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Feature Article

Camera Trap Survey of Hong Kong Terrestrial Mammals in 2002-06

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Mammal Working Group

本文總結本署過去五年利用紅外線自動攝影機調查本地中型至大型哺乳動物狀況的結果。為更精確分析各品種的相對數目及其分布狀況，所有數據均以相同的土地面積為計算單位。跟據這計算方法，十七種本港有記錄的品種可分為「十分常見」、「常見」、「不常見」及「稀有」。在稀有品種當中，只有食蟹獴、穿山甲和歐亞水獺因被確認為原生品種而受保育關注。

Introduction

Camera traps (Fig. 1) have been used to record wildlife activities for more than 40 years (Karanth & Nichols, 1998; Cutler & Swann, 1999). It is effective for studying biodiversity, ecology, population estimations and behaviour, and generating activity and spatial distribution patterns of mammals (Karanth & Nichols, 1998; Cutler & Swann, 1999; Shek, 2003; Shek & Wan, 2006). A passive infra-red camera trap, an auto-focus camera wired to an electronic triggering device connected to an infrared sensor, is the most popular camera trapping system which allows photographs of wildlife to be taken automatically whenever a "warm" animal (mammals, birds or even reptiles after basking in the sun) crosses in front of the sensor. This method is particular efficient to detect elusive or rare species. It collects data day and night in a more consistent way than any other traditional methods, such as cage trapping. The resulting photographs also provide undeniable records, allowing a rapid assessment of the conservation status of the species in question.

Fig 1. Camera trap survey.

Contents

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The Agriculture, Fisheries and Conservation Department (AFCD) started a long-term, territory-wide camera trap survey of medium and large non-flying terrestrial mammals (i.e. with head-to-body length exceeding 25 cm) of Hong Kong in 2002. Based on the preliminary data collected in 2002, the Crab-eating Mongoose (*Herpestes urva* 食蟹獴), the Chinese Pangolin (*Manis pentadactyla* 穿山甲), and the Eurasian Otter (*Lutra lutra* 歐亞水獺) were considered as species of conservation concern (Shek, 2003). This preliminary report considered the whole territory as a single unit and derived the Occurrence Index (OI) of each species by merging the data from all camera traps, dividing the total number of photographs taken of each species by the total number of camera working hours (a fixed value of 588,580 hours). Such calculation was under an assumption that camera traps were evenly or randomly distributed throughout Hong Kong. However, more camera traps were installed in some sites, such as the Mai Po Nature Reserve for the Eurasian Otter monitoring. Thus, for an unbiased comparison, it is necessary to derive the OIs by dividing the actual survey effort (the number of camera traps installed and the duration of survey periods) per unit area.

In this paper, the status of the medium and large non-flying terrestrial mammals was re-evaluated using data collected in 2002-06. A Species Account is also presented with photographs, distribution maps and activity patterns of the species recorded.

Methodologies

Camera traps setup generally followed Shek (2003). Instead of "camera working hours", "camera working days" was used to represent survey effort in this study, as this unit was more widely used in similar studies (Karanth & Nichols, 1998; O'Brien *et al.*, 2003; Yasuda, 2004). OI is defined as the number of photographs taken divided by the total amount of trapping effort in 100 camera working days. Serial photographs belonging to the same species taken within 30 minutes were treated as a single record to prevent over-representation of the lingering individuals. In analysing species ranking, data from all camera traps within each 1-km^2 grid were merged. Overall OI of a species was derived as the sum of OIs of all grids with records of the species and it can be expressed as:

$$OI = \sum_{i=1}^{p} \left(\frac{\sum_{i=1}^{n} e_i}{\sum_{i=1}^{n} d_i} \right)_i$$

where e = number of photographs taken of the species of camera traps installed in grids
d = number of camera working days of the camera traps installed in grids
n = number of camera traps installed in grids
p = number of grids with records of the species

In the Species Account, OIs of the species in each 1 km^2 land grids were shown in the distribution map. For activity pattern, it was constructed as the numbers of times a species were recorded within each one-hour interval throughout the day. Species were classified as either diurnal (<10% of observations in the dark), mostly diurnal (between 10 to 30% of observations in the dark), nocturnal (> 90% of observations in the dark), mostly nocturnal (between 90 and 70% of observations in the dark), or cathemeral (sporadic and random intervals of activity during the day or night) as in van Schaiks and Griffiths (1996).

Results and Discussion

A total of 65,471 camera working days were logged by over 140 camera traps from 494 camera trap stations in 286 1-km^2 grids between 2002 and 2006 (Fig. 2). 10,389 photographs of five orders, ten families, and 17 species of medium to large mammals were recorded (Table 1), which accounted for about 30% of the total terrestrial mammalian species (56 species) in Hong Kong (Shek, 2006). Among these, the East Asian Porcupine was the most abundant species, photographed 2,254 times (21.70% of all photographs) and with an OI of 915.15 (20.21% of total OI of all species). The Red Muntjac was the most widely distributed species with records in 206 grids (72.02% of grids surveyed). In contrast, the rarest species was the Greater Bandicoot Rat with only five records (0.05% of all photographs) and an OI of 1.53 (0.03% of total OI of all species). The Eurasian Otter had the most restricted distribution with a few records in 4 grids (1.42% of grids surveyed).

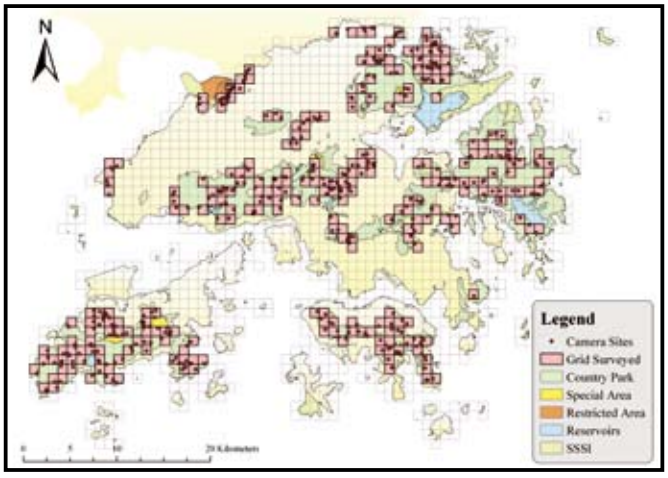


Fig 2. Locations of the 494 camera sites in 286 1-km^2 grids.

Table 1. Occurrence Index and distribution of medium to large non-flying mammals in Hong Kong.

