

# Status and occurrence of Bonelli's Eagle, *Hieraaetus fasciatus*, in Turkey and Eastern Mediterranean – A Population Estimate

by Edwin W.A.M. Vaassen

**Abstract:** The status and occurrence of Bonelli's Eagle, *Hieraaetus fasciatus* in Turkey and other Eastern Mediterranean countries is discussed using comparative parameters of habitat use, breeding biology, migration and behaviour of the species in Western European countries while reviewing all available Turkish records from 1966 to 1998. Over 106 records, including 40 unpublished, relating to a total of 153 individuals have been reviewed. Movements of the species are discussed to interpret migration and dispersal. It has been concluded that the Turkish population consists of 20-35 pairs, still surviving in small isolated populations scattered throughout the country. The species' future and survival depends on continuous intensive monitoring and proper conservation to be carried out throughout the Eastern Mediterranean region estimated to hold only 75-125 pairs.

**Keywords:** *Falconiformes*, *Hieraaetus fasciatus*, zoogeography, population estimate, distribution, migration, conservation

## Introduction

---

The Bonelli's Eagle, *Hieraaetus fasciatus* is known to be a local and scarce resident breeding species in countries surrounding the Mediterranean Sea and the Middle East (Gensbøl, 1987; Rocamora, 1994), but occurs more commonly in the south-eastern Palearctic, South Asia and South-east Asia; *H. f. renschi* occurs in the Lesser Sunda Islands whilst south of the Sahara the race is *H. f. spilogaster*; Stresemann, 1932, often treated as a separate species. (Brown, 1970) The entire European population is of the nominate race *H. f. fasciatus*, Vieillot, 1822, with a total population estimate of between 820 and 1,000 pairs (Rocamora, 1994) in 1993 and a higher estimate in 1996 of 938 to 1,039 pairs (Real & Mañosa, 1997) all restricted to countries surrounding the Mediterranean Sea (*see* Table 1). The species has a conservation status of Endangered in Europe (Tucker & Heath, 1994) with less than 2,500 breeding pairs. There have been large declines of >50% in many countries and an overall decline of 15-20% in the Spanish population ( $\pm$  750 pairs), which represents about 75% of the European population (incl. Turkey).

The aim of this paper is to review the knowledge of Eastern Mediterranean Bonelli's Eagle populations, their ecology and natural history and to provide a better impression of the importance of its Turkish population, its minimum population size, and its conservation problems.

### Status & Distribution in Turkey

Porter (1991) describes the status of Bonelli's Eagle as "Regionally Significant Breeder", a category for a species where more than 20% of the regional population, or 20% of the regional range occurs in Turkey, with the Region being defined as the eastern half of the West Palearctic, including the whole of Iran. However, Bonelli's Eagle has only been recorded scarcely as a breeding resident in a few regions in western, southern and southeastern Turkey (Kasperek, 1992; Bilgin & Kasperek, 1996; E. Vaassen, *pers. observ.*).

Kasperek (1992) mentions that less than 50 pairs breed throughout Turkey. However, the population may be even smaller considering possible confusion of the species with other raptors, especially immature Honey Buzzard, *Pernis apivorus*, and perhaps also the recently recorded vagrant Crested Honey Buzzard, *P. ptilorhynchus*, (Davidson & Kirwan, 1997; Kirwan, 1997). These authors consider that some of the published older data, especially pre 1900 (Kirwan, *pers. comm.*) may be erroneous and inaccurate, (Kasperek 1992; Kirwan & Martins 1994). More recently Bilgin & Kasperek, (1996) suggest that the species' population may lie between 10-100 pairs as mentioned earlier by Rocamora, (1994) in Tucker & Heath (1994).

Table 1. Breeding pair estimates of Bonelli's Eagle in countries surrounding the Mediterranean Sea.

	<b>Cramp &amp; Simmons 1980</b>	<b>Gensbøl 1987</b>	<b>Rocamora 1994</b>
Albania	n.a.	?	0-2 (1993)
Algeria	n.a.	Frequent	n.a.
Croatia	n.a.	n.a.	5-10 (1993)
Cyprus	50 (1950)	10 (1985)	10-15 (1993)
Egypt	(1930) <sup>1</sup>	n.a.	n.a.
France	30-35 (1965)	50 (1982)	29-31 (1992)
Greece	< 100 (1974)	60	35-45 (1993)
Israel	19 (1977)	19-20	n.a.
Italy	<i>see</i> Sardinia / Sicily	15-30	15-20 (1993) <sup>2</sup>
Lebanon	*(1974)	n.a.	n.a.
Libya	(1979) <sup>3</sup>	n.a.	
Morocco	n.a.	500-1000 (1982)	n.a.
Portugal	n.a.	30-40 (1982)	40-60 (1989)
Sardinia	10-20 (1977)	10-20 (1981)	<i>see</i> Italy
Sicily	10 (1977)	10 (1981)	<i>see</i> Italy
Spain	c. 500 (1977)	611-699 (1987)	675-751 (1990)
Syria	few (1968)	n.a.	n.a.
Tunisia	12 (1975)	40-50 (1982)	n.a.
Turkey	n.a.	50 (1982)	10-100 (1993)

<sup>1</sup> Recorded but no estimate

<sup>2</sup> Including Sicily and Sardinia

<sup>3</sup> Recorded breeding but no estimate

\* Bred in past but no recent breeding record (1974); probably extinct

### Recent Status in other Eastern Mediterranean Countries

In March 1996, an occupied nest was recorded in northern Lebanon and a pair was observed regularly throughout the breeding season just east of Damour (Ramadan-Jaradi & Ramadan-Jaradi, 1997). Historically the species' status has been described as "no proved breeding in Lebanon in recent years" Tohmé & Neuschwander (1974); a nest "recorded years ago in the Anti-Lebanon" Benson (1970); and pairs are "reported many times, apparently breeding in one of the river valleys on the west side of the Lebanon" (Ramadan-Jaradi & Ramadan-Jaradi, 1997) all suggesting that only a few records of the species are available for the country. This is similar to the situation in Turkey where only a few records are available, but as the species is strictly resident it seems probable that a very small population (1-5 pairs) 'still' breeds in Lebanon.

This is similar to the population in Jordan where Andrews (1995) estimates c. 10 breeding pairs and also to the situation in Syria where only a few confirmed records exist, (Kumerlovee, 1968) but there has been no recent research to determine the current situation.

It is also similar to the situation in Israel where a small population of 19-20 pairs was estimated in 1979 (Cramp & Simmons, 1980). Here Leshem (1976) studied the biology of 16 pairs between 1973-1976. In 1998, R. Yosef, *pers comm.* estimated that only 9-10 pairs remained indicating that a serious decline had occurred in the country in recent decades. This could be a parallel decline to the status of Bonelli's Eagle in central Arabia - Rietkerk & Wachter (1996) recorded the species, together with Bearded Vulture, *Gypaetus barbatus*, Griffon Vulture, *Gyps fulvus*, Lanner Falcon, *Falco biarmicus* and Saker Falcon, *F. cherrug*, in low numbers in 1984 and 1985 but none of these species were recorded during later surveys from 1988 to 1994. No reason for this decline is given. Hallman (1985) already mentions the conservation problems of the Bonelli's Eagle and other birds of prey in Greece, and while estimating the species population to be 60 pairs he indicates a recent decline, especially in the northern part of the country. Also the population in Macedonia has shown a recent decline with no records since 1954 (Vasic *et al.*, 1985). The regional decline seems to continue as Rocamora (1993) estimates only 35-45 pairs (*see table 1.*) to breed in Greece. Little is known about the status of Bonelli's Eagle in Northern Africa, Parkin (1895) and Meinertzhagen (1930) provide some information on its status in Egypt but no specific research has been carried out recently. Mullié & Meininger (1985) estimate 1-10 pairs to be resident throughout the country and neither they could give a trend according the numbers provided in Meinertzhagen (1930) Again a similar situation exists in Libya where only a few recent records exist.

Alltogether the Eastern Mediterranean population appears not to be larger than 75-125 pairs with the largest stronghold in Greece, Turkey and a few remnant populations of 1-10 pairs surviving in most other countries in the region. Hence, the situation in less studied countries like Lybia, Syria and Lebanon is not very clear.

