



NATIVE FISH OF CONSERVATION CONCERN IN HONG KONG (PART 2)

May 2019

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Cover photo: Fish survey using active snorkeling method (Hong Kong SAR 2017)

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 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 confidentially identified in the field. Photographs taken in Hong Kong and mostly 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: *Kuhlia marginata*, *K. rupestris*, *Clarias fuscus*, *Glyptothorax pallozonus*, *Macropodus hongkongensis* and *M. opercularis*. The first two are diadromous species and the latter four are primary freshwater species. Their ratings when considering the red list categories are as follows:

Species Name	Level of risk
<i>Kuhlia marginata</i>	Vulnerable
<i>Kuhlia rupestris</i>	Vulnerable
<i>Clarias fuscus</i>	Near Threatened
<i>Glyptothorax pallozonus</i>	Critically Endangered
<i>Macropodus hongkongensis</i>	Near Threatened
<i>Macropodus opercularis</i>	Endangered

3.2 Detailed evaluation results for each species and conservation recommendations are presented in relevant appendices (**Appendix 1: *Kuhlia marginata***, **Appendix 2: *K. rupestris***, **Appendix 3: *Clarias fuscus***, **Appendix 4: *Glyptothorax pallozonus***, **Appendix 5: *Macropodus hongkongensis*** and **Appendix 6: *M. opercularis***).

4. References

Chan, Bosco P.L. 1999. Hong Kong's Freshwater Fish: Who Cares?!? *Porcupine! Newsletter of the Department of Ecology & Biodiversity, The University of Hong Kong* 19: 15-16.

Chan, Bosco P.L. 2001. *Sustainability and Biodiversity: The Impact, Alternative Design and Prospects for Restoration of Channelized Lowland Streams in Hong Kong*. Unpublished Ph.D. thesis, The University of Hong Kong, Hong Kong.

Chong, D.-h. and Dudgeon, D. 1992. Hong Kong fishes: an annotated checklist with remarks on

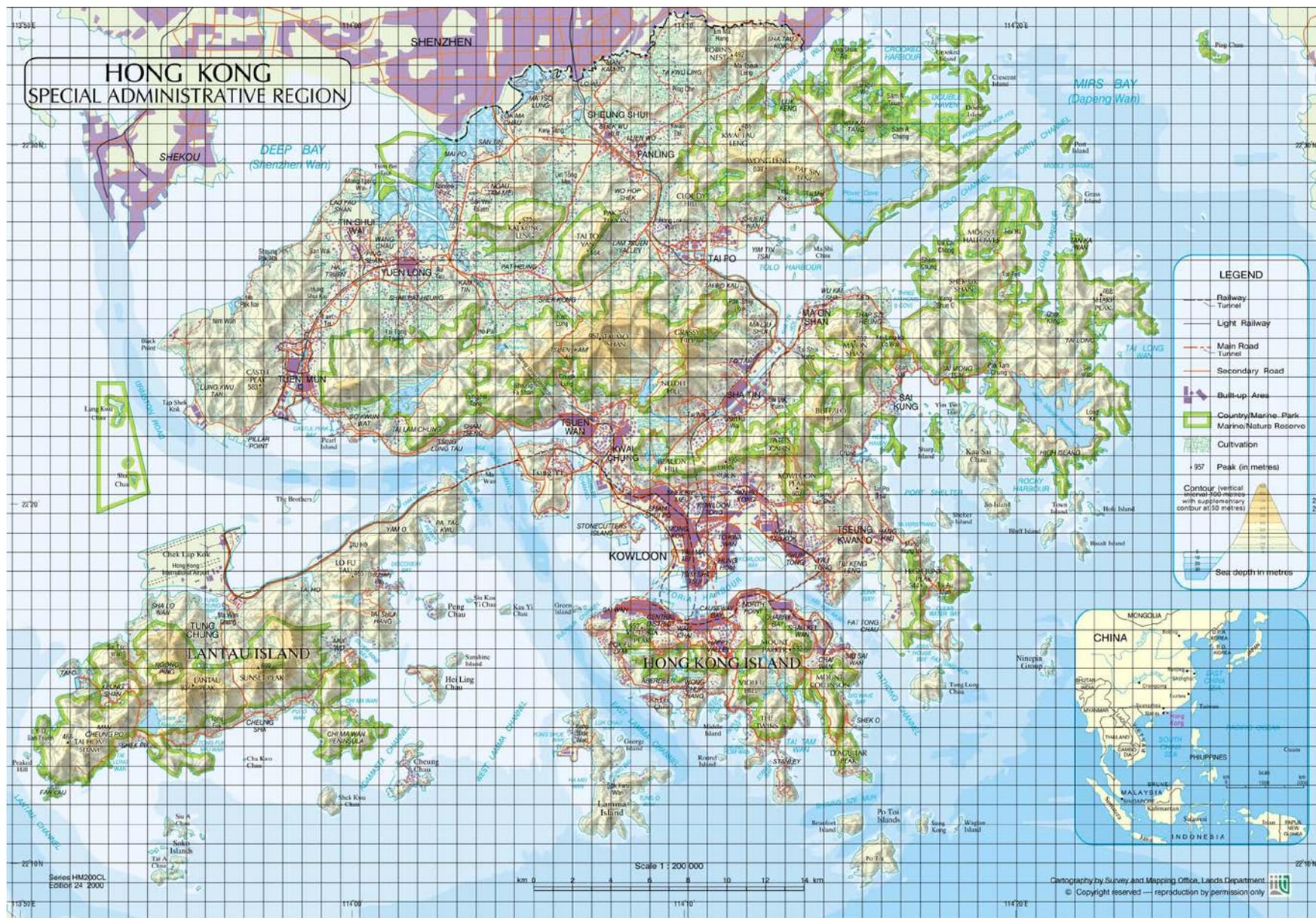
conservation status. *Memoirs of the Hong Kong Natural History Society* 19: 79-112.

