

Exceptional wintering and spring migration of the booted eagle *Hieraetus pennatus* in Italy in 2004 and 2005

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Abstract - After the exceptional influx of booted eagles *Hieraetus pennatus* from Western Europe in October 2004, we reviewed the species' presence in Italy over the period December 2004 - February 2005 and during spring 2005. We documented the size of the species' wintering population by gathering the sightings from various regions of Italy. We surveyed the spring migration of the species through simultaneous raptor counts at several sites (mostly in Sicily and Sicilian islands). The remarkable wintering population of 2004-2005 (estimated range: 173 - 202 individuals) was related to the unusual migratory influx that took place in the previous autumn and it agrees with an apparent trend towards an increasing number of birds wintering in southern Italy, particularly in Sicily (estimated range: 132 - 157 individuals). The northward spring migration observed from the southern regions of Italy along the Tyrrhenian coast (towards France), validates the hypothesis of a West European origin of the individuals migrating in the spring of 2005 and can be regarded as a case of circuitous migration in the booted eagle.

Riassunto - Svernamento e migrazione primaverile dell'aquila minore *Hieraetus pennatus* in Italia. Facendo seguito all'eccezionale fenomeno migratorio osservato nell'ottobre 2004, abbiamo esaminato le successive presenze invernali e primaverili dell'aquila minore in Italia (Dicembre 2004 - Febbraio 2005 e primavera 2005). Abbiamo documentato l'entità dello svernamento tramite la raccolta di segnalazioni provenienti da varie zone del territorio italiano e abbiamo monitorato la migrazione pre-nuziale della specie mediante conteggi simultanei in più siti (la maggior parte dei quali in Sicilia e nelle isole siciliane). Lo straordinario afflusso di individui della specie verificatosi nell'autunno 2004 ha causato un aumento consistente dei contingenti svernanti nell'Italia meridionale (range stimato: da 173 a 202 individui), in particolar modo in Sicilia (range stimato: 132 - 157 individui). La migrazione primaverile, osservata dalle isole circum-siciliane lungo il versante tirrenico in direzione della Francia, conferma l'ipotesi dell'origine occidentale degli individui in migrazione pre-riproduttiva e suggerisce un caso di migrazione primaverile "a circuito" nell'aquila minore.

The booted eagle *Hieraetus pennatus* is considered "rare" in Europe, where it breeds both in Western Europe (France, Portugal and Spain) with several thousand pairs and in Eastern Europe (most in Russia, Turkey and Ukraine), with a few thousand pairs (BirdLife International 2004). Although the species is mainly a trans-Saharan migrant, some individuals overwinter in Southern Europe and North Africa (Cramp and Simmons 1980, Zalles and Bildstein 2000).

During the migration across the Mediterranean basin, most booted eagles of the western and the eastern European populations concentrate at the Straits of Gibraltar and Bosphorus, respectively (Finlayson 1992). Until now the Central Mediterranean and the Italian Peninsula were only

partially interested by the migration of this species (Cramp and Simmons 1980, Bijleveld 1986, Zalles and Bildstein 2000, Corso 2001, Agostini 2002).

In Italy the booted eagle is considered a regular migrant and irregular wintering species (though it is regular in Sicily) (Brichetti and Fracasso 2003). Premuda and Baghino (2004) investigated the autumn migration of Booted Eagle through the Italian Peninsula, analysing existing information from 1985 to 2003 and suggesting a western European origin for some of the booted eagles migrating in Italy during autumn (Premuda 2003).

The influx migration of more than 500 booted eagles from Spain and France through Italy that took place in October 2004 was a well-documented phenomenon (Baghino and Premuda 2005, Baghino 2005, Guillosson *et al.* 2006). This work presents new data collected in Italy from winter

2004 to spring 2005, aiming at quantifying the winter presences of the species and at analysing its spring movements.

METHODS

The study area covers the Italian Peninsula as a whole, with a particular focus on some selected sites interested by a concentrated passage of migrant raptors (Figure 1).

