A FALL LAND BIRD MIGRATION ACROSS THE SOUTH CHINA SEA FROM INDO-CHINA TO THE GREATER SUNDA ISLANDS[1]

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(With two text-figures)

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We encountered 150 land birds representing 14 families along the cruise track of the Soviet Oceanographic Research Vessel *AKADEMIK KOROLEV* in the South China Sea. We saw most of these birds during a 3-day period in a small area *c.* 350 km southeast of the southern tip of the Indo-China Peninsula. These observations suggest that a significant land bird migration corridor crosses the South China Sea from Viet Nam to Borneo.

INTRODUCTION

Until 1960, migration corridors for eastern Asia were poorly known (Wetmore 1926, Delacour 1947, McClure 1974, Medway and Wells 1976), but important flights have recently been discovered: one extends south from Japan and eastern China through the Philippine Islands, and another corridor passes down the Malay Peninsula (McClure 1974, Medway and Wells 1976). A less important passerine migration pathway crosses the Gulf of Thailand from Indo-China to the Malay Peninsula (McClure 1974).

Evidence for a land bird migration corridor across the South China Sea is very limited. Biologists from the Chinese Academy of Science and the Beijing Natural History Museum (Anon. 1974) noted 44 species of land birds during 1974 surveys of the islets in the northern two-thirds of the South China Sea (outside our study area). More recently, Simpson (1983a; b) encountered hundreds of migrant land birds at the Tembungo offshore oil drilling platform near the northeastern tip of Borneo during the fall migration of 1981. 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 likely moving south and west from the Philippines. Further, McClure (1974) asserts that many migrants passing through the Philippines enroute to Borneo fly west from Palawan then south to Borneo. More recently, Simpson (Wells pers. comm. and 1990) reported a substantial fall movement of land birds (36 species) in the Terengganu oil field (*c.* 05°25' N, 105°13'E, see Fig. 1). Although this location is only *c.* 200 km east of the Malay Peninsula, Simpson's records provide the best evidence to date of a direct South China Sea crossing for migrant land birds.

The geography of the land masses surrounding the South China Sea seem to create three natural funnels that should concentrate migrant land birds into three primary corridors. First, migrants moving south from Burma and western Thailand should flow onto the Malay Peninsula. Second, many of those in eastern China could island-hop south through the Philippines, and third, those moving south into Indo-China would naturally converge south of the Mekong River delta on Mui Bai Bung cape. From the Indo-China Peninsula, birds travelling overland must fly north and west into Thailand before proceeding south, while those capable of a relatively short oversea migration can fly southwest toward the Malay Peninsula. Those adapted for long over-water passage could fly south toward the distant land masses of Borneo and the other Greater Sunda Islands.

The first two routes (i.e. down the Malay Peninsula and island-hopping through the Philippines) are known to be important corridors for fall migrants (Wetmore 1926, McClure 1974, Ng 1978). In addition, McClure (1974) and Hails (1987) portray a minor pathway for land birds extending from Indo-China across the Gulf of Thailand to the Malay Peninsula. McClure (1974) also mentions a fall passage of Willow Warblers (*Phylloscopus* sp.) across the South China Sea to

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Sarawak (Borneo) without offering details on their point of origin north of the sea. Further, Ng (1978) presents evidence for a Barn Swallow *(Hirundo rustica)* migration from mainland China to the Philippines. Finally, McClure (1968 *in* McClure 1974) illustrated a coastal migration route from Taiwan to northern Viet Nam, thence south crossing the South China Sea to Borneo. However, none of these authors report the pooling of migrants on the tip of Indo-China or at any other point of departure north of the South China Sea. The only published suggestion of such a migration corridor is Simpson's (1983a) observations of sizable movements of land birds near the northeastern tip of Borneo, not far southwest of Palawan. This location, however, lies 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

In this report, we present observations of migrant land birds encountered during our 23-31 October 1988 indirect passage (Fig. 1) from Balabac Strait to Singapore on the Soviet Research Vessel AKADEMIK KOROLEV (Ellis *et al.* 1992). While in transit, we observed birds during dawn-to-dusk seabird surveys from the flying bridge (12 m above sea level). During a 3-day period while the ship was anchored or drifting without power (Fig. 1, station 13; 06° 01' N, 106° 55' E), we conducted periodic walking inspections of the ship (usually at half-hour intervals) and searched the ship each night by torch to count roosting birds. Five raptors and several Barn Swallows were captured by hand (primarily during these nightly tours) and examined for physical condition.

