Disclaimer: The applicant's report addressing the Terms of Reference is circulated for public comment in compliance with section 303EF (2b) of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The views and opinions expressed in this report are those of the applicant and do not necessarily reflect those of the Australian Government or the Minister for the Environment and Water.

A draft report to address the potential environmental impacts associated with the importation of a *Melanotaenia praecox,* Neon Dwarf rainbowfish for use as an ornamental fish species within Australia.

[redacted]

Melanotaenia praecox

Melanotaenia praecox Photo © Gunther Schmida. Permission granted to use photograph.

Etymology:
Melanotaenia praecox (Weber & de Beaufort 1922). Praecox is a Latin term meaning premature, referring to elevated rhombic form, which is obtained at a much smaller size than all members of family known by the authors

Introduction
The keeping of tropical fish species in aquaria is growing in popularity and gained in popularity during the lock down period attributed to the Covid19 Pandemic. Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The ornamental aquatic life, fish, invertebrates, and aquatic plants industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld.

The Authors of this report will determine that the Rainbowfish, of the genus *Melanotaenia* do not possess any of the aspects of an organism that will cause problems should it escape effective human control. The undesirable aspects of an introduced pest are reproduced from a statement prepared for a Court Case in the NT when an aquarium shop bought unassessed imported aquatic life to a Darwin Aquarium Shop. The statement was to be presented in the witness box by the author 2 of this report, however the accused offender pleaded guilty.

Disease
Introduced unassessed aquatic life entering Australia without appropriate quarantine or a risk assessment of the exporting country can carry exotic parasites and disease that may negatively impact on native species and aquaculture enterprises.

Competition with native species
Introduced unassessed aquatic life that escapes human control may breed into very large numbers out competing native species for food and space possibly causing local extinctions of native species.

Destruction of aquatic habitat
Introduced unassessed aquatic life that escapes human control may damage waterways by digging and moving substrate causing water to be clouded with silt, smothering plants, and contributing to erosion.

Dangerous species
Introduced unassessed aquatic life that escapes human control may have features that are a danger to humans, large venomous spines, very sharp teeth, even high voltage electrical discharge and could pose a danger to recreational and commercial activities in natural waterways.

Impacts associated with Genetic Changes
Introduced unassessed aquatic life that escapes human control may be closely related to native aquatic life and be able to hybridise causing the loss of genetic diversity.

References:

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "*The effects of interacting with fish in aquariums on human health and well-being: A systematic review*" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. 2016 "*Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting*" published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

1. Taxonomy

Provide information on the taxonomy of the species including Family, genus, species and subspecies, as well as any synonyms.

Kingdom: Animalia
Phylum: Chordata
Class: Actinopterygii (ray-finned Fishes)
Order: Atheriniformes (Silversides)
Family: Melanotaeniidae (Rainbowfishes)
Genus: *Melanotaenia* (origin - Greek word *melanos* meaning black and the Latin word *taenia* meaning stripe.
Species: Melanotaenia praecox, x (Weber & de Beaufort, 1922), **Synonym**. Rhombatractus praecox Weber & de Beaufort, 1922. Dwarf Rainbowfish, Neon Dwarf Rainbowfish. Neon Rainbowfish.

Melanotaenia praecox (wild caught, Pagai Village) - photo© Gary Lange. Permission to use photo granted.

2. Identification

Discuss the identification of the individuals in this species, including if the sexes of the species are readily distinguishable, and if the species is difficult to distinguish from other species. Provide representative photographs of female and male specimens at all life stages. Ensure you have appropriate copyright permission as the report will be published on the department's website.

Species Summary

Melanotaenia praecox have an intense, bright neon blue body with red dorsal, anal, and caudal fins. They may reach a maximum size of 8 cm, but usually less than 5 cm SL. Males are generally larger and more colourful than the females. The fins of females often show a yellow-orange colour as well.

Melanotaenia praecox is very similar in appearance to *Melanotaenia rubrivittata*. The two species share a number of similarities including a neon-blue ground colour, brilliant red markings on the median fins, relatively small maximum size (less than about 50 mm SL), overlapping counts for dorsal rays, anal rays, pectoral rays, predorsal scales, and cheek scales, and most morphometric proportions. Genetic results reveal the two species are clearly separable. In addition, *M. praecox* lacks the characteristic red body stripes of male *M. rubrivittata*. The males of *M. praecox* also tend to be deeper bodied than males of *M. rubrivittata*. There is also a slight difference in snout length with *M. praecox* generally having a shorter snout than *M. rubrivittata*. Lastly, *M. praecox* has fewer lateral scales (usually 29-30 versus 32-33) and frequently has 11 transverse scales (always 10 in *M. rubrivittata*).

Distribution & Habitat

Melanotaenia praecox was initially collected by the Dutch naturalist W.C. van Heurn in 1910 from a tributary of the Mamberamo River in West Papua. Gerry Allen collected specimens in 1991 from two small localities near the airstrips at Dabra and Iritoi on the edge of the Mamberamo Plains (middle portion of the Mamberamo River). In 2000, he collected more specimens from a tributary of the Tiri River approximately 4 km west of Dabra. The habitat consisted of a small, turbid stream (average 4 m wide and 0.5 m deep with pools to 1.5 m), slow flowing over mud, gravel, and leaf litter and running through closed canopy rainforest. Temperature 24 - 29°C and pH 6.6 - 8.0. In 2008, additional live specimens were collected from near the village of Pagai in the Mamberamo River region by Johannes Graf and Gary Lange.

Keeping & Caring

I obtained aquarium-bred specimens of *Melanotaenia praecox* in August 1994, from a hobbyist in Germany and maintained a small population until around 2000. I successfully bred and raised the fry under the following water conditions: Temperature 26-29°C, pH 7.5-8.0, Alkalinity 30-75 mg/L, Conductivity 410-500 µS/cm, and hardness levels of 80-120 mg/L.

Breeding trials conducted by Said (2008) with *M. praecox* over a six-month period on the viability regarding the number of eggs, fertilisation rate, hatching rate, the length of incubation period, and survival rate in a seven days rearing period. While observations of growth rate, survival rate, and male percentage were conducted until 6 months old in three replicates. The results reported the average of number of eggs was 27 eggs/spawning, fertilisation rate was 92.93%; hatching rate was 98.18%; length of incubation period was 8 days (7-9), and survival rate in the seven days rearing period was 89.45%, respectively. The growth rate up to 6 months rearing period was 3 cm, while the survival rate was 94 (92-96)%, and the male percentage was 42.58%.

In another study (Radael *et al*., 2013) *M. praecox* embryos were examined throughout their development to describe the initial ontogeny. The mean values reported for the physical and chemical parameters of the water from the incubators during the trial period were 28.06 ± 0.49°C for temperature, 6.98 ± 0.15 for pH and 8.78 ± 0.85 mg/L for dissolved oxygen. The diameter of the newly fertilised eggs varied from 0.99 mm to 1.04 mm. The fertilised eggs had a spherical shape, with a translucent corium and yolk sac. The eggs had adhesive filaments in a small area of the corium close to the animal pole that are used for adhesion to the spawning substrate. Eggs that were not fertilised appeared opaque.

Hatching of *M. praecox* embryos began at 119.50 hours post-fertilisation and continued until 126.53 hours post-fertilisation. The main features of the newly hatched larvae were excellent swimming activity, a reduced yolk sac, mouth movement and an apparently functional digestive system, which is similar to observations of other *Melanotaenia* species. Newly hatched larvae still contained yolk residue with droplets of oil. Filling of the swim bladder could not be observed in the newly hatched larvae of *M. praecox*, but sinking did not occur when they stopped swimming. Larvae of *M. splendida* (Humphrey *et*

al., 2003) fill their swim bladder at the moment of hatching. Newly hatched larvae were very active and possessed excellent swimming ability.

Remarks
Melanotaenia praecox were originally introduced to the aquarium hobby by Charles Nishihira around 1991 who had obtained wild-caught specimens from a local aquarist in Jayapura. Heiko Bleher collected live specimens from an undocumented location in 1992. Fish from all collections have been bred and distributed in the aquarium hobby.

Early Stages -

The eggs and larvae of most species of *Melanotaenia* are very similar, mostly clear or light amber in colour, usually 0.5 mm to 1.5 mm diameter but mostly about 1.0 mm with a few sticky filaments coming from the egg. The larvae are generally 4 to 5 mm long on hatching. A request was sent to Johannes Graf of Germany and he sent back two photos, eggs and small fry of *Melanotaenia* with permission to publish in this report.


