

Captive Breeding of the European Black Vulture *Aegypius monachus* and the Reintroduction Project in France

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ABSTRACT

The Black Vulture Conservation Foundation (BVCF) started in 1986 to organise a captive breeding project with the final aim of supporting wild populations with the offspring obtained. Breeding success could be increased but is still not satisfactory. Since 1988, a part of the offspring has been released. Since 1993, the Breeding Project has relied on the support of birds from recovery centres in Spain, which are not fit for re-release. The first release of captive-bred Black Vultures was carried out by the hacking method on the island of Mallorca, Spain. In 1992, the first reintroduction project was initiated in the Cévennes, France, by the BVCF in collaboration with FIR (Fond d'Intervention pour les Rapaces), with support by the National Park of the Cévennes. Ten zoo-bred Black Vultures and two recovered from the wild in Spain have been released as nestlings in the Cévennes. Eight birds from Spanish recovery centres have been released via an acclimatisation cage. Petitions from various European countries for future reintroduction projects have been received. The final goal is the recovery of a connected Black Vulture population in the northern Mediterranean.

INTRODUCTION

The European Black Vulture *Aegypius monachus* is kept in many European and Asian Zoological Gardens. The species became increasingly endangered in its European distribution range during the second half of the 20th century. In 1986, the Black Vulture Conservation Foundation was created with the aim of organising a captive-breeding project using birds from

European zoos. The Black Vulture was soon after included in the European Endangered Species Breeding Programme (EEP). The project was planned not only to create a self-sustaining captive population which did not draw on more birds from the wild, but also to become a source of young birds which could repopulate areas of the species' former distribution range, where conditions were favourable. Special attention should be paid to saving remnant populations before they became extinct. This "European Black Vulture Conservation Project" is carried out by the BVCF, Frankfurt Zoological Society (FZS) and the Wassenaar Wildlife Breeding Centre (WWBC).

The first releases took place in 1988 in the Black Vulture Recovery project in Mallorca, where different management techniques were tested for their suitability (Tewes 1994). By 1990, the restocking project was on the way to completion in Mallorca and a new release point was to be selected according to the criteria of the BVCF. Priority would be given to the restocking of a still existing colony to avoid its disappearance, but this proved impossible as the last small nuclei in Sardinia, Italy, and Mount Olympus, Greece, had already become extinct. The other existing colonies in Spain and the only remaining Balkan one in Greece did not need restocking support. So the situation warranted the start of the first reintroduction of the species. Several sites throughout the northern Mediterranean were taken into consideration. Among possible sites in Greece, Bulgaria, Croatia, Sardinia and France, the last-named offered the best conditions. In France the Black Vulture is supposed to have been extinct since the 17th century (Terrasse 1989).

MATERIAL AND METHODS

Captive breeding

The basic sources for the captive-breeding project are zoological gardens and breeding stations wishing to collaborate with conservation projects. This has the advantage that the breeding project involves almost no economic outlay, as the keeping costs are borne by the zoos. Methods of achieving an increased breeding success consist mainly of organising the exchange of birds, the sex determination of unsexed individuals and keeping the participants informed about husbandry and breeding guide-lines. The BVCF normally uses chromosome analysis of blood samples for sex determination with the help of Rob Beltermann of the Rotterdam Zoo laboratory. The organisational work is now shared with the EEP, which keeps the Black Vulture stud-book (Brouwer 1992).

The breeding network currently comprises 64 participants which keep about 180 Black Vultures. To maintain the captive population without importing

birds from the wild, about half the offspring bred remain in captivity. Since 1993, moreover, birds from Spanish recovery centres which are unfit for re-release have been donated by the Spanish authorities to the project (see Table 3).

Since breeding success did not increase in the way expected, a study was carried out on the influence of the breeding conditions in which 36 stations participated by filling out a questionnaire.

Reintroduction in France: criteria for the selection of the site and release strategy

The situation in the Cévennes, in the Massif Central of France, allowed an almost immediate start of the reintroduction programme for the following reasons:

- * The reintroduced Griffon Vulture *Gyps fulvus* colony is reproducing successfully and growing continuously (FIR 1994).
- * The area lies within the historic distribution range of the species.
- * Education and information campaigns by FIR during the last 15 years have prepared the human population to accept and support vultures in their area.
- * Hunting and poisoning were not a danger in that area.
- * The experienced staff of the FIR were interested in carrying out the reintroduction in collaboration with the BVCF.
- * The area has a famous cheese production, for which one million sheep are kept in the district of Avignon, in a semi-extensive way, which guarantees the availability of food. In the Grands Causses, which are used at present by the vultures, there are 128,556 adult ewes and 247,900 lambs (Briquet 1987).
- * The National Park of the Cévennes and the National Government (Ministry of Environment) support the reintroduction of the Griffon Vulture as well as of the Black Vulture.

