Hong Kong Biodiversity
Agriculture, Fisheries and Conservation Department Newsletter

Issue No. 5 August 2003

From the Editor

Since the start of our ecological survey programme in 2002, we have been busy collecting, compiling and analyzing the data collected. However, some may not be aware of the progress of the programme and interested parties outside AFCD may have difficulty in accessing the information and results.

We have already taken steps to disseminate the results of our surveys through sending copies of this AFCD internal newsletter to outside parties upon request, while stock lasts. To further increase circulation of this newsletter, we will keep a "subscription list" and send copies of future issues to those on the list. If you know anyone (either within or outside AFCD) who is interested in receiving a copy of this newsletter, please let me know.

Progress of the ecological survey programme is moving on rapidly. It is particularly exciting to witness new records being made for Hong Kong, including the four new dragonfly, and one butterfly, records reported in this issue.

Although Hong Kong is becoming one of the best-studied cities in the world in terms of its biodiversity, there is still more to be discovered. In particular, the small size and patchiness of our habitats require a much higher resolution in our knowledge on the distribution of local fauna and flora for their conservation. We will need to work harder to improve our understanding of local biodiversity.

P. M. So

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Feature Article

The Population and Breeding Ecology of White-bellied Sea-eagles in Hong Kong

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Bird Working Group

本文報告鳥類工作小組在2001年11月至2003年5月在全港觀察白腹海鵰的部份結果，包括白腹海鵰在全港的分佈、數目、巢數、以及繁殖期間的覓食行為，為了解本物種在香港的情況提供最新的資料。

Introduction

White-bellied Sea-eagle *Haliaeetus leucogaster* (WBSE, 白腹海鵰) is one of the ten species of fish eagle in the world, belonging to the Family Accipitridae (鷹科)(Ferguson-Lees and Christie, 2001) (Figure 1). It occurs from India and Sri Lanka, through southeastern Asia to Australia and Tasmania. The global population of breeding adults, non-breeders and immatures is estimated to be over 10,000 (del Hoyo *et al.*, 1994; Ferguson-Lees and Christie, 2001).

WBSEs are specialists in coastal areas and offshore island. Juveniles are dispersive in nature, but breeding males and females usually form permanent pairs and are mostly sedentary once a home range has been established. They are monotypic but females are slightly larger. Nests are usually near water, in tall trees, living or dead, or on remote coastal cliffs (Clunie, 1994). The nests may be used for several years. WBSEs are opportunistic carnivores, with a wide range of prey foods, including fish, reptiles,

birds, mammals and carrion (Clunie, 1994; Zheng and Wang, 1998; Ferguson-Lees and Christie, 2001).

WBSE is known as an uncommon resident along the coasts of southeastern China, including Hong Kong, Guangdong, Fujian and Hainan and rarely in Jiangsu and Taiwan (Zheng and Wang, 1998; MacKinnon and Phillipps, 2000; Carey *et al*., 2001), suggesting that southeastern China is the northern limit of natural distribution of this species.

Like all wild birds in Hong Kong, WBSEs and their eggs and nests are protected by the Wild Animals Protection Ordinance (Cap. 170). In addition, the import and export of WBSEs are controlled by the Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187). WBSE is listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), but they are not globally threatened. It is listed in the China - Australia Migratory Birds Agreement, signed in Canberra in 1986, under which both countries agree to co-operate in the protection of migratory birds and their environments.

Objectives

To improve our understanding of local WBSEs, we carried out a study to:

(i) Record the local distribution of the species.
(ii) Estimate the local population size.
(iii) Characterize the nests and nesting sites.
(iv) Monitor the behaviour of breeding birds.

This paper summarizes the key findings of the study.

Key Findings

Distribution and Population of WBSEs

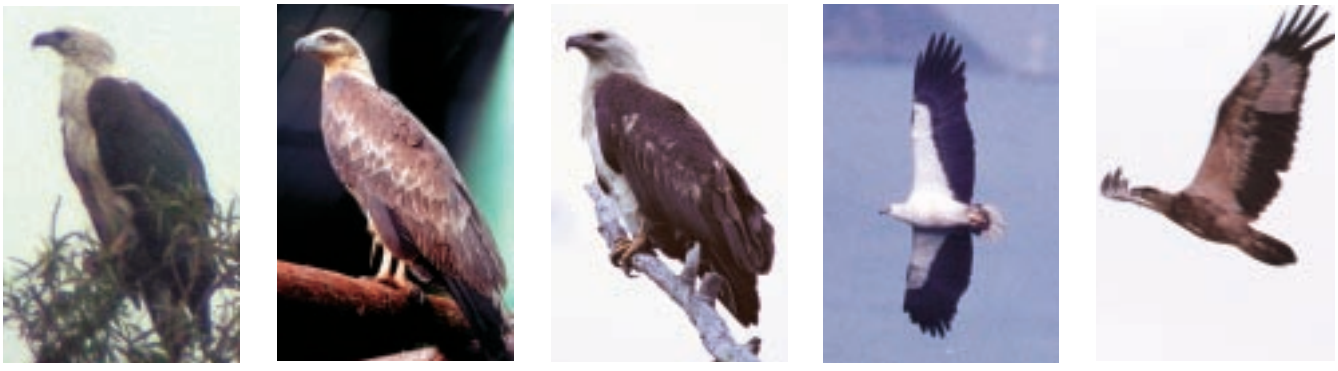
More than 100 sighting records of WBSEs were obtained between November 2001 and May 2003 (Figure 2). After excluding any possible double counting of the same individual, it is estimated that there was a total of 39 WBSEs in Hong Kong, including 23 adults and 16 immatures/juveniles (12 immatures and four unfledged juveniles) as at the end of May 2003. This is based on records of 23 individual records of sedentary adults, four unfledged juveniles that were still staying in nests, and four juveniles seen perched close to each other at the same place and time. The other sighting records of juveniles were re-examined and considered as eight individual juvenile WBSEs.

In general, most of the WBSEs inhabit the eastern waters of Hong Kong (20 birds or 51.3% of the local population) and the southern waters and harbour areas (14 birds or 35.9% local population), whereas the western waters support fewer WBSEs (5 birds or 12.8% local population). In addition, WBSEs were frequently observed perching, foraging or bathing around five of the Hong Kong reservoirs, namely High Island, Plover Cove, Kowloon, Tai Lam Chung and Tai Tam.

