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***Boraras brigettae*: Report addressing the Department of Agriculture, Water and the Environment terms of reference for proposed amendments to the *List of Specimens taken to be Suitable for Live Import* (Live Import List)**



October 2022 (Updated May 2023)

Executive Summary

Consideration of the Department of Agriculture, Water and the Environment (DAWE) terms of reference for proposed amendments to the List of Specimens taken to be Suitable for Live Import (Live Import List) against information available for the Chili Rasbora (*Boraras brigittae*) indicates the risk of allowing the importation of the species would pose minimal biosecurity risk to Australia. The species has not been reported as having established in the wild outside its natural range. Related species such as *Boraras maculatus* (Dwarf spotted rasbora) and 11 Rasbora species have not established self-maintaining wild populations in Australia despite decades of importation. Small numbers of *B. brigittae* already exist in the domestic hobby having been regularly bred and traded in Australia over the last 25 years — although these are not large commercial numbers of fish, these populations have not led to the establishment of feral populations in Australia.

Importantly, most of the information available about this species is from the ornamental fish hobby literature; there is little information in the scientific literature, especially as it relates to establishment risks. The absence of such reports despite the many decades of worldwide trade is precisely because of the benign nature of the species since scientific study (and associated literature) focuses almost exclusively on species found to be invasive. Indeed, three of the five criteria used in the Bomford methodology (Bomford 2008) for determining establishment success (as used in the Department's own assessments) pertain to the presence or absence of reported historical establishment — the other two criteria being the species' climatic and geographical range. The absence of published scientific literature about the species should not therefore be the sole basis of decision making, especially when there is a long history of trade to draw on — to do so is considered outside the intended applicability of the Environment Protection and Biodiversity Conservation Act's precautionary principle.

Of the many species that would add value to the ornamental fish hobby sector in Australia, this species has been selected for application to add to the Live Import List largely because it is not considered invasive or otherwise ecologically harmful, nor associated with diseases exotic to Australia. It is a small, benign species similar in many respects to fish already deemed appropriate to be imported into Australia.

B. brigittae would be a welcome addition to the species permitted live importation, especially given the growing popularity of the ornamental fish hobby in Australia and the significant economic and social benefits of the aquarium fish trade to Australia. The addition of *B. brigittae* would be consistent with current import policy given it is closely related to and likely shares a similar environmental risk profile to other closely related species currently permitted live importation to Australia.

A structured risk assessment based on the methodology of Bomford (2008) estimated a 'low' risk, *B. brigittae* also received a SARDI method risk score of 0 which is considered low risk. These results further support and reinforce the data already presented using the Bomford model and will enable high level of confidence in the data presented. *B. brigittae* should be considered a lower risk than many if not most of the species currently permitted live importation to Australia. It is recommended that *B. brigittae* is added to the Live Import List.

This TOR report should be read together with the 'Frequently Asked Questions' (Appendix 1) document that forms part of the package of information submitted to the DEWA in support of the Pet Industry Association of Australia's application to add *B. brigittae* to the Live Import List.

DAWE terms of reference

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

- Chili rasbora, *Boraras brigittae* Boulenger 1901
- Actinopterygii (ray-finned fishes); Cypriniformes (Carps); Danionidae (Danios); Rasborinae (rasboras)
- *Synonyms: Rasbora urophthalma brigittae; Rasbora brigittae*
- *Common names: chili rasbora*

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

- *Boraras brigittae* is not CITES listed.
- This species is listed on the International Union for Conservation of Nature's Red List of Threatened Species as data deficient. This species has a wide distribution in Borneo, where widespread large-scale destruction of its peat swamp habitat is the primary threat (Lumbantobing 2020).
- *B. brigittae* is native to Borneo in South and Central Kalimantan provinces where it inhabits slow flowing, tannin-stained swamp water. The species is considered common in these habitats, including the type locality near Banjarmasin (Lumbantobing 2020).
- Most supply for the aquarium trade is sourced from captive breeding from commercial fish farms (Lumbantobing 2020).

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

As with most aquarium species, much of the information about the ecology, including environmental requirements, of *B. brigittae* is not available in the peer reviewed scientific literature. Where such information is lacking, this assessment relies on hobbyist information websites, so applies largely to aquarium behaviour and requirements (Woods n.d., Yang 2020 and Seriously Fish n.d.).