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.

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

Yamasaki, N. & Tachihara, K. 2006. Reproductive biology and morphology of eggs and larvae of *Stiphodon percnopterygionus* (Gobiidae: Sicydiinae) collected from Okinawa Island. *Ichthyological Research* 53: 13-18.

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



Appendix 1: *Kuhlia marginata*



1. Classification/ Names

- Scientific Name : *Kuhlia marginata* (Cuvier, 1829)
- Order : Perciformes
- Family : Kuhliidae
- Synonym(s) : *Dules marginatus* Cuvier, 1829
Dules maculatus Valenciennes, 1831
Dules papuensis Macleay, 1884
- English common name(s) : Spotted Flagtail, Dark-margined Flagtail, Silver Flagtail, Red-tailed Jungle Perch
- Chinese common name(s) : 黑邊湯鯉, 紅尾冬
- Other common names : Not known

2. Geographic Range

2.1 The species is widespread throughout the Indo-Pacific, from Japan to Australia and east to the Federated States of Micronesia (Caroline Islands). It also appears in Taiwan and Hong Kong. In Taiwan, this species is considered to be common.

2.2 This species mainly appears in the New Territories and Lantau in Hong Kong. AOO is about 8 km². No map is provided in order to protect the population from over-exploitation by local fish hobbyists.

3. Habitat and Ecology

3.1 The species mainly inhabits clean freshwater streams. Although it is catadromous, it is considered to be a freshwater species primarily (Randall and Randall 2001, Feutry *et al.* 2013).

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

4.1 This species has been considered to be of local conservation concern by Fellowes *et al.* (2002).

5. Local Conservation Status Assessment

5.1 According to Oka and Tachihara (2008) and Feutry *et al.* (2013), this catadromous species spawns in inshore waters, and larvae grow in the sea. When the larvae reach approximately 20 mm in standard length, they actively migrate to freshwater streams; the small juveniles then grow and become adults in the freshwater environment. Adults then migrate back to the sea for breeding (Oka and Tachihara 2008). Oka and Tachihara (2008) considered that, after breeding, the adult females then return to the freshwater environment, while some adult males may stay or simply die at sea; they have also suggested that adults of this species are scarce in the marine environment. Another

study concerning other catadromous species of this family has also concluded that mature individuals are usually absent in the marine environment (Feutry *et al.* 2012).