Species	Naturalness	Photos	OI	Grids	Activity Pattern	Status
East Asian Porcupine (*Hystrix brachyura* 東亞豪豬)	Native	2254	915.15	166	Nocturnal	Very Common
Red Muntjac (*Muntiacus muntjac* 赤麂)	Native	1528	693.18	206	Cathemeral	Very Common
Small Indian Civet (*Viverricula indica* 小靈貓)	Native	1357	654.64	193	Mostly nocturnal	Very Common
Eurasian Wild Pig (*Sus scrofa* 野豬)	Native	1193	519.29*	135	Mostly diurnal	Very Common
Domestic Dog (*Canis lupus familiaris* 野狗)	Introduced	1137	458.94	152	Mostly diurnal	Common
Small-toothed Ferret Badger (*Melogale moschata* 鼬獾)	Native	749	319.84	125	Mostly nocturnal	Common
Masked Palm Civet (*Paguma larvata* 果子狸)	Native	519	203.05*	114	Nocturnal	Common
Domestic Ox (*Bos taurus* 黃牛)	Introduced	230	167.56*	45	Mostly diurnal	Common
Leopard Cat (*Prionailurus bengalensis* 豹貓)	Native	415	164.10	121	Mostly nocturnal	Uncommon
Small Asian Mongoose (*Herpestes javanicus* 紅頰獴)	Native?	228	161.31	29	Diurnal	Uncommon
Rhesus Macaque (*Macaca mulatta* 獼猴)	Reintroduced	345	113.46*	37	Diurnal	Common
Domestic Cat (*Felis catus* 野貓)	Introduced	260	108.02	70	Cathemeral	Uncommon
Crab-eating Mongoose (*Herpestes urva* 食蟹獴)	Native	99	25.44	21	Diurnal	Conservation#
Chinese Pangolin (*Manis pentadactyla* 穿山甲)	Native	37	12.31	20	Nocturnal	Conservation#
Yellow-bellied Weasel (*Mustela kathiah* 黃腹鼬)	Native?	22	8.11	10	Mostly diurnal	Rare
Eurasian Otter (*Lutra lutra* 歐亞水獺)	Native	11	1.80	4	Insufficient data[n]	Conservation#
Greater Bandicoot Rat (*Bandicota indica* 板齒鼠)	Native?	5	1.53	5	Insufficient data[n]	Rare

* – Underestimation due to their very large body sizes or arboreal lifestyle
# – Species of Conservation Concern
n – Less than 20 records

Species Status

One of the major problems in any review of rarity is that it has no unambiguous definition. It may refer to few individuals, few breeding individuals or species with restricted distribution (Gatson, 1994). According to the “quartile definition” by Gaston (1994) which define rare species as those in the lower quartile of the frequency distribution of species abundance, five medium to large mammal species in Hong Kong could be classified as “Rare”. Among them, the “nativeness” of the Yellow-bellied Weasel and the Greater Bandicoot Rat are doubtful and therefore only the Crab-eating Mongoose, the Chinese Pangolin and the Eurasian Otter are considered rare and to be species of conservation concern. By extrapolating this quartile definition to the other three quartiles, the remaining species can be ranked as Very Common, Common and Uncommon (Fig. 3).

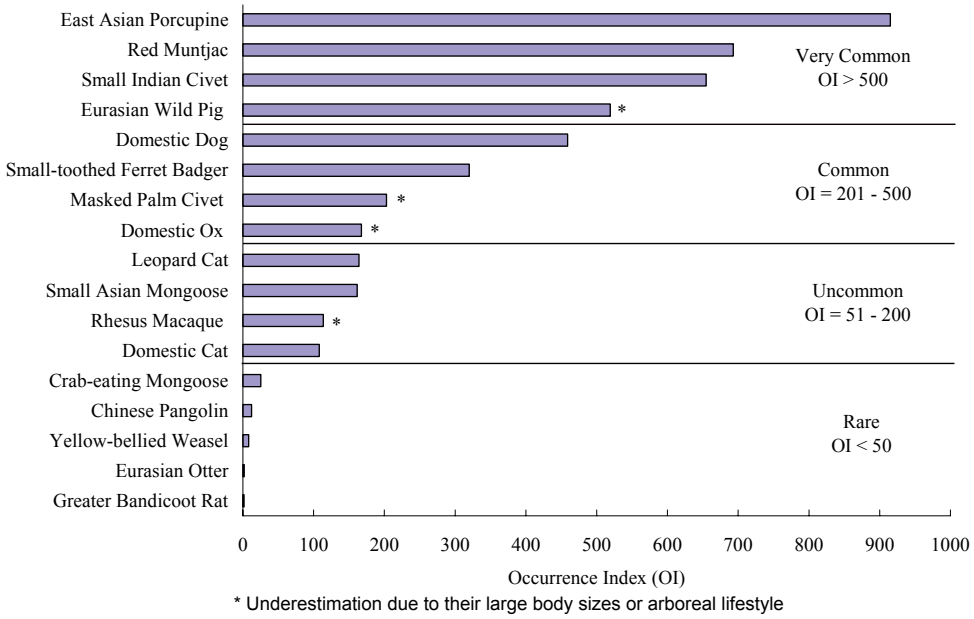


Fig 3. Status of medium to large mammals in Hong Kong.

Underestimation

Camera trap is considered as a reliable tool to provide an index of animal abundance that cannot be individually recognised from their markings (O'Brien *et al.*, 2003). However, it is difficult to identify the small mammals, such as rats and shrews, into species level by the captured images and only medium to large mammals are covered in this study.

This survey is a general baseline survey targeting to study the mammalian diversity in Hong Kong. The methodology adopted was not species specific and the abundance of a few species was probably underestimated. First, the locations of camera traps were chosen to cover different types of habitats and terrain in the study areas. Some camera traps were located in dense / spiny bushes which are less preferable or inaccessible to some very large mammals such as the Domestic Ox and the Eurasian Wild Pig and they would be underrepresented in such camera trap locations. Second, during the survey, all camera traps were installed 1.5 to 2 m above ground, which would have missed arboreal species including the Masked Palm Civet and the Rhesus Macaque. The photographic events of such arboreal species only recorded their activities on the ground level which may represent less than half of their actual activities in the areas, for the example, the Masked Palm Civet may spend 80% of their time on tree (Rabinowitz, 1991).

