 and 3. Notably, full compliance with the *Escherichia coli* (*E. coli*) and Unionised Ammonia Nitrogen (NH_3-N) WQOs in all applicable WCZs have been achieved for eight consecutive years since 2015. The compliance rates of the Dissolved Oxygen (DO) and Total Inorganic Nitrogen (TIN) WQOs were 92% and 62% respectively in 2022.

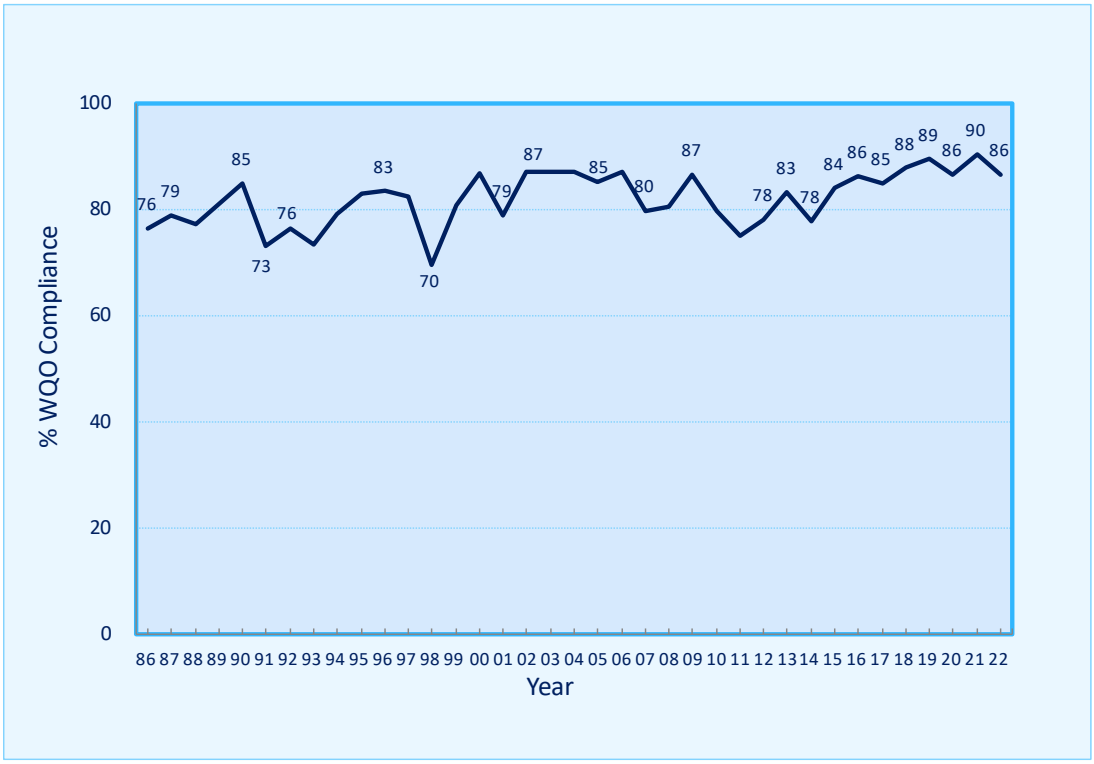


Figure 1. Overall marine WQO compliance rates, 1986-2022

For the DO WQO, localised non-compliance was observed in the Tolo Harbour and Channel WCZ, the Mirs Bay WCZ and the Port Shelter WCZ. For the TIN WQO, non-compliance was observed in waters with a background level of TIN that has been consistently higher than other waters, covering the Deep Bay WCZ, the Southern WCZ, the North Western WCZ and, to a lesser extent, in the Victoria Harbour WCZ. The WQO compliance status of individual WCZs are presented in Chapter 3, with details of water quality monitoring data and compliance status of individual monitoring stations presented in Appendices B and C respectively.

[1] The overall marine WQO compliance rate for Hong Kong's marine waters is calculated based on the overall average of the compliance rates for all monitoring stations for the four key marine WQO parameters including DO, TIN, NH_3-N and *E. coli*.

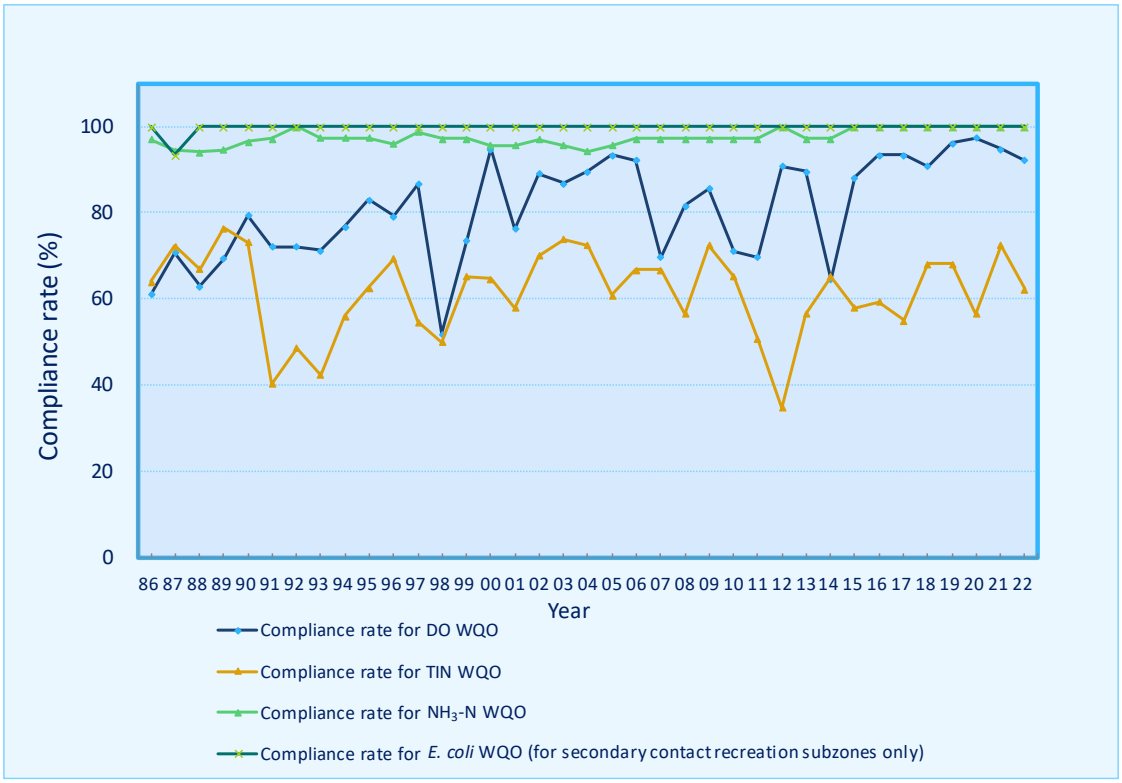


Figure 2. Compliance rates for four key marine WQOs, 1986-2022

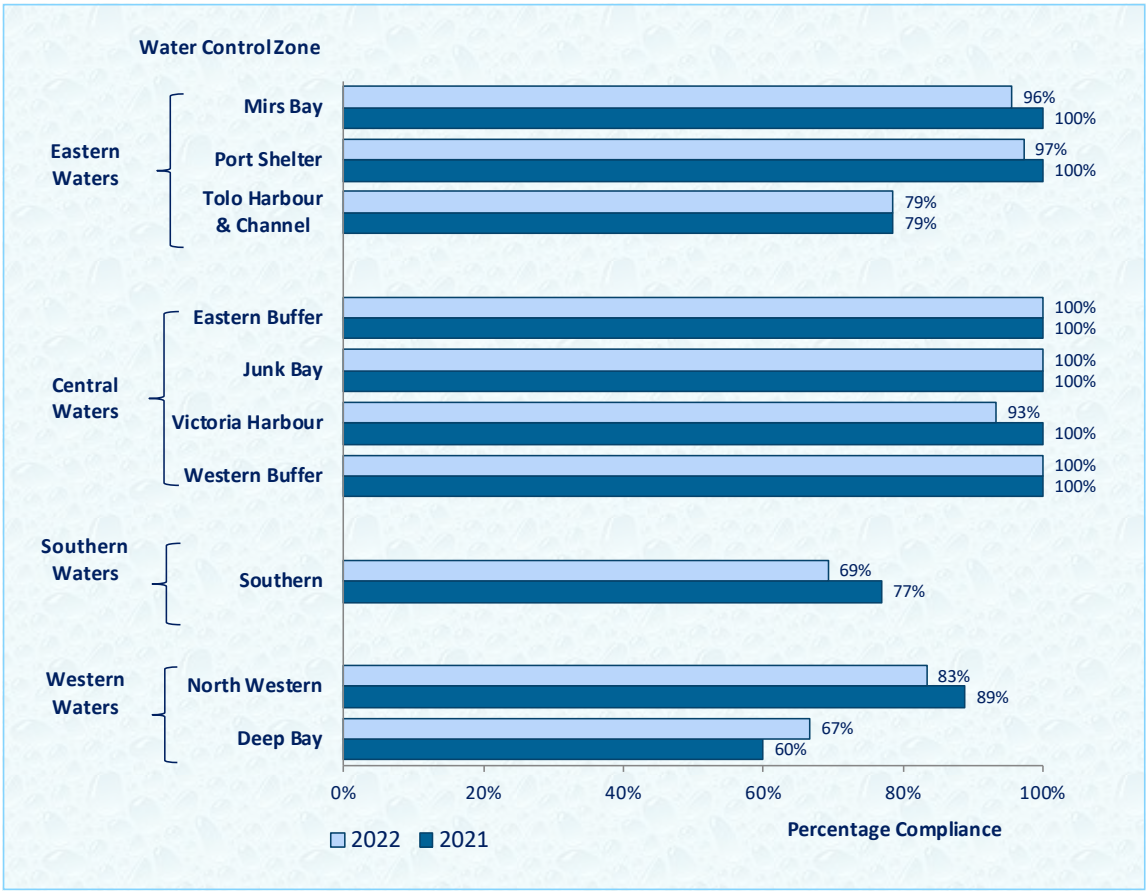


Figure 3. Marine WQO compliance rates for the ten WCZs, 2021-2022

2.2 Highlight in 2022 – Water Quality of Victoria Harbour

The vibrant Victoria Harbour, where more than half of Hong Kong's population reside, has seen significant improvement in its water quality upon staged implementation of the Harbour Area Treatment Scheme (HATS) in the last 20 years. As illustrated in Figure 4, over the recent seven years after the implementation of HATS Stage 2A, the average annual levels of *E. coli* and NH_3-N have significantly decreased to 397 counts per 100mL and 0.004 mg/L respectively, while that of DO has maintained at 5.5 mg/L.

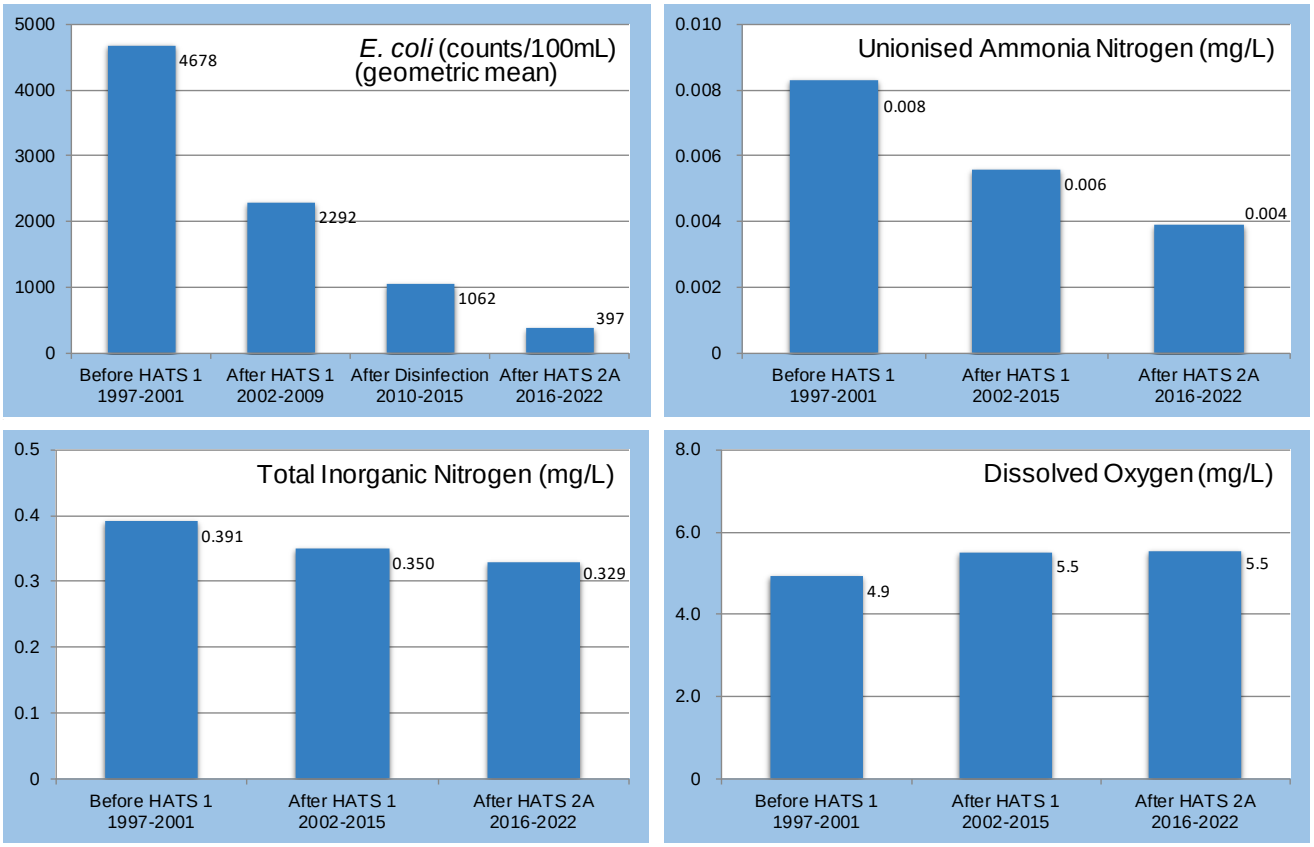
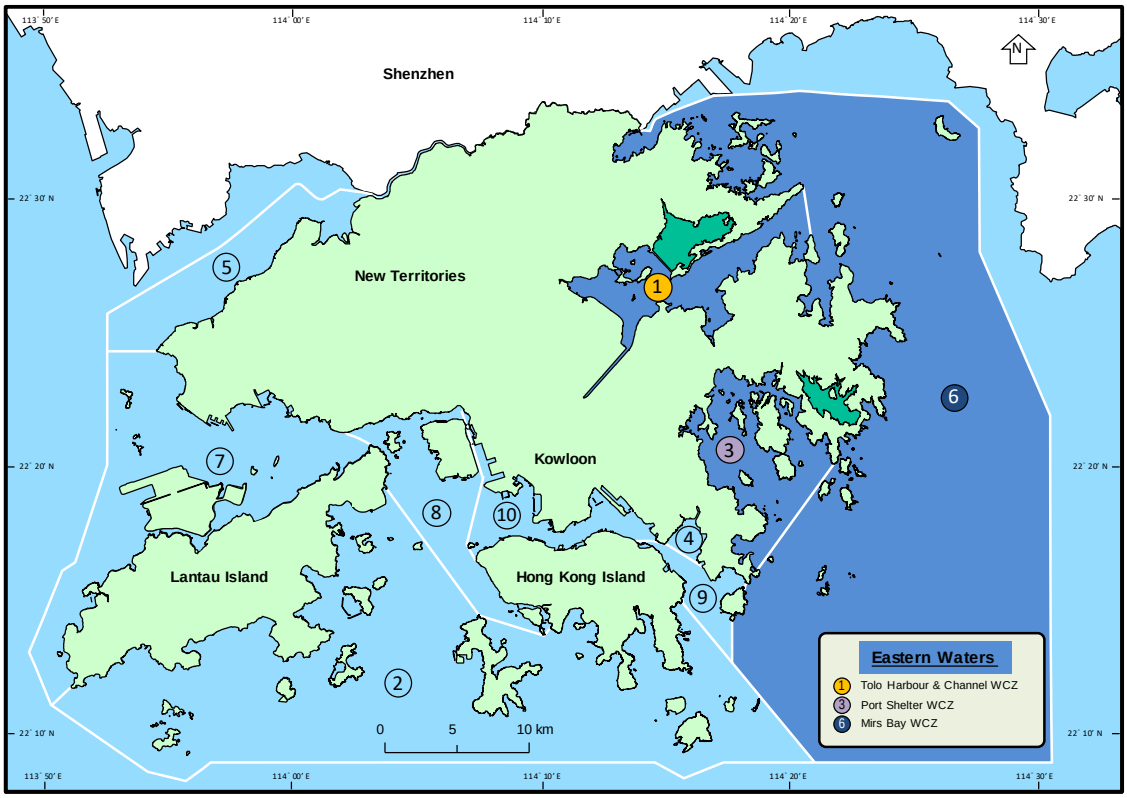


Figure 4. Water quality improvement in Victoria Harbour after the phased implementation of Harbour Area Treatment Scheme (HATS) since 2001

3. Water Quality of the Ten Water Control Zones (WCZs)

Based on the hydrographical conditions of Hong Kong waters and the proximity to the Pearl River Estuary, the ten WCZs are grouped into four main areas: namely Eastern, Central, Western and Southern Waters. Details of their respective water quality conditions are reported in the following sections.

3.1 Eastern Waters



The eastern waters comprise three WCZs: namely the Mirs Bay WCZ, the Port Shelter WCZ and the Tolo Harbour and Channel WCZ. These waterbodies cover seven gazetted bathing beaches, three marine parks, the Hong Kong Geopark, 20 fish culture zones and beautiful natural coastlines with pristine water quality supporting a diversified array of marine life, fisheries and recreation activities.

Mirs Bay Water Control Zone

In 2022, the Mirs Bay WCZ attained a high overall marine WQO compliance rate of 96%. The water quality was very good with high DO, and low nutrient and *E. coli* levels, fitting for various recreational and mariculture uses. Figures 5 and 6 illustrate the WQO compliance rates and some long-term water quality trends for the Mirs Bay WCZ in the past three decades.

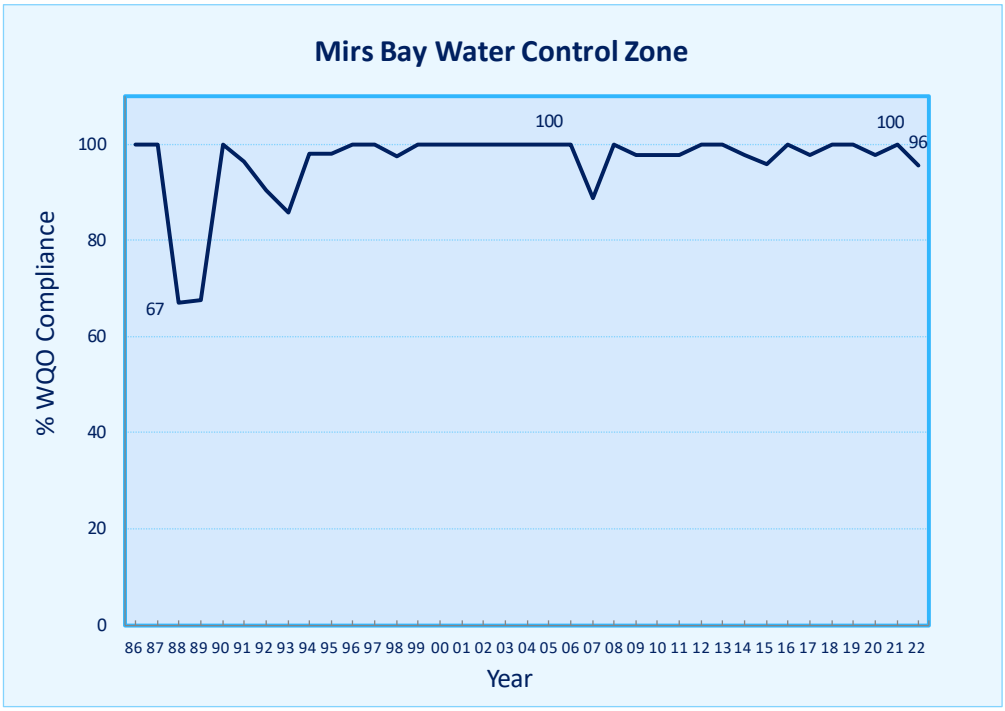


Figure 5. Overall WQO compliance rate for the Mirs Bay WCZ, 1986-2022

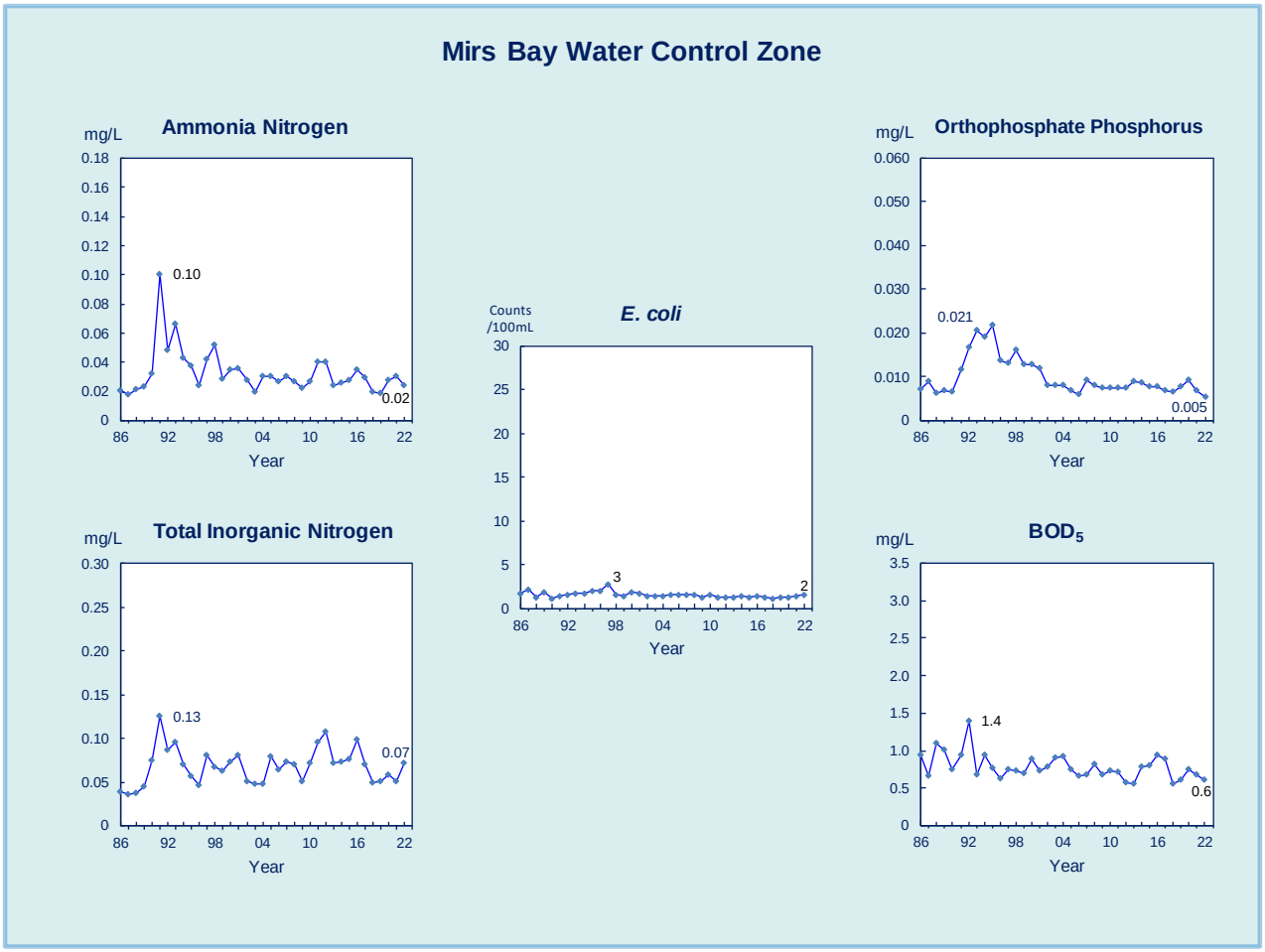


Figure 6. Long-term water quality trends in the Mirs Bay WCZ, 1986-2022

Port Shelter Water Control Zone

In 2022, the pristine water quality of the Port Shelter WCZ sustained with a high overall WQO compliance rate of 97%.

The WQO compliance rates and long-term water quality trends for the Port Shelter WCZ since 1986 are illustrated in Figures 7 and 8. In addition to the generally low pollution levels, there was also a steady decrease in nutrients concentrations (including ammonia nitrogen (NH_4-N) and orthophosphate phosphorus (PO_4-P)).

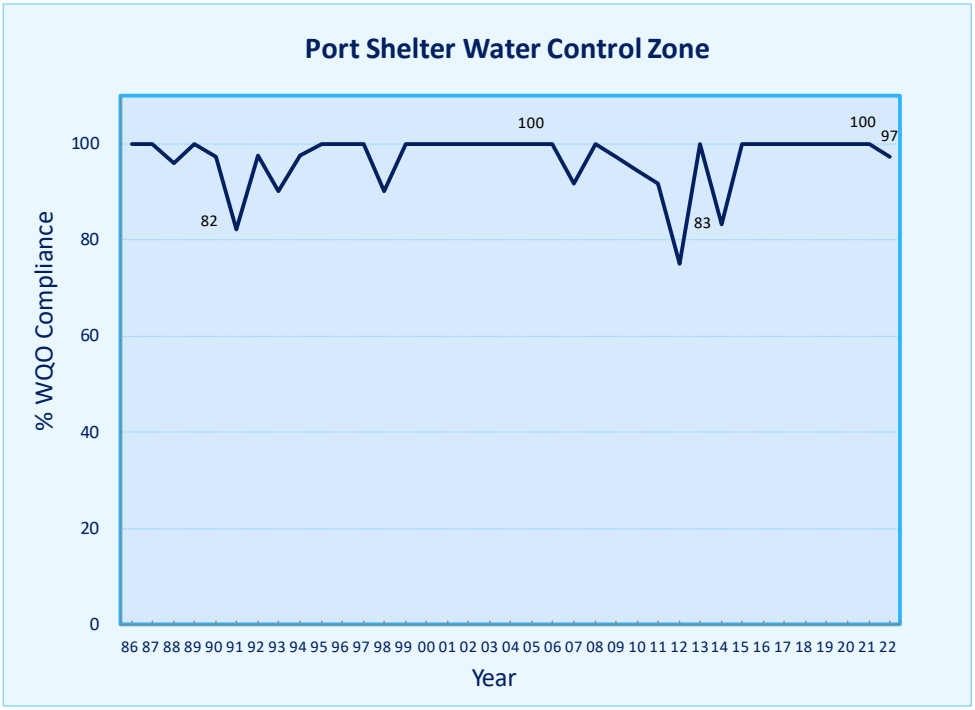


Figure 7. Overall WQO compliance rate for the Port Shelter WCZ, 1986-2022

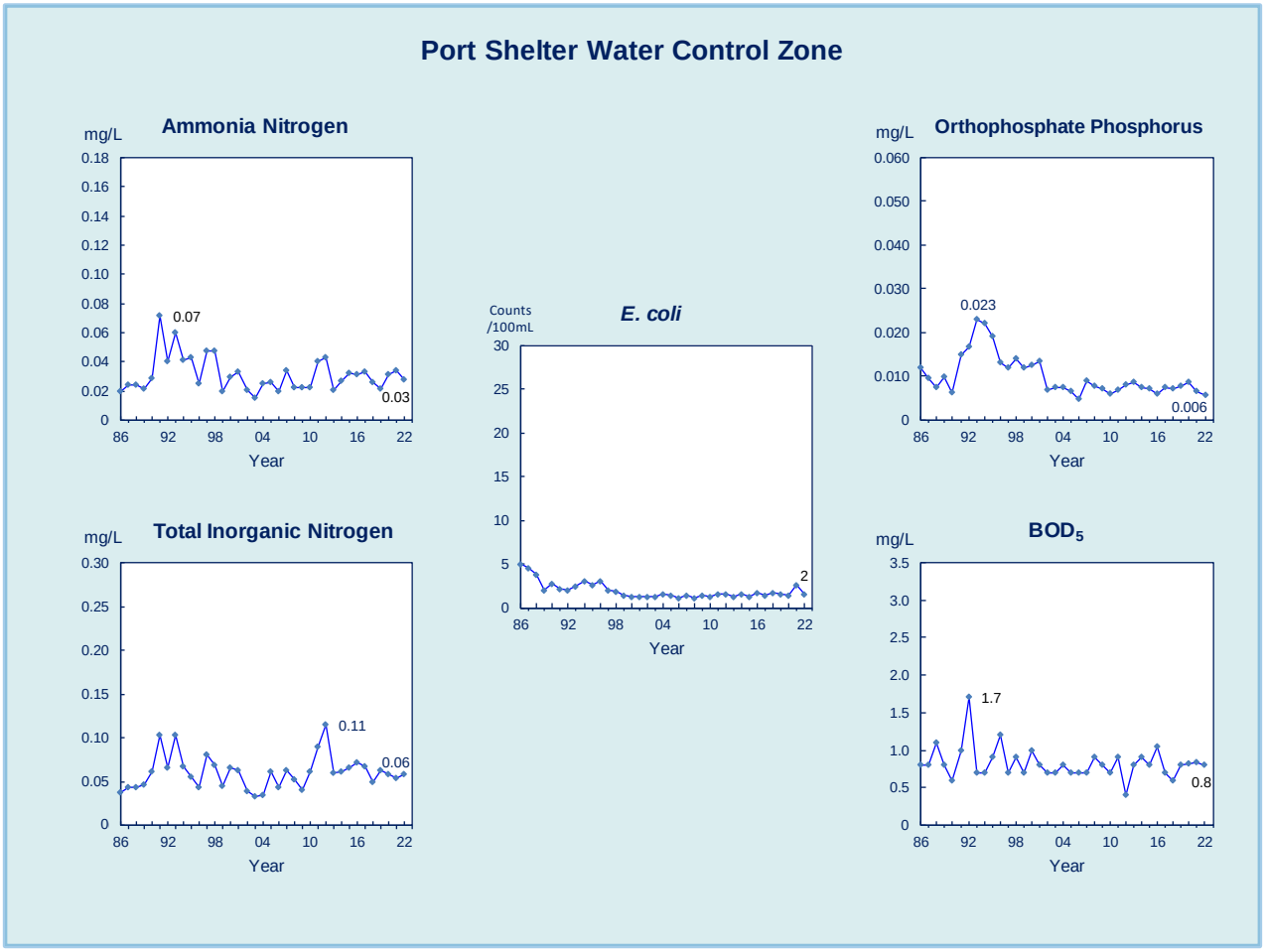


Figure 8. Long-term water quality trends in the Port Shelter WCZ, 1986-2022

Tolo Harbour and Channel Water Control Zone

The overall marine WQO compliance rate for the Tolo Harbour and Channel WCZ was 79% in 2022. The Tolo Harbour and Channel WCZ consistently complied with the bacteriological WQO for secondary contact recreational uses. This embayment of water is, however, subject to a natural hydrological phenomenon of water column stratification and associated formation of bottom layer water masses with relatively low DO level in summer period due to restricted water exchange with the open waters.

Upon the implementation of the Tolo Harbour Action Plan since the mid-1980s, there has been substantial improvement in the water quality in Tolo Harbour in the past three decades, as shown in Figures 9 and10.

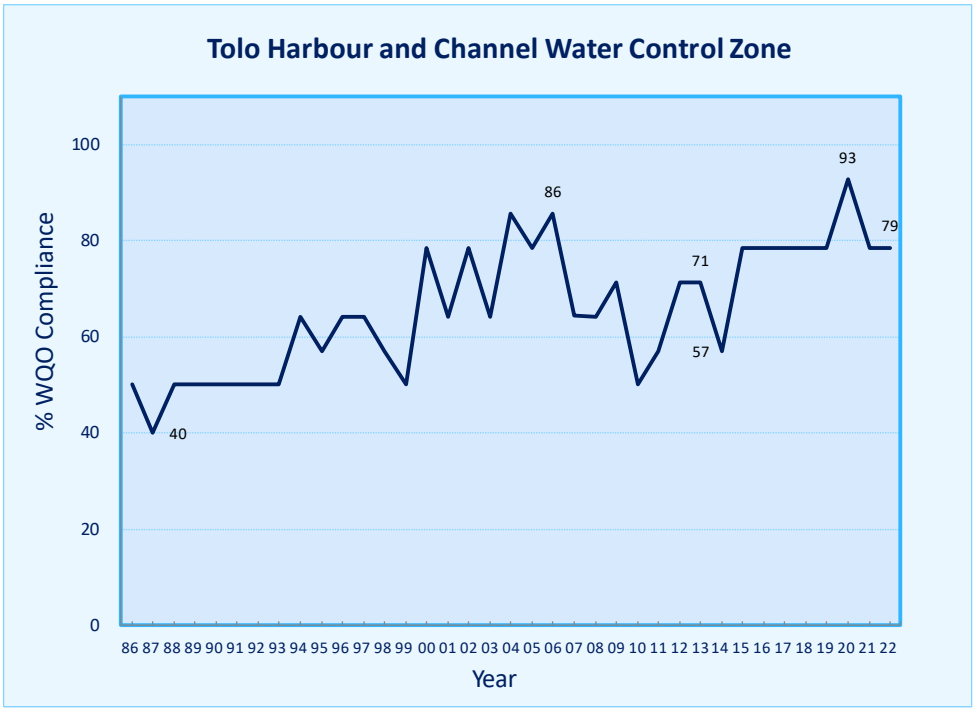


Figure 9. Overall WQO compliance rate for the Tolo Harbour and Channel WCZ, 1986-2022

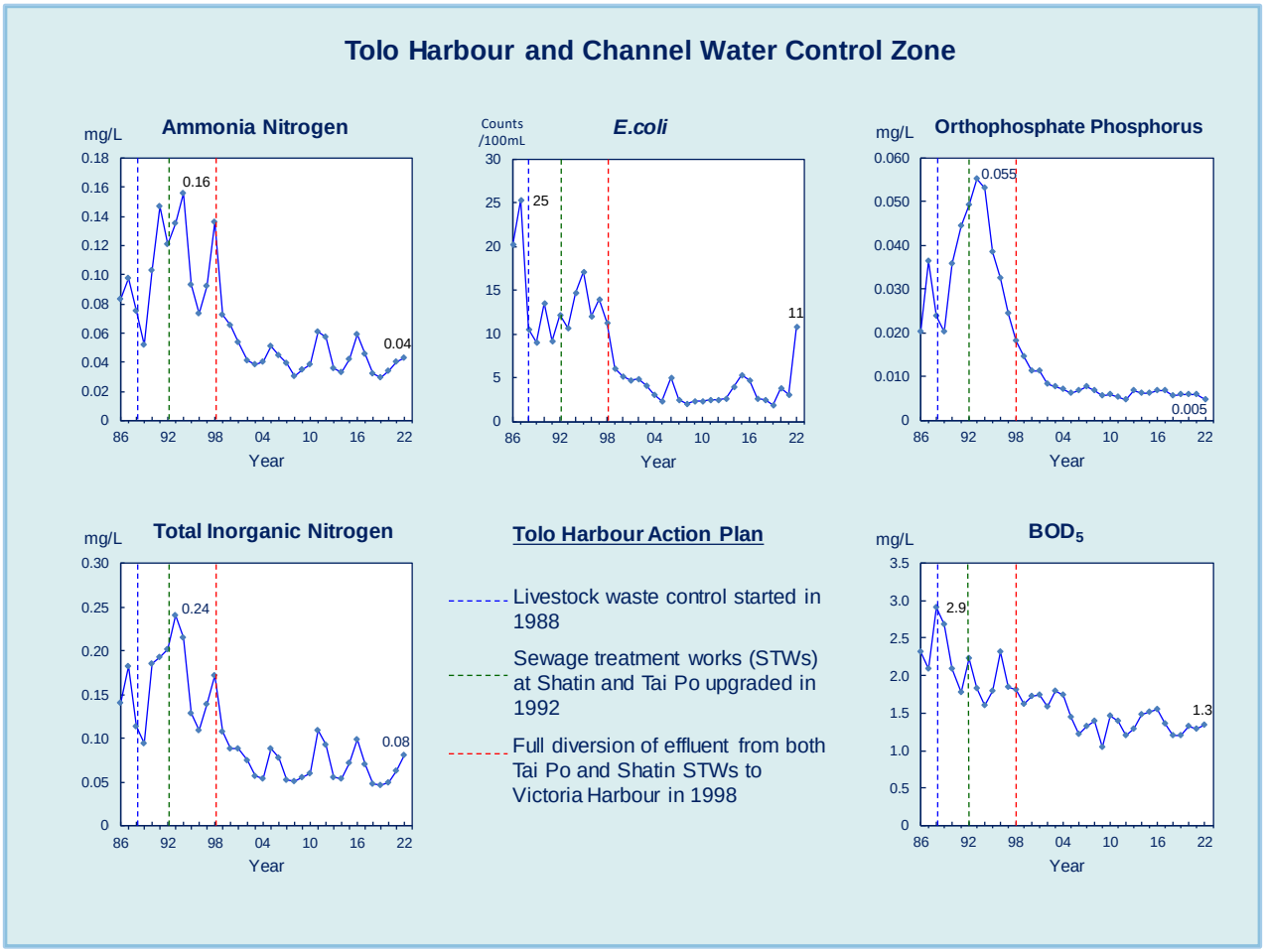
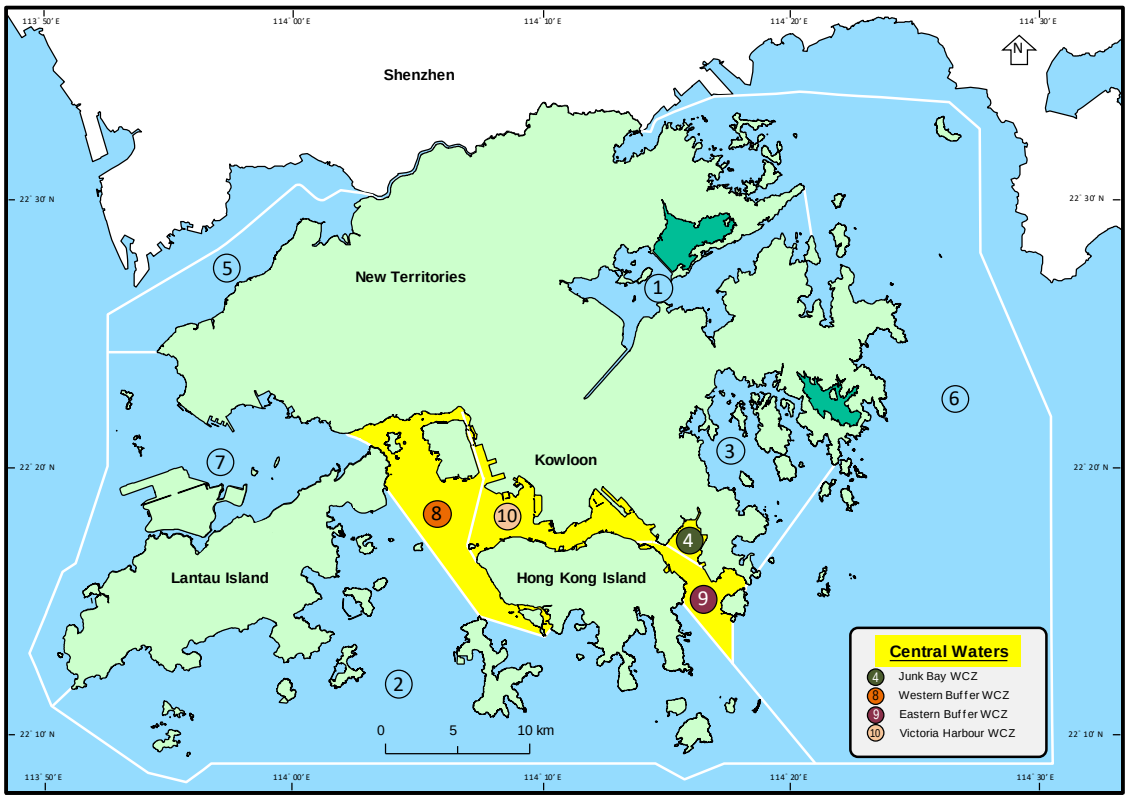


Figure 10. Long-term water quality trends in the Tolo Harbour and Channel WCZ, 1986-2022

3.2 Central Waters



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

Victoria Harbour Water Control Zone

The Victoria Harbour WCZ achieved an overall WQO compliance rate of 93% in 2022.

As shown in Figure 11, the *E. coli* level in the eastern side of Victoria Harbour has decreased markedly since the implementation of HATS Stage 1 in 2001. The annual Cross Harbour Swim, suspended since 1979 because of poor water quality, was resumed on the eastern side of the harbour in 2011 after implementation of the HATS ADF. With full commissioning of the HATS Stage 2A, the *E. coli* level of the central harbour area has been further reduced. Since 2017, the race route of the event has returned to the traditional route in the central harbour.

Figures 12 and 13 show the WQO compliance rates and some long-term water quality trends for the Victoria Harbour WCZ in the period of 1986 to 2022.

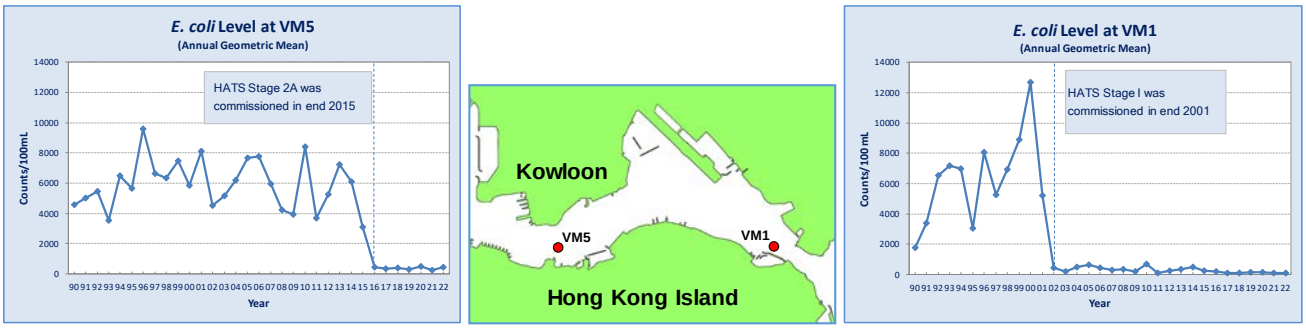


Figure 11. *E. coli* level at the central (VM5) and eastern (VM1) parts of the Victoria Harbour WCZ, 1990-2022

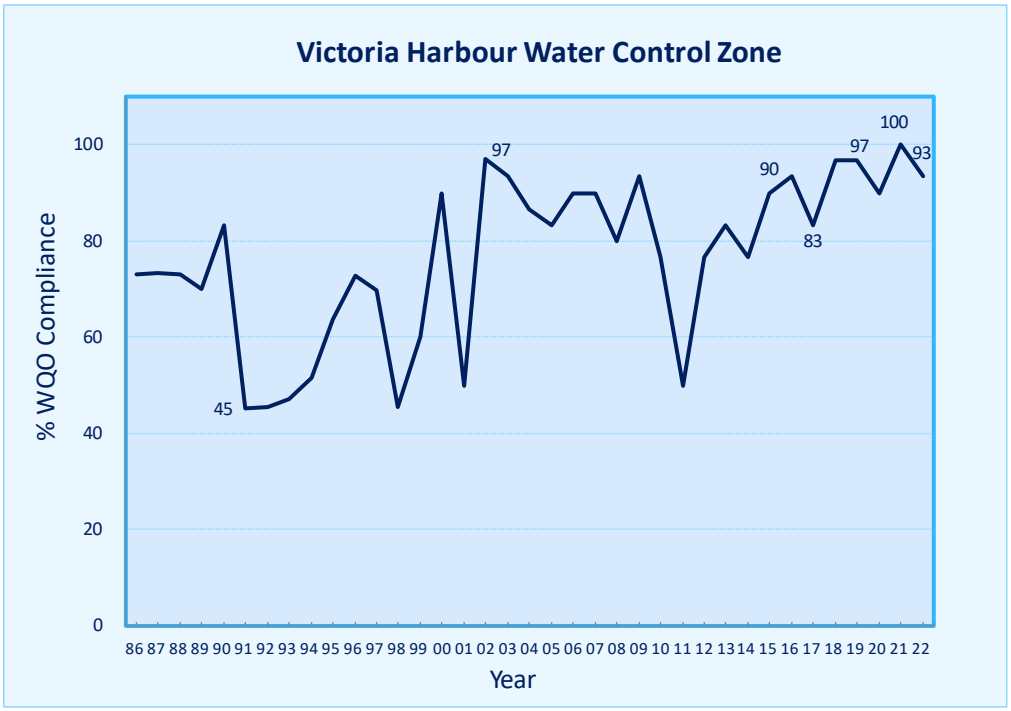


Figure 12. Overall WQO compliance rate for the Victoria Harbour WCZ, 1986-2022

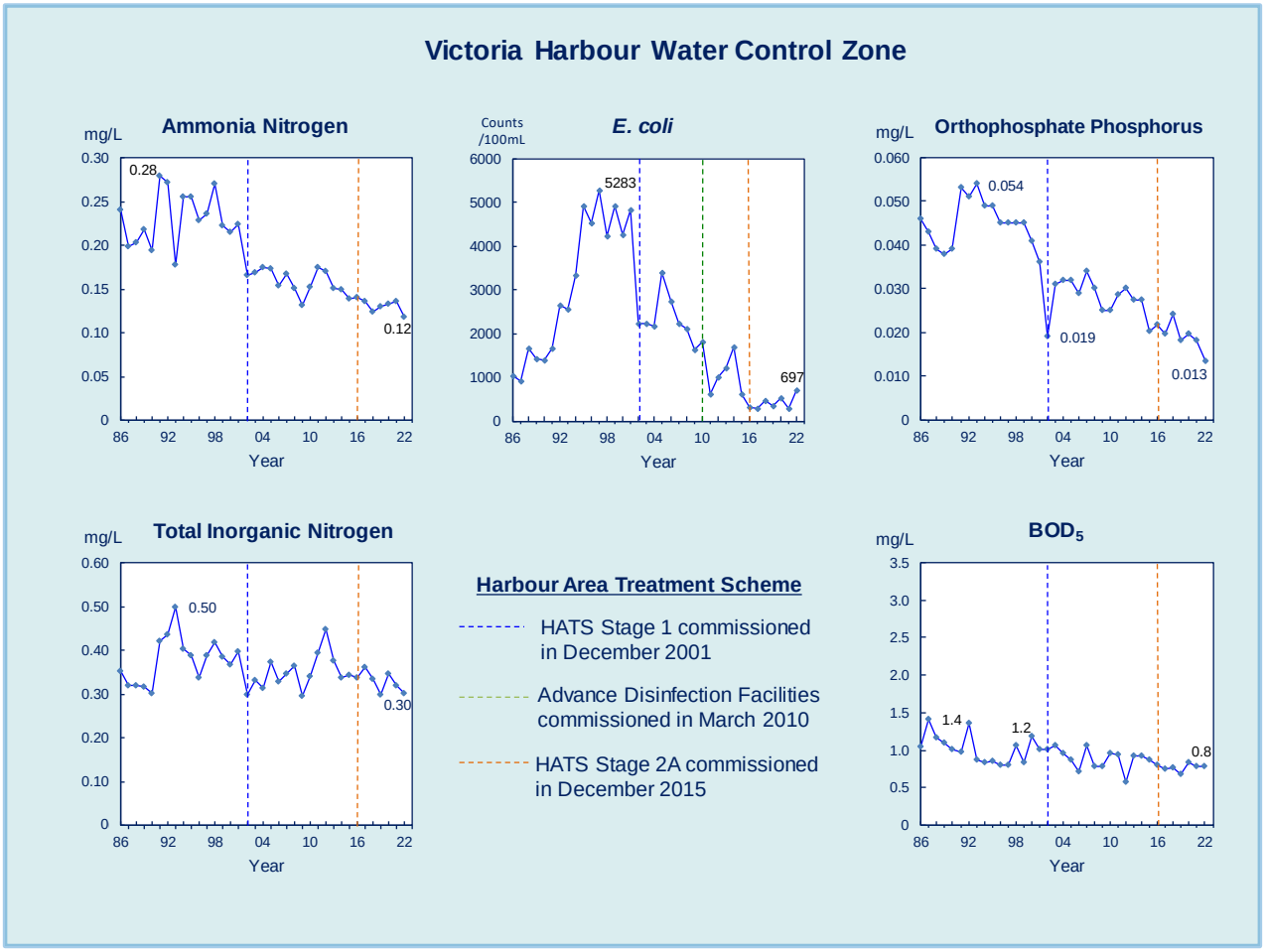


Figure 13. Long-term water quality trends in the Victoria Harbour WCZ, 1986-2022

Eastern Buffer Water Control Zone and Junk Bay Water Control Zone

Both the Eastern Buffer WCZ and the Junk Bay WCZ have fully achieved the marine WQOs for the past 23 years. Since the implementation of the HATS Stage 1 in 2001, the water quality of these two WCZs has improved noticeably with significant increase in DO level and decrease in nutrient and bacteria levels.

Figures 14 to 17 present the WQO compliance rates and long-term water quality improving trends for the Eastern Buffer WCZ and the Junk Bay WCZ over the past three decades.

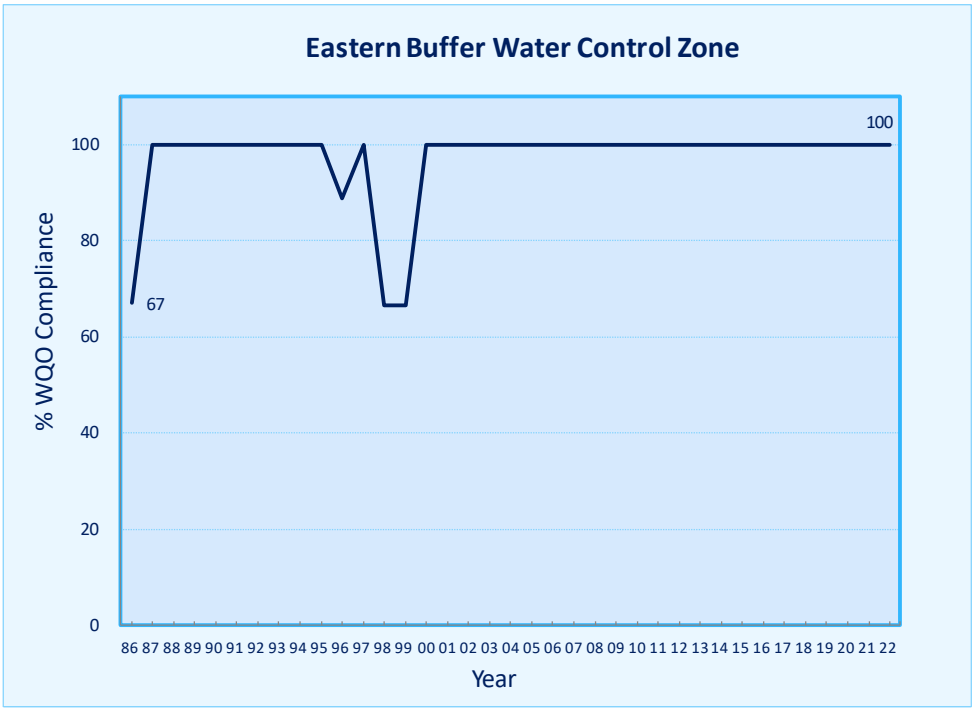


Figure 14. Overall WQO compliance rate for the Eastern Buffer WCZ, 1986-2022

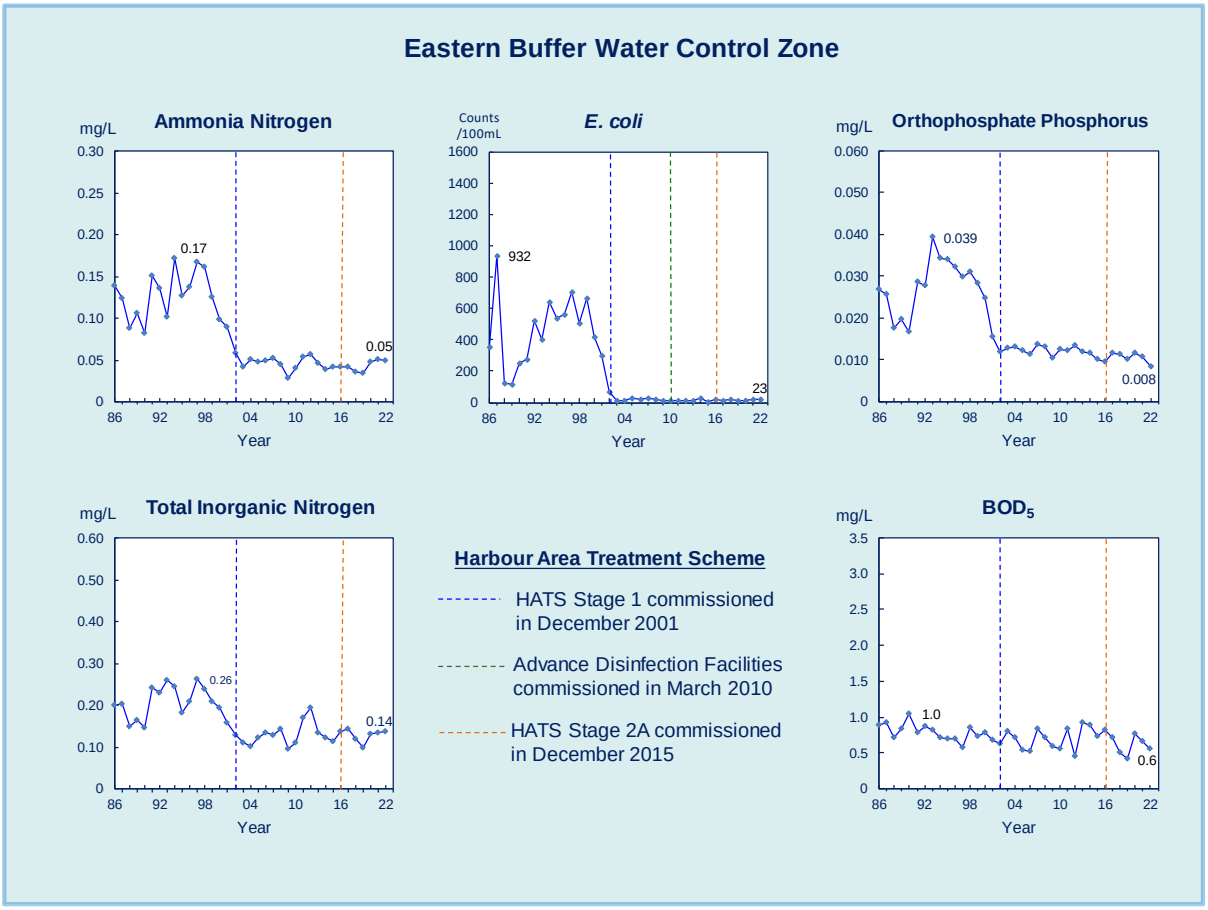


Figure 15. Long-term water quality trends in the Eastern Buffer WCZ, 1986-2022

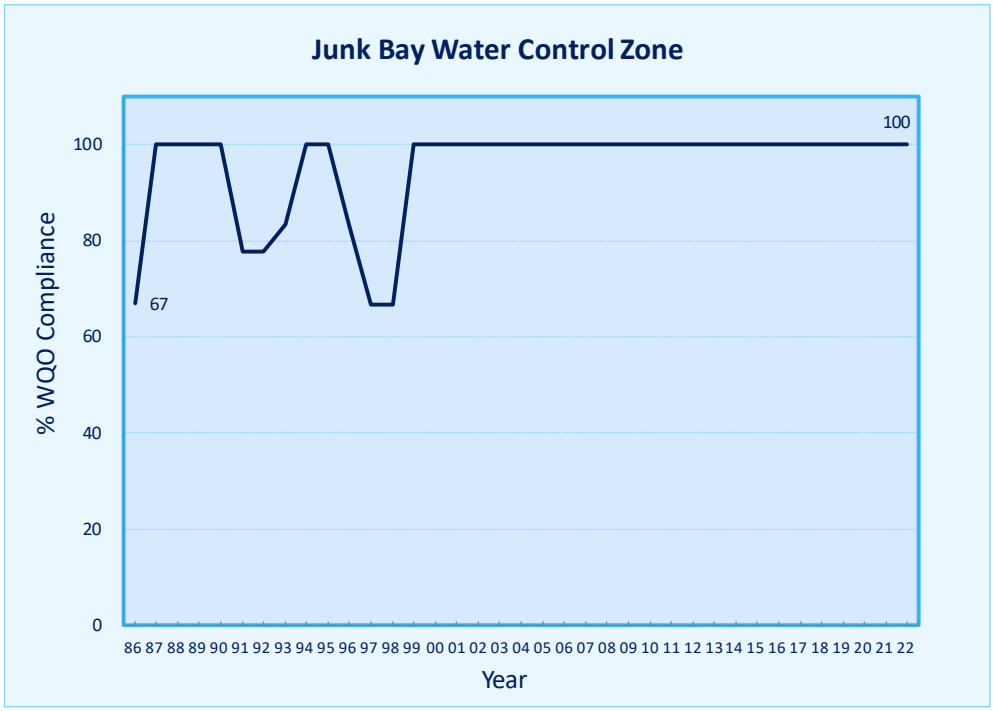


Figure 16. Overall WQO compliance rate for the Junk Bay WCZ, 1986-2022

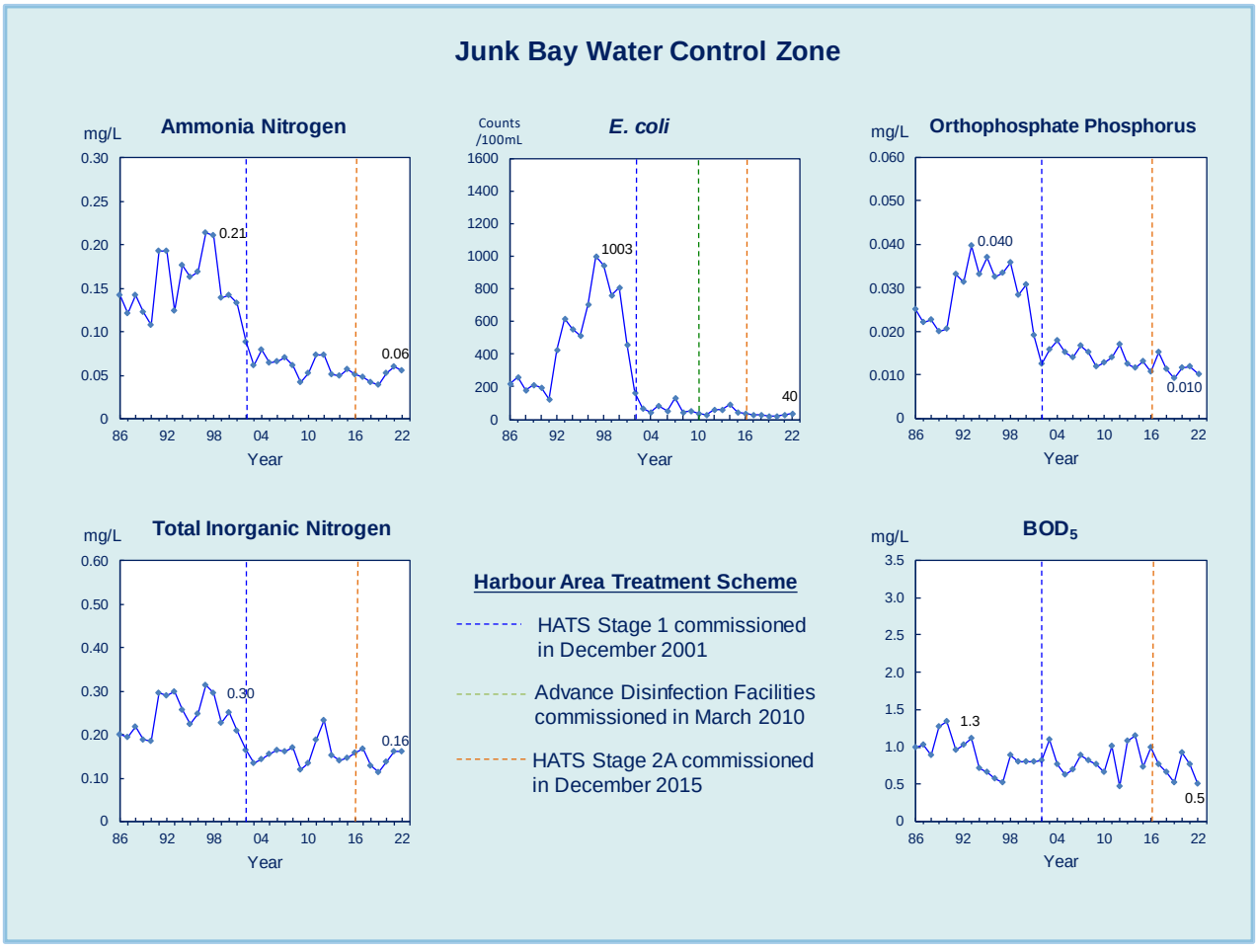
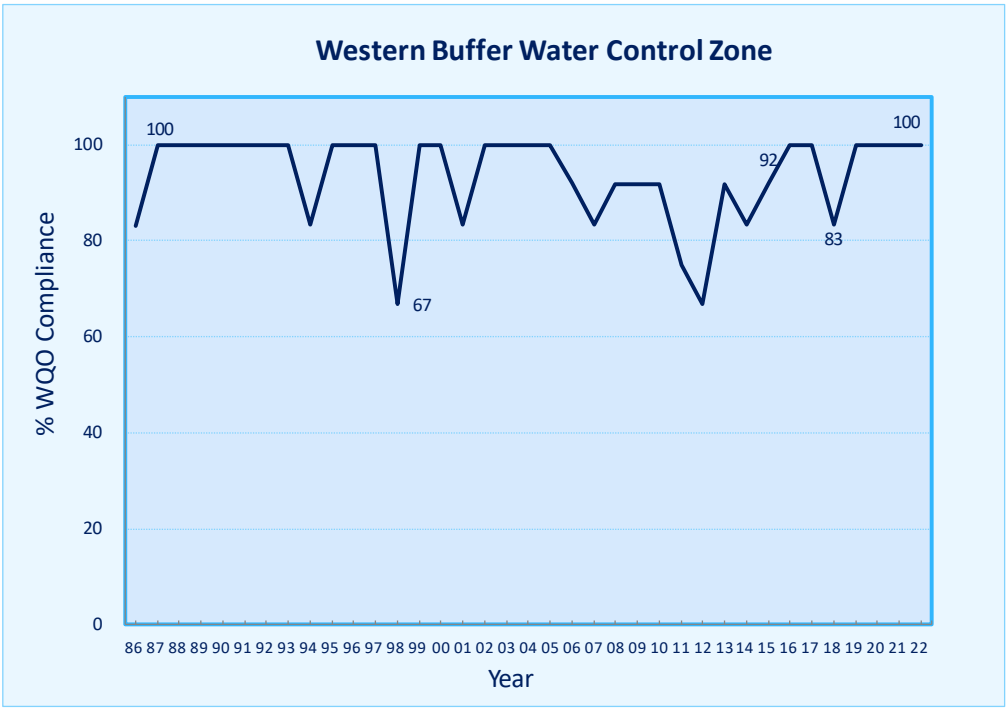


Figure 17. Long-term water quality trends in the Junk Bay WCZ, 1986-2022

Western Buffer Water Control Zone

The Western Buffer WCZ fully achieved the WQOs in 2022. Since the commissioning of the HATS ADF in 2010, the *E. coli* level in the WCZ decreased substantially.

Figures 18 and 19 illustrate the WQO compliance rate and some long-term water quality trends for the Western Buffer WCZ since 1986. Similar to other WCZs in the central waters, significant improvement of water quality as reflected in reduction in levels PO_4-P has been observed.



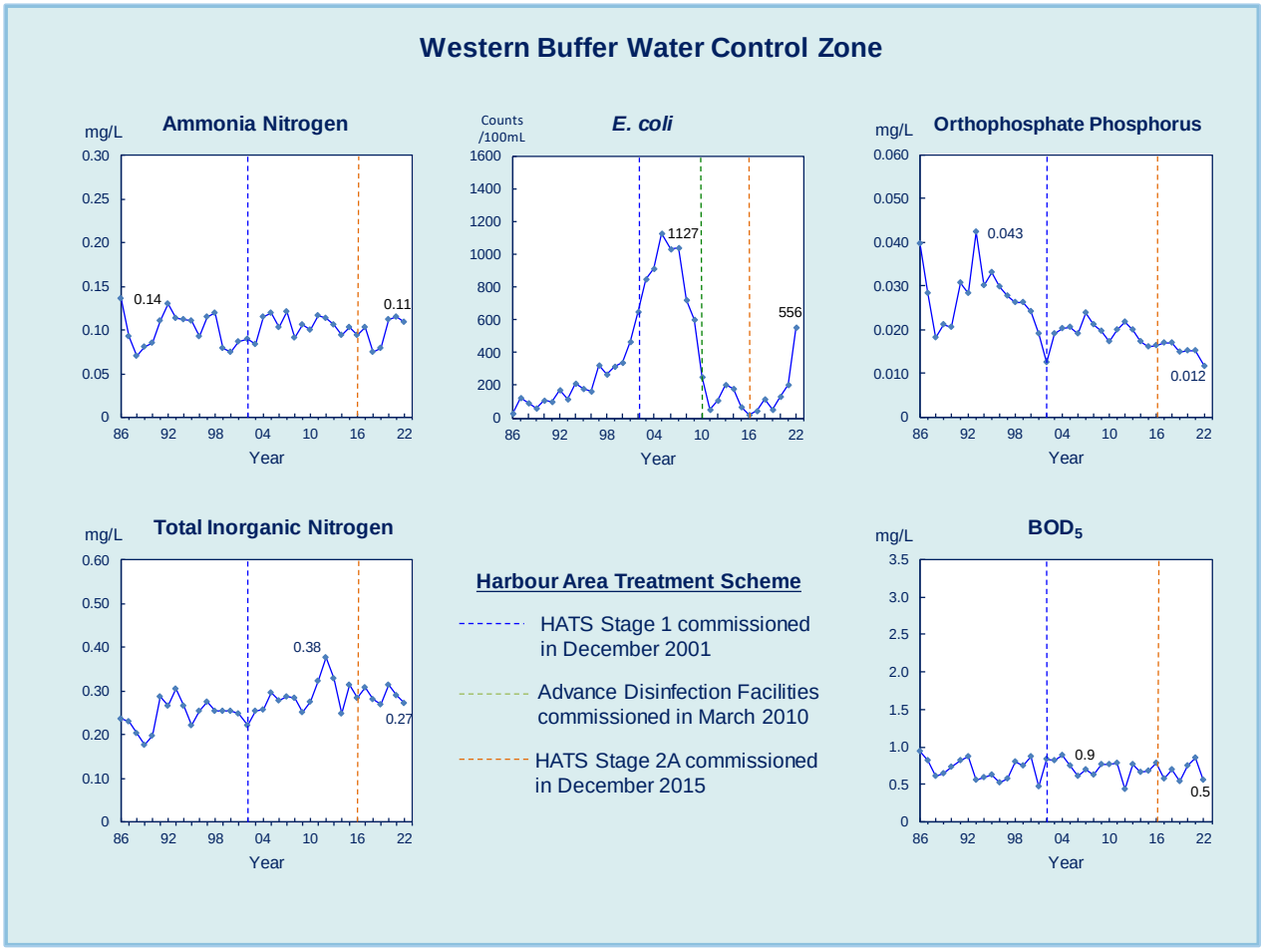
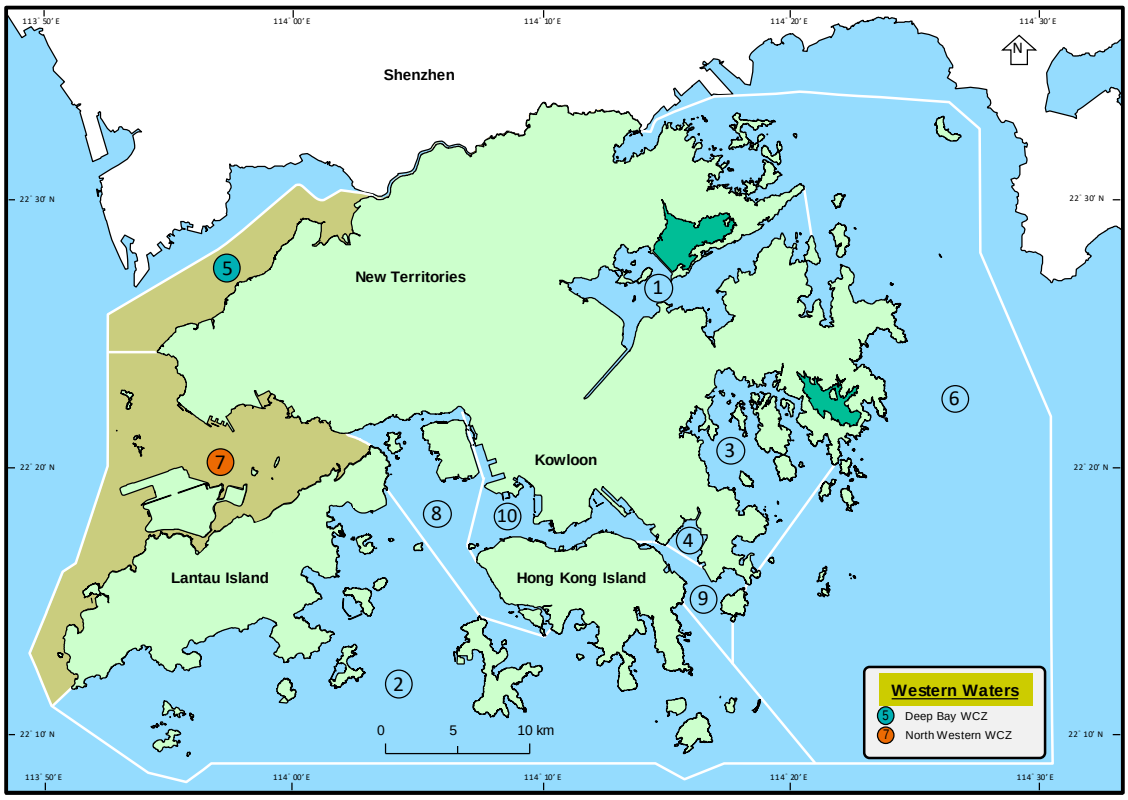


Figure 19. Long-term water quality trends in the Western Buffer WCZ, 1986-2022

3.3 Western Waters



The Deep Bay WCZ and the North Western WCZ are located in the western part of Hong Kong. The former includes the ecologically sensitive Mai Po Inner Deep Bay Ramsar Site and areas of oyster culture. The latter covers the waters around the North and Western side of Lantau Island, Tuen Mun, Sha Chau and Lung Kwu Chau.

