

SPRING 1994 RAPTOR MIGRATION AT EILAT, ISRAEL

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ABSTRACT.—In the Old World, most raptors and other soaring birds breed north of 35°N latitude and winter between 30°N and 30°S. An estimated 3 000 000 raptors from Europe and Asia migrate through the Middle East. Israel is the only land bridge for birds migrating south between Europe and Asia to Africa in autumn, and north to their breeding grounds in spring. In spring 1994 a total of 1 031 387 soaring birds were counted in 92 d of observation. Of these 1 022 098 were raptors of 30 species, for an average of 11 110 raptors per day. The most abundant species were the honey buzzard (*Pernis apivorus*) and the steppe buzzard (*Buteo buteo vulpinus*). Levant sparrowhawks (*Accipiter brevipes*), steppe eagles (*Aquila nipalensis*), and black kites (*Milvus migrans*) numbers were smaller by an order of magnitude. A total of 1999 raptors were unidentified to species (0.19% of total).

KEY WORDS: *Eilat; Israel; migration; raptors; spring 1994; survey.*

Migración de rapaces en la primavera de 1994 en Eilat, Israel

RESUMEN.—En el viejo mundo, la mayoría de las rapaces y otras aves planeadoras nidifican al norte de los 35°N, y en invierno se encuentran entre los 30°N y 30°S. Se ha estimado en tres millones de rapaces de Europa y Asia que migran a través del Medio Este. Israel es solamente el puente de tierra para aves que migran a África desde Europa y Asia durante el otoño, y al norte durante la primavera hacia sus áreas reproductivas. En la primavera de 1994 un total de 1 031 387 de aves fueron contadas en 92 días de observación. De ellas, 1 022 098 fueron rapaces de 30 especies, i.e., con un promedio de 11 110 rapaces por día. Las especies más abundantes son *Pernis apivorus* y *Buteo buteo vulpinus*. *Accipiter brevipes*, *Aquila nipalensis* y *Milvus migrans* resultaron ser menos abundantes en un orden de magnitud. Un total de 1999 rapaces no fueron identificados a nivel de especies (0.19% del total).

[Traducción de Ivan Lazo]

Since Christensen et al. (1981) published their classic report on the phenomenon of a bottleneck of raptors and other soaring birds over the northern tip of the eastern arm of the Red Sea, several raptor migration (Thomson 1953) surveys have been made in spring and autumn (Shirihai 1987, 1988, Shirihai and Yekutieli 1991, Shirihai and Christie 1992). The most recent survey was in the spring of 1988.

In the Old World, most raptors breed north of 35°N latitude and winter between 30°N and 30°S (Shirihai and Christie 1992). An estimated 3 000 000 raptors from Europe and Asia migrate through the Middle East. The largest count achieved in a survey was in 1985 wherein 1 193 229 raptors of 27 species (Shirihai and Christie 1992) were counted in 100 days (for method see Thomson 1953).

Eilat is at the hub of the only land bridge between three continents, and is a junction for birds migrating south between Europe and Asia to Africa in autumn and north to their breeding grounds in spring (Safriel 1968, Yom-Tov 1988). Almost 300 bird species mi-

grate over this southern point of Israel including waders, waterfowl, passerines, and pelagic species. These latter species are mostly nocturnal migrants (Bruderer 1994).

Eilat is at the southern end of the Arava Valley which forms part of the rift valley, a tectonic depression extending from Anatolia to central Africa (Safriel 1968). On the Israeli side of the valley (west) the mountains reach heights of 700 m above sea level, and on the Jordanian side (east) about 1200 m.

Eilat is on the northern fringe of the Sahara-Arabian desert belt at the edge of almost 2000 km of continuous desert. Additionally, to the north-northeast are 650 km of the Syrian Desert, and the Arabian Desert lies to the east (Fig. 1). Hence many birds land in Eilat to rest before (in autumn) or after (in spring) crossing these deserts (Yom-Tov 1988). The northward journey of those that have overwintered in Africa is directed north or northeast in the shortest route to their Palearctic or Holarctic breeding grounds.

