

Ecological and Conservation Importance of Tung Chung, Lantau



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Cover photo: Tung Chung Bay

Executive Summary

In 2012 and again in January 2013, the government announced that the remaining rural area of Tung Chung would be included in a large scale development plan. In May 2011, the government became bound by the principals of the Convention on Biological Diversity (CBD) which was extended to Hong Kong. Under CBD local natural heritage should be appropriately protected through a Biodiversity Strategy and Action Plan (BSAP).

Many areas in Tung Chung are of high ecological value and should be protected from development. The objective of this report is to provide up-to-date information that should assist decision-makers in identifying the sensitive ‘no-go’ areas in Tung Chung. Areas of high conservation importance include streams, marshland, estuaries, the mudflat and associated mangrove as well as wooded areas. These components of the local ecosystem provide habitats for many species of conservation concern – some depend largely on the Tung Chung ecosystem, and thus they should not be adversely affected. We consider that good planning in Tung Chung with reference to the CBD is essential, and can provide a model for similar new town developments in the future.

1. Background and Introduction

Tung Chung includes many habitats of high ecological value. The stream system is unique and contains several species of conservation concern; the riparian woodland, secondary woodland, Fung Shui Woodland and marsh provide connectivity with the Lantau Country Parks; the mudflat and mangrove at Tung Chung Bay are habitats occupied by Horseshoe Crabs and many intertidal species. Notwithstanding this value to local biodiversity, the Government is proposing to carry out land reclamation at the Bay and large-scale infrastructure development, in order to provide land for housing and other development needs (please refer to the Project Profile submitted for Application for EIA Study Brief, Application No. ESB-251/2012; <http://www.epd.gov.hk/eia/register/profile/latest/esb251/esb251.pdf>).

Although we appreciate the local need to increase land supply for housing, we object to the proposal. We consider there are still many other available options, such as urban renewal, re-zoning of abandoned/ underused industrial sites and developing brown-field sites, to cater for development needs. A wiser tactic would be to look at all other options first before encroaching valuable natural environment.

The Convention on Biological Diversity (CBD) has been extended to Hong Kong. The Hong Kong Government is obligated to protect our natural heritage, and the Chief Executive and senior Environmental Officials have agreed to do so. Therefore development proposals that would significantly affect important habitats should not be approved, or should be revised.

This report summarizes the ecologically important areas in Tung Chung, and also assesses their ecological value, following guidance from the Technical Memorandum on Environmental Impact Assessment Process (TM-EIAO).

2. Methods

2.1 Surveys and Data from other Environmental NGOs

Several field visits were undertaken in 2011 and 2012. KFBG experts surveyed plants, amphibians and reptiles, butterflies and aquatic fauna along intertidal areas, streams, woodlands and other natural/ semi-natural habitats. Daytime and night-time surveys were conducted. Additional information on faunal groups was provided by Conservancy Association, WWF-HK, Hong Kong Bird Watching Society and Green Power.

Because the main aim of this report is to highlight the ecological importance of Tung Chung, it primarily documents species of conservation interest and does not contain detailed species lists.

As mentioned above, we have also assessed the ecological value of different habitats in Tung Chung based on the criteria from the TM-EIAO.

The general status of different habitats was assessed based on our expertise, site observation, relative biological diversity and the presence/ absence of species of conservation interest. Status of species mainly follows Fellowes *et al.* (2002), Hu *et al.* (2003), IUCN Red List, AFCD's database and other documented sources.

3. Results

3.1 Tung Chung Stream and Riparian Zone

There are no doubts regarding the ecological and conservation importance of the Tung Chung Stream system. It contains a diverse fish community, habitats for many amphibian and reptile species of conservation importance and also habitats for many invertebrates such as dragonflies and crustaceans. Its riparian zone is important to amphibians and reptiles and also many plant species of conservation concern. Besides the section at Shek Lau Po, the whole stream system is largely natural and intact, and this can explain the appearance of so many species of conservation interest. Tung Chung Stream is a unique system in Hong Kong – having a natural estuary and largely natural stream courses from upper hillside to lowland area. Any further significant alteration of the remaining stream and estuary ecosystem would represent an immeasurable impact on Hong Kong's ecology.

Amphibians and Reptiles

The herpetofauna community associated with the stream is moderately diverse. The community also contains many species of conservation importance. Most of these species were found within the Potential New Town Development Extension Area proposed by the government (PNTDEA; please refer to ESB 251/2012).

Liuixalus romeri (Romer's Tree Frog)

This species inhabits the riparian zones of the stream, including those within the PNTDEA. Seasonal tributaries (especially very small ones) are also believed to provide breeding habitats for this species. This species is endemic to Hong Kong and protected under Cap. 170, and is also considered to be Globally Endangered (IUCN 2013). Mating calls of this species were heard in the riparian zone during the survey, indicating that this zone also constitutes a breeding habitat for the species.

Paramesotriton hongkongensis (Hong Kong Newt)

This is a protected species in Hong Kong and is considered to be Globally Near Threatened (IUCN 2013). It inhabits the main stream, tributaries and the riparian zone, and has been recorded in areas some distance away from the stream (can be found almost 400 m from the water edge (Fu 2010)); juveniles of this species mainly inhabit terrestrial areas (Fu 2010). Reduction in the riparian habitat area (riparian forest) would undoubtedly cause an impact on this species (Fu 2010). The newt was not discovered during the current study, but it has been recorded in the tributaries of Tung Chung Stream and Wong Lung Hang Stream (Lau and Dudgeon 1999).

