Creekwatch

ANNUAL REPORT

July 2022 – June 2023

Geoffrey M. Collins and Adrian Macey
OzFish Unlimited
Townsville, QLD, Australia

— This page intentionally left blank —

Table of Contents

Report prepared for Townsville City Council
30 June 2023

Report should be cited as:
Collins, G.M. and Macey, A., 2023, Creekwatch Annual Report, July 2022 – June 2023. OzFish Unlimited, Townsville, QLD. 11 pp.

— This page intentionally left blank —

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, water quality monitoring, litter clean-ups and habitat condition assessment of creeks and wetlands.

OzFish Unlimited has been running the Creekwatch program for TCC since 2021. During this time the OzFish project team have been implementing weekly monitoring of waterways around Townsville. A core group of volunteers assist with weekly monitoring activities, which focus 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 July 2022 – June 2023.

Figure 1 – Creekwatch volunteers sorting macroinvertebrate samples.

Townsville Waterways Overview

The Townsville region is located in the coastal dry tropics of north QLD. TCC encompasses three river basins (Ross, Black and upper 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). The majority of waterways are < 100 m a.s.l. (which is where all 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; Bluewater Creek; Alligator Creek). The ecology of Townsville's waterways is influenced primarily by the biophysical characteristics mentioned above, and the region contains a diverse array of aquatic flora and fauna.

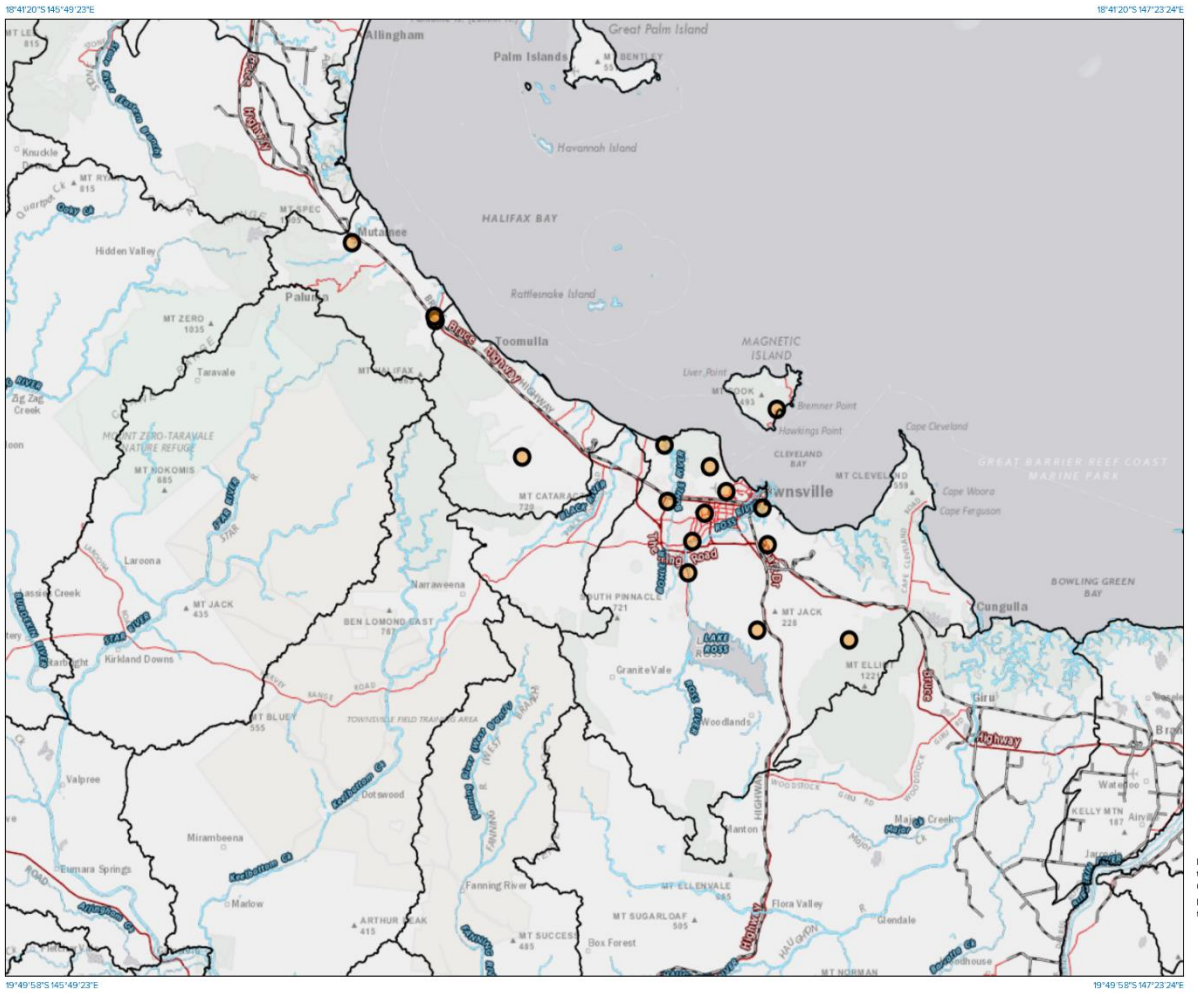

Figure 2 – Map of Townsville City Council area sub-catchments (Ross, Bohle, Black and Haughton), with Creekwatch Sampling locations indicated by black & orange circles. Map is from the QLD Gov Department of Environment and Science QGlobe.

Monitored Sites

Creekwatch activities are presently undertaken at 14 waterways across the Townsville region (see Figure 2). 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 school-based Creekwatch activities (Adopt-A-Creek). Other sites such as Gustav Creek (Magnetic Island) and Alligator Creek have been monitored less frequently than other locations due to issues with site access and community engagement, however both of these sites are now being monitored quarterly, in line with other sites in the program. Monitoring activities consist of macro-invertebrate sampling, fish surveys, water quality monitoring and habitat condition assessments. We also run litter clean-ups at many of our sites with qualitative and quantitative data collected at each location.

Macroinvertebrates

Macroinvertebrate (macro) 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 assess changes in diversity over time, rather than being used as a proxy for waterway pollution. The diversity (SIGNAL 2) score is calculated according to the equation:

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

Macroinvertebrate sampling is a regular Creekwatch activity and was conducted at every site during the July 2022 – June 2023 period. The macro sampling protocol consists of collection, sorting, and identification to Family level at the survey location. Samples are collected from the edge of waterways and in-stream using handheld kick nets. Samples are transferred into shallow (<50 mm depth) plastic sorting trays and sorting of each sample is completed in 15 – 30 minutes. During sorting, macroinvertebrates are transferred into ice cube trays using pipettes for sorting and closer examination. Macroinvertebrates are identified using ID charts, reference books (The Waterbug Book) and apps (The Waterbug App), with further confirmation on ID provided by OzFish staff. Any exotic species or larger macros are preserved in a solution of alcohol for future reference and to display when attending or hosting community engagement events.