Deep Bay Water Control Zone

In 2022, the overall WQO compliance rate for the Deep Bay WCZ was 67%, as compared with a ten-year average of 47% in 2009-2018. Overall, with the measures under the Deep Bay Water Pollution Control Joint Implementation Programme taken progressively by the governments of Hong Kong and Shenzhen, there have been significant water quality improvements in Deep Bay. In particular, there has been full compliance of the NH_3-N WQO in the past seven years. Although Deep Bay, as compared with other WCZs, shows higher nutrient levels with annual depth-averaged TIN levels exceeding the respective TIN WQOs, a noticeable long-term decrease in TIN levels since mid-2000s has been seen. The improvement in the WQO compliance rates and long-term water quality trends for Deep Bay since mid-2000s are illustrated in Figures 20 to 22.

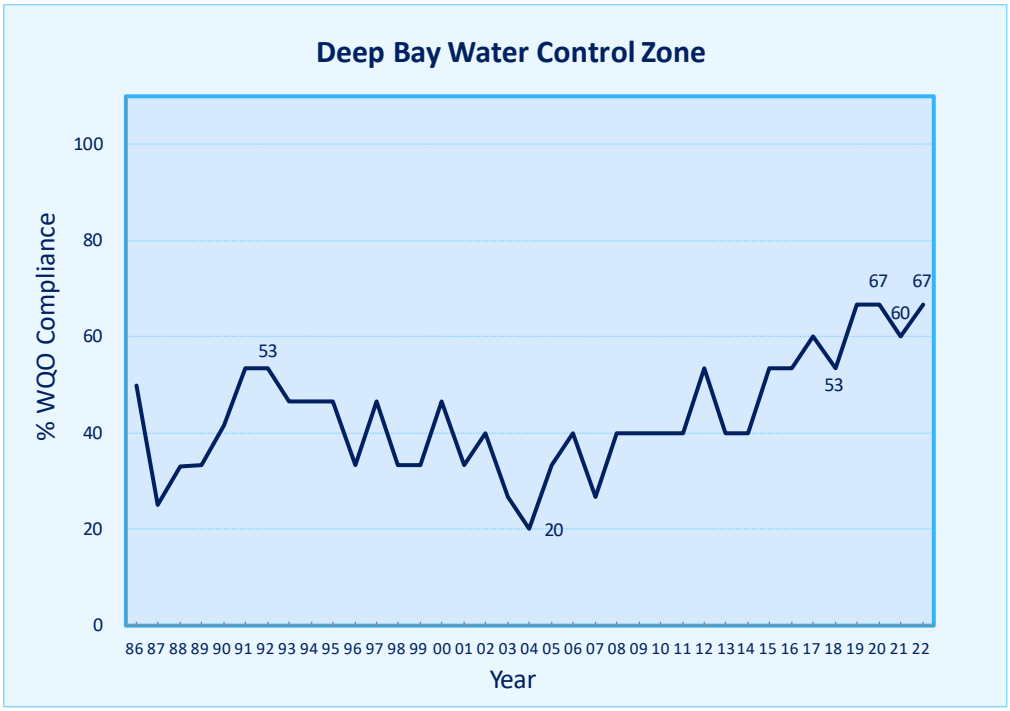


Figure 20. Overall WQO compliance for the Deep Bay WCZ, 1986-2022

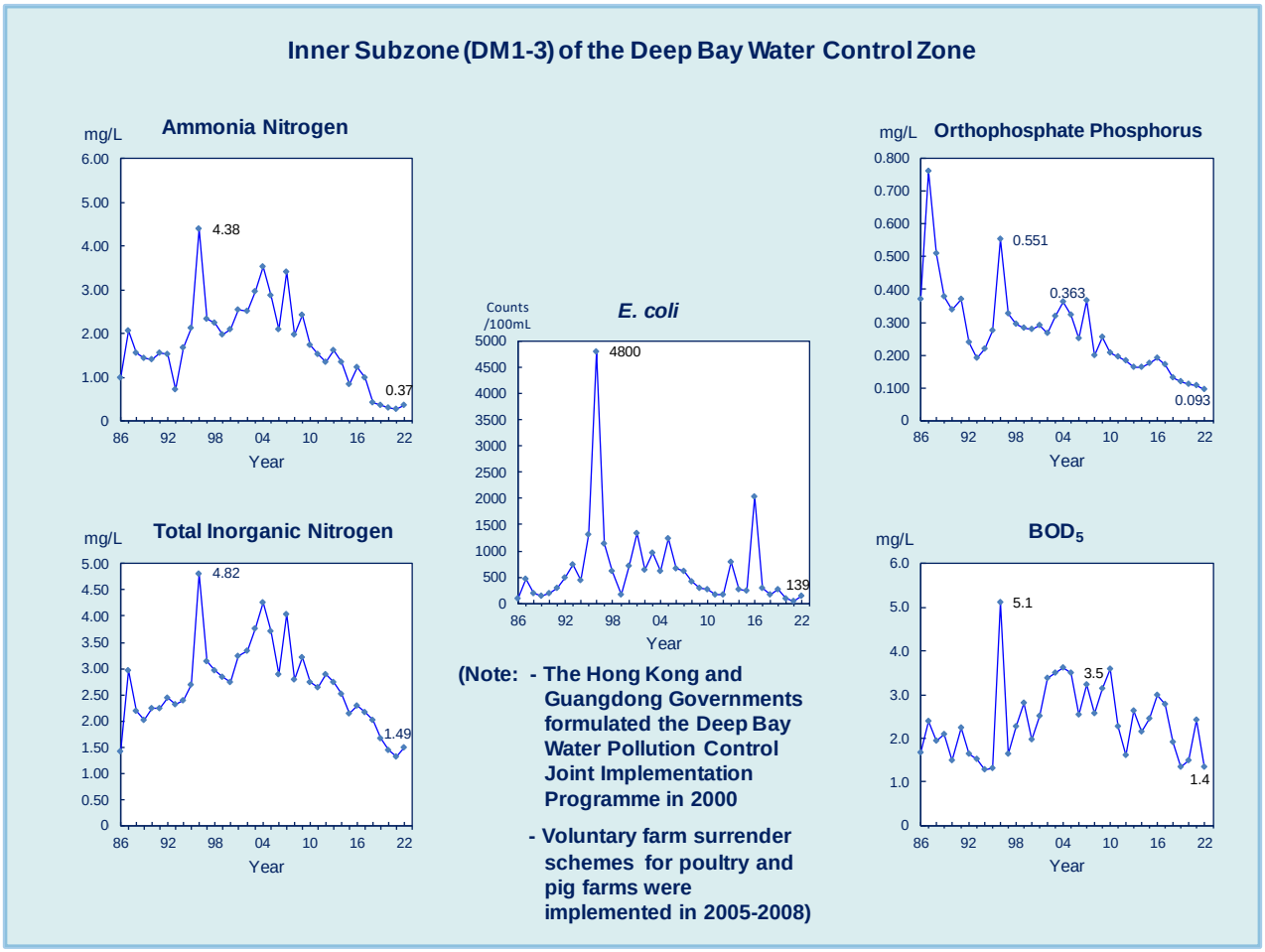


Figure 21. Long-term water quality trends in Inner Subzone of the Deep Bay WCZ, 1986-2022

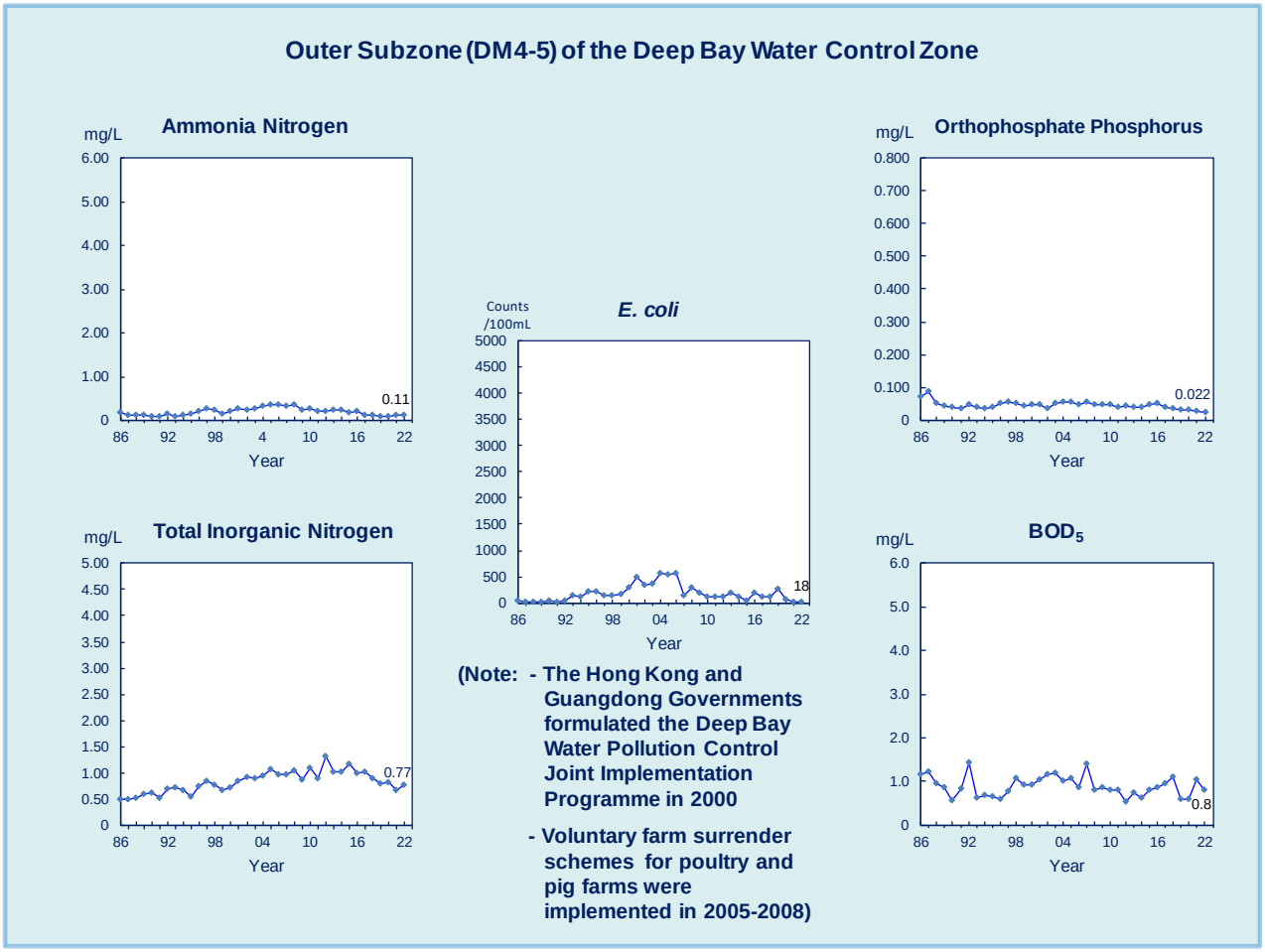


Figure 22. Long-term water quality trends Outer Subzone of the Deep Bay WCZ, 1986-2022

North Western Water Control Zone

In 2022, the overall WQO compliance rate of the North Western WCZ was 83%, with the DO and NH_3-N WQOs fully met. Under the influence of high seasonal background level in the Pearl River Estuary, the compliance rate for TIN WQO was 50%. The WQO compliance rate and long-term water quality trends for the North Western Water WCZ are illustrated in Figures 23 and 24.

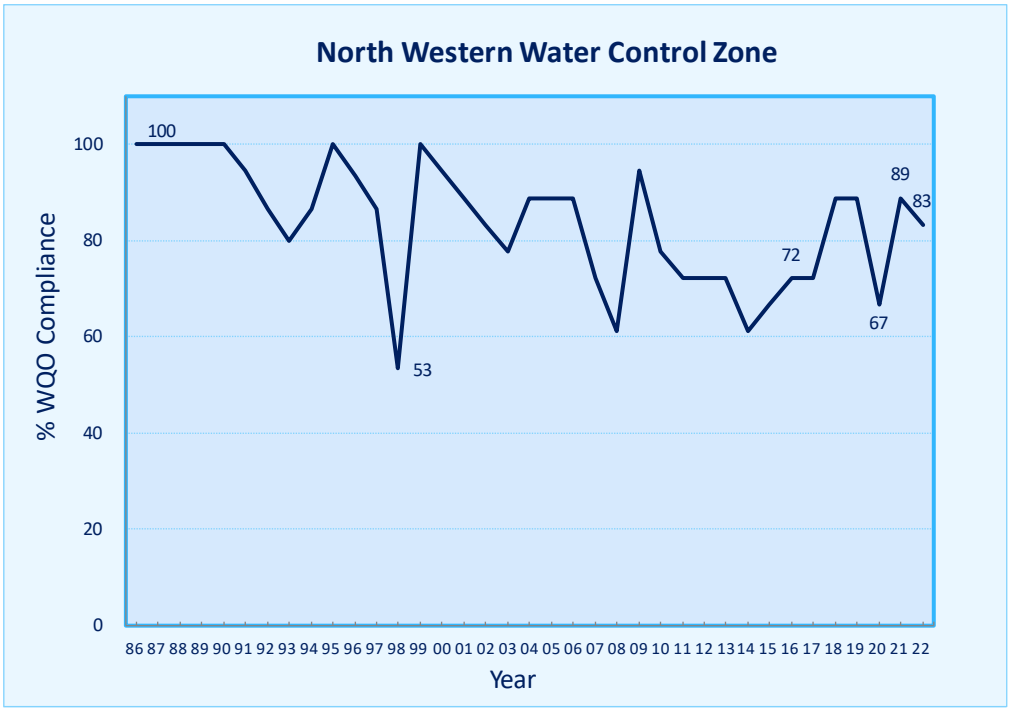


Figure 23. Overall WQO compliance for the North Western WCZ, 1986-2022

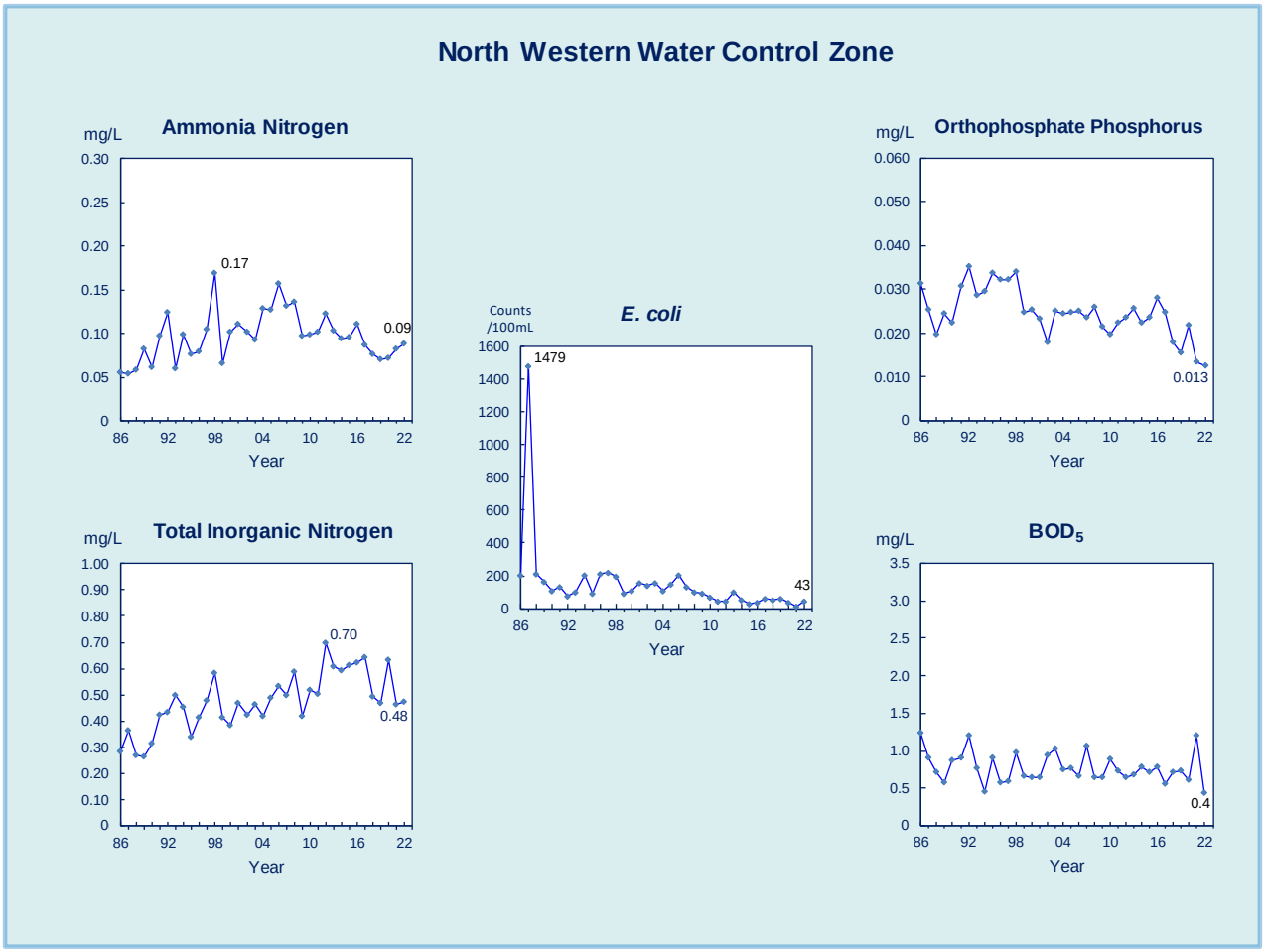
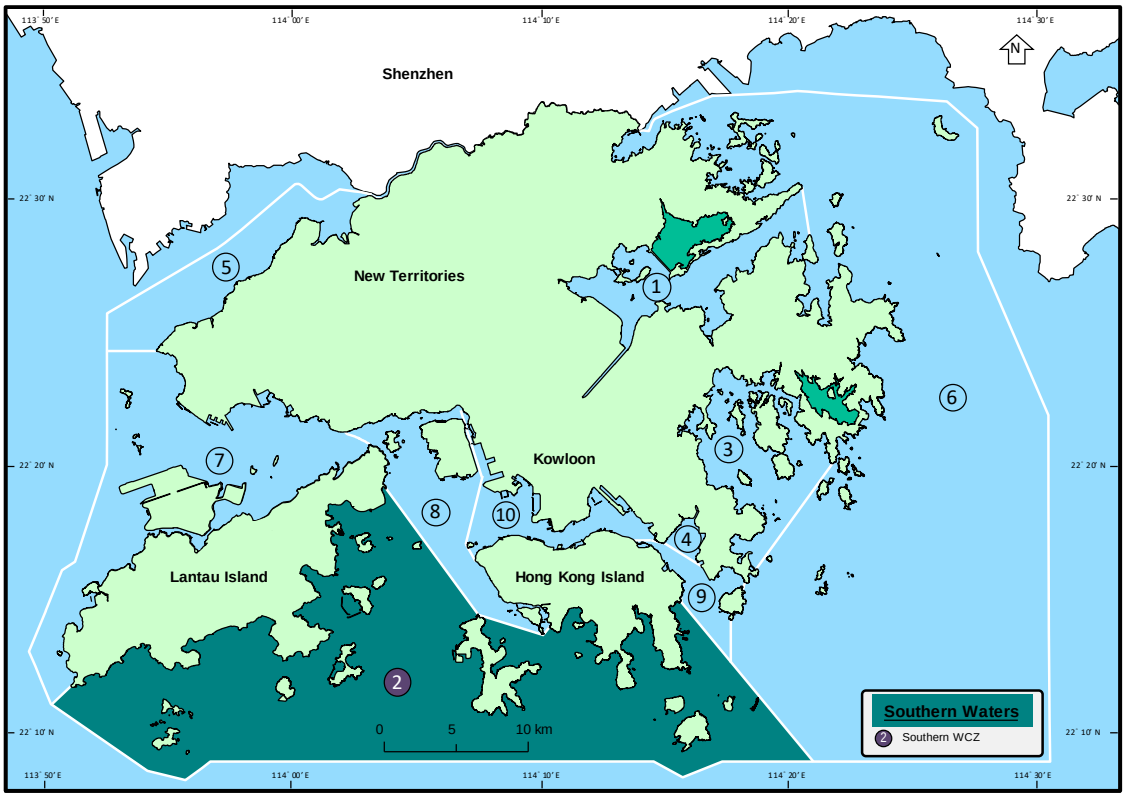


Figure 24. Long-term water quality trends in the North Western WCZ, 1986-2022

3.4 Southern Waters



The southern waters cover the Southern WCZ, stretching from south of Hong Kong Island to Lantau Island. This water body covers 21 gazetted beaches, two marine parks, one marine reserve and four fish culture zones.

Southern Water Control Zone

In 2022, the Southern WCZ achieved an overall WQO compliance rate of 69%, with full attainment of the DO and NH_3-N WQOs. While the TIN level in the southern waters was generally lower than the adjacent western and central waters, it could not meet the more stringent TIN WQO of the WCZ.

The Southern WCZ also covers a number of secondary contact recreation subzones mainly located along the southern coast of Hong Kong Island and the outlying islands. In 2022, full compliance with the bacteriological WQO on *E. coli* for all these secondary contact recreation subzones was achieved. The WQO compliance rates and long-term water quality trends for the Southern WCZ are plotted in Figures 25 and 26.

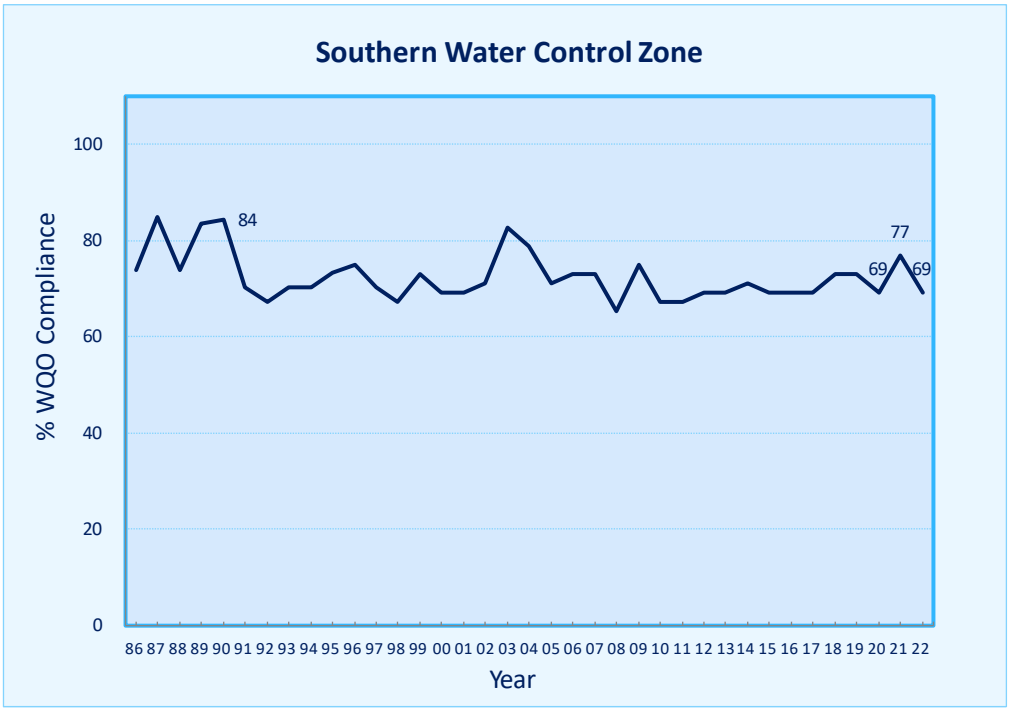


Figure 25. Overall WQO compliance for the Southern WCZ, 1986-2022

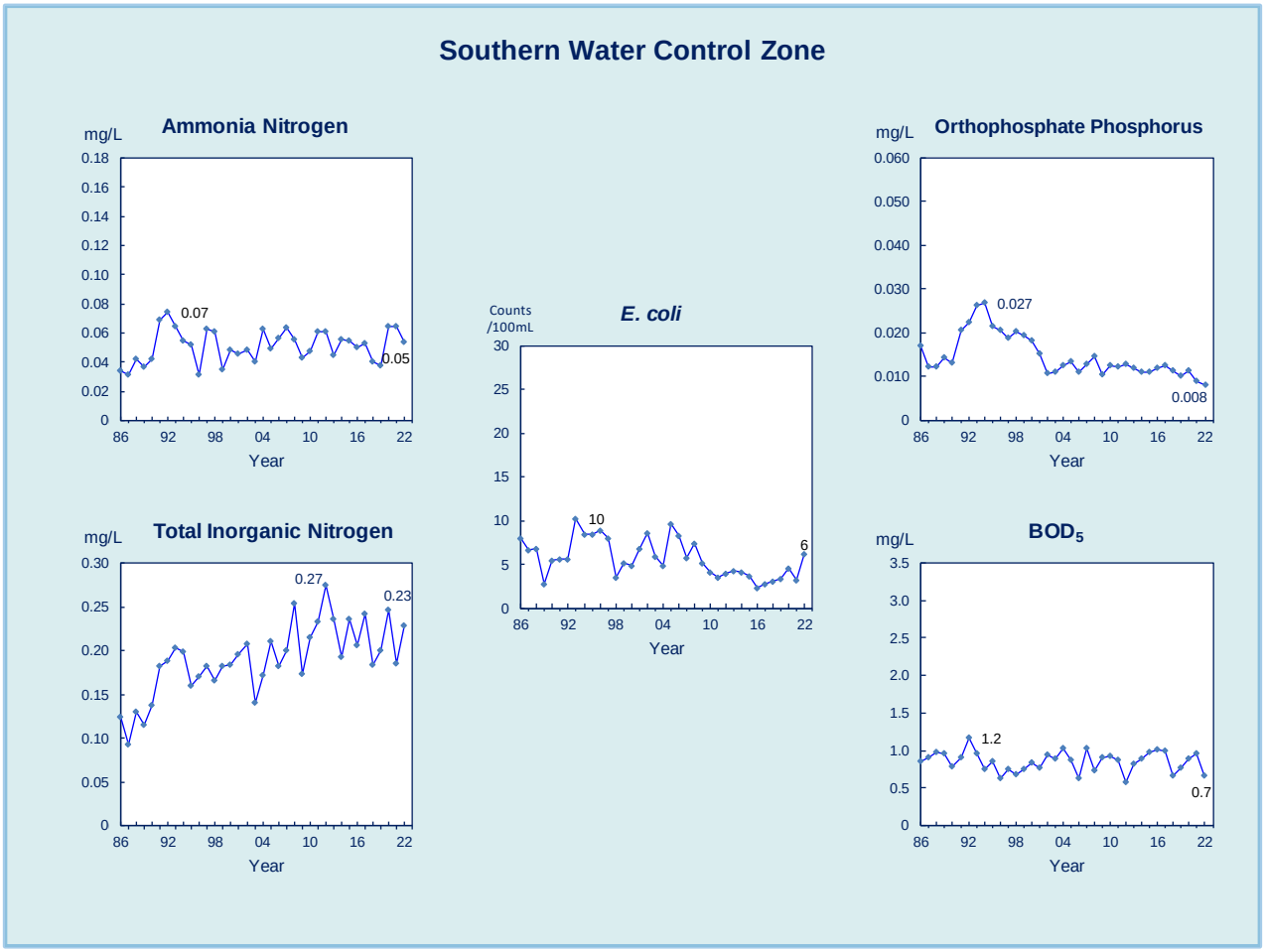


Figure 26. Long-term water quality trends in the Southern WCZ, 1986-2022

4. Marine Sediment Quality

Marine sediment samples taken in different parts of Hong Kong were analysed for over 60 physical, chemical and biological parameters. Details of marine sediment quality in all WCZs in the last five years (2018-2022) are summarised in Appendix E.

5. Typhoon Shelters

The EPD monitored the water quality of 14 typhoon shelters, three sheltered anchorages and the Government Dockyard. Some of these typhoon shelters (e.g. Causeway Bay Typhoon Shelter and Kwun Tong Typhoon Shelter) are located adjacent to densely populated residential, commercial and/or industrial areas. Others (e.g. Cheung Chau Typhoon Shelter and Shuen Wan Typhoon Shelter) are located in outlying islands or relatively away from urban areas. There is no bacteriological WQO set for typhoon shelters which are used only for vessel mooring. In 2022, the NH_3-N levels recorded in all typhoon shelters were generally low, and well within the respective NH_3-N WQOs.

Overall, the water quality of the typhoon shelters in Hong Kong has been improving over the last decade. Figure 27 shows the long-term improving trend in the depth-averaged DO level in the Kwun Tong Typhoon Shelter.

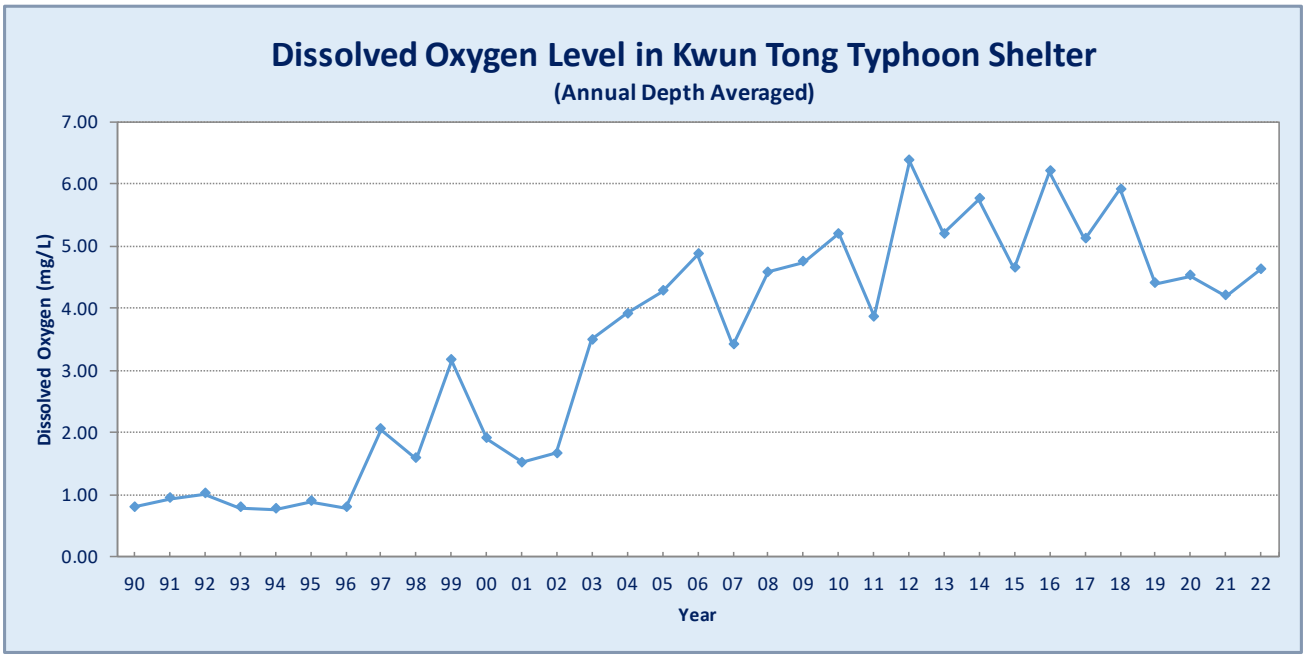


Figure 27. Long-term improvement in dissolved oxygen level in the Kwun Tong Typhoon Shelter, 1990-2022

6. Phytoplankton and Red Tides

The EPD conducts monthly sampling of phytoplankton at 26 marine water quality monitoring stations to determine the long-term changes and trends in their composition and densities in Hong Kong marine waters. In 2022, a total of 95 phytoplankton species were recorded in Hong Kong waters, on par with a five-year average of 94 phytoplankton species in 2017-2021. Of these, 53 species were diatoms (56%), 28 were dinoflagellates (29%) and 14 were from other minor algal groups[1] (15%). This phytoplankton composition profile was generally similar to those observed in the past five years. Of the samples examined in 2022, diatoms were the dominant group found in our coastal waters in terms of species richness (number of species identified). Diatoms were also the dominant group in terms of cell density.

The total phytoplankton densities were generally higher at the monitoring stations in the Tolo Harbour and Channel WCZ. The densities of diatoms, dinoflagellates and other minor phytoplankton groups followed a similar spatial pattern compared with the total phytoplankton density. The most abundant diatoms were *Pseudo-nitzschia* spp. which constituted 2% to 48% of the diatom population found in various WCZs. The most abundant dinoflagellates were *Gymnodinium* spp. which constituted 25% to 52% of the dinoflagellate population in various WCZs.

In 2022, there were a total of seven reported red tide incidents in Hong Kong waters, as compared to an average of 12 incidents in the past five years. Among them, three incidents involved only one WCZ; two incidents involved two WCZs; one incident involved seven WCZs and one incident involved eight WCZs. The seven red tide incidents were caused by different red tide species, all of which are non-toxic species except for *Heterosigma akashiwo* and *Pseudo-nitzschia calliantha.* Nevertheless, no red tide related fish kill in Hong Kong waters was recorded in 2022.

The details of red tide incidents in 2022 are shown in the following table.

[1] Phytoplankton can be classified into different groups based on their morphological characteristics, photosynthetic pigments and nutrition modes. In this report, phytoplankton other than the two major groups, i.e., diatoms and dinoflagellates, are collectively regarded as other minor phytoplankton groups to facilitate the data presentation.

Incident No.	Sighting Period	Red Tide Species
1	12/3/2022 – 19/4/2022	*Noctiluca scintillans*
2	14/3/2022 – 23/3/2022	*Heterosigma akashiwo* *
3	14/3/2022 – 23/3/2022	*Akashiwo sanguinea*
4	11/4/2022 – 13/4/2022	*Noctiluca scintillans* *Scrippsiella trochoidea*
5	21/7/2022 – 1/8/2022	*Pseudo-nitzschia calliantha* *
6	2/8/2022 – 10/8/2022	*Dactyliosolen phuketensis*
7	19/8/2022 – 24/8/2022	*Cerataulina dentata*

Red tide incidents in Hong Kong marine waters in 2022

*: *Heterosigma akashiwo* and *Pseudo-nitzschia calliantha* are potentially toxic species

(Source: Agriculture, Fisheries and Conservation Department)

The number of red tide incidents in Tolo Harbour has dropped significantly from the record high of 43 in 1988 to an annual average of about only four incidents in the recent five years. This is ascribed to the substantial improvement in water quality in the past decades following the successful implementation of the Tolo Harbour Action Plan, as clearly shown in Figure 28.

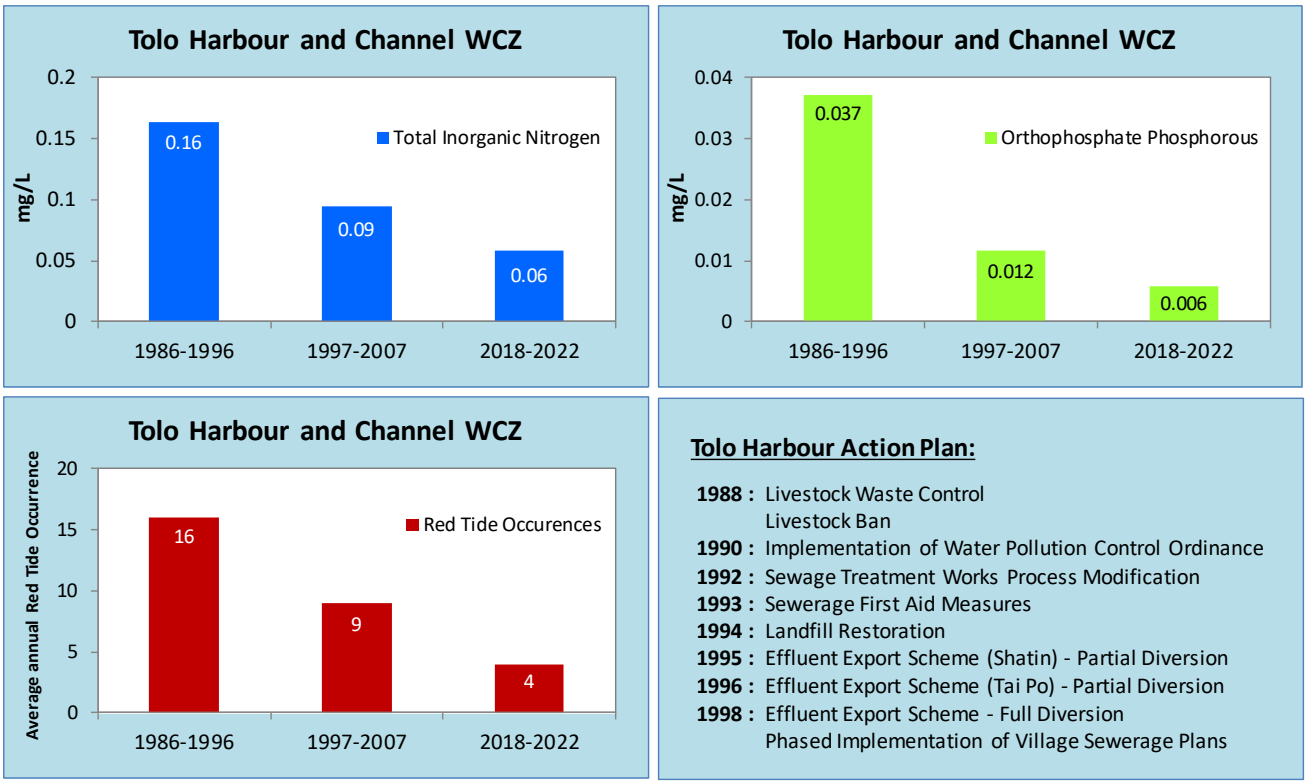
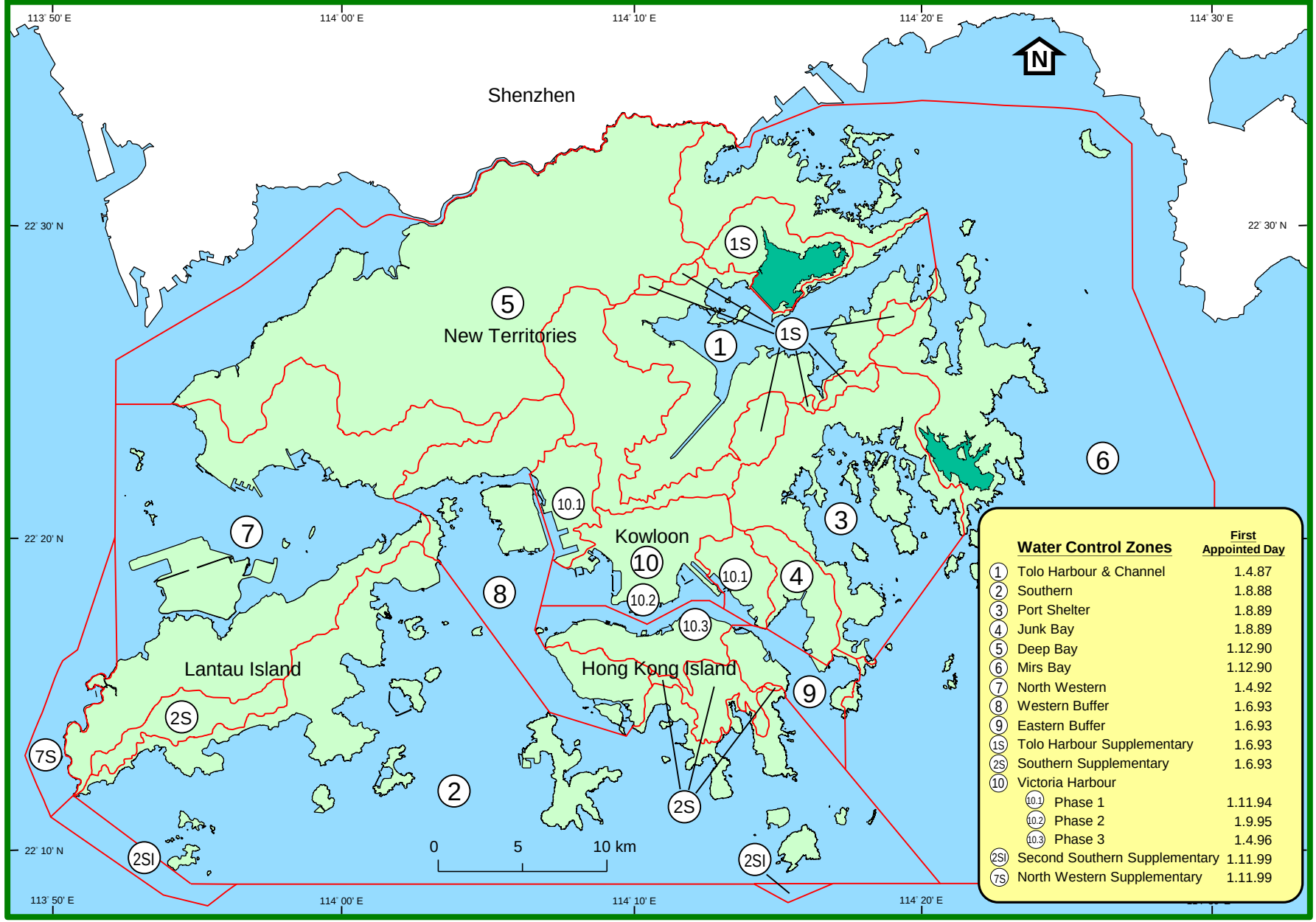


Figure 28. Reduction of nutrients levels with the average annual red tide occurrences in Tolo Harbour, 1986-2022

Appendices

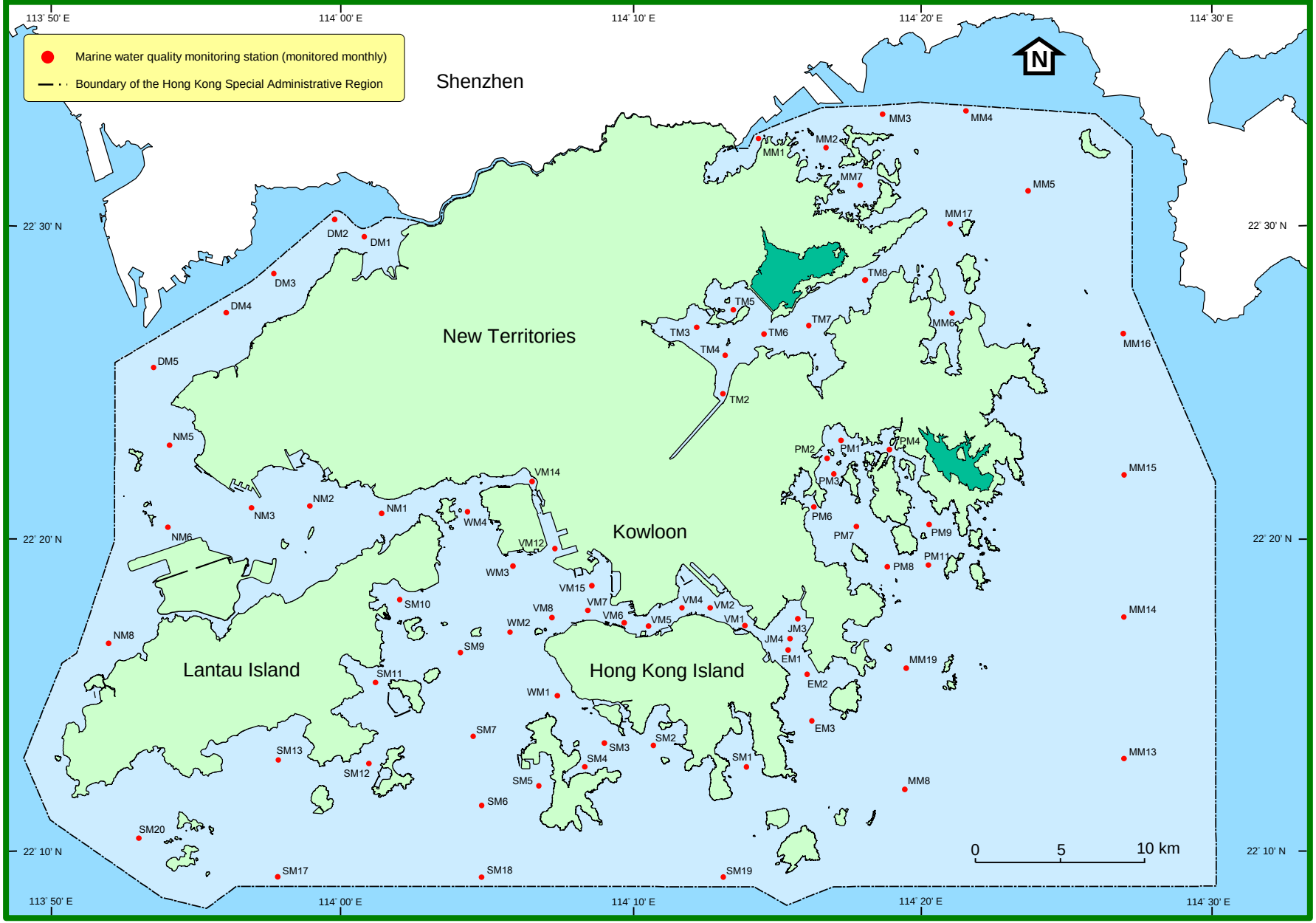
The Water Control Zones in Hong Kong

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

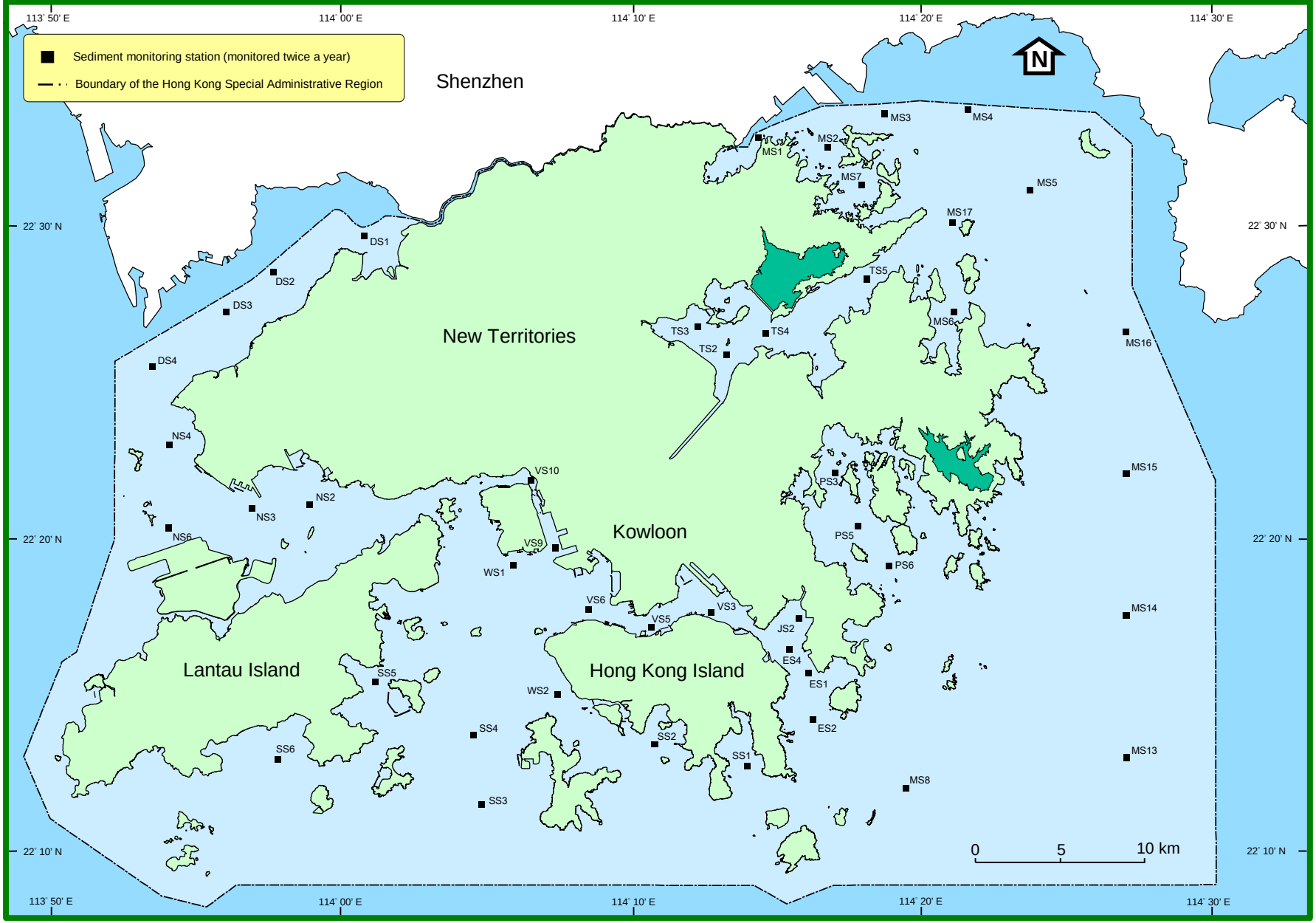


Water Control Zones		First Appointed Day
1	Tolo Harbour & Channel	1.4.87
2	Southern	1.8.88
3	Port Shelter	1.8.89
4	Junk Bay	1.8.89
5	Deep Bay	1.12.90
6	Mirs Bay	1.12.90
7	North Western	1.4.92
8	Western Buffer	1.6.93
9	Eastern Buffer	1.6.93
1S	Tolo Harbour Supplementary	1.6.93
2S	Southern Supplementary	1.6.93
10	Victoria Harbour	
10.1	Phase 1	1.11.94
10.2	Phase 2	1.9.95
10.3	Phase 3	1.4.96
2SI	Second Southern Supplementary	1.11.99
7S	North Western Supplementary	1.11.99

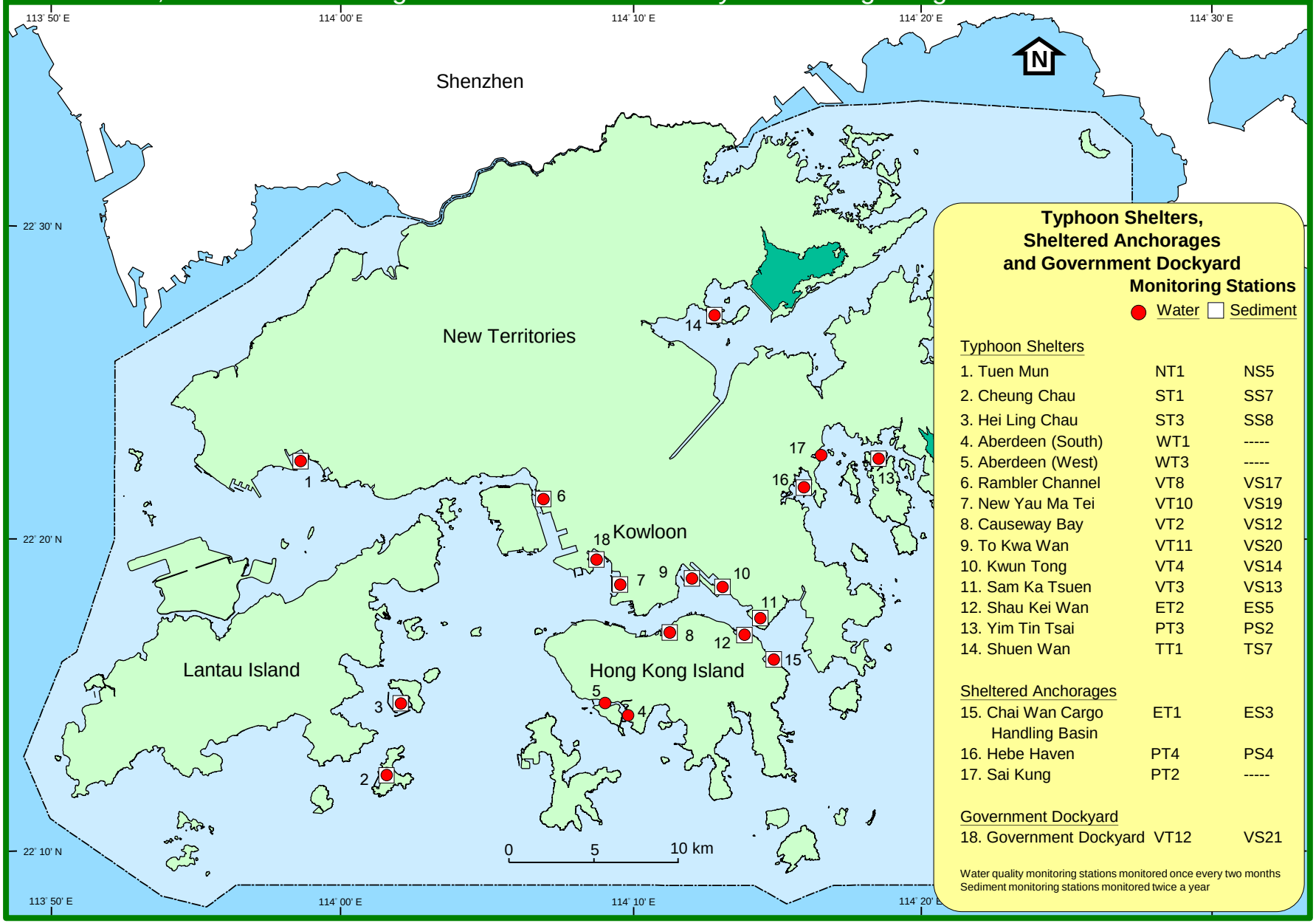
The 76 water quality monitoring stations in the open waters of Hong Kong in 2022



The 45 sediment monitoring stations in the open waters of Hong Kong in 2022



The 18 water quality monitoring stations and 15 sediment quality monitoring stations in the typhoon shelters, sheltered anchorages and Government Dockyard of Hong Kong in 2022



Typhoon Shelters, Sheltered Anchorages and Government Dockyard Monitoring Stations

● Water ☐ Sediment

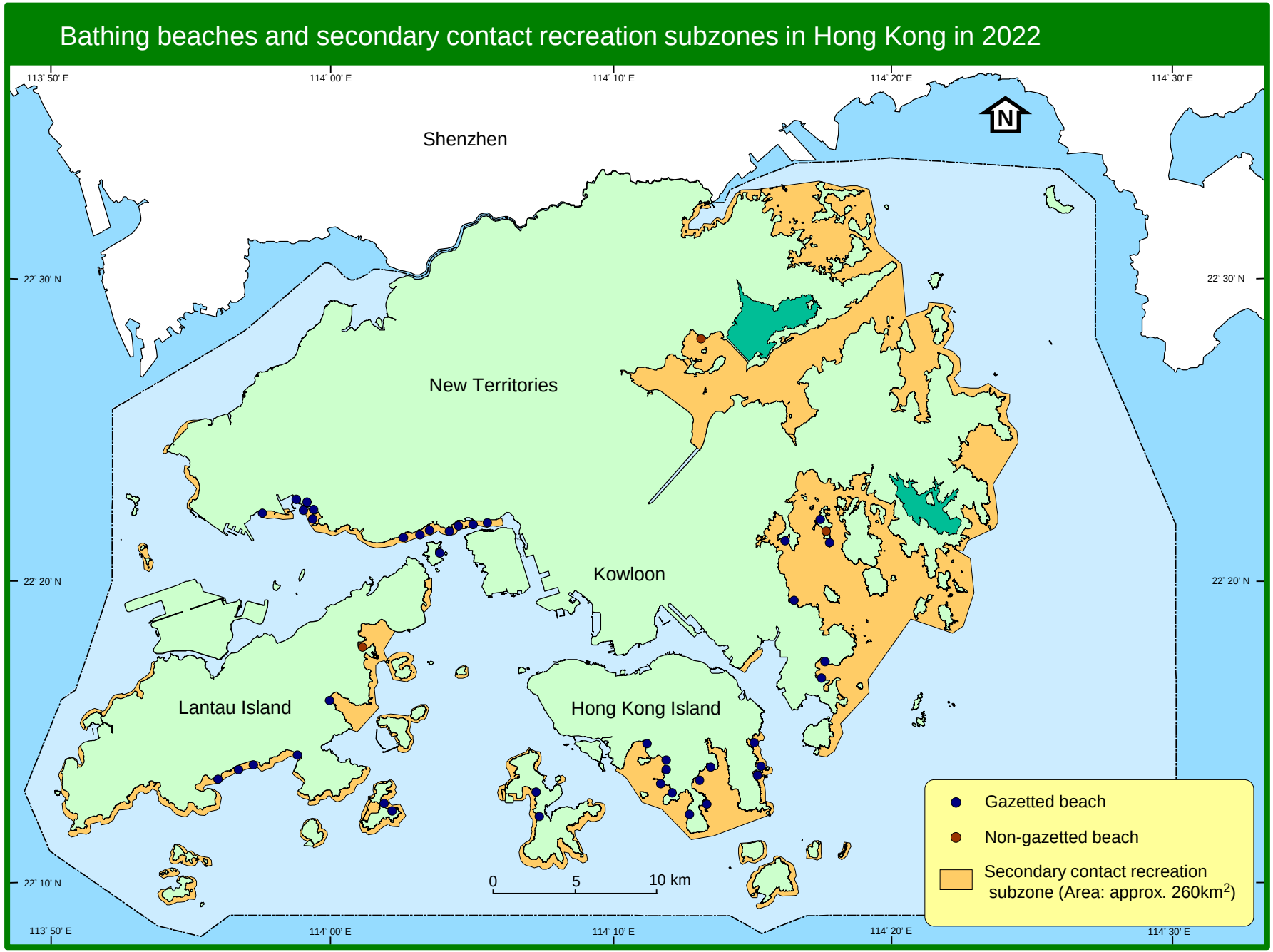
Typhoon Shelters		
1. Tuen Mun	NT1	NS5
2. Cheung Chau	ST1	SS7
3. Hei Ling Chau	ST3	SS8
4. Aberdeen (South)	WT1	-----
5. Aberdeen (West)	WT3	-----
6. Rambler Channel	VT8	VS17
7. New Yau Ma Tei	VT10	VS19
8. Causeway Bay	VT2	VS12
9. To Kwa Wan	VT11	VS20
10. Kwun Tong	VT4	VS14
11. Sam Ka Tsuen	VT3	VS13
12.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

Water quality monitoring stations monitored once every two months
Sediment monitoring stations monitored twice a year

Locations of marine water and sediment quality monitoring stations

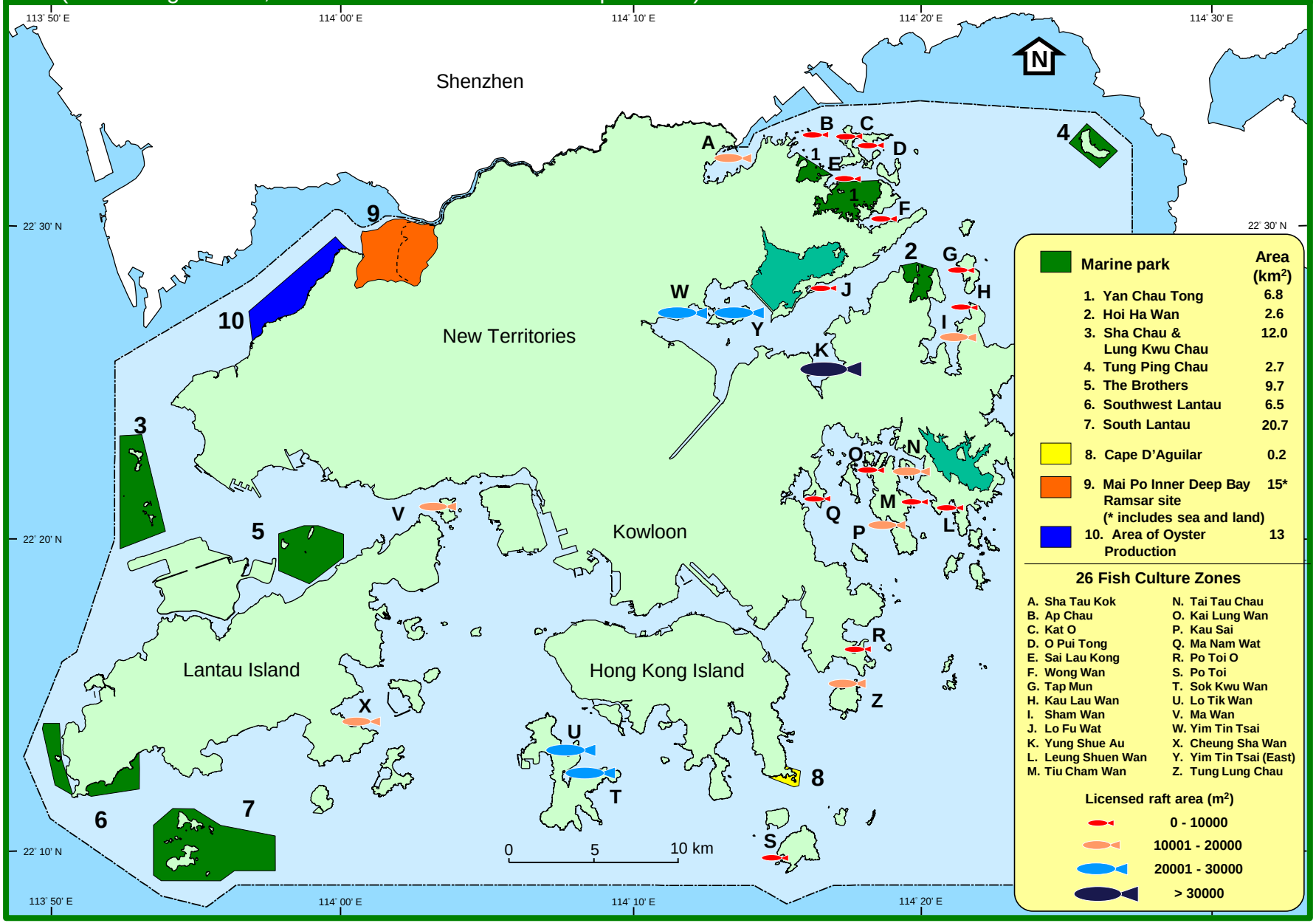
Water Control Zone	Station		Location				Depth (m) approx.
	Water	Sediment	Latitude		Longitude		
Tolo Harbour and Channel	TM2		22° 24.744'	N	114° 13.085'	E	4
	TM3	TS3	22° 26.857'	N	114° 12.181'	E	7
	TM4	TS2	22° 25.964'	N	114° 13.176'	E	8
	TM5		22° 27.426'	N	114° 13.456'	E	4
	TM6	TS4	22° 26.631'	N	114° 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	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	6
	* 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° 20.783'	N	113° 56.783'	E	14
	NM5	NS4	22° 23.051'	N	113° 53.972'	E	20
	NM6	NS6	22° 20.366'	N	113° 53.908'	E	8
	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	11
	* VT2	* VS12	22° 17.194'	N	114° 11.304'	E	5
	* VT3	* VS13	22° 17.448'	N	114° 14.250'	E	5
	* VT4	* VS14	22° 18.734'	N	114° 12.814'	E	6
	* VT8	* VS17	22° 21.360'	N	114° 6.867'	E	5
	* VT10	* VS19	22° 18.590'	N	114° 9.430'	E	5
	* VT11	* VS20	22° 18.981'	N	114° 11.814'	E	6
	* VT12	* VS21	22° 19.429'	N	114° 8.587'	E	5

Note: 1. All locations are based on WGS84 datum
2. Water quality and sediment monitoring stations in typhoon shelters are marked with an asterisk *

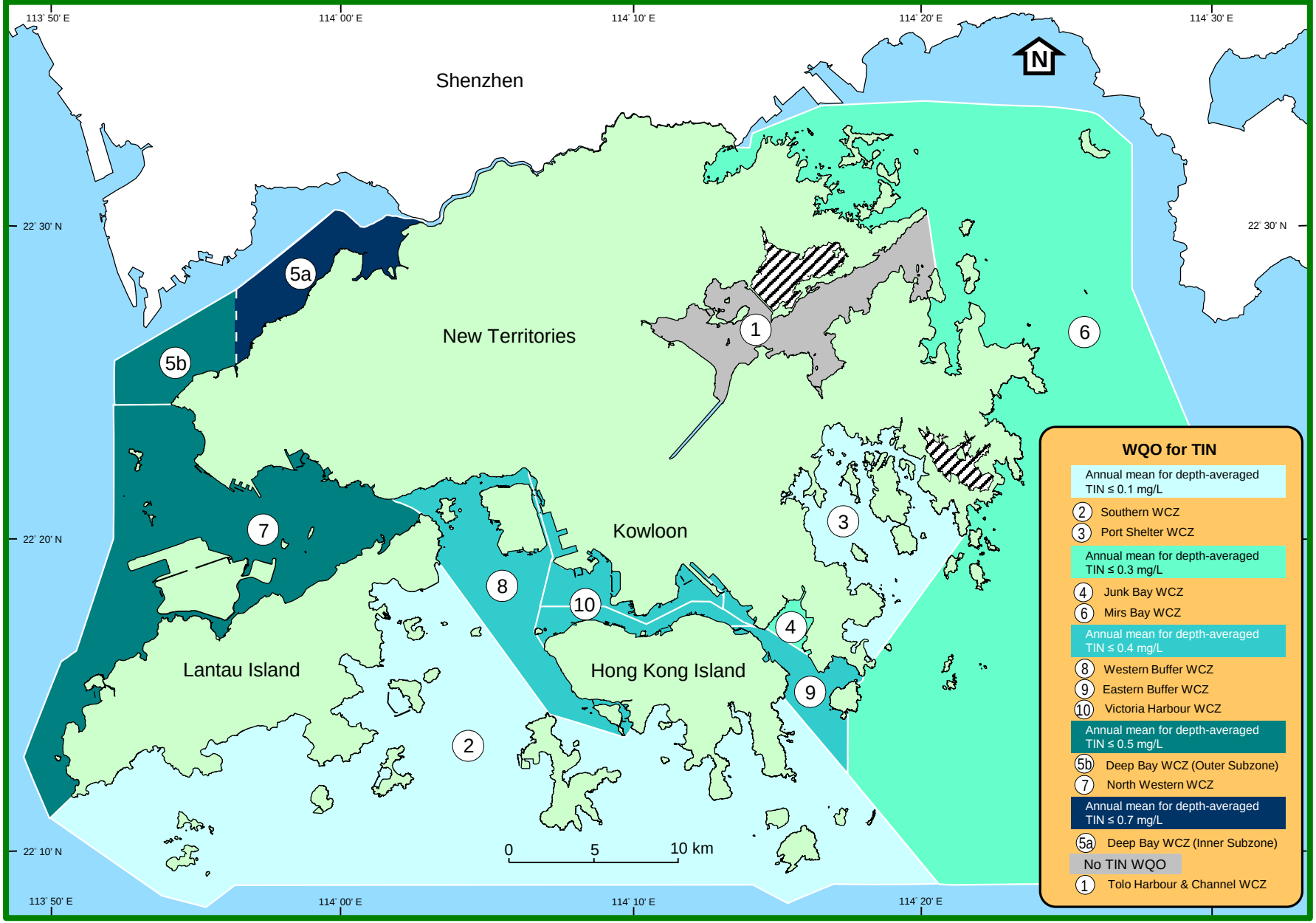

Bathing beaches and secondary contact recreation subzones in Hong Kong in 2022
113° 50' E
114° 00' E
114° 10' E
114° 20' E
114° 30' E
22° 30' N
22° 20' N
22° 10' N
N
Shenzhen
New Territories
Kowloon
Lantau Island
Hong Kong Island
0
5
10 km
Gazetted beach
Non-gazetted beach
Secondary contact recreation subzone (Area: approx. 260km2)

Fish and shellfish culture zones and marine conservation sites in Hong Kong in 2022

(source: Agriculture, Fisheries and Conservation Department)



Water Quality Objective (WQO) for Total Inorganic Nitrogen (TIN) in the 10 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 2 mg/L	Harbour Subzone in Tolo Harbour & Channel WCZ
	Not less than 3 mg/L	Buffer Subzone in Tolo Harbour & Channel WCZ
	Not less than 4 mg/L	Channel Subzone in Tolo Harbour & Channel WCZ
Dissolved Oxygen (surface to 2m above bottom)	Not less than 4 mg/L	Harbour Subzone and Buffer Subzone in Tolo Harbour & Channel WCZ
Dissloved Oxygen (all depths)	Not less than 4 mg/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°C	All WCZs (Whole zone) except Tolo Harbour & Channel WCZ
	Change due to waste discharge not to exceed 1°C	Tolo Harbour & Channel WCZ
Suspended Solids	Waste discharge not to raise the natural ambient level by 30% nor cause the accumulation of suspended solids which may adversely affect aquatic communities	Marine waters of all WCZs except Tolo Harbour & Channel WCZ
Toxicants	Not to be present at levels producing significant toxic effect	All WCZs (Whole zone)
Chlorophyll-*a*	Not to exceed 20mg/m^3 (µg/L) calculated as running arithmetic mean of 5 daily measurements for any location and depth	Harbour Subzone in Tolo Harbour & Channel WCZ
	Not to exceed 10mg/m^3 (µg/L) calculated as running arithmetic mean of 5 daily measurements for any location and depth	Buffer Subzone in Tolo Harbour & Channel WCZ
	Not to exceed 6mg/m^3 (µg/L) calculated as running arithmetic mean of 5 daily measurements for any location and depth	Channel Subzone in Tolo Harbor & 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

Note: 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 Test method B	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	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	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 based on ASTM D3590-11 Test method B	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	GL
	Total Phosphorus[5] (soluble; soluble & particulate)	mg/L	0.02	S,M,B	In-house methods GL-IN-14 and GL-IN-16 based on ASTM D515-88 Test method B and APHA 22ed 4500-P G	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	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
	Phaeo-pigment [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: S - 1m below water surface; M - mid-depth of water column; B - 1m above seabed.
    If water depth is 4 to 5 m, "M" is skipped; If water depth is 3m or less, "M" and "B" are skipped.
12. i) Bower C.E. and Bidwell J.P. (1978), Ionization of ammonia in seawater: Effect of temperature, pH and salinity. J. Fish. Res. Board Can. Vol.35, pp.1012-1016;
    ii) K., Russo R.C. & et. al. (1975), Aqueous ammonia equilibrium calculations: effect of pH and temperature. J. Fish. Res. Board Can. Vol.32, pp.2379-2383.
13. Total Inorganic Nitrogen = Ammonia Nitrogen + Nitrite Nitrogen + Nitrate Nitrogen ; Total Nitrogen = Total Kjeldahl Nitrogen (soluble & particulate) + Nitrite Nitrogen + Nitrate Nitrogen
14. i) DoE, DHSS & PHLS (1983); The Bacteriological Examination of Drinking Water Supplies 1982, Sec.7.8 & 7.9;
    ii) B.S.W. Ho and T.Y. Tam (1997), Enumeration of E. coli in environmental waters and wastewater using a chromogenic medium. Wat. Sci. Tech.Vol.35, No.11-12, pp.409-413;
    method adopted in 1997.
15. MMT/EPD - Marine Monitoring Team, Water Policy and Science Group, Environmental Protection Department.
16. EML/EPD - Environmental Microbiology Laboratory, Water Policy and Science Group, Environmental Protection Department.
17. WSL/EPD - Water Sciences Laboratory, Water Policy and Science Group, Environmental Protection Department.
18. GL - Government Laboratory.
19. i) Lund, J.H., Kipling, C. and Le Cren, E.D. 1958. The inverted microscope method of estimating algal numbers, and the statistical basis of estimations by counting.
    Hydrobiologia Vol. 11, pp. 143-170.
    ii) Utermohl, H. 1958. Zur Vervollkommung der Quantitativen Phytoplankton-Methodik. Mitt. Inter. Verein. Lim. Vol. 9, pp. 1-38.
20. Mention of brand names and commercial products does not constitute or imply endorsement or recommendation by the Environmental Protection Department.

