

# Feeding of Wintering Black-faced Spoonbills in Hong Kong: When and How Long?

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**Abstract.**—The Black-faced Spoonbill (*Platalea minor*) has often been considered to be a mainly nocturnal feeder. The present study shows that this species is better classified as crepuscular, being predominantly active around sunrise and sunset, but they may also feed during the day and at night. The periods of twilight and the tides interact in the timing of feeding. On average, just over 4 hours per day (17%) is spent for feeding, about 19.5 h (81%) loafing and less than a half hour (1.6%) flying. Received 26 April 2003, accepted 20 July 2003.

**Key words.**—*Platalea minor*; feeding time, feeding duration, Hong Kong, China.

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The Black-faced Spoonbill (*Platalea minor*) is confined to the eastern fringe of the Asian coasts (del Hoyo *et al.* 1992; Hancock *et al.* 1992). The bird is presently considered as globally threatened (Collar *et al.* 1994; Baillie and Groombridge 1996) with less than 1,000 individuals (Dahmer and Felley 2000; BirdLife International 2001).

Spoonbills are tactile feeders (Allen 1942; Kushlan 1978) and therefore are able to feed in turbid water and during the night. Theoretically, they can feed at any time of the day, which gives them a potential feeding time of 24 h per day. However, the Black-faced Spoonbill spends many hours loafing during daytime, and this has led to the suggestion that they are primarily nocturnal feeders (Wang and Hu 1995; Leader 1998; Wang *et al.* 1999), but the suggestion of predominantly nocturnal feeding has never been substantiated by conclusive data. However, on the basis of energetic calculations, Melville *et al.* 1999 suggested that this species may need to feed at night in order to balance their energy budget.

Ueng and Kuo (1992) have reported daytime feeding in Taiwan, and we found considerable numbers of feeding Black-faced Spoonbills during daylight in South Korea, Taiwan, China, and Vietnam. These observations throw doubt on the idea that Black-faced Spoonbills are primarily nocturnal feeders. Daytime and nighttime feeding has also been noted in the Royal Spoonbill (*Pla-*

*talea regia*) (Lowe 1982), Yellow-billed Spoonbill (*Platalea flavipes*) (Vestjens 1975), Roseate Spoonbill (*Platalea ajaja*) (Allen 1942; Powell 1987), and Eurasian Spoonbill (*Platalea leucorodia*) (Aguilera 1990).

Black-faced Spoonbills have been seen feeding at all times of the day and night (Leader 1998; unpubl. data of the authors). However, locating feeding spoonbills is extremely difficult in the dark and depends on good luck, while it is easy to discover feeding spoonbills at considerable distances during daytime. Based on such field observations, it is possible to get the impression that the Black-faced Spoonbill is more a diurnal than a nocturnal feeder, but that may be not true.

Very little has been published about how much time the Black-faced Spoonbill, or any other spoonbill, spends in feeding. Feeding flocks persist from 10 to 320 minutes (C. Swennen and Y. T. Yu, unpubl. data). However, individual birds join the flock all the time, while others may stop feeding to loaf. Uninterrupted feeding by individuals ranges from seven minutes to somewhat more than one hour (C. Swennen and Y. T. Yu, unpubl. data). It is clear that it is impossible to collect sufficient field data in this way.

We have studied these problems by the use of an inverse method for calculating the timing and duration of feeding in the Black-faced Spoonbill wintering in Hong Kong. The method is based on the observation that loafing (resting, bathing, preening, social interac-

tions), feeding (trying to locate, catch and swallow a prey in shallow water) and flying are the main activities of Black-faced Spoonbills outside the breeding season. Therefore, the time that birds are not loafing or flying can be considered as the feeding time.

#### MATERIALS AND METHODS

The study was conducted in the Deep Bay area in the northwest of the New Territories, Hong Kong SAR (Fig. 1) in the wintering seasons of 1998-99 and 1999-2000. Black-faced Spoonbills were counted as feeding and non-feeding birds.

The Mai Po Nature Reserve is the main loafing site in the Deep Bay area and also provides limited feeding opportunities when the ponds in the reserve are drained. In the reserve, spoonbills were counted every two hours from 07.00 h to 19.00 h on the days of the new moon, first quarter, full moon and last quarter between November and April in 1998-99 and 1999-2000, in 1998-99 also on the day before and after these moon days (total 73 days). Less frequently, the birds were counted at night every three hours from 20.00 h to 05.00 h, mostly at full moon, but three times at other moon phases (in total 13 nights). Light from the moon and reflection of lights of surrounding towns by clouds helped us to locate the birds in the reserve at night.

