

Wilinggin-West Kimberley **Bush Blitz**

Freshwater Fishes

18–28 July 2022

Submitted: 30 June 2023

Glenn Moore & Michael Hammer



Charnley River, Wilinggin IPA, West Kimberley (BBK22-02) and male Bachsten Gudgeon (Hypseleotris sp. 2), a Kimberley narrow range endemic, from the site (photos M. Hammer)

Nomenclature and taxonomy used in this report is consistent with:

The Australian Faunal Directory (AFD)

<http://www.environment.gov.au/biodiversity/abrs/online-resources/fauna/afd/home>

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List of contributors

List of contributors to this report			
Name	Institution/affiliation	Qualifications/area of expertise	Level/form of contribution
Dr Glenn Moore	Western Australian Museum (WAM)	Curator of Fishes	Logistics, survey, & reporting
Dr Michael Hammer	Museum and Art Gallery of the Northern Territory (MAGNT)	Curator of Fishes	Logistics, survey, & reporting

Abstract

A two week dedicated freshwater fishes sampling trip was undertaken to the remote West Kimberley region, within the Wilinggin Indigenous Protected Area and incorporating the Charnley River-Artesian Range Sanctuary, in the dry season of 2022 as part of a larger Bush Blitz expedition survey team. A total of 19 sites were sampled, ranging from sandstone escarpment streams above and below waterfalls to larger rocky rivers across seven separate river catchments (Calder, Charnley, Drysdale, Isdell, Lennard, Prince Regent and Sale), using a combination of helicopter and vehicle access and appropriate gear types (i.e. primarily compact gear including back pack electrofishing). The survey focus was a baseline assessment of poorly sampled habitats (i.e. remote) and a focus on mapping narrow range endemic species. The objectives were of species discovery, new to western science, and to provide information for land management, with a specific focus being to support taxonomy and the wider picture of Kimberley/northern Australian biodiversity. Eighteen freshwater fishes were recorded (all native), including six narrow range endemic species, with new range records for two of these (i.e. Bachsten Gudgeon *Hypseleotris* sp. 2 from the Sale River; Tiger Grunter *Amniataba* sp. from the Isdell River) and important other population data noted (confirmation of narrow range/habitat specialisation for Dillie Grunter *Syncomistes dilliensis* largely restricted to the Charnley Sanctuary). Replicate samples of more widespread species such as Kimberley Purplespotted Gudgeon *Mogurnda oligolepis* from different river systems were also made to contribute to future understanding of cryptic species. Additional opportunistic data was obtained on decapod crustaceans. Waterfalls appeared to have a significant two-way filtering effect with contrasting species richness/composition above and below these natural barriers, and other landscape features also seemed important for other species (e.g. atypical basalt areas with high abundance of Greenway's Grunter *Hannia greenwayi*). Specific region and site based management recommendations are made along with suggestions to continue to build on survey results in this unique aquatic landscape.

1. Introduction

Freshwater fishes are a key part of natural resource management due to their diversity in number and form, intriguing life histories and adaptations, role in human culture and use, links within food-chains, value as bio-indicators, and as icons for aquatic conservation and environmental awareness (Bunn and Arthington, 2002; Morgan *et al.*, 2004; Kennard *et al.*, 2006; Pusey, 2011; Pusey *et al.*, 2017; Lintermans *et al.*, 2020; Tims and Saupe, 2023). Fish diversity in Australia increases dramatically in the topical north, and there is still much to be documented in terms of the species baseline. New, novel forms continue to be recorded from remote regions of Australia, and recent interrogation with genetic techniques suggest that there are likely to be two to three times the number of species actually present than is currently recognised (Adams *et al.*, 2013; Hammer *et al.*, 2013; Adams *et al.*, 2014). Hence, detailed surveying and taxonomic review of local fish faunas is likely to provide important and exciting biodiversity updates as the foundation for management and conservation.

