

## Monitoring juvenile Bearded Vultures in the Swiss National Park and the Parco Nazionale dello Stelvio

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### Introduction

Since 1991, young Bearded Vultures have been released in the Engadine by the „Stiftung pro Bartgeier“ (Foundation Pro Bearded Vulture; SPB) within the framework of the international reintroduction project of the Bearded Vulture into the Alps. The juveniles have been separated from their parents some time before their transfer to a cave in the Stabelchod Valley (Swiss National Park, SNP) and their subsequent fledging. During the next six weeks, they were provided with food and monitored by collaborators of the SPB and of the SNP. Apart from checking on the vitality and the health of the birds, these observations proved also to be useful with regard to the monitoring of the reintroduction project. The notes are catalogued and the development of the juveniles is systematically documented. The following aspects are emphasized:

1. Description of activities and behavioural development of the juvenile Bearded Vultures at the release site.
2. To point out individual differences and overall validity of behavioural patterns.
3. Comparison of the behaviour of released juveniles with that of wild-born young birds.
4. Repeated observations and dispersal behaviour of released Bearded Vultures.
5. Presence and behaviour of immature, subadult and adult Bearded Vultures at the release site (philopatric behaviour).
6. Intra- and interspecific interactions.

In the present study, the above-mentioned points were applied to 10 young Bearded Vultures, released in the SNP since 1994, and to the wild-born young bird in the Valle del Braulio in 1998.

### Methods

#### *Observation situation and released young birds*

The young Bearded Vultures were released in the Val Stabelchod in the SNP. The release site is situated in an extended ridge, at approx. 2100 m altitude. It is easy to observe and to monitor from an adjacent ridge, where a small observation hut was built. The distance between the release cave and the observation hut is approx. 250m. The nest site in the Valle del Braulio is situated on approx. 2400 m altitude and can be observed from the opposite side of the valley at a distance of about 1km.

**Table 1** gives data of the observed, juvenile Bearded Vultures

No.	Name	hatched	released	age in days when released	sex	ring left	ring right	period of observation		
								from	to	N days
210	Pisoc	03-03-94	09-06-94	98	m	gold	red	10-06-94	06-08-94	22
220	Valimosch	27-02-94	09-06-94	102	m	green	red	10-06-94	06-08-94	22
263	Berna	04-03-96	07-06-96	95	m	gold	green	08-06-96	14-08-96	42
285	Mauritz	08-03-96	07-06-96	91	m	green	green	08-06-96	14-08-96	42
283	Tell	18-03-97	20-06-97	94	m	green	bronze	21-06-97	31-07-97	41
285	Sina	24-03-97	20-06-97	88	f	gold	bronze	21-06-97	31-07-97	41
299	Gildo	04-03-98	04-06-98	92	f	green	silver	04-06-98	15-07-98	42
301	Diana-Valais	13-03-98	04-06-98	83	m	gold	silver	04-06-98	15-07-98	42
321	Veronika	23-02-99	03-06-99	100	f	green	gold	03-06-99	13-07-99	41
323	Sempach	27-02-99	03-06-99	96	m	gold	gold	03-06-99	13-07-99	41
	Stelvio	23-03-98	-	-	?	-	-	11-05-98	09-08-98	30

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### Observation of juvenile Bearded Vultures

Since 1997, instantaneous behaviour of the birds was noted four times a day for 1.5 hours. When collecting this kind of data, the behaviour observed was noted every five minutes (Instantaneous Sampling). The length of time of Instantaneous Sampling covered 12 hours in 2 days from 07:35 to 19:30:

Day 1: 07:35 - 09:00 10:35 - 12:00 13:35 - 15:00 16:35 - 18:00

Day 2: 09:05 - 10:30 12:05 - 13:30 15:05 - 16:30 18:05 - 19:30

In 1996, observations were carried out every day from 08:30 to 09:30, from 11:00 to 12:00, from 13:30 to 14:30 and from 17:00 to 18:00. Instantaneous Sampling was undertaken during the whole day in the SNP in 1994, and while monitoring the wild-born young Bearded Vulture in the Valle del Braulio in 1998.

Observed behavioural patterns are defined in **Table 2**. In addition to the description of the behavioural patterns, the distance of Bearded Vulture to Bearded Vulture, and Bearded Vulture to the nearest piece of food were noted (less than 2 "animal-lengths" {AL}, 2 to 10 AL and over 10 AL).