## Material & Methods

---

### Breeding & Feeding Habitat

In Turkey Bonelli's Eagle occurs in two quite different habitats, the first is a quite humid Mediterranean highland habitat providing maquis covered canyons and valleys with small pastures and orchards but no dense forests or woods during the breeding season and wetlands, deltas and plains used to prey on waterfowl in winter (Thiollay, 1968; Vaassen, 1997; Vaassen, 2000). The second is the rough and fairly dry desert-steppe habitat of southeastern Turkey which also provides some canyon landscape at the edges of the plain and marginal cultivation amongst the two main rivers, Euphrates and Tigris. In most cases a river or wetland can be found within a very short distance of a breeding locality either in Mediterranean or steppe habitat. Breeding most frequently occurs on rocky cliffs in a fairly dry subtropical climate between 100 and 1,500m above sea level. The steppe habitat is fairly comparable with the main habitat of the Bonelli's Eagle in Morocco which still has a favourable large population (Thévenot *et al.*, 1985)

The species has been confirmed as breeding on most of the larger Mediterranean islands such as Sardinia, Sicily, Crete, Cyprus and Rhodos, (Glutz *et al.*, 1971) and including Mallorca and Corsica (Kinzelbach & Martens, in *Bonner. Zool. Beitr.* 16, (1965)), though the latter two islands are not mentioned by Cramp & Simmons, 1980 and Rocamora, (1994) states that the species is absent from Corsica and the Balearic Islands. Recently the species has been recorded on some of the smaller islands, i.e. Foça islands and Alaçatlı island along the Turkish Aegean coast. (Eken, 1997) Adults forage at least 5-6km and exceptionally up to 25km from their breeding locality (Glutz *et al.*, 1971), but in autumn and winter are frequently recorded 25 to 50km from the nearest possible breeding locality. (Central & Southern Spain, Bernis 1966a in Cramp & Simmons 1980).

In contrast to the African Hawk Eagle, *H. (fasciatus) spilogaster*, (Hustler & Howells, 1988; Hartley *et al.*, 1996) and Cassin's Hawk Eagle, *H. africanus* (Skorupa *et al.*, 1985) which almost exclusively breed in trees, Bonelli's Eagle breeds most regularly on rocky cliffs, (Cugnasse, 1984; Rufino *et al.*, 1985; Donazar *et al.*, 1989; Fernandez & Insausti, 1990; Ontiveros, 1999) even coastal cliffs (Palme, 1985). Brown & Amadon (1968) also mention that the African Hawk Eagle has been recorded to breed on old buildings. However, the southeastern Asian race *H. f. renschii* breeds almost exclusively in trees up to 2.000m a.s.l. in the Lesser Sunda Isles (Indonesia) (Balen, 1994). Tree nesting may occur at sites providing a commanding outlook, (*e.g.* in Portugal, J.Tavarez, *pers. comm.*) but has not been recorded in Turkey where there is an abundance of rocky habitat available. Tree nesting is usual in areas lacking highland habitat but this should also provide excellent hunting habitat with shrubs, pastures and grassland offering abundant prey and mostly away from urbanization. In some cases the species has been recorded as breeding quite near to habitation, *e.g.* in Saudi Arabia where a pair was confirmed as breeding in Wadi Nimar only 6 km from Riyadh City center (James, 1996). In India tree nesting must be common as Ali, (1949) states that Bonelli's Eagle is by no means restricted to the highlands but can be seen throughout the Indian peninsula from 7,000 feet in the Himalayas south to Ceylon (Sri Lanka). This could explain sightings from the Central Anatolian Plateau, an area at first sight unsuitable as most of the plain is either a treeless salt-steppe or intensively cultivated land lacking appropriate breeding and hunting conditions. Prakash (1989) mentions the Bonelli's Eagle breeding in forest with adjoining marsh in Keoladeo NP. Sightings at Aladag (3,907m) show that the species occurs from sea level to about 3.000m whereas Glutz *et al.*, 1971 mention a maximum height of 2.100m in the Atlas Mountains, North Africa. In general the species is only occasionally recorded above 1.500m.

Often Bonelli's Eagle forages in pairs, gliding along the steep walls of valleys and canyons, regularly following the same route and preying on medium sized mammals and birds. (Rivoire & Hüe, 1949; Gubler, 1965; Blondel *et al.*, 1969; E. Vaassen, *pers. obs.*) The species is most active late in the morning and late in the evening, frequently spending the early morning and afternoon preening. Only rarely is the species recorded soaring high in the air and it can be considered to be a silent hunter catching its prey as described above.

### Feeding Ecology

Generally hunts in pairs but also solitary, feeding on medium-sized mammals and birds, less often reptiles and rarely carrion. (Blondel *et al.*, 1969; Cheylan, 1977) There has been no research on the prey of Bonelli's Eagle in Turkey but studies elsewhere suggest that the most favoured prey is probably rabbit, *Oryctolagus cuniculus*, (although only scarcely distributed in Turkey the rabbit can be found in most possible breeding areas near islands and coastline in the western half of Turkey), Partridge, *Perdix perdix* and Chukar, *Alectoris chukar*. However Brown (1970), Leshem (1976) and Newton (1979) point out that birds are preferred for mammals. For Israel, Yosef (1996b) mentions Sand Partridge, *Ammoperdix beyi* as the main prey item in spring. Other prey includes Jackdaw, *Corvus monedula*, Woodpigeon, *Columba palumbus* and larks, (Alaudidae), occasionally gulls, (Laridae), ducks, (Anatinae) and rails, (Rallidae), other mammals such as hare, *Lepus spp.*, which could replace rabbit (Sánchez, 1998), rat, *Rattus spp.*, and reptiles such as lizards, *Lacerta viridis* are commonly recorded as prey in similar habitat in *e.g.* Iberia. Cano & Parrinder (1961) mention that lizards, especially *Lacerta lepida* are the main prey in dry regions of Southern Spain and that *Alectoris rufa* although abundant is only rarely taken. This could also be the situation for the Bonelli's Eagle population in southeastern Turkey. In France waders, (Charadriiformes), birds of prey (Falconiformes) and herons, *Ardea spp.* have also been recorded as prey items (Thiollay 1968). Brown (1970) indicates that the African Hawk Eagle kills almost the same range of prey as does the Matrial Eagle, *Polemaetus bellicosus*, twice its weight and very much larger, but adds that the Bonelli's Eagle in North Africa kills birds as large as Storks and

mammals as large as Rabbits. Kumar (1993) mentions Bonelli's Eagle killing a Blackbuck fawn, *Antelope cervicapra* so larger prey may prove not to be uncommon.

### Movements

From the literature it is clear that no migration occurs from Turkey to Europe where the species is recorded either accidentally or as a vagrant (1-7) in all West and Central European countries except Britain and Ireland with extreme records in Letonia (1) – Lippe & Wille, (1986); Sweden (1) – Gerell (1964); Finland (1) - Hollsten & Hurmerinta (1965) but later rejected. Glutz *et al.*, 1971 and Cramp & Simmons, (1980) also mention, Bulgaria and Rumania whereas Cramp & Simmons (1980) do not include Sweden despite the 1964 record which is mentioned in Glutz *et al.*, (1971). Most records relate to dispersing juveniles, with sub-adults recorded only as vagrants. Although the species has been recorded during autumn migration at important 'bottleneck' sites such as Arhavi, Borçka (Andrews *et al.*, 1977; Beaman, 1977) and Belen (*description in* Sutherland & Brooks, 1981; Bijlsma, 1987) it is not a regular migrant, and it would be more accurate to describe these movements as dispersal or wandering instead. (E. Vaassen, *pers.comm.*)

Cramp & Simmons, (1980) mention 1-3 'migrants' over Turkey and Lebanon (Nielsen & Christensen, 1970), plus singles during the migration counts at Borçka in 1977 and 1980, (Kok & Ongenae, 1995), 1 there on 18 September 1993, (Legge, *unpubl.*) and 8 !? (*see* Notes on some records) there in 1994, (Mrlík *et al.*, 1995). In the case of Belen, Southern Coastlands 2 migrants have been recorded, on 13 and 15 September 1976, (Cramp & Simmons, 1980), however these are most probably cited erroneously and relate to "Single immature birds on 2, 13 and 18 September 1976 behaved as typical migrants" in Sutherland & Brooks, (1981).

Given the comparatively small foraging range and territory size of breeding pairs, as well as the availability of suitable habitat, the records from Belen (in Cramp & Simmons, 1980) could as easily relate to a resident pair breeding in the surrounding area especially as a resident immature is mentioned as being seen occasionally at Belen (Sutherland & Brooks, 1981). According to recent information gained during a migration survey at Belen established by RRGTT (Raptor Research Group Turkey) and KAD (Turkish Bird Society) in April 1998, a pair and a single immature were confirmed to be resident in the area.

Some pre-1966 records of migration (Nisbet & Smout, 1957; Balance & Lee, 1961; Glutz *et al.* 1971) do exist for the Bosphorus but these are now thought to be erroneous (Sutherland & Brooks, 1981; G. Kirwan, *pers. comm.*). Examination of more recent data from 1966 to 1997, reveals that the species has neither been recorded during 'migration' nor in any other season at the Bosphorus (*Spring/Autumn* 1966-1976 – OST, 1969, 1972, 1975, 1978; *Autumn*, 1988 - Tucker, 1989, *Autumn* 1997 – A. Aykurt, *pers. obs.*).

A similar situation may apply to some of the older records (1950-1975) of Bonelli's Eagle from the northern half of Turkey, approximately above the line from Izmir, Konya, and Erzurum to Borçka. However, where these relate to immatures or sub-adults some may be reliable as the situation could be similar to that of the Iberian plain where juveniles and sub-adults disperse over large areas and can be seen frequently in areas with abundant prey. (Cugnasse & Cramm, 1990; Real *et al.* 1991).

