Hong Kong Biodiversity

Agriculture, Fisheries and Conservation Department Newsletter

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Guest Editorial

To better understand our biological assets and to facilitate the formulation of the new nature conservation policy and measures, we have initiated the ecological survey programme in 2002 with a view to establishing a more comprehensive territory-wide ecological database for Hong Kong in phases by 2005.

So far, over 35,000 records of about 1,500 species of plants and animals have been collected, verified, and stored preliminarily on spreadsheets. We have also established a web, the HK Biodiversity Online (www.hkbiodiversity.net), to make part of the baseline information available to the public for education purpose.

Our findings so far confirm that Hong Kong has a rich biodiversity. We have found a number of species which are new to Hong Kong or even new to science and there are many species awaiting our discovery/rediscovery.

Our surveys also enrich our knowledge on the distribution of our animals and plants. Findings suggest that our protected areas are protecting a very significant portion of our biodiversity. For the species groups surveyed and analyzed, over 95% of the terrestrial and freshwater representatives which are regularly seen in Hong Kong have representative population(s) inside our protected areas.

Although our surveys are not intended to replace ecological assessment required under the environment impact assessment and town planning application processes, the information helps project proponents assess such impacts and take necessary precautionary actions at the early planning stage. The information also enables assessment of the ecological importance of different sites / species in the territory-wide scale and facilitates the formulation of relevant conservation action plans. For example, making reference to the findings, we have compiled a list of 33 ecologically important streams outside country parks for incorporation into a technical circular on the protection of natural streams and rivers, which will be issued shortly by the Environment, Transport and Works Bureau.

Since ecology is dynamic, we need to follow up the surveys with long term continuous monitoring and repeated surveys to update the database. Based on the survey results, we will also further develop and implement conservation action plans for specific sites / species. So, the message is - "the survey programme will go on."

The conservation of biodiversity requires concerted efforts. While we have convened a number of specialist group meetings comprising experts from local specialist organizations and tertiary institutions to seek experts' advice on issues related to biodiversity conservation in Hong Kong, we also value the views of every member of the community. Should you have any views or findings, you are most welcomed to share them with us.

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Contribution to the *Hong Kong Biodiversity*

Do you have any views, findings and observations to share with your colleagues on the Biodiversity Survey programme? Please prepare your articles in MS Word format and send as attachment files by email to the *Article Editor*.

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Feature Articles

AFCD Survey of Local *Fung Shui* Woods
漁農自然護理署風水林的植物調查

Joseph K.L. Yip, Yuen-ngor Ngar, Jackie Y. Yip, Eric K.Y. Liu and Patrick C.C. Lai, Plant Working Group
葉國樑、魏遠娥、葉彥、廖家業、黎存志 (植物工作小組)

Figure 1. The dense vegetation of *fung shui* wood backs onto denuded hill slopes (1952, Tai Lam Chung).
圖1. 濃密的風水林和附近光禿的山頭形成強烈的對比（攝於1952年，大欖涌）

漁農自然護理署植物工作小組從2002年開始，展開全港性風水林植物調查，為風水林這華南的獨特生境，蒐集環境、植物種類和整體狀況的第一手資料。小組成員連同香港標本室的職員，調查了香港116個大大小小的風水林，進入林中記錄所有植物，以及四周環境如坡向、海拔、林相及優勢種等特徵。風水林內沒有明顯路徑，考察時往往要披荊斬棘，穿越茂密的林下層，又因為林木高聳，常要借助望遠鏡幫助辨認特徵。本文概述本地風水林的植物種類，其中的樹木以大戟科、桑科、樟科為主，灌木和草本植物則主要是茜草科和蝶形花科，反映了本地風水林屬於南亞熱帶低地常綠闊葉林。這些工作成果，為建立全港性風水林資料庫奠下基礎，有助我們以全港性的宏觀角度評估風水林的生態價值，從而定出值得加強保護的地點，在制定保育措施時作為參考。

In the early days villagers settled close to wooded areas, and they preserved the native forests behind their homes for *fung shui* reasons. They planted fruit trees and other economic plants on the edges of native forests to increase the usefulness and benefits of the naturally existing woodland. These enhanced forests, seen today behind many villages, typically in a crescent shape, are known as *fung shui* woods (FSWs). Most FSWs make a clear contrast with the sparse grass and shrubs on their nearby slopes. This is because, as generally believed, FSW contain patches of primary forest which were never cleared - and so they offer clues for understanding Hong Kong's original native vegetation. Hence, from both botanical and conservation viewpoints, FSWs are important assets.

Figure 2. Lin Au *fung shui* wood
圖 2. 蓮澳風水林

The Agriculture, Fisheries and Conservation Department (AFCD) initiated a territory-wide FSW survey in 2002. In just over a year, members of the plant working group, together with staff of the Hong Kong Herbarium, surveyed 116 FSWs of various sizes to assess their latest status. The study aimed to be comprehensive, but given the total number and wide geographical extent of FSWs in Hong Kong the survey could not be exhaustive. During each trip, we gathered information on plants and the environment, such as slope aspects, altitude, general appearance and dominant species of the FSW. As few real trails exist in the FSWs it took real effort to get through the thick and dense understorey. For small sites, we surveyed the entire site and recorded all vascular plants encountered. For large sites, representative parts of each site were covered as far as possible; and each survey continued until no new plant species could be found. We also used binoculars to observe and identify species within the high canopy. The boundaries of the FSWs were sometimes difficult to define, where the vegetation merged with that of the surrounding secondary forests. In these situations, the boundaries were delineated at a point when there were significantly fewer large trees, and/or where there was a marked change from dense, closed-canopy to a more open-canopy woodland.

Figure 3. AFCD Plant Working Group in the field after work
圖 3. 植物工作小組野外工作後留影

The survey of 116 local FSWs shows that FSW trees mainly belong to the families of Euphorbiaceae (大戟科), Moraceae (桑科) and Lauraceae (樟科), while shrubs and herbs are mostly members of Rubiaceae (茜草科) and Fabaceae (Papilionaceae) (蝶形花科). These are families typical of tropical or sub-tropical evergreen broad-leaved forests. They mirror a regional characteristic of Hong Kong's vegetation, with its southern sub-tropical lowland evergreen broad-leaved forests.

Figure 4. Some common plant species of local FSWs (from left to right): Sterculia (*Sterculia lanceolata*), Aporusa (*Aporusa dioica*), Asiatic Ardisia (*Ardisia quinquegona*) and Incense Tree (*Aquilaria sinensis*).
圖 4. 本地風水林一些常見植物品種(左至右)：假蘋婆、銀柴、羅傘樹及土沉香

The figures below show the number of FSWs in which each common FSW plant species was found: Lance-leaved Sterculia (假蘋婆, *Sterculia lanceolata*) (99); Longan (龍眼, *Dimocarpus longan*) (92); Aporusa (銀柴, *Aporusa dioica*) (92); Incense Tree (土沉香, *Aquilaria sinensis*) (89); Ivy tree (鵝掌柴, *Schefflera heptaphylla*) (82); Hance's Syzygium (韓氏蒲桃, *Syzygium hancei*) (64); Camphor Tree (樟, *Cinnamomum camphora*) (56) and Machilus species (潤楠屬植物). The most common undergrowth shrubs are Wild Coffee (九節, *Psychotria asiatica*) (96); Asiatic Ardisia (羅傘樹, *Ardisia quinquegona*) (89) and Uvaria (紫玉盤, *Uvaria macrophylla*) (70). These plants are all widely distributed in the forests in Hong Kong. Endospermum (黃桐 *Endospermum chinense*), Pygeum (臀果木, *Pygeum topengii*) and Butulang Canthium (魚骨木, *Canthium dicoccum*) are also common in FSWs but less common in other lowland forests. Some plants such as Pea-like Fruit Popowia (嘉陵花, *Popowia pisocarpa*), Long-leaved Xylosma (長葉柞木, *Xylosma longifolium*) and Medicinal Fat-head Tree (烏檀 *Nauclea officinalis*) are found only in FSWs. Either FSWs provide a unique environment for these species, or they are remnants of the native vegetation which have escaped forest clearance - and today have restricted distribution due to isolation or limited dispersal ability. Evidently, FSWs are unique habitats of particular and important ecological significance.