Xenophrys brachykolos (Short-legged Toad)

All confirmed records of this species are from Hong Kong and thus it is considered to be an endemic species. It is considered to be Globally Endangered (IUCN 2013) and a species of potential concern by AFCD (2009). The mating call of this species was heard from the middle section of the main stream (near Shek Mun Kap) during the present study (within the PNTDEA). It is believed that the tributaries draining into the main stream provide breeding habitats for this species; adults of the toad forage on the forest floor (e.g. the riparian woodland).

Amolops ricketti (South China Cascade Frog)

This species has been recorded in the upper tributaries of Tung Chung Stream (Lau 2005). In Hong Kong, this species seems to be restricted to Lantau, and is considered to be of potential concern by AFCD (2009). It was not recorded during the current study.

Python bivittatus (Burmese Python)

An individual was observed swimming at the mouth of the main stream during a site visit in 2012 (observation made by Conservancy Association; within the PNTDEA). It is considered to be Globally Vulnerable (IUCN 2013) and Critically Endangered in China (Wang and Xie 2004). It has also been listed as a Class I State Key Protected Wildlife in China (<http://zdx.forestry.gov.cn/portal/bhxxh/s/709/content-85157.html>). The riparian woodland (and other woodlands in the vicinity) provides suitable habitats for this species.

Fish

There should be no doubt that the aquatic community of Tung Chung Stream is highly diverse. It has once been considered to be the second most species rich stream in Hong Kong, in terms of fish community (Chong and Dudgeon 1992). A total of five species of high conservation concern and one uncommon species were recorded from Tung Chung Stream in 2012; one more species which is believed to inhabit the stream is also discussed.

Anguilla japonica (Japanese Eel)

This is a catadromous species and needs to migrate between the sea and the stream, but can also inhabit brackish waters. It was not recorded in the Tung Chung Stream system during our surveys; but casual sightings have been made in the mangrove area and other small estuaries inside Tung Chung Bay (Tony Nip Pers. Obs.). It can inhabit the natural lower section of Tung Chung Stream and its estuary. Lee *et al.* (2004) considered that it is uncommon and appears in low abundance in Hong Kong. In fact, this species is suffering from overfishing globally (although nearly all Japanese Eel individuals appearing in the market are from fish farms, fry of this species are still heavily harvested from the wild to support the culture business), and the Japan government has recently listed it as an endangered species (<http://www.env.go.jp/press/press.php?serial=16264>).

In order to protect this species, the stream-ocean corridor should not be blocked (i.e. channelization at certain sections, or culverted); stream flow and stream bed should remain natural (e.g. stream flow should not be further reduced). The coastal brackish marsh and mangrove should also be protected. All habitats described are within the PNTDEA.

Anguilla marmorata (Giant Marbled Eel)

This is another catadromous species which needs to migrate between the sea and the stream. A dead individual was observed in the mid-stream section of the western main tributary of the Tung Chung Stream system during the survey (**Figure 1**). Adults of this species inhabit streams with natural bottoms (with large rocks, gravel and sand), and the Tung Chung Stream and tributaries provide suitable habitats. In order to protect this species, the stream-ocean corridor should not be blocked (i.e. channelized at certain sections or culverted); stream flow and the stream bed should remain natural (e.g. stream flow should not be reduced); simply speaking, the whole stream should be preserved in order to protect this species. All habitats for this species lie within the PNTDEA. The conservation status of this species is as follows: conservation concern (AFCD 2011), Endangered in the China Species Red List (AFCD 2011), Class II State Key Protected Wildlife in China (AFCD 2011) and Global Conservation Concern (Fellowes *et al.* 2002).

Acrossocheilus beijiangensis (Beijiang Thick-lipped Barb)

This barb is considered to be a species of conservation concern by AFCD (2011). A significant population of the species can be found in the Tung Chung Stream system (throughout the main stream and tributaries; within the PNTDEA; **Figure 2**); it can also be found in other nearby stream systems (i.e. Wong Lung Hang Stream and San Tau Stream). In addition to the localities on North Lantau, another population of this species which is believed to be native to Hong Kong inhabits a

stream on Hong Kong Island. Fellowes *et al.* (2002) suggested that this fish is of Global Conservation Concern.

Glyptothorax pallozonum (White-lined Chinese Chest-catfish)

In Hong Kong, this species is restricted to North Lantau. Although AFCD reported that it has been recorded from Tai Po (AFCD 2011), we consider that more survey effort is required to confirm the status as further observations by KFBG staff at Tai Po consider that the Chinese Chest-catfish species at the location may be un-described for Hong Kong.

Although AFCD (2011) reported that the last record of this species was made in 2001 in Hong Kong, we observed one individual in 2012 in the mid-stream section of Tung Chung Stream (**Figure 3**). We consider that sections within the PNTDEA also provide suitable habitats for this species. The fish is considered to be extremely rare and of high conservation concern in Hong Kong (Nip and Cheng 2012). It is also considered to be of conservation concern by AFCD (2011) and of Global Conservation Concern by Fellowes *et al.* (2002).

Based on our observation, this species is not abundant in Hong Kong; but a small population inhabits Tung Chung Stream and its tributaries.

Oryzias curvinotus (Curved-back Rice Fish)

This species is considered to be of conservation concern by AFCD (2011) and of Global Conservation Concern by Fellowes *et al.* (2002). The fish has once been found in the inland area of Tung Chung (Cheung 1998) but now many suitable inland habitats have disappeared. At present, a small population can still be found in the lower section and the estuary of the Tung Chung Stream system (**Figure 4**), and also in the remaining marshes and mangrove along the coast of Tung Chung Bay (within the PNTDEA).

