

Preventing extinctions of Australian freshwater fishes: A national assessment

Research findings

Nov 2024



Utchee rainbowfish (*Melanotaenia utcheensis*).
Image: spqrbake CC-BY-NCiNaturalist

This factsheet summarises key findings of the first comprehensive assessment of the extinction risk of Australian freshwater fish species and includes urgent recommendations to prevent extinctions.

The research was undertaken by a team of 52 Australian freshwater fish experts who are based at universities and research organisations, museums, state government agencies, natural resource management groups, ecological consultancies and non-government groups. The lead author is Associate Professor Mark Lintermans from the University of Canberra.

The study was published in the peer-reviewed journal *Biological Conservation*. The citation is: Lintermans, M., et al. (2024). Troubled waters in the land down under: Pervasive threats and high extinction risks demand urgent conservation actions to protect Australia's freshwater fishes. *Biological Conservation*. <https://doi.org/10.1016/j.biocon.2024.110843>.

Key findings

In Australia, many freshwater fish species have been declining since European settlement. Declines have accelerated since the 1950s. Preventing extinctions and conserving biodiversity will require identifying the species most at risk.

Prior to this study, the extinction risk of most freshwater fish species had not been assessed and there had not been a strategic assessment of the whole group.

There are currently 63 species of freshwater fish listed on Australia's federal threatened species list under the Environment Protection and Biodiversity Conservation (EPBC) Act.

This study identified 35 additional species at risk of extinction (1 Extinct, 3 Critically Endangered, 14 Endangered, 17 Vulnerable). See list in table 1.

It also identified 17 species that are currently EPBC Act listed that should have their threat category reviewed, as 13 would likely qualify for uplisting, 3 for down listing and 1 (Murray cod) for de-listing. See list in table 1.

The study estimated 37% of our native freshwater fish species are now at risk of extinction. At least 20 are more likely than not to become extinct within the next 20 years unless there is major new effort to conserve them.

All of the species assessed as Critically Endangered were small-bodied fish (less than 20 cm), with the native galaxiids across southern Australia hit very hard. But large-bodied fish such as Mary River cod and the Australian lungfish equally face uncertain futures.

The study also reviewed the major threats and current conservation actions for each species. Although resources for freshwater fish conservation are limited, the analysis revealed a disconnect between the most common threats driving native fish declines, and the most common conservation actions being employed.

For example, invasive species are a major threat to 92% of the species identified as of conservation concern, but invasive species control and prevention programs are only in place for only 21% of those species; mainly in Tas. The invasive species that present the greatest threat to the most native species are trout, gambusia and redfin perch.

The other most common threats are modification of freshwater ecosystems (including dams and changed flows), and climate change and severe weather. However the most commonly occurring conservation actions are species being within a Protected Area or conservation area, monitoring and planning, and education and awareness programs.

Current conservation efforts are insufficient to prevent extinctions.

Recommendations

Urgently **assess 35 species for listing as threatened** under the EPBC Act and **re-assess 17 species for up/down/delisting** as identified in table 1. Assess the conservation status of 15 newly described species.

Urgently develop and resource major new conservation measures that **target the key threats driving declines** to avoid imminent extinctions:

- 1. Tackle the impact of invasive species** on threatened native fish populations. Include major new action to address trout, gambusia and redfin perch.
- 2. Improve flow regimes and water provision** to mitigate impacts from water extraction and regulation and climate change.
- 3. Halt ongoing habitat loss and improve habitats** that have been impacted
- 4. Identify, establish and protect additional refuge sites** for species which currently occur in only a small number of small locations which could be wiped out by a single event such as a bushfire.

Background to the issue

The Australian Government has committed to averting extinctions. Biodiversity loss has profound effects on ecosystem function and productivity, and consequently poses risks to ecosystem services vital for human wellbeing.