Until recently it was assumed that the rift valley was a convenient flyway that funneled the migrants headed north from eastern Africa (Yom-Tov 1988). However, detailed studies (e.g., Safriel 1968, Wimpfheimer et al. 1983, Shirihai and Christie 1992), suggest that the routes bypass the Red Sea, cut across the Sinai Peninsula, and converge over the northern part of its eastern arm, at Eilat or slightly further north. A proportion of migrating birds also cuts across the Straits of Jubal toward Ras Muhammad and Sharm-el-Sheikh (Christensen et al. 1981). These birds then continue north along the cliffs of the Gulf of Aqaba coastline. This explains why large concentrations of soaring birds are seen mostly in the spring (February to May) at Eilat in the diurnal hours (Yom-Tov 1988), and why migrating waders, waterfowl, passerines (Bruderer 1994) and raptors (Stark and Liechti 1993) can be detected by radar at night.

METHODS

Observations were made at three points for approximately 12 h a day from 15 February to 19 May 1994, except for 2 d of sandstorms; 92 d of observations were carried out. Each raptor observation included the exact time of observation, species, exact or estimated number seen, estimated height and direction of flight, and prevailing weather conditions. Counting of small flocks (up to mid-hundreds) was fairly accurate by counting individual birds or groups of ten; and flocks of thousands were counted to within an accuracy estimated as $\pm 10\%$ or better (similar to Shirihai and Christie 1992). Double counts were eliminated by comparing recording sheets at the end of the day. All data were summarized by 5-d periods for all species, and compared to previous surveys.

Observation points were close to those used by Christensen et al. (1981) and were improved by Hadoram Shirihai (Shirihai and Christie 1992). The observation points were such that soaring birds frequently flew within 50 m of the observers in mornings and late evenings. During midday the birds used thermals and could be discerned only with binoculars or telescopes. The use of telescopes considerably increased the number of identified individuals. The extensive information provided by previous surveys allowed us to concentrate on the best areas at the best times of the day. However, observers were at all stations at all times, even if no birds were expected in the vicinity.

I classified the species according to the scheme suggested by Shirihai and Christie (1992), who separated the species into four classes based on their relative abundance in migration at Eilat. The most abundant species were further subdivided into two levels: level 1 were those seen in hundreds of thousands and level 2 in tens of thousands. Common species were in their hundreds, uncommon species in tens, and rare were singles. This scheme was chosen for consistency because Shirihai and Christie (1992) analyzed the migration of six (nonconsecutive) springs, and my study represents only spring 1994.

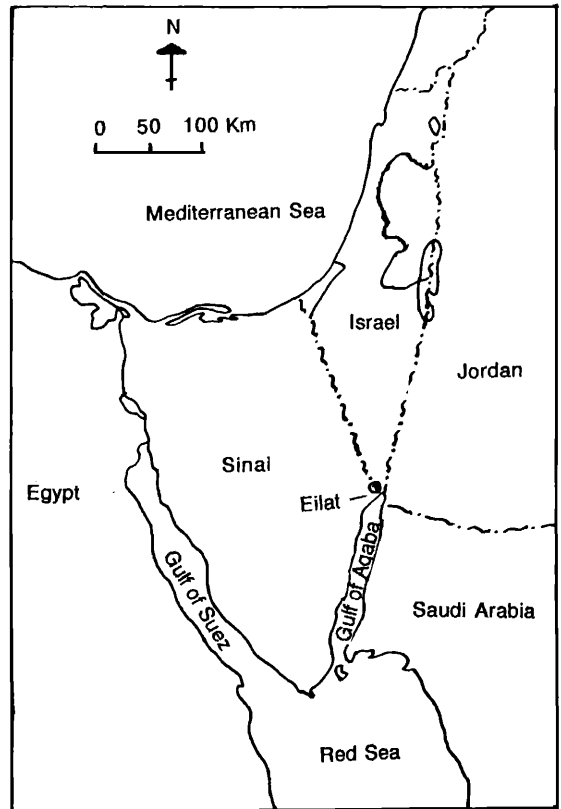


Figure 1. Map of the region showing location of Eilat. Curved line with dots represents international boundaries