The mobility of this species is not high and it is highly vulnerable to environmental degradation. For instance, reclamation of the estuary and diversion of the lower stream section would cause a direct, significant impact on the remaining population of this species in Tung Chung.

Glossogobius olivaceus (Spotted Band Goby)

This species is considered to be uncommon in Hong Kong (Lee *et al.* 2004). A population can be found at the mouth of Tung Chung Stream (**Figure 5**).

Stiphodon atropurpureus (Purple Neon Goby)

This is an amphidromous species with a complex life cycle: adults live and breed in freshwater streams; eggs hatch in freshwater streams and larvae drift passively to the sea; larvae grow in the marine environment and juveniles actively return to freshwater streams. Therefore, in order to protect this species, the stream-ocean corridor should not be blocked; stream flow and the stream bed should remain natural (e.g. stream flow should not be further reduced); simply speaking, the whole stream should be preserved.

A pair of gobies was observed in a section just upstream from the channelized section at Shek Lau Po in 2012 (within the PNTDEA). This species was recorded in the same stream system by Highways Department (2002). As long as the Tung Chung Stream system receives no further impacts (e.g. further channelization, culverting, diversion), it will continue to provide habitats for this species. We also believe that if the channelized section at Shek Lau Po can be restored, the Tung Chung Stream system can provide more habitats for diadromous species.

It is a species considered to be of Global Conservation Concern by Fellowes *et al.* (2002), although Nip (2010) has considered that it is only of Regional Conservation Concern as this species has been found to be common in the Philippines (Watson and Chen 1998).

Horseshoe Crabs

Laurie (2012) recorded a Horseshoe Crab (*Carcinoscorpius rotundicauda*) at the estuary of Tung Chung Stream in 2011. The estuary is likely to provide suitable habitats for the two Horseshoe Crab species occurring in Hong Kong.

Butterflies

There is a marshy area within the middle section of Tung Chung Stream, and a rare butterfly species, *Aeromachus jhora*, was found during the survey (within the PNTDEA). This species is considered to be rare by AFCD (AFCD 2013). A population of this butterfly species inhabits the marsh.

Plants

Along the streamside, three flora species of conservation concern were recorded during the surveys.

Nepenthes mirabilis (Pitcher Plant)

This species was recorded at the middle section of Tung Chung Stream (within the PNTDEA; **Figure 6**), along the stream bank. The Pitcher Plant is protected under Cap. 96 and Cap. 187. It is threatened by habitat destruction and illegal harvesting, and is considered to be Vulnerable in China by Hu *et al.* (2003).

Spiranthes hongkongensis (Hong Kong Spiranthes)

This is an orchid species. All orchid species are protected under Cap. 96 and Cap. 187. It is considered to be Vulnerable (Barretto *et al.* 2011). Many orchid species suffer from illegal harvesting in Hong Kong.

This species was observed along the streamside (in the mid-stream section) of Tung Chung Stream (within the PNTDEA) during the survey in 2012.

Goodyera procera (Tall Rattlesnake Plantain)

This orchid species is considered to be of Least Concern (Barretto *et al.* 2011), and is protected in Hong Kong. Two individuals were observed along Tung Chung Stream, but not within the PNTDEA. However, we believe that the riparian zone within the PNTDEA provides suitable habitats for this species.

3.2 Woodlands and Orchard

Tung Chung Valley contains Fung Shui Woodlands and secondary woodlands. Fung Shui Woodlands are generally associated with indigenous villages, usually located behind/ next to the villages and are commonly high in floral diversity; most are within/ close to the PNTDEA (**Figure 7**). Secondary woodlands are flourishing adjacent to the Fung Shui Woodlands and maintain good ecological linkage with the Lantau Country Parks. During our surveys, many flora and fauna species were recorded in the woodlands. A pair of *Accipiter trivirgatus* Crested Goshawk were observed in the Fung Shui Woodland near Chap Mun Tau (**Figure 8**) and were likely to be breeding within the woodland/ in nearby wooded areas. Moreover, we also recorded Romer's Tree Frog in the wooded areas; even in the orchard we were able to record the species. The above observations reflect the naturalness of the area and the ecological value of the woodlands.

Plants

Aquilaria sinensis (Incense Tree)

Many mature *Aquilaria sinensis* trees (Incense Tree) were found in the Fung Shui Woodlands and the secondary woodlands (within the PNTDEA), some had been illegally felled (**Figure 9**). This species is protected under Cap. 96 and is seriously threatened due to illegal harvesting. It is considered to be Near Threatened in China and is a Wild Plant under State Protection (Category II) (Hu *et al.* 2003).

Gmelina chinensis (Little-leaved Rourea)

This is a tree species considered to be Vulnerable in China (Hu *et al.* 2003). Two individuals were observed in the secondary woodland within the PNTDEA (**Figure 10**).

Dioscorea hispida (White Yam)

This is a rare plant species (Dr. Ng Sai-chit Pers. Obs.) and one individual was discovered in the Fung Shui Woodland behind Mok Ka Village (within the PNTDEA) (**Figure 11**).

Gymnosphaera hancockii (Toothed Black Tree-fern)

G. hancockii has been recorded in the Fung Shui Woodland behind Mok Ka Village (Dr. Ng Sai-chit Pers. Obs.), but it was not found during the present survey. It is considered to be Vulnerable in China and is a Wild Plant under State Protection (Category II) (Hu *et al.* 2003).