**Table 2. Definition of behavioural displays, defined after Instantaneous Sampling**

Behaviour	Definition
<b>Flight training</b>	The Bearded Vulture flaps its wings several times up and down. Both wings are synchronized in moving. The Bearded Vulture does not loose contact with the ground or at most for 5 seconds
<b>Locomotion</b>	The Bearded Vulture hops or steps, the wings may be stretched, but are not moved synchronously up and down.
<b>Occupation</b>	The Bearded Vulture manipulates an object with its bill. This object is neither food, nor a social partner nor its own body.
<b>Feeding</b>	The bill of the Bearded Vulture is touching a piece of carcass or looks at a piece of carcass below it, or is gulping down a piece of carcass, moving its neck.
<b>Flying</b>	The Bearded Vulture is in the air.
<b>Drinking</b>	The Bearded Vulture drinks water or eats snow.
<b>Comfort behaviour</b>	The Bearded Vulture preens with its bill, talon or head its body, or stands, sits or lays down with stretched wings, or shakes its ruffled plumage, or takes a bath in water or mud.
<b>Social behaviour</b>	The distance between two Bearded Vultures is less than 10 AL and the Bearded Vulture shows one of the behavioural patterns, given in Table 3.
<b>Inactive</b>	The Bearded Vulture stays, sits or lays with smooth plumage and does not show any of the abovementioned behavioural patterns
<b>Not to observe</b>	The behaviour of the Bearded Vulture cannot be observed.

From 07:30 to 19:30, all observed flight practising (see **Table 2**), the number of wing beats, and every flight (from 1997 on flight-duration was also included) were noted. As soon as the distance between two Bearded Vultures diminished to less than 10 AL, all social behaviour patterns, shown in **Table 3**, were noted in 5 minute intervals (since 1996). Additionally, air temperature, soil humidity (dry - moist - wet), cloudiness (cover in eighth parts), rain (yes/no) was noted every hour.

### Immature, subadult and adult Bearded Vultures

With respect to immature, subadult and adult Bearded Vultures, the beginning and the end of their flights, the use of roosting sites (mentioning the name of the spot), the duration of presence at the nest site (in case of the natural brooding), and the feeding of *Stelvio* by its parents were noted. For each observation, a specific note was added, even if only a "partial" (minimum-time) or a "complete" observation (for example a note on the time of take off and landing of a flight). In addition, all provision of food as well as inter- and intraspecific interactions were described in protocol covering one day. Additionally, all social interactions of subadult birds were recorded in the same way as in the case of the juvenile ones. The behaviour of the adults in the Valle del Braulio was also recorded by using Instantaneous Sampling. Whenever possible, photos were taken of all Bearded Vultures to allow a clear identification.

**Table 3. Definition of social behavioural displays.**

Behaviour	Definition
Approach	The Bearded Vulture approaches directly another Bearded Vulture (a minimum of 2 steps)
Depart	The Bearded Vulture moves back from the other Bearded Vulture (a minimum of 2 steps)
Begging	The Bearded Vulture makes begging sounds and looks at the second Bearded Vulture ( begging can also be recognized by the rhythmic movement of the mandibula)
Threat	The Bearded Vulture ruffles its plumage and looks at the other Bearded Vulture
Aggression	The Bearded Vulture beats the other Bearded Vulture with its wings or pecks at it with its bill.
Defence	As „Aggression“ but as a reaction to „Aggression“ by the other Bearded Vulture
Friendly	The Bearded Vulture preens the other Bearded Vulture or touches the bill of the other bird with its bill. The other Bearded Vulture does not step aside.
Flying together	The Bearded Vulture flies together with another Bearded Vulture at a distance of less than 10 AL.

### *Bearded Vulture observation cards*

In their first 2 years, and partly in the 3rd year after release, Bearded Vultures can be identified because of their wing marks. With the help of observation cards filled in by game keepers, tourists, employees of the National Park, these data are subsequently stored in a data bank.

The present study is based on observations, made since 1995.

## Results

### **Activities and behavioural development of juvenile Bearded Vultures in the SNP**

**Table 4** shows the most commonly observed behavioural patterns in percentages.

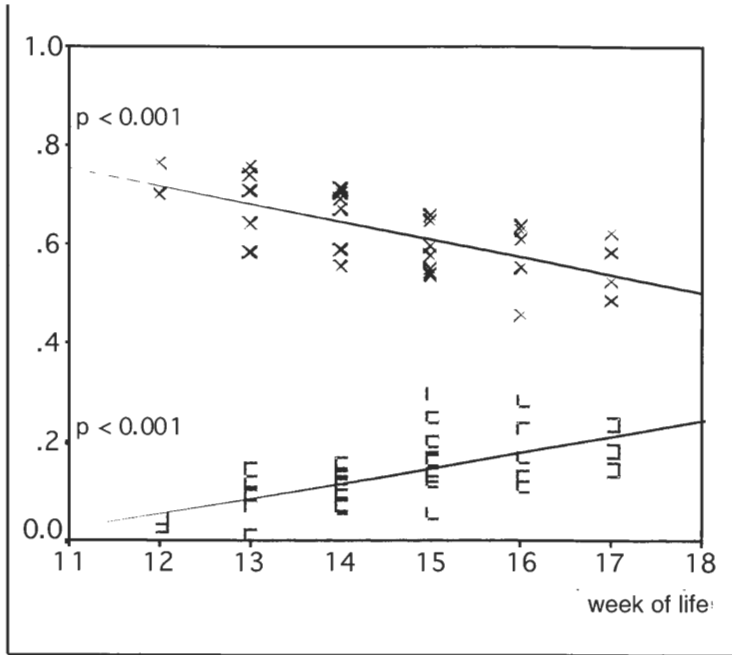
The most frequently observed behavioural patterns, i. e. "inactive", "comfort" and "feeding" make together 94.4% of all observed behavioural elements.

