HEALTHY WATERS PARTNERSHIP dry tropics

Townsville Dry Tropics
Waterways Report Card 2025

TECHNICAL REPORT

PART 3: Freshwater Results

Reporting on data collected 2023 - 2024

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

4 Freshwater Environment

Within the freshwater environment, water quality, pesticides, habitat and hydrology, and fish are the four indices scored. Each of these indices are made up of indicator categories and indicators which are updated on varying time scales from annually to every three to four years. All indicator categories use data provided by multiple partners of the Partnership. In the Townsville Dry Tropics region, the water quality and pesticides indices are updated annually, with the most recent data from the 2023–2024 financial year.

For the second time since the Partnership began reporting, the Pesticides index has been included in the technical report. However, as of the 2023-2024, report the pesticides index is not combined with the water quality index and is not representative of the entire Ross and Black Basins, but rather the specific sampling sites within the Ross and Black Basins. This is because it uses a different method of calculation in comparison to the other water quality measures and data is only sourced from two locations.

Index scores are calculated for the Ross Freshwater Basin and the Black Freshwater Basin. The extent of each basin is shown in Figure 15 (below), and the results are presented below.

4.1 Water Quality

The water quality index for the freshwater environment of the Townsville Dry Tropics regions consists of two indicator categories: Nutrients, and Physical-Chemical Properties. These are divided into five indicators and for each indicator the parameters used to calculate the scores were the:

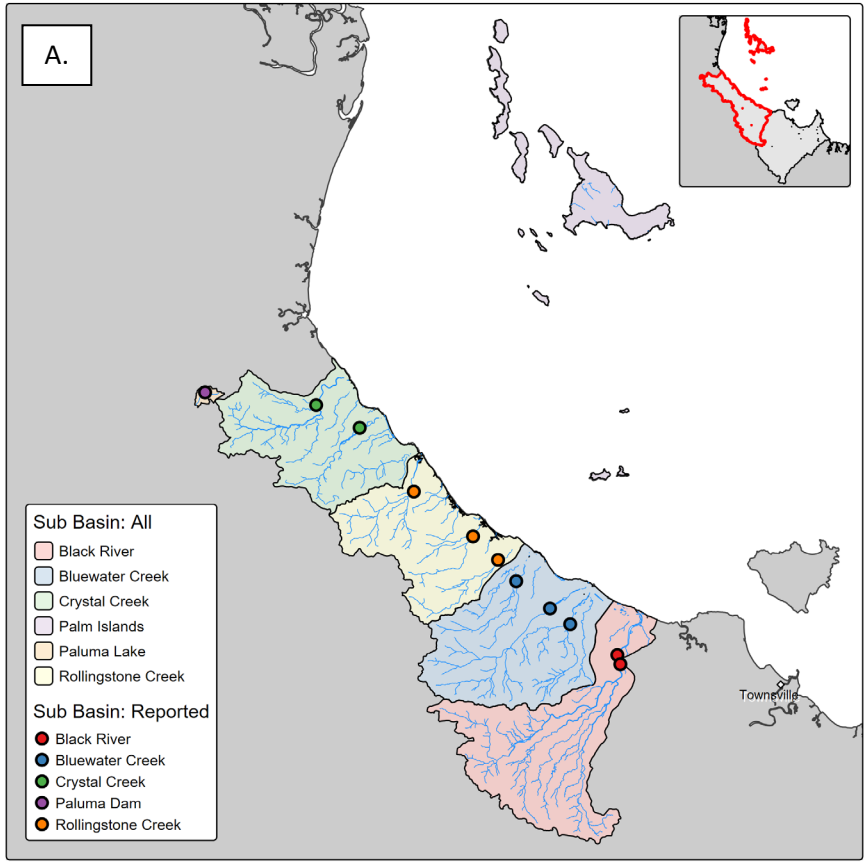
- Water Quality Objectives (WQOs);
- Scaling factors (SF);
- Annual medians, calculated from the monthly medians; and
- 80th percentile (and 20th percentile for DO), calculated from the monthly medians, and,
- The weighted basin scores include the proportion of the sub basin area for each basin area.

The Townsville Dry Tropics Methods Document (2025) provides definition of the WQO and SF for each watercourse, and the conversion of the raw data to a standardised score using the annual medians and percentiles, and sub basin weights. Values can also be found in Appendix H and Appendix J.

The nutrients indicator category is comprised of two indicators, Dissolved Inorganic Nitrogen (DIN), and Total Phosphorus (TP) and the scores for nutrients are averaged from the scores of the two indicators. The physical-chemical properties indicator category is comprised of three indicators, Turbidity, High DO, and Low DO. The score is calculated as the average of Turbidity and the minimum score from High DO and Low DO.

4.1.1 Monitoring Sites

Data for the two freshwater indicator categories are collected from the same sites. There are 24 sites (codes) spread across the two basins, divided into eight (8) sub basins in line with the Water Quality Improvement Plan (WQIP) WQIP (Townsville City Council, Queensland Government, Australian Government 2010) (Table 23 and Figure 15).



