Lammergeier
(Gypaetus barbatus)

European Union Species Action Plan for the Lammergeier *(Gypaetus barbatus)*

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Milestones in production of action plan

Workshop:	12-15 December 1996 (Ansó, Spain)
First draft:	January 1997
Final draft:	November 1997

Reviews

This action plan should be reviewed and updated every two years. An emergency review should be undertaken if sudden major environmental changes, liable to affect the population, occur within the species range.

Geographical scope

Within the EU this plan is intended for implementation in: Austria, France, Germany, Greece, Italy and Spain. Information has been also compiled for Andorra, Morocco, Switzerland, Turkey and Morocco.

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SUMMARY

The Lammergeier or Bearded Vulture *Gypaetus barbatus* is an Endangered species in Europe because its population numbers fewer than 250 breeding pairs. It is listed on Annex I of the EU Wild Birds Directive and Appendix II of the Bern Convention and Bonn Convention.

The species is sedentary. The global population is not concentrated in Europe, but the species persists in Spain (Pyrenees), Turkey, France (Pyrenees and Corsica) and Greece (Crete and the continent). The European population is 162 breeding pairs, with 93 in the EU; additionally North Africa has 5 pairs in Morocco. Only the Spanish and Turkish populations number 50 breeding pairs or more.

Following very severe declines during the last two centuries, which exterminated the species from some ten countries of central and south eastern Europe, the population in Europe is now increasing in Spain, stable in France and Russia and decreasing in Albania, Greece and probably Turkey. The peripheral population in Morocco is particularly threatened having declined sharply. A reintroduction initiative has been implemented in the Alps since 1986; more recently, a reintroduction project has started in the region of Andalucía in southern Spain.

Threats and limiting factors

- Poisoning - potentially critical
- Decline in extensive livestock farming - high
- Habitat loss and deterioration - high
- Overhead cables - high
- Food shortage - locally high
- Disturbance - potentially high
- Illegal shooting - locally high

Conservation priorities

Careful monitoring of poisoning incidents and implementation of anti-poisoning campaigns - essential

Habitat protection, especially at the breeding territories, through the designation of Special Protection Areas - essential

Targetted supplementary feeding to assist winter survival and boost breeding populations -high

Access restrictions to sites which are regularly disturbed - high

Corrective measures to prevent collision with over-head cables - high

Effective monitoring, especially during the breeding season - high

Special wardening at sensitive sites - medium

Restoration of wild ungulate populations - medium

Effective coordination and information exchange at the international level - medium

Reintroduction to vacant areas of the former range – low

Maintenance of extensive pastoral farming in mountain regions - high

1. Introduction

The Lammergeier or Bearded Vulture *Gypaetus barbatus* is a specialised scavenger which inhabits mountain areas in southern Europe. It is endangered at Europe level, numbering fewer than 250 pairs, but its global population is not concentrated in Europe (Tucker and Heath 1994). The species is listed on Annex I of the EU Birds Directive, Appendix II of the Bern Convention, Bonn Convention and CITES.

The population under the scope of the action plan comprises 198 breeding pairs, of which 93 are in the EU. Once widespread across the continent, it has undergone dramatic declines leading to extinction in the Alps, the Balkans, the Carpathians, Cyprus and Sicily. The declines were due mainly to persecution by man. The remnant populations are isolated and in urgent need of conservation action assisted by international cooperation and provision of expertise.

This action plan is based on a workshop, held in Ansó (Huesca, Spain) on 13 December 1996, hosted by the regional authorities of Aragón and attended by 14 people from the current EU range states: Spain, France and Greece. It also draws on an extensive consultation process which was carried out thereafter and a thorough review of the available literature.

We expect this action plan to be a catalyst for conservation action and we hope it will serve as a bridge for the exchange of expertise among those involved in the research and management of this emblematic species.

2. Background Information

2.1 Distribution and population

The Lammergeier is widely distributed in mountainous regions in Eurasia and Africa with a small proportion of its global range in Europe (Tucker and Heath 1994). There are apparently large populations in East Africa, Central Asia and the Himalayas (del Hoyo *et al.,* 1994). The species is resident throughout its range.

In Europe, the species now breeds only in Andorra, Spain (regions of Navarra, Aragón and Cataluña, all in the Pyrenees), France (Pyrenees, Corsica and the Alps), Greece (in Crete and on the continent in Thrace, Epirus, Thessaly and the Pindus range), Turkey (throughout Anatolia) and in North Africa, only in Morocco (Atlas range). The total population for Europe and North Africa is ca. 167 pairs of which 148 breed regularly, including 112 pairs in the EU of which 93 breed regularly.

The species was exterminated from Germany by 1855, Switzerland 1884, Bosnia and Herzegovina 1893, Austria 1906, Italy 1913, Romania 1935, Czechoslovakia 1942, Yugoslavia (Serbia, Montenegro) 1956, Bulgaria 1966, and the Former Yugoslav Republic of Macedonia in 1990 (Tucker and Heath 1994). The decline continued during 1970-1990 in Greece and Albania. However, the species is locally stable, or decreasing only slightly in Russia, stable in Turkey and France and increasing in Spain (Tucker and Heath 1994).

A reintroduction project in the Alps (Austria, France, Italy and Switzerland) has released 72 captive bred birds during 1986-1997 at 5 release sites. The number of free-flying birds is estimated at 37-44. One pair laid eggs in the French Alps in 1996 and hatched one chick in 1997.

