INTERNATIONAL BEARDED VULTURE MONITORING

International Bearded vulture Monitoring (IBM)

Annual Report 2010

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&

The project partner:
Parc Nationale du Mercantour
Parco Naturale Alpi Marittime
Parc National les Ecrins
Parc National de la Vanoise
Regione Autonoma Valle d'Aosta & Parco Nazionale Gran Paradiso
A.S.T.E.R.S.
Parco Nazionale dello Stelvio/NP Stilfserjoch
Stiftung Pro Bartgeier
Vulture Conservation Foundation

Scientifically and technically managed by the **Vulture Conservation Foundation** and supervised by **ALPARC**

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GLOSSARY

1 Objectives of the IBM

The global objective of the IBM is its function as a tool primarily to asses the Alpine population status and furthermore to evaluate conservation measures such as release, protection of reproduction sites, reduction of mortality risks, etc. Therefore the main operational objectives of the IBM will be on the long-term to:

- Evaluate and thereby underline the success of reintroduction (e.g. by referring to conservation actions)
- Assess the population health status
- Identify monitoring gaps (to help IBM members to close them on the regional level)
- Provide feedback (e.g. reports, maps etc.) as a basis for IBM members to raise public awareness
- Point out to which extent gene flow (between Alps and other populations) has been observed
- Facilitate external scientific analyses
- Increase the overall networking effort among collaborators

All this information provided will help to elaborate an Alpine Action Plan (external action).
Raising funds is not a task of the IBM administration; however the outcome of the project supports fundraising on the regional and international level.

(The overview of objectives is based on the results of the workshop held during the IBM Steering Committee in Vercors 2010)

2 IBM Data base

2.1 Intensity of Data base use in 2010

The **figure 1** shows the percentage of use of the IBM data base by every partner and country (note: the figure doesn't refer to the amount of data entered, but to the frequency of logging in the Data base). The countries are marked by different colors, being yellow Austria, orange Switzerland, blue France and green Italy; the IBM, as it cannot be considered from any country has a special color, and other particular cases are marked in grey.

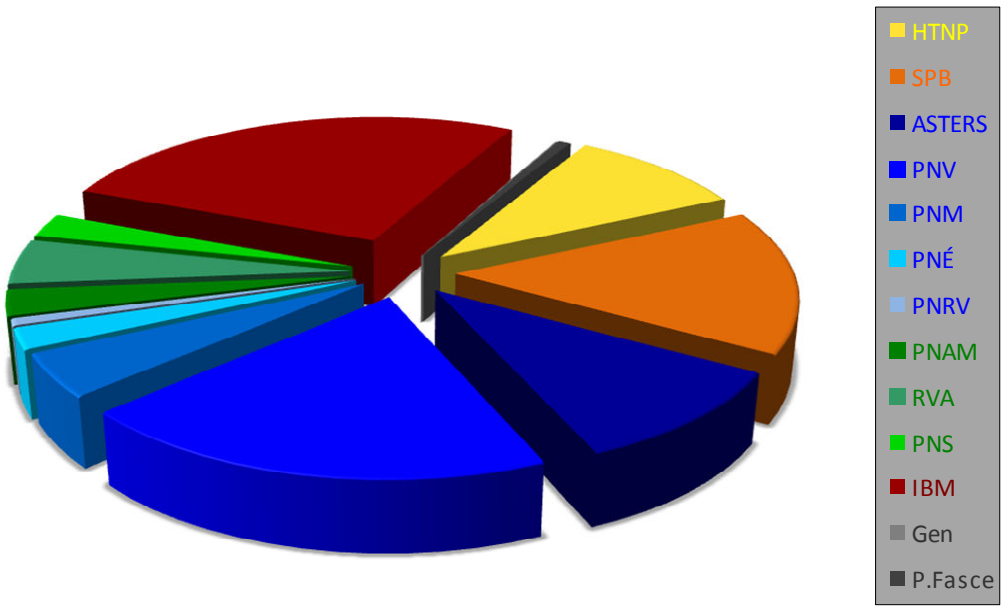


Figure 1: Percentage of use of the IBM Database per partner in the year 2010 (n = 1680)

HTNP: Hohe Tauern National Park, SPB: Stiftung Pro Bartgeier, ASTERS: Agir pour la Sauvegarde des Territoires et des Espaces Remarquables ou Sensibles, PNV: Parc National de la Vanoise, PNM: Parc National du Mercantour, PNE: Parc National des Ecrins, PNRV: Parc Naturel Régional du Vercors, PNAM: Parco Naturale Alpi Marittime, RVA: Regione Autonoma Valle d'Aosta, PNS: Parco Nazionale dello Stelvio, IBM: International Bearded Vulture Monitoring (Administration), Gen: Genetic Monitoring Administration, Paolo Fasce

It can be appreciated that the French partners, and specially the group of PN Vanoise, are the most active users of the Data base. Nevertheless, when looking at the number of observations entered (see **figure 2**), there's little or no difference between countries or partners. Some partners enter more information and some others are more active in using the information stored.

2.2 Observations in 2010

In the 25 years of monitoring of the alpine population of bearded vultures there have been more than 42.000 observations entered in the Data base. The **figures 2** and **3** show the evolution in the use of the data base across the years. It can be seen that there was a gradual increase that reached its maximum in the year 2004 (3545 observations), and from then on has fallen to levels similar to those registered 15 years ago. Although these figures might seem discouraging, the reasons might not be so grim; with the time, many of the observations originally entered as Common observations (only type considered for the figures) have

been progressively started to be entered in the Reproduction section, so the number significantly increases. Nevertheless, the overall number has effectively decreased, but not the monitoring effort, so it is necessary to bear in mind that all observations should be entered in the Data base to keep its high quality standards.

With respect to the previous year, 2010 presented a slight decrease in the number of observations entered, from 1414 in 2009 to the actual 1397 in 2010. However, when comparing with the results obtained in 2008, the result is that in the last 2 years the number of observations entered have decreased in more than 25%.

When focusing only in the year 2010, there are a few remarks to be considered; it should be mentioned that there are no big differences when looking at the observations entered per country (**figure 2**), especially between Italy, France and Austria, although it's slightly lower in Switzerland. If we look at the amount of observations entered per partner (**Figure 3**), the situation is not much different, although if we consider the 3 partners that have entered the highest number of observations (Hohe Tauern N.P., R.V. d'Aosta and P.N. la Vanoise), they alone already cover 60% of the total number of observations. The **figure 4** is a map showing the distribution of observations on 2010 per geographic area. In this figure it is possible to appreciate the absence of observations in wide areas of the Alps, in particular between E- and C- Alps and between C-Alps and NW-Alps; these monitoring gaps have been reported in the past but it seems unfeasible to close it completely in the short term. Nevertheless, seemingly that lack of observations in some local areas is not necessarily due to a lesser monitoring effort, but to the absence or low number of bearded vultures in the surroundings, probably product of either unsuitability of the region for the species or a phylopatric effect towards the release areas.

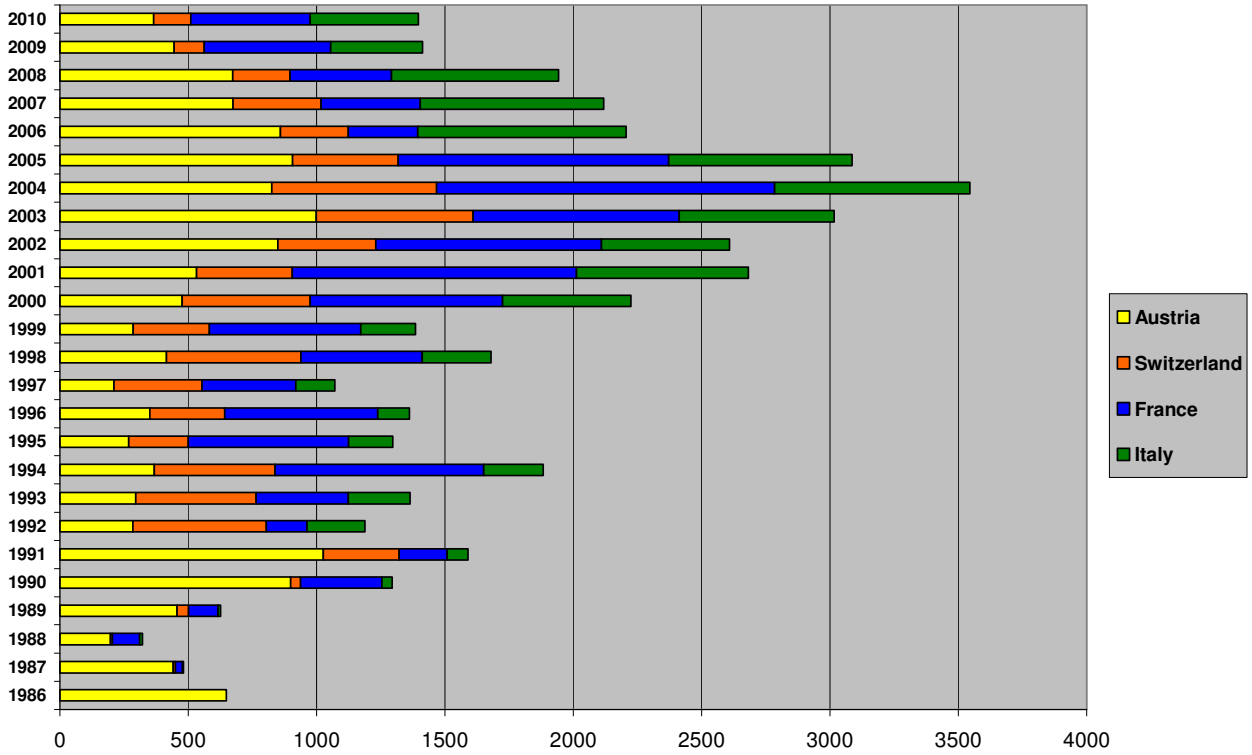


Figure 2: Total number of observations entered in the IBM Database per country (Austria, Switzerland, France and Italy) since 1986.

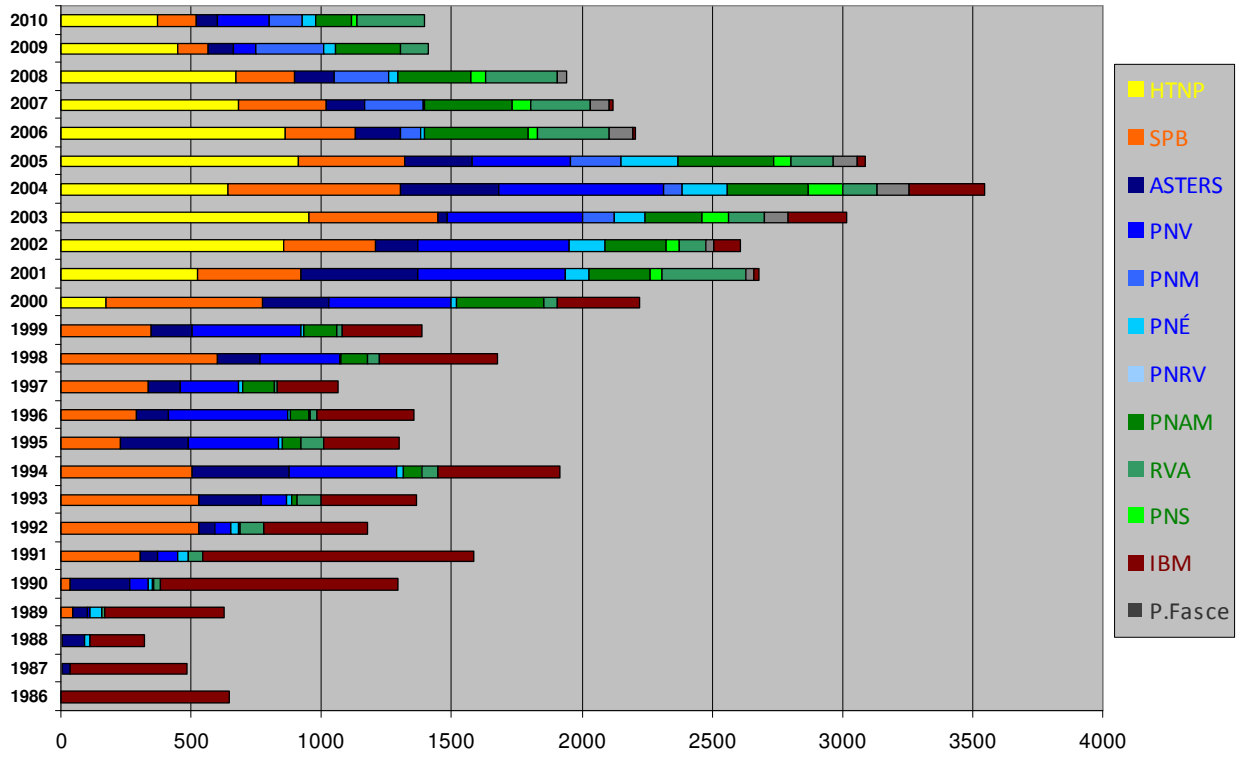


Figure 3: Total number of observations entered in the IBM Database per IBM Partner since 1986.