A small gathering of four immatures/juveniles was observed at the shore of Wang Tau Tun in High Island Reservoir on 29 December 2002. This record is the largest aggregate of WBSEs in this study. Three WBSEs were also recorded flying close to each other at three locations including Hung Shek Mun (26 July 2002), Stonecutters Island (28 July 2002) and Kowloon Reservoir (12 November 2002). Outside Hong Kong, gatherings of up to about 14 immatures have been observed (Ferguson-Lees and Christie, 2001).

Number and Density of WBSE Nests

Eight nests were confirmed in Hong Kong by this study (Figure 3). The nests at Tai Ngam Hau (Sai Kung) and Tsim Chau were newly reported by AFCD, and the nest on Stonecutters Island by the Kite Research Group of Hong Kong Bird Watching Society (HKBWS) in 2003. Based on the sighting records, it is suspected that there may be at least two additional nests at Chi Ma Wan and Tai Tam, adding to as many as ten breeding pairs of



(a) (b) (c) (d) (e)

Figure 1 (a) Adult WBSE, its head, neck, distal half of tail, and whole under-part and thighs white; back and wing-coverts dark brownish-grey; (b) juvenile WBSE, head, neck and under-part creamy color with brown stripes, scaled brown back and wing-coverts; (c) sub-adult WBSE, less brown and more grey above and white below with more uniform black at base of tail; (d) adult WBSE in flight showing long broad wings, narrow head on well protruding neck and short wedge-shaped tail; (e) juvenile WBSE in flight showing pale-streaked brown in lower-part, whitish diagonals/windows, dark tail-band. Note: birds in figure 1(a) - (e) are different individuals

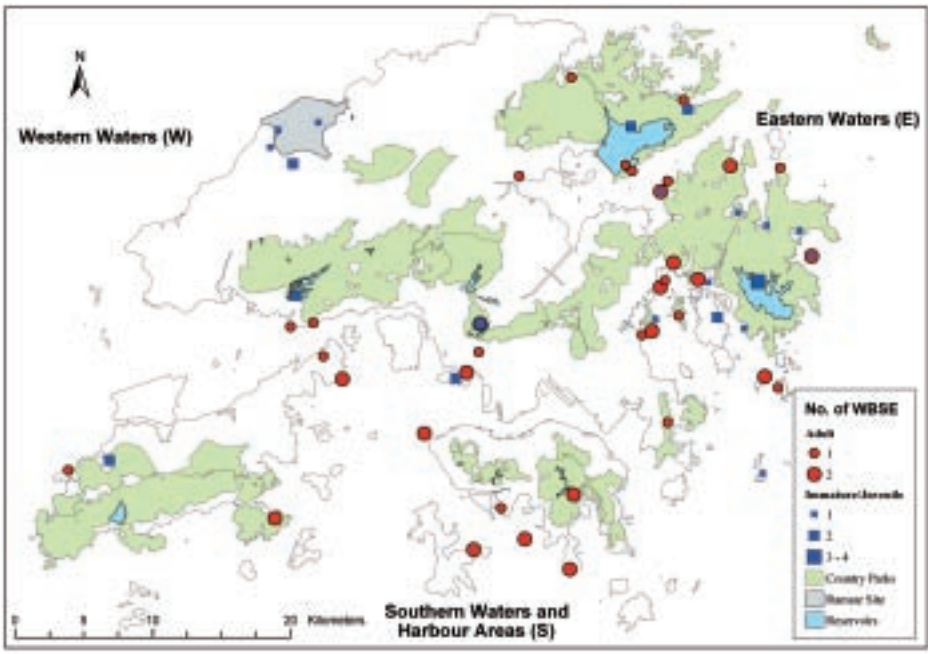


Figure 2 Locations of sighting records of WBSEs from November 2001 to May 2003.

WBSEs in Hong Kong. The number of breeding pairs (8 - 10) is comparable to previous findings in the mid-1990's (Carey *et al*., 2001), implying a steady breeding population size of WBSEs in Hong Kong.

The shortest distance between nests varies from 3.4 - 14.4 km, with a mean distance of 8.9km (Figure 3). Since the total length of Hong Kong's coastline is about 1,100km, there is about one pair of WBSE per 110 km (assuming 10 breeding pairs) to one pair per 140 km (assuming eight breeding pairs) of coastline in Hong Kong.

Characteristics of WBSE Nests and Nesting Sites

Both native and exotic tree species were used for nest building by local WBSEs. At least five tree species, including *Ficus variegata var. chlorocarpa* (青果榕), *Ficus microcarpa*(榕樹), *Acacia confusa* (台灣相思), *Machilus* sp.(楠屬) and *Cinnamomum camphora* (樟), were recorded being utilized for nesting by WBSEs in Hong Kong. Among these, *Ficus* sp. seems to be more commonly utilized as a host tree. Unidentified species of dead trees, covered with climbers, were utilized as host trees by the pairs in Sham Chung and Tsim Chau.

Of the eight characterized nests, the median nest diameter and depth is about one meter (range: 1 - 2 meters) and 0.5 meter (range: 0.3 - 1 meter) respectively. The median altitude of nests is about 40 meters above sea level (range: 8 - 80 meters). The median shortest distance of the nest to coast is about 40 meters (range: 5 - 350 meters). All the eight known nests are located on government land, and two of them (at Sham Chung and Tai Ngam Hau) are inside Country Parks.

The orientation of the nests may be related to the prevailing wind direction during the breeding season. Wind data from Hong Kong Observatory in 1999-2002 shows that easterly winds (NE - SE) occurred in more than half of the days during the breeding season from October to May next year, while seven out of the eight characterized nests face westward, which would give more protection to the nests and the nestlings during the chick-rearing period.

Number of Chicks Raised, 2002/2003

In year 2002/03, four juveniles from three breeding pairs (two in Tai Ngam Hau, one in Sham Chung and one in Tsim Chau) fledged, while no successful breeding was recorded for the four breeding pairs on Yeung Chau, Wong Ma Kok, Pa Tau Kwu and Green Island. There is no information on the breeding activities of the pair on Stonecutters Island. About half of the breeding pairs of WBSE successfully raised chicks in Hong Kong in 2003. Further studies would be required to estimate the overall breeding success and to assess the local population trend.