Species Without Records

Three species, the Long-tailed Macaque (*Macaca fascicularis* 長尾獼猴), the Domestic Water Buffalo (*Bubalus bubalis* 水牛) and the Chinese Muntjac (*Muntiacus reevesi* 黃麂) which had been reported in other literatures on local mammalian diversity, were missing in this study. The introduced Long-tailed Macaque was reported as rare in Hong Kong (Shek, 2006) and the direct counting survey of AFCD found less than five individuals in Kam Shan Country Park (C.L. Wong, personal communication). In addition to their arboreal habit, their population is too low to be detected by camera traps in this study. The introduced Domestic Water Buffalo prefers abandoned paddy fields/marshes and is found in Kam Tin and Pui O in open areas where camera traps could not work. It comes as no surprise to have no photograph record of this species. The Chinese Muntjac was thought to be the only muntjak species in the territory (Marshall, 1967; Loft, 1976). However, Bosco Chan and other local ecologists firstly questioned the size of a local muntjac specimen which was relatively larger than the Chinese Muntjac found in the nearby region (Reels & Crow, 1999). In 2003, Suen *et al.* suggested and confirmed by an mtDNA analysis, that all muntjac detected by camera trapping were the Indian Muntjac which is another common name of the Red Muntjac.

In this study, two different forms of pelages of muntjac were found. The paler form has a reddish-yellow pelage with varying grey overtone but little variation in overall tone and lack of color contrast (Fig. 4a). On the other hand, the darker form has a chestnut-brown pelage with darker legs and mid-back (Fig. 4b). Such two forms of pelages are similar to the description of the Guangdong subspecies (*M. muntjak guangdongensis*) (Li & Xu, 1996). It is possible that some of the local individuals, especially the paler form, were misidentified as the Chinese Muntjac in previous studies. Species identity can be confirmed irrefutably using karyotypic study, as the chromosome number of the Chinese Muntjac is 2n = 8, while those of Red Muntjac is 2n = 17 to 19 (Groves, 2003).

Fig 4a. Darker form of the Red Muntjac recorded in Tai Lam Country Park. Fig 4b. Paler form of the Red Muntjac recorded in Sha Tau Kok.

Species Accounts

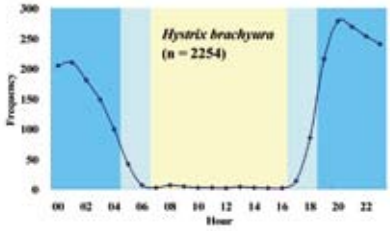
East Asian Porcupine (*Hystrix brachyura* 東亞豪豬) (Fig. 5a-c)

Classification: Rodentia (齧齒目), Hystricidae (豪豬科)

Status: Native / very common / nocturnal

a.

b.



c.

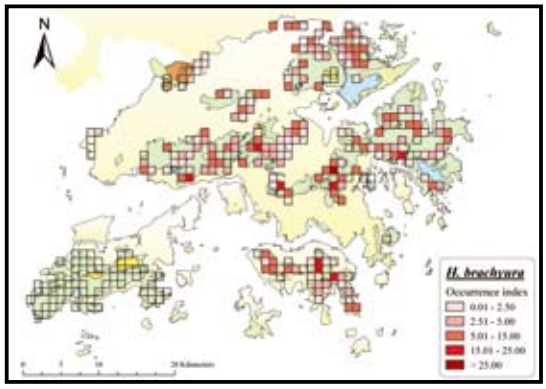


Fig 5. a) Photograph; b) activity pattern and c) distribution of the East Asian Porcupine.

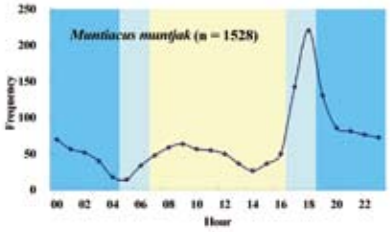
Red Muntjac (*Muntiacus muntjac* 赤麂) (Fig. 6a-c)

Classification: Artiodactyla (偶蹄目), Cervidae (鹿科)

Status: Native / very common

a.

b.



c.

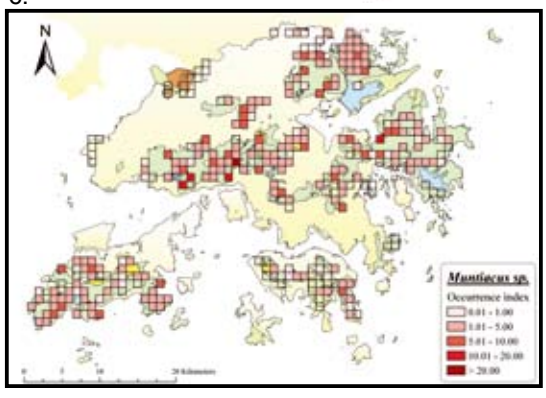


Fig 6. a) Photograph; b) activity pattern and c) distribution of the Red Muntjac.

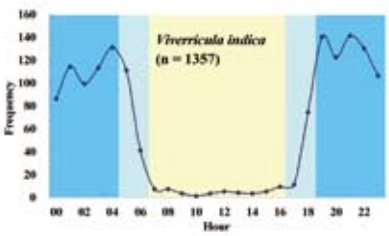
Small Indian Civet (*Viverricula indica* 小靈貓) (Fig. 7a-c)

Classification: Carnivora (食肉目), Mustelidae (鼬科)

Status: Native / very common

a.

b.



c.

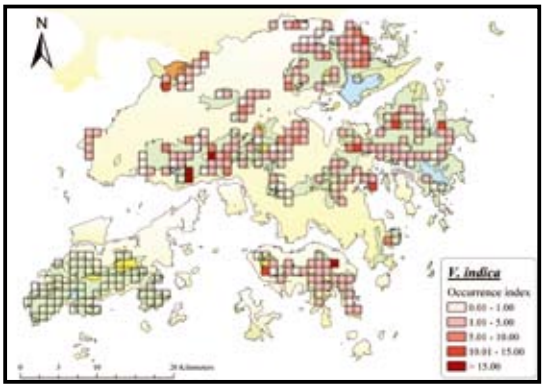


Fig 7. a) Photograph; b) activity pattern and c) distribution of the Small Indian Civet.

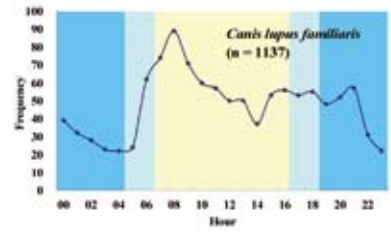
Domestic Dog (*Canis lupus familiaris* 野狗) (Fig. 8a-c)

Classification: Carnivora (食肉目), Canidae (犬科)

Status: Exotic / common

a.

b.



c.