Wintering

Winter records were collected from December 2004 to January 2005. In Eastern Sicily counts were performed only in January 2005, because the eagles appeared to be still involved in migration movements during December 2004. Moreover, only for Sicily, we also analysed data collected during winter 2005-2006. During the study period, the main areas investigated were: Po Delta (Emilia-Romagna), Tuscany, Latium, Campania, Salento peninsula, Sardinia and Sicily.

In these areas the authors and some field observers carried out 1-3 visits per area. The visits included all sites in



Figure 1. Map of the major sites of wintering and spring migration of booted eagle through Italy in 2004-2005. The circles show the main wintering areas (bold = most important zones), the arrows indicate the routes followed by the species. The black dots indicate the following sites: AR = Arenzano; AA = Apuane Alps; CO = Conero; PN = Panarea; MA = Marettimo; ER = Erice; SM = Stretto di Messina; PA = Pantelleria. -*Principali siti di svernamento e migrazione primaverile dell'aquila minore in Italia nel 2004-2005. Le frecce indicano le probabili rotte di migrazione seguite dalla specie.* = Arenzano; AA = Apuane Alps; CO = Conero; PN = Panarea; MA = Marettimo; ER = Erice; SM = Stretto di Messina; PA = Pantelleria.

which the species was observed in the previous autumn. The remaining Italian regions were also surveyed by many birdwatchers but without results (data mainly obtained from www.ebnitalia.it), although it cannot be excluded that some undetected individuals may have wintered in southern Italy (mainly in Calabria and Basilicata), where coverage was poor.

In order to reduce the likelihood of double counts, both moult pattern and colour morphs with individual plumage characters were recorded whenever possible. Birds were aged on the basis of moult patterns and silhouette (Conzemi 1996, Clark 1999, Forsman 1999). With regards to morphs, the rufous morph reported by Clark (1999), was not taken into consideration and any birds appearing intermediate and/or rufous were recorded as dark morph individuals.

Spring migration

The survey was carried out in springs 2004 and 2005. At the Apuane Alps (Lucca, Tuscany) and at Arenzano (Genoa, Liguria; Fig. 1, Tab. 2) visual counts were made simultaneously from 6 to 21 March. At Arenzano, another 16-day raptor migration count took place from 5 to 20 May. In addition, from 20 April to 20 May, the following sites were monitored for the Project "Rapaci Migratori", organised by LIPU-Birdlife Italy: Pantelleria, Marettimo, Panarea, Strait of Messina (Sicily) and Mount Conero (Marche); the Erice site was surveyed only in 2005 (Fig. 1, Tab. 2).

Observations were carried out during daylight time (8-10 hours/day at each site) and were interrupted only in case of rain and poor visibility.

RESULTS

Wintering

During winter 2004-2005, we estimated that 173-202 booted eagles wintered in Italy, among which 41-45 individuals in continental regions and Sardinia, and 132-157 individuals in Sicily (Tab. 1, Fig.1). Many booted eagles were observed in wetlands: Po Delta, Circeo National park, Diaccia Botrona, Ombrone mouth, Cixerri and Colostrai lake, Saline of Siracusa, Cozzo Pantano, Vendicari, Simeto marshes, Pontebarca, Lentini lake, Biviere di Gela (Tab. 1).

We established the morph of 44 birds: 31 were in light morph and 13 in dark morph. Out of the 48 birds that were aged with certainty in Sicily, only 1 adult was detected, the other being juveniles. During the following winter (2005/2006), about 93-112 booted eagles wintered in Sicily: 17 in Siracusa province, 4-6 in Ragusa province, 3-5 in Messina province, 14-17 in Catania province, 10-12 in Caltanissetta province, 40-50 in Agrigento province, 5 in Trapani province (1 at Favignana island, 4 at Pantelleria island). In January 2006, we aged 35 individuals of which 7 were juveniles, 5-6 adults and the other 22-23 individuals were in their 3rd calendar year.