Apart from wild flora, one also finds trees of economic value planted by villagers on the fringes of FSWs. Examples are fruit trees like longan, lychee, wampi, banana, pomelo, mandarin, rose apple, guava and papaya. FSWs also used to provide other useful plants for villagers. For instance, the Incense Tree can be refined into lignum which is a Chinese herbal medicine. In the old days, villagers planted these trees in many parts of the New Territories. After years of natural propagation, they are now so widely distributed that it is difficult to tell wild colonies from planted ones.

Figure 5. Cultivated plants of local *fung shui* woods: Longan (left) and Lychee (right)
圖 5. 本地風水林一些常見的栽培植物：龍眼(左)和荔枝(右)

Figure 6. Shing Mun *fung shui* wood
圖 6. 城門風水林

A comprehensive study on FSWs could be used to demonstrate how we could assess the relative conservation importance of Hong Kong's habitats. A ranking scheme has been developed based on four assessment criteria, namely area, species richness (total number of species recorded), number of FSW indicator species (indicator species were selected based on a cluster analysis of FSW species data) and number of species of conservation concern (rare or protected under local and national legislation). The relative score for each criterion was computed as a proportion of the "best" site of that criterion. (In other words, the largest site will have a score of 100 for the area criteria, and the site half of that size will have a score of 50). This approach was found more appropriate than the use of simple ranking or ordinal value as the absolute difference between the importance of individual sites would be reflected in the relative score. The four criteria had equal weighting and the total score of each site was the average of the respective scores of the four criteria. Conservation recommendations could then be made for these FSWs, based on the total score, land status, disturbance status and existing protection status to better conserve this unique ecological and cultural feature of South China.

When the scores of the 116 sites were plotted on a graph, seven of the sites (namely the FSWs at Shing Mun, Nam Fung Road, Mui Tze Lam at Ma On Shan, Wu Kau Tang (Mirror Pool), Tai Om, Fung Yuen and She Shan Tsuen) were found to have significantly higher scores than the others. Hence, these sites deserve the status of Site of Special Scientific Interest (SSSI) for their conservation. In fact, Shing Mun, Nam Fung Road, Mirror Pool and She Shan Tsuen FSWs are currently listed as SSSIs. However, some 20 of the sites have been heavily disturbed and were poor in species diversity. The remaining 89 sites deserve some form of conservation status. For instance, the FSW behind Cheung Uk in Sha Lo Tung has been zoned as Conservation Area in the relevant statutory land use plan.

The botanical and environmental information gathered in this survey of local FSWs forms a solid basis for establishing a comprehensive database. This information helps assess the ecological value of FSWs from a territory-wide perspective, and to identify sites that deserve a higher level of protection.

Acknowledgements

We gratefully acknowledge the assistance provided by Dr. Bryan S.F. Wong and Mr. S. H. Lee (Technical Services Section) regarding the verification and statistics on land status.

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Endemic Species Highlights - Romer's Tree Frog

Simon K.F. Chan, Ka-shing Cheung, Ching-yee Ho, Fung-ngai Lam & Wing-sze Tang
Herpetofauna Working Group

In 1952, the naturalist J.D. Romer discovered a tiny, drab coloured frog in a cave on Lamma Island. The frog was later found to be new to science, and it was named after him as *Philautus romeri*, commonly known as the Romer's Tree Frog (Smith, 1953). The frog was subsequently found to occur naturally on three other Hong Kong islands, but nowhere else outside Hong Kong (Lau, 1998). In other words, the species is endemic to Hong Kong.

Figure 7. Adult Romer's Tree Frog

Taxonomy

Romer's Tree Frog is generally placed under the following taxonomic hierarchy (Fei *et al*., 2000):

Class: Amphibia
Order: Anura
Family: Rhacophoridae
Genus: *Philautus*
Species: *Philautus romeri*

Based on the presence of a free-living tadpole stage and the labial teeth formula, Bossuyt & Dubois (2001) suggested that Romer's Tree Frog might either belong to a new genus yet to be described, or it should be placed in the genus *Chirixalus*. However, in view of its morphological similarities to other *Philautus* species, it is generally considered that the frog should be maintained in *Philautus* unless further taxonomic evaluation suggests otherwise.

Morphology

Romer's Tree Frog has an average length of 1.5 to 2.5 cm. Females are bigger than males. It is the smallest amphibian in Hong Kong. It has a small head. The skin is granulated and the digits have small suction discs. The belly is whitish while the back is brownish, with a characteristic X-marking (Figure 7). Some common Brown Tree Frogs (*Polypedates megacephalus*) also have an X-shaped marking on their back but one can easily distinguish them from Romer's Tree Frog by their larger size (5 - 8 cm in length), wide triangular head and smooth skin.

Habit and Habitat

Romer's Tree Frog breeds in fishless, oligotrophic, shaded, still or slow-flowing waters. The breeding sites are usually associated with forest or shrubland, while non-breeding individuals are found in forest, plantations and clearings within them.

During the breeding season from early March to September, males emit a characteristic metallic cricket-like mating call to attract females. A female frog lays up to 120 eggs onto submerged plant debris, stones or vegetation. The tiny tadpoles are free swimming and metamorphosis is completed in 4 to 6 weeks (Figures 8 and 9). Adults feed on small arthropods such as termites (Lau, 1998). The frogs are predominantly nocturnal but sometimes also active during the daytime (AFCD, unpublished record).

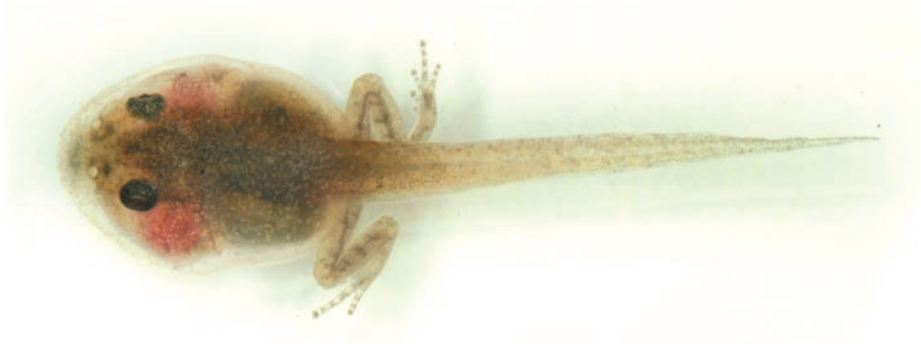

Figure 8. Free swimming tadpole of Romer's Tree Frog

Romer's Tree Frog can breed in small, temporary water bodies such as seasonally inundated wetlands and pools of rainwater contained in tree holes, ceramic pots or plastic containers, thus avoiding predation by fish.

Figure 9. Newly metamorphosed juvenile of Romer's Tree Frog

Distribution

The natural populations of Romer's Tree Frog are restricted to the four islands listed below.

Chek Lap Kok - Before construction of the new airport on Chek Lap Kok, Romer's Tree Frogs were found in the freshwater marshes in the northern and southern parts of the island. To help preserve the population of Romer's Tree Frog at Check Lap Kok, they were collected from the island and subsequently translocated to other sites in the New Territories and Hong Kong Island. At present, a small population of Romer's Tree Frog still occurs in a densely wooded area in the eastern knoll (Scenic Hill) of Chek Lap Kok. Breeding was observed in small water bodies created by rainwater in trash or structures such as water troughs, water tanks or plastic pots among some ruins in the summer of 2004 (AFCD, unpublished record).

Lamma Island - Lamma Island is the type locality of Romer's Tree Frog. The frog is common in the southern parts, including Lo So Sing, Sok Kwu Wan, Mo Tat, Mo Tat Wan, Yung Shue Ha and Tung O. It also occurs in Yung Shue Wan and Hung Shing Ye and the western parts of Shan Tei Tong (Lau, 1998; AFCD, unpublished record).

Lantau Island - Romer's Tree Frog is common and widespread on Lantau Island and has been recorded from Ngong Ping, Yi O, Shui Lo Cho, Fan Kwai Tong, Tei Tong Tsai, Tung Chung, Wong Lung Hang, Sunset Peak, Yi Tung Shan, A Po Long, Pak Ngan Heung, Lin Fa Shan, Mui Wo, San Shek Wan, Tong Fuk, Shui Hau, Shek Pik, Sham Wat and Keung Shan (Lau, 1998; AFCD, unpublished record). Hundreds of juveniles were observed in the riparian zone of a slow flowing stream in Ngong Ping in the 2002 breeding season, suggesting that this area supports a large population of Romer's Tree Frog (AFCD, unpublished record).