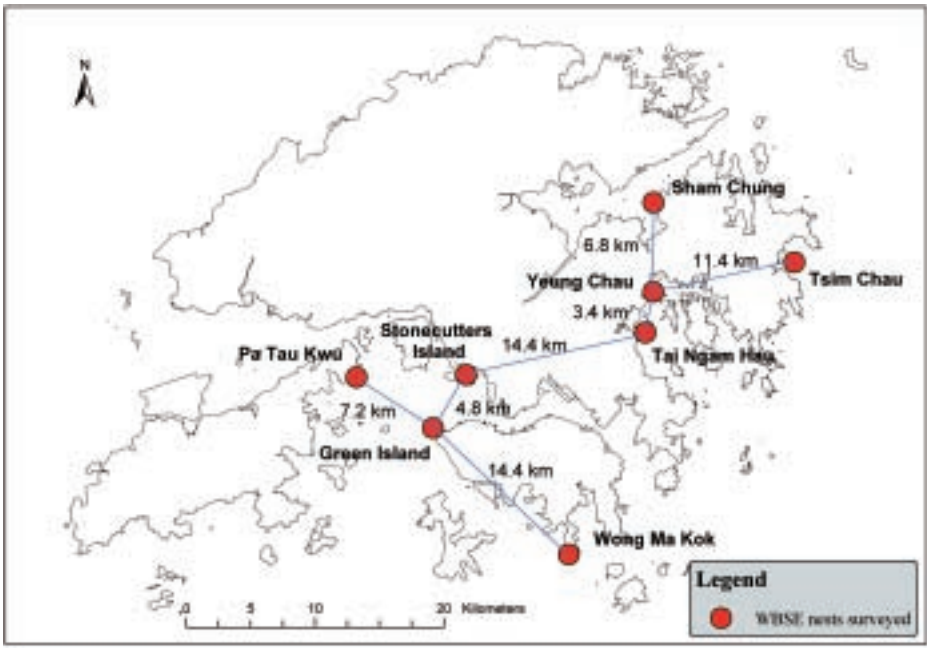


Figure 3 Locations of WBSE nests surveyed in this study. Shortest distance between two nearest nests of WBSE is shown.

Foraging Behaviour of Breeding Adults

The foraging behaviour of the two breeding pairs on Yeung Chau (during incubation period) and Tai Ngam Hau (during chick-rearing period) was studied. A total of 26 and 22 foraging behaviours were recorded from the pairs on Yeung Chau and Tai Ngam Hau respectively. Although the behaviours of the male and female were recorded separately, there is no significant difference in terms of number and duration of foraging attempts (data not shown). Table 1 shows the summary of the foraging behaviour of both pairs. Both pairs of WBSE mostly foraged between 7 am to 11 am, and between 3 pm to 7 pm, with the peak foraging time between 5 pm to 7 pm.

Common foraging habitats of both pairs were open sea and typhoon shelter in this study. Aerial foraging referred to WBSEs robbing food from other birds. Figure 5 shows the foraging locations of the two pairs of WBSEs on Yeung Chau and Tai Ngam Hau. The Yeung Chau pair had a maximum foraging range of 2 km in radius and that of the Tai Ngam Hau pair 1.7 km (Table 1; Figure 5).

There were more foraging attempts per day during the chick-rearing period due to the need to feed the nestlings. The number of foraging attempts increased from 4.4 foraging attempts in egg incubation period to 7 foraging attempts in the early chick-rearing period (5th week, 7 March 2003), reaching a high at 11 foraging attempts per day in the 8th week (25 March 2003), and then dropped to 4 foraging attempts per day in the 12th week (24 April 2003). Such variation of food demand by the nestlings could be explained by the postnatal growth patterns of birds described by Campbell and Lack (1985).

Home Range of Paired WBSEs and their Interactions

The Yeung Chau pair had been observed flying as far as east of Sharp Island and Tai Mong Tsai area, which are about 4 km from the nest. The Tai Ngam Hau pair had been observed flying close to HKUST, which is about 3 km from the nest. The ranges of territory of these two breeding pairs were therefore estimated to be 3 - 4 km in radius during the breeding period.

The size of territory of these two pairs may be used with caution for reference to extrapolate to other breeding pairs in Hong Kong. The sheltered environment, with numerous islands in Inner Port Shelter and Port Shelter, is favourable to support raptors, including WBSEs, allowing the nests to be just 3.4 km apart, which is at the lower end of the range in Hong Kong (Figure 3).

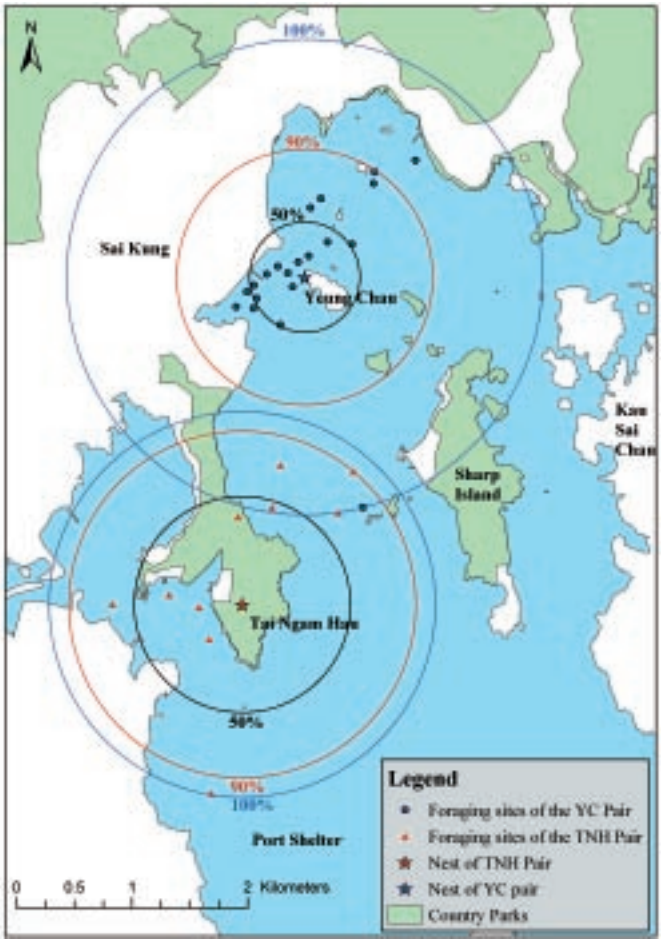


Figure 4 Recorded foraging locations of the pairs on Yeung Chau (YC) and Tai Ngam Hau (TNH). The circles show the area in which 50%, 90% and 100% of the recorded foraging behaviours took place, using the location of the nests as the centre.