Results And Discussion

During our 9-day passage, we encountered *c.* 150 land birds (121 by conservative count, 84 minimum count; Table 1) representing 14 Families. Almost all were migrants that winter (at least in part) south of the South China Sea. Most of these birds (104 by conservative count) arrived on the ship during the 3-day period while we were stationary (Fig. 1, station 13) *c.* 350 km southeast of the southern tip of Indo-China. The presence of land birds at this location suggests that these birds were in passage across the South China Sea from Indo-China to the Greater Sunda Islands. The low bird counts seen before arriving at and after leaving this location (Table 2) strongly suggests that this spot lies on a rather narrow migratory corridor. Alternately, birds may be reluctant to approach a moving vessel. Simpson's (Wells 1990) 1982 observations, made in the Terengganu oil field (Fig. 1) very near our cruise track, suggest that he was sampling the same corridor we visited; if so, the pathway may be somewhat wider than we detected.

The number of birds we observed (Tables 1 and 2) is small when compared with record counts for well-known migration pathways. However, our visit was brief and probably too late for detecting the bulk of migrating land birds. Simpson's (1983a) dates for 6 of 9 frequently encountered land birds near northeastern Borneo fell before the time of our visit, and, just as important, migrating land birds most often aggregate where land and water configurations encourage them to collect (e.g. on north or south projecting peninsula). By contrast, we were on the open sea where birds are much less likely to concentrate. Considering these factors, it seems likely that adequate spatial and temporal sampling will reveal many thousands of land birds moving south from Indo-China across the South China Sea.

Although our records and Simpson's (Wells 1990) 1982 observations demonstrate that a sizable migration is probably normal across the South China Sea, we should mention an alternate hypothesis that may help explain the presence of these birds where and when we observed them. First, our passage occurred when Typhoon Ruby was ravaging the Philippine Islands (Anon. 1989). Although we did not encounter heavy seas or strong winds, some of the birds we observed may have been forced out to sea, if non-migratory, or shunted away from their normal migration route, if migratory, by the storm.

TABLE 1
LAND BIRD TOTALS FOR R.V. AKADEMIK KOROLEV CRUISE TRACK SEGMENTS AND STATIONARY WATCHES IN THE SOUTH CHINA SEA, OCTOBER 1988

Date	Station / Segment[2] Number	Length (Km)	Duration of Obs. (min.)	No. Land Birds Observed[1] Raptors Min.	Raptors cons.	Non-raptors Min.	Non-raptors Cons.	All land birds Min.	All land birds Cons.
23	1	38	88	0	0	0	0	0	0
	2	15	45	0	0	0	0	0	0
24	3	6	17	0	0	0	0	0	0
	4	67	158	0	0	0	0	0	0
	5	14	44	0	0	0	0	0	0
	6	19	48	0	0	0	0	0	0
	7	49	109	0	0	1	1	1	1
25	8	22	50	0	0	0	0	0	0
	9	3	11	0	0	0	0	0	0
	10	30	67	0	0	0	0	0	0
	11	17	38	0	0	0	0	0	0
	12	63	143	0	0	4	4	4	4
26-28	13	ca 0	912	22	30	32	44	54	74
28	14	ca 0	43	1	1	0	0	1	1
	15	22	10	0	0	0	0	0	0
	16	26	78	0	0	0	0	0	0
	17	ca 0	195	1	4	4	8	5	12
29	18	ca 0	105	1	1	1	4	2	5
	19	ca 0	20	0	0	0	0	0	0
	20	25	62	0	0	0	1	0	1
	21	ca 0	80	0	0	0	0	0	0
30	22	ca 0	23	1	1	3	3	4	4
	23	ca 0	110	0	0	2	4	2	4
	24	ca 0	25	0	0	0	1	0	1
	25	ca 0	95	0	1	3	3	3	4
	26	ca 0	54	0	0	0	0	0	0
	27	ca 0	52	0	0	3	5	3	5
	28	ca 0	30	1	1	0	0	1	1
31	28	ca 0	15	0	0	0	0	0	0
	29	ca 0	15	0	0	0	0	0	0
	30	135	280	1	1	3	3	4	4
Totals			3,022	28	40	56	81	84	121

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

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

TABLE 2

MINIMUM AND CONSERVATIVE LAND BIRD COUNTS ALONG CRUISE TRACK OF R.V. AKADEMIK KOROLEV IN THE SOUTH CHINA SEA, 23-31 OCTOBER[1, 2]

