

NATIVE FISH OF CONSERVATION CONCERN IN HONG KONG (PART 3)



December 2019

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Document citation

Kadoorie Farm and Botanic Garden. 2019. *Native Fish of Conservation Concern in Hong Kong (Part 3)*. Kadoorie Farm and Botanic Garden, Hong Kong Special Administrative Region. 43 pp.

Cover photo: Fish survey undertaken by snorkeling in a stream (taken in Hong Kong in 2010; © CHENG Chi Fai)

1. Background and Introduction

1.1 Many fauna groups in Hong Kong receive intense attention and their abundance as well as habitats are routinely monitored by the public and professionals (e.g., birds, feral cattle, wild boar); some groups, that contain many species of high conservation concern, receive less study and are not under the regular spotlight of active conservation. In many cases valid information for these groups is sparse or lacking. The freshwater fish community falls into the latter category (see Chan 1999). Because freshwater fish have been widely overlooked and there has been minimal conservation action in connection with the species and habitats, many are under threat and their habitats are being degraded at an alarming rate. The local distribution range of some species which were previously considered to be common just a decade ago has greatly reduced. There is thus an urgent need to evaluate the status of the freshwater fish species, before many completely disappear in Hong Kong.

1.2 In 2002, a scientific paper attempted to evaluate the status of many local fauna species, including some fishes, and the results were duly published (i.e., Fellowes *et al.* 2002). The evaluation system employed by this paper, however, did not follow the international standards for IUCN red data listing. In addition, since the paper was published, there has been no systematic evaluation to provide updated information on the local fish communities.

1.3 In 2014, a qualified redlisting trainer from the IUCN was invited by the Kadoorie Farm and Botanic Garden (KFBG) to provide a training workshop for local experts from various sectors, including environmental NGOs (eNGOs) and the HKSAR Government. Following this training, some local fish species of conservation concern (e.g., some already listed in Fellowes *et al.* 2002) were selected for evaluation. The current assessment took reference to the guidelines provided and practised in the workshop, and provides the results of the evaluation for future reference purposes.

1.4 The present report pulls together some of the information which is available from past and present studies and provided by fish enthusiasts, and is aimed to assist future studies related to the local fish fauna. With the provision of the updated information on the status of some selected local fishes, we hope to be able to assist local eNGOs, environmental consultancies, developers and Government departments in making informed decisions related to development projects/ proposals that might threaten the local fish communities. The information can also assist in the formulation of conservation action plans for the most threatened species.

2. Methodology

2.1 The results of this report are based on data collected from 2008 to 2014. During this period, over 200 sites were surveyed within the territory of the Hong Kong SAR, including remote islands (31 field sites were surveyed by Chong and Dudgeon (1992) and 43 sites were surveyed by Chan (2001)). One site is considered to represent one section/ tributary of a stream system, e.g., Hoi Ha Stream and Pak Sha O Stream are considered to be two separate sites, although they are in the same stream system; various tributaries of a river system (such as Kau Lung Hang Lo Wai and Tai Wo of the upper Ng Tung River system) are considered to be different sites. Biodiversity hot spots were inspected regularly. There is understandable concern regarding the exact disclosure of the locations of these sites, as this could attract collection by aquarists/ traders. Many species are already suffering from harvesting in the wild and remain in low densities (e.g., the impact of such collection on fish populations is widely recognised in the scientific community; see Yamasaki and Tachihara (2006), Nip (2010)). Fishes at all sites were surveyed by snorkeling (see Cover Photo)/ direct observation along the streamside/ bank (sometimes using binoculars) and recorded by waterproof cameras (e.g., Sanyo Xacti CA8, Canon IXUS 870IS with housing WP-DC26, Canon Powershot G9 with housing WP-DC21, Canon Powershot G10 with housing WP-DC28, Canon

IXY 510IS with housing WP-DC32). All species in the present report can be identified in the field with confidence. Photographs taken in Hong Kong (except *Plecoglossus altivelis*) and at the original habitats of the species are presented in the relevant appendices.

2.2 Personal observations by local experts were also gathered to supplement the findings in this report. The observations were made in recent years (e.g., after 2000). Data from other sources such as pertinent literature and Environmental Impact Assessment (EIA) reports were reviewed and considered in completing the present report.

2.3 As aforementioned, the present status evaluations were compiled with reference to the 'IUCN Red List Categories and Criteria, Version 3.1', 'Guidelines for Using the IUCN Red List Categories and Criteria' and 'Guidelines for Application of IUCN Red List Criteria at Regional and National Levels' (all are open-accessed documents; <https://www.iucnredlist.org/resources/grid/guidelines>). Area of occupancy (AOO) is estimated using a map with grid lines as shown in **Figure 1** and/ or hiking maps of Hong Kong districts (also with grid lines) by the Lands Department. Extent of occupancy (EOO) is estimated using the 'area measuring tool' in the GeoInfo Map website (<http://www2.map.gov.hk/gih3/view/index.jsp>) of the Lands Department. The evaluations were also reviewed by local ecologists, Prof. David Dudgeon and Dr. Bosco Chan, who have considerable experience of aquatic ecosystems in Hong Kong and South China.

3. Results

3.1 The species reported in the present document include: *Mastacembelus armatus*, *Metzia lineata*, *Oryzias curvinotus*, *Plecoglossus altivelis*, *Pseudobagrus trilineatus*, *Rhinogobius leavelli*, *Rhodeus ocellatus*, *Stiphodon atropurpureus*, *S. imperorientis* and *S. multisquamus*. *P. altivelis* and *Stiphodon* spp. are diadromous species, and the others are primary freshwater species. Their ratings are as follows:

Species Name	Level of risk
<i>Mastacembelus armatus</i>	Vulnerable
<i>Metzia lineata</i>	Vulnerable
<i>Oryzias curvinotus</i>	Vulnerable
<i>Plecoglossus altivelis</i>	Critically Endangered
<i>Pseudobagrus trilineatus</i>	Critically Endangered
<i>Rhinogobius leavelli</i>	Vulnerable
<i>Rhodeus ocellatus</i>	Vulnerable
<i>Stiphodon atropurpureus</i>	Vulnerable
<i>Stiphodon imperorientis</i>	Critically Endangered
<i>Stiphodon multisquamus</i>	Endangered

3.2 Detailed evaluation results for each species and conservation recommendations are presented in relevant appendices (**Appendix 1: *Mastacembelus armatus***, **Appendix 2: *Metzia lineata***, **Appendix 3: *Oryzias curvinotus***, **Appendix 4: *Plecoglossus altivelis***, **Appendix 5: *Pseudobagrus trilineatus***, **Appendix 6: *Rhinogobius leavelli***, **Appendix 7: *Rhodeus ocellatus***, **Appendix 8: *Stiphodon atropurpureus***, **Appendix 9: *S. imperorientis*** and **Appendix 10: *S. multisquamus***).