Po Toi - The frogs occurs in the eastern and southern part at Shan Liu, Wan Tsai, Ngong Chong and Lau Shui Hang (Lau, 1998; AFCD, unpublished record).

The present distribution of Romer's Tree Frog in Hong Kong is listed in the following table and shown in Figure 10.

Threats

Similar to many other species, human disturbance and habitat degradation/loss are threats to Romer's Tree Frog. As the species usually breeds around small streams or seepages, pollution, sedimentation or extreme weather such as prolonged periods of drought or heavy rain adversely affect its breeding success.

The tadpoles and eggs of Romer's Tree Frog are also susceptible to predation. For example, Lau (1998) showed that predation by the exotic Mosquito Fish (*Gambusia affinis*) increased mortality of any newly-hatched tadpoles of Romer's Tree Frog.

Conservation of Romer's Tree Frog

Romer's Tree Frog has received considerable concern in the last decades and a great deal of effort has been made to conserve this endemic species.

a) Legal Protection

The frog is protected under the Wild Animals Protection Ordinance, Cap. 170. It is an offence to take, possess, sell or export any Romer's Tree Frog and its egg, or to disturb the frog or its egg. Offenders are liable to a maximum fine of $100,000 and one year imprisonment.

b) Research

Not much was known about Romer's Tree Frog from its discovery in 1952 until an environmental impact assessment (EIA) was conducted for the new Chek Lap Kok airport development in the early 1990s. The following recommendations were made in the New Airport Master Plan EIA Report to mitigate the impacts of the new airport construction to the island's population of Romer's Tree Frog (Anon, 1991):

i) Investigation of habitat utilization, breeding habits, larval development, biotic interactions and over-wintering behaviour of Romer's Tree Frog.

ii) Collation and synthesis of existing scientific data on the biology and ecology of Romer's Tree Frog.

iii) Establishment and maintenance of a breeding population of Romer's Tree Frog in the laboratory under a controlled environment.

iv) Development of a conservation programme for Romer's Tree Frog including identification and translocation of the species to suitable uncolonized sites.

Natural populations	Translocation sites
Chek Lap Kok	Kadoorie Farm and Botanic Garden
Lamma Island	Pat Sin Leng Country Park
Lantau Island	Tai Lam Country Park
Po Toi	Tai Po Kau Nature Reserve
	Tsiu Hang Special Area
	Tai Tam Country Park
	Hong Kong Zoological and Botanical Gardens

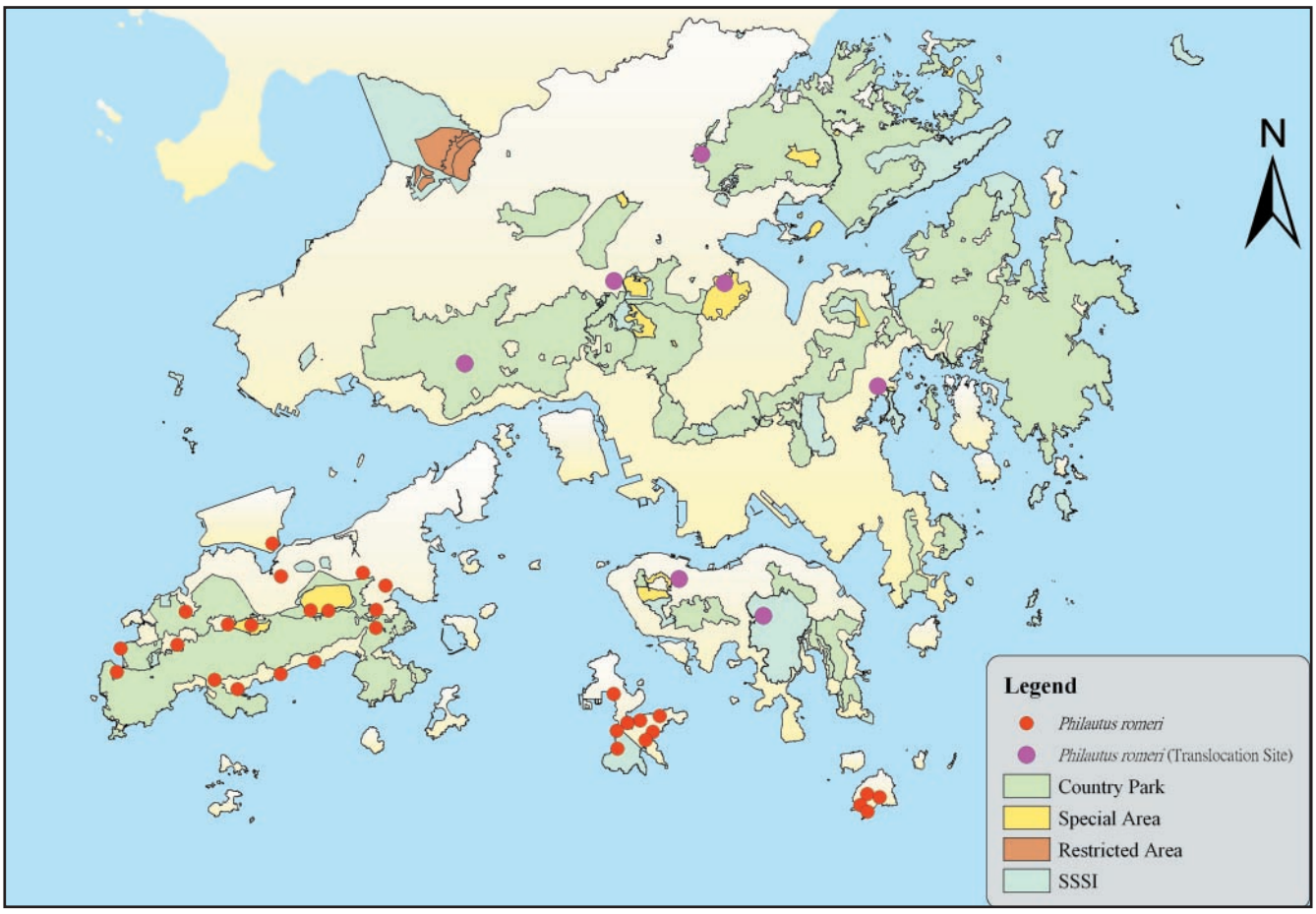

Figure 10. The Distribution of Romer's Tree Frog in Hong Kong.

A study on the habitat use of amphibians in Hong Kong, with special emphasis on Romer's Tree Frog was conducted by Michael Lau of the University of Hong Kong during 1991 to 1997. Funding for this study was provided by the Royal Hong Kong Jockey Club Charities Ltd. Over 200 wetland sites across the territory were surveyed to determine their amphibian fauna and new localities of Romer's Tree Frog were identified during the surveys (Lau, 1998).

c) Translocation

World Wide Fund for Nature Hong Kong initiated a rescue operation for Romer's Tree Frogs in the northern part of Chek Lap Kok in 1991. They collected 40 adults, 3 juveniles, 26 tadpoles and 31 eggs which were kept in laboratories for captive breeding and subsequent translocation (Lau, 1998).

Between November 1991 and December 1992, Michael Lau further collected 220 adults, 13 juveniles, 8 tadpoles and 7 egg clutches from the southern part of the island. The frogs were kept and captive-bred in the University of Hong Kong and Melbourne Zoo. Suitable recipient sites were later identified by Michael Lau, in collaboration with the Planning Department, Lands Department and AFCD for the frogs. Over 1,100 frogs and 1,600 captive-bred tadpoles were released to the recipient sites from 1993 to 1994. Each site received at least 90 frogs, thus providing a viable founding population to increase the chance of successful establishment (Lau, 1998). Earthen/plastic pots or concrete/butynol-lined pools were also provided to increase the number of breeding grounds. The recipient sites have been monitored since then (Lau, 1998; Chan *et al*., 2003).