Species	Segments 1-7 (Oct. 23-24) Min. (Cons.)	Segments 8-19 (Oct. 25-29) Min. (Cons.)	Segments 20-30 (Oct. 29-31) Min. (Cons.)
Small juv. accipiter (*Accipiter* ap.)	0 (0)	14 (24)	3 (3)
Ad. Japanese Sparrow-hawk (*Accipiter gularis*)	0 (0)	2 (2)	0 (0)
Ad. Shikra (*A. badius*)[3]	0 (0)	1 (2)	0 (0)
Ad. Crested Goshawk (*A. trivirgatus*)[3]	0 (0)	2 (2)	0 (0)
Eagle/Kite (Accipitridae)	0 (0)	1 (1)	0 (0)
Peregrine Falcon (*Falco peregrinus*)	0 (0)	3 (3)	0 (0)
Oriental Scops Owl (*Otus sunia*)[4]	0 (0)	2 (2)	0 (1)
Chinese Pond Heron (*Ardeola bacchus*)	0 (0)	0 (0)	3 (3)
Watercock (*Gallicrex sinerea*)	0 (0)	1 (1)	0 (0)
Dove (*Streptopelia* sp.)[3]	0 (0)	1 (1)	0 (0)
Grey Nightjar (*Caprimulgus indicus*)	0 (0)	1 (1)	1 (1)
Fork-tailed Swift (*Apus pacificus*)	0 (0)	4 (4)	0 (0)
Swift (Apodidae)	0 (0)	2 (2)	0 (0)
Dollarbird (*Eurystomus orientalis*)	1 (1)	0 (0)	0 (0)
Barn Swallow (*Hirundo rustica*)	0 (0)	14 (29)	5 (10)
Swallow (*Hirundo* sp.)	0 (0)	1 (1)	0 (0)
Ashy Minivet (*Pericrocotus divaricatus*)[4]	0 (0)	1 (1)	1 (1)
Lanceolated Warbler (*Locustella lanceolata*)[4]	0 (0)	1 (1)	1 (1)
Great Reed Warbler (*Acrocephalus arundinaceus*)	0 (0)	1 (1)	0 (0)
Warbler (*Acrocephalus* sp.)	0 (0)	1 (2)	1 (1)
Arctic Warbler (*Phylloscopus borealis*)	0 (0)	0 (0)	1 (1)
Flycatcher (*Ficedula* sp.)	0 (0)	2 (2)	0 (0)
Brown Shrike (*Lanius cristatus*)	0 (0)	6 (6)	1 (1)
Unidentified passerines or remains	0 (0)	5 (8)	0 (1)
Totals	1 (1)	66 (96)	17 (24)

[1]Cruise track segments and stations are illustrated in Fig. 1 and described in Table 1.

[2]Abbreviations in column headings are: Min. (minimum count) and Cons. (conservative count) as explained in Table 1, Footnote 1.

[3]Because these birds are considered non-migratory, these identifications should be treated as tentative. All are based on nearby visual observations aided by 10 x binoculars, but without photographic or other substantiation.

[4]Individuals of these species were deposited in the U.S. National Museum: Oriental Scops Owl, USNM No. 607190: Ashy Minivet, USNM No. 607193; and Lanceolated Warbler, spirit specimen (not assigned numbers at USNM).

TABLE 3
PHYSICAL CONDITION AND MIGRATORY STATUS OF LAND BIRDS ARRIVING ON R.V. AKADEMIK KOROLEV, 25-29 OCTOBER 1988, SOUTH CHINA SEA[1,2]