5.2 In Hong Kong, this species has been observed in eight streams, but has not been observed in the marine environment. Both juveniles and adults usually remain in the lower sections and sometimes the middle sections of the streams. The known freshwater streams can be considered as the essential habitats for this catadromous species (i.e., nurseries for juveniles); based on the present understanding, the AOO of this species is considered to be about 8 km² in Hong Kong by the present authors.

5.3 The abundance of this species is always low in Hong Kong, although sometimes abundance of recruited juveniles observed can be more than 50 individuals in a single stream. Mature individuals are always rare (e.g., maximum abundance observed would not be more than 10 individuals in a single stream); this indicates that not many juveniles reach adult stage in the streams in Hong Kong. As the local population size is always at a low level, there is no obvious decreasing/ increasing trend observed. Based on field observations, the maximum number of mature individuals of this species is estimated to be far fewer than 250.

5.4 In local marine waters, *K. mugil*, which is a non-diadromous marine congener of *K. marginata*, is the only member of the Kuhlidae family recorded (Sadovy and Cornish 2000, AFCD 2014), and *K. marginata* has never been reported. Based on the scientific information aforementioned and field observations, it is considered that the number of mature individuals of this species observed in local freshwater streams could well-represent its local population size. This species is thus considered to be Endangered using criterion D (EN D). However, since the species has a sea borne pelagic larval stage and it is possible that larvae of this species from other regions, such as Taiwan and The Philippines, where it is common, could drift to Hong Kong by ocean currents and replenish the local population, the rating is downlisted to **Vulnerable** (VU° D).

6. Human Uses

6.1 Fish hobbyists collect this species from the wild. It can be seen in pet trade.

7. Main Threats to the Species

7.1 Habitat destruction, river channelisation, blockage of migration pathway and pollution are the main threats that the species is facing in Hong Kong and other parts of the world. Since this is a catadromous species, man-made structures (i.e., culverts, concrete channels, weirs, dams, beams) built across estuaries and streams can greatly affect the recruitment, and thus the population size.

8. Conservation Recommendations

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

8.2 Due to the catadromous 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 developments 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 Vulnerable 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 maintained 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 its habitats.

9. References

AFCD. 2014. *Hong Kong Fish Net*. Available at: <http://www.hk-fish.net>. (Accessed: 30 May 2014).

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.

Feutry, P., Castelin, M., Ovenden, J.R., Dettai, A., Robinet, T., Cruaud, C. and Keith, P. 2013. Evolution of diadromy in fish: insights from a tropical genus (*Kuhlia* Species). *The American Naturalist* 181(1): 52-63.

Feutry, P., Tabouret, H., Maeda, K., Pécheyran, C. and Philippe, K. 2012. Diadromous life cycle and behavioural plasticity in freshwater and estuarine Kuhliidae species (Teleostei) revealed by otolith

microchemistry. *Aquatic Biology* 15: 195-204.

Oka, S. and Tachihara, K. 2008. Migratory history of the spotted flagtail, *Kuhlia marginata*. *Environmental Biology of Fishes* 81: 321-327.

Randall, J.E. and Randall, H.A. 2001. Review of the fishes of the genus *Kuhlia* (Perciformes: Kuhliidae) of the Central Pacific. *Pacific Science* 55(3): 227-256.

Sadovy, Y. and Cornish, A. 2000. *Reef Fishes of Hong Kong*. Hong Kong: Hong Kong University Press.