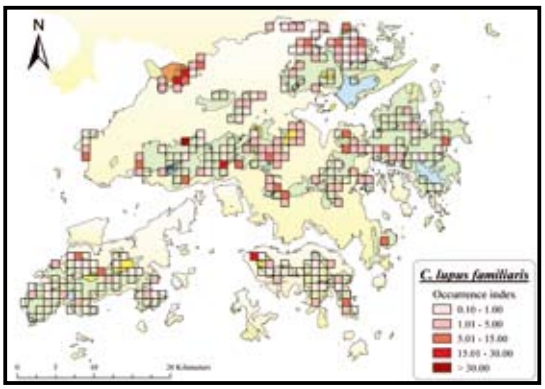


Fig 8. a) Photograph; b) activity pattern and c) distribution of the Domestic Dog.

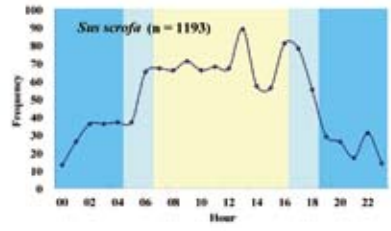
Eurasian Wild Pig (*Sus scrofa* 野豬) (Fig. 9a-c)

Classification: Artiodactyla (偶蹄目), Suidae (豬科)

Status: Native / common

a.

b.



c.

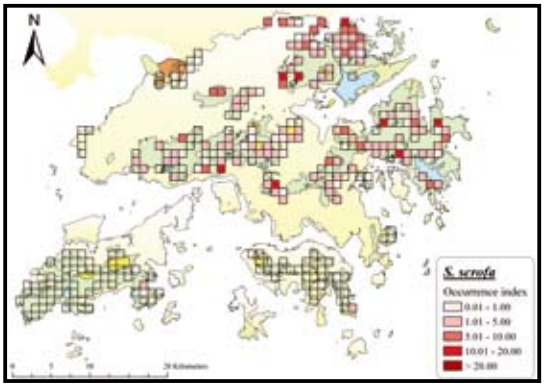


Fig 9. a) Photograph; b) activity pattern and c) distribution of the Eurasian Wild Pig.

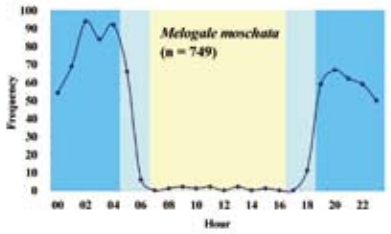
Small-toothed Ferret Badger (*Melogale moschata* 鼬獾) (Fig. 10a-c)

Classification: Carnivora (食肉目), Mustelidae (鼬科)

Status: Native / common

a.

b.



c.

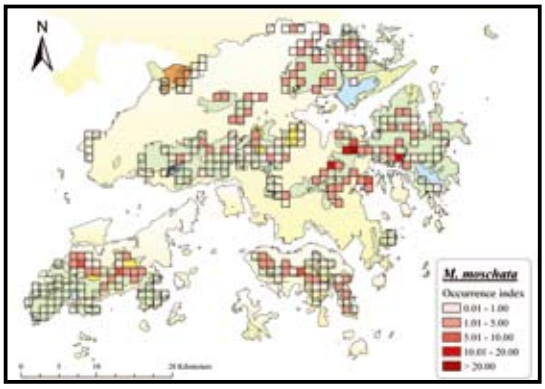


Fig 10. a) Photograph; b) activity pattern and c) distribution of the Small-toothed Ferret Badger.

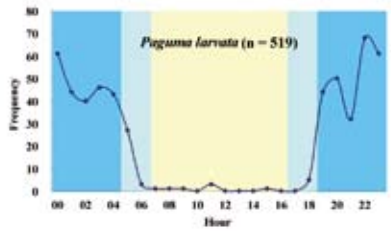
Masked Palm Civet (*Paguma larvata* 果子狸) (Fig. 11a-c)

Classification: Carnivora (食肉目), Mustelidae (鼬科)

Status: Native / Uncommon

a.

b.



c.

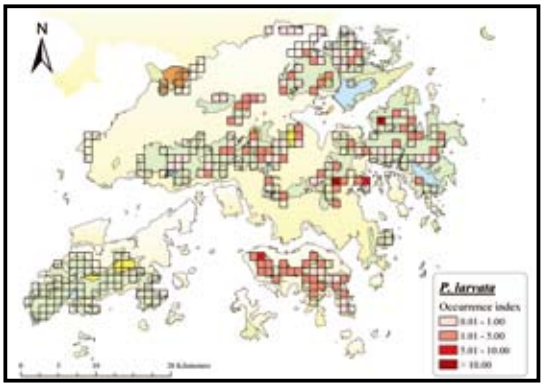


Fig 11. a) Photograph; b) activity pattern and c) distribution of the Masked Palm Civet.

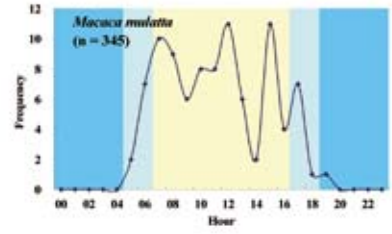
Rhesus Macaque (*Macaca mulatta* 獼猴) (Fig. 12a-c)

Classification: Primates (靈長目), Cercopithecidae (猴科)

Status: Reintroduced / uncommon

a.

b.



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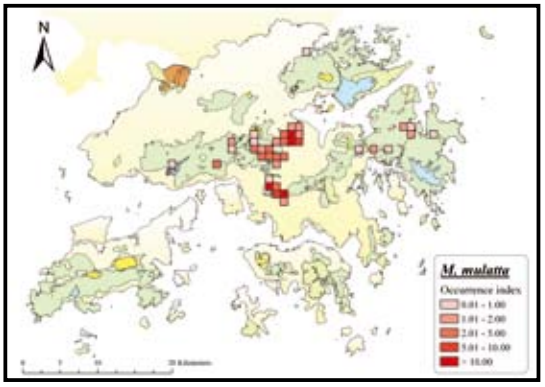


Fig 12. a) Photograph; b) activity pattern and c) distribution of the Rhesus Macaque.

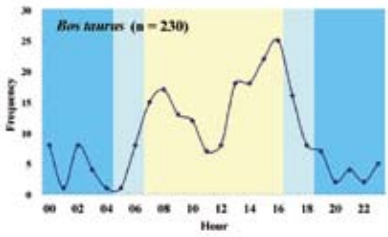
Domestic Ox (*Bos taurus* 黃牛) (Fig. 13a-c)

Classification: Artiodactyla (偶蹄目), Bovidae (牛科)

Status: Introduced / common

a.

b.



