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EVIDENCE FOR A FALL RAPTOR MIGRATION PATHWAY ACROSS THE SOUTH CHINA SEA

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ABSTRACT.—While conducting seabird surveys along the cruise track of the Soviet oceanographic Research Vessel **Akademik Korolev** in the South China Sea in late October, 1988, we encountered about 150 land birds, including about 40 raptors. Most of the raptors were small accipiters, but we also recorded small numbers of Peregrine Falcons (*Falco peregrinus*) and Oriental Scops Owls (*Otus sunia*). We saw most of the raptors during a 3-day period in a restricted area ca 350 km southeast of the southern tip of the Indo-China Peninsula. The observations suggest that a significant raptor migration corridor exists between Viet Nam and Borneo. The behavior and body condition of the diurnal raptors suggest that they were in good health and were making extensive use of the ship for perching, roosting, and hunting.

Evidencia de una ruta de migración otoñal de aves de rapiña atravesando el Mar del Sur de China

EXTRACTO.—Mientras conducíamos un estudio de las aves marinas en la ruta de la embarcación soviética de investigación oceanográfica **Akademik Korolev,** en el Mar del Sur de China a finales de octubre de 1988, hemos hallado 150 aves de tierra, incluyendo 40 aves de rapiña. La mayoría de estas últimas han sido pequeños gavilanes (*Accipiter* spp.), pero también hemos registrado unos cuantos halcones peregrinos (*Falco peregrinus*) y buhos (*Otus sunia*). Hemos observado la mayoría de las aves de rapiña durante un período de tres días en una área restringida, aproximadamente a 350 km al sudeste del extremo sur de la Península Indochina. Las observaciones sugieren que existe una ruta de significativa migración de este tipo de aves entre Viet Nam y Borneo. Por la conducta y condiciones físicas de estas aves de rapiña diurnas concluimos que éstas se encontraban con buena salud y hacían uso extensivo de la embarcación para posarse, para dormir, y para cazar.

[Traducción de Eudoxio Paredes-Ruiz]

The most noteworthy areas where birds of prey aggregate during fall migration are in Middle America, Europe, and the Middle East (Kerlinger 1989). Except for the Straits of Malacca (Robinson 1927), migration corridors for raptors in eastern Asia are poorly known (Wetmore 1926, Delacour 1947, McClure 1974, Medway and Wells 1976); however, important flights for non-raptors are known from Japan and eastern China south through the Philippine Islands, with another corridor down the Malay Peninsula (McClure 1974, Medway and Wells 1976).

Evidence for raptor migration across the South China Sea is very limited. Biologists from the Chinese Academy of Science and the Beijing Natural History Museum (Anon. 1974) encountered unspecified numbers of two species of raptors among 44 species of land birds noted during 1974 surveys of the islets in the northern South China Sea (outside our study area). Recently Simpson (1983a, 1983b) encountered hundreds of migrant land birds and raptors of three species at the Tembungo oil platform, west of the northern tip of Borneo (Fig. 1) during the fall migration of 1981. His most commonly observed raptor, the Japanese Sparrowhawk (*Accipiter gularis*), was seen regularly from late September to mid October. Although Simpson reported his observations as evidence of a passage directly over the South China Sea, his location near Balabac Strait suggests that the migrants he observed were moving south and west from the Philippines. McClure (1974) asserts that many migrants enroute to Borneo through the Philippines fly west from Palawan, then south to Borneo. More recently, however, Simpson (Wells, pers. comm. and in press) provided more conclusive evidence for a direct South China Sea crossing by migrant land birds. He reported a substantial fall movement of land birds (36 species) including at