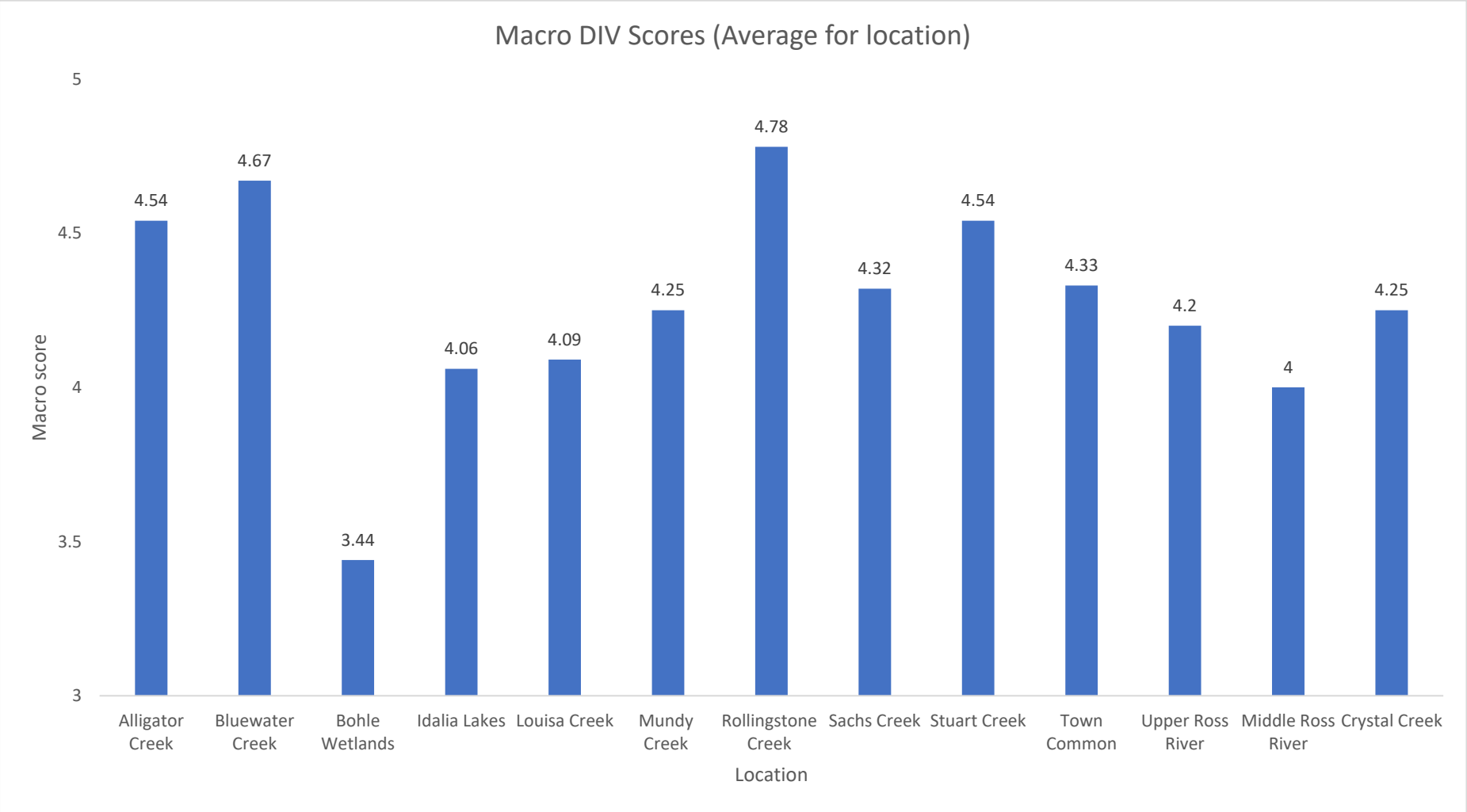

Figure 3 – MACRO DIV (SIGNAL 2) average scores, plotted according to sampling location. Each location has had the MACRO DIV scores averaged and includes samples from August 2022 – June 2023.

Median diversity across all sampling locations was 4.32 (interquartile range = 4.63 – 4.00; see Figure 3). The highest average diversity (Macro DIV Score = 4.78) of any individual location was observed at Rollingstone Creek—a waterway with low impact from urban centres and an intact riparian zone. The lowest average diversity (Macro DIV Score = 3.44) was at Bohle wetlands—a wetland impacted from urban development and disconnected from the main river channel for most of the year.

As a general trend, locations with high influence from urban centres (e.g. Bohle wetlands, Idalia Lakes, Louisa Creek) displayed lower macro diversity than areas with low urban influence (e.g. Rollingstone Creek, Bluewater Creek, Alligator Creek). Looking more broadly across river sub-catchments, macroinvertebrate diversity was highest in the Black River and lowest for the Bohle River regions. This finding is expected due to differences in land-use between these areas, however most macro scores were highly similar and within the range 4.0 – 4.5. As an example, Crystal Creek and Mundy Creek have highly different hydrology and land-use, yet we observed an identical macro score at both locations (4.25). It would be highly useful to the Creekwatch program, therefore, to explore alternative methods of data collection and analysis, with the aim of improving our comparisons between locations. The OzFish team will work with researchers on alternative methods of data collection and analysis in the second half of 2023 and beyond as part of our ongoing efforts to refine the quality of data collected by the Creekwatch program.

Fish

Fish surveys have been completed at 13 sites for the Creekwatch program over the past 12 months using a combination of box traps and unbaited underwater video (UwV). At each survey location box traps (*N* = 4) are baited and set for 30 – 60 min. UwV units (*N* = 2) are deployed for 10 min at each site, with the aim of capturing footage from different micro-habitats within waterways (e.g. sandy substrate, undercut banks, weed beds, riffles). A total of 18 fish species have been recorded by the Creekwatch team across all locations sampled over the past 12 months, with more species generally being detected using UwV where visibility is suitable. We have identified a total of 52 native fish species that spend at least some portion of their life in Townsville's freshwater systems, and our observation of 18 species (~35%) is high considering the limitations within the Creekwatch program in terms of time and access to equipment.

Species richness varied between locations, however overall trends were similar to those observed for macros, with species diversity generally higher in the Black River region, and lower in the Bohle region (Figure 5). The highest species richness was observed at Rollingstone Creek (*N* = 9), and the lowest species richness was in the Town Common (*N* = 3). The variability in species richness between locations is most likely due to differences in land-use pressures, with higher species richness generally observed in waterways outside of the Townsville urban area.