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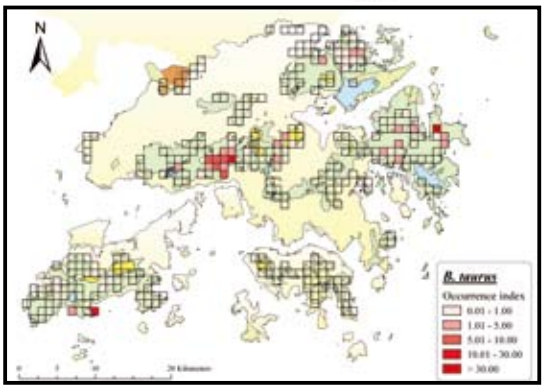


Fig 13. a) Photograph; b) activity pattern and c) distribution of the Domestic Ox.

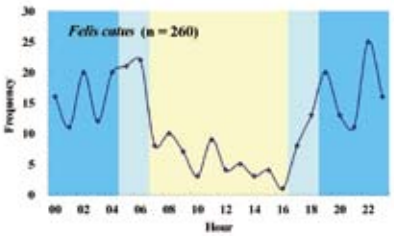
Domestic Cat (*Felis catus* 野貓) (Fig. 14a-c)

Classification: Carnivora (食肉目), Felidae (貓科)

Status: Introduced / uncommon

a.

b.



c.

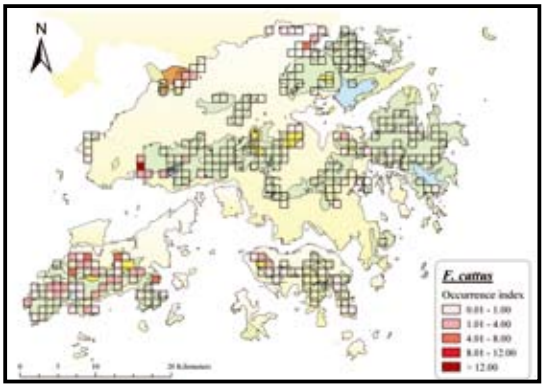


Fig 14. a) Photograph; b) activity pattern and c) distribution of the Domestic Cat.

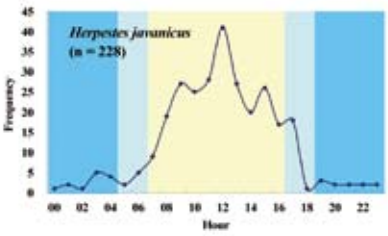
Small Asian Mongoose (*Herpestes javanicus* 紅頰獴) (Fig. 15a-c)

Classification: Carnivora (食肉目), Mustelidae (鼬科)

Status: Native (?) / uncommon

a.

b.



c.

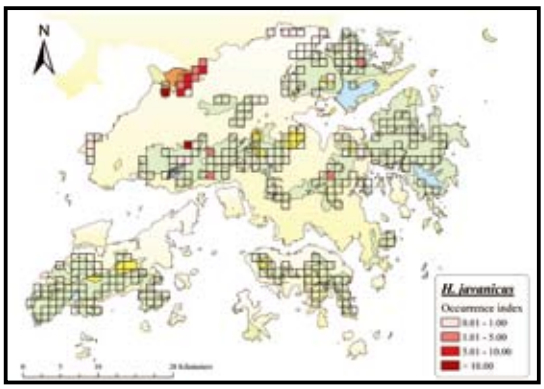


Fig 15. a) Photograph; b) activity pattern and c) distribution of the Small Asian Mongoose.

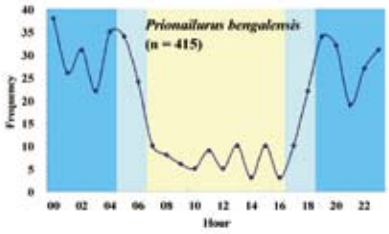
Leopard Cat (*Prionailurus bengalensis* 豹貓) (Fig. 16a-c)

Classification: Carnivora (食肉目), Felidae (貓科)

Status: Native / uncommon

a.

b.



c.

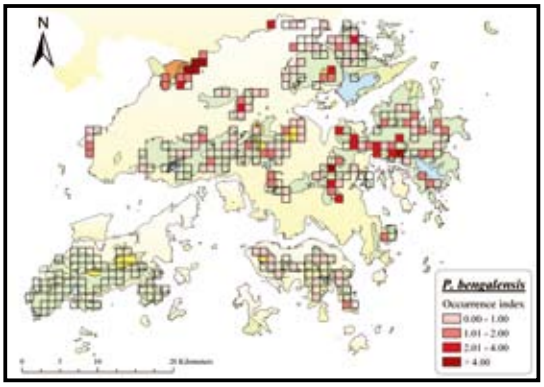


Fig 16. a) Photograph; b) activity pattern and c) distribution of the Leopard Cat.

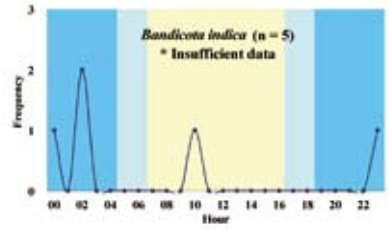
Greater Bandicoot Rat (*Bandicota indica* 板齒鼠) (Fig. 17a-c)

Classification: Rodentia (齧齒目), Muridae (鼠科)

Status: Native (?) / rare

a.

b.



c.

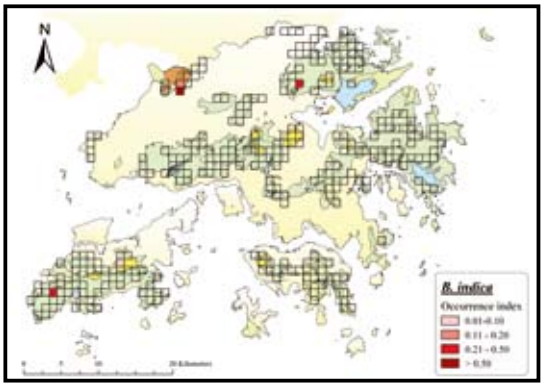


Fig 17. a) Photograph; b) activity pattern and c) distribution of the Greater Bandicoot Rat.

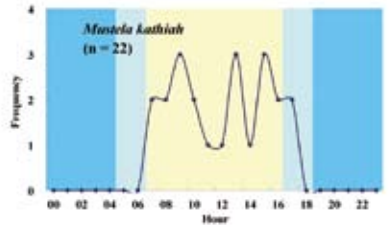
Yellow-bellied Weasel (*Mustela kathiah* 黃腹鼬) (Fig. 18a-c)

Classification: Carnivora (食肉目), Mustelidae (鼬科)

Status: Native (?) / rare

a.

b.



c.

