

***Yasuhikotakia modesta*: Application 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)**



September 2021

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 Redtail Botia (*Yasuhikotakia modesta*) indicates the risk of allowing the importation of the species would pose minimal biosecurity risk to Australia. There is a single report of *Y. modesta* being found in the wild outside its natural range, although it is not confirmed to have established a self-maintaining population. Similar species such as *B. lohachata* have not established self-maintaining wild populations in Australia despite over 16 years of importation. Furthermore, populations of *Y. modesta* likely exist in the domestic ornamental fish hobby having been intermittently traded in Australia over the last 40 years — these 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 is an indication of the benign nature of the species since scientific study (and associated literature) focuses almost exclusively on invasive species that have some ecological impact. 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 not considered 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.

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

A structured risk assessment based on the methodology of Bomford (2008) estimated a 'moderate' risk, generally consistent with the risk that would be posed by most of the species currently permitted live importation to Australia. It is recommended that *Y. modesta* is added to the Live Import List.

DAWE terms of reference

1. *Provide information on the taxonomy of the species.*
 - Redtail Botia, *Yasuhikotakia modesta* Bleeker 1864.
 - Actinopterygii (ray-finned fishes); Cypriniformes (Carps); Botiidae (loaches); Sub-family Botiinae.
 - Synonyms: *Botia modesta* Bleeker 1864; *Botia rubripinnis* Sauvage 1876 (Froese and Pauly n.d.—a)
 - Common names: Red-finned Loach, Blue Botia (Thoene 2007).
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.

- *Yasuhikotakia modesta* is not CITES listed.
- This species is listed on the IUCN Red List as Least Concern (LC) (Allan 2011).
- *Y. modesta* is found in the Mekong and Chao Phraya basins and Mae Khlong basin (Laos, Thailand, Cambodia (Froese and Pauly n.d.—a), where they are valued as food and for the aquarium trade (Hanjanavit *et al.*, 2013). It is one of the main species caught at the Rhone waterfall fishery in Laos (Roberts and Baird, 1995) and form a small part of the overall Dai fishery in the Tonle Sap in Cambodia (Halls *et al.* 2013).

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

Virtually all information about *Y. modesta* aside from taxonomic information comes from hobbyist websites so applies to aquarium behaviour and requirements. Some sites do give limited information on diet needs in the wild. There is one specific paper describing diet (Hanjanavit *et al.* 2013), one on behaviour and vocalisations (Raffinger and Ladich 2009) and others describing the migratory habits of and fishery for the species (Halls *et al.* 2013, Kottelat 1998, Roberts and Baird 1995).

The species lives in the Mekong River, a turbid river with strong seasonal flows. They are caught in the main channels in the region's many artisanal fisheries (Roberts and Baird 1995; Halls *et al.* 2013). All Botiids are recommended as snail control in aquaria and are considered likely to eat much smaller tank companions. They are gregarious in aquaria, suggesting that they live in small groups in the wild.

Water requirements in aquaria are for very clean water, with most websites recommending at least weekly water changes and high filtration levels. Water parameters are 23-30°C, pH of 6-8 and hardness 36-215 mg/L (2-15 dGH) (Seriously Fish nd—a, Thoene 2007).

There is no published information on the fecundity of *Y. modesta*. The species migrates into tributaries and small streams to spawn early in the flood season, then moves back to the main river channels to migrate upstream (Froese and Pauly n.d.—a). Studies on a mountain species (*B. almorhae*) found that it bred in the northern hemisphere spring in slow moving water, producing 908-3616 eggs depending on size (Joshi and Pathani 2009). Another species (*Botia dario*) produced 5245 to 53754 eggs averaging 31833 (Hossain *et al.* 2007).

- Lifespan of the species: 5-12 years (Thoene 2007).
- *Size and weight range:* *Yasuhikotakia modesta* grows to about 250mm total length in the wild (Kottelat 1998), but most aquarium specimens are around 180mm (Thoene 2007).
- *Natural geographic range:* Asia: Mekong and Chao Phraya basins and Mae Khlong basin (Laos, Thailand, Cambodia (Froese and Pauly n.d.—a).
- *Habitat:* No precise habitat descriptions for *Y. modesta* have been published, although FishBase reports it from flooded fields, and that the species moves from the main water courses into smaller tributaries for spawning (Froese and Pauly n.d.—a).