At three feeding locations, two intertidal areas and one drained pond, systematic observations were gathered in which feeding and non-feeding birds were separately counted. (1) Between 2 January and 23 April 1999, a wide intertidal mudflat at a distance of 2-3 km from the loafing site in Mai Po was surveyed from the jetty of Tsim Bei Tsui. The birds were counted every 20 minutes between dawn and dusk on 13 days at the same day as the counts at Mai Po. (2) In the winter 1999-2000, eleven sites were surveyed for numbers of feeding and non-feeding spoonbills along the seven km coastline between Ha Pak Nai and Tsim Bei Tsui at 07.00 h, 09.00 h and 11.00 h over 13 days. Here they feed on a narrow intertidal flat at a distance of 4-11 km from the Mai Po loafing site. The selected days were at the first and last quarter of the moon, which gave low tides in the morning. (3) Between 19 to 28 November 1999, feeding and non-feeding birds were counted daily every hour from 06.00 h to 19.00 h and every two hours from 21.00 h to 05.00 h during the draining of a large pond about 1 km from the main loafing site.

#### RESULTS

Peak numbers of wintering Black-faced Spoonbills in 1998-99 and 1999-2000 were 152 and 164 respectively, but the number in the daily peaks varied between consecutive days

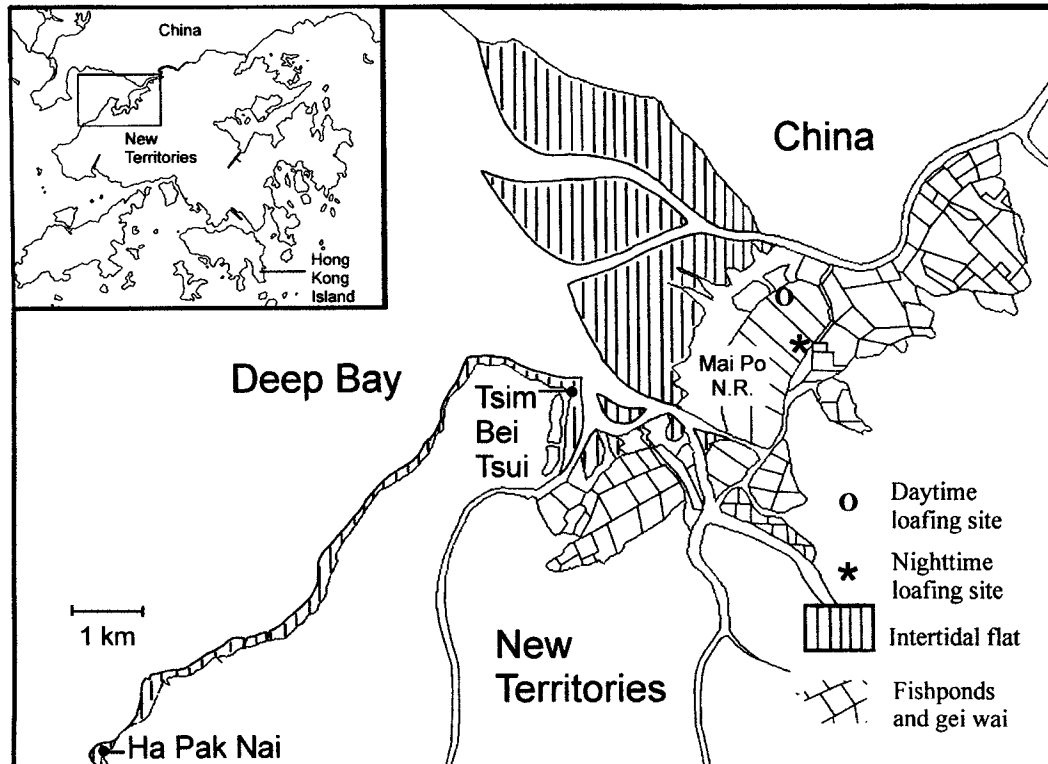


Figure 1. Map of the study area in the northwest New Territories of Hong Kong Special Administrative Region, with the names used in the text.

and over the season. Therefore, the numbers of loafing spoonbills in any time counted were transformed into percentages of the daily peak number for analyses. Numbers of loafing Black-faced Spoonbills in Mai Po showed a general pattern with a peak in the late morning or early afternoon. A similar pattern was found during the night, when numbers of loafing birds peaked after midnight. A plot of mean hourly percentages of the daytime or night peaks clearly shows two wide peaks and two dips every 24 h (Fig. 2). Calculation of the mean presence in the Mai Po loafing sites over the day shows that 74% of the time the birds were loafing at Mai Po, thus 26% of the time the birds were absent (Table 1).