Breeding and successful establishment were confirmed at all sites except Tin Fu Tsai. Establishment at the Tin Fu Tsai site is believed to have failed as no frogs could be found after years of monitoring. Excluding Tin Fu Tsai, monitoring results indicate that Romer's Tree Frogs have dispersed from the successful released locations to the surrounding habitats though the range and population size of the frogs remain small. Artificial man-made water bodies provided safe, fishless breeding grounds for the frogs, in particular where the recipient sites lack suitable natural breeding habitats (Lau, 1998; AFCD unpublished record).

d) Development Control

In recognition of its ecological value and scientific importance in relation to Romer's Tree Frog, Ngong Ping on Lantau Island was designated as a Site of Special Scientific Interest (SSSI) in May 1999. The valley there supports a large number of Romer's Tree Frogs. The SSSI includes the seasonally flowing stream and surrounding forest, plantation and shrubland - thus protecting the breeding and non-breeding habitats of Romer's Tree Frog there from development. The area is also zoned "SSSI" on the Ngong Ping Outline Zoning Plan.

On Lamma Island, most of the areas in which the frogs occur are zoned "Conservation Area" on the Lamma Island Outline Zoning Plan.

e) Monitoring

An ongoing monitoring program of Romer's Tree Frog has been administered by the Herpetofauna Working Group of AFCD since 2002. The purpose of the program is to monitor the survivorship of Romer's Tree Frogs in their natural range and at the translocation sites as well as the condition of their habitats. Surveys are conducted during the warm breeding season from March to September each year.

Discussion

Despite extensive surveys in the New Territories, on Hong Kong Island and other outlying islands including Soko Islands, Shek Kwu Chau, Cheung Chau, Hei Ling Chau, Sunshine Island, Peng Chau and Green Island, no natural populations of Romer's Tree Frog have been found outside Lantau Island, Lamma Island, Po Toi and Chek Lap Kok (Lau, 1998; AFCD, unpublished record). The reasons behind this restricted range is not clear. Dudgeon & Lau (1999) suggested that it was probably due to habitat destruction/degradation (e.g. forest clearance, construction of reservoirs, agricultural development etc.) in mainland New Territories and on Hong Kong Island. Lau (1998) further suggested that, combined with other factors, any surviving Romer's Tree Frogs there were probably wiped out through predation on tadpoles and/or eggs with the introduction of Mosquito Fish to Hong Kong in 1927. However, if there were any populations of Romer's Tree Frogs in the New Territories and on Hong Kong Island prior to the introduction of the fish, it would be logical to assume that at least some would survive in the remote parts of the territory where suitable habitats are available and Mosquito Fish have not colonized.

Yet, up to the present, and despite extensive surveys, no naturally occurring Romer's Tree Frogs have been found in the New Territories or on Hong Kong Island (Lau, 1999; Chan *et al*., 2003) - even though Romer's Tree Frogs can breed in small water bodies, including tree holes, pools and artificial containers which cannot sustain Mosquito Fish. So it is unlikely that predation by Mosquito Fish is the main reason for the restricted distribution of Romer's Tree Frog, while forest clearance, the construction of reservoirs and agricultural development might be the main causes for the disappearance of Romer's Tree Frog (Michael Lau, pers. comm.). However, as Mosquito Fish is widespread in the territory, it may affect the dispersal and colonization of habitats by Romer's Tree Frogs, in particular for those recently established populations at the translocation sites in the New Territories and Hong Kong Island. Any future translocation programme for the *ex situ* conservation of the species should take this into consideration and the recipient sites should not have any Mosquito Fish.

Although naturally occurring populations of Romer's Tree Frog are restricted to four islands in Hong Kong, it is common and widespread there. Together with the successfully established populations in the New Territories and on Hong Kong Island, Romer's Tree Frog is now regarded as having a secure population status. Adequate protection of the major habitats, mostly within protected areas, and/or areas with appropriate conservation zonings on statutory land use plans, should safeguard the long-term survival of Romer's Tree Frog. However, this tiny frog is still susceptible to threats such as habitat degradation. Dedicated conservation efforts, in particular species monitoring, should be continued to ensure the conservation of this endemic amphibian of Hong Kong. In this regard, an action plan, including a species monitoring program, is being implemented by AFCD for the long-term conservation of Romer's Tree Frog.

Acknowledgements

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Working Group Column

Short-tailed Shearwater, its first record in Hong Kong

Gary K.L. Chow, Bird Working Group

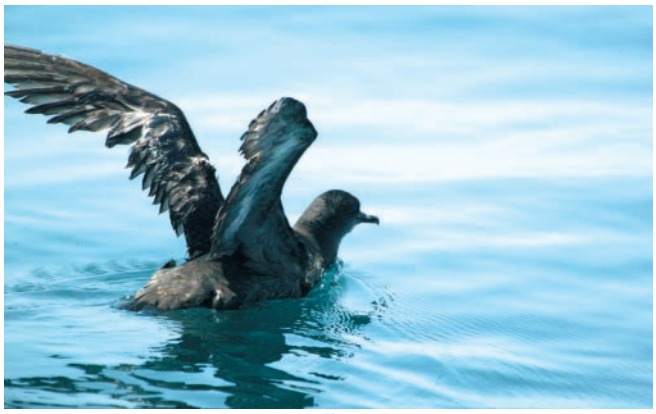

Figure 11. Short-tailed Shearwater *Puffinus tenuirostris* with its wings spread.

On 16th May 2004, while carrying out a tern survey in Mirs Bay, I sighted a small dark sea bird, subsequently identified as a Short-tailed Shearwater *Puffinus tenuirostris*. The bird was seen resting on the water. Our vessel slowly approached, so I was able to observe the bird for about 15 minutes.

My initial impression of the bird was a small-sized sea bird, about 10 percent smaller than the Eurasian Wigeon. The bird was generally black to greyish brown, except for its off-white throat. The bill was slender and slightly hooked, with tubular external nostrils. It had silvery-grey underwings, with heavily worn flight feathers visible as it spread its wings. The bird rested quietly on the water, making occasional short flights. During our 15 minutes' observation, photos were taken by I.C. Choi and myself; and a video was taken by C.Y. Chow.

Identification

The dark plumage, black bill, short tail and tubular external nostrils limit the possible species the bird could be to Sooty, Wedge-tailed or Short-tailed Shearwaters. The Wedge-tailed Shearwater can be ruled out as the bird had a short tail, rather than a long wedged tail. However, further distinguishing Sooty and Short-tailed Shearwaters is difficult as the variation in plumage differences are subtle (Gillson, 2000). Detailed examination of a combination of characters shown on the photos taken was thus undertaken to verify the bird's identity.

The paleness on the underwing of the bird, extending to the primaries, was not restricted to the interior of the wings (Figure 11). Such a characteristic is marginal but resembles more the Short-tailed Shearwater (Gillson, 2000). Furthermore, the forehead of the bird was deep, so suggesting a slightly protruded head (Figure 12), like that of the Short-tailed Shearwater - in contrast to the flat forehead of the Sooty Shearwater. In addition, the bird had a relatively short and slender bill, which is one of the characteristics of the Short-tailed Shearwater.

We conclude from these combined characteristics - including underwing colour, head shape, neck length and bill length - that the bird is a Short-tailed Shearwater. This is a transequatorial migrant bird. It breeds off southern Australia, migrating north to Alaska and western coasts of North America (Harrison, 1985). In China, it has been recorded in Zhejiang, Taiwan and Hainan (Zheng, 1997). This is the first record of this species in Hong Kong.

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Figure 12. Short-tailed Shearwater *Puffinus tenuirostris* showing its slightly protruded head.

House Crows *(Corvus splendens)* - Notes on their Population and Control in Hong Kong

Wai-hung LEE and Ip-chung CHOI, Wetland and Fauna Conservation Division

The native range of the House Crow *Corvus splendens* (家鴉) includes the Indian subcontinent, western China, Burma and Thailand. The species may have arrived in Hong Kong unintentionally, aboard ships coming from other ports (Carey *et al*., 2001). Previously it was not common in Hong Kong, with only 12 sightings reported from the early to mid 1990s (Carey *et al*., 2001). But in 2002, some 100 - 150 individuals were reported gathering in Sham Shui Po. In 2003, the Agriculture, Fisheries and Conservation Department (AFCD) conducted a preliminary survey and found 200 - 250 House Crows in Hong Kong. They had gathered mainly in the Sham Shui Po and Kowloon City areas (AFCD, unpublished record).