- *Diet, including potential to feed on agricultural plants:* *Y. modesta* feeds largely on benthic invertebrates and like all Botiids, on snails. The diet includes dipteran and trichopteran larvae, zooplankton, molluscs, terrestrial dipteran adults, plant materials and green algae (Tropical Fish Keeping 2019). Plant parts and filamentous algae were also found in the analysed gut contents (Hanjanavit *et al.* 2013). *Y. modesta* is not considered a threat to planted aquaria.
 - *Social behaviour and groupings:* Although *Y. modesta* is not considered to be a true schooling species, the species is gregarious as are all Botiids, preferring to live in groups of over five as they maintain complex social hierarchies (Seriously Fish nd—a). All Botiids are also known to nip fins of larger, slow moving fish with large fins (Brough and Roche n.d.). *Y. modesta* also vocalises (clicks) audibly as part of its intraspecific threat behaviour (Raffinger and Ladich, 2009).
 - *Territorial and aggressive behaviours:* *Y. modesta* is not territorial but may nip fins or eat small fish in aquaria. The species in aquarium settings needs to be in a larger group because in smaller groups, a dominant fish may prevent smaller fish from eating (Seriously Fish nd—a).
 - *Natural predators:* Not reported in the scientific literature but the species would likely be prey to piscivorous birds, mammals or fish in their natural habitat.
 - *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. The species has sub-ocular spines which could cause a minor injury if carelessly handled.
4. *Provide information on the reproductive biology of the species:*
- Y. modesta* is farmed commercially. In the wild, the species like others in the genus is a seasonal, migratory spawner (Seriously Fish nd—a). *Y. modesta* undergoes an upstream migration, apparently triggered by receding water levels, between November and March each year, and down-stream from May to July as waters rise to spawn (Seriously Fish nd—a).
- *Age at maturity (first breeding):* 3 years
 - *How frequently breeding occurs:* Not known but likely once per year in the wild given that it is a seasonal migratory spawner (Seriously Fish nd—a). Under aquaculture conditions, females can spawn up to three times a year.
 - *Can the female store sperm:* Females are not reported to store sperm. It is unlikely as there is no intromittent organ.
 - *How many eggs or live-born young are produced at each breeding event:* The fecundity of *Y. modesta* in the wild has not been reported. A fecundity of approximately 200 eggs per spawn is achieved when the species is bred commercially. The fecundity of two other species of the Botiinae in the wild (*Botia almorhae* and *Botia dario*) reported higher fecundities of 908-3616 and 3,000 to 55,000 eggs per spawn, respectively (Joshi and Pathani 2009, Hossain *et al.* 2007).
 - *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:* There are no reports of hybridisation

in wild populations. Hybridisation in the family through captive breeding has been reported (Seriously Fish nd—b).

– *If the species can hybridise, are the progeny fertile:* Not known.

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.*

There is a single report of *Y. modesta* being found in the Philippines, although it is unknown if this represents an established feral population (Froese and Pauly n.d.—a). This single case is despite the species being traded internationally as an aquarium species for over 40 years.

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 did not identify any previous environmental risk assessment of this species. The species is not on the BRS 'grey list' of ornamental fish species, i.e. non-native species that are present in Australia through historical imports that are not on the Live Import List, nor is it 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). It is noted that the BRS grey list is currently under review by a technical working group of the Vertebrate Pest Committee and is being amended to better reflect the ornamental fish species historically present and traded in Australia. It is further noted that *Y. modesta* has been present and intermittently traded domestically in Australia in the past and small numbers likely persist as aquarium specimens.

The addition of *Y. modesta* to the Live Import List would be generally consistent with Australia's biosecurity arrangements for live fish given that the species is closely related to and shares a similar environmental risk profile with the clown loach (*Chromobotia macracanthus*), the dwarf chain loach (*Ambastaia sidthimunki*) and the yoyo loach (*Botia lohachata*), all of which are 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 template terms of reference 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 is an indication of the benign nature of the species since scientific study and associated literature focuses almost exclusively on invasive species that have some ecological impact. 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 not considered invasive or otherwise ecologically harmful.