Table 1. Records of booted eagle in Italy during winter 2004-2005. – *Osservazioni invernali di aquila minore in Italia (inverno 2004-2005).*

Region	Locality/area	Number of individuals	Data source/Observer
Emilia-Romagna	Valle Canneviè	2	Passarella M. pers.com.
Emilia-Romagna	Valle Mandriole	1	Passarella M. pers.com.
Emilia-Romagna	Ortazzo	1	Passarella M. pers.com.
Tuscany	Migliarino-San Rossore-Massaciuccoli	3-4	Paesani G. pers. com.
Tuscany	Maremma livornese	2	Paesani G. pers. com.
Tuscany	Maremma grossetana, Orbetello, Diaccia Botrona, river Ombrone mouth	2-3	Paesani G. pers. com.
Latium	Circeo National Park	6	Molajoli R. pers. com.
Latium	Around Civitavecchia	1	Molajoli R. pers. com.
Latium	Maccarese	1	Molajoli R. pers. com.
Latium	Rome: Decima Malafede	1	Molajoli R. pers. com.
Latium	Castel di Guido	5-7	Molajoli R. pers. com.
Campania	Caserta, Salerno and Naples provinces	2-4	Mancuso <i>et al.</i> (2005).
Apulia	Salento	4	Marzano G. pers. com.
Sardinia	Capitana-S. Isidoro	4	Grussu M., Pisano S. pers. com.
Sardinia	Cixerri lake	3	Grussu M., Pisano S. pers. com.
Sardinia	Colostrai lake	1	Grussu M., Pisano S. pers. com.
Sardinia	Surroundings of Nora	1	Grussu M., Pisano S. pers. com.
Sardinia	Surroundings of Sanluri	1	Grussu M., Pisano S. pers. com.
Sicily	Siracusa-Ragusa province (M ^a Iblei area)	30-45	Corso A.
Sicily	Catania province (river Simeto mouth and suburbs of Catania)	19-25	Corso A. Rannisi G. pers. com.
Sicily	Caltanissetta province	15	Falci A. pers. com.
Sicily	Palermo province	8-12	Corso A.
Sicily	Messina province	6	Corso A.
Sicily	Trapani province	4	Marchese M. pers. com.
Sicily	Agrigento town and province	50	Grenci S. pers. com.
Total		173-202	

Spring migration

At all study sites, an increase in the number of booted eagles was recorded in spring 2005 as compared to spring 2004 (Tab. 2; Wilcoxon test, $Z_8 = 2.52$, $P = 0.012$). This was evident in the Sicilian sites, particularly at the Strait of Messina, where the maximum counts were achieved (2004: 8 individuals, 2005: 87 individuals; Tab. 2), but also in Northern Italy (e.g. the Arenzano site in May; 2004: 2 individuals, 2005: 20 individuals; Tab. 2).

During April-May 2004, at the Sicilian sites, the birds were all juveniles, except one adult observed in Pantelleria. In April-May 2005, at the Strait of Messina 62 birds were carefully observed at close range: they resulted all juveniles. In May 2005 at Arenzano site, the age was established for nine individuals and they were all juveniles. However, in this site in March 2005 and in the Apuane Alps in March 2004 and 2005 only adults were observed (6, 2 and 7 individuals, respectively).

In April-May 2004, the morph of eagles was recorded only in the Strait of Messina: 7 individuals were in pale and 1 in dark morph. In spring 2005, pale morph individuals were predominant among the eagles observed in the study

sites (pale vs. dark morph: Wilcoxon test, $Z_8 = 2.20$, $P = 0.028$; Tab. 3).

The flight direction of the migrant eagles was N-NE at the Sicilian channel and Conero promontory, N-NW at the Strait of Messina, NW at the Apuane Alps site, SW at the Arenzano site (Fig.1).

DISCUSSION

Wintering

The high number of booted eagles recorded in Italy during winter 2004-2005 (estimated range: 173 - 202 individuals; 132 - 157 in Sicily), compared to the lower numbers in previous years, appears to be strongly related to the exceptional influx from Western Europe that occurred during autumn 2004 (Baghino and Premuda 2005). At the same time, it strengthens the trend towards an increasing number of birds wintering in Italy, mainly in Sicily.

Over the last twenty years, there has been an increase in the number of booted eagles wintering in areas of the Central Mediterranean (Corso and Iapichino 1998, Corso 2005).