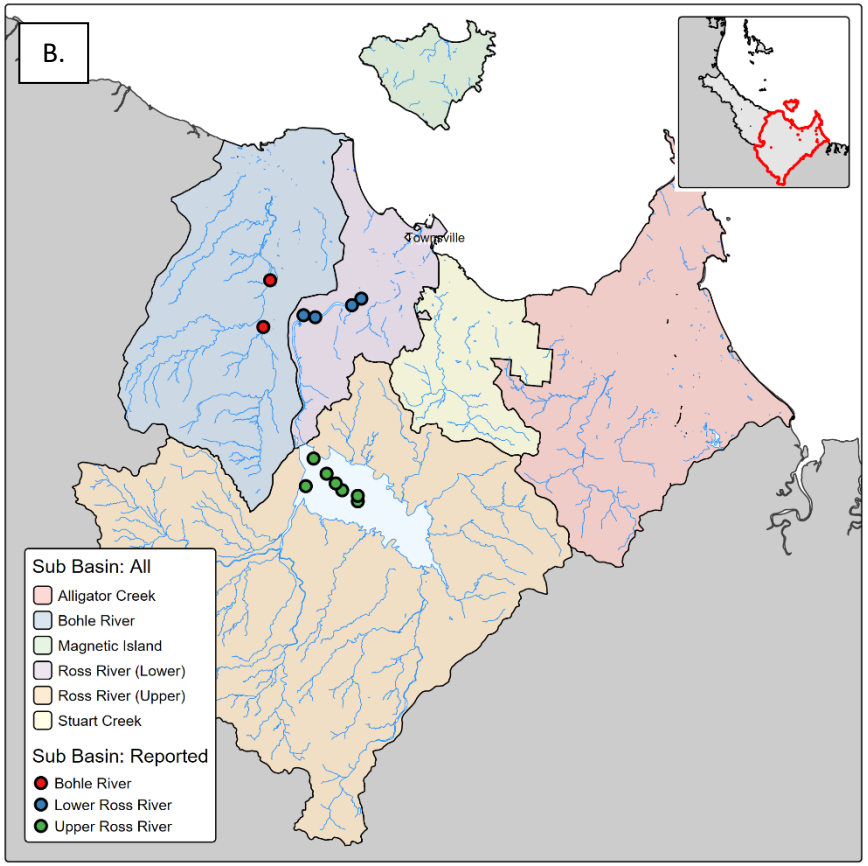


Figure 1. Freshwater basins (A. = Black, B. = Ross), and sub basins (see legend).

Table 1. Townsville Dry Tropics freshwater water quality site summary.

Basin	Sub Basin	Watercourse	Number of Sites
Ross	Upper Ross	Ross Lake	7
	Lower Ross	Ross River	4
	Bohle	Bohle River	2
Black	Black River	Black River	2
	Bluewater Ck	Althaus Ck	1
		Bluewater Ck	1
		Sleeper Log Ck	1
	Rollingstone Ck	Leichhardt Ck	1
		Saltwater Ck	1
		Rollingstone Ck	1
	Crystal Ck	Ollera Ck	1
		Crystal Ck	1
	Paluma	Paluma Lake	1

4.1.2 Overall Summary: Freshwater Water Quality

The overall water quality grade remained "good" in both the Black and Ross Freshwater Basins, and no score change was recorded in the Ross Basin. However, the overall water quality score increased in the Black Basin (from 66 to 71) (Table 24), and the nutrients grade and score increased in the Ross Basin (from "moderate" (60) to "good" (72) (Table 24, Table 25)).

Table 2. Freshwater Water Quality Index Scores and Grades with comparison to previous years.

Basin	Nutrients	Phys-Chem Properties	Water Quality					
			23-24	22-23	21–22	20–21	19–20	18–19
Ross	72	63	67	67	70	73	70	66
Black	67	74	71	66	68	68	67	62

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 | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

Table 3. A comparison of nutrient and physical chemical properties indicator category scores, and the water quality index scores, for freshwater sub basins between years.

Sub Basin	Nutrients					Phys-Chem					Water Quality				
	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
Upper Ross	90	81	75	90	65	81	90	90	90	90	85	85	82	90	77
Lower Ross	75	66	75	75	68	58	71	57	70	82	67	68	66	72	75
Bohle River	6	0	24	27	7	41	44	58	54	45	24	22	41	40	26
Ross Basin (Weighted)	72	60	71	73	60	63	74	68	74	80	67	67	70	73	70
Black River	51	51	62	ND[1]	ND	77	68	68	ND	ND	64	60	65	ND	ND
Bluewater Ck	64	73	76	ND	ND	72	45	44	ND	ND	68	59	60	ND	ND
Rollingstone Ck	82	85	85	ND	ND	78	69	74	ND	ND	80	77	79	ND	ND
Crystal Ck	90	90	79	ND	ND	69	67	67	ND	ND	79	78	73	ND	ND
Paluma Lake	90	90	90	ND	ND	71	71	72	ND	ND	80	67	69	ND	ND
Black Basin (Weighted)	67	70	73	66	67	74	63	64	70	67	72	66	68	68	67

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 | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

[1] These scores cannot be back calculated due to changes in the method of grouping data.

4.1.2.1 *Key Messages*

- The Ross Freshwater Basin grade remained "good" with no change in overall water quality score.
    - However, the nutrients grade and score increased in the Ross Basin (from "moderate" (60) to "good" (72), while the physical chemical properties score decreased from 74 to 63.
    - In both instances these changes were predominantly driven by changes in the Lower Ross Sub Basin, with notably improved DIN scores and reduced Low DO scores. For both indicators, no strong temporal trends are yet apparent.
    - The Bohle River TP grade remained "very poor" for the sixth[2] year in a row, and the DIN grade remained "very poor" although increased compared with 2022-2023.
    - DIN values in the Upper Ross and Paluma Lake sub basins remain "NA" due to the Water Quality Objective values (WQOs) being equal to or less than the Limit of Reporting values (LOR).
- The Black Freshwater Basin score increased from 66 to 71 within the same grade of "good".
    - This improvement was largely driven by an improvement in the physical-chemical indicator category from 63 to 74. Specifically, the turbidity indicator in the Bluewater Creek Sub Basin improved from "poor" (28) to "moderate" (59). This increase is after several years of lower scores and will need to be monitored for consistency.
    - Althaus Creek shows ongoing low scores and grades for the TP and Turbidity indicators (42 and 58, "moderate"), and further investigation would be required to isolate specific drivers. An increase in grade has been noted, however this may be driven by the limited number of samples collected (Appendix J), continued improvement is needed particularly in years with a greater number of samples.

4.1.3 Nutrients

For the 2023–2024 technical report the nutrients indicator category is comprised of two indicators, Dissolved Inorganic Nitrogen (DIN), and Total Phosphorus (TP). The scores and grades for the Ross and Black freshwater basins, and their associated sub basins are presented in Table 26. Annual medians, samples collected, months sampled, WQOs, and SFs are presented in Appendix H. Historical scores are presented in Appendix I.

As there have been continuous gaps in the data for TP, investigation is continuing into the potential to include Filterable Reactive Phosphorus (FRP) in the analysis. Discussions for this are ongoing.

