Ranging Behaviour of the Griffon Vulture *Gyps fulvus*

in Kresna Gorge and South-western Bulgaria

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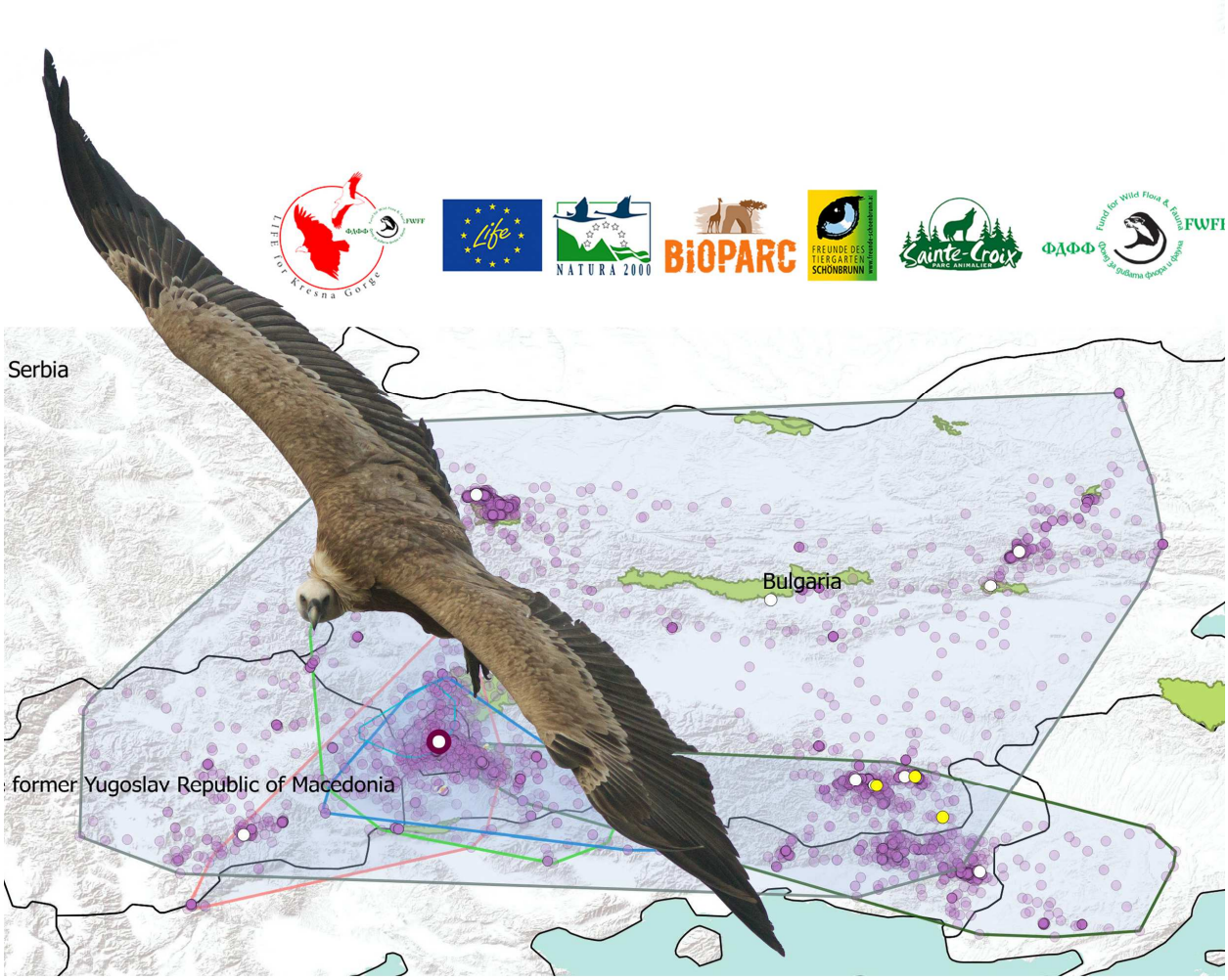

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Abstract

Little is known about the spatial ecology and ranging behaviour of Griffon Vulture in Bulgaria and Balkans. The precise knowledge of the ranging behaviour and spatial parameters is particularly important for the restoration and conservation of Griffon Vulture, which inhabits human-dominated areas where human activities frequently lead to direct threats for the species – poisoning, electrocution, collisions with power lines and wind generators, shooting etc. Most over the reintroduction of the Griffon Vulture in Kresna Gorge since 2010, raised some questions about way of adaptation and territory use by the released birds as well as establishment of the new colony and interactions with wild conspecifics.

In this study we used GPS satellite telemetry to assess home-ranges of nine non-breeding Eurasian Griffon Vultures, released and wild caught in Kresna Gorge, South-west Bulgaria, trying to answer the main questions on when, how far and where vultures range. The results were dully used to inform conservation measures within the LIFE for Kresna Gorge project - LIFE11 NAT/BG/363.

