South West Georgia: An Important Bottleneck for Raptor Migration during Autumn

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South West Georgia: an important bottleneck for raptor migration during autumn

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Counts of migrating raptors at Batumi, Georgia, revealed the eastern Black Sea coast to form one of the most important bottlenecks for raptor migration during autumn in the Eurasian–African migration system. Totals for 10 species (European Honey-buzzard *Pernis apivorus*, Steppe Buzzard *Buteo buteo vulpinus*, Black Kite *Milvus migrans*, Eurasian Sparrowhawk *Accipiter nisus*, Levant Sparrowhawk *Accipiter brevipes*, Montagu's Harrier *Circus pygargus*, Pallid Harrier *Circus macrourus*, Lesser Spotted Eagle *Aquila pomarina*, Greater Spotted Eagle *Aquila clanga*, Booted Eagle *Aquila pennata*) exceeded 1% of their estimated world population. We compare the observed abundance of each species to estimates of the presumed source populations in European Russia. Counts of most species involved only a limited subset of these source populations, except for European Honey-buzzard and Lesser Spotted Eagle, which were more numerous than predicted. This could be due to inaccurate population estimates or because birds from NE Europe or W Asia are also using this migration route.

Key words: raptor migration, migration count, monitoring, Caucasus, Batumi, Black Sea, phenology

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Many raptor species minimize energetic costs by using atmospheric updrafts from thermal convection or orographic lift during migration (Kerlinger 1989, Bruderer & Boldt 2001, Shamoun-Baranes et al. 2003). Therefore, migration routes are often situated along 'leading lines', geographic features where favourable atmospheric conditions for slope- or thermal soaring prevail (Mueller & Berger 1967). Furthermore, soaring raptors are reluctant to cross barriers such as wide spans of open water or high mountain ranges, where a lack of thermal updraft for assisted flight requires compensation by flapping (Bruderer *et al.* 1994). This leads to the occurrence of 'bottlenecks', where migration routes converge and large numbers of migrants can be observed (Zalles & Bildstein 2000). In the European-African migration system, several large water bodies act as a barrier, and a large proportion of the migration of soaring birds between these two continents is concentrated at just a few bottlenecks around the Mediterranean Sea, Black Sea and Red Sea (Evans & Lathbury 1973, Bijlsma 1987, Porter & Beaman 1985, Zalles & Bildstein 2000, Shirihai *et al.* 2000). Systematic surveys of raptor migration by ground-based observers started in North America in the 1930s (Bednarz *et al.* 1990). At some sites, such as Hawk Mountain (Bildstein 2006), data have been collected for over 60 years. In the European-African migration system several major bottlenecks were described in the 1960s to 1980s: Eilat (Safriel 1968, Christensen *et al.* 1981), Straits of Gibraltar (Evans & Lathbury 1973, Bernis 1980), the Bosphorus (Nisbet & Smout 1957, Porter & Willis 1968) and Suez (Bijlsma 1983).

The first indications of raptor migration along the eastern Black Sea date back to the 1960s when Jähme (1965) and Kumerloeve (1967) made some counts at Gudauta, USSR and at various locations in NE Turkey. Later, in 1976, a systematic full-season count was organized in NE Turkey and covered both the Black Sea

