Spring migration of soaring birds over the Bosphorus, Turkey, in 2006

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The Bosphorus is one of the most important migration bottlenecks in the Middle East. However, most counts have been done during autumn and complete spring counts are very few. In spring 2006, a complete count of migrating soaring birds over the Bosphorus was carried out. We report a total of 100 051 birds, which consisted of 51 958 White Storks *Ciconia ciconia*, 16 185 Common Buzzards *Buteo buteo*, 15 232 Lesser Spotted Eagles *Aquila pomarina* and 9085 Honey Buzzards *Pernis apivorus*. The study demonstrates the importance of the Bosphorus for the spring migration of soaring birds.

INTRODUCTION

Turkey has major Western Palearctic migration crossroads, with corridors and bottlenecks for soaring birds in the northwestern (Bosphorus in Istanbul, Figure 1), northeastern (Borçka, Artvin province) and southern (Belen, Hatay province) parts of the country (Grimmett & Jones 1989). The Bosphorus is a well-known migration bottleneck for soaring birds due to its location at the junction between Europe and Asia. The whole population of eastern White Storks *Ciconia ciconia*, over 340 000 birds, flies over the Bosphorus. Zalles & Bildstein (2000) reported between 29 000 and 75 000 migrant raptors in autumn over the Bosphorus whereas a very recent multi-station but short survey has shown that more than 150 000 raptors use the area in autumn (Milvus Group 2008). Most of the world population of Lesser Spotted Eagles *Aquila pomarina* and Levant Sparrowhawks *Accipiter brevipes*, at least in autumn, crosses into Asia via the Bosphorus (Kirwan *et al* 2008) using the east Mediterranean route (Shirihai *et al* 2000). Other important species, with their maximum autumn counts, are White Stork (210 000 in 1971), Black Stork *Ciconia nigra* (17 000 in 2008), European Honey Buzzard *Pernis apivorus* (26 000 in 1971), Black Kite *Milvus migrans* (2700



Figure 1. Northwest Turkey showing the location of the Bosphorus.

in 1971), Short-toed Eagle *Circaetus gallicus* (4600 in 2008) and Common Buzzard *Buteo buteo* (80 000 in 2008) (Shirihai *et al* 2000, Milvus Group 2008).

Most published work of complete and partial counts at the Bosphorus is from the autumn. Complete coverage was achieved in 1966 (Porter & Willis 1968), with partial counts by Alléon & Vian (1869–70), Steinfatt (1932), Nisbet & Smout (1957), Beaman (1973), Beaman & Jacobsen (1974), Somçağ (1981), Bijlsma (1990), Robel & Bräuning (1992) and Howes (1996). The autumn period has been covered for several reasons. Some species move through in larger flocks and pass through in shorter periods of time in the autumn. This is especially true of the most numerous species, the White Stork, the vast majority of which pass through in less than a few weeks. The Levant Sparrowhawk's migration, though, happens in a very short period of time in both spring and autumn (Shirihai *et al* 2000).

Spring migration over the Bosphorus is much more poorly documented (Shirihai *et al* 2000), with few publications: Mauve (1937), Collman & Croxall (1967), Ritzel (1980) and MME (1993). These publications provide a benchmark but, together with the older autumn studies, can suffer from identification problems as some of them predate the publication of modern raptor identification guides (especially Porter *et al* 1974). In some cases even individuals of some common species, such as European Honey Buzzard and Common Buzzard, might have been misidentified. The present study, in 2006, represents the first attempt to perform a reasonably complete census of the soaring birds passing over the Bosphorus in spring.

METHODOLOGY

Observation point

The census was conducted from a single observation point at 182 m asl at Keskin Viraj, between Sarıyer and Rumelifeneri on the European side in the northern part of Istanbul (41° 12′ N 29° 04′ E, Figure 2). It is reached from the road between Sarıyer and Rumelifeneri 950 m east of the entrance to Koç University. The area has a wide and fairly open view east to the Bosphorus and from Poyrazköy (on the Asian side) in the north to Maslak (on the European side) in the south. The area is covered with Mediterranean maquis scrub and Black Pine *Pinus nigra* plantations.