Summary of marine sediment[1] quality 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 Test method A (open reflux)	GL
	Total Carbon (TC)	% w/w	0.1	In-house method GL-OR-33 based on APHA 20ed 5310 B and BS EN 13137:2001	GL
Nutrients and Inorganic Constituents [3]	Ammonia-Nitrogen	mg/kg	0.05	In-house method GL-IN-19 based on ASTM D3590-11 Test method B	GL
	Total Kjeldahl Nitrogen	mg/kg	0.5	In-house methods GL-IN-14 and GL-IN-15 based on ASTM D3590-11 Test method B	GL
	Total Phosphorus	mg/kg	0.2	In-house methods GL-IN-14 and GL-IN-16 based on ASTM D515-88 Test method B and APHA 22ed 4500-P G	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 method GL-TE-103 (ICP-MS)	GL
	Arsenic (As)	mg/kg	0.1	In-house method GL-TE-103 (ICP-MS)	GL
	Barium (Ba)	mg/kg	0.2	In-house method GL-TE-103 (ICP-MS)	GL
	Boron (B)	mg/kg	5	In-house method GL-TE-103 (ICP-MS)	GL
	Cadmium (Cd)	mg/kg	0.1	In-house method GL-TE-103 (ICP-MS)	GL
	Chromium (Cr)	mg/kg	0.2	In-house method GL-TE-103 (ICP-MS)	GL
	Copper (Cu)	mg/kg	0.2	In-house method GL-TE-103 (ICP-MS)	GL
	Iron (Fe)	mg/kg	5	In-house method GL-TE-103 (ICP-MS)	GL
	Lead (Pb)	mg/kg	0.2	In-house method GL-TE-103 (ICP-MS)	GL
	Manganese (Mn)	mg/kg	1	In-house method GL-TE-103 (ICP-MS)	GL
	Mercury (Hg)	mg/kg	0.05	In-house method GL-TE-103 (ICP-MS)	GL
	Nickel (Ni)	mg/kg	0.2	In-house method GL-TE-103 (ICP-MS)	GL
	Silver (Ag)	mg/kg	0.2	In-house method GL-TE-103 (ICP-MS)	GL
	Vanadium (V)	mg/kg	0.1	In-house method GL-TE-103 (ICP-MS)	GL
	Zinc (Zn)	mg/kg	0.2	In-house method GL-TE-103 (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 2022

Parameter		Mirs Bay	Crooked Island		Port Island	Mirs Bay North		
		MM1	MM2	MM7	MM17	MM3	MM4	MM5
Number of samples		11	12	11	12	11	12	11
Temperature (°C)		25.1 (18.5 - 30.5)	24.5 (18.3 - 29.8)	24.6 (18.1 - 28.9)	23.7 (17.3 - 28.4)	24.3 (17.7 - 28.6)	23.8 (17.6 - 28.7)	23.9 (17.3 - 28.3)
Salinity		31.1 (26.0 - 33.5)	31.7 (26.6 - 33.8)	31.9 (27.3 - 33.8)	32.2 (28.7 - 33.8)	32.3 (29.5 - 33.7)	32.4 (29.6 - 33.6)	32.5 (29.7 - 33.7)
Dissolved Oxygen (mg/L)		6.1 (5.1 - 7.0)	6.0 (4.6 - 7.0)	5.7 (3.9 - 6.9)	5.9 (4.0 - 7.8)	5.8 (4.2 - 7.4)	5.8 (4.4 - 7.6)	5.6 (4.0 - 7.2)
	Bottom	5.9 (4.3 - 7.7)	5.5 (3.3 - 7.4)	4.6 (0.6 - 7.3)	5.1 (0.8 - 7.7)	5.1 (0.8 - 7.8)	4.9 (0.7 - 8.0)	4.5 (1.8 - 7.6)
Dissolved Oxygen (% Saturation)		87 (75 - 98)	86 (68 - 101)	81 (61 - 96)	84 (61 - 99)	82 (64 - 97)	83 (68 - 97)	79 (61 - 93)
	Bottom	85 (64 - 110)	78 (49 - 95)	64 (9 - 94)	70 (11 - 100)	72 (11 - 102)	68 (10 - 102)	63 (26 - 97)
pH		7.8 (7.4 - 8.4)	7.8 (7.3 - 8.4)	7.8 (7.3 - 8.4)	7.7 (7.3 - 8.4)	7.8 (7.4 - 8.4)	7.7 (7.3 - 8.4)	7.7 (7.3 - 8.4)
Secchi Disc Depth (m)		2.1 (1.4 - 2.5)	2.7 (1.5 - 3.7)	2.9 (1.7 - 4.5)	3.4 (2.0 - 4.5)	3.0 (1.5 - 4.6)	3.6 (1.8 - 6.3)	3.7 (2.1 - 5.8)
Turbidity (NTU)		11.4 (2.0 - 27.6)	8.0 (2.9 - 15.6)	7.4 (3.5 - 11.9)	12.7 (3.7 - 71.8)	12.3 (2.4 - 46.6)	11.2 (4.3 - 37.3)	10.5 (5.3 - 25.1)
Suspended Solids (mg/L)		3.3 (2.2 - 4.8)	2.9 (1.4 - 4.8)	2.8 (1.2 - 5.5)	3.0 (0.8 - 7.5)	3.9 (1.5 - 6.7)	3.6 (1.5 - 6.7)	3.3 (1.3 - 5.7)
5-day Biochemical Oxygen Demand (mg/L)		0.9 (0.4 - 1.5)	0.7 (0.2 - 1.7)	0.9 (0.1 - 2.9)	0.6 (0.4 - 1.0)	0.7 (<0.1 - 1.2)	0.6 (0.2 - 1.4)	0.7 (0.1 - 3.0)
Ammonia Nitrogen (mg/L)		0.038 (0.012 - 0.098)	0.032 (0.009 - 0.088)	0.028 (0.012 - 0.063)	0.028 (0.007 - 0.050)	0.028 (0.011 - 0.059)	0.024 (0.012 - 0.054)	0.019 (0.005 - 0.038)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.006)	0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.004)	<0.001 (<0.001 - 0.002)	0.001 (<0.001 - 0.005)	<0.001 (<0.001 - 0.002)	<0.001 (<0.001 - 0.002)
Nitrite Nitrogen (mg/L)		0.005 (<0.002 - 0.011)	0.006 (<0.002 - 0.021)	0.005 (<0.002 - 0.013)	0.006 (<0.002 - 0.022)	0.006 (<0.002 - 0.015)	0.008 (<0.002 - 0.047)	0.008 (<0.002 - 0.048)
Nitrate Nitrogen (mg/L)		0.052 (<0.002 - 0.183)	0.038 (<0.002 - 0.167)	0.032 (<0.002 - 0.153)	0.033 (<0.002 - 0.138)	0.032 (<0.002 - 0.130)	0.034 (<0.002 - 0.130)	0.039 (<0.002 - 0.143)
Total Inorganic Nitrogen (mg/L)		0.09 (0.03 - 0.28)	0.08 (0.03 - 0.23)	0.06 (0.02 - 0.21)	0.07 (0.02 - 0.20)	0.07 (0.02 - 0.20)	0.07 (0.02 - 0.18)	0.07 (0.02 - 0.18)
Total Kjeldahl Nitrogen (mg/L)		0.34 (0.12 - 0.64)	0.32 (0.08 - 0.57)	0.31 (0.07 - 0.64)	0.35 (0.07 - 0.77)	0.31 (0.09 - 0.56)	0.36 (0.13 - 0.65)	0.29 (0.06 - 0.58)
Total Nitrogen (mg/L)		0.40 (0.14 - 0.70)	0.36 (0.09 - 0.61)	0.35 (0.09 - 0.67)	0.39 (0.08 - 0.78)	0.35 (0.09 - 0.60)	0.40 (0.16 - 0.75)	0.34 (0.06 - 0.69)
Orthophosphate Phosphorus (mg/L)		0.003 (<0.002 - 0.008)	0.004 (<0.002 - 0.007)	0.003 (<0.002 - 0.006)	0.004 (<0.002 - 0.008)	0.004 (<0.002 - 0.008)	0.005 (<0.002 - 0.011)	0.005 (<0.002 - 0.008)
Total Phosphorus (mg/L)		0.03 (0.02 - 0.07)	0.04 (0.02 - 0.06)	0.03 (<0.02 - 0.08)	0.04 (<0.02 - 0.08)	0.03 (0.02 - 0.07)	0.04 (0.02 - 0.06)	0.04 (0.02 - 0.07)
Silica (as SiO_2) (mg/L)		0.87 (0.44 - 2.00)	0.67 (0.20 - 1.17)	0.67 (0.33 - 0.99)	0.59 (0.12 - 0.96)	0.63 (0.23 - 1.12)	0.62 (0.23 - 1.02)	0.61 (0.31 - 0.92)
Chlorophyll-*a* (µg/L)		3.7 (0.6 - 7.7)	3.1 (1.1 - 7.9)	2.4 (0.6 - 5.7)	2.3 (0.8 - 5.6)	2.6 (0.6 - 5.8)	2.2 (0.3 - 7.6)	1.9 (0.3 - 5.2)
E.coli (count/100mL)		13 (1 - 2700)	3 (<1 - 200)	2 (<1 - 48)	1 (<1 - 8)	2 (<1 - 99)	1 (<1 - 4)	1 (<1 - 3)
Faecal Coliforms (count/100mL)		26 (2 - 5600)	5 (<1 - 410)	2 (<1 - 69)	2 (<1 - 45)	2 (<1 - 190)	2 (<1 - 22)	1 (<1 - 5)

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

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

3. Data in brackets indicate the ranges.

4. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

Summary of water quality statistics for the Mirs Bay WCZ in 2022 (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		11	11	11	12	12	12	11
Temperature (°C)		23.3 (15.6 - 28.8)	23.2 (15.2 - 28.6)	23.7 (15.0 - 28.8)	23.2 (16.2 - 28.6)	23.1 (16.1 - 28.6)	23.1 (15.2 - 28.6)	24.3 (17.3 - 29.1)
Salinity		32.9 (31.8 - 33.6)	32.6 (30.8 - 33.6)	32.8 (30.4 - 34.3)	32.9 (31.8 - 33.6)	32.9 (31.8 - 33.6)	32.8 (31.7 - 33.6)	32.1 (28.4 - 33.8)
Dissolved Oxygen (mg/L)		6.0 (4.6 - 7.5)	6.1 (4.2 - 7.5)	6.2 (4.9 - 8.0)	6.3 (5.1 - 7.2)	6.1 (5.0 - 7.5)	6.1 (4.4 - 7.7)	6.0 (4.7 - 7.5)
	Bottom	5.6 (2.4 - 7.5)	5.8 (3.0 - 7.6)	5.9 (3.2 - 7.7)	5.9 (3.0 - 7.6)	5.8 (2.4 - 7.5)	5.6 (2.0 - 7.6)	5.5 (3.4 - 7.8)
Dissolved Oxygen (% Saturation)		85 (67 - 92)	86 (63 - 96)	89 (75 - 99)	88 (78 - 94)	86 (74 - 92)	85 (66 - 96)	86 (70 - 96)
	Bottom	78 (34 - 93)	80 (41 - 93)	82 (45 - 93)	83 (42 - 94)	81 (34 - 94)	78 (27 - 97)	77 (51 - 100)
pH		7.9 (7.4 - 8.4)	7.9 (7.4 - 8.4)	7.9 (7.4 - 8.4)	7.9 (7.4 - 8.4)	7.8 (7.4 - 8.4)	7.8 (7.5 - 8.3)	7.7 (6.9 - 8.4)
Secchi Disc Depth (m)		3.2 (1.4 - 5.5)	3.5 (1.5 - 7.6)	3.5 (2.0 - 5.5)	3.4 (2.0 - 5.9)	3.8 (1.9 - 7.3)	3.7 (2.1 - 7.1)	3.4 (1.9 - 4.1)
Turbidity (NTU)		7.3 (1.0 - 19.9)	7.8 (1.5 - 18.8)	7.1 (1.4 - 18.5)	6.8 (1.2 - 13.6)	8.0 (0.9 - 16.1)	9.7 (1.1 - 34.9)	14.3 (3.2 - 86.1)
Suspended Solids (mg/L)		4.8 (2.2 - 12.1)	6.5 (1.0 - 17.0)	4.8 (1.7 - 13.3)	4.4 (1.6 - 10.7)	4.4 (0.8 - 9.8)	3.6 (1.1 - 8.0)	3.0 (1.4 - 5.6)
5-day Biochemical Oxygen Demand (mg/L)		0.5 (<0.1 - 1.9)	0.5 (<0.1 - 1.6)	0.4 (<0.1 - 1.5)	0.5 (<0.1 - 1.6)	0.4 (0.1 - 0.9)	0.5 (<0.1 - 1.8)	0.7 (0.1 - 1.4)
Ammonia Nitrogen (mg/L)		0.019 (0.006 - 0.046)	0.018 (<0.005 - 0.047)	0.018 (0.006 - 0.041)	0.020 (0.005 - 0.047)	0.019 (0.007 - 0.051)	0.027 (0.007 - 0.068)	0.025 (0.013 - 0.045)
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 - 0.002)	<0.001 (<0.001 - 0.002)	<0.001 (<0.001 - 0.002)
Nitrite Nitrogen (mg/L)		0.010 (<0.002 - 0.036)	0.014 (<0.002 - 0.045)	0.010 (<0.002 - 0.037)	0.008 (<0.002 - 0.033)	0.009 (<0.002 - 0.046)	0.009 (<0.002 - 0.047)	0.005 (<0.002 - 0.011)
Nitrate Nitrogen (mg/L)		0.040 (<0.002 - 0.082)	0.060 (<0.002 - 0.207)	0.051 (<0.002 - 0.198)	0.034 (<0.002 - 0.098)	0.033 (<0.002 - 0.065)	0.036 (<0.002 - 0.086)	0.033 (<0.002 - 0.148)
Total Inorganic Nitrogen (mg/L)		0.07 (0.03 - 0.10)	0.09 (0.03 - 0.25)	0.08 (0.02 - 0.23)	0.06 (0.02 - 0.12)	0.06 (0.03 - 0.11)	0.07 (0.03 - 0.12)	0.06 (0.02 - 0.20)
Total Kjeldahl Nitrogen (mg/L)		0.43 (0.12 - 1.13)	0.46 (0.15 - 1.23)	0.43 (0.15 - 1.17)	0.37 (0.11 - 0.60)	0.36 (0.09 - 0.57)	0.44 (0.13 - 1.13)	0.29 (0.05 - 0.66)
Total Nitrogen (mg/L)		0.48 (0.19 - 1.21)	0.53 (0.22 - 1.32)	0.49 (0.21 - 1.26)	0.41 (0.21 - 0.62)	0.40 (0.15 - 0.67)	0.49 (0.22 - 1.22)	0.33 (0.06 - 0.69)
Orthophosphate Phosphorus (mg/L)		0.006 (<0.002 - 0.013)	0.008 (<0.002 - 0.018)	0.007 (<0.002 - 0.015)	0.006 (<0.002 - 0.014)	0.006 (<0.002 - 0.013)	0.006 (<0.002 - 0.014)	0.005 (<0.002 - 0.008)
Total Phosphorus (mg/L)		0.05 (0.02 - 0.08)	0.05 (0.02 - 0.08)	0.05 (0.02 - 0.09)	0.05 (<0.02 - 0.09)	0.04 (0.02 - 0.08)	0.05 (<0.02 - 0.08)	0.04 (0.02 - 0.07)
Silica (as SiO_2) (mg/L)		0.62 (0.32 - 1.13)	0.69 (0.29 - 1.33)	0.55 (0.16 - 1.17)	0.58 (0.33 - 1.07)	0.61 (0.31 - 1.03)	0.63 (0.18 - 1.10)	0.54 (0.18 - 1.13)
Chlorophyll-*a* (µg/L)		2.0 (0.3 - 10.5)	3.1 (0.3 - 14.5)	1.7 (0.3 - 8.1)	2.4 (0.2 - 12.6)	1.1 (0.4 - 2.2)	1.3 (0.7 - 3.5)	2.7 (1.0 - 7.0)
E.coli (count/100mL)		1 (<1 - 1)	1 (<1 - 2)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 10)
Faecal Coliforms (count/100mL)		1 (<1 - 4)	1 (<1 - 4)	1 (<1 - 2)	1 (<1 - 2)	1 (<1 - 12)	2 (<1 - 14)	3 (<1 - 27)

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

3. Data in brackets indicate the ranges.

4. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

Summary of water quality statistics for the Port Shelter WCZ in 2022

Parameter		Inner Port Shelter PM1	Inner Port Shelter PM2	Inner Port Shelter PM3	Inner Port Shelter PM4	Hebe Haven PM6
Number of samples		11	11	12	11	11
Temperature (°C)		24.8 (17.3 - 30.1)	24.5 (17.4 - 30.0)	23.7 (17.3 - 29.4)	24.7 (17.2 - 30.3)	24.1 (17.4 - 29.3)
Salinity		32.0 (28.9 - 33.5)	32.1 (28.9 - 33.3)	32.4 (29.9 - 33.3)	32.0 (28.8 - 33.4)	32.2 (29.5 - 33.4)
Dissolved Oxygen (mg/L)		6.3 (5.3 - 7.9)	6.4 (5.5 - 8.1)	6.1 (4.2 - 7.8)	6.2 (5.1 - 8.2)	5.9 (4.1 - 7.4)
	Bottom	6.5 (5.1 - 8.6)	6.4 (4.9 - 8.2)	5.4 (1.5 - 7.6)	6.3 (5.1 - 8.9)	5.5 (1.3 - 7.6)
Dissolved Oxygen (% Saturation)		90 (78 - 106)	92 (79 - 109)	86 (64 - 106)	90 (78 - 110)	84 (57 - 100)
	Bottom	93 (77 - 116)	91 (73 - 112)	75 (21 - 100)	90 (75 - 119)	77 (19 - 100)
pH		7.8 (7.3 - 8.2)	7.8 (7.4 - 8.2)	7.8 (7.3 - 8.2)	7.8 (7.3 - 8.2)	7.7 (7.3 - 8.1)
Secchi Disc Depth (m)		2.6 (1.7 - 3.3)	2.9 (1.5 - 4.0)	3.9 (1.9 - 9.9)	2.6 (1.7 - 3.8)	3.0 (2.1 - 3.7)
Turbidity (NTU)		7.9 (4.2 - 17.5)	7.2 (4.1 - 13.0)	7.7 (4.1 - 24.1)	7.4 (4.2 - 16.4)	10.0 (4.0 - 35.9)
Suspended Solids (mg/L)		3.7 (1.3 - 6.1)	3.7 (1.2 - 8.0)	4.6 (1.1 - 9.7)	4.4 (1.8 - 8.8)	3.7 (1.5 - 8.4)
5-day Biochemical Oxygen Demand (mg/L)		1.2 (0.2 - 2.9)	1.2 (<0.1 - 3.7)	1.0 (<0.1 - 3.4)	0.9 (0.1 - 1.8)	0.9 (<0.1 - 1.9)
Ammonia Nitrogen (mg/L)		0.028 (0.011 - 0.061)	0.028 (0.014 - 0.044)	0.033 (0.011 - 0.067)	0.028 (0.007 - 0.063)	0.034 (0.017 - 0.052)
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 - 0.002)
Nitrite Nitrogen (mg/L)		0.003 (<0.002 - 0.006)	0.003 (<0.002 - 0.007)	0.004 (<0.002 - 0.008)	0.002 (<0.002 - 0.004)	0.004 (<0.002 - 0.009)
Nitrate Nitrogen (mg/L)		0.018 (<0.002 - 0.049)	0.018 (<0.002 - 0.034)	0.025 (<0.002 - 0.075)	0.015 (<0.002 - 0.038)	0.030 (<0.002 - 0.071)
Total Inorganic Nitrogen (mg/L)		0.05 (0.02 - 0.09)	0.05 (0.02 - 0.08)	0.06 (0.02 - 0.09)	0.05 (0.02 - 0.08)	0.07 (0.02 - 0.10)
Total Kjeldahl Nitrogen (mg/L)		0.38 (0.12 - 0.69)	0.39 (0.08 - 0.61)	0.41 (0.11 - 0.73)	0.38 (0.11 - 0.80)	0.37 (0.11 - 0.67)
Total Nitrogen (mg/L)		0.40 (0.15 - 0.71)	0.41 (0.12 - 0.64)	0.44 (0.14 - 0.74)	0.39 (0.15 - 0.81)	0.40 (0.16 - 0.70)
Orthophosphate Phosphorus (mg/L)		0.004 (<0.002 - 0.014)	0.005 (<0.002 - 0.014)	0.006 (<0.002 - 0.014)	0.004 (<0.002 - 0.013)	0.006 (<0.002 - 0.013)
Total Phosphorus (mg/L)		0.04 (0.02 - 0.09)	0.05 (0.02 - 0.08)	0.05 (0.02 - 0.08)	0.04 (<0.02 - 0.10)	0.04 (<0.02 - 0.09)
Silica (as SiO_2) (mg/L)		0.65 (<0.05 - 1.37)	0.63 (<0.05 - 1.47)	0.62 (0.14 - 1.50)	0.67 (<0.05 - 1.30)	0.72 (0.11 - 2.10)
Chlorophyll-*a* (µg/L)		3.8 (1.5 - 12.6)	4.4 (0.8 - 10.5)	4.6 (0.8 - 20.1)	3.2 (0.9 - 10.5)	3.4 (0.8 - 9.2)
E.coli (count/100mL)		2 (<1 - 75)	4 (<1 - 16)	2 (<1 - 25)	1 (<1 - 4)	3 (<1 - 25)
Faecal Coliforms (count/100mL)		5 (<1 - 480)	17 (2 - 160)	4 (<1 - 170)	2 (<1 - 20)	7 (1 - 90)

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3. Data in brackets indicate the ranges.

4. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

Summary of water quality statistics for the Port Shelter WCZ in 2022 (continued)

Parameter		Outer Port Shelter PM7	Outer Port Shelter PM8	Rocky Harbour PM9	Bluff Island PM11
Number of samples		12	11	11	11
Temperature (°C)		23.4 (17.4 - 29.0)	23.5 (17.4 - 27.6)	23.7 (17.1 - 29.2)	23.4 (17.2 - 27.2)
Salinity		32.5 (30.4 - 33.3)	32.7 (31.2 - 33.4)	32.6 (30.6 - 33.4)	32.8 (31.7 - 33.5)
Dissolved Oxygen (mg/L)		6.2 (4.5 - 7.4)	5.9 (3.6 - 7.5)	6.1 (4.6 - 7.6)	6.0 (4.1 - 7.2)
	Bottom	5.5 (2.1 - 7.4)	5.5 (2.4 - 7.4)	5.5 (1.7 - 7.7)	5.5 (2.0 - 7.6)
Dissolved Oxygen (% Saturation)		87 (68 - 105)	83 (54 - 107)	86 (70 - 98)	85 (61 - 101)
	Bottom	76 (29 - 97)	76 (26 - 103)	76 (24 - 100)	77 (28 - 101)
pH		7.8 (7.3 - 8.2)	7.8 (7.4 - 8.2)	7.8 (7.3 - 8.2)	7.8 (7.3 - 8.2)
Secchi Disc Depth (m)		4.6 (1.9 - 11.0)	4.0 (1.8 - 7.4)	3.8 (1.8 - 8.9)	3.7 (1.8 - 7.0)
Turbidity (NTU)		8.6 (4.1 - 24.0)	8.3 (4.2 - 21.8)	10.9 (4.1 - 39.5)	16.1 (4.1 - 87.9)
Suspended Solids (mg/L)		2.9 (1.5 - 8.6)	3.0 (1.3 - 5.4)	3.1 (1.5 - 6.2)	3.7 (1.7 - 7.5)
5-day Biochemical Oxygen Demand (mg/L)		0.5 (<0.1 - 0.9)	0.4 (<0.1 - 0.9)	0.6 (0.1 - 1.1)	0.5 (<0.1 - 1.5)
Ammonia Nitrogen (mg/L)		0.027 (0.010 - 0.057)	0.021 (0.006 - 0.034)	0.026 (0.007 - 0.048)	0.022 (0.007 - 0.044)
Unionised Ammonia (mg/L)		<0.001 (<0.001 - 0.001)	<0.001 (<0.001 - 0.002)	<0.001 (<0.001 - 0.002)	<0.001 (<0.001 - 0.002)
Nitrite Nitrogen (mg/L)		0.004 (<0.002 - 0.008)	0.006 (<0.002 - 0.013)	0.005 (<0.002 - 0.013)	0.006 (<0.002 - 0.017)
Nitrate Nitrogen (mg/L)		0.030 (<0.002 - 0.091)	0.030 (<0.002 - 0.080)	0.045 (<0.002 - 0.168)	0.034 (0.003 - 0.073)
Total Inorganic Nitrogen (mg/L)		0.06 (0.03 - 0.11)	0.06 (0.03 - 0.10)	0.08 (0.03 - 0.20)	0.06 (0.03 - 0.09)
Total Kjeldahl Nitrogen (mg/L)		0.35 (0.12 - 0.71)	0.32 (0.07 - 0.66)	0.34 (0.12 - 0.68)	0.32 (0.14 - 0.59)
Total Nitrogen (mg/L)		0.39 (0.15 - 0.74)	0.36 (0.10 - 0.69)	0.39 (0.15 - 0.72)	0.36 (0.16 - 0.63)
Orthophosphate Phosphorus (mg/L)		0.006 (<0.002 - 0.013)	0.007 (<0.002 - 0.013)	0.006 (<0.002 - 0.014)	0.007 (<0.002 - 0.013)
Total Phosphorus (mg/L)		0.04 (0.02 - 0.08)	0.04 (0.02 - 0.08)	0.04 (0.02 - 0.07)	0.04 (0.02 - 0.08)
Silica (as SiO_2) (mg/L)		0.60 (0.22 - 1.27)	0.60 (0.19 - 1.14)	0.64 (0.21 - 1.07)	0.56 (0.22 - 1.05)
Chlorophyll-a (µg/L)		1.4 (0.4 - 2.3)	1.3 (0.6 - 2.3)	2.1 (0.7 - 6.4)	1.5 (0.7 - 2.8)
E.coli (count/100mL)		1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)	1 (<1 - 1)
Faecal Coliforms (count/100mL)		1 (<1 - 2)	1 (<1 - 5)	1 (<1 - 4)	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.

4. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

Summary of water quality statistics for the Tolo Harbour and Channel WCZ in 2022

Parameter		Harbour Subzone			Buffer Subzone		Channel Subzone	
		TM2	TM3	TM4	TM5	TM6	TM7	TM8
Number of samples		11	12	12	11	12	11	12
Temperature (°C)		24.7 (17.5 - 30.5)	24.5 (17.8 - 30.5)	24.2 (17.6 - 29.8)	25.3 (17.7 - 30.6)	24.0 (17.8 - 29.2)	24.3 (17.8 - 29.1)	23.4 (17.6 - 27.7)
Salinity		29.5 (25.2 - 32.6)	30.5 (25.9 - 33.2)	30.9 (27.2 - 33.1)	30.4 (25.6 - 33.2)	31.5 (28.0 - 33.3)	31.6 (28.7 - 33.4)	32.0 (29.5 - 33.8)
Dissolved Oxygen (mg/L)		6.0 (5.0 - 6.9)	5.9 (4.8 - 6.9)	5.9 (4.8 - 7.1)	5.8 (5.1 - 6.5)	5.6 (4.2 - 7.0)	5.8 (4.5 - 6.9)	5.3 (3.0 - 6.9)
	Bottom	5.9 (3.6 - 7.3)	5.6 (3.4 - 6.9)	5.3 (2.2 - 7.6)	5.9 (5.1 - 7.0)	5.0 (2.9 - 7.1)	5.3 (2.8 - 7.1)	4.2 (0.6 - 7.2)
Dissolved Oxygen (% Saturation)		86 (70 - 95)	84 (71 - 95)	84 (68 - 95)	84 (75 - 96)	79 (61 - 90)	82 (70 - 89)	74 (45 - 89)
	Bottom	83 (56 - 101)	79 (52 - 95)	74 (32 - 98)	85 (78 - 101)	69 (32 - 91)	74 (41 - 94)	58 (8 - 92)
pH		7.6 (6.8 - 8.3)	7.8 (7.3 - 8.4)	7.7 (7.2 - 8.4)	7.8 (7.3 - 8.3)	7.8 (7.3 - 8.4)	7.8 (7.3 - 8.4)	7.7 (7.2 - 8.3)
Secchi Disc Depth (m)		1.9 (1.0 - 2.3)	2.2 (0.6 - 3.2)	2.2 (1.1 - 3.3)	2.3 (1.1 - 3.4)	2.6 (1.6 - 3.6)	2.7 (1.2 - 3.4)	3.0 (1.2 - 4.9)
Turbidity (NTU)		8.8 (3.0 - 23.4)	6.6 (4.1 - 8.9)	7.0 (4.0 - 15.2)	7.4 (1.4 - 14.7)	6.3 (1.3 - 9.4)	7.1 (1.8 - 13.0)	8.8 (2.6 - 23.2)
Suspended Solids (mg/L)		4.6 (1.7 - 10.2)	4.6 (1.8 - 9.1)	4.0 (1.9 - 8.9)	3.0 (1.6 - 7.5)	3.1 (1.4 - 7.0)	3.7 (1.7 - 7.9)	3.7 (1.5 - 7.3)
5-day Biochemical Oxygen Demand (mg/L)		2.1 (0.9 - 4.7)	1.7 (0.6 - 4.3)	1.7 (0.6 - 4.7)	1.1 (0.7 - 1.7)	1.1 (0.3 - 1.9)	0.9 (<0.1 - 1.6)	0.7 (0.2 - 1.3)
Ammonia Nitrogen (mg/L)		0.071 (0.031 - 0.195)	0.053 (0.026 - 0.135)	0.043 (0.022 - 0.086)	0.036 (0.017 - 0.054)	0.035 (0.019 - 0.066)	0.029 (0.014 - 0.047)	0.035 (0.012 - 0.067)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.007)	0.002 (<0.001 - 0.005)	0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)		0.006 (<0.002 - 0.034)	0.006 (<0.002 - 0.043)	0.007 (<0.002 - 0.050)	0.004 (<0.002 - 0.017)	0.007 (<0.002 - 0.040)	0.008 (<0.002 - 0.053)	0.007 (<0.002 - 0.019)
Nitrate Nitrogen (mg/L)		0.059 (<0.002 - 0.255)	0.045 (<0.002 - 0.203)	0.030 (<0.002 - 0.123)	0.022 (<0.002 - 0.083)	0.022 (<0.002 - 0.067)	0.019 (<0.002 - 0.052)	0.023 (<0.002 - 0.086)
Total Inorganic Nitrogen (mg/L)		0.14 (0.05 - 0.43)	0.10 (0.03 - 0.38)	0.08 (0.04 - 0.25)	0.06 (0.03 - 0.14)	0.06 (0.02 - 0.15)	0.06 (0.02 - 0.14)	0.07 (0.03 - 0.10)
Total Kjeldahl Nitrogen (mg/L)		0.39 (0.23 - 0.52)	0.41 (0.23 - 0.62)	0.39 (0.18 - 0.63)	0.35 (0.10 - 0.66)	0.36 (0.12 - 0.57)	0.33 (0.11 - 0.59)	0.35 (0.12 - 0.59)
Total Nitrogen (mg/L)		0.45 (0.26 - 0.59)	0.47 (0.27 - 0.63)	0.43 (0.24 - 0.65)	0.38 (0.18 - 0.67)	0.39 (0.15 - 0.58)	0.35 (0.17 - 0.61)	0.38 (0.13 - 0.62)
Orthophosphate Phosphorus (mg/L)		0.006 (<0.002 - 0.042)	0.004 (<0.002 - 0.010)	0.005 (<0.002 - 0.013)	0.003 (<0.002 - 0.007)	0.005 (<0.002 - 0.010)	0.004 (<0.002 - 0.012)	0.007 (<0.002 - 0.013)
Total Phosphorus (mg/L)		0.05 (0.02 - 0.09)	0.05 (0.02 - 0.08)	0.04 (0.02 - 0.07)	0.04 (<0.02 - 0.07)	0.04 (0.02 - 0.09)	0.04 (0.02 - 0.07)	0.04 (0.02 - 0.09)
Silica (as SiO_2) (mg/L)		1.52 (0.67 - 3.20)	1.22 (0.55 - 3.40)	1.00 (0.60 - 2.20)	0.94 (0.51 - 1.65)	0.89 (0.45 - 1.67)	0.87 (0.49 - 1.73)	0.86 (0.54 - 1.53)
Chlorophyll-*a* (µg/L)		6.4 (1.4 - 14.0)	5.6 (0.9 - 9.7)	5.4 (1.0 - 12.0)	3.0 (1.4 - 5.6)	3.6 (1.5 - 5.9)	3.2 (1.8 - 6.2)	2.1 (0.9 - 3.5)
E.coli (count/100mL)		100 (2 - 7200)	58 (1 - 7600)	34 (1 - 1200)	4 (1 - 150)	4 (<1 - 220)	3 (<1 - 320)	2 (<1 - 61)
Faecal Coliforms (count/100mL)		590 (45 - 21000)	220 (1 - 21000)	150 (6 - 3200)	11 (1 - 630)	12 (1 - 930)	5 (<1 - 980)	2 (<1 - 200)

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3. Data in brackets indicate the ranges.

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Summary of water quality statistics for the Southern WCZ in 2022

Parameter		Hong Kong Island (South) SM1	SM2	SM19	East Lamma Channel SM3	SM4
Number of samples		11	11	12	12	11
Temperature (°C)		23.8 (16.9 - 27.9)	24.2 (17.5 - 28.0)	23.3 (16.8 - 27.0)	23.5 (17.8 - 28.4)	24.3 (17.9 - 28.2)
Salinity		32.4 (29.7 - 33.6)	32.0 (28.1 - 33.8)	32.5 (30.0 - 33.5)	32.4 (30.1 - 33.9)	31.6 (26.5 - 33.7)
Dissolved Oxygen (mg/L)		6.2 (5.2 - 7.1)	6.1 (4.8 - 6.8)	6.0 (4.2 - 7.2)	5.8 (4.1 - 6.8)	6.0 (4.4 - 7.3)
	Bottom	5.8 (3.3 - 7.4)	5.9 (3.0 - 7.2)	5.7 (3.2 - 7.4)	5.7 (2.5 - 7.2)	6.0 (4.0 - 7.4)
Dissolved Oxygen (% Saturation)		88 (77 - 95)	87 (70 - 103)	85 (62 - 91)	83 (61 - 96)	86 (67 - 100)
	Bottom	81 (47 - 96)	84 (44 - 99)	79 (46 - 95)	80 (35 - 97)	85 (59 - 101)
pH		7.8 (7.3 - 8.3)	7.8 (7.2 - 8.3)	7.8 (7.3 - 8.3)	7.7 (7.0 - 8.1)	7.7 (7.1 - 8.2)
Secchi Disc Depth (m)		3.3 (1.9 - 6.5)	3.0 (1.8 - 5.4)	3.4 (1.6 - 8.0)	2.5 (1.7 - 3.7)	2.7 (1.7 - 5.8)
Turbidity (NTU)		12.2 (3.9 - 41.1)	12.9 (4.1 - 58.7)	15.3 (4.2 - 57.1)	7.6 (4.1 - 18.6)	11.8 (0.9 - 33.4)
Suspended Solids (mg/L)		3.9 (1.3 - 9.2)	4.3 (1.3 - 9.3)	4.3 (2.0 - 10.5)	4.7 (1.7 - 8.2)	4.2 (1.7 - 9.1)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (0.2 - 1.7)	0.6 (<0.1 - 1.7)	0.5 (<0.1 - 1.3)	0.5 (<0.1 - 1.4)	0.6 (<0.1 - 2.1)
Ammonia Nitrogen (mg/L)		0.025 (0.010 - 0.037)	0.033 (0.010 - 0.066)	0.026 (0.007 - 0.069)	0.047 (0.015 - 0.098)	0.051 (0.013 - 0.087)
Unionised Ammonia (mg/L)		<0.001 (<0.001 - 0.002)	0.001 (<0.001 - 0.005)	0.001 (<0.001 - 0.005)	0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)		0.009 (<0.002 - 0.020)	0.015 (0.002 - 0.038)	0.010 (<0.002 - 0.023)	0.014 (<0.002 - 0.058)	0.019 (0.002 - 0.044)
Nitrate Nitrogen (mg/L)		0.073 (<0.002 - 0.220)	0.094 (0.003 - 0.317)	0.083 (<0.002 - 0.343)	0.071 (0.006 - 0.200)	0.130 (0.018 - 0.367)
Total Inorganic Nitrogen (mg/L)		0.11 (0.04 - 0.26)	0.14 (0.04 - 0.38)	0.12 (0.03 - 0.39)	0.13 (0.06 - 0.27)	0.20 (0.05 - 0.45)
Total Kjeldahl Nitrogen (mg/L)		0.35 (0.13 - 0.62)	0.34 (0.09 - 0.54)	0.37 (0.11 - 0.64)	0.35 (0.09 - 0.68)	0.36 (0.11 - 0.65)
Total Nitrogen (mg/L)		0.43 (0.13 - 0.66)	0.45 (0.19 - 0.64)	0.47 (0.16 - 0.76)	0.44 (0.10 - 0.73)	0.51 (0.26 - 0.76)
Orthophosphate Phosphorus (mg/L)		0.008 (<0.002 - 0.021)	0.009 (<0.002 - 0.019)	0.008 (<0.002 - 0.020)	0.008 (0.003 - 0.013)	0.012 (<0.002 - 0.021)
Total Phosphorus (mg/L)		0.04 (<0.02 - 0.08)	0.04 (0.02 - 0.09)	0.04 (<0.02 - 0.07)	0.04 (0.02 - 0.08)	0.04 (0.02 - 0.08)
Silica (as SiO_2) (mg/L)		0.65 (0.17 - 1.47)	0.75 (0.16 - 1.90)	0.79 (0.31 - 2.17)	0.72 (0.37 - 1.47)	0.93 (0.19 - 2.37)
Chlorophyll-*a* (µg/L)		3.0 (0.8 - 8.1)	3.6 (0.8 - 11.1)	1.9 (0.5 - 7.8)	3.2 (0.3 - 17.8)	4.1 (0.5 - 23.0)
E.coli (count/100mL)		1 (<1 - 3)	2 (<1 - 24)	1 (<1 - 5)	23 (<1 - 1200)	5 (<1 - 120)
Faecal Coliforms (count/100mL)		2 (<1 - 7)	4 (<1 - 73)	2 (<1 - 16)	60 (1 - 2200)	11 (<1 - 400)

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3. Data in brackets indicate the ranges.

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Summary of water quality statistics for the Southern WCZ in 2022 (continued)

Parameter		West Lamma Channel				
		SM5	SM6	SM7	SM9	SM18
Number of samples		11	12	11	11	11
Temperature (°C)		24.6 (18.5 - 29.1)	23.9 (18.3 - 27.8)	24.5 (18.0 - 28.5)	24.3 (17.6 - 28.4)	24.1 (17.4 - 27.7)
Salinity		31.4 (24.7 - 34.0)	31.9 (27.8 - 33.9)	30.9 (24.6 - 33.4)	30.3 (22.1 - 33.5)	32.2 (28.7 - 34.1)
Dissolved Oxygen (mg/L)		6.3 (5.5 - 7.1)	5.9 (4.1 - 7.0)	6.1 (4.4 - 6.8)	5.7 (4.3 - 7.8)	6.0 (4.5 - 7.1)
	Bottom	6.4 (5.1 - 7.6)	5.2 (1.3 - 7.1)	5.8 (3.2 - 7.3)	5.7 (4.3 - 8.2)	5.3 (2.5 - 7.3)
Dissolved Oxygen (% Saturation)		90 (81 - 102)	84 (57 - 99)	87 (67 - 101)	81 (66 - 115)	85 (66 - 94)
	Bottom	92 (78 - 114)	73 (20 - 97)	83 (48 - 95)	81 (64 - 120)	75 (36 - 97)
pH		7.8 (7.3 - 8.3)	7.8 (7.3 - 8.3)	7.8 (7.3 - 8.3)	7.7 (7.2 - 8.0)	7.8 (7.3 - 8.3)
Secchi Disc Depth (m)		2.6 (1.4 - 5.2)	2.7 (1.4 - 6.0)	2.4 (1.0 - 6.0)	2.2 (1.6 - 2.8)	3.2 (1.4 - 8.5)
Turbidity (NTU)		11.5 (4.1 - 42.4)	16.9 (4.1 - 44.8)	14.7 (4.1 - 45.6)	11.7 (4.2 - 53.2)	13.6 (4.1 - 38.4)
Suspended Solids (mg/L)		5.3 (2.3 - 10.6)	5.9 (2.2 - 18.0)	4.5 (1.9 - 13.5)	6.1 (2.1 - 10.5)	4.8 (2.1 - 12.7)
5-day Biochemical Oxygen Demand (mg/L)		0.8 (<0.1 - 1.7)	0.6 (<0.1 - 1.5)	0.7 (0.1 - 2.4)	0.5 (<0.1 - 2.0)	0.5 (<0.1 - 1.6)
Ammonia Nitrogen (mg/L)		0.030 (0.009 - 0.077)	0.036 (0.013 - 0.068)	0.055 (0.017 - 0.130)	0.111 (0.050 - 0.173)	0.025 (0.007 - 0.057)
Unionised Ammonia (mg/L)		0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.004)	0.002 (<0.001 - 0.006)	0.003 (<0.001 - 0.007)	<0.001 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)		0.014 (<0.002 - 0.036)	0.016 (<0.002 - 0.045)	0.023 (0.003 - 0.058)	0.030 (0.007 - 0.083)	0.015 (<0.002 - 0.035)
Nitrate Nitrogen (mg/L)		0.127 (<0.002 - 0.443)	0.118 (<0.002 - 0.423)	0.168 (0.027 - 0.423)	0.194 (0.050 - 0.687)	0.139 (<0.002 - 0.517)
Total Inorganic Nitrogen (mg/L)		0.17 (0.03 - 0.51)	0.17 (0.02 - 0.48)	0.25 (0.08 - 0.47)	0.34 (0.15 - 0.83)	0.18 (0.02 - 0.57)
Total Kjeldahl Nitrogen (mg/L)		0.33 (0.06 - 0.63)	0.32 (0.14 - 0.49)	0.37 (0.12 - 0.75)	0.38 (0.16 - 0.83)	0.32 (0.14 - 0.73)
Total Nitrogen (mg/L)		0.47 (0.12 - 0.67)	0.45 (0.25 - 0.57)	0.56 (0.30 - 0.94)	0.60 (0.25 - 0.93)	0.48 (0.16 - 0.84)
Orthophosphate Phosphorus (mg/L)		0.007 (<0.002 - 0.019)	0.008 (<0.002 - 0.018)	0.010 (<0.002 - 0.024)	0.013 (<0.002 - 0.024)	0.007 (<0.002 - 0.020)
Total Phosphorus (mg/L)		0.04 (0.02 - 0.08)	0.04 (0.02 - 0.07)	0.04 (0.02 - 0.08)	0.05 (0.03 - 0.11)	0.04 (0.02 - 0.07)
Silica (as SiO_2) (mg/L)		0.90 (0.11 - 2.83)	0.88 (0.14 - 2.40)	1.06 (0.40 - 3.03)	1.48 (0.68 - 4.47)	0.99 (0.11 - 3.40)
Chlorophyll-*a* (µg/L)		4.0 (0.7 - 11.0)	3.2 (0.6 - 12.2)	6.0 (1.0 - 34.3)	4.5 (0.6 - 28.0)	3.9 (0.6 - 14.1)
E.coli (count/100mL)		1 (<1 - 7)	1 (<1 - 6)	6 (<1 - 220)	390 (13 - 2500)	1 (<1 - 6)
Faecal Coliforms (count/100mL)		2 (<1 - 25)	2 (1 - 10)	13 (<1 - 510)	710 (35 - 4800)	2 (<1 - 23)

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3. Data in brackets indicate the ranges.

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Summary of water quality statistics for the Southern WCZ in 2022 (continued)

Parameter		Lantau Island (East) SM10	Lantau Island (East) SM11	Lantau Island (South) SM12	Lantau Island (South) SM13	Lantau Island (South) SM17	Soko Islands SM20
Number of samples		11	11	11	11	12	11
Temperature (°C)		24.3 (15.7 - 29.1)	24.2 (15.6 - 29.2)	24.2 (15.8 - 28.9)	24.3 (16.2 - 29.3)	23.7 (15.9 - 29.0)	24.2 (16.2 - 29.3)
Salinity		29.2 (18.4 - 33.4)	29.8 (21.3 - 33.5)	30.0 (18.8 - 33.5)	29.8 (19.0 - 33.5)	31.1 (25.1 - 33.5)	30.0 (21.1 - 33.5)
Dissolved Oxygen (mg/L)		5.8 (4.3 - 7.3)	6.0 (4.6 - 8.6)	6.1 (4.9 - 8.5)	6.4 (5.0 - 8.9)	6.3 (4.2 - 8.6)	6.3 (4.9 - 8.5)
	Bottom	5.9 (4.5 - 7.6)	5.7 (3.5 - 8.7)	6.0 (4.5 - 8.6)	6.5 (5.1 - 9.3)	6.0 (3.3 - 8.6)	6.4 (4.6 - 8.9)
Dissolved Oxygen (% Saturation)		81 (67 - 106)	84 (65 - 125)	86 (71 - 124)	91 (73 - 129)	88 (60 - 123)	89 (71 - 123)
	Bottom	82 (69 - 111)	80 (50 - 126)	85 (66 - 125)	93 (75 - 134)	84 (48 - 123)	90 (67 - 128)
pH		7.6 (7.1 - 8.2)	7.6 (7.3 - 8.2)	7.6 (7.3 - 8.2)	7.7 (7.4 - 8.3)	7.7 (7.4 - 8.2)	7.7 (7.4 - 8.2)
Secchi Disc Depth (m)		1.8 (1.2 - 2.7)	1.8 (1.6 - 2.6)	1.8 (1.4 - 2.7)	1.8 (1.4 - 3.2)	2.1 (1.5 - 3.0)	2.0 (1.5 - 3.1)
Turbidity (NTU)		26.4 (3.1 - 114.0)	29.7 (4.1 - 112.0)	29.0 (4.1 - 93.3)	19.2 (4.1 - 57.5)	23.0 (4.1 - 66.0)	16.8 (6.6 - 56.0)
Suspended Solids (mg/L)		8.0 (3.3 - 15.0)	8.6 (2.7 - 12.8)	7.4 (3.1 - 10.3)	8.1 (2.9 - 20.3)	7.2 (2.3 - 16.0)	7.1 (3.1 - 14.3)
5-day Biochemical Oxygen Demand (mg/L)		0.9 (<0.1 - 3.8)	0.7 (0.1 - 2.0)	0.7 (<0.1 - 1.6)	0.7 (0.1 - 1.2)	0.9 (0.2 - 3.4)	0.8 (0.1 - 1.6)
Ammonia Nitrogen (mg/L)		0.097 (0.043 - 0.160)	0.087 (0.034 - 0.143)	0.075 (0.030 - 0.143)	0.064 (0.014 - 0.120)	0.047 (0.015 - 0.104)	0.054 (0.019 - 0.113)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.004)	0.002 (<0.001 - 0.003)	0.002 (<0.001 - 0.004)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)		0.031 (0.009 - 0.075)	0.030 (0.008 - 0.089)	0.028 (0.006 - 0.083)	0.018 (<0.002 - 0.049)	0.017 (<0.002 - 0.057)	0.019 (<0.002 - 0.059)
Nitrate Nitrogen (mg/L)		0.268 (0.048 - 0.950)	0.240 (0.058 - 0.847)	0.224 (0.029 - 0.953)	0.200 (<0.002 - 0.977)	0.153 (<0.002 - 0.817)	0.198 (0.003 - 0.927)
Total Inorganic Nitrogen (mg/L)		0.40 (0.20 - 1.09)	0.36 (0.17 - 0.97)	0.33 (0.15 - 1.04)	0.28 (0.02 - 1.05)	0.22 (0.02 - 0.89)	0.27 (0.02 - 1.00)
Total Kjeldahl Nitrogen (mg/L)		0.35 (0.11 - 0.93)	0.36 (0.09 - 0.82)	0.33 (0.10 - 0.75)	0.33 (0.06 - 1.01)	0.32 (0.07 - 0.82)	0.32 (0.06 - 0.84)
Total Nitrogen (mg/L)		0.65 (0.35 - 1.15)	0.63 (0.29 - 1.03)	0.58 (0.31 - 1.14)	0.55 (0.29 - 1.12)	0.49 (0.26 - 0.95)	0.54 (0.28 - 1.07)
Orthophosphate Phosphorus (mg/L)		0.007 (<0.002 - 0.020)	0.008 (<0.002 - 0.023)	0.006 (<0.002 - 0.015)	0.005 (<0.002 - 0.011)	0.005 (<0.002 - 0.014)	0.005 (<0.002 - 0.013)
Total Phosphorus (mg/L)		0.06 (0.03 - 0.10)	0.06 (0.02 - 0.10)	0.05 (0.02 - 0.09)	0.05 (0.02 - 0.07)	0.04 (0.03 - 0.07)	0.05 (0.03 - 0.08)
Silica (as SiO_2) (mg/L)		1.52 (0.62 - 5.60)	1.44 (0.17 - 5.37)	1.39 (0.20 - 5.73)	1.36 (0.10 - 6.10)	1.10 (0.11 - 4.60)	1.31 (0.12 - 5.53)
Chlorophyll-a (µg/L)		5.1 (0.6 - 16.0)	5.9 (0.7 - 19.7)	4.7 (0.9 - 17.3)	4.9 (0.6 - 18.7)	3.7 (0.4 - 16.4)	4.4 (0.5 - 15.7)
E.coli (count/100mL)		50 (2 - 2700)	11 (<1 - 580)	15 (1 - 260)	11 (<1 - 220)	5 (<1 - 180)	5 (<1 - 95)
Faecal Coliforms (count/100mL)		120 (6 - 6000)	17 (1 - 1100)	29 (1 - 550)	23 (1 - 470)	8 (<1 - 370)	10 (1 - 240)

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3. Data in brackets indicate the ranges.

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Summary of water quality statistics for the Victoria Harbour WCZ in 2022

Parameter		Victoria Harbour (East) VM1	Victoria Harbour (East) VM2	Victoria Harbour (Central) VM4	Victoria Harbour (Central) VM5	Victoria Harbour (Central) VM6
Number of samples		12	12	12	12	11
Temperature (°C)		23.2 (17.6 - 27.9)	23.4 (17.6 - 28.0)	23.7 (17.6 - 28.0)	23.9 (17.7 - 27.9)	24.2 (17.7 - 28.0)
Salinity		32.6 (30.8 - 33.8)	32.4 (29.7 - 33.7)	32.0 (28.3 - 33.7)	31.7 (27.7 - 33.6)	31.8 (28.2 - 33.5)
Dissolved Oxygen (mg/L)		6.0 (4.2 - 7.0)	6.0 (5.1 - 7.0)	5.8 (4.8 - 6.7)	5.8 (4.6 - 6.9)	5.7 (5.0 - 6.9)
	Bottom	5.7 (3.1 - 7.0)	5.8 (3.0 - 6.9)	5.6 (2.9 - 6.9)	5.7 (4.2 - 6.9)	5.2 (2.6 - 6.7)
Dissolved Oxygen (% Saturation)		84 (60 - 97)	85 (74 - 96)	82 (70 - 93)	83 (70 - 95)	81 (75 - 88)
	Bottom	81 (44 - 98)	81 (42 - 97)	79 (41 - 93)	81 (62 - 100)	74 (37 - 90)
pH		7.7 (7.1 - 8.3)	7.7 (7.2 - 8.3)	7.7 (7.2 - 8.3)	7.7 (7.2 - 8.2)	7.7 (7.2 - 8.2)
Secchi Disc Depth (m)		2.8 (2.0 - 4.5)	2.7 (1.8 - 4.5)	2.4 (2.0 - 3.6)	2.4 (2.0 - 3.4)	2.3 (1.9 - 3.1)
Turbidity (NTU)		16.0 (3.5 - 55.5)	11.9 (3.4 - 49.0)	13.7 (2.8 - 49.0)	13.0 (3.7 - 41.2)	13.6 (3.2 - 47.5)
Suspended Solids (mg/L)		5.2 (2.2 - 8.5)	5.8 (2.8 - 10.3)	6.1 (3.5 - 10.3)	4.9 (2.9 - 8.5)	5.4 (3.7 - 7.5)
5-day Biochemical Oxygen Demand (mg/L)		0.7 (0.3 - 1.4)	0.8 (<0.1 - 2.3)	0.8 (0.3 - 2.2)	0.9 (0.3 - 2.6)	0.8 (0.1 - 2.2)
Ammonia Nitrogen (mg/L)		0.056 (0.036 - 0.094)	0.064 (0.035 - 0.120)	0.076 (0.040 - 0.117)	0.105 (0.060 - 0.187)	0.121 (0.065 - 0.237)
Unionised Ammonia (mg/L)		0.001 (<0.001 - 0.006)	0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.007)	0.003 (<0.001 - 0.011)	0.003 (<0.001 - 0.011)
Nitrite Nitrogen (mg/L)		0.012 (<0.002 - 0.028)	0.014 (0.003 - 0.030)	0.015 (0.004 - 0.030)	0.017 (0.006 - 0.035)	0.019 (0.009 - 0.036)
Nitrate Nitrogen (mg/L)		0.079 (<0.002 - 0.227)	0.108 (0.013 - 0.313)	0.119 (0.020 - 0.350)	0.133 (0.030 - 0.387)	0.147 (0.054 - 0.393)
Total Inorganic Nitrogen (mg/L)		0.15 (0.05 - 0.28)	0.19 (0.06 - 0.38)	0.21 (0.08 - 0.42)	0.26 (0.13 - 0.47)	0.29 (0.15 - 0.47)
Total Kjeldahl Nitrogen (mg/L)		0.46 (0.09 - 0.77)	0.41 (0.14 - 0.65)	0.43 (0.12 - 0.75)	0.49 (0.16 - 0.85)	0.49 (0.17 - 0.91)
Total Nitrogen (mg/L)		0.55 (0.14 - 0.87)	0.53 (0.33 - 0.74)	0.56 (0.38 - 0.85)	0.64 (0.48 - 0.98)	0.65 (0.49 - 1.04)
Orthophosphate Phosphorus (mg/L)		0.010 (<0.002 - 0.019)	0.010 (<0.002 - 0.020)	0.012 (<0.002 - 0.019)	0.012 (0.003 - 0.027)	0.014 (0.005 - 0.030)
Total Phosphorus (mg/L)		0.05 (0.03 - 0.12)	0.05 (0.02 - 0.11)	0.05 (0.03 - 0.12)	0.06 (0.03 - 0.12)	0.06 (0.04 - 0.12)
Silica (as SiO_2) (mg/L)		0.72 (0.10 - 1.70)	0.75 (0.11 - 1.70)	0.78 (0.14 - 1.73)	0.82 (0.12 - 1.73)	0.91 (0.29 - 1.80)
Chlorophyll-*a* (µg/L)		3.5 (0.4 - 10.2)	4.1 (0.4 - 12.9)	4.5 (0.3 - 15.7)	5.3 (0.4 - 20.0)	4.9 (0.5 - 15.1)
E.coli (count/100mL)		120 (7 - 480)	140 (8 - 1100)	320 (13 - 2400)	450 (25 - 6500)	830 (93 - 14000)
Faecal Coliforms (count/100mL)		280 (11 - 1400)	290 (13 - 3300)	710 (45 - 6300)	1100 (42 - 17000)	2100 (210 - 27000)

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3. Data in brackets indicate the ranges.

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Summary of water quality statistics for the Victoria Harbour WCZ in 2022 (continued)

Parameter		Victoria Harbour (West) VM7	Victoria Harbour (West) VM8	Stonecutters Island VM15	Rambler Channel VM12	Rambler Channel VM14
Number of samples		12	11	11	11	11
Temperature (°C)		24.0 (17.8 - 28.0)	24.3 (17.6 - 27.9)	24.8 (17.4 - 28.8)	24.5 (18.0 - 28.5)	25.0 (18.1 - 28.9)
Salinity		31.4 (26.4 - 33.5)	31.7 (27.5 - 33.6)	30.5 (23.2 - 33.6)	30.6 (25.8 - 33.7)	28.7 (20.6 - 33.7)
Dissolved Oxygen (mg/L)		5.7 (4.6 - 6.5)	5.7 (4.7 - 6.6)	5.4 (4.2 - 6.9)	5.2 (4.2 - 6.7)	5.8 (4.6 - 8.4)
	Bottom	5.6 (4.2 - 6.6)	5.2 (2.5 - 6.8)	4.6 (2.1 - 7.0)	4.8 (3.1 - 6.6)	5.4 (4.3 - 7.6)
Dissolved Oxygen (% Saturation)		81 (70 - 97)	81 (71 - 96)	77 (63 - 94)	74 (60 - 86)	82 (68 - 124)
	Bottom	79 (64 - 97)	74 (37 - 94)	66 (31 - 89)	68 (46 - 85)	77 (65 - 112)
pH		7.7 (7.2 - 8.2)	7.7 (7.2 - 8.3)	7.7 (7.1 - 8.2)	7.6 (7.1 - 8.3)	7.7 (7.1 - 8.3)
Secchi Disc Depth (m)		2.2 (1.7 - 3.0)	2.2 (1.7 - 2.9)	2.5 (1.8 - 3.7)	2.5 (1.7 - 4.2)	2.1 (1.5 - 3.7)
Turbidity (NTU)		14.1 (4.2 - 55.5)	15.7 (4.0 - 53.1)	18.9 (4.1 - 66.5)	19.6 (4.2 - 68.4)	15.7 (4.2 - 42.1)
Suspended Solids (mg/L)		5.2 (2.8 - 10.1)	5.9 (3.9 - 9.8)	5.7 (3.1 - 10.1)	6.7 (3.6 - 11.6)	4.8 (2.4 - 7.4)
5-day Biochemical Oxygen Demand (mg/L)		0.9 (0.1 - 2.8)	0.9 (0.2 - 2.3)	0.8 (0.1 - 2.6)	0.6 (<0.1 - 1.2)	0.6 (<0.1 - 2.2)
Ammonia Nitrogen (mg/L)		0.153 (0.056 - 0.310)	0.148 (0.055 - 0.283)	0.196 (0.067 - 0.390)	0.148 (0.069 - 0.217)	0.108 (0.024 - 0.180)
Unionised Ammonia (mg/L)		0.004 (<0.001 - 0.012)	0.004 (0.001 - 0.012)	0.007 (<0.001 - 0.027)	0.004 (<0.001 - 0.016)	0.003 (<0.001 - 0.011)
Nitrite Nitrogen (mg/L)		0.018 (0.007 - 0.037)	0.018 (0.006 - 0.039)	0.029 (0.012 - 0.061)	0.030 (0.009 - 0.047)	0.041 (0.013 - 0.098)
Nitrate Nitrogen (mg/L)		0.143 (0.047 - 0.443)	0.139 (0.039 - 0.480)	0.195 (0.018 - 0.507)	0.222 (0.071 - 0.537)	0.335 (0.079 - 0.960)
Total Inorganic Nitrogen (mg/L)		0.31 (0.17 - 0.51)	0.31 (0.13 - 0.57)	0.42 (0.10 - 0.65)	0.40 (0.23 - 0.65)	0.48 (0.28 - 1.08)
Total Kjeldahl Nitrogen (mg/L)		0.52 (0.13 - 0.93)	0.52 (0.16 - 0.83)	0.49 (0.20 - 0.90)	0.42 (0.15 - 1.01)	0.31 (0.11 - 0.69)
Total Nitrogen (mg/L)		0.68 (0.51 - 1.07)	0.68 (0.36 - 0.94)	0.72 (0.41 - 1.06)	0.68 (0.39 - 1.12)	0.68 (0.34 - 1.24)
Orthophosphate Phosphorus (mg/L)		0.014 (0.004 - 0.030)	0.012 (<0.002 - 0.025)	0.018 (<0.002 - 0.029)	0.018 (0.007 - 0.033)	0.014 (<0.002 - 0.029)
Total Phosphorus (mg/L)		0.06 (0.03 - 0.12)	0.06 (0.03 - 0.13)	0.07 (0.04 - 0.11)	0.07 (0.04 - 0.14)	0.06 (0.03 - 0.09)
Silica (as SiO_2) (mg/L)		0.90 (0.27 - 1.73)	0.94 (0.25 - 1.77)	1.18 (0.40 - 2.70)	1.36 (0.54 - 3.20)	1.83 (0.53 - 4.83)
Chlorophyll-*a* (µg/L)		5.2 (0.3 - 20.0)	5.9 (0.5 - 18.7)	4.3 (0.4 - 17.6)	3.0 (0.6 - 14.0)	5.2 (0.7 - 28.7)
E.coli (count/100mL)		2000 (16 - 26000)	3200 (31 - 13000)	4100 (850 - 15000)	1300 (200 - 11000)	390 (44 - 3900)
Faecal Coliforms (count/100mL)		4600 (49 - 34000)	6200 (61 - 28000)	9100 (1800 - 44000)	3100 (380 - 20000)	910 (92 - 9100)

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. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

Summary of water quality statistics for the Eastern Buffer WCZ in 2022

Parameter	Chai Wan	Tathong Channel	
	EM1	EM2	EM3
Number of samples	12	12	11
Temperature (°C)	23.6 (17.1 - 28.6)	23.5 (17.0 - 28.5)	23.8 (16.9 - 28.5)
Salinity	32.2 (29.5 - 33.8)	32.4 (29.7 - 33.8)	32.5 (30.2 - 34.0)
Dissolved Oxygen (mg/L)	5.8 (4.1 - 7.3)	5.8 (4.2 - 7.1)	5.9 (4.1 - 7.5)
Bottom	5.7 (2.7 - 7.3)	5.7 (2.7 - 7.4)	5.8 (2.6 - 7.4)
Dissolved Oxygen (% Saturation)	81 (57 - 93)	81 (56 - 94)	83 (60 - 95)
Bottom	80 (39 - 94)	80 (39 - 95)	81 (37 - 94)
pH	7.7 (7.2 - 8.1)	7.7 (7.2 - 8.1)	7.7 (7.2 - 8.1)
Secchi Disc Depth (m)	2.9 (1.9 - 5.3)	2.7 (1.6 - 6.2)	2.9 (2.0 - 4.0)
Turbidity (NTU)	11.8 (4.1 - 50.7)	17.6 (4.1 - 115.0)	11.8 (4.1 - 56.9)
Suspended Solids (mg/L)	4.5 (2.5 - 8.9)	5.3 (1.6 - 9.3)	4.2 (1.2 - 9.9)
5-day Biochemical Oxygen Demand (mg/L)	0.6 (<0.1 - 2.2)	0.5 (<0.1 - 1.9)	0.6 (0.1 - 3.1)
Ammonia Nitrogen (mg/L)	0.063 (0.015 - 0.118)	0.051 (0.013 - 0.080)	0.035 (0.007 - 0.062)
Unionised Ammonia (mg/L)	0.002 (<0.001 - 0.006)	0.001 (<0.001 - 0.004)	0.001 (<0.001 - 0.003)
Nitrite Nitrogen (mg/L)	0.016 (<0.002 - 0.045)	0.014 (<0.002 - 0.032)	0.009 (<0.002 - 0.022)
Nitrate Nitrogen (mg/L)	0.085 (<0.002 - 0.297)	0.075 (<0.002 - 0.283)	0.063 (<0.002 - 0.247)
Total Inorganic Nitrogen (mg/L)	0.17 (0.02 - 0.41)	0.14 (0.03 - 0.38)	0.11 (0.03 - 0.31)
Total Kjeldahl Nitrogen (mg/L)	0.39 (0.12 - 0.75)	0.36 (0.12 - 0.75)	0.37 (0.12 - 0.75)
Total Nitrogen (mg/L)	0.49 (0.23 - 0.77)	0.45 (0.20 - 0.76)	0.44 (0.20 - 0.76)
Orthophosphate Phosphorus (mg/L)	0.009 (<0.002 - 0.016)	0.008 (<0.002 - 0.020)	0.008 (<0.002 - 0.021)
Total Phosphorus (mg/L)	0.04 (0.02 - 0.08)	0.04 (0.02 - 0.08)	0.04 (0.02 - 0.07)
Silica (as SiO_2) (mg/L)	0.83 (0.40 - 1.87)	0.79 (0.40 - 1.77)	0.70 (0.25 - 1.50)
Chlorophyll-a (µg/L)	2.0 (0.6 - 7.5)	1.8 (0.6 - 6.8)	2.1 (0.5 - 9.4)
E.coli (count/100mL)	54 (4 - 960)	41 (2 - 430)	5 (<1 - 71)
Faecal Coliforms (count/100mL)	130 (8 - 2200)	100 (7 - 910)	11 (<1 - 230)

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. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