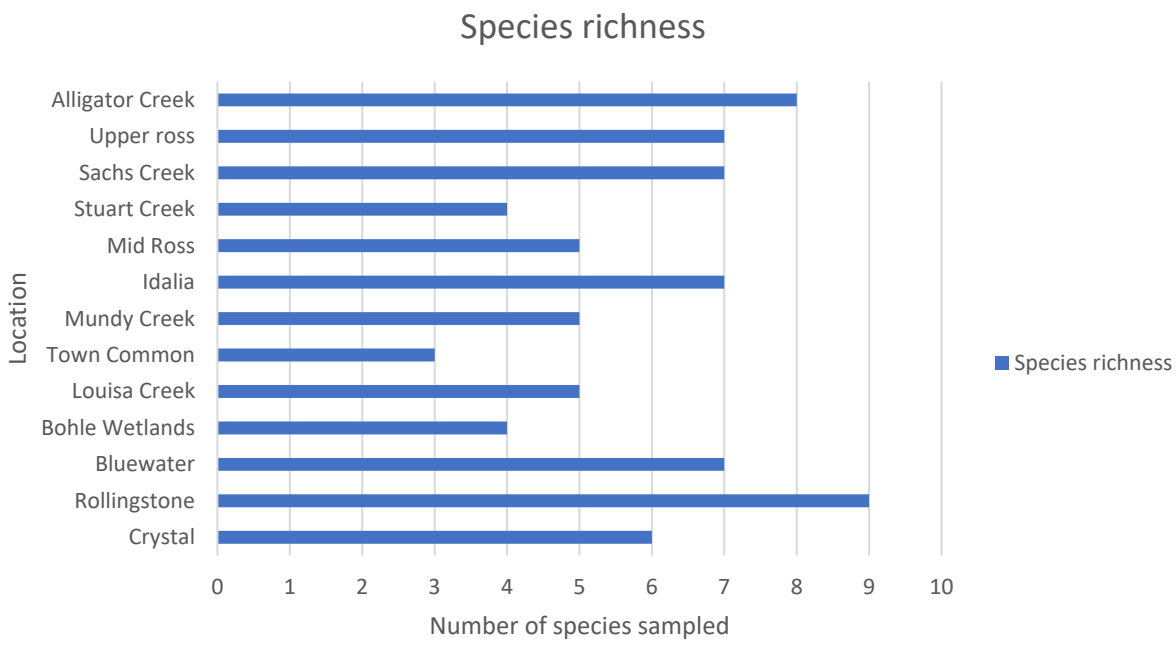

Figure 4 – Data have been aggregated for each creek and across multiple sampling times and survey methods (box traps, dip nets, underwater video and visual observation)

Additional monitoring of Townsville waterways for fish has been completed by the OzFish team using environmental DNA (eDNA) sampling. This sampling has been completed in collaboration with James Cook University's TropWATER group, and is supported with funding from the Great Barrier Reef Foundation (GBRF). eDNA samples have been collected at four locations across Townsville (Crystal, Rollingstone and Alligator Creeks and Ross River). eDNA sampling has also been completed as part of this program in the Herbert and Burdekin River catchments. The first round of sampling (mid wet season) was completed in March, and the second round was completed in April. This project is part of a methods development study and results are expected to be available towards the end of 2023. Further funding has been secured to continue this program through to June 2024 and is being run in collaboration with JCU, CSIRO and the University of Queensland (UQ).

Riparian Assessments

Riparian condition assessments are conducted as part of Creekwatch activities. Volunteers use a simple method to assess riparian habitat coverage and condition, with plant species documented to genus level and four metrics recorded for each location: canopy cover, ground cover, weeds in canopy and weeds in ground cover (Table 2). Results have been highly variable between sites due to the different habitat and riparian conditions of the waterways assessed.

We observed a weak inverse relationship between ground cover and canopy cover across the TCC region—as expected, higher canopy cover is generally associated with lower ground cover. Most of the Ross and Bohle catchment areas are urbanised and show high levels of weed in the ground cover. As an example, Louisa creek had 70% ground cover and 50% canopy cover, with the proliferation of ground cover most likely the result of historical clearing and current land and vegetation management practices. Results were highly variable across all of the studied locations and alternative methods of riparian habitat assessment will be incorporated into the Creekwatch program in the second half of 2023.

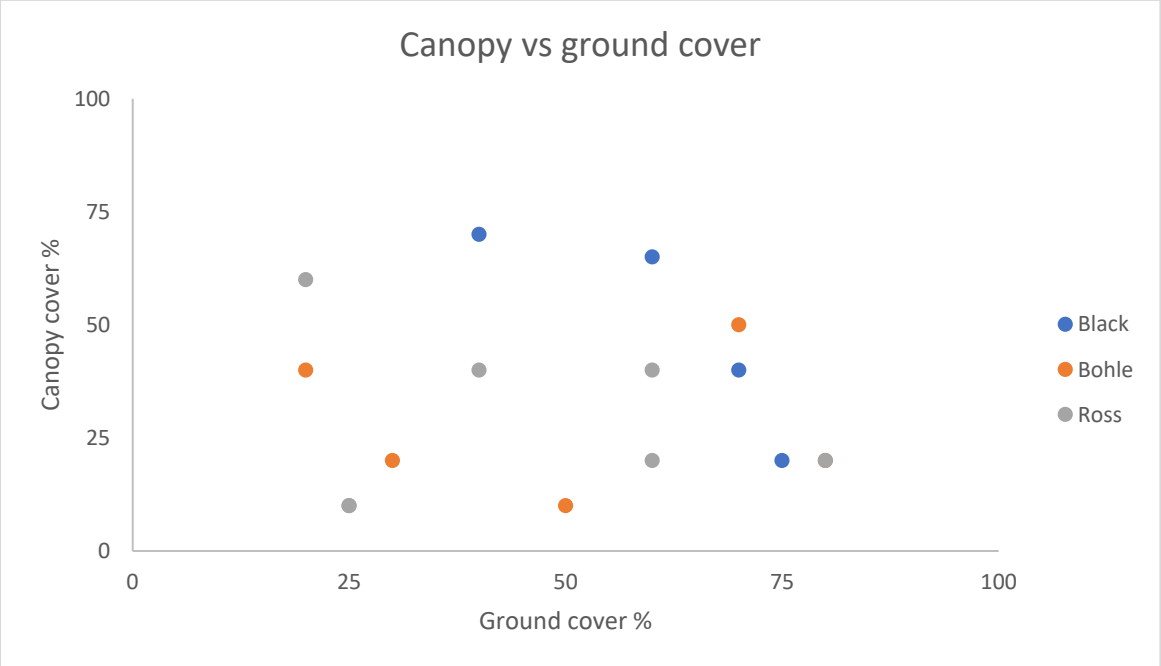

Figure 5 – Proportion of canopy cover (y-axis) plotted against proportion of ground cover (x-axis), and coloured according to catchment.