The reintroduction is carried out as a collaboration between three parties: the BVCF, the FIR and the National Park of Cévennes (FIR 1990).

In 1992, preparations in France were completed and the first release could take place (BVCF 1992). To minimise the possibility that the released birds would leave the region the following strategy was adopted: in the first year only the hacking method of release would be used, as the nestlings would have a natural fixation on their release site (BVCF/FIR 1992). To support this, the hacking site was selected

- * close to the Griffon Vulture colony,

- * close to a feeding place and
- * close to a cage where a pair of Black Vultures was kept as an added attraction.

In the second year release by means of an acclimatisation cage should be used, if the fixation of the birds of the first year was confirmed.

In following years both methods would be used until at least 50 birds were present in the Cévennes region.

RELEASE METHODS

Release by Hacking

The hacking method for the release of falcons is described in detail by Sherrod & Cade (1978). Later it has been applied to a series of raptor species as summarised by Busse (1994). The process has been used in different versions; especially in Cathartid vultures an adaptation of the method to the species was necessary (Wallace & Temple 1987; Wallace & Wiley 1991).

The method is based on the fact that the introduction of a raptor into a new habitat and the fledging of a nestling require almost the same capabilities from the individual: adaptation to an unknown habitat and integration into an unknown population. For this reason a bird is most apt to meet the requirements of release as a nestling.

The method takes advantage of the instinctive fixing of the nestlings on their birthplace and its surroundings. This has as consequences that the young

- * remain close to the release site after fledging,
- * have a tendency to return to the release area for breeding (philopatry) and
- * can find a breeding partner among the other released birds that return to the area.

When nestlings reach fledging age, they themselves determine their "release" date: when they feel fit to undertake their first flight, becoming "free" while learning to fly. Thus this type of release is not a short lived event as in other methods, but covers several weeks until the young bird is able to fly and has passed the post-fledging period.

Hacking is the most natural release method, which allows the birds to develop normally and therefore avoids the appearance of unnatural behaviour.

In order to allow the birds to develop their capacities as much as possible during their nestling, fledgling and post-fledging periods, hacking needs to

be carried out in as natural a way as possible. Parental interactions have to be substituted whenever possible. Regular feeding and rigorous observation are the conditions to guarantee optimum results.

Hacking was used for the first time with the Black Vulture in the recovery programme in Mallorca between 1988 and 1990. The method gave excellent results under the island conditions. Basic principles for the hacking of Black Vultures were established (Tewes 1996).

The release site in France was chosen in a quiet, undisturbed valley close to the Gorge du Jonte. It was about 2.5 km from the cages and nearest feeding place. The artificial nest was prepared on a platform about 20 m² in a small cliff, 10 m in height. A small pool was made available for drinking and bathing. A wooden palisade prevented the nestlings from walking away from the release site, which provided enough space for six birds to stay at the same time.

Any human intervention (e.g. feeding) was carried out during the night, taking every precaution to avoid any noise or waking the nestlings.

After arrival at the release site minced meat was offered until the young vultures were able to feed from larger pieces of meat.

Feeding frequency ranged between one and three days, depending on the nestlings' needs and the prevailing weather conditions, as the food should not turn bad, causing a decrease in its nutritive quality. To avoid serious conflicts among the birds, several pieces of meat were offered at the same time.

While the main food was sheep, additionally goat and rabbit were given. As often as possible new-born lambs or embryos were given. If small animals were not available, the bones of adult sheep were broken into small pieces so that they could be swallowed by the vultures or a calcium-vitamin powder was distributed over the food. The provision of food at the nest site and in the release area was stopped when all young birds fed at the regular feeding place or on carcasses found by themselves.

The intensity of monitoring depended on the phase of the release:

Nestling period: Medium intensive observation was carried out. The nestlings were observed daily as much as possible. Especially after arrival each bird was watched to ensure it was healthy and fed well.

Fledging period: Just before and during the fledging period, observation was continuous during all daylight hours, using strategic observation points, from which the first flights could be followed without losing sight of the bird. After fledging, the birds were observed all the time from a safe distance until they could fly well. Walkie-talkies were an important help during this phase.