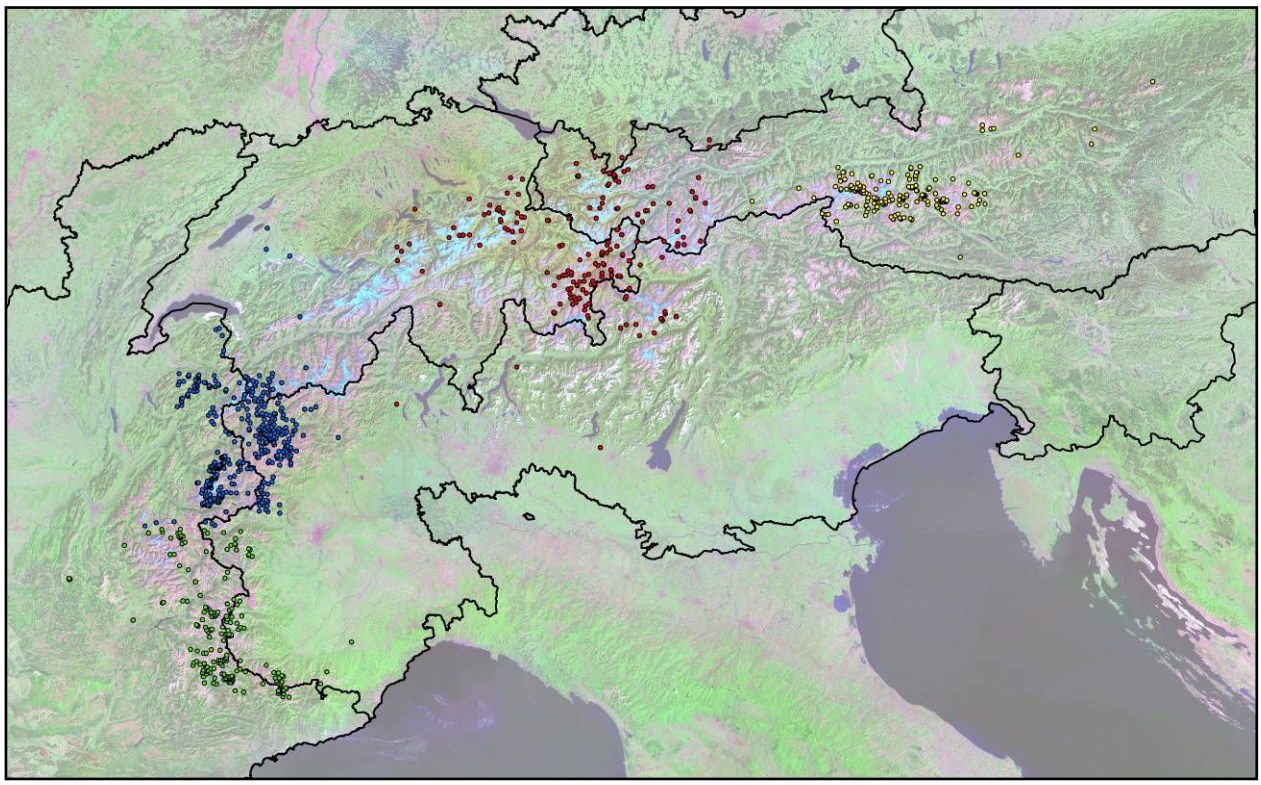


Figure 4: Map showing the distribution of observations on each geographic region of the Alps.

2.3 Evolution of age classes

The **figure 5** is a 100% stacked bars chart displaying the percentage of each age class in the total number of Common observations per year. The age classes presented in the Data base have been clustered as follows: Juvenile (juvenile + juvenile/immature?), Immature (2.year + 3.year + dark head), Subadult (immature/subadult? + 4.year + 5-6.year + subadult/adult?), Adult (adult + bright head) and unknown. For this figure only observations stored as common observations have been used. After 1992, year when the first released birds (from 1986 on) reached the adult stage, the number of adults has been steadily increasing, as well as the number of couples (see **table 7**), although this is not represented in this figure since the data stored in reproduction, and therefore information of many adult birds in the wild, has not been included here. The reason why not doing so is because they might bias the general results since the pairs have been more intensely monitored than assumed for the rest of the surveyed areas where no pairs are found, and thus there would be more observations of adult birds by this method than for the rest of age classes. On the other hand, common observations as such are not completely unbiased either; there's, for instance, a higher level of monitoring of juvenile released birds than of other birds in the wild, which also affects the general percentage of observations. For these and other reasons such as the differential monitoring effort per area, the method of using solely the common observations in a raw way for assessing the population status proves unfeasible, and so the figure should be regarded more as guidance than as reflection of the age composition of the Alpine population. In order to get a more clear idea of the current situation, it would be necessary to try different approaches, which will be done, if possible, in the close future.

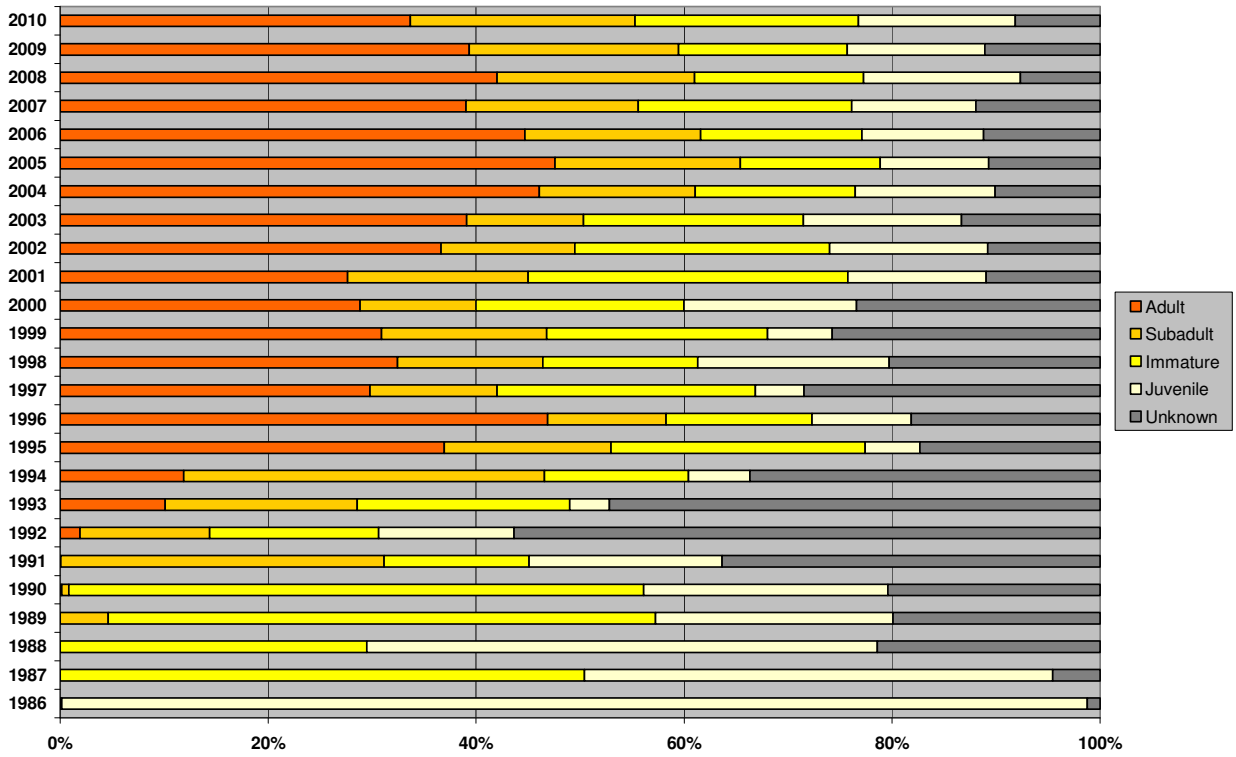


Figure 5: percentage of each age class (Adult, Subadult, Immature and Juvenile, and Unknown) in the total number of observations stored per year since 1986.

2.4 Telemetry data (By Daniel Hegglin)

In 2010, we marked 8 of the 10 released bearded vultures in the Alps with satellite tags. So far, we received a total of 2016 GPS locations of seven of these birds (one transmitter failed to send any data due to a technical failure). The home ranges during the first seven months after fledging varied between 384 km2 and 6362 km2.

In the release region of Vercors, one of the three birds released stayed mainly very close to the release site, while the two others ranged mostly in areas at distances of 40 to 140 km of the release site. The core areas of these three birds were situated more in the west than the juvenile, satellite tagged birds that were released in Mercantour in earlier years. This fact gives evidence that the new release site in Vercors can be a first step stone for the connection of the Alpine and the Pyrenean bearded vulture populations.

In 2010 a second new release site was established. It is situated in the Northern Alps in the Swiss Calfeisen Valley. The satellite telemetry revealed that all three birds released in this place stayed during their first winter most of their time in this new release region. Interestingly direct sightings of these three young bearded vultures were also regularly reported to the IBM and to ornitho.ch by the public in this region. This fact gives evidence that the absence of regular observations in the central part of Switzerland in the past cannot simply be interpreted as a lack of observers in this region. Rather it supports the assumption that bearded vulture only occasionally visited this part of the Alps in the past.