Results indicated that vultures ranged mainly in areas where frequently supplied feeding sites (vulture restaurants) are found and where traditional stock-raising and pasturing were still practiced and are close to suitable roosting sites. The overall foraging range, calculated as median Minimum Convex Polygon (MCP) (10 999 km2), or as 95% and 50% kernel contours (493 km2 and 54 km2, respectively), differed from similar studies in Spain and Crete. The MCP was bigger in our study while the home-ranges 95% and 50% were smaller compared to Spain. This might be attributed to feeding sites network density, which is bigger in Teruel and Castleon Provinces in Spain – average distance among them of 71.53 km (n=12), while in Bulgaria it is 117.78 km (n=10).
Out of the known vulture restaurants in Bulgaria, FYR of Macedonia and Greece, the vultures rarely stayed more than an overnight on-passage and never were feeding with exception of few places that should be given priority for application of urgent vulture conservation measures and to secure them as Vulture Safe Areas instead playing roles of ecological traps.

These are Kaymakchalan peak on the border between Greece and FYR of Macedonia; Pirin National Park in Bulgaria; the Valley of Krumovitsa River and the hills to the west of it in Eastern Rhodopes in Bulgaria; the area between the Dadia National Park and Kompsatos River valley in Greeceq with center around the village of Esochi.

It seems that strategically placed and permanently supplied vulture restaurants, may concentrate large numbers of Griffon Vultures in a relatively small and possible to control areas. This, in combination with implementation of site based conservation activities may buffer the impact of any hardly controlled and acting on large scale threats, such as poisoning and electrocution.

All this falls into the concept of a necessity of establishment of attractive Vulture Safe Areas (in last several years Kresna Gorge was turned into such), where any migrating or vagrant vultures of any vulture species may refuel and spend some time (summering, wintering, on-passage etc.), this way increasing the survival of the birds on the Balkan population. The more such sites on Balkans and beyond the greater chance for the vultures populations to recover and sustain.

Key words: conservation, home-range, satellite-tracking, Bulgaria, Vulture Safe Areas

Introduction

This Technical Report is representing the work done by FWFF team under the Action A1 "Release and GPS/GSM and VHF tracking of Griffon Vultures to establish foraging area and to inform conservation actions" of the LIFE for Kresna Gorge Project – LIFE11 NAT/BG/363.

GPS tracking is a relatively new method available to provide precise data about the home ranges, dispersal and migration of birds. It allows identification of most often used area for search of food, as well as unknown roosting and breeding sites that may need protection.

Monitoring of birds via GPS/GSM is undertaken from an office, but at certain points, a ground team of FWFF was sent to ground truth and characterise the identified feeding, roosting and breeding sites and to describe their conditions, threats and analyze the manner of use by the tagged birds. Unfortunately, through GPS/GSM tags also were used to collect dead birds, killed by electrocution. The dispersal movements of Griffon Vultures, as well as the home-range are poorly known, especially in South-western Bulgaria, where the species was recently reintroduced. Some birds travelled extensively through and also outside Bulgaria, thus also showing the link with other existing colonies and the crucial importance of the existing feeding sites (vulture restaurants) network. The tracked birds were good ambassadors, helping our team to establish close contacts with colleagues in the areas of their sojourn. Also their whereabouts were presented to the wider public almost in real time trough the internet site of the project.

Twelve griffon vultures were tracked through GPS/GPRS for up to two years, providing invaluable data to identify the foraging area, roosting and breeding sites. This directly informed a series of conservation actions in the project, e.g. dangerous power lines insulation and others.

Materials and Methods

Ethics Statement

The study was not specifically approved by an ethical committee as a permit for equipping vultures with loggers was provided as part of the licence of team members of FWFF, according to the Ministry of Environment and Waters applying the Bulgarian Biodiversity Law for allowing the owners of a licence to capture and handle birds from protected species, and mark them (with rings or any other device like GPS units).

All care was taken to reduce any potential discomfort to the birds: to reduce stress of birds, the head was covered by a tissue and handling time was reduced to minimum (<10 min). Logger mass was <1% of bird body mass, i.e. < the 3% generally recommended for flying birds. Logger harnesses were designed to fall off after a few years to prevent these long-lived birds from carrying the logger for the rest of their lives.

To further improve the well being of the birds we developed and introduced a new type of transmitter attachment, so far used only in Californian Condor – patagial-tag (see details further in the text).

Study Area and Vulture Population

Bulgaria is found in the middle of Balkan Peninsula in Europe. Following dramatic decline since the first half of XX Century, the Griffon Vulture has extinct from Bulgaria in 1960s. Although the species naturally recovered in Eastern Rhodopes in late 1970s and after conservation efforts its population increased to over 50 pairs in 2010. The same year a project to restore the species in Kresna Gorge was initiated by FWFF. Until 2016 63 birds were released and this same year the first successful reproduction in the area was recorded. From 6-8 formed pairs, two laid eggs and 2 chicks successfully fledged.

The idea of the reintroduction of the Griffon Vulture in the Kresna Gorge was to connect the increasing Eastren Rhodopean population with the declining one in FYR of Macedonia (11-15 pairs), while also supporting the last one with direct release of birds.