4.1.3.1 *Results: Freshwater Nutrients*

The nutrient indicator category for the Ross Freshwater Basin was graded as "good" with a weighted score of 72, a notable increase from the previous report of 60 (moderate). The Upper Ross sub basin maintained its "good" grade, however, did not receive DIN scores as the assigned water quality objective (WQO) is equal to or less than the limit of reporting (LOR). The Lower Ross sub basin maintained a "good" grade and showed improvements in the DIN indicator, whilst the Bohle River sub basins remained "very poor". The increase in DIN scores in the Lower Ross Sub Basin were the main driver of the overall improvement in Ross Basin nutrients. The source of nutrient inputs continues to require investigation, so that management can be implemented to improve the water

[2] Only five years of data are shown in each technical report. Historical scores are available upon request.

quality. Note; the Ross freshwater water quality index received a confidence grade of “low” (4.1.5 Confidence Scores).

The nutrients indicator category for the Black Freshwater Basin was graded as “good” with a weighted score of 67, a slight decrease from the previous reports score of 70 (good). Sub basins grades for nutrients ranged from “moderate” to “very good”, across the board despite an overall decrease in basin score. TP scores improved from “very poor” to “moderate” in Althaus Creek (Appendix I) however should be monitored closely to ensure the trend is maintained and will require additional investigation to determine the cause. Paluma Lake did not receive DIN scores due to issues with LOR and WQO values.

Table 4. Unweighted and weighted standardised scores and grades for the nutrient indicators and indicator category in the Townsville Dry Tropics Freshwater Basins.

Basin	Sub Basin	Watercourse	Unweighted Score and Grade					Weighted Score and Grade	
			DIN	TP	Nutrients[3]	Weighting (proportion)	Area (km2)	Sub Basin	Basin
Ross	Upper Ross	Ross Lake	NA[4]	90	90	0.32	458	23.4	72
	Lower Ross	Aplins Weir	60	ND	60	-	-	-	
		Gleesons Weir	90	ND	90	-	-	-	
		Blacks Weir	64	90	77	-	-	-	
			71	90	75	0.56	786	37.1	
	Bohle River	Bohle Mid-Field	0	0	0	-	-	-	
		Bohle Far-Field	25	0	12	-	-	-	
			12	0	6	0.12	169	0	
			47	45	54	1	1413		
Black	Black River	Black River	59	42	51	0.37	250	19.1	67
	Bluewater Ck	Althaus Ck	68	42	55	-	-	-	
		Bluewater Ck	46	76	61	-	-	-	
		Sleeper Log Ck	90	61	75	-	-	-	
			68	60	64	0.24	162	17.6	
	Rollingstone Ck	Leichhardt Ck	90	73	81	-	-	-	
		Saltwater Ck	90	90	90	-	-	-	
		Rollingstone Ck	61	90	75	-	-	-	
			80	84	82	0.21	145	18.3	
	Crystal Ck	Ollera Ck	90	90	90	-	-	-	
		Crystal Ck	90	90	90	-	-	-	
			90	90	90	0.17	116	15.5	
	Paluma Lake	Paluma Lake	NA[4]	90	90	0	2	0.3	
			76	74	76	1	675		

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) | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

[3] Sites indicators are average within each indicator to calculate watercourse indicators which are averaged to calculate sub basin indicators. Watercourse indicators are averaged between each indicator to calculate watercourse indicator categories, which are averaged to calculate sub basin indicator categories.

[4] Data removed as the LOR was >= the WQO, and more than half (Ross Lake: 157 of 158, Paluma Lake: 17 of 24) of the concentration values were <= the WQO.

4.1.4 Physical-Chemical Properties

For the 2023–2024 technical report the physical-chemical properties indicator category is comprised of three indicators, Turbidity (NTU), High DO, and Low DO. The scores and grades for the Ross and Black freshwater basins, and their associated sub basins are presented in Table 27. Annual medians, samples collected, months sampled, WQOs, and SFs are presented in Appendix J. Historical scores are presented in Appendix K.

4.1.4.1 *Results: Freshwater Physical-Chemical Properties*

The physical-chemical indicator category for the Ross Freshwater Basin was graded as “good” with a weighted score of 63, a decrease from the previous report of 74 (good). The Upper Ross sub basin was graded as “very good”, the Lower Ross sub basin was graded as “moderate”, and the Bohle River sub basin was graded as “moderate”. Both the Upper Ross and Bohle sub basins did not record a change in grade, however the Lower Ross basin decreased (from “good” to “moderate”). This decrease was driven largely by a decline in the low DO indicator at all three sites in the Sub Basin (decreased from “moderate” and “good” to “poor”). It is acknowledged that the Lower Ross River often experiences high weed growth, further investigation and an increased sampling frequency would be required to establish if this is a driving influence. Further, increased sampling frequency is recommended for all sites measuring DO, such as via loggers. Note; the Ross freshwater water quality index received a confidence grade of “low” (4.1.5 Confidence Scores).

The physical-chemical indicator category for the Black Freshwater Basin was graded as “good” with a weighted score of 74, an increase from the previous report of 63 (good). All sub basins received physical-chemical properties grades of “good”, however, turbidity ranged from “poor” to “very good”, and Low DO ranged from “very poor” to “very good” at select sites. The increase in overall Basin score was driven largely by improvements in the turbidity indicator at multiple sites in the Bluewater Creek Sub Basin (e.g. 0 – 58, 70 – 90, and 13 – 30). However, it is likely that the low number of sampling opportunities due to limited rainfall influenced these scores (Appendix J). Despite these improvements the Althaus Creek and Sleeper Log Creek sites should be monitored closely to ensure the trend is maintained, particularly in years with more sampling, and will require additional investigation to determine the cause.

Table 5. Unweighted and weighted standardised scores and grades for the physical-chemical properties indicators and indicator category in the Townsville Dry Tropics Freshwater Basins.

