Status of the Golden Eagle *Aquila chrysaetos* in Veneto

Giuseppe Tormen[1], Silvana De Col[1]

[1] *Via S. Cipriano 279, 32024 Castion Belluno (BL); tormengiuseppe@virgilio.it*

The first investigations on the Golden Eagle in Veneto were started in the second half of the 1980s in the provinces of Vicenza (Pedrini & Smaniotto 1993), Belluno and Treviso (Tormen & Cibien 1991). Another research project was then carried out in a smaller territorial area, in the province of Belluno within the Dolomiti Bellunesi National Park, during the AQUILALP project, Intereg III Italy Austria (Tormen *et al.* 2008). Concerning the province of Verona, where a Golden Eagle's reproductive population is known, we are unaware of any specific surveys and there are only estimates originating from generic ornithological publications. In all of these cases, investigations have covered only a short time period, and there are therefore no continuous data series over the years, particularly regarding the reproductive success.

Following classic methods for investigating raptors, the research took place by identifying the territorial pairs and their nesting sites, and collecting information on the structure of the population, the reproductive success, diet, and factors of disturbance and mortality.

Veneto is 18,264 km^2 in size, however the mountain range suitable for the Golden Eagle is only 26.3% of the entire regional territory, i.e. about 4800 km^2, 3000 km^2 of which lies in the province of Belluno (excluding Val Belluna, about 700 km^2) (Fig. 1).

The first estimate of the breeding population in Veneto dates back to 1985 (AA.VV. 1985), and it was more based on the environmental suitability than on an actual census of the pairs present. Over successive decades, this estimate has gradually increased (Tab. 1) (De Franceschi 1991, Tormen & Cibien 1991, Pedrini & Smaniotto 1993, Tormen & Cibien 1995, Tormen & De Col 2011, Mezzavilla *et al*. 2016). How much of this increase is due to our increase in knowledge or instead to the real expansion of new pairs, is difficult to establish; undoubtedly both causes were important. Particularly in the late 1980s and in mid-1990s, it was possible to document the presence of this raptor in areas where it was not previously present as breeding, but also as a result of the division of previously known territories.

As already stated, continuous data on reproductive success are not available for Veneto; in fact data collection took place for scattered periods and different areas, therefore we consider appropriate to present them separately (Tab. 2). These values fall within the average range of other populations in the Alps.

Regarding the characteristics of the breeding sites in the provinces of Belluno and Treviso, about 140 nests are known, for 129 of which some environmental parameters have been detected, such as altitude a.s.l., slope exposure and coordinates.

The average elevation of nests was 1343 m a.s.l. (S.D. = 368.8), with a minimum of 550 m and a maximum of

Figure 1. Study area, Veneto Nord East Italy.

Table 1. Censused and estimated pairs in Veneto in 1985 and 2016.

Pairs/year	Belluno	Vicenza	Verona	Treviso	**Total** in Veneto
1985	20-25	2-3	0-1	0	22-29
2016	38-40	5-8	1-3	1-2	45-53

2150 m. In Fig. 2 there are two prevailing peaks at about 1100 m and 1700 m; this is to be associated to the different altitudes of the mountain groups. There has been a significant correlation ($p < 0.001$) between the elevation of the nests and the maximum elevation of the mountain groups in which they are located. In the central-southern part of the province of Belluno, reliefs have in fact lower elevations than in the northern area where the larger dolomite groups are located. The average elevation of the main peaks ($n = 16$) in the central-southern area was 2325 m a.s.l. (S.D. = 253.2) and the average elevation of nests resulted 1160 (S.D. = 268.9). In the northern part ($n = 17$), the average value was instead 2912 m (S.D. = 289.1) while that of the nests was 1750 (S.D. = 194.3). It is interesting to note how, in both cases, the altitude difference between the mean of the nests and that of the peaks is similar, respectively 1165 m and 1162 m, with a difference of only 3 m. This correlation between the elevation of nests and that of the adjacent peaks was also found in Trentino (Pedrini 1992).

In the province of Vicenza the average elevation is 1100 m, minimum 750 m, maximum 1400 m (Pedrini & Smaniotto 1993). The mean number of pair nests in the province of Belluno resulted 3.8 (taking into consideration only pairs for which at least one nest is known), the maximum number of nests was of 13.

The slope exposure of the nesting cliffs is as follows: N 2.4%, N-E 7.1%, E 13.5%, S-E 23.8%, S 25.5%, S-W 20%, W 15.9%, N-W 7.1%. There is a prevalence of southern quadrants, 65.2% between S-E and S-W (Fig. 3). This could therefore be an important factor for the reproductive success, considering that on the northern slopes, during the incubation phase and the first weeks of the chicks life, weather conditions are still to be considered as winter.

All of the known nests are located on rocky cliffs; no nest on trees were found. The prevailing locations are inside cavities (74.8%), on ledges (9.7%) and on terraces/spikes (15.4%). Thus the largest percentage of nests is sheltered from the atmospheric precipitations and from the sun during the mid-day hours.

