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Records of Globally Red-listed Bird Species Migrating through the Besh Barmag Bottleneck, Azerbaijan Republic

Michael Heiss
Vogelwarte Hiddensee, Zoological Institute and Museum, Ernst Moritz Arndt University of Greifswald, Soldmannstraße 23, 17489 Greifswald, Germany

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Abstract
Several migratory bird species have undergone rapid population decline in recent decades for various reasons. The immediate detection of such declines is necessary to prevent their extinction. One important tool for such detections is long-term monitoring at bird migration count sites, which are often located at migration bottlenecks. Such a bottleneck was recently discovered at Mount Besh Barmag in the Azerbaijan Republic. Studies carried out at this site revealed the passage of an estimated 1.24–1.51 million migrant birds in autumn 2011 and 0.65–0.82 million in spring 2012. Among 278 bird species recorded in these studies, 34 are thought likely to exceed the 1% criterion of the world or flyway populations, making them valuable target species for long-term monitoring programmes. Six of these species are considered by the IUCN Red List as threatened or near threatened. A further 22 globally threatened or near threatened bird species were also observed. The present paper discusses these 28 species focusing on numbers, phenology and suitability for long-term monitoring projects.

1. Introduction

Migratory birds as a group of animals interacting on a global scale are exposed to global changes and threats in various ways within their breeding, wintering and passage areas. Threats such as hunting (Villafuerte *et al.* 1998; Hirschfeld & Heyd 2005), climate change (Both *et al.* 2006; Møller *et al.* 2008), land-use change (Newton 2004), infrastructural developments (de Lucas *et al.* 2004; Reijnen & Foppen 2006; Summers *et al.* 2011) and other human activities often negatively affect bird populations (Kirby *et al.* 2008), which in extreme cases have led to the extinction of bird species in the past (BirdLife International 2014). Any intervention to avert further outcomes of this nature requires knowledge about negative developments in population size and dynamics both at local and global levels.

One method of gathering such information is to carry out bird migration counts at so-called 'bottlenecks', where a concentration of migratory birds takes place along coastlines or in association with topographical barriers (Berthold 2000). Long-term monitoring efforts at such locations provide important population data without incurring the high costs involved in breeding bird surveys (Gregory *et al.* 2004).

One such location was recently described for the Azerbaijan Republic at Mount Besh Barmag (Heiss & Gauger 2011). The estimated passage of 1.24–1.51 million migrants in autumn 2011 and 0.65–0.82 million in spring 2012 elevated this bottleneck to international importance (Heiss 2013). Furthermore, according to Heiss (2013), of the 278 bird species recorded at the site, the numbers of 34 are expected to satisfy the "1% criterion", a measurement describing a

* Corresponding: *michaheiss@aol.com*

critical threshold for populations (Yosef *et al.* 2000; BirdLife International 2001).

As information about this ornithologically speaking remote and little studied area is outdated or sparse, e.g. for most waterbirds along this flyway (Nagy *et al.* 2015), this paper aims to provide researchers working in this area with data on the current situation of globally threatened or near threatened bird species that were observed during the migration periods in autumn 2011 and spring 2012 at the Besh Barmag bottleneck.

2. Material and Methods

2.1. Study area

Bird migration counts were conducted at Besh Barmag bottleneck (40°59'N, 49°13'E). Here, the eastern foothills of the Greater Caucasus almost reach the Caspian Sea coast forming a three kilometre wide coastal plain through which birds are funnelled during migration. Three different observation points were used to gain information about the main migration types. Waterbird migration was observed from a fixed point at the shoreline. A second point on the coastal plain focused on passerines migrating through the coastal plain. The third point was located on top of the foothills at Besh Barmag to count migrating raptors (cf. Heiss 2013).

2.2. Bird migration counts

Counting took place in autumn from 2 August to 17 November 2011 (755 hours of observation) and in spring from 1 March to 29 May 2012 (615 hours of observation). Except on foggy days when visibility was much reduced, counts were conducted even under poor weather conditions such as storm, rain or snowfall. A pair of binoculars (10x42) and a spotting scope (20–60x) were used for bird observations. In both seasons, counting was done daily starting at sunrise. For each subsequent hour, data were recorded for bird species, numbers and flight direction of all birds.