Western Australia's Kimberley region represents a distinct biogeographic province characterised by high endemism (Unmack, 2001; Shelley *et al.*, 2019). The aquatic landscape is one containing a series of highly structured, dendritic river systems draining off rugged sandstone escarpment often with prominent and multiple waterfalls, promoting isolation and diversification. While local fishes are well known by Aboriginal people (e.g. Morgan *et al.*, 2004; Shelley *et al.*, 2018a), western science knowledge of the fauna has gradually improved with dedicated surveys (e.g. Morgan *et al.*, 2004; Morgan *et al.*, 2011; Moore and Hammer, 2015; Shelley *et al.*, 2018b) and synthesis of available data the first field guide to freshwater fishes of the region, funded through the Bush Blitz program (Shelley *et al.*, 2018a). However, due to the relatively inaccessible landscape of much of the region, many waterways remain poorly surveyed to science, particularly in the remote west, while many narrow range endemic species are poorly mapped.

The Wilinggin Indigenous Protected Area (IPA) covers a huge area of the rugged and remote central-north Kimberley (some 2.4 million hectares). The western portion of the IPA incorporates the Charnley River-Artesian Range Sanctuary managed by Australian Wildlife Conservancy (AWC), which was the base for the current Bush Blitz (i.e. sampling within and adjacent to the Sanctuary within the IPA). The survey region is unique, being positioned at a headwater juncture point of multiple river systems, each draining to a different isolated coastline of the Kimberley. For example the Drysdale draining to the north, Prince Regent to the east, and the Charnley/Calder/Isdell to the south-east. There has been patchy scientific sampling in the region previously, but only along accessible vehicle tracks. Large parts of the area have no previous museum records or point survey data. The remoteness of the region across multiple isolated catchments and a series of waterfalls presented high chances of important range extensions or discovering species new to western science.

This report summarises the results of a two week survey of fishes in the Wilinggin-West Kimberley in July 2022. This provided the opportunity to include fishes in broader property management, to obtain valuable information on range restricted species, engage in two-way learning with traditional owners and Wunggurr Rangers, and collect genetic samples with associated vouchers for broader review of the Australian freshwater fish fauna. The current study also builds on fish data and research from previous Bush Blitz surveys across northern Australia (Fish River Station, Wongalara Sanctuary, East Kimberley, Olkola, Judbarra National Park, Bradshaw Field Training Area, Groote Eylandt IPA). Decapod crustaceans were opportunistically sampled as part of freshwater fishes site sampling.

2. Methods

2.1 Site selection

Sites were selected to provide even spatial coverage and representation of different river systems within the study region, primarily of upland streams habitats and especially looking for major waterfall barriers (isolated habitats). Sites were directed also at broader taxonomic research and of conservation/management interest as viewed from a review of museum specimens and historical data. Different teams collaborated on fish sampling concurrently with other target groups (e.g. molluscs, AWC field ecology team). Nineteen sites were visited between 19 and 27 July 2022 (Figure 1; Table 1). Sampling occurred at the end of successive poor-modest wet seasons, but most sites were still in good condition with clear water having low to medium flow at the time of sampling.

2.2 Survey techniques

Sampling employed a rapid assessment design in order to cover as wide a spatial distribution and variety of habitats/environmental conditions as possible, and maximise efficiency with regard to the time window for helicopter access into remote and inaccessible areas:

- 1) **Backpack electrofishing** using a Smith-Root model LR-20B with voltage and frequency adjusted according to water conductivity. Electrofishing temporarily shocks fish, and allows capture of target fish species, with remaining fish quick to recover once electrofishing is ceased. This was the primary survey technique, employed at wadeable sites especially smaller streams or runs between larger pools. Standardised sampling targeted 1000 seconds of electrofishing on time, being less in some smaller habitats, or increased proportionally for different major habitat sections (i.e. above and below waterfalls; large rocky runs and pools).
- 2) **Bait traps** are collapsible mesh nets with conical openings on each end (45 x 25 x 25 cm coming in multiple colours) that were set on strings amongst vegetation cover, flat on the bottom, for 1-2 daylight hours and baited with fish flavoured dry cat food. This passive survey technique was used to supplement electrofishing or in supplementary sampling by other teams at some sites.
- 3) **Angling** was used as a supplemental method at several sites, and works well for opportunistic sampling of predatory species especially grunTERS (bream) and catfish.