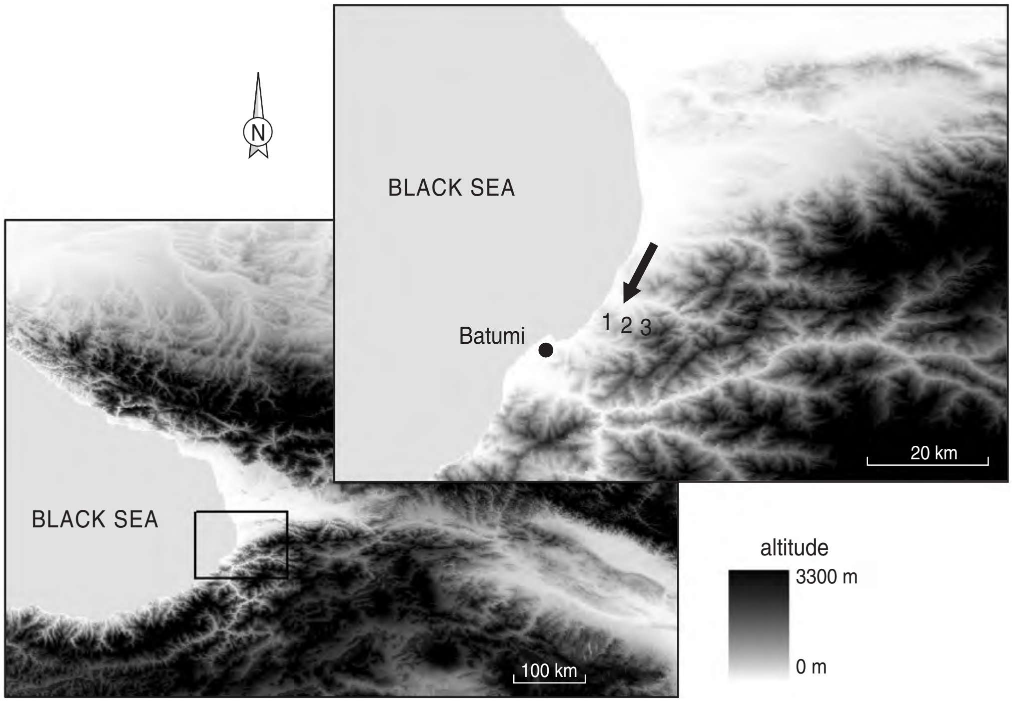

Figure 1. Location of count stations (1 and 2) and the station where pilot counts were conducted (3). The main direction of autumn migration is indicated by an arrow. The 'bottleneck' is wedged in between Black Sea and Lesser Caucasus.

coast and the Chorokhi Valley further inland. During this survey, c. 370,000 raptors were observed (Andrews *et al.* 1977). Since then, several short-term surveys have been carried out on the Turkish side of this bottleneck. Data from that site are available for 1977 (11–25 October), 1978 (18–27 September), 1980 (20 September – 2 October) and 1990 (16–28 September) (Beaman 1977, Kok & Ongenae 1995). On the Georgian side, irregular counts have been made during autumn 2002 and 2005 (Abuladze 2008), and a one-month count took place in 2003 (Goradze, unpubl.). However, none of the counts in Georgia revealed more than 150,000 raptors.

During autumn, migrants are funnelled into a narrow corridor formed by the Black Sea coast and the Lesser Caucasus mountains, the latter rising to over 2000 m within 25 km from the coast. The effect of the mountains in concentrating raptor migration is possibly enhanced by the dense clouds in which they are often covered. The bottleneck reaches its narrowest point near the city of Batumi. Further south, autumn migrants either continue their journey along the coast or follow a more inland route through the Chorokhi valley (Andrews *et al.* 1977).

A closer examination of the local topography and dynamics of migration by B. Verhelst and J. Jansen in 2007 led to the suspicion that the magnitude of migration through this bottleneck could be much higher than assumed and more concentrated on the Georgian than on the Turkish side. Bijlsma (1983) suggested that apparently low counts of some species may have been the result of non-complete coverage of the migration corridor by Andrews *et al.* (1977). In autumn 2008, the first Batumi Raptor Count took place (www.batumiraptorcount.org) to document the magnitude and timing of raptor migration at the Georgian side of the eastern Black Sea coast. This survey was repeated in 2009.

This paper documents the results of the 2008 and 2009 field surveys. We compare our observations to presumed source populations, describe the phenology of the most abundant species, and discuss the potential of the bottleneck for future monitoring of raptor populations.

METHODS

Study area & period

The study area is located NE of Batumi, Georgia, on the coastal plains of the Black Sea and in the foothills of the Lesser Caucasus mountain range. Two count stations were chosen on an approximate east–west transect, 2 and 6 km eastward from the coast (41°41'05"N–41°43'51"E and 41°41'08"–41°46'43"E, Fig. 1). Pilot counts took place on a third station further east, 13 km inland. Counts were conducted from 21 August until 13 October. They lasted from one hour after sunrise until two hours before sunset, and were interrupted only by heavy rain and thunderstorms, when there was virtually no migration and counting became difficult.

Main observed species

The European Honey-buzzard *Pernis apivorus* breeds from West Europe to the Altai region (Ferguson-Lees & Christie 2000). Adult birds are known to concentrate at bottlenecks, while juveniles migrate over a broader front (Hake *et al.* 2003). They winter in West and Central Africa (Ferguson-Lees & Christie 2000, Mebs & Schmidt 2006).