Photo : Johannes Graf – permission to use photo obtained 28/01/2023

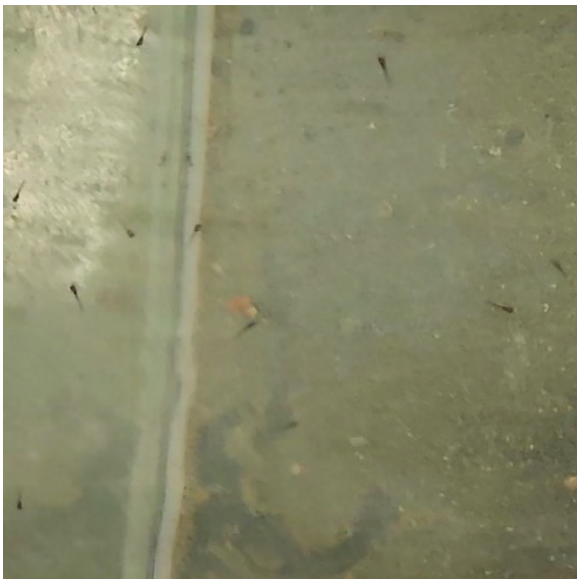


Photo: Johannes Graf – permission to use photo obtained 28/01/2023

The visual identification of the species from eggs or larvae would not be possible. To correctly identify species from such a small sample would require the use of a molecular biologist to identify samples to DNA level..

The larvae of *Melanotaenia* are approx. 4 mm similar to all other newly hatched rainbowfish. Most rainbowfish species are hard to identify until 2cm in length or larger. Lange's Rainbowfish I easily distinguished from the closest looking relative.

Sexual maturity is reached at a size of approx. 25 mm SL and 6 months of age, based on aquarium observations. Males develop a deeper body than females, and have moderately elongated and pointed unpaired fins, compared with short and rounded in females. Colour of the unpaired fins in males red, fading to yellowish orange towards the body, those of females translucent with faint dark margin. In males, the tip of the first dorsal fin is coloured whitish blue and extends posteriorly past the origin of the second dorsal fin, which is not the case in females. Depth of the body in adult males (over 50 mm SL) ranges from 32–37% of SL, and for females from 30–33% of SL. Males below 50 mm SL show the same proportions as females. Males develop elongated dorsal and anal fins from approx. 25 mm SL, based on aquarium observations.

Reference:

Tappin A.R. (2018) “Rainbowfish”, URL - https://rainbowfish.angfaqld.org.au/Praecox.htm

3. Conservation Status

Provide information on the status of the species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the IUCN. For example, is the species listed on CITES Appendix I, II or III, and if so, are there any specific restrictions on the movement of this species? Is the species included in the IUCN Red List of Threatened Species? Include information on the conservation value of the species.

A search of Convention for International Trade in Endangered Species (CITES) checklist with the search terms “Rainbowfish” and “*Melanotaenia*” revealed no results for those entities. Found at: https://cites.org/eng/search?search_api_fulltext=rainbowfish and https://cites.org/eng/search?search_api_fulltext=melanotaenia+ respectively.

Melanotaenia praecox has most recently been assessed for *The IUCN Red List of Threatened Species* in 2020. As the species has a limited distribution, the IUCN RedList will always score a higher classification *Melanotaenia praecox* is listed at Least Concern. Assessment shows:

Allen, G.R. & Kadarusman. 2020. Melanotaenia praecox. The IUCN Red List of Threatened Species 2020: e.T13074A147688071. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T13074A147688071.en

Red List Category & Criteria: Least Concern ver 3.1

Year Published: 2020

Date Assessed: December 6, 2019

Justification:
This species is widespread in the Mamberamo River system. There are a number of localised threats but no major threats across the entire range. Therefore, it is assessed at Least Concern.

Previously Published Red List Assessments
1996 – Data Deficient (DD)
1994 – Rare (R)

The authors believe that if a small colourful fish such as a rainbowfish from Papua or Irian Jaya was listed, it should be cultured and kept in captive populations bred from a limited collection of wild

specimens taken at a time of plenty, usually at the end of the wet season populations are at their most abundant. The species that we are applying for are all available as captive bred. There is no need to harvest from the wild.

The NT Government employed a world-renowned environmentalist to formulate its "Sustainable Use of Wildlife as a Conservation Tool" policy. [redacted] helped Author 2 formulate a method to use vulnerable small fish as an aquarium subject and sell it with a care sheet and information about its status, then share profits from sales with the land owner. This gives the fish or other wildlife value and the species and its habitat will be more likely considered during any further development of the land.

References.

CITES. Convention on International Trade in Endangered Species of Wild Fauna and Flora. https://cites.org/eng accessed on 25/03/2023

IUCN. 2022. The IUCN Red List of Threatened Species. Version 2022-2. Available at: https://www.iucnredlist.org

IUCN. 2022. The IUCN Red List of Threatened Species. Version 2022-2. Available at: https://www.iucnredlist.org/species/13074/147688071

Lawson, David (1997) The Northern Territory Government policy "*Strategy for Conservation through Sustainable Use of Wildlife*" located at : https://www.aquagreen.com.au/files/strategy_for_conservation_through_sustainable_utilisation_of_wildlife.pdf

4. Purpose and source of import

Provide a summary of the types of activities that the specimen may be used for if imported into Australia (e.g., research, education, exhibition, conservation breeding, household pet or travelling exhibition, or for commercial purposes) and from where the animals will be obtained. Please include information on the rationale for this species, the numbers you want to import and standards for importation.

If approved, farmed specimens of *Melanotaenia praecox* will be sourced from Licensed overseas exporters with product approved for import under Australian Biosecurity regulations. There are approved farms producing this species in Indonesia, Germany and the United States of America.

The species is to be used as an ornamental species and will be farmed by Author 2 under NT Fisheries Aquaculture License C1/533 for sale to aquarium fish distributors, aquarium shops and aquarium hobbyists within Australia. It is also likely to be imported by larger ornamental fish importers such as Aquarium Industries and Bay Tropical Fish for sale through Australian retail aquarium outlets.

Studies into mental health have proven that an aquarium can produce a soothing effect on the human mind that tends toward anxiety. This trend to worry about the future seems to be increasing in recent times. Studies have demonstrated stress reduction from viewing aquatic life in an aquarium, lower heart rates and decrease in blood pressure. (Clements 2019 and Cracknell 2016)

The Aquarium Industry is not like industries that produce food and shelter it is more like the Fashion Industry that relies on new products to excite customers to buy the latest trend. The rise of social media and other instant news forums has produced an intense interest in owning possessing the latest trend. This has happened recently with the smuggling of the small Mexican red crayfish and the Indonesian Assassin Snail. Neither of those are on the allowable import list. There is also a large Australia wide trade in red cherry shrimps and other small colourful crustaceans, all of which are smuggled except the native species from tropical NT and Qld. Author 2 had a couple of conversations with Mary Bomford about 2005, she said that enthusiasts will go to great lengths to obtain the latest fish discovery by-passing disease controls and environmental risk assessment. However, she said that if they can obtain the animals legally the enthusiasts are more likely to report on the smugglers.

References:

Bomford, M. and Glover, J. (June 2004) "Risk assessment model for the import and keeping of exotic freshwater and estuarine finfish"

Clements, Valentin, Rankin, Baker, Gee, Snellgrove, Sloman (2019) "The effects of interacting with fish in aquariums on human health and well-being: A systematic review" published by Institute of Biomedical and Environmental Health Research, School of Health and Life Sciences, University of the West of Scotland, Paisley, United Kingdom.

Cracknell, White, Pahl, Nichols & Depledge. (2016) “Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting” published by Environment and Behavior2016, Vol. 48(10) 1242 –1269© 2015 SAGE Publications

5. Legislative controls

Provide information on all other Commonwealth, state and territory legislative controls on the species, including the species' current quarantine status, or pest or noxious status, or whether it is prohibited or controlled by permit or licence in any state or territory.

In the book by Robert Francis (2012) *A Handbook of Global Freshwater Invasive Species* , there are no references or instances of *Melanotaenia* being an invasive or noxious species, anywhere in the world.

The Commonwealth Government

Regulation of fish imports is in two parts, biosecurity and possible risk to the environment. Environmental risk is controlled and assessed under provisions the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia and shows that *Melanotaenia species* are not included on the current list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 Information about importation of fishes is available on Department of The Environment and Energy web site accessed on 25/03/2023 at https://www.legislation.gov.au/Series/F2006B01053

The disease risk assessment used to be controlled by the provisions of the Quarantine Act 1908. The current legislation is the Biosecurity Act 2015 as in force 9th April 2020 available at https://www.legislation.gov.au/Details/C2020C00127 and accessed 25/03/2023. The Australian Government Department of Climate Change, Energy, the Environment and Water is responsible for the administration of these acts.

The Northern Territory Government

The Northern Territory Fisheries Division Department of Industry, Tourism and Trade will not allow *Melanotaenia species* across its border unless they has passed the Commonwealth guidelines for acceptance into Australia. The list of species of fishes allowed into the Northern Territory for ornamental fishes is the same as Commonwealth list under the provisions of the EPBC Act 1999 or native to Australia but with the possibility of having the native species rejected if it is deemed unsuitable by the NT. Minister for Fisheries as outlined in section 26 of the Northern Territory Fisheries Regulations 2017.

