HEALTHY WATERS PARTNERSHIP dry tropics

Townsville Dry Tropics
Waterways Report Card 2025

TECHNICAL REPORT

PART 8: References and Appendices

Reporting on data collected 2023 - 2024

JULY 2025 | Written by Adam Shand and Dinny Taylor,
Healthy Waters Partnership (HWP)

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Appendices 2023-2024

Written by Adam Shand and Dinny Taylor

As part of the results for the Townsville Dry Tropics Report Card 2025 (Reporting on data from July 2023– June 2024)

Healthy Waters Partnership for the Dry Tropics (HWP)

July 2025

9 Appendices

Appendix A. Ross Basin Long-Term Annual Rainfall Trends

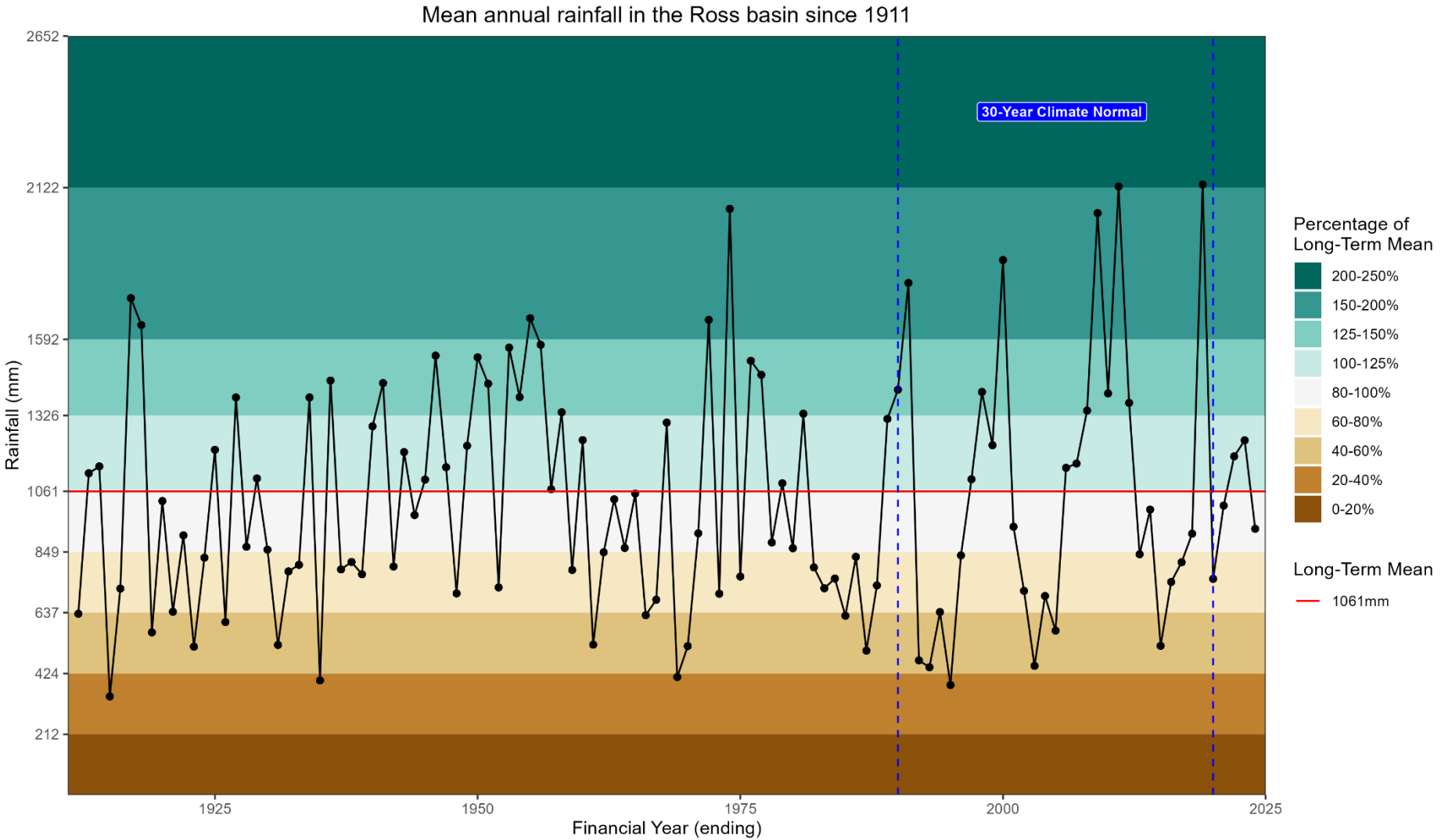

Figure 1. Ross Basin long-term annual rainfall trends.

Appendix B. Black Basin Long-Term Annual Rainfall Trends

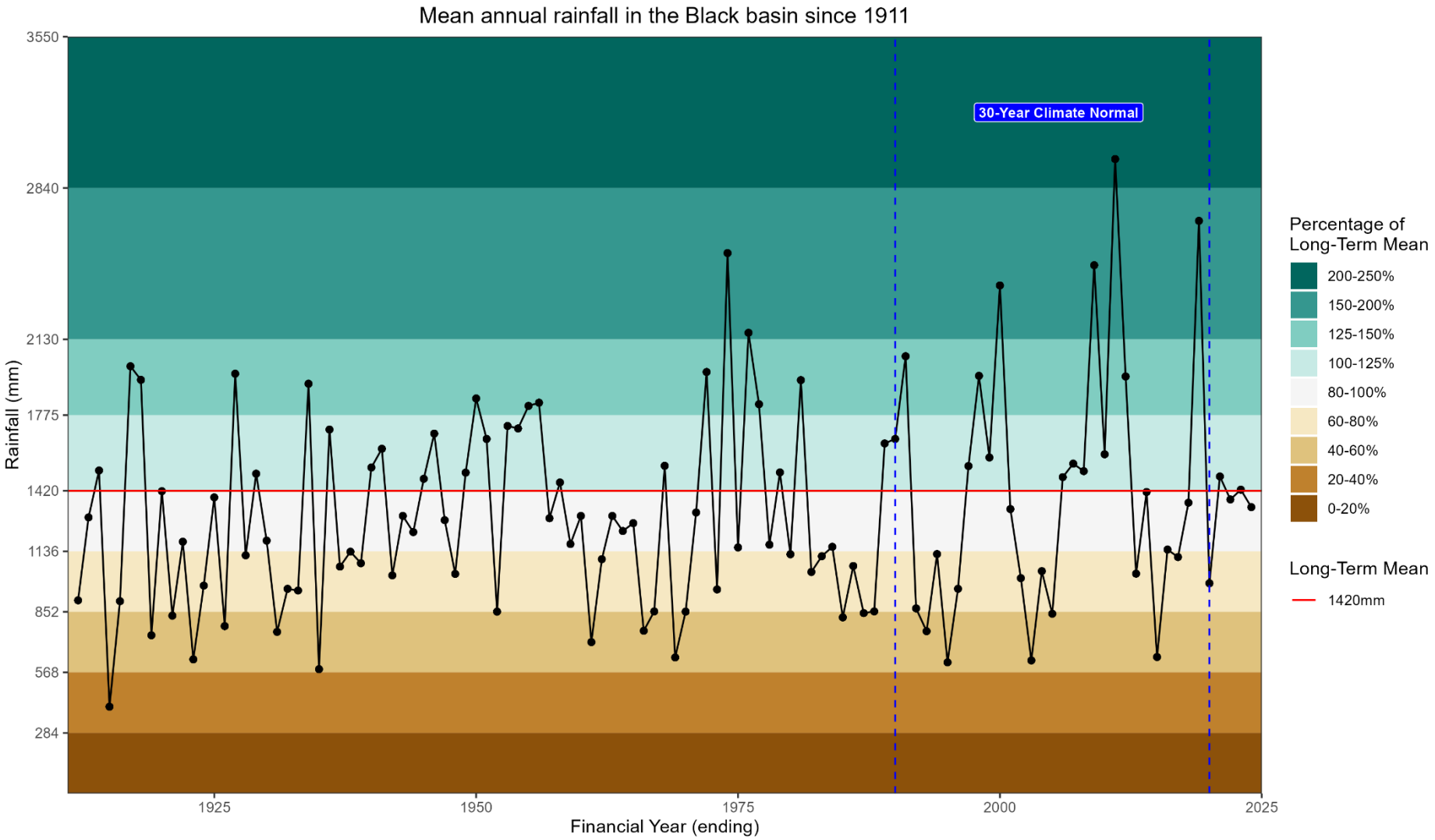

Figure 2. Black Basin long-term annual rainfall trends.

Appendix C. Season-specific Annual Rainfall Trends for the Ross and Black Basins

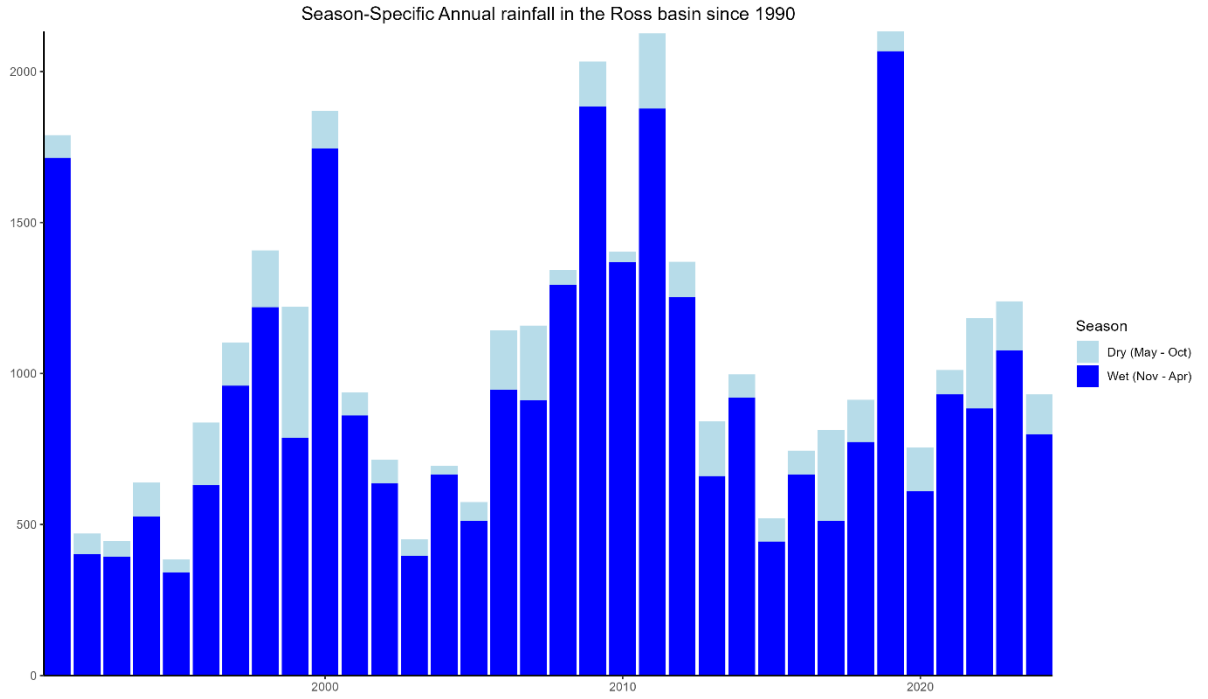

Figure 4. Season-specific annual rainfall in the Ross Basin since 1990.

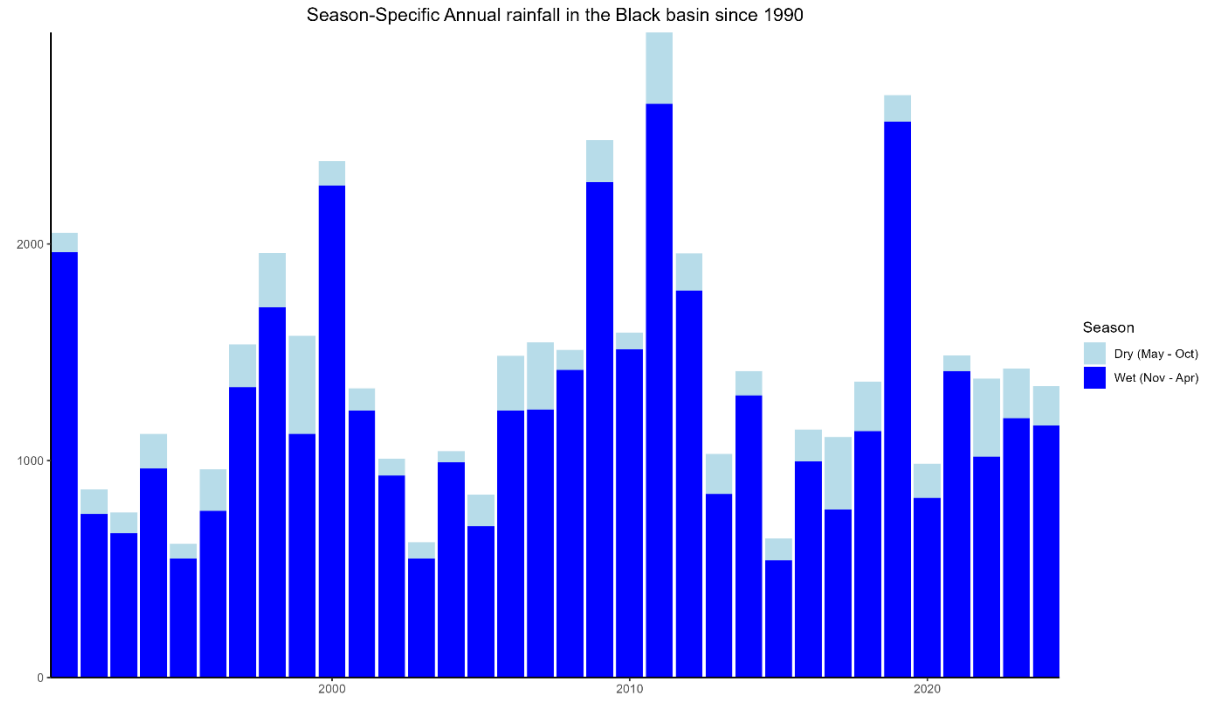

Figure 3. Season-specific annual rainfall in the Black Basin since 1990.

Appendix D. Ross Basin Long-Term Annual Air Temperature

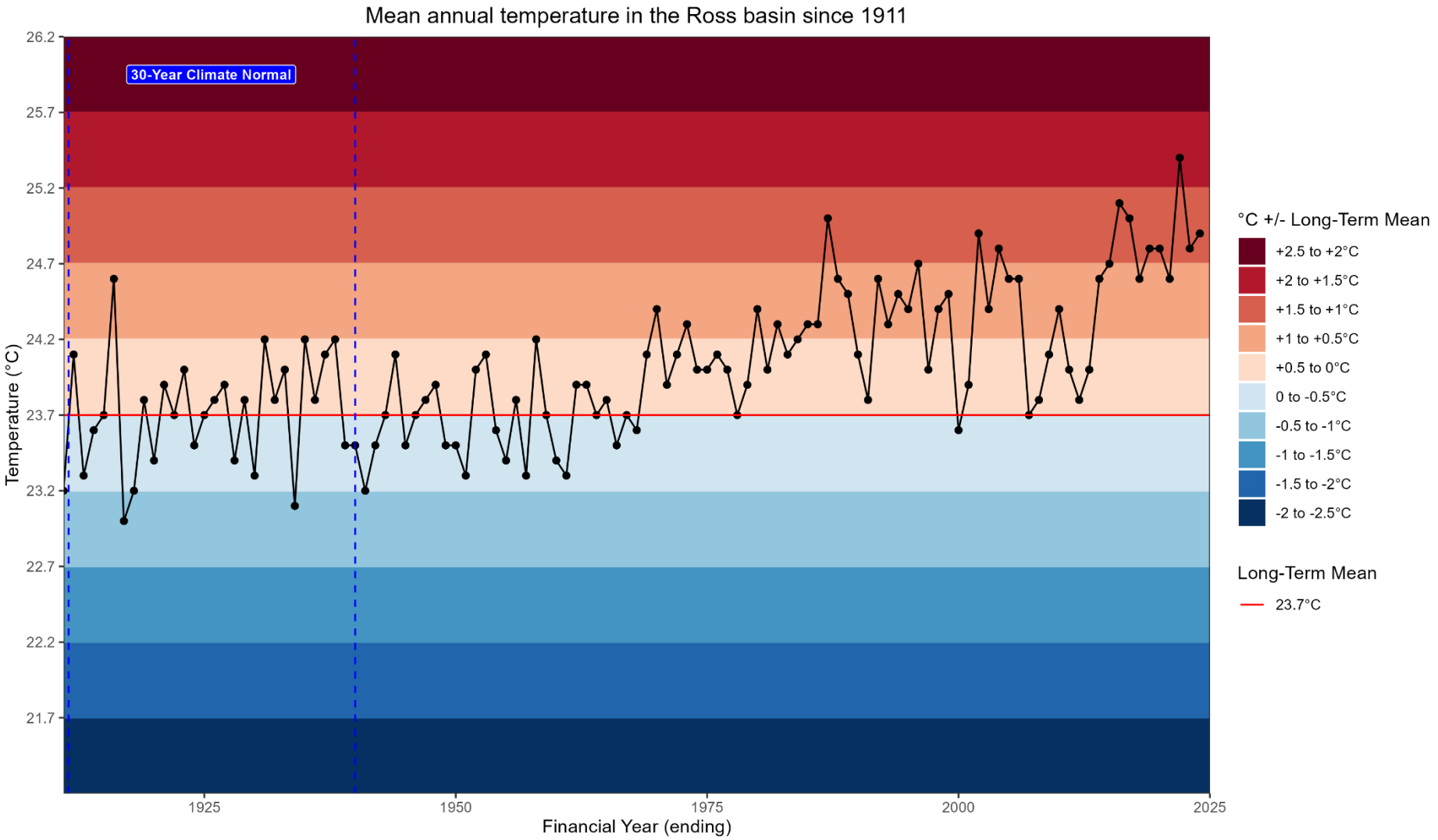

Figure 5. Ross Basin long-term annual air temperature trends.

Appendix E. Black Basin Long-Term Annual Air Temperature

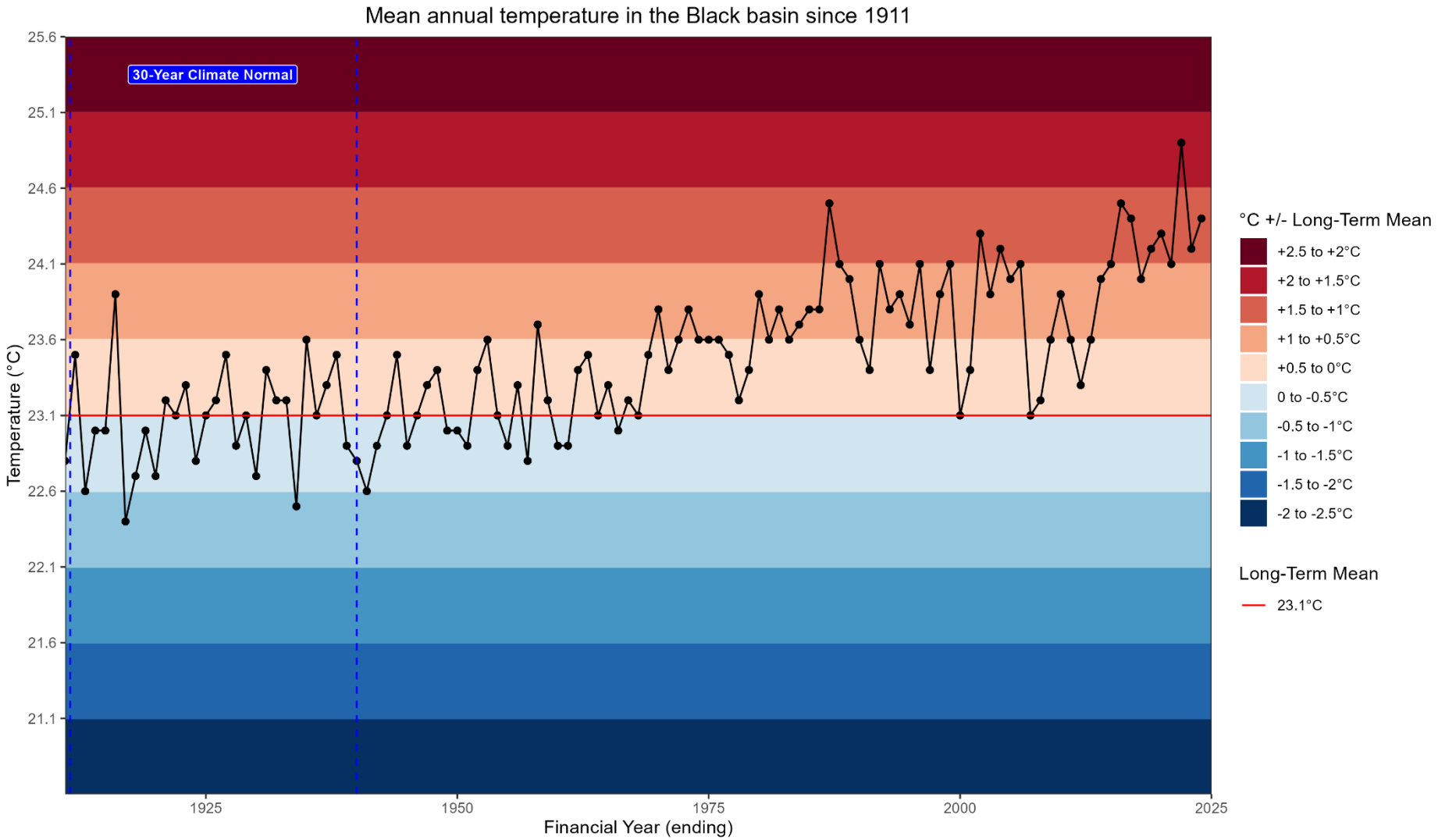

Figure 6. Black Basin long-term annual air temperature trends.

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

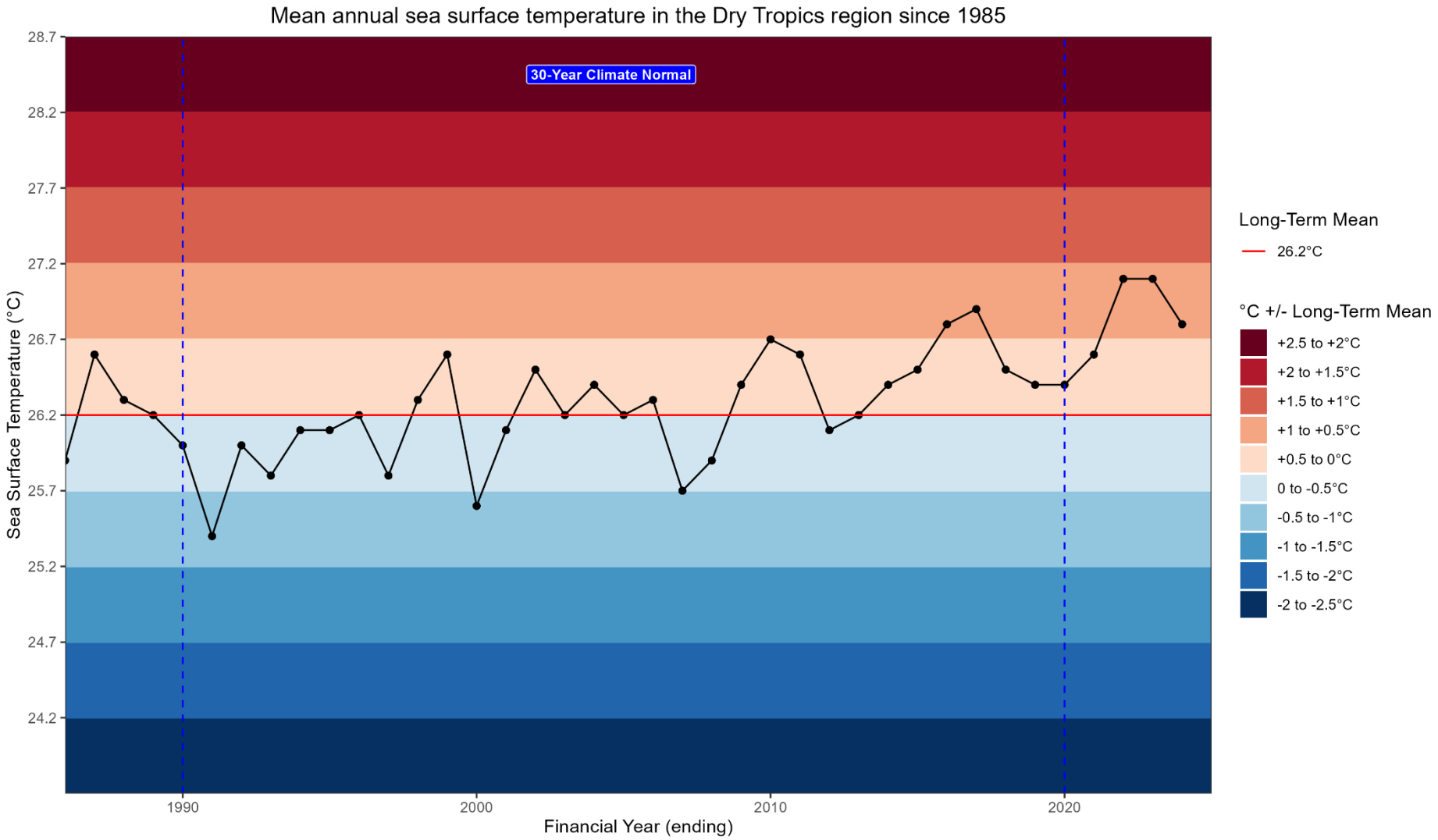

Figure 7. Black Basin long-term annual sea surface temperature trends.

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

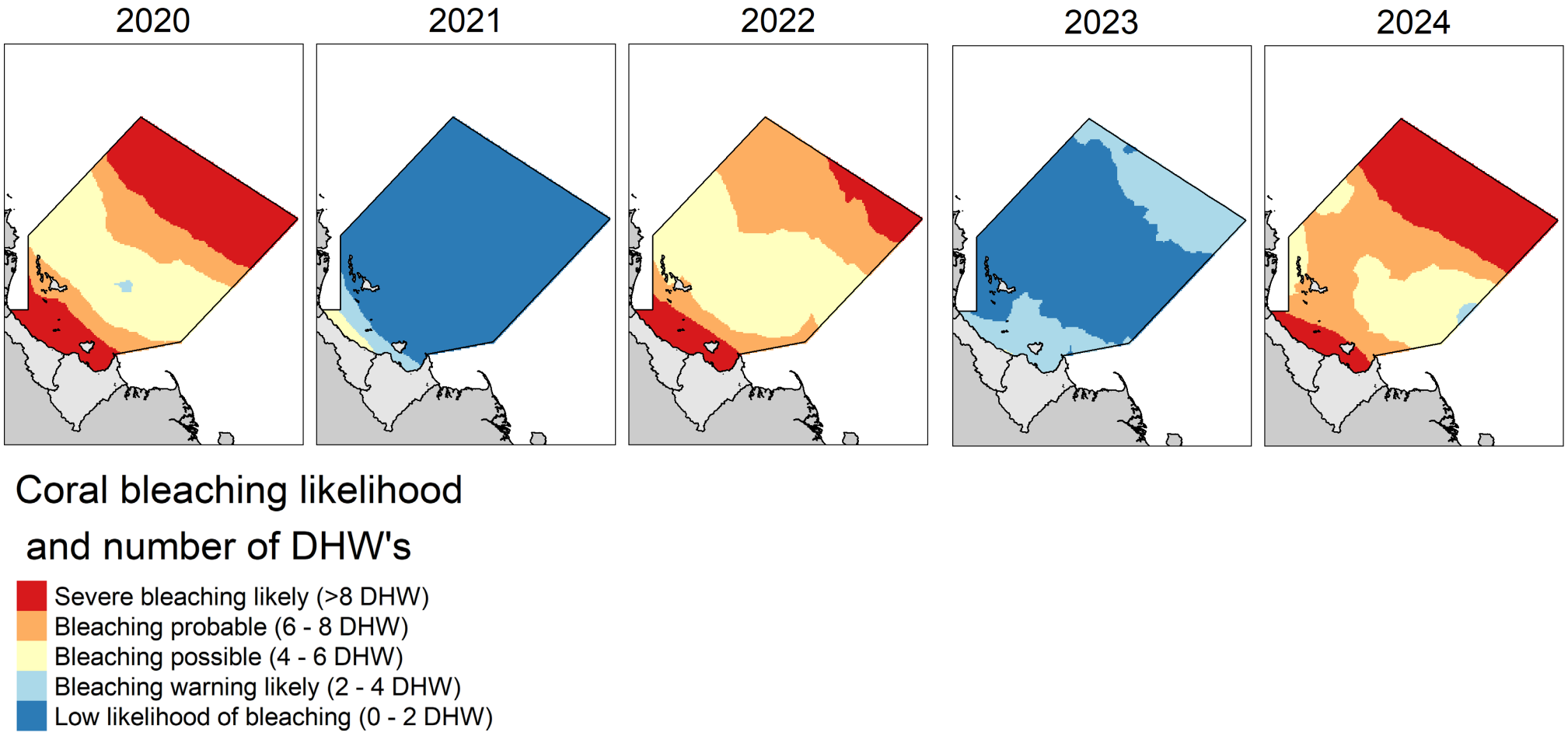

Figure 8. Dry Tropics Marine Region 5-year Historic Degree Heating Week Map.

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

Table 1. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for DIN and TP in the Townsville Dry Tropics Freshwater Environments.

Watercourse	DIN (mg/L)					TP (mg/L)				
	N.Samples	N.Months	Median	WQO	SF	N.Samples	N.Months	Median	WQO	SF
Ross Lake	-	-	-	0.02	0.38	79	11	0.02	0.03	0.46
Aplin's Weir	66	12	0.025	0.02	0.38	ND	ND	ND	0.03	0.46
Gleesons Weir	11	11	0.015	0.02	0.38	ND	ND	ND	0.05	0.46
Blacks Weir	11	11	0.015	0.02	0.38	11	11	0.01	0.03	0.46
Bohle Mid-Field	12	11	4.399	0.08	0.38	12	11	5	0.05	0.46
Bohle Far-Field	12	11	0.257	0.08	0.38	12	11	2.3	0.05	0.46
Black River	74	12	0.021	0.02	0.05	11	11	0.023	0.02	0.03
Althaus Ck	5	5	0.012	0.02	0.05	5	5	0.023	0.02	0.03
Bluewater Ck	11	11	0.027	0.02	0.05	11	11	0.013	0.02	0.03
Sleeper Log Ck	11	11	0.004	0.02	0.05	11	11	0.02	0.02	0.03
Leichhardt Ck	11	11	0.006	0.02	0.05	11	11	0.015	0.02	0.03
Saltwater Ck	10	10	0.005	0.02	0.05	10	10	0.01	0.02	0.03
Rollingstone Ck	11	11	0.016	0.02	0.05	11	11	0.01	0.02	0.03
Ollera Ck	9	9	0.009	0.02	0.05	9	9	0.011	0.02	0.03
Crystal Ck	11	11	0.013	0.02	0.05	11	11	0.008	0.02	0.03
Paluma Lake	-	-	-	0.02	0.05	12	10	0.01	0.03	0.06

Key: = Mean/Median meets the guideline value | = Mean/Median does not meet the guideline value | ND = No Data | - = Not Applicable (data available but not usable).

Appendix I. Freshwater Water Quality Nutrients Scores Historic Comparison

Table 2. Townsville Dry Tropics freshwater water quality historic nutrient indicator scores.

Basin	Sub Basin	Watercourse	DIN					TP				
			23-24	22-23	21–22	20–21	19–20	23-24	22-23	21–22	20–21	19–20
Ross	Upper Ross	Ross Lake	-	-	90	90	68	90	73	61	90	61
	Lower Ross	Aplin's Weir	60	62	61	59	66	ND	ND	ND	ND	ND
		Gleesons Weir	90	59	90	62	74	ND	ND	ND	ND	ND
		Blacks Weir	64	63	59	61	59	90	90	90	90	70
			71	61	70	60	66	90	90	90	90	70
	Bohle River	Bohle Mid-Field	0	0	36	43	0	0	0	0	0	0
		Bohle Far-Field	25	0	60	66	29	0	0	0	0	0
			12	0	48	54	15	0	0	0	0	0
			47	37	66	68	49	45	40	37	60	33
Black	Black River	Black River	59	63	63	61	78	42	39	61	54	9
	Bluewater Ck	Althaus Ck	68	90	90	67	74	42	18	48	90	90
		Bluewater Ck	46	73	66	63	90	76	90	90	73	66
		Sleeper Log Ck	90	90	71	74	62	61	77	90	90	90
			68	84	75	68	75	60	61	76	84	82
	Rollingstone Ck	Leichhardt Ck	90	90	90	74	90	73	90	90	76	55
		Saltwater Ck	90	90	90	70	90	90	90	90	90	90
		Rollingstone Ck	61	61	62	0	64	90	90	90	90	90
			80	80	80	48	81	84	90	90	85	78
	Crystal Ck	Ollera Ck	90	90	71	66	63	90	90	90	90	90
		Crystal Ck	90	90	69	90	90	90	90	90	90	90
			90	90	70	78	76	90	90	90	90	90
	Paluma Lake	Paluma Lake	-	-	-	63	90	90	90	90	90	90
			76	82	74	63	79	74	76	82	83	76

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | - = Not Applicable (data available but not usable) | X = Data was not updated this year.

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

Table 3. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for Turbidity, High DO, Low DO, in the Townsville Dry Tropics Freshwater Environments.

Watercourse	Turbidity (NTU)					Dissolved Oxygen (%Sat)						
	N.Samples	N.Months	Median	WQO	SF	N.Samples	N.Months	Median	High DO WQO	High DO SF	Low DO WQO	Low DO SF
Ross Lake	79	11	8	10	35	79	11	100.45	110	120	90	70
Aplin's Weir	11	11	4.3	10	35	11	11	81.188	110	120	90	70
Gleesons Weir	11	11	3.7	10	35	11	11	81.272	110	120	90	70
Blacks Weir	11	11	3.4	10	35	11	11	77.467	110	120	90	70
Bohle Mid-Field	12	11	9.9	22	35	12	11	64.57	110	120	85	70
Bohle Far-Field	12	11	6.4	22	35	12	11	48.38	110	120	85	70
Black River	11	11	1.01	5	10	11	11	98.9	105	120	90	70
Althaus Ck	5	5	5.21	5	10	5	5	97.4	105	120	90	70
Bluewater Ck	11	11	1.6	5	10	11	11	93.8	105	120	90	70
Sleeper Log Ck	11	11	7.47	5	10	11	11	92.8	105	120	90	70
Leichhardt Ck	11	11	2.79	5	10	11	11	90.2	105	120	90	70
Saltwater Ck	10	10	2.605	5	10	10	10	97.4	105	120	90	70
Rollingstone Ck	11	11	0.63	5	10	11	11	86.2	105	120	90	70
Ollera Ck	9	9	0.54	5	10	9	9	72.9	105	120	90	70
Crystal Ck	11	11	0.74	5	10	11	11	99.2	105	120	90	70
Paluma Lake	12	10	1.8	10	20	12	10	87.666	110	120	90	70

Key: ■ = for Turbidity Mean/Median meets the guideline value, for DO, Median is within the range between the High and Low DO guideline values | ■ = for Turbidity Mean/Median ds not meet the guideline value, for DO, the Median is higher than the High DO or Lower than the Low DO guideline value | ND = No Data | - = Not Applicable (data available but not usable).

Appendix K. Freshwater Water Quality Physical-Chemical Properties Scores Historic Comparison

Table 4. Townsville Dry Tropics freshwater water quality historic physical-chemical indicator scores.