Basin	Sub Basin	Watercourse	Unweighted Score and Grade						Weighted Score and Grade	
			Turbidity	High DO	Low DO	PhysChem	Weighting (proportion)	Area (km2)	Sub Basin	Basin
Ross	Upper Ross	Ross Lake	72	90	90	81	0.32	458	28.8	63
	Lower Ross	Aplin's Weir	90	90	34	62	-	-	-	
		Gleesons Weir	78	90	34	56	-	-	-	
		Blacks Weir	90	90	22	56	-	-	-	
			86	90	30	58	0.56	786	40.0	
	Bohle River	Bohle Mid-Field	90	90	0	45	-	-	-	
		Bohle Far-Field	77	90	0	38	-	-	-	
			83	90	0	41	0.12	169	5.3	
			82	90	30	56	1	1413		
Black	Black River	Black River	90	64	90	77	0.37	250	25.4	74
	Bluewater Ck	Althaus Ck	58	73	90	65	-	-	-	
		Bluewater Ck	90	90	90	90	-	-	-	
		Sleeper Log Ck	30	90	90	60	-	-	-	
			59	84	90	72	0.24	162	10.8	
	Rollingstone Ck	Leichhardt Ck	90	90	61	75	-	-	-	
		Saltwater Ck	90	90	90	90	-	-	-	
		Rollingstone Ck	90	90	49	69	-	-	-	
			90	90	66	78	0.2148	145	15	
	Crystal Ck	Ollera Ck	90	90	8	49	-	-	-	
		Crystal Ck	90	90	90	90	-	-	-	
			90	90	49	69	0.1719	116	11.6	
	Paluma Lake	Paluma Lake	90	90	53	71	0.003	2	0.2	
			80	85	71	73	1	675	64	

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) | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

4.1.5 Confidence Scores

There was low confidence in the water quality scores for the Ross Freshwater Basin due to limited spatial sampling in the basin, with only two rivers and Ross Lake sampled. There was moderate confidence in the water quality scores for the Black Freshwater Basin, with most major watercourses sampled. The score for each criterion is shown in Table 28.

Table 6. Confidence scores for the freshwater water quality indicator categories.

Basin	Indicator category	Maturity (*0.36)	Validation (*0.71)	Representativeness (*2)	Directness (*0.71)	Measured error (*0.71)	Final Score	Rank
Ross	Nutrients	2	3	1	3	1	7.6	Low (2)
	Phys-chem	2	3	1	3	1	7.6	Low (2)
	Water quality index						7.6	Low (2)
Black	Nutrients	2	3	1.5	3	1	8.6	Mod (3)
	Phys-chem	2	3	1.5	3	1	8.6	Mod (3)
	Water quality index						8.6	Mod (3)

Rank based on final score: Very low (1): 4.5 – 6.3; Low (2): >6.3 – 8.1; Moderate (3): >8.1 – 9.9; High (4): >9.9 – 11.7; Very high (5): >11.7 – 13.5.

Confidence criteria were scored 1–3 and weighted by the value identified in parenthesis. Weighted scores were summed to produce a final score (4.5 – 13.5). Final scores were ranked from 1 to 5 (very low to very high).

4.2 Pesticides

The pesticides index (Pesticides Risk Metric – PRM) for the freshwater environment of the Townsville Dry Tropics region represent the average pesticide risk over the wet season for 182 days. 22 pesticides, including nine PSII herbicides (Photosystem II inhibitors), 10 non PSII herbicides and three insecticides were measured. The wet season is determined as commencing when a rise in river water level occurs, which coincides with an increase in aqueous pesticides concentrations (Warne, et al. 2023).

4.2.1 Monitoring Sites

Data for the pesticides index are collected from two sample sites, one in the Ross Freshwater Basin, along Ross River, and one in the Black Freshwater Basin, along Black River (Table 29, and Appendix N).

Table 7. Townsville Dry Tropics freshwater pesticides site summary.

Basin	Sub Basin	Watercourse
Ross	Lower Ross	Ross River
Black	Black	Black River

4.2.2 Overall Summary: Pesticides

As noted above, the pesticide index and pesticide results are not representative of the entire Ross and Black Basins, but rather the individual monitoring sites within each Basin. Further, the pesticides index is a risk matrix, even if scores are "very good", this does not necessarily indicate the absence of pesticides completely.

The overall pesticides grade was "very good" (84) for the Black River sampling site and increased from the previous reporting period, however the pesticides grade for the Ross River sampling site was only "good" (75) and decreased in both score and grade since the previous reporting period. (Table 24). This is the second year that pesticides data have been reported in the HWP Technical Report. Historical data shown has been back calculated.

Table 8. Freshwater Pesticides Index Scores and Grades with comparison to previous years.

Monitoring Site	Pesticides					
	23-24	22-23	21–22	20–21	19–20	18–19
Ross River	75 (B)	81 (A)	89 (A)	94 (A)	89 (A)	98 (A)
Black River	84 (A)	82 (A)	91 (A)	92 (A)	89 (A)	100 (A)

Standardised scoring range: ■ = Very High Risk: 0 to <21 | ■ = High Risk: 21 to <41 | ■ = Moderate Risk: 41 to <61 | ■ = Low Risk: 61 to <81 | ■ = Very Low Risk: 81 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

4.2.2.1 *Key Messages*

- This is the second year in which pesticides data have been reported in the Townsville Dry Tropics Technical Report.
- Pesticide results and scores are not representative of the entire basin, as pesticides were only monitored at two sites (one in Ross River and one in Black River).
- The pesticides index is a risk metric, even if scores are "very low risk", this does not indicate the absence of pesticides completely.

- The score for the Black Basin sample site increased from 82 to 84 although did not change grade.
- Notably, both the score and grade decreased for the Ross River sample site, from "very low risk" (81) to "low risk" (75).
    - Two new pesticides were detected (Hexazinone (PSII) and Metsulfuron-methyl (non-PSII)), for the first time in more than 5 years, while one pesticide was not detected from the previous year (Triclopyr (non-PSII)).
    - In particular, even a single detection of Metsulfuron-methyl for a single day can result in a notable contribution to the annual wet season Pesticide Risk Metric PRM due to its high toxicity and very low guideline value. Continued monitoring is required to understand if this sharp decrease in scores continues.

4.2.3 Results: Pesticides

The scores and grades for the Ross and Black freshwater monitoring locations, are presented in Table 31. The relevant contribution of each of the pesticide classes are presented in Figure 44 and Figure 43 in Appendix O.

Table 9. The percentage of species protect and standardised scores for the pesticide risk metric in the Ross and Black freshwater basins.