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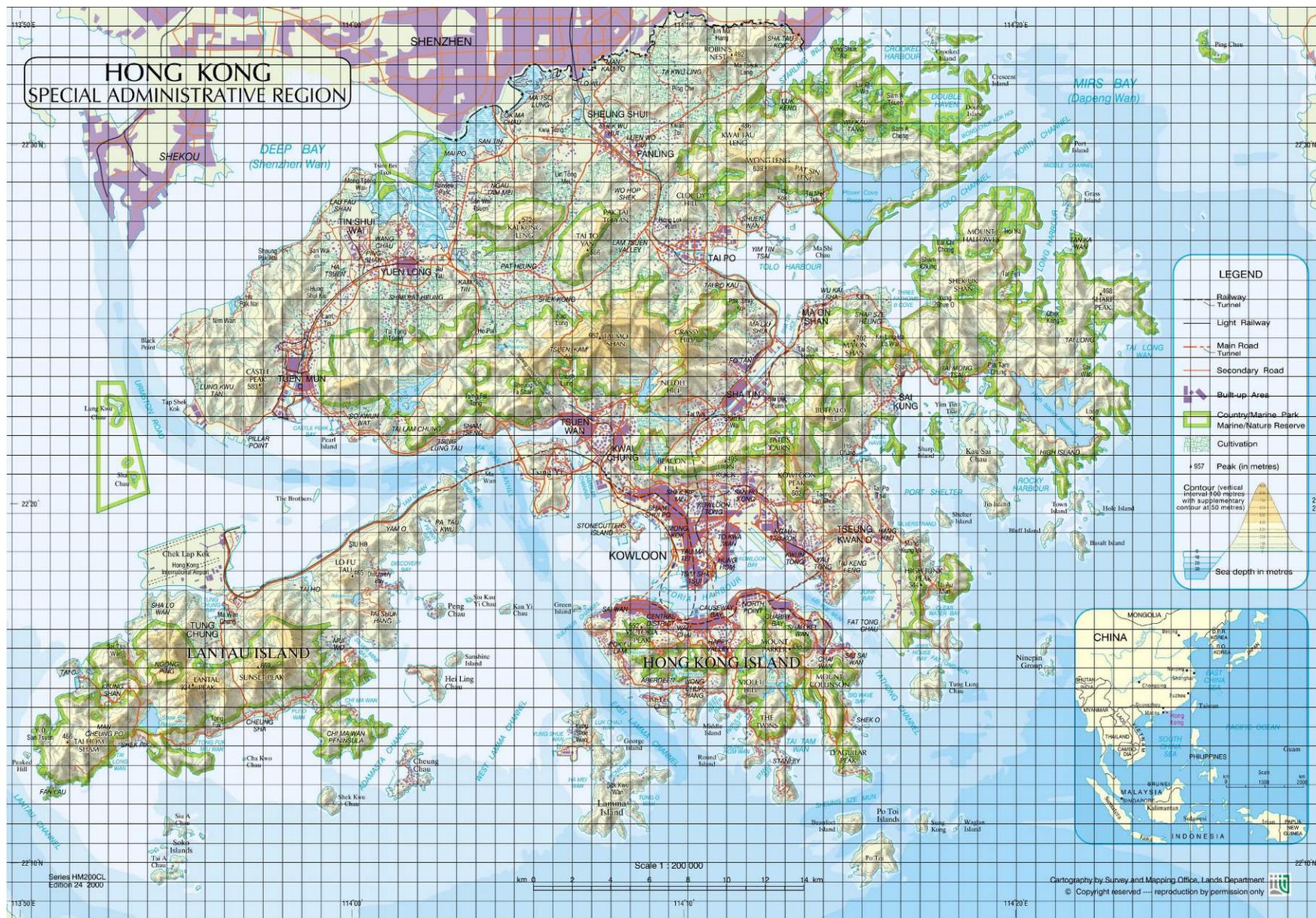
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Figure 1. A Hong Kong map with 1 km² grid lines.



Appendix 1: *Mastacembelus armatus*



1. Classification/ Names

- Scientific Name : *Mastacembelus armatus* (Lacepède, 1800)
- Order : Synbranchiformes
- Family : Mastacembelidae
- Synonym(s) : *Macrognathus armatus* Lacepède, 1800
Mastacembelus armatus armatus (Lacepède, 1800)
Mastacembelus ponticerianus Cuvier, 1832
Mastacembelus marmoratus Cuvier, 1832
Macrognathus caudatus McClelland, 1842
Macrognathus hamiltonii McClelland, 1844
Macrognathus hamiltoni McClelland, 1844
Mastacembelus manipurensis Hora, 1921
Macrognathus undulatus (non McClelland, 1844)
- English common name(s) : Zig-zag Eel
- Chinese common name(s) : 大刺鰻
- Other common names : Not known

2. Geographic Range

- 2.1 The species is known from Pakistan to Vietnam and Indonesia; it also appears in South China.
- 2.2 In Hong Kong, this species appears in the New Territories. AOO is about 4 km² and EOO is about 30 km².

3. Habitat and Ecology

- 3.1 This species can be found in reservoirs and streams.

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

- 4.1 It has been considered to be of local conservation concern by Fellowes *et al.* (2002). It is also considered to be a freshwater fish species of conservation concern in Hong Kong by the AFCD (http://www.epd.gov.hk/epd/english/boards/advisory_council/files/ncsc_paper01_2011.pdf) and a fish species of special interest by Lai (2011).

5. Local Conservation Status Assessment

- 5.1 This primary freshwater fish species has been recorded at four sites; AOO is estimated to be 4 km²; EOO is about 30 km².

5.2 Threats affecting this species include competition with and predation from invasive species as well as prolonged droughts (e.g., affecting the water level of reservoirs); the subpopulation living at one site would also be affected by potential village expansion and associated pollution in the future.

5.3 Based on the above, this species is now considered to be **Vulnerable** under criterion D2 (VU D2; AOO < 20 km² or number of locations \leq 5.). Three out of the four sites are not considered to be ecologically connected with the mainland of China effectively; the level of connection of the remaining site with other possible habitats in mainland China is also highly uncertain. Therefore, the rating is not downlisted.

6. Human Uses

6.1 It may occasionally be caught by local fish hobbyists to keep as a pet. It is utilized as a food fish in mainland China.

7. Main Threats to the Species

7.1 Competition with and predation from invasive species and development within the catchment area of the stream (and associated pollution) are the main threats that this species is facing in Hong Kong. In other parts of the world, pollution and development would be the major threats that this species is facing.

8. Conservation Recommendations

8.1 At present, no specific conservation measures are in place.

8.2 Developments/ activities that would cause significant impact on the habitats for this species (e.g., by land filling, site formation, culverting of watercourses, channelisation) should be avoided. Channelised stream sections should be restored, or rehabilitated; dams/ weirs/ beams in streams/ rivers should be removed. The 30 m riparian zones of the streams where this species occurs should be protected from development, and no new development should be permitted. Unprotected habitats for this species should be incorporated into the protected area system (e.g., Country Park, SSSI, Conservation Area).

8.3 When there are new development proposals, stream works (e.g., channelisation, desilting) and making of/ amendments to land use zoning plans that would affect the habitats used by this species (e.g., streams), the conservation status of the species should be highlighted, and the authorities should prevent inappropriate development proposals/ land use planning/ stream works that would affect the survival of this species.

8.4 When stream channelisation is deemed necessary (e.g., from a flood-prevention viewpoint), the proponents should leave the natural bottom of the watercourse to be channelised largely untouched, and the natural riparian zone should also be retained as far as possible. The proponents should also review the effectiveness and adequateness of some 'green measures' that may be adopted in any channelisation projects (e.g., rip-rap, stone gabion, cellular grassed concrete) as they may not be ecologically-friendly. No man-made obstacles (e.g., dams, weirs, beams) that would affect the migration of this species should be installed.

8.5 'Desilting' would occasionally be carried out by the drainage authorities to remove the 'excessive' sediment/ gravel on the streambed, in order to reduce 'flooding risk'. This work should be carefully planned and should consider being undertaken in different phases (i.e., both spatial and temporal). If possible, the desilting works should be carried out manually (i.e., avoiding the use of heavy machines).

8.6 Due consideration should be given to include this species into the Wild Animal Protection Ordinance in order to protect it from over-exploitation.

8.7 The authorities should also consider additional measures (e.g., new regulations) to control the release of exotic and invasive animals (e.g., through mercy release).

8.8 The conservation authority should maintain regular monitoring of the status of this species and its habitats.

9. References

Fellowes J.R., Lau M.W.N., Dudgeon D., Reels G.T., Ades, G.W.J., Carey, G.J., Chan B.P.L., Kendrick, R.C., Lee K.S., Leven M.R., Wilson K.D.P. and Yu Y.T. 2002. Wild animals to watch: terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 123-159.