The situation in more southern countries such as Israel seems to be a little different with the species being recorded regularly in low number during both spring and autumn migration. For example, at Eilat 1-6 (mean 3) migrants were recorded annually during seven 3 month long spring surveys conducted between 1977 and 1988 (Shirihai & Christie, 1992). This pattern is in agreement with the statement of Cramp & Simmons, (1980) that 1-3 migrate over Turkey, these derived from the observations provided in Nielsen & Christensen (1970) and Sutherland & Brooks (1981). However, 12 individuals were recorded at Eilat during a three month spring survey in 1994. (*Table 1.* in Yosef, 1995). This count is double the maximum counts from 1977 to 1988 and significantly increases the mean for Israel to 4.5.

In another article about the 1994 spring migration at Eilat, Yosef, (1996a) surprisingly mentions that two of the birds recorded were identified as juveniles and 8 as adults (*Table 1. in Yosef, 1996a*) and were observed at ranges down to about 50m in early mornings and late evenings. This recalls the regular foraging behaviour of resident individuals (*see Material & Methods*), in case of adult individuals.

Leshem (1994) gives a thorough overview of both spring and autumn migration occurring at Kafr Kassem and the Northern Valleys of Israel where around 500,000 raptors have been counted annually from 1982-1990 from 25 observation points along a 75km broad front with a total of 224,000 hours of observation by 150 experienced birdwatchers. Throughout this period no Bonelli's Eagles were recorded, even though sophisticated equipment such as light aircrafts and motorised gliders were used. Neither were any recorded migrating during previous studies in 1981-1982 (Dovrat, 1982; Leshem, 1985) at Kafr Kassem. Surprisingly Shirihai (1996) mentions single immatures with a maximum of four migrating, mostly at end September and in October during the autumn migration studies at Kfar Quasim (=Kafr Kassem) in 1984, 1985 and 1986.

Also large numbers appear to 'migrate' northward over Lebanon as 13 individuals were recorded on autumn migration between 20 August and 15 October 1981 (Khairallah, 1991). However, none were recorded as migrants during a 3 year survey in Jordan (Andrews, 1996) nor were any recorded during spring migration counts at Suez from March 3, to May 29 in 1990 (Meininger & de Roder, 1990) or Gebel el Zeit, Egypt from 1992 to 1994 (Grieve, 1996). However, in earlier publications (Goodman & Meininger, 1989) the Bonelli's Eagle has been designated as being a scarce migrant during both spring (2 in 1981 - Bruun, 1985; 3 in 1982 - Wimpfheimer et al., 1983) and autumn (6 in 1981 - Bijlsma, 1983) migration. Goodman & Meininger do not mention the ages of the Bonelli's Eagles assumed migrating through Egypt. However Bijlsma (1983) indicates that all observations at Suez in Autumn 1981 were either immature or juvenile.

Turkey alike it would be accurate to describe the movements of the Bonelli's Eagle in the Levant and North Africa as dispersal or wandering of immature and juvenile individuals. Adults are strongly resident throughout the Mediterranean region (Porter & Beaman, 1985; Bijlsma, 1987; Abreu, 1989), and normally do not leave, but enlarge their home-range in winter (Thiollay, 1968; Cugnasse, 1984). The movements in Egypt are most likely to be local wandering (Bijlsma, *pers. comm.*) whereas the movements in Israel may prove a little more dispersal alike. Movements occur mainly over short distances probably within the wandering range of 50-200km for local wintering populations, and possibly even in larger dispersal ranges upto 500km in case of foreign populations wintering in the region. (Shirihai, 1996).

Although the Bonelli's Eagle population is almost exclusively found resident north of the Sahara, (Brown, 1970; Newton, 1979) some scarce movement is recorded at the Bab-el-Mandeb Straits between Yemen (Porter et al., 1996) and Djibouti (2 in autumn 1985 - Welch & Welch, 1989) where still a small isolated population of the nominate Bonelli's Eagle survives, probably due the possible exchange with populations on the Arabian Peninsula (G. Welch, *pers. comm.*), i.e. probably the most common eagle in Southern Yemen (Porter et al., 1996) and is in East Africa completely replaced in the south by Ayres' Hawk Eagle, *Hieraaetus ayresii* and west and north by African Hawk Eagle, *H. spilogaster*. (Brown, 1970)

### **Population estimate**

All records available between 1966 and 1998 for Turkey are presented in Appendix 2 and summarised by geographical region in Appendix 1 (*sources*: Beaman, 1986; Martins, 1989; Kirwan & Martins, 1994). Based on the breeding behaviour, habitat and dispersal range of Bonelli's Eagle, as reviewed under Material & Methods, possible breeding sites have been marked on a 1:500.000 map with a territorial circle surrounding the actual location of records. These territorial circles are based on information relating to conspecific nesting territories in France which are usually not less than 4-12km apart and covering mostly between 50-250km<sup>2</sup> with an activity radius of 5-25km (Thiollay, 1968; Cugnasse, 1984). In Spain Bonelli's Eagle has a breeding

density ranging from 0.13 pairs/100km<sup>2</sup> in Navarra to 0.48 pairs/100km<sup>2</sup> in Castello (Real & Mañosa, 1997). Although highly territorial, Bonelli's Eagle tolerates most other raptors except Griffon Vulture, *Gyps fulvus* (Géroutet, 1965), *Aquila* eagles (Cheylan, 1973; Jordano, 1981; Donazar *et al.*, 1989; Bahat, 1989; Watson, 1997) and Booted Eagle, *Hieraetus pennatus* (Glutz *et al.*, 1971) to which they behave very aggressive. The location of known territories of these untolerated species have been compared with the possible sites of Bonelli's Eagle. Although there exist a few exceptions of Bonelli's Eagle breeding near settlements (Brown & Amadon, 1968; James, 1996), this agonistic behaviour is also taken in account for human disturbance. Even though Brown (1970) cites that he hasn't been more frightened by any other species than the African Hawk Eagle, the species seems to abandon nest sites with regular human disturbance. Another criteria for the general location of possible breeding sites is the fact that Bonelli's Eagles often have regular foraging routes 1-4km from the nest site (Glutz *et al.*, 1971; G. Magnin, *pers. comm.*; E. Vaassen, *pers. obs.*).

## Discussion

---

Due its geographical position Turkey is situated at a biological bridge between eastern Europe and the Middle East. For the conservation of such a rare and highly territorial species as Bonelli's Eagle, the Turkish population should, ideally, be large enough to provide the possibility of gene exchange throughout the Eastern Mediterranean and Middle East populations and the country has the potential to do so as there is much suitable breeding and feeding habitat. Unfortunately not much is known about the stability of the Turkish population, but based on studies of the annual turnover rate in other well monitored Mediterranean countries such as Spain (Arroyo, 1991; Real *et al.*, 1991 & 1996; Real & Mañosa, 1997) and France (Cheylan & Simeon, 1984; Cugnasse, 1984; Cheylan, 1977), the Turkish population can at most be stable if not declining due habitat loss, hunting and poisoning. As there are comparatively few records of the species during the last 35 years it is probable that the Turkish population has never been large at all. However, it should be noted that only a few Turkish regions have been monitored thoroughly and even then mostly only wetlands and coastal regions. Therefore it is currently impossible to give a meaningful population trend. Consideration should be given to studying the potential for gene exchange between the existing isolated populations by monitoring dispersal using radio- or satellite tagging. At present it seems likely that conservation of the species will become increasingly difficult if an overall decline continues throughout the Middle East and the Eastern Mediterranean even if the Turkish population is considered to be stable.

Previous monitoring work in France and Spain has shown that the species has a low breeding density and that the species is not a regular migrant but immatures will undertake dispersal movements, normally less than 200 km but exceptionally more than 500 km. It is yet not clear if the same could be said about the eastern Mediterranean population but it is likely that not much dispersal occurs in and out of Turkey, although in less favourable habitat, i.e. the Caucasus region, some interchange between populations seems to occur. In Turkey the species seems to be dependent on wetlands in winter as most breeding sites are within the 50km of such feeding areas, though again this may be a misinterpretation due to a lack of monitoring work in highland and montane regions. Equally it could be true as most of the population is known to breed between 100-1.000m a.s.l. It is more likely that dispersal or wandering occurs between Israel and Southern Arabian countries, which do not have many wetlands and opportunities for feeding in winter, to countries such as Egypt, Ethiopia and Somalia in North-East Africa. Again more work is required to confirm this either by observations at more locations around the Red Sea or by radio- or satellite tracking.

### Some Notes on Turkish Records

A pair recorded at Adapazarı in April 1968 and one individual near Manyas on 25/04/66 may erroneously have been Honey Buzzard, *Pernis apivorus* as there have been no subsequent records. However, due to the availability of both suitable breeding and winter feeding habitats in the area, it is possible these records represent the last possible breeding birds in that region as the species seems to no longer breed in the northern half of Turkey.

