

## Bearded Vulture European Endangered Species Programme (EEP): Annual report 2022

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### SUMMARY

In 2022, 47 Bearded Vulture pairs laid 73 eggs, from which 31 hatched and 27 survived. From these 27 fledglings, 14 came from the specialized captive breeding centres (23 breeding pairs), and 13 from Zoos, recovery centres and private collections (24 breeding pairs). 15 fertile eggs didn't hatch, and 3 chicks died.

7 from 11 experienced breeding pairs that failed in 2021, didn't reproduce a chick in 2022, showing an aging effect as several breeding pairs are more than 30 years old. On the other hand, 5 new pairs reproduced with success for the first time in 2022.

14 nestlings have been released in the wild and 13 kept for the captive breeding network with the goal to increase the EEP breeding capacity in a near future.

A new protocol has been put in place whereby blood is taken from all nestlings at the age of 90 days. The aim is to obtain reference values for each of the different blood parameters, so that in the future it will be possible to determine the health status of a young Bearded Vulture in a more accurate way.

There has been an unusual high mortality inside the EEP (15 birds), being not possible to obtain the goals established for the EEP in 2022. Preliminary results on the causes of this high mortality rate show that climate change is playing an important role (long periods with high temperatures and propagation of vectors like mosquitos that carried West Nile Virus).

The second trial of the study about the effectiveness of the equine WNV vaccine in Bearded vultures was done in 2022. 14 birds of the Breeding Centre from Vallcalent were vaccinated against West Nile Virus. None of them showed adverse effects.

Unfortunately, avian influenza is playing an increasingly important role in the successful development of the EEP. A Bearded Vulture has died due bird flu infection for the first time and three birds could not be transferred because of restrictions.

13 from the 19 previewed transfers were done (3 could not be done because of bird flu restrictions in France, 2 for illness and 1 because the breeding season had already started).

Housing capacity inside the EEP has been increased with the construction of a new middle-large specialized breeding centre in Parc Animalier des Pyrénées (France). Further, two new aviaries have been constructed in Richard Faust Zentrum (Austria), six in Centre de Fauna Vallcalent (Spain), four of which were financed with LIFE GypRescue project budget, and four new small aviaries for keeping birds separately have been constructed at the Guadalentín Breeding Centre (Spain).

Thanks to the financial support from EEP zoos and other organizations, the VCF managed to establish an effective EEP coordination which kept the specialized breeding centre Vallcalent in Catalonia open for 2022 - we thank you for your support, without this the future of the Bearded Vulture in Europe would look bleaker!

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## INTRODUCTION

In 1978, the Bearded Vulture Reintroduction Project started in the Alps (FZG 832/78; WWF 1567/78) based on a captive breeding programme. This Bearded Vulture captive breeding network has been included in the European Endangered Species programme (EEP) since the EEP began, and is a VCF-coordinated network of zoos, animal parks, captive breeding centres and private collections aiming to breed this species in captivity for conservation purposes. In 1978, it was clear that only offspring from Zoos could be used, because the autochthonous populations were threatened. At that time nearly 40 Bearded Vultures were still distributed throughout European zoos, including only one successful breeding pair. From the beginning, it was possible to convince all European zoos to cede their birds for this conservation goal and to transfer most of these birds to the Richard Faust Centre in Austria. Paired birds and juveniles went back to the zoos, and so from 1978-1985 the European breeding network emerged and was a precursor of the later established EEP.

One of the first objectives of the Bearded Vulture captive breeding program was to ameliorate the breeding success of the captive population. This would primarily satisfy the needs of the zoos, stop the importation of wild birds and assure a minimum production of chicks per year for the release. To achieve this first objective a breeding centre was created on the outskirts of Vienna, Richard Faust Breeding Centre (RFZ) with the function to coordinate the whole program, to study behaviourally problematic birds, obtain information about the needs of this species to maintain in captivity in well conditions, to reproduce with them and finally develop the housing guidelines for this species. When birds were paired and juveniles were produced at RFZ, they went back to the zoos, and so from 1978-1985 the European breeding network emerged and was a precursor of the later established EEP.

The Bearded Vulture EEP network is composed of a vast number of different types of institutions: private and municipal Zoos, private collections, NGO and Governmental wildlife recovery centres, and several of them are not EAZA (European Aquaria and Zoo Association) members. That's why an international foundation structure (Vulture Conservation Foundation) was created to make sure that all partners accept, respect, and follow the guidelines of the EEP. The Vulture Conservation Foundation's final goal is to restore the species across its former range in Europe, and establish a European Bearded Vulture meta-population, with connections between the current European autochthonous isolated populations (Pyrenees, Corsica and Crete) with the reintroduced populations, in a continuum that goes from northern Africa (Morocco) to Asia (Turkey & the Caucasus).

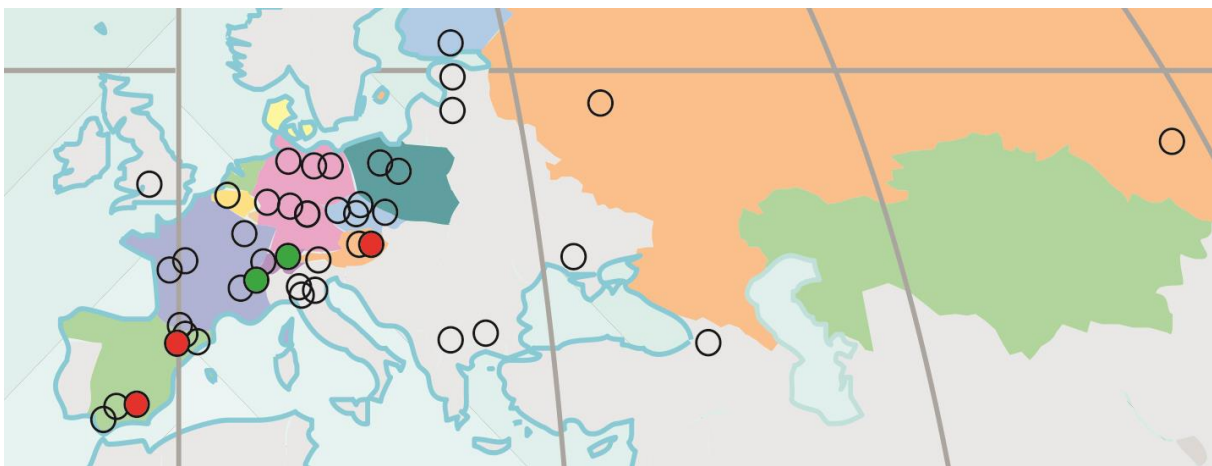
The goals of this program are to create a captive stock as genetic reserve and at the same time build an ex-situ genetic reserve from European autochthonous endangered populations (Pyrenees and Corsica). Further to produce chicks able to reproduce as they get sexual maturity and appropriate for the reintroduction, because the final goal of the captive network is the conservation in situ, establishing a wild population capable to survive and reproduce, independently of human intervention. That's why the Logo of the Bearded Vulture EEP is: Quality before Quantity.

Because pair formation in Bearded Vultures can be complicated and dangerous, the EEP decided that it was necessary to create a distinction between centres dedicated exclusively to breeding (zoos and private centres) and centres dedicated to breeding and pair formation (Specialized Breeding Centres: SBCs). The role of the former is to house already established pairs and to breed the maximum number of offspring from them, while the latter, is where specialized staff are responsible for establishing new pairs, taking in new founders (injured birds from the wild), adopting chicks, housing problematic birds, and creating a genetic reserve by receiving specimens from all genetic lineages that make up the EEP. Further in 2018 regarding the losses that the EEP

## Bearded Vulture EEP: results for 2022

suffered in 2017 (West Nile Virus and aspergillosis), it was necessary to draft a new bird distribution strategy between the Specialized BV captive breeding centres (SBC). This distribution takes in account the potential, resources, geographical location and the specialization of each SBC, and additionally its supply capacity on birds for the vicinity reintroduction projects.

Thanks to this structure the number of yearly produced chicks increased continuously having currently a captive stock from 172 birds -88.95% of these are owed by the VCF- distributed in around 34 (mainly European) zoos, 3 recovery centres, 2 private keepers, and 3 large (red spots) and 2 smaller (green spots) specialized captive breeding centres. The VCF owns 88.95% of these (n= 153; 71 males & 82 females). From these 172 birds, 81 are males with an average age of 16.0 years old (range from 44 years to 2 years old) and 91 females with an average of 15.0 years old and with a range from 45 years to 1 year old (see table 1 & 2 in Annex).



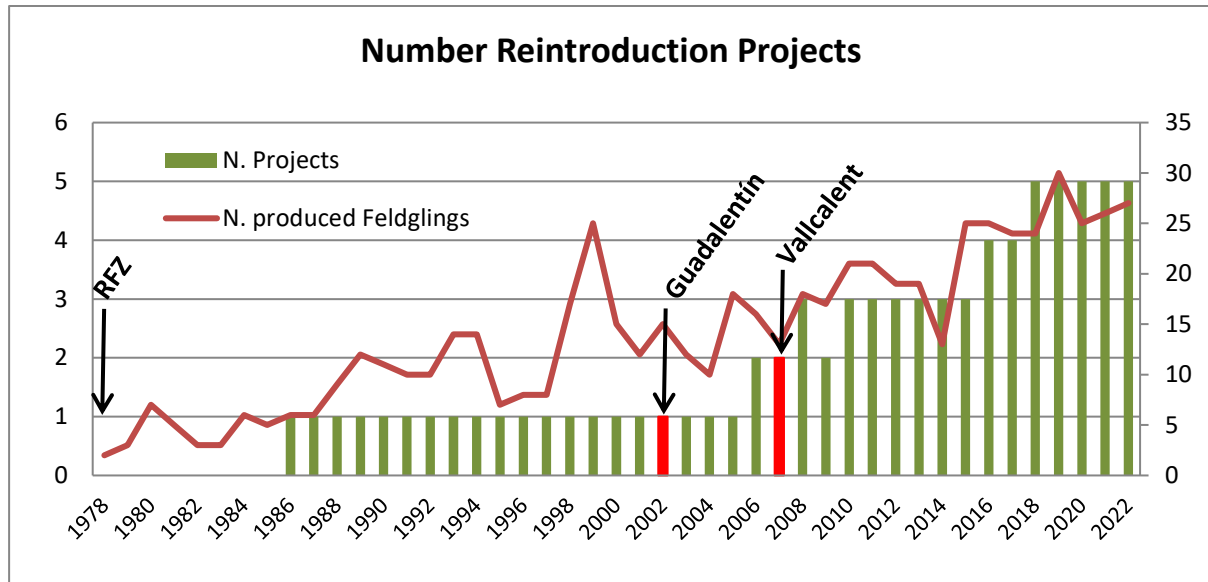
*The distribution of the captive stock over many Zoos lowers bulk risks, e.g. epidemic diseases (December 2022).*

The yearly increase on chicks' production makes possible to expand the initial goals and start other reintroduction projects. Nevertheless, it took 20 years between the first release in the Alps, which took place in Austria in 1986, and a second reintroduction project could start. This was in Andalusia in 2006. Afterwards the waiting time for starting a new project has significantly shortened, being possible in 2008 to start a third reintroduction project in Sardinia. Unfortunately, it was necessary to stop the project at the same year because of different internal/release problems. In 2012 Grands Causses (France) could receive first nestlings and three years later a reinforcement project started at the Corsican Island where the population is near verge of extinction. The last but not the least reintroduction project started in 2018, in Maestrazgo (Spain), with the goal to establish a bridge between the Andalusian reintroduced population and the wild Pyrenean one, the same as Grands Causses for the Pyrenean and the Alpine population.

The substantial increase in number of projects over the last decade is due to the presence of two new Specialised Breeding Centres (see graphic below). Further, thanks the new advice service from the VCF, giving the opportunity EEP-partners after request to receive in situ a visit from a specialist, to help ameliorate the housing conditions and train the staff, the average age of death during the last 10 years at the Breeding Centres (zoos, private collections and recovery centres) could be increase from 15.1 years old (n= 69 birds; 1978-2011) to 20.8 years old (n= 39 birds; 2012-2022). Additionally, all new partners before receiving birds need to have aviaries which follow the housing guidelines of the EEP. All above mentioned made it possible to reduce the death of birds and increase the captive population and the number of breeding pairs. However, with all this effort, it has not been possible to ameliorate the breeding success at the zoos (0.41 fledglings/breeding pair), more than half

## Bearded Vulture EEP: results for 2022

as low as in the SBCs (0.95 fledglings/breeding pair). This is due of the special reproduction biology of the species (late sexual maturity, high level of aggressiveness during breeding season, cannibalism behaviour by chicks, special diet and feeding behaviour of chicks, etc.) and that zoos, by holding in average only one breeding pair, it takes many breeding years for them to gain experience.