This location has been known to local birdwatchers since the 1990s and previous observations have shown it to be the best spring site. Most birds use the most northern part of the Bosphorus, north of the centre of Sarıyer, and a great majority of these arrive in the 5 km belt between the observation point and Garipçe village. As birds arrive over the European side of the Bosphorus, they are low and have lost altitude after crossing the water. Those arriving north of the observation point turn to the south to glide along the hillside to make use of thermals on the slopes of the Bosphorus. This involves circular as well as linear soaring. After flying over the observation point and passing south, they suddenly head west and enter the Rumelikavağı valley system. Strong thermals regularly occur in this area, enabling the birds to swiftly gain height by soaring and move east to the ridge just southwest of Koç University campus, and leave for the relatively flat area in the direction of Terkos lake (Durusu, Figure 2).

Observation period

Daily observations were made 18 March–31 May 2006, with the exception of 19 March, 8 April and 13 May, for a total of 72 days. Soaring birds were counted between 09.30 and 17.30 h on most days, but bad weather sometimes led us to abandon observations for some hours. A total of 538 hours was spent making observations of soaring birds. The change to local Summer Time, on 28 March, was ignored.



Figure 2. The Bosphorus region in northwest Turkey. The small black bar between Keskin Viraj and Sarıyer indicates the Rumelikavağı valley, just south of the observation point used in this study. The total length of the scale bar, bottom left, indicates 10 km.

At least two observers were present on all days (Plate 1). Most observers had 8× or 10× binoculars whilst a 20×60 telescope was used during the entire period. Two of us (ÖÜ and E Birel) used Nikon D70 and Canon 20D cameras, which allowed us to consider the identification of problematic individuals, especially of eagles and harriers.



Plate I. Members of the Istanbul Birdwatching Society, count participants, at the Bosphorus observation point, Turkey, April 2006. © *Özkan Üner*

Weather

The weather 18 March–31 May was very variable. On 22 of the 75 days of the period conditions were generally sunny, on 47 days it was fully or partially cloudy and on 6 days misty. Though lower on misty days, visibility was generally satisfactory. Rain occurred on 11 days. Prevailing winds were from the north (52 of 75 days) and south-southwest (23 of 75 days). Wind speeds peaked between 09.00 and 16.00 h. In contrast to autumn, spring in Istanbul is wetter and cloudier, and weather conditions can change dramatically. When the wind direction changes from north to south the temperature can rise by 10°C.

RESULTS AND DISCUSSION

From 18 March–31 May, a total of 100 051 soaring birds were counted, with White Stork, Common Buzzard, Lesser Spotted Eagle and European Honey Buzzard being the most numerous species (Table 1). The number of birds passing in each period of five days is shown by species in Figure 3 while Figure 4 presents the distribution of migrating birds in hourly intervals, by species, over the entire period.

Black Stork *Ciconia nigra*: 1118, peak 25 March when 207 passed. The migration period of the species had started before the study period and extended into June. A second peak, probably of non-breeders, was observed during mid-May.

White Stork Ciconia ciconia: 51 958 (Plate 2), the most numerous species, with 9569 on 25 and 26 March combined, marking the peak. The route taken at the site by White Storks differed from that of most other species. Most passed 5 km north of the observation point, over Poyrazköy on the Asian side and Garipce on the European side, and thus many birds might have passed undetected, making our total an underestimate of the real number of passing birds. Moreover, the species is known to use the coast of the sea of Marmara, as well as the Kapıdağ peninsula during spring migration where Tuncalı (in litt) counted 8 948 birds in spring 2008. The migration period of the species had started before the study period and extended into June. A second peak, probably of nonbreeders, was observed during mid-May.

Great White Pelican *Pelecanus onocrotalus*: 62, 27 April–31 May. Passage coincided with the middle of the period of northerly winds and with peak wind strengths. Most passage occurred during May, peak 25 May. The

Table I. Number of migrant soaring birds countedfrom the Bosphorus observation point, Turkey, 18March-31 May 2006.