The Buzzard *Buteo buteo m*igration at Batumi consists mainly of the *vulpinus* subspecies. This broad-winged raptor depends on thermals that allow soaring-gliding (Spaar 1997, 1999), and therefore concentrates at bottlenecks (Ferguson-Lees & Christie 2000). This is supported by the lack of cross-Mediterranean flights. *B. buteo vulpinus* populations winter in East and South Africa (Mebs & Schmidt 2006).

Black Kite *Milvus migrans* is a medium-sized raptor with relatively narrow, long wings enabling both soaring and flapping flight strategies (Spaar 1997). The nominate *migrans* breeds from the former Soviet Union to the Tien Shan mountains in Central Asia. In large parts of Central Europe the species has seriously declined (Birdlife International 2004).

Levant Sparrowhawk *Accipiter brevipes* breeds from the Balkans through Ukraine and Turkey to SE Russia (Birdlife International 2004), but population sizes and reproductive success are not well known (Mebs & Schmidt 2006). The species migrates in flocks and is partly constrained to use bottlenecks. It relies on soaring and flapping flight (Spaar 1997).

Eurasian Sparrowhawk *Accipiter nisus* breeds from West Europe to the Pacific Ocean (Mebs & Schmidt 2006). The European population size is large (with 160,000–180,000 in European Russia) and consists of short-distance migrants wintering in Europe. The species mainly uses active flapping flight and is not expected to concentrate at bottlenecks. It usually migrates singly or in small flocks (Ferguson-Lees & Christie 2000).

Booted Eagle *Aquila pennata* is a broad-winged long-distance migrant (Ferguson-Lees & Christie 2000) with a strong tendency to avoid crossing geographical barriers like the Mediterranean Sea (Premuda *et al.* 2007). The European population shows a clear east-west migratory divide (Ferguson-Lees & Christie 2000). European populations winter in Africa south of the Sahara (Mebs & Schmidt 2006).

The Short-toed Eagle *Circaetus gallicus* distribution reaches from the Mediterranean basin to West Siberia and Kazakhstan. The European population shows a relatively clear migratory divide (Ferguson-Lees & Christie 2000), with a circuitous migration around the Mediterranean (Agostini *et al.* 2002). Short-toed Eagles from Europe winter in the Sahel (Mebs & Schmidt 2006).

Lesser Spotted Eagle *Aquila pomarina* breeds from NE Germany and Poland south through Slovakia and Hungary to the Balkans, and east to Belarus, Ukraine and the Caucasus (Ferguson-Lees & Christie 2000). It is a long distance migrant, mostly wintering in SE Africa.

Count method

Each station was occupied by at least two observers, equipped with binoculars and spotting scopes. All stations registered every migrating bird or group of birds with the time of passage and their position relative to the station. When migration intensity was low, birds were counted individually. When intensities became higher, they were counted in multiples of 10. Most birds were identified to species level and, if possible, they were sexed and aged. Because of the limited distance between the stations, some overlap in observations occurred, and data recorded at each station were compared to check and eliminate possible double counts using timing and location of the passage (Agostini *et al.* 2007, see also Dovrat 1991). In so doing, we adopted a conservative and standardized approach, and the recorded numbers therefore are a minimum estimate. Radio and mobile phone communication between the stations further reduced double counting bias.

Correcting for unidentified birds

In order to improve the estimates of abundances of migrating raptors, we corrected the observed totals by attributing unidentified birds to the most probable species. The method used was based on the assumption that, within a day, the proportions of species are roughly the same in both identified and unidentified birds. In many cases, birds were registered as unidentified between two similar species, e.g. Levant/Eurasian Sparrowhawk *Accipiter brevipes/nisus*, and because of their rather different phenology, recalculation should

Table 1. Raptor species recorded at the Batumi bottleneck during autumn migration in 2008–2009, showing total observed and corrected numbers (corrected for unidentified birds; see Methods), coefficient of variation (CV, %; for species with >50 per year), average median date, date of first 5% and first 95% of passage (for species with >10 per year) and length of central 90% of passage (days).

