CREEKWATCH REPORT

Jan – Jun 2022

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29 July 2022

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Creekwatch Program Overview

Creekwatch is a citizen science and community awareness program established by Townsville City Council (TCC) in 2003. The program encourages community members to be actively involved in long-term monitoring activities and to become custodians of waterways in the Townsville City Council area. Regular activities include macroinvertebrate sampling, fish surveys, and water quality monitoring of local creeks and wetlands.

OzFish Unlimited has been running the Creekwatch program for TCC since early 2021. During this time the OzFish project team have been implementing weekly monitoring of waterways around Townsville. A core group of volunteers have assisted with weekly monitoring activities, which have focussed primarily on macroinvertebrate and fish sampling activities. A total of 21 sites have been monitored for macroinvertebrates and 12 sites monitored for fish.

This report details the results of the program for the period January – June 2022. We also present comparisons with results dating back to April 2021.

Figure 1 – Demonstration of fish sampling at Junior Landcare event (upper panel) and data collection at Crystal Creek (lower panel)

Townsville Waterways Overview

The Townsville region is located in the coastal dry tropics of northern QLD. TCC encompasses three river basins (Ross, Black and upper Haughton Rivers), with four smaller sub-catchments also located in the region (Black, Bohle, Ross and Haughton Rivers). A very small portion of the upper Burdekin catchment (~20 km^2) is also within TCC area near Paluma and Paluma Dam.

The region contains a mixture of waterways in the southern wet tropics (Bluewater Creek and waterways further north-west, and Mount Elliott) and dry tropics (Ross, Bohle and upper Haughton catchments). A large portion of the waterways of TCC are < 100 m a.s.l. (which is where the majority of Creekwatch events occur), however, some of the headwater streams are at elevations >1 000 m a.s.l. (e.g. Mount Elliott and Paluma range). The western portion (~150 km^2) of the Bowling Green Bay Wetlands—an internationally recognised wetland habitat—is located at the eastern limit of TCC.

Creekwatch activities are concentrated on waterways that are largely ephemeral (e.g. Sachs Creek; Louisa Creek; Stuart Creek; Mundy Creek), but the program also encompasses palustrine wetlands (Town Common), constructed lacustrine habitat (Idalia Lakes; upper Ross River) and wet tropics streams that may retain year-round baseline flow (Rollingstone Creek; Crystal Creek; Alligator Creek). The ecology of the waterways is influenced primarily by the biophysical characteristics mentioned above, and the region thus contains a diverse array of aquatic flora and fauna.

Figure 2 - Townsville City Council area (outlined in blue), with major sub-catchments (Ross, Bohle, Black and Haughton) outlined in pink. Map is from the QLD Gov Department of Environment and Science [Wetland Mapping System](#).

Monitored Sites

Creekwatch activities are presently undertaken at 14 waterways across the Townsville region (see Appendix for map of sample locations and schedule). One waterway is monitored each week and sampling effort is repeated quarterly for each sampling location. Some systems, such as Crystal Creek and Middle Ross River, have received additional monitoring effort as part of the school-based Creekwatch activities. We monitor one waterway on Magnetic Island (Gustav Creek), however this system is monitored less frequently than other locations due to its highly ephemeral nature. Monitoring activities consist of macro-invertebrate sampling, fish surveys and water quality monitoring.

Macroinvertebrates

Macroinvertebrate communities are frequently used to indicate the biological health of water bodies as different species and taxa have different levels of pollution sensitivity, which can be quantified as a SIGNAL 2 score. For the purposes of Creekwatch, however, this score is used to monitor changes in diversity over time, rather than an indication of pollution. Macroinvertebrate sampling is a regular Creekwatch activity and was conducted at every site during the January to June 2022 period, with the exception of Alligator Creek which remains closed to public access.

The sampling protocol consisted of collection, sorting, and identification to Family level at the survey location. Samples were collected from the edge of waterways or in-stream using handheld kick nets. Samples were transferred into shallow (<50 mm depth) plastic sorting trays and sorting of each sample was completed in 15 – 30 minutes. During sorting, macroinvertebrates were transferred into ice cube trays using pipettes for sorting and closer examination. Macroinvertebrates were identified using ID charts and reference text books with further confirmation on ID provided by OzFish staff. The diversity (SIGNAL 2) score was calculated according to the equation:

$$\text{MACRO DIV} = \frac{\sum_{i=1}^{n} Sensitivity\ Score_i}{Site\ Taxa\ Richness}$$