Counts were conducted for at least six hours per day with additional randomly distributed hours to cover the rest of the day. This study design produces off-watch periods for a single observer, allowing him to take a rest and avoid loss of concentration. These data gaps were subsequently filled by interpolation to reveal information about total daily numbers. Other data gaps occurred because each of the observation points was visited only once in a three-day cycle, leaving two days unwatched between visits. Data for these unwatched days were also interpolated in order to reveal information about migration phenology and allow estimates of the total number of migrants. Thus the estimated numbers are those that might have been derived from full day counts throughout the entire observation period. The interpolation method is described in detail in Heiss (2013).

In addition, raw data obtained from 29 September to 24 October 2007 (from Heiss & Gauger 2011) and from 10 October to 7 November 2014 (H., S. & F. Olk, pers. comm.; available on http://www.trektellen.org/site/totals/1533/2014) were also taken into consideration to give a better picture.

3.1. Results and Discussion

During the counts in autumn 2011 and in the following spring, 278 bird species were observed (Heiss 2013). Of these, 28 species (Table 1) are globally threatened or near threatened, one species being listed as ‘critically endangered’ (CR), four as ‘endangered’ (EN), eight as ‘vulnerable’ (VU) and 15 as ‘near threatened’ (NT) by the International Union for Conservation of Nature and Natural Resources (IUCN 2015). The occurrence of these species is discussed below.

Table 1. Numbers of individuals of globally threatened bird species, i.e. 'critically endangered' (CR), 'endangered' (EN), 'vulnerable' (VU), and 'near threatened' (NT), according to IUCN (2015) at Besh Barmag bottleneck. Due to the design of the study, it has been necessary to calculate an estimate (mean ± SD) to give a more precise total migration number. This interpolation method is described in Heiss (2013).

Species	Autumn 2011		Spring 2012		IUCN status
	Observed	Estimated	Observed	Estimated	
Lesser White-fronted Goose *Anser erythropus*	10	50*	0	–	VU
Common Pochard *Aythya ferina*	54	100*	60	100*	VU
Ferruginous Duck *Aythya nyroca*	9	50*	0	–	NT
Velvet Scoter *Melanitta fusca*	4	15*	0	–	VU
White-headed Duck *Oxyura leucocephala*	0	–	1	–	EN
Slavonian Grebe *Podiceps auritus*	6	15*	0	–	VU
Dalmatian Pelican *Pelecanus crispus*	1,225	5,000*	4,046	5,155 ± 579	VU
Lammergeier *Gypaetus barbatus*	0	–	1	–	NT
Egyptian Vulture *Neophron percnopterus*	4	20*	16	30*	EN
Cinereous Vulture *Aegypius monachus*	60	75*	35	50*	NT
Pallid Harrier *Circus macrourus*	61	158 ± 30	85	226 ± 14	NT
Greater Spotted Eagle *Aquila clanga*	1	5*	1	5*	VU
Steppe Eagle *Aquila nipalensis*	140	250*	262	798 ± 0	EN
Eastern Imperial Eagle *Aquila heliaca*	42	100*	11	50*	VU
Red-footed Falcon *Falco vespertinus*	2	5*	0	–	NT
Saker Falcon *Falco cherrug*	1	5*	1	5*	EN
Little Bustard *Tetrax tetrax*	100,988	114,693 ± 8,798	4,105	10,000*	NT
Northern Lapwing *Vanellus vanellus*	1,677	2,615 ± 392	414	781 ± 112	NT
Sociable Lapwing *Vanellus gregarius*	19	50*	27	50*	CR
Eurasian Oystercatcher *Haematopus ostralegus*	78	227 ± 35	7	15*	NT
Eurasian Curlew *Numenius arquata*	20	50*	4	15*	NT
Black-tailed Godwit *Limosa limosa*	13	50*	10	50*	NT
Red Knot *Calidris canutus*	1	–	0	–	NT
Curlew Sandpiper *Calidris ferruginea*	52	173 ± 37	8	15*	NT
Black-winged Pratincole *Glareola nordmanni*	4,286	5,000*	1,923	5,000*	NT
European Turtle Dove *Streptopelia turtur*	67	92 ± 10	24	62 + 19	VU
Redwing *Turdus iliacus*	81	200*	4	10*	NT
Meadow Pipit *Anthus pratensis*	692	2,641 ± 694	735	2,034 ± 203	NT

*Tentative estimate based on expert knowledge because data were insufficient for interpolation.