The methods employed at each site are shown in Table 2. As with many northern Australian waterways, danger from Saltwater Crocodiles was carefully considered in survey design and implementation (e.g. active sampling techniques such as backpack electrofishing were restricted to sites above waterfalls or in narrow runs; distance from water maintained and observers used in larger pools).

Environmental data including physical characteristics, habitat components and water quality was recorded for each site (Table 2). Samples of larger crustaceans caught opportunistically as part of fish sampling were also made for future processing and investigation.

Sampling was conducted under WA Fisheries Exemption 250966222, in accordance with Charles Darwin University Animal Ethic Committee approval A12009.

2.2.1 Methods used at standard survey sites

Sampling of fishes was made at the periphery of BBK22-09 (=SS1) via backpack electrofishing using the standard effort of 1000 seconds on-time. Sampling was effective in this small wadeable stream habitat, but as an ephemeral upland habitat, strong interannual and seasonal variability in water availability is likely and should be accounted in any future monitoring.

2.3 Identifying the collections

Captured fishes were sorted to species on site with the majority returned to the point of capture. Representative subsamples retained as vouchers were held in a bucket with aeration and transported back to the field laboratory. Retained fish were ultimately euthanased using AQUI-S, and vouchers were either (a) fixed in 10% formalin solution with a matching genetic tissue sample preserved in both 80% analytical grade (AR) ethanol or (b) for smaller specimens fixed whole in 80% AR grade ethanol. On return to WAM, all material was sorted and re-examined to provide final confirmation of identifications after Shelley *et al.* (2018a) and primary literature keys where applicable (e.g. Hammer *et al.*, 2021). Specimens are permanently accessioned in the WAM fish collection (registration P. 35342 to P. 35357) and will ultimately be available on the Atlas of Living Australia.

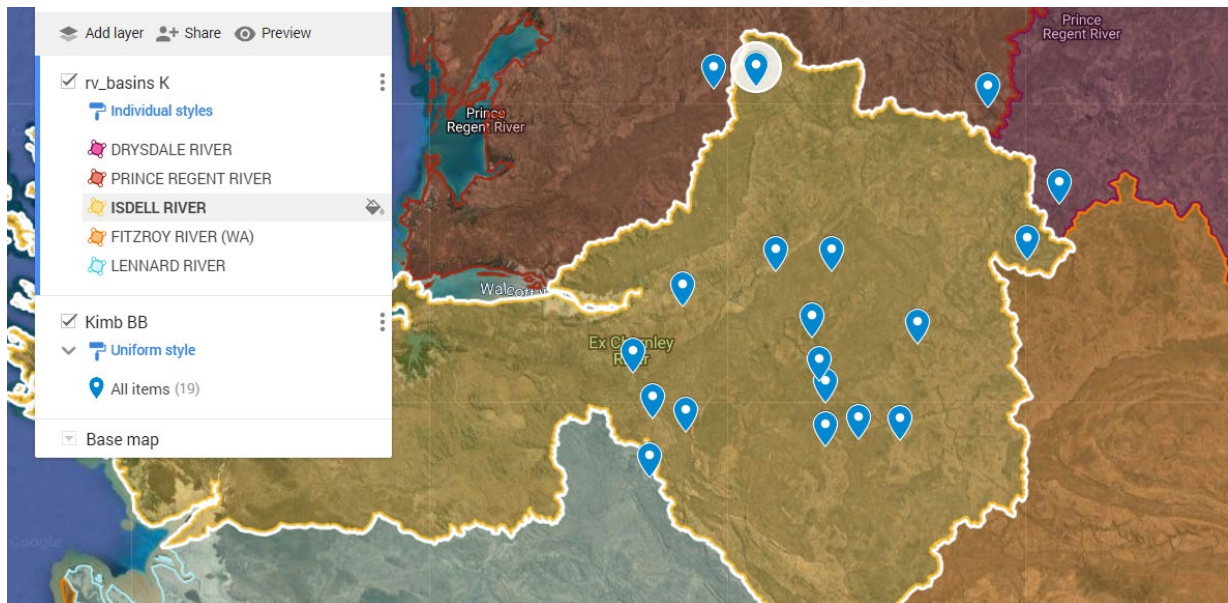


Figure 1. Google map image of Wilinggin-West Kimberley Bush Blitz 2022 survey sites (blue icons) relative to the different major river basins in the study region (Terrametrics 2023).