Basin	Sub Basin	Watercourse	Turbidity					High DO					Low DO				
			23-24	22-23	21–22	20–21	19–20	23-24	22-23	21–22	20–21	19–20	23-24	22-23	21–22	20–21	19–20
Ross	Upper Ross	Ross Lake	72	90	90	90	90	90	90	90	90	90	90	90	90	90	90
	Lower Ross	Aplin's Weir	90	90	90	90	90	90	90	80	90	90	34	46	55	74	90
		Gleesons Weir	78	90	90	90	90	90	90	90	90	90	34	67	11	50	73
		Blacks Weir	90	90	90	90	90	90	90	90	90	90	22	44	19	26	56
			86	90	90	90	90	90	90	90	90	90	30	53	28	50	73
	Bohle River	Bohle Mid-Field	90	62	67	90	90	90	90	90	90	90	0	50	26	0	0
		Bohle Far-Field	77	63	66	90	90	90	90	90	90	90	0	0	40	37	0
			83	63	66	90	90	90	90	90	90	90	0	25	33	18	0
			82	81	82	90	90	90	90	88	90	90	30	49	40	52	51
Black	Black River	Black River	90	72	90	69	90	64	64	47	53	62	90	90	90	90	90
	Bluewater Ck	Althaus Ck	58	0	0	12	90	73	51	90	69	4	90	90	90	90	81
		Bluewater Ck	90	70	90	90	90	90	90	79	90	90	90	62	66	77	11
		Sleeper Log Ck	30	13	0	90	70	90	90	90	90	90	90	72	20	76	32
			59	28	30	64	83	84	77	86	90	90	90	75	59	81	41
	Rollingstone Ck	Leichhardt Ck	90	68	90	90	90	90	90	90	90	90	61	62	61	61	27
		Saltwater Ck	90	57	75	90	90	90	90	90	90	90	90	90	90	66	90
		Rollingstone Ck	90	90	90	90	90	90	90	90	90	90	49	51	40	74	51
			90	72	90	90	90	90	90	90	90	90	66	67	63	67	56
	Crystal Ck	Ollera Ck	90	90	90	90	90	90	90	90	90	90	8	0	0	59	0
		Crystal Ck	90	90	90	90	90	90	90	90	90	90	90	90	90	73	75
			90	90	90	90	90	90	90	90	90	90	49	45	45	66	37
	Paluma Lake	Paluma Lake	90	90	90	90	90	90	90	90	90	90	53	52	55	90	69
			80	64	70	80	88	85	83	85	85	79	71	66	60	75	53

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | - = Not Applicable (data available but not usable) | X = Data was not updated this year.

Appendix L. Freshwater Water Quality 2022–2023 Boxplots

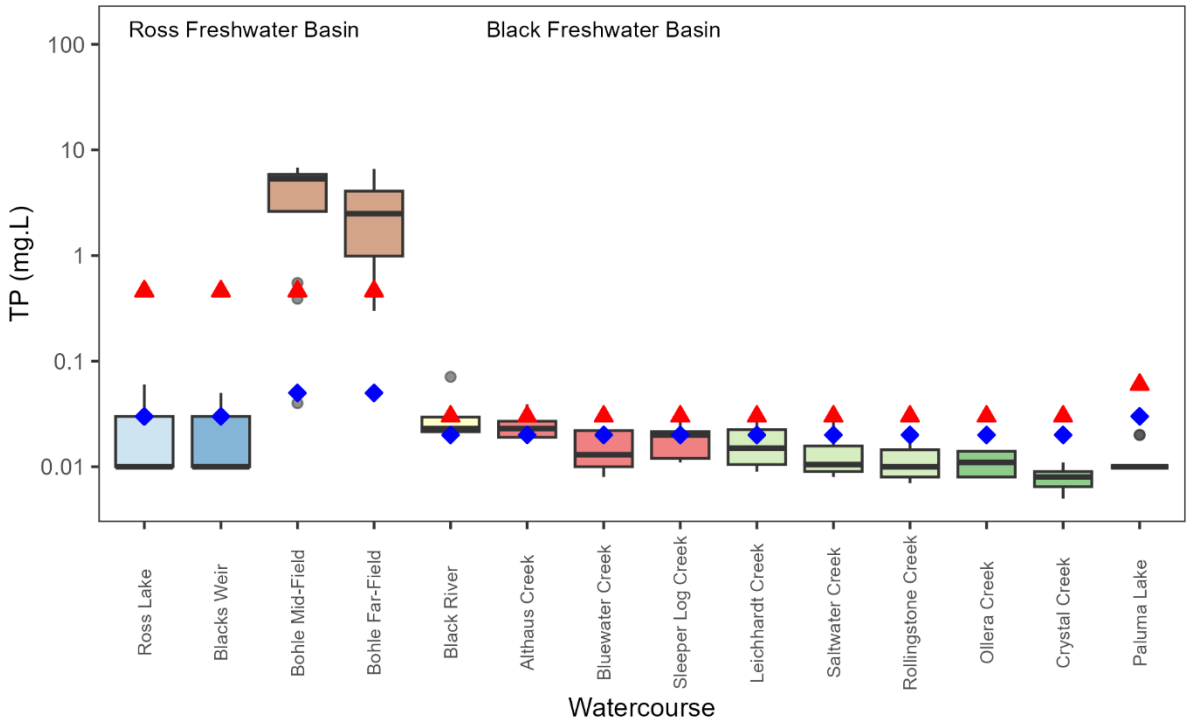

Figure 10. Total Phosphorus (TP) (mg/l) boxplot: red triangles indicate the scaling factor, blue diamonds indicate the water quality objective.

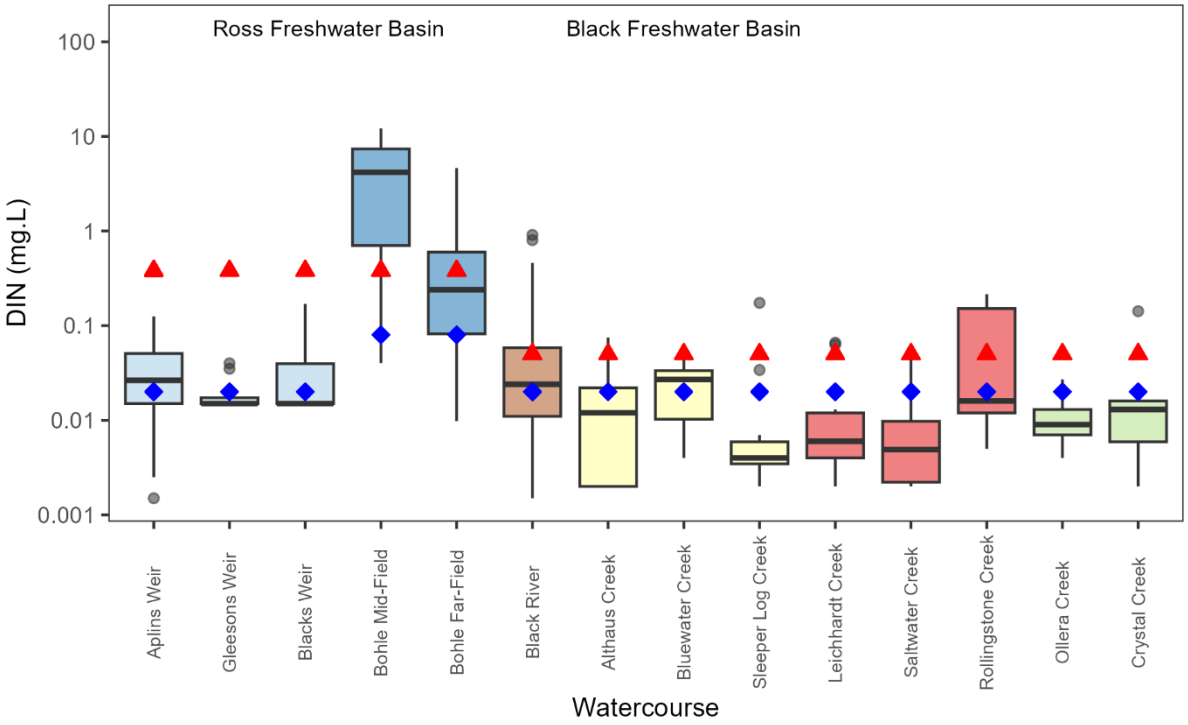

Figure 9. Dissolved Inorganic Nitrogen (DIN) (mg/L) Boxplot: red triangles indicate the scaling factor, blue diamonds indicate the water quality objective.

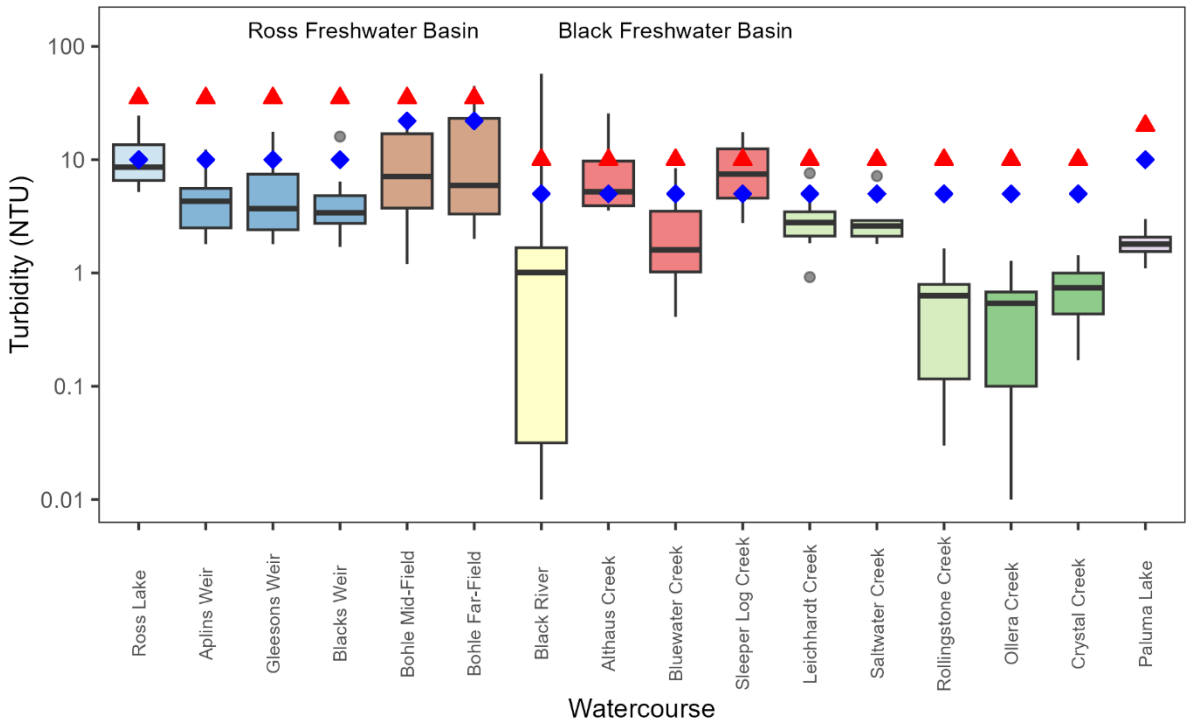

Figure 12. Turbidity (NTU) boxplot: red triangles indicate the scaling factor, blue diamonds indicate the water quality objective.

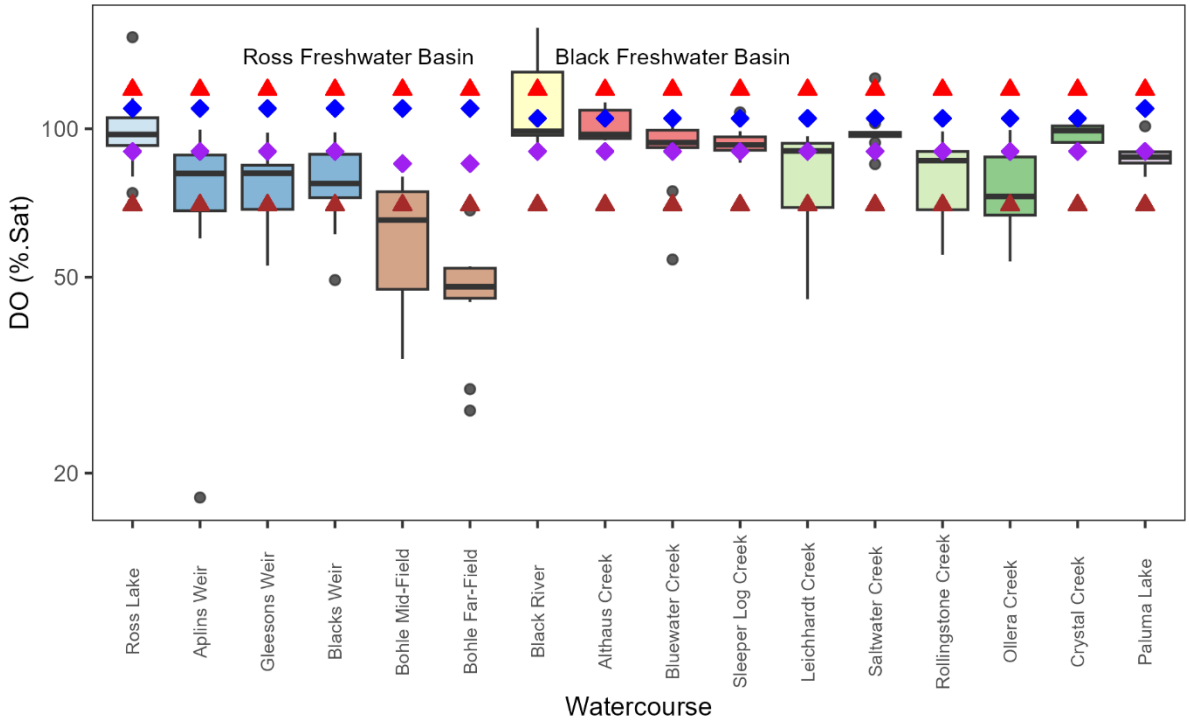

Figure 11. Dissolved Oxygen (DO) (% Saturation) boxplot: red triangles indicate the high DO scaling factor, blue diamonds indicate the high DO water quality objective, purple diamonds indicate the low DO water quality objective, and brown triangles indicate the low DO scaling factor.

Appendix M. Freshwater Water Quality Line Plots

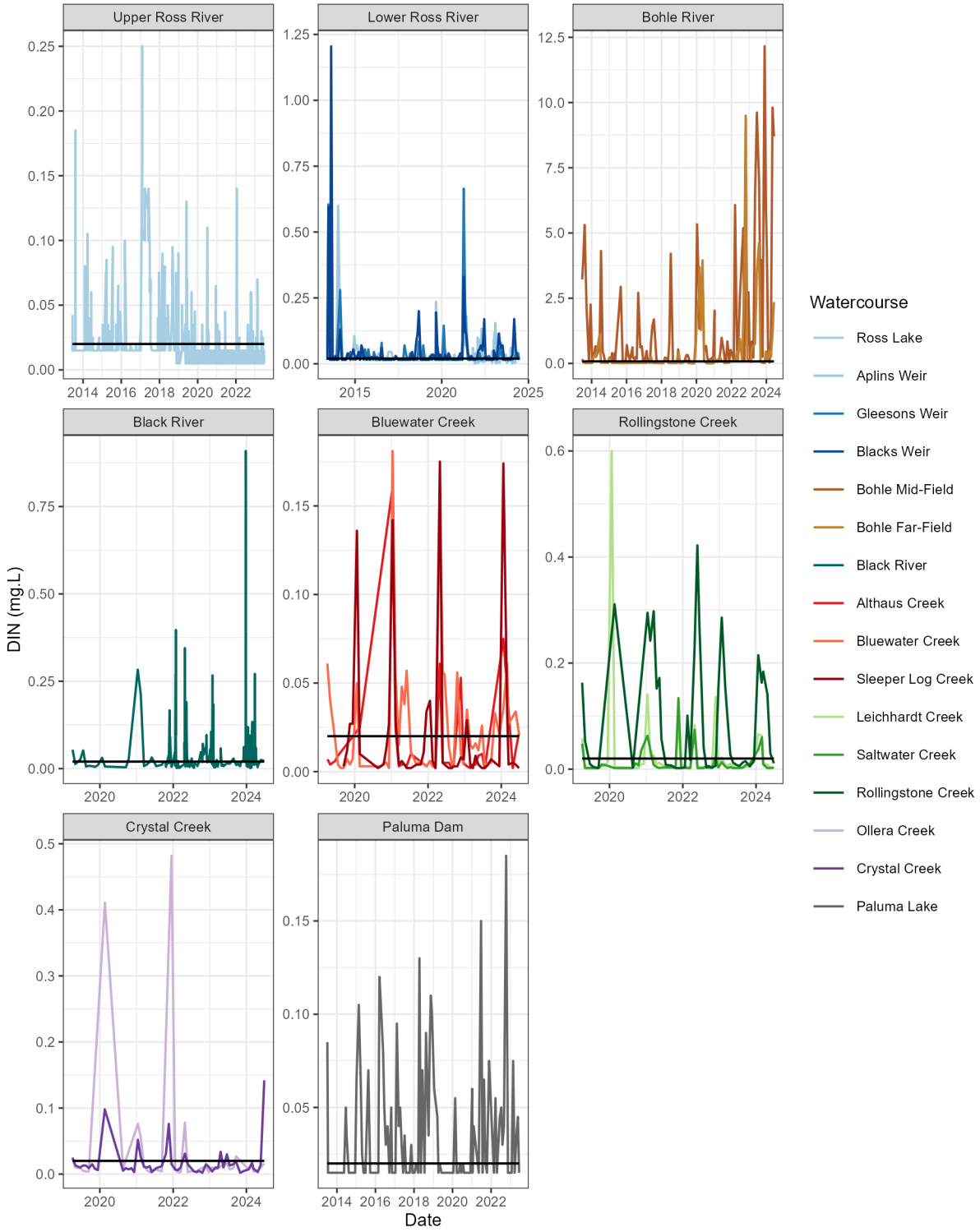

Figure 13. Historical concentrations of dissolved inorganic nitrogen (DIN) in the freshwater sub basins. Black line indicates the water quality objective.

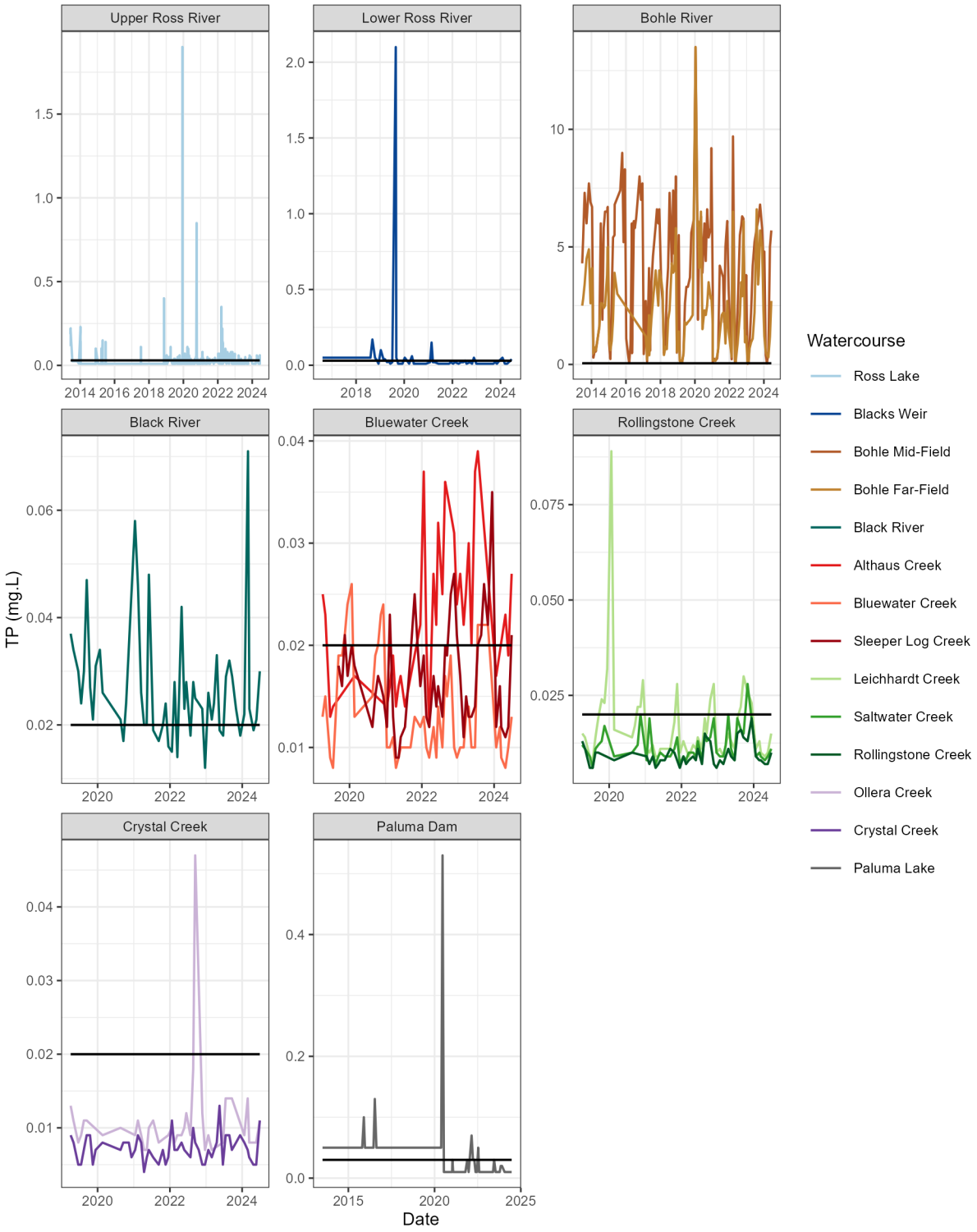

Figure 14. Historical data for total phosphorus in the freshwater sub basins. Black line indicates the water quality objective.

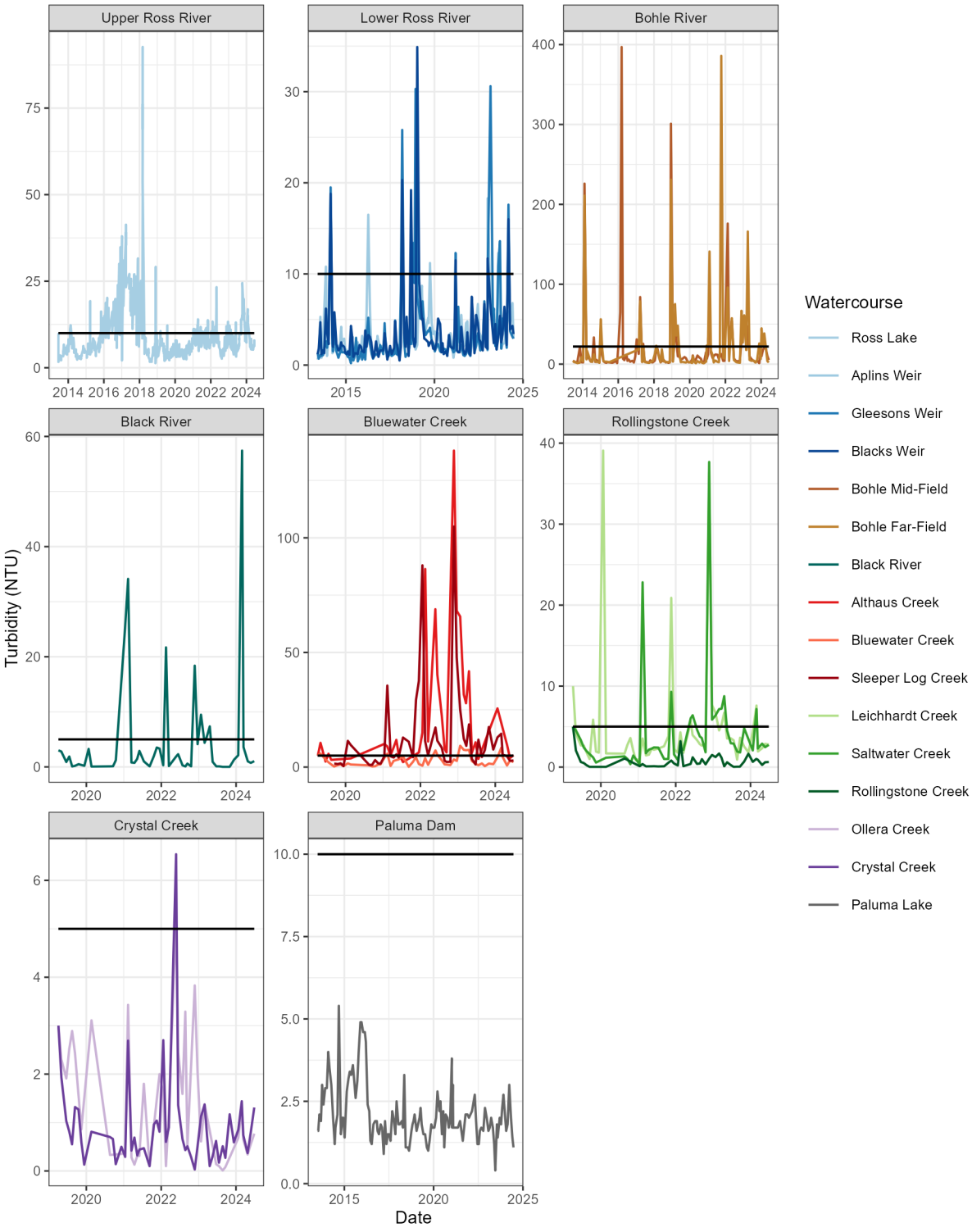

Figure 15. Historical turbidity in the freshwater sub basins. Black lines indicates the water quality objectives.

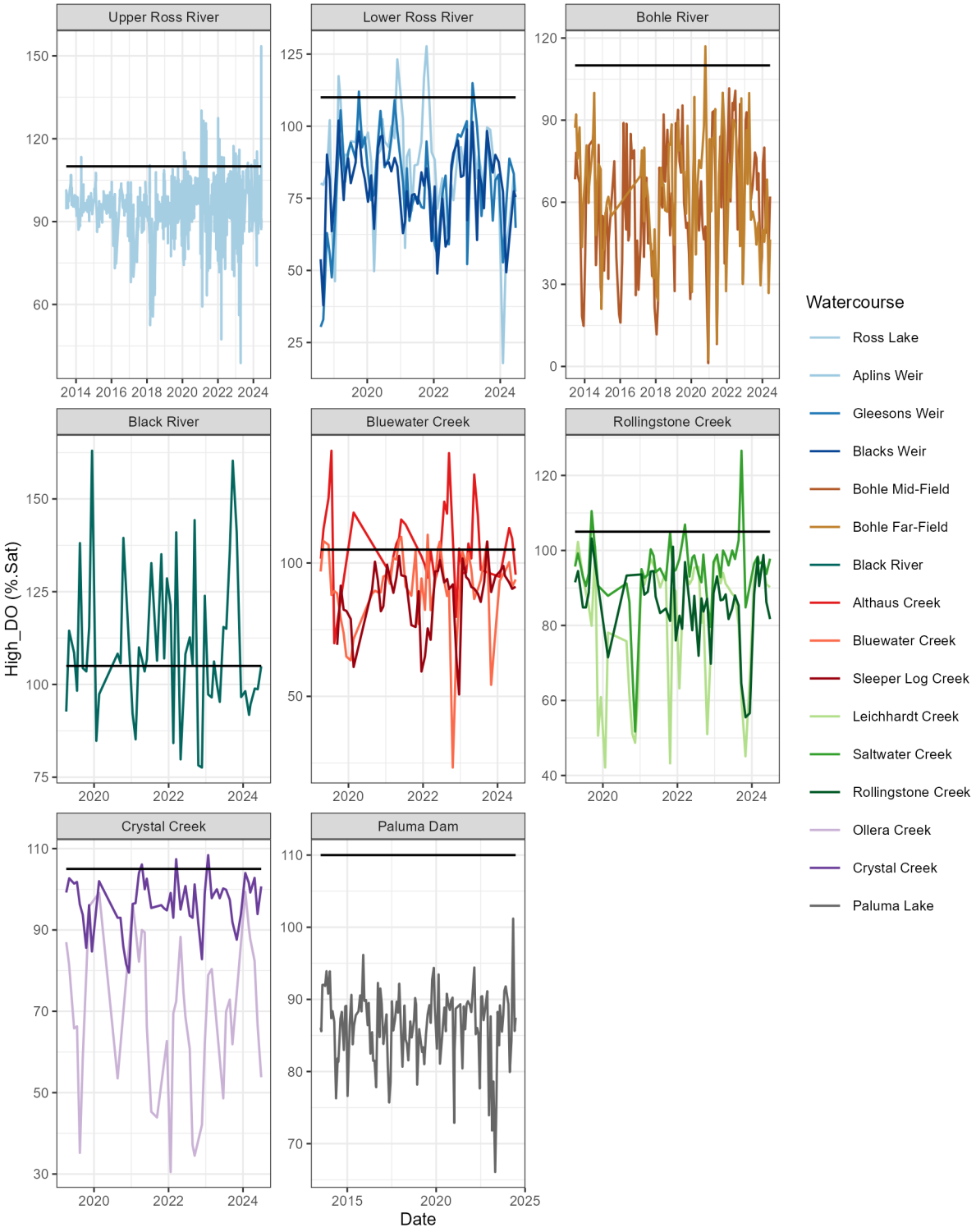

Figure 16. Historical dissolved oxygen in the freshwater sub basins. Black lines indicate the water quality objective (High DO).

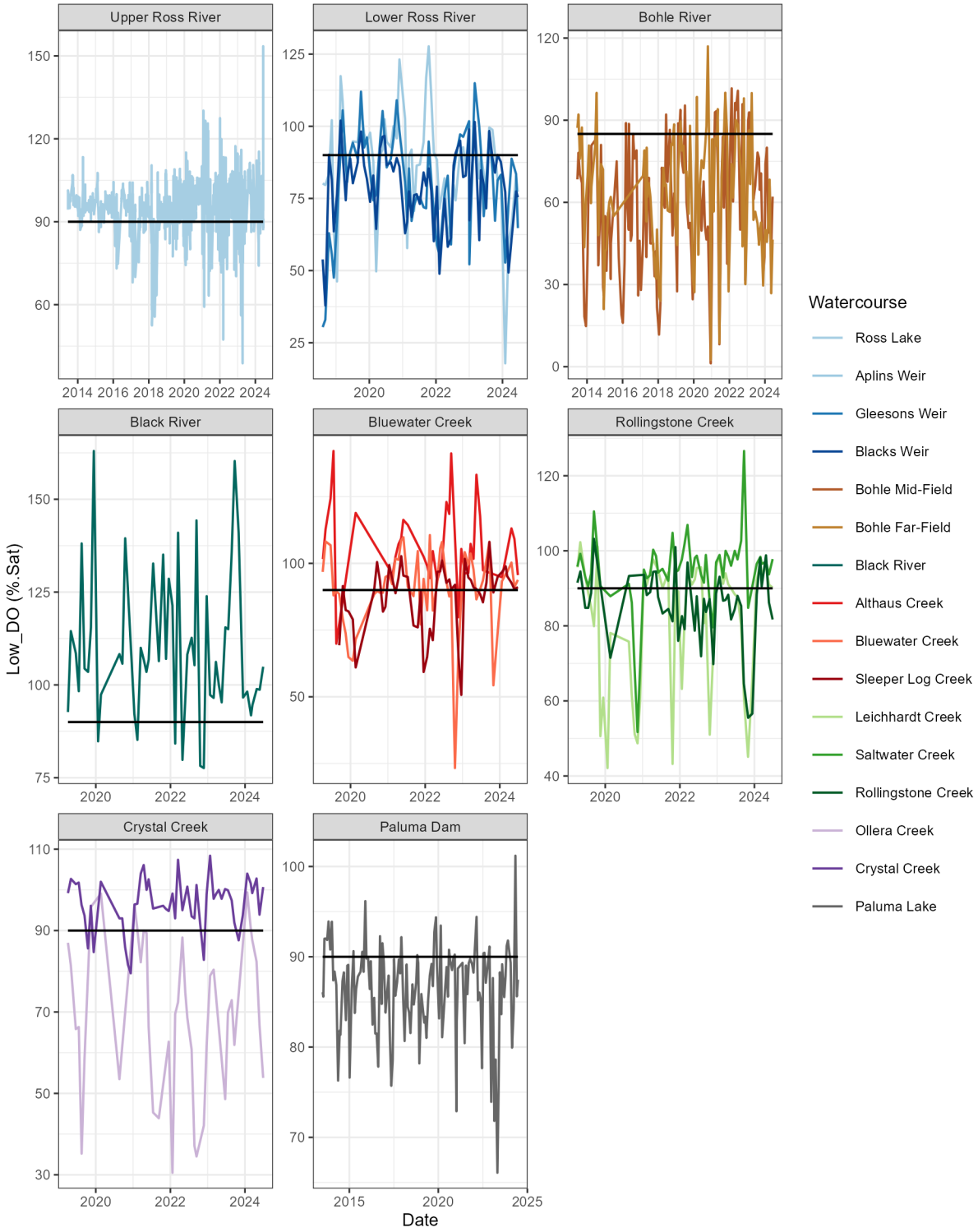

Figure 17. Historical dissolved oxygen in the freshwater sub basins. Black lines indicate the water quality objective (Low DO).

Appendix N. Freshwater Pesticides Sampling Locations

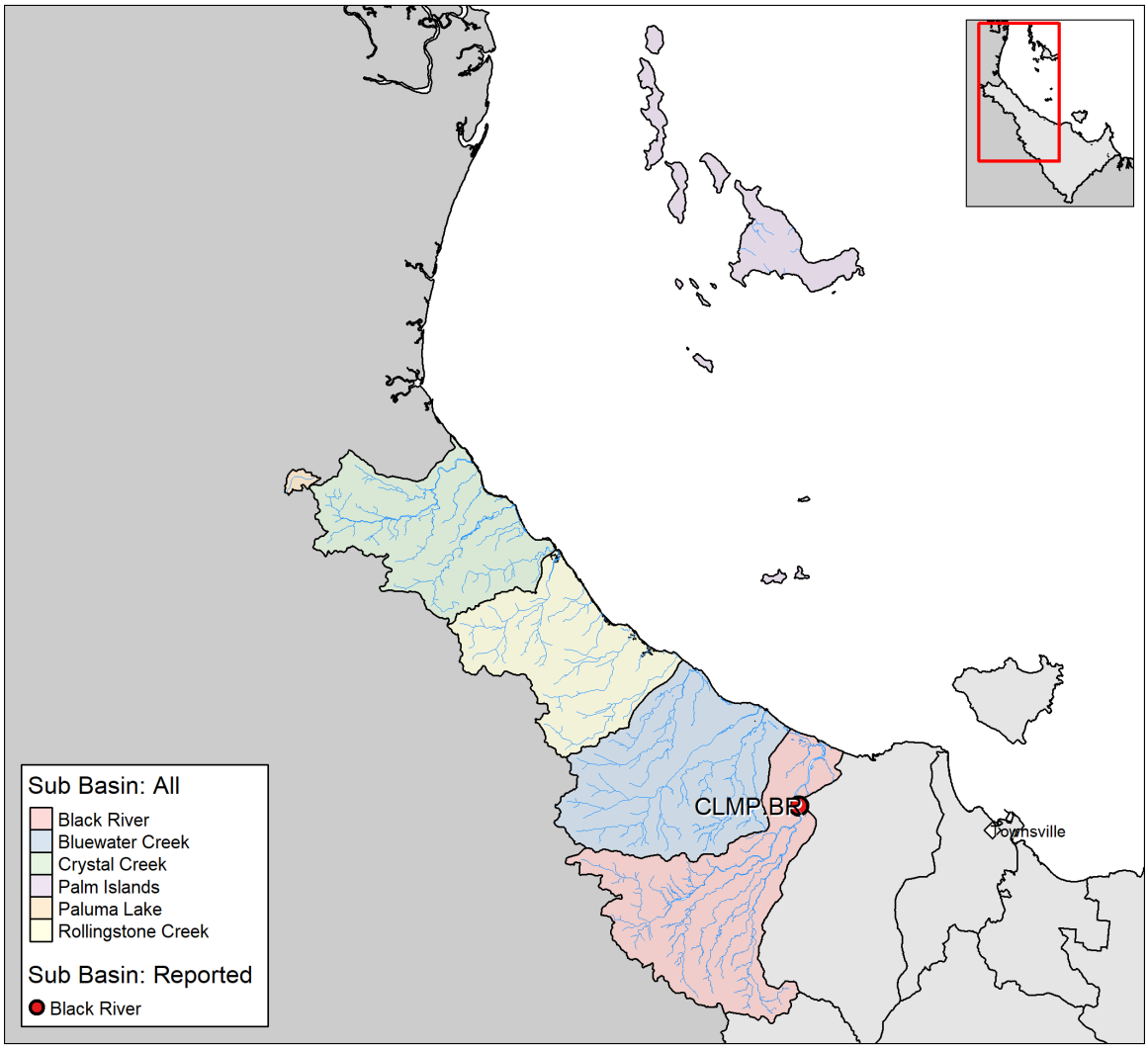

Figure 18. Black Freshwater Basin pesticide site locations. The red box in the inset map defines the extent of the Black Basin.