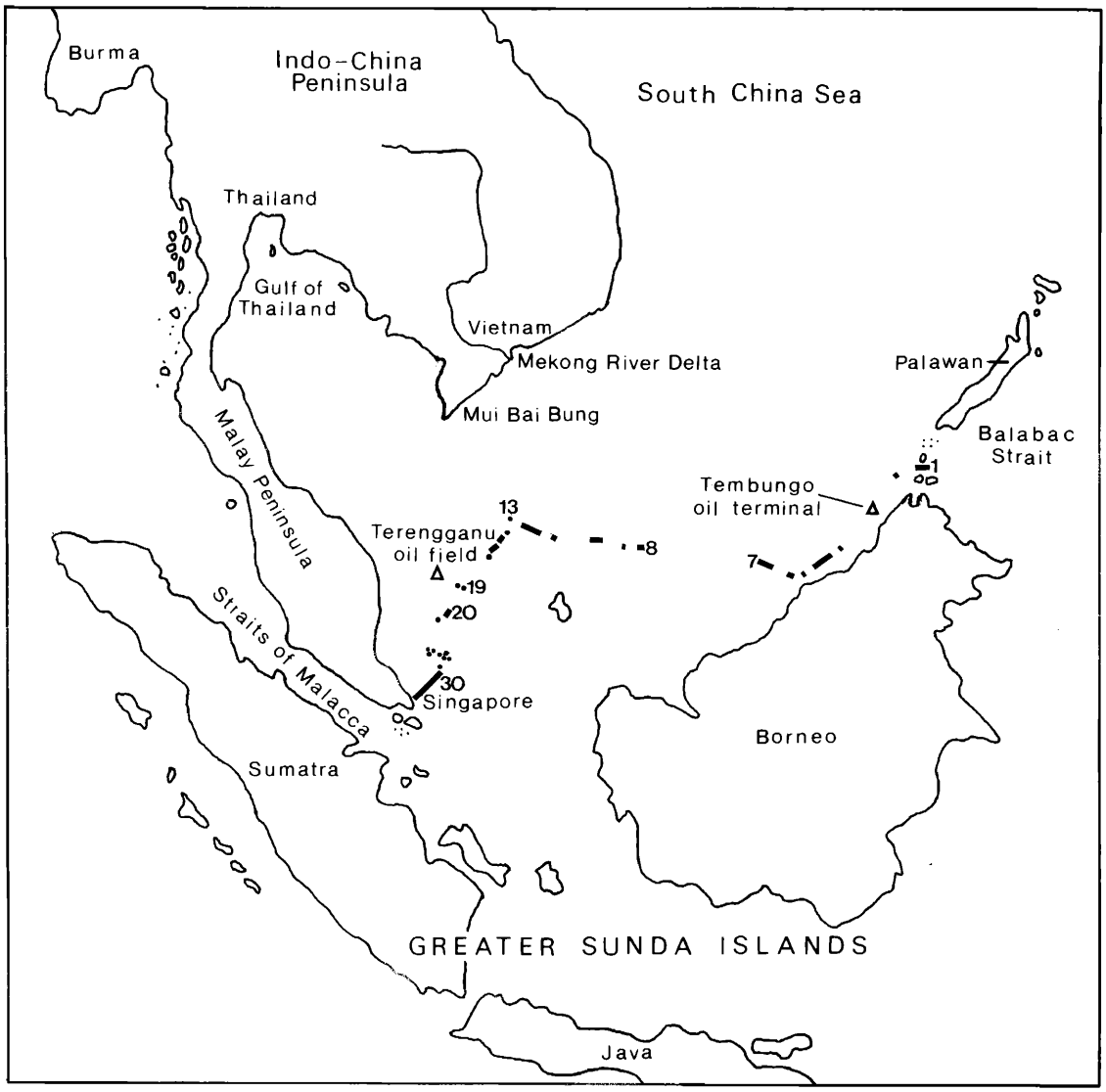


Figure 1. Geography of the southern half of the South China Sea showing bird survey locations. Numbered segments are bird survey locations for **R.V. Akademik Korolev,** 23–31 October 1988.

least two species of diurnal raptors and the Oriental Hawk-owl (*Ninox scutulata*) from the Terengganu oil field (05°25′N, 105°13′E, Fig. 1). This location is approximately 200 km east of the Malay Peninsula.

The geography of the land masses surrounding the South China Sea form three natural funnels that should concentrate migrant raptors into three primary corridors. First, migrants moving south from Burma and western Thailand should flow onto the Malay Peninsula. Many of those in eastern China could "island-hop" south through the Philippines, and those moving south into the Indo-China Peninsula would naturally converge south of the Mekong River delta on Mui Bai Bung cape. From the Indo-China Peninsula, those traveling overland must fly north and west into Thailand. Those capable of a short oversea migration could fly southwest toward

Table 1. Raptor and other land bird counts along **R. V. Akademik Korolev** cruise track in the South China Sea, October 1988.[1,2]