The Kresna Gorge is situated in South-west Bulgaria along the Struma River valley between the village of Krupnik to north and the town of Kresna to south. On the east - the foot of the Pirin Mountain and on the west – the foothills of the Maleshevska Mountain form the Struma river valley and forming the Gorge. The climate is transitory Mediterranean. The Kresna Gorge is a rocky complex on a silicate base. It features steep stony slopes, a rock massif with vertical cliff walls and smaller rocky habitats. South of the gorge there are hills covered with Mediterranean vegetation, with altitude up to 500 m. The mixed oak forests - *Quercus pubescens*, *Carpinus orientalis*, and *Fraxinus ornus*, as well as the mixed forests of *Juniperus excelsa* and *Q. pubescens* with undergrowth of evergreen Mediterranean shrubs are widely spread at an altitude of up to 500 m. Forests of *Juniperus excelsa* with undergrowth of *Juniperus oxycedrus* prevail at certain places. *Paliurus spina-cristi* and *Pistacia terebinthus* occur mainly along the gorges. In the more southern regions occur some typical Mediterranean evergreen species as *Quercus coccifera* and *Phillyrea media*.

In this study, 9 of the tracked birds were released in the frame of reintroduction project (mostly imported from Spain and France and/or captive bred), while 3 were purposely wild caught (native to Balkans).

Table 1. Numbers of released and wild-caught Griffon Vultures in the area of Kresna Gorge and GPS tags deployed.

Year	Griffon Vultures released as part of re-introduction process	Wild Griffon Vultures captured and marked	Released Griffon Vultures tagged with GPS/GSM transmitters	Wild Griffon Vultures tagged with GPS/GSM transmitters
2010	19	-	-	-

2011	7	-	-	-
2012 (start of LIFE for Kresna gorge project)	10	2	4	-
2013	9	-	-	-
2014	4	4	1	1
2015	5	1	2	1
2016	9	1	2	1
Total	**63**	**8**	**9**	**3**

GPS Tracking

Twelve Griffon Vultures were equipped with GPS units, but individuals tracked for less than 50 days (Table 2) were removed from analysis. Thus the data for 9 tracked Griffon Vultures was analyzed. Of these 7 birds were released in the frame of reintroduction project in Kresna Gorge and 2 native to Balkan Peninsula were wild caught in the same area. All tracked birds were immatures (<4 years old). The birds for which we did not know the year of fledging were aged according to the moulting pattern (Zuberogoitia et al. 2013).

All transmitters, but one were manufactured in Bulgaria – 90 gr backpack birdtracker EBT90 of Electroninvest Ltd.

http://www.electron-gps.com/images/stories/pdfbg/bglistowka%20ebt%202012%20v2.pdf . Searching a safer solution, by the idea and consultancy from FWFF team, Ornitela Ltd from Lithuania, developed patagial tag – 33 gr – OT-P33 http://www.ornitela.com/patagial-transmitter . This last one is still in experimental use, but shows excellent results.

The data were collected automatically from the transmitters via GPS satellites and transferred through GPRS to an internet platform, where from downloaded.

Table 2. Tracking histories and home-range parameters of 12 Griffon Vultures released and wild-caught in Kresna Gorge. The marked in grey are not pooled, due to early transmitter detachment (B25-E), early transmitter failure (2X), or permanent emigration of the bird (B97-7).

No.	Name of the bird	Date of Transmitter attachment	Last date of data received	Total time of tracking (days)	Number of fixes received	50% Kernel home range km²	90% kernel home range km²	MCP 100% in km²	Reason to stop tracking
1	G48-C Ceto	25.04.2012	25.06.2012	61	1002	4	57	1337	Death of the bird
2	B25-E Eto	18.06.2012	26.06.2012	8	3 files	-	-	-	Transmitter detachment
3	B31-U Uto	24.06.2012	19.09.2012	78	2899	10	485	6451	Transmitter detachment
4	B17-M Muto	30.06.2012	09.08.2013	405	7275	7	653	22518	Transmitter life span expiration
5	B37-K Kuto	26.07.2012	13.12.2012	140	1825	2	78	2208	Death of the bird
6	B93-3 Svarog	29.05.2014	06.10.2015	493	7183	4495	70670	127206	Transmitter life span expiration
7	B97-7 Troyan	31.10.2014	23.11.2016	758	5531	205	1960	70222	Transmitter life span expiration
8	9	15.04.2015	27.05.2016	407	4434	27	502	12682	Transmitter life span

	Perun								expiration
9	F64-12 Veles	15.04.2015	30.06.2016	420	8414	81	82	9316	Transmitter life span expiration
10	B2A Zornitsa	22.07.2015	20.08.2016	393	2577	2325	12999	23105	Transmitter life span expiration
11	2X	2016	Did not start working	0	-	-	-	-	Did not start working
12	89-Ramunas, OX	15.07.2016	12.02.2017 ongoing	>210	3309	94	476	1341	Still working

We received and analyzed in total 45 675 fixes received by 9 Griffon Vultures over for in total 3 365 days in different years and seasons. The average number of locations per bird was 4444.90.