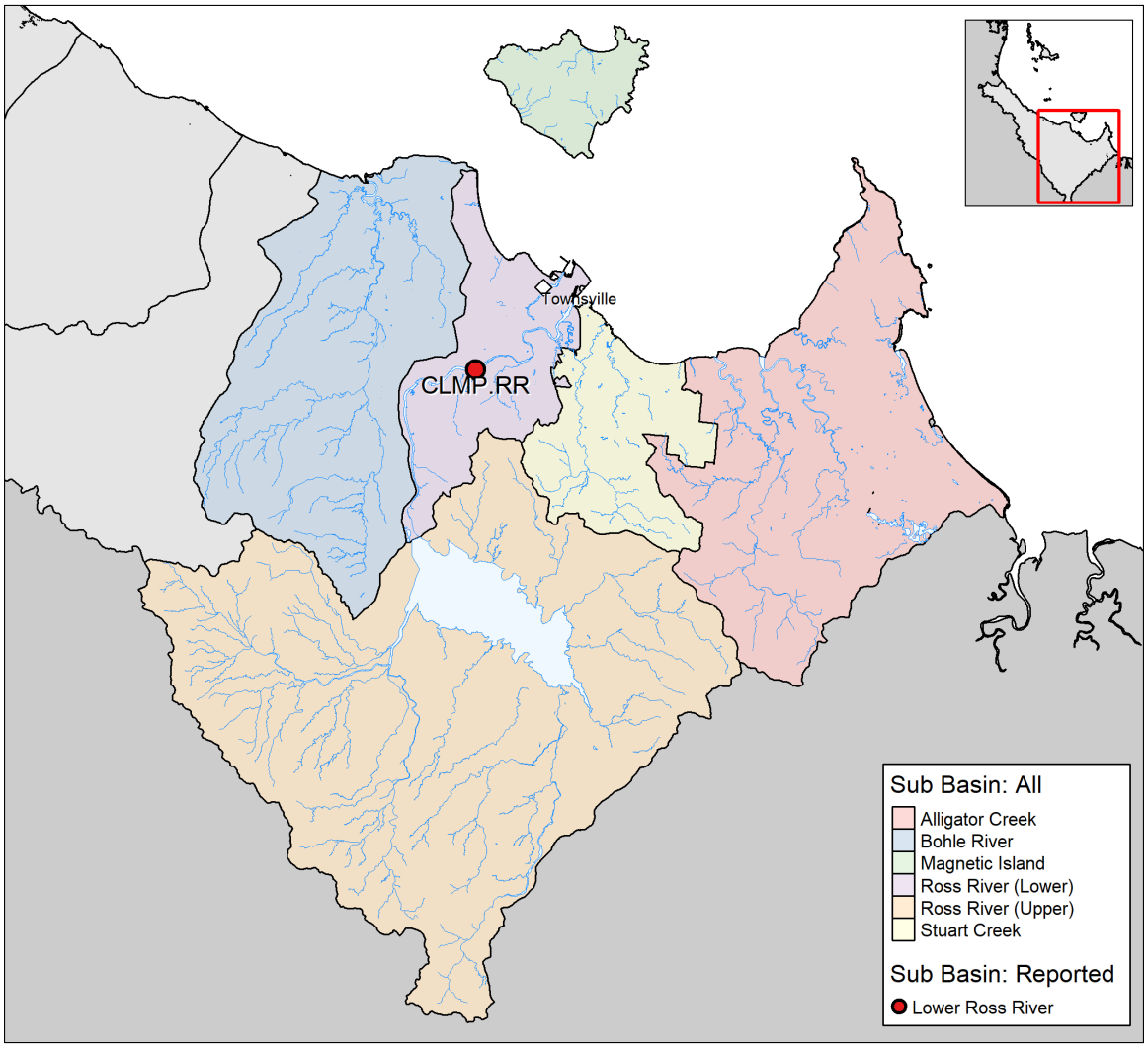

Figure 19. Ross Freshwater Basin pesticide site locations. The red box in the inset map defines the extent of the Ross Basin.

Appendix O. Freshwater Pesticides Historical Species Affected

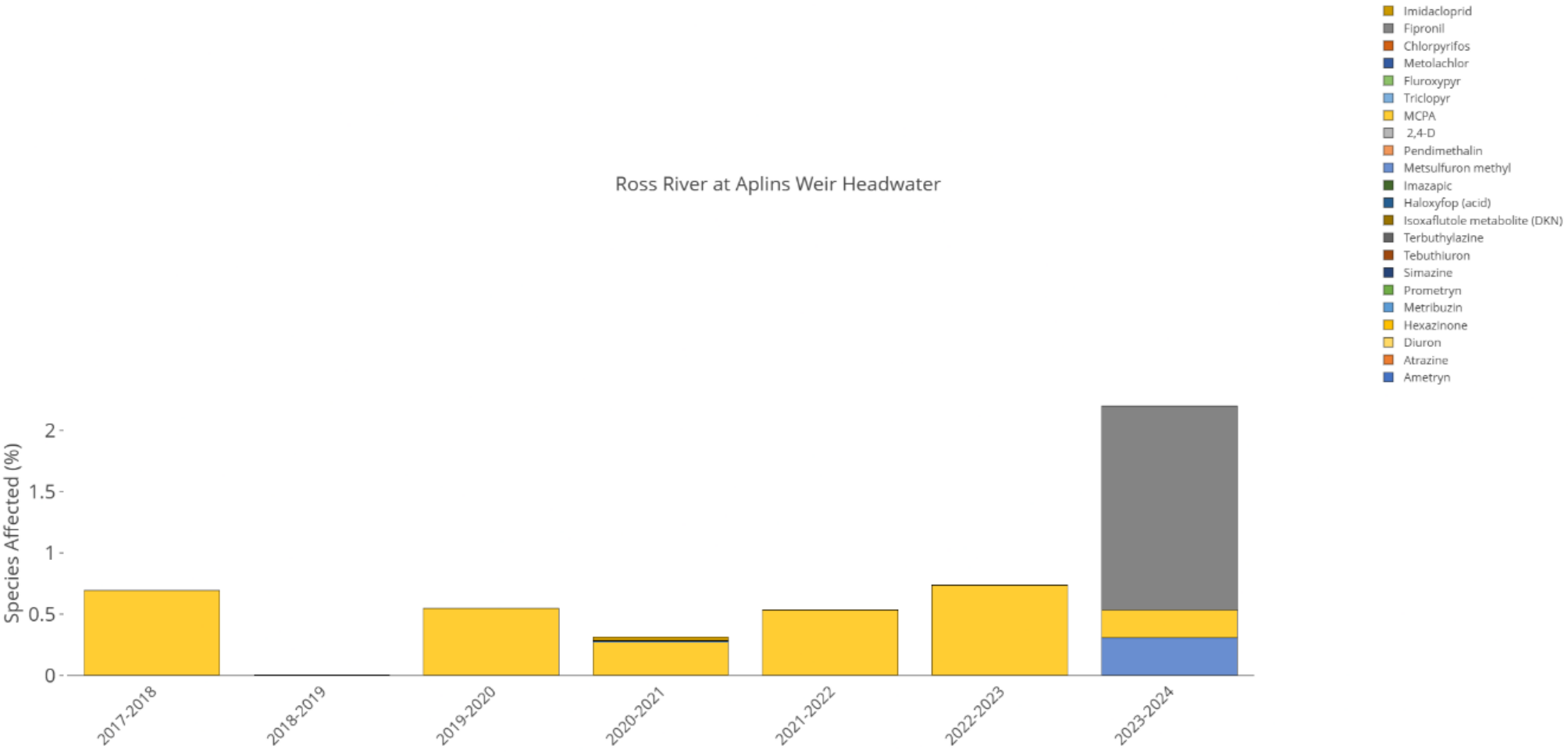

Figure 20. Historic pesticide proportions at the Ross River at Aplins Weir Headwater CLMP monitoring site.

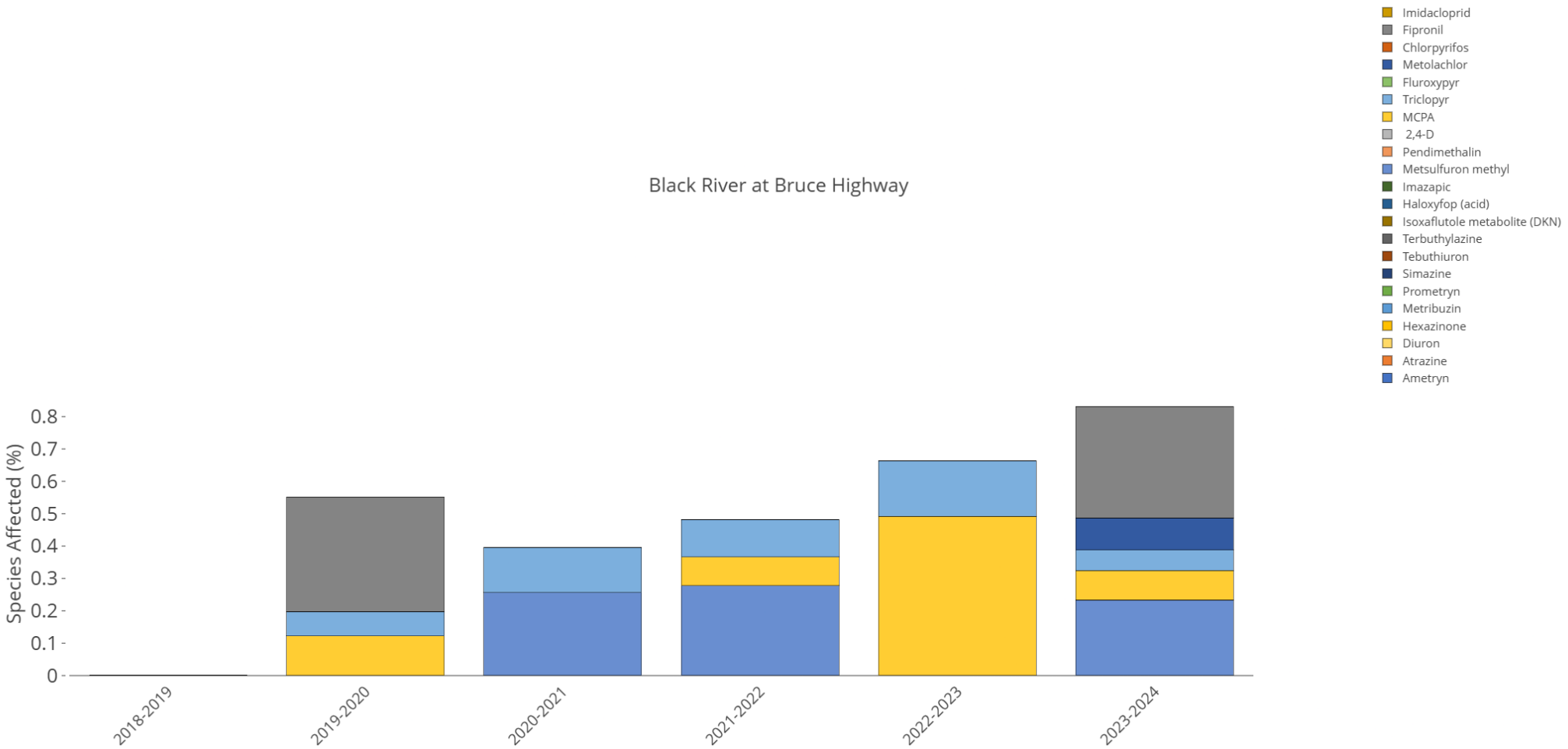

Figure 21. Historic pesticide proportions at the Black River CLMP monitoring site.

Appendix P.Freshwater Riparian Extent: Assessed Area in the Ross Basin of the Townsville Dry Tropics Region

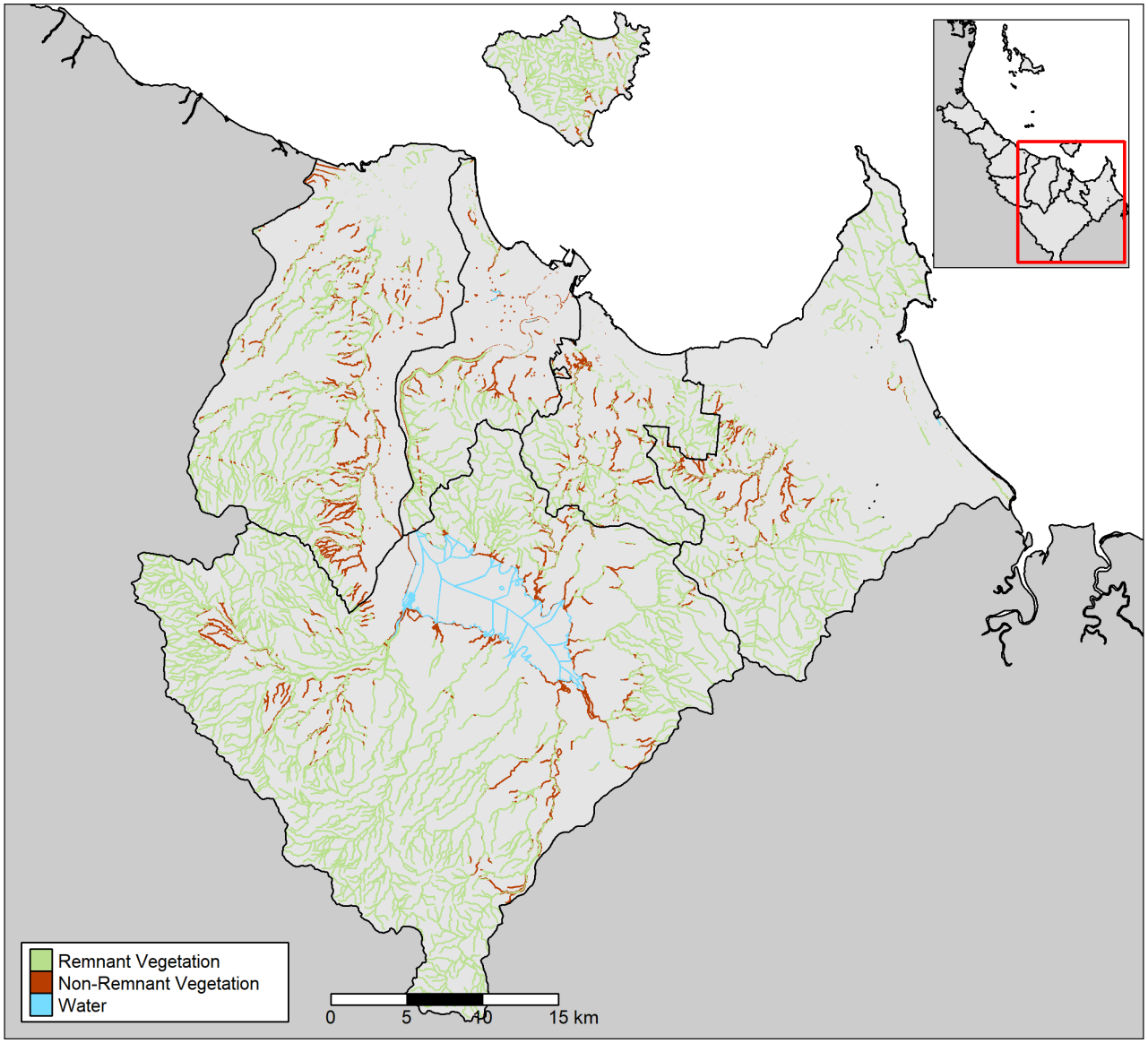

Figure 22. Freshwater riparian extent assessed for vegetation in the Ross Basin of the Dry Tropics region.

Appendix Q. Freshwater Riparian Extent: Assessed Area in the Black Basin of the Townsville Dry Tropics Region

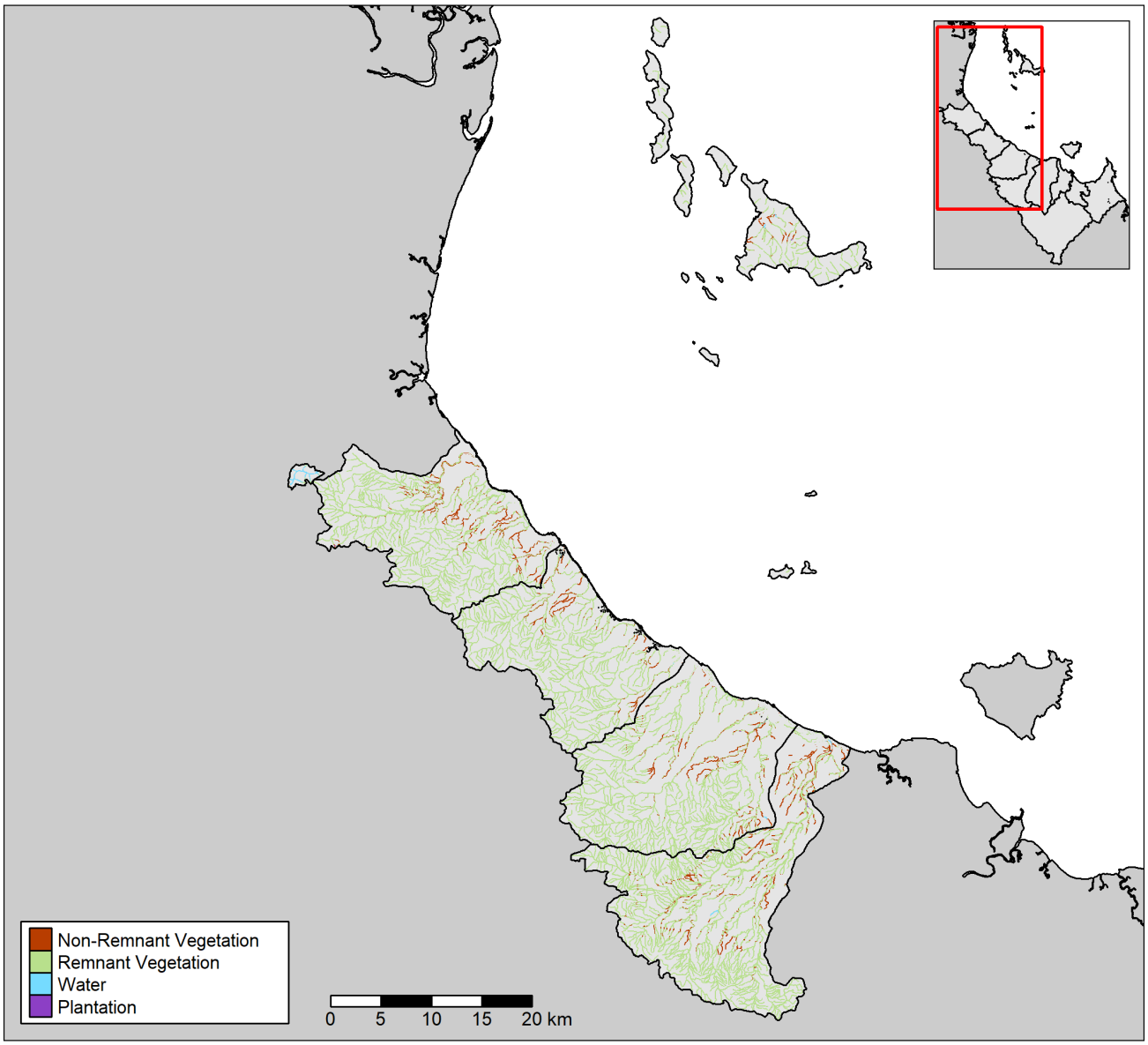

Figure 23. Freshwater riparian extent assessed for vegetation in the Black Basin of the Dry Tropics region.

Appendix R. Freshwater Riparian Extent Historical Scores

Table 5. Townsville Dry Tropics freshwater riparian extent historic scores.

Basin/Sub Basin	Extent Change: 19-21 Report Card Year: 23-24	Extent Change: 19-21 Report Card Year: 22-23	Extent Change: 19-21 Report Card Year: 21-22	Extent Change: 19-21 Report Card Year: 20-21	Extent Change: 19-21 Report Card Year: 19-20
Alligator Ck	X	57	X	X	ND
Bohle River	X	60	X	X	ND
Magnetic Island	X	80	X	X	ND
Ross River (Lower)	X	80	X	X	ND
Ross River (Upper)	X	52	X	X	ND
Stuart Ck	X	35	X	X	ND
Ross freshwater	X	54	X	X	44
Black River	X	81	X	X	ND
Bluewater Ck	X	81	X	X	ND
Crystal Ck	X	81	X	X	ND
Palm Islands	X	80	X	X	ND
Paluma Lake	X	80	X	X	ND
Rollingstone Ck	X	81	X	X	ND
Black freshwater	X	81	X	X	56

Appendix S. Ross Freshwater Riparian Vegetation Change Over Time

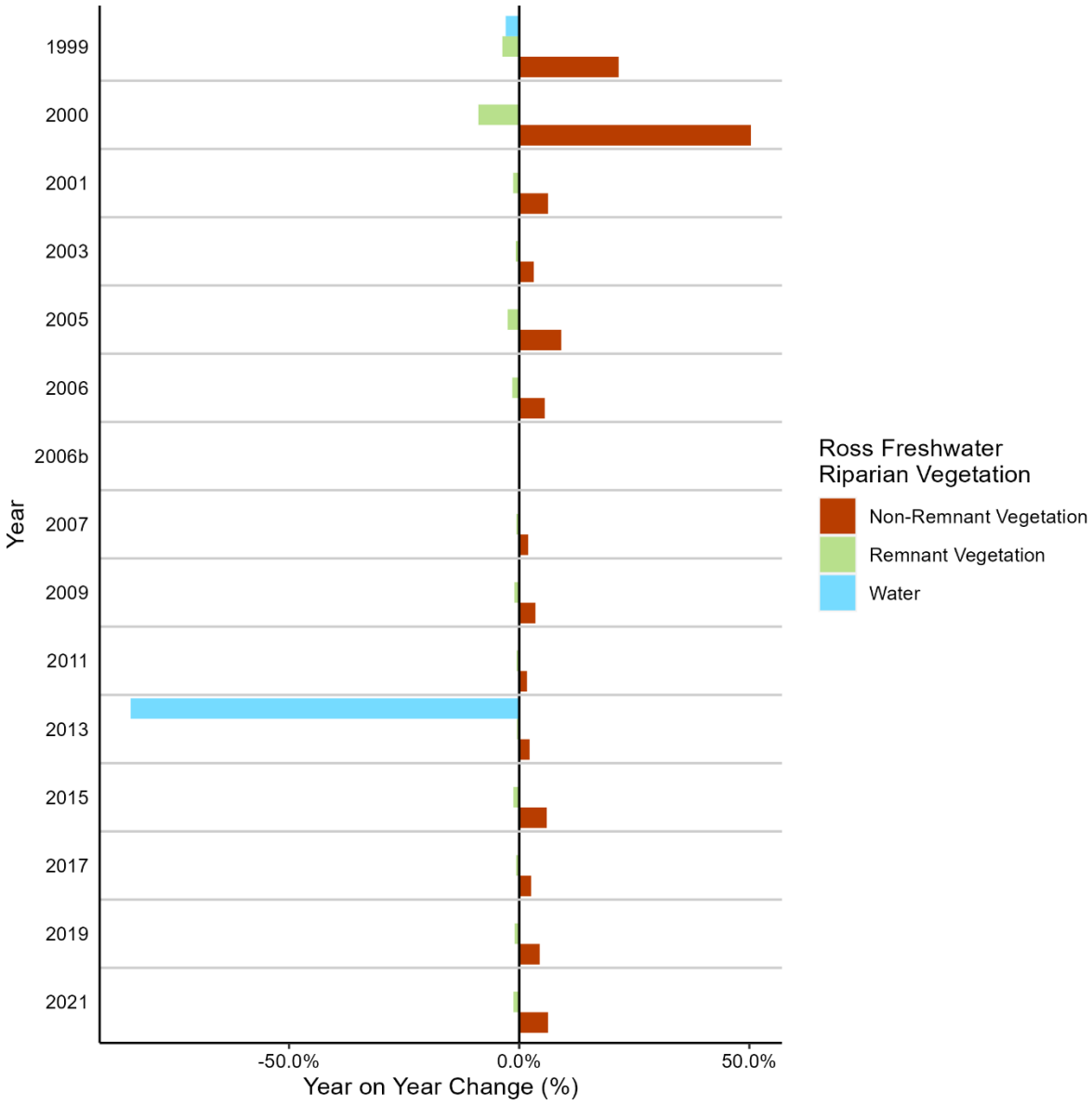

Figure 24. Ross Freshwater riparian vegetation change over time.

Appendix T. Black Freshwater Riparian Vegetation Change Over Time

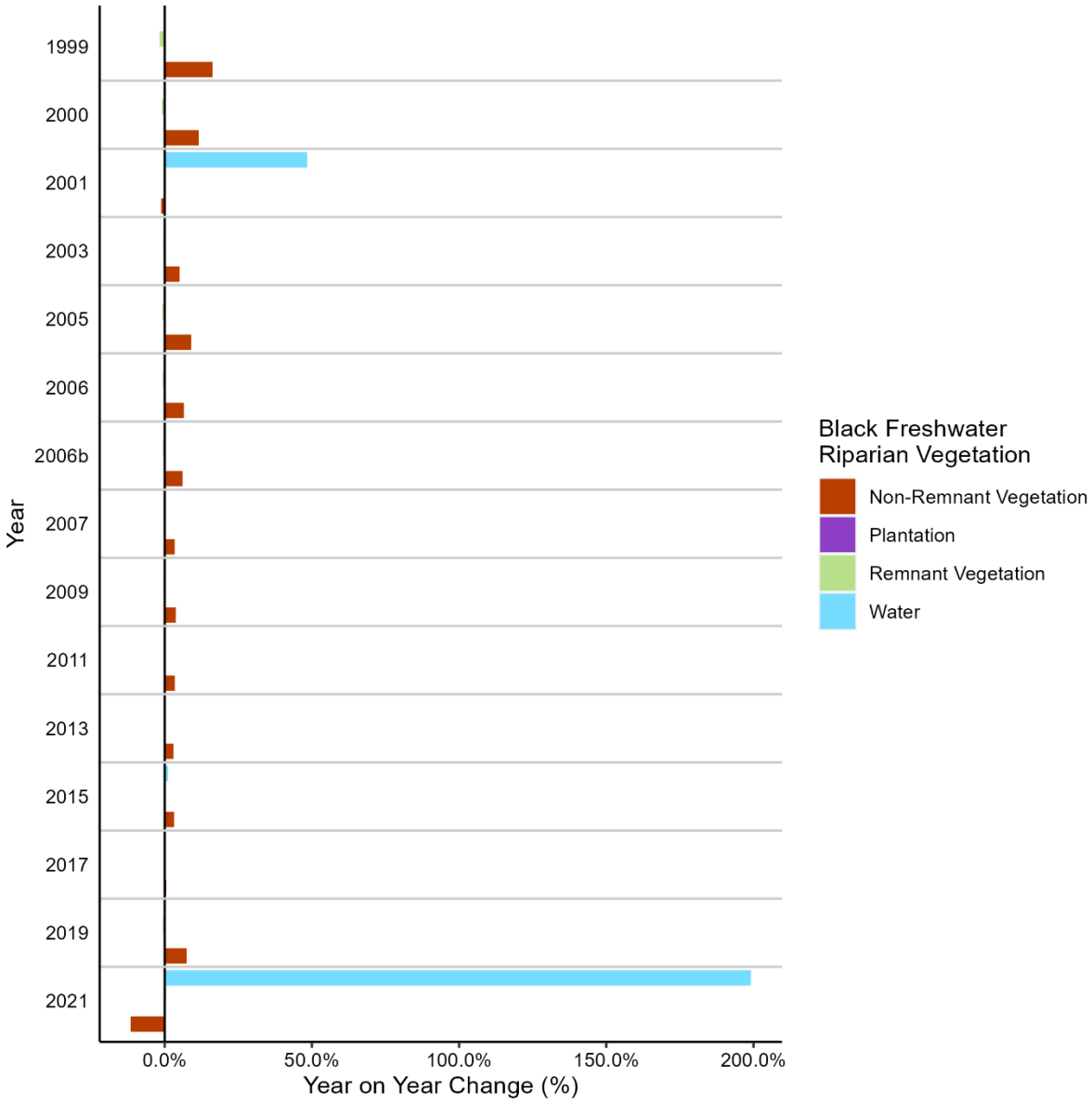

Figure 25. Black Freshwater riparian vegetation change over time.

Appendix U. Freshwater Wetland Extent: Assessed Area in the Ross Basin of the Townsville Dry Tropics Region

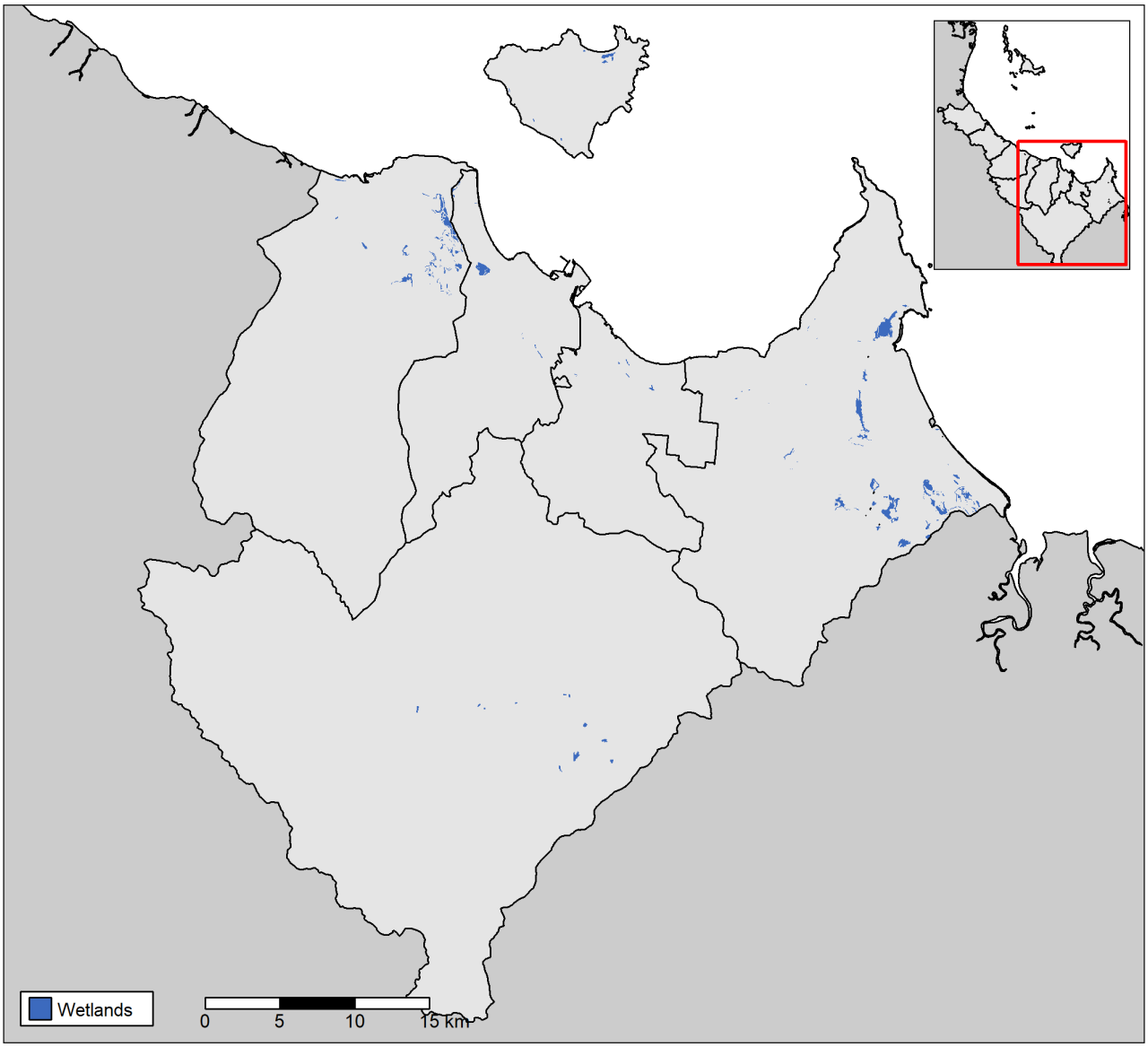

Figure 26. Freshwater wetlands assessed in the Ross freshwater environment of the Dry Tropics region.

Appendix V. Freshwater Wetland Extent: Assessed Area in the Black Basin of the Townsville Dry Tropics Region

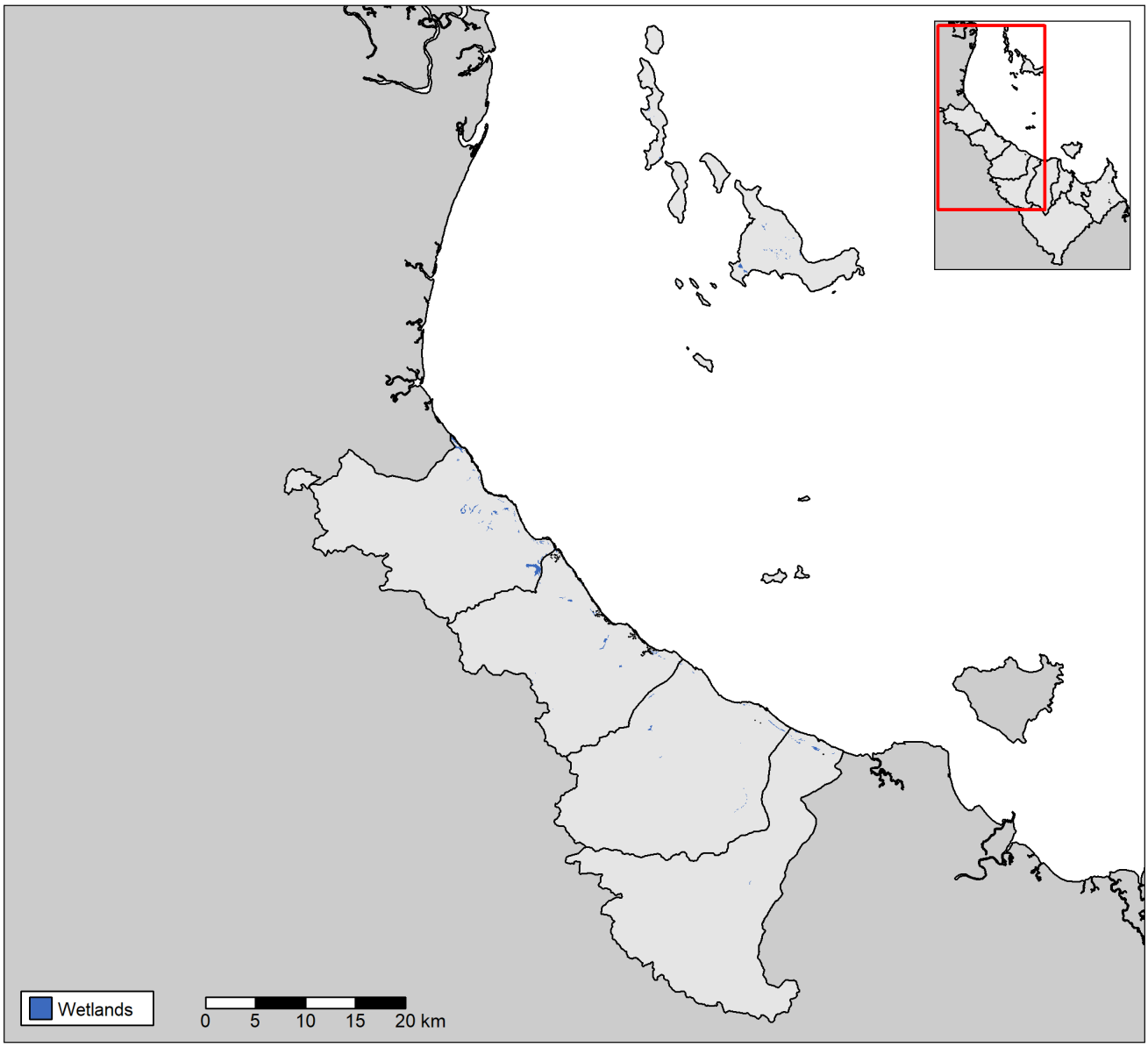

Figure 27. Freshwater wetlands assessed in the Black freshwater environment of the Dry Tropics region.