The most current version of the Northern Territory Fisheries Regulations accessed at Aquatic pests: marine and freshwater on 25/03/2023 shows that no *Melanotaenia species* are listed on this schedule as a noxious fish

The Queensland Government

The Queensland legislation to control possession of noxious fish called “Restricted Matter” comes under the provisions of the Biosecurity Act 2014, Schedule 2 lists Noxious Fish in the Restricted matter schedule . Part 6 of the Act lists further Noxious Fish. No *Melanotaenia species* are listed on this schedule as noxious fish or listed in the restricted matter schedule. In Queensland, invasive fish are listed under the Biosecurity Act 2014 and the Biosecurity Regulation 2016 The most current version of Queensland Biosecurity Act 2014 accessed on 25/03/2023 at: Invasive fish of Queensland (06/20)

The Western Australian Government

Under Regulation 176 of the Fish Resources Management Regulations 1994, a person must not bring into the State a species of fish not endemic to the State without the written approval, or written authority, of the Executive Director of the Department of Fisheries. Species listed as noxious under Schedule 5 of the Fish Resources Management Regulations 1995 and prohibited to be imported into the State. There are no *Melanotaenia species* listed as noxious or restricted in Western Australia. West Australian Government Fish Resources Management Regulations 1995 current at April 2021, and accessed 25/03/2023 at, http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf , and shows no *Melanotaenia* on that list.

The South Australian Government

Section 49 of the Fisheries Act 1982 makes it an offence to import or sell exotic fish. The South Australian Fisheries regulations relating to exotic aquarium fish are the Fisheries (Exotic Fish, Fish Farming and Fish Diseases) Regulations 2000, Regulations under The Fisheries Act 1982. Part 6 of the regulations creates schedule 3 that lists the fishes exempt from Section 49 of the fisheries Act. The ACT can be found at: Fisheries ACT 1982 . The South Australian Government of noxious fish list accessed 25/03/2023, is available at

http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list#toc1 and shows no *Melanotaenia* on that list.

The New South Wales Government
On 1 July 2017, the way government, industry and the community manage biosecurity in NSW changed. The *Biosecurity Act 2015* (the Act, No. 24) came into effect on 1 July 2017. The regulations, instruments, policies and procedures that underpin the Act were developed in consultation with industry, community and government partners. Under the *Biosecurity Act 2015* there is a general obligation on people to be aware of their surroundings and take action to prevent the introduction and spread of pests, diseases, weeds and contaminants. Read about the general biosecurity duty.

The New South Wales noxious fish list accessed on 25/03/2023, is available at https://www.dpi.nsw.gov.au/fishing/aquatic-biosecurity/pests-diseases/freshwater-pests/freshwater-finfish , and shows no *Melanotaenia* on that list

The Victorian Government
Section 75 of the Victorian Fisheries Act 1995, allows the declaration of certain species as "Noxious Aquatic Species". The Victorian Government publishes the Noxious Aquatic Species List on their web site. No *Melanotaenia species* appear on this list. The list of Victorian Government declared noxious species is available.

The Victorian Fisheries Act accessed 25/03/2023 is available at https://vfa.vic.gov.au/operational-policy/pests-and-diseases/noxious-aquatic-species-in-victoria/noxious-aquatic-species-in-victoria and shows no *Melanotaenia* on that list.

Tasmania
To import freshwater aquarium or pond fish into Tasmania the Inland Fisheries Service requires registration as a Fish Dealer. Certain species may be imported under permit with written consent of the Director of the Inland Fisheries Service. Species listed as Controlled under the *Inland Fisheries Act 1995* cannot be imported into Tasmania. These species include European carp (*Cyprinus carpio*) mosquito fish (*Gambusia* spp.) Didymo a freshwater algae (*Didymosphenia geminata*) and freshwater turtles. The Tasmanian noxious list accessed on 25/03/2023 can be found at: http://dpipwe.tas.gov.au/invasive-species/invasive-animals/invasive-freshwater-species there are no *Melanotaenia* listed on the page.

Under the *Biosecurity Act 2019* there is a general obligation on people to be aware of their surroundings and take action to prevent the introduction and spread of pests, diseases, weeds and contaminants. Read about the Biosecurity Act 2019.

Australian Capital Territory
Under s. 155 of the Nature Conservation Act 2014, held under a nature conservation licence, or listed on Part 1 of the Live Import List, established under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999. Part 1 of the Live Import List identifies non-native animals that can be brought into Australia without a permit.

Under s. 22 of the Act, it is an offence for a person to keep a prohibited pest animal if the person is 'reckless' about whether the animal is a prohibited animal and is also 'reckless' about whether keeping the animal would result, or would be likely to result, in the spread of prohibited animals of that kind. For example, a person who keeps a fish that is declared as a prohibited pest animal is unlikely to be committing an offence if they keep that fish isolated in a tank and do not allow it to spread into public waters. However, if the species is also declared as notifiable, that person will now be required to notify the ACT Government that the species is being kept.

Proposed Amendments to the Pest Plants and Animals (Pest Animals) declaration discussion paper (May 2019) was to be published in 2020. It was accessed on 25/03/2023. It can be found at: Proposed amendments to the pest plants and animals (pest animals) declaration . There are no *Melanotaenia* species listed.

6. Is the species highly domesticated or captive bred for commercial, angling or ornamental purposes?

Melanotaenia praecox are widely available from commercial fish exporters overseas. Some have been commercially available for 40 years. The main purpose of the collection of various species was to use the species as an ornamental species. The species have been successfully introduced to many countries. Specimens have made their way to an Indonesian Commercial breeder and Commercial breeders in Europe and North America, which most of the fish would be obtained from. Fishbase notes that the majority of the Melanotaenia family are used commercially as an aquarium fish.

References:

Froese, R. and D. Pauly. Editors. 2023.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2023) available at: https://www.fishbase.se/NoRecord.php?Type=Summary&typesearch=simple&crit1_operator=EQUAL&crit1_value=Melanotaenia&crit2_operator=EQUAL&crit2_value=&group=summary&computeall=false

IUCN. 2022. The IUCN Red List of Threatened Species. Version 2022-2. https://www.iucnredlist.org. Accessed on 25/03/2023 available at: https://www.iucnredlist.org/search?query=melanotaenia&searchType=species

7. Has the species established one or more self-sustaining populations beyond its native range?

Provide information on the locations this species has been introduced and/or established populations outside its range, and if so, where those populations are.

No records of *Melanotaenia praecox*, were found as being introduced in any waterways in the world.

Reference:

Froese, R. and D. Pauly. Editors. 2023.FishBase. World Wide Web electronic publication. www.fishbase.org, 02/2023 available at: https://www.fishbase.se/country/CountryChecklist.php?showAll=yes&what=list&trpp=50&c_code=608&cpresence=Reported&sortby=alpha2&ext_CL=on&ext_pic=on&vhabitat=fresh

8. Are any subspecies or varieties referenced on FishBase (https://www.fishbase.se/search.php)?

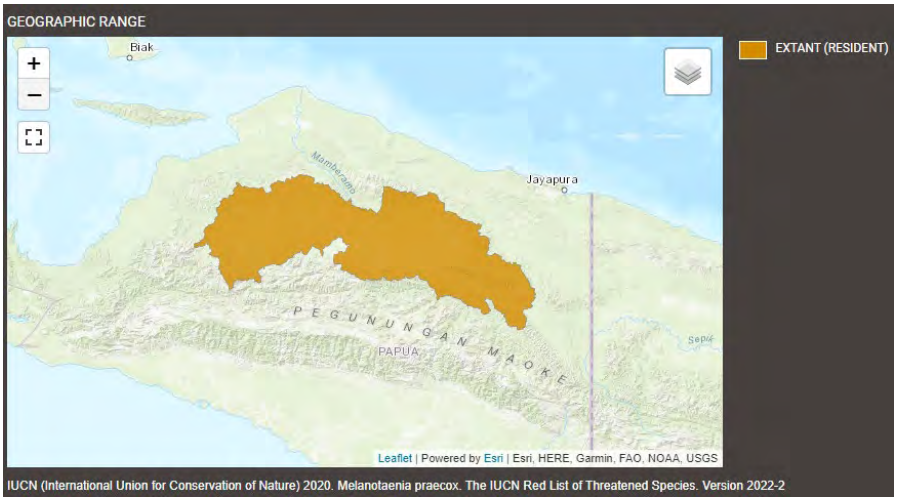
A search of the IUCN RedList Accessed on 25/03/2023 available at: https://www.iucnredlist.org/search?query=melanotaenia&searchType=species Shows there are no sub species or varieties listed.

Reference:

IUCN. 2022. The IUCN Red List of Threatened Species. Version 2022-2. https://www.iucnredlist.org. Accessed on 25/03/2023 available at: https://www.iucnredlist.org/search?query=melanotaenia&searchType=species

9. What is the country of origin and the natural distribution of this species?

Range Description: This species is known only from the Middle Mamberamo River system of Papua Province, Indonesia (Weber and de Beaufort 1922, [redacted]).



