

REINFORCEMENT OF THE EGYPTIAN VULTURE POPULATION IN BULGARIA

**Integrated report on the release of captive-bred and wild Egyptian Vultures in
the Eastern Rhodopes, Bulgaria in 2024**



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Photo on the cover page: Nika roosting on a tree in the first days after the release

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Introduction

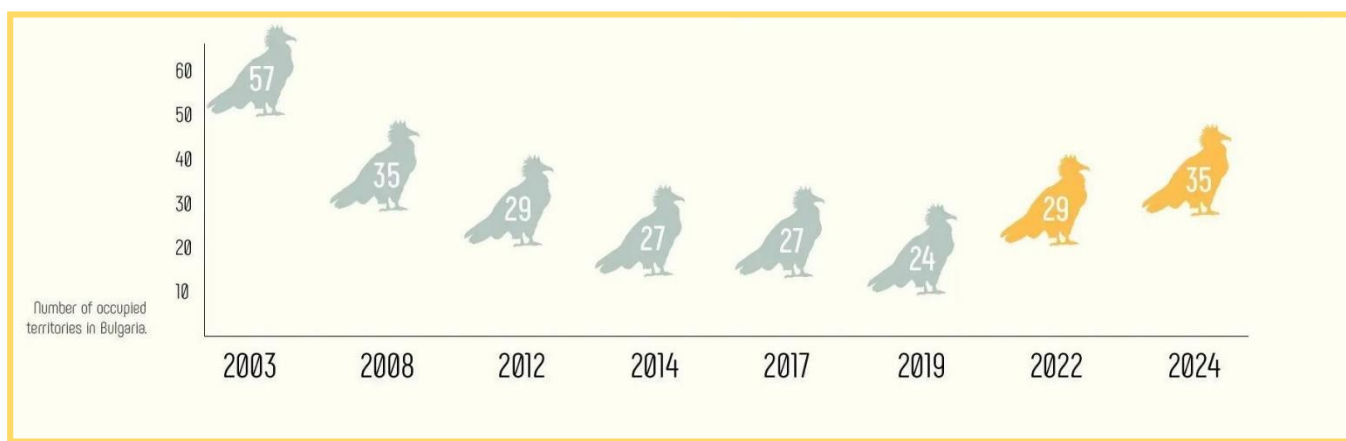
The Egyptian Vulture is a globally Endangered species according to IUCN. The Balkan population of the species has dropped down to about 50 pairs with a calculated decline of about 4-8 % per year over the past three decades (Velevski *et al.* 2015). Among the main threats for the species are the illegal use of poison baits, electrocution, poaching and drowning of the juveniles during their first migration. These threats operating along the entire flyway lead to the continuous reduction of the breeding territories across the Balkans (Oppel *et al.* 2015, Velevski *et al.* 2015). An integrated population model shows that reinforcement of the population with captive-bred individuals would reduce the probability of extinction by 2049 from 48% to <1% if 12 or more birds are released every year for 30 years. The model and a Feasibility Study suggest that a 4% improvement in the survival of the wild individuals combined with the release of 9 birds per year for 20 years would lead to a stable population while releases continue (Saravia *et al.* 2020, Oppel *et al.* 2021).

In 2018 in the frame of the 'Egyptian Vulture New LIFE' project (LIFE16 NAT/BG/874) a pilot Reinforcement program for the species started in Bulgaria. Three different methods for releases of captive-bred Egyptian Vulture were tested –

delayed release, fostering and hacking. The results from the trial releases indicated that the most feasible and successful releasing technique is the delayed release. Based on these results a Reinforcement Strategy for the Egyptian Vulture in Bulgaria and Greece was developed (Arkumarev *et al.* 2022) and is currently under implementation. By delivering urgent conservation measures towards eliminating major known threats in the breeding grounds and along the entire flyway we aim to increase the survival of the wild and released individuals which is in line with the "Flyway Action Plan for the Conservation of the Balkan and Central Asian Populations of the Egyptian Vulture *Neophron percnopterus*" (EVFAP), (Annex 4) of the CMS Vulture Multispecies Action Plan (Botha *et al.* 2017).

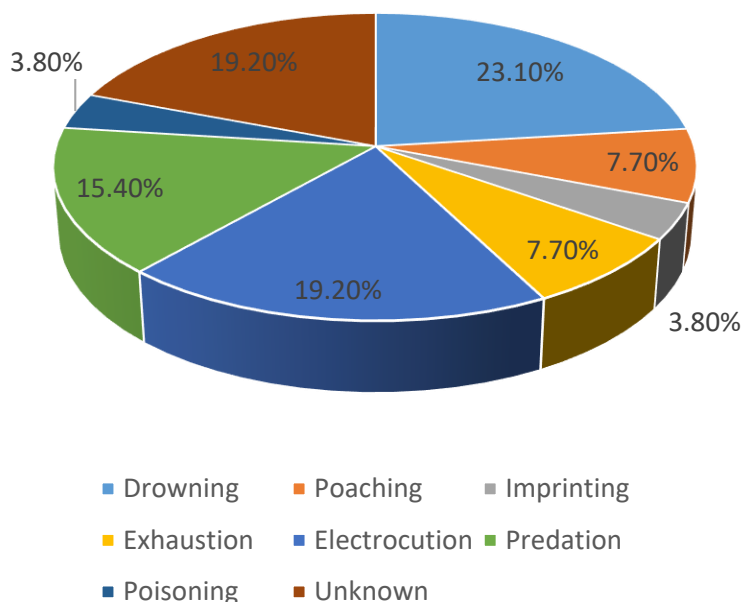
Our most recent study revealed that the population growth rate across the Balkans increased by 6.9% and the Egyptian Vulture population has remained stable for five years (2018-2022). In Bulgaria 35 occupied territories were found in 2024 which is a 20% increase compared to last year and for the first time in 40 years the population shows steady increase. However, the ongoing management along the flyway and reinforcement are required to ensure that the Egyptian Vulture population on the Balkans can recover (Oppel *et al.* 2023).

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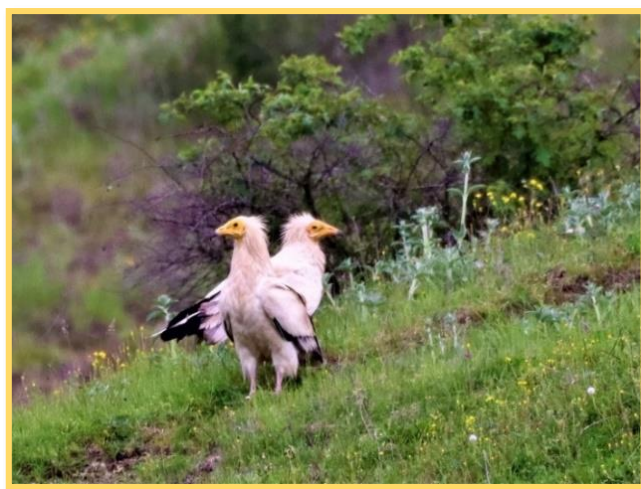
Summary of the results (2016-2024)

Over the course of the past 8 years (2016, 2018-2024) 32 captive-bred and 8 wild Egyptian Vultures were released in Bulgaria (Arkumarev *et al.* 2018, 2019, 2020, 2021, 2022, Arkumarev 2023). Twenty-seven vultures were released through delayed release method, 9 through hacking and 4 through fostering. Delayed release was established as the most successful method as the survival of these individuals until the end of the first autumn migration was the highest and even higher than the survival of the wild juveniles. The main cause of mortality of the released individuals is drowning in the Mediterranean Sea ($n=6$, mostly vultures released through hacking). The other most significant factors are electrocution and predation (see the figure below).