RESULTS

A total of 1022098 raptors of 30 species were counted in 92 d of observation (Table 1); i.e., an average of 11110 raptors per day. The most abundant species in my survey were the honey buzzard (*Pernis apivorus*) and steppe buzzard (*Buteo buteo vulpinus*; Table 1). Levant sparrowhawks (*Accipiter brevipes*), steppe eagles (*Aquila nipalensis*; see Clark 1992) and black kites (*Milvus migrans*) numbers were smaller by an order of magnitude. Egyptian vultures (*Neophron percnopterus*), short-toed eagles (*Circaetus gallicus*), booted eagles (*Hieraetus pennatus*), osprey (*Pandion haliaetus*), marsh harriers (*Circus aeruginosus*), and sparrowhawks (*Accipiter nisus*) were seen in hundreds. Griffon vultures (*Gyps fulvus*), Bonelli's eagles (*Hieraetus fasciatus*), long-legged buzzards (*Buteo rufinus*), pallid harriers (*Circus macrourus*), lesser kestrels (*Falco naumanni*), Eurasian

kestrels (*Falco tinnunculus*), hobbies (*Falco subbuteo*), and Eleonora's falcons (*Falco eleonora*) were uncommon species.

A total of 1999 raptors were unidentified (0.19% of total). Of these the majority (1685, 0.16%) were due to uncertainty of identification between species with similar flight or silhouette, or were observed from a distance that did not allow a good view. In this category, 1557 (0.15%) remain unclassified as steppe/honey buzzards, 104 (0.01%) as lesser/Eurasian kestrels, and 24 (0.002%) as sparrowhawks. In addition, others identified to genus were 37 harriers (*Circus* spp.), 29 eagles (*Aquila* spp.), and 21 medium to large falcons (*Falco* spp.). Only 227 (0.02%) raptors could not be further classified.

Abundant Species. *Level 1.* The honey buzzard was a very late migrant and the most numerous (Fig. 2). It comprised 52% of the total spring migration. The first individuals were seen on 17 April and peak migration was between 1–5 May (51% of total seen). The largest number seen in a single day was on 2 May when 176 424 honey buzzards were counted. Small flocks were still passing at the termination of the survey and migration of this species in mid-June has been previously documented (Shirihai and Christie 1992).

The steppe buzzard was the second most numerous species and comprised 36% of the total migration. Observed regularly throughout the season, peak migration was on 28 March when 39 832 recorded (Fig. 2). Our observations concur with Clark et al. (1986) and Gorney and Yom-Tov (1994) that most, if not all, buzzards observed belong to the eastern subspecies *B. buteo vulpinus*.

Level 2. Levant sparrowhawks constituted 4.2% of the total migration. This confirmed the numbers (40 000–50 000) seen on migration in previous years in autumn (Dovrat 1991) or spring (Shirihai and Christie 1992). Recent radar studies (Stark and Liechti 1993) indicate that visual censuses may be deficient for this species because it is possible that a part of the population migrates at night. The numbers observed in migration are greatly in excess of those reported from the breeding range (V.M. Galushin pers. comm.) and warrants further study to locate unidentified regions where this species breeds, or to determine if a significant population of non-breeders comprises the population seen in migration. Shirihai and Christie (1992) report that in previous surveys the earliest Levant sparrowhawk seen was on 25 March. In the present study the first was seen

on 19 March and the last on 5 May (Fig. 2). Peak migration occurred over 2 d when compact flocks of thousands were observed. On 25 April 25 522 were seen and on 26 April an additional 14 472; i.e., 90% of the observations occurred within a span of 48 hr. This concurs with earlier reports (Phillips 1915, Hollom 1959, Safriel 1968, Shirihai and Christie 1992) that peak migration of this species occurs on 25 or 26 April (Shirihai and Yekutieli 1991).

Steppe eagles formed 3.0% of total raptors seen. My data concur with those of Safriel (1968) and Shirihai and Christie (1992) that the steppe eagle migration begins in late January with a major peak occurring between the third week of February and mid-March and a smaller secondary wave in mid-April (Fig. 2). On 4 March the largest number (4292) was counted. Considered to be a species that is observed in small numbers throughout spring, the last individual was observed on 9 May. It constituted 99.5% of all *Aquila* eagles seen.