In **Figure 1** it can be seen, that young Bearded Vultures spent more time on "feeding" with increasing age and less time being "inactive". These trends can be described with a significant, linear regression. With regard to behaviour "comfort", no such correlation could be found. With respect to the not so common behavioural elements, "locomotion" augmented with increasing age, whereas "social behaviour" decreased (**Table 4**).

The single points in Fig. 1 are widely dispersed around the regression straight line and indicate, that single behavioural patterns may occur in very different frequency. These individual differences are shown in **Figure 2** with respect to the most common behavioural elements. *Berna* (BG 263) for example, was more "inactive" after her 16th week of life, whereas the "inactive" - values of *Veronika* (BG 321) and *Sempach* (BG 323) remained constant.

**Table 4. Percentage of the most common behavioural patterns from the 13th to the 17th week of life (mean of 10 juvenile Bearded Vultures; Standard Deviation in parenthesis. Mean: i.e. mean of week 13 to week 17.**

Behaviour	Week of life				
	13	14	15	16	17
Inactive (mean: 59.7%)	66.1% ( $\pm 7.6\%$ )	65.3% ( $\pm 7.3\%$ )	58.0% ( $\pm 4.8\%$ )	56.8% ( $\pm 7.8\%$ )	52.6% ( $\pm 10.1\%$ )
Comfort (mean: 17.8%)	16.9% ( $\pm 8.8\%$ )	17.1% ( $\pm 7.9\%$ )	16.8% ( $\pm 8.6\%$ )	17.6% ( $\pm 7.2\%$ )	20.7% ( $\pm 6.7\%$ )
Feeding (mean: 16.9%)	12.5% ( $\pm 3.9\%$ )	12.6% ( $\pm 3.3\%$ )	19.9% ( $\pm 8.0\%$ )	19.0% ( $\pm 5.0\%$ )	20.3% ( $\pm 6.3\%$ )
Locomotion (mean 2.8%)	1.8% ( $\pm 1.0\%$ )	1.8% ( $\pm 0.8\%$ )	2.1% ( $\pm 1.2\%$ )	3.2% ( $\pm 1.5\%$ )	5.0% ( $\pm 1.6\%$ )
Social (mean: 1.2%)	1.4% ( $\pm 0.7\%$ )	1.7% ( $\pm 1.4\%$ )	1.4% ( $\pm 1.4\%$ )	1.1% ( $\pm 1.5\%$ )	0.2% ( $\pm 0.4\%$ )
Others (mean: 1.6%)	1.3%	1.4%	1.9%	2.3%	1.2%
Total (mean: 100.0%)	100%	100%	100%	100%	100%



**Figure 1.** Percentage of valuable behavioural patterns per Bearded Vulture and week of life. The figure shows the behavioural displays of "feeding" ( $\square$ ) and "inactive" ( $\times$ ), the correlated linear regressions and their p-values. If a behaviour pattern of a Bearded Vulture did not account for more than 20%, the data of this week of life were not counted.

"Feeding" increased in all birds. The frequency of "feeding" decreased in most of the birds for a short period, in particular during the week of fledging. The behavioural pattern "comfort" varied rather considerably and reached values between 7% (*Mauritz*, **BG 264**, week 13) and 34% (*Sempach*, **BG 323**, week 15).

#### Flight practise and flying

The average number of flight exercises per day increased usually in the days before fledging and decreased afterwards (**Table 5**). However, a number of birds differed in this pattern. *Veronika* (**BG 321**) and *Sempach* (**BG 323**) showed the highest values in week 2 and 3 respectively; *Tell* (**BG 283**) and *Sina* (**BG 285**) trained their wings often, even after fledging. The average number of wing flaps per flight exercise varied between 4.1 (*Tell*, **BG 283**, week +1) and 7.8 (*Mauritz*, **BG 264**, week -1) and differed only slightly in the individual weeks of life.

**Table 5.** Average number of flight exercises per day from 3rd week before (week -3) up to the first week after fledging (week +1). Only those days are shown, on which a minimum of 9 hours per day was spent observing (a minimum of 3 observation days per Bearded Vulture and per week of life; data as from 1996).

