First identification of the migration routes and wintering sites of Egyptian Vultures breeding in Uzbekistan.

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http://dx.doi.org/10.4314/vulnew.v85i1.2

Abstract

The aim of this project is to identify for the first time the migration routes and wintering sites of Egyptian Vulture *Neophron percnopterus* breeding in central Asia. Four juvenile Egyptian Vultures from Uzbekistan were tagged in their nests with GPS transmitters between 26th July 2021 – 6th August 2021. Three of the tags successfully transmitted data and three birds started to migrate from Uzbekistan between 5-15th September 2021. Each bird took a different route with two migrating via Turkmenistan, Afghanistan and Pakistan and ultimately wintering in India (Rajasthan and Haryana). The third bird took a longer journey with several stops through Turkmenistan, Iran, Iraq, Kuwait, Saudi Arabia and finally arriving in Yemen in late November 2021. All individuals remained in their wintering countries during the first spring, but by the time the birds were one year old only one individual made a return migration from India to the Tian Shan mountains on the border of Uzbekistan and Tajikistan in the summer of 2022. During the migration, we identified (using satellite photos and ground visits by local collaborators) frequent use of refuse dumps and slaughter sites by the Egyptian Vultures in each country. Notably, Balkan and Central Asian Egyptian Vultures are connected via their overlapping wintering locations in the Middle East.

Introduction

The Egyptian Vulture *Neophron percnopterus* is an Endangered (BirdLife International 2019) species that occurs across Europe, Africa and Asia with the global population in decline through most of its range (BirdLife International 2019). The factors behind the decline are diverse, including poisoning, electrocution and illegal killing for example, and in most of the cases regionally specific (Oppel *et al.* 2021). The distribution, numbers and trend are well studied in the western part of the range of the species and considerable conservation efforts have been undertaken (BirdLife International 2019). In contrast, almost nothing is known about the Central Asian population of the Egyptian Vulture, however, ten years ago the population was categorised as stable to declining with an estimated 700-1,300 breeding pairs in Central Asia and Caucasus regions (Abuladze & Shergalin 1998, Kashkarov & Lanovenko 2011, Sklyarenko & Katzner 2012).

Our project is focused on the Egyptian Vulture population in Uzbekistan. Uzbekistan is the only country in Central Asia to have carried out investigations on the species population status and drafted a National Species Action Plan (Kashkarov & Lanovenko 2011). The Egyptian Vulture was recently classified as nationally endangered and added to the Uzbekistan National Red Data Book due to perceived population declines (Uzbekistan Red Databook 2019). The Uzbekistan Society for

the Protection of Birds (UzSPB) made the first analysis of Egyptian Vulture data collected between 2000 – 2010 to determine the breeding range and threats (see Kashkarov & Lanovenko 2011 for a summary). Distribution data are high quality and show a breeding range in western Tian Shan, Pamir-Alay and the low deserts of central Kyzylkum. The Uzbek Egyptian Vulture breeding population was estimated as 135 pairs in 2011 and is considered rare (Kashkarov & Lanovenko 2011). Overall, data reliability is low for population number and trend, as they were not systematically collected through space or time. However, expert opinion concluded the population was likely to be declining, with losses of 26% in Babatag and Kugitang (Kashkarov & Lanovenko 2011). Since the National Action Plan in 2011 (Kashkarov & Lanovenko 2011) there has been no further countrywide census. However, the first systematic surveys in the central Kyzylkum Desert of nesting sites were conducted partially in 2017 and fully in 2018, estimating the population density in this 57,000 km^2 region to be 0.68-1.3 pair per 100 km^2 (Ten *et al.* 2017, Ten *et al.* 2018).