Amphibians and Reptiles

Although few herpetofauna species were observed during woodland surveys, these habitats are believed to be important to this fauna group, in view of their naturalness and linkages with the Country Parks.

Gekko gecko (Tokay Gecko)

One individual was heard in the wooded area at Shek Mun Kap (within the PNTDEA) during the present study. This species is considered to be Endangered in China (Wang and Xie 2004) and of Regional Concern (Fellowes *et al.* 2002). Tung Chung is one of its strongholds in Hong Kong (AFCD 2013).

Liuixalus romeri (Romer's Tree Frog)

In Tung Chung, this endemic species can be found in woodlands and orchards (**Figure 12**). Tree holes and sometimes even a broken pot filled with water can provide breeding sites for this tiny frog.

Butterflies

Troides helena (Common Birdwing)

This protected butterfly was recorded during the current study, near the Fung Shui Woodland at Shek Mun Kap (within the PNTDEA). Indeed, an individual was recorded in the same area some years ago (**Figure 13**). It is believed that its host plant *Aristolochia tagala* is present in the woodland in that area.

The butterfly is protected under Cap. 170 and Cap. 586, and is considered to be uncommon and of conservation concern in Hong Kong (AFCD 2013).

Troides aeacus (Golden Birdwing)

This species was not recorded in our study but has been recorded in Tung Chung by Green Power. It is protected under Cap. 586 and is considered to be rare and of conservation concern in Hong Kong (AFCD 2013). It is likely to share the same habitat with Common Birdwing as they rely on the same host plant.

Tajuria cippus (Peacock Royal)

Green Power has recorded this species from Tung Chung. It is considered to be rare by AFCD (2013) and of local conservation concern (Fellowes *et al.* 2002). This species can inhabit the wooded areas in Tung Chung.

Birds

The Hong Kong Bird Watching Society and WWF-HK have respectively recorded the two bird species of conservation concern below, and we consider that they would utilize the wooded areas.

Chalcophaps indica (Emerald Dove)

This is a woodland species and is considered to be rare in Hong Kong (AFCD 2013) and Vulnerable in China (Zheng and Wang 1998).

Bubo bubo (Eurasian Eagle Owl)

This is a large owl species and can utilize woodland habitats in the region. It is considered to be rare in China (Zheng and Wang 1998) and of Regional Concern (Fellowes *et al.* 2002).

3.3 Tung Chung Bay

Tung Chung Bay contains several mangrove stands, marsh areas, a seagrass bed and an extensive mudflat. Its productivity is high and this can be reflected by the shellfish harvesting activity present almost every day at low tide (**Figure 14**). It is a recognized nursery and breeding site for Horseshoe Crabs and two species, *Tachypleus tridentatus* and *C. rotundicauda*, can be found in Tung Chung Bay (Laurie 2012, Shin *et al.* 2007). Moreover, extensive mangrove mudflat like the one in Tung Chung can provide nurseries for fish species (Nip and Wong 2010). Several birds of conservation concern have been recorded in Tung Chung Bay (see Table 1 below).

Horseshoe Crabs

The conservation importance of Horseshoe Crabs is well recognized; AFCD, local scholars and local conservation groups have long been engaged in the conservation of this fauna group (e.g. <http://www.cityu.edu.hk/bch/iwscahc2011/index.htm>). We consider that protecting any single piece of their habitat, including existing habitats, potential habitats and habitats historically occupied by Horseshoe Crabs but still suitable, should be a priority. In recent years, local populations have declined dramatically (Shin *et al.* 2007), and this further highlights the urgent need for conservation action.

Laurie (2012) found both *T. tridentatus* and *C. rotundicauda* in Tung Chung Bay (in 2010 and 2011). During our surveys in 2012, we found two breeding pairs of *C. rotundicauda* in a small stream flowing through the mudflat (**Figure 15**). These updated data confirm the importance of Tung Chung Bay to Horseshoe Crabs (i.e. breeding and nursery grounds; larvae usually stay in the breeding ground for years before moving to adult habitat).

Mangrove, Brackish Marsh, Seagrass Bed and Rare Plants

Mangrove stands can be found along the edge of the Bay – along the western side, around the mouth of Tung Chung Stream, around the mouth of Wong Lung Hang Stream (e.g. at Sha Tsui Tau), at Ma Wan Chung and along the coast just outside the Yat Tung Estate, nearly all within the PNTDEA. In general, it is believed that mangrove is important in providing habitats for many species such as fish, crustaceans and birds (e.g. high structural heterogeneity, providing carbon source). Mangrove mudflat has also been considered to be important as a fish nursery in Hong Kong (Nip and Wong 2010). According to the TM-EIAO, established mangrove stands of any size are considered to be important habitats.

A piece of seagrass bed can be found at San Tau. During our surveys, two seagrass species, *Halophila* sp. and *Zostera japonica*, were found (**Figure 16**). Seagrass beds are considered to be of ecological importance as mentioned in the TM-EIAO and the latter species has been listed as a rare and precious plant of Hong Kong (Hu *et al.* 2003).

Some brackish marshes can be found along the edge of the bay. Large areas of marshland can be seen at the south-western corner of the bay.