TABLE 1. Population status of the Lammergeier in the European Union, Turkey, North Africa

Country	Number of breeding pairs	Number of occupied territories	Year of estimate	Population trend	Source
Andorra	(1)*				
Spain	56	66	1996	increase	R. Heredia own data
France	25	28		stable	M. Razin, pers comm
- Pyrenees	16	19	1996	slight increase	J.C. Thibault pers comm
- Corsica	8	8	1996	stable	J.J. Lafitte *in litt*.
- Alps	1	2	1997		
Greece	12	18		large decrease	Handrinos& Akriotis 1997
- continent	3	7	1996	stable	G. Handrinos *in litt*.
- Crete	9	11	1996		S. Xirouchakis pers comm
Total EU	**93**	**112**	**1996**		
Morocco	5	5	1996	decline	B. Heredia own data
Turkey	100	100	1996	decline	B. Heredia own data
Total	**198**	**217**			

*The pair in Andorra is shared with Spain.

Breeding pairs are those which reproduce regularly. Occupied territories include breeding pairs, pairs which have recently established territories but not yet bred and traditional territories where one or both birds are still present but not breeding. Figures are those contributed at the Ansó workshop, December 1996

2.2 LIFE history

Breeding

The Lammergeier breeds in caves and on cliffs in mountain ranges at 400-2000 metres a.s.l. It builds a bulky stick nest and lays one or two eggs from late December to early March. Both adults participate in incubation. After 54-58 days the young hatch in February or March and after 112-119 days they fledge in June. Although both chicks may hatch one normally dies due to sibling agression; one of the few records of both chicks fledging is from Ethiopia in 1996. The young remain in the area until the beginning of the next breeding cycle in November (Heredia, 1991a). Sexual maturity is at about seven years or later (del Hoyo, 1994).

Usually monogamous. Polyandrous trios, normally two males and one female, were first recorded in the Pyrenees in 1979. Numbers of such records have increased ever since including in Corsica; 14% of the breeding territories in the Pyrenees were occupied by trios in 1996. Trios have similar reproductive success to that of the pairs which formerly occupied the same territories and also to that of neighbouring pairs. The formation of trios has been attributed to biased sex ratios, low food availability, high breeding density or genetic relatedness between males, but as yet there is no proof of which is the key factor (Donazar 1991, Fasce *et al* 1989). The phenomenon could have important implications for conservation of the Lammergeier.

Feeding

The diet of the Lammergeier consists of bones (up to 85% of diet), especially large bones and flesh taken from dead animals (del Hoyo, 1994). It breaks large bones into small pieces which it can eat by flying up with the bone and dropping it on special rocky slopes. Small animals (birds and rodents) are fed to chicks, forming an important part of their diet.

In the Pyrenees: 88% of prey items are mammals, mainly domestic ungulates (extremities of sheep and goat), Chamois *Rupicapra rupicapra* and Marmot *Marmotta marmotta;* 7% birds; and 0.7% reptiles (n=152 prey items) (Heredia, 1991b). A recent study of a nestling in the Spanish Pyrenees revealed that 59% of prey items were sheep or goat, 25% rabbit, 3% wild boar, 3% cow/horse, 1.6% dog and 1.6% fox (n=78 prey items) (Margalida and Bertram 1997).

In Corsica the diet is mainly limbs of domestic ungulates (36% sheep and goat, 33% cattle, mostly calves), pigs, both wild and domestic (16%), Mouflon (12%); birds and small mammals are scarce in the diet (Thibault *et al.* 1993). Breeding success on Corsica seems to depend on particular stock rearing activities as their main food source is transhumant caprines and free range cattle.

In the Alps, the main diet of the released birds is Chamois and Ibex between December and June and sheep between July and November. Marmot is also a source of food, especially spring (C. Coton, *in litt*. 1997).

Habitat Requirements

The Lammergeier forages over montane and sub-alpine vegetation, mostly above 1000 m, where both domestic and wild ungulates occur. In winter and early spring it exploits mid-altitude and steep-cliff areas where snow does not accumulate (Thibault *et al.* 1993). In the Pyrenees, during winter and spring, the bird visits the *muladares*, which are places near the villages where domestic animal carcasses are dumped regularly. In the Alps pairs prospect an area of ca 500 sq km during the summer and ca 120 sq km during the winter (C. Coton, *in litt*. 1997).

Movements

It is largely a resident species, although with enormous home ranges and the young may disperse widely. Although there have been more than 100 sightings of Lammergeiers outside the Pyrenees since the late 1980s (M. Hernández, *in litt.* 1997), none of the 33 young wing tagged in the Pyrenees during 1987-1996 were seen among them (R. Antor *in litt.* 1997). The average home range of 13 of these young was 4,932 (950-10,294) sq km (Heredia 1991c). No adults have so far been wing tagged or radio tagged. In the Alps 70% of the released birds return to the release site although one bird was recorded ca. 1,300 km from the release area, outside the Alps, two strategies appear to emerge: birds with an average home range of 1,000 sq km and birds with an average home range of 1,500 sq km (C. Coton, *in litt*. 1997).

2.3 Threats and limiting factors

Poisoning

The only two radio-tagged juvenile Lammergeiers recovered dead to date in the Spanish Pyrenees were found to be poisoned, one with Strychnine and the other with Warfarin (a rodenticide) (M. Hernández *in litt.,* 1997). It is likely that the use of poisoned baits for predator control is increasing in the Pyrenees, especially in hunting areas to eliminate fox and corvids, and at rubbish dumps to eliminate rats.