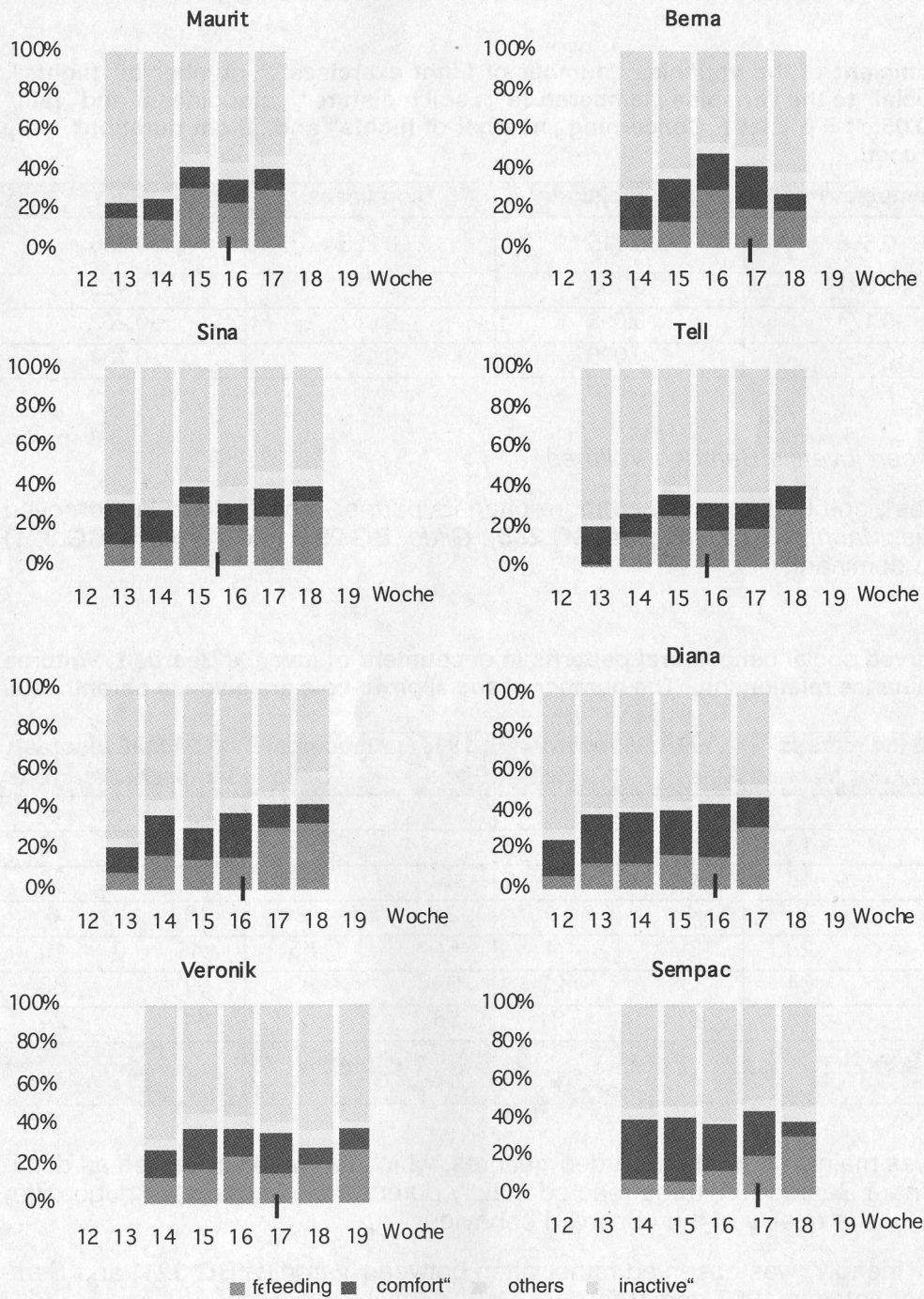
	Berna	Mauritz	Tell	Sina	Gildo	Diana	Veronika	Sempach	Mean
Week -3	9.0	8.7	10.4	12.1	10.0	18.6	12.8	17.2	12.4
Week -2	12.8	10.8	10.8	12.3	13.4	18.6	15.3	15.2	13.7
Week -1	20.6	13.9	17.3	11.6	19.1	26.7	13.2	11.0	16.7
Week +1	3.0	8.3	15.4	10.3	5.0	2.6	6.7	6.0	7.2

The juvenile Bearded Vultures undertook an average of 4-5 flights per day during the first 2 weeks after fledging (**Table 6**). Most of them were only of short duration. *Sina* (**BG 285**) and *Tell* (**BG 283**) both fledged rather early, and made only a few flights during the first week. But *Tell* (**BG 283**) flew more often than *Sina* (**BG 285**), and compared to other birds as well, in the 2nd week after fledging. *Mauritz* (**BG 264**), who too fledged rather early, showed an average of 9 flights per day and was the most "flight-loving" Bearded Vulture. More and longer flights were observed as from the 2nd week after fledging. However, little difference to the 1st week was seen in most birds.