In 2024 six Egyptian Vultures (2 cy) were released in the Eastern Rhodopes through the delayed release method. Three birds were raised in captivity and three more were extracted from wild nests in 2023 (see next chapters for details).

This year 7 Egyptian Vulture released previously have returned to Bulgaria (6 released through delayed release and one released through hacking). Four of these vultures formed pairs in the wild and occupied breeding territories with wild partners. Since the start of the Reinforcement program in total 5 different released individuals have occupied breeding territories – 4 were female and one male. This year we celebrated the first successful breeding attempts of released individuals. Two pairs laid eggs and both hatched chicks. Two fledglings were raised in one of the nests and a single one in the other one. All three chicks fledged successfully from the nests and started their autumn migration. This success is an important milestone in the species' recovery in Bulgaria and the Balkans. It was achieved only 6 years after the start of the programme and confirms its importance for the recovery of the population





We have released 40 Egyptian Vultures in Bulgaria so far. Many of them survived the migration to Africa and returned back to Bulgaria. Now the eldest birds are breeding in the wild giving hope for the recovery of the Endangered Egyptian Vulture in Bulgaria and the Balkans.

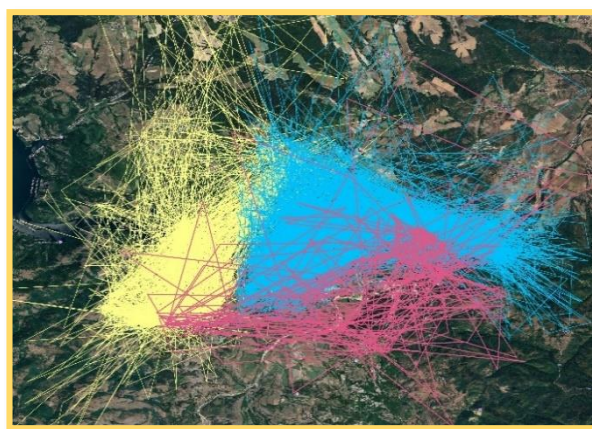
Movements of the Egyptian Vultures released in 2018 – 2023

Delayed release

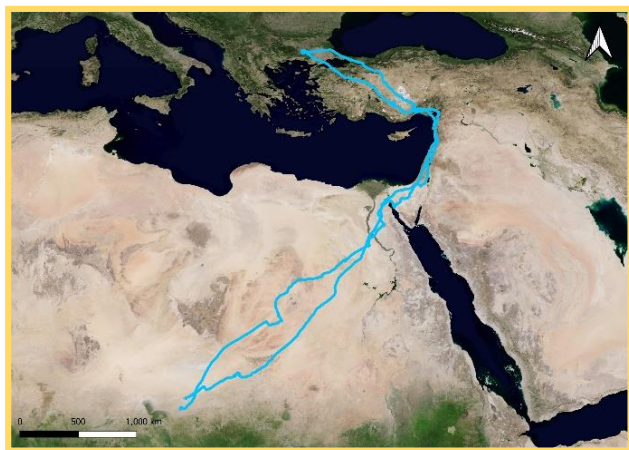
Panteley (7 years old; released 2018)

Panteley spent the winter of 2023 in Chad, east of lake Chad, in the same area where he spent the previous winter as well. His spring migration started on the 07th March and crossed the Sahara desert in only 10 days. Same as last year he stopped for 4 days in Turkey, south of the city of Konya. Panteley returned to his breeding territory on 31st March (one week earlier than last year). Upon arrival he started displaying and exploring the territory. On the 07th April he landed in a valley just 800 m from the nest of the neighbouring pair. For more than 24 hours Panteley was immobile and our team went to check whether he is alive. However, he has left the area an hour before we arrive and he returned to the breeding cliff. The reason for this unusual behavior is not clear but we suspect that he was attacked by the male from the neighbouring pair and forced to land in the bushes. Such territorial fights may sometimes lead to serious injuries and could even be fatal for one of the males but Panteley survived this time. In the end of April, he was observed with another vulture sitting on the cliff and flying around. However, the detailed observations showed that the other bird is

male as well. For a couple of days the two males were building a nest but did not show strong bond. In June Panteley moved to another cliff within the same territory which is located 2.5 km from the previous one. On the map below are shown the territories of the three neighbouring pairs as drawn by their GPS transmitters. Panteley's territory is the one in blue.



In August Panteley was observed in the company of a female and the new pair was displaying and roosting together. The pair remained together until 12th September when Panteley started his autumn migration (one day earlier than in 2023). On his way south he did not make any long stops and arrived in the same wintering area in Chad on 02nd October (one day later than last year).



Zara (6 years old; released in 2020 r.)

Zara spent the winter in eastern Sudan in the same area where she wintered in 2023. She started the spring migration on 20th February and did not make any long stops along the way. On 15th March she crossed the Dardanelles and until the evening she arrived back in its breeding territory in Bulgaria. On the next evening she spent the night roosting in the nest of its neighboring pair which was not yet in the area. On the next day she visited the nest of another pair close to the vulture feeding station where she was released in 2020. Zara stayed in this territory and started displaying around the nest and feeding daily at the feeding station. On 28th March we observed copulation between her and the male from that territory and displays near the nest. However, five days later the female from



The autumn migration for Zara started on 15th September (in 2023 she started migration on 18th September). Unlike last year in 2024 Zara did not stop for feeding and rest anywhere along the flyway and on 25th September flew over Suez. Then she followed Nile further south and three days later was already in southern Egypt. There we lost signal from her transmitter. Most probably she returned to her usual wintering sites in Sudan.



that pair returned from Africa and managed to chase away Zara from her land. Therefore, Zara straight away returned to her last year's territory. There she started building a nest with her partner and around 20th April laid eggs. Zara and her partner successfully raised one chick which fledged from the nest in August. This is the first successful breeding in the wild in Bulgaria of an Egyptian Vulture raised in captivity and released in the frame of the Reinforcement program.



Izi (5 years old, released in 2020)

Izi is the younger sister of Zara and share similar life story. She spent the winter of 2023 north from Hartoum, in Sudan. On the 09th March she started migration back to Bulgaria. On 24th March Izi reached Turkey but unlike last year she did not stop for feeding anywhere there and continued straight north. On 28th March she crossed the Dardanelles and returned to her breeding territory the same day. She occupies this territory with her partner Lucky since 2022. Lucky returned from Africa on 03rd April. The pair immediately started displaying, copulating and building the nest. This year for the first time Izi laid eggs and started incubation. In June two chicks hatched and were successfully raised by the pair. Izi and her sister Zara became the first captive-bred Egyptian Vultures to successfully breed in the wild in Bulgaria which is a historic success for the Reinforcement programme. The fledglings of Izi were tagged with GPS transmitters as well and were named Lizi and Isabela. We monitored the movements of the entire family.