Species	Total
Black Stork Ciconia nigra	
White Stork Ciconia ciconia	
unid stork Ciconia	51 750
Groat White Polican Pelecanus onecretalus	40
Osprov Pandion haliaetus	9
European Honey Buzzard Pernis abiyorus	9085
Black Kite Mikus migrans	222
White-tailed Eagle Haliaeetus albicilla	223
Fryntian Vulture Neothron berchobterus	11
Eurosian Griffon Vulture Gybs fulwus	9
Cinereous Vulture Aerobius monachus	1
Short-toed Spake Fagle Circaetus gallicus	473
Western Marsh Harrier Circus genusionsus	138
Hen Harrier Circus ovaneus	92
Pallid Harrier Circus macrourus	10
Montagu's Harrier Circus byggrgus	12
unid. harrier Circus	7
Levant Sparrowhawk Accipiter brevipes	16
Eurasian Sparrowhawk Accipiter nisus	1701
Northern Goshawk Accipiter gentilis	5
unid. sparrowhawk Accipiter	12
Common Buzzard Buteo buteo	16 185
Long-legged Buzzard Buteo rufinus	28
Rough-legged Buzzard Buteo lagopus	2
unid. buzzard Buteo/Pernis	112
Lesser Spotted Eagle Aquila pomarina	15 232
Greater Spotted Eagle Aquila clanga	9
Steppe Eagle Aquila nipalensis	5
Eastern Imperial Eagle Aquila heliaca	32
Golden Eagle Aquila chrysaetos	1
Booted Eagle Aquila pennata	161
Bonelli's Eagle Aquila fasciatus	I
unid. eagle Aquila	25
unid. raptor Accipitridae	3082
Common Kestrel Falco tinnunculus	55
Red-footed Falcon Falco vespertinus	50
Eurasian Hobby Falco subbuteo	64
Saker Falcon Falco cherrug	I
Peregrine Falcon Falco peregrinus	I
unid. falcon <i>Falco</i>	10
Total	100 051

species is known to stage at Manyas Gölü, south of the sea of Marmara, and fly across the sea. Tuncalı (*in litt*) counted a total of 39 734 Great White Pelicans over Kapıdağ peninsula in spring 2008 (Figure 1), probably the whole European population of 4100–5100 breeding pairs (Birdlife International 2004).

Osprey Pandion haliaetus: nine, mostly singles, 1-22 April.























Figure 3. Total number of migrating birds, by species, passing the Bosphorus observation point (vertical axis) in each of 15 pentads (period of five days), 18 March-31 May 2006. Pentad I 18–22 Mar*, 2 23–27 Mar, 3 28 Mar–1 Apr, 4 2–6 Apr, 5 7–11 Apr*, 6 12–16 Apr, 7 17–21 Apr, 8 22–26 Apr, 9 27 Apr–1 May, 10 2–6 May, 11 7–11 May, 12 12–16 May*, 13 17–21 May, 14 22–26 May, 15 27–31 May. Three observation days were missed: periods with * have totals for 4 days not 5.

Plate 2 (above). A group of White Storks *Ciconia ciconia* crossing the Bosphorus south of the observation point, April 2006. © *Özkan Üner*

Plate 3 (right). A juvenile Cinereous Vulture Aegypius monachus on passage past the Bosphorus observation point, a rare sighting for Istanbul birdwatchers, 7 April 2006. © *Ertuğrul Birel*

European Honey Buzzard *Pernis apivorus*: 9085. Although the first were observed on 12 April, the main bulk of the passage did not commence until 30 April with a peak of 1185 birds on 12 May. The migration



period of the species extends into June. Only 1.3% of birds occurred before 1 May, whereas in Israel the first 5% moved between 20 April and 1 May (Shirihai *et al* 2000).

Black Kite *Milvus migrans*: 223, 21 March–31 May, with a single-day maximum of 21 on 7 May. However, peak passage occurred in late March. The migration period of the species had started before the study period and extended into June. A second peak, probably of non-breeders, was observed mid-May.

White-tailed Eagle Haliaeetus albicilla: singles, 16 April and 22 May.

