dry tropics partnership for healthy waters

Dry Tropics Partnership for Healthy Waters
Waterways Report Card 2023

TECHNICAL REPORT

PART 8: Appendices

Reporting on data collected 2021 - 2022

JULY 2023 | Dry Tropics Partnership for Healthy Waters (DTPHW)

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16 Appendices

Appendix A. All Indicators, Indicator Categories, and Indices

Table 74. All indicators, indicator categories, and indices used in the 2021–2022 Technical Report and Report Card.

Indicator	Indicator Category	Index	Zone
Dissolved Inorganic Nitrogen	Nutrients	Water Quality	Freshwater
Total Phosphorus			
Turbidity	Phys-Chem		
High/Low DO			
Change in riparian extent	Riparian vegetation	Habitat and Hydrology	
Change in wetland extent	Wetlands		
Fish barriers	Artificial barriers		
Impoundment length			
Fish	Fish	Fish	
Total Phosphorus	Nutrients	Water Quality	Estuary
DIN			
High/Low DO	Phys-Chem		
Turbidity			
Change in mangrove and saltmarsh extent	Mangrove and Saltmarsh Extent	Habitat	
Change in riparian extent	Riparian Vegetation		
Total Phosphorus	Nutrients	Water Quality	Inshore Marine
Nitrogen Oxides			
Total Nitrogen			
Filterable Reactive Nitrogen			
Total Suspended Solids	Phys-Chem		
Turbidity			
Secchi Depth			
Chlorophyll-a	Chlorophyll-a		
Composition	Coral	Habitat	
Change in cover			
Juvenile Density			
Macroalgae cover			
Cover			
Biomass	Seagrass		
Meadow area			
Species composition			
Change in cover	Coral	Habitat	Offshore Marine
Juvenile density			
Cover			

Appendix B. Climatic and Land Use, Additional Material

Land Use

Land use data[23] describes what the dominant use for the land is, with nationally consistent descriptions set by the Australian Land Use and Management (ALUM) Classification system (Department of Agriculture, Fisheries and Forestry 2023). Land use in the Dry Tropics is summarised in Table 75 and visualised in Figure 4.

Land use follows a 3-level hierarchical structure with six primary classes:

- Conservation and Natural Environments
- Intensive Uses (such as urban development)
- Production From Dryland Agriculture and Plantations
- Production From Irrigated Agriculture and Plantations
- Production From Relatively Natural Environments
- Water

The Dry Tropics region includes the largest city in North Queensland (Townsville), and land use reflects this, with large areas of intensive use and urban development. The effect of intensive land uses are cited as a major driver of environmental change, often resulting in impervious surfaces, artificial barriers, and changes to waterways, all of which impact water quality and water flow (Hill 2021, McGrane 2016). In 2021, 296.54km^2 (or 10.2%) of the Dry Tropics region was classified as intensive use. Intensive land use in Dry Tropics region has increased by 53.14km^2 (1.9%) since 1999 (from 243.40km^2, 8.3%), however has only increased by 6.19km^2 (0.4%) since 2016 (from 290.35km^2, 9.9%) (Table 75). Increases are most visible in the Ross Basin, west of the CBD (Figure 4).

The conservation and natural environment land use category includes national parks, wilderness areas, and natural areas of land owned/used by the Australian Defence Force. Given sufficient size this category can act as a cornerstone for biodiversity and provide a host of ecosystem services (DeFries 2007, Schulze 2017). This land use is the second largest in the Dry Tropics, in 1999 conservation and natural environment land use covered approximately 835.63km^2 (or 28.6%) of the Dry Tropics, in 2016 this increased to 1026.13km^2 (or 35.1%), and in 2021 increased to 1030.98km^2 (35.5%) (Table 75). A large proportion of this expansion has occurred along the hinterlands and coastal plain of the Black Basin (Figure 4).

Both dryland agriculture, and irrigated agriculture are a very small proportion of the land use in the Dry Tropics region. Dryland agriculture and plantations include forest plantations and cropping. This accounts for only 1.74km^2 (0.1%) of the Dry Tropics and has decreased from a total of 2.63km^2 (0.1%) in 1999, however did spike in 2016 with an area of 3.17km^2 (0.1%). Irrigated agriculture include almost identical land use types (forest plantations, cropping, etc.) although they are irrigated. This accounts for 33.44km^2 (1.2%) of the Dry Tropics and has increased from a total of 31.75km^2 (1.1%) in 1999. Similarly, this land use type also spiked in 2016, covering 35.75km^2 (1.2%) (Table 75). Irrigated agriculture is visible to the west of the Ross River Dam (Figure 4).

By area the most substantial land use category is production from relatively natural environments, which includes grazing and wood production from native forests. This land use type covered 1375.00km^2 (or 47.3%) of the Dry Tropics region in 2021. However, has noticeably declined from 1999 levels of 1636.67km^2 (56.0%), and from 2016 levels of 1397.60km^2 (47.8%) (Table 75). The

[23] All land use data was downloaded from QSpatial's [Catalogue] (Queensland Government 2023).

reduction has been driven by the expansion of conservation and natural environments land use in the Black Basin hinterlands, and the expansion of intensive land use in the Ross Basin (Figure 4).

The water land use type reduced slightly from 169.67km^2 in 2016, to 169.12km^2 in 2021 (Figure 4) (Table 75).

Table 75. Total area and percentage of region for land use classes in the Dry Tropics region in 1999 and 2021 at the primary level.

Land Use	2021		2016		1999	
	%	km^2	%	km^2	%	km^2
Conservation and Natural Environments	35.5	1030.98	35.1	1026.13	28.6	835.63
Intensive Uses	10.2	296.54	9.90	290.35	8.3	243.40
P. f. Dryland Agriculture and Plantations	0.1	1.74	0.1	3.17	0.1	2.63
P. f. Irrigated Agriculture and Plantations	1.2	33.44	1.2	35.75	1.1	31.75
P. f. Relatively Natural Environments	47.3	1375.00	47.8	1397.60	56.0	1636.67
Water	5.8	169.12	5.8	169.67	5.9	172.76

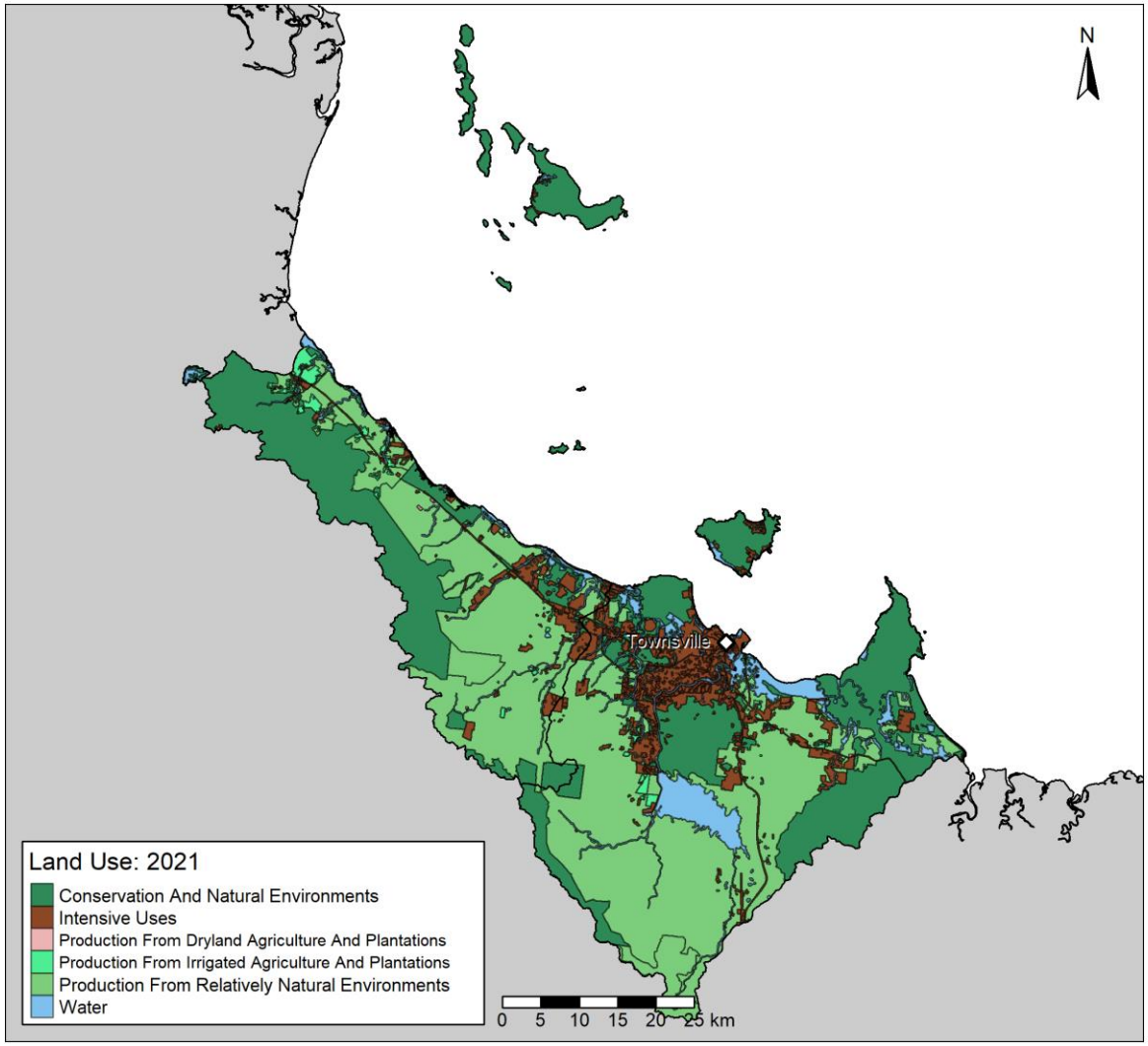

Figure 14. Land use categories in the Dry Tropics region in 2021 shown at the primary level.

A changing climate and extreme weather can have a major impact on the health of the environment both globally and within the Townsville Dry Tropics region. These forces directly and indirectly put pressure on local waterways and can influence the results presented in this report (IPCC 2022, United Nations 2023). Between 1st July 2021 and 30th June 2022, the Dry Tropics region recorded a wide range of weather events. There was no major flooding, no cyclones, and no change to the current La Niña event (Bureau of Meterology 2023, Climate Council 2021). However, multiple heatwaves were experienced, periods of extremely high and low rainfall were recorded, water temperature was above average, and the chance of coral bleaching was above average (Bureau of Meterology 2023, NOAA 2023). Below key influences are explored in detail.

Rainfall

The amount of rainfall directly influences the quality of water, especially in urban environments such as the Dry Tropics, where impervious surfaces allow high levels of runoff. During rainfall events, stormwater can rapidly enter the natural environment carrying high levels of nutrients, sediments, and heavy metals, producing high biological oxygen demand, low dissolved oxygen levels, and

increasing levels of pollution (Australian Government 2022, National Geographic 2017). In rural and agricultural locations rainfall has also been linked to the excessive loss of land-based nutrients through run off, particularly in areas with inadequate riparian buffers (Drewry. J. J. 2006).

Monthly rainfall[24] across the Dry Tropics region was unevenly distributed, with monthly percentile rainfall in the Ross and Black basins ranging from "very much below average" (1st – 10th percentiles) to the "highest 1%" (99th percentile) on record. Both of these extremes were recorded during the wet season that is typically experienced during summer months (Nov – Apr). This reporting period the wet season occurred uncharacteristically late, with a drier than usual February and March followed by high rain in April and May. In contrast the "dry season" that typically occurs during winter (May – Oct) recorded no months with below average rainfall for either basin (Table 17).

Table 76. Monthly rainfall percentiles in the Ross Basin and the Black Basin grouped into seven categories.

Basin	2021						2022						Annual
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Ross													
Black													

■ = Lowest 1% | ■ = Very much below average | ■ = Below Average | ■ = Average | ■ = Above Average | ■ = Very much above average | ■ = Highest 1%

The spatial variation of annual rainfall was similarly uneven across the Ross and Black basins, with areas of high rainfall receiving up to 1000mm more annually than areas of low rainfall. Rainfall was the greatest in the hinterlands of the Black Basin with up to 2000mm, while the least amount of rainfall was recorded on the southern plateau of the Ross Basin with only 800 to 1000mm (Figure 5).

The annual rainfall anomaly (the amount +/- of rain that fell in comparison to the long-term mean) revealed that, although the Black Basin contained the area with the greatest amount of rainfall, a large area of the Black Basin in the north received less rain that usual. In contrast, the southern end of the Black Basin and centre of the Dry Tropics region received more rain than the long-term mean, and across the entire Ross Basin, no area received less rain that the long-term mean (Figure 5).

[24] All rainfall data was downloaded from the BOM's [Australian Water Outlook] portal (Bureau of Meteorology 2022).

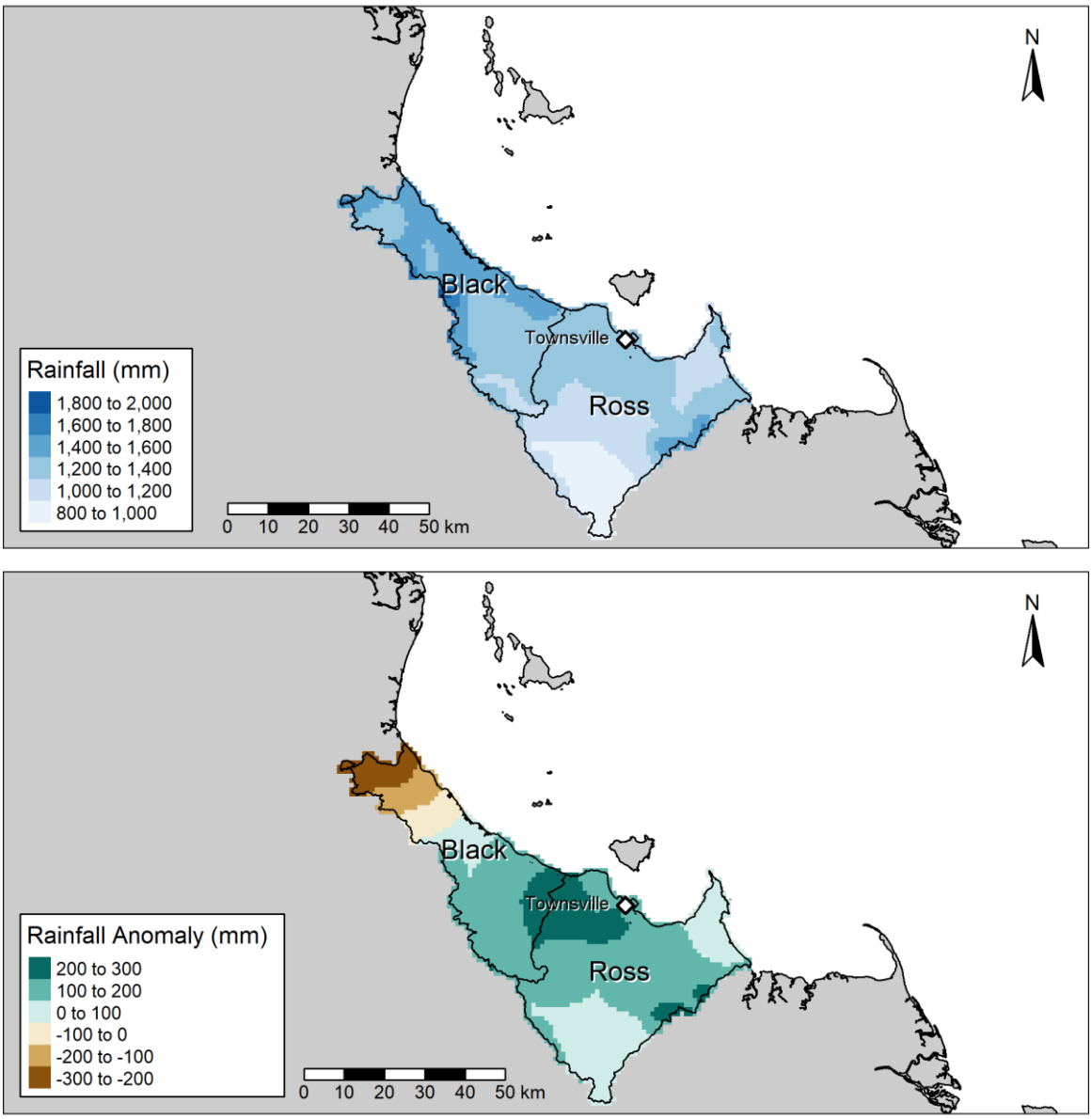

Figure 15. Total annual rainfall and rainfall anomaly in the Ross and Black Basin.

For the 2021–2022 reporting period the total annual rainfall in the Ross Basin was 1166mm, this was 137mm (or 113%) more than the long-term mean of 1029mm. In the Black Basin total annual rainfall was 1383mm, which was 57mm (104%) more than the long-term mean of 1326mm (Table 18). This represents an increase from last year in the Ross Basin (Appendix C), and a decrease from last year in the Black Basin (Appendix D).

Table 77. Annual rainfall summary statistics for the Ross Basin and Black Basin.

Basin	Annual Rainfall	Long-term mean (ltm)	Anomaly (+/- ltm)	Percentage of the ltm
Ross	1166mm	1029mm	+137mm	113%
Black	1383mm	1326mm	+57mm	104%

Air Temperature

Mean annual air temperature has a direct impact on the overall climatic conditions experienced in the Dry Tropics region. Warmer temperatures affect the oceans, weather patterns, plants, and animals. Increased temperatures can change the distribution and habitable range of species and reduce their abundance and density (Environmental Protection Authority 2017). Higher temperatures worsen many types of disasters including storms, heat waves, floods, and droughts, and are causing sea level rise and ocean acidification (Natural Resources Defense Council 2022, New South Wales Government 2023).

Mean monthly air temperature[25] in the Dry Tropics basin was consistently equal to or greater than average every month of the reporting period across both the Ross and Black basins. For five months of the year each basin recorded their "highest 1%" air temperature on record, in only two months were monthly air temperature recorded as "average", and in the remaining five months air temperature was recorded as either "above average" or "very much above average". The "highest 1%" temperatures were recorded in July, August, and October, indicating a warmer than usual winter, and notably in March and April which coincided with a large spike in rainfall (Rainfall, Table 19).

Table 78. Monthly air temperature percentiles in the Ross Basin and the Black Basin grouped into seven categories.

Basin	2021						2022						Annual
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	
Ross													
Black													

■ = Lowest 1% | ■ = Very much below average | ■ = Below Average | ■ = Average | ■ = Above Average | ■ = Very much above average | ■ = Highest 1%

Annual air temperature varied spatially, with a maximum mean annual temperature of more 26°C in both basins and a minimum mean temperature of ~22°C in the Ross Basin and ~21°C in the Black Basin. The highest temperatures were recorded along the coastline and lower lying areas of each basin, in contrast, cooler mean annual temperatures were recorded on the southern and western edges of the basins where elevation increases. This is particularly apparent across the inland ridge of the Black Basin (Figure 6).

Annual temperature anomalies show that all areas within the Dry Tropics regions recorded mean temperatures above the long-term mean, with a difference of ~1.30°C to ~1.50°C throughout. There was no measurable change in anomaly when moving from coast to ridgeline, suggesting the spatial trend visible in the annual mean air temperature plot is a standard occurrence, however, temperature anomalies did increase consistently from south to north, particularly in the most northern reaches of the Black Basin (Figure 6).

[25] All air temperature data was downloaded from BOM's [Gridded Climatology Data] portal (Bureau of Meteorology 2022)

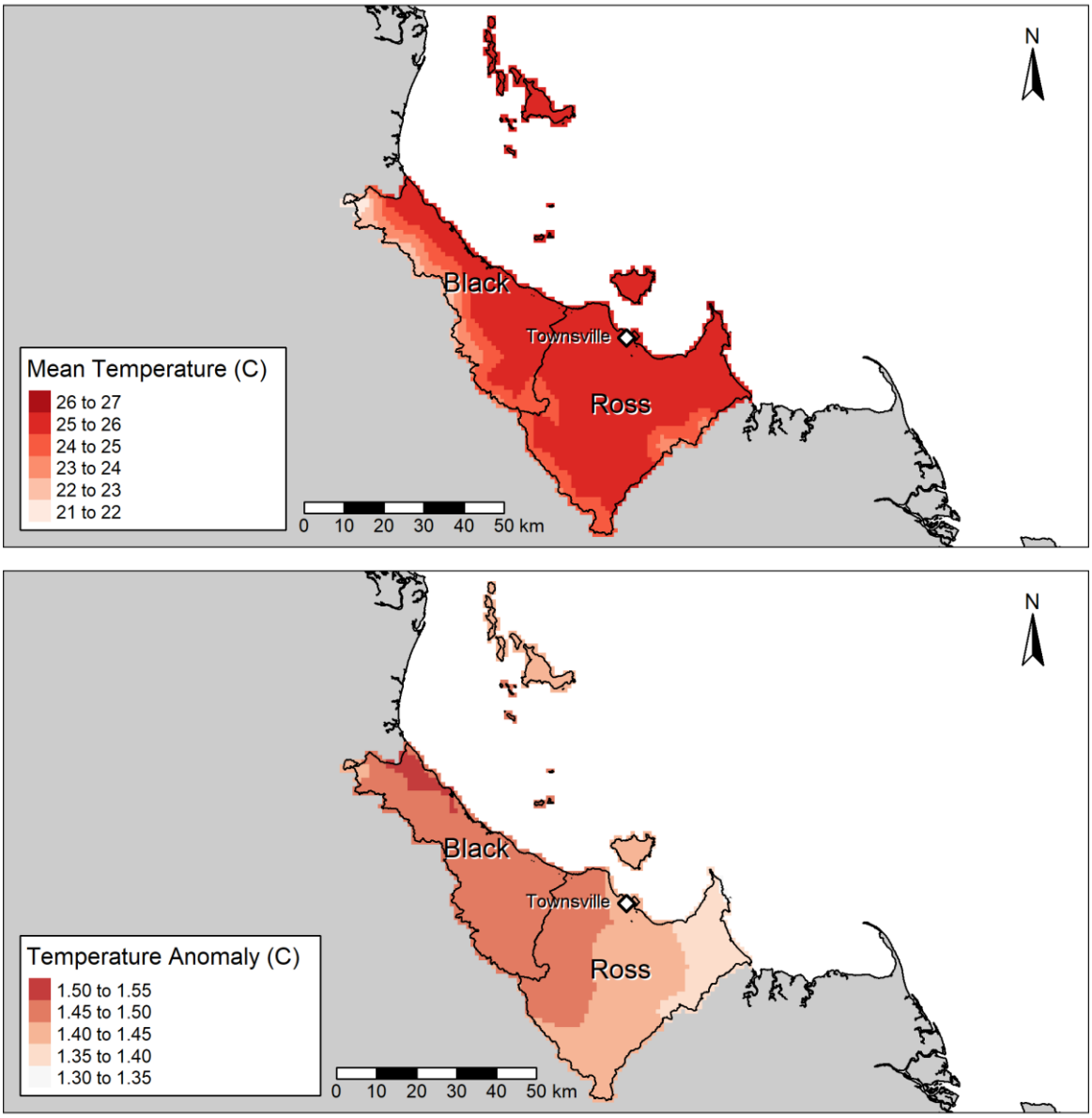

Figure 16. Total annual air temperature and air temperature anomaly in the Ross and Black Basin.

During the 2021–2022 reporting period the mean annual air temperature in the Ross Basin was 25.4°C, this was 1.4°C (or 106%) more than the long-term mean of 24.0°C. In the Black Basin mean annual air temperature was 24.9°C, which was 1.4°C (106%) more than the long-term mean of 23.5°C (Table 18). This represents an increase from last year in the Ross Basin (Appendix E), and an increase from last year in the Black Basin (Appendix F).

Table 79. Annual air temperature summary statistics for the Ross Basin and the Black Basin.

Basin	Annual Air Temperature	Long-term mean (ltm)	Anomaly (+/- ltm)	Percentage of the ltm
Ross	25.4°C	24.0°C	+1.4°C	106%
Black	24.9°C	23.5°C	+1.4°C	106%

Sea Surface Temperature

The world's oceans absorb a significant amount of excess heat produced from greenhouse gases and play an important role in the global climate. Without this oceanic buffer, global temperatures would have risen significantly more than they have so far. However, long-term increases in sea surface temperatures (as a proxy for ocean temperature), threaten food security, cause more extreme weather events, lead to a loss of coastal protection, result in ocean acidification, and increase the rate of sea level rise (Climate Policy Watcher 2023, IUCN 2017).

Monthly sea surface temperature[26] in the Dry Tropics marine region was "very much above average" or the "highest 1%" on record for ten months of the year. In only two months of the year was monthly sea surface temperature "average" or "above average". Three of the four "highest 1%" months were recorded consecutively during October, November, and December before cooling down for the following two months and then rising again in March and April. This roughly aligns with monthly air temperatures spikes recorded from October to December, followed by a decrease in the following three months, and then a subsequent increase again (Air Temperature, Table 21).

Table 80. Monthly air temperature percentiles in the Ross Basin and the Black Basin grouped into seven categories.

Region	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Dry Tropics													

■ = Lowest 1% | ■ = Very much below average | ■ = Below Average | ■ = Average | ■ = Above Average | ■ = Very much above average | ■ = Highest 1%

Annual sea surface temperature in the Dry Tropics marine region varied spatially, with an annual maximum mean temperature of more than ~27.4°C and annual minimum mean temperature of ~26.4°C. The highest temperatures were recorded in the northern most reaches of the marine region and gradually decreased southward. Interestingly the lowest temperatures were recorded about 30km offshore of the coastline, starting at the Palm Island group heading southeast (Figure 7).

Annual sea surface temperature anomalies further highlighted that lower temperatures recorded approximately 30km offshore were not a frequent occurrence. Annual temperature anomalies ranged from about +0.75°C to more than +1.1°C, with the largest temperature anomalies occurring directly on the coastline. These anomalies suggest that the near coastal waters were abnormally warm during the 2021–2022 reporting period (Figure 7).

[26] All sea surface temperature data was downloaded from NOAA's [Coral Reef Watch] portal (NOAA 2023)

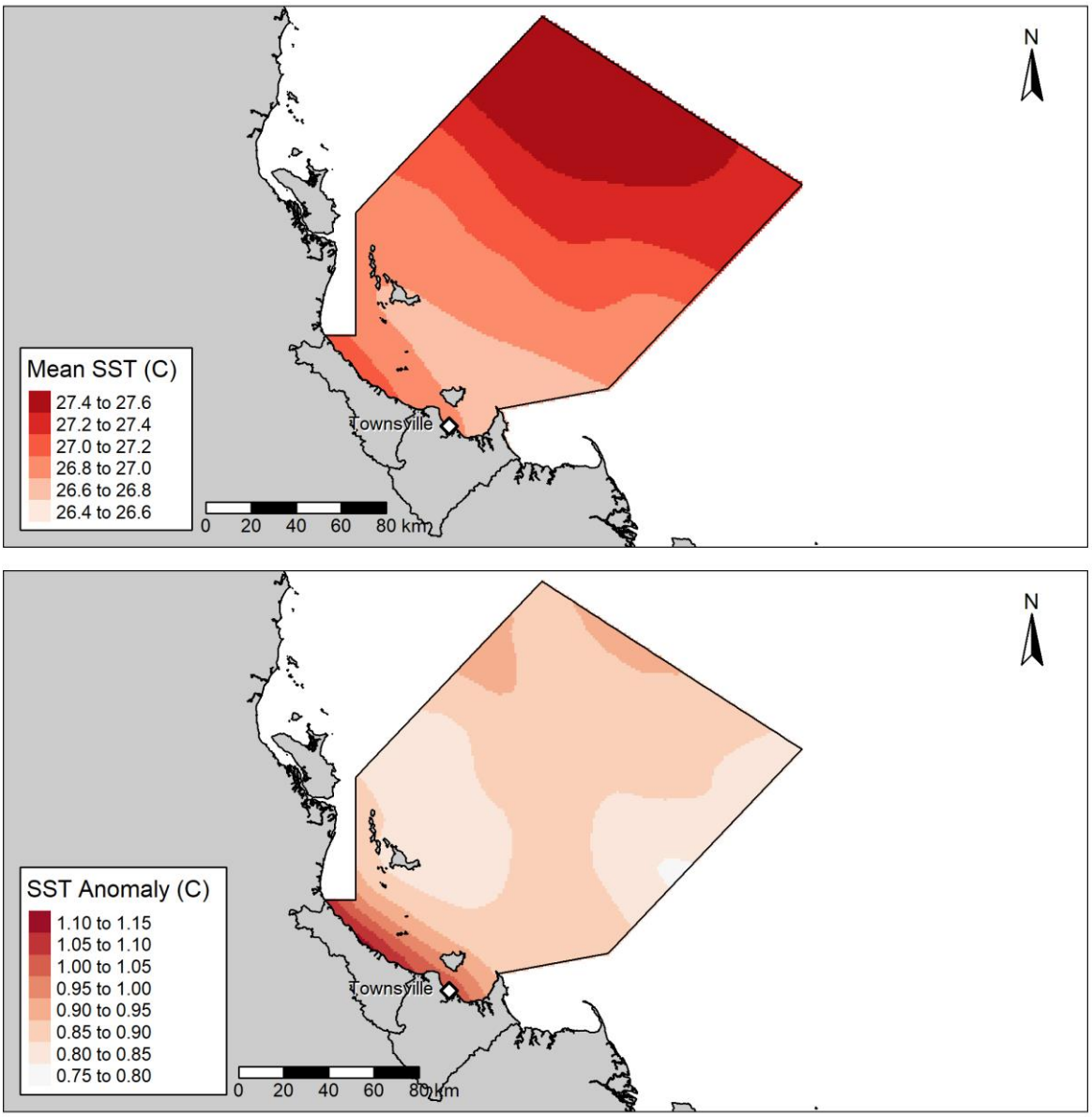

Figure 17. Total annual sea surface temperature and sea surface temperature anomaly in the Dry Tropic marine region.

Over the 2021–2022 reporting period the mean annual sea surface temperature in the Dry Tropics marine region was 27.1°C, this was +0.8°C (or 103%) more than the long-term mean of 26.3°C, and represents an increase from last year in the Dry Tropics marine region (Appendix G, Table 22).

Table 81. Annual sea surface temperature summary statistics for the Dry Tropics marine region.

Region	Annual Sea Surface Temperature	Long-term mean (ltm)	Anomaly (+/- ltm)	Percentage of the ltm
Dry Tropics	27.1°C	26.3°C	+0.8°C	103%

Coral Bleaching (Degree Heating Weeks)

Mass coral bleaching has been linked to prolonged periods of heat stress (Glynn and D'Croz 1990). NOAA's Coral Reef Watch degree heating week (DHW) dataset provides a measure of this heat stress and acts as a proxy to coral bleaching[27] (NOAA 2023). The DHW dataset shows the accumulated heat stress experienced by corals in the prior three months and is a cumulative measure of both intensity and duration of heat stress. Temperatures exceeding 1°C above the usual summertime maximum are sufficient to cause stress, including bleaching, and are the basis of a degree heating week. A DHW of 2 is equivalent to one week of Hot Spot values persistently at 2°C, or two weeks of Hot Spot values persistently at 1°C above usual summertime maximum temperatures. DHWs over 4 °C have been shown to cause significant coral bleaching, and values over 8°C have caused severe bleaching and significant mortality (NOAA 2023).

In 2021–2022, coral bleaching risk in the Dry Tropics marine region ranged from "possible" to "highly likely", with no region showing low risk. DHWs ranged from 4 to 6, up to >8 and highly likely bleaching risk (>8 DHWs) was predominantly recorded in the coastal waters, and at the eastern edge of the region (Figure 8). The greater number of DHWs inshore aligns with the records of increased annual sea surface temperature and increased annual sea surface temperature anomalies in the same location (Sea Surface Temperature, Figure 7). Further, the 2021–2022 period has recorded a greater number of DHWs than four of the past five years (Appendix H)

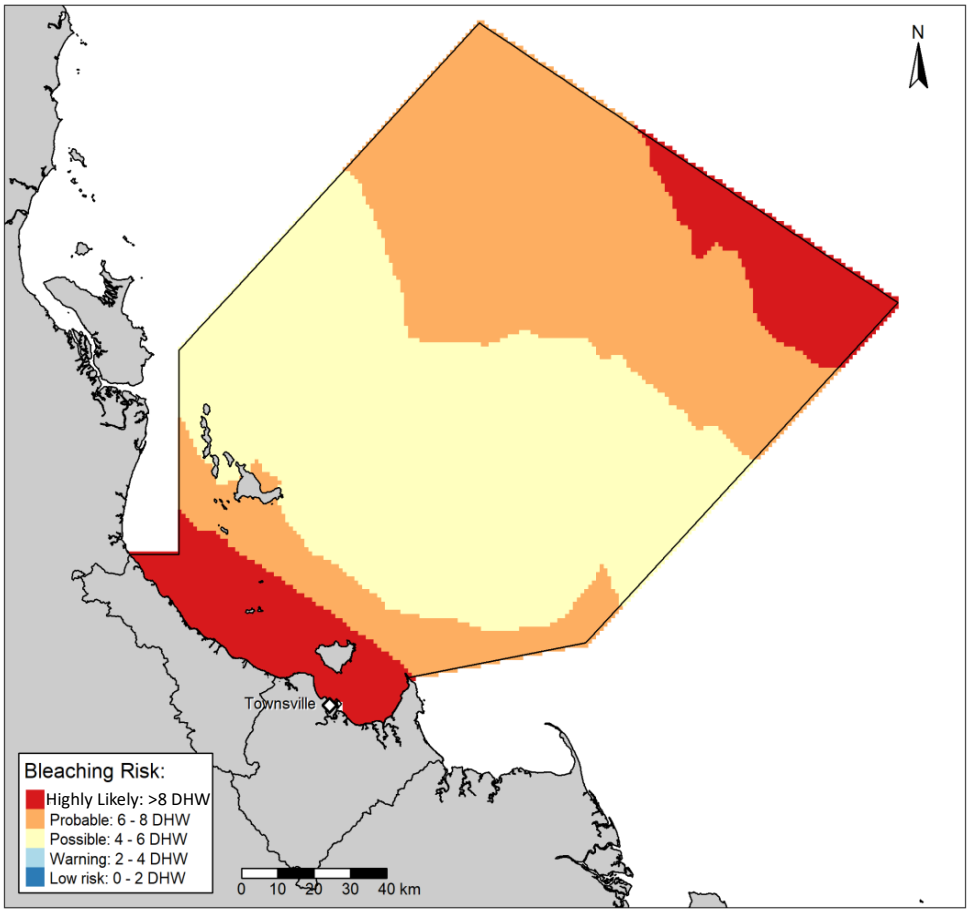

Figure 18. Total annual degree heating weeks (bleaching events) in the Dry Tropic marine region.

[27] All degree heating week data was downloaded from NOAA's [Coral Reef Watch] portal (NOAA 2023)

Appendix C. Ross Basin Long-Term Annual Rainfall Trends

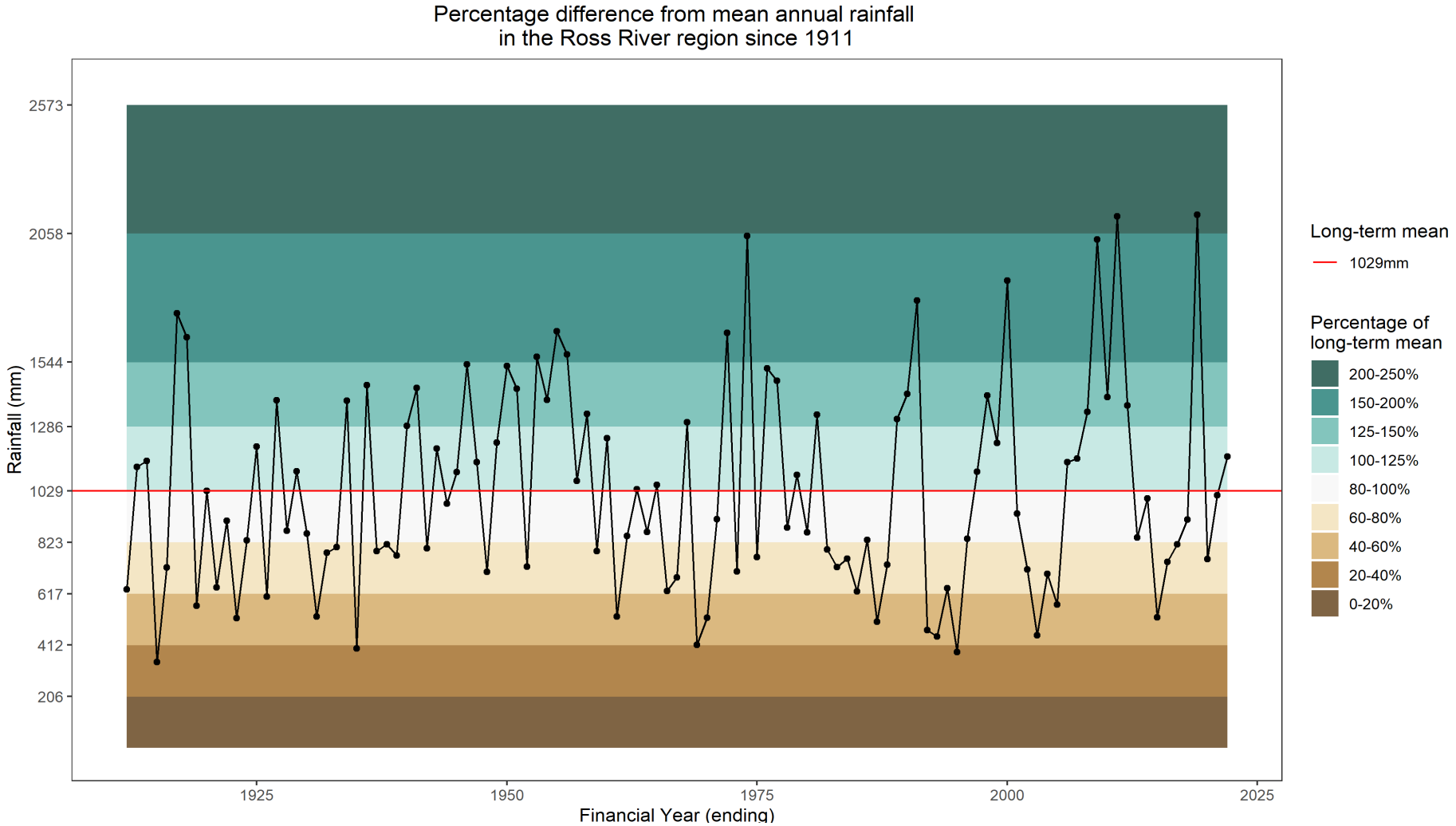

Figure 19. Ross Basin long-term annual rainfall trends.

Appendix D. Black Basin Long-Term Annual Rainfall Trends

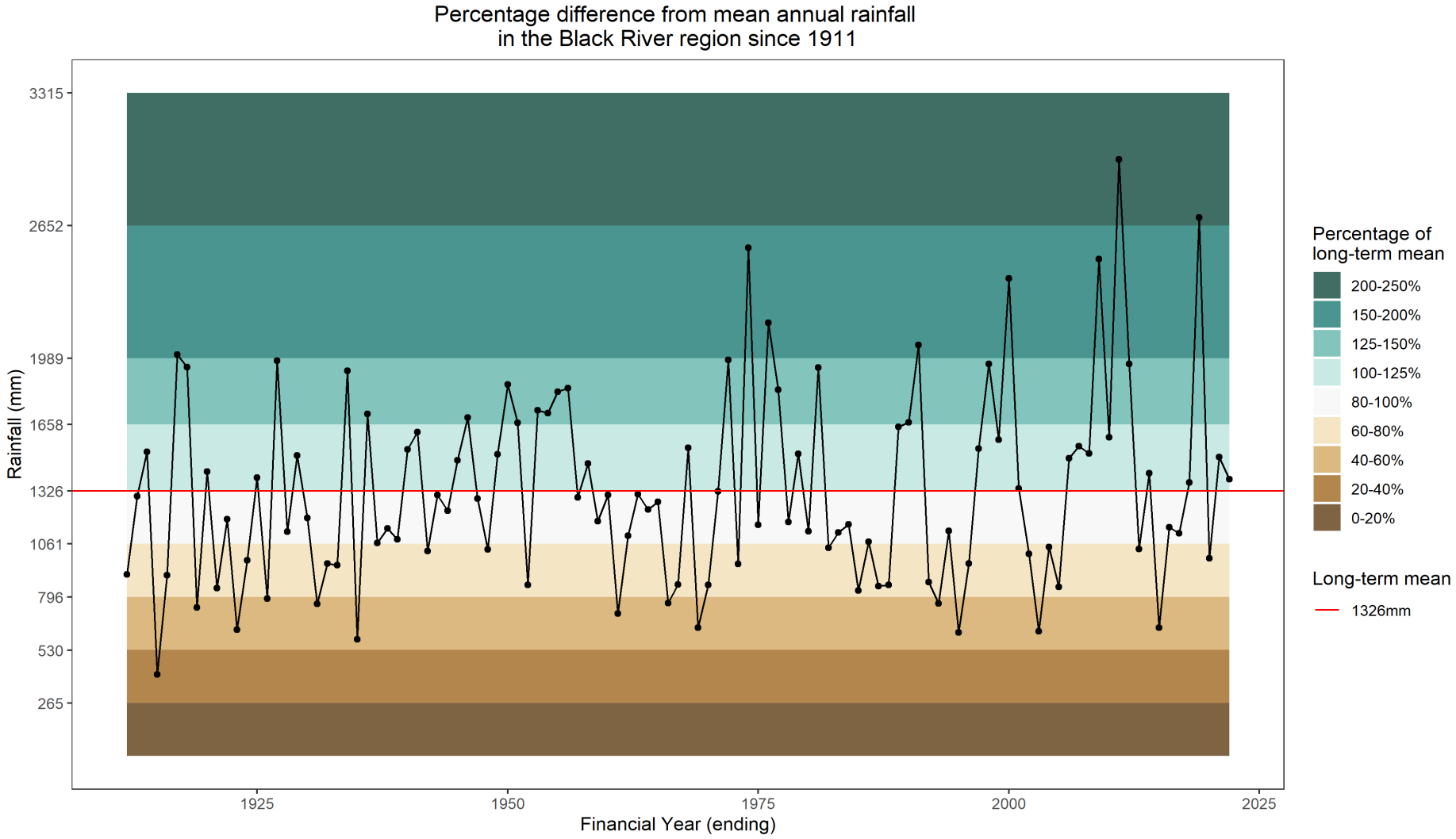

Figure 20. Black Basin long-term annual rainfall trends.

