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Short note

Long-distance Exploratory Dispersal of an Immature Egyptian Vulture (Neophron percnopterus) from the Balkans

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Abstract. Dispersal, a behavior typical of several raptor species has important implications for population genetics and demographic processes, including the capacity for recolonization, (meta) population persistence and breeding output. Many raptor species are migratory and return to reproduce in a territory close to their natal area where they have fledged (natal philopatry). The Egyptian vulture is the smallest of the four vulture species breeding in Europe and the only one that migrates. Here we describe the first case of long-distance exploratory dispersal of an immature Egyptian vulture from the Balkans across three continents. To accomplish this extreme long-distance exploratory dispersal, Dobromir crossed 23 countries in 168 days, covering more than 30,000 km (mean 179km/day).

Key words: Egyptian vulture, philopatry, site fidelity, migratory, scavenger.

Dispersal behavior is one of the fundamental features of an organism. It plays an important role in geographical distribution, population structure, and population dynamics (Walters, 2000). Generally, the evolution of dispersal is associated with a tradeoff between fitness-related costs and benefits. Dispersal is defined either as the movement of juveniles from the natal site to the site of first breeding (natal dispersal) or as breeding dispersal (but see Pearce, 2007). The later one is the movement of individuals that have previously reproduced, between subsequent breeding attempts (Terraube et al., 2014). Dispersal is a behavior typical of several raptor species and has important implications for population genetics and demographic processes, including the capacity for recolonization, (meta) population persistence and breeding output (Grande et al., 2008; Elorriaga et al., 2009; Di Vittorio et al., 2016). Many raptor species are migratory and return to reproduce in a territory close to their natal area where they have fledged (natal philopatry)(Newton, 1979). However, some typical long-distance migrants before recruiting to a breeding territory might explore and disperse to locations far from their natal areas. Even rare, these events might have important genetic implications and role in population dynamics as long-distance dispersal can be underestimated (Grande et al., 2008; Di Vittorio et al., 2016).

The Egyptian vulture is the smallest of the four vulture species breeding in Europe and the only one that migrates to Africa (Cramp & Simmons, 1980). Due to the rapid and steady decline in most of its range, the species is declared Endangered (BirdLife International,

2020). Across Europe, the population of the species in the Balkans has experienced one of the steepest declines due to increased mortality in the breeding grounds (Velevski et al., 2015), on migration (Oppel et al., 2015) and in the wintering grounds (Buechley et al., 2018).

The Egyptian vulture spatial and temporal variability in migration movements are well studied. It is known that it exhibits a high level of variability at the subpopulation level and flexibility at the individual level in respect to basic migration parameters (Phipps et al., 2019). As a long-distance migratory bird, the Egyptian vulture remains in Africa where explores wide areas with different centers of activity for at least 1.5 years before returning to the breeding grounds (Oppel et al., 2015). Thus, the extent of juvenile dispersal and recruitment into the breeding population when sexual maturity is reached, is crucial for the survival of the species and at an evolutionary level (Greenwood, 1980; Grande et al., 2008). Once birds reach maturity they disperse close to their natal areas, facilitating the replacement of dead individuals and/or recolonization of abandoned territories (Carrete et al., 2007; Grande et al., 2008). Furthermore, the behavior of individuals in small populations is relatively more important than that in larger populations (Gosling, 2003). Here we describe the first case of long-distance exploratory dispersal of an immature Egyptian vulture from the Balkans across three continents.

Dobromir is a juvenile Egyptian vulture tagged with a satellite transmitter in northern Bulgaria in 2012. We used a solar-powered 45-g GPS satellite transmitters (Microwave Telemetry) attached to the birds' back with a Teflon ribbon harness in a backpack configuration. The entire transmitter equipment did not exceed 3% of the birds' body mass, which is considered safe for the bird and unlikely to influence its migratory performance and life spam (Bodey et al., 2018). The satellite transmitter was set to record the location of the bird with GPS accuracy every 2 h between 04:00 and 22:00 h on a daily basis. Data were downloaded via the ARGOS satellite system and deposited in Movebank.

The bird migrated successfully in the Autumn of 2012 to Darfur region, Sudan, a wintering ground for birds originating from the Balkans, Middle East, the Caucasus (Buechley et al., 2018). As other juvenile and immature birds wintering in the Sahel, Dobromir had different centers of activity in the two consecutive years before returning to the north in the spring of 2014 (Oppel et al., 2015). On the 18th of April, 2014 Dobromir started its first migration to the north, from Sudan towards the Balkans. The bird used the Suez flyway bottleneck, then traversed to the north and reached Turkey where it stayed between 4th and 23rd of June. On the 23rd of June, Dobromir crossed the Dardanelles and reached Bulgaria. In one month (between 23rd of June and 23rd of July) the bird was wandering across the east of the country and made two long trips reaching as far as northern Romania. The bird flew to the west of the Balkan peninsula visiting former breeding grounds of the species in North Macedonia and Serbia (Dobrev, 2017). Between 23rd and 27th of July, Dobromir returned to the its natal territory and was feeding and perching close to its nest. On the 27th, the bird left and started its movement to the north, traversing the Black sea and the sea of Azov to the east. Dobromir reached the region of Rostov, Russia on the 8th of August where it turned south and crossed the Caucasus mountains on the 18th. Then it resided for 6 days in Azerbajdzhan and for 22 days in northeastern Iraq. Afterwards, it continued moving slowly to the south, following known migratory flyway through Saudi Arabia and Yemen (Buechley et al., 2018). Finally, the bird reached the wintering grounds in Ethiopia on the 2nd of October crossing Bab el Mandeb. To accomplish this extreme long-distance exploratory dispersal across the three continents, Dobromir crossed 22 countries in 168 days, covering more than 30,000 km (mean 179km/day) (Fig. 1).