Post-fledging period: Young birds, which have learned basic flight techniques and were in physical condition to spend normal amounts of time in the air, were surveyed less intensively; the length of their daily presence in the release valley and their integration into the population were recorded as long as each bird returned to sleep there.

Integration period: Extensive and regular observation. Integration of the young vultures into their new habitat and the already existing population starts already at the release site and continues until they are fully integrated into the breeding population. All vultures are followed as far as possible to monitor the development of their increasing range of activity (feeding and resting places, foraging areas) and social life. In this the participation of local ornithologists and nature conservationists has been of great value.

Release with an acclimatisation cage

This method was used successfully in Mallorca (Tewes & Mayol 1993) and is now applied also in the Reintroduction Project in France. It is used for birds from recovery centres donated by the Spanish authorities.

These birds are rehabilitated for several months. A blood sample is taken for sex determination and the birds undergo several veterinary checks. After their arrival in the Cévennes they are marked individually and transferred to the release cage. The two cages used in the reintroduction of the Griffon Vultures were restored and adapted.

For this release method, only birds with experience in the wild are used. For others, such as those brought into captivity as nestlings, the risk is too high: The ability to adapt to a life in the wild diminishes with increasing age and time spent in the cage. Nestlings from recovery centres are released by hacking. Older birds without experience in the wild are retained for captive breeding.

Basic principles for this method of release were established (Tewes 1996).

Minimum disturbance during the adaptation period is important. The birds were kept in the release cage for at least four weeks. This is located close to a feeding place, so that after release the vultures do not need to go foraging immediately and can discover their new habitat in a gradual, unforced way. They have an added reason to stay close to the release site and not disperse immediately. They also have an unlimited opportunity to build up the necessary muscles. Moreover it allows the birds in the cage to make contact with the free-living population while still in the cage, which helps their integration after release. Plenty of food was made available at the feeding place until all birds were independent from it.

After acclimatisation the releases took place under favourable weather conditions and were closely followed up until the birds left the area. From then on they were monitored in the same way as the already existing population.

Individual marking methods

All birds are marked individually by bleaching or discolouring of primary or secondary feathers for flight identification (see Figure 4). All birds are fitted with official metal rings from the Natural History Museum of Paris on one leg as well as colour rings on the other. The latter rings were a combination of four different plastic rings which could be of different colours or white plastic rings with black numbers. They are also equipped with a BIOTRACK radio transmitter fixed to a tail-feather with a battery life of one year.

Monitoring

A team of two ornithologists of the FIR and two wardens of the Cévennes National Park take turns for monitoring. During the release, especially with the hacking method, this team counts on the support of the BVCF and the help of volunteers. Further information, especially from far distances, is obtained by a network of collaborating ornithologists.

Provenance of the released birds and sex determination

Nine of the Black Vultures released up to April 1995 in the Cévennes were donated by the Spanish Autonomous Communities (see Table 3). Three

Table 1. Black Vultures donated to the BVCF by Spanish Authorities and Zoological Gardens from 1992 to April 1995.

<i>Origin</i>	<i>Total number donated (1992-95)</i>	<i>Destined for release in France</i>	<i>Destined for captive breeding</i>
Extremadura (E)	6	4	2
Castilla la Mancha (E)	2	0	2
Andalucía (E)	4	3	1
Doñana National Park (E)	3	1	2
Valencia (E)	1	1	0
Baleares - Son Reus Centre (E)	2	2	0
Münster Zoo (D)	3	2	1
P.O. Villars les Dombes (F)	1	1	0
Schönbrunn Zoo (A)	1	1	0
de Haye Zoo (F)	1	1	0
Vienna Breeding Unit (A)	1	1	0
Doué la Fontaine Zoo (F)	1	1	0
Total	26	18	8

birds from the Junta de Andalucía, 1 from the Doñana National Park, 1 from Valencia and 4 from Extremadura. Nine nestlings were donated by different zoological gardens and breeding stations (see Table 3), one of which died before release.

The BVCF prefers chromosome analysis of blood samples for sex determination. Rob Beltermann, specialist at the Rotterdam Zoo laboratory, collaborates as a free service to the conservation project. Recently also the laboratory of the Veterinary University of Barcelona has been carrying out some analyses for the BVCF.

In exceptional cases vultures were sexed by endoscopy.