Home Ranges Estimation

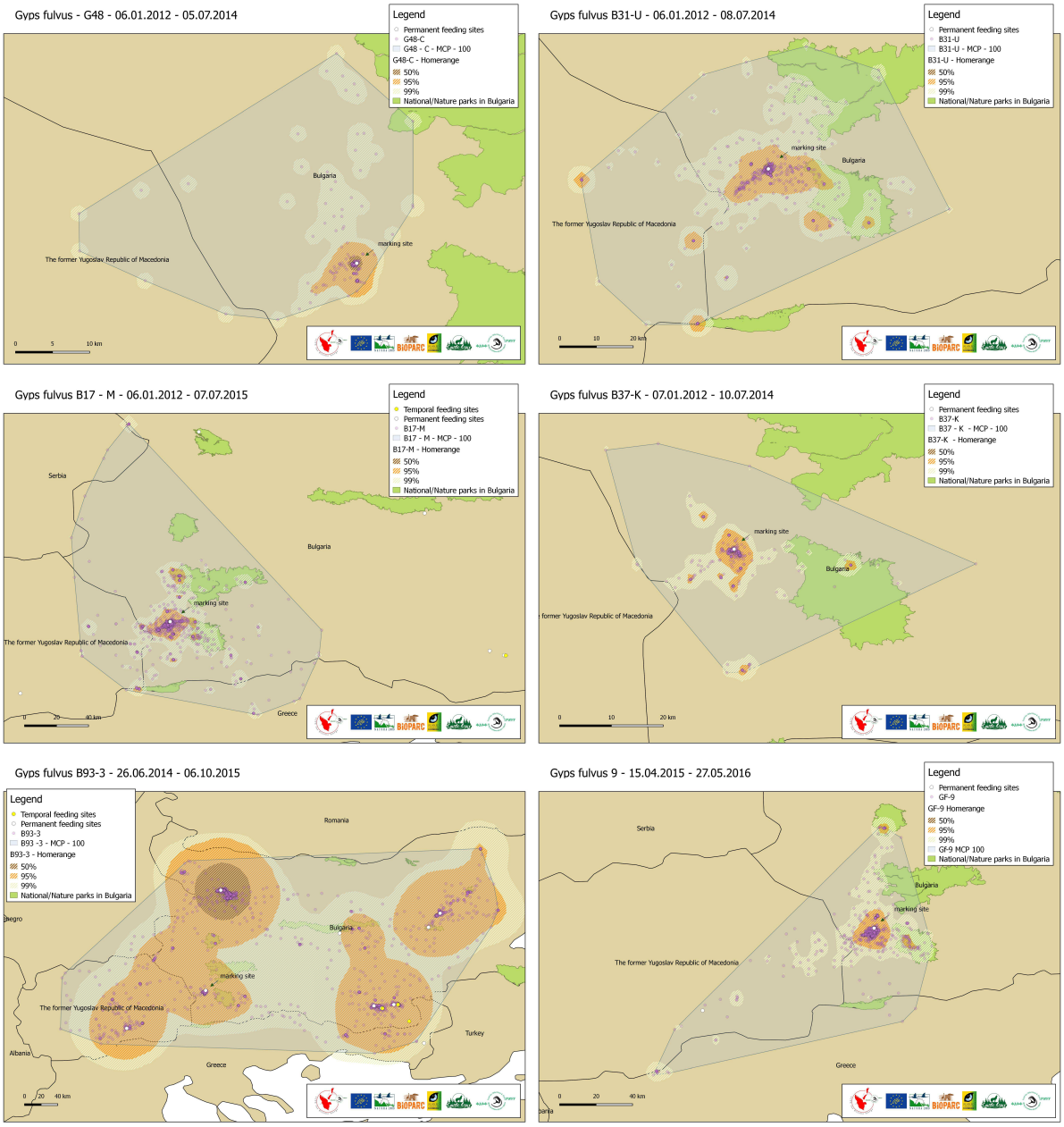
We estimated the vultures' home-range by means of a kernel density approach (Kenward 2001). Home-range analyses were performed within Movebank platform. The home range shows the 50% and 95% home range of the animals, it is calculated using the classical kernel method (kernelUD, points, extent=0.1). Additionally, we also calculated the overall median foraging range as the Minimum Convex Polygon (MCP) encompassing all GPS locations obtained for each bird (Worton 1989). These estimates were computed to facilitate comparisons between studies and regions (Vasilakis *et al.* 2008; Ripolles *et al.* 2011, Xirochakis & Andreou 2009). Cartography was elaborated in QGIS (https://www.qgis.org/).

Results

The overall median foraging range, calculated as MCP, for the ten pooled Griffon Vultures was 10 999 km². For the 95% and 50% kernel contours, medians were 493 km² and 54 km² respectively (Table 2) and it differed from similar studies in Spain and Crete. The MCP was bigger in our study while the home-ranges 95% and 50% were smaller compared to the study of Ripploes *et al*., 2011 in Spain. This might be attributed to feeding sites network density, which is bigger in the researched area of Teruel and Castleon Provinces in Spain – average distance among them of 71.53 km (n=12), while in Bulgaria, and the nearby Macedonia and Greece it is 117.78 km (n=10).