Water Quality Monitoring

Physio-chemical water quality (WQ) parameters are monitored weekly at every site using a WQ probe and meter (TPS 90, FLT model, Brendale, QLD). Parameters measured include temperature, pH, electrical conductivity (EC), salinity, total dissolved solids (TDS), oxidation / reduction potential (ORP), dissolved oxygen (DO) and turbidity.

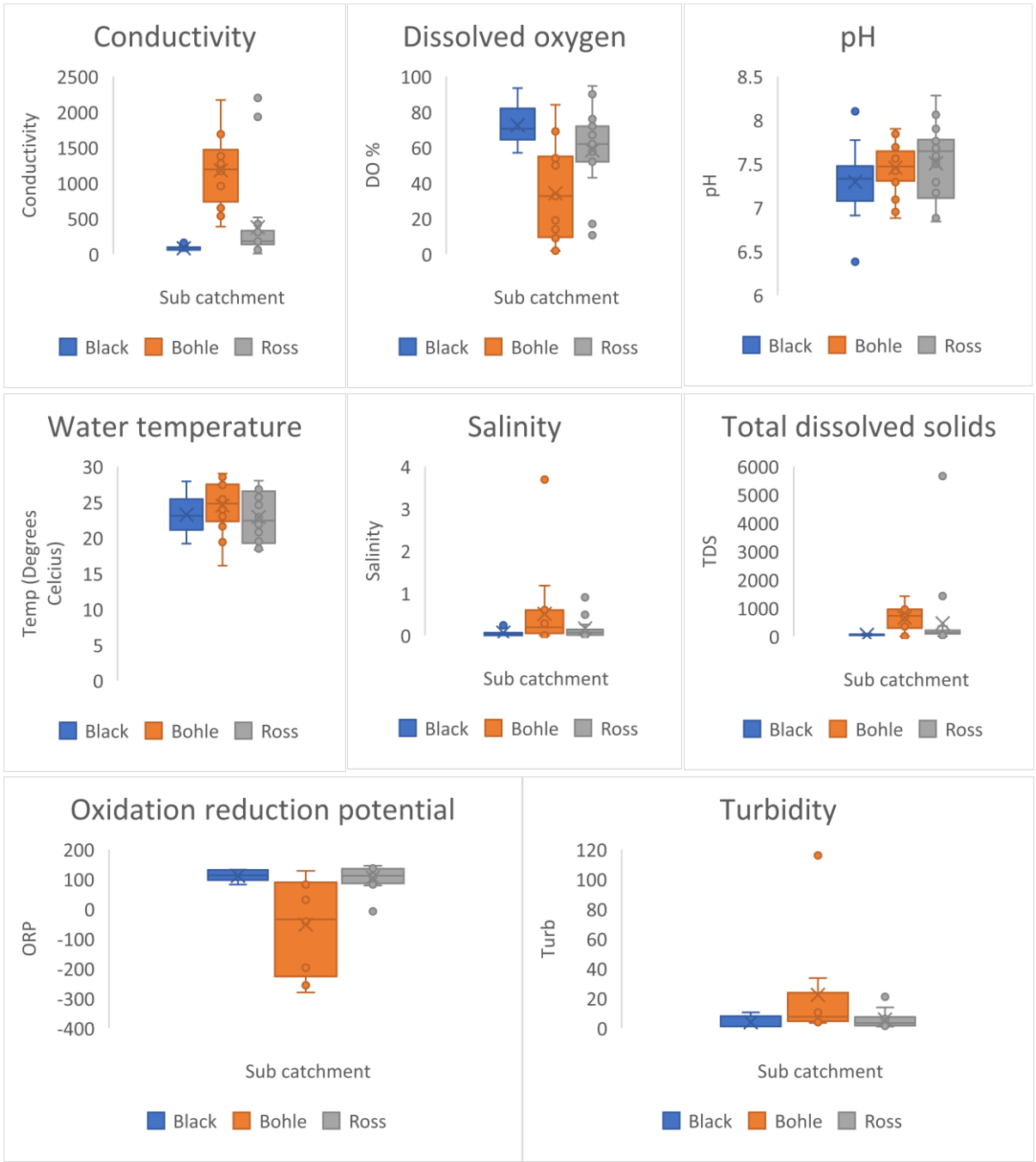

Figure 6 – Water quality measurements recorded at creeks across Townsville City Council area, grouped according to sub-catchment. Measurement type is indicated in the text above each individual plot: Conductivity = electrical conductivity (µS · cm^{-1}); Dissolved oxygen = dissolved oxygen (% saturation); pH = pH (unitless); Salinity = salinity (ppt); Total dissolved solids = total dissolved solids (mg · L^{-1}); Water temperature = temperature (°C); Turbidity = Nephelometric Turbidity Units (NTU); Oxidation reduction potential = ORP measured in millivolts (mV)

Annual rainfall varies across the region with areas of the Wet Tropics and Mount Elliott generally experiencing higher rainfall than Townsville and the Ross and Bohle catchments (see Figures 10 & 11). Average annual rainfall in Townsville is ~1 m per year, whereas areas near Rollingstone, Crystal and Alligator Creeks often receive closer to 2 m of rainfall per year, with most rain falling between December and May during the tropical wet season. WQ across each of the three catchments displayed a high variability in the parameters measured (Figure 6), however some general trends were apparent. Many of the parameters were higher for the Bohle than for the Black or Ross catchments (EC, salinity, TDS and turbidity), reflecting the poorer condition of many waterways in the Bohle. DO was also lower in the Bohle compared with the other regions, which is similarly due to overall poorer condition of waterways, and the proliferation of palustrine wetlands in that catchment, which are often associated with low DO during the dry season.

School Involvement and Adopt-A-Creek Progression

We currently have six schools directly involved in waterway monitoring: St Benedict's Catholic School, Ignatius Park College, Mutarnee State School, Ryan Catholic College, Riverside Adventist College and Belgian Gardens State School. Most of these schools are visited on a quarterly basis, depending on timing and availability of school staff.

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 have 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 staff.

Interest from additional schools has been positive, and Carinity College are already engaged and prepared to sign up in the next financial year (2023/24). We have added interest from high school groups and are looking to expand our monitoring programs to include intertidal and mangrove wetlands. Some further schools that we are in discussion with are: Townsville State High School – (Ross Creek), Thuringowa State High School – (Bohle River), Heatley State High School – either Tchooratippa Creek or Louisa Creek.

Figure 8 – Creekwatch event at the Upper Ross River, hosting 40+ home schooling children and their families.

Community Involvement

Community engagement and environmental stewardship are fundamental to the Creekwatch program. Volunteer feedback continues to be positive, with OzFish members, long-term volunteers and home-school groups contributing hundreds of hours towards monitoring the health of their local waterways every year. An average of 6 volunteers contribute to waterway monitoring around Townsville every Wednesday morning, which is an increase in average attendance since OzFish has started running Creekwatch activities. Events are posted regularly on the OzFish website with an online registration form, and the Creekwatch Facebook page has contributed to new volunteers discovering the Creekwatch program and attending events.