Black kites were the only species counted in considerably lower numbers in the 1994 survey compared to previous studies. The 15 659 kites seen is well below the minimum of 24 728 seen in 1986. In the 1994 survey, they comprised only 1.5% of total raptors observed in comparison to 2–4.6% in previous years. Peak migration, when 1000–2000 kites per day were seen, was spread over 2 wk—22 March to 2 April. Although seen throughout late April and May, appearance was irregular with many days having no kites at all.

Common Species. The Egyptian vulture comprised 0.04% (417) of the total raptors observed, and was within the range of previous surveys (263–802). Present in small numbers throughout the survey period, these vultures had the same three peak migration periods (>30 per day) described by Shirihai and Christie (1992).

The short-toed eagle was seen from mid-February until late April and peak migration (10 per day) was spread from 12–31 March. In spring, the species migrated mostly in pairs and mingled with other species in thermals.

Sparrowhawks are solitary migrants and their size and flight at low altitudes makes it difficult to spot and identify them. So, more may migrate through Eilat than the 122 seen. However, their relative abundance in the migration could possibly represent their peak migration period. The maximum numbers (>3 per day) were seen between 6 and 25 April.

The first marsh harrier was seen on 11 March

Table 1. Number of raptors counted at Eilat, Israel, Spring 1994. Question mark denotes species not officially accepted to occur in the region.

SPECIES	1994 SPRING SURVEY	MEAN ANNUAL SPRING SURVEY (1977-88) ^a	RANGE FOR ALL SPECIES
Total all raptors	1 022 098	795 228	474 124-1 193 229
Honey buzzard (<i>Pernis apivorus</i>)	545 562	363 221	188 914-851 598
Black kite (<i>Milvus migrans</i>)	15 735	28 249	24 728-31 774
White-tailed eagle (<i>Haliaeetus albicilla</i>)	0	0	0-2
Pallas's fish eagle (?) (<i>Haliaeetus leucoryphus</i>)	1	0	0
Egyptian vulture (<i>Neophron percnopterus</i>)	417	428	263-802
Griffon vulture (<i>Gyps fulvus</i>)	14	10	2-22
Cinereous vulture (<i>Aegyptius monachus</i>)	0	0	0-1
Short-toed eagle (<i>Circaetus gallicus</i>)	159	162	59-345
Bateleur (<i>Terathopius ecaudatus</i>)	0	0	0-1
Marsh harrier (<i>Circus aeruginosus</i>)	120	179	71-371
Hen harrier (<i>Circus cyaneus</i>)	0	0	0-1
Pallid harrier (<i>Circus macrourus</i>)	57	57	7-113
Montagu's harrier (<i>Circus pygargus</i>)	7	19	7-55
<i>Circus</i> spp.	37	28	1-3
Goshawk (<i>Accipiter gentilis</i>)	0	1	1-3
Sparrowhawk (<i>Accipiter nisus</i>)	122	163	52-456
Shikra (<i>Accipiter badius</i>)	0	0	0-1
Levant sparrowhawk <i>Accipiter</i> spp.	44 524 24	16 281 298	905-49 836 0-1360
Steppe buzzard (<i>Buteo buteo vulpinus</i>)	381 516	326 278	142 793-465 827
Long-legged buzzard (<i>Buteo rufinus</i>)	65	45	28-105
<i>Pernis/Buteo</i> spp.	1557	41 260	3757-149 258
Lesser spotted eagle (<i>Aquila pomarina</i>)	65	54	21-74
Spotted eagle (<i>Aquila clanga</i>)	2	6	4-10
Steppe eagle (<i>Aquila nipalensis</i>)	31 198	28 032	10 922-75 053

Table 1. Continued.

