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Coastal Bird Migration at the Caspian Shore of the Azerbaijan Republic in October 2007

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Abstract
The barrier function of mountains and open waters cause a concentration of migrating birds in Azerbaijan. Here, the foothills of the Greater Caucasus and the Caspian Sea act like a bottleneck at the mountain Besh Barmag, 80 km north of Baku and force migrating birds to pass through an only three kilometre wide coastal plain. During the study period from 29 September to 24 October 2007, a total number of 310,495 migrants was observed and 174 bird species were identified. Among them were three species new to the Azerbaijan National List: Taiga Flycatcher *Ficedula albicilla,* Little Bunting *Emberiza pusilla* and Audouin's Gull *Ichthyaetus audouinii*. The most common species was Common Starling *Sturnus vulgaris* with 182,547 individuals. Generally, passerine migration was restricted to the coastal plain. Along the coastline strong migration of terns, gulls and ducks was noticed while raptor migration was rather weak and mainly restricted to the adjacent mountains. Among migrants were eight species with international conservation status. Due to the high numbers of passing birds, the entire region has a high value for international bird protection. As main threats to migrants, power lines, wind energy plants and hunting have been identified.

1. Introduction

Every year millions of birds leave their breeding grounds in Eurasia to reach their wintering grounds further south, e.g. Africa, Arabia or India. On their often several thousand kilometres long journeys, barriers like mountains or open water bodies occur, which they generally try to avoid. In this case, they have to change their flight direction, which leads to a concentration of migrating birds at special points. Especially barriers in a west-east direction disturb the north-south directed flyways. Coastlines also have a leading function for migrants (Berthold 2000).

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In particular, both migration barrier types occur in Azerbaijan. Here, the interaction between Greater Caucasus and Caspian Sea leads to a concentration of migrating birds in the coastal plain near the mountain 'Besh Barmag'. The catchment area (breeding grounds) of this bottleneck covers the vast landmass from Eastern Europe to Western Siberia. Therefore, we expect huge numbers of migrating birds in this region.

Bird migration is recently hardly investigated in Azerbaijan. Observations of migrating birds are mostly casual or restricted to a special group of birds, e.g. waterbirds (Sultanov 2004, Sultanov 2008), migrating waders (Shubin 1991) or sparse bird ringing (Gauger & Pietzsch 2005). The importance of the west Caspian coast for waders and

waterbirds (e.g. ducks) is known (Shubin 1998, Patrikeev 2004, Sultanov 2008), but a general overview of migrating birds including passerines and raptors does not exist. This short study should clear up some details about species composition, numbers and temporal occurrence of migrants along the Caspian coast of the Azerbaijan Republic.

2. Study Area and Methods

2.1. Study area

The study area (40°59'N, 49°13'E) is located near the city Siyezen, 80 km northwest of the capital Baku. Here, the eastern foothills of the Greater Caucasus with elevations of about 500 m a.s.l. almost reach the shore of the Caspian Sea (Fig. 1). A barely three kilometre wide coastal plain is a bottleneck for high numbers of migrants. Human settlements, grazed semi-desert vegetation, oil production and the huge Siyezen poultry farm dominate the region. Along coastline lagoons, dry forests of Russian Olive *Eleagnus angustifolia* and sandy dunes are found (Fig. 2).

Observations took place at two fixed points within the coastal plain. One point was about 500 meters from the Caspian shore, to observe migrating birds through the coastal plain. The second point was on the Caspian shore on top of a sand dune and focused on waterbird migration.

Fig. 1. Study area with a coastal lagoon in the foreground and the foothills of the Greater Caucasus with mountain Besh Barmag in the background.

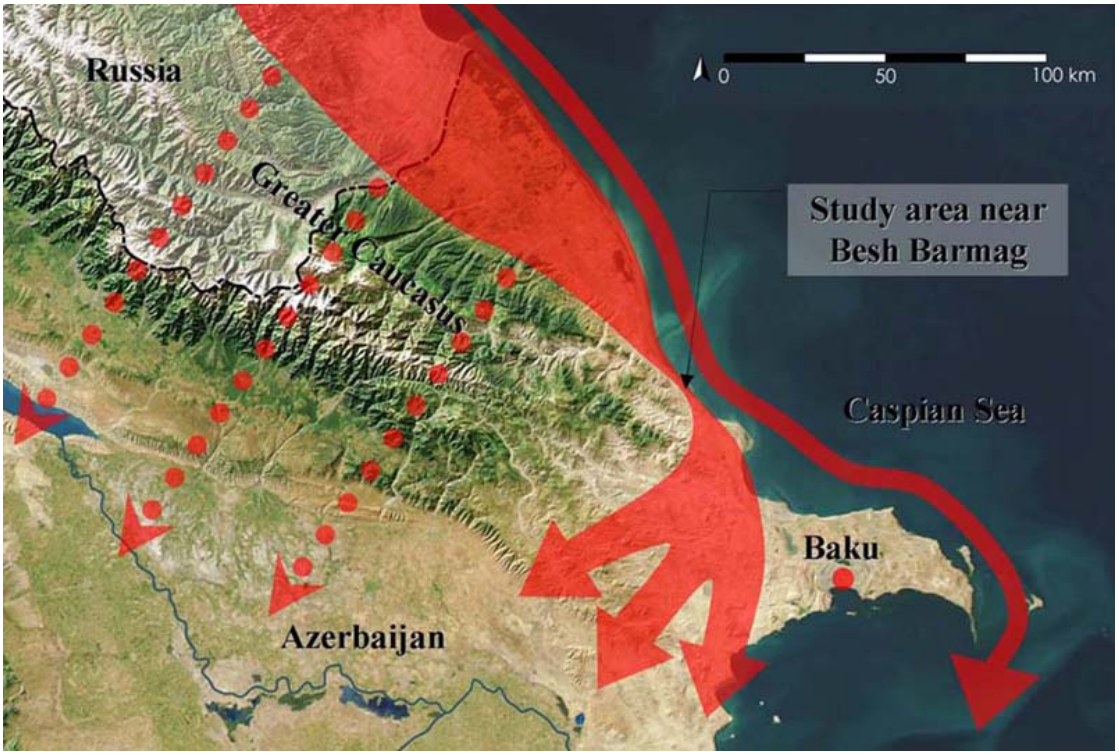

Fig. 2. The study area at mountain 'Besh Barmag' (Azerbaijan) with important migration routes (red). The barrier function of the Greater Caucasus and the Caspian Sea lead to a concentration of migrating birds at this point. Dotted line = weak migration route through the Greater Caucasus, broad line = main migration route through the lowland, narrow line = coastal waterbird migration route.