The released Griffon Vultures were always well attached to the release site in Kresna Gorge and made short-time excursions to other vulture areas in Bulgaria, Macedonia and Greece. The two wild caught birds were more erratic and moved larger distances – the B93-3 having record large MCP, and HR95%. In terms of roosting sites and foraging areas use there was no difference from released and wild birds. All tracked birds made use of traditional roosting places and even when away from the natal area, they always joined other vulture sites, where colonies exist e.g. Eastern Rhodopes, Vrachanski Balkan and Kotel in Bulgaria, or Demir Kapia in Macedonia. In such areas they re-used frequently 3 to 5 roosting places, which are traditional ones for the local colony. These roosting sites were always close to feeding sites - linear distance between 1 and 10 km. In most cases, satellite-tracking data showed how vultures were temporarily linked to a particular vulture restaurant and/or places with seasonally abundant free ranging livestock e.g. Pirin National Park and Kaymakchalan on Greek-FYROM border, as well as traditional livestock breeding areas - two areas in Eastern Rhodopes (between Studen kladenets Reservoir and the town of Krumovgrad in BG and around the village of Esochi in GR). In Eastern Rhodopes the vultures frequently move to Kompsatos river valley in so called “Tracian Meteora” in Greece for roosting, but feedings in this area were not detected.

Fig. 1 to 9. Ranging behaviour of nine Eurasian Griffon Vultures according to the kernel home-range analysis. The Minimum Convex Polygon (solid line), 95% kernel (orange) and 50% kernel (brown) are shown. Note the scale variance. National borders are shown. Individuals (1–9) are shown from top to down and from left to right.