- *Propagule pressure—the release of large numbers of animals at different times and places enhances the chance of successful establishment: Yasuhikotakia modesta lives in the Mekong River, which is a turbid with strong seasonal flows. They are caught in the main channels in the many artisanal fisheries there (Roberts and Baird 1995; Halls et al. 2013). As such, the opportunity to find shelter in the event of deliberate or inadvertent release into the wild would be limited to some streams in the wet tropics of far northern Queensland. It is unlikely 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 a populated area. 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 (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 was used to assist in identifying possible habitats in Australia that the species could inhabit if released (Bomford, 2008). Y. modesta is endemic to the Mekong and Chao Phraya basins, and Mae Khlong basin (Thailand Laos and Cambodia). Climatch (original v1.0) was run with the source region set to circumscribe an area across Thailand, Laos and Cambodia consistent with the probable distribution described in Allen (2013). A climate match prediction was generated using the Euclidian algorithm applied to the ‘world stations’ data set. Climatch calculated a ‘value X’ (Climate Euclidian Sum Level 5) of 741, equating to a climate match score of 5. DAWE (2020a) suggested the need for some caution in predicting climate suitability for freshwater aquatic species because Climatch is based on terrestrial climate measurements. The new upgraded version of Climatch (v2.0) was not used in this assessment because its improved mapping resolution results in higher output values that are yet to be calibrated for purposes of applying the Bomford methodology.*
- *Overseas range: Y. modesta is endemic to the Mekong and Chao Phraya basins, and Mae Khlong basin (Thailand Laos and Cambodia). Based on the species distribution in Allen (2013), the species is estimated to occupy a total 78, 1° latitude x 1° longitude grid squares (Bomford 2008).*
- *History of establishment elsewhere—previous successful establishment: There is a single report of Y. modesta being found in the Philippines, although it is unknown if this represents an established feral population (Froese and Pauly n.d.—a). This single case is despite the species being traded internationally as an aquarium species for over 40 years and likely inadvertent or deliberate introductions as an internationally traded aquarium species. The species is categorised as having “only established exotic population(s) on island(s)” (Bomford 2008).*

- *Introduction success*: There is a single report of *Y. modesta* being found in the Philippines, although it is unknown if this represents an established feral population (Froese and Pauly n.d.—a). After many decades of trade worldwide it can be assumed the species has been released into non-native areas on many occasions. The introduction success rate is conservatively considered (that is erring on the side of overestimation) to be less than 0.25 (Bomford 2008).
- *Taxonomic group—belonging to a family or genus which has a high establishment success rate*:
At a taxa level, of the nine species of valid *Yasuhikotakia* species recognised on FishBase, five are internationally traded as ornamental species (Froese and Pauly n.d.—b). As internationally traded aquarium species, it is reasonable to assume that there would have been many instances of inadvertent or deliberate introduction of these five species around the world – conservatively (erring on the side of overestimation) – 25 past introductions are assumed for the purposes of this risk assessment. There are only three records (representing three species) on FishBase of *Yasuhikotakia* species being found to have been introduced into the wild outside the countries to which they are native, although it is unknown if these introductions have led to establishment of wild populations (Froese and Pauly n.d.—b). The ‘genus level’ taxa risk is therefore $3/25$ (12%). Notably, several loaches including *Botia lohachata* and *Chromobotia macracanthus* are on the current list of specimens taken to be suitable for live import, have been imported to Australia for many decades and have not established wild populations.
- *Ability to find food sources*: As a carnivore feeding primarily on benthic invertebrates, 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)*: *Y. modesta* lives in large turbid rivers in Thailand, Cambodia and Laos. The species requires a tropical climate and water parameters of 6.0-8.0 pH, 2-15 dGH hardness and a temperature range of 23 to 30°C. This climatic range together with its stream habitat requirements limits the potential geographical range where the species could theoretically establish to some of the permanent flood plain rivers of northern Australia.
- *Ability to find shelter*: As a river dwelling tropical fish, opportunity to find shelter in the event of deliberate or inadvertent release into the wild would be limited to some streams in the wet tropics of northern Australia.
- *Rate of reproducing*: Reproductive rate (the number of offspring that a female produces during its lifetime) data in wild populations have not been reported. Under aquaculture conditions, females are productive for about 3 years, spawn three times a year and produce in the order of 200 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, the likelihood of establishment is considered to be very low, in main because there has been only a single report of *Y. modesta* being found in the wild outside its natural range (although it is unknown if this represents an established feral population), despite

many decades of international trade and because 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 *Y. modesta* with similar species such as *Botia lohachata* that have not established self-maintaining wild populations despite over 16 years of importation to Australia for the aquarium trade. Furthermore, captive aquarium populations of *Y. modesta* likely exist in the domestic hobby – these have not resulted in the establishment of feral populations in Australia.

