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RESULTS OF THE REINTRODUCTION OF GRIFFON VULTURE (*GYPS FULVUS*) IN VRACHANSKI BALKAN NATURE PARK, NW BULGARIA

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Abstract: In 2003 a project for the reintroduction of Griffon Vulture started in Vrachanski Balkan with its preparation phase, when a feasibility study was elaborated. At 2015, the project is still on-going. The programme is led by the Birds of Prey Protection Society (BPPS) together with the Green Balkans - Stara Zagora NGO and the Fund for Wild Flora and Fauna, supported by the Vrachanski Balkan Nature Park Directorate as a local partner.

The first supplementary feeding site for vultures in the area was established in 2004 in an attempt to attract Griffon Vultures that migrate through the area. A specialized adaptation aviary and a second supplementary feeding site nearby were built in 2008.

In April 2009 the first group of 8 Griffon Vultures imported from Spain was accommodated into the adaptation aviary. The first release of 8 birds took place in October 2010. Groups of Griffon Vultures have been released every year since then and at 2015 the total number of birds released is 43.

The largest numbers of Griffon Vultures identified and present in the area of release through the years have been as follows: 2010 – 7 ind.; 2011 – 12 ind.; 2012 – 13 ind.; 2013 – 29 ind.; 2014 – 46 ind.; 2015 – 53 ind. The largest number of simultaneously observed Griffon Vultures in the area is 53, counted in September 2015.

The first breeding attempts of two pairs were reported in 2014, but they were unsuccessful. In 2015 a total of five breeding pairs were observed of which one pair successfully raised an offspring. This has been the very first successful reproduction and the first young Griffon Vultures fledged into the wild registered in the Balkan Mountains of Bulgaria for more than 60 years.

Mortality caused by electrocution on a 20 kV aerial power line was found out as the main negative factor impacting the Griffon Vultures released in the area. A total of four individuals were found electrocuted out of the 43 Griffon Vultures released in the area.

INTRODUCTION

Griffon Vulture (*Gyps fulvus*) was a numerous and widespread breeding species in Bulgaria to 1940s (Patev 1950). After the middle of the last century the species got rarely observed in various parts of the country (Boev, Mitchev. 1981). A new breeding locality of the species was discovered in 1978 in the Eastern Rhodopes with an estimated number of nesting pairs between one (Mitchev et al. 1980) or 1-4 (Yankov and Profirov 1991). Thanks to a variety of conservation measures the species slowly recovered to 70 breeding pairs in 2014 (Dobrev and Stoychev, 2014). The Eastern Rhodopes appeared to be the only place in Bulgaria, where the speceis bred at the beginning of the XXIst century, until 2010, when several reintroduction projects were launched in the Balkan Mountains (Stoev *et al*., Yankov *et al.* this volume) and Kresna Gorge (Peshev et al. 2015).

There is specific data on the nesting of the species in Vrachanski Balkan. A total of 7 areas where the species can be assumed with high reliability to have bred until about 1950s have been identified based on information collected by interviews of elderly local residents (Stoyanov, 2010 a; Stoyanov, 2010 b).

The work on the restoration of Griffon Vulture in Vrachanski Balkan went through several stages, as follows:

1. Feasibility study and preparation for the start of the main actions: 2003.

2. Initiation of field work, preliminary studies carried out on test feedings, field inventories of suitable territories, construction of the first supplementary feeding site, preparation of a Viability Study for the reintroduction of Griffon Vulture in Vrachanski Balkan (Stoyanov *et al*. 2006), establishment of contacts with various authorities, feeding, monitoring, etc.: 2004 – 2008.

3. Construction of a second supplementary feeding site and an adaptation aviary, feeding, monitoring, etc. - 2008 – 2009.

4. Start of the Vultures Return in Bulgaria LIFE10 NAT/BG/278 Project and the first practical steps towards vulture reintroduction: import of Griffon Vultures from Spain and France, keeping them in the adaptation aviary and periodic release into the wild; feeding, monitoring and others - 2010 – 2015.

The Griffon Vulture restoration activities in the Vrachanski Balkan area are an integral part of a large international project - the Action Plan for the Recovery and Conservation of Vultures on the Balkan Peninsula and Adjacent Regions (BVAP). In Bulgaria it is implemented along the entire Balkan Mountain chain (Stara Planina) in four target sites as follows: Vrachanski Balkan (UTM FN99), Central Balkan (UTM LH32), Sinite Kamani - Grebents (UTM MH43) and Kotlenska Planina (UTM MH65). The project is implemented by Green Balkans

- Stara Zagora NGO, the Fund for Wild Flora and Fauna (FWFF) and the Birds of Prey Protection Society (BPPS). In the area of Vrachanski Balkan the main local partner is the Vrachanski Balkan Nature Park Directorate (VBNPD). The Bulgarian Environmental Partnership Foundation was also a partner in the period 2004 to 2009. Foreign partners supporting the programme are the Frankfurt Zoological Society, the Deutche Bundesstiftung Umwelt (DBU), the Black Vulture Conservation Foundation (BVCF) and later the Vulture Conservation Foundation (VCF). In 2010 the practical reintroduction was carried out through the Vultures Return in Bulgaria project LIFE08 NAT/BG/278, co-funded by the financial instrument of LIFE+ of EC.

MATERIALS AND METHODS

The release methodology chosen was the successfully used for the restoration of Griffon Vulture in the France, published by Choisy and Henriquet (1992), Terrasse (2006) and Terrasse and Choisy (2007).