Freshwater fishes (and their habitats) are declining at alarming rates in many parts of the world, including in Australia, where the populations of many species have fallen sharply since the 1950s. The declines have been attributed to habitat loss, introduced species, alteration to natural flow regimes, habitat fragmentation, water pollution and overexploitation.

Australia supports more than 300 native freshwater fish species, with almost three-quarters found nowhere else.

Around one third of Australia's freshwater fish species have not yet been formally described and named by scientists. Government investment in taxonomy is needed to address this.

To effectively reduce biodiversity loss and guide conservation efforts, there is an urgent need to

The threats facing native fish at risk of extinction

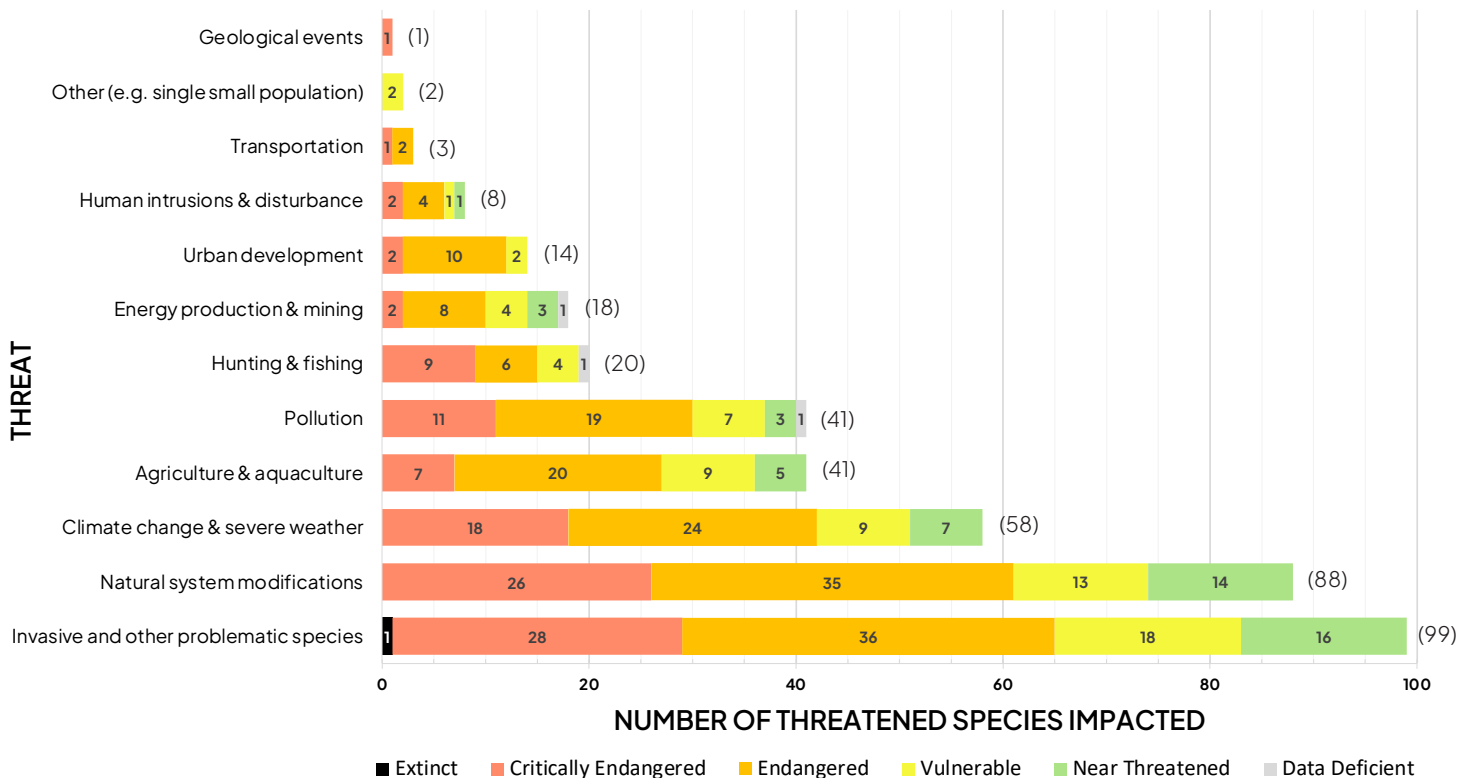


Figure 1. The number of threatened freshwater fish species of conservation concern that are impacted by the 12 most prevalent threats. Numbers in brackets at end of bars are the total number of species impacted by that threat. The graph shows that invasive and other problematic species (eg diseases) impact the most species (99 in total), while water pollution impacts 41 species.

identify species at risk of extinction and to improve our understanding of the current threats to these species.

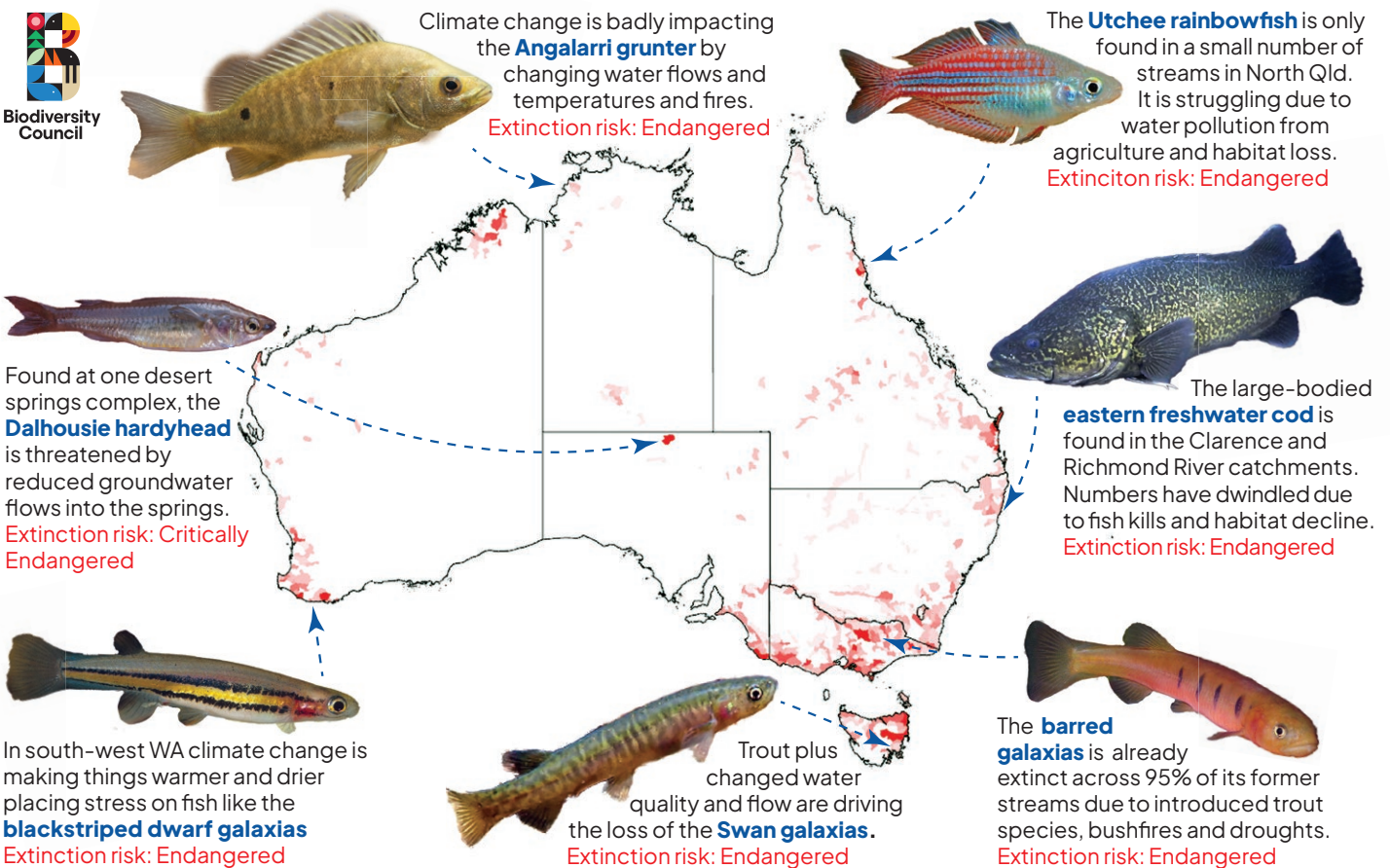
In Australia freshwater fishes are in bigger trouble than other species groups, based on the number of species at high risk of extinction. At least 20 freshwater fish species are estimated as having a greater than 50% probability of being extinct within 20 years.