Table 1. Details of fish sampling sites from the Wilinggin Bush Blitz (GDA94)

Station	Date	River system	Waterway	Specific locality	Longitude	Latitude
BBK22-01	19/07/2022	Isdell	Isdell River trib.	Charnley River homestead	125.46004	-16.7168
BBK22-02	20/07/2022	Charnley	Charnley River	Black Cliffs	125.26691	-16.3380
BBK22-03	20/07/2022	Charnley	Maurice Creek trib.	Above waterfall	125.60221	-16.5021
BBK22-04	21/07/2022	Drysdale	Drysdale River	Headwaters	125.93574	-16.1846
BBK22-05	21/07/2022	Charnley	Maurice Creek trib.	Waterfall	125.85808	-16.3115
BBK22-06	22/07/2022	Isdell	Tulmulnga Creek	ds Reva Falls	125.05387	-16.7017
BBK22-07	22/07/2022	Isdell	Sanford River	Gorge	124.97453	-16.6708
BBK22-08	23/07/2022	Charnley	Plain Creek	Track crossing	125.38419	-16.6368
BBK22-09	23/07/2022	Charnley	Gravillia Creek	Potts Camp (SS1)	125.35253	-16.4889
BBK22-10	23/07/2022	Charnley	Long River	Track crossing	125.36727	-16.5861
BBK22-11	24/07/2022	Charnley	Kalumba Creek	Bassalt bar	125.39880	-16.3390
BBK22-12	24/07/2022	Isdell	Donkey Creek	Waterfall	125.56013	-16.7201
BBK22-13	24/07/2022	Charnley	Upland tributary	N of Attenborough Hut	125.04738	-16.4172
BBK22-14	25/07/2022	Calder	Upper Calder River	Waterfalls	125.21850	-15.9205
BBK22-15	25/07/2022	Sale	Upper Sale River	Gorge and swamp	125.12122	-15.9272
BBK22-16	26/07/2022	Isdell	Isdell River	Lower gorge	124.92735	-16.5677
BBK22-17	26/07/2022	Lennard	Barker River	Gorge and waterfall	124.97042	-16.8040
BBK22-18	26/07/2022	Isdell	Dillie Creek	Dillie Gorge	125.38312	-16.7342
BBK22-19	27/07/2022	Prince Regent	Prince Regent River	Waterfall, upper catchment	125.76476	-15.9691

Table 2. Details of sampling method and environmental data at fish survey sites

Station	Method	Seconds	Habitat	Flow	uScm ⁻¹	°C	pH	gH	kH
BBK22-01	EF	1000	Small rocky stream, seasonal flow	Trickle	61	20.3	6.5	0	0
BBK22-02	EF	2000	Large river with boulders and pools	High	169	21.9	7	40	30
BBK22-03	EF	500	Small upland sandstone stream	Trickle	30	27.7	6.5	0	0
BBK22-04	EF	2000	Small sandstone stream	Low	27	23.3	7	0	0
BBK22-05	EF	1000	Upland sandstone stream & plunge pool	Low	12	26.2	6	0	0
BBK22-06	EF	1500	Rocky braided channels	Low	563	22.9	9	>240	>180
BBK22-07	EF	1000	Rocky gorge	High	47	22.6	7	0	0
BBK22-08	EF	1000	Seasonal shallow creek	Low	63	21.2	6	0	10
BBK22-09	EF	1000	Seasonal upland sandy pools	Trickle	24	21.8	6	0	0
BBK22-10	EF	700	Seasonal shallow creek	None	762	24.0	8.5	>240	>180
BBK22-11	EF	1500	Midland rocky river	Low	334	21.1	8	120	120
BBK22-12	EF	1000	Sandstone stream	Med	23	23.1	6	0	0
BBK22-13	BT		Small rocky stream, seasonal flow	Low	54	-	-	-	-
BBK22-14	EF	3000	Sandstone rocky stream	Med	57	21.1	6.5	0	0
BBK22-15	EF	1700	Upland stream	Low	80	23.9	6	10	10
BBK22-16	EF	1500	Lowland rocky gorge	High	146	24.0	7.5	40	30
BBK22-17	EF	1500	Sand stone gorge and stream	Low	199	23.2	7	50	100
BBK22-18	AN		Mid land rocky gorge	Low	-	-	-	-	-
BBK22-19	EF	1500	Sandstone small stream	Low	64	23.7	6.5	0	0

