

The Bonelli's eagle (*Hieraetus fasciatus*) in Greece

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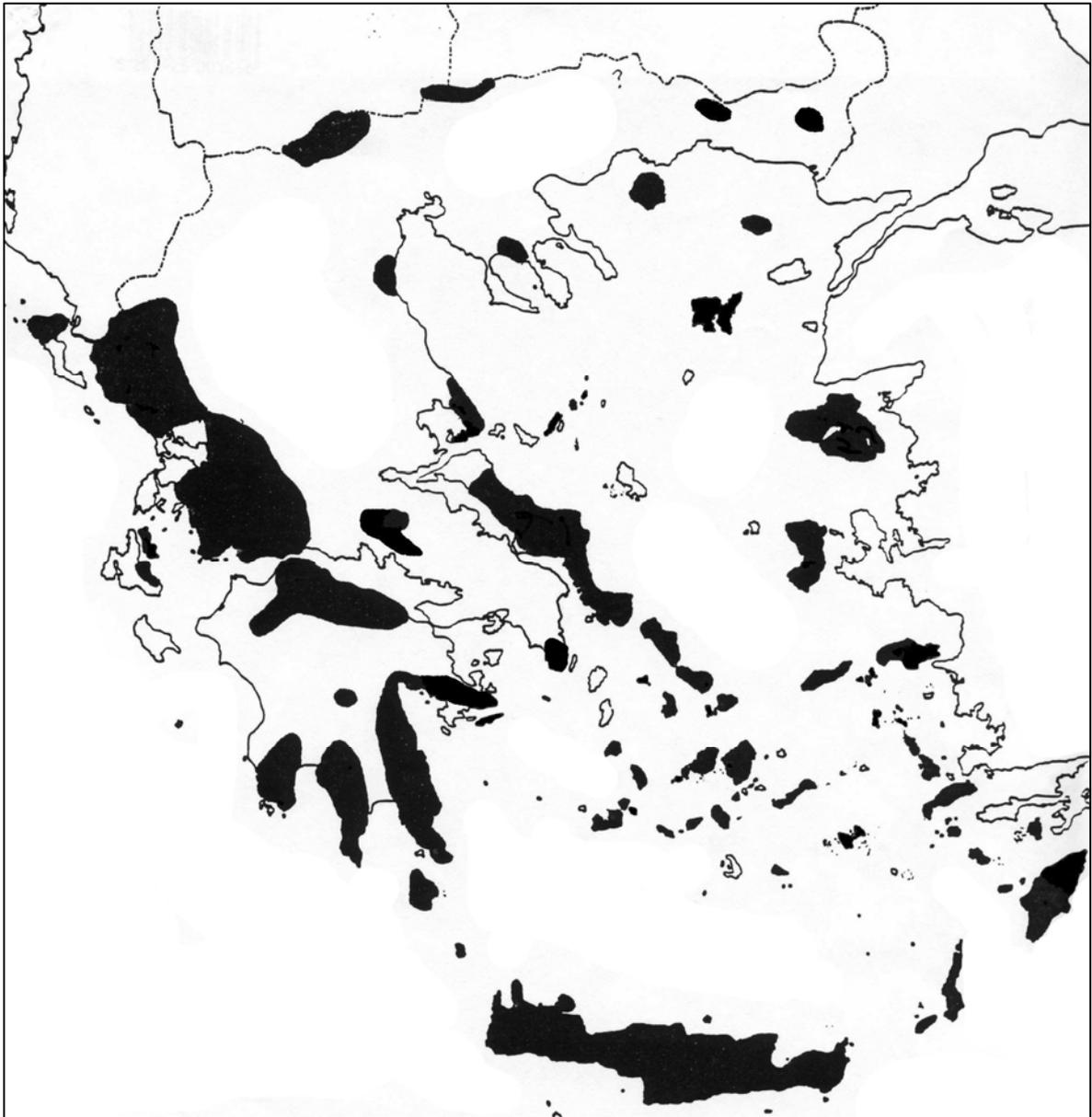
Distribution