Appendix W. Ross Freshwater Wetland Vegetation Change Over Time

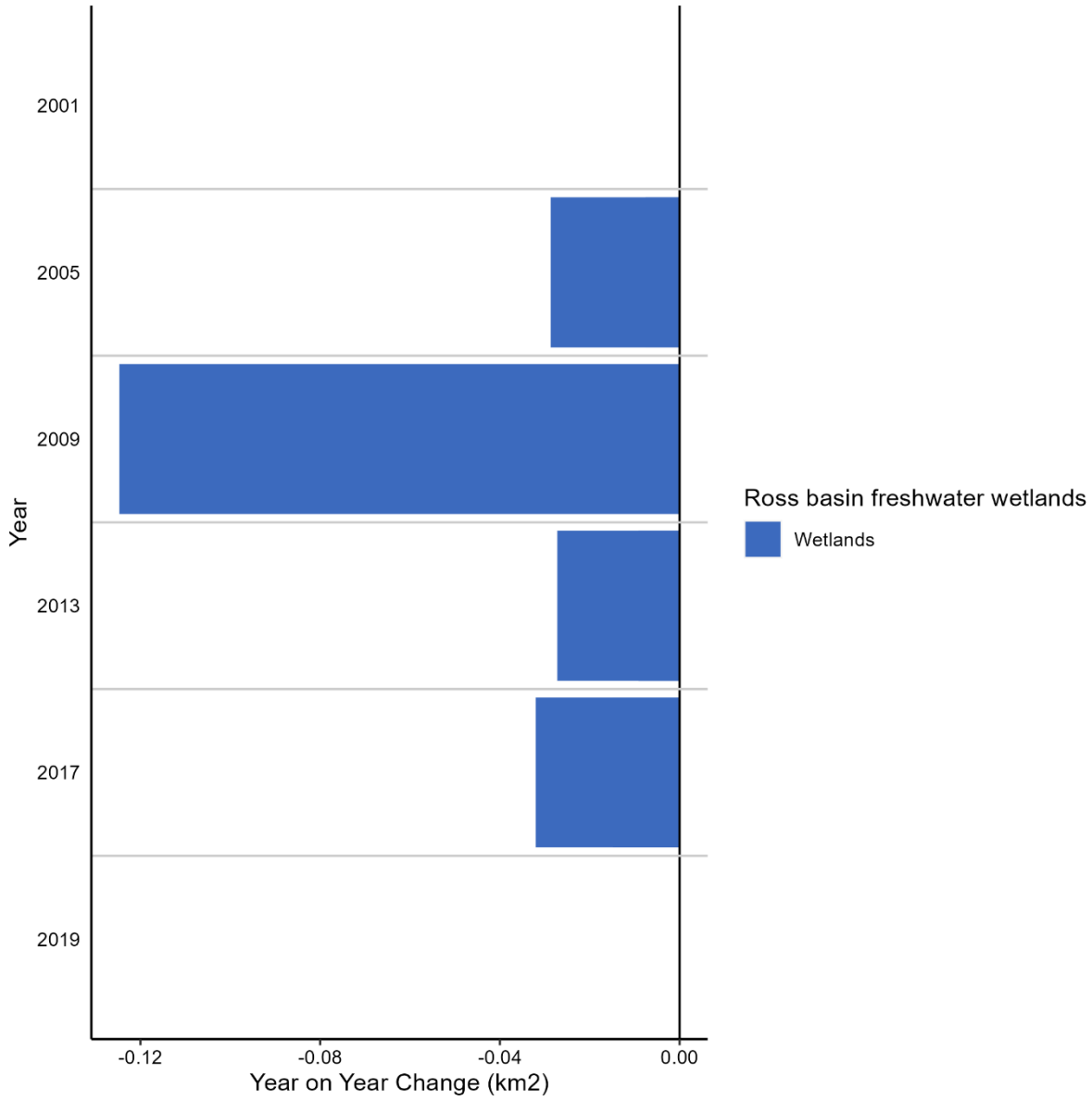

Figure 28. Ross freshwater wetland vegetation change over time.

Appendix X. Black Freshwater Wetland Vegetation Change Over Time

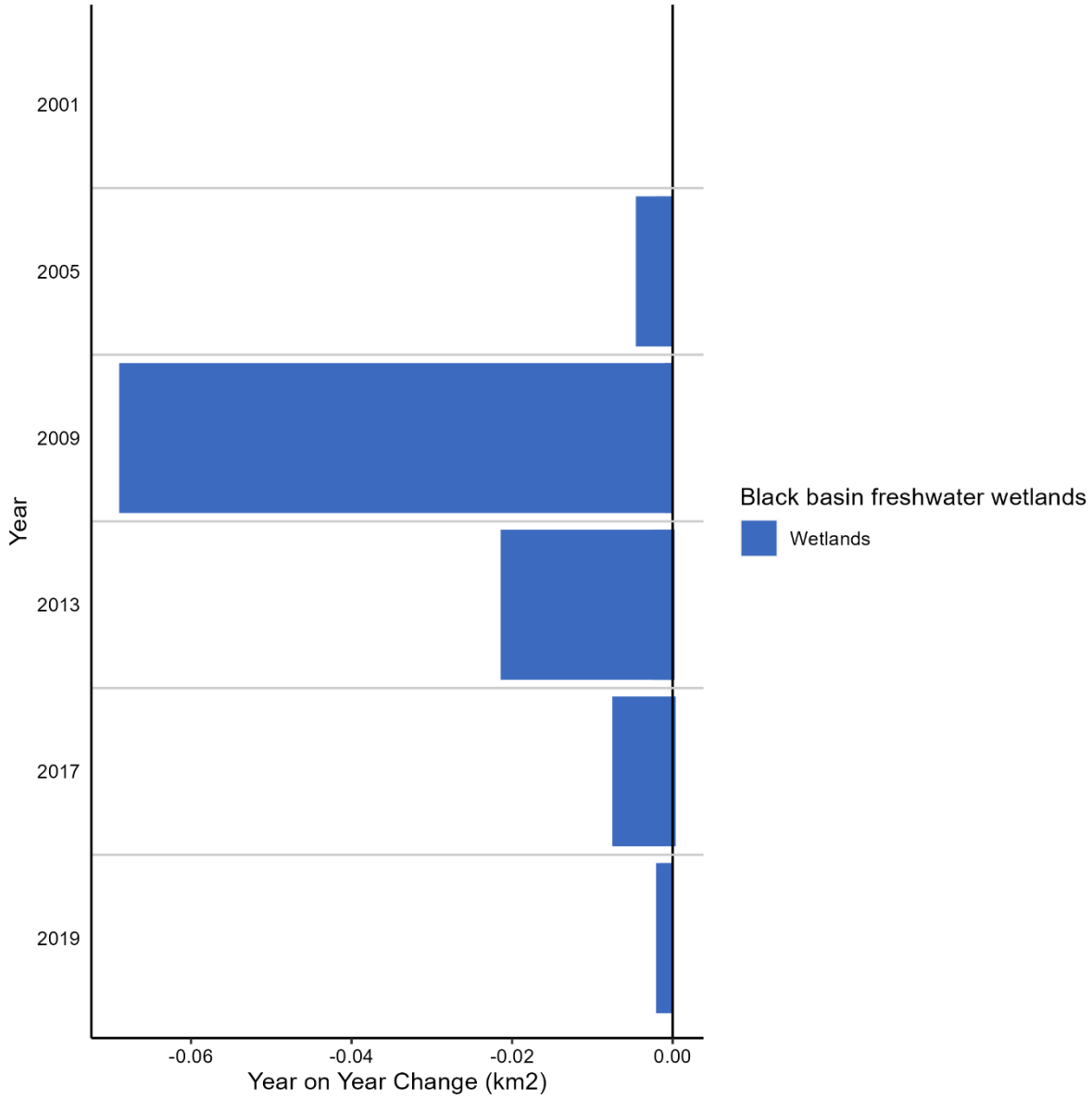

Figure 29. Black freshwater wetland vegetation change over time.

Appendix Y. Effect of the New Wetland Vegetation Dataset

Table 6. Old (version 5.0 data) and new (version 6.0 data) freshwater wetland extent in 2017.

Basin/Sub Basin	Freshwater Wetland Extent		Difference (ha)
	Area (NEW) 2017 (ha)	Area (OLD) 2017 (ha)	
Alligator Ck	526.5	364	162.5
Bohle River	206.1	192.6	13.5
Magnetic Island	28.3	11.8	16.5
Ross River (Lower)	61.0	43.3	17.7
Ross River (Upper)	46.0	46	0
Stuart Ck	11.1	10.1	1
Ross freshwater	**879.0**	**667.7**	**211.3**
Black River	33.5	13.6	19.9
Bluewater Ck	45.1	43.6	1.5
Crystal Ck	219.1	213.8	5.3
Palm Islands	61.9	47.4	14.5
Paluma Lake	-	-	-
Rollingstone Ck	76.9	77.3	-0.4
Black freshwater	**436.6**	**395.6**	**41**

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

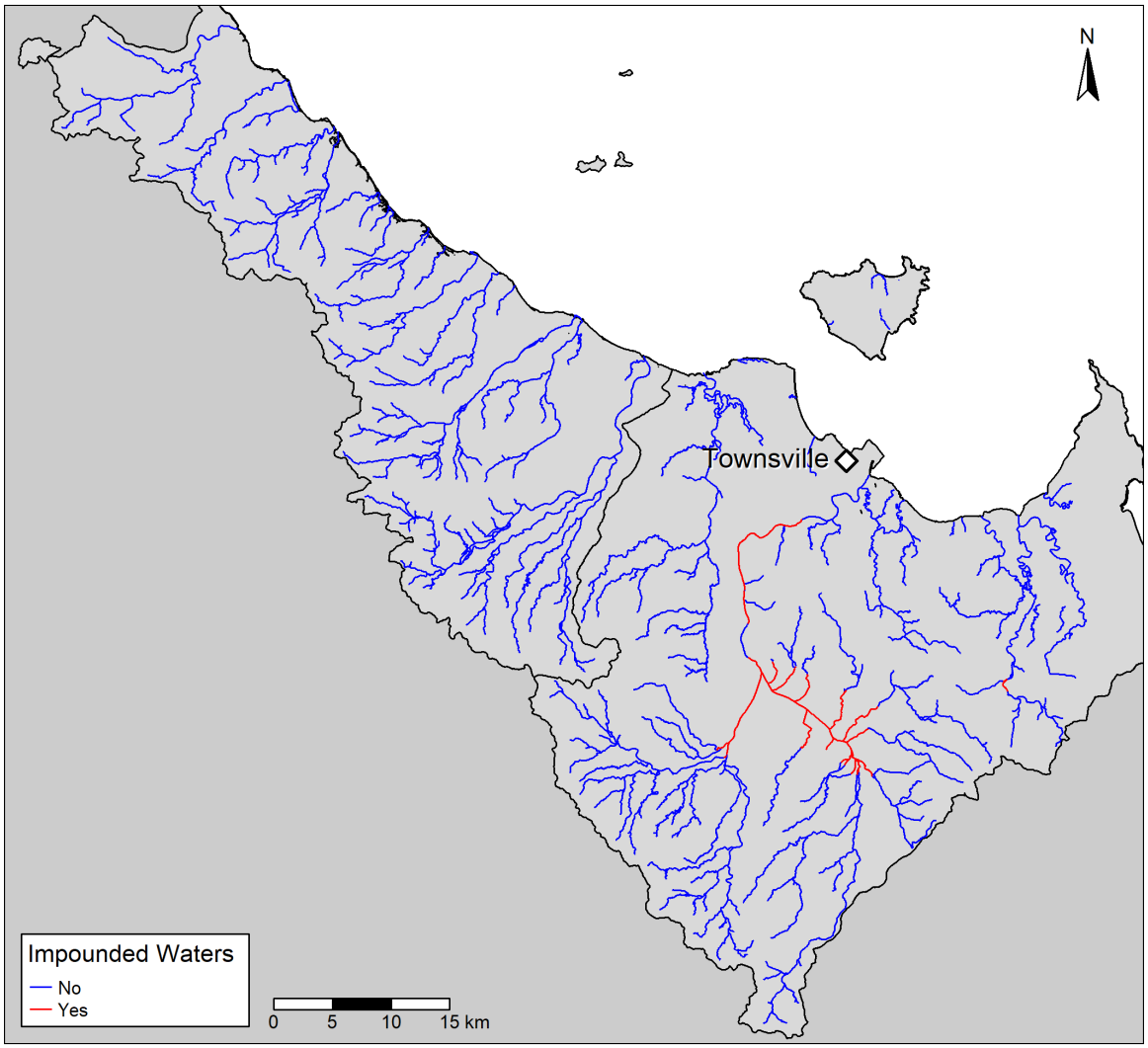

Figure 30. Impounded and non-impounded waters in the Dry Tropics region.

Appendix AA.Freshwater Fish Barrier Locations in the Townsville Dry Tropics Region

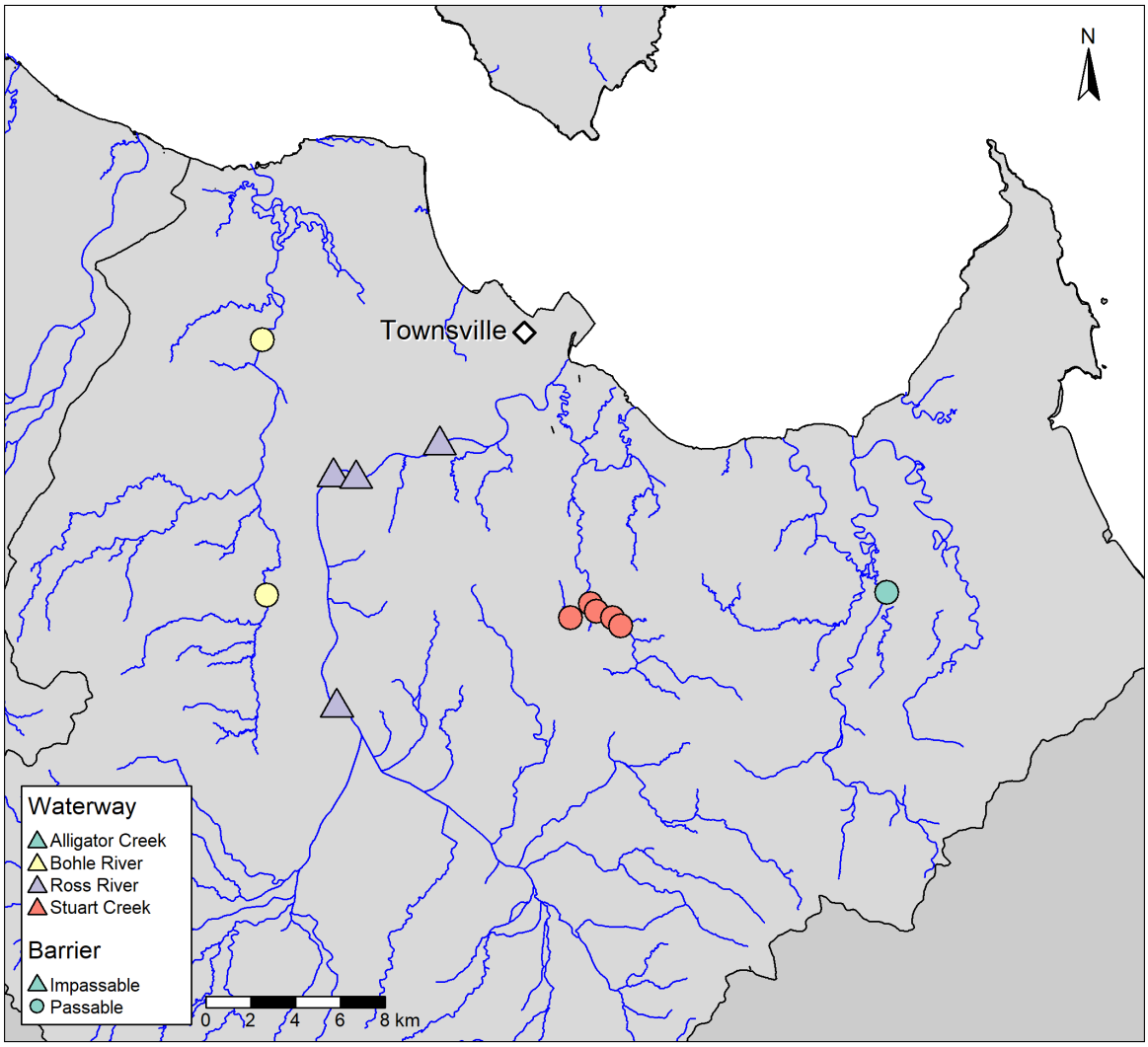

Figure 31. Fish barriers located on major and high importance waterways in the Dry Tropics region.

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

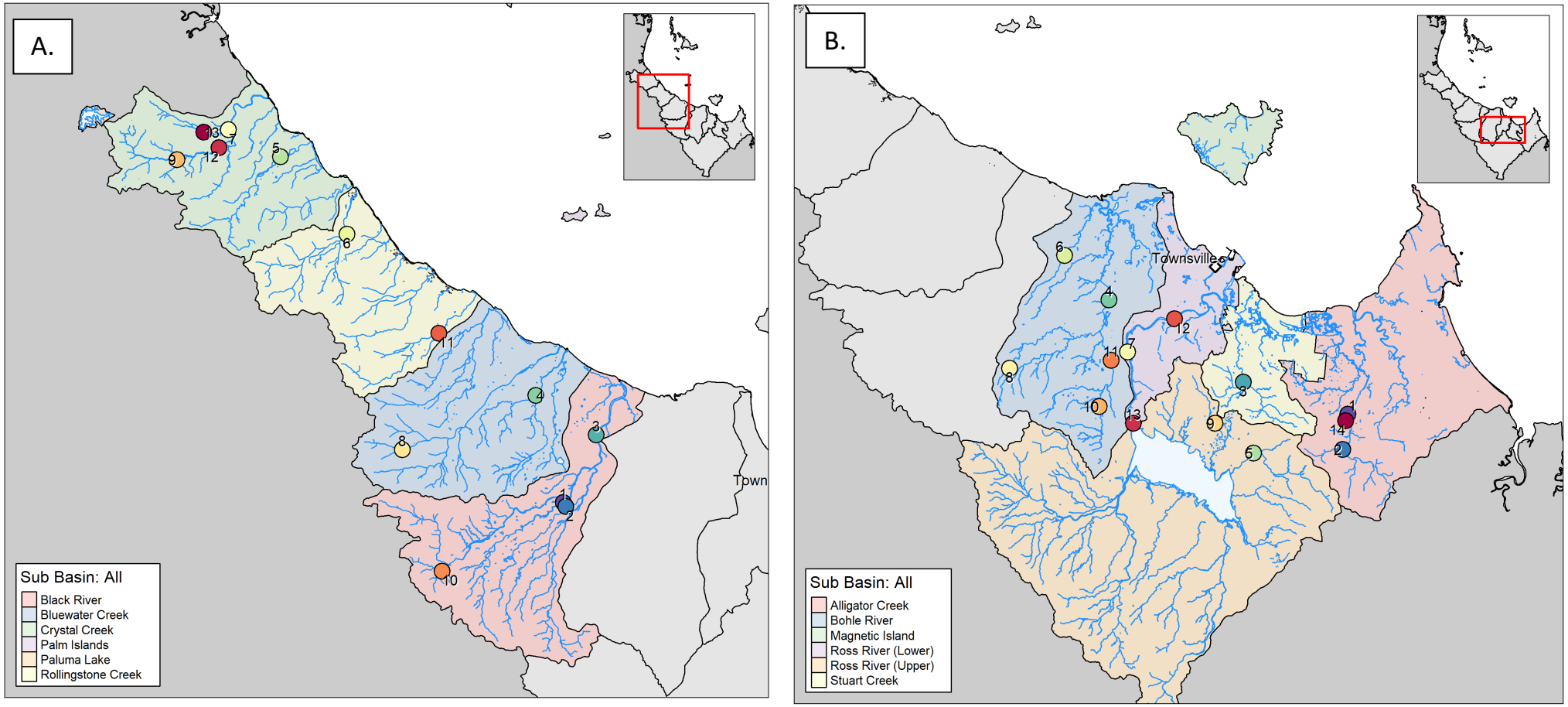

Figure 32. 2022-2023 freshwater fish sampling locations in the Townsville Dry Tropics Region. (A. = Black Basin, B. = Ross Basin). For Site ID's refer to Table 85 below.

Table 7. List of Site Names and Site Numbers for the 2022-2023 fish monitoring locations.

Basin	Site	Site Number
Ross	Alligator Ck Road, Alligator Ck	1
	Alligator Ck Road, Bowling Green Bay National Park, Mount Elliot	2
	Bougainville Street, Roseneath	3
	Dalrymple Road, Mount Louisa	4
	Flinders Highway, Ross River	5
	Geaney Lane, Deeragun	6
	Gollogly Drive, Rasmussen	7
	Granitevale Road, Alice River	8
	Kavenagh Court, Oak Valley	9
	Off Laudberg Road, Kelso	10
	Off S Beck Drive, Rasmussen	11
	Riverview Park, Annandale	12
	Riverway Drive, Kelso	13
	Strachan Road, Alligator Ck	14
Black	Adrenaline Paintball, Black River	1
	Black River Road, Black River	2
	Bruce Highway, Black River	3
	Bruce Highway, Bluewater	4
	Bruce Highway, Mutarnee	5
	Bruce Highway, Rollingstone	6
	Daly Road, Mutarnee	7
	Forestry Road, Paluma Range National Park, Lynam	8
	Intake Road, Paluma Range National Park, Crystal Ck	9
	Page Road, Hervey Range	10
	Setter Road, Bluewater	11
	Spiegelhauer Road, Mutarnee	12
	Volk Road, Mutarnee	13

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

Table 8. Key of freshwater fish species found in the Townsville Dry Tropics region.

Basin	Species	Type	Key
Ross	Barred grunter	Indigenous	1
Ross	Blue gourami	Alien	2
Ross	Bony bream	Indigenous	3
Ross	Freshwater longtom	Indigenous	4
Ross	Midas cichlid	Alien	5
Ross	Mouth almighty	Indigenous	6
Ross	Northern carp gudgeon (undescribed)	Indigenous	7
Ross	Rendahl's tandan	Indigenous	8
Ross	Seven-spot archerfish	Indigenous	9
Ross	Sleepy cod	Translocated	10
Ross	Speckled goby	Indigenous	11
Black/Ross	Barramundi	Indigenous	12
Black/Ross	Butter jew	Indigenous	13
Black/Ross	Eastern rainbowfish	Indigenous	14
Black/Ross	Empire gudgeon	Indigenous	15
Black/Ross	False Celebes goby	Indigenous	16
Black/Ross	Fly-specked hardyhead	Indigenous	17
Black/Ross	Gambusia	Alien	18
Black/Ross	Guppy	Alien	19
Black/Ross	Hyrtl's tandan	Indigenous	20
Black/Ross	Jungle perch	Indigenous	21
Black/Ross	Long-finned eel	Indigenous	22
Black/Ross	Mangrove jack	Indigenous	23
Black/Ross	Mozambique tilapia	Alien	24
Black/Ross	Northern perchlet (undescribed)	Indigenous	25
Black/Ross	Platy	Alien	26
Black/Ross	Southern purple-spotted gudgeon	Indigenous	27
Black/Ross	Spangled perch	Indigenous	28
Black/Ross	Swamp eel	Indigenous	29
Black	Black spine-cheek gudgeon	Indigenous	30
Black	Brown spine-cheek gudgeon	Indigenous	31
Black	Giant mottled eel	Indigenous	32
Black	Roman-nose goby	Indigenous	33
Black	Scaleless goby	Indigenous	34
Black	Sea mullet	Indigenous	35
Black	Snake-head gudgeon	Indigenous	36

Appendix DD. Presence/Absence of Fish Species in Waterways Across the Ross Freshwater Basin and Black Freshwater Basin

Table 9. Fish species present within waterways across the Ross Freshwater Basin.

Site #.	Species #																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	0	1	1	0	1	1	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0
5	0	0	1	0	0	1	1	0	0	1	0	0	0	1	0	0	1	1	0	1	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0
7	1	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
11	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0
12	1	0	1	1	1	1	1	0	1	1	1	1	0	1	0	0	1	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0
13	1	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0	1	1	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0
14	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	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.

Table 10. Fish species present within waterways across the Black Freshwater Basin.

Site #	Species #																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	1	0	1	0	0
8	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	1	0	0	1
12	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	0	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 EE. Distribution of Fish Data Across All Monitoring Sites in The Ross Freshwater Basin and Black Freshwater Basin

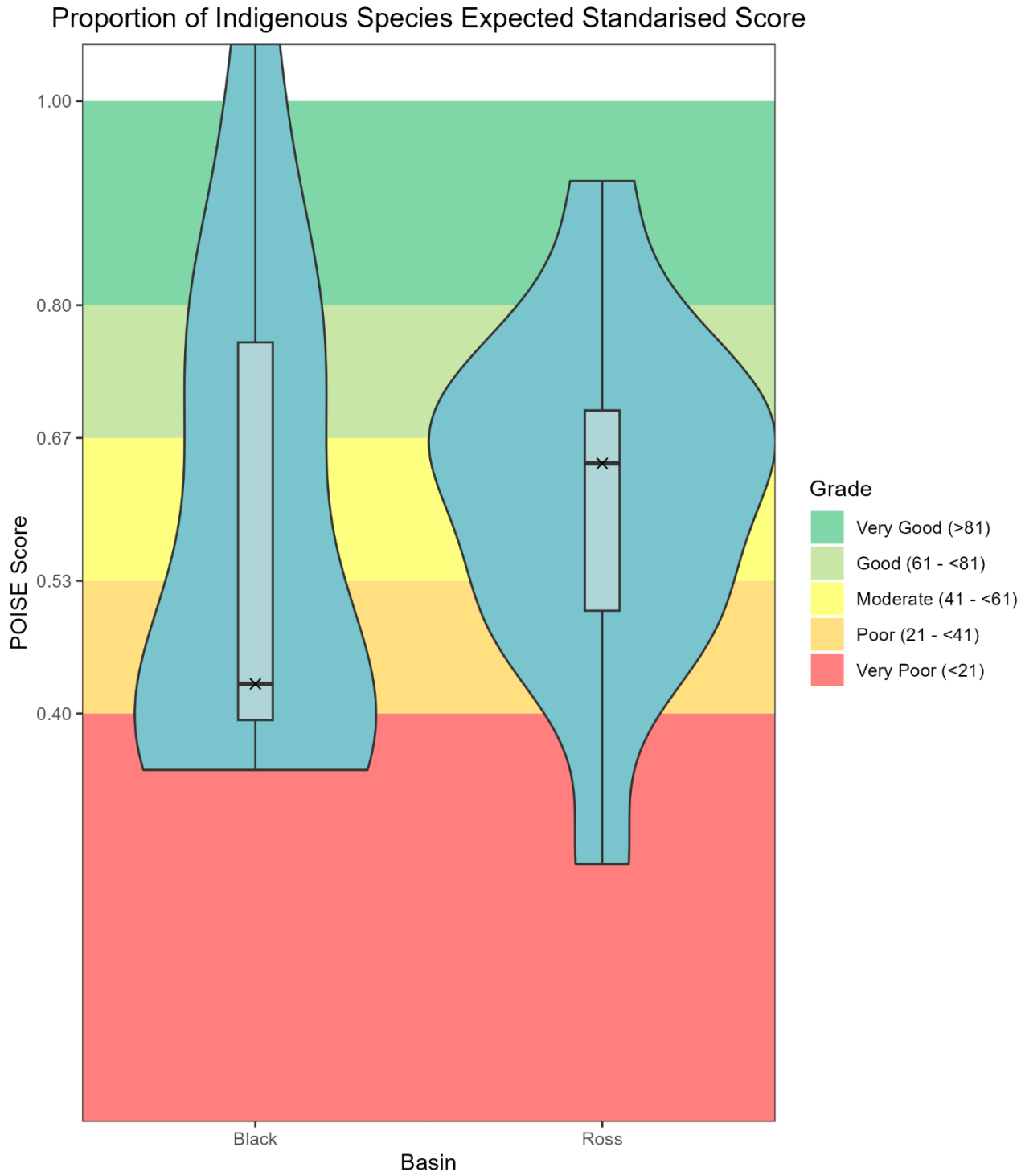

Figure 33. POISE scores for sites in each basin of the Townsville Dry Tropics region.

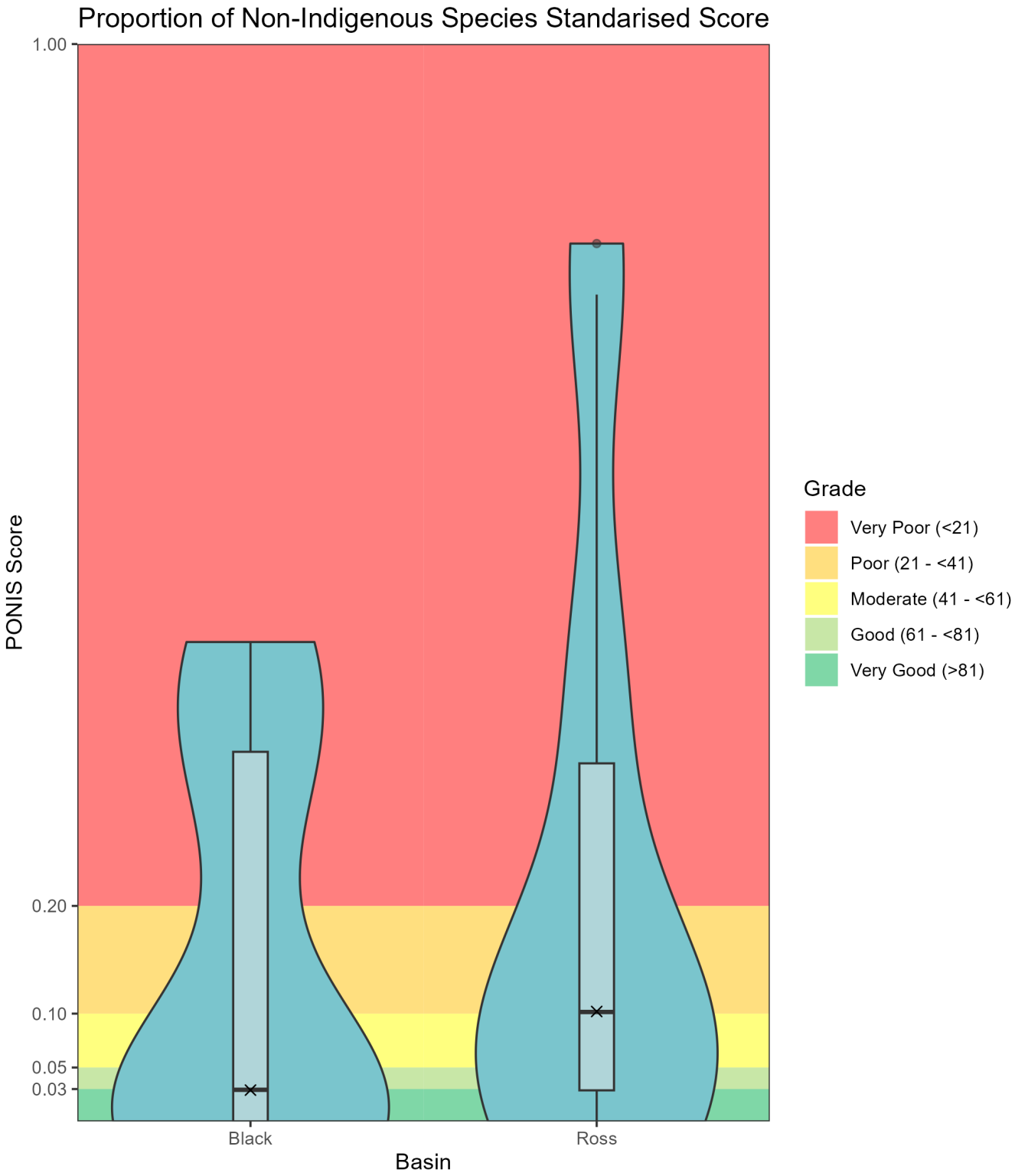

Figure 34. PONIS scores for sites in each basin of the Townsville Dry Tropics region.

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

Table 11. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for DIN and TP in the Townsville Dry Tropics Estuarine Environments.

Watercourse	DIN (mg/L)					TP (mg/L)				
	N.Samples	N.Months	Median	WQO	SF	N.Samples	N.Months	Median	WQO	SF
Bohle River	12	11	0.006	0.07	0.09	12	11	0.05	0.05	0.09
Louisa Ck	36	11	0.162	0.07	0.09	36	11	0.11	0.05	0.09
Ross Ck	6	3	0.05	0.07	0.09	8	4	0.003	0.05	0.09
Ross River	3	3	0.017	0.07	0.09	4	4	0.002	0.05	0.09
Sandfly Ck	22	10	0.022	0.07	0.09	22	10	0.042	0.05	0.09
Alligator Ck	10	9	0.003	0.07	0.09	10	9	0.03	0.05	0.09
Althaus Ck	11	11	0.017	0.02	0.09	11	11	0.021	0.025	0.04
Bluewater Ck	10	10	0.032	0.02	0.09	10	10	0.016	0.025	0.04
Sleeper Log Ck	8	8	0.019	0.02	0.09	8	8	0.021	0.025	0.04
Camp Oven Ck	33	11	0.019	0.02	0.09	33	11	0.002	0.025	0.04
Saltwater Ck	44	12	0.029	0.02	0.09	44	12	0.002	0.025	0.04
Rollingstone Ck	11	11	0.058	0.02	0.09	11	11	0.013	0.025	0.04
Crystal Ck	11	11	0.048	0.02	0.09	11	11	0.019	0.025	0.04

Key: = Mean/Median meets the guideline value | = Mean/Median does not meet the guideline value | ND = No Data | - = Not Applicable (data available but not usable).

Appendix GG. Estuarine Water Quality Nutrients Scores Historic Comparison

Table 12. Townsville Dry Tropics estuarine water quality historic nutrient indicator scores.

Basin	Sub Basin	Watercourse	DIN					TP				
			23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20
Ross Estuarine	Bohle	Bohle River	90	90	90	90	90	61	90	90	90	90
		Louisa Ck	0	67	79	75	74	0	0	79	75	74
			45	78	85	83	82	30	45	85	83	82
	Lower Ross	Ross Ck	90	90	90	90	90	90	90	90	90	90
		Ross River	90	90	90	90	90	90	90	90	90	90
			90	90	90	90	90	90	90	90	90	90
	Stuart	Sandfly Ck	90	90	76	90	90	70	90	76	90	90
	Alligator	Alligator	90	90	90	90	90	74	90	90	90	90
			75	86	85	88	88	64	75	85	88	88
Black Estuarine	Bluewater Ck	Althaus Ck	62	49	90	69	90	74	56	90	69	90
		Bluewater Ck	50	65	63	53	70	72	90	63	53	70
		Sleeper Log Ck	62	61	90	90	ND	77	90	90	90	ND
			58	58	81	71	80	74	78	81	71	80
	Rollingstone Ck	Camp Oven Ck	62	80	80	90	ND	90	90	80	90	ND
		Saltwater Ck	52	78	70	90	66	90	90	70	90	66
		Rollingstone Ck	27	34	61	36	49	90	90	61	36	49
			47	64	71	72	58	90	90	71	72	58
	Crystal Ck	Crystal Ck	36	56	65	27	58	71	90	65	27	58
			50	60	72	57	65	80	85	72	57	65

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | - = Not Applicable (data available but not usable) | X = Data was not updated this year.

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

Table 13. Number of samples, number of months sampled, median, water quality objective values, and scaling factors for Turbidity and DO in the Townsville Dry Tropics Estuarine Environments.

Watercourse	Turbidity (NTU)					Dissolved Oxygen (%Sat)						
	N.Samples	N.Months	Median	WQO	SF	N.Samples	N.Months	Median	High DO WQO	High DO SF	Low DO WQO	Low DO SF
Bohle River	12	11	18.6	20	45	12	11	88.62	105	120	85	70
Louisa Ck	36	11	15.9	20	45	36	11	64.975	105	120	85	70
Ross Ck	8	4	2.93	20	45	8	4	85.079	105	120	85	70
Ross River	4	4	6.46	20	45	4	4	78.236	105	120	85	70
Sandfly Ck	22	10	27.575	20	45	22	10	87.432	105	120	85	70
Alligator Ck	10	9	21	20	45	10	9	87.75	105	120	85	70
Althaus Ck	11	11	12.87	8	15	11	11	96.7	105	120	85	70
Bluewater Ck	10	10	11.727	8	15	10	10	92.975	105	120	85	70
Sleeper Log Ck	8	8	10.935	8	15	8	8	89.5	105	120	85	70
Camp Oven Ck	33	11	5.65	8	15	33	11	70.6	105	120	85	70
Saltwater Ck	44	12	4.212	8	15	44	12	95.334	105	120	85	70
Rollingstone Ck	11	11	7.91	8	15	11	11	96.5	105	120	85	70
Crystal Ck	11	11	11.21	8	15	11	11	97.8	105	120	85	70

Key: ■ = for Turbidity Mean/Median meets the guideline value, for DO, Median is within the range between the High and Low DO guideline values | ■ = for Turbidity Mean/Median does not meet the guideline value, for DO, the Median is higher than the High DO or Lower than the Low DO guideline value | ND = No Data | - = Not Applicable (data available but not usable).

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

Table 14. Townsville Dry Tropics estuarine water quality historic physical-chemical indicator scores.