Country Occurrence: Native, Extant (resident): Indonesia (Papua)

Population:
This species was common when collected in 2002 and 2008 [redacted]. The population trend is presumed to be stable.

Current Population Trend: Stable

Habitat and Ecology
This species occurs in clear, relatively swift-flowing streams in primary rainforest bordering the Mamberamo Plains. It can grow to a maximum size of about 4 cm SL (Weber and de Beaufort 1922, [redacted]).

Systems: Freshwater (=Inland waters)

Use and Trade This species is found in the aquarium trade, but individuals are from captive bred populations [redacted]

Threats
At present, the region which this species inhabits is largely undisturbed. However, future threats to biodiversity in northern New Guinea include regional development plans, such as construction of forest concessions, oil palm plantations, coal mines, and the proposed Mamberamo Dam. Invasive species are also found within the distribution.

Conservation Actions
The distribution of this species is within a natural reserve. However, there are no conservation actions in place for this species. Research into the population and distribution is recommended.

Recently, (2022) A project, funded by the Environmental Biosecurity Project Fund through the Commonwealth Department of Agriculture, Water, and the Environment, to assess whether 447 species of fish on the "greylist" (fish claimed to be in Australia before the EPBC Act came into effect. The publication by Millington et al. using the South Australian Research Development Institute (SARDI) risk assessment tool (Deveney 2018), capable of identifying the invasive potential of grey-listed non-indigenous ornamental species traded within Australia. This tool uses queries to score three categories: 1) estimation of the likelihood of release, 2) likelihood of invasion, and 3) an assessment of consequences. Through the use of a series of scores based on the presence or absence of specific parameters that encompass different contributions to risk posed by each parameter, species are categorised as:

1. "high risk" (>150)
2. "moderate risk" (51 – 149)
3. "low risk" (<50)

Eleven species of rainbowfish from the Melanotaenia family, were fast assessed. They were all assessed as having a "low" chance of: 1) estimation of the likelihood of release, 2) likelihood of invasion, and 3) an assessment of consequences.

The authors of these reports will be applying for 9 of these 11 species. Each of these species will have an individual report prepared.

Melanotaenia boesemani	Boeseman's rainbowfish	HT	LV	Yes	None	L	32		
Melanotaenia herbertaxelrodi	Lake Tebera rainbowfish	HT	LV	Yes	None	L	16		
Melanotaenia kamaka	Kamaka rainbowfish	HT	LV	No	No	L	7	DD	DD
Melanotaenia lacustris	Lake Kutubu rainbowfish	HT	LV	Yes	None	L	32		
Melanotaenia papuae	Papuan rainbowfish	MT	LV	No	No	L	6	DD	DD
Melanotaenia parkinsoni	Parkinson's rainbowfish	MT	LV	No	No	L	6	DD	DD

Melanotaenia parva	Lake Kuromai rainbowfish	MT	LV	No	No	L	7		
Melanotaenia praecox	Dwarf rainbowfish	HT	LV	No	No	L	14		
Melanotaenia sexlineata	Fly River rainbowfish	MT	LV	No	No	L	18	DD	

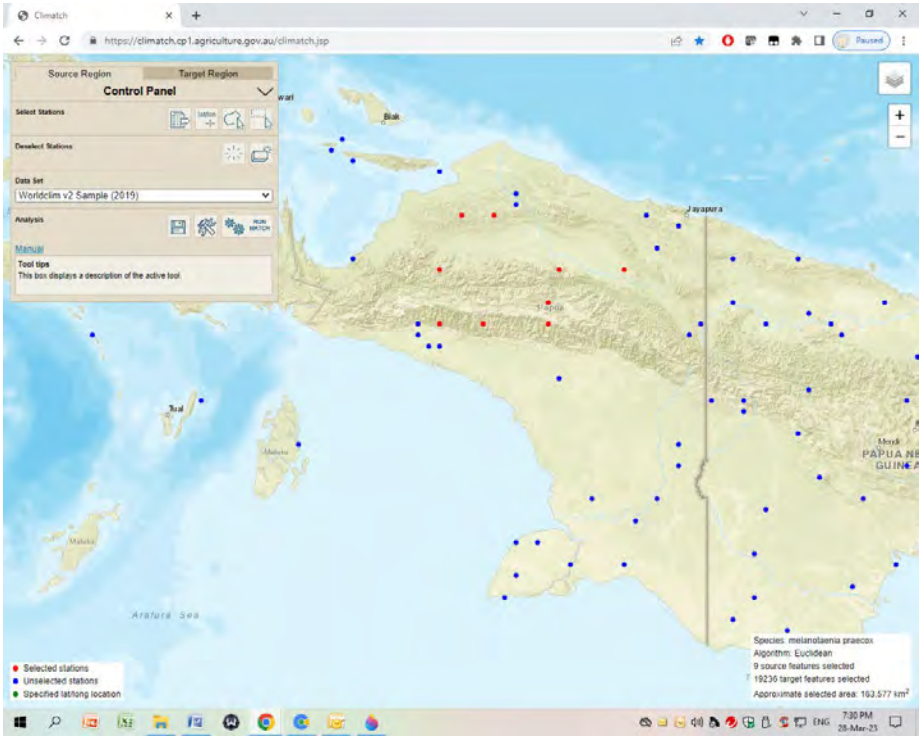
As acknowledged in the Millington et al. (2022) report, the SARDI tool is not appropriate for an Australian-wide risk assessment. It overlooks key information, includes features that resulted in underscoring, and data deficiencies were a continuing theme. The authors noted that precautionary principles were not applied in the SARDI tool, and the prevalent data deficiencies may have resulted in underscoring of invasive potential, marring true invasion risk. Consequently, the authors note that the department does not take into consideration the outcomes of the Millington et al. (2022) study when assessing species for the Live Import List.

Reference:

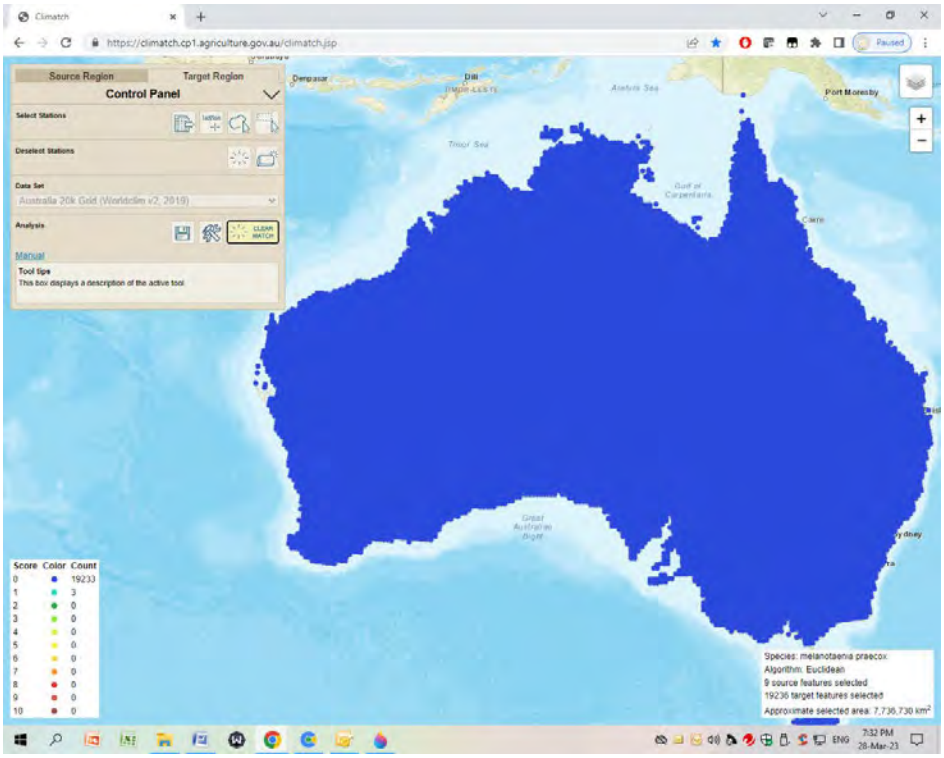
Millington M, Sierp M, Gaylard S (2022) Assessing the Invasiveness Risk of Non-Indigenous Fish in theAustralian Ornamental Trade. Department of Agriculture and Fisheries, Brisbane. 62pp.

10. Are there areas in Australia that are climatically similar to the species' native range?

Climatch Source Region



Climatch Target Region



Using the copy of Climex for PC, the process indicates the species has a low to moderate chance of survival in Australian water ways.