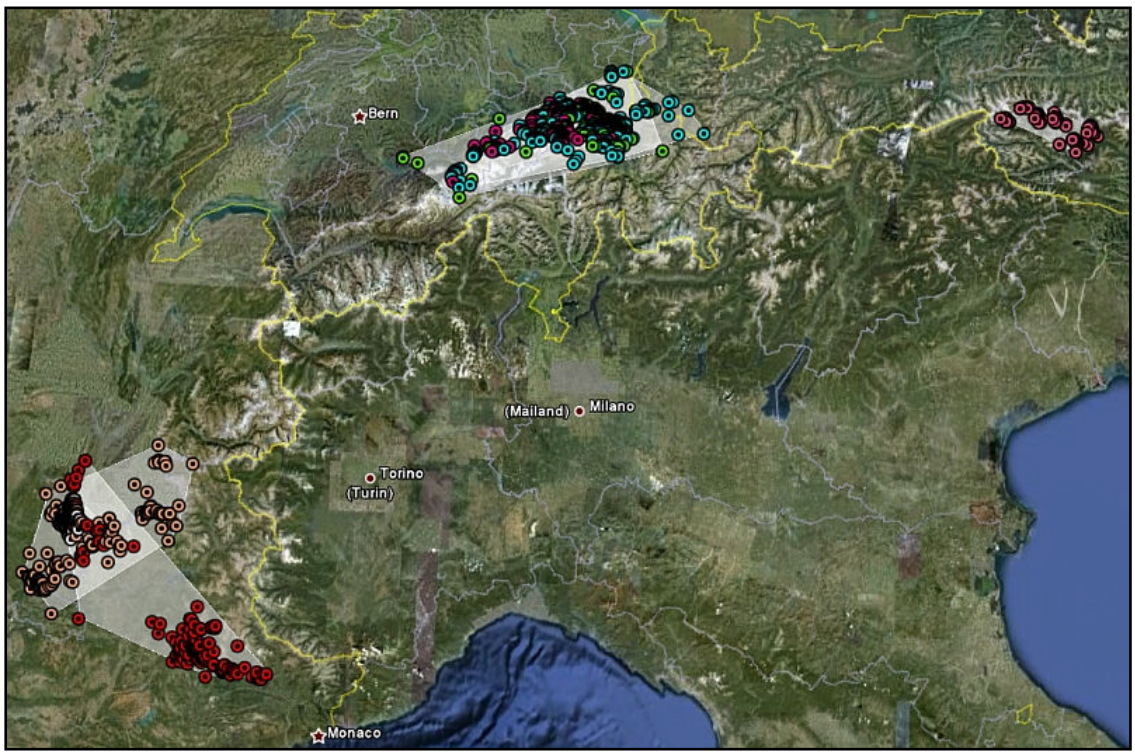
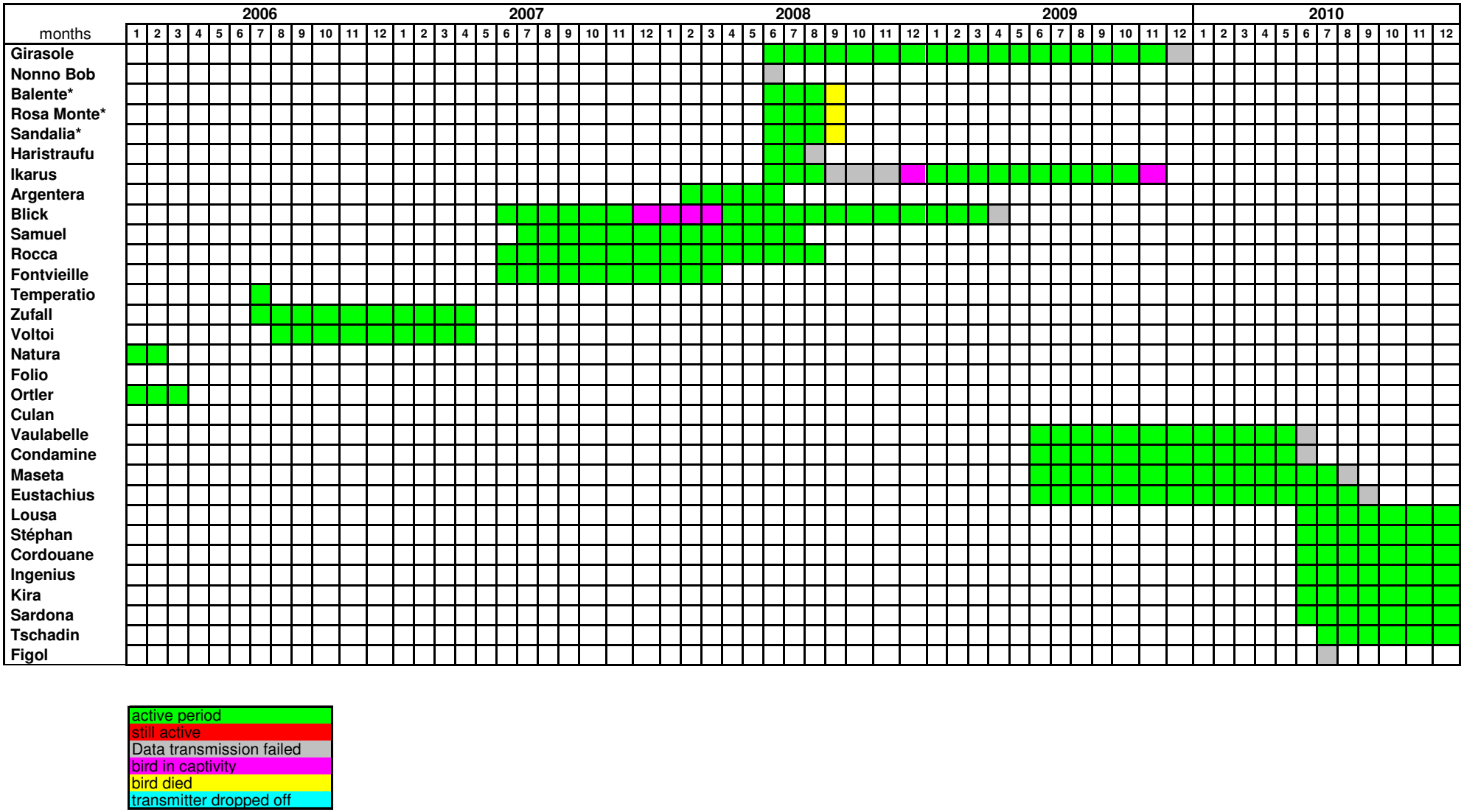


Figure 6: Locations of the seven bearded vultures marked with satellite tags in 2010.

Table 1: Overview on the transmitters used in released bearded vultures in the Alps since 2006



2.5 Identified birds

From the 1st of January to the 31st of December 2010, a total of 49 birds have been identified. This information has been gathered from common observations, territorial birds and reproduction, Telemetry, Alpine Observations Days, genetic report 2010 and several local reports. No released birds have been found dead this year. The **table 2** shows all birds identified in 2010, their age (by the end of 2010) and the source of information, while the **table 3** shows the percentage of identified birds in relation to the potential number of birds for each age class (clustered as explained in **section 2.3**).

Table 2: List of the birds identified in 2010 displaying Age Class, Age (in days and years), and source of information

Birds					Source of information				
Identified birds	**Bird ID**	**Age Class**	**Age (d)**	**Age (y)**	**C.Obs.**	**Repr.**	**AOD**	**Sat.**	**Gen.**
Tschadin	629	juvenile	287	0,8	x		x	x	
Figol	628	juvenile	290	0,8	x		x	x	
Kira	626	juvenile	295	0,8	x		x	x	
Ingenius	621	juvenile	300	0,8	x			x	
Stéphan	616	juvenile	305	0,8				x	
Cordouane	618	juvenile	305	0,8				x	
Sardona	624	juvenile	305	0,8	x		x	x	
Lousa	619	juvenile	306	0,8	x			x	
Spelugue	615	juvenile	310	0,8	x		x		
Elena	613	juvenile	317	0,9	x		x		
Eustachius	587	immature	669	1,8	x			x	
Condamine	586	immature	671	1,8	x		x	x	
Maseta	585	immature	671	1,8	x		x	x	
Vaulabelle	583	immature	675	1,8	x			x	
Rurese	559	immature	1024	2,8	x				
Pinzgarus	558	immature	1031	2,8	x		x		
Girasole	549	immature	1049	2,9	x		x		
Nonno Bob	548	immature	1053	2,9	x				
Samuel	526	immature	1386	3,8					x
Rocca	516	immature	1410	3,9	x				
Zufall	493	subadult	1684	4,6	x				
Doraja	465	subadult	2119	5,8	x		x		
Escalero	462	subadult	2133	5,8	x				
Hubertus 2	446	adult	2462	6,7	x	x	x		x
Guillaumes	411	adult	2874	7,9					x
Martell	395	adult	3220	8,8	x	x			x
Ambo	392	adult	3229	8,8		x	x		x
Paolo Peila	388	adult	3235	8,9			x		
Felice	375	adult	3591	9,8		x			
Roure	370	adult	3605	9,9		x	x		x
Louis	364	adult	3918	10,7		x	x		x
Montblanc	361	adult	3946	10,8		x			
Pablo	359	adult	3954	10,8		x	x		
Retia	357	adult	3955	10,8	x	x			
Georg	355	adult	3969	10,9					x
Sereno	348	adult	3984	10,9		x	x		x
Veronika	321	adult	4330	11,9		x			
Diana Valais	301	adult	4676	12,8		x			
Gildo	299	adult	4694	12,9		x	x		
Republic11	288	adult	4697	12,9	x	x			
Gelas	279	adult	5050	13,8		x			
Andreas Hofer	260	adult	5422	14,9	x	x	x		
Firmin	229	adult	5784	15,9	x				
Cic	186	adult	6513	17,8		x			
Jo	169	adult	6871	18,8		x			
Moische	146	adult	7233	19,8		x			
Assignat	111	adult	7944	21,8		x			
Colleen	112	adult	7985	21,9			x		
Balthazar	99	adult	8353	22,9	x	x			

Table 3 refers to the demographic model calculated by Schaub *et al.* (2009) for the Alpine population of bearded vulture. However, in this case the calculations have been re-adapted to span only released vultures since they are, in general terms, the only birds that can be undoubtedly recognized. Therefore, there's an estimation of 101 non-native born birds in the wild in 2010, out of the 165 birds that have been released and successfully fledged since the beginning of the program. By using the percentage of "Common observations" previously obtained for each class out of the 1401 observations that were stored in the Data base in 2010, we attempted to roughly estimate the number of birds per age class. Finally, the percentage of identified birds per age class can be calculated by using the number of birds identified in 2010.

Table 3: List of the birds identified in 2010 displaying Age Class, Age (in days and years), and source of information

	Observations	%	expected Inds/age	identified birds	% identified
Adults	471	33,6	34	26	**76,6**
Subadults	303	21,6	22	3	**13,7**
Immature	300	21,4	22	10	**46,2**
Juveniles	211	15,1	15	10	**65,7**
Unknown	116	8,3	8	-	**-**
Total	1401	100,0	~ 101	49	**50,6**

There's an estimated average of more than half (50,6%) of the total of "identifiable" birds (released birds) actually identified. These results are subjected to the same limitations as in **section 2.3** (only Common observations considered) that restrain interpretations from being completely reliable. Nevertheless, it can be seen that adults and juveniles have the highest percentage of identified birds (respectively 76,6% and 65,7%); this can be understood when considering that these are the groups most frequently observed and about which there's more information available, adults for being territorial and so stationary and often observed, and juveniles for being more frequently monitored after release. Immatures also offer a high number of identified birds (46,2%) since in many cases they still present the individual marking pattern (bleached feathers) with which they were released. Subadults are by far the least known group (13,7% of identified individuals), since it's common that birds are roaming around even out of the Alps during their immature phase and early subadult phase, so they disappear from an area reappearing later on in another point of the Alps, already with the new plumage. Therefore the only way to identify them is by the colored rings, which is quite difficult from a distance and even more in punctual observations; once these birds settle down in an area, the chances to identify them increase, and soon after it's when they reach the adult phase.

3 Released birds 2010

3.1 Summary of the birds released in the Alps in 2010

This year a total of 10 birds have been released in the Alps in 4 different sites, Argentera, in the Parco Naturale delle Alpi Marittime (Italy); Chatillon en Diois, in the Parc Naturel Régional du Vercors (France); Kals, in the Nationalpark Hohe Tauern (Austria); and Calfeisen in the Swiss Alps (Switzerland). Besides, 5 birds were released in Andalucía (Spain): BV612 (Tranco), BV614 (Quiteria), BV631 (Hortelano), BV632 (Huéscar) and BV633 (Blimunda). Each released bird have been marked with a unique pattern by bleaching some tail or/and wing feathers in their dark plumage (Frey & Zink, 2000). The shown silhouettes of the birds are seen from below; the primaries and secondaries are counted continuously from the wing tip towards the body and the tail feathers are counted from the sides to the centre. Colors shown for the rings have been tried to match those used in reality, when possible.

3.1.1 Argentera, Parco Naturale delle Alpi Marittime (Italy)

This year there were 2 release sites located in the South-Western Alps; In Argentera, 2 females (Elena and Spelugue) were released on the 23rd of May, Elena and Spelugue.