Appendix 2: *Kuhlia rupestris*



1. Classification/ Names

- Scientific Name : *Kuhlia rupestris* (Lacepède, 1802)
- Order : Perciformes
- Family : Kuhliidae
- Synonym(s) : *Centropomus rupestris* Lacepède, 1802
Dules rupestris subspecies *hedleyi* Ogilby, 1897
Dules guamensis Valenciennes, 1831
Dules haswellii Macleay, 1881
Dules vanicolensis Valenciennes, 1831
Kuhlia caeruleascens Regan, 1913
Perca ciliata Cuvier, 1828
- English common name(s) : Rock Flagtail, Jungle Perch, Buffalo Bream, Mountain Trout
- Chinese common name(s) : 大口湯鯉, 烏尾冬
- Other common names : Not known

2. Geographic Range

2.1 This species is widely distributed from the western Indian Ocean, north to Japan (Ryukyu Islands), south to Queensland, Australia and east to the Federated States of Micronesia (the Caroline Islands), Fiji and Samoa. It also appears in Taiwan where it is considered to be common. The description provided in the IUCN Global Redlist which suggests that it is possibly extinct in Taiwan is definitely incorrect (Nip, Pers. Obs.).

2.2 This species mainly appears in the New Territories and Lantau in Hong Kong. AOO is approximately 10 km². No map is provided to protect the population from over-exploitation by local fish hobbyists.

3. Habitat and Ecology

3.1 This species mainly inhabits clean freshwater streams. Although it is catadromous, it is considered to be a freshwater species primarily (Randall and Randall 2001, Feutry *et al.* 2013).

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

4.1 The species is considered to be of Least Concern (2014) under the global IUCN Red List.

5. Local Conservation Status Assessment

5.1 According to Feutry *et al.* (2013), this catadromous species spawns in inshore waters, and larvae grow at sea. Small juveniles actively migrate to freshwater streams; these small juveniles then become adults in the freshwater environment, and afterwards they migrate back to the sea to

breed (Feutry *et al.* 2013). Lewis and Hogan (1987) considered that the adults of this species return to the freshwater environment after breeding. Feutry *et al.* (2012) suggested that adults of this species are scarce in the marine environment.

5.2 In Hong Kong, this species has been observed in 10 streams, but has not been observed in the marine environment. Both juveniles and adults usually remain in the lower sections and sometimes the middle sections of the streams. The freshwater streams can be considered as the essential habitat for this catadromous species (i.e., nurseries for juveniles); based on this, AOO of this species is considered to be about 10 km² in Hong Kong by the present authors.

5.3 The abundance of this species is low in Hong Kong, although abundance of recruited juveniles observed can be more than 50 individuals in a single stream; adults are always rare (e.g., maximum abundance observed would not be more than 10 individuals in a single stream); this suggests that not many juveniles reach adult stage in Hong Kong streams. As the local population size is always small, there is no obvious decreasing/ increasing trend observed. Based on field observations, the maximum number of mature individuals of this species is estimated to be fewer than 250 in Hong Kong.

5.4 In local marine waters, *K. mugil*, which is a non-diadromous marine congener of *K. marginata*, is the only member of the Kuhlidae family recorded (Sadovy and Cornish 2000, AFCD 2014), and *K. rupestris* has never been reported. Indeed, this species has not been formally reported before this assessment. Based on the scientific information above and field observations, the number of mature individuals of this species observed in local freshwater streams could well-represent its local population size. The species is thus considered to be Endangered using criterion D (EN D). However, since it has a sea borne pelagic larval stage and larvae of this species from other regions, such as Taiwan and The Philippines, where this species is 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 Fish hobbyists collect this species from the wild. It can be seen in pet trade.

7. Main Threats to the Species

7.1 Habitat destruction, river channelisation, blockage of migration pathway and pollution are the main threats that the species is facing in Hong Kong and other parts of the world. Since this is a catadromous species, man-made structures (i.e., culverts, concrete channels, weirs, dams, beams) built across estuaries and streams can greatly affect the recruitment, and thus the population size.

8. Conservation Recommendations

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

9. References

AFCD. 2014. *Hong Kong Fish Net*. Available at: <http://www.hk-fish.net>. (Accessed: 30 May 2014).

Feutry, P., Castelin, M., Ovenden, J.R., Dettai, A., Robinet, T., Cruaud, C. and Keith, P. 2013. Evolution of diadromy in fish: insights from a tropical genus (*Kuhlia* Species). *The American Naturalist* 181(1): 52-63.

