

LIFE
SAFE FOR
VULTURES



Technical manual on the feeding stations

E.2 ACTION



LIFE19/NAT/IT/000732 Life Safe for Vultures
First step to the restoration of the vulture guild in Sardinia

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Introduction



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First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna

The Griffon vulture (*Gyps fulvus*) is an Old World vulture, whose diet is based almost entirely on carrion. These include mostly domestic livestock, across a big share of the species range, as well as wild ungulates and other wildlife, when available (Bildstein et al., 2021). Like all other vultures, Griffons deliver paramount ecosystem services, such as regulating the nutrient cycle, reducing parasite loads and disease transmission (Berlinguer et al., 2021) and, at least for anthropized ecosystem, also sparing farmers from burning carrion and producing greenhouse gases (Plaza and Lambertucci, 2022).

The Griffon vulture is distributed across a vast geographical area, spanning from Mediterranean Europe to the Caucasus and the Black Sea, to the Middle East (Botha et al., 2017). Griffons are philopatric and breed in large colonies on cliffs, where they engage in social interactions that facilitate foraging and breeding success (van Overveld et al., 2020). However, young individuals often move in their first year of age, like in the Iberian Peninsula, where thousands of juvenile Griffons overwinter in Northern Africa. The species does not exhibit seasonal migrations, if not in some populations (Genero et al., 2020).

In Europe and the Mediterranean, a total of 35,438 – 41,948 couples are estimated, approximately 90% of which occur in the Iberian peninsula (31,224 – 37,710, Terraube et al., 2022). Both Griffon distribution and conservation status in Europe increased, due to multiple reintroduction projects, and conservation initiatives counteracting poisoning and ensuring safe and regular food at feeding stations (Deinet et al., 2013).

In Italy, the species was once well distributed, with verified breeding records in Sicily and Sardinia. However, between the XIX and the XX century the specie disappeared from the Italian peninsula, due to human persecution. Therefore, starting from the late 1980s the Griffon vulture was reintroduced at multiple protected areas in the mountains of the Friuli Venezia-Giulia, Abruzzo, Calabria and Sicily regions. Overall, these reintroductions were successful, raising population numbers to 270-290 breeding pairs. All these populations seem to be connected among themselves, and also with other European colonies (Le Gouar et al., 2008). Due to these numbers, in Italy the Griffon vulture is still listed by the IUCN as “Critically Endangered” (Rondinini et al., 2013).

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Università degli Studi di Sassari
Via Vienna 2 | 07100, Sassari
mail: lifeforvultures@uniss.it | tel: +39 079 229904
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The Griffon vulture in Sardinia



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First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna

Until the late 1940's Sardinia hosted an almost complete vulture guild, with a population of about 800-1,200 Griffon vultures (Schenk et al., 2008), as well as several dozen couples of Cinereous vulture (*Aegypius monachus*) and Bearded vulture (*Gypaetus barbatus*). However, in the second half of the XX century, the widespread use of poisonous baits resulted in the complete extinction of both Cinereous and Bearded vulture, and in a steady reduction in the number of Griffons. In 2015, the Griffon vulture population included only 36 reproductive couples, limited to the North-Western portion of the island, between Alghero and Bosa. Between 1987 and 1995, restocking with Griffons from Spain, and the activation of feeding stations, were carried out by the Regional Forestry Office. However, all these conservation efforts were undermined by three poisoning events in 1997, 1998 and 2006. Between 2015 and 2020, the conservation status of the species has improved, thanks to actions within the LIFE "Under Griffon Wings" (LIFE14/NAT/IT/000484) project. The project combined the release of 76 individuals, mostly from wildlife rehabilitation centres and captive breeding programs, aimed at halting the demographic decline, and multiple actions targeting uncertain food supplies, human disturbance and the risk of poisoning. Overall, these actions raised population size from 100-120 individuals (36 breeding couples) in 2015, to 230-250 individuals (57 breeding couples) in 2019.

To maintain this increase (Aresu et al., 2020), in 2020 the LIFE "Safe for Vultures" project (LIFE19 NAT/IT/000732) was co-financed by the European Commission. The project aims to continue conservation actions undertaken by the LIFE "Under Griffon Wings" project in North-Western Sardinia, and also extend them to other areas of the island, with the goal of sustaining a decentralized population of Griffon vultures, with a second colony in South-Eastern Sardinia. Among sustained actions, the LIFE "Safe for Vultures" project aims to build a widespread network of farm feeding stations at Natura2000 sites in the whole Sardinia island.

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Supplementary feeding - legal framework for member states of the European Union



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First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna

After the first outbreak of Bovine Spongiform Encephalopathy (BSE, the so-called “mad cow disease”), between 1986 and 1996, the European Commission enforced a Regulation (n. 2000/148/CE) that aimed to counteract the spread of Transmissible Spongiform Encephalopathies (TSEs). TSEs are caused by some misfolded proteins, called prions, which accumulate in particular tissues such as those from the central nervous system, the cranium and the ileum of cattle, sheep and goats. Although the epidemiology of TSEs is still unclear, the Regulation established that all carrions containing body parts susceptible to contain prions must be removed from the environment and incinerated. From a practical viewpoint, once translated into national decrees, the Regulation prevented farmers from leaving livestock carrion in the environment, as they had done for centuries in the Mediterranean area (Oléa and Mateo-Tomás, 2009).

This decision had major impact on vulture populations in the European Union. Although some species of vultures partially shifted to wildlife carrion (Donázar et al., 2010), many populations faced a sudden curtailment of food resources and experienced a decreased reproductive success, caused by the impossibility to feed chicks and to accumulate adequate body reserves for egg deposition (Almaraz et al., 2022; Donázar et al., 2020).

As a result, many conservation practitioners and researchers gathered scientific evidence to call for a revision of Regulation n. 2000/148, which was then changed 7 times in less than a decade. First updates, such as those contained in Regulation n. 1774/2002 and Decision n. 322/2003, allowed for the use of livestock carrion only at fenced stations preventing large carnivores from accessing them. Then, Regulation m. 1069/2009, which allowed for the use of livestock carrion not only in the conservation of endangered scavenging birds, but also in the management and conservation of large carnivores, listed in Annex II of the Habitat Directive (n. 92/43/CE), which live in extensive pasture ecosystems. Then the Regulation n. 142/2011, about animal byproducts, clearly established the terms for the provisioning of livestock carrion in conservation projects targeting scavengers. This European legal framework was implemented in a non-harmonized way (Margalida et al., 2010; Arrondo et al., 2018), and it locally even lacked any concrete enforcement (Férandéz-Gómez et al., 2022; Mateo-Tomás et al., 2022), however it constrained the gamut of actions for vulture conservation through supplementary feeding.

Apart from allowing for the disposal of livestock carrion at supplementary feeding

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LIFE SAFE for VULTURES

First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



stations, Regulation n. 142/2011 (article 3, paragraph III) also allows to leave live-stock carrion on the ground. This option is envisioned for some geographically limited areas, that have been previously identified by competent national authorities as important for the conservation of scavengers. However, the amount of livestock carrion which could be left on the ground is based on assessments about the daily food requirements of target scavenger populations occurring at those areas.

The Regulation n. 142/2011, at Section 2 of Annex IV, states that for Italy, live-stock carrion might be left on the field for the following species:

1. Bearded vulture (*Gypaetus barbatus*)
2. Cinereous vulture (*Aegypius monachus*)
3. Egyptian vulture (*Neophron percnopterus*)
4. Griffon vulture (*Gyps fulvus*)
5. Golden eagle (*Aquila chrysaetos*)
6. Black kite (*Milvus migrans*)
7. Red kite (*Milvus milvus*)

In an official note, published on the 10th of July 2013 (DGISAN n. 29562) the General Directorate for Food Hygiene and Safety and Nutrition, of the Italian Ministry of Health, provided operational indications to local authorities, for the authorization of fenced feeding stations for scavenging birds. The note establishes that Regional authorities, as well as competent authorities from the Trento and Bolzano autonomous provinces, should ask the National Institute for Environmental Protection and Research (ISPRA) for an assessment of the capacity of supplementary feeding to contribute to the conservation of specific scavengers. This point aligns with what is stated at letter d), point 1, Section II, Paragraph II, Annex IV of the Regulation n.142/2011. The note also clearly identifies local health units (ASL, Azienda Sanitaria Locale), as the main body responsible for authorization. ASL should also develop specific authorization forms for supplementary feeding stations.

Finally, the note states the characteristics of the sites where supplementary feeding stations can be build (e.g., distance from human settlements, e.g., height of the fence) and how carrion can be brought to these sites.

As for the provisioning of carrion outside fenced feeding stations, the note does not provide any specific detail, nor any operational advice. Notably, apart from obligations already described in Annex VI or Regulation n. 142/2011, there is no particular indication on how to authorize farmers that already produce animal byproducts, nor any technical/operational criterion to respect, in order to leave animal byproducts on the field, to benefit scavengers.

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Supplementary feeding as a conservation measure



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LIFE SAFE for VULTURES

First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna

Supplementary feeding is a widespread conservation practice, aimed at increasing available trophic resources for animals that live in a certain area. It might be used during the first stages of restocking/reintroduction projects, with the goal of increasing site fidelity among translocated individuals. Moreover, supplementary feeding could also be used to increase the demographic parameters of wildlife populations, whenever survival and breeding success have been constrained by depleted food resources and the population is facing a limited recruitment of new individuals.

As outlined in the previous paragraph, supplementary feeding is particularly important for the conservation of vultures worldwide, including Europe, due to existing sanitary regulations limiting the number of livestock carrion in the wild. Moreover, supplementary feeding might be useful to avoid the creation of ecological traps around human infrastructures or where there is a need to inspect livestock or wildlife carrion to minimize accidental poisoning from, respectively, residual veterinary drugs or lead (Cortés-Avizanda et al., 2016). Available evidence indicates that supplementary feeding might have long-lasting positive impacts on the demography of vulture populations.