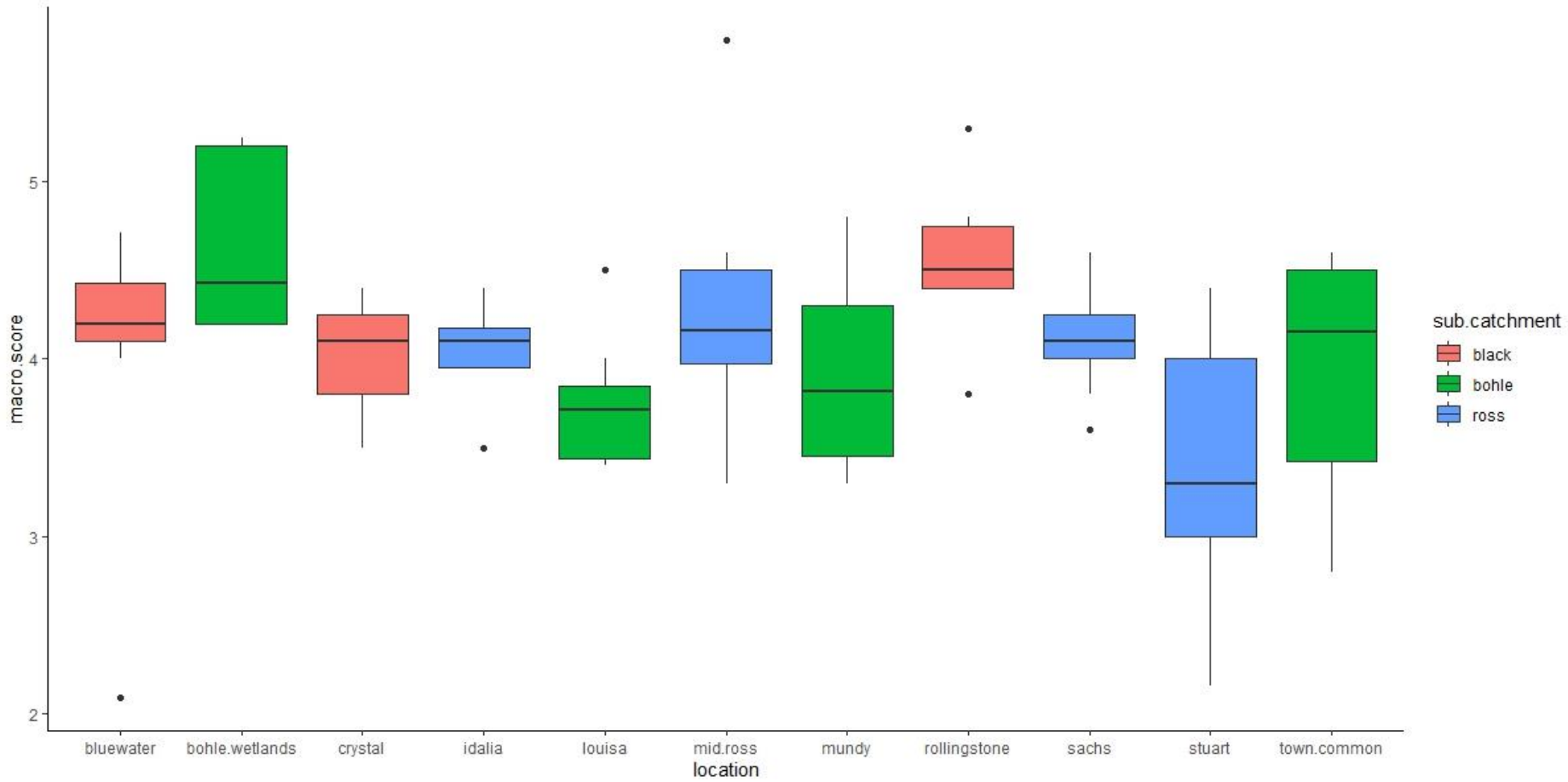

Figure 3 – MACRO DIV (SIGNAL 2) scores, plotted according to sampling location and coloured according to sub-catchment. Macro DIV data has been aggregated for each site and includes all samples from 2021 – 2022

Median diversity across all sampling locations was 4.2 (interquartile range = 3.9 – 4.4; see Figure 3). The highest diversity (Macro DIV Score = 5.3) was observed at Rollingstone Creek and the lowest diversity (Macro DIV Score = 0.28) was observed at Idalia Lakes during a heatwave in March 2022.

Macroinvertebrate diversity tended to be higher in the Black sub-catchment (median Macro DIV = 4.4) compared with the Bohle (median DIV = 4.0) and Ross (median DIV = 4.1) sub-catchments. Variability within samples tended to be higher for the Bohle sub-catchment (coefficient of variation (CV) = 15.8), than for samples collected from the Black (CV = 14.1) or Ross (CV = 13.9).

Temporal variability in Macro DIV scores differed within and between sampling locations (Figure 4). Temporal differences can be attributed to a range of factors, including seasonal environmental variability (e.g. water temperatures) and random variability in spatial coverage of survey effort, however it is possible that further environmental factors are contributing to some of the large temporal variability observed. The median change in Macro DIV Score (i.e. the difference between the two most recent DIV Scores) for all waterways sampled from Jan – Jun 2022 was 0 (interquartile range = -0.4 – 0.2).