Feutry, P., Tabouret, H., Maeda, K., Péchéyan, C. and Philippe, K. 2012. Diadromous life cycle and behavioural plasticity in freshwater and estuarine Kuhliidae species (Teleostei) revealed by otolith microchemistry. *Aquatic Biology* 15: 195-204.

Lewis, A.D. and Hogan, A.E. 1987. The enigmatic jungle perch – recent research provides some answers. *SPC Fisheries Newsletter* 40: 22-31.

Randall, J.E. and Randall, H.A. 2001. Review of the fishes of the genus *Kuhlia* (Perciformes: Kuhliidae) of the Central Pacific. *Pacific Science* 55(3): 227-256.

Sadovy, Y. and Cornish, A. 2000. *Reef Fishes of Hong Kong*. Hong Kong: Hong Kong University Press.

Appendix 3: *Clarias fuscus*



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1. Classification/ Names

- Scientific Name : *Clarias fuscus* (Lacepède, 1803)
- Order : Siluriformes
- Family : Clariidae
- Synonym(s) : *Clarias pulicaris* Richardson, 1845
Macropteronotus fuscus Lacepède, 1803
- English common name(s) : Hong Kong Catfish, Chinese Catfish, Whitespotted Walking Catfish, Whitespotted Freshwater Catfish
- Chinese common name(s) : 塘虱, 鬍鯰, 鬍子鯰, 土虱
- Other common names : Not known

2. Geographic Range

2.1 The species is known from southern China, Taiwan, northern Vietnam (Kottelat 2001) and northeastern Lao PDR. The fish has been introduced to the Hawaiian Islands (Yamamoto 1992), Japan (Okinawajima and Ishigakijima Islands, Ryukyu Archipelago; Masuda *et al.* 1984), and The Philippines.

2.2 This species appears in the New Territories and Lantau in Hong Kong.

3. Habitat and Ecology

3.1 The species inhabits lowland streams, ponds and adjacent marshes.

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

4.1 The species is considered to be of Least Concern (2012) under the global IUCN Red List.

5. Local Conservation Status Assessment

5.1 This primary freshwater fish species is considered to be ‘widespread and common’ by Lee *et al.* (2004), although Chong and Dudgeon (1992) only recorded this species at one site and Chan (2001) only at seven sites (out of the 43 sites surveyed).

5.2 Based on recent field observations, this species can be considered to be widespread (e.g., appearing throughout the territory) but is not abundant or “common”. The species prefers lowland habitats, including low-lying streams, ponds and marshes; however, most of these habitats have been significantly impacted by channelisation, development of village houses/ residential areas, haphazard developments and pollution in recent years. Furthermore, many of the remaining habitats suitable for this species have been occupied by its congener – the North African Catfish *C. gariiepinus*. *C. gariiepinus* is not native to Hong Kong and is believed to have been introduced for

aquaculture purposes many years ago. This species has now become established in Hong Kong and can be found in most lowland aquatic habitats in the New Territories and Lantau, as well as some urban drains. Its maximum total length has been reported to be 170 cm (<http://www.fishbase.de/summary/Clarias-gariepinus.html>), but the maximum standard length of *C. fuscus* is only 24.5 cm (<http://www.fishbase.de/summary/Clarias-fuscus.html>). *C. gariepinus* is also considered to be a potential pest (<http://www.fishbase.de/summary/Clarias-gariepinus.html>). *C. fuscus* is considered to be seriously threatened by *C. gariepinus* in Hong Kong as they share similar habitats and prey items. For instance, *C. fuscus* was found in Tai Ho Stream, Lantau, by Chong and Dudgeon (1992); however, no *C. fuscus* was found at this site in recent surveys but a large individual of *C. gariepinus* was observed.

5.3 Given the reasons above, the population trend of this species is considered to be decreasing. However, it is difficult to estimate the reduction rate of the local population just based on the above, and the number of mature individuals of this species is also not able to be estimated. This species can be recorded at more than 10 sites currently, although the subpopulations at many of these sites are likely to be suffering from the impacts mentioned above. No quantitative analysis has been carried out for this species.