Supplementary feeding is based on two alternative models: centralized feeding stations (also known as “vulture restaurants”) and light, or diffused, feeding stations. Centralized feeding stations are based on one, or few, locations where biomass is made available to vultures, whereas light feeding stations are based on a higher number of sites, usually corresponding to different farms. Although easier to build and maintain, a supplementary feeding program based exclusively on centralized feeding stations can have unintended negative consequences for vultures and the environment. Whenever food resources are predictable in space and time, vultures reduce their dispersal and foraging movements, aggregating into larger colonies which could be subjected to density-dependent dynamics (van Overveld et al., 2020).

Light feeding stations are usually built within livestock farms, and they are sites where farmers could leave carrion by themselves. Although more demanding to control and maintain, these feeding stations provide scavengers with biomass in a way that is more unpredictable in time and space, mimicking natural dynamics. This can encourage vultures to move across larger areas (Alarcón and Lambertucci, 2018), and promotes niche segregation between different species (Arrondo et al., 2015; Moreno-Opo et al., 2015). Moreover, by actively engaging farmers in vulture conser-

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Università degli Studi di Sassari
Via Vienna 2 | 07100, Sassari
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LIFE SAFE for VULTURES

First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



vation, they have the potential to increase the awareness of local communities about vultures and the important ecosystem services they deliver.

The main drawback of light feeding stations, especially when their number is not high, lies in the possibility of having prolonged periods of time when no food is made available to vultures. Although adult vultures might cope with prolonged scarcity of carrion, by lowering their metabolism, scarce food resources could undermine vulture reproduction and the establishment phase of released individuals.

Therefore, for small vulture populations supplementary feeding should ideally be based on a combination of light feeding stations and few centralized feeding stations, maintained by local authorities. This model was adopted in Sardinia, where two centralized feeding stations were created by Agenzia Fo.Re.S.T.A.S at sites where aviaries for vulture restocking had been built. Centralized feeding stations are thus functional both to the fixation of the restocked vultures at the release site, especially during the establishment phase, and to the provision of carcasses in period of low provisioning by the network of light feeding stations, created at extensive livestock farms within the Natura 2000 network. It is worth mentioning that Sardinia is the first (and at the moment, only) region in Italy, where a similar model, largely based on feeding stations at livestock farms, was allowed by regional and local authorities. A state-of-the-art about existing models for the supplementary feeding of Griffon vulture in Europe is provided in Annex 1, where we gathered abstracts from presentations that were brought at the International Workshop on Supplementary feeding for Griffon vultures, held in Alghero between the 18th and 20th of October 2022.

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Via Vienna 2 | 07100, Sassari

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Impact of supplementary feeding for the Griffon Vulture population in Sardinia



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First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna

Between 2017 and 2023, we had complete records about food provisioning to farm feeding stations from 26 farms (Fig. 1), out of 37 farm feeding stations.



Figure 1

Farm feeding stations (points) for which we had a complete record or provided biomass between 2017 and 2021.

Overall biomass was variable between years, peaking in 2019. Considering the estimated number of griffon vultures in Sardinia, we deemed provided biomass to have sustained a considerable portion of individuals between 2017 and 2019. However, biomass brought to feeding stations declined in 2020 - 2023 (Table 1).

These values have been complemented by two centralized feeding stations in Monte Minerva and Porto Conte, operated by Agenzia Fo.Re.S.T.A.S. Overall, between 2017 and 2023, approximately 19.8 tons of carrion were provided in Monte Minerva and 17.5 tons in Porto Conte. A detailed account of provided biomass on each year, in each station is provided in Table 1.

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Via Vienna 2 | 07100, Sassari
mail: lifeforvultures@uniss.it | tel: +39 079 229904
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First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



Year	Biomass provided to stations (tons)		Estimated number of Griffon vultures	Sustained individuals (% of population)
	Farm feeding stations	Centralized feeding stations		
2017	16.9	0.9	137	71%
2018	16.8	5	192	62%
2019	27.6	9	240	84%
2020	14.7	6.1	256	45%
2021	7.3	6.8	284	27%
2022	11.9	5.3	316	30%
2023	8.8	4	332	21%

Table 1. Total amount of biomass provided to centralized and farm feeding stations between 2017 and 2023

By decomposing data across 2017 – 2021, we can see that a total of 16 tons of goat and sheep carrion, as well as 67 tons of cattle carrion were consumed by Griffon vultures at farm feeding stations. These referred to 421 individuals of goat/sheep and 160 cattle, that were brought to feeding stations on 355 and 144 occasions, respectively. In terms of biomass, provisioning to feeding stations was dominated by cattle, compared to goats and sheep carrion (Fig.2). However, total biomass of cattle was highly variable, across the various months. For example, in 2017 it peaked in December, whereas it peaked in January in 2018, in September in 2019 and in March in 2020. Total amounts were particularly high in January 2018.

Total monthly biomass at feeding stations (2017 - 2021)

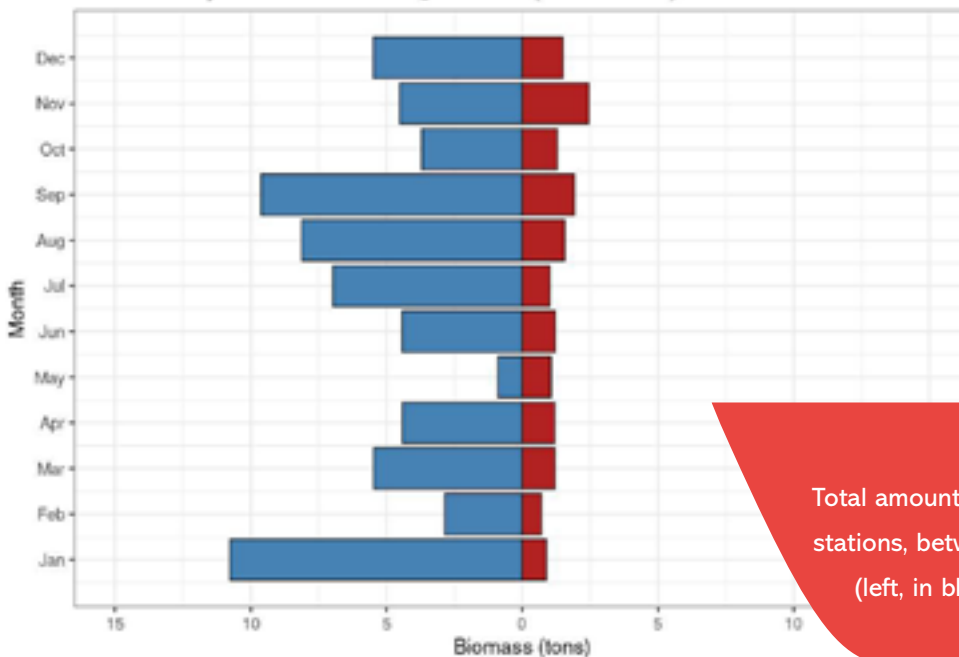


Figure 2

Total amount of biomass provided to farm feeding stations, between 2017 and 2021, showing cattle (left, in blue) and goat/sheep (right, in red).

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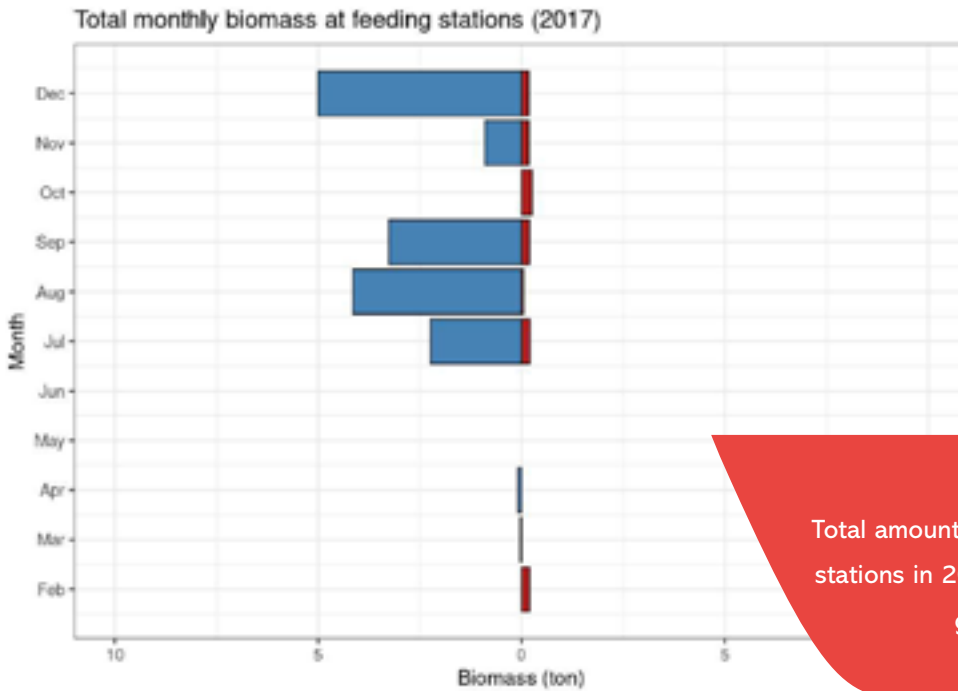


Figure 3
 Total amount of biomass provided to farm feeding stations in 2017, showing cattle (left, in blue) and goat/sheep (right, in red).