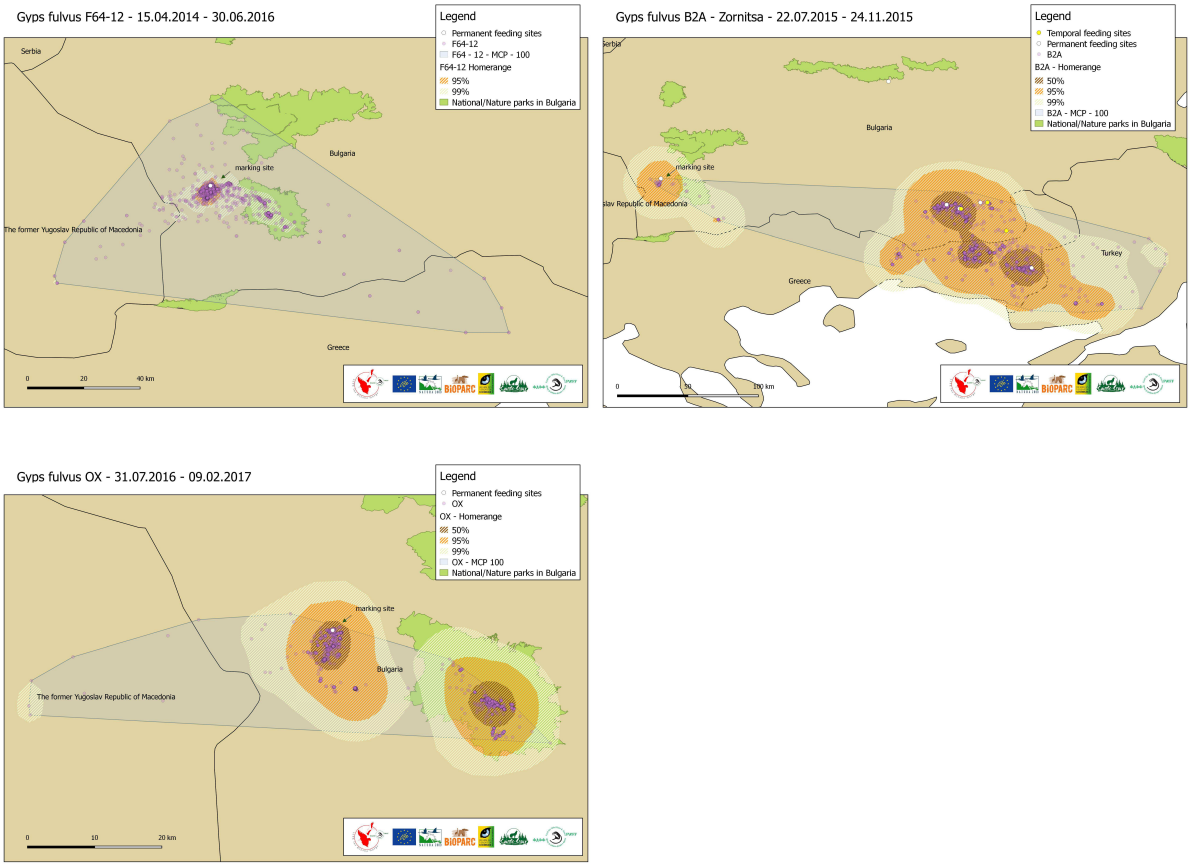
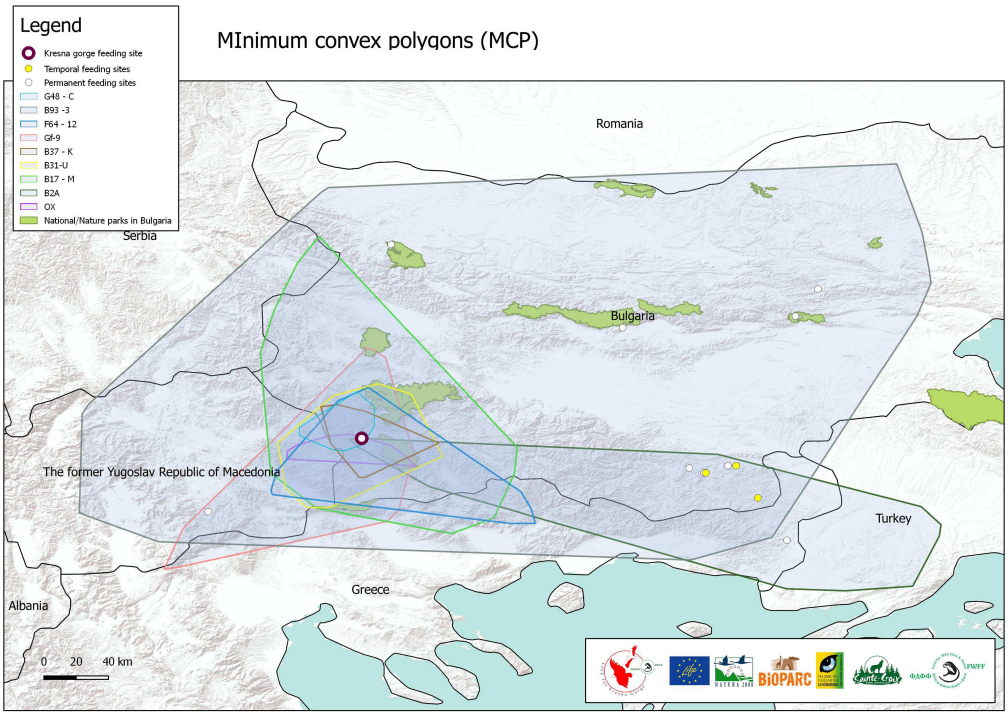
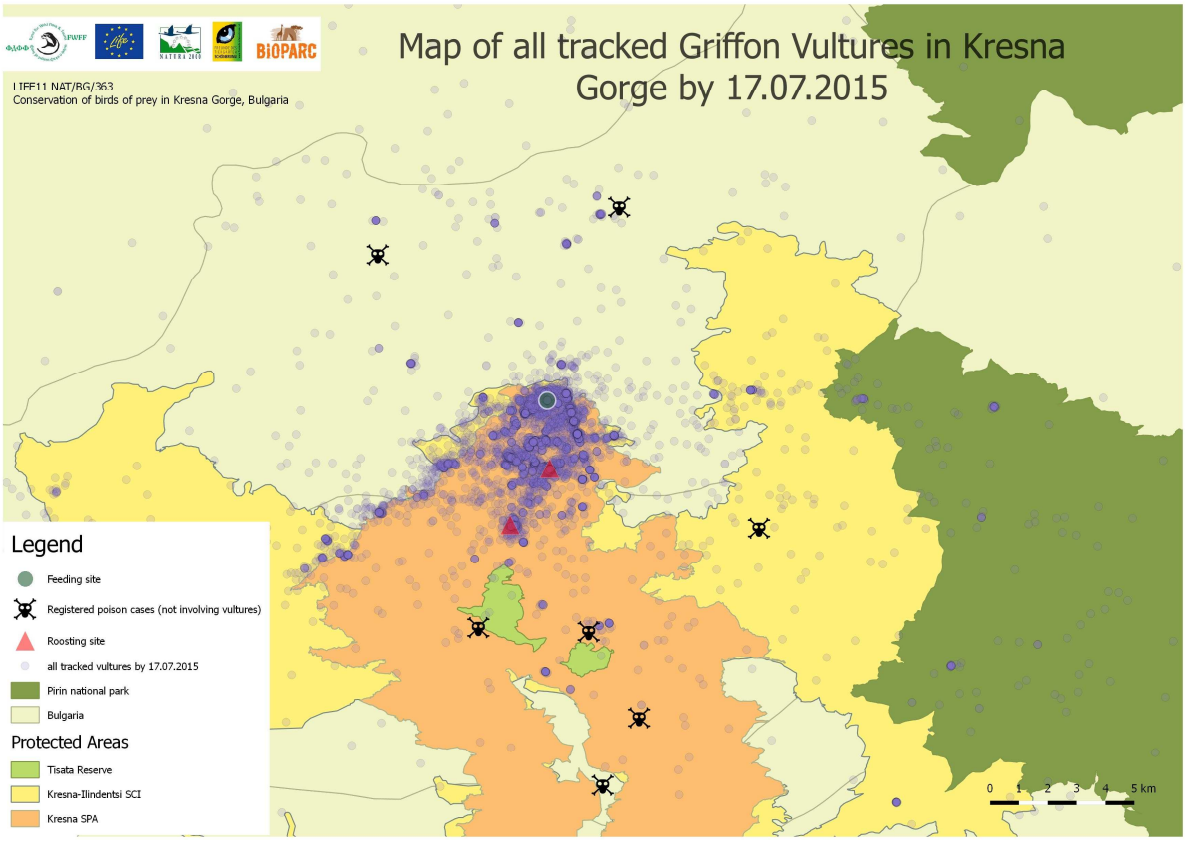


Fig. 10. Ranging behaviour of nine Eurasian Griffon Vultures – 100% MCP superimposing individual patterns.