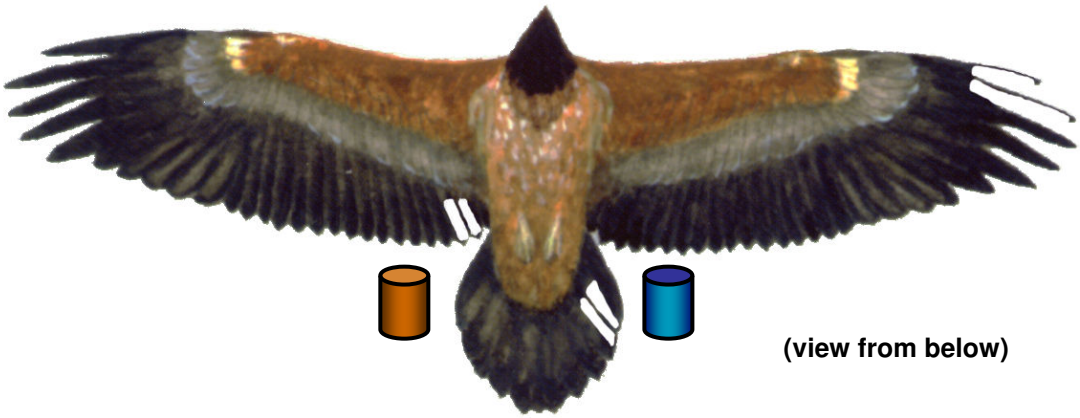
1) BV613: ELENA

Place of birth:	Zoo of Liberec (CZ)
Birth date:	17.2.2010
Equipped with transmitter:	no
Marks:	left wing: 2-4
Rings:	right: cupreous; left: black.
Sex:	female
Release date:	23.5.2010

(view from below)

2) BV615: SPELUGUE

Place of birth:	Richard Faust Centre (A)
Birth date:	24.2.2010
Equipped with transmitter:	no
Marks:	right wing: 25-26 left wing: 1-2 tail left: 2-3
Rings:	right: cupreous; left: blue
Sex:	female
Release date:	23.5.2010



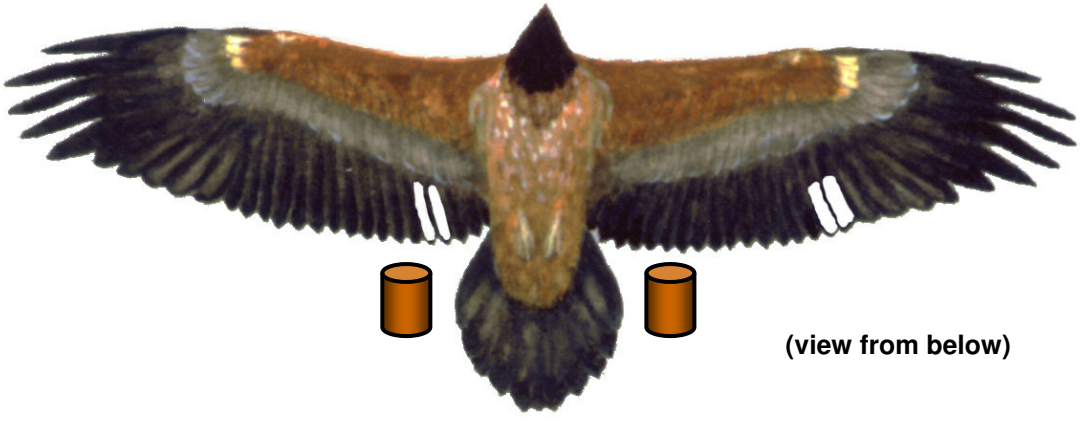
(view from below)

3.1.2 Chatillon en Diois, Parc Naturel régional du Vercors (France)

The second site in the South-Western Alps, Vercors, is the westernmost release site so far. This year 3 birds were released in this new site on the 11th of June

1) BV616: STÉPHAN

Place of birth:	Richard Faust Centre (A)
Birth date:	1.3.2010
Equipped with transmitter:	yes
Marks:	right wing: 23-24 left wing: 11-12
Rings:	right: cupreous; left: cupreous
Sex:	male
Release date:	11.6.2010



(view from below)

2) BV618: CORDOUANE

Place of birth:	Zoo of Ostrava (CZ)
Birth date:	1.3.2010
Equipped with transmitter:	yes
Marks:	left wing: 5-6; 20-21 tail right: 3-4
Rings:	right: cupreous; left: pink
Sex:	male
Release date:	11.6.2010

(view from below)

3) BV619: LOUSA

Place of birth:	Breeding Center Haute-Savoie (F)
Birth date:	28.2.2010
Equipped with transmitter:	yes
Marks:	right wing: 2-3; 20-21 left wing: 4-5
Rings:	right: cupreous; left: orange
Sex:	female
Release date:	11.6.2010

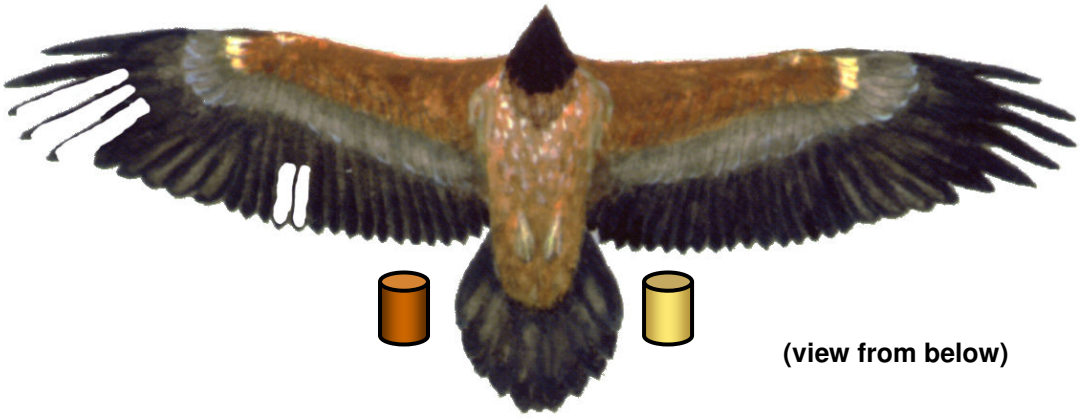
(view from below)

3.1.3 Calfeisen, Swiss Alps (Switzerland)

In the central Alps, a new site has been selected this year to release 3 birds. The event took place on the 13th of June.

1) BV621: INGENIUS

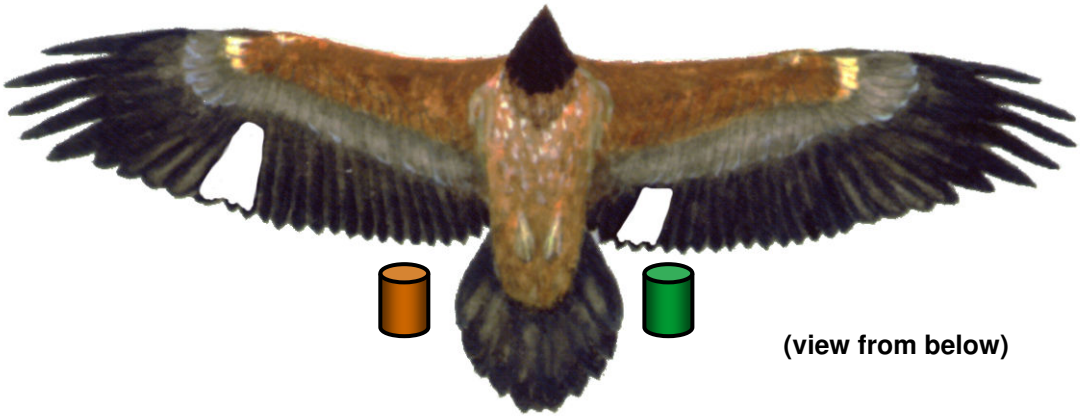
Place of birth:	Centro de Fauna Valcallent (E)
Birth date:	6.3.2010
Equipped with transmitter:	yes
Marks:	right wing: 3-5; 14-15
Rings:	right: cupreous; left: gold
Sex:	male
Release date:	13.6.2010



(view from below)

2) BV624: SARDONA

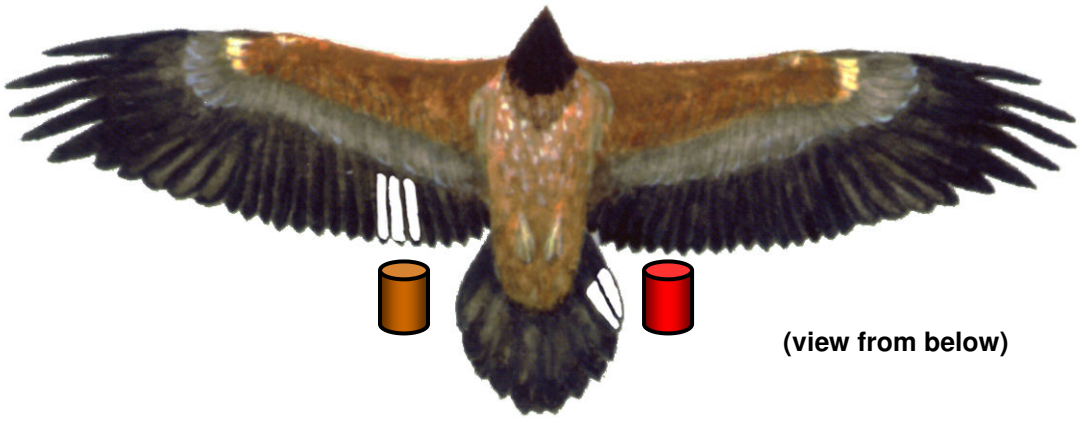
Place of birth:	Breeding centre Goldau (CH)
Birth date:	1.3.2010
Equipped with transmitter:	yes
Marks:	right wing: 10-11(12) left wing: 23-25 (**visible only from above**)
Rings:	right: cupreous; left: green
Sex:	male
Release date:	13.6.2010



(view from below)

3) BV626: KIRA

Place of birth:	Zoo of Ostrava (CZ)
Birth date:	11.3.2010
Equipped with transmitter:	yes
Marks:	right wing: 20-22 tail left: 1-2
Rings:	right: cupreous; left: red
Sex:	female
Release date:	13.6.2010



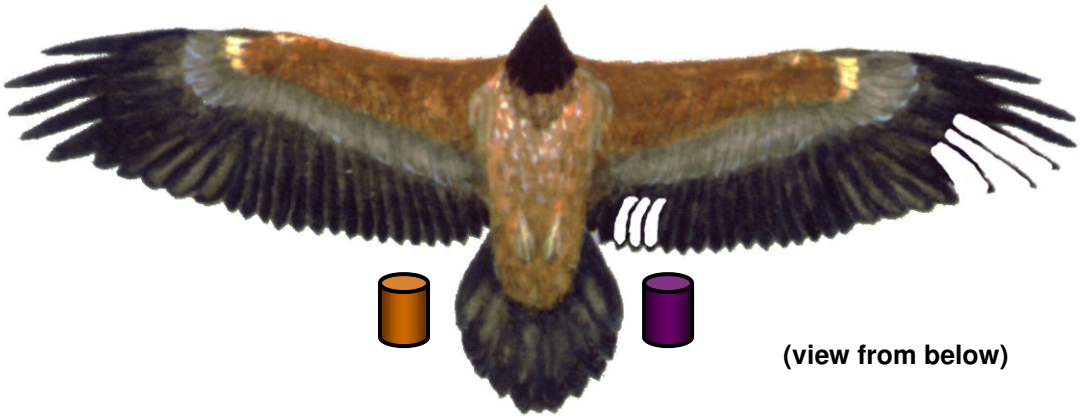
(view from below)

3.1.4 Kals, Nationalpark Hohe Tauern (Austria)

One more year the municipality of Kals am Großglockner have been selected to release birds in the Hohe Tauern National Park, where 2 juvenile females were set free on the 12th of June.

1) BV628: FIGOL

Place of birth:	Centro de Fauna Valcallent (E)
Birth date:	16.3.2010
Equipped with transmitter:	yes
Marks:	left wing: 4-6; 23-25
Rings:	right: cupreous; left: violet
Sex:	female
Release date:	12.6.2010



(view from below)

2) BV629: TSCHADIN

Place of birth:	Tierpark Berlin (G)
Birth date:	19.3.2010
Equipped with transmitter:	yes
Marks:	right wing: 10-11 left wing: 20-22 tail left: 3-4
Rings:	right: cupreous; left: silver
Sex:	female
Release date:	12.6.2010

(view from below)

3.1.5 Summary of the marking pattern in the Alps 2010

The **table 4** is a brief outline of the distinctive marks of each bird released in the Alps in 2010.

Table 4: Summary of the marking pattern and ringing of each bird released in 2010

Bird		bleached feathers				rings	
ID	Name	left wing	tail left	tail right	right wing	left talon	right talon
613	Elena	2-4	-	-	-	cupreous	black
615	Spelugue	1-2	2-3	-	25-26	cupreous	blue
616	Stéphan	11-12	-	-	23-24	cupreous	cupreous
618	Cordouane	5-6; 20-21	-	3-4	-	cupreous	pink
619	Lousa	4-5	-	-	2-3; 20-21	cupreous	orange
621	Ingenius	-	-	-	3-5; 14-15	cupreous	gold
624	Sardona	23-25*	-	-	10-11(12)*	cupreous	green
626	Kira	-	1-2	-	20-22	cupreous	red
628	Figol	4-6; 23-25	-	-	-	cupreous	violet
629	Tschadin	20-22	3-4	-	10-11	cupreous	silver

3.2 Released birds since 1986

Although traditionally it's been said that 170 birds have been released, in practice it would be more accurate to speak about 165 birds, since 5 vultures died before fledging. In principle releasing of birds should only be necessary in reintroduction projects until the population is stable enough to self-sustain on wild-born individuals (which seems to be already the case in the Alps cf. Schaub et al 2009). Therefore the focus of attention and resources invested in release and monitoring, main aim of the IBM, should be shifted to monitoring of reproduction in the wild and supervision of the population development, in particular on terms of reproductive output and genetic connectivity with other populations to avoid the Founder effect that might become a potential problem in the future. For this reason, however, it has been decided to continue with releases in the Alps.