Species	Numbers observed/corrected 2008	Numbers observed/corrected 2009	CV	Median date	Date of first 5%	Date of first 95%	Length of central 90%
European Honey-buzzard *Pernis apivorus*[2]	394,425/406,276	446,017/500,612	9	04/09	26/08	12/09	17
Steppe Buzzard *Buteo buteo*[1,2]	269,440/300,277	167,635/215,381	33	29/09	18/09	13/10	25
Black Kite *Milvus migrans*[2]	57,999/66,161	71,108/100,117	14	19/09	02/09	06/10	34
Eurasian Sparrowhawk *Accipiter nisus*[1]	4054/6547	5187/7452	17	21/09	05/09	13/10	38
Western Marsh Harrier *Circus aeruginosus*	4094/4123	4234/4314	2	14/09	28/08	02/10	35
Booted Eagle *Hieraaetus pennatus*	3549/–	4738/	20	19/09	28/08	29/09	32
Levant Sparrowhawk *Accipiter brevipes*[2]	3286/4462	3078/4874	5	11/09	29/08	22/09	24
Lesser Spotted Eagle *Aquila pomarina*[2]	1814/3280	3512/6307	45	26/09	16/09	09/10	23
Montagu's Harrier *Circus pygargus*	947/6913	1505/3474	32	02/09	25/08	14/09	20
Short-toed Eagle *Circaetus gallicus*[1,2]	639/–	712/712	8	27/09	10/09	11/10	31
Pallid Harrier *Circus macrourus*	510/1965	484/1338	4	16/09	28/08	30/09	33
Eurasian Hobby *Falco subbuteo*	418/531	447/587	5	16/09	30/08	07/10	38
Red-footed Falcon *Falco vespertinus*[1]	265/353	168/205	32	02/10	12/09	10/10	28
Steppe Eagle *Aquila nipalensis*[1,2]	169/364	162/299	3	30/09	07/09	13/10	35
Common Kestrel *Falco tinnunculus*	43/218	164/444	83	24/09	07/09	08/10	31
Long-legged Buzzard *Buteo rufinus*	109/–	88/–	15	02/10	31/08	13/10	43
Greater Spotted Eagle *Aquila clanga*[1,2]	74/122	75/174	1	03/10	12/09	13/10	31
Lesser Kestrel *Falco naumanni*[2]	90/337	59/169	29	16/09	08/09	30/09	22
Osprey *Pandion haliaetus*	55/–	47/–		15/09	28/08	02/10	35
Peregrine Falcon *Falco peregrinus*	22/–	27/–		12/09	28/08	08/10	41
Northern Goshawk *Accipiter gentilis*	12/–	20/–		14/09	23/08	12/10	50
Egyptian Vulture *Neophron percnopterus*	13/–	13/–		13/09	30/08	26/09	27
Eastern Imperial Eagle *Aquila heliaca*	21/–	4/–		4/10	19/09	14/10	25
Hen Harrier *Circus cyaneus*	7/–	15/–					
Merlin *Falco columbarius*	8/–	7/–					
White-tailed Eagle *Haliaeetus albicilla*	6/–	6/–					
Griffon Vulture *Gyps fulvus*	1/–	8/–					
Saker Falcon *Falco cherrug*	3/–	3/–					
Oriental Honey-buzzard *Pernis ptilorhyncus*	0/–	2/–					
Golden Eagle *Aquila chrysaetos*	1/–	1/–					
Red Kite *Milvus milvus*	1/–	0/–					
Cinereous Vulture *Aegypius monachus*	1/–	0/–					
Rough-legged Hawk *Buteo lagopus*	1/–	0/–					
Lanner Falcon *Falco biarmicus*	0/–	1/–					
Unidentified raptor	51370/0	131641/0					
Pallid/Montagu's Harrier	7264/0	2664/0					
Levant/Eurasian Sparrowhawk	3669/0	4061/0					
Large eagle	1711/0	3031/0					
Common/Lesser Kestrel	422/0	390/0					
Eurasian Hobby/Red-footed Falcon	166/0	177/0					
Total	806679	851491					

[1]Species that had not finished migration at the end of the survey (>1% recorded after 10 October).
[2]Species flocking with conspecifics or heterospecifics during migration.

lead to only minor bias. The proportions of birds assigned using this method, were 8% in 2008 and 17% in 2009. We did not perform this correction for species that are easily recognizable or for which the number of positively identified individuals was too small to justify such an approach. Some less abundant species often migrate together with a much more numerous species from which they are not easily distinguished (e.g. Oriental Honey-buzzard *Pernis ptilorhynchus*, Greater Spotted *Eagle Aquila* clanga, Long-legged buzzard *Buteo rufinus*, Hen Harrier *Circus cyaneus*). It was very hard to make an accurate estimate of the abundance of these species, and they were probably more numerous than our records suggest.