In 2004, a study commissioned by AFCD found around 250 House Crows in Hong Kong, mainly in the Kowloon peninsula in particular Sham Shui Po and Kowloon Tsai Parks (Anon, 2004). The Cheung Sha Wan Wholesale Food Market seemed to have become a major foraging ground for the crows in the Sham Shui Po area.

A detailed population survey was conducted bi-weekly, at dusk, from late February to late April 2004 in Sham Shui Po Park, Cheung Sha Wan area (Wholesale Food Market), Tai Hang Tung, Kowloon Tsai Park area and Hoi Sham Park area - and also in each area's general vicinity (Anon, 2004). The results appear in Tables 1a and 1b.

Table 1a. Number of House Crow recorded at 17:00 session

Areas	Sites	Number					
		Date of survey (dd/mm)					Total
		5/3	19/3	27/3	2/4	30/4	
Cheung Sha Wan (Food Wholesale Market) area	CSW Wholesale Fish Market, CSW Wholesale Food Market, West Rail Station, Stonecutters Island and harbour	54	17	10	15	20	116
Sham Shui Po Park area	Sham Shui Po Park, Lai Kok Estate, Cheung Sha Wan Road (Lai Kok Section), CSW Wholesale Vegetable Market	82	62	57	42	40	283
Tai Hang Tung area	Mong Kok Stadium & Fa Hui, Nam Shan Estate, Tai Hang Tung Recreation Ground, Police Sports Club	16	26	17	14	29	102
Kowloon Tsai Park area	Kowloon Tsai Park, Kowloon Walled City Park, Chinese Christian Cemetery	123	73	36	31	30	293
Hoi Sham Park area	Kowloon City Ferry Pier, King Wan Street Hoi Sham Park, Chi Kiang Street	0	0	0	0	0	0
	Total =	275	178	120	102	119	794

Table 1b. Number of House Crow recorded at 18:00 session

Areas	Sites	Number					
		Date of survey (dd/mm)					Total
		5/3	19/3	27/3	2/4	30/4	
Cheung Sha Wan (Food Wholesale Market) area	CSW Wholesale Fish Market, CSW Wholesale Food Market, West Rail Station, Stonecutters Island and harbour	0	6	5	6	12	29
Sham Shui Po Park area	Sham Shui Po Park, Lai Kok Estate, Cheung Sha Wan Road (Lai Kok Section), CSW Wholesale Vegetable Market	80	92	41	61	27	301
Tai Hang Tung area	Mong Kok Stadium & Fa Hui, Nam Shan Estate, Tai Hang Tung Recreation Ground, Police Sports Club	0	3	5	9	8	25
Kowloon Tsai Park area	Kowloon Tsai Park, Kowloon Walled City Park, Chinese Christian Cemetery	170	117	127	123	117	654
Hoi Sham Park area	Kowloon City Ferry Pier, King Wan Street Hoi Sham Park, Chi Kiang Street	0	0	0	0	0	0
	Total =	250	218	178	199	164	1009

The survey revealed that Tai Hang Tung was a day roosting site for the House Crows. Twenty-nine House Crow nests were found in the study, mainly in Sham Shui Po and Kowloon Tsai Parks. In addition, it was estimated that the House Crows foraged within an area of about two km radius from their night roosts.

The study suggests that the House Crows have had limited impact, at least for the time being and in the near future, on local biodiversity. However, if the population of the House Crows were to increase significantly and / or individuals to become spread to the countryside, they could well affect the local ecology and biodiversity. For example, Pied Crows in Kenya are reported to have been displaced by House Crows (Archer, 2001; Anon, 2004), and House Crows are having a major negative impact on indigenous biodiversity by preying on native birds, small reptiles and mammals (Archer, 2001; Anon, 2004). This is why, though the presence of House Crow at present is mainly an environmental hygiene and nuisance issue, AFCD is actively involved in advising the public on control measures and has prepared an action plan to monitor and control the species population in Hong Kong.

The study also suggests a number of measures to control the nuisance caused by House Crows. These measures include:

a. Improving environmental hygiene.
b. Proper handling and disposal of garbage.
c. Prohibiting feeding to reduce food source.
d. Egg and chick removal.
e. Cage trapping.
f. Poisoning.
g. Shooting.

Measures Undertaken by AFCD

We have already implemented measures (a) to (d) above, and we plan to step up control measures to control the population of House Crow in Hong Kong.

On 19 May 2004, the Leisure and Cultural Services Department and AFCD carried out a chick removal exercise jointly, when six House Crow nests (four at Kowloon Tsai Park and two at Sham Shui Po Park) were successfully approached with the aid of a platform-vehicle. Fourteen chicks were collected from these nests (one nest had four chicks, two nests had three chicks, one nest had two chicks and two nests had one chick) but no eggs were found. We tried to approach another three nests at the Sham Shui Po Park on the same day but failed, as the nests could not be approached by the platform-vehicle. Immediately after collection, all the chicks were transferred to an Animal Management Centre of AFCD for disposal by euthanasia. We will repeat this removal in the breeding season of crows (April/May) in future.

We have been conducting trials on measure (e) since June 2004 in the Cheung Sha Wan Wholesale Food Market, Kowloon Tsai Park and Sham Shui Po Park. However, no bird has been successfully trapped so far.

A House Crow's nest

A chick guarded by its parent.

Three chicks in a nest.

We have also consulted local bird experts and green groups, who have no objection on the use of poison (i.e. measure (f)) to control House Crows. A trial is being planned and will be carried out when the poison alpha-chloralose is available.

AFCD will continue monitoring the population and distribution of House Crows with a view to making decisions on the best measures to control their population.

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Distribution of Seagrasses in Hong Kong

Winnie P.W. Kwok, Josephine K.Y. Yang, Pauline Y.F. Tong and Chun-pong Lam
Coastal Community Working Group

Introduction

Seagrasses (海草) are flowering plants that occur in coastal marine or estuarine waters. They have leaves, underground (usually horizontally-oriented) stems called rhizomes, and deep roots. In Hong Kong, seagrass beds occur mainly in the low to middle inter-tidal area, especially where the sediments are silty or sandy. Seagrass communities often are associated with mangroves. Superficially somewhat alike in appearance, but in fact fundamentally different, seagrasses are sometimes confused with seaweeds (海藻). However, in fact seaweeds are plants without true leaves, stems and roots.

Seagrasses are predominantly found submerged in shallow waters, and only exposed to the atmosphere at low-tide. To cope with the adverse aspects of their growing environment, seagrasses have developed various adaptations - such as an extensive underground rhizome system for anchoring, to withstand wave action, and the ability to pollinate underwater. The species of seagrasses identified number 58 (Kuo and McComb, 1989) of which the following four have been recorded in Hong Kong.

***Halophila ovalis* (喜鹽草)** is characterized by its elliptical, spoon-like leaves (1.0-4.0 mm long, 0.5-2.0 mm wide) with more than 12 clear parallel veins and thin, fragile stems (Figures 13 and 14). It has a worldwide distribution, widely distributed from low inter-tidal to shallow sub-tidal areas. It was first recorded in Hong Kong from Kowloon Bay (Dunn and Tutcher, 1912), and is now found in areas such as Kai Kuk Shue Ha, San Tau, Siu Tan and Yam O.

***Halophila beccarii* (貝克喜鹽草)** is similar to *H. ovalis* except that the leaves are longer (6.0-11.0 mm long, 1.0 - 2.0 mm wide), and without cross veins (Figures 15 and 16). It is widely distributed in the South China Sea, generally occurring in the lower regions of the eulittoral zone or even descending to the upper fringe of the sublittoral zone. It was first recorded in Hong Kong from Tsim Bei Tsui (Morton and Wu, 1975), and is now found in Nam Chung Yeung Uk, Sha Kong Tsuen and Sheung Pak Nai.