Appendix E. Ross Basin Long-Term Annual Air Temperature

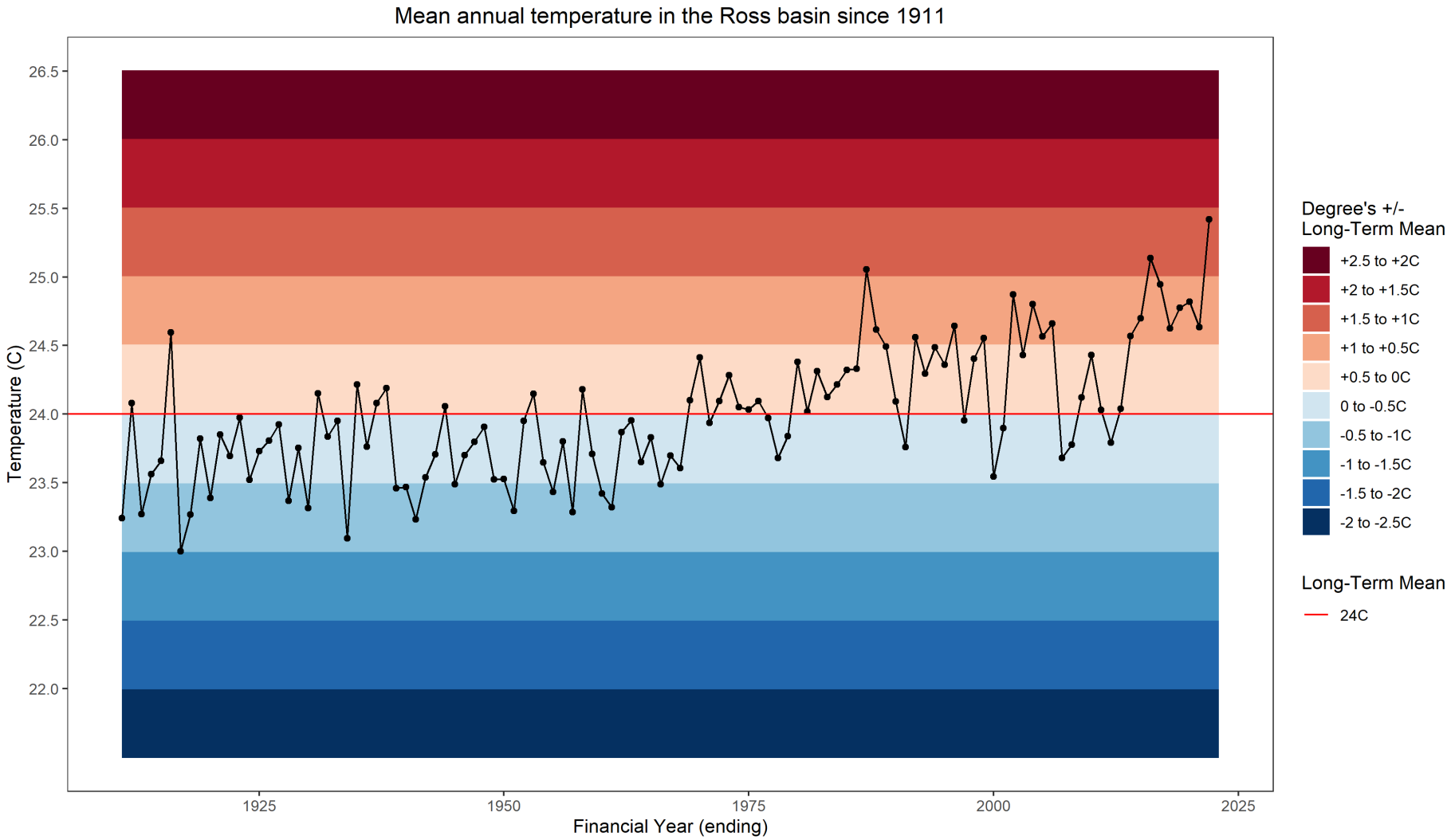

Figure 21. Ross Basin long-term annual air temperature trends.

Appendix F. Black Basin Long-Term Annual Air Temperature

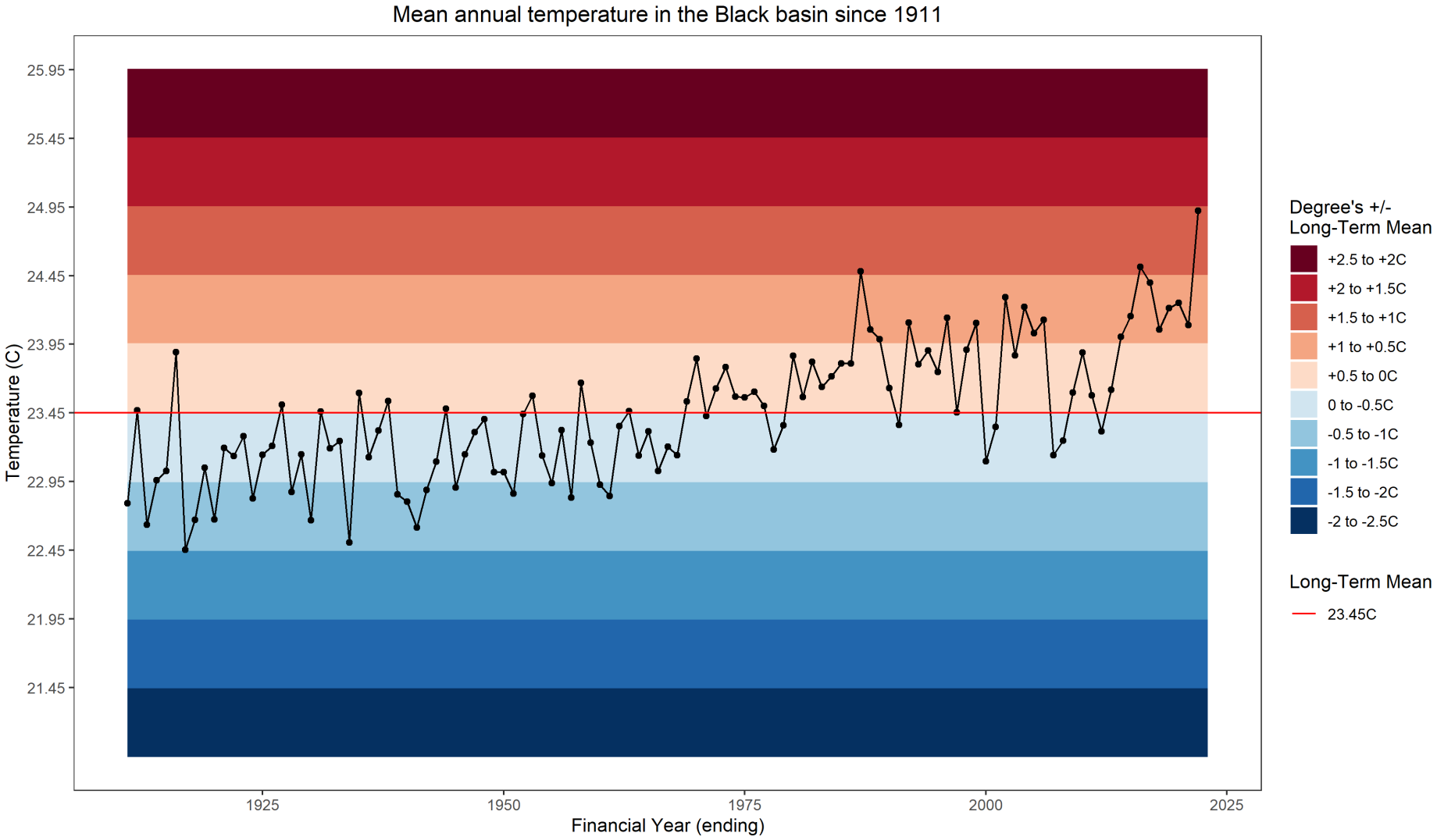

Figure 22. Black Basin long-term annual air temperature trends.

Appendix G. Dry Tropics Marine Waters Long-Term Annual Sea Surface Temperature

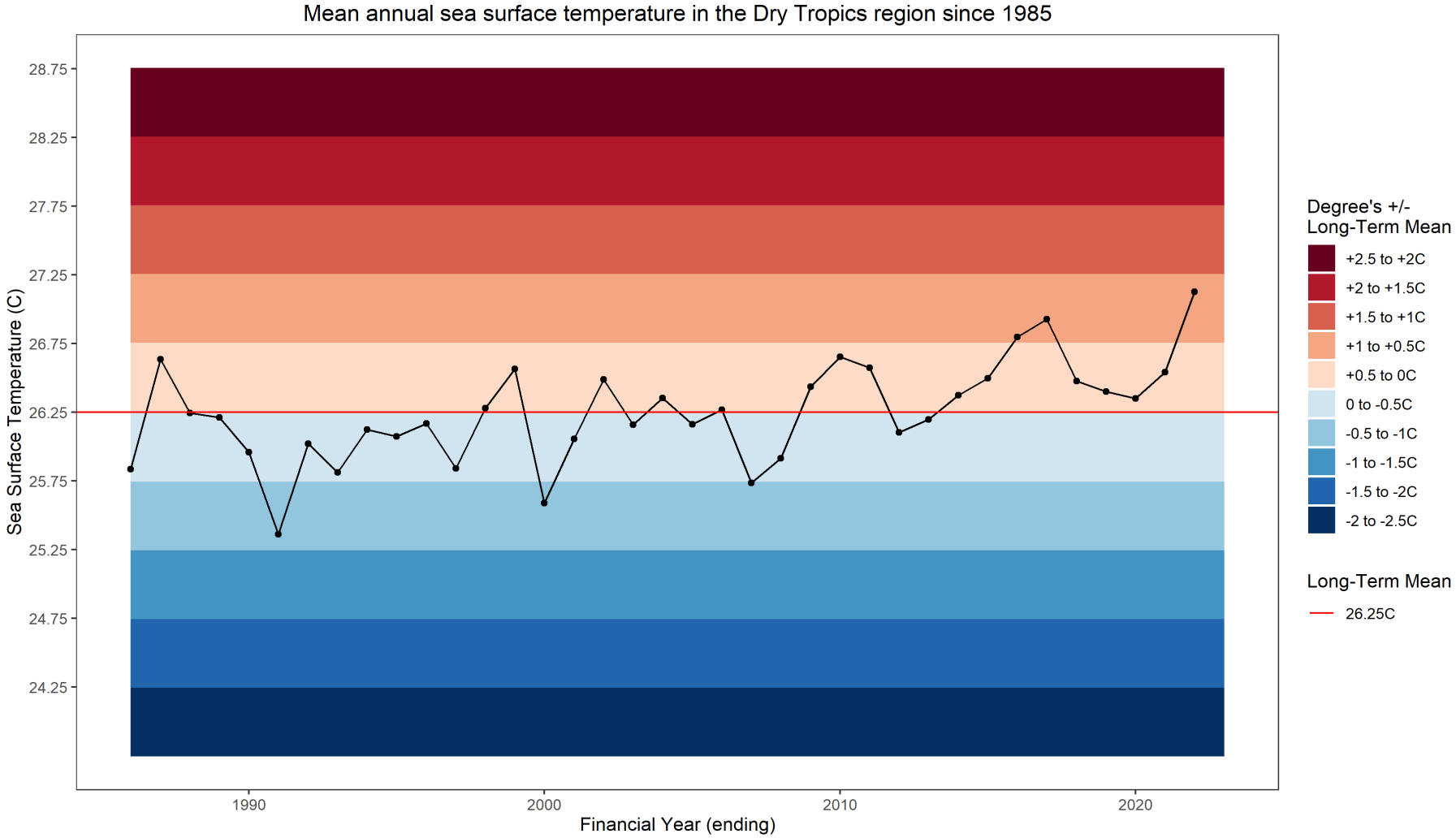

Figure 23. Black Basin long-term annual sea surface temperature trends.

Appendix H. Dry Tropics Marine Waters 5-year Historic Degree Heating Week Maps

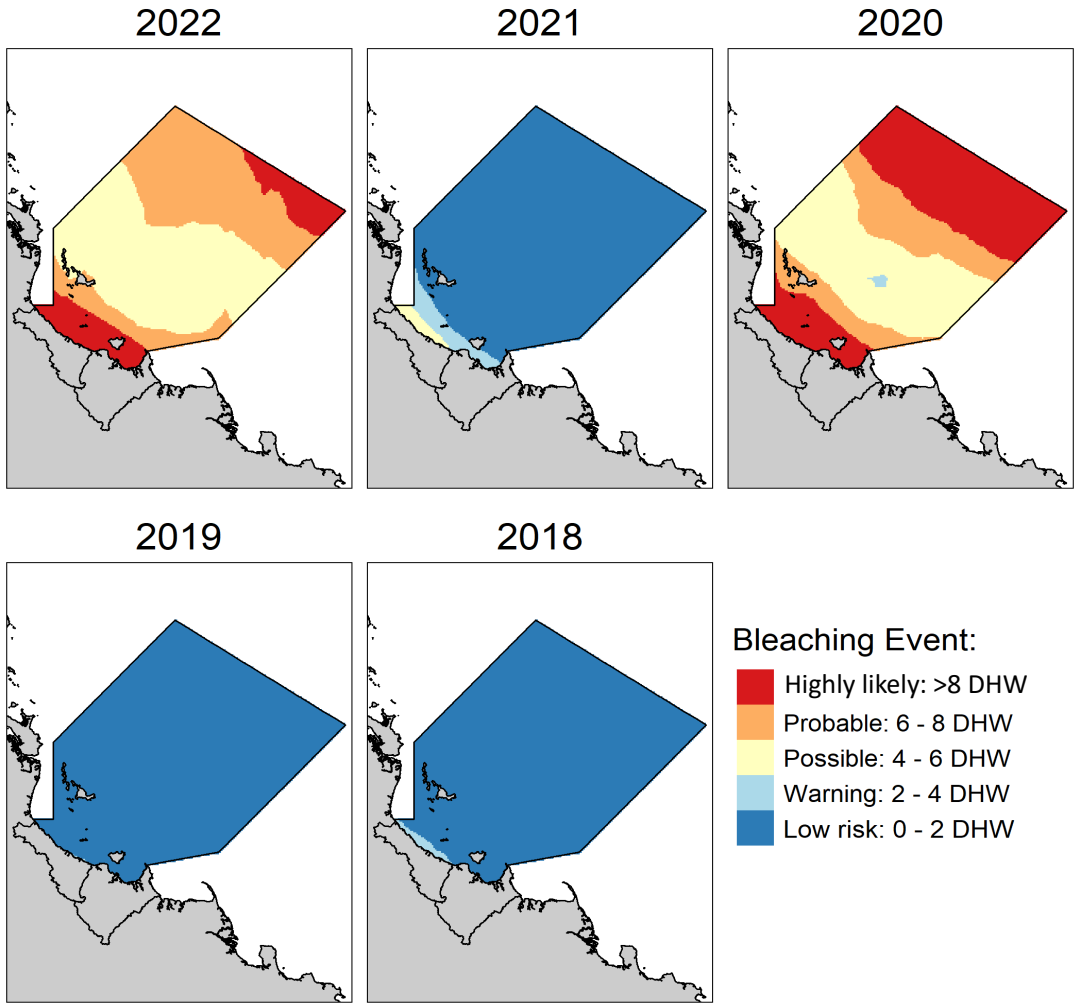

Figure 24. Dry Tropics Marine Region 5-year Historic Degree Heating Week Map.

Appendix I. Freshwater Quality Sampling Locations

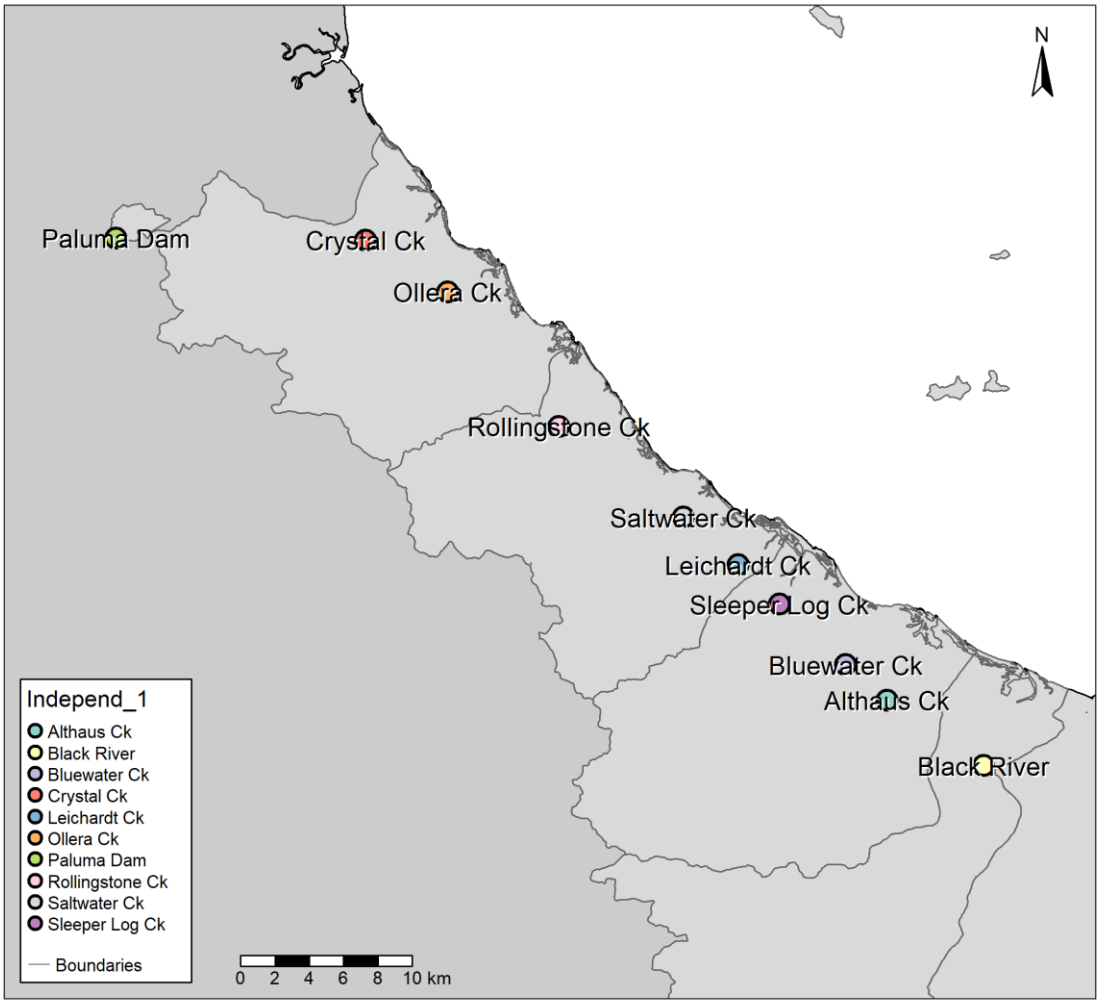

Figure 25. Black Freshwater Basin water quality site locations.

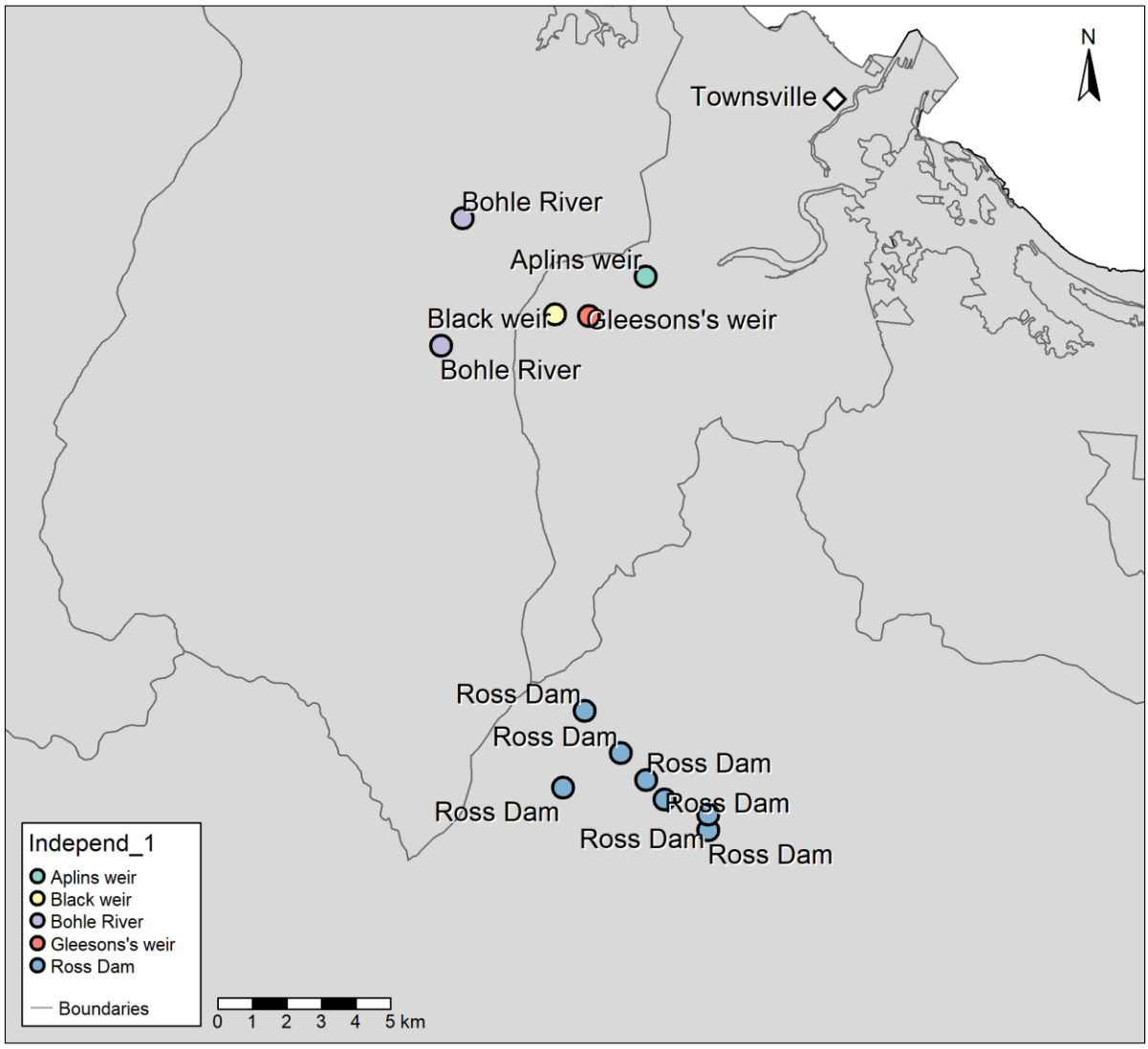

Figure 26. Ross Freshwater Basin water quality site locations.

Appendix J. Freshwater Quality Nutrients: Sampling Frequencies, Medians, Water Quality Objectives, and Scaling Factors

Table 82. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for DIN, TP and FRP in the Dry Tropics Freshwater Environments.

Watercourse	DIN (mg/L)					TP (mg/L)					FRP (mg/L)				
	N.Samples	N.Months	Median	WQO	SF	N.Samples	N.Months	Median	WQO	SF	N.Samples	N.Months	Median	WQO	SF
Ross Lake	151	12	0.015	0.02	0.38	150	12	0.03	0.03	0.46	132	12	0.005	0.01	NA
Aplin's Weir	54	12	0.020	0.02	0.38	0	0	NA	0.03	0.46	54	12	0.005	0.02	NA
Gleesons Weir	11	11	0.015	0.02	0.38	0	0	NA	0.03	0.46	11	11	0.005	0.02	NA
Blacks Weir	11	11	0.030	0.02	0.38	10	10	0.01	0.03	0.46	11	11	0.005	0.02	NA
Bohle Mid-Field	11	11	0.200	0.08	0.38	11	11	3.2	0.05	0.46	11	11	3.2	0.02	NA
Bohle Far-Field	11	11	0.082	0.08	0.38	11	11	1.4	0.05	0.46	11	11	1	0.02	NA
Black River	52	11	0.012	0.02	0.05	11	11	0.020	0.02	0.03	51	11	0.012	0.02	NA
Althaus Ck	8	8	0.005	0.02	0.05	8	8	0.022	0.02	0.03	8	8	0.005	0.02	NA
Bluewater Ck	11	11	0.006	0.02	0.05	10	10	0.011	0.02	0.03	11	11	0.003	0.02	NA
Sleeper Log Ck	11	11	0.005	0.02	0.05	11	11	0.016	0.02	0.03	11	11	0.003	0.02	NA
Leichhardt Ck	11	11	0.006	0.02	0.05	11	11	0.011	0.02	0.03	11	11	0.003	0.01	NA
Saltwater Ck	11	11	0.003	0.02	0.05	11	11	0.009	0.02	0.03	11	11	0.002	0.01	NA
Rollingstone Ck	11	11	0.008	0.02	0.05	10	10	0.009	0.02	0.03	11	11	0.002	0.01	NA
Ollera Ck	9	9	0.004	0.02	0.05	9	9	0.009	0.02	0.03	9	9	0.003	0.01	NA
Crystal Ck	11	11	0.012	0.02	0.05	10	10	0.007	0.02	0.03	11	11	0.002	0.01	NA
Paluma Lake	0	0	NA	0.02	0.05	11	11	0.010	0.03	0.06	11	11	0.005	0.01	NA

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

Appendix K. Freshwater Quality Nutrients Scores Historic Comparison

Table 83. Dry Tropics freshwater water quality historic nutrient indicator scores.

Basin	Sub Basin	Watercourse	DIN			TP		
			2021–2022	2020–2021	2019–2020	2021–2022	2020–2021	2019–2020
Ross	Upper Ross	Ross Lake	90 (A)	90 (A)	68 (B)	61 (B)	90 (A)	61 (B)
	Lower Ross	Aplin's Weir	61 (B)	59 (C)	66 (B)	ND	ND	ND
		Gleesons Weir	90 (A)	62 (B)	74 (B)	ND	ND	ND
		Blacks Weir	59 (C)	61 (B)	59 (C)	90 (A)	90 (A)	70 (B)
			70 (B)	60 (C)	66 (B)	90 (A)	90 (A)	70 (B)
	Bohle River	Bohle Mid-Field	36 (D)	43 (C)	0 (E)	0 (E)	0 (E)	0 (E)
		Bohle Far-Field	60 (C)	66 (B)	29 (D)	0 (E)	0 (E)	0 (E)
			48 (C)	54 (C)	15 (E)	0 (E)	0 (E)	0 (E)
			66 (B)	68 (B)	49 (C)	37 (D)	60 (C)	33 (D)
Black	Black River	Black River	63 (B)	61 (B)	78 (B)	61 (B)	54 (C)	9 (E)
	Bluewater Ck	Althaus Ck	90 (A)	67 (B)	74 (B)	48 (C)	90 (A)	90 (A)
		Bluewater Ck	66 (B)	63 (B)	90 (A)	90 (A)	73 (B)	66 (B)
		Sleeper Log Ck	71 (B)	74 (B)	62 (B)	90 (A)	90 (A)	90 (A)
			75 (B)	68 (B)	75 (B)	76 (B)	84 (A)	82 (A)
	Rollingstone Ck	Leichhardt Ck	90 (A)	74 (B)	90 (A)	90 (A)	76 (B)	55 (C)
		Saltwater Ck	90 (A)	70 (B)	90 (A)	90 (A)	90 (A)	90 (A)
		Rollingstone Ck	62 (B)	0 (E)	64 (B)	90 (A)	90 (A)	90 (A)
			80 (B)	48 (C)	81 (A)	90 (A)	85 (A)	78 (B)
	Crystal Ck	Ollera Ck	71 (B)	66 (B)	63 (B)	90 (A)	90 (A)	90 (A)
		Crystal Ck	69 (B)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)
			70 (B)	78 (B)	76 (B)	90 (A)	90 (A)	90 (A)
	Paluma Lake	Paluma Lake	NA	63 (B)	90 (A)	90 (A)	90 (A)	90 (A)
			74 (B)	63 (B)	79 (B)	82 (A)	83 (A)	76 (B)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 90. (Scores are capped at 90).

Appendix L. Freshwater Quality Physical-Chemical Properties: Sampling Frequencies, Medians, Water Quality Objectives and Scaling Factors

Table 84. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for Turbidity, High DO, Low DO, in the Dry Tropics Freshwater Environments.

Watercourse	Turbidity					High DO					Low DO	
	N.Samples	N.Months	Median	WQO	SF	N.Samples	N.Months	Median	WQO	SF	WQO	SF
Ross Lake	133	12	8	10	35	151	12	96	110	120	90	70
Aplin's Weir	12	12	3	10	35	11	11	88	110	120	90	70
Gleesons Weir	11	11	1	10	35	10	10	74	110	120	90	70
Blacks Weir	11	11	2	10	35	10	10	76	110	120	90	70
Bohle Mid-Field	11	11	12	22	35	10	10	77	110	120	85	70
Bohle Far-Field	11	11	8	22	35	10	10	80	110	120	85	70
Black River	10	10	2	5	10	11	11	108	105	120	90	70
Althaus Ck	7	7	15	5	10	8	8	100	105	120	90	70
Bluewater Ck	10	10	3	5	10	11	11	93	105	120	90	70
Sleeper Log Ck	10	10	12	5	10	11	11	77	105	120	90	70
Leichhardt Ck	10	10	3	5	10	11	11	90	105	120	90	70
Saltwater Ck	10	10	2	5	10	11	11	98	105	120	90	70
Rollingstone Ck	10	10	0	5	10	11	11	83	105	120	90	70
Ollera Ck	8	8	2	5	10	9	9	69	105	120	90	70
Crystal Ck	10	10	1	5	10	11	11	96	105	120	90	70
Paluma Lake	11	11	2	10	20	11	11	88	110	120	90	70

Key: = for Turbidity Mean/Median is lower than the guideline value, for DO, Median is within the range between the High and Low DO guideline values | = for Turbidity Mean/Median is higher than the guideline value, for DO, the Median is higher than the High DO or Lower than the Low DO guideline value.

Appendix M. Freshwater Quality Physical-Chemical Properties Scores Historic Comparison

Table 85. Dry Tropics freshwater water quality historic physical-chemical indicator scores.

Basin	Sub Basin	Watercourse	Turbidity			High DO			Low DO		
			2021–2022	2020–2021	2019–2020	2021–2022	2020–2021	2019–2020	2021–2022	2020–2021	2019–2020
Ross	Upper Ross	Ross Lake	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)
	Lower Ross	Aplin's Weir	90 (A)	90 (A)	90 (A)	80 (B)	90 (A)	90 (A)	55 (C)	74 (B)	90 (A)
		Gleesons Weir	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	11 (E)	50 (C)	73 (B)
		Blacks Weir	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	19 (E)	26 (D)	56 (C)
			90 (A)	90 (A)	90 (A)	86 (A)	90 (A)	90 (A)	28 (D)	50 (C)	73 (B)
	Bohle River	Bohle Mid-Field	67 (B)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	26 (D)	0 (E)	0 (E)
		Bohle Far-Field	66 (B)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	40 (D)	37 (D)	0 (E)
			66 (B)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	33 (D)	18 (E)	0 (E)
			82 (A)	90 (A)	90 (A)	88 (A)	90 (A)	90 (A)	40 (D)	52 (C)	51 (C)
Black	Black River	Black River	90 (A)	69 (B)	90 (A)	47 (C)	53 (C)	62 (B)	90 (A)	90 (A)	90 (A)
	Bluewater Ck	Althaus Ck	0 (E)	12 (E)	90 (A)	90 (A)	69 (B)	4 (E)	90 (A)	90 (A)	81 (A)
		Bluewater Ck	90 (A)	90 (A)	90 (A)	79 (B)	90 (A)	90 (A)	66 (B)	77 (B)	11 (E)
		Sleeper Log Ck	0 (E)	90 (A)	70 (B)	90 (A)	90 (A)	90 (A)	20 (E)	76 (B)	32 (D)
			30 (D)	64 (B)	83 (A)	86 (A)	90 (A)	90 (A)	59 (C)	81 (A)	41 (C)
	Rollingstone Ck	Leichhardt Ck	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	61 (B)	61 (B)	27 (D)
		Saltwater Ck	75 (B)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	66 (B)	90 (A)
		Rollingstone Ck	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	40 (D)	74 (B)	51 (C)
			85 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	63 (B)	67 (B)	56 (C)
	Crystal Ck	Ollera Ck	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	0 (E)	59 (C)	0 (E)
		Crystal Ck	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	73 (B)	75 (B)
			90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	45 (C)	66 (B)	37 (D)
	Paluma Lake	Paluma Lake	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	55 (C)	90 (A)	69 (B)
			70 (B)	**80 (B)**	**88 (A)**	**85 (A)**	**85 (A)**	**79 (B)**	**60 (C)**	**75 (B)**	**53 (C)**

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 90. (Scores are capped at 90)

Appendix N. Freshwater Quality 2021–2022 Boxplots

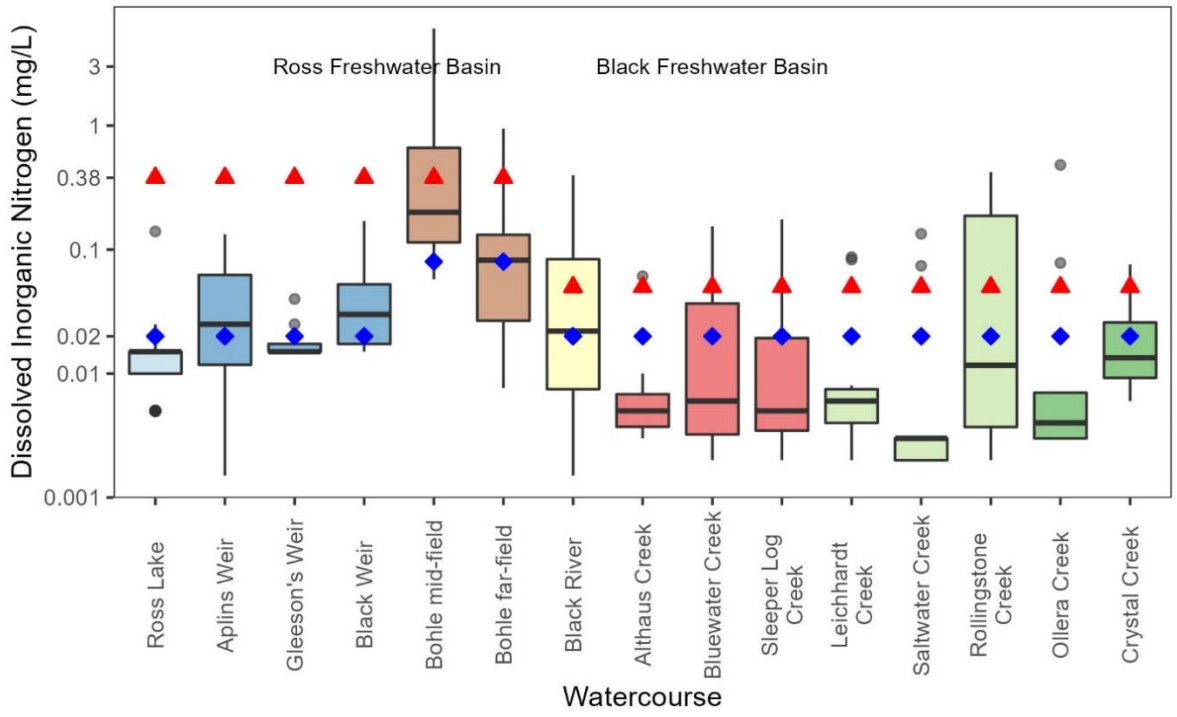

Figure 27: Dissolved Inorganic Nitrogen (DIN) (mg/L) Boxplot: red triangles indicate the scaling factor, blue diamonds indicate the water quality objective.

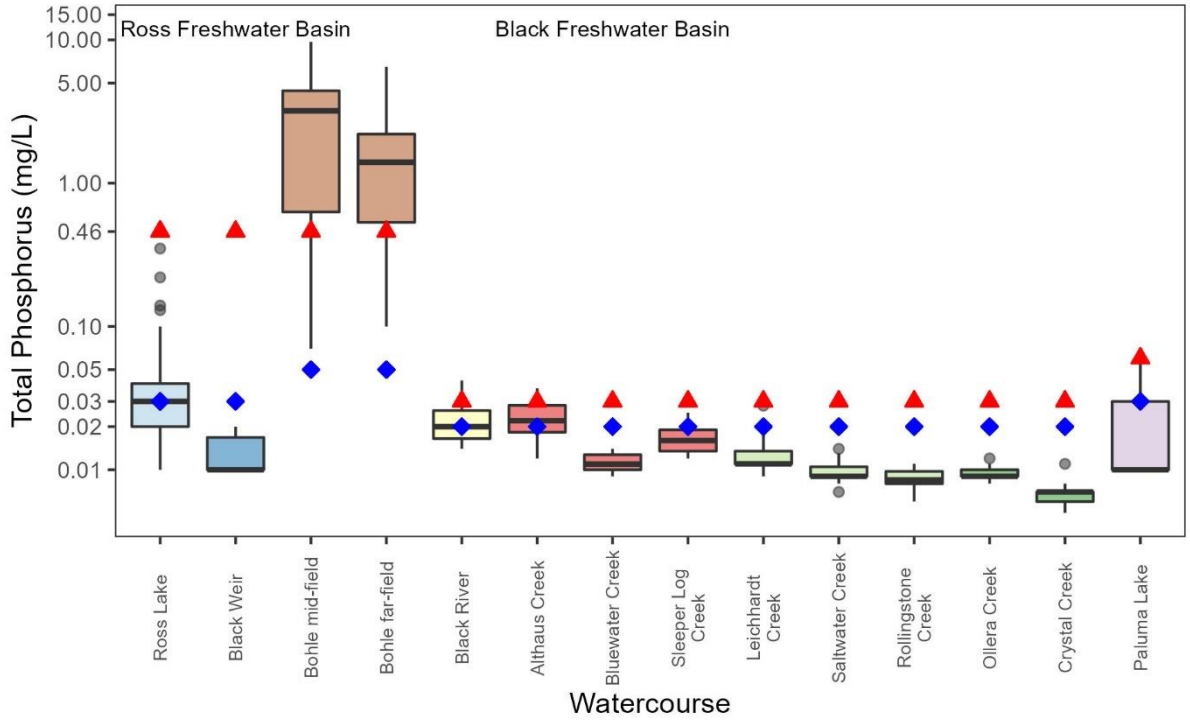

Figure 28: Total Phosphorus (TP) (mg/l) boxplot: red triangles indicate the scaling factor, blue diamonds indicate the water quality objective.

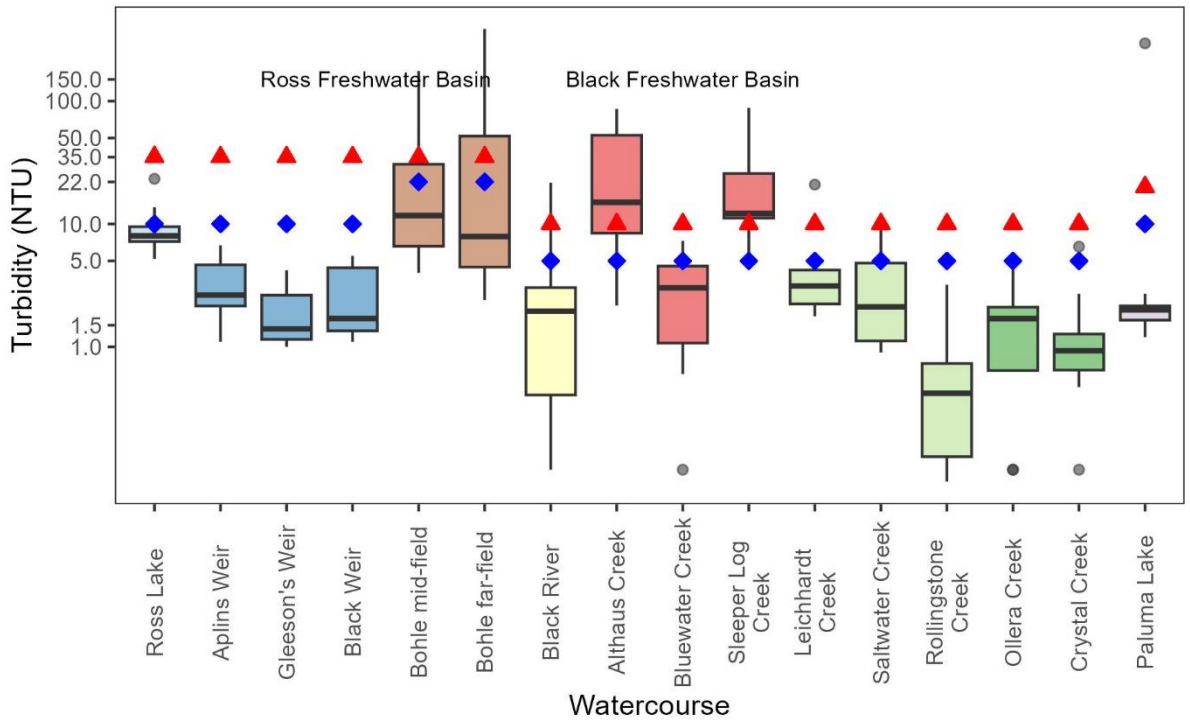

Figure 29: Turbidity (NTU) boxplot: red triangles indicate the scaling factor, blue diamonds indicate the water quality objective.

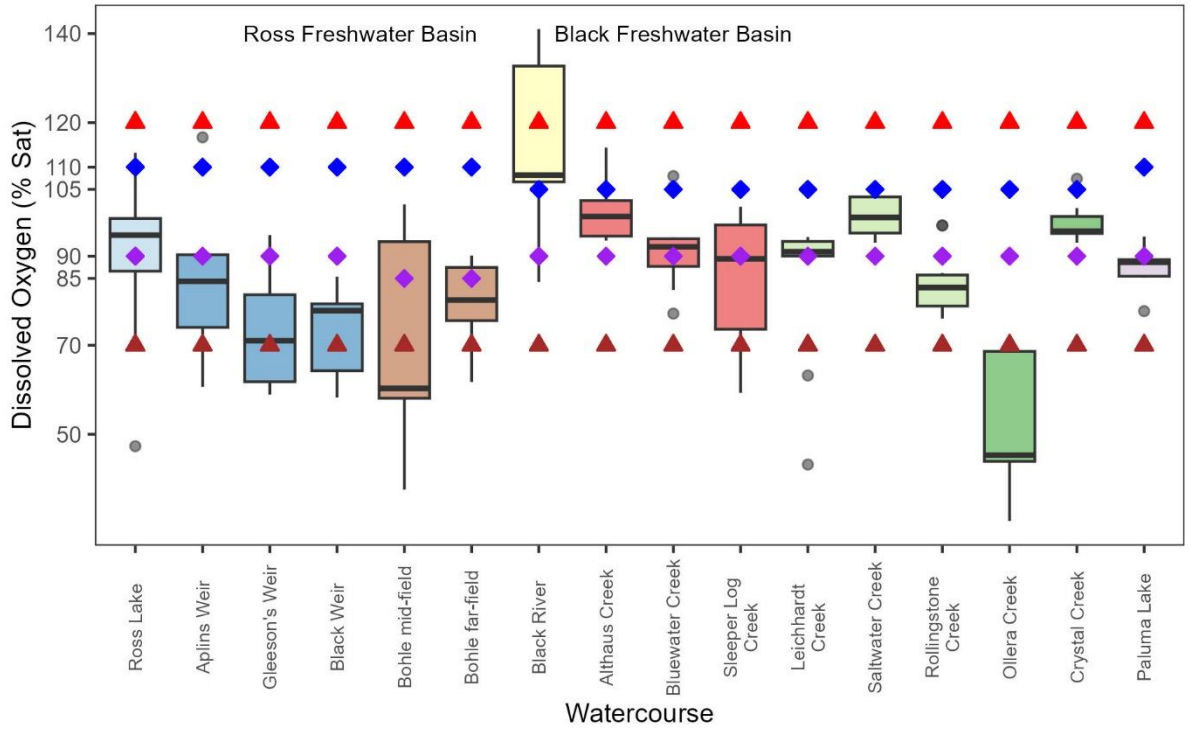

Figure 30: Dissolved Oxygen (DO) (% Saturation) boxplot: red triangles indicate the high DO scaling factor, blue diamonds indicate the high DO water quality objective, purple diamonds indicate the low DO water quality objective, and brown triangles indicate the low DO scaling factor.