Comparing observed numbers with breeding population size

We compared the abundances observed in Batumi with breeding bird data (Birdlife International 2004) and surveys of migration of soaring birds at the western Black Sea coast. We divided Eastern Europe arbitrarily into three parts, which are thought to feed the major flyways along the east and west side of the Black Sea:

- *Balkans*: soaring raptors from these areas are thought to migrate along the west side of the Black Sea (Albania, Austria, Bosnia, Bulgaria, Croatia, Czech Republic, Greece, Hungary, Macedonia, Moldova, Poland, Romania, Serbia, Slovakia & Slovenia).
- *European Russia*: populations thought to migrate east of the Black Sea.
- N*E Europe*: populations for which it is unclear along which side of the Black Sea they migrate (Belarus, Estonia, Finland, Latvia, Lithuania & Ukraine).

By including reproductive success, as summarized by Mebs & Schmidt (2006), we can make an estimate of the number of autumn migrants that can be expected at bottlenecks on both sides of the Black Sea. Discrepancies between expected and recorded numbers at the Black Sea bottlenecks could then result from 1) wrong estimates of breeding populations in the hinterland or 2) an important inflow from birds breeding further east or west.

RESULTS

During the surveys in 2008 and 2009 at the Batumi bottleneck, on average 829,085 migrating raptors per autumn were observed (Table 1). The vast majority of these consisted of three species: European Honey-buzzard *Pernis apivorus* (51%, 55% after correction for unidentified birds), Steppe Buzzard *Buteo buteo vulpinus* (26% and 31%) and Black Kite *Milvus migrans* (8% and 10%). A total of 34 different species were recorded, 30 of which occurred in both years.

Table 1 and Figures 2A–H describe the phenology of the most numerous species. The duration of the central 90% of migration varied between 17 and 50 days. Although there is a high uncertainty in breeding population estimates, the corrected average totals for ten species probably exceeded 1% of their world population (Table 2).

Observed numbers compared to breeding population size

The East European populations of **European Honey-buzzard** are estimated at maximum 80,000 breeding

Table 2. International importance of the Batumi bottleneck for migratory raptors (numbers averaged for 2008 and 2009, and based on corrections; see text) for which >1% of the estimated world breeding population was recorded. World population estimates are from the website of Birdlife International.

Species	Average Batumi count	World population estimate	Percentage at Batumi
European Honey-buzzard	453,444	350,000–1,000,000	45–130
Black Kite	83,139	1,000,000–6,000,000	1–8
Pallid Harrier	1652	18,000–30,000	6–9
Montagu's Harrier	5194	100,000	5
Levant Sparrowhawk	4668	10,000–100,000	5–47
Steppe Buzzard	257,829	4,000,000	6
Lesser Spotted Eagle	4794	42,000–57,000	8–11
Greater Spotted Eagle	148	5000–13,000	1–3
Steppe Eagle	332	10,000	3
Booted Eagle	4144	10,000–100,000	4–41