Table 1 Summary of the foraging behaviour of the nesting WBSEs during incubation period (Yeung Chau pair) and chick-rearing period (Tai Ngam Hau pair)

		Incubation period (6 monitoring days)	Chick-rearing period (3 monitoring days)
Number of foraging behaviour recorded		26	22
Foraging Distance	Median	0.5 km	1 km
	Range	0.05 - 2.0 km	0.3 - 1.7 km
Foraging habitat	Open sea	17 (65%)	8 (36%)
	Typhoon shelter	7 (27%)	0 (0%)
	Aerial	2 (8%)	1 (5%)
	Woodland	0 (0%)	1 (5%)
	Unidentified	0 (0%)	12 (55%)
Foraging period	Morning (7 a.m. - 11 a.m.)	7 (27%)	9 (41%)
	Mid-day (11 a.m. - 3 p.m.)	4 (15%)	2 (9%)
	Afternoon (3 p.m. - 7 p.m.)	15 (58%)	11 (50%)

Implications of Extra-pair Copulation Behaviour of the Pair on Yeung Chau

WBSEs are usually described as monogamous, forming pairs and mating for life (Ferguson-Lees and Christie, 2001). In our observation on the breeding pair on Yeung Chau, the paired female shared the responsibility of nesting and egg incubation with the paired male. However, interactions between an intruding male with the breeding pair on Yeung Chau were recorded on six of the 11 days of survey (Figure 6), and the paired female was observed copulating with the intruded male for three times. Extra-pair copulation behaviour of Osprey has been related to the proximity to other males and frequency of territorial intrusions (Mougeot *et al.*, 2002). The same may be true for WBSEs, implying that there could be more WBSEs in the Sai Kung area than is recorded in the current study.

Influence of Human Activities

The number of vessels and helicopters within 500m of the Yeung Chau nest was recorded to study the influence of human "traffic" activities on their breeding behaviour. It is shown that the amount of traffic during weekends was much higher than on weekdays. However, no difference in the behaviour of the WBSEs was observed, in terms of the duration of incubating and foraging behaviours (data not shown). In fact, the choice of nesting site on Yeung Chau by the WBSEs strongly suggests that they can tolerate the disturbance and still regard the area as safe for breeding.

Foraging at typhoon shelter and fish culture zone by the pairs on Yeung Chau and Tai Ngam Hau (Figure 5, Table 1) demonstrated that WBSEs could tolerate, and may even be attracted to, certain types of human activity. Typhoon shelters or fish culture zones may be favourable for WBSE, as they provide easy prey and/or fish carrion. In fact, 27% of foraging attempts of the Yeung Chau pair occurred in the typhoon shelter (Table 1).

Discussion

Current Status of White-bellied Sea Eagle in Hong Kong

Among the 26 species of raptor recorded in Hong Kong, only six of them, including WBSEs, are residents and have breeding records. Carey *et. al.* (2001) reported that the number of breeding pairs for this uncommon resident species had increased from three in the 1930s and 1960s to ten in 1980s and 1990s. This study confirmed that there are at least eight, and probably up to ten, breeding pairs in Hong Kong. Together, a total of 39 WBSEs including adults and immatures/juveniles, were recorded in Hong Kong.

The mean distance between known WBSE nests (8.9 km, Figure 3) and the home range of the Yeung Chau and Tai Ngam Hau pairs (about 4 km in radius) in this study are comparable to the range of daily movement of immature WBSEs in Sai Kung and Plover Cove Country Parks area recorded by radio tracking (Griffiths and Tsim, in prep.). These indicate that WBSEs in Hong Kong are not as uncommon as expected before. The mean distance between known WBSE nests in Hong Kong (8.9 km) falls within the lower end of the range of distance between the nests, given as 8-10 km in Australia (Ferguson-Lees and Christie, 2001). Ferguson-Lees and Christie (2001) reported about 500 breeding pairs on 60,000 km coastline in Australia. On average, there is one pair of WBSE per 120 km coastline in Australia. This is comparable to one pair per 110-140 km of coastline in Hong Kong. The density of nest is indeed comparable to that in Australia, where WBSEs are regarded as common in and near coastal areas.

Distribution and Habitat Requirements

WBSEs are restricted to particular coastal habitats and the offshore islands. In Hong Kong, all the surveyed nesting sites are located in coastal areas. The

Figure 5 **(a) On 15 February 2003, an intruding adult male approached the paired female WBSE on Yeung Chau. The intruding male perched on a prominent tree on Yeung Chau and waited for an opportunity to copulate with the paired female. The male of this pair was sitting on the nest at that time. (b) On 16 February 2003, at 1:54 p.m., the paired male sat on the nest on Yeung Chau, the paired female perched on the middle of a prominent tree and the intruded male perched on the top of a prominent tree.**

selection of nesting sites seems to be related to the orientation of the site (generally facing westward) and the availability of food (such as the proximity to typhoon shelter or fish culture zone) with an acceptable level of disturbance. A variety of native and exotic tree species are utilized, so the availability of nesting trees should not be a limiting factor. But the morphology of the nesting trees might need further study.

Our surveys also revealed that WBSEs were mainly distributed in the eastern waters and southern waters/harbour area of Hong Kong (Figure 2). This distribution pattern may be related to the better water quality in these marine areas, and the supply of suitable prey items in fish culture zones and typhoon shelters. A large number of sightings of WBSEs were also made in reservoirs, many of these sightings being juveniles/immatures. The reservoirs may provide alternative foraging grounds and shelters, particularly to the immatures/juveniles which may not be able to compete with adults in the coastal areas.