The extinction in the Balkan peninsula was largely due to extensive poisoning campaigns against wolves and jackals. In France five birds were poisoned between 1955 and 1991 (Terrasse 1991). In Crete there is a risk of poisoning from agriculture pesticides and insecticides used to protect cattle. In the Alps (Austria, Germany and Switzerland) raptors have been poisoned with Carbofuran, an agricultural pesticide normally used as a seed dressing.

Importance: potentially critical

Pollution

There is no evidence that pesticide levels in the Lammergeier have been high enough to cause breeding failure although:

- pesticide residue analyses of three eggs from two clutches and six carcasses from the Spanish Pyrenees found medium levels of Lindane, HCH isomers, Dieldrin, DDT and dervatives and hexachlorobenzene in both eggs and carcasses; and
- scanning Electron Microscopy of the comparative ultrastructure and composition of 14 Lammergeier eggshells from Spain and France and eight eggshells from museums collected before the use of pesticides found any serious sign of pollution of the modern eggs.

With the rapid intensification of farming and industrial development of the Spanish and French Pyrenees, pollution levels are expected to increase in future, and may become a threat if agrochemical use and industrial waste are not carefully regulated.

Importance: medium/potentially high

Lead Poisoning

Lead poisoning is a possible cause of death in areas of intensive hunting (Heredia and Heredia 1994) and migration pathways. Lead may reach Lammergeiers through consumption of prey shot by hunters (wood pigeons, thrushes, etc.). However, a study in Aragón (Spain) on chronic lead exposure, found lead levels far below those indicative of chronic poisoning in blood from 16 individuals including chicks, juveniles and adults and liver and bone samples from 13 individuals.

Importance: medium/potentially high

Illegal shooting

This is an important cause of mortality. In the Pyrenees, in Spain six (all adults) out of 11 birds found dead during the last 13 years were shot and on the French side three adults have been shot since 1986 (M. Razin pers. comm. 1996). Lammergeiers often fly over colls and passes where hunters wait for game, thus providing an easy target. In Corsica two birds were shot in 1991 (J.C. Thibault pers. comm. 1997). Since the beginning of the reintroduction project three birds have been shot in the Alps, in France in 1993 one in Italy in 1994 and one in Switzerland in 1997. In the Alps this is the most important cause of death (C. Coton, *in litt.* 1997).

Importance: high

Habitat loss and deterioration

The risk of progressive, piecemeal development of mountain areas is one of the major threats for the future of the species. Developments such as roads, dams, ski-resorts etc. can cause irreversible habitat loss and also disturbance. For example, the creation of tracks in sensitive areas can bring the risk of disturbance and associated development to previously inaccessible places. Such tracks are often associated with modern forestry developments (FIR 1996). In the French Pyrenees one breeding area was abandoned due to the construction of a small hydroelectric power station.

In addition, habitat deterioration that leads to a decline in wild ungulates and marmots

could be a problem, especially where there is a shortage of domestic stock.

Importance: high

Decline in extensive livestock farming

The Lammergeier relies largely on domestic animals for survival, especially sheep and goats. The decrease or the total abandonment of traditional farming practices could be a great problem in the near future. The lack of food resources can be especially acute during the winter, when herds come down to lower altitudes to be kept indoors or move to other areas out of the bird's range. Wild ungulates, an important food source, are usually scarce and localised.

Food scarcity during winter is an important limiting factor for young birds (0-3 years), which are unexperienced and often lack knowledge of the territory and food storage behaviour.

Food may be a limiting factor in Corsica but does not seem to be in Crete. In the French Pyrenees the birds rely largely on wild ungulates and feeding stations. Food is not a limiting factor in the Alps, where wild ungulates are not scarce (C. Coton, *in litt*. 1997).

Importance: high (potentially critical in Corsica)

Changes in methods of carcass disposal

New regulations mean that traditional methods of disposing of carcasses, which involved leaving them in the open where they could be accessible to scavengers, are no longer acceptable at least within the EU. This could remove an important food source of the Lammergeier, e.g. in Spain (Heredia, 1991b).

Importance: high

Disturbance

The Lammergeier is especially sensitive to disturbance. Any human intrusion at or near the nest during the breeding period can lead to reproductive failure. The main cause of disturbance are hunting parties, where people, dogs and 4-wheel drive vehicles pass through the valleys making noise and flushing wildlife towards the colls and passes where hunters are waiting. Wild boar hunting in this way is a very popular sport in the Pyrenees, and it takes place during the winter months when the Lammergeier is laying or incubating. Every year there are reproductive failures which are directly caused by these hunting parties. In France one clutch was lost for this reason in 1983 and a pair could not lay in 1996.

Another source of disturbance in the Pyrenees is military training, which often takes place during the incubation period, including traffic of heavy vehicles along forest tracks, shooting exercises and overflying of planes and helicopters.

In the French Pyrenees two pairs suffer disturbance from low-flying aircraft. Fires lit by farmers are also a problem (FIR 1996).

Mountain sports, such as rock-climbing, ice-climbing, parachuting and canyoning, are an increasing problem disturbing breeding pairs. In Crete there is a great problem with rock climbing on Mt. Dicti, Asteroussia and Lefca Ori.

