# A draft report to address the potential environmental impacts associated with the importation of *Labidochromis caeruleus,* The Electric Yellow Cichlid for use as an ornamental species within Australia.

The proponents wish to use live specimens of *Labidochromis caeruleus,* The Electric Yellow Cichlid to breed in licensed aquaculture facilities. The species is one of the most popular in the aquarium hobby, widely traded within Australia except for the Northern Territory where the allowable list of species permitted to be imported into the territory under the provisions of the NT Fisheries Legislation is linked to the list of permitted species under the provisions of the Environment Protection Biodiversity Conservation Act 1999. (EPBC Act). To use this species as an aquaculture subject in the Northern Territory it is required to be listed as an allowable import into Australia. The proponents do not currently wish to import any specimens and will access brood stock from southern states wholesalers or breeders of ornamental fishes. The proponents realise that if listed on EPBC Act section 303EB list other business may import this species from overseas facilities that comply with Australian Biosecurity import regulations.

This colour variant of the species has been in circulation within Australia since the 1990's with the first specimens distributed onto the world stage in 1986. It is readily available in the aquarium trade in all states except the NT. If the proponents are successful, good quality, disease free broodstock will be sought from reputable suppliers and used to supply the Australian Ornamental Aquarium Fish Industry.

Male Labidochromis caeruleus, photograph by Devon Barnes, Permission to use obtained 23 March 2017

***Draft Assessment Report to address the terms of reference***

***1. Provide information on the taxonomy of the species***

*The following information is required about the taxonomy of the species and its role in its natural environment:*

*1.a ) Family name: Identify which family the species belongs to.*

*1b) Genus name: Identify which genus the species belongs to.*

*1.c ) Species: Identify the species.*

Kingdom: Animalia, Phylum: Chordata, Class: Actinopterygii, Order: Perciformes, Family: Cichlidae, Genus: Labidochromis, Species: *caeruleus* Fryer 1956

*Labidochromis caeruleus* is described as a brightly coloured perch like small lacustrine insectivore that grows up to 13 cm total length but more common 8 to 10 cm. It inhabits deep rocky areas in Northern parts of Lake Malawi (Africa), it occurs in depths from 10 to 25 meters. The population has some variation in colour forms ranging from pale silver to light blue with darker vertical bars to bright yellow with black borders on dorsal, anal and pelvic fins. Konings 2016 (page 142) reports that the population of this species in the aquarium trade worldwide could be up to a thousand times greater than that in lake Malawi. Konings 2016 also describes the locations in Lake Malawi of the colour variations of this species.

Reference: Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*"

Reference: Wikipedia accessed 13 March 2017, available on the world wide web at universal resource locator https://en.wikipedia.org/wiki/Labidochromis_caeruleus

Reference: California Catalogue of Fishes
http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=25522
Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015).

*1.d ) Subspecies: Are there any recognised subspecies, and if so, what subspecies does the proposed specimen for import belong to?*

A search of Fishbase and California Catalogue of Fishes and other resource material revealed no record of any *Labidochromis caeruleus* sub species .

Reference: California Catalogue of Fishes
http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=25522

Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015).

*1.e ) Taxonomic Reference: e.g. Axelrod, page no., illustration page no.*

Froese, R. and D. Pauly. Editors FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015).

Reference: Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*"

*1.f ) Common Names: Note what common names the species is known as (if any) e.g. the Plains Zebra (common name) is known scientifically as Equus burchelli, where 'Equus' is the genus and 'burchelli' is the species. Zebras belong to the family Equidae.*

Country - Common Name

Australia - Electric yellow

USA - blue streak hap, Lemon yellow hap

Malawi - Labidochromis white

Malawi - Labidochromis yellow

Philippines - Yellow prince

Reference - Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015).

Reference: Wikipedia, accessed on 25 march 2017, available on the world wide web at universal resource locator at https://en.wikipedia.org/wiki/Labidochromis_caeruleus

*1.g ) Is the species a genetically-modified organism (GMO)? Identify if the species has been genetically modified. If the species has been genetically modified or engineered, you will need to contact the Office of the Gene Technology Regulator (www.ogtr.gov.au) before proceeding with this application.*

*Labidochromis caeruleus* Fryer, 1956 is a naturally occurring species endemic to the Northern parts of Lake Malawi in Africa. It is not genetically modified.

References: Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015).

***2. Provide information on the status of the species under CITES***

*The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international treaty involving over 150 countries with the purpose of protecting wildlife from unregulated trade. Australia, as a member country, controls the import and export of species that are threatened or could become threatened due to trade in them or their products.*

*A species may be affected in its natural environment by factors such as habitat destruction and fragmentation, and illegal collection for a variety of purposes e.g. for the pet industry. To help mitigate the threat of collection and trade, the species could be listed in the CITES Appendices. A species on CITES Appendix I or II requires appropriate CITES import permits to enter Australia.*

*If the proposed species for import is listed on CITES Appendix I or II, discuss as appropriate:*

*2.a )Implications of illegal trade*

*Labidochromis caeruleus* is not listed under Convention for the International Trade in Endangered Species (CITES), a search of CITES Check list revealed no record of *Labidochromis caeruleus*. It is not listed by the International Union for the Conservation of Nature (IUCN). A search of the IUCN red list of Threatened Species revealed a classification for *Labidochromis caeruleus* of “least concern”. It occurs in deep water among rock in Lake Malawi, the collection of large amounts would be impractical when the species is readily bred in captivity. The species is produced in large numbers at aquaculture facilities to supply the ornamental fish trade. It is freely traded in Australia in southern and Eastern states. If brood stock was imported into Australia before 1999 then currently it is only the Northern Territory where it is illegal to trade, possess or import. This puts the NT ornamental fish retail outlets and aquaculturists at a disadvantage to the rest of the country. The disadvantage of trade between the states gives the appearance of a situation that is unconstitutional. Section 92, Trade within the Commonwealth to be free. There is no reference that could be found that the species is traded illegally anywhere throughout the world.

If there is an illegal trade into the NT it would occur among hobbyists that are avid collectors of cichlid species that may import specimens from other jurisdictions in Australia without a NT Fisheries Permit. Currently the Fisheries Division of the Department of Primary Industry and Resources requires anyone wishing to import any live fish into the Territory that they apply for a translocation permit. If fish are moved around by hobbyists across borders and the fish is not an invasive species the other risk is the transfer of disease. It would be possible to bring unwanted disease into the NT.

References - Cites Checklist is available on the world wide web at universal resource locator, http://checklist.cites.org/#/en accessed 13 March 2017.

IUCN Red List of Threatened Species. Version 2016-3. <www.iucnredlist.org>. accessed on 13 March 2017.

Australian Constitution accessed 13 March 2017, is available on the world wide web at universal resource locator http://www.austlii.edu.au/au/legis/cth/consol_act/coaca430/

*2.b )popularity of the species in trade e.g. pet industry*

*Labidochromis caeruleus* is widely and freely traded within Australia from specimens bred in captivity. It is not a permitted import so the trade relies on progeny of specimens that were in the country prior to the commencement of the Environment Protection Biodiversity Conservation Act 1999. It is in constant request from local NT Aquarium outlets (pers com Author 2- Avis Hurley proprietor of Hurley's Aquarium, Palmerston NT. and Tracey Smith proprietor of Hibiscus Pet and Aquariums, Leanyer NT.
The price of the fish within Australia from on-line aquarium trade ranges from $10 to $50 each depending on size. Prices listed were found on the world wide web at universal resource locators for retail shops "Live Fish", "Coburg Aquarium" and "Aquarium Warehouse", these retail on line traders send fish throughout Australia. If a Northern Territory customer accidentally buys a popular fish such as *Labidochromis caeruleus*, the electric yellow cichlid, they are committing an offence against the NT Fisheries Laws.

*Labidochromis caeruleus* is produced in at least one commercial fish hatchery in the Cairns area Qld by Dean Datodi. It is produced for Aquarium Industries in Melbourne (pers com. Bruce Hansen). It is fish like this and Bristlenose Catfish *Ancistris* sp. that are the reason that some ornamental fish hatcheries are able to survive against competition from imports produced on Asian fish farms. The species produced are those that can no longer be imported since the introduction of the EPBC Act in 1999. This puts Ornamental Fish Farms in the Northern Territory under the control of the NT Fisheries Legislation at a distinct disadvantage against the principles of free trade among the states and territories of Australia as outlined in the Australian Constitution, Section 92.

Australian Constitution accessed 25 March 2017, is available on the world wide web at universal resource locator http://www.austlii.edu.au/au/legis/cth/consol_act/coaca430/

References : Live Fish aquarium retail on line seller catalogue available on the world wide web at universal resource locator https://www.livefish.com.au/tropicals/cichlids/african/lake-malawi.html?p=4

Coburg Aquarium retail on line seller catalogue available on the world wide web at universal resource locator http://shop.coburgaquarium.com.au/livestock/cichlids.html?p=2

Aquarium Warehouse aquarium retail on line seller catalogue available on the world wide web at universal resource locator https://aquariumwarehouse.com.au/Livestock/Cichlids/African

*2.c ) status of the species in its natural range e.g. threatened, endangered, protected etc.*

A search of the IUCN Red List of threatened species was conducted using the key words *Labidochromis caeruleus* yielded no results. It should be noted that the proponents will not seek wild caught specimens but captive bred specimens if application is approved thus not impacting on wild populations.

IUCN Search - http://www.iucn.org/search/node/Labidochromis%20caeruleus

*2.d ) reason the species is threatened.*

The species is not recorded as threatened, a search of IUCN Red list for *Labidochromis caeruleus* revealed a least concern listing and a search of CITES checklist for *Labidochromis caeruleus* revealed a listing of "did not match any taxa".

References - CITES Checklist is available on the world wide web at universal resource locator, http://checklist.cites.org/#/en accessed 13 March 2017.

IUCN Red List of Threatened Species. Version 2016-3. Available on the world wide web at universal resource locator http://www.iucnredlist.org Downloaded on 13 March 2017.

***3. Provide information about the ecology of the species***

*These characteristics may influence the likelihood of the species to establish feral populations:*

*a) Longevity: what is the average lifespan of the species in the wild and in captivity?*

The lifespan of *Labidochromis caeruleus* is reported to be 6 to 8 years in the aquarium, there is no information about life span in Lake Malawi. It has been reported in other small forage species, that aquarium specimens can live up to twice as long as natural specimens. (Allen. Midgley and Allen 2000)

Reference : Aquarium Wiki - http://theaquariumwiki.com/Labidochromis_caeruleus

Allen, Midgley and Allen, (2002), "Freshwater Fishes of Australia", published by the West Australian Museum.

*b) What is the maximum length and weight that the species attains? Provide information on the size and weight range for males and females of the species.*

*Labidochromis caeruleus* is reported to grow to a length of 10 to 13 centimetres in an aquarium. Rarely over 8 centimetres in natural location. Males are reported to be approximately one third larger than females.

Brough, David & Clare, "Animal World, Electric Yellow Cichlid" available on the world wide web at universal resource locator http://animal-world.com/encyclo/fresh/cichlid/electricyellow.php

Reference : Aquarium Wiki - http://theaquariumwiki.com/Labidochromis_caeruleus

Elieson, Mark (2002) "Labidochromis caeruleus" , published on the world wide web available at universal resource locator http://www.cichlid-forum.com/articles/l_caeruleus.php accessed 25 March 2017.