Protection against foxes and stray dogs

The hacking site is protected by fences and naphthalene. The feeding places are protected by solar-powered electric fences.

Feeding places

Five feeding places are regularly supplied for Griffon and Black Vultures. They are at a distance of 5 to 37 km apart. The distances between feeding places and release sites are shown in Table 1. They cover 100-400 m² and are wire-fenced. The food normally consists of sheep; additionally goats, pigs, calves, rabbits, wild boars and roe deer are given

Table 2. Distance of feeding places from release places in km.

	<i>No. 1</i>	<i>No. 2</i>	<i>No. 3</i>	<i>No. 4</i>	<i>No. 5</i>
Hacking	2.5	7.5	16.5	16.5	25.5
Cage	0	5	14	19	28

Construction of artificial nests

Artificial nests were constructed to stimulate the breeding behaviour of the young pairs. This began in 1995, when the oldest birds were three years of age. Two nests were built in that year, 200 m apart, without visual contact and about 500 m from the hacking sites. Only natural materials, such as branches, earth, dry leaves and moss were used, creating a platform 150-180 cm in diameter and 60 cm deep with a flat surface. They were built on tree-tops, considering the characteristics of natural nests. Although some branches of the tree were above the nest level, there was always adequate access for the vultures.

Education and information

The Black Vulture has fully benefited from the education campaign conducted over 15 years for the reintroduction of the Griffon Vulture in the

Figure 1: Dispersal movements of Black Vultures released in the Cévennes.

«Arrian», released in August 1992
 «Münster», released in August 1993
 * Release place

- 1...20th October 1993: «Arrian» and «Münster» disappeared.
- 2...November 93 to April 94: «Arrian» was observed near Tarifa, Spain.
- 3...12th April 1994: «Münster» and a second Black Vulture are observed 150 km from the release place.
- 4...28th April 1994: «Münster» observed in the French Pyrenees.
- 5...30th April 1994: «Münster» observed in the Spanish Pyrenees.
- 6...July 1994: «Münster» came back to the release place.

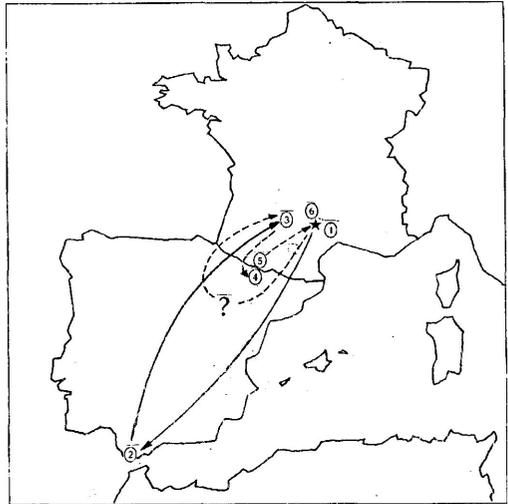


Figure 2: Exceptional movements outside the normal foraging area.

- 1... 15th November 1992: «Arrian» observed 150 km from the release place and disappeared for 7 months.
- 2... 23rd April 1993: Two Black Vultures were observed on a meadow 75 km distant. They were back after two days.
- 3...8th July 1993: Three Black Vultures were flying over the «Mont Lozère» at 65 km distance.
- 4...October 1993: Three Black Vultures and 70 Griffon Vultures observed at 30 km distance.
- 5...17th November 1993: «Anjou» was found at 150 km distance.

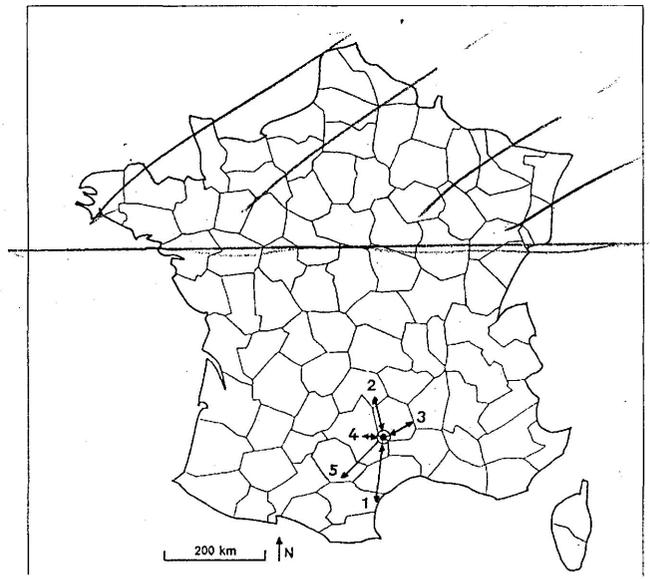


Figure 3: Monitoring results in 1994 (see also Table 5)