Reference:

ABARES 2020, Climatch v2.0 (Australian Bureau of Agriculture and Resource Economics and Sciences) November 2020'

11. In the species' introduced range, are there impacts to:
wild stocks of angling or commercial species
aquacultural, aquarium or ornamental species
rivers, lakes, threatened species or ecological communities?

If any boxes are ticked, please provide additional information.

Melanotaenia praecox have not been introduced as an angling species, too small, no use to anglers. There are only 3 records of melanotaenia being introduced outside their natural range, and the introductions were not successful. There are no threat to any threatened species or ecological communities. (Fishbase)

Reference:
Froese, R. and D. Pauly. Editors. 2023.FishBase. World Wide Web electronic publication. www.fishbase.org, 02/2023 available at: https://www.fishbase.se/country/CountryChecklist.php?showAll=yes&what=list&trpp=50&c_code=608&cpresence=Reported&sortby=alpha2&ext_CL=on&ext_pic=on&vhabitat=fresh

12. Are other members of the genus known to be invasive?

The authors could find no references or records of rainbowfish being invasive. The three major genera of Rainbowfishes, Melanotaenia, Chilatherina were searched on Fishbase, there are a couple of records of Rainbowfishes being introduced into natural waters of the Philippines. There is no information to suggest any of them have established. There is no record of *Melanotaenia species* being introduced into any waterways. A Search of Melanotaenia, Chilatherina and Glossolepis on Fishbase. https://www.fishbase.se/search.php showed no results.

Reference:
Froese, R. and D. Pauly. Editors. 2023.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2023) accessed on 25/03/2023 at: https://www.fishbase.se/search.php

13. **Does the species have any harmful characteristics (poisonous/venomous/spines/aggression), or pose any risks to human health?**

Fishbase, report that *Melanotaenia praecox* are harmless to humans.

Reference:
Froese, R. and D. Pauly. Editors. 2023.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2023) *Melanotaenia* https://www.fishbase.se/Nomenclature/ScientificNameSearchList.php?

14. Is the species known to be aggressive towards other species? Does the species out-compete native species?

Males with close areas will sometime circle each other flaring their fins. This rarely causes any damage and as it is mostly stylised display to establish male dominance. Rainbowfishes are peaceful towards each other and other species except for the male displays mentioned earlier. Keepers of aggressive species such as some cichlids use rainbowfishes as “dither fish” to diffuse aggressive behaviour because they are able to keep out of the way and distract the aggressive species from hurting each other.

References:
Allen, G.R. & Cross, N.J. (1982) “*Rainbowfishes of Australia and Papua New Guinea”*. Published by Angus and Robertson.

Tappin, A.R., (2015) “Home of the Rainbowfish”, https://rainbowfish.angfaqld.org.au

15. Is the species parasitic of other species?

The authors could find no references or records of rainbowfish being parasitic.

References:

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Froese, R. and D. Pauly. Editors. 2023.FishBase. World Wide Web electronic publication. www.fishbase.org, (02/2023) *https://www.fishbase.se*

16. Is the species unpalatable to, or lacking, natural predators?

Although the fishes swim in the open, shelter in the form of aquatic vegetation and submerged forest debris is never far away. Fry and young fish are strongly reliant on cover, not only to escape normal predators, but also cannibalism by larger individuals of their own species. Young are often present in large numbers among submerged grasses and other shoreline vegetation. Predators of adult rainbows include large fishes such as **grunters** (family Terapontidae), **cardinalfishes** (genus *Glossamia),* **Barramundi** *(Lates calcarifer),* and freshwater **snappers** *(Lutjanus).* They are also preyed on by a variety waterfowl, especially during drought periods when water levels are greatly reduced. Last, but not least, humans occasionally hunt rainbows for food. Neat piles of freshly caught Red Rainbows are sold at the market next to Lake Sentani. Allen 1995, "I've only resorted to eating rainbows on one occasion - during a jungle trek in New Guinea when there was nothing else to eat. They were terrible - the flesh was full of bones and laced with a strong formic-acid flavour".

Reference:
Allen, G.R., (1995) Rainbowfishes In Nature and in the Aquarium, Their identification, care and breeding. Tetra-Verlag Germany. ISBN 1-56465-149-5 (pp.20)

17. What native species would the species likely feed upon? Are natural predators of these native prey species also present?

The diet of *Melanotaenia praecox* has been recorded. The diet of other members of the *Melanotaenia* genus are well recorded. All rainbowfishes of the family Melanotaeniidae are reasonably similar in their dietary preferences. They are omnivores, eating a variety of small aquatic and terrestrial creatures and plant matter. Rainbowfishes have villiform teeth that extend outside their mouth around their lips to enable them to scrape algae from submerged hard surfaces. The diet includes algae, ants, aquatic insect larvae and small crustaceans. (Allen 1991)

References:
Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A.R., (2011) "*Rainbowfishes, their care and keeping in captivity*" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

18. Does the species host, and/or is it a vector, for one or more recognised non-native infectious diseases/parasites (see Australia's National List of Reportable Diseases of Aquatic Animals)?

No, none of the diseases recorded on the **Australia's National List of Reportable Diseases of Aquatic Animals** are applicable. Rainbows and blue-eyes are remarkably free of disease in normal circumstances. I have sometimes gone for several years at a time without any disease problems. Often, when obvious diseases do occur, they tend to be isolated incidents affecting only a few fish in one particular tank. It may seem cruel, but I prefer to destroy diseased fish, lest they contaminate others. New fish should be quarantined for 1 -2 weeks in order to be absolutely certain that no diseases are evident. Also it is advisable to avoid routinely moving fish from one tank to another, particularly if the water chemistry varies in your fish room. The chance of disease is greatly reduced if your fishes are given plenty of space. This is easier said than done. especially if you are breeding.

A very manageable situation, with lots of fry being held in small containers, quickly turns to chaos when the fish begin to grow. Two of the most common crowd-induced diseases are white spot (Ichthyopthirius multifilis) and velvet disease (Oodinium). Both are caused by parasitic protozoans. They can be treated with standard remedies sold by aquarium dealers. There is a large range of so-called "cures", but they vary greatly in quality and effectiveness. Body and fin fungus (Saprolegnia) occasionally attacks

rainbows, particularly if they have wounds resulting from fighting or scraping against sharp objects. Chances are the infection will spread to other fishes in the same tank so it is best to treat the entire tank. Increased temperature (up to 5‘ C if fish are being held at temperatures below 25° C), stronger aeration, bottom cleaning with a siphon, and partial water changes (20 percent) every 2-3 days should help to overcome the problem, If it does not completely disappear, use also a special medication.

Reference:
Allen, G.R., (1995) Rainbowfishes In Nature and in the Aquarium, Their identification, care and breeding. Tetra-Verlag Germany. ISBN 1-56465-149-5 (pp.39-40)

19. What is the species' common and maximum body size?

Melanotaenia praecox which has a recorded maximum of size of 8cm, but most are under 5cm.

Reference:
Tappin (2011) "*Rainbow Fishes, their care and keeping in captivity*" available as a download from URL https://rainbowfish.angfaqld.org.au/Praecox.htm

20. Does the species have a wide salinity tolerance at any stage of its life cycle?

According to the IUCN Redlist: Melanotaenia praecox occurs in clear, relatively swift-flowing streams in primary rainforest bordering the Mamberamo Plains.

Reference:
IUCN. 2022. The IUCN Red List of Threatened Species. Version 2022-2. https://www.iucnredlist.org. Accessed on 25/03/2023 available at: https://www.iucnredlist.org/species/13074/147688071

21. Is the species (at any life stage) able to withstand being out of water for extended periods (e.g. minimum of one or more hours)?

The only reference that Author 1 found was: The eggs are tough and can withstand short periods (10-15 minutes) out of water as long as they are kept moist. Author 2 breeds many species of Rainbowfishes [redacted] and can attest that they die quite quickly when removed from the water. It is not conceivable that any *Melanotaenia* species would be much different.

Reference:
Allen, G.R., (1995) "*Rainbowfishes In Nature and in the Aquarium, Their identification, care and breeding*". Tetra-Verlag Germany. ISBN 1-56465-149-5 (p.35)

22. Is the species tolerant of a range of water velocity conditions?

There is no information available on the ability of *Melanotaenia praecox* to negotiate white water rapids, however there is general information about how most species of fish travel. Tappin 2011 states smaller rainbowfishes prefer slow or no current, adults congregate in areas of slow and moderate flow near obstacles and aquatic vegetation. The tendency for Australians to make dams and weirs over all flowing waters has reduced the distribution of many freshwater species by restricting travel and lowering water temperatures. Author 2 collected rainbowfishes in the billabongs adjacent the Murrumbidgee River near Wagga Wagga NSW in the 1970's, but now no one has been able to locate that species in the same places from the 1990's onward.