Appendix O. Fresh Water Quality Line Plots

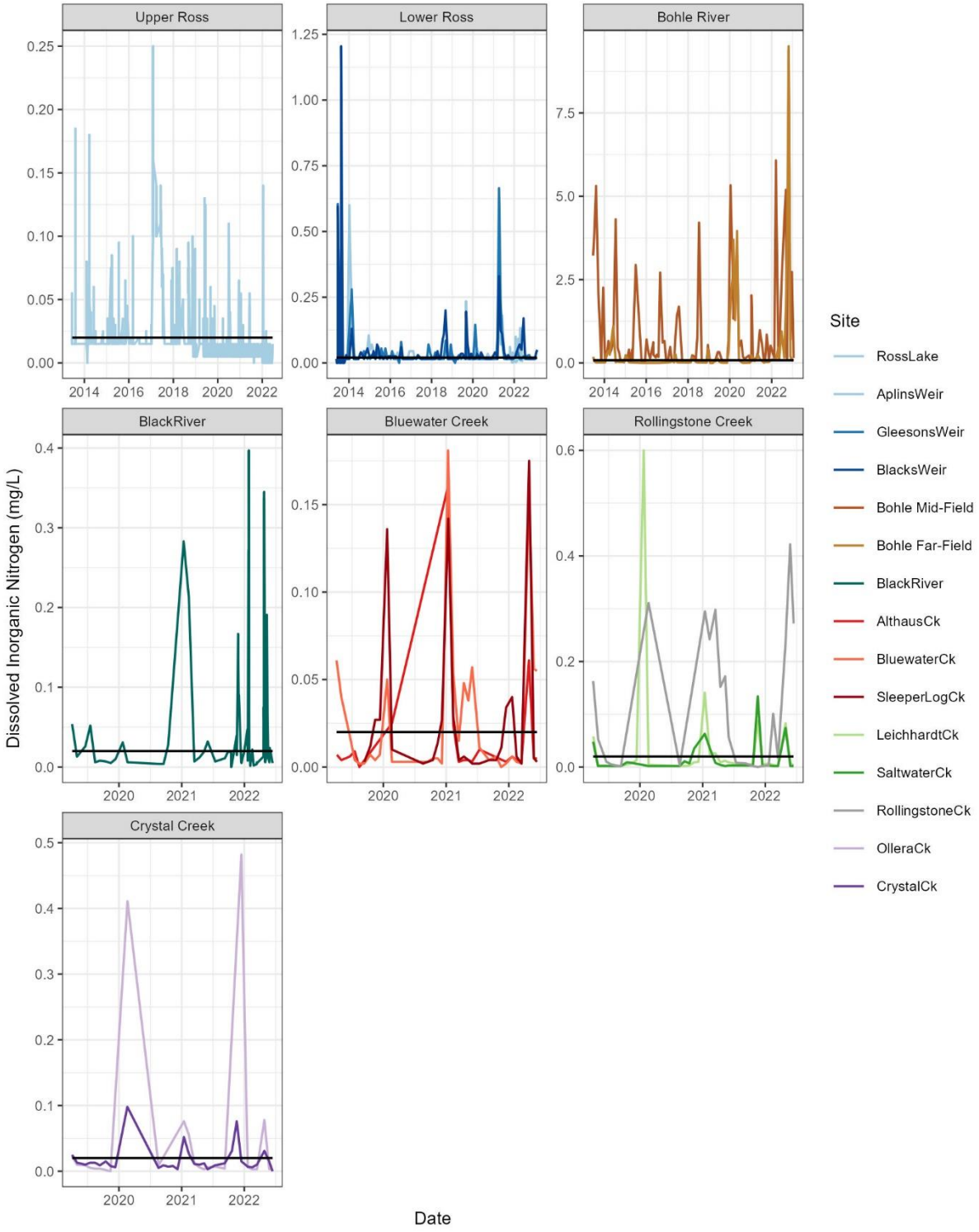

Figure 31: Historical concentrations of dissolved inorganic nitrogen (DIN) in the freshwater sub basins.

Black line indicates the water quality objective.

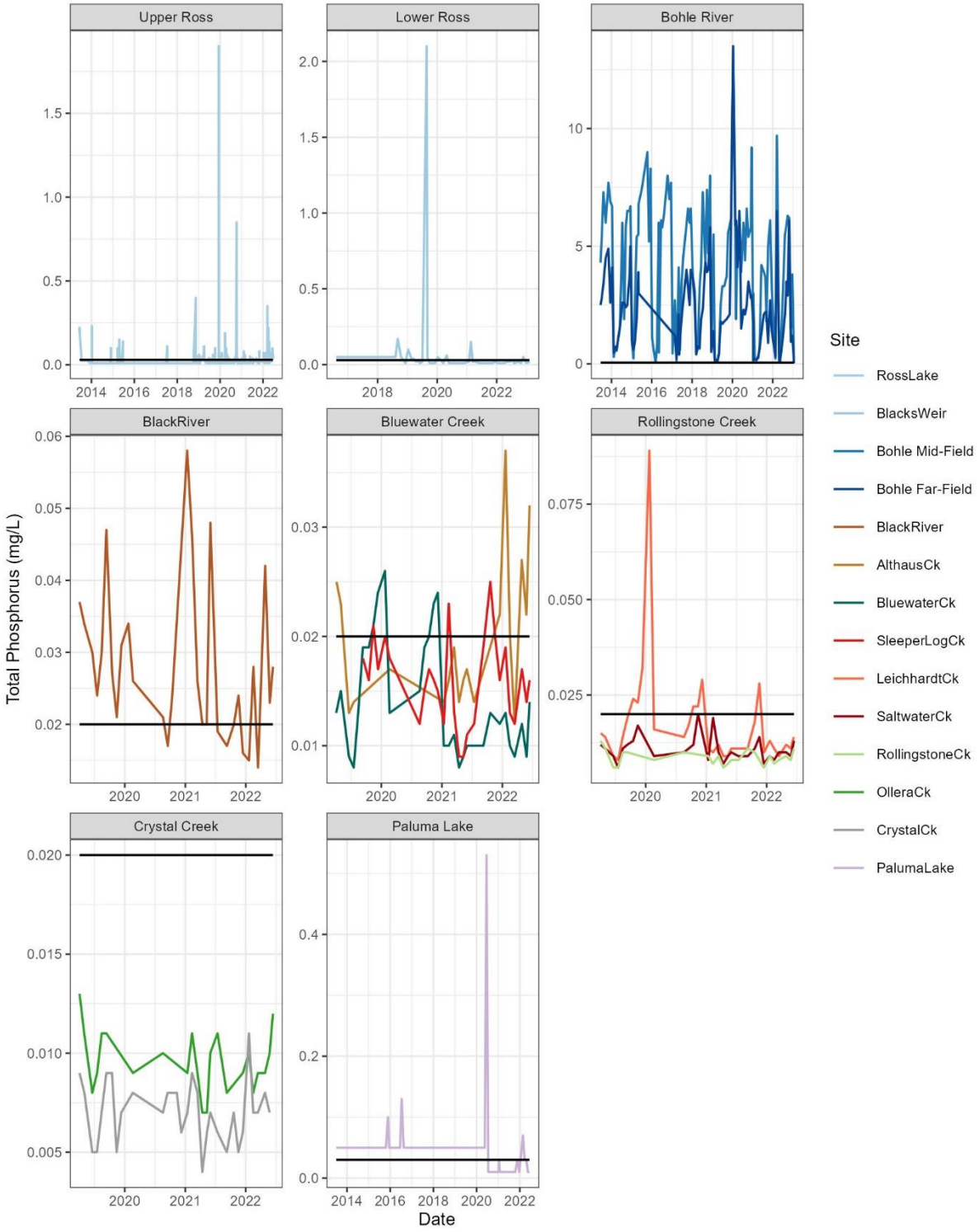

Figure 32: Historical data for total phosphorus in the freshwater sub basins.

Black line indicates the water quality objective.

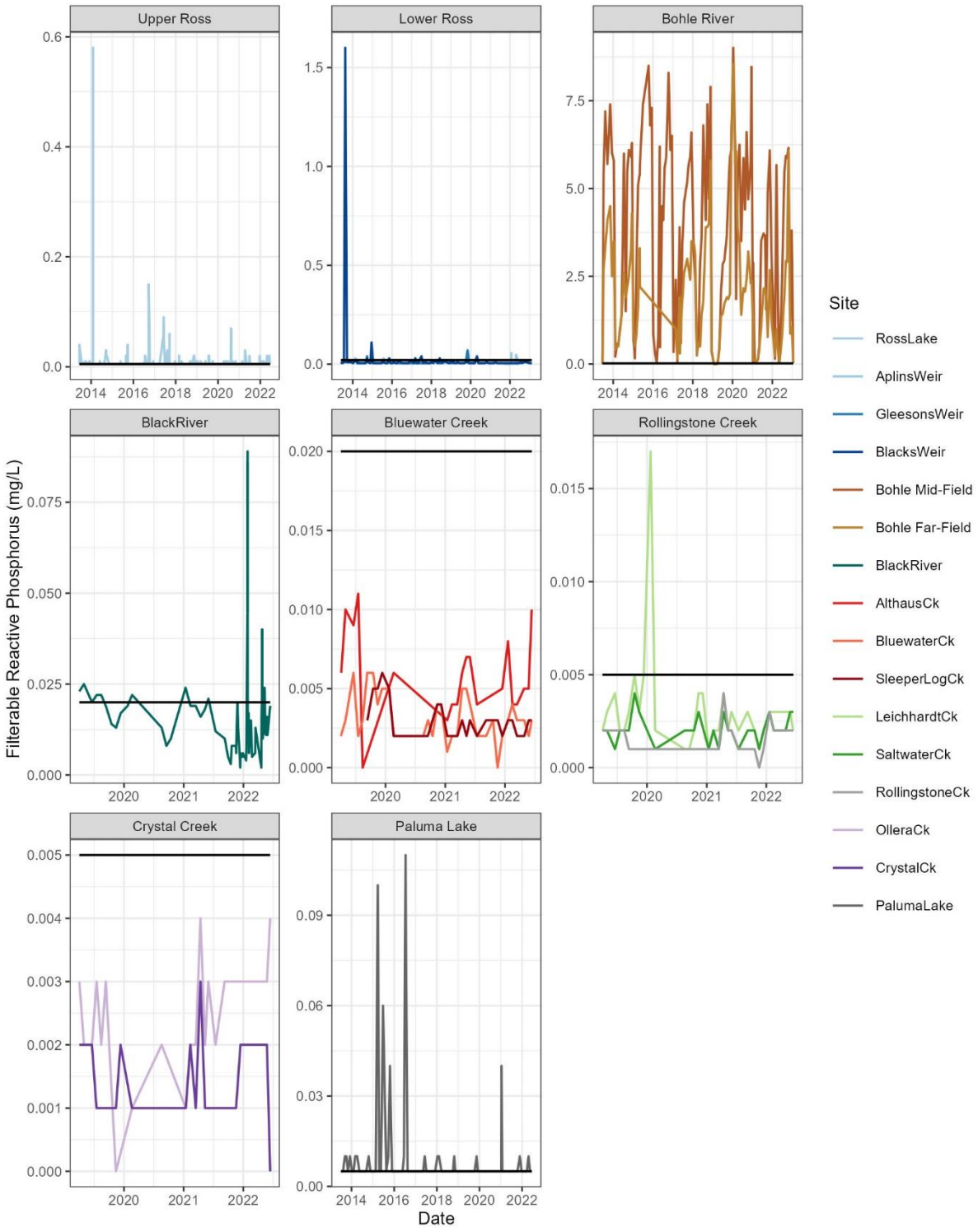

Figure 33: Historical concentrations of filterable reactive phosphorus (FRP) in the freshwater sub basins.

Black line indicates the water quality objective.

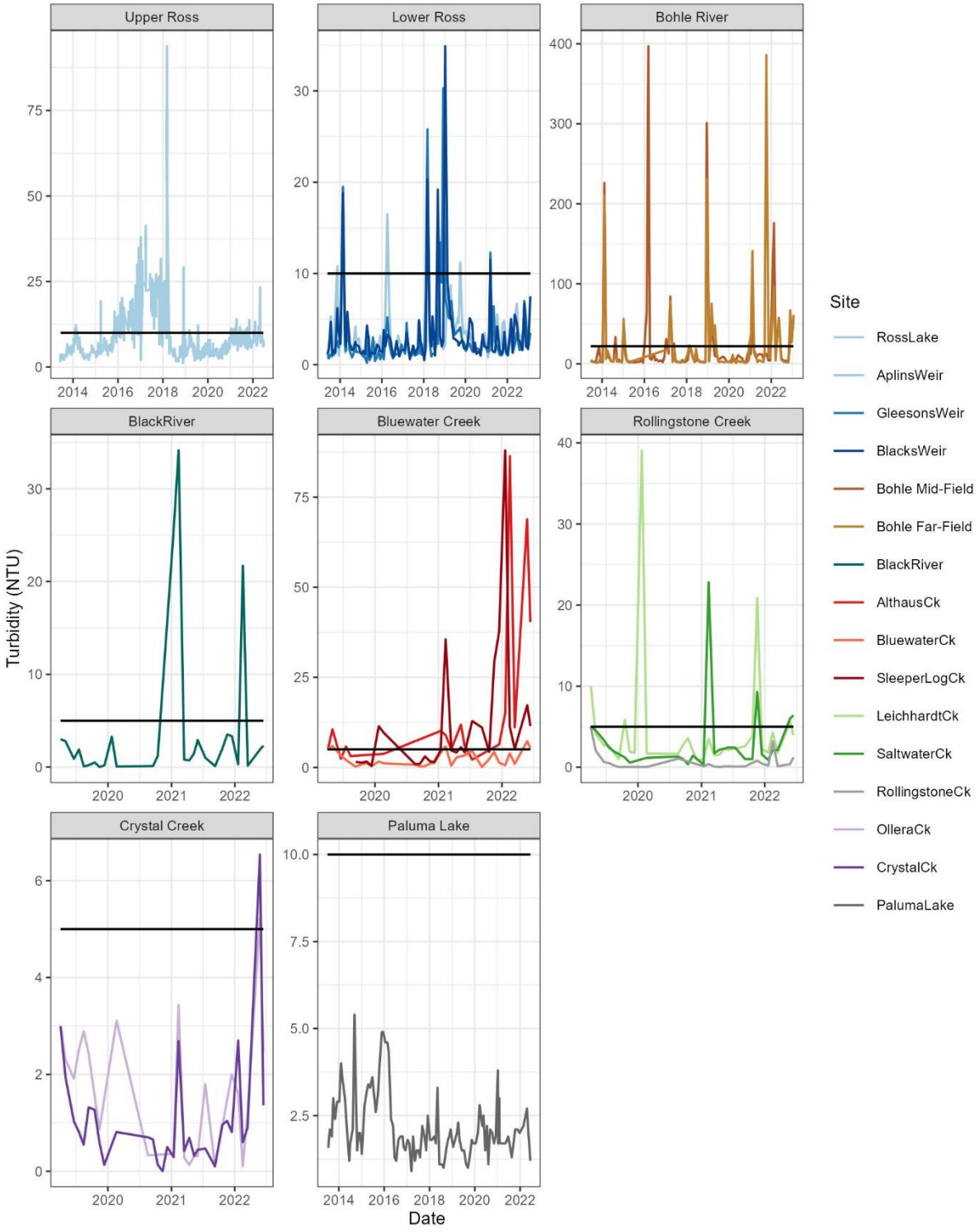

Figure 34: Historical turbidity in the freshwater sub basins.

Black line indicates the water quality objective.

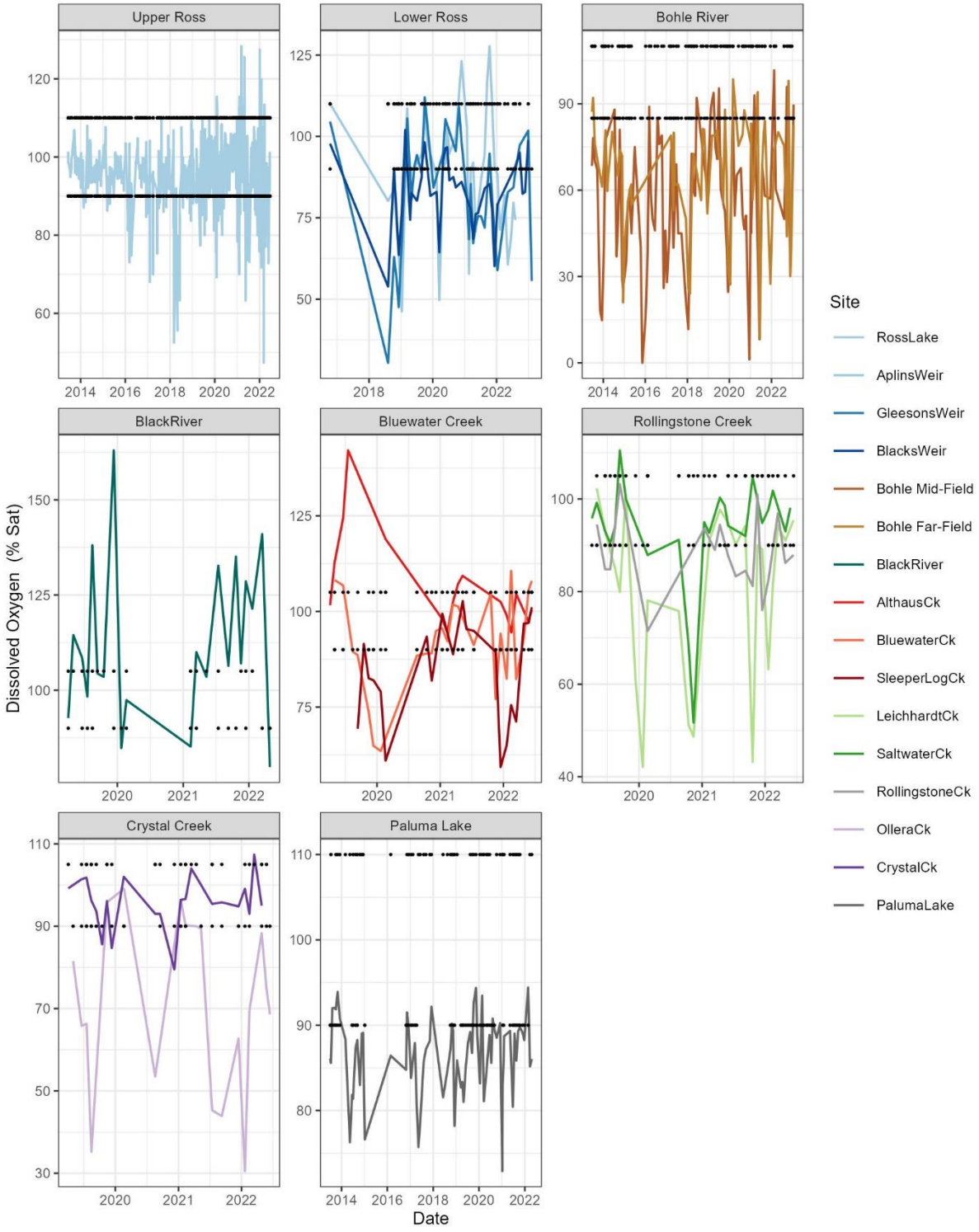

Figure 35: Historical dissolved oxygen in the freshwater sub basins.

Black points indicate the water quality objectives (high DO and low DO).

Appendix P.Freshwater Riparian Extent: Assessed Area in the Dry Tropics Region

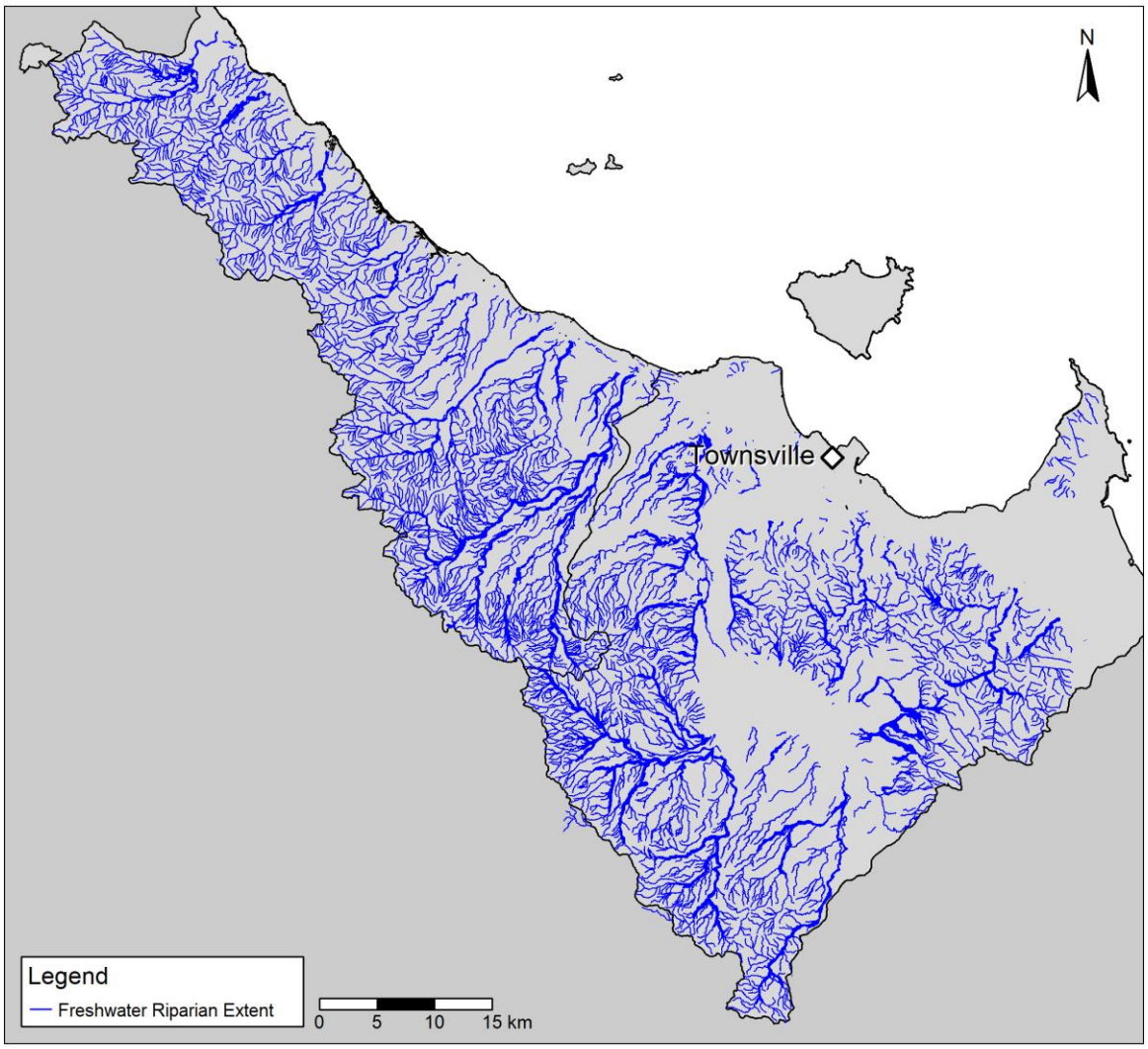

Figure 36. Freshwater riparian extent assessed for vegetation in the Dry Tropics region.

Appendix Q. Freshwater Wetland Extent: Assessed Area in the Dry Tropics Region

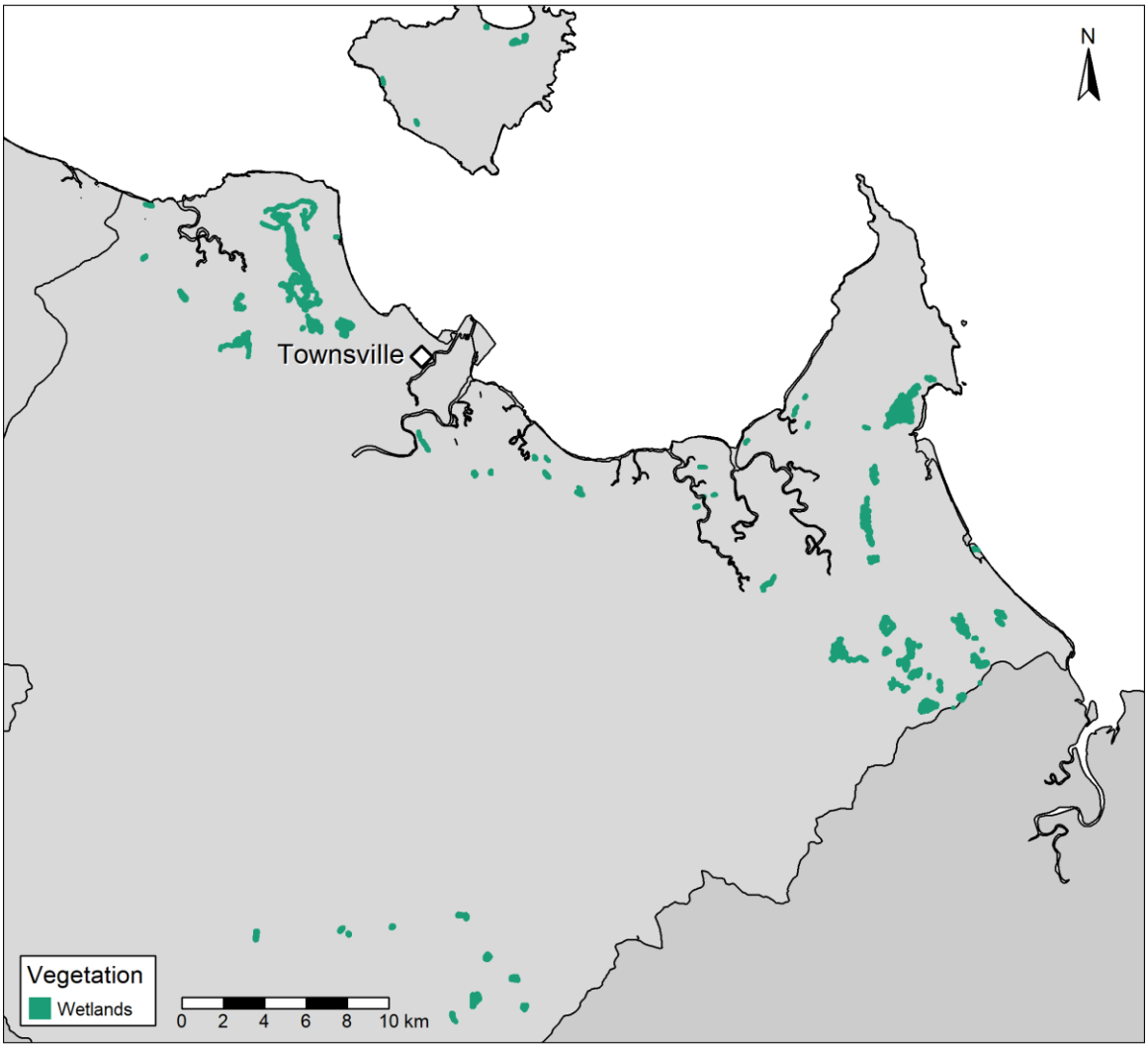

Figure 37. Freshwater wetlands assessed in the Ross freshwater zone of the Dry Tropics region.

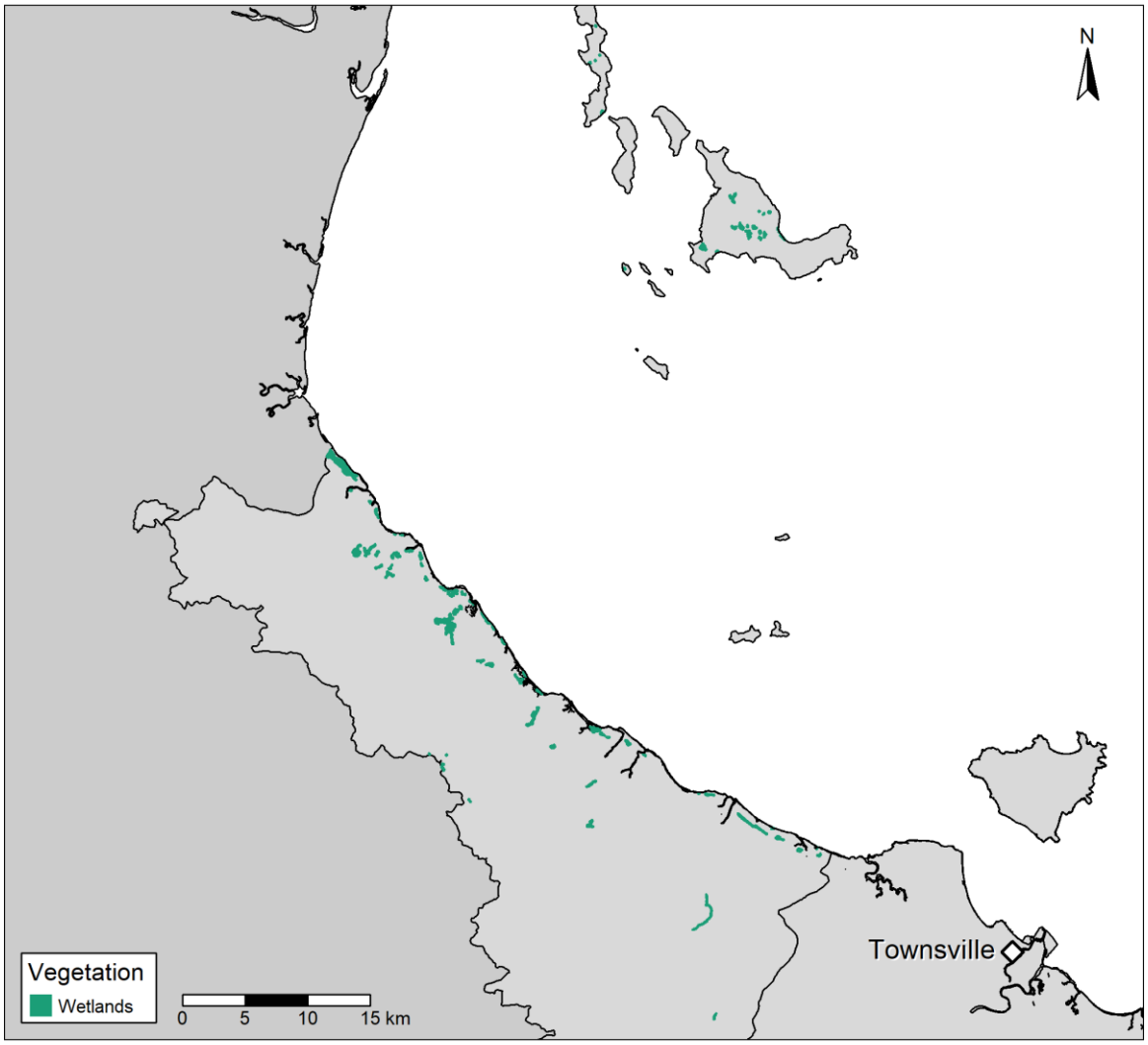

Figure 38. Freshwater wetlands assessed in the Black freshwater zone of the Dry Tropics region.

Appendix R. Freshwater Impoundment Length Assessed Area in the Dry Tropics Region

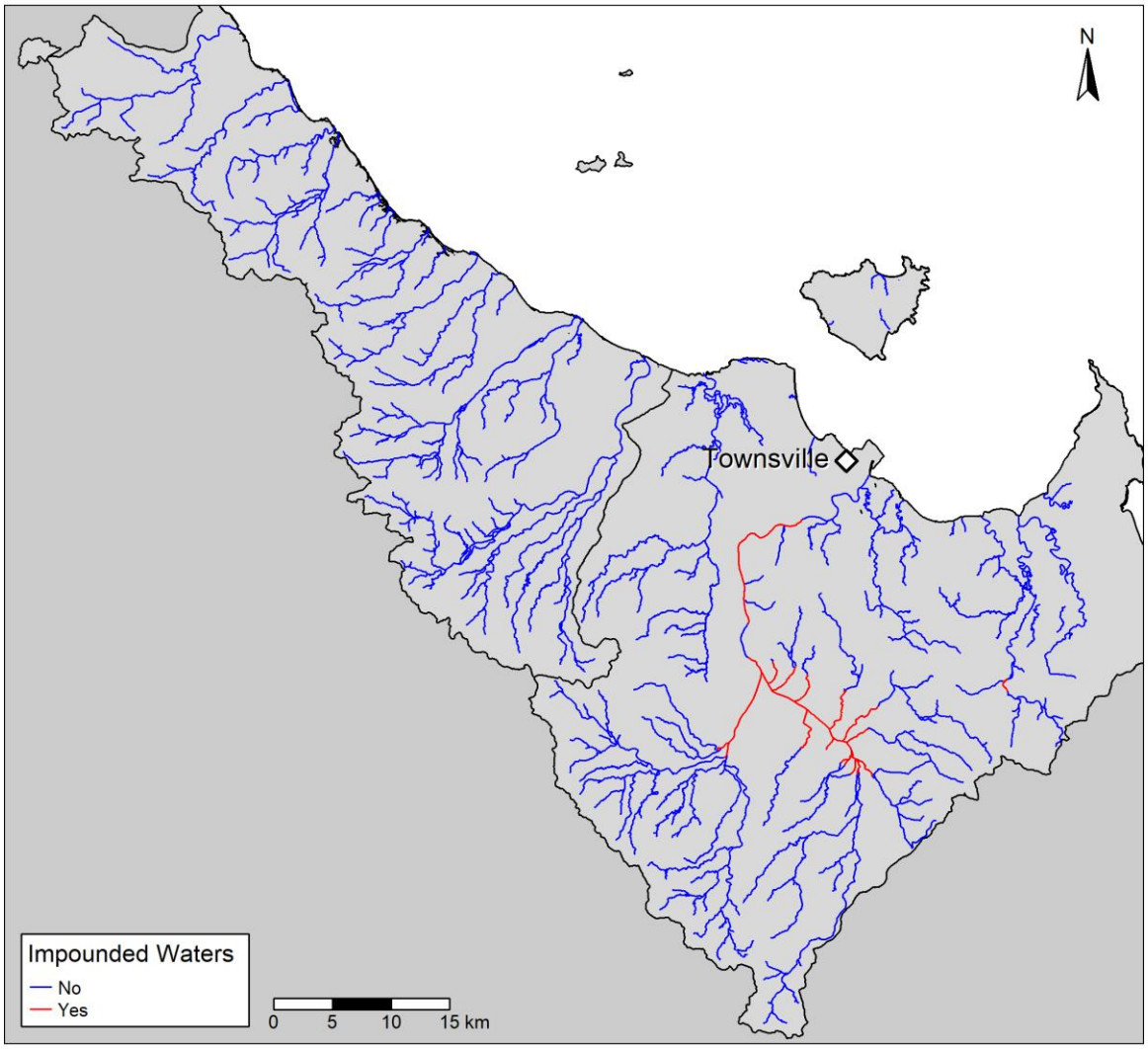

Figure 39. Impounded and non-impounded waters in the Dry Tropics region.

Appendix S.Freshwater Fish Barrier Locations in the Dry Tropics Region

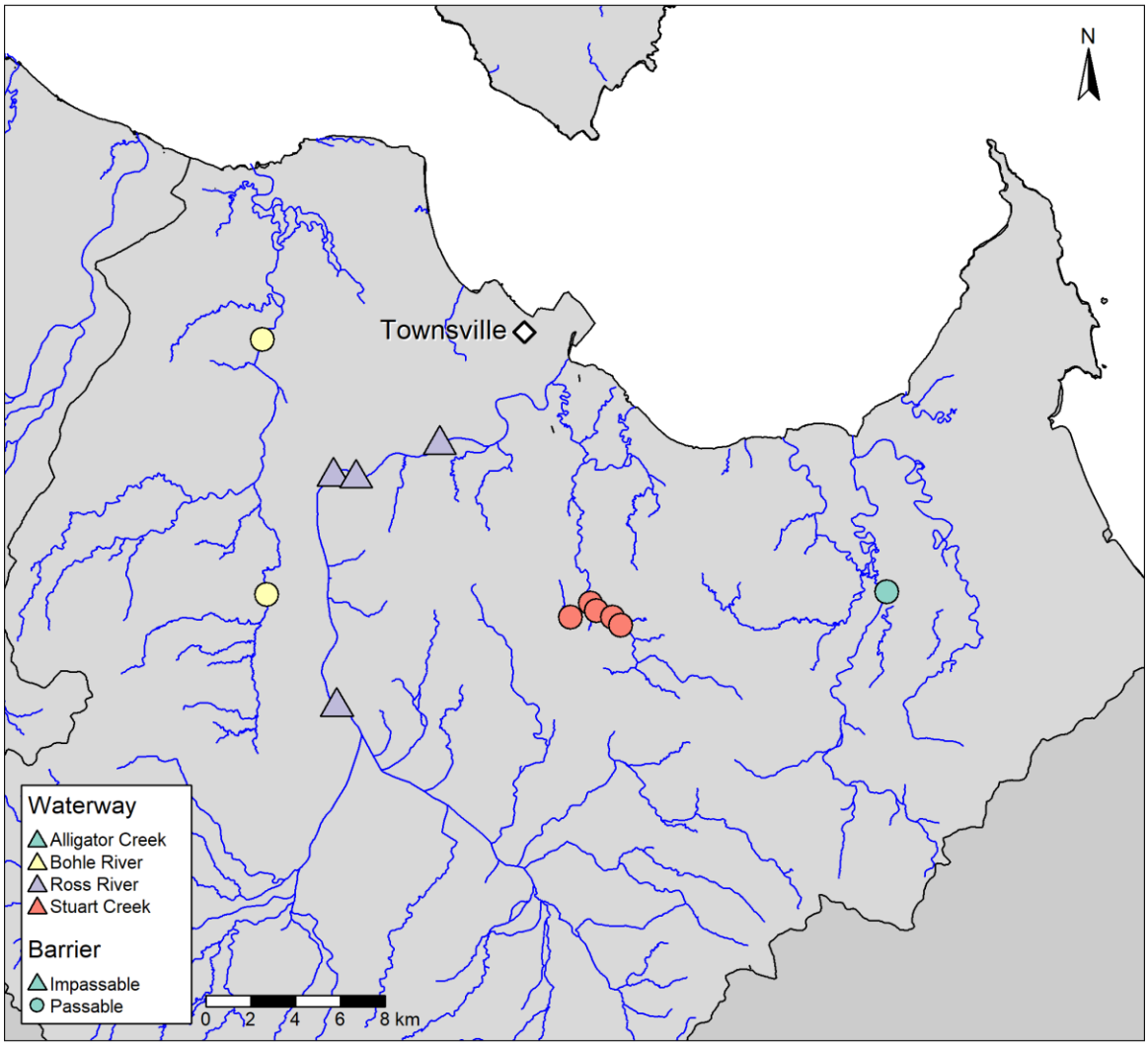

Figure 40. Fish barriers located on major and high importance waterways in the Dry Tropics region.

Appendix T. Freshwater Wetland Extent Standardised Scores Pre- and Post-Back Calculation

Table 86. Standardised scores for the habitat and hydrology index pre back calculation

Basin	Wetland Extent	
	Post-Back Calculation	**Pre-Back Calculation**
Ross Freshwater	60 (C)	59 (C)
Black Freshwater	57 (C)	55 (C)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100

Appendix U. Freshwater Habitat and Hydrology Updates

Table 87. Standardised scores for the habitat and hydrology index and the three indicator categories that compose the index in the Ross Freshwater Basin and Black Freshwater Basin. Updated wetland extent and updated aggregation method.

Basin	Riparian Extent	Wetland Extent	Artificial Barriers	Habitat and Hydrology Index		
				2021–2022	2020–2021	2019–2020
Ross freshwater	44 (C)	60 (C)	49 (C)	51 (C)	51 (C)	51 (C)
Black freshwater	56 (C)	57 (C)	100 (A)	71 (B)	71 (B)	71 (B)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100

Table 88. Standardised scores for the habitat and hydrology index and the three indicator categories that compose the index in the Ross Freshwater Basin and Black Freshwater Basin. Old Wetland Extent and updated aggregation method.

Basin	Riparian Extent	Wetland Extent	Artificial Barriers	Habitat and Hydrology Index		
				2021–2022	2020–2021	2019–2020
Ross freshwater	44 (C)	59 (C)	49 (C)	50 (C)	50 (C)	50 (C)
Black freshwater	56 (C)	55 (C)	100 (A)	70 (B)	70 (B)	70 (B)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100

Table 89. Standardised scores for the habitat and hydrology index and the three indicator categories that compose the index in the Ross Freshwater Basin and Black Freshwater Basin. Updated wetland extent and old aggregation method.

Zone	Habitat (Combined Riparian and Wetland Extent)	Artificial Barriers	Habitat and Hydrology Index		
			2021–2022	2020–2021	2019–2020
Ross freshwater	(44 + 60)/2 = 52 (C)	49 (C)	50 (C)	50 (C)	50 (C)
Black freshwater	(56 + 57)/2 = 56 (C)	100 (A)	78 (B)	78 (B)	78 (B)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100

Table 90. Standardised scores for the habitat and hydrology index and the three indicator categories that compose the index in the Ross Freshwater Basin and Black Freshwater Basin. Old wetland extent and old aggregation method.

Zone	Habitat (Combined Riparian and Wetland Extent)	Artificial Barriers	Habitat and Hydrology Index		
			2021–2022	2020–2021	2019–2020
Ross freshwater	(44 + 59)/2 = 51 (C)	49 (C)	50 (C)	50 (C)	50 (C)
Black freshwater	(56 + 55)/2 = 55 (C)	100 (A)	77 (B)	77 (B)	77 (B)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100

Appendix V. Freshwater Fish Sampling Locations in the Dry Tropic Reporting Region

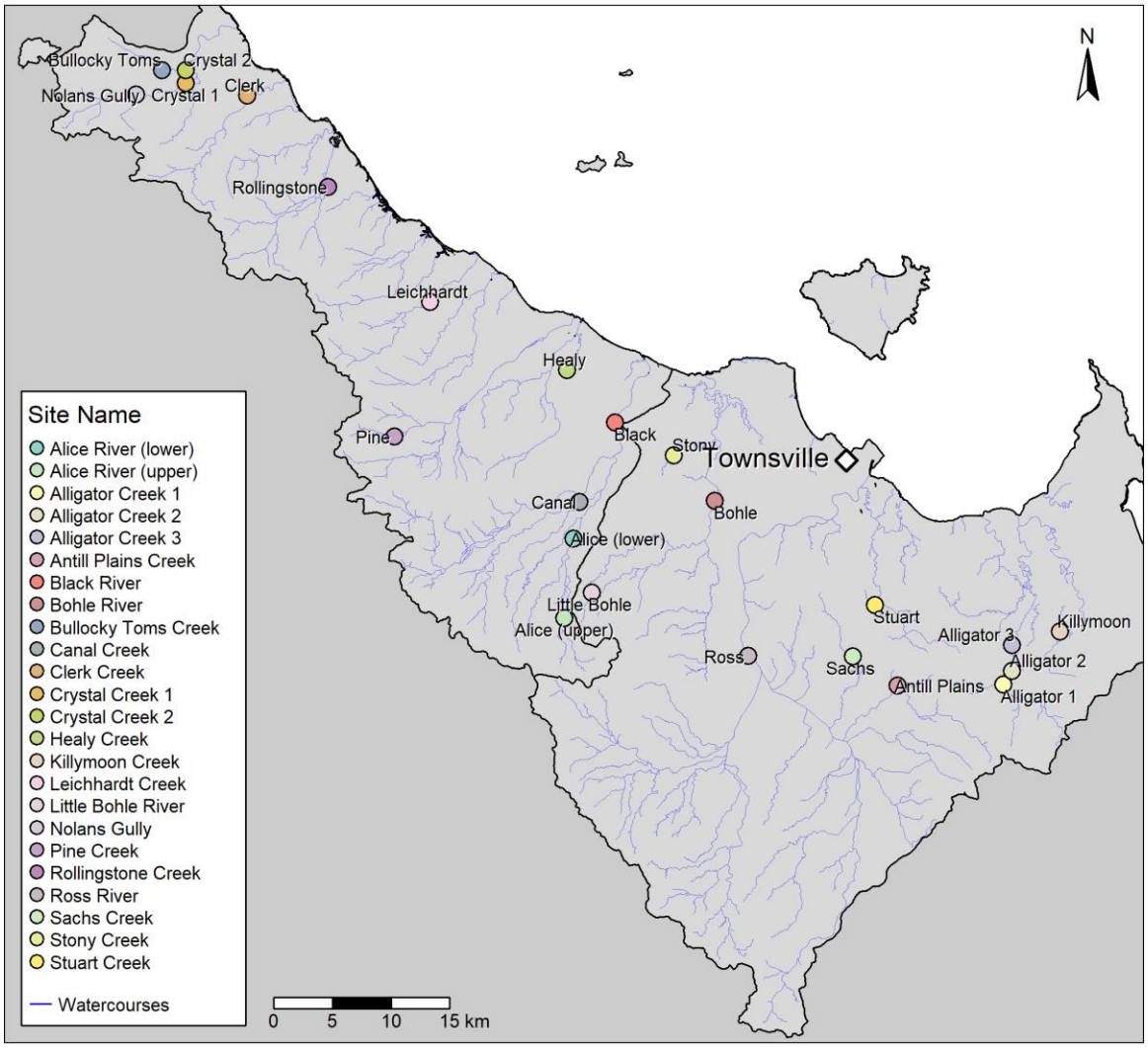

Figure 41. Fish monitoring locations in the Dry Tropics region.