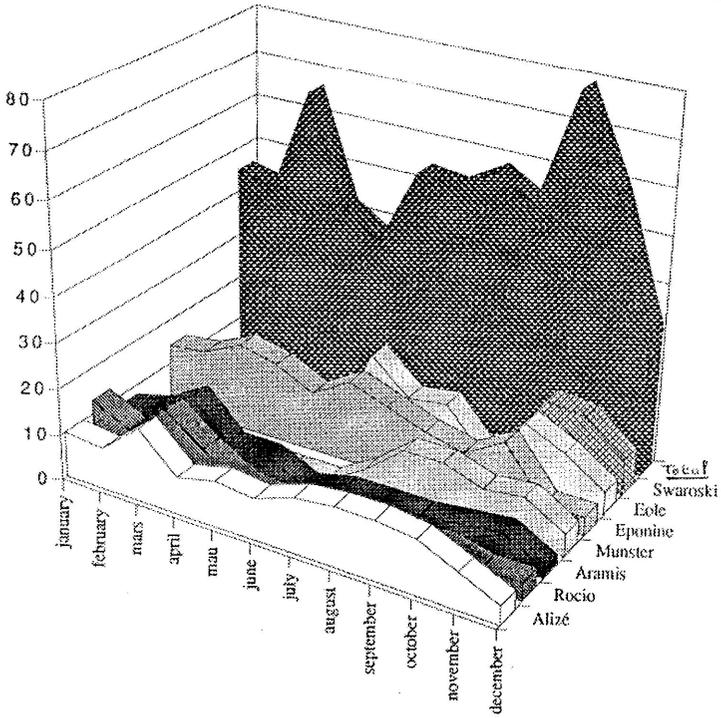
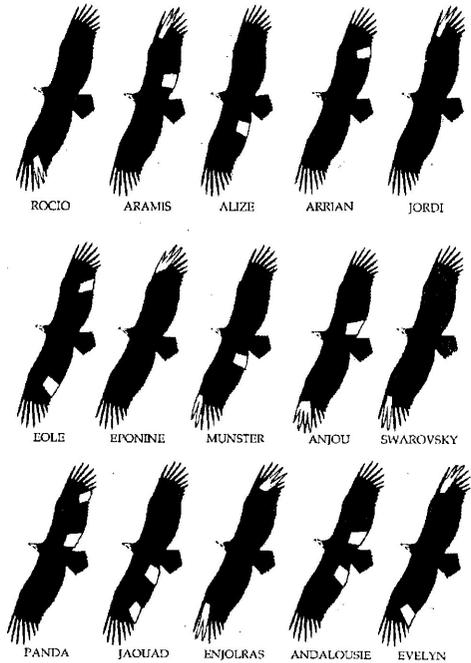


Figure 4: Individual father decolouration marks for flight identification.



same area. An information centre has been built for the public in the Jonte Valley. Since 1992, 20,000-30,000 people have visited this centre. About 2,000 people participate yearly in guided field trips and are kept informed through films.

RESULTS

Captive breeding

By improved captive-breeding success and organisation among the different project participants, the traffic with species proceeding from the wild in Asia can be reduced. Recently, also the incorporation of impaired Black Vultures from Spanish recovery centres has helped to boost the captive population. A total of seven birds have been donated by the Spanish autonomous communities (See Table 3).

Since the beginning of the project, an increase in breeding success can be noted, mostly due to a deeper awareness in the zoological gardens of the importance of the species. Nevertheless breeding success should still be much better than it actually is. A total of 52 nestlings have been raised up to 1994. Out of 75 formed pairs only 25 have ever reproduced successfully (Tewes 1996). Out of 50 nestlings bred during the 10 years of activity of the BVCF, 20 have been selected for release in Mallorca or France (see Table 2).

The statistical interpretation of the questionnaire returned by the project participants was done by t-test and stepwise discriminant analysis and showed that the cage size and form as well as the nest high influence significantly the breeding success. Pairs which live in large and rectangular cages with high nests have better breeding results than pairs under other conditions (Tewes, 1996).