Ligustrum punctifolium (a rare shrub species)

This shrub species is very rare and can only be found at several sites in Hong Kong. It has not been recorded from Mainland China, and globally apart from Hong Kong, the species has only been found in Vietnam. It should be noted that although the Tung Chung population is small, it is very far away from other local populations; thus it should be a distinct population requiring special attention (Dr. NG Sai-kit Pers. Obs.). It has been listed as a rare and precious Hong Kong plant (Hu *et al.* 2003).

It was found at the mouth of Tung Chung Stream, in the mangrove area, very close to the boundary of the PNTDEA (**Figure 17**).

Fish

Anguilla japonica (Japanese Eel)

The conservation importance of this species has been documented above. This species was not recorded in the present survey but individuals of this species have been observed in the mangrove area of the bay (Tony Nip Pers. Obs.).

Oryzias curvinotus (Curved-back Rice Fish)

The conservation importance of this species has been mentioned above. A large population inhabits the mangrove and marshy areas along the coastline of Tung Chung Bay (**Figure 18**). It seems to be the largest brackish population of this species in Hong Kong; others found in Northeastern New Territories are all low in abundance (Tony Nip Pers. Obs.).

Eugnathogobius polylepis (a mangrove goby)

This species was first formally reported from Hong Kong by Nip (2011). In Hong Kong, it is restricted to mangrove areas and has only been found in several locations, usually in very low numbers. This species is also rare in other places and in China, it is considered to be Endangered (Wu and Zhong 2008); it is believed that the local populations share the same status. Two individuals were observed during the survey, one within the PNTDEA (at Sha Tsui Tau) and another one at the boundary (at the south-western corner of the bay; **Figure 19**). In general, the mangrove area within the bay provides suitable habitats for this species.

Hemigobius hoevenii (a mangrove goby)

Lee *et al.* (2004) considered that in Hong Kong this species could only be found in Lantau (under the name *Mugilogobius obliquifasciatus*). This species was found along the mangal coastline within the bay (**Figure 20**).

Scartelaos histophorus (Green Mudskipper)

This species is not common in Hong Kong and a small population has been found at Ma Wan Chung mudflat (Tony Nip Pers. Obs.), although it was not recorded in the present study.

Birds

According to observations made by the Hong Kong Bird Watching Society, at least three wetland-dependent species have been found at Tung Chung Bay, including *Egretta eulophotes* Swinhoe's Egret, *Egretta sacra* Pacific Reef Egret and *Corvus torquatus* Collared Crow. The conservation status of these species is listed in the table below.

Table 1. Bird species of conservation interest recorded at Tung Chung Bay

Species	Local Status	Conservation Status	Required Habitat
Swinhoe's Egret	Scarce migrant	IUCN (2013): Globally Vulnerable Class II Protected Species in China* Fellowes <i>et al.</i> (2002): Global Concern	Intertidal area and marsh
Pacific Reef Egret	Uncommon resident	Class II Protected Species in China* Fellowes <i>et al.</i> (2002): Local Concern	Coastal area
Collared Crow	Uncommon resident	IUCN (2013): Globally Near Threatened Fellowes <i>et al.</i> (2002): Local Concern	Wetland

*<http://zdx.forestry.gov.cn/portal/bhxx/s/709/content-85157.html>

During our survey, we also observed one Pacific Reef Egret foraging at the mouth of Wong Lung Hang Stream (**Figure 21**).

3.4 Inland Marsh and Agricultural Land

Tung Chung, like other rural areas in the New Territories, was once covered with agricultural lands. When the agricultural activities ceased, the abandoned farmlands were vegetated through natural succession; as the result of a particular topography, some areas became marshy.

The Floating Frog *Occidozyga lima* has been recorded at Tung Chung (Lau and Dudgeon 1999). This species, however, has not been recorded from Hong Kong since 1995 (Lau and Dudgeon 1999). Curved-back Rice Fish have also been recorded in the abandoned agricultural land at Tung Chung (Cheung 1998). During our survey, we also spotted one Chinese Bull Frog *Hoplobatrachus chinensis* in a small pool (**Figure 22**). This species is a Class II State Key Protected Wildlife (<http://zdx.forestry.gov.cn/portal/bhxx/s/709/content-85157.html>) and is considered to be of Potential Regional Concern (Fellowes *et al.* 2002).

Currently, there are not many marshes and agricultural lands (**Figure 23**) left at Tung Chung; instead, we observed a lot of stockpiling or land filling activities. If the marshes and agricultural lands are filled further, habitats suitable for some of the above species will disappear from Tung Chung Valley.

3.5 Other Species of Conservation Concern

During the survey, a butterfly species, *Leptotes plinius* Oriental Striped Blue, was found in a bush at Hau Wong Temple. A recently recorded species, *Zizula hylax* Tiny Grass Blue, was also recorded within the PNTDEA. The Oriental Striped Blue is considered to be very rare in Hong Kong (AFCD 2013) and its distribution is highly dependent on the presence of its host plant *Plumbago zeylanica*.

In 2012, Green Power recorded 69 butterfly species in Tung Chung and eight rare/ very rare species (AFCD 2013) were recorded: *Eurema brigitta* Small Grass Yellow, Golden Birdwing, *Papilio xuthus* Swallowtail, *Neptis soma* Sullied Sailer, *Udaspes folus* Grass Demon, *Tajuria cippus* Peacock Royal, Tiny Grass Blue and Oriental Striped Blue. They also recorded the Common Birdwing. Sullied Sailer, Tiny Grass Blue, Oriental Striped Blue and both Birdwings are considered to be species of conservation concern by AFCD (2013).