Table 5 is a list with all birds released since the beginning of the project indicating some information such as last time the bird was seen and current status. This information has been gathered from the IBM Database and other diverse publications (for instance the Infogipeto magazines or Alpine Observation Days reports). If someone has some updated information about any bird that we might have missed, we would be extremely glad to get feedback.

It seems important to us to emphasize at this point that there's an extended mismatch between the observations stored in the Database and data from other media, meaning that in many cases there are reported observations that have not been added to the Database (i. e. birds identified during the Alpine Observation Days 2010 whose last observation stored dates back to 2003). In order to keep the high quality of our Database it's necessary to solve such problems, so once again we recommend you to store as many observations as possible.

Table 5: List of all birds released in the Alps since 1986 displaying sex, year of release, ring colors and current status, giving the last year of observation when this is unknown. Birds released after 1996 that have been identified by genetics are indicated with "BG".

Bird			Year of release	Release area	Current status		rings	
ID/Genotype	Name	Sex			status	last obs.	right	left
84	**Hans**	m	1986	NP Hohe Tauern, Rauris	?	1991	red	silver
88	**Fritz**	f	1986	NP Hohe Tauern, Rauris	?	1990	red	black
89	**Ellen**	f	1986	NP Hohe Tauern, Rauris	?	1987	red	red
91	**Winnie**	f	1986	NP Hohe Tauern, Rauris	captivity	-	-	-
92	**Heinz**	m	1987	NP Hohe Tauern, Rauris	?	1987	-	green
96	**Nina**	f	1987	NP Hohe Tauern, Rauris	dead	-	-	-
93	**Melusine**	f	1987	Haute-Savoie, Bargy	dead	-	-	-
94	**Saturnin**	m	1987	Haute-Savoie, Bargy	dead	-	-	green
95	**Marie Paradise**	f	1987	Haute-Savoie, Bargy	?	1988	-	green
100	**Alexa**	f	1988	NP Hohe Tauern, Rauris	?	1990	silver	-
99	**Balthazar**	m	1988	Haute-Savoie, Bargy	alive	2010	silver	-
101	**Melkior**	m	1988	Haute-Savoie, Bargy	?	2006	silver	-
102	**Ulli**	m	1988	NP Hohe Tauern, Rauris	?	1991	silver	-
106	**Paradatsch**	f	1988	NP Hohe Tauern, Rauris	?	1996	silver	-
109	**Karl**	m	1989	NP Hohe Tauern, Rauris	?	1991	-	golden
110	**Joey**	m	1989	NP Hohe Tauern, Rauris	?	2001	-	golden
111/GT007	**Assignat**	f	1989	Haute-Savoie, Bargy	alive	2010	-	golden

112	**Colleen**	f	1989	NP Hohe Tauern, Rauris	alive	2010	-	golden
113	**Danton**	m	1989	Haute-Savoie, Bargy	dead	-	-	-
114	**Robespierre**	m	1989	Haute-Savoie, Bargy	dead	-	-	-
115	**Marie-Antoinette**	f	1989	Haute-Savoie, Bargy	captivity	-	-	golden
116	**Charlotte**	f	1989	Haute-Savoie, Bargy	?	1991	-	golden
117	**Baselisk**	f	1989	NP Hohe Tauern, Rauris	?	1990	-	golden
121	**Hubertus 1**	m	1990	NP Hohe Tauern, Rauris	captivity	-	-	-
123	**Lotte**	f	1990	NP Hohe Tauern, Rauris	?	1992	black	-
126	**Yvan**	f	1990	Haute-Savoie, Bargy	?	1990	black	-
127	**Robin**	f	1990	Haute-Savoie, Bargy	?	1990	black	-
138/GT013	**Nicola**	f	1991	NP Hohe Tauern, Rauris	?	2008?	-	blue
139/GT001	**Diana**	f	1991	NP Hohe Tauern, Rauris	?	2009	-	blue
140/GT014	**Avarell**	m	1991	Haute-Savoie, Bargy	dead	-	-	blue
143	**Settschient**	m	1991	NP Engadin, Zernez	?	2003	-	blue
144	**Republic**	f	1991	Haute-Savoie, Bargy	dead	-	-	-
146/GT006	**Moische**	f	1991	NP Engadin, Zernez	alive	2010	-	blue
147	**Xxx**	m	1991	Haute-Savoie, Bargy	dead	-	-	-
149/GT002	**Margunet**	m	1991	NP Engadin, Zernez	?	2007	-	blue
165	**Republic 2**	?	1992	Haute-Savoie, Bargy	?	2002	violet	-
166	**Republic 3**	m	1992	Haute-Savoie, Bargy	?	2004	violet	-
167	**Bernhard**	m	1992	NP Hohe Tauern, Rauris	?	1992	violet	-
168	**Fulvio**	m	1992	NP Hohe Tauern, Rauris	?	1992	violet	-
169/GT003	**Jo**	f	1992	NP Engadin, Zernez	alive	2010	violet	-
170	**Ivraina**	f	1992	NP Engadin, Zernez	?	1994	violet	-
181	**Republic 4**	f	1993	Haute-Savoie, Bargy	?	1994	-	pink
182	**Republic 5**	f	1993	Haute-Savoie, Bargy	dead	-	-	-
183	**Helmut**	m	1993	NP Hohe Tauern, Rauris	?	1994	-	pink
186/GT005	**Cic**	m	1993	NP Engadin, Zernez	alive	2010	-	pink
191	**Winfried**	m	1993	NP Hohe Tauern, Rauris	?	1995	-	pink
193	**Felix**	m	1993	NP Engadin, Zernez	dead	1994	-	-
195	**Argentera**	f	1993	PN du Mercantour, Vignols	?	2008	-	pink
196	**Mounier**	m	1993	PN du Mercantour, Vignols	dead	1996	-	-
197	**Florent**	m	1993	PN du Mercantour, Vignols	?	2000	-	pink
208	**Hans Rupert**	f	1994	NP Hohe Tauern, Rauris	?	1999	red	-
210	**Pisoc**	m	1994	NP Engadin, Zernez	?	1997	red	golden
213	**Mercantour**	f	1994	PN Alpi Marittime, Argentera	?	1994	red	blue
214	**Jackpot 1**	f	1994	NP Hohe Tauern, Rauris	dead	-	-	-
215	**Topolino**	m	1994	PN Alpi Marittime, Argentera	?	1995	red	black
216	**Republic 6**	f	1994	Haute-Savoie, Bargy	?	2004	red	brown
219	**Republic 7**	m	1994	Haute-Savoie, Bargy	dead	-	-	-
220	**Valimosch**	m	1994	NP Engadin, Zernez	?	1997	red	green
227	**Geo**	f	1995	PN du Mercantour, Vignols	captivity	-	-	-
229/GT030	**Firmin**	m	1995	PN du Mercantour, Vignols	alive	2010	silver	black
258	**Republic 8**	f	1996	Haute-Savoie, Bargy	?	1997	green	cupreous
258	**Republic 9**	?	1996	Haute-Savoie, Bargy	?	1998	green	red
260	**Andreas Hofer**	m	1996	NP Hohe Tauern, Rauris	alive	2010	green	violet
261	**Marga**	f	1996	NP Hohe Tauern, Rauris	?	2003	green	grey
263	**Berna**	m	1996	NP Engadin, Zernez	?	1999	green	golden
264/GT264	**Mauritio**	m	1996	NP Engadin, Zernez	?	2005	green	black
266	**Entraque**	m	1996	PN Alpi Marittime, Argentera	?	1997	green	blue
268/GT017	**Valdieri**	f	1996	PN Alpi Marittime, Argentera	?	2004	green	black
275	**Pelat**	m	1997	PN du Mercantour, Vignols	?	1998	dark-cupreous	blue
279/BG279	**Gelas**	f	1997	PN du Mercantour, Vignols	alive	2010	dark-cupreous	black
283/BG283	**Tell**	m	1997	NP Engadin, Zernez	?	2009	dark-cupreous	green

285/BG285	**Sina**	f	1997	NP Engadin, Zernez	dead	-	dark-cupreous	golden
288/BG288	**Republic 11**	f	1998	Haute-Savoie, Bargy	alive	2010	silver	cupreous
289	**Crystal**	f	1998	Haute-Savoie, Bargy	?	2002	silver	red
291	**Daniel**	m	1998	NP Hohe Tauern, Rauris	?	2000	silver	violet
296/BG296	**Jackpot 3**	m	1998	NP Hohe Tauern, Rauris	?	2005	silver	silver
299/BG299	**Gildo**	f	1998	NP Engadin, Zernez	alive	2010	silver	golden
301	**Diana-Valais**	m	1998	NP Engadin, Zernez	alive	2010	silver	green
304/BG304	**Aisone**	m	1998	PN Alpi Marittime, Argentera	?	2007	silver	blue
305/BG305	**Vernante**	m	1998	PN Alpi Marittime, Argentera	?	2005	silver	black
311/BG311	**Roubion**	m	1999	PN du Mercantour, Vignols	?	2008	golden	blue
312	**Peone**	f	1999	PN du Mercantour, Vignols	?	1999	golden	black
316	**Zonta**	f	1999	NP Hohe Tauern, Rauris	?	1999	golden	violet
321/BG321	**Veronika**	f	1999	NP Engadin, Zernez	alive	2010	golden	green
323/BG323	**Sempach**	f	1999	NP Engadin, Zernez	dead	-	golden	golden
329	**Keno**	f	1999	NP Hohe Tauern, Rauris	captivity	-	-	-
335	**Republic 13**	m	1999	Haute-Savoie, Bargy	?	2006	golden	cupreous
339	**Doran**	m	1999	Haute-Savoie, Bargy	?	1999	golden	red
348/BG348	**Sereno**	m	2000	PN Alpi Marittime, Argentera	alive	2010	blue	blue
349	**Ciabri**	f	2000	PN Alpi Marittime, Argentera	?	2003	blue	black
350	**Bingo**	f	2000	NP Hohe Tauern, Mallnitz	?	2005	blue	violet
354	**Interreg**	m	2000	NP Stilfserjoch, Martell	?	2009	blue	pink
355/BG355	**Georg**	m	2000	NP Hohe Tauern, Mallnitz	alive	2010	blue	silver
357/BG357	**Retia**	f	2000	NP Stilfserjoch, Martell	alive	2010	blue	alu special
359/BG357	**Pablo**	m	2000	Haute-Savoie, Bargy	alive	2010	blue	cupreous
361/BG361	**Montblanc**	m	2000	Haute-Savoie, Bargy	alive	2010	blue	red
363	**Christelle**	f	2000	NP Engadin, Zernez	?	2005?	blue	golden
364/BG364	**Louis**	m	2000	NP Engadin, Zernez	alive	2010	blue	green
369	**Larche**	m	2001	PN du Mercantour, Vignols	?	2003	pink	blue
370/BG370	**Roure**	f	2001	PN du Mercantour, Vignols	alive	2010	pink	black
372	**El Dorado**	f	2001	NP Hohe Tauern, Matrei	?	2005	pink	violet
373	**Christa**	f	2001	NP Hohe Tauern, Matrei	?	2003	pink	silver
374	**Roseg**	f	2001	NP Engadin, Zernez	dead	-	pink	golden
375/BG375	**Felice**	f	2001	NP Engadin, Zernez	alive	2010	pink	green
377	**Europa Life**	m	2001	Haute-Savoie, Bargy	dead	-	pink	red
380	**Natura Mate**	f	2001	Haute-Savoie, Bargy	dead	-	pink	cupreous
386	**Alpidoc**	f	2002	PN Alpi Marittime, Argentera	?	2005	black	blue
387	**Franz**	m	2002	NP Hohe Tauern, Gastein	dead	-	black	violet
388	**Paolo Peila**	m	2002	PN Alpi Marittime, Argentera	alive	2010	black	black
392/BG392	**Ambo**	f	2002	NP Hohe Tauern, Gastein	alive	2010	black	silver
393/BG393	**Stift**	f	2002	NP Stilfserjoch, Martell	?	2008	black	golden
395/BG395	**Martell**	f	2002	NP Stilfserjoch, Martell	alive	2010	black	green
402	**Life**	m	2002	Haute-Savoie, Doran	?	2007	black	cupreous
405	**Aravis**	m	2002	Haute-Savoie, Doran	?	2005	black	red
411/BG411	**Guillaumes**	f	2003	PN du Mercantour, Vignols	alive	2010	violet	golden
413/BG413	**Jausiers**	f	2003	PN du Mercantour, Vignols	?	2006	violet	green
415	**Sadri**	f	2003	Haute-Savoie, Doran	?	2005	violet	cupreous
418	**Transalpaete**	f	2003	Haute-Savoie, Doran	?	2005	violet	red
420	**Joker**	f	2003	NP Hohe Tauern, Mallnitz	?	2005	violet	violet
422	**Kasati**	m	2003	NP Hohe Tauern, Mallnitz	?	2005	violet	silver
424	**Thuri**	f	2003	NP Engadin, Zernez	?	2005	violet	blue
433/BG433	**Blangiar**	m	2004	PN Alpi Marittime, Argentera	dead	-	red	blue
435	**Palanfre**	f	2004	PN Alpi Marittime, Argentera	?	2006	red	black
438/BG438	**Culan**	m	2004	NP Stilfserjoch, Martell	dead	-	red	golden
439	**Ortler**	f	2004	NP Stilfserjoch, Martell	?	2006	red	green

