

Summary of marine water quality parameters

| | Parameter | Unit | Reporting Limit | Sampling Depth | Standard Method / Technique used ²⁰ | Analysed by |
|--|---|-----------------------------------|-----------------|---|---|-----------------------|
| Physical and Aggregate Properties | Temperature ¹ | °C | 0.1 | Depth Profiling ¹⁰ | Instrumental (thermistor), SEACAT19+ CTD and Water Quality Profiler | MMT/EPD ¹⁵ |
| | Salinity ^{1,8} | - | 0.1 | Depth Profiling | Instrumental (electrical conductivity), SEACAT19+ CTD and Water Quality Profiler | MMT/EPD |
| | Dissolved Oxygen ¹ | mg/L % saturation ⁹ | 0.1 1 | Depth Profiling | Instrumental (membrane electrode), SBE23Y dissolved oxygen sensor linked to SEACAT19+ CTD and Water Quality Profiler | MMT/EPD |
| | Turbidity ² | NTU | 0.1 | Depth Profiling | Instrumental (nephelometric / infrared back scattering), OBS-3 turbidity sensor linked to SEACAT 19+ CTD and Water Quality Profiler | MMT/EPD |
| | pH ¹ | - | 0.1 | Depth Profiling | Instrumental (electrodeometric) SBE18 pH sensor linked to SEACAT19 + CTD and Water Quality Profiler | MMT/EPD |
| | Secchi Disc Depth ² | m | 0.1 | --- | Manual | MMT/EPD |
| | Suspended Solids ² | mg/L | 0.5 | S,M,B ¹¹ | In house method GL-PH-23, based on APHA 20ed. 2540D (weighing) | GL ¹⁸ |
| Volatile Suspended Solids ³ | mg/L | 0.5 | S,M,B | In house method GL-PH-23, based on APHA 20ed. 2540E (weighing) | GL | |
| Aggregate Organic Constituents | 5-day Biochemical Oxygen Demand (BOD ₅) ⁴ | mg/L | 0.1 | S,M,B | In house method based on APHA 18ed. 5210B | EML/EPD ¹⁶ |
| Nutrients and Inorganic Constituents | Ammonia Nitrogen ⁵ | mg/L | 0.005 | S,M,B | In house method GL-IN-15, based on ASTM D3590-89 B (FIA) | GL |
| | Unionised Ammonia ⁵ | mg/L | 0.001 | S,M,B | By calculation ¹² | MMT/EPD |
| | Nitrite Nitrogen ⁵ | mg/L | 0.002 | S,M,B | In house method GL-IN-18, based on APHA 20ed. 4500-NO ₂ -B (FIA) | GL |
| | Nitrate Nitrogen ⁵ | mg/L | 0.002 | S,M,B | In house method GL-IN-18, based on APHA 20ed. 4500-NO ₃ -F & I (FIA) | GL |
| | Total Inorganic Nitrogen ⁵ | mg/L | 0.01 | S,M,B | By calculation ¹³ | MMT/EPD |
| | Total Kjeldahl Nitrogen ⁵ (soluble; soluble & particulate) | mg/L | 0.05 | S,M,B | In house method GL-IN-14 & GL-IN-15, based on ASTM D3590-89 B (FIA) & APHA 20ed 4500-N A&D (FIA) | GL |
| | Total Nitrogen ⁵ | mg/L | 0.05 | S,M,B | By calculation ¹³ | MMT/EPD |
| | Orthophosphate Phosphorus ⁵ | mg/L | 0.002 | S,M,B | In house method GL-IN-16, based on ASTM D515-88 A (FIA) | GL |
| Total Phosphorus ⁵ (soluble; soluble & particulate) | mg/L | 0.02 | S,M,B | In house method GL-IN-14 & GL-IN-16, based on ASTM D515-88 B (FIA) & APHA 20ed 4500-P G (FIA) | GL | |
| Silica (as SiO ₂) (soluble) ⁵ | mg/L | 0.05 | S,M,B | In house method GL-IN-17, based on APHA 20ed. 4500-SiO ₂ C&E (FIA) | GL | |
| Biological and Microbiological Examination | Chlorophyll- <i>a</i> ⁶ | µg/L | 0.2 | S,M,B | In house method GL-OR-34, based on APHA 20ed. 10200H 2 (spectrophotometric) | GL |
| | <i>Escherichia coli</i> (<i>E. coli</i>) ⁷ | cfu/100mL | 1 | S,M,B | In house method, membrane filtration with CHROMagar Liquid <i>E. coli</i> -coliform culture ¹⁴ | EML/EPD |
| | Faecal Coliforms ⁷ | cfu/100mL | 1 | S,M,B | In house method, membrane filtration with CHROMagar Liquid <i>E. coli</i> -coliform culture ¹⁴ | EML/EPD |
| | Phytoplankton | cell/mL | 1 | S | In house method, 10 ml settled sub-sample using plankton chamber and inverted microscope ¹⁹ | WSL/EPD ¹⁷ |

Note: 1. Indicate general oceanographic condition of marine water

2. Low transparency and light penetration 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) promote 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. Salinity (S) is calculated and presented 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 at 1m intervals from 1m below the surface to 1m above the seabed

11. If water depth is 6m or above, sampling is taken at three depths during upcast: S – 1m below water surface; M – mid–depth of water column; B – 1m above seabed. If water depth is 4 to 5 m, "M" is skipped; If water depth is 3m or less, "M" and "B" are skipped.

12. i) Bower C.E. and Bidwell J.P. 1978, Ionization of ammonia in seawater: Effect of temperature, pH and salinity. J. Fish. Res. Board Can. Vol.35, pp.1012-1016;

ii) K., Russo R.C. & et. al. 1975, Aqueous ammonia equilibrium calculations: effect of pH and temperature. J. Fish. Res. Board Can. Vol.32, pp.2379-2383

13. Total Inorganic Nitrogen = Ammonia Nitrogen + Nitrite Nitrogen + Nitrate Nitrogen ; Total Nitrogen = Total Kjeldahl Nitrogen (soluble & particulate) + Nitrite Nitrogen + Nitrate Nitrogen

14. i) DoE, DHSS & PHLS 1983; The Bacteriological Examination of Drinking Water Supplies 1982, Sec.7.8 & 7.9;

ii) B.S.W. Ho and T.Y. Tam 1997, Enumeration of *E. coli* in environmental waters and wastewater using a chromogenic medium. Wat. Sci. Tech.Vol.35, No.11-12, pp.409-413; method adopted in 1997.

15. MMT/EPD – Marine Monitoring Team, Waste & Water Science Group, Environmental Protection Department.

16. EML/EPD – Environmental Microbiology Laboratory, Waste & Water Science Group, Environmental Protection Department.

17. WSL/EPD – Water Sciences Laboratory, Waste & Water Science Group, Environmental Protection Department

18. GL – Environmental Chemistry B Section, Environmental Chemistry & Other Scientific Services Group, 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.