*EF = backpack electrofishing; BT = bait trap; AN = angling. Blue highlight indicates basalt sites with contrasting water chemistry



The Charnley River winding its way through the vast and remote West Kimberley (photo M. Hammer)



Example of remote and isolated habitats in the study region (BBK22-14), waterfall on the upper Calder River (photo M. Hammer)



Small waterfall in the upper Prince Regent River (BBK22-19), example of a natural barrier with contrasting fish communities above and below (photo M. Hammer)



Fish sampling at the upper Drysdale River (BBK22-04) using backpack electrofishing (photo Kate Gillespie)

3. Results and Discussion

Appendix 1 lists all fishes recorded during the Bush Blitz, with species relative abundance by site listed in Appendix 2; this includes notes on the fish assemblage above (a) and below (b) waterfalls. Collections made during this Bush Blitz resulted in 83 lots being added to public collections and 112 site records being added to publicly accessible databases. This includes 18 native fish species in seven families. Opportunistic samples of decapod crustaceans are also listed in Appendix 1 and 2.

3.1 Un-named or not formalised taxa

Two species previously recognised as being new to western science but lacking a formal scientific name were recorded on the survey (Table 3); both are detailed in the Field Guide to Kimberley Freshwater Fishes (Shelley *et al.*, 2018a) and under current taxonomic review (J. Shelley pers. comm. 2022). Future genetic confirmation of Tiger Grunter *Amniataba* sp. is warranted given phenotypic variation in different populations of the genus.

Purplespotted Gudgeons of the genus *Mogurnda* have been highlighted to be taxonomically problematic including high rates of cryptic speciation (Adams *et al.*, 2013). Several distinct lineages are known in the Kimberley Purplespotted Gudgeon *Mogurnda oligolepis* and preliminary (ongoing) nuclear genetic data incorporating 2022 Bush Blitz material suggests that as many as four lineages (candidate species) occur in the study area loosely aligned to broader river basins. Bush Blitz material collected will aid a broader revision in the genus.

Taxon	Comment
Bachsten Gudgeon <i>Hypseleotris</i> sp. 2	A recognised undescribed species currently under taxonomic review
Tiger Grunter <i>Amniataba</i> sp.	A recognised undescribed species currently under taxonomic review
Kimberley Purplespotted Gudgeon <i>Mogurnda oligolepis</i> complex	A known species complex across the Kimberley, as many as 4 lineages in study area

3.2 Putative new species (new to science)

In this report, 'putative new species' means an unnamed species that, as far as can be ascertained, was identified as a new species to western science as a direct result of this Bush Blitz. No obviously new species were observed on the survey, but future taxonomic investigation on museum samples may yield such species.

3.3 Exotic and pest species

No alien or translocated native fish species were recorded.

3.4 Threatened species

No species recorded are listed as Critically Endangered, Endangered, Vulnerable or Conservation Dependent under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth). One species, the Kimberley Spangled Perch, is listed as a specially protected fauna (P2 category) under *WA Biodiversity Conservation Regulations 2018* (Table 4). This is one of six narrow range endemic species which warrant closer management attention including two of which that have a global conservation listing (IUCN, 2023); see Table 4.

