Macquaria wujalwujalensis, Bloomfield River Cod

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Citation: Brooks, S., Kennard, M. & Ebner, B. 2019. *Macquaria wujalwujalensis*. The IUCN Red List of Threatened Species 2019: e.T123387799A129046401. <http://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T123387799A129046401.en>

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Taxonomy

Kingdom	Phylum	Class	Order	Family
Animalia	Chordata	Actinopterygii	Perciformes	Percichthyidae

Taxon Name: *Macquaria wujalwujalensis* (Pusey & Kennard, 2001)

Synonym(s):

- *Guyu wujalwujalensis* Pusey & Kennard, 2001

Common Name(s):

- English: Bloomfield River Cod

Taxonomic Source(s):

Pusey, B.J., Kennard, M.J. 2001. *Guyu wujalwujalensis*, a new genus and species (Pisces: Percichthyidae) from north-eastern Queensland, Australia. *Ichthyological Exploration of Freshwaters* 12: 17–28.

Assessment Information

Red List Category & Criteria: Vulnerable D2 [ver 3.1](#)

Year Published: 2019

Date Assessed: February 13, 2019

Justification:

The Bloomfield River Cod has a very restricted distribution, and is known only to occur in an ~8 km section of the main channel of the Bloomfield River upstream of Bloomfield Falls (EOO = 12 km² and AOO ~12 km², assuming 2 km grid cells). There is however a continuing and prominent threat of fish species introductions that could result in a decline in the number of mature individuals at its one location, leading it to become Critically Endangered within a short timeframe. It is therefore assessed as Vulnerable D2.

Geographic Range

Range Description:

The Bloomfield River Cod has a very restricted distribution, known only to occur in an ~8 km section of the main channel of the Bloomfield River upstream of Bloomfield Falls. It may occur further upstream in main channel and large tributaries (~16 km of river network), but sampling elsewhere in the catchment indicates it is very unlikely to occur in tributaries further upstream or downstream.

Country Occurrence:

Native: Australia (Queensland)

Distribution Map

Macquaria wujalwujalensis

Range

Extant (resident)

Compiled by:

Lintermans, M. and colleagues 2019 IUCN Red List assessment for Australian freshwater fish.

The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

Population

This species is locally common but persists in a highly restricted range. There is no evidence to suggest that this species is declining or quantitative information to evaluate if there has been any change in distribution or in abundance over the last 25 years. Occasional sampling using electrofishing, netting and visual observation has occurred at four river reaches within its range in the 1990s (Pusey and Kennard 1994, 2001; Hansen, 2000). Fyke net based surveys, spotlight searches and snorkel observations on two occasions in the last decade confirm that the species is still present (Brendan Ebner and James Donaldson, unpublished data), however, the use of different survey techniques from the initial research do not enable comparison of abundance over time.

Current Population Trend: Unknown

Habitat and Ecology (see Appendix for additional information)

The following account is drawn from Pusey and Kennard (2001) and Pusey *et al.* (2004). Occurs in lotic habitats ranging from cascade sections to runs and deep pools. In-stream cover is limited, consisting of granite boulders and bedrock, undercut banks, rootmasses and sparse woody debris. Water clarity is very high (secchi disc depth > 4m), pH between 5 and 6 and water conductivity very low (28-30 $\mu\text{S cm}^{-1}$). The riverine habitat in which this species occurs varies from 30 and 40 m wide and depth varied from less than 1 m to over 4 m. The reaches in which it has been collected are a complex mix of cascade sections, runs and deep pools. Water velocities ranged from greater than 1 m sec^{-1} in the cascade sections to 0.03 m sec^{-1} in the pools. In-stream cover was limited and consisted of boulders, some bank undercutting and associated root masses, and sparse woody debris. Specimens collected by electrofishing during the day were almost always associated with these cover elements. Specimens collected at night were often observed high in the water column in open water about 1 m from the bank. Snorkelling surveys revealed that *M. wujalwujalensis* was distributed over a wide range of depths. Fish were observed at depths of 4 m but were always within 0.5 m of the bottom. Such fish rapidly sought cover amongst the cracks and tumbled slabs of rock on the stream-bed. Information on the diet provided below indicates that the Bloomfield cod spends most of its time foraging on the stream-bed but occasionally forages at the water's surface. Nothing is known about the tolerances of this species. *Macquaria wujalwujalensis* has been collected (during April September) from well-oxygenated, very clear water (Secchi disc depth >4 m) with pH values between 5 and 6. Water temperature was 21°C (September) and 23°C (April) and conductivity was extremely low (28–30 $\mu\text{S cm}^{-1}$). Given these conditions, it is highly unlikely to tolerate degraded water quality. Very little known about the breeding biology of *M. wujalwujalensis*. This species matures to the point where gender is discernible upon internal examination at small size; 42 and 43 mm SL are the minimum sizes for distinguishably male and female fish, respectively. The spawning season is unknown, however the holotype (101 mm SL), a mature male collected in April, was running ripe at the time of capture. Age at first breeding unknown (estimate 2-3 years). Gender discernible at 42 mm SL, Running ripe male observed at 101 mm SL. Age of oldest breeding individual unknown (estimate 10 years max). Specimen held by S. Brooks in captivity for approx 12 years (70 mm TL at start, 140 mm TL at end). Maximum body length likely 150 mm TL. Nothing is known of the movement biology of this species. Judging from its apparent absence from upper tributary streams, it does not disperse into such habitats. *Macquaria wujalwujalensis* is almost exclusively carnivorous; only 3% of the diet was composed of plant material (2% algae and 1% terrestrial vegetation). Given this small contribution it is probable that the plant matter was incidentally ingested. Fish (juvenile *M. wujalwujalensis*) comprised 6% of the diet but were present in one individual only.

