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Current status of the Golden Eagle *Aquila chrysaetos* in the province of Trento (central and Eastern Alps)

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The Golden Eagle *Aquila chrysaetos* has been regarded as one of the most representative breeding bird species in the province of Trento, and has been the focus of several research projects since the 1980s (Pedrini 1992, Pedrini & Sergio 2001a, 2002), as well as several conservation initiatives (P.A.T. 2011, LIFE11/NAT/IT/000187 "TEN" - Trentino ecological Network; www.lifeten.tn.it).

The Golden Eagle is classified as "vulnerable" in the Red List of birds breeding in Trentino (Pedrini *et al.* 2005). Its conservation status, coupled with the importance of this species for the Trento province, promoted research projects in the past (Sergio *et al.* 2006) and also monitoring activities in several protected areas in Trentino (Adamello-Brenta Park, Stelvio National Park) and in other pre-alpine mountain areas (carried out by Muse, formerly Museo Tridentino di Scienze Naturali).

This paper provides an update of the conservation status of this species in Trentino, on the basis of the ongoing monitoring activities, and compares it with the status of this species at the national level, which is considered "inadequate" mostly because of the reduction of high-altitude grasslands (Gustin *et al*. 2016).

The Trento province (6206 km^2) is a prevalently mountainous area, with several mountain massifs characterized by different geology and elevation ranges, and separated by large valleys. Two main sectors can be identified: the 'true' Alpine area (in the northern portion of the province) and the pre-Alpine sector (in the southern part of the province). Elevation ranges between 67 m a.s.l. (Benaco, Lake Garda area) and 3769 m a.s.l. (Mount Cevedale). Forests cover more than 55% of this area, and are expanding because of land abandonment of formerly grazed or cultivated areas. Lowland areas and valley floors are intensively cultivated and partly urbanized. Three protected areas (Natural and National Parks) cover 16.7% of the total area of Trento province.

During the 1983-1990 periods (Pedrini 1992) 46 territorial pairs of Golden Eagles were counted, leading to a total estimate of 54 territorial pairs. The Golden Eagle's population in Trentino showed higher densities in the Alpine sector (7 pairs/1000 km^2) than in the pre-Alpine sector (3.8 pairs/1000 km^2; Pedrini & Sergio 2002), with an average productivity of 0.61 fledged juveniles per breeding attempt (n. of pairs equal to 109; Pedrini & Sergio 2001a), a reproductive success of 55.7% (% of successful breeding attempts) and a fledgling rate of 1.1 (fledged juveniles per successful pair). The number of established pairs increased to 56 known pairs (total estimate: 60 territorial pairs; Pedrini & Sergio in Pedrini *et al.* 2005), but the productivity showed an overall decline (0.31 for 66 pairs).

A long-term systematic monitoring was initiated in 1996 and continued until 2016 (except for 2007 and 2008) in the Adamello-Brenta Natural Park and in the neighbouring areas (about 1300 km^2).

The Golden Eagle's population increased in the area (from 14 to 19 territorial pairs; 14.6 pairs/1000 km^2). During the same period of time, the average productivity resulted to be 0.37, with a tendency to decrease over the years, whereas the reproductive success was 35.4% and the fledgling rate equal to 1.04 (Volcan, unpublished).

In the most recent period (2000-2016) the systematic monitoring, coupled with the collection of opportunistic observations, allowed us to update our knowledge about the species distribution and abundance, which now includes 65 known territorial pairs with a total estimate of the current population of about 70 territorial pairs.

Overall, the Golden Eagle's population in Trentino has significantly increased over the last 40 years, from 46-54

to 65-70 pairs. On the other hand, a decrease in productivity was observed during the same period, with values decreasing from 0.61 in the 1983-1990 to 0.31 in 1995-2005 period (Pedrini *et al.* 2005), as also observed in other areas in the Alps (Fasce & Fasce 2003, Fasce *et al.* 2011). Similarly, in the same period reproductive success decreased from 55.7% to 35.4%. This trend should be interpreted as positive outcome of the legal protection of this species, guaranteed by the current provincial and national laws (provincial law 24/1991; national law 157/1992).

The increased abundance of its main prey (especially, *Marmota marmota*), due to the protection assured by laws, is likely to be another main reason of the positive population trend of this species.

Although the trend is positive, some potential threats remain at a local scale and, at least in some cases, they have further increased, such as the disturbance due to infrastructures close to the breeding sites. Disturbance in fact has generally increased in recent years (1990-2010), because of the easier access granted to tourists and public in general, by roads, parkings and paths in mountain areas. Nesting disturbance may also come from unethical wildlife photographers, sport climbing and free climbing, as well as from other sporting activities (paragliding, mountain-bike competitions), which are very common in the Trentino mountains. Fortunately, awareness and sensitivity about potential bird disturbance are on the increase by the general public, including wildlife photographers who have adopted rules to reduce disturbance, while also conservation initiatives have been implemented within parks to protect nesting sites during the breeding season (e.g., Stelvio National Park and Adamello-Brenta Park).

Further risks are represented by the installation of repeaters and antennas for telephony communication close to reproductive sites, and by the widespread presence of suspended cables in the hunting territories, which threaten both territorial eagles and young individuals. Lead poisoning (Bassi present volume) is potentially a serious threat in Trentino as well (E. Bassi *pers. comm.*). Although it is now much reduced (Pedrini & Sergio 2001a), the illegal killing or injuring of eagles still occurs and may, therefore, represent a threat to this species (Lipu/PAT Raptor Recovery Center, unpublished data).

An important issue deserving more research and monitoring is the long-term effect of natural reforestation, resulting from land abandonment of pastures and fields in mountain areas. On one hand, such process can favour this species by decreasing direct disturbance but, on the other hand, land abandonment can seriously impact the availability of habitats suitable for its prey species and for hunting (Pedrini & Sergio 2001b), mainly in the pre-Alps where forest upslope shift can be very rapid and boosted by climate change.

Because of these threats, monitoring of the Golden Eagle is still essential, also to accomplish the requirements of the Birds Directive. In this view, since 2017 the Province of Trento has identified a set of sampling areas, hosting an overall 20-25 territorial pairs (LIFE T.E.N. A5, www.life.ten.it), to form part of a long-term monitoring programme. These monitoring efforts should be preferably carried out simultaneously with similar initiatives in other Italian regions included in the Golden Eagle's national range, in order to allow for a accurate definition of its trend.

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