

## Status of the Golden Eagle *Aquila chrysaetos* in the region of Friuli Venezia Giulia

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The monitoring of the Golden Eagle *Aquila chrysaetos* population in Friuli Venezia Giulia was carried out at a regional scale only in the mid 90s (Genero & Caldana 1997). Since then, regional data was never updated; however, since 1999 a systematic monitoring of the species has been carried out by the “Parco Naturale delle Dolomiti Friulane” (PNDF), covering almost the whole mountainous sector of the Western Friuli (Borgio 2009a), a total area of 690 km<sup>2</sup>. The update of the situation and knowledge level are therefore very heterogeneous, as the PNDP acts as a sample study area for the monitoring of this species at a regional level. The PNDP performs this long-term monitoring of the Golden Eagle because some population parameters and diet composition have been identified as indicators of factors and dynamics affecting the ecosystem (fanALP 2010).

Observations, carried out through established methodologies, has been focused on the monitoring of pairs, nests localization and determination of the typical parameters used to study the breeding biology of the species. Data collection on the diet was carried out by observing prey transport to the nest or, in rare cases, by collecting prey remains at the end of the breeding season (Borgio 2009a). The pair density has been measured using the Nearest Neighbour Distance method (NNDM).

The mountainous area of the Friuli Venezia Giulia region presents high forest cover and low availability of high-altitude meadows, whose abundance is more significant only in the inner section of the Alpine arc, in the Julian and Carnic Alps. These features affect the Golden Eagle's population, influencing the size of the pairs' home ranges (Borgio 2003) and their diet, which is characterized by a wide food niche in the pre-alpine and dolomite sectors (Borgio 2013). These environmental factors also explain the historically lower productivity values compared

to those found in the Central and Western Alps, which are characterized by larger availability of grassland habitats. In 1997 a total of 27 pairs were estimated to occur in the region (Genero & Caldana 1997). Today, 35-38 pairs of Golden Eagle are estimated in Friuli Venezia Giulia, with a substantial increase compared to 1997. This positive trend is well documented in the western part of the Region, where the monitoring carried out by the PNDP allowed for the accumulation of more accurate estimates and to verify the establishment of three new pairs, with a population density increased from 1.33 pairs/100 km<sup>2</sup> (n = 8), to 1.80 pairs/100 km<sup>2</sup> (n = 11) (Borgio 2014).

In recent years, attempts by immature pairs to settle in marginal territories of the foothills have been noticed, with frequent observations of individuals hunting in the meadows and “magredi” habitats of the high Friulian plain. As in the entire Italian distribution range of the species, the density increase has been enabled primarily by the improvement of trophic resources and therefore, of the carrying capacity of the territory. The observed density increase seems also to be supported by the end of, or at least by the substantial reduction, of human persecutions registered over the last 40 years. The new pairs, in fact, often establish in close proximity to human settlements, in areas previously avoided by eagles for breeding and where no nests were ever found in the past (Borgio 2014).

The study carried out in the PNDP shows a wide food niche and the very importance of carnivores to the Golden Eagle's diet, probably because of the lower availability of optimal prey, such as the Alpine Marmots *Marmota marmota* and Hares *Lepus timidus* (Borgio 2013). The same study has also highlighted that the diet of the Golden Eagle changed significantly between 1989-1995 and 1999-2012, due to the increase in occurrence of the marmot and the diminution in frequency of reptiles, Falconiformes and

Strigiformes. As a consequence of the diet improvement, the average prey weight in the recent period resulted higher (1841 g, S.E. = 261) than in the past (1348 g, S.E. = 351) (Borgo 2013). These results point out the efficacy and the relevance for the ecosystem of the reintroduction of the Alpine Marmot in the area, confirming its importance as management measure for the conservation of the Golden Eagle in the eastern and southern parts of the Alps (Borgo & Mattedi 2003). Information about population breeding biology is only available for the western part of the Region. In 2016 low values were observed, both in terms of pair number and productivity. Breeding failures were greater than in the previous three years (Fig. 1). Historical

data series allowed us to analyze the breeding trends of the western regional population. Between 2000 and 2008, an increase in both the percentage of egg laying pairs (incubating pairs/pairs checked) and productivity (juv. fledged/pairs checked) was observed, with average triennial values even higher than 74% (Figs 1 and 2). This is probably related to the improvement of food availability as a result of the increase in chamois *Rupicapra rupicapra* and deer *Cervus* sp. populations (Borgo 2009). Currently, the percentage of pairs laying eggs has decreased, with an average value of 50.8% for the last three years (2014-2016). In spite of the reduction in the percentage of egg-laying pairs, productivity remains stable on values significantly higher