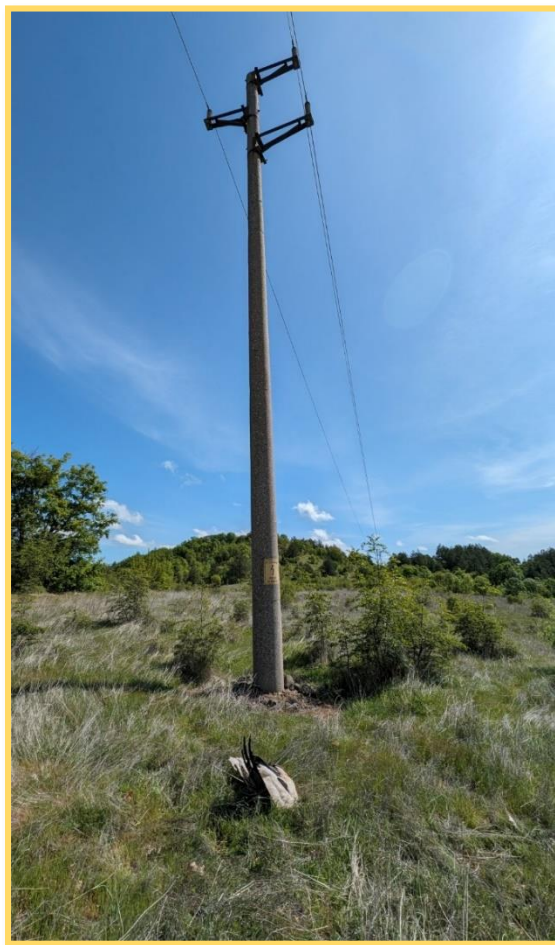
Izi started the autumn migration on 12th September. On the same date but separately Isabela started migration as well. The younger sibling Lizi left the breeding territory first - on 08th September while the father Lucky left the last - on 14th September. None of the four tracked birds were flying together. Lizi followed the Turkish sea coast and undertook a hazardous attempt to cross the Mediterranean Sea but failed and drowned. Isabel was shot by poachers at the Adrasan Peninsula in Turkey. Izi and Lucky successfully reached Africa. We lost signal from Izi's transmitter on 23 September when she flew to Sudan.

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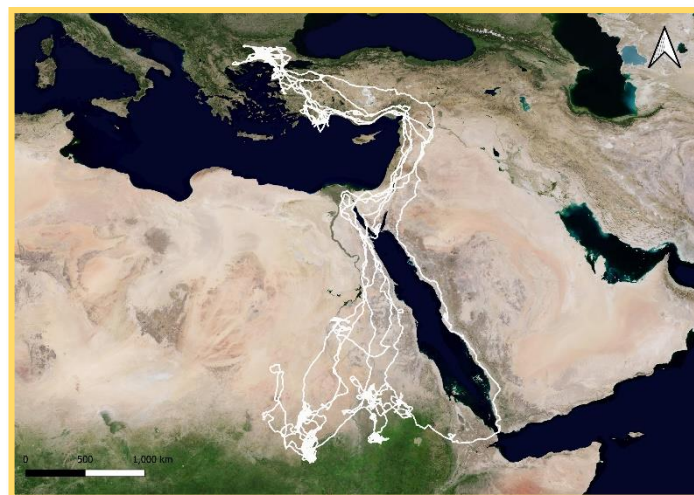


Ferdinand (5 years old; released in 2021 r.)

Ferdinand spent the winter in West Kordofan, Sudan. On 01st April he started flying north to return to Bulgaria. Along his way he stopped for just for a day south of Kayseri in Turkey. On 19th April he flew over the Dardanelles and in the afternoon arrived at the supplementary feeding station where he was released three years ago. He spent the last few hours of that day feeding along with other vultures. On the next day Ferdinand made a short visit to northern Greece and in the afternoon visited the adaptation aviary and feeding site for Cinereous Vultures near Madzharovo. He stayed there for the night. On 21st April Ferdinand left the area and flew towards Studen kladenets damn. However, near the village of Svatbare he was forced to land due to strong rain. He decided to land on a hazardous electric pylon on the top of a hill. Due to the type of the pylon which is among the most hazardous to birds and the high humidity from the rain Ferdinand got electrocuted and died. BSPB immediately informed about the case the Regional Inspectorate of Environment and Waters which gave prescription to the electric company to insulate the killer pole and the nearby poles on this hill top. The electric company EP-Yug insulated the pylons quickly to prevent other mortalities of birds.



The map below shows the movements of Ferdinand over the past three years. He has visited 13 countries in Europe, the Middle East and Africa during his life in the wild.



Siphera (3 years old; released in 2022)

Siphera spent the winter in Chad, southwest from lake Fitri. On 15th April she started the spring north migration towards Bulgaria. On 27th April she flew over Suez and then followed the Mediterranean coast through Lebanon and Syria to reach Turkey. She stopped for a four days break in an area located south from the town of Nevsehir in Turkey. Then Siphera continued flying north and on 10th May flew over the Bosphorus. On the next day she reached Sakar mountain in Bulgaria and over the next week she travelled over the Upper Thracian Plain reaching the town of Pazardzhik and then south to Evros Delta in Greece. On 17th May Siphera returned for the first time to the supplementary feeding station where she was released two years ago. In the next couple of days she explored the area of the Eastern Rhodopes and Sakar mountain. On 08th June she initiated an exploratory trip over the Balkans visiting consecutively North Macedonia, Kosovo, Serbia and Romania and on 12th June returned back to the feeding station in the Eastern Rhodopes. On 29th of June she moved to an area close to the town of Galabovo where she spent most of the summer. The BSPB team visited the site and found out that the area is a vast pasture with a small stream nearby and water holes and holds a large number of buffalos, cattle and horses.



She was observed with an adult Egyptian Vulture in that area. Gradually the number of vultures at this spot increased throughout the summer and the maximum number was recorded in August – 9 individuals of various age. This place turned into the most important congregation site for the species outside the core area in the Eastern Rhodopes. The team of BSPB started a study on the threats in the area and discovered that the powerline running through the pasture is of hazardous type and has caused mortality of Ravens and White Storks. BSPB immediately contacted the electric company EP-Yug with a request to insulate the hazardous powerlines. The company approved and insulated the pylons to prevent mortalities of Egyptian Vultures and other species at this spot. We established also good contacts and collaboration with the owners of the farm and other stakeholders like hunters in the area.



On 22nd September Siphera started the south migration. In just four days she crossed Turkey and reached Syria. Few days later she was already in Sinai but spent 4 days trying to find a wat out of the peninsula. Finally, she flew over Suez and on the 09th October reached the wintering grounds in Chad.