Summary of water quality statistics for the Western Buffer WCZ in 2022

Parameter		Hong Kong Island (West) WM1	Hong Kong Island (West) WM2	Tsing Yi (South) WM3	Tsing Yi (West) WM4
Number of samples		11	12	12	11
Temperature (°C)		23.8 (17.7 - 28.4)	23.8 (17.6 - 28.4)	23.7 (17.7 - 28.5)	24.0 (17.7 - 28.6)
Salinity		32.4 (30.0 - 33.8)	31.2 (25.8 - 33.4)	31.7 (29.3 - 33.2)	31.4 (27.0 - 33.4)
Dissolved Oxygen (mg/L)		5.7 (4.1 - 6.9)	5.7 (4.3 - 6.8)	5.4 (3.9 - 6.6)	5.3 (3.5 - 6.3)
	Bottom	5.5 (2.4 - 7.1)	5.3 (2.1 - 7.0)	5.3 (2.2 - 6.8)	5.0 (2.0 - 6.6)
Dissolved Oxygen (% Saturation)		81 (57 - 93)	80 (67 - 88)	77 (56 - 86)	74 (51 - 86)
	Bottom	78 (35 - 96)	75 (30 - 90)	74 (31 - 89)	71 (30 - 86)
pH		7.8 (7.3 - 8.1)	7.7 (7.2 - 8.1)	7.7 (7.2 - 8.1)	7.7 (7.2 - 8.0)
Secchi Disc Depth (m)		2.4 (1.8 - 3.3)	2.4 (1.7 - 3.4)	2.3 (1.7 - 2.8)	2.2 (1.7 - 3.3)
Turbidity (NTU)		10.2 (4.1 - 35.7)	9.6 (4.2 - 37.0)	11.4 (4.2 - 52.8)	10.7 (4.1 - 40.5)
Suspended Solids (mg/L)		5.4 (3.2 - 11.4)	4.9 (2.4 - 9.6)	5.6 (2.7 - 8.8)	5.6 (2.3 - 10.5)
5-day Biochemical Oxygen Demand (mg/L)		0.5 (0.1 - 1.7)	0.5 (0.2 - 1.5)	0.7 (0.1 - 1.8)	0.6 (<0.1 - 1.5)
Ammonia Nitrogen (mg/L)		0.057 (0.015 - 0.115)	0.100 (0.024 - 0.170)	0.154 (0.042 - 0.313)	0.123 (0.025 - 0.223)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.006)	0.003 (0.001 - 0.008)	0.003 (0.001 - 0.008)
Nitrite Nitrogen (mg/L)		0.017 (0.002 - 0.065)	0.020 (0.003 - 0.050)	0.023 (0.006 - 0.053)	0.027 (0.008 - 0.051)
Nitrate Nitrogen (mg/L)		0.085 (0.006 - 0.250)	0.164 (0.015 - 0.500)	0.143 (0.042 - 0.287)	0.180 (0.039 - 0.400)
Total Inorganic Nitrogen (mg/L)		0.16 (0.05 - 0.33)	0.28 (0.09 - 0.60)	0.32 (0.18 - 0.47)	0.33 (0.21 - 0.49)
Total Kjeldahl Nitrogen (mg/L)		0.33 (0.07 - 0.68)	0.38 (0.16 - 0.69)	0.45 (0.16 - 0.83)	0.41 (0.17 - 0.79)
Total Nitrogen (mg/L)		0.43 (0.12 - 0.70)	0.56 (0.31 - 0.83)	0.62 (0.43 - 0.90)	0.62 (0.44 - 0.86)
Orthophosphate Phosphorus (mg/L)		0.009 (<0.002 - 0.020)	0.010 (<0.002 - 0.024)	0.013 (<0.002 - 0.025)	0.014 (<0.002 - 0.025)
Total Phosphorus (mg/L)		0.04 (0.02 - 0.10)	0.05 (0.03 - 0.10)	0.05 (0.03 - 0.10)	0.05 (0.04 - 0.11)
Silica (as SiO_2) (mg/L)		0.84 (0.35 - 1.77)	1.24 (0.45 - 3.37)	1.04 (0.52 - 1.93)	1.30 (0.54 - 2.70)
Chlorophyll-a (µg/L)		3.3 (0.4 - 19.3)	2.9 (0.4 - 16.5)	2.6 (0.2 - 14.9)	1.7 (0.4 - 6.2)
E.coli (count/100mL)		39 (1 - 3100)	400 (2 - 3700)	4100 (490 - 27000)	1500 (110 - 6800)
Faecal Coliforms (count/100mL)		100 (3 - 4500)	760 (5 - 7200)	8100 (700 - 59000)	2800 (270 - 10000)

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. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

Summary of water quality statistics for the Junk Bay WCZ in 2022

Parameter	Junk Bay JM3	Junk Bay JM4
Number of samples	11	12
Temperature (°C)	24.0 (17.3 - 28.5)	23.5 (17.0 - 28.4)
Salinity	32.1 (29.4 - 33.7)	32.3 (29.8 - 33.7)
Dissolved Oxygen (mg/L)	5.6 (4.2 - 7.2)	5.7 (4.3 - 7.1)
Bottom	5.6 (2.8 - 7.3)	5.7 (2.6 - 7.3)
Dissolved Oxygen (% Saturation)	80 (62 - 91)	80 (58 - 91)
Bottom	79 (41 - 93)	80 (38 - 93)
pH	7.6 (7.1 - 8.1)	7.7 (7.2 - 8.1)
Secchi Disc Depth (m)	2.6 (2.0 - 3.4)	2.9 (2.0 - 5.3)
Turbidity (NTU)	12.2 (4.1 - 53.5)	14.3 (4.1 - 63.8)
Suspended Solids (mg/L)	3.6 (1.8 - 6.3)	4.6 (1.7 - 9.7)
5-day Biochemical Oxygen Demand (mg/L)	0.5 (<0.1 - 1.1)	0.5 (<0.1 - 1.8)
Ammonia Nitrogen (mg/L)	0.056 (0.013 - 0.096)	0.056 (0.009 - 0.085)
Unionised Ammonia (mg/L)	0.001 (<0.001 - 0.004)	0.002 (<0.001 - 0.004)
Nitrite Nitrogen (mg/L)	0.017 (0.004 - 0.042)	0.015 (<0.002 - 0.035)
Nitrate Nitrogen (mg/L)	0.098 (<0.002 - 0.287)	0.081 (<0.002 - 0.260)
Total Inorganic Nitrogen (mg/L)	0.17 (0.04 - 0.38)	0.15 (0.03 - 0.35)
Total Kjeldahl Nitrogen (mg/L)	0.31 (0.11 - 0.58)	0.33 (0.13 - 0.72)
Total Nitrogen (mg/L)	0.42 (0.19 - 0.78)	0.42 (0.20 - 0.75)
Orthophosphate Phosphorus (mg/L)	0.009 (<0.002 - 0.018)	0.011 (0.003 - 0.024)
Total Phosphorus (mg/L)	0.05 (0.03 - 0.09)	0.05 (0.02 - 0.08)
Silica (as SiO_2) (mg/L)	0.84 (0.41 - 1.73)	0.79 (0.35 - 1.73)
Chlorophyll-a (µg/L)	2.2 (0.6 - 9.2)	2.0 (0.6 - 9.5)
E.coli (count/100mL)	35 (7 - 190)	46 (3 - 210)
Faecal Coliforms (count/100mL)	110 (35 - 520)	100 (5 - 770)

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. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

Summary of water quality statistics for the Deep Bay WCZ in 2022

Parameter		Inner Deep Bay			Outer Deep Bay	
		DM1	DM2	DM3	DM4	DM5
Number of samples		11	11	12	11	12
Temperature (°C)		24.8 (17.9 - 32.4)	25.0 (18.0 - 32.1)	24.9 (18.9 - 31.0)	25.0 (18.5 - 30.6)	24.5 (18.4 - 29.9)
Salinity		14.9 (0.5 - 23.3)	17.0 (0.4 - 25.8)	21.6 (5.4 - 29.1)	23.2 (8.0 - 31.2)	25.2 (9.0 - 32.7)
Dissolved Oxygen (mg/L)		6.5 (4.9 - 9.2)	6.0 (4.9 - 7.8)	6.0 (4.8 - 6.9)	5.9 (4.7 - 7.0)	5.8 (5.0 - 6.7)
	Bottom	N/A N/A	N/A N/A	N/A N/A	5.7 (4.1 - 7.4)	5.8 (4.7 - 7.2)
Dissolved Oxygen (% Saturation)		85 (63 - 123)	80 (66 - 111)	82 (71 - 94)	80 (67 - 94)	80 (71 - 90)
	Bottom	N/A N/A	N/A N/A	N/A N/A	79 (57 - 99)	80 (67 - 92)
pH		7.4 (7.0 - 8.5)	7.4 (6.9 - 8.3)	7.5 (7.1 - 7.9)	7.5 (7.1 - 7.9)	7.6 (7.1 - 8.0)
Secchi Disc Depth (m)		1.1 (0.9 - 1.6)	1.2 (0.9 - 1.5)	1.5 (1.2 - 2.2)	1.9 (1.2 - 2.9)	1.9 (1.7 - 2.7)
Turbidity (NTU)		85.9 (9.9 - 288.0)	90.0 (9.4 - 384.0)	46.0 (1.8 - 264.0)	32.3 (5.4 - 144.0)	23.4 (4.0 - 78.1)
Suspended Solids (mg/L)		27.6 (7.0 - 58.0)	26.2 (4.7 - 65.0)	9.3 (2.6 - 22.0)	7.4 (3.2 - 14.0)	5.2 (3.3 - 9.7)
5-day Biochemical Oxygen Demand (mg/L)		1.8 (<0.1 - 6.0)	1.5 (0.4 - 3.2)	0.8 (0.2 - 3.5)	0.7 (<0.1 - 3.3)	0.9 (0.1 - 2.9)
Ammonia Nitrogen (mg/L)		0.538 (0.088 - 1.200)	0.379 (0.050 - 1.400)	0.182 (0.024 - 0.420)	0.127 (0.038 - 0.200)	0.098 (0.009 - 0.190)
Unionised Ammonia (mg/L)		0.008 (0.002 - 0.024)	0.007 (<0.001 - 0.043)	0.003 (<0.001 - 0.011)	0.002 (<0.001 - 0.007)	0.002 (<0.001 - 0.006)
Nitrite Nitrogen (mg/L)		0.161 (0.094 - 0.420)	0.119 (0.067 - 0.200)	0.066 (0.025 - 0.130)	0.061 (0.033 - 0.130)	0.057 (0.020 - 0.137)
Nitrate Nitrogen (mg/L)		1.200 (0.840 - 1.800)	1.120 (0.510 - 2.300)	0.700 (0.280 - 1.200)	0.630 (0.300 - 1.200)	0.558 (0.140 - 1.270)
Total Inorganic Nitrogen (mg/L)		1.90 (1.13 - 2.61)	1.61 (0.70 - 2.89)	0.95 (0.41 - 1.49)	0.82 (0.43 - 1.43)	0.71 (0.28 - 1.41)
Total Kjeldahl Nitrogen (mg/L)		0.93 (0.46 - 2.10)	0.73 (0.37 - 2.10)	0.40 (0.19 - 0.82)	0.35 (0.18 - 0.64)	0.31 (0.12 - 0.88)
Total Nitrogen (mg/L)		2.29 (1.40 - 3.37)	1.96 (0.95 - 3.59)	1.16 (0.51 - 1.85)	1.04 (0.56 - 1.61)	0.93 (0.44 - 1.56)
Orthophosphate Phosphorus (mg/L)		0.120 (0.018 - 0.180)	0.100 (0.014 - 0.130)	0.059 (<0.002 - 0.160)	0.029 (<0.002 - 0.073)	0.016 (<0.002 - 0.038)
Total Phosphorus (mg/L)		0.26 (0.16 - 0.41)	0.22 (0.13 - 0.35)	0.12 (0.05 - 0.21)	0.09 (0.04 - 0.13)	0.06 (0.03 - 0.10)
Silica (as SiO_2) (mg/L)		5.74 (1.70 - 8.90)	5.17 (0.96 - 11.00)	3.74 (1.30 - 7.40)	3.57 (0.99 - 7.50)	3.00 (0.86 - 8.10)
Chlorophyll-a (µg/L)		8.8 (2.1 - 45.0)	8.9 (2.1 - 33.0)	3.0 (0.8 - 7.5)	1.9 (0.5 - 5.2)	2.0 (0.5 - 5.9)
E.coli (count/100mL)		500 (31 - 4900)	170 (3 - 10000)	32 (<1 - 430)	17 (<1 - 250)	20 (2 - 940)
Faecal Coliforms (count/100mL)		1200 (88 - 24000)	430 (9 - 18000)	53 (<1 - 900)	35 (1 - 760)	43 (2 - 1900)

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/A (Not Applicable) indicates the measurement was not made due to shallow water.
5. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

Summary of water quality statistics for the North Western WCZ in 2022

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	11	12	11	11	11
Temperature (°C)		23.9 (16.0 - 29.0)	24.5 (16.0 - 29.1)	24.4 (18.2 - 29.2)	24.5 (15.9 - 29.4)	24.5 (15.3 - 29.3)	24.4 (15.3 - 29.1)
Salinity		30.0 (22.8 - 33.5)	28.0 (15.4 - 33.4)	28.1 (17.3 - 33.4)	27.3 (19.7 - 33.1)	25.7 (10.8 - 33.2)	27.5 (13.2 - 33.9)
Dissolved Oxygen (mg/L)		5.3 (4.0 - 6.8)	5.6 (4.3 - 6.7)	5.6 (4.2 - 6.9)	5.5 (4.1 - 6.8)	5.7 (4.2 - 7.3)	5.8 (4.6 - 7.1)
	Bottom	5.1 (3.0 - 7.1)	5.3 (3.9 - 7.0)	5.3 (3.6 - 7.0)	5.2 (3.5 - 7.0)	5.7 (4.1 - 7.5)	5.7 (3.0 - 7.4)
Dissolved Oxygen (% Saturation)		74 (58 - 89)	78 (63 - 95)	77 (61 - 89)	77 (56 - 86)	79 (61 - 88)	80 (62 - 91)
	Bottom	72 (43 - 88)	75 (55 - 92)	75 (53 - 89)	73 (51 - 87)	79 (58 - 90)	80 (43 - 91)
pH		7.6 (7.2 - 8.0)	7.6 (7.1 - 8.1)	7.6 (7.2 - 8.0)	7.6 (7.1 - 8.0)	7.5 (7.1 - 8.0)	7.6 (7.2 - 8.0)
Secchi Disc Depth (m)		2.4 (1.9 - 3.6)	2.2 (1.7 - 3.1)	1.9 (1.1 - 2.6)	1.9 (1.2 - 2.7)	1.9 (1.2 - 2.7)	1.6 (0.9 - 2.2)
Turbidity (NTU)		18.6 (4.1 - 83.8)	17.7 (4.4 - 50.7)	28.7 (4.4 - 139.0)	32.8 (4.1 - 120.0)	28.9 (4.1 - 105.0)	43.6 (4.3 - 206.0)
Suspended Solids (mg/L)		6.0 (1.8 - 11.3)	5.4 (2.1 - 7.8)	7.0 (2.1 - 11.8)	10.4 (2.6 - 30.0)	7.7 (2.0 - 16.7)	11.4 (3.5 - 25.0)
5-day Biochemical Oxygen Demand (mg/L)		0.4 (<0.1 - 0.9)	0.4 (<0.1 - 1.0)	0.5 (<0.1 - 0.9)	0.5 (<0.1 - 0.9)	0.4 (<0.1 - 1.0)	0.4 (<0.1 - 0.9)
Ammonia Nitrogen (mg/L)		0.106 (0.018 - 0.193)	0.094 (0.033 - 0.170)	0.104 (0.029 - 0.167)	0.094 (0.034 - 0.177)	0.078 (0.020 - 0.157)	0.047 (0.012 - 0.099)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.004)	0.002 (<0.001 - 0.004)	0.002 (<0.001 - 0.007)	0.002 (<0.001 - 0.005)	0.001 (<0.001 - 0.005)	0.001 (<0.001 - 0.005)
Nitrite Nitrogen (mg/L)		0.037 (0.007 - 0.091)	0.047 (0.006 - 0.107)	0.055 (0.008 - 0.117)	0.057 (0.011 - 0.120)	0.059 (0.015 - 0.127)	0.043 (0.006 - 0.079)
Nitrate Nitrogen (mg/L)		0.236 (0.057 - 0.740)	0.327 (0.059 - 1.070)	0.360 (0.069 - 1.200)	0.356 (0.066 - 0.917)	0.421 (0.109 - 1.270)	0.332 (0.046 - 1.230)
Total Inorganic Nitrogen (mg/L)		0.38 (0.15 - 0.83)	0.47 (0.18 - 1.17)	0.52 (0.20 - 1.30)	0.51 (0.20 - 1.02)	0.56 (0.23 - 1.36)	0.42 (0.10 - 1.32)
Total Kjeldahl Nitrogen (mg/L)		0.40 (0.10 - 1.20)	0.40 (0.11 - 1.27)	0.31 (0.13 - 0.79)	0.39 (0.13 - 1.15)	0.34 (0.13 - 0.89)	0.34 (0.09 - 1.00)
Total Nitrogen (mg/L)		0.67 (0.26 - 1.29)	0.78 (0.31 - 1.35)	0.73 (0.37 - 1.40)	0.81 (0.42 - 1.23)	0.82 (0.47 - 1.51)	0.72 (0.38 - 1.42)
Orthophosphate Phosphorus (mg/L)		0.014 (0.005 - 0.031)	0.013 (<0.002 - 0.033)	0.013 (<0.002 - 0.032)	0.016 (0.005 - 0.038)	0.012 (<0.002 - 0.032)	0.008 (<0.002 - 0.019)
Total Phosphorus (mg/L)		0.06 (0.03 - 0.10)	0.06 (0.03 - 0.09)	0.06 (0.03 - 0.13)	0.06 (0.04 - 0.10)	0.06 (0.03 - 0.08)	0.06 (0.02 - 0.10)
Silica (as SiO_2) (mg/L)		1.58 (0.28 - 4.40)	2.13 (0.54 - 6.57)	2.27 (0.66 - 7.60)	2.24 (0.72 - 5.47)	2.61 (0.78 - 8.03)	2.20 (0.60 - 7.43)
Chlorophyll-a (µg/L)		1.4 (0.3 - 4.0)	1.7 (0.4 - 5.5)	1.4 (0.5 - 3.6)	1.4 (0.5 - 3.4)	1.6 (0.4 - 5.3)	2.3 (0.9 - 9.7)
E.coli (count/100mL)		640 (29 - 4700)	83 (4 - 720)	42 (5 - 370)	41 (4 - 770)	16 (3 - 390)	4 (1 - 250)
Faecal Coliforms (count/100mL)		1300 (46 - 11000)	170 (12 - 1500)	96 (18 - 1700)	89 (8 - 1400)	40 (3 - 1100)	8 (1 - 940)

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).

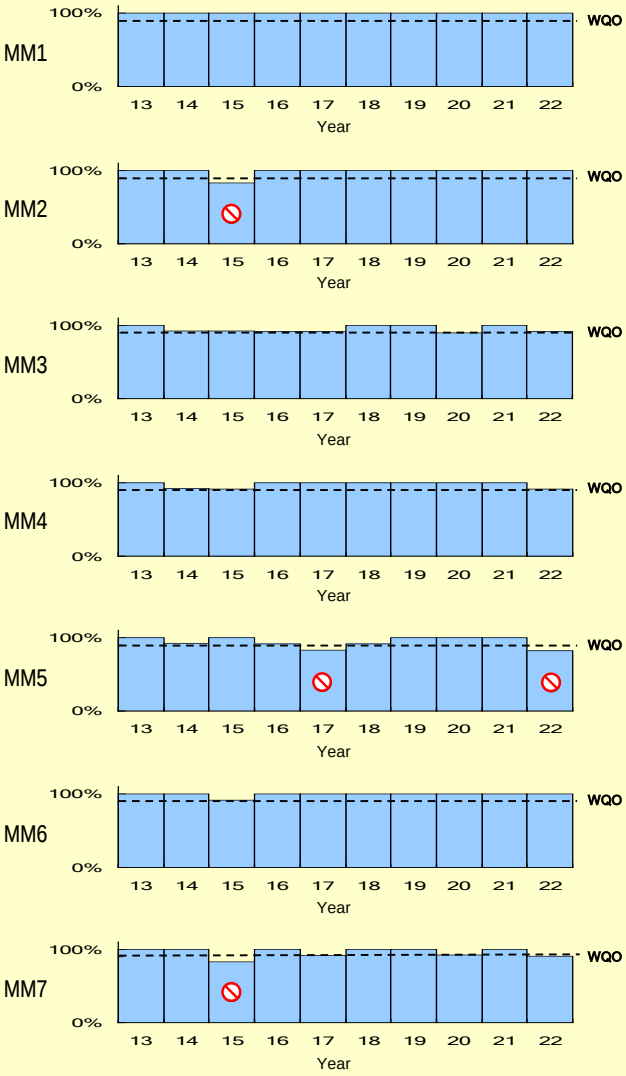
2. Data presented are annual arithmetic means of the depth-averaged results except for *E. coli* and faecal coliforms which are annual geometric means.

3. Data in brackets indicate the ranges.

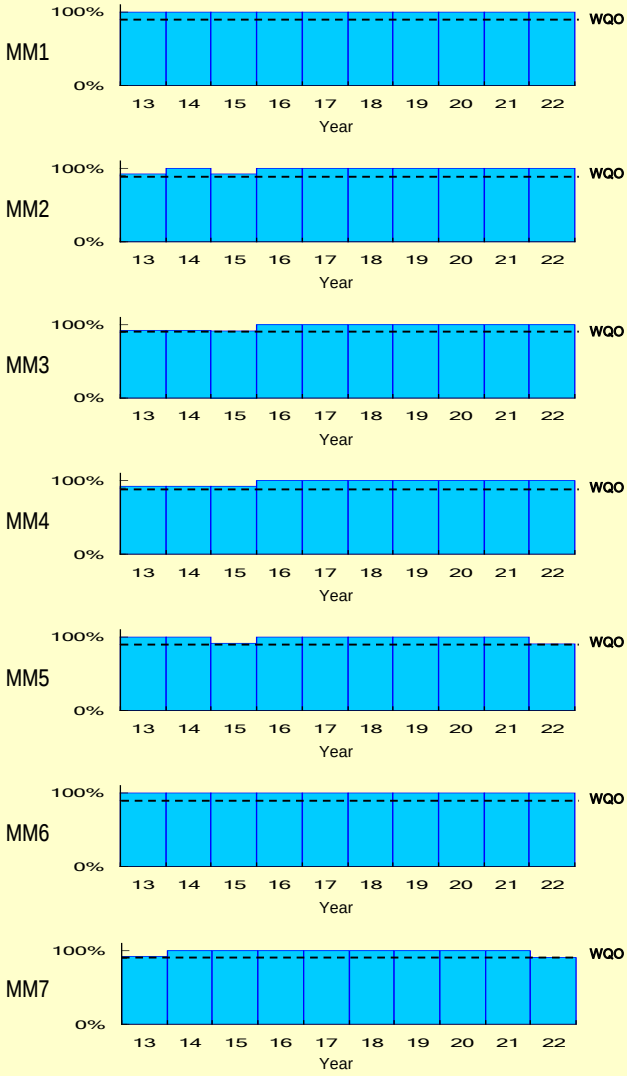
4. During the periods of the special work arrangement under the COVID-19 pandemic in 2022, marine water quality monitoring frequency was adjusted and sampling at representative monitoring stations were maintained. Full scale monitoring was conducted in the periods of January to February and April to December 2022.

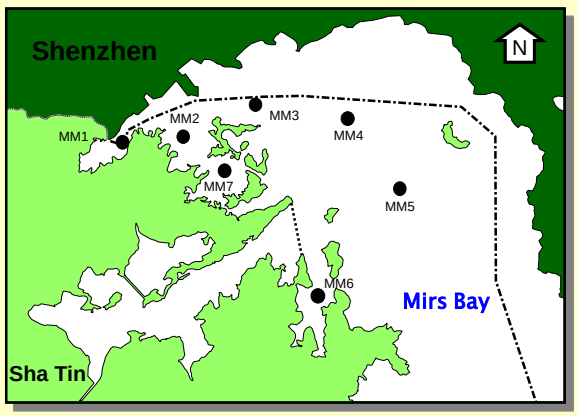
WQO compliance rates for the Mirs Bay WCZ

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)



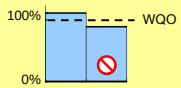


Dissolved Oxygen (DO)

1. Bottom

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

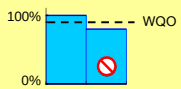
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

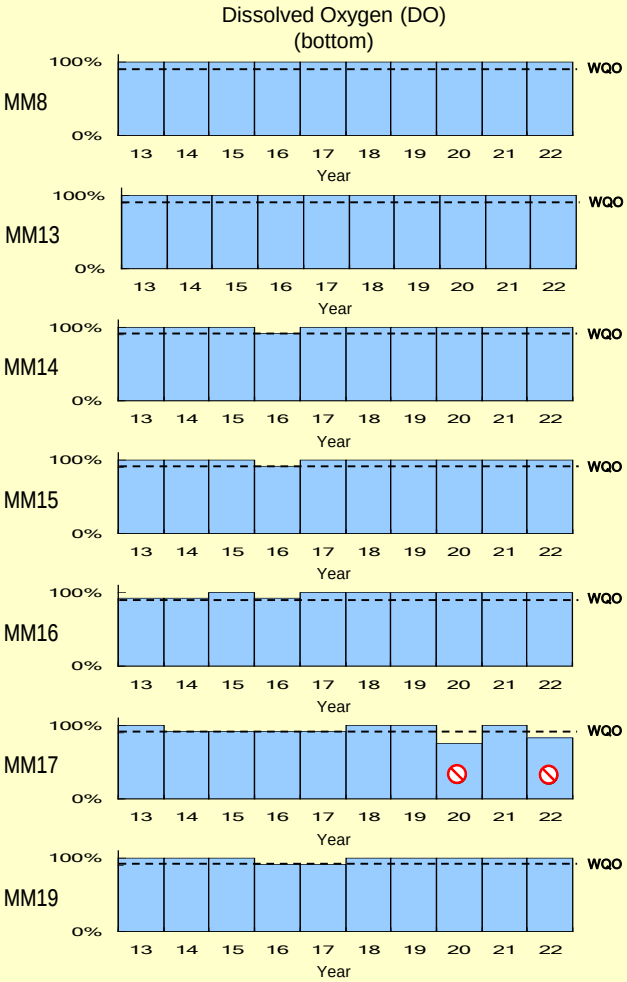
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

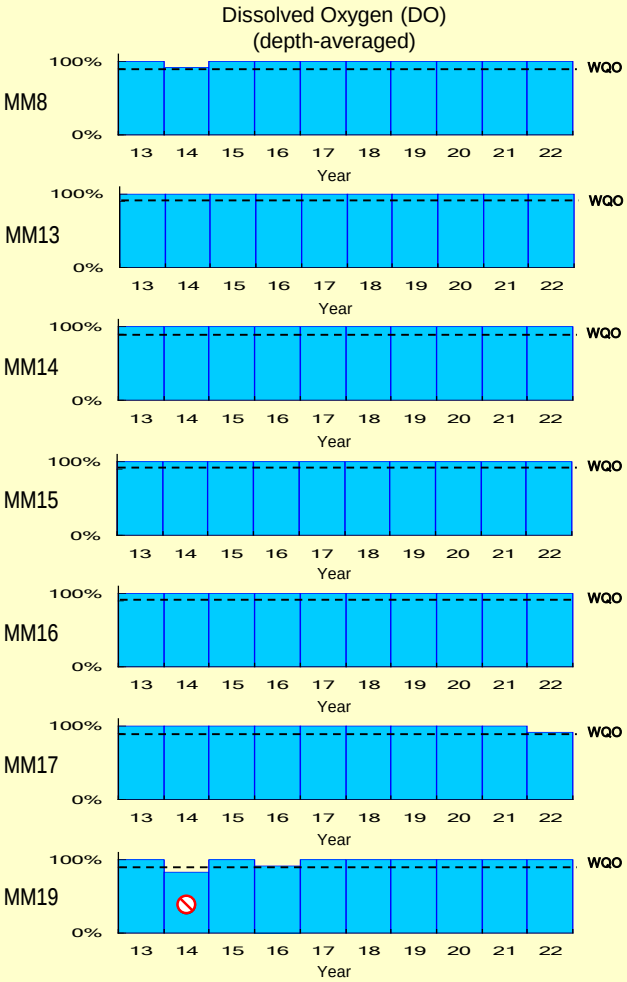
% sample with depth-averaged DO ≥ 4 mg/L

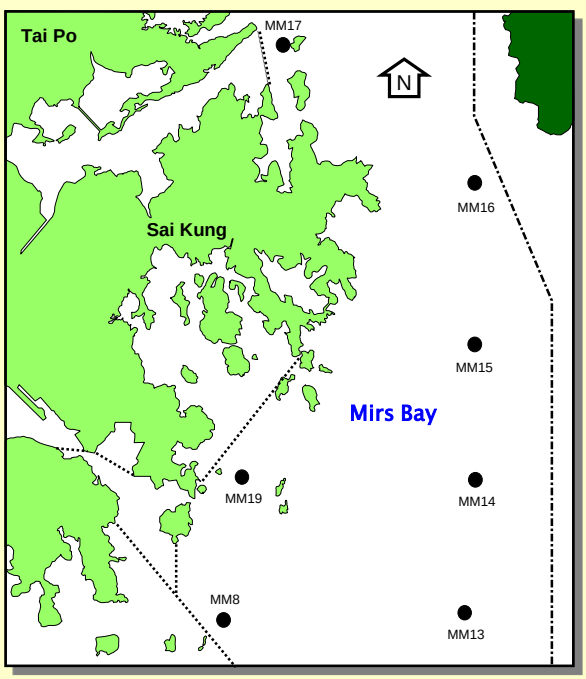


Non-compliance

WQO compliance rates for 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

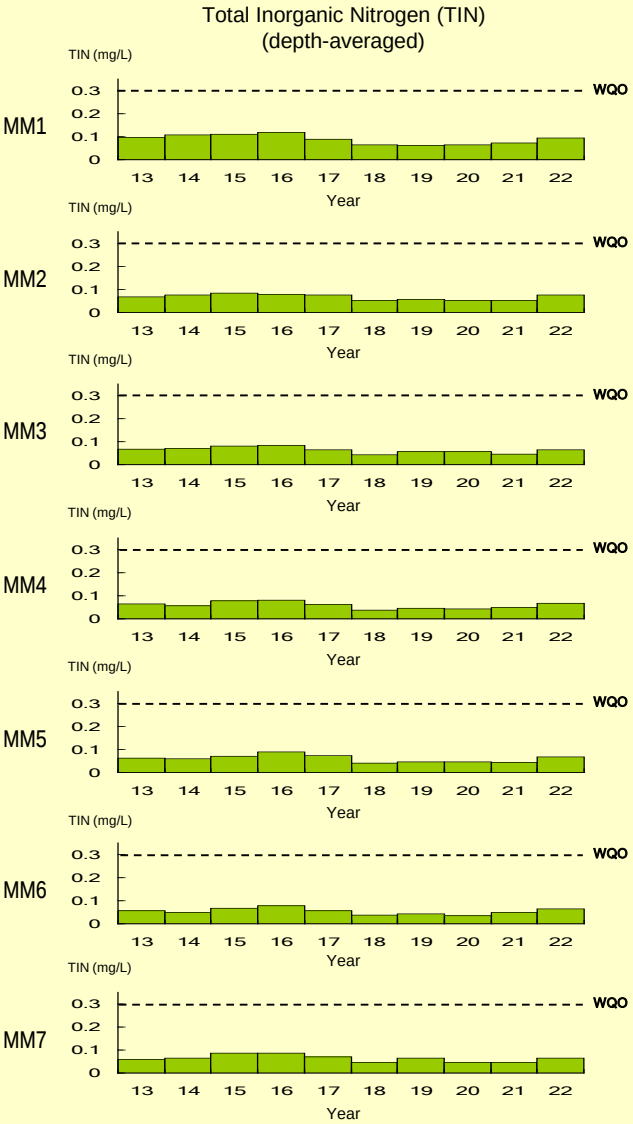
2. Depth-averaged

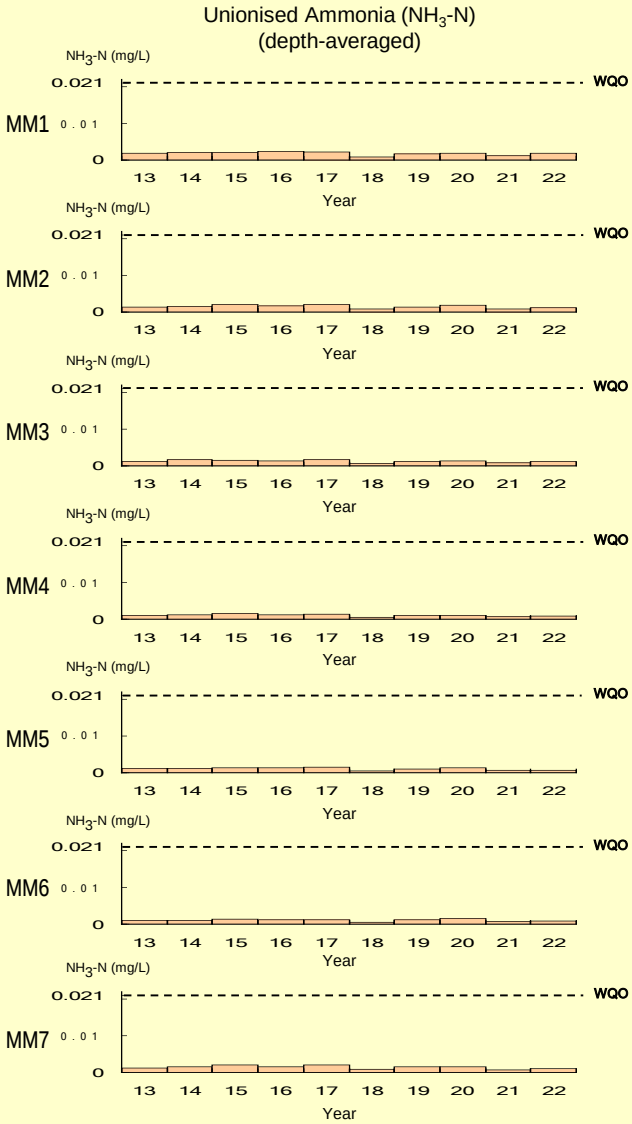
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

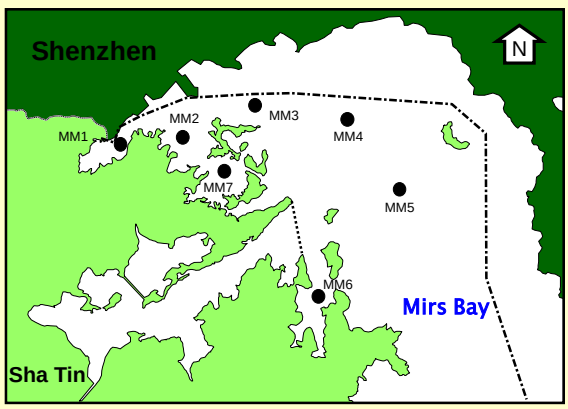
% sample with depth-averaged DO ≥ 4 mg/L

Non-compliance

WQO compliance rates for the Mirs Bay WCZ (continued)







Total Inorganic Nitrogen (TIN)

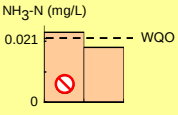
WQO : annual mean for depth-averaged TIN $\leq$ 0.3 mg/L

annual mean for depth-averaged TIN

Unionised Ammonia (NH_3-N)

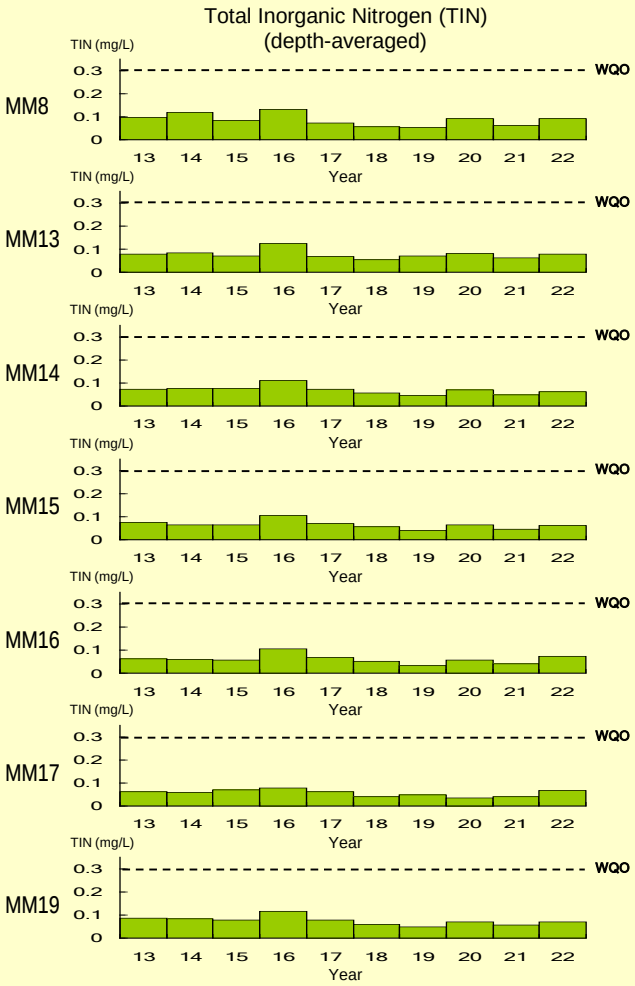
WQO : annual mean for depth-averaged NH_3-N $\leq$ 0.021 mg/L

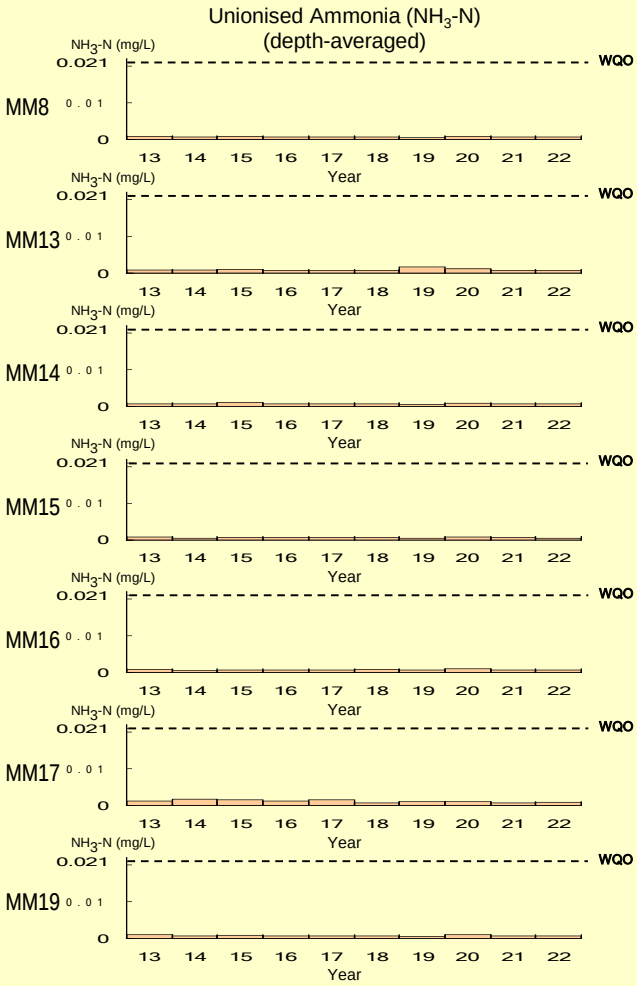
annual mean for depth-averaged NH_3-N

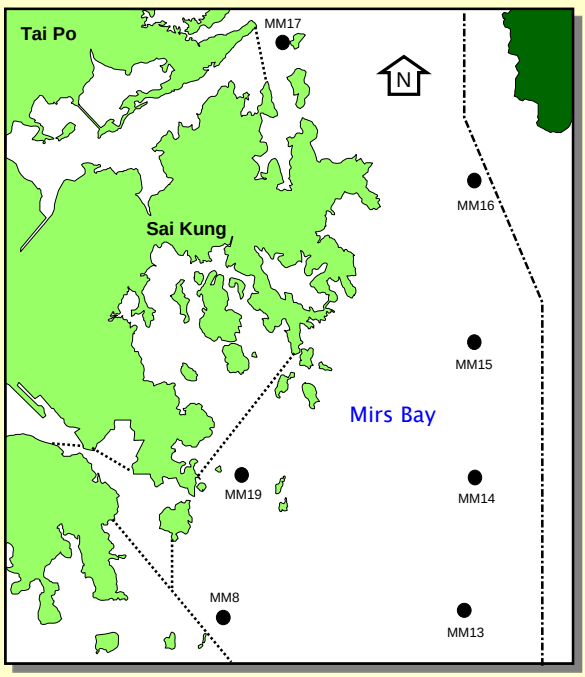


Non-compliance

WQO compliance rates for the Mirs Bay WCZ (continued)



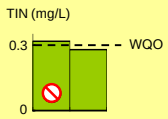




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

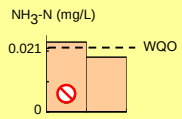


Unionised Ammonia (NH_3-N)

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

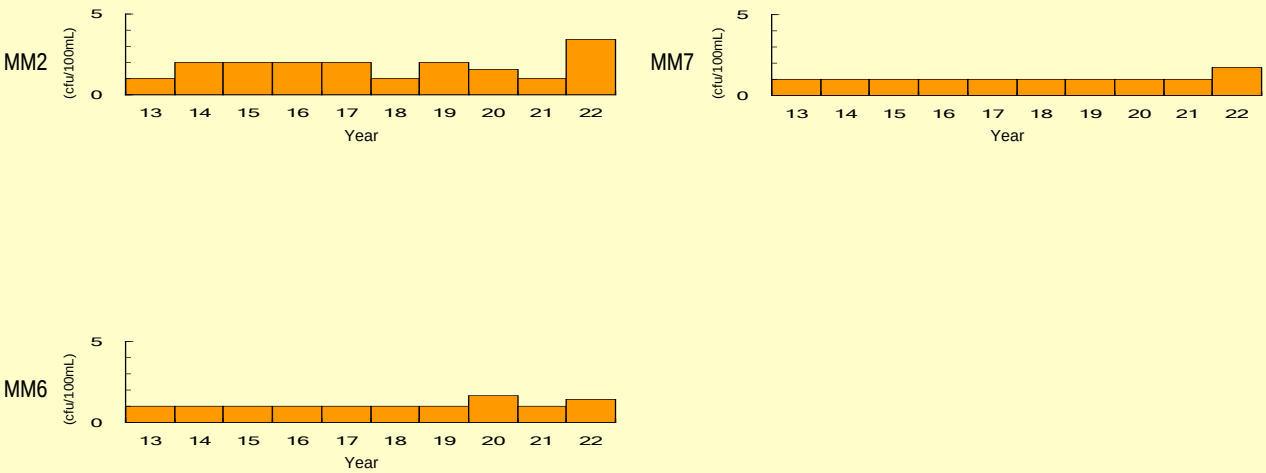
annual mean for depth-averaged NH_3-N

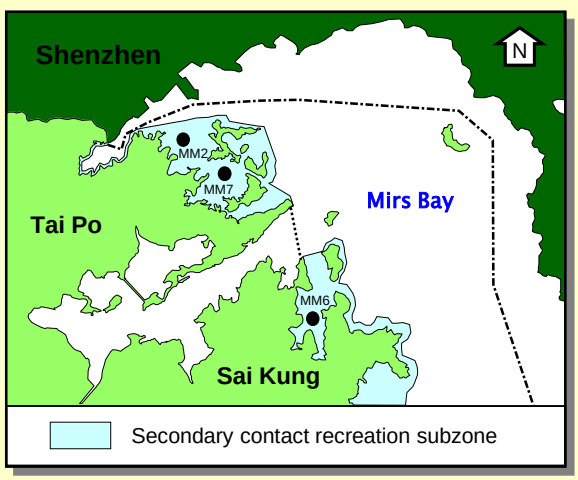
Non-compliance

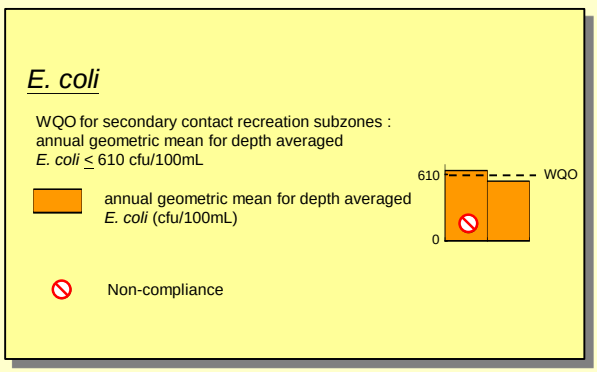


WQO compliance rates for the Mirs Bay WCZ (continued)

E. coli
(annual geometric mean)

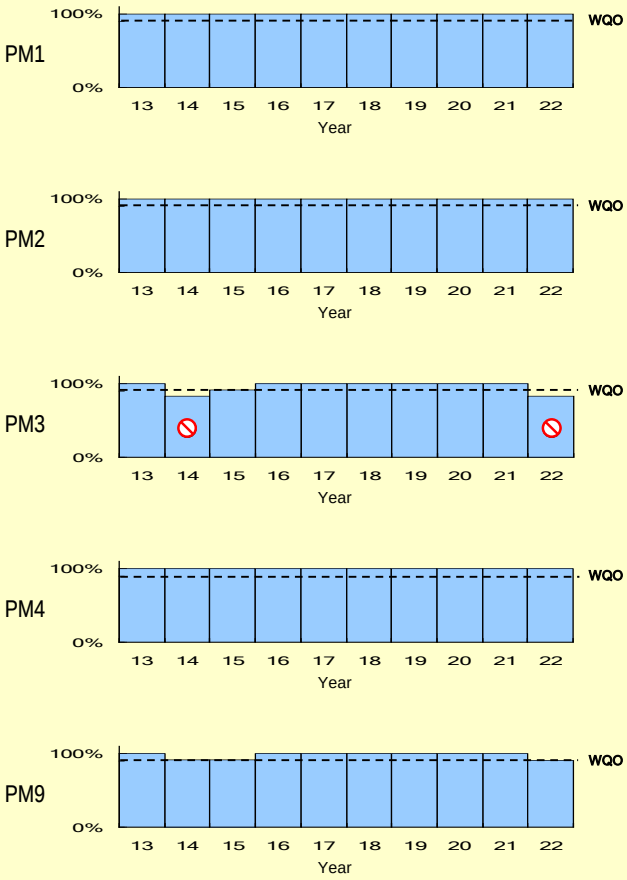




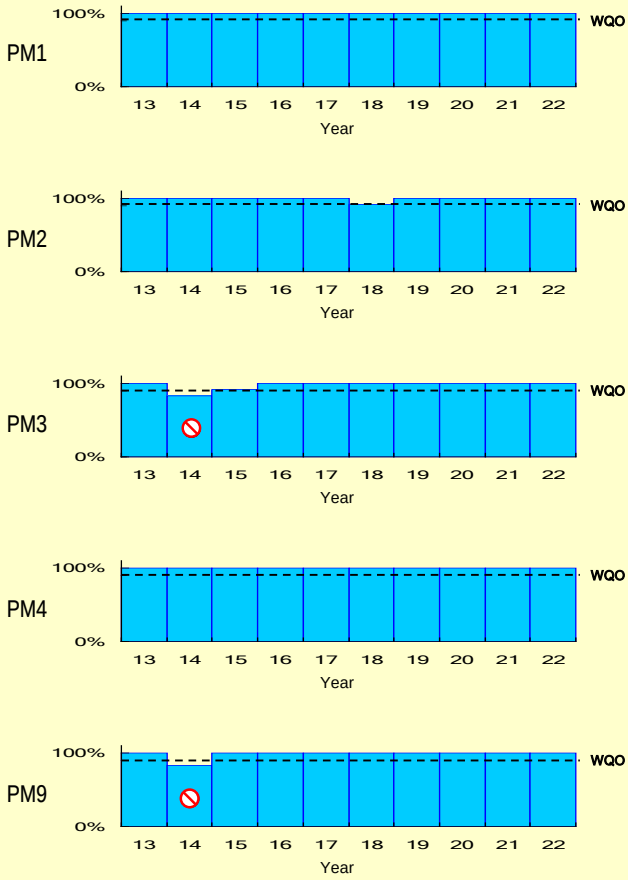


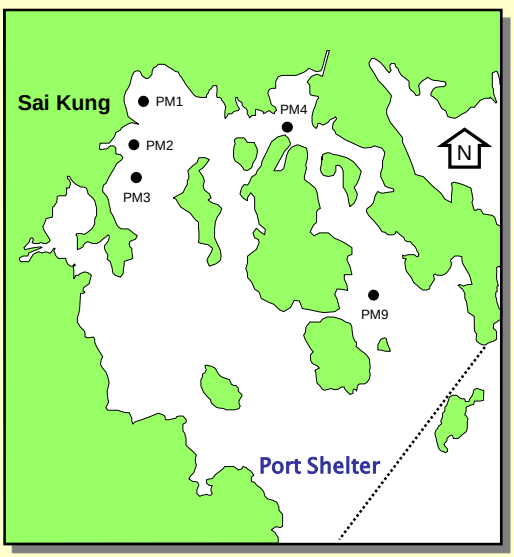
WQO compliance rates for the Port Shelter WCZ

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)



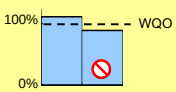


Dissolved Oxygen (DO)

1. Bottom

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

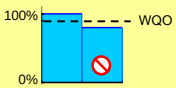
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

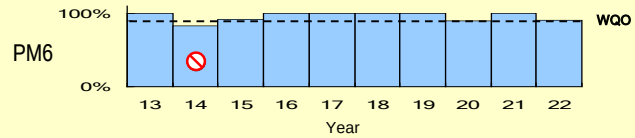
% sample with depth-averaged DO ≥ 4 mg/L

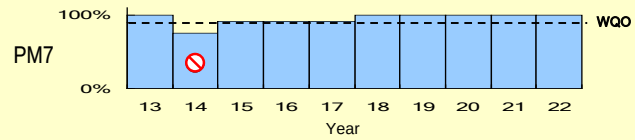


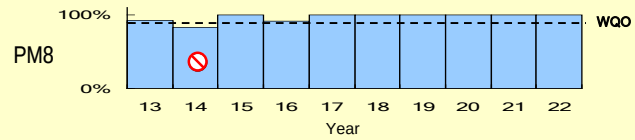
Non-compliance

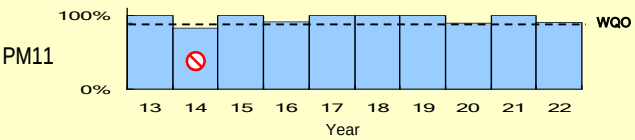
WQO compliance rates for the Port Shelter WCZ (continued)

Dissolved Oxygen (DO)
(bottom)

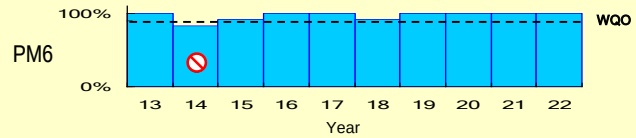


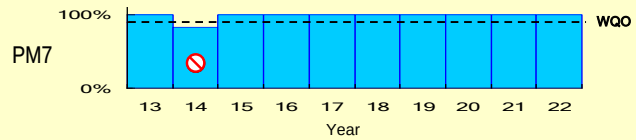


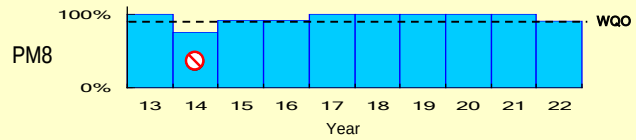


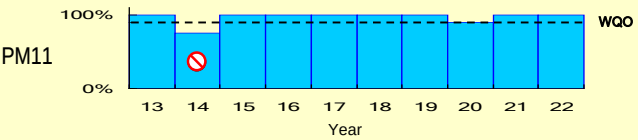


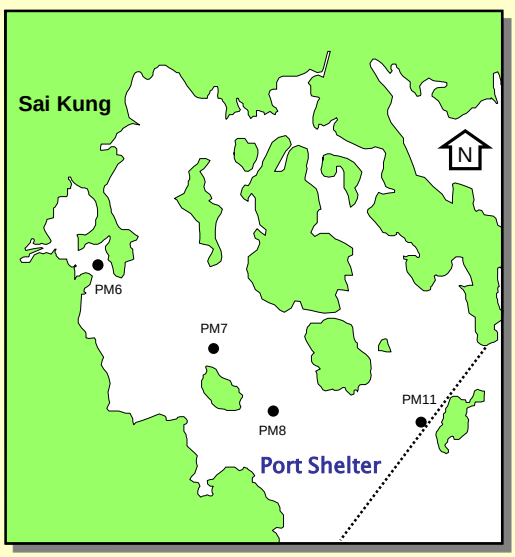
Dissolved Oxygen (DO)
(depth-averaged)









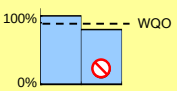


Dissolved Oxygen (DO)

1. Bottom

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

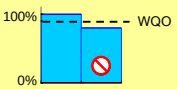
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

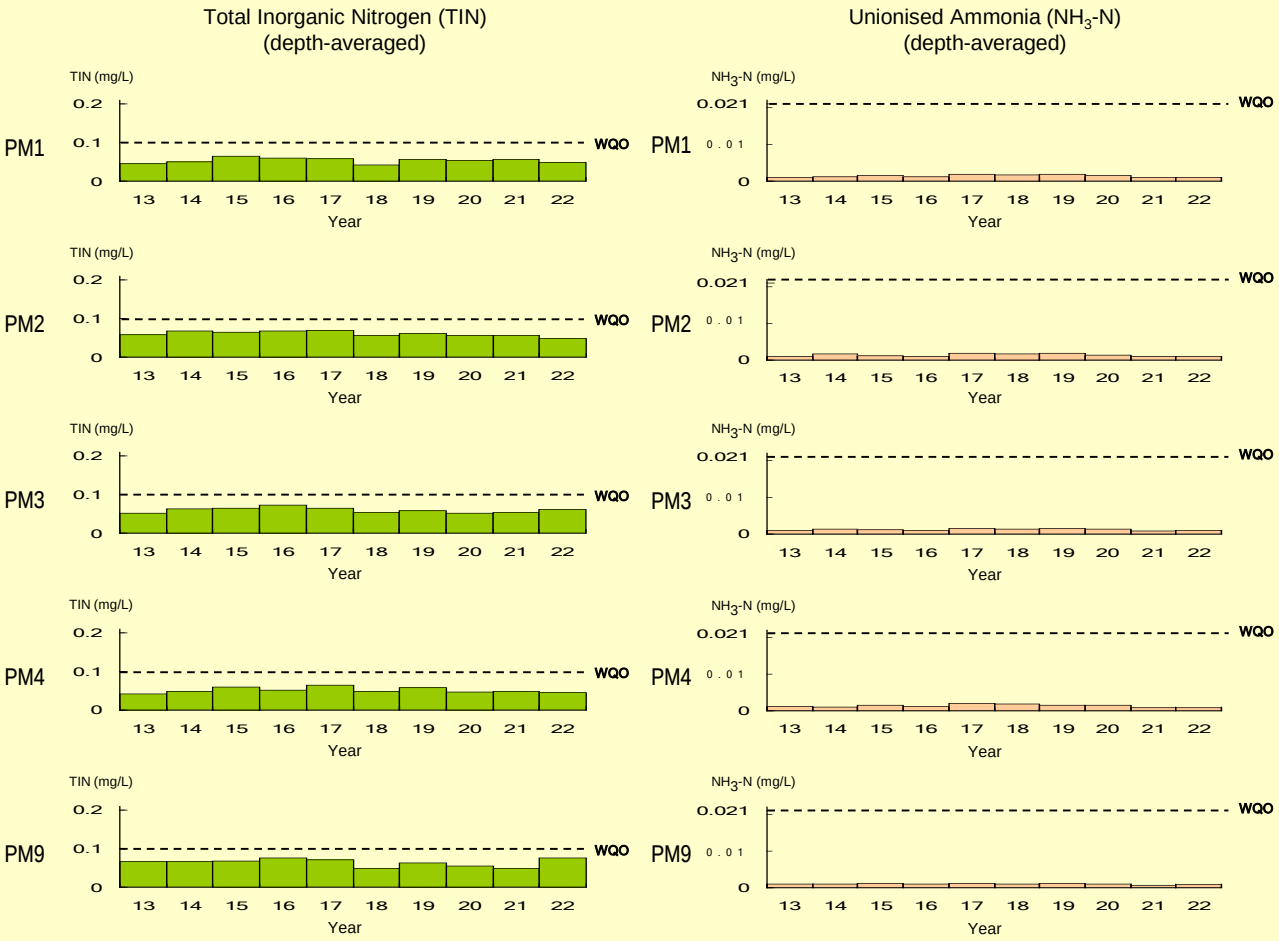
WQO : 90% sample with depth-averaged DO ≥ 4 mg/L

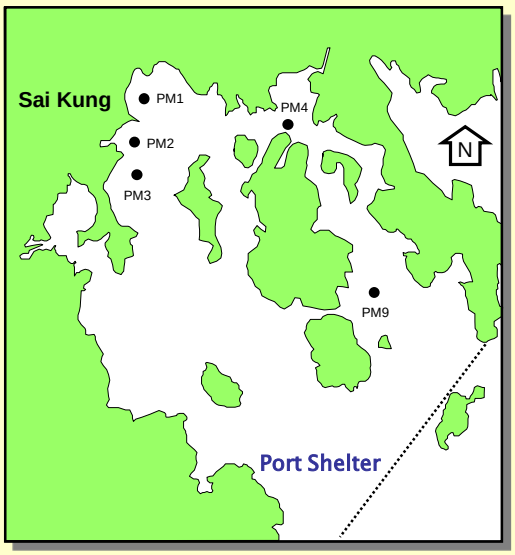
% sample with depth-averaged DO ≥ 4 mg/L



Non-compliance

WQO compliance rates for the Port Shelter WCZ (continued)





Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN $\leq$ 0.1 mg/L

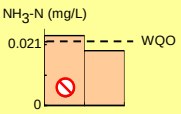
annual mean for depth-averaged TIN

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

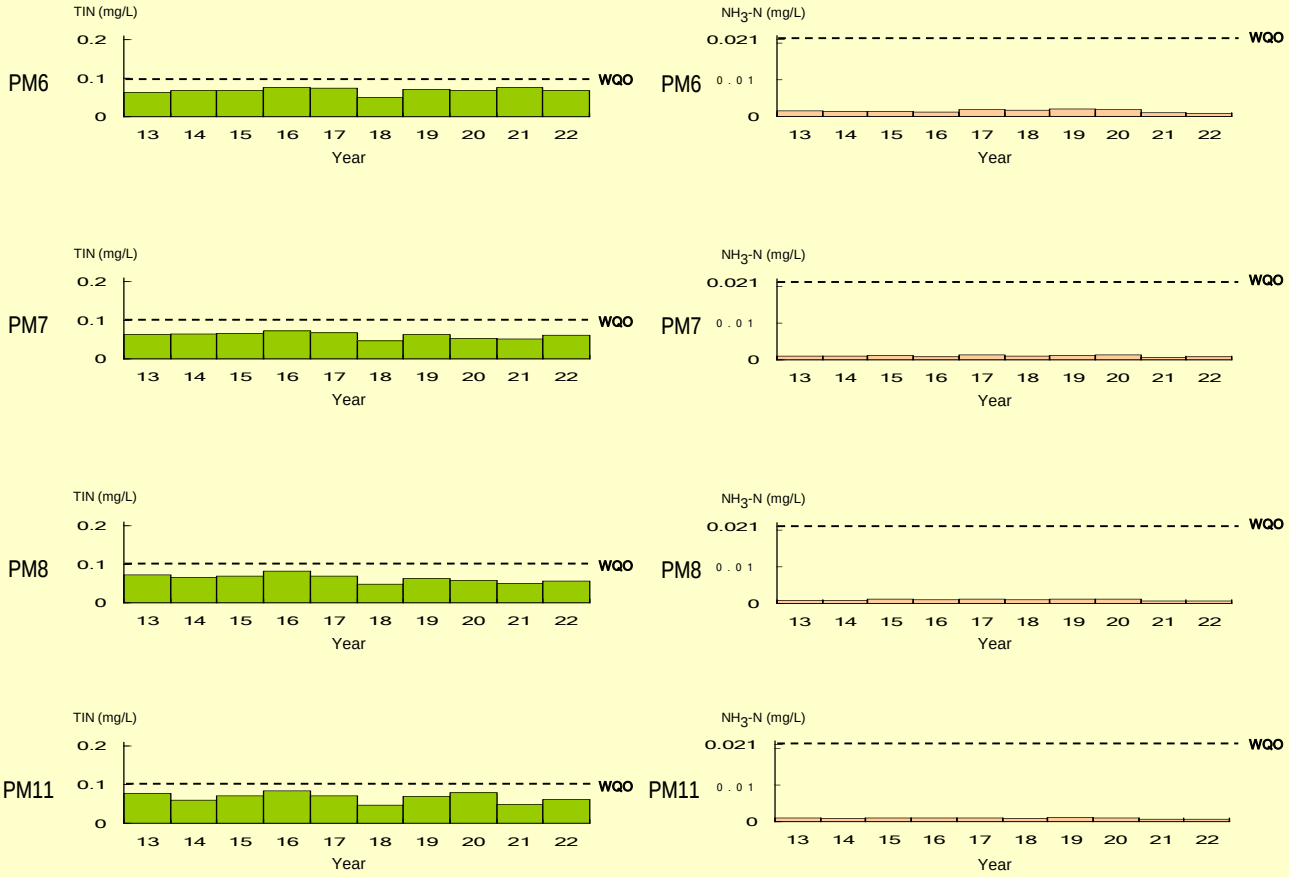
Non-compliance

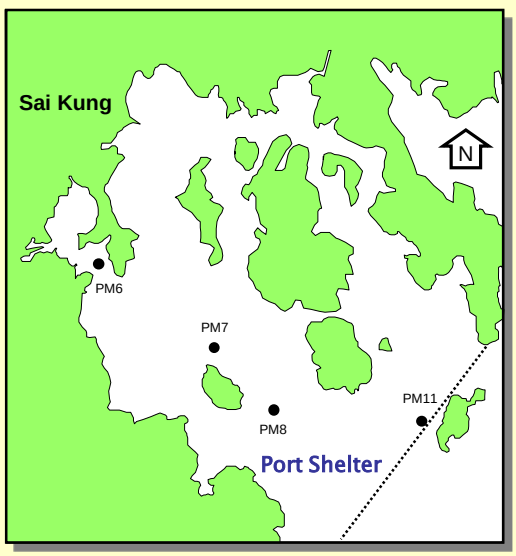


WQO compliance rates for the Port Shelter WCZ (continued)

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

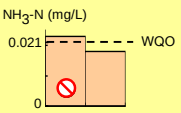
annual mean for depth-averaged TIN

Unionised Ammonia (NH_3-N)

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

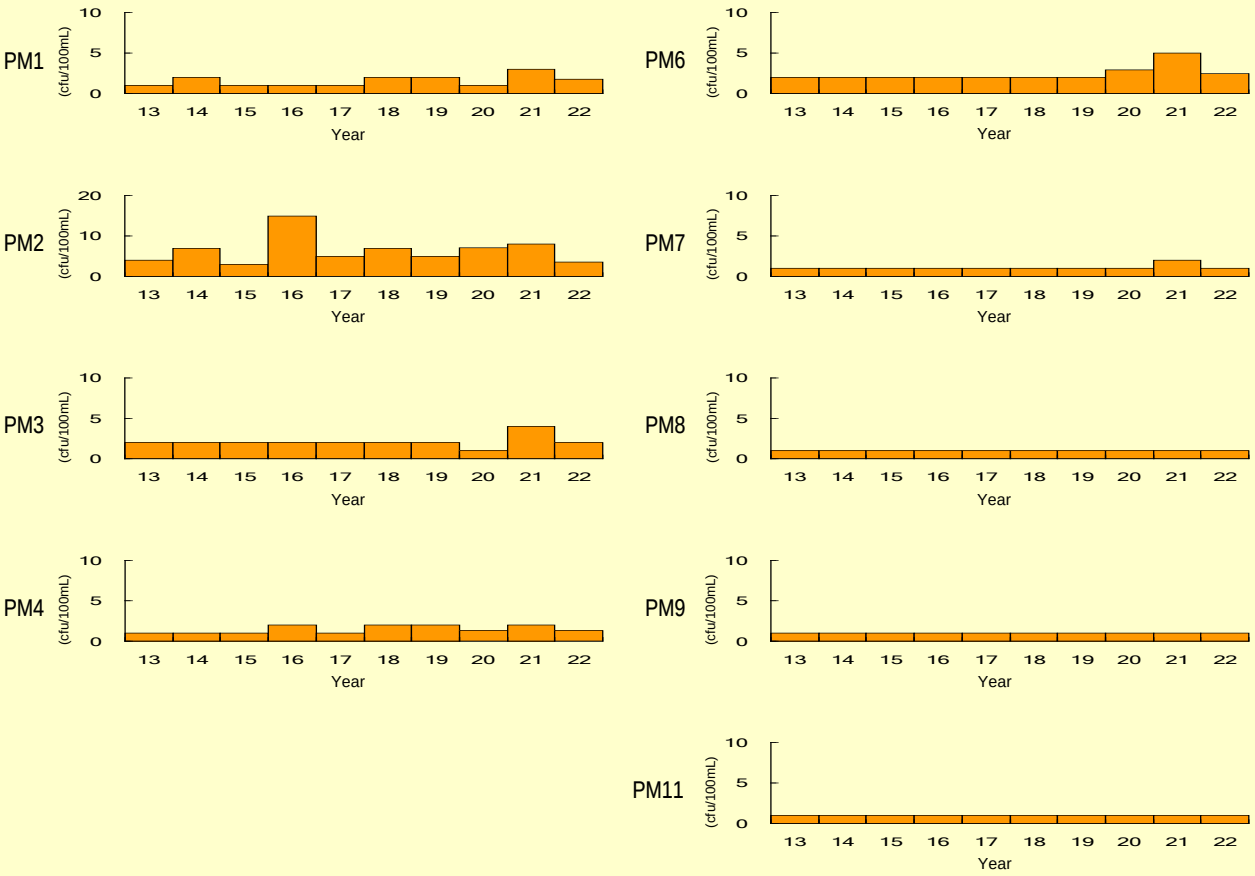
annual mean for depth-averaged NH_3-N

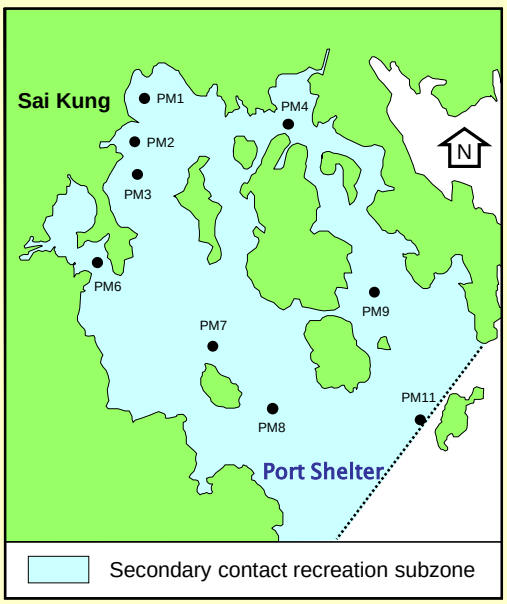
Non-compliance



WQO compliance rates for the Port Shelter WCZ (continued)

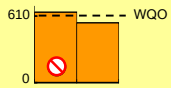
E. coli
(annual geometric mean)





E. coli

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

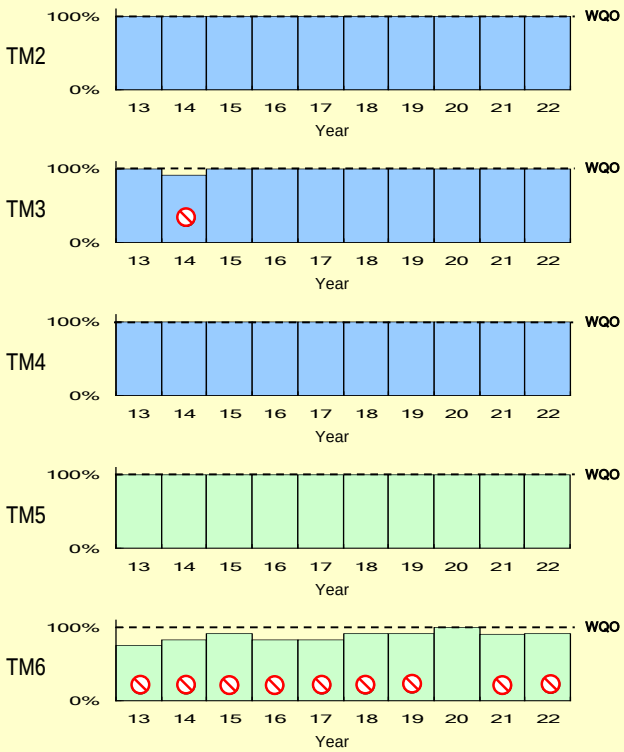


annual geometric mean for depth averaged
E. coli (cfu/100mL)

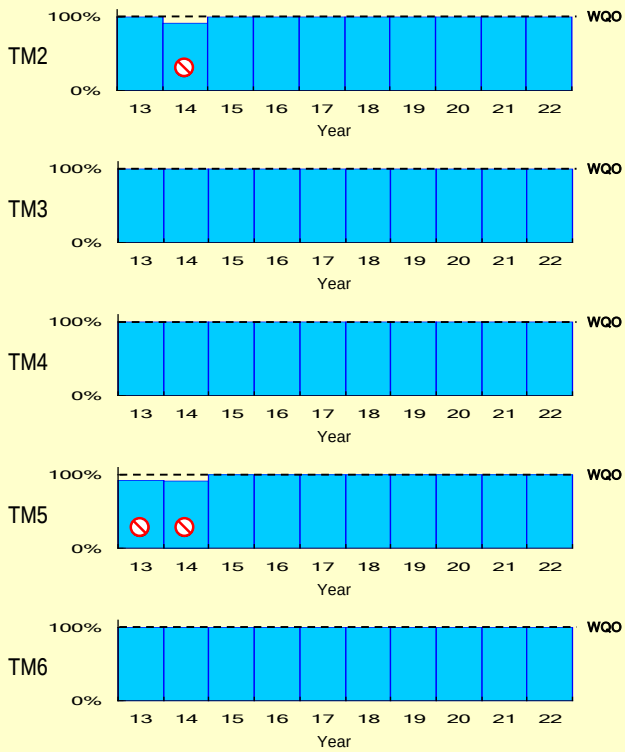
Non-compliance

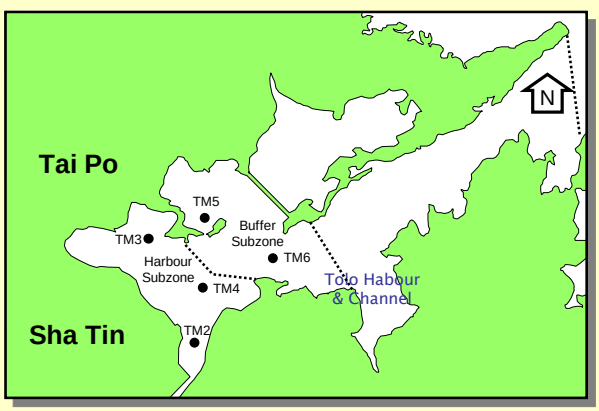
WQO compliance rates for the Tolo Harbour and Channel WCZ

