



Short communication

Foraging behavior of the black-eared kite *Milvus migrans lineatus* at Victoria Harbour and Kowloon Bay, Hong KongGraham R. Fulton^{a,b,*}, Yee Wan Cheung^c^a School of Biological Sciences and Biotechnology, Murdoch University, WA, 6150, Australia^b Centre for Biodiversity and Conservation Science, The University of Queensland, Brisbane, Queensland, 4072, Australia^c Room 1310, Kwong Yin House, Tseung Kwan O, Kowloon, Hong Kong

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ABSTRACT

Black-eared kites *Milvus migrans lineatus* were observed 122 times over 5 days foraging from Victoria Harbour and Kowloon Bay, Hong Kong. They were found to forage significantly more in Kowloon Bay and take flight paths parallel to the shore, though over the water, at lower altitudes. Their preferential foraging suggests that their food (refuse) may be clumped and not randomly distributed. We tentatively suggest that this species might help identify refuse hotspots in Hong Kong waterways, although we have not drawn a direct link between refuse distribution and kite foraging behavior.

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Introduction

The black-eared kite *Milvus migrans lineatus* (hereafter kite) is a large diurnal raptor, in the family Accipitridae (del Hoyo and Collar 2014). It has a patchy distribution through south-east Asia and may be extending its range into Indonesia (e.g. Sukmantora et al 2009; Schellekens 2014). It is a familiar raptor commonly seen over the waterways in Hong Kong. Despite the familiarity of the species, little has been published on it in Asia. Over 100 years ago it was recorded foraging from Victoria Harbour, “At all times it may be seen hawking over the harbor at Hong Kong, picking up all sorts of floating refuse, anon such material it chiefly feeds” (Vaughan and Jones 1913).

Victoria Harbour is the waterway that separates Hong Kong Island from the mainland. The area around Victoria Harbour and Kowloon Bay is one of the most densely populated areas on Earth (Yip et al 2004). Litter in the waterways of Hong Kong has long been regarded as a serious problem (Willmott 2000). The Marine Department, Hong Kong Special Administration Region of the People’s Republic of China (hereafter Marine Department) reported

that more than 11,000 tons of litter is collected from the harbor annually (Marine Department 2011).

The purpose of this study was to quickly quantify basic foraging metrics of the kite, to construct a picture of how it utilizes Victoria Harbour and Kowloon Bay for foraging, to confirm that it does forage for floating refuse, and if kite foraging might highlight refuse hotspots. More specifically, we aimed to identify any relationship existing between the kite and floating refuse within a very short time-frame, which might be used to aid in the management of marine refuse in Hong Kong.

Materials and methods

Study area

This study was undertaken at Victoria Harbour and Kowloon Bay, Hong Kong. Victoria Harbour separates Kowloon from Hong Kong Island to the south. Observations were made from vantage points along the shore, including an elevated vantage point, at 30.6 m above ground level, at the Harbour Grand Kowloon Hotel (22° 18′ 10.01″ N, 114° 11′ 32.23″ E). The elevated vantage point was situated on the Kowloon waterfront over the reclaimed Hung Hom Bay, where Victoria Harbour meets the western side of Kowloon Bay. The vantage point provided clear vision southward to North Point (directly across the harbor), southwest to Causeway Bay, and eastward along Victoria Harbour to and beyond the eastern side of

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Kowloon Bay, towards Junk Bay. To the west, Victoria Harbour could be seen as far as the Causeway Bay Typhoon Shelter, but not Central and Wan Chai, on Hong Kong Island or Tsim Sha Tsui on the mainland. Kowloon Bay was surveyed by walking along the promenade that follows its western shore; commencing from where it adjoins Victoria Harbour, northward for 1.7 km to Hoi Sam Park. Surveys were conducted over 5 days (8–12 May, 2012); totaling 22.75 hours.

Observations

Observations were initially made by eye, then field binoculars were used for distant and detailed observations such as observing what the kites were holding, eating, or taking from the surface of the water. All observations were made in clear conditions without any visual interference from inclement weather – the days were fine and clear. Food items were recorded when observed.

The heights at which the kites flew were estimated and divided into three classes, where a story is assumed to be 2.5 m: high (≥ 10 story's = 25 m), medium (between 10 and 2 story's = 25–5 m), and low (≤ 2 story's to sea level = 5–0 m). The main flight paths taken by kites were recorded as either across, along parallel to the shore (over the water), and along the center of the waterway. Kites observed touching the water were also recorded. They were presumed to touch the water for food. Touch data were recorded in observation periods and paired with the total number of kite observations per period. These periods were variable from 0.25 hours to 6.75 hours.

Statistical analyses

An independent samples *t* test was performed to test for a difference between observations per hour at Kowloon Bay and Victoria Harbour. The numbers of kites that touched the water and their total observations per period for both sites were compared using a difference between proportions test. A χ^2 one-dimensional goodness-of-fit test was used to determine if the kites took any flight path more frequently. All analyses used computational calculators on the VassarStats computational website (Lowry 2012).

Results

Black-eared kites were observed 122 times over 25.75 hour at an average of 6.2 observations per hour, with a range of between 2 and 11 observations per hour (Table 1). Mean observations per hour were 4.8 at Victoria Harbour and 10.0 Kowloon Bay.