Monitoring Site	% of Species Affected: Insecticides	Other Herbicides	PSII Herbicides	% of Species Protected	Standardised Scores
Ross River	1.51	0.53	0.0	97.9	75 (B)
Black River	0.64	0.50	0.0	99.2	84 (A)

Pesticide risk metric scoring range: ■ Very Poor = <80% (very high risk)| ■ Poor = <90 to 80% (high risk)| ■ Moderate = <95 to 90% (moderate risk)| ■ Good = <99 to 95% (low risk)| ■ Very Good = ≥99% (very low risk). **Standardised scoring range:** ■ = Very High Risk: 0 to <21 | ■ = High Risk: 21 to <41 | ■ = Moderate Risk: 41 to <61 | ■ = Low Risk: 61 to <81 | ■ = Very Low Risk: 81 to 100 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

Analysis of the samples found that 6 unique pesticides were detected at the Ross River site (Tebuthiuron, Fluroxypyr, Fipronil, Hexazinone, Metsulfuron-methyl, and MCPA), and 8 were detected at the Black River site (Fipronil, Fluroxypyr, 2,4-D, Metsulfuron-methyl, Triclopyr, MCPA, Imidacloprid, and Metolachlor). This is an increase in the Ross and decrease in the Black since the 2022-2023 reporting period (Ross: 5, Black: 10). In the Ross Basin, two new pesticides were detected for the first time in more than five years (Hexazinone and Metsulfuron-methyl), and in the Black Basin three pesticides were detected for the first time in more than five years (Fluroxypyr, Imidacloprid, and Metolachlor). Note; the freshwater pesticides index received a confidence grade of "low" (4.2.4 Confidence Scores).

4.2.4 Confidence Scores

There was low confidence in the pesticide scores for both the Ross and Black Freshwater Basins due to limited spatial and temporal sampling in the basin (only two rivers sampled and only for part of the year) (Table 32).

Table 10. Confidence scores for the freshwater pesticide index.

Index	Maturity (*0.36)	Validation (*0.71)	Representativeness (*2)	Directness (*0.71)	Measured error. (*0.71)	Final Score	Rank
Pesticides	3	2	1	2	2	7.3	Low (2)

Rank based on final score: Very low (1): 4.5 – 6.3; Low (2): >6.3 – 8.1; Moderate (3): >8.1 – 9.9; High (4): >9.9 – 11.7; Very high (5): >11.7 – 13.5.

Confidence criteria were scored 1–3 and weighted by the value identified in parenthesis. Weighted scores were summed to produce a final score (4.5 – 13.5). Final scores were ranked from 1 to 5 (very low to very high).

4.3 Habitat and Hydrology

The habitat and hydrology index in the freshwater environment consists of the habitat indicator categories (Freshwater Riparian Extent and Freshwater Wetland Extent), and the hydrology indicator category (Artificial Barriers). Results are provided by a combination of partners of the Partnership and from the Reef 2050 Report Card. There is no update for the 2023-2024 Technical Report; data for these indicator categories is updated approximately every four years with the most recent update occurring in 2023.

4.3.1 Overall Summary: Freshwater Habitat and Hydrology

For the 2023-2024 reporting period the standardised scores for the habitat and hydrology index did not change (see above). The Ross Freshwater Basin received a score of 61 (good), and the Black Freshwater Basin received a score of 79 (good) (Table 33). For the second time since the beginning of this technical report, sub basin results have also been calculated and presented. Note; the habitat and hydrology index received a confidence grade of "low" to "very low" (4.3.5 Confidence Scores).

Table 11. Standardised scores for the habitat and hydrology indicator categories and index in the Ross Freshwater Basin and Black Freshwater Basin.

Basin	Riparian Extent	Wetland Extent	Artificial Barriers	Habitat and Hydrology Index				
				23-24	22-23	21–22	20–21	19–20
Ross	54	80	49	X	61	X	X	51
Black	81	64	100	X	79	X	X	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 | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

4.3.1.1 *Key Messages*

- There is no new data available for the freshwater habitat and hydrology section, thus scores have not changed since the previous report. Historic key messages are presented below:
    - Standardised scores for the habitat and hydrology index increased in both freshwater basins.
        - The riparian extent indicator category improved in both basins, with the Black Freshwater Basin recording its first increased in freshwater riparian vegetation since the beginning of this Dry Tropics Technical Report.
    - Sub basin scores have been calculated and presented for the first time. This allowed for several new observations such as:
        - Identifying the Stuart Creek sub basin as the location with the greatest loss of riparian vegetation extent between 2019 and 2021.
        - Identifying the Bluewater and Rollingstone Creek sub basins as the locations with the greatest loss of wetland extent between 2019 and 2021.
        - Identifying several sub basins with the Black Freshwater Basins that have gained riparian vegetation extent between 2019 and 2021.

4.3.2 Freshwater Riparian Extent

The Partnership uses methods sourced from the Reef Water Quality Report Card, although presents results at a sub basin level. Data is scored based on the amount of vegetation coverage in

comparison to the most recent previous dataset. For this report 2021 vegetation data (published in late 2023) is compared against 2019 data. The objective of this index is to record zero loss in vegetation between datasets.

4.3.2.1 *Monitoring Sites*

The area for the riparian extent indicator category is provided in Appendix P and Appendix Q.

4.3.2.2 *Results: Freshwater Riparian Extent*

For the 2023–2024 reporting period no sub basins in the Ross Basin gained vegetation, and no sub basins in the Black Basin lost vegetation (Table 34). The Stuart Creek sub basin had greatest percent-loss change, possibly due to the "state development area" within its boundaries (Queensland Government State Development and Infrastructure 2003).

Table 12. Riparian extent area, loss and standardised score in the freshwater basins and sub basins of the Townsville Dry Tropics.