*c) 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.*

Sexual dimorphism : it is reported in aquarium wiki that dominant males will generally show more black in their fins and males develop a more pronounced forehead. Males tend to have much more black on their pelvic and anal fins, and are usually 1/3 larger than females at adulthood.

An exert from Elieson 2002 *"L. caeruleus* was first identified in 1956 by G. Fryer. He described this fish as normally being white, with a black stripe through the dorsal fin, which would become a pale blue cast in breeding males (probably the morph from Nkhata Bay, Malawi). Believe it or not, this species was named caeruleus (meaning "blue" in Latin) for this very reason. It wasn't until around 1980 that this xanthic colour variant was discovered by Stuart Grant and his divers. Grant et. al supposedly discovered a small colony of "Electric Yellows" at Lion's Cove, Malawi".

Reference : Aquarium Wiki - http://theaquariumwiki.com/Labidochromis_caeruleus

Reference : Elieson, Mark (2002) "Labidochromis caeruleus" , published on the world wide web available at universal resource locator http://www.cichlid-forum.com/articles/l_caeruleus.php accessed 25 March 2017.

*Where possible 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.*

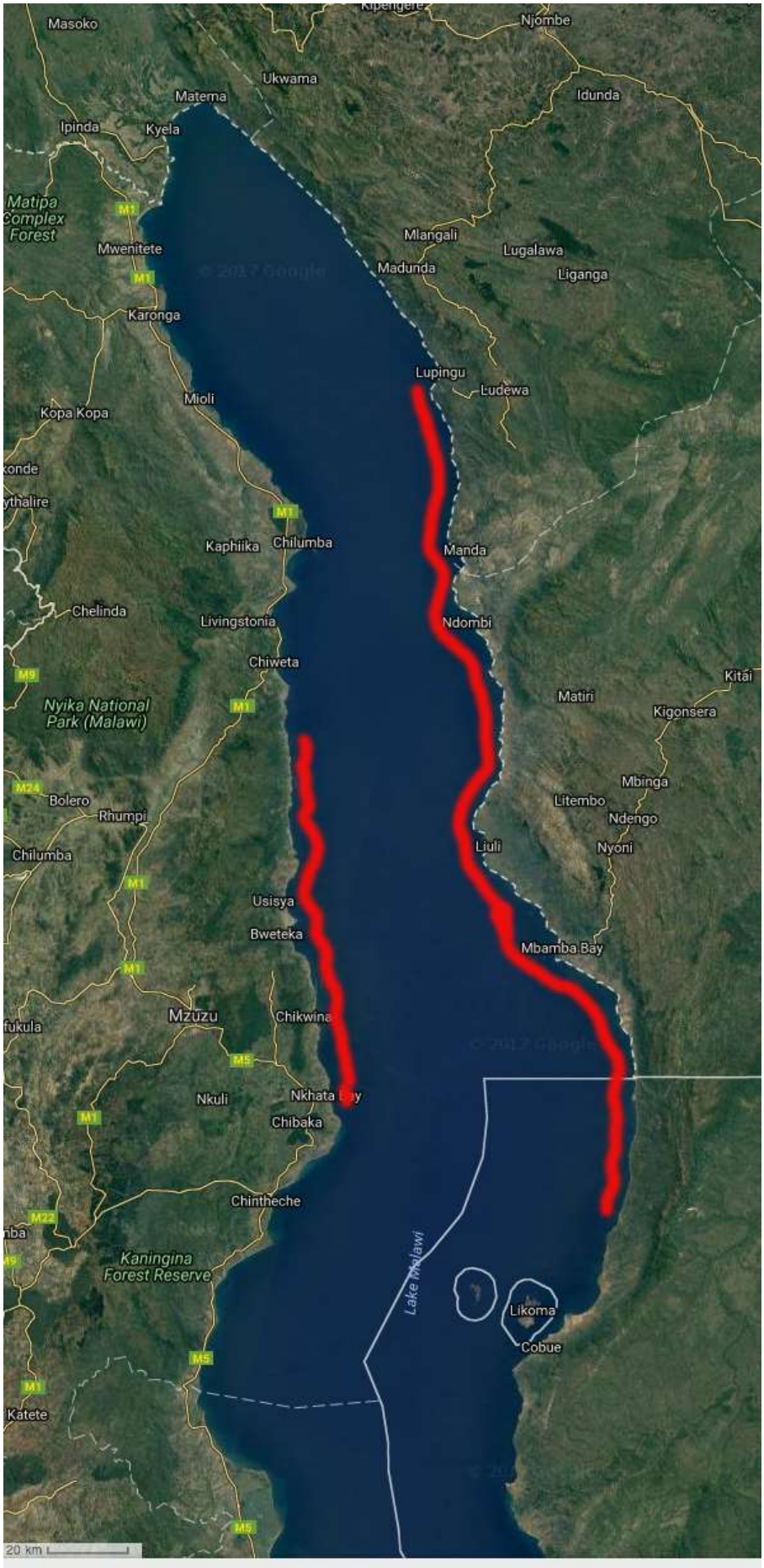
Male *L.caeruleus* photograph by Devon Barnes, Permission to use 23 March 2017

Pair of *L.caeruleus,* female upper right of photograph, photograph by Devon Barnes, Permission to use 23 March 2017.

*d) Natural geographic range. What is the country of origin and what is the natural distribution of this species? Where does the species occur naturally? Exclude any areas where the species has been introduced through human intervention. Describe any population limiting influences in its natural range including: predator/prey relationships, competition, availability of resources etc.*

The known natural geographic range of *Labidochromis caeruleus* is along the coast of lake Malawi from approximately $10^{O}$ 07' South to $11^{O}$ 55' South. A map has been drawn from Google Maps and the known range of *Labidochromis caeruleus* from Konings 2016 has been marked in red. The African Counties that this species occurs are Malawi, Mozambique and Tanzania. There is no known area outside this natural range where Labidochromis caeruleus has established. There is one report of an introduction in the Philippines from Fishbase but no further information if the species actually established. Lever 1996 has no record of *Labidochromis caeruleus* becoming established anywhere outside its known natural geographic range.

Lever, Christopher, (1996) “Naturalised Fishes of the World” published by Academic Press, Cambridge, Massachusetts, United Stated of America.


Masoko
Njombe
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Ipinda
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Mwenitete
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Lugalawa
Madunda
Liganga
Karonga
Lupingu
Ludewa
Mioli
Kopa Kopa
Kaphiika
Chilumba
Manda
Chelinda
Livingstonia
Ndombi
Chiweta
Kitai
Matiri
Nyika National Park (Malawi)
Kigonsera
Mbinga
Bolero
Litembo
Rhumpi
Ndengo
Liuli
Nyoni
Chilumba
Usisya
Bweteka
Mbamba Bay
Mzuzu
Chikwina
Nkuli
Chibaka
Chintheche
Kaningina Forest Reserve
Lake Malawi
Likoma
Cobue
Katete
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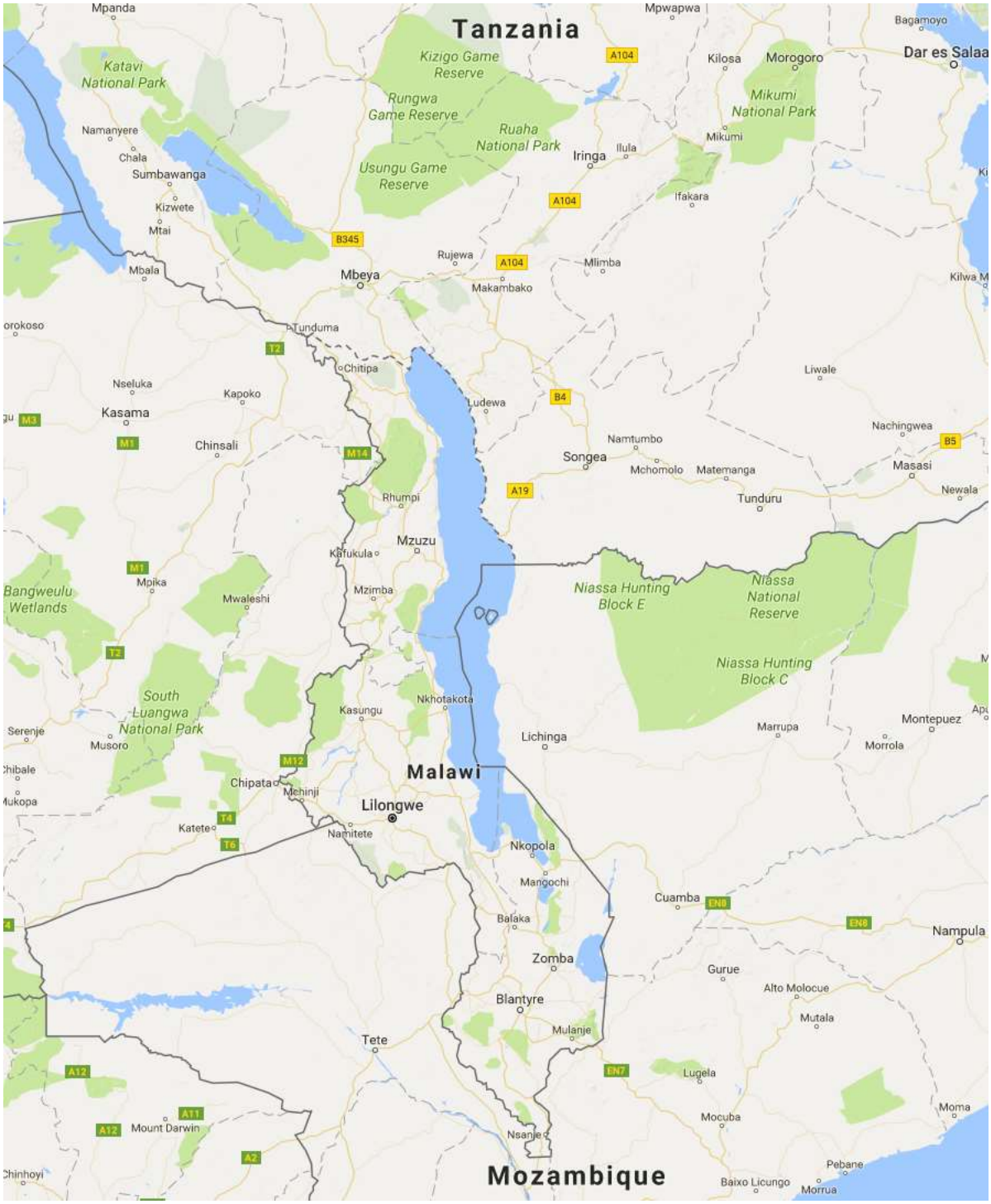



Kasembe, J. 2006. *Labidochromis caeruleus*. The IUCN Red List of Threatened Species 2006: e.T61090A12431335. http://dx.doi.org/10.2305/IUCN.UK.2006.RLTS.T61090A12431335.en. Downloaded on 03 August 2016.

Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

Google Maps, available on the world wide web at universal resource locator - https://www.google.com.au/maps/@-16.5353652,33.8532015,5.06z downloaded 18 march 2017.