Elizabeth (3 years old; released in 2022)

Elizabeth spent the winter in Chad, mostly in the Oadi-Rime-Oadi-Achim Faunal Reserve. On 07th April she moved north through the Sahara and reached the northern parts of Egypt where she spent 6 days. Then she continued north towards the Middle East. Elizabeth was progressing slower than Siphera flying shorter distances per day. On 11th May she reached Izmir in Turkey and shortly visited two Greek islands – Chios and Psara but realized that this is not the right way and returned to continental Turkey progressing north. On 15th May she crossed the Dardanelles and on the same day landed on the supplementary feeding station in Dadia-Soufli-Lefkimi Forest National Park. On the next day Elisabeth flew straight to the feeding station in Bulgaria where she was released two



years ago. She spent the next few weeks exploring the area of the Eastern Rhodopes and was frequently feeding at the feeding station. On 15th July probably during a fight with another Egyptian Vulture her GPS transmitter dropped off but in less than 24 hours she was trapped and tagged again by the team of BSPB. Elisabeth spent the rest of the summer in the Eastern Rhodopes but was also visiting the area near the town of Galabovo where Siphera was staying. In August a few times she

visited the supplementary feeding station in Dadia, Greece.



On 14th September Elizabeth started the south migration and two days later flew over the Marmara Sea. On 17th August she reached the Adrasan Peninsula in Turkey but with no hesitation found the right route out of it and followed the coast to the east. Three days later flew over the bottleneck near Sarimazi. Similar to Siphera she also had difficulties to find the way out of Sinai but finally crossed the Gulf wide 30 km to reach Africa. Then she followed Nile south, crossed Sudan and returned to the wintering grounds in Oadi-Rime-Oadi Achim Faunal Reserve in Chad.

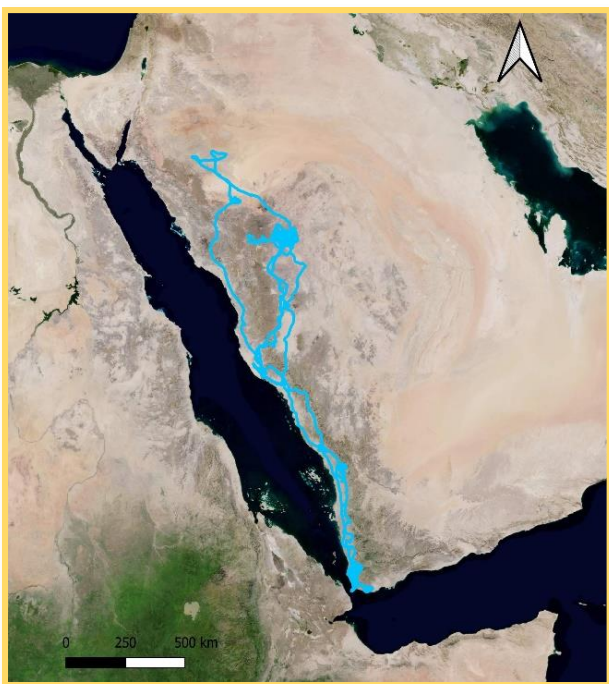


Pia (3 years old; released in 2022)

Pia was wintering in Yemen in 2022 but in January 2023 we lost signal from her GPS transmitter. In 2024 we have not received any new data from Pia. She might have died or dropped her transmitter, or is still in area with no GSM coverage. Her fate remains unknown for now.

Luis (2 years old; released in 2023)

Luis spent the winter of 2023 in Yemen, east from the town of Mocha. On 04th April he moved north and crossed the border with Saudi Arabia. He spent a week along the coast south of Jeddah but then continued north and on 05th may reached the area in the northern part of Saudi Arabia close to the city of Tabuk. Later he crossed the mountains again to return back to the area near Jeddah, but soon after made another crossing of the mountains to northeast. Luis stopped in an area located about 160 km northeast from Medinah. He spent there the entire summer and on 03rd September moved south again. In only 6 days he returned back to his wintering areas in Yemen, where he spent the winter last year.



Hacking

Deni (4 years old; released in 2020)

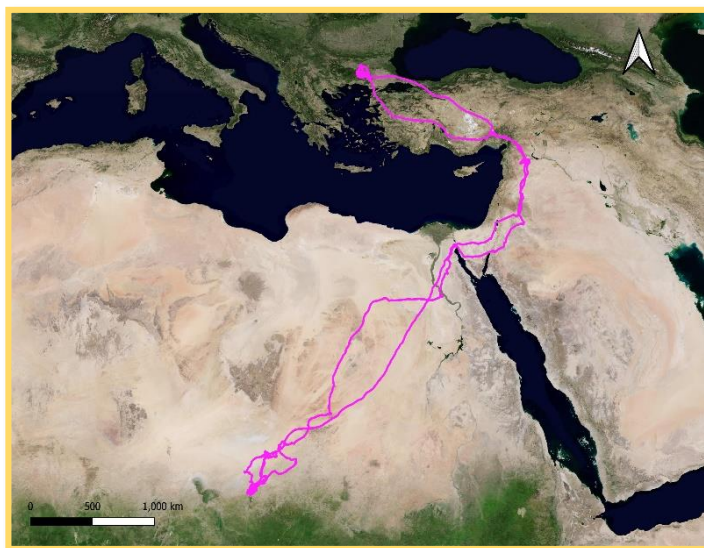
Deni spent the winter in Chad, north of lake Fitri. The spring migration started on 16th March which was more than two weeks earlier than last year. The passage over Sahar was long and took 14 days and on 02nd April she reached Suez. After that she continued further south with a greater speed through Israel, Jordan and Syria. In northern Syria she stopped for two days and then continued through Turkey. On 15th April Deni crossed the Dardanelles and on the next day returned to the Eastern Rhodopes and immediately visited the supplementary feeding station where she was released 4 years ago. Until the end of April, she was exploring the Eastern Rhodopes and made a few visits to the feeding station in Dadia-Soufli-Lefkimi Forest National Park in Greece as well. On 07th May she visited a known breeding territory of the species located 18 km south from the release site.



The pair in this territory was already incubating at that time. The observations of our local collaborator showed that Deni is landing on the breeding cliff while the other female is incubating but she was not chased by the male. During our

next visit on 11th May we found the nest half destroyed and the eggs were missing. That probably is a result of a vigorous fight between Deni and the pair. However, the female from the pair was missing too and was never observed again. Deni was chasing the male who was landing at different spots around the cliffs but was trying to avoid the presence of Deni. After a couple of days, the two birds started to behave as a pair and even started repairing the nest. The new pair remained in the territory until the autumn. In August Deni enlarged the area of activity and was regularly visiting the supplementary feeding station near Potochnitsa.

On 14th September Deni started the autumn migration and on the same day crossed the Bosphorus. On a high speed she flew through Turkey, Syria, Jordan, Israel and Egypt. On 30th September she reached her wintering areas in central Chad. She flew over 5000 km on migration for only 16 days



Summary of the results from 2024

In 2024 six Egyptian Vultures were released through the delayed release method in the Eastern Rhodopes, Bulgaria. All birds were born in 2023 and hence are released in their second calendar year.

Three of the vultures are captive-bred – Nika was raised in Prague zoo, Adela and Sylva were raised in Ostrava Zoo, Czech Republic. The other three birds – Kaloyan, Veli and Electra were harvested from wild nests in the Eastern Rhodopes in summer 2023 and were raised in the Wildlife Rehabilitation and Breeding Center of Green Balkans in Bulgaria. These birds hatched very late in breeding season 2023 and would have fledged in late August/early September therefore would have limited time to prepare for the migration and would suffer increased risk of mortality. Our data indicates that such juveniles have lower chances for survival and by releasing them in the next spring we aim to increase their survival. The extraction of chicks from wild nests is done in line with strict criteria set in the Reinforcement strategy (Arkumarev et al. 2022).