Other notable causes of disturbance are filming and photography. There is an increasing demand from photographers and film makers to get Lammergeier shots. In Spain any filming at the nest needs a specific permit. In France a permit is also needed to film in protected areas (Nature Reserves and National Parks). Illegal filming causes disturbance problems in both countries. in the Alps it is forbidden to film in a radious of 0.7 km around the nest.

Tourism in mountain areas is not a big problem at present, but it could become so in the future if the numbers of visitors continues to increase.

Importance: medium (high in the Pyrenees and in Crete)

Overhead cables

Overhead cables are, together with illegal shooting, the most important cause of mortality in the Pyrenees. At least four birds (three adults and one subadult) have died so far on both sides of the range. Also, collision with high tension power lines caused the death of three birds in the French Alps. Medium sized lines with three cables are especially dangerous, since they are difficult to see, especially when they cross high colls

and passes. The construction of dams, ski-resorts, antennas, etc. usually brings the associated construction of new electric lines.

Importance: high

Lack of awareness

In the French and Spanish Pyrenees and in Crete a number of public awareness campaigns have been carried out in recent years, with EU LIFE funding. This is not the case in continental Greece, Turkey and Morocco, where public awareness of the Lammergeier and the problems it is facing remains low. This constitutes a threat in itself as it is not easy to undertake conservation measures where there is a lack of concern about the species status and trends. This relates particularly to the threats of direct persecution and poisoned baits.

Importance: low

2.4 Conservation status and recent conservation measures

Andorra

There is one breeding pair which is shared with Cataluña, Spain and foraging birds from other areas are very often seen. The main threats are Chamois hunting, tourist developments and helicopters. There is no specific legislation for nature conservation and neither EU Directives nor international conventions apply. The species has been monitored since 1980.

Austria

As part of the Alpine reintroduction project, 25 birds have been released during 1986-1996.

France

Pyrenees

The Lammergeier has been protected since 1963. In recent years there has been a slight population increase, but long term stability is not guaranteed. There are 19 occupied territories and 16 breeding pairs. One of these is within the Pyrenees National Parc (an SPA) and two more are in protected areas (sites classés). New reserves and other legal measures are foreseen to cover breeding areas.

In some areas there are agreements to prevent disturbance by helicopters, fires lit by farmers and forest exploitation. Vulnerable nests are guarded every day during the breeding period. Since 1994 supplementary food has been provided at 14 sites. This operation is very helpful to breeding pairs, especially those at lower altitudes. It also assists the establishment of new pairs in the eastern part of the range. A Restoration Plan has been prepared by FIR and endorsed by the Ministry of the Environment (FIR 1996 and Ministère de l'Environnement 1997).

Corsica

The breeding population has been stable at eight pairs during 1983 to 1996. They all breed within the Natural-Regional Park of Corsica. This provides a soft level of protection. The designation of protected areas in Corsica is a priority for the future.

Monitoring is carried out annually by Paolo Fasce in collaboration with the Natural-Regional Park. Breeding data have been collected from 1976 and since 1983 almost the whole population has been checked (Fasce *et al*. 1989). During 1983-1996 the mean productivity was 0.22 fledged young/checked pair/year; this low ratio may correspond to insular conditions and high density, but data from Crete are insufficient to confirm these hypotheses. There could be a problem of infertility in one pair at least, which is attributed to aging in addition to food shortage (P. Fasce, pers comm. 1996). In 1979 one trio was formed (Fasce *et al.* 1989).

During the 20th century, stock rearing activities in Corsica have undergone important changes. Numbers of sheep and goats decreased during the 1950s and 1960s, becoming more stable during the 1970s although with a 40% decrease in the number of transhumant animals. During 1979-1988 the number of cattle has increased by 42% because of new subsidies, so cattle are now a very important food source for the Lammergeier (Thibault *et al.* 1993). The Mouflon population is estimated at less than 1000 (J.C. Thibault, pers comm. 1996).

Supplementary food - mainly goat and sheep carcasses - is put out in autumn at four inaccessible sites, by helicopter and at two other places by car during autumn and spring.

Persecution is rare (although 2 immatures were shot in 1991) and overhead wires do not seem to be a problem.

An action plan for Corsica is being prepared (C. Coton, *in litt.* 1997).

French Alps

As part of the alpine reintroduction project, there has been a project to restore the species to the Haute Savoie and Alpes Maritimes by releasing captive bred birds: 30 at two release sites during 1987-1997. One territorial pair and one breeding pair have been established (J.J. Lafitte *in litt.* 1997) and the first chick hatched in 1997. New pairs are expected in the next two years.

Greece

The total population for Greece is estimated at 12-18 pairs (Handrinos and Akriotis, 1997), although other sources claim that the species no longer breeds on the continent, despite a juvenile being seen in 1995 (C. Papaconstantinou *in litt.* 1997). The Lammergeier has been protected since 1977 and particularly since 1985 (Joint Ministerial Decision nº 414985/85). It is included in the Greek Red Data Book as Endangered (Handrinos 1992). All the breeding areas have been designated as SPAs under the EU Birds Directive (79/409/EEC) and as prospective NATURA 2000 sites under the Habitats Directive (43/92/EEC).