In the last 12 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 2023 – June 2024 Program Direction

The OzFish project team will continue to work on expanding face-to-face volunteer involvement in the Creekwatch program over the next 12 months. A list of new locations around the Townsville region will be prioritised for additional monitoring according to impact from land-use, and ease of access for volunteers. The program has potential to expand to regions that haven't been monitored recently, including Majors Creek (Haughton catchment), Ross Creek, Stony Creek (Bohle), Annandale wetlands (Ross), Alice/Black River, Ollera Creek (Crystal), Paluma town (Crystal), Paluma Dam (Burdekin). The program also has potential to expand into estuarine environments and to assess mangrove and saltmarsh health, as well as fish, invertebrate and crustacean diversity. The assessment of mangrove and oyster reef health are the highest priority habitats for assessments in inter-tidal areas with our current resourcing and sampling equipment.

We will also work with researchers to assess alternative methods of macroinvertebrate data collection and analysis, and to look at ways to improve comparisons across habitats. Improving the quality of macroinvertebrate data is a priority for the Creekwatch program in the next 12 months, as well as increasing overall community and stakeholder engagement. We will continue to improve habitat assessment metrics and will include wetland condition assessments, as well as riparian vegetation cover in future monitoring and reporting. We will also work with Reef Ecologic, the Dry Tropics Partnership and other groups to assess how fish and macroinvertebrate data can be used in platforms such as the Atlas of Living Australia.

.

APPENDIX – Tables & Figures

Table 1 – Fish species presence/absence table for all locations sampled (1 = present; 0 = absent). Species richness for each location is displayed at the bottom of each column. This table includes all fish species observed from August 2022 – June 2023.

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	Upper ross	Alligator Creek
AmbAga	1	Ambassis agrammus	Sailfin Glassfish	1	0	1	0	1	1	0	1	0	1	1	0	0
AmnPer	9	Amniataba percoides	Barred Grunter	0	0	1	0	0	0	0	0	0	0	0	1	1
CraSte	3	Craterocephalus stercusmuscarum	Fly-speckled hardyhead	1	1	1	0	0	0	0	1	1	1	1	1	1
GamHol	24	Gambusia holbrooki	Mosquito fish	0	1	0	0	1	1	0	1	1	0	1	1	0
GerFil	14	Gerres filamentosus	Threadfin silverbiddy	1	1	0	0	0	0	1	0	0	0	0	0	0
GloApr	11	Glossamia aprion	Mouth almighty	0	0	1	0	0	0	0	0	1	0	0	1	0
HypBuc		Hypseleotris bucephala	Carp gudgeon	0	0	0	0	0	0	0	0	0	0	1	1	1
HypCom	4	Hypseleotris compressa	Empire gudgeon	1	1	1	1	0	0	1	1	1	1	1	1	0
KuhRup	7	Kuhlia rupestris	Jungle perch	0	1	0	0	0	0	0	0	0	0	0	0	1
LeiUni	10	Leiopotherapon unicolor	Spangled perch	0	0	0	0	0	0	0	0	0	0	0	0	1
LutArg	6	Lutjanus argentimaculatus	Mangrove jack	1	1	0	0	0	0	0	0	0	0	0	0	0
MegCyp	5	Megalops cyprinoides	Tarpon	0	0	0	0	0	0	1	0	0	0	0	0	0
MelSpl	2	Melanotaenia splendida	Eastern rainbowfish	1	1	1	1	1	0	0	1	0	1	1	0	1
MogAds	15	Mogurnda adspersa	Purple spotted gudgeon	0	1	0	0	0	0	0	0	0	0	0	0	1
OreMos	26	Oreochromis mossambicus	Mozambique tilapia	0	1	1	1	1	0	1	1	0	0	1	0	1
OxyLin	18	Oxyeleotris lineolata	Sleepy cod	0	0	0	0	0	1	0	0	0	0	0	0	0
RedBik	21	Redigobius bikolanus	Speckled goby	0	0	0	0	0	0	0	0	0	0	0	1	0
XipMac	25	Xiphophorus maculatus	Platy	0	0	0	1	1	1	1	1	1	0	0	0	0
			Species richness	6	9	7	4	5	3	5	7	5	4	7	7	8