Green Power also recorded 36 odonate species in Tung Chung Valley and 27 were recorded within/ close to the PNTDEA. Four species of conservation interest, *Agriomorpha fusca* Chinese Yellowface, *Protosticta beaumonti* Short-winged Shadowdamsel, *Sinosicta ogatai* Yellow-spotted Shadowdamsel and *Zygonyx iris* Emerald Cascader, were recorded, but mainly in the upper Tung Chung Stream sections.

4. Evaluation of Habitats

We assess the value of the main habitats (natural/ semi-natural) now appearing within and around the PNTDEA following the guidance of the TM-EIAO. Indeed, we consider that the entire ecosystem of Tung Chung is unique: a natural estuary, a large, natural stream system, connection between the stream and the sea, presence of mangrove, seagrass bed and intertidal mudflat, and also the presence of many species of conservation concern. In Hong Kong, Tai Ho in Lantau and Lai Chi Wo in Northeast New Territories have similar landscapes. The former is covered partially by SSSI zoning but the whole area has been listed as one of the Priority Sites under the New Nature Conservation Policy (2004); the marine area of Lai Chi Wo has been designated as a Marine Park. Currently, the remaining area of Tung Chung receives no statutory protection, from a conservation point of view; it is not even covered by a Development Permission Area Plan/ Outline Zoning Plan, despite the fact that the Tung Chung ecosystem is larger than the two mentioned above.

Table 2. Ecological value of the Tung Chung Stream system (including the riparian zone)

Criteria	
Naturalness	Except the section at Shek Lau Po and the banks of certain portions such as the lower section, most sections and tributaries are natural. Most of the riparian zone is still natural.
Size	Large for Hong Kong
Diversity	High, as reflected from Sections 3.1 and 3.5 above
Rarity	Many rare species occur, including five herpetofauna species of conservation interest (two endemic), seven fish species of conservation concern, one rare butterfly species and three protected plant species. The estuary would also provide habitats for Horseshoe Crab.
Re-creatability	The Tung Chung Stream event happened some years ago has showed that a natural stream is re-creatable. But such a recreation is not easy and it also depends on the nature of the destruction. For instance, it would be harder to convert a concrete channel into a stream.
Fragmentation	The Shek Lau Po man-made section fragments the lower and middle sections; some man-made structures on the streams also cause some fragmentation; however, the appearance of amphidromous species in the section just above the channelized section implies that the upper section can still be linked with the lower section to a certain extent.
Ecological linkage	The western main tributary of the system is not heavily fragmented (i.e. no channelization). Even the partially channelized eastern main tributary also provides habitats for diadromous species. This shows that the whole system is linked with the sea. The riparian zone and the stream itself are linked with surrounding wooded areas.

Criteria	
Potential value	Very high if the channelized Shek Lau Po section is restored and linkage between the riparian zone and the wooded areas can be enhanced.
Nursery/ breeding ground	Breeding and nursery grounds for fishes, crustaceans, amphibians and insects. Juvenile Horseshoe Crab can appear in the estuary.
Age	Largely natural, N.A.
Abundance/ Richness of wildlife	Very high
Ecological value	Very High (presence of rare/ endemic species and many species of conservation importance, largely natural, good connection with surrounding natural habitats; its uniqueness (e.g. a large, untouched estuary) further enhances its value)

Table 3. Ecological value of the Tung Chung woodlands

Criteria	
Naturalness	Secondary woodlands were formed through natural succession; Fung Shui Woodlands were maintained by villagers in the past and became self-sustained over time. Both are dominated by native plant species and close to the structure of a natural woodland (e.g. rich understorey); thus both can be considered to be largely natural.
Size	Woodlands within the PNTDEA can be considered to be large, in Hong Kong terms.
Diversity	Both flora and fauna: high (e.g. habitats for herpetofauna, birds, insects and mammals)
Rarity	Rare plants and animals have been found, as shown in Section 3.2.
Re-creatability	Hard to be re-created (i.e. take many decades), especially Fung Shui Woodlands.
Fragmentation	The human activities (i.e. stockpiling) now at Tung Chung Valley are fragmenting the woodlands; Tung Chung Road has also fragmented the woodlands. Further expansion of the village areas would also fragment the woodlands.
Ecological linkage	Linked with the stream, the riparian area and the Country Parks
Potential value	High
Nursery/ breeding ground	Can be breeding and nursery grounds for birds, insects and herpetofauna.
Age	Developed for decades; Fung Shui Woodlands would be older
Abundance/ Richness of wildlife	Very high
Ecological value	High (presence of rare/ endemic species and many species of conservation importance, largely natural, good connection with Country Parks)

Table 4. Ecological value of Tung Chung Bay

Criteria	
Naturalness	Largely natural, although part of the coastline has been affected
Size	Medium, based on Hong Kong's scale (e.g. Mai Po is the largest estuarine bay in Hong Kong)
Diversity	High (e.g. habitats for many vertebrates and invertebrates)
Rarity	Rare plants and animals have been found, as shown in Section 3.3.
Re-creatability	Not quite possible to be re-created
Fragmentation	The airport may block the migration pathway of some marine organisms to a certain extent; but in general the bay is still connected with other habitats (i.e. the streams, western Hong Kong waters).
Ecological linkage	The bay is still connected with other habitats (i.e. the streams, western Hong Kong waters) to a certain extent.
Potential value	If the seagrass bed at San Tau and the mangrove stands along the coastline expand, the habitat heterogeneity of the bay would increase.
Nursery/ breeding ground	Breeding and nursery grounds for Horseshoe Crabs, fishes and other marine creatures.
Age	Natural, N.A.
Abundance/ Richness of wildlife	Very high
Ecological value	Very High (its connection with a large natural stream, its importance to Horseshoe Crabs and the presence of both seagrass bed and mangrove make this bay quite unique in Hong Kong).