Appendix W.Key of Freshwater Fish Species Found in the Dry Tropics Region

Table 91. Key of freshwater fish species found in the Dry Tropics region .

Key	Species	Basin	Classification
1	Northern perchlet	Both	Indigenous
2	Barred grunter	Ross	Indigenous
3	Long-finned eel	Both	Indigenous
4	Roman-nose goby	Both	Indigenous
5	Fly-specked hardyhead	Both	Indigenous
6	Mouth almighty	Both	Indigenous
7	Empire gudgeon	Both	Indigenous
8	Northern carp gudgeon (undescribed)	Ross	Indigenous
9	Jungle perch	Both	Indigenous
10	Barramundi	Both	Indigenous
11	Spangled perch	Both	Indigenous
12	Indo-Pacific tarpon	Ross	Indigenous
13	Eastern rainbowfish	Both	Indigenous
14	Southern, purple-spotted gudgeon	Both	Indigenous
15	Bony bream	Ross	Indigenous
16	Butter jew	Ross	Indigenous
17	Hyrtl's tandan	Both	Indigenous
18	Swamp eel	Both	Indigenous
19	Greenback mullet	Ross	Indigenous
20	Rendahl's tandan	Ross	Indigenous
21	Speckled goby	Ross	Indigenous
22	Seven-spot archerfish	Ross	Indigenous
23	Giant mottled eel	Black	Indigenous
24	Bunaka	Black	Indigenous
25	Silver biddy	Black	Indigenous
26	Snake-head gudgeon	Black	Indigenous
27	False Celebes goby	Black	Indigenous
28	Mangrove jack	Black	Indigenous
29	Scaleless goby	Black	Indigenous
30	Gambusia	Both	Alien
31	Guppy	Both	Alien
32	Mozambique tilapia	Both	Alien
33	Sleepy cod	Ross	Translocated

Appendix X. Presence/Absence of Fish Species in Waterways Across the Ross Freshwater Basin

Table 92. Fish species present within waterways across the Ross Freshwater Basin.

Waterway	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	30	31	32	33
Little Bohle River	1	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	1	0	1	0
Bohle River	1	0	1	1	1	0	1	0	1	1	1	0	1	0	0	0	0	0	1	0	0	0	1	0	1	0
Sachs Creek	1	0	0	0	1	1	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0
Killymoon Creek	1	0	1	0	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Alligator Creek	1	1	1	0	1	1	1	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0
Site 1	1	0	1	0	1	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Site 2	0	1	1	0	1	0	1	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0
Site 3	1	0	1	0	1	1	1	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0
Stuart Creek	1	0	1	0	1	0	0	0	0	0	1	0	1	0	1	0	1	0	0	0	0	0	1	0	1	0
Ross River	1	1	1	0	1	1	0	0	0	0	1	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1
Stony Creek	1	0	0	0	0	0	1	1	0	0	1	1	1	0	1	0	0	0	0	0	0	0	1	0	1	0
Antill Plains Creek	1	0	0	0	1	1	0	1	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1

Legend: ■ = Species Present | ■ = Species Absent. **Note:** where multiple sites occur in a river or creek, they are combined to create the site score.

Appendix Y. Presence/Absence of Fish Species in Waterways Across the Black Freshwater Basin.

Table 93. Fish species present within waterways across the Black Freshwater Basin.

Waterway	1	23	3	4	24	5	25	26	6	27	7	9	10	11	28	13	14	17	18	29	30	31	32
Pine Creek	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0
Black River	0	0	1	1	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	0	1	0	1
Rollingstone Creek	1	0	1	0	0	1	0	0	0	1	1	1	0	1	0	1	1	1	0	0	0	0	1
Healy Creek	1	0	1	0	0	0	1	0	0	0	1	0	1	1	0	1	0	0	0	0	1	0	0
Canal Creek	1	0	1	0	0	0	0	0	0	1	1	0	0	1	0	1	1	0	0	0	1	1	1
Crystal Creek	0	1	1	1	0	1	1	0	0	1	1	1	1	0	1	1	1	0	1	1	1	0	0
Site 1	0	0	1	1	0	1	0	0	0	1	1	1	0	0	1	1	1	0	0	0	1	0	0
Site 2	0	1	1	1	0	1	1	0	0	1	1	1	1	0	1	1	0	0	1	1	0	0	0
Leichhardt Creek	1	0	1	1	1	1	0	1	1	0	1	0	0	1	0	1	1	1	0	0	0	0	1
Bullocky Toms Creek	0	0	1	1	0	1	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0
Alice River	1	0	1	1	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	0	1	1
Site 1	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	1
Site 2	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	0	1	1
Nolan's Gully	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0	0
Clerk Creek	1	0	1	1	0	0	0	0	0	0	1	0	0	1	0	1	1	1	0	0	1	0	0

Legend: ■ = Species Present | ■ = Species Absent. **Note:** where multiple sites occur in a river or creek, they are combined to create the site score.

Appendix Z. Distribution of Fish Data Across All Monitoring Sites in The Ross Freshwater Basin and Black Freshwater Basin

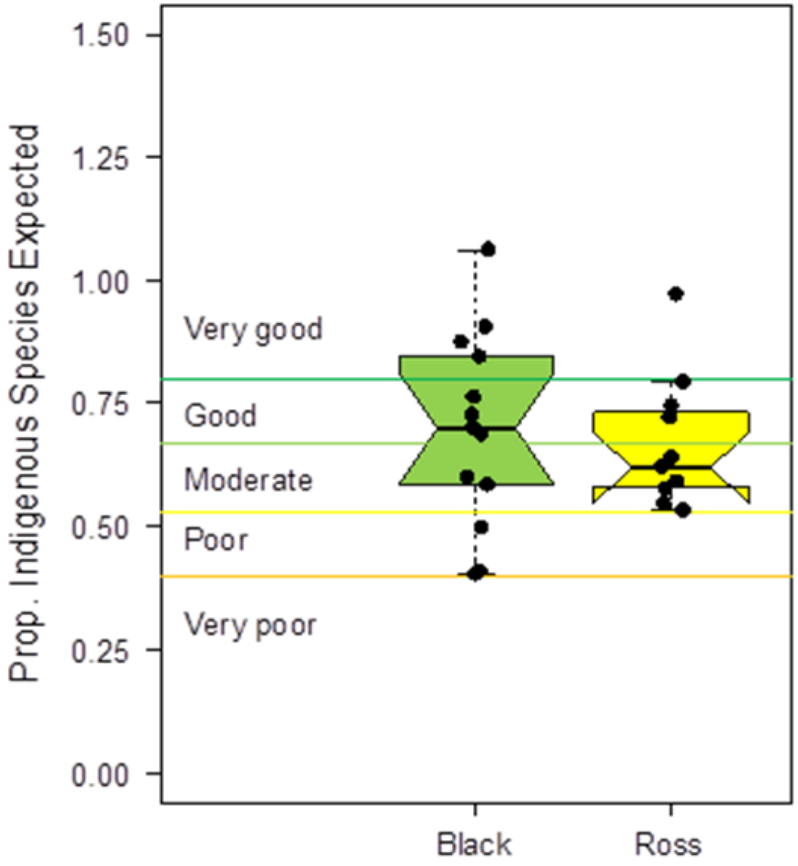

Figure 43. Proportion of Indigenous Species Expected (POISE) in waterways across the Dry Tropic region.

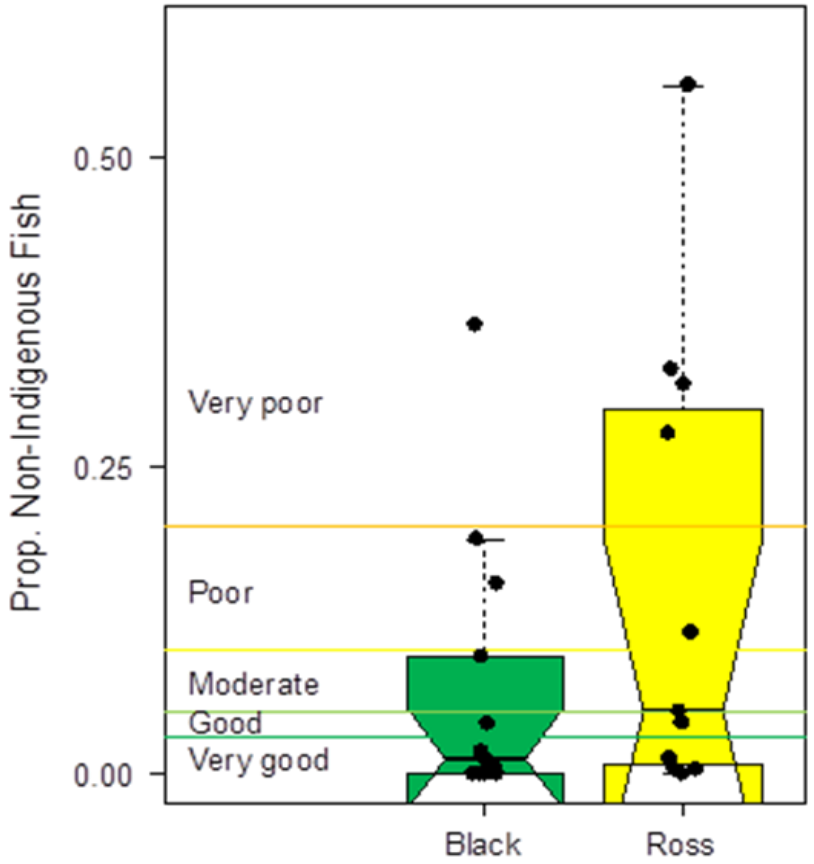

Figure 42. Proportion of Non-Indigenous Species Expected in waterways across the Dry Tropics region.

Appendix AA. Estuarine Water Quality Sampling Locations

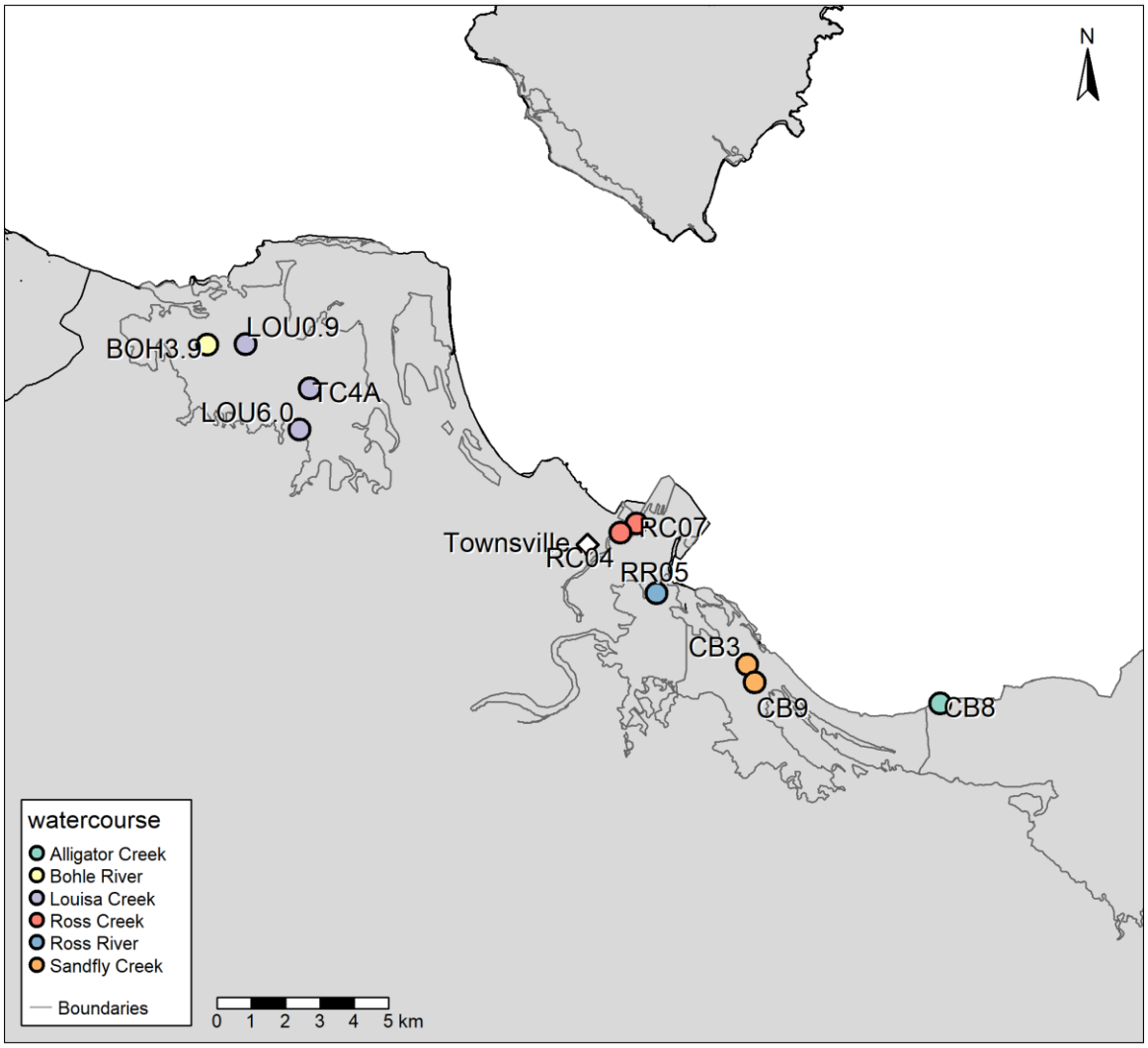

Figure 44. Ross Estuarine Basin water quality site locations.

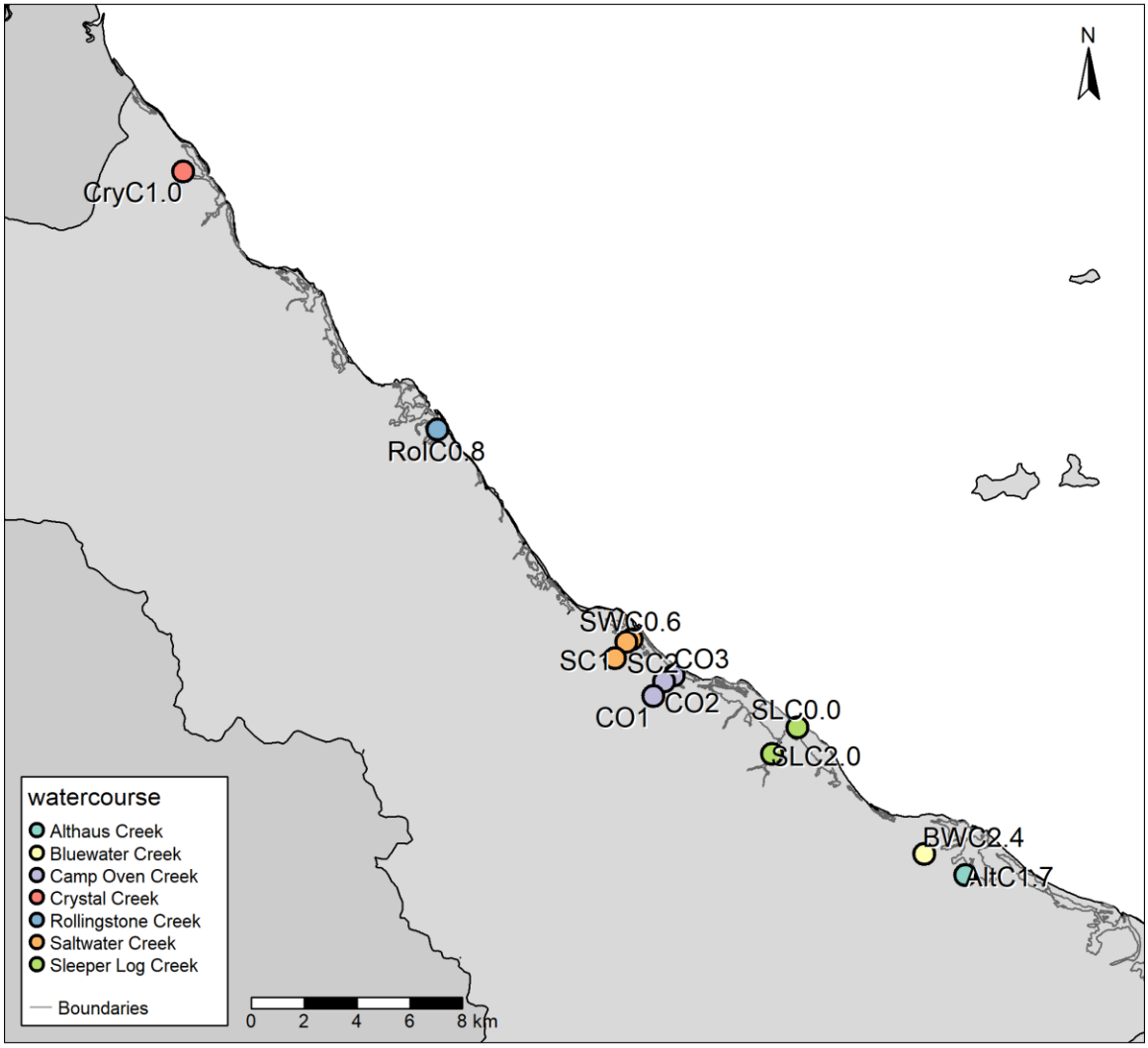

Figure 45. Black Estuarine Basin water quality site locations.

Appendix BB. Estuarine Water Quality Nutrients: Sample Frequencies, Medians, Water Quality Objectives, and Scaling Factors

Table 94. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for DIN in the Dry Tropics Estuarine Environments.

Watercourse	Site	DIN (mg/L)					
		Number of Months	Number of Unique Months	Annual Median	WQO	SF	LOR
Bohle River	BOH3.9	12	12	0.011	0.07	0.09	0.006
Louisa Creek	LOU0.9	12	12	0.015	0.07	0.09	0.006
	LOU6.0	12	12	0.043	0.07	0.09	0.006
	TC4A	12	12	0.043	0.07	0.09	0.006
Ross Creek	RC04	5	4	0.008	0.07	0.09	0.002
	RC07	5	4	0.006	0.07	0.09	0.002
Ross River	RR05	5	4	0.007	0.07	0.09	0.002
Sandfly Creek	CB3	14	12	0.066	0.07	0.09	0.006
	CB9	12	12	0.017	0.07	0.09	0.006
Alligator Creek	CB8	12	12	0.005	0.07	0.09	0.006
Althaus Creek	AltC1.7	11	11	0.01	0.02	0.09	0.002
Bluewater Creek	BWC2.4	11	11	0.011	0.02	0.09	0.002
Sleeper Log Creek	SLC0.0	8	8	0.004	0.02	0.09	0.002
	SLC2.0	7	7	0.004	0.02	0.09	0.002
Camp Oven Creek	CO1	13	12	0.01	0.02	0.09	0.002
	CO2	13	12	0.008	0.02	0.09	0.002
	CO3	13	12	0.009	0.02	0.09	0.002
Saltwater Creek	SWC0.6	11	11	0.004	0.02	0.09	0.002
	SC1	13	12	0.026	0.02	0.09	0.002
	SC2	13	12	0.017	0.02	0.09	0.002
Rollingstone Creek	RolC0.8	11	11	0.019	0.02	0.09	0.002
Crystal Creek	CryC1.0	10	10	0.012	0.02	0.09	0.002

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

Table 95. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for TP in the Dry Tropics Estuarine Environment.

Watercourse	Site	TP (mg/L)					
		Number of Months	Number of Unique Months	Annual Median	WQO	SF	LOR
Bohle River	BOH3.9	12	12	0.025	0.05	0.09	0.01
Louisa Creek	LOU0.9	12	12	0.035	0.05	0.09	0.01
	LOU6.0	12	12	0.115	0.05	0.09	0.01
	TC4A	12	12	0.09	0.05	0.09	0.01
Ross Creek	RC04	5	4	0.005	0.05	0.09	0.005
	RC07	5	4	0.002	0.05	0.09	0.005
Ross River	RR05	5	4	0.009	0.05	0.09	0.005
Sandfly Creek	CB3	14	12	0.025	0.05	0.09	0.01
	CB9	12	12	0.007	0.05	0.09	0.01
Alligator Creek	CB8	12	12	0.005	0.05	0.09	0.01
Althaus Creek	AltC1.7	11	11	0.021	0.025	0.04	0.003
Bluewater Creek	BWC2.4	11	11	0.011	0.025	0.04	0.003
Sleeper Log Creek	SLC0.0	8	8	0.014	0.025	0.04	0.003
	SLC2.0	7	7	0.011	0.025	0.04	0.003
Camp Oven Creek	CO1	13	12	0.002	0.025	0.04	0.005
	CO2	13	12	0.002	0.025	0.04	0.005
	CO3	13	12	0.008	0.025	0.04	0.005
Saltwater Creek	SWC0.6	11	11	0.009	0.025	0.04	0.003
	SC1	13	12	0.002	0.025	0.04	0.005
	SC2	13	12	0.002	0.025	0.04	0.005
Rollingstone Creek	RolC0.8	11	11	0.009	0.025	0.04	0.003
Crystal Creek	CryC1.0	10	10	0.016	0.025	0.04	0.003

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

Appendix CC. Estuarine Water Quality Nutrients Scores Historic Comparison

Table 96. Dry Tropics estuarine water quality historic nutrient indicator scores.

Watercourse	Site	DIN				TP			
		2021–2022	2020–2021	2019–2020	2018–2019	2021–2022	2020–2021	2019–2020	2018–2019
Bohle River	BOH3.9	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)
Louisa Creek	LOU0.9	90 (A)	90 (A)	90 (A)	90 (A)	66 (B)	90 (A)	90 (A)	90 (A)
	LOU6.0	73 (B)	68 (B)	65 (B)	0 (E)	0 (E)	0 (E)	0 (E)	0 (E)
	TC4A	75 (B)	68 (B)	67 (B)	0 (E)	0 (E)	0 (E)	0 (E)	0 (E)
Ross Creek	RC04	90 (A)	90 (A)	90 (A)	0 (E)	90 (A)	90 (A)	90 (A)	90 (A)
	RC07	90 (A)	90 (A)	90 (A)	0 (E)	90 (A)	90 (A)	90 (A)	90 (A)
Ross River	RR05	90 (A)	90 (A)	90 (A)	0 (E)	90 (A)	90 (A)	90 (A)	90 (A)
Sandfly Creek	CB3	63 (B)	90 (A)	90 (A)	63 (B)	90 (A)	90 (A)	90 (A)	30 (D)
	CB9	90 (A)	90 (A)	90 (A)	77 (B)	90 (A)	90 (A)	90 (A)	90 (A)
Alligator Creek	CB8	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)
Althaus Creek	AltC1.7	90 (A)	69 (B)	90 (A)	90 (A)	90 (A)	90 (A)	72 (B)	90 (A)
Bluewater Creek	BWC2.4	63 (B)	53 (C)	70 (B)	46 (C)	90 (A)	90 (A)	90 (A)	90 (A)
Sleeper Log Creek	SLC0.0	90 (A)	90 (A)	NA	NA	90 (A)	90 (A)	NA	NA
	SLC2.0	90 (A)	90 (A)	NA	NA	90 (A)	90 (A)	NA	NA
Camp Oven Creek	CO1	72 (B)	90 (A)	NA	NA	90 (A)	90 (A)	NA	NA
	CO2	90 (A)	90 (A)	NA	NA	90 (A)	70 (B)	NA	NA
	CO3	79 (B)	90 (A)	NA	NA	90 (A)	90 (A)	NA	NA
Saltwater Creek	SWC0.6	90 (A)	90 (A)	66 (B)	57 (C)	90 (A)	90 (A)	90 (A)	90 (A)
	SC1	56 (C)	90 (A)	NA	NA	90 (A)	90 (A)	NA	NA
	SC2	66 (B)	90 (A)	NA	NA	90 (A)	90 (A)	NA	NA
Rollingstone Creek	RolC0.8	61 (B)	36 (D)	49 (C)	8 (E)	90 (A)	90 (A)	90 (A)	90 (A)
Crystal Creek	CryC1.0	65 (B)	27 (D)	58 (C)	27 (D)	90 (A)	90 (A)	90 (A)	90 (A)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 90. (Scores are capped at 90).

Appendix DD. Estuarine Water Quality Physical-Chemical Properties: Sampling Frequencies, Medians, Water Quality Objectives and Scaling Factors

Table 97. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for Turbidity in the Dry Tropics Estuarine Environment.

Watercourse	Site	Turbidity (NTU)					
		Number of Months	Number of Unique Months	Annual Median	WQO	SF	LOR
Bohle River	BOH3.9	12	12	10.3	20	45	0.1
Louisa Creek	LOU0.9	12	12	10.85	20	45	0.1
	LOU6.0	12	12	19.6	20	45	0.1
	TC4A	12	12	18.15	20	45	0.1
Ross Creek	RC04	5	4	3.165	20	45	0.1
	RC07	5	4	3.56	20	45	0.1
Ross River	RR05	5	4	2.975	20	45	0.1
Sandfly Creek	CB3	13	12	16.25	20	45	0.1
	CB9	12	12	18.8	20	45	0.1
Alligator Creek	CB8	12	12	12.55	20	45	0.1
Althaus Creek	AltC1.7	10	10	20.04	8	15	0.1
Bluewater Creek	BWC2.4	10	10	5.8	8	15	0.1
Sleeper Log Creek	SLC0.0	8	8	10.965	8	15	0.1
	SLC2.0	8	8	6.185	8	15	0.1
Camp Oven Creek	CO1	13	12	3.916	8	15	0.1
	CO2	13	12	9.402	8	15	0.1
	CO3	13	12	18.001	8	15	0.1
Saltwater Creek	SWC0.6	10	10	6.94	8	15	0.1
	SC1	12	11	2.021	8	15	0.1
	SC2	13	12	4.38	8	15	0.1
Rollingstone Creek	RolC0.8	10	10	5.385	8	15	0.1
Crystal Creek	CryC1.0	10	10	14.15	8	15	0.1

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

Table 98. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for High DO in the Dry Tropics Estuarine Environment.

Watercourse	Site	High DO (% Saturation)					
		Number of Months	Number of Unique Months	Annual Median	WQO	SF	LOR
Bohle River	BOH3.9	12	12	94.775	105	120	0
Louisa Creek	LOU0.9	12	12	90.29	105	120	0
	LOU6.0	12	12	67.505	105	120	0
	TC4A	12	12	65.22	105	120	0
Ross Creek	RC04	4	3	88	105	120	0
	RC07	4	3	92.2	105	120	0
Ross River	RR05	4	3	90.6	105	120	0
Sandfly Creek	CB3	13	12	92.115	105	120	0
	CB9	12	12	91.825	105	120	0
Alligator Creek	CB8	12	12	89.805	105	120	0
Althaus Creek	AltC1.7	11	11	111.7	105	120	0
Bluewater Creek	BWC2.4	11	11	104.1	105	120	0
Sleeper Log Creek	SLC0.0	8	8	95.8	105	120	0
	SLC2.0	8	8	91.5	105	120	0
Camp Oven Creek	CO1	13	12	76.285	105	120	0
	CO2	13	12	85.731	105	120	0
	CO3	13	12	91.966	105	120	0
Saltwater Creek	SWC0.6	11	11	94.3	105	120	0
	SC1	13	12	100.325	105	120	0
	SC2	13	12	91.817	105	120	0
Rollingstone Creek	RolC0.8	11	11	96.3	105	120	0
Crystal Creek	CryC1.0	11	11	97.1	105	120	0

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

Table 99. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for Low DO in the Dry Tropics Estuarine Environment.

Watercourse	Site	Low DO (% Saturation)					
		Number of Months	Number of Unique Months	Annual Median	WQO	SF	LOR
Bohle River	BOH3.9	12	12	94.775	85	70	0
Louisa Creek	LOU0.9	12	12	90.29	85	70	0
	LOU6.0	12	12	67.505	85	70	0
	TC4A	12	12	65.22	85	70	0
Ross Creek	RC04	4	3	88	85	70	0
	RC07	4	3	92.2	85	70	0
Ross River	RR05	4	3	90.6	85	70	0
Sandfly Creek	CB3	13	12	92.115	85	70	0
	CB9	12	12	91.825	85	70	0
Alligator Creek	CB8	12	12	89.805	85	70	0
Althaus Creek	AltC1.7	11	11	111.7	85	70	0
Bluewater Creek	BWC2.4	11	11	104.1	85	70	0
Sleeper Log Creek	SLC0.0	8	8	95.8	85	70	0
	SLC2.0	8	8	91.5	85	70	0
Camp Oven Creek	CO1	13	12	76.285	85	70	0
	CO2	13	12	85.731	85	70	0
	CO3	13	12	91.966	85	70	0
Saltwater Creek	SWC0.6	11	11	94.3	85	70	0
	SC1	13	12	100.325	85	70	0
	SC2	13	12	91.817	85	70	0
Rollingstone Creek	RolC0.8	11	11	96.3	85	70	0
Crystal Creek	CryC1.0	11	11	97.1	85	70	0

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

Appendix EE. Estuarine Water Quality Physical-Chemical Properties Scores Historic Comparison

Table 100. Dry Tropics estuarine water quality historic physical chemical indicator scores.

Watercourse	Site	Turbidity				High DO				Low DO			
		2021–2022	2020–2021	2019–2020	2018–2019	2021–2022	2020–2021	2019–2020	2018–2019	2021–2022	2020–2021	2019–2020	2018–2019
Bohle River	BOH3.9	66 (B)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	75 (B)
Louisa Creek	LOU0.9	73 (B)	75 (B)	90 (A)	80 (B)	90 (A)	74 (B)	90 (A)	90 (A)	90 (A)	64 (B)	90 (A)	58 (C)
	LOU6.0	61 (B)	65 (B)	90 (A)	76 (B)	90 (A)	0 (E)	90 (A)	5 (E)	90 (A)	0 (E)	90 (A)	0 (E)
	TC4A	64 (B)	65 (B)	90 (A)	70 (B)	90 (A)	0 (E)	90 (A)	4 (E)	90 (A)	0 (E)	90 (A)	0 (E)
Ross Creek	RC04	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	NA	NA
	RC07	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	NA	NA
Ross River	RR05	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	70 (B)	90 (A)	90 (A)	90 (A)	90 (A)	NA	NA
Sandfly Creek	CB3	90 (A)	79 (B)	53 (C)	58 (C)	90 (A)	90 (A)	90 (A)	74 (B)	90 (A)	90 (A)	90 (A)	73 (B)
	CB9	62 (B)	59 (C)	51 (C)	60 (C)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)
Alligator Creek	CB8	90 (A)	69 (B)	90 (A)	41 (C)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)	90 (A)
Althaus Creek	AltC1.7	0 (E)	0 (E)	3 (E)	90 (A)	33 (D)	90 (A)	68 (B)	90 (A)	28 (D)	90 (A)	90 (A)	90 (A)
Bluewater Creek	BWC2.4	90 (A)	90 (A)	7 (E)	90 (A)	76 (B)	90 (A)	73 (B)	90 (A)	0 (E)	90 (A)	90 (A)	90 (A)
Sleeper Log Creek	SLC0.0	35 (D)	78 (B)	NA	NA	90 (A)	90 (A)	90 (A)	90 (A)	NA	NA	NA	NA
	SLC2.0	90 (A)	90 (A)	NA	NA	90 (A)	90 (A)	90 (A)	70 (B)	NA	NA	NA	NA
Camp Oven Creek	CO1	78 (B)	90 (A)	NA	NA	90 (A)	25 (D)	90 (A)	90 (A)	NA	NA	NA	NA
	CO2	48 (C)	46 (C)	NA	NA	90 (A)	61 (B)	90 (A)	90 (A)	NA	NA	NA	NA
	CO3	0 (E)	53 (C)	NA	NA	90 (A)	74 (B)	90 (A)	90 (A)	NA	NA	NA	NA
Saltwater Creek	SWC0.6	68 (B)	77 (B)	90 (A)	48 (C)	76 (B)	90 (A)	90 (A)	90 (A)	75 (B)	90 (A)	90 (A)	90 (A)
	SC1	90 (A)	90 (A)	NA	NA	64 (B)	90 (A)	90 (A)	90 (A)	NA	NA	NA	NA
	SC2	90 (A)	90 (A)	NA	NA	90 (A)	90 (A)	90 (A)	90 (A)	NA	NA	NA	NA
Rollingstone Creek	RolC0.8	69 (B)	65 (B)	73 (B)	10 (E)	90 (A)	90 (A)	90 (A)	90 (A)	64 (B)	90 (A)	90 (A)	90 (A)
Crystal Creek	CryC1.0	7 (E)	68 (B)	90 (A)	41 (C)	90 (A)	90 (A)	90 (A)	90 (A)	69 (B)	90 (A)	34 (D)	90 (A)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 90. (Scores are capped at 90).

Appendix FF. Estuarine Water Quality 2021–2022 Boxplots

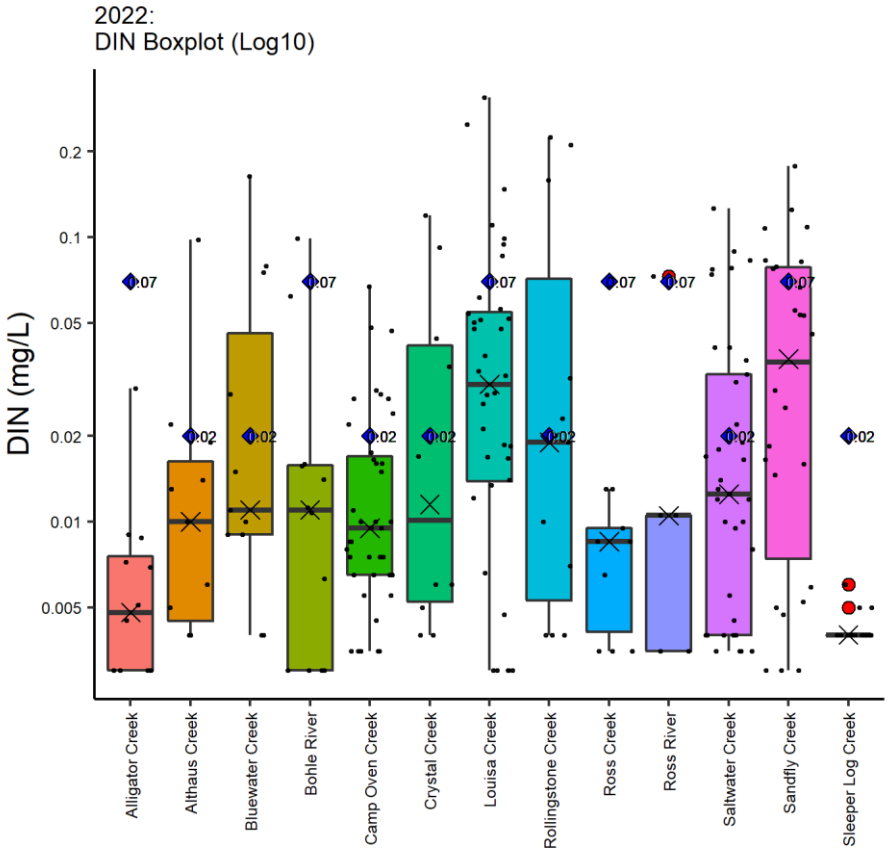

Figure 47. Dry Tropics estuarine water quality boxplots: DIN. Blue diamond's indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (median).

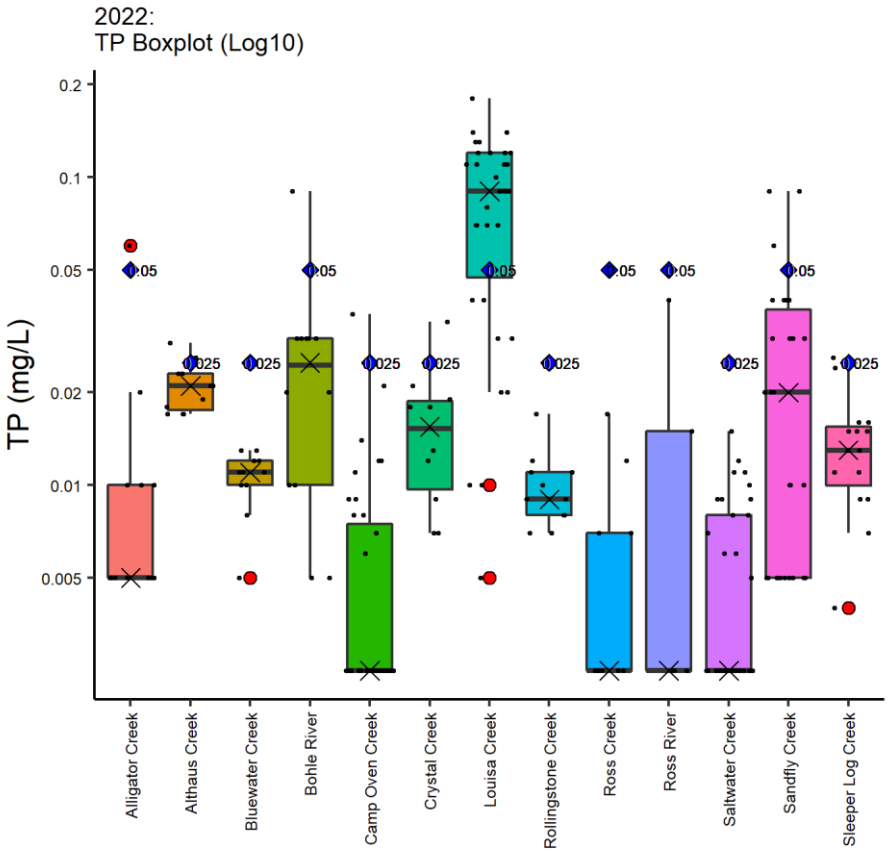

Figure 46. Dry Tropics estuarine water quality boxplots: TP. Blue diamond's indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (median).

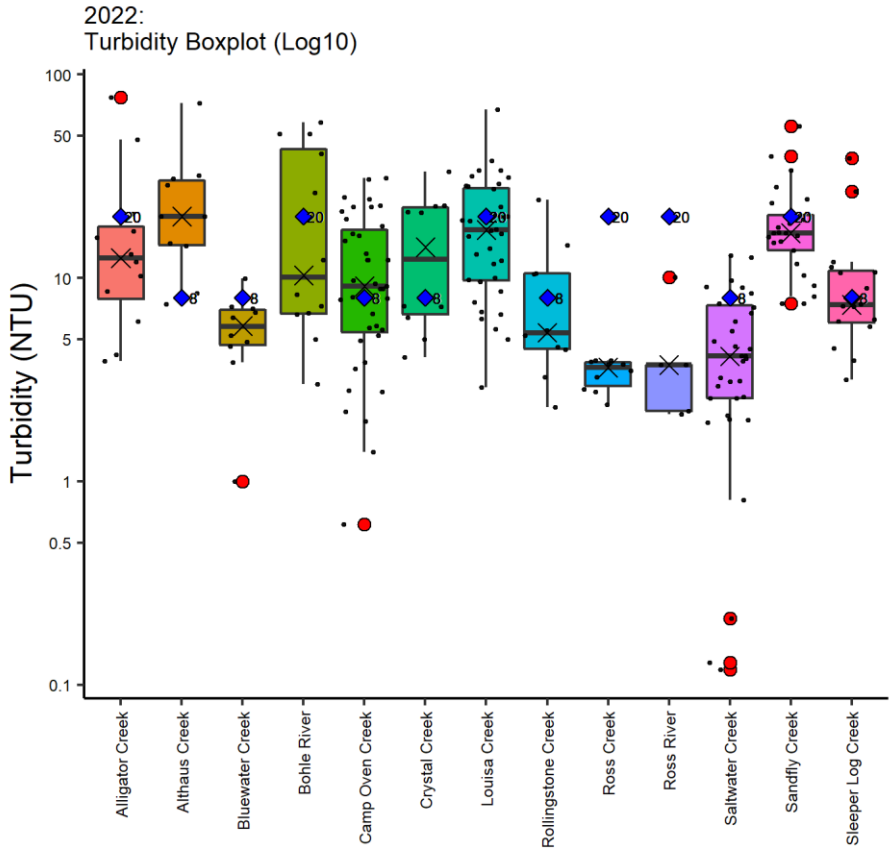

Figure 48. Dry Tropics estuarine water quality boxplots: Turbidity. Blue diamond's indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (median).

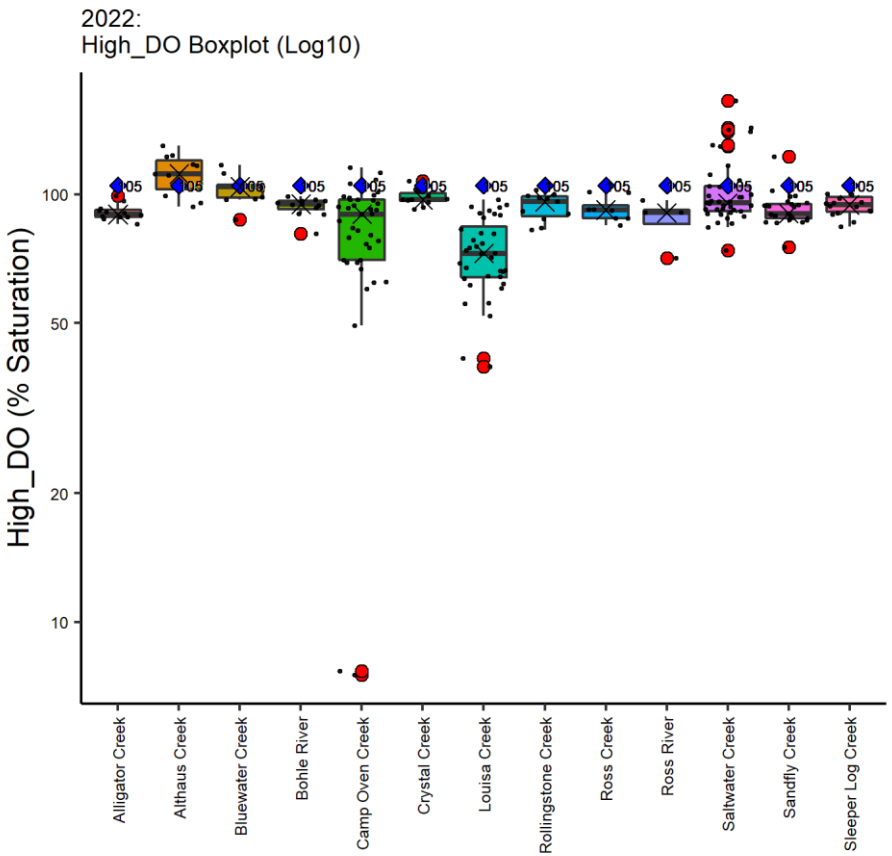

Figure 49. Dry Tropics estuarine water quality boxplots: High DO. Blue diamond's indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (median).