Basin/Sub Basin	Freshwater Riparian Extent						
	Area (ha)				Extent Change (19-21)		Standardised Score
	Pre-Clear	…	2019	2021	ha	%	
Alligator Ck	5,303.2	…	4,551	4,542.7	-8.3	-0.18	57
Bohle River	6,544.4	…	4,874.3	4,868.5	-5.9	-0.12	60
Magnetic Island	2,013.0	…	1,916.1	1,916.1	0	0	80
Ross River (Lower)	2,097.5	…	1,527.5	1,527.5	0	0	80
Ross River (Upper)	19,426.9	…	16,328.2	16,282.2	-46.0	-0.28	52
Stuart Ck	2,889.8	…	2,307.7	2,292.8	-14.9	-0.64	35
Ross freshwater	38,274.8	…	31,504.9	31,429.8	-75.1	-0.24	54
Black River	9,918.1	…	8,904.9	8,909.2	+4.3	+0.05	81
Bluewater Ck	7,614.3	…	6,896.2	6,908.2	+12.0	+0.17	81
Crystal Ck	7,071.3	…	6,337.7	6,345.7	+8.0	+0.13	81
Palm Islands	901.2	…	775.1	775.1	0	0	80
Paluma Lake	121.7	…	28	28	0	0	80
Rollingstone Ck	5,806.1	…	5,396.7	5,406.5	+9.8	+0.18	81
Black freshwater	31,432.7	…	28,338.5	28,372.6	+34.1	+0.12	81

Riparian extent scoring range: ■ = Very Poor: >1% loss | ■ = Poor: 0.51 to 1% loss | ■ = Moderate: 0.11 to 0.5% loss | ■ = Good: 0 to 0.1% loss| ■ = Very Good: increase in vegetation.

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 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

The final standardised scores were 54 in the Ross Basin, and 81 (very good) in the Black Basin. Notably, the Black Basin recorded an increase in freshwater riparian vegetation, however it is not clear if this is the result of growth of native vegetation or weed species (Table 35). Further, it should be noted that because vegetation is compared to most recent previous assessment, a score of "good" simply means that there was no vegetation loss since the previous assessment, not since

"pre-European times". Historic vegetation trends for each basin are presented in Appendix R and Appendix T.

Table 13. Historic standardised score for the Freshwater Riparian indicator category.

Basin	Freshwater Riparian Extent Standardised Scores					
	23-24	22-23	21-22	20-21	19-20	18-19
Ross Freshwater	X	54	X	X	X	44
Black Freshwater	X	81	X	X	X	56

Riparian extent scoring range: ■ = Very Poor: >1% loss | ■ = Poor: 0.51 to 1% loss | ■ = Moderate: 0.11 to 0.5% loss | ■ = Good: 0 to 0.1% loss| ■ = Very Good: increase in vegetation.

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 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

4.3.3 Freshwater Wetland Extent

The Partnership uses methods sourced from the Reef Water Quality Report Card, however, presents results at a sub basin level with minor changes to the assessed area: including Magnetic Island and the Palm Island group in the analysis of wetland extent. Data is scored based on the amount of wetland coverage in comparison to the most recent previous dataset. For this report 2019 wetland data (published in late 2023) is compared against 2017 data. The objective of this index is to record zero loss in vegetation between datasets.

4.3.3.1 *Monitoring Sites*

The area for the wetland extent indicator category is provided in Appendix U and Appendix V.

4.3.3.2 *Results: Freshwater Wetland Extent*

For the 2023–2024 reporting period only the Bluewater Creek and Rollingstone Creek sub basins recorded a loss in vegetation, no sub basins recorded a gain in vegetation (Table 36). The final standardised scores were 54 (moderate) in the Ross Basin, and 81 (very good) in the Black Basin. It should be noted that although no increases in wetland vegetation were detected, due to selective nature of the assessment (only measuring pristine palustrine) this does not mean that there wasn't a gain/loss of other types of wetlands within the area. Further, because vegetation is compared to most recent previous assessment, a score of "good" simply means that there was no vegetation loss since the previous assessment, not since the "pre-European times". Historic vegetation trends for each basin are presented in Appendix W and Appendix X.

Table 14. Freshwater wetland area, loss and standardised score in the freshwater basins and sub basins of the Townsville Dry Tropics.

Basin/Sub Basin	Freshwater Wetland Extent						
	Area (ha)				Extent Change (17-19)		Standardised Score
	2001	...	2017	2019	ha	%	
Alligator Ck	528.1	...	526.5	526.5	0.0	0.0	80
Bohle River	227.4	...	206.1	206.1	0.0	0.0	80
Magnetic Island	28.3	...	28.3	28.3	0.0	0.0	80
Ross River (Lower)	62.5	...	61.0	61.0	0.0	0.0	80
Ross River (Upper)	46	...	46.0	46.0	0.0	0.0	80
Stuart Ck	11.1	...	11.1	11.1	0.0	0.0	80
Ross freshwater	903.4	...	879.0	879.0	0.0	0.0	80
Black River	33.5	...	33.5	33.5	0.0	0.0	80
Bluewater Ck	52.1	...	45.1	44.9	-0.2	-0.46	43
Crystal Ck	222	...	219.1	219.1	0.0	0.0	80
Palm Islands	61.9	...	61.9	61.9	0.0	0.0	80
Paluma Lake	ND	...	ND	ND	ND	ND	ND
Rollingstone Ck	77.7	...	76.9	76.8	-0.2	-0.2	56
Black freshwater	447.3	...	436.6	436.2	-0.4	-0.08	64

Wetland extent scoring range: ■ = Very Poor: >3% loss | ■ = Poor: 0.51 to 3% loss | ■ = Moderate: 0.11 to 0.5% loss | ■ = Good: 0 to 0.1% loss| ■ = Very Good: increase in vegetation.

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 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

Table 15. Historic standardised score for the Freshwater wetland indicator category.

Basin	Freshwater Wetland Extent Standardised Scores					
	23-24	22-23[5]	21-22	20-21	19-20	18-19
Ross Freshwater	X	80	X	X	40	45
Black Freshwater	X	64	X	X	58	40

Wetland extent scoring range: ■ = Very Poor: >3% loss | ■ = Poor: 0.51 to 3% loss | ■ = Moderate: 0.11 to 0.5% loss | ■ = Good: 0 to 0.1% loss| ■ = Very Good: increase in vegetation.

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 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

[5] The data and method used to map wetland extent was updated in 2023 (Version 6.0). Although results can no longer be compared to previous technical reports the latest data includes a remapping of all previous years of data. This remapping has been used to back calculate all historic scores presented in Table 36. A comparison between new and old scores is shown in Appendix Z.

4.3.4 Freshwater Artificial Barriers

The artificial barriers indicator category is comprised of two indicators: impoundment length and fish barriers. Both indicators are updated approximately every four years, with impoundment length updated in 2022 and fish barriers scheduled to be updated in 2025.