Terrestrial invertebrates (mostly ants) contributed 7% to the diet. The greater bulk of the diet was comprised of small aquatic invertebrates: chironomid larvae (17%), ephemeropteran nymphs (18%), pyralid larvae (13%) and trichopteran larvae (6%). Unidentified arthropod fragments made up the remainder (28%). The specimens of *Macquaria wujalwujalensis* from which this summary was derived ranged in length from 34–79 mm SL.

Systems: Freshwater

Use and Trade

There is no known utilization of and/or trade in the taxon. There is some interest in this species in the aquarium trade and there is a small amount of illegal capture.

Threats (see Appendix for additional information)

The extremely restricted distribution of this species may make it highly susceptible to threats described below. The major threats to this species include future introductions of translocated native fish (particularly the Sooty Grunter, *Hephaestus fuliginosus*, and Khaki Grunter, *H. tulliensis*) and non-native fish (particularly cichlids and poeciliids). These species do not appear to currently occur in the Bloomfield River catchment but have been introduced widely throughout the Wet Tropics region (Burrows 2004, 2009; Kroon *et al.* 2015; Pusey *et al.* 2004). Their introduction to the Bloomfield River could lead to a very rapid decline in the number of immature and mature individuals (through competition and/or predation). The risk of translocating native fish is exemplified by the known translocation of *Tandanus tropicanus* which is now abundant in this part of the river (B. Ebner pers. comm. 2019). The implications of this translocation is not yet known. In addition at least one attempt to translocate Sooty Grunter to this river has been made but this was not successful. It is an ongoing risk because this part of the river contains no large angling species and therefore local anglers are likely to try and establish target species.

Feral pigs are also a potential threat as they can degrade in-stream habitat for Bloomfield Cod by damaging streamside vegetation and causing riverbank erosion and in-stream siltation (Commonwealth of Australia 2015). At present this threat is minimal. There are not generally signs of large scale damage along the banks of the main channel in the mid-catchment and the discharge regime is such that siltation effects are unlikely to be severe in the main channel (B.C. Ebner personal observation).

5.4.1 Intentional use: subsistence/small scale (species being assessed is the target) - There is anecdotal evidence to suggest illicit harvesting of Bloomfield River cod is occasionally occurring.

7.2 Dams & water management/use - There is currently minimal water resource development in the Bloomfield River (i.e. dams, water extraction), but if it were to occur in the future, it could lead to flow alteration, loss of lotic (flowing) habitat in impounded areas, and barriers to connectivity.

8.1.2 Named species (Cichlidae: *Oreochromis mossambicus*, *Pelmatolapia mariae*, etc) - These non-native invasive fish species do not appear to currently occur in the Bloomfield River catchment but have been introduced widely throughout the Wet Tropics region (Burrows 2004, 2009; Kroon *et al.* 2015; Pusey *et al.* 2004). The introduction of these species upstream of Bloomfield Falls could lead to a very rapid decline in Bloomfield River cod (through competition and/or predation).

8.1.2 Named species (Poeciliidae: *Gambusia holbrooki*, *Xiphophorus hellerii*, *Xiphophorus maculatus*, *Poecilia reticulata*, etc) - These non-native invasive fish species do not appear to currently occur in the Bloomfield River catchment but have been introduced widely throughout the Wet Tropics region (Burrows 2004, 2009; Kroon *et al.* 2015; Pusey *et al.* 2004). The introduction of these species upstream of Bloomfield Falls could lead to a decline in Bloomfield River cod (through competition and/or predation)

8.1.2 Named species (Suidae: *Sus scrofa*) - Feral pigs can degrade in-stream habitat for Bloomfield River cod by damaging streamside vegetation and causing riverbank erosion and in-stream siltation (Commonwealth of Australia 2015). However, there are not generally signs of large scale damage along the banks of the main channel in the mid-catchment and the discharge regime is such that siltation effects are unlikely to be severe in the main channel (B.C. Ebner personal observation).