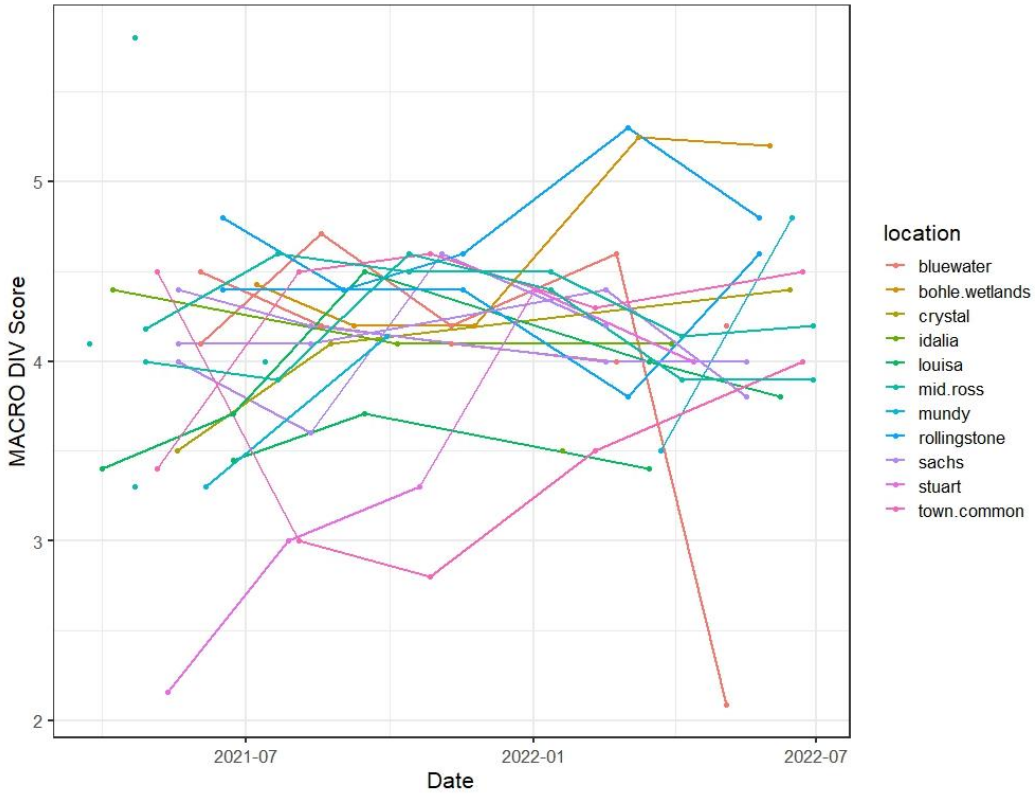

Figure 4 – MACRO DIV (SIGNAL 2) scores, plotted according to waterway and sampling locations from April 2021 – June 2022. Locations with repeated sampling effort are plotted as lines to track changes in Macro DIV scores over time, whereas locations that have a single sampling effort are presented as individual points.

Fish

Fish surveys have been completed at 12 sites for the Creekwatch program over the past six months, using a combination of box traps and underwater video. At each survey location box traps (*N* = 2) are baited and set for 30 min and underwater video (UwV) units (*N* = 2) are deployed for 10 min. A total of 28 fish species have been recorded by the Creekwatch team across all locations sampled (see Table 1 & Figures 9 – 11). UwV is generally a more successful method than baited traps for detecting fish presence in waterways, however UwV can only be used in water with sufficient depth and clarity, which is limiting its application across all sampling sites. The project team will develop monitoring methods using environmental DNA (eDNA) over the next 18 months which will complement and enhance the work we are doing to sample fish in Townsville's waterways.

Distinct variation in fish species diversity was observed for some locations (see Figure 5), and these differences can be attributed to a range of environmental factors (e.g. baseline water flow), their proximity to urban development and position within the catchment (e.g. above major fish barriers such as Aplin's weir).

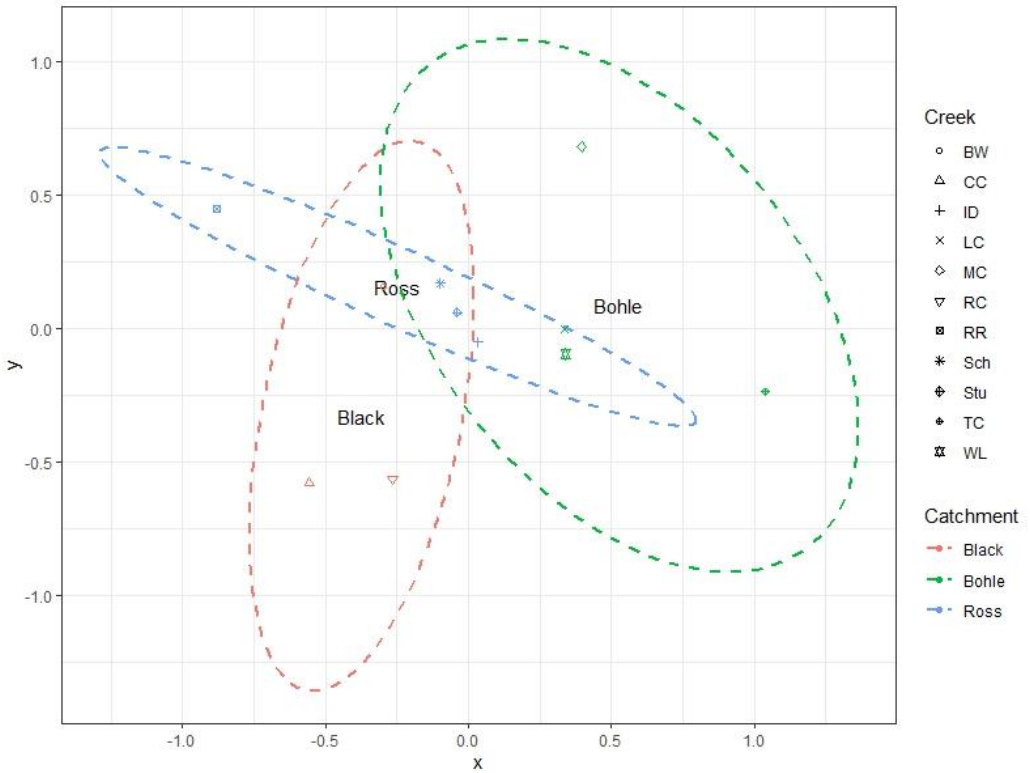

Figure 5 – Multidimensional scaling (MDS) ordination of fish species diversity. Scores are plotted for each Creek (*N* = 11) and are colour-coded according to Catchment. Data have been aggregated for each creek and across multiple sampling times and survey methods (box traps, dip nets, underwater video and visual observation)

Riparian Assessments

During the 2021/2022 wet season, riparian assessments were conducted as part of Creekwatch activities. This will continue for each sampled site on an annual basis to monitor changes to habitat condition. Volunteers used a simple method to assess riparian habitat coverage and condition, with four metrics recorded for each location and plant species documented to genus level (Table 2).

Results were highly variable due to the different habitat and riparian conditions of the different waterways assessed. Canopy cover was generally higher in waterways of the southern wet tropics (i.e. Bluewater and Rollingstone Creeks), which is not unexpected. Six of the 14 sites assessed had canopy cover of ≤20%, which can be considered poor. Weeds present in the canopy tended to be low for most sites, but was as high as 60% for parts of the Ross River catchment (Sachs Creek). The percentage of ground cover was highly variable, with little difference apparent at the sub-catchment level. The percentage of weeds in the ground cover was also highly variable between sites, but was ≥40% for 12 of the 14 sites assessed.