Table 4. Threatened species (and list of narrow range endemic species recorded)			
Species	Listing status and level (EBPC, State/Territory)	Location sighted/observed	Indication of abundance
Dillie Grunter <i>Syncomistes dilliensis</i>	NA, but considered Vulnerable IUCN Red List. Narrow range endemic.	7 sites in the Charnley, Calder and Isdell catchments being representative of its total global distribution	Typically rare with patchy distribution in specialised habitat (gorge and rocky riffles)
Tiger Grunter <i>Amniataba</i> sp. tiger	NA. Narrow range endemic.	1 site in the Isdell River; occurs also in the Calder, Sale and Glenelg rivers	Rare
Winton's Grunter <i>Hannia wintoni</i>	NA. Narrow range endemic.	1 site in the Prince Regent River. Known only from Prince Regent and Roe rivers	Rare
Kimberley Spangled Grunter <i>Leiopotherapon macrolepis</i>	P2 - Specially protected fauna under WA <i>Biodiversity Conservation Regulations 2018</i> Narrow range endemic.	1 sites in the Prince Regent River. Known only from Prince Regent and Roe rivers	Locally common
Slender Carp Gudgeon <i>Hypseleotris ejuncida</i>	NA, but considered Critically Endangered IUCN Red List. Narrow range endemic.	1 sites in the Prince Regent River. Known only from the upper Prince Regent River	Locally common but highly restricted
Bachsten Gudgeon <i>Hypseleotris</i> sp. 2	NA. Narrow range endemic.	3 sites, 1 each in the Charnley, Calder and Sale rivers; 3 previous records in the first two catchments also	Rare



Images of the narrow range endemic species from the upper Prince Regent River (BBK22-19), (top) Kimberley Spangled Perch, (middle) Winton's Grunter, and (lower) Slender Gudgeon (photos M. Hammer)



Photos of Dillie Grunter, (top) in situ in large plunge pool (BBK22-05), (middle) typical colour of adult, and (lower) one colour form displayed by sub-adult/juveniles (photos M. Hammer)

3.5 Range extensions

The distribution of Kimberley Fishes has recently been reviewed and mapped (Shelley *et al.*, 2018a), helping informed assessment of range extensions (Table 5). Two notable range extensions as a result of this Bush Blitz are for Bachsten Gudgeon and Tiger Grunter, being new records from the Sale and Isdell rivers respectively. While the distribution points are close geographically (as the crow flies), these aquatic animals occur in independent catchments with historical freshwater connectivity only under low sea levels (with a remote possibility of dispersal during flood plumes). Genetic characterisations of these populations will help to assess their status as potentially unique lineages. The third record is for Australia's most widespread fish Spangled Perch *Leiopotherapon unicolor*, which apparently does not interact well with the related narrow range endemic Kimberley Spangled Perch *L. macrolepis* being previously reported absent from the Prince Regent River, but being recorded on this survey primarily as an isolated population above a waterfall. The Giant Gudgeon *Oxyeleotris selheimi* is widespread in the Kimberley, with the Isdell now an additional recorded catchment.

Table 5. Range extensions or significant infill in distribution records for species

Species	Location sighted/observed	Distance from nearest known record (km)	Comments
Bachsten Gudgeon <i>Hypseleotris</i> sp. 2	BBK22-15 Upper Sale River	10 km (200 km aquatic distance)	New record for catchment
Tiger Grunter <i>Amniataba</i> sp.	BBK22-16 Isdell River, Lower gorge	20 km (50 km aquatic distance)	New record for catchment
Spangled Perch <i>Leiopotherapon unicolor</i>	BBK22-19 Upper Prince Regent River waterfall	10 km (250 km aquatic distance)	New record for catchment
Giant Gudgeon <i>Oxyeleotris selheimi</i>	BBK22-06 Isdell River catchment	100 km (400 km aquatic distance)	New record for catchment



Aquarium photo of juvenile Tiger Grunter from the Isdell River gorge (BBK22-16); further genetic evaluation to confirm this identity is warranted (photo M. Hammer)

3.6 Genetic information

Representative tissues for species and catchments were made using a paired tissue-voucher system to allow full comparison of live photos, vouchers and DNA from the same individuals in combined lines of evidence taxonomic assessments.

4. Information on species lists

This survey provided a reasonably comprehensive list of species in the study area, targeting more upland habitats (Appendix 1). Other species recorded from lowland habitats of the study area such as the lower Charnley River include forktail catfish (*Neoarius midgleyi*), eel-tail catfish (*Neosilurus ater*), glassfish (*Ambassis* sp. NW) and Barramundi (*Lates calcarifer*).

Further taxonomic evaluation is required to understand cryptic diversity in Kimberley Purplespotted Gudgeon and to confirm the identity of the juvenile Tiger Grunter from the Isdell River gorge.

