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### Habitat Use of the Black-faced Spoonbill

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**Abstract.**—The Black-faced Spoonbill (*Platalea minor*) uses habitats that are intertidal or within 2-3 km from tidal areas for feeding and loafing. Habitats used for feeding are water bodies containing fish and shrimps and a relatively wide zone of shallow water with a depth ranging between 6 and 21 cm. The bottom consisted of fine sediments with no or little vegetation or other obstructions such as stones, twigs, branches and roots of trees, wide and deep channels, or debris. They have a preference for highly turbid water, but seemed indifferent to salinity, which was varied between 0‰ and 48‰. Such sites are found on flooded intertidal mudflats, and also in tidal lagoons, brackish pools, fishponds, and gei wai (traditional ponds for shrimp farming in mangrove areas). Feeding habitats have to contain suitable food and also be relatively safe. In contrast with the requirements for their feeding habitats, the choice of loafing areas is extensive, and includes places of relative safety: undisturbed, with an open view for early discovery of predators in time and the possibility of easy escape. Shallow (<15 cm) water is necessary for bathing. They loaf in water of a depth of 0-15 cm and also on land, in trees and on human-made structures. Habitat characters, other than water, are subordinate to those of safety. The difference in requirements is evident in narrow channels between high and dense vegetation where Black-faced Spoonbills feed, but where they never loaf. Received 26 April 2003, accepted 30 September 2003.

**Key words.**—*Platalea minor*, Black-faced Spoonbill, East Asia, habitat, feeding, loafing.

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The Black-faced Spoonbill (*Platalea minor*) is the smallest and rarest of the six spoonbill species in the world. Its distribution is confined to east Asia, where they mainly breed around the Yellow Sea (Kernerly 1990; del Hoyo *et al.* 1992; Hancock *et al.* 1992). They are migratory and winter along the east Asian coast, from Cheju, the southern island of Korea to the delta of the Red River in the north of Vietnam (Dahmer and Felley 2000). The species is globally threatened (Collar *et al.* 1994; Baillie and Groombridge 1996) with less than 1,000 individuals in the world (Dahmer and Felley 2000; BirdLife International 2001).

When not nesting or migrating, the main activities of spoonbills can be classified as loafing, feeding, and flying between loafing and feeding sites. Loafing includes resting, sleeping, digesting, bathing, preening, and social interactions (Amlaner and Ball 1983; Bacon 1985). For practical reasons, loafing is used

outside of the breeding period for all activities that are not classified as feeding or flying. Feeding involves activities directed towards making contact with a prey item, catching and swallowing it. The average time spent in loafing, feeding, and flying in Hong Kong has been estimated as 1,170, 247 and 23 min per day, respectively (Yu and Swennen 2004).

The habitat requirements have been described in detail for the Roseate Spoonbill (*P. ajaja*) (Allen 1942; Dumas 2000), Royal Spoonbill (*P. regia*) (Vestjens 1975; Lowe 1982), and Yellow-billed Spoonbill (*P. flavipes*) (Vestjens 1975). The habitat of the Black-faced Spoonbill has been described in general terms as tidal flats, estuaries, and fishponds (Hancock *et al.* 1992; del Hoyo *et al.* 1992). Leader (1998) noted that those wintering in Hong Kong feed in drained fishponds and gei wai. [Gei wai (singular and plural) are traditional pond(s) for shrimp farming in mangrove areas. They are filled via a sluice during

a high tide for letting in seawater with shrimp larvae and are drained for harvesting during a low tide]. In Taiwan, they loaf on intertidal flats and shallow water and feed in estuaries and fishponds (Lee *et al.* 1995).

We have studied the habitats used by Black-faced Spoonbills for feeding and loafing in several sites over their whole distribution area and describe the main characteristics in the present paper. Our study is a part of a project aimed at collecting ecological information for drafting a conservation management plan for the species in Hong Kong, in line with the action plan for recovery of the species (Severinghaus *et al.* 1995).

#### STUDY AREAS

The study sites include the three main wintering areas and a locality where the Black-faced Spoonbill congregate before their autumn migration (Fig. 1). Feeding and resting habitats were studied in the following countries, sites, and periods:

1. *Vietnam*: The Xuan Thuy Nature Reserve Ramsar Site in the delta of the Red River was studied in December 1999. Up to 43 birds were present during our visit of 6-18 December 1999.
2. *China*: The Mai Po and Inner Deep Bay Ramsar Site and the surrounding intertidal flats and fishponds in the northwest of Hong Kong were studied throughout the 1998-99 and 1999-2000 winters. In the same period, the Futian National Nature Reserve in Shenzhen, and the intertidal mudflats of Macau were also visited, but less regularly. This complex is the second largest wintering concentration, with peak numbers

of 250 birds during our study periods between November 1998 and April 2000.