One of the important activities started from the very beggining and developed over the years is the establishment of a system for supplying food for vultures. The food comprises mostly carcasses of domestic animals submitted by local farmers or shipped from more distant commercial farms. The feeding of Griffon Vultures is carried out on a specificall built supplementary feeding site, which is securely fenced and certified by the veterinary services in Bulgaria (NVS), as required by the EC (Commission Regulation (EC) № 1774/2002), (Regulation (EC) № 1069 / 2009). Regular feeding has been provided, to secure permanent food availability on site, accessible for both the released and the wild Griffon Vultures.

The Griffon Vultures were reared in an aviary built on the territory of NPVB, 4 km from Dolno Ozirovo village (municipality Varshets, Montana). It has a solid metal supporting structure spouse of concrete bricks and wooden roof. The cage is surrounded by a wire mesh that the roof has a large “eye” (up to 20x20 cm) not to hold a lot of snow. The cage is divided into two cells: large dimensions 16 m × 10 m and a small 6 m x 10 m. The height of the two cells at the front end is 4 m, and the rear end 2 m. In both cells are constructed concrete basins of 150 liters of water for drinking and bathing vultures during the warmer months of the year. At the feeding site outside the cages, in moveable containers water was also supplied to released and wild vultures coming to eat here.

Periodically, groups of Griffon Vultures from Spain and France were transferred to the adaptation aviary. They were kept about one year in captivity and then were released into the wild. The first group of 6 birds was set up in April 2009. In October 2010, the first release of eight birds together took place. By the end of 2015 in Vrachanski Balkan release site were released 43 Griffon Vultures.

Observations of Griffon Vultures were carried out mainly in the area of the feeding site and the adaptation aviary in the vicinity of Dolno Ozirovo village. In addition to the standard optics for observations – powerful telescope and binoculars, since 2013 a motion detection camera is in use. Periodic observations for the presence of vultures have been conducted in other important sites of Vrachanski Balkan - especially large rocks. Besides personally collected data, in certain cases also information from other sources was also collected and analized – e.g. by Directorate of the National Park Vrachanski Balkan, tourists, locals, etc.

Description of the area

Geographic situation

Vrachanski Balkan Nature Park is situated in North-Western Bulgaria (see Figure 1), to the North of the main Balkan Mountains range (Stara Planina) and to the West of the town of Vratsa. (altitude between 43° and 44° N and longitude between 28° and 24° W).

Fig. 1. Vrachanski Balkan Nature Park

The mountain has Northwestern and Southeastern exposure. It is about 30 km long and some 15 km wide. It comprises a total territory of 355 km². The territory of the Vrachanski Balkan Nature Park covers a total of 288, 5 km². The lowest part is at 350 m a.s.l., while the highest reaches 1482 m a.s.l. – peak "Beglichka mogila".

The entire massif of Vrachanski Balkan has a karst geological structure and features a large number of vertical rock formations, cliffs, single rocks, screes, wreaths, clint fields. Many of the rock massifs are difficult to reach due to their

natural protection by steep screens and vegetation formed by tree and bush species. The ridge areas are covered by large grasslands.

The area comprises the Vratsata Gorge, which has a karst structure and features a vertical cliff, which is more than 400 m high. These are the highest limestone verticals in the Balkan Peninsula, and at the same time the highest pure verticals at such an altitude in Europe. Additionally, there are plenty of cliffs, single rocks and rocky areas. Here is the longest mountainous cliff massif in Bulgaria – about 6 km long cliff, with some parts exceeding 100 m in hight.

Climate

The climate in the mountain features big diversity and quick changes. The climate is a mixture between sub-continental and mountain climate zones. The average annual temperature is +7°C. The average for January is +1.6° C. Temperatures lower than – 10° are registered very rare. During winter there is a striking difference between the temperatures and the snow coverage because of the exposition of the hills. At lower altitudes the snow cover stays about 50 – 60 days, while at the higher altitudes it lasts some 80 – 100 days.

Spring comes relatively later and is cold. Summer is hot, especially below 1 000 m a.s.l. Long-lasting thick fogs are characteristic for the Vratsa valley (East of the mountain), but they are rarer and short lasting in the mountains.

The winds in the mountain are mainly (65%) with NW – SE direction. "Feuhn" winds occasionally occur in early spring and late autumn. The peak of the rainfalls is May – June, the driest periods being February and August. The average amount of the rainfall is 1 000 mm.

Suitable habitats for reintroduction

Vrachanski Balkan Mountains is one of the amplest regions in Bulgaria with respect to suitable rock massifs for Griffon Vulture. The reason is the presence of vertical cliffs with height ranging from tens of meters to 100-200 m. The highest can reach up to 400 m sheer precipice. A big part of these rock habitats are situated in the altitude range of 100-400 m, and many of the cliff walls have Southern and Eastern expositions.

The Karst structure of the rocks determines the abundance of holes, caves, rock cornices on the territory of Vrachanski Balkan and makes the rock massifs very suitable as nesting habitats for Griffon Vulture.

Protected areas

The protected areas located in the region are as follows: Vrachanski Balkan Nature Park with a total areaof 28 844,8 ha. (of which 20 733,4 ha are forests).

This is the second biggest nature park in Bulgaria. Within its territory is situated Vrachanski Karst Reserve at a total area of 1 409 ha, and a buffer zone of 623 ha.

There is a proposal for extending the reserve.

In addition to the reserve, there are some more protected territories in the park, mainly rock formations comprising some 15% of the area of the park, such as the Lakatnishki Skali and Vezhdata Protected Areas, the Nature Landmarks Ritlite, the Ledenika Cave, the Vratzata Gorge.