- *Lifespan of the species: 4-8 years in aquaria if maintained properly* (Woods n.d., Yang 2020).
- *Size and weight range: The fish grow to 15-20mm length* (Seriously Fish n.d.).

- *Natural geographic range*: *B. brigittae* is found in southern and central Borneo in peat forest blackwater swamps.
- *Habitat*: Habitat requirements are well documented for maintaining in aquaria. *B. brigittae* lives in peat swamps where the water is exceptionally pure, stained with tannin, soft (negligible hardness dH 3-12) and acidic (pH 4-7). The species requires a temperature range of 20-28°C (Seriously Fish n.d., Woods n.d.) and stable water quality with no rapid fluctuations (Yang 2020).
- *Diet, including potential to feed on agricultural plants*: Chili rasboras are pelagic omnivores that feed primarily on insects and other small arthropods (Brittan 1972 and Ward-Campbell *et al.* 2005 cited in Lumbantobing 2020). The food types indicate water column feeding without ingestion of significant terrestrial plant material.
- *Social behaviour and groupings*: Details of social behaviours have not been reported, although the species shoals in their native habitat (Vogt 1978, Kottelat and Vidthayanon 1993 and [REDACTED] cited in Lumbantobing 2020). Fish-keeping hobby websites sites recommend schools of at least six fish, preferably more (Woods n.d.).
- *Territorial and aggressive behaviours*: None recorded. Some aquarist websites promote them as a community tank species, although their very small size limits compatible tank mates.
- *Natural predators*: Not reported but piscivorous insects, birds, mammals or fish in their habitat would likely prey on them.
- *Characteristics that may cause harm to humans and other species*: No characteristics that may cause harm to human or other species have been reported in this species. FishBase reports the species as harmless to humans (Froese and Pauly n.d.—a).

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

The reproductive biology of *B. brigittae* is fairly well understood in as far as the species is routinely bred in aquaria, although detailed observations of breeding behaviours have not been reported.

- *Age at maturity (first breeding)*: 2 years ([REDACTED])
- *How frequently breeding occurs*: The species is bred commercially for the ornamental fish trade. Females spawn constantly under aquarium conditions (Woods n.d.).
- *Can the female store sperm*: No. External fertilisation; broadcast spawners.
- *How many eggs or live-born young are produced at each breeding event*: Not described although a small number of eggs are produced at each spawning.
- *Has the species hybridised with other species (both in the wild and in captivity) or has it the potential to hybridise with any other species*: Hybridisation has not been reported in this species, although it is sympatric with *Boraras merah*.

- If the species can hybridise, are the progeny fertile: N/A.

5. Provide information on whether this species has established feral populations, and if so, where those populations are. Include information on whether this species has been introduced to other countries, even if it has not established feral populations.

The species has not been reported as having established feral population outside of their natural geographic distribution (Froese and Pauly n.d.—a), despite being traded internationally for the aquarium trade. The species is unlikely to breed and form self-sustaining populations outside its optimal water temperature range of 20-28°C.

6. Provide information on, and the results of any other environmental risk assessments undertaken on the species both in Australia and overseas, including any Import Risk Analyses undertaken.

A search of the scientific literature identified a recent risk assessment of the species by Millington M, Sierp M, Gaylard S (2022) page 29. This assessment used the SARDI method contained in the report Deveney, M. (2018) Assessing the risks associated with the Australian Trade in live ornamental fish species: development of a risk assessment tool. Importantly the SARDI methodology also considers the already existing risk associated with the trade of species already present in Australia, something overlooked by other models. The SARDI methodology compiles risk scores from responses to 40 separate risk queries covering three separate categories, the likelihood of release, likelihood of invasion, and consequences of invasion. It must also be recognized that the SARDI risk assessment was developed with funding from environment and invasive committee (EIC) and endorsed by all federal, state and industry stakeholders and participants in the EIC, as well as the aquatic pest vertebrate and invertebrate working group, as a suitable method to determine risk associated with the trade of ornamental fish already in Australia. *B. brigittae* received a SARDI risk score of 0 which is considered low risk. These results further support and reinforce the data already presented using the Bomford model and will enable high level of confidence in the data presented.