**Table 6.** Age on the day of fledging (number of days), average number of flights per day and average duration per day (number of minutes in parenthesis) in the first 2 weeks after fledging. Only days on which a minimum of 9 hours was spent observing were counted (a minimum of 3 observation days per Bearded Vulture)

	Berna	Mauritz	Tell	Sina	Gildo	Diana	Veronika	Sempach	Mean
age at fledging	122	114	114	112	118	116	122	121	117
Week +1	7.4 (-)	5.5 (-)	0.7 (2,00)	0.3 (1,30)	4.9 (2,19)	5.3 (2,08)	4.4 (1,02)	3.4 (0,42)	4.0 (1,37)
Week +2	6.0 (-)	9.9 (-)	5.9 (3,14)	0.7 (2,24)	7.0 (3,26)		5.4 (1,52)	3.3 (0,31)	5.3 (2,17)

Approximately 10% of all behavioural patterns are assumed to have not been visible due to weather conditions in the period before fledging. After fledging, the birds more often stayed away from the release cave area and this resulted in an increase of not valuable behavioural patterns to approximately 28%.



**Figure 2.** Percentage of the behavioural patterns "inactive", "comfort", "feeding" and "others" of the entire observed behaviour per week of life and per Bearded Vulture (without Pisoc, BG 210 and Valimosch, BG 220). The line on the x-axis marks the day of fledging.

### The influence of weather conditions on the behaviour

Low temperature during the day and increased soil moisture were correlated with a significantly higher number of flight exercises (see **Table 7**). The behavioural pattern "social" was more often observed at higher temperatures. The young birds flew significantly less when it rained. With respect to the remaining behavioural patterns, no significant correlation could be observed.

**Table 7.** Correlation coefficient of the variables „number of flight exercises“, „number of flights“, „flight duration“ and „social“ to the variables „temperature“, „soil moisture“, „cloudiness“ and „rain“ (mean per day). \* =  $p < 0.05$ ; \*\* =  $p < 0.01$ . Concerning „number of flights“ and „flight duration“, only data after fledging were used.

	Temperature	Soil moisture	Cloudiness	Rain
number of flight exercises	-0.565 **	0.415 **	0.205	0.336
number of flights	0.081	-0.153	-0.151	-0.423 **
flight duration	-0.174	-0.098	-0.087	-0.262
social	0.354 *	-0.006	-0.189	-0.134

### Social interactions between juvenile Bearded Vultures

In all 4 released "couples", one bird approached more often its partner, whereby the latter moved away (see **Table 8**). Thus, *Mauritz* (BG 264), *Sina* (BG 285), *Gildo* (BG 299) and *Veronika* (BG 321) were classified as being dominant.

**Table 8.** Number of observed social behavioural patterns in encounters of juvenile Bearded Vultures and the influence of dominance relationship. The number of social protocols are given in parenthesis.

Behavioural pattern	1996 (84 records)		1997 (45 records)		1998 (120 records)		1999 (126 records)	
	Berna	Mauritz	Sina	Tell	Diana	Gildo	Sempach	Veronika
Begging	2	1	17			6	29	25
Friendly	10	13					23	25
Aggressiv	1	18	4	2	3	47	8	20
Defensive	3	1			24	2	12	6
Threat	9	28	3	4	54	55	4	10
Approach	31	64	33	22	29	93	59	83
Step aside	52	13	6	31	56	41	34	24
Dominant Bearded Vulture	Mauritz		Sina		Gildo		Veronika	

Aggressive behaviour was mainly shown by Bearded Vultures, which had been classified as dominant, whereas subdominant Bearded Vultures reacted mainly defensively. There were huge differences in number as well as in quality of the observed behaviour.

Whereas the behaviour "friendly" was observed rather often between *Veronika* (BG 321) and *Sempach* (BG 323), it was not noted in 1997 and 1998.

The dominance in the relationship between *Sina* (BG 285) and *Tell* (BG 283) changed during the observation period. At the beginning, *Sina* (BG 285) was subdominant and fell down from a rock ledge during an aggressive interaction. Afterwards she left the nearer release cave area for the next 2 weeks. After fledging, *Sina* (BG 285) became dominant, and *Tell* (BG 283) often left when *Sina* approached him.

There exist no social protocols of *Pisoc* (BG 210) and *Valimosch* for 1994. D. HEGGLIN (1995) however reported, that *Valimosch* (BG 220) was the dominant bird.

*Valimosch* (BG 220) and *Pisoc* (BG 210) fed significantly less together than expected (Chi-Square;  $p < 0.001$ ). In the case of the other 8 birds, the opposite happened as they fed together much more than expected (Chi-Square;  $p < 0.001$ ). These results are not caused by a synchronous day-rythm, as the evaluation was only based on data, obtained during the first observation interval (07:30 to 10:30). Social interactions were mainly observed when a Bearded Vulture approached its feeding partner. These social interactions mostly ended, when the approaching Bearded Vulture left and started to feed on another piece of meat or when the feeding Bearded Vulture left its piece of food. Only *Veronika* (BG 321) and *Sempach* (BG 323) were never observed to feed together on the same piece of meat.