VBNP was designated a protected natural area with international significance for protection of biodiversity and the richness and beauty of nature in 1997.

On 04.11.2008 NPVB was designated a Natura 2000 protected site - SPA BG0002053. It is also a SCI

RESULTS AND DISCUSSION

In the period January 2010 - June 2015, a total of 44 Griffon Vultures imported from Spain and France were released from the Vrachanski Balkan release site (see Table 1). Out of these 41 were immatures (2-3 years old), 1 subad (4 years) and 1 ad (>5 years). Most vultures were released in the period March–November (See Table 2). Sixteen were males, 21 females and 7 unknown.

Table 1. Released Griffon Vultures in Vrachanski Balkan by year

Year	Number of released birds
2010	8
2011	7
2012	5
2013	8
2014	12
2015	4
Total	**44**

Table 2. Released Griffon Vultures in Vrachanski Balkan by month

Month	Number of released birds
Jan	0
Feb	0
Mar	7
Apr	6
May	6
Jun	4
Jul	2
Aug	4
Sep	4
Oct	9
Nov	2
Dec	0
Total	**44**

The maximum number of observed Griffon Vultures in Vrachanski Balkan release site by year and months is presented on Table 3 and Figure 2:

Table 3. Maximum number of observed Griffon Vultures in Vrachanski Balkan release site by year and months

Total number of Griffon Vultures by months and years	Months											
	J	F	M	A	M	J	J	A	S	O	N	D
2010								2	6	13	8	7
2011	6	7	8	8	9	9	9	10	12	12	11	13
2012	9	6	9	8	10	11	12	13	13	14	12	11
2013	12	12	7	24	21	28	26	23	29	19	20	19
2014	23	20	21	26	30	50	44	44	35	45	40	40
2015	40	40	40	37	43	40	50	48	53	47	43	46

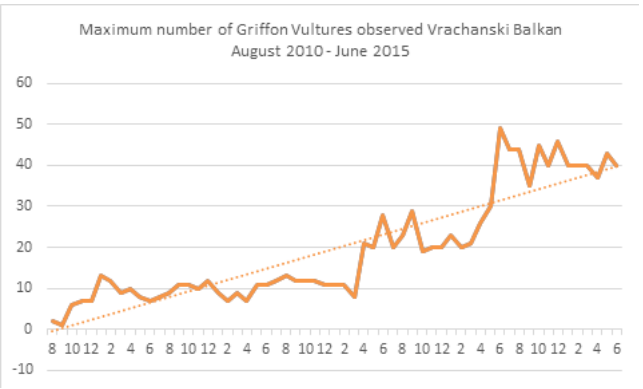

Fig. 2. Maximum number of Griffon Vultures observed in Vrachanski Balkan, August 2010 - June 2015

There is a very big difference in the presence of Griffon Vultures in the period 2003- 2009 (Stoyanov 2010 a; Stoyanov b), compared to the data from 2010 to 2015. The first period covers the time when only soft measures were implemented in Vrachanski Balkan – supplementary feeding, hoping that vultures would be attracted to the area. In the second period, an adaptation aviary was constructed and release of vultures took place in the area in addition to the supplementary feeding carried out. In the first period, only single Griffon Vultures were very rarely observed. These birds only briefly stayed in the Vrachanski Balkan area, in spite of the feeding present and the abundance of suitable nesting cliffs. At the same time, monitoring data from 2010 to 2015 shows long-lasting presence of the species in the area and a progressive increase of the number of vultures each year, with not only released within the project, but also with wild, non marked ones, or such marked elsewhere. This is due to several factors. On one hand, this is related to the fact, that the released vultures formed a "nucleus" of birds that permanently stayed in the area and attracted conspecifics passing through the Vrachanski Balkan are. Observations show that the adaptation aviary and the birds inside also play a key role in attracting exogenous vultures on passage. Such were seen perching on the roof of the aviary and getting food at the feeding site, which is just in front of the aviary. The increased amount and frequency of food provision at the feeding site (See Table 7 and Table 8) also had a great importance for increasing the number and the continued detention of Griffon Vultures in the area all-year-round.

The areas where vultures are tagged and released from adaptation aviaries in Bulagria are as follows: Vrachanski Balkan, Central Balkan, Sinite Kamani - Grebenets, Kotlenska Planina (the release sites of Green Balkans, FWFF and BPPS along the Balkan Mountains) and Kresna Gorge (release site of FWFF). The Griffon Vulture "Michelle" is a non-tagged juvenile Griffon Vulture successfully fledged from a nest in Vrachanskia Balkan in 2015. The vultures from Serbia and Croatia have been marked as fledglings in the nests, while those marked in Israel are trapped on field. A total of 103 different Griffon Vultures with tags were observed and identified in Vrachanski Balkan between 2010 - 2015. A total of 44 of them had been released in Vrachanski Balkan, 20 vultures originated from the Central Balkan release site, 8 vultures had been released in Sinite Kamani, 4 vultures in Kotlenska Planina, 9 vultures originated from Kresna Gorge, 5 vultures from Serbia, 3 vultures from Croatia, 7 vultures had been tagged in Israel and three vultures were carrying unreadable markings and thus their origin remained unknown (See Table 4).