The species is not on the BRS 'grey list' of likely high biosecurity risk ornamental fish species, i.e. non-native species that are present in Australia through historical imports that are not on the Live Import List, noting, the grey list is not extensive and does not cover all ornamental species that are historically present in Australia. It is also not one of the species of non-native freshwater fish that are reported to have established self-sustaining populations in the wild in Australia (Corfield *et al.* 2008). However, the species is known to be captive bred and traded domestically in Australia ([REDACTED]). It is unknown how the first individuals arrived in Australia — it is plausible that they may have been shipped to Australia inadvertently as they resemble some closely related species on the current Live Import List.

The addition of *B. brigittae* to the Live Import List would be generally consistent with Australia's biosecurity arrangements for live fish given that the species is present in Australia and given that it is closely related to and likely shares a similar environmental risk profile with species such as *B. maculatus* currently permitted live importation to Australia.

7. *Assess the likelihood that the species could establish a breeding population in the Australian environment should it ever be released from effective human control.*

Assessing the risk of the potential of introducing a new organism into the environment involves assessing the risk of it becoming established and spreading and the likely impacts if establishment occurred. The risk assessment method 'Exotic Freshwater Fish Model 1' developed by Mary Bomford has been adopted by DAWE for its freshwater fish risk assessments (Bomford 2008). The following considers each of the risk factors considered by Bomford to be applicable to freshwater fish and is guided by the recent Australian Government risk assessment of glass catfish (DAWE 2020a). The specific criteria in the DAWE terms of reference template are also covered. The potential impacts of established feral populations are addressed in the next term of reference (#8). A structured risk assessment based on the Bomford methodology is at Appendix A.

Importantly, most of the information available about this species is from the ornamental fish hobby literature; there is little information in the scientific literature, especially as it relates to establishment risks. The absence of such reports despite the many decades of worldwide trade is precisely because of the benign nature of the species since scientific study (and associated literature) focuses almost exclusively on species found to be invasive. Indeed, three of the five criteria used in the Bomford methodology (Bomford 2008) for determining establishment success (as used in the Department's own assessments) pertain to the presence or absence of reported historical establishment – the other two criteria being the species' climatic and geographical range. The absence of published scientific literature about the species should not therefore be the sole basis of decision making, especially when there is a long history of trade to draw on – to do so is considered outside the intended applicability of the Environment Protection and Biodiversity Conservation Act's precautionary principle.

Of the many species that would add value to the ornamental fish hobby sector in Australia, this species has been selected for application to add to the Live Import List taking into account the fact that the species has not been reported to be invasive or otherwise ecologically harmful, nor associated with diseases exotic to Australia. It is a relatively small, benign species similar in many respects to fish already deemed appropriate to be imported into Australia.

- *Propagule pressure—the release of large numbers of animals at different times and places enhances the chance of successful establishment: B. brigittae* is a schooling species. As the species lives in still, tropical, blackwater environments there would be some limited opportunities to establish in the blackwater swamps in northern coastal Australia. ([REDACTED]) It is unlikely therefore that enough fish would be released into a suitable receiving environment to establish a breeding population as a result of an accident or being deliberately released into the local waterways in or near populated areas. There are examples of tropical aquarium species such as *Poecilia reticulata* that have established small populations in disturbed habitats in urban and peri-urban areas like those found in Darwin, Cairns or Brisbane (Arthington et al. 1999). *B. brigittae* is not known to have established in the any such habitats overseas despite the trade in this species for decades. A moderate to high probability of establishing a self-sustaining population would require deliberate release into very specific waterways – it is unlikely therefore

the last many decades of international trade, this would mean that release events are very rare and that the overall risk is commensurately minute.). The 'genus level' taxa risk is therefore 0/50 (0%). Notably, the related *B. maculatus* is on the current list of specimens taken to be suitable for live import and has been imported to Australia for many years without wild populations being established. Furthermore, *B. brigittae* already exists in the domestic hobby having been bred and traded in Australia over for many years – although these are not large commercial numbers of fish, these populations have not led to the establishment of feral populations in Australia.