Scope of research

The study assessed the conservation status of 241 native freshwater fish species and compiled the results of assessments of 21 additional species that were assessed since 2015 through other projects. 15 species were not assessed as they were unknown or undescribed at the time of the assessments.

The study used Red List for Threatened Species criteria from the International Union for Conservation of Nature (IUCN) to assess their risk of extinction. The Red List is considered the global benchmark for evaluating species at risk.

The assessments were undertaken by a team of 52 fish scientists who have spent their careers studying and conserving freshwater fish. The assessments took into account available information on biology, ecology, distribution, threats and existing conservation measures. This information was compiled from scientific publications, museum databases, records in the Atlas of Living Australia, government datasets, citizen science data and the knowledge of freshwater fish experts.



Native freshwater fish at risk of extinction

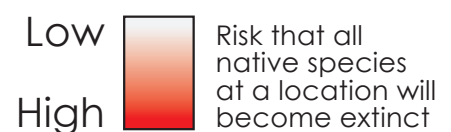


Figure 2: A map of extinction risks across Australia with examples of fish at risk and their IUCN Red List category. Red areas have high risk of their native species becoming extinct. White areas have a low risk. Pink is moderate. Fish images clockwise from top left: Michael Hammer, ANGA Qld, Brett Vercoe, Steven Kuitert, Inland Fisheries Service, Gerald R Allen, Michael Hammer. Overall figure: M. Lintermans, N. Whiterod and J. Dielenberg

Results

Conservation status assessments

Of the 262 species now assessed using IUCN Red List criteria 117 species (45%) are of conservation concern, including 1 Extinct (>1%), 30 Critically Endangered (12%), 41 Endangered (16%), 21 Vulnerable (8%), 19 Near Threatened (7%) and 5 Data Deficient (2%). The remaining 145 species (55%) assessed are Least Concern or not threatened with extinction.

Table 1 presents the IUCN assessment category for 52 freshwater fish species where this does not match the current national EPBC Act threatened species list. This includes 35 species that are not yet listed but should be urgently assessed for listing, and 17 species that will potentially qualify for a change to their listing assessment (either up-, down- or de-listing).

It also flags 15 additional as yet un-assessed species which were not yet described at the time of this study and should be assessed.

Threats and actions to address them

The study identified the prevalence of threats to species of conservation concern (see Fig. 1), and the prevalence of conservation actions. The analysis revealed a stark misalignment between the major pressures on threatened species and which conservation actions limited resources are being directed to.

The most common threats for the species of conservation concern identified in this assessment are:

Invasive species are the most common threat across all species identified as threatened, Near Threatened or Data Deficient, impacting 92% of species. This threat category includes introduced fish species such as trout, gambusia and redfin perch, which are the introduced fish species that impact the greatest number of threatened native species. It also includes problematic native species (such as those moved by humans to new areas where they pose a threat to local species through hybridisation), and diseases.

Although invasive species are the most common threat, invasive species control and prevention actions were in place for only 23% of species, predominantly in Tasmania (64%).