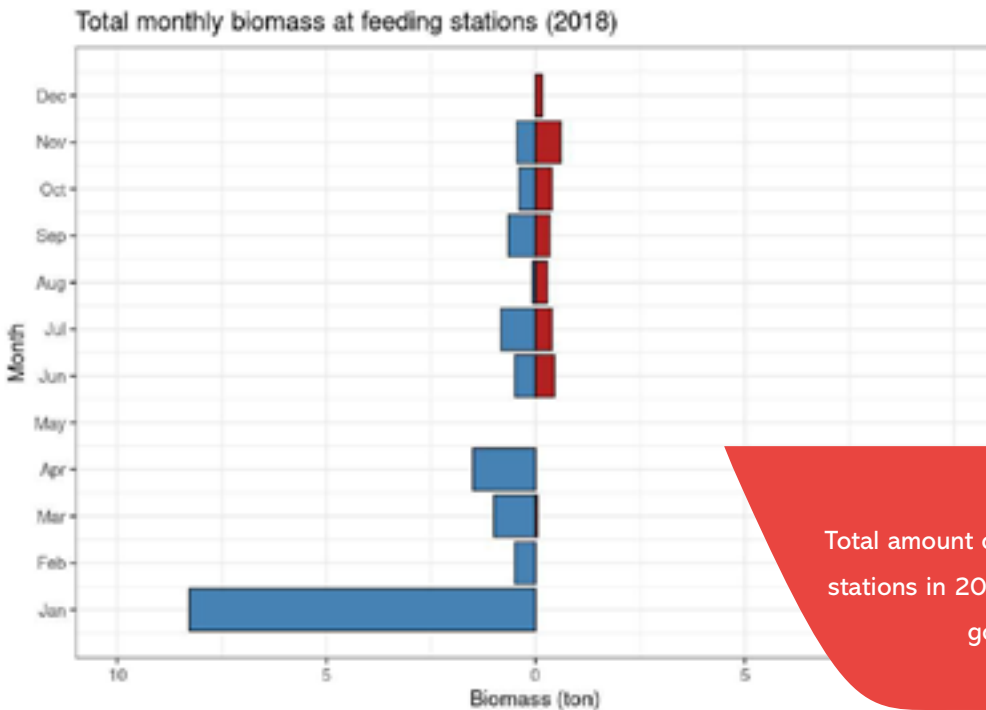


Figure 4
 Total amount of biomass provided to farm feeding stations in 2018, showing cattle (left, in blue) and goat/sheep (right, in red).

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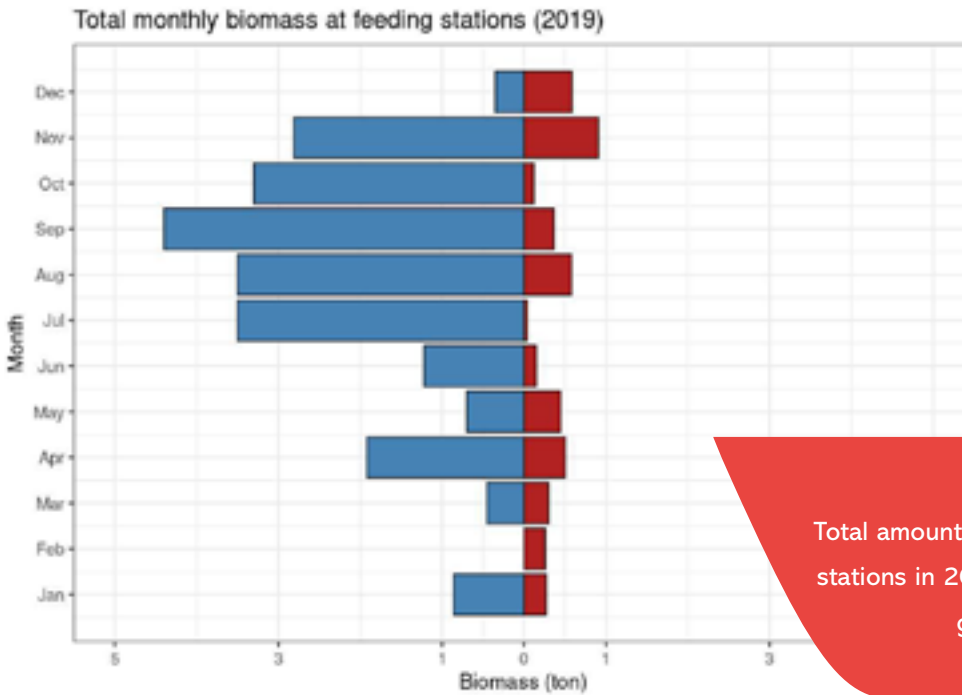


Figure 5
 Total amount of biomass provided to farm feeding stations in 2019, showing cattle (left, in blue) and goat/sheep (right, in red).

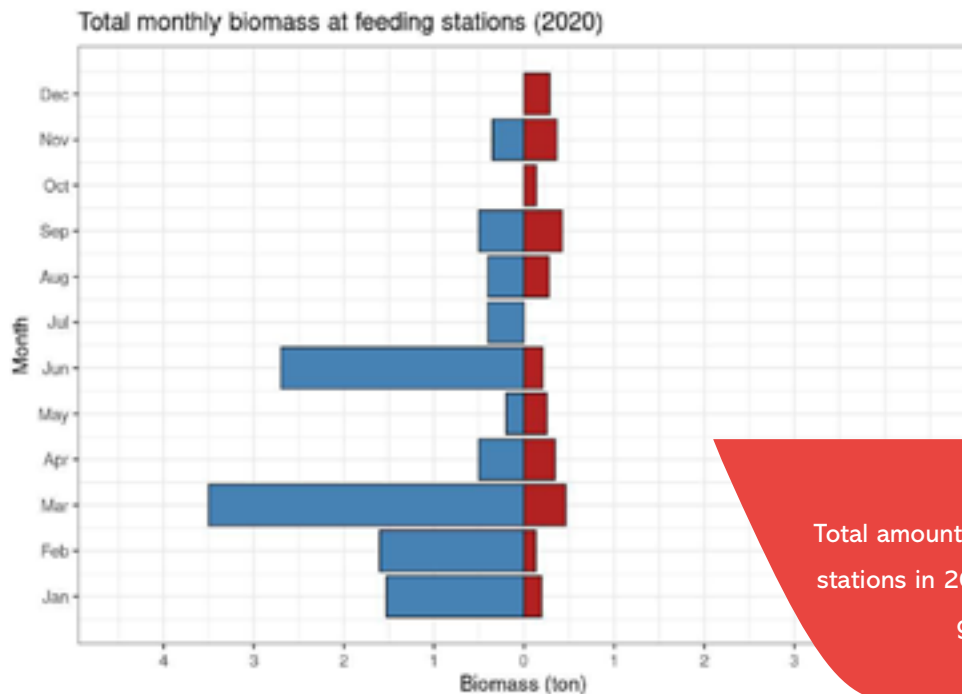


Figure 6
 Total amount of biomass provided to farm feeding stations in 2021, showing cattle (left, in blue) and goat/sheep (right, in red).

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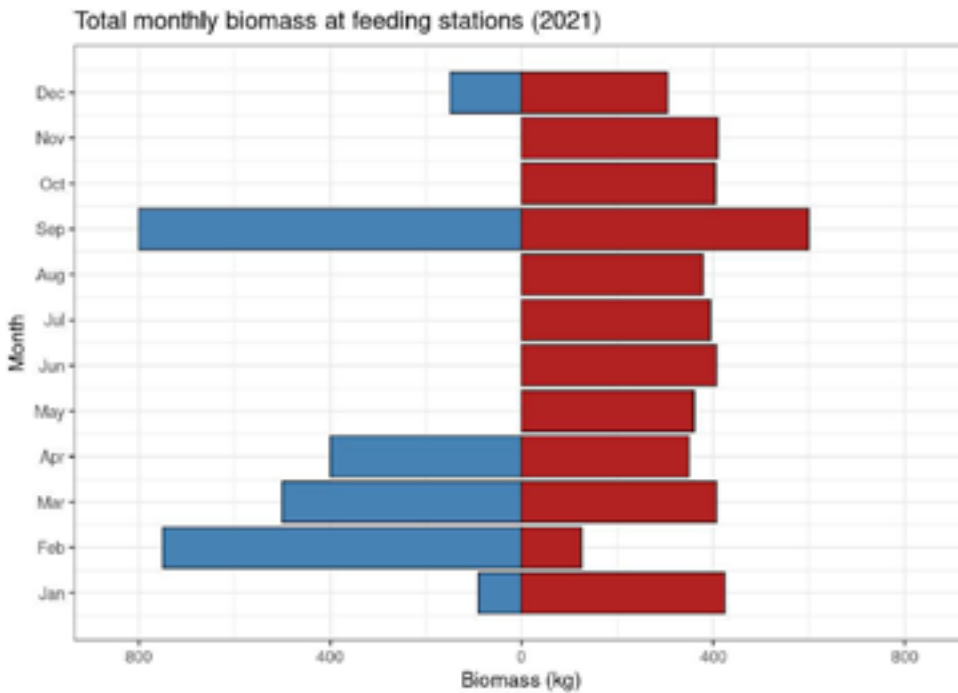


Figure 7

Total amount of biomass provided to farm feeding stations in 2021, showing cattle (left, in blue) and goat/sheep (right, in red).

Conversely, we could see that the total number of feeding provisions with sheep were far more constant through the various months of the year. That is because sheep are bred in a semi-extensive way, they are more exploited and they live less; cattle, on the other hand, are almost free-ranging so mortality is lower, plus their economic value is higher, so farmers invest more on their health; however, they are more subject to stochastic events such as drought or blackleg outbreaks.