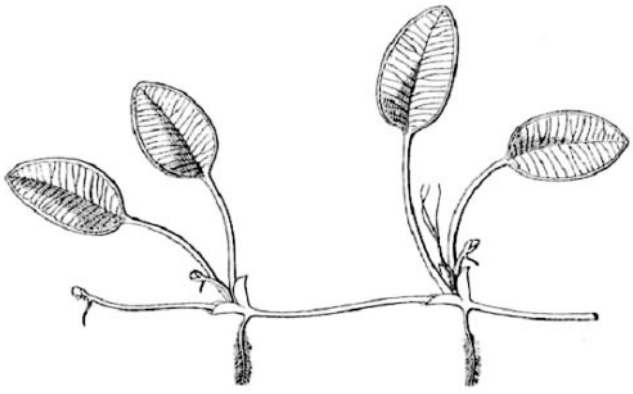

Figure 13. *Halophila ovalis* 喜鹽草

***Zostera japonica* (矮大葉藻)** is the only species of *Zostera* of Hong Kong. It can be easily distinguished from *Halophila* species by its ribbon-like linear leaves (5.0-35.0 mm long, 1.0-2.0 mm wide, Figures 17 and 18). It occurs from northern Japan to Vietnam in East Asia. This species is commonly found in the middle to lower shore and may extend into the sublittoral zone. It was first recorded in Hong Kong from Lai Chi Wo (Hodgkiss and Morton, 1978) and is now found in areas such as Lai Chi Wo, San Tau, Sheung Sze Wan and Siu Tan.

***Ruppia maritime* (川蔓藻)** is characterized by its thread-like leaf blade (2-10 mm long, 0.3-0.5 mm wide). There is little information on this species in Hong Kong. It was once recorded in a lagoon in Shek O (Dunn and Tutcher, 1912), and was last recorded in Mai Po Marshes (Melville and Chan, 1992).

Ecological significance of seagrasses

Apart from the well-known contribution of seagrasses to human, as a food source or additive, seagrass beds are of considerable conservation value, playing an important ecological role in the coastal environment. They help to stabilize the coastlines and sediments, and serve as shelters, feeding grounds and food sources for a variety of animals such as fishes, crabs, gastropods, horseshoe crabs and turtles. The high productivity of seagrasses supports many other animals, and hence any disturbance to seagrass communities is likely to have significant impacts on the associated coastal and marine ecosystem.

Seagrass Baseline Survey

The Coastal Community Working Group of AFCD began seagrass bed survey in January 2002. Its main aim was to collect baseline information, especially concerning the distribution of seagrasses here, to facilitate their conservation. The group has visited 53 coastal areas so far and, whenever practicable, the seagrass beds found were mapped by employing GIS techniques.

Figure 14. Photo of *H. ovalis*

Figure 15. *Halophila beccarii* 貝克喜鹽草

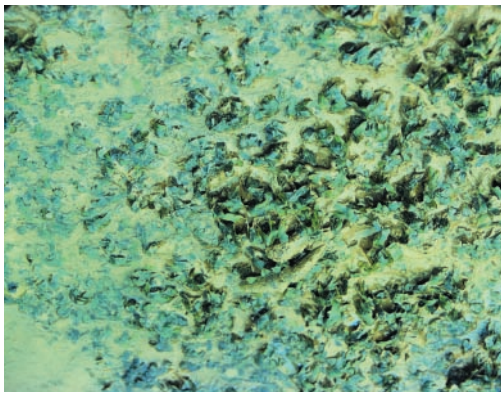

Figure 16. Photo of *H. beccarii*

Results

Among the 53 sites visited, seagrass beds were found at 16 sites, of which 11 had not been reported before (Figure 19). *H. ovalis, H. beccarii* and *Z. japonica* were observed (but not *R. maritime*) during the survey. *H. ovalis* was the most abundant and widely distributed species (found at 13 sites) while *Z. japonica* and *H. beccarii* were relatively less abundant with limited distribution (at five and three sites respectively). The size and species composition of the 16 existing seagrass beds are summarized in Table 2.

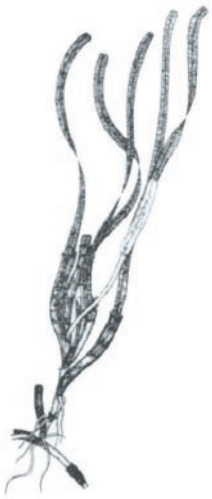

Figure 17. *Zostera japonica* 矮大葉藻

Discussion

Most of the newly reported seagrass beds (9 out of 11) are located in the eastern coastal areas. This distribution pattern may be related to the differences in substratum type, salinity and wave action between the eastern and western coastlines of Hong Kong. Further investigation and monitoring are required to ensure this is the correct conclusion.

It is noted that *H. ovalis* exists in most of the new-found seagrass beds. The wide distribution of *H. ovalis* in the eastern coastline is probably due to the dispersion of this species from the known seagrass beds nearby such as Hoi Sing Wan and Wu Shek Kok. The same may be true for the new seagrass beds found on Lantau Island (Yam O and Nim Shue Wan), which may well have spread from Tung Chung.

The Lantau finding reveals an interesting characteristic of *H. ovalis*. The populations of seagrass in San Tau were once dominated by *Z. japonica* but this had almost entirely disappeared in 1999 (Fong, 1999). The present survey shows that *H. ovalis* has recolonized the area and is gradually becoming the dominant species there (AFCD record, May 2003). This indicates that *H. ovalis* may be more adaptive to adverse conditions, and thus more successful in colonizing any vacant habitats. Such opportunism may also explain its wide distribution in Hong Kong.

Conservation of Seagrasses in Hong Kong

Current protection measures for seagrasses in Hong Kong

Among the 16 seagrass sites studied in the survey, six of them are protected under different conservation status in Hong Kong ("Site of Special Scientific Interest" for Lai Chi Wo, San Tau and Sheung Pak Nai; "Marine Park" for Hoi Ha and "Coastal Protection Area" for Ham Tin and Sheung Sze Wan) as all the three seagrass species can be found. Apart from this, all established seagrass beds are considered important habitats under the Environmental Impact Assessment Ordinance. Any proposed development that may affect this habitat has to undergo the ecological impact assessment process, so as to avoid / minimize the threats to the seagrass communities.

Ways forward

The Coastal Community Working Group will continue monitoring the existing seagrass beds, and also survey other coastal areas where seagrasses may have colonized. Specific studies, such as transplanting of seagrasses to new sites, will also be explored to enhance the conservation of seagrasses in Hong Kong.