5.4 From the information stated above, this species does not qualify for all threatened categories but is believed to be under serious stress in Hong Kong. It is thus considered to be a **Near Threatened** species. There is no known linkage between the local population and the mainland China's subpopulations; thus the rating is not downlisted.

6. Human Uses

6.1 It is a food fish species and would be caught locally.

7. Main Threats to the Species

7.1 Channelisation, competition with and predation from invasive species, development within the catchment areas of the streams and 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. It is generally believed that *C. gariepinus* would threaten most lowland fishes, amphibians, aquatic snails and crustaceans. The conservation authority should develop a management plan aimed at controlling the population of this invasive species which is likely to have serious consequences on the local aquatic biodiversity.

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., marshes, lowland streams), the Near Threatened 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 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 maintained 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 machines).

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.

8.8 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).

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

9. References

Chan, P.L.B. 2001. *Sustainability and Biodiversity: The Impact, Alternative Design and Prospects of Restoration of Channelized Lowland Streams in Hong Kong*. Unpublished Ph.D. thesis. Hong Kong: The University of Hong Kong.

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.

Kottelat, M. 2001. *Freshwater fishes of northern Vietnam. A preliminary check-list of the fishes known or expected to occur in northern Vietnam with comments on systematics and nomenclature*. Washington DC: The World Bank.

Lee, V.L.F., Lam, S.K.S., Ng, F.K.Y., Chan, T.K.T. and Young, M.L.C. 2004. *Field Guide to the Freshwater Fish of Hong Kong*. Hong Kong: Agriculture, Fisheries and Conservation Department.

Masuda, H., Amaoka, K., Araga, C., Uyeno, T. and Yoshino, T. 1984. *The fishes of the Japanese Archipelago*. Tokyo: Tokai University Press.

Yamamoto, M.N. 1992. *Occurrence, distribution and abundance of accidentally introduced freshwater aquatic organisms in Hawaii*. State of Hawaii: Fisheries Research and Surveys, Project No. F-14-R-16.

Appendix 4: *Glyptothorax pallozonus*



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1. Classification/ Names

Scientific Name	: <i>Glyptothorax pallozonus</i> (Lin, 1934)
Order	: Siluriformes
Family	: Sisoridae
Synonym(s)	: <i>Glyptosternum pallozonum</i> Lin, 1934 <i>Glyptothorax pallozonum</i> (Lin, 1934)
English common name(s)	: Not known
Chinese common name(s)	: 白線紋胸鮡
Other common names	: Not known

2. Geographic Range

- 2.1 This species is only known from Guangdong, China (including Hong Kong SAR).
- 2.2 This species appears in the New Territories and Lantau. AOO is about 4 km²; EOO is about 60 km². No map is provided in order to protect the population from over-exploitation.

3. Habitat and Ecology

- 3.1 The species inhabits fast flowing streams with boulders and pools.

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 is only recorded at four sites in Hong Kong. Individuals are usually located in sections with fast-flowing water, boulders and pools; this kind of environment is usually restricted to the upper and middle courses of hill streams. The streams where this species has been observed are separated from each other (i.e., not ecologically linked); thus the subpopulations are isolated. AOO of this species is considered to be about 4 km² (EOO is about 60 km²) by the present authors.

- 5.2 All subpopulations are considered to be in very low abundance. Only one or less than five individuals were observed at each site, during each survey. The nocturnal and cryptic nature of the species will contribute to low counts, but it is estimated that no more than 50 mature individuals would appear at each site. Thus the total number of mature individuals of this species in Hong

Kong would not be more than 200.

5.3 Based on the above (i.e., AOO and subpopulation at each site are very small, the sites are isolated from each other), the local population is considered to be severely fragmented.

5.4 One of the streams where this species can be found is suffering from sedimentation, which is believed to be worsened by the construction and operation of a vehicle road, and associated drains, recently built nearby. Increased sedimentation would reduce the quality of the habitat for this species as the sediment would simply fill the gaps and cracks between boulders which this benthic species usually occupies. The lower and middle sections of this stream and another stream are also suffering from channelisation and pollution. It is also anticipated that there will be a large-scale development next to one of these streams, and thus the quality of this habitat would be further affected. The other two localities are relatively stable, at the present moment, but development proposals are common at one site, and this greatly increases the uncertainty regarding the quality of this habitat.