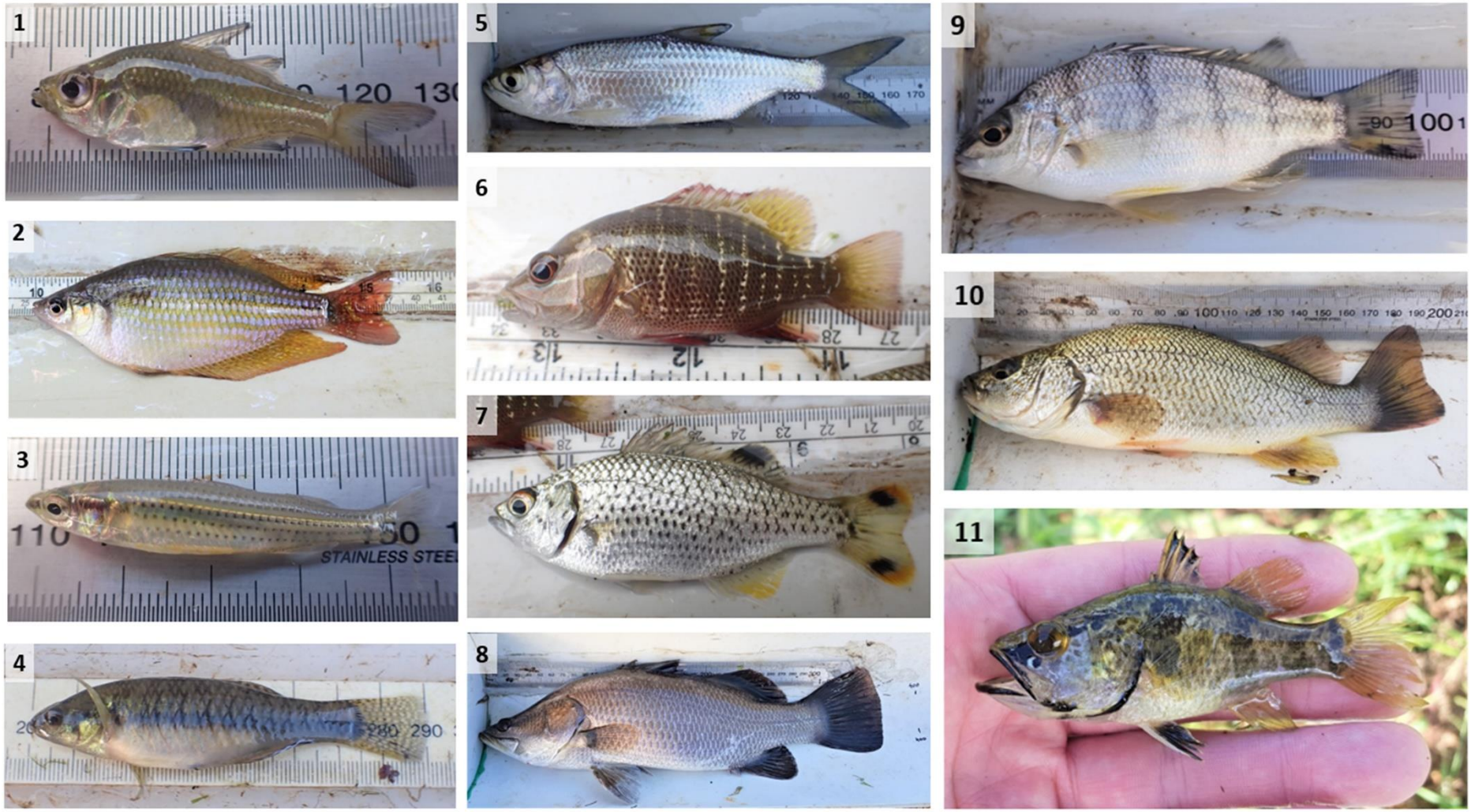

Figure 7 – Native fish species observed in Townsville freshwater systems. Species names and common names are indicated by the Reference # in Table 1.

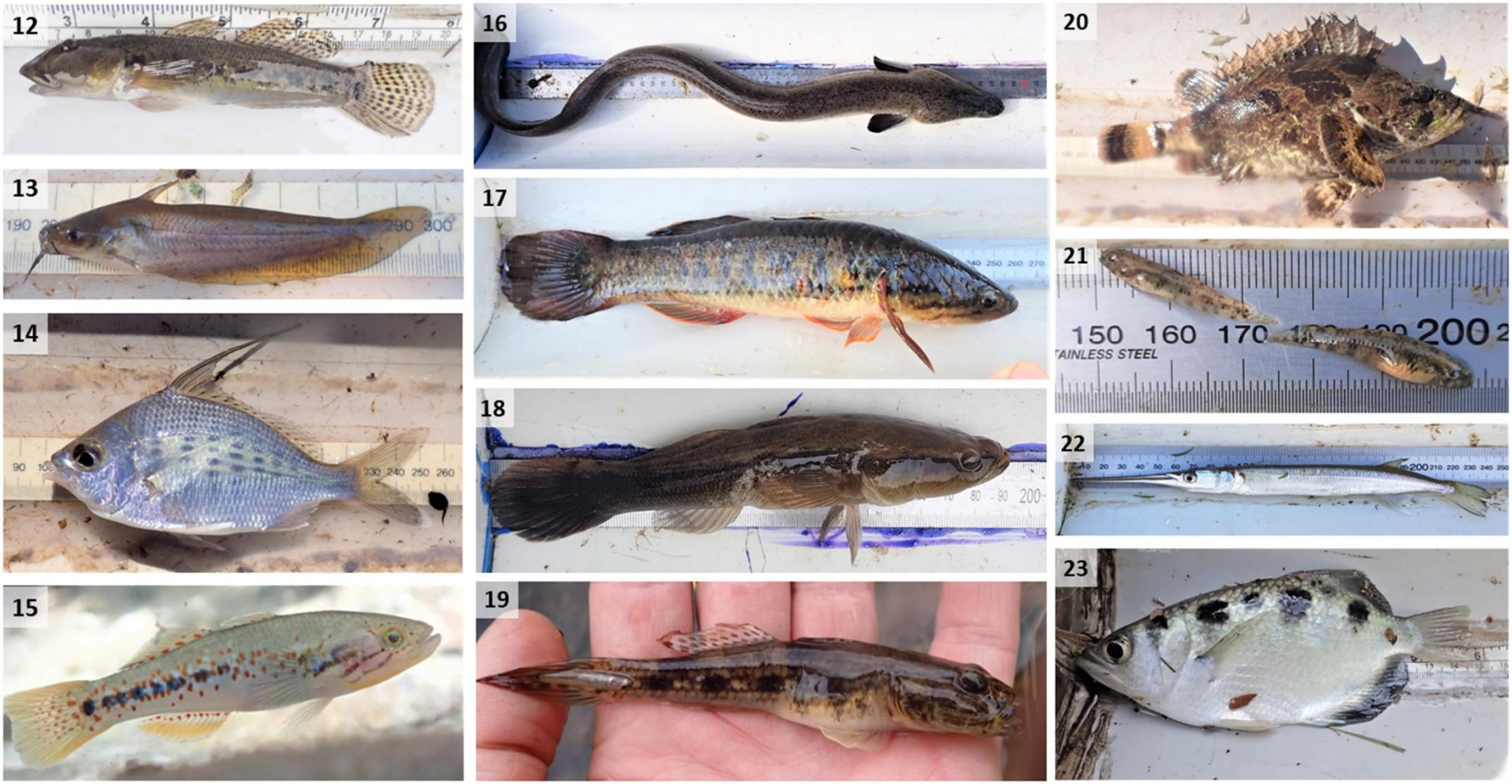

Figure 8 – Native fish species observed in Townsville freshwater systems. Species names and common names are indicated by the Reference # in Table 1.

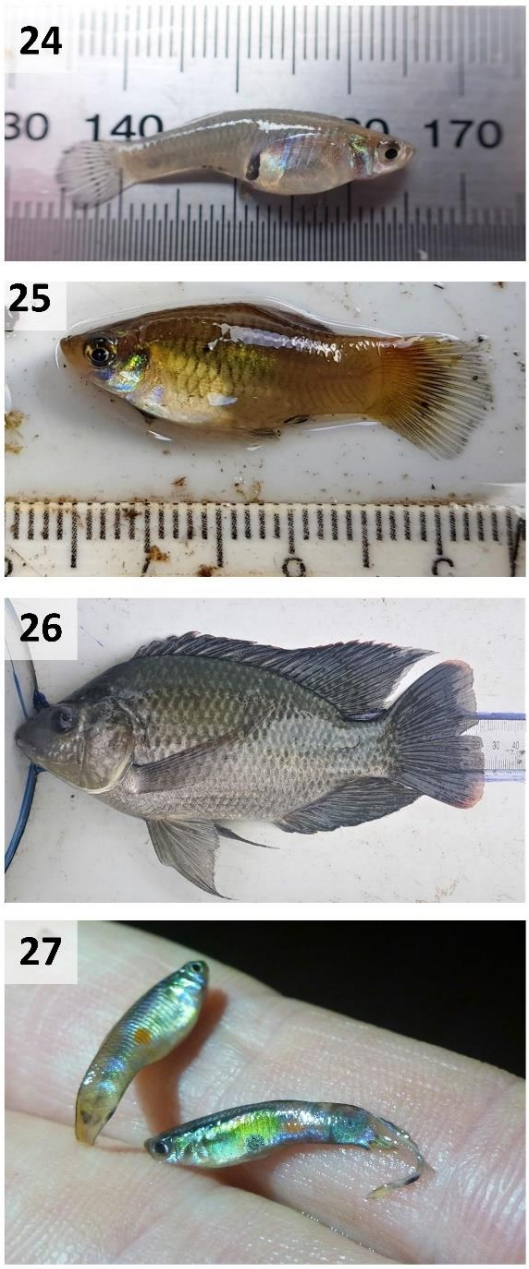

Figure 9 – Invasive fish species observed in Townsville freshwater systems. Species names and common names are indicated by the Reference # in Table 1.