440	**Gilbert**	f	2004	Haute-Savoie, Doran	?	2006	red	cupreous
441	**Bella Cha**	f	2004	Haute-Savoie, Doran	?	2006	red	red
444	**Toto**	m	2004	NP Hohe Tauern, Kals	captivity	-	red	violet
446/BG446	**Hubertus 2**	m	2004	NP Hohe Tauern, Kals	alive	2010	red	silver
452	**Monaco**	f	2005	PN du Mercantour, Vignols	?	2007	green	blue
455	**MonteCarlo**	f	2005	PN du Mercantour, Vignols	?	2007	green	black
459	**Swaro**	m	2005	Haute-Savoie, Doran	?	2008	green	cupreous
460	**Sallanches**	f	2005	Haute-Savoie, Doran	?	2007	green	red
462/BG462	**Escalero**	f	2005	NP Hohe Tauern, Rauris	alive	2010	green	violet
463/BG463	**Folio**	f	2005	NP Engadin, Zernez	?	2009	green	golden
464/BF464	**Natura**	f	2005	NP Engadin, Zernez	?	2007	green	green
465/BG465	**Doraja**	f	2005	NP Hohe Tauern, Rauris	alive	2010	green	silver
488	**Michegabri**	m	2006	PN Alpi Marittime, Argentera	?	2009	blue	blue
491	**Cuneobirding**	f	2006	PN Alpi Marittime, Argentera	?	2008	blue	black
493	**Zufall**	f	2006	NP Stilfserjoch, Martell	alive	2010	blue	red
494	**Voltoi**	f	2006	NP Stilfserjoch, Martell	?	2008	blue	green
495	**Temperatio**	f	2006	NP Stilfserjoch, Martell	?	2007	blue	golden
497	**Portobello**	m	2006	NP Hohe Tauern, Mallnitz	?	2008	blue	violet
498	**Tauernwind**	m	2006	NP Hohe Tauern, Mallnitz	?	2007	blue	silver
516	**Rocca**	m	2007	PN du Mercantour, Vignols	?	2009	pink	blue
520	**Fontvieille**	f	2007	PN du Mercantour, Vignols	?	2009	pink	black
524	**Blick**	m	2007	NP Engadin, Zernez	?	2009	pink	golden
526/BG526	**Samuel**	m	2007	NP Engadin, Zernez	alive	2010	pink	green
528	**Romaris**	f	2007	NP Hohe Tauern, Kals	?	2009	pink	violet
530	**Calce**	m	2007	NP Hohe Tauern, Kals	?	2008	pink	silver
548	**Nonno Bob**	m	2008	PN Alpi Marittime, Argentera	alive	2010	golden	blue
549	**Girasole**	f	2008	PN Alpi Marittime, Argentera	alive	2010	golden	black
556	**Haristraufu**	m	2008	NP Stilfserjoch, Martell	?	2008	golden	golden
557	**Ikarus**	m	2008	NP Stilfserjoch, Martell	dead	-	golden	green
558	**Pinzgarus**	m	2008	NP Hohe Tauern, Rauris	alive	2010	golden	violet
559	**Rurese**	m	2008	NP Hohe Tauern, Rauris	alive	2010	golden	silver
583	**Vaulabelle**	f	2009	PN du Mercantour, Vignols	alive	2010	black	blue
585	**Maseta**	f	2009	NP Hohe Tauern NP, Mallnitz	alive	2010	black	violet
586	**Condamine**	f	2009	PN du Mercantour, Vignols	alive	2010	black	black
587	**Eustachius**	f	2009	NP Hohe Tauern NP, Mallnitz	alive	2010	black	silver
613	**Elena**	f	2010	PN Alpi Marittime, Argentera	alive	2010	cupreous	black
615	**Spelugue**	f	2010	PN Alpi Marittime, Argentera	alive	2010	cupreous	blue
616	**Stephan**	m	2010	PN Vercors, Trechenu-Creyers	alive	2010	cupreous	cupreous
618	**Cordouane**	m	2010	PN Vercors, Trechenu-Creyers	alive	2010	cupreous	pink
619	**Lousa**	f	2010	PN Vercors, Trechenu-Creyers	alive	2010	cupreous	orange
621	**Ingenius**	m	2010	Calfeisen, Vaettis	alive	2010	cupreous	golden
624	**Sardona**	m	2010	Calfeisen, Vaettis	alive	2010	cupreous	green
626	**Kira**	f	2010	Calfeisen, Vaettis	alive	2010	cupreous	red
628	**Figol**	f	2010	NP Hohe Tauern NP, Kals	alive	2010	cupreous	violet
629	**Tschadin**	f	2010	NP Hohe Tauern NP, Kals	alive	2010	cupreous	silver

3.3 Released birds per geographic region

Out of the 165 birds released and successfully fledged in the Alps during the last 25 years, 49 were released in the E-Alps, 40 in the C-Alps, 39 in the SW-Alps and finally 35 in the NW-Alps. **Table 6** and **figure 7** illustrate these results; besides, in the **table 6,** the sex-ratio (nº of males / nº females) of released birds per zone and in total for released birds in the Alps is also shown. The results obtained for the sex-ratio clearly show the necessity to increase the release of males to equilibrate these figures: In each region independently the number of males is lower, ranging from the 0.9 in the C-Alps to the 0.75 in the NW-Alps, being the total for the Alps 0.83 (0.84 in 2009). In 2010 there were 6 females and 4 males out of the 10 birds released, being therefore the sex-ratio as low as 0.67. In conservation and reintroduction of monogamous species, like the bearded vulture, it is essential to keep a sex-ratio as close to 1 (1:1) as possible, to maximize the probability of pair formation. Furthermore, in this species there is a certain percentage of polyandrous trios, which means that a sex-ratio slightly higher than 1:1 could even be beneficial, being thought even more important to release more males than females in the future.

Another factor that must be considered for the survival of the Alpine population in the long term is the genetic variability. Most of the birds that integrate the reproductive nuclei in the Alps come from a few captive pairs (founders), while there are some lines that are little represented so far. For this reason it is intended to release these rare lines in "safer" areas with a higher suitability leaving the most "common" lines for new sites and less optimal ones. Besides, it becomes more and more important to connect with other extant populations. This is the case in particular for the Pyrenean and the Corsican populations. A new site has been chosen recently in the Massif Central for future release to function as stepping stone between Pyrenees and Alps.

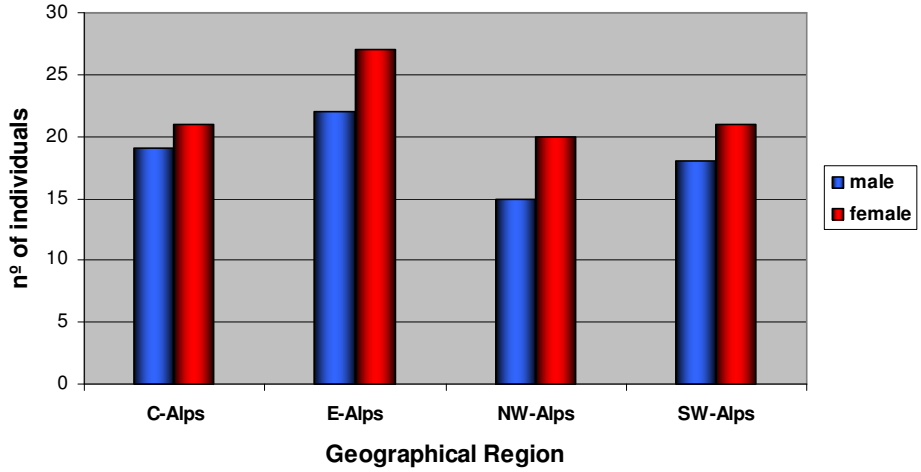


Figure 7: Number of males and females released per Geographic region since 1986

Table 6: Calculation of the sex ratio (nº of males / nº of females) for each Geographic Region and for the whole Alps. In NW-Alps there are 2 birds of sex unknown.

Region	Males	Females	Total	Sex-ratio
C-Alps	19	21	40	0,90
E-Alps	22	27	49	0,81
NW-Alps	15	20	35 + 2*	0,75
SW-Alps	18	21	39	0,86
Total	**74**	**89**	**165**	**0,83**

4 Reproduction in the Alps 2009/2010

4.1 Summary of the season 2009/2010

The breeding season 2009/10 has been the most successful in the whole history of the project since 1997 (year when the first fledgling took place in the wild) with the highest number of clutches and hatchlings, equal to 2007, however, in the final number of fledglings (see **table 7**); expressed in figures, in the season 2009/10 there was a total amount of 18 Clutches, 15 Hatchings (50% more than in 2008/09) and 10 fledglings, including the first case of successful breeding in the Austrian Alps (!). These results are represented in the **figure 8** and the **table 7**. By November 2010 there were 19 registered mature couples, which makes 2 more in comparison to the same time in 2009; these new pairs were found in C- and SW-Alps (Italian and French territories). Moreover, there is evidence of the existence of at least one more undetected pair breeding in the C-Alps: This is the case of a feather found in the valley of Lechtal (Austria), which revealed the new genotype GT038, related to the bird Kasati (BG422) and GT031 (a female offspring of the Livigno pair), which might be so far an undocumented pair.

Table 7: Reproductive parameters of the whole Alpine population since 1995

		positive trend →															
	year	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	Total
C1	controlled territories	1	1	2	3	4	5	6	9	11	18	15	18	18	15	17	19	**162**
C2	Mature, territorial pairs	1	1	2	3	4	4	5	8	9	14	12	16	16	15	17	19	**146**
D	Breeding pairs (clutch)	0	1	1	2	4	4	5	6	7	8	8	9	13	15	13	18	**114**
E	Reproduction with hatching	0	1	1	2	3	3	4	6	4	5	8	7	12	11	10	15	**92**
F	successful pairs (fledgelings)	0	0	1	2	1	3	1	5	2	5	7	6	10	7	9	10	**69**

Data collected by: PN Mercantour, PN Alpi Marittime, PN Ecrins, Autonomous Region of Valle d' Aosta, PN Vanoise, A.S.T.E.R.S., PN Stelvio, Pro Bartgeier, NP Hohe Tauern, VCF. Data consolidation by NPHT/EGS - R.Zink in close cooperation with VCF and ALPARC

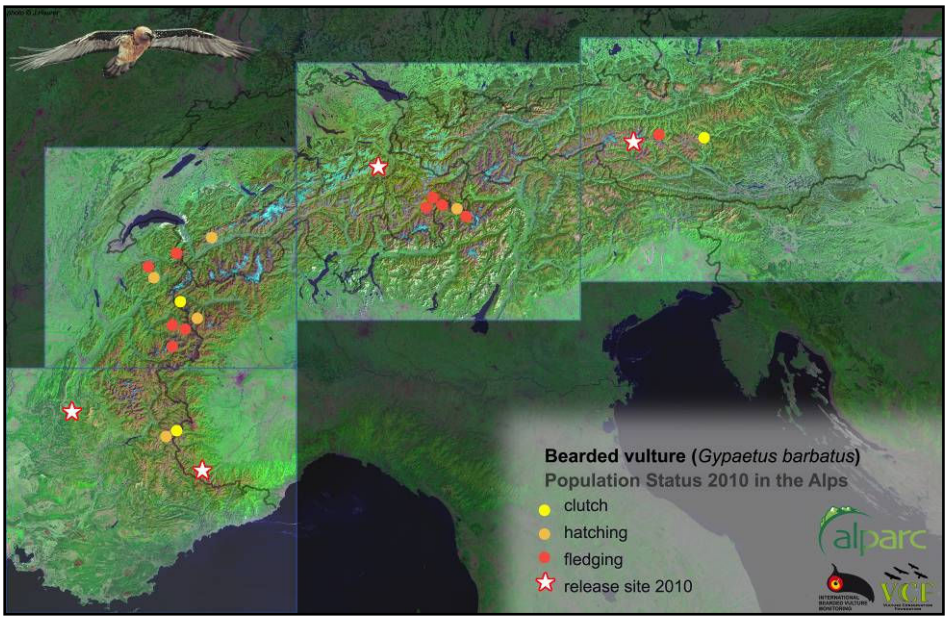


Figure 8: Reproductive parameters on the Alpine population in 2010, showing pairs with clutch, hatchings and finally fledglings, as well as the release sites

Table 8: Summary of the activity of breeding pairs in the Alps in 2010 organized by country, showing the identity of the pair members, important dates in the reproductive season, offspring (if any) and years of first occupation and breeding. The pair Ofenpass didn't attempt breeding.