- *Ability to find food sources*: As a carnivore feeding primarily on insects and microcrustaceans, the species is expected to find food sources in the unlikely event it is introduced into the wild.
- *Ability to survive and adapt to different climatic conditions (e.g. temperatures, rainfall patterns)*: Temperature range is 20-28°C, pH 4.0-7.0 and hardness 18-179ppm (Seriously Fish n.d.). Notably temperature ranges in many of the potentially suitable environments in Australia fluctuate outside of these parameters (Herbert *et al.* 1994, Pusey *et al.* 2000).
- *Ability to find shelter*: As a swamp dwelling tropical fish with an affinity for still, black water there would be some limited habitat in the type of swamps that have the required temperature range in Northern Australia.
- *Rate of reproducing*: Overall rate is unknown. The species does spawn freely in aquaria (Woods n.d.), but numbers of eggs laid on each occasion have not been reported. In aquaculture conditions, females produce approximately 30 eggs per spawning ().
- *Any characteristics that the species has which could increase its chance of survival in the Australian environment*: The species is not considered to have any characteristics that would increase its likelihood of survival in the wild in Australia.

In summary, *B. brigittae* is considered unlikely to establish, in main because the species is not reported to have established breeding populations outside its natural range despite being traded internationally as an ornamental species for many decades and there are few areas in Australia expected to have habitat suitable for the species to establish. This conclusion can be ground-truthed to an extent by comparing the species with the related *B. maculatus*, which has not established self-maintaining wild populations despite several decades of importation to Australia for the aquarium trade. Furthermore, *B. brigittae* already exists in the domestic hobby having been bred and traded in Australia over many years – although these are not large commercial numbers of fish, these populations have not led to the establishment of feral populations in Australia.

Using the SARDI method, specifically risk queries 25 to 40, show little to no consequences of invasion should *B. brigittae* establish feral populations in Australia (Millington M, Sierp M, Gaylard S 2022). The SARDI risk assessment included a thorough review of all available literature showed that *B. brigittae* has no recorded impacts on any wild or farmed aquatic species outside its natural range. It is not a parasitic species, nor is there any novel or notifiable diseases in the literature. It is not a migratory species, causes no harm to humans and has no records of altering the

function of ecosystems, nor does it outcompete or prey on any fish species, beyond its natural range. It also cannot hybridise with any Australian native fish. Furthermore, there is no evidence in any literature, worldwide, that the species has ever caused any deleterious environmental, social or economic impacts. (Millington M, Sierp M, Gaylard S 2022).

8. *Provide a comprehensive assessment of the potential impact of the species should it establish feral population/s in Australia. Include, but do not restrict your assessment to the impact of this species on:*
 - *Similar niche species (i.e. competition with other species for food, shelter etc.):* In the unlikely event this species establishes in the wild in Australia, it may compete for pelagic microcrustaceans with other small tropical fish typically in blackwater habitats. These niche species could include threadfin rainbows (*Iriatherina wernerii*), Gertrude's blue-eye (*Psedomugil gertrudae*), Pacific blue-eye (*Psedomugil signifier*) pennyfish (*Denariusa bandata*) and Macchulloch's rainbowfish (*Melanotaenia macchullochi*) (Herbert and Peeters 1995). There are no reports in the scientific literature of any ecological impacts as a result of the species establishing outside its natural range in other countries. As noted in TOR 7 above, the absence of such reports is an indication of the benign nature of the species since scientific literature focuses almost exclusively on species that have some ecological impact.
 - *Is the species susceptible to, or could it transmit any pests or disease:* No significant pests or diseases have been associated with this species or the family as a whole, including any of the diseases to which there are disease-specific risk management measures applied by DAWE for importation of ornamental fish to Australia.
 - *Probable prey/food sources, including agricultural crops:* *B. brigittae* feeds on insects and microcrustaceans. It does not feed on any agricultural crops.
 - *Habitat and local environmental conditions:* *B. brigittae* has not been reported to change its environment or habitat. It is a swamp dwelling fish with a narrow temperature and pH range.
 - *Control/eradication programs that could be applied in Australia if the species was released or escaped:* Potential control measures include listing as a noxious species; eradication or containment programs (including movement controls) or broader education/awareness building campaigns such as labelling aquarium fish bags with messaging.
 - *Characteristic or behaviour of the species which may cause land degradation i.e. soil erosion from hooves, digging:* There are no reports of this species exhibiting behaviours that may cause habitat degradation.
 - *Potential threat to humans:* The species is not reported as posing any threat to humans (Froese and Pauly n.d.—a).
9. *What conditions or restrictions, if any, could be applied to the import of the species to reduce any potential for negative environmental impacts (e.g. single sex imports, de-*

sexing animal prior to import etc.).