TAXON OR GROUP	MINIMUM COUNT	CONSERVATIVE COUNT
Segments 1–7 (Oct. 23–24) Balabac Strait and offshore Borneo		
Raptors	0	0
Non-raptors	1	1
Segments 8–19 (Oct. 25–29) South-central South China Sea		
Raptors:		
Accipiter sp.	19	30
Eagle/kite	1	1
Peregrine Falcon	3	3
Oriental Scops Owl	2	2
Non-raptors:		
Barn Swallow	14	29
Other non-raptors	27	31
Segments 20–30 (Oct. 29–31) Near southern tip of Malay Peninsula		
Raptors:		
Accipiter sp.	3	3
Oriental Scops Owl	0	1
Non-raptors:		
Barn Swallow	5	10
Other non-raptors	9	10
Totals for Segments 1–30 (Oct. 23–31)		
Raptors:		
Diurnal raptors	26	37
Owls	2	3
Non-raptors:		
Barn Swallows	19	39
Other non-raptors	37	42

[1] Because accurate bird counts were sometimes difficult to obtain for stationary watches (i.e., some birds remained aboard ship for an extended period), we report both the minimum number of birds observed (based on subtractive values) and a conservative number (based primarily on new arrivals). The actual number is believed to be about 20% higher than the conservative count.

[2] Cruise track segment locations are illustrated in Figure 1.

the Malay Peninsula. Those capable of a long overwater passage could fly south toward Borneo and the other Greater Sunda Islands. Except for birds encountering the Natuna Islands, this route would require a single crossing of more than 800 km.

The first two routes, down the Malay Peninsula and island hopping through the Philippines, are important corridors for fall migrants (Wetmore 1926, McClure 1974, Ng 1978). In addition, McClure (1974) and Hails (1987) present maps showing a minor pathway extending southwest from Indo-China across the Gulf of Thailand to the Malay Peninsula. However, none of these authors report the pooling of migrants on the tip of the Indo-China Peninsula or any other likely point of departure north of the South China Sea. For raptors, we lack published evidence for routes south or southeast from the Indo-China Peninsula directly across the South China Sea. The only published suggestion of such a raptor migration corridor is Simpson's (1983a) observations of small numbers of diurnal raptors (3 species) and 1 or 2 individual owls near the northeastern tip of Borneo and, therefore, on a migration route already recognized by McClure (1974) as important in the passage of birds, not across the South China Sea to Borneo, but through the Philippines to Borneo.

STUDY AREA AND METHODS

We observed raptors and other migrant land birds during our 23–31 October 1988 indirect passage (Fig. 1) from the Balabac Strait (southwestern Philippine Islands) to Singapore, on the Soviet Research Vessel **Akademik Korolev** (7000 tons, 124 m length). We provide greater detail on the non-raptors in a companion paper (Ellis et al., in press). While the ship was in transit, we observed birds during dawn to dusk watches from the flying bridge of the ship (12 m above sea level). During the 3-day period while the ship was anchored or drifting without power (Fig. 1, station 13; 06°01′N, 106°55′E), we conducted walking inspections (usually at half-hour intervals) during daylight hours and searched the ship each night by flashlight to count roosting raptors.

Juveniles of several species of small Asian accipiters are extremely difficult to identify. For this reason, we grouped all of those we visually observed as "small juvenile accipiters". However, four were captured by hand, two while roosting on the ship's rigging. We used wing formulae and size (King and Dickinson 1975) to tentatively classify them.

RESULTS AND DISCUSSION

During our 9-day passage through the South China Sea, we encountered about 150 land birds, including 40 raptors (28 by minimum count; Table 1). Almost all were Asian migrants that winter (at least in part) south of the South China Sea. Most of the land birds, and nearly all of the raptors (Table 1), visited the ship during the 3-day period while we were anchored or drifting (Fig. 1, station 13) south of Indo-China. The presence of these birds at this location suggests that they were in passage across the South

China Sea from Indo-China to the Greater Sunda Islands. The low numbers for raptors seen before arriving at, and after leaving, this location (Table 1) reinforces the hypothesis that this spot lies on a rather narrow migratory corridor. However, Simpson's (Wells, in press) 1982 observations from the Terengganu oil field (Fig. 1) suggest that the pathway may be wider than we detected. The fact that few birds were observed while in transit may reflect a tendency to avoid moving ships. Of all land birds seen (Table 1), a high proportion (over 30%) were raptors. Most were small accipiters, but three were peregrine falcons. We also encountered one eagle/kite and two to three Oriental Scops Owls, including one that died on board (USNM No. 607190).