The importance of a captive breeding project of a species for its conservation raises with its degree of being endangered. If the species recovers in the wild and is not any longer considered to be endangered, as is the case with the Black Vulture in Spain, the continuation of the breeding project has to be re-evaluated to avoid unnecessary costs when funds are needed for conservation in the wild or for other species which are more endangered.

There was no doubt over continuing the Black Vulture breeding project although the Spanish population recovered from about 206 breeding pairs in 1974 (Hiraldo, 1974; Garzón, 1974) to at least 1027 in 1993 (Sánchez, in press). It has its justification in the precarious status of the species at European level, in the low costs involved and in the importance of the nestlings used for release into the wild. These are especially valuable as they facilitate reintroduction of the species where it is extinct and fixation to the release area just as a colony is fixed to its breeding site.

Reintroduction of the Black Vulture in France

Development of the releases: In the first year, in 1992, six nestlings were selected for release by hacking (see Table 4). One of them ("Rocío") was recovered from the wild in Andalucía, reared in captivity together with the nestling of a captive pair in Mallorca. The other five were derived from the captive breeding project.

Table 3. Annual captive breeding success and releases, 1986-1995.

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	Total
Nr. nestlings reared	3	1	4	6	9	3	9	4	5	6	50
Nr. nestlings released	0	0	2	6	2	0	5	2	1	2	20

One of the six nestlings ("Eole") had to be brought back from the release site because of a deformation of one leg, due to which it could not walk normally. The other five fledged successfully. One of them ("Arrian") stayed in the release area for seven weeks after fledging and then left the Cévennes. The other four remained around the release area. They have been observed in a radius of up to 100 km, at which larger distances they stayed for up to two weeks. The independence of the Black Vultures from the release site was considerably greater than that of the Griffons.

In 1993, two nestlings were released by hacking and, for the first time, one bird by the cage. All three integrated successfully into the already free-living group.

In 1994, again two nestlings were released by hacking. A third bird, "Eole", after an operation on its leg, was released by the cage. One nestling ("Celia") came from the wild and was rehabilitated in the Doñana Recovery Centre. Its plumage showed strong signs of malnutrition, which later caused the tail feathers to break. Although it now appeared to have recovered perfectly, it did not fledge successfully, was recaptured and has been integrated into the captive breeding project.

In spring 1995, five birds were released via the cage. All of them integrated well into the Black Vulture group.

A total of 16 birds had been released up to April 1995. From those, 12 were still present in the Cévennes.

Integration into the free-living group: The presence of the Griffon Vulture colony, now numbering more than 180 individuals, had an important influence on the adaptation of the first Black Vultures released in 1992. As soon as they were able to fly, they often joined the Griffons. During the first 4-6 weeks

Table 4. Data on the Black Vultures released in the Cévennes, updated to May 1996.

<i>Name of Vulture</i>	<i>Origin, Captive breeding (c.b.)</i>	<i>Hatching date</i>	<i>Sex</i>	<i>Date and age on arrival in Cévennes</i>	<i>Date and age at fledging or release</i>	<i>Time spent on hacking cliff (h) or in cage (c)</i>
Jordi	Mallorca (c.b.)	17.5.92	m	25.7.92 70 days	13.9.92 120 days	50 days (h)
Rocio	Andalucia	26.4.92	f	25.7.92 91 days	25.8.92 123 days	31 days (h)
Alizé	Villars les Dombes (c.b.)	11.5.92	-	27.7.92 78 days	13.9.92 126 days	48 days (h)
Arrian	Vienna (c.b.)	19.4.92	f	4.8.92 108 days	21.8.92 125 days	17 days (h)
Aramis	Münster (c.b.)	30.4.92	m	4.8.92	22.8.92 97 days	18 Days (h) 116 days
Eole	Zoo de Haye	11.5.92	-	27.7.92 78 days	-	-
Eponine	Andalucia	1992	f	22.4.93	14.7.93 1 year	84 days (c)
Münster	Münster (c.b.)	21.4.93	m	22.7.93 93 days	4.8.93 106 days	13 days (h)
Anjou	Dou la Fontaine (c.b.)	8.5.93	-	22.7.93 75 days	25.8.93 109 days	34 days (h)
Eóle	Zoo de Haye (c.b.)	11.5.92	-	30.7.93 1 year	30.5.94 2 years	10 months (h)
Celia	Andalucia	June 94	f	2.9.94 86-91 days	-	-
Swarovski	Vienna B.U. (c.b.)	22.5.94	-	2.9.94 104 days	25.9.94 127 days	23 days (h)
Enjorlas	Extremadura	1992	m	6.7.94	7.2.95 2 years	7 months (c)
Evelyn	Extremadura	1992	f	19.12.94	7.2.95 3 years	48 days
Andalousie	Extremadura	1993	f	11.10.94	28.2.95 2 years	3.5 months
Panda	Valencia	1992	f	6.7.94	7.4.95 3 years	9 months
Jaquad	Extremadura	1993	f	6.7.94	7.4.95 2 years	9 months
Mayol	Münster (c.b.)	1995	-	2.8.95 106 days	17.8.95 121 days	15 days
Peter	Vienna B.U. (c.b.)	1995	-	3.8.95 90 days	31.8.95 117days	28 days
Lady Day	Extremadura	1993	f	21.10.95	24.4.96 3 years	6 months
Juan	Andalusia	1994	m	9.6.95	9.4.96 2 years	10 months