Since 1986, where first release took place in Austria, 381 nestlings have been used for in situ projects: in the Alps (243), Andalucía (82), Grands Causses (32), Sardinia (3), Corsica (10), Maestrazgo (11). The rest of the produced birds were included in the captive breeding network (257). The first reproduction of Bearded Vulture in the wild occurred in 1997 (France) and, until 2022, 402 nestlings have fledged in the Alpine mountains, more than released birds. In 2015 a great event was achieved by the Andalusia Bearded vulture reintroduction project: after nine years of releases the first chick hatched in the wild from a female that was only five years old. Until 2022, 11 fledglings have been produced in the Andalusian mountains. Furthermore, in 2022, in the framework of the LIFE project GypConnect, a pair in Vercors release site (French pre-Alps) produced its first chick which fledged with success.

## BREEDING RESULTS 2022

During the breeding season 2021-2022, most of the experienced breeding pairs that failed in 2021 (both breeding pairs from Tierpark Friedrichsfelde, the pair from Nuremberg, Parco Natura Viva, Schönbrunn and from Chomutov zoo, the young pair from Ostrava Zoo, one pair from Tierpark Goldau, two pairs in Richard Faust Zentrum and one pair in Vallcalent), failed again in 2022. Only four from 11 produced a chick (young pair from Ostrava Zoo, Parco Natura Viva, one pair from Tierpark Goldau and one pair in Vallcalent). From the seven that have failed, five are composed of aging individuals (>30 years), which will increasingly fail in the future. On the other hand, of the six pairs which bred with success for the first time in 2021 (Beauval, Helsinki, Puy du Fou, one pair at Richard Faust Zentrum, Guadalentín and Asters respectively), four have successfully reproduced again in 2022. Additionally in 2022 five new pairs produced for the first time a fledgling (Monticello centre, Belgrade Zoo, and one pair in Asters, Guadalentín and Richard Faust Zentrum respectively). These new pairs make possible to

## Bearded Vulture EEP: results for 2022

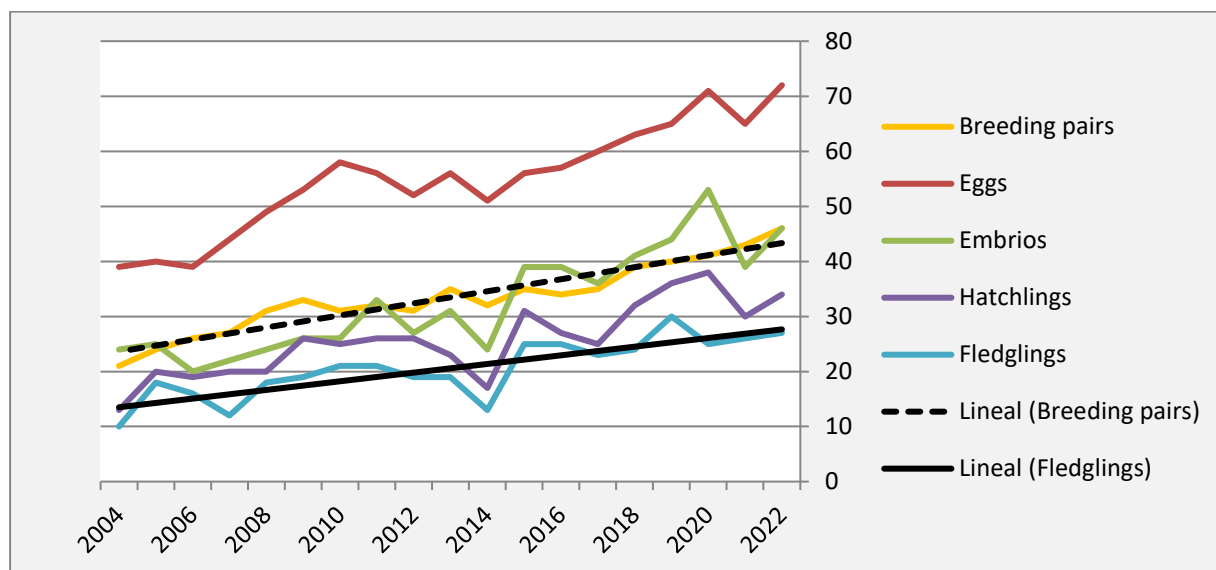
maintain similar breeding parameters as in previous years and even surpassing the 25 produced chick's barrier established in 2015.

In conclusion, in 2022, 47 bearded vulture breeding pairs laid 73 eggs, from which 31 hatched and 27 survived, one more than last season, so the trend continues being positive. Of the four that have not survived, one died 10 days after hatching because of several neck vertebrae malformation being not able to hold the head and take food from its parents. Two hatchlings disappeared in the nest: one, a few hours after hatching, was seen being eaten by its parents and the second disappeared 3 weeks after hatching. And the fourth disappeared during the night after adoption by an experienced breeding pair. Of the remaining 42 eggs, 15 were fertile. From these, three aborted during the hatching process, 5 just before internal pip and the remaining 7 eggs aborted in different incubation's stage.

In the previous two years, due to the restrictions caused by Covid 19, the releases took priority over the breeding programme, to ensure that all partners involved in the reintroduction projects could continue their in-situ conservation activities. Consequently, the number of individuals included in the EEP was minimal, far from covering the losses in both years (in 2020 4 birds were included in the EEP and there were 5 losses; in 2021 2 birds included in the EEP and 9 losses). That's why for 2022, it was accorded prioritising the breeding programme over releases, to counteract the low incorporations in previous years, and thus prevent to have a negative impact for the breeding program in the future.

For the above reasons, from these 27 survived fledglings, only 14 nestlings were used for release: four in Andalusia, four in the framework of the LIFE project GypConnect (two in Grands Causses and two in Baronnies), two in Switzerland, two in Germany (Berchtesgaden, a new release site included in the Alpine project), two in Corsica and two in Maestrazgo, and the remaining 13 birds were added to the breeding network (three females). From these 27 fledglings, 14 came from the specialized captive breeding centres (23 breeding pairs), and 13 from Zoos, recovery centres and private collections (24 breeding pairs).

The breeding results from 2022 shows that the Bearded Vulture EEP has a solid base and, even if several experienced couples fail, it has a positive trend, with forecasts for the coming years being very encouraging (see figure).





## Bearded Vulture EEP: results for 2022

### Specialized captive breeding centres

- Richard Faust Bartgeier Zuchtzentrum (RFZ) - Eulen- und Greifvogelstation Haringsee (EGS).

The RFZ, headquarters of the EEP and with a captive stock of 30 birds on the 31<sup>st</sup> of December 2021, is specialized in the reproduction with founder birds. Further RFZ was responsible to establish the guidelines for captive breeding of this species and to determine the best release method for Bearded Vultures.

As mentioned before, in the breeding season 2021/22 most of the experienced pairs didn't manage to produce chicks, and this is what happened in RFZ, where three of the most experienced pairs of the breeding programme failed and only the pair consisting of BG017 and BG070 succeeded in producing one chick. However, this is the chick number 40 of this pair, becoming the pair that have produced more chicks in the history of the EEP. On the other hand, one pair, BG857 x BG835 laid an egg and produced a chick for first time. The chick had hatching problems, becoming the female nervous, taking the hatching egg with the beak and placing the egg on the nest edge. The egg was immediately removed and exchanged with a dummy egg. The egg was heavily crushed in the area where it was pecked (see picture). The chick needed assisted hatch, being extracted finally at midnight when the blood vessels were completely dry. It was extremely oedematous, also in the navel area and the whole abdomen and neck. Even the legs were oedematous. The hatchling, BG 1157, was treated with antibiotics (Enrofloxacin) for 3 days as prevention of possible infection. It was adopted by the old female BG006.



*BG1157, the chick which needed human help just before being adopted.*

## Bearded Vulture EEP: results for 2022

The pair BG681 x BG560, that produced their first and last chick in 2019, this year both eggs showed to be fertile and produced two chicks.

More pairs laid eggs than last year. In total, nine pairs produced twelve eggs, (four more pairs laid eggs than in 2021). Three of those eggs were infertile, including the egg laid by the old female BG006. Two eggs disappeared in the nest, including one of the eggs laid by the experience pair BG017 x BG070. The only egg of the pair BG087 x BG547, an experienced male and a female that has never bred before and was successfully paired for the first time last year with this male, unfortunately aborted. The old pair BG108 x BG175 laid two eggs that hatched, one in the nest and the second one with human assistance, but both died, the first one died during the night at their parents' nest and the second one, adopted by pair BG017 x BG070, also disappeared during the night.

Four chicks survived: the chick BG1135 from the pair BG017 x BG070, a male named Sperit, was released in Maestrazgo-El's Ports, in Spain. The two chicks of the pair BG681 x BG560 unfortunately died as fledglings in RFZ: BG1148 died in September due to an aspergillosis and pox virus infection (was negative in West Nile Virus), and BG1151 died in August due to aspergillosis too. The fourth chick, the female BG1157, born from the unexperienced pair BG857 x BG835 and that needed help during hatching, stayed withing the EEP network for being the first descendant of this pair.



*One of the two new aviaries built in 2022 at Richard Faust Centre (Austria).*



## Bearded Vulture EEP: results for 2022

- Centro de Cría de Guadalentín (CCG)

The CCG, with a captive stock of 26 birds at the end of 2021, is the basis of the Andalusia Bearded Vulture reintroduction project. The new pair formed last year by an experienced male and a young female, BG286 x BG580, unfortunately was dissolved in the middle of the season because the male suffered an accident and he can't jump on the female anymore. On the other hand, a new pair that was put together last season, BG590 x BG658, not only has copulated and laid eggs, but has produced two chicks. In total, eight pairs produced 16 eggs, from which 5 were infertile, 2 aborted and one died during hatching, so in total CCG produced 8 chicks these season, 4 males and 4 females.

All chicks are hatched artificially in the brooder, being the clutches from 8 pairs removed between a few days to two weeks before hatching and exchanged with dummy eggs or receive a chick for adoption. From the ninth pair, all three eggs were removed on the same laying day or the day after having laid. Artificial incubation is carried out according to the protocol established for the species, being one of its peculiarities to expose the eggs four times a day for 5 minutes at an outside temperature.



7 of the 8 fledglings were released: 1 in Maestrazgo-Els Ports, 2 in N.P. Berchtesgaden, 2 in Baronnies, 1 in Andalusia and 1 in Corsica. The last one has been kept in captivity.



*Three of the 8 produced chicks in Guadalentín Breeding Centre during their 7 days hand rearing process.*

## Bearded Vulture EEP: results for 2022

- Centre de Fauna Vallcalent (CFV)

This centre is one of the five rehabilitation stations from the Generalitat of Catalonia, located in Lleida (Spain), and has a Bearded Vulture captive breeding Unit, which is managed by the VCF through the EEP species coordinator (staff from the Vulture Conservation Foundation). One of its priorities is to get offspring from difficult birds, which did not reproduce elsewhere, regardless of quantity as is the case of the Guadalentín Breeding Centre (Andalusia, Spain). Furthermore, to treat wild recovered injured birds and to conduct studies/analyses of new treatments as well as prophylaxis.

At the beginning of the breeding season, 12 birds were housed in CFV facilities, four of them from the Pyrenees. Three pairs laid six eggs, although only one was fertile, the first egg from the only experience pair, BG297 x BG115. The other two pairs mated successfully and laid egg this season for first time, but all of them were infertile. BG371 x BG456 was paired in December of last season after they both lost their respective pairs, but no signs of pairing were seen until January 2022. Unfortunately, they started to mate just a few days before the egg laying, that is the reason why the two eggs that BG456 laid were infertile. The last pair, BG551 x BG398, showed pairing behaviour since last season, but the male didn't jump on the female's back to copulate, mating on the perches close to her instead. Short logs were placed over on the perches to facilitate the male to jump onto the female, and eventually mated successfully on 20<sup>th</sup> of January 2022, again too late, so the BG398 laid two infertile eggs.

The chick born from the second egg of the pair BG297 x BG115, BG1130 was initially adopted by the imprinted male BG368, but, after a few days, this chick, who was a little weak, was placed with his parents and BG368 adopted and raised the chick BG1133 born in Torreferrusa Rescue Centre in Barcelona.

In March, the second egg from the pair of Beauval Zoo was taken to Vallcalent, were it hatched artificially, and this chick, BG1153, was adopted by the female BG115, after separating the male BG297 and their chick BG1130.