Table 4. Number of marked Griffon Vultures observed in Vrachanski Balkan by years

Area of origin of the marked Griffon Vulture	2010	2011	2012	2013	2014	2015	Total
Vrachanski Balkan	8	14	15	20	26	28	44
Central Balkan	0	0	0	8	11	12	20
Sinite Kamani	0	0	1	7	3	2	8
Kotlenska Planina	0	0	0	0	3	3	4
Kresna Gorge	0	0	0	2	6	6	9
Serbia	0	0	0	2	1	4	5
Croatia	0	0	0	1	2	1	3
Israel	2	0	1	2	2	3	7
Unknown	0	1	0	3	1	1	3

Imigration

Between 1 and 10 non-marked individuals were observed for some time throughout the year in the reporting period. The number of these birds is very likely greater, but their individual identification is difficult. A dedicated study carried out in Kresna Gorge, where visual marking by photographing of each individual was applied, the number of non-marked Griffons was found out to be up to 3 times bigger than the locally released birds present in the area (Peshev et al. 2015).

Dispersal and movements

Griffon Vultures released in Vrachanski Balkan have been observed in different parts of the Balkan Peninsula – Northern Serbia on the border with Hungary, Eastren Serbia, Eastren Rodopes (Bulgaria), Sinite Kamani/ Kotlenska Planina (Bulgaria), Dadia (Greece), Romania, Kresna Gorge (Bulgaria), etc.

Adaptation of the released Griffon Vultures

The first group of 8 Griffon Vultures was released on 27.10.2010. It is often rainy, cold and foggy in this time of the year. The weather had a very negative impact on the released vultures. The birds were observed moving on foot around the release site, because it was often wet, the visibility was poor, and the area was still unfamiliar to them. These vultures perched and kept roosting mainly on the ground or stones protruding above the ground, very rarely on trees. In the winter of 2010-2011 individual birds were seen perching on electricity pylons. Single birds were seen landing on roofs of houses in and around settlements. During this period, the vultures flew infrequently and mostly over short distances. These first flights of the birds exploring the release area revealed several problems. Birds perched on low sites, overgrown with vegetation, so they could not take off and had to move to higher sites walking. Thus vultures were observed to walk from a few dozen to more than 200 meters on foot in some cases.

The releases of Griffon Vultures in 2011- 2015 took place mainly in warmer months of the year – a total of 32 individuals were released in the period from March to September. These birds experienced faster adaptation than those released in autumn and winter (from October to November). This is due to the more favorable weather conditions and the longer daylight in the period from March to September. The already formed nucleus of previously released birds also played a great role, so that the newly released ones followed them during their adaptation period and thus made it shorter.

Wintering

In low temperatures (-27° C) and at the presence of permanent snow cover the Griffon Vultures reintroduced in Vrachanski Balkan, stayed mostly in the lower parts of the mountain and the adjacent lowland areas. A vulture perching on rocks in higher sites was a very rare sight in case the presence of snow in this period. In winter, the vultures were seen perching / roosting in trees, such as deciduous and coniferous trees, electricity pylons, the roof of the aviary, roofs of different types of buildings around settlements and rarely in villages. Large metal electricity pylons (along 400 kV power lines), which are located about 4 km away from the supplementary feeding site form an important place for roosting of the Griffon Vultures in winter, but also in bad weather conditions in late autumn and early spring. On overall, vultures were much less mobile during the cold months of the year. Their main flights were between the roosting place and the supplementary feeding site. The greatest distances between these two points are up to about 5 km.

Food for vultures

The establishment of a network for supplying food is of key importance for the feeding of the vultures. Numerous contacts with veterinarians, mayors, farmers, etc. were established in the target area, through a long-term awareness raising campaign. It was implemented through dissemination of leaflets/brochures, radio- and TV broadcasts, multiple meetings with vetertinarians, mayors, local farmers, etc. held in the target areas. In the period 2003-2010, this network mostly comprised small-scale farmers in a 30 km radius from the supplementary feeding site. The network secured mainly goats and sheep, less often donkeys and horses and very rarely cows. In occasional cases, road kills were also used – dogs, jackals, foxes and badgers. In 2011 the team also started obtaining food from big-scale pig farms, located up to 130 km away from the supplementary feeding site. This has become necessary following the arrival and first release of Griffon Vultures in October 2010.

Yet another important reason to use pig farms is the progressively decreasing number of livestock of the small-scale farmers in the districts of Montana and Vratsa. This negative trend has been observed for decades and is still valid in the years of vulture restoration efforts (Table 5 and Table 6) Collective (1956), Collective (1960), Collective (1969), Collective (1978), Collective (1981), Collective (1987), Collective (1995), Collective (1996 a), Collective (1996 b); unpublished data of the Regional Food Safety Agency of Montana and Vratsa for 2015.

The use of carcasses from big-scale pig-breeding farms for supplementary feeding proved to be of extreme importance for the successful work with Griffon Vultures in Vrachanski Balkan. Between 50 to 90 % of the food for Griffon Vultures in the area in various periods (months) from 2011 to 2015 was secured this way. In isolated cases, when carcasses were not available, offal and other slaughter waste was used instead. Griffon Vultures do not prefer such food, except for large pieces of offal, such as lungs, liver and heart. Furthermore, it attracts an unwanted number of Ravens. A significant step for securing waste carcasses for supplementary feeding is the obtaining of the necessary legal permits. BPPS obtained such permits from the veterinary authorities at regional and national level in 2005 and 2011. This process was significantly eased by the ratification of EC - Regulation 1774 / 2002 and EC Regulation 1069 / 2009.