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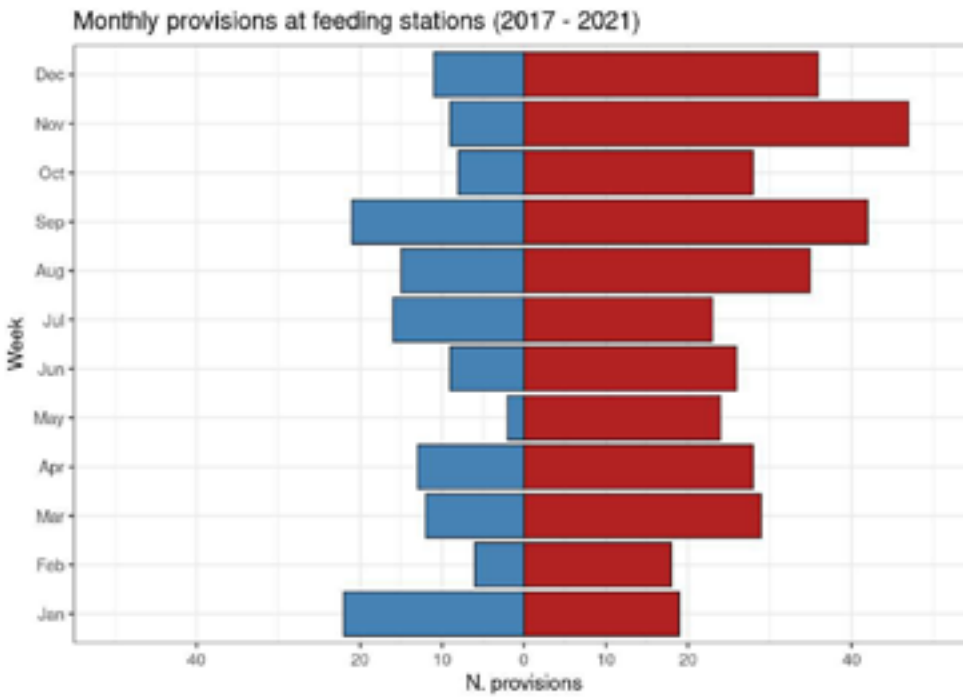


Figure 8

Total number of provisions to farm feeding stations, between 2017 and 2021, showing cattle (left, in blue) and goat/sheep (right, in red).

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Conclusions



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LIFE SAFE for VULTURES

First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna

To secure the long-term survival of the Griffon Vulture population in Sardinia, a new LIFE project is ongoing - LIFE Safe for Vultures (2021- 2026; LIFE19/NAT/IT/000732). The partnership includes the University of Sassari as coordinating beneficiary, Agenzia Forestas, RAS-CFVA, e-distribuzione and the Vulture Conservation Foundation as associated beneficiaries. The project aims at enlarging Griffon Vulture area of occupancy, increasing its carrying capacity and mitigating the main threats such as poisoning and interaction with energy infrastructures. More specifically, to enlarge the area of occupancy of Griffon vultures and its carrying capacity a minimum of 30 farm feeding stations will be activated in pasturelands located in Natura 2000 sites in central, eastern and southern Sardinia to attract vultures. A SPA will be enlarged to incorporate in Natura 2000 network an important foraging and roosting area. FFSs will dispose livestock carcasses in the pasturelands for a total of 21.000 kilos/year (feeding requirements of 115 vultures/year) thus contributing at increasing the carrying capacity of the territory. They will be managed to ensure that carcasses provisioned are free from veterinary drug residues.

Moreover, the project will create a second nucleus of Griffon Vultures in south Sardinia (at > 100 km of distance from the main colony) to catalyse their expansion by implementing a restocking program: the release strategy foresees an acclimatisation period which, together with the presence of a centralised feeding station, will be functional to the fixation of the vultures to the new area. Other actions aim at mitigating the main threats as the risk of poisoning events, including lead poisoning by facilitating the transition versus lead-free ammunition in ungulate hunting, and the risks of collision to energy infrastructures and electrocution.

In the LIFE Safe for Vulture project supplementary feeding is managed not only to secure food availability but also to catalyze the expansion of the population and to fix the restocked vultures to the new site. The data gathered in the management of both centralized and farm feeding stations suggest that the more effective solution at these aims would be to:

- Ensure the regular provisioning of the centralized feeding stations to avoid food shortage in case of low provisioning from the farm feeding stations and to guarantee food availability in the expansion area to fix the restocked vultures to the territory;

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Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



- Create a network of farm feeding stations, at least 70 are foreseen at the end of 2026, of which approx. 70% of small ruminants farms - higher mortality, provisioning is more regular - and 30% of cattle farms - lower mortality but higher biomass.

With feeding stations carcasses are both a safe meal for scavengers and an attraction for photographers and birdwatchers. The growing demand to photograph in natural contexts where there are symbolic species such as the Griffon vulture can make Sardinia one of the main destinations for eco-tourism. For these reasons, centralized feeding stations are all visible from birdwatching stations and trails realized and managed by the Forestas Agency. Moreover, farm feeding stations will be included in eco-touristic routes. Their intrinsic economic value and the possibility to generate integrative income for the herder will positively impact the profitability of the sector. This project will thus implement European tourism policy: as pointed out in the Commission Communication COM (2010) 352 of 30/06/2010, the sector's competitiveness is closely linked to its sustainability.

These actions will ultimately increase the touristic and cultural value of Griffon Vultures, thus sustaining their long-term conservation.

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mail: lifeforvultures@uniss.it | tel: +39 079 229904
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ANNEX



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LIFE SAFE for VULTURES

First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna

International workshop on supplementary feeding for griffon vultures

18-20 October 2022, Alghero, Italy

Agenda

Day 1 – Tuesday 18th October

09:00 – Welcome and registration

09:30 – Opening addresses

10:00 – The LIFE Safe for Vultures – review of the project and the action on supplementary feeding, Fiammetta Berlinguer, Dipartimento di Medicina Veterinaria, Università degli Studi di Sassari, LIFE Safe for Vultures

10:30 – Implementation, Monitoring and Impact of Supplementary Feeding Stations for Griffon Vultures: A review of the scientific literature, Julien Terraube, VCF

11:00 – The Sardinia regulation on supplementary feeding, Sara Rebecca Cagelli, Servizio Veterinario Igiene degli Allevamenti e delle Produzioni Zootecniche ASL 1, Sassari

11:30 – Coffee-break

12:00 – Feeding sites for vultures and other birds of Prey in Italy, Fulvio Genero, VCF

12:30 – The role of the centralized feeding stations in Sardinia, Marco Muzzeddu, Agenzia Regionale Forestas

12:45 - The activities of the CFVA in the project and the relationship with the territory, Commissario Superiore Giovanni Tesei, Regione Autonoma della Sardegna - Corpo Forestale e di Vigilanza Ambientale

13:00 – Lunch

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15:00 – Supplementary feeding for Vultures in Spain: current situation, legislation, volumes and impacts, Ruben Moreno-Opo, MITECO

15:30 – Supplementary feeding in France: the system of farm-feeding stations: regulation and practice, Raphael Neouze, LPO/VCF

16:00 – Griffon usage of supplementary feeding in Bulgaria, Volen Arkumarev, BSPB

16:30 – Supplementary feeding and food availability for griffons in the Balkans, Uros Pantovic, VCF

17:00 – Operating a farm-feeding station in Sardinia – the view from the field, Ilaria Fozzi, Dipartimento di Medicina Veterinaria, Università degli Studi di Sassari, LIFE Safe for Vultures

17:30 – Movements of released griffon vultures in Sardinia: what do they tell us?, Jacopo Cerri, Dipartimento di Medicina Veterinaria, Università degli Studi di Sassari, LIFE Safe for Vultures

Day 2 – Wednesday 19th October

09:00 - Supplementary feeding for griffons – problems, challenges and opportunities. Context for discussion, José Tavares, VCF

09:30 - Supplementary feeding and ecosystem services: Methodologies to quantify scavenging services and carrying capacity, Julien Terraube, VCF

10:00 – Past and current role of supplementary feeding sites for scavengers to mitigate lead intoxication impact in two high hunting density scenarios. Comparison between the Alps and Massif Central/French Pre-Alps, Enrico Bassi, Stelvio NP - VCF

10:30 – Role and priority of supplementary feeding in the conservation strategy of griffon vultures in the Apennines, Mario Posillico/Mario Cipollone, Reparto Carabinieri Biodiversità Castel di Sangro, Rewilding Apennines

11:00 - The role of feeding points for scientific research, monitoring and ecotoxicological investigations. Pierpaolo Storino/Alessandro Andreotti, ISPRA

11:30 Coffee break

12:00 – workshop 1: what are the main bottlenecks in adopting more flexible sup-

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plementary feeding regulations (Peninsular Italy, Cyprus, Portugal). Facilitated by José Tavares, VCF and Fiammetta Berlinguer, Dipartimento di Medicina Veterinaria, Università degli Studi di Sassari, LIFE Safe for Vultures

13:00 – lunch

15.00 – workshop 2 methods to monitor impact of supplementary feeding stations, implementation good practice. Facilitated by Julien Terraube, VCF and Jacopo Cerri, Dipartimento di Medicina Veterinaria, Università degli Studi di Sassari, LIFE Safe for Vultures

16:30 – Conclusions

Day 3 – Thursday 20th October – fieldtrip

Visit to two farm feeding stations and to the main griffon vulture breeding colony in Bosa

Departure from the hotel at 10.00 am

Arrival in Bosa at Badde Orca at approximately 11.30 a.m.