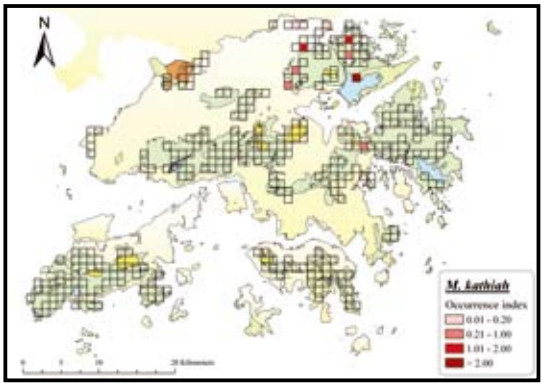
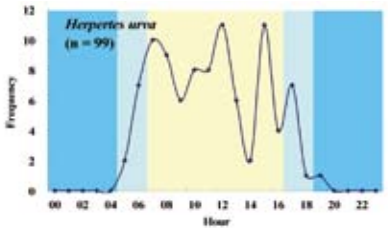


Fig 18. a) Photograph; b) activity pattern and c) distributionh of the Yellow-bellied Weasel.

Crab-eating Mongoose (*Herpestes urva* 食蟹獴) (Fig. 19a-c)
Classification: Carnivora (食肉目), Mustelidae (鼬科)
Status: Native / species of conservation concern

a.

b.



c.

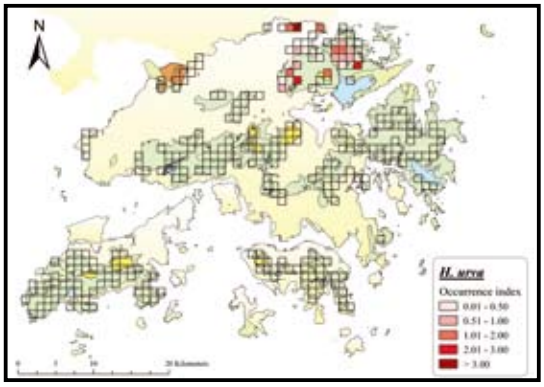
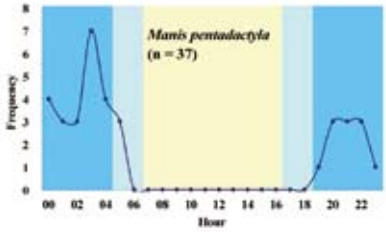


Fig 19. a) Photograph; b) activity pattern and c) distribution of the Crab-eating Mongoose.

Chinese Pangolin (*Manis pentadactyla* 穿山甲) (Fig. 20a-c)
Classification: Pholidota (鱗甲目), Manidae (穿山甲科)
Status: Native / species of conservation concern

a.

b.



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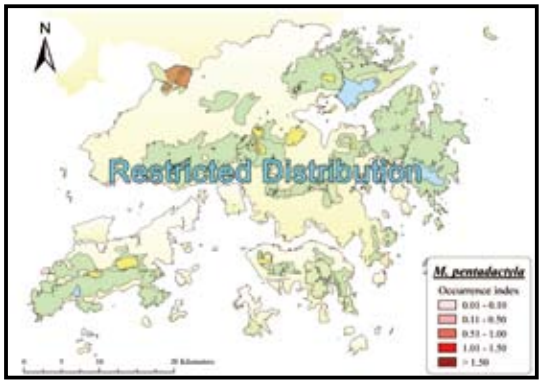
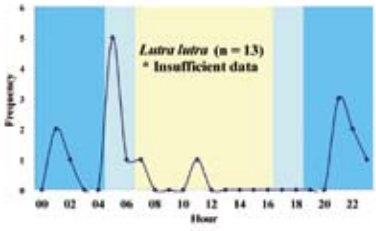


Fig 20. a) Photograph; b) activity pattern and c) distribution of the Chinese Pangolin.

Eurasian Otter (*Lutra lutra* 歐亞水獺) (Fig. 21a-c)
Classification: Carnivora (食肉目), Mustelidae (鼬科)
Status: Native / species of conservation concern

a.

b.



c.

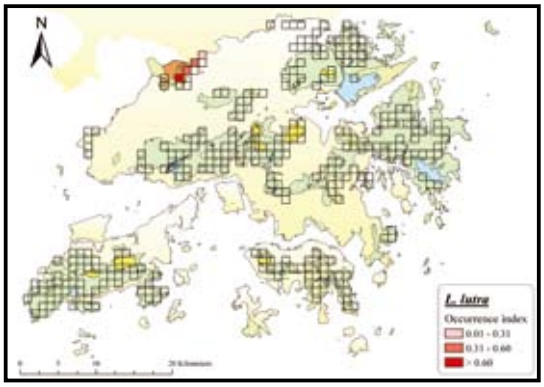


Fig 21. a) Photograph; b) activity pattern and c) distribution of the Eurasian Otter.

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Division Column

An Update on the Population Control of House Crow *Corvus splendens* in Hong Kong

Wai-hung Lee and Gary, K.L. Chow

Wetland and Fauna Conservation Division

Introduction

The natural geographical range of the House Crow *Corvus splendens* (Fig. 22) includes the Indian subcontinent, western China, Burma and Thailand (Feare & Mungroo, 1990; Carey *et al.*, 2001; Soh *et al.*, 2002; Brook *et al.*, 2003). The species has spread widely throughout Asia (e.g. Singapore and Malaysia), Africa, the Middle East and various oceanic islands owing to both inadvertent global sea traffic and deliberate releases (Feare & Mungroo, 1990; Brook *et al.*, 2003; Anon, 2004). House Crows may roost communally in large numbers in one place, sometimes reaching as many as 20,000 individuals (Peh & Sodhi, 2002).

Fig 22. House Crow *Corvus splendens*, an invasive bird species in Hong Kong.

It is well known that House Crow is gregarious, intelligent and cunning. In addition, it is an opportunistic omnivore, scavenging largely on food scraps (Ryall & Reid, 1987; Archer, 2001; Soh *et al.*, 2002; Lim *et al.*, 2003). These behaviours attribute to the success of the species.

AFCD reported on issues concerning House Crows in early 2005 (Lee & Choi, 2005) with some suggested measures to control the nuisance caused by the House Crow in Hong Kong. This paper updates the status of the House Crow in Hong Kong, and presents the results of its population control in 2006 and 2007.