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Appendix 2: *Metzia lineata*



1. Classification/ Names

- Scientific Name : *Metzia lineata* (Pellegrin, 1907)
- Order : Cypriniformes
- Family : Cyprinidae
- Synonym(s) : *Ischikauia lineata* Pellegrin, 1907
Rasborichthys altior Regan, 1913
Rasborinus lineatus (Pellegrin, 1907) subspecies *lineatus* (Pellegrin, 1907)
Rasborinus fukiensis Nichols, 1925
Rasborinus hainanensis Nichols & Pope, 1927
Rasborinus lineatus (Pellegrin, 1907)
- English common name(s) : Lesser Bream
- Chinese common name(s) : 線細鯿, 線梅氏鯿
- Other common names : Not known

2. Geographic Range

2.1 *Metzia lineata* has a Southeast Asia distribution. In China, it is known from the Pearl River drainage in Guangxi, Guizhou, Yunnan, and Guangdong Provinces, the Jiulong-Jiang River and Jin-Jiang River drainages in Fujian Province, the Red River drainage in Yunnan Province and Hainan Island (Chu and Chen 1989, Luo and Chen 1998, Gan *et al.* 2009). In Vietnam, it is distributed from An Lao River (Binh Dinh Province) to the Red River basin (Kottelat 2001, Nguyen and Ngo 2001, Serov *et al.* 2006). It has been introduced into other river basins in China and spreading to northern Laos (Kottelat 2001).

2.2 This species does not appear in Taiwan; the geographic range of this species described in the IUCN Global Redlist (<http://www.iucnredlist.org/details/181085/0>; claiming that it could be found in Taiwan) is not correct.

2.3 This species mainly appears in the New Territories and Lantau in Hong Kong. At present, it can be regularly recorded in two streams and one reservoir. AOO is about 11 km²; EOO is about 80 km². No map is provided in order to protect the population from over-exploitation by local fish hobbyists.

3. Habitat and Ecology

3.1 This species mainly inhabits clean lowland streams and reservoirs in Hong Kong.

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

4.1 The species is considered to be of Least Concern (2010) under the global IUCN Red List.

5. Local Conservation Status Assessment

5.1 Historically, in Hong Kong, this primary freshwater fish species was found in a stream in Tai Po and ‘most reservoirs’, and it has once been considered to be introduced by some scholars (Chong and Dudgeon 1992). Nevertheless, it is still considered to be a local species of conservation concern (http://www.epd.gov.hk/epd/english/boards/advisory_council/files/ncsc_paper01_2011.pdf).

5.2 The stream in Tai Po is no longer considered to be suitable for this species because of extensive channelisation and pollution. Now stable subpopulations of this species are believed to be confined to two streams and one reservoir. AOO is about 11 km² and EOO is about 80 km².

5.3 The three locations are well separated from each other, and the reservoir is largely surrounded by Country Park. The reservoir is unlikely to receive development pressure and serious pollution but it contains many exotic species. Some of the exotic species would be highly invasive and pose serious threats (e.g., competition and/ or predation) to the natives. For instance, in the Wong Nai Chung Reservoir on Hong Kong Island, exotic species are very abundant, and the introduction of the exotics is believed to be the root cause of the disappearance of most native species (i.e., native to Hong Kong/ South China) in that reservoir. It is hard to predict whether or not in the future there will be more exotic species released into the reservoir to further compete with *Metzia*. If in the future some highly invasive species are released into this reservoir and become established, the subpopulation of *M. lineata* there may be greatly impacted. In addition, serious droughts occurred in Hong Kong (e.g., 1963-1967, 1974, 1977, 1981); and if these climatic events happen again, the reservoir will be greatly affected and thus the *M. lineata* community would be at potential risk. The other two sites are under potential development threat but at present the threats have not yet appeared. At present, this species is assessed to be **Vulnerable** based on criterion D2 (VU D2) (i.e., number of locations ≤ 5 ; AOO < 20 km²). Two out of the three sites are not considered to be ecologically connected with the mainland of China effectively; the level of connection of the remaining site with other possible habitats in mainland China is also highly uncertain. Therefore, the rating is not downlisted.

6. Human Uses

6.1 Some fish hobbyists may collect this species from the wild.

7. Main Threats to the Species

7.1 Development within the catchment areas of the streams (and associated pollution) and competition with and predation from invasive species are the main threats that this species is facing in Hong Kong. In other parts of the world, pollution and development would be the major threats that this species is facing.

8. Conservation Recommendations

8.1 Please make reference to Section 8 of **Appendix 1**.

9. References

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Appendix 3: *Oryzias curvinotus*



1. Classification/ Names

Scientific Name	: <i>Oryzias curvinotus</i> (Nichols & Pope, 1927)
Order	: Beloniformes
Family	: Adrianichthyidae
Synonym(s)	: <i>Aplocheilus curvinotus</i> Nichols & Pope 1927
English common name(s)	: Rice Fish, Hainan Medaka
Chinese common name(s)	: 弓背青鱗
Other common names	: Not known

2. Geographic Range

2.1 This species is known from southern China, including Hainan Island, Hong Kong and Guangdong and Quang Ninh Province, Vietnam. It would also appear in Guangxi, China.

2.2 This species appears in the New Territories and on Lantau in Hong Kong. AOO is about 18 km² and EOO is about 750 km². No map is provided in order to protect the population from over-exploitation by local fish hobbyists.

3. Habitat and Ecology

3.1 This species can inhabit both freshwater and brackish environments. It mainly appears in marshy areas or still waters (e.g., reservoirs) but can also be found in the low-lying sections of streams.

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

4.1 The species is considered to be Data Deficient (2011) under the global IUCN Red List.

4.2 *O. latipes sinensis* appearing in China (including Guangdong) is considered to be Vulnerable, according to Wang and Xie (2009). However, the Rice Fish species appearing along the coastal region of Guangdong should be *O. curvinotus* (Dr. Lynne Parenti Pers. Comm.). It has also been considered to be of global conservation concern by Fellowes et al. (2002) and is considered to be a freshwater fish species of conservation concern in Hong Kong by the AFCD (http://www.epd.gov.hk/epd/english/boards/advisory_council/files/ncsc_paper01_2011.pdf). It is also considered to be a fish species of special interest by Lai (2011).

5. Local Conservation Status Assessment

5.1 Although the subpopulations at some sites (e.g., some reservoirs) will be relatively stable, other subpopulations are facing threats from development and pollution, and the quality of some of the habitats is declining. In addition, large-scale development zones have been/ will be designated

at some sites; this means that the habitat quality of these areas is likely to decline and this would lead to reduction in AOO, EOO and the size of the local population.

5.2 Although there is no published information on the local population size, it should be noted that the local population was observed to be under decline many years ago (Chong and Dudgeon 1992); the AFCD also considers that the local population is continuously declining (https://www.afcd.gov.hk/tc_chi/conservation/hkbiodiversity/speciesgroup/speciesgroup_freshwater_fish.html#key).

5.3 Individuals likely to have been collected from local habitat(s) have been observed on sale at a local aquarium market.

5.4 This species is considered to be **Vulnerable** (VU D2), based on the fact that the AOO is smaller than 20 km². As there is no known linkage between the local population and the subpopulations outside Hong Kong, the rating is not downlisted.

6. Human Uses

6.1 Some local fish hobbyists actively collect this species from the wild.

7. Main Threats to the Species

7.1 Development and pollution are the main threats to this species in Hong Kong. Competition with and predation from invasive species would also threaten this species. In other parts of the world, pollution and development are the major threats that this species is facing.

8. Conservation Recommendations

8.1 Please refer to Section 8 of **Appendix 1**.

9. References

Chong, D.H. and Dudgeon, D. 1992. Hong Kong stream fishes: An annotated checklist with remarks on conservation status. *Memoirs of The Hong Kong Natural History Society* 19: 79-112.