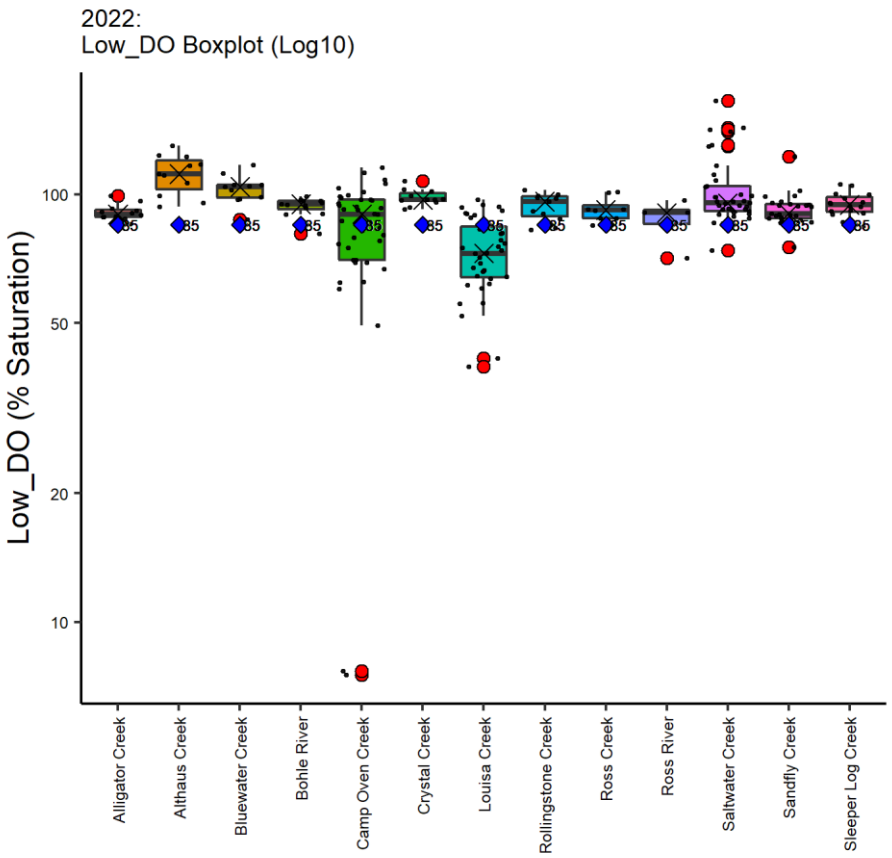

Figure 50. Dry Tropics estuarine water quality boxplots: Low DO. Blue diamond's indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (median).

Appendix GG.Estuarine Water Quality Line Plots

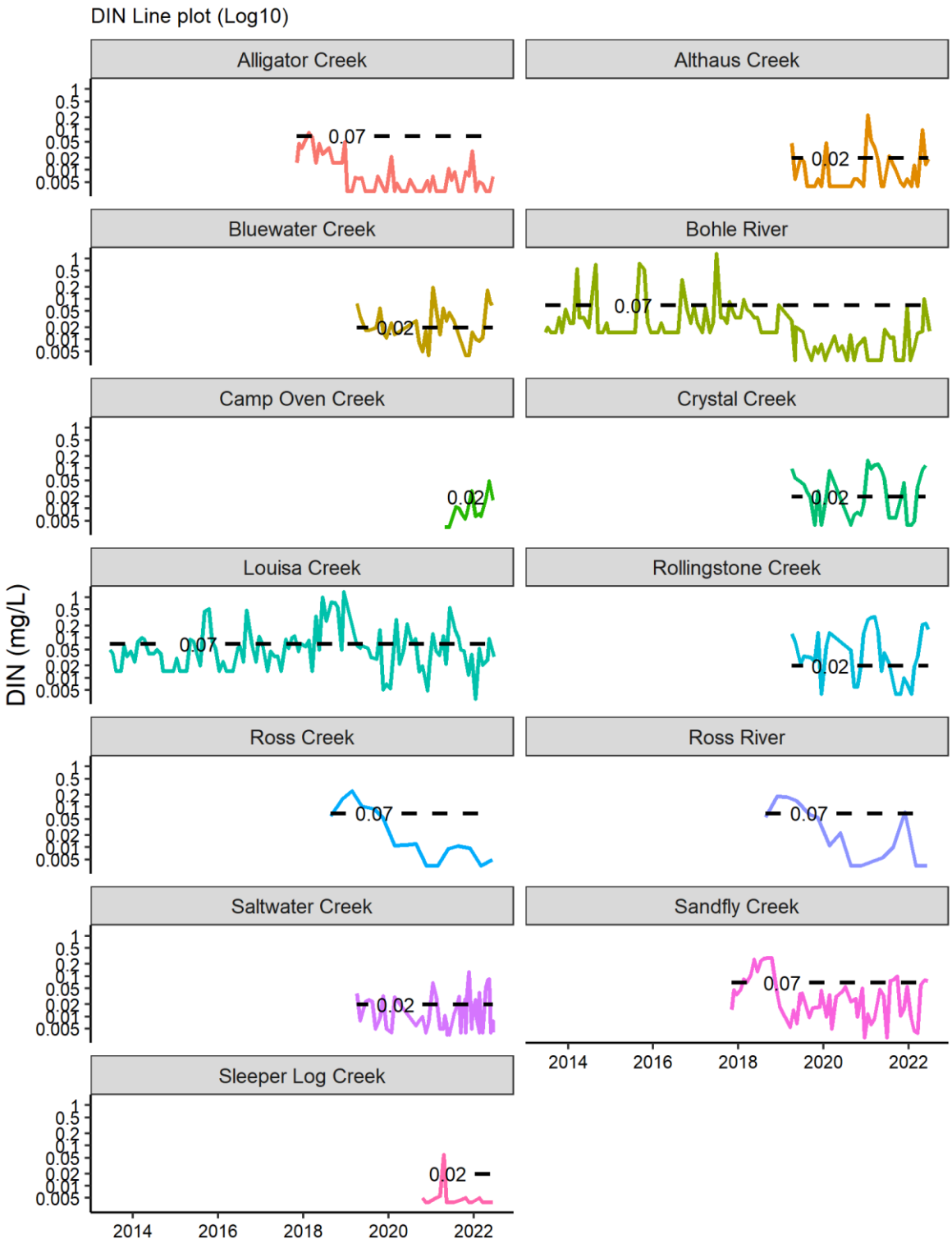

Figure 51. Dry Tropics estuarine water quality line plots: DIN. The dashed line indicates water quality guidelines.

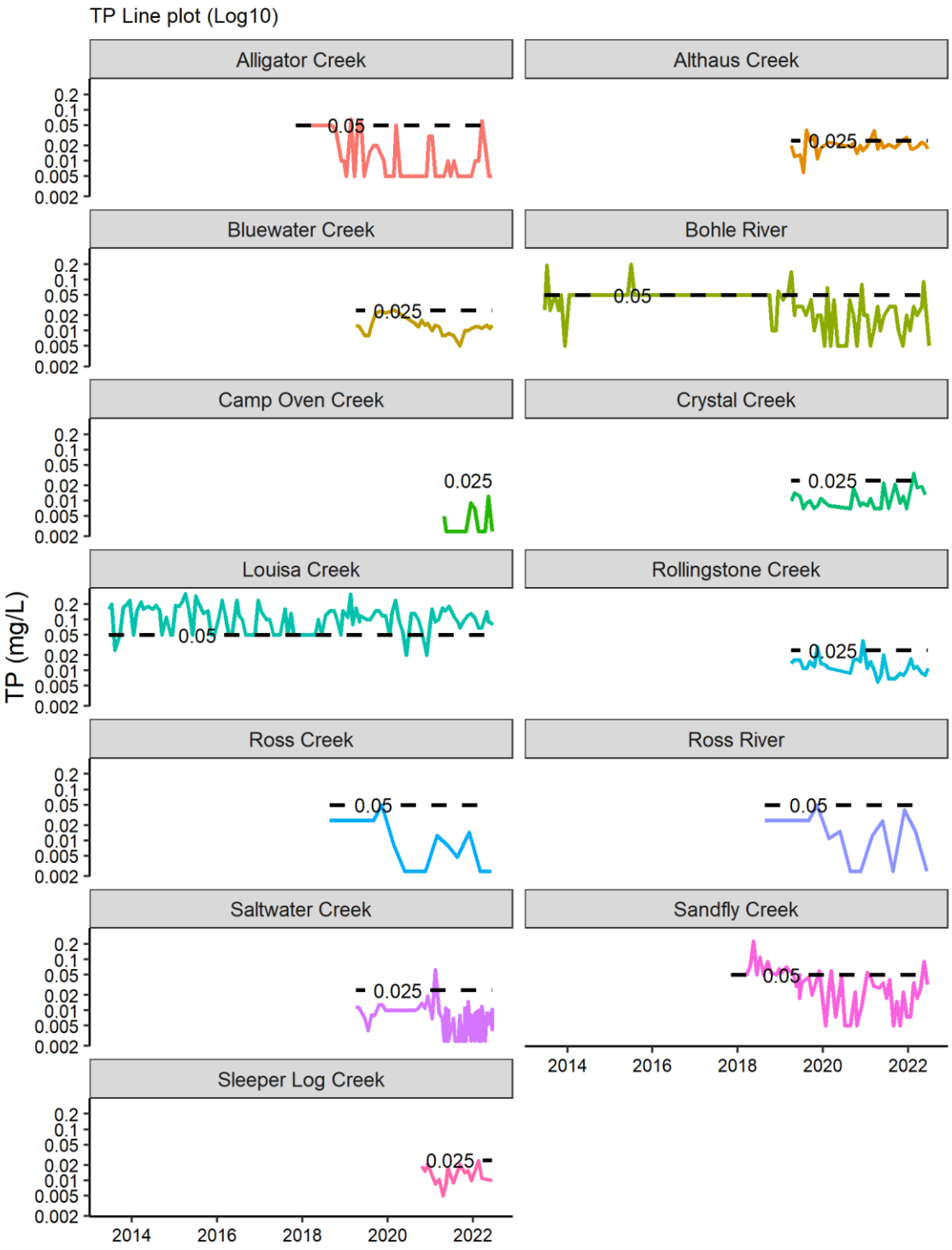

Figure 52. Dry Tropics estuarine water quality line plots: TP. The dashed line indicates water quality guidelines.

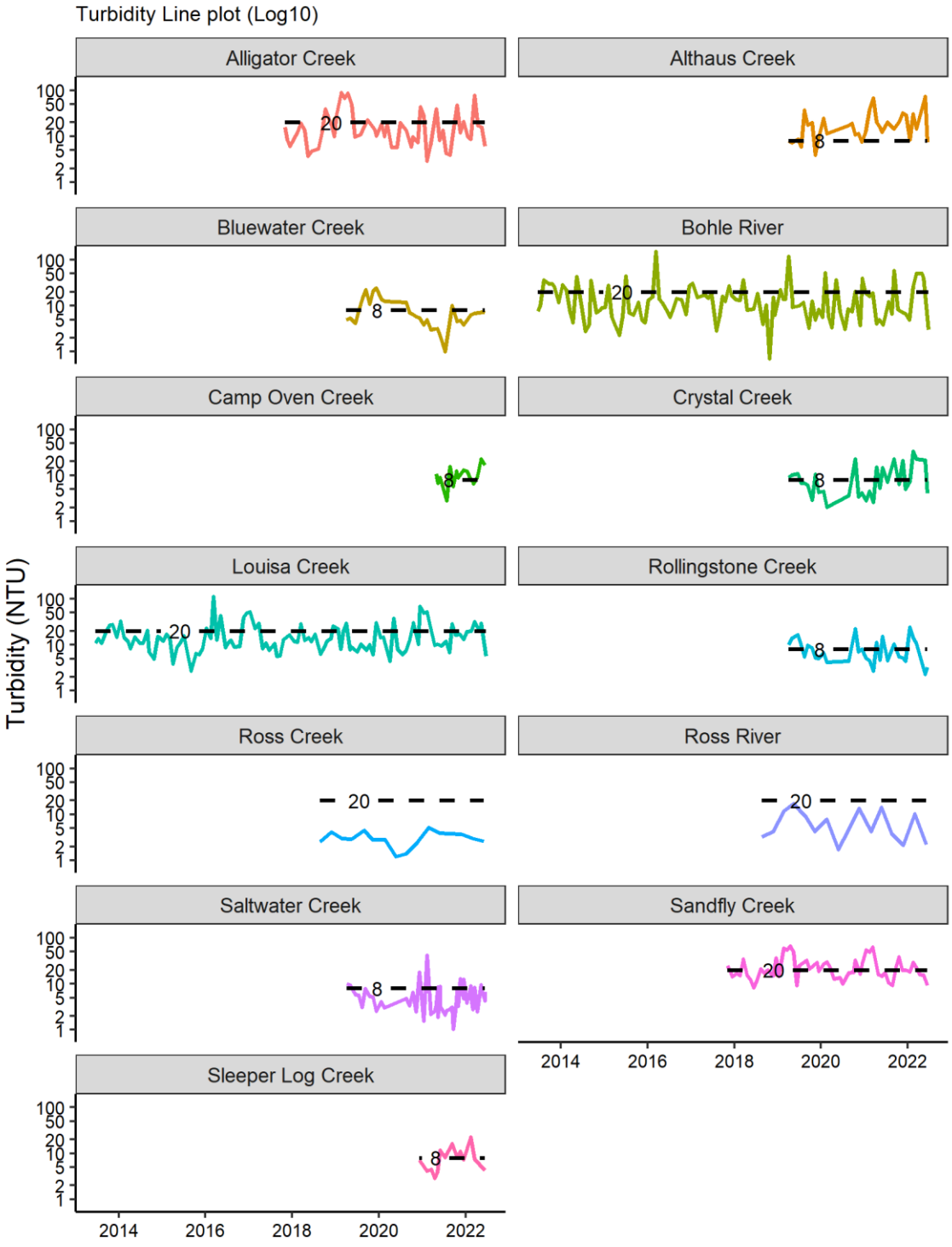

Figure 53. Dry Tropics estuarine water quality line plots: NTU. The dashed line indicates water quality guidelines.

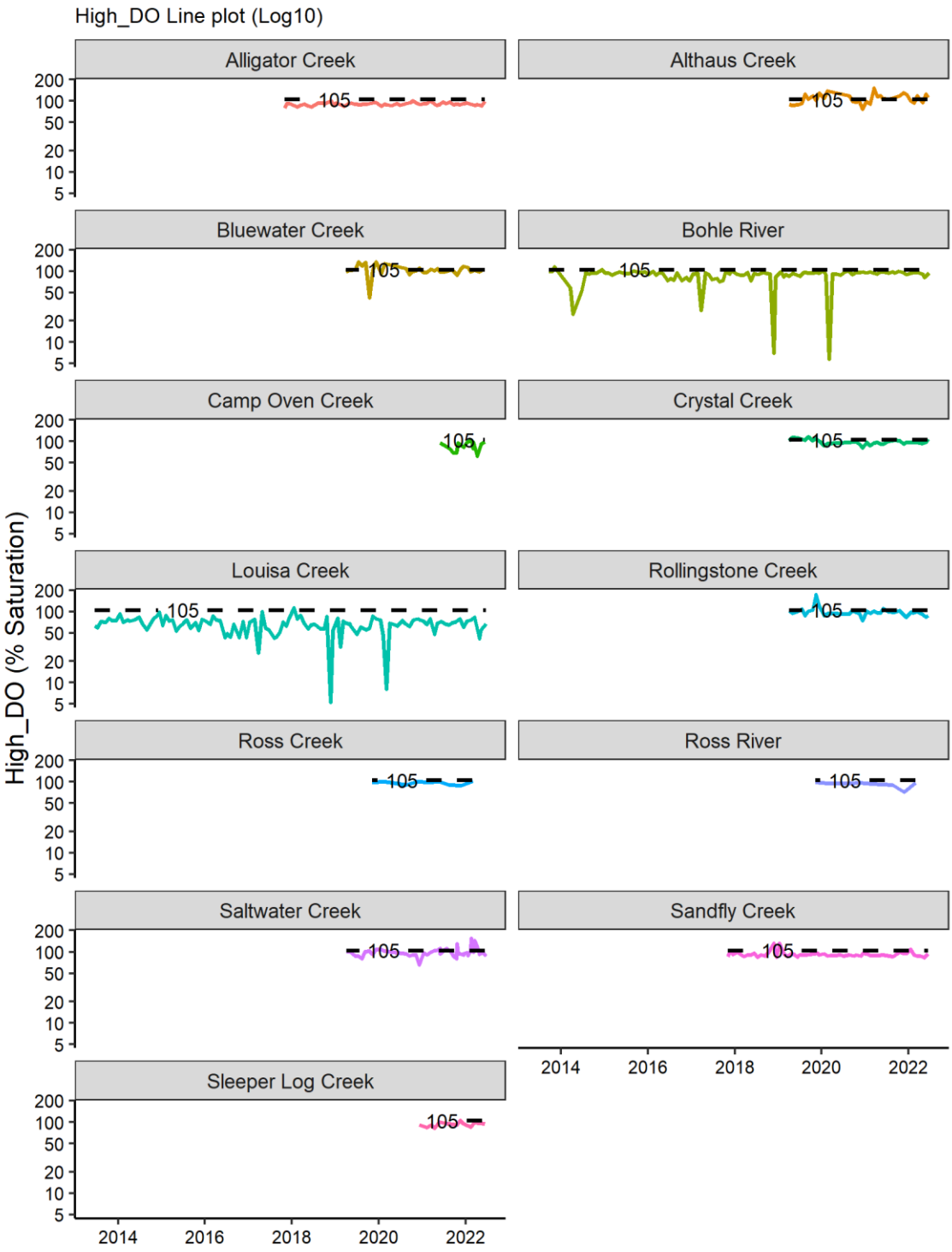

Figure 54. Dry Tropics estuarine water quality line plots: High DO. The dashed line indicates water quality guidelines.

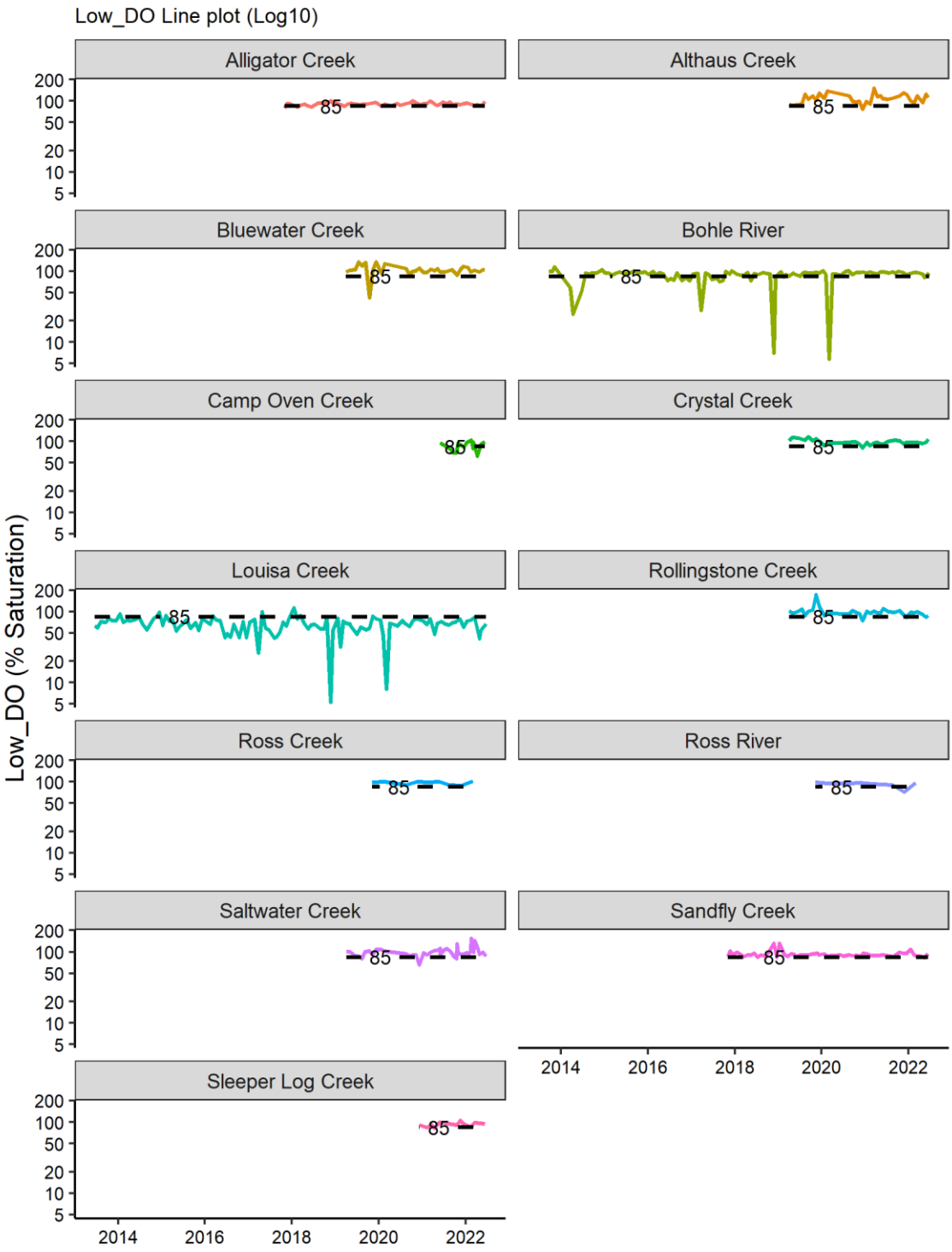

Figure 55. Dry Tropics estuarine water quality line plots: Low DO. The dashed line indicates water quality guidelines.

Appendix HH.Estuarine Water Quality Special Analysis of TP in the Ross Estuarine Basin

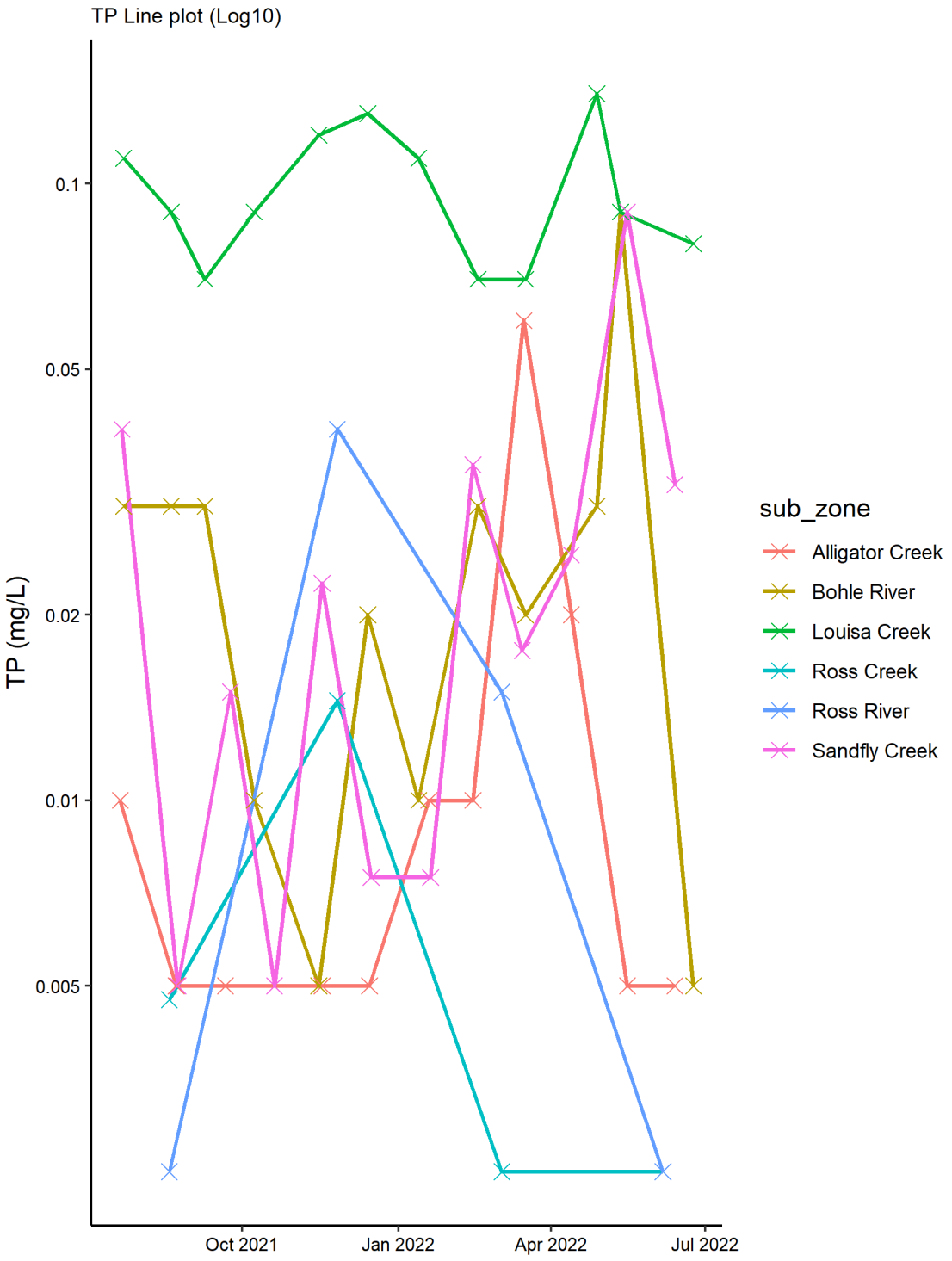

Figure 56. Dry Tropics Estuarine water quality special analysis line plot of TP in the Ross Estuarine Basin for the 2021-2022 reporting year. Crosses mark specific times a sample was collected.

Appendix II. Estuarine Mangrove and Saltmarsh Extent: Assessed Area in the Dry Tropics Region

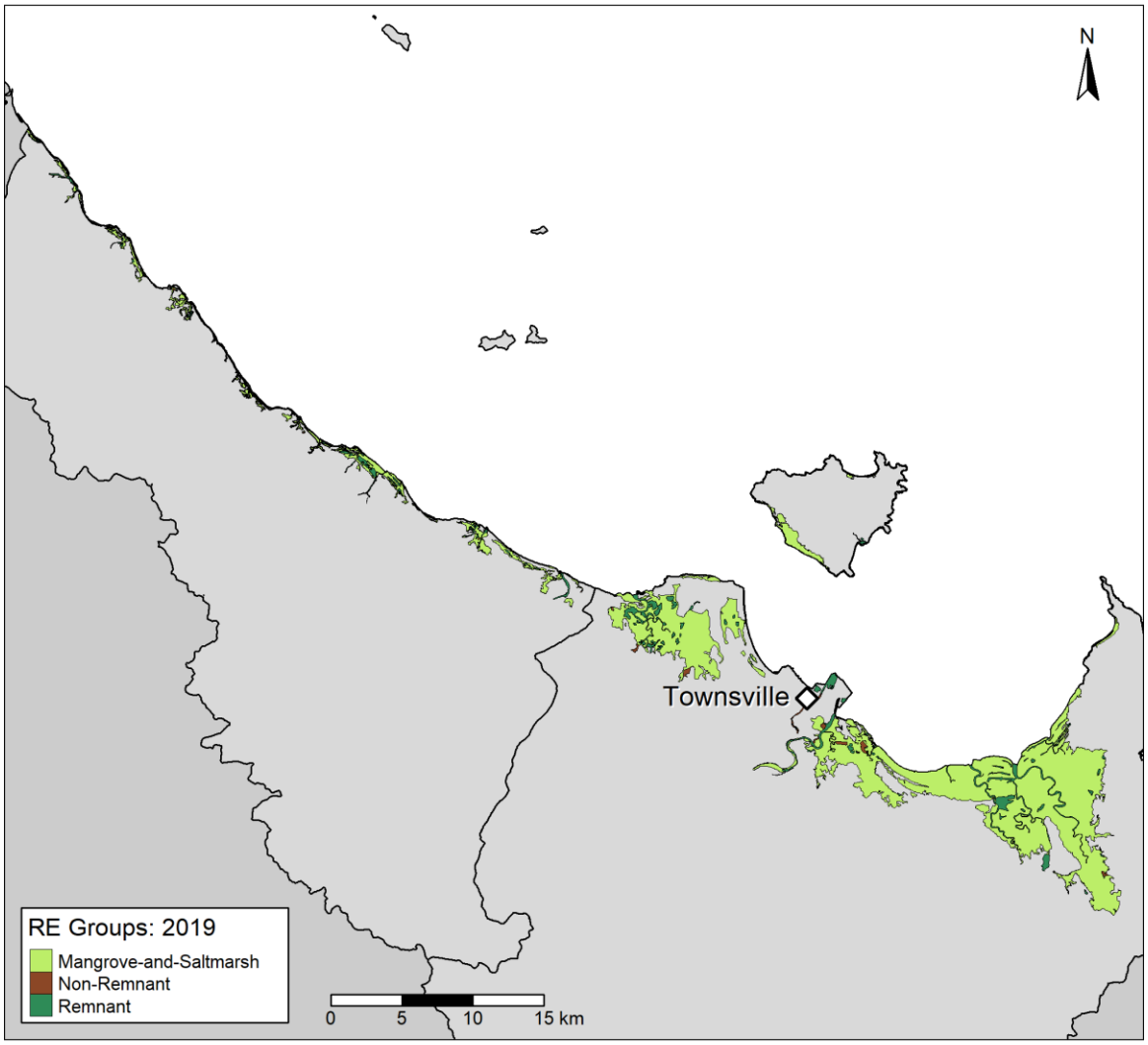

Figure 57. Total area of the Dry Tropics region that was assessed for changes in Mangrove and Saltmarsh extent.

Appendix JJ. Estuarine Riparian Extent: Assessed Area in the Dry Tropics Region

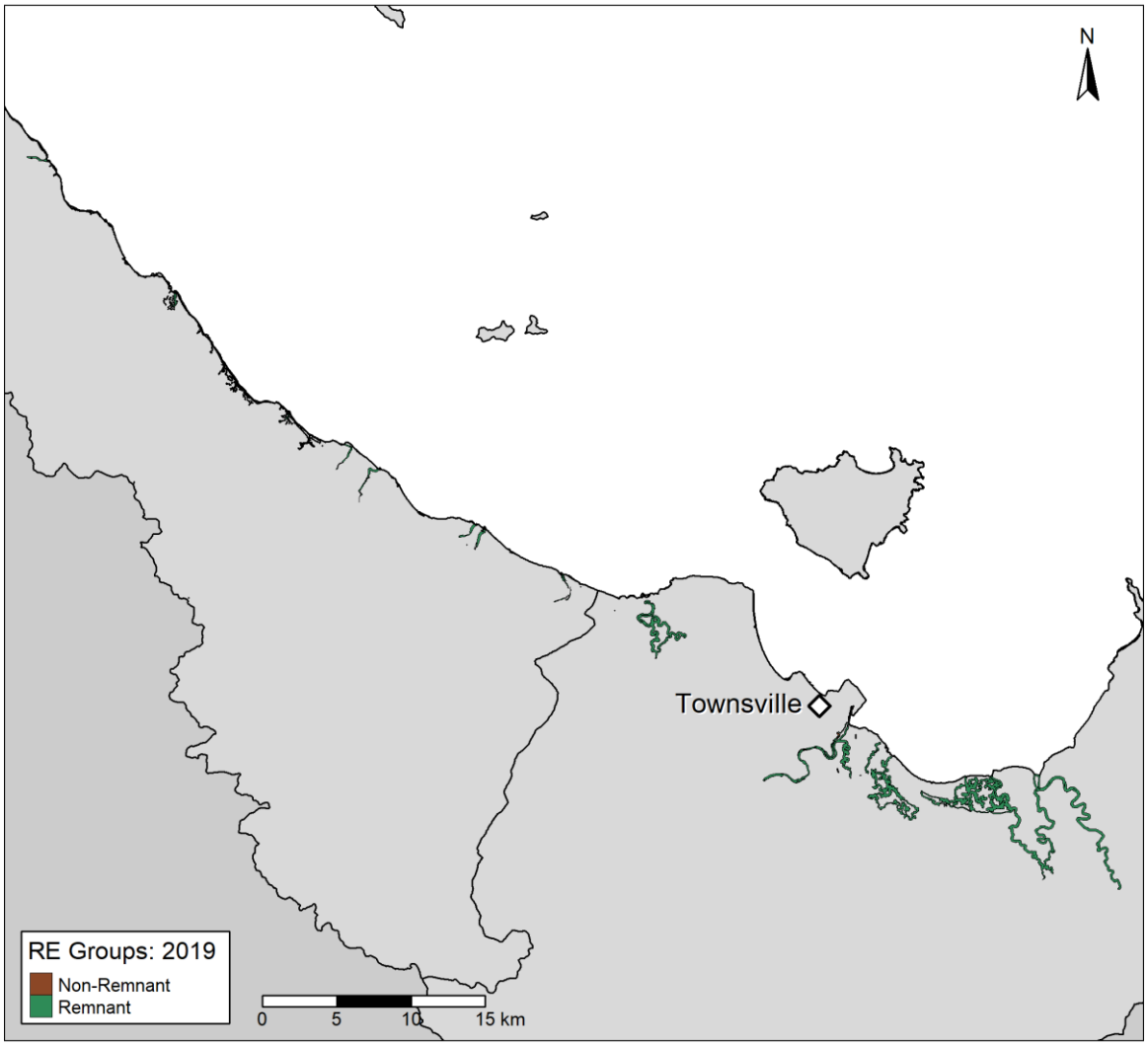

Figure 58. The estuarine riparian buffer zone in the Dry Tropics region that was assessed for changes in total vegetation.

Appendix KK. Ross Estuarine Area Mangrove and Saltmarsh Vegetation Change

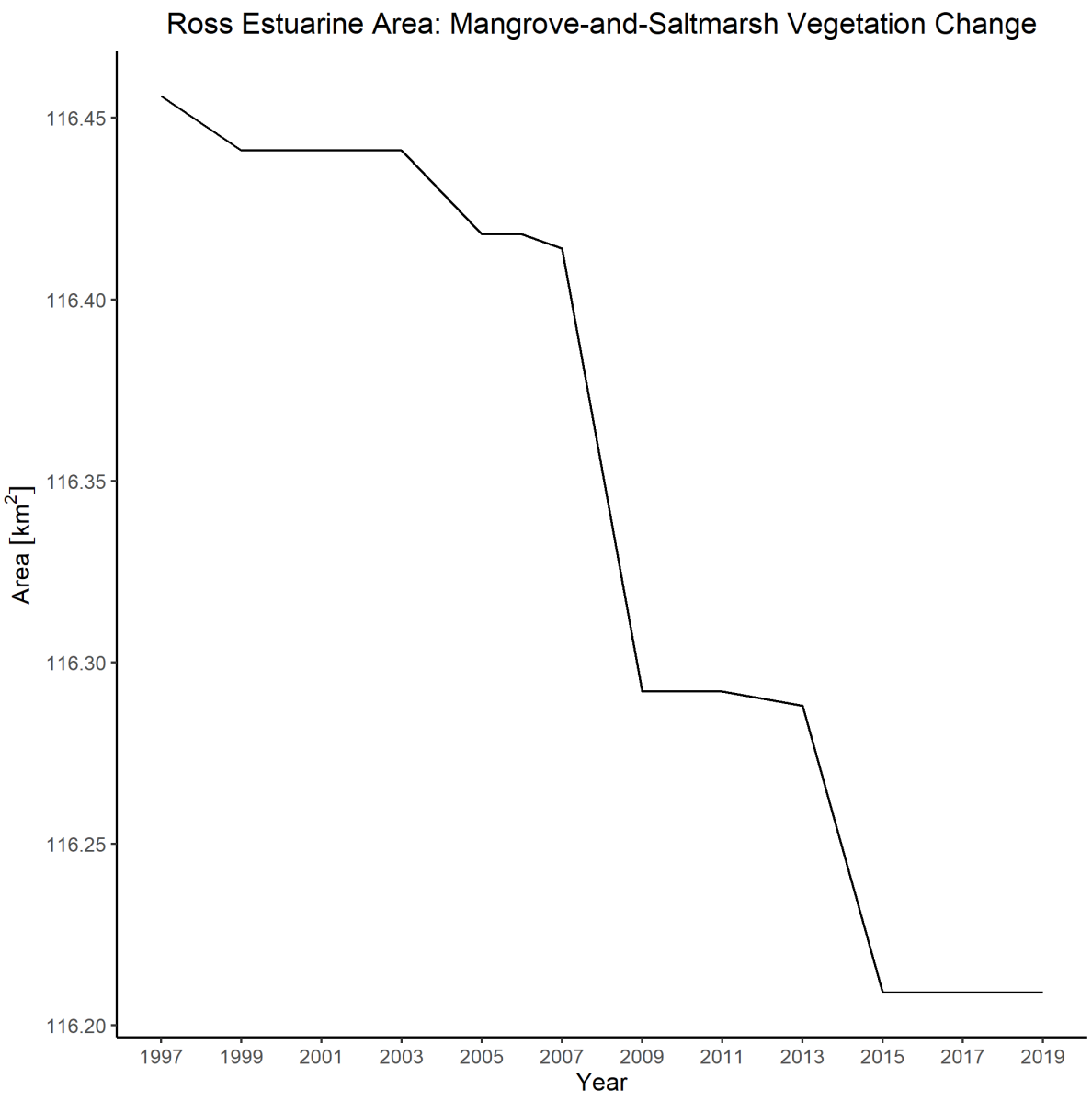

Figure 59. Ross Estuarine Area Mangrove and Saltmarsh Vegetation Change.

Appendix LL. Black Estuarine Area Mangrove and Saltmarsh Vegetation Change

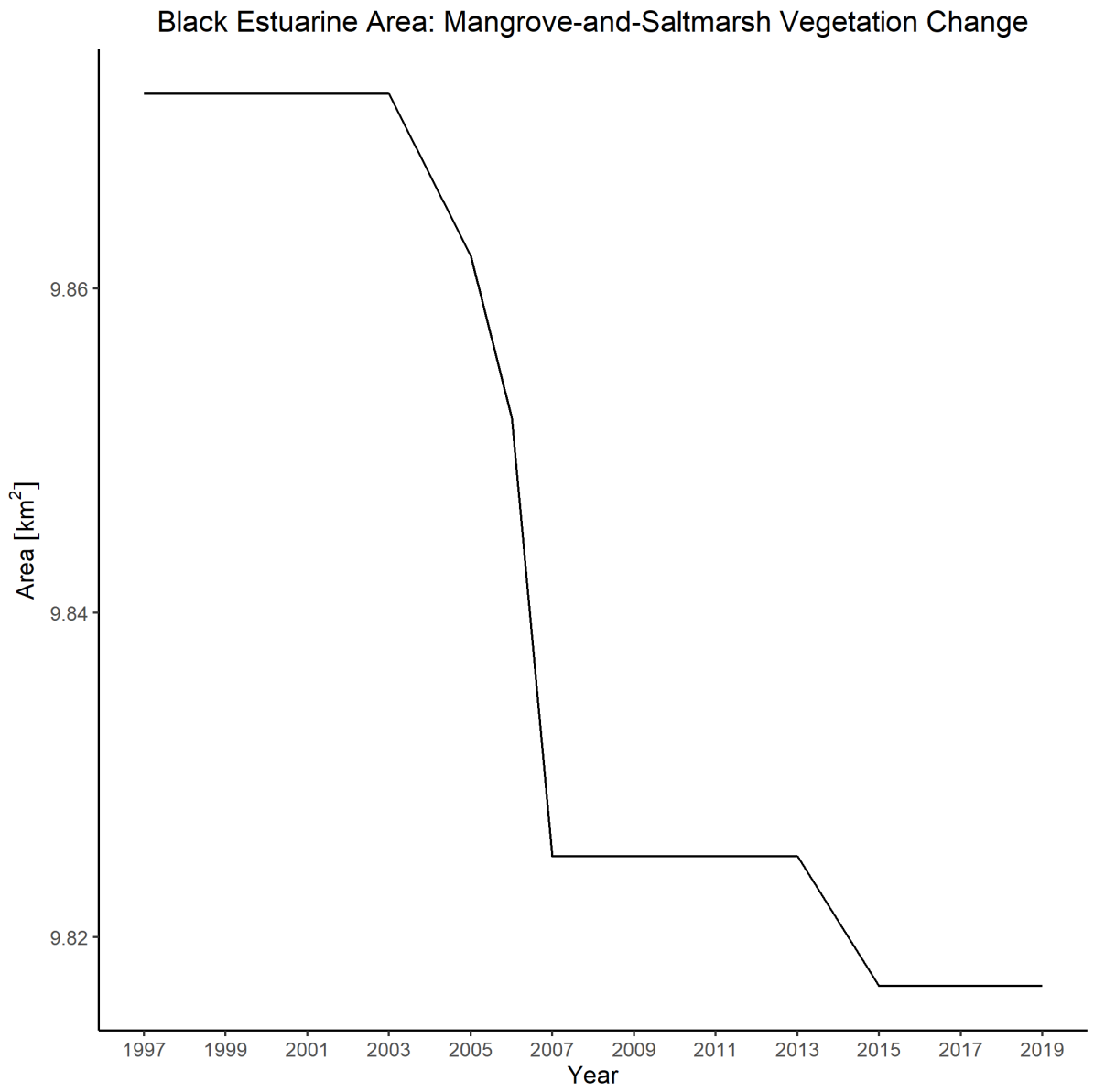

Figure 60. Black Estuarine Area Mangrove and Saltmarsh Vegetation Change.