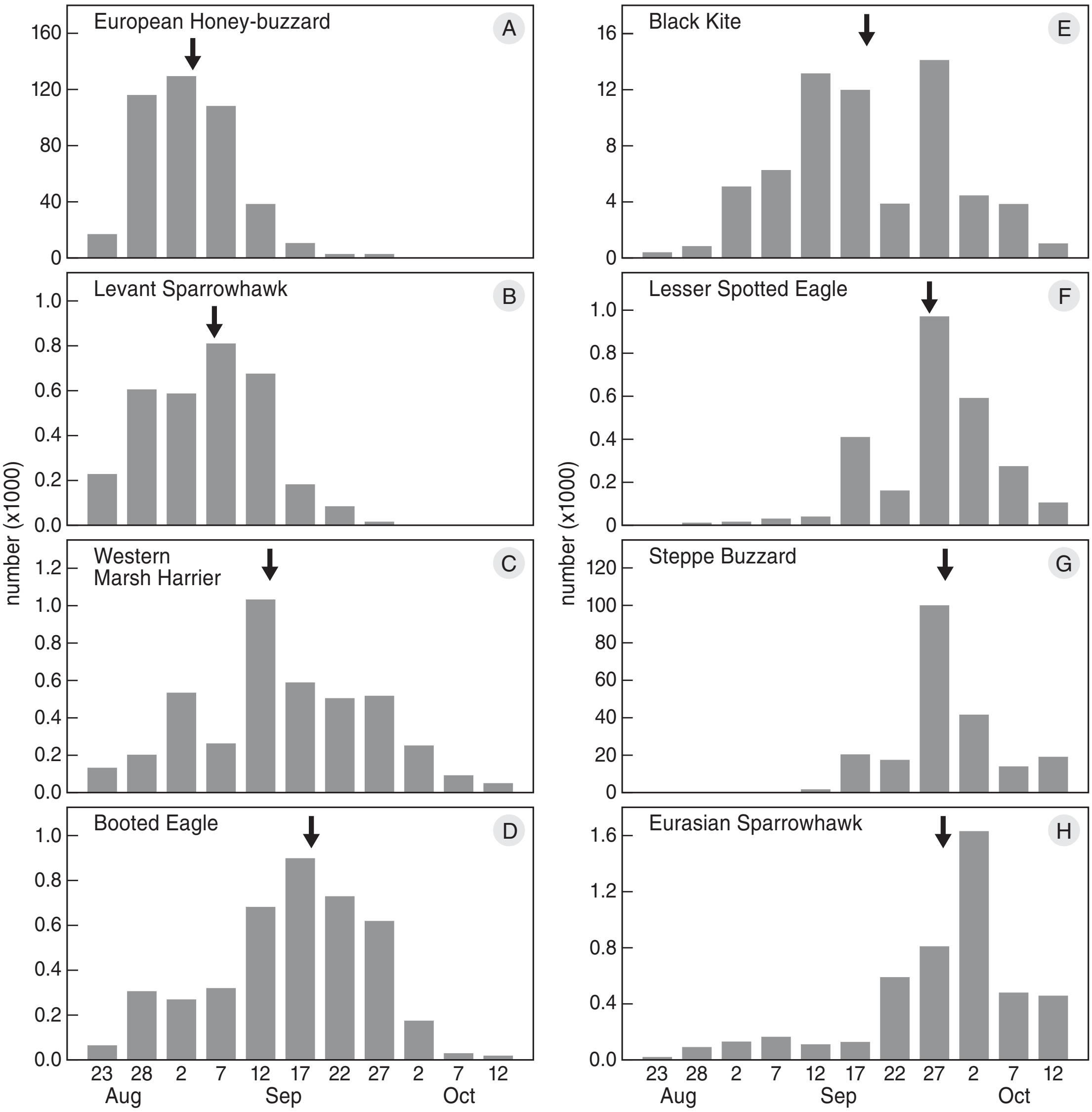

Figure 2. A–H). Phenology of the 8 most numerous species. The graphs give the observed number of individuals averaged over 2008–2009 during each block of five days. Arrows indicate the average median date.

pairs (bp) in European Russia, 22,100 in NE Europe and 21,810 in the Balkans (Birdlife International 2004), and a reproductive rate of 1.15 fledglings/bp was recorded in Germany (Mebs & Schmidt 2006). Even if the whole European Russian population would migrate along the eastern Black Sea coast, this would result in only about 250,000 birds, which is much lower than the abundances recorded in Batumi.

The breeding population of **Steppe Buzzard** consists of 200,000–500,000 bp in European Russia, 71,500–97,000 in NE Europe and 133,000–200,000 in the Balkans (Birdlife International 2004). The totals recorded at the Bosphorus (at least 78,000; Milvus Group 2008) and Batumi (on average 210,000) are relatively low. Observations in Batumi indicate that Steppe Buzzards commonly fly further east over the mountains, a route that Honey-buzzards seem to avoid.

In European Russia the **Black Kite** population size is estimated at 30,000–50,000 bp (Birdlife International 2004). Regionally important numbers of Black Kites winter in Israel (Shirihai *et al.* 2000) and the Caucasus (Abuladze 2008). Despite having an intermediate flight strategy (flapping and soaring), the majority of Black Kites seem to concentrate at bottlenecks in Europe

(Zalles & Bilstein 2000). At a maximum reproductive rate of 3 fledglings/bp (Mebs & Schmidt 2006) we expect autumn populations of 150,000–250,000 individuals from European Russia (30,000–50,000 bp, BirdLife 2004) and 4,600–8,200 individuals from the Balkans (920–1,640 bp, BirdLife 2004). An important part of the European Russian population therefore seems to migrate through the eastern Black Sea bottleneck.