Considering the dates, singles on 14/09/68, north of Çankaya (a suburb of Ankara), and 24/07/74 at Kızılcahamam could have been dispersing immatures, although both are well away from the nearest known breeding sites. One individual at Iğneada on 4/5/94 is most probably erroneous as dispersal of the species does not commence until the end of July. However, it may be correct given that a small population still exists about 200 km away in Greek Thrace, though this requires recent confirmation as serious decline is recorded in Northern Greece since 1980 (Hallman, 1985). If the Greek population no longer exists then the nearest known (possible) breeding site lies about 350 km away.

Eight individuals reported during the autumn migration at Borçka from 24/9-5/10/94 appears highly unlikely as this would mean that at least 23-40%\* of the whole Turkish population would 'migrate' (or disperse) north or that a large part of an yet undiscovered large population in Caucasia would migrate south into Turkey. This assumption is supported by the fact that there have been no records of Bonelli's Eagle in Georgia (Abuladze, 1994) which would be the first country crossed by birds migrating over Arhavi / Borçka in autumn or spring before or after Turkey. An option could be Armenia and NW Iran where the species has been recorded to breed earlier. (also need for recent confirmation). However this would take a sweepstake around the high Caucasian Mountains to get there if leaving Turkey by Arhavi / Borçka. Even if a stronghold still exists in the region it would be not more than local dispersal or wandering individuals, mostly immatures of juveniles. On the other hand it would probably mean that a population as large as the Turkish population would survive in this region, which seems less than possible. Another possibility is that the records relate to multiple observations of the same individual(s) as the species is known to use the same foraging route from time to time. As adults are strongly resident, records of migrating or dispersing birds are more likely to relate to juveniles or immatures increasing the likelihood of confusion with other species such as Honey Buzzard, *P. apivorus* (Porter *et al.*, 1992) or possibly even Crested Honey Buzzard, *P. ptilorhynchus*.

(\*8 out of 20-35 young individuals, assuming a breeding productivity of 1 young bird/eyrie/year.

### Conservation

---

As is the case with most species in Turkey, conservation of the Bonelli's Eagle is hampered by the lack of data on breeding and breeding sites. In recent years preliminary work has been carried out on several globally endangered raptors such as Black Vulture, *Aegypius monachus* (Heredia *et al.*, 1997), Imperial Eagle, *Aquila heliaca* (Gürsan, M.Sc. Thesis, 1999) and Lesser Kestrel, *Falco naumanni* (Parr *et al.*, 1995; Parr *et al.*, 1997).

Monitoring of Bonelli's Eagle populations in Spain and France has shown the species to have a very high mortality rate and a very low reproductive rate. In Spain and France the main causes of juvenile and immature mortality are shooting and electrocution, followed by poisoning and trapping. (Real *et al.*, 1996; Real and Mañosa, 1997) Fortunately adult survival is in the order of 84% to 96%.

The juvenile survival rate from fledging to maturity is no more than 15% (12.8% in Real *et al.*, 1996, 10% in Real & Manosa, 1997) which means that individuals have to survive for at least 16 years to establish a stable and healthy population. This juvenile survival rate is even lower than that of Peregrine Falcon, *Falco peregrinus*, 44% (Newton & Mearns, 1988), 26% (Wootton & Bell,



1992) and of Osprey, *Pandion haliaetus*, 37% (Poole, 1989) but is comparable with the survival rate of Spanish Imperial Eagle, *Aquila adalberti*, 8-17% (Ferrer & Calderón, 1990).

Predation by other large raptors such as Eagle Owl, *Bubo bubo*, is a small factor in juvenile mortality in Spain (Real & Manosa, 1990) but could play an important role in some parts of Turkey e.g. the Göksu Canyon where Eagle Owl is known to be abundant e.g. 5-15 pairs estimated to breed in 80 km<sup>2</sup>. (van der Winden & van der Berk, 1997).

Only three possible breeding sites lie within the vicinity of a protected area, Samsun Dağı, Dilek Yarımadası MP, Milli Parkı (*National Park*), Datça Yarımadası ÖÇKA, Özel Çevre Koruma Alanı (*Special Protected Area*) and the newly established (February 1998) Birecik-Euphrates Av Koruma Sahası (*Wildlife Reserve*). It is clear that more protection should be provided especially in the Taurus Mountains (where hunting is prevalent) and in Western Anatolia, where there is extensive hunting and fast increasing tourism. Magnin, (1989) estimates the trapping and killing of raptors in northeastern Turkey to be about 25,000 birds annually. In Spain direct persecution and electrocution as well as habitat loss are the factors most threatening the species. (Cugnasse, 1989; Real, 1991; Real *et al*, 1991; Real & Mañosa, 1992; Rocamora, 1994). Similar factors are likely to be operating in Turkey and could explain the small Turkish population – the country has enough suitable breeding habitat to support at least as many pairs as in the Iberian Peninsula. Another factor could be the lack of Rabbits, *Oryctolagus cuniculus*, an important prey item in most of the species' breeding range, but Bonelli's Eagles are known to take a wide range of alternative prey in other Middle Eastern and North African countries. (Brown, 1970, Leshem, 1976; Newton, 1979) In Turkey poisoning and pesticides may be important factors for high mortality both for Bonelli's Eagle and many other vulnerable birds of prey (e.g. vultures, Imperial Eagle, *Aquila heliaca* and Lesser Kestrel, *Falco naumanni*). The impact of these has yet not been researched in Turkey.

## Conclusion

---

Compared to the western part of Europe the Bonelli's Eagle population of the eastern Mediterranean and bordering countries of the Middle East is very small and herein estimated to lay between 75 and 125 pairs. In Turkey the total population is estimated to be 20-35 breeding pairs. This number is a little lower than the population in Greece and comparable with the population in France, though in Turkey the population is more widely scattered throughout the country. The majority of the population (14-24 pairs) is estimated to breed in Mediterranean habitats with the remainder (6-11 pairs) in the dry semi-desert and highland habitats of southeastern and eastern Anatolia. The latter may be an underestimate as little research has been carried out in that part of Turkey, particularly not within the last 20 years. Only a few records exist from this region and, for the purposes of this paper, all are accepted as being breeding sites. So establishing a minimum of 20 pairs. To estimate a fair maximum population, including lack of research and less accessible regions another 15 pairs (+75%) have been added and dispersed over the geographical regions. In the western half of Turkey, Bonelli's Eagle is most common in the Mediterranean habitats of the Western Anatolian Region with 7-12 pairs distributed from just north of Izmir to Dalyan, and the Southern Coastlands Region, with 7-12 pairs mainly in the Taurus and Nur mountains. In Southeastern Anatolia two separate regions are of importance for the species. The first could be described as the Euphrates - Gaziantep region with 2-3 pairs and the second as the Tigris – Siirt region, with another 2 pairs. Both of these regions are on the border of the southeastern Anatolian semi-desert plain. The situation in Eastern Anatolia is that a few pairs may still survive in the vicinity of Lake Van and possibly along the Çoruh River near Erzurum. If this is the case, dispersal of immature birds from this area could account for the 'migration' recorded at Borçka.

Where populations are separated by more than 200km they can be considered to be isolated populations. Using this definition four isolated populations - Western Anatolian Region,

Southern Anatolian Region, Euphrates Region and Tigris Region - have been identified of which some pairs are situated just on the limit of this range. Another population may exist in Eastern Anatolia north of Lake Van.

Based on previous estimates of the Turkish population, ranging from 10-100 breeding pairs (Rocamora, 1994; Bilgin & Kasperek, 1996), the current estimate of 35 pairs represents an increase on the minimum figure but a three-fold decrease on the maximum. According to L. Palme (in Gensbøl, 1987) and Kasperek (1992) up to 50 pairs may breed in Turkey, this figure is some 30% higher than the 35 pairs estimated in this paper.

It is not possible to give an accurate population trend due to the lack of data. The species is known to have undergone a large decline on the Iberian Peninsula (Rocamora, 1994; Real & Mañosa, 1997) and in other Middle Eastern countries (e.g. Israel) but the Turkish population has most probably not been higher than 50 pairs throughout the last century (G. Kirwan, *pers comm.*).

It is of great importance to locate the exact breeding sites of Bonelli's Eagle in Turkey in order to devise a recovery plan and to monitor the species' breeding and feeding ecology. Additionally new protected areas should be established to provide an opportunity for Bonelli's Eagles and other species to recover. Measures should also be taken to prevent habitat destruction and human disturbance at and around breeding sites and to control the expansion of tourism and development including dam building (c.f. the construction of a new barrage at Birecik). Attention should also be paid to the impact of hunting and poisoning.