3. *Taiwan*: The wintering area at Chi-ku, near Tainan was studied in December 1999 and March 2000. It is the largest wintering concentration with peak numbers of 465 birds.
4. *South Korea*: An area along the south coast of Kanghwa Island was studied in September 2000. Up to 150 Black-faced Spoonbills were present.

#### METHODS

In all areas, local naturalists were interviewed about their knowledge of sites in their area where spoonbills had been seen feeding or resting, and all sites were visited. Notes were made of each habitat in which we saw Black-faced Spoonbills feeding or loafing. Positions of sites and the distances between them were determined with the help of a GPS (Garmin 12XL). Most details noted were depth, temperature, salinity and transparency of the water, whether it was tidal or non-tidal, the amount and type of vegetation, and the substrate. Water depth was measured with a ruler or estimated with the help of the known measurements of the birds (Table 1). Temperature of the water was read from a digital thermometer (Johnson, USA), salinity was determined with a hand refractometer (Atago, Japan), and transparency measured with a mini secchi disc.

Specific measurements of morphological characteristics of the Black-faced Spoonbill were taken on ten live specimens caught in Hong Kong (with a permit from the Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government) for a migration study (Anonymous 1999).

Density of loafing spoonbills was determined in five 25 sq. m (5 m × 5 m) squares, which were marked in shallow water areas. When birds used the area between the posts, photographs were taken of the birds from a high observation tower near the pond, and the numbers of loafing spoonbills counted within the squares from the photographs.

#### RESULTS

##### Feeding Habitat

Black-faced Spoonbills were seen feeding only in shallow water on intertidal flats in sheltered estuaries, in tidal lagoons, and in non-tidal, man-made habitats such as fishponds, gei wai, ditches and canals. Non-tidal habitats in which Black-faced Spoonbills were seen feeding were all within 2-3 km of tidal water. In none of the areas was feeding seen further inland or reported by local observers.

The feeding sites had no or only a modest growth of submerged, emergent, or floating plants. However, a few times prey was caught after a pursuit in marginal emergent

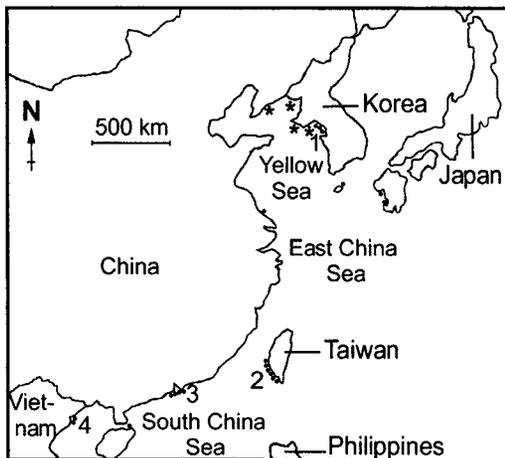
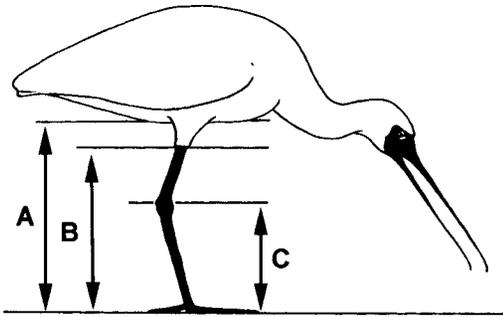


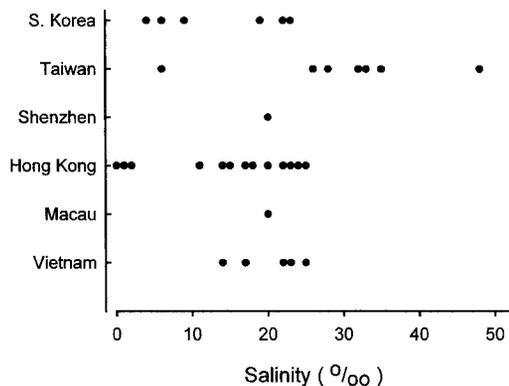
Figure 1. Distribution of the Black-faced Spoonbill. The breeding area is indicated with asterisks and the survival areas are shown with dots. Study sites: 1 Kanghwa, 2 Tainan, 3 Deep Bay, 4 Red River delta.