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Appendix 4: *Plecoglossus altivelis*



© 周銘泰; taken in Taiwan

1. Classification/ Names

Scientific Name	: <i>Plecoglossus altivelis</i> (Temminck & Schlegel, 1846)
Order	: Osmeriformes
Family	: Plecoglossidae
Synonym(s)	: <i>Salmo altivelis</i> Temminck & Schlegel, 1846
English common name(s)	: Ayu Sweetfish
Chinese common name(s)	: 香魚
Other common names	: アユ, 鮎 (Japan); 은어 (Korea)

2. Geographic Range

2.1 This amphidromous species is found in Japan, Korea, China and probably Vietnam. The native subpopulation in Taiwan is believed to be extinct.

2.2 The species has only been recorded from one location on Lantau. AOO is about 2 km². No location map is provided in order to protect the population from over-exploitation.

3. Habitat and Ecology

3.1 This is an amphidromous species: adults breed in the lower reaches of streams; some individuals die but some return to the sea after breeding. Larvae enter the sea but return to freshwater streams when they become juveniles; they grow in the middle reaches of the stream. In spring, mature individuals (both from the sea and the streams) move to the lower reaches to breed. Larvae feed on plankton, and juveniles and adults mainly feed on algae growing on pebbles, but sometimes will also take invertebrates.

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

4.1 It is considered to be Vulnerable in mainland China (see Wang and Xie (2009)); the native subpopulation of this species in Taiwan is considered to be extinct (Lin 2007). It is considered to be Data Deficient (2012) under the global IUCN Red List.

5. Local Conservation Status Assessment

5.1 This species was first recorded in Hong Kong by Chong and Dudgeon (1992) (specimens found in 1985), and also recorded later by Chong (1993); the subpopulation found in Hong Kong is believed to be diadromous (see Chong 1993). Afterwards there were claims that this species could still be recorded in Hong Kong (from one EIA report published in 2009 and one ongoing EIA study). According to these studies and reports, this species could be found at two streams in Hong Kong (but both drain into the same bay). A total of 10 mature individuals were observed in 1985 (Chong and Dudgeon (1992)), and one in 1993 (Chong 1993); no abundance data could be obtained from

the EIA studies. This species could not be recorded by Chan (2001) and in our surveys. As the species breeds in the lower reach of the stream, AOO of this species is considered to be 2 km² in Hong Kong (the total area of the two potential breeding sites). The generation length of this species is not known but maximum reported age is three years (some consider the life span of this species would only be one year; see <http://www.fishbase.de/summary/Plecoglossus-altivelis+altivelis.html>). Although it was recorded at two streams, they are close to each other (distance between the two river mouths: less than 400 m) and drain into the same bay, and they are facing the same threat (i.e., expansion of the development area); therefore, it is considered that in Hong Kong this species would occur in only one location. Also, a highway was built outside this bay some years ago; it is considered that this would have a profound impact on the individuals moving between the streams and the sea (as this is a diadromous species).

5.2 This species is considered to be **Critically Endangered** under criteria B, C and D (CR B2ab(iii, v); C2a(i, ii); D). There is no record of this species from nearby regions (e.g., Shenzhen), and the subpopulations of the species in mainland China are also facing threats (i.e., it is considered to be Vulnerable in mainland China; see Wang and Xie (2009)); the native subpopulation of this species in Taiwan is considered to be extinct (Lin 2007). Thus there would not be significant rescue effect and the rating is not downlisted.

6. Human Uses

6.1 It is a commercial fisheries species in China, Korea and Japan.

7. Main Threats to the Species

7.1 The highway built in front of the bay where this species can be found would greatly affect the species. The potential expansion of the development area close to the two streams would also highly threaten the species. Fishing activities carried out in the estuaries also threaten the species.

7.2 Globally, habitat destruction, blockage of migration pathway, pollution and overharvesting are the main threats facing this species.

8. Conservation Recommendations

8.1 At present, no specific conservation measures are in place.

8.2 Due to its diadromous nature, it is critical to ensure that the migration pathways of this species (i.e., between the sea and the freshwater habitats) are not blocked; the stream-ocean corridor should remain open naturally (i.e., no man-made obstacles such as dams/ weirs/ culverts/ beams), and the stream environment including the bottom and the stream flow should remain natural – the entire stream should remain as natural as possible (see Nip 2010).

8.3 Developments/ activities that would cause significant impact on the habitats for this species (e.g., by land filling, site formation, culverting of watercourses, channelisation) should be avoided. Channelised stream sections should be restored, or rehabilitated; dams/ weirs/ beams in streams/ rivers should be removed. The 30 m riparian zones of the streams where this species occurs should be protected from development, and no new development should be permitted. Unprotected habitats for this species should be incorporated into the protected area system (e.g., Country Park, SSSI, Conservation Area).

8.4 When there are new development proposals, stream works (e.g., channelisation, desilting) and making of/ amendments to land use zoning plans that would affect the habitats used by this species (e.g., estuarines, lowland streams, hill streams), the conservation status of the species should be highlighted, and the authorities should prevent inappropriate development proposals/ land use planning/ stream works that would affect the survival of this species.

8.5 When stream channelisation is deemed unavoidable (e.g., from a flood-prevention viewpoint), the proponents should leave the natural bottom of the watercourse to be channelised largely untouched, and the natural riparian zone should also be retained as far as possible. The proponents should also review the effectiveness and adequateness of some 'green measures' that may be adopted in any channelisation projects (e.g., rip-rap, stone gabion, cellular grassed concrete) as they may not be ecologically-friendly. No man-made obstacles (e.g., dams, weirs, beams) that would affect the migration of this species should be installed.

8.6 'Desilting' would occasionally be carried out by the drainage authorities to remove the 'excessive' sediment/ gravel on the streambed, in order to reduce 'flooding risk'. This work should be carefully planned and should consider being undertaken in different phases (i.e., both spatial and temporal). If possible, the desilting works should be carried out manually (i.e., avoiding the use of heavy machinery).

8.7 Due consideration should be given to include this species into the Wild Animal Protection Ordinance in order to protect it from over-exploitation (i.e., collection for the pet trade).

8.8 The authorities should also consider additional measures (e.g., new regulations) to control the release of exotic and invasive animals (e.g., during mercy release practices).

8.9 The conservation authority should regularly monitor the status of this species and/ or its habitats.

9. References

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Appendix 5: *Pseudobagrus trilineatus*



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1. Classification/ Names

Scientific Name : *Pseudobagrus trilineatus* (Zheng, 1979)

Order : Siluriformes

Family : Bagridae

Synonym(s) : *Leiocassis trilineatus* Zheng, 1979

English common name(s) : Not known

Chinese common name(s) : 三線擬鱔

Other common names : Not known

2. Geographic Range

2.1 This species is only known from Guangdong, China (including Hong Kong).

2.2 This species appears in Tai Po and Sai Kung only. AOO is about 9 km²; EOO is about 13 km². No locality map is provided in order to protect the local population from over-exploitation (e.g., by fish hobbyists).

3. Habitat and Ecology

3.1 This species inhabits fast-flowing streams with boulders and pools, and can appear in nearby marshes.

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

4.1 This species has been considered to be of global conservation concern by Fellowes *et al.* (2002). It is also considered to be a freshwater fish species of conservation concern in Hong Kong by the AFCD (http://www.epd.gov.hk/epd/english/boards/advisory_council/files/ncsc_paper01_2011.pdf).

5. Local Conservation Status Assessment

5.1 This primary freshwater fish species has only been recorded in two stream systems in Hong Kong, one in Tai Po and one in Sai Kung. The habitat for this species in Tai Po has been greatly affected by channelisation (e.g., the lower section of the stream is no longer suitable for this species), and is continuously affected by the discharge of sewage from nearby village houses. Although the habitat in Sai Kung is relatively stable now, the site is threatened by farming activities and the associated vegetation clearance and tree felling along the stream. Also, the exclusion of this site from the Country Park system also increases the uncertainty of the status of the habitat; there may be large-scale development of village houses within the catchment area of this stream system, and this would greatly affect this subpopulation.

5.2 The size of the local population is not known. Although the site in Tai Po has been seriously impacted and thus the subpopulation at this site would have been affected, the subpopulation in Sai Kung seems to be relatively stable at present.