The distance between the centres of adjacent reproductive sites ranges between a minimum of 4.5 km and a max-

Table 2. Reproductive parameters success in Veneto, in 1984-2005 period.

		Vicenza 1984-1992	**Belluno e Treviso** 1989-1994	**Dolomiti Bellunesi National park** 2003-2005
Detected pairs	A	5	40	8
Checked pairs	B	31	82	19
Nesting pairs	D	-	47	8
Not nesting pairs	E	-	28	11
Failed nidifications	F	-	7	0
Successful nidifications	G	15	40	8
Pairs with 1 young that took off	H	14	39	8
Pairs with 2 young that fledged	I	1	1	0
No. young that fledged	J	16	41	8
% laying pairs	L = D/B	-	57.3%	42.1%
% successful hatches	M = G/D	-	85.1%	100%
% chick-rearing pairs	N = G/B	48.4%	48.7%	42.1%
Productivity	O = J/B	0.51	0.50	0.42
Take-off rate	P = J/G	1.06	1.02	1
Reproductive success	U = J/D	-	0.87	1
Bibliographic source		Pedrini & Smaniotto 1993	Tormen & Cibien 1995	Tormen *et al.* 2008

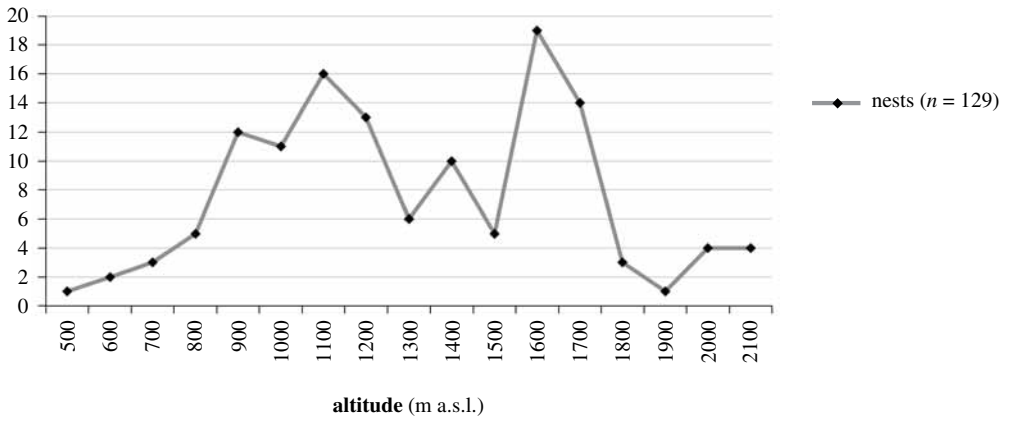

Figure 2. Elevation a.s.l. of nests in the provinces of Belluno and Treviso.

imum of 22.5 km in the pre-alpine area, with an average value of 6.8 km. (S.D. = 3.5).

The average size of the territories in the province of Belluno is 78.9 km^2 per pair (3000 km^2/38 pairs), equivalent to 12.6 pairs per 1000 km^2. Locally, like in the Dolomiti Bellunesi National Park, there were higher densities with a minimum of 50 km^2 per pair, i.e. 20 pairs/1000 km^2 (Tormen & De Col 2013). An approximate assessment can be made for the entire regional area, where the average extension of the territories was 106.6 km^2 per pair (4800 km^2/45 pairs), i.e. 9.4 pairs/1000 km^2.

Individual characteristics for each specimen were detected from 1083 observations carried out in the provinces of Belluno and Treviso (years 1989-2016) and these were divided by sex and age class:

a) sex: 590 males (54.5%), 493 females (45.5%);
b) age classes: 771 adults (71.2%), 194 immature/sub-adults (17.9%), 118 first year young (10.9%).

The composition of the detected territorial pairs is shown in Tab. 3.

Added information from third parties as well as from the news media, between 1970 and 2016 it was possible to recover 19 eagles from the province of Belluno, 14 of which found death and 5 injured. It was not always possible to establish the cause of injury, illness or death as only a small number were inspected by us and analyzed in veterinary laboratories. There is also a lack of specific investigations on saturnism, which could possibly be the main reason of some cases. The following list is therefore only indicative: electrocution 31.5%, poaching 15.7%, territorial dispute with other eagles 21.1%, and unknown 31.5%.

The factors of mortality and disturbance are the same as in other Alpine areas: suspended cables, electrocution, flights over the breeding areas by helicopters, disturbance by photographers, hikers, abandonment by hunters of carcasses of ungulates containing lead, and poaching. The latter seems in any case in regression compared to the past decades although, on the basis of news not ascertainable, the disappearance of a pair in the province of Treviso in the late 1990s seems to be attributable to this cause.

The situation of the Golden Eagle in Veneto can be considered overall satisfactory, with the presence of a stable population tending to a potential increase. Particularly in the province of Belluno, in areas like the Dolomiti Bellunesi National Park, it holds the maximum density of pairs compared to the current environmental potential, and it is conceivable that it can increase only with an increase of its prey, in particular the Marmot *Marmota marmota* (Tormen & de Col 2013).