BG1130 wasn't released because he lost the sight in his left eye due to an infection followed by an atrophy during his first weeks of life, and unfortunately died in Vallcalent in October due to an Aspergillosis infection. The female BG1133 from Torreferrusa was paired with the male from Beauval BG1153 and both were transferred to MònNatura Planes de Son, since their pair was taken to Vallcalent to investigate why they don't breed.



**Left picture:** BG368 with chick BG1133 from Torreferrusa Rescue Centre. **Right picture:** BG551 incubating his first egg with BG398.

## Bearded Vulture EEP: results for 2022

- Breeding centre Asters (Conservatoire d'Espaces Naturels Haute Savoie)

Asters' centre is located at 700m a.s.l. in Sallanches (near Montblanc, France), giving the best climatology conditions for the species, and has the function to house birds from less common blood lines inside the EEP. At the end of 2021 the centre was keeping four pairs and a ninth recovered injured bird, that has been released in 2020 in Baronnies. In January 2022 a tenth recovered injured bird released in Corsica arrived at Asters breeding centre. Six months later, the juvenile bird was transferred to Parc Animalier des Pyrénées. Of the four pairs, three consisted of adult birds and the fourth of a pair of juveniles. Of the three adult pairs, two of them laid one egg each the third pair stopped mating and building nest at the beginning of February.

The oldest pair, BG454 x BG502, laid a single clutch. On the 5<sup>th</sup> of February the chick BG1128 showed hatching problems. The egg membrane was completely dry, being necessary to remove it from the egg. After the third night the hatching had to be retired after noticing that it was too weak, being necessary to force feed it and treat it with antibiotics. Next morning, the chick was already able to hold its head and asking food with open eyes. After being warmed, fed and treated with antibiotics, it was put back and adopted immediately by his parents. The second pair, BG860 x BG622, copulated successfully this season for the first time, but they started too late, like the two pairs in Vallcalent, so the egg was infertile and exploded after one month and a half of incubation. The produced nestling BG1128, a male, was named *Rei del Causse* and release in Grand Causses.

The third pair, BG700 x BG627, although successful matings were observed, the female didn't lay. The pair bred with success the year before.

- Bearded Vulture Breeding Centre in Natur und Tierpark Goldau

At the end of 2021 the centre was keeping one adult pair, one young pair and two young females. The adult female laid one egg, but the chick died in the nest during the hatching process.

☞ **Summary** 23 breeding pairs in the specialized captive breeding centres laid 37 eggs. 14 offspring were successfully reared: 9 males and 5 females. Of these chicks, 9 were released at the following sites: 1 in Andalusia, 2 in Maestrazgo, 2 in Berchtesgaden, 1 in Corsica, and finally 1 in Grand Causses and 2 in Baronnies within the framework of the project GypConnect. 5 were kept for the EEP, although 3 of them died as fledglings.

And finally, three new pairs, one in RFZ and two in Centre de Fauna Vallcalent, produced their first clutch.

## Zoos, animal parks, recovery centres & private collections

- Zoos & animal parks and recovery centres

The Zoos play a crucial role in the EEP and the conservation of Bearded Vultures. Although the success rate is on average lower than in the specialized breeding centres, they still contribute substantially to the number of young birds raised annually. This season they produced almost the same number of fledglings as the specialized breeding centres. Furthermore, by maintaining a captive stock distributed in several separate locations, we decrease the risks (for example, in case of epidemic diseases). In addition, by showing this species as well as publicizing the in-situ conservation efforts to large audiences in several countries, they contribute significantly to raise public awareness about the species. The zoos help to build core support for vulture conservation that would otherwise be impossible to achieve.



## Bearded Vulture EEP: results for 2022

On the 31st of December 2022, 33 zoos (mostly European), two recovery centres and one private collection housed 90 birds.

During the breeding season 2022, Belgrade Zoo, Helsinki Zoo, Parco Natura Viva Zoo and Puy du Fou produced respectively 1 chick each, meanwhile Beauval Zoo, Ostrava Zoo and Tallinn Zoo produced two. Regarding the recovery centres, Green Balkans (Bulgaria) and Torreferrusa (Spain) had one chick each. The pair of the private collection of Montowl (Italy) manage to produce one fledgling this year, after losing the two chicks during their first days of life in previous years. In Liberec Zoo a chick was born with several problems (malformations of several distal neck vertebrae) and died after 10 days, and another one died during hatching. One more chick died in Ostrava Zoo during the hatching process. For the third year in a row Tallinn Zoo followed the Nest-Box protocol established in 2020 during the pandemic to rear their two chicks, due to difficulties in transferring the chicks for adoption to other centres.

This high and similar breeding success at the zoos like at the Specialized Breeding Centres (24 laying pairs produced 13 fledglings and 23 breeding pairs produced 14 fledglings respectively), is thanks to the direct supervision of the EEP coordinator, who supported 5 zoos/private collections making possible to produce 6 chicks (Beauval Zoo 2, Belgrade 1, P.N. Viva 1 (double adoption), Puy du Fou 1 and Montowl 1). The coordinator's support consisted of daily advice at least twice a day on the exact amount of food that the team of each institution should offer to the chick in question, to ensure that the chick was kept alive, but still hungry enough to ask for and encourage the parents to feed it, so that the parents could learn how to feed the chick correctly.



**From left to right, from up to down:** 1<sup>st</sup> Beauval Zoo egg being assisted in hatching by the EEP coordinator through video WhatsApp. 2<sup>nd</sup> Beauval chick, hatched and reared at Vallcaient. One day old Belgrade Zoo hatchling BG1142. Montowl chick BG1150 just after hatching and Parco Natura Viva chick BG1143 on its adoption.



## Bearded Vulture EEP: results for 2022

At Beauval Zoo, for the first time the pair produced two chicks, and the first hatchling could be reared by its own parents. The second egg was transferred to CF Vallcalent where the hatchling was reared. Belgrade Zoo and Montowl private collection produced for the 1st time a chick (see pictures above). The chick from Montowl, after 3 weeks hand-rearing avoiding human visual contact, was transferred to Parco Natura Viva, it was adopted by the female, which was already rearing her own chick. She has been able to rear two chicks for the first time.

The breeding pairs from Berlin Zoo, Tierpark Friedrichsfelde Berlin, Alpenzoo Innsbruck, Chomutov, Frankfurt, Nuremberg, Pairi Daiza, Parc Animalier des Pyrénées, Parc des Oiseaux, Poznan, Prague and Schönbrunn zoos failed to produce a young, as well as the young pair from Liberec. Furthermore, the old pair from Tierpark Friedrichsfelde Berlin, BG294 x BG292, were both predated.

**Summary** 24 breeding pairs in the zoos/recovery centres laid 36 eggs, just one more egg than last year. From the 36 eggs, 25 showed to be fertile and 16 hatched. 13 nestlings fledged with success (10 males and three females). 5 of them, all of them males, have been released (1 in Grands Causses in the framework LIFE project GypConnect, 1 in Corsica, and 3 in Andalusia). The remaining five, 2 males and 3 females, have been kept for the EEP. The one from Montowl died in October, probably because of an Aspergillosis infection.

In conclusion, in 2022, 47 bearded vulture breeding pairs laid 73 eggs, from which 31 hatched and 27 survived (see Table 3 in Annex - Breeding pairs in 2022). From these 27 survived fledglings, 14 nestlings were released: four in Andalusia, four in the framework of the LIFE project GypConnect (two in Grands Causses and two in Baronnies), two in Switzerland, two in Germany (Berchtesgaden, a new release site included in the Alpine project), two in Corsica and two in Maestrazgo, and the remaining birds, 13, were added to the breeding network (see Table 4 in Annex – Offspring in 2022). From these 27 fledglings, 14 came from the specialized captive breeding centres (23 breeding pairs), and 13 from Zoos, recovery centres and private collections (24 breeding pairs).

Out of the 42 not hatched eggs, 21 were infertile, 3 putrefied, 3 unknowns (broken and disappeared in the nest), 12 aborted and 3 died during the hatching process.

### Breeding results 2022 overview:

	Pairs	Eggs	Fertile E.	Hatchlings	Fledglings
<b>SBCs:</b>	<b>23</b>	<b>37</b>	<b>21</b>	<b>18</b>	<b>14</b>
Richard Faust	9	12	7	6	4
Guadalentín	8	16	11	9	8
Vallcalent	3	6	1	1	1
T. Goldau	1	1	1	1	
Asters	2	2	1	1	1
<b>BCs:</b>	<b>24</b>	<b>36</b>	<b>25</b>	<b>16</b>	<b>13</b>
Zoos	21	31	22	13	10
Priv. collection	1	1	1	1	1
R. centers	2	4	2	2	2
<b>TOTAL</b>	<b>47</b>	<b>73</b>	<b>46</b>	<b>34</b>	<b>27</b>

Bearded Vulture EEP: results for 2022

<i>LOSES</i>	<i>incubation (fertile eggs)</i>	<i>before internal pick (fertile eggs)</i>	<i>hatching</i>	<i>adoption</i>	<i>rearing</i>	<i>Total</i>
<i>SBCs</i>	1	2	1	2	1	7
<i>BCs</i>	6	3	2		1	12
<i>TOTAL</i>	7	5	3	2	2	19



Hansruedi Weyrich ©

One of our protagonists photographed by Hansruedi Weyrich.

## Bearded Vulture EEP: results for 2022

### TRANSFERS / INCREASES / LOSSES

#### Transfers

The final goal of bird transfers is to increase the genetic variability of the captive stock, and at the same time assure in the long term a minimum number of chicks produced per year to satisfy the ex-situ (captive breeding network, EEP) and in-situ (birds release) needs. Therefore, the number of breeding pairs must at least be maintained, and this can be only achieved by building continuously new pairs for replacing potential future losses or breeding failures and assure a minimum yearly production of chicks. In general, the pair bonding scheme is drafted at the same time when the destination of the descendants is determined; genetics and location are the most important criteria to be considered.

During 2022, 13 individuals from the 19 previewed could be transferred, 6 males and 7 females, between 12 different locations to build new pairs or because of reconstruction of aviaries.

On the 10<sup>th</sup> of February, the female BG1020 from Liberec Zoo (2019), and located at Richard Faust Breeding Centre, was transferred to Tierpark Goldau with the goal to build a new pair with the Guadalentin male BG1152 still to be transferred.

On the 28<sup>th</sup> of February, Richard Faust Breeding Centre received the young male BG1090 from Tallin Zoo (Estonia), born in 2020, to be paired with the female BG1108. Unfortunately, this male died in November due to an aspergillosis infection.

On the 22<sup>nd</sup> of April, a wild injured female that was donated to Almaty Zoo (Kazakhstan), was transferred to Nobosibirsk Zoo (Russia) and included in the EEP with the number BG1158. There she was paired with the male BG1008.

The female BG1096 Spinella, released in Corsica the previous year and recovered on the 17<sup>th</sup> of July 2021 because of a fracture in her right femur, on the 27<sup>th</sup> of January 2022 was transferred to Asters Breeding Centre. Five months later, on the 29<sup>th</sup> of June Spinella was transferred to Parc Animalier des Pyrénées, to be paired with the male BG1154 from Tallin Zoo (Estonia).

On the 13<sup>th</sup> of September, the male BG1154 was transferred from Tallinn Zoo to Parc Animalier des Pyrénées (France), to be paired with the female BG1096.

The old female BG091 Winnie, on the 4<sup>th</sup> of October arrived at Richard Faust Breeding Centre coming from Tierpark Goldau (Switzerland), to be paired with male BG212 after his male BG060 died last year. She was one of the first birds released in Hohe Tauern National Park in Austria in 1986. She had to be recaptured in 1987 when she was found at a river shore with frozen feathers and became a reproductive female in Tierpark Goldau.

On the 7<sup>th</sup> of October the male chick BG1150, born in March in Monticello Montowl Private Collection in Italy, was transferred to Parc Animalier des Pyrénées (France). It arrived weak and showing a severe dyspnoea and died two hours later.

On the 13<sup>th</sup> of October the old pair BG201 x BG044 was transferred from Schönbrunn Zoo to Richard Faust Breeding Centre, both places located in Vienna, since the facilities in Schönbrunn have been rehabilitated.

## Bearded Vulture EEP: results for 2022

And finally, the pair BG662 x BG668 was transferred on the 27<sup>th</sup> of October from MónNatura Pirineus to Centre de Fauna de Vallcalent Breeding Centre, to study the reasons why this pair hasn't reproduced yet. In exchange, they received on the 19<sup>th</sup> of November two young birds: the male BG1153, transported as egg from Beauval Zoo in France to Vallcalent Breeding Centre to be raised there by a foster pair, since his parents have a chick already, and the female BG1133 Guka, born in Torreferrusa Recovery Centre and transferred to Vallcalent as a young chick for the same reason, to be raised by a foster pair.