Most of the accipiters were juveniles. Four of these were captured and identified by wing formulae (King and Dickinson 1975): three as Japanese Sparrowhawks (No. 1: tail 116.4 mm, wing chord L 161 mm, R 159 mm; No. 2: 128 g, tail 121 mm, wing chord L 180.5 mm, R 180 mm; No. 3: tail 114.6 mm, wing chord L 164 mm, R 164 mm) and one as a Shikra (*Accipiter badius*) (129 g, tail 130 mm, wing chord L 186 mm, R 185 mm). All four were in good flesh and flew well upon release. Because Shikras are not believed to migrate over the South China Sea (Brown and Amadon 1968) and were unreported by Simpson (1983a, and D. R. Wells, pers. comm.) for other regions of the South China Sea, we present our identifications as tentative.

However, adult accipiters are distinguishable in the field: we identified two as male Japanese Sparrowhawks and one that was clearly seen as a male Shikra. In addition, although we know of no evidence for migratory movements of the Crested Goshawk (*Accipiter trivirgatus*), we clearly observed two nearby birds (Fig. 1, station 13). The bold, high contrast, ventral barring and streaking, left little doubt that they were adults of this species. However, both birds were observed only in flight, so we had little opportunity to and failed to see the diagnostic occipital crest.

The number of birds we encountered (Table 1) is small when compared with record counts for well-known migrant concentration areas elsewhere around the world. However, our visit was brief and probably too late for detecting the peak of the accipiter migration. Simpson (1983a) reported his highest counts for Japanese Sparrowhawks near northeastern Borneo around 10 October. Further, migrating raptors are most often counted where local topography encourages them to aggregate. By contrast, we were on the open sea where birds are less likely to concentrate. Considering these factors and Simpson's (Wells, in press) observations, it seems likely that adequate spatial and temporal sampling will reveal thousands of accipiters and a few other raptors moving south from Indo-China across the South China Sea.

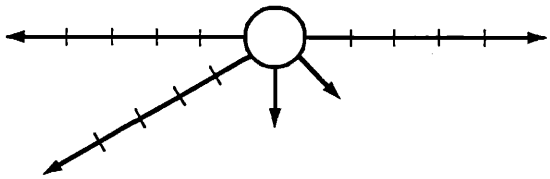
Although our records and Simpson's (Wells, in press) 1982 observations are sufficient to demonstrate that a considerable raptor migration crosses the South China Sea, we should mention two alternate hypotheses that may explain the presence of the birds we observed. First, our passage occurred when Typhoon Ruby was ravaging the Philippine Islands (Anon. 1989). Some of the birds we observed may have been forced out to sea or shunted away from their normal migration route by the storm. The storm hypothesis may also explain our anomalous observations of "non-migratory" Shikras and Crested Goshawks and migratory Oriental Scops Owls 350 km from land.

A second alternate hypothesis is that some of the raptors were not in passage at all, but were foraging at sea during the fall land bird migration (see Kerlinger 1989 for pertinent references). During the 3-day waiting period (Fig. 1, station 13), we recorded raptors perching for extended periods, roosting nightly on the ship, and engaging in at least 21 hunting forays (Table 2). Of 14 forays for which the outcome was known, 13 (93%) were successful. Some accipiters even used the ship's deck lights to forage at night. We gathered remains of 20 prey during the 3-day period. Two species, the Barn Swallow (*Hirundo rustica*) and the Brown Shrike (*Lanius cristatus*) suffered heavy mortality from predation. Of at least 14 Barn Swallows observed from 25–29 October, at least 7 were recovered as prey. Even more significant, at least 5 of at least 6 Brown Shrikes became prey. Simpson's (1983a and Wells, in press) observations of raptor behavior at both oil fields led him to conclude that Japanese Sparrowhawks were hunting and "commuting between nearby rigs." Our observations confirm that the raptors were opportunistically using our stationary ship for perching, roosting, and hunting. When the ship was under power, however, none of the raptors perched for long and none roosted on the ship.

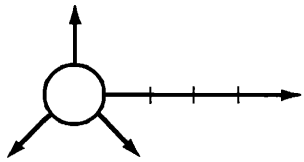
Flight direction for the raptors and other birds may give additional evidence for each hypothesis. If migrating while avoiding the typhoon, birds would

Table 2 Predation episodes and prey remains aboard **R. V. Akademik Korolev**, South China Sea 27-29 October 1988