Rainbowfishes and Blue-eyes can be located in floodwaters at the margins of creeks and rivers outside their banks among riparian grasses and other vegetation, both authors have collected rainbowfishes while avoiding crocodiles in floodwaters of the Howard River in the grassland adjacent the river in the early 2000's wet season. There are larger barriers such as waterfalls in Kakadu National Park where there are different species above the waterfalls to what is found below the waterfalls. During wet season migrations of forage fishes professional ornamental fish collectors in the NT, catch fishes that accumulate at restrictions to upstream movement of fishes. The NT A12 Licensed collectors at Scotts Creek on the old Woolner Station access road put a trap above the small restriction of the road in the latter stages of the wet season. The trap was designed to catch fishes that had negotiated the fast water, not white water but a fast riffle and a rise of 30 to 40 cm from the creek level below the bridge obstruction. The trap caught grunters and Plotosidae catfish but not rainbowfishes. That is an

observation of Author 2, who assisted Albert Costa the NT Fisheries A12 licensed collector. That area is now a National Park and the fishes are not used by humans any longer but die in their thousands from the man made structure and make the water birds gorging on dying fish so fat they can hardly fly.

In general from observations of Australian Rainbowfishes they do not negotiate fast water but travel along the margins in times of flood when the obstacles are under many more meters of water. They cannot travel from one river system to the next via the sea as they are not tolerant of seawater.

23. Does feeding or other behaviours of the species reduce habitat quality for native species?

For example, benthic foraging or burrow construction that leads to an increase in suspended solids, reducing water clarity?

Rainbowfishes are nearly all mid water to surface ranging and a species forming loose aggregations that do not disturb any substrate or any other underwater structures that would lead to any form of silting or increase in suspended solids.

Reference:
Tappin, A. R. (1996-2019) "Home of the Rainbowfish" https://rainbowfish.angfaqld.org.au

24. What is the diet and feeding behaviour of the species?

Analysis of stomach contents reveal they feed on a variety of tiny insects that fall onto the surface, ants, are a favourite item. Aquatic insects and various larval forms are also consumed with lesser amounts of small micro-crustaceans and filamentous green algae.

Reference:
Allen, G.R., (1995) Rainbowfishes In Nature and in the Aquarium, Their identification, care and breeding. Tetra-Verlag Germany. ISBN 1-56465-149-5 (p.20)

25. Does the species exhibit parental care?

For example, is it a mouth-brooder, does it bear live young, does it nest guard?

There are no known observations of spawning fish exhibiting any form of parental care. All rainbowfishes of three genera known to the Authors breed in a similar fashion. There is no evidence to suggest that any *Melanotaenia species* will breed in any manner different to the other *Melanotaenia*. The male elects an area that is near an object or some aquatic plants. It displays by flaring fins and trying to herd the female to the selected place. Once the pair come together and spawn there is no further interest in the eggs.

Reference:
Tappin, (2005) "*Rainbowfishes ~ Their Care & Keeping in Captivity 2nd Edition - 2011"* available at: http://www.mediafire.com/file/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

26. Does the species hybridise under natural conditions? Is the species likely to hybridize with native species in Australia?

Reports of naturally occurring rainbowfish hybrids in the wild are extremely rare. A report of naturally occurring hybrids between the genera Melanotaenia and Chilatherina can be found in Allen & Cross (1992) but there are no known naturally occurring hybrids between Glossolepis sp. and Melanotaenia spp.

Based on Allen (1989) and other works, the species in this genus have evolved in isolation from each other and almost certainly differences in courtship and spawning behaviour would have evolved at the same time (indeed, such isolating mechanisms must be available in this one habitat for two or more taxa to have evolved to the level of genus!). Distinct species as we know them have evolved as separate breeding units because of physicochemical, behavioural and recognition cues. These are complex and species-specific and effectively restrict hybridization. That many species of rainbowfish are being raised in ponds adjacent to each other by breeders in Asia and elsewhere (and it is so unlikely that the tanks would always be uncontaminated), negates the likelihood of easy hybridisation between this and other rainbowfish taxa. There are reports, both published and anecdotal, of hybridisation between the various species of Melanotaenia, Glossolepis, Chilatherina and Rhadinocentrus as well as between genera. Virtually all of these have taken place either accidentally or on purpose under the artificial conditions

within captivity. The hobby groups that keep Rainbowfishes discourage attempts at hybridisation, see two codes of conduct referred.

There was no record or mention from any of the scientist collectors of any other hybrids of *Melanotaenia* in its natural location. Hybridisation in rainbowfishes, although rarely occurring in nature, can be forced in the aquarium by providing only one sex of two different species. A closely related species, *Glossolepis incisus* was hybridized with a *Melanotaenia praecox* by an aquarium fish importer attempted to create appealing aquarium subject for commercial purposes. The resulting offspring were infertile. Overseas (Europe and USA) some attempts have been made to establish “aquarium” strains of hybrids between various Melanotaenia species and none of these have become established in the trade, mainly because of hobby , club and market resistance to such crosses . The hobby groups overseas such as the RSG (Rainbowfish Study Group, in the USA) and the IRG (IRG – International Rainbowfish Association in Europe) and ANGFA (here in Australia regularly advise hobbyists against buying or perpetuating such hybrids even when they are disguised under “pseudo-scientific” names such as Melanotaenia marcii etc. Hobbyists engage in continuous dialogue on various aspects of husbandry and conservation of rainbowfishes (as well as other species) on the Internet, social media and various discussion forums in several languages. The members of the Australia and New Guinea Rainbowfishes Association have a “Code of Conduct” that encourages enthusiasts to stay away from hybrid fish.

There are wild places that have many species of Rainbowfish living together, if hybridisation was common or easy there would only be one species with the features of the original 4 or 6 species at that location. The Mary River NT, at the southern end entry to Kakadu National Park has 4 species of Rainbowfish, *Melanotaenia trifasciata*, *M.exquisita*, *M.nigrans* and *M.splendida inornata*. No hybrids have been found there during many collections by Author 2. However Author 2 did find and photograph a natural hybrid between *Melanotaenia exquisita* and *Melanotaenia australis* in Pine Creek approx. 200 km south of Darwin in the Northern Territory.

The photo shows a natural hybrid, centre fish has features of *Melanotaenia exquisita*, fish pictured at bottom of photo and *Melanotaenia australis*, not in photo.

Photograph by Dave Wilson [redacted] taken October 2014, permission to publish 25 Feb 2023

The Jardine River in far North Queensland has six species of Rainbowfish recorded with no record of any hybrids.

Majtánová and all, 2020, concluded that their DNA in the family *Melanotaeniidae* was sufficiently close for them all to hybridise. Author 2 called a scientist, an expert in the field of rainbowfish for clarification and was reminded that Rainbowfishes have been imported into Australia for many decades and none have caused any trouble from introductions to natural waterways, However there has been an hybridisation event in Running River a tributary of Barnett River Qld where a different rainbowfish *Melanotaenia splendida splendida* has been introduced to a different rainbowfish *Melanotaenia splendida* known as Running River Rainbowfish. Researchers for Australian National University (Unmack 2015) have taken steps to preserve that over run species. However these are both in the *Melanotaenia splendida* group, very closely related. There is an extensive program started by Canberra University to

move the affected fish to a safe location and Author 2 has that species cultured and it is sold with its story.

References:
Allen, G.R. and N.J. Cross (1982). "*Rainbowfishes of Australia and Papua New Guinea*". Angus & Robertson.

ANGFA "Code of Conduct" https://www.angfa.org.au/about-constitution/206-angfa-code-of-conduct.html

IRG (International Rainbowfish Association, available at URL - https://www.irg-online.de/we-about-us/ accessed 11 March 2023.

Majtánová, Unmack, Prasongmaneerut, Shams, Srikulnath, Ráb and Ezaz (2020) "*Evidence of Interspecific Chromosomal Diversification in Rainbowfishes(Melanotaeniidae, Teleostei)*" published Genes2020,11, 818; doi:10.3390/genes11070818

Tappin, A.R., (2011) "Rainbowfishes, their care and keeping in captivity" available at: http://www.mediafire.com/download/g7qzn85uqde8v8o/Rainbowfishes.2011.pdf

Tappin A.R, (2013) Home of the Rainbowfish http://rainbowfish.angfaqld.org.au/splendida.htm

Wilson, D.N. & Biggs, C (2004) "Aquarium and Pond Keepers Code of Conduct" available as a download from World Wide Web electronic publication at URL http://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

Wilson D.N.(2017) "*Running River Rainbowfish*, Melanotaenia *sp. Fact Sheet*" available at URL https://www.aquagreen.com.au/plant_data/Melanotaenia_sp.html

Unmack & Hammer (2015) "Burdekin River Rainbowfish on the verge of disappearing from Running River" , Fishes of Sahul; V24 NO. 4, page 933

27. Is the species hermaphroditic, or it is capable of parthenogenesis?

The authors could find no record in any Rainbowfish books or papers examined of this family being able to store sperm. Rainbow fish are egg scatterers with eggs and sperm ejected simultaneously requiring both sexes for a successful fertile egg laying.