SPECIES	1994 SPRING SURVEY	MEAN ANNUAL SPRING SURVEY (1977-88) ^a	RANGE FOR ALL SPECIES
Imperial eagle (<i>Aquila heliaca</i>)	52	47	12-95
Golden eagle (<i>Aquila chrysaetos</i>)	10	1	0-7
<i>Aquila</i> spp.	29	2560	17-9083
Booted Eagle (<i>Hieraetus pennatus</i>)	140	138	105-175
Bonelli's eagle (<i>Hieraetus fasciatus</i>)	12	3	0-6
Osprey (<i>Pandion haliaetus</i>)	101	83	49-130
Lesser kestrel (<i>Falco naumanni</i>)	83	22	0-55
Eurasian kestrel (<i>Falco tinnunculus</i>)	80	57	11-190
Red-footed falcon (<i>Falco vespertinus</i>)	6	2	0-12
Merlin (<i>Falco columbarius</i>)	0	0	0-1
Hobby (<i>Falco subbuteo</i>)	22	23	6-54
Eleonora's falcon (<i>Falco eleonora</i>)	17	10	6-21
Sooty falcon (<i>Falco concolor</i>)	5	1	0-2
Lanner (<i>Falco biarmicus</i>)	0	3	0-7
Saker (<i>Falco cherrug</i>)	0	0	0-2
Peregrine falcon (<i>Falco peregrinus</i>)	4	1	0-4
Barbary falcon (<i>Falco pelegrinoides</i>)	3	1	0-3
<i>Falco</i> spp.	125	28	0-68
Unidentified raptors	227	1824	0-8601

^a Shirihai and Christie (1992).

and the species was present in small numbers throughout the survey. Two peaks were evident between 22 March to 10 April and 21-27 April when up to five marsh harriers were observed per day.

Uncommon Species. Imperial eagles were seen throughout the survey. Although two main periods of migration have been previously described (Christensen et al. 1981, Shirihai and Christie 1992) that pattern was not evident in 1994.

Although the lesser spotted eagle was regularly seen in small numbers from mid-March to mid-

April, the first was seen on 22 February. It is possible that some individuals of this species were misidentified and counted as steppe eagles, especially when seen from a distance.

Booted eagles are dispersed and solitary migrants. Eighty-nine percent of the 130 seen occurred between 22 March and 20 April. Of the two morphs known for this species, 53% seen at Eilat were the light morph and 47% the dark (for descriptions see Holmgren 1984, Clark 1987). This ratio is consistent with previous studies (e.g., Christensen et al.

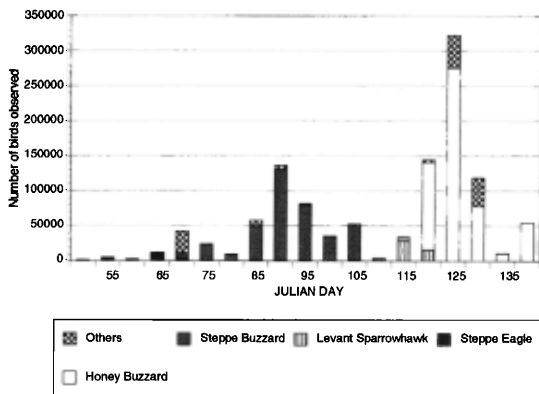


Fig. 2. Phenology of the four dominant species of raptors in spring migration at Eilat, Israel. Data are presented in 5-d periods. These four species comprise 65–98% of the raptors seen during any given period.

1981, Shirihai and Christie 1992) and is attributed to the fact that dark-morph booted eagles are easily overlooked when they are part of black kite flocks. Christensen et al. (1981) assumed that the two morphs comprise a 50:50 ratio in the natural population.

The osprey is considered a rather scarce migrant and was regularly observed from 19 March until 8 May, during which at least one bird per day was seen. The largest number occurred on 24 March when 10 were observed. Ospreys are mostly solitary migrants, but they can occasionally be observed in thermals with small flocks. Although there are no breeding pairs in the immediate area, an individual that loitered at the shore was excluded from all counts.

Long-legged buzzards migrate in small numbers from late-February to late-April. Numbers may have been underestimated because of its similarity to and tendency to migrate with the more common steppe buzzard (see Shirihai and Forsman 1992).

Pallid harriers were seen only for 3 wk—between 19 March and 11 April. Peak migration was on 23 March when 14 individuals were recorded. Gender difference in timing of migration was obvious. Males migrated from 19 March until 3 April, and females from 29 March until 11 April. Similar to the report of Shirihai and Christie (1992), no juveniles were seen in 1994.