5. Recommendations

The Convention on Biological Diversity (CBD) was applied to Hong Kong by the Central People's Government in May 2011. Recently, the Hong Kong Government has commenced a dialogue with Environmental NGOs, scholars and Local Concern Groups regarding the strategy for the implementation of the CBD and development of a local Biodiversity Strategy and Action Plan.

Article 8 (in-situ conservation) of the CBD (<http://www.cbd.int/convention/articles/?a=cbd-08>) requires that the contracting parties follow the approaches below:

Article 8, (d): Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings

Article 8, (i): Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components

Based on the above, we consider that the Hong Kong Government should regard our seas and other natural habitats as a precious resource and heritage of Hong Kong. It is not only Victoria Harbour which requires protection. Hong Kong needs to protect its sea and natural environments.

As documented in the paragraphs above, Tung Chung contains many invaluable habitats and species, and these must receive concerted protection. We sincerely hope that the recommendations below can be adopted by the Hong Kong Government:

1. There should not be any reclamation within the Tung Chung Bay.
2. There should not be any further stream diversion/ channelization/ formation of culverts. The entire Tung Chung Stream system (the estuary, the mainstream, the tributaries and the riparian zone (about 30 m from each side of the stream)) should not be affected, indirectly or directly; instead, the whole system should be protected. If possible, the channelized Shek Lau Po section should be restored; that section should not be culverted.
3. The estuary of Wong Lung Hang Stream should not be directly affected. The channelized Wong Lung Hang Stream sections, if possible, should be restored. The natural section of Wong Lung Hang Stream should be preserved.
4. There should not be direct impacts on the woodlands. The ecological linkage between the woodlands and the Country Parks should be maintained (i.e. a contiguous wooded area).
5. The existing connection between the riparian areas and existing woodlands should not be blocked.
6. The remaining marsh and agricultural areas in Tung Chung Valley should not be further degraded.
7. Appropriate planning control should be in place for the whole area.
8. If possible, important habitats within Tung Chung should be incorporated into the Country Park system.

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Figures

Figure 1. Dead Giant Marbled Eel observed in the mid-stream section of the western main tributary of the Tung Chung Stream system



Figure 2. Beijiang Thick-lipped Barb



Figure 3. White-lined Chinese Chest-catfish



Figure 4. Curved-back Rice Fish



Figure 5. Spotted Band Goby



Figure 6. Pitcher Plant



Figure 7. Fung Shui Woodlands at Tung Chung (approximately marked by the red line)