		Mobility Classes[4]				
Physical Condition[3]	Taxon (Number)	Known Migrant	Known Over-water Migrant[5]	Known Colonizer of Islands	Known Straggler to Islands	Comments
Good	Japanese Sparrow-hawk (*Accipiter gularis*) (2)	+	-	-	-	Common migrant.
Good	Shikra (*A. badius*) (2)	+	-	-	-	Western population is highly migratory; eastern population migratory in Malasia.
Good	Crested Goshawk (*A. trivirgatus*) (2)	-	-	-	-	Non-migrant throughout range.
Good	Peregrine Falcon (*Falco peregrinus*) (3)	+	+	+	+	
Fatigued	Watercock (*Gallicrex cinerea*) (1)	+	-	-	-	Winters in Greater Sunda Islands and Celebes; very few records as straggler.
Good	Dove (Streptopella sp. (1)	-	-	-	-	
Emaciated	Oriental Scops Owl (*Otus sunia*) (1)	+	-	-	-	
Good	Grey (Jungle) Nightjar (*Caprimulgus indicus*) (1)	+	+	-	+	Strongly migratory, scatters across Malasia in winter.
Good	Fork-tailed Swift (*Apus pacificus*) (4)	+	-	-	-	A few migratory stragglers recorded as far east as Marshall Islands.
Good	Barn Swallow (*Hirundo rustica*) (29)	+	+	-	+	Winters throughout region and tropics world wide.
Fatigued	Ashy Minivet (*Pericrocotus divaricatus*) (1)	-	-	-	-	Winters on larger islands of Indonesia, but not on islands separated by large bodies of water.
Fatigued	Lanceolated Warbler (*Locustella lanceolata*)	+	-	-	-	Winters in Greater Sunda Islands.
Good	Great Reed Warbler (*Acrocephalus arundinaceus*) (1)	+	+	-	+	Common migrant in Indonesia.
Good	Brown shrike (*Lanius cristatus*) (6)	+	+	-	-	Common migrant to Greater Sunda Islands; recorded in Palau.

[1]Data are included only for that portion of the cruise track (stations 8-19) where the ship was far (over 100 km) from land.

[2]Assignment to mobility class (i.e., regular migrant over land and overlarge bodies of water, colonizer of distant land masses and islands as a breeding bird, straggler either on migration or as a resident) is at best tentative for some species, but was largely made from information in Brown and Amadon (1968), Clements (1978), King and Dickinson (1975), Medway and Wells (1976), and Pratt *et al.* (1987).

[3]Physical condition was reported Good, if bird flew well and was adept at avoiding capture by hand; Fatigued, if readily captured by hand; and Emaciated, if sternum was sharply protruding upon capture.

[4]Symbols in these columns: + = yes, - = no.

[5]Those species scored as + in this column are known to regularly cross large bodies of water (> 500 km) on migration.