5.5 As the local population size is always at a low level, there is no obvious decreasing/increasing trend observed.

5.6 This species can occasionally be observed in local aquarium markets. Although the individuals would likely be imported from mainland China, the possibility that some individuals are collected from these local sites cannot be completely ruled out.

5.7 This species is considered to be **Critically Endangered** (CR B1ab(iii) + 2ab(iii)) in Hong Kong, due to the small AOO (< 10 km²), the severely fragmented nature of the local population and also the decline in habitat quality observed and projected. No linkage can be proven between the local population and the mainland subpopulations; thus the rating is not downlisted.

6. Human Uses

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

7. Main Threats to the Species

7.1 Development within the catchment areas of the streams, pollution, competition with invasive species and sedimentation are the main threats that this species is facing in Hong Kong. This species is also susceptible to over-exploitation. 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.

8.3 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., hill streams), the Critically Endangered 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 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 maintained 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 machines).

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.

8.8 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).

8.9 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.

Appendix 5: *Macropodus hongkongensis*



1. Classification/ Names

Scientific Name	: <i>Macropodus hongkongensis</i> Freyhof & Herder, 2002
Order	: Perciformes
Family	: Osphronemidae
Synonym(s)	: <i>Macropodus concolor</i> (non Ahl, 1937) (misapplied)
English common name(s)	: Hong Kong Paradise Fish
Chinese common name(s)	: 香港鬥魚, 黑叉尾鬥魚
Other common names	: Not known

2. Geographic Range

- 2.1 The species is known from southern China, including Hong Kong.
- 2.2 This species mainly appears in the New Territories in Hong Kong. AOO is about 21 km² and EOO is about 192 km².

3. Habitat and Ecology

- 3.1 This species inhabits streams, ponds and nearby marshes.

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

- 4.1 It 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/nscs_paper01_2011.pdf).

5. Local Conservation Status Assessment

5.1 This primary freshwater fish species has been considered to be ‘uncommon’ by Lee *et al.* (2004) (recorded at less than 20 sites). Currently, it can be found at 17 sites, and AOO is estimated by the present authors to be about 21 km² (EOO is estimated to be about 192 km²). This species can be found in lowland marshes and streams but can also be found in marshes and streams in upland areas. Many of these sites are found within protected areas but individuals in these areas are threatened by illegal collection and habitat degradation. Subpopulations outside protected areas are facing threats such as village expansion and pollution, and some of their habitats have been largely impacted. Nevertheless, there has been no obvious decline in the size of the local population (or AOO/ EOO) in recent years and they are still abundant at some sites.

5.2 This species can almost be classified to be Endangered under criterion B (e.g., AOO < 500 km², EOO < 5000 km², and habitat degradation has been observed at some sites). However, as the number of locations where this species can be found is larger than 10 and the local population

cannot be considered to be severely fragmented, it cannot pass through the threshold at this moment. Thus now it is considered by the authors to be **Near Threatened**. The category is not downlisted as other subpopulations in mainland China are not able to replenish the local population (i.e., there are no natural linkages between them).

5.3 Some large colonies of this species are found within Country Park Enclaves (outside protected areas) and these subpopulations would be threatened by the development of village houses in the future; the status of these subpopulations (and their habitats) should be closely monitored. If in the future the number of locations decreases, the rating of this species would need to be upgraded (i.e., to a threatened category).

6. Human Uses

6.1 It is a target of fish hobbyists and can be seen in 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 that this species is facing in Hong Kong. This species is also susceptible to over-exploitation in the Hong Kong SAR. In mainland China, 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.

8.3 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., marshes, streams), the Near Threatened 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 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 maintained 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 machines).

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.

8.8 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).

8.9 The conservation authority should maintain a monitoring programme for 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.