## Acknowledgments

---

I would like to thank M. Akif Aykurt, Kerem Ali Boyla, & Gernant Magnin (DHKD) for supplying their records. Many thanks also to Guy M. Kirwan who criticised the preliminary manuscript and provided the annotations of the Turkey Bird Reports. Further I am grateful to Sühendan Karauz, H. Mehmet Gürsan and Rob Bijlsma for their help with references and information. Also my sincere thanks to Geoff Welch who reviewed and corrected the English used in my final manuscript.

## References

---

- Abreu, M.V. (1989)** The migration of raptors through Portugal. Pp. 115-122. in Meyburg, B.-U. & Chancellor, R.D. [Eds] (1989) *Raptors in the Modern World, Proceedings of the III World Conference on Birds of Prey and Owls*, WWGBP, Berlin, Germany.
- Abuladze, A. (1994)** Birds of Prey in Georgia in the 20<sup>th</sup> Century. Pp. 23-28 in Meyburg, B.-U. & Chancellor, R.D. [Eds] (1994) *Raptor Conservation Today, Proceedings of the IV World Conference on Birds of Prey and Owls*, WWGBP, The Pica Press, Berlin, Germany.
- Ali, S. (1949)** (*Sixth impression, 1994*) Indian Hill Birds, *Oxford University Press*, Bombay.
- Andrews, I. J. (1995)** Birds of the Hashmite Kingdom of Jordan. *Andrews*, Musselburgh.
- Andrews, I. J. (1996)** Preliminary data on raptor passage in Jordan. *Sandgrouse* 18(2):36-45.
- Andrews, J., Beaman, M., Fisher, P., Hereward, T., Heubeck, M., Morton, M., Porter, R. & Round, P. (1977)** A new raptor migration route through N.E. Turkey. *Bull. Orn. Soc. Turkey* 14:2-5.
- Arroyo, B. (1991)** Results of the national census of Bonelli's Eagle. [In Spanish] *Quercus* 70:17.
- Bahat, O. (1989)** Aspects in the ecology and biodynamics of the Golden Eagle (*Aquila chrysaetos homeyeri*) in the arid regions of Israel. *M. Sc. Thesis. Tel-Aviv University*, Tel-Aviv.
- Balance, D.K. & Lee, S.L.B. (1961)** Notes on autumn migration at the Bosphorus and in the Aegean. *Ibis* 103:195-204.
- Balen, S. van (1994)** The status and conservation of birds of prey in the Sondaic and Wallacean Regions of Indonesia. Pp. 245-254 in Meyburg, B.-U. & Chancellor, R.D. [Eds] (1994) *Raptor Conservation Today, Proceedings of the IV World Conference on Birds of Prey and Owls*, WWGBP, The Pica Press, Berlin, Germany.
- Barış, S., Akçakaya, R. & Bilgin, C. (1984)** The Birds of Kızılcıhamam. *Birds of Turkey* 3. *Kasperek Verlag*, Heidelberg.
- Beaman, M. (1977)** Further news on raptor migration in the North East. *Bull. Orn. Soc. Turkey* 15:9.

- Beaman, M. (1986)** Turkey Bird Report 1976-81. *Sandgrouse* 8: 1-41.
- Benson, S.V. (1970)** Birds of Lebanon and the Jordan area. *International Council for Bird Preservation*, Cambridge.
- Bijlsma, R.G. (1983)** The migration of raptors near Suez, Egypt, Autumn 1981. *Sandgrouse* 5:19-44.
- Bijlsma, R.G. (1987)** Bottleneck areas for migratory birds in the Mediterranean region. *ICBP Study-report* 18. Cambridge.
- Bilgin, C.C. & Kasperek, M. (1996)** *Aves*. In Kence, A. & Bilgin, C.C. [Eds.] Türkiye Omurgalıları Tür Listesi. *Tübitak & DPT*, Ankara.
- Blondel, J., Coulon, L., Girerd, B. & Hortigue, M. (1969)** Deux cents heures d'observation auprès de l'aire de l'Aigle de Bonelli. [In French] *Nos Oiseaux* 30:37-60.
- Bradshaw, C.G. and Kirwan, G.M. (1994)** The ornithological importance of the Akşehir Gölü wetlands, Central Plateau, Turkey. *Sandgrouse* 16(2): 118-138.
- Brown, L.H. (1970)** African Birds of Prey. A study of Africa's 89 diurnal raptors and 31 owls. *Houghton Mifflin Company*, Boston.
- Brown, L.H. & Amadon, D. (1968)** Eagles, hawks and falcons of the world. *Country Life Books*, London
- Bruun, B. (1985)** Raptor migration in the Red Sea area. Pp. 55-60 in Newton, I. & R.D. Chancellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. *ICBP Technical Publication No. 5.*, ICBP, Cambridge, UK.
- Cano, A. & Parrinder, E.R. (1961)** Studies of less familiar birds, Bonelli's Eagle. *British Birds* 54:422-427.
- Cramp, S. & Simmons, K.E.L. (1980)** Birds of West Palearctic Vol. 2, *Oxford University Press*.
- Cheylan, G. (1973)** Notes on the competition between the golden eagle *Aquila chrysaetos* and Bonelli's eagle *Hieraaetus fasciatus*. [In French] *Alauda* 41:203-212.
- Cheylan, G. (1977)** La place trophique de l'aigle de Bonelli *Hieraaetus fasciatus* dans les biocénoses Méditerranéennes. [In French] *Alauda* 45:1-15.
- Cheylan, G. & Simeon, S. (1984)** Reproduction of Bonelli's Eagle in Provence. [In French] *Bull. Cem, Rech. Orn. Provence* 6:36-37.
- Cugnasse, J.M. (1984)** Bonelli's Eagle, *Hieraaetus fasciatus*, in Languedoc-Roussillon. [In French] *Nos Oiseaux* 37:223-232.
- Cugnasse, J.M. (1989)** Protection strategy for Bonelli's Eagles, *Hieraaetus fasciatus*, in Languedoc-Roussillon, France. [In German] *Laufeyer Seminarbeitr.* 1:65-66.
- Cugnasse, J.M. & Cramm, P. (1990)** Wandering Bonelli's Eagle, *Hieraaetus fasciatus*, in France. [In French] *Alauda* 58:59-66.
- Davidson, P. & Kirwan, G.M. (1997)** Crested Honey Buzzard, *Pernis ptilorhynchus*, in Around the Region, *Sandgrouse* 19(1):77.
- Dijksen, L.J. and Kasperek, M. (1985)** The Birds of Kızılırmak Delta. *Birds of Turkey* 4. *Kasperek Verlag*, Heidelberg.
- Dijksen, L.J. and Kasperek, M. (1988)** The Birds of Acigöl. *Birds of Turkey* 7. *Kasperek Verlag*, Heidelberg.
- Donazar, J.A., Ceballos, O. & Fernandez, C. (1989)** Factors influencing the distribution and abundance of seven cliff-nesting raptors: a multivariate study. Pp. 545-552. in Meyburg, B.-U. & Chancellor, R.D. [Eds] (1989) *Raptors in the Modern World, Proceedings of the III World Conference on Birds of Prey and Owls*, WWGBP, Berlin, Germany.
- Dovrat, E. (1982)** Summary of 5 years survey of raptor migration at Kafer Kassem. *Torgos* 2(1): 53-115.
- Eken, G. (1997)** Türkiye Kıyılarındaki Adaların Deniz Kusları Açısından Önemi. Türkiye Kıyıları '97 Konferansı Bildiriler Kitabı:453-466. [In Turkish] KAY Türk Milli Komitesi, Ankara.
- Fernandez, C. & Insausti, J.A. (1990)** Golden eagles take up territories abandoned by Bonelli's eagles in northern Spain. *Journal of Raptor Research* 24:124-125.
- Ferrer, M. & Calderón, J. (1990)** The Spanish imperial, *Aquila adalberti* C.L. Brehm 1861 in Doñana National Park (south west Spain): a study of population dynamics. *Biological Conservation* 51:151-161.
- Gensbøl, (1987)** *Birds of Prey of Britain and Europe – North Africa and the Middle East*. *Collins*, London, UK. 384pp.
- Gerell, R. (1964)** First record of Bonelli's eagle (*Hieraaetus fasciatus*) in Sweden. [In Swedish] *Vår Fågelvärld* 23:57-60
- Géroudet, P. (1965)** L'Aigle de Bonelli. Pp. 105-111 in "Les Rapaces Diurnes et nocturnes d'Europe". [In French] *Neuchâtel*. Paris.