2.2. Materials and methods

The investigation was conducted from 29 September to 24 October 2007, the peak autumn migration period of birds. Counting was done using binoculars and spotting scopes. For identification of birds Schulze (2003) and Svensson et al. (1999) were used. During the observations, data were recorded including date, time, bird species, numbers, flight direction, wind direction and force, cloud cover, and height and strength of waves on the Caspian Sea. Each day was divided into two observation periods with four hours of counting in the morning at a fixed point in the coastal plain and four hours in the afternoon at the Caspian shore. Observation hours were divided into 30-minute intervals and for each, notes about birds and weather were taken. Furthermore, all striking and rare birds (e.g. raptors, pelicans and Blue-cheeked Bee-eaters *Merops persicus*), resting birds of the coastal lagoons (e.g. waders and ducks) and bushes (e.g. warblers and flycatchers) were noted outside the daily observation periods. On a few days, birds were caught with mist nets. This produced records of additional species, only noticed by this method.

3. Results

During the entire study, 331,091 birds flying to the south and 20,596 birds flying to the north were counted. In general, no daily loop migration was observed, maybe due to the absence of suitable roosting sites or feeding grounds. Hence, to gain a total number of migrants north flying birds were subtracted from the south flying birds to avoid double counting, resulting in 310,495 migrants during the entire study period (Table 1). This number also includes casual observations of migrating birds outside the two observation periods. Within the two daily observation periods of four hours each, a total of 307,407 individuals was recorded (Table 1, Fig. 3).

A total of 174 species of birds was observed during the study period. Some 127 species were seen actively migrating (Table 1 give results for 83 species in numbers of more than five individuals; additional species are listed in Appendix I). 35 bird species were only recognised indirectly as migrants, when they were resting in shrubs or at lagoons but had not bred here. Night migrating birds, especially waders, warblers or flycatchers, belong to this group. Only 12 bird species seemed to be resident or showed no migrating behaviour, e.g. Crested Lark *Galerida cristata* and vultures (Appendix 1). Some 64% of the recorded bird species were non-passerines, whereas 36% were passerines.

The most numerous migrant was Common Starling *Sturnus vulgaris* with 182,547 individuals in total (Table 1). Calandra Lark *Melanocorypha calandra* was the second most common bird species with 23,471 individuals in total. On a few days, this species migrated offshore at a great distance from the coastline. Hence, a number of migrating larks could not be securely identified due to confusion with Eurasian Skylark *Alauda arvensis*, which accounts for a total of 1,186 unidentified larks. The five most common migrating species were passerines with a total of 250,062 individuals. They passed the Besh Barmag bottleneck mainly through the coastal plain. Common Starling, Calandra Lark and White Wagtail *Motacilla alba*, as the three most common species, had their migration peak in October (Table 1, Fig. 6). The most common non-passerine was the Eurasian Teal *Anas crecca* with 5,973 migrating individuals. This species had a mass migration day on 3 October (Fig. 5).

Some migrating species were difficult to identify. The most common species among them were sparrows *Passer* spp. but separation of migrating House Sparrows *Passer domesticus* and Spanish Sparrows *Passer hispaniolensis* was difficult, as males were not in breeding plumage and identification by their flight calls impossible. However, mixed flocks, also including Tree Sparrows *Passer montanus,* have been observed resting in shrubs nearby. Similar species such as ducks, gulls and white herons, which migrated occasionally in huge distances to the coastline, caused further confusion.

Table 1. Total numbers of 83 observed bird species (with numbers up to 5 individuals). All of these species showed active migration. The numbers of north-flying individuals are subtracted from that of south-flying resulting in totals during study period. The overall totals include also casual observations outside the daily observation periods. Lower overall totals than totals during study periods are a result of consideration of north-flying individuals outside the daily observation periods.