Autumn counts of **Levant Sparrowhawk** at Israel (>50,000 in 1987; Leshem &Yom-Tov 1996) record a remarkably larger number than is recorded during surveys at either Bosphorus (6,516 in 1978; Bijlsma 1987) or Batumi (4,000–5,000). Observations made at the pilot station (e.g. 644 on 12 September 2009), east of the main eastern Black Sea flyway (see Fig. 1), suggest that high numbers may pass further inland through the Caucasus.

At Batumi, an important age-dependent timing of migration by **Eurasian Sparrowhawk** has been observed, with median dates of passage on 7 September for juveniles and 2 October for adults. However, the migration period is not fully covered by the Batumi survey and the actual median passage date of adults should be even later in the season (Fig. 2).

Given a reproductive rate for **Booted Eagle** of 1 young/bp (Mebs & Schmidt 2006), and breeding population estimates of 240–450 bp in the Balkans, 265–420 bp in NE Europe and 800–1,500 bp in European Russia (Birdlife International 2004) we expect totals of 720–1,350, 795–1,260 and 2,400–4,500 birds for these regions respectively. Counts of only hundreds (maximum of 523 in 1971; Bijlsma 1987) are recorded at the Bosphorus. Bourgas surveys recorded only low numbers of Booted Eagles (at most 155 in 1989; Michev *et al.* 2011). The Batumi counts are consistent with expected numbers, and seem to cover a large part of the East European populations.

Given a reproductive rate for **Short-toed Eagle** of 0.75 young/bp (Mebs & Schmidt 2006) and breeding bird estimates for the Balkans (990–1,750 bp), NE Europe (770–1,000 bp) and European Russia (500–1,000 bp) (Birdlife International 2004), the autumn populations for these regions are estimated at respectively 2,700–4,800, 2,120–2,750 and 1,375–2,750 birds. The Batumi surveys thus cover only a small part of the East European source populations.

Given a reproduction rate for **Lesser Spotted Eagle** of 0.39–0.69 young/bp (Mebs & Smidth 2006), the autumn populations in the Balkans, NE Europe and European Russia are estimated at 13,000–17,000, 20,000–33,000 and 750–1,200 birds respectively (Birdlife International 2004). Of this flocking migrant high concentrations have been noted along the western Black Sea coast, with up to 15,000 at Bourgas (Michev *et al.* 2011), 60,000 across the Bosphorus in 2008 (Milvus Group 2008) and on average 82,000 in Israel in autumn (Shirihai *et al.* 2000). The migration near Batumi (Table 1) is small in comparison, but higher than the expected 1,200 migrants calculated for the Russian hinterland.

Because of the difficulty of distinguishing juveniles and females of **Montagu's and Pallid Harriers**, only a minority (17% in 2008, 43% in 2009) have been identified to species level. Harriers are not known to flock during migration, but in both years and especially on the peak days 'loose flocks' of Montagu's/Pallid Harriers were recorded. The biggest flock, one of 845 individuals, was recorded on 4 September 2008, the peak day for Montagu's Harrier in 2008. The relatively high numbers of harriers observed in Batumi, however, are only small in comparison to the size of breeding populations in European Russia.

DISCUSSION

In comparing breeding population estimates for European Russia to abundances observed at Batumi, three cases occur: (1) observed abundances were higher than expected, (2) observed abundances were in agreement with those expected and (3) lower abundances were recorded than expected.

The first case includes European Honey-buzzard and Lesser Spotted Eagle. The high numbers of European Honey-buzzards observed during the Batumi surveys suggest that populations in European Russia are underestimated or that some birds that migrate through the eastern Black Sea bottleneck originate from Asia. For Lesser Spotted Eagle it is unclear whether the high counts at Batumi are due to underestimated populations in European Russia or if part of the NE European population also migrates east of the Black Sea.

The second case holds for Booted Eagle. This could mean that the whole European Russian population of this species migrates along the eastern Black Sea coast, or that this population is underestimated and partly migrates via other routes. Further counts at other potential bottlenecks in the Caucasus region could resolve this question.

For most species though, only a subset of the European Russian population migrates through the eastern Black Sea bottleneck. It is likely that much of their migration occurs over a broader front, and other important migration routes through the Caucasus may exist.