Basin	Sub Basin	Watercourse	Turbidity					High DO					Low DO				
			23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20
Ross Estuarine	Bohle	Bohle River	62	67	66	90	90	90	90	90	90	90	66	90	90	90	90
		Louisa Ck	67	65	66	68	90	90	90	90	25	90	0	0	24	21	90
			64	66	66	79	90	90	90	90	57	90	33	45	41	56	90
	Lower Ross	Ross Ck	90	90	90	90	90	90	90	90	90	90	61	90	90	90	ND
		Ross River	90	75	90	90	90	90	90	90	70	90	33	90	90	90	ND
			90	82	90	90	90	90	90	90	80	90	47	90	90	90	ND
	Stuart	Sandfly Ck	42	34	76	33	52	90	90	90	90	90	68	90	90	90	90
	Alligator	Alligator	58	48	90	69	90	90	90	90	90	90	65	90	90	90	90
			68	63	81	68	81	90	90	90	79	90	49	75	90	81	90
Black Estuarine	Bluewater Ck	Althaus Ck	18	0	0	0	3	90	80	33	90	68	90	90	28	90	90
		Bluewater Ck	28	63	90	90	7	90	90	76	90	73	70	73	0	90	90
		Sleeper Log Ck	35	59	63	84	ND	90	90	90	90	90	90	90	90	90	ND
			27	40	51	58	5	90	86	66	90	77	83	84	39	90	90
	Rollingstone Ck	Camp Oven Ck	90	55	42	63	ND	90	90	90	53	90	2	42	54	65	ND
		Saltwater Ck	75	69	83	86	90	90	90	77	90	90	90	90	75	90	90
		Rollingstone Ck	62	80	69	65	73	76	90	90	90	90	90	77	64	90	90
			75	68	65	71	82	85	90	86	78	90	60	70	64	81	90
	Crystal Ck	Crystal Ck	32	43	7	68	90	90	90	90	90	90	90	90	69	90	34
			48	53	41	66	59	88	88	81	86	86	74	79	57	87	71

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | - = Not Applicable (data available but not usable) | X = Data was not updated this year.

Appendix JJ. Estuarine Water Quality 2022–2023 Boxplots

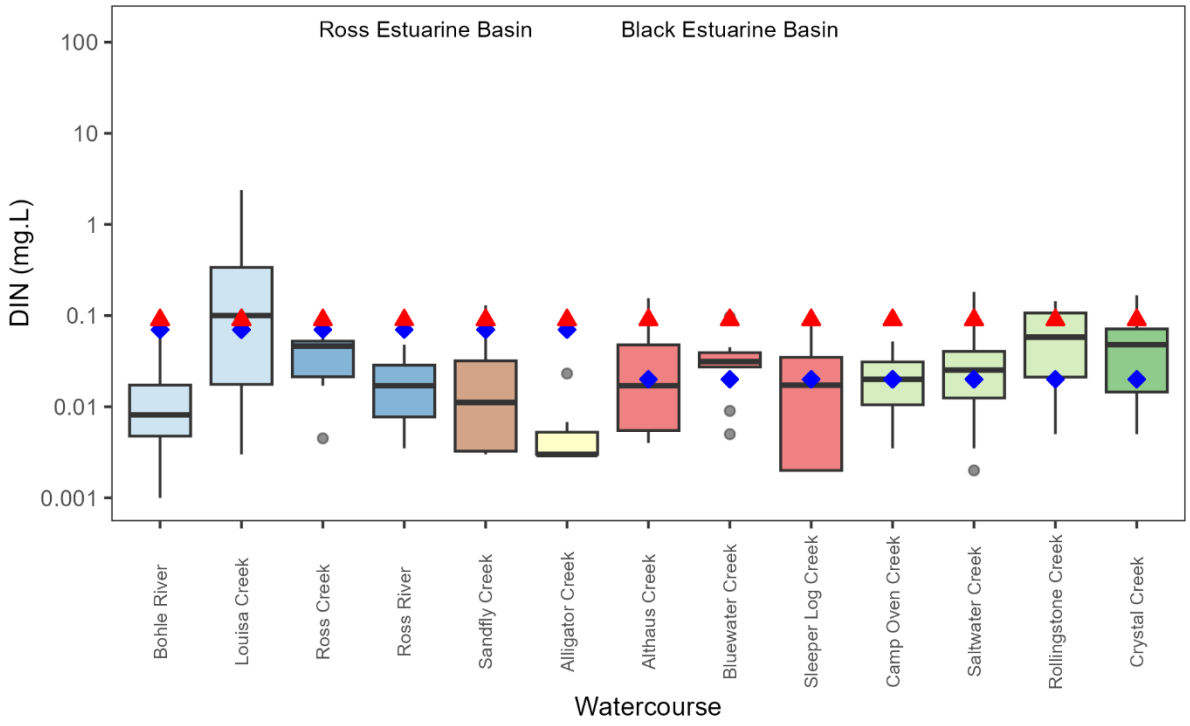

Figure 36. Dissolved Inorganic Nitrogen (DIN) (mg/L) Boxplot: red triangles indicate the scaling factor; blue diamonds indicate the water quality objective.

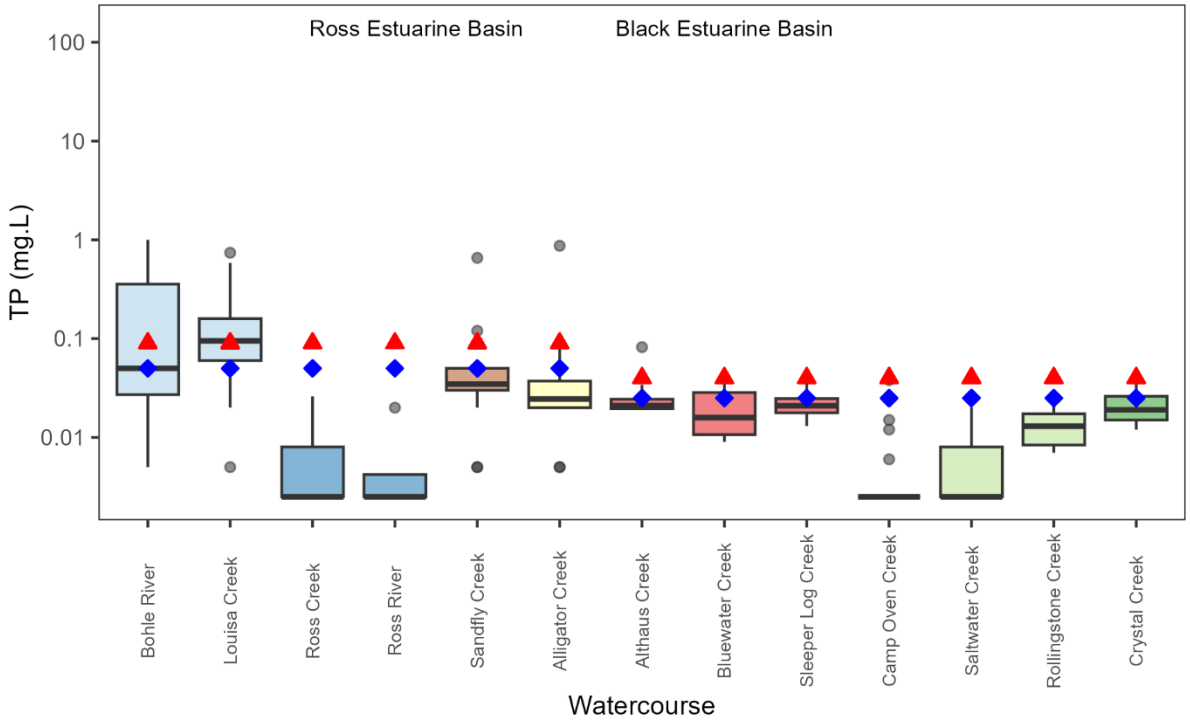

Figure 35. Total Phosphorus (TP) (mg/L) Boxplot: red triangles indicate the scaling factor; blue diamonds indicate the water quality objective.

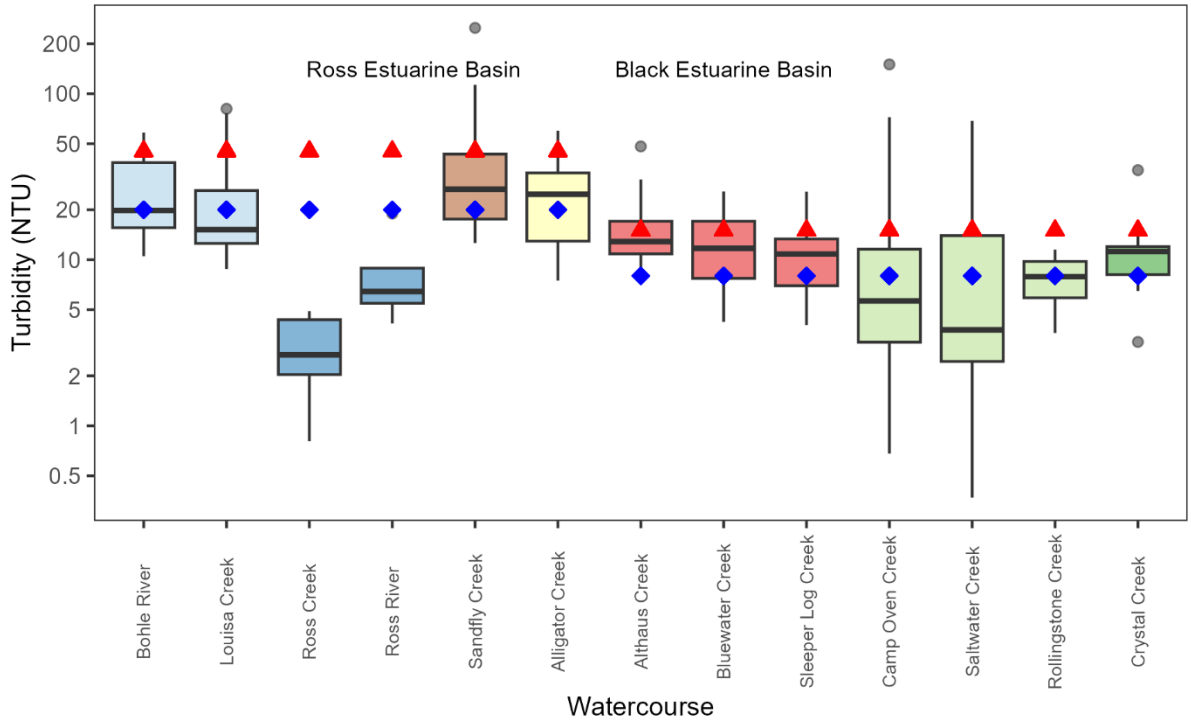

Figure 38. Turbidity (NTU) Boxplot: red triangles indicate the scaling factor; blue diamonds indicate the water quality objective.

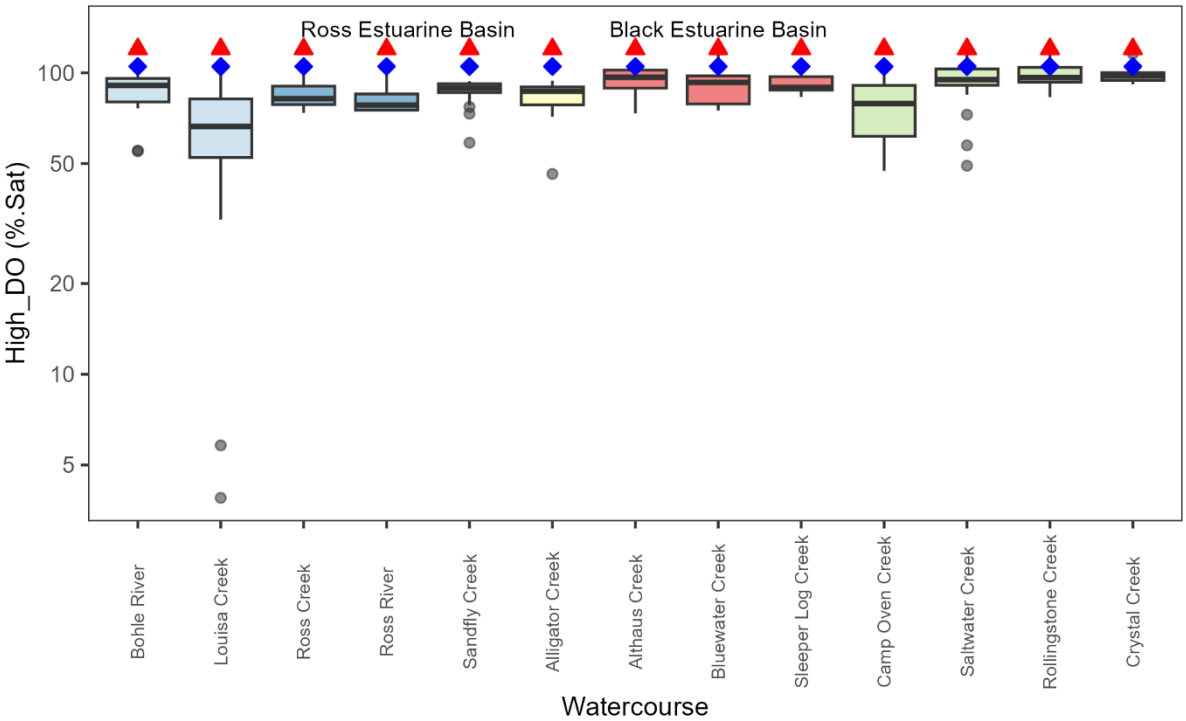

Figure 37. Dissolved Oxygen (DO) (% Saturation) boxplot: red triangles indicate the high DO scaling factor, blue diamonds indicate the high DO water quality objective, purple diamonds indicate the low DO water quality objective, and brown triangles indicate the low DO scaling factor.

Appendix KK. Estuarine Water Quality Line Plots

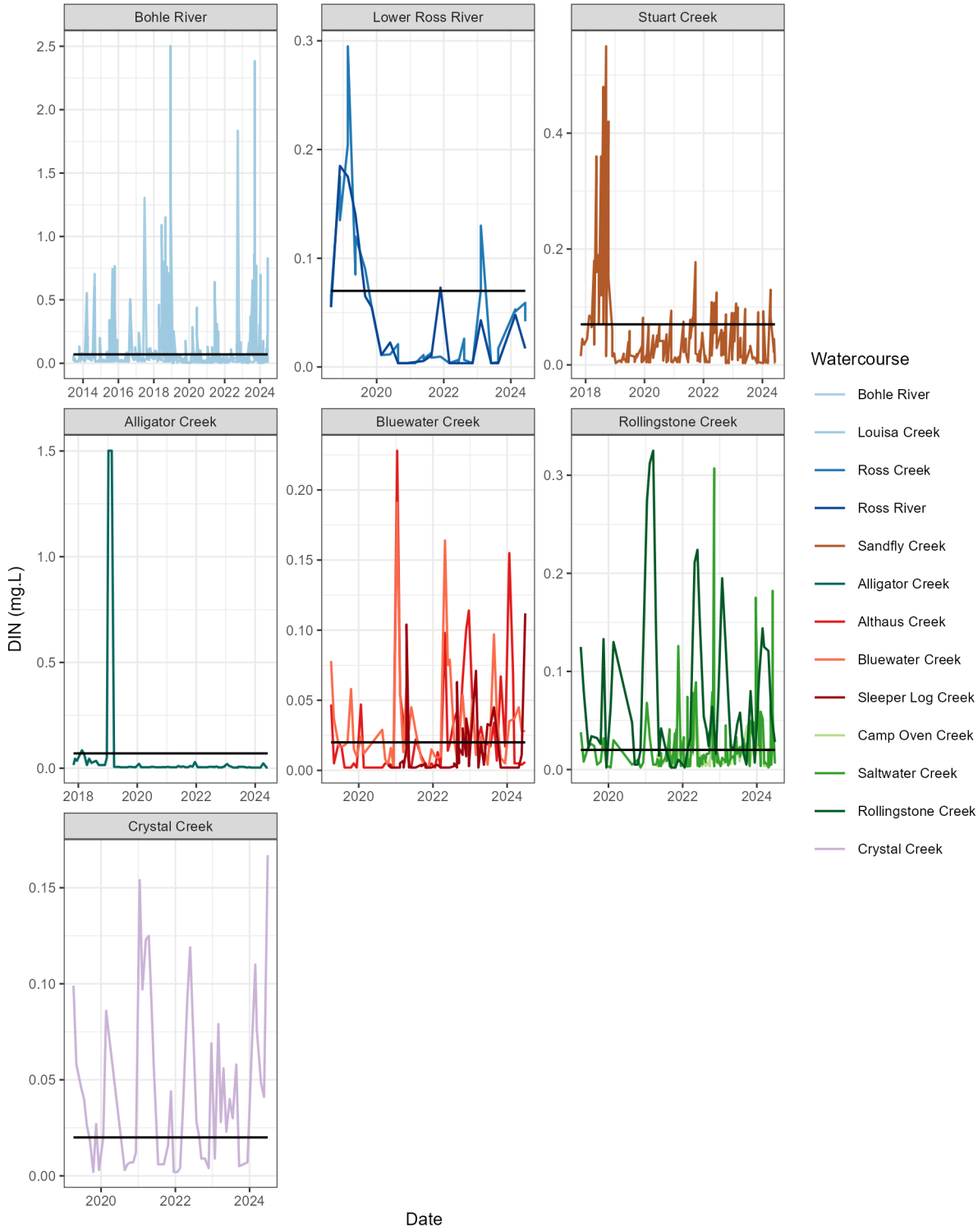

Figure 39. Historical concentrations of dissolved inorganic nitrogen (DIN) in the freshwater sub basins. Black line indicates the water quality objective.

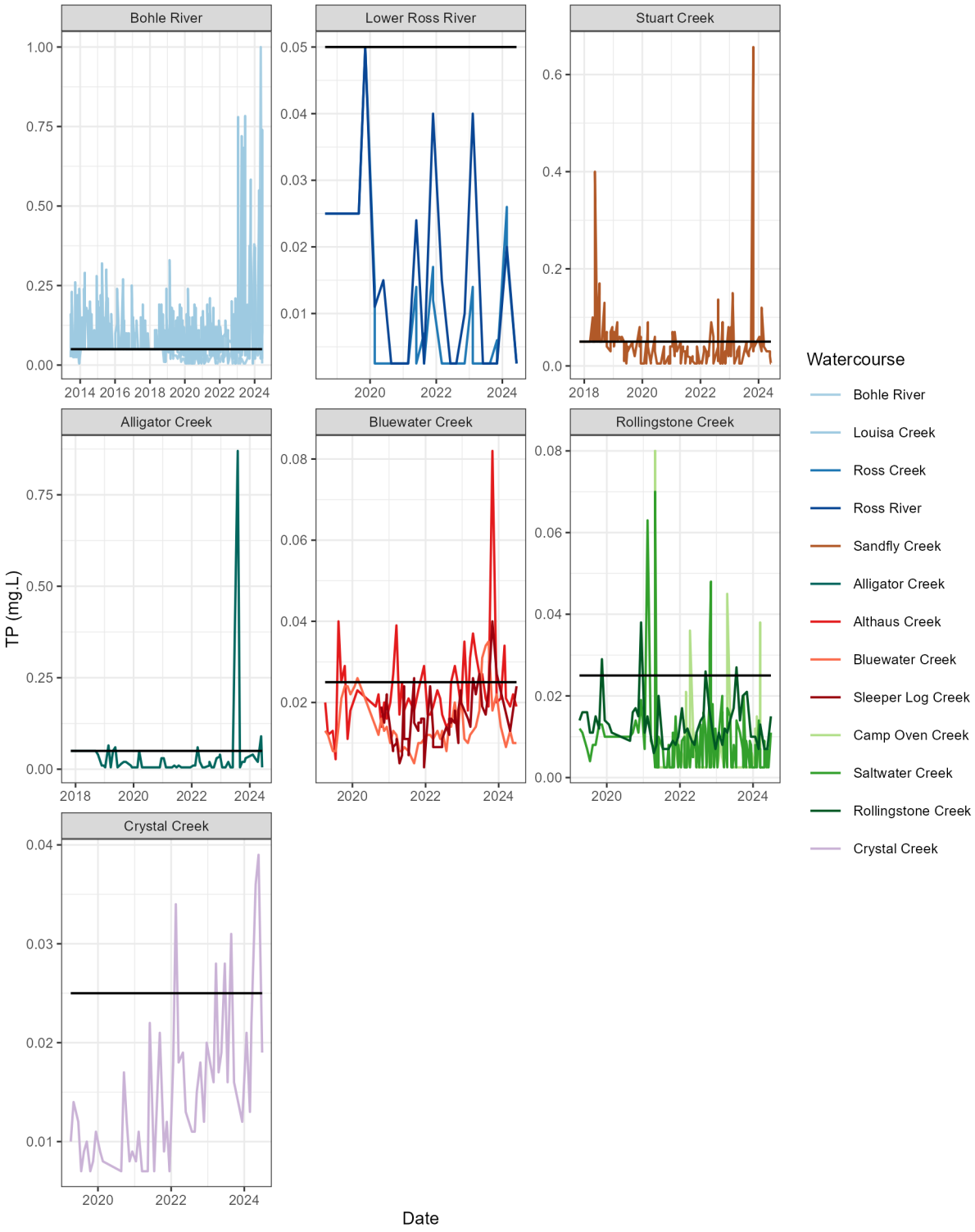

Figure 40. Historical concentrations of Total Phosphorus (TP) in the freshwater sub basins. Black line indicates the water quality objective.

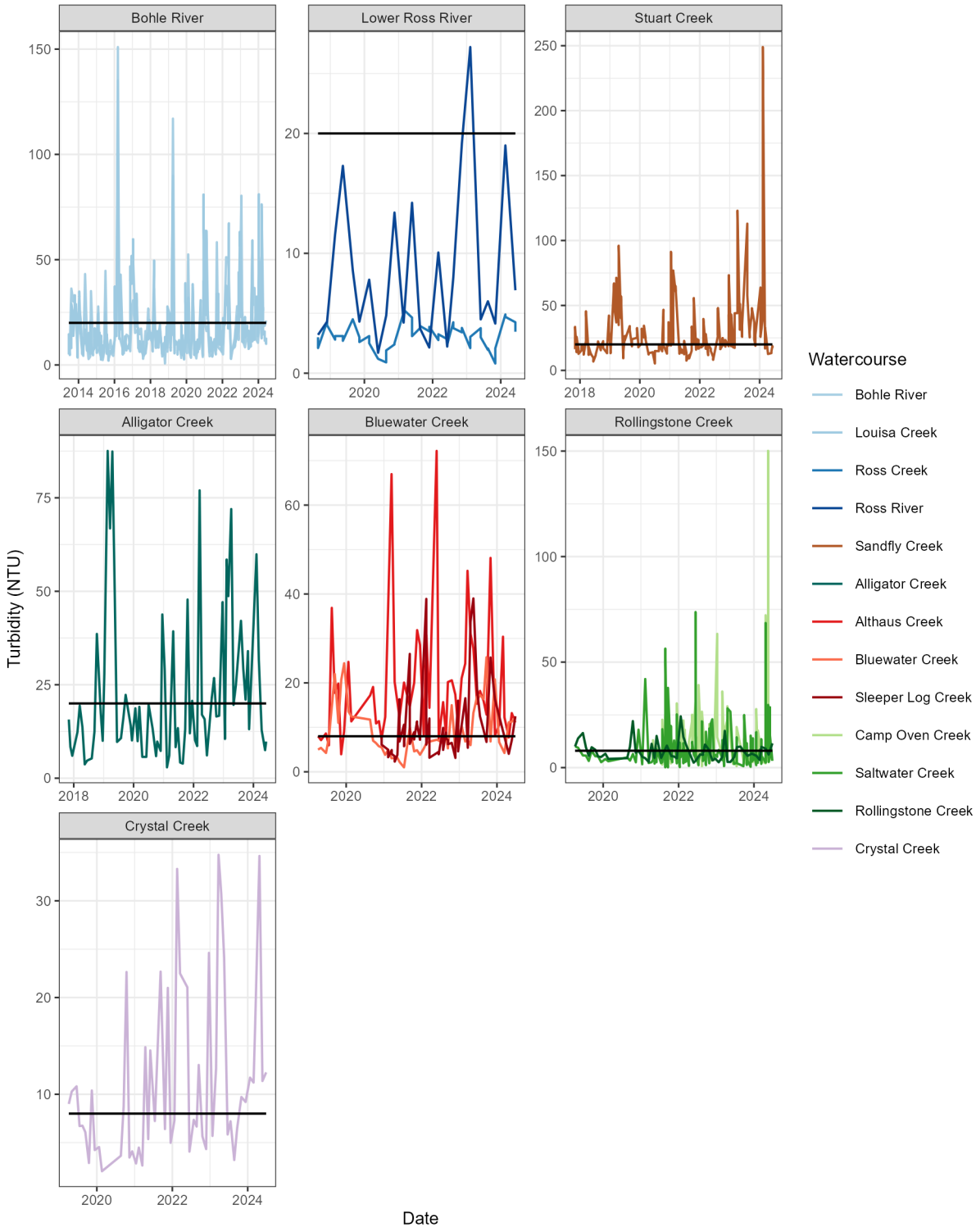

Figure 41. Historical concentrations of turbidity (NTU) in the freshwater sub basins. Black line indicates the water quality objective.

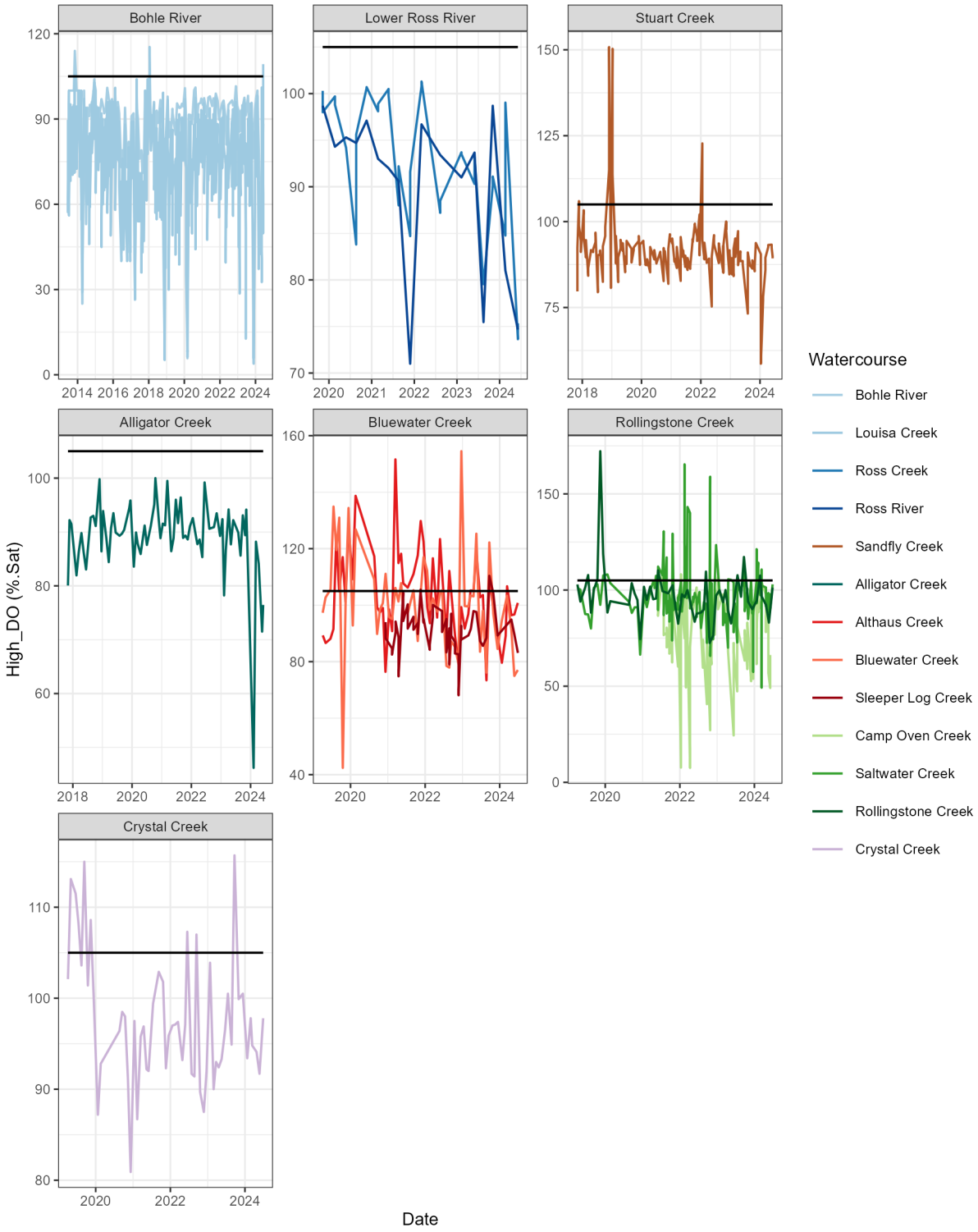

Figure 42. Historical dissolved oxygen in the freshwater sub basins. Black lines indicate the water quality objective (High DO).

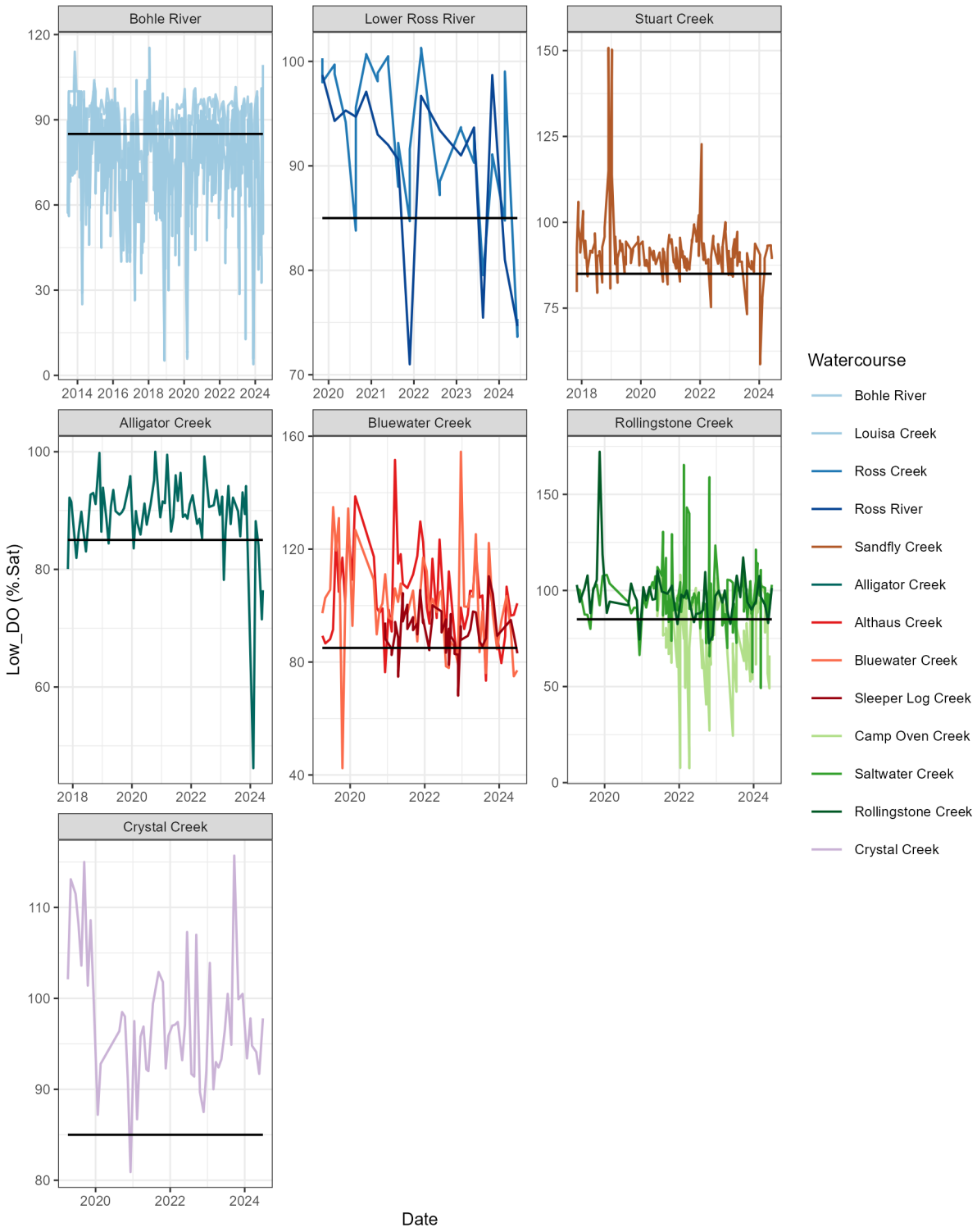

Figure 43. Historical dissolved oxygen in the freshwater sub basins. Black lines indicate the water quality objective (Low DO).

Appendix LL. Estuarine Mangrove and Saltmarsh Extent: Assessed Area in the Ross Basin of the Townsville Dry Tropics Region

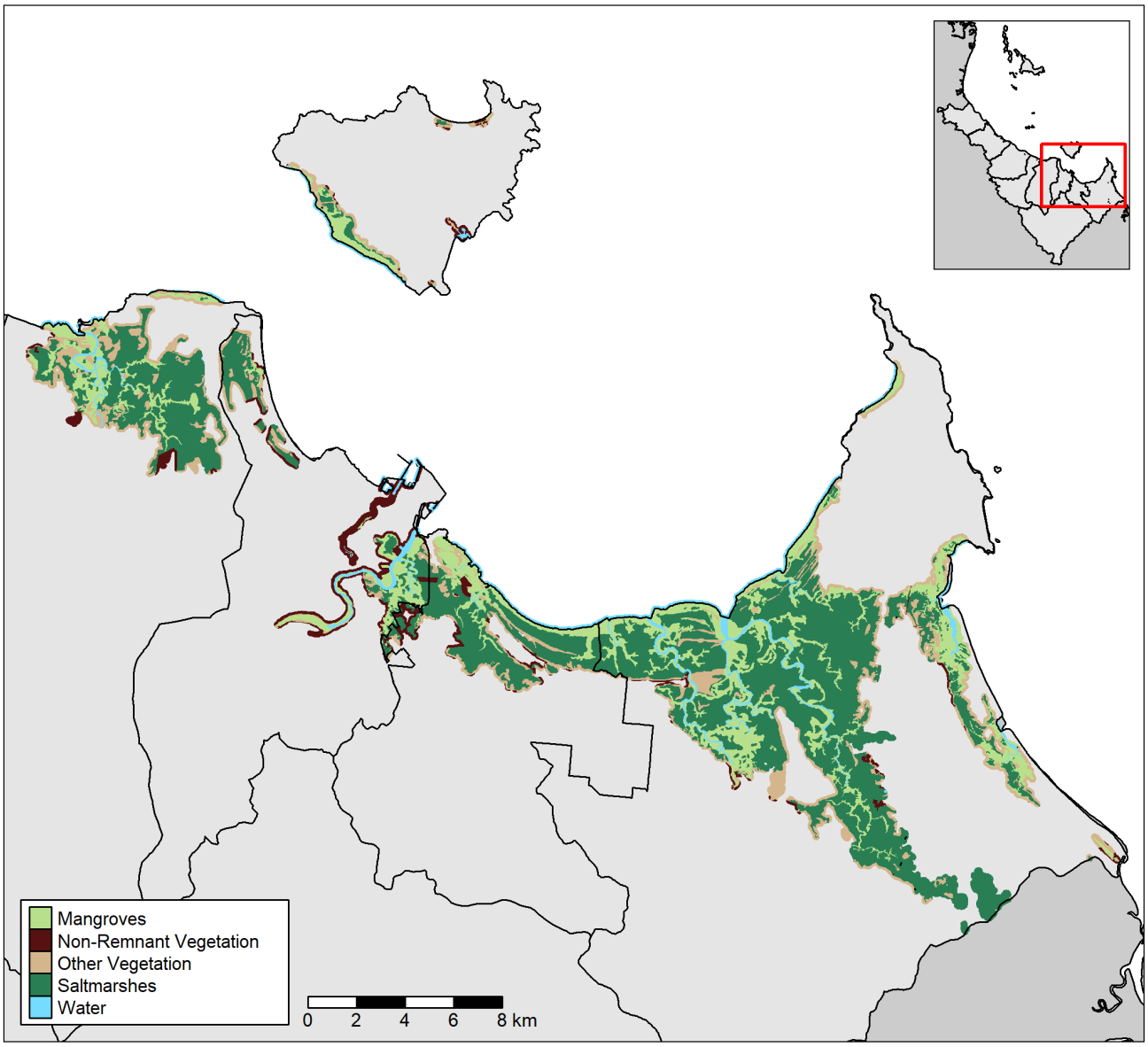

Figure 44. Total area in the Ross Basin of the Dry Tropics region that was assessed for changes in Mangrove and Saltmarsh extent.