Utilization of Country Parks

A significant portion (15 birds or 28.5%) of the local population of WBSE is frequently sighted at seven Country Parks: Tai Tam Country Park, Tai Lam Country Park, Ma On Shan Country Park, Plover Cove Country Park, Kiu Tsui Country Park, Sai Kung West Country Park and Sai Kung East Country Park (Figure 2). This implies that the Country Parks are utilized by WBSEs. WBSEs were also recorded in Clear Water Bay Country Park, Lantau South Country Park and Lantau North Country Park. The parks' roosting and nesting sites, and their association with reservoirs, make them an important attraction to the WBSEs in Hong Kong - especially where the parks are also adjacent to the coast.

Tolerance to Human Activities

The presence of WBSE nests on Stonecutters Island, Green Island and Yeung Chau indicated that WBSEs tolerate a certain level of human activities, such as marine traffic in Victoria Harbour and Inner Port Shelter. This view is supported by the fact that the Yeung Chau pair successfully foraged in the busy typhoon shelter in Sai Kung, showing no sign of adverse response to human activities nearby. Another adult was recorded perching for at least one hour on a tree at the roadside of Shum Wan Road (Aberdeen), where many double-decked buses were parking and passing there to the Ocean Park. This hints that WBSEs can tolerate a certain level of terrestrial traffic as well, and the WBSE might be attracted by a potential food source (i.e. proximity to the Aberdeen typhoon shelter).

Potential Impacts and Mitigation Measures

The main factors that have caused the decline of raptor populations elsewhere in the world are habitat destruction, hunting and poisoning by agricultural pesticides (Newton, 1990). In Hong Kong, with the Wild Animals Protection Ordinance (Cap. 170) and the Pesticides Ordinance (Cap. 133), both hunting and poisoning are unlikely to have significant impacts on the WBSEs. Therefore, the major potential threat to this bird in Hong Kong remains the loss of coastal habitats due to development.

The Environmental Impact Assessment Ordinance (Cap. 499) (EIAO), which came into operation in 1998, provides a statutory framework for the assessment of environmental impacts of Designated Projects (DP). Although EIAO does not specifically mention WBSEs, all key ecological components, including the population and the breeding sites of WBSEs, are assessed at the EIA stage. Practicable measures would be implemented to prevent and/or mitigate any unacceptable impacts to the environment.

The data from this study also provides hints on the avoidance and minimization of potential impacts of development projects to WBSEs. The distribution and characteristics of the sighting records and nesting sites of WBSEs could be used to assess whether a proposed project may have any adverse impact on WBSEs. If so, disturbance to WBSEs may be minimized by, for example, minimizing human activities within the main foraging areas (say the distance from the nest where 50% of foraging attempts occur) during the main foraging times (as in Table 1 and Figure 5) during their breeding season, especially during the chick-rearing period.

Conservation Measures

Apart from routine law enforcement and EIA work, measures to enhance the conservation of the WBSEs in Hong Kong could include:

- Regularly monitoring the known nesting sites during the breeding season.
- Investigating the ecology of the species (e.g. foraging distances in non-breeding seasons, breeding success and preferred food items) through co-operation with interested parties such as green groups and universities.
- Promoting conservation education and publicity programmes.
- Providing rescue/rehabilitation services when any sick or injured birds are found (e.g. the existing collaboration between the Agriculture, Fisheries and Conservation Department and Kadoorie Farm and Botanic Garden).

Acknowledgement

The authors would like to thank the Kite Research Group of the HKBWS for the information concerning the nest on Stonecutters Island. The assistance of AFCD's staff in the Nature Conservation Division, Wetland and Fauna Conservation Division and the Biodiversity Conservation Division are also very much appreciated.

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Working Group Column

New Butterfly Record for Hong Kong - *Thoressa monastyrskyi*

Eric Wong, PC Leung, Phoebe Sze, Alfred Wong, Vinci Li, Butterfly Working Group

本署職員於2002年捕捉到一隻弄蝶科蝴蝶，後確認為首次在香港發現的黑斑陀弄蝶 *Thoressa monastyrskyi* 。

Specimen of *Thoressa monastyrskyi* (upper side/under side)

On 17 May 2002, at Yung Shue O in Sai Kung West Country Park, a live butterfly specimen was caught by Mr Chu Kwok Wai (FA/NC1). On careful examination of the genitalia structure, the specimen was confirmed to be the species *Thoressa monastyrskyi*, a member of the Hesperiidae. Last year, *Thoressa monastyrskyi* was confirmed a new species to science from a small number of specimens collected in Vietnam (Devyatkin, 2002). This was the first Thoressa species recorded in Hong Kong.

The specimen caught by Mr Chu was a male, with forewing length of about 18mm. The forewing is blackish-brown, with slightly yellow hyaline spots on both the upperside and underside. The hindwing has a similar colour to the forewing. The wing base of the upperside has greenish-yellow hairs, while the underside has a series of postdiscal black spots and one spot near the base.

Thoressa monastyrskyi

The genus *Thoressa* includes about 20 species, known from east and southeast Asia, and nine of which occur in China (Chou, 1998). There is little recorded information for *Thoressa monastyrskyi*.

The site was visited again on 7 May 2003 by AFCD staff, and another live male specimen was found.

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Male genitalia *Thoressa monastyrskyi*

Four New Dragonfly Records for Hong Kong

TAM Tze-wai, Dragonfly Working Group

香港在2003年夏初增加了四個蜻蜓新記錄，令蜻蜓品種數目增至 111 種。即將出版的香港蜻蜓圖鑑將包括這四個新記錄。

Four new dragonfly species were recorded at the start of the 2003 dragonfly flying season. They were: *Anax nigrofasciatus nigrofasciatus* (黑紋偉蜓 Blue-spotted Emperor), *Cephalaeschna klotsi* (克氏頭蜓 Yellow-spotted Dusk-hawker), *Pseudagrion pruinosum frasei* (赤斑蟌 Ferruginous-faced Sprite) and *Trithemis pallidinervis* (灰脈褐蜻 Dancing Dropwing).

Pseudagrion pruinosum frasei ♂

The first new record, a male *Pseudagrion pruinosum frasei*, was collected on 23 April 2003 by Tam Tze-wai, near a lowland stream that drains from Lau Shui Heung Reservoir. This damselfly belongs to Family Coenagrionidae (蟌科). The male is easily distinguished from other *Pseudagrion* (斑蟌屬) species by its orange upper mouth part (labrum and clyperus), red face, red anterior part of frons, and red lower half of eyes. Its synthorax and dorsal part of the ninth and tenth abdominal segments are pruinosed blue. This species, tolerant of mild organic stream pollutants, is widespread in Guangdong's agricultural foothills.