Table 5. Monthly individual records in 1994.

	Alizé	Rocio	Aramis	Münster	Eponine	Eole	Swarowsky	Total
January	10	13	8	0	14	-	-	45
February	9	9	10	0	15	-	-	43
March	16	16	15	0	19	-	-	66
April	8	10	7	0	17	-	-	42
May	10	5	7	0	13	2	-	37
June	9	4	3	0	18	20	-	54
July	12	3	5	5	15	13	-	53
August	13	1	5	12	12	14	1	58
September	13	5	5	12	10	5	3	53
October	12	6	6	9	15	15	16	79
November	8	4	7	10	4	11	15	59
December	4	4	2	5	4	5	8	32
Total	124	80	80	53	156	85	43	621

they stayed in the surroundings of the release site, after which they became increasingly independent. The Griffon colony helped the Black Vultures to discover rapidly the whole foraging area of the former as well as the feeding places. Nevertheless, the released Black Vultures also constantly maintained contact with each other or flew alone. The release area continued to be the preferred diurnal and nocturnal roosting place.

In 1993 and 1994 the released birds immediately integrated into the Black Vulture group. The nestling "Swarowsky" of 1994, which fledged alone as its hacking partner "Celia" was not fit for release, joined two vultures, "Alizé" and "Eponine", which seemed to form a pair, and was accepted by them also at their roosting place.

At present there are five favourite roosting places recognised, which are used alternately. They lie within 2 km of the Jonte Gorge, close to the Griffon Vulture colony. None of the roosting places has been used by the whole colony, the maximum number present being four birds. They roost on Scots Pines (*Pinus silvestris*) or rocks, overlooking the valley.

The birds released via the cage sometimes roosted on its roof during the first nights after release.

Foraging: The foraging area of the Black Vultures is about the same as that of the Griffons. It covers 40,000 ha, which are not patrolled regularly, but to a varying extent in the different seasons (weather conditions, food availability). High altitude movements are mostly made with Griffon Vultures. At carcasses the young Black Vultures are dominant over the Griffons, nevertheless they often wait until the end of the meal before entering into

competition on the carcase. They have also been observed feeding on small animals such as hares which died of V.H.D. Four of the birds could be observed feeding on carcasses found by themselves.

Local fixation of the Black Vulture group: Two of the released birds, "Arrian" and "Münster", showed strong dispersal behaviour (see Figure 1). Seven weeks after fledging, "Arrian" left the Cévennes and was relocated 150 km further south. Seven months later, in May 1993, it reappeared in the Cévennes to spend five months with the local Black and Griffon Vultures. In its second winter this bird was observed for several months in Andalucia, around Tarifa. "Münster" was absent in its first winter from November to July and was observed several times in the French and Spanish Pyrenees before returning to the Cévennes.

Three of the released birds, "Rocio", "Alizé" and "Aramis", wandered for distances of 50-150 km, always for a few days or up to 1 or 2 weeks.

Another two, "Eponine" and "Eole", stayed within the main foraging area.

Problems and deaths: Five birds suffered problems during or after release: apart from "Eole" and "Celia" already mentioned, another bird ("Jordi") was found dead six months after release. An autopsy could not reveal the cause of death. A fourth bird ("Anjou"), had problems with fledging, was recaptured and released six weeks later via the cage. It dispersed and was found four weeks later 150 km away in a very weak condition. It died the next day and during autopsy the remains of plastic bags were found in the intestines. The fifth bird ("Alizé"), suffered problems during its first flights, due to an injury to one wing. It was recaptured and released again two months later. At first it adapted well but one year later, in October 1993, it was recaptured, recovered in the cage and was re-released two months later, since when it has shown normal behaviour.