Egyptian Vultures in Uzbekistan are migratory but there is currently no data on the migration routes or wintering sites used by the birds, and thus the types and number of threats they face during migration and on the wintering grounds are unidentified. It is unknown how important the breeding population in Uzbekistan is for the species, however, Uzbekistan itself is a very important part of the Central Asia Migratory Corridor and it is likely to be a key area, not only for breeding Egyptian Vultures but also passage Egyptian Vultures. The lack of detailed biological knowledge on this species is severely limiting the development of an evidence-based action plan for their future conservation management in central Asia. The aim of this project is to identify migration routes, wintering sites and threats to Egyptian Vultures breeding in central Asia. Here we report the findings from tracking three juvenile Egyptian Vultures through the first year of their life.

Materials and Methods

Study area

Our work was focused on the Egyptian Vulture population breeding in the central Kyzylkum desert, Uzbekistan (Fig. 1). The Kyzylkum Desert covers a large area in Uzbekistan and Kazakhstan between the Amu Darya and Syr Darya rivers and is a flat semi-desert with a number of depressions and sparse low mountain ranges. The area has a heterogenous mix of shifting sand, compacted sandy desert and stony desert with clay substrate. Most habitats contain short halophytic shrubs at a low density, and an almost entire absence of large trees. A general limitation for Egyptian Vultures in this region is availability of nesting locations in the form of rocky outcrops and cliffs, which are few and sparsely distributed. Fieldwork was carried out between 28-30 May and 27 July-4 August 2021.

Legal procedures

Permissions to tag the Egyptian Vultures were obtained from The State Committee for Ecology and Environmental protection of the Republic of Uzbekistan, which, in accordance with the national procedures, issuing permit No. 000045 to carry out work on tagging in the Central Kyzylkum Mountains on the basis of the application of the Institute of Zoology No. 01-09397 dated July 14, 2021 and the conclusion of the Academy of Sciences No. 01-09 / 409 dated July 26, 2021.

Nest searching and monitoring

We monitored eight Egyptian Vulture nests in the study area in May 2021 in order to register the breeding outcome and estimate the age of the chicks. Additionally, we obtained information about the breeding outcome of another two pairs by Dr. Roman Kashkarov and Dr. Elena Bykova.

During the visits, the age of the observed chicks was estimated as 5-7 to 9-11 days old (Fig. 2). Based on the projected date when chicks would reach a suitable age for tagging (≥60 days old), a second visit was scheduled between the end of July and the beginning of August.

From July 27 to August 31, 2021, the team revisited the ten vulture nests in Arystantau, Muruntau, Bukantau and Ayakagitma (Central Kyzylkum). Seven of the nests were successful and we recorded nine juveniles, whereas three other nests were found empty and they had either failed or the chicks had fledged at least a week prior to our arrival.

Figure 1: Study area (red square) in the center of the Kyzylkum Desert, Uzbekistan, containing known Egyptian Vulture nesting sites.

Figure 2: Two Egyptian Vulture chicks, 5-7 and 9-11 days old, Arystantau, 30.05.2021. (V.Soldatov)

Tagging

Tagging was carried out when the chicks reached ≥ 60 days, just prior to fledging when they are big enough to fit the transmitters safely. Three nests had chicks appropriate for tagging, two nests in Bukantau (one chick each) and one in Ayakagitma (two chicks in one nest). In total four chicks were taken out of the nest for tagging and biometric measurements (weight and lengths of tail, cranium and tarsometatarsus, Fig. 3). Each chick was ringed with a metal ring on the left leg. We used three Ornitela Ornitrack-30 GPS/GSM, 30g solar-powered transmitters (Fig. 3) and one Fleetrax backpack transmitter (this unit never transmitted data) to track the vultures. Transmitters were fitted with Teflon ribbon backpack harness in a leg loop configuration. The transmitter with the harness did not exceed 3% of the body mass of the bird and thus unlikely to affect the survival of the migrating bird (Klaassen *et al.* 2014). It is possible to programme the Ornitela tags remotely and we varied the number of GPS fixes per day dependent on the battery levels, reducing the number of transmissions when the battery was low and increasing when the battery levels were high due to good exposure to the sun.