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(water column average)





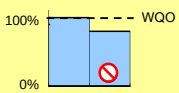
Dissolved Oxygen (DO)

Harbour Subzone (TM2 - TM4)

1. Bottom

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

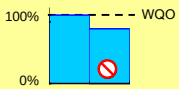
% sample with bottom DO ≥ 2 mg/L



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

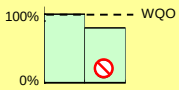


Buffer Subzone (TM5 - TM6)

1. Bottom

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

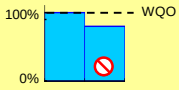
% sample with bottom DO ≥ 3 mg/L



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

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

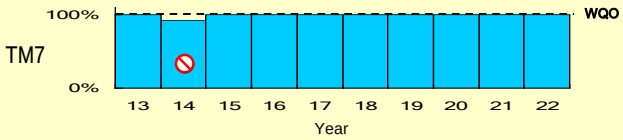
% sample with water column average DO ≥ 4 mg/L

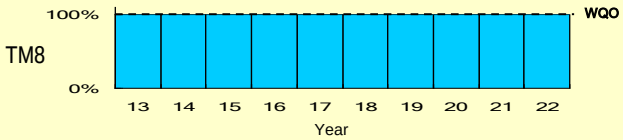


Non-compliance

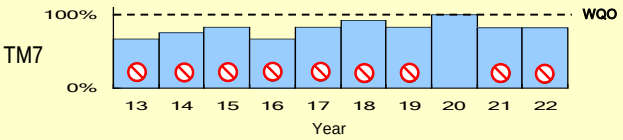
WQO compliance rates for the Tolo Harbour and Channel WCZ (continued)

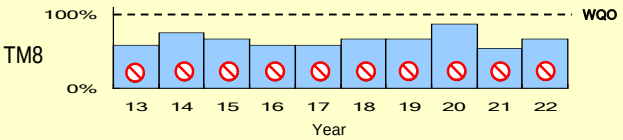
Dissolved Oxygen (DO)
(surface)



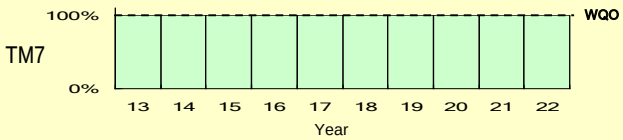


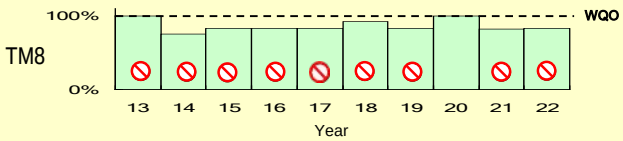
Dissolved Oxygen (DO)
(bottom)





Dissolved Oxygen (DO)
(middle)





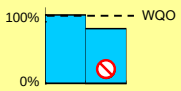
Dissolved Oxygen (DO)

Channel Subzone (TM7 - TM8)

1. Surface

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

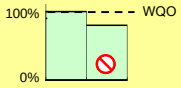
% sample with surface DO ≥ 4 mg/L



2. Middle

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

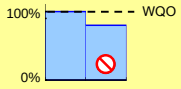
% sample with middle DO ≥ 4 mg/L



3. Bottom

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

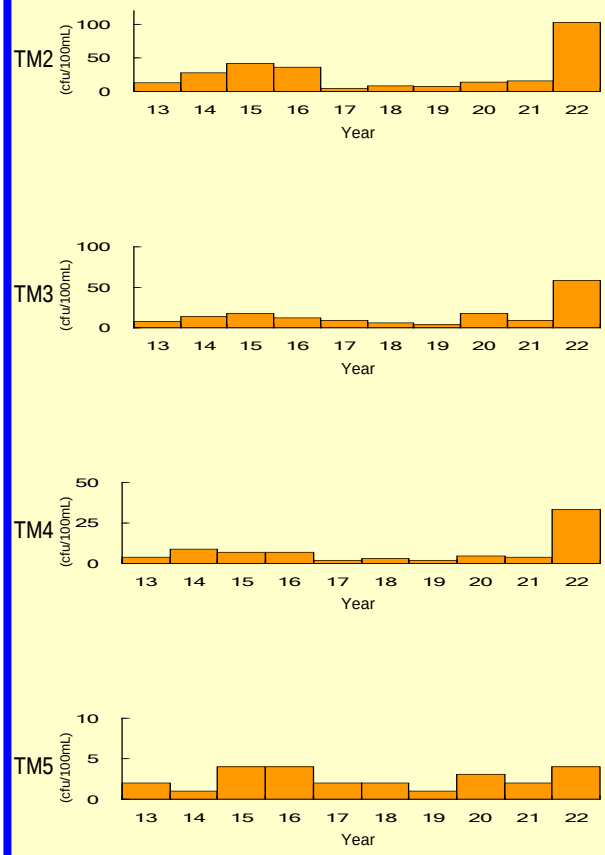
% sample with bottom DO ≥ 4 mg/L

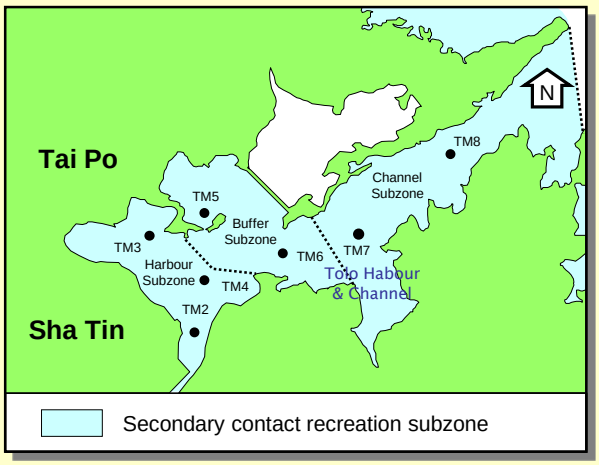


Non-compliance

WQO compliance rates for the Tolo Harbour and Channel WCZ (continued)

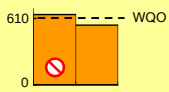
E. coli
(annual geometric mean)





E. coli

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



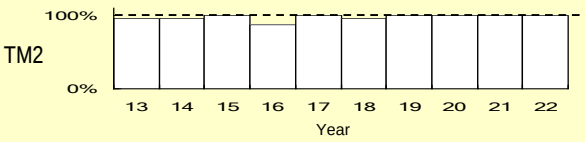
annual geometric mean for depth averaged *E. coli* (cfu/100mL)

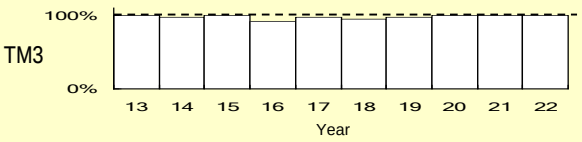
Non-compliance

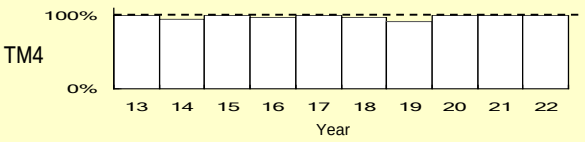
WQO compliance rates of chlorophyll-*a* levels for the Tolo Harbour and Channel WCZ

Chlorophyll-*a*

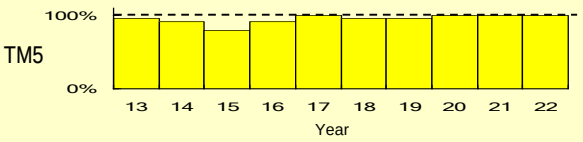
1. Harbour Subzone

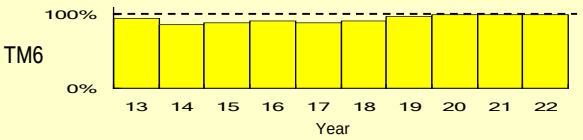




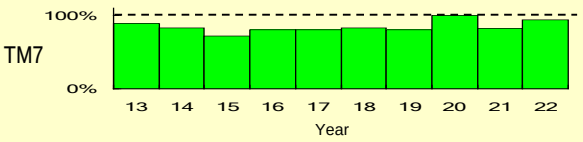


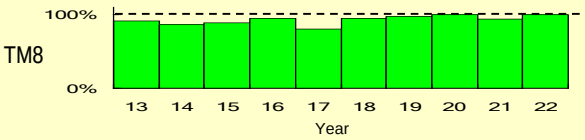
2. Buffer Subzone

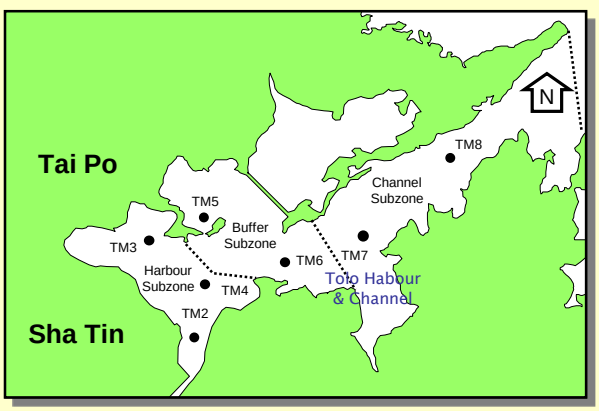




3. Channel Subzone







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

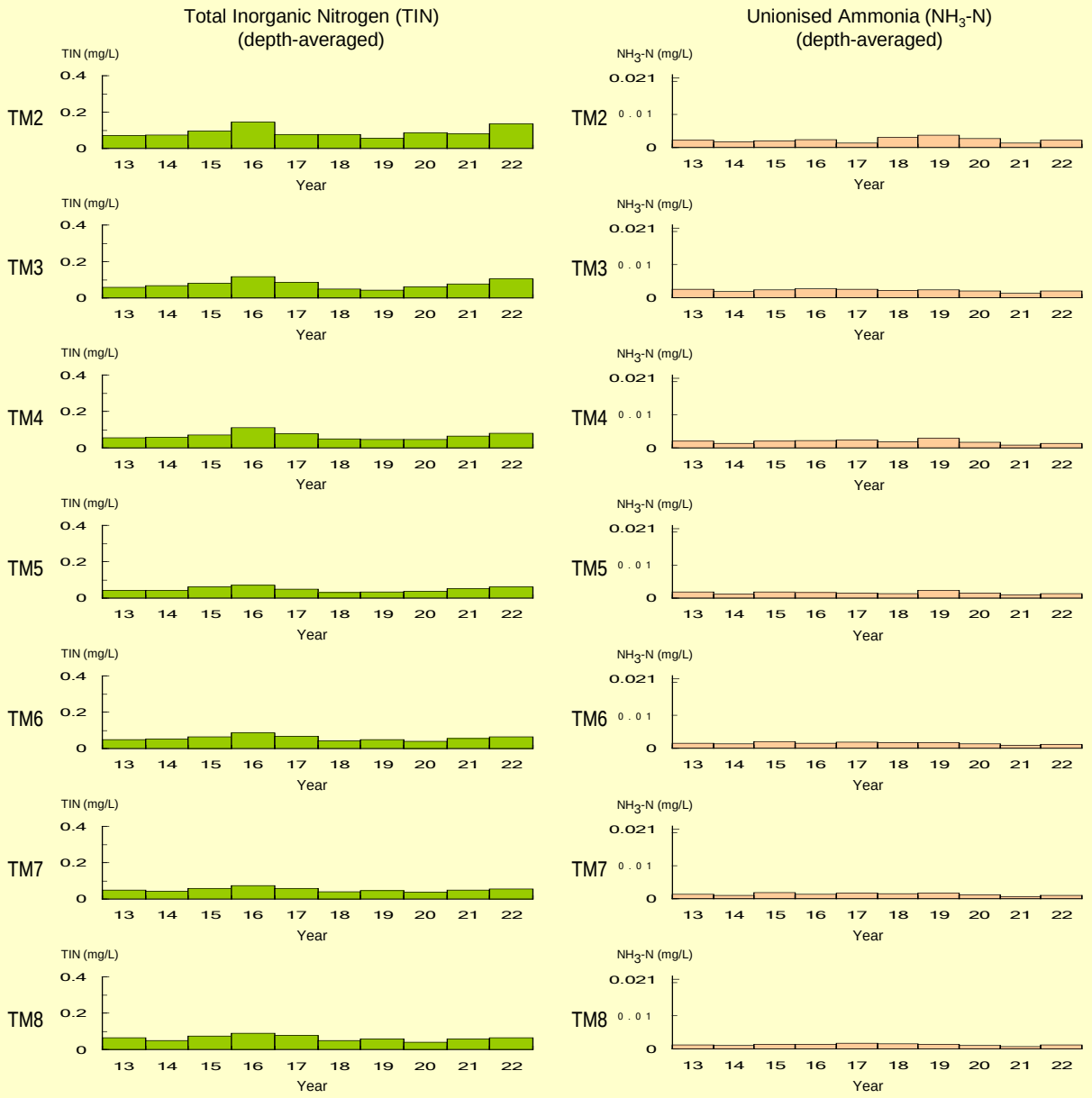
WQO : Chlorophyll-*a* ≤ 10 μg/L

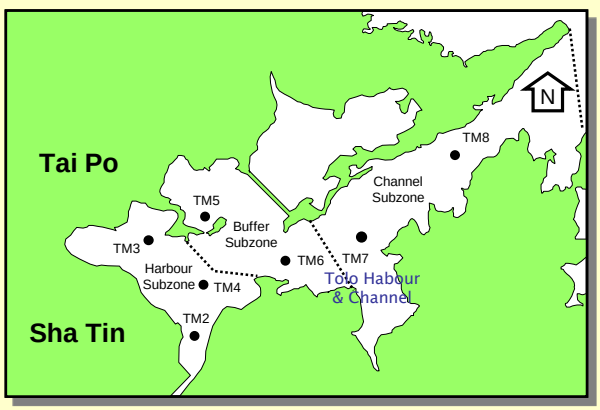
3. Channel Subzone

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

WQO : Chlorophyll-*a* ≤ 6 μg/L

Total inorganic nitrogen and unionised ammonia levels in the Tolo Harbour and Channel WCZ





Total Inorganic Nitrogen (TIN)

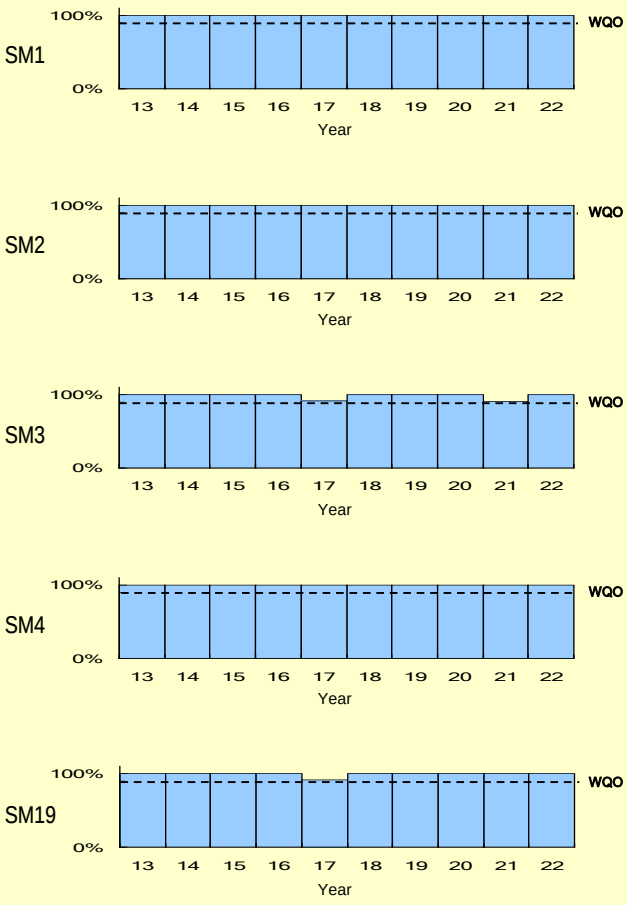
annual mean for depth-averaged TIN (mg/L)

Unionised Ammonia (NH_3-N)

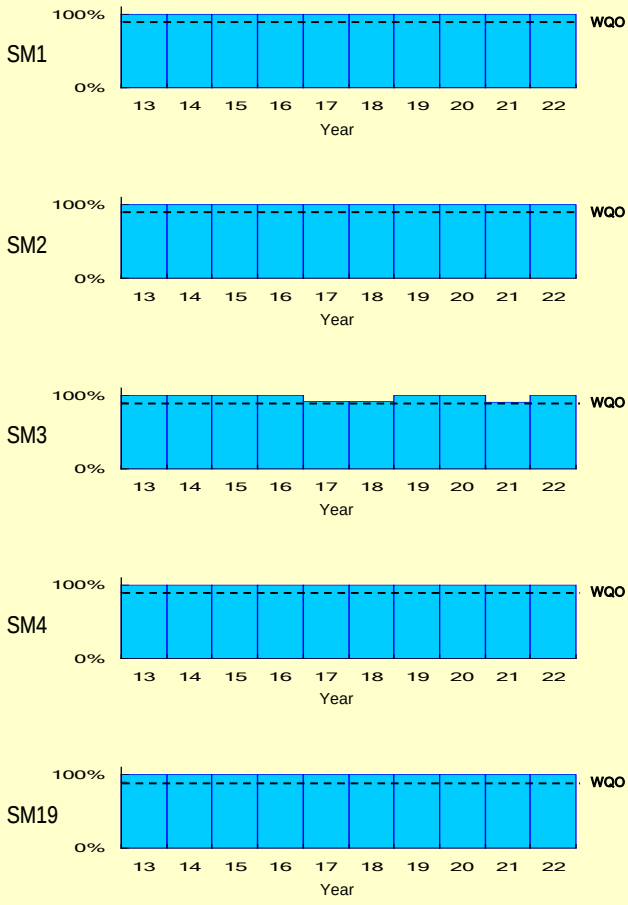
annual mean for depth-averaged NH_3-N (mg/L)

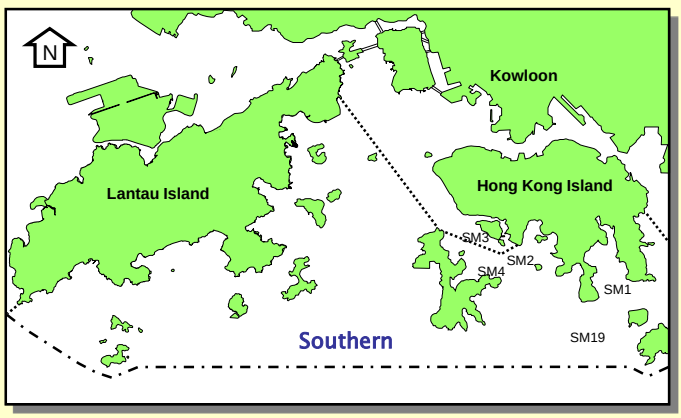
WQO compliance rates for the Southern WCZ

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)



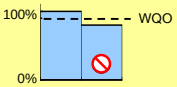


Dissolved Oxygen (DO)

1. Bottom

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

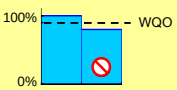
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

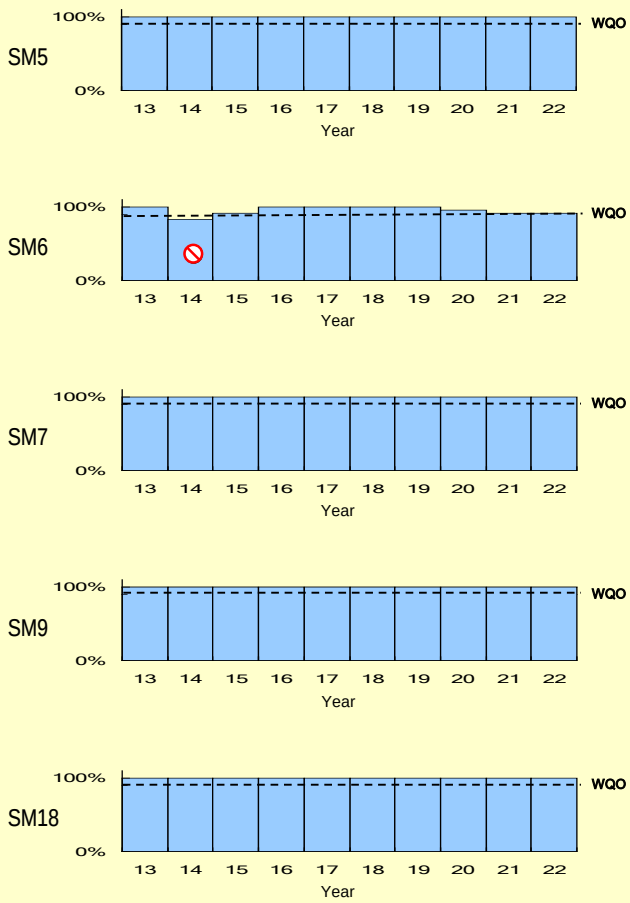
% sample with depth-averaged DO ≥ 4 mg/L



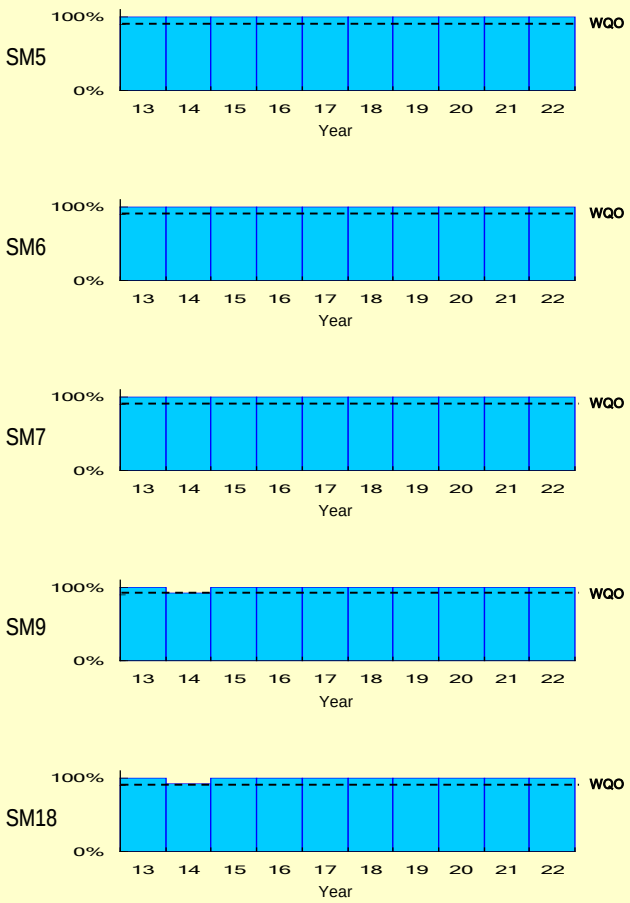
Non-compliance

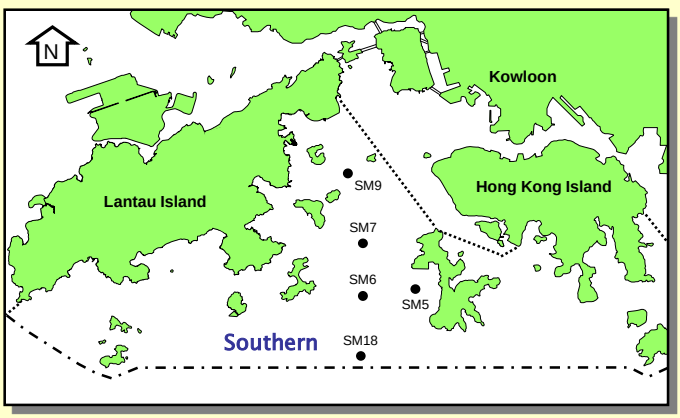
WQO compliance rates for the Southern WCZ (continued)

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)



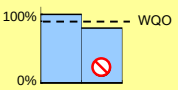


Dissolved Oxygen (DO)

1. Bottom

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

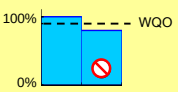
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

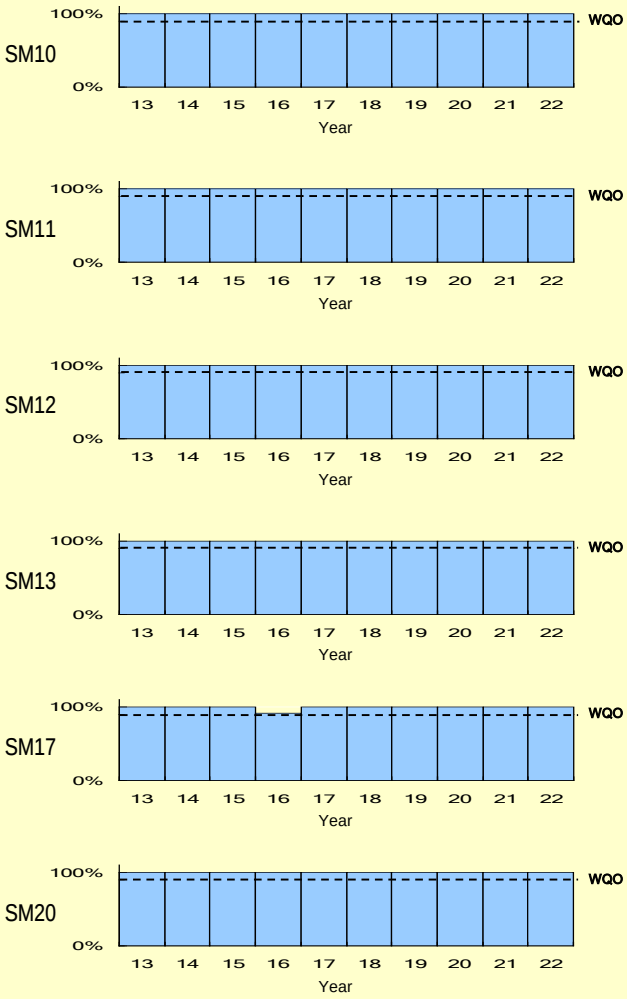
% sample with depth-averaged DO ≥ 4 mg/L



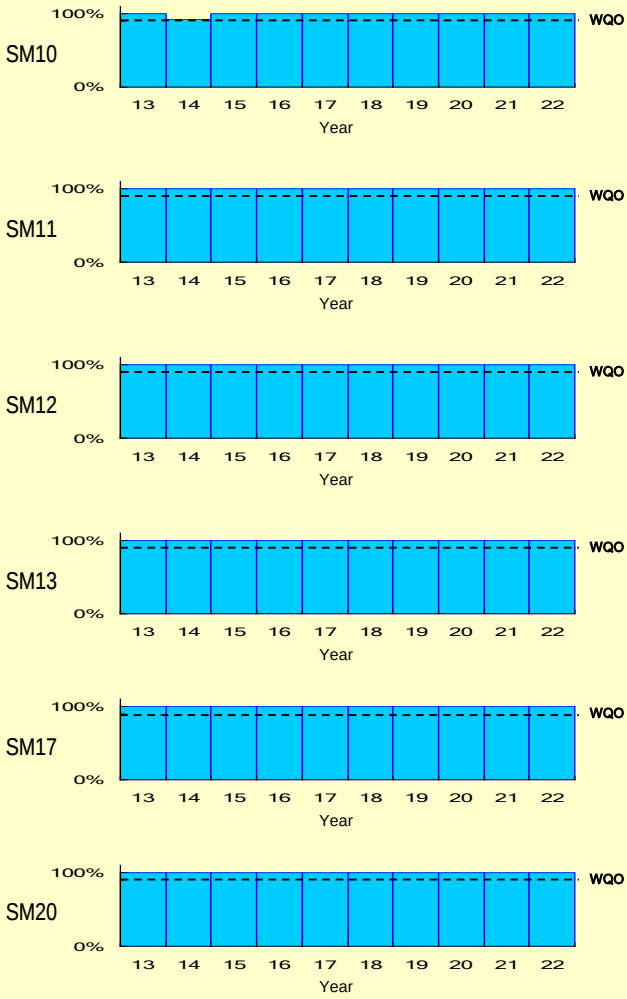
Non-compliance

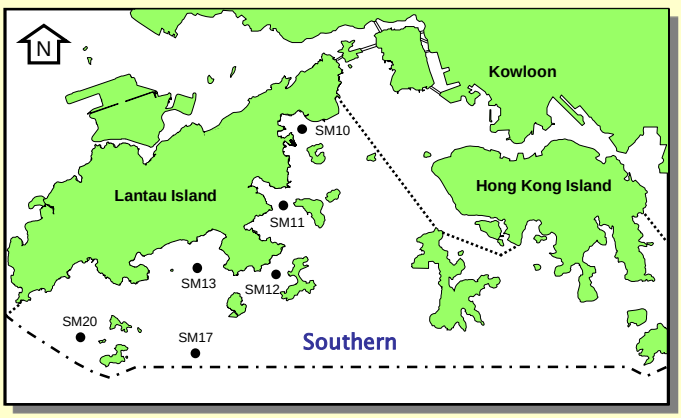
WQO compliance rates for the Southern WCZ (continued)

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)



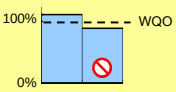


Dissolved Oxygen (DO)

1. Bottom

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

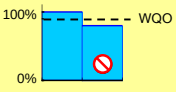
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

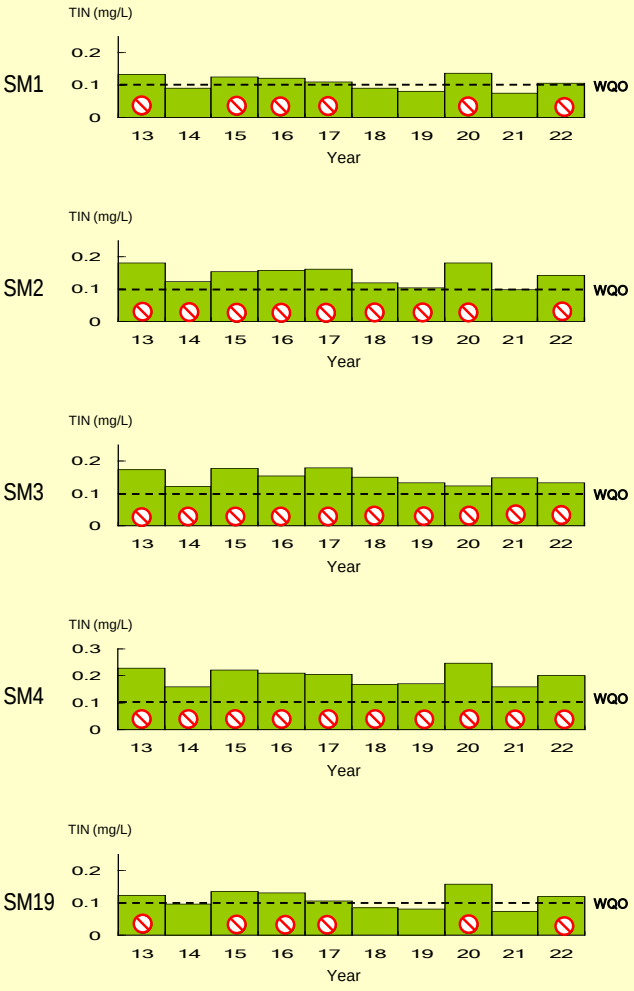
% sample with depth-averaged DO ≥ 4 mg/L



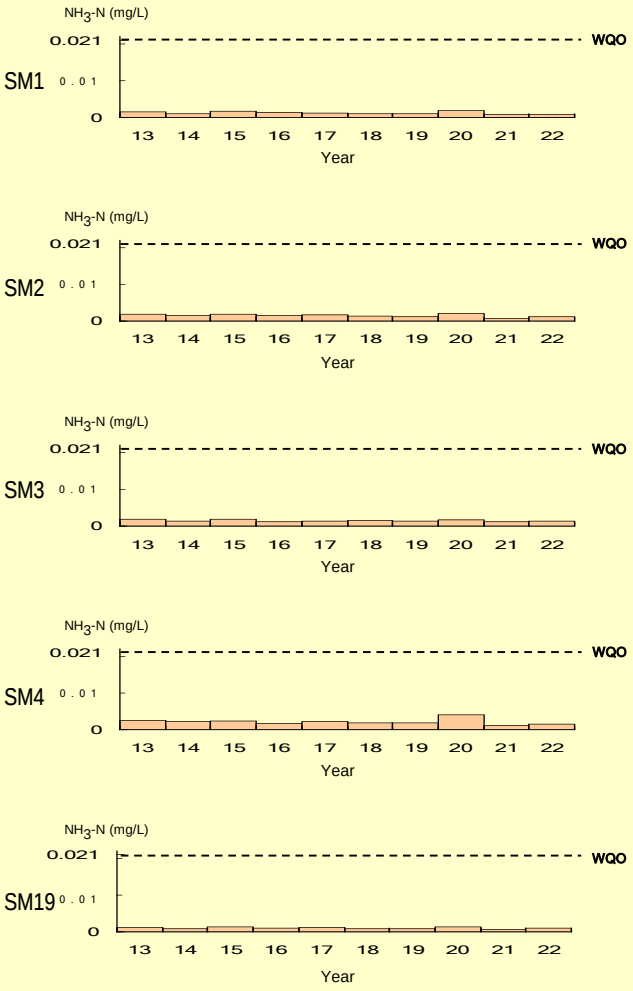
Non-compliance

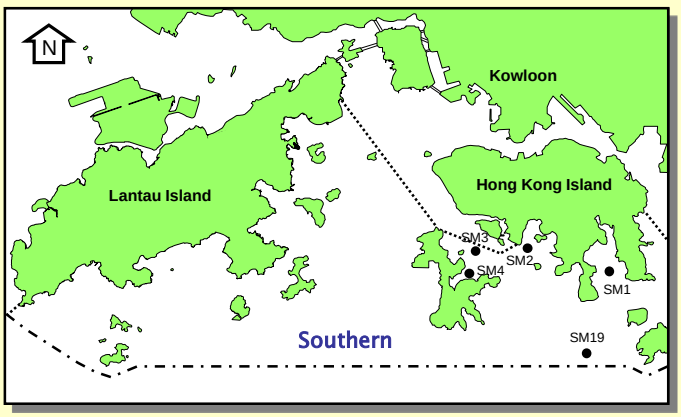
WQO compliance rates for the Southern WCZ (continued)

Total Inorganic Nitrogen (TIN)
(depth-averaged)



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

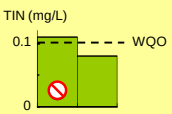




Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN $\leq$ 0.1 mg/L

annual mean for depth-averaged TIN

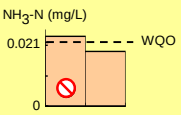


Unionised Ammonia (NH_3-N)

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

annual mean for depth-averaged NH_3-N

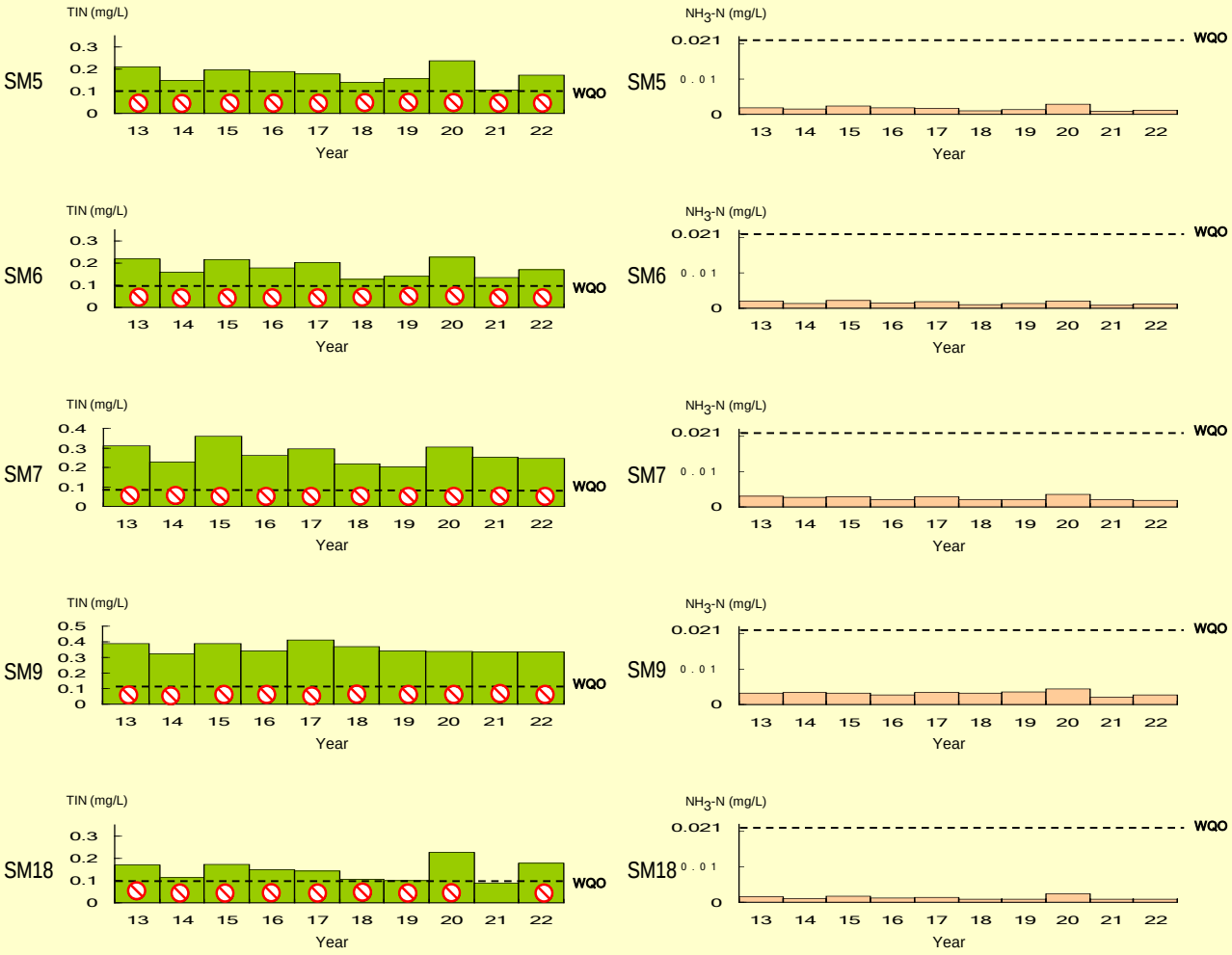
Non-compliance

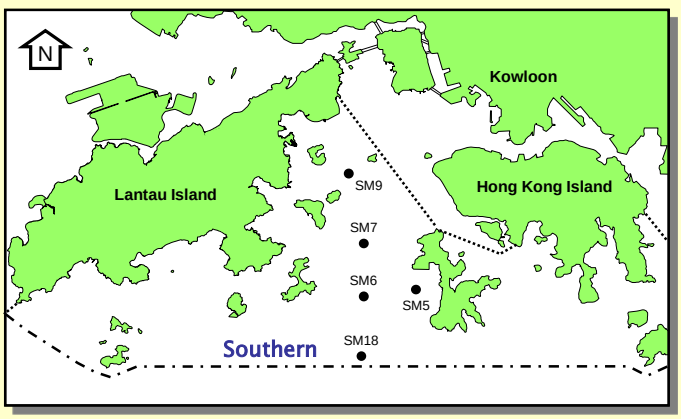


WQO compliance rates for the Southern WCZ (continued)

Total Inorganic Nitrogen (TIN)
(depth-averaged)

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

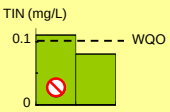




Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN $\leq$ 0.1 mg/L

annual mean for depth-averaged TIN

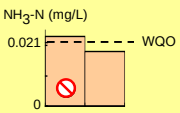


Unionised Ammonia (NH_3-N)

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

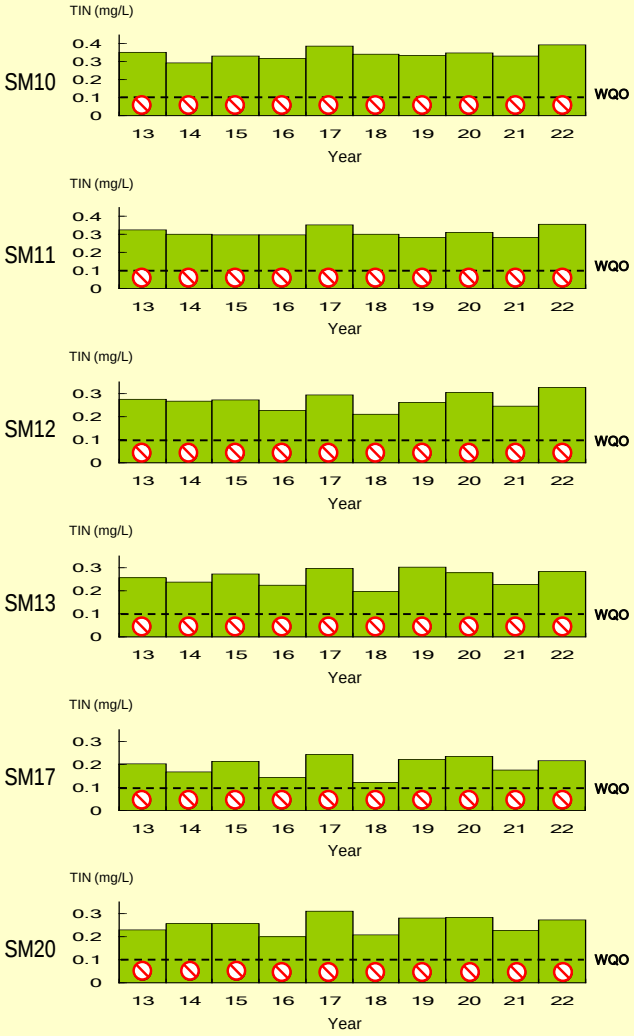
annual mean for depth-averaged NH_3-N

Non-compliance

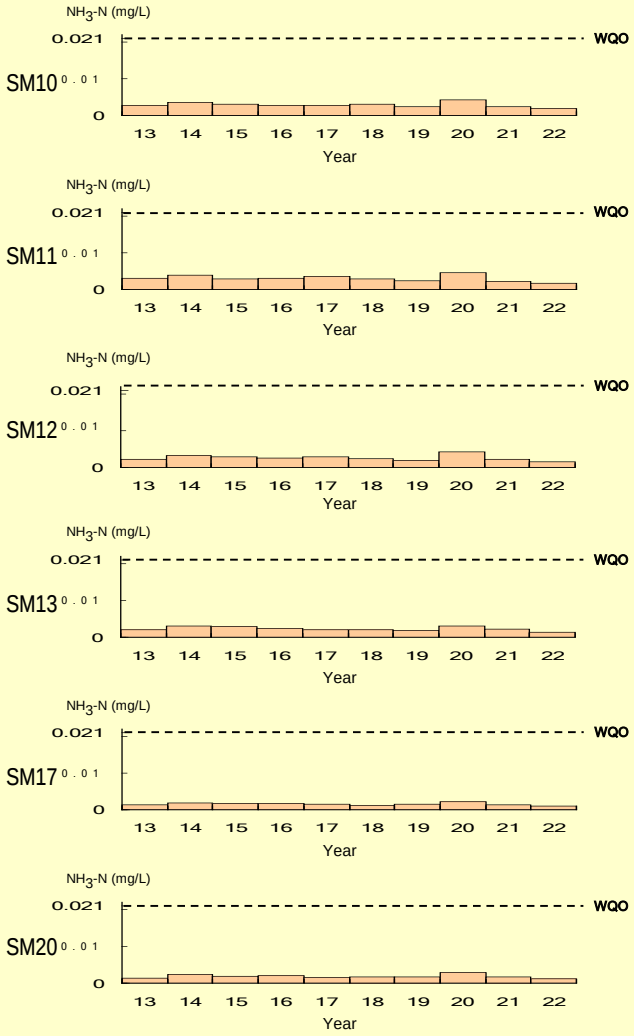


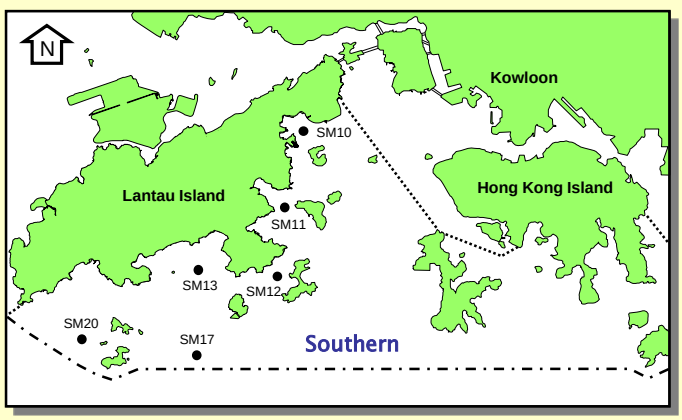
WQO compliance rates for the Southern WCZ (continued)

Total Inorganic Nitrogen (TIN)
(depth-averaged)



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

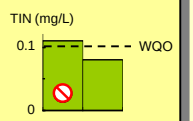




Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN $\leq$ 0.1 mg/L

annual mean for depth-averaged TIN

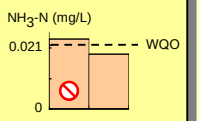


Unionised Ammonia (NH_3-N)

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

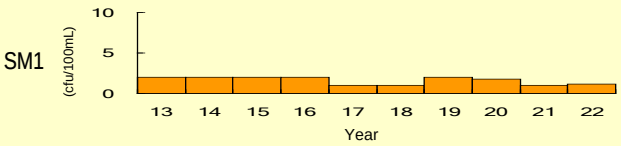
annual mean for depth-averaged NH_3-N

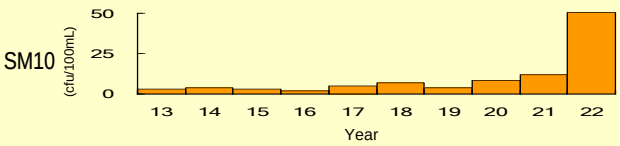
Non-compliance

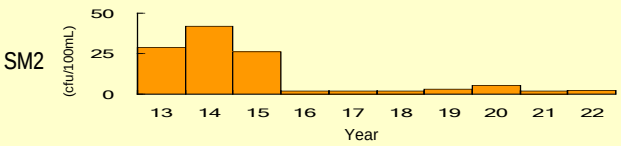


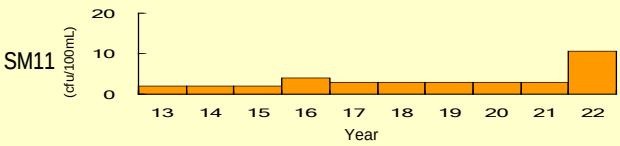
WQO compliance rates for the Southern WCZ (continued)

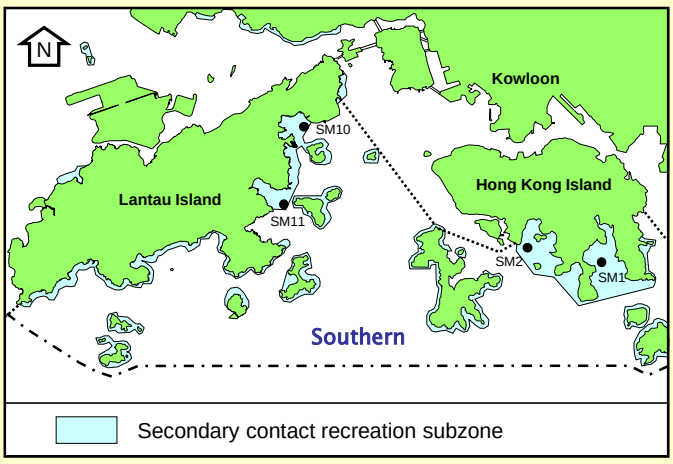
E. coli
(annual geometric mean)









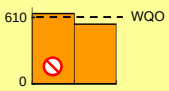


E. coli

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

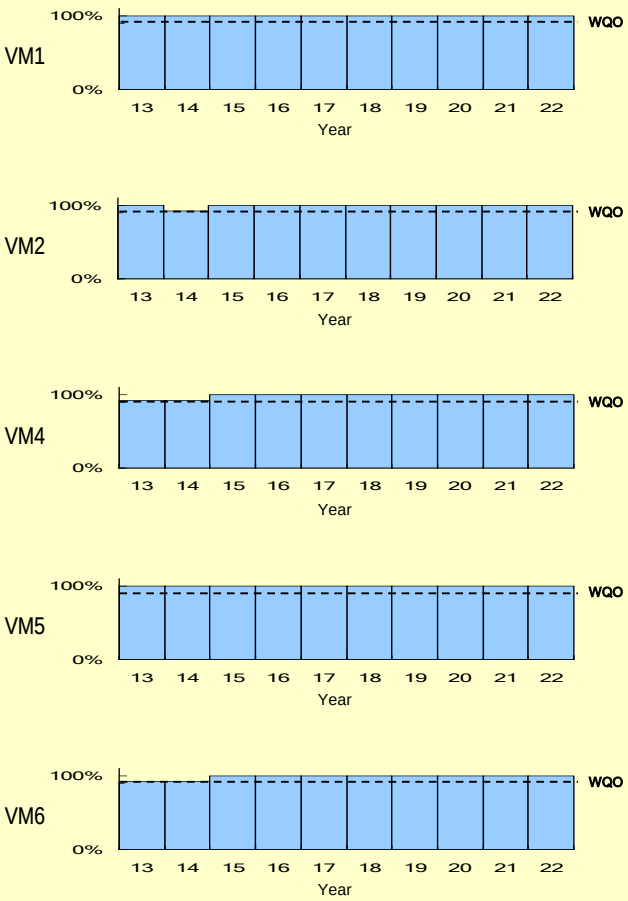
annual geometric mean for depth averaged *E. coli* (cfu/100mL)

Non-compliance

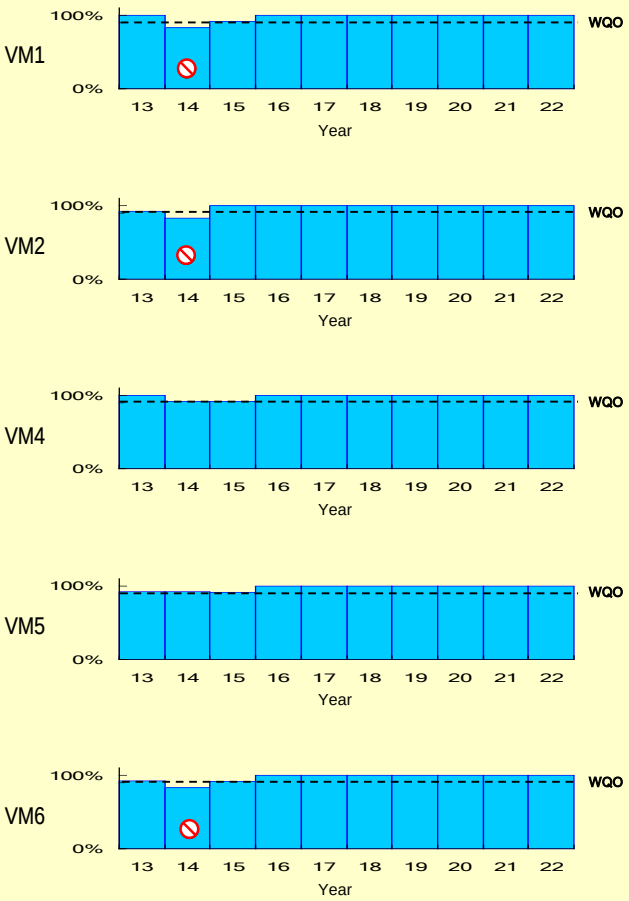


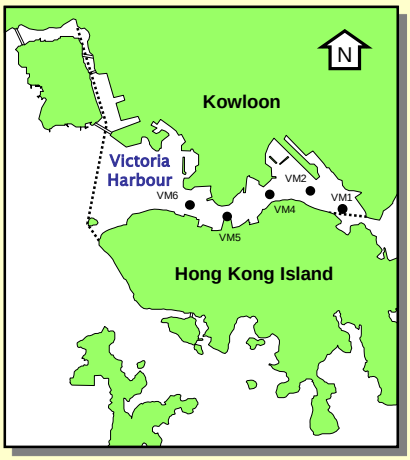
WQO compliance rates for the Victoria Harbour WCZ

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)





Dissolved Oxygen (DO)

1. Bottom

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

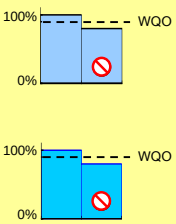
% sample with bottom DO ≥ 2 mg/L

2. Depth-averaged

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

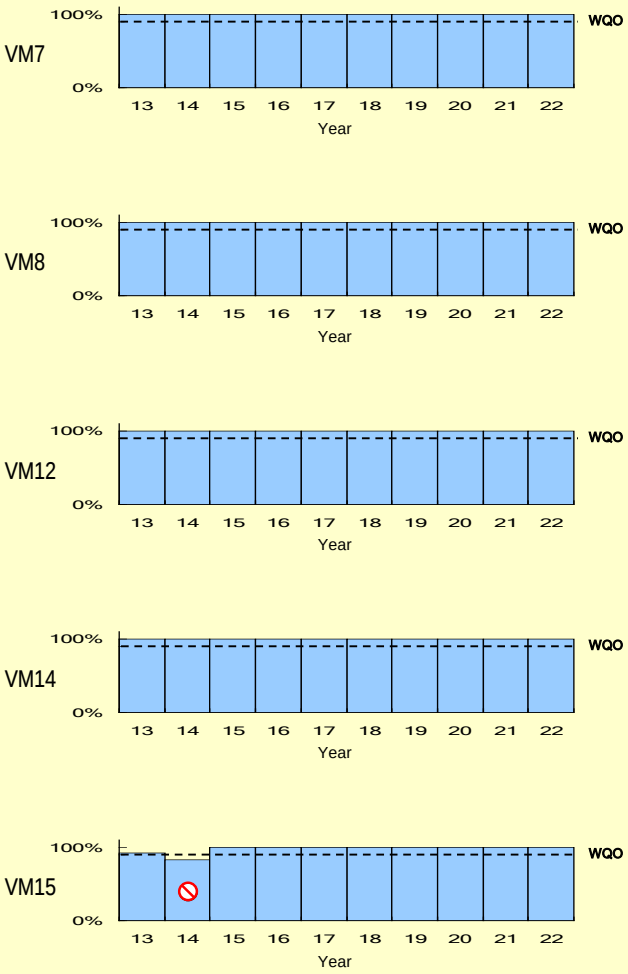
% sample with depth-averaged DO ≥ 4 mg/L

Non-compliance

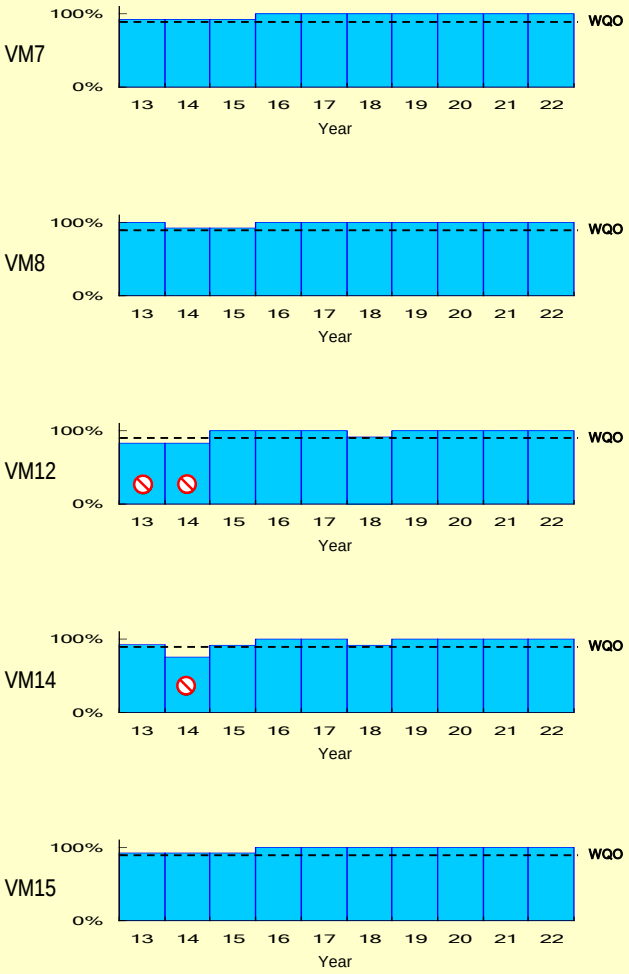


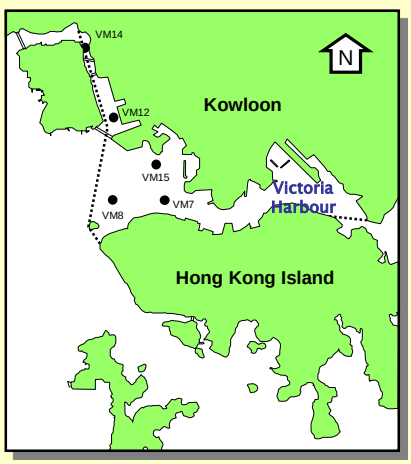
WQO compliance rates for the Victoria Harbour WCZ (continued)

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)



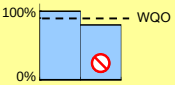


Dissolved Oxygen (DO)

1. Bottom

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

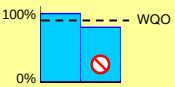
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

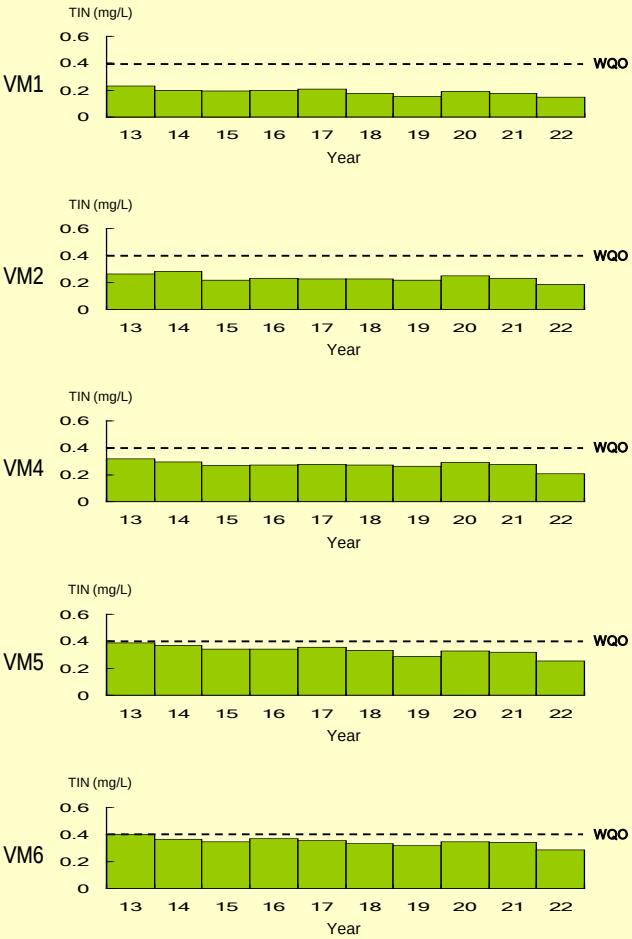
% sample with depth-averaged DO ≥ 4 mg/L



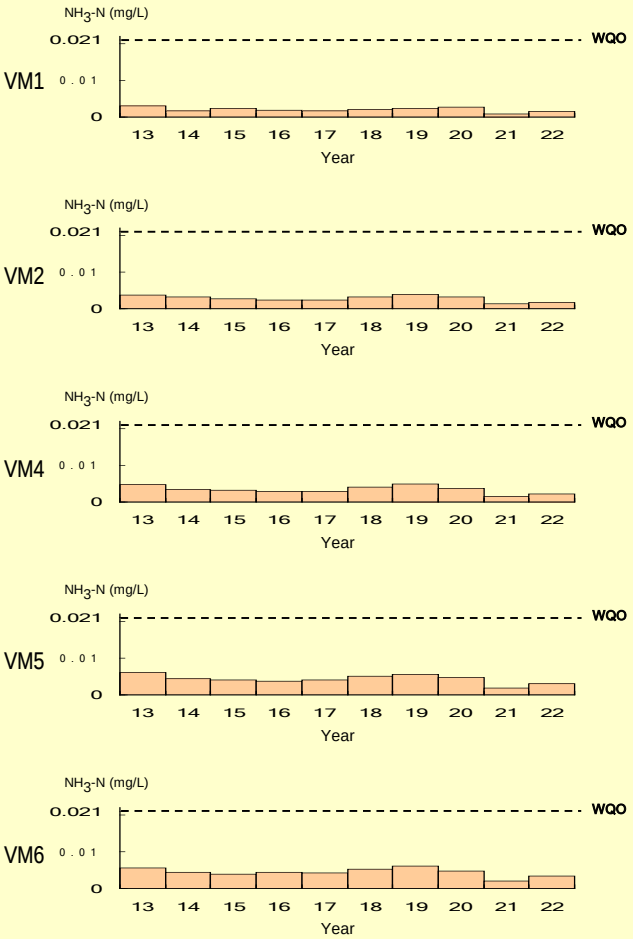
Non-compliance

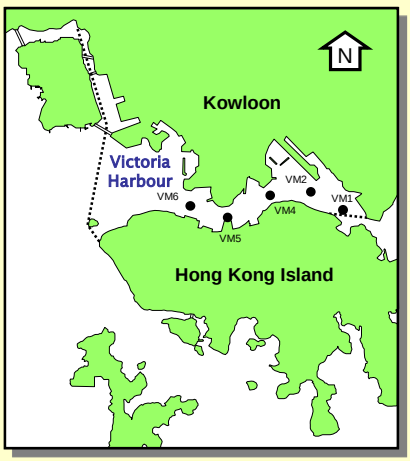
WQO compliance rates for the Victoria Harbour WCZ (continued)

Total Inorganic Nitrogen (TIN)
(depth-averaged)



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

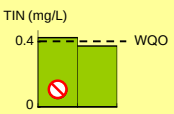




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

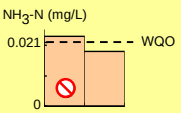


Unionised Ammonia (NH_3-N)

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

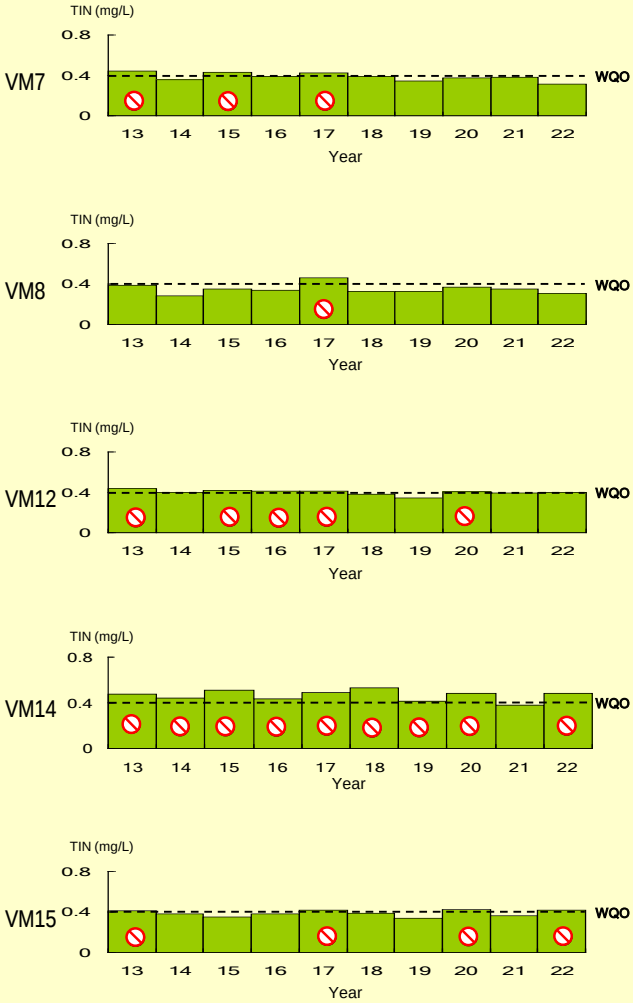
annual mean for depth-averaged NH_3-N

Non-compliance

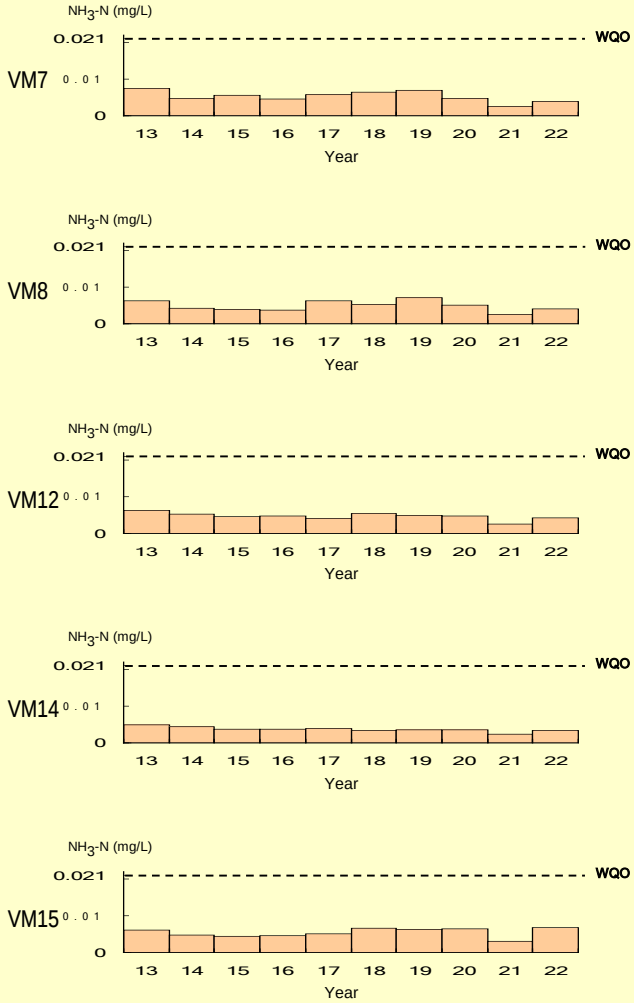


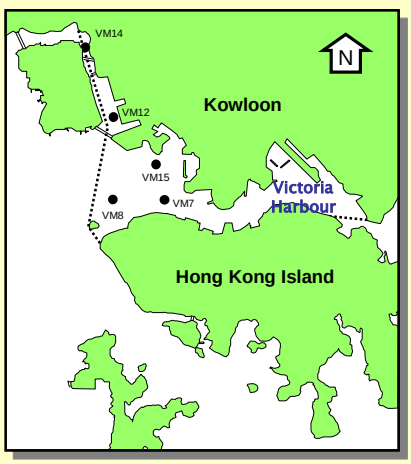
WQO compliance rates for the Victoria Harbour WCZ (continued)

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

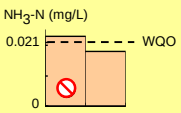
annual mean for depth-averaged TIN

Unionised Ammonia (NH_3-N)

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

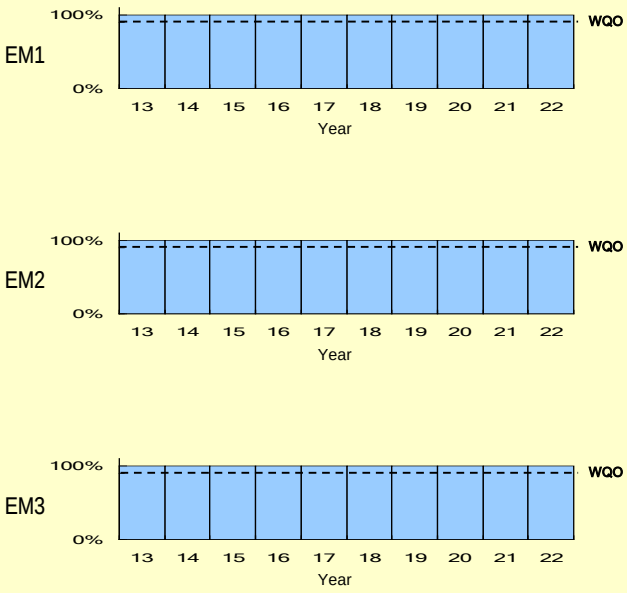
annual mean for depth-averaged NH_3-N

Non-compliance

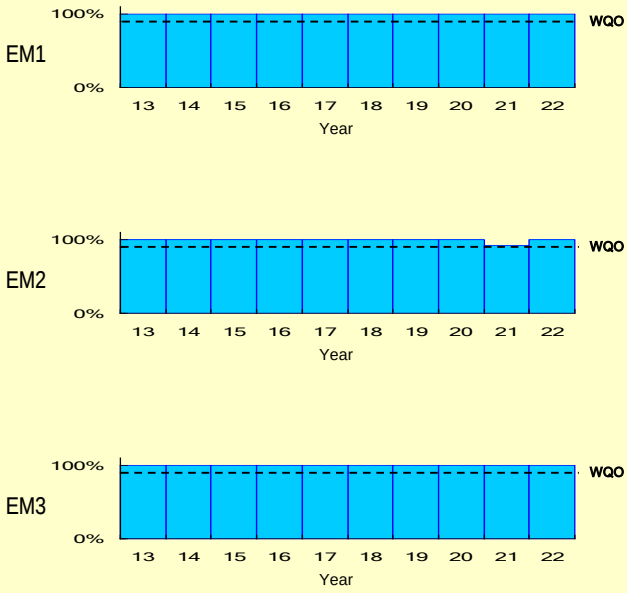


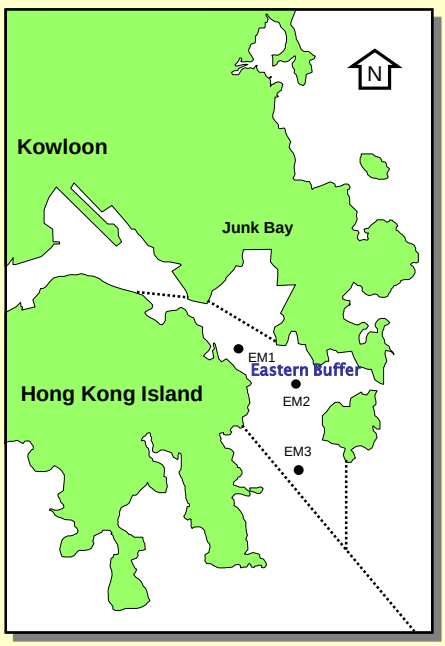
WQO compliance rates for the Eastern Buffer WCZ