Country	Pair	Birds ID		Important dates			Offspring	Year of first	
		Male	Female	Clutch	Hatch	Fledge		Occupation	Breeding
Austria	Gastein	Andreas Hofer (BV260)	GT015	10.01.2010	15.03.2010	17.07.2010	Kruml (W77)	2002	2010
	Katschberg	Hubertus 2 (BV446)	Ambo (BV392)	24.02.2010	-	-	-	2009	-
Total	**2**			**2**	**1**	**1**	**1**		
France	Bargy	Balthazar (BV099)	Assignat (BV111)	26.01.2010	21.03.2010	11.07.2010	Bargy 2010 (W70)	1996	1997
	Aravis	GT028	Republic 11 (BV288)	15.01.2010	13.03.2010	-	-	2006	2009
	Termignon	GT018	Gelas (BV279)	21.12.2009	20.02.2010	20.06.2010	Jef (W75)	2002	2002
	Val d'Isere	GT009 (Republic 3?)	GT010	22.01.2010	13.03.2010	20.06.2010	Flocon (W72)	1995	2002
	Peisey Nancroix	Phenix Alp action (W01)	GT027	09/01/2010	05.03.2010	04.07.2010	Primevert (W47)	2004	2005
	Source de l'Ubaye	Sereno (BV348)	Roure (BV370)	27.01.2010	-	-	-	2007	2008
	Sixt Fiz	Montblanc (BV361)	Veronika (BV321)	21.01.2010	15.03.2010	27.06.2010	Bangor (W73)	2004	2007
	Châtelet	?	Roure (BV370)	22.02.2010	18.04.2010	-	-	2010	-
Total	**8**			**8**	**7**	**5**	**5**		
Switzerland	Tantermozza	Zebru (W12)	Martell (BV395)	28.01.2010	25.03.2010	25.07.2010	Tantermozza 2010 (W76)	2006	2007
	Ofenpass	GT023 (Livigno, W08?)	Retia (BV357)	-	-	-	-	2006	2007
	Albula	Louis (BV364)	Diana-Stelvio (W07)	26.01.2010	01.04.2010	15.07.2010	Albula 2010 (W79)	2006	2008
	Dérborence	Pablo (BV359)	Gildo (BV299)	14.01.2010	02.03.2010	-	-	2004	2007
Total	**4**			**3**	**3**	**2**	**2**		
Italy	Valdigne	Republic 13 (BG335)	?	17.01.2010	-	-	-	2004	-
	Zebru	GT029	Felice (BV375)	10.01.2010	06.03.2010	20.07.2010	Gyp-Cam (W80)	2002	2002
	Livigno	Cic (BV186)	Moische (BV146)	28.01.2010	27.03.2010	11.07.2010	Francesca (W82)	1999	2000
	Rhemes 2	?	?	13.02.2010	22.04.2010	-	-	2010	-
	Valle del Braulio	Tell (BG283)?	Jo (BV169)	31.01.2010	29.03.2010	-	-	1997	1998
Total	**5**			**5**	**4**	**2**	**2**		

4.2 Re-colonization of the Alps

The re-colonization pattern showed by mature bearded vultures in the Alps is characterized by the tendency to settle down preferably in NW- (9 couples) and C-Alps (5 couples), and less frequently in E- and SW-Alps (both with 2 couples). This could be explained on the basis of 3 different parameters: Philopatric behavior, mortality and habitat suitability. Besides, when looking at the distribution of breeding sites, it is also of high interest to study the productivity of the couples in terms of successfully raised chicks (fledglings)/couple, which marks how healthy a population is and the tendency of growth for the future.

4.2.1 Philopatric behaviour:

At this point of the reintroduction project there are 2 different kinds of bird that might show this behaviour: birds born in the wild and birds born in captivity and released afterwards. When considering birds born after 2004 (adults) and without considering deaths and loses, so far there could be found adult wild-born birds only in the C-Alps (11) and NW-Alps (9), whereas the number of released birds that could have reached the adult stage is 25 in SW-Alps, 37 in NW-Alps, 28 in C-Alps and 39 in E-Alps. Summarizing these results (see **figure 9**), we obtain a total of birds that might show philopatric behaviour of 25 individuals in SW-Alps, 46 in NW-Alps (9 w-b + 37 r), and 39 in both C- (11 w-b + 28 r) and E-Alps.

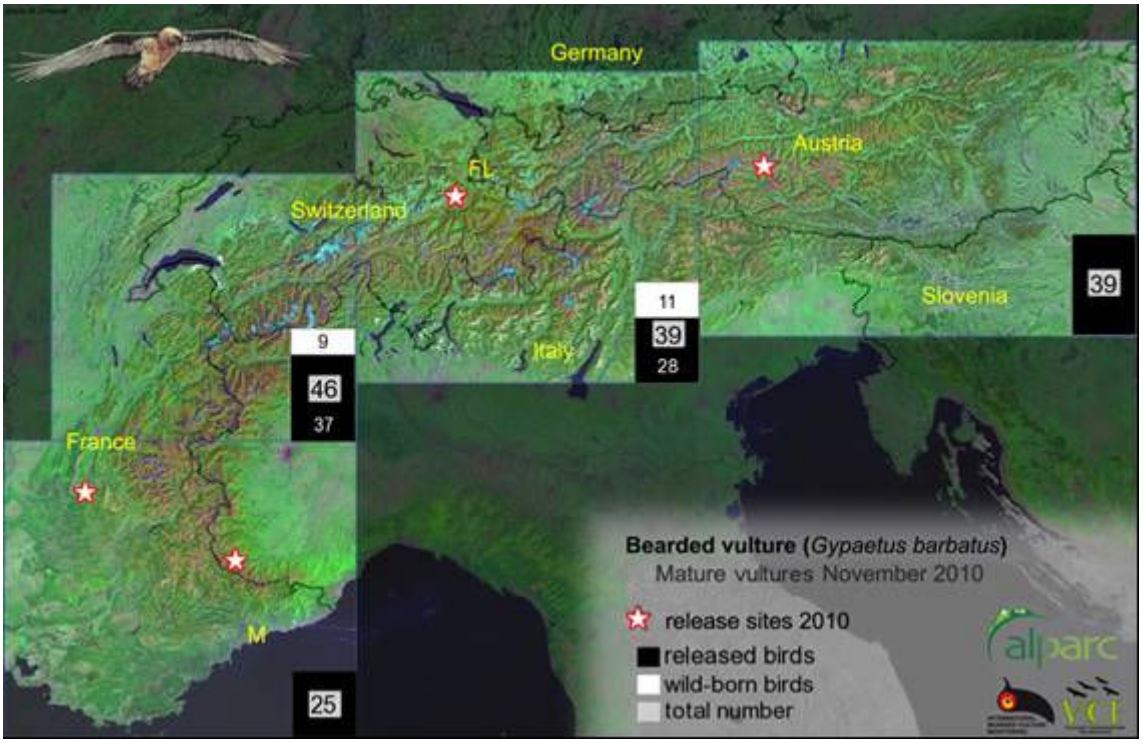


Figure 9: Map of the Alps showing the release point used in 2010 and the theoretical number of mature birds per region with wild-born and released birds

Curiously, when comparing the number of Couples to the number of mature birds (both from released birds and wild-borns) on each area (**table 9**), the result is exactly the opposite, finding this time the highest proportion in the NW-Alps (40%) and the lowest in the E-Alps (10%). In case philopatry was the main driving force for site selection, the expected result would be a higher number of couples in the sites where more birds were released/born, but since this is not the case, we assume that philopatry can only explain the situation to some extent and there must be other factors implicated, like differential mortality.

Table 9: Results of the coefficient between couples and number of released + wild-born birds on each region of the Alpine range

Sector	SW-Alps	NW-Alps	C-Alps	E-Alps
Released & wild-borns (A)	25	46	39	39
Couples (B)	2	9	5	2
A / B	16%	40%	26%	10%

4.2.2 Mortality:

Up to the end of 2009, 35 cases of deceased animals have been documented in the Alps. Out of those, there is approximately the same number of dead juveniles (17) as of immatures + adults (18). Although the reasons of death are unknown in almost half of the cases, when known, it has been seen (see **figure 10**) that juveniles mainly die by predation, diseases or accident whereas immatures and adults are killed by shooting, collisions (both anthropologic causes) or avalanches (natural).

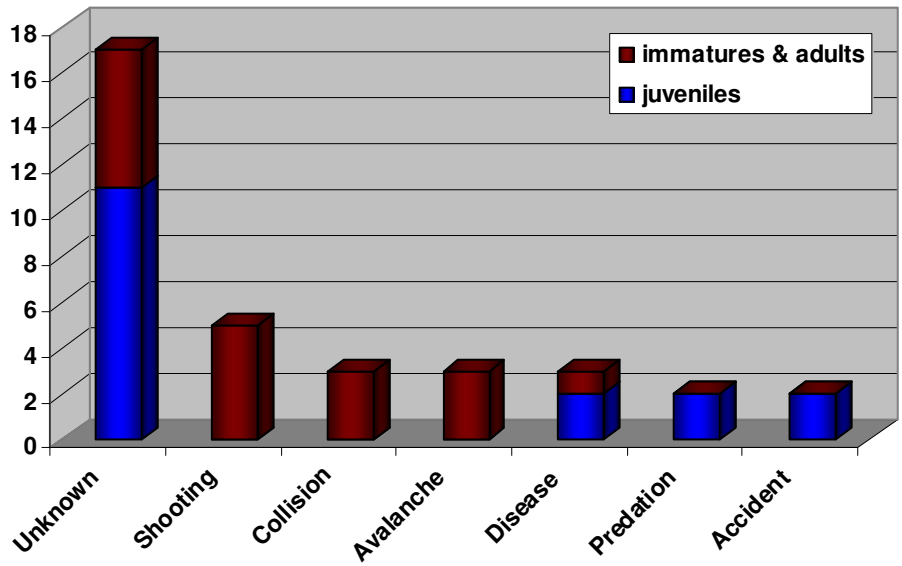


Figure 10: Number of deceased animals (n=35) and the mortality reasons in the Alpine population, differentiating between juveniles and immatures + adults

In the year 2010 there were another two mortality cases:

1) Unknown: On 8th of May an adult Bearded Vulture was found dead in Valfurva (Italy). The bird seems to be born in nature since it had no ring. The genetic identification of this bird hasn't been carried out.

2) GT039: On 10th of October the carcass of the female offspring of the breeding pair in Bormio (BG283 and GT003) was found dead below a power line in Sixt-Emosson (France).

In both cases samples were sent to the laboratory of Dr. Barbara Hefti-Gautschi for further analyses.

When looking at the locations of those deaths, we find that more than 80% of the cases happened in C- and NW- Alps, especially if we focus on mortality cases of birds older than 160 days, when the percentage increases to ~ 90%. So thus far there is no evidence that delayed re-colonization of SW- and E-Alps is caused by increased mortality. Besides, these results show that the proportion of mortality cases depends simply on population density, which is higher in C- and NW-Alps.