- Glutz von Blotzheim, U.N., Bauer, K.M. & Bezzel, E. (1971)** Handbuch der Vögel Mitteleuropas, Band 4, *Falconiformes*. 2. Ed. (1989) [In German] *Aula Verlag*, Switzerland.
- Goodman, S. & Meininger, P.L. (1989)** The Birds of Egypt. *Oxford University Press*, Oxford, UK.
- Grieve, A. (1996)** Spring raptor movements at Gebel el Zeit, Egypt. *Sandgrouse* 18/1:61-63.
- Gubler, W. (1965)** Über den Habichtsadler und seine Erkennungsmerkmale. [In German] *Der Ornithologische Beobachter* 62:32-43.
- Gürsan, H.M. (1999)** Imperial Eagle in Turkey. *M.Sc. Thesis (draft)*, *Middle East Techn. Univ.*, Ankara, Turkey.
- Hallmann, B. (1985)** Status and conservation problems of birds of prey in Greece. Pp. 55-60 in Newton, I. & R.D. Chanchellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. *ICBP Technical Publication No. 5.*, ICBP, Cambridge, UK.
- Hartley, R.R., Hustler, K. & Mundy, P.J. (1996)**. The impact of man on raptors in Zimbabwe. Pp.337-353. in D.M. Bird, D.E. Varland & J.J. Negro [Eds.] *Raptors in Human Landscapes. Adaptions to built and cultivated environments*. *Academic Press*, San Diego, CA.
- Heredia, B., Parr, S.J. & Yazar, M. (1997)** A baseline survey of the Black Vulture, *Aegypius monachus* in western Turkey. *Sandgrouse* 19/2:126-132.
- Hollsten, J. & Hurmerinta, M. (1965)** Bonelli's eagle recorded in Finland. [In Finnish] *Ornis Fennica* 42:34.
- Hustler, K. & Howells, W.W. (1988)** The effect of primary production on breeding success and habitat selection in the African Hawk Eagle. *Condor* 90:583-587.
- James, D. (1996)** Bonelli's Eagle breeds in the Riyadh suburbs. *Phoenix* 13:24.
- Jordano, P. (1981)** Interspecific relationships and coexistence of breeding golden eagles (*Aquila chrysaetos*) and Bonelli's eagles (*Hieraetus fasciatus*) in central Sierra Moreno. *Ardeola* 28:67-88.
- Kasperek, M. (1992)** Die Vögel der Türkei. [In German] *Kasperek Verlag*, Heidelberg.
- Khairallah, N.H. (1991)** Notes on the autumn raptor migration over the Lebanon in 1981. *Sandgrouse* 13:34-41.
- Kılıç, A. & Kasperek, M. (1989)** Birds of Köyceğiz – Dalyan. *Birds of Turkey* 8., *Kasperek Verlag*, Heidelberg.
- Kirwan, G.M. (1993)** Birds of Hotamış Marshes. *Birds of Turkey* 9., *Kasperek Verlag*, Heidelberg.
- Kirwan, G.M. (1997)** Crested Honey Buzzard, *Pernis ptilorhynchus*, in Around the Region, *Sandgrouse* 19(2):157.
- Kirwan, G.M. & Martins, R.P. (1994)** Turkey Bird Report 1987-91. *Sandgrouse* 16/2:76-117.
- Kirwan, G.M. & Martins, R.P. (in prep.)** Turkey Bird Report 1992-1996. *Sandgrouse*.
- Kok, M. & Ongenae, J.P. (1995)** Raptor migration in the north-east of Turkey, September 1990. *OSME Bull.* 34:8-11.
- Kumar, S. (1993)** Bonelli's eagle (*Hieraetus fasciatus*) killing a blackbuck (*Antilope cervicapra*) fawn. *Journal of Raptor Research* 27(4):218-219.
- Kumerloeve, H. (1968)** Recherches sur l'avifaune de la République Arabe Syrienne essai d'un aperçu. *Alanda* 36:190-207.
- Leshem, Y. (1976)** The biology of the Bonelli's Eagle (*Hieraetus fasciatus fasciatus*) in Israel. M. Sc. Thesis, *Tel-Aviv University*, Tel-Aviv.
- Leshem, Y. (1985)** Israel: an international axis of raptor migration. Pp. 243-250 in Newton, I. & R.D. Chanchellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. *ICBP Technical Publication No. 5.*, ICBP, Cambridge, UK.
- Leshem, Y. (1994)** Global raptor migration "Bottlenecks" as a parameter of long-term variations in raptor populations. Pp. 49-53. in Meyburg, B.-U. & Chancellor, R.D. [Eds] (1994) *Raptor Conservation Today, Proceedings of the IV World Conference on Birds of Prey and Owls, WWGBP*, The Pica Press, Berlin, Germany.
- Lippens, L. & Wille, H. (1986)** *Uitzonderlijke vogels in België en West-Europa I, Watervogels, Dagroofvogels en Steltlopers*. [In Flemish] ISBN 90 70481 75-8.
- Magnin, G. (1989)** Falconry and hunting in Turkey during 1987. *ICBP Study Report* 34, Cambridge.
- Martins, R.P. (1989)** Turkey Bird Report 1982-86. *Sandgrouse* 11:1-41.
- Meinertzhagen, L. (1930)** *Nicoll's Birds of Egypt*. Hugh Rees Ltd, London, UK. (2 Vols) 700pp.
- Meininger, P.L. & de Roder, F.E. (1990)** The migration of birds of prey at Suez, Spring 1990. *The Courser* 3:23-34.
- Mrlík, V., Bobek, M., Pojer, F., Skopek, J. & Formanek, J. (1995)** Raptor migration in north-east Turkey, autumn 1994. *OSME Bulletin* 35:41-45.

- Mullié, W.C. & Meininger, P.L. (1985)** The decline of birds of prey in Egypt. Pp. 61-82 in Newton, I. & R.D. Chanchellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. ICBP Technical Publication No. 5., ICBP, Cambridge, UK.
- Muntaner, J. & C.R.P.R. (1985)** The status of diurnal birds of prey in Catalonia, Northeastern Spain. Pp. 29-44 in Newton, I. & R.D. Chanchellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. ICBP Technical Publication No. 5., ICBP, Cambridge, UK.
- Newton, I. (1979)** Population Ecology of Raptors. *Buteo Books*, Vermillion, SD.
- Newton, I. & Mearns, R. (1988)** Population ecology of Peregrine falcons in South Scotland. Chapter 62 in T.J. Cade, J.H. Enderson, J.G. Thelander & C.M. White [Eds.] *Peregrine Falcon Populations. Their Management and Recovery. The Peregrine Fund Inc.*, Boise, ID.
- Nielsen, B.P. & Christensen, S. (1970)** Observations on the autumn migration of raptors in the Lebanon. *Ornis Scandinavica* 1:65-73.
- Nisbet, I.C.T. & Smout, T.C. (1957)** Autumn observations on the Bosphorus and Dardanelles. *Ibis* 99:483-499.
- Ontiveros, D. (1999)** Selection of nest cliffs by Bonelli's eagle (*Hieraaetus fasciatus*) in southeastern Spain. *Journal of Raptor Research* 33:110-116.
- Ornithological Society of Turkey (1969)** Bird Report 1. (1966-67). OST, Sandy.
- Ornithological Society of Turkey (1972)** Bird Report 2. (1968-69). OST, Sandy.
- Ornithological Society of Turkey (1975)** Bird Report 3. (1970-73). OST, Sandy.
- Ornithological Society of Turkey (1978)** Bird Report 4. (1974-75). OST, Sandy.
- Palma, L. (1985)** The present situation of birds of prey in Portugal. Pp. 3-14 in Newton, I. & R.D. Chanchellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. ICBP Technical Publication No. 5., ICBP, Cambridge, UK.
- Parkin, T. (1895)** On Bonelli's eagle in Egypt. *Ibis* 1895:506-507
- Parr, S.J., Collin, P., Silk, S., Wilbraham, J., Williams, N.P. & Yazar, M. (1995)** A baseline survey of lesser kestrels, *Falco naumanni* in Central Turkey. *Biological Conservation* 72:45-53.
- Parr, S.J., Naveso, M.A. & Yazar, M. (1997)** Habitat and potential prey surrounding lesser kestrel, *Falco naumanni* colonies in Central Turkey. *Biological Conservation* 79:309-312.
- Poole, A.F. (1989)** Ospreys: a natural and unnatural history. *Cambridge University Press*, Cambridge.
- Porter, R. (1991)** Priority bird species in Turkey. *OSME Bulletin* 26:1-8.
- Porter, R.F. & Beaman, M.A.S. (1985)** A resume of raptor migration in Europe and the Middle East. Pp. 237-242 in Newton, I. & R.D. Chanchellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. ICBP Technical Publication No. 5., ICBP, Cambridge, UK.
- Porter, R.F., Martins, R.P., Shaw, K.D. & Sorensen, U. (1996)** The status of non-passerines in southern Yemen and the records of the OSME survey in spring 1993. *Sandgrouse* 17: 22-53.
- Porter, R.F., Willis, I., Christensen, S. & Nielsen, B.P. (1992)** Flight Identification of European Raptors. *T & AD Poyser*, Carlton.
- Prakash, V. (1989)** Population and distribution of raptors in Keoladeo National Park, Bharatpur, India. Pp. 129-137. in Meyburg, B.-U. & Chanchellor, R.D. [Eds] (1989) *Raptors in the Modern World, Proceedings of the III World Conference on Birds of Prey and Owls, WWGBP*, Berlin, Germany.
- Ramadan-Jaradi, G. & Ramadan-Jaradi, M. (1997)** Notes on some breeding birds in Lebanon. *Sandgrouse* 19(2):122-125.
- Real, J. (1991)** Bonelli's Eagle in Catalonia: status, feeding ecology, breeding biology and demography. [In Spanish] *Barcelona University (Ph. D. thesis)*
- Real, J. & Mañosa S. (1990)** Eagle owls (*Bubo bubo*) predation on juvenile Bonelli's eagles (*Hieraaetus fasciatus*). *Journal of Raptor Research* 24:69-71.
- Real, J. & Mañosa, S. (1992)** The conservation of the Bonelli's Eagle in Catalonia. [In Spanish] *Memoria Barcelona University*.
- Real, J. & Mañosa, S. (1997)** Demography and conservation of western European Bonelli's Eagle, *Hieraaetus fasciatus* populations. *Biological Conservation* 79:59-66.
- Real, J., Mañosa, S., Del Amo, R., Sánchez, J.A., Sánchez, M.A., Carmona, D. & Martínez, J.E. (1991)** The decline of the Bonelli's Eagle: a question of demography. [In Spanish] *Quercus* 70:6-12.
- Real, J., Mañosa, S., Cheylan, G., Bayle, P., Cugnasse, J.M., Sánchez-Zapita, J.A., Sánchez, M.A., Carmona, D., Martínez, J.E., Rico, L., Codina, J., Del Amo, R., & Eguía, S. (1996)** A preliminary demographic approach to the Bonelli's Eagle population decrease in Spain and France. Pp. 523-528 in