Food items taken from the water surface included: (1) a small fish about 5 cm long and already dead, which had been floating on the surface; (2) a small bolus (1–2 cm diameter), snatched from paper in the water; (3) a rat *Rattus norvegicus* ~ 18 cm; and (4) an

unidentified bolus, snatched and eaten. All food items were taken from the surface of the water. One kite touched two different pieces of white paper with its feet/talons, but did not pick them up. It appeared to feel them and then let them go, suggesting that it was searching them for food and did not find any.

Foraging search-height was determined in 145 observations. This number is greater than the total observations because some birds flew at different heights in a single observation. Seventy-two (50%) of observations were within two stories of the water, 55 (38%) were between 2 and 10 stories high, and 18 (12%) were over 10 stories high (Figure 1). Kites flew along the shore line, but over the water, 53% of the time (43 out of 81 observations) (Figure 2). Kites flew less often across or along the center of the waterways 23% and 15% respectively ($p < 0.001$, $\chi^2 = 15.41$, *df* 2). Kites touched the water more frequently in Kowloon Bay (14 out of 30 observations) than in Victoria Harbour (25 out of 92) ($p = 0.016$, $z = 2.141$) (Table 2).

Discussion

Litter in Hong Kong's waterways has long been an important concern (Marine Department 2011). While data on the refuse present during the study period were unavailable, data were obtained from the Hong Kong Marine Pollution Control Unit for 2011. This highlighted that 4,773 tons of floating-refuse was collected in 2011, from Victoria Harbour alone (Li Xing *in litt.*).

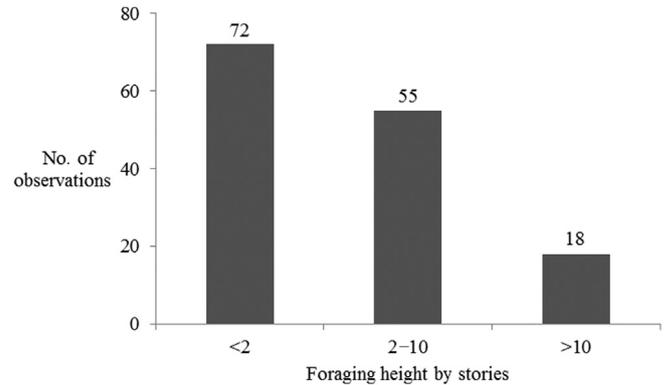


Figure 1. Numbers of black-eared kites observed foraging by height class: given as lowest <2, mid-height between 2 and 10, and highest >10 stories.

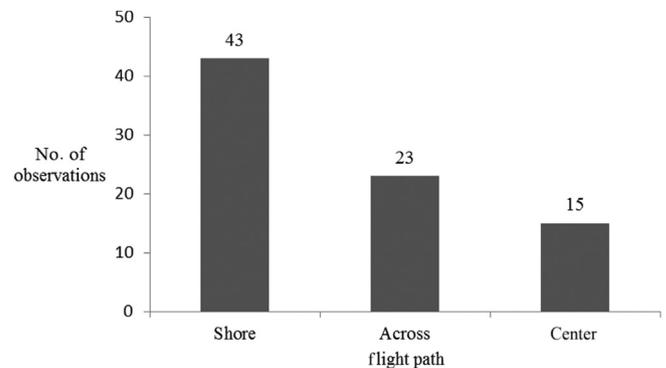


Figure 2. The main flight paths taken by black-eared kites over the study site. Shore: flew parallel to the shore though clearly over the water; Across flight path: flew across Victoria Harbour; Center: flew along the center of Victoria Harbour.

Table 1. Black-eared kite observations at Victoria Harbour and Kowloon Bay.

Victoria Harbour			Kowloon Bay			
Hour (H)	Sight (S)	S/H	Hour (H)	Sight (S)	S/H	
4	6	1.5	1	8	8	
1	2	2.0	1	11	11	
6.75	18	2.7	1	11	11	
2.75	10	3.6				
0.25	2	8.0				
1	8	8.0				
0.5	3	6.0				
6.5	43	6.6				
Totals	22.75	92	mean 4.8	3	30	mean 10

Overall mean observations/h = 6.2.

Table 2. The frequency that black-eared kites touched the water surface and the total number of observations per period.

Site	Observations	Touched
Subtotals		
Kowloon Bay	30	14
Victoria Harbour	92	25
Totals	122	39

Other studies have confirmed that black kites *M. migrans* forage close to water, and more so when urban areas meet aquatic habitats (Sergio and Boto 1999; Sergio et al 2003). Shiraishi et al (1990) found that the black-eared kite takes mainly fish, especially when the fish were dead and available as floating refuse. Galbreath et al (2014) highlighted behavioral flexibility in the species related to land-use and opportunity while reporting their natural prey as fish, thus drawing them to aquatic environments. Observations of kites, in this study, confirmed they take refuse from the water. In this study, kites manipulated floating paper to search it for food, suggesting they are adept at finding and manipulating refuse for food.

Kites preferentially foraged nearer to the shore and at lower altitudes, suggesting that more refuse is obtainable near the shore. Kites were also observed more frequently in Kowloon Bay than Victoria Harbour, despite the latter having a much greater area. This difference may result from unevenly dispersed refuse with more availability in Kowloon Bay. The greater frequency of kite activity over any waterway in Hong Kong suggests that more refuse may be found there. However, we did not correlate refuse abundance with kite abundance during our study. Yet such detailed studies are needed to determine if kites could be reliably used as indicators of refuse hotspots in Hong Kong's waterways, and/or if foraging patterns of kites might instruct where cleaning parties could concentrate their efforts.

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