8.2.2 Named species (Terapontidae: *Hephaestus fuliginosus*) - Sooty Grunter does not appear to currently occur in the Bloomfield River catchment but has been introduced widely throughout the Wet Tropics region (Burrows 2004, 2009; Kroon *et al.* 2015; Pusey *et al.* 2004). There are anecdotal reports of Sooty Grunter being translocated to the Bloomfield River upstream of Bloomfield Falls, but it appears not to have successfully established (Burrows 2002, S. Brooks, pers. comm., B.C. Ebner unpublished data). The introduction of Sooty Grunter upstream of Bloomfield Falls could lead to a very rapid decline in Bloomfield River cod (through competition and/or predation).

8.2.2 Named species (Latidae: *Lates calcarifer*) - Barramundi does not currently occur upstream of Bloomfield Falls but is a popular recreational angling species and widely stocked elsewhere (Burrows 2004, 2009; Kroon *et al.* 2015; Pusey *et al.* 2004). The introduction of Barramundi upstream of Bloomfield Falls could lead to a very rapid decline in Bloomfield River Cod (through competition and/or predation) including nocturnal predation on juvenile and adult phase Bloomfield River Cod.

8.2.2 Named species (Terapontidae: *Hephaestus tulliensis*, Eleotridae: *Oxyeleotris* spp.) - These species do not currently occur in the Bloomfield River catchment but have been introduced to several other rivers in the Wet Tropics region (Burrows 2004, 2009; Kroon *et al.* 2015; Pusey *et al.* 2004). The introduction of these species upstream of Bloomfield Falls could lead to a decline in Bloomfield River Cod (through competition and/or predation) and most likely through diurnal predation on juvenile Bloomfield River Cod.

11.3 Temperature extremes - The reproductive ecology including spawning and larval development of this species is unknown. However, at least theoretically the reproduction and larval requirements of this species are at risk to climate change including changes to the main channel thermal regime since the species is effectively fixed not only to a single catchment but to a midrange elevation within the catchment.

12.1 Other threat (**Single small population**) - This species occurs as a small population in a single stream, so the chances of recovery from a stochastic catastrophe such as extreme high temperature event is very low.

Conservation Actions (see Appendix for additional information)

This species is not currently under active conservation management. The following describes various relevant management strategies to address listed threats.

5.4.1 Intentional use: subsistence/small scale (species being assessed is the target). There is some international literature on management options to minimise the threat of Illicit harvesting (e.g. for aquarium hobby and/or commercial trade). The Bloomfield River Cod is listed as a “No Take” species under Queensland legislation. However, this does not necessarily prevent illicit harvesting as monitoring and enforcement by Government is minimal.

7.2 Dams & water management/use - There appears little prospect of Water resource development (i.e. dams, water extraction) appearing in the distant future (but it cannot be ruled out). 8.1 Invasive non-native/alien species/diseases - Once established, introduced fish species are extremely difficult to eradicate. Many non-native invasive fish species are listed as a “Prohibited noxious fish” under the Queensland Biosecurity Act 2014 (Schedule 1, noxious fish). However, this does not necessarily prevent introductions as monitoring and enforcement by Government is minimal.

8.1.2 Named species - Although there is ongoing management of feral pigs in some areas of Queensland, there is limited management of this threat within the range of Bloomfield River Cod.

8.2 Problematic native species/diseases (Translocated native fish species) - Once established, introduced fish species are extremely difficult to eradicate. The Queensland Government provides guidance on responsible native fish stocking. However, this does not necessarily prevent introductions as monitoring and enforcement by Government is minimal.

11.3 Temperature extremes (due to climate change) - Foundation research on reproductive period and hydrological cycle and thermal regime would be useful to match with climate change projections.

12.1 Other threat (Single small population) - A captive breeding program for this species warrants serious consideration, which should include discussions and permissions of the relevant traditional owners.

Its known localities are on freehold unprotected land.

Credits

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Reviewer(s): Hammer, M. & Unmack, P.