*e) Is the species migratory? Identify if the species moves seasonally between different habitats. Migratory behaviour may occur between countries, within one country, or may occur on a small scale, for example from high altitudes to low altitudes on a mountain range.*

A search of all available reference material failed to locate any evidence that *Labidochromis caerulues* has the tendency to migrate. Konings 2016 lists the slight differences in various populations of the species suggesting it stays close to its home range when there are no physical barriers to it travelling. It is also reported in Konings 2016 that this species does not attempt to travel into any rivers that feed Lake Malawi. This indicates it is a true lacustrine species.

Reference: Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

*f) Does the species have the ability to hibernate in winter or aestivate (go into stasis or torpor) in the summer months)?*

A search of all available reference material failed to locate any evidence *Labidochromis caerulues* has the ability to hibernate or aestivate.

Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015).

*g) Does the species have the ability to breathe atmospheric air i.e. has accessory breathing organs? (fish and other mobile aquatic animals)*

A search of all available reference material failed to locate any evidence *Labidochromis caerulues* has the ability to breath atmospheric air.

*h) Outline the habitat requirements for all life stages of the species:*

- *physical parameters (e.g. salinity, oxygen, pH, temperature) of the natural habitat;*

Water Quality of Lake Malawi Talling & Talling (1965)

| | | |
|---|---|---|
| Alkalinity as an equivalent of CaCO3 | - | 118 – 129 mg/L |
| Calcium | - | 16.4 – 20.7 Mg/L |
| Chloride | - | 3.57 – 4.3 mg?/L |
| Electrical conductivity microsemens | - | 210-220 umho |
| Magnesium | - | 4.7 – 8.8 mg/L |
| Nitrate Nitrogen | - | - |
| Potassium | - | 6.4 mg/L |
| pH | - | 8.5 to 8.6 |
| Phosphate | - | < 7.3 mg/L |
| Silicates , dissolved | - | 1.1 – 4 mg/L |
| Sodium | - | 21 mg/L |
| Sulphates | - | 5.5 mg/L |
| Total calcium as an equivalent of CaCO3 | - | 41 – 49 mg/L |

Total Hardness as an equivalent of CaCO3 - 61 – 85 mg/L

Total solids average - 130 – 140 mg/L

Known only from the northern coast of Lake Malawi, in deep rocky areas 10 to 25 meters deep. The recommended water quality parameters to keep this species in captivity are – temperature 22 to 28 deg C, hardness 200 to 300 ppm, pH 8.5 to 8.6,

It does not form schools and is usually alone and tolerated in other cichlids territories. It shelters among the rocks. It has not been recorded from any other habitat type.

Reference: Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

Reference: Talling, J.F., and I.B. Talling. (1965) The chemical composition of African lake waters. Internationale Revue der Gesamte Hydrobiologie 50 (3):421-463.

- *climate;*

The natural occurrence of the species ranges from $12^{O}$ South to $14^{O}$ South on Lake Malawi. This makes it a tropical species.

http://www.our-africa.org/malawi/climate-agriculture

The vast water surface of Lake Malawi also profoundly affects the climate. The margins of the lake have long hot seasons and high humidity, with mean annual temperatures of 24°C (75°F). The temperature generally decreases and the rainfall increases with altitude. Malawi is noted for its rapid transitions from low to high rainfall. (http://www.travelmalawiguide.com/climate.html)

Malawi generally is described as having a tropical climate and the weather is usually quite predictable.

Hot wet season: December–April

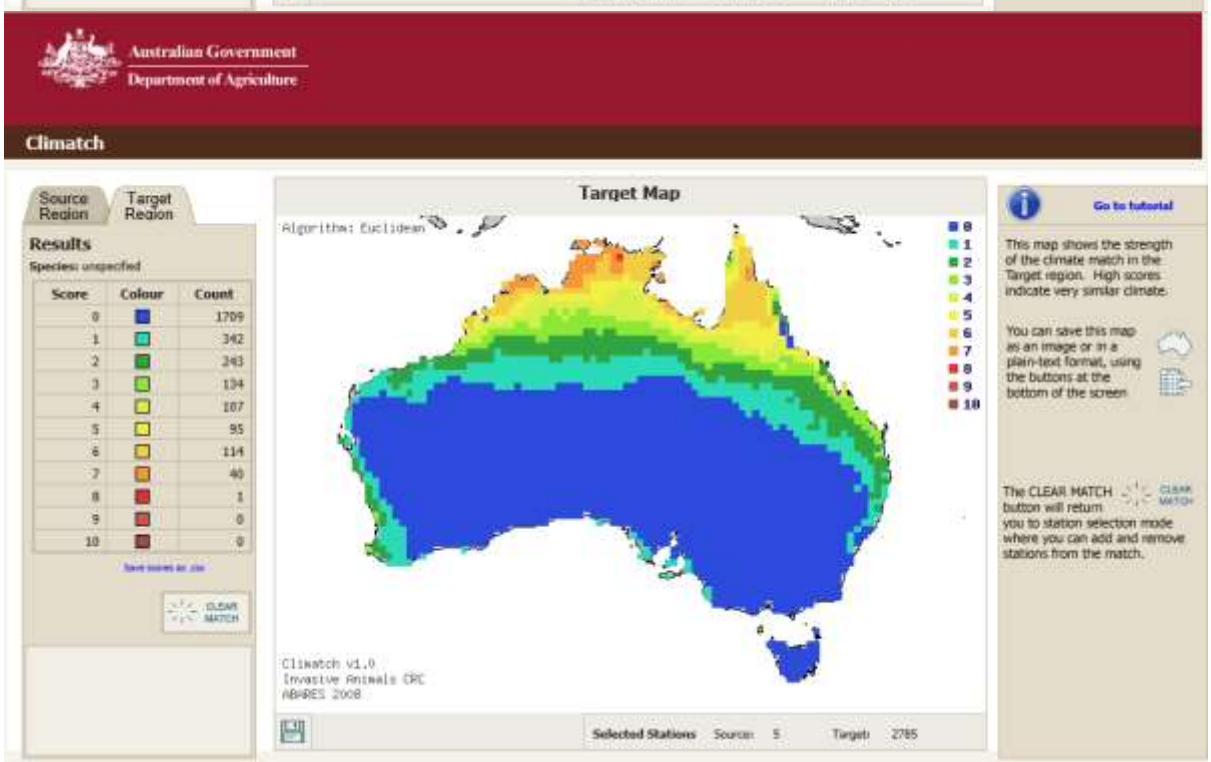
Nearly all of Malawi's rain (over 95%) falls during this warm and wet season. Temperatures usually range from 14–24°C, although they can reach into the 30s around the lake and in southern areas. On the high plateaux, temperatures are generally lower.

Cool dry season: May–August

During the middle months of the year, temperatures vary from 10°C up to 27/28°C in the southern valleys. In the northern region, it can be cold at night, with temperatures dipping down to 5°C. In some isolated areas, such as in the upper plateau areas, there can even be frosts. Hot dry season: September–November. At this time of the year, temperatures can vary from around 16°C–35°C. In some areas, such as around Lake Malawi and in the Shire Valley, they can soar up to 42°C. The temperatures remain high until the rainy season begins, though it can be hot and humid then, so the rains don't necessarily bring relief.

Comparison of the climate in the natural range of *Labidochromis caeruleus* climate to all of Australia climate. The climate at the North of Lake Malawi is the source region for a climate match. It has been compared using the Australian Government Department of Agriculture Climatch web site. http://data.daff.gov.au:8080/Climatch/climatch.jsp All of Australia is the target region for the climate comparison. There is only one

Australian Government Department of Agriculture Climatch web site. http://data.daff.gov.au:8080/Climatch/climatch.jsp All of Australia is the target region for the climate comparison


- *What nest sites can the species use? 'Nest' is taken to mean a specific area individuals return to in order to sleep, bear or rear young. Identify where the species does/can nest. For example tree hollows; burrows; caves; buildings; cliff faces; dams, lake, pond marsh, swamp, reed-bed; particular ground surface; particular vegetation type; other (specify).*

No nest sites are used, *Labidochromis caeruleus* a rock dwelling cichlid occurs at the greatest depth of all species endemic to Lake Malawi in the *Labidochromus* genus (average depth occurrence of 25 m). It is rarely found in waters less than 10 meters deep. Males will establish a breeding territory to court passing females. The male may dig a shallow spawning pit adjacent the rocks, Fertilization of the eggs is intrabuccal, the development interval is 21 days at 82-85 degrees F and Labidochromis species do not practice post release

brood care. (Loiselle, P.V, 1985) It is usually another month before the female can breed again due to loss of condition during the mouth brooding period. The female does not eat while mouth brooding.

Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

The cichlid aquarium, p199 Loiselle, P.V, 1985

- *Does the species nest, shelter or feed in or around any of the following habitats? Marshes or swamps; estuaries, lakes, ponds or dams, rivers, channels or streams, banks of water bodies; coastal beaches or sand dunes (specify). This question seeks to identify if the species could impact on habitat(s) listed.*

This species lives deep in Lake Malawi at 20 meters depth. They inhabit rocky areas that provide both food, protection and spawning areas.

Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

*i) Social behaviour or groupings. Describe how the animal would naturally dwell, for example in social groups, pairs, solitary; animals may be predominantly solitary except during breeding seasons etc. How does the species behave towards its own kind and other species?*

Konings 2016 describes the behaviour of *Labidochromis caeruleus* as occurring singularly, an insectivore that never lingers in one particular spot. It is reported to wander through the territories of other cichlid species where they are mostly tolerated.

Elieson 2002 describes behaviour of *L. caeruleus*. In natural habitat and aquarium. They prefer dark caves, but they are always careful to inspect the ceiling for prey. Likewise, in the aquarium, rock work, and particularly honeycomb limestone (aka holey rock), is appreciated. Holy rock allows females to hide from the male. This provides her an opportunity for females to escape male aggressive entreaties when she is not interested or ready to spawn. And as already mentioned, *L. caeruleus* has a very wide distribution in the lake, with the yellow morph occurring between Charo and Lion's Cove on the Malawi side of the lake, at a depth of 20 meters. Broods usually number between 15 and 20 fry, with incubation periods lasting typically 28 days. Males tend to have much more black on their pelvic and anal fins, and are usually 1/3 larger than females at adulthood.

*j) Is this species ever territorial or does it exhibit aggressive behaviour? Is the species naturally territorial? If so, what would the natural territory range be? Identify whether this species has ever acted in an aggressive manner towards other species, including humans, outside of any usual predator-prey interactions.*

*Labidochromis caeruleus* is described by Konings 2016 as one of the least aggressive least territorial species of African cichlids. It does not form a territory and is said to wander through the territories of other cichlids where it is largely ignored.

*k) Characteristics that may cause harm to humans or any other species. Is the animal capable of inflicting harm? A response for this question would arise if the species has organs such as teeth, a bill, spines or claws that are capable of causing injuries to people that are more significant than minor cuts or bruises.*

There is no record of any venomous spines, poisonous flesh or anything that may cause any harm or injury to humans.

Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015).

***4. Provide information on the reproductive biology of the species***

*Assess and describe the reproductive characteristics of the species*

*a) At what age does this species reach sexual maturity (males and females)?*

Labidochromis caeruleus males and females like most rock dwelling species in lake Malawi reach sexual maturity approximately 6-8 months post release in captivity. (Loiselle, P.V, 1985)

The Cichlid Aquarium, p199 Loiselle, P.V, 1985

*b) Discuss the species' ability to reproduce; triggers for breeding; breeding site requirements.*

A maternal mouth brooder, females incubate the eggs. Broods usually number between 15 and 20 fry, with incubation periods lasting typically 28 days. Spawning usually occurs in a shallow sand pit dug by the male near rocky cover. Once eggs are laid female takes them into her mouth for the incubation period.