Trekking to visit the main griffon vulture breeding colonies with a visit to an Farm Feeding Station

Packed lunch provided by the organisation

Return to hotel in the afternoon

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LIFE SAFE FOR VULTURES
Partecipando alla restaurazione della falange dei vulturini in Sardegna
Partecipando al corso di ripristino della gilda dei vulturini in Sardegna



Watch the video
on Sardinian feeding stations
best practice

INTERNATIONAL WORKSHOP ON SUPPLEMENTARY FEEDING FOR GRIFFON VULTURES

18-20 OCTOBER 2022
ALGHERO, ITALY
SALA CONFERENZE
DELLA FONDAZIONE ALGHERO
LARGO LO QUARTER, ALGHERO (SS)

18/10: FIRST WORKSHOP
19/10: SECOND WORKSHOP
20/10: FEEDING STATIONS FIELDTRIP

DETAILED PROGRAM &
REGISTRATION FORM:



SCAN ME

Con il patrocinio di:
Comune di Alghero



**FONDAZIONE
ALGHERO**
Musei | Eventi | Turismo | Arte



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Griffon usage of supplementary feeding in Bulgaria

Volen Arkumarev, Bulgarian Society for the Protection of Birds – BSPB - Sofia 1111, p.o. box 50 Yavorov District, Block 71, entr. 4, app. 1

Supplementing vulture populations with carcasses disposed at feeding stations is a common management and conservation practice worldwide. However, there is a lack of knowledge on the dependence of large vultures on the supplementary feeding stations (SFS) in areas with high abundance of natural food. We tagged 11 Griffon Vultures (*Gyps fulvus*) with GSM/GPS transmitters in the Eastern Rhodopes, Bulgaria and studied the seasonal dynamic of feedings at SFS and at occasional carcasses found in the field. We used a remote-sensing technique based on GPS and accelerometry data to identify the feeding locations, and ground-truthing to identify the carcass species and investigate the causes of mortality. Our results show that most of the feeding events occurred at occasional carcasses found in the wild (77.4%), whereas only 22.6% were at SFS, but high seasonal variation was observed. Vulture's reliance on feeding stations was the lowest in summer ($19.82 \pm 7.8\%$) and the highest in winter when $56.5 \pm 16.1\%$ of the feedings were at the SFS. Griffon Vultures travelled longer daily distances in days feeding in the wild compared to days when they were not feeding or were visiting SFS. We identified 13 taxa in the diet of Griffon Vultures. Cattle comprised 48.5% of the diet, followed by sheep (24.3%), while wild animals were 13.1%. We observed seasonal variation in the proportion of small stock and game species in the diet. Predation was reported as the main cause of mortality (60.2%) for prey species, while natural causes accounted for 37.6%. Vultures were mainly feeding in areas south of their breeding colonies in Bulgaria and Greece. Free-ranging livestock creates favourable feeding conditions for vultures, especially in areas with rugged terrain and a high density of predators. An increase in the number of wild ungulates can potentially buffer the fluctuations in livestock numbers and be beneficial for vultures, especially in the autumn and winter months. Our study indicates that in habitats with high abundance of natural food, vultures tend to actively forage and use feeding stations as supplemental sources of food, mostly during long periods of adverse weather or in winter when foraging conditions are worse and natural food is less abundant.

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Past and current role of artificial feeding sites for scavengers to mitigate lead intoxication impact in two high hunting density scenarios.

Enrico Bassi¹, Roberto Facchetti², Maria Ferloni³, Alessandro Bianchi⁴, Alessandro Mercogliano¹ & Alessandro Andreotti⁵

In collaboration with Mario Posillico⁶, Stefano Pesaro⁷, Fulvio Genero⁷ & Arianna Mocali⁸

To assess the impact of lead poisoning on large avian scavengers, 595 tissues from 252 birds of prey

(29 Bearded Vultures BV, 112 Griffon Vultures GV, 19 Cinereous Vultures CV, and 92 Golden Eagles GE) were analysed (Bassi et al. 2021). Tissue samples were excised from birds coming from Italy, France, Switzerland, and Austria from 2005-2019. Overall, 111 out of 252 birds (44.0%) had lead concentrations above background thresholds in at least one tissue and 66 (26.2%) had values showing clinical poisoning. These data suggest that large avian scavengers are highly susceptible to lead poisoning in the investigated area, which can be detrimental to their conservation. This research highlighted also some peculiar geographical convergences: the most abundant species with a diet based on soft tissues were the most contaminated: GV was significantly more exposed (44.3% vs 26.3%) to lead poisoning than CV in Massif Central-French Prealps, an area with a high number of regular artificial feeding sites (AFS), and GE was more exposed (52% vs 17.2%) than BV in the Alps, where only 8 AFS occur in France and Italy.

Further analysis showed that 1 out of 6 GV carcasses (17%) was chronically lead-contaminated in NE Alps (Friuli-Venezia Giulia where 3 AFS occur). Moreover, 42 blood samples from captured GV in Cornino Lake NR, showed a range of subclinical poisoning of 19-62% (Pesaro, unpublished data) in relation to the different literature references. Similarly, in NW Alps (Piedmont), 5 out of 5 GV carcasses (100%) showed chronic and subchronic lead exposure. Also, in Central Apennines (mostly in Abruzzo), 10 (77%) out of 12 GV and 1 GE were lead-contaminated, with 3 chronic/acute cases.

In conclusion, free-ranging raptors are widely and severely lead-contaminated in South Central EU, also in areas with a solid network of AFS. AFS attract scavengers and could indirectly become strategic Collection Data Centres but we urgently need:

¹ERSAF - Direzione Parco Nazionale dello Stelvio (SO)- E-mail: enrico.bassi76@gmail.com

²Via per Esino 118, 23828 Perledo (LC)

³Provincia di Sondrio, Via XXV Aprile, 22, 23100 Sondrio

⁴Istituto Zooprofilattico Sperimentale Lombardia ed Emilia-Romagna-Head Sondrio and Bologna

⁵ISPRA – Istituto Superiore Protezione e Ricerca Ambientale, Ozzano E. (BO)

⁶Reparto Carabinieri Biodiversità Castel di Sangro (AQ)

⁷Università degli Studi di Udine – Dip. Scienze Agro-alimentari, Ambientali e Animali, Centro ricerca e Coordinamento per il Recupero Fauna Selvatica

⁸Riserva Naturale Regionale del Lago di Cornino, Cornino (UD)

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Via Vienna 2 | 07100, Sassari

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1) a lead ban in a buffer of at least 50-100 km from the AFS to avoid potential «trap effects»; 2) complete lead analysis of vultures tissues samples; 3) an evaluation of veterinary drug remains and lead remains (through X-ray) respectively in livestock and wild animals provided meat; 4) a gradual extension of the AFS network.

The LIFE Safe for Vultures – review of the project and the action on supplementary feeding

Fiammetta Berlinguer, Dipartimento di Medicina Veterinaria, Università degli Studi di Sassari, Via Vienna 2, 07100 Sassari - LIFE Safe for Vultures

The griffon vulture was once widespread in Sardinia, with approximately 1,000 individuals in the early XX century. Then, griffons declined from the 1950s to the early 2000s, due to multiple threats, including illegal killing, poisoning and the reduction in extensive animal husbandry. The release of 60 individuals from Spain and France, between the 1980s and 1990s, was ineffective, as its benefits were offset by large poisoning events.

Therefore in 2014 the population in Sardinia was restricted to 100 individuals (35 -40 breeding pairs) that produced less than 20 juveniles every year, characterized by mortality rates up to 85%. By being on an island, immigration from other populations in peninsular Italy was low and the risk of extinction high.

In 2014 the LIFE “Under Griffon Wings project” was carried out to increase the size of the population, while also decreasing critical factor undermining griffon conservation. The project included the release of 72 individuals from wildlife rehabilitation centres and zoos in Europe, the creation of anti-poisoning dog units, communication campaigns to minimize disturbance from outdoor activities and the enforcement of a supplementary feeding program, that provided 83.2 tons of livestock carrion between 2017 and 2022. These actions increase population to more than 300 individuals and 45 fledged juveniles in 2021.

The project has been followed by LIFE “Safe for Vultures” in 2020, which wants to consolidate the achievement of LIFE “Under Griffon Wings”. Safe for Vultures aims to enlarge the area occupied by griffons in Sardinia, by creating a third colony in the South-East portion of the island. And also, to mitigate the risk of poisoning, encouraging lead-free ammunition for hunting, reducing the risk of collision and electrocution with power lines and increase public awareness.

The creation of the third colony of griffons will be promoted by releasing 45 individuals from captivity in the municipality of Villasalto, from 2023 to 2024. Individuals will be acclimatized in an aviary for a minimum of 6 months, before being released. Simultaneously, the project will broaden the network of farm feeding stations operating in the island, by creating 31 new stations at Natura 2000 sites of Central and Southern Sardinia. This network will promote griffon movements across the island, increasing the connectivity between the two populations.

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The Sardinia regulation on supplementary feeding

Sara Rebecca Cagelli, Servizio Veterinario Igiene degli Allevamenti e delle Produzioni Zootecniche ASL 1, Via Rizzeddu 21 B, Sassari

Dietary supplementation of vultures aims to protect endangered indigenous fauna resulting from a reduced natural supply of food resources. The reduction in the usable biomass originates from the lower availability of animal carcasses, left on the ground in extensive farms, due to the insurgent compulsory disposal of animal remains, which contain specific endangered material, as required by EU regulations. It is well known how the survival of the griffon vulture is closely tied to the availability of carrion from domestic ungulates, being a compulsory necrophagous animal species.

To increase the share of food needed to feed the griffon vultures present on Sardinian territory and to hope for an increase in their numbers, the Department of Veterinary Medicine of the University of Sassari promoted a feasibility study in 2013, approved by ISPRA and regulated by the Departments of Environment and Health of the Region of Sardinia, for the installation of feeding stations for food supplementation at livestock farms. The Region of Sardinia has subsequently drafted a procedure, which regulates the application and authorization of the feeding station on the island's territory. Breeders who fall within the area deemed useful for the purpose of supplementary feeding of griffon vultures can apply to the relevant local health authority. These breeders must prove that they are properly using the drugs on their farm and have a regular registry; they undertake to properly account for the foraging of the feeding station, by recording each load on a carcass register. The feeding station authorization is renewed annually only if the behaviour of the farmer complies with the commitments signed at the time of granting, otherwise it is suspended or permanently revoked by the Asl Veterinary Service. Monitoring activities are carried out by the Veterinary Services, which cooperate with licensed breeders daily. The University's Department of Veterinary Medicine, in collaboration with the accredited Laboratory, performs random checks on carcasses, placed in the feeding station, for residues of drugs toxic to vultures. Among the strengths, noted after four years of operation of the feeding stations was the special sensitivity of the breeders to griffon vultures and the constant maintenance of contact between the breeder and Veterinary Services.

Movements of released griffon vultures in Sardinia - What do they tell us?

Jacopo Cerri, Postdoc, Dipartimento di Medicina Veterinaria, Università degli Studi di Sassari, Via Vienna 2, 07100 Sassari - LIFE Safe for Vultures

Starting from 2017, 76 griffon vultures from captivity breeding programs or wildlife rehabilitation centres were released in North-Western Sardinia, within the LIFE Project

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“Under Griffon Wings” (LIFE14/NAT/IT/000484). This initiative aimed to increase the size of the breeding population, which had been declining since the 1990’s.