Continental Greece

The precise number of breeding pairs in continental Greeece is unknown at the moment though there is a pessimistic estimate of 1-2 pairs with single adults in Dadia, Olympus and the border with FYR Macedonia (S. Xirouchakis pers comm. 1996). In 1980 it was present in Thrace (2-3 pairs), Macedonia (1-2 pairs), Epirus (1-2 pairs), Thessaly (more than 2 pairs on Mt Olympus and probably in the central Pindus), Sterea (5-6 pairs in the Parnassos, Giona and Vardoussia mountains). The total estimate at that time was 23 pairs (Handrinos 1985). The most recent published estimate is 3-7 pairs (Handrinos and Akriotis 1997).

There has been a dramatic population decline which is attributed to poison baits laid for wolves and shortage of food (S. Xirouchakis pers comm. 1996). Shooting and the construction of mountain roads are also a threat. Overall, a factor responsible for the species decline is the Government's lack of capability to control land-use changes and enforce protective measures (C. Papaconstantinou *in litt.* 1997).

Crete

It is present in all the mountain chains of the island above 400 m. Areas of major importance include the mountains of Selinou province, Lefka Ori, Mt. Krioneritis, Mt. Kedros, Mt. Idi, Mt. Dikti, Asterusia Ori and Mts. Thrypti and Orno. There are nine pairs and two more territories occupied by single adults. The total population is 31 birds, 38% of which are juveniles and immature. The population is considered to have been stable for the last ten years, though one or two pairs may have been lost due to direct persecution by man (Xirouchakis and Giannatos 1996, Xirouchakis pers comm. 1996).

The main problem is illegal shooting by young stock breeders and hunters. Target shooting is very popular and perhaps the cause of the species decline in certain areas. Road building is another serious problem, especially the network of truck roads which now render accessible previously remote areas. As a result, human pressure and disturbance has increased considerably in some territories. Habitat loss due to a forest fire was recorded at Mt. Dikti, where a nest was abandoned in 1995. Poisoned baits do not currently seem to be a problem, although beekeepers use lindane and farmers use poison for ravens (Xirouchakis and Giannatos 1996, Xirouchakis pers comm. 1996). Neither does food shortage as there are ca. 800.000 free range domestic ungulates on the island, mainly goats and sheep.

During 1995-1996 EU LIFE-Nature funding was given to the NGO, Immediate Intervention for the Protection of Nature, for a project to conserve the species in Crete. This included study of the ecology, distribution, feeding habits and demographics with a view to proposing conservation action eg identification of potential SPAs, establishment of articficial feeding stations and wardening schemes at vulnerable nests and a public information campaign targetted at local communities and authorities.

Italy

As part of the alpine reintroduction project, four birds have been released during 1994-1996, the release site being a protected area.

Morocco

In recent years the range has contracted and the Lammergeier is now probably extinct in the Rif, the central plateau and most of the middle Atlas. It is now very localised, occuring only in small numbers in the high Atlas (Toubkal and Oukaimeden), the anti-Atlas (between Tiznit and Tafraout) and probably in Figuig province (Z. Arhzaf in litt. 1995, Thevenot *et al* 1985). Information on the Moroccan population is very scarce and fragmented.

Spain

Pyrenees

The Lammergeier is listed as endangered in the Spanish Red Data Book (Blanco and González 1992) and in the National Catalogue of Threatened Species (Royal Decree 439/90). The species breeds only in the Pyrenees, but there are observations of dispersing birds in numerous places outside the Pyrenees, especially in the Iberian range (*cordillera Ibérica*), Cantabrian range (*cordillera Cantábrica*) and central mountains (S*istema Central*).

In 1996 there were 56 breeding pairs and 66 territories (6 in Navarra, 44 in Aragón and 16 in Cataluña). Thirteen (20%) of these territories are occupied by polyandrous trios made of two males (sometimes three) and one female. There has been an annual population growth of 10% during 1986-1996 (Heredia *in litt*, 1996).

The first survey was done in the 1970s in Aragón and since 1984 the population has been regularly monitored. According to Figure 1 there is an average growth of 5.22% for territorial pairs (n=10) and 3.5% for breeding pairs (n=10) (R. Antor *in litt.* 1997). About 60% of the fledged young reach maturity (R. Antor pers. comm. 1996), an exceptionally high survival rate.

In 1988 an action plan was launched by ICONA and the regions of Navarra, Aragón and Cataluña. Legally binding recovery plans were approved in Navarra in 1991, and in Aragón and Cataluña in 1994.

A supplementary feeding program began in 1986. A network of feeding stations provides predictable food (90% sheep extremities, 10% domestic ungulate skeletons) usually on a weekly basis from December to April. The stations are located in in steep, quiet locations with very little disturbance and low hunting pressure: protected areas, Game Reserves, Special Protection Areas and also in private hunting grounds in agreement with their tenants or landowners. Sites are selected if they have a high winter concentration of juveniles, to increase pre-adult survival; and no breeding pairs, to attract potential breeding birds. They provide the birds with a safe, poison free food source and help to fix young erratic birds.

The two main reasons for the population growth are: an increase in pre-adult survival (60% of fledged young reaching maturity); and relatively high breeding success (78% pairs laying eggs, 59% raising young) (Heredia in litt 1996). The program of supplementary feeding plays a large part in enabling the high survival rate and is also helpful to breeding pairs, especially when they have small chicks in February - March.

To help achieve one of the recovery plan objectives, to increase breeding success, a number of pairs which regularly fail are wardened every year. This has proved to be effective with 88% of wardened nests succeeding in raising young. Also, the continous observation of one particular nest provides interesting data on the species breeding biology.

Only 28% of the breeding territories are within protected areas. The designation of protected areas in the Pyrenees is a priority for the future.