*c) How frequently does breeding occur?*

When conditions are favourable and food is plentiful a pair of *Labidochromis caeruleus* is capable of producing a brood every 2 months.

*d) For sessile aquatic invertebrates include details of:*

- *the length of time spent as motile larvae or plankton*
- *growth patterns (e.g. is it colonial or does it grow as a solitary animal) characteristics or behaviour that enable the species to survive drought, or other adverse conditions (e.g. forming cysts or spores).*

*e) Can individuals of the species change sex? (reptiles, amphibians, fish and other mobile aquatic animals)*

A search of available reference material failed to indicate any information relating to specimens having the ability to change sex at any stage during their life.

*f) Ability of the species to hybridise. Describe any known crosses. Are progeny of such crosses fertile?*

A search of available reference material failed to indicate any evidence of for *Labidochromis caeruleus* to hybridise. However, there are 2 internet reports indicating that there may have been some hybridization done deliberately in captivity between (red zebra) *Metriaclima estherae* and *Labidochromis caeruleus*. Solid Electric Yellow" in which the females and the juveniles do not have barring. In order for that strain to exist the fish were actually cross bred with Red Zebras.
https://www.facebook.com/photo.php?fbid=10202886372989995&set=pcb.716279218390335&type=1&relevant_count=1&ref=nf

*g) Could the species hybridise with any Australian native species? Identify whether the species could negatively impact native species through hybridisation (cross-breeding with native species).*

There are no cichlid species native to Australia, it would not be possible for *Labidochromis caeruleus* to hybridise with any native species in Australia.

*h) Are individuals single sexed? (i.e. either male or female) or hermaphroditic (i.e. have both male and female reproductive organs)*

Individuals are one sex only, a search of available reference material failed to find any evidence of hermaphrodite tendencies.

***5. Provide information on whether this species has established feral populations***

*5.1) Has this species ever established a breeding population outside of its native range? Identify any areas where this species has established a breeding population outside of its natural range.*

A search of all available reference material and a google search engine on the world wide web available at universal resource locator https://www.google.com.au/webhp?gws_rd=ssl failed to produce any evidence of Labidochromis caeruleus establishing a breeding population outside of its native range.

*5.2) Is the species considered a pest anywhere in its natural or introduced range? A pest is a species of animal that causes wide-scale economic cost or amenity loss through its presence or activities. Identify whether this species is subject to active management to reduce population numbers.*

A search of all available reference material and a google search engine on the world wide web available at universal resource locator https://www.google.com.au/webhp?gws_rd=ssl failed to produce any evidence of *Labidochromis caeruleus* becoming established or becoming a pest anywhere on the planet.

*5.3) Has the species been introduced to other countries, even if it has not established feral populations?*

There is no known area outside this natural range where *Labidochromis caeruleus* has established. There is one report of an introduction in the Philippines from Fishbase but no further information if the species actually established. Lever 1996 has no record of *Labidochromis caeruleus* becoming established anywhere outside its known natural geographic range.

Lever, Christopher, (1996) "Naturalised Fishes of the World" published by Academic Press, Cambridge, Massachusetts, United Stated of America.

Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015).

***6. Environmental risk assessments of the species***

*6.1 ) Have any risk assessments of the species, or similar species been carried out in Australia or overseas? Include the results of those assessments in the report.*

New Zealand Ministry of Agriculture and Forestry, PO Box 2526, Wellington New Zealand, Biosecurity New Zealand in their publication "Import Health Standard for Ornamental Fish and Marine Invertebrates from all Countries", lists *Labidochromis caeruleus* in appendix two, **approved species** of ornamental fish and marine invertebrates, freshwater ornamental fish page 33 of 72.

Reference: New Zealand Biosecurity, "*Import Health Standard for Ornamental Fish and Marine Invertebrates from All Countries"* available on the World Wide Web at universal resource locator - https://www.mpi.govt.nz/document-vault/1782 Accessed 12 March 2017.

The **South Australian Research and Development Institute,** SARDI, Aquatic Sciences
2 Hamra Avenue, West Beach SA 5024 have developed a proposed risk assessment process for ornamental fish. One of the species in their work to develop a risk assessment tool is *Labidochromis caeruleus*. The authors risk assessment tool has assessed *Labidochromis caeruleus,* the electric yellow cichlid, as low environmental risk in Australia. Table page 19 of their report.

Reference: Deveney, M. and Beyer, K. (2014). Assessing the risks associated with the Australian trade in live ornamental fish species: development of a risk assessment tool. Report to Freshwater Fish Working Group of National Biosecurity Committee. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2014/000000-1. SARDI Research Report Series No. 000. https://www.environment.gov.au/.../risk-assessment-live-ornamental-fish-draft-report. Accessed 12 March 2017.

***7. Assess the likelihood that the species could establish a breeding population in Australia***

*The following points outline the information required for determining the likelihood that the species could establish and inhabit possible matches in the Australian environment.*

*7.a ) Ability to find food sources. Is the species a generalist feeder or does it have specific food needs? What is the likelihood of it finding food in Australia if it was released or escaped? Describe the feeding characteristics of the species, including whether it has a similar diet to any Australian native species.*

In Lake Malawi *Labidochromis caeruleus* is reported to be mostly an insectivore with some populations eating molluscs. They are reported to forage among large boulders entering caves and searching the ceiling and crevices for aquatic insects. In an aquarium they adapt to an omnivore diet accepting many different types of prepared foods. If they were to escape effective human control they would forage with local forage species. Eating insects and molluscs, they may adapt to other foods as suggested by their aquarium care. The species is reported to be the least aggressive of the Lake Malawi cichlids and owing to its bright colour would be a target for predators and most likely driven away from food areas by our local grunters.

Reference: Brough, David & Clare, "Animal World, Electric Yellow Cichlid" available on the world wide web at universal resource locator http://animal-world.com/encyclo/fresh/cichlid/electricyellow.php

*7.b ) Ability to survive and adapt to climatic conditions. Describe the characteristics or behaviour that would enhance its ability to survive extreme climatic conditions (e.g. drought) and its ability to adapt to different environments.*

The climate map comparing the Northern parts of Lake Malawi and surrounding countries to the climate of all of Australia limits the possible areas to above about 16 deg South with mostly a 10% or 20% climate match for most of that area, there is only one place that has a 80% match and that appears to be near Kakadu National Park or West Arnhem Land in the Northern Territory. The waters of West Arnhem Land and Kakadu are very soft, originating in sandstone escarpment which is mostly quartz and non-reactive to water. The habitat of *Labidochromis caeruleus* is hard alkaline waters of lake Malawi which has no water quality match anywhere in Kakadu National Park or East Arnhem land. There is some waters in the Kimberley that are hard alkaline lacustrine, a match for the habitat of *Labidochromis caeruleus*, Lake Argyle and Lake Kununurra would be suitable water quality and temperature range for this species.

The bright yellow coloration of *L.caeruleus* would make them very visible to predatory species, fish and other predators would include Barramundi, Midgley's Catfish, Salmon Catfish. Lesser Salmon Catfish, Longtoms, Spangled Grunter, Banded Grunter, Freshwater Crocodiles, Merten's Water Monitors, Emydura Turtles, Northern Longneck turtles, Snapping Turtles, Cormorants, Snake Birds, Giant Glassfish, Mouth Almighties, Black Bream, Archer Fish, Northern Trout Gudgeon, Flathead Goby, Sleepy Cod, Cherubim and other small predators (Merrick 1984). A similar location in Queensland with hard alkaline still waters is Lawn Hill Gorge National Park. The Lawn Hill Creek that flows through Lawn Hill Gorge, a tributary of the Gregory River has the correct climate and water quality to hold this species however it also has a full suite of predators similar in species structure to Lake Argyle (Merrick 1984). The Burnett River in Qld has hard alkaline water that may be suitable for this species.

A deliberate or accidental introduction to any of these habitats with this species is most unlikely. To have enough specimens, to travel to the remote suitable areas and release many fish worth a considerable amount would be beyond the logistical skills of most. Population dynamics of Australia also preclude the accidental introduction to a natural waterway that would suit the survival of this species. The lacustrine environments with the rocky habitats are well away from populated areas except Lake Kununurra.

The areas within Australia where most tropical aquarium fish introductions have occurred are Townsville, Cairns and Darwin. The Ross River at Townsville has many species of introduced ornamental fishes due to its proximity to a large population. This is believed to be partly caused by the proximity to the military base. Personal communication with Damien Burrows of James Cook University.

There are other large tropical rivers in the tropics, for example the Daly River NT, Victoria River NT, Ord River WA, Goyder River NT,

Reference: Brough, David & Clare, "Animal World, Electric Yellow Cichlid" available on the world wide web at universal resource locator http://animal-world.com/encyclo/fresh/cichlid/electricyellow.php

Queensland Department of National Parks, Sport and Racing. Lawn Hill Gorge accessed 16 march 2107 on the world wide web at universal resource locator https://www.npsr.qld.gov.au/parks/boodjamulla-lawn-hill/

Merrick and Schmida, (1984) "Australian Freshwater Fishes, Biology and Management".

Allen, Midgley and Allen, (2002), "Freshwater Fishes of Australia", published by the West Australian Museum.

*7.c ) Ability to find shelter. Can the species live in modified habitats? Identify if this species can live in habitats that have been modified by humans, either directly or indirectly, e.g. plantation forests; gardens; orchards; vineyards; crops; cities or towns; buildings; improved pastures; dams, channels or drains; other (please specify).*

*Labidochromis caeruleus* is a specialist rock dwelling species, found from 10 to 20 meters deep in rocky habitat, the rocks range from a few meters to 10's of meters diameter. It is also a specialist insect feeder searching the ceiling of the rock crevices for food. There is a population that has become a mollusc (water snail) feeder. It is reported to be difficult to keep in captivity if the water quality, and physical parameters are not met. Hard alkaline water is required and kept very clean otherwise the species does not fare well.

*7.d ) Reproduction. Could factors such as longevity, birth rates and numbers of offspring increase the likelihood of the species to establish?*

*L. caeruleus* has a very wide but patchy distribution in Lake Malawi, with the yellow morph occurring between Charo and Lion's Cove on the Malawi side of the lake, at a depth of 20 meters. Broods usually number between 15 and 20 fry, with incubation periods lasting typically 28 days. Males tend to have much more black on their pelvic and anal fins, and are usually 1/3 larger than females at adulthood.