In the provinces of Vicenza and Verona, the situation is less known; however, we believe there are still margins for the settlement of new breeding pairs.

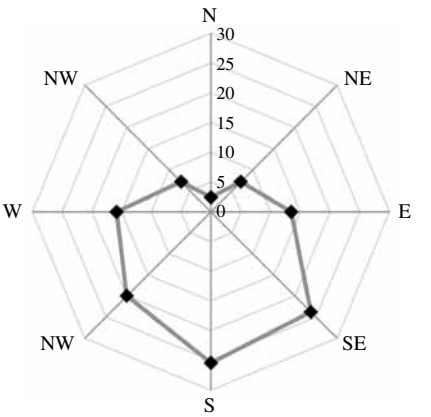

Figure 3. Slope exposures (%) of nests in the provinces of Belluno and Treviso (*n* = 129).

Table 3. Pair composition by age in the provinces of Belluno and Treviso, years 1989-2016.

Checked pairs	A	108
Adult pairs	B	90
Pairs with adult / immature-subadult	C	13
Pairs with both immature-subadult	D	5
Pairs with adult male/ immature-subadult female	E	4
Pairs with adult female/ immature-subadult male	F	9
% adult pairs	G = B/A	83%
% pairs with adult / immature-subadult	H = C/A	12%
% pairs with both immature-subadult	I = D/A	5%
% pairs with adult male/ immature-subadult female	J = E/C	30%
% pairs with adult female/ immature-subadult male	L = F/C	70%

In the pre-alpine area and in lower-altitude areas, the gradual and steady increase of forests, due to the abandonment of traditional mowing and pasture activities, could however reduce, in the medium and long term, the trophic areas of the marginal Golden Eagles' pairs of the Veneto.

The knowledge about this raptor is dated and new investigations are needed. It is therefore desirable that young researchers can be attracted to continue work on the species, perhaps aided by monitoring activities or projects initiated by protected areas, such as regional and national parks present in Veneto.

Acknowledgments – Quoting all the people who have contributed to the investigations over the years is impossible; thanks go to Ivan Farronato and Maurizio Sighele who have provided information about the provinces of Vicenza and Verona, to Gianfranco Martignago and Francesco Mezzavilla for the province of Treviso and especially to Antonello Cibien, Enrico Canal and Fabrizio Friz, with whom we shared many days in company of the eagles.

REFERENCES

AA. VV., 1985. Carta delle vocazioni faunistiche del Veneto. Regione del Veneto. Industria Grafica Padova, pp. 82-83.

De Franceschi P., 1991. Atlante degli uccelli nidificanti in provincia di Verona 1983-1987. Mem. Mus. Civ. St. Nat., Verona.

Mezzavilla F., Scarton F. & Bon M., 2016. Gli uccelli del Veneto. Danilo Zanetti Ed., Montebelluna, pp. 126-127.

Pedrini P., 1992. L'Aquila reale in provincia di Trento: Status, Ecologia e Biologia riproduttiva. Pp. 83-130. In: Atti Conv. Aquila reale, Gallo cedrone, Coturnice alpina, Marmotta alpina. Tipografia Rotaltype, Mezzocorona, Trento.

Pedrini P. & Smaniotto R., 1993. L'Aquila reale *Aquila chrysaetos* in provincia di Vicenza. Pp. 113-116. In: Mezzavilla F. & Stival E. (eds), Atti I° Conv. Faunisti Veneti, Montebelluna.

Tormen G. & Cibien A., 1991. L'Aquila reale nelle province di Belluno e Treviso. Gruppo Natura Bellunese, Provincia di Belluno. Tipografia Niero, Belluno, 75 pp.

Tormen G. & Cibien A., 1995. Ecologia e biologia riproduttiva dell'Aquila reale *Aquila chrysaetos* nelle province di Belluno e Treviso. Avocetta 19: 103.

Tormen G.,Vettorazzo E., Poloniato G., Canal E. & Friz F., 2008. Stato dell'Aquila reale *Aquila chrysaetos* nel Parco Nazionale delle Dolomiti Bellunesi. Pp. 168-171. In: Bon M., Bonato L. & Scarton F. (eds). Atti 5° Conv. Faunisti Veneti. Boll. Mus. Civ. St. Nat. Venezia 58 (suppl.).

Tormen G. & De Col S., 2011. Rapaci diurni e notturni della provincia di Belluno. Pp. 183-217. In: Gruppo Natura Bellunese (eds), Atti 2° Conv. Aspetti Natur. prov. Belluno. Tipografia Piave, Belluno.

Tormen G. & De Col S., 2013. I Rapaci diurni e notturni del Parco Nazionale delle Dolomiti Bellunesi. Pp. 7-36. In: Gustin M. & Vettorazzo E. (eds), Studi ornitologici nel Parco Nazionale Dolomiti Bellunesi. Collana Rapporti 9. Tipografia DBS, Seren del Grappa, Belluno.