Table 2 – Riparian habitat assessments

Location	Site	Canopy (%)	Ground Cover (%)	Weeds in Canopy (%)	Weeds in Ground Cover (%)	Main Species Observed
Stuart Creek	SC2	10	25	2	90	*Argemone ochroleuca* (Mexican thistle), *Ricinus communis* (Castor oil plant), *Nicotiana tabacum* (Tobacco plant), *Leucaena leucocephala* (Horse tamarind), *Hyptis suaveolens* (Hyptis), *Stachytarpheta cayennensis* (Snake weed), *Lantana camara* (Lantana).
Town Common	TC2	20	30	5	30	*Hibiscus heterophyllus* (Native hibiscus), *Pandanus tectorius* (Coastal pandanus), *Urochloa mutica* (Parra grass), *Megathyrsus maximus* (Guinea grass), *Acacia holosericea* (Acacia).
Sachs Creek	SC1	40	40	10	40	*Melaleuca sp* (Paperbark tree), *Argemone ochroleuca* (Mexican thistle), *Ziziphus mauritania* (Chinee apple), *Casuarina sp.* (Sheoak), *Leucaena leucocephala* (Horse tamarind), *Passiflora foetida* (Bush passionfruit), *Alternanthera denticulata* (Lesser joyweed).
Sachs Creek	SC2	60	20	10	30	*Pleiogynium timorense* (Burdekin plum), *Casuarina sp* . (Sheoak), *Eucalyptus sp* ., *Crotalaria lanceolata* (Lance leafed rattlepod), *Eustrephus latifolius* (Wombat berry), *Porttulaca* (Pig-weed).
Bluewater Creek	BC1	65	60	20	80	*Melaleuca sp* (Paperbark tree), *Eucalyptus sp.* , *Pandanus tectorius* (Coastal pandanus), *Leucaena leucocephala* (Horse tamarind), *Megathyrsus maximus* (Guinea grass), *Parthenium hysterophorus* (Parthenium weed), *Asclepias syriaca* (Milk weed).
Bluewater Creek	BC2	20	75	10	80	*Mangifera indica* (Mango), *Leucaena leucocephala* (Horse tamarind), *Megathyrsus maximus* (Guinea grass), *Stachytarpheta cayennensis* (Snake weed), *Sphagneticola trilobata* (Singapore daisy).
Rollingstone	RC1	70	40	10	60	*Allamanda cathartica* (Yellow allamanda), *Melaleuca sp* (Paperbark tree), *Casuarina sp* . (Sheoak), *Eucalyptus sp* .
Rollingstone	RC2	40	70	5	60	*Eucalyptus sp* ., *Melaleuca sp* (Paperbark tree), *Megathyrsus maximus* (Guinea grass), *Stachytarpheta cayennensis* (Snake weed), *Urochloa mutica* (Parra grass).
Bohle Wetlands	BW1	40	20	10	10	*Urochloa mutica* (Parra grass), *Eucalyptus sp* ., *Melaleuca sp* (Paperbark tree) *Ficus sp* . (Fig), *Casuarina sp* . (Sheoak).
Mundy Creek	MC1	20	80	10	60	*Eucalyptus sp* ., *Urochloa mutica* (Parra grass), *Typha sp* . (Bullrush), *Melaleuca sp* (Paperbark tree).
Upper Ross River	UR1	40	60	10	80	*Melaleuca sp* (Paperbark tree), *Sphagneticola trilobata* (Singapore daisy), *Urochloa mutica* (Parra grass), *Leptospernum brachyandrum* (Tea tree), *Cascabela thevetia* (Yellow oliander), *Ficus benjamina* (Weeping fig).
Upper Ross River	UR2	20	60	10	50	*Melaleuca sp* (Paperbark tree), *Sphagneticola trilobata* (Singapore daisy), *Urochloa mutica* (Parra grass), *Eucalyptus sp* ., *Lomandra longifolia* (Lomandra), *Archontophoenix alexandrae* (Alexandra palm).
Idalia Lakes	FW1	20	80	0	50	*Melaleuca sp* (Paperbark tree), *Pandanus tectorius* (Coastal pandanus), *Livistona australis* (Cabbage tree palm), *Ficus benjamina* (Weeping fig).
Louisa Creek	LC1	10	50	0	40	*Urochloa mutica* (Parra grass), *Leucaena leucocephala* (Horse tamarind).
Louisa Creek	LC2	50	70	0	70	*Peltophorum pterocarpum* (Yellow poinciana), *Alternanthera denticulata* (Lesser joyweed), *Eleusine indica* (Crowsfoot grass), *Urochloa mutica* (Parra grass), *Stylosanthes humilis* (Townsville lucerne), *Stachytarpheta cayennensis* (Snake weed).