Egyptian Vulture *Neophron percnopterus*: 11, 23 March–23 May. Egyptian Vulture is a globally threatened species categorised as Vulnerable, with decreasing populations in Europe. BirdLife International (2004) estimated a total of 300–450 pairs in Balkan countries (Albania, Bosnia and Herzegovina, Bulgaria, Greece and FYR Macedonia). The passage is evenly distributed through the migration season.

Eurasian Griffon Vulture *Gyps fulvus*: nine, 27 March–23 May, 6 of them 27 March–12 April.

Cinereous Vulture Aegypius monachus: one, 7 April (Plate 3).



Plate 4. (left) Short-toed Snake Eagles *Circaetus gallicus* occurred mostly in singles or pairs past the Bosphorus observation point (photo May 2006). © *Özkan Üner*

Plate 5. (right) Mostly singles of Eurasian Sparrowhawk Accipiter nisus occurred on passage past the Bosphorus observation point (photo April 2006). © Ertuğrul Birel

Short-toed Snake Eagle *Circaetus gallicus*: 473 (Plate 4). Migration peaked on 26 March when 43 passed. One bird seemed to stay for 2–3 days, feeding on lizards and snakes found in the area. Most passage occurred in late March. Thereafter, daily numbers gradually decreased until late May. Presumably the flow of birds started before the study period and continued afterwards.

Western Marsh Harrier *Circus aeruginosus*: 138 with the largest single-day total of 14 on 22 April. Most passage occurred at the beginning of April but passage continued during May. The migration period of the species extends into June.

Hen Harrier *Circus cyaneus*: 92, 23 March–28 April. Migration peaked on 10 April when ten individuals passed. Hen Harrier migration began in late March and gradually declined through April with the last birds at the end of the month. This is by far the largest total recorded at any watch point in the Middle East in either season (Shirihai *et al* 2000).

Pallid Harrier Circus macrourus: 10, mostly singles, 26 March-19 April.

Montagu's Harrier *Circus pygargus*: 12, 31 March–16 May, with a single-day maximum of five on 22 April.

Levant Sparrowhawk *Accipiter brevipes*: 16, 31 March–19 May, with 12 on 19 May. Very few birds have been observed in spring, in contrast with thousands of birds passing annually in autumn. This species was previously known to occur in very low numbers over the Bosphorus during spring migration and therefore Shirihai *et al* (2000) suggested that Levant Sparrowhawk may prefer the eastern Black sea migration route in spring. However, R Tuncali (*in litt*) counted 1726 birds during spring 2009 over the Kapıdağ peninsula (Figure 1), which suggests that spring migration towards breeding grounds in the Balkan countries may still pass through northwest Turkey but not over the Bosphorus.

Eurasian Sparrowhawk *Accipiter nisus*: 1701, 20 March–22 May (Plate 5). Eurasian Sparrowhawks peaked on 2 April with 125 birds. The migration period of the species started before the study period. Most passage occurred late March/April.

Northern Goshawk Accipiter gentilis: five singles, 20 March–24 May. Migration started before the study period.































Figure 4. Total number of migrating birds, by species, passing the Bosphorus observation point (vertical axis) in 12 hourly intervals during the day, 18 March–31 May 2006 (1 07.30–08.30, 2 08.30–09.30, 3 09.30–10.30, 4 10.30–11.30, 5 11.30–12.30, 6 12.30–13.30, 7 13.30–14.30, 8 14.30–15.30, 9 15.30–16.30, 10 16.30–17.30, 11 17.30–18.30, 12 18.30–19.30 h).

Common Buzzard *Buteo buteo*: 16 185, with a single-day maximum of 1840 on 26 March. Common Buzzard was the most common raptor species and most passage occurred late March. Thereafter, daily numbers started declining slowly until late May when the passage seemed to cease. Passage at the Bosphorus starts mid-February and its peak could have been before the study period. The median peak day in Israel, 1977–1997, was calculated to be 1 April and its range 22 March–9 April (Shirihai *et al* 2000). Calculating the distance between Israel and the Bosphorus as 1500 km and a mean migration speed of 220 km/ day, we could have expected peak passage one week after this period. However, peak passage at the Bosphorus, at least in 2006, was earlier than the one in Israel (Shirihai *et al* 2000). Possibly the main bulk of wintering birds in Turkey forms the birds observed over the Bosphorus or the majority of birds that fly over Israel may continue, rather, through northeast Turkey.