Three from the six remaining birds could not be transferred because of bird flu restrictions. Since summer, bird flu restrictions in France made it impossible to transfer one juvenile from Puy du Fou, one juvenile from Beauval Zoo and an immature handicapped bird from Asters to Richard Faust Zentrum (Austria). The transfer had to be postponed several times, being now accorded to try it beginning 2023. Another juvenile bird could not be transferred from Richard Faust Zentrum to Parc Animalier des Pyrénées because the bird becomes sick from pox virus infection. Furthermore, an immature bird BG1044 from Tallinn Zoo and located at Richard Faust Zentrum could not be transferred to Vallcalent centre because it becomes sick from aspergillosis infection. And finally, the male BG1152 from Guadalentín breeding centre: it was not possible to remove the bird without disturbing the breeding pairs, because the breeding season already started, being necessary to postpone the transfer as soon as the breeding season finished.

### Increases:

In 2022, 13 juvenile reproduced birds (9 males and 4 females) have been included in the EEP, with the goal to increase the breeding capacity of the EEP (see table 4 in annexes for more details). Furthermore, one wild injured female that was donated to Almaty Zoo, probably born in 2013-2014, could be transferred to Novosibirsk Zoo and included in the EEP, with the goal to try pair bonding with an adult founder male housed at Novosibirsk Zoo.



*One of the 13 produced chicks included in the EEP (2<sup>nd</sup> chick from Beauval Zoo at CF Vallcalent).*

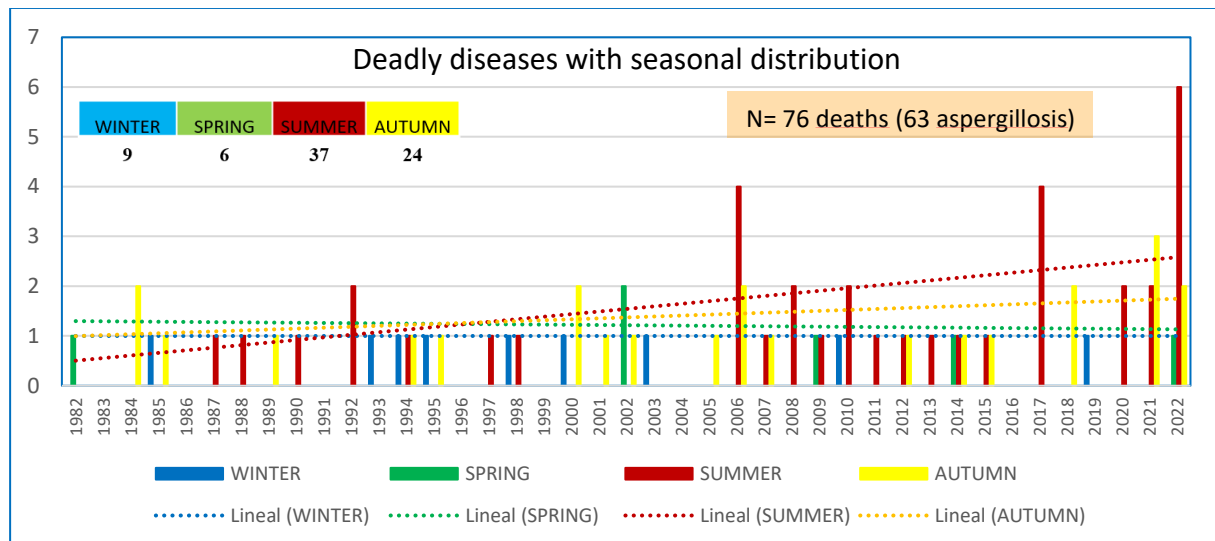


## Bearded Vulture EEP: results for 2022

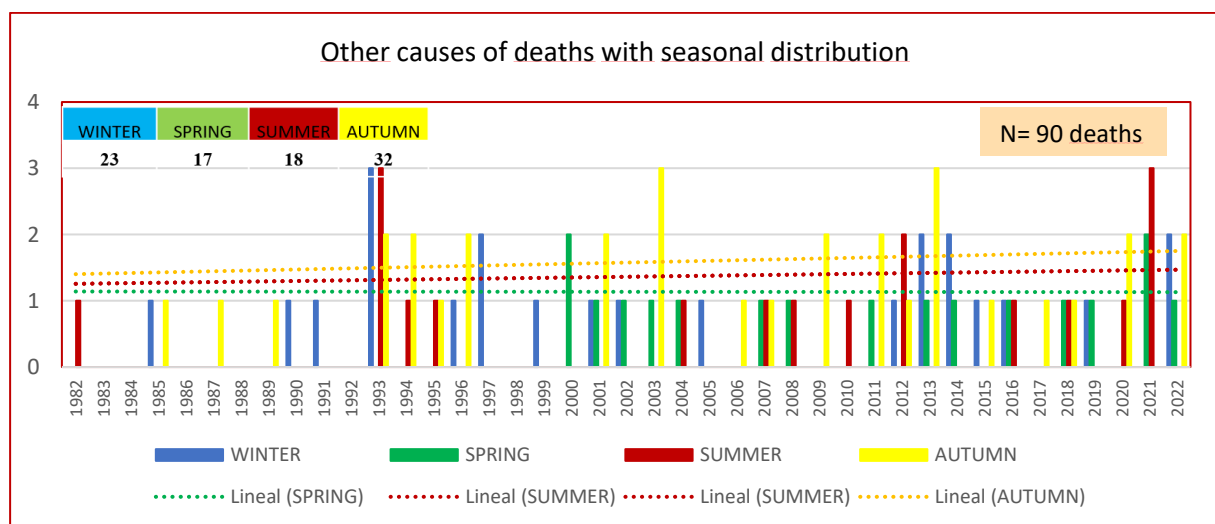
### Losses:

During 2022, 15 birds died within the EEP network, which is the highest number of losses in one year to date, 11 males and 4 females. 6 of them died because of different causes: an old breeding pair have been predated by scaped yellow-throated marten (Tierpark Friedrichsfelde), one adult female died after second surgery trying to fix the Achilles tendon that had slipped off the heel (private collection in Wales), two birds had to be euthanized (one old male because of senility at RFZ and one 5 years old male because suffered on a severe osteomyelitis on both claws at CFV) and one adult male died after a collision in the aviary (Frankfurt zoo). The remaining 9 birds died because of diseases. Eight of them showed respiratory problems and the last one died because of bird flu (Cordoba Zoo). It has been the first time that avian flu has been the cause of the death of a bird in our collection.

A study has been carried to analyse these deaths, coming to the results that most of the birds which died because of a disease has been during the summer and autumn, being known that most of the birds that died in autumn had become sick in the summer.



On the other hand, deaths from other causes have occurred at any time of the year.



## Bearded Vulture EEP: results for 2022

In conclusion, high summer temperatures cause environmental stress that negatively influences the immune system of our birds, making them more vulnerable to becoming ill from aspergillosis infection. Aggravating that, this year we have suffered on exceptional long high heat waves, promoting in addition the spread of vector-borne diseases like West Nile Virus, it is understandable that more birds have suffered from this extreme situation, and that the mortality rate has increased significantly by 2022. Unfortunately, with the climate change, these kinds of hot summers will become more often, being necessary to find building solutions on the aviaries to promote better airflow and protect our birds against WNV using vaccines.

In relation to the EEP chick's production capacity, thanks to the still existing high number of potential breeding pairs, these losses will have low impact in the short term on the potential breeding capacity of the programme, but will have a severe impact in the long term if they are not replaced within a short period of time. To maintain in long term the breeding capacity inside the EEP, it will be necessary to take special attention on the EEP needs in the coming years.

On the 25<sup>th</sup> of January, the 23 years old male BG294 died at Tierpark Berlin Friedrichsfelde predated by a yellow-throated marten scaped 2 months ago from its enclosure. Unfortunately, his female, BG292, also 23 years old, died on the 31<sup>st</sup> of the same month for the same reason. This pair produce 14 offspring in 16 years and acted as foster pair as well.

On the 26<sup>th</sup> of May, the 7 years old female BG859 died at Cordoba Zoo (Spain) due to bird flu H5N1. His male had died the previous year because of Aspergillosis, so this zoo has lost his only pair.

On the 16<sup>th</sup> of June, the 5 years old male BG972 Flamadel had to be euthanised in the specialised breeding centre of Vallcalent (Spain) due to a severe osteomyelitis in both claws after a chronic pododermatitis. Flamadel was removed from his nest in Pyrenees in 2017 being around three months old because he was limping. He was taken to recovery centre LPO Hérault and shortly after transferred to CF Vallcalent. He had a severe fracture of his left leg and had several surgeries in Vallcalent and AMUS recovery centre. Unfortunately, he developed pododermatitis that led to severe complications, being necessary to euthanise him.

On the 8<sup>th</sup> of August, the 4 months old male BG1151 was found dead in front of the nest platform, at Richard Faust Breeding Centre, after two days of staying there accompanied by the foster male. He didn't show any symptom of sickness before. The necropsy revealed that the cause of death was aspergillosis.

On the 20<sup>th</sup> of August, the 7 years old male BG830 died at Moticello Montowl Private Collection (Italy) due to an aspergillosis infection, having a secondary mycobacteria infection too.

On the 1<sup>st</sup> of September, the 5 years old female BG956 died in Green Balkans Rescue Centre (Bulgaria) because of an air sacs infection. She was found lying in the water pond and was treated during nearly one month, unfortunately without success.

On the 3<sup>rd</sup> of September, the 11 years old male BG672 died in Frankfurt Zoo because of trauma, maybe caused in a collision. He was paired with female BG576 for two years and produced one egg, but it broke in the nest.

On the 4<sup>th</sup> of September, the 31 years old male BG145 died in Richard Faust Breeding Centre because of an aspergillosis infection. The necropsy analysis was positive for West Nile Virus encephalitis, with an associated non-purulent hepatitis. This old male produces 7 young bearded vultures.

## Bearded Vulture EEP: results for 2022

On the 10<sup>th</sup> of September, the young male BG1148 died in Richard Faust Breeding Centre being only 5 months old due to an aspergillosis infection. He was negative in West Nile Virus.

On the 17<sup>th</sup> of September, another very young male, BG1130, Borni, died in CF Vallcalent because of an aspergillosis infection as well. He was negative in West Nile Virus. This bird was not released because his left eye was atrophied during the early stages of his growing, probably due to a small injury and a subsequent infection. It is worth mentioning that Borni it was the only from 14 vaccinated birds against WNV, that didn't seroconvert.

On the 7<sup>th</sup> of October, the barely six months old male BG1150 died in Parc Animalier des Pyrénées Breeding Centre (France) because of a caseous abscess in thorax and abdomen. There was suspicion of aspergillosis.

On the 8<sup>th</sup> of October, the 12 years old female BG724 died in the private collection of M. Horstmann in Wales, after second surgery trying to fix the Achilles tendon that had slipped off the heel.

On the 17<sup>th</sup> of October, the old male (at least 37 years old) BG199 had to be euthanised in Richard Faust Breeding Centre due to his age, he was showing severe signs of senility and finally would not even get up from the nest or react to its partner. He was originally confiscated from a circus in Czech Republic and was with the female BG107 during more than 26 years, producing 47 eggs, from which 23 hatched and 19 survived, being the tenth pair that has produced the most chicks in captivity.

Finally, on 5<sup>th</sup> of November, the 2.5 years old male BG1090 died in Richard Faust Breeding Centre, again due to an Aspergillosis infection. The analysis of West Nile Virus was negative.