Figure 3: Measuring of juvenile Egyptian Vultures (top row), installing the transmitter on a vulture chick 65 days old (bottom left), tagged bird in nest (bottom right).

Migration

We determined the start and end points of migration, and the wintering sites used based on the behaviour and movements of the birds. In particular, we identified migration start dates as a transition from local movements near the natal sites to commencement of clear repeated southward directional movements. We classified the end of the migration movement as the first site reached after the transition from repeated directional movements to local movements around a central location for greater than three days. We calculated the straight-line migration distance and the total length of the migration tracks between the start and end points of migration. None of the birds adopted a single wintering location, but movements between different sites which they utilised for period of weeks to months. We defined the final wintering country as the country where the bird passed the majority of its wintering period. In this case, all birds passed the whole winter without crossing national boundaries. Juvenile Egyptian Vultures often remain on their wintering sites in the first year (Oppel *et al.* 2015), but we defined a return migration again as the transition from local movements to repeated northerly directional movements departing the wintering location and arriving to the natal latitudes. In this report we cover the first year of the birds' lives from fledging in August 2021 until August 2022.

Results

Migration onset and wintering sites

Three tags successfully transmitted data, providing information over the first year of three birds' lives (Table 1). All birds started migration from Uzbekistan between the 5th and 15th of September, 2021. Two of the birds reached northern India where they spent the winter (Arys.212859a and Anya.212860a, covering 2,429 km and 1,488 km respectively, Table 1), whereas the third bird (Timur.212861) covered 6,730 km before settling in western Yemen (Fig. 4). Only one individual, Arys.212859a, returned to the breeding range in the first year, departing the non-breeding area in India on the 8th May 2022 and arriving to Uzbekistan on the 30th May 2022. Arys settled in the Tian Shan mountains on the border of Uzbekistan and Tajikistan rather than returning to his natal site in the desert.

Table 1: Summary of the first migrations undertaken by Egyptian Vultures originating in Uzbekistan.

Bird ID	Estimated hatch date	Tagging date	Autumn migration departure date	Autumn migration arrival date	Total migration distance [straight line]	Non-breeding/ overwintering site	Return migration in first year
Timur.212861.2021	02/06/2021	01/08/2021	15/09/2021	02/11/2021	6,730 km [3,630 km]	Yemen	No, remained on non-breeding area
Anya.212860a.2021	19/05/2021	28/07/2021	05/09/2021	13/09/2021	2,429 km [1,790 km]	Migration stopped in Pakistan, but wintered in India	No, remained on non-breeding area
Arys.212859a.2021	24/05/2021	28/07/2021	12/09/2021	19/09/2021	1,488 km [1,242 km]	India	Returned to Uzbekistan on 18-30 May 2022

Migration routes

Anya.212860a followed a direct route south from Uzbekistan avoiding mountain crossings until she reached the Rann of Kutch, north of the Indus near Karachi, Pakistan, by 13th September 2021. Anya.212860a, remained here until crossing the Indus and into the Thar Desert, west of Barmer in Rajasthan, India, on 29th September 2021. Anya.212860a has remained in an area west of Shiv and Barmer since her arrival, making local movements and frequently crossing the border into Pakistan (Fig.4). Satellite imagery suggests she has largely remained in remote areas and not utilised human refuse sites. Anya.212860a did not undertake a return migration in her first year.

Arys.212859a also wintered in India but he used a different migratory route to reach India that was further east and over the Hindu Kush Mountain range in Afghanistan/Pakistan (Fig. 4). He then followed the ridge of the Sulaiman range in Pakistan and crossed the Indus into the Thar Desert reaching Rajasthan, India, on the 18th September 2021. Notably, his first arrival point in India, Bhadriya (60 km east of Jaisalmer), was near a livestock slaughter facility, after which he moved east to the town of Bikaner on 25th September 2021 and stayed here until 20th October 2021. Bikaner has a carcass dump which attracts thousands of vultures and steppe eagles during the winter months (Chhangani 2009). Arys then travelled directly to New Delhi by 21st October 2021 and spent one month south of Delhi mainly near Faridabad and Nuh. During this time, he took a two-day trip in a loop south to Jaipur, passing directly over the city at a height of 1,500 m on the 29th October. Arys.212859a moved to Agra on the 29th December, where he remained resident on the banks of the Yamuna River, east of the Taj Mahal, and remained making local movements for the next four months. Arys.212859a initiated a return migration on the 8th May 2022 and arrived to Uzbekistan by the 30th May 2022 (Fig. 5). Arys.212859a returned to the Tian Shan mountains on the border of Uzbekistan and Tajikistan rather than the desert.