Definition of areas of concentration and potential and actual threats

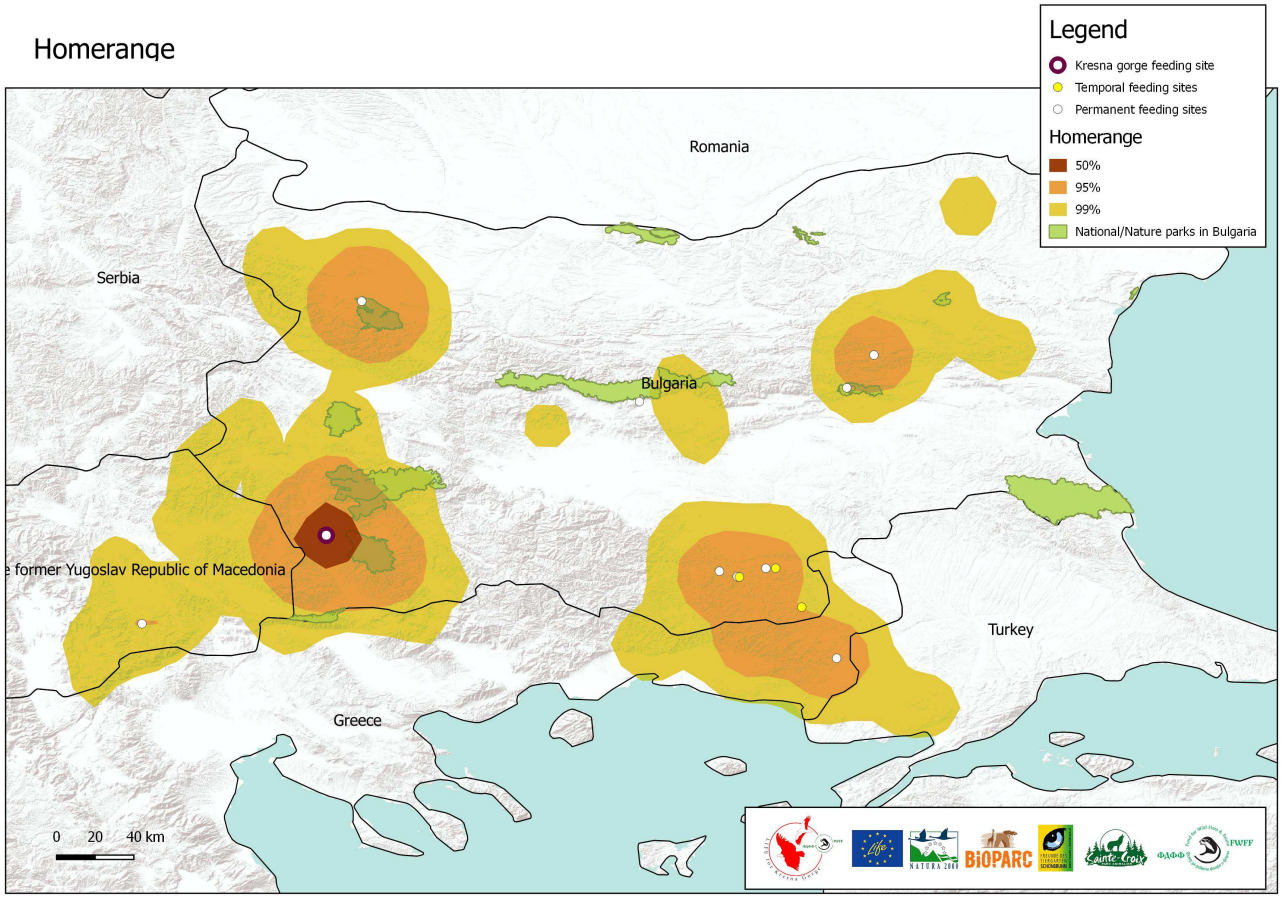


This map shows the activity (violet small dots) of the Griffon Vultures in Kresna Gorge and adjacent areas as well as reserves (light green), Natura 2000 sites (Kresna SPA - orange and Kresna Ilindentsi SCI- yellow) and National Parks (dark green). The concentration of birds is observed at roosting sites in Kresna Gorge (the two red triangles) and the nearby feeding site (green dot). Some poisoning cases of dogs occurred in the area and poisoned carcasses appeared in the field for some time (sculls and crossed bones on the map) on direct sight from vultures' roosting sites. The birds did not attempt to feed on the occasionally available carcasses. In the summer entire colony of the Griffon Vultures move to alpine treeless zone of Pirin National Park and feeds there on livestock carcasses.