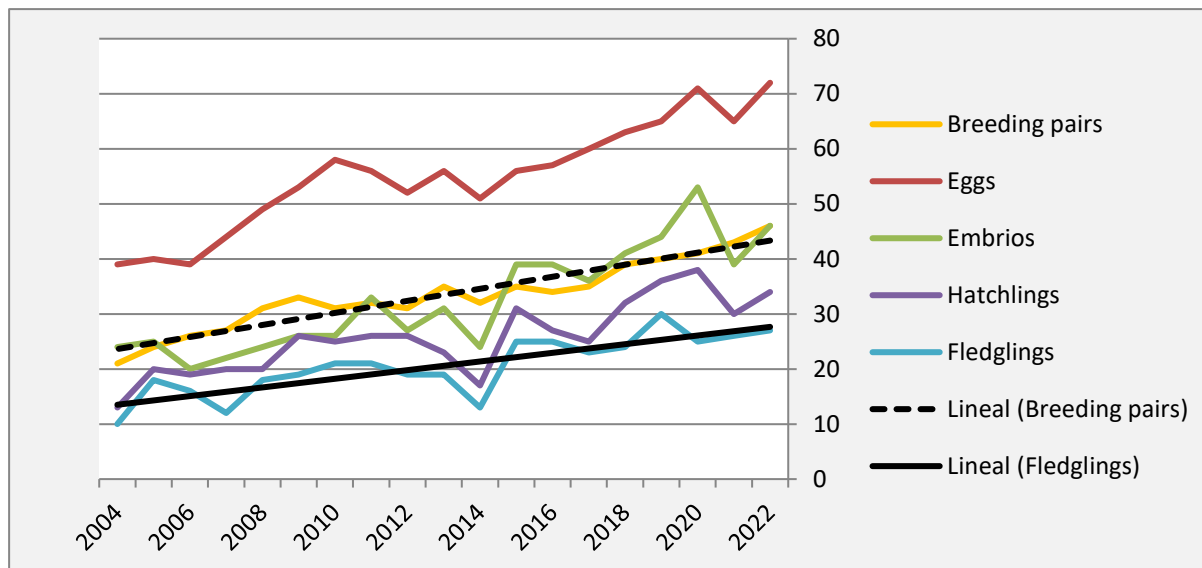
## STATUS BEARDED VULTURE EEP

On the 31st of December 2022, there were 172 birds included in the EEP (one less than 2021). From them, 81 were males and 91 females, being the average age between males and females almost the same: for males 16.0 years old (range from 44 years to 2 years old) and for females 15.0 years old (range from 45 years to 1 year old). Even though there are very old birds, the average is still very low, showing the existence of a high number of young individuals (<7 years old), what represents the 29.06% of the total captive population (22 males and 28 females). Further, the distribution of specimens in each age class between males and females are almost the same, what gives a pyramid shape on age distribution and reflects demographically a very healthy and stable captive population (see annex table 2). The actual Bearded Vulture EEP population structure makes possible to guarantee a stable yearly production on chicks covering the EEP needs and the on-going reintroduction projects as well.

But, as it has been previously mentioned, most of the experienced breeding pairs that failed in 2021, failed again in 2022. Only four from 11 produced a chick. From the seven that have failed, five are composed of aging individuals (>30 years), what will increasingly fail in the future. On the other hand, the six pairs which bred with success for the first time in 2021 (Beauval, Helsinki, Puy du Fou, one pair at Richard Faust Zentrum, Guadalentín and Asters respectively), four have successfully reproduced again in 2022. Additionally in 2022 five new pairs produced for the first time a fledgling (Monticello centre, Belgrade Zoo, and one pair in Asters, Guadalentín and Richard Faust Zentrum respectively). These new pairs make possible to maintain similar breeding parameters as in previous years and even increase them (in 2021 43 laying pairs, 65 eggs, 26 fledgelings; 2022 47 laying pairs, 73 eggs, 27 chicks fledgelings).

## Bearded Vulture EEP: results for 2022

This increase is very well reflected in all reproductive parameters, especially in the total number of breeding pairs, showing a continuous upward trend (see graphic below).



This can be possible only because every year a minimum number of produced fledglings are included in the breeding programme, replacing old pairs that have stopped breeding and even increase the total number of breeding pairs. Consequently, the annual number of produced chicks has been positively affected, with a current number >25 fledglings/year, and even with a record of 30 fledglings in 2019.

This strategy has made possible that during the last years the number of potential pairs which can produce a chick has been stable around 25 pairs (see table on the right). Also, the number of pairs classified into high, medium, and low probability to breed with success has remained stable.

Potential breeding pairs		2016	2017	2018	2019	2020	2021	2022
High probability	Number	7	6	8	7	10	10	9
	clutch	6	5	8	7	10	10	9
	hatchling	2	1	4	5	5	5	3
	fledgling	1	0	2	3	1	2	3
Medium probability	Number	13	12	11	10	6	9	11
	clutch	3	2	3	5	0	4	2
	hatchling	1	1	0	0	0	3	0
	fledgling	1	1	0	0	0	3	2
Low probability	Number	5	8	8	8	10	16	9
	clutch	0	2	2	1	1	3	0
	hatchling	0	0	0	0	0	0	0
	fledgling	0	0	0	0	0	1	0
<b>Total potential pairs</b>		<b>25</b>	<b>26</b>	<b>27</b>	<b>25</b>	<b>26</b>	<b>35</b>	<b>29</b>
N. pairs reaching sexual maturity in 1-2 years					10	10	3	6

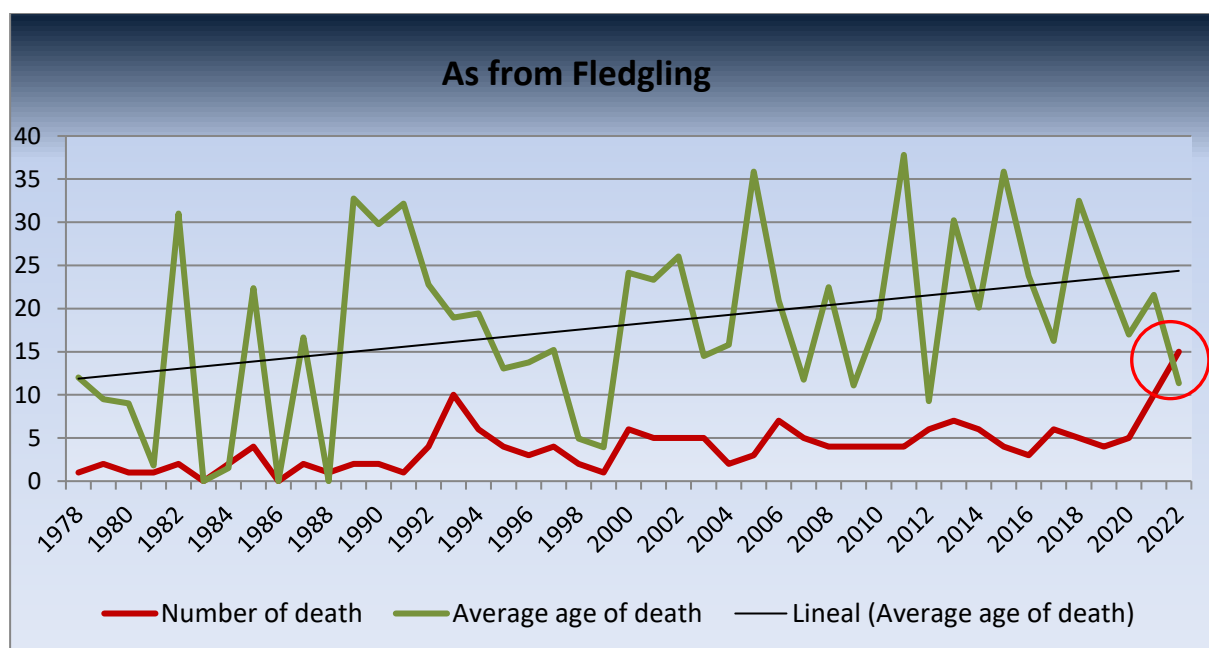
However, in 2022 the EEP suffered an unusual high number of bird losses, and most of them during the summer. In total 15 birds from different age classes have died. Nine of them because of diseases. The year before we also suffered on a high number of losses, nine birds, although it had a low impact on the EEP breeding capacity -only one breeding bird and a potential breeding individual was affected-. But this has not been the same for 2022, with a loss of 11 breeding/potential breeding birds: a full breeding pair, one breeding male, and 8 birds with a potential to be able to breed in the future (1 adult, 3 subadults and 4 juveniles). These losses will have



## Bearded Vulture EEP: results for 2022

little impact in the short term on the potential breeding capacity of the programme but will have a severe impact in the long term if they are not replaced within a short period of time.

Furthermore, in addition to the fact that mortality has increased in summer, the average age of death has decreased significantly during the last two years (see graphic below), showing that the observed diseases are affecting mainly the young population. However, we also observed that it affects adults that have been moved to areas with a high presence of aspergillosis and mosquitoes (WNV infection), showing that these birds were not adapted to the new environment.



On the other hand, the EEP was created as a basis for the reintroduction projects approved by the VCF/EEP, which entails a commitment on the part of the EEP to supply a minimum number of birds annually for all current projects. Nevertheless, the supply of birds for the projects must never jeopardize the future of the EEP and a balance has always been sought between both sides, giving priority to projects for some years and to the breeding programme for others. Following this dynamic the number of birds included in the EEP during the period 2009-2022 was as follows:

- During the EEP priority years, the average number of birds included in the breeding programme has been 10.75 individuals.
- During the reintroduction projects priority years, the average number of birds included in the breeding programme has been only 4.5 individuals, below the average number of individuals dying per year 5.64 birds, not being able to compensate the annual loss, and resulting in a negative deficit to the EEP.

Thanks to this dynamic incorporation of birds, the number of potential breeding pairs -including pairs which will arrive their sexual maturity in 1-2 years-, has been able to be maintained between 28-36 pairs, and the total number of included birds into the EEP has been higher than the number of deaths (113 to 79 respectively; period 2009-2022). Nevertheless, it should not be forgotten that the number of individuals from native European populations (n= 10 birds) and the recovered released birds (n= 4 birds), incorporated into the program has had a significant influence on the total number of birds incorporated into the EEP (14 birds; 12.39% of the total

## Bearded Vulture EEP: results for 2022

number of incorporations). However, mostly half of them (6 birds) were handicapped individuals, and four already died. Additionally, several birds died before arriving sexual maturity, being the real number of incorporation 94 individuals, what represents in average 1 incorporation per year (period 2009-2022).

In the previous two years, because of the Covid-19 restrictions, the priority to projects was further strengthened, releasing a higher number as the theoretical number assigned in a good breeding year (44 birds have been released instead the 34 agreed) and a few of them were descendants from new breeding pairs, completely against the established guidelines of the EEP. That's why in 2022 the needs of the EEP were prioritized, offering the minimum number of nestlings to every reintroduction projects so as not to affect their release dynamics.

Although 13 nestlings have been included in the EEP, the total number of birds listed in the EEP on the 31<sup>st</sup> or December was 172, one less for the date in 2021. This was due the high mortality suffered in 2022. Under this scenario, if we don't want to jeopardize the future of the EEP, and we want to ensure a similar breeding capacity in the future, in the coming years it will be necessary to pay special attention to the needs of the EEP.

## NEW BREEDING CENTRES

In 2022, most of the specialized breeding centres made a huge effort to increase their housing capacity or to be able to better manage the captive collection on their centres: Richard Faust Zentrum (Austria), Centre de Fauna Vallcalent (Spain) and Guadalentín breeding centre (Spain). Furthermore, Parc Animalier des Pyrénées (France) has been able to finish the building of the new middle-large specialized breeding centre.

### Richard Faust Zentrum (Austria)

In 2022 two additional aviaries have been built with the goal to increase the housing and its breeding capacity. Although the centre is the largest and hosts the largest number of birds (31 individuals on the 31<sup>st</sup> of December 2022), many of them are birds with a low probability of breeding or with a very low breeding rate. However, due to their genetics or their function as foster pairs, they are occupying a large part of the cages destined for the species, not being able to house additional specimens with a greater chance of reproduction.





## Bearded Vulture EEP: results for 2022

### Guadalentín breeding centre (Spain)

In 2022, four smaller aviaries (8 x 6 x 4m high) have been built outside of the breeding unit, with the goal to be able to receive birds without introducing them in the breeding unit, particularly those nestlings which are foreseen to be released in the framework of the Andalusian reintroduction project and not to be part of Guadalentín captive stock. This makes it possible to handle the incoming chicks (tagging, ringing, feather bleaching, etc.) without disturbing the rest of the birds that are still in the reproductive process in the breeding unit.



*Guadalentín breeding centre with the four new smaller aviaries outside from the breeding area, for receiving birds at any time of the year without disturbing the breeding pairs.*

### Centre de Fauna Vallcalent (Spain)

In 2022 three double aviaries have been built, almost doubling the housing capacity at the Bearded Vulture Captive Breeding Unit in Vallcalent recovery centre. Two of them have been built within the framework of the LIFE project GypRescue. The third have been constructed through VCF budget. The objective is to increase its



## Bearded Vulture EEP: results for 2022

breeding capacity. Until today, due of lack of infrastructure, its main function has been to receive and help to find solutions to birds with behavioural or physical problems coming from zoos/other institutions with no or very low breeding success. Furthermore, to receive wild recovered birds for its treatment. Consequently, there was no space for housing birds without disabilities (either physical or behavioural), being impossible to increase its chick production capacity.

All new aviaries have been provided with double high-quality video-cameras to monitor well the nest and the whole aviary.