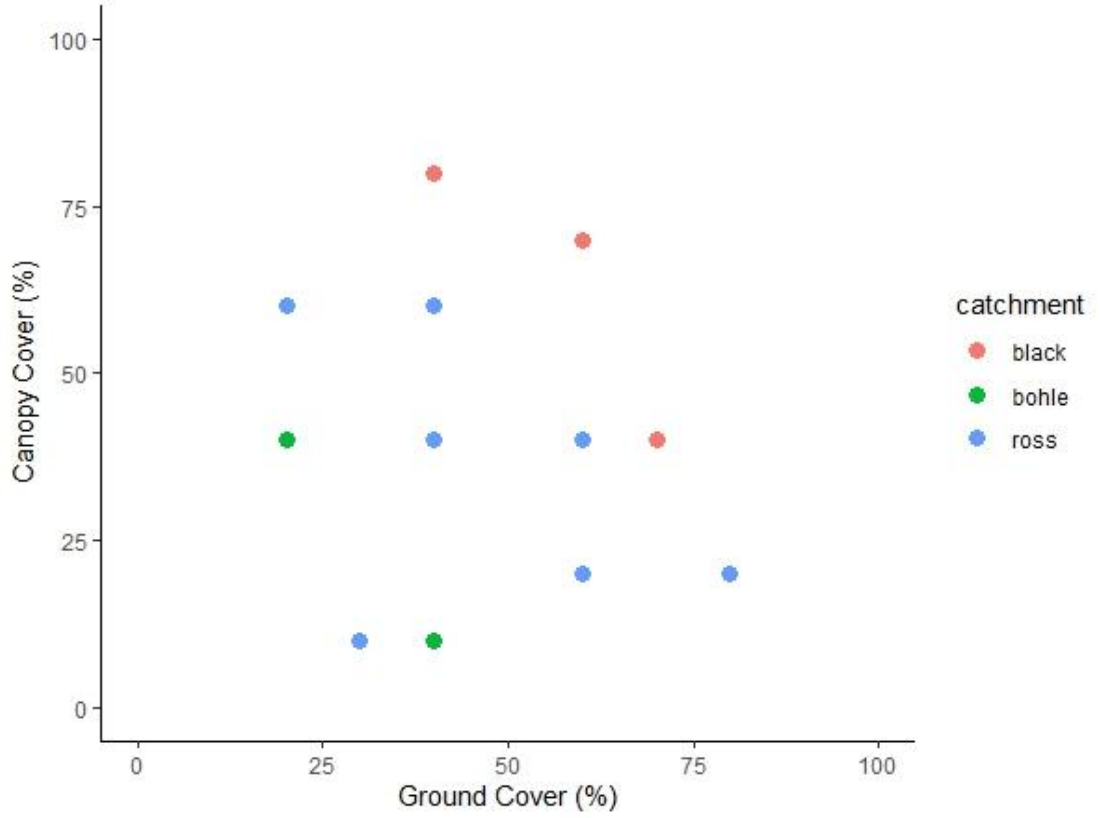

Figure 6 – Canopy cover (y-axis) plotted against ground cover (x-axis), and coloured according to catchment.

Water Quality Monitoring

Physio-chemical water quality (WQ) properties are monitored weekly at every site. An Apera PC60 multi-parameter WQ probe is used to measure temperature, pH, electrical conductivity (EC), salinity and total dissolved solids (TDS). An Ultrapen PT5 is used to measure dissolved oxygen (DO).

WQ parameters displayed high spatial and temporal variability, and the low temporal resolution of measurements (i.e. once quarterly per site) make it challenging to draw conclusions, however some overall trends were present (see Figure 7). Sampling sites in the Black River catchment tended to have lower EC and TDS and higher DO when compared with other catchments, most likely due to the low level of urban development along those waterways. Conversely, DO and pH tended to be lower and TDS was marginally higher overall at sampling sites in the Bohle River catchment, which is perhaps reflective of the highly disturbed nature of many of the sampling sites in that catchment.