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)



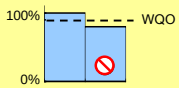


Dissolved Oxygen (DO)

1. Bottom

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

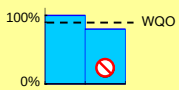
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

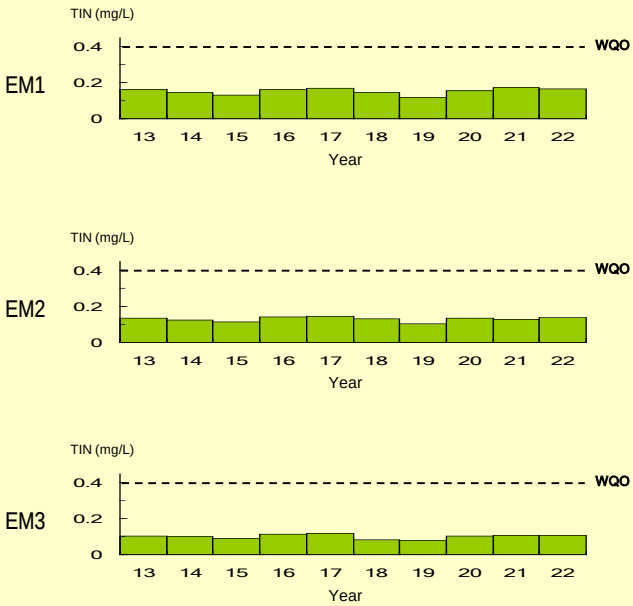
% sample with depth-averaged DO ≥ 4 mg/L



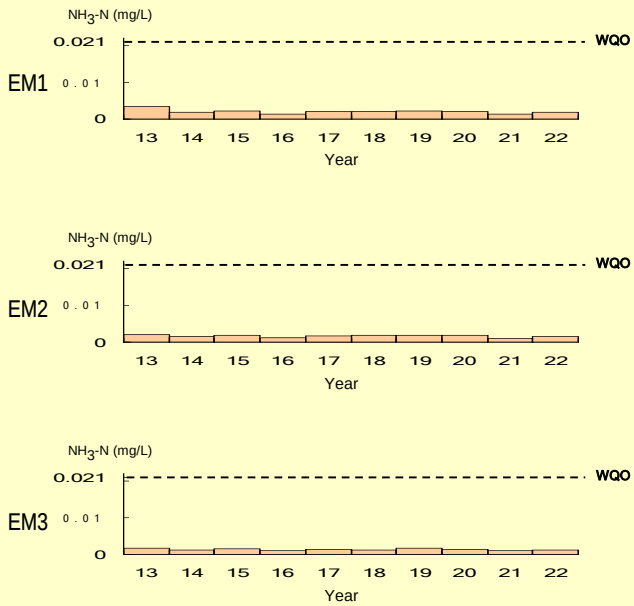
Non-compliance

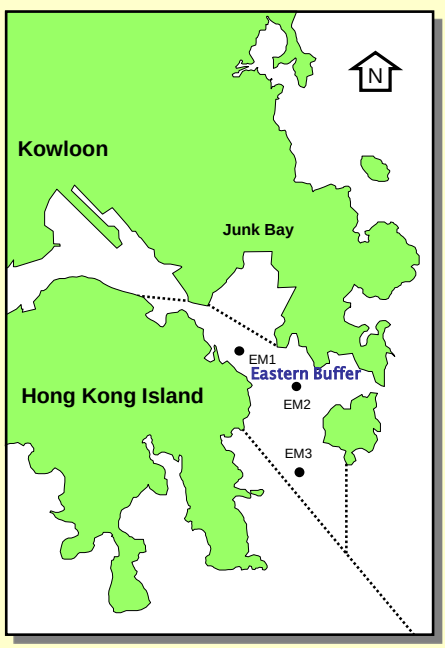
WQO compliance rates for the Eastern Buffer WCZ (continued)

Total Inorganic Nitrogen (TIN)
(depth-averaged)



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





Total Inorganic Nitrogen (TIN)

WQO : annual mean for depth-averaged TIN $\leq$ 0.4 mg/L

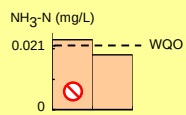
annual mean for depth-averaged TIN

Unionised Ammonia (NH_3-N)

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

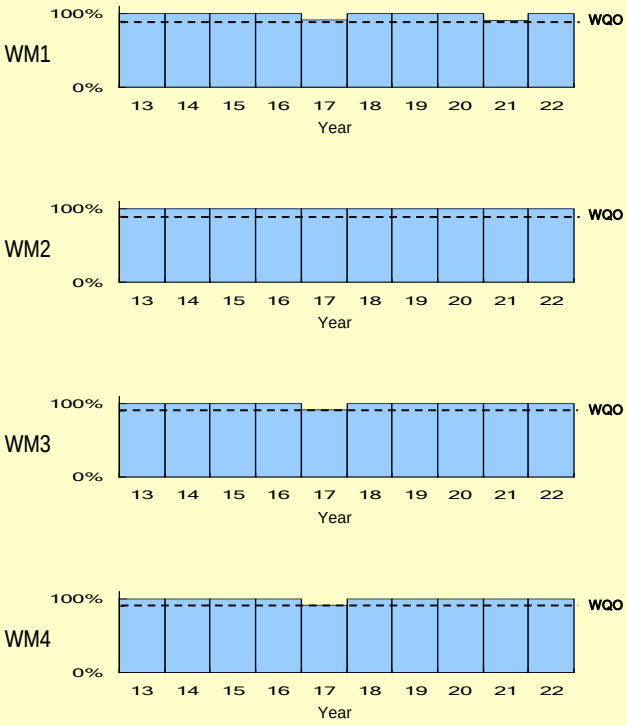
annual mean for depth-averaged NH_3-N

Non-compliance

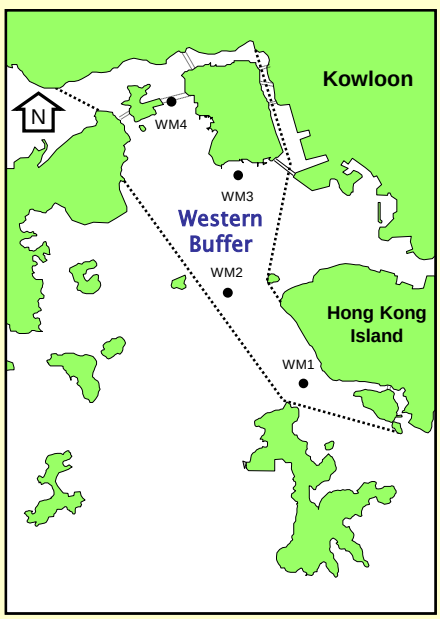


WQO compliance rates for the Western Buffer WCZ

Dissolved Oxygen (DO)
(bottom)



Dissolved Oxygen (DO)
(depth-averaged)

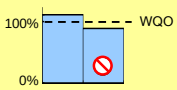


Dissolved Oxygen (DO)

1. Bottom

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

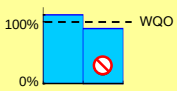
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

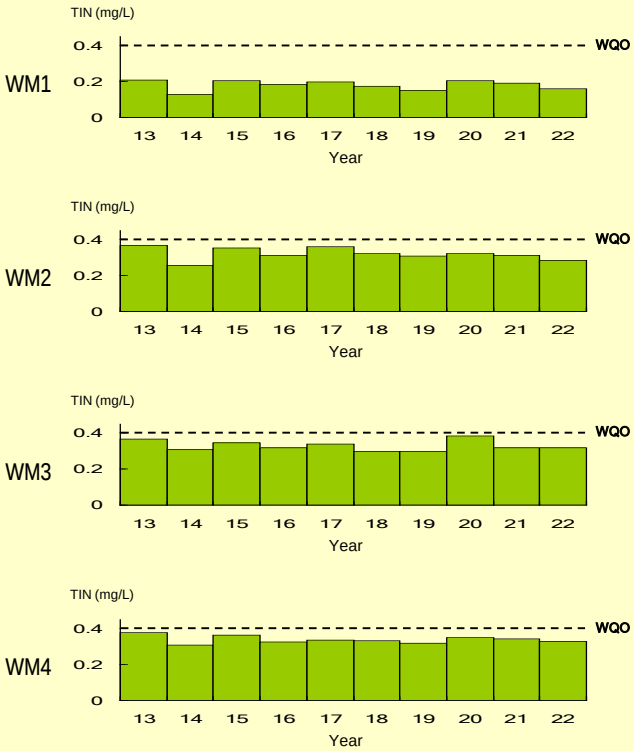
% sample with depth-averaged DO ≥ 4 mg/L



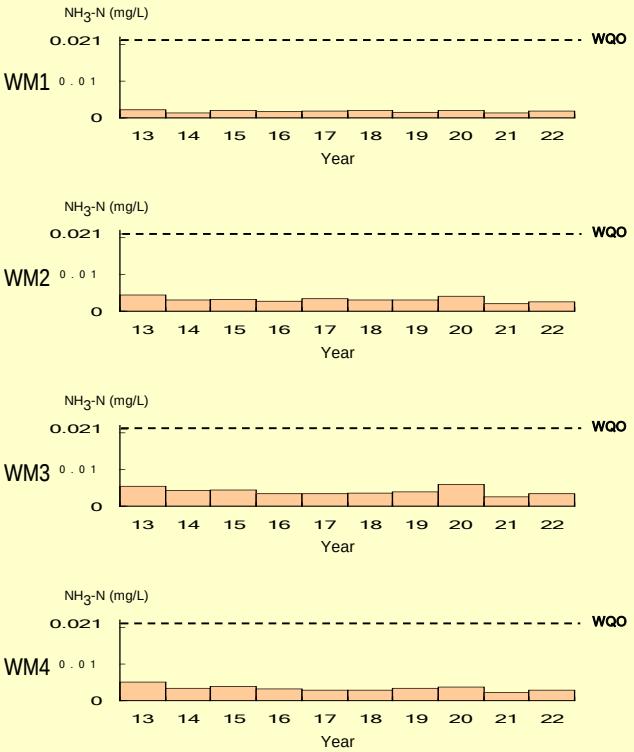
Non-compliance

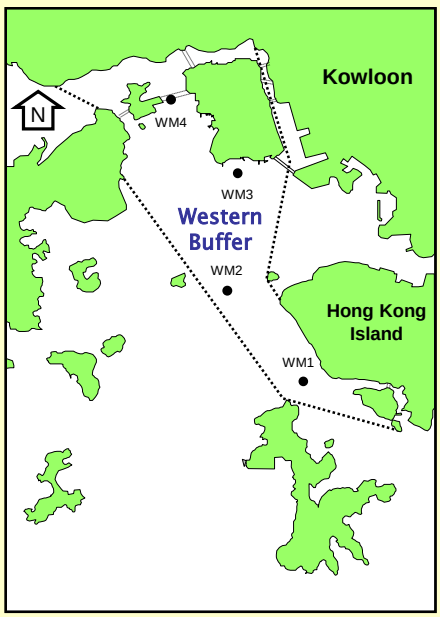
WQO compliance rates for the Western Buffer WCZ (continued)

Total Inorganic Nitrogen (TIN)
(depth-averaged)



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

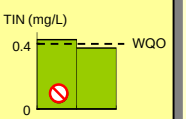




Total Inorganic Nitrogen (TIN)

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

annual mean for depth-averaged TIN

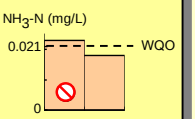


Unionised Ammonia (NH_3-N)

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

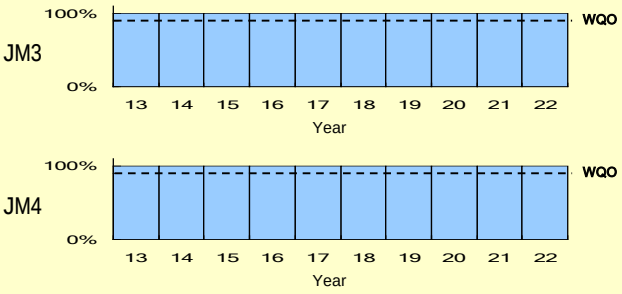
annual mean for depth-averaged NH_3-N

Non-compliance

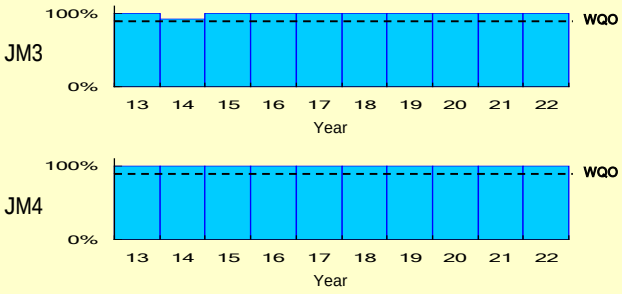


WQO compliance rates for the Junk Bay WCZ

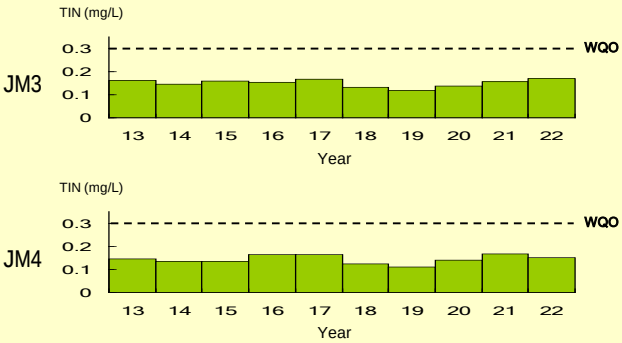
Dissolved Oxygen (DO)
(bottom)



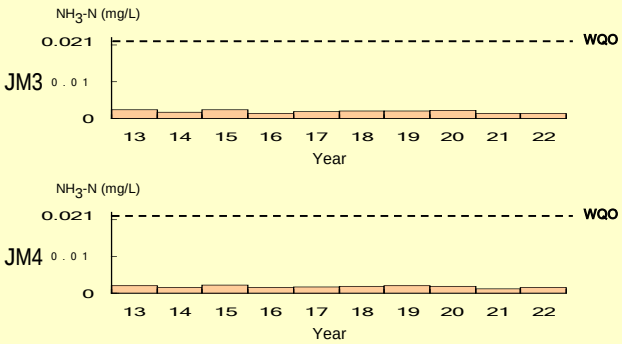
Dissolved Oxygen (DO)
(depth-averaged)

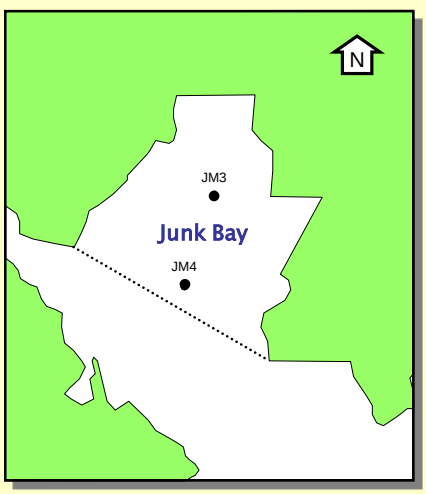


Total Inorganic Nitrogen (TIN)
(depth-averaged)



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



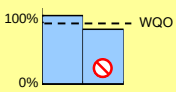


Dissolved Oxygen (DO)

1. Bottom

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

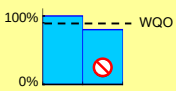
% sample with bottom DO ≥ 2 mg/L



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

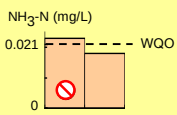
annual mean for depth-averaged TIN

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



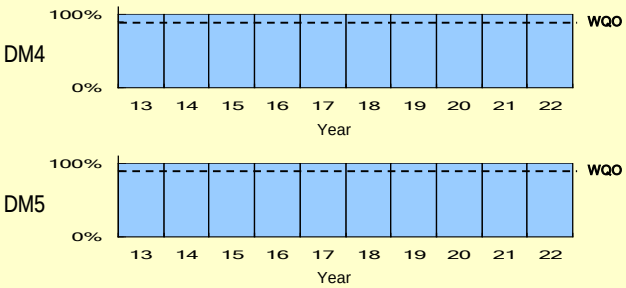
WQO compliance rates for the Deep Bay WCZ

Dissolved Oxygen (DO)
(bottom)

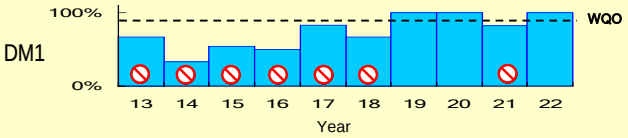
DM1 DO (bottom) not measured, water depth ≤ 3m

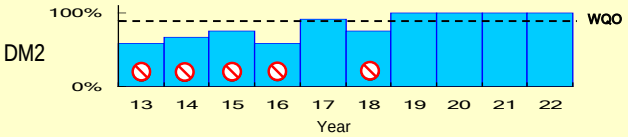
DM2 DO (bottom) not measured, water depth ≤ 3m

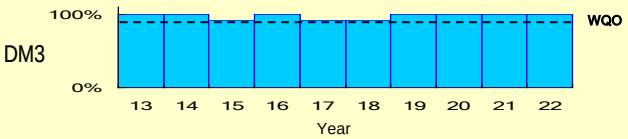
DM3 DO (bottom) not measured, water depth ≤ 3m

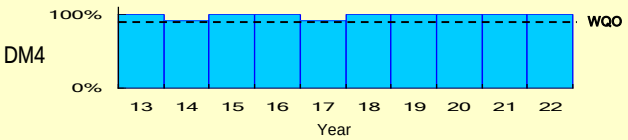


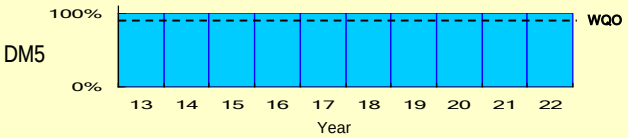
Dissolved Oxygen (DO)
(depth-averaged)

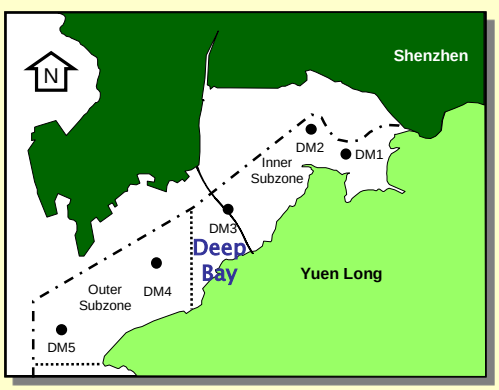










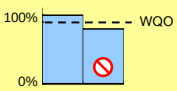


Dissolved Oxygen (DO)

1. Bottom

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

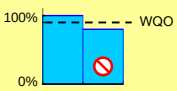
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

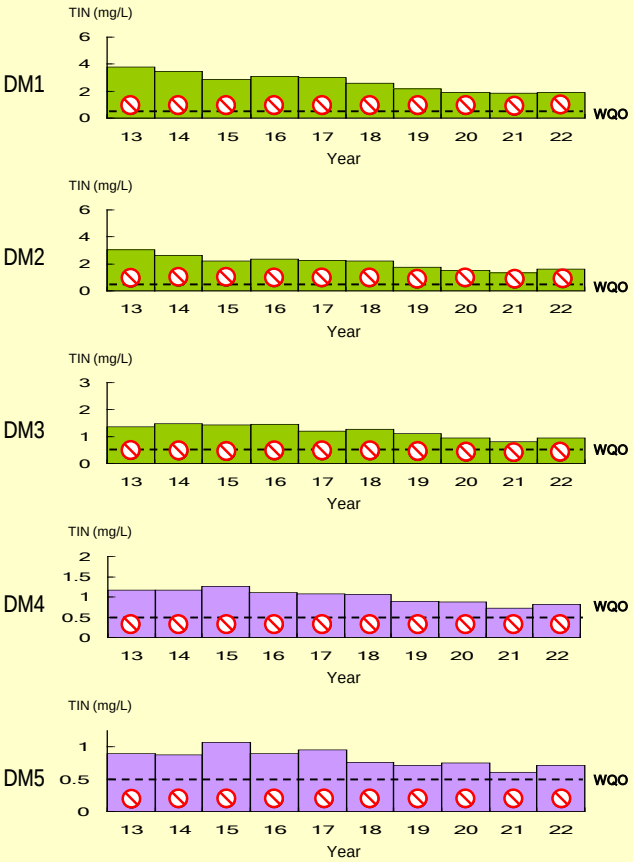
% sample with depth-averaged DO ≥ 4 mg/L



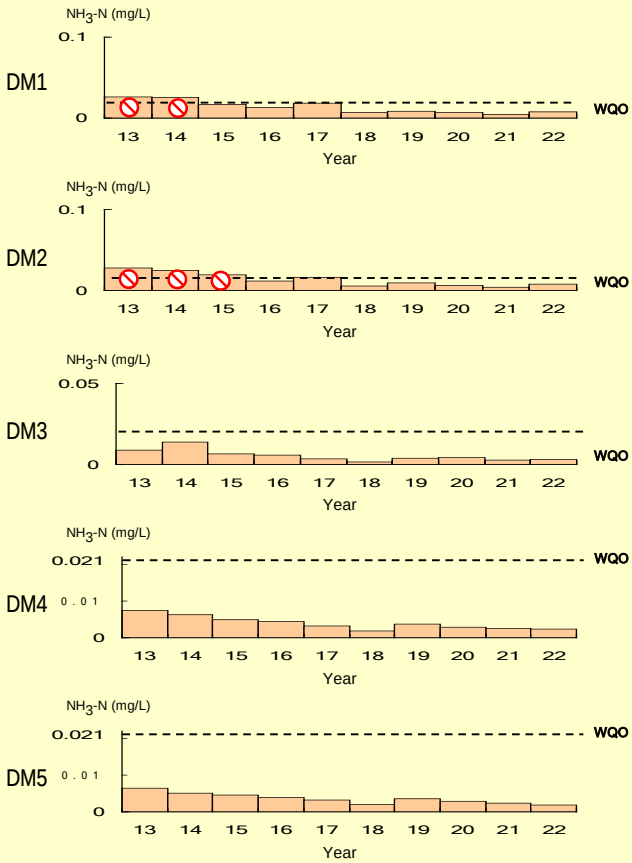
Non-compliance

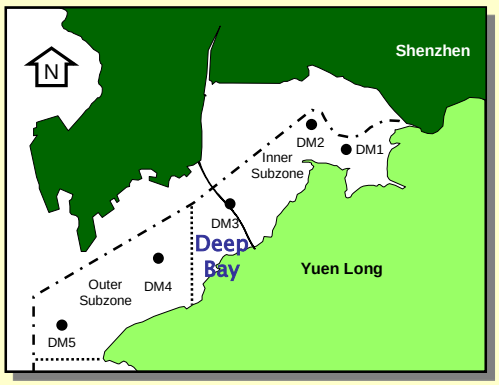
WQO compliance rates for the Deep Bay WCZ (continued)

Total Inorganic Nitrogen (TIN)
(depth-averaged)



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



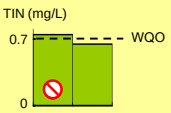


Total Inorganic Nitrogen (TIN)

Inner Subzone (DM1 - DM3)

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

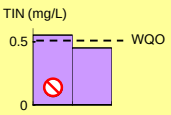
annual mean for depth-averaged TIN



Outer Subzone (DM4 - DM5)

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

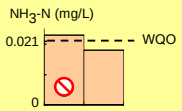
annual mean for depth-averaged TIN



Unionised Ammonia (NH_3-N)

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

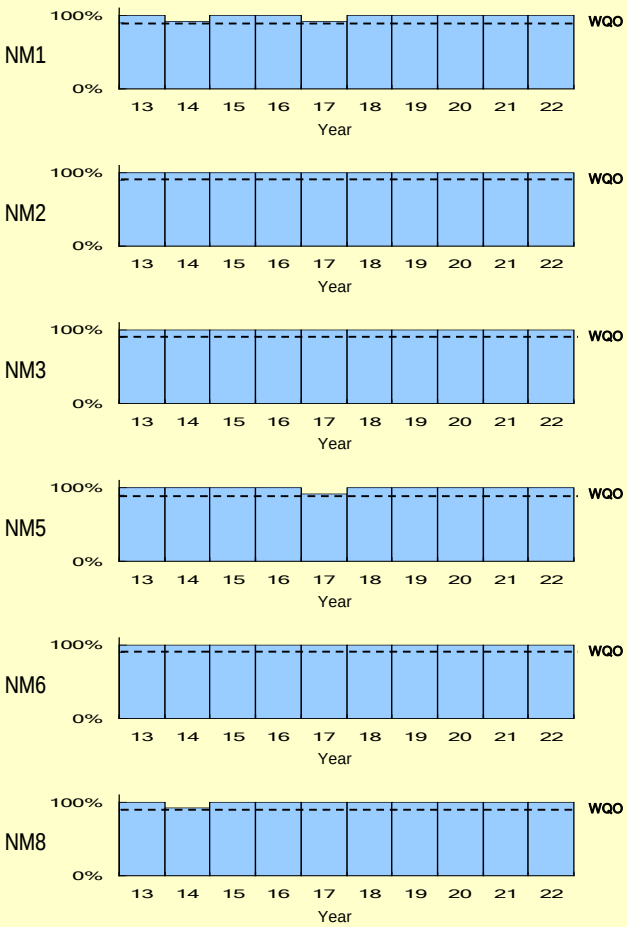
annual mean for depth-averaged NH_3-N



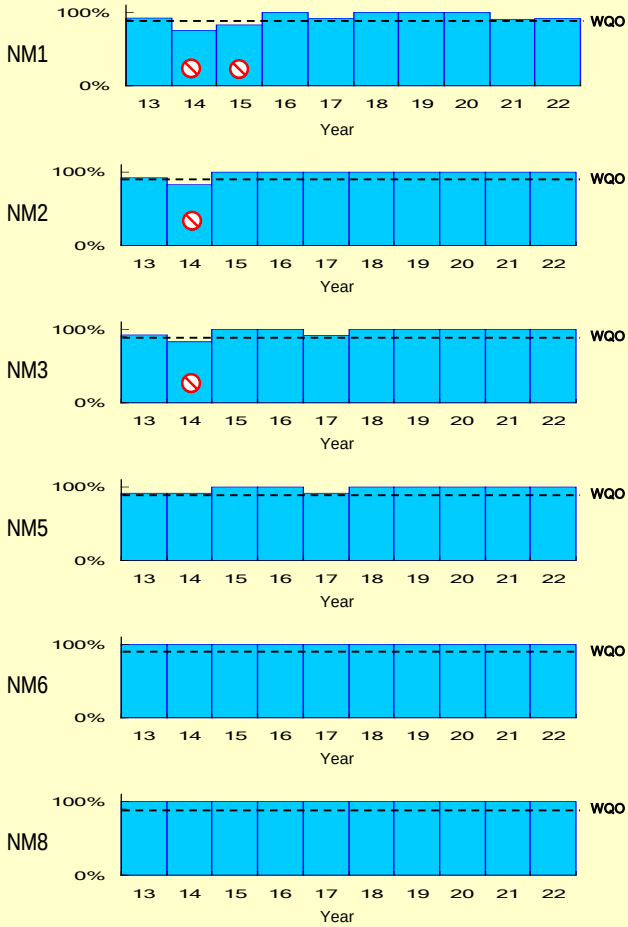
Non-compliance

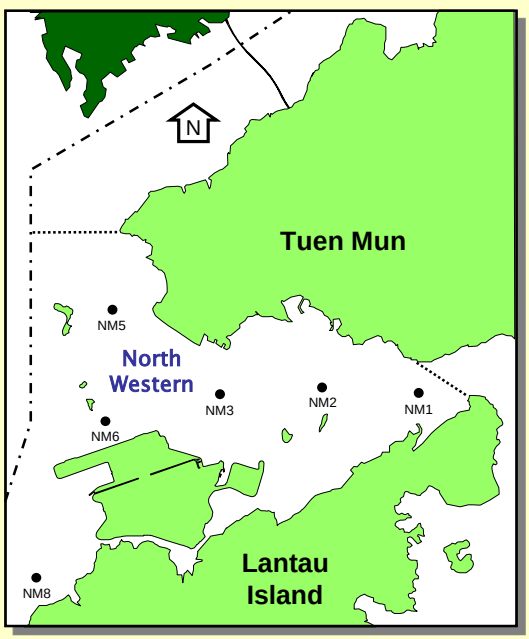
WQO compliance rates for the North Western WCZ

Dissolved Oxygen (DO) (bottom)



Dissolved Oxygen (DO) (depth-averaged)



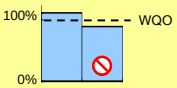


Dissolved Oxygen (DO)

1. Bottom

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

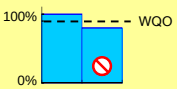
% sample with bottom DO ≥ 2 mg/L



2. Depth-averaged

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

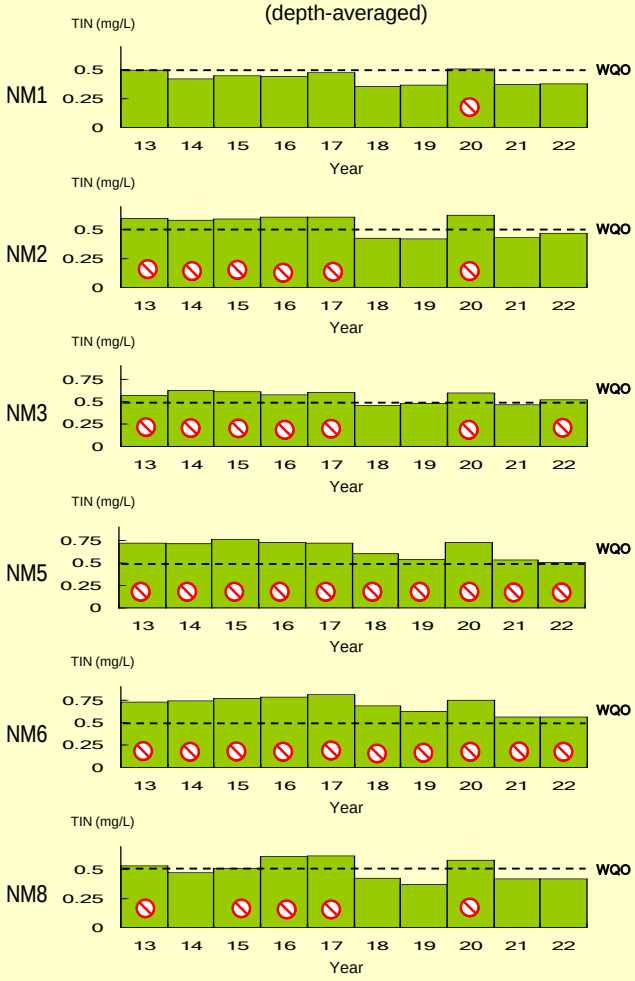
% sample with depth-averaged DO ≥ 4 mg/L



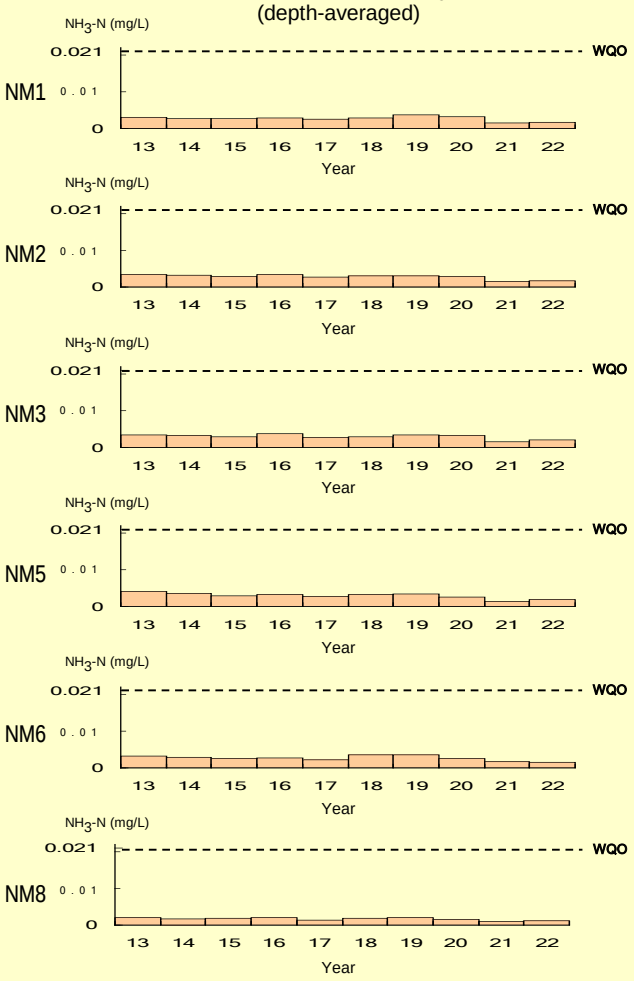
Non-compliance

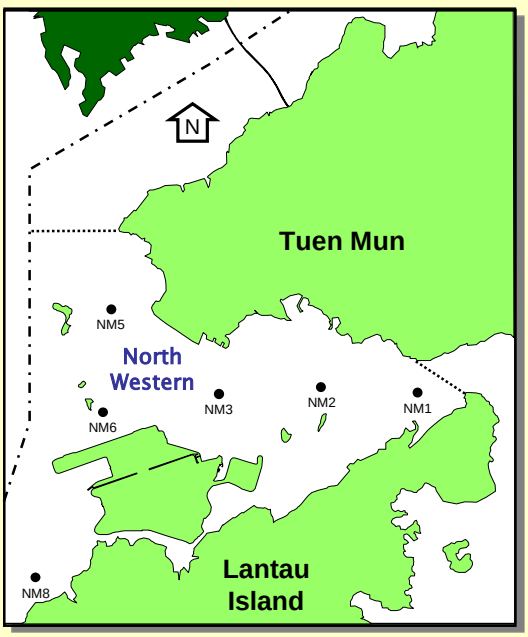
WQO compliance rates for the North Western WCZ (continued)

Total Inorganic Nitrogen (TIN) (depth-averaged)



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





Total Inorganic Nitrogen (TIN)

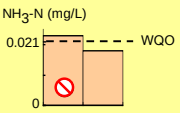
WQO : annual mean for depth-averaged TIN $\leq$ 0.5 mg/L

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

Long-term water quality trend analyses in the Mirs Bay WCZ, 1991 - 2022

Monitoring Station		MM1	MM2	MM3	MM4	MM5	MM6	MM7
Monitoring Period		1991 – 2022	1991 – 2022	1991 – 2022	1991 – 2022	1991 – 2022	1991 – 2022	1991 – 2022
Parameter	Water Depth							
Temperature (℃)	Surface	-	-	-	-	-	↗	-
	Middle	↗	↗	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘
	Bottom	-	-	↘	↘	↘	-	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Dissolved Oxygen (%)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	-	-	-	-	↘	-
	Bottom	-	-	-	↘	↘	-	-
	Average	↘	-	↘	↘	↘	↘	↘
pH	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	-	-	↘	↘	-	-
Turbidity (NTU)	Surface	-	-	-	-	-	-	-
	Middle	↘	-	-	-	-	-	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	-	-	-	-	-	-
Suspended Solids (mg/L)	Surface	-	↗	↗	↗	↗	↗	↗
	Middle	-	↗	↗	↗	↗	↗	↗
	Bottom	-	↗	↗	↗	↗	-	↗
	Average	-	↗	↗	↗	↗	↗	↗
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

Long-term water quality trend analyses in the Mirs Bay WCZ, 1986 - 2022

Monitoring Station		MM8	MM13	MM14	MM15	MM16	MM17	MM19
Monitoring Period		1991 – 2022	1991 – 2022	1994 – 2022	1994 – 2022	1994 – 2022	1986 – 2022	2001 – 2022
Parameter	Water Depth							
Temperature (℃)	Surface	↗	↗	-	-	↗	↗	-
	Middle	↗	↗	-	↗	↗	↗	-
	Bottom	↗	↗	-	↗	↗	↗	-
	Average	↗	↗	-	↗	↗	↗	-
Salinity	Surface	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	-	-	-	-	-
	Bottom	↘	↘	-	↘	↘	-	-
	Average	↘	↘	↘	↘	↘	↘	-
Dissolved Oxygen (%)	Surface	-	-	↘	↘	↘	↘	↘
	Middle	-	-	-	-	-	-	-
	Bottom	-	-	-	↘	↘	-	-
	Average	-	-	↘	↘	↘	-	-
pH	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		-	↘	↘	↘	↘	↘	-
Turbidity (NTU)	Surface	-	-	-	-	-	-	↘
	Middle	-	-	↘	-	-	-	↘
	Bottom	-	-	↘	↘	↘	-	↘
	Average	-	-	↘	↘	-	-	↘
Suspended Solids (mg/L)	Surface	↗	↗	↗	↗	↗	-	↗
	Middle	↗	-	↗	↗	↗	-	-
	Bottom	↗	-	-	-	-	-	-
	Average	↗	↗	-	↗	↗	-	-
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

Long-term water quality trend analyses in the Port Shelter WCZ, 1986 - 2022

Monitoring Station		PM1	PM2	PM3	PM4	PM6	PM7	PM8	PM9	PM11
Monitoring Period		1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1993 – 2022
Parameter	Water Depth									
Temperature (℃)	Surface	↗	↗	↗	↗	↗	↗	↗	↗	-
	Middle	↗	↗	↗	↗	↗	↗	↗	↗	-
	Bottom	↗	↗	↗	↗	↗	↗	↗	↗	-
	Average	↗	↗	↗	↗	↗	↗	↗	↗	-
Salinity	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	-
	Middle	-	-	-	↘	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	↘	↘	↘	↘	↘	-
Dissolved Oxygen (%)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	↗	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
pH	Surface	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	-	-	↗	-	↘	-	-
Turbidity (NTU)	Surface	-	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↗	-	-	↗	-	-	-	-	↗
	Middle	-	-	-	-	-	-	-	-	↗
	Bottom	-	-	↗	-	↗	↗	↗	↗	↗
	Average	-	-	-	-	-	-	↗	↗	↗
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

Long-term water quality trend analyses in the Tolo Habour and Channel WCZ, 1986 - 2022

Monitoring Station		TM2	TM3	TM4	TM5	TM6	TM7	TM8
Monitoring Period		1986 – 2022	1986 – 2022	1986 – 2022	1988 – 2022	1986 – 2022	1988 – 2022	1986 – 2022
Parameter	Water Depth							
Temperature (℃)	Surface	↗	↗	↗	↗	↗	↗	↗
	Middle	NA	↗	↗	NA	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-	-	-
	Middle	NA	-	-	NA	-	-	-
	Bottom	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	-	-	NA	-	-	-
	Bottom	↗	↗	↗	-	-	-	-
	Average	-	-	-	↘	↘	↘	↘
Dissolved Oxygen (%)	Surface	-	↘	↘	↘	↘	↘	↘
	Middle	NA	-	-	NA	-	-	-
	Bottom	↗	↗	↗	-	-	-	-
	Average	-	-	-	↘	-	-	↘
pH	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗	-
Turbidity (NTU)	Surface	-	-	-	-	-	-	-
	Middle	NA	-	-	NA	-	-	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	-	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	-	-	-	-	-	-
	Middle	NA	-	-	NA	-	-	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	-	-	-	-	-	-
Total volatile solids (mg/L)	Surface	↘	-	-	-	-	-	-
	Middle	NA	-	-	NA	-	-	-
	Bottom	↘	-	-	-	-	-	-
	Average	↘	-	-	-	-	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	↘
	Bottom	↘	-	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘
Ammonia nitrogen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	NA	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘	-
	Average	↘	↘	↘	↘	↘	↘	-
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

Long-term water quality trend analyses in the Southern WCZ, 1986 - 2022

Monitoring Station		SM1	SM2	SM3	SM4	SM5	SM6	SM7	SM9
Monitoring Period		1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1988 – 2022
Parameter	Water Depth								
Temperature (℃)	Surface	↗	↗	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-	-	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	-
	Middle	-	-	↘	-	-	-	-	-
	Bottom	-	-	↘	-	-	↘	-	-
	Average	↘	-	↘	-	↘	↘	-	-
Dissolved Oxygen (%)	Surface	↘	-	-	-	-	-	↘	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-
pH	Surface	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-	-	-	-	↘
	Middle	-	-	-	-	-	-	-	↘
	Bottom	-	-	-	-	-	-	↘	↘
	Average	-	-	-	-	-	-	-	↘
Suspended Solids (mg/L)	Surface	-	-	-	-	-	↗	-	-
	Middle	-	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	↘
	Average	-	-	-	-	-	-	-	-
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

Long-term water quality trend analyses in the Southern WCZ, 1986 - 2022 (continued)

Monitoring Station		SM10	SM11	SM12	SM13	SM17	SM18	SM19	SM20
Monitoring Period		1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1989 – 2022	1989 – 2022	1989 – 2022	1999 – 2022
Parameter	Water Depth								
Temperature (℃)	Surface	↗	↗	↗	↗	↗	↗	↗	↗
	Middle	NA	↗	↗	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	↘	-	-	-	↘
	Average	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	-
	Middle	NA	↘	↘	↘	-	-	-	-
	Bottom	-	-	-	↘	-	↘	↘	-
	Average	↘	↘	↘	↘	-	↘	↘	-
Dissolved Oxygen (%)	Surface	↘	↘	↘	↘	↘	↘	↘	-
	Middle	NA	-	-	↘	-	-	-	-
	Bottom	-	-	-	-	-	-	-	-
	Average	-	-	↘	-	-	-	-	-
pH	Surface	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	↘	-	-	-	-	-	-	↘
	Middle	NA	↘	-	-	-	-	-	↘
	Bottom	↘	-	-	↘	↘	-	-	↘
	Average	↘	-	-	-	-	-	-	↘
Suspended Solids (mg/L)	Surface	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	-	-	-
	Bottom	-	-	-	-	-	-	-	↘
	Average	-	-	-	-	-	-	-	↘
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

Long-term water quality trend analyses in the Victoria Harbour WCZ, 1986 - 2022

Monitoring Station		VM1	VM2	VM4	VM5	VM6
Monitoring Period		1988 – 2022	1988 – 2022	1988 – 2022	1986 – 2022	1988 – 2022
Parameter	Water Depth					
Temperature (℃)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-
	Middle	↗	-	-	-	-
	Bottom	↗	↗	↗	-	-
	Average	↗	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Dissolved Oxygen (%)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
pH	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	↘	-	-
	Average	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘
	Bottom	-	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
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

Long-term water quality trend analyses in the Victoria Harbour WCZ, 1986 - 2022 (continued)

Monitoring Station		VM7	VM8	VM12	VM14	VM15
Monitoring Period		1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1993 – 2022
Parameter	Water Depth					
Temperature (℃)	Surface	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-
	Middle	-	-	-	-	-
	Bottom	-	-	-	-	-
	Average	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	-	↗	↗	↗
	Middle	↗	-	↗	↗	↗
	Bottom	↗	-	↗	↗	↗
	Average	↗	-	↗	↗	↗
Dissolved Oxygen (%)	Surface	↗	-	↗	↗	↗
	Middle	↗	-	↗	↗	↗
	Bottom	↗	-	↗	↗	↗
	Average	↗	-	↗	↗	↗
pH	Surface	↘	↘	↘	↘	-
	Middle	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-	-
	Middle	-	-	-	-	↘
	Bottom	↘	-	↘	-	↘
	Average	-	-	-	-	-
Suspended Solids (mg/L)	Surface	↘	↘	-	↘	↘
	Middle	↘	↘	-	↘	↘
	Bottom	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘
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

Long-term water quality trend analyses in the Eastern Buffer WCZ, 1986 - 2022

Monitoring Station		EM1	EM2	EM3
Monitoring Period		1986 I 2022	1986 I 2022	1988 I 2022
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

Long-term water quality trend analyses in the Western Buffer WCZ, 1986 - 2022

Monitoring Station		WM1	WM2	WM3	WM4
Monitoring Period		1988 – 2022	1988 – 2022	1986 – 2022	1986 – 2022
Parameter	Water Depth				
Temperature (℃)	Surface	↗	↗	↗	↗
	Middle	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗
	Average	↗	↗	↗	↗
Salinity	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	↗	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	↘	-	↘
	Middle	-	↘	-	↘
	Bottom	-	-	-	-
	Average	-	↘	-	↘
Dissolved Oxygen (%)	Surface	-	-	-	-
	Middle	-	-	-	-
	Bottom	-	-	-	-
	Average	-	-	-	-
pH	Surface	↘	↘	↘	↘
	Middle	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘
	Average	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗
Turbidity (NTU)	Surface	-	-	-	-
	Middle	-	-	↘	-
	Bottom	-	↘	↘	-
	Average	-	-	↘	-
Suspended Solids (mg/L)	Surface	-	-	↘	↘
	Middle	-	-	↘	-
	Bottom	↗	-	-	-
	Average	-	-	↘	-
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

Long-term water quality trend analyses in the Junk Bay WCZ, 1986 - 2022

Monitoring Station		JM3	JM4
Monitoring Period		1986 – 2022	1986 – 2022
Parameter	Water Depth		
Temperature (℃)	Surface	↗	↗
	Middle	↗	↗
	Bottom	↗	↗
	Average	↗	↗
Salinity	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
Dissolved Oxygen (mg/L)	Surface	-	-
	Middle	↗	↗
	Bottom	↗	-
	Average	↗	-
Dissolved Oxygen (%)	Surface	↗	↗
	Middle	↗	↗
	Bottom	↗	↗
	Average	↗	↗
pH	Surface	↘	↘
	Middle	↘	↘
	Bottom	↘	↘
	Average	↘	↘
Secchi disc depth (m)		↗	↗
Turbidity (NTU)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
Suspended Solids (mg/L)	Surface	-	-
	Middle	-	-
	Bottom	-	-
	Average	-	-
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

Long-term water quality trend analyses in the Deep Bay WCZ, 1986 - 2022

Monitoring Station		DM1	DM2	DM3	DM4	DM5
Monitoring Period		1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1991 – 2022
Parameter	Water Depth					
Temperature (℃)	Surface	↗	↗	↗	↗	↗
	Middle	NA	NA	NA	NA	↗
	Bottom	NA	NA	NA	↗	↗
	Average	↗	↗	↗	↗	↗
Salinity	Surface	↘	↘	-	-	-
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	↘
	Average	↘	↘	-	-	-
Dissolved Oxygen (mg/L)	Surface	-	-	↘	↘	↘
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	-
	Average	-	-	↘	↘	↘
Dissolved Oxygen (%)	Surface	-	-	↘	↘	↘
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	-
	Average	-	-	↘	↘	↘
pH	Surface	↘	↘	↘	↘	↘
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	↘
	Average	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	↘	-	-	-	-
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	↘
	Average	↘	-	-	-	↘
Suspended Solids (mg/L)	Surface	-	-	-	-	↘
	Middle	NA	NA	NA	NA	↘
	Bottom	NA	NA	NA	↘	↘
	Average	-	-	-	↘	↘
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

Long-term water quality trend analyses in the North Western WCZ, 1986 - 2022

Monitoring Station		NM1	NM2	NM3	NM5	NM6	NM8
Monitoring Period		1988 – 2022	1986 – 2022	1986 – 2022	1988 – 2022	1991 – 2022	1999 – 2022
Parameter	Water Depth						
Temperature (℃)	Surface	↗	↗	↗	↗	↗	↗
	Middle	↗	↗	↗	↗	↗	↗
	Bottom	↗	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗
Salinity	Surface	-	-	↘	-	-	-
	Middle	-	↘	↘	-	-	-
	Bottom	-	-	↘	-	↘	↘
	Average	-	-	↘	-	-	-
Dissolved Oxygen (mg/L)	Surface	↘	↘	↘	↘	↘	-
	Middle	↘	↘	-	↘	↘	-
	Bottom	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	-
Dissolved Oxygen (%)	Surface	-	-	↘	↘	↘	-
	Middle	↘	↘	-	-	↘	-
	Bottom	-	↘	↘	-	-	-
	Average	-	↘	↘	↘	↘	-
pH	Surface	↘	↘	↘	↘	↘	↘
	Middle	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗
Turbidity (NTU)	Surface	↘	-	-	-	-	↘
	Middle	↘	↘	↘	↘	↘	↘
	Bottom	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘
Suspended Solids (mg/L)	Surface	-	-	-	↘	-	-
	Middle	-	-	-	-	-	-
	Bottom	-	-	↘	-	↘	-
	Average	-	-	↘	-	-	-
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 marine sediment quality in the Tolo Harbour and Channel and Southern WCZs, 2018 - 2022

	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)	71 (2 - 93)	80 (20 - 98)	65 (9 - 93)	82 (6 - 98)	50 (25 - 75)	72 (14 - 91)	77 (21 - 99)	72 (6 - 96)
Electrochemical Potential (mV)	-272 (-357 - -85)	-271 (-347 - -102)	-307 (-379 - -226)	-293 (-370 - -180)	-144 (-259 - -89)	-146 (-266 - -69)	-123 (-263 - -40)	-125 (-250 - -46)
Total Solids (%w/w)	37 (29 - 44)	37 (31 - 44)	38 (33 - 50)	31 (28 - 32)	59 (53 - 65)	49 (42 - 59)	50 (40 - 54)	45 (40 - 50)
Total Volatile Soilds (%TS)	9.0 (5.9 - 12.0)	9.0 (7.4 - 11.0)	9.7 (6.3 - 11.0)	10.6 (9.0 - 15.0)	5.5 (4.8 - 6.2)	7.1 (5.4 - 8.0)	6.6 (5.4 - 8.5)	6.9 (5.2 - 7.4)
Chemical Oxygen Demand (mg/kg)	20600 (17000 - 25000)	20700 (18000 - 27000)	18900 (15000 - 24000)	17200 (13000 - 20000)	9800 (7800 - 11000)	11460 (7200 - 16000)	11660 (8000 - 14000)	12600 (11000 - 14000)
Total Carbon (%w/w)	0.8 (0.7 - 0.9)	0.6 (0.5 - 0.8)	1.0 (0.7 - 1.5)	0.8 (0.7 - 0.8)	0.9 (0.8 - 1.1)	0.9 (0.6 - 1.4)	0.8 (0.6 - 0.9)	0.6 (0.5 - 0.7)
Ammonical Nitrogen (mg/kg)	5.82 (2.80 - 8.50)	3.75 (0.05 - 9.20)	8.58 (2.50 - 16.00)	10.44 (5.10 - 15.00)	5.14 (0.44 - 11.00)	8.83 (1.30 - 51.00)	4.78 (0.74 - 9.70)	5.92 (1.30 - 11.00)
Total Kjeldahl Nitrogen (mg/kg)	630 (500 - 750)	550 (330 - 690)	660 (580 - 870)	690 (500 - 770)	560 (380 - 1200)	530 (410 - 590)	500 (390 - 550)	610 (500 - 920)
Total Phosphorus (mg/kg)	180 (160 - 200)	170 (140 - 190)	210 (160 - 240)	190 (160 - 230)	250 (160 - 430)	240 (220 - 270)	240 (210 - 260)	230 (210 - 250)
Total Sulphide (mg/kg)	86.8 (11.0 - 260.0)	59.7 (18.0 - 160.0)	72.7 (7.1 - 150.0)	106.3 (23.0 - 230.0)	14.4 (2.7 - 29.0)	42.2 (3.7 - 260.0)	20.8 (5.2 - 54.0)	29.8 (8.2 - 58.0)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	<0.1 (0.1 - <0.1)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	<0.1 (0.1 - <0.1)
Arsenic (mg/kg)	13.8 (10.0 - 18.0)	14.1 (10.0 - 18.0)	11.5 (9.5 - 16.0)	9.4 (3.6 - 13.0)	8.3 (5.2 - 11.0)	10.1 (8.9 - 11.0)	9.0 (6.8 - 9.9)	10.2 (8.4 - 12.0)
Cadmium (mg/kg)	0.6 (0.5 - 0.7)	0.6 (0.4 - 0.8)	0.4 (0.2 - 0.6)	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)	27 (20 - 35)	27 (20 - 37)	27 (19 - 34)	37 (31 - 55)	23 (16 - 31)	33 (25 - 43)	31 (21 - 45)	37 (29 - 47)
Copper (mg/kg)	44 (29 - 92)	37 (26 - 60)	40 (23 - 77)	29 (21 - 56)	19 (8 - 82)	25 (15 - 37)	19 (13 - 30)	28 (21 - 34)
Lead (mg/kg)	100 (77 - 180)	96 (67 - 130)	77 (59 - 96)	58 (50 - 83)	31 (22 - 42)	38 (33 - 56)	34 (30 - 38)	39 (35 - 44)
Mercury (mg/kg)	0.07 (0.05 - 0.09)	0.06 (0.05 - 0.08)	0.06 (0.05 - 0.09)	0.06 (0.05 - 0.08)	0.07 (0.05 - 0.18)	0.08 (0.07 - 0.10)	0.15 (0.05 - 0.80)	0.12 (0.10 - 0.17)
Nickel (mg/kg)	18 (5 - 38)	15 (5 - 21)	18 (11 - 24)	26 (22 - 35)	16 (11 - 21)	22 (17 - 25)	21 (15 - 27)	23 (19 - 28)
Silver (mg/kg)	0.4 (0.3 - 0.4)	0.3 (0.2 - 0.5)	0.3 (0.2 - 0.3)	0.2 (0.2 - 0.3)	0.2 (0.2 - 0.3)	<0.2 (0.2 - <0.2)	<0.2 (0.2 - <0.2)	<0.2 (0.2 - <0.2)
Zinc (mg/kg)	260 (180 - 410)	270 (170 - 410)	200 (120 - 340)	160 (130 - 240)	84 (53 - 140)	110 (80 - 130)	110 (69 - 250)	130 (87 - 180)
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] [6]	92 (90 - 110)	96 (90 - 140)	100 (90 - 140)	110 (90 - 170)	91 (90 - 94)	90 (90 - 90)	90 (90 - 93)	91 (90 - 97)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	52 (27 - 110)	43 (22 - 82)	49 (25 - 79)	55 (33 - 100)	38 (20 - 54)	67 (21 - 110)	51 (26 - 92)	78 (26 - 140)

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 marine sediment quality in the Southern, Junk Bay and Deep Bay WCZs, 2018 - 2022

	Lantau Island (East)	Lantau Island (South)	Junk Bay	Inner Deep Bay		Outer Deep Bay	
Parameter	SS5	SS6	JS2	DS1	DS2	DS3	DS4
Number of samples	10	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	83 (7 - 99)	68 (48 - 81)	72 (2 - 98)	74 (17 - 98)	69 (15 - 84)	74 (10 - 93)	62 (20 - 92)
Electrochemical Potential (mV)	-160 (-225 - -68)	-135 (-216 - -82)	-139 (-265 - -93)	-167 (-340 - -93)	-148 (-346 - -88)	-150 (-360 - -76)	-155 (-323 - -90)
Total Solids (%w/w)	38 (36 - 42)	61 (54 - 68)	48 (40 - 73)	47 (41 - 55)	48 (36 - 52)	50 (43 - 66)	47 (40 - 68)
Total Volatile Soilds (%TS)	7.8 (6.9 - 8.8)	4.2 (2.9 - 5.9)	6.9 (3.2 - 8.3)	6.4 (4.2 - 9.1)	6.7 (4.7 - 8.4)	6.5 (2.8 - 7.6)	6.6 (5.6 - 7.4)
Chemical Oxygen Demand (mg/kg)	13400 (11000 - 16000)	8500 (3600 - 12000)	14450 (8500 - 18000)	21200 (15000 - 30000)	15300 (12000 - 20000)	13390 (9900 - 18000)	12800 (10000 - 15000)
Total Carbon (%w/w)	0.5 (0.5 - 0.6)	0.5 (0.4 - 1.1)	0.7 (0.6 - 0.9)	0.7 (0.4 - 1.0)	0.6 (0.4 - 0.7)	0.5 (0.2 - 0.7)	0.6 (0.4 - 1.3)
Ammonical Nitrogen (mg/kg)	8.03 (0.67 - 13.00)	8.94 (0.40 - 20.00)	4.32 (0.16 - 7.90)	13.51 (0.67 - 53.00)	3.64 (0.16 - 8.30)	2.89 (0.19 - 8.00)	2.74 (0.38 - 6.80)
Total Kjeldahl Nitrogen (mg/kg)	570 (500 - 620)	340 (190 - 460)	530 (440 - 620)	560 (440 - 970)	460 (350 - 550)	440 (290 - 540)	450 (270 - 530)
Total Phosphorus (mg/kg)	190 (180 - 200)	210 (170 - 320)	200 (100 - 230)	350 (240 - 630)	280 (210 - 320)	240 (210 - 260)	220 (170 - 250)
Total Sulphide (mg/kg)	30.6 (0.4 - 67.0)	13.9 (0.2 - 44.0)	17.0 (0.2 - 38.0)	243.4 (26.0 - 660.0)	38.9 (0.2 - 270.0)	22.9 (0.2 - 83.0)	39.3 (1.0 - 200.0)
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)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)
Arsenic (mg/kg)	9.5 (8.4 - 12.0)	7.1 (4.7 - 11.0)	8.7 (4.1 - 12.0)	13.2 (5.3 - 19.0)	16.5 (11.0 - 22.0)	14.6 (10.0 - 17.0)	14.7 (12.0 - 17.0)
Cadmium (mg/kg)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	0.1 (0.1 - 0.2)	0.7 (0.3 - 1.3)	0.4 (0.2 - 0.7)	0.2 (0.1 - 0.4)	0.1 (0.1 - 0.2)
Chromium (mg/kg)	42 (34 - 52)	22 (13 - 33)	39 (12 - 54)	45 (21 - 71)	47 (28 - 77)	43 (29 - 60)	39 (25 - 54)
Copper (mg/kg)	38 (30 - 56)	12 (3 - 33)	69 (19 - 130)	65 (31 - 100)	57 (34 - 84)	52 (35 - 69)	38 (19 - 45)
Lead (mg/kg)	45 (38 - 53)	24 (17 - 34)	46 (24 - 55)	54 (31 - 78)	76 (51 - 250)	53 (41 - 59)	52 (39 - 110)
Mercury (mg/kg)	0.13 (0.10 - 0.16)	0.06 (0.05 - 0.08)	0.24 (0.10 - 0.64)	0.23 (0.07 - 0.46)	0.17 (0.12 - 0.35)	0.12 (0.10 - 0.16)	0.10 (0.05 - 0.12)
Nickel (mg/kg)	27 (22 - 30)	13 (7 - 19)	20 (6 - 25)	27 (18 - 40)	27 (16 - 42)	28 (18 - 35)	24 (18 - 32)
Silver (mg/kg)	0.3 (0.2 - 0.4)	<0.2 (0.2 - <0.2)	0.8 (0.2 - 1.3)	0.6 (0.3 - 1.1)	0.4 (0.3 - 0.6)	0.3 (0.3 - 0.5)	0.2 (0.2 - 0.3)
Zinc (mg/kg)	160 (130 - 180)	73 (43 - 120)	150 (52 - 200)	290 (180 - 430)	230 (150 - 340)	180 (130 - 280)	150 (110 - 200)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	18 (18 - 18)	19 (18 - 26)	18 (18 - 18)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4] [6]	90 (90 - 90)	90 (90 - 90)	94 (90 - 99)	110 (90 - 170)	96 (90 - 120)	91 (90 - 95)	92 (90 - 97)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	61 (29 - 74)	29 (17 - 57)	200 (54 - 350)	290 (75 - 690)	110 (42 - 270)	75 (28 - 170)	83 (22 - 130)

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 marine sediment quality in the Port Shelter and Mirs Bay WCZs, 2018 - 2022

	Inner Port Shelter	Outer Port Shelter		Starling Inlet	Crooked Island		Port Island	Mirs Bay (North)
Parameter	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)	78 (10 - 96)	58 (9 - 96)	65 (9 - 86)	82 (26 - 98)	81 (4 - 99)	61 (<1 - 98)	76 (6 - 99)	75 (7 - 94)
Electrochemical Potential (mV)	-212 (-310 - -103)	-155 (-248 - -74)	-152 (-276 - -71)	-193 (-264 - -105)	-293 (-360 - -194)	-292 (-380 - -137)	-207 (-333 - -58)	-193 (-312 - -108)
Total Solids (%w/w)	35 (30 - 39)	48 (33 - 64)	49 (44 - 54)	42 (37 - 47)	33 (30 - 36)	30 (27 - 34)	34 (31 - 39)	40 (36 - 43)
Total Volatile Soilds (%TS)	11.8 (11.0 - 13.0)	8.8 (6.4 - 12.0)	8.7 (7.7 - 9.7)	7.5 (5.9 - 8.8)	9.1 (7.4 - 10.0)	10.2 (8.5 - 12.0)	9.7 (7.6 - 11.0)	7.9 (6.0 - 10.0)
Chemical Oxygen Demand (mg/kg)	15600 (11000 - 19000)	13900 (12000 - 16000)	13300 (11000 - 16000)	14600 (11000 - 17000)	15200 (12000 - 18000)	16000 (14000 - 18000)	15400 (14000 - 18000)	14300 (12000 - 18000)
Total Carbon (%w/w)	1.1 (0.8 - 1.3)	1.5 (0.8 - 2.3)	1.3 (1.0 - 1.8)	0.6 (0.5 - 0.8)	0.6 (0.5 - 0.7)	0.7 (0.6 - 0.8)	0.7 (0.6 - 0.7)	0.6 (0.6 - 0.7)
Ammonical Nitrogen (mg/kg)	7.63 (1.10 - 12.00)	5.65 (0.57 - 8.90)	4.62 (0.92 - 7.70)	9.18 (5.30 - 19.00)	10.15 (8.50 - 13.00)	9.85 (7.30 - 18.00)	8.17 (5.50 - 11.00)	8.96 (2.20 - 15.00)
Total Kjeldahl Nitrogen (mg/kg)	680 (590 - 740)	550 (440 - 650)	610 (540 - 650)	560 (460 - 740)	600 (450 - 710)	680 (530 - 770)	710 (610 - 770)	590 (500 - 780)
Total Phosphorus (mg/kg)	200 (180 - 230)	190 (150 - 210)	220 (190 - 270)	200 (170 - 230)	180 (150 - 200)	170 (150 - 230)	210 (180 - 250)	200 (140 - 310)
Total Sulphide (mg/kg)	29.3 (4.2 - 65.0)	25.5 (13.0 - 43.0)	19.6 (3.5 - 36.0)	35.8 (4.3 - 170.0)	54.1 (19.0 - 110.0)	55.1 (17.0 - 100.0)	27.4 (11.0 - 50.0)	25.7 (2.9 - 54.0)
Total Cyanide (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)	0.2 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)
Arsenic (mg/kg)	7.5 (6.2 - 8.6)	7.5 (4.3 - 10.0)	7.5 (6.2 - 9.4)	10.7 (8.3 - 13.0)	10.6 (8.5 - 12.0)	8.7 (4.0 - 11.0)	9.5 (7.5 - 11.0)	9.3 (6.9 - 11.0)
Cadmium (mg/kg)	<0.1 (0.1 - <0.1)	0.1 (0.1 - 0.2)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	0.3 (0.2 - 0.4)	0.3 (0.2 - 0.5)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)
Chromium (mg/kg)	27 (22 - 34)	25 (14 - 30)	25 (19 - 30)	35 (26 - 44)	42 (30 - 53)	38 (27 - 56)	38 (26 - 51)	35 (24 - 50)
Copper (mg/kg)	23 (18 - 32)	21 (7 - 49)	14 (10 - 22)	22 (17 - 31)	27 (21 - 38)	23 (18 - 28)	19 (15 - 22)	15 (12 - 19)
Lead (mg/kg)	39 (31 - 46)	32 (22 - 38)	33 (26 - 37)	43 (34 - 53)	49 (36 - 58)	47 (38 - 56)	46 (38 - 58)	38 (31 - 54)
Mercury (mg/kg)	0.09 (0.06 - 0.12)	0.07 (0.05 - 0.13)	0.05 (0.05 - 0.06)	0.05 (0.05 - 0.09)	0.06 (0.05 - 0.07)	0.07 (0.05 - 0.09)	0.06 (0.05 - 0.10)	<0.05 (0.05 - <0.05)
Nickel (mg/kg)	18 (15 - 19)	15 (10 - 20)	17 (14 - 22)	22 (16 - 27)	27 (20 - 32)	25 (19 - 29)	26 (19 - 31)	23 (17 - 28)
Silver (mg/kg)	0.2 (0.2 - 0.3)	<0.2 (0.2 - <0.2)	<0.2 (0.2 - <0.2)	0.3 (0.2 - 0.5)	0.2 (0.2 - 0.3)	0.2 (0.2 - 0.3)	<0.2 (0.2 - <0.2)	<0.2 (0.2 - <0.2)
Zinc (mg/kg)	110 (89 - 130)	110 (46 - 180)	86 (62 - 110)	120 (95 - 160)	130 (110 - 150)	120 (97 - 150)	120 (94 - 130)	96 (79 - 130)
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] [6]	100 (90 - 150)	100 (90 - 160)	100 (90 - 150)	91 (90 - 100)	90 (90 - 94)	95 (90 - 130)	98 (90 - 150)	100 (90 - 140)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	49 (34 - 92)	32 (16 - 58)	27 (20 - 37)	34 (17 - 78)	31 (16 - 48)	40 (19 - 65)	38 (19 - 89)	25 (16 - 61)

Note:
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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 marine sediment quality in the Mirs Bay WCZ, 2018 - 2022

	Mirs Bay (North)		Long Harbour	Waglan Island	Mirs Bay (South)		Mirs Bay (Central)	
Parameter	MS4	MS5	MS6	MS8	MS13	MS14	MS15	MS16
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	84 (5 - 99)	84 (1 - 99)	71 (3 - 97)	68 (3 - 96)	73 (40 - 96)	85 (4 - 99)	85 (8 - 99)	71 (38 - 90)
Electrochemical Potential (mV)	-217 (-329 - -74)	-202 (-321 - -82)	-220 (-304 - -131)	-129 (-241 - -73)	-127 (-255 - -36)	-139 (-272 - -85)	-132 (-303 - -65)	-119 (-217 - -42)
Total Solids (%w/w)	39 (33 - 44)	38 (34 - 46)	34 (30 - 46)	49 (36 - 65)	50 (35 - 60)	50 (43 - 54)	48 (44 - 55)	53 (44 - 60)
Total Volatile Soilds (%TS)	8.4 (6.5 - 11.0)	8.3 (5.3 - 9.9)	10.7 (8.8 - 13.0)	6.6 (5.3 - 8.9)	6.1 (5.3 - 7.3)	6.5 (5.6 - 7.4)	6.9 (6.1 - 8.3)	6.1 (4.9 - 7.6)
Chemical Oxygen Demand (mg/kg)	13900 (12000 - 16000)	14400 (12000 - 17000)	15400 (12000 - 17000)	10080 (8500 - 11000)	9830 (7200 - 14000)	9600 (6400 - 13000)	9710 (6100 - 11000)	9320 (5200 - 11000)
Total Carbon (%w/w)	0.6 (0.5 - 0.7)	0.6 (0.6 - 0.9)	1.0 (0.8 - 2.0)	0.7 (0.4 - 1.3)	0.6 (0.5 - 0.9)	0.6 (0.5 - 1.0)	0.6 (0.5 - 0.7)	0.6 (0.5 - 0.7)
Ammonical Nitrogen (mg/kg)	8.32 (5.20 - 13.00)	7.06 (0.45 - 10.00)	7.94 (0.78 - 16.00)	2.27 (0.08 - 3.90)	2.85 (1.40 - 6.20)	3.02 (2.30 - 4.20)	3.76 (0.08 - 7.20)	4.60 (0.33 - 8.70)
Total Kjeldahl Nitrogen (mg/kg)	610 (410 - 710)	640 (530 - 730)	730 (610 - 780)	500 (340 - 680)	440 (340 - 520)	530 (460 - 620)	520 (410 - 650)	540 (460 - 730)
Total Phosphorus (mg/kg)	200 (170 - 220)	200 (170 - 220)	210 (170 - 230)	210 (150 - 240)	230 (180 - 280)	240 (210 - 270)	240 (220 - 270)	250 (220 - 320)
Total Sulphide (mg/kg)	27.5 (10.0 - 85.0)	22.3 (3.4 - 44.0)	30.6 (9.4 - 78.0)	19.4 (2.0 - 140.0)	14.8 (0.2 - 34.0)	11.0 (2.6 - 30.0)	13.7 (3.3 - 27.0)	16.5 (2.3 - 37.0)
Total Cyanide (mg/kg)	<0.1 (0.1 - <0.1)	0.1 (0.1 - 0.2)	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)
Arsenic (mg/kg)	8.5 (6.0 - 11.0)	9.2 (7.8 - 11.0)	8.0 (3.5 - 11.0)	8.6 (5.2 - 11.0)	9.1 (6.9 - 11.0)	9.1 (8.0 - 10.0)	8.7 (7.2 - 11.0)	8.2 (6.6 - 10.0)
Cadmium (mg/kg)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)
Chromium (mg/kg)	36 (22 - 55)	35 (28 - 47)	35 (22 - 75)	32 (16 - 49)	32 (21 - 51)	33 (26 - 42)	32 (23 - 41)	29 (22 - 47)
Copper (mg/kg)	17 (12 - 29)	17 (14 - 23)	16 (7 - 22)	15 (11 - 21)	14 (10 - 24)	32 (10 - 200)	13 (10 - 16)	92 (9 - 830)
Lead (mg/kg)	39 (32 - 46)	43 (35 - 59)	41 (28 - 47)	35 (21 - 41)	34 (28 - 43)	35 (31 - 37)	35 (29 - 40)	31 (26 - 41)
Mercury (mg/kg)	0.05 (0.05 - 0.06)	0.05 (0.05 - 0.06)	0.06 (0.05 - 0.09)	0.07 (0.05 - 0.13)	0.06 (0.05 - 0.10)	0.06 (0.05 - 0.10)	0.05 (0.05 - 0.06)	<0.05 (0.05 - <0.05)
Nickel (mg/kg)	24 (14 - 32)	25 (21 - 33)	23 (15 - 33)	22 (11 - 30)	22 (16 - 31)	23 (17 - 27)	23 (18 - 27)	22 (16 - 38)
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)	110 (71 - 170)	110 (89 - 160)	110 (74 - 130)	86 (51 - 120)	88 (69 - 130)	120 (71 - 400)	87 (68 - 120)	110 (64 - 420)
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] [6]	94 (90 - 130)	110 (90 - 330)	92 (90 - 110)	92 (90 - 100)	93 (90 - 120)	91 (90 - 93)	90 (90 - 90)	90 (90 - 93)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	31 (17 - 67)	76 (16 - 520)	36 (17 - 64)	50 (19 - 200)	32 (20 - 65)	30 (20 - 69)	23 (18 - 30)	21 (18 - 27)