Lesser White-fronted Goose *Anser erythropus*
Ten individuals were observed flying north on 30 October and one individual flying south later on the same day (K. Gauger, pers. comm.). There were probably more individuals among the 3,037 unidentified 'grey geese' observed in autumn 2011. Other single birds are likely to have been overlooked in mixed flocks with Greater White-fronted Geese *Anser albifrons*. Fifteen individuals of the Lesser White-fronted

Goose were also observed in a short-term study between 28 October and 3 November 2014 (H., S. & F. Olk, pers. comm.), closely matching the number of individuals and phenology in autumn 2011. There were no records in autumn 2007 (Heiss & Gauger 2011), but this study ended on 24 October, which is probably slightly too early to cover the passage of Lesser White-fronted Geese in its entirety. No observation was registered in the spring 2012 count. In the Azerbaijan Republic, this species has an important wintering site in the Gyzylagach State Reserve with more than 4,000 individuals (Sultanov 2004; Sultanov 2008; Patrikeev 2004).

Common Pochard *Aythya ferina*
One individual was observed on 21 August 2011 followed by occasional records in October and November 2011. The largest migrating flocks of 20 and 15 individuals were observed on 9 and 14 October, respectively. Small numbers were also observed in autumn 2007 (Heiss & Gauger 2011) and autumn 2014 (H., S. & F. Olk, pers. comm.). This species was observed regularly offshore in March and 3 April 2012. During this time, migratory movements were rarely observed, but resting flocks were a regular sight offshore, with as many as 60 individuals on 24 March. The Common Pochard is an abundant wintering species with several tens of thousands of individuals in southern Azerbaijan (Sultanov 2008), which suggests that most of the passage of this species either occurs outside the counting periods or takes place out of sight of observers.

Ferruginous Duck *Aythya nyroca*
This is a scarce migrant with a total of only nine individuals observed: five migrating on 2 September and four on 14 September 2011, but none in spring 2012. Similarly low numbers were observed in a short-term study in autumn 2007 (Heiss & Gauger 2011), but in view of the high numbers of unidentified ducks in the counts (27,115 in autumn 2011 and 46 in spring 2012; Heiss 2013) and owing to the risk of being overlooked when migrating in mixed flocks with other duck species, slightly higher numbers may be presumed. This species, however, breeds and winters in considerable numbers in the Azerbaijan Republic (Sultanov 2003; Sultanov & Agayeva 2003; Patrikeev 2004). Therefore, the observed and estimated numbers (Table 1) should probably be seen in the context of generally low numbers of diving ducks *Aythya* species in contrast to high numbers of dabbling ducks *Anas* species at the observation site (Heiss & Gauger 2011; Heiss 2013).

Velvet Scoter *Melanitta fusca*
In 2011, Velvet Scoters were only observed in late autumn: two individuals migrating south on 8 November and two individuals resting offshore on 15 November. This species was also observed in autumn 2014, with seven individuals on 27 October (H., S. & F. Olk, pers. comm.), but not in autumn 2007 (Heiss & Gauger 2011).

White-headed Duck *Oxyura leucocephala*
Only one male was observed from 8 to 10 April 2012 resting in a coastal lagoon. This endangered species winters regularly in fair numbers in the Azerbaijan Republic (Patrikeev 2004; Sultanov 2004; Sultanov 2006; Sultanov 2008).

Slavonian Grebe *Podiceps auritus*
Six individuals were seen resting offshore on 5 November and two flew north on 11 November 2011. Low numbers were also observed in autumn 2007 (Heiss & Gauger 2011) and autumn 2014 (H., S. & F. Olk, pers. comm.).

Dalmatian Pelican *Pelecanus crispus*
In autumn 2011, the first migrating flock was observed on 22 September with 30 individuals in the coastal plain (C. Gibbins, pers. comm.). On 23 September, four individuals were discovered resting offshore. Regular migration was noted throughout October and November (Heiss 2016), when migration peaked on 9 November with 701 individuals in four flocks (155, 125, 380 and 41 individuals). The flock of 380 individuals on this day was the largest observed flock. This species was also observed in autumn 2007 with a total of 239 individuals (Heiss & Gauger 2011) and in autumn 2014 with a total of 176 individuals (H., S. & F. Olk, pers. comm.), but these two studies probably did not cover the entire autumn migration period of Dalmatian Pelicans at Besh Barmag. In spring 2012, this species was primarily

observed in March (Heiss 2016). The maximum daily count was on 4 March with 1,038 individuals in nine flocks (170, 240, 14, 12, 30, 285, 110, 170 and 7 individuals) flying north. On the same day, about 300 individuals were found resting on the nearby waste dump of a chicken factory, where about 50 individuals were also found dead, possibly from starvation during the winter months. In spring, an estimated 33%–57% of the world and 51%–96% of the flyway population passed through, revealing this area to be a crucial bottleneck for this species (Heiss 2013).