In 2024 all six Egyptian Vultures that were released adapted well to the wild and survived the critical first month. Five of these birds remained in the release area for the entire summer – Adela, Sylva, Nika, Electra and Veli. They were feeding mostly at the supplementary feeding station managed by BSPB but were also observed feeding at carcasses found in the wild in the area. Kaloyan was the only one that left the area soon after the release and spent his first month and half in the wild in northern Bulgaria. However, after that he also returned to the release site and stayed there until the autumn migration. The young vultures were roosting on cliffs and trees mostly at safe and high locations. All released birds followed the traditional migratory route for the species through Turkey and the Middle East and did not try to cross the Mediterranean Sea. Five of the birds followed the flyway along the eastern shore of the Red Sea and remained for the winter in the Arabian Peninsula. Only Kaloyan flew towards Egypt to enter Africa. The table below provided information for the start and end dates of migration of the six Egyptian Vultures released in 2024. The dates marked with * are not the end date of migration, but the last date on which a signal was received from the GPS transmitter while the bird was still migrating.

Name	Migration start date	Migration end date
Kaloyan	08.10.2024	11.01.2025
Electra	14.09.2024	09.10.2024 *
Veli	14.09.2024	06.10.2024 *
Adela	23.09.2024	18.10.2024
Sylva	23.09.2029	20.10.2024
Nika	16.09.2024	15.10.2024

*date of last GSM connection but possibly not the end date of migration

Release method

In 2024 six Egyptian Vultures were released through the delayed release method. This method foresees releases in spring when they are in their 2nd or 3rd calendar year. When the birds are released in the spring they have more time before the autumn migration to gain experience, improve their physical fitness, socialize with other non-breeding Egyptian Vultures, gain knowledge for important feeding sites, communal roost sites, etc. They spend 2 months of adaptation in an aviary and are released in the second half of May/early June when other immatures birds are already present in the area. Then they have 4 months to adapt in the wild before the onset of the autumn migration.

Origin of the released Egyptian Vultures

Nika, Sylva and Adela are captive-bred birds provided by the Egyptian Vulture EEP under EAZA. Nika was born in 2023 in Prague Zoo, while Sylva and Adela were born and raised in the same year in Ostrava Zoo, Czech Republic. Kaloyan, Veli and Electra were harvested from wild nests in the Eastern Rhodopes in 2023 as they hatched very late in the breeding season and therefore had lower chances for survival during the first autumn migration. They were raised in the WRBC of Green Balkans in Stara Zagora, Bulgaria



Management in captivity

Nika, Sylva and Adela were raised by their parents in the zoos in aviaries that were not exposed to zoo visitors in order to avoid contacts with people. Kaloyan, Veli and Electra were raised by their wild parents in the nests until age of about 50-55 days when they were extracted from the nests. In the WRBC of Green Balkans they were raised in aviary with minimum contact with humans.

Release site

The release site is located in the Eastern Rhodopes, Bulgaria at a vulture feeding station. It is considered suitable as it meets the following conditions:

Safety of the area. The release site is located in a vulture safe area where no major threats for vultures exist. It is located in the core area of the Egyptian Vulture breeding population on the Balkans. The area holds increasing and healthy population of Griffon Vultures and is regularly visited by foraging Cinereous Vultures. In the vicinity of the release site (5km radius) there are no poisoning or poaching events for at least 5 years, there are no windfarms and the majority of the powerlines are safe or have been insulated and thus don't pose a risk for the vultures.

Food availability. The release site is located at a predictable food source - vulture feeding station where about 30 t of food for the vultures are provided annually. The adaptation aviary faces the feeding station which allows the adapting Egyptian Vultures to observe the behavior of the other scavengers and their wild conspecifics. Supplementary food is regularly provided at the vulture feeding station during the pre-release period and in the post-release period as well.

Predator control. The feeding station is electric fenced in order to avoid the presence and access of

terrestrial predators (stray dogs, foxes, jackals, wolves, martens etc.).

Conspecifics presence. The release site is in area with regular presence of non-breeding Egyptian Vultures and breeding pairs. The adaptation aviary is located about 1.5km away from an active nest of a wild Egyptian Vulture pair in order to avoid unwanted aggressive interactions with the young birds after the release. The feeding station is regularly visited by adult wild Egyptian Vultures and non-breeding individuals. The permanent presence of other non-breeding Egyptian Vultures in the area is important for the socialization of the released vultures.



Other species' presence. The release site is located outside the breeding territories of other territorial raptors in order to avoid aggressive interactions with the released Egyptian Vultures. Such species are Golden eagle (*Aquila chrysaetos*), Eagle owl (*Bubo bubo*), Long-legged Buzzard (*Buteo rufinus*). In addition, the feeding station is regularly visited by only low numbers of Corvids, e.g. up to 5-10 Ravens (*Corvus corax*) and 12-20 Crows (*Corvus cornix*). Ravens often congregate in big numbers near vulture feeding stations and compete with the vultures for food and roosting sites showing prominent aggressive behavior. Because only a few Ravens are present at the feeding station they are outcompeted by the

Egyptian Vultures and there was no serious risk for the released birds.

Griffon and Cinereous vultures are regularly present at the feeding station and in the vicinity of the release site. The area holds a population of 140 Griffon Vulture pairs and 2 Cinereous Vulture pairs but also Cinereous Vultures from Greece frequently visiting. During the post-release period the captive-bred Egyptian Vultures have the opportunity to interact with the other scavengers at the feeding station and find their place in the intra-guild hierarchy.



Roosting substrate. The release site is located in area with high inaccessible cliffs which are used as safe roosting sites by the released birds. The availability of dead trees is an advantage as well because very often Egyptian Vultures roost on such trees. All pylons and powerlines in the vicinity of the release site are of safe types or were insulated.

Adaptation aviary

Location. The adaptation aviary was located inside the electric fenced feeding station. It was installed about 100 m away from the area where the supplementary food for the wild vultures is placed. This allowed direct visual contact between the birds in the aviary and the feeding place without

disturbing the wild vultures. In addition, the aviary was installed under the top of the hill in order to avoid the strongest winds and harsh weather



conditions. The area around the aviary was open without bushes or dense forest which might make the vultures feel unsafe.

Exposition. The aviary is facing east, south and west. The northern exposition, from where harsher weather conditions usually occur, is covered.

Size and structure of the aviary. In 2022 new larger aviary was constructed. The dimensions of the aviary are 12m/8m/4m. This size allows the vultures to fly from one side to the other, strengthen their wings and prepare for the first flight after the release. The main construction is built of metal and sandwich panels. Wire mesh with 25x25 mm openings was used for covering the aviary. The floor of the aviary remained uncovered to prevent vulture's legs from injuries while walking and feeding. The wire mesh on the sides was extended with additional 50 cm and put in the ground in order to prevent predators from entering in the aviary.