Note:
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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 marine sediment quality in the North Western and Western Buffer WCZs, 2018 - 2022

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)	66 (20 - 97)	63 (25 - 96)	57 (28 - 89)	65 (13 - 88)	68 (17 - 94)	68 (26 - 87)
Electrochemical Potential (mV)	-128 (-170 - -69)	-142 (-217 - -76)	-151 (-197 - -109)	-133 (-222 - -87)	-185 (-318 - -97)	-196 (-290 - -108)
Total Solids (%w/w)	46 (37 - 57)	50 (42 - 59)	56 (49 - 64)	49 (41 - 64)	44 (38 - 52)	45 (38 - 54)
Total Volatile Soilds (%TS)	6.8 (4.9 - 7.8)	6.6 (5.3 - 7.6)	5.4 (4.2 - 6.4)	6.7 (4.6 - 8.2)	7.2 (6.1 - 8.8)	7.0 (5.9 - 8.6)
Chemical Oxygen Demand (mg/kg)	11820 (9200 - 16000)	13970 (6700 - 19000)	12580 (8800 - 17000)	12580 (9800 - 21000)	16370 (8700 - 22000)	14280 (9800 - 18000)
Total Carbon (%w/w)	0.6 (0.5 - 0.9)	0.7 (0.6 - 0.8)	0.6 (0.5 - 0.8)	0.5 (0.4 - 1.2)	0.7 (0.6 - 0.8)	0.6 (0.5 - 0.7)
Ammonical Nitrogen (mg/kg)	3.97 (0.05 - 11.00)	7.51 (0.32 - 15.00)	6.18 (0.43 - 24.00)	7.61 (0.65 - 45.00)	14.87 (1.40 - 24.00)	6.05 (0.58 - 22.00)
Total Kjeldahl Nitrogen (mg/kg)	470 (370 - 540)	450 (380 - 530)	430 (300 - 740)	450 (370 - 570)	620 (510 - 770)	530 (370 - 650)
Total Phosphorus (mg/kg)	220 (170 - 280)	220 (180 - 230)	210 (180 - 250)	230 (190 - 280)	230 (200 - 270)	220 (170 - 250)
Total Sulphide (mg/kg)	36.7 (2.5 - 77.0)	60.8 (3.7 - 120.0)	22.1 (4.3 - 78.0)	27.2 (1.2 - 87.0)	114.2 (9.4 - 290.0)	34.8 (0.8 - 81.0)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)
Arsenic (mg/kg)	12.9 (9.6 - 23.0)	13.3 (9.7 - 18.0)	11.5 (8.3 - 16.0)	16.6 (14.0 - 22.0)	10.8 (7.5 - 15.0)	11.0 (7.8 - 14.0)
Cadmium (mg/kg)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	0.2 (0.1 - 0.2)	0.1 (0.1 - 0.3)
Chromium (mg/kg)	40 (26 - 55)	35 (22 - 51)	29 (17 - 48)	38 (30 - 50)	40 (27 - 59)	39 (27 - 57)
Copper (mg/kg)	36 (23 - 48)	30 (17 - 43)	25 (16 - 44)	30 (23 - 39)	50 (26 - 71)	41 (22 - 63)
Lead (mg/kg)	49 (36 - 90)	39 (32 - 48)	35 (25 - 42)	44 (35 - 52)	43 (33 - 52)	40 (32 - 46)
Mercury (mg/kg)	0.11 (0.06 - 0.14)	0.09 (0.06 - 0.12)	0.12 (0.06 - 0.54)	0.11 (0.06 - 0.17)	0.16 (0.10 - 0.25)	0.15 (0.08 - 0.32)
Nickel (mg/kg)	23 (16 - 31)	21 (13 - 28)	18 (10 - 27)	23 (17 - 28)	23 (17 - 33)	23 (18 - 30)
Silver (mg/kg)	0.2 (0.2 - 0.3)	0.2 (0.2 - 0.3)	<0.2 (0.2 - <0.2)	<0.2 (0.2 - <0.2)	0.5 (0.3 - 0.7)	0.4 (0.2 - 0.9)
Zinc (mg/kg)	160 (100 - 220)	120 (94 - 160)	130 (78 - 200)	120 (98 - 180)	170 (94 - 300)	150 (94 - 180)
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] [6]	97 (90 - 140)	98 (90 - 150)	97 (90 - 150)	90 (90 - 95)	96 (90 - 100)	91 (90 - 100)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	75 (44 - 110)	140 (30 - 600)	81 (28 - 220)	66 (24 - 130)	190 (91 - 390)	150 (29 - 360)

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 marine sediment quality in the Eastern Buffer and Victoria Harbour WCZs, 2018 - 2022

	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)	69 (24 - 99)	74 (10 - 98)	81 (52 - 97)	65 (17 - 96)	78 (20 - 97)	59 (11 - 98)	83 (10 - 98)	72 (5 - 97)
Electrochemical Potential (mV)	-140 (-220 - -98)	-159 (-243 - -103)	-136 (-187 - -68)	-192 (-337 - -102)	-257 (-377 - -168)	-227 (-319 - -124)	-264 (-387 - -189)	-206 (-335 - -112)
Total Solids (%w/w)	53 (42 - 63)	55 (46 - 73)	50 (35 - 63)	43 (35 - 50)	40 (35 - 53)	45 (35 - 60)	41 (36 - 51)	42 (34 - 58)
Total Volatile Soilds (%TS)	6.6 (4.3 - 8.6)	6.2 (3.8 - 7.9)	6.9 (4.7 - 9.3)	7.8 (6.7 - 9.2)	8.2 (6.0 - 9.6)	7.1 (5.3 - 8.4)	7.2 (5.0 - 9.2)	7.5 (5.4 - 8.8)
Chemical Oxygen Demand (mg/kg)	12870 (8800 - 17000)	10940 (6400 - 15000)	13660 (9600 - 19000)	17800 (15000 - 22000)	17180 (9800 - 24000)	17700 (11000 - 22000)	15620 (7200 - 20000)	16800 (10000 - 22000)
Total Carbon (%w/w)	0.9 (0.7 - 1.2)	0.9 (0.5 - 2.5)	0.9 (0.6 - 1.9)	0.7 (0.5 - 1.0)	0.8 (0.6 - 1.4)	0.7 (0.6 - 0.8)	0.6 (0.5 - 0.9)	0.7 (0.5 - 0.9)
Ammonical Nitrogen (mg/kg)	4.51 (0.25 - 9.30)	8.23 (0.27 - 29.00)	6.18 (1.00 - 17.00)	4.00 (0.10 - 11.00)	9.59 (1.70 - 27.00)	11.52 (0.81 - 46.00)	15.46 (1.80 - 31.00)	7.24 (0.95 - 15.00)
Total Kjeldahl Nitrogen (mg/kg)	500 (350 - 730)	450 (340 - 640)	510 (380 - 620)	560 (480 - 670)	610 (510 - 780)	640 (570 - 770)	560 (420 - 780)	560 (480 - 670)
Total Phosphorus (mg/kg)	200 (180 - 250)	190 (140 - 230)	210 (180 - 240)	200 (190 - 210)	200 (160 - 210)	230 (200 - 270)	220 (190 - 300)	210 (190 - 250)
Total Sulphide (mg/kg)	19.5 (4.6 - 43.0)	29.2 (0.2 - 83.0)	31.0 (2.3 - 59.0)	95.2 (6.1 - 180.0)	158.1 (39.0 - 450.0)	114.1 (15.0 - 240.0)	160.8 (38.0 - 440.0)	113.2 (7.5 - 500.0)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.2)	<0.1 (0.1 - <0.1)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.3)	0.2 (0.1 - 0.4)	0.2 (0.1 - 0.3)
Arsenic (mg/kg)	6.8 (5.1 - 8.5)	6.6 (3.6 - 9.7)	7.8 (4.2 - 11.0)	9.3 (6.4 - 13.0)	10.1 (6.1 - 14.0)	10.9 (8.0 - 14.0)	11.0 (9.2 - 14.0)	11.5 (6.8 - 16.0)
Cadmium (mg/kg)	<0.1 (0.1 - <0.1)	<0.1 (0.1 - <0.1)	0.1 (0.1 - 0.2)	0.3 (0.1 - 0.4)	0.3 (0.2 - 0.4)	0.3 (0.2 - 0.4)	0.8 (0.2 - 6.1)	0.4 (0.2 - 0.8)
Chromium (mg/kg)	28 (16 - 42)	27 (8 - 50)	34 (17 - 51)	41 (23 - 57)	44 (20 - 62)	42 (21 - 69)	53 (32 - 120)	60 (28 - 120)
Copper (mg/kg)	29 (14 - 50)	27 (5 - 54)	50 (23 - 83)	89 (49 - 120)	94 (42 - 120)	75 (33 - 130)	110 (43 - 400)	130 (48 - 220)
Lead (mg/kg)	32 (21 - 40)	32 (15 - 46)	41 (22 - 55)	50 (33 - 59)	56 (48 - 62)	58 (44 - 110)	47 (37 - 92)	53 (37 - 79)
Mercury (mg/kg)	0.14 (0.05 - 0.41)	0.09 (0.05 - 0.14)	0.17 (0.10 - 0.31)	0.33 (0.22 - 0.47)	0.33 (0.18 - 0.42)	0.36 (0.25 - 0.60)	0.22 (0.16 - 0.50)	0.21 (0.10 - 0.37)
Nickel (mg/kg)	16 (10 - 25)	16 (6 - 27)	18 (9 - 25)	20 (11 - 26)	22 (10 - 29)	20 (12 - 32)	28 (19 - 62)	28 (13 - 43)
Silver (mg/kg)	0.3 (0.2 - 0.6)	0.3 (0.2 - 0.6)	0.7 (0.3 - 1.6)	1.7 (0.8 - 2.8)	1.3 (0.7 - 1.7)	1.0 (0.5 - 1.3)	1.4 (0.6 - 5.4)	1.4 (0.5 - 2.9)
Zinc (mg/kg)	95 (53 - 150)	94 (30 - 140)	140 (63 - 210)	180 (120 - 240)	220 (120 - 340)	220 (160 - 340)	180 (130 - 400)	220 (99 - 360)
Total Polychlorinated Biphenyls (PCBs) (μg/kg) [3]	18 (18 - 18)	18 (18 - 18)	18 (18 - 21)	19 (18 - 30)	19 (18 - 22)	18 (18 - 19)	18 (18 - 22)	20 (18 - 33)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4] [6]	94 (90 - 100)	110 (90 - 290)	100 (90 - 150)	250 (90 - 740)	120 (90 - 220)	120 (90 - 190)	97 (90 - 120)	110 (90 - 170)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	160 (37 - 440)	160 (17 - 700)	230 (43 - 560)	900 (87 - 4700)	460 (160 - 860)	360 (51 - 550)	160 (44 - 380)	350 (120 - 910)

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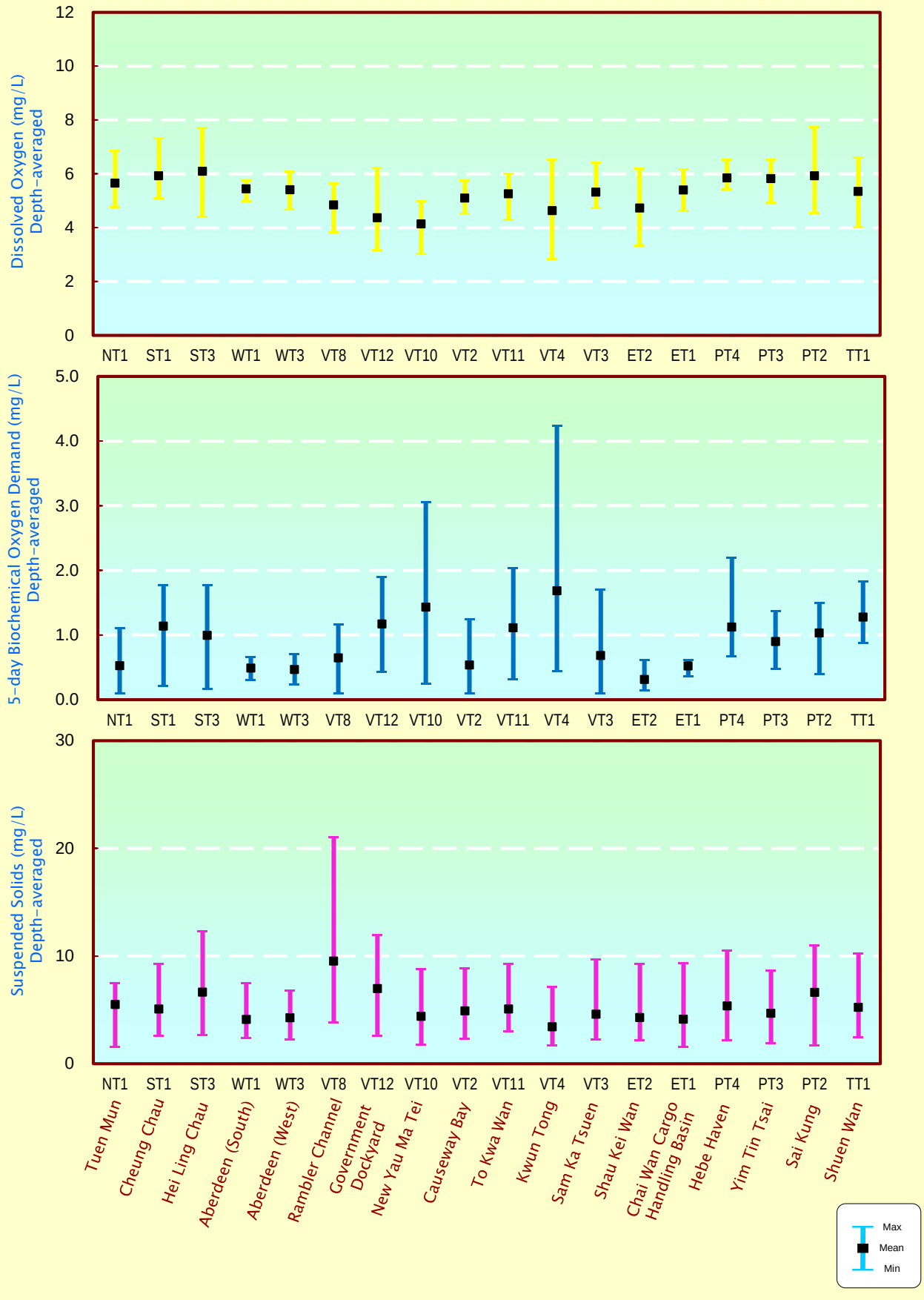
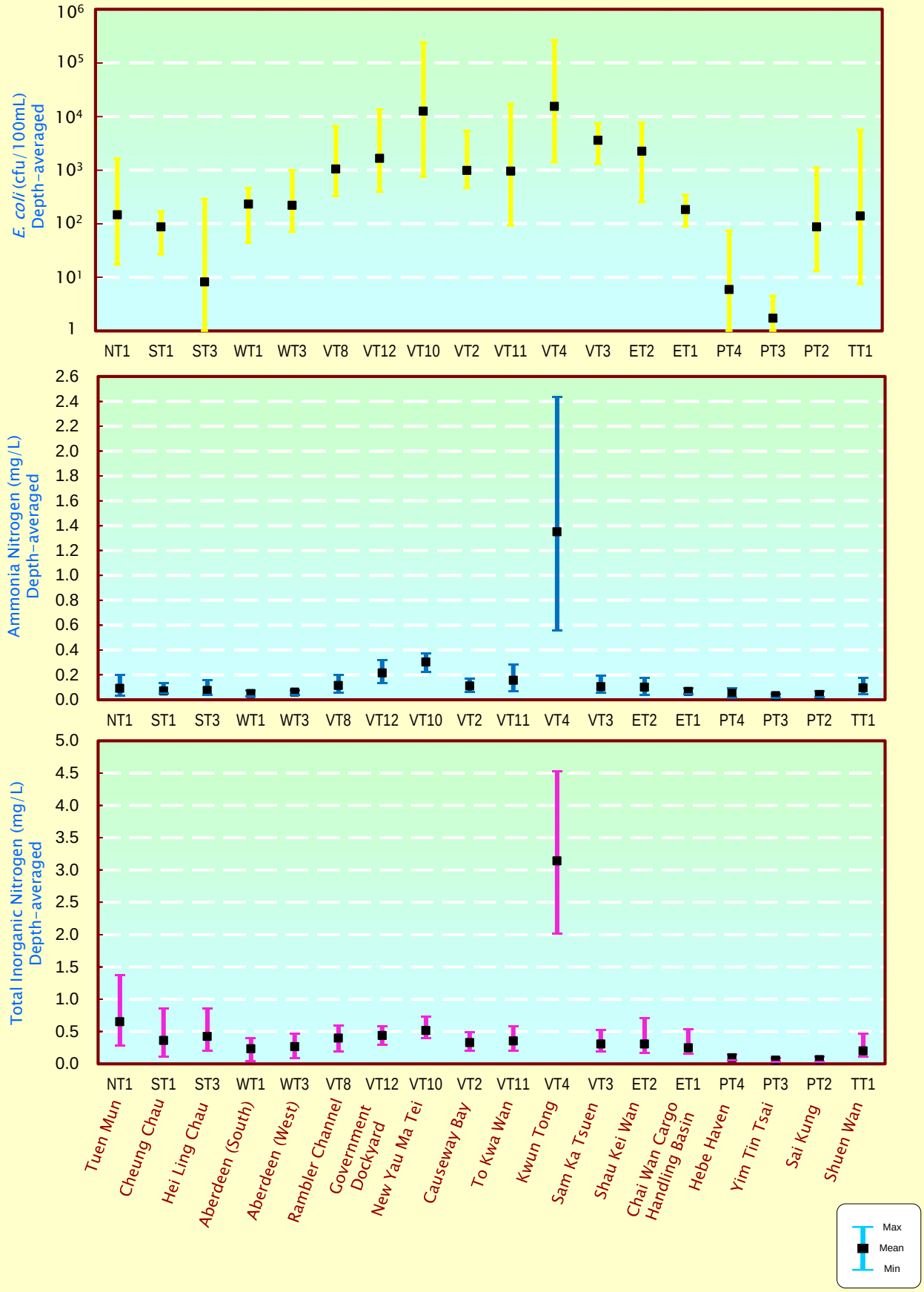
6 Low and high molecular weight PAHs results are derived from the summation of the corresponding congeners. If the concentration of a congener is below report limit (RL), the result will be taken as 0.5xRL in the calculation.

Water quality of typhoon shelters, sheltered anchorages and Government Dockyard in 2022



Water quality of typhoon shelters, sheltered anchorages and Government Dockyard in 2022 (continued)



Long-term water quality trend analyses in typhoon shelters, sheltered anchorages and Government Dockyard, 1986-2022

Monitoring Station		NT1	ST1	ST3	WT3	WT1	VT8	VT10	VT2	VT11
Monitoring Period		1986 – 2022	1986 – 2022	2000 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1993 – 2022	1986 – 2022	1994 – 2022
Parameter	Water Depth									
Temperature (℃)	Surface	↗	↗	-	↗	↗	↗	↗	↗	↗
	Middle	NA	-	↗	↗	↗	NA	NA	NA	↗
	Bottom	↗	↗	↗	-	↗	↗	↗	↗	↗
	Average	↗	↗	↗	↗	↗	↗	↗	↗	↗
Salinity	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (mg/L)	Surface	↗	-	-	-	-	↗	↗	↗	↗
	Middle	NA	-	-	-	-	NA	NA	NA	↗
	Bottom	↗	-	-	-	-	↗	↗	↗	↗
	Average	↗	-	-	-	-	↗	↗	↗	↗
Dissolved Oxygen (%)	Surface	↗	-	-	-	-	↗	↗	↗	↗
	Middle	NA	-	-	-	-	NA	NA	NA	↗
	Bottom	↗	-	-	-	↗	↗	↗	↗	↗
	Average	↗	-	-	-	-	↗	↗	↗	↗
pH	Surface	↘	↘	↘	↘	↘	↘	-	-	↘
	Middle	NA	↘	↘	↘	↘	NA	NA	NA	↘
	Bottom	-	↘	↘	↘	↘	↘	-	-	↘
	Average	↘	↘	↘	↘	↘	↘	-	-	↘
Secchi disc depth (m)		↗	↗	↗	↗	↗	↗	↗	↗	-
Turbidity (NTU)	Surface	↘	↘	↘	↘	-	-	↘	-	-
	Middle	NA	↘	↘	↘	↘	NA	NA	NA	-
	Bottom	-	↘	↘	-	↘	-	↘	-	-
	Average	↘	↘	↘	↘	↘	-	↘	-	-
Suspended Solids (mg/L)	Surface	↘	-	-	-	-	↘	↘	-	-
	Middle	NA	-	↗	-	-	NA	NA	NA	-
	Bottom	-	-	-	-	↗	↘	↘	-	-
	Average	↘	-	-	-	-	↘	↘	-	-
Total volatile solids (mg/L)	Surface	↘	-	-	-	-	↘	↘	-	-
	Middle	NA	-	↗	-	-	NA	NA	NA	-
	Bottom	-	-	-	-	-	↘	↘	-	-
	Average	↘	-	↗	-	-	↘	↘	-	-
5-day Biochemical Oxygen Demand (mg/L)	Surface	↘	↘	-	-	-	↘	-	↘	↘
	Middle	NA	-	-	↘	↘	NA	NA	NA	↘
	Bottom	↘	-	-	↘	-	↘	↘	↘	↘
	Average	↘	↘	-	↘	-	↘	-	↘	↘
Ammonia nitrogen (mg/L)	Surface	↘	-	-	↘	-	↘	↘	↘	↘
	Middle	NA	-	-	↘	↘	NA	NA	NA	↘
	Bottom	↘	-	-	↘	↘	↘	↘	↘	↘
	Average	↘	-	-	↘	↘	↘	↘	↘	↘
Unionised Ammonia(mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	↘	↘	NA	NA	NA	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘	↘
Nitrite nitrogen (mg/L)	Surface	↗	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	-	-	-	-	-	↗	-	-	-
	Average	↗	-	-	-	-	↗	-	-	-
Nitrate nitrogen (mg/L)	Surface	↗	-	↗	-	-	↗	↗	↗	↗
	Middle	NA	-	↗	-	-	NA	NA	NA	↗
	Bottom	↗	-	↗	-	-	↗	↗	↗	↗
	Average	↗	-	↗	-	-	↗	↗	↗	↗
Total inorganic nitrogen (mg/L)	Surface	↗	-	↗	-	-	-	↘	↘	-
	Middle	NA	-	↗	-	-	NA	NA	NA	↘
	Bottom	↗	-	-	-	-	-	↘	↘	↘
	Average	↗	-	↗	-	-	-	↘	↘	↘
Total Kjeldahl nitrogen (mg/L)	Surface	↘	-	↗	↗	↗	↘	-	↘	-
	Middle	NA	↗	↗	↗	↗	NA	NA	NA	↘
	Bottom	↘	-	↗	↗	↗	↘	-	↘	-
	Average	↘	-	↗	↗	↗	↘	-	↘	-
Total nitrogen (mg/L)	Surface	-	↗	↗	↗	↗	↘	↘	↘	-
	Middle	NA	↗	↗	↗	↗	NA	NA	NA	-
	Bottom	-	↗	↗	↗	↗	↘	↘	↘	-
	Average	-	↗	↗	↗	↗	↘	-	↘	-
Orthophosphate phosphorus (mg/L)	Surface	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Middle	NA	↘	↘	↘	↘	NA	NA	NA	↘
	Bottom	↘	↘	↘	↘	↘	↘	↘	↘	↘
	Average	↘	↘	↘	↘	↘	↘	↘	↘	↘
Total phosphorus (mg/L)	Surface	↘	-	-	-	-	↘	↘	↘	↘
	Middle	NA	-	-	-	-	NA	NA	NA	↘
	Bottom	↘	-	-	-	-	↘	↘	↘	↘
	Average	↘	-	-	-	-	↘	↘	↘	↘
Silica (mg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
Chlorophyll-*a* (μg/L)	Surface	-	-	-	-	-	-	-	-	-
	Middle	NA	-	-	-	-	NA	NA	NA	-
	Bottom	-	-	-	-	-	-	-	-	-
	Average	-	-	-	-	-	-	-	-	-
E. coli (cfu/100mL)	Surface	↘	↘	-	↘	↘	↘	↘	↘	↘
	Middle	NA	-	-	↘	↘	NA	NA	NA	↘
	Bottom	↘	↘	-	↘	↘	↘	↘	↘	↘
	Average	↘	↘	-	↘	↘	↘	↘	↘	↘
Faecal coliforms (cfu/100mL)	Surface	↘	↘	-	↘	↘	↘	-	↘	-
	Middle	NA	↘	-	↘	↘	NA	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

Long-term water quality trend analyses in typhoon shelters, sheltered anchorages and Government Dockyard, 1986-2022

Monitoring Station		VT12	VT4	VT3	ET2	ET1	PT4	PT3	PT2	TT1
Monitoring Period		2000 – 2022	1987 – 2022	1986 – 2022	1993 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022	1986 – 2022
Parameter	Water Depth									
Temperature (℃)	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 (mg/L)	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, sheltered anchorages and Government Dockyard in 2022

Parameter		Tuen Mun NT1	Cheung Chau ST1	Hei Ling Chau ST3	Aberdeen (South) WT1	Aberdeen (West) WT3	Rambler Channel VT8
Number of samples		6	6	6	6	6	6
Temperature (°C)		25.8 (19.2 - 29.2)	25.6 (19.1 - 29.6)	25.5 (19.2 - 29.1)	25.1 (20.1 - 28.0)	24.9 (20.1 - 28.0)	25.3 (19.4 - 28.4)
Salinity		23.7 (6.5 - 32.8)	28.7 (19.4 - 33.5)	28.2 (19.6 - 33.4)	30.9 (26.0 - 33.6)	30.9 (25.5 - 33.7)	29.7 (23.1 - 33.3)
Dissolved Oxygen (mg/L)		5.7 (4.8 - 6.9)	5.9 (5.1 - 7.3)	6.1 (4.4 - 7.7)	5.5 (5.0 - 5.8)	5.4 (4.7 - 6.1)	4.9 (3.8 - 5.7)
	Bottom	5.6 (4.9 - 6.5)	6.3 (5.3 - 8.0)	6.3 (4.5 - 8.5)	5.5 (4.5 - 6.4)	5.4 (4.5 - 6.1)	4.7 (3.9 - 5.5)
Dissolved Oxygen (% Saturation)		80 (65 - 98)	85 (73 - 106)	87 (68 - 111)	79 (76 - 82)	78 (71 - 82)	70 (59 - 82)
	Bottom	79 (64 - 93)	91 (76 - 116)	90 (69 - 124)	80 (67 - 91)	78 (67 - 86)	68 (56 - 79)
pH		7.6 (7.1 - 8.1)	7.7 (7.3 - 8.2)	7.7 (7.3 - 8.3)	7.6 (7.2 - 8.0)	7.5 (6.6 - 7.9)	7.6 (7.2 - 8.1)
Secchi Disc Depth (m)		1.5 (1.1 - 1.9)	2.1 (1.6 - 3.0)	2.0 (1.3 - 2.8)	2.7 (1.9 - 4.3)	2.5 (2.2 - 3.2)	1.7 (1.2 - 2.5)
Turbidity (NTU)		27.0 (6.8 - 72.8)	20.4 (6.7 - 52.0)	26.6 (6.1 - 67.9)	14.9 (6.7 - 33.0)	18.6 (6.9 - 36.9)	45.4 (6.4 - 166.0)
Suspended Solids (mg/L)		5.5 (1.6 - 7.5)	5.1 (2.6 - 9.3)	6.6 (2.6 - 12.3)	4.1 (2.4 - 7.5)	4.3 (2.3 - 6.8)	9.5 (3.8 - 21.0)
5-day Biochemical Oxygen Demand (mg/L)		0.5 (<0.1 - 1.1)	1.1 (0.2 - 1.8)	1.0 (0.2 - 1.8)	0.5 (0.3 - 0.7)	0.5 (0.2 - 0.7)	0.7 (<0.1 - 1.2)
Ammonia Nitrogen (mg/L)		0.092 (0.033 - 0.200)	0.071 (0.053 - 0.133)	0.075 (0.037 - 0.157)	0.050 (0.028 - 0.075)	0.061 (0.038 - 0.073)	0.115 (0.056 - 0.200)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.005)	0.002 (<0.001 - 0.004)	0.002 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.003)	0.003 (<0.001 - 0.008)
Nitrite Nitrogen (mg/L)		0.050 (0.020 - 0.075)	0.026 (0.007 - 0.078)	0.030 (0.011 - 0.072)	0.018 (<0.002 - 0.035)	0.022 (0.002 - 0.041)	0.030 (0.011 - 0.045)
Nitrate Nitrogen (mg/L)		0.510 (0.155 - 1.250)	0.266 (0.049 - 0.767)	0.319 (0.120 - 0.757)	0.165 (<0.002 - 0.330)	0.183 (0.011 - 0.370)	0.254 (0.083 - 0.510)
Total Inorganic Nitrogen (mg/L)		0.65 (0.28 - 1.37)	0.36 (0.11 - 0.86)	0.42 (0.20 - 0.85)	0.23 (0.04 - 0.40)	0.27 (0.08 - 0.46)	0.40 (0.19 - 0.60)
Total Kjeldahl Nitrogen (mg/L)		0.32 (0.16 - 0.66)	0.31 (0.09 - 0.59)	0.29 (0.11 - 0.62)	0.32 (0.09 - 0.65)	0.30 (0.10 - 0.51)	0.46 (0.17 - 0.70)
Total Nitrogen (mg/L)		0.88 (0.40 - 1.51)	0.60 (0.43 - 0.96)	0.63 (0.41 - 0.95)	0.50 (0.32 - 0.76)	0.51 (0.37 - 0.64)	0.75 (0.56 - 0.97)
Orthophosphate Phosphorus (mg/L)		0.010 (<0.002 - 0.028)	0.004 (<0.002 - 0.014)	0.006 (<0.002 - 0.019)	0.008 (<0.002 - 0.018)	0.009 (<0.002 - 0.016)	0.016 (<0.002 - 0.027)
Total Phosphorus (mg/L)		0.06 (0.03 - 0.10)	0.06 (0.04 - 0.11)	0.06 (0.03 - 0.09)	0.05 (0.03 - 0.11)	0.06 (0.03 - 0.13)	0.06 (0.04 - 0.10)
Silica (as SiO_2) (mg/L)		2.84 (0.46 - 8.45)	1.52 (0.22 - 4.10)	1.63 (0.24 - 4.10)	1.04 (0.19 - 1.77)	1.22 (0.28 - 2.53)	1.63 (0.90 - 3.05)
Chlorophyll-a (µg/L)		5.4 (0.9 - 11.8)	5.2 (0.8 - 14.0)	4.6 (0.8 - 15.3)	2.9 (0.8 - 6.2)	1.7 (0.5 - 4.4)	3.4 (0.5 - 8.7)
E.coli (count/100mL)		150 (17 - 1600)	88 (27 - 170)	8 (1 - 290)	230 (44 - 460)	220 (71 - 990)	1100 (330 - 6500)
Faecal Coliforms (count/100mL)		910 (160 - 7700)	240 (38 - 630)	15 (2 - 600)	760 (120 - 4900)	720 (320 - 5400)	3200 (1300 - 28000)

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, sheltered anchorages and Government Dockyard in 2022 (continued)

Parameter		Government Dockyard VT12	New 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)		25.6 (19.4 - 29.4)	25.4 (19.4 - 29.1)	25.2 (19.0 - 29.0)	25.1 (18.8 - 28.8)	24.7 (19.0 - 29.0)	25.0 (18.7 - 28.6)
Salinity		29.2 (22.2 - 32.6)	29.4 (21.8 - 32.7)	29.9 (23.0 - 32.8)	30.3 (24.3 - 32.9)	29.1 (22.0 - 32.0)	30.5 (25.1 - 32.9)
Dissolved Oxygen (mg/L)		4.4 (3.2 - 6.2)	4.2 (3.0 - 5.0)	5.1 (4.5 - 5.8)	5.3 (4.3 - 6.0)	4.6 (2.9 - 6.5)	5.3 (4.7 - 6.4)
	Bottom	4.2 (3.1 - 6.2)	3.7 (2.5 - 5.0)	5.2 (4.0 - 6.3)	5.4 (3.8 - 6.1)	5.4 (4.6 - 6.4)	5.2 (4.0 - 6.0)
Dissolved Oxygen (% Saturation)		63 (48 - 92)	60 (46 - 73)	73 (66 - 85)	76 (62 - 89)	66 (41 - 96)	76 (70 - 87)
	Bottom	61 (46 - 91)	53 (36 - 71)	75 (58 - 93)	78 (55 - 89)	78 (69 - 94)	76 (58 - 87)
pH		7.5 (7.1 - 8.0)	7.5 (7.1 - 8.0)	7.6 (7.1 - 8.1)	7.6 (7.2 - 8.1)	7.5 (6.8 - 8.0)	7.5 (7.1 - 8.1)
Secchi Disc Depth (m)		1.5 (1.4 - 1.8)	1.6 (1.1 - 2.0)	2.0 (1.1 - 3.1)	2.0 (1.3 - 3.1)	2.0 (1.2 - 3.0)	2.3 (1.7 - 3.5)
Turbidity (NTU)		20.9 (8.0 - 47.9)	17.3 (7.3 - 40.1)	13.5 (6.3 - 34.3)	23.3 (6.1 - 81.0)	24.8 (7.2 - 52.3)	17.2 (7.8 - 48.5)
Suspended Solids (mg/L)		7.0 (2.6 - 12.0)	4.4 (1.8 - 8.8)	4.9 (2.3 - 8.9)	5.1 (3.0 - 9.3)	3.4 (1.7 - 7.1)	4.6 (2.3 - 9.7)
5-day Biochemical Oxygen Demand (mg/L)		1.2 (0.4 - 1.9)	1.4 (0.3 - 3.1)	0.5 (<0.1 - 1.3)	1.1 (0.3 - 2.0)	1.7 (0.4 - 4.2)	0.7 (<0.1 - 1.7)
Ammonia Nitrogen (mg/L)		0.215 (0.135 - 0.320)	0.304 (0.225 - 0.370)	0.111 (0.060 - 0.170)	0.157 (0.070 - 0.283)	1.350 (0.560 - 2.430)	0.106 (0.059 - 0.195)
Unionised Ammonia (mg/L)		0.004 (<0.001 - 0.009)	0.007 (0.001 - 0.018)	0.003 (<0.001 - 0.007)	0.004 (<0.001 - 0.011)	0.030 (0.004 - 0.072)	0.003 (<0.001 - 0.006)
Nitrite Nitrogen (mg/L)		0.028 (0.014 - 0.041)	0.032 (0.015 - 0.042)	0.021 (0.010 - 0.027)	0.023 (0.014 - 0.031)	0.555 (0.390 - 0.987)	0.021 (0.011 - 0.032)
Nitrate Nitrogen (mg/L)		0.196 (0.130 - 0.400)	0.180 (0.125 - 0.325)	0.197 (0.106 - 0.400)	0.175 (0.089 - 0.353)	1.230 (0.377 - 2.300)	0.182 (0.098 - 0.335)
Total Inorganic Nitrogen (mg/L)		0.44 (0.30 - 0.59)	0.52 (0.40 - 0.73)	0.33 (0.20 - 0.49)	0.36 (0.21 - 0.59)	3.14 (2.02 - 4.53)	0.31 (0.19 - 0.52)
Total Kjeldahl Nitrogen (mg/L)		0.57 (0.34 - 0.94)	0.78 (0.51 - 1.15)	0.45 (0.21 - 0.71)	0.51 (0.15 - 0.81)	1.78 (0.85 - 3.13)	0.45 (0.22 - 0.71)
Total Nitrogen (mg/L)		0.80 (0.61 - 1.13)	0.99 (0.70 - 1.39)	0.67 (0.46 - 0.85)	0.71 (0.47 - 0.93)	3.57 (2.09 - 5.23)	0.66 (0.39 - 0.85)
Orthophosphate Phosphorus (mg/L)		0.025 (<0.002 - 0.041)	0.033 (0.020 - 0.040)	0.017 (<0.002 - 0.030)	0.022 (<0.002 - 0.043)	0.240 (0.134 - 0.333)	0.017 (<0.002 - 0.029)
Total Phosphorus (mg/L)		0.08 (0.04 - 0.15)	0.09 (0.06 - 0.13)	0.06 (0.04 - 0.09)	0.07 (0.04 - 0.10)	0.32 (0.21 - 0.51)	0.06 (0.05 - 0.09)
Silica (as SiO_2) (mg/L)		1.60 (1.05 - 2.10)	1.57 (0.96 - 2.85)	1.31 (0.72 - 2.10)	1.21 (0.39 - 1.93)	3.83 (2.20 - 5.50)	1.18 (0.67 - 1.70)
Chlorophyll-a (µg/L)		4.5 (0.6 - 11.8)	2.9 (0.4 - 6.3)	3.5 (0.5 - 10.5)	4.3 (0.7 - 10.4)	6.5 (0.6 - 25.3)	3.4 (0.4 - 11.0)
E.coli (count/100mL)		1700 (400 - 13000)	13000 (750 - 240000)	980 (460 - 5300)	960 (93 - 17000)	16000 (1400 - 260000)	3600 (1300 - 7300)
Faecal Coliforms (count/100mL)		4200 (850 - 47000)	24000 (1200 - 450000)	3000 (1100 - 16000)	2900 (140 - 31000)	36000 (2800 - 610000)	6900 (2500 - 20000)

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, sheltered anchorages and Government Dockyard in 2022 (continued)

Parameter		Shau Kei Wan ET2	Chai Wan Cargo Handling Basin 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)		24.7 (20.0 - 28.2)	24.9 (20.1 - 28.8)	26.2 (19.4 - 30.4)	26.1 (19.1 - 30.2)	26.5 (19.3 - 31.5)	25.8 (19.6 - 29.9)
Salinity		31.7 (27.3 - 33.5)	31.4 (26.7 - 33.3)	31.4 (30.2 - 33.2)	32.0 (30.8 - 33.5)	31.6 (30.4 - 33.4)	30.0 (26.0 - 32.7)
Dissolved Oxygen (mg/L)		4.7 (3.3 - 6.2)	5.4 (4.6 - 6.2)	5.9 (5.4 - 6.5)	5.8 (4.9 - 6.5)	5.9 (4.6 - 7.8)	5.4 (4.0 - 6.6)
	Bottom	4.3 (2.4 - 6.1)	5.0 (4.1 - 5.8)	6.2 (5.7 - 6.6)	5.9 (5.1 - 7.3)	N/A N/A	4.8 (2.2 - 6.4)
Dissolved Oxygen (% Saturation)		68 (48 - 83)	78 (72 - 83)	86 (79 - 95)	86 (77 - 95)	87 (73 - 102)	78 (63 - 87)
	Bottom	62 (35 - 83)	73 (63 - 82)	91 (85 - 99)	86 (76 - 96)	N/A N/A	69 (33 - 86)
pH		7.5 (6.9 - 8.0)	7.7 (7.2 - 8.1)	7.6 (6.9 - 8.1)	7.7 (7.3 - 8.1)	7.8 (7.3 - 8.1)	7.6 (7.2 - 8.0)
Secchi Disc Depth (m)		3.0 (2.4 - 3.6)	2.5 (1.9 - 3.3)	2.4 (1.7 - 3.2)	3.0 (2.5 - 3.3)	2.1 (1.7 - 2.8)	2.0 (1.0 - 2.8)
Turbidity (NTU)		12.5 (6.3 - 29.2)	12.2 (6.2 - 24.2)	8.6 (6.1 - 15.1)	10.8 (6.1 - 21.6)	14.4 (6.3 - 31.3)	10.4 (6.9 - 19.3)
Suspended Solids (mg/L)		4.3 (2.2 - 9.2)	4.1 (1.5 - 9.3)	5.4 (2.2 - 10.5)	4.7 (1.9 - 8.7)	6.6 (1.7 - 11.0)	5.2 (2.5 - 10.2)
5-day Biochemical Oxygen Demand (mg/L)		0.3 (0.1 - 0.6)	0.5 (0.4 - 0.6)	1.1 (0.7 - 2.2)	0.9 (0.5 - 1.4)	1.0 (0.4 - 1.5)	1.3 (0.9 - 1.8)
Ammonia Nitrogen (mg/L)		0.102 (0.039 - 0.173)	0.068 (0.042 - 0.091)	0.052 (0.016 - 0.093)	0.034 (0.017 - 0.047)	0.042 (0.020 - 0.069)	0.096 (0.047 - 0.177)
Unionised Ammonia (mg/L)		0.002 (<0.001 - 0.003)	0.002 (<0.001 - 0.004)	0.001 (<0.001 - 0.003)	0.001 (<0.001 - 0.002)	0.001 (<0.001 - 0.003)	0.003 (<0.001 - 0.008)
Nitrite Nitrogen (mg/L)		0.028 (0.006 - 0.056)	0.023 (0.006 - 0.038)	0.003 (<0.002 - 0.008)	0.002 (<0.002 - 0.002)	<0.002 (<0.002 - <0.002)	0.008 (<0.002 - 0.024)
Nitrate Nitrogen (mg/L)		0.177 (0.077 - 0.500)	0.158 (0.073 - 0.423)	0.040 (<0.002 - 0.095)	0.021 (<0.002 - 0.045)	0.021 (<0.002 - 0.062)	0.098 (0.016 - 0.283)
Total Inorganic Nitrogen (mg/L)		0.31 (0.17 - 0.71)	0.25 (0.16 - 0.53)	0.10 (0.05 - 0.15)	0.06 (0.03 - 0.09)	0.06 (0.04 - 0.12)	0.20 (0.11 - 0.46)
Total Kjeldahl Nitrogen (mg/L)		0.38 (0.12 - 0.62)	0.39 (0.18 - 0.62)	0.29 (0.12 - 0.53)	0.29 (0.11 - 0.59)	0.30 (0.08 - 0.53)	0.45 (0.30 - 0.59)
Total Nitrogen (mg/L)		0.59 (0.31 - 0.82)	0.57 (0.36 - 0.71)	0.33 (0.16 - 0.53)	0.31 (0.12 - 0.60)	0.32 (0.09 - 0.54)	0.56 (0.37 - 0.73)
Orthophosphate Phosphorus (mg/L)		0.018 (0.008 - 0.035)	0.012 (0.004 - 0.021)	0.006 (0.003 - 0.010)	0.003 (<0.002 - 0.006)	0.004 (<0.002 - 0.015)	0.007 (<0.002 - 0.028)
Total Phosphorus (mg/L)		0.06 (0.04 - 0.10)	0.05 (0.03 - 0.10)	0.05 (0.02 - 0.07)	0.04 (0.02 - 0.05)	0.04 (0.02 - 0.07)	0.05 (<0.02 - 0.07)
Silica (as SiO_2) (mg/L)		1.28 (0.57 - 2.77)	1.29 (0.51 - 2.63)	0.89 (0.15 - 2.05)	0.68 (0.11 - 1.37)	0.64 (0.18 - 1.60)	1.31 (0.73 - 1.80)
Chlorophyll-a (µg/L)		1.3 (0.4 - 4.0)	4.1 (0.4 - 10.0)	3.6 (1.7 - 7.0)	2.3 (0.6 - 4.8)	3.2 (0.6 - 5.7)	3.5 (0.9 - 6.0)
E.coli (count/100mL)		2300 (250 - 7600)	180 (89 - 340)	6 (<1 - 73)	2 (<1 - 4)	87 (13 - 1100)	140 (8 - 5600)
Faecal Coliforms (count/100mL)		4800 (590 - 20000)	920 (590 - 1200)	30 (6 - 320)	3 (1 - 11)	480 (90 - 3100)	520 (55 - 15000)

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/A (Not Applicable) indicates the measurement was not made due to shallow water.

Summary statistics of marine sediment quality of typhoon shelters, sheltered anchorages and Government Dockyard, 2018- 2022

Parameter	Tuen Mun NS5	Cheung Chau SS7	Hei Ling Chau SS8	Rambler Channel VS17	Government Dockyard VS21	New Yau Ma Tei VS19	Causeway Bay VS12
Number of samples	10	10	10	10	10	10	10
Particle Size Fractionation <63µm (%w/w)	71 (4 - 97)	66 (12 - 98)	83 (3 - 98)	71 (8 - 87)	78 (2 - 99)	77 (30 - 97)	73 (23 - 98)
Electrochemical Potential (mV)	-154 (-211 - -79)	-269 (-366 - -118)	-202 (-316 - -132)	-233 (-308 - -64)	-286 (-387 - -145)	-350 (-390 - -302)	-252 (-359 - -127)
Total Solids (%w/w)	49 (38 - 58)	36 (33 - 41)	35 (31 - 39)	39 (36 - 43)	36 (28 - 42)	45 (42 - 48)	49 (37 - 64)
Total Volatile Soilds (%TS)	6.6 (5.0 - 7.7)	7.9 (6.8 - 9.3)	7.8 (6.9 - 8.7)	9.2 (8.4 - 12.0)	8.0 (7.1 - 9.1)	7.8 (6.3 - 9.1)	7.8 (5.5 - 9.6)
Chemical Oxygen Demand (mg/kg)	16500 (13000 - 20000)	15600 (12000 - 25000)	12860 (9800 - 15000)	23500 (18000 - 29000)	17900 (13000 - 26000)	20200 (14000 - 26000)	22660 (9600 - 29000)
Total Carbon (%w/w)	0.7 (0.5 - 1.2)	0.6 (0.5 - 0.7)	0.5 (0.4 - 0.5)	0.9 (0.8 - 1.2)	0.5 (0.5 - 0.6)	0.8 (0.6 - 1.1)	1.0 (0.4 - 1.7)
Ammonical Nitrogen (mg/kg)	10.14 (0.29 - 23.00)	18.10 (8.00 - 28.00)	8.50 (3.60 - 13.00)	8.58 (5.10 - 15.00)	12.97 (3.60 - 41.00)	25.20 (10.00 - 35.00)	5.57 (0.26 - 14.00)
Total Kjeldahl Nitrogen (mg/kg)	470 (330 - 750)	550 (420 - 660)	520 (430 - 580)	580 (440 - 700)	450 (340 - 510)	580 (460 - 730)	570 (300 - 790)
Total Phosphorus (mg/kg)	220 (170 - 270)	270 (190 - 340)	170 (160 - 180)	220 (210 - 240)	190 (170 - 260)	240 (200 - 280)	220 (120 - 310)
Total Sulphide (mg/kg)	40.4 (6.7 - 120.0)	98.8 (4.3 - 360.0)	39.0 (8.4 - 80.0)	137.3 (9.7 - 290.0)	56.5 (0.5 - 240.0)	119.0 (29.0 - 340.0)	157.3 (18.0 - 410.0)
Total Cyanide (mg/kg)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	<0.1 (0.1 - <0.1)	0.2 (0.1 - 0.4)	<0.1 (0.1 - <0.1)	0.2 (0.1 - 0.2)	0.2 (0.1 - 0.3)
Arsenic (mg/kg)	10.4 (7.5 - 13.0)	10.0 (8.0 - 14.0)	9.6 (8.0 - 11.0)	13.2 (8.6 - 17.0)	11.2 (8.8 - 13.0)	9.2 (6.4 - 11.0)	9.9 (7.4 - 16.0)
Cadmium (mg/kg)	0.2 (0.1 - 0.6)	0.2 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.7 (0.6 - 0.9)	0.5 (0.4 - 0.6)	0.5 (0.3 - 0.8)	0.6 (0.2 - 1.1)
Chromium (mg/kg)	36 (26 - 52)	47 (36 - 56)	42 (34 - 65)	120 (88 - 160)	52 (39 - 65)	42 (29 - 56)	48 (21 - 100)
Copper (mg/kg)	40 (23 - 61)	93 (39 - 140)	36 (28 - 45)	210 (150 - 260)	180 (150 - 240)	110 (64 - 170)	190 (65 - 580)
Lead (mg/kg)	49 (31 - 89)	50 (33 - 72)	45 (40 - 51)	89 (61 - 120)	56 (46 - 63)	61 (33 - 120)	96 (73 - 120)
Mercury (mg/kg)	0.08 (0.05 - 0.11)	0.16 (0.07 - 0.24)	0.12 (0.10 - 0.15)	0.29 (0.17 - 0.62)	0.26 (0.17 - 0.59)	0.31 (0.15 - 0.81)	0.65 (0.18 - 0.94)
Nickel (mg/kg)	20 (12 - 28)	24 (20 - 30)	32 (22 - 80)	42 (30 - 51)	25 (21 - 30)	23 (17 - 27)	21 (10 - 36)
Silver (mg/kg)	1.4 (0.3 - 9.7)	0.3 (0.2 - 0.4)	0.3 (0.2 - 0.3)	2.5 (1.9 - 3.6)	1.3 (1.2 - 1.5)	1.3 (0.8 - 3.2)	1.8 (0.7 - 2.7)
Zinc (mg/kg)	170 (98 - 260)	190 (120 - 250)	150 (120 - 210)	380 (300 - 460)	310 (230 - 430)	300 (190 - 420)	330 (170 - 510)
Total Polychlorinated Biphenyls (PCBs) (µg/kg) [3]	18 (18 - 18)	18 (18 - 19)	18 (18 - 18)	56 (22 - 260)	22 (18 - 29)	19 (18 - 22)	38 (18 - 89)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [4] [6]	93 (90 - 110)	92 (90 - 99)	92 (90 - 100)	190 (100 - 490)	150 (90 - 320)	140 (90 - 390)	1200 (100 - 3800)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (µg/kg) [5] [6]	220 (35 - 650)	150 (86 - 280)	61 (40 - 91)	1300 (490 - 3300)	670 (270 - 2400)	650 (130 - 1500)	13000 (140 - 46000)

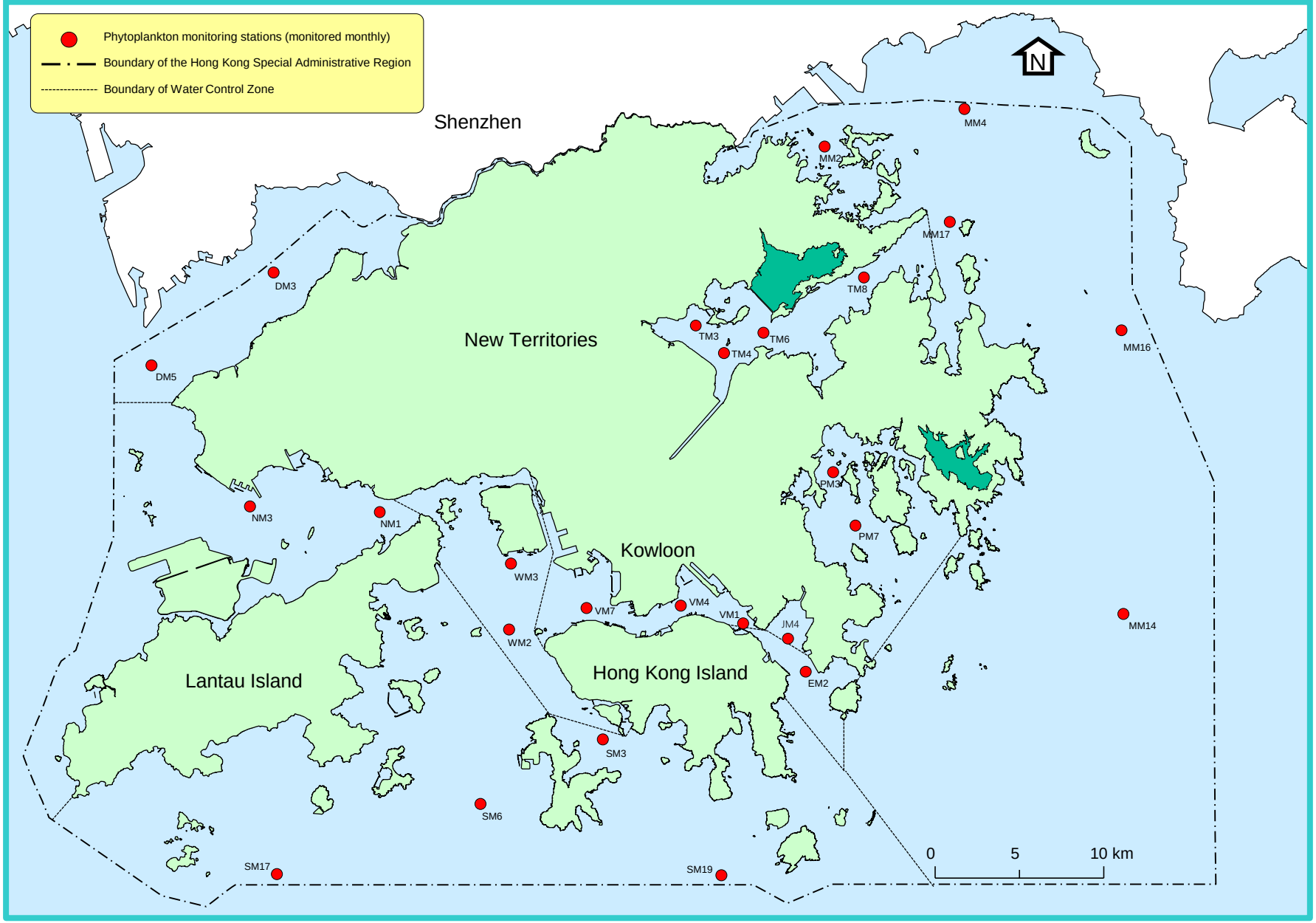
Note:
1. Data presented are arithmetic means ; data in brackets indicate ranges.
2. All data are based on the analyses of bulk (unsieved) sediment and are reported on a dry weight basis unless stated otherwise.
3. Total PCBs results are derived from the summation of 18 congeners. If the concentration 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 marine sediment quality of typhoon shelters, sheltered anchorages and Government Dockyard, 2018- 2022

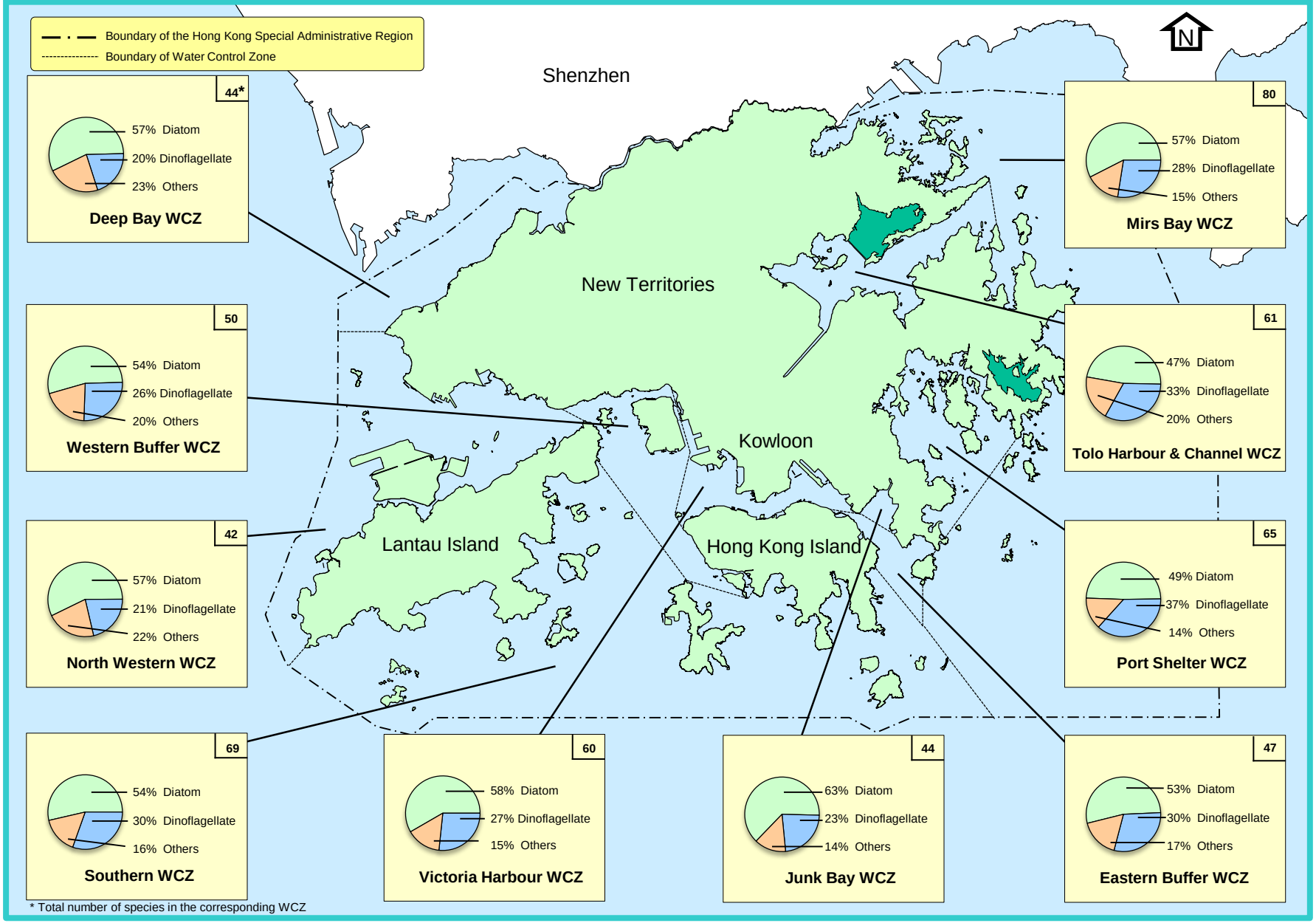
Parameter	To Kwa Wan VS20	Kwun Tong VS14	Sam Ka Tsuen VS13	Shau Kei Wan ES5	Chai Wan Cargo Handling Basin ES3	Hebe Haven PS4	Yim Tin Tsai PS2	Shuen Wan TS7
Number of samples	10	10	10	10	10	10	10	10
Particle Size Fractionation <63μm (%w/w)	78 (47 - 98)	82 (13 - 98)	65 (3 - 93)	73 (1 - 99)	81 (9 - 95)	79 (18 - 97)	77 (10 - 92)	68 (5 - 90)
Electrochemical Potential (mV)	-274 (-384 - -47)	-249 (-363 - -130)	-182 (-283 - -82)	-323 (-366 - -208)	-200 (-267 - -93)	-190 (-304 - -113)	-172 (-333 - -101)	-235 (-362 - 318)
Total Solids (%w/w)	46 (35 - 58)	35 (25 - 58)	42 (36 - 55)	30 (28 - 37)	47 (36 - 53)	41 (35 - 46)	47 (37 - 53)	36 (29 - 44)
Total Volatile Soilds (%TS)	9.2 (5.7 - 20.0)	10.3 (6.2 - 12.0)	8.9 (7.4 - 11.0)	9.8 (7.3 - 11.0)	7.8 (7.0 - 8.9)	9.6 (8.2 - 11.0)	10.1 (7.8 - 12.0)	9.0 (5.8 - 12.0)
Chemical Oxygen Demand (mg/kg)	22400 (8000 - 29000)	23100 (19000 - 32000)	22900 (20000 - 34000)	17900 (16000 - 20000)	20600 (14000 - 25000)	20200 (13000 - 25000)	17600 (14000 - 22000)	20800 (13000 - 28000)
Total Carbon (%w/w)	1.3 (0.6 - 3.7)	1.0 (0.7 - 1.6)	1.0 (0.9 - 1.3)	0.6 (0.5 - 0.7)	0.9 (0.8 - 1.2)	1.0 (0.8 - 1.2)	1.7 (1.1 - 2.7)	0.8 (0.7 - 0.9)
Ammonical Nitrogen (mg/kg)	15.54 (8.90 - 24.00)	25.46 (5.60 - 46.00)	9.68 (4.70 - 16.00)	30.70 (22.00 - 41.00)	4.66 (0.53 - 9.70)	6.25 (1.20 - 10.00)	7.70 (5.80 - 10.00)	6.50 (2.50 - 10.00)
Total Kjeldahl Nitrogen (mg/kg)	540 (330 - 670)	590 (430 - 770)	630 (380 - 780)	530 (380 - 670)	540 (430 - 680)	690 (540 - 810)	720 (620 - 850)	690 (410 - 940)
Total Phosphorus (mg/kg)	240 (170 - 310)	230 (170 - 430)	310 (270 - 360)	180 (140 - 310)	230 (200 - 270)	200 (170 - 230)	200 (180 - 240)	200 (170 - 230)
Total Sulphide (mg/kg)	74.7 (24.0 - 140.0)	110.4 (1.7 - 300.0)	173.5 (39.0 - 350.0)	338.9 (49.0 - 510.0)	54.7 (0.2 - 250.0)	48.8 (6.1 - 97.0)	31.2 (7.4 - 81.0)	87.5 (17.0 - 150.0)
Total Cyanide (mg/kg)	0.2 (0.1 - 0.3)	0.3 (0.1 - 0.5)	0.2 (0.1 - 0.4)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.3)	0.1 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.2 (0.1 - 0.2)
Arsenic (mg/kg)	10.2 (9.1 - 11.0)	11.3 (8.6 - 15.0)	11.0 (8.6 - 13.0)	10.1 (7.9 - 13.0)	10.8 (9.8 - 13.0)	11.6 (9.2 - 13.0)	6.4 (4.7 - 7.8)	13.3 (10.0 - 15.0)
Cadmium (mg/kg)	0.9 (0.6 - 1.5)	1.9 (1.0 - 3.2)	0.9 (0.3 - 1.1)	0.4 (0.2 - 0.5)	0.4 (0.3 - 0.5)	0.2 (0.1 - 0.2)	0.1 (0.1 - 0.2)	0.5 (0.3 - 0.7)
Chromium (mg/kg)	85 (64 - 110)	220 (130 - 440)	81 (39 - 130)	55 (42 - 74)	72 (56 - 82)	29 (22 - 48)	20 (13 - 27)	27 (20 - 38)
Copper (mg/kg)	640 (340 - 1200)	1400 (600 - 3500)	270 (80 - 520)	140 (110 - 170)	210 (150 - 230)	64 (42 - 79)	17 (10 - 25)	97 (33 - 150)
Lead (mg/kg)	120 (75 - 290)	120 (92 - 200)	97 (62 - 110)	64 (57 - 75)	81 (62 - 140)	42 (35 - 47)	37 (25 - 43)	99 (82 - 110)
Mercury (mg/kg)	1.27 (0.77 - 1.70)	0.67 (0.43 - 1.20)	1.05 (0.70 - 1.60)	0.24 (0.10 - 0.30)	0.46 (0.33 - 0.90)	0.13 (0.10 - 0.15)	0.07 (0.05 - 0.10)	0.12 (0.05 - 0.21)
Nickel (mg/kg)	32 (23 - 46)	66 (37 - 160)	25 (16 - 35)	26 (21 - 32)	24 (21 - 27)	12 (8 - 32)	12 (6 - 16)	15 (11 - 23)
Silver (mg/kg)	3.4 (2.5 - 5.5)	6.9 (3.9 - 23.0)	2.0 (0.8 - 2.4)	1.3 (1.0 - 1.9)	5.8 (1.4 - 12.0)	0.2 (0.2 - 0.4)	<0.2 (0.2 - <0.2)	0.4 (0.2 - 0.5)
Zinc (mg/kg)	300 (230 - 380)	480 (230 - 820)	380 (250 - 480)	290 (220 - 370)	290 (240 - 410)	200 (150 - 330)	92 (56 - 130)	300 (210 - 380)
Total Polychlorinated Biphenyls (PCBs) (μg/kg) [3]	87 (43 - 150)	140 (40 - 280)	38 (18 - 96)	18 (18 - 19)	29 (18 - 37)	18 (18 - 18)	18 (18 - 18)	45 (18 - 290)
Low Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [4] [6]	13000 (760 - 44000)	140 (96 - 230)	130 (90 - 190)	110 (90 - 160)	140 (110 - 240)	98 (90 - 160)	100 (90 - 140)	120 (90 - 320)
High Molecular Weight Polycylic Aromatic Hydrocarbons (PAHs) (μg/kg) [5] [6]	130000 (9700 - 420000)	870 (450 - 1500)	680 (380 - 1000)	360 (260 - 510)	560 (350 - 1100)	65 (18 - 94)	52 (23 - 220)	190 (38 - 720)

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.