*Vallcalent breeding centre with the three new double aviaries. The two on the left have been built within the framework of the LIFE project GypRescue. The double aviary on the right with VCF funds.*



*All aviaries have been provided with high-quality video-cameras to ensure good monitoring of future breeding pairs and their offspring.*



## Bearded Vulture EEP: results for 2022

### Parc Animalier des Pyrénées (France)

Given the problem that Bearded Vultures are very sensitive to aspergillosis infection, especially if they are exposed to high temperatures in low areas (near sea level), Parc Animalier des Pyrénées, located in the French Pyrenees, expressed in 2021 the wish to support the EEP and build a specialised breeding centre 500m from the zoo, at the foot of the Pyrenees, thus offering a place to house birds of high genetic value for the EEP (less common blood lines in the captive network), in climatic conditions that are more suitable to the species. In 2021 the construction of the new centre started and finished in spring 2022. Four double aviaries have been built and a building which includes a small office, nursery and a warehouse for storage and prepare food. The whole building process has been supervised by the coordinator of the EEP.



*A new Specialized Breeding Centre has been built at Parc Animalier des Pyrénées zoo with the goal to house birds from less common blood lines in the EEP.*

## OUTLOOK / NEWS

### STUDY EQUINE WNV VACCINE BY BEARDED VULTURES

Co-author: **Dra. Ursula Höfle**, SaBio (Health and Biotechnology) National Game and Wildlife Research Institute IREC (CSIC-UCLM) in Ciudad Real, Spain.

In the year 2008, West Nile Virus (WNV) was confirmed for the first time on postmortem in a bird that had died from aspergillosis. Since then, 11 birds suffered WNV infection and only one died from a severe acute WNV infection. All 10 remaining birds showed secondary diseases (mostly aspergillosis infection), and only two recovered after treatment.

BG	Month	Centre	Cause
104	Sep	RFZ	West-Nile virus infection / finally died because bacterial fibrinous to diphtheroid enteritis
554	Sep	RFZ	West-Nil virus infection / finally died because severe aspergillosis infection
178	Aug	RFZ	West-Nil virus infection / finally died because severe aspergillosis infection
966	Sep	RFZ	West-Nil virus infection / finally died because severe aspergillosis infection
968	Sep	RFZ	West-Nil virus infection / finally died because severe aspergillosis infection
135	Aug*	Prague Zoo	West-Nil virus infection (linage 1) (*died in February -senile decay- but WNV symptoms in August)
789	Aug	Jerez Zoo	West-Nil virus acute infection (linage 1)
142	Aug*	CFV	West-Nil virus infection + Plasmodium (*died in October but symptoms in August)
398	Aug	CFV	West-Nil virus infection + Plasmodium (only disease)
368	Sep	CFV	West-Nil virus infection + aspergillosis infection (only disease)
145	Sep	RFZ	West-Nil virus infection / finally died because severe aspergillosis infection

Faced with this new disease, which principally affects the immune capacity of the birds, the staff from Jerez Zoo proposed to initiate a study on the effectiveness of the equine WNV vaccine against WNV in Bearded Vultures. The study itself was designed and is led by Dra. Ursula Höfle.

In 2021 the study was launched with the non-breeding pair from Jerez Zoo (Spain). The vaccine used was the only vaccine licensed for commercial use in Spain: the equine vaccine against WNV from Zoetis (EQUIP WNV) that contains inactivated VM2 strain of WNV. Both birds received 3 1ml doses spaced three to four weeks apart (1<sup>st</sup> dose day 0, 2<sup>nd</sup> dose day 21 and third dose day 28 from 2<sup>nd</sup> dose). Blood samples were taken before each vaccination was carried out (day 0, 21 and 49) and a month after receiving the fourth dose. These individuals were revaccinated with a single dose twelve months later, and again a blood sample was taken prior to vaccination. Blood was centrifuged and serum separated to confirm seroconversion by ELISA and determine the neutralizing antibody titre by seroneutralization test in cell culture in biosecurity level three facilities.

## Bearded Vulture EEP: results for 2022

After observing seroconversion by the Jerez's birds, in absence of any adverse effects, it was agreed to increase the number of samples. It was decided to extend the study to Vallcalent, as its collection was composed of specimens of different ages (from 3 months to 34 years; n= 14 birds). In 2022 all birds were vaccinated against WNV according to the established protocol.

The preliminary results were as follows:

- No adverse effects were observed in any of the birds.
- All birds except for one individual seroconverted, showing a clear response in the WNV specific ELISA. The only seronegative individual BG1130 was 3 months old. This bird died a few months later from aspergillosis. Probably had a previous immunity problem.
- Those birds which were in touch with a flavivirus before the vaccination (n= 5), showed a clear Immune response, producing high concentration on neutralising antibodies.
- Juvenile birds have a lower response.
- The bird from Jerez Zoo that seroconverted with a high neutralising antibody titre maintained this titre throughout the year after vaccination.
- It is assumed that in those birds that showed a lower response it provides some protection against mortality or disease, but it cannot totally prevent infection.
- And it is advisable to use 3 doses by the first vaccination, as it may play an important role in maintaining long-term titres in birds that have shown a clear immunological reaction.

Importantly these preliminary results also show that there is a possibility that some birds may not be able to show any immune response when faced with WNV infection. Consequently, there is a possibility that it may not always be possible to determine the presence of the virus when the bird is suffering on a secondary infection like aspergillosis, since the viremia can disappear after several weeks.

Unfortunately, the number of samples is still very low to arrive to a conclusion especially with view to the efficacy of the vaccine in long-term protection of previously unexposed birds. Accordingly, D. Höfle suggested increasing the number of samples, including birds from different ages, and it was decided to continue with the study using the captive stock at Vallcalent centre.

*\*For additional information, please review Bearded Vulture EEP annual report 2020 pag. 30.*

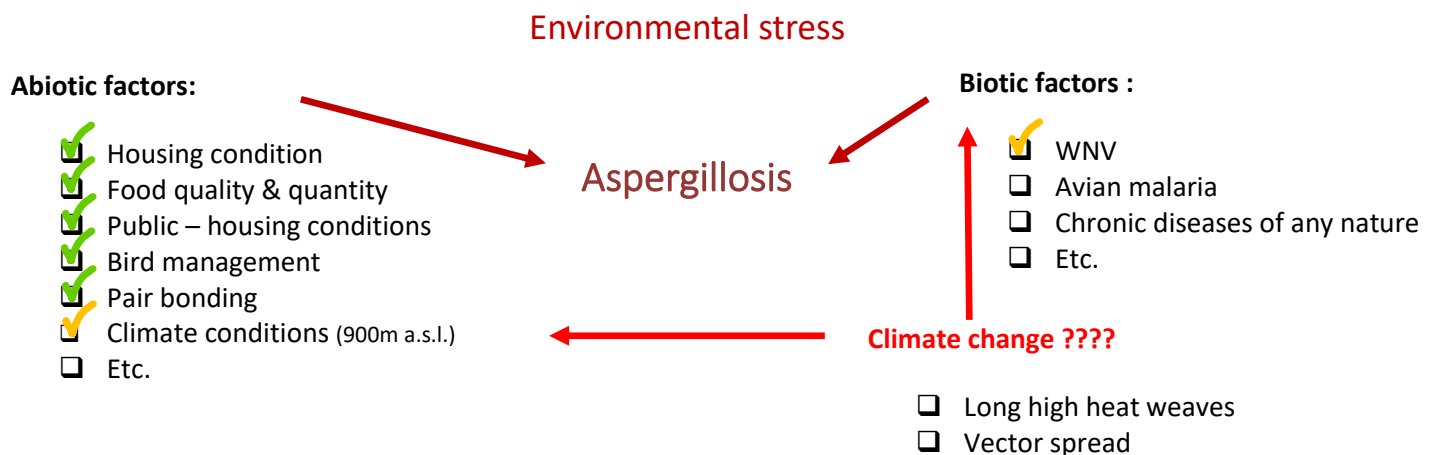
## CONTINUING TO INVESTIGATE HOW TO MITIGATE THE HEAT

It is well known that any factor that may negatively influence the immune system can provoke a secondary aspergillosis infection. Not only biotic factors can cause environmental stress affecting the immune system, but also abiotic factors, such as housing conditions, diet, bird management and pair bonding protocol. Thanks to 45 years of experience in captive breeding of this species, the listed abiotic factors are very well known, and protocols are in place (e.g. guidelines for housing and feeding). We also know that altitude affect the pathogenicity of aspergillosis, losing it completely over 900m a.s.l. But we cannot move all the captive stock to the mountains by creating new centres, for both budgetary and operational reasons. Furthermore, zoos play a key role by exposing the species. A trial on the effectiveness of the equine vaccine against WNV by the Bearded Vulture is currently underway, with the hope of obtaining good results and thus mitigating the effects of WNV by them.



## Bearded Vulture EEP: results for 2022

However, since more than a decade ago, we detected that the highest incidences on aspergillosis infection occurs during the summer period, and that those cases of aspergillosis infection up to 2008 could be real and not masking a WNV infection - unfortunately not all birds that died on aspergillosis in summer were tested for WNV -, as before this period there was already a high incidence of aspergillosis at this time of the year. These high incidences during the summer could very well be caused by climate change, as heat waves are becoming more frequent and longer. Unfortunately, climate change has an impact not only on temperature, but also on the spread of vectors. In 2018 mosquitos infected with plasmodium were already detected at 1800m a.s.l. in the Pyrenees.



For all the above reasons, new methods to fight heat are being tested in Vallcalent. For this purpose, shading nets were stretched over the cage and windows were opened in two aviaries to promote airflow. After proving that the temperature in aviaries that have windows in the back is 2-4 grades lower than the others, it was decided to open big windows in all aviaries.



*To fight the heat, additional to stretch shading nets over the cage, big windows were opened on the back of the aviary at platform level to promote airflow during the hot periods of the year (Centre de Fauna Vallcalent).*



## STUDY TO GET BLOOD REFERENCES VALUES FROM 90 DAYS OLD NESTLINGS

Since the reintroduction project of the Bearded Vulture exists, blood samples have been taken from our nestlings for sex determination and in some cases took the opportunity to analyse Blood chemistry and Haematology. But all that has not been done in a standardised way (same age, same extraction moment, analysed different parameters, the technology has changed significantly in all these years, etc.), having results without being able to compare them with each other.

Most of the samples were extracted when the nestlings were around 2 months old, for sex determination. Considering its exaggerated growth rate in this period, the values could change significantly depending on the age, since up to two months the bird invests the most in body growth (with 2 months are already showing similar weights like adult birds), whereas after two months it invests the most in feather growth.

In 2022 a new protocol has been put in place whereby blood is taken from all chicks at the age of 90 days. The aim is to obtain reference values for each of the different blood parameters (biochemistry and haematology), so that in the future it will be possible to determine the health status of a young Bearded Vulture in a more accurate way. To reduce stress as much as possible the following protocol was developed:

1. **for the nestlings to be released:** to extract a blood sample the day when the nestling is removed from the adults for the transfer to the release site. That would give us additionally picture of its condition before sending it to its release site, even if the results will arrive later when the nestlings are already in the hacking cave.
2. **for the nestlings included in the EEP:** to extract a blood sample when the nestling is around 90 days old. By including this group, in a few years' time we will have a significant sample size and consequently be able to determine the average value of each parameter.