The breeding potential from 10 pair in one year of Guppies (*Poecilia reticulate)* has been calculated over 4,000,000 (Meffe and Nelson 1989). The Guppy (*Poecilia reticulate)* is a permitted import species under the provisions of the EPBC Act. It is listed in the permitted species schedule created by the provisions of Section 303EB of the EPBC Act 1999

To calculate the breeding potential of 10 pair of *Labidochromis caeruleus* we are going to assume that conditions, diet, space, no mortality and water quality are perfect and add in the calculations from maximum size broods of 20 produced each 28 days and assuming all fish are sexually mature in 8 months and equal numbers of the sexes are produced the maximum number of *L.caeruleus* in one year will be calculated below.

| | | | | |
|---|---|---|---|---|
| Start | 01 Jan XX – | | 10.10.0 | fish bought together, last column total |
| first brood | 28 Jan XX | - | B1 10.10.200 | 220 |
| 2 broods | 24 Feb XX | - | B2 10.10.200 | 420 |
| 3 broods | 24-Mar-XX | - | B3 10.10.200 | 620 |
| 4 broods | 21 Mar XX | - | B4 10.10.200 | 820 |
| 5 Broods | 18 April XX | - | B5 10.10.200 | 1020 |
| 6 broods | 19 May XX | - | B6 10.10.200 | 1220 |
| 7 Broods | 16 Jun XX | - | B7 10.10.200 | 1420 |
| 8 Broods | 14 Jul XX | - | B8 10.10.200 | 1620 |

| | | | | |
|---|---|---|---|---|
| 9 Broods | 11 Aug XX | - | B9 10.10.200 | 1820 |
| 1 Sept XX | 8 months now first batch of young are mature | | | |
| First brood fry now mature 1 Sept | 100 pair start to breed each 28 days | | | |
| 10 Broods | 8 Sept XX | - | 10.10.200 | 2020 |
| B1 mature | 28 Sept XX | - | 100.100.2000 | 4020 |
| 10 Broods | 6 Oct XX | - | 10.10.200 | 4220 |
| B2 mature | 24 Oct XX | - | 100.100.2000 | 6220 |
| B1 mature | 26 Oct XX | - | 100.100.2000 | 8220 |
| B3 mature | 8 Nov XX | - | 100.100.2000 | 10,220 |
| B2 mature | 21 Nov XX | - | 100.100.2000 | 12,220 |
| B4 mature | 21 Nov XX | - | 100.100.2000 | 14,220 |
| B1 mature | 23 Nov XX | - | 100.100.2000 | 16,220 |
| 11 Broods | 28 Nov XX | - | 10.10.200 | 16,420 |
| B3 mature | 6 Dec XX | - | 100.100.2000 | 18,420 |
| B5 mature | 18 Dec XX | - | 100.100.2000 | 20,420 |
| B4 mature | 19 Dec XX | - | 100.100.2000 | 22,420 |
| B2 mature | 19 Dec XX | - | 100.100.2000 | 24,420 |
| B1 mature | 21 Dec XX | - | 100.100.2000 | 26,420 |
| 12 Broods | 28 Dec XX | - | 10.10.200 | 26,620 |

The calculations are based on optimum conditions. The breeding potential for 10 pair of *Labidochromis caeruleus in* one year is 26,620. (Calculations Author 2) The breeding potential for 10 pair of guppies (*Poecilia reticulate)* in one year is over 4,000,000. The calculations of the breeding potential of *Labidochromis caeruleus* are probably much less because the mouth incubation period of 28 days was used as time between broods, however aquarium notes say 2 months because the female needs time to regain condition. The potential is probably much less than the amount reached in the calculations.

Meffe, G.M. and Nelson, F.F. (1989) "*Ecology and Evolution of Livebearing Fishes (Poeciliids)"*

*7.e ) Are there any limiting influences on the species' natural range? Predator/prey relationships, competition, availability of resources etc. Assess what similar population constraints might exist in Australia.*

Lake Malawi has 456 species of fish listed as inhabiting the lake. Most are Cichlids but it also has some large predators that feed on small cichlids (Fishbase). This would indicate there are some predators of this species. Fishbase lists trophic levels for the species in the lake.

Each species with a trophic level over 4 is likely to eat small cichlids. There are 63 species in Lake Malawi that would likely use *Labidochromis caeruleus* as a prey item. This figure is derived from the trophic structure of species in Lake Malawi listed in Fishbase.

http://www.fishbase.org/trophiceco/FishEcoList.php?ve_code=12

| | | | | | | |
|---|---|---|---|---|---|---|
| *Aristochromis christyi* | | Cichlidae | benthopelagic | 30.0 TL | 4.0 | endemic |
| *Buccochromis atritaeniatus* | | Cichlidae | benthopelagic | 28.0 TL | 4.2 | endemic |
| *Buccochromis heterotaenia* | | Cichlidae | benthopelagic | 40.0 TL | 4.2 | endemic |
| *Buccochromis lepturus* | Slender tail hap | Cichlidae | benthopelagic | 41.7 TL | 4.2 | endemic |
| *Buccochromis nototaenia* | Stripeback hap | Cichlidae | benthopelagic | 23.0 TL | 4.0 | endemic |
| *Buccochromis oculatus* | | Cichlidae | benthopelagic | 28.0 TL | 4.1 | endemic |
| *Buccochromis rhoadesii* | | Cichlidae | benthopelagic | 34.1 TL | 4.2 | endemic |
| *Buccochromis spectabilis* | | Cichlidae | benthopelagic | 25.6 TL | 4.1 | endemic |
| *Caprichromis liemi* | Happy | Cichlidae | benthopelagic | 23.3 TL | 4.0 | endemic |
| *Caprichromis orthognathus* | | Cichlidae | benthopelagic | 19.5 TL | 4.0 | endemic |
| *Champsochromis caeruleus* | | Cichlidae | benthopelagic | 32.2 TL | 4.2 | endemic |
| *Champsochromis spilorhynchus* | | Cichlidae | benthopelagic | 30.0 TL | 4.2 | endemic |
| *Corematodus shiranus* | | Cichlidae | benthopelagic | 27.0 TL | 4.4 | endemic |
| *Corematodus taeniatus* | | Cichlidae | benthopelagic | 19.0 TL | 4.4 | endemic |
| *Dimidiochromis compressiceps* | Malawi eyebiter | Cichlidae | benthopelagic | 23.0 TL | 4.2 | endemic |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Dimidiochromis dimidiatus* | Ncheni type haplochromis | Cichlidae | benthopelagic | 20.0 TL | 4.0 | endemic |
| *Dimidiochromis kiwinge* | | Cichlidae | benthopelagic | 30.0 TL | 4.2 | native |
| *Diplotaxodon aeneus* | | Cichlidae | benthopelagic | 17.1 TL | 4.0 | endemic |
| *Diplotaxodon argenteus* | | Cichlidae | benthopelagic | 24.9 TL | 4.2 | endemic |
| *Diplotaxodon ecclesi* | | Cichlidae | benthopelagic | 17.8 TL | 4.2 | endemic |
| *Diplotaxodon greenwoodi* | | Cichlidae | benthopelagic | 30.1 TL | 4.2 | endemic |
| *Docimodus johnstoni* | | Cichlidae | benthopelagic | 25.0 TL | 4.2 | endemic |
| *Exochochromis anagenys* | Threespot torpedo | Cichlidae | benthopelagic | 24.4 TL | 4.2 | endemic |
| *Genyochromis mento* | | Cichlidae | benthopelagic | 12.6 TL | 4.4 | endemic |
| *Iodotropheus sprengerae* | Lavender mbuna | Cichlidae | benthopelagic | 13.2 TL | 4.0 | endemic |
| *Maylandia elegans* | | Cichlidae | demersal | 16.1 TL | 4.0 | endemic |
| *Melanochromis baliodigma* | | Cichlidae | benthopelagic | 10.4 TL | 4.3 | endemic |
| *Melanochromis chipokae* | | Cichlidae | demersal | 14.6 TL | 4.2 | endemic |
| *Melanochromis lepidiadaptes* | | Cichlidae | benthopelagic | 10.6 TL | 4.4 | endemic |
| *Mylochromis formosus* | | Cichlidae | benthopelagic | 12.7 TL | 4.0 | endemic |
| *Mylochromis gracilis* | Haplochromis torpedo stripe | Cichlidae | demersal | 22.0 TL | 4.0 | endemic |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Mylochromis spilostichus* | | Cichlidae | demersal | 22.2 TL | 4.2 | endemic |
| *Naevochromis chrysogaster* | | Cichlidae | demersal | 17.9 TL | 4.0 | endemic |
| *Nimbochromis fuscotaeniatus* | Fuscotaeniatus | Cichlidae | demersal | 25.0 TL | 4.2 | endemic |
| *Nimbochromis linni* | | Cichlidae | demersal | 25.0 TL | 4.2 | endemic |
| *Nimbochromis livingstonii* | | Cichlidae | demersal | 25.0 TL | 4.2 | native |
| *Nimbochromis polystigma* | | Cichlidae | demersal | 23.0 TL | 4.2 | endemic |
| *Nimbochromis venustus* | | Cichlidae | demersal | 25.0 TL | 4.2 | endemic |
| *Otopharynx brooksi* | | Cichlidae | demersal | 15.0 TL | 4.2 | endemic |
| *Otopharynx ovatus* | | Cichlidae | demersal | 20.0 TL | 4.0 | endemic |
| *Otopharynx speciosus* | | Cichlidae | demersal | 25.2 TL | 4.2 | endemic |
| *Pseudotropheus benetos* | | Cichlidae | benthopelagic | 11.1 TL | 4.2 | endemic |
| *Rhamphochromis esox* | | Cichlidae | demersal | 51.2 TL | 4.2 | endemic |
| *Rhamphochromis ferox* | | Cichlidae | demersal | 45.0 TL | 4.2 | endemic |
| *Rhamphochromis lucius* | | Cichlidae | demersal | 40.0 TL | 4.2 | endemic |
| *Rhamphochromis macrophthalmus* | | Cichlidae | demersal | 36.4 TL | 4.2 | endemic |
| *Sciaenochromis ahli* | Electric blue hap | Cichlidae | demersal | 20.0 TL | 4.2 | endemic |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Sciaenochromis benthicola* | | Cichlidae | demersal | 17.1 TL | 4.1 | endemic |
| *Sciaenochromis fryeri* | | Cichlidae | demersal | 14.0 TL | 4.2 | endemic |
| *Serranochromis robustus* | Yellow-belly bream | Cichlidae | demersal | 56.0 TL | 4.1 | native |
| *Stigmatochromis macrorhynchos* | | Cichlidae | benthopelagic | 15.6 TL | 4.0 | endemic |
| *Stigmatochromis melanchros* | | Cichlidae | benthopelagic | 18.9 TL | 4.1 | endemic |
| *Stigmatochromis modestus* | | Cichlidae | demersal | 25.0 TL | 4.2 | endemic |
| *Stigmatochromis woodi* | | Cichlidae | demersal | 25.0 TL | 4.2 | endemic |
| *Tyrannochromis macrostoma* | | Cichlidae | demersal | 30.0 TL | 4.2 | endemic |
| *Tyrannochromis maculiceps* | | Cichlidae | demersal | 29.5 TL | 4.2 | endemic |
| *Tyrannochromis nigriventer* | | Cichlidae | demersal | 20.7 TL | 4.2 | endemic |
| *Tyrannochromis polyodon* | | Cichlidae | demersal | 22.7 TL | 4.1 | endemic |
| *Bathyclarias filicibarbis* | | Clariidae | demersal | 79.2 TL | 4.1 | endemic |
| *Bathyclarias worthingtoni* | | Clariidae | demersal | 97.6 TL | 4.0 | endemic |
| *Clarias ngamensis* | Blunt-toothed African catfish | Clariidae | demersal | 73.0 TL | 4.3 | native |
| *Enteromius litamba* | | Cyprinidae | benthopelagic | 42.7 TL | 4.0 | endemic |
| *Mastacembelus shiranus* | Malawi spinyeel | Mastacembelidae | benthopelagic | 26.0 TL | 4.0 | endemic |