The north side of the aviary is closed with sandwich panels. This is the side from where the strongest and more frequent winds were expected. This side of the aviary should protect the birds from the harsh weather conditions. Wooden perches are mounted along the sides of the aviary.

The perches are at about 2 m height above the ground. They are about 20 cm wide and placed about 40 cm away from the net in order to provide enough space between the vultures and the net, thus avoiding any unwanted damages on their flight feathers. In 2023 a dead tree high about 4 m was inserted in the aviary to be used by the Egyptian Vultures for roosting. There are two doors for releases placed at the two sides of the long side of the aviary. The doors are 2 m long and



1.5 m high. This dimensions and position of the entrances allow the vultures to leave the aviary by flying out straight from the perches.

Food and water delivery port. The food and water are delivered through 2 small windows at the covered side of the aviary in order to avoid direct visual contact between the keeper and the vultures.

Video surveillance. Video cameras with wide-angle lens are installed in the two corners of the aviary to closely monitor the behavior of the vultures during the adaptation period. The cameras have good visibility towards the place where the food is delivered in order to closely monitor the food intakes by the different individuals in the aviary.

Adaptation period

Insertion in the adaptation aviary. The six Egyptian Vultures were inserted in the adaptation aviary on the 28th of March, soon after the arrival of the first breeding pairs which visit the feeding station. This allowed the young birds to observe their wild conspecifics since their first day in the adaptation aviary. All birds were ringed with different colored plastic rings to ease the identification during the adaptation period. The color rings were removed before the release.



Feeding. The vultures were fed every second day with about 150-200 g per day per individual. However, in cases when whole carcass was provided or the food in the aviary was not completely consumed and was still fresh the frequency of the feedings was decreased until most of the food was consumed. Food and water were provided through small windows from the covered side of the aviary in order to avoid the direct visual contact between the vultures and the keeper. Water was kept clean and permanently available. The food provided was as diverse as possible. As the birds have used to some specific type of food (rats, hares, chickens) as a main food source provided during the captivity period, the same food items were used in the first days of the adaptation. After that period the quantity of these food items was gradually decreased and at the

same time the quantity of other food items was increased. The Egyptian Vulture is an opportunistic scavenger with very wide diet spectrum which includes carcasses of bigger animals, eggs, invertebrates, slow-moving small animals which are captured alive, faeces etc. (Negro *et al.* 2002, Hidalgo *et al.* 2005, Dobrev *et al.* 2016). Training the captive-bred Egyptian Vultures to recognize different food items might be crucial for their survival and successful adaptation into the wild. Thus, the food provided during the adaptation period was as diverse as possible including whole parts of carcasses (e.g. sheep legs), pieces of red meat or skin small animals (e.g. lizards, snakes, hares, tortoises, hedgehogs, birds), bones with some meat on them, offal.

Monitoring. The behavior and the interactions between the vultures in the aviary were permanently monitored and recorded. An experienced observer was recording which food items are consumed, any aggressive behavior between the birds or social exclusions.

Tagging. All Egyptian Vultures were tagged with 30g GSM/GPS Ornitela transmitters prior to release. They were tagged 1 month before the release. During the tagging the birds were thoroughly examined by vets and treated against ecto- and endoparasites because this was their last handling prior to release. The tags were set to provide high frequency of GPS points (GPS locations every 5 min) and high frequency of data deliveries (30 min). This allowed the field team to immediately react if the birds experience some problems after the release. The transmitters were mounted using leg-loop harness (Anderson *et al.* 2020). All vultures were ringed with metal rings and had microchips for identification. The color rings were removed as in the wintering grounds in central Africa some birds are killed because of the color rings.



Release

Release period. The adaptation period lasted 54 days. All vultures were released on the 10th of June. The release took place after the arrival of the first non-breeding Egyptian Vultures in order to allow the inclusion of the captive-bred birds into the social structure of the wild conspecifics near the feeding station. In the Balkans the non-breeding birds start arriving in early May.

Feedings. At the day prior release supplementary food was provided at the feeding station. About 400 kg of offal was provided and was scattered on the feeding station. The aim was to ensure that the released vultures will have access to food even if Griffon Vultures monopolize the food and outcompete the other vultures.

Release. The vultures were released in the morning (around 11:00 am local time) on the 10th June by opening the two side entrances of the adaptation aviary. All further observations were held from a distance of about 400 m in order to avoid disturbance. All birds left the aviary in the first 30 minutes after the gates were open

Post-release monitoring and actions

Monitoring. After the release the Egyptian Vultures were closely monitored by experienced field team. The most critical period was expected to be the first night when the birds might not roost on a high safe place.

The monitoring of the released birds continued 5 days until they started feeding at the feeding station. After that period the released birds were closely monitored by the GPS transmitters and visual observation about once per week.

Feeding. Supplementary food was permanently present at the feeding station after the release and until the start of the autumn migration. This approach aimed to attach the birds to a safe food source and in area visited by other non-breeding Egyptian Vultures. Whole carcasses and offal were regularly provided. Food items were scattered in order to ensure easy access to food for the released vultures. Food was also places in a walk-in trap frequently used by the Egyptian Vultures but not used by the Griffon Vultures and thus the competition with the latter was minimized.

19



Movements, migration and wintering

Kaloyan

Post-release movements

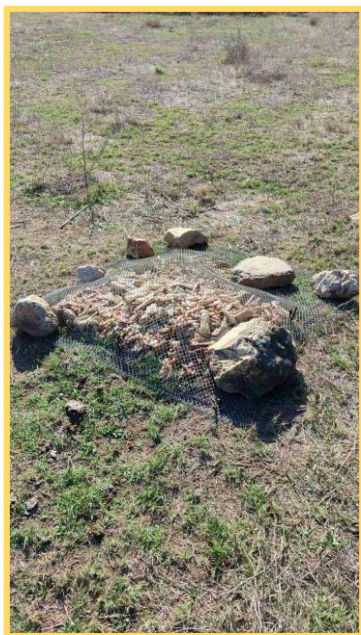
Kaloyan left the aviary few minutes after the gates were open. After a short flight he landed on a hilltop 300 m away. In the afternoon he moved to the high cliff above the feeding station and spent there the rest of the day and his first night in the wild. In the next two days he was moving mostly between that hill top and the cliff where he was roosting but did not feed on the feeding. In the morning on 13th June Kaloyan moved 3 km to the west and spent the night on a cliff there. On the next day he made an exploratory flight over the Hunting reserve “Studen kladenets” and spent most of the day sitting on a tree in a dense forest but in the afternoon flew to a nearby large cliff complex and protected area named “Golemiat

stayed for the night on the cliff complex. After that he reached his northern most point near Bucharest but on 20th June Kaloyan swirled south and reached the village Trem in Hitrino municipality in northern Bulgaria. He stayed there for over a month. The field visit of local collaborators revealed that he is feeding with leftovers from a livestock farm that is dumped in a pasture nearby.



sipey” for the night. On 15th June he visited the area of Madzharovo and spent the night on the cliffs in another protected area “Patronka” where a local breeding pair was present. On the next day he moved north and reached Sakar Mountain where he settled for the night on a tree. But early on the next morning continued his journey north reaching the Balkan Mountain and on 18th June flew over the mountain top. In the evening he reached the Nature Park “Rusenski Lom” and

Dozens of ravens were also present. Kaloyan was roosting on a tree about 1 km from the feeding area and his movements were mostly restricted between that tree and the pasture. On 07th August Kaloyan left the area and flying through Sakar Mountain reached the Central Rhodopes near the village Hvoyna. On 14th August he returned to the release site where he settled for the rest of the summer. In August he was trapped and the examination showed that he is in good health. On 24th September Kaloyan moved north to the town of Sliven and then quickly swirled south to reach Corlu in Turkey but instead of flying over the Bosphorus he returned back to Bulgaria. He settled in an area near the town of Harmanli where he spent the next 11 days. The team of BSPB visited the site to check what attracted the vulture there and found offal covered with net which was used to attract carnivores for shooting. However, this food was unreachable for the vulture.