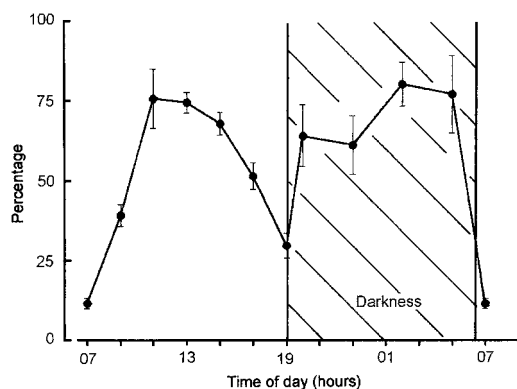
Feeding Black-faced Spoonbills were found as far as Ha Pak Nai, about 12 km from the Mai Po resting sites (Fig. 1). The observations at the feeding areas showed that the birds were not constantly feeding. Besides preening and bathing, which often occurred after a period of feeding, the birds often formed a resting group. This occurred when they experienced a low feeding success for 10-15 minutes in tidal water and they waited for better feeding opportunities (C. Swennen and Y. T. Yu, unpubl. data), and when they took paused after catching a few large

fish. Notwithstanding that the observations were conducted in different habitats and at different intervals, the percentages of time spent in feeding showed high similarity (Table 2). The outcome is that on average only 70% of the time was spent on feeding when the birds are at a feeding site.

## DISCUSSION

The large proportion of Black-faced Spoonbills loafing during daytime agrees with earlier observations of Leader (1998), Wang and Hu (1995) and Wang *et al.* (1999). However, peak numbers loafing are present only for a relatively short time, indicating that not all individuals are loafing during the whole day. This is corroborated with the fact that birds were found feeding on intertidal flats and in drained fishponds at times when all birds were not at loafing sites in Mai Po. The average peak in the graph (Fig. 2) does not reach 100%, because the time of the individual peaks varied on both sides of noon, depending on the time of high tide (Swennen 2000). Of particular note is the discovery of large numbers of loafing Black-faced Spoonbills at night. Loafing at night had been overlooked in earlier studies, probably because few or no birds used the daytime loafing sites at night, and the birds used more concealed sites during darkness. Not all birds were at the loafing site during the night, which agrees with observations of Black-faced Spoonbills feeding at night (Wang and Hu 1995; Leader 1998). The shape of the graph (Fig. 2) suggests that fewer birds are feeding during the night than during the day.

The two sharp dips in the number of loafing birds at Mai Po indicate the existence of two main potential feeding periods: one around 07.00 h and the other around 19.00 h, which correspond to sunrise and sunset during winter in Hong Kong. Our results reject the suggestion that the Black-faced Spoonbill is primarily a nocturnal feeder (Wang and Hu 1995; Leader 1998; Melville *et al.* 1999; Wang *et al.* 1999). The species is better classified as a crepuscular feeder. It may also actively and successfully feed during the day and the night, possibly more so during



**Figure 2.** Proportion (% of the daily maximum) of Black-faced Spoonbills (mean  $\pm$  1 SE) loafing at Mai Po during daytime (07.00 h-19.00 h; 73 days) and during the night (20.00 h-05.00 h; 13 nights) in the winters 1998-99 and 1999-2000. The shaded area indicates the period between average sunset and sunrise. Note that in the graph 07.00 h is repeated for clarity. The intervals between counts were 2 h during daytime and 3 h during the night. In winter sunrise is between 06.15 h and 07.15 h, and sunset between 17.38 h and 18.38 h.