Table 5. Number of livestock in the district of Montana between 1961 - 2015

Year	1961	1965	1976	1985	1990	1995	2001	2015
Sheep	295773	327890	325197	318554	226000	118000	67213	36804
Cattle	67854	60202	70064	61336	48000	12000	10000	14329
Pigs	110863	112205	218513	165463	153000	93000	17258	3971
Goats	18356	12250	29411	30000	35000	38584	33277	16053
Buffalo	5387	2857	2557	1313	no data	no data	412	416
Horses	7837	7196	4498	4073	no data	no data	5457	2273
Donkeys and mules	no data	4920	8795	13036	no data	no data	8384	1482
Total for the year	**506070**	**527520**	**659035**	**593775**	**462000**	**261584**	**142001**	**75328**

Table 6. Number of livestock in the district of Vratsa between 1956 - 2015

Year	1956	1965	1976	1985	1990	1995	2001	2015
Sheep	1061973	159889	168746	319062	281022	136945	100032	48015
Cattle	295707	52117	66823	64515	64874	16955	22449	22486
Pigs	268433	123103	148829	210072	229872	48461	49275	2490
Goats	62144	no data	no data	32146	31105	39797	40888	17460
Buffalo	23308	no data	400	2203	2272	1538	832	1179
Horses	53978	10670	4477	6373	no data	no data	7968	4315
Donkeys and mules	10072	no data	no data	17829	no data	no data	9072	1664
Total for the year	**1775615**	**345779**	**389275**	**652200**	**609145**	**243696**	**230516**	**97609**

The first supplementary feeding site was constructed in 2004 above the village of Dolno Ozirovo at 430 m above sea level, on a high, open area (43º 14′ 38. 62″ N, 23º 22′ 20. 49″ EO). It covers an area of 2 dka and is surrounded with a metal fence, carried by concrete poles, 150 cm above the ground. The entire length of the fence is concreted so no predators can dig under and enter the fenced area. The closest rocks are located some 5 km line of sight. We consider this distance as the main reason why Griffon Vultures were never observed to use the site. This supplementary feeding site was maintained until 2008 and after that only the second one was used.

The second supplementary feeding site was constructed in 2009, in direct proximity to the adaptation aviary. The overall area surrounded by fence is 900 square meters, at 375 m a.s.l., GPS 43º 15′. 261″ N 23º 22′. 522″EO. There are several small vertical cliffs up to 20 m high, located some 250 m from the line of sight. We consider that the proximity of these cliffs turned out to be of key importance for the acceptance of this feeding site. Vultures almost always land on these cliffs to check the area before landing on the feeding site. The cliffs are also used for roosting overnight. Yet another advantage of the terrain is that the slope is steep, what allows the Griffon Vultures to take off easily, gaining height. Two other factors had additional positive impact on the acceptance and use of the feeding site. One of them is the presence of Griffon Vultures in the adaptation aviary, as they attracted the vultures already released, as well as additional exogenous birds. On the other hand, wooden perches were mounted on the roof of the aviary and they were often used by the vultures, before landing for food.

The initial feeding of the vultures was done outside a specific weekly schedule, disposing food as soon as it was available. Later on, thanks to the connections established with local livestock owners and farms, the supplementary feeding was carried out twice or four times a week. Our experience shows that the most effective schedule for the area is carrying out supplementary feeding twice a week. The main aim is to secure greater amount of fresh food on a regular basis. On the other hand, such feeding considers the rough terrain, the difficult access and the distance to the supplementary feeding site, as well as the transport costs and the depreciation costs of the vehicles. The supplementary feedings were carried out within an interval of about 3 days. Following this schedule, it was always attempted to provide a greater amount of food - from 150-300 kg to about 500 kg at a single feeding event. Mainly carcasses of farm animals were used. The skin of the carcasses, especially that of the greater animals, was partially cut to ease the access of the vultures.

At first a single, but later two freezers (500 l) were used for storing food for the vultures. This food was used for feeding during the summer months, when there are usually fewer calls for dead livestock. In the winter, when there is food in excess, the carcasses were safely stored at the very supplementary feeding site. This way, there is abundant food at the site, which can be naturally stored by the

low temperatures in winter. This reserve on the spot was used multiple times in severe winter conditions, when even off-road vehicle cannot access the site. In the winter of January - February 2012 the food for the vultures was deposited with a rented motor sledge and an ATV Track. In case of permanent snow cover, the snow was periodically shovelled to ease the access of the vultures to the food.

The total amount of food disposed for the vultures between 2004 – 2015 is shown on Table 7 and Table 8 below.

Table 7. Number of livestock in the district of Montana between 1961 - 2015

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total kg	3900	7985	5510	6680	1500	6748	6175	12905	15670	22265	30120	46845
Average kg/ month	325	665	459	556	125	562	514	1075	1305	1855	2510	3903

Table 8. Table 8. Quantities of food (kg) for supplementary feeding of the Griffon Vultures at the supplementary feeding site and adaptation aviary of the village of Dolno Ozirovo by months and years for the period of releasing Griffon Vultures, October 2010 - 2015

Month/ year	1	2	3	4	5	6	7	8	9	10	11	12
2010										890	1020	765
2011	980	860	600	845	365	1290	1080	1095	1670	1250	1530	1340
2012	1450	300	1000	1490	1420	1060	1110	1760	1100	1935	1025	2020
2013	1525	1240	1025	1660	1580	2005	1630	3140	1960	1800	2780	1920
2014	2150	2860	1040	2360	2330	1250	4310	2970	2740	2780	3030	2300
2015	3720	2660	2490	4020	4560	3680	4700	3800	4740	4870	3885	3720

Water sources, used by the Griffon Vultures

There are very few surface water sources, suitable for use by Griffon Vultures in Vrachanski Balkan, due to the karst character of the terrain, the steep slopes, the narrow gorges and overgrown river valleys. The first groups of vultures released in 2010-2011 were observed drinking from open areas of the river-beds of Botunya and Cherna reka rivers. Since mid-2012 the Griffon Vultures released in Vrachanski Balkan have started using small (several tens of square meters) endorheic lakes, located along the ridge of the mountain. The vultures prefer these small wetlands and they currently have a key role for the birds. This is probably due to the fact that these lakes are located at high open areas, where heavy birds, such as Griffon Vultures can easily land and take off. Furthermore, these sites are seldom visited by people or vehicles, which could potentially disturb the birds.