*Immature, subadult and adult Bearded Vultures at the release site Val Stabelchod*

Figure 4 shows the presence of immature, subadult and adult Bearded Vultures at the release site Val Stabelchod during the observation period. The partners of both pairs ZERNEZ/LIVIGNO (*Baron - Aurora*) and BRAULIO (*Zora - Collare*) were given names D. JENNY invented for them, as an exact identification had not been possible until then. It is now assumed that *Baron* is *CIC* (BG 186) and *Zora* is *Jo* (BG 169). Both were released in the SNP in 1993 and 1992 respectively.

Of all 8 young birds, released between 1994 and 1998, *Mauritz* (BG 264) was the only one to return to Val Stabelchod in later years (released in 1996, returned in 1997). But *Marga* (BG 261) was observed regularly since 1997 after she was released in Rauris 1996. She was mostly observed on some consecutive days for 3 hours a day on average.

*Baron* and *Aurora* have been observed irregularly since 1997 - *Baron* mostly together with *Aurora*, *Aurora* often alone.

**Table 9.** Number of observed interactions of immature, subadult and adult Bearded Vultres with juvenile ones. In paranthesis: aggressive interactions.

Interactions	at the ground:					in the air:				
	Aurora	Baron	Zora	Marga	Mauritz	Aurora	Baron	Zora	Marga	Mauritz
1997 Sina Tell				3 (3) 2 (2)	12 13 (11)	1 (1) 2 (1)		1 (1)	3 (1)	
1998 Diana Gildo	2 (2)			29 (22) 45 (18)		3 (1)	3 4 (3)		1 (1)	
1999 Sempach Veronika				7 (3) 11 (3)		1 1				

**Interactions with juvenile Bearded Vultures**

Table 9 shows the number of interspecific interactions between the juvenile and sub-adult Bearded Vultures. Looking at the times of presence of the Bearded Vultures (see Fig. 3) there were only few interactions. Interactions occurred mainly between *Marga* (BG 261) or *Mauritz* (BG 264) and the juvenile birds. Most of these interactions took place on the ground. The contact of adult Bearded Vultures with juveniles almost exclusively consisted of flying together.

Many of the interactions also included aggressive behaviour (values in parenthesis of Table 9). On the ground this meant, with only one exception, "threatening" behaviour of the juvenile bird towards the sub-adult bird. As a result, juvenile birds often chased away sub-adult ones from food. Such behaviour was never observed in the opposite direction. In 9 out of 20 meetings in the air, juvenile birds were chased, while in some cases the adult birds attacked them with their talons. Only twice (*Mauritz* immature/*Sina* juvenile) the behavioural pattern "friendly" (in this case mutual feather picking and billing) occurred between a juvenile and non-juvenile bird.

There were nearly no contacts made between non-juvenile Bearded Vultures. Once, *Marga* (BG 261) flew together with *Baron* on the 27th July 1997 and *Aurora* attempted a landing beside *Marga* (BG 261) on the 25th of June 1999. *Aurora* attacked *Marga* (BG 261) fiercely and chased her over a long distance on the 10th, 15th and 28th of June 1998. Before the attack of the 15th of June, *Marga* (BG 261) was present every day, but after the attack she stayed away for 4 days. Following the attack of the 28th of June, she left Val Stabelchod for the rest of the observation period (see Fig. 4).





### Stealing of food

Four out of 5 Bearded Vultures, which were observed in Val Stabelchod since 1997 carried away food, which had been provided for released juvenile birds (see **Table 10**). Whenever they approached the food, they did this very cautiously, and were often chased away by the juvenile Bearded Vultures. Usually, they took a piece of meat and flew away immediately afterwards. Rather seldom, they stayed and fed at the release cave. Taking the frequency of observation into consideration, the two immature Bearded Vultures *Marga* (**BG 261**) and *Mauritz* (**BG 264**) carried away food much more often than the adult Bearded Vultures.