Overall, 43 griffons had been equipped with GPS/GSM transmitters, which had been set up to collect GPS locations every two hours, from dawn to dusk. A final sample of 37 individuals collected $3,038 \pm 2,525.1$ GPS locations (mean \pm sd), over a time-span of 674.4 ± 432.7 days between January 2017 and June 2022.

To quantify the area covered by griffons during their everyday movements, we estimated the occurrence distribution at the time of the study, by fitting dynamic Brownian Bridges Movement Models (hereinafter dBMM), which quantify the uncertainty surrounding movement paths of individuals through time. As GPS/GSM transmitters were powered through solar panels, data acquisition was not homogeneous across the year, peaking in June and July, when the daylength and intensity of solar radiation were at their maximum. So, data were linearly interpolated, to ensure a homogeneous sampling rate.

Griffons travelled an average distance of 38.3 ± 34.3 km per day, with considerable variation between different months. Namely, griffons peaked in their average daily movements in July, when they covered on average 58.8 ± 38.5 km per day, whereas they had a minimum of movements in December, when they covered 15.4 ± 15.4 km per day.

The size of the area delimited by the 95% isopleth, corresponding to those portions of the study area that were visited on a regular basis, but not too intensively, by individuals was 956.3 ± 677.8 km². The size of the area delimited by the 50th percent isopleth, corresponding to those parts of the study area that were intensively visited by griffons, was 73.9 ± 48.2 km².

Griffons consistently moved between the two main breeding colonies, in Porto Conte and Bosa, usually avoiding crossing the sea in front of Alghero. Moreover, although animals covered a considerable portion of the study area, areas with the highest utilization concentrated around colonies in Bosa, and where farm feeding stations had been activated. Some individuals (n = 5) also included the Asinara National Park in the area they visited on a regular basis.

Our findings indicate that farm feeding stations that were built during the Life “Under Griffon Wings” project fell indeed into the area the most utilized by griffon vultures and therefore were an effective tool to increase foraging efficiency of griffons and sustain their breeding colonies.

Operating a Farm Feeding Station in Sardinia – The view from the field

Ilaria Fozzi, PhD student, Dipartimento di Medicina Veterinaria, Università degli Studi di Sassari, Via Vienna 2, 07100 Sassari - LIFE Safe for Vultures

During the LIFE Project Under Griffon Wings (2014-2020) 37 farm feeding stations were activated; the livestock reared in the 37 farms that activated a feeding station

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amounted to 2897 cattle and 13368 sheep and goats. The feeding stations were located in a marginal area of the farm, occupying an average space of 500 square meters, and were delimited by an electric fence.

Of the 37 farm feeding stations that were activated 10 were never used (2 had their authorization revoked). Between 2017 and 2021 a total of 421 cattle and 160 goat/sheep were provisioned in the farm feeding stations, corresponding to 67.253 and 16.041 tons of biomass respectively. During the first three years a high amount of biomass of cattle was provisioned, reaching 23.01 tons in 2019, then it declined in 2020 and 2021, while in 2021 the provisioning of goat/sheep increased, with 114 animals provisioned in 2021.

Comparing the biomass provisioned every year and the estimated Griffon vulture population present, we calculated the number of individuals, and the percentage of the population sustained every year thanks to the farm feeding stations; in 2017 67.8% of the population was sustained, 47.9% in 2018, 62.9% in 2019, 31.6% in 2020 and 14.1% in 2021.

We also computed the seasonal distribution of biomass and of provisioning for every year; while for goat/sheep the distribution was quite constant throughout the seasons, the provisioning of cattle showed a higher amount during summer and winter and the lowest one during spring. That is because sheep are bred in a semi-extensive way, they are more exploited and they live less; cattle, on the other hand, are almost free-ranging so mortality is lower, plus their economic value is higher, so farmers invest more on their health; however, they are more subject to stochastic events such as drought or blackleg outbreaks.

Within the project LIFE Safe for Vultures 31 new farm feeding stations will be activated in 15 Natura2000 protected areas in different parts of Sardinia (16 in the north-centre, 5 in the south-east, 5 in the centre-east and 5 in the south-west). The estimated biomass that will be provisioned is 23840 kg, that will sustain 130 Griffon vulture annually.

Farm feeding stations in Sardinia might also become an important eco-touristic attraction for photographers and birdwatchers, following the example of other countries where this activity is already present and has become a significant source of income for local population.

Feeding points for vultures and other birds of prey in Italy

Fulvio Genero Università degli Studi di Udine – Dip. Scienze Agro-alimentari, Ambientali e Animali, Centro ricerca e Coordinamento per il Recupero Fauna Selvatica, Enrico Bassi ERSAF - Direzione Parco Nazionale dello Stelvio (SO)- E-mail: enrico.bassi76@gmail.com

In Italy, the first feeding stations were built in the 70s and 80s, last century, to support griffons in Sardinia and in the eastern Alps. Subsequently, more feeding stations

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Via Vienna 2 | 07100, Sassari

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LIFE SAFE for VULTURES

First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



were built for the conservation of vultures and raptors.

Overall, 82 feeding points were detected, 38 of which represented farm feeding stations (FFS). Of the remaining 44 structures, 14 are not active, 2 are under construction and 28 are currently operating (6 in the north, 4 in the centre, 6 in the south, 9 in Sicily and 3 in Sardinia plus the 38 FFS).

The currently working feeding points have been created to support vultures (10 for the griffon vulture GV, plus 38 FFS in Sardinia; 10 for the Egyptian vulture EV; 6 for kites and 2 mixed. Most of them are typical feeding stations (21); platforms are less frequent (6) and mainly built to feed kites and the EV and 1 has both structures. Almost all structures are fenced and 50% are equipped with webcams or camera traps. Pigs, cattle, sheep and goats are the most commonly provided food to GV and, in 5 cases, wild ungulates from culling or road accidents are provisioned too. For the EV, category 3 animal by-products (SOA3, Regulation (EC) n.1069/2009), culled wild boars, and slaughterhouse waste are used. For the kites rats, mice, chicks and SOA3 represent the most used food.

Out of the 66 feeding points operating in 2021, only 10 (15,1%) have been working for more than 10 years. Despite this, with a total contribution of about 1000 q/year, these structures helped supporting the populations of necrophagous raptors, by ensuring continuous feeding and controlled food. The rapid increase in farm feeding stations in Sardinia is substantial and represents an example that should be replicated in other regions, where the necessary conditions are met.

To ensure the quality of the provided food, it would be important to evaluate the presence of veterinary drug residues in the carcasses and the wild animals should be checked in advance by X-ray to exclude the presence of lead from hunting ammunition, preventing saturnism.

It would be desirable to gradually extend the network of supplementary feeding points, while at the same time carrying out monitoring activities to test appropriate management methods to guarantee the conservation of scavenger birds.

Situation of supplementary feeding of avian scavengers in Spain: legislation and implementation

Dr. Rubén Moreno-Opo, Ministry for the Ecological Transition and the Demographic Challenge, P. de la Castellana 160, C.P. 28046 Madrid, España

Owing to the importance that Spain has for the conservation of scavenger raptors, and especially for vulture populations in the Western Palearctic, the management of food availability for these species is a priority for public administrations and, in general, for the whole society.

Following the changes in the management of the carcasses of livestock and hunting ungulates after the mad cow crisis in the 1990s and 2000s that reduced the availability of carrion in the wild, European Union authorities extended the legal

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Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



possibilities to provide food to priority scavenger species through several categories of animal by-products not intended for human consumption. The two European regulations (1069/2009 and 142/2011) allow not only the establishment of fenced supplementary feeding sites – *heavy feeding stations* –, but also the non-collection of carcasses on the farms, which would remain available for their consumption by wild scavengers. The farms authorized to provide carcasses must be located in key areas for the feeding of scavengers, must develop a non-intensive management system and must comply with sanitary conditions that prevent the spread of diseases. Further legislation has been developed in Spain during the 2010s to expand the feeding possibilities of vultures with the aim of ensuring their favourable conservation status, reducing conflicts with socioeconomic interests and facilitating their use of trophic resources in a more ecologically sustainable way. And not only for the management of livestock carcasses, but also for an important source of food such as remains of wild hunted ungulates. The Spanish regions (comunidades autónomas) have approved action and monitoring plans in relation to vulture feeding, which are offering positive results as the populations of the four Spanish vulture species continue to show a positive population trend or, in the case of the Egyptian vulture, is at least stable. These plans even benefit farmers through savings due to the absence of costs for the collection of carcasses—insurances and costs of transport and removal of carcasses.

Fourteen out of 17 autonomous communities have approved their plans to adapt national and EU legislation territorially, declaring almost 2/3 of the whole Spain as special protection areas for the feeding of scavenger species (ZPAEN). In 2019, at least 251 fenced supplementary feeding points – *heavy feeding sites* – officially operated in Spain which provided 3.6 M kg of carrion. On the other hand, the most suitable feeding technique, which is the abandonment of extensive livestock carcasses in ZPAEN, also improves in Spain; in 2019, 16,540 farms were authorized to leave mainly sheep and goat carcasses for vultures, providing a minimum of 6.3 M kg. It is estimated that approximately half of the trophic requirements of the wild animals shaping the obligate and facultative scavenger guild present in Spain is supplied through these official management programs.