Long-legged Buzzard *Buteo rufinus*: 28, 20 March–31 May, with a clear peak in early April when the single-day maximum of 12 was recorded on 9 April. The migration period of the species had started before the study period.

Rough-legged Buzzard *Buteo lagopus*: two, 15 April. This species is a rare winter visitor in Turkey.

Lesser Spotted Eagle *Aquila pomarina*: 15 232 (Plate 6), with numbers peaking at the end of March and the single-day maximum of 3673 being noted on 31 March. Previous observers, in 1937, 1965 and 1978, failed to see large numbers though 27 407 were counted in spring 1993 (MME 1994). The migration period of the species had started before the study period and extended into June. A second peak, probably of nonbreeders, was observed mid-May.

Greater Spotted Eagle *Aquila clanga*: nine, mostly singles, 28 March–3 May (Plate 7). Although this species is categorized as Vulnerable by BirdLife International, it is probably under recorded for several reasons. Identification problems still exist and individuals among the more common Lesser Spotted Eagle can escape even experienced eyes. Greater Spotted Eagles are known to be short-distance migrants and some are likely to have passed through the Bosphorus before the study period.

Steppe Eagle *Aquila nipalensis*: five singles, 9 April–11 May, of which four passed 9–15 April. The species is a regular but rare passage migrant over the Bosphorus.



Plate 6 (top). A Lesser Spotted Eagle Aquila pomarina gliding south along the Bosphorus before entering the Rumelikavağı valley, April 2006. © *Ertuğrul Birel*

Plate 7 (bottom). A juvenile Greater Spotted Eagle Aquila clanga soaring on southern winds past the Bosphorus observation point, April 2006. © Özkan Üner

Eastern Imperial Eagle *Aquila heliaca*: 32, 30 March–24 May. The passage peaked in early May. Large numbers of migrants have not been observed in Israel in May, and our birds may relate to juveniles moving between populations in Turkey and southeast Europe. The

migration period of the species had started before the study period and migration of adults had most probably finished before the study period. In Israel, adults usually predominate in the first wave of migration (March–April) and juveniles follow in May (Shirihai *et al* 2000).

Golden Eagle Aquila chrysaetos: a single, 21 May.

Booted Eagle *Aquila pennata*: 161, 22 March–31 May, with a maximum of 25 on 6 April. Most passage occurred in early April. The migration period started before the study period and extended into June.

Bonelli's Eagle Aquila fasciatus: a single, 11 April.

Common Kestrel *Falco tinnunculus*: 55, 22 March–31 May, with single-day maxima of four each on 2 and 11 April. The peak was observed in mid-April. A second peak, probably of non-breeders, was observed during mid-May. The migration period of the species extends into June.

Red-footed Falcon *Falco vespertinus*: 50, 30 April–23 May, with a single-day maximum of 14 on 6 May. There was a very clear peak in early May when 43 (85% of the total) passed 3–7 May.

Eurasian Hobby *Falco subbuteo*: 64 birds, 3 April–31 May. Migration peaked at the beginning of May, with 19, 1–5 May. Birds were observed to stage around the observation site and feed on migrant passerines. Sometimes distinguishing between passage birds and local residents was not possible. Birds seen toward the end of the migration period may well have been residents.

Saker Falcon Falco cherrug: a single, 24 May.

Peregrine Falcon Falco peregrinus: one, 30 April.

Effect of wind and rain on bird numbers

During the study two general wind patterns were observed in the area: northerly winds and southerly winds. The flyway of birds generally shifted according to these two patterns. When the wind blew from the north, there were more birds observed flying south of Sarıyer, above the Maslak area (Figure 2). When the wind blew from the south, many birds flew between Garipçe and Rumelifeneri. On days with heavy rain showers, 24 and 30 March and 29 April, the migration almost ceased. However, light rain observed on other days did not seem to affect passage.

Height of migration

Birds usually flew low, between *c*10–100 m above the level of the observation point. There was little variation with time of day.