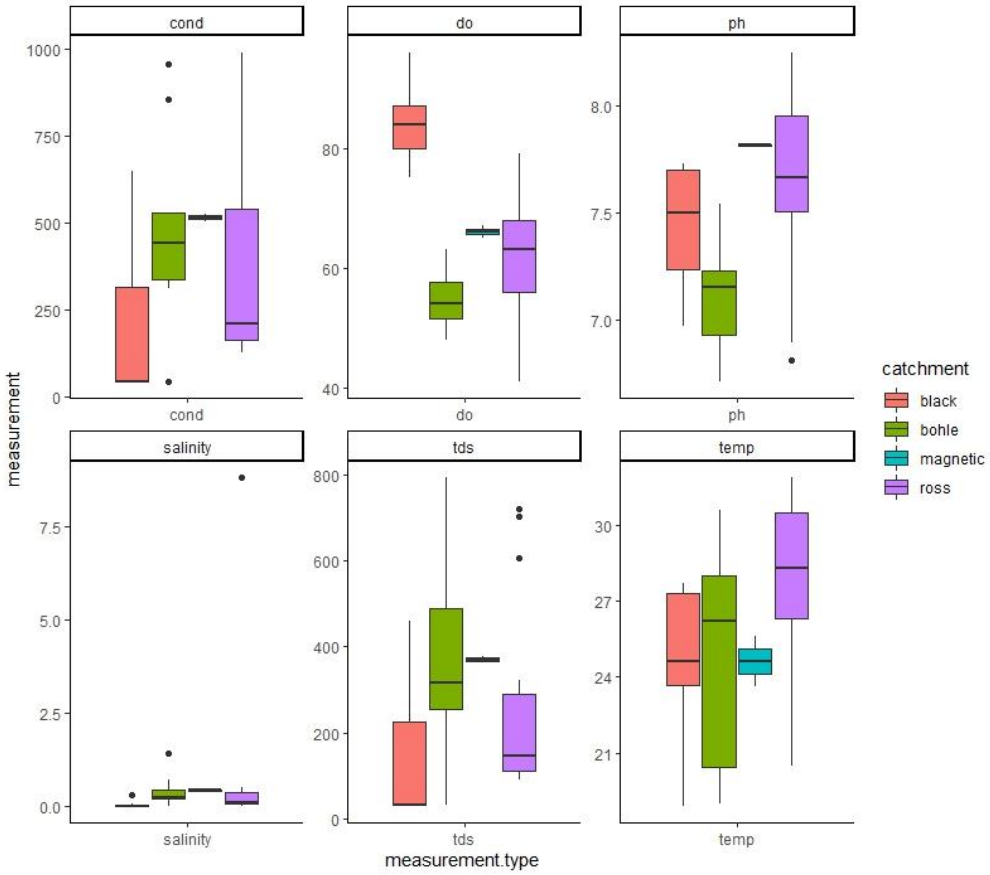

Figure 7 – Water quality measurements recorded at creeks across Townsville City Council area, grouped according to sub-catchment. Measurement type is indicated in the text above each individual plot: cond = electrical conductivity (µS · cm^{-1}); do = dissolved oxygen (% saturation); ph = pH (unitless); salinity = salinity (ppt); tds = total dissolved solids (mg · L^{-1}); temp = temperature (°C)

School Involvement and Adopt-A-Creek Progression

We currently have five schools directly involved in the program (St Benedict's Catholic School, Ignatius Park College, Mutarnee State School, Ryan Catholic College, and Riverside Adventist College). Most of these schools are visited on a monthly or quarterly basis, depending on the school's preference and availability.

Four of these schools have registered to be involved in the Adopt-A-Creek (AAC) program, which commenced in January 2022. Garbutt State School and Coastal Dry Tropics Junior Landcare also participated in the Adopt-A-Creek program (six groups in total). General feedback from AAC groups has been overwhelmingly positive. Teachers and group leaders enjoy the flexibility that comes with AAC activities, along with the support offered by TCC and OzFish in regards to expertise and equipment.

OzFish is excited to welcome more groups to the program in the new financial year, including Kirwan Scouts Group.

Community Involvement

The response from the community regarding OzFish running the Creekwatch program continues to be positive. Creekwatch continues to draw in an average of 6 volunteers every Wednesday morning. The Creekwatch Facebook page continues to be used to share information on upcoming events and activities. This platform is also useful to showcase the program, share information and connect with potential volunteers. Upcoming Creekwatch events are promoted on the OzFish website, attached with an easy-to-use online expressions of interest form. These platforms have been used to regularly promote the program to the general public, schools, and community groups, and encourage volunteers to participate in our regular monitoring days and community events.

In the last 6 months, OzFish staff have also promoted the Creekwatch program at events including:

- Clean Up Australia Day
- World Science Festival Schools Day
- World Science Festival Community Day
- Magnetic Island
- Ryan Catholic College Eco Fest
- St Benedicts School Eco Fest

July – December 2022 Direction

The OzFish project team will continue to work on expanding volunteer involvement in the Creekwatch program over the next 12 months. We will continue to improve our water quality monitoring through upgrading some of the equipment, and we will further refine our data collection methods for fish, macroinvertebrates and habitat assessments.

The OzFish project team have partnered with the TropWATER research group at James Cook University to develop eDNA sampling methods for tropical freshwater systems, with funding for this project provided by a grant from the Great Barrier Reef Foundation. We expect to start collecting samples and developing this method during the second half of 2022. The detection of fish using eDNA has the potential to improve how we sample fish, and also permits the consideration of additional sites for sampling. During the development of this project we will also be working with researchers from the QLD Government (Department of Environment and Science) and CSIRO.

APPENDIX – Tables & Figures

Figure 8 – Map of Townsville Council area, with Creekwatch sampling locations indicated and coloured according to location

Table 1 – Fish species presence/absence table for all locations sampled (1 = present; 0 = absent). Fish species in grey text have been encountered in Townsville waterways in electrofishing surveys conducted by QLD Gov Department of Environment and Science, but were not detected as part of our sampling.