Scientific name	South-flying individuals	North-flying individuals	Totals during study periods	Overall totals	Date of strongest migration with daily totals in 2007
Sturnus vulgaris	196,389	14,417	181,972	182,547	19 Oct: 31,340 inds.
Melanocorypha calandra	23,615	144	23,471	23,471	14 Oct: 8,858 inds.
Motacilla alba	16,460	109	16,351	17,427	8 Oct: 2,242 inds.
Hirundo rustica	15,518	214	15,304	15,225	2 Oct: 6,913 inds.
Corvus frugilegus	11,397	95	11,302	11,392	20 Oct: 1,899 inds.
Anas crecca	5,987	14	5,973	5,973	3 Oct: 3,916 inds.
Chroicocephalus ridibundus	4,504	0	4,504	4,504	21 Oct: 855 inds.
Alauda arvensis	2,957	13	2,944	2,944	13 Oct: 866 inds.
Thalasseus sandvicensis	2,837	10	2,827	2,827	29 Sep: 563 inds.
Columba oenas	1,751	5	1,746	1,750	9 Oct: 242 inds.
Anas acuta	1,692	0	1,692	1,812	3 Oct: 571 inds.
Anas clypeata	1,642	0	1,642	1,642	3 Oct: 657 inds.
Hydrocoloeus minutus	1,429	15	1,414	1,414	5 Oct: 571 inds.
Emberiza calandra	1,614	577	1,037	1,040	24 Oct: 884 inds.
Motacilla flava	732	2	730	732	29 Sep: 271 inds.
Ardea cinerea	744	39	705	966	2 Oct: 499 inds.
Merops persicus	699	5	694	1034	1 Oct: 163 inds.
Phalacrocorax carbo	694	38	656	679	12 Oct: 230 inds.
Phoenicopterus roseus	604	31	573	573	20 Oct: 250 inds.
Fringilla coelebs	555	41	514	514	18 Oct: 194 inds.
Anas platyrhynchos	433	0	433	435	3 Oct: 92 inds.
Tadorna tadorna	430	0	430	430	15 Oct: 95 inds.
Riparia riparia	390	1	389	384	2 Oct: 157 inds.
Sterna hirundo	372	0	372	372	7 Oct: 143 inds.
Corvus monedula	338	6	332	329	20 Oct: 83 inds.
Anas querquedula	320	0	320	320	3 Oct: 166 inds.
Vanellus vanellus	333	26	307	308	16 Oct: 95 inds.
Platalea leucorodia	297	0	297	407	30 Sep: 120 inds.
Carduelis carduelis	391	135	256	107	23 Oct: 119 inds.
Accipiter nisus	224	1	223	231	11 Oct: 55 inds.
Pelecanus crispus	237	14	223	239	11 Oct: 120 inds.
Circus aeruginosus	225	4	221	229	16 Oct: 66 inds.
Anas penelope	214	0	214	214	3 Oct: 97 inds.
Carduelis chloris	290	102	188	188	20 Oct: 79 inds.
Ardea alba	166	1	165	268	18 Oct: 90 inds.
Anthus pratensis	148	15	133	133	24 Oct: 43 inds.
Podiceps cristatus	132	5	127	127	21 Oct: 32 inds.
Chroicocephalus genei	111	0	111	124	3 Oct: 36 inds.
Carduelis cannabina	115	8	107	107	22 Oct: 40 inds.
Passer montanus	93	0	93	93	21 Oct: 42 inds.
Larus fuscus heuglini	90	5	85	167	4 Oct: 77 inds.
Calidris alba	99	30	69	69	3 Oct: 30 inds.
Calidris alpina	66	0	66	66	3 Oct: 50 inds.
Anthus campestris	64	3	61	62	8 Oct: 10 inds.
Anas strepera	60	0	60	60	3 Oct: 40 inds.
Chlidonias leucopterus	59	0	59	59	2 Oct: 33 inds.
Recurvirostra avosetta	51	0	51	51	22 Oct: 30 inds.
Columba palumbus	71	25	46	46	20 Oct: 26 inds.
Tadorna ferruginea	40	0	40	40	11 Oct: 13 inds.
Chlidonias hybrida	39	0	39	47	4 Oct: 16 inds.
Hydroprogne caspia	39	0	39	41	7 Oct: 11 inds.
Egretta garzetta	36	0	36	65	7 Oct: 24 inds.
Charadrius hiaticula	35	0	35	35	29 Sep: 15 inds.
Anthus spinoletta	32	2	30	30	15 Oct: 19 inds.
Emberiza schoeniclus	30	0	30	30	19 Oct: 7 inds.
Limosa limosa	30	0	30	30	9 Oct: 30 inds.
Ardea purpurea	25	0	25	39	12 Oct: 12 inds.
Anthus trivialis	24	0	24	24	1 Oct: 8 inds.
Pluvialis squatarola	24	0	24	24	30 Sep: 20 inds.
Asio flammeus	22	0	22	22	19 Oct: 7 inds.
Aythya ferina	20	0	20	20	20 Oct: 9 inds.
Phalacrocorax pygmaeus	20	0	20	20	29 Sep: 20 inds.
Philomachus pugnax	20	0	20	27	9 Oct: 14 inds.
Corvus cornix	20	1	19	19	Up to 90 inds. resident

Falco columbarius	17	0	17	17	23 Oct: 4 inds.
Podiceps grisegena	17	0	17	19	21 Oct: 7 inds.
Fringilla montifringilla	15	0	15	15	19 Oct: 4 inds.
Stercorarius parasiticus	15	0	15	19	9 Oct: 5 inds.
Aythya marila	14	0	14	14	3 Oct: 8 inds.
Bucephala clangula	14	0	14	14	30 Sep: 10 inds.
Falco subbuteo	13	0	13	15	16 Oct: 4 inds.
Anser anser	12	0	12	12	-
Buteo buteo vulpinus	13	1	12	12	16 Oct: 7 inds.
Calandrella rufescens	12	0	12	12	23 Oct: 3 inds.
Streptopelia decaocto	12	0	12	12	21 Oct: 5 inds.
Motacilla cinerea	11	0	11	11	9 Oct: 3 inds.
Sternula albifrons	9	0	9	9	29 Sep: 5 inds.
Coccothraustes coccothraustes	18	10	8	8	-
Gallinago gallinago	15	7	8	10	-
Aythya nyroca	6	0	6	6	2 Oct: 4 inds.
Larus canus	6	0	6	6	-
Bubulcus ibis	5	0	5	5	-
Podiceps nigricollis	5	0	5	5	-
SUBTOTAL for 83 species	**298,324**	**16,171**	**282,153**	**284,825**	
Unidentified birds					
Passer sp.	14,905	2,324	12,581	12,573	
Anas/Aythya sp.	8,221	0	8,221	8,256	
Ardea sp.	1,211	0	1,211	1,333	
Alaudidae sp.	1,186	0	1,186	1,186	
Chroicocephalus ridibundus/genei	870	0	870	870	
Sterna/Chlidonias sp.	572	0	572	572	
Larus sp.	352	0	352	352	
Charadriiformes sp.	351	10	341	341	
Stercorarius sp.	23	0	23	23	
Aquila sp.	15	0	15	16	
Falco tinnunculus/naumanni	11	0	11	11	
Falco sp.	9	0	9	9	
Podiceps sp.	6	0	6	6	
SUBTOTAL for unidentified birds	**27,732**	**2,334**	**25,398**	**25,548**	
TOTAL for listed species	**326,056**	**18,505**	**307,551**	**310,373**	
TOTAL for observation periods	**326,834**	**19,427**	**307,407**		
TOTAL for all observed migrants	**331,091**	**20,596**		**310,495**	

The number of migrating species in the coastal plain was higher with a daily average of 25.2 bird species compared to 18.0 species along the Caspian shore in October. From both observation points together, an average of 38.7 bird species migrated daily during the study period. However, fluctuations in daily total species number are visible, but remain more or less constant over the study period (Fig. 4). The species number along the Caspian shore decreases slightly, whereas the number of observed species in the coastal plain slightly increases during the whole study period (Fig. 4).