Potential environmental impacts from importation of live animals into Australia can take the form of direct pest risks or indirect risks associated with the introduction of new diseases that may be carried in imported stock. In the case of *B. brigittae*, importation under Australia's current import conditions would reduce potential disease risks to an acceptable level, consistent with previous Australian Government disease risk analyses (Kahn *et al.* 1999, DOA, 2014).

10. Provide a summary of the types of activities that the specimen may be used for if imported into Australia (e.g. pet, commercial, scientific).

- *Benefit of this species for these activities:* Permitting importation of this species will bolster the ornamental fish industry. In a broader context, the ornamental fish hobby is an important one. Aside creating employment and contributing to the economy of all states and Territories, it has become especially important during the CoViD pandemic where individuals subject to movement restrictions are turning increasingly to the hobby for recreation – the hobby therefore plays a significant part in helping alleviate the stressors associated with the pandemic and post-CoViD recovery, both from economic and social perspectives.

The direct and indirect economic benefits of ornamental fish importation carry through the aquarium industry supply chain and into the hobby. The economic beneficiaries include, but are not limited to, aquarium fish importers, wholesalers, aquarium hard goods distributors, retail pet and aquarium shops, commercial and hobby breeders as well as freight and logistics providers and other associated suppliers.

Importantly, keeping ornamental fish fosters companion animal care which has benefits to society beyond the direct economic value of the trade. There are companionship as well as mental health benefits. There has never been a more important time for these benefits to flow through Australian society. The aquarium hobby also plays an often undervalued educational role, especially relevant to younger Australians. The benefits in this respect include, but are not limited to, an increased understanding of, and appreciation for, biology, chemistry, physiology as well as geography and natural history.

- *Potential trade in the species:* The species is routinely traded internationally and would be a welcome addition to the species permitted importation. In the order of 2 million fish of the species are traded internationally and given the growing popularity of the hobby in Australia, the likely market demand in Australia for imported *B. brigittae* would represent about one percent of this ([REDACTED]).
- *Why this species has been chosen:* Internationally, the species is in high demand by hobbyists. New rasbora species, particularly of such a small size and bright colouration, would be popular in Australia, adding variety to the species available to Australian hobbyists. The species is not aggressive and compatible to keep in

aquaria with other most other very small tropical species. One other species, *Boraras maculatus*, is currently permitted for import to Australia.

Although small numbers of this species are known to be present in the Australia hobby, these are not available with the reliability or in sufficiently large commercial volumes needed by the industry. Imported stock would provide reliable access to the numbers, range in sizes and varieties (such as new colour morphs) needed to meet Australian hobby demand.

11. *Provide detailed guidelines on the way in which the species should be kept, transported and disposed of in accordance with the types of activity that the species may be used for if imported into Australia.*

- *The containment (e.g. cage, enclosure) and management standards for this species to prevent escape or release. This should also talk about the security standards for this specimen:* The fish will be transported as per the International Air Transport Association (IATA) guidelines and the provisions of the *BICON Import Conditions for Freshwater Aquarium Fish: Effective 18 July 2020* (DAWE 2020b)
- *The disposal options for surplus specimens:* Fish will be imported for purposes of supplying the aquarium fish trade and as such no surplus specimens are expected. In the event of mortality, animals will be disposed as per the provisions of the *BICON Import Conditions for Freshwater Aquarium Fish: Effective 18 July 2020* (DAWE 2020b) and in accordance with the Pet Industry Association of Australia (PIAA) National Code of Practice (PIAA 2008).

12. Provide information on all other Commonwealth, state and territory legislative controls on the species, including:

- *The species' current quarantine status:* The species is not currently on the permitted species list (closely related species are).
- *Pest or noxious status:* The species is not listed on any state or federal pest or noxious species list.
- *Whether it is prohibited or controlled by permit or licence in any state or territory:* The species is not prohibited or controlled by permit or licence in any state or territory.