During hacking in 1994, a fox appeared once on the release platform, obviously attracted by the food for the vultures. Plastic bands were fixed to the gap through which the fox came to the release platform, preventing it from entering again.

Age and sex structure: The age structure of the group of 12 surviving free-living birds in April 1995 was as follows: 1 bird in the first year of life, 3 birds in the second year and 8 birds in the third year.

In principle all birds are sexed before release. Nevertheless, with some the sex remained unknown, as not all analyses were successful. At least once a mistake occurred due to the reproductive behaviour of the birds. From the group of 12 surviving free-living birds, 3 are male, 6 are female and 3 are of

unknown sex (see Table 4).

Reproductive behaviour: The first reproduction in France could not be expected before 1996, when the first released birds are four years old. Earliest breeding occurred at this age with several released Black Vultures in Mallorca. Nest construction was initiated already at three years. Observations in April 1995 in the Cévennes indicated that already two pairs were formed. Also nuptial flights and territorial behaviour were observed. From one "pair", both partners ("Eponine" and "Alizé") were seen carrying branches to their favourite roosting tree.

Acceptance of artificial nests: Both nests were used as roosting places by several Black Vultures. One young bird, "Mayol", used a nest regularly for roosting some weeks after its release. One pair, "Alizé" and "Eponine", regularly frequented one of the artificial nests.

Results until May 1996: Since April 1995, two Black Vultures have been released via the cage and two nestlings by hacking (see Table 4). One bird, "Mayol", was found dead after collision with an electric power line. Another bird, "Arrian", was found dead in Andalucía, the cause of death being unknown. In 1996, the first egg was laid on 5th or 6th March. The pair consists of "Rocio" and "Aramis", both released by the hacking method. Incubation took place without problems and on 30th of April a nestling hatched (55 or 56 days of incubation). It is cared for by both parents. This breeding result revealed a mistake in the sex determination as both birds were considered to be females. The nest tree selected by the pair is *Pinus silvestris*, located about 500 m from their release site and 40 m from an artificial nest.

DISCUSSION AND CONCLUSIONS

Over four years 20 birds were released in France, of which 15 are still present in the Cévennes. Without taking into account the natural reproduction of the colony, and assuming a similar frequency of release, the reintroduction period in the Cévennes would last in total about 12 years. An increase in natural reproduction would shorten this period as well as improved captive breeding and collaboration by the Spanish authorities, two factors which would make possible a higher release frequency.

First successful breeding took place at an age of four years, while first nest construction activities could be observed already at three years. These early ages correspond to those observed with released birds in Mallorca. Nevertheless, such an early start was not expected in the reintroduction project, as no breeding colony was present with which the young birds could integrate. The very good result of the project is considered to be due on the one hand to

the presence of a colony of Griffon Vultures (182 birds including 50 pairs), and on the other to the importance of release by hacking.

The location of the first successful nest is of great importance, as probably further nests will be built in its neighbourhood. The selection of nest site by the released birds could be influenced by the situation of the release nest and probably also stimulated by the artificial nests. The breeding site of the reintroduced colony could therefore enhance the possibilities for protection and monitoring.

Dispersal behaviour, which was different in each individual, provoked an increased mortality. Three of the four birds which died were found at considerably greater distances than the normal foraging area of the colony.

Detailed, individual monitoring is possible because of the quite high fidelity of most birds to the release area and the possibility of identifying rings at feeding and roosting places.

Sex determination is considered to be an important element. An unfavourable sex relation would have a negative influence on pair building and first breeding attempts.

Considering the relatively large number of Black Vultures kept in captivity, the number of nestlings successfully raised each year is still disappointing. Up to now, in most years, there has been no more than the minimum number of nestlings - 2 individuals - available for release. The species is difficult to breed, if it is not provided with a series of minimum conditions. The BVCF is making efforts to increase breeding success in collaboration with the EEP and intensifying direct contact with all project participants. Improving breeding conditions in a project based on collaboration with zoological gardens is often long-lasting, as breeding is not a priority in many cases. If breeding success cannot be improved considerably in the following years, the establishment of a specialised breeding station should be considered. Experiences with other species (Frey, pers. comm.) show that the existence of such a centre has important advantages and could increase the total breeding success of the project.

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