References:
Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson

Tappin, A. R. (1996-2019) "Home of the Rainbowfish" https://rainbowfish.angfaqld.org.au/

28. Is the species dependent on the presence of another species or specific habitat features to complete its life cycle?

For example, fast-flowing water, particular species of plant or types of substrata

Rainbowfishes live in a variety of habitats from clear streams and lakes through large turbid rivers, floodplain habitats, and isolated rocky pools or waterholes in arid regions. Most species form loose aggregations, which swim either in midwater or just below the surface. There is no known dependence on other species to complete their life cycle. Author 2 produces many species of Rainbowfish in ponds that have no other species present. Adult fish spawn on mops made from acrylic yarn and floats. Once mop has eggs adhering to the yarn it is moved to a pond with natural plankton. Apart from small plankton species used as food no other species are required to raise young rainbowfish. This method is used for all species farmed on Author 2 property. The method is described in Tappin 2011

References:
Tappin (2011) "Rainbow Fishes, their care and keeping in captivity"

29. What is the fecundity of the species (number of eggs per spawn), and does it produce offspring multiple times in a lifecycle, or have an extended spawning season?

The authors found numerous record or observation for *Melanotaenia species, most species* will produce about 40 to 100 viable eggs a day for several consecutive days in a two week period. This amount of egg production will continue during times of good water quality and abundant foods which would occur for several months before, during and shortly after the wet season.

References:
Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A. R. (1996-2019) "Home of the Rainbowfish" https://rainbowfish.angfaqld.org.au

30. What is the time from hatching to full maturity?

Generally rainbowfishes start to breed about 6 months of age and are reported to live for about 4 years in their natural habitat and up to 8 years in captivity.

References:
Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

Tappin, A. R. (1996-2019) "*Home of the Rainbowfish*" https://rainbowfish.angfaqld.org.au/

31. Are life stages likely to be dispersed unintentionally?

For example, bait buckets, live eggs on anglers' gear, accidental release during aquarium maintenance as a food fish or an angling amenity, for ornament or unusual appearance, for cultural reasons, as a contaminant of other commercially sold fish.

If *Melanotaenia praecox* was approved, it would be unlikely to be used as live bait in the tropics because of its small size. There have been media reports of Tilapia being used as live bait near Atherton in Qld, there was prosecutions mentioned in the same report.

Ponds in tropical areas overflowing in the wet season is another way for feral fish to be introduced to drains. There are small populations of guppies around the drains of Darwin.

Eggs sticking to aquarium plants. The eggs of *Melanotaenia* like the eggs of other rainbowfishes and may attach to aquarium plants. Generally, aquarium plants have a one-way trip from the aquarium shop to an aquarium where they gradually die and then are replaced by more plants from the Aquarium shop. Author 2 produces aquatic plants for the aquarium trade and has local species of Blue-eye, *Pseudomugil tenellus*, in the plant production ponds for mosquito control. Customers occasionally asked what the small fish that hatched from their plants. The eggs of *Pseudomugil* although slightly larger have similar small filaments attached to their eggs like rainbowfish.

Water changes going to garden sewer or septic and should cause no problem transferring eggs.

32. Is it likely to be deliberately released from aquariums due to growth rate, social behaviour etc?

Melanotaenia praecox are generally thought of by aquarium hobbyists as peaceful community aquarium subjects that do not grow very big so are not a problem because they get to large nor do they become more aggressive as they grow older. Tappin 2011 pages 4 to 6 outlines the history and reasons Rainbowfishes have become popular.

Frogwatch Northern Territory, [redacted] went on local TV and Radio to promote the use of *Pseudomugil tenellus* for "Frog Pond" tadpole friendly mosquito control. This was done to stop the people using Guppies *Poecilia reticulata*, a common belief they were native was dispelled by members of ANGFA and NT Frogwatch. Similar programs were started in other states by ANGFA members. Author 2 was a member of NT Frogwatch Committee along with Ex Lord Mayor of Darwin Graeme Sawyer [redacted]

Generally there has been programs directed toward Aquarium and Pond keepers to make their pond and aquariums secure. See “Code of Conduct” from various organisations associated with the aquarium industry.

Arthington et al. (1999) considered that there is a low or residual probability that New Guinea rainbowfishes would establish feral populations in Australia. Indeed, G. incisus has been here, and popular, for more than 40 years (and other New Guinea rainbowfishes are cultivated here also) and there are no feral populations of this fish in natural waterways.

References :

ANGFA “Code of Conduct” available on the world wide web at URL https://angfa.org.au/index.php?option=com_attachments&task=download&id=64

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry.

Tappin (2011) “Rainbow Fishes, their care and keeping in captivity” available as a download from URL - https://rainbowfish.angfaqld.org.au/Book.htm

Wilson, D.N. & Biggs, C (2004) “Aquarium and Pond Keepers Code of Conduct” available as a download from World Wide Web electronic publication at URL http://www.aquagreen.com.au/files/Code_of_Conduct_V5.pdf

33. Are eggs or larvae dispersed by water current, or can they move between water bodies via connections?

For example, climbing vertical surfaces, through pipes

Rainbowfishes generally do not climb and in nature congregate at barriers to upstream movement. They also are not salt water tolerant so cannot move into the sea to move between river systems.

34. Are juveniles or adults of the species known to migrate (spawning, smolting, feeding)?

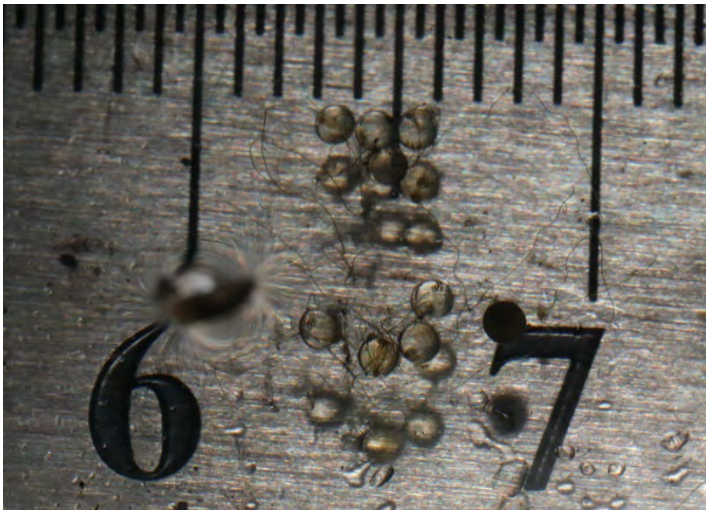
Authors were unable to find any record of large upstream migrations of any species of Rainbowfishes. It is generally believed by collectors that rainbowfishes are reduced in numbers during dry season and repopulate areas during wet season flows that give them access to places that are dry during cooler months of the dry season. Personal observations Author 2.

35. Are eggs of the species known to be dispersed by other animals?

For example, accidentally by water fowl when they move from water body to water body?

There is no proof, but it is possible if highly unlikely, that the eggs of rainbowfish have filaments that are mildly sticky and cause the eggs to catch in aquatic plants. It has been suggested they can attach to the legs of wading birds but this cannot be verified. There are different species below waterfalls in Kakadu National Park to the species of rainbowfishes above the waterfalls.

Author 2 collected the eggs of *Melanotaenia trifasciata* within one hour of laying 13 March 2023 and photographed them in a small Petrie dish on top of a metal ruler. You can see the filaments coming from the eggs as small dark lines. The eggs did not stick to authors fingers. All rainbowfish eggs have these filaments (Tappin 2011)



Reference:
Tappin (2011) "*Rainbow Fishes, their care and keeping in captivity*" available as a download from URL - https://rainbowfish.angfaqld.org.au/Book.htm

36. What are the species environmental tolerances, including water quality, oxygen, pH and temperature extremes?

Water quality measurements for this species taken by the original collectors of *Melanotaenia species* are well recorded. Allen (1995) writes, rainbows and blue-eyes inhabit natural waters that display very characteristic properties of hardness and pH. Some species such as Iriatherina werneri and Melanotaenia nigrans are invariably found in soft, acidic conditions, whereas others, for example M. lacustris and M. boesemani are associated with alkaline waters. Fortunately, rainbows and to a lesser extent blue-eyes are very adaptable with regards to water chemistry. Most species will survive comfortably at harness and pH ranges of 0-100ppm and 6.5-7.5. Hardness does not seem to be a very critical factor. The normal values for tapwater at most locations is acceptable.

I have never bothered to measure the hardness of our tapwater and have never encountered any problems with keeping or breeding rainbows. As far as pH is considered, a good rule of thumb is to keep the reading close to neutral (7.0) when in doubt. It is always advisable to maintain your fish within a pH range that approximates the natural conditions.

Acidic conditions can be created by using a fine layer of peat below the substrate, and furnishing with abundant plant growth.

More alkaline conditions can be achieved by slowly adding a dissolved solution of sodium bicarbonate.