Species Code	Reference #	Species Name	Common Name	Crystal	Rollingstone	Bluewater	Bohle Wetlands	Louisa Creek	Town Common	Mundy Creek	Idalia	Mid Ross	Stuart Creek	Sachs Creek
AmbAgr	1	*Ambassis agrammus*	Sailfin glassfish	1	1	1	1	1	1	0	1	0	1	1
AmnPer	9	*Amniataba percoides*	Barred grunter	0	0	0	0	0	0	0	0	1	1	1
AngMar	-	*Anguilla marmorata*	Giant mottled eel	-	-	-	-	-	-	-	-	-	-	-
AngRei	16	*Anguilla reinhardtii*	Marbled eel	1	1	0	0	0	0	0	1	0	0	0
AwaAcr	12	*Awaous acritosus*	Roman-nose goby	0	1	0	0	0	0	0	0	0	0	0
BunGyr	-	*Bunaka gyrinoides*	Greenback gudgeon	-	-	-	-	-	-	-	-	-	-	-
CraSte	3	*Craterocephalus stercusmuscarum*	Fly-specked hardyhead	1	1	1	0	0	0	0	1	1	1	1
GamHol	24	*Gambusia holbrooki*	Mosquito fish	0	1	0	1	1	1	1	1	0	1	1
GerFil	14	*Gerres filamentosus*	Threadfin silverbiddy	0	1	1	0	0	0	0	0	0	0	0
GiuMar	17	*Giuris margaritaceus*	Snakehead gudgeon	0	1	0	0	0	0	0	0	0	0	0
GloApr	11	*Glossamia aprion*	Mouth almighty	0	0	0	0	0	0	0	0	1	0	0
GloIll	19	*Glossogobius illimis*	False celebes goby	1	0	0	0	0	0	0	0	0	0	0
HypCom	4	*Hypseleotris compressa*	Empire gudgeon	1	1	1	1	1	0	1	1	1	1	1
HypSp1	-	*Hypseleotris sp. 1*	Carp gudgeon	-	-	-	-	-	-	-	-	-	-	-
KuhRup	7	*Kuhlia rupestris*	Jungle perch	1	1	0	0	0	0	0	0	0	0	0
LatCal	8	*Lates calcarifer*	Barramundi	0	1	0	0	1	0	0	0	0	0	0
LeiUni	10	*Leiopotherapon unicolor*	Spangled perch	0	0	0	0	0	0	0	0	1	0	1
LutArg	6	*Lutjanus argentimaculatus*	Mangrove jack	1	1	0	0	0	0	0	0	0	1	0
MegCyp	5	*Megalops cyprinoides*	Tarpon	1	1	0	0	0	0	0	0	0	0	0
MelSpl	2	*Melanotaenia splendida*	Eastern rainbowfish	1	1	1	1	1	0	0	1	1	1	1
MogAds	15	*Mogurnda adspersa*	Purple-spotted gudgeon	1	1	0	0	0	0	0	0	1	0	0
NemEre	-	*Nematalosa erebi*	Bony bream	-	-	-	-	-	-	-	-	-	-	-
NeoAte	-	*Neosilurus ater*	Black catfish	-	-	-	-	-	-	-	-	-	-	-
NeoHyr	13	*Neosilurus hyrtlii*	Hyrtl's tandan	0	0	0	0	0	0	0	0	1	0	0
NotRob	20	*Notesthes robusta*	Bullrout	0	1	0	0	0	0	0	0	0	0	0
OphGut	-	*Ophisternon gutturale*	Swamp eel	-	-	-	-	-	-	-	-	-	-	-
OreMos	26	*Oreochromis mossambicus*	Mozambique tilapia	0	1	1	0	1	0	1	1	1	1	1
OxyLin	18	*Oxyeleotris lineolata*	Sleepy cod	0	0	0	0	0	0	0	0	1	0	0
PlaLiz	-	*Planiliza subviridis*	Greenback mullet	-	-	-	-	-	-	-	-	-	-	-
PoeRet	27	*Poecilia reticulata*	Guppy	1	0	0	0	0	0	0	0	0	0	0
PorRen	-	*Porochilus rendahli*	Rendahl's catfish	-	-	-	-	-	-	-	-	-	-	-
RedBik	21	*Redigobius bikolanus*	Speckled goby	0	0	0	0	0	0	0	0	0	0	0
SchHoe	-	*Shcismatogobius hoesei*	Scaleless goby	-	-	-	-	-	-	-	-	-	-	-
StrKre	22	*Strongylura krefftii*	Freshwater longtom	0	0	0	0	0	0	0	0	1	0	0
ToxCha	23	*Toxotes chatareus*	Seven-spot archerfish	0	0	0	0	0	0	0	0	1	0	0
XipHel	-	*Xiphophorus helleri*	Swordtail	0	0	0	0	1	0	0	0	0	0	0
XipMac	25	*Xiphoporus maculatus*	Platy	0	0	0	1	1	0	0	1	0	1	0
			Species Richness	11	16	6	5	8	2	3	8	12	9	8