**Table 10.** Frequency of observation of immature and adult Bearded Vultures in Val Stabelchod from 1997 to 1999, as well as the frequency of food robbery and food intake at the release cave.

	adult Bearded Vultures:			immature Bearded Vultures:	
	Aurora	Barone	Zora	Marga	Mauritz
Days of presence (N)	26	7	7	28	5
Carrying of food (N)	4	0	1	16	3
Feeding at the release cave (N)	0	0	0	2	2

### Interspecific Interactions at the release site

#### Golden Eagles

A total of 65 sightings of Golden Eagles were noted between 1996 and 1999. In seven of these observations, the Golden Eagles stayed in the vicinity of a Bearded Vulture or in the vicinity of the nest site without any interaction. Six encounters can be described as direct interaction. On the 9th of July 1996, one adult Golden Eagle appeared behind the ridge above the nest site area and landed beside *Mauritz* (**BG 264**), whereupon *Mauritz* (**BG 264**) left. On the 23rd of June 1997, *Mauritz* (**BG 264**) and a Golden Eagle flew together and showed an indication to attack. In the same year (on the 22nd and 26th of July 1997), *Marga* (**BG 261**) had two clashes with a Golden Eagle. She followed the Eagle along the Piz Nair and attacked it 3 times, while the Eagle attacked once. On the 9th July 1998, one adult Golden Eagle landed a few metres away from *Diana* (**BG 301080081**) at a peak, who was preening herself. *Diana* (**BG 301**) seemed not to be disturbed by the Eagle. Later on, this Eagle flew low above the sitting *Baron* (*CIC*, **BG 186**) before disappearing behind the peak.

#### Other animals

Again and again, pieces of food disappeared over night. In 1999, a fox was observed, carrying away food directly beside the juvenile Bearded Vultures. In this case, no interaction with the young birds took place. Ravens were rather seldom observed. Only once (since 1996) a Raven stayed at the release cave and approached the feeding place.

Two direct encounters with ungulates were observed: on the 13th August 1996, when *Mauritz* (**BG 264**) flew beneath a chamois, who chased him away, after his landing. On the 9th of June 1998, a female Red Deer was observed, who ran away from the low flying *Marga* (**BG 261**).

### Repeated observations of juveniles, released in Val Stabelchod

All juvenile Bearded Vultures, released in Val Stabelchod, were observed one year after the release (see **Table 11**). Also in the second and the third year after the release, all birds released in the subsequent years have been seen again. But two years after the release, only a few birds could be observed, with the exception of *Pisoc* (**BG 210**) and *Valimosch* (**BG 220**).

Since 1996, most of the immature Bearded Vultures were observed in the area surrounding Val Stabelchod (less than 10km). But only *Mauritz* (**BG 264**) was observed near the release cave during the release period.

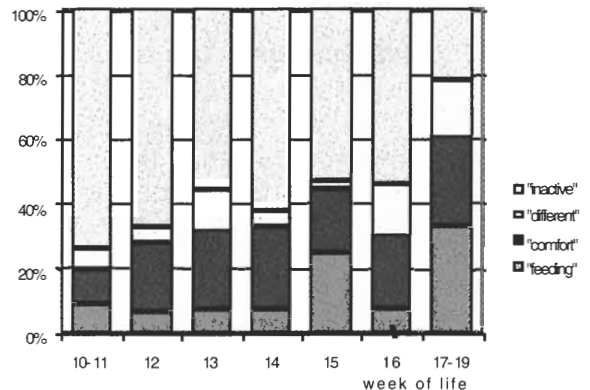
**Table 11.** Number of observations (i. e. observation cards) of Bearded Vultures, released in the Swiss National Park. The data cover observations from the first to the third year after release and are arranged respective to the distance of the spot of observation to the release site. - indicates years, for which up to now no data are available.

Distance (km) to the eyrie after release	first year			second year			third year		
	10	10-100	100	10	10-100	100	10	10-100	100
<i>Pisoc</i> (BG 210)	9	7	6	2	26	1	-	2	1
<i>Valmosch</i> (BG 220)	-	1	5	1	5	3	-	1	-
<i>Berna</i> (BG 263)	1	2	1	-	-	-	1	-	-
<i>Mauritz</i> (BG 264)	6	9	2	-	1	-	-	2	-
<i>Tell</i> (BG 283)	7	7	1	-	1	1	-	-	-
<i>Sina</i> (BG 385)	-	4	-	1	2	-	-	-	-
<i>Gildo</i> (BG 299)	-	1	11	-	-	-	-	-	-
<i>Diana Valais</i> (BG 301)	-	5	-	-	-	-	-	-	-

### Natural brooding in Valle del Braulio

#### Behaviour of *Stelvio* (BGW 02)

Because the eyrie was badly visible, 32% of all protocolled behavioural patterns could not be evaluated. This percentage was highest in the 12th week of life (46%). However, the most common behavioural patterns presented a similar picture compared to the observations made at the release site (see **Figure 2** and **Figure 5**). The young bird was more active with increasing age and eating, seemingly, took more time towards the end of the observation period. "Locomotion" was almost impossible because of the restricted space available. *Stelvio* had only the choice between the inner of the nest site, the edge and a small rock ledge outside. It spent approx. 55% of the time in the nest, approx. 40 % outside and sat only seldom on the edge. The restricted space available affected also the flight exercises - *Stelvio* often flapped only with one wing or interrupted the exercise having touched the rocks around it. Only after fledging, the number of flight exercises increased to 14 per day, reaching values similar to those of the released young birds in the SNP (see **Table 5**). But the number of wing flaps per flight exercise was within the range of that of the released birds.