The third vulture, Timur.212861, took a very different strategy from the other two individuals

and migrated to the Middle East. Timur.212861 made a direct migration south from Uzbekistan over the course of seven days whereupon he reached the Iranian coast near Bandar e Khamir and Qeshm, areas that are frequented by Egyptian Vultures (McGrady *et al.* 2022). Timur then wandered east towards Pakistan before returning west and following the Persian Gulf coast to Iraq, then he turned southwest into Kuwait and Saudi Arabia on the 12th October 2021. Timur followed a route southwest through Saudi Arabia, passing the Mahazat as-Sayd Reserve, before crossing the Asir mountain range onto the Saudi Arabian coastal escarpment and followed this feature south to Yemen, crossing the border on the 1st November 2021. Timur.212861 did not make a return migration in his first year and remained on two areas called Abal and Al Mafraq on the coastal plain escarpment. The west of Yemen is known as an important passage and wintering area for migrant Egyptian Vultures originating from the Balkans and Caucasus regions (Phipps *et al.* 2019).

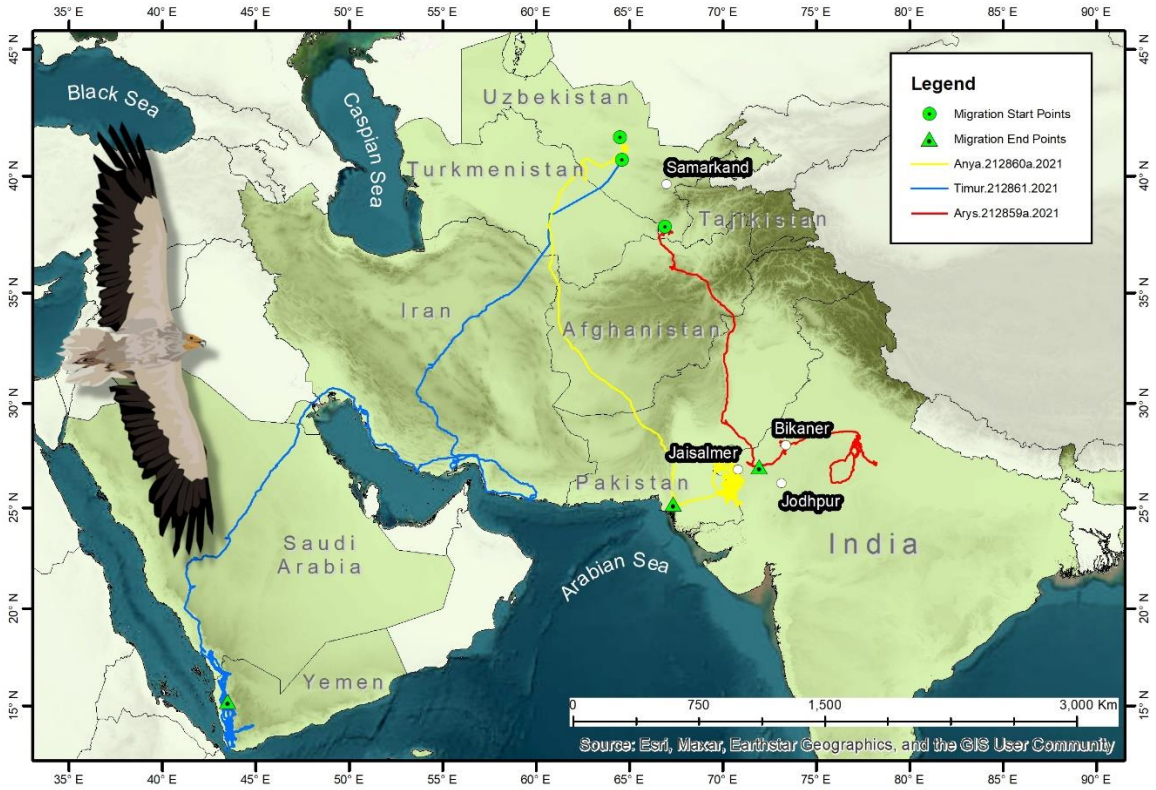

Figure 4: Autumn migration routes in and wintering grounds of the three juvenile Egyptian Vultures originating from central Uzbekistan.

Figure 5: The first autumn outward (2021) and first spring return (2022) migration for a juvenile Egyptian Vulture (Arys.212859a.2021) originating in Uzbekistan.

Discussion

This study contributes new knowledge and fulfils goals set out in the Vulture Multi-species Action Plan Annex 4: Egyptian Vulture Flyway Action Plan (EVFAP)(Nikolov *et al.* 2016, Botha *et al.* 2017). Firstly, the EVFAP was lacking information on the distribution and migration of the central Asian population when the plan was endorsed as this population had never been studied. In particular, Afghanistan, Pakistan and India were missing from the EVFAP (Nikolov *et al.* 2016). Afghanistan and Pakistan should be added to the list of migration range states and India added as a wintering country for the N. p. percnopterus subspecies. The migration data supports the theory that the long-observed annual wintertime increases in Egyptian Vulture in India is primarily due to the arrival of migrants from Central Asia (Saran & Purohit 2014). Secondly, the EVFAP Subsection 4.1.5. sets gaining a better understanding of the population connectivity as a key target (Nikolov *et al.