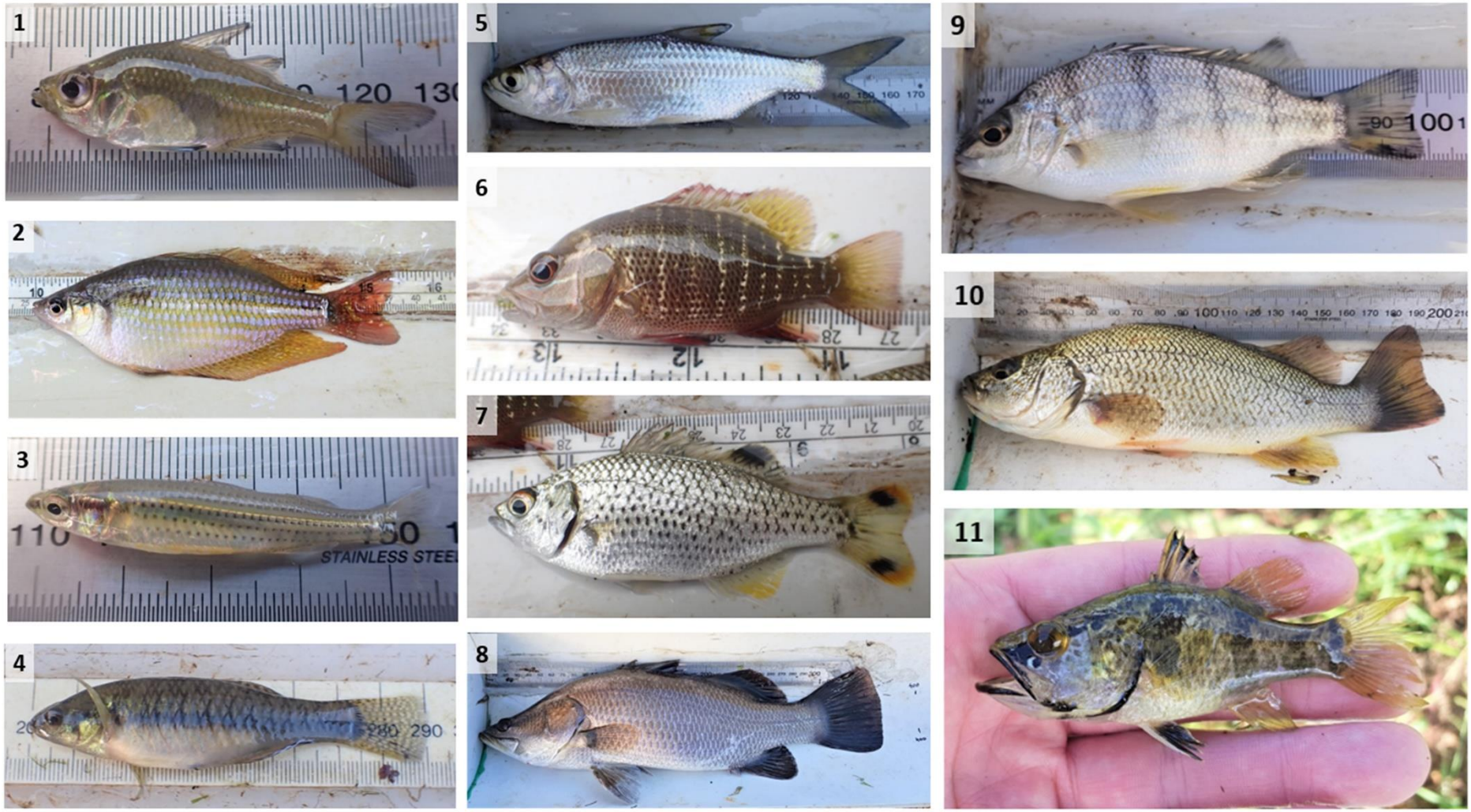

Figure 9 – Native fish species observed in Townsville freshwater systems. Species names and common names are indicated by the Reference # in Table 1.

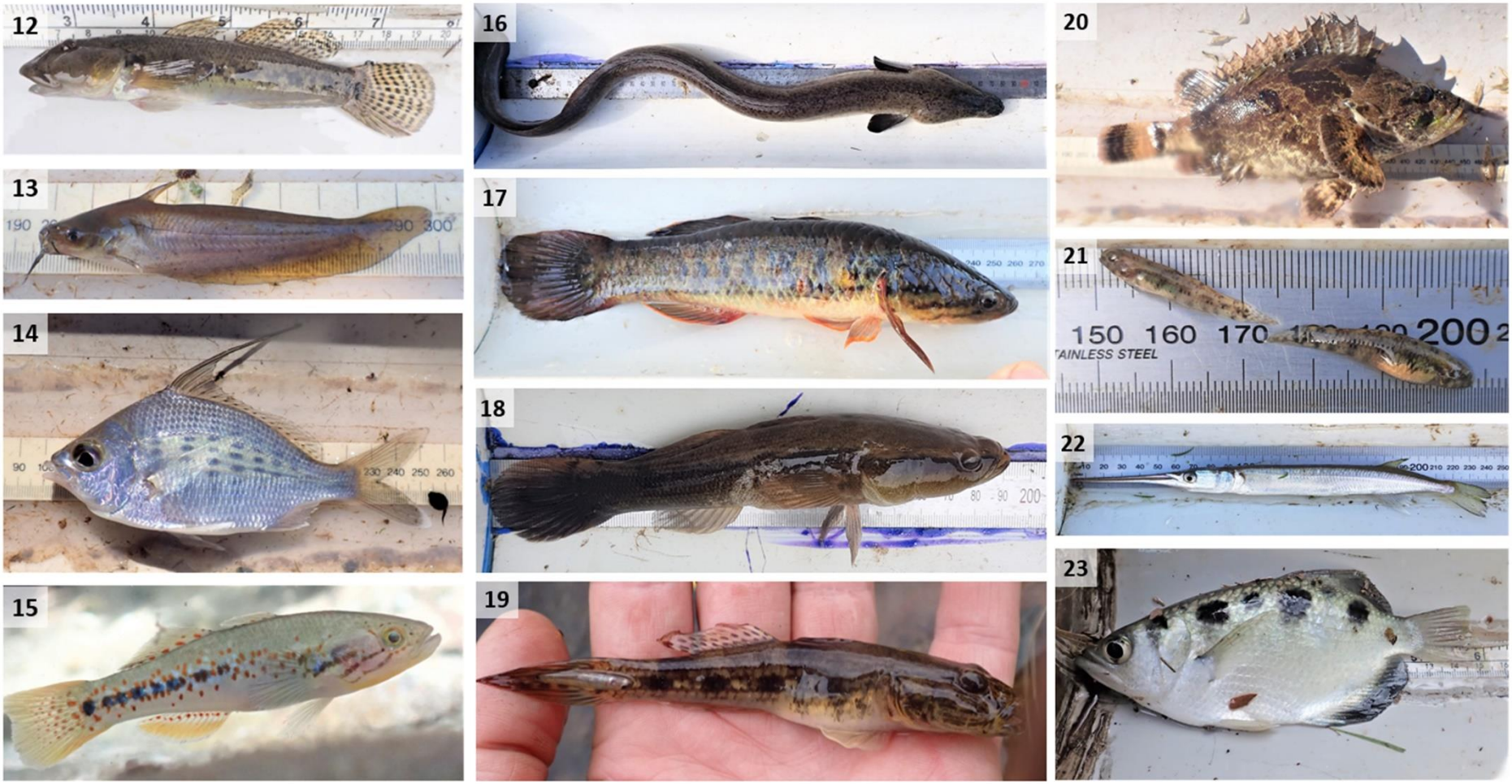

Figure 10 – Native fish species observed in Townsville freshwater systems. Species names and common names are indicated by the Reference # in Table 1.