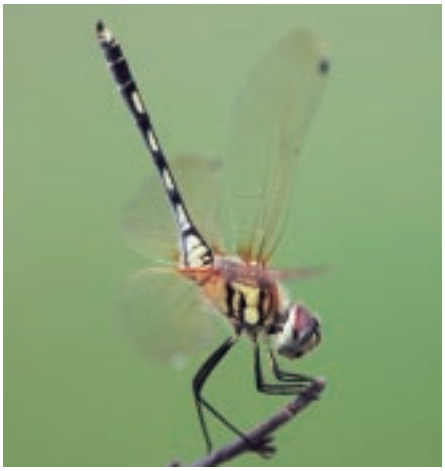
The second new record, a male *Anax nigrofasciatus nigrofasciatus*, was made on 25 April 2003 by Boris Kwan, near a small pond on the northern side of Ma On Shan. This species belongs to Family Aeshnidae (蜓科). Colourful blue spotting on its abdomen and thick black sutures on the sides of its synthorax distinguish it from the other *Anax* (偉蜓屬) species of Hong Kong. It has been observed on two previous occasions, in 1994 and 2002, by Keith Wilson at Sha Lo Tung. But this is the first confirmed record with a specimen collected. *A. n. nigrofasciatus* is found in China (including Guangxi, Guangdong and Taiwan), Japan, Korea and the Philippines.

The third new record was a teneral female *Cephalaeschna klotsi* made on 25 April 2003 by Woo Ting-kwong and Hui Wing-leung, Field Officers of the Country Park Ranger Services Division, at the waterfall of Ng Tung Tsai in the Tai Mo Shan Country Park. The female has large bright yellow frons and a brown abdomen with yellow spots. The adult female of this species has broad black and yellow strips in the synthorax, black and yellow abdomen with pairs of yellow spots between segments on the dorsal surface. This species, belonging to the Family Aeshnidae, was first described by Asahina (1982) from Fukien Province. It is a rare, little known species, and mainly crepuscular in activity. *Cephalaeschna klotsi* is the only species belonging to the Genus *Cephalaeschna* (頭蜓屬) found in Hong Kong.

Anax nigrofasciatus nigrofasciatus ♂

Cephalaeschna klotsi ♀

The latest new dragonfly record was made on 20 May 2003 by Graham Reels, who discovered several individuals of *Trithemis pallidinervis* in a shallow wetland newly created by the Kowloon-Canton Railway Corporation at Kam Tin. This species belongs to Family Libellulidae (蜻科), whose members dominate the dragonfly fauna of most regions of the world and account for nearly one third of the species found in Hong Kong. Both males and females of *T. pallidinervis* possess very long, spidery legs relative to other members of the Genus. The pterostigma is black with a small white distal portion. They frequent marshes and still waters - but not streams. This species occurs in Bangladesh, Burma, China (including Taiwan), Indonesia, India, Laos, Nepal, Oman, Peninsular Malaysia, Philippines, Singapore, Sri Lanka, Thailand and Vietnam.



Trithemis pallidinervis ♂

The addition of these four new dragonflies has increased the total number of dragonfly species recorded in Hong Kong from 107 (Wilson, 1997) to 111. Descriptions of each of the previous 111 species can be found in a new field guide to the dragonflies of Hong Kong by Wilson *et al.* (2003).

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Illigera celebica at the Shing Mun Arboretum

Patrick Lai and Joseph Yip, Hong Kong Herbarium

本文敍述本署於城門標本林栽培寬藥青藤的成果。其中，在寬藥青藤上及在附近發現以寬藥青藤為寄主植物的燕鳳蝶幼蟲及成蟲，尤其令人鼓舞。

The Shing Mun Arboretum was established in the early 1970s, for *ex-situ* plant conservation and as an outdoor classroom to complement the Hong Kong Herbarium for studying living specimens of native plants in Hong Kong. The Arboretum has been recently enriched with a new climber collection, one species of which is the *Illigera celebica* (寬藥青藤, Illigera), When we visited the Arboretum in June this year, most of the leaves of the Illigera were half-eaten. The plants looked miserable, with an appearance that most gardeners or horticulturists would not like to see.

On closer examination, there were numerous caterpillars feeding on the leaves and almost none of the leaves remained intact. The tiny creatures are not some kind of "pest" but the larvae of an uncommon butterfly, the White Dragontail (燕鳳蝶, *Lamproptera curius*). We also noticed a few adults nearby, flying restlessly like dragonflies. The co-existence of the butterflies and their food plant was, despite the "plant damage", a good sign of biodiversity conservation.

There is only one species of Illigera in Hong Kong. S.T. Dunn named it as a new species *Illigera platyandra*, in the 1908 in the Journal of the Linnean Society, Botany – based on a specimen originally collected in Wong Nai Chung and cultivated in the Hong Kong Botanical Garden. The scientific name was later on considered as a synonym of *Illigera celebica*, with a distribution range from Yunnan, Indochina to Malaysia.

Illigera has local conservation interest because it is the larval food plant of the uncommon and elegant White Dragontail, and also because of its own local rarity. It has been recorded from only a few localities in Fung Yuen, Sai Kung, She Shan Tsuen and Tai Mo Shan. The species is listed in the Forestry Regulations, a subsidiary legislation of Forests and Countryside Ordinance, Cap. 96. Collection, selling or possession of this species are prohibited.

Several trials of propagating Illigera have been carried out in the last few years, but all attempts by cutting have not been promising. However, seeds collected from various locations have had fairly good germination rates (c.a. 30%) and the young seedlings have had relatively high survival rates. A few batches of Illigera seedlings have been raised in the nursery and reintroduced to suitable locations in the natural or semi-natural environment (e.g. Tai Tong, Shing Mun Arboretum and Fanling). The populations appear to be establishing quite well. Indeed, the above recent observation of White Dragontail larvae feeding on the Illigera growing at Shing Mun Arboretum is an encouraging initial sign of our conservation work for the Illigera and White Dragontail.