Control Measures

Improving environmental hygiene

Since House Crows' roosting may have environmental hygiene concern and may cause nuisance to nearby residents, AFCD has been advising the relevant parties, including the Housing Department, Leisure and Cultural Services Department, Food and Environmental Hygiene Department, Marine Department and the management office of Stonecutters Island Barracks on measures to improve environmental hygiene of the areas concerned. The relevant parties have put up posters and notices in the housing estates and parks to advise the public not to feed wild birds and pigeons. They have also stepped up cleansing in the areas frequented by House Crows and monitored disposal of garbage. Selected trees in the housing estates were trimmed by the estate managers. As a result of these measures, the food sources for the house crows have been greatly reduced, the environmental hygienic conditions of the housing estates have been improved and public awareness enhanced.

Egg and chick removal

AFCD began removing House Crow's eggs and chicks as a trial in the breeding seasons (i.e. between April to July) of 2004 and 2005 (Fig. 23). A total of 14 and 145 eggs / chicks were removed in 2004 and 2005 respectively (Fig. 24 a&b). In the 2006 breeding season, similar operations were conducted at Sham Shui Po Park, Tai Hang Tung Recreation Ground, Kowloon Tsai Park, Tung Chau Street Park, Lai On and Lai Kok Estates, Stonecutters Island and Yau Yat Tsuen with 68 eggs and 82 chicks removed from 49 nests (Table 2). In 2007, a wider area (e.g. Sham Shui Po Sports Ground, Wang Tau Hom Estate and Tsuen Wan Riviera Park) was searched for crow's nests and more egg / chick removal operations were conducted. As a result, 136 nests were found with 60 eggs and 183 chicks removed from 85 nests.

Fig 23. Egg / chick removal operation carried out at Kowloon Tsai Park.

Fig 24. a) A House Crow nest with one chick and four eggs; b) a nest with four chicks.

To date a total of 552 House Crow eggs / chicks have been removed, from nests mainly found in the Kowloon City and Sham Shui Po Districts. The clutch size ranged from one to six which is similar to that reported overseas. The nests were mainly made of tree branches but some were also made of other materials, such as construction materials, plastic waste and even metal wires (Fig. 25). It was observed that nests were not reused by the House Crows, with new ones being built in each breeding season. Their nests were mainly built in common urban trees. Among these, House Crows appear to prefer nesting in *Ficus microcarpa*, *Casuarina equisetifolia*, *Melaleuca leucadendron* and *Acacia confusa.* Each year, more than 60% of the nests were found in these trees between 2005 and 2007. Apart from nesting in trees during breeding season, a few nests were also found at the top of floodlights.

Fig. 25. Two House Crow nests with special materials – metal wire.

Generally if eggs were found in nests, they were replaced by imitation ones to trick the parents to continue their incubating activities and if chicks were found, they would be removed. These treated nests were not destroyed to avoid excessive disturbance to the House Crows, which may cause the dispersal of the breeding population to other areas. Subsequent monitoring revealed that in some cases (two nests) the imitation eggs disappeared and another clutch of eggs were laid in the nests and in other cases new nests (six nests) were built nearby. As such, it was necessary to conduct weekly surveys to monitor the treated nests and their vicinity to check for new nests and new eggs would be replaced if found.

Cage trapping

Cage trappings using baits have been conducted since June 2004 at Cheung Sha Wan Wholesale Food Market, Stonecutters Island Barracks, Sham Shui Po and Kowloon Tsai Parks (Fig. 26a&b) but no bird was trapped. Starting from early 2006, five traps have also been installed on the roofs of selected buildings in Lai Kok Estate. So far, no bird has been trapped. The failure in the former locations might probably be due to the presence of other food sources in the vicinity of the traps and the latter location might be due to the alertness of the foraging House Crow. The test of cage trapping is being continued using a modified cage trap with a remote control device at one of the House Crow gathering sites (Fig. 27).

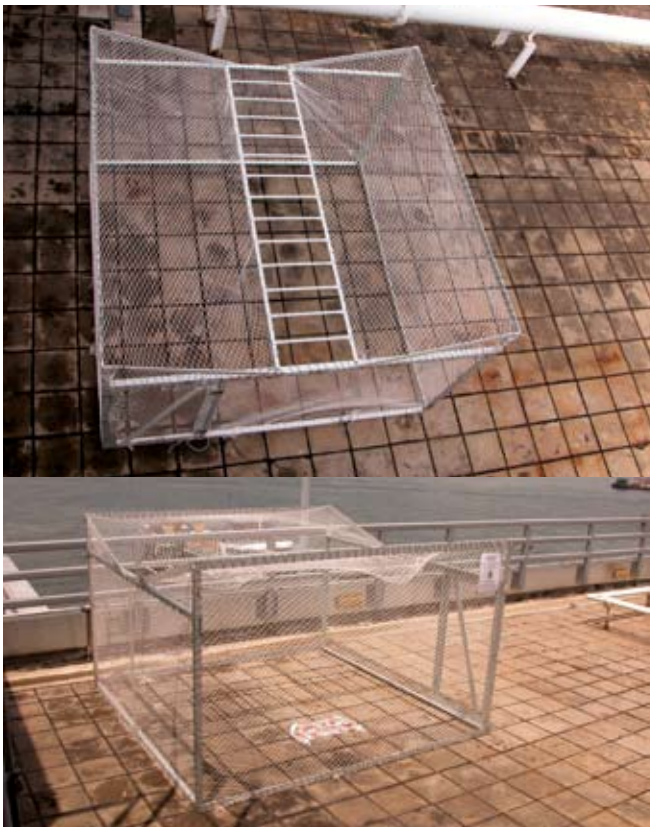

Fig 26. Cage trap -- a) the inlet of the trap is a "ladder" like structure to prevent the escape of the bird after entered; b) the trap with bait to attract House Crow.

Fig 27. A modified cage trap - all four sides can be opened and bait is placed on the platform inside. The trap is controlled either by infra-red or remote control devices.

Baiting

Since February 2005, AFCD has been conducting trials using baits (e.g. fish, pork, beef, canned meat, barbecued pork and bread) treated with alpha-chloralose (an anaesthetic commonly used overseas e.g. USA, South Africa and Australia for the population control of wild animals) in Cheung Sha Wan Wholesale Food Market.

House Crows are clever. They learn from experience, in particular when a member of the group has been baited and collected. The baiting operations, including the frequency, locations and type of baits, were designed to be flexible to increase their effectiveness.

The treated baits were closely monitored by AFCD staff to avoid any potential contact by the public or non-targeted animals. The staff involved in the baiting operations was required to follow the safety guidelines on handling and disposing of the anaesthetic, treated baits and anaesthetized birds. These baiting operations had been carried out in Kowloon Tsai Park, Sham Shui Po Park and Stonecutters Island Barracks, Tai Hang Tung Recreation Ground, Yau Yat Tsuen, government dockyard on Stonecutters Island, Lai On, Lai Kok and Tai Hang Tung Estates, Sung Wong Toi Park and Tsuen Wan Riviera Park.