Freshwater ecosystem modification is the second most prevalent threat. It is a problem for 82% of the species of conservation concern. This includes damming rivers, water extraction and flow modification, adding weirs and other infrastructure, and habitat loss or modification, including removing fallen timber.

Climate change and severe weather are the third most prevalent threat. They are a problem for 54% of the species of conservation concern. Freshwater fish are increasingly threatened by climate change related impacts, such as bushfires, and extremes in droughts and floods.

Other common threats are: **agriculture and aquaculture**, including grazing, **farming and timber plantations** (38%); **pollution**, including soil erosion, sedimentation, herbicides and pesticides (38%); **hunting and fishing** (19%), **energy production and mining** (17%), and **urban development** (13%).

The most common conservation action is **occurrence in at least one protected area** (88% of of the species of conservation concern had this in place) and/or **occurrence within a conservation site** (55%). These were the only conservation measures documented for almost half of the species (44%).

Monitoring and planning is occurring for 30%. This was most common for species of conservation concern in Tasmania (64% of species), Murray-Darling Basin (46%) and South East Coast (Victoria) (42%).

Education and awareness programs were in place for 27%, including for all species of conservation concern in the South West Plateau Drainage Division.

Additional findings

The study found greater proportions of species are threatened in areas with more people (see Fig. 2), including in South West WA (55% of species assessed as threatened), Tas (54%) and South East Vic (45%).

An analysis of population trends found that of the species of conservation concern, 49 (46%) are declining, 23 (22%) are stable, 1 (1%) is increasing and 34 (32%) had insufficient data.



Invasive eastern gambusia are a major driver of the loss of native fish, as although they are small they nip the fins off other fish, devour their eggs and are an aggressive competitor for resources. Image: Rod Seager CC-BY-NC / iNaturalist

Galaxiids (Galaxiidae) – a family in trouble

The galaxiids are one of the most at risk Australian fish families with 31 of the 40 species (78%) listed as threatened. These species, growing to less than 15cm, occur in stream habitats across southeastern Australia and Tas. The galaxiids have been severely impacted by trout, predatory species which were introduced for recreational fishing (which continue to be stocked). Many galaxiids do not thrive or readily breed in captivity, so their persistence relies on the availability of perennial trout-free streams.

There has been some progress towards managing the threat of trout, but our assessment indicates that the status quo management of trout will result in extinctions of native galaxiids. Installing trout barriers where possible, and performing carefully considered translocations of galaxiids to establish new populations are key to ensuring their long-term survival. However, urgent sustained effort is needed to improve trout management, including collaborations with recreational anglers, increased awareness, and changing values among government and key sectors of society. Other threats to galaxiids include changes to flow regimes, inappropriate fire regimes and other climate-related threats.

Other families with large numbers of threatened species are cod and perch (Percichthyidae) – 14 of 22 species (64%), and rainbowfish (Melanotaeniidae) – 10 of 19 species (53%) are threatened.

The Critically Endangered stocky galaxias (Galaxias tantangara) is found only in a small section of stream above a waterfall which can't be scaled by trout. Image: Tarmo Raadik.



Brown trout were introduced from the United Kingdom. Image: Peguichas CC-BY-NC/iNaturalist

Trout

Since their introduction, trout species (brown and rainbow) have become widespread throughout much of the South East Australian mainland and Tasmania where they are major predators of small native fish like galaxiids and drive their loss. They are also a major contributor to declines of some threatened native frogs, like the spotted tree frog.

Trout breed in the wild. In addition, several million trout fingerlings are released into the wild by state governments every year to boost numbers for recreational fishing, placing additional strain on native fish populations across these regions.



Table 1: The species for which the national threatened species list is likely incorrect, and the proposed action required for each, including listing (35), up-listing (13), down-listing (3), de-listing (1), data collection to address data deficiency (5) and assessment for species undescribed at the time of the study (15). The categories are: EX - Extinct, CR - Critically Endangered, EN - Endangered, VU - Vulnerable, NT - Near Threatened, DD - Data Deficient, LC - Least Concern.