Andalucía

A project to reintroduce the Lammergeier is ongoing in Andalucía. Breeding facilities have been built at the Natural Park of the Sierras de Cazorla, Segura y Las Villas and three birds from the Alps project are being kept for captive breeding. A habitat study to assess the feasibility of reintroduction was carried out by the Doñana Biological Station.

In 1995 the regional government of Andalucía also promoted a genetic study to determine the most suitable source of birds for the reintroduction project. The study was carried out by the Doñana Biological Station on the basis of samples from 20 wild birds

from the Pyrenees and captive birds from the Alps project.

Switzerland

As part of the alpine reintroduction project, 13 birds were released during 1991-1997.

Turkey

Widespread across the country except in the European part, the central Anatolian plain and the Black sea coast. The population has been estimated at 100 breeding pairs (Heredia and Heredia 1994) but more recent data suggest there may be only 50 pairs. Main threats are poison baits laid for wolves and other predators, illegal shooting and lack of awareness.

3. Aims and Objectives

Aims

In the short term, to maintain and enchance the existing Lammergeier populations in Europe.

In the long term, to encourage the recolonisation of the former range.

Objectives

3.1 Policy and legislation

3.1.1. Develop the Common Agriculture Policy to maintain traditional farming practices in mountain areas throughout the EU.

Priority: high
Time-scale: ongoing

3.1.2. Make provision for maintenance of the traditional system of disposal of animal carcasses near villages, ensuring adequate sanitary control.

Priority: medium
Time-scale: long

3.1.3. Ensure full legal protection for the Lammergeier at international and national level

3.1.3.1. Ensure that the Lammergeier is given the highest degree of protection under national and international legislation.

Priority: essential (Greece, Turkey, Morocco)
Time-scale: short

3.1.3.2. Promote the elaboration of national catalogues and inventories of threatened species and incorporate recovery plans into domestic legislation.

Priority: high (France, Greece, Turkey, Morocco)
Time-scale: medium

3.1.3.3. Encourage States to joint the relevant international treaties and conventions, in particular the Bern Convention.

Priority: medium
Time-scale: medium

3.1.4. Ensure Environmental Impact Assessment for all activities likely to affect habitats or species on SPAs.

Priority: high
Time-scale: medium

3.1.5. Promote the inclusion of as many Lammergeier territories as possible within the European networks of protected areas.

Whilst the Lammergeier is a species that ranges widely over a given area and is dependent on certain human activities within its habitat, it is also sensitive to specific intrusions within its immediate nesting area. Protected area mechanisms that allow a combination of specific protection measures in traditional nesting areas, along with wider agricultural and livestock management measures in the surrounding countryside, are needed.

Priority: high
Time-scale: medium

3.2. Species and habitat conservation

3.2.1. *Pursue the designation as Special Protection Areas of IBAs which include the Lammergeier.*

Priority: high
Time-scale: short

3.2.2. Elaborate international conservation projects to be submitted to the EU LIFE regulation or other funding agencies.

Priority: high
Time-scale: short

3.2.3. Undertake specific supplementary feeding in all the European populations and especially in the island populations.

Priority: essential (high in Crete)
Time-scale: short

3.2.4. Prevent disturbance at the breeding sites during incubation and the early stages of breeding (December to May). All human activities within 1 km around the nest should be restricted.

Priority: medium
Time-scale: short

3.2.5. Undertake specific wardening campaigns at those sites where Lammergeiers regularly fail to breed succesfully.

Priority: medium
Time-scale: short

3.2.6. Promote the restoration of wild ungulate populations and control poaching of them.

Priority: medium
Time-scale: long

3.2.7. Ensure that livestock which dies in the field is left out for the vultures and re-establish the old tradition of dumping animal carcasses at a specific place near the villages with full agreement and cooperation of local authorities, local farmers and hunters.

Priority: high
Time-scale: long

3.2.8. Oppose or seek modification of damaging developments, such as road construction, within Lammergeier areas

Priority: high
Time-scale: ongoing

3.2.9 Enforce prohibitions on shooting Lammergeiers morr effectively

Priority: med
Time-scale: short

3.3. Monitoring and research

3.3.1. Promote international cooperation and exchange of experience among experts working on the species.

Priority: essential (Greece, Turkey, Morocco)
Time-scale: short

3.3.2. Survey and monitoring

3.3.2.1. Carry out baseline surveys of population status in countries where the species is less known.

Priority: high
Time-scale: short

3.3.2.2 Carry out regular monitoring of the breeding population, including breeding success.

Priority: high
Time-scale: short

3.3.2.3. Carry out annual searches for new pairs.

Priority: high
Time-scale: short

3.3.2.4. Monitor attendance at feeding stations.

Priority: medium
Time-scale: short

3.3.2.5. Ensure adequate monitoring and follow up of reintroduction projects.

3.3.3. Undertake research on requirements and factors influencing population trends sufficient to prepare national recovery plans.

3.3.3.1. Carry out studies on population dynamics and age structure and complete population viability analysis on islands and in countries where the species is decreasing.

Priority: medium
Time-scale: long

3.3.3.2. Undertake detailed research to find out causes of repeated breeding failure in island populations.

Priority: high
Time-scale: short

3.3.3.3. Undertake satellite tracking to find out causes of mortality, survival rates and dispersal patterns.

Priority: high
Time-scale: short

3.3.3.4. Promote research on genetic variation at European and global level, and undertake genetic studies to determine the degree of inbreeding in isolated populations.