Appendix MM. Ross Estuarine Riparian Vegetation Change

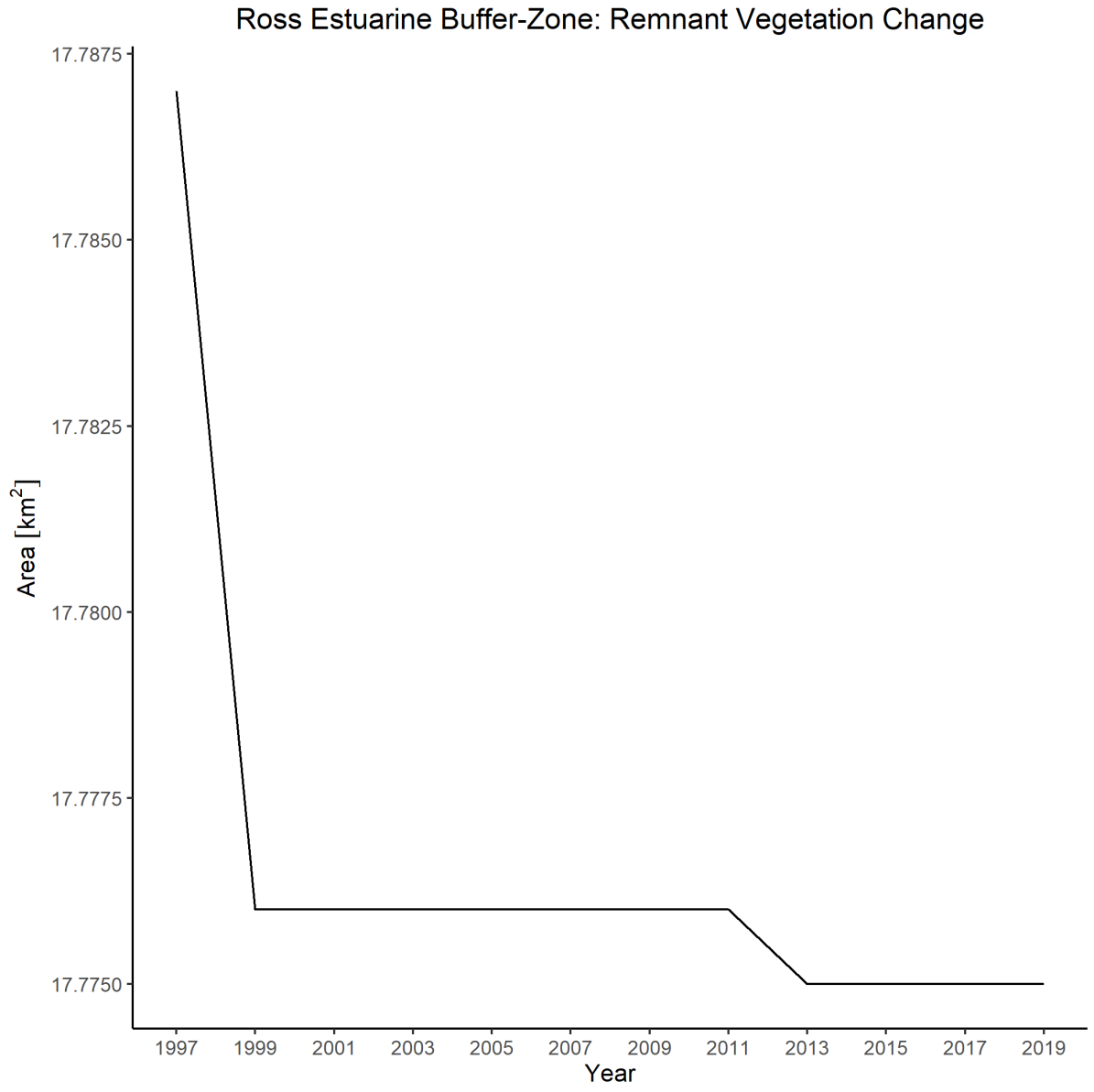

Figure 61. Ross Estuarine Riparian Vegetation Change.

Appendix NN. Black Estuarine Riparian Vegetation Change

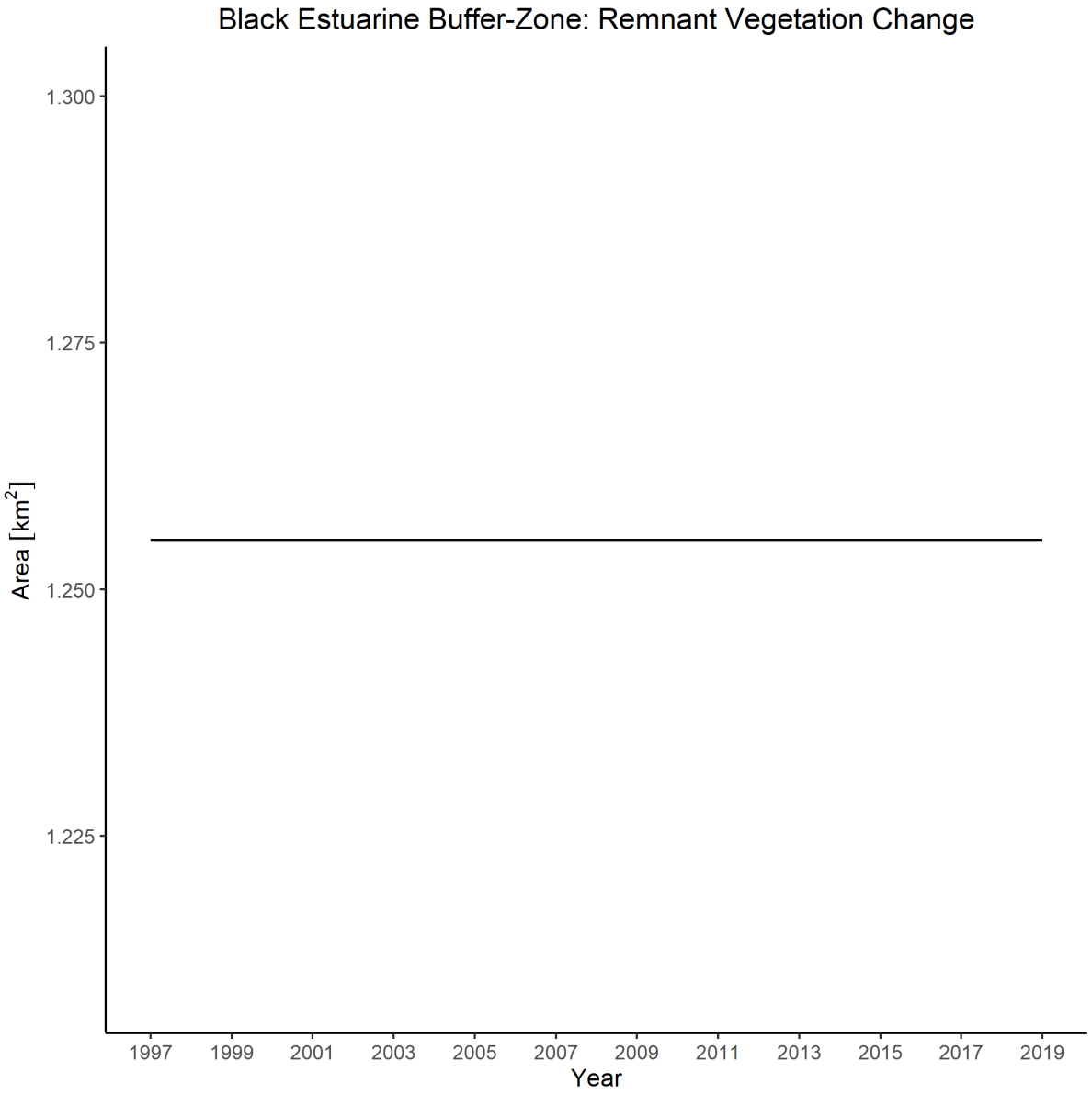

Figure 62. Black Estuarine Riparian Vegetation Change.

Appendix OO. Estuarine Habitat Scores Pre and Post Back-Calculation

Table 101. Estuarine indicator category scores post back calculation.

Basin	Mangrove and Saltmarsh	Riparian Extent	Habitat Index 2021–2022
Ross Estuarine	67 (B)	80 (B)	73 (B)
Black Estuarine	63 (B)	80 (B)	71 (B)

Table 102. Estuarine indicator category scores pre back calculation.

Basin	Mangrove and Saltmarsh	Habitat Index 2020–2021	Habitat Index 2019–2020
Ross Estuarine	71 (B)	71 (B)	71 (B)
Black Estuarine	77 (B)	77 (B)	77 (B)

Appendix PP. Inshore Marine Water Quality Sampling Locations

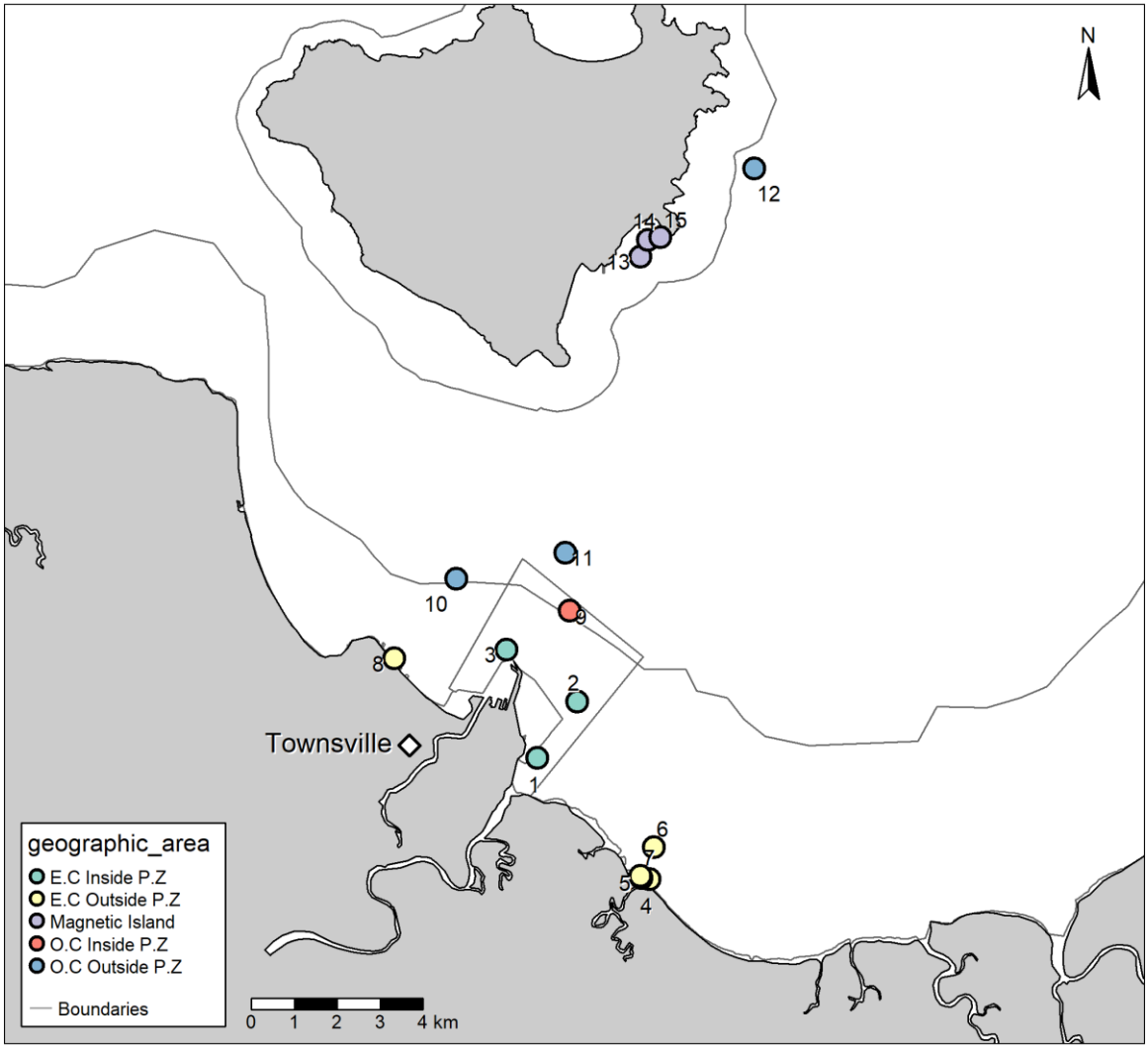

Figure 63. Cleveland Bay inshore marine zone water quality site locations.

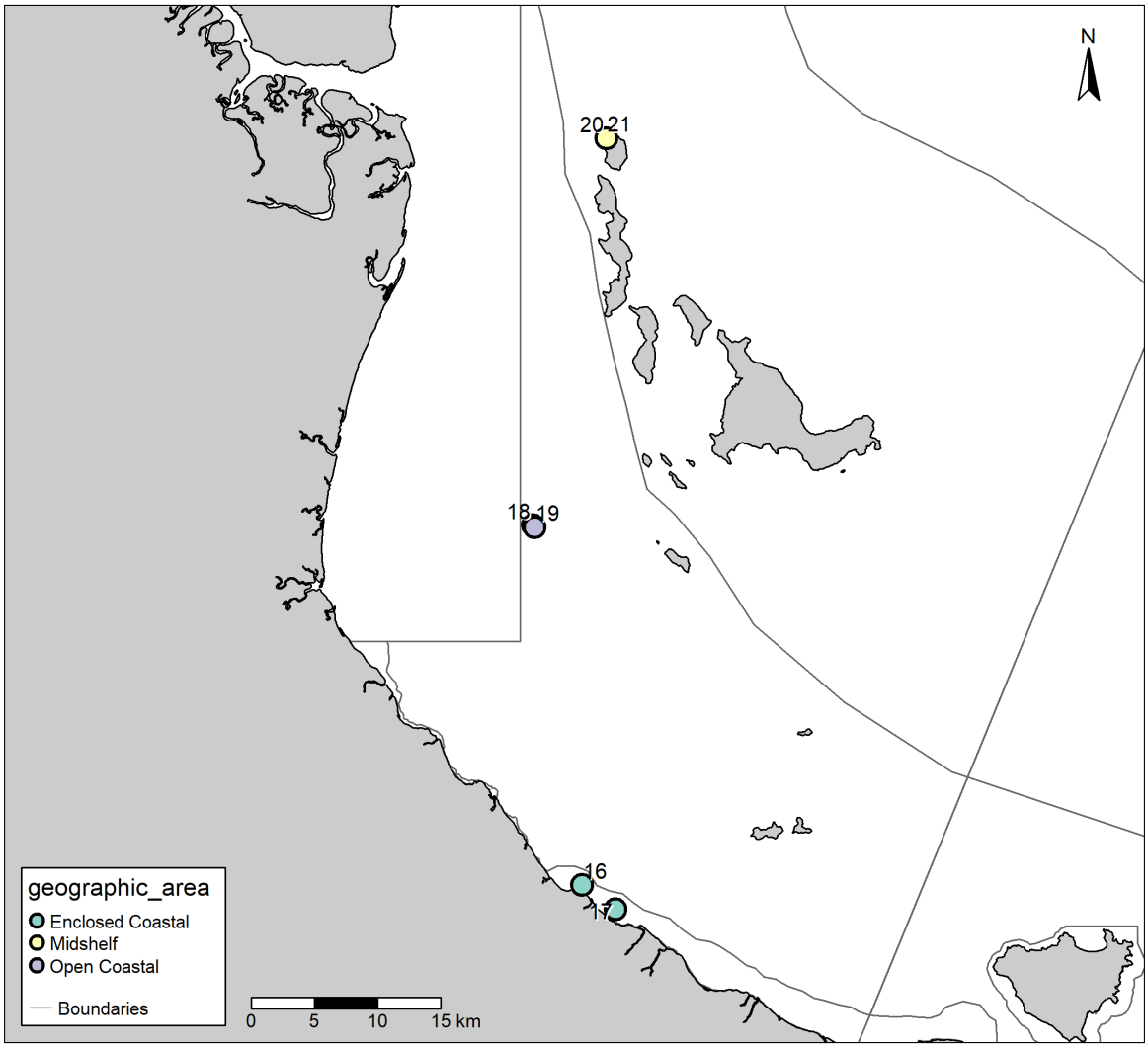

Figure 64. Halifax Bay inshore marine zone water quality site locations.

Appendix QQ. Inshore Marine Water Quality Nutrients: Sample Frequencies, Means, Medians, and WQOs

Table 103. Number of samples, days sampled, mean, median and water quality objective values for nitrogen based nutrient indicators in the Dry Tropics Inshore Marine Environment.

Area	NOx (mg/L)				PN (ug/L)				TN[28] (mg/L)			
	N. Samples	Sample Days	Mean	WQO	N. Samples	Sample Days	Mean	WQO	N. Samples	Sample Days	Mean	WQO
CB: E.C.IPZ	12	4	0.001	0.009	NA	NA	NA	NA	12	4	0.11	0.22
CB: E.C.OPZ	4	4	0.001	0.009	NA	NA	NA	NA	4	4	0.105	0.22
CB: O.C.IPZ	4	4	0.001	0.009	NA	NA	NA	NA	4	4	0.090	0.22
CB: O.C.OPZ	8	4	0.001	0.002	NA	NA	NA	20.0	8	4	0.091	0.13
CB: Mag. Is.	10	10	0.003	0.001[29]	10	10	35.55	21.0[29]	NA	NA	NA	0.20[29]
HB: E.C.W	22	11	0.097	0.003	NA	NA	NA	NA	NA	NA	NA	0.10
HB: O.C	10	10	0.0021	0.002	10	10	27.98	20.0	NA	NA	NA	0.13
HB: Mid	10	10	0.0018	0.002[29]	10	10	24.16	20.0	NA	NA	NA	0.10

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

[28] TN is included only as an indicator. TN is not aggregated within the nutrient indicator category.

[29] These values have been adjusted via expert opinion to accurately reflect local conditions and requirements.

Table 104. Number of samples, number of days sampled, mean, median and water quality objective values for phosphorous based nutrient indicators in the Dry Tropics Inshore Marine Environment.

Area	PP (ug/L)				TP (mg/L)				FRP[30] (mg/L)			
	N. Samples	Sample Days	Mean	WQO	N. Samples	Sample Days	Median	WQO	N. Samples	Sample Days	Mean	WQO
CB: E.C.IPZ	NA	NA	NA	NA	12	4	0.0025	0.030	12	4	0.0005	0.011
CB: E.C.OPZ	NA	NA	NA	NA	4	4	0.0025	0.030	4	4	0.0005	0.011
CB: O.C.IPZ	NA	NA	NA	NA	4	4	0.0025	0.030	4	4	0.0005	0.011
CB: O.C.OPZ	NA	NA	NA	2.80	8	4	0.0025	0.020	8	4	0.0005	0.007
CB: Mag. Is.	10	10	3.57	2.80[29]	NA	NA	NA	0.020[29]	10	10	0.0012	0.003
HB: E.C.W	NA	NA	NA	NA	22	11	0.0025	0.014	22	11	0.0005	0.006
HB: O.C	10	10	2.19	2.80	NA	NA	NA	0.020	10	10	0.0011	0.002
HB: Mid	10	10	1.89	2.80	NA	NA	NA	0.014[29]	10	10	0.0011	0.002

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

[30] FRP is included only as an indicator. FRP is not aggregated within the nutrient indicator category.

Appendix RR. Inshore Marine Water Quality Nutrients: Water Quality Objective Values Pre- and Post-Adjustment

Table 105. Dry Tropics Inshore Marine Environment water quality objectives (Nutrients). PRE-ADJUSTMENT. Red boxes highlight values that have changed.

Area	EPP Site Code	NOx(mg/L) (mean)	PN (ug/L) (mean)	PP (ug/L) (mean)	TP (mg/L) (median)	TN (mg/L) (mean)	FRP (mg/L) (mean)
Enclosed Coastal: Inside Port Zone	MD2241	0.009	NA	NA	0.030	0.22	0.011
Enclosed Coastal: Outside Port Zone	MD2242.enclosed	0.009	NA	NA	0.030	0.22	0.011
Open Coastal: Inside Port Zone	MD2241	0.009	NA	NA	0.030	0.22	0.011
Open Coastal: Outside Port Zone	MD2242.open	0.002	20.0	2.80	0.020	0.13	0.007
Magnetic Island	SD2244.open	0.000	17.0	2.80	0.01	0.105	0.001
Enclosed Coastal	Halifax Bay Enclosed Coastal	0.003	NA	NA	0.014	0.10	0.006
Open Coastal	SD3124	0.002	20.0	2.80	0.020	0.13	0.002
Midshelf	HEV3124	0.000	20.0	2.80	0.011	0.10	0.002

Table 106. Dry Tropics Inshore Marine Environment water quality objectives (Nutrients). POST-ADJUSTMENT. Red boxes highlight values that have changed.

Area	EPP Site Code	NOx(mg/L) (mean)	PN (ug/L) (mean)	PP (ug/L) (mean)	TP (mg/L) (median)	TN (mg/L) (mean)	FRP (mg/L) (mean)
Enclosed Coastal: Inside Port Zone	MD2241	0.009	NA	NA	0.030	0.22	0.011
Enclosed Coastal: Outside Port Zone	MD2242.enclosed	0.009	NA	NA	0.030	0.22	0.011
Open Coastal: Inside Port Zone	MD2241	0.009	NA	NA	0.030	0.22	0.011
Open Coastal: Outside Port Zone	MD2242.open	0.002	20.0	2.80	0.020	0.13	0.007
Magnetic Island	SD2244.open	0.001	21.0	2.80	0.020	0.20	0.003
Enclosed Coastal	Halifax Bay Enclosed Coastal	0.003	NA	NA	0.014	0.10	0.006
Open Coastal	SD3124	0.002	20.0	2.80	0.020	0.13	0.002
Midshelf	HEV3124	0.002	20.0	2.80	0.014	0.10	0.002

Appendix SS.Inshore Marine Water Quality Nutrient: Scores Historic Comparison

Table 107. Dry Tropics Inshore Marine Environment water quality nutrient indicator and indicator category scores.

Area	2021–2022						2020–2021						2020–2019					
	NOx	PN	PP	TP	TN	FRP	NOx	PN	PP	TP	TN	FRP	NOx	PN	PP	TP	TN	FRP
CB: E.C.IPZ	100	NA	NA	100	100	100	100	NA	NA	100	100	100	100	NA	NA	100	52	100
CB: E.C.OPZ	100	NA	NA	100	100	100	100	NA	NA	100	100	100	100	NA	NA	100	55	100
CB: O.C.IPZ	100	NA	NA	100	100	100	100	NA	NA	100	100	100	100	NA	NA	100	35	100
CB: O.C.OPZ	100	NA	NA	100	81	100	100	NA	NA	100	81	100	100	NA	NA	100	0	100
CB: Mag. Is.	0	15	40	NA	NA	NA	0	28	46	NA	NA	NA	25	13	38	NA	NA	NA
HB: E.C.W	0	NA	NA	100	NA	100	23	NA	NA	100	NA	100	No data provided.					
HB: O.C	57	32	75	NA	NA	NA	56	41	39	NA	NA	NA	43	0	65	NA	NA	NA
HB: Mid	64	45	83	NA	NA	NA	33	48	76	NA	NA	NA	35	1	68	NA	NA	NA

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100.

Appendix TT. Phys-Chem and Chlorophyll *a*: Sample Frequencies, Means, Medians, and WQOs

Table 108. Number of samples, mean, median, and water quality objective values for physical-chemical properties indicators in the Dry Tropics Inshore Marine Environment.

Area	Turbidity (NTU)				TSS (mg/L)				Secchi (m)[31]			
	N. Samples	Sample Days	Median	WQO	N. Samples	Sample Days	Mean	WQO	N. Samples	Sample Days	Mean	WQO
CB: E.C.IPZ	12	4	2.18	4.9	12	4	9.33	22.0	12	4	1.74	1.0
CB: E.C.OPZ	52	17	12.15	4.9	52	17	28.92	15.0	4	4	1.48	1.0
CB: O.C.IPZ	4	4	2.29	4.9	4	4	9.00	22.0	4	4	2.10	1.0
CB: O.C.OPZ	323	315	3.93	3.0	8	4	10.87	10.0	8	4	2.33	3.0
CB: Mag. Is.	669	365	2.03	2.7[32]	10	10	2.43	3.7[32]	10	10	4.19	3.0[32]
HB: E.C.W	22	11	6.25	6.0	22	11	11.95	15.0	NA		NA	1.5
HB: O.C	365	365	1.13	1.5	10	10	1.65	2.0	10	10	5.34	10.0
HB: Mid	345	345	0.63	1.5[32]	10	10	1.51	2.0	10	10	6.96	10.0

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

[31] The secchi depth indicator operates inversely to all other indicators. I.e., a "good" value is one that is above the guideline value, as this shows greater water clarity.

[32] These values have been adjusted via expert opinion to accurately reflect local conditions and requirements.

Table 109. Number of samples, mean and water quality objective values for the Chlorophyll a indicator in the Dry Tropics Inshore Marine Environment.

Area	Chlorophyll *a* (ug/L)			
	N. Samples	Sample Days	Mean	Obj.
CB: E.C.IPZ	NA	NA	NA	2.60
CB: E.C.OPZ	46	13	1.26	2.60
CB: O.C.IPZ	NA	NA	NA	2.60
CB: O.C.OPZ	NA	NA	NA	1.00
CB: Mag. Is.	375	365	0.56	0.84[33]
HB: E.C.W	22	11	0.68	2.00
HB: O.C	375	365	0.35	0.45
HB: Mid	355	346	0.49	0.45

Key: = Mean/Median is lower than the guideline value | = Mean/Median is higher than the guideline value.

[33] These values have been adjusted via expert opinion to accurately reflect local conditions and requirements.

Appendix UU. Inshore Marine Water Quality Physical-Chemical Properties and Chlorophyll a: Water Quality Objective Values Pre- and Post-Adjustment

Table 110. Dry Tropics Inshore Marine Environment water quality objectives (Physical-Chemical Properties and Chlorophyll a). PRE-ADJUSTMENT. Red boxes highlight values that have changed.

Area	EPP Site Code	Turbidity (NTU) (median)	TSS (mg/L) (mean)	Secchi (m) (mean)	Chl *a* (ug/L) (mean)
Enclosed Coastal: Inside Port Zone	MD2241	4.9	22.0	1.0	2.60
Enclosed Coastal: Outside Port Zone	MD2242.enclosed	4.9	15.0	1.0	2.60
Open Coastal: Inside Port Zone	MD2241	4.9	22.0	1.0	2.60
Open Coastal: Outside Port Zone	MD2242.open	3.0	10.0	3.0	1.00
Magnetic Island	SD2244.open	1.3	1.9	4	0.59
Enclosed Coastal	Halifax Bay Enclosed Coastal	6.0	15.0	1.5	2.00
Open Coastal	SD3124	1.5	2.0	10.0	0.45
Midshelf	HEV3124	0.8	2.0	10.0	0.45

Table 111. Dry Tropics Inshore Marine Environment water quality objectives (Physical-Chemical Properties and Chlorophyll a). POST-ADJUSTMENT. Red boxes highlight values that have changed.

Area	EPP Site Code	Turbidity (NTU) (median)	TSS (mg/L) (mean)	Secchi (m) (mean)	Chl *a* (ug/L) (mean)
Enclosed Coastal: Inside Port Zone	MD2241	4.9	22.0	1.0	2.60
Enclosed Coastal: Outside Port Zone	MD2242.enclosed	4.9	15.0	1.0	2.60
Open Coastal: Inside Port Zone	MD2241	4.9	22.0	1.0	2.60
Open Coastal: Outside Port Zone	MD2242.open	3.0	10.0	3.0	1.00
Magnetic Island	SD2244.open	2.7	3.7	3.0	0.84
Enclosed Coastal	Halifax Bay Enclosed Coastal	6.0	15.0	1.5	2.00
Open Coastal	SD3124	1.5	2.0	10.0	0.45
Midshelf	HEV3124	1.5	2.0	10.0	0.45

Appendix VV. Inshore Marine Water Quality Physical-Chemical Properties and Chlorophyll *a* Historic Comparison

Table 112. Dry Tropics Inshore Marine Environment water quality physical-chemical properties indicator and indicator category scores.

Area	2022–2021				2021–2020				2020–2019			
	NTU	TSS	Secchi	Chla	NTU	TSS	Secchi	Chla	NTU	TSS	Secchi	Chla
CB: E.C.IPZ	100	100	92	NA	90	85	94	NA	75	100	78	NA
CB: E.C.OPZ	0	3	83	100	0	13	100	94	0	17	79	100
CB: O.C.IPZ	100	100	100	NA	100	98	100	NA	100	100	100	NA
CB: O.C.OPZ	38	54	39	NA	14	76	57	NA	62	82	48	NA
CB: Mag. Is.	77	85	80	83	73	86	78	83	78	100	90	81
HB: E.C.W	58	74	NA	100	100	84	NA	100	No data provided			
HB: O.C	77	72	6	75	73	64	16	69	89	93	6	67
HB: Mid	100	77	30	54	93	92	39	61	100	100	34	69

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100.

Appendix WW. Inshore Marine Water Quality 2021–2022 Boxplots

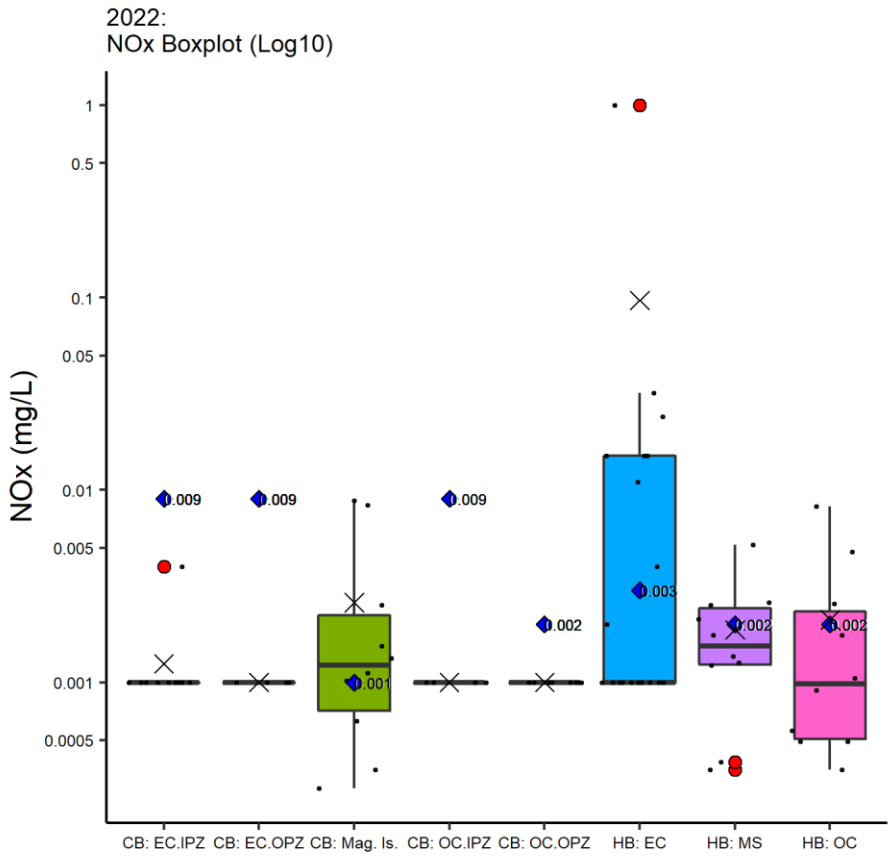

Figure 66. Dry Tropics inshore marine water quality boxplots: NOx. Blue diamonds indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (mean).

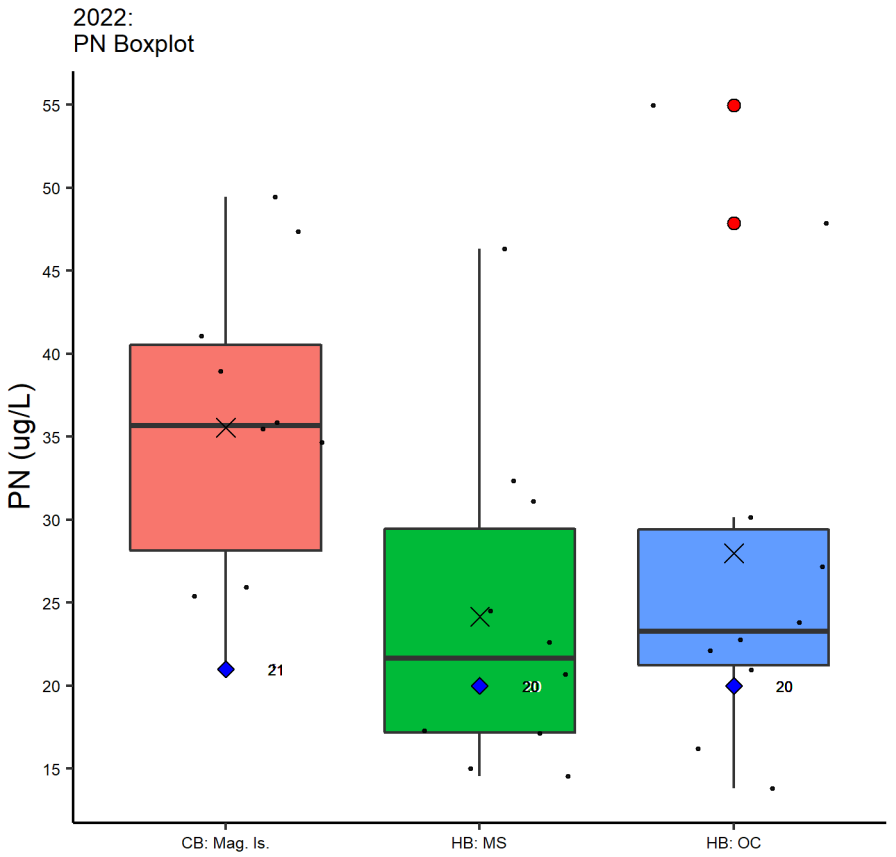

Figure 65. Dry Tropics inshore marine water quality boxplots: PN. Blue diamonds indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (mean).

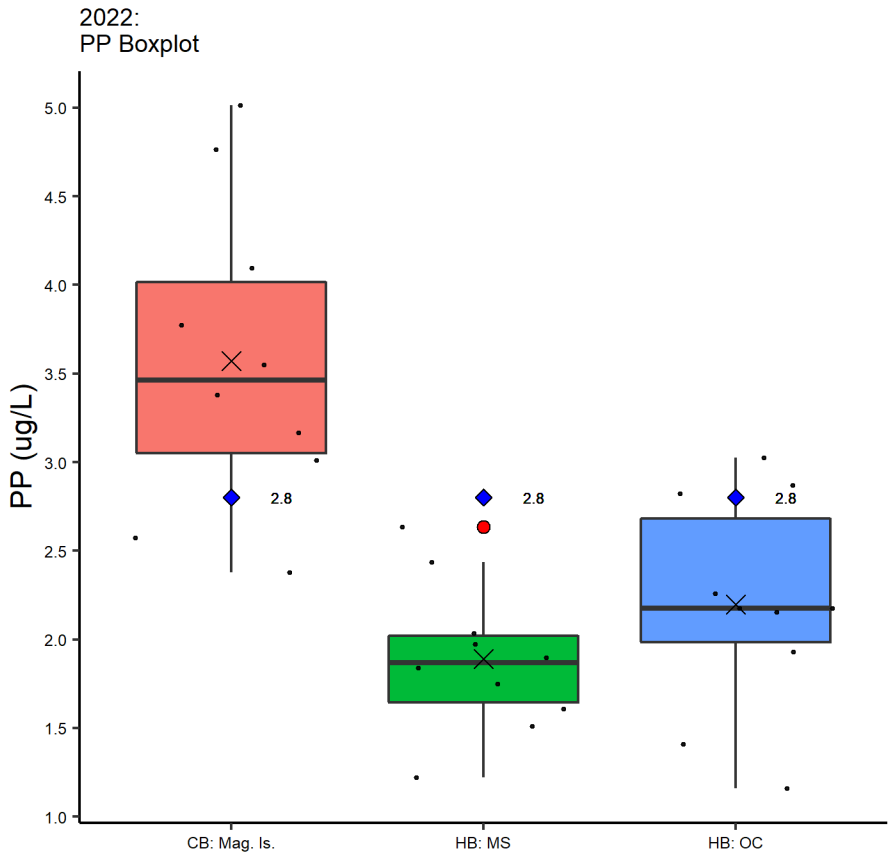

Figure 67. Dry Tropics inshore marine water quality boxplots: PP. Blue diamonds indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (mean).

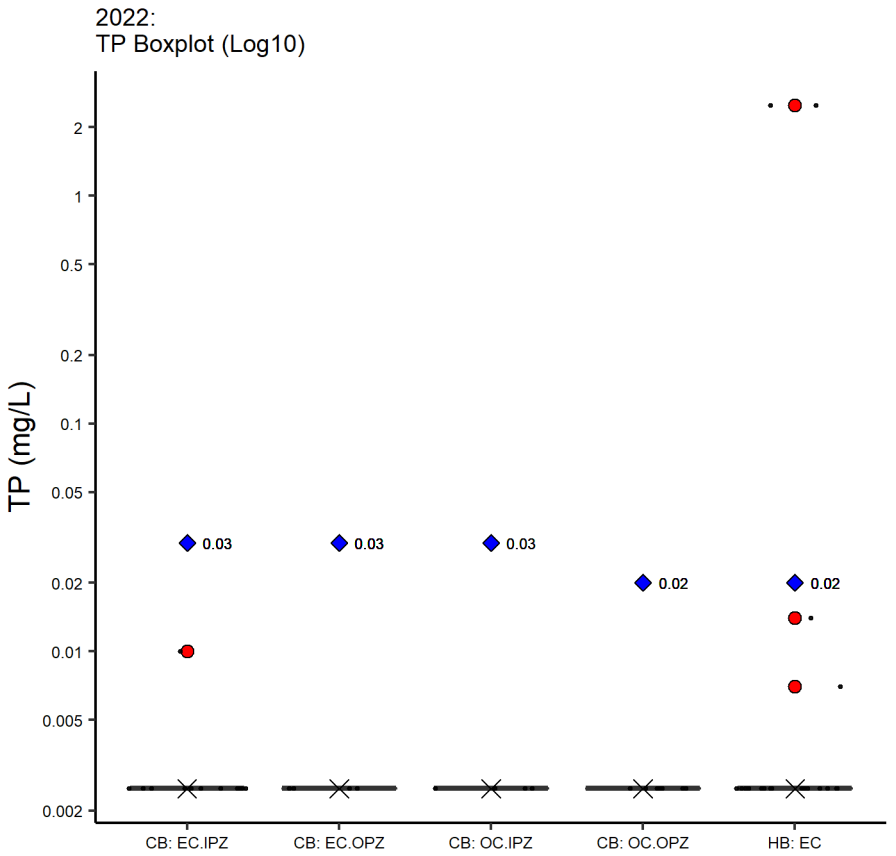

Figure 68. Dry Tropics inshore marine water quality boxplots: TP. Blue diamonds indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (median).

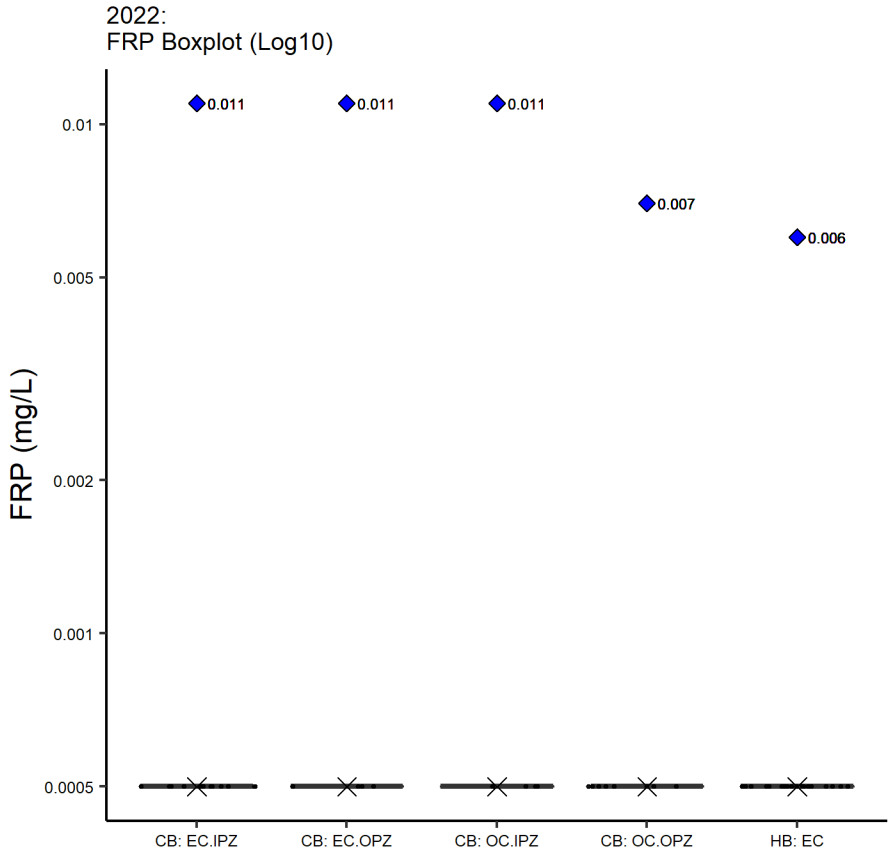

Figure 70. Dry Tropics inshore marine water quality boxplots: FRP. Blue diamonds indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (mean).

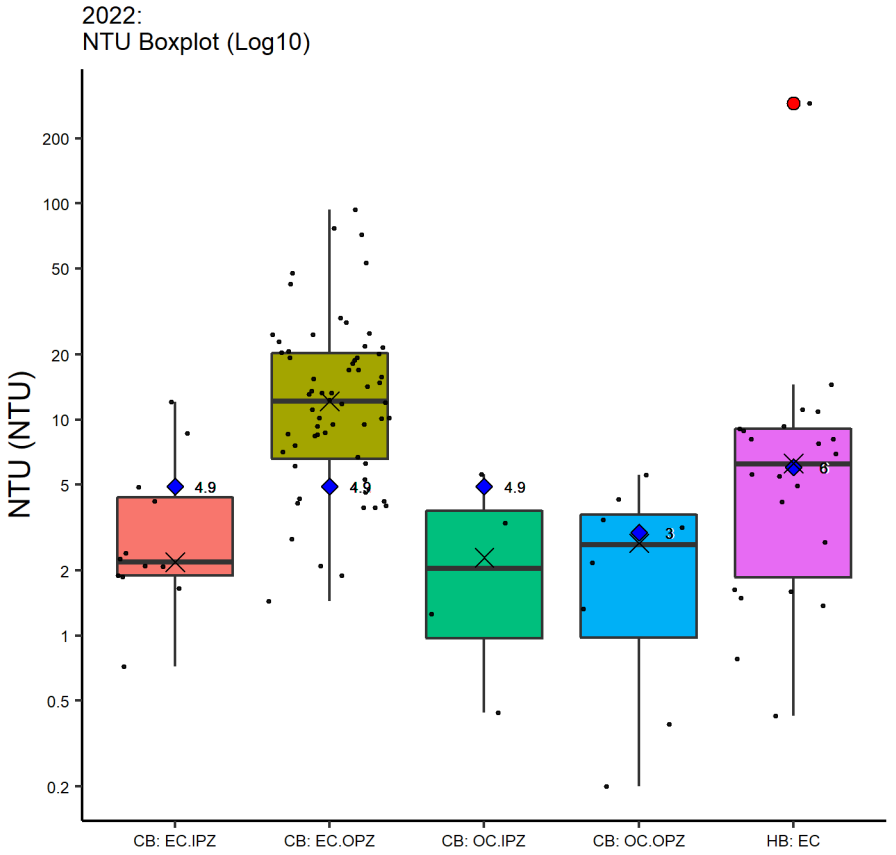

Figure 69. Dry Tropics inshore marine water quality boxplots: NTU. Blue diamonds indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (median).