The Egyptian vulture is a long-distance migrant and adult birds are faithful to the migratory ways and to the timing during the migration (Phipps et al., 2019). Home ranges of wintering adult birds significantly differ compared to juvenile and immature birds, with the latest being much larger (Oppel et al., 2015). Younger birds do exploratory flights before

reaching maturity. They stay at least 1.5 years in Africa and then start moving to the breeding grounds and their natal areas (philopatry). Thus, the phenomena acts as a mechanism for recolonization of abandoned breeding territories assisting population recoveries or colonization of new areas (Grande et al., 2008). Reagrdless that birds originating from different regions might form congregations at communal roosts or at the wintering grounds, due to the high level of natal philopatry the probability of effective dispersal and recruitment in places different from their natal is low (Sará & Di Vittorio, 2003; Donázar, 2004). However, as evidenced in some cases the social attraction might prevail over the natal philopatry, and birds might disperse far away from their natal areas (Elloriaga et al., 2009; Di Vittorio et al., 2016). Some important ecological processes may operate at the population level as a result of behavioral decisions made by individuals (Carrete et al., 2007), and dispersal events even if anecdotal, may play an important role in the species' population dynamics and persistence (Elorriaga et al., 2009). This might have happened with Dobromir when wandering in the Balkans during the movement in 2014 and visiting former breeding grounds of the species. The social attraction by other conspecifics and the network of vulture feeding stations across the Balkans might have bridged his movements. Natal philopatry was probably the reason why Dobromir returned to its natal area. Naturally as evidenced (see Oppel et al., 2015), juveniles tend to make very long dispersals when residing in Africa and shifting their activity centers for different reasons (i.e. food availability, habitat alterations). Dobromir was still only 2 years old and the ranging behavior in combination with other factors (i.e. social attraction, migration instincts) might explain partially the extreme long-distance dispersal across the steppes of Russia, the Caucasus and the Middle East.

This case, even a single, reveals mechanisms that might affect population dynamics and genetics and demonstrate that animal movement and dispersal could go beyond explanation. It also provides evidences on Egyptian vulture movements and connections between different subpopulations of the species.

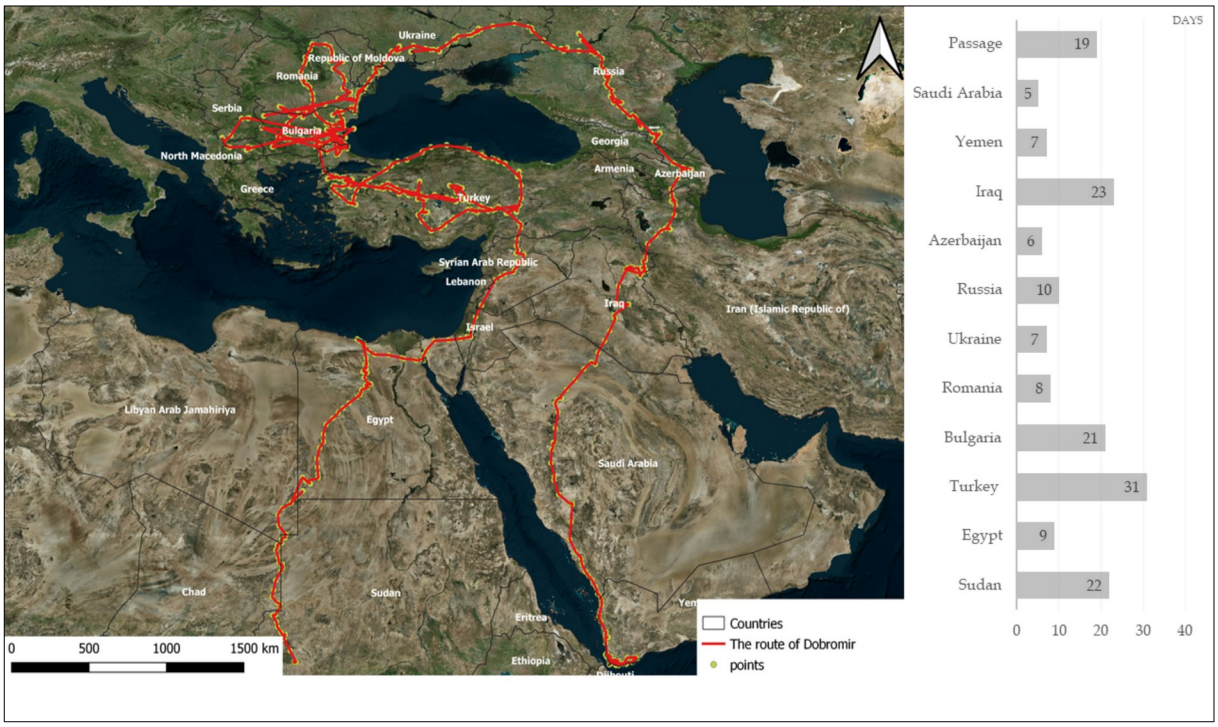

Fig. 1. Long-distance exploratory route of the tagged vulture (Dobromir) in 2014 and days per countries where the bird spent more than 5 days during the exploratory dispersal.

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