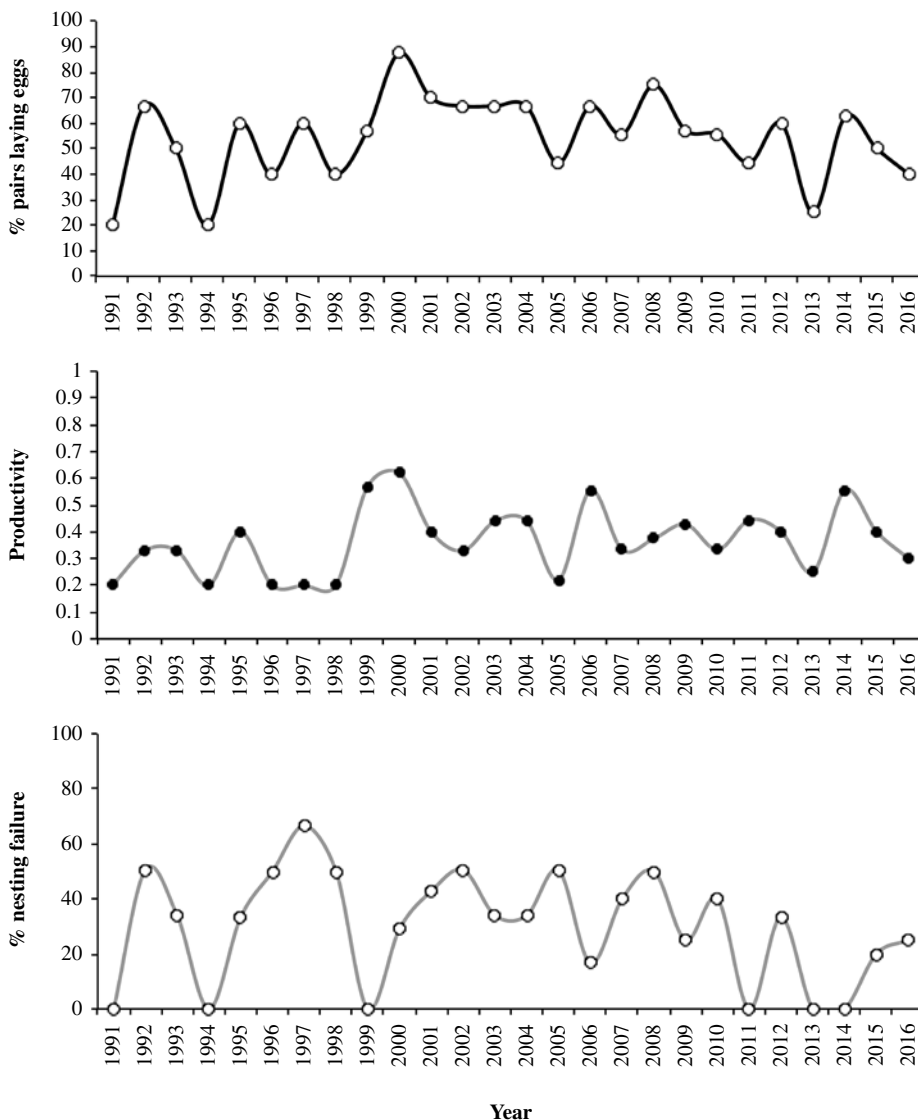
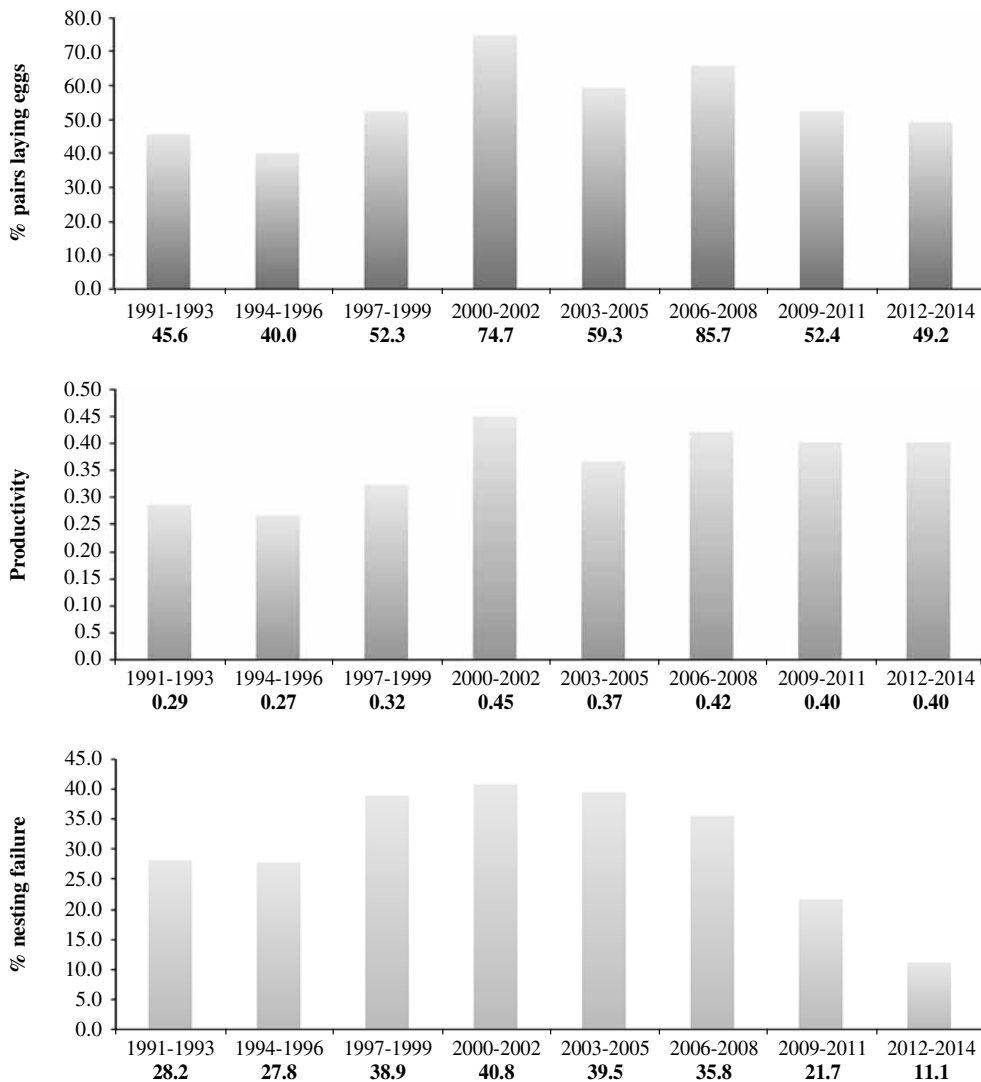