Illigera celebica

Survey of Hong Kong Non-flying Terrestrial Mammals by Camera Trapping in 2002

Shek Chung-tong, Mammal Working Group

在 2002 年的陸上哺乳類動物調查中，我們於 17 個郊野公園及 2 個自然保護區內，共裝置了 140 部紅外線自動相機，並錄得 588,580 相機拍攝小時和 4,189 張共17個品種的中型及大型陸上哺乳類動物的照片。根據這些相機所記錄到的各品種的相對出現數目和出現的相機百分比，並考慮牠們是否外來或害獸品種之後，我們評估了各品種的現有狀況和其生態的價值。評估的結果是，在17個品種之中，食蟹獴、穿山甲和水獺被列為可考慮優先加強保育的稀有及分佈狹窄的本地品種。

Introduction

The land mammals that inhabit Hong Kong's natural environment can be classified into seven orders, 19 families, 35 genera, and 52 species. Among these, 22 species are flying mammals, such as bats, and ten species are small mammals (head-to-body length < 30 cm), including shrews, rats and squirrels. The remaining 20 species are medium (head to body length is 30-60 cm) to large (head-to-body length > 60 cm) mammals, such as Wild Boar, Masked Palm Civet and Rhesus Macaque (Nowak, 1991).

Much of our knowledge about Hong Kong's mammalian biodiversity is scattered through the literature, and it is based on different survey methods. This historical data is insufficient to provide an adequate baseline against which the status of Hong Kong mammals can be currently assessed. Given this, a long term monitoring program of medium to large mammals by camera trapping was begun in 2002. Its overall aim is to estimate the species diversity, abundance and spatial distribution of mammalian species throughout Hong Kong. It will also give baseline information to identify changes in the populations that are of conservation concern.

Camera trapping has been widely used in monitoring wildlife diversity for over 30 years (Karanth and Nichols, 1998). It is a non-invasive method, and it records data more consistently than by other traditional methods. However, the camera trapping cannot easily identify small mammals and thus only medium and large mammals are covered in this study.

Methodology

A total of 140 auto-trigger cameras (model: Wildlife TWO by Wildlife Conservation Foundation Ltd.) were installed in 17 Country Parks, and at the Tai Po Kau and Mai Po Inner Deep Bay Nature Reserves. The auto-trigger cameras were attached individually to tree trunks, about 1.5 to 2.5 meters above ground, with their locations chosen to cover different types of habitats and terrain in the various study areas. Film collection and battery replacement were done every 2 to 4 weeks for each camera, depending on the abundance of local wildlife. The camera operating hours for each roll of film was the time span between the starting time of a new roll of film, i.e. the time recorded on the first photo, and the end time, i.e. the time recorded on the last photo. The relative abundance of each species was measured by the Occurrence Index (OI), the number of photos taken of a particular mammal species in a particular area per 1,000 camera working hours. The extent of distribution of a species was measured by the percentage of camera locations (out of 140 locations) at which a particular species was recorded.

Result and Discussion

A total of 588,580 camera working hours were logged by the 140 cameras in the 2002 survey. During this period, 4,189 photos of 17 species of medium and large mammals were recorded (Table 1).

Of these 17 species, Stray Dog, Feral Cattle and Feral Cat are introduced species, and have minimal conservation value. Stray Dog ranked fifth in relative abundance and are widespread throughout Hong Kong. This suggests that significant populations of Stray Dog have become established in Hong Kong's natural environment, and they may prey on, and pose threats to, other native wildlife (Dahmer, 2002). In addition, Javan Mongoose and Yellow-bellied Weasel, both recently recorded, are likely to be species which have expanded into Hong Kong, naturally or as a result of deliberate release of individuals outside their natural range. Although relatively less abundant and limited in distribution, their priority for conservation action is lower because of their possible non-native status.

Chinese Pangolin 穿山甲 *Manis pentadactyla*

Crab-eating Mongoose 食蟹獴 *Herpestes urva*

Chinese Otter 水獺 *Lutra lutra chinensis*

Among the native medium and large mammals, the Porcupine and Indian Muntjac were most abundant and widely distributed, while Small Indian Civet, Wild Boar, Chinese Ferret Badger, Masked Palm Civet and Chinese Leopard Cat were relatively abundant and widespread. Rhesus Macaque was also relatively abundant, but its distribution was relatively limited, mostly to the Kowloon Hills area.

However, Crab-eating Mongoose, Chinese Pangolin, Chinese Otter and Greater Bandicoot Rat were relatively rare, with restricted distribution. Though being locally rare, the Greater Bandicoot Rat is considered an agricultural pest in the grain crops in other Asian countries and their occurrence is always linked to the agricultural activities. The local rarity of Greater Bandicoot Rat is probably related to the decline in Hong Kong's rice farming. In view of its status as a pest in many areas in the region, this species can be considered to have a lower priority for conservation action. After excluding Greater Bandicoot Rat, the species which may be considered for enhanced conservation include Crab-eating Mongoose, Chinese Pangolin, and Chinese Otter, which are rare native species with restricted Hong Kong distribution.

This camera trapping survey is a long term monitoring program for medium and large mammals in Hong Kong, and more protected areas will be covered in the survey of 2003. In addition, extra effort, and more cameras, will be given to sites where rare native species with restricted distribution have been found, such as Plover Cove CP and Pat Sin Leng CP for Crab-eating Mongoose, Lam Tsuen CP for Chinese Pangolin, and Mai Po Inner Deep Bay Nature Reserve for Chinese Otter.