Lammergeier *Gypaetus barbatus*
One immature individual was observed flying through the foothills on 11 April 2012.

Egyptian Vulture *Neophron percnopterus*
A few individuals were recorded in August and September 2011: e.g. above the Greater Caucasus foothills, two individuals on 4 August, one on 14 August and one juvenile on 7 September; one adult on 27 September on the plain. None showed clear migratory behaviour. In spring 2012, the species was first recorded on 11 April with one individual flying north in the foothills. From then until the end of May, there were several other observations from this site, and a total of 16 individuals were thought to be on migration. Most individuals flying north were observed on 9 May, with seven individuals in two small flocks (4 and 3 individuals). The observation of two individuals at a waste dump on 17 April was the only spring record away from the foothills. This species was a more or less regular sight at Besh Barmag, but distinguishing between migratory and local movements was difficult. Egyptian Vultures are thought to breed nearby, and the waste dump of a chicken factory, a picnic site frequently visited by tourists and locals, and the large amounts of waste produced by the ritual slaughtering of sheep for religious purposes at Mount Besh Barmag not far from the observation points, all attract these vultures into the area. These will further obscure actual migratory movements.

Cinereous Vulture *Aegypius monachus*
As in other vulture species, migrating individuals were hardly separable from local birds. Throughout autumn 2011, Cinereous Vultures were highly attracted by the waste dump of a chicken factory, initially in low numbers in August (e.g. two individuals on 4 August), then with a maximum of 60 individuals on 17 November. The situation in spring 2012 was similar. Starting with low numbers at the beginning of March (e.g. two individuals on 5 March), numbers increased until mid-April. The largest numbers were noted on 2 April and 17 April with 30 and 35 individuals, respectively. This species was observed until 21 April, when three individuals were seen in the foothills, although in general, birds were concentrated at the waste dump on the plain. Concentrations at the waste dump were also observed in autumn 2007 (Heiss & Gauger 2011), autumn 2014 (H., S. & F. Olk, pers. comm.) and winter 2015 (42 individuals on 25 January 2015, M. Heiss, pers. obs.).

Pallid Harrier *Circus macrourus*
In autumn 2011, migration started in early September with one individual on 5 September and a peak of 23 individuals on 18 September. Migration continued in low numbers until 7 November (Heiss 2016), when two individuals were observed. Birds of this species passed mainly through the coastal plain. Migration was noted throughout the spring count in 2012 (Heiss 2016). The main migration period was from mid-March to the end of April with two peaks of 15 individuals on 25 March and 12 individuals on 18 April. The last individual was observed on 19 May flying north. From March to mid-April, migration took place in the coastal plain, but then shifted into the lower foothills. For both counting seasons, the true number of migrating Pallid Harriers must be regarded as greater than the observed number owing to the uncertainties involved in the identification of female-coloured harriers. Observations from autumn 2007 (Heiss & Gauger 2011) and autumn 2014 (H., S. & F. Olk, pers. comm.) suggest a regular occurrence of migrating Pallid Harriers at Besh Barmag. Calculated migration estimates (Table 1) reveal that this species probably fulfils the 1% criterion of the flyway population at Besh Barmag (Heiss 2013), making it an interesting target species for monitoring purposes.

Greater Spotted Eagle *Aquila clanga*

Only one individual was observed per counting season: one migrating through the coastal plain on 7 November 2011 and one migrating along the foothills on 25 May 2012.