The observations of the Griffon Vultrues kept at the adaptation aviary show

that they need water very much during summer and they would also eagerly use it for bathing. This is why, the adaptation aviary is regularly provided with water through a system for collecting rainwater installed on site or through transporting water tanks from the village of Dolno Ozirovo.

Breeding

Two pairs of immature birds were first observed demonstrating breeding behaviour on suitable nesting sites on cliffs to the East of the village of Dolno Ozirovo in March 2013. The rock massif there consists of vertical limestone cliffs at an overall length of 6 km and predominant height of some 30-100 m, reaching up to 100-200 m at sites. The main exposure of the massif is South-West, while the altitude is about 800-1000 m a.s.l. In April 2013 individual adults of the group were observed landing in suitable nesting sites on that massif.

On 14.02.2015 the photo-trap set on the roof of the adaptation aviary photographed copulations of K54 (male) and K41 (female). Towards the end of February 2015, five pairs of Griffon Vultures were displaying nesting behaviour on suitable sites in the cliff above the village of Dolno Ozirovo.

Five pairs were once again observed displaying nesting behaviour on the cliff above the village of Dolno Ozirovo on 2.03.2015. Around 5-8.03.2015 there was a heavy snow in the area. On 16.03.2015 the photo-trap photographed two immature individuals copulating. The male was possibly K4M. The Griffon Vultures also regularly visited the cliffs / roosting site close to the town of Vratsa throughout March 2015.

At April 2015 there was no information on the nesting success of the nesting Griffon Vultures above the village of Dolno Ozirovo. At the same time Griffon Vultures (up to 15 individuals) were often seen on the cliffs near the town of Vratsa.

Two incubating birds were located in May 2015 on two of the five sites where nesting activity had been detected earlier in March 2015.

The very first pullus of Griffon Vulture was observed in a nest on the cliff above the village of Dolno Ozirovo on 9.06.2015. The hatching of that chick had most probably happened towards the end of May 2015. The other pair of vultures seen incubating in May 2015 was not found on 9.06.2015 so we believe that its attempt was not successful. In June 2015 about 5 Griffon Vultures spent time and roosted on the cliff near the town of Vratsa.

At July 2015 the young Griffon Vulture was developing well in the nest above the village of Dolno Ozirovo. It was already quite big, with good plumage, flapping wings and movind along the edge of the nest. At the same time, some 4-5 Griffon Vultures were seen at the roosting site to the South-West of the town of Vratsa, above the village of Zgorigrad. Another 6 Griffon Vultures were seen on a different rock massif to the East of the town of Vratsa. Two of them were reported to have landed in an old nest of Black Stork (*C. nigra*) and were seen arranging the nesting material. Data shows that a second roosting site for Griffon Vultures

formed in the area near the town of Vratsa in July 2015.

This new site was confirmed by the data sent by the transmitter of Griffon Vulture tagged "3", which roosted on these rocks in July, but also used a rock massif to the East of the village of Opletnya, high above the Iskar Gorge (pers. comm. E. Stoynov, FWFF).

At August 2015 the juvenile Griffon Vulture was still in its nest. It had already reached the size of a full-grown adult. The parents of the juvenile were identified as 837, male, released from Vrachanski Balkan and K56, female, released from the Sinite kamani release site.

On 3.10.2015 the juvenile was seen leaving the nest. It flew quite well, following one of its parents and calling for food. At the same date, a climber reached the nest and found out that it had no nesting material. The rock ledge, where the nest was located, is some 70-100 cm wide and some 3 m long. The nest was at about 80 meters above the base of the cliff and some 55 m from the top, the exposure was South-West. The juvenile had probably fledged on 1-2.10.2015. Until the end of October 2015, the young vulture was often seen to return to the nest for roosting during the day or the night. The two parents were seen still feeding the juvenile either in the nest or close to it. This first successfully fledged Griffon Vulture was called Michel, after Michel Terrasse, who is among the leading French experts carried out the first successful reintroductions of Griffon Vulture in the 70s of the XXth century in France. Mr. Terrasse is among the experts who consulted the current restoration project in the Balkan Mountains and has had a significant impact for its successful implementation.

The juvenile fledged in 2015 is the first successfully fledged wild-born Griffon Vulture among all sites for reintroducting the species in Bulgaria.

Other species, observed at the supplementary feeding sites above the village of Dolno Ozirovo

Egyptian vulture (*N. percnopterus*)

Between June - August 2005, the first supplementary feeding site was regularly visited by single adult birds from the pair nesting in the Northern parts of the Vrachanski Balkan Nature Park.

Between April - August 2006 and 2007 single adult birds from the same pair also regularly visited the site.

From May to Jule 2009, a single or two adult birds from the pair were observed feeding together at the second supplementary feeding site multiple times.

A single adult Egyptian Vulture periodically used the supplementary feeding site between June - August 2012.

A single adult Egyptian Vulture was observed at the supplementary feeding site of Dolno Ozirovo in the end of May and the entire June until 6.07.2014. This bird carried a metal ring and a highly discoloured plastic yellow ring on its left foot. The bird was therefore identified as a juvenile, ringed in the nest by

our colleagues from BSPS BirdLife Bulgaria sometime between in 2008-2010 in another region of Bulgaria.