Priority: medium
Time-scale: short

3.3.3.5 Promote research on food availability, especially in winter, where scarcity is believed to be factor

Priority: medium
Time-scale: short

3.3.4. Examine specimens to determine cause of death/failure and levels of environmental contaminents

3.3.4.1. Undertake pathological examination of dead specimens to determine cause of death and ensure proper collection, handling and conservation of pathologic, genetic or scientific material.

Priority: medium
Time-scale: short

3.3.4.2. Undertake toxicological and pathological examinations of failed eggs and examine by Scanning Electron Microscopy eggshells from eggs with suspected or confirmed high pesticide levels or from pairs with repeated breeding failure, to determine fertility and embryo development.

Priority: low
Time-scale: long

3.3.4.3. Investigate the exposure and incidence of lead poisoning in untested populations or in susceptible populations.

Priority: low
Time-scale: long

3.4. Public awareness and training

3.4.1. Prepare information and education materials about the Lammergeier, underlining the problems of poisoning, illegal shooting and habitat degradation. These materials should be targetted at landowners, hunters and livestock farmers.

Priority: medium/high
Time scale: short/medium

3.4.2. Where poisoning is a problem, prepare specific information materials and undertake a campaign targetted at farmers, gamekeepers and landowners.

Priority: essential
Time-scale: short

3.4.3. Incorporate a special section on the Lammergeier at information centers within protected areas where the species occurs.

Priority: medium
Time-scale: medium

4. References

Blanco, J.A. and González, J.L., eds (1992) *Red Data book of Spanish vertebrates* Madrid Instituto Nacional para la Conservacion de la Naturaleza.

del Hoyo, J., Elliott A. and Sargatal. J., eds (1994) *Hardbook of the Birds of the World Vol. 2. New World Vultures to Guineafowl* Barcelona: Lynx Edicions.

Donazar, J.A. (1991) Unidades reproductoras inusuales: Trios poliándricos. In pp 39-46 R. Heredia and B. Heredia eds. *El Quebrantahuesos en los Pirinéos: Características ecológicas y biología de la conservación.* Colección Técnica. Madrid Instituto Nacional para la Conservación de la Naturaleza (ICONA).

Fasce, P., Fasce, L. and Torre. J (1989) Census and observations on the biology of the Bearded Vulture on the island of Corsica. pp 335-340 In: B-U Meyburg and R.D. Chancellor, eds *Raptors in the modern world* . Berlin, London and Paris: WWGBP.

FIR (1996) *Plan de Conservation du Gypaete Barbu dans les Pyrénées*. Unpublished.

Handrinos, G. (1985) *The status of vultures in Greece*. ICBP Technical Publication No 5. Cambridge.

Handrinos, G. (1992). Aves. In M. Karandeinos *ed The Red Data Book of Greek Vertebrates*. Athens: Hell. Zool. Soc. and Hell. Orn. Soc. pp:123-243.

Handrinos, G. and Akriotis. T (1997) *The Birds of Greece*. London C. Helm

Heredia, R. (1991) Biología de la reproducción. pp. 27-38 In R. Heredia and B. Heredia, eds. *El Quebrantahuesos en los Pirinéos: Características ecológicas y biología de la conservación.* Colección Técnica. Madrid Instituto Nacional para la Conservación de la Naturaleza (ICONA).

Heredia, R. (1991b) Alimentación. pp 78-88 In Heredia, R. and Heredia, B eds *El Quebrantahuesos en los Pirinéos: Características ecológicas y biología de la conservación.* Colección Técnica. Madrid Instituto Nacional para la Conservación de la Naturaleza (ICONA).

Heredia, R. (1991c) Dispersión juvenil. pp 67-76 In Heredia, R. and Heredia, B eds *El Quebrantahuesos en los Pirinéos: Características ecológicas y biología de la conservación.* Colección Técnica. Madrid Instituto Nacional para la Conservación de la Naturaleza (ICONA).

Heredia, R. and Heredia, B (1994) Lammergeier. pp. 152-153 in Tucker, G.M. and M.F. Heath, *Birds in Europe: their conservation status*. Cambridge BirdLife International.

Heredia, B., Rose, L. and Painter, M (1996) eds *Globally threatened birds in Europe: Action plans*. Strasbourg Council of Europe.

Hiraldo, F., Delibes, M. and Calderón, J (1979) *El Quebrantahuesos: Sistemática, Taxonomía*, *Biología, Distribución y Protección*. Monografía nº 22. Madrid Instituto Nacional para la Conservación de la Naturaleza.

Margalida, A. and Bertran, J. (1997) *Dieta y seleccion de alimento de una pareja de Quebrantahuesos en los Pirinéos durante la crianta*. Ardeola 44: 193-199.

Ministère de l'Environnement (1997*) Le plan de restauration du Gypaète barbu dans les Pyrénées.* Unpublished report.

Sunyer, C. (1990) Perióodo de emancipación. pp 47-65 In Heredia, R. and Heredia, B eds *El Quebrantahuesos en los Pirinéos: Características ecológicas y biología de la conservación.* Colección Técnica. Madrid Instituto Nacional para la Conservación de la Naturaleza (ICONA).

Terrasse, J F. (1991) Le Gypaete tartu dans les Pyrenees Françaises. Pp 127-138 in Heredia, R. and Heredia, B. eds. *El Quebrantahuesos en los Pirinéos: caracteristicas ecológicas y biologia de la conservación*. Colección Técnica. Madrid.