Lee, V.L.F., Lam, S.K.S., Ng, F.K.Y., Chan, T.K.T. and Young, M.L.C. 2004. *Field Guide to the Freshwater Fish of Hong Kong*. Hong Kong: Agriculture, Fisheries and Conservation Department.

Appendix 6: *Macropodus opercularis*



1. Classification/ Names

- Scientific Name : *Macropodus opercularis* (Linnaeus, 1758)
- Order : Perciformes
- Family : Osphronemidae
- Synonym(s) : *Labrus opercularis* Linnaeus, 1758
Chaetodon chinensis Bloch, 1790
Macropodus chinensis (Bloch, 1790)
Macropodus viridiauratus Lacepède, 1801
Macropodus venustus Cuvier, 1831
Macropodus ctenopsoides Brind, 1915
Macropodus filamentosus Oshima, 1919
- English common name(s) : Paradise Fish, Forktail Paradise Fish, Chinese Fighting Fish
- Chinese common name(s) : 叉尾鬥魚, 蓋斑鬥魚, 中國鬥魚, 塘金皮, 膨皮婆
- Other common names : チョウセンブナ (Japan)

2. Geographic Range

- 2.1 The species is known from southern China, Taiwan, northern Vietnam and southern Japan.
- 2.2 This species mainly appears in the New Territories. Currently, AOO is about 20 km² and EOO is about 147 km².

3. Habitat and Ecology

- 3.1 This species inhabits lowland streams, ponds and nearby marshes.

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

- 4.1 This species has been considered to be Near Threatened in Taiwan (Chen *et al.* 2012) and Critically Endangered in Japan (<http://www.jpnrdb.com/search.php?mode=map&q=0503170310500>).

5. Local Conservation Status Assessment

- 5.1 This primary freshwater fish species has been considered to be common in Hong Kong (Lee *et al.* 2004; recorded at more than 20 sites). In recent years, however, many sites where this species has been recorded have been impacted significantly by human activities. For instance, most freshwater marshes at Tung Chung (a past hotspot for this species; e.g., this species was found at Tung Chung according to Chong and Dudgeon (1992), Chan (2001) and Lee *et al.* (2004)) have been filled and this species could not be recorded there in recent surveys; the Pak Sha O marsh has also been turned into a farmland recently, and the species has not been recorded afterwards. This

species is a lowland species mainly appearing in slow-flowing streams and marshes, and most of these habitats have been disappearing at an alarming rate in Hong Kong in the past decade. Indeed, the sites where this species can still be found now are mostly threatened by pollution, haphazard development and large-scale development plans. It will not be surprising if the local population size further decreases in the foreseeable future.

5.2 The average generation length of this species lies somewhere between two and eight years (Chen *et al.* 2012).

5.3 Based on the observations mentioned in Section 5.1 above, it is estimated that the local population of this species has declined by more than 50% in the past 15 years (ca. three generations). Thus this species is considered to be **Endangered** using criteria A2ac (EN A2ac) by the present authors. There is no known linkage between the local population and the mainland China's subpopulations; thus the rating is not downlisted.

6. Human Uses

6.1 It is a target of fish hobbyists and a popular aquarium species.

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 that this species is facing in Hong Kong. It is also susceptible to over-exploitation 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 refer to Section 8 of **Appendix 5**.

9. References

Chan, P.L.B. 2001. *Sustainability and Biodiversity: The Impact, Alternative Design and Prospects of Restoration of Channelized Lowland Streams in Hong Kong*. Unpublished Ph.D. thesis. Hong Kong: The University of Hong Kong.

Chen, I.-s., Tzeng, C.-s. and Shao K.-t. 2012. *Red Data Book of Freshwater Fishes in Taiwan*. Taiwan: Forestry Bureau, COA, Executive Yuan.

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.

Lee, V.L.F., Lam, S.K.S., Ng, F.K.Y., Chan, T.K.T. and Young, M.L.C. 2004. *Field Guide to the Freshwater Fish of Hong Kong*. Hong Kong: Agriculture, Fisheries and Conservation Department.

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.