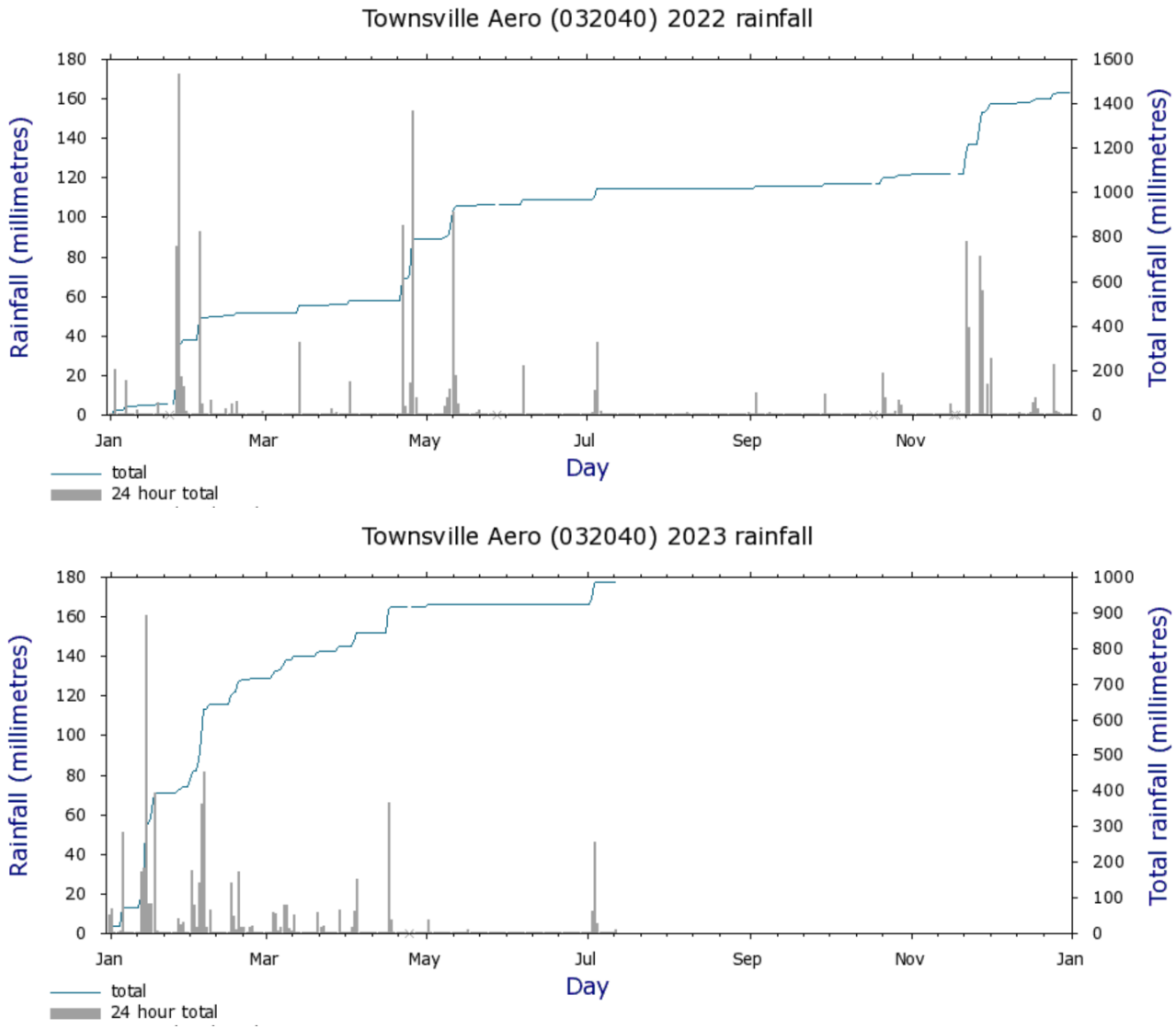

Figure 10 – Daily rainfall totals for Townsville Airport from Climate Data Online (BoM)

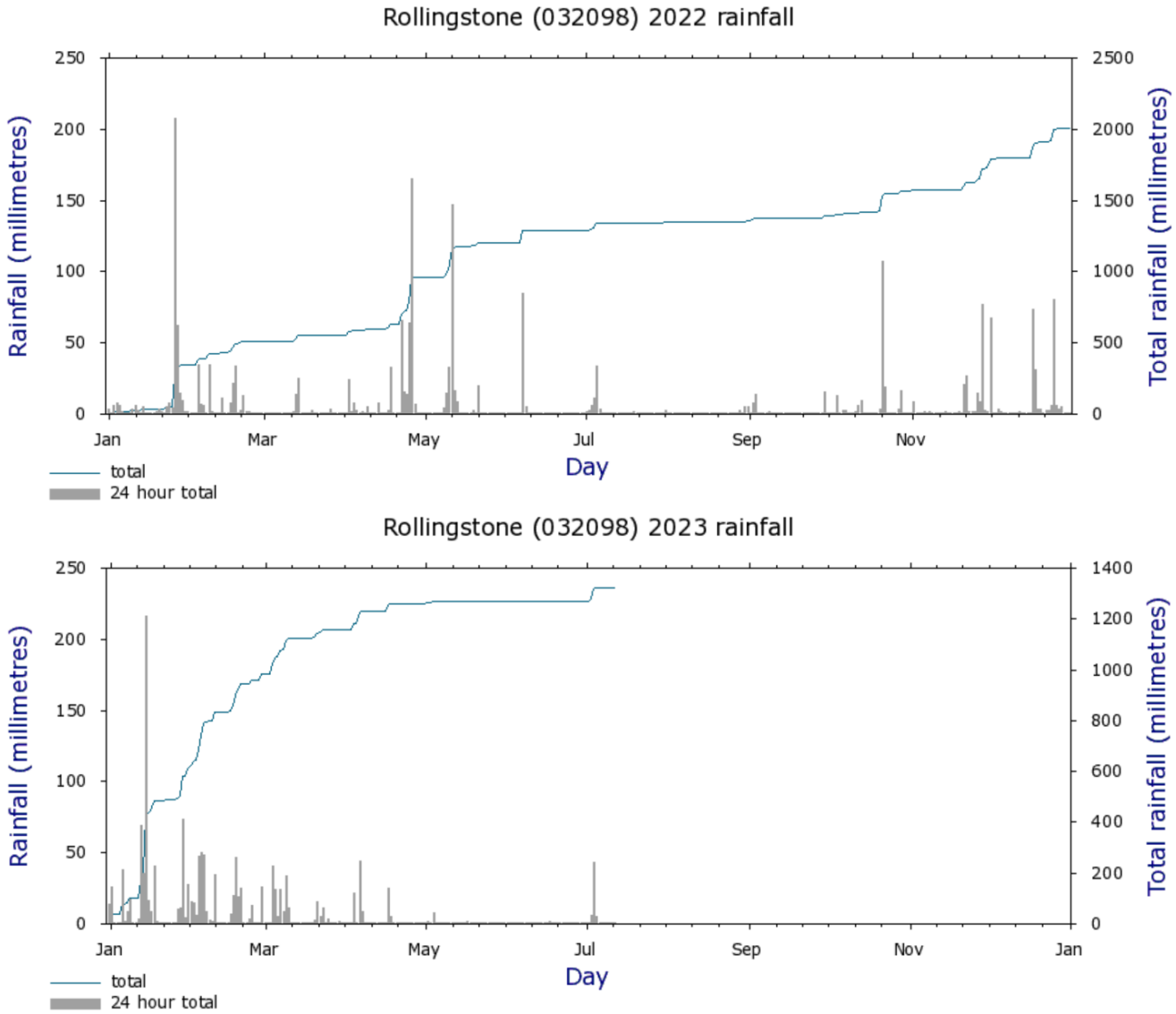

Figure 11 – Daily rainfall totals for Rollingstone from [Climate Data Online (BoM)]