Supplementary feeding in France. The system of farm-feeding stations regulation and practice

Raphael Néouze, Ligue pour la protection des oiseaux – LPO, Boutique LPO – CS 90263 – 17305 Rochefort Cedex/Vulture Conservation Foundation – VCF, Sandstrasse 2, CH-8003 Zürich, Switzerland

As part of the reintroduction and conservation of vultures in France starting in Grands Causses, the creation of collective recycling feeding stations and then individual farm feeding station has been one of the key elements of the success of these

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Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



programs. As soon as the Griffon Vulture returned, breeders became aware of the role of natural scavengers played by these birds. Historically, the local stakeholders carried out an organised collection of carcasses to let on four then eight collective recycling feeding stations which they managed progressively over the south of France. In order to legalize the deposit of animal carcasses from agriculture, the regulations on sanitary conditions have been changed, making it possible to leave the carcasses of small livestock (less than 300 kg) from farms available to vultures: in 2001, the first individual farm feeding station was born in the Causses. They are part of the continuity of practices to contribute to the integration of these necrophagous raptors in the Southern French pastoral ecosystem and make it possible to formalize an already long-lasting existing practice.

In addition, their implementation makes it possible to gradually reduce in the appropriate regions, the industrial quartering service while preserving the volume of the food resource made available to the vultures.

Indeed, there are many arguments in favour of the farm recycling feeding stations (FFS), as ecological service is an important piece fixing the puzzle of European vulture conservation.

Benefits for long term conservation:

- FFS, where the food is unpredictable in time and spread over the region, reduce competition between vultures (adults/young),
- FFS allow the presence of other scavengers (Egyptian vultures, Black and Red Kites...),
- FFS help the vultures to increase their foraging area and to be less dependent on the collective feeding stations and of the conservation structures,
- FFS favour the spontaneous discovery of other sources of food (dead domestic and wild animals...),
- The acceptance of the vulture's presence is much helped in the region with high occurrence of FFS. In these regions the reports of Interactions between livestock and vultures remain low.

The efficiency of carcass removal for farmers, the reduced economic costs for them and for the society, the important decrease in carbon emission, make the French model of FFS a perfect tool to maintain this reciprocal and long-term benefit between human and scavengers. Thus, the restoration of scavenger populations based on the ecological service the FFS provide to farmers, constitutes a flagship example of a win-win strategy idealized in the concept of sustainable development.

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Supplementary feeding and food availability for griffons in the Balkans

Uros Pantovic, Vulture Conservation Foundation – VCF, Sandstrasse 2, CH-8003 Zürich, Switzerland

Of the 4 vulture species native to Balkan Peninsula, the Griffon Vulture is the only species whose populations have partially recovered since the steep decline in numbers during the second half of the 20th century, and is slowly showing signs of recovery in Bulgaria, Croatia, Serbia, and are dependent on supplementary feeding stations (SFSs) for their viability.

The current SFSs for vultures in the Balkan countries provide enough food to match the trophic requirements of the vulture populations inhabiting this region. The only exception is Croatia, where the annual amount of food delivered to the existing feeding sites meets only 22% of the current vulture population. Therefore, the lack of food can be considered one of the main local restrictive factors for vultures in Croatia. Further assessment is needed towards estimating the intake of other necrophagous species relevant to food availability for vultures, such birds of prey and mammalian predators.

The main function of the existing SFSs in the Balkans is to support the local breeding populations of vultures by providing a safe food source on a regular basis. All SFSs depend on local livestock populations and animal by-products derived from local slaughterhouses for their operation. The current legislation in all Balkan countries does not functionally allow abandonment of dead livestock in the environment or establishment of small-scale feeding stations, where local livestock breeders can dispose of dead animals. The majority of food is disposed of and concentrated in several intensive feeding stations with a high predictability of food, both in space and in time.

Abandonment of traditional, extensive agro-grazing practices, along with a general downward trend of livestock populations, significantly reduces the availability of food for vultures in the in the Balkan Peninsula. All these factors combined makes this food source practically unavailable, apart from the supplementary feeding programmes for vultures already in place.

To address the issue of food availability for vultures on a regional level we recommend that future conservation initiatives be directed towards the creation of a network of small feeding stations supplied sporadically with food, which would thus avoid the concentration of food in just a few places, reduce the chances of poisoning incidents occurring and support natural dispersion of birds and better connectivity among different populations in the region.

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First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



Role and priority of supplementary feeding in the conservation strategy of Griffon vultures (*Gps fulvus*) in the Apennines

Elena Di Filippo¹, Filippo La Civita¹, Rosita Giuliani¹, Giancarlo Opramolla¹, Antonello Pascazi¹, Mario Posillico¹, Samuele Spacca¹, Nicolò Borgianni², Mario Cipollone², Fabrizio Cordischi², Jan-Niklas Trei²

Griffon vultures were reintroduced in the central Apennines in the 1990s. Breeding population is slowly increasing, with up to 72 pairs in 2022 (10 years average 51, ± 13), fledging an average of 36 juveniles (± 8) (47 in 2022). Individuals from neighbouring populations occur frequently, with resighting of 78 marked vultures (2010-2021). Griffon vultures' mortality rate (8-12%) is higher and the rate of increase of breeding population is lower than other European populations. Causes of death are human-related in 67% of cases. Vultures were subsidised twice a week with 2,600 kg food/year (1,900-3,700 kg) during last ten years, purposely decreasing from 43,000 kg in 2003-2004. Ninety-% of provisions were attended, although often (74% provisions) we recorded only 1-15 birds. Griffon vultures' food (free-ranging livestock >90%; wildlife 8%) is mostly found outside feeding stations. GPS clusters surveys (2018-2022) yielded a minimum estimate of a minimum-rough estimate of available carrions of 0.44-0.94/day.

The reintroduction of the Griffon vulture in the central Apennines is a successful story in the short-term. Yet, anthropogenic threats suggest caution in the long-term. Population viability analysis reported that extinction probabilities boosted by 22-38% corresponding to a 20% increase in mortality rate, whatever the carrying capacity considered. So, conservation should address anthropogenic mortality first. Increase in carrying capacity should be targeted later, by enforcing EU regulations for a wider release of dead livestock across pastures, and further setting of feeding stations in relevant areas, to exploit ecosystem services provided by vultures. Implementing feeding stations deserves a sound approach and should be carried out when significant and science-proofed conservation benefits for vultures would be achieved, requiring guidelines and adaptive management. Being a wide-ranging species, conservation actions need to be planned and implemented at a proper scale. Coordination would avoid actions not supported by evidence, allocating resources to relevant interventions for durable benefits.

¹ Reparto Carabinieri Biodiversità Castel di Sangro, 45 Via Sangro, 67031 Castel di Sangro AQ-ITALY

² RewildingApennines, 5 Via S. Giorgio, 67055 Gioia dei Marsi AQ-ITALY

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Università degli Studi di Sassari
Via Vienna 2 | 07100, Sassari
mail: lifeforvultures@uniss.it | tel: +39 079 229904
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Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



The role of the centralized feeding stations in Sardinia

Dionigi Secci, Agenzia Forestale Regionale per lo Sviluppo del Territorio e dell' Ambiente della Sardegna - FoReSTAS, Viale Luigi Merello, 86, 09123 Cagliari

To talk about griffon vulture conservation in Sardinia, we must necessarily refer to Helmar Schenk.

Arriving as a student in Sardinia in 1964, he began documenting the last vestiges of the presence of species such as the Bearded Vulture, the Cinereous Vulture and the White-tailed Eagle on the island, but above all, the gradual disappearance of the last Griffon Vultures from the Supramonte-Gennargentu area and the main part of the Island's territory.

Before to the recent Life Under Griffon Wings project and the current Life Safe for Vultures, it was H. Schenk himself who instigated concrete actions for the conservation of the last natural Italian colony of this vulture located in the northwest part of the Island.

From 1974 to 2003, four projects were promoted to ensure the survival of this species.

Thanks to these projects, the first feeding stations were set up to provide 'healthy' and controlled carcasses for the island's last griffon vultures.

In 1986, the first restocking experiments began with individuals from Spain and France (a total of 60 griffon vultures released from 1986 to 1995).

Over the years and along the projects, five feeding stations have operated at different times, in different ways and under different management, until the entry of more restrictive Community regulations (EC Reg. No. 1774/2002 of the European Parliament on 3 October 2002):

- "La Guixera" - Porto Conte-Alghero;
- "Maria Pilu" - Bosa;
- "Pradu" - Oliena;
- "Pabarile" – Santulussurgiu;
- "M.te Minerva" - Villanova Monteleone.

Only "La Guixera" in Porto Conte-Alghero and "Maria Pilu" in Bosa, operated continuously until the last "Entulzu Bosa Project" (2002).

Currently, and thanks to the Projects Life14 NAT/IT/000484 Under Griffon Wings (2015-2020) and Life19 NAT/IT/000732 Safe for Vultures (2021-2026), the centralised feeding stations, managed by the Fo.Re.S.T.A.S. Agency, represent the core of the necrophagous feeding stations network in Sardinia:

- "La Guixera" - Porto Conte-Alghero;
- "M.te Minerva" - Villanova Monteleone (located on other site than the old supply point)
- "Cea Romana" – Villasalto

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Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



These centralised feeding stations, together with the farm feeding stations directly managed by private, represent an important contribution to the griffon vulture healthy feeding problem and, also thanks to restocking with young animals from Spanish recovery centres, have made the important task of ensuring the rapid demographic recovery of the Island's population.

With the activation of the "Cea Romana" – Villasalto feeding station, a further step towards the colonization of old territories, where the species was present until a few decades ago, is expected.

Supplementary feeding for griffons – problems, challenges and opportunities. Summary of main conclusions

José Tavares, Vulture Conservation Foundation – VCF, Sandstrasse 2, CH-8003 Zürich, Switzerland

These are the main points that emerged from Workshop on Supplementary feeding for griffon vultures:

The availability of food is a key aspect for vulture conservation in Europe, as it has been recognized in the Vulture Multi-species Action Plan, the global blueprint for vulture conservation. Supplementary feeding can be done in different formats, with a gradient going from regular, ex-situ supply of food (centralized feeding stations) to variable in-situ natural recycling of food (farm feeding stations - FFS). Increasing food availability through supplementary feeding is a key tool for the conservation of vultures, but supplementary feeding can have negative impacts on the health, behaviour and ecology of vultures, including interspecific competition.