5. Information for land managers

The West Kimberley is a remote region with unregulated stream catchments, an important landscape feature when considering development elsewhere in Australia. The area has high conservation value as a strong hold for narrow range endemic species, particularly the Dillie Grunter that has a global range almost totally enclosed by Charnley Sanctuary; the type locality of the species is Dillie Gorge at the heart of the Sanctuary. The species is reported to have a specialised diet as an algae scraper (Shelley *et al.*, 2018a) and occupies permanent pools (adult habitat) and flowing rock riffles (juvenile habitat); and so may be susceptible to land use changes and fire management that may impact water quality and flow for example. Likewise the Bachsten Gudgeon has a narrow range and patchy distribution only within Charnley Sanctuary and the immediate surrounding areas of Willinggin IPA. Further afield the upper section of the Prince Regent River that stretches into the IPA captures a part of an exceptionally biodiverse catchment, and further Ranger lead surveys to map and monitor fish communities in areas like this and the upper Drysdale would be important (e.g. bait traps). Maintaining the pest fish free status of the Kimberley is also a high management priority. Future watch and proactive preventative management should be maintained for Tilapia *Oreochromis mossambicus* recently established further south in Western Australia (Pilbara), and for other ornamental species sometimes kept in home aquaria/ponds (e.g. Guppies *Poecilia reticulata*) and which could become pests. Finally, while there was a diversity of habitats available in the early dry season sampling period, documenting core refuges in dry times when water pools contract right back could be an important focus for site based habitat protection (e.g. stock exclusion) to protect core areas, populations and species resilience.

6. Other significant findings

In addition to baseline information on species distribution, several ecological insights were provided from the level of sampling intensity. Waterfalls clearly provided a strong influence on the fish community at a reach level, as a filter affecting species composition. The species richness below waterfalls was 50–400% higher than that above with the smaller upland habitats either isolated to or not suitable for larger growing species. Other sites were evidentially influenced by downstream barriers not directly assessed, where additional species would otherwise have been expected based on habitat size (e.g. BBK22-11 Kalumba Creek; BBK22-04 upper Drysdale River). The importance of this habitat mosaic appears to extend a refuge value (e.g. isolation from competitors/predators) to some smaller sized habitat specialists that were typically only recorded above waterfalls (e.g. Kimberley Purplespotted Gudgeon). Several sites where prevailing sandstone gave way to basalt yielded quite different water chemistry (more saline and alkaline), and there was a corresponding difference in species composition and abundance, most notably with the high abundance of Greenway's Grunter *Hannia greenwayi*.

7. Conclusions

The targeted survey for fishes during the 2022 Bush Blitz added significant spatial information on species distributions in the Charnley Sanctuary and Wiliggin IPA, from escarpment habitats to lowland gorges across seven isolated river systems (Calder, Charnley, Drysdale, Isdell, Lennard, Prince Regent and Sale). The habitat is remote and without the major threats of river regulation and alien fishes. Freshwater fish endemism is high, and mapping and monitoring the multiple narrow range endemics in the region is a strong management recommendation. There is scope for further Wunggurr Ranger lead surveys of additional catchments and areas of Wiliggin IPA, and ongoing collaborative research efforts to resolve taxonomy on problematic groups will further highlight the diversity and uniqueness of the West Kimberley region.

Acknowledgements

We would like to acknowledge the Traditional Owners of the West Kimberley, and recognise their ongoing cultural connection to land and water. We pay our respects to Elders past, present and emerging. We thank the Wunggurr Rangers, AWC staff, DBCA, teachers/EarthWatch and BHP employees for their help and involvement in the survey, with a special thanks to Steve McIntosh for additional fish sampling. We also wish to thank the helicopter pilots, catering and Bush Blitz team for their help on the survey.