Steppe Eagle *Aquila nipalensis*
In autumn 2011, the first individual arrived on 7 September, followed by eight on 22 September. Birds were observed throughout October, with a peak of 124 individuals on 28 October migrating through the foothills of the Greater Caucasus (K. Gauger, pers. comm.). Small numbers of Steppe Eagles were also counted in autumn 2007 (Heiss & Gauger 2011) and in autumn 2014 (H., S. & F. Olk, pers. comm.). In spring 2012, the first two individuals were observed on 4 and 11 April, respectively. Migration in greater numbers started on 15 April with 20 individuals. A peak was observed on 18 April with 96 individuals. Migration continued until the end of May with 52 individuals on 19 May and 12 individuals on 25 May. At Besh Barmag, the autumn occurrence of Steppe Eagles, and indeed of other soaring raptor species, is thought to be related to weather conditions (Heiss 2013). This was probably the case when 4,500 individuals (daily maximum: 1,400 individuals) were observed migrating south of the bottleneck area within a few days in autumn 2008 (Heiss & Gauger 2011). In spring, Steppe Eagles migrate through the foothills on a regular basis. In spring 2012, the 1% criterion of the flyway population was met (Heiss 2013).

Eastern Imperial Eagle *Aquila heliaca*
This species was observed almost daily throughout autumn 2011, but it was often difficult to separate migrating individuals from those making local movements. Most individuals were observed in the foothills with a peak of 20 individuals migrating on 28 October (K. Gauger, pers. comm.). Only a few observations were made in spring 2012. One individual was found at the waste dump on the coastal plain on 2 March, suggesting wintering at this site. Individuals that were thought to be on migration were observed mainly in the foothills between mid-April and the beginning of May. Eastern Imperial Eagles were also observed in autumn 2007 (Heiss & Gauger 2011) and autumn 2014 (H., S. & F. Olk, pers. comm.).

Red-footed Falcon *Falco vespertinus*
There were only two sightings in autumn 2011: one individual on 22 September feeding among Lesser Kestrels *Falco naumanni* and one on 11 October 2011. There was no record in spring 2012.

Saker Falcon *Falco cherrug*
Only two sightings: one individual migrating on 29 October 2011 (K. Gauger, pers. comm.) and one individual migrating on 21 April 2012 along the foothills.

Little Bustard *Tetrax tetrax*
Exceptionally large numbers of this species were observed in autumn 2011 (Table 1). The first migrating birds arrived on 24 October with 462 individuals in two flocks (456 and 6 individuals). Subsequently, this species was observed almost daily until 15 November. The high total number is the result of a mass migration event that took place on 7 November. The first frost in combination with a first thin layer of snow drove south at least 84,548 migrating individuals. The size of eight of these flocks exceeded 3,000 individuals (3,000, 3,100, 3,600, 4,000, 5,000, 5,650, 7,000 and 8,500 individuals). The migration was spread across the whole coastal plain and several large flocks were even observed migrating offshore, suggesting a possible crossing of the Caspian Sea. On the following day, this migration event continued with smaller but still impressive numbers (>10,000 individuals on 8 November). Small numbers of Little Bustards were also observed in autumn 2007 (Heiss & Gauger 2011) and in autumn 2014 (H., S. & F. Olk, pers. comm.), but clearly these two studies finished too early to cover the complete migration period. In spring 2012, the first birds were observed on 2 March with four migrating individuals, followed by 183 individuals on 7 March, 36 on 15 March, one on 19 March, 112 on 22 March and so on until 1 April, when 3,500 individuals were counted. The last birds were seen on 10 April. Calculated estimates of the autumn 2011 migration revealed the passage of 41%–48% of the world and 71%–82% of the flyway populations (Heiss 2013), making this bottleneck area an important migration corridor for this species. The individuals observed here are almost certainly

those wintering at several locations in the steppes of Azerbaijan where there is an estimated total wintering population of about 150,000 individuals (Gauger 2007).

Northern Lapwing *Vanellus vanellus*
This species was an almost daily sight throughout both observation seasons as it was also a local breeding bird. Migratory movements in autumn 2011 started at the beginning of September and lasted until and beyond the end of the study on 17 November. Further migrants would certainly have passed through after that date. The highest daily counts were reached in November, with a peak of 1,168 individuals on 7 November. The numbers observed and estimated here are lower than those of H., S. & F. Olk (pers. comm.), who counted 5,711 individuals in autumn 2014, with a peak of 2,891 individuals on 3 November. In spring 2012, migration was observed throughout March and continued until 4 April. A peak of 156 individuals was observed on 7 March. Considering the calculated estimate of the migration number and the estimated number of the flyway population, the Northern Lapwing is believed to exceed the 1% criterion of the flyway population in both observation seasons (Heiss 2013).