Montagu's harriers (*Circus pygargus*) migrated about a week later than pallid harriers, i.e., from 8 to 23 April. Although classified as an uncommon

species, only seven were seen during the survey period. They are more commonly seen along valley floors, e.g., 33 km north of Eilat.

Solitary hobbies were seen in small numbers from 17 April and on throughout the survey. Some may have been missed owing to their low, dodging flight in the canyons below the observation posts.

Allowing for the local breeding population of Eurasian kestrels, only birds that displayed migratory behavior (e.g., no hunting, no loitering) were included in final tally. They were observed in small numbers throughout the survey.

Rare Species. A Pallas's fish eagle (*Haliaeetus leucorhynchus*) sighting is the first for the region and the observation remains unconfirmed. The crested honey buzzard (*Pernis ptilorhynchus*), also a first for the region, was observed by Hadoram Shirihai on Mount Yishay in early May, but not by any observers in my survey.

Most (9 of 14) griffon vultures were recorded early in the survey—between 21 February and 4 March. They were always seen in flocks of steppe eagles and/or black kites.

Spotted eagles were only seen in late February. Possibly some were misidentified when flying in thermals with lesser spotted or steppe eagles. Migrating Bonelli's eagles were rare sightings.

The lesser kestrel was a rare but regular migrant. The peak of 67 (81% of total for survey) occurred on 19 March, but it is possible that many were missed because it migrates mostly along coasts and in open areas. Ninety-one unidentified kestrel species could have included lesser kestrels. Red-footed falcons (*Falco vespertinus*) were rare migrants and although known to migrate gregariously on other routes, were always observed singly at Eilat. The species was seen between 7 April and 5 May. Eleonora's falcon (*Falco eleonora*) was a late migrant, solitary, and occurred in small numbers. Observed between 15 April and 7 May, single birds were reported until late June. The sooty falcon (*Falco concolor*) was also a late migrant, solitary, and occurred in very low numbers. Shirihai and Christie (1992) considered the ones seen in Eilat to be those that breed in the Dead Sea or Negev Desert regions. Peregrine falcons (*Falco peregrinus*) were rare, sporadic, and seen singly. The first one was seen 22 February, the second on 23 March, and two more on 24 and 25 April, respectively. Allowing for the local breeding population of about two pairs, only barbary falcons (*Falco pelegrinoides*) that displayed migratory behavior were

included in final tally. These falcons were seen singly on 17, 24, and 27 April.

DISCUSSION

Migration was dominated in the eastern Palearctic by two species, honey buzzard and steppe buzzard (Table 1). At Eilat the three dominant species comprised between 65–98% of the birds seen on any given day (Fig. 2). Most flocks were mixed-species flocks with black kite, steppe eagle, imperial eagle (*Aquila heliaca*), lesser spotted eagle (*Aquila pomarina*), short-toed eagle, and Egyptian vulture being the species most often observed with honey buzzards and steppe buzzards. On the other hand, harriers and falcons were almost always seen singly.

Political instability in the Middle East and in other areas (e.g., former Yugoslavia) that lie in the path of major migratory routes make it especially important to periodically monitor avian populations. Monitoring migrating raptors is one of the most reliable methods of evaluating their populations. Other techniques such as banding (e.g., Clark et al. 1986), understanding parameters influencing flight-distance capabilities and physiological constraints (e.g., Gorney and Yom-Tov 1994), and evaluation of blood parasites as markers of the movements of bird populations (e.g., Earle 1993) should also be undertaken.

The variation in raptor migration among years at Eilat indicates that results obtained there should be used cautiously in representing population trends on a species level. Very few species have data that might be reliably used for that purpose (e.g., Levant sparrowhawk). Most other species are known to use alternative routes if inclement weather prevails (e.g., steppe eagles, steppe buzzards). The very low numbers of black kites observed during this survey may, for example, be explained if the majority of the population followed routes further north of Eilat. Annual and seasonal surveys conducted at regular intervals would allow the evaluation of future trends. The present political stability in the region may allow ornithologists to conduct simultaneous surveys at the other well-known bottlenecks. Only comprehensive and coordinated surveys will aid in evaluating the existing populations of raptors in the Palearctic, and the respective proportions that follow the various routes through the Middle East.

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