The parameters to be analysed are as follows:

Biochemistry	Haematology
ALT – GPT (U/L)	Haematocrit (Packed Cell Volume (%))
AST - GOT (U/L)	Haemoglobin (g/L)
ALP (U/L)	Red Blood Cells ( $\times 10^{12}/L$ )
CK (U/L)	MCV (fL)
GLDH (U/L)	MCH (pg)
LDH (U/L)	MCHC (g/dL)
Uric acid (mmol/L)	White Blood Cells ( $\times 10^9/L$ )
Glucose (mmol/L)	Lymphocytes (relative count)
Calcium (mmol/L)	Lymphocytes ( $\times 10^9/L$ )
Phosphor (mmol/L)	Monocytes relative count)
Potassium (mmol/L)	Monocytes ( $\times 10^9/L$ )
Sodium (mmol/L)	Heterophils (relative count)
Total protein (g/L)	Heterophils ( $\times 10^9/L$ )
Albumin (g/L)	Eosinophils (relative count)
$\alpha_1$ protein (g/L)	Eosinophils ( $\times 10^9/L$ )

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$\alpha_2$ protein (g/L)	Basophils (relative count)
$\beta$ protein (g/L)	Basophils ( $\times 10^9$ /L)
$\gamma$ protein (g/L)	

Bearded Vulture EEP: results for 2022



Hansruedi Weyrich©

*Thanks to the good cooperation in the Bearded Vulture EEP, the goal to re-establish an European meta-population is getting closer.*

Bearded Vulture EEP: results for 2022

We would like to thank our sponsors:





## Bearded Vulture EEP: results for 2022

## ANNEX I

Table 1: EEP stock and its distribution as on 31<sup>st</sup> December 2021

N. ♂	N. ♀	LOCATION	COUNTRY	Age ♂	Age ♀	PARENTAGE {m/f} / {m/f}	GENERATION ♂	GENERATION ♀	REMARKS
1024	982	Aachen zoo	Germany	4	5	{500/513} / {410/290}	F1 / F2/F3	F2	
753	653	Acad. Puy du Fou	France	10	12	{371/103} / {124/041}	F3/F2 / F2/F3	F2	
	1155			1		{753/653} /	F4-F3/F3-F4 / F3		
912	889	Amnéville Zoo	France	7	7	{461/483} / {286/153}	F2/F3 / F3-F4/ F3	F1	
454	502	ASTERS	France	18	17	{108/175} / {179/281}	F2/F3 / F2	F2	
700	622			11	13	{286/153} / {371/103}	F1	F3-F2/F2-F3	
860	627			8	13	{500/513} / {371/103}	F1 / F2/F3	F3-F2/F2-F3	
1039	1045			4	4	{681/560} / founder	F1 / F4-F3/F3-F4	F0	
1061				3		{201/044}	F1/F2		
763	635	Beauval Zoo	France	10	13	{129/481} / {159/270}	F3/F1	F1	
	1149				1	/ {763/635}		F4/F2 / F2	
611	634	Beozoo	Serbia	13	13	{199/107} / {034/130}	F1/F2	F1/F2	
	1142				1	/ {611/634}		F2/F3 / F2/F3	
298	320	Berlin Zoo	Germany	25	24	{122/108} / {018/272}	F2	F2	
124	329	CC Guadalentín	Spain	33	24	{131/132} / {043/040}	F1	F1	
286	580			33	14	founder / {201/044}	F0	F1/F2	
313	330			24	24	{009/006} / {108/119}	F1/F2	F2-F3/F2	
337	317			24	24	{201/044} / {017/070}	F1/F2	F2	
362	389			23	21	{080/081} / {199/107}	F2	F1/F2	
391	360			21	23	{124/041} / {018/272}	F2	F2	
410	290			20	25	{286/153} / {134/135}	F1	F1	
590	658			14	12	{223/329} / {199/107}	F2/F3	F1/F2	
947	908			6	7	{223/725} / founder	F2/F1	F0	
1006	987			5	5	{681/560} / {500/513}	F1 / F4-F3/F3-F4	F1 / F2/F3	
973*	1010*			6	5	{GT099/493} / {GT099/493}	?/ F2/F3	?/ F2/F3	Feather problems
1050	911			4	7	founder / {431/436}	F0	F1 / F3/F2	
	976				5	/ {362/389}		F3 / F2/F3	Cataracts
	1120				2	/ {763/635}		F4/F2 / F2	
1152				1		{313/330} /	F2-F3 / F4-F3/F3		
500	513	CF Torreferrussa	Spain	17	16	founder / {009/006}	F0	F1/F2	
297	115	CF Vallcalent	Spain	25	34	{086/104} / {019/021}	F2	F1	
371	456			21	18	{105/178} / {286/153}	F2/F1	F1	
551	398			15	21	founder / {159/270}	F0	F1	
652	680			14	14	founder / founder	F0	F0	

## Bearded Vulture EEP: results for 2022

N. ♂	N. ♀	LOCATION	COUNTRY	Age ♂	Age ♀	PARENTAGE {m/f} / {m/f}	GENERATION ♂	GENERATION ♀	REMARKS
662	668	CF Vallcalent	Spain	12	12	{371/103} / {172/290}	F3/F2 / F2/F3	F2/F3 / F2	
368				23		{159/270} /	F1		Handraised
1091	588			4	14	founder / {371/103}	F0	F3-F2/F2-F3	
340	338	Chomutov Zoo	Czech Rep.	24	24	{018/272} / {134/135}	F2	F1	
826	978	FPWC - CWR	Armenia	23?	5	founder / {826/828}	F0 / F1		
	576	Frankfurt Zoo	Germany		14	/ {108/175}		F2/F3 / F2	
788	281	Helsinki Zoo	Finland	9	26	{297/115} / {131/132}	F3/F2	F1	
804	801	Alp. Innsbruck	Austria	9	9	{340/338} / {371/103}	F3/F2	F3-F2/F2-F3	
847	829	La Garenne Zoo	Zwitzerland	8	8	{313/330} / {108/175}	F2/F3 / F3-F4/F3	F2/F3 / F2	
180	274	Liberec Zoo	Czech Rep.	38	37	{161/162} / founder	F1	F0	
654	656			12	12	{108/175} / {180/274}	F2/F3 / F2	F2/F1	
1153	1133	MónNatura	Spain	1	1	{763/635} / {500/503}	F4/F2 / F2	F1 / F2/F3	
748	832	Moscow Zoo	Rusia	10	8	{108/175} / {180/274}	F2/F3 / F2	F2/F1	
	726	Nikolaev Zoo	Ucraina		15	/ founder		F0	
744	657	Novosibirsk Zoo	Rusia	27	12	founder / {223/329}	F0	F2/F3	
1008	1158			24	?	founder / founder	F0	F0	
18	336	Nuremberg Zoo	Germany	44	24	{019/021} / {201/044}	1	F1/F2	
993	896	Oasi Sant' Alessio	Italy	5	7	{199/107} / {399/278}	F1/F2	F2 / F2/F3	
325	322	Ostrava Zoo	Czech Rep.	24	24	{017/070} / {152/153}	F2	F1	
207	233			29	28	{017/070} / {122/118}	F2	F2	
850	747	P. Animalier Pyrénées	France	8	10	{223/725} / {286/153}	F2/F1	F1	
1154	1096			1	2	{431/436} / {399/278}	F1 / F3/F2	F2 / F2/F3	
894	598	Parc des Oiseaux	France	7	13	{286/153} / {145/276}	F1	F2 / F2/F3	
664	659	Parc Pairi Daiza	Belgium	12	12	{391/360} / {017/070}	F3	F2	
451	469	Parco Nat. Viva	Italy	18	18	{108/175} / {018/272}	F2/F3 / F2	F2	
914	903	Plock Zoo	Poland	7	7	{461/483} / {174/118}	F2/F3 / F3/F4 / F3	F2	
328	561	Poznan Zoo	Poland	24	15	{080/081} / {313/330}	F1	F2/F3 / F3-F4/F3	
511	519	Prague Zoo	Czech Rep.	16	16	{002/003} / {105/178}	F1	F2/F1	
1065	1072			3	3	{410/290} / {431/436}	F2	F1 / F3/F2	
234	397	Priv. Montowl	Italy	28	21	{086/104} / {201/044}	F2	F1/F2	
	620			8	13	/ {172/290}		F2/F3 / F2	
591		Priv. B. Sloman	England	14		{080/081} /	F1		


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N. ♂	N. ♀	LOCATION	COUNTRY	Age ♂	Age ♀	PARENTAGE {m/f} / {m/f}	GENERATION ♂	GENERATION ♀	REMARKS
461	483	RC Green Balkans	Bulgaria	18	17	{199/107} / {108/175}	F1/F2	F2/F3 / F2	
1035				4		{654/656} /	F3/F4 / F3 / F3/F2		
1034	999			4	5	{399/278} / {340/338}	F2 / F2/F3	F3/F2	
17	70	Richard Faust Center	Austria	44	39	{019/021} / {022/023}	F1	F1	
108	175			34	31	{065/040} / {152/153}	F1/F2	F1	
212	107			29	35	{152/153} / {150/151}	F1	F1	
594	892			14	7	{172/290} / {223/725}	F2/F3 / F2	F2/F1	
399	278			21	26	{159/270} / {065/074}	F1	F1/F2	
468	381			18	22	{223/132} / {159/270}	F2/F1	F1	
87	547			37	15	{014/010} / {105/178}	F1	F2/F1	
681	560			15	15	founder / {371/103}	F0	F3-F2/F2-F3	
857	835			8	8	{468/453} / {399/278}	F3/F2 / F2	F2 / F2/F3	
	619				13	/ {297/115}		F3/F2	
80	518			38	16	{019/021} / {087/054}	F1	F1	
327	6			24	45	{105/178} / {019/020}	F2/F1	F1	
	969				6	/ {145/276}		F2 / F2/F3	
	1044				4	/ {431/436}		F1 / F3/F2	
	1048				4	/ {431/436}		F1 / F3/F2	
	1108				2	/ {468/381}		F3/F2 / F2	
	1157				1	/ {857/835}		F4/F3 / F3 / F3 / F3/F4	
	91				37	/ {005/006}		F2	
201	44			35	43	founder / {002/003}	F0	F1	
977	1007	Riga Zoo	Letonia	5	5	{297/115} / {108/175}	F3/F2	F2/F3 / F2	
431	436	Tallinn Zoo	Estonia	23	19	founder / {180/274}	F0	F2/F1	
1156				1		{431/436} /	F1 / F3/F2		
437	503	Tierpark Friedrichsfelde	Germany	19	17	{180/274} / {294/292}	F2/F1	F3 / F2/F3	
174	118	Tier.Goldau	Zwitzerland	31	34	{134/135} / {154/155}	F1	F1	
	1106				2	/ {788/281}		F4/F3 / F2	
1066	1028			3	4	{298/320} / {371/103}	F3	F3-F2/F2-F3	
	1020				4	/ {180/274}		F2/F1	
	209	Walsrode	Germany		29	/ {150/151}		F1	
844	673	Zoobotanic Jerez		8	11	{337/317} / {313/330}	F2/F3 / F3	F2/F3 / F3-F4/F3	

\*Wild born descendant from released birds

MALE

FEMALE

 minimum age  
\* founder



## Bearded Vulture EEP: results for 2022

Table 3: Breeding pairs and their results in 2022

COUNTRY	PAIR	LAY DATE	HATCH DATE
<b>AUSTRIA</b>			
Alpenzoo Innsbruck	BG 804240338 x BG 801371103	1 <sup>st</sup> : 07 <sup>th</sup> Jan	Aborted (1.5cm embryo)
Tiergarten Schönbrunn	BG 201 x BG 044002003	1 <sup>st</sup> : 31 <sup>st</sup> Dec	Aborted (died early stage)
Richard Faust Zentrum	BG 327105178 x BG006019020	1 <sup>st</sup> : 11 <sup>th</sup> Feb	Infertile
	BG 108065040 x BG 175152153	1 <sup>st</sup> : 28 <sup>th</sup> Nov 2 <sup>nd</sup> : 08 <sup>th</sup> Dec	20 <sup>th</sup> Jan (disappeared 17 <sup>th</sup> Feb) 29 <sup>th</sup> Jan (disappeared 3 <sup>rd</sup> Feb)
	BG 017019021 x BG 070022023	1 <sup>st</sup> : 31 <sup>st</sup> Dec 2 <sup>nd</sup> : 8 <sup>th</sup> Jan	21 <sup>st</sup> Feb Disappeared
	BG 399159270 x BG 278065074	1 <sup>st</sup> : 01 <sup>st</sup> Jan	Infertile
	BG 468223132 x BG 381159270	1 <sup>st</sup> : ?28 <sup>th</sup> Dec	Disappeared
	BG 087014010 x BG 547105178	1 <sup>st</sup> : ?28 <sup>th</sup> Dec	Aborted
	BG681 x BG560371103	1 <sup>st</sup> : 14 <sup>th</sup> Jan 2 <sup>nd</sup> : 24 <sup>th</sup> Jan	10 <sup>th</sup> Mar 17 <sup>th</sup> Mar
	BG080019021 x BG518087054	1 <sup>st</sup> : 07 <sup>th</sup> Jan	Infertile
	BG857468453 x BG835399278	1 <sup>st</sup> : 17 <sup>th</sup> Feb	11 <sup>th</sup> Apr
<b>BELGIUM</b>			
Pairi Daiza	BG664391360 x BG659017070	1 <sup>st</sup> : ?in Mar	Infertile
<b>BULGARIA</b>			
Rescue Centre Green Balkans	BG 461199107 x BG 483108175	1 <sup>st</sup> : 30 <sup>th</sup> Dec 2 <sup>nd</sup> : 8 <sup>th</sup> Jan	Broken 3 <sup>rd</sup> Mar
<b>ESTONIA</b>			
Tallinn Zoo	BG 431 x BG 436180274	1 <sup>st</sup> : 03 <sup>rd</sup> Feb 2 <sup>nd</sup> : 10 <sup>th</sup> Feb	27 <sup>th</sup> Mar 04 <sup>th</sup> Apr
<b>FINLAND</b>			
Helsinki Zoo	BG 788297115 x BG 281131132	1 <sup>st</sup> : 11 <sup>th</sup> Jan	?05 <sup>th</sup> Mar
<b>FRANCE</b>			
Beauval Zoo	BG 763129482 x 635159270	1 <sup>st</sup> : 20 <sup>th</sup> Jan 2 <sup>nd</sup> : 30 <sup>th</sup> Jan	15 <sup>th</sup> Mar 23 <sup>rd</sup> Mar
Asters Breeding centre	BG 454108175 x BG 502179281	1 <sup>st</sup> : 13 <sup>th</sup> Dec	5 <sup>th</sup> Feb
	BG 860500513 x BG 622371103	1 <sup>st</sup> : 30 <sup>th</sup> Dec	Putrefied (15 <sup>th</sup> Feb exploited)