The 26 phytoplankton monitoring stations in Hong Kong marine waters

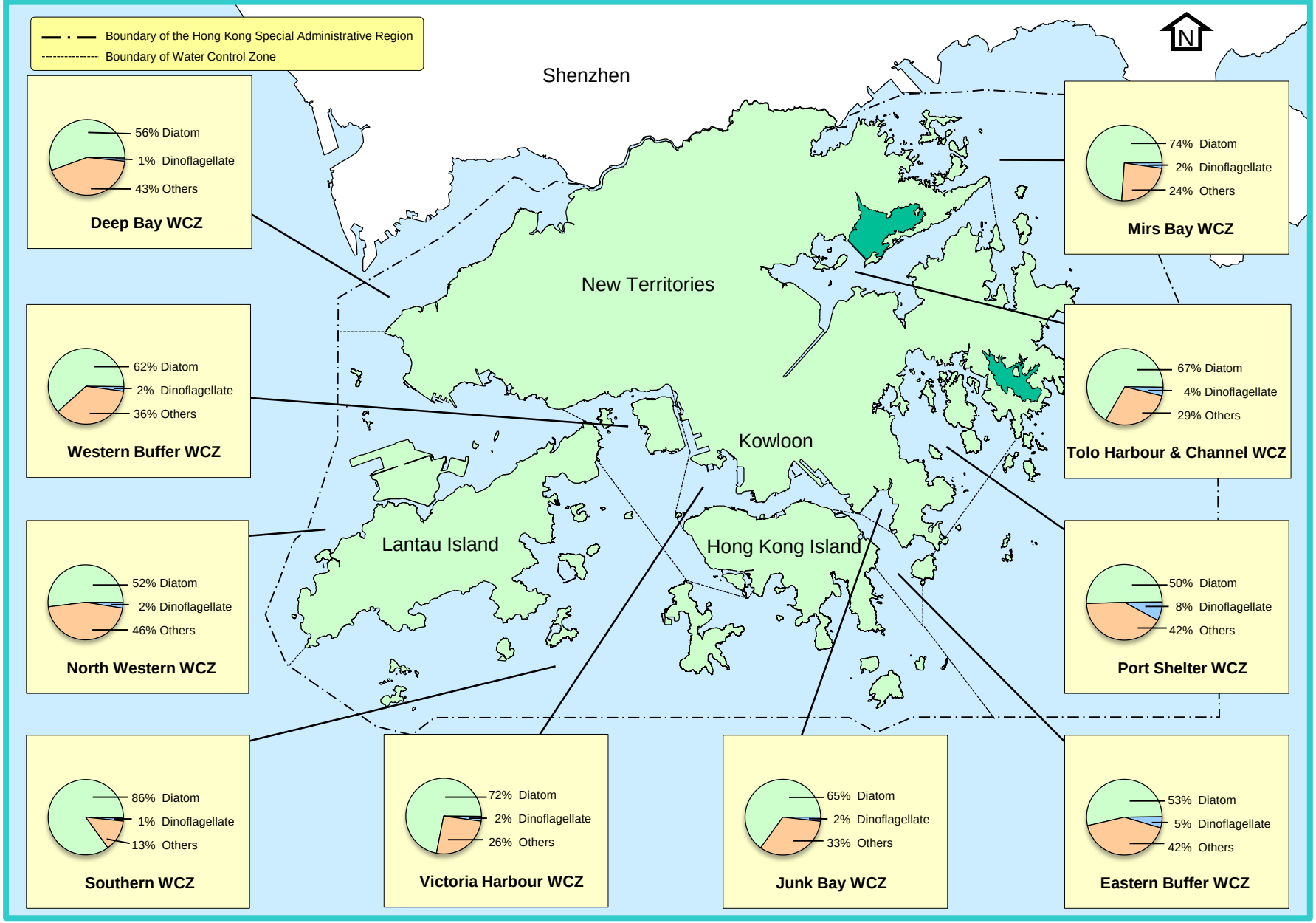


Composition (%) of phytoplankton groups in terms of total number of species in the 10 WCZs in 2022

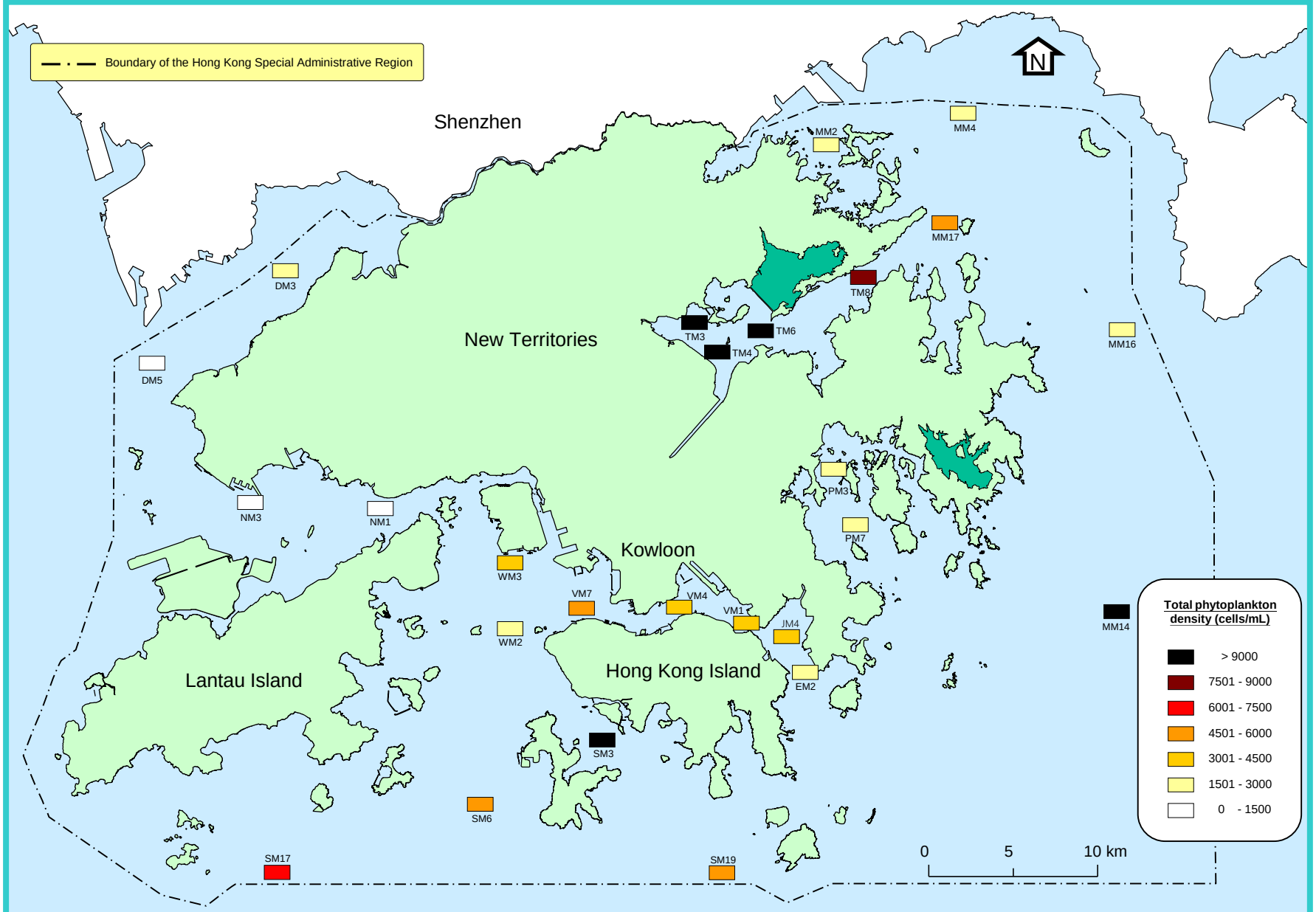


* Total number of species in the corresponding WCZ

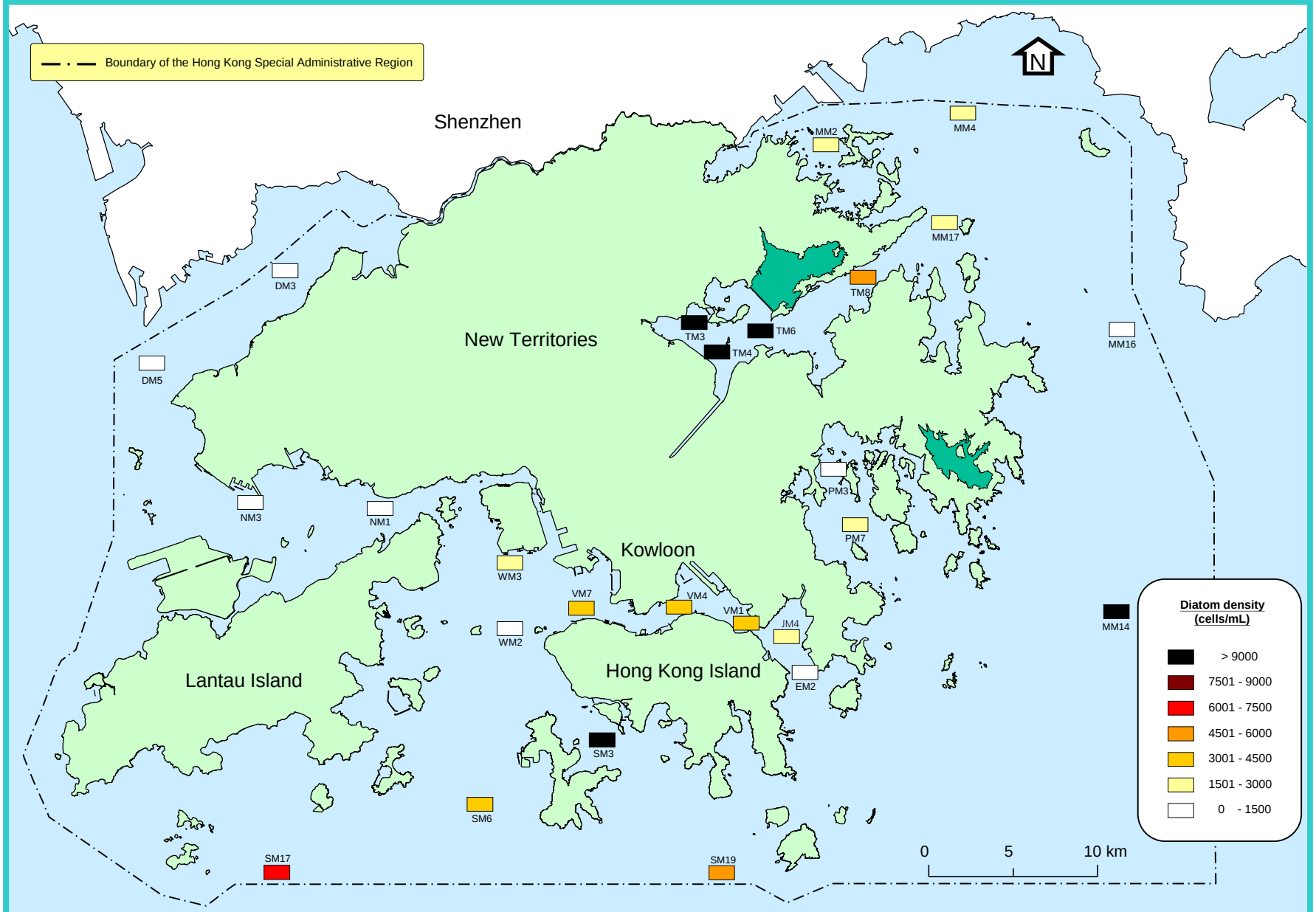
Composition (%) of phytoplankton groups in terms of total density in the 10 WCZs in 2022



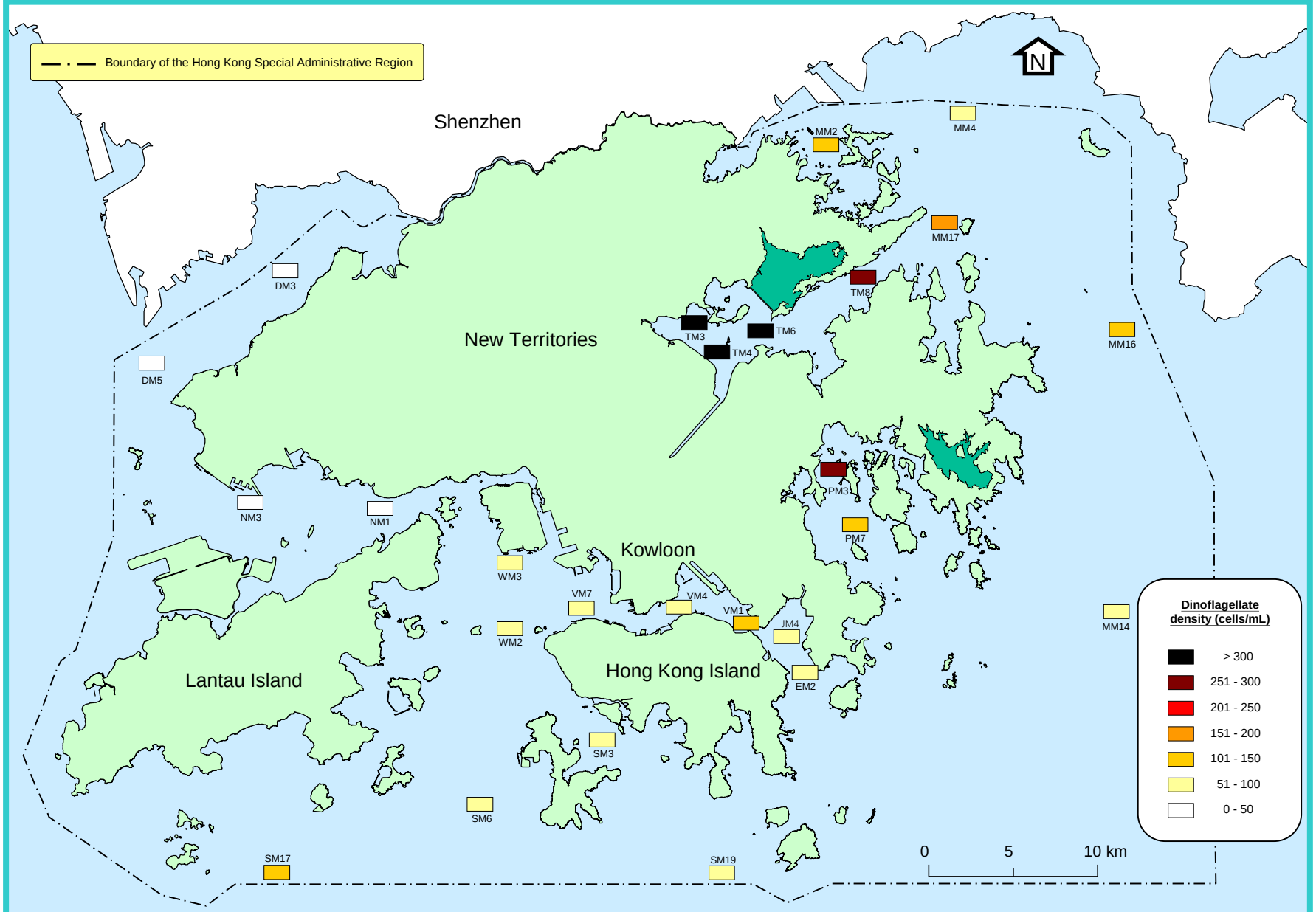
Annual mean total phytoplankton densities at 26 monitoring stations in Hong Kong waters in 2022



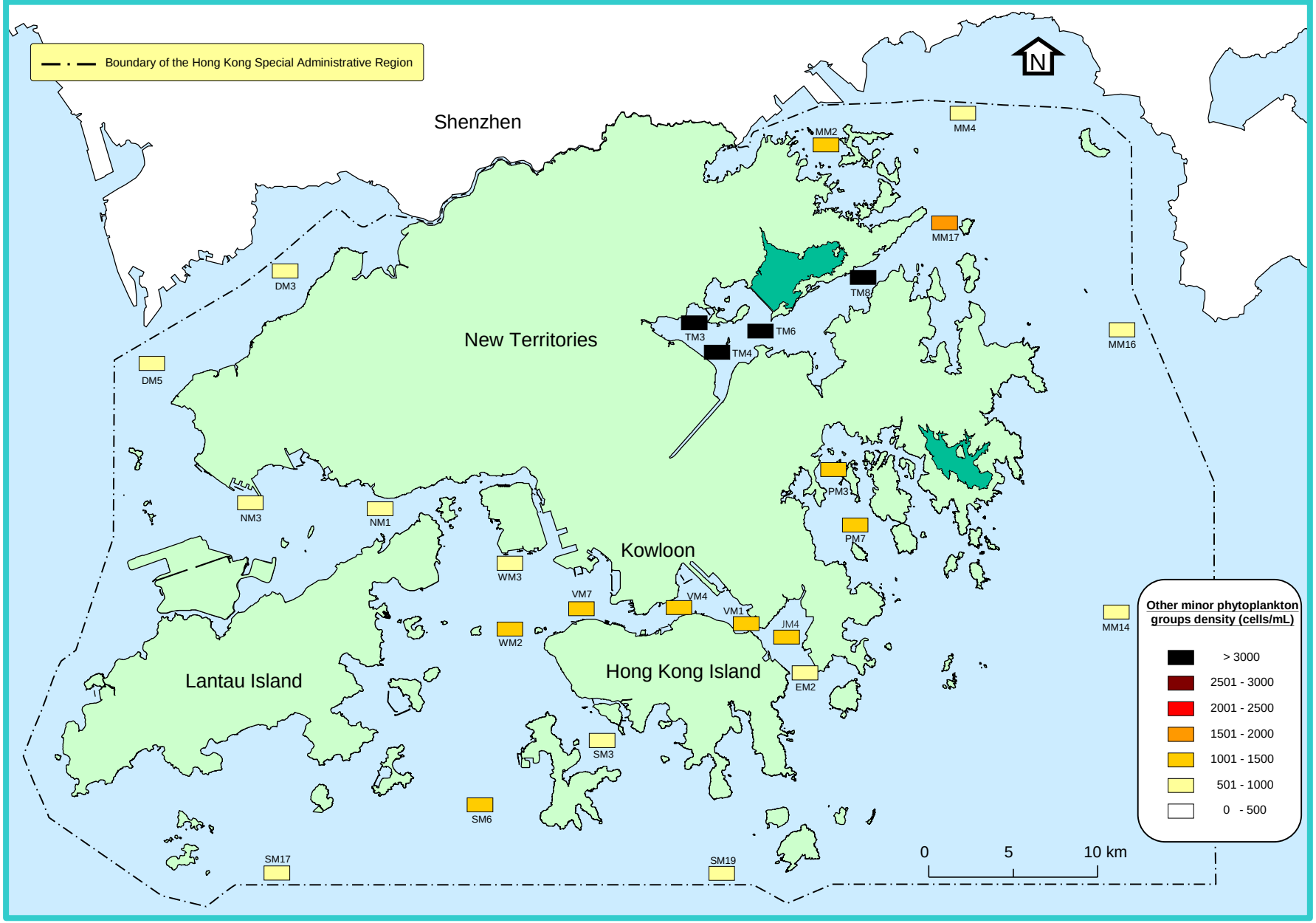
Annual mean diatoms densities at 26 monitoring stations in Hong Kong waters in 2022



Annual mean dinoflagellates densities at 26 monitoring stations in Hong Kong waters in 2022

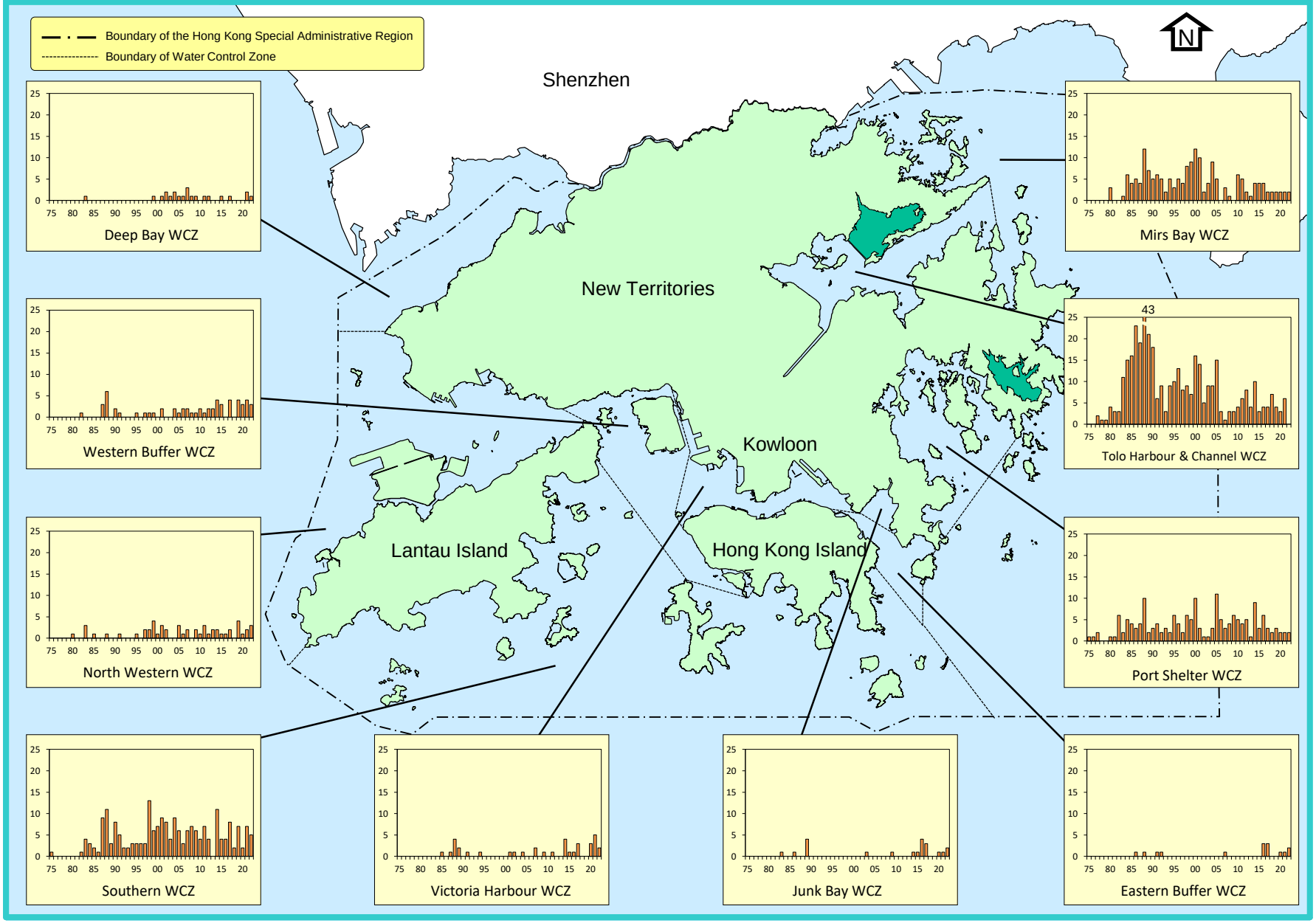


Annual mean densities of other minor phytoplankton groups at 26 monitoring stations in Hong Kong waters in 2022



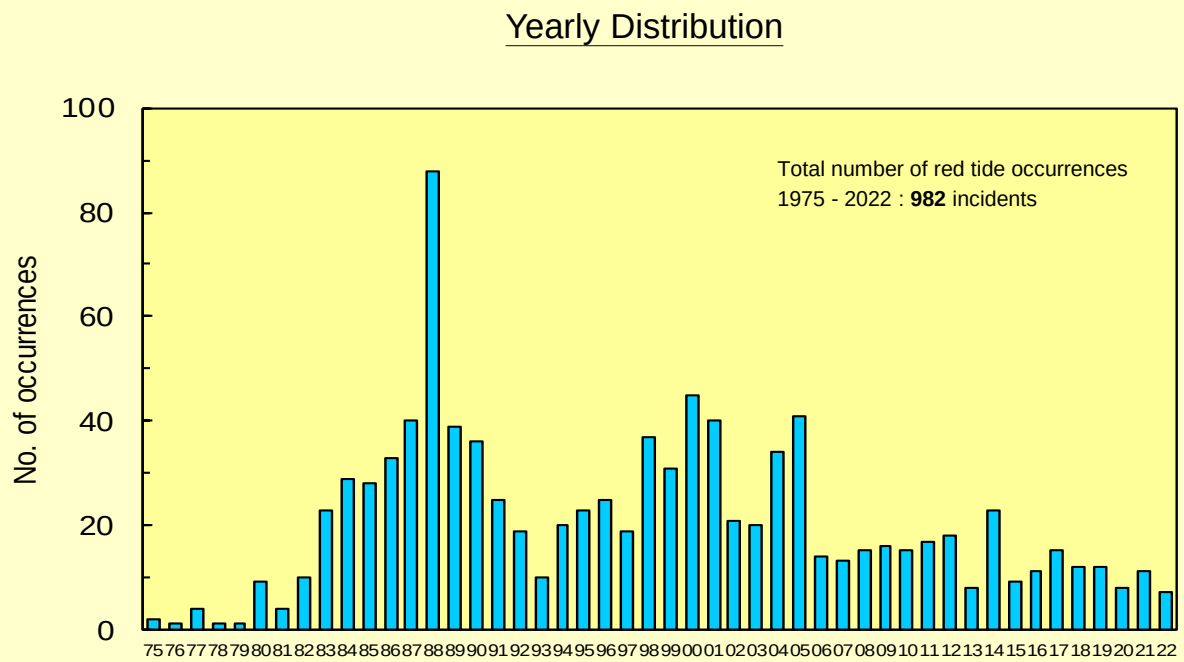
Occurrence of red tides in the 10 WCZs in Hong Kong waters, 1975 - 2022

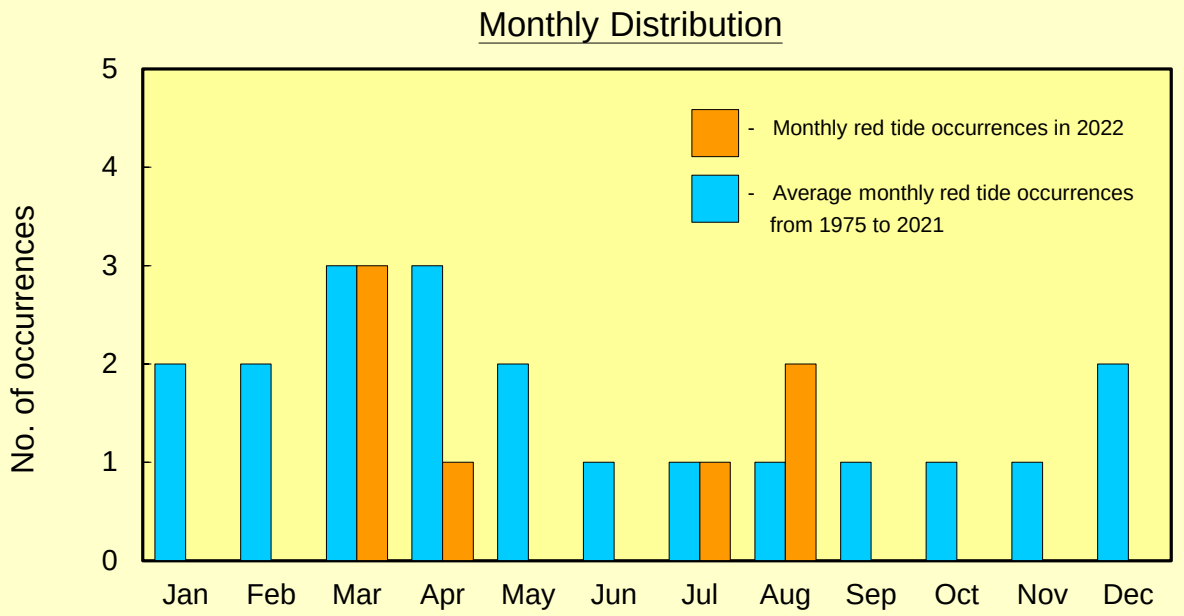
(Source: Agriculture, Fisheries and Conservation Department)



Occurrence of red tides in Hong Kong waters, 1975-2022

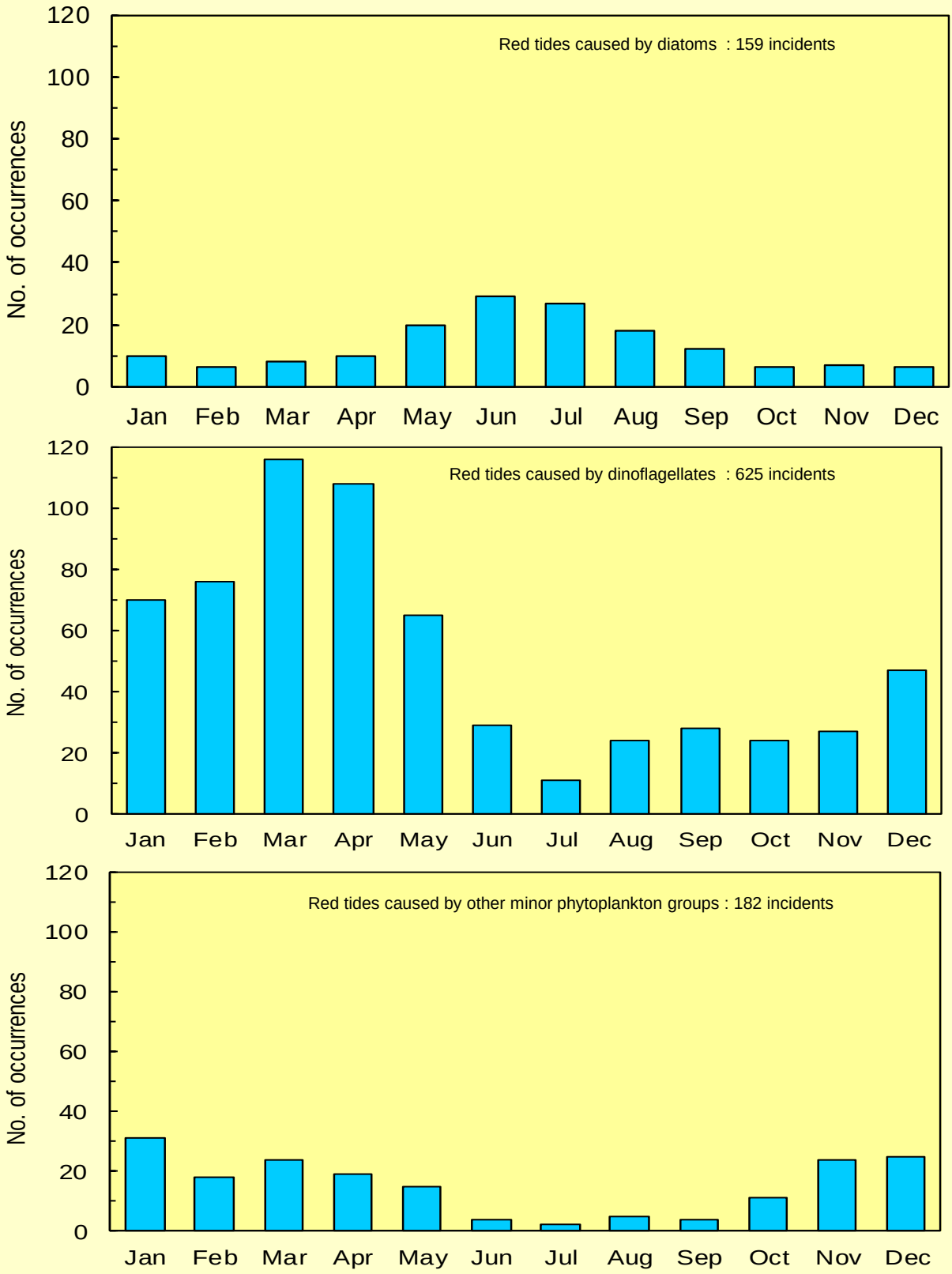
(Source: Agriculture, Fisheries and Conservation Department)





Seasonal distribution of red tides caused by different phytoplankton groups in Hong Kong, 1975-2022

(Source: Agriculture, Fisheries and Conservation Department)



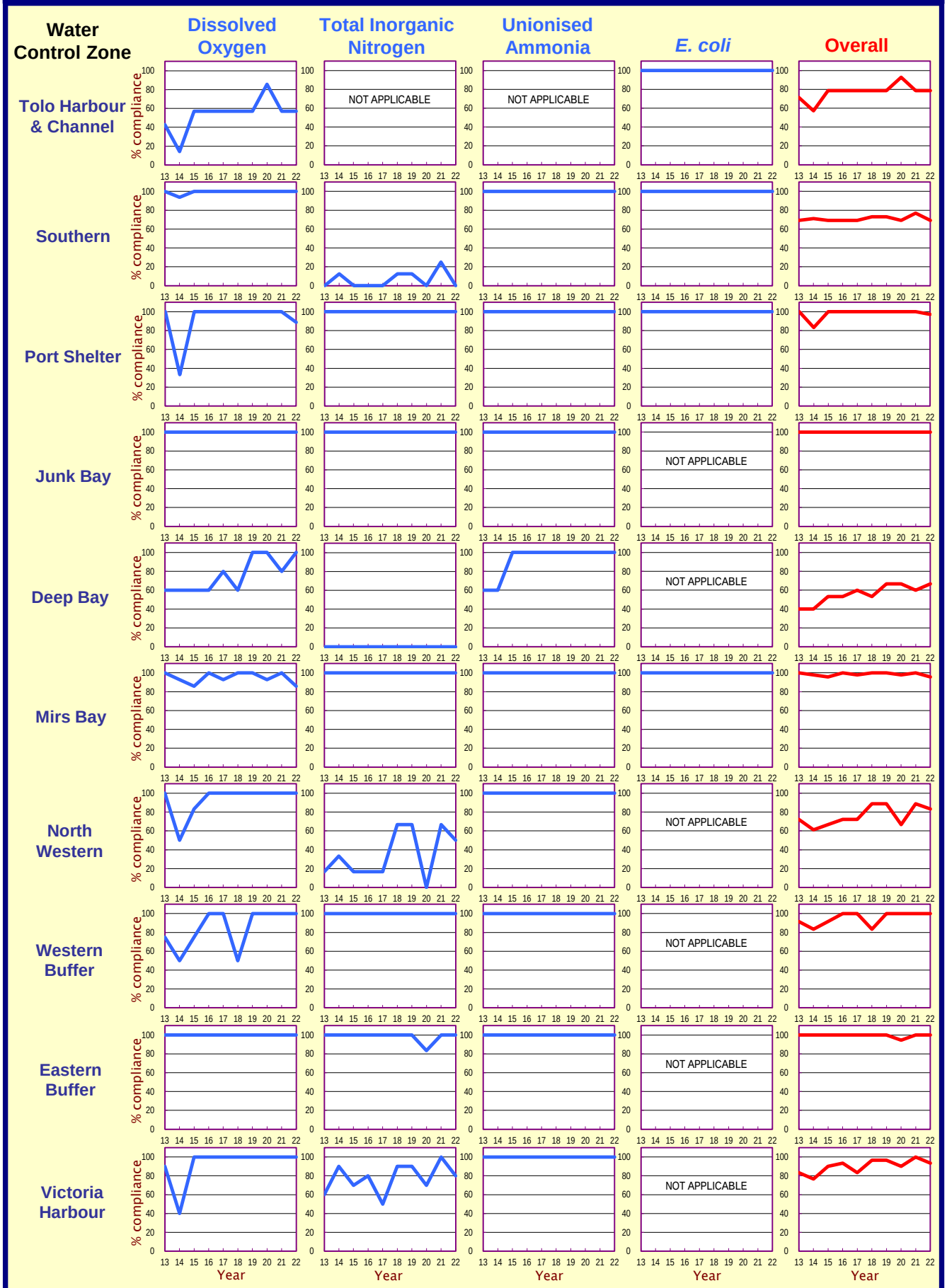
Percentage abundance of the three most dominant phytoplankton species in different WCZs in 2022

Species	% Abundance[1]	Species	% Abundance
Deep Bay WCZ		**Mirs Bay WCZ**	
Diatoms		Diatoms	
Skeletonema costatum	37.65	*Pseudo-nitzschia* spp.	48.39
Thalassiosira spp.	36.51	*Dactyliosolen fragilissimus*	22.13
Navicula spp.	7.62	*Chaetoceros* spp.	6.42
Dinoflagellates		Dinoflagellates	
Gymnodinium spp.	46.42	*Gymnodinium* spp.	51.53
Gyrodinium spp.	20.38	*Gyrodinium* spp.	9.93
Scrippsiella spp.	9.25	*Amphidinium* spp.	8.59
Others[2]		Others	
small flagellates	45.63	small flagellates	77.10
Plagioselmis prolonga	26.24	*Plagioselmis prolonga*	14.73
Teleaulax acuta	26.06	*Teleaulax acuta*	6.71
Western Buffer WCZ		**Tolo Harbour & Channel WCZ**	
Diatoms		Diatoms	
Pseudo-nitzschia spp.	36.93	*Leptocylindrus danicus*	29.30
Dactyliosolen fragilissimus	14.91	*Dactyliosolen fragilissimus*	15.22
Thalassiosira spp.	14.73	*Ceratoneis closterium*	14.17
Dinoflagellates		Dinoflagellates	
Gymnodinium spp.	51.33	*Gymnodinium* spp.	40.61
Gyrodinium spp.	18.59	*Scrippsiella* spp.	30.65
Amphidinium spp.	13.70	*Gyrodinium* spp.	9.01
Others		Others	
small flagellates	58.30	small flagellates	77.08
Plagioselmis prolonga	24.13	*Plagioselmis prolonga*	13.64
Teleaulax acuta	15.54	*Teleaulax acuta*	6.71
North Western WCZ		**Port Shelter WCZ**	
Diatoms		Diatoms	
Thalassiosira spp.	42.31	*Dactyliosolen fragilissimus*	24.03
Skeletonema costatum	37.15	*Pseudo-nitzschia* spp.	23.34
Chaetoceros spp.	7.29	*Chaetoceros* spp.	16.09
Dinoflagellates		Dinoflagellates	
Gymnodinium spp.	50.90	*Gymnodinium* spp.	24.81
Amphidinium spp.	24.41	*Karenia papilionacea*	18.64
Gyrodinium spp.	8.88	*Akashiwo sanguinea*	17.31
Others		Others	
small flagellates	57.37	small flagellates	71.50
Plagioselmis prolonga	21.65	*Plagioselmis prolonga*	20.61
Teleaulax acuta	19.43	*Teleaulax acuta*	6.74
Southern WCZ		**Eastern Buffer WCZ**	
Diatoms		Diatoms	
Pseudo-nitzschia spp.	39.32	*Thalassiosira* spp.	42.59
Skeletonema costatum	18.00	*Chaetoceros* spp.	25.45
Dactyliosolen fragilissimus	11.43	*Skeletonema costatum*	14.10
Dinoflagellates		Dinoflagellates	
Gymnodinium spp.	40.43	*Gymnodinium* spp.	48.05
Gyrodinium spp.	21.56	*Amphidinium* spp.	17.32
Scrippsiella spp.	14.49	*Scrippsiella* spp.	10.75
Others		Others	
small flagellates	71.72	small flagellates	60.54
Plagioselmis prolonga	13.61	*Plagioselmis prolonga*	22.87
Teleaulax acuta	12.80	*Teleaulax acuta*	13.26
Victoria Harbour WCZ		**Junk Bay WCZ**	
Diatoms		Diatoms	
Leptocylindrus danicus	30.37	*Thalassiosira* spp.	54.40
Chaetoceros spp.	21.02	*Skeletonema costatum*	18.27
Dactyliosolen fragilissimus	18.34	*Chaetoceros* spp.	14.62
Dinoflagellates		Dinoflagellates	
Gymnodinium spp.	42.63	*Gymnodinium* spp.	46.98
Gyrodinium spp.	22.46	*Gyrodinium* spp.	29.22
Scrippsiella spp.	17.20	*Amphidinium* spp.	9.95
Others		Others	
small flagellates	74.30	small flagellates	67.24
Plagioselmis prolonga	16.52	*Plagioselmis prolonga*	23.07
Teleaulax acuta	5.80	*Teleaulax acuta*	8.92

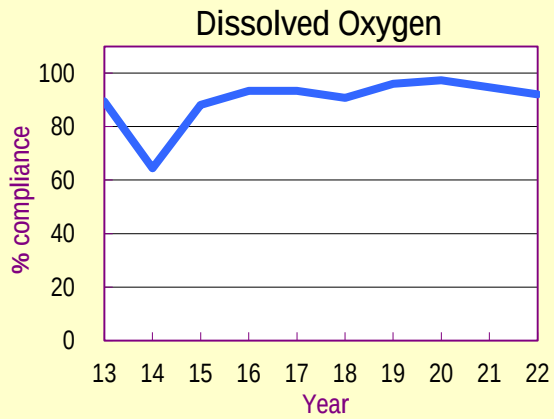
Note: 1 The % abundance of dominant species of diatoms, dinoflagellates and other minor phytoplankton groups in different WCZs.

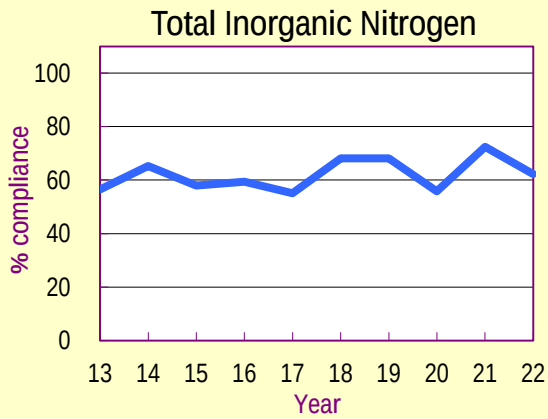
2 Other minor phytoplankton groups.

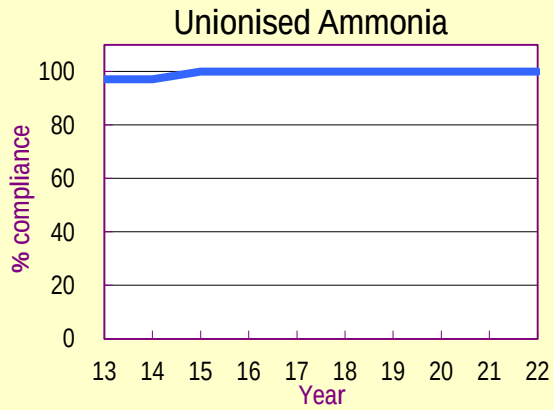
Marine WQO compliance rates for the 10 WCZs, 2013 - 2022

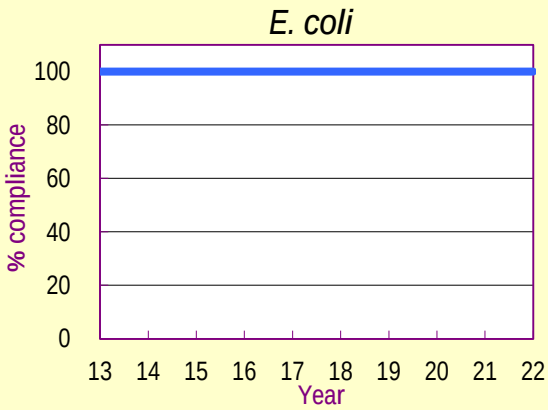


Compliance rates for key marine WQOs, 2013 - 2022

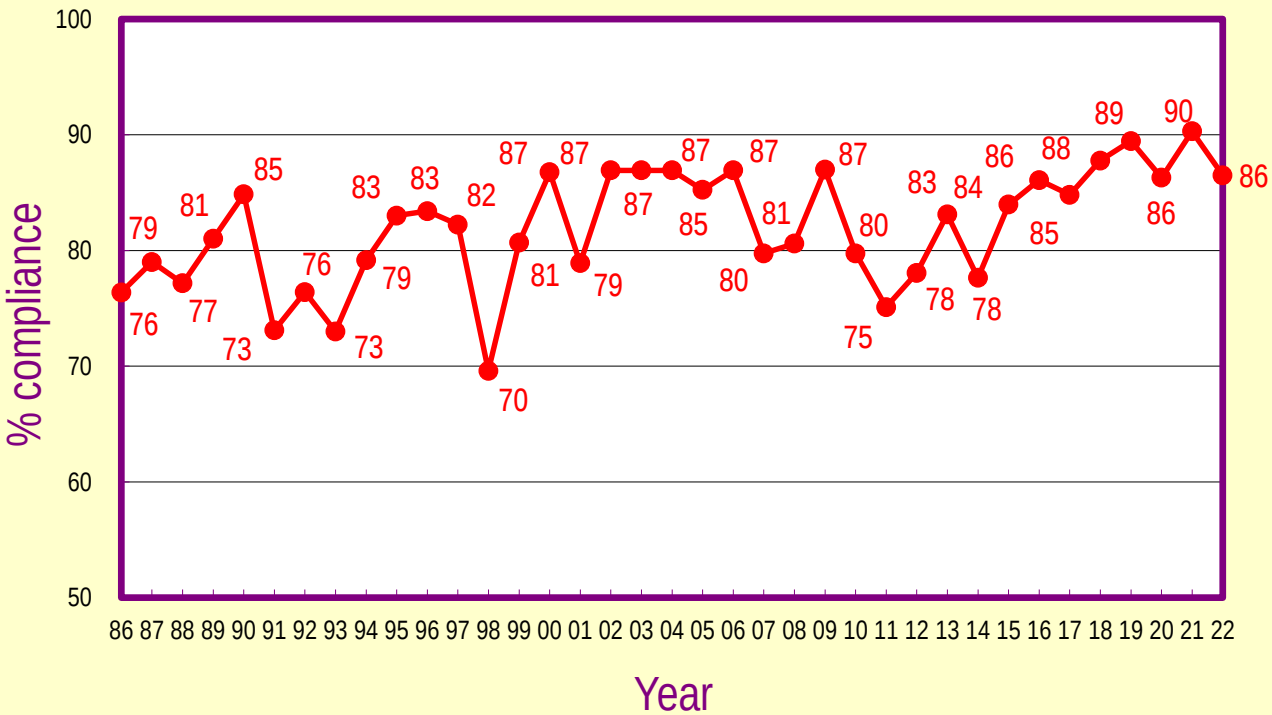




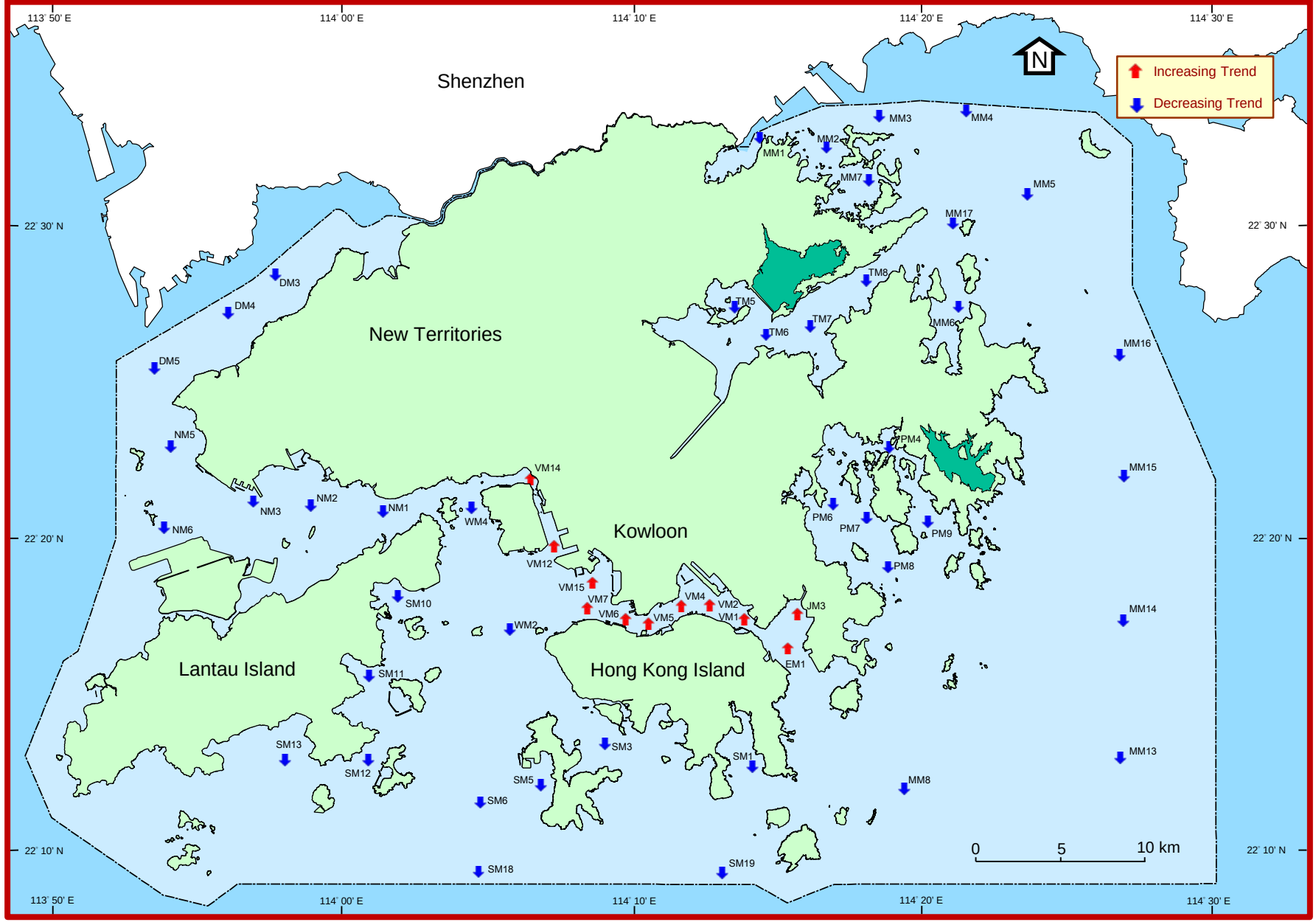




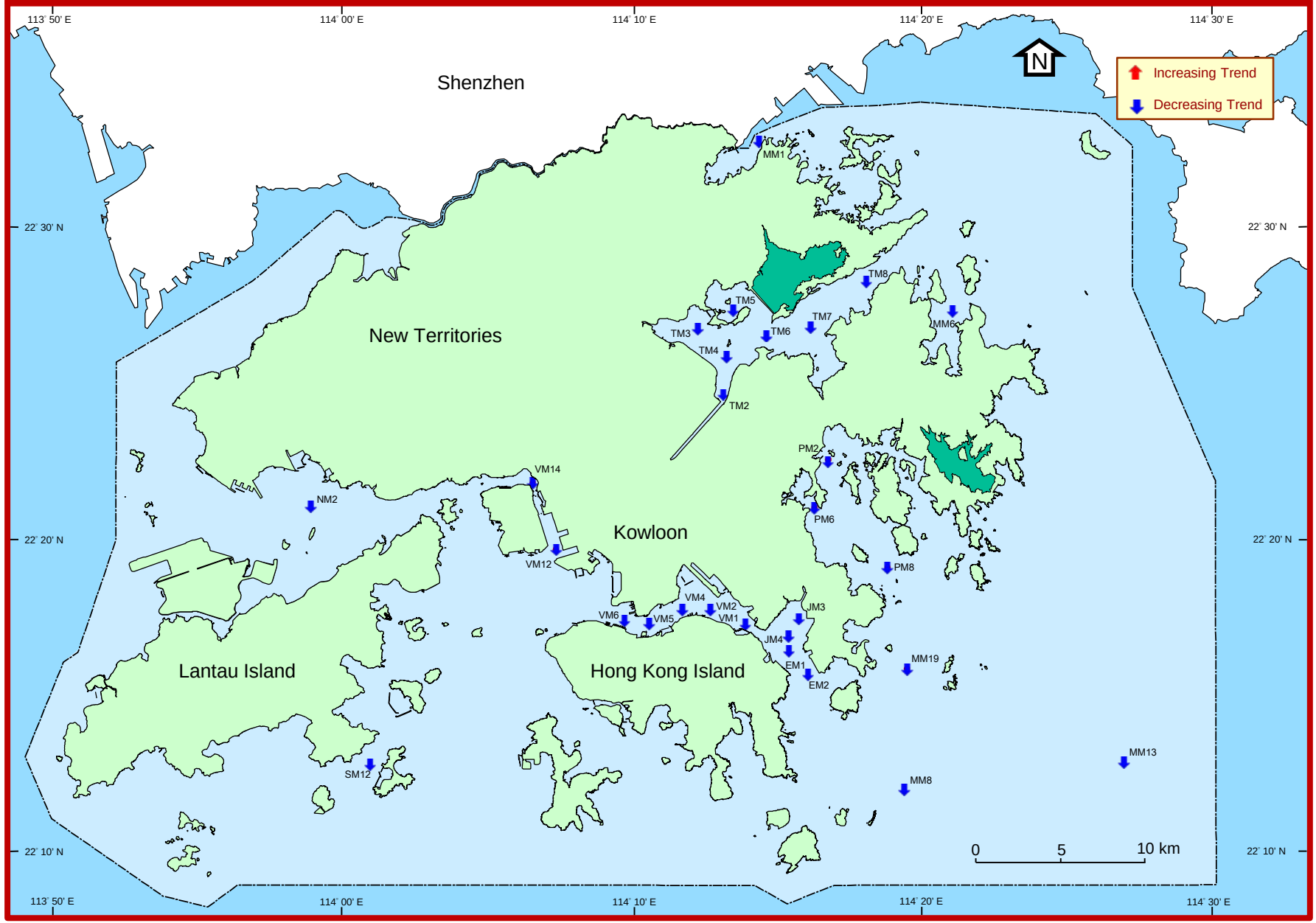
Overall compliance rates for key marine WQOs, 1986 - 2022



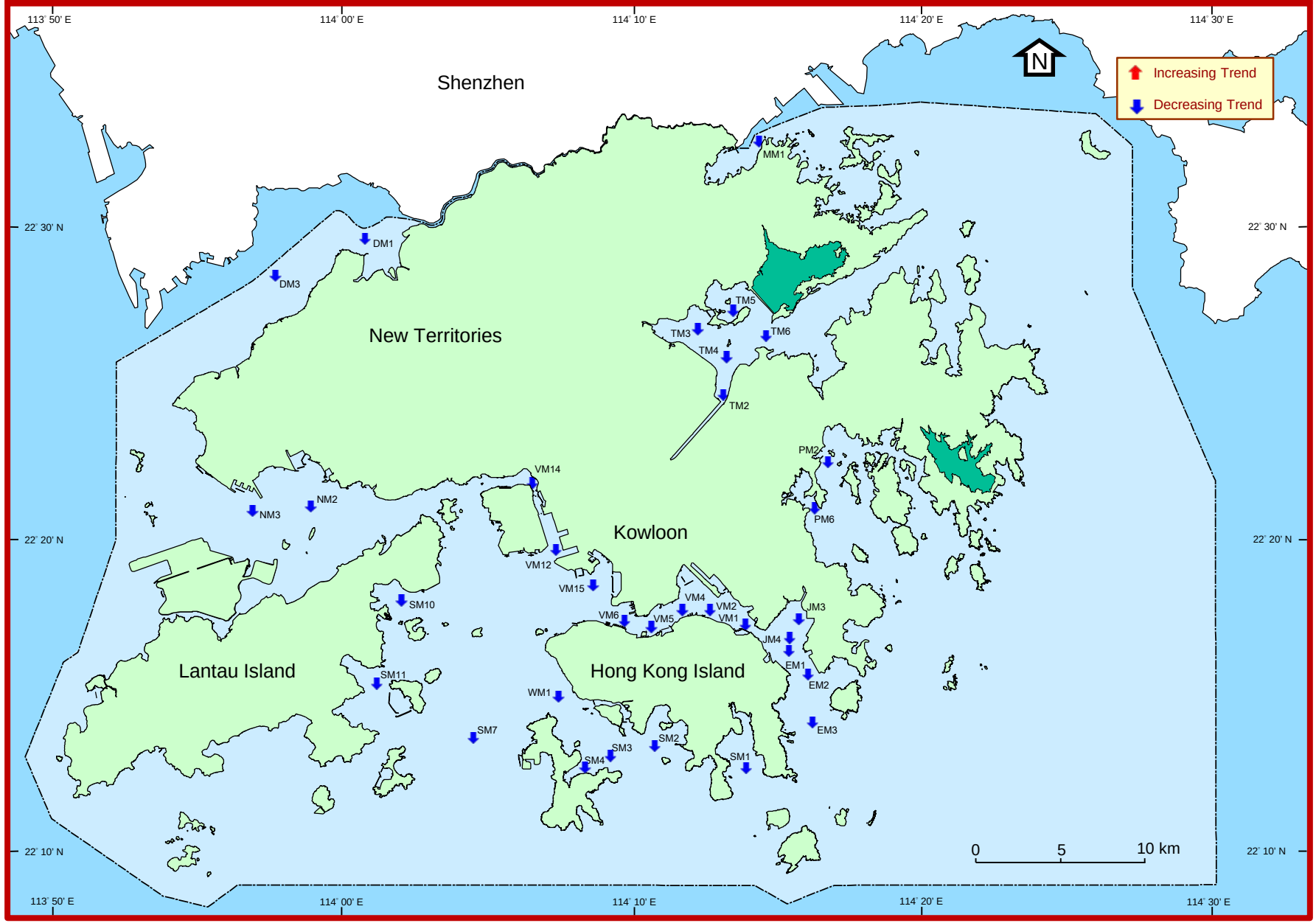
Long-term changes in dissolved oxygen levels in Hong Kong marine waters, 1986-2022



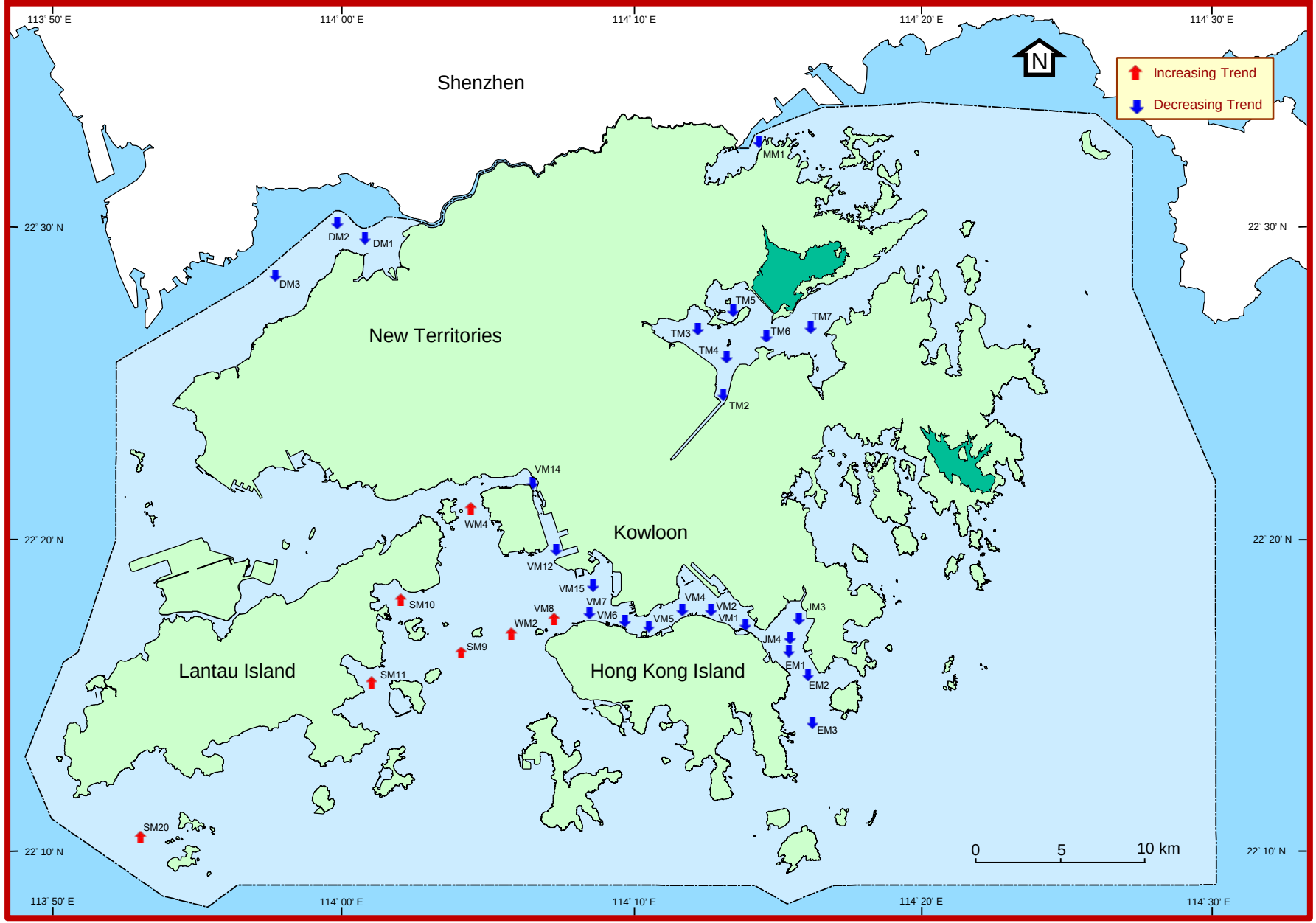
Long-term changes in 5-day biochemical oxygen demand levels in Hong Kong marine waters, 1986-2022



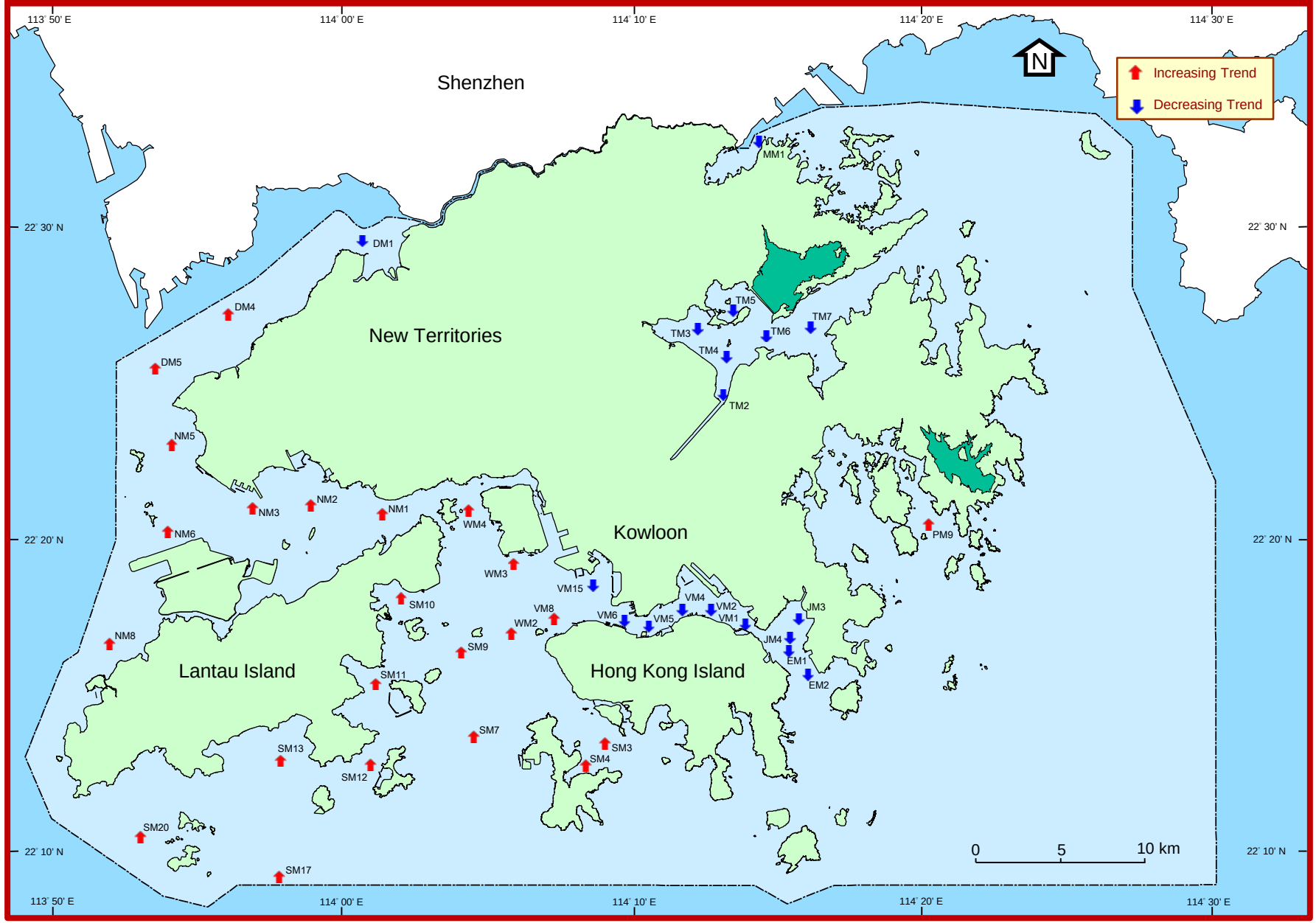
Long-term changes in *E.coli* levels in Hong Kong marine waters, 1986-2022



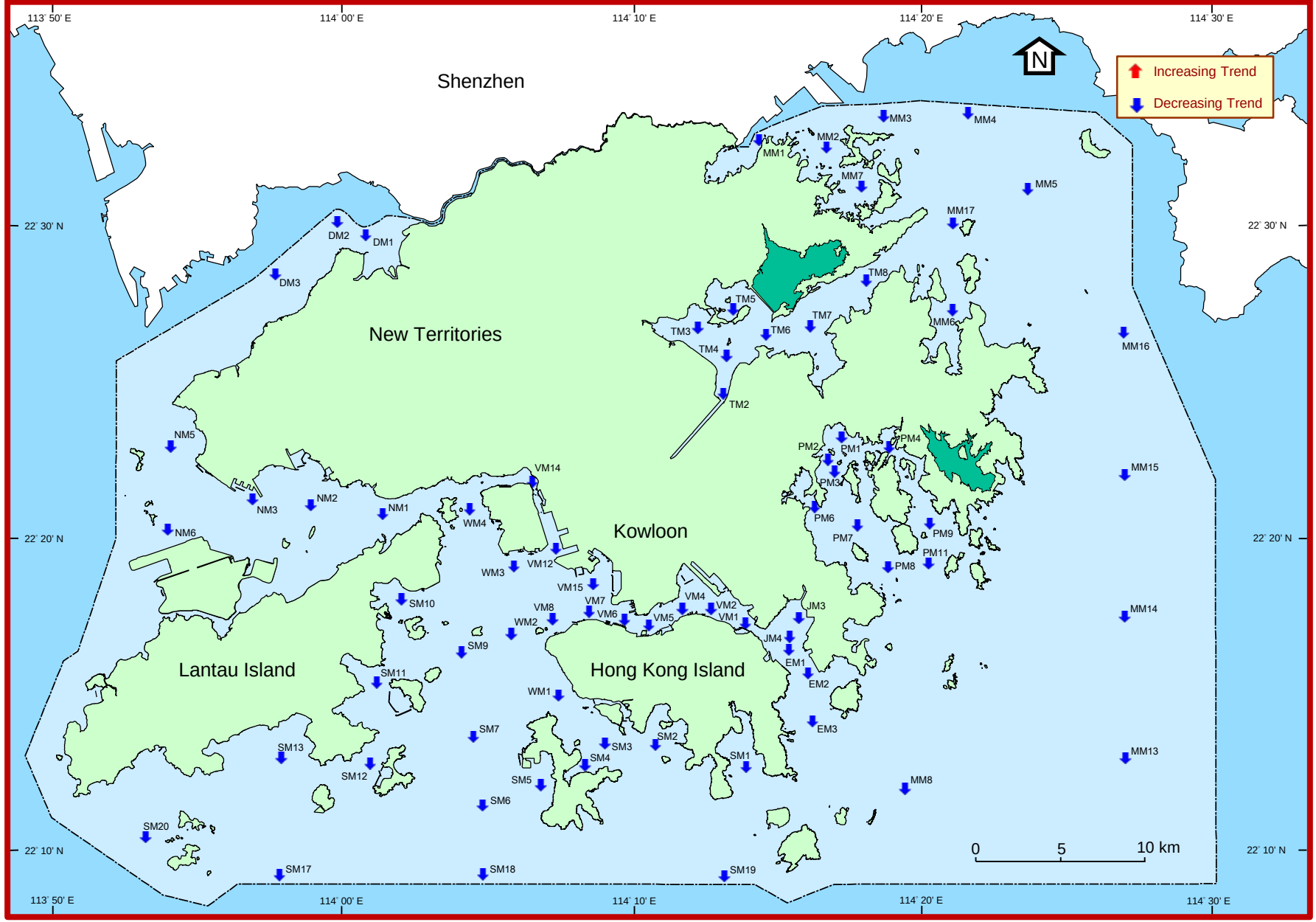
Long-term changes in ammonia nitrogen levels in Hong Kong marine waters, 1986-2022



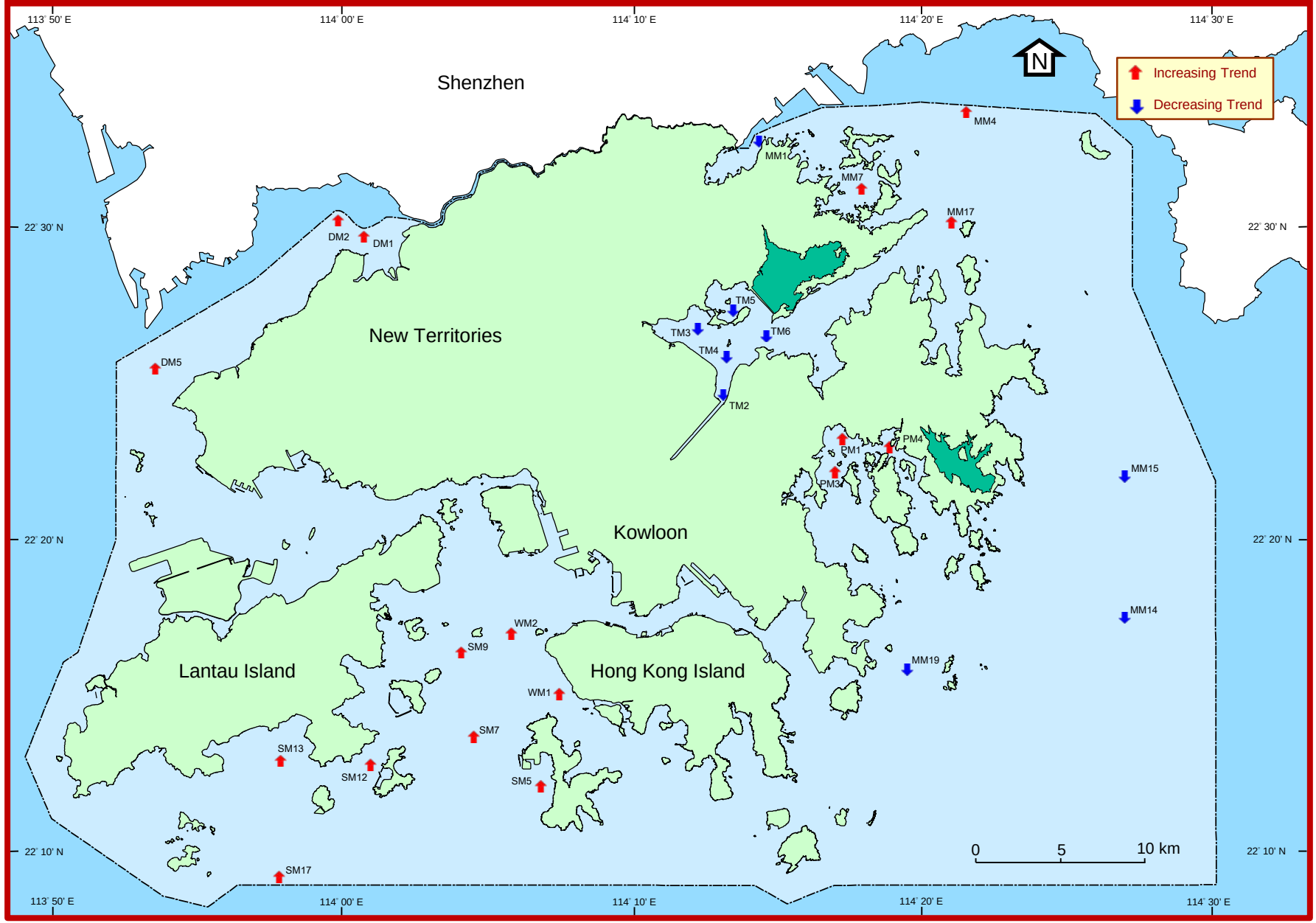
Long-term changes in total inorganic nitrogen levels in Hong Kong marine waters, 1986-2022



Long-term changes in orthophosphate phosphorus levels in Hong Kong marine waters, 1986-2022



Long-term changes in chlorophyll-*a* levels in Hong Kong marine waters, 1986-2022



Long-term changes in temperature in Hong Kong marine waters, 1986-2022