**Table 1. Proportion (mean %·hr<sup>-1</sup>) of Black-faced Spoonbills loafing in the Mai Po Nature Reserve during daytime and darkness. Day and night values are separately calculated over the day peak (100%) and the night peak (100%), in view of the difference in peak numbers and time intervals [73 series of counts in daytime (07.00 h-19.00 h) and 13 series at night (20.00 h-05.00 h)].**

Day							Night				Mean	
Hour	07	09	11	13	15	17	19	20	23	02	05	
%	15	52	100	99	90	68	37	80	77	100	96	74

the day than during the night. It can be concluded that two natural cycles, the light (this paper) and the tidal cycle (Swennen 2000) play a prominent role in the timing of feeding in the Black-faced Spoonbill, with the light factor dominating.

The tides provide opportunities for feeding on intertidal flats, where small fish and shrimps migrate from deeper water into the shallows during the incoming tide and then retreat when the water level falls. During the twilight period, more shrimps and several species of fish move into open shallows than when the sun is high (Helfman 1993; Vance 1999), which is likely to make feeding at that time more successful. The time of twilight depends on the sun, but the time of the tides depend largely on the moon. When their positive effects coincide or overlap, the effect is strengthened, and when they do not coincide their effects on the feeding times are damped. The negative effect of high tide on feeding success is somewhat balanced by the use of fishponds, especially while the negative effect of midday is probably neutralized by the choice of highly turbid water (Yu and Swennen 2004).

According to Kushlan (1978), white dorsal plumage makes diurnal wading birds conspicuous to congeners, while a white ventral plumage makes them less conspicuous to un-

der water prey during daylight. Both fit with the gregarious feeding on fish and shrimps by the Black-faced Spoonbill during daytime and twilight. However, it should be noted that Tickell (2003) found conflicting results about the benefits of white or partial white plumage in birds.

The average presence of loafing birds at Mai Po was 74%. This means that 26% of the time the birds are absent (Table 1). During that time the birds could be flying, feeding or loafing elsewhere. Flying occurs between loafing and feeding sites and between feeding sites. Feeding occurs in an area of up to 12 km from the loafing site of Mai Po, but most feeding occurs within a radius of 1-3 km. We have adopted 4 km as the “average” feeding range, taking into account some changes in feeding sites in the feeding period (Yu and Young 1999). Our unpublished observations gave a mean flying speed of 42 km/h<sup>-1</sup> for Black-faced Spoonbills at Mai Po. The distance and speed suggest that on average 23 min per day is spent in flying between the main loafing site in Mai Po and the main feeding grounds in the surroundings. This leaves 351 min on the feeding grounds, where about 30% of the time is used for loafing or waiting for a good feeding opportunity (Table 2) and about 70% for feeding, i.e. 246 min or about 4 h per day.

**Table 2. Feeding activities of Black-faced Spoonbills at feeding sites in Hong Kong.**

Locality	Days	Period	Counting interval	N scans	N spoonbills	N feeding	% feeding
Intertidal flat at Tsim Bei Tsui	13	Daytime	20 minute	399	1886	1359	72.1
Intertidal flat between Ha Pak Nai - Tsim Bei Tsui	11	Low tide	1-3 per low tide	24	552	394	71.4
Drained pond	3.75	Day and night	1 hour	54	900	578	64.2
Total					3338	2331	69.8

**Table 3. Mean time per day spent in the three main groups of activities of Black-faced Spoonbills wintering in the Deep Bay area, Hong Kong.**

	Loafing at central sites	Loafing at feeding sites	Total loafing	Feeding	Flying
Time per day	17 h 43 min (1063 minutes)	1 h 47 min (107 minutes)	19 h 30 min (1170 minutes)	4 h 7 min (247 minutes)	23 min (23 minutes)
Percentage of 24 h	73.8%	7.4%	81.2%	17.2%	1.6%

In the foregoing calculations, the average is given without confidence limits because that would suggest a higher accuracy than was possible. Not all averages were of data collected throughout the wintering period. It can be expected that total feeding time varies over the season, for example by changes in the temperature or the need for storing energy prior to migration. The average time spent per day in the various activities is summarized in Table 3.

The above result differs considerably from the preliminary estimate of feeding time of 6-14 h per day by Melville *et al.* (1999). However, their estimates were based on a calculation with assumptions for the daily requirements of the birds, and on prey size and energy values of the prey. Vestjens (1975) followed two Yellow-billed Spoonbills for eight hours and found that the birds fed for about 7 h, but the other data presented by this author do not suggest that such long times are normal.

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