Time of day

During the day, the first birds were observed before 09.30 h but most birds were counted 10.30–17:30 h, with a third of the total passing 12.30–14.30 h. When looking at the distribution of migrating birds in hourly intervals during the day (Figure 4), two patterns can be identified. The first applies for most species, where the total number per hour increases until midday, reaching its peak at *c*13.00 h, when thermals are most abundant, and then slowly decreasing towards the evening. The other pattern applies to species such as European Honey Buzzard, Black Kite, Short-toed Snake Eagle and Booted Eagle. Their passage continues roughly with the same intensity, 09.00–16.00 h but decreases in late

afternoon. Cessation of passage at midday, as observed in Israel in autumn (Shirihai *et al* 2000), was not observed spring 2006, although it is very frequent during autumn migration over the Bosphorus.

Comparison with previous studies

This study produced a much higher total number of birds compared with previous Bosphorus spring counts. Mauve (1938) counted 1634 birds 16 March–24 April compared to 31 884 in this study for the same period. Collman & Croxall (1967) counted 2254 birds during 10 days 23 March–6 April, compared to 17 643 birds counted in the present study in 14 days during the same period. Ritzel (1980) counted a total of 2779 birds 20 March–4 April compared to 18 375 birds in our study in the same period. We assume the main reason to be lack of suitable ID literature and experience to identify passage birds and perhaps the poorer quality of optical equipment. They all failed to document the existence of significant numbers of Common Buzzard and Lesser Spotted Eagle, perhaps because they did not identify them and discarded unidentified birds. However the totals of some easily identifiable or familiar species, such as Common Kestrel, Black Kite, Egyptian Vulture, and Short-toed Snake Eagle are at a relatively similar level.

The only published modern census in spring for the Bosphorus is the counts in 1993 by the Hungarian Ornithological Society (MME 1993), and its results are similar to those of the present study. HOS recorded 27 514 birds in comparison to 23 936 during this study, 18 March–9 April. The source of the difference is mainly due to higher number of Lesser Spotted Eagles, MME counted 17 325 in comparison to 11 313 in our study.

We also compared the total number of migrating birds in our study with spring counts from northeast Turkey in 1993 (Faldborg 1994) and 1994 (M Henriksen *in litt*). The total number of migrant raptors in spring is much higher in northeast Turkey, Faldborg (1994) recorded 151 606 raptors in 25 days and M Henriksen (*in litt*) 57 920 birds in 30 days in comparison to 46 862 raptors counted in the present study in 72 days. Common Buzzard, European Honey Buzzard and Black Kite make up the biggest proportion of migrants in northeast Turkey and occur in much higher numbers, with maxima of 136 327, 29 323 (M Henriksen *in litt*) and 9069 (Faldborg 1994) respectively. Similarly, both authors recorded over 1000 Levant Sparrowhawks in spring, a figure much higher than the number of birds recorded at the Bosphorus. However, we recorded a higher number of Lesser Spotted Eagles, 15 232 in comparison to 277 recorded by Faldborg (1994) in northeast Turkey.

The total numbers recorded during the present study are probably far less than the actual number of birds crossing the Bosphorus. For example, *c*52 000 White Storks were recorded and yet there are 180 000–220 000 breeding pairs in Europe (Burfield & van Bommel 2004) and 200 000–350 000 birds have been counted in autumn over the Bosphorus (Porter & Willis 1968, Beaman 1973). Storks were frequently observed to cross the Bosphorus, over Garipçe, *c*4.5 km north of the study site. Many of those birds were probably missed from our observation point.

A single observation point is not sufficient to cover the whole migration front over the Bosphorus (Van den Bossche & Lens 1994). A recent study in autumn 2008 by the Milvus Group (2008) used a team of 17 persons and five watchpoints along the Bosphorus and counted 150 217 raptors, approximately four times higher than the *c*37 000 raptors counted in 1966 by Porter & Willis (1967). Similarly, at least four points are needed to cover the whole spring migration over the Bosphorus, and if combined with other count stations on the Kapıdağ peninsula and possibly the Dardanelles, spring counts in northwest Turkey could be an important tool for monitoring populations of east European storks, pelicans and raptors.

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