Scientific name	Common name	IUCN Red List category	EPBC Act listing Nov 2024	Jurisdiction	Proposed action
<i>Macquaria</i> sp. nov. 'Kangaroo'	Kangaroo River perch	EX		NSW	Listing
<i>Chlamydogobius squamigenus</i>	Edgbaston goby	CR	VU	QLD	Uplisting
<i>Craterocephalus fluviatilis</i>	Murray hardyhead	CR	EN	SA, Vic, NSW	Uplisting
<i>Galaxias tanycephalus</i>	Saddled galaxias	CR	VU	Tas	Uplisting
<i>Hypseleotris ejuncida</i>	Slender carp gudgeon	CR		WA	Listing
<i>Hypseleotris notata</i>	Drysdale gudgeon	CR		WA	Listing
<i>Milyeringa justitia</i>	Barrow cave gudgeon	CR		WA	Listing
<i>Pristis pristis</i>	Freshwater sawfish	CR	VU	WA, NT, QLD	Uplisting
<i>Scaturiginichthys vermeilipinnis</i>	Redfin blue eye	CR	EN	QLD	Uplisting
<i>Gadopsis</i> sp. nov. 'Western Vic'	SW 'Vic' blackfish	EN		Vic	Listing
<i>Galaxiella munda</i>	Western dwarf galaxias	EN		WA	Listing
<i>Glossogobius bellendenensis</i>	Mulgrave goby	EN		QLD	Listing
<i>Hypseleotris aurea</i>	Golden carp gudgeon	EN		WA	Listing
<i>Hypseleotris kimberleyensis</i>	Barnett River gudgeon	EN		WA	Listing
<i>Leiopotherapon aheneus</i>	Fortescue grunter	EN		WA	Listing
<i>Lepidogalaxias salamandroides</i>	Salamanderfish	EN		WA	Listing
<i>Melanotaenia gracilis</i>	Slender rainbowfish	EN		WA	Listing
<i>Melanotaenia utcheensis</i>	Utchee rainbowfish	EN		QLD	Listing
<i>Milyeringa veritas</i>	Cave gudgeon	EN	VU	WA	Uplisting
<i>Mogurnda clivicola</i>	Flinders Ranges mogurnda	EN	VU	SA, QLD	Uplisting
<i>Nannatherina balstoni</i>	Balston's pygmy perch	EN	VU	WA	Uplisting
<i>Nannoperca variegata</i>	Ewens pygmy perch	EN	VU	SA, Vic	Uplisting
<i>Neoceratodus forsteri</i>	Australian lungfish	EN	VU	QLD	Uplisting
<i>Neochanna cleaveri</i>	Australian mudfish	EN		SA, Tas, Vic	Listing
<i>Neosilurooides cooperensis</i>	Cooper Creek catfish	EN		SA, QLD	Listing
<i>Ophisternon candidum</i>	Blind cave eel	EN	VU	WA	Uplisting
<i>Paragalaxias dissimilis</i>	Shannon galaxias	EN	VU	Tas	Uplisting
<i>Paragalaxias electroides</i>	Great Lake galaxias	EN	VU	Tas	Uplisting
<i>Paragalaxias julianus</i>	Julian galaxias	EN		Tas	Listing
<i>Scortum neilli</i>	Angalarrri grunter	EN		NT	Listing
<i>Syncomistes rastellus</i>	Drysdale grunter	EN		WA	Listing
<i>Carcharhinus leucas</i>	Bull shark	VU		NSW, NT, QLD, SA, Vic	Listing