5.3 The two subpopulations are not ecologically linked. There is also no known linkage between the local population and the subpopulations in Guangdong. Both local subpopulations live in relatively short stream sections (total AOO is about 9 km²; EOO is about 13 km²) and could be seriously impacted by local inconsiderate activities. It is thus considered that the local population occupies small and isolated patches; that means it is considered to be severely fragmented.

5.4 This species can be occasionally observed in local aquarium markets. Although the individuals are likely to have been imported from mainland China, the possibility that some individuals may have been collected from these two local sites cannot be ruled out.

5.5 This species is considered to be **Critically Endangered** (CR B1ab(iii) + 2ab(iii)) in Hong Kong, because the local population is severely fragmented, the AOO is smaller than 10 km² and the habitat quality has declined. As mentioned above, no linkage can be proven between the local population and the mainland subpopulations; thus the rating is not downlisted.

6. Human Uses

6.1 It may be collected from the wild by fish hobbyists and has been observed in the local pet markets.

7. Main Threats to the Species

7.1 Habitat degradation, channelisation, competition with and predation from invasive species, development within the catchment areas of the streams, pollution and filling of freshwater marshes are the main threats faced by this species in Hong Kong. In mainland China, pollution and development would be the major threats to this species.

8. Conservation Recommendations

8.1 Please refer to Section 8 of **Appendix 1**.

9. References

Fellowes J.R., Lau M.W.N., Dudgeon D., Reels G.T., Ades, G.W.J., Carey, G.J., Chan B.P.L., Kendrick, R.C., Lee K.S., Leven M.R., Wilson K.D.P. and Yu Y.T. 2002. Wild animals to watch: terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 123-159.

Appendix 6: *Rhinogobius leavelli*



Adult male; © CHENG Hung Tsun



Adult female; © Tony NIP

1. Classification/ Names

- Scientific Name : *Rhinogobius leavelli* (Herre, 1935)
- Order : Perciformes
- Family : Gobiidae
- Synonym(s) : *Ctenogobius leavelli* Herre, 1935
Ctenogobius cericosquamus Wu, Lu and Ni, 1986
Ctenogobius brunneus (nec Temminck et Schlegel, 1981)
Rhinogobius cericosquamus (Wu, 2000)
- English common name(s) : Not known
- Chinese common name(s) : 李氏吻鰕虎魚
- Other common names : Not known

2. Geographic Range

- 2.1 It is distributed in Laos, Vietnam and China.
- 2.2 In Hong Kong, it mainly appears in the New Territories. AOO is 13 km²; EOO is about 288 km².

3. Habitat and Ecology

- 3.1 It is a primary freshwater species mainly appearing in streams and reservoirs.

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

- 4.1 This species is considered to be of Least Concern (2009) under the global IUCN Red List.

5. Local Conservation Status Assessment

5.1 This primary freshwater species has been recorded at 10 sites in Hong Kong; AOO is about 13 km² and EOO is about 288 km². There is no information regarding its local population trend and size, but the subpopulation at Lam Tsuen River seems to have been seriously impacted by the channelisation works there and it has not been recorded in recent surveys. It is still possible that a remnant population is still present in Lam Tsuen (in view of its habitat requirements and the status of the remaining habitats). Most of the sites are within protected areas (e.g., near reservoirs), but populations are threatened by exotic species.

5.2 Based on the above, this species is considered to be **Vulnerable** using criterion D2 (VU D2; AOO < 20 km²). The rating is not downlisted as the subpopulations in mainland China are unlikely to have any natural linkage with the local population.

6. Human Uses

6.1 Local fish hobbyists may collect this species. It is also an aquarium fish species; individuals believed to be imported from mainland China can occasionally be observed in local pet markets.

7. Main Threats to the Species

7.1 Threats such as habitat degradation, pollution and competition with exotic species would affect this species.

8. Conservation Recommendations

8.1 Please refer to Section 8 of **Appendix 1**.

9. References

Fellowes J.R., Lau, M.W.N., Dudgeon, D., Reels, G.T., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. and Yu, Y.T. 2002. Wild animals to watch: terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 123-159.

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Appendix 7: *Rhodeus ocellatus*



1. Classification/ Names

Scientific Name	: <i>Rhodeus ocellatus</i> (Kner, 1866)
Order	: Cypriniformes
Family	: Cyprinidae
Synonym(s)	: <i>Pseudoperilampus ocellatus</i> Mori, 1928 <i>Pseudoperilampus ocellatus</i> Kner, 1866 <i>Rhodeus ocellatus</i> (Kner, 1866) subspecies <i>vietnamensis</i> Mai, 1978 <i>Rhodeus pingi</i> Miao, 1934 <i>Rhodeus kurumeus</i> Jordan & Thompson, 1914 <i>Rhodeus maculatus</i> Fowler, 1910 <i>Rhodeus wangkinfui</i> Wu, 1930
English common name(s)	: Rose Bitterling, Rosy Bitterling
Chinese common name(s)	: 高體鰱鯪, 牛屎鯪, 鬼打扁, 葵扇魚
Other common names	: バラタナゴ, 薔薇鰾, 薔薇鯪 (Japan); 떡납줄갱이, 흰줄납줄개 (Korea); Glazchatyi gorchak (Russia); Hořavka asijská (Czech Republic)

2. Geographic Range

2.1 According to the IUCN Global Redlist page, this primary freshwater fish species is considered to be ‘probably’ native to Taiwan only (<http://www.iucnredlist.org/details/62207/0>), and according to a document entitled ‘*International Introductions of Inland Aquatic Species*’ prepared by the Food and Agriculture Organization (FAO), this species is claimed to be introduced to mainland China (eastern) from Taiwan, and also to Japan and Korea from China (<http://www.fao.org/docrep/x5628e/x5628e00.htm>), in ancient times, as an ornamental species. No reference or scientific evidence, however, is available to support this claim in both websites, and indeed it is unlikely to be true.

2.2 The first scientific record of this species was documented in 1866 – type locality: Shanghai, China (mainland), holotype (unique): NMW 10837, under the name *Pseudoperilampus ocellatus* (<http://research.calacademy.org/redirect?url=http://researcharchive.calacademy.org/research/ichthyology/catalog/getnameViaColl.asp&contains=Rhodeus%20ocellatus&rank=Species>), and subsequently it was also discovered in some Chinese provinces (around and to the south of Yangtze River) including Hainan Island, Taiwan, Guangdong, Zhejiang, Jiangsu, Sichuan, Hubei and Guangxi (in 1919, 1930, 1935, 1937, 1943, 1959, 1964, 1976, 1981, etc.) (see references at Pearl River Fisheries Research Institute, Chinese Academy of Fisheries Science 1991, Chen *et al.* 1998, Fisheries Research Institute of Guangxi Zhuang Autonomous Region and Institute of Zoology, Chinese Academy of Science 2006, Li and Arai 2010 and Chen 2013). In addition, Yang *et al.* (2002) stated that this species could also be found in some northern Chinese provinces such as Heilongjiang, Liaoning and Shandong.

2.3 Regarding the claim aforementioned, we have also consulted some local and Taiwan scholars. Dr. Bosco Chan, a local ichthyologist and also the Head of the Kadoorie Conservation

China Programme of the Kadoorie Farm and Botanic Garden, Hong Kong, and Prof. Tzeng Chyng-Shyan, one of the authors of the '*Red Data Book of Freshwater Fishes in Taiwan*' and also a professor of the National Tsing Hua University, Taiwan, both doubt the claim made in the IUCN and the FAO websites (Pers. Comm.). A recent phylogenetic study conducted by scholars from mainland China, Taiwan and Japan has also suggested that '*the most recent common ancestor of R. ocellatus was from Lower Yangtze region*', and '*the lineage F in Taiwan (the R. ocellatus community in Taiwan) was dispersed from the mainland China through the land bridge in the Pleistocene*' (Tsao *et al.*, 2016). Indeed, the Ministry of the Environment of Japan has also listed the community found in Japan (*R. o. kurumeus*) as a Critically Endangered species (<http://jpnrdp.com/search.php?mode=map&q=0503060010077>), despite the claim made in the IUCN and the FAO websites.