After mid-June 2014, a single, non-marked immature (1-2 years old) was registered at the supplementary feeding site. In some cases immature and adult Egyptian Vultures were seen to use the feeding site together.

Raven (*C. corax*)

The most common and abundant species, using the supplementary feeding sites all-year-round. Most numerous in the cold period of the year, when there is a great quanitity of easily accessible food, such as offal and segmented carcasses. Maximum concentrations of up to 150-200 Ravens at a single feeding are seen then.

Eurasian Magpie (*P. pica*)

Very rare - single observations, most probably vagrant individuals, passing through the area.

Hooded Crow (*C. cornix*)

Very rare - single observations, most probably vagrant individuals, passing through the area.

Rook (*C. frugilegus*)

A single individual voluntarily entered the aviary through the netting of the roof and was trapped on 20.03.2010.

Golden Eagle (*A. chrysaetos*)

Observed multiple times at the first supplementary feeding site above the village of Dolno Ozirovo during the cold months of the year. This was especially true for periods with permanent snow cover. Single immature and adult birds have been seen, as well as a pair with a juvenile, which had not left its parents.

No foraging birds have been seen using the second supplementary feeding site, even though individuals have been seen landing nearby. This is probably due to the fact that the Golden Eagles are intimidated by the construction of the aviary, located right next to the supplementary feeding site.

White-tailed Eagle (*H. albicilla*)

A single immature White-tailed Eagle was observed at the supplementary feeding site in the period October-November 2013. This bird was regularly foraging here, perching on the aviary. Initially the group of Griffon vultures got scared when the White-tailed Eagle appeared. They however soon got used to one another and were seen foraging or roosting together.

On 29-30.12.2014 a subadult White-tailed Eagle was reported foraging at the supplementary feeding site and once it appeared, the Girffons vacated the area.

Common Buzzard (*B. buteo*)

Single individuals often seen foraging at the supplementary feeding sites during the winter period.

Rough-legged Buzzard (*B. lagopus*)

Very rarely single individuals seen foraging on the first supplementary feeding site in the winter period.

Goshawk (*A. gentilis*)

Single individuals seen foraging on the first supplementary feeding site above the village of Dolno Ozirovo in the winter period.

Red Kite (*M. milvus*)

A single individual reported and trapped on 18.04.2011. The bird had entered through the coarse netting of the roof of the vulture adaptation aviary.

Black Kite (*M. migrans*)

One or two Kites have been reported foraging at the second supplementary feeding site above the village of Dolno Ozirovo in separate years. Such observations are usually done in spring or at the start of summer - April, the beginning of June, less often in autumn - September, October. The species is also reported at the waste-disposal sites in nearby areas, close to the town of Montana.

Black Stork (*C. nigra*)

Single individuals observed landing on the supplementary feeding site in front of the adaptation aviary a number of times in May 2009. Black Storks were probably foraging on rodents or large insects abundant on the animal carcasses.

The following insectivore species of birds have been reported at the supplementary feeding site or in the air above, attracted by the great number of insects: Common Starling (*St. vulgaris*), Great Tit (*P. major*), Chaffinch (*Fr. coelebs*), Yellowhammer (*E. citrinella*), Corn Bunting (*E. calandra*), Rock Bunting (*E. cia*), Black Redstart (*P. ochruros*), Robbin (*E. rubecula*), White Wagtail (*M. alba*), Red-backed shrike (*L. collurio*), Barn Swallow (*H. rustica*), Red-rumped Swallow (*H. daurica*), Common house martin (*D. urbica*), Crag martin (*P. rupestris*), Alpine Swift (*P. melba*).

Direct negative factors impacting Griffon Vultures in the area

- Electrocution and collision with 20 kV power lines. This is the main factor causing mortality of the Griffon Vultures released. It has been proven to have caused the death of at least four Griffon Vultures (K1N, K15, KOW, K37) from the ones released from Vrachanski Balkan. It is very likely that there are more casualties which have not been found. In 2013 and 2014 CEZ Ltd (the local electicity provider) isolated 20 of the most dangerous pylons along a 20 kV powerline in the area of the village of Dolno Ozirovo.
- Predators. A single, almost entirely eaten Griffon Vulture (tagged K11) was found on the ground, close to the supplementary feeding site, eaten by predators - foxes, jackals, etc. in January 2012. An additional negative factor which has most probably contributed to the death of this bird was the severe winter with over 1 meter of snow cover and temperatures of -20 ^{0}C. Furthermore, the bird probably lacked experience, released towards the end of August 2011 and spending its first winter out. There are several other documented cases of

jackals or stray dogs stalking and attacking Griffon Vultures on the ground without success even in warmer seasons. This threat is greater for recently released Griffon Vultures; vultures, which are roosting on the ground; wet vultures on the ground or vultures resting in the shade of trees or bushes on the ground, where they can be easily surprised by predators.