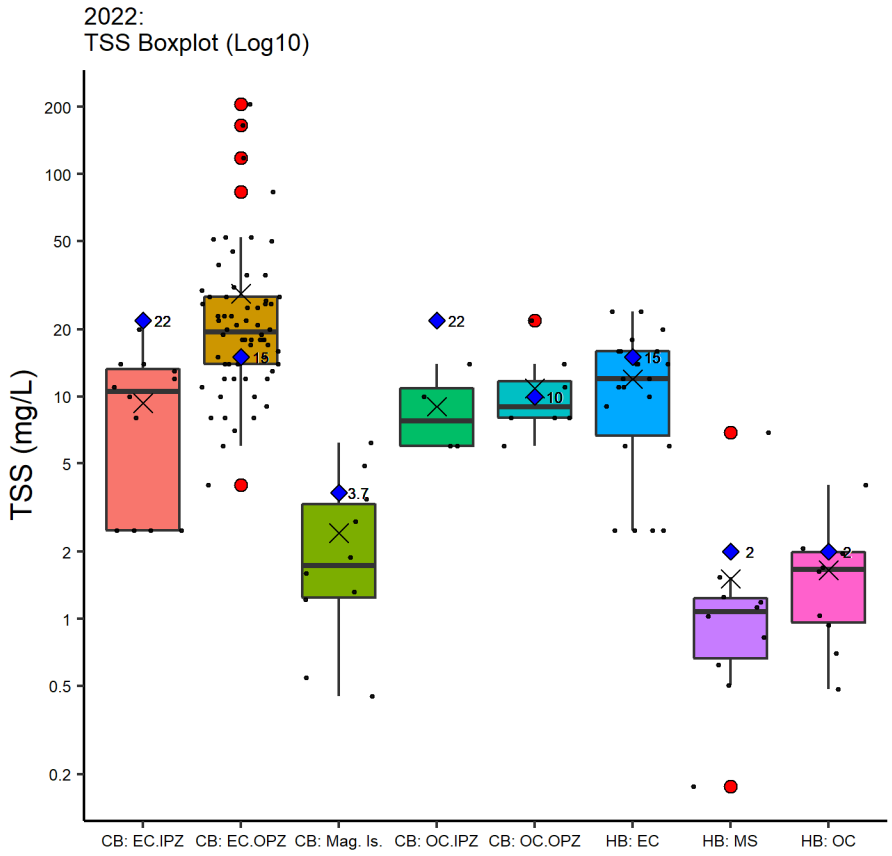

Figure 72. Dry Tropics inshore marine water quality boxplots: TSS. Blue diamonds indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (mean).

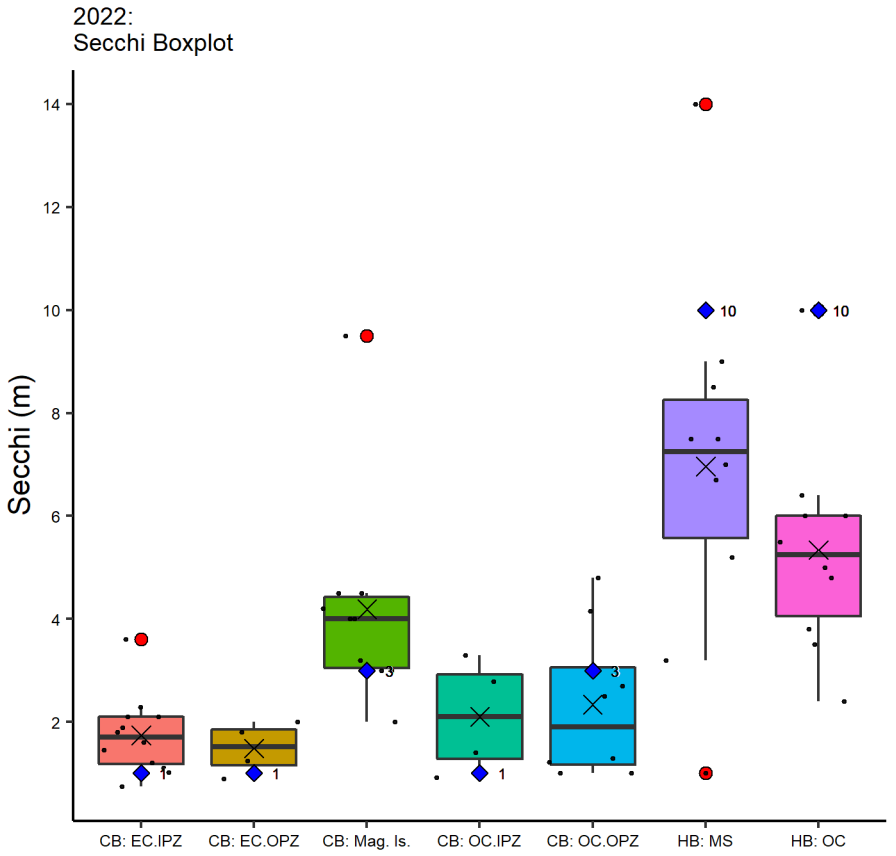

Figure 71. Dry Tropics inshore marine water quality boxplots: Secchi. Blue diamonds indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (mean).

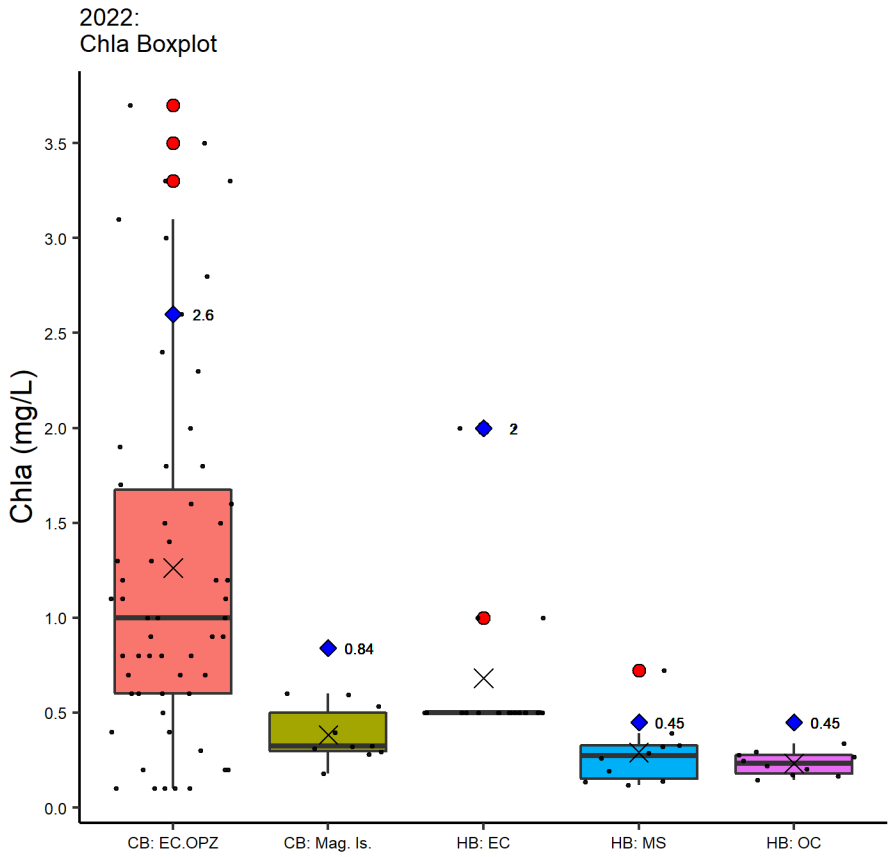

Figure 73. Dry Tropics inshore marine water quality boxplots: Chla. Blue diamonds indicate water quality guidelines, red circles indicate outliers, and the black cross indicates the value compared to the guideline value (mean).

Appendix XX. Inshore Marine Water Quality Line Plots

Figure 74. Dry Tropics inshore marine water quality line plots: NOx. The dashed line indicates water quality guidelines.

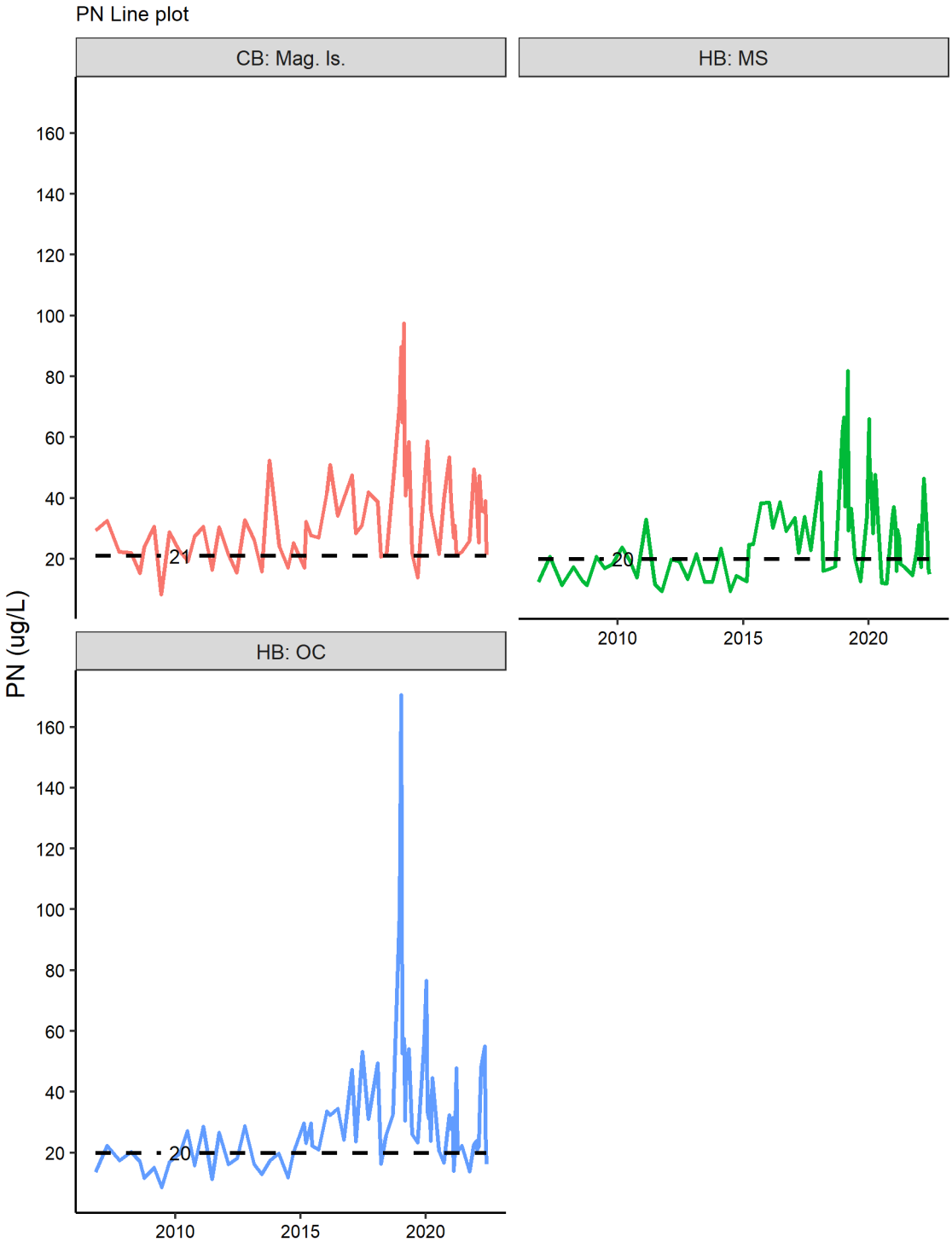

Figure 75. Dry Tropics inshore marine water quality line plots: PN. The dashed line indicates water quality guidelines.

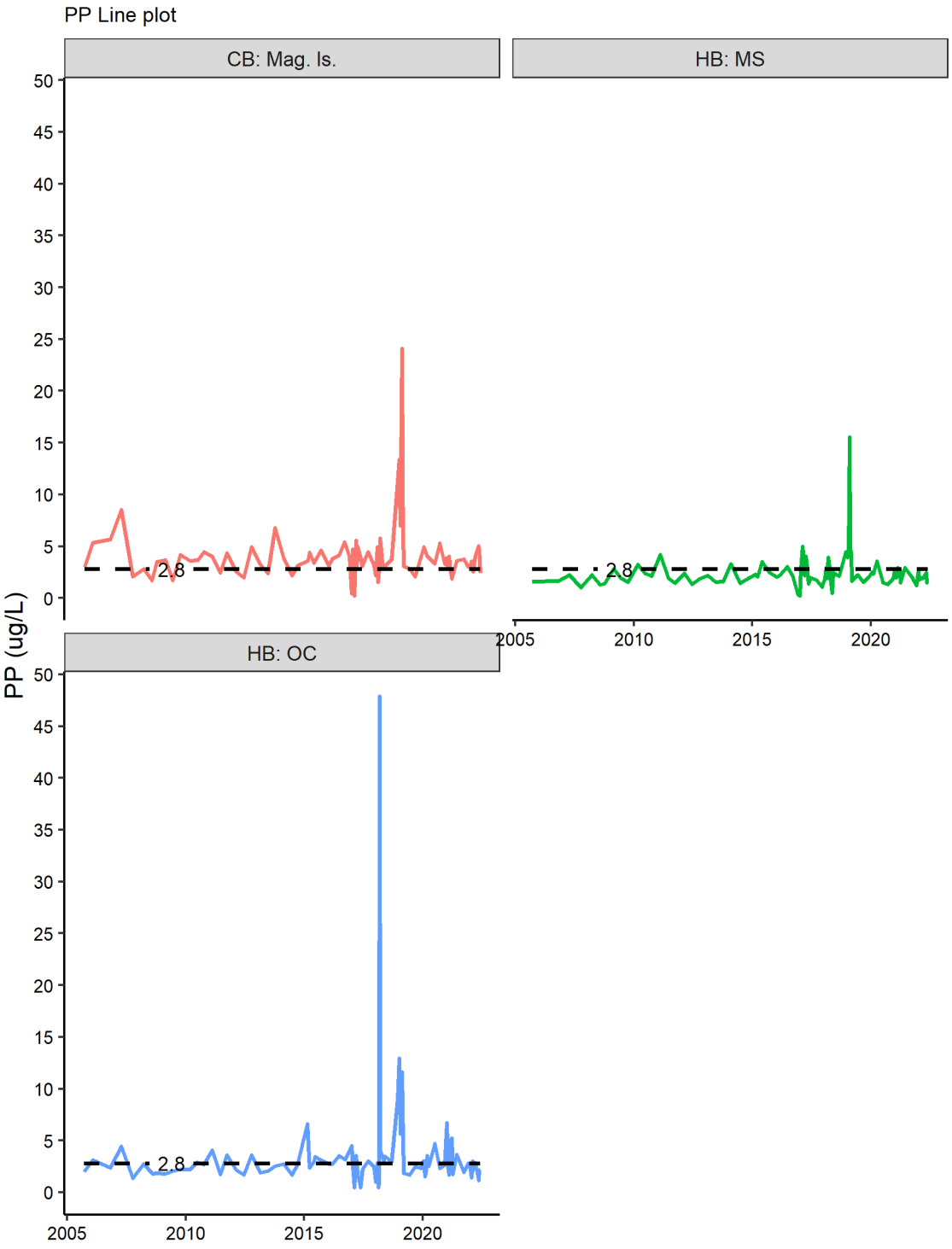

Figure 76. Dry Tropics inshore marine water quality line plots: PP. The dashed line indicates water quality guidelines.

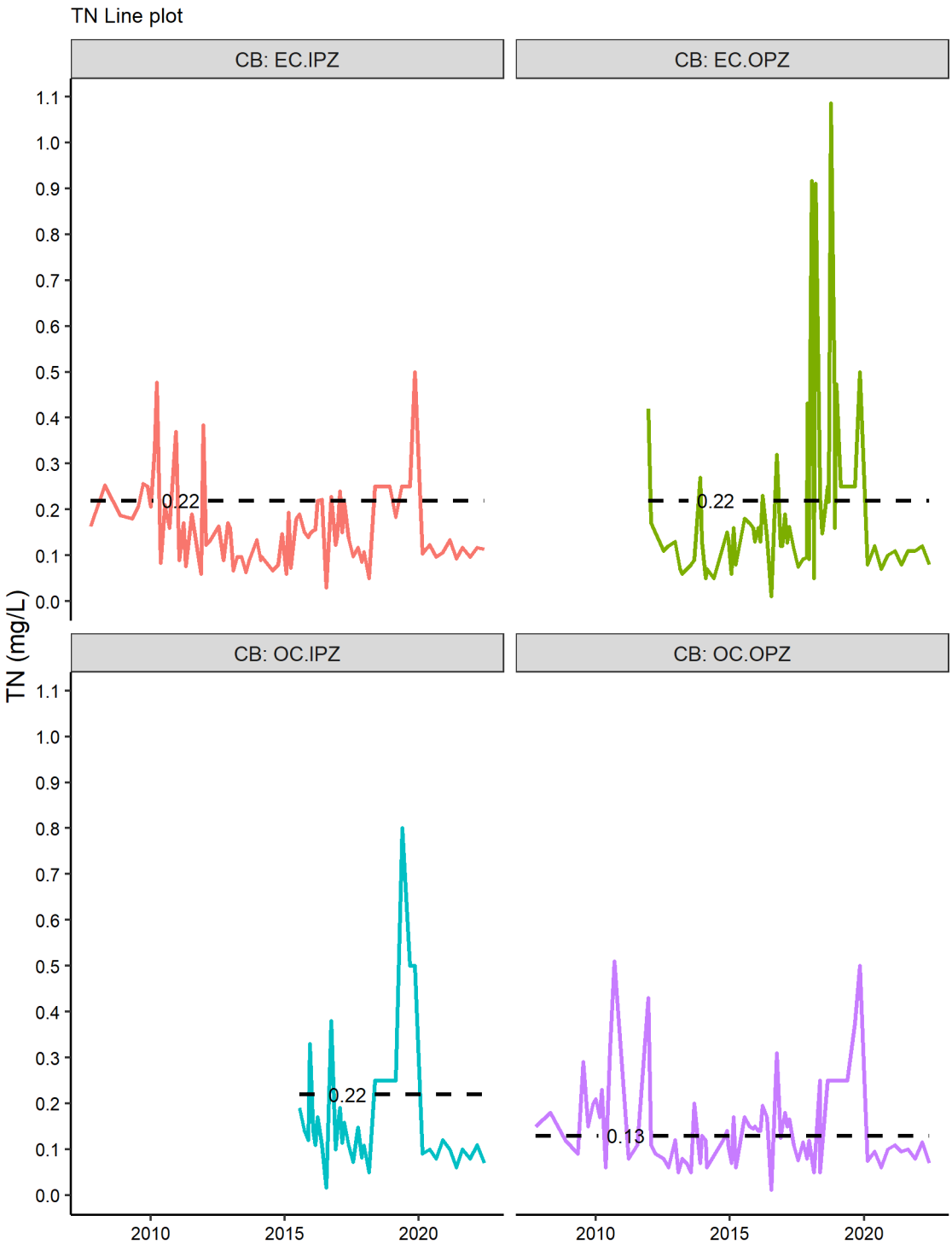

Figure 77. Dry Tropics inshore marine water quality line plots: TN. The dashed line indicates water quality guidelines.

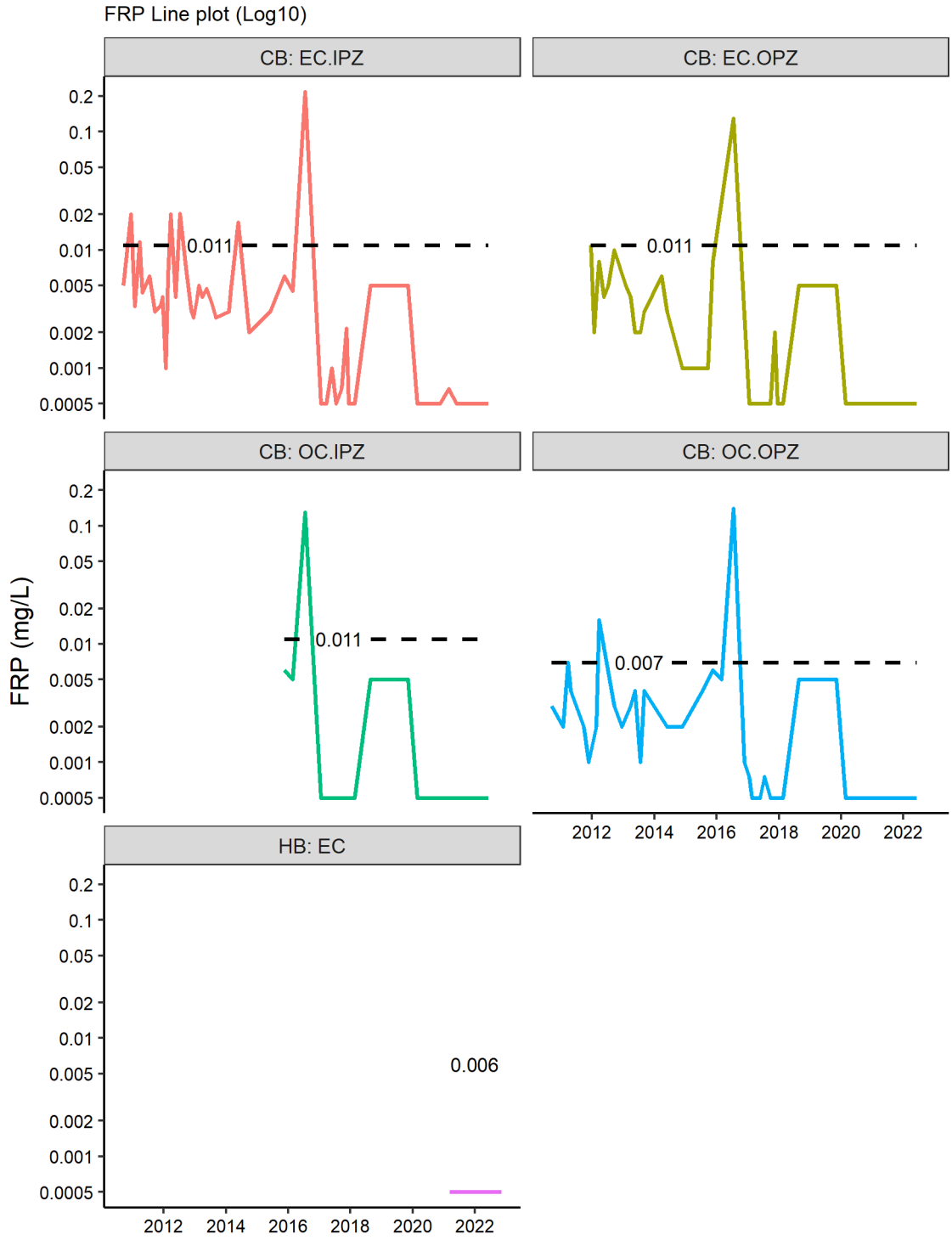

Figure 78. Dry Tropics inshore marine water quality line plots: FRP. The dashed line indicates water quality guidelines.

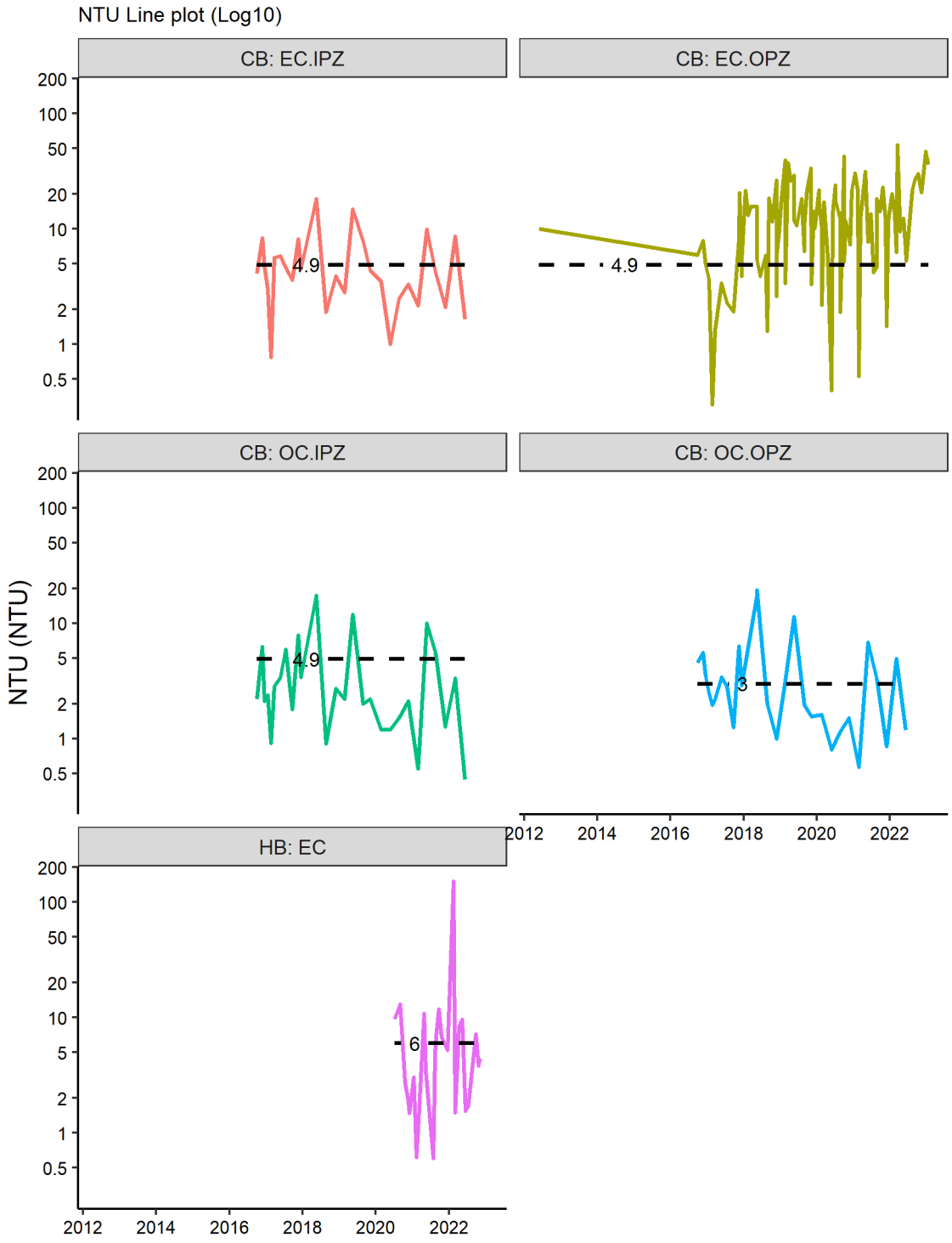

Figure 79. Dry Tropics inshore marine water quality line plots: NTU. The dashed line indicates water quality guidelines.

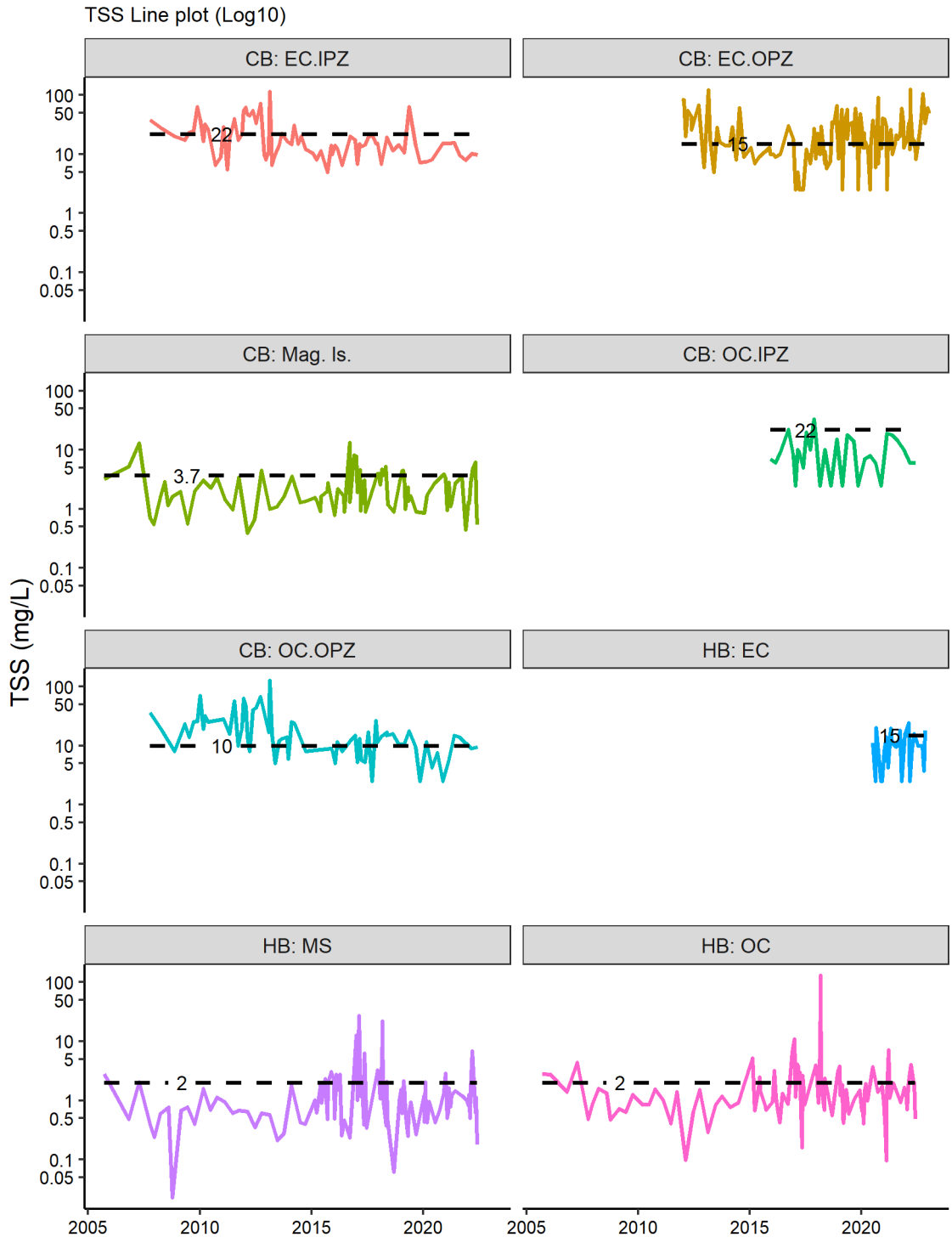

Figure 80. Dry Tropics inshore marine water quality line plots: TSS. The dashed line indicates water quality guidelines.

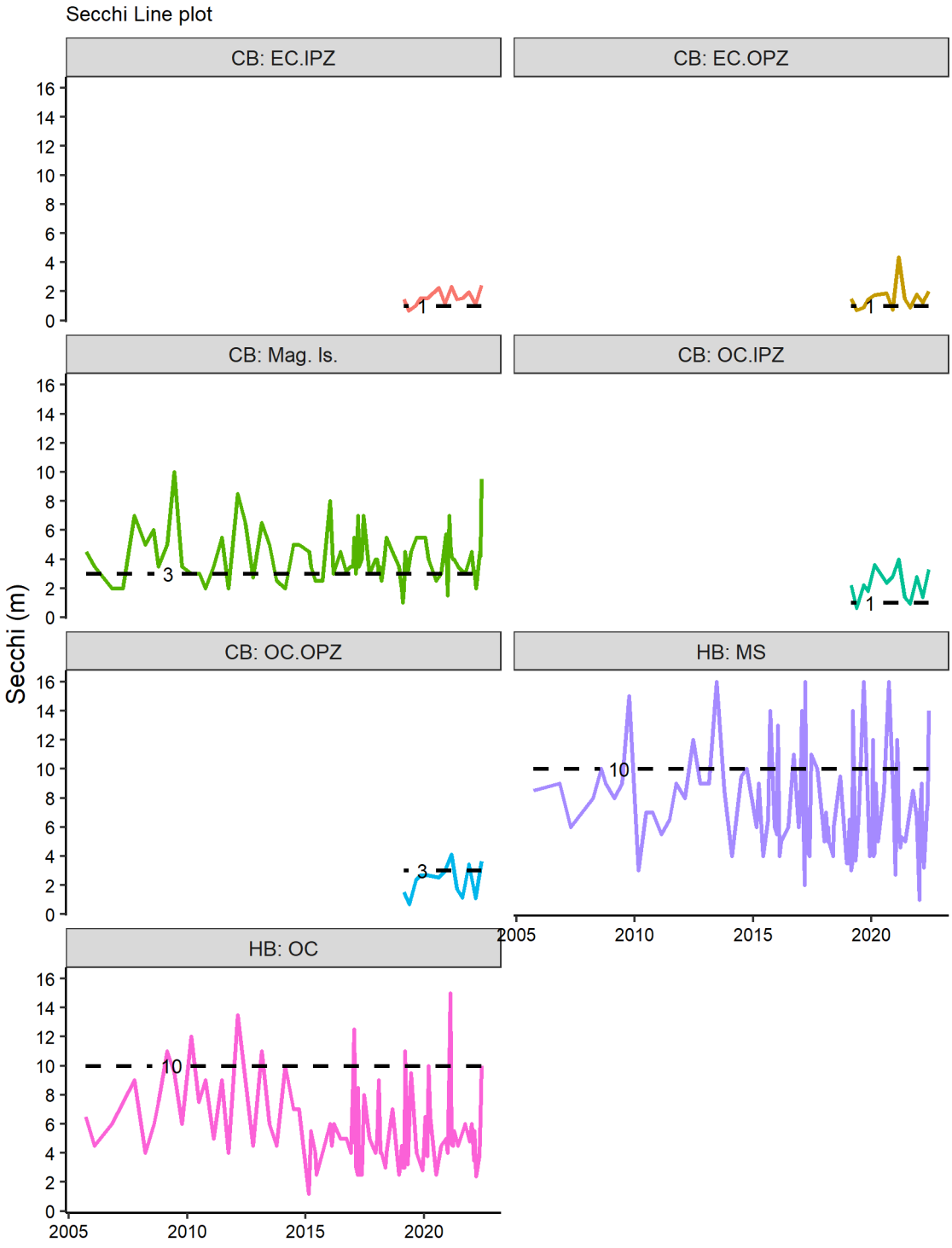

Figure 81. Dry Tropics inshore marine water quality line plots: Secchi. The dashed line indicates water quality guidelines.

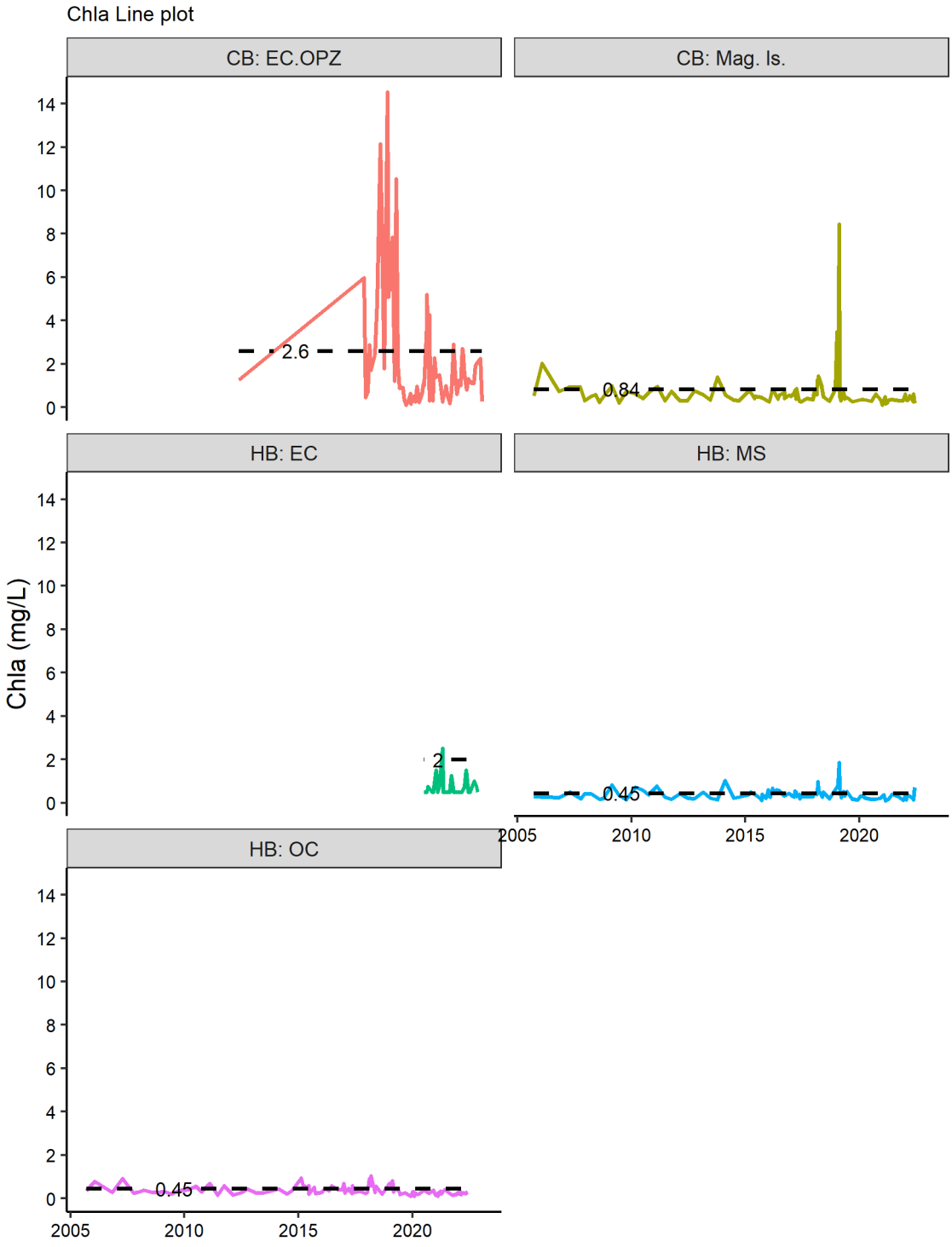

Figure 82. Dry Tropics inshore marine water quality line plots: Chla. The dashed line indicates water quality guidelines.

Appendix YY. Inshore Marine Water Quality Special Analysis of NOx in Cleveland Bay

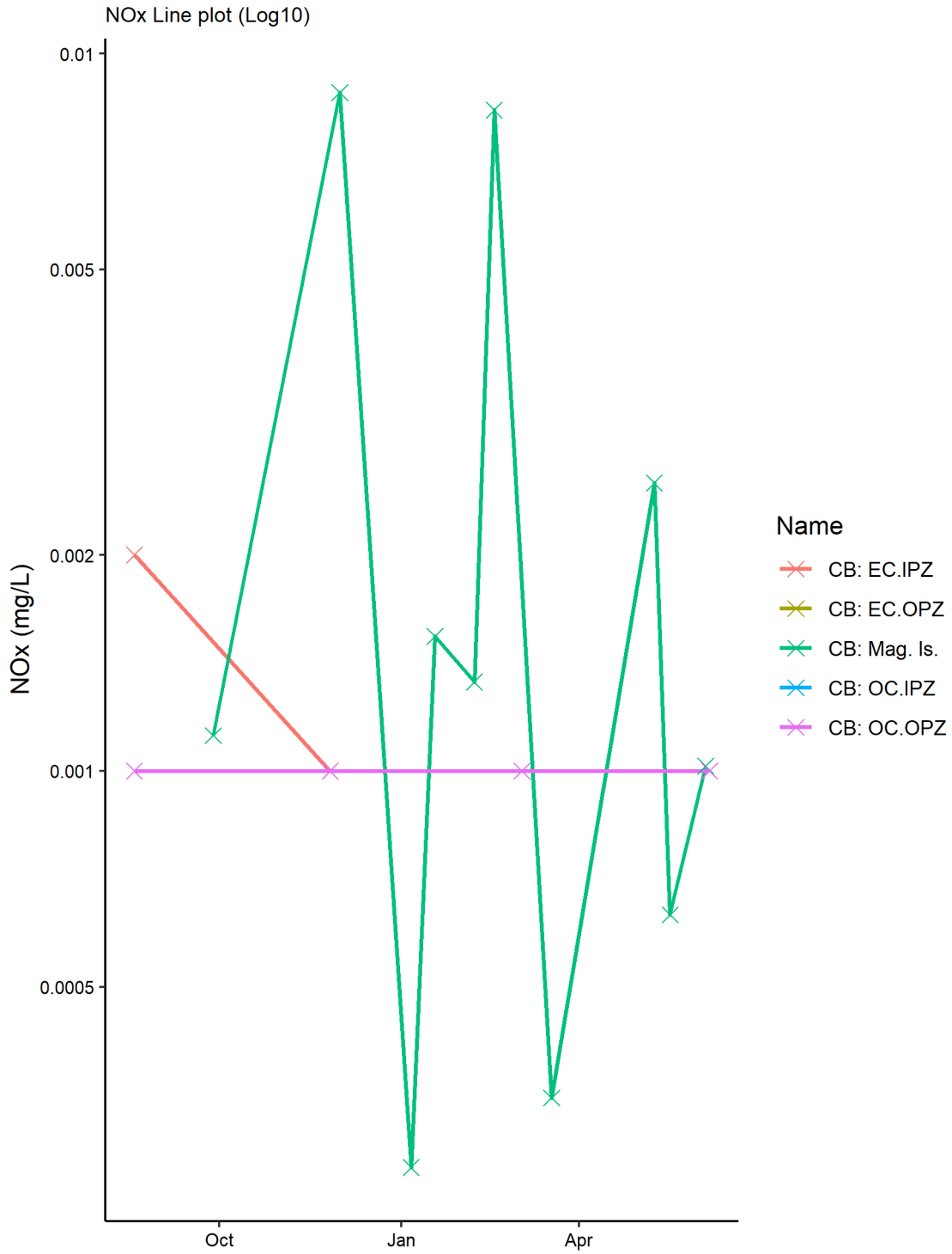

Figure 83. Dry Tropics inshore marine water quality special analysis line plot of NOx in Cleveland Bay for the 2021-2022 reporting year. Crosses mark specific times a sample was collected.

Appendix ZZ. Inshore Marine Water Quality Special Analysis of NOx in Halifax Bay

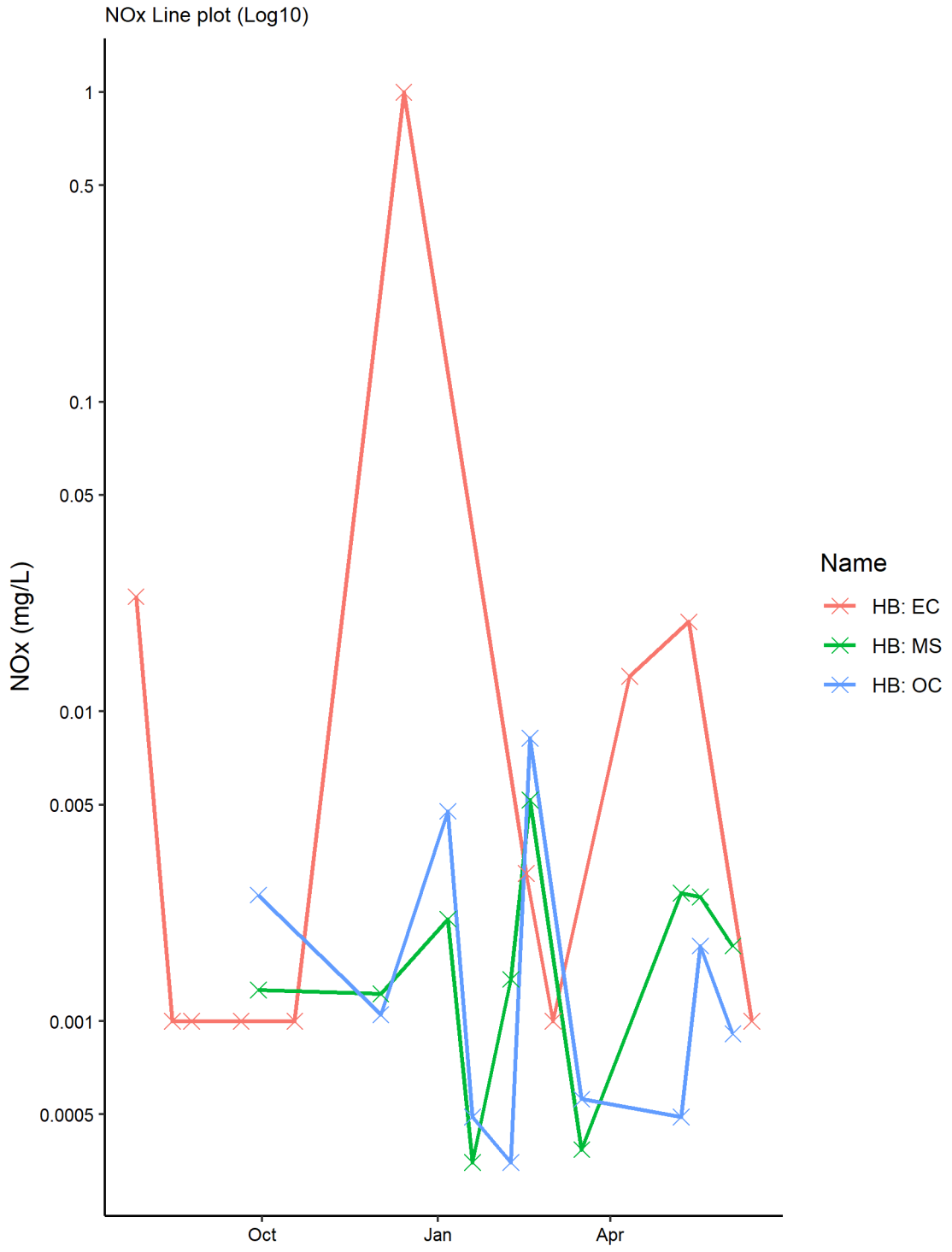

Figure 84. Dry Tropics inshore marine water quality special analysis line plot of NOx in Halifax Bay for the 2021-2022 reporting year. Crosses mark specific times a sample was collected.