2.5 According to the IUCN Global Redlist page (<http://www.iucnredlist.org/details/62207/0>), in addition to mainland China, Hainan and Taiwan, this species could also be found in Korea, Japan, Turkmenistan, Uzbekistan and Fiji.

2.2 In Hong Kong, it mainly appears in lowland streams and reservoirs in the New Territories. AOO is about 9 km²; EOO is about 206 km².

3. Habitat and Ecology

3.1 This species inhabits lowland streams, rivers and ponds. It has an unusual spawning symbiosis with freshwater mussels; it uses only the interlamellar spaces of gills of living unionid freshwater mussels as a spawning substratum. During the breeding period, females develop a long ovipositor, which is used to place their eggs on the gills of a mussel through the mussel's exhalant siphon. Males defend small territories around mussels and court females with extended ovipositor. In *Rhodeus* spp., females spawn one to six (usually three) eggs in a mussel, and males fertilize the eggs by releasing sperm into the inhalant siphon of the mussel, such that water filtered by the mussel carries the sperm to the eggs. Embryonic development of bitterling eggs is completed inside the mussel gill chamber and lasts 3–6 weeks (Kitamura 2005). After absorbing their yolk sac, the juvenile swim out from the host mussel's exhalant siphon (Kitamura 2005, 2006a, b). The timing of emergence is determined by larval age (Kitamura 2005), but also the diel cycle (Kondo *et al.* 1987). Kondo *et al.* (1987) showed that emergence of juvenile of the species in the laboratory occurred during the night, peaking at approximately midnight.

3.2 The only potential host for *R. ocellatus* in Hong Kong is *Anodonta woodiana* (Dudgeon 1985).

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

4.1 This species is considered to be of local conservation concern by Fellowes *et al.* (2002). It is also considered to be a freshwater fish species of conservation concern in Hong Kong by the AFCD (http://www.epd.gov.hk/epd/english/boards/advisory_council/files/ncsc_paper01_2011.pdf). It is also considered to be a fish species of special interest by Lai (2011). The species is considered to be Data Deficient (2010) under the global IUCN Red List.

5. Local Conservation Status Assessment

5.1 In Hong Kong, the Rose Bitterling was first formally recorded by Chong and Dudgeon

(1992) (specimens were collected in Fanling, New Territories, in 1985), and has also been found by other local ichthyologists including Mr. Cheung Kwok Wai (Senior Conservation Officer, AFCD) (Cheung 1998, 1999), Dr. Bosco Chan (Chan 1999, 2001) and Mr. Stephen Y.H. Lai (Agricultural Officer, AFCD) (Lai 2011). Recently, the species was also found at Lok Ma Chau, some reservoirs and three meanders of the Ng Tung River (in Fanling North). The AFCD has also released this species into a wetland reserve in Tin Shui Wai and this subpopulation is considered to be stable (<https://www.wetlandpark.gov.hk/en/download/newsletter?year=2014>).

5.2 The sites where this species has been found are listed below:

1. Fanling (Chong and Dudgeon 1992)
2. A site at Kam Tin River (Cheung 1998, 1999, Chan 1999, 2001)
3. A reservoir near Shatin, within a protected area (Cheung 1999, Lai 2011, H.T. Cheng Pers. Obs.)
4. A site at Tai Lam, within a protected area (Cheung 1999, H.T. Cheng Pers. Obs.)
5. A stream at Lok Ma Chau (Tony Nip Pers. Obs.)
6. A reservoir at Kam Tin, within a protected area (H.T. Cheng Pers. Obs.)
7. Three meanders of Ng Tung River, Fanling North (H.T. Cheng Pers. Obs.)
8. A wetland reserve in Tin Shui Wai

5.3 Surveys carried out after 2001 at Site 2 mentioned above could not record any individual of this species, and the site has been modified by some channelisation works. It is believed that the subpopulation at Site 2 has disappeared. It is also considered that the three meanders of Ng Tung River would represent the only localities where this species can still be found in Fanling now as this region (Fanling) has been highly urbanised and most suitable habitats will have disappeared. Notwithstanding this, it has been announced that one of these meanders would be filled and turned into a residential area. The other two meanders are also facing other localised threats (summarised below). The three meanders are considered to be three sites (e.g., 7a, 7b and 7c). Based on the above, AOO is estimated to be about 9 km² (EOO is about 206 km²).

5.4 The threats these sites are facing are listed below:

- A. Pollution from nearby residential areas (affecting Sites 5, 7a, 7b and 7c)
- B. Competition and predation from exotic species (Sites 3, 4, 5, 6, 7a, 7b, 7c and 8).
- C. Habitat destruction (Site 7c)

5.5 Therefore, in view of the above, this species is considered to be found at eight locations (i.e., Sites 3, 4, 5, 6, 7a, 7b, 7c and 8).

5.6 The size of the local population is not known; although one of the subpopulations has disappeared (i.e., at Site 2) and another one will disappear (i.e., in one of the meanders), the overall trend of the local population is hard to estimate as some of the subpopulations within protected areas (i.e., Sites 3, 4, 6 and 8) are considered to be relatively stable.

5.7 Based on the above, this species is assessed to be **Vulnerable** following criteria D2 (VU D2; AOO < 20 km²). The category is not downlisted as there is no evidence to show that individuals from mainland China can naturally replenish the local population.

6. Human Uses

6.1 Fish hobbyists may collect this species from the wild. The exact location should not be

further disclosed in order to protect the population from over-exploitation.

7. Main Threats to the Species

7.1 Pollution, habitat destruction (by development) and competition with and predation from exotic species are the main threats that this species is facing in Hong Kong. Pollution and habitat destruction are also threatening the host (which the fish requires during breeding) of this species (i.e., freshwater bivalves; see Dudgeon 1985). For instance, in many channelisation projects, the natural soft bottom of the streams has been turned into concrete or completely destroyed (e.g., turned into stone gabion, rip-rap); this greatly impacts on the bivalve species, subsequently making the survival of the fish population impossible. In other parts of the world, pollution and development would be the major threats that this species is facing

8. Conservation Recommendations

8.1 Please refer to Section 8 of **Appendix 1**.

8.2 It is claimed that there would be a translocation plan for the subpopulation in one of the meanders of Ng Tung River.