4.3.4.1 *Monitoring Sites*

The area for the artificial barriers indicator category is provided in Appendix Z and Appendix AA.

4.3.4.2 *Results: Freshwater Artificial Barriers*

There is no change to the results for the artificial barriers indicator category or the impoundment length and fish barrier indicators in this technical report. The Black Freshwater Basin received a standardised score of 100 (very good) due to the lack of artificial barriers, and the Ross Freshwater Basin received a standardised score of 49 (moderate) due to the high frequency of barriers, and their proximity to the downstream limit of the water way, particularly in the Ross River (Table 38).

Table 16. Standardised scores for the artificial barrier's indicator category in the Ross Freshwater Basin and Black Freshwater Basin.

Basin	Impoundment Length	Fish Barriers	Artificial Barriers
Ross freshwater	34	65	49
Black freshwater	100	100	100

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 | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

4.3.4.3 *Results: Freshwater Impoundment length*

Impoundment length in the Townsville Dry Tropics region has remained consistent between reporting periods. The Black Basin received a score of 100 (very good), with no impoundments. In the Ross Basin, of the 895km of assessed waterways, 72km were impounded. The Ross basin received a score of 34 (poor) due to the Ross River Dam, and three weirs (Black, Gleeson and Aplin's) on the Ross River.

Table 17. Natural and Impounded stream length and standardised score in the freshwater basin of the Townsville Dry Tropics.

Basin	Waterway				Standardised Score (Grade)
	Natural	Impounded	Total	% Impounded	
Ross freshwater	824km	72km	895km	8.0%	34
Black freshwater	659km	0km	659km	0.0%	100

Standardised scoring range: ■ = Very Poor: ≥10% impoundment ■ = Poor: 7 to <10% ■ = Moderate: 4 to <7% ■ = Good: 1 to <4% ■ = Very Good: <1% impoundment | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

4.3.4.4 *Results: Freshwater Fish Barriers*

In the Ross Basin, there were 12 barriers across five measured waterways, four were classified as impassable, and all were located on the Ross River. In the Black Freshwater Basin 92km of the Black River was assessed, and no fish barriers, passable or impassable, were identified (Table 40). Barrier density in the Ross Basin ranged from 3.5km of waterway per barrier, to 65.9km per barrier, and the

percentage of stream to first barrier ranged from 0.4% to 100%. In the Black Basin, percentage of stream to first barrier was 100% (Table 41). The fish barrier indicator received a standardised score of 65 (good) in the Ross Basin, and 100 (very good) in the Black Basin (Table 41).

Table 18. Waterway characteristics and fish barriers in the Ross Freshwater Basin and Black Freshwater Basin.

Basin	Waterway Name	length	Number of Barriers: Passable	Number of Barriers: Impassable	Length to first barrier: Passable	Length to first barrier: Impassable
Ross freshwater	Ross River	263.6km	0	4	1.0km	1.0km
	Bohle River	51.1km	2	0	7.2km	51.1km
	Stuart Ck	17.5km	5	0	11.9km	17.5km
	Alligator Ck	13.7km	1	0	0.7km	13.7km
	Whites Ck	11.1km	0	0	11.1km	11.1km
Ross Average		71.4km	1.6	0.8	6.4km	18.9km
Black freshwater	Black River	92.0km	0	0	0.0km	92.0km

Table 19. Standardised scores for the components of the fish barrier's indicator.

Waterway	Barrier density (km/barrier)	Percentage of stream to first … barrier: Passable	Percentage of stream to first … barrier: Impassable	Standardised Score (Grade)
Ross River	65.9km	0.4%	0.4%	40
Bohle River	25.5km	14.1%	100%	61
Stuart Ck	3.5km	68.2%	100%	60
Alligator Ck	13.7km	5.2%	100%	60
Whites Ck	NA	100%	100%	100
Ross Average	27.2km	37.6%	80.1%	65
Black River	NA	100%	100%	100

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 | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

4.3.5 Confidence Scores

Confidence in the riparian extent, wetland extent, and artificial barriers indicator categories was low or very low with a rank of 1, 1, and 2 out of 5 respectively.

Table 20. Confidence scores for the mangrove and saltmarsh extent and riparian extent indicator categories.

Indicator Category	Maturity (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Score (Rank)
R. Extent	2	2	1	2	1	6.3 (1)
W. Extent	2	2	1	2	1	6.3 (1)
A. Barriers	2	1	2	2	1	7.6 (2)

Rank based on score: 1 (very low) = 4.5 to 6.3; | 2 (low) = >6.3 to 8.1; | 3 (moderate) = >8.1 to 9.9; | 4 (high) = >9.9 to 11.7; | 5 (very high) = >11.7 to 13.5.

4.4 Fish

The Fish index for the freshwater basin of the Townsville Dry Tropics regions consists of two indicator categories, the Proportion of Indigenous Species Expected (POISE), and the Proportion of Non-Indigenous Species (PONIS). Results for this index are provided by partners of the Partnership and are updated every three years. There are no updates for the 2023-2024 Technical Report, the latest update occurred in the 2022–2023 Technical Report using data collected in 2021-2022. This is the second time since the beginning of the report card that the fish index has been measured.

4.4.1 Monitoring Sites

The monitoring sites used for the fish index are provided in Appendix BB.

4.4.2 Overall Summary: Freshwater Fish

For the 2023-2024 reporting period the standardised scores for the fish index declined in both freshwater basins. The Ross Basin received a score of 49 (moderate), and the Black Basin received a score of 55 (moderate) (Table 43).

Table 21. Standardised scores for the POISE and PONIS indicator categories and fish index in the Ross and Black Basins.

Basin	POISE	PONIS	Fish Index				
			23-24	22-23	21-22	20-21	19-20
Ross	58	41	X	49	X	X	57
Black	25	84	X	55	X	X	78

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 | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

4.4.2.1 *Key Messages*

- There is no new data available for the freshwater fish section, thus scores have not changed since the previous report. Historic key messages are presented below:
    - This is the second time the fish index has been measured and scores for the fish index declined in both basins.
        - The primary driver was the PONIS indicator category in the Ross Basin (decreased from 60 to 41), and the POISE indicator category in the Black basin (decreased from 66 to 25).
    - Within the Ross Basin, 4011 fish from 29 species were caught during sampling.
        - 86% (3447) were indigenous and were released after identification.
        - 14% (564) were non-indigenous and were euthanised.
            - 529 fish were alien, 35 were translocated.
        - Scores indicate that most waterways were “moderate”.
    - Within the Black Basin, 2217 fish from 25 species were caught during sampling.
        - 83% (1830) were indigenous and were released after identification.
        - 17% (387) were non-indigenous and were euthanised.
            - All non-indigenous species were alien.
        - Scores indicate that some waterways were “very good’ whilst others were “very poor”.