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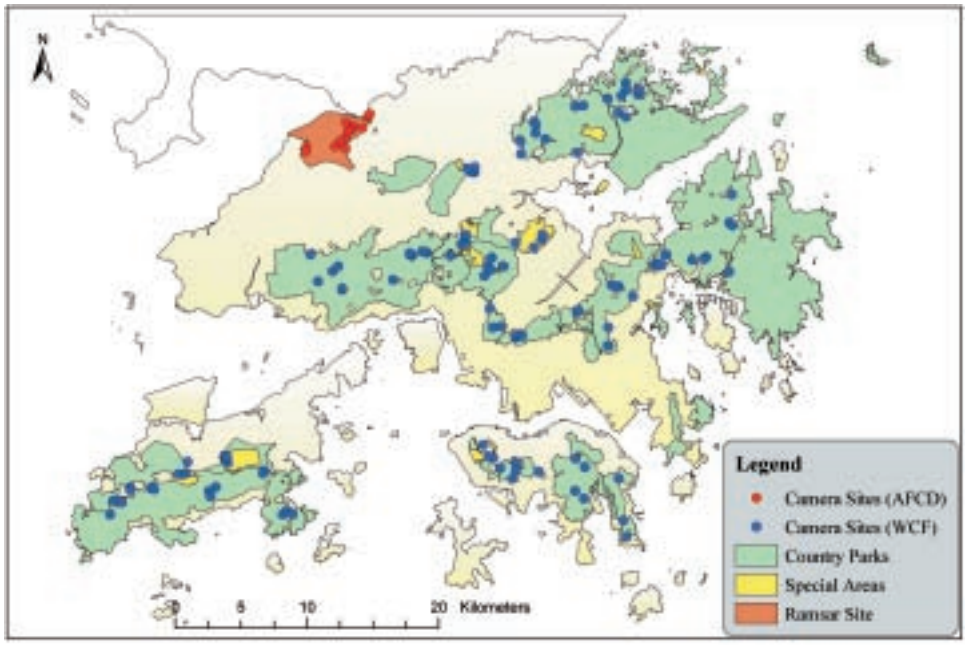

Location of the 140 camera sites.

Table 1. Results of medium and large mammal survey by camera trapping in 2002

Common Name	Species Name	Photos*	OI*	% camera*	Status*
Porcupine (豪豬)	*Hystrix brachyura*	974	1.643	61.4%	Native
Indian Muntjac (赤麂)	*Muntiacus muntjak*	618	1.043	75%	Native
Small Indian Civet (小靈貓)	*Viverricula indica*	483	0.815	65%	Native
Wild Boar (野豬)	*Sus scrofa*	445	0.751	57.1%	Native
Stray Dog (野狗)	*Canis familiaris*	411	0.693	57.1%	Introduced
Chinese Ferret Badger (鼬獾)	*Melogale moschata*	326	0.550	50.7%	Native
Masked Palm Civet (果子狸)	*Paguma larvata*	234	0.395	50%	Native
Rhesus Macaque (獼猴)	*Macaca mulatta*	219	0.369	19.3%	Native**?
Chinese Leopard Cat (豹貓)	*Felis bengalensis*	153	0.258	43.6%	Native
Javan Mongoose (紅頰獴)	*Herpestes javanicus*	119	0.201	15%	Introduced?
Feral Cattle (黃牛)	*Bos taurus*	82	0.138	15.7%	Introduced
Feral Cat (野貓)	*Felis catus*	70	0.118	15.7%	Introduced
Crab-eating Mongoose (食蟹獴)	*Herpestes urva*	27	0.046	5.7%	Native
Chinese Pangolin (穿山甲)	*Manis pentadactyla*	11	0.019	6.4%	Native
Yellow-bellied Weasel (黃腹鼬)	*Mustela kathiah*	8	0.013	2.1%	Introduced?
Chinese Otter (水獺)	*Lutra lutra chinensis*	5	0.008	2.1%	Native
Greater Bandicoot Rat (鬼鼠)	*Bandicota indica*	4	0.007	3.6%	Native
Total :	**17 species**	**4189**	**7.067**	**140**	

*Photos: Number of photos recorded; OI: Occurrence Index of mammalian species; % camera: Percentage of cameras with the mammal species; Status: status subject to further verification are marked with a "?"
**Believed to be re-introduced populations

Book Review

Invasive Alien Species in China (中國外來入侵種)

LI Zhen-yu and XIE Yan (Eds.). China Forestry Publishing House (2002) (In Chinese). ISBN: 7-5038-3277-0

Virginia Lee

《中國外來入侵種》一書詳細介紹了外來入侵種在中國的現狀，及其對經濟、環境、生物多樣性、人類健康所造成的影響與成因，並詳述了127種外來入侵種的分佈地區、鑒別特徵、生物學特性、原產地、引入擴散原因和危害，以及如何進行控制等。

The prevention, control and management of Invasive Alien Species (IAS) is a major issue highlighted in the Convention of Biological Diversity (CBD). According to the International Union for the Conservation of Nature (IUCN) (2000), IAS are defined as alien species (non-native, non-indigenous, foreign, exotic) which become established in natural or semi-natural ecosystems or habitats, act as agents of change, and threaten the existing native biological diversity. The Union has rated IAS as the second greatest threat to global biodiversity after habitat loss. The book *Invasive Alien Species in China* is the most comprehensive publication to date, which addresses the situation, effects and management of IAS in China. The book is the product of on-going research, extensive literature review and the implementation of management measures contributed by the Eco-security Task Force (former Biodiversity Working Group) of the China Council for International Cooperation on Environment and Development (CCICED).

The book begins with a broad, informative overview of IAS in China, illustrated by various examples. It highlights the biological and ecological characters of invaders and the degrees of susceptibility of different habitats/ ecosystems to 'invasives'. The next section describes the mechanisms and pathways for alien species introductions. Major pathways are classified into two categories: intentional and unintentional introductions. The associations between human activities and IAS establishment are discussed in Section 3. The book moves on to a review of the species diversity of 'invasives' in China. The threats that these IAS pose to China are further elaborated in Section 5. Section 6 lists the international organizations and agreements relevant to China with regard to IAS. It provides the criteria and procedures to assess the potential risk of IAS, so as reach decisions on necessary actions to detect and combat IAS in their initial stages. The final section considers the strategies, measures and techniques to control, regulate and eradicate IAS.

The main body of the book, with 127 examples of IAS in China, is organized into two parts: fauna and flora. Each case study has brief notes on taxonomy, biology/ diagnostic features, the country of origin, local distribution, introduction pathways, impacts, management and control methods concerning 'invasives'. A few of the 127 IAS are 'native invasives' (or 'local invasives') rather than 'aliens', which nonetheless have extended to modified habitats beyond their natural distribution ranges - often due to human activities, as well as accidental introductions. Examples of these 'native invasives' include grass carp and long-legged ant.

In the concluding pages, the authors note that several taxonomic groups, including fungi, bacteria, viruses and other micro-organisms, have been left out from the book - this because there is very little available information about them. The authors also urge the public to help to inspect and report any new invading species that they may find.

For further information, please visit CCICED's website at *www.chinabiodiversity.com*. Copies of the book are also available from AFCD's departmental library, or from the book collection of the Biodiversity Conservation Division.

References

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