**Figure 5** Behavioural elements „inactive“, „comfort“, „feeding“ and „different“ in percentages of the observed behaviour per week of life of *Stelvio*. The line on the x-axis marks the day of fledging.

In the 16th week of life, *Stelvio* fledged with an age of approx. 117 days and never returned to the nest. It tried several times to land at the eyrie, but without any success. The strong thermal winds hindered it in keeping its balance and the young bird sometimes developed a spin. The number of flights per day increased continuously from 1 to 5.5 in the 4th week. In the second week after fledging, 9 flights were observed in 3 days of observation. This means a lower flying frequency in comparison to the released young birds in the SNP (see **Table 6**). Maybe this is an illusion caused by the bad observation conditions in the Valle del Braulio, whereby individual short flights may have been missed. During most of its flights, *Stelvio* was attacked by Kestrels, something which has also been observed in the case of adults and released young birds.

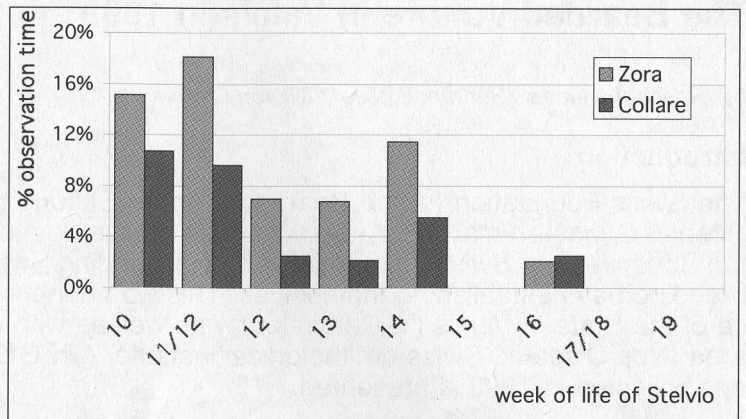
#### Adult Bearded Vultures

*Zora* was observed for 29.8% and *Collare* for 26.5% of the observation time in the Valle del Braulio. It is assumed that the real presence of both birds in the valley was much higher, as the adults were difficult to detect, in particular at the beginning of the observation period. During the observation period, it was possible to identify a total of 64 sitting and roosting sites, many of them regularly used. During the day, *Zora* and *Collare* often sat together and showed "friendly" interactions. Only once, both adults spent the night together at the same spot.

The frequency of presence of the pair at the nest site increased during the observation time (see **Figure 6**). In the 15th week of *Stelvio's* life, the adult birds were not present, but this does not mean that the birds did not use the eyrie, they just did not approach it. After fledging in the 16th week of life, the eyrie was not anymore used by the breeding pair.

Both adults stayed rather seldom together at the nest site. Usually, one partner left immediately after the landing of the other, stayed just for a very short time to leave soon after. *Zora* was observed approx. twice as long as *Collare* until *Stelvio* fledged (8.7 % vs. 4.8 % of the observation time; see

**Figure 6**). *Collare* showed a higher frequency of approaches to the eyrie and of food carrying (see **Table 12**). In 5 out of 7 cases, the food was only deposited at the nest. Because the eyrie was hardly livable, feeding of *Stelvio* by its parents was observed on five occasions - twice by *Zora*, three times by *Collare*.



**Figure 6.** Mean frequency of the presence at the nest site of *Zora* (Jo) and *Collare* (Settschient) in percentage of the observation time, per week of life of *Stelvio*.

**Table 12.** Number of observed events: „carrying of food“, „carrying of food to *Stelvio*“, „carrying of food to the nest site“, and „approach to the nest“. Numbers were counted throughout the entire observation period.

	Collare	Zora	total
Carrying of food	11	6	17
Carrying of food to <i>Stelvio</i>	7	3	10
Carrying of food to the nest site	6	1	7
Approach to the eyrie	25	30	55

## Conclusions

The released Bearded Vultures showed homogenous and identical patterns of behaviour and activity. Individual behavioural patterns showed great individual differences. These differences seem however to have no bearing on the bird's vitality and ability to survive. Even Bearded Vultures, which only made few flight exercises (like *Mauritz*, **BG 264**) or which showed less flight activity (for example *Sina*, **BG 285**) were observed again in their first and second year after their release. To see whether this way of the effectivity measuring the survival rate holds true more observations of the birds in their second and third year after release would be needed.

A first comparison between the behaviour and development of the wild born bird *Stelvio* in the Valle del Braulio, and the birds, released in the Swiss National Park, did not reveal any differences. But it should be kept in mind, that the conditions of observation in the Valle del Braulio were worse than in the Swiss National Park. Observations on natural brooding in better situated eyries will provide more detailed information.

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