**Facilitators(s) and
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Citation

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External Resources

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Appendix

Habitats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Habitat	Season	Suitability	Major Importance?
5. Wetlands (inland) -> 5.1. Wetlands (inland) - Permanent Rivers/Streams/Creeks (includes waterfalls)	Resident	Suitable	Yes

Threats

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Threat	Timing	Scope	Severity	Impact Score
11. Climate change & severe weather -> 11.3. Temperature extremes	Ongoing	Whole (>90%)	Causing/could cause fluctuations	Medium impact: 7
12. Other options -> 12.1. Other threat	Ongoing	Whole (>90%)	Rapid declines	High impact: 8
5. Biological resource use -> 5.4. Fishing & harvesting aquatic resources -> 5.4.1. Intentional use: (subsistence/small scale) [harvest]	Ongoing	Majority (50-90%)	Causing/could cause fluctuations	Medium impact: 6
7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.11. Dams (size unknown)	Future	Minority (50%)	Causing/could cause fluctuations	Low impact: 3
7. Natural system modifications -> 7.2. Dams & water management/use -> 7.2.3. Abstraction of surface water (agricultural use)	Future	Minority (50%)	Causing/could cause fluctuations	Low impact: 3
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (Gambusia holbrooki)	Future	Whole (>90%)	Causing/could cause fluctuations	Low impact: 5
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (Oreochromis mossambicus)	Future	Whole (>90%)	Rapid declines	Medium impact: 6
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (Pematolapia mariae)	Future	Whole (>90%)	Rapid declines	Medium impact: 6
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (Sus scrofa)	Ongoing	Majority (50-90%)	Negligible declines	Low impact: 5
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (Poecilia reticulata)	Future	Whole (>90%)	Causing/could cause fluctuations	Low impact: 5

8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (<i>Xiphophorus hellerii</i>)	Future	Whole (>90%)	Causing/could cause fluctuations	Low impact: 5
8. Invasive and other problematic species, genes & diseases -> 8.1. Invasive non-native/alien species/diseases -> 8.1.2. Named species (<i>Xiphophorus maculatus</i>)	Future	Whole (>90%)	Causing/could cause fluctuations	Low impact: 5
8. Invasive and other problematic species, genes & diseases -> 8.2. Problematic native species/diseases -> 8.2.2. Named species (<i>Hephaestus tulliensis</i>)	Future	Whole (>90%)	Slow, significant declines	Low impact: 5
8. Invasive and other problematic species, genes & diseases -> 8.2. Problematic native species/diseases -> 8.2.2. Named species (<i>Lates calcarifer</i>)	Future	Whole (>90%)	Very rapid declines	Medium impact: 7
8. Invasive and other problematic species, genes & diseases -> 8.2. Problematic native species/diseases -> 8.2.2. Named species (<i>Hephaestus fuliginosus</i>)	Future	Whole (>90%)	Very rapid declines	Medium impact: 7
8. Invasive and other problematic species, genes & diseases -> 8.2. Problematic native species/diseases -> 8.2.2. Named species (<i>Oxyeleotris lineolata</i>)	Future	Majority (50-90%)	Slow, significant declines	Low impact: 4
8. Invasive and other problematic species, genes & diseases -> 8.2. Problematic native species/diseases -> 8.2.2. Named species (<i>Oxyeleotris selheimi</i>)	Future	Majority (50-90%)	Slow, significant declines	Low impact: 4

Conservation Actions in Place

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Actions in Place
In-Place Research, Monitoring and Planning
Action Recovery plan: No
Systematic monitoring scheme: No
In-Place Land/Water Protection and Management
Conservation sites identified: No
Occur in at least one PA: No
Percentage of population protected by PAs (0-100): 0
Area based regional management plan: Unknown
Invasive species control or prevention: No
In-Place Species Management
Harvest management plan: Yes
In-Place Education

Conservation Actions in Place
Subject to recent education and awareness programmes: No
Included in international legislation: No
Subject to any international management/trade controls: No

Conservation Actions Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Conservation Actions Needed
1. Land/water protection -> 1.2. Resource & habitat protection
2. Land/water management -> 2.1. Site/area management
3. Species management -> 3.4. Ex-situ conservation -> 3.4.1. Captive breeding/artificial propagation

Research Needed

(<http://www.iucnredlist.org/technical-documents/classification-schemes>)

Research Needed
1. Research -> 1.2. Population size, distribution & trends
1. Research -> 1.3. Life history & ecology
1. Research -> 1.5. Threats
2. Conservation Planning -> 2.2. Area-based Management Plan
3. Monitoring -> 3.1. Population trends

Additional Data Fields

Distribution
Estimated area of occupancy (AOO) (km ²): 12
Continuing decline in area of occupancy (AOO): No
Extreme fluctuations in area of occupancy (AOO): Unknown
Estimated extent of occurrence (EOO) (km ²): 12
Continuing decline in extent of occurrence (EOO): No
Extreme fluctuations in extent of occurrence (EOO): Unknown
Number of Locations: 1
Continuing decline in number of locations: No
Extreme fluctuations in the number of locations: Unknown

Distribution
Lower elevation limit (m): 100
Upper elevation limit (m): 150
Population
Population severely fragmented: No
Habitats and Ecology
Continuing decline in area, extent and/or quality of habitat: No
Movement patterns: Not a Migrant

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