- Meyburg, B.-U. & Chancellor, R.D. (1996) [Eds] Eagle Studies. *Abstracts V World Conference on Birds of Prey*, WWGBP, Berlin.
- Rietkerk, F.E. & Wacher, T. (1996)** The birds of Thumamah, Central Province, Saudi Arabia. *Sandgrouse* 18(1):24-52.
- Rivoire, A. & Hüe, F. (1949)** L'Aigle de Bonelli. [In French] *L'Oiseau* 19:118-149.
- Rocamora, E. (1994)** Bonelli's eagle, *Hieraaetus fasciatus*. Pp. In *Tucker, G.M. & Heath, F.M.*, eds., (1994) *Birds in Europe, Their Conservation Status, Birdlife Conservation Series No.3*, Birdlife International.
- Rufino, R., Araujo, A. & Abreu, M.V. (1985)** Breeding raptors in Portugal. Pp. 15-28 in Newton, I. & R.D. Chancellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. ICBP *Technical Publication No. 5.*, ICBP, Cambridge, UK.
- Sánchez, J.M.G. (1998)** Prey selection by Bonelli's eagles (*Hieraaetus fasciatus*) during the breeding season in Granada (southeastern Spain) [In Spanish] *Ardeola* 45:151-160.
- Shirihai, H. (1996)** The Birds of Israel. *Academic Press*, London.
- Shirihai, H. & Christie, D.A. (1992)** Raptor migration at Eilat. *British Birds* 85:141-186.
- Skorupa, J.P., Kalina, J., Butynski, T.M., Tabor, G. & Kellogg, E. (1985)** Notes on the breeding biology of Cassin's Hawk Eagle, *Hieraaetus africanus*. *Ibis* 127:120-122.
- Sutherland, W.J. & Brooks, D.J. (1981)** The autumn migration of raptors, storks, pelicans and spoonbills at the Belen pass, southern Turkey. *Sandgrouse* 2:1-21.
- Thévenot, M., Bergier, P. & Beaubrun, P. (1985)** Present distribution and status of raptors in Morocco. Pp. 83-102 in Newton, I. & R.D. Chancellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. ICBP *Technical Publication No. 5.*, ICBP, Cambridge, UK.
- Thiollay, J.-M. (1968)** Essai sur les rapaces du midi de la France. Distribution, écologie, tentative de dénombrement. Aigle de Bonelli. [In French] *Alauda* 36:52-60.
- Thomé, G. & Neuschwander, J. (1974)** Nouvelles données sur l'avifaune de la République Libanaise. [In French] *Alauda* 13:243-258.
- Tucker, N. (1989)** A new raptor watchpoint at the Bosphorus. *OSME Bull.* 22:1-6.
- Tucker, G.M. & Heath, F.M. (1994)** Birds in Europe, Their Conservation Status, *Birdlife Conservation Series No.3*, Birdlife International.
- Vaassen, E.W.A.M. (1997)** Two Bonelli's Eagles, *Hieraaetus fasciatus*, in the Göksu Delta, an identification, Turkey. (*Unpubl. report*)
- Vaassen, E.W.A.M. (2000)** Habitatgebruik, activiteit en jachtwijze van overwinterende roofvogels in de Göksu Delta, Zuid Turkije. *De Takkeling* 8(2): (*in press*)
- Vasic, V., Grubac, B., Susic, G. & Marinkovic, S. (1985)** The status of birds of prey in Yugoslavia, with particular reference to Macedonia. Pp. 45-54 in Newton, I. & R.D. Chancellor [Eds.] *Conservation Studies on Raptors, Proceedings of the Second World Conference on Birds of Prey*, Thessaloniki, 1982. ICBP *Technical Publication No. 5.*, ICBP, Cambridge, UK.
- Watson, J. (1997)** The Golden Eagle. *T. & A.D. Poyser Ltd.*, London.
- Welch, G. & Welch, H. (1989)** Autumn migration across the Bab-el-Mandeb Straits. The migration of raptors through Portugal. Pp. 115-122. in Meyburg, B.-U. & Chancellor, R.D. [Eds] (1989) *Raptors in the Modern World, Proceedings of the III World Conference on Birds of Prey and Owls*, WWGBP, Berlin, Germany.
- Wimpfheimer, D., Bruun, B., Baha el Din, S.M. & Jennings, M.C. (1983)** The migration of birds of prey in the northern Red Sea area. Report of the 1982 Suez study. *The Holy Land Conservation Fund*, NY.
- Winden, J. van der & Berk, V. van den (1997)** Breeding birds of the Taurus foothills bordering the Göksu Delta, south Turkey. *Sandgrouse* 19(1):45-50.
- Wootton, J.T. & Bell, D.A. (1992)** A metapopulation model of the Peregrine falcon in California: viability and management strategies. *Ecological Applications* 2(3):307-321.
- Yosef, R. (1995)** Spring 1994 migration at Eilat, Israel. *Journal of Raptor Research* 29(2):127-134.
- Yosef, R. (1996a)** Sex and age classes of migrating raptors during the spring of 1994 at Eilat, Israel. *Journal of Raptor Research* 30(3):160-164.
- Yosef, R. (1996b)** Raptors feeding on migration at Eilat, Israel: Opportunistic behavior or migratory strategy? *Journal of Raptor Research* 30(4):242-245.

**Edwin W.A.M. Vaassen**

*Raptor Research & Rehabilitation Center Turkey (RRRCT)*

Turkish Society for Scientific Research and Rehabilitation of Diurnal & Nocturnal Birds of Prey  
Gimat II Sitesi. 679. Sokak, Blok 10-10, 06530 - Çayyolu/Ankara, Turkey.

**e-mail:** [RRRCT@about.com](mailto:RRRCT@about.com)

*Appendix 1. Estimated population according to Turkish geographical regions.*

Geographical Region	Estimate	Related Records ( <i>See Appendix 2</i> )
---------------------	----------	---

<b>Western Anatolia</b>		
Acıgöl	1	9, 11
Dalyan	1	16, 17, 19
Marmaris	1	23, 26
Dağç/Hzır_ah	1	28, 31, 32
Karaburun/Alaçatlı	1	2?, 5, 6, 7, 10, 29
I_ıklı/Pamukören	1	3, 27
Samsun Da_ı/Dilek Yarımada NP	1 - 2	4, 8, 12, 13, 14, 15, 18, 20, 21, 22, 24
<b>Total</b>	<b>7 - 12</b>	
<b>Southern Coastlands</b>		
Akseki	1	1, 32
Anamur	1	4, 6
Bahçe/Hasanbeyli	1	2, 7, 16
Göksu Canyon	1 - 2	5, 14, 15, 19, 20, 22, 24, 27, 28, 30, 31
Hassa/Belen	1 - 2	8, 9, 10, 34, 35, 36
_mamlı/Uzuncaburç	1	3, 17, 25, 26, 29
Pozantı	1	11, 13, 21, 23
<b>Total</b>	<b>7 - 12</b>	
<b>Southeastern Anatolia</b>		
Cizre-Baykan	1	4, 7, 12
Halfeti	1 - 2	2, 3, 5, 6, 8, 9, 10, 11, 13, 14
Kilis	1	1
<b>Total</b>	<b>4 - 7</b>	
<b>Eastern Anatolia</b>		
Tatvan	1	2, 4
A_ri/Patnos	1	1
<b>Total</b>	<b>2 - 4</b>	
<b>Grand Total</b>	<b>20-35</b>	