The freshwater fish species in Northern Australia are listed in Fishbase, we will count fishes that occur above the tropic in Queensland Northern Territory and Western Australia. There are 355 species of freshwater fishes in Australia from Fishbase. Thirty six species of tropical Australian fresh water species are recognised as a possible predator of *Labidochromis caeruleus* by the trophic rating in the Fishbase list of Australian freshwater fishes.

http://www.fishbase.org/trophiceco/FishEcoList.php?ve_code=380

| | | | | | | |
|---|---|---|---|---|---|---|
| *Parambassis gulliveri* | Giant glassfish | Ambassidae | demersal | 29.3 TL | 4.0 | endemic |
| *Glossamia aprion* | Mouth almighty | Apogonidae | benthopelagic | 22.0 TL | 3.5 | endemic |
| *Neoarius graeffei* | Blue salmon catfish | Ariidae | demersal | 73.2 TL | 3.6 | endemic |
| *Neoarius latirostris* | Broad-snouted catfish | Ariidae | benthopelagic | 61.0 TL | 3.5 | endemic |
| *Neoarius leptaspis* | Salmon catfish | Ariidae | demersal | 73.2 TL | 3.0 | endemic |
| *Neoarius midgleyi* | Silver cobbler | Ariidae | benthopelagic | 170.8 TL | 4.1 | endemic |
| *Carcharhinus leucas* | Bull shark | Carcharhinidae | reef-associated | 400.0 TL | 4.3 | native |
| *Bostrychus aruensis* | Island gudgeon | Eleotridae | demersal | 22.0 TL | 4.0 | endemic |
| *Bostrychus strigogenys* | Striped-cheek gudgeon | Eleotridae | demersal | 22.3 TL | 4.0 | endemic |
| *Bostrychus zonatus* | Barred gudgeon | Eleotridae | demersal | 22.6 TL | 4.0 | endemic |
| *Butis amboinensis* | Olive flathead-gudgeon | Eleotridae | demersal | 17.1 TL | 4.2 | native |
| *Prionobutis microps* | Small-eyed loter | Eleotridae | demersal | 28.1 TL | 4.0 | endemic |
| *Thryssa scratchleyi* | New Guinea thryssa | Engraulidae | pelagic-neritic | 48.8 TL | 4.2 | endemic |
| *Glossogobius aureus* | Golden tank goby | Gobiidae | demersal | 30.5 TL | 4.0 | native |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Glossogobius flavipinnis* | | Gobiidae | demersal | 80.0 TL | 4.0 | endemic |
| *Glossogobius giuris* | Tank goby | Gobiidae | benthopelagic | 61.0 TL | 3.7 | native |
| *Lates calcarifer* | Barramundi | Latidae | demersal | 200.0 TL | 3.8 | native |
| *Lutjanus argentimaculatus* | Mangrove red snapper | Lutjanidae | reef-associated | 150.0 TL | 3.6 | native |
| *Megalops cyprinoides* | Indo-Pacific tarpon | Megalopidae | benthopelagic | 150.0 TL | 3.5 | native |
| *Gymnothorax polyuranodon* | Freshwater moray | Muraenidae | demersal | 150.0 TL | 4.2 | native |
| *Scleropages jardinii* | Australian bonytongue | Osteoglossidae | pelagic | 122.0 TL | 2.8 | endemic |
| *Scleropages leichardti* | Spotted bonytongue | Osteoglossidae | pelagic | 122.0 TL | 3.9 | endemic |
| *Pristis microdon* | Largetooth sawfish | Pristidae | demersal | 700.0 TL | 3.8 | native |
| *Pristis pristis* | Common sawfish | Pristidae | demersal | 750.0 TL | 4.0 | native |
| *Hephaestus carbo* | Black grunter | Terapontidae | benthopelagic | 33.0 TL | 3.2 | endemic |
| *Hephaestus epirrhinos* | Long-nose sooty grunter | Terapontidae | benthopelagic | 51.2 TL | 3.7 | endemic |
| *Hephaestus fuliginosus* | Black bream | Terapontidae | benthopelagic | 59.9 TL | 2.8 | endemic |
| *Oxyeleotris lineolata* | Sleepy cod | Eleotridae | demersal | 54.9 TL | 3.7 | endemic |
| *Glossamia aprion* | Mouth almighty | Apogonidae | benthopelagic | 22.0 TL | 3.5 | endemic |
| *Glossamia aprion* | Mouth almighty | Apogonidae | benthopelagic | 22.0 TL | 3.5 | endemic |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Hephaestus jenkinsi* | Western sooty grunter | Terapontidae | benthopelagic | 48.8 TL | 3.3 | endemic |
| *Leiopotherapon unicolor* | Spangled perch | Terapontidae | demersal | 37.8 TL | 4.1 | endemic |
| *Terapon jarbua* | Jarbua terapon | Terapontidae | demersal | 36.0 TL | 3.9 | native |
| *Toxotes chatareus* | Spotted archerfish | Toxotidae | pelagic | 48.8 TL | 4.0 | native |
| *Toxotes lorentzi* | Primitive archerfish | Toxotidae | benthopelagic | 22.0 TL | 3.2 | endemic |
| *Toxotes oligolepis* | Western archerfish | Toxotidae | benthopelagic | 15.0 TL | 3.2 | endemic |

In the areas where this species may establish bearing in mind that it is a lacustrine species with specialised water quality requirements and habitat structure requirements discussed in other areas of this report. The natural locations where establishment may be possible are areas such as, Lake Argyle WA, Lake Kununurra WA, Lawn Hill Gorge Qld, Flora River NT and to a lesser extent some of the large limestone influenced rivers, Daly River NT, Burnett River Qld, Victoria River NT, Goyder River NT. All of the natural Australian locations where *L.caeruleus* may establish have a full range of predators.

Areas around civilisation where the usual species from the ornamental fish hobby establish are disturbed habitats such as the drains around Darwin, Cairns and Townsville. These areas have livebearing tooth carps. Other areas of big population but lower temperate climates such as Canberra have cold water species, carp, trout, weather loaches and gambusia.

Water Quality of these places are from the ANGFA Database and notes in possession of Author 2 while preparing the North Australia Fish Atlas data for the Scientists in James Cook University.

Australia and New Guinea Fishes Association database accessed 9 April 2017 on the world wide web at universal resource locator http://db.angfa.org.au/index.php assessors of this report can contact Author 2 David Wilson for a password for access to the ANGFA database.

North Australian Fish Atlas species maps available on the world wide web at universal resource locator https://research.jcu.edu.au/tropwater/fishatlas/GenusList.htm

Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015). Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015). Trophic structure of Australian Freshwater fish. http://www.fishbase.org/trophiceco/FishEcoList.php?ve_code=380 The trophic structure of fish species in Lake Malawi - http://www.fishbase.org/trophiceco/FishEcoList.php?ve_code=12

*7.f ) Address the issue of increased potential for feral population establishment if more individuals of the species were present in Australia.*

Only one reference to a translocation can be found, Fishbase record a possible introduction into the Philippines, 1989 the Aquarium Science Association of the Philippines report an introduction but there is no other information, it also reports that it is unknown if *Labidochromis caeruleus* became established.

This species is widely used in Australia at present, it has been bred into large numbers throughout the world since its introduction to the Aquarium trade in the 1986 by Pierre Brichard. It is always available in Aquarium shops in other jurisdictions since its introduction to the Aquarium trade in the late 1980's. Information from Aquarium Industries ornamental fish buyer, Glenn Briggs (pers. Com.) and Elieson 2002 is that the bright yellow form *Labidochromis caeruleus* has been produced from just a few specimens taken by Pierre Brichard and bred in a fish farm on the shores of Lake Tanganyika an aquarium fish exporter.

It is already very common in Australian aquariums within the Eastern and Southern Jurisdictions, it has unique water quality requirements and conditions that are not common in the Northern Parts of Australia. It is a rock dwelling specialist with a very small home range (Keenleyside 1991), with a requirement for very clean, hard alkaline water. It does not wander far from its home range and is reported to be the most peaceful of the African Rift Lake cichlids. The places that would be suitable for this species to establish have a full range of large and medium predators. Given this species has been in Australia for about the past 25 years in the aquarium trade and no feral populations have established this tends, to indicate a low establishment risk.

It also has a high value even though common in the Australian aquarium trade since the mid 1980's therefore less likely to be dumped like guppies and goldfish that have established and are EPBC Act permitted species.

Elieson, Mark (2002) "*Labidochromis caeruleus*" , published on the world wide web available at universal resource locator http://www.cichlid-forum.com/articles/l_caeruleus.php accessed 25 March 2017.

Froese, R. and D. Pauly. Editors. 2015. FishBase. World Wide Web electronic publication. www.fishbase.org, version (10/2015). Trophic structure of Australian Freshwater fish.
http://www.fishbase.org/trophiceco/FishEcoList.php?ve_code=380

Keenleyside, M.H.A. (1991) "Cichlid Fishes Behaviour, ecology and evolution", published by Chapman and Hall

***8. Provide a comprehensive assessment of the potential impact of the species should it become established in Australia***

*Summarise the potential impact on the environment of importing the specimen. Address both the potential impacts of the particular import that is proposed, and the potential impacts of the species should the specimen(s) ever be released from effective human control.*

*It is important that a full explanation and comprehensive analysis, including the costs and benefits, of each aspect is undertaken.*

*An application will not be continued if information provided in this section is inadequate.*

*a) Does the species have similar niche/living requirements to native species?*

Given the life history previously described in this assessment this species very few niche/living requirements to native species. *Labidochromis caeruleus* comes from a very specific niche environment itself which as documented previously is very unlikely to occur in Australia. It is already very common in Australian aquariums within the Eastern and Southern Jurisdictions, it has unique water quality requirements and conditions that are not common in the Northern Parts of Australia. It is a rock dwelling specialist with a very small home range (Keenleyside 1991), with a requirement for very clean, hard alkaline water. It does not wander far from its home range and is reported to be the most peaceful of the African Rift Lake cichlids. The places that would be suitable for this species to establish have a full range of large and medium predators.

Given this species has been in Australia for about the past 25 years in the aquarium trade and no feral populations have established this tends to indication the low establishment risk.

- *Could wild populations of the species use the same resources as native Australian species, for example that it would compete with for food, shelter etc.*

Given the unique water quality and specialist environmental requirements it is unlikely that it would find suitable habitat to establish itself. It is more likely that native species more suited to our environment would out compete it causing its demise. The suitable habitats identified are mostly in very remote locations away from populated areas. Areas of greatest human population is the area most commonly affected by non native fish introductions.

It is possible for *Labidochromis caeruleus* to establish in those areas reported as suitable in 7)e. however the full range of local predators would most likely notice a bright yellow food size item. *Labidochromis caeruleus* has the ability to adapt its diet in aquaria so it is likely it can adapt in a place that has the correct water quality and some cover.

- *If 'yes', what types of resources could be used and which types of Australian native species could be affected: food; water; space; rest or shelter sites; nest sites; other. What native species would be affected?*

Space - If *Labidochromis caeruleus* did become established it would use some space among rock and logs that may displace smaller crevice creatures such as shrimp and small forage fishes however there would be other rock dwelling species such as Macrobrachium and Cherax and other small grunters would most likely drive it out. It is smaller than our largest tropical crustaceans and reported to be the least aggressive cichlid among the species in Lake Malawi where it lives.