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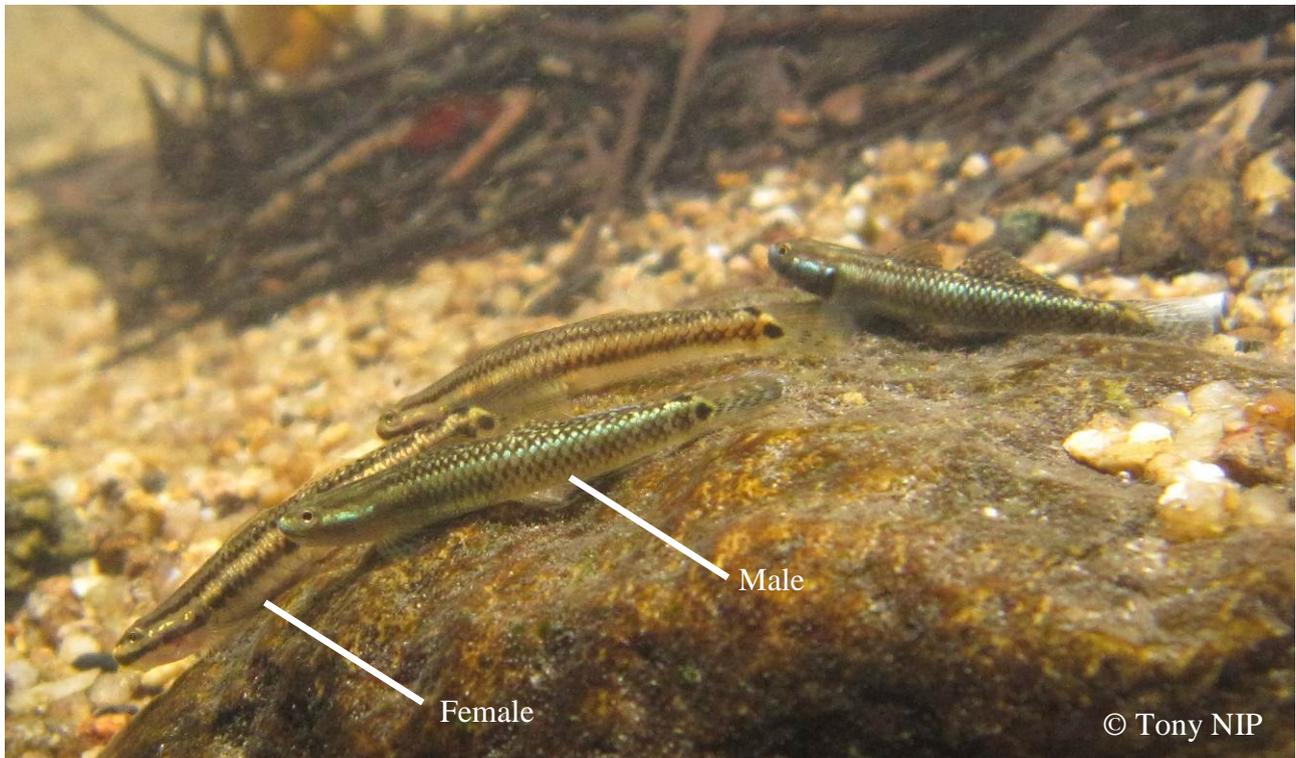
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Appendix 8: *Stiphodon atropurpureus*



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1. Classification/ Names

- Scientific Name : *Stiphodon atropurpureus* (Herre, 1927)
- Order : Perciformes
- Family : Gobiidae
- Synonym(s) : *Microsicydium atropurpureum* Herre, 1927
Microsicydium formosum Herre, 1927
Stiphodon formosum (Herre, 1927)
- English common name(s) : Purple Neon Goby
- Chinese common name(s) : 紫身枝牙鰕虎魚, 菲律賓枝牙鰕虎魚
- Other common names : コンテリボウズハゼ (Japan)

2. Geographic Range

2.1 This amphidromous species is widely distributed in Asia: Japan, Taiwan, Malaysia, The Philippines and South China.

2.2 In Hong Kong, it mainly occurs in the New Territories. AOO is about 18 km². Detailed location information is not provided in order to protect the population from over-exploitation by local fish hobbyists.

3. Habitat and Ecology

3.1 This is an amphidromous species: adults live and breed in freshwater streams, hatched larvae drift downstream passively into the sea and live in the marine environment. They actively return to freshwater streams when they reach juvenile age. The species requires rapid flowing, clean stream sections for the adult and juvenile habitats.

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

4.1 This species has been considered to be of global conservation concern by Fellowes *et al.* (2002). It is also considered to be a freshwater fish species of conservation concern in Hong Kong by the AFCD (http://www.epd.gov.hk/epd/english/boards/advisory_council/files/ncsc_paper01_2011.pdf). This species is also considered to be Near Threatened in Taiwan (Chen *et al.* 2012) and Critically Endangered in Japan (<http://jpnrdp.com/search.php?mode=map&q=0503170260351>).

5. Local Conservation Status Assessment

5.1 In Hong Kong, *S. atropurpureus* has been recorded from approximately 18 streams. These freshwater streams can be considered as the essential habitat for this amphidromous species (i.e., breeding sites); based on this, AOO of this species is estimated to be about 18 km² in Hong Kong.

5.2 However, the abundance of this species fluctuates a lot in Hong Kong (and AOO also). The number of mature individuals usually drops to a very low level after winter, and sometimes a tenfold decrease (as compared to the abundance recorded in previous year) could be observed (i.e., extreme fluctuation). Since it is primarily a tropical species (i.e., it is common in The Philippines (Watson and Chen 1998)), many individuals in Hong Kong may not be able to pass through the cool, dry winter. Nevertheless, recruitment in summer can replenish (but may not fully restore) the local population. The length of the pelagic larval stage of this species is unknown. But Yamasaki *et al.* (2007) have found that the length of the pelagic larval duration of its congener, *S. percopterygionus*, is about 100 days. Thus the larvae produced during the wet season in Hong Kong streams (i.e., courtship display only appears between late March and early November in Hong Kong) may not be able to fully replenish the local population. The local population is therefore likely a sink (i.e., sustained by larvae produced outside Hong Kong (e.g., The Philippines)).

5.3 The abundance of mature individuals observed in a single stream could reach around 50; but indeed most mature individuals are mainly observed in around five to seven streams in Hong Kong, and usually only less than five mature individuals could be observed in each of the other streams. This reflects that the local population is in fact concentrating in several streams only.

5.4 Although some of its habitats (including some of the key streams where this species would be abundant) are facing threats such as haphazard development along riparian zones, channelisation and pollution, and thus the quality of these habitats is declining, the overall population size cannot be considered to be reducing (as it fluctuates considerably). It is highly recommended that key habitats should be closely monitored and protected.

5.5 Although the population size fluctuates, based on field observations, the number of mature individuals of this species may be fewer than 250 in Hong Kong. The species is thus considered to be Endangered using criterion D (EN D). However, since this species has a pelagic larval stage in the sea and it is possible that larvae of this species from other regions, such as The Philippines, where this species would be common, can drift to Hong Kong by ocean currents and replenish the local population, the rating of this species is downlisted to **Vulnerable** (VU^o D).

6. Human Uses

6.1 Some fish hobbyists will collect this species from the wild; it is considered to be a high-priced aquarium species (Chan 2002).

7. Main Threats to the Species

7.1 Habitat destruction, channelisation, blockage of migration pathway and pollution are the main threats that this species is facing in Hong Kong and other parts of the world. Since this is an amphidromous species, man-made structures (i.e., culvert, concrete channel, weir, dam, beams) built in estuaries or streams can greatly affect the recruitment, and thus the population size. Commercial or amateur collection for the aquarium hobby can also be a serious threat to this species.

8. Conservation Recommendations

8.1 Please refer to Section 8 of **Appendix 4**.

9. References

Chan, B.P.L. 2002. Should Hong Kong's freshwater fishes be protected by law? *Porcupine! Newsletter of the Department of Ecology & Biodiversity, The University of Hong Kong* 25: 13-14.

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Nip, T.H.M. 2010. First records of several sicydiine gobies (Gobiidae: Sicydiinae) from mainland China. *Journal of Threatened Taxa* 2(11): 1237-1244.

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Yamasaki, N., Maeda, K. and Tachihara, K. 2007. Pelagic larval duration and morphology at recruitment of *Stiphodon percnopterygionus* (Gobiidae: Sicydiinae). *The Raffles Bulletin of Zoology* Supplement 14: 209-214.

Appendix 9: *Stiphodon imperiorientis*



1. Classification/ Names

Scientific Name : *Stiphodon imperorientis* Watson & Chen, 1998

Order : Perciformes

Family : Gobiidae

Synonym(s) : Nil

English common name(s) : Akihito Neon Goby

Chinese common name(s) : 明仁枝牙鰕虎魚

Other common names : ハヤセボウズハゼ (Japan)

2. Geographic Range

2.1 This amphidromous species can be found in China, Taiwan and Japan.

2.2 In Hong Kong, this species mainly appears in the New Territories. AOO is about 6 km². No map is provided in order to protect the population from over-exploitation.

3. Habitat and Ecology

3.1 Please refer to Section 3 of **Appendix 8**.

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

4.1 This species is considered to be Vulnerable (2009) under the global IUCN Red List. This species is also considered to be Critically Endangered in Japan (<http://jpnrd.com/search.php?mode=map&q=0503170260349>).