**Appendix 2. Bonelli's Eagle records in Turkey. (1966-1999)**

<i>Site</i>	<i>Nr.</i>	<i>Date</i>	<i>Record</i>	<i>Publ.</i>
<b>Thrace</b>				
İğneada	1	4/5/94	Barov & Petrov	Unpubl.
<b>Black Sea Coastlands</b>				
Adapazarı	1 pr.	Apr. '68	OM et al.	OST 2
Kızılırmak D.	1 imm.	13/8/72	KW	OST 3
Erzurum-İspir	1 imm.	29/8/73	KW	OST 3
Borçka/Arhavi	1	18/9 - 7/09/78	Kok & Ongenae	OSME Bull.34
Borçka/Arhavi	1	20/9 - 2/10/80	Kok & Ongenae	OSME Bull.34
Borçka	2	2/9/88	Raes et al.	Sandgr. 16/2
Alaçam-Kızlan	1 imm.	29/5/93	Bar_ et al.	Unpubl.
Borçka	1	18/9/93	Legge	Unpubl.
Borçka	8	24/9 - 5/10/94	Mrlík et al.	OSME Bull.35
<b>Western Anatolia</b>				
Manyas Lake	1	25/4/66		OST 1
Near İzmir	1	Spr. '67		OST 1



Pamukören	1	23/4/68	WK, FD	OST 2
Ephesus	1	3/4/72	EDHJ, GFJ	OST 3
Karaburun	2	25/5/75	PT, PJ	OST 4
South of Sındirgi	1	29/7/75	MH, JH	OST 4
Gümüldür	1	7/10/76	Boerma	Sandgrouse 8
Samsun Dağı	2	28/5/79	Inskip	Sandgrouse 8
Acıgöl	1	17/5/80	KKL	BOT 4
Harmancık	2	15/6/81	Glimmerveen & Hols	Sandgrouse 8
Acıgöl	1	22/1/86	Dijksen	Sandgrouse 11
Büyük Menderes Deltası	3	24/1/86		Sandgrouse 11
East of Kuşadası	1	24/1/86		Sandgrouse 11
Davutlar	1 imm.	30/5/86		Sandgrouse 11
Samsun Dağı	1	23/5/86		Sandgrouse 11
Dalyan	1	27/10/87	Vos	BOT
Dalyan	1	29/10/87	Vos	Sandgr.16/2
Ephesus	2	27/3/88	Moore & Burell	Sandgr.16/2
Dalyan	2	29/3/88	Moore & Burell	Sandgr.16/2
Dilek Yarımadası NP	1	20/6/89	Moyle	Sandgr.16/2
Priene	3	27/9/90	Wake	Sandgr.16/2
Kuşadası-Söke	1	Aug. '92	Boyla	Unpubl.
Marmaris-Kumlubük	1 ad.	Autumn 1992	Gürsan	Unpubl.
Büyük Menderes Deltası	2 ad.	19/3/93	Welch	Unpubl.
Yalıkavak	1 ad.	26/6/93	Faldborg	Unpubl.
Hisarönü	1	21/5/94	Marsh	Unpubl.
İçki	1 imm.	23/5/94	Boon	Unpubl.
Datça	1 imm.	Aug.'94	Aykurt	Unpubl.
Alaçatı Adaları	1	29/4/95		Eken 1997
Foça Adaları	1	3/9/96	Staub	Eken 1997
Hızır_ah- Datça	1 juv.	12/9/96	Aykurt	Unpubl.
Hızır_ah- Datça	1 ad.	21/9/96	Aykurt	Unpubl.
Bafa Gölü	1	11/5/97	Tireli	Unpubl.

### Southern Coastlands

Akseki	1 pr.	Spr. '68	ATM	OST 2
Gaziantep- Adana	2	4/7/70	CAB et al.	OST 3
East of Silifke	1	14/10/70	JRH	OST 3
Anamur	1	30/11/70	Dijksen	OST 3
Silifke	1	26/9/73	OMSE, MTB	OST 3
Anamur	1	2/10/74	DRT,DP et al.	OST 4
Bahçe	1	3/10/74	MB et al.	OST 4
Hassa	1	12/5/75	KW	OST 4
Belen	1 imm.	2/9/76	Sutherland & Brooks	1981
Belen	1 imm.	13/9/76	Sutherland & Brooks	1981
Belen	1 imm.	18/9/76	Sutherland & Brooks	1981
South of Pozantı	1 pr.	4/4/85		Sandgrouse 11
South of Elek Lake	1	15/1/85		Sandgrouse 11
Alada_	1	23/7/85		Sandgrouse 11
North of Silifke	1 juv.	5/8/86		Sandgrouse 11
Göksu Delta	1	24/4/88	Jürgens	Unpubl.
Hasanbeyli	1	14/5/89	Fanck	Sandgr.16/2
Uzuncaburç	1	10/6/90	Wallander et al.	Unpubl.
South of Kemer	1 ad.	24/6/92	Hofland	Unpubl.
Göksu Canyon	1	12/4/93	Vaassen	Unpubl.
Göksu Canyon	1 pr	10/5/93	Vaassen	Unpubl.
Pozantı	1 imm.	24/5/93	Vaassen	Unpubl.
North of Silifke	1	12/6/93	Vaassen	Unpubl.

Pozantı	1 pr.	26/6/93	Vaassen	Unpubl.
Göksu Canyon	1	12/7/93	Vaassen	Unpubl.
_mamlı	1 juv.	21/7/93	Vaassen	Unpubl.
_mamlı	1 pr.	6/8/93	Vaassen	Unpubl.
Göksu Canyon	1 imm.	22/8/93	Vaassen	Unpubl.
Göksu Canyon	1 imm.	5/9/93	Vaassen	Unpubl.
Ke_iltürkmenli	1 pr.	17/10/93	Vaassen	Unpubl.
Göksu Canyon	1pr+1i	25/10/93	Vaassen	Unpubl.
Bey_ehir-Akseki	1	28/5/96	Browne & Ganney	Unpubl.
Göksu Delta	1 pr.	9/2/97	Vaassen	Vaassen, 1997b
Belen	1 imm.	6/4/98	RRGT/KAD	Unpubl.
Belen	1pr+1i	8/4/98	RRGT/KAD	Unpubl.
Belen	1 ad.	9/4/98	RRGT/KAD	Unpubl.

### Central Anatolian Plateau

North of Çankaya	1	14/9/68	Vittery	OST 2
Kızılcahamam	1	24/7/74	HWF	BOT 3
Ere_li Marshes	1	5/5/82	Jürgens	Unpubl.
Hotamı_- Karaman	1	15/5/85	AE	BOT 9
Zelve	2 imm.	16/5/85		Sandgrouse 11
Ak_ehir Gölü	1 imm.	23/4/92	Bradshaw & Kirwan	Unpubl.

### Southeastern Anatolia

West of Kilis	1pr+2j	7/4/71	KW	OST 3
Halfeti	A's+j's	5-7/6/73	UH	OST 3
Halfeti	1	15/4/82		Sandgrouse 11
Cizre-Eruh	2a+ 2j	26/6/83		Sandgrouse 11
Halfeti	1	16/3/86		Sandgrouse 11
Halfeti	1	20/3/86		Sandgrouse 11
South of _ırnak	1	14/6/86		Sandgrouse 11
Halfeti	2	31/5/87	Eames	Eames, 1987
Halfeti	1 pr.	Reg.		Sandgrouse 11
Halfeti	1 imm.	21/4/88	Rushforth et al.	Sandgrouse 11
Halfeti	1 imm.	7/5/89	Green et al.	Sandgrouse 11
Halfeti	1 imm.	23/5/89	Young et al.	Sandgrouse 11
Kurtulan- Baykan	1	29/5/89	Brown	Sandgrouse 11
Halfeti	2a+ 2j	29/4/96	Boyla	Unpubl.
Birecik	1 ad.	25/4/97	Güne_ & Freedman	Unpubl.
West of Gaziantep	1 ad.	1/10/97	Vaassen	Unpubl.

### Eastern Anatolia

Patnos-A_rı	Sev.	17-21/7/66		OST 1
East of Tatvan	1	22/5/85		Sandgrouse 11
Malatya-Erzurum	1	29/7/94	Prinsen & v/d Vliet	Unpubl.
Tatvan	1	13/7/97	Tireli	Unpubl.

### Abbreviations for Appendix 2:

BOT3: Barış *et al.* (1984), BOT4: Dijksen & Kasperek (1985), BOT7: Dijksen & Kasperek (1988), BOT8: Kılıç & Kasperek (1989), BOT9: Kirwan (1993), OST1: OST (Bird Report 1), OST2: OST (Bird Report 2), OST3: OST (Bird Report 3), OST4: OST (Bird Report 4), Sandgrouse 8: Beaman (1986), Sandgrouse 11: Martins (1989), Sandgrouse 16/2: Bradshaw & Kirwan (1994).