Generally speaking, moving away from centralized towards FFS is recommended, and there is evidence that farm feeding stations offers the best tool, in terms of conservation impact, and has resulted in substantial increase of populations in Spain & France, and the doubling population in Sardinia. However, in many countries in Europe (e.g., Portugal, Cyprus, the Balkans, or mainland Italy) there are only centralized feeding systems.

Before establishing a supplementary feeding program, regardless of its type, it is important to assess the availability of carrion in the environment, both in terms of its biomass and temporal concentration. There is no consensus on seasonal dynamics: in some areas, like Sardinia, carrion peak in summer, while at other areas like Bulgaria in winter. The location of farm feeding station should be evaluated carefully, as it can influence dispersal and recolonization, but also jeopardize vultures.

It is important to evaluate the impact of farm feeding stations. Therefore, we need to record the volume of biomass provided to vultures, as well as its frequency. And

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Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



we also need to strengthen our monitoring of food quality (including on veterinary medicines and lead), and there is a general lack of information about costs and savings from supplementary feeding. These are major gaps that should be addressed as soon as possible.

EU Sanitary legislation is quite flexible, and allows for FFS, so usually stricter requirements are imposed by national authorities. Ideally one should transition from centralized to diffused feeding stations - this would mean to move from fenced to unfenced feeding station systems, like those in place in Spain. Electric fences, like those used in Sardinia might be a good intermediate step.

The use of hunting remains as a form of food should be monitored carefully to avoid lead intoxication. Scientific validation from research authorities, is crucial for changing sanitary legal frameworks.

Engaging farmers is key to any supplementary feeding, as they need to recognize the benefits that could arise from scavenging. These include financial ones, from the reduction of insurance costs, but also the reduction of operational liabilities arising from the lack of incineration.

Operating FFS pose a series of concrete issues: costs for carcass testing, ensuring adequate quality of carcasses, managing carnivores and associated conflicts with human activities, ensuring that initiatives remain sustainable in the long-term.

Implementation, Monitoring and Impact of Supplementary Feeding Stations for Griffon Vultures: A review of the scientific literature

Julien Terraube, Vulture Conservation Foundation – VCF, Sandstrasse 2, CH-8003 Zürich, Switzerland

Feeding stations (FS hereafter) have been widely implemented worldwide as a conservation tool to reverse the decline of vulture populations and restore carcass disposal services. Two main FS types are found in Europe: i) structures receiving large amount of carcasses on a frequent basis, traditionally called 'heavy feeding stations' (HFS hereafter), and farm feeding stations (FFS), which are light structures where farmers provide local livestock carcasses. Station type and associated variations in management can influence spatial and temporal predictability of carcasses and therefore their impact on vultures. However, little information is available about FS management and effectiveness at the European scale.

My objective here was to conduct a systematic literature review in order to give a clear picture of management, monitoring methods and impacts of HFS and FFS, focusing on the most widespread European avian scavenger, the Griffon Vulture.

Data were extracted from 30 articles published in SCI scientific journals. I completed

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this dataset collecting station management data from European collaborators. Combining these two approaches, I managed to gather data on the management of 72 FS distributed across 10 different countries between 1969 and 2021.

Results of this work show that the annual median biomass of carcasses distributed is 19 times higher on HFS than on FFS ($28\,800 \pm 23\,800$ kg/an vs. 1540 ± 1430 kg/an). I also highlighted high variations between countries in the median biomass of carcasses distributed at HFS, with low biomass distributed in Italy compared to other countries. Overall, carcasses were supplied weekly in 65% of feeding stations ($n=32$). However, frequency of carcass inputs varied greatly between station type, reaching 3 inputs per week for 24% of HFS while carcasses were supplied only once a month in 30% of FFS. This illustrated the important variations in terms of temporal predictability of carcasses between station types.

The three most frequent monitoring methods to estimate station use were: i) direct observation following carcass inputs (35%, $n=17$); GPS monitoring of tagged vultures in order to assess foraging movements (29%, $n=17$); and the use of camera traps/webcams (24%, $n=17$).

Total biomass of carcasses available and season were the two most important variables influencing FS attendance by Griffon Vultures ($n=9$ studies).

In terms of impact, available studies show that FS do not seem to influence foraging movements as Griffon vultures showed low levels of routine and maintained their ability to exploit alternative resources.

FS can increase the probability of colonization of new territories by floaters. However, their impact on Griffon vulture population dynamics remains poorly understood. The effects of FS on population viability vary depending on the environmental context and the occurrence of other anthropogenic threats like poison.

FS type can also impact individual health in our study species. Griffon vultures relying heavily on HFS provisioned with carcasses from intensive livestock farming (swine and poultry) had poor health, i.e., high bacterial infection prevalence, frequent ingestion of antibiotics and occurrence of antibiotic resistant bacteria.

Finally, FS also had an impact on competitive interactions between avian scavenger species. High carcass biomass and the high spatial and temporal predictability at HFS tended to favour early arrival of large groups of Griffon Vultures. As a consequence, this dominant species often restrained the attendance of small avian scavengers at HFS, e.g., Red Kites or Egyptian Vultures.

This work suggests that HFS have more negative impacts than FFS on Griffon Vultures and avian scavenger communities. However, more research is needed on the impacts of FS on the population dynamics and health of Griffon Vultures across Europe. Improving FS management considering food availability in local ecosystems and conservation context is crucial to enhance the positive impact of such conservation measures on European avian scavengers.

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Supplementary feeding and ecosystem services: Methodologies to quantify scavenging services and carrying capacity

Julien Terraube, Vulture Conservation Foundation – VCF, Sandstrasse 2, CH-8003 Zürich, Switzerland

Food availability is too rarely assessed before creating new feeding stations (FS) or after their establishment in order to evaluate their effectiveness in meeting vulture energetic requirements. Few guidelines are actually available to evaluate ecosystem carrying capacity for vultures, which can restrict the implementation of such assessments. We identified six steps aimed at estimating food availability for Griffon Vultures in the context of local conservation projects. First step focuses on delineating as accurately as possible the study area, for example determining home range of local vultures tagged with GPS transmitters or using buffers around breeding colonies. Second step aims at estimating carcass consumption, taking into account Griffon Vulture local population size, energetic requirements and average weight of the main livestock species occurring in the study area. Third, government records on annual livestock numbers can be collected for each municipality included in the study area. Fourth, in all European countries veterinary services should be able to provide records of livestock carcasses collected by official carcass disposal. Using data from steps three and four, livestock mortality rates can be estimated at the national scale. This will allow evaluating the number of dead livestock available in each municipality included in the core foraging range of monitored vultures. In certain areas, wild ungulates can be important alternative resources for Griffon Vultures and therefore need to be taken into account during assessments of ecosystem carrying capacity. Collecting available data on average weight and annual mortality rates for wild ungulate species occurring in the study area will allow computing the number of dead wild ungulates available within the study area.

Final output would be the total number of carcasses (livestock and wild ungulates) required per vulture population (considering the number of individuals in the population and their energetic requirements) and per year.

However, seasonal variations in food availability and energetic requirements should be taken into account during such assessments. For example, in mountain areas, transhumance is linked to a sharp increase in the number of livestock carcasses during summer while energetic requirements of Griffon Vultures peak much earlier during the chick-rearing period in late winter and spring. It is crucial to consider such mismatches in ecosystem carrying capacity in order to adapt FS management to the actual energetic requirements of local vulture populations.

A last step should be to investigate if all the estimated carcasses are actually available to vultures. Information on the type of farming systems carcasses originate from and on potential legislative barriers can help assessing if vultures will have access or not to the estimated meat biomass. Mainstreaming this type of assessment to all vulture conservation projects in Europe is crucial to improve FS management and amplify conservation impacts.

Coordinating Beneficiary

Università degli Studi di Sassari

Via Vienna 2 | 07100, Sassari

mail: lifeforvultures@uniss.it | tel: +39 079 229904

www.lifesafeformvultures.eu

Associated Beneficiaries

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Progetto LIFE19NAT/IT/000732

LIFE SAFE for VULTURES

First step to the restoration of the vulture guild in Sardinia

Primo passo verso il ripristino della gilda dei vulturidi in Sardegna



The activities of the CFVA in the project and the relationship with the territory

Commissario Superiore Giovanni Tesei, Regione Autonoma della Sardegna – Corpo Forestale e di Vigilanza Ambientale – CFVA, Via Dante, 37 - 07100 Sassari

According to the aim of this meeting, this presentation regards the role of CFVA in the project “Life Safe for Vultures” and the relationships with territory. Thanks to the project Life Safe for Vultures, it was possible set up four Dog Units for poison searching composed by CFVA personnel and dog conductor of Veterinary Department of University of Sassari. The four Dog Units are located in Sassari, Oristano, Nuoro and Cagliari. Beside searching poison bait two Dog unit (Oristano and Sassari) have the task of checking a power line (action D.4) which will be made safe from electrocution risk. The most dangerous power lines have been selected after a risk assessment conducted by University of Sassari and E-distribuzione. The power line is located in the centre of the areal of the indigenous Griffon population. The Monitoring consist of randomized patrolling along track of power line before and after protecting works. Anyway, the main task of the four Dog Unit is patrolling the most of area which are expected to be explored by the captive-bred specimens which will be released with restocking (Action C.6). Moreover, Dog Units can be activated on call for inspection on suspected poisoned site. The patrolling results after the first year of project (2022) are the following:

- 43 preventive inspections
- 4 inspections on call
- 264 km were walked by feet

Beside poisoned bait searching, patrolling is undoubtedly a significative action for

- dissuasion
- environmental education
- strengthen moral of staff and personnel
- promotion and dissemination to rural communities

In particular promotion and dissemination to rural communities have the purpose of develop consciousness that vultures aren't predators, though they are raptors which in most of cases are. Anyway, taking account on that illegal actions against wildlife are always forbidden and dangerous for environment. This action is definitely important and maybe the most challenging because it requires to keep in strict contact with rural communities, especially all people such as shepherds and breeders who often live far away from main settlements.

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