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 benthic invertebrates with other small tropical benthic fish typically in habitats with sandy or gravel substrates. These niche species could include bottom feeders such as eel tailed catfishes (*Neosilurus* spp., *Porochilus* spp.) or juvenile eels (*Anguilla reinhardtii*). No competition would be expected with mid-water or surface feeding fish. Most of the potential habitat streams in tropical Australia are dominated by species that penetrate freshwaters from the sea. 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. Botiids are susceptible to white spot of fish (*Ichthyophthirius multifiliis*) as are most fish with small or no scales (including Neosilurids). Another disease (called skinny disease) thought to be caused by the flagellate parasite *Spirionucleus* sp. (Seriously Fish n.d.). This parasite is found throughout the world in most vertebrates but is poorly characterised although they may be reasonably species specific (Williams *et al.* 2011).
- *Probable prey/food sources, including agricultural crops:* *Y. modesta* feeds mostly on benthic invertebrates. It does not feed on any agricultural crops.
- *Habitat and local environmental conditions:* *Y. modesta* has not been reported to change its environment or habitat. It does inhabit the large, permanent, seasonally flooding muddy rivers in tropical Asia of which there are no equivalents in size or continuous turbidity in Australia.
- *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 any 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 *Y. modesta*, 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 support the ornamental fish industry. In a broader context, the ornamental fish hobby is an important one. Aside from 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 stresses 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 vendors.

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 1.0 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 *Y. modesta* stock would represent about one percent of this.
- *Why this species has been chosen:* Internationally, the species is in high demand by hobbyists and would be extremely popular in Australia. Similar loach species currently permitted importation such as *Chromobotia macrocanthus*, *Ambastaiia sidthimunki* and

Botia lohachata are very popular in Australia. The species is not aggressive and compatible to keep in aquaria with most other tropical species.

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.
- *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: *Yasuhikotakia modesta*

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 *Yasuhikotakia modesta* (Bleeker 1864) 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 *Yasuhikotakia modesta* lives in the Mekong River, which is a turbid muddy river with strong seasonal flows. They are caught in the main channels in the many artisanal fisheries there (Roberts and Baird 1995; Halls *et al.* 2013). As such, the opportunity to find shelter in the event of deliberate or inadvertent release into the wild would be limited to streams in the wet tropics of far northern Queensland. It is unlikely 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 area. 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 (DAWE 2020a). It is unlikely that enough fish would be accidentally or deliberately released into a suitable receiving environment to establish a breeding population.

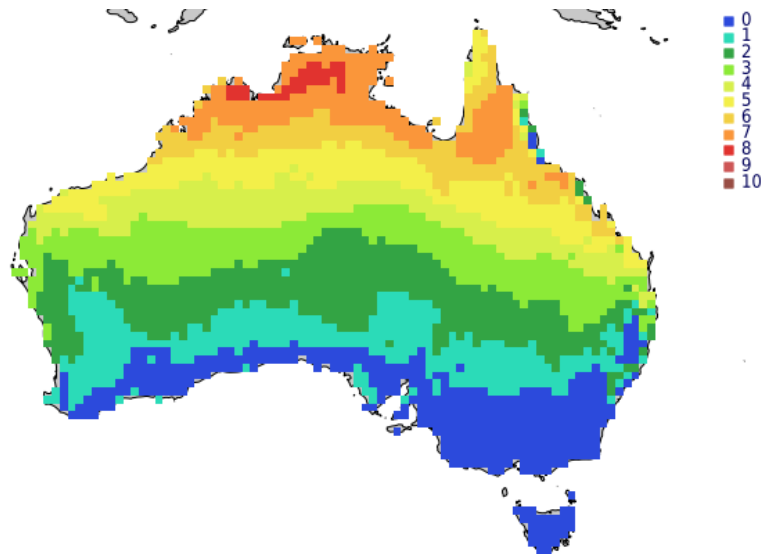
If permitted importation *Y. modesta* would be freely available in Australia through aquarium stores. The species would be common enough in Australia that theft due to lack of availability is unlikely.

Only a very deliberate and planned release might result in establishment of the species, although the limited potentially suitable habitats and their remoteness from populated areas makes this scenario highly unlikely.

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

Climatch (original v1.0) was run with the source region set to circumscribe an area across Thailand, Laos and Cambodia consistent with the probable distribution described in Allen (2013). A climate match prediction was generated using the Euclidian algorithm applied to the 'world stations' data set. Climatch calculated a 'value X' (Climate Euclidian Sum Level 5) of 741, equating to a climate match score of 5. DAWE (2020a) suggested the need for some caution in predicting climate suitability for freshwater aquatic species because Climatch is based on terrestrial climate measurements. The new upgraded version of Climatch (v2.0) was

not used in this assessment because its improved mapping resolution results in higher output values that are yet to be calibrated for purposes of applying the Bomford methodology.