Sociable Lapwing *Vanellus gregarius*
A few individuals and small flocks were observed migrating through the coastal plain in both counting seasons. In autumn 2011, the first flock was observed with 14 individuals on 18 September, followed by three individuals on 26 September, one individual on 9 October and one individual on 7 November. In spring 2012, the migration period was rather short with six individuals resting on heavily-grazed steppe on 30 March, 13 individuals migrating along the coast on 2 April (F. Eidam, pers. comm.) and five and three other migrating individuals on 4 and 5 April, respectively. The observed passage of four individuals on three observation days in October 2014 (H., S. & F. Olk, pers. comm.) suggests a regular occurrence at Besh Barmag. This critically endangered species has undergone intense research after continuing population decline (e.g. Eichhorn & Khrokov 2002). Detailed surveys of the breeding (Watson *et al.* 2006, Kamp *et al.* 2009) and stopover sites (Biricik 2009; Donald *et al.* 2016) have been conducted. Stopover sites in the Azerbaijan Republic are known in Gobustan (Patrikeev 2004, own obs.) and have recently been discovered at Lake Hajigabul (Vidal & Sheldon 2016).

Eurasian Oystercatcher *Haematopus ostralegus*
In autumn 2011, migration was regularly observed between 2 August and 20 September. Migration peaked in the second half of August with daily maximum counts of 20 individuals on 15 and 20 August. Owing to the early passage of this species, it was not recorded in the autumn 2007 study (Heiss & Gauger 2011) and autumn 2014 (H., S. & F. Olk, pers. comm.). In spring 2012, only single birds or pairs were observed between 17 March and 18 May. The Eurasian Oystercatcher is regarded as a rare migrant along the western Caspian coast (Shubin 1998; Patrikeev 2004).

Eurasian Curlew *Numenius arquata*
An uncommon migrant in both observation seasons. In autumn 2011, the earliest arrivals were three individuals on 31 August. The passage peaked on 3 September with ten individuals. The last two birds were seen on 7 October and 7 November, respectively. Similar small numbers were also observed in autumn 2014 (H., S. & F. Olk, pers. comm.). In spring 2012, this species was observed on only three days: one on 19 March, two on 22 March and one on 5 April. In the Azerbaijan Republic, the numbers of wintering Eurasian Curlews have noticeably decreased in the past (Shubin 1998) and reports of current population trends in this region are not available.

Black-tailed Godwit *Limosa limosa*
An uncommon migrant at Besh Barmag with observations on only four days in autumn 2011: two flying north on 24 August, one flying south on 14 October, one on 30 October (K. Gauger, pers. comm.) and a further 13 individuals on 7 November. Similar small numbers were also observed in autumn 2007 (Heiss & Gauger 2011) and autumn 2014 (H., S. & F. Olk, pers. comm.). In spring 2012, seven individuals headed south on 26 March. Three birds were found resting on 10 and 11 May. Despite the low migration numbers at Besh Barmag, this wader is among the most common migrating

species along the western Caspian coast (Shubin 1998; Patrikeev 2004).

Red Knot *Calidris canutus*
One individual was observed migrating south on 1 November 2011. This species is rare on the western Caspian coast (Shubin 1998; Patrikeev 2004).

Curlew Sandpiper *Calidris ferruginea*
In autumn 2011, migrating birds were observed between 6 August and 6 September. The largest migrating flock was comprised of 42 individuals on 21 August. No active migration was observed in spring 2012 but single birds and small flocks of up to three individuals were found feeding in a coastal lagoon between 7 and 21 May.

Black-winged Pratincole *Glareola nordmanni*
In autumn 2011, the earliest birds arrived on 18 September, with 111 migrating individuals in the morning hours and a huge migrating flock of 3,880 individuals at the late afternoon. A flock of such a size has never been recorded before in the Azerbaijan Republic (cf. Patrikeev 2004), but a flock of 20,000 individuals was observed in 2006 at the nearby Chagraiskoe reservoir, Manych, Russia (BirdLife International 2016). Single birds and flocks of up to 200 individuals continued to be observed until 15 October. The migration in spring 2012 started on 10 April with peaks of 400 individuals on 17 April and 593 on 2 May. The last birds were observed on 8 May. In autumn, the 1% criterion was met for the world and flyway populations (Heiss 2013).