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Appendix A: Bomford model risk assessment: *Boraras brigittae*

Assessing the risk of the potential of introducing a new organism into the environment involves assessing the likelihood of it becoming established and spreading and the likely impacts if the species does establish. The following analysis applies the assessment method for determining the risk of establishment of exotic freshwater fish introduced to Australia (Model 1) described in Bomford (2008) and is guided by the recent DAWE risk assessment of glass catfish (DAWE 2020a).

Bomford (2008) identified a range of factors that determined establishment success of freshwater fish, including propagule pressure, climate match, history of establishment elsewhere, geographic range and taxonomic group. These risk factors together with potential impacts should *B. brigittae* (Vogt 1978) establish wild populations in Australia are discussed below, as are the outputs of applying the Bomford (2008) methodology. These findings should be considered together with information addressing the DAWE terms of reference for proposed amendments to the *List of Specimens taken to be Suitable for Live Import (Live Import List)* in the body of this submission.

Establishment success

Propagule pressure—the release of large numbers of animals at different times and places

B. brigittae is a schooling species. A moderate to high probability of establishing a self-sustaining population would require deliberate actions by a knowledgeable individual to introduce a large number of fish into very specific aquatic habitats. As the species lives in blackwater peat swamps there could be some limited opportunities to establish in the few suitable locations in northern tropical Australia (). There are examples of tropical aquarium species with known invasive characteristics such as *Poecilia reticulata* that have established small populations in disturbed habitats in urban and peri-urban areas such as those that exist in Darwin, Cairns or Brisbane (Arthington et al. 1999). *B. brigittae* is not known to have established in the many such habitats overseas despite the trade in this species for decades. A moderate to high probability of establishing a self-sustaining population would require deliberate release into very specific waterways – it is unlikely therefore to happen at random, similar in risk to glass catfish (*Kryptopterus vitreolus*) as noted in a recent Departmental risk assessment (DAWE 2020a). It is unlikely that enough fish would be accidentally or deliberately released into a suitable receiving environment to establish a breeding population.

Climate match—introduction to an area with a climate that closely matches that of the species' original range:

Climatch (v2.0) was run with the source region set to circumscribe an area in southern Borneo described in Lumbantobing (2020). A climate match prediction was generated using the Euclidian algorithm applied to the 'world stations' data set. Climatch calculated a 'value 5' (Climate Euclidian Sum Level 5) of 0, equating to a climate match score of 1 using recalibrated 'value 5' ranges for Climatch v2.0 provided by ABARES². DAWE (2020a) suggested the need for some caution in predicting climate suitability for freshwater aquatic species because Climatch is based on terrestrial climate measurements.

² Recalibrated Climatch v2 'value 5' ranges corresponding to climate match scores 1-8: 1(0), 2 (1-276), 3(277-1036), 4(1037-2763), 5(2764-6907), 6(6908-10361), 7(10362-17268), 8 (>17268)



Score	0	1	2	3	4	5	6	7	8	9	10
Count	19225	10	1	0	0	0	0	0	0	0	0

Figure 1 Climatch output for *Boraras brigittae*

History of establishment elsewhere-previous successful establishment:

There are no reports on FishBase of introductions or establishment of this species outside its known natural range (Froese and Pauly n.d.-a). The absence of established populations outside its natural range is despite being actively traded internationally as an aquarium species for many years (Jared Patrick, Premier Pet, pers. com.).

Overseas range:

The species is endemic to Borneo. The confirmed area in Kalimantan with suitable habitat of over 87,000 km² (Lumbantobing 2020) was used to determine a total overseas range of 14, 1° latitude x 1° longitude grid squares for purposes of the Bomford (2008) assessment.

Introduction success:

The species is not known to have established outside its native range. However, it can be assumed that the species has been released into non-native areas on many occasions over the many years of trade worldwide as an aquarium species. The introduction success rate is conservatively considered to be less than 0.25 (Bomford 2008).