Appendix MM. Estuarine Mangrove and Saltmarsh Extent: Assessed Area in the Black Basin of the Townsville Dry Tropics Region

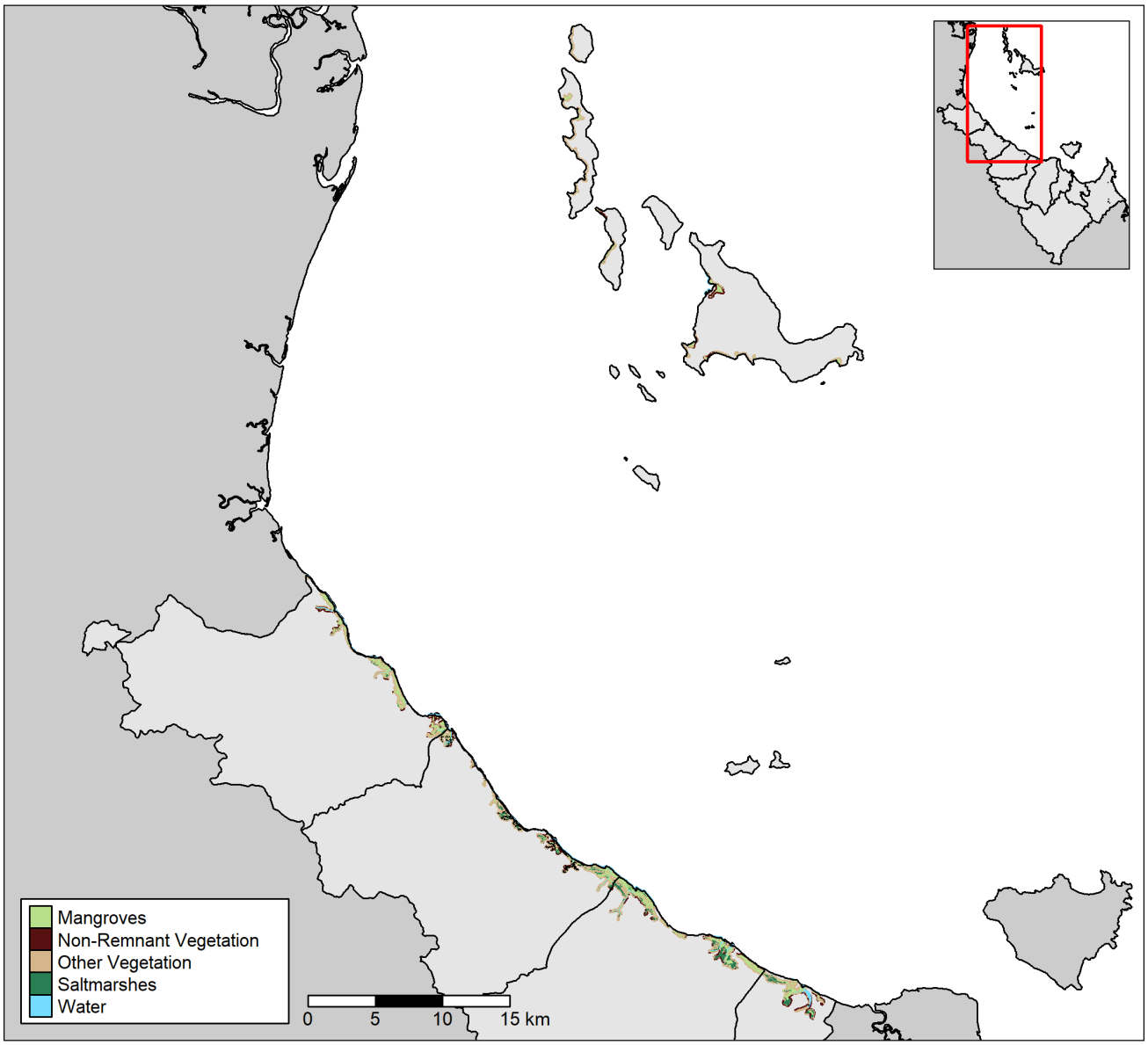

Figure 45. Total area in the Black Basin of the Dry Tropics region that was assessed for changes in Mangrove and Saltmarsh extent.

Appendix NN. Ross Estuarine Area Mangrove and Saltmarsh Vegetation Change Over Time

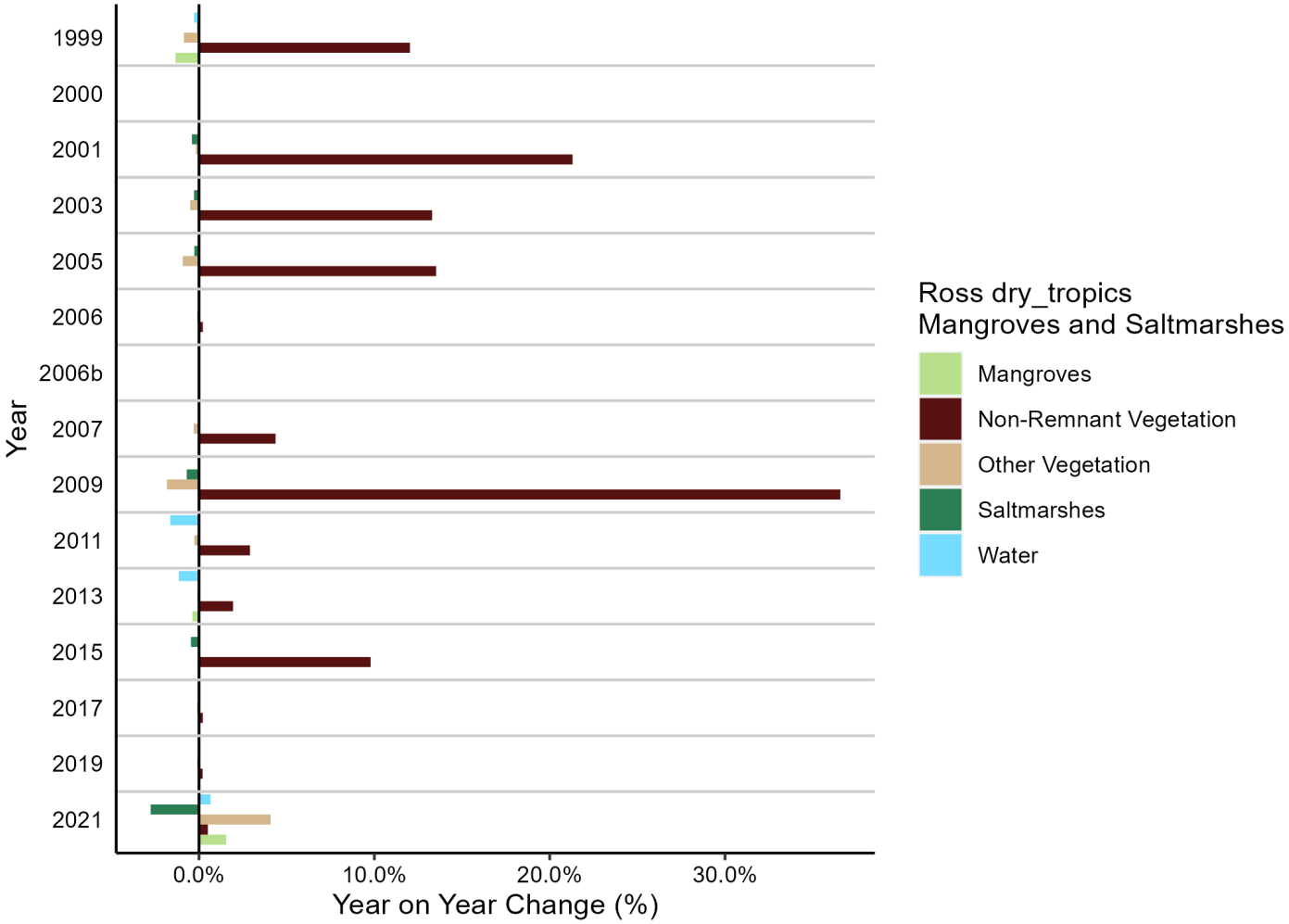

Figure 46. Ross Estuarine Area Mangrove and Saltmarsh Vegetation Change.

Appendix OO. Black Estuarine Area Mangrove and Saltmarsh Vegetation Change Over Time

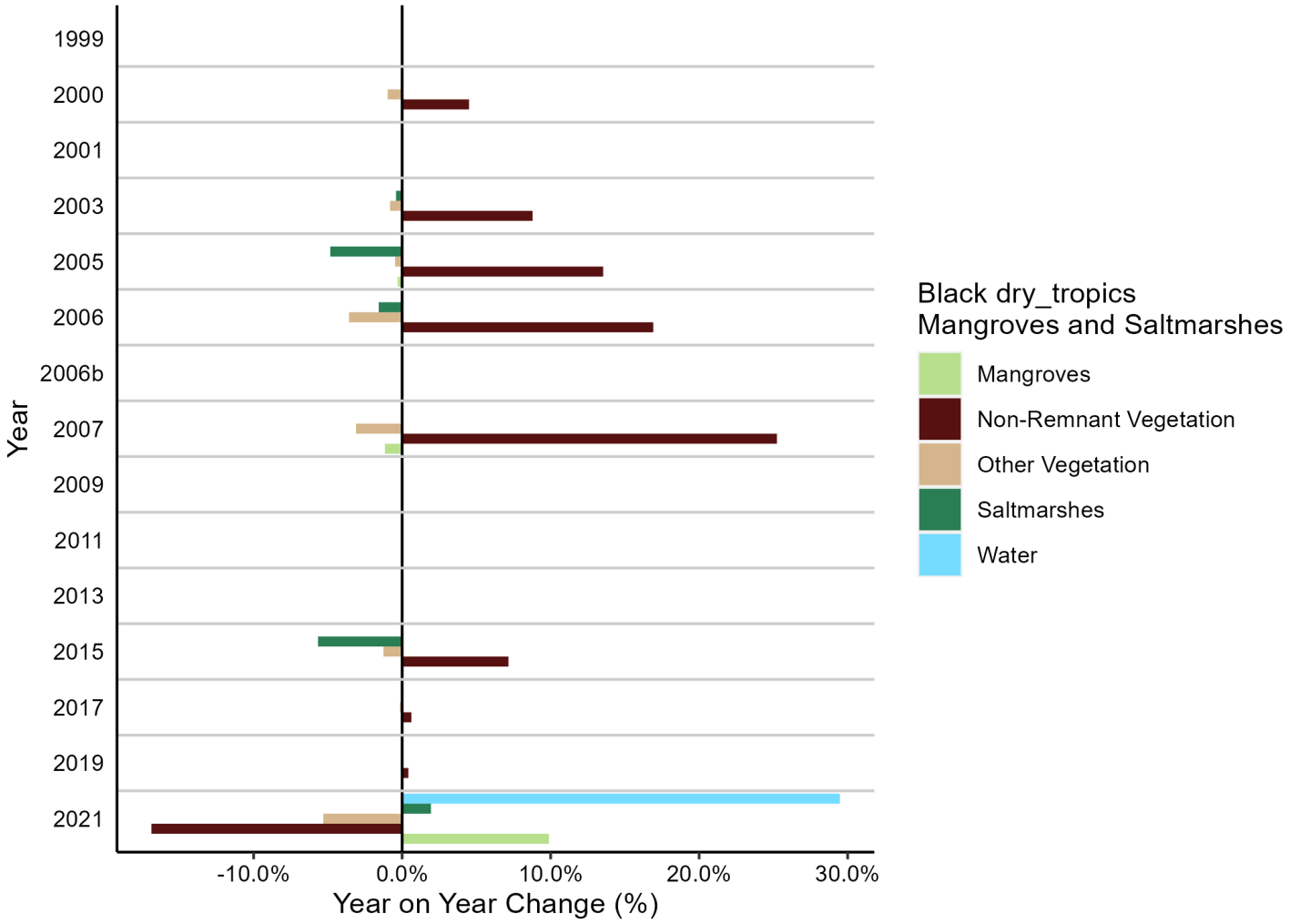

Figure 47. Black Estuarine Area Mangrove and Saltmarsh Vegetation Change.

Appendix PP. Estuarine Riparian Extent: Assessed Area in the Ross Basin of the Townsville Dry Tropics Region

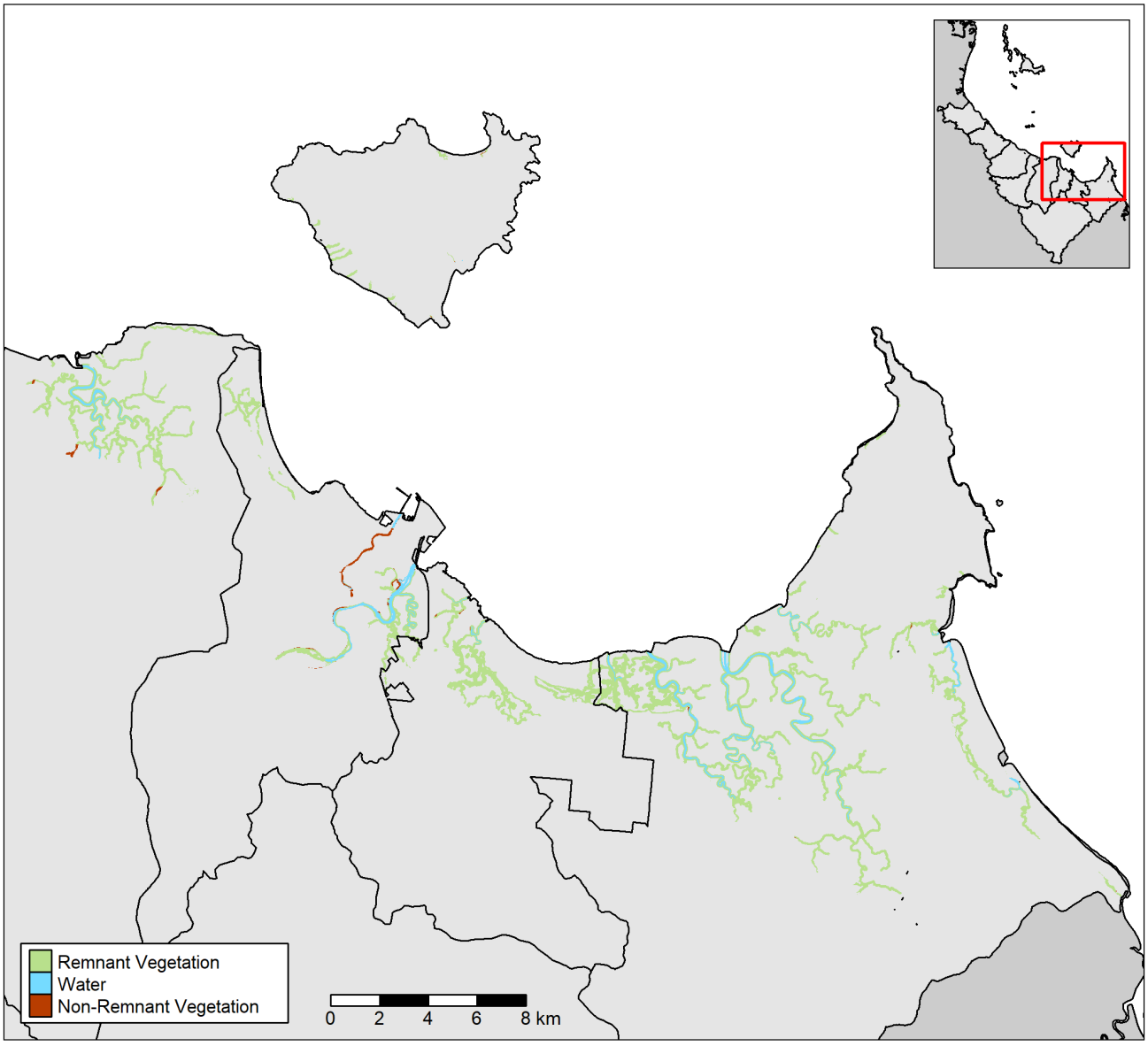

Figure 48. Ross Estuarine Riparian Vegetation Change.

Appendix QQ. Estuarine Riparian Extent: Assessed Area in the Black Basin of the Townsville Dry Tropics Region

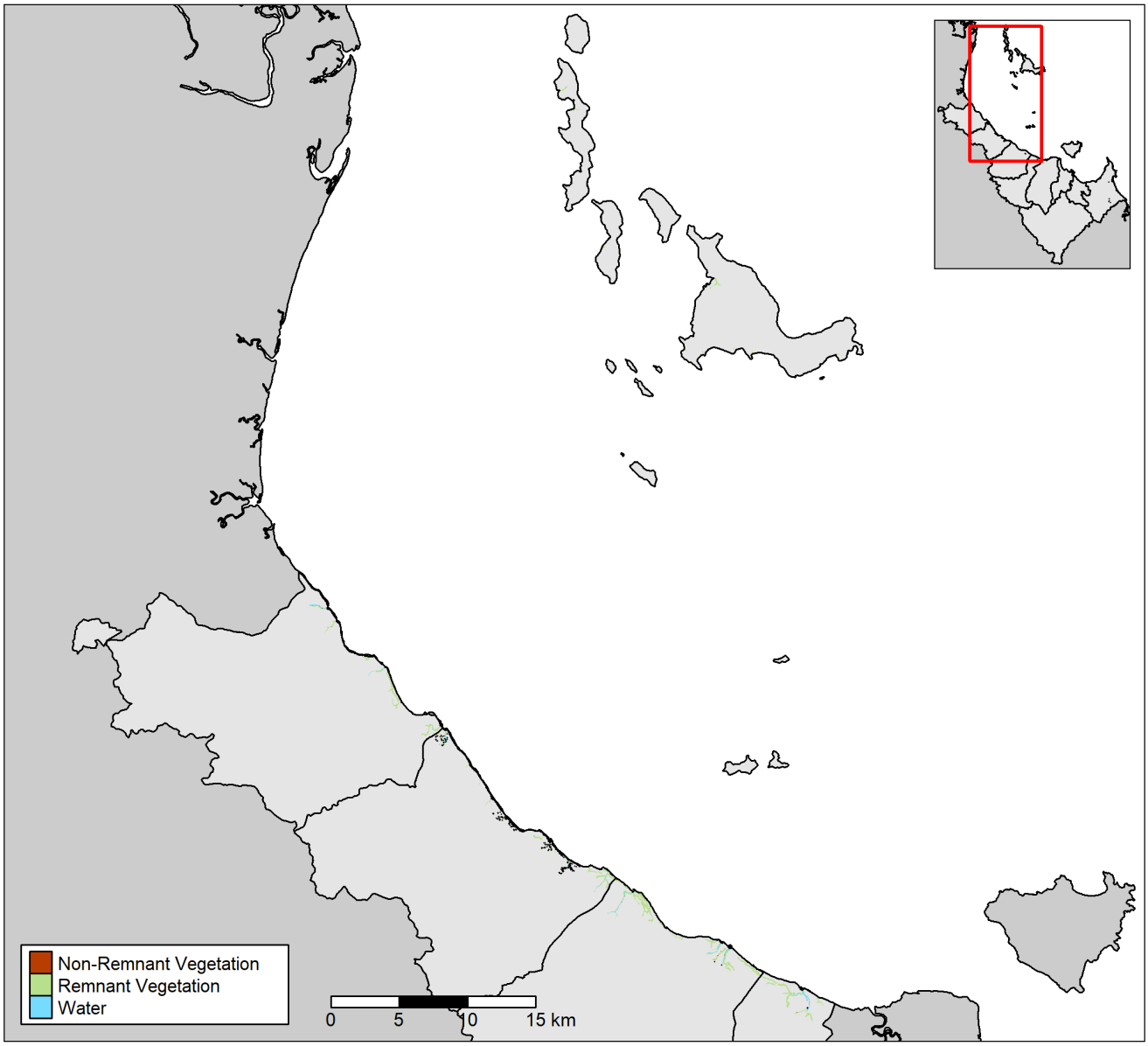

Figure 49. Black Estuarine Riparian Vegetation Change.

Appendix RR. Ross Estuarine Riparian Vegetation Change Over Time

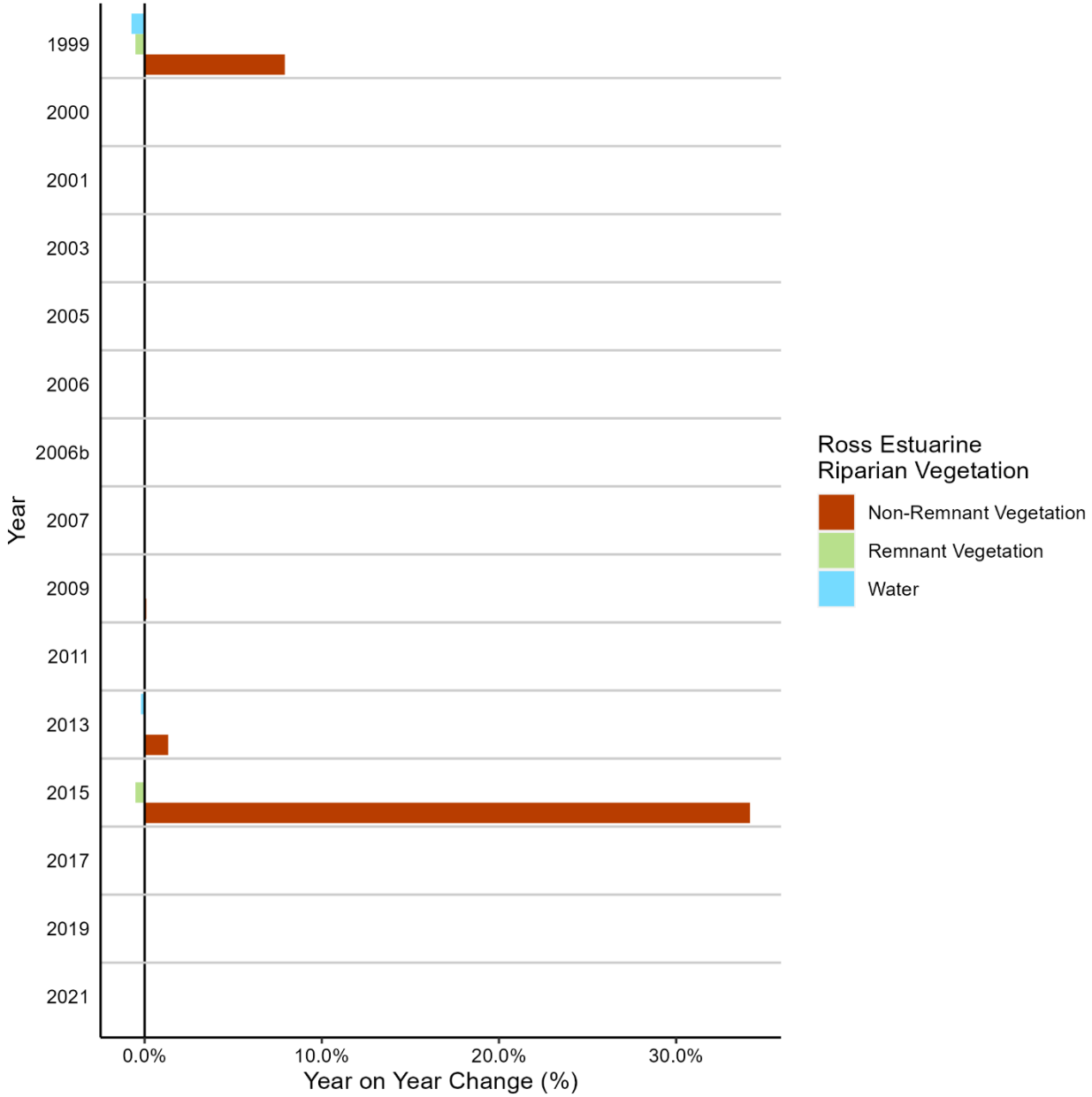

Figure 50. Ross Estuarine riparian vegetation change over time.

Appendix SS. Black Estuarine Riparian Vegetation Change Over Time

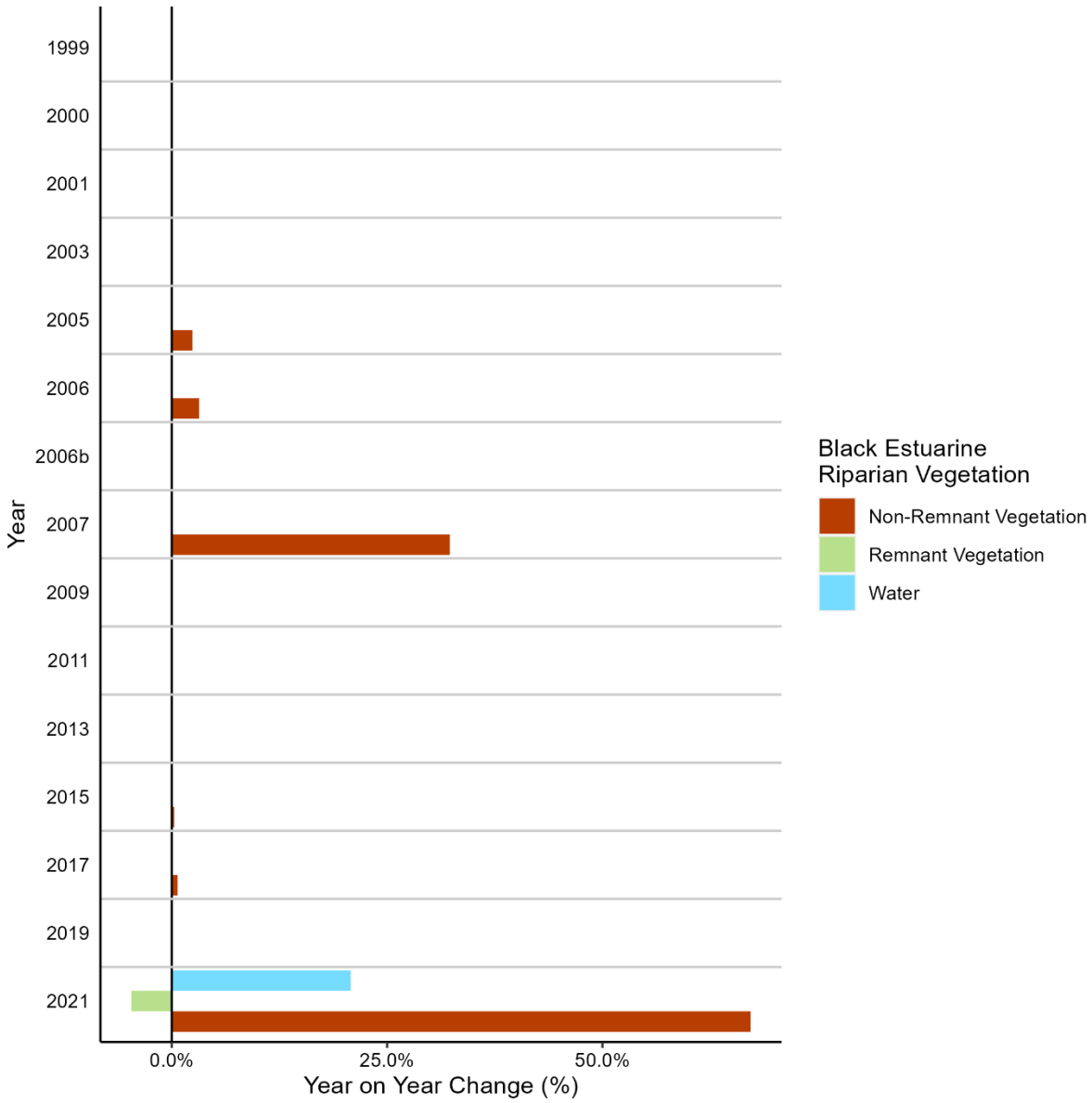

Figure 51. Black Estuarine riparian vegetation change over time.

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

Table 15. Number of samples, days sampled, mean, median and water quality objective values for nutrient indicators in the Townsville Dry Tropics Inshore Marine Environment.

Area	NOx (mg/L)				PN (ug/L)				PP (mg/L)				TP (mg/L)			
	N. Samples	N. Months	Median	WQO	N. Samples	N. Months	Mean	WQO	N. Samples	N. Months	Mean	WQO	N. Samples	N. Months	Median	WQO
E.C.IPZ	6	2	0.001	0.009	ND	ND	ND	ND	ND	ND	ND	ND	12	4	0.0025	0.03
E.C.OPZ	35	10	0.0015	0.009	ND	ND	ND	ND	ND	ND	ND	ND	37	10	0.01	0.03
O.C.IPZ	2	2	0.001	0.009	ND	ND	ND	ND	ND	ND	ND	ND	4	4	0.0025	0.03
O.C.OPZ	4	2	0.001	0.002	ND	ND	ND	ND	ND	ND	ND	ND	8	4	0.0025	0.02
Mag. Is.	9	7	0.0011	0.001	9	7	0.0351	0.021	9	7	0.0035	0.0028	ND	ND	ND	ND
E.C.W	16	8	0.001	0.003	ND	ND	ND	ND	ND	ND	ND	ND	16	8	0.0025	0.02
O.C.W	9	7	0.0008	0.002	9	7	0.0289	0.02	9	7	0.003	0.0028	ND	ND	ND	ND
Mid	9	7	0.0013	0.002	9	7	0.0268	0.02	9	7	0.002	0.0028	ND	ND	ND	ND

Key: ■ = Mean/Median meets the guideline value | ■ = Mean/Median does not meet the guideline value | ND = No Data | - = Not Applicable (data available but not usable).

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

Table 16. Townsville Dry Tropics inshore marine environment historic nutrient indicator scores.

Zone	Sub Zone	Area	NOX					PN					PP					TP				
			23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20
Cleveland Bay	Enclosed Coastal	E.C.IPZ	100	100	100	100	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	100	100	100
		E.C.OPZ	100	100	100	94	94	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	100	16	16
			100	100	100	97	97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	100	58	58
	Open Coastal	O.C.IPZ	100	100	100	100	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	100	100	100
		O.C.OPZ	100	-	100	100	-	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	100	100	100
			100	100	100	100	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	100	100	100
	Magnetic Island	Mag. Is.	57	19	23	0	4	15	8	3	23	13	41	40	36	55	29	ND	ND	ND	ND	ND
			89	79	80	73	74	15	8	3	23	13	41	40	36	55	29	100	100	100	79	79
Halifax Bay	Enclosed Coastal	E.C.W	100	100	100	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	100	100	100	100	ND
	Open Coastal	O.C.W	100	100	97	75	36	28	32	18	33	0	56	63	76	38	66	ND	ND	ND	ND	ND
	Midshelf	Midshelf	85	100	55	94	19	35	25	32	27	0	79	71	82	73	64	ND	ND	ND	ND	ND
			95	100	84	90	28	32	29	25	30	0	67	67	79	55	65	100	100	100	100	ND

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | - = Not Applicable (data available but not usable) | X = Data was not updated this year.

Appendix VV. Inshore Marine Water Quality Phys-Chem and Chlorophyll *a*: Sample Frequencies, Means, Medians, and WQOs

Table 17. Number of samples, mean, median, and water quality objective values for physical-chemical properties and Chlorophyll a indicators in the Townsville Dry Tropics Inshore Marine Environment.

Area	Turbidity (NTU)				TSS (mg/L)				Secchi (m)[1]				Chlorophyll a (ug/L)			
	N. Samples	N. Months	Median	WQO	N. Samples	N. Months	Mean	WQO	N. Samples	N. Months	Mean	WQO	N. Samples	N. Months	Mean	WQO
E.C.IPZ	12	4	4.695	4.9	12	4	10.4167	22	9	3	2.1489	1	ND	ND	ND	ND
E.C.OPZ	37	10	16.9	4.9	37	10	28.7838	15	3	3	2.2867	1	33	10	2.4727	2.6
O.C.IPZ	4	4	3.21	4.9	4	4	7.875	22	3	3	1.98	1	ND	ND	ND	ND
O.C.OPZ	331	12	7.3632	3	8	4	5.375	10	6	3	2.7883	3	ND	ND	ND	ND
Mag. Is.	533	12	2.4003	2.7	9	7	1.9031	3.7	9	7	3.7111	3	375	12	0.5933	0.84
E.C.W	16	8	7.11	6	16	8	13.6562	15	ND	ND	ND	ND	16	8	1	2
O.C.W	288	11	1.1666	1.5	8	6	1.7178	2	9	7	5.1222	10	297	11	0.5674	0.45
Mid	361	12	0.7688	1.5	8	6	0.8709	2	9	7	7.4889	10	370	12	0.5976	0.45

Key: ■ = Mean/Median meets the guideline value | ■ = Mean/Median does not meet the guideline value | ND = No Data | - = Not Applicable (data available but not usable).

[1] 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.

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

Table 18. Townsville Dry Tropics inshore marine environment historic physical-chemical and Chlorophyll a indicator scores.

Zone	Sub Zone	Area	Turbidity					TSS					Secchi					Chlorophyll *a*				
			23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20	23-24	22-23	21-22	20-21	19-20
Cleveland Bay	Enclosed Coastal	E.C.IPZ	63	28	100	89	74	100	85	100	85	100	100	60	92	93	78	ND	ND	ND	ND	ND
		E.C.OPZ	0	0	0	0	0	3	0	3	20	14	100	63	83	100	78	63	90	81	63	100
			31	14	50	44	37	51	43	51	52	57	100	62	87	96	78	63	90	81	63	100
	Open Coastal	O.C.IPZ	84	66	100	100	100	100	44	100	98	100	99	72	100	100	100	ND	ND	ND	ND	ND
		O.C.OPZ	0	30	38	15	63	95	3	54	76	81	54	0	39	56	47	ND	ND	ND	ND	ND
			42	48	69	57	81	97	24	77	87	90	77	36	69	78	73	ND	ND	ND	ND	ND
	Magnetic Island	Mag. Is.	67	89	77	73	78	98	100	85	85	100	73	85	80	83	77	80	84	83	83	80
			43	42	65	58	63	79	46	71	73	79	85	56	78	86	76	72	87	82	73	90
Halifax Bay	Enclosed Coastal	E.C.W	46	88	58	100	ND	66	88	74	84	ND	ND	ND	ND	ND	ND	100	100	100	100	ND
	Open Coastal	O.C.W	75	82	77	73	89	69	86	72	63	92	2	11	6	29	6	40	61	74	69	66
	Midshelf	Midshelf	98	100	100	93	100	100	100	77	92	100	36	41	30	21	1	36	43	53	60	69
			73	90	78	88	94	78	91	74	80	96	19	26	18	25	3	59	68	76	76	68

Standardised scoring range: ■ Very Poor (E) = 0 to <21 | ■ Poor (D) = 21 to <41 | ■ Moderate (C) = 41 to <61 | ■ Good (B) = 61 to <81 | ■ Very Good (A) = 81 – 100 | ND = No Data | - = Not Applicable (data available but not usable) | X = Data was not updated this year.

Appendix XX. Inshore Marine Water Quality 2021–2022 Boxplots

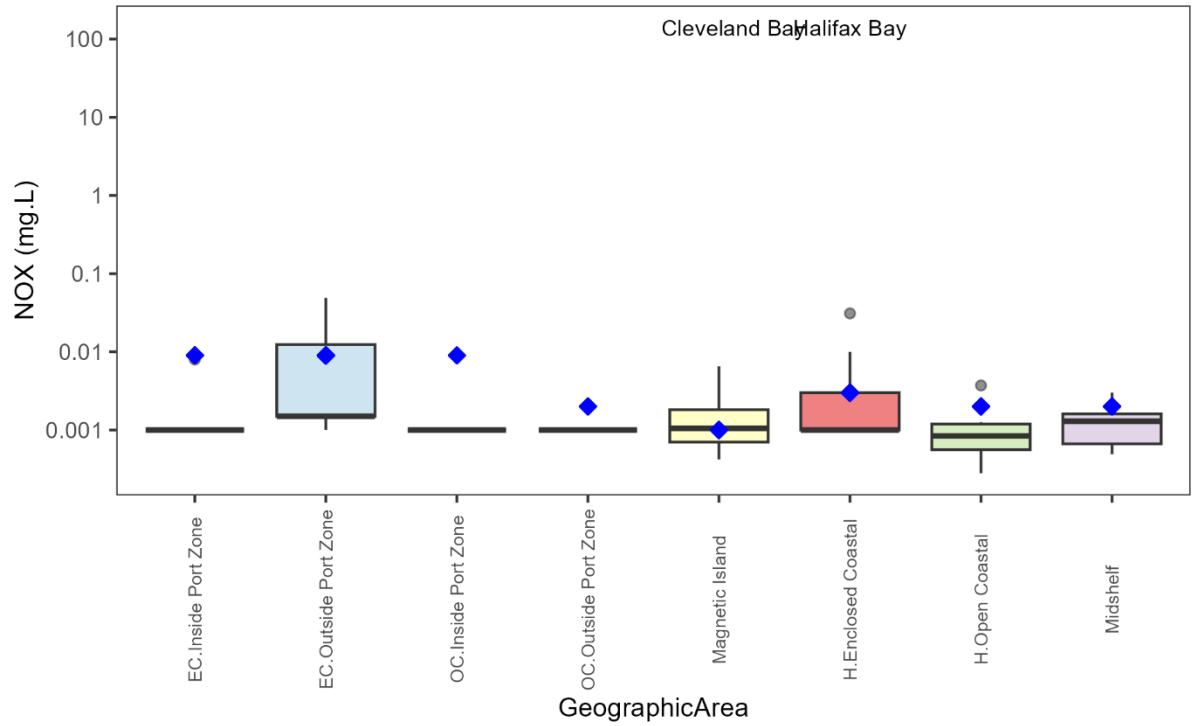

Figure 53. Nitrogen Oxides (NOX) (mg/L) Boxplot: blue diamonds indicate the water quality objective.