**Table 1.** Measurements (mm) taken from live Black-faced Spoonbills caught and released in Hong Kong in 1998 and 1999.

Water surface reaching to:	Mean (mm)	SD	Range (mm)	N
A Belly	225.0	22.6	170-255	10
B Trousers (feathers on tibia)	194.1	16.4	160-220	10
C Ankle (intertarsal joint)	130.2	14.7	105-155	10
Bill length	181.7	13.0	163-207	22



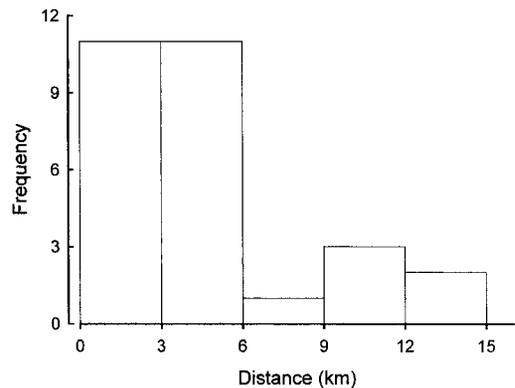
plants or an isolated clump of plants. Salinity levels of the water varied between 0‰ and 48‰, and in most localities the water was brackish (Fig. 2). The water was nearly always very turbid and secchi depths were usually less than 15 cm, indicating that the bottom could usually not be seen from the surface (Fig. 3). The turbidity was mostly due to suspended sediment or detritus, but sometimes caused by a dense concentration of microplankton or material brought into suspension by movements of fish and feeding birds. The water in most sites probably became more turbid while the birds were feeding.

**Figure 2.** Salinity of the water in the feeding habitats of Black-faced Spoonbills.

During our observations, the water temperature was 18-23°C (September) in Korea, 13°C (December) and 21-27°C (March) in Taiwan, 11-28°C (October-April) in Hong Kong and 16-20°C (December) in Vietnam.

All feeding sites had a bottom of mud, fine sandy-mud or muddy sand. Water with similar sediments, but with dense vegetation of submerged higher plants or algae, littered with twigs and branches of mangrove trees, or densely covered by deep nest-craters of large Tilapia (*Oreochromis* sp.) were avoided. Shallow water in front of exposed sand and pebble beaches or rocky shores, and inundated reed beds and mangrove woods were not visited for feeding. However, small open areas, ditches and canals in reed beds and mangrove woods were occasionally used.

Feeding depth ranged from 5-25 cm, and most feeding was in 8-16 cm deep water. The depth range corresponds to feeding in water in which the widest part of the bill was just submerged and feeding in water in which the feathers of the belly were touching the water surface (Table 1). All food items were caught in the water column. Terrestrial or

**Figure 3.** Frequency distribution of distances between feeding and loafing sites of Black-faced Spoonbills in the studied sites.

aerial feeding was never noted, although birds standing on dry land were seen taking solid objects in their bills and even made swallowing movements. This kind of “playing” was always with inedible materials.

### Loafing Habitats

The distance between loafing and feeding sites ranged up to 14.4 km (Taiwan: Tsengwen Estuary) and 12 km (Hong Kong: Mai Po), but most feeding in Hong Kong occurred within 6 km of the loafing site and the average distance was only 3.2 km (Fig. 3). The area occupied by loafing birds was always considerable less than the available space. The birds were more crowded at rest than during bathing and extensive preening. Counts of birds within marked areas in Mai Po gave (mean and SD) values of  $0.36 \pm 0.30$  birds<sup>-2</sup>, with a median of 0.3 and a maximum of 1 (N = 37).

The loafing sites could be classified in several ways: tidal or non-tidal, natural (intertidal flats and lagoons) or man-made (gei wai and fishponds), and in water or on land. Another classification was into short-lasting loafing sites that usually bordered a feeding site, and persistent sites that might be at some distance from feeding sites.

The loafing sites in water in non-tidal areas included gei wai and aquaculture ponds (Mai Po, Xuan Thuy), and brackish and freshwater fishponds (Kanghwa Island, near the Tsengwen River estuary, in and near Mai Po). The non-tidal loafing sites were all within two kilometers of tidal water. Loafing sites in water were usually at water depths of <12 cm (below “ankle”). Secchi values were often over 15 cm, and usually the bottom could be seen from the surface (Fig. 4). Intertidal loafing sites were found on mudflats (Deep Bay, Xuan Thuy, Kanghwa Island) and in tidal lagoons (Mai Po, Tsengwen estuary). The birds frequently walked to higher levels when the tide was rising and to lower levels when the tide went out. In the Tsengwen estuary, this resulted in walking about 1 km and then back again during a long loafing period.