- The large decrease in the POISE indicator category score is most likely connected to heavy rainfall before sampling dispersing the fish populations.

4.4.3 Proportion of Indigenous Species Expected (POISE)

The proportion of indigenous species expected (POISE) indicator category is a measure of observed versus expected species and compares the richness of indigenous[6] species. Presence/Absence and site scores are provided in Appendix CC to Appendix EE.

4.4.3.1 *Results: POISE*

The POISE indicator category was measured to be 0.645 in the Ross Basin and 0.429 in the Black Basin, showing that despite the large number of indigenous species, presence is still lower than the pre-disturbance model for both basins. Standardised scores were 58 (moderate) and 25 (poor) in the Ross and Black Basins respectively (Table 44). The grade did not change within the Ross Basin (moderate) however did decrease from "good" to "poor" in the Black Basin. This grade change was most likely driven by heavy rainfall preceding sampling that dispersed the fish populations. Several site locations had to be altered as they were no longer suitable due to a large increase in water depth.

Table 22. The Proportion of Indigenous Species Expected (POISE) indicator category raw and standardised scores for each basin in the Townsville Dry Tropics Region.

Basin	POISE	Standardised Score				
		23-24	22-23	21-22	20-21	19-20
Ross	0.645	X	58	X	X	54
Black	0.429	X	25	X	X	66

Scoring range (POISE): ■ = Very Poor: 0 to <0.40 | ■ = Poor: 0.40 to <0.53 | ■ = Moderate: 0.53 to <0.67 | ■ = Good: 0.67 to <0.80 | ■ = 0.80 to 1.

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 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

In the Ross Basin 4011 fish of 29 species were caught, 86% (3447) of which were indigenous. In the Black Basin 2217 fish of 25 species were caught, 83% (1830) of which were indigenous. All indigenous species were released after identification. Despite the similar percentages, the standardised score for the Black Freshwater Basin was notably lower (58 compared to 25). This is because the standardised scores are calculated from the median POISE value. In turn this indicates that the Black Freshwater Basin had a great number of waterways with a very poor number of indigenous species found compared to what was expected, and a few waterways with an exceptional (very good) number of indigenous species. Comparatively, most waterways in the Ross Freshwater Basin were moderate.

[6] Species classification definitions can be found in "Methods for Townsville Dry Tropics 2023–2024 Report Card (released in 2025)".

4.4.4 Proportion of Non-Indigenous Species (PONIS)

The proportion of non-indigenous species (PONIS) indicator category is a measure of observed translocated and alien species compared to the total number of observed species. Presence/Absence and site score are provided in Appendix CC to Appendix EE.

4.4.4.1 *Results: PONIS*

Within the PONIS indicator category, the median proportion of translocated species was measured to be 0.0 in both the Ross Freshwater Basin and Black Freshwater Basin, due to the very low presence of translocated species (note that although some translocated species were reported, the median measurement was 0.0). While the median proportion of alien species was 0.102 in the Ross Freshwater Basin, and 0.029 in the Black Freshwater Basin. Thus, the PONIS indicator category was also measured to be 0.102 and 0.029 in the Ross and Black Basins respectively. Standardised scores were 41 (moderate) in the Ross Basin and 96 (very good) in the Black Basin (Table 45).

Table 23. The Proportion of Non-Indigenous Species (PONIS) indicator category raw and standardised scores for each basin in the Townsville Dry Tropics Region.

Basin	Proportion of:		PONIS	Standardised Score				
	Translocated	Alien		23-24	22-23	21-22	20-21	19-20
Ross	0.0	0.102	0.102	X	41	X	X	60
Black	0.0	0.029	0.029	X	96	X	X	91

Scoring range (PONIS): ■ = Very Poor: >0.2 to 1 | ■ = Poor: >0.1 to 0.2 | ■ = Moderate: >0.05 to 0.1 | ■ = Good: >0.03 to 0.05 | ■ = 0 to 0.03.

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 | ND = No Data | NA = Not Applicable (data available but not usable) | X = Data was not updated this year.

In the Ross Basin, of the 4011 fish caught, 14% (564) were non-indigenous (529 alien, 35 translocated). In the Black Basin, of the 2217 fish caught, 17% (387) were non-indigenous (all of which were alien). All non-indigenous species were euthanised. Once again, despite similar percentages, the standardised scores for each basin are notably different (41 compared to 96). This is because the standardised scores are calculated from the median PONIS value. In turn this indicates that the Black Freshwater Basin had a great number of waterways with a very good (low) numbers of non-indigenous species, and a few waterways with a very poor (high) numbers of non-indigenous species. Comparatively, most waterways in the Ross Freshwater Basin were moderate.

4.4.5 Confidence Scores

Confidence in the fish index was moderate with a rank of 3 out of 5. The fish index received a maturity score of 2, as the methodology has been peer-reviewed, but not yet published. A validation score of 2 as frequent in-field observations were conducted, however a level of modelling was required to calculate pre-disturbance populations. A representativeness of 2 due to a limited sample size and number sampling locations relative to the population. A directness of 3 as the fish species were measured directly, and a measured error of 1 as the final scores are reliant on modelled populations (Table 46).

Table 24. Confidence scores for the fish index in the freshwater basin of the Townsville Dry Tropics.

Index	Maturity (x0.36)	Validation (x0.71)	Representativeness (x2)	Directness (x0.71)	Measured error (x0.71)	Score (Rank)
Fish	2	2	2	3	1	9.7 (3)

Rank based on score: 1 (very low) = 4.5 to 6.3; | 2 (low) = >6.3 to 8.1; | 3 (moderate) = >8.1 to 9.9; | 4 (high) = >9.9 to 11.7; | 5 (very high) = >11.7 to 13.5.