The Bonelli's eagle is distributed primarily in the Greek islands and to a lesser extent in the mainland. Although our knowledge on its former distribution is rather inadequate (Reiser 1905), it was regarded as more widespread in the past, at least till the late 1950s (Handrinos & Akriotis 1997). Its breeding range has been stable during the period 1970-1990 coinciding with that of its preferred prey e.g. partridges and wild rabbits (Handrinos & Dimitropoulos 1982). The species has disappeared from some regions of north and central Greece e.g. Macedonia, Thrace and Thessaly (Hallmann 1985, Xirouchakis 1993, Hallmann 1996) except from some remote peninsulas (e.g. Chalkidiki, Trikeri) and mainland coasts where isolated nesting pairs still occur (Handrinos & Akriotis 1997, Bourdakís 1997). A detailed survey carried out during the mid 1990s revealed that Bonelli's eagles were thinly distributed in Epirus, Sterea Hellas and the west and north parts of Peloponnesus. In the insular country they were absent from most of the Ionian Islands with indications of breeding in Kerkyra, Kefallinia and Ithaki. At present the species strongholds includes the southeast Peloponnesus, the islands of the Cyclades and Dodecanese complexes and the large islands of northeast Aegean e.g. Ikaria, Samos, Chios and Lesbos (Fig. 1). In Crete the species is distributed all over the island although nesting pairs are far apart from each other (> 15 km). All territories are located in the periphery of the major massifs usually in steep gorges some of them near the sea at an altitude that ranges from 200-600m. The Bonelli's Eagle is sedentary in Greece with very few data on migrating individuals. Observations of young birds in the Kythira island during autumn (Kominos 1995), most likely constitute juvenile dispersal.

Habitat

Typical raptor of the Mediterranean landscape, the Bonelli's eagle prefers open hilly or mountainous country covered with maquis and garrigues. In the islands it is found exclusively in rocky habitat with very sparse vegetation, often in deep gorges and coastal cliffs. Young birds can be observed in atypical habitat such as lowlands with cultivations (vineyards and olive groves) or water reservoirs quite far away from any known breeding territory. Normally the Bonelli's eagles selects rugged terrain from sea level up to 500m. Territories are rather small, depending on food availability. In Crete territory size ranges from 25-60 km², while breeding birds have been recorded hunting up to 8 km away from the nest. Meanwhile in small islands of the Dodecanese high food availability, mainly due to hunting prohibition, has led to a high population density with territories of 15-20 km² (Alivizatos pers. com.),

Fig. 1 Distribution of the Bonelli's Eagle in Greece



Population status

The Greek population of Bonelli's Eagle was estimated at 60 pairs in the early 1980s, almost all of them in the east Aegean islands and Crete (Hallmann 1985, Vaglianos 1981). The species population is reported to have declined thereafter numbering no more than 50 pairs with 10-14 of them occurring in Crete (Tucker & Heath 1994, Hallmann 1992, Handrinos & Akriotis 1997). However as no regular monitoring has ever been carried out in the country, most population estimates have been occasional

or originated from different time periods thus do not allow reliable comparisons and assessment of population trends. In addition the species illusive character made monitoring in coastal areas most difficult. More recent records obtained in mid 1990s during the update of the Important Areas of Greece by Hellenic Ornithological Society (HOS) (Bourdakis and Vareltzidou 2000) revealed that the Bonelli's population size has been underestimated. In contrast to the decline reported in certain areas 85-105 territories were still occupied with 50% of them occurring in the Aegean Islands and Crete (Bourdakis 1997, Schaffer & Gallo-Orsi 2001). However by reviewing the existing literature from the year 2000 onwards (e.g. unpublished reports from HOS' surveys in remote islands with suitable breeding habitat, Specific Environmental Studies, etc.) the Bonelli's Eagle proved to be quite a common raptor throughout the Aegean and the southeast rocky coasts of Peloponnesus. In the latter region a rather high population density was detected with a mean nearest-neighbour distance of 5-6 km (Bousbouras 2007). Overall the Greek population numbers 100-140 breeding pairs with the largest insular one found on Crete (10-16 pairs).

Breeding biology

The Bonelli's Eagle breeds in steep cliffs and rock crevices sometimes just over the sea or in remote gorges away from human settlements. It builds 2-5 or more alternative nests in middle altitude areas that rarely exceed 400m. Nest constructions are quite conspicuous due to their large size (> 1 m height) as some nests are used in successive years. Egg laying takes place in early February although in Crete some early attempts have been recorded in January (25th). Clutch size ranges from 1-2 eggs though 3-egg clutches are not uncommon. Incubation lasts ca. 40 days and the chicks abandon the nest after 2-2.5 months in late May or early June. The juvenile birds remain in the natal territory for a period of 3 months depending on the parents for food at least for the first 3-4 weeks after fledging. Usually young birds are observed in flight along with the parents in the vicinity of the nesting area during June-July. Juvenile dispersal takes place in autumn (Sep-Oct) and young birds spent their first winter in areas that are not used by breeding adults. Data on breeding success are limited, though 14 pairs in south Greece (mainland and Aegean islands) that were monitored during 1999 produced 0.93 young/ nesting pair/ year (Alivizatos & Bourdakias 2002). In Crete a nest with three chicks was found in 1999 which fledged successfully, though this case was rather exceptional (Xirouchakis & Sakoulis unpublished data).