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Parc Animalier de Pyrénées	BG 850223725 x BG 747286153	1 <sup>st</sup> : 12 <sup>th</sup> Jan	Aborted (died end incubation)
Puy du Fou	BG 753371103 x BG653124041	1 <sup>st</sup> : 04 <sup>th</sup> Feb 2 <sup>nd</sup> : 10 <sup>th</sup> Feb	Aborted (died middle incubation) 3 <sup>rd</sup> April
<b>GERMANY</b>			
Tierpark Friedrichsfelde Berlin	BG 294017070 x BG 292199107	1 <sup>st</sup> : 31 <sup>st</sup> Jan	Infertile
	BG 437180274 x BG 503294292	1 <sup>st</sup> : 05 <sup>th</sup> Feb 2 <sup>nd</sup> : 11 <sup>th</sup> Feb	Disappeared Infertile
Berlin Zoo	BG 298122118 x BG 320018272	1 <sup>st</sup> : 12 <sup>th</sup> Jan	Infertile
Nuremberg Zoo	BG 018019021 x BG 336201044	1 <sup>st</sup> : 06 <sup>th</sup> Feb 2 <sup>nd</sup> : 15 <sup>th</sup> Feb	Aborted (died just before hatching) Aborted (died 2/3 incubation)
<b>ITALY</b>			
Centre Monticello (M. Albertini)	BG 234086104 x BG 397201044	1 <sup>st</sup> : 20 <sup>th</sup> Jan	15 <sup>th</sup> Mar
Parco Natura Viva	BG 451108175 x BG 469018272	1 <sup>st</sup> : 11 <sup>th</sup> Jan 2 <sup>nd</sup> : 20 <sup>th</sup> Jan	3 <sup>rd</sup> Mar Aborted (formed chick present)
<b>RUSSIA</b>			
Novosibirsk Zoo	BG 744 x BG 657223329	1 <sup>st</sup> : 16 <sup>st</sup> Jan	Infertile
<b>SERBIA</b>			
Belgrade Zoo	BG 611199197 x BG 634034130	1 <sup>st</sup> : 8 <sup>th</sup> -9 <sup>th</sup> Jan	4 <sup>th</sup> Mar
<b>SPAIN</b>			
Centro de Cría Guadalentín	BG 286 x BG 580201044	1 <sup>st</sup> : 29 <sup>th</sup> Jan 2 <sup>nd</sup> : 16 <sup>th</sup> Feb	Infertile Infertile
	BG 313009006 x BG 330108119	1 <sup>st</sup> : 15 <sup>th</sup> Jan 2 <sup>nd</sup> : 29 <sup>th</sup> Jan	9 <sup>th</sup> Mar 21 <sup>st</sup> Mar
	BG 391124041 x BG 360018272	1 <sup>st</sup> : 02 <sup>nd</sup> Jan 2 <sup>nd</sup> : 09 <sup>th</sup> Jan	26 <sup>th</sup> Feb 06 <sup>th</sup> Mar
	BG 337201044 x BG 317017070	1 <sup>st</sup> : 07 <sup>th</sup> Jan 2 <sup>nd</sup> : 12 <sup>th</sup> Jan	Aborted (died during hatching) Aborted (died end incubation)
	BG 362080081 x BG 389199107	1 <sup>st</sup> : 20 <sup>st</sup> Dec 2 <sup>nd</sup> : 25 <sup>th</sup> Dec	15 <sup>th</sup> Feb Infertile
	BG 410286153 x BG 290134135	1 <sup>st</sup> : 04 <sup>th</sup> Jan 2 <sup>nd</sup> : 13 <sup>th</sup> Jan  3 <sup>rd</sup> : 23 <sup>rd</sup> Jan	27 <sup>th</sup> Feb (died during hatching) 07 <sup>th</sup> Mar  Infertile
	BG 124131132 x BG329043040	1 <sup>st</sup> : 05 <sup>th</sup> Dec	Putrefied

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	BG590223329 x BG658199107	1 <sup>st</sup> : 30 <sup>th</sup> Dec 2 <sup>nd</sup> : 05 <sup>th</sup> Jan	23 <sup>rd</sup> Feb 26 <sup>th</sup> Feb
Centre de Fauna Vallcalent	BG 297086104 x BG 115019021	1 <sup>st</sup> : 19 <sup>th</sup> Dec 2 <sup>nd</sup> : 26 <sup>th</sup> Dec	10 <sup>th</sup> Feb Infertile
	BG551 x BG398159270	1 <sup>st</sup> : 27 <sup>th</sup> Dec 2 <sup>nd</sup> : 02 <sup>nd</sup> Jan	Infertile Infertile
	BG371105178 x BG456286153	1 <sup>st</sup> : 25 <sup>th</sup> Dec 2 <sup>nd</sup> : 31 <sup>st</sup> Dec	Infertile Infertile
Centre de Fauna Torreferrussa	BG 500 x BG 513009006	1 <sup>st</sup> : 25 <sup>st</sup> Dec 2 <sup>nd</sup> : 06 <sup>th</sup> Jan	15 <sup>th</sup> Feb Infertile
<b>TS-REPUBLIC</b>			
Liberec Zoo	BG 180161162 x BG 274	1 <sup>st</sup> : 08 <sup>th</sup> Dec 2 <sup>nd</sup> : 16 <sup>th</sup> Dec	31 <sup>st</sup> Jan (died during hatching) 05 <sup>th</sup> Feb (died on 22 <sup>nd</sup> Feb)
	BG 654108175 x BG 656180274	1 <sup>st</sup> : 01 <sup>st</sup> Jan 2 <sup>nd</sup> : 07 <sup>th</sup> Jan	Infertile Aborted (died middle Feb)
Chomutov Zoo	BG 340018272 x BG 338134135	1 <sup>st</sup> : 05 <sup>th</sup> Jan	Aborted (died end incubation)
Ostrava Zoo	BG 207017070 x BG 233122118	1 <sup>st</sup> : 20 <sup>th</sup> Dec 2 <sup>nd</sup> : ?	12 <sup>th</sup> Feb (died after hatching) 25 <sup>th</sup> Feb
	BG 325017070 x BG 322152153	1 <sup>st</sup> : 10 <sup>th</sup> Dec	01 <sup>th</sup> Feb
Prague Zoo	BG 511108175 x BG 519105178	1 <sup>st</sup> : 25 <sup>th</sup> Dec 2 <sup>nd</sup> : 31 <sup>st</sup> Dec	Infertile Infertile
<b>SWITZERLAND</b>			
Breeding Centre Goldau/Rigi	BG 174134135 x 118154155	1 <sup>st</sup> : 28 <sup>th</sup> Dec	18 <sup>th</sup> Feb (died during hatching)



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Table 4. Destination Offspring in 2022

STUDBOOK	PARENTAGE	SEX	BREEDING	DESTINATION
BG 1124 <sup>1)</sup>	BG 108 x BG 175		RFZ	<b>DIED</b>
BG 1125 <sup>2)</sup>	BG 108 x BG 175		RFZ	<b>DIED</b>
BG 1126 <sup>3)</sup>	BG 180 x BG 274		Liberec zoo	<b>DIED</b>
BG 1127	BG 325 x BG 322	m	Ostrava Zoo	RELEASE (Lozère, Grands Causses, FRANCE)
BG 1128	BG 454 x BG 502	m	Asters	RELEASE (Lozère, Grands Causses, FRANCE)
BG 1129 <sup>4)</sup>	BG 180 x BG 274		Liberec zoo	<b>DIED during hatching</b>
BG 1130 <sup>5)</sup>	BG 297 x BG 115	m	CF Vallcalent	<b>DIED as fledgling</b>
BG 1131 <sup>6)</sup>	BG 207 x BG 233		Ostrava Zoo	<b>DIED during hatching</b>
BG 1132	BG 362 x BG 389	f	CC Guadalentín	RELEASE (P.N. Tinença, Valencia, SPAIN)
BG 1133	BG 500 x BG 513	f	Torreferrosa	<b>BREEDING</b> (Món Natura, Planes de Son)
BG 1134 <sup>7)</sup>	BG 174 x BG 118	m	Tierpark Goldau	<b>DIED</b>
BG 1135	BG 017 x BG 070	m	RFZ	RELEASE (P.N. Tinença, Valencia, SPAIN)
BG 1136	BG 590 x BG 658	f	CC Guadalentín	RELEASE (Baronnies, Leroux-Valley, FRANCE)
BG 1137	BG 207 x BG 233	m	Ostrava Zoo	RELEASE (Guadalentín, Andalusia, SPAIN)
BG 1138	BG 391 x BG 360	m	CC Guadalentín	RELEASE (Baronnies, Leroux-Valley, FRANCE)
BG 1139	BG 590 x BG 658	m	CC Guadalentín	RELEASE (Guadalentín, Andalusia, SPAIN)
BG 1140 <sup>8)</sup>	BG 410 x BG 290		CC Guadalentín	<b>DIED during hatching</b>
BG 1141	BG 461 x BG 483	m	Green Balkans	RELEASE (Castril, Andalusia, SPAIN)
BG 1142	BG 611 x BG 634	f	Belgrade zoo	<b>BREEDING</b> (Belgrade Zoo, right eye atrophied)
BG 1143	BG 451 x BG 469	m	Parco Natura Viva	RELEASE (Castril, Andalusia, SPAIN)
BG 1144	BG 788 x BG 281	m	Helsinki Zoo	RELEASE (Corsica, Niolo Valey, FRANCE)
BG 1145	BG 391 x BG 360	f	CC Guadalentín	RELEASE (NP Berchtesgaden, GERMANY)
BG 1146	BG 410 x BG 290	m	CC Guadalentín	RELEASE (Corsica, Niolo Valey, FRANCE)
BG 1147	BG 313 x BG 330		CC Guadalentín	RELEASE (NP Berchtesgaden, GERMANY)
BG 1148 <sup>9)</sup>	BG 681 x BG 560	m	RFZ	<b>DIED as fledgling</b>
BG 1149	BG 763 x BG 635	f	Beauval zoo	<b>BREEDING</b> (Beauval Zoo)
BG 1150 <sup>10)</sup>	BG 234 x BG 397	m	Monticello	<b>DIED as fledgling</b>
BG 1151 <sup>11)</sup>	BG 681 x BG 560	m	RFZ	<b>DIED as fledgling</b>
BG 1152	BG 313 x BG 330	m	CC Guadalentín	<b>BREEDING</b> (CC Guadalentín)
BG 1153	BG 763 x BG 635	m	Beauval Zoo	<b>BREEDING</b> (Món Natura, Planes de Son)
BG 1154	BG 431 x BG 436	m	Tallinn Zoo	<b>BREEDING</b> (Parc Animalier des Pyrénées)
BG 1155	BG 753 x BG 653	m	Puy du Fou	<b>BREEDING</b> (Puy du Fou)
BG 1156	BG 431 x BG 436	m	Tallinn Zoo	<b>BREEDING</b> (Tallinn Zoo)
BG 1157	BG857 x BG835	f	RFZ	<b>BREEDING</b> (RFZ)

1) disappeared during the night (28 days old).

2) disappeared during the night (2 days old).

3) mal formation several distal neck vertebrae (22 days old).

4) died during hatching, mispositioned.

5) died because of aspergillosis on 17<sup>th</sup> September.

6) died during hatching in nest.

7) died during or just after hatching and eaten by one of the adults.

8) died during hatching, very oedematous and yolk sack still not reabsorbed.

9) died because of aspergillosis and pox virus infection on 10<sup>th</sup> Sep.

10) died because caseous abscess thorax and abdomen, severe cachexia, aspergillosis suspicion on 7<sup>th</sup> Oct.

11) died because of aspergillosis on 5<sup>th</sup> Aug.