Score	0	1	2	3	4	5	6	7	8	9	10
Count	437	401	512	404	290	288	214	209	30	0	0

Figure 1 Climatch output for *Yasuhikotakia modesta*

History of establishment elsewhere—previous successful establishment:

There is a single report of *Y. modesta* being found in the Philippines, although it is unknown if this represents an established feral population (Froese and Pauly n.d.—a). This single case is despite the species being traded internationally as an aquarium species for over 40 years and likely inadvertent or deliberate introductions as an internationally traded aquarium species. The species is considered to have “only established exotic population(s) on island(s)” (Bomford 2008).

Overseas range:

Y. modesta is endemic to the Mekong and Chao Phraya basins, and Mae Khlong basin (Thailand Laos and Cambodia). Based on the species distribution in Allen (2013), the species is estimated to occupy a total 78, 1° latitude x 1° longitude grid squares (Bomford 2008).

Introduction success:

There is a single report of *Y. modesta* being found in the Philippines, although it is unknown if this represents an established feral population (Froese and Pauly n.d.—a). After many decades of trade worldwide it can be assumed the species has been released into non-native areas on many occasions. The introduction success rate is conservatively considered (that is erring on the side of overestimation) to be less than 0.25 (Bomford 2008).

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

At a taxa level, of the nine species of valid *Yasuhikotakia* species recognised on FishBase, five are traded as ornamental species (Froese and Pauly n.d.—b). As internationally traded aquarium species, it is reasonable to assume that there would have been many instances of inadvertent or deliberate introduction of these five species around the world – conservatively (erring on the side of overestimation) – 25 past introductions are assumed for the purposes of this risk assessment. There are only three records (representing three species) on FishBase of *Yasuhikotakia* species being found to have been introduced into the wild outside the countries to which they are native, although it is unknown if these introductions have led to establishment of wild populations (Froese and Pauly n.d.—b). The ‘genus level’ taxa risk is therefore $3/25$ (12%). Notably, several loaches including *Botia lohachata* and *Chromobotia macracanthus* are on the current list of specimens taken to be suitable for live import, have been imported to Australia for many decades and have not established wild populations.

Potential impacts of established feral populations

As there are no reports of *Y. modesta* establishing feral populations direct impacts are not certain but unlikely. In the unlikely event this species establishes in the wild in Australia, it may compete for benthic invertebrates with other small tropical benthic fish typically in habitats with sandy or gravel substrates. These niche species could include bottom feeders such as eel tailed catfishes (*Neosilurus* spp., *Poroichilus* spp.) or juvenile eels (*Anguilla reinhardtii*). No competition would be expected with mid-water or surface feeding fish. Most of the potential habitat streams in Australia are dominated by species that penetrate freshwaters from the sea.

Y. modesta poses a minor impact risk to the Australian environment as they have been freely traded internationally for many years, with no evidence of establishment of feral populations or any detrimental impact in any other country.

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. Botiid fishes as a group are considered of low risk in terms of disease risk 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	Redtail Botia
Scientific name	<i>Yasuhikotakia modesta</i> Bleeker 1864
Date assessed	6 January 2021
Literature Search Type and Date:	FishBase December 2020

Risk criterion	Value	Explanation
A. Climate Match Score (1–8)	5	Climatch (v1.0) Euclidian Sum Level 5 (Value X) = 741. This value equates to a climate match score of 5.
B. Overseas Range Score (0–4)	4	Estimated to occupy a total 78 1° latitude x 1° longitude grid squares.

C. Establishment Score (0–3)	2	The species is considered to have “only established exotic population(s) on island(s)” (Bomford 2008).
D. Introduction Success Score (0–4)	1	There is a single report of <i>Y. modesta</i> being found outside its natural range despite likely release into non-native areas on many occasions. The introduction success rate is conservatively considered (that is erring on the side of overestimation) to be less than 0.25 (Bomford 2008).
E. Taxa Risk Score (0–5)	2	Conservatively, 25 past introductions of the 5 internationally traded species of the genus are assumed for the purposes of this risk assessment. There are three records (representing three species) on FishBase of <i>Yasuhikotakia</i> species being found to have been potentially established outside the countries to which they are native. The ‘genus level’ taxa risk is therefore 3/25 (12%).

Summary	<i>Score</i>	<i>Rank</i>
Establishment Risk	14	Moderate

Conclusion

The estimated risk of ‘moderate’ using the Bomford (2008) methodology is generally consistent with the risk that would be posed by most of the species currently permitted live importation to Australia. It is recommended that *Yasuhikotakia modesta* is added to the Live Import List.