By the end of November 2007, 281 House Crows were collected and no non-targeted animal was affected (Table 2). Apparently, more House Crows approached the baits when the weather condition was poor (e.g. cloudy, rainy or with sudden temperature drops) and the birds have no preference for the food types being used as baits. All the anaesthetized House Crows were collected by AFCD staff and transferred to the New Territories North Animal Management Centre of AFCD for disposal by euthanasia.

Discussion

As at early November 2007, there is an estimated 210 House Crows in Hong Kong, found mainly on Stonecutters Island, Sham Shui Po Park, Tai Hang Tung, Yau Yat Tsuen, Kowloon Tsai Park, Tung Chau Street Park, Lai On and Lai Kok Estates (AFCD, unpublished data). When compared with the estimated 200 - 250 individuals in 2003 before the application of the control measures (Lee & Choi, 2005), it appears that the control measues are effective in containing the population of House Crow in Hong Kong. However, we should be cautious about this interpretation as only limited information on the distribution of House Crows was available back in 2003 when the population might have been underestimated.

Since 2004, more than 830 birds have been collected through the various control measures (Table 2). Without such measures, it is estimated that the current population of House Crow would have been over 1,000. It is obvious that there is a continuous need to control, through multiple measures persistenly, the population growth of the House Crow in Hong Kong. These measures include egg / chick removal (to be followed by weekly monitoring) during the breeding season, baiting throughout the year in particular in poor weather condition when the baits are more attractive to the birds, and further trials on the feasibility of cage trapping.

Acknowledgements

We are grateful to the Leisure and Cultural Services Department, Food and Environmental Hygiene Department, Housing Department, Marine Department, management office of Stonecutters Island Barracks, and other concerned parties for their co-operation in undertaking the control measures.

Table 2. Summary of the Results of House Crow Population Control Measures in 2004 - 2007

Year	Removed House Crow/no.				Remarks
	Egg	Chick	Adult (collected by baiting)	Total	
2004	0	14	Not yet implemented	14	The egg / chick removal operation as a trail was conducted in May. Six House Crow nests (four at Kowloon Tsai Park and two at Sham Shui Po Park) were successfully approached and 14 chicks were collected. No egg was found.
2005	77	68	90	235	During the egg / chick removal operations, 81 nests were inspected at 10 sites. In which, 48 nests had egg(s)/chick(s) and the others were empty. The baiting had been commenced since February.
2006	68	82	91	241	During the egg / chick removal operations, 72 nests were inspected at 10 sites. In which, 49 nests had egg(s)/chick(s) and the others were empty. Imitation eggs were placed in the treated nests.
2007 (up to 30 Nov)	60	183	100	343	During the egg / chick removal operations, 136 nests were inspected at 22 sites. In which, 85 nests had egg(s)/chick(s) and the others were empty. Imitation eggs were placed in the treated nests.
Total	**205**	**347**	**281**	**833**	

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An Unusual Record : a Juvenile Green Turtle in Aberdeen West Typhoon Shelter

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Wetland and Fauna Conservation Division

Green turtles (*Chelonia mydas*) sightings have occasionally been reported in the eastern and southern waters of Hong Kong and the adjacent Mainland China waters. In early December 2006, a local fisherman reported to the Agriculture, Fisheries and Conservation Department of his frequent sightings of a sea turtle in an unexpected setting - the Aberdeen West Typhoon Shelter.

The residents nearby told us that the green turtle was first seen in October 2006, mainly in the morning and late afternoon. It could be seen nearly everyday by the morning walkers at the Ap Lei Chau Waterfront Promenade. After spending some five months in the typhoon shelter, the green turtle was last seen in late February 2007.

Our site investigations showed that it was a juvenile green turtle (Fig. 28). It had an estimated carapace length of 50 cm, which appeared to be in good physical condition, without any marks or identifying tagging. The turtle surfaced regularly, breathing approximately three times per hour within our sight.

Fig 28. The coloration and carapace length showed that the green sea turtle was a juvenile.

Amidst the busy marine traffic, we noted the turtle's ability to be aware of the sea traffic and to escape moving vessels - as it only emerged when no vessel was approaching (Fig. 29). We believed the turtle was only a visitor to the typhoon shelter as the water area of only about 0.8 km^2 there would be too small for it. Tracking studies showed that juvenile green turtles could venture up to 5 to 6 km^2 a day (Seminoff & Jones, 2006; Makowski *et al.*, 2006).

Juvenile green turtles usually leave the pelagic nursery for the coastal habitats at a carapace length of about 30 - 40 cm or larger (Musick & Limpus 1997). Many then undertake further migration along the coastal habitats, in response to the variation of the supply of essential resources (Makowski *et al.*, 2006). Wanshan Qundao (萬山群島), the archipelago south of the Hong Kong Island, is known to be a foraging site for green turtles. We postulate that this unusual green turtle might have left its pelagic nursery and temporarily stayed in the typhoon shelter, a superficially unfavourable habitat, due to the abundance of food supply there from the nearby Aberdeen Wholesale Fish Market.

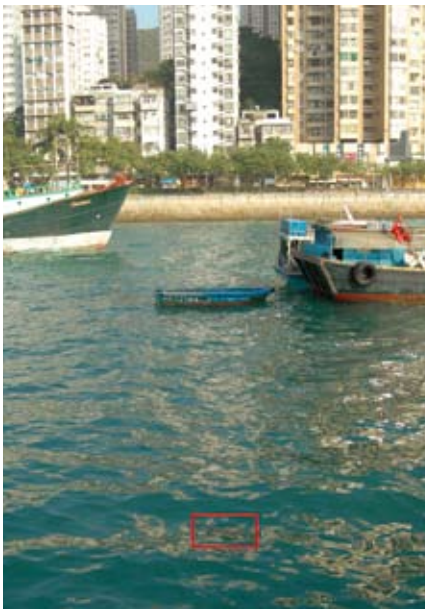

Fig 29. The juvenile green turtle was coming up to surface when no vessel was approaching.

Information on juvenile sea turtles in Hong Kong is limited to their species diversity and general distribution, and is mainly derived from public's reports, casual observations and rehabilitation of injured individuals. Further studies on their diet, activities and distribution hotspots should provide valuable information to help conserve them.

Acknowledgements

We would like to thank Joseph So of the Wetland and Fauna Conservation Division and Cynthia Chan of the Biodiversity Conservation Division for their help in carrying out site investigations.

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