These observations provide data for an important conclusion. The behavioural features of Griffon Vultures - conservativeness of foraging area use and gregariousness let the birds avoid usage of occasionally available carcasses outside their very own and known area. Furthermore, if they are not easily accessible and/or attractive. The vultures obviously prefer

to feed in areas, where the food is repeatedly and frequently available in accessible and not compromised sites. Such are the cases at the feeding site in Kresna Gorge and the very proximate area, as well as the alpine zone of Pirin National Park. These features of the Griffon Vultures behaviour might help its conservation, based proper directed management by creation of Vulture Safe Areas (VSA), where all threatening factors are mitigated and the birds concentrated in safe environment.

Fig. 11. Ranging behaviour of nine Eurasian Griffon Vultures – heat-map of 95% and 50% kernels, superimposing individual patterns. The white dots are permanent feeding sites in Vulture Safe Areas.



Discussion

This study provides a first preliminary insight of the territory use of the reintroduced and native to Balkans immature Griffon Vulture in South-west Bulgaria. The northern part of the Kresna Gorge, where the feeding site is, together with the nearby cliffs and 400 kV pylons is the core zone of the newly established colony. Flights of the soaring birds are becoming easier in wormer months and the Griffon Vultures move to Pirin National Park, Rila National Park and to lesser extent Maleshevska Mts. and Macedonia, and sometimes make large-distant and short-time excursions, of 150 km a day. However, roosting is rarely happening outside the traditional few sites, and feeding outside the vulture restaurant in the Gorge or any other such specialized site in Bulgaria, FYROM and Greece was rare. Exception is the sojourn of the entire colony of Griffon Vultures from Kresna Gorge in the treeless zone of Pirin National Park, where each summer, together with summering guest birds from other colonies are feeding on carcasses of free ranging cattle.

We are now aware that effectively, the new colony could be protected by concentrating our conservation efforts for Kresna Gorge in an area of 493 km² - the HR95% which represents about 12.5 km radius from the feeding site. But the top priority should be given to the area of 54 km² - the HR50%, or just 4.14 km radius centred in the Gorge.

Our results indicate that although immature Griffon Vultures travel long distances across Bulgaria and neighbouring countries, they almost exclusively roost and feed in already established Griffon Vulture colonies or join seasonal gathering of conspecifics, which are usually found, where feeding site or abundant easy accessible food is available. This gives us the first proves that the national network of vulture restaurants is playing an important role for Balkan native and reintroduced Griffon Vulture population. Furthermore, this greatly supports the concept for the need of establishment of a network of Vulture Safe Areas (VSA), where in relatively small areas the full spectrum of threats for the species could be addressed and mitigated. In such areas through maintenance of permanent feeding sites, the vultures might be concentrated and kept in safe environment, while avoiding threats like

poisoning and electrocution, which are: 1. acting on vast territory; 2. unpredictable in space and time; and 3. hardly controlled in short –term.

It seems that the natural instinct of the Griffon Vultures to travel long distances is not necessarily related with taking food outside their well known area. This conservatism together with the gregariousness of the species may be used for its conservation. The only serious problem for this approach appears, when the deadly threat (poisoning, electrocution, direct persecution etc.) appears in the core of the presumed Vulture Safe Area – thus turning into an ecological trap. This increases the level of responsibility of the managers of any VSA. However, the sole role of each such area may be reduced if their number and density is increased.

The lack of a much higher sample size, the limited duration of the transmitters' batteries and the lack of adult individuals constitute limitations preventing us from deeper analyses.

Ongoing research projects will grant complementary information about breeding individuals and inter-sexual differences that will improve our understanding of the spatial ecology and behaviour of the Griffon Vulture in Bulgaria and Balkans.

References

Fieberg J. 2007. Kernel density estimators of home range: smoothing and the autocorrelation red herring. Ecology 88: 1059–1066.

García-Ripollés C., López-López P., Urios V. 2011. Ranging behaviour of non-breeding Eurasian Griffon Vultures *Gyps fulvus*: A GPS-telemetry study. Acta Ornithologica Vol 46 (2011) No. 2: 127-134.

Kenward R. E. 2001. A manual for wildlife radio tagging. Academic Press, London.

Monsarrat S., Benhamou S., Sarrazin F., Bessa-Gomes C., Bouten W., Duriez O. 2013. How Predectability of Feeding Patches Affects Home Range and Foraging Habitat Selection in Avian Social Scavengers? PLoS ONE 8(1): e53077. doi: 10.1371/journal.pone.0053077

Vasilakis D. P., Poirazidis K. S., Elorriaga J. N. 2008. Range use of a Eurasian black vulture (*Aegypius monachus*) population in the Dadia-Lefkimi-Soufli National Park and the adjacent areas, Thrace, NE Greece. J. Nat. Hist. 42: 355–373.

Worton B. J. 1989. Kernel methods for estimating the utilization distribution in home-range studies. Ecology 70: 164–168.

Xirouchakis S. M., Andreou G. 2009. Foraging behaviour and flight characteristics of Eurasian griffons *Gyps fulvus* in the island of Crete, Greece. Wildlife Biol. 15: 37–52.