Loafing sites above water level were found on the floors of drained gei wai and aquacul-

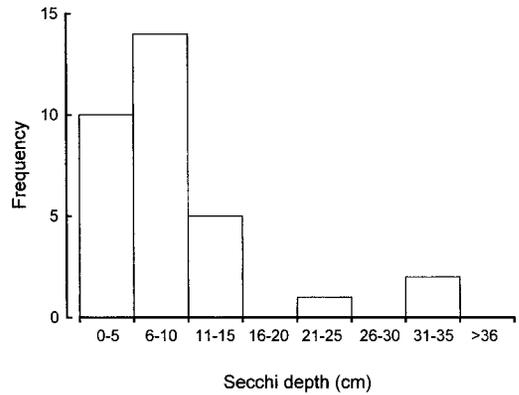


Figure 4. Turbidity (Secchi disk values) of the water in the feeding habitats of Black-faced Spoonbills.

ture ponds (Mai Po, Xuan Thuy), on dykes and dams in or between ponds or gei wai (Mai Po, Xuan Thuy, Kanghwa Island). Emerged rocks (Kanghwa, Futian), and the tops of mangroves and other trees (Futian, Mai Po) were used, as was a man-made platform in an abandoned fishpond (near Mai Po).

The Black-faced Spoonbills loafed on various substrata: submerged mud and fine mud, emerged wet soft mud, dry, cracked mud, sandy mud, stones, rocks, trees, and man-made structures of wood and metal wire mesh. They loafed most frequently on totally bare areas or in low (1-7 cm high) vegetation. Trees used for loafing were 3-5m in height, growing in or just at the side of water; the birds stood or sat on the top or in the higher branches. The variation made it difficult to describe a loafing habitat in terms of physical or biological characteristics, any place seemed suitable that was open and in or near shallow water. Moreover, the various loafing areas were as far as possible from high walls and high vegetation that could facilitate potential predators to make an unnoticed approach. The daytime, non-tidal loafing sites in Mai Po differed from those used during the night. This was related to differences in human disturbances during the day (groups visiting the reserve along a path) and during the night (border patrols along the border road). The distance between the two loafing sites was about 650 m. The physical characters of both sites were the same, but at night the birds remained in the water and never stood on bare islands or trees.

## DISCUSSION

## Feeding Habitat

Spoonbills feed tactily by swinging their bills over a wide arc in water while slowly walking (Kushlan 1978; del Hoyo *et al.* 1992). This feeding method confined the usable water depth to that deep enough to immerse the widened, distal part of the bill and that shallow enough for walking (Table 1). The birds needed a bottom that was flat or gradually sloping and largely free of obstructions. High turbidity of the water is an important factor, reducing the chance that potential prey can see the searching spoonbill and escape. Turbidity may be enhanced by the criss-cross walking of individuals in a group of feeding spoonbills. The presence and density of food items are also of importance, but this was not studied.

The habitats which best match the above requisites are intertidal flats in sheltered bays and estuaries. Tidal movements always bring mud in suspension into the shallow areas, and schools of shrimps and small fish move in with the rising tide to feed on the flats, pulling back to deeper water with the falling tide. However, the obligatory narrow depth range needed by the birds becomes severely reduced in bad weather with relatively high waves action. Therefore, besides large intertidal flats, alternative areas are needed which are better sheltered, such as channels in salt marshes or mangroves, lagoons, and brackish pools. Nowadays, most of these alternative habitats have been lost by reclamation, but their function has been replaced by ditches in embankments, gei wai and fishponds. The feeding conditions in these man-made alternative sites largely depend on the management, such as lowering of water levels for harvesting. Even at large intertidal flats, only a small zone, which moves with the tides, is available for feeding due to the narrow suitable depth range.

## Loafing Habitat

In contrast with feeding, loafing occurred in a wide variety of habitats. Any substrate on which they can stand is suitable when it is in

or near water for bathing, but the site must be difficult for a predator to approach. The unifying characteristic of the loafing sites seemed to be related to risk of predation.

When loafing in water, the preferred depth was below the ankle, presumably because it was easier and quicker to become airborne to escape predators. The differences between the daytime and the night loafing sites in Mai Po are clearly related to differences in the frequency of disturbances. The usual daytime site is in view of the road along the border fence (erected to prevent humans illegally crossing the border). The birds are rarely disturbed here during daytime; visitors are infrequent and can be seen from a distance. At night, however, spotlights illuminate the fence, and the Hong Kong police frequently patrol along the fence and drive vehicles close to the area. The night loafing site is farther inland and near a path on which many persons visit the reserve and its education center during daylight. Therefore daytime disturbances are frequent in this site. No visitors are allowed to enter Mai Po at night and so no human disturbance occurs then. Moreover, the lights from other areas are not visible to the birds because trees and reed screen the pond.

Lee *et al.* 1995, Wang and Hu 1995 and Wang *et al.* 1999 have reported that in Taiwan most Black-faced Spoonbills leave the daytime loafing site around sunset to feed and return after sunrise. However, it seems not to have been checked if they return in the dark after feeding, or that they loaf on another site at night. That they need the whole night for feeding is unlikely in view of the results of the research in Hong Kong (Yu and Swennen 2004).

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