Numbers of migrating birds in the coastal plain was mostly higher than along the Caspian shore (Fig. 3).

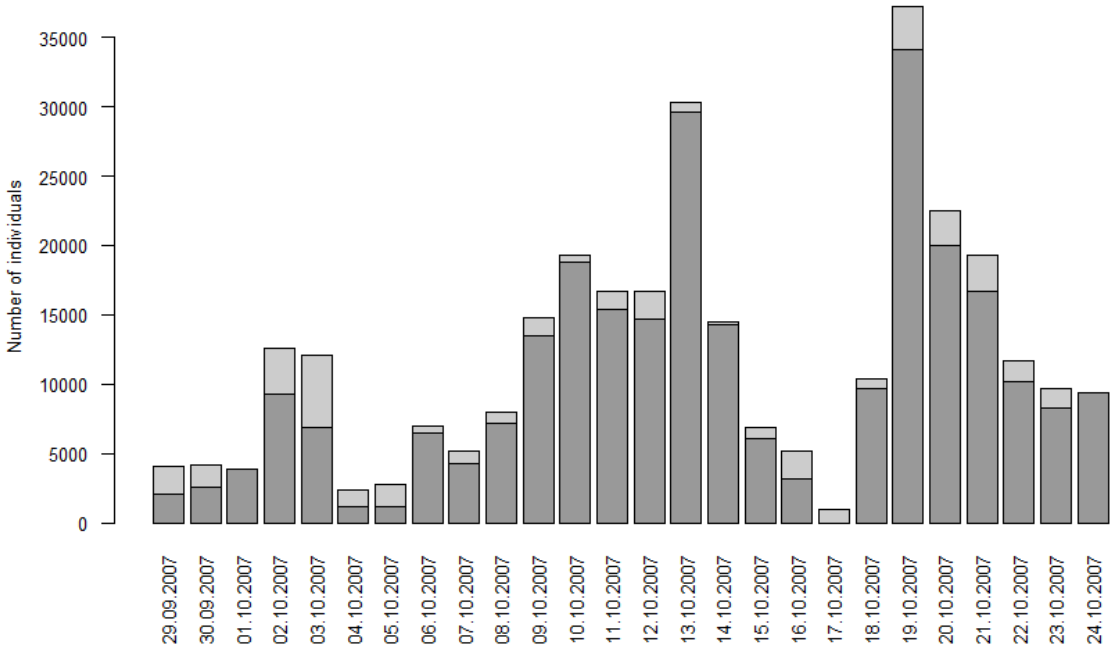

Fig. 3. Daily total numbers of migrating birds during both observation periods (light grey = observation at the Caspian shore in the afternoon, dark grey = observation in the coastal plain in the morning). North-flying birds are subtracted from south-flying. On 1 Oct. and 24 Oct. 2007, no counting took place at the Caspian shore. On 17 Oct. 2007 bird migration in the coastal plain was inhibited due to rainy weather conditions.

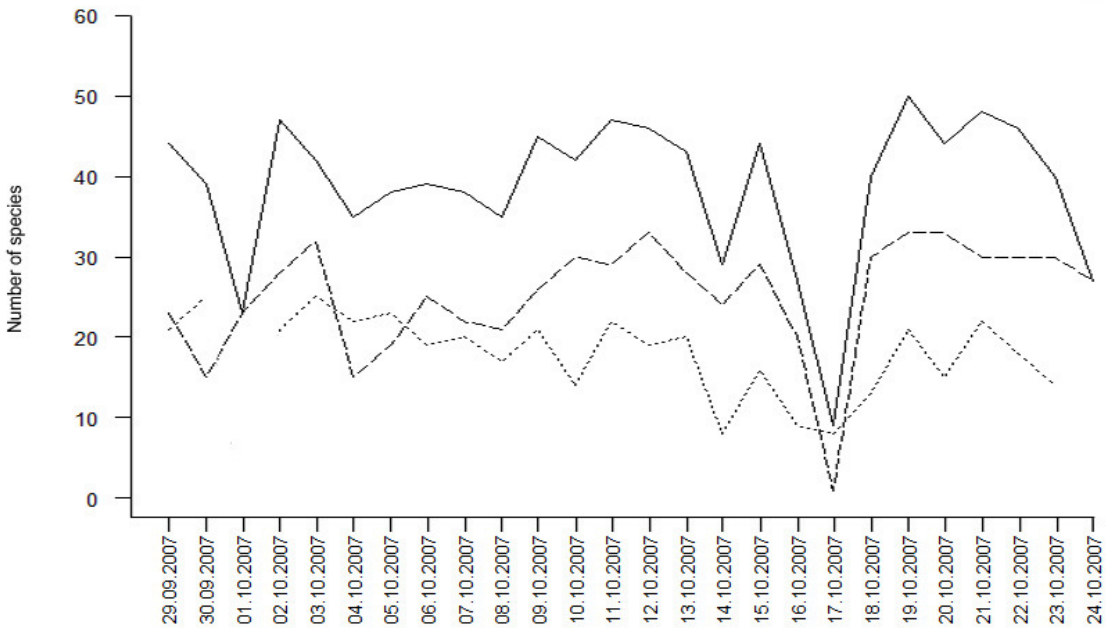

Fig. 4. Daily bird species numbers during the study periods. Species outside these periods are not included. Solid line = total daily species number, dotted line = daily species number at the Caspian shore in the afternoon, long dashed line = daily species number in the coastal plain in the morning. On 17 Oct. 2007 bird migration in the coastal plain was inhibited due to rainy weather conditions, when only weak migration of *Motacilla alba* was observed.