Scientific name	Common name	IUCN Red List category	EPBC Act listing Nov 2024	Jurisdiction	Proposed action
<i>Chlamydogobius japalpa</i>	Finke goby	VU		NT	Listing
<i>Chlamydogobius micropterus</i>	Elizabeth Springs goby	VU	EN	QLD	Downlisting
<i>Galaxiella toourtkoourt</i>	Little galaxias	VU		SA, Vic	Listing
<i>Glyphis garricki</i>	Northern river shark	VU		NT, WA	Listing
<i>Glyphis glyphis</i>	Speartooth shark	VU		NT, QLD, WA	Listing
<i>Hephaestus epirrhinos</i>	Longnose sooty grunter	VU		WA	Listing
<i>Hypseleotris hutchinsi</i>	Mitchell gudgeon	VU		WA	Listing
<i>Maccullochella macquariensis</i>	Trout cod	VU	EN	ACT, NSW, Vic, SA	Downlisting
<i>Macquaria</i> sp. nov. 'Hawkesbury'	Blue Mountains perch	VU		NSW	Listing
<i>Macquaria wujalwujalensis</i>	Bloomfield River cod	VU		QLD	Listing
<i>Melanotaenia pygmaea</i>	Pygmy rainbowfish	VU		WA	Listing
<i>Melanotaenia wilsoni</i>	Little rainbowfish	VU		NT	Listing
<i>Nannoperca vittata</i>	Western pygmy perch	VU		WA	Listing
<i>Neosilurus mollespiculum</i>	Softspine catfish	VU		QLD	Listing
<i>Rhadinocentrus ornatus</i>	Ornate rainbowfish	VU		NSW, QLD	Listing
<i>Syncomistes dilliensis</i>	Dillie grunter	VU		WA	Listing
<i>Syncomistes moranensis</i>	Moran grunter	VU		WA	Listing
<i>Variichthys lacustris</i>	Lake grunter	VU		QLD	Listing
<i>Bidyanus bidyanus</i>	Silver perch	NT	CR	ACT, NSW, QLD, SA, Vic	Downlisting
<i>Anguilla obscura</i>	Pacific shortfin eel	DD		QLD	Collect data
<i>Clupeoides papuensis</i>	Papuan River sprat	DD		QLD	Collect data
<i>Geotria australis</i>	Pouch lamprey	DD		NSW, SA, Tas, Vic, WA	Collect data
<i>Synclidopus hogani</i>	Sole	DD		QLD	Collect data
<i>Thryssa scratchleyi</i>	Freshwater anchovy	DD		NT, QLD	Collect data
<i>Maccullochella peelii</i>	Murray cod	LC	VU	ACT, NSW, QLD, SA, Vic	Delisting



The IUCN Red List assessment identified the southwest 'Vic' blackfish (*Gadopsis* sp. nov. 'Western Vic') as Endangered. It should be assessed for inclusion on Australia's national EPBC Act threatened species list. Image: Tarmo Raadik



Above: By preventing trout from moving upstream, this waterfall in NSW has protected the last population of stocky galaxias from extinction. But occurring in only one small section of stream is also a risk as the population could be wiped out by fire or drought. One of the most important actions to prevent extinctions of galaxiids is identifying and protecting new refuge sites where populations of native fish that are highly vulnerable to trout can be established. Image: Mark Lintermans

Left: The native trout cod (*Maccullochella macquariensis*), which occurs in ACT, NSW, Vic and SA, should be assessed for down-listing from Endangered to Vulnerable on Australia's EPBC Act threatened species list. Image: Glen Denning Family CC-BY-NC/iNaturalist.



Additional references:

Lintermans, M., Geyle, H.M., Beatty, S., Brown, C., Ebner, B.C., Freeman, R., Hammer, M.P., Humphreys, W.F., Kennard, M.J., Kern, P., 2020. Big trouble for little fish: identifying Australian freshwater fishes in imminent risk of extinction. *Pacific Conservation Biology* 26, 365–377.

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Biodiversity Council



The Biodiversity Council was founded by 11 universities with support from The Ian Potter Foundation, The Ross Trust, Trawalla Foundation, The Rendere Trust, Isaacson Davis Foundation, Coniston Charitable Trust and Angela Whitbread.