The team noticed that Kaloyan has lost numerous feathers from both the wings and the tail. Therefore, it was decided to try to trap the vulture and keep it in captivity. However, the stress from the human activity in the area seems to have triggered its migration instinct and he left the area on the same day and

started the autumn migration. The map below shows the movements from the release until the onset of the autumn migration.



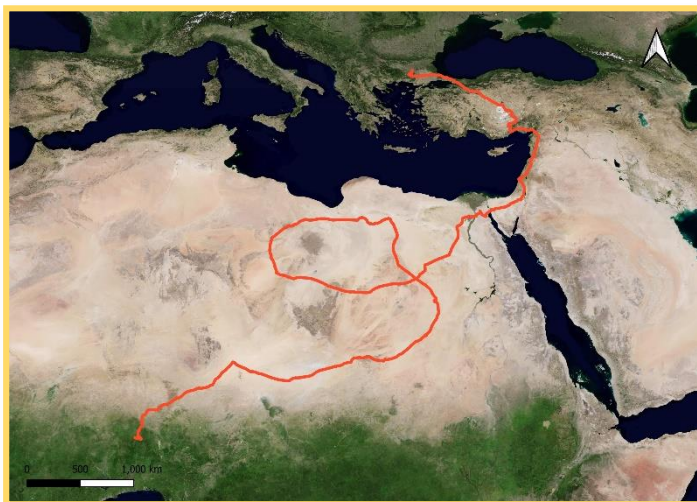
Migration

Kaloyan started the autumn migration on 08th October. He was the last Egyptian Vulture to leave Bulgaria. On 10th October he flew over the Bosphorus and continued south through Central Anatolia but with a lower speed than the other vultures released this year. On 19th October he entered into Syria.

On 25th October he was spotted at a vulture feeding station at Hai-Bar Carmel in Israel. He could be observed thanks to the online camera installed at the feeding station and maintained by INPA (Israel Nature and Park Authority). The vulture showed



normal behavior at the feeding station and stayed there for 5 days. On 02nd November he flew over Suez. On 15th November he crossed the border with Libya and for over a month travelled 3000 km in the Sahara Desert. After that he continued south through Sudan, Chad, Niger and Nigeria to reach the wintering grounds in the northern parts of Benin. It is the first Egyptian Vulture from the Balkans to winter in Benin. During its first autumn migration Kaloyan travelled 10 000 km which is twice longer distance than the usual for the species.



Electra

Post-release movements

Electra left the aviary immediately and flew to the nearby hilltop. Her behavior in the first hours after the release was identical with Kaloyan's - first she was mostly walking on the hilltop and then with short flights reached the nearby cliff where she spent the first night. Two days later she flew to Boynik Mountain and in few consecutive nights was roosting on deciduous and coniferous trees.



She was observed by the field team to fly well and soar using well the air thermals. Over the next week Electra was exploring Boynik mountain and on 18th June she made her first longer flight to reach the river Varbitsa near the village Stareyshino. She spent a day there and then returned back to Boynik mountain. On 21st June she made a two-day visit to Madzharovo and then she flew straight to the release site and landed on the supplementary feeding station there. The next two months Electra spent mostly near the supplementary feeding station but was observed to also feed on carcasses found in the wild. She joined the group of wild non-breeding Egyptian Vultures which was roosting on a dry tree near the feeding station in the nearby reserve. Electra was exploring the Eastern Rhodopes in a radius 20-30 km from the release site but most of the days she was returning

to roost near the feeding station. Her longest trip was on 13th August when she reached the area of the town of Mineralni Bani but returned to the release site in the afternoon.

Migration

Electra started the autumn migration on 14th September and two days later flew over the Bosphorus. For ten days (17.09-27.09) she stopped south of Polatli in Turkey. During that period, she visited the known Egyptian Vulture congregation site near the city rubbish dump only once. After the break Electra moved south with a greater speed and on 29th September entered in Syria. She flew over Jordan to reach Saudi Arabia and followed the east coast of Red Sea. On 09th October we lost signal from her transmitter when she was near the border with Yemen. Most probably she crossed the border and settled to winter in area with poor coverage in Yemen. Hopefully, we will receive signal in the spring when she leaves the area and move north again.

The map below shows Electra's migration track from Bulgaria to Yemen.



Veli

Post-release movements

Veli left the aviary 10 min after opening the gates and same as Electra and Kaloyan he flew about 300 m to the nearest hilltop. Unlike them he spent much more time in flight during his first day in the wild and was soaring and gliding but staying close to the release site. He spent the first night on the same high cliff near the release site. Only two days after the release Veli landed at the feeding station



for feed with the other Egyptian Vultures there. On the same day he made a longer flight and stayed to roost on a tree in Boynik Mountain. In the next weeks Veli stayed close to the feeding station and was making daily short trips in radius 10-20 km from the release site to explore the area. In the evening he was always returning to roost on trees or cliffs near the release site. On 21st July he made his first longer exploratory flight and visited the Greek part of the Eastern Rhodopes reaching Komotini. On the next day he returned back to the release site. After a week he made another exploratory flight to the southeast and visited the area of Byala reka. Until the end of the summer Veli

stayed close to the feeding station where he was feeding daily with the other released and over 10 other non-breeding Egyptian Vultures.

Migration

Veli started the autumn migration on 14th September together with Electra. The two vultures left the feeding station together in the morning and flew straight east towards Greece and Turkey. They spent the night together roosting on a tree near the suburbs of Istanbul. However, on the next day they continued separate but both vultures stayed near the Bosphorus. On 16th September they crossed the Bosphorus but at different time – Electra was first 4 hours ahead of Veli. Veli made a five day break in the southern tip of Ankara region, about 50 km south of Polatli. Afterwards he continued through Central Anatolia and on 26th September flew over Sarimazi. He crossed Syria and Jordan to reach Saudi Arabia. Then he followed the east coast of the Red Sea. On 06th October near Jazan we lost signal from his transmitter. Most probably he crossed the border with Yemen and entered into area with no coverage. The map below shows the migration route of Veli between Bulgaria and Yemen.