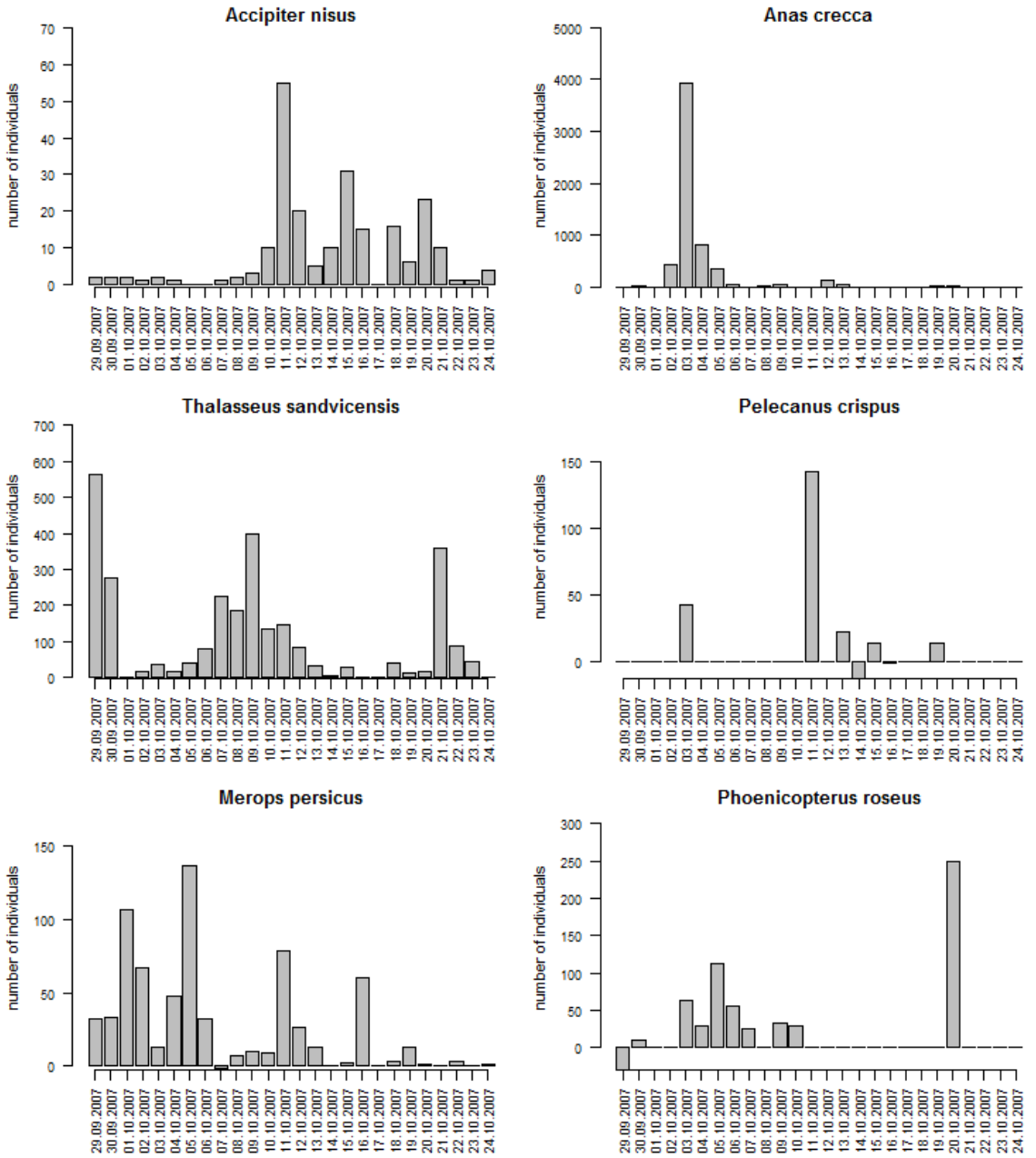

Fig. 5. Seasonal migration patterns of selected non-passerines. The daily totals are a result of the subtraction of north-flying birds from south-flying. Negative results are on days with predominantly northwards migration. Note the different scaling of the y-axis.

4. Discussion

During the study period, we recorded three bird species which are not listed in Patrikeev (2004) and are therefore new to the Azerbaijan Republic. On 7 October, a resting Little Bunting *Emberiza pusilla* and on 10 October a Taiga Flycatcher *Ficedula albicilla* were recorded. On 23 October 2007 an Audouin's Gull *Ichthyaetus audouinii* in third year plumage flew south along the coast. Audouin's Gull was once recorded as vagrant at the Black Sea coast of Georgia (Olsen & Larsson 2003). However, these three new species are pending acceptance by a rarities committee.

Also not mentioned in Patrikeev (2004) is Heuglin's Gull *Larus fuscus heuglini*. This species occurred between 29 September and 16 October 2007 with 166 individuals. The biggest flock consisted of 27 individuals and rested on the beach and could therefore be well studied. The first Heuglin's Gull for the Azerbaijan Republic was observed in March 2001 in Kyzyl Agach Zapovednik (Heinicke & Ryslavy 2002) and a few other individuals were noticed between 2004 and 2007 (K. Gauger, pers. obs.).