Feeding ecology

The Bonelli's Eagle feeds primarily on small-sized mammals and birds up to 2 kg. Wild rabbits (*Oryctolagus cuniculus*) and Chukar partridges (*Alectoris chukar*) comprise the main prey species, though its diet depends on what is available in the territory e.g. Rock doves (*Columba livia*) and gulls (*Larus spp.*) near sea cliffs, Corvids and Chukar partridges in gorges and livestock (e.g. chicken and newborn lambs and goat kids near pastureland and villages, pers. obs.). Analysis of pellet and prey remains collected from nests and roosts during 1997-1999 identified 12 species in 71 items that consisted of 57.7% mammals, 39.4% birds and 2.8% reptiles (Table 1, Alivizatos & Bourdakias 2002).

Table 1. Diet of the Bonelli's Eagle in southern Greece (Alivizatos & Bourdakis 2002)

Prey	No. items	% Number	% Biomass
Reptilia	2	2.8	0.2
<i>Lacerta trilineata</i>	2	2.8	0.2
Aves	28	39.4	25.6
<i>Falco tinnunculus</i>	1	1.4	0.4
<i>Alectoris chukar</i>	5	7.0	4.0
<i>Larus cachinnans</i>	6	8.5	11.6
<i>Athene noctua</i>	2	2.8	0.5
<i>Oenanthe hispanica</i>	1	1.4	< 0.1
<i>Turdus merula</i>	1	1.4	0.2
<i>Corvus corone</i>	10	14.1	8.8
<i>Passeriformes sp.</i>	1	1.4	0.1
<i>Aves sp.</i>	1	1.4	0.8
Mammalia	41	57.7	74.2
<i>Capra hircus (juv)</i>	6	8.5	24.1
<i>Rattus rattus</i>	5	7.0	1.2
<i>Lepus europeus</i>	1	1.4	2.4
<i>Oryctolagus cuniculus</i>	29	40.8	46.6
Total	71	-	-

Threats and limiting factors

The main threats for the species in order of significance are direct persecution, habitat destruction, food shortage and human disturbance (Handrinos 1992). Extensive road construction at remote areas and development of wind farms at southeast Peloponnesus and Aegean islands comprise serious threats to Bonelli's Eagle locally (Bourdakis 1997, Bousbouras 2005). No records on electrocution or, collision with power lines exist probably because the species is located in remote islands or coastal cliffs where relevant human constructions are absent.

Illegal shooting is possibly the main mortality factor in the Aegean islands as the species is considered as lamb and goat-kids predator and a competitor of hunters for game species. The problem is more severe in some small isolated islands, which have been designated as hunting reserves, and wild rabbits have been reintroduced or the restocking of Chukar partridges has taken place. Eagles usually move from one island to the other if food is readily available and breed in the most remote ones avoiding humans. Food shortage is increasing problem in mainland Greece due to land use alterations and in some islands of the Dodecanese due to rabbit epidemics that have wiped out their population.

In Crete, food shortage is also suspected to be the most significant limiting factor for the species. Crucial foraging habitat such as the cereal cultivation in traditional terraces has been abandoned, while overhunting of Chukars and night poaching of hares with spotlights have deprived the eagles of the most important prey species. At least two cases of nest failure during incubation have been confirmed due to food scarcity, while in one more; both adults were away for hunting leaving their newly hatched chick unattended (Xirouchakis pers. obs.). On the contrary, illegal shooting is not regarded as that critical since the species resides in long gorges and coastal areas with vertical cliffs inaccessible to humans

(Xirouchakis & Dretakis 2006). Inter-specific competition with Golden eagles (*Aquila chrysaetos*) might also play a role for the Bonelli's Eagle low population density. Both species have similar nesting and foraging requirements and seem to avoid each other by selecting areas of different altitude.

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