Thevenot, M., Bergier, P. and Beaubrun, P (1985) *Present distribution and status of raptors in Morocco*. Cambridge ICBP Technical Publication No 5.

Thibault, J.C., Vigne, J.D. and Torre, J (1993) The diet of young Lammergiers in Corsica: its dependence on extensive grazing. *Ibis* 135: 42-48.

Xirouchakis, S. M. and Giannatos, G (1996*) Preliminary results on the status of the Lammergeier in Crete*. Immediate Intervention for the Protection of Nature: unpublished report.

5. ANNEX

Recommended conservation actions by country

Andorra

1.3.1 Promote the development of legislation to protect nature in general and threatened species in particular

1.3.2 Full incorporation into the conservation plan which is ongoing in the French and Spanish Pyrenees

4 Undertake awareness campaigns for the Lammergeier, highlighting its conservation problems

Austria

2.4, 2.5 Undertake surveillance of newly formed pairs

3.2.2 Improve population monitoring

4 Promote public awareness of the reintroduction scheme and of the species in general

France

General

2.1 Designate new SPAs that cover all territories of the species in the Pyrenees and Alps

2.4
3.2.2 Undertake close surveillance and monitoring of the existing pairs during breeding

Pyrenees

1.3.2 Stimulate the implementation of the Restoration Plan (FIR 1996 and Ministère de l'Environnement 1997) recently approved by the Ministry of the Environment

2.3 Continue the effort to supply food during winter and spring

2.4 Reduce disturbance of breeding pairs, especially those related to hunting, sports, photography and tourism

2.5 Undertake specific wardening campaigns at those sites which fail regularly

2.8 Enforce regulations to restrict road building and human activity near the breeding areas

3.1 Improve coordination with Spain and promote joint activities

3.2.2 Promote surveillance and monitoring of the existing pairs during breeding

3.3 Promote research projects for the restoration of the population in the eastern part of the range

4.2 Undertake public awareness and information among hunters in order to prevent the risk of accidents

Corsica

2.3 Increase the effort to supply food during winter and spring

2.6 Promote the restoration of wild ungulates

3.1 Promote cooperation and information exchange with experts working in the Pyrenees

3.3.2 Identify causes of breeding failure

3.3.3 Identify and monitor causes of juvenile mortality

3.3.4 Undertake a genetic study under the framework of a broader European project

Alps

2.4 Undertake surveillance of newly formed pairs

3.2.2 Ensure the monitoring and follow up of the reintroduction project in the French Alps and improve population monitoring generally

4 Promote public awareness

Greece

General

1.3.2
2.4
3.2.2 Undertake a national conservation and monitoring project, including close surveillance and wardening

2.1 Designate new SPAs if and when new sites foir the species are identified, and managing existing SPAs in accordance with the needs of the species

2.8 Object or seek modification of damaging land use changes, especially road construction

2.9, 4.1 Reduce illegal hunting

Continental Greece

1.3.2 Elaborate a recovery plan and seek endorsement from national authorities

2.3 Provide supplementary feeding at Sterea Hellas and in selected areas where the species still exists

2.8
4.1 Undertake a specific campaign against road building on sensitive areas

3.2.1 Undertake an urgent survey and assess conservation status

2.9, 4.1 Prevent poaching of large raptors

4.2 Carry out a public awareness campaign against poisoning and enforce existing regulations

Crete

1.3.2 Prepare a conservation plan for adoption by regional authorities

3.1 Promote information exchange with the Pyrenees

3.2.2 Continue to monitor the population and its breeding success on a regular basis

3.3.3 Identify and monitor causes of juvenile mortality

3.3.5 Assess food availability during winter

Italy

2.4 Undertake surveillance of newly formed pairs

3.2.2 Improve population monitoring

4 Promote public awareness

Morocco

1.3.2 Undertake a conservation program

2.1 Identify potential protected areas; designate breeding areas as protected areas and manage them appropriately

3.2.1 Carry out a national survey and evaluate conservation status

Spain

Pyrenees

1.3.2. Continue with the implementation of the regional recovery plans and extend their geographic scope to areas newly occupied

2.3 Extend the network of feeding stations to areas in the periphery of the Pyrenees, such as the Iberian range or the Cantabric range.

2.6 Undertake the restoration of wild ungulates

2.1 Designate new SPAs at breeding and feeding areas according to the following priority Important Bird Area list:

Turbón-Espés-Sis
Dos Ríos, Orba and Leire Mountain Range
Santo Domingo, Riglos, Gratal
Oturia-Canciás
Saint Gervais Mountains
Boumort Mountains
Monteixo-Lorri-Tornafort
San Juan de la Peña-Oroel crag
Montsech and Montgai Mountains
Panticosa-Viñamala-Tendeñera

3.1 Improve coordination with France and promote joint activities

3.2.2 Monitor population size

3.3 Promote research programs focussed on the conservation and management

3.3 Identify and monitor causes of mortality

3.4.1 Evaluate the incidence of poisoning on the population and undertake toxicology studies

Andalucía

1.3.2 Elaborate and approve an official Recovery Plan for the Lammergeier in the region

Switzerland

2.4 Undertake surveillance of newly formed pairs

3.2.2 Improve population monitoring

4 Promote public awareness

Turkey

3.2.1 Carry out a national survey

4.2 Undertake anti-poisoning campaigns