* 2016). Here, we found that in addition to the connectivity between Uzbekistan and Indian sub-populations, the central Asian bird's migration through the Middle East confirms connectivity with the Balkan, Middle East and Caucasus populations through the shared flyway along the Red Sea Flyway and have overlapping wintering locations in Yemen (Buechley *et al.* 2018). With the overlapping ranges in the Middle East and India, the migrant Egyptian Vultures share similar threats to those identified for birds on the Red Sea Flyway, including poisoning, illegal killing and electrocution (Oppel *et al.* 2021). Nevertheless, the threats in India, along the Central Asian Flyway and in the breeding grounds in Central Asia are unclear and remain to be quantified. This novel data will be

useful to the update of the species National Action plan for Egyptian Vulture in Uzbekistan (Kashkarov & Lanovenko 2011) and the forthcoming update to the EVFAP. Furthermore, the study proves for the first time that the central asian population of the species overwinter in India using the Central Asian Flyway and underlines the necessity for building adequate conservation strategies and projects to conserve the Egyptian Vulture in this part of its range.

Acknowledgements

For the implementation of this project, finance support was also received from the Ornithological Society of the Middle East, the Oriental Bird club and the Hawk Conservancy Trust, UK (Dr Campbell Murn and Hannah Shaw). Thanks to their support, we were able to increase the number of transmitters and conduct research in planned volumes. The study was also supported by the Institute of Zoology of Zoology of the Academy of Sciences of the Republic of Uzbekistan, represented by the director B.R. Kholmatov. and the State Committee for Ecology of Uzbekistan, represented by the head of the biodiversity conservation department Kazakov A.B. Thanks to their support, we received permission to carry out work on tagging EVs in Uzbekistan. We also thank Dr. Roman Kashkarov, PhD, Director of UzSPB, for the organizational support; dr Elena Bykova, Maria Gritsyna and Timur Abduraupov for their help in providing information on the location of the vulture and their nests in 2021.

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