An important question arises from the observations at Batumi: will it be possible to infer population trends from count data if we continue this standardized survey in the future? Several studies based on data from watch points in the USA have confirmed migration counts as a cost-effective way of monitoring populations of raptors that are hard to survey in their breeding area (Bednarz *et al.* 1990, Dunn & Hussel 1995, Bildstein 1998, Hoffman & Smith 2003). In the European-African migration system, similar analyses have been performed on long-term datasets for Scandinavian populations monitored at Falsterbo, Sweden (Kjellén 1997, Kjellén & Roos 2000) and for European populations migrating across the Pyrenees (Filippi-Codaccioni *et al.* 2010), over the Gibraltar Strait (Bensusan *et al.* 2007) and along the west coast of the Black Sea (Michev *et al.* 2011).

The success of such an approach at the eastern Black Sea coast will depend on the ability to delineate the geographic range of source populations and on the long-term availability of volunteers to conduct a standardized count. A better understanding of how weather conditions affect migration behaviour and of the complex picture of raptor migration through the Caucasus is likely to increase the precision of the monitoring scheme. Insights into these factors can be derived from satellite-tracking and through pilot counts at other potential bottlenecks in the Caucasus region. Lewis & Gould (2000) performed an extensive assessment of the potential of six raptor watch sites in the USA to detect population trends of migrating raptors. They suggest that any detected trend can only be representative for the population if the proportionality of observed numbers to true abundance remains constant throughout the study period or can be accurately estimated. This condition can be violated if migration routes shift over time, or if an increasing proportion of the population winters north of the bottleneck (for Common Buzzard, see Bensusan *et al.* 2007). Furthermore, migration surveys at bottlenecks face numerous obstacles that impact the accuracy of the count: weather conditions shift birds out of sight from observers, high-altitude soaring makes them difficult to detect, elimination of double counts between different watch points may be arbitrary, constant observer effort may be difficult to maintain. Bottlenecks where the width of the migration corridor is minimal and can be covered by a limited number of watch points should offer the best conditions to conduct a monitoring scheme.

According to Lewis & Gould (2000), the main factor determining the potential of a watch site to detect population trends is the coefficient of variation (CV). To make an average annual decrease of 3% detectable in counts over 25 years with a power of 80%, a CV of 30% or less is required. For most species with on average more than 50 individuals counted, we recorded a CV lower than this (but based on 2 years only). Only Montagu's Harrier, Lesser Spotted Eagle, Common Kestrel, Lesser Kestrel and Red-footed Falcon had CVs of 30–50%. A particular advantage of the Batumi bottleneck is that birds pass low, and are concentrated in a narrow strip along the coast. Pilot counts from a third watch point further inland detected only minor numbers of most species, but relatively high numbers of Steppe Buzzard and Levant Sparrowhawk. Migration over this watch point was more intensive during the second half of the survey, which is consistent with the observations by Andrews *et al.* (1977).

In conclusion, we can state that the Batumi bottleneck has several features potentially favouring a long-term monitoring scheme: the internationally important numbers of many species, the apparent low variability of count totals, the possibility to cover most of the bottleneck with only two count stations, and the relative ease with which birds can be counted. However, more research into the source areas, concentration effects at the bottleneck and the effects of weather conditions on migration are needed to assess the value of monitoring large-scale population trends at the site.

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SAMENVATTING

In het zuidwesten van Georgië vormen de Zwarte Zee aan de ene kant en de Kaukasus aan de andere kant een smalle doorgang voor trekvogels. De auteurs laten in het onderhavige onderzoek zien dat dit gebied in het najaar een belangrijk onderdeel vormt van een trekroute van roofvogels. Zij deden gedurende de najaarstrek van 2008 en 2009 bij de stad Batumi, op het smalste punt van de doorgang, systematische tellingen van trekkende roofvogels. In beide jaren passeerde voor 10 soorten roofvogels meer dan 1% van de totale wereldpopulatie het gebied. De auteurs vergeleken de getelde aantallen met de geschatte populatiegroottes in Europees Rusland in de veronderstelling dat een groot deel hiervan langs Batumi zou trekken. De aantallen lagen voor de meeste soorten echter beneden de verwachting, behalve voor Wespendief *Pernis apivorus* en Schreeuwarend *Aquila pomarina* die beide talrijker waren dan berekend. Dit verschil wordt waarschijnlijk veroorzaakt doordat de herkomst van de langstrekkende vogels niet altijd bekend is. Als hier meer gegevens over bekend zijn, zo concluderen de auteurs, zouden structurele tellingen op dit punt langs deze trekroute nuttige informatie kunnen opleveren over fluctuaties in populatieaantallen. (KvO)

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