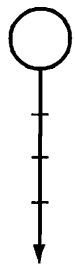
Date	Time	Predator	Prey	Capture Attempts: Observed	Capture Attempts: Success	Comments
27	0625	Juv. *Accipiter*	Barn Swallow (*Hirundo rustica*)	+	+	Hawk captured swallow on foredeck, then flew into wheelhouse.
27	0705	Juv. *Accipiter*	Small bird	−	+	Hawk arrived on ship with prey.
27	0945	Juv. *Accipiter* (same as 0625)	Gray Nightjar (*Caprimulgus indicus*)	+	+	Less than 1 min after nightjar arrived on ship, it was captured by hawk, but thereafter it probably escaped or fell into sea.
27	1532	Juv. Peregrine Falcon	Reed Warbler (*Acrocephalus* sp.)	+	+	Falcon attacked as warbler approached ship, then devoured it on communications antenna.
27	1538	Juv. Peregrine Falcon	Brown Shrike (*Lanius cristatus*)	+	+	Same falcon captured reed warbler only 6 min earlier.
27	1605	Ad. male Shikra	Barn Swallow	+	+	Swallow captured over stern, then carried ca. 0.4 km to sea with Parasitic Jaeger (*Stercorarius parasiticus*) in pursuit. Jaeger and hawk bound together and whirled into water. After ca. 7 sec in water, hawk rose and flew away.
27	1720	Ad. Japanese Sparrowhawk	Barn Swallow	−	+	Hawk flushed from feather pile on stern.
27	1805	Juv. Peregrine Falcon	3 small passerines	+	−	Passerines seen ca. 0.5 km at sea flying toward ship. Falcon left perch on communications antenna and pursued them, but returned without prey.
27	2130a	Juv. *Accipiter*	Small passerine	+	+	Hawk captured prey on bow using decklights.
27	2130b	Juv. *Accipiter*	Small passerine	+	+	Hawk captured prey on bow using decklights.
27	2145	Juv. *Accipiter*	Barn Swallow	+	+	Hawk captured prey on bow using decklights.
28	0805	Ad. Japanese Sparrowhawk	Brown Shrike	−	+	Hawk flew with prey to platform on mast. We recovered prey remains later in day.
28	0900	Juv. *Accipiter*	Size of Brown Shrike	−	+	Hawk, believed to be same bird, left ship, then returned 25 min later with prey.
28	0945	Juv. *Accipiter*	Prob. Barn Swallow	+	+	Hawk left ship, captured prey, returned to elevated platform to devour prey.
28	1023	Juv. *Accipiter*	Prob. *Ficedula* sp.	−	+	Hawk observed feeding on elevated platform above stern.
28	1023	Juv. *Accipiter*	Brown Shrike	−	+	Hawk arrived on ship with prey.
28	1400	Juv. *Accipiter*	Barn Swallow	−	+	Hawk observed with prey.
28	1752	Ad. Japanese Sparrowhawk	Barn Swallow	+	+	Hawk captured swallow above stern.
28	1813	Juv. *Accipiter*	Brown Shrike	+	+	Shrike captured and eaten on the flying bridge.
28	1823	Juv. *Accipiter*	Barn Swallow	+	+	Hawk stooped from perch in rigging and captured swallow circling ship.
29	0651	Juv. *Accipiter*	Brown Shrike	+	+	Hawk captured shrike over water and returned to bow to eat.



A. Accipiters (N = 17)



B. Passerines and Swifts (N = 7)



C. Barn Swallows (N = 4)

Figure 2. Arrival and departure directions for birds seen on cruise track segments 8–19 of **R.V. Akademik Korolev,** 26–29 October 1988.

probably have been heading southwest. If in passage from a concentration zone on the Indo-China Peninsula to Borneo, they should have been traveling southeast to encounter our vessel. If wintering at sea, there would likely be no consistent orientation for arriving or departing birds. In Figure 2, there is no clear east-west directional trend in arriving or departing flights. However, although the data are few, a pronounced southward tendency is evident. In constructing Figure 2, we eliminated bearings for birds seen on cruise track segments 1–7 and 20–30 because these segments were near enough to land (within 100 km) that the birds' direction of flight would likely have been influenced by sight or sign of nearby land. Flight bearing also could have been influenced by the presence of the ship. It was evident from the relaxed attitude of two of the falcons and many of the accipiters while perching and roosting on the ship, and their behavior while hunting from the ship, that these birds may have slowed or interrupted their own southward passage to forage from ships, oil platforms or other stationary structures in the South China Sea. For these birds, it would be interesting to learn departure times and ultimate destinations.

An assessment of the magnitude of this migratory pathway must await additional field work. September–November surveys of raptors staging at Mui Bai Bung cape and within 100 km off shore to the south and southeast should reveal the magnitude of this movement. Documentation of the magnitude and duration of foraging at sea by falcons and hawks would be revealed by periodic spot checks from anchored ships, other stationary platforms, and/or on the Natuna Islands between Viet Nam and Borneo.

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