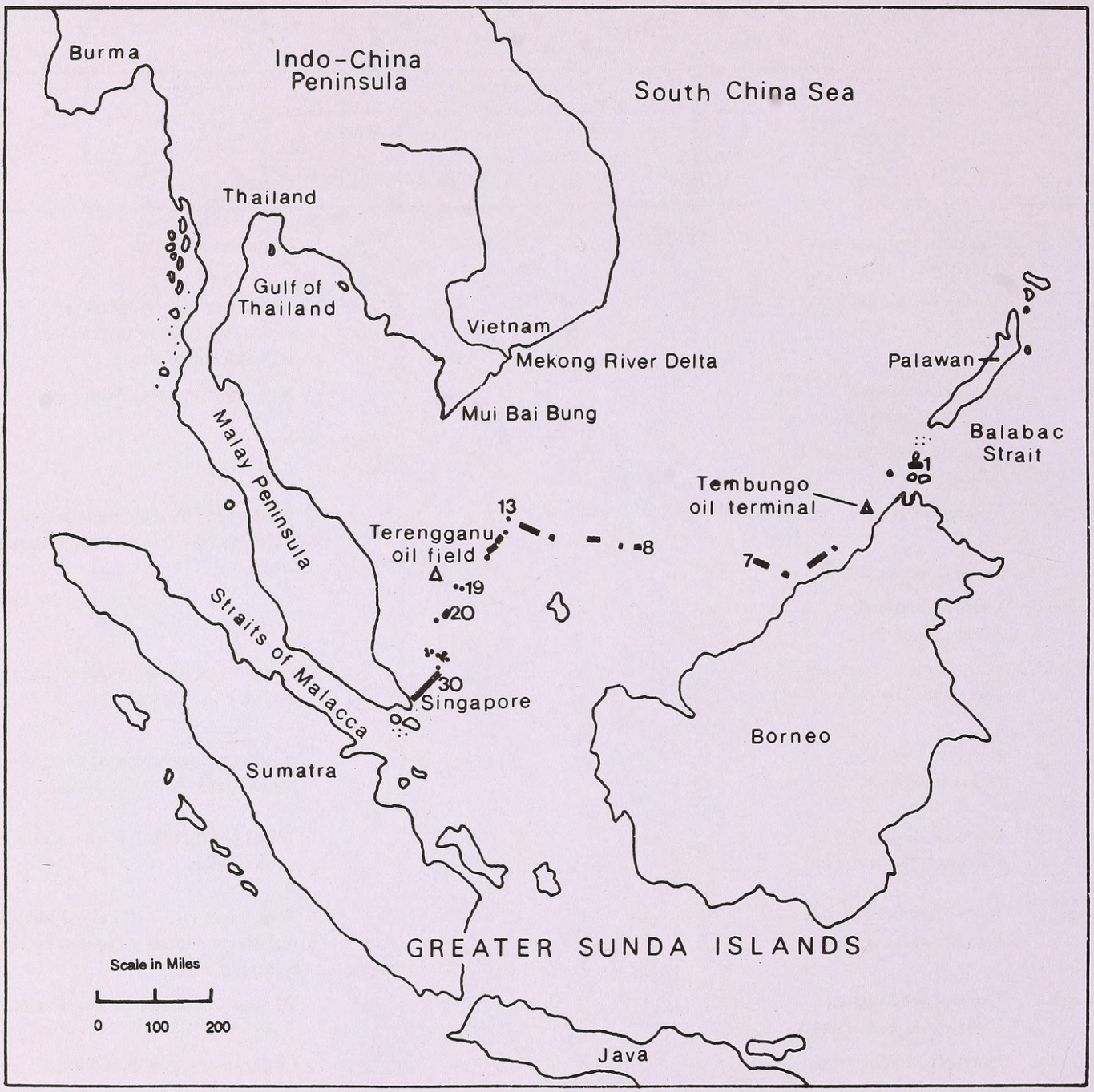

Fig. 1. Geography of the southern half of the South China Sea showing bird survey locations. Numbered segments are bird survey locations for *R.V. Akademik Korolev*, 23-31 October 1988.

However, most of the birds we observed far from land (Table 3) are known to be strong migrants. The four hawks tentatively identified as Shikras (*Accipiter badius*) and Crested Goshawks (*A. trivirgatus*), and the dove (*Streptopelia* sp.) are the only real surprises although a few others in Table 3 would not be expected this far from land.

Flight direction may give some indication of the likelihood of either hypothesis. If the birds were displaced migrants, they would probably have been heading southwest (i.e. away from the storm). If in passage from a concentration zone on the Indo-China Peninsula to Borneo, they should have been heading southeast to encounter our vessel. If, as we observed, the raptors (33% of all land birds) were foraging at sea (Ellis *et al.* 1990) rather than

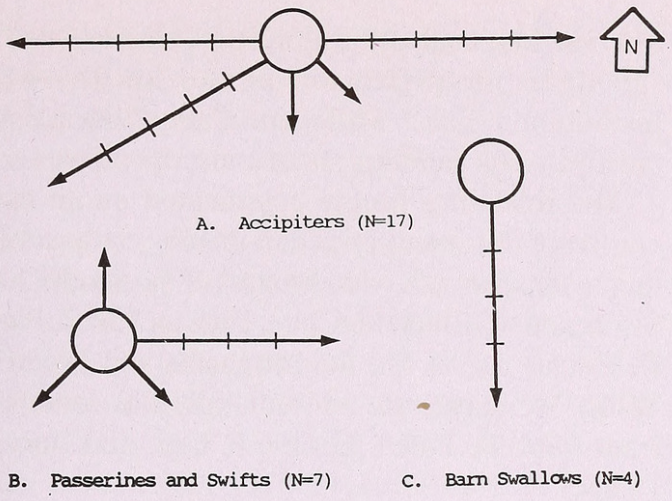

Fig. 2. Arriving and departing flight directions for birds seen on cruise track segments 8-19 of R.V. *Akademik Korolev*, 26-29 October 1988.

migrating, there would likely be no consistent trend in their flight direction. In Fig. 2, there is no clear east-west trend in arriving or departing flights. However, although the data are very few, a strong southward component is evident. In constructing Fig. 2, we eliminated directional readings for birds seen on cruise track segments 1-7 and 20-30 because these segments were near enough to land (i.e. within 100 km) that the birds' flight directions would probably have been influenced by sight or sign of nearby land. In addition, flight bearing could have been influenced by the presence of the ship.