Taxonomic group—belonging to a family or genus which has a high establishment success rate:

FishBase recognises 6 species of *Boraras* (Froese and Pauly n.d.-b). *B. brigittae* belongs to the family Rasborinae (rasboras). FishBase recognises 6 species of *Boraras* (Froese and

Pauly n.d.—b). Of these, 3 species are reported in FishBase as traded internationally as commercial aquarium species and none have been reported in the wild outside their natural range. As internationally traded aquarium species, it is reasonable to assume (in the absence of published scientific data) that there would have been many past instances (perhaps in the hundreds) of inadvertent or deliberate introduction of these four species around the world over the many decades that these species have been traded – an introduction being a release event where one or more individuals of these species are directly or indirectly released into natural waters outside their natural range. A conservative 50 past introductions are assumed for the purposes of this risk assessment. (If a much smaller number of release events are deemed to have occurred over the last many decades of international trade, this would mean that release events are rare and that the overall risk is commensurately low.) If the Bomford (2008) methodology is applied to the genus *Boraras*, where the genus success rate % = 100 x (Number of successful introductions to all countries of species in the genus/Total number of introductions to all countries of species in the genus), the 'genus level' taxa risk is 0/50 (0%). Notably, the related *B. maculatus* is on the current list of specimens taken to be suitable for live import and has been imported to Australia for many years without wild populations being established. Furthermore, *B. brigittae* already exists in the domestic hobby having been bred and traded in Australia over for many years – although these are not large commercial numbers of fish, these populations have not led to the establishment of feral populations in Australia.

Potential impacts of established feral populations

There is no evidence of any detrimental impact caused by the establishment of the species. In the unlikely event this species establishes in the wild in Australia, it may compete for pelagic microcrustaceans with other small tropical fish typically in blackwater habitats. These niche species could include threadfin rainbows (*Iriatherina werneri*), Gertrude's blue-eye (*Pseudomugil gertrudae*), Pacific blue-eye (*Pseudomugil signifier*), pennyfish (*Denariusa bandata*) and Macchulloch's rainbowfish (*Melanotaenia macchullochi*) (Herbert *et al.* 1995, Pusey *et al.* 2000). There are no reports in the scientific literature of any ecological impacts as a result of the species establishing outside its natural range in other countries. No competition would be expected with benthic or surface feeding fish.

Disease transmission to Australian fish and aquarium fish populations

No significant pests or diseases have been associated with this species, including any of the diseases to which there are disease-specific risk management measures applied for importation of ornamental fish to Australia. Rasboras fishes as a group are considered of low risk in terms of disease risks in that they are subject to the minimum one-week post arrival quarantine isolation on importation to Australia (DAWE 2020b).

Bomford 2008 Exotic Freshwater Fish Risk Assessment Model

Common name	Chili rasbora
Scientific name	<i>Boraras brigittae</i> Vogt 1978
Date assessed	8 December 2021
Literature Search Type and Date:	FishBase December 2021

Risk criterion	Value	Explanation
A. Climate Match Score (1-8)	1	Climatch (v201.0) Euclidian Sum Level 5 (Value X) = 0. This value equates to a climate match score of 1.
B. Overseas Range Score (0-4)	2	<i>B. brigittae</i> is estimated to occupy a total range of 14, 1° latitude x 1° longitude grid squares.
C. Establishment Score (0-3)	0	The species is considered to have been "introduced but never established", representing an establishment score of 0.
D. Introduction Success Score (0-4)	1	The species is not known to have established outside its native range. However, after many decades of trade worldwide it can be assumed it has been released into non-native areas on many occasions. The introduction rate is conservatively considered (that is erring on the side of overestimation) to be <0.25, representing an introduction success score of 1.
E. Taxa Risk Score (0-5)	0	Conservatively, 50 past introductions of the 3 internationally traded species of the genus are assumed for the purposes of this risk assessment. There are no records on FishBase of <i>Boraras</i> species being found to have been potentially established outside the countries to which they are native. The 'genus level' taxa risk is therefore 0/50 (0%).

Summary	Score	Rank
Establishment Risk	4	Low

Conclusion

The estimated risk of 'low' using the Bomford (2008) methodology is generally less than the risk that would be posed by many if not most of the species currently permitted live importation to Australia. It is recommended that *Boraras brigittae* is added to the Live Import List.