Approaching a sampling site (BBK22-16) on the lower Isdell River gorge (photo M. Hammer)

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Appendices

Appendix 1. List of Freshwater Fishes recorded during the Wilinggin-West Kimberley Bush Blitz

Family	Species	Common name
Fishes		
Clupeidae	<i>Nematalosa erebi</i>	Bony Bream
Plotosidae	<i>Neosilurus hyrtlii</i>	Hyrtl's Catfish
Plotosidae	<i>Neosilurus pseudospinosus</i>	Falsespine Catfish
Melanotaeniidae	<i>Melanotaenia australis</i>	Western Rainbowfish
Terapontidae	<i>Amniataba percoides</i>	Barred Grunter
Terapontidae	<i>Amniataba</i> sp.	Tiger Grunter
Terapontidae	<i>Hannia greenwayi</i>	Greenway's Grunter
Terapontidae	<i>Hannia wintoni</i>	Winton's Grunter
Terapontidae	<i>Hephaestus jenkinsi</i>	Jenkin's Grunter
Terapontidae	<i>Leiopotherapon macrolepis</i>	Kimberley Spangled Perch
Terapontidae	<i>Leiopotherapon unicolor</i>	Spangled Perch
Terapontidae	<i>Syncomistes dilliensis</i>	Dillie Grunter
Toxotidae	<i>Toxotes kimberleyensis</i>	Kimberley Archerfish
Eleotridae	<i>Mogurnda oligolepis</i>	Kimberley Purplepsotted Gudgeon
Eleotridae	<i>Hypseleotris ejuncida</i>	Slender Carp Gudgeon
Eleotridae	<i>Hypseleotris</i> sp. 2	Bachsten Carp Gudgeon
Eleotridae	<i>Oxyeleotris selheimi</i>	Giant Gudgeon
Gobiidae	<i>Glossogobius giuris</i>	Tank Goby
Decapod Crustaceans (opportunistic)		
Palaemonidae	<i>Macrobrachium bullatum</i>	Northwest Australian River Prawn
Palaemonidae	<i>Macrobrachium spinipes</i>	Cherabin
Atyidae	<i>Caridina</i> spp.	Freshwater shrimps
Gecarcinucidae	<i>Austrothelphusa transversa</i>	Freshwater Crab

Appendix 2. Relative abundance of Freshwater Fishes recorded at each survey site

Data is presented for sampling above (a) and below (b) waterfalls; *some other sites were apparently isolated by barriers further downstream

BBK22-	1	2	3a	4*	5a	5b	6	7*	8	9	10	11	12	13*	14a	14b	15	16	17a	17b	18	19a	19b
<u>Fishes</u>																							
<i>Nematalosa erebi</i>	1						30		1											30	30		10
<i>Neosilurus hyrtlilii</i>	5			20			5	10	5		5		10		10		10		5				
<i>Neosilurus pseudospinosus</i>		2							1				3			1		2			1		
<i>Melanotaenia australis</i>	100	50		500	100	30	200	10	50		30	100	20	100	100	50	50	20	20	100	20		50
<i>Amniataba percoides</i>																				10			
<i>Amniataba sp. (tiger)</i>																		20					
<i>Hannia greenwayi</i>		5					500		20				30			100					10		
<i>Hannia wintoni</i>																							20
<i>Hephaestus jenkinsi</i>	5	200					30		50				30			100	10	50		30	20		10
<i>Leiopotherapon macrolepis</i>																							100
<i>Leiopotherapon unicolor</i>	20	10		20		10	20	100	300	50	30	100	20		20	10	20	5	20	50	20	30	10
<i>Syncomistes dilliensis</i>		20				20						30	50			30		20				5	
<i>Toxotes kimberleyensis</i>																					20		
<i>Mogurnda oligolepis</i>	30			50	30			10				30		30	20		50		5	30		20	20
<i>Hypseleotris ejuncida</i>																							200
<i>Hypseleotris sp. 2 (Bachsten)</i>		10														30	15						
<i>Oxyeleotris selheimi</i>							10																
<i>Glossogobius giurus</i>							5						20					5		5			
Species Richness	6	7	0	4	2	3	8	4	7	1	3	4	8	2	4	7	6	7	4	7	8	2	8
<u>Decapod crustaceans</u>																							
<i>Macrobrachium bullatum</i>	x			x			x	x	x	x	x	x	x			x	x	x		x		x	x
<i>Macrobrachium spinipes</i>		x					x		x			x				x	x	x		x	x	x	x
<i>Caridina spp.</i>				x		x	x			x		x				x	x					x	x
<i>Austrothelphusa transversa</i>								x	x														