However water quality and environmental preferences for rainbowfishes varies little across their extensive range. They are tolerant of a variety of water hardness, alkalinity, pH but temperature varies from the upper and lower latitudes. Closer to the equator fishes tend to tolerate higher temperatures for longer periods (observations Author 2 attempting to grow temperate rainbowfishes at 12 deg South near Darwin NT) *Melanotaenia* from northern NSW and the Murray Daring do not survive long periods of water over 32 deg C in the NT.

Reference:
Allen, G.R., (1995) Rainbowfishes In Nature and in the Aquarium, Their identification, care and breeding. Tetra-Verlag Germany. ISBN 1-56465-149-5 (p.28)

37. Does the species tolerate or benefit from environmental disturbance?

For example, floods, spates, desiccation, including both short- and long-term human impacts.

There is no information available however [redacted] the NT Dept of Fisheries, 2016 and 2017 and noted that the last fish to die in a low dissolved oxygen event were Tarpon and Gudgeon species, the rainbowfishes and other small forage fishes died after the larger species that require more oxygen.

Reference:
Saunders, T., Allsop, Q., Wilson D. (2017) "*Fish Kills Investigation Manual*" published by NT Dept Primary Industries. (copy available from Author 2)

38. Are there effective natural enemies of the species present in Australia?

Rainbowfishes will form the diet of many predatory species of fish, water birds, aquatic reptiles and humans. Some of the predatory fish families that eat rainbowfishes that occur in Australia and West Papua are; Ambassidae, Anguillidae, Apogonidae, Ariidae, Belonidae, Butidae, Carcharhinidae, Dasyatidae, Eleotridae, Gobiidae, Kuhliidae, Latidae, Lutjanidae, Megalopidae, Muraenidae, Osteoglossidae, Plotosidae, Sciaenidae, Synbranchidae, Terapontidae and Toxotidae.

Reference:
Allen, G.R. & Cross, N.J. (1982) "*Rainbowfishes of Australia and Papua New Guinea"*. Published by Angus and Robertson.

39. Are there similar niche species present in Australia that it would compete with for food and resources? If 'yes', what types of resources could be used: food; water; space; rest or shelter sites; nest sites; other. Include species names, in particular for threatened species.

It is unlikely that Melanotaenia praecox would establish in Australia (Kailola & Arthington). If it did, it would be an additional small rainbowfish, larger native fishes are natural predators of this fish family. The established populations would not alter the habitat, and a perceived increase in intergeneric competition for resources would be contained.

References:
Kailola, P.J. (2004) "*Risk assessment of ten species of ornamental fish under the Environment Protection and Biodiversity Conservation Act 1999*"

Arthington, A. H.; Kailola, P. J.; Woodland, D. J.; Zaluki, J. M. (1999) Baseline environmental data relevant to an evaluation of quarantine risk potentially associated with the importation to Australia of ornamental finfish. Report to the Australian Quarantine and Inspection Service. Canberra, ACT, Department of Agriculture, Fisheries and Forestry.

40. What would be the probable prey/food sources in Australia? Include species names, in particular for threatened species.

Analysis of stomach contents reveal they feed on a variety of tiny insects that fall onto the surface, ants in particular are a favourite item. Aquatic insects and various larval forms are also consumed with lesser amounts of small micro-crustaceans and filamentous green algae.

Reference:
Allen, G.R., (1995) Rainbowfishes In Nature and in the Aquarium, Their identification, care and breeding. Tetra-Verlag Germany. ISBN 1-56465-149-5 (p.20)

41. Is there the potential for any habitat or ecological community changes resulting from establishment?

For example, prey for native predators, habitat alterations, facilitation of the survival of other species, changes to community dynamics

If any *Melanotaenia* praecox were to escape effective control and did establish in a natural or disturbed waterway it is not conceivable that it would cause any changes to natural environment.

It is unlikely that the species would establish in Australia (Kailola & Arthington). If it did, it would be an additional small rainbowfish, larger native fishes are natural predators of this fish family. The established populations would not alter the habitat, and a perceived increase in intergeneric competition for resources would be contained.

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42. In the event of establishment, are there any potential social or cultural impacts?

Social or cultural effects may arise as a result of impacts to commercial or recreational values, life support/human health, cultural significance, biodiversity, aesthetics or beneficial uses. When considering social and cultural impacts, effects to human and animal health, indigenous cultural values, quality of life, should be considered, e.g., distress caused by dead/dying fish as a result of disease spread, or at treated infestation sites; reduced access to water bodies due to eradication measures.

Melanotaenia praecox are not known to carry any zoonotic disease. If specimens are imported from licensed aquaculture facilities under disease surveillance It should be detected and eradicated before the border protection phase of any import, should the application be approved.

There is one disease that is zoonotic and ubiquitous in the Aquarium shops of Australia and the fish family *Melanotaenidaie* are susceptible and that is Mycobacteriosis. The bacteria can be transferred from an infected fish to a cut on the hand of a keeper and is known as "Fish Fanciers Finger". This is a type of tuberculosis and is difficult to cure. (Tappin 2011)

Reference:
Tappin (2011) "*Rainbow Fishes, their care and keeping in captivity*" available as a download from URL - https://rainbowfish.angfaqld.org.au/Book.htm

43. Are there any potential economic impacts?

For example, impacts to trade, livestock or crops, aquaculture. Economic impacts may include loss of earnings due to reduced productivity, costs of mitigation, remediation and eradication, research costs, reduced earnings, impacts to export markets, banning of sale of commercially popular species etc.

If any *Melanotaenia praecox* were to escape effective control and did establish in a natural or disturbed waterway it is not conceivable that it would cause any potential economic impacts.

It is unlikely that the species would establish in Australia (Kailola & Arthington). If it did, it would be an additional small rainbowfish, larger native fishes are natural predators of this fish family. The established populations would not alter the habitat, and a perceived increase in intergeneric competition for resources would be contained.

References:
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44. What control / eradication programs could be applied in Australia if the species was released or escaped?

If *Melanotaenia praecox* was to escape to a place it may survive, suggest from the climate match data that it would be North Qld, WA or NT. NT has a major population area near the coast, Darwin. There are numbers of feral fishes around Darwin, particularly Live Bearing Tooth carps such as Guppies *Poecilia reticulata* where people either allow them to overflow from Garden Ponds during the wet season or in some cases believe they are doing a good thing for mosquito control by introducing them to natural waters. Governments and local Aquarium societies run education programs. And promote native species for mosquito control with NT Fisheries. There are similar programs run by other State Governments

[redacted] NT Fisheries through 2016 and 2017 where the last known population of Gambusia holbrooki was eradicated and guppies from the Botanic Gardens and local

drains have been poisoned with rotenone. The feral Fighting Fish on the Adelaide River floodplain have not been targeted by NT Fisheries because of the size of the area. In smaller waterways the native fish are removed by electrofishing then taken to ponds off site. Rotenone is applied then after it has dissipated the native species reintroduced.

Generally, if the pest fish is in a smaller waterway they are controlled by poison, however if they are over a large area control is not possible.

If *Melanotaenia praecox* was to establish in a northern waterway it would blend in with the other forage species, hardyheads, glassfishes, small gudgeons and most likely be first species selected by predator because of its brighter colours. If it did establish in a smaller closed waterway it would most likely be eradicated with rotenone.

Feral Fish eradication strategies in the Northern Territory are discussed in Hammer et al 2019. The Siamese Fighting Fish, *Betta splendens*, has established on the Adelaide River floodplain from upstream of the Arnhem Highway to downstream of Fogg Dam and observed in wetlands on both sides of the Adelaide River by Author 2.

Reference :
Hammer, Skarlatos Simoes, Needham, Wilson [redacted] Barton and Lonza (2019) **"**Establishment of Siamese Fighting Fish on the Adelaide River floodplain: the first serious invasive fish in the Northern Territory, Australia" published Springer Nature Switzerland AG 2019

45. What conditions or restrictions could be applied to the import of the species to reduce any potential negative environmental impacts?

e.g., single sex imports, size restrictions etc. If the outcome of the assessment is that the specimen can be imported subjected to conditions, limiting imports to eligible non-commercial purposes only, excluding household pets, it will be placed on Part 2 of the Live Import List (i.e. the species of animals and plants suitable for live import with an import permit issued under the Environment Protection and Biodiversity Conservation Act.).

There is no point restricting imports to single sex only as that would take away the Hobby Fish Keepers passion to breed their fish. One of the aspects of the hobby and the fish keeping clubs is to swap their fish among members at meetings and have fish auctions in the States and Territories where it is legal to sell fish, as part of fund-raising activities for those clubs.

The only condition that could be imposed is a size restriction on imports to ensure the correct identification of the specimens.

The Authors are all members of ANGFA, Australia and New Guinea Fishes Association, Authors 1 and 2 are or were members of CDAS, Canberra and District Aquarium Society, both organisations have breeding, information sharing and conservation of native fishes as listed club activities.

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