European Turtle Dove *Streptopelia turtur*
In autumn 2011, birds were observed between 3 August and 24 September, with a peak of 50 migrating individuals in three flocks (36, 11 and 3 individuals) on 26 August. In spring 2012, the earliest arrivals appeared on 5 May. Subsequently, small flocks of up to seven individuals were counted on 14 May. Singing individuals might indicate breeding in this area but no birds were seen after 17 May.

Redwing *Turdus iliacus*
In autumn 2011, the first individual was observed on 30 October (K. Gauger, pers. comm.). Most of the migration took place on a single day triggered by the onset of winter on 7 November, with 80 individuals migrating in seven flocks of between four and 23 individuals. A similar number of birds was also observed in autumn 2014 (H., S. & F. Olk, pers. comm.). In spring, this species was recorded on only two days (10 and 17 March). The data presented here refer to diurnal migration activity only. However, this species is mainly a nocturnal migrant. with migration periods ranging from mid-October to the end of the study on 17 November 2011, and in spring 2012 from the beginning of the count to the beginning of April. In the autumn 2011 count, the greatest nocturnal migration activity was recorded on 14 November with 30 calls, and in the spring 2012 count, on 30 March with 24 calls (M. Heiss, unpubl. data).

Meadow Pipit *Anthus pratensis*
This species was a common migrant in both observation seasons. In autumn 2011, migration started on 15 October with increasing numbers (up to 237 individuals on 24 October) until the end of the month. Movements continued until beyond the end of the study on 17 November, so that the whole migration period was not covered in this analysis. Meadow Pipits were also observed in smaller numbers in autumn 2007 (Heiss & Gauger 2011) and autumn 2014 (H., S. & F. Olk, pers. comm.). In spring 2012, the migration period was from 5 March to 19 April. The largest numbers were observed between late March and mid-April with a peak of 331 individuals on 10 April.

3.2. Monitoring implications

In order to obtain reliable information about population dynamics at bottleneck sites, a standardised counting method is necessary for several years (Dunn & Hussell 1995; Lewis & Gould 2000). At the Besh Barmag bottleneck, no such long-term data exist. The few other studies conducted here differ in survey duration, daily observation intensities and number of observers, biasing daily and seasonal migration totals. The use of the already existing data to identify population trends would thus lead to inaccuracies but awareness of such trends is all-important in detecting population declines at an early stage. This is even more critical in poorly surveyed regions such as the vast central Eurasian landmass, which is home

to most of the migrating birds occurring at Besh Barmag bottleneck (Heiss 2013).

Of the 28 species presented here, 12 species (namely Dalmatian Pelican, Pallid Harrier, Steppe Eagle, Eastern Imperial Eagle, Little Bustard, Northern Lapwing, Sociable Lapwing, Eurasian Oystercatcher, Curlew Sandpiper, Black-winged Pratincole, European Turtle Dove and Meadow Pipit) are red-listed and can be suitable target species for long-term monitoring programmes, as they occur in fairly large numbers. Except for six species (Eastern Imperial Eagle, Sociable Lapwing, Eurasian Oystercatcher, Curlew Sandpiper, European Turtle Dove and Meadow Pipit), they meet the 1% criterion of the flyway population, while some also meet the 1% criterion of the world population (Heiss 2013). This site provides excellent monitoring opportunities, especially for the outstandingly large numbers of Dalmatian Pelicans and Little Bustards (Heiss 2013; Heiss 2016). The remaining less numerous species might be unsuitable target species for long-term monitoring, as they are probably too rare in this area or they are not influenced by the bottleneck. Their low numbers probably do not provide reliable quantities for monitoring projects and subsequent trend analyses. They might be better monitored in their wintering areas (for ducks, geese) or at stop-over sites (for waders), e.g. in the Gyzylagach State Reserve in the Azerbaijan Republic (Shubin 1998; Sultanov 2008). Nevertheless, they could provide an important piece of the puzzle of understanding population declines on a global scale. In contrast, species that are currently not globally red-listed and thus not discussed here might be declining at (flyway) population level which would make them of conservation importance on a regional scale. Together with those that are currently numerous at Besh Barmag, they should be taken into account in future monitoring schemes as they might later be up-listed and their population dynamics might be relevant in connection with those of the presently threatened species. Therefore, a comprehensive monitoring programme including all species is recommended.

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