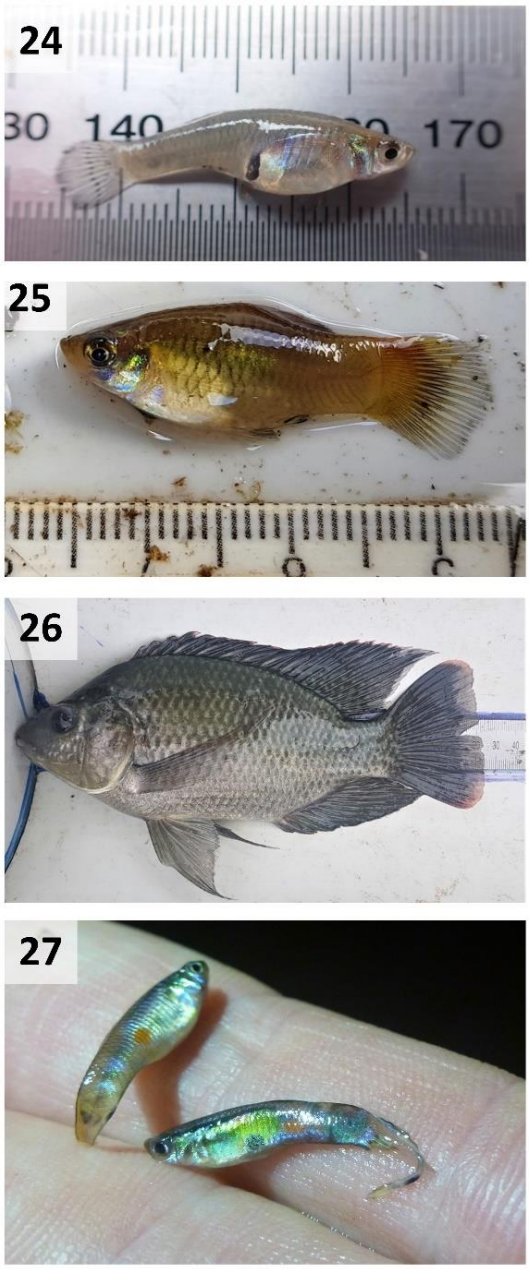

Figure 11 – Invasive fish species observed in Townsville freshwater systems. Species names and common names are indicated by the Reference # in Table 1.

Table 2 – Riparian habitat assessments

Location	Site	Canopy (%)	Ground Cover (%)	Weeds in Canopy (%)	Weeds in Ground Cover (%)	Main Species Observed
Stuart Creek	ST1	10	30	40	85	*Argemone ochroleuca* (Mexican thistle), *Ricinus communis* (Castor oil plant), *Nicotiana tabacum* (Tobacco plant), *Leucaena leucocephala* (Horse tamarind)
Town Common	TC2	10	40	10	40	*Hibiscus heterophyllus* (Native hibiscus), *Pandanus tectorius* (Coastal pandanus), *Urochloa mutica* (para grass), *Megathyrsus maximus* (Guinea grass), *Acacia holosericea*
Sachs Creek	bridge	60	40	60	60	*Delonix regia* (Poinciana), *Leucaena leucocephala* (Horse tamarind), *Eucalyptus* sp., *Cascabela thevetia* (Yellow oleander), *Andropogon virginicus* (Whisky grass), *Ziziphus mauritania* (Chinee apple)
Sachs Creek	SC1	40	40	30	40	*Melaleuca* sp. (Paperbark tree), *Argemone ochroleuca* (Mexican thistle), *Ziziphus mauritania* (Chinee apple), *Casuarina* sp. (She-oak), *Leucaena leucocephala* (Horse tamarind), *Passiflora foetida* (Bush passionfruit)
Sachs Creek	SC2	60	20	10	30	*Pleiogynium timorense* (Burdekin plum), *Casuarina* sp. (She-oak), *Eucalyptus* sp., *Crotalaria lanceolata* (Lance-leaved rattlepod), *Eustrephus latifolius* (Wombat berry), *Portulaca oleracea* (Pig-weed)
Bluewater Creek	BC1	70	60	20	80	*Melaleuca* sp. (Paperbark tree), *Eucalyptus* sp., *Pandanus tectorius* (Coastal pandanus), *Leucaena leucocephala* (Horse tamarind)
Bluewater Creek	BC2	20	80	20	80	*Mangifera indica* (Mango), *Leucaena leucocephala* (Horse tamarind)
Rollingstone	RC1	80	40	10	60	*Allamanda cathartica* (Yellow allamanda), *Melaleuca* sp. (Paperbark), *Casuarina* sp. (She-oak), *Eucalyptus* sp.
Rollingstone	RC2	40	70	20	60	*Melaleuca* sp. (Paperbark), *Eucalyptus* sp.
Bohle Wetlands	BW1	40	20	10	10	*Urochloa mutica* (para grass), *Melaleuca* sp. (Paperbark), *Eucalyptus* sp., *Ficus* sp. (Fig)
Mundy Creek	MC1	20	80	10	60	*Urochloa mutica* (para grass), *Melaleuca* sp. (Paperbark), *Eucalyptus* sp., *Typha* sp. (Bullrush), *Tecticornia* sp. (Samphire)
Upper Ross River	UR1	40	60	10	80	*Urochloa mutica* (para grass), *Melaleuca* sp. (Paperbark), *Sphagneticola trilobata* (Singapore daisy), *Leptospermum brachyandrum* (Tea tree), *Cascabela thevetia* (Yellow oleander), *Ficus benjamina* (Weeping fig)
Upper Ross River	UR2	20	60	10	50	*Urochloa mutica* (para grass), *Melaleuca* sp. (Paperbark), *Sphagneticola trilobata* (Singapore daisy), *Eucalyptus* sp., *Allamanda cathartica* (Yellow allamanda), *Archontophoenix alexandrae* (Alexander palm)
Idalia Lakes	FW1	20	80	0	50	*Melaleuca* sp. (Paperbark), *Ficus benjamina* (Weeping fig), *Livistona australis* (Cabbage tree palm), *Pandanus tectorius* (Coastal pandanus)