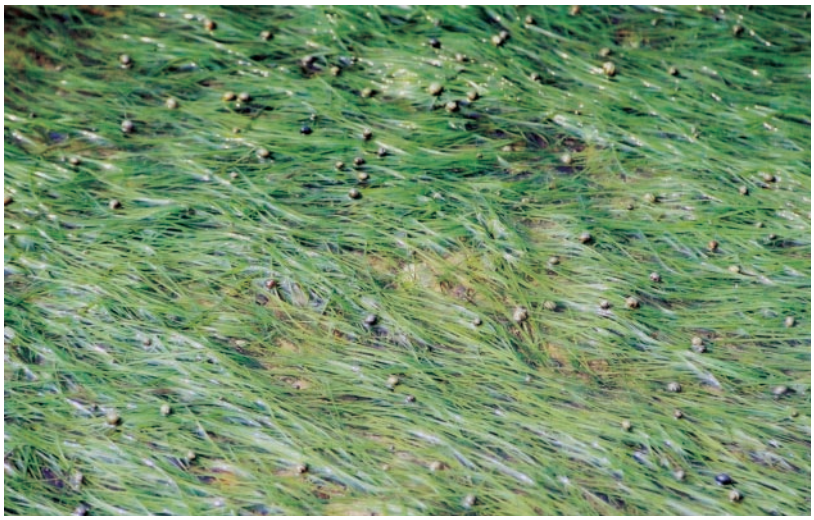

Figure 18. Photo of *Z. japonica*

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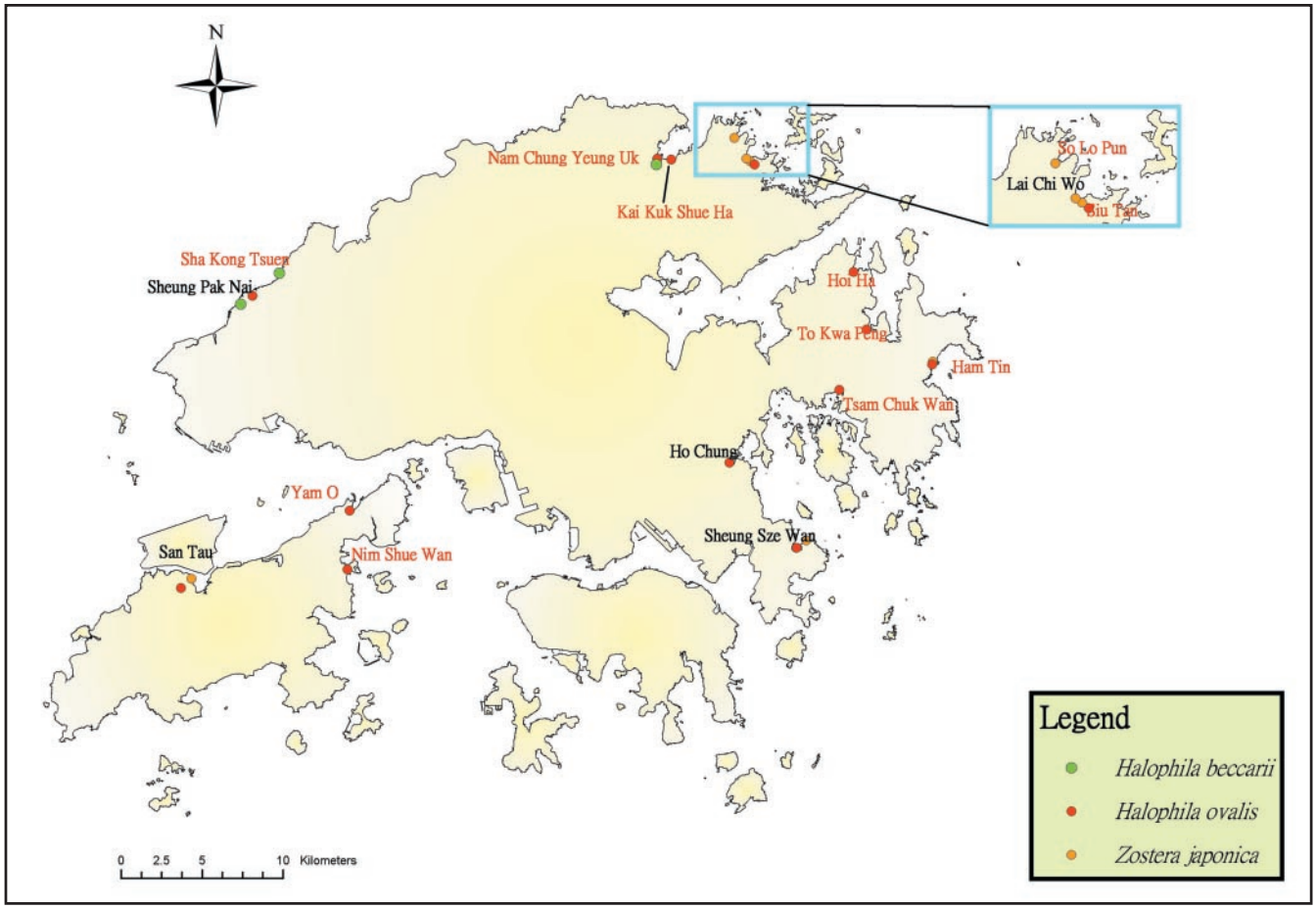

Figure 19. Map showing the distribution of seagrasses in Hong Kong. The site name of new seagrass bed localities found in this survey are highlighted in Red.

Table 2. Distribution and species composition of seagrass beds in Hong Kong.

No.	Site Name	Species Found [Appromixate Area (m^2)]	Area (m^2)	New Localities Found in this Survey
1	Ham Tin	*H. ovalis* [Not Recorded]	-	✓
2	Ho Chung	*H. ovalis* [60]	60	
3	Hoi Ha	*H. ovalis* [Not Recorded]	-	✓
4	Kai Kuk Shue Ha	*H. ovalis* [3000]	3000	✓
5	Lai Chi Wo	*Z. japonica* [10715]	10715	
6	Nam Chung Yeung Uk	*H. beccarii* [2000] *H. ovalis* [tiny]	2000	✓
7	Nim Shue Wan	*H. ovalis* [1400]	1400	✓
8	San Tau	*H. ovalis* [3820] *Z. japonica* [20]	3840	
9	Sha Kong Tsuen	*H. beccarii* [2700]	2700	✓
10	Sheung Pak Nai	*H. beccarii* [30] *H. ovalis* [Not Recorded]	30	
11	Sheung Sze Wan	*H. ovalis* [6] *Z. japonica* [375]	381	
12	Siu Tan	*H. ovalis* [7000] *Z. japonica* [50]	7050	✓
13	So Lo Pun	*Z. japonica* [7000]	7000	✓
14	To Kwa Peng	*H. ovalis* [600]	600	✓
15	Tsam Chuk Wan	*H. ovalis* [125]	125	✓
16	Yam O	*H. ovalis* [7500]	7500	✓

Breeding Terns in Hong Kong - Their Prey

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Introduction

Three species of terns, Black-naped Tern *Sterna sumatrana*, Bridled Tern *S. anaethetus* and Roseate Tern *S. dougallii*, regularly visit and breed on some of the remote islands in Hong Kong's eastern waters - from May to early September (Carey *et al*., 2001). During the breeding season, especially during the chick-rearing period, parent terns forage a great deal to feed their chicks. This study aims at identifying and describing the prey of these three species of terns, from individuals that nest on Shek Ngau Chau (SNC).

Methodology

Collection of prey items and identification

The terns' prey items were collected from SNC during the chick-rearing period on seven separate days, during the summer of 2003. SNC was chosen to minimize the overall disturbance to the breeding population of terns in Hong Kong by carrying out this study simultaneously with the nest box survey (Lee *et al*., in prep.). Only prey items found on the ground, near clutches of eggs, chicks of tern species, or the artificial nest boxes were collected (Figure 20). Since no other fish-eating birds were recorded in the core breeding area of terns on SNC during the study period, it is assumed that all the prey items collected were brought back by parent terns, and accidentally discarded during courtship or chick feeding. The collected prey samples, usually completely dry, were re-hydrated in water for two hours prior to preservation in 70% alcohol. Then, the standard length (i.e. snout to caudal peduncle) and body depth (dorsal to ventral fin) of the fish samples were measured and identified under dissecting microscope (45x) (Figure 21). Nomenclature of the fishes follows Anon (1962) and the Hong Kong Fish Net (www.hk-fish.net).

The prey items of terns in Hong Kong were preliminarily studied by examining discarded fishes and regurgitates from Black-naped Tern chicks collected on a single day (Wong, 1999). While analysis of regurgitates gave species-specific information on prey items, discarded prey items were used in this study for three reasons: less disturbance to breeding terns and chicks, better condition of the prey items for identification, and more representative sample size. As the foraging methods of these three tern species are similar and they share the same nesting and foraging sites in the study area, this study did not attempt to study species-specific information and so discarded preys were used for analysis in this study.

Results and Discussion

The prey items of terns

68 samples of prey items were collected during the surveys, including 65 fish and three squid. The 65 fish samples belong to 18 species in 16 genera, either of tropical or subtropical marine fishes commonly found in Hong Kong and the South China Sea (Anon, 1962) (Table 3). The five most common fish genera, which made up 80% of the fish prey samples were Codlet *Bregmaceros* sp., Cardinal fish *Apogon* sp., Silverside *Hypoatherina* sp., Shrimp scad *Alepes* sp. and Pony fish *Secutor* sp. (Table 3). Although squid were relatively uncommon in the terns' diet, they have been noted as the preferred prey of Bridled Terns (del Hoyo *et al*., 1996).