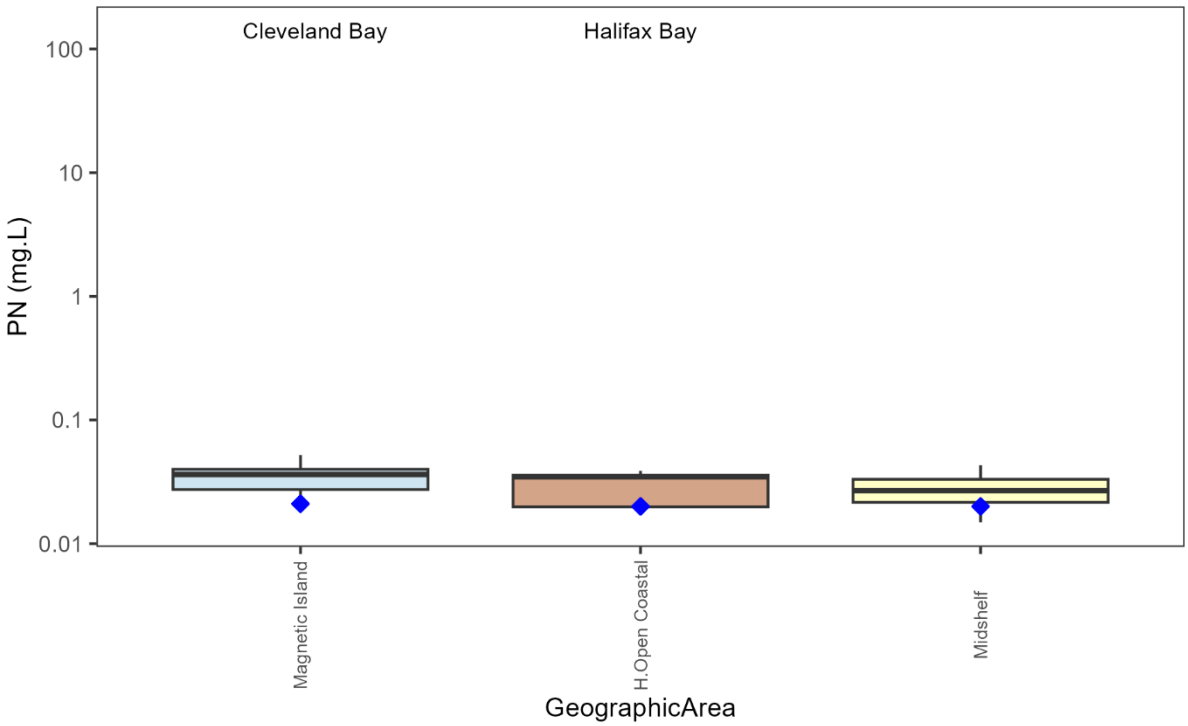

Figure 52. Particulate Nitrogen (PN) (mg/L) Boxplot: blue diamonds indicate the water quality objective.

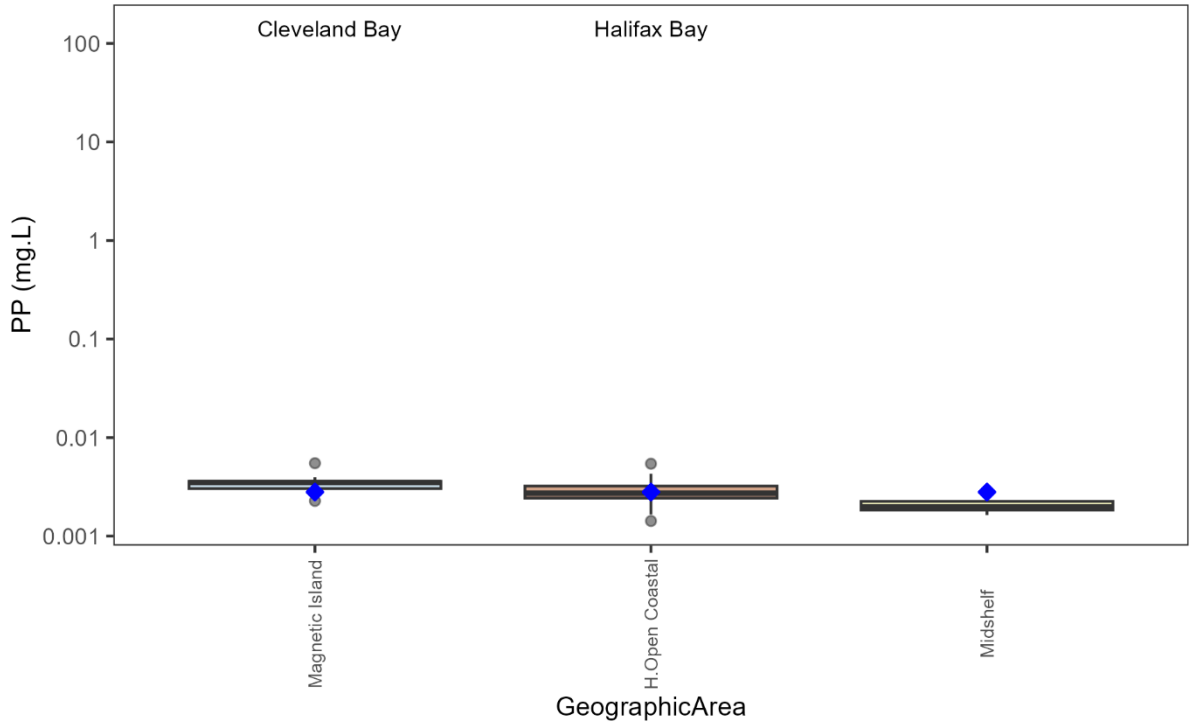

Figure 55. Particulate Phosphorus (PP) (mg/L) Boxplot: blue diamonds indicate the water quality objective.

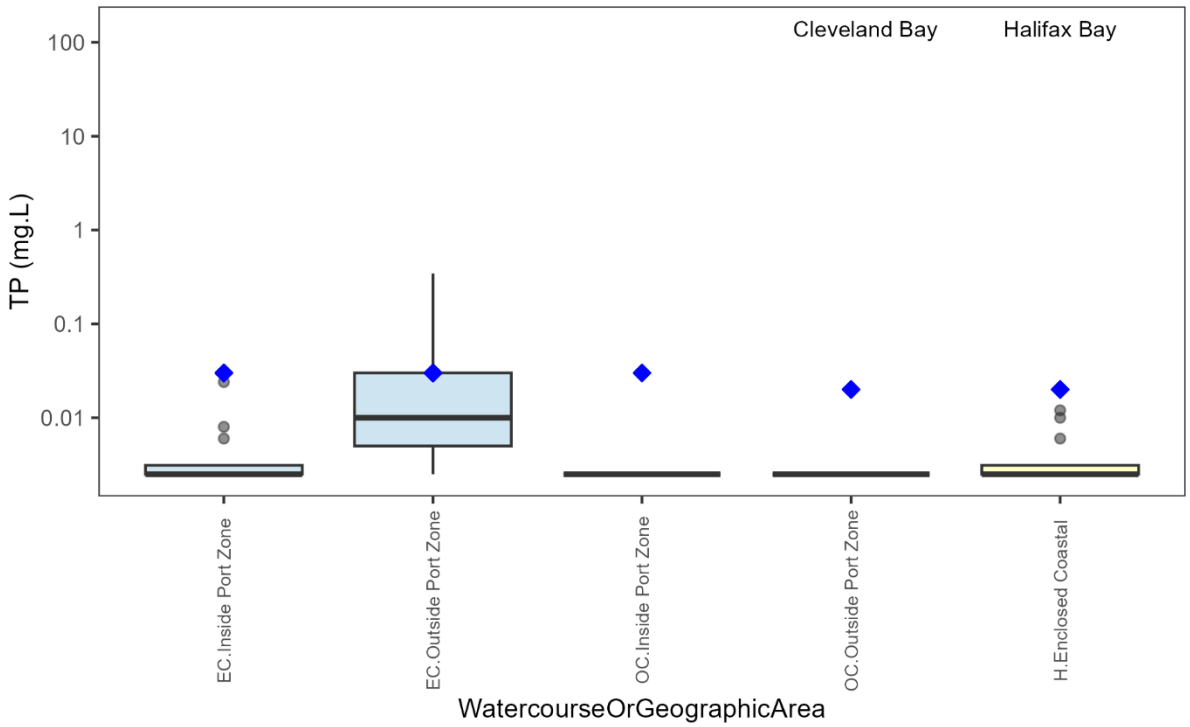

Figure 54. Total Phosphorus (TP) (mg/L) Boxplot: blue diamonds indicate the water quality objective.

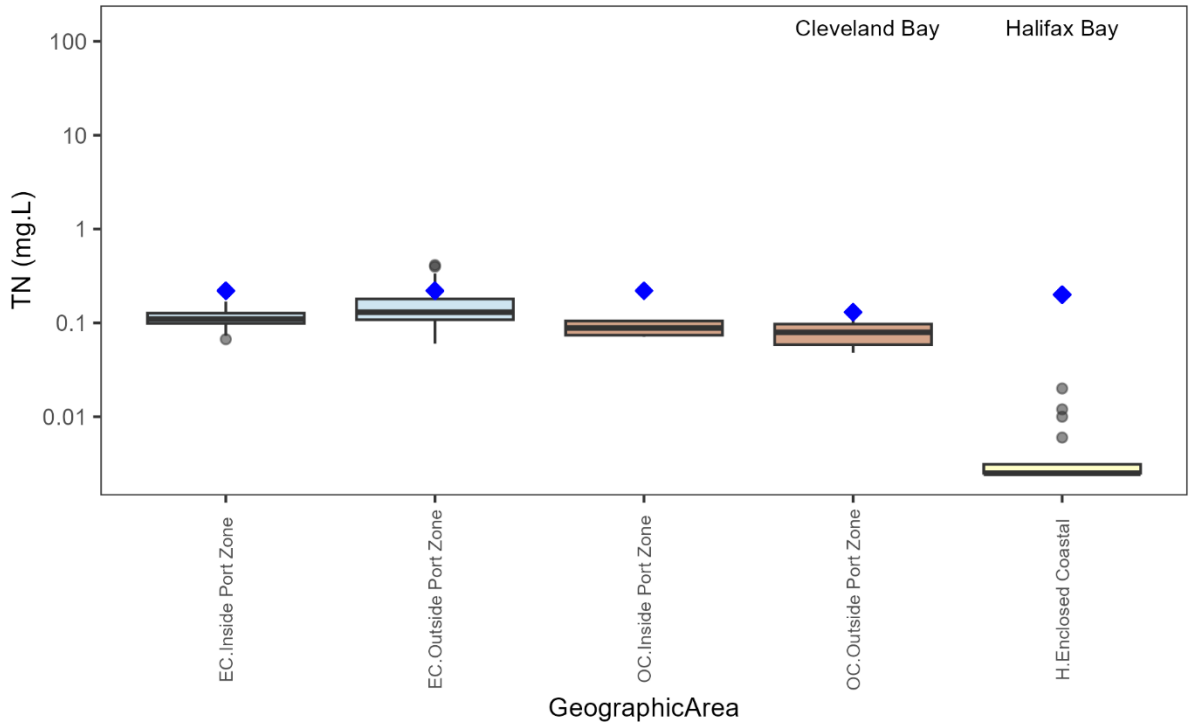

Figure 57. Total Nitrogen (TN) (mg/L) Boxplot: blue diamonds indicate the water quality objective.

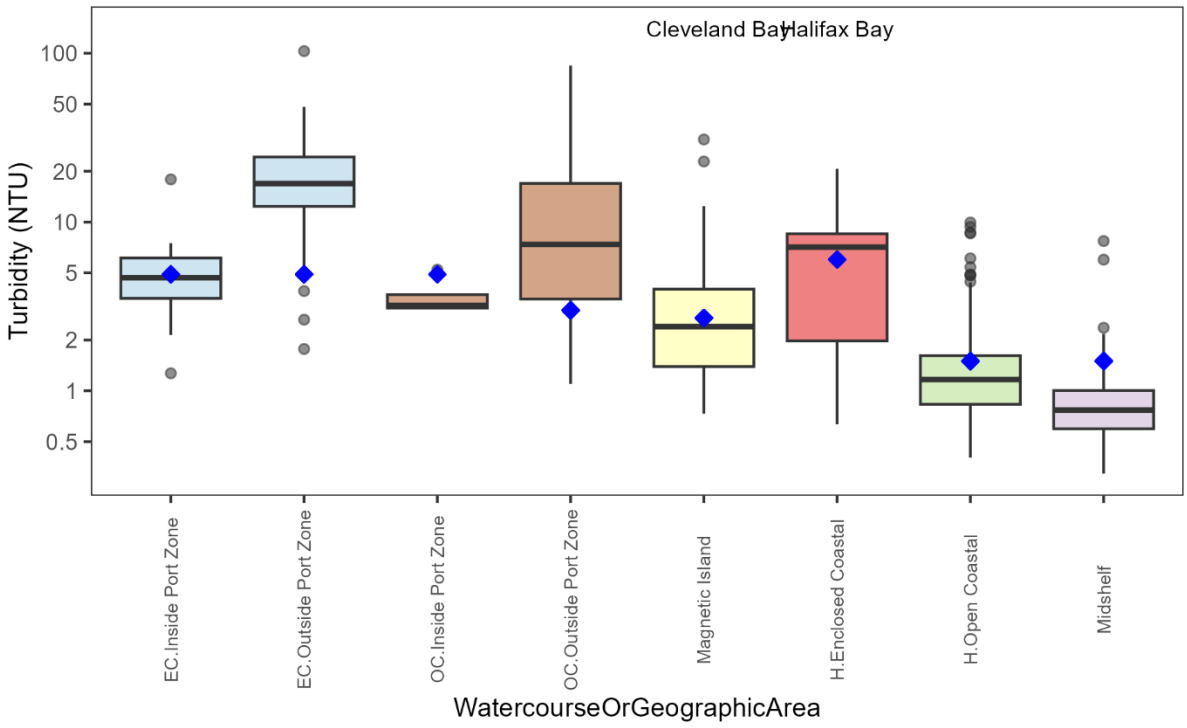

Figure 56. Turbidity (NTU) Boxplot: blue diamonds indicate the water quality objective.

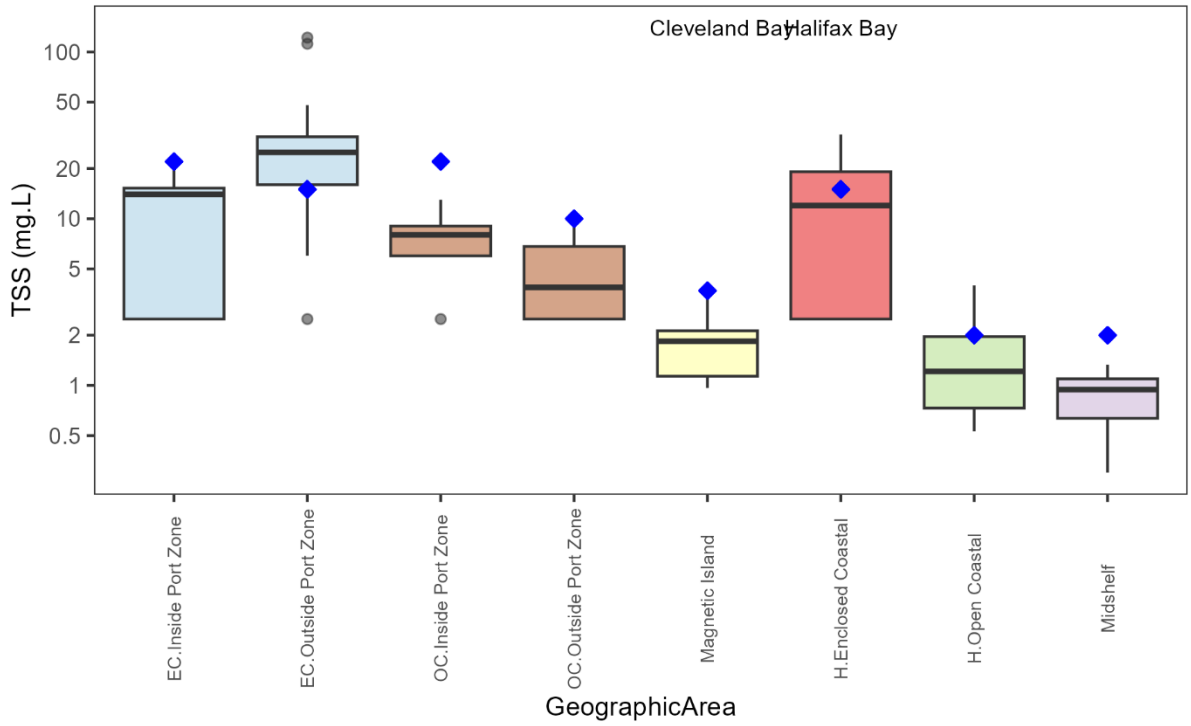

Figure 59. Total Suspended Solids (TSS) (mg/L) Boxplot: blue diamonds indicate the water quality objective.

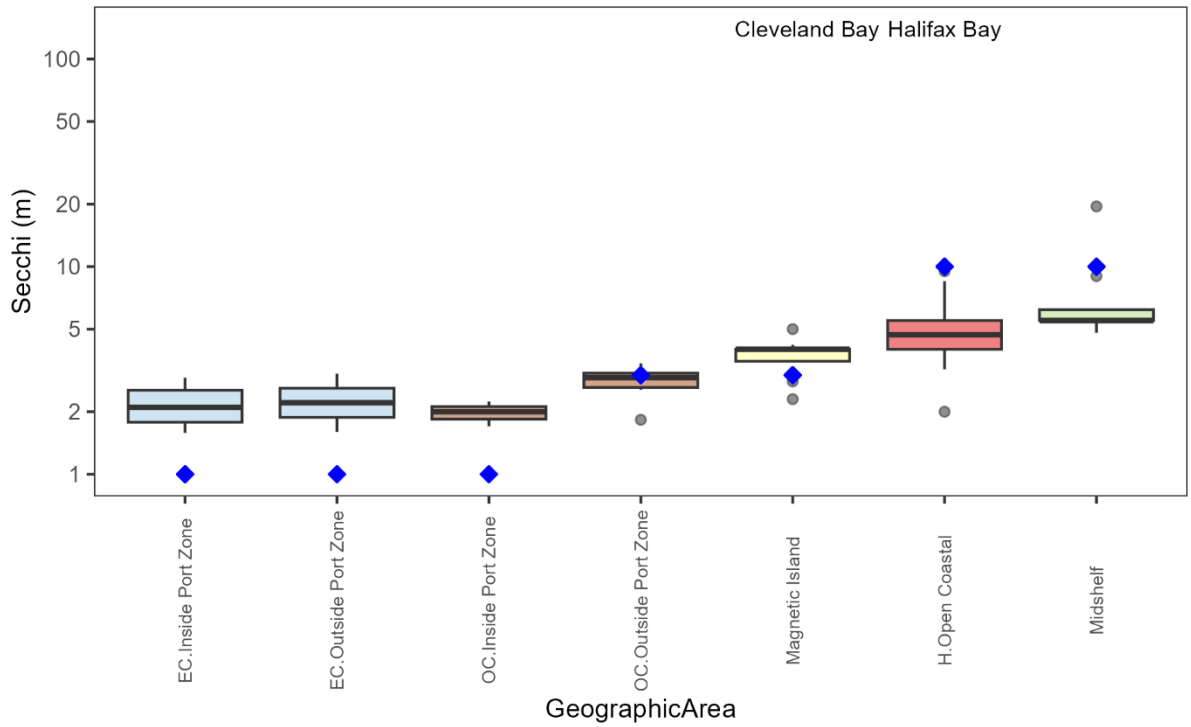

Figure 58. Secchi Depth (m) Boxplot: blue diamonds indicate the water quality objective.

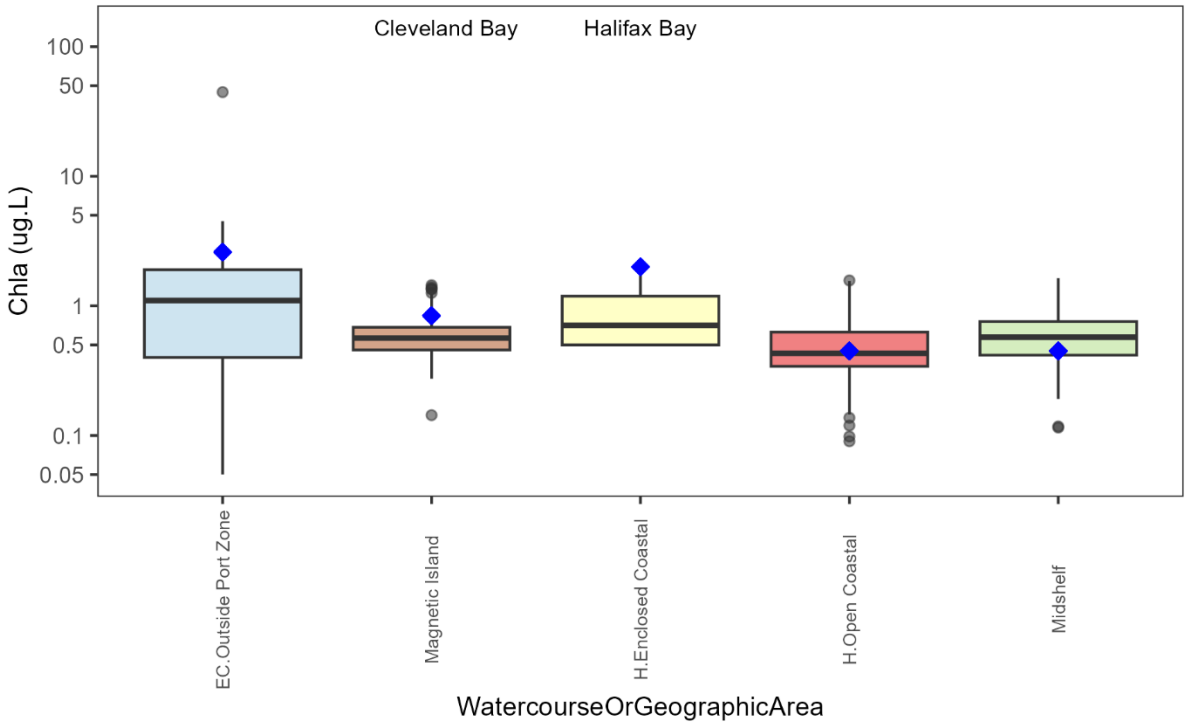

Figure 60. Chlorophyll a (ug.L) Boxplot: blue diamonds indicate the water quality objective.

Appendix YY. Inshore Marine Water Quality Line Plots

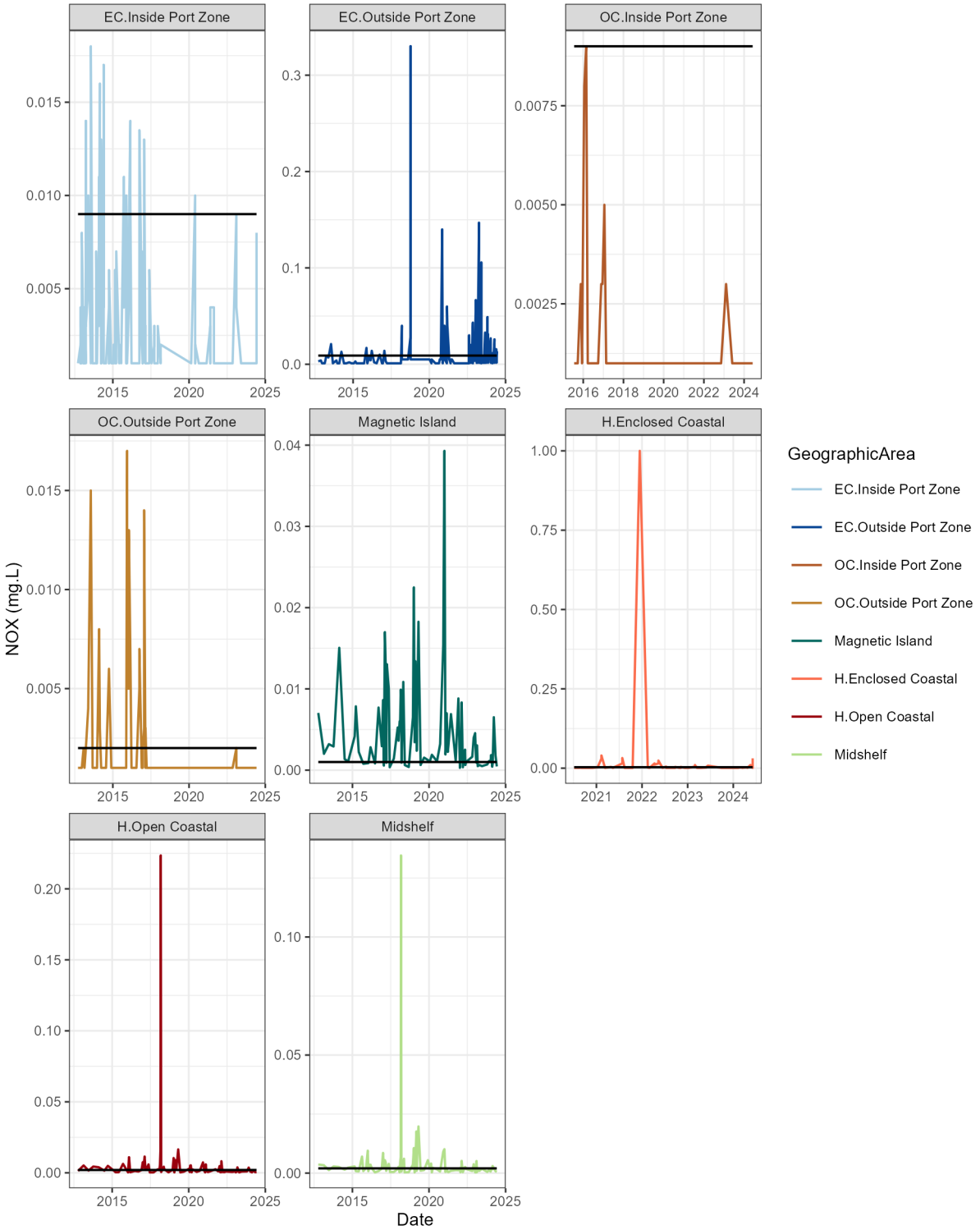

Figure 61. Dry Tropics inshore marine water quality line plots: NOx. The black line indicates water quality guidelines.

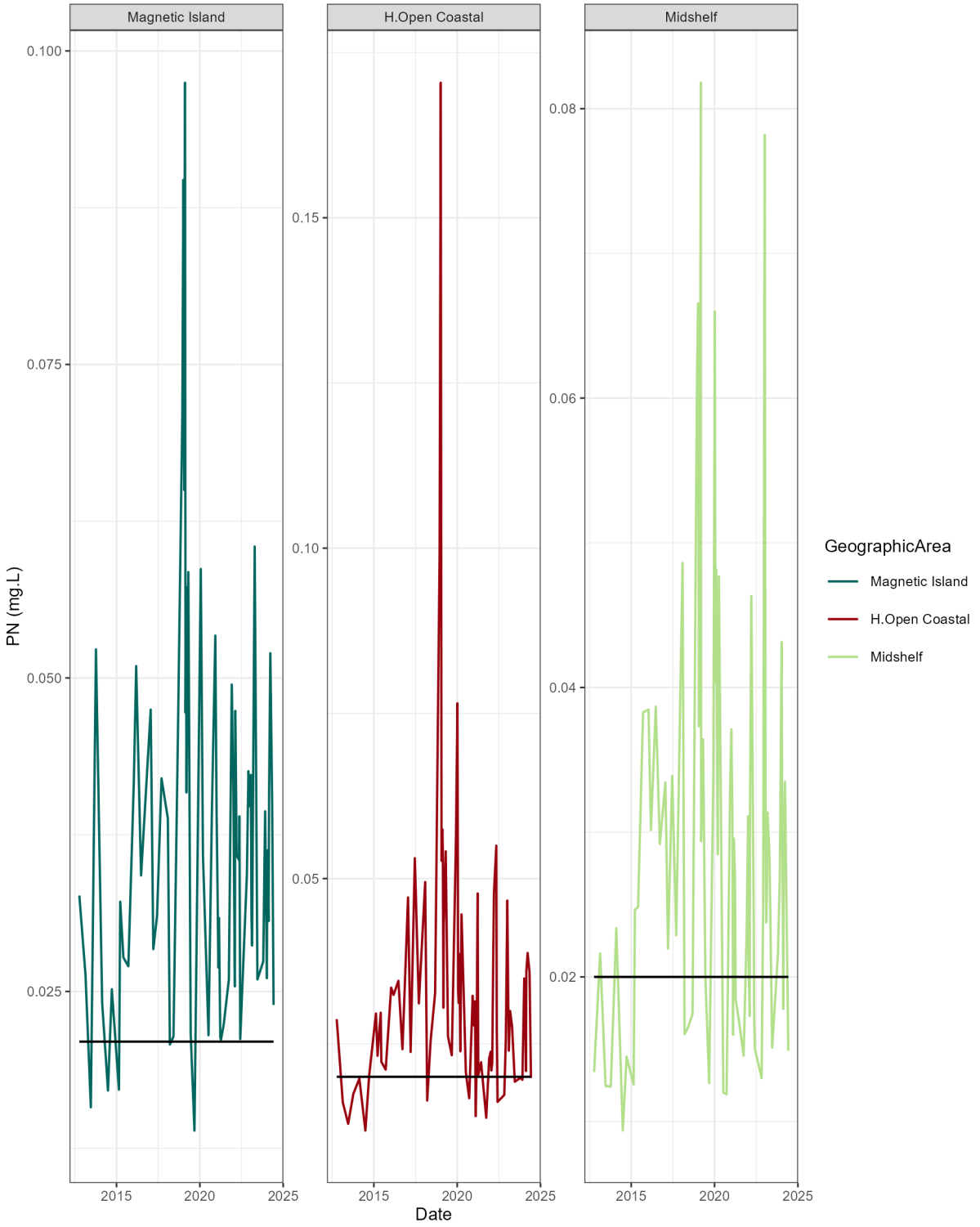

Figure 62. Dry Tropics inshore marine water quality line plots: PN. The black line indicates water quality guidelines.

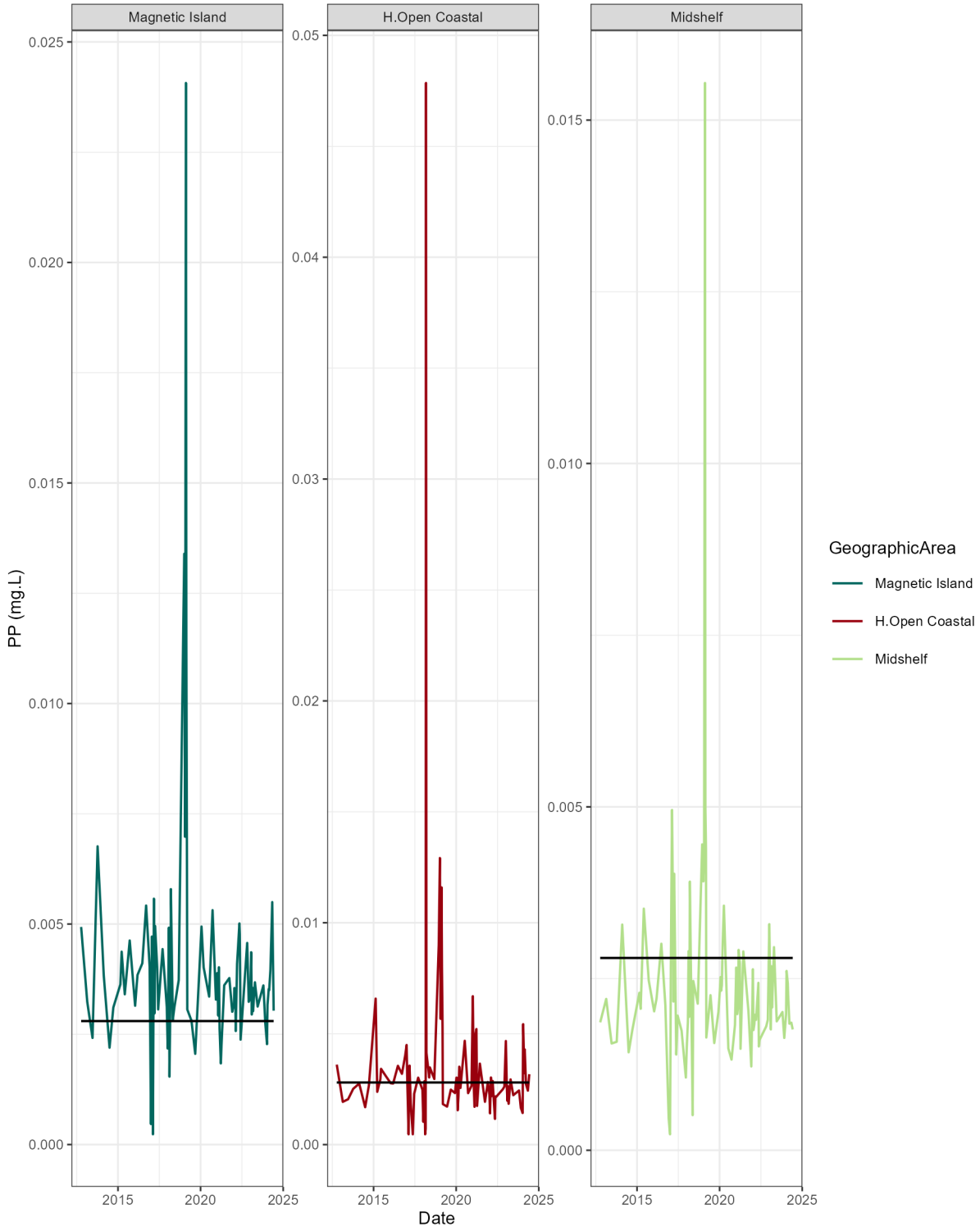

Figure 63. Dry Tropics inshore marine water quality line plots: PP. The black line indicates water quality guidelines.

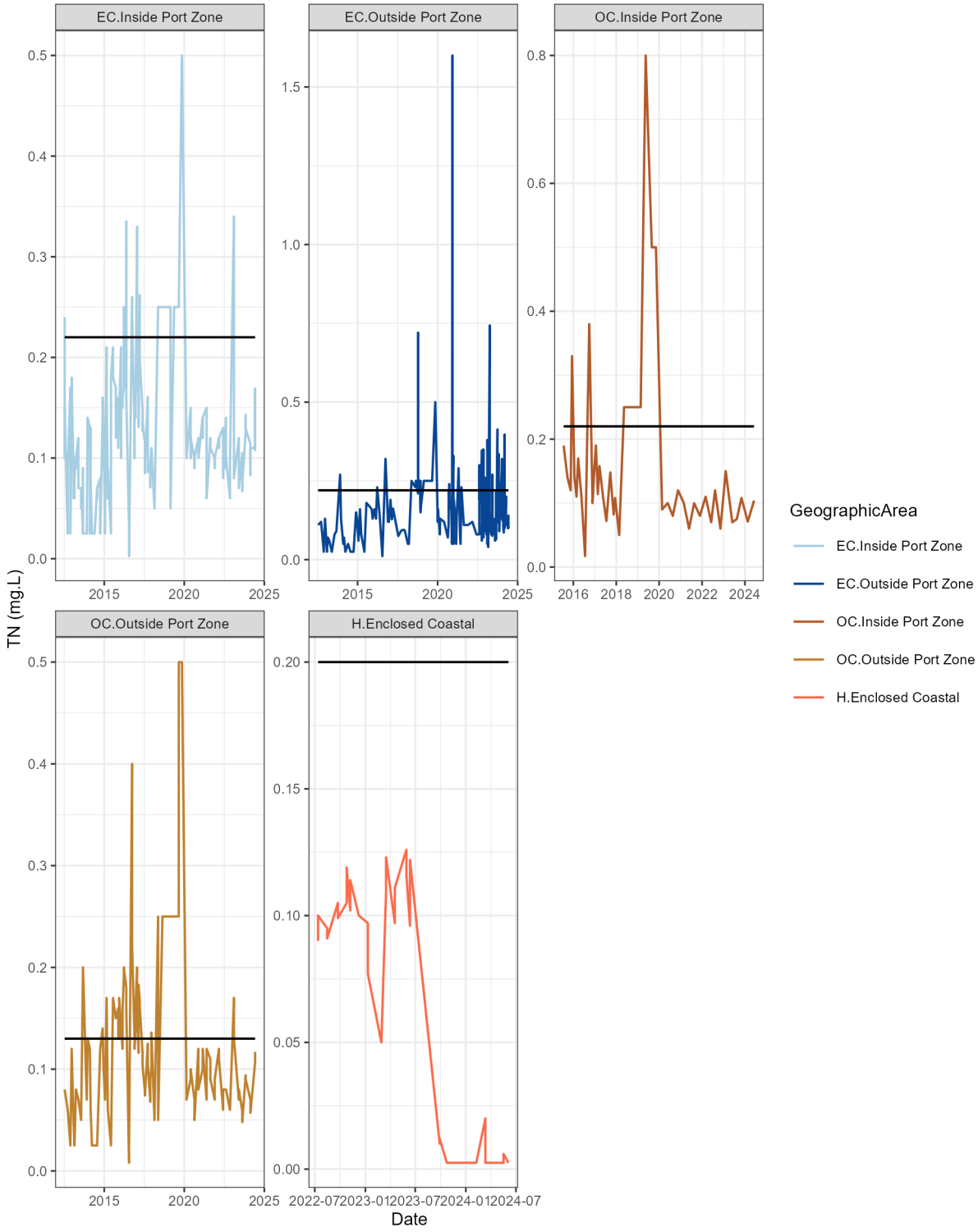

Figure 64. Dry Tropics inshore marine water quality line plots: TN. The black line indicates water quality guidelines.