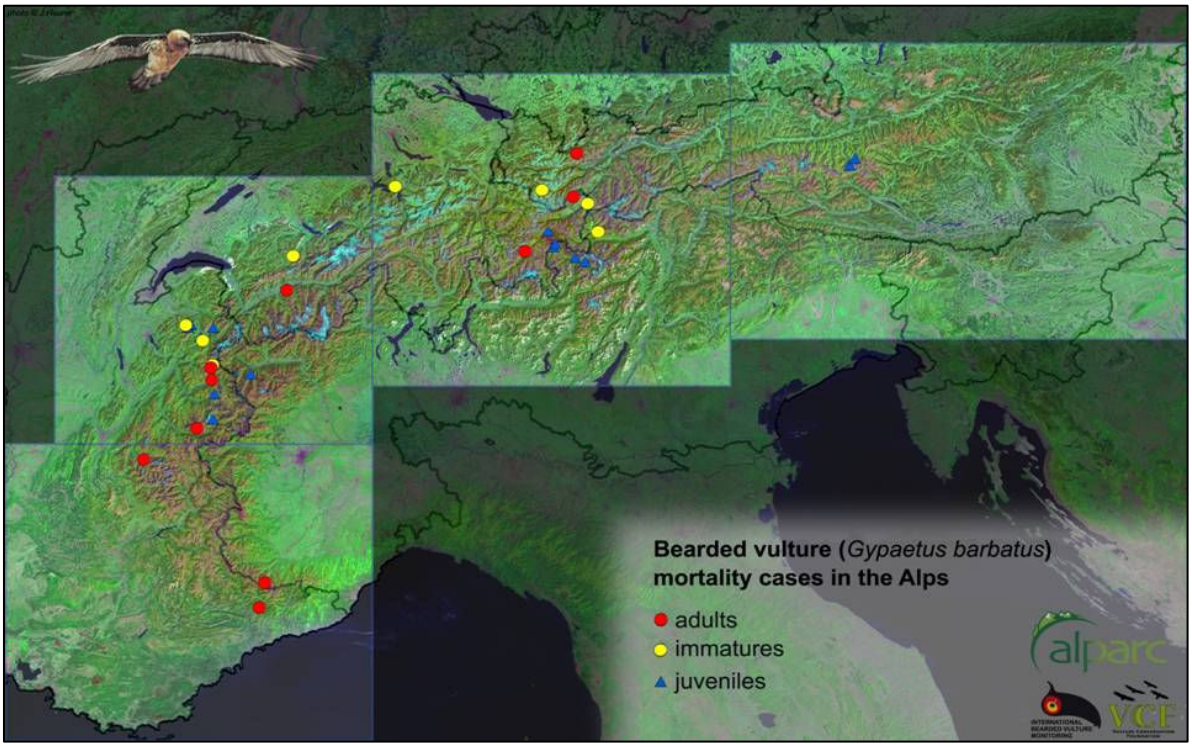


Figure 11: Map showing the location of dead birds found in the Alps and their age class

Nevertheless, it is very likely that there are more unknown cases of death by poisoning, shooting and collision, which are very difficult to detect. Therefore, it might well be that the E- and SW-Alps are more exposed to such risks (i.e. unproved but known cases of illegal shooting in Austria), and so there are unnoticed losses in these areas, although this remains unclear.

The stability of the current bearded vulture population (estimated in 2010 at 154 individuals) is steadily increasing since the beginning of the project. Schaub et al. (2009) showed that this stability would still remain unaffected by an increase of 50% on the mortality rate; however promising this might seem, the situation changes when looking at the numbers: Unlike other regions such as South Africa, where the mortality rate is as high as 87% during the first 4 years of life (Brown, 1997), in the Alps the mortality rate is quite low, 11%

during the first year of life that drops to 5% for birds older than a year, meaning approximately 26% in the first 4 years of life to compare figures with the 87% previously mentioned for South Africa. These alpine percentages expressed in number of individuals, mean the annual death of approximately 6 birds older than a year plus 1-2 younger birds, which makes a total of 7-8 dead birds per year. Now, when looking again at the increase of 50% of mortality that would affect the stability, we find that the death of only 4 more birds per year would turn the positive trend into a negative one. There are several factors that might lead to an increase of these mortality rates in the close future, such as the arise of new threads (i.e. the mushrooming of windmills, increase of poisoning on the local level, like areas of wolf, etc.), or the need for the birds to settle down in less-suitable places once the best sites are already occupied. Thus, it becomes necessary to evaluate the mortality risks and elaborate an action plan to fight them, which might prove essential for the selection of new release sites in the future.

Bearded vultures start breeding at an average age of 8.3 years, which is quite an advanced age, so the population would need a long time to recover from the deaths of adult birds, which might be the case for example in cases of illegal shooting for trophy.

4.2.3 Reproduction and productivity:

The productivity is calculated as the number of fledglings per checked couple, or per total number of couples when speaking of productivity of a particular region. Compared to 2009, on average the productivity in the Alps in 2010 (0.5) hasn't changed, since even though there has been an increase on the number of pairs (+2), there has not been an according increase on the number of chicks (only +1), affecting the total percentage (see **table 10**). The productivity differs significantly when looking at the 4 described regions independently (see **table 11**): For 2010 the lowest productivities can be found in the E-Alps, with an average of only 8%, and the SW-Alps (17%), being far from the other 2 regions, which show an average of 48% in the NW-Alps and 68%, the highest, in the C-Alps.

Table 10: Reproductive & productivity parameters of the whole Alpine population across the years

	year	95	96	97	98	99	00	01	02	03	04	05	06	07	08	09	10	Total
C1	controlled territories	1	1	2	3	4	5	6	9	11	18	15	18	18	15	17	19	**162**
C2	Mature, territorial pairs	1	1	2	3	4	4	5	8	9	14	12	16	16	15	17	19	**146**
D	Breeding pairs (clutch)	0	1	1	2	4	4	5	6	7	8	8	9	13	15	13	18	**114**
E	Reproduction with hatching	0	1	1	2	3	3	4	6	4	5	8	7	12	11	10	15	**92**
F	successful pairs (fledgelings)	0	0	1	2	1	3	1	5	2	5	7	6	10	7	9	10	**69**
F/C2	Productivity	0	0	0,5	0,7	0,3	0,8	0,2	0,6	0,2	0,4	0,6	0,4	0,6	0,5	0,5	0,5	**0,5**
D/C2	% breeding	0	1	0,5	0,7	1	1	1	0,8	0,8	0,6	0,7	0,6	0,8	1	0,8	0,9	**0,8**
F/D	% successful	0	0	1	1	0,3	0,8	0,2	0,8	0,3	0,6	0,8	0,7	0,8	0,5	0,7	0,6	**0,6**

Data collected by: PN Mercantour, PN Alpi Marittime, PN Ecrins, Autonomous Region of Valle d' Aosta, PN Vanoise, A.S.T.E.R.S., PN Stelvio, Pro Bartgeier, NP Hohe Tauern, VCF. Data consolidation by NPHT/EGS - R.Zink in close cooperation with VCF and ALPARC

Table 11: Results on reproduction and productivity per region on each region of the Alpine range until 2010

Sector	SW-Alps	NW-Alps	C-Alps	E-Alps
Seasons (C2)	6	69	50	12
Clutches (D)	3	57	44	10
Hatchlings (E)	2	44	41	5
Fledglings (F)	1	33	34	1
Average Productivity (F/C2)*100	17%	48%	68%	8%

The **figure 12** shows that the trend line calculated for the number of wild-born fledglings/year adjusts better to an exponential growth and presents a strong R^2= 0.77 (2010), which has been steadily increasing across the years. Since 2006, the wild-born birds outnumber the average of released birds (6.67 birds). Regarding the number of egg-laying couples, the trend also follows an exponential growth, with an even stronger R^2 (=0.89 in 2010).

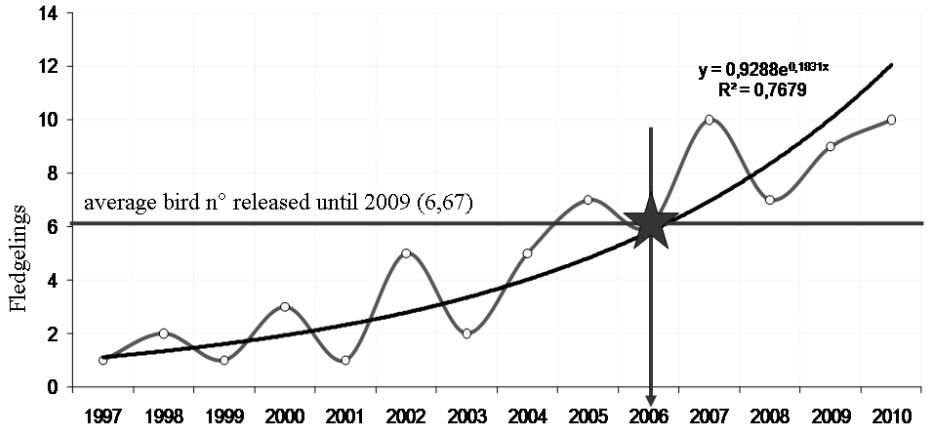


Figure 12: nº of wild-born fledglings/year since 1997. The trend line shows an exponential growth with a R2= 0.7679. The average number of birds released until 2009 is also represented.

The high differences found in percentages of productivity across the Alps is similar to that found of number of mature pairs, being higher in the C- and NW-Alps and lower in the extremes of the alpine range (SW- and E-Alps). To study the reasons for this pattern, 2 parameters were studied: number of fledglings / released + wild-born birds, and number of fledglings / couple (breeding units) on each region.

The results for the first parameter (number of fledglings / released + wild-born birds) are shown at the **table 12**. The idea is that there should be more fledglings in areas where more birds were raised since the beginning of the project (both wild-born and captive bred) according to the abovementioned philopatric behaviour. If this was the case, it could be expected a higher percentage in the NW-Alps, and similar results in C- and E-Alps. However, the results are very different, and the highest percentage appears in the C-Alps (87%), followed by the NW-Alps, and surprisingly, the lowest rate is found in the E-Alps (3%). Thus, this parameter cannot explain the differential productivity.

Table 12: Results of the number of fledglings / released + wild-born birds in the Alpine population until 2010

Sector	SW-Alps	NW-Alps	C-Alps	E-Alps
Released & wild-borns (R)	25	46	39	39
Fledglings (F)	1	33	34	1
F / R	4%	72%	**87%**	3%

The second parameter, fledglings / breeding units assumes that there should be a higher productivity in areas where more couples are breeding, since the selection of a certain habitat to breed means better conditions and therefore higher chances to raise chicks successfully. According to this theory, there should be a higher number of fledglings/couple in the NW-Alps, where there are 9 breeding units. The results (**table 13**) show that, however, once again the higher number is found in the C-Alps (6.8), although it is also high (3.7) in the NW-Alps. SW- and E-Alps, both with 0.5 fledglings/couple, seem to fit in the theory. Therefore it cannot be said that the theory is proven completely wrong, but neither that it fully explains the results obtained.

Table 13: Results on reproduction success per region and the coefficient between nº of fledglings / couple

Sector	SW-Alps	NW-Alps	C-Alps	E-Alps
Couples (C)	2	9	5 (6)	2 (3)
Fledglings (F)	1	33	34	1
F / C	0.5	3.7	**6.8**	0.5

Then, why has productivity been higher in the C-Alps? The answer can simply be that couples breeding in this area are more stable and experienced, being specially this second factor, experience, decisive in the process of successful breeding. For this reason it is expected an increase in the breeding rate in young couples with the time, which needs to be further studied. Another interesting factor to consider is that couples in the C-Alps are more focalized in a smaller area than observed, for example, in the NW-Alps; in case of the appearance of new mortality threads in the local level, the scattered NW-Alpine population would “buffer” the negative impact, being therefore this situation advantageous, whereas other populations like the one in the C-Alps could be seriously affected.

On the long term, it is expected that habitat suitability is the best way to explain site selection, pair formation and hopefully reproductive output, so it is important to work further on in the topic in order to better understand the causes underlying the population dynamics of the species and act accordingly. So far there is no clear explanation for the low results obtained in the E and SW- Alps, which makes even more necessary to understand these causes.

5 Further recommendations

- Define the focus of monitoring depending on the area: Dispersal and mortality (SW- and E-Alps) and reproduction (NW- and C-Alps).
- Calculate reliable survival rates to check the condition of the population: Identification of individuals, information from satellite tracked birds, get genetic samples, synchronous counts and demography modeling.
- Work on mortality threads: The problem of lead, intentional poisoning in areas of wolf, effect of windmills and aerial cables.
- Fine tune release tactics: compensate the sex-ratio, add rare genotypes in save places, choose the best geographical positions, and avoid sites with high mortality risks (use other vultures as indicator).
- Assess the habitat quality impact in the distribution of adult birds and pairs: Try to extend the habitat modeling to the entire population range (Alps).
- Maintain and re-connect extant populations: Like the current action of releasing birds in the Massif Central (France) to connect the Pyrenean and Alpine populations, but also and extremely important, a future plan to re-connect with the Corsican population.
- Study the effect of age in successful breeding, as well as the date when pairs start breeding (earlier the more experienced a couple is) each year. There are suspicions that changes in these dates might be a sign of turn-over.

6 Acknowledgements

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