Furthermore, Patrikeev (2004) listed some of the bird species recorded in the Azerbaijan Republic as 'accidental visitors' such as Arctic Skua *Stercorarius parasiticus*. At least 19 individuals of this species were observed. The total number is likely higher, because further 23 skuas *Stercorarius* sp. could not be identified exactly. Until this study this species was only recorded at the end of the 19th century and the beginning of the 20th century (Patrikeev 2004) and three times since 2002 (J. Etzold, pers. comm.; K. Gauger, pers. obs.). However, in subsequent years, Arctic Skuas were regularly observed along the Caspian coast of Azerbaijan.

A single Pomarine Skua *Stercorarius pomarinus* was observed on 10 October 2007. This was the first record for Azerbaijan since the beginning of the 20th century (Patrikeev 2004). The skuas followed migrating terns and gulls. Chasing and attacking of Sandwich Terns *Thalasseus sandvicensis* and Little Gulls *Hydrocoloeus minutus* was observed, also the killing of a Little Gull by an Arctic Skua. Feeny et al. (1968) and Arkhipov & Blair (2007) list further observations of skuas along the coast of the Caspian Sea of Russia, Turkmenistan, Iran and offshore of Azerbaijan. This underlines that skuas are more common in the Azerbaijan Republic than Patrikeev (2004) mentioned, though the low level of ornithological investigations suggest that these species were rare in the 20th century.

The study period of only four weeks does not cover the complete outward migration. During a short visit of three days in early September 2007, European Roller *Coracias garrulu*s, Eurasian Hoopoe *Upupa epops*, Menetries's Warbler *Sylvia mystacea* and Woodchat Shrike *Lanius senator* were seen resting in the area. During the study period about 4 weeks later, they had already left the area. Other species such as Yellow Wagtail *Motacilla flava* and Barn Swallow *Hirundo rustica* had their migration peak in September; hence most of the migrating Yellow Wagtails were not counted (Fig. 6). Late migrating birds such as finches and buntings obviously reached their peak after the study period (Fig. 6). Only a few species, e.g. White Wagtail and Common Starling, had their migration peak within the study period (Figs. 6–7). An extension of the study period from August to November would lead to much more information about the actual situation. Nevertheless, even then not all birds can be seen and counted due to nocturnal flights, high altitude migration, or poor light and air conditions on some days (Gatter 2000).

Among raptors, only Eurasian Sparrowhawk *Accipiter nisus* and Western Marsh Harriers*Circus aeruginosus* were numerous (Table 1). These two species migrate actively without thermal uplifts (Gatter 2000). Raptor migration over the sea was only observed for a few Merlin *Falco columbarius*, but passage over the Caspian Sea is not unusual for raptors (*cf.* Casement & Howe 2005). The numbers of larger raptors were rather low. Their main migration time around noon and later when thermal conditions are the best (Gatter 2000) is not covered by the study design. Furthermore, eagles and other soaring birds are perceived to migrate more inland across the Greater Caucasus (M. Heiss & K. Gauger, pers. obs.). The Caspian Sea probably shields large amounts of raptor populations coming from Central Asia from migrating through Azerbaijan in autumn. Nevertheless, high numbers of Steppe Eagles *Aquila nipalensis* have been observed further south in Shirvan national park. In autumn 2008 daily maximum numbers of up to 1,400 Steppe Eagles have been counted there (M. Heiss & K. Gauger, pers. obs.). In addition, raptor migration might be higher at Besh Barmag in spring, caused by the barrier function of the Caspian Sea. Lacking thermal uplifts offshore probably forces soaring birds, especially raptors, to migrate northwards along the coast to reach their breeding grounds in northeastern directions.