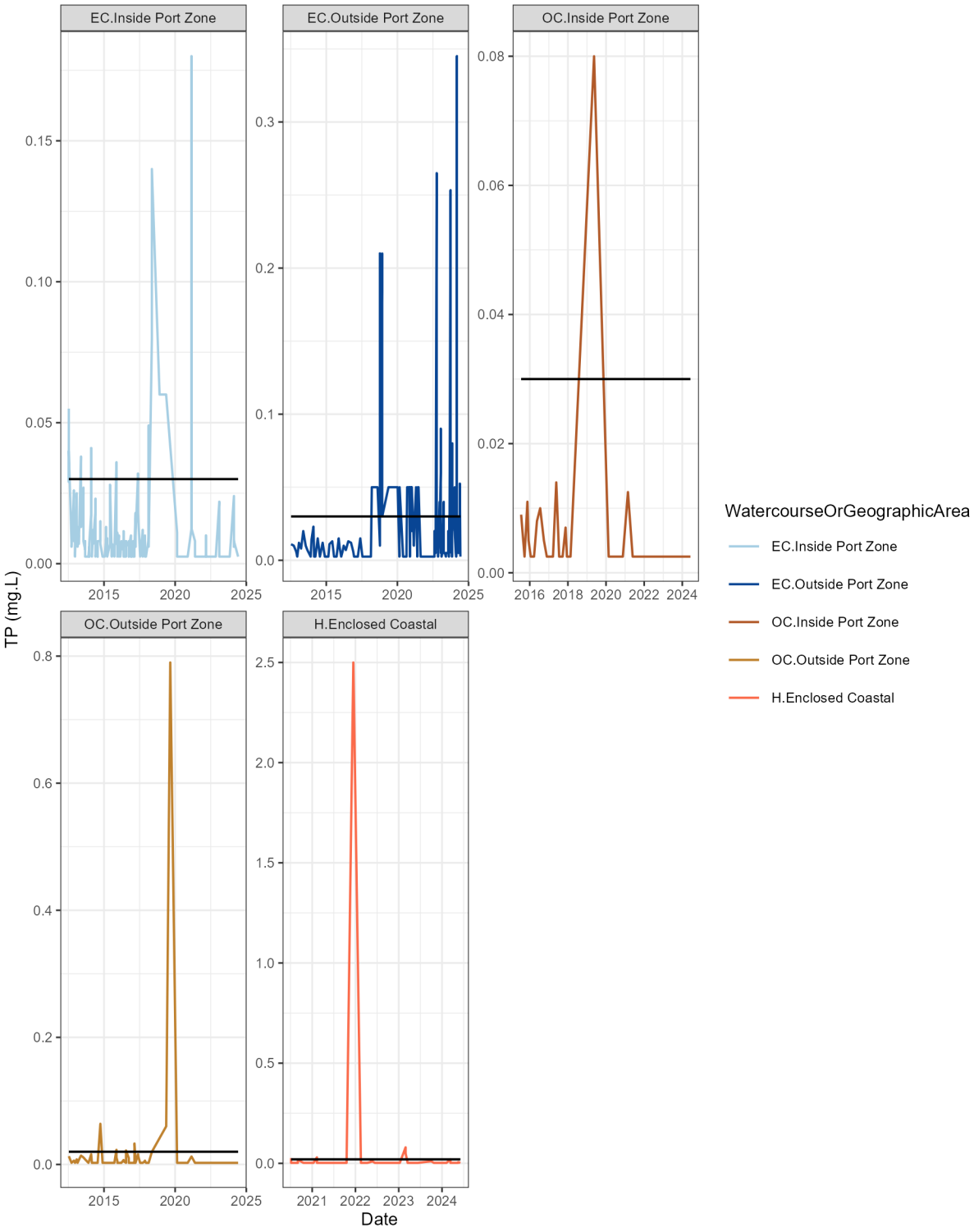

Figure 65. Dry Tropics inshore marine water quality line plots: TP. The black line indicates water quality guidelines.

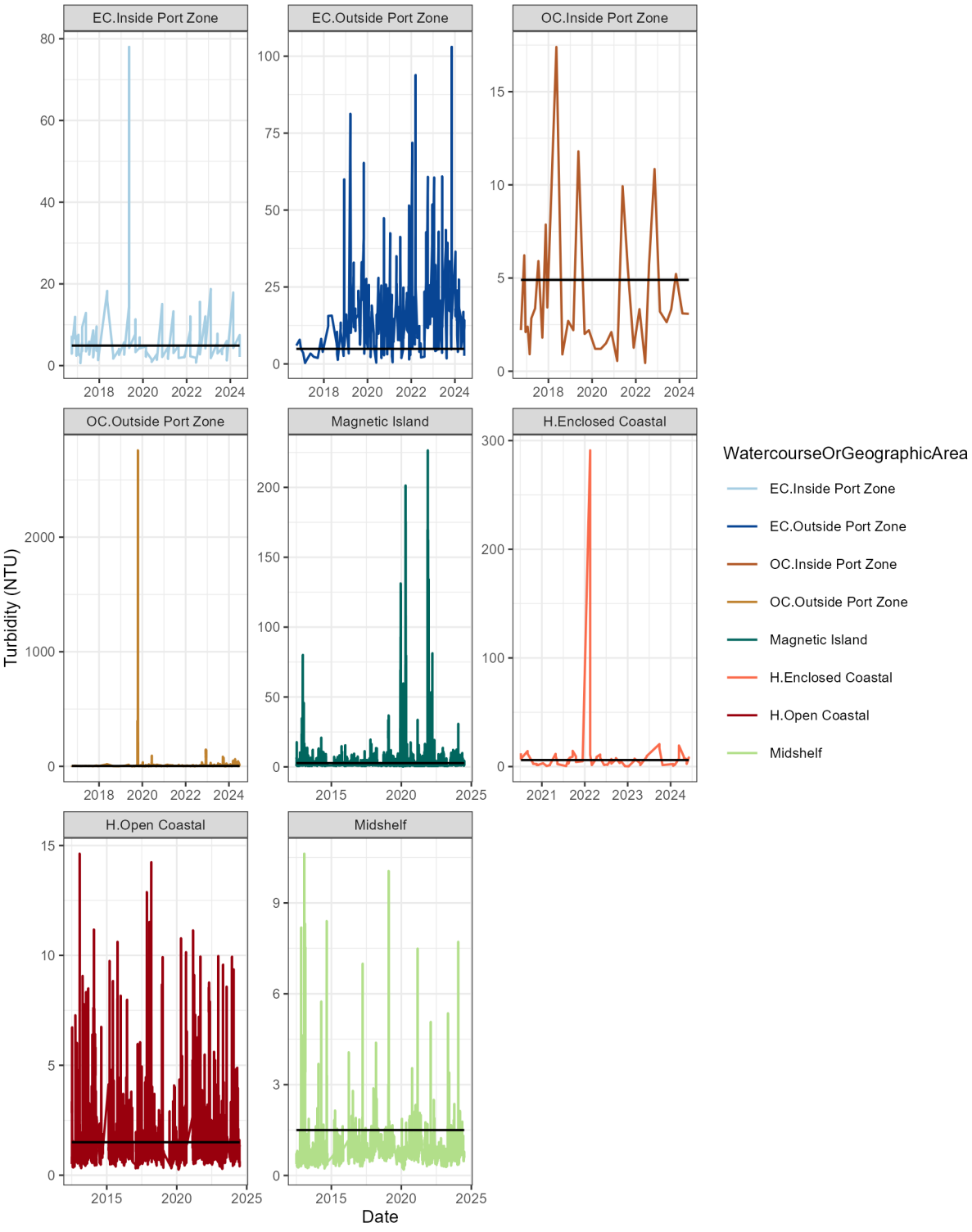

Figure 66. Dry Tropics inshore marine water quality line plots: NTU. The black line indicates water quality guidelines.

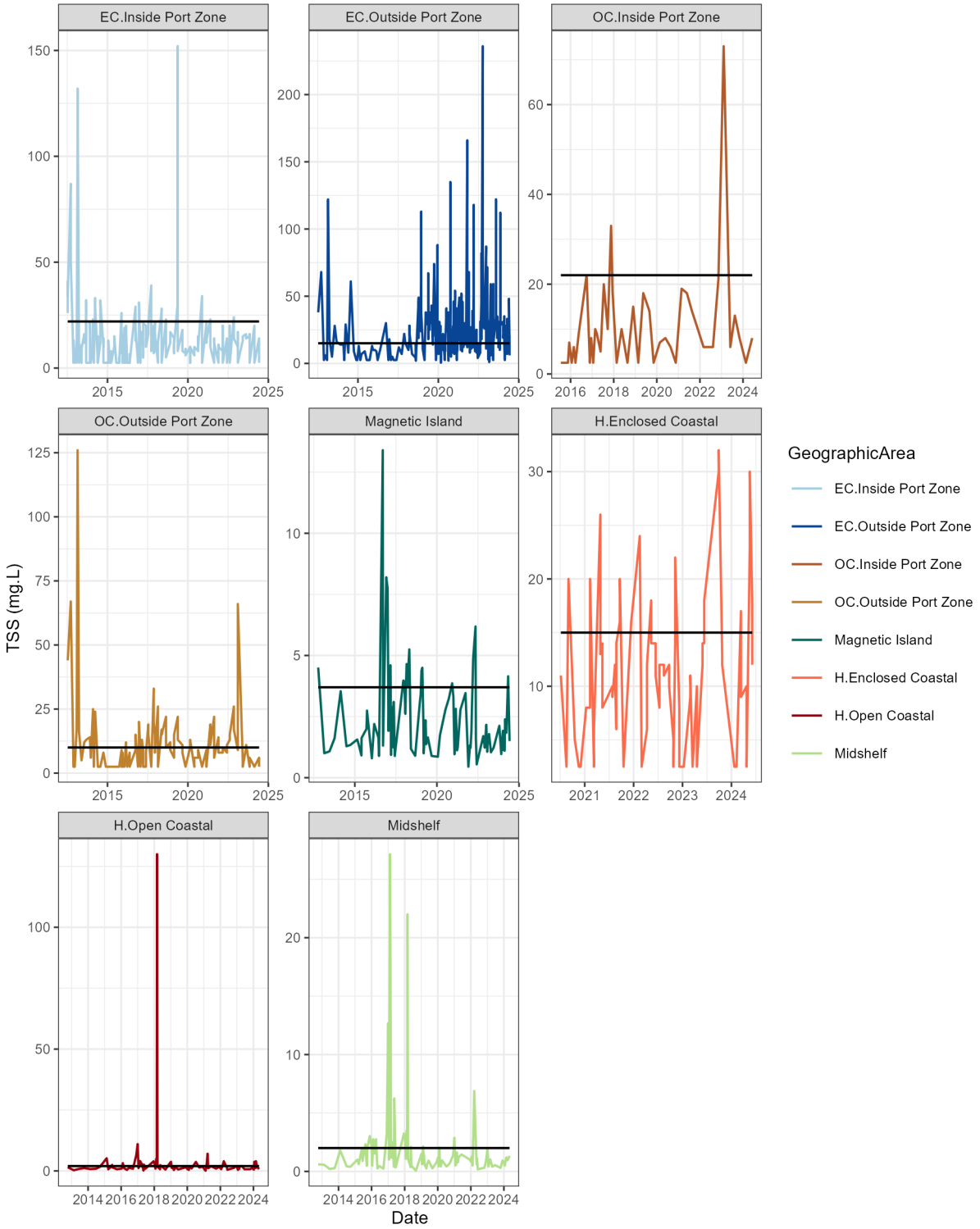

Figure 67. Dry Tropics inshore marine water quality line plots: TSS. The black line indicates water quality guidelines.

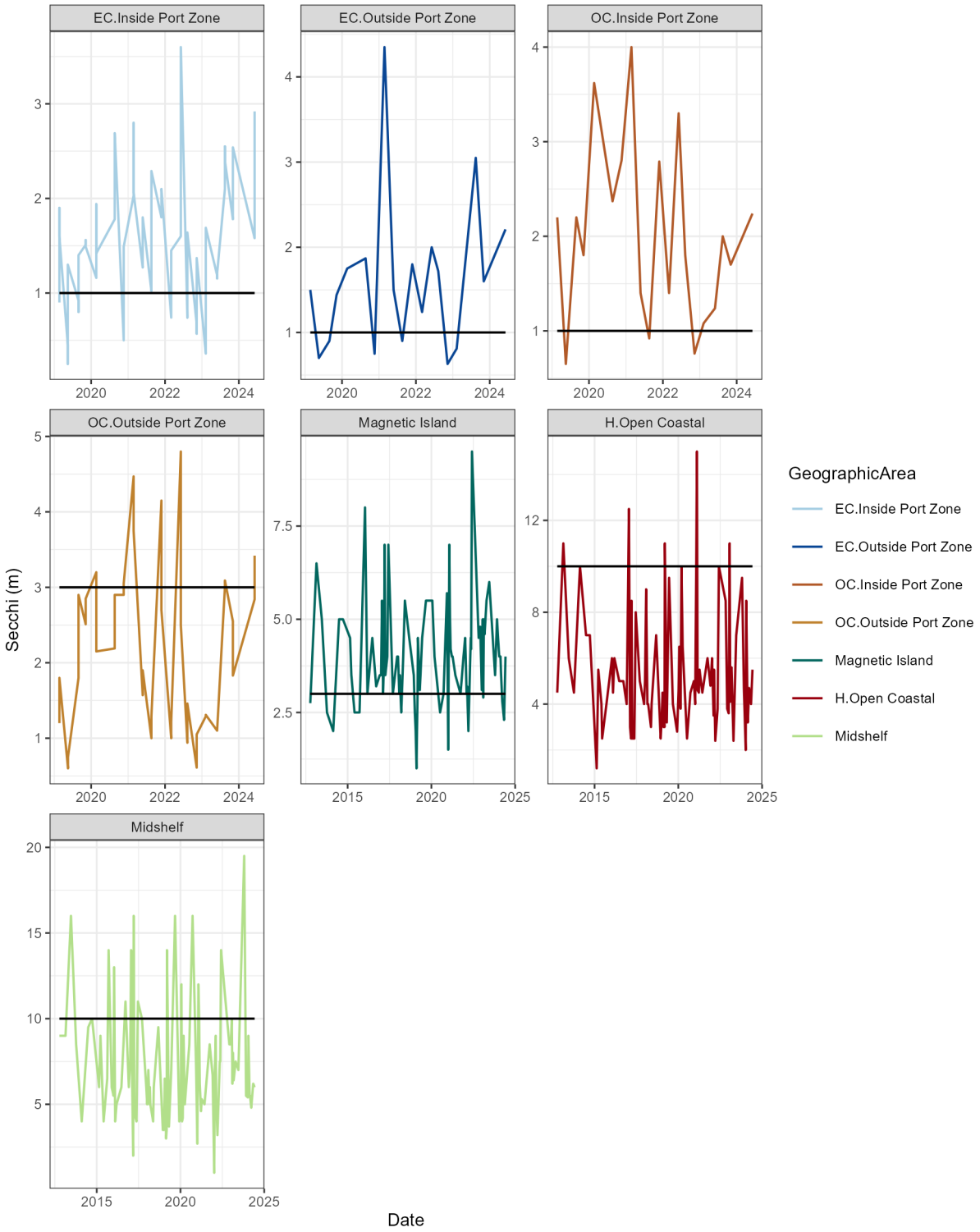

Figure 68. Dry Tropics inshore marine water quality line plots: Secchi. The black line indicates water quality guidelines.

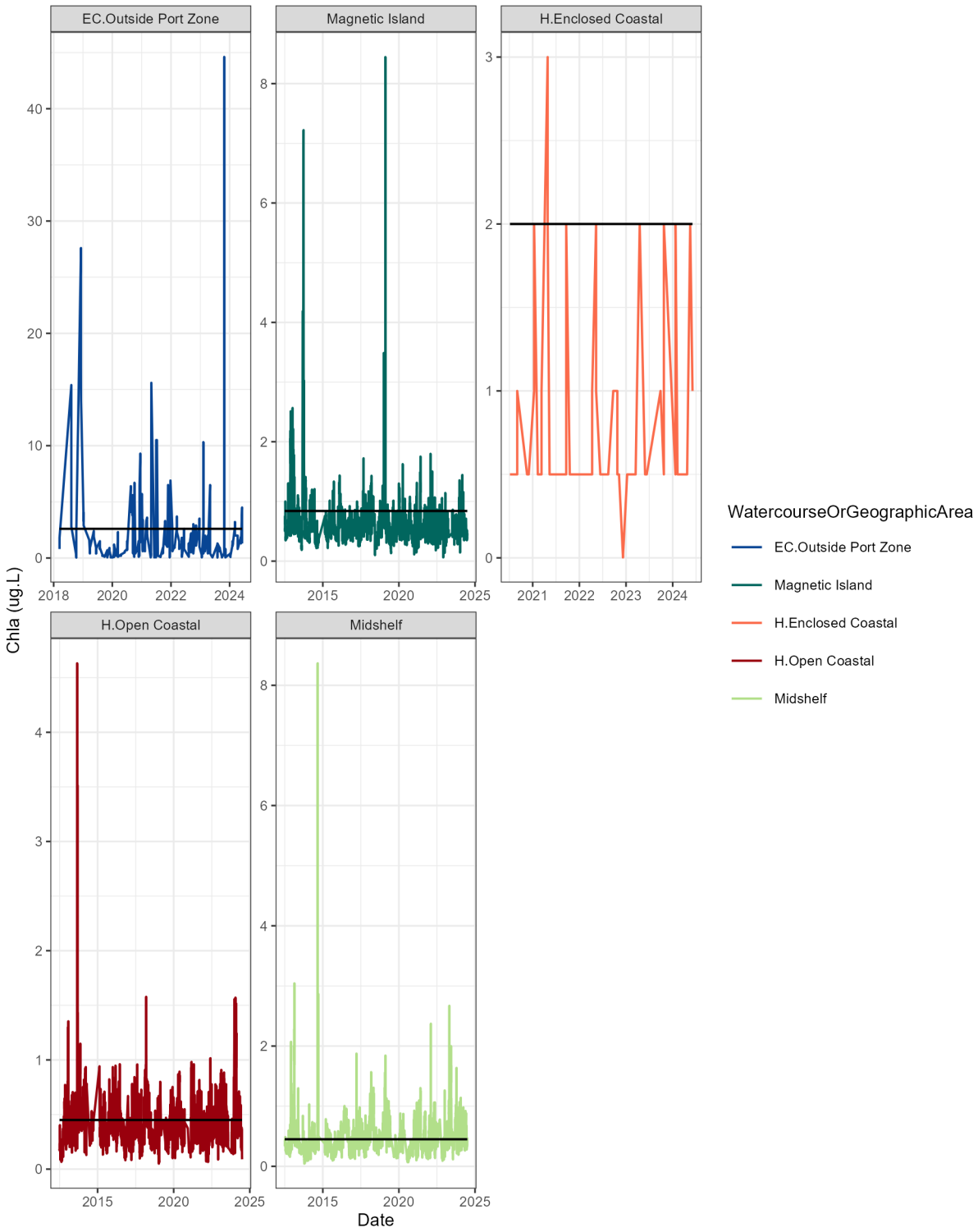

Figure 69. Dry Tropics inshore marine water quality line plots: Chl a. The black line indicates water quality guidelines.

Appendix ZZ. Overlap of Dry Tropics and Wet Tropics Sampling Sites

Table 19. Comparison between the Dry Tropics and Wet Tropics inshore marine water quality (nutrient indicator category) scores .

Region	Zone	Sub Zone	Area	NOx	PN	PP	TP	Nutrients	Zone Nutrients
Dry Tropics	Halifax Bay	Enclosed Coastal	Enclosed Coastal	100	ND	ND	100	100	76
		Open Coastal	Open Coastal	100	28	56	ND	61	
		Midshelf	Midshelf	85	35	79	ND	66	
				95	32	67	100	76	
Wet Tropics	Palm Island	-	-	88	32	68	ND	66	66

Standardised scoring range: Very Poor (E) = 0 to <21 | Poor (D) = 21 to <41 | Moderate (C) = 41 to <61 | Good (B) = 61 to <81 | Very Good (A) = 81 – 100 | ND = No Data | - = Not Applicable (data available but not usable) | X = Data was not updated this year.

Table 20. Comparison between the Dry Tropics and Wet Tropics inshore marine water quality (physical-chemical properties indicator category) scores.

Region	Zone	Sub Zone	Area	Turbidity	TSS	Secchi	Phys Chem	Zone Phys Chem
Dry Tropics	Halifax Bay	Enclosed Coastal	Enclosed Coastal	46	66	ND	56	61
		Open Coastal	Open Coastal	75	69	2	49	
		Midshelf	Midshelf	98	100	36	78	
				73	78	19	61	
Wet Tropics	Palm Island	-	-	75	84	ND	80	80

Standardised scoring range: Very Poor (E) = 0 to <21 | Poor (D) = 21 to <41 | Moderate (C) = 41 to <61 | Good (B) = 61 to <81 | Very Good (A) = 81 – 100 | ND = No Data | - = Not Applicable (data available but not usable) | X = Data was not updated this year.

Appendix AAA. Seagrass Extent Change Over Time

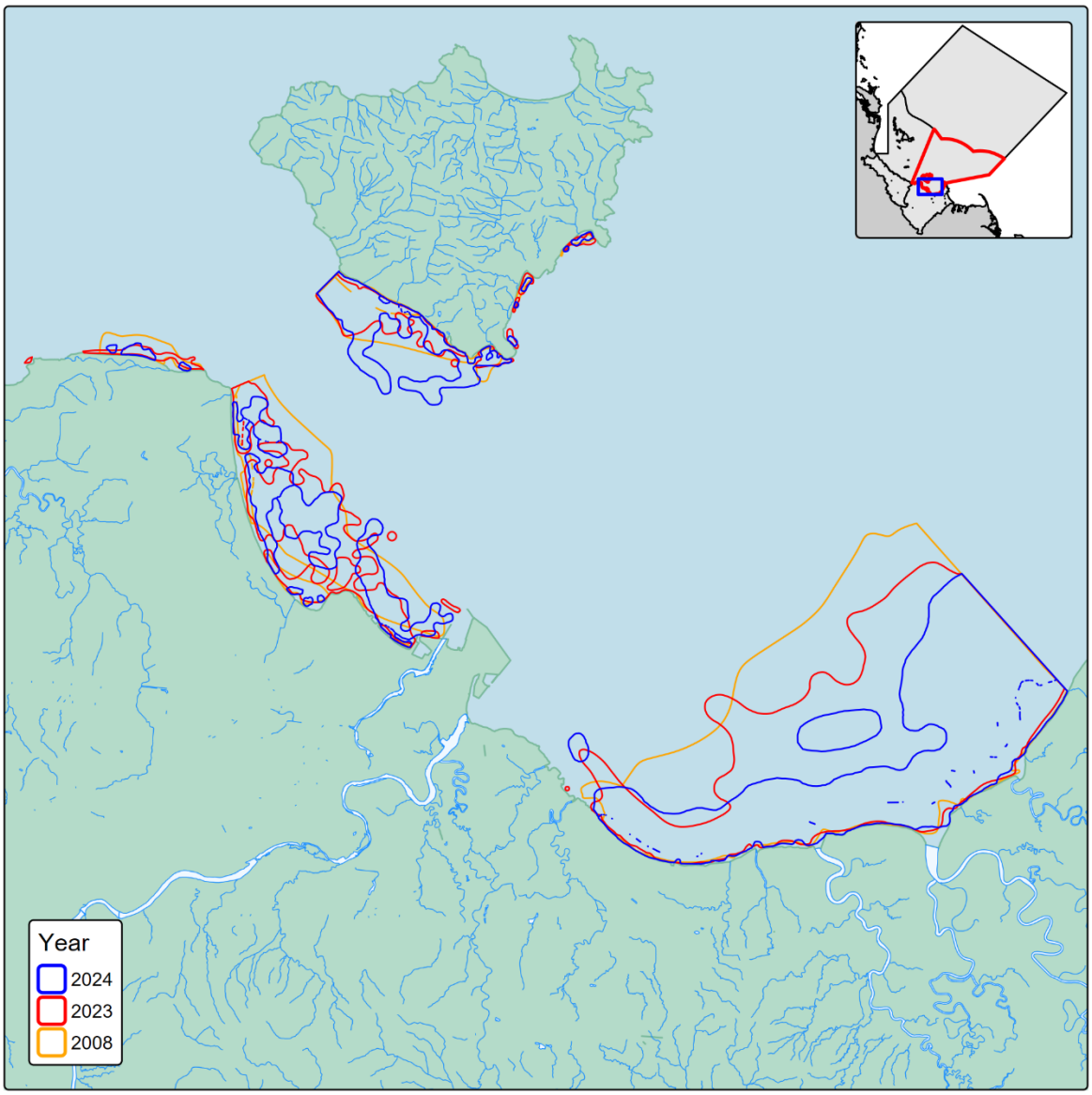

Figure 70. A comparison of seagrass meadow extent over time (2008 - surveys began, 2023 - previous reporting period, 2024 - current reporting period).

Appendix BBB. Report Change Log

The table below lists section number, page and paragraph number, and summary of updates for the 2023–2024 Technical Report to assist reviewers.

Section	Page Number	Details
Header	NA	NA
Footer	NA	Dates.
Throughout Doc	NA	Change log key table added (temporary – removed for final publication).
Front Cover	i	Dates.
General	ii	NA
Authorship Statement	ii	Dates. Katie added in place of Angus RRC TOs removed
Current DTPHW Members	ii	All DESI acronyms changed to DETSI.
Acknowledgements	iii.	NA
Executive Summary	iv	NA
The Healthy Waters Partnership for the Dry Tropics	iv-v	Dates. Link to web articles added.
Climate and Land use in the Dry Tropics Region	vi	Dates. Values (e.g., mm of rainfall, degrees).
State and Condition of the Environment	vi-vii	Table updated with latest year of data.
Freshwater Environment	vii-xi	Tables updated with 2023-2024 results. Key Messages added for all indices.
Estuarine Environment	ix-x	Tables updated with 2023-2024 results. Key Messages added for all indices.
Inshore Marine Environment	x-xi	Tables updated with 2023-2024 results. Key Messages added for all indices.
Offshore Marine Environment	xi	Tables updated with 2023-2024 results. Key Messages added for all indices.
Litter	xii-xiv	Tables updated with 2023-2024 results. Key Messages added for the index.
Table of Contents	xv-xvi	NA
Glossary of Terms	xvii-xxi	NA
Table of Tables	xxii-xxiv	Table titles shortened to single line.
Table of Figures	xxv-xxvii	Figure titles shortened to single line.
1. Introduction	1	NA
1.1 Overview	1	Dates.
1.2 Report Card Zones	1-3	Dates.

Section	Page Number	Details
1.3 Purpose of This Document	3	Dates.
1.4 Report Card History	3	Dates.
2. Methods	3	Dates.
2.1 Terminology and Aggregation	3-5	Dates.
2.2 Scoring	5	NA
2.3 Presentation	5-6	NA
2.4 Confidence Measure	6	NA.
Environmental Stressors Page divider	7	Dates.
3. Environmental Stressors in the Townsville Dry Tropics Region	8	Dates. Values/descriptions of stressors.
3.1 Land Use	9-10	NA
3.2 Climate	11	Dates. Updated text with relevant annual climatic events.
3.2.1 Rainfall	11-14	Dates. Values (e.g., mm of rainfall).
3.2.2 Air Temperature	15-17	Dates. Values (e.g., degrees). Monthly line plots removed.
3.2.3 Sea Surface Temperature	18-19	Dates. Values (e.g., degrees).
3.2.4 Degree Heating Weeks (Coral Bleaching)	20	Dates. Values (e.g., DHWs).
Freshwater Page divider	21	Dates.
4 Freshwater Environment	22	Dates.
4.1 Water Quality	22	Dates.
4.1.1 Monitoring Sites	22-24	NA
4.1.2 Overall Summary: Freshwater Quality	24-25	Text updated. Table updated with new results. Key messages updated.
4.1.3 Nutrients	25-26	Dates. Results text updated. Table updated with new results.
4.1.4 Physical-Chemical Properties	27-28	Dates. Results text updated. Table updated with new results.
4.1.5 Confidence Scores	29	NA

Section	Page Number	Details
4.2 Pesticides	30	NA
4.2.1 Monitoring Sites	30	NA
4.2.2 Overall Summary: Pesticides	30-31	Text updated to reflect new results.
4.2.3 Results: Pesticides	31	Scores updated. Text updated to reflect new results.
4.2.4 Confidence Scores	31	NA
4.3 Habitat and Hydrology	32	NA
4.3.1 Overall Summary: Freshwater Habitat and Hydrology	32	Dates. No new data.
4.3.2 Freshwater Riparian Extent	32	NA
4.3.2.1 Monitoring Sites	33	NA
4.3.2.2 Results: Freshwater Riparian Extent	33-34	NA
4.3.3 Freshwater Wetland Extent	34	NA
4.3.3.1 Monitoring Sites.	34	NA
4.3.3.2 Results: Freshwater Wetland Extent	34-35	NA
4.3.4 Artificial Barriers	36	NA
4.3.4.1 Monitoring Sites.	36	NA
4.3.4.1 Results: Freshwater Artificial Barriers	36	NA
4.3.4.2 Results: Freshwater Impoundment Length	36	NA
4.3.4.3 Results: Freshwater Fish Barriers	36-37	NA
4.3.5 Confidence Scores	37	NA
4.4 Fish	38	NA
4.4.1 Monitoring Sites	38	NA
4.4.2 Overall Summary: Freshwater Fish	38-39	NA
4.4.3 Proportion of Indigenous Species Expected	39	NA
4.4.3.1 Results: POISE	39	NA
4.4.4 Proportion of Non-Indigenous Species Expected	40	NA
4.4.4.1 Results: PONISE	40	NA

Section	Page Number	Details
4.4.5 Confidence Scores	40-41	NA
Estuarine Page divider	42	Dates. Names.
5 Estuarine Environment	43	Dates.
5.1 Water Quality	43	Dates.
5.1.1 Monitoring Sites	43—45	NA
5.1.2 Overall Summary: Estuarine Water Quality	45-46	Text and table updated with newest results.
5.1.3 Nutrients	46-47	Table updated with newest results. Results text updated with newest results.
5.1.4 Physical Chemical Properties	48-49	Table updated with newest results. Results text updated with newest results.
5.1.5 Confidence Scores	50	NA
5.2 Habitat	51	Dates.
5.2.1 Overall Summary: Estuarine Habitat	51	Dates. Values (scores, grades). Key Messages.
5.2.2 Mangrove and Saltmarsh Extent	52	Dates.
5.2.2.1 Monitoring Sites	52	NA
5.2.2.2 Results: Estuarine Mangroves and Saltmarsh	52-53	Dates. Values (e.g., ha of vegetation).
5.2.3 Estuarine Riparian Extent	54	NA
5.2.3.1 Monitoring Sites	54	NA
5.2.3.2 Results: Estuarine Riparian Extent	54-55	Text shortened. Values (scores, grades).
5.2.5 Confidence Scores	55	NA
Inshore Page divider	56	Dates.
6 Inshore Environment	57	NA
6.1 Water Quality	57	Dates.
6.1.1 Monitoring Sites	57-58	Dates.
6.1.2 Overall Summary: Estuarine Water Quality	59	Text and score updates. Table updated with latest year of data.
6.1.3 Updated Methodology	59	NA
6.1.4 Nutrients	59-61	Dates. Scores and text updated. Tables updated with latest year of data.
6.1.5 Physical Chemical Properties	62-63	Dates. Scores and text updated.

Section	Page Number	Details
		Tables updated with latest year of data.
6.1.6 Chlorophyll a	64	Dates. Scores and text updated. Tables updated with latest year of data.
6.1.7 Overlap with the Wet Tropics Technical Report	64	NA (appendix updated).
6.1.8 Confidence Scores	65	NA
6.2 Habitat	66	NA
6.2.1 Overall Summary: Inshore Habitat	66	Text and scores updated. Tables updated with latest results.
6.2.2 Coral	67	NA
6.2.2.1 Monitoring Sites	67-69	NA
6.2.2.2 Results: Inshore Coral	69-70	Values. Discussion.
6.2.3 Seagrass	71	Dates.
6.2.3.1 Monitoring Sites	71-72	Dates. Maps updated with newest seagrass boundaries
6.2.3.2 Results	72-73	Values. Discussion.
6.2.4 Confidence Scores	73-74	Text shortened.
Offshore Page divider	75	Dates. Names.
7 Offshore Marine Environment	76	Add new maps detailing area.
7.1 Water Quality	76-77	Dates. Table updated.
7.1.1 Data Source	77	Dates.
7.2 Habitat	77	Dates.
7.2.1 Overall Summary: Offshore Habitat	77	Values (Score), table updated. Key messages updated.
7.2.2 Coral	78	Dates of sampling updated.
7.2.2.1 Monitoring Sites	78	NA
7.2.2.2 Results: Offshore Coral	78-79	Values. Discussion.
7.2.3 Confidence Scores	79	NA
Litter Page divider	84	Dates. Names.
8 Litter	85	Text updated
8.1 Monitoring Sites	85-88	Text updated. Maps yet to be updated

Section	Page Number	Details
8.2 Comparison with previous years	88-89	Table and text updated
8.3 Key Messages	89	Text updated
8.4 Results	89-90	Table and text updated
8.5 Confidence Scores	90-91	NA
9. References	92-93	NA
Appendices page divider	94	Dates. Names.
10. Appendices	95-179	NA
Appendix A. to G.		New climate graphs/maps
Appendix H.		Table updated with summary stats for latest year.
Appendix I.		2023-2024 DIN and TP scores added.
Appendix J.		Table updated with summary stats for latest year.
Appendix K.		2023-2024 Turbidity and High/Low DO scores added.
Appendix L.		New table, adding historical sub basin indicator category scores.
Appendix M. and N.		New freshwater box and line plots for latest results added.
Appendix O.		NA
Appendix P.		Update pesticide proportion graphs with 2023-2024 data.
Appendix Q. to R.		NA
Appendix S.		Add 2023-2024 results (no results).
Appendix T. to FF.		NA
Appendix GG.		Table updated with summary stats for latest year.
Appendix HH.		2023-2024 DIN and TP scores added.
Appendix II.		Table updated with summary stats for latest year.
Appendix JJ.		2023-2024 Turbidity and High/Low DO scores added.
Appendix KK.		New table, adding historical sub basin indicator category scores.
Appendix LL. and MM.		New estuarine box and line plots for latest results added.
Appendix NN. to UU.		NA
Appendix VV.		Table updated with summary stats for latest year.
Appendix WW.		2023-2024 NOx, PN, PP, and TP scores added.
Appendix XX.		Table updated with summary stats for latest year.

Section	Page Number	Details
Appendix YY.		2023-2024 Turbidity, TSS, Secchi and Chla scores added.
Appendix ZZ.		New table, adding historical sub basin indicator category scores.
Appendix AAA. and BBB.		New inshore box and line plots for latest results added.
Appendix CCC.		Values for DT and WT updated.
Appendix DDD.		New Seagrass Extent change Over Time map