Diet – Aquarium specimens are reported to adapt away from their insectivorous or mollusc diet and take a full range of small local species as food items. They would be competing with similar size and smaller omnivores for the available foods.

Competition with local species - Author 2 has placed Australian Native Grunters in with cichlids in an Aquarium Shop in Belconnen ACT in the early to mid 1980's. One vivid memory is a 75mm long Bar-Tailed Grunter, *Amniataba caudivittata* placed in a one meter cube freshwater aquarium with 4 X 150 mm long Oscars, *Astronotus ocellatus* and we watched to make sure the Oscars did not kill the grunter. Within a few hours the Oscars were packed tightly in one corner together and the grunter was swimming in the whole area of the aquarium obviously the owner of the whole space. (Personal Obs Dave Wilson 1980's). Another example of feral fish failing to compete against local predators is the live-bearing toothcarps in the Darwin Rural area. Author 2 has taken reports of Guppys and received live specimens when working for NT Parks and Wildlife Commission as Supervisor of Australias Largest Freshwater Public Aquarium at Territory Wildlife Park. The reports were from Howard River between Howard Springs and Humpty Doo where there are many 2 hectare size rural living blocks. Each time the area was surveyed for the ferals, none were found. In the disturbed drains of Darwin the live bearing toothcarps are common with populations of guppies *Poecilia reticulata*, platys *Xiphophorus variatus* and swordtails *Xiphophorus hellerii*. These incursions particularly around the Fannie Bay Race Course have been poisoned by NT Fisheries on numerous occasions over the last 20 years but keep returning. The most likely cause of the return of these ferals to the drains is the overflowing of garden ponds in the wet season. Many Darwin gardeners use guppies as mosquito control. The point being the live bearing tooth carps fail to establish in the rural area because of the full range of small predators still present natural waterway compared to the disturbed habitat of local Darwin drains.

- *If the species you are proposing to import is a mammal, identify if it can climb trees.*

*Labidochromis caeruleus* is not able to climb trees. It is a fish.

*b) Is the species susceptible to, or capable of transmitting any pests or diseases?*

There is a process in place under the provisions of the new Biosecurity Act for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to

import any *Labidochromis caeruleus* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture and Water Resources.

Australian Government Department of Agriculture and Water Resources Biosecurity Import Conditions System (BICON) available on the world wide web at universal resource locator (accessed 25 March 2017) http://www.agriculture.gov.au/import/online-services/bicon

http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

*c) Probable prey/food sources*

- *Does the species attack or prey on wildlife? Identify if the species has the capacity to attack or prey on wildlife. If 'yes', specify whether the prey are: waders or waterfowl; other birds; mammals < 1 kg; mammals 1–5 kg mammals > 5 kg; amphibians; vertebrate eggs; fish; aquatic invertebrates; reptiles; insects; land invertebrates; other; (specify).*

The wild populations of *Labidochromis caeruleus* are insectivores in their natural habitat, the rocky depths of Lake Malawi. In captivity they eat small prepared aquarium foods. They can attain 13 cm in captivity but generally 8 cm in a natural place. They may take small crustaceans, molluscs, algae and other items in a place where they could survive if they escaped effective human control. They are from a lacustrine environment with specialised water conditions living among large rocks from 10 to 25 meters depth.

- *Does the species attack or prey on domestic or commercial animals or plants?*

There would be no domesticated plants or animals that this species could damage or destroy.

*d) Impacts on habitat and local environments.*

- *Could the species reduce the ground vegetation cover to an extent where it could cause or increase soil erosion? This question looks at identifying if the species, through feeding, digging or other activities could have a detrimental impact on vegetation such that the underlying soil is exposed to increased erosion.*

*Labidochromis caeruleus* does not dig. Accounts of its spawning habits do not indicate any digging. Konings 2016

Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid

Press.

- *Does the species construct burrows or dig near or around waterways? Identify if the species does/can burrow or otherwise disturb the substrate (soil or sand) around waterways.*

*Labidochromis caeruleus* does not dig. Accounts of its spawning habits do not indicate any digging. Konings 2016

Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

- *Has the species ever been recorded causing damage to: native animals' habitats; natural communities; native plants; forestry; agriculture?*

*Labidochromis caeruleus* is a rock dwelling fish, a maternal mouth brooder, they spawn on any surface without digging as other cichlids. There is no habitat disturbing behaviour possible for this species.

Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

- *Could the species inhibit tree seedling regeneration in forests and woodland? This question aims to identify if the species could have a negative impact on regeneration in native forests and woodlands.*

*Labidochromis caeruleus Labidochromis caeruleus* is a fish, an insectivore. It could not be conceived that this species could affect regeneration of forests or woodlands.

Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

- *Could the species spread weeds? Identify whether the species could spread weeds through carrying seeds on their fur/feathers, defecating the seeds at a distance from the parent plant or moving viable vegetative matter to new areas.*

*Labidochromis caeruleus* is a fish, an insectivore. It could not be conceived that this species could spread weeds, aquatic or otherwise.

Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

*e) Discuss any control/ eradication programs that could be applied in Australia if the species escaped or were released. Are any such eradication programs already available in Australia?*

*Labidochromis caeruleus* is a small fish, if it escaped to an area that has its specialised water quality and there was enough specimens to start a self supporting population, control would be dependent on the size of the water body, large remote water bodies, control may prove difficult. The state Fisheries Departments have various units that control outbreaks of feral fishes. Each situation is different and depending on the extent of the release, control measures are different for each event. Both proposed locations are approved aquaculture facilities which are required to meet standards to prevent the escape of any stock. In the unlikely event of an escape from the breeding facility there would be no survivors due to the poor access to nearby natural water bodies and the nature of the surrounding water quality. In small contained environments and enclosed waterways aquarium fishes are controlled with a fish poison called Rotenone. The Northern Australian state and territories have feral fish control officers in their Fisheries Departments. If an outbreak or release of a feral species is localised, then the usual method in the NT in recent years is the destruction of all the fish in the area. However, prior to the use of rotenone to kill all the fish, nets and electro fishing methods are used to collect as many native fish and reptiles as possible then these are either housed at the Territory Wildlife Park Aquarium or the Darwin Aquaculture Centre. The feral infected area is then dosed with rotenone. After the rotenone has dissipated and the waterway is suitable for fish life the original collected native fish are reintroduced. In some circumstances the area is left for natural reestablishment of native species. A personal communication with Steven Brooks of Qld Fisheries revealed a similar strategy when dealing with feral fish outbreaks. In order for possible control of a feral introduction the control measures need to be implemented early when the infestation is small.

Author 2 has been working with the NT Fisheries Pest Management area for many years dating back to 1995 and recently worked in the area for 20 months as part of the team that eradicated the last known population of *Gambusia holbrooki* in the NT.

*f) Behaviours that cause environmental degradation*

- *Behavioural characteristics. Describe any behaviours of the species which cause physical disturbance to the environment e.g. hooves, digging etc.*

*Labidochromis caeruleus* does not dig or alter its environment.

- *Does the species eat or disturb wetlands/wetland vegetation? This question seeks to identify negative impacts the species may have on wetlands.*

*Labidochromis caeruleus* would not be able to survive in a wetland, fluctuations in water quality vastly different from the stable alkaline in Lake Malawi and often low dissolved oxygen levels of wetlands would prevent this occurrence. In aquaria if hard alkaline stable water quality is not provided the species does not survive very long.

Konings, Ad. (2016) "*Malawi Cichlids in their natural Habitat, 5th edition*", publish in ElPaso USA by Cichlid Press.

- *Could the species cause pollution of water bodies? This question seeks to identify if the species could impact native aquatic flora or fauna by polluting waterways.*

*Labidochromis caeruleus* would not be able to survive in a polluted water way and none of its reported behaviours indicate it capable of polluting any water way.

- *If possible, outline the current health of the possible habitat matches in Australia and analyse their sensitivity to possible introductions from the species being assessed.*

*g) Impacts on primary industries*

- *Has the species ever been recorded causing damage to: livestock, poultry, agriculture?*

A search of all available reference material failed to find any reference to reports of any impacts on primary industry.

- *Could a wild population of the species eat or damage any of the following: plant parts or products; flowers or buds; nuts; root vegetables; leaf vegetables; sugarcane; fodder crops; cotton; nursery/garden plants; timber forests or plantation trees; fruit orchards; stored grain or seeds; legumes; cereal grain in field; oilseeds or coarse grains in field; other (specify).*

This part does not apply to fish.

- *Could wild populations of the species use any resources that might cause it to compete with livestock? This question seeks to identify if this species could compete with livestock.*

This part does not apply to fish.

- *Has the species ever inflicted damage to trees, shrubs or their seedlings that has caused tree death or affected their value as timber? This question aims to identify if the species may have a negative impact on tree plantations/silvicultural activities.*

This part does not apply to fish.

*h) Damage to property*

- *Could the species deface or physically damage buildings? Identify if the species could damage buildings either through physical damage, or through depositing excrement on the exterior of the building.*

This part does not apply to fish. However, an aquarium within a building has been known to cause damage from water if it fails. The inhabitants of the aquarium will not survive such an event. (Personal observations author 2)

- *Could the species damage fences? Identify if the species has the capacity to damage fences.*

This part does not apply to fish.

- *Could the species damage equipment? Identify if the species could cause damage to domestic or commercial equipment.*

Small fish are unlikely to be able to damage equipment.

*i)* *Is the species a social nuisance or danger? For example because of the following behaviours: invading buildings; forming large noisy colonies or flocks; polluting equipment, buildings, parks or other public facilities with urine, droppings or nesting material; posing a risk to aircraft when present in flight ways or at airports; other (please specify).*

This part does not apply to fish.

*j) Describe any potentially harmful characteristics of the species.*

- *Any potential threat to humans, any available mitigation measures (such as anti-venom), and methods for appropriate handling.*

A search of all available references failed to reveal any report of *Labidochromis caeruleus* causing harm to people. It is conceivable that some African divers have received dive related injuries trying to catch this species in Lake Malawi as it occurs in very deep waters but no references to this could be found.

- *Has the species ever injured people? Identify whether there are any recorded instances of this species causing harm to people.*

A search of all available references failed to reveal any report of *Labidochromis caeruleus* causing harm to people.

- *Is the species susceptible to, or could it transmit any pests or diseases? Identify if the species could potentially transmit harmful diseases or parasites to humans or any other species.*

Any fish imported will be required to go through the Federal Government Biosecurity protocols. Theoretically should not be able to import any parasites or disease. The only Zoonotic aquarium disease of fishes already very prevalent in Australian Aquarium trade is Fish Fanciers Finger *Mycobacteria marinum*. Once in Aquarium shops the Electric Yellow Cichlid may catch this disease along with all the other aquarium fish. ***Mycobacterium marinum*** (formerly ***M. balnei***) is a free-living bacterium, which causes opportunistic infections in humans. *M. marinum* sometimes causes a rare disease known as aquarium granuloma, which typically affects individuals who work with fish or keep home aquariums.

Wikipedia *Mycobacterium marinum* accessed on 24 Apr 2017 available on the world wide web at universal resource locator https://en.wikipedia.org/wiki/Mycobacterium_marinum

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

*Conditions may be suggested that would reduce the impacts on the Australian environment of importing the specimen (e.g. single sex imports, deseeding an animal prior to import, limiting imports to eligible non-commercial purposes only, excluding household pets etc.). If the outcome of the assessment is that the specimen can be imported subjected to conditions, it will be placed on Part 2 of the Live Import List (i.e. the regulated part of the list).*

This species has been in Australia since the 1990's and is one of the most popular aquarium species traded freely around Australia with the exception of the NT where it is not permitted due to it not being on the allowable live import list for Australia.