These 18 fish species can generally be classified into pelagic species (surface or middle depths associated), demersal species (bottom associated) and benthopelagic species (bottom living). 36 fish samples (or 55%) belong to pelagic species, including the most abundant Codlet

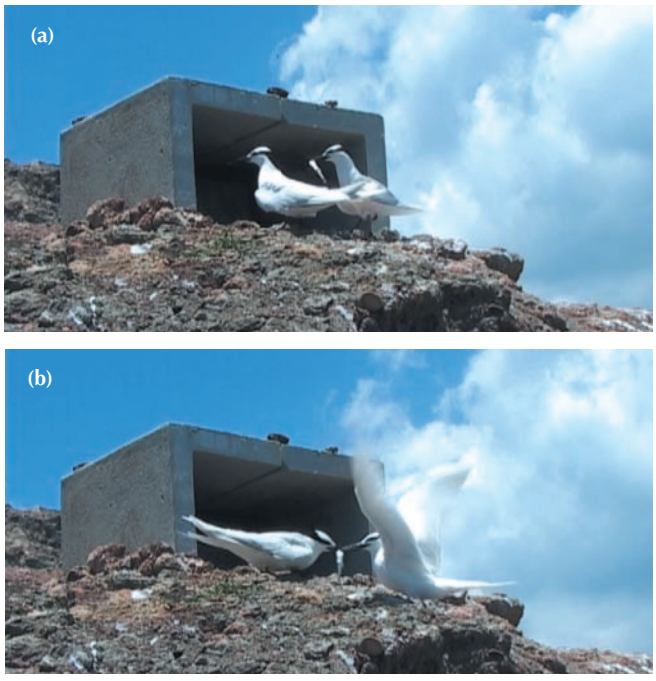

Figure 20. (a) & (b). A Black-naped Tern (right) brought a fish back to courtship feed the partner (left) which was guarding the artificial nest box with chicks.

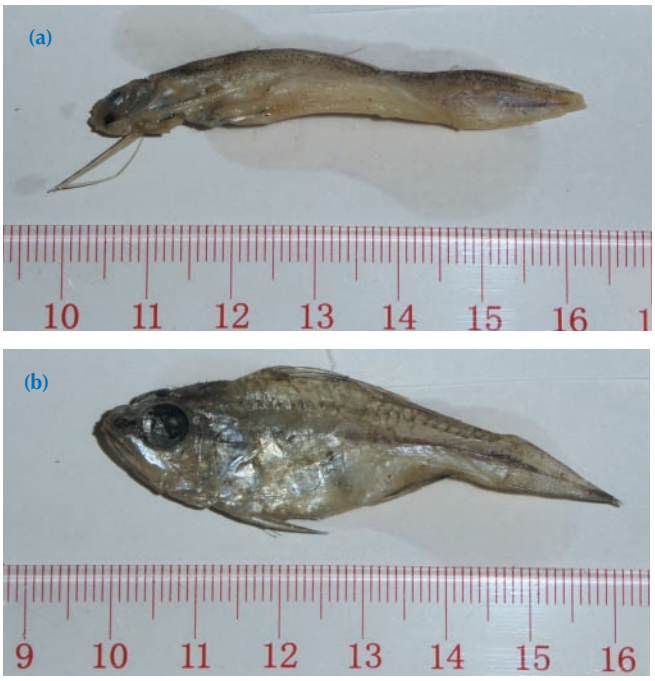

Figure 21. Prey items collected near the nests and brought back to lab for measurement. (a) Codlet; (b) Cardinal Fish.

Bregmaceros sp., while 28 samples (or 43%) belong to demersal species, including 18 samples of Cardinal fish *Apogon* sp. (Table 3). On the other hand, 19 samples (or 29%) are fish species associated with artificial reefs (Table 3).

Terns generally feed by plunge diving, but they also use other methods such as contact dipping (del Hoyo *et al*., 1996). However, the three tern species at SNC either do not submerge (Bridled Tern) or only submerge at shallow depths (Black-naped Tern, and up to 50cm for Roseate Tern) (del Hoyo *et al*., 1996), and so the demersal fish species in the terns' diet may have been brought to the surface by boats trawling in the surrounding area (personal observation; Wong, 1999). In fact, terns have also been commonly found scavenging behind the commercial fishing vessels in Mirs Bay (personal observation). It is noteworthy that one Goby *Odontamblyopus rubicundus*, a benthopelagic species, was also identified in the terns' prey in this study.

Size and shape of prey items

The average length of fish samples ranged from 20 mm to 90 mm, with a mean of 55 mm, while the body depths ranged from 6 mm to 30 mm with a mean of 18 mm (Table 3). The lengths of terns' prey of this study are similar to the prey size of Black-naped Terns (40 - 80 mm), Bridled Terns (i.e. < 60 mm) and Roseate Terns (i.e. 60 - 100 mm) found from other studies (del Hoyo *et al*., 1996). The maximum body depth of 30 mm is also probably limited by the width of the terns' bill (del Hoyo *et al*., 1996). The mean ratio of body depth to length was 0.33 (Table 3), indicating that terns prefer elongated (e.g. Codlet) and oblong (e.g. Cardinal Fish) fishes.

Conclusion

The results of the study indicate that the three tern species, at least when breeding, consume a wide range of fish species - including pelagic and demersal species. The size (small fish of ~55 mm standard length) and shape (i.e., elongated finger-shape) of the fish are probably important factors in prey selection, due to the width of the terns' bills that limits the size of fish taken in.

Acknowledgement

The authors would like to thank Ms. Wong Sau-wah, Mr. Choi Ip-chung and Mr. Gary K.L. Chow for their assistance in collecting, preparing and identifying the prey items in this study.

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Table 3. Fish species of terns' prey collected on Shek Ngau Chau.

Species Name	Common Name in English	Common Name in Chinese	No. of Sample	Mean Standard Length (mm)	Mean Body Depth (mm)	Mean Body Depth to Mean Standard Length Ratio
Bregmaceros mcclellandi▲	**Spotted codlet**	**麥氏犀鱈**	**19**	**70.2**	**14.2**	**0.20**
***Apogon* sp. (total)**	**Cardinal fish**		**18**	**51.9**	**17.1**	**0.33**
– *Apogon doederleini*■A	Cardinal fish	十線蓑鲉	1	69.0	25.0	0.36
– *Apogon fasciatus*■A	Cardinal fish	四間蓑鲉	10	54.2	17.5	0.32
– *Apogon lineatus*■	Cardinal fish	蓑鲉	1	45.0	17.0	0.38
– *Apogon* sp.■	Cardinal fish	蓑鲉	6	46.3	15.2	0.33
Hypoatherina valenciennei▲	**Sumatran silverside**	**重鱗**	**6**	**72.0**	**13.3**	**0.18**
Alepes djedaba■A	**Shrimp scad**	**蝦鰺**	**5**	**41.8**	**17.8**	**0.43**
***Secutor* sp. (total)**	**Pony fish**		**4**	**39.5**	**23.0**	**0.58**
– *Secutor ruconius*■	Deep pugnose pony fish	花鰏	3	44.3	24.3	0.55
– *Secutor* sp.■	Pony fish	油力	1	25.0	19.0	0.76
Nemipterus japonicus■	**Japanese threadfin bream**	**瓜衫**	**2**	**59.0**	**20.5**	**0.35**
***Sardinella* sp.**▲	**Sardine**	**沙甸**	**2**	**70.5**	**20.5**	**0.29**
***Caranx* sp.**▲A	**Crevalle**	**池魚**	**1**	**51.0**	**19.0**	**0.37**
***Chorinemus* sp.**▲	**Talang**	**黃祥**	**1**	**77.0**	**18.0**	**0.23**
Collichthys lucidus■	**Lion head croaker**	**獅頭魚**	**1**	**52.0**	**14.0**	**0.27**
Dussumieria elopsoides▲	**Slender rainbow sardine**	**海河**	**1**	**50.0**	**9.0**	**0.18**
Lagocephalus spadiceus■A	**Puffer fish**	**雞泡**	**1**	**25.0**	**20.0**	**0.80**
Odontamblyopus rubicundus*	**Goby**	**鰕虎魚**	**1**	**42.0**	**6.0**	**0.14**
Pennahia anea■	**Greyfin croaker**	**雞蛋鰔**	**1**	**85.0**	**28.0**	**0.33**
Terapon jarbua■A	**Jarbua terapon**	**釘公**	**1**	**39.0**	**13.0**	**0.33**
***Thryssa* sp.**▲	**Horned anchovy**	**黃姑**	**1**	**86.0**	**22.0**	**0.26**
			Total 65	Median = 52 Mean = 55	Median = 18 Mean = 18	Median = 0.33 Mean = 0.35

▲pelagic species; ■demersal species; *benthopelagic species (Anon, 1962).
Areef fishes found on artificial reefs (Wilson, 2003)