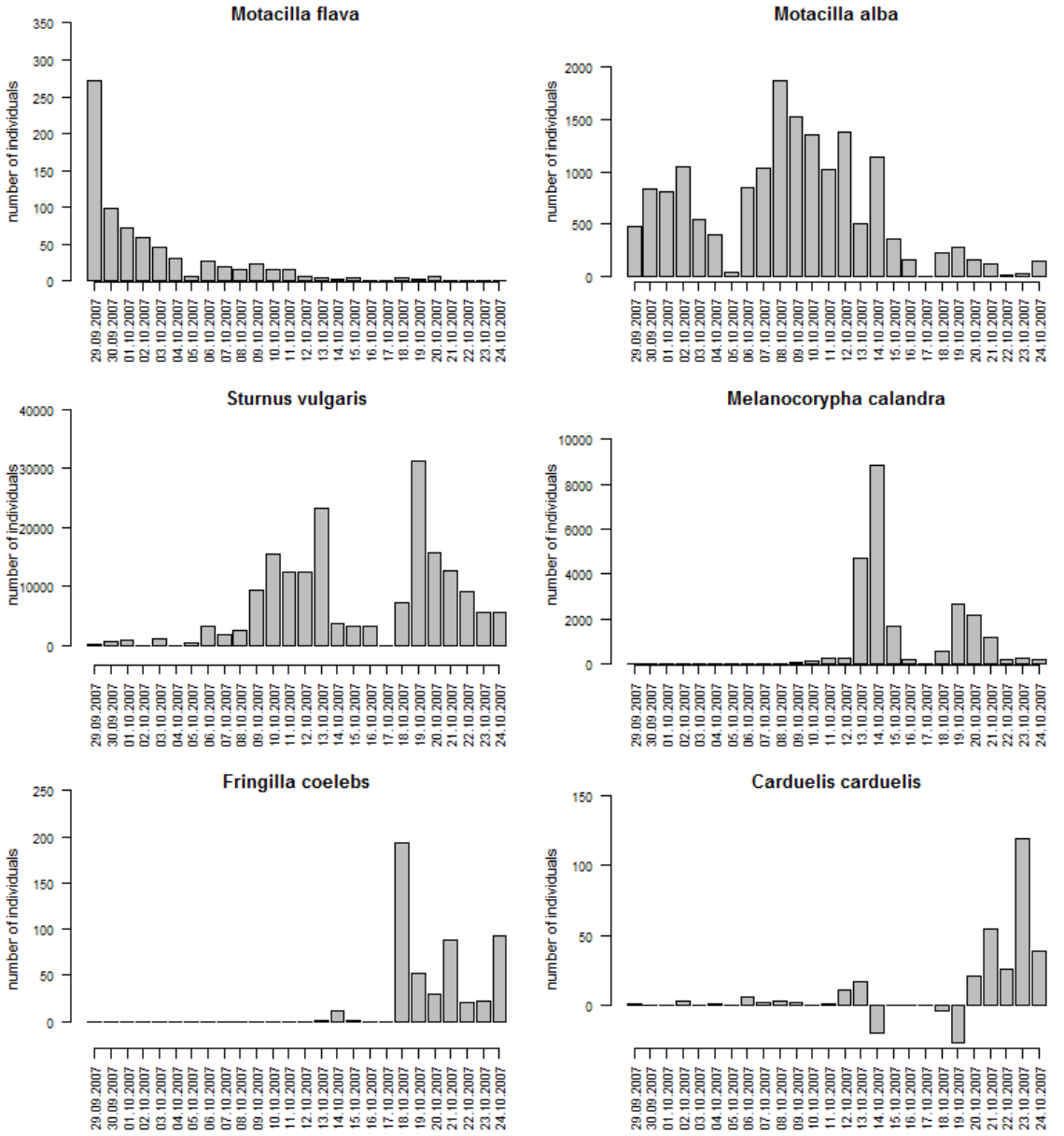

Fig. 6. Seasonal migration patterns of selected passerines. The daily totals are a result of the subtraction of north-flying birds from south-flying. Negative results are on days with predominantly northward migration. Note the different scaling of the y-axis.

Our casual observations in April 2008 and results of satellite-tracked Steppe Eagles (Meyburg et al. 2003) support this assumption. A similar situation occurs in the southeast corner of the Caspian Sea. Here, at Ashura Deh (Iran) Ullman & Ullman (2010) observed high raptor migration numbers in spring, whereas Feeny et al. (1968) observed at the same location a rather weak raptor migration in autumn. However, an observation point in the adjacent foothills and a detailed study in spring would clarify the migration behaviour of raptors at Besh Barmag.

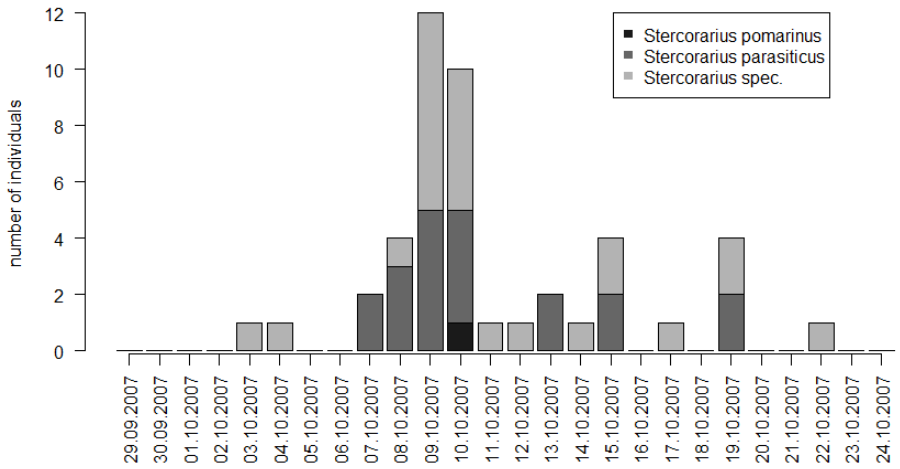

Fig. 7. Seasonal migration pattern of south-flying skuas *Stercorarius* spp.

Influence of weather

Generally, the observation conditions within the study period were good. Usually the sky was cloudless, air turbulences occurred only around noon and the negative influence of wind was low for most of the time. However, on some cloudy days, strong wind and rain reduced the ability of birds for migration. Figures 3–6 show examples of the influence of weather conditions on migration activities. Generally, under poor weather conditions bird migration is inhibited, resulting in lower numbers of migrants and lower species numbers (Figs. 3–4). A migration break-out of White Wagtails on 5 October 2007 originated in strong wind from southern directions (head wind) and on 17 October 2007, when it was raining almost the whole day (Fig. 6). Eurasian Teal had a short and sharp peak on 3 October 2007 (Fig. 5). On this day, 3,916 individuals of a total of 5,987 individuals were observed. The reasons for this peak are the wind conditions. Only on 3 and 4 October 2007, strong winds from eastern directions occurred and we conclude that these winds pushed migrating teals from the open sea to the coastline and the birds became visible to the observers. In this situation, more ducks were also better identified on the species level because of the closer distance.

Nevertheless, we expect that every day during the migration periods hundreds or thousands of ducks and other seabirds fly a great distance parallel to the coast. Observations offshore, on islands or oil platforms or vessels (Casement & Howe 2005), could clear up this supposition.

Feeny et al. (1968) give evidence of increased visibility of migrants during disturbed weather conditions in the southeastern Caspian region (Iran), especially on overcast days. His assumption could not be confirmed in this study, because almost all days were unclouded. However, on 11 October a total cloud cover might be in keeping with an increased number of migrating raptors observed (e.g. *Accipiter nisus* in Fig. 5).

Threats and Conservation

Generally, bird poaching is a serious problem in Azerbaijan (e.g. Patrikeev 2004, Gauger 2007, Sultanov 2008). There is hunting throughout the year but it peaks in the migration periods and winter. Then all wetlands are regularly visited by hunters and in many regions the activities are even commercial with the selling of shot birds. Species of interest are mainly ducks, coots and geese. In semi-desert areas, Little Bustards *Tetrax tetrax* are a favored prey. In contradiction to some Mediterranean countries, it seems as if there is no hunting of songbirds.

The densely populated coastal region is marked by many power lines and wires. Due to the high numbers of power lines and mass migration of birds, huge numbers of victims are expected. An intense search for birds killed by power lines would reveal information about unsafe power lines. We expect that power lines crossing migration routes in the east-west direction have a serious impact.