Whilst the proponents are not currently seeking to import any specimens it may be possible that the large fish importers such as Aquarium Industries would import this species if they were placed on the allowable live import list in which instance they would have to meet the current quarantine protocols put in place by the Department of Agriculture and Water Resources. The conditions for importing live fish is available on the

world wide web at universal resource locator http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

The Department of Agriculture and Water Resources web page outling conditiond for importing live fish. http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

*Recommended conditions should be relevant to the conservation status of the species and/or the risks posed by the import. Conditions should mitigate the likely establishment and impact that a species may have.*

***10. Summary of proposed activity***

*What is the proposed purpose of the import? Specify the reason you want to import the species. This may be for eligible non-commercial purposes such as research, education, exhibition, conservation breeding, household pet or travelling exhibition, or for commercial purposes. Where appropriate discuss:*

- *The rationale for choosing to import this species into Australia.*

There is no reason to import the species, the purpose for this report is to merely make it legal in the Northern Territory. The reason is explained in the opening paragraphs on the first page of the report. The spirit of fair trading between the states and territories is a principle outlined in the Australian Constitution. Section 92 of the Australian Constitution allows for free trade between the States and Territories. It is not free when other jurisdictions freely use this species and the NT cannot.

Commonwealth of Australia Constitution Act is available on the world wide web at universal resource locator http://www.austlii.edu.au/au/legis/cth/consol_act/coaca430/

- *Clearly state the numbers of animals you want to import.*

This species is already breed and traded in large numbers in Australia. Both Authors are currently not proposing to import any specimens but source brood stock from the fish already present in Australia. However other larger importers will most likely try to access cheaper specimens from Asia and perhaps better quality specimens from the very precise German fish breeders. The Authors will obtain their specimens from these importers or Easter states breeders already using this species within Australia.

- *Discuss the interaction between males of this species. Do they need to be segregated?*

Breeding size adult males will not like to be near each other they have a stylised ritualised bumping of bodies, the weaker of the two will retreat before any real damage is sustained. Many species of fish behave this way when there is a selection of females. In a holding tank of cichlids or other territorial fish, if you crowd them they don't behave badly toward each other. A method used with many species by fish farmers and aquarists when dealing with aggressive species.

- *If the purpose is for breeding discuss the management and control of excess progeny in the breeding program. How many animals will be kept at any time on the premises? How will lack of genetic variation be managed in the breeding program?*

The species has low fecundity, and the demand in the aquarium trade is strong, excess progeny should not be an issue. Both applicants will probably keep several set ups with one male and up to 5 females. The females will be stripped of their fertilized eggs and the eggs will be raised artificially. The fry will progress through the aquaculture facilities from hatchery to grow out ponds to holding tanks then to market. The same method for any production of the ornamental species.

Both proponents are licenced aquarium aquaculture facilities and dispose of any culls and excess fish humanely. If the ornamental fish breeder can initiate trends or predict trends in demand, then their business is more profitable.

- *Discuss any other potential uses for this species should it be imported into Australia. Where applicable, describe its human uses (e.g. zoos, research, pets etc.).*

This species is for ornamental purposes only. It is not known if any other use would be feasible. The fish is too small to use as a food species. It is possible researchers may use the species for some purpose but as it is already freely available within Australia they will have no trouble sourcing specimens.

- *Provide details on where animals are obtained, e.g. captive bred populations or from the wild.*

No *Labidochromis caeruleus* will be sourced from their natural location in Lake Malawi. The species is produced by Aquaculture for the aquarium trade. It is already within Australia. None are being proposed to be imported by the authors. This is a report to allow us to legally poses and culture this species within the Northern Territory in a similar way to ornamental fish breeders in Eastern and Southern States.

***11. Guidelines on how species should be kept***

*As appropriate discuss the following issues:*

*11.1) What are the standards for transporting animals? Will the animals be transported according to International Air Transport Association (IATA) regulations?*

Author 1 and 2 are both very experienced transporters of aquatic life. Both have many years' experience sending fish long distances. All fish transport in the NT is via commercial airlines. All airlines will inspect shipments to ensure compliance with IATA Regulations. If the shipment is not packed correctly it is rejected for transport. Any *Labidochromis caeruleus* bought into the NT should the species be accepted as a permitted import will be from interstate breeder or wholesaler and will also be subject to the same commercial airline scrutiny of packing methods.

*How does enclosure size relate to territory requirements?*

*Discuss the containment and management standards for Australia e.g. the proportion of males to females and the maximum number that should be kept in enclosures/aquaria. Also if single sex populations would be contained within enclosures to limit breeding etc.*

*11.2) What standards are used for the enclosures/aquaria in which this species would be kept? What are the best practice standards? Who applies these standards? Will enclosures/aquaria be sufficiently large enough for the humane containment of the animals? For example, providing sufficient depth and length?*

NT Aquaculture Licensees are monitored by the NT Department of Primary Industries and Resources. The farms are inspected regularly and audited. Disease surveillance is carried out by Dr Kitman Dyrting of the Berrimah Animal Health Laboratories, a service provided by DPIR. The farms are run to a plan which is submitted and approved prior to commencement of operations. Aquaria for the breeding of this species will be approximately one to 1.2 meters wide, 150 to 250 litres. They will be furnished with rocky hiding places and one male will be placed with 4 or 5 females. As they are maternal mouth brooders, when they spawn the females will be caught and the eggs removed for artificial hatching. The young will be grown up in rearing ponds. These ponds are under shade cloth enclosures and have approved NT regulated biosecurity measures in place.

*11.5) Address welfare issues in housing captive specimens.*

*Labidochromis caeruleus* is a small fish that requires specialised water quality to be maintained and breed. The objective of a commercial aquaculture operation is to breed the fish to sell to the ornamental fish trade. If they are not maintained correctly taking care of their water quality, space and dietary requirements then the venture will be a commercial failure. The care and provisions of life support systems for aquarium fish comes under the provisions of the Northern Territory Animal Welfare Act. If the animals are not cared for there are offence provisions available for Animal Welfare Inspectors. Responsible operators such as the proponents Author 2 and Author 1 offer care sheets to their customers. It is good practise to help wholesale and retail customers be successful with their fish keeping. An example of a care sheet for a species sold by Author 2 is the Threadfin Rainbowfish *Iriatherina werneri* from Central Arnhem Land in the Northern Territory. These are sometimes difficult to keep but not if the directions provided by the commercial breeder are followed.

Author twos notes on the care of its species available on the world wide web at Universal Resource Locator.

Author 1 offers a more personalised service, his speciality is African Cichlids and Siamese Fighting Fish, *Betta splendens*. Author 1 has a busy Facebook page where he tends his customers fish keeping questions. The Facebook page is accessed through the Facebook Social Media network.

The Facebook Social Media network is available on the world wide web at universal resource locator https://m.facebook.com/home.php

The NT Animal Welfare Act is accessible on the world wide web at universal resource locator http://www.austlii.edu.au/au/legis/nt/consol_act/awa128/

***12. State/Territory controls***

*Outline any Commonwealth, state, or territory legislative controls on the species and provide information on any other relevant assessments that have been made of the species.*

*As each state and territory of Australia has different legislation regarding legally keeping different species, and some states/territories prohibit keeping certain animals, therefore please check what the restrictions each state/territory imposes.*

12.1 The Commonwealth Government
Regulation of fish imports comes under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). The list of allowable species of fishes for importation into Australia was attached as schedule 6 of the Wildlife Protection (Regulation of Imports and Exports) Act 1982 and *Labidochromis caeruleus* was not included on this list. The current list of fishes allowed for importation occurs in section 303 EB of the Environment Protection and Biodiversity Conservation Act 1999 and *Labidochromis caeruleus* is not listed in that legislation.
Information about importation of fishes is available on Department of The Environment and Energy web site accessed through universal resource locator accessed 10 March 2017 - https://www.legislation.gov.au/Series/F2006B01053

12.2 The Northern Territory
The Northern Territory Department of Primary Industry and Resources will not allow *Labidochromis caeruleus* across its border unless it 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 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 is available on line at universal resource locator accessed 12 March 2017 - http://dcm.nt.gov.au/strong_service_delivery/supporting_government/current_northern_territory_legislation_database

12.3 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. *Labidochromis caeruleus* is not listed on this schedule as noxious fish or listed in the restricted matter schedule. The most current version of Queensland Biosecurity Act 2014 can be accessed on the world wide web at universal resource locator - https://www.legislation.qld.gov.au/LEGISLTN/CURRENT/B/BiosecurityA14.pdf

12.4 Western Australian Government
Under Regulation 176 of the Fish Resources Management Regulations 1995, 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.
*Labidochromis caeruleus* is not listed as noxious or restricted in Western Australia.
West Australian Government Fish Resources Management Regulations 1995 current at 9 Dec 2016 accessed 14 March 2017, available on world wide web universal resource locator - https://www.slp.wa.gov.au/legislation/statutes.nsf/main_mrtitle_1458_homepage.html
The West Australian Government of noxious fish list accessed 13 March 2017 is available on the world wide web at universal resource locator - http://www.fish.wa.gov.au/Documents/biosecurity/noxious_fish_list.pdf

12.5 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.

12.6 The New South Wales Government
New South Wales Fisheries Management Act 1994 No 38 sections 209, 210 and 211 declare certain fish and plants to be noxious and it is an offence to possess or sell noxious fish. Section 217 controls the importation of live fishes into the state.
Section 340 of the New South Wales Fisheries Management (General) Regulations 2002 declares certain fish, aquatic invertebrates and plants to be noxious.
*Labidochromis caeruleus* is not listed as noxious in this Regulation.

12.7 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. *Labidochromis caeruleus* does not appear on this list. The list of Victorian Government declared noxious species is available on the World Wide Web at universal resource locator http://agriculture.vic.gov.au/fisheries/policy-and-planning/marine-pests-and-diseases/noxious-aquatic-species-in-victoria
The Victorian Fisheries Act accessed 14 March 2017 is available on the World Wide Web at universal resource locator - http://www.austlii.edu.au/au/legis/vic/consol_act/

*Are you aware of quarantine requirements for bringing live animals into Australia? Is the species you are proposing to have added to the Live Import List allowed to be imported under the Quarantine Act 1908? Does an import permit need to be obtained from AQIS?*

*If not, contact Biosecurity Australia to discuss the undertaking of an Import Risk Analysis (IRA) by telephone on (02) 6272 3933 or visit their website for more information at www.BiosecurityAustralia.gov.au.*

There is a process in place under the provisions of the new Biosecurity Act 2015 for importing Ornamental Fishes and the disease protocols to prevent fish carrying disease into Australia. The proponents do not intend to import any *Labidochromis caeruleus* into Australia but realise that other importers may do so. Any importer will have to follow the quarantine protocols put in place by the Department of Agriculture and Water Resources.

Australian Government Department of Agriculture and Water Resources, conditions for importing liveornamental fish into Australia available on the world wide web at universal resource locator - http://www.agriculture.gov.au/import/goods/live-animals/importing-live-fish-aus

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