Adela

Post-release movements

Adela also left the aviary only 10 minutes after opening the gates and landed on the nearby hilltop. After a while she also moved to the nearby high cliff. In this first day she was not flying actively and spend most of the day sitting on the cliff where she also spent the night. On the next day she moved on a scree under another cliff used by vultures for roosting and she stayed there for the night. On the third day after the release she was about to roost again on the scree but at accessible place where fox was previously observed passing. Therefore, the field team visited the place to scare the vulture and force it to move to a safer place. Adela moved to a higher cliff but just before darkness she landed again on an accessible cliff where she stayed for the night. After that day Adela became more cautious and started roosting on inaccessible cliffs and trees. On 17th June she landed for the first time to feed on the feeding station. After that day she was visiting the feeding station daily and was socializing with the wild vultures. Over the next few weeks Adela was exploring the area of the Eastern Rhodopes in 8-12 km radius from the release site. On 28th July she made her first longer distance flight reaching the towns of Lyubimets and Harmanli. On 02nd August she made another longer flight to Mineralni Bani and Haskovo. Adela crossed the border with Greece for a first time on 16th September and explored the Greek part of the mountain. She did the same again 5 days later. These long distance flights were probably preparatory flights for the south migration.

Migration

Andela moved south on 23rd September and reached Marmara Sea. On the next day she flew

over the Bosphorus and continued on a high speed south. She reached Syria on 29th September and four days later she crossed the border with Jordan. In the period 03-07th October she stopped for a break in Jordan about 70 km east from Ma'an. After that short break Adela moved further south following the east coast of Red Sea through Saudi Arabia. For six days she stopped also near the town Yanbu. On 18th October Adela reached the wintering grounds in the southern parts of Saudi Arabia, about 50 km north from the city of Jazan.



Sylva

Post-release movements

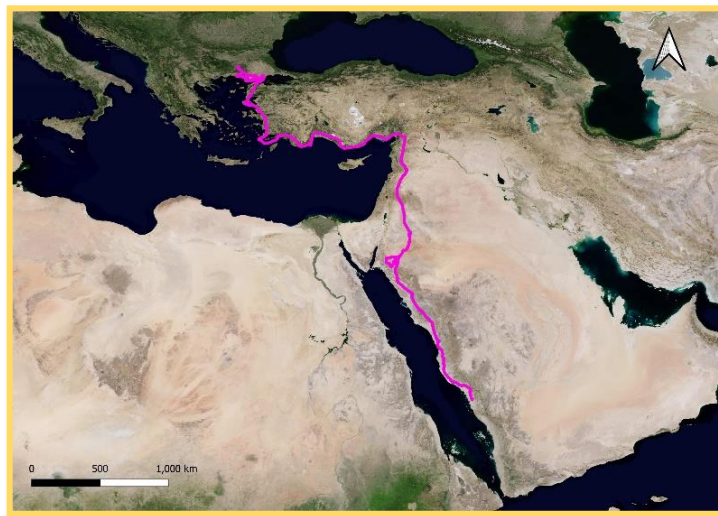
Sylva left the aviary immediately after opening the gates and shortly landed on the nearby hilltop. Soon after she returned to the feeding station and was feeding in the late afternoon together with other wild Egyptian Vultures. In the evening she moved to the base of the nearby cliff and was roosting either on a tree or on the scree. On the next day she was flying in only short distances and was soaring above the cliff. However, she did not move far from the release site and early in the morning on 13th June she returned to the feeding station to feed. On 18th June she made the first longer distance flight 12-15 km from the release site and then returned back. In the next months Sylva was exploring small area mostly around Krumovitsa river valley and Boynik mountain. She made also a few visits to Madzharovo and one longer flight to Byala reka valley to the east and the ridge Gorata to the north.



Migration

Sylva started the autumn migration on 16th September and reached Marmara Sea, but did not cross that day. Instead, she followed the coast to the west and reached Alexandroupolis and in the evening she spent the night in the forest of Dadia-Soufli-Lefkimi Forest National Park in Greece. On 19th September following the coast to the east she reached Marmara Sea again and stayed to roost nearby. On the next morning Sylva crossed 20 km over the sea to reach Anatolia but she continued in southwestern direction and reached the island of Lesbos. There she spent one night and on the next morning returned back to Turkey but followed the coast to the south. On 22nd September she visited a few Greek islands – Kos, Nisiros, Tilos and Simi but after that she returned back to the coast. On the next day Sylva reached the Adrasan Peninsula but quickly found a way out following the coast to the east. Sylva flew over Syria and Jordan and reached Saudi Arabia. North of the city of Tabuk she stopped for 10 days in an agricultural area. Afterwards she continued further south following the east coast of Red Sea. On 15th October she reached the wintering grounds east of the town of Al-Qunfudhah in Saudi Arabia. In the same area is wintering also Nika.

25



Nika

Post-release movements

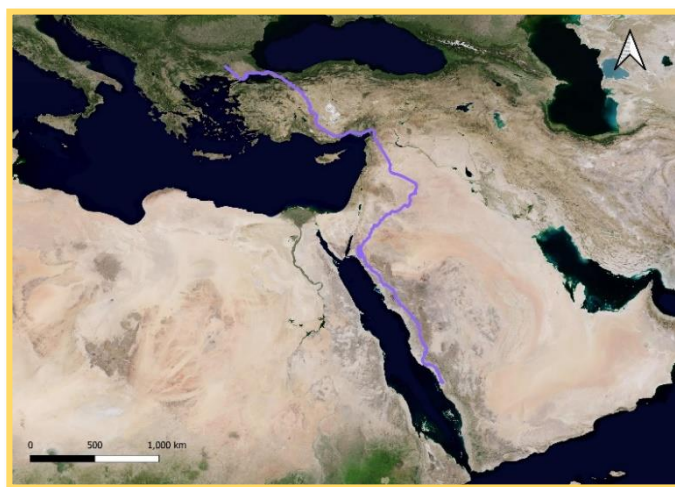
Nika was the last that left the adaptation aviary, about 20 min after the gates were open. She also landed on the nearby hilltop and later flew to the nearby high cliff that was used by all other released birds this year. In the late afternoon Nika left the cliff and flew to another cliff complex about 1 km away but decided to roost on a tree in the forest.



Over the next week Nika spent most of her time sitting on a tree in the forest with only short flights around. In the evenings she was roosting on trees. On 18th June she made her first longer flight about 30 km to Krumovitsa river. In the late afternoon Nika landed on the supplementary feeding station to feed for the first time. In the next two and a half months Nika was mostly exploring the area between Krumovgrad, Madzharovo, Studen kladenets dam and the ridge Gorata to the north. It is a small area with a center of activity – the supplementary feeding station where she was feeding daily and roosting nearby. However, Nika was also observed to feed on carcasses found in the wild. In September she was roosting with the other non-breeding Egyptian Vultures on a dead tree near the feeding station.

Migration

Nika started the autumn migration on 23rd September and on the same day reached the shore of Marmara Sea in Turkey. On the next day she followed the coast and flew over the Bosphorus. Nika continued in southeast direction through Anatolia. On 29th September she flew over Sarimazi and then crossed Syria, Iraq, Jordan and on the 6th October she crossed the border with Saudi Arabia. There Nika stopped for a longer break for the first time and spent 9 days in the mountain Jabal al-Lawz. Then she continued south at a higher speed following the Red sea coast and on 20th October reached the wintering grounds east of the town Al-Qunfundhah. In the same area is wintering Sylva as well. There is a known congregation site of about 200 Egyptian Vultures in that area found in 2019 by the team of BSPB and NCW.



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