Appendix AAA. Inshore Marine Water Quality Special Analysis of Turbidity in Cleveland Bay

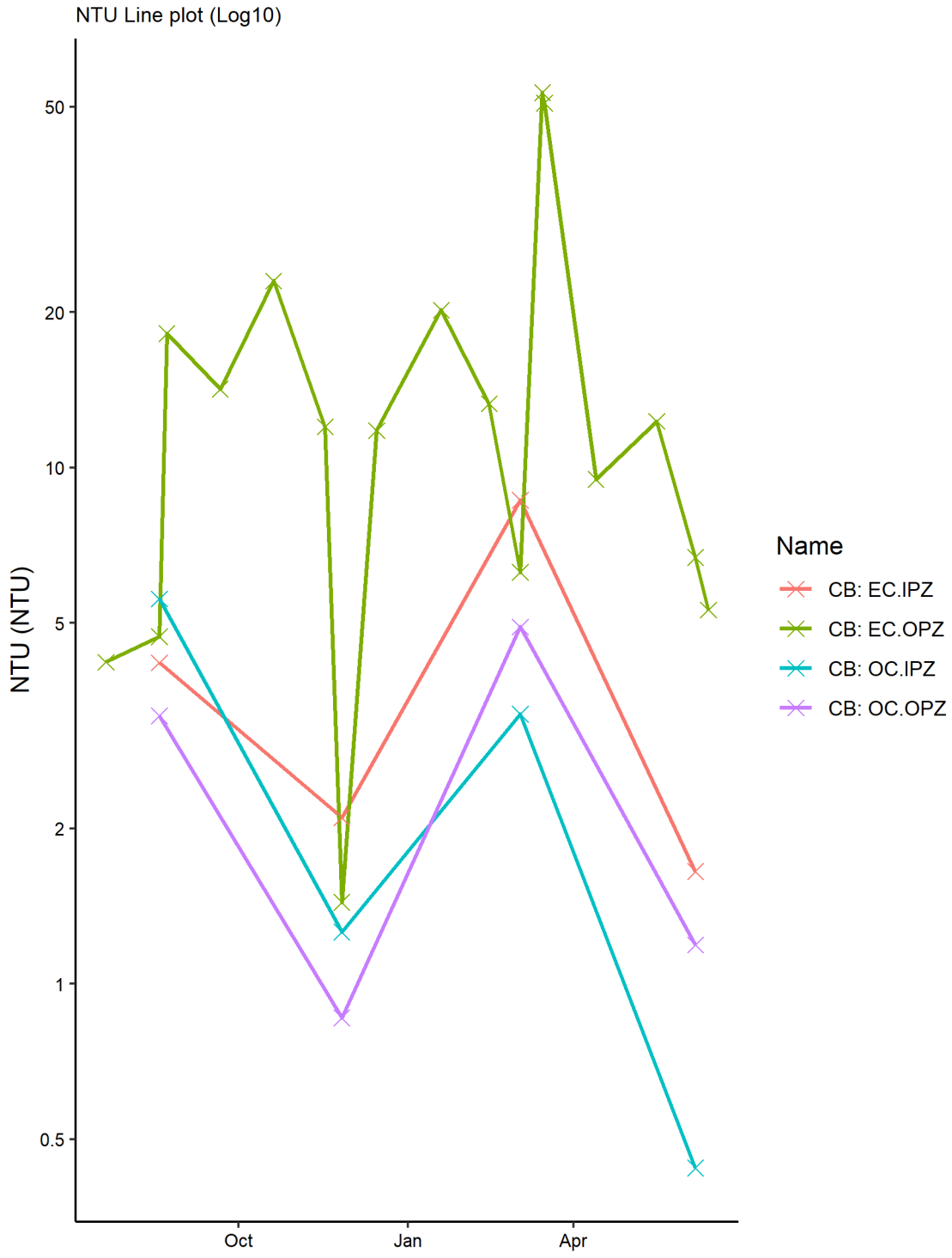

Figure 85. Dry Tropics inshore marine water quality special analysis line plot of Turbidity in Cleveland Bay for the 2021-2022 reporting year. Crosses mark specific times a sample was collected.

Appendix BBB. Inshore Marine Water Quality Special Analysis of TSS in Cleveland Bay

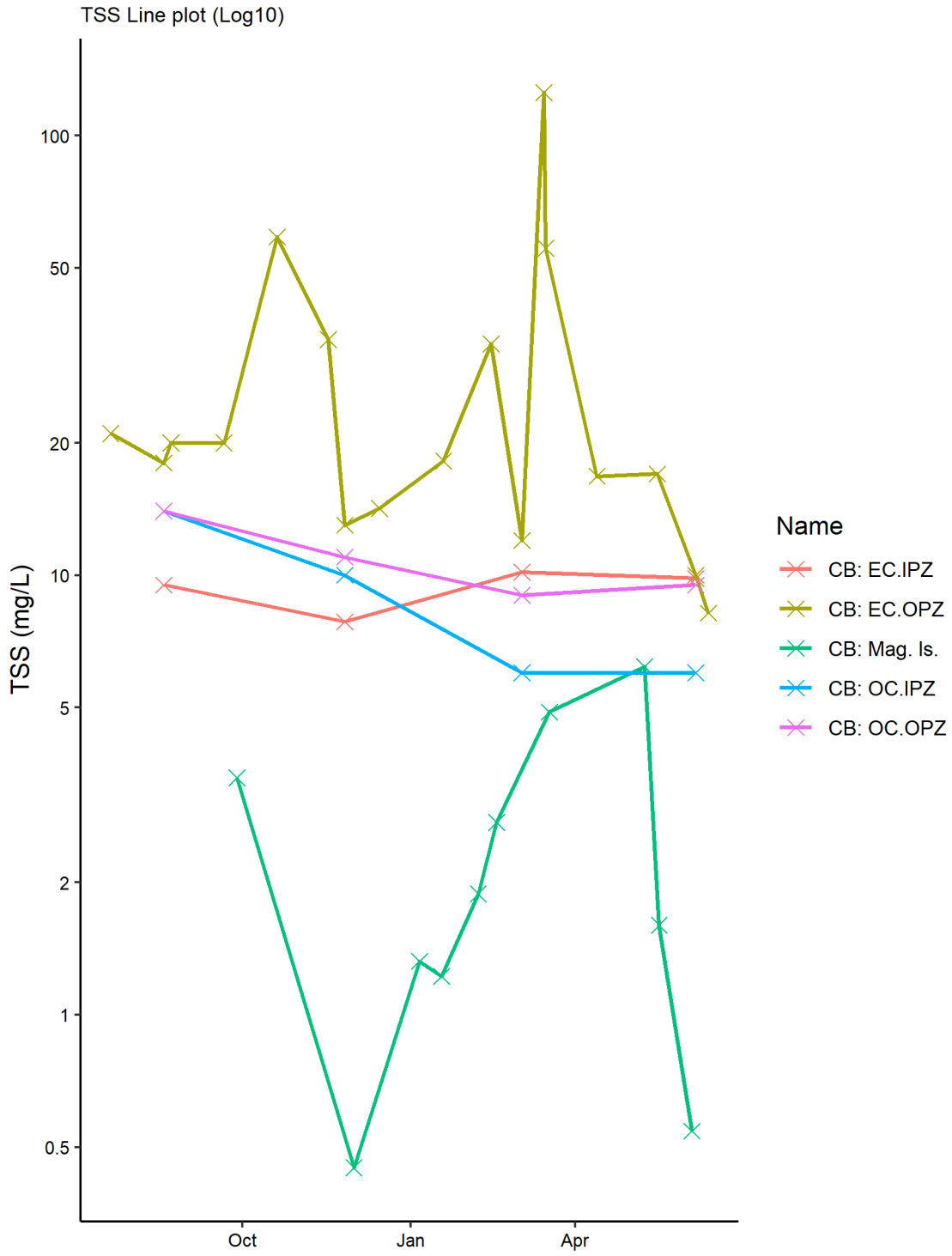

Figure 86. Dry Tropics inshore marine water quality special analysis line plot of TSS in Cleveland Bay for the 2021-2022 reporting year. Crosses mark specific times a sample was collected.

Appendix CCC. Inshore Marine Water Quality Special Analysis of Secchi in Cleveland Bay

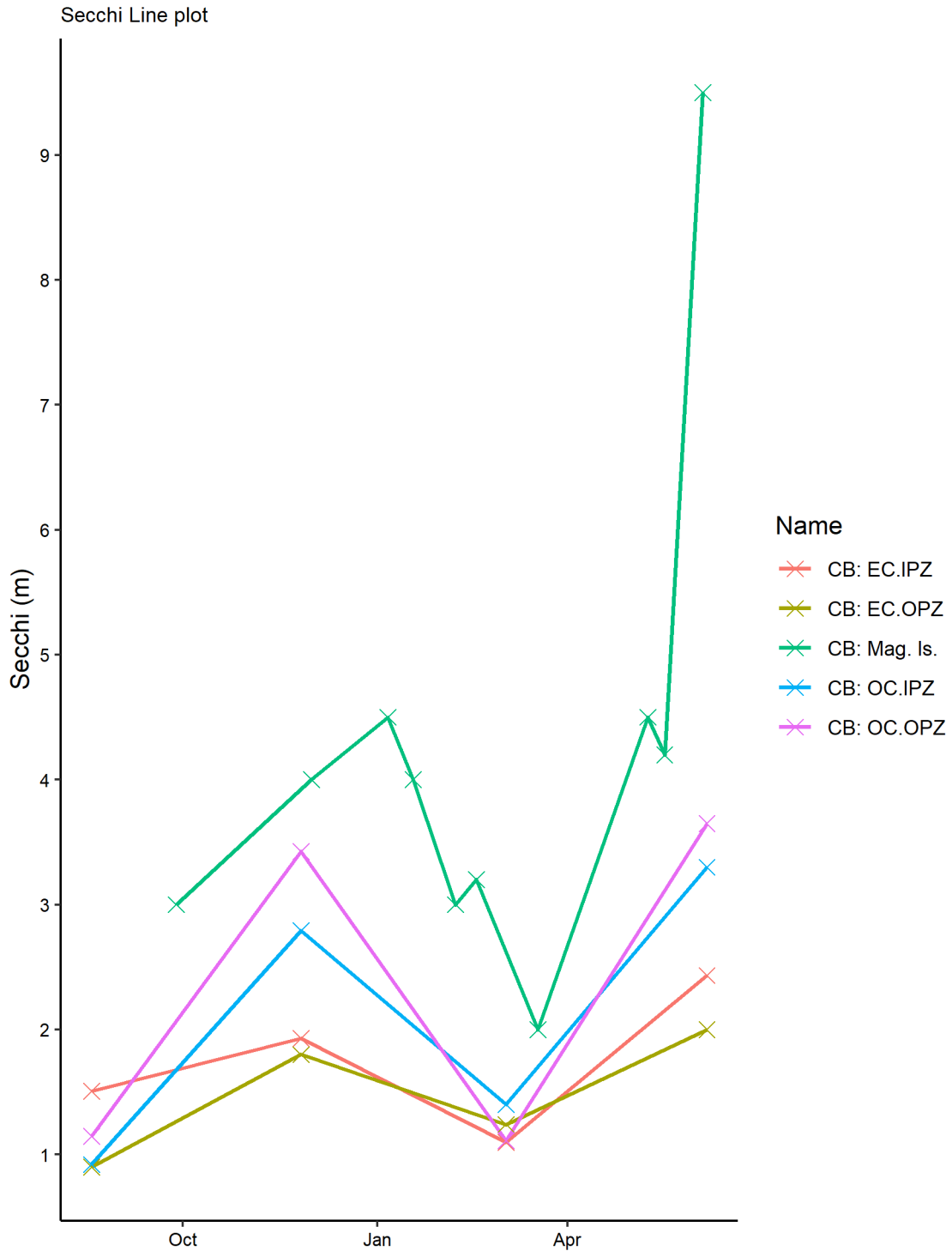

Figure 87. Dry Tropics inshore marine water quality special analysis line plot of Secchi in Cleveland Bay for the 2021-2022 reporting year. Crosses mark specific times a sample was collected.

Appendix DDD. Comparison of Dry Tropics and Wet Tropics Site Overlaps

Table 113. Comparison of Dry Tropics and Wet Tropics site overlaps. Note that the difference occurs in the averaging of sub zones for the Wet Tropics technical report. Red boxes highlight values that have changed.

Region	Zone	Sub Zone	Code/Site	NOx	PN	PP	Nutrients	Mean Nutrients	Score
Wet Tropics	Palm	NA	21	0.09	-0.27	0.57	0.13	0.03	61
			19	-0.08	-0.48	0.35	-0.07		
Dry Tropics	Halifax Bay (without Enclosed Coastal)	Midshelf	21	0.09	-0.27	0.57	0.13	NA	66
		Open Coastal	19	-0.08	-0.48	0.35	-0.07		57

Appendix EEE. Inshore Marine Water Quality Nutrients Results including FRP and TN

Table 114. Scores for the nutrient indicator category in the Dry Tropics Inshore Marine Environment. Including FRP and TP. Red boxes highlight values that have changed.

Zone	Sub Zone	Area	NOx	PN	PP	TP	TN	FRP	Nutrients Area	Nutrients Sub Zone	Nutrients Zone
Cleveland Bay	Enclosed Coastal Waters	Inside Port Zone	100 (A)	NA	NA	100 (A)	100 (A)	100 (A)	100 (A)	100 (A)	83 (A)
		Outside Port Zone	100 (A)	NA	NA	100 (A)	100 (A)	100 (A)	100 (A)		
	Open Coastal Waters	Inside Port Zone	100 (A)	NA	NA	100 (A)	100 (A)	100 (A)	100 (A)	98 (A)	
		Outside Port Zone	100 (A)	NA	NA	100 (A)	81 (A)	100 (A)	95 (A)		
	Magnetic Island	Magnetic Island	0 (E)	15 (E)	40 (D)	NA	NA	100 (A)		44 (C)	
Halifax Bay	Enclosed Coastal Waters	E.C.W	0 (E)	NA	NA	100 (A)	NA	100 (A)		74 (B)	72 (B)
	Open Coastal Waters	O.C.W	57 (C)	32 (D)	75 (B)	NA	NA	96 (A)		68 (B)	
	Midshelf	Midshelf	64 (B)	45 (C)	83 (A)	NA	NA	96 (A)		74 (B)	

Table 115. Scores for the nutrient indicator category in the Dry Tropics Inshore Marine Environment. NOT including FRP and TP.

Zone	Sub Zone	Area	NOx	PN	PP	TP	TN[34]	FRP[35]	Nutrients Area	Nutrients Sub Zone	Nutrients Zone
Cleveland Bay	Enclosed Coastal Waters	Inside Port Zone	100 (A)	NA	NA	100 (A)	100 (A)	100 (A)	100 (A)	100 (A)	78 (B)
		Outside Port Zone	100 (A)	NA	NA	100 (A)	100 (A)	100 (A)	100 (A)		
	Open Coastal Waters	Inside Port Zone	100 (A)	NA	NA	100 (A)	100 (A)	100 (A)	100 (A)	100 (A)	
		Outside Port Zone	100 (A)	NA	NA	100 (A)	81 (A)	100 (A)	100 (A)		
	Magnetic Island	Magnetic Island	0 (E)	15 (E)	40 (D)	NA	NA	100 (A)		18 (E)	
Halifax Bay	Enclosed Coastal Waters	E.C.W	0 (E)	NA	NA	100 (A)	NA	100 (A)		61 (B)	61 (B)
	Open Coastal Waters	O.C.W	57 (C)	32 (D)	75 (B)	NA	NA	96 (A)		57 (C)	
	Midshelf	Midshelf	64 (B)	45 (C)	83 (A)	NA	NA	96 (A)		66 (B)	

[34] TN is included only as an indicator. TN is not aggregated within the nutrient indicator category.

[35] FRP is included only as an indicator. FRP is not aggregated within the nutrient indicator category.

Appendix FFF.Inshore Marine Coral Sampling Locations

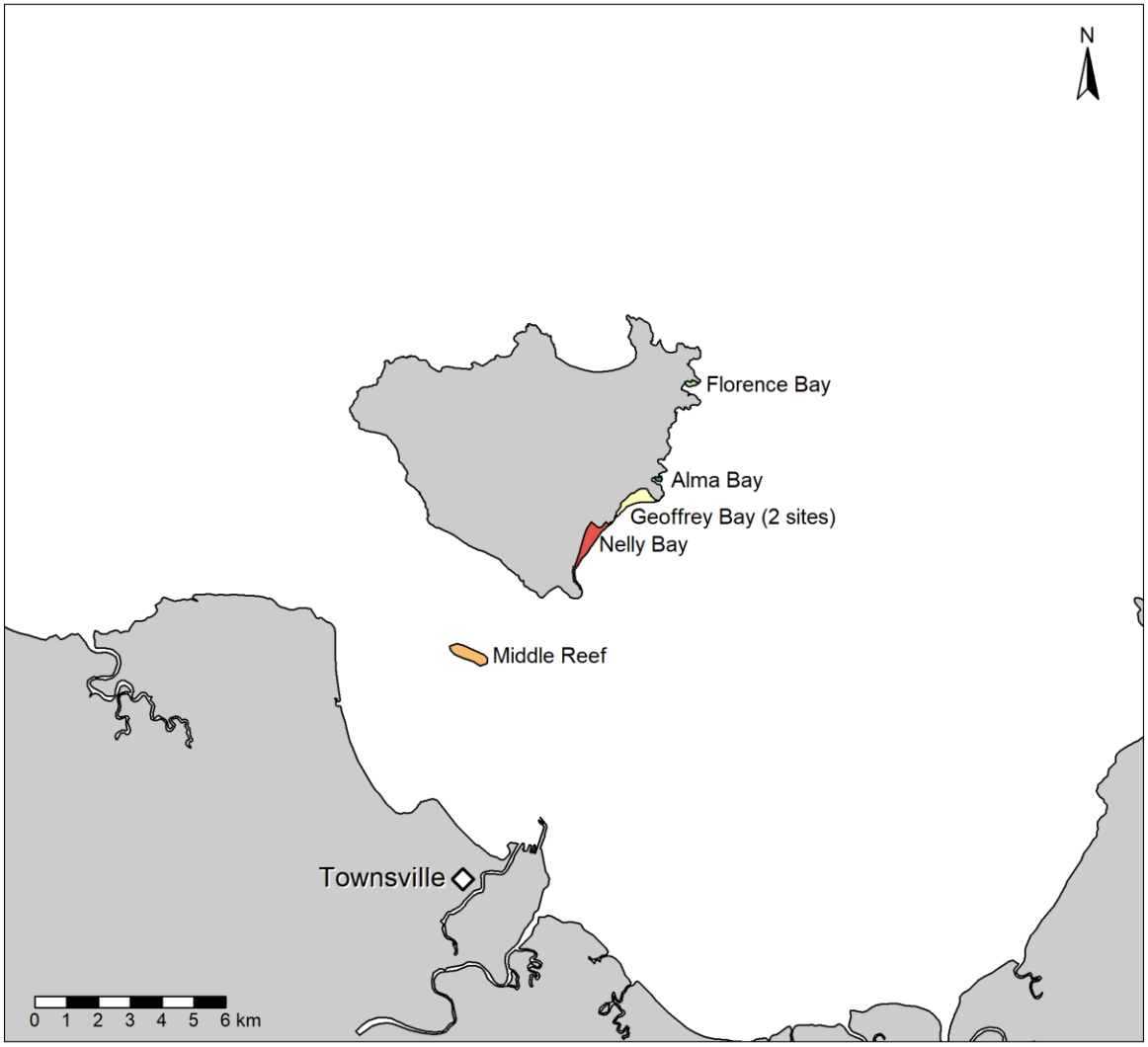

Figure 88. Coral reef sampling locations in the Cleveland Bay Inshore marine zone.

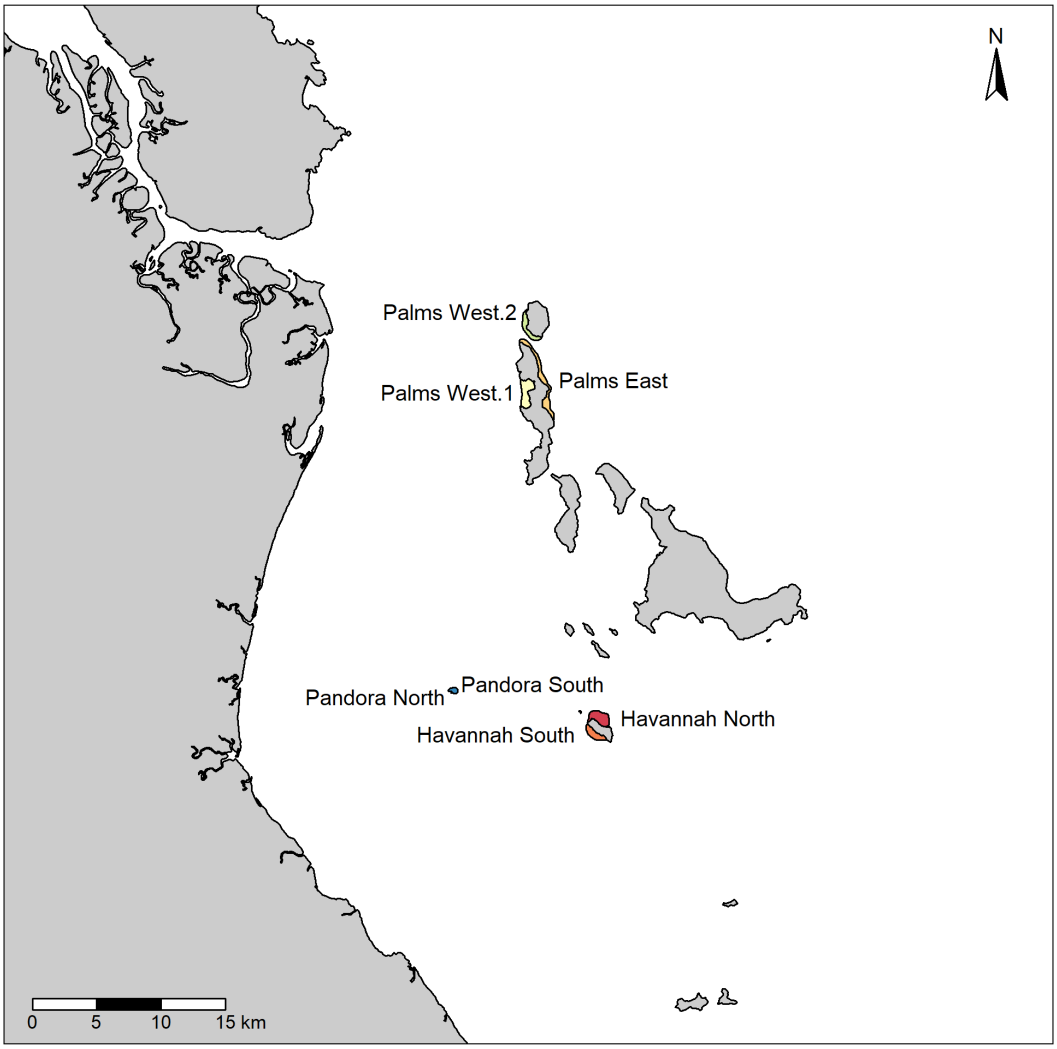

Figure 89. Coral reef sampling locations in the Halifax Bay Inshore marine zone.

Appendix GGG. Inshore Marine Coral Historic Scores

Table 116. Inshore Marine Environment coral indicator category scores for previous technical report. After back calculation. Red boxes highlight values that have changed.

Zone	Coral Standardised Score		
	2020–2021	2019–2020	2018–2019
Cleveland Bay	36 (D)	44 (C)	38 (D)
Halifax Bay	48 (C)	50 (C)	52 (C)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100.

Table 117. Inshore Marine Environment coral indicator category scores for current and previous technical reports. Prior to back calculations

Zone	Coral Standardised Score		
	2020–2021	2019–2020	2018–2019
Cleveland Bay	36 (D)	44 (C)	38 (D)
Halifax Bay	49 (C)	52 (C)	52 (C)

Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100.

Appendix HHH. Inshore Marine Seagrass Meadow Locations

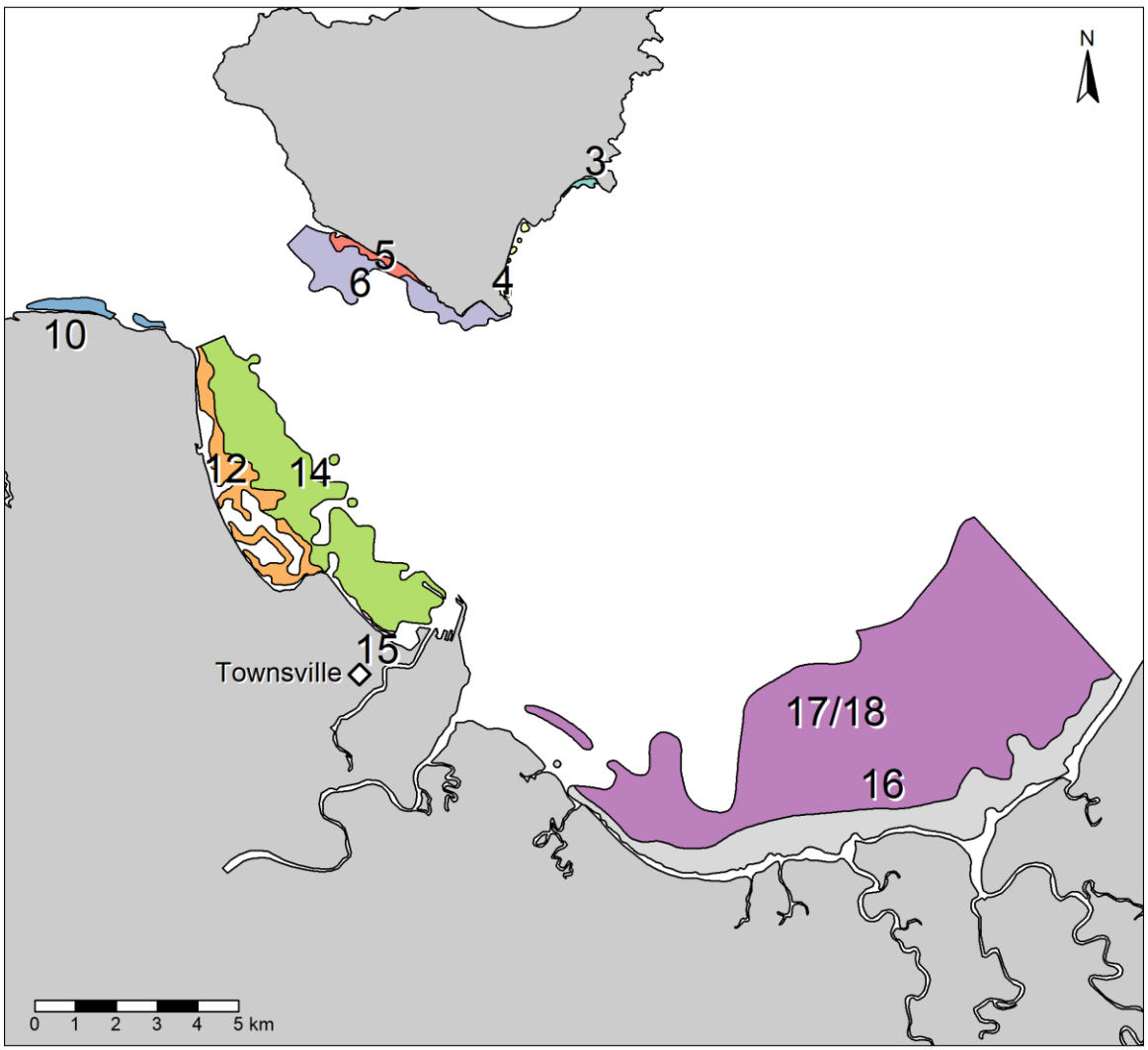

Figure 90. Seagrass meadow sampled for the LTSMP assessment.

Appendix III. Offshore Marine Coral Sampling Locations

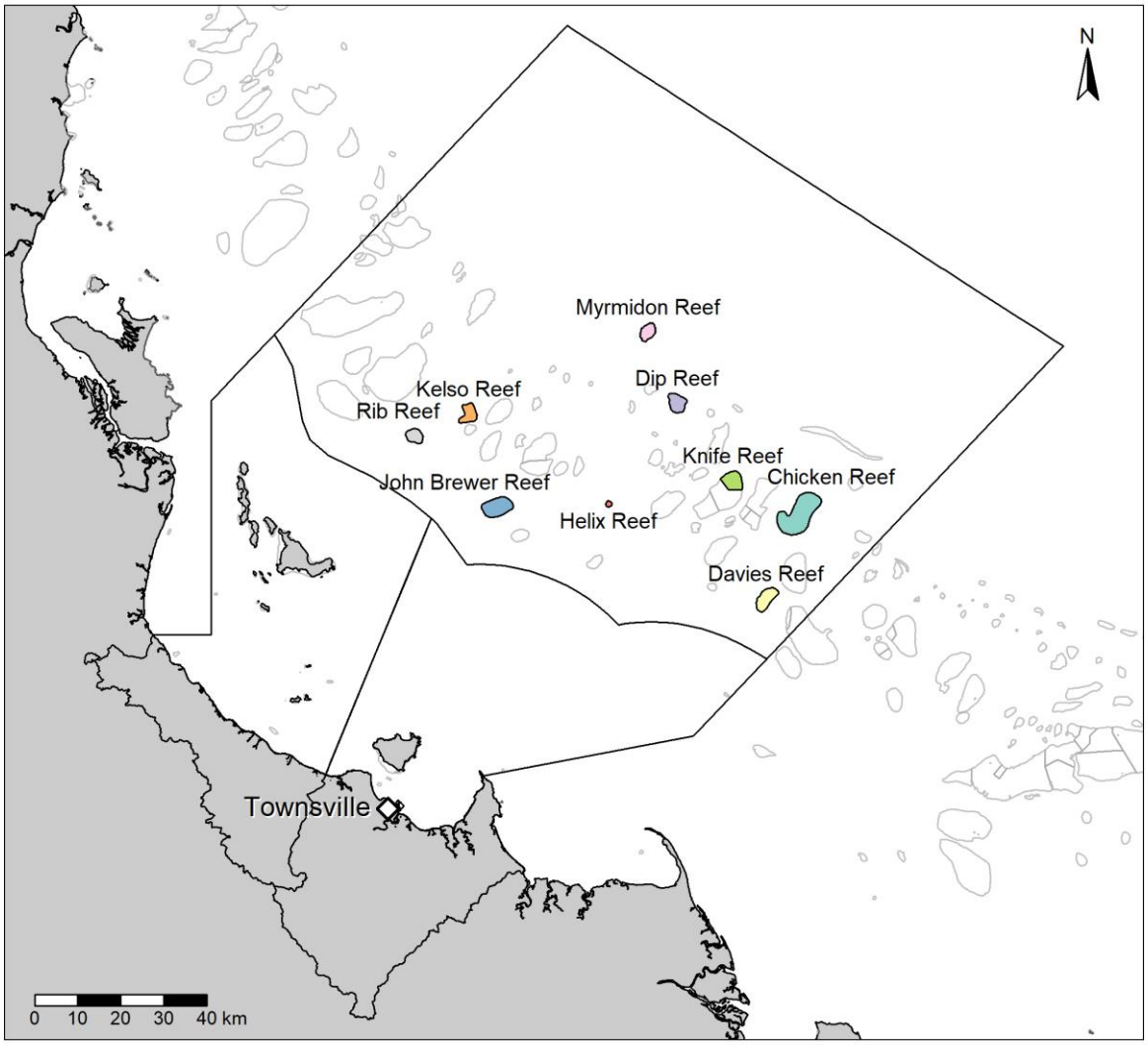

Figure 91. Offshore marine coral sampling locations in the Dry Tropics region.

Appendix JJJ. Offshore Marine Coral Historic Scores

Table 118. Standardised score for the Offshore Marine Zone habitat index. After back calculation. Red boxes highlight values that have changed.

Zone	Habitat Index		
	2020–2021	2019–2020	2018–2019
Offshore Marine	62 (B)	54 (C)	59 (C)

Coral Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100.

Table 119. Standardised score for the Offshore Marine Zone habitat index. Prior to back calculations

Zone	Habitat Index		
	2020–2021	2019–2020	2018–2019
Offshore Marine	62 (B)	56 (C)	59 (C)

Coral Standardised scoring range: ■ = Very Poor: 0 to <21 | ■ = Poor: 21 to <41 | ■ = Moderate: 41 to <61 | ■ = Good: 61 to <81 | ■ = Very Good: 81 to 100.

Appendix KKK. Report Change Log

The table below lists section number, page and paragraph number, and summary of updates for the 2021–2022 technical report to assist reviewers.

Section	Page Number	Details
1. General		
1.1 Authorship Statement	p. ii	Dates.
1.2 Current DTPHW Members	Table 1. p. ii	Update member details
1.3 Acknowledgements	p. ii	More detailed acknowledgements
2. Executive Summary	p. iii	Dates. Climate" changed to "Climate and Land Use".
2.1 The Dry Tropics Partnership	Table 2 Figure 1 Table 3 p. iii – iv	Partnership summary refined: Text updated. New tables (table 2 and table 3). New Map (Figure 1).
2.2 Climate and Land Use (Previously Climate)	p. v	"Climate" changed to "Climate and Land Use". Updates to each driver/factor (e.g., amount of rainfall).
2.3 State and Condition of the Environment	Table 4 p. v	Dates. New table to summarise indices and zones
2.3.1 to 2.3.5 (Executive Summary of each section of results)	p. vii – ix	All dates, results, and key messages updated (excluding repeat data e.g., the Fish index).
4. Glossary of Terms	P xiii	Definitions updated.
7. Introduction		Dates. Partnership summary refined (new map, text changed to tables).
7.1 Overview	p. 1	Dates
7.2 Report Card Zones	Table 11. Figure 2 p.1 – 2	Partnership summary refined: Text updated. New table (table 1). New Map (Figure 2).
7.3 Purpose of This Document	p. 2	Dates
8 Methods		
8.2 Scoring	p. 3	Minor text clarification
8.3 Presentation	Figure 3. p. 4	Additional Coastal added to figure 3
9 Climate and Land use (Previously Climate) 9.1, 9.2, 9.2.1 – 9.2.4, 9.3	p. 7 – 16 Tables 16 – 22	Entire section rewritten; everything new. Urban environment Rainfall

Section	Page Number	Details
	Figures 4 – 8 Appendix B – G	Air Temperature Sea Surface Temperature Coral Bleaching
10. Freshwater Basin	p. 18 – 24	Text clarification and date changes Freshwater basins mapped including sub basins.
10.1 Freshwater Water Quality	p. 18 – 24	Sample locations map moved to appendix. Introduction of the sub basin aggregation, has no impact on weighted scores at basin level. Tables updated to include sub basin. Detailed table (watercourse level) of indicator category to overall water quality removed. Historical comparison provided in appendix.
10.2 Habitat and Hydrology	p. 25	Text clarifications Wetland Extent specified as its own indicator category
10.2.1.1 Freshwater Riparian Extent Monitoring Sites	p. 25 Appendix L.	Data sources provided. New figure created (placed in Appendix L.)
10.2.1.2 Results Freshwater Riparian Extent	Table 27. p. 25 – 26	Text clarification: context for additional years of data New Table with additional data (Table 27).
10.2.2 Freshwater Wetland Extent	p. 26	Text update acknowledging changes to assessed area. Notes the inclusion of back calculations.
10.2.2.1 Freshwater Wetland Extent Monitoring Sites	p. 26 Appendix P.	Text update acknowledging changes to assessed area. New figure created (placed in Appendix P.)
10.2.2.2 Results Freshwater Wetland Extent	Table 29 – 30 p. 26 – 27	Text clarification: context for additional years of data New Table with additional data (Table 29). The wetland extent indicator category now has its own indicator category table (table 30)
10.2.2.3 Change to Assessed Area	p. 27 Appendix S.	<u>New section</u> Dedicated sub section to explore the impact of changes to the assessed area
10.2.3 Artificial Barriers		
10.2.3.1 Monitoring Sites	p. 27 – 28 Appendix R.	Text updated to provide data sources. Text update acknowledging changes to assessed area. New figure created (placed in Appendix R.)
10.2.3.2 Results Impoundment Length	Table 31 p. 28	Minor changes to assessed area (no change to score)
10.2.3.2 Results Fish Barriers	p. 28	Text clarification: No changes

Section	Page Number	Details
10.2.4 Results Freshwater Habitat and Hydrology	p. 30	Text update to acknowledge changes to assessed area, distinction of Wetland Extent as its own indicator category, and back calculations
10.2.4.1 Change to Aggregation and Wetland Extent indicator	p. 30 Appendix T.	New section Dedicated sub section to explore the impact of separating Wetland Extent as its own indicator category
10.2.5 Confidence Scores	Table 36. p. 31.	Text updated to clarify derivation of confidence scores. Artificial Barriers Included in the same table (table 36).
10.3 Fish	p. 32	Text clarification. No changes to results
10.3.3. Confidence scores	p. 34	Text updated to clarify derivation of confidence scores.
11. Estuarine Environment	Figure 10. p. 36	New map created to provide overview of Estuarine Environment
11.1 Water Quality		
11.1.1 Monitoring Sites	Table 41. p. 37	New level of aggregation added “Sub Basin”, this has no impact on weighted scores at basin level (used for additional reporting context in separate documents).
11.1.2 Nutrients	p. 37 – 40	Results and discussion updated for the 2021–2022 report. Additional material moved to appendix
11.1.3 Physical Chemical Properties	p. 40 – 43	Results and discussion updated for the 2021–2022 report. Additional material moved to appendix
11.1.3 Final Results	p. 43	Results and discussion updated for the 2021–2022 report
11.2 Habitat	p. 45	Text clarifications providing data sources
11.2.1 Mangrove and Saltmarsh Extent	p. 45	Target vegetation types listed
11.2.1.1 Monitoring Sites	p. 45 Appendix HH.	New figure created (placed in Appendix HH.)
11.2.1.2 Results	Table 48 – 49 p. 26 – 27 Appendix JJ, KK	Text clarification: context for additional years of data New Table with additional data (Table 48). Results and discussion update for the 2021–2022 report (table 49). Additional graphs for historic data (place in Appendix JJ, KK)
11.2.2 Estuarine Riparian Extent	p. 46	New Indicator Category, all sections new

Section	Page Number	Details
11.2.2.1 Monitoring Sites	p. 46 Appendix II.	New figure created (placed in Appendix HH.)
11.2.2.2 Results	Table 50 – 51 p. 26 – 27 Appendix LL, MM	Entire section is new. Results and discussion update for the 2021–2022 report (table 51). Additional graphs for historic data (place in Appendix JJ, KK)
11.2.3 Final Results: Estuarine Habitat	Table 52. p. 47	Results and discussion updated for the 2021–2022 report (table 52). New indicator category added.
11.2.3.1 Back Calculated Scores	p. 47 – 48 Appendix NN	New section Dedicated sub section to explore the impact of introducing the new indicator category.
11.2.4 Confidence scores	p. 48	Text updated to clarify derivation of confidence scores.
12 Inshore Marine	Figure 11, p. 50	New map created to provide overview of inshore environment
12.1 Water Quality	p. 51.	Text note that acknowledges the separation of the Halifax open coastal and midshelf sub zones (acknowledgement will be removed post ISP).
12.1.1 Monitoring Sites	p. 51 Appendix PP, SS	New figure created (placed in Appendix PP and SS.)
12.1.2 Nutrients	p. 51 – 54	Results and discussion updated for the 2021–2022 report. Additional material moved to appendix
12.1.3 Physical Chemical Properties	p. 54 – 56	Results and discussion updated for the 2021–2022 report. Additional material moved to appendix
12.1.4 Chlorophyll a	p. 57	Results and discussion updated for the 2021–2022 report. Additional material moved to appendix
12.1 Final Result Inshore Water Quality	p. 57 – 58	Results and discussion updated for the 2021–2022 report. Additional material moved to appendix
12.1.5.1 Overlap with the Wet Tropics Report	p. 58. Appendix CCC	Dedicated sub section to acknowledge the overlap with the Wet Tropics Report and differences between each report
12.2 Habitat		
12.2.1 Coral		
12.2.1.1 Monitoring Sites	p. 59 Appendix EEE	New figure created (placed in Appendix EEE.)
12.2.1.2 Results	p. 60–61	Text clarification to acknowledge the original source of results discussion.

Section	Page Number	Details
		Source of data provided. Results and discussion updated for the 2021–2022 report.
12.2.1.3 Back Calculated Scores	p. 62 Appendix FFF	New section Dedicated sub section to acknowledge and explore the impact of changing coral sites (additional material in appendix FFF)
12.2.2 Seagrass		
12.2.2.1 Monitoring Sites	Table 63 p. 62 Appendix GGG	Table (63) updated and refined from previous version. New figure created (placed in Appendix GGG.)
12.2.2.2 Results	p. 62 – 64	Text clarification to acknowledge the original source of results discussion. Source of data provided. Results and discussion updated for the 2021–2022 report.
12.2.3 Final Results Inshore Habitat	p. 65	Results and discussion updated for the 2021–2022 report.
12.2.4 Confidence scores	p. 65	Text updated to clarify derivation of confidence scores. Coral maturity confidence score increased. Seagrass measured error confidence score increased. All overall sores increased.
13. Offshore Marine	Figure 12, p. 67	New map created to provide overview of offshore environment
13.1 Water Quality	p. 67 – 68	No updates to results or data. Text and table clarifications reflect this
13.2.2.1 Monitoring Sites	p. 68 Appendix HHH	Text updated to acknowledge the change in sampling sites New figure created (placed in Appendix HHH.)
13.2.1.2 Coral Results	p. 68–69	Results and discussion updated for the 2021–2022 report.
13.2.2 Overall results	p. 69	Results and discussion updated for the 2021–2022 report.
13.2.2.1 Back Calculated Scores	p. 69 – 70	New section Dedicated sub section to acknowledge and explore the impact of changing coral sites (additional material in appendix LLL)
13.2.3 Confidence scores	p. 70	Text updated to clarify derivation of confidence scores.

Section	Page Number	Details
		Coral measured error confidence score increased.
Litter	p. 72 – 75	Model updated with new data (~2012–2019). Separate model for each partnership region fit and highlighted different results in areas of overlap. Combined model for all partnership regions to be developed. Landuse category included in zone definition within model Land Sea Source Index (AMDI) included with results for further information.