Figure 1. Annual trend of the Golden Eagle’s breeding parameters in the Western part of the Friuli Venezia Giulia region.



**Figure 2.** Average triennial trend of the Golden Eagle’s breeding parameters in the Western part of the Friuli Venezia Giulia region.

than those recorded before 2000, with an average value of 0.42 for the last three years (2014-2016) (Figs 1 and 2).

In spite of the decline in the percentage of pairs that start breeding, the stability of productivity is maintained by the decrease in nesting failures, once a more common factor (Figs 1 and 2). This can be related to both the improvement of food availability and quality (Borgo 2013), and decreased disturbance at the nest sites by irresponsible photographers (Borgo 2009a). The decline in the percentage of egg-laying pairs may be a consequence of the increase in population density, which has led to contraction of the pair territories and to greater defence efforts.

In the western part of Friuli Venezia Giulia harsh me-

teorological conditions in late winter and spring may also play a role in the annual variability of the breeding success (Borgo 2009b). Today, the knowledge of the conservation status of the regional population of Golden Eagle is adequate, although there is a strong heterogeneity in data availability for different areas. The species is systematically monitored only in one sector of the western part of the Region, thanks to the work carried out by the PNDF, which considers this species as one of the environmental indicators of its ecosystem quality.

In the remaining portion of the Region, data have not been updated after the surveys carried out between 1987 and 1993 (Genero & Caldana 1997). It is therefore desira-

ble to invest greater efforts primarily for updating information on the number of pairs present in the regional territory. Consequently, it would be important to increase the sample of monitored pairs, in order to better represent the entire breeding regional population. Finally, the evolution of the major threats, such as reforestation and pressure from mountain tourism, should be monitored as they may have significant effects on the status of the Golden Eagle's population over the coming years.

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