5. Local Conservation Status Assessment

5.1 This is an amphidromous species: adults live and breed in freshwater streams, hatched larvae drift downstream passively into the sea and live in the marine environment. They return actively to freshwater streams when they become juveniles.

5.2 In Hong Kong, *S. imperorientis* has been recorded in six streams only. These freshwater streams can be considered as the essential habitat for this amphidromous species (i.e., breeding sites); based on this, AOO of this species is estimated to be about 6 km² in Hong Kong.

5.3 The number of mature individuals usually drops after winter, and extreme fluctuation in the number of mature individuals could be observed; but the abundance of mature individuals observed in Hong Kong is usually less than 50.

5.4 Its habitats are facing various threats such as pollution, habitat destruction and desilting

works, although one of its habitats is within a protected area. It is highly recommended that the key habitats should be closely monitored and protected.

5.5 This species is considered to be **Critically Endangered** using criterion D (CR D). Since it is also considered to be rare globally (e.g., Watson and Chen 1998; Vulnerable under the IUCN redlist; Critically Endangered in Japan), there would not be significant rescue effect and thus the rating is not downlisted.

6. Human Uses

6.1 Fish hobbyists will collect this species from the wild (see Chan 2002); sicydiine gobies are usually high-priced aquarium species (Tony Nip Pers. Obs.).

7. Main Threats to the Species

7.1 Please refer to Section 7 of **Appendix 8**.

8. Conservation Recommendations

8.1 Please refer to Section 8 of **Appendix 4**.

9. References

Chan, B.P.L. 2002. Should Hong Kong's freshwater fishes be protected by law? *Porcupine! Newsletter of the Department of Ecology & Biodiversity, The University of Hong Kong* 25: 13-14.

Nip, T.H.M. 2010. First records of several sicydiine gobies (Gobiidae: Sicydiinae) from mainland China. *Journal of Threatened Taxa* 2(11): 1237-1244.

Watson, R.E. and Chen, I. 1998. Freshwater gobies of the genus *Stiphodon* from Japan and Taiwan (Teleostei: Gobiidae: Sicydiinae). *Aqua* 3: 56-66.

Appendix 10: *Stiphodon multisquamus*



Adult male; © Tony NIP



Adult female; © Tony NIP

1. Classification/ Names

Scientific Name	: <i>Stiphodon multisquamus</i> Wu & Ni, 1986
Order	: Perciformes
Family	: Gobiidae
Synonym(s)	: <i>Stiphodon elegans multisquamus</i> Wu & Ni, 1986
English common name(s)	: Not known
Chinese common name(s)	: 多鱗枝牙鰕虎魚
Other common names	: トラフボウズハゼ (Japan)

2. Geographic Range

2.1 This amphidromous species can be found in China; recently it has also been recorded from Malaysia, Japan and Vietnam.

2.2 In Hong Kong, the species mainly appears in the New Territories. AOO is about 16 km². No map is provided in order to protect the population from over-exploitation.

3. Habitat and Ecology

3.1 Please refer to Section 3 of **Appendix 8**.

4. IUCN Global Red List Status and/ or International/ Regional Conservation Status

4.1 This species is considered to be of global conservation concern by Fellowes *et al.* (2002) and Nip (2010), and Endangered in China by Wang and Xie (2009). It is also considered to be a freshwater fish species of conservation concern in Hong Kong by the AFCD (http://www.epd.gov.hk/epd/english/boards/advisory_council/files/nscs_paper01_2011.pdf).

5. Local Conservation Status Assessment

5.1 This is an amphidromous species: adults live and breed in freshwater streams, larvae drift downstream passively into the sea and live in the marine environment. They return actively to freshwater streams when they become juveniles.

5.2 In Hong Kong, *S. multisquamus* has been recorded from around 16 streams. These freshwater streams can be considered as the essential habitat for this amphidromous species (i.e., breeding sites); based on this, AOO of this species is estimated to be about 16 km² in Hong Kong.

5.3 The number of mature individuals usually drops after winter, but no extreme fluctuation has been observed. The abundance of mature individuals observed in Hong Kong is unlikely to exceed 250; most mature individuals have been observed in approximately five streams in Hong Kong, and

usually only less than five mature individuals can be observed in each of the remaining stream habitats. This suggests that the local population is in fact concentrated in a discreet number of streams only.

5.4 Although some of its habitats (including some of the key streams where this species is abundant) are facing threats such as haphazard development along riparian zones, channelisation and pollution, and thus the quality of these habitats is declining, its overall population size cannot be considered to be reducing. But it is highly recommended that the key habitats be closely monitored and protected.

5.5 This species is thus considered to be **Endangered** using criterion D (EN D). Since it is also considered to be rare in nearby areas (i.e., mainland China (e.g., Endangered, Wang and Xie 2009)), there would not be significant rescue effect and thus the rating is not downlisted.

6. Human Uses

6.1 Some fish hobbyists will collect this species from the wild (see Chan 2002); sicydiine gobies are high-priced aquarium species (Tony Nip Pers. Obs.).

7. Main Threats to the Species

7.1 Please refer to Section 7 of **Appendix 8**.

8. Conservation Recommendations

8.1 Please refer to Section 8 of **Appendix 4**.

9. References

Chan, B.P.L. 2002. Should Hong Kong's freshwater fishes be protected by law? *Porcupine! Newsletter of the Department of Ecology & Biodiversity, The University of Hong Kong* 25: 13-14.

Fellowes, J.R., Lau, M.W.N., Dudgeon, D., Reels, G.T., Ades, G.W.J., Carey, G.J., Chan, B.P.L., Kendrick, R.C., Lee, K.S., Leven, M.R., Wilson, K.D.P. and Yu, Y.T. 2002. Wild animals to watch: terrestrial and freshwater fauna of conservation concern in Hong Kong. *Memoirs of the Hong Kong Natural History Society* 25: 123-159.

Maeda, K. and Saeki, T. 2013. First record of a sicydiine gobies, *Stiphodon multisquamus* (Actinopterygii: Gobiidae: Sicydiinae), from Okinawa Island, Japan. *Species Diversity* 18: 215-221.

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About KFBG

Kadoorie Farm and Botanic Garden (KFBG) is situated in the rural New Territories, on the northern slopes of Tai Mo Shan, Hong Kong's highest mountain. Two steep spurs enclose its deep-set valley. Within KFBG are streams, woodlands, orchards, vegetable gardens, walking trails, live animal exhibits, floral exhibits, sustainable agriculture demonstration plots, art exhibits, a wild animal rescue centre, a native tree nursery, and, other conservation and education facilities.

In the post-war years, Hong Kong was flooded with destitute refugees. Many had traditional knowledge of crop production and livestock farming but no stock, others had land but no experience. They required support to rebuild their lives. The farm site at Pak Ngau Shek was established in 1956 as a base for livestock breeding and distribution, agricultural research, farmers training, public education and recreation. The barren slopes were terraced and planted with orchards and vegetable gardens. The development of the botanic garden began in 1963 and the plant conservation programme from 1972.

On 20th January, 1995, the Legislative Council of Hong Kong passed an Ordinance (Chapter 1156) incorporating KFBG as a non-profit corporation designated as a conservation and education centre. It is a unique public-private partnership, for while the KFBG Corporation is a public organisation, it is privately funded by the Kadoorie Foundation.

Since 1995, KFBG has been conducting a wide range of nature education, nature conservation and sustainable living programmes both on-site, and, throughout Hong Kong and South China.

In this time of severe global crisis KFBG raises awareness, undertakes rigorous science-based species conservation and ecosystem restoration, and offers new ways of thinking and living to respond to the world's problems. Hence, our work brings hope and improvement by focusing on nature conservation, sustainable living and holistic education that re-connects people with nature. By working together with the public, Governments, academia, NGOs and businesses, we can protect our common future.

Our mission is to harmonise our relationship with the environment. Our vision is a world in which people live sustainably with respect for each other and nature.