- Stray dogs. Despite the fences, dogs sometimes manage to penetrate the vulture supplementary feeding sites. They can then disturb or attack the vultures on the site, as well as eat a significant quantity of the food or permanently damage the integrity of the netting.
- Ravens. Numerous species seen at the supplementary feeding sites all-year-round, reaching up to 150-200 individuals in winter. Ravens eat a hige quantity of food being active throughout the day and being unsusceptible to poor weather conditions. Ravens have also been reported to directly persecute or disturb vultures on numerous occasions. In some of the cases Ravens systematically chased a particular vulture in the aviary or outside it, until the disturbed bird threw up the content of its crop, which got immediately eaten. On other cases, Ravens learned quickly the location of the incubating Griffon Vultures on the cliffs. In 2014 - 2015 there were numerous observations of a single, two or even three Ravens simultaneously attacking a laying Griffon Vulture in vain, in attempt to chase off the incubating bird and eat the egg.
- Poison. One of the Griffon Vultures (K1N) found dead under an electricity pylon tested positive for organic pesticides. Because of the location of the carcass and the signs of electrocution, the identified traces of pesticides could not be confirmed to have been the main cause of death. There is no data for the use of strychnine, luminal and other toxic substances in Vrachanski Balkan Nature Park for the period 2003-2015.
- Poaching. We have data for two non-tagged Griffon Vultures shot by poachers, but this information has not been confirmed.

Problems and challenges

The following chapter briefly presents the main difficulties challenging the restoration of Griffon Vultrue in the Vrachanski Balkan area. This information is important to better understand the local environment, as well as consider when planning future efforts in the area.

- Constant on-going rapid decline in livestock (see Tables 5 and 6). This situation has not changed following the accession of Bulgarai in EU in 2007 and the issue is worsening in many aspects.
- Almost total lack of large wild animals, suitable and accessible as food for the vultures in the wild;
- Poverty, which prevents people from submitting sick / weak domestic animals, as they are used for human consumption;
- Inquirying payment for submitted carcasses due to poverty or lack of interest for cooperation;

- Periodical full bans for disposing particular livestock, imposed by the veterinarian authorities due to the occurrence of diseases, such as: swine fever, bluetongue disease, bovine spongiform encephalopathy, anthrax, brucellosis, etc.
- The dead livestock is used by the local farmers for feeding domestic dogs;
- Competition with groups of people, who illegally collect waste meat for human consumption, commercial dog breeding or attracting wolves on hunting hides.
- Severe depopulation in the area - fewer people maintaining livestock;
- Very limited choice of sites suitable for constructing supplementary feeding sites or adaptation aviaries;
- Difficult or impossible access to the supplementary feeding sites and the adaptation aviary for long periods of time due to poor roads and deep snow cover in winter;
- Very common problems with the vehicles used;
- Many challenges in recruiting suitable local people to directly involve in the vulture restoration activities;
- A huge proportion of the food disposed for the vultures being eaten by great concentrations of Ravens;
- Re-occurring problems with stray dogs and foxes damaging the integrity of the fence surrounding the supplementary feeding site. These animals not only eat a lot of the food, but also chase and disturb the Griffon Vultures visiting the supplementary feeding site.

CONCLUSION

There are several key aspects in the efforts aiming at restoring Griffon Vulture as a nesting species in the Vrachanski Balkan Nature Park.

The activities implemented between 2004 - 2009 were focused on providing supplementary feeding only. Despite these efforts, no vultures were permanently attracted or started nesting in the region in this period. Between 2010 - 2015 a total of 43 Griffon Vultures were gradually released from the adaptation aviary, while the efforts on securing supplementary food continued. A permanent group of constantly present Griffon Vultures was established as a result. The first two unsuccessful breeding attempts were registered as early as 2014, only four years after the first releases in the area. Already five pairs nested in 2015 and one of them successfully raised a chick from its second clutch. These results show that the restoration of Griffon Vulture in the Vrachanski Balkan Nature Park only succeeded following the start of the reintroduction efforts in 2010 - 2015.

We consider that at the current stage, this is the only possible way to achieve such considerable success in Vrachanski Balkan or any other area with similar characteristics in Bulgaria.

Based on experience, there are several key points which need to be considered when planning the future Griffon Vulture related work in Vrachanski Balkan. The regular provision of huge quantities of food is crucial for maintaining and increasing the results achieved by now. The food needed to maintain a group of some 50 Griffon Vultures present in the area is about 2000 - 2500 kg or more per month. These quantities are necessary as it has been proven that some 50 - 70 % of the food disposed does not reach vultures but is eaten by Ravens or decays in the hot summer months. It should also be considered that the meat and offal of a carcass is below 50 % of its total weight while the other parts (skin, bones, etc.) cannot be utilized by Griffon Vultures. The supplementary feeding shall continue at the already established feeding site above the village of Dolno Ozirovo, as well as one extra site. We therefore recommend the construction of an additional supplementary feeding site in the Eastern parts of the Vrachansi Balkan Nature Park. This area is very close to suitable nesting massifs near the town of Vratsa and the Iskar Gorge. It is very important that this feeding site is located so that it is well-accepted by the Griffon Vultures, is supported by the local population so no disturbance occurs and is easily accessible throughout the year.

Further data analysis should show whether it would be necessary to continue the vulture releases. In case sufficient food is available, releasing additional Griffon Vultures in the area could be beneficial for the restoration activities in the area.

Continuing the already established collaboration is of crucial importance for the future vulture restoration activities. Key partners are the Vrachanski Balkan Nature Park Directorate, the large-scale commercial farms, the structures of the Bulgarian food Safety Agency, the Ministry of Environment and Waters and the Regional Inspectorates of Environment and Waters, the Regional Forestry Managment of Berkovitsa and the local Forestry Boards, municipalities and town halls in various settlements. The wide-scale awareness raising campain should also continue, involving various actors, such as hunters, farmers, climbers, etc.

The current results show that the restoration of Griffon Vulture in Vrachanski Balkan as a nesting species is completely feasible in the contemporary environment. Considering our current experience, there is a great potential in elaborating these efforts, achieving even better results.

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