The construction of wind energy plants, especially in the narrow coastal plain between the Greater Caucasus and the Caspian Sea, will

seriously influence bird migration and might be a serious further threat to many bird species. It is difficult for migrants to avoid wind energy plants in the narrowness of this area. Along ridges of coastal foothills, which offer excellent wind conditions, a construction of wind energy plants would negatively influence raptor migration. Offshore wind farms along the coast of the Caspian Sea would also have a strong impact on migrating birds, killing high numbers of birds. Here, detailed studies should be done to gain information about bird migration patterns so that subsequent cautious planning might reduce the risk of bird collisions.

Waterbirds are threatened by oil production on the Caspian coast and islands. In the past, oil spills have caused several thousands of victims among waterfowl (Sultanov 2004), but in this study no hints of oil pollution could be observed, probably because oil-producing areas are too far away from the study site.

On the IUCN Red List (IUCN 2010), the species with highest numbers was the vulnerable (Vu) Dalmatian Pelican *Pelecanus crispus* with 239 individuals. In smaller numbers, other threatened bird species such as the vulnerable Eastern Imperial Eagle *Aquila heliaca* (1 ind.) and Lesser Kestrel *Falco naumanni* (1 ind.) and the endangered (En) Saker Falcon *Falco cherrug* (1 ind.) migrated. Near-threatened category birds (NT) were Black-tailed Godwit *Limosa limosa* (30), Ferruginous Duck *Aythya nyroca* (6), Pallid Harrier *Circus macrourus* (4) and Little Bustard *Tetrax tetrax* (2). The latter winters in huge numbers of more than 150,000 individuals in Azerbaijan (Gauger 2007) and probably passes this region in high numbers. The critically endangered Siberian Crane *Grus leucogeranus* was not observed in this survey, despite the fact that the study site is located along the migration route of the western population that winters in northern Iran (Kanai et al. 2002).

The study showed that this narrow coastal plain around Besh Barmag is an important corridor for common, rare and globally threatened bird species. To guarantee safe passage of birds through this sensitive point, special protection is needed. Large building projects, wind energy plants and the construction of further power lines should be renounced or at least planned with high regulatory requirements.

As at this point a concentration of migrating raptors (foothills), passerines (coastal plain) and seabirds (Caspian Sea) takes place, it is the most suitable spot in Azerbaijan for the establishment of a bird migration observatory. Such observation stations, some including bird ringing, can be found throughout Europe, e.g. Akyatan, Aras, Diyarbakir (Turkey), Batumi (Georgia), Eilat (Israel), Rybachy (Russia), Falsterbo (Sweden), Helgoland (Germany), and a station in Azerbaijan could close the huge gap of knowledge in the bird migration system. Here, a monitoring of migrants could deliver the necessary data to investigate population trends of unexplored northern bird populations (Dunn 2005). Furthermore, it would help to understand migration patterns on a global scale and subsequently guide further nature conservation programmes.

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Appendix I. List of bird species not mentioned in Table 1 with numbers up to 5 individuals during the study periods or casually observed. * *Phylloscopus collybita* is already listed in 'actively migrating bird species' and therefore *tristis* must not be recalculated.

Actively migrating bird species	Indirectly identified migrant bird species	Resident bird species
Cygnus olor	*Podiceps auritus*	*Milvus migrans*
Netta rufina	*Ixobrychus minutus*	*Aegypius monachus*
Aythya fuligula	*Haliaeetus albicilla*	*Gyps fulvus*
Mergus merganser	*Falco peregrinus*	*Falco tinnunculus*
Coturnix coturnix	*Porphyrio porphyrio*	*Larus cachinnans*
Gavia arctica	*Tetrax tetrax*	*Streptopelia senegalensis*
Pelecanus onocrotalus	*Charadrius dubius*	*Athene noctua*
Nycticorax nycticorax	*Haematopus ostralegus*	*Pica pica*
Plegadis falcinellus	*Tringa totanus*	*Corvus corax*
Ciconia nigra	*Tringa ochropus*	*Galerida cristata*
Pandion haliaetus	*Actitis hypoleucos*	*Parus major*
Circaetus gallicus	*Phalaropus lobatus*	*Passer domesticus*
Circus cyaneus	*Otus scops*	
Circus macrourus	*Asio otus*	
Accipiter brevipes	*Alcedo atthis*	
Accipiter gentilis	*Lanius collurio*	
Aquila nipalensis	*Cyanistes caeruleus*	
Aquila heliaca	*Remiz pendulinus*	
Falco naumanni	*Cettia cetti*	
Falco cherrug	*Acrocephalus melanopogon*	
Grus grus	*Acrocephalus scirpaceus*	
Pluvialis apricaria	*Phylloscopus collybita tristis**	
Scolopax rusticola	*Phylloscopus nitidus*	
Numenius sp.	*Sylvia communis*	
Tringa glareola	*Sylvia curruca*	
Calidris minuta	*Musciapa striata*	
Calidris ferruginea	*Ficedula parva*	
Glareola sp.	*Ficedula albicilla*	
Ichthyaetus audouinii	*Erithacus rubecula*	
Gelochelidon nilotica	*Luscinia svecica*	
Stercorarius pomarinus	*Phoenicurus phoenicurus*	
Lanius excubitor	*Saxicola torquatus (*ssp. *maurus* & *variegates)*	
Calandrella brachydactyla	*Oenanthe oenanthe*	
Lullula arborea	*Emberiza citrinella*	
Delichon urbicum	*Emberiza pusilla*	
Phylloscopus collybita	*Carpodacus erythrinus*	
Turdus philomelos		
Pastor roseus		
Prunella modularis		
Motacilla citreola		
Anthus cervinus		
Emberiza rustica		
Carduelis spinus		
Passer hispaniolensis		
44 species (including 2 unidentified)	**35 species**	**12 species**