Figure 8. Crested Goshawk



Figure 9. Felled Incense Trees



Figure 10. Little-leaved *Rourea*



Figure 11. White Yam



Figure 12. Romer's Tree Frog



Figure 13. Common Birdwing



Figure 14. Shellfish harvesting

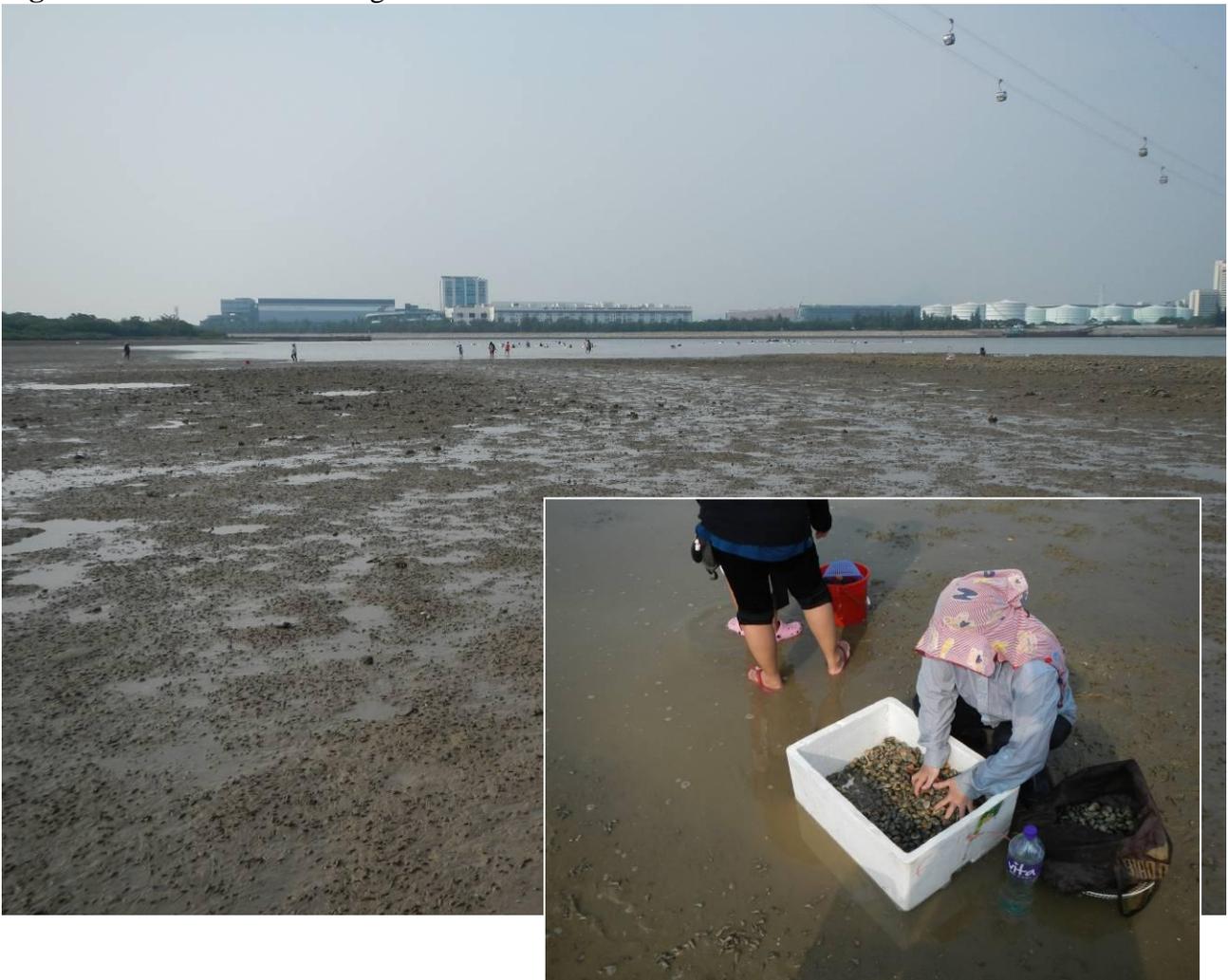


Figure 15. Breeding pairs of *Carcinoscorpius rotundicauda*



Figure 16. *Halophila* sp. and *Zostera japonica*



Figure 17. *Ligustrum punctifolium*



Figure 18. Curved-back Rice Fish



Figure 19. *Eugnathogobius polylepis*



Figure 20. *Hemigobius hoevenii*

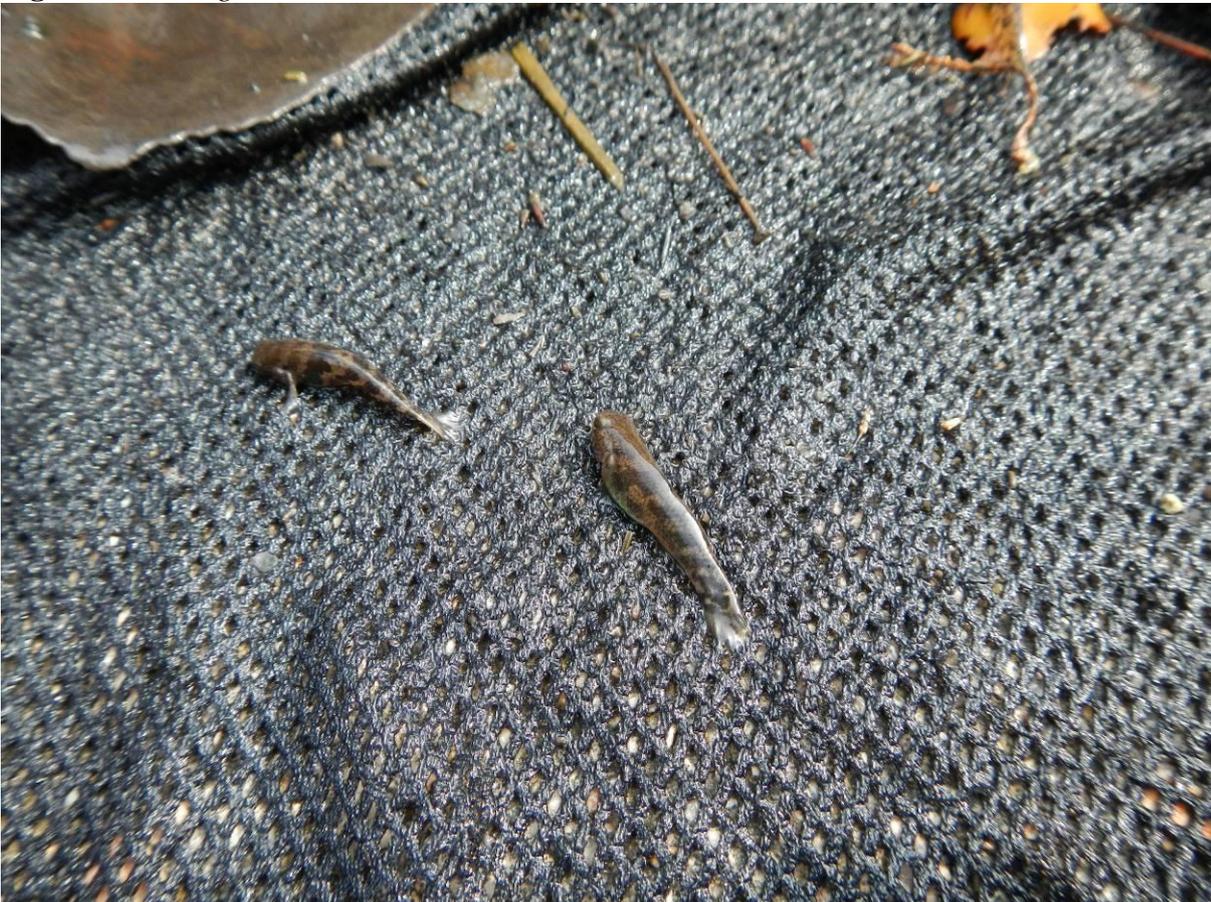


Figure 21. Pacific Reef Egret



Figure 22. Chinese Bull Frog



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Figure 23. Active agricultural lands at Tung Chung



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.