Physical condition of the birds we observed may also be an indicator of the regularity with which this migration route is used. If a high proportion of the known overseas migrants were in good body condition this far from land, it is more tenable to suppose that these species regularly use this route. In Table 3, our best estimate of physical condition is compared for all species encountered far from land. We know from handling a few captives, and infer from the energetic flight of others, that the raptors and the Barn Swallows at station 13 were in good physical condition. For the other species, too few individuals were present to draw firm conclusions, but all individuals of most species appeared to be in good condition.

A final hypothesis may explain the presence of some of the raptors. Many of these were opportunistically foraging at sea. 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. 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 prey remains during the 3-day period consisting of at least 20 kills. Two species, the Barn Swallow and the Brown Shrike (*Lanius cristatus*) suffered heavy mortality from predation. Of 14 Barn Swallows (minimum count) observed from 25-29 October, at least 7 turned up as prey. Even more significant, 5 of 6 (minimum count) Brown Shrikes seen during the same 5-day period were observed as prey. Simpson's (1983a and Wells 1990) observations of raptor behavior at both oil fields led him to conclude that Japanese Sparrowhawks (*Accipiter gularis*) 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 moving under power, however, none of the raptors perched for any extended period and none roosted on the ship.

From all available evidence, it seems most likely that the birds we encountered were a small part of what must be a sizable wave of fall migrants on their way across the South China Sea. The configuration of the land masses suggests that the point of departure for these birds was the southern tip of Indo-China; however, further land-based research is needed to substantiate the point of origin and destination of birds crossing the South China Sea to Borneo. Additional work at sea will also be helpful in determining the timing and magnitude of the migration, as well as corridor width. Work on islands in the South China Sea or stationary platforms may substitute in part for the at-sea studies, but it is important to examine birds on arrival in the Greater Sunda Islands to determine body condition. Intensive banding operations in Viet Nam, at sea, and in Borneo could reveal much about survival rates and all other aspects of this little known migration route.

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REFERENCES

ANONYMOUS (1974): Report of the Zoological Survey of the Islands of the South China Sea. *ACTA Zoologica Sinica 20(2):* 113-130.

ANONYMOUS (1989): Marine Weather Review. *Mariners Weather Log 33(2):* 40-50.

BROWN L. & D. AMADON (1968): Eagles, Hawks and Falcons of the World. Country Life Books, London.

CLEMENTS, J.F. (1978): Birds of the World: a Check List. Two Continents Publishing Group, New York.

DELACOUR, J. (1947): Birds of Malaysia. Macmillan Co., New York.

ELLIS, D.H., A.K. KEPLER & C.B. KEPLER (1990): Evidence for a Fall Raptor Migration Pathway Across the South China Sea. *J. Raptor Res. 24:* 12-18.

ELLIS, D.H., A.K. KEPLER & C.B. KEPLER (1992): Evidence for a Major Fall Land Bird Migration Corridor Across the South China Sea from Indo-China to the Greater Sunda Islands. Pp. 247-252. *In:* P.A. Nagel (ed.). Results of the First Joint US-USSR Central Pacific Expedition (BERPAC), Autumn 1988. US Fish and Wildlife Service, Washington, D.C.

HAILS, C. (1987): Birds of Singapore. Times Editions, Singapore.

KING, B.F. & E.C. DICKINSON (1975): A Field Guide to the Birds of South-East Asia. Houghton Mifflin Co., Boston.

MCCLURE, H.E. (1974): Migration and Survival of the Birds of Asia. U.S. Army Medical Component, SEATO Medical Project, Bangkok, Thailand.

MEDWAY, LORD & D.R. WELLS (1976): Birds of the Malay Peninsula, Vol. V. Witherby, London.

NG, SOON CHYE (1978): Migratory Barn Swallows (*Hirundo rustica*) in the South China Sea. *Malayan Nature J. 32:* 67-73.

PRATT, D.H., P.L. BRUNER & D.G. BERRETT (1987): The Birds of Hawaii and the Tropical Pacific. Princeton Univ. Press, Pinceton, N.J.

SIMPSON, D.M. (1983a): Autumn Migration of Landbirds off North Borneo in 1981. *Sea Swallow 32:* 48-54.

SIMPSON, D.M. (1983b): Birds Seen at the Tembungo Gas Flare, North Borneo During the Development of Typhoon 'Clara.' *Sea Swallow 32:* 82-83.

WELLS, D.R. (1990): Malayan Bird Report: 1982 and 1983. *Malayan Nature J.* 43(3): 116-147.

WETMORE, A. (1926): The Migrations of Birds. Harvard Univ. Press, Cambridge, Mass.