Table 2. Geographical coordinates, altitude, census period and number of observations of migrating booted eagles during the springs 2004 and 2005, for each study site. – *Coordinate, altitudine, periodo di censimento e numero di individui di aquila minore osservati durante la primavera 2004 e 2005 per ciascun sito di osservazione.*

Area	Site	Coordinates	Altitude (m a.s.l.)	Census period	Number of individuals	
					2004	2005
Apuane Alps (NW Tuscany)	Capriglia	43° 58' N - 10° 14' E	378	6-21 March	2	7
Beigua Regional Nature Park – Western Liguria	Arenzano	44° 24' N - 8°40' E	350	6-21 March	1	9
Sicilian Channel	Pantelleria	36°48'N – 11° 57'E	100	20 April 20 May	1	6
Egadi Islands	Marettimo	37°57'N – 40°02'E	500	20 April 20 May	1	13
Inner Sicily	Erice	38°02' N – 12°35'E	750	20 April 20 May	Not surveyed	18
Aeolian Archipelago	Panarea	38°38'N – 14°04'E	421	20 April 20 May	2	30
Strait of Messina	M. Peloritani	38°11'N – 15°33'E	500	20 April 20 May	8	87
Marche (Adriatic coast)	Conero	43°32'N – 13°26'E	200	20 April 20 May	0	1
Beigua Regional Nature Park – Western Liguria	Arenzano	44° 24' N - 8°40' E	350	5-20 May	2	20

Such an increase has also been recorded in Spain, mostly in the south of the country (Franco and Amores 1980, Schmid 1986, Sunyer and Viñuela 1996, Martínez and Sánchez-Zapata 1999, García Dios 2004, J.L.Copète pers. com.), in Portugal, again mostly in the south (Costa 1994), and in France, mainly in the Mediterranean area (Yeatman-Berthelot 1991, Dubois *et al.* 2001) and Crete (Londei 1991).

In Italy, prior to 1980, there were only two winter records of booted eagle: one adult at Torviscosa, NE Italy, 20 December 1948 (Fantin 1974), one individual near Rivoltella-Sirmione, N Italy, in December 1979 (Bricchetti and Cambi 1981). The number of records increased after 1980: one individual in NW Italy in January 1981 (Guolo 1981), another in Tuscany in 1988 (Tellini Fiorenzano *et al.* 1997), one in Latium in 1989 (Ruda *et al.* 1991); again, two in Tuscany, one in Liguria and one in Emilia-Romagna in 1998 (Arcamone and Bricchetti 2000). In Sardinia, in the past years the species was regarded as irregular, whereas now it is considered to be possibly regular migrant and irregular in winter (Grussu 2001).

Sicily hosts the greatest number of booted eagles wintering in Italy, and observations indicate a possible increase. This trend began to be noticed in the late 1980s (Iapichino and Massa 1989, Iapichino 1993, Ciaccio and Priolo 1997). Winter records became increasingly frequent in the early 1990s (Lo Valvo *et al.* 1993). Later, 5 individuals on aver-

age were estimated to be wintering in eastern Sicily each year (Grussu and Corso 1997, Corso and Iapichino 1998). In January 2003, a minimum of 12 individuals was recorded in Siracusa and Agrigento provinces (Ruggieri 2004) with 20-24 individuals in 2004 (Corso 2005). The main wintering areas have always been the Siracusa and Agrigento provinces.

Table 3. Pale, dark, and not valuated morph of booted eagles observed in migration at the Strait of Messina, Pantelleria, Marettimo, Erice, Panarea island, Apuane Alps and Arenzano (see Tab. 2 for census periods). – *Frequenze dei diversi morfi di aquila minore osservati durante la migrazione nei diversi siti di osservazione.*

	Pale morph	Dark morph	Not evaluated
Strait of Messina	53	14	18
Pantelleria	5	1	0
Marettimo	8	3	2
Erice	0	0	18
Panarea	29	1	0
Apuane Alps	2	3	2
Arenzano, March	4	1	1
Arenzano, May	14	2	4
Total	115	25	45

The *age-ratio* of the birds wintering in Sicily in 2004-05 compared to 2005-06 is very interesting: most birds aged in 2004-05 were juveniles (97.9%), while in 2005-06 most birds were immature (>62%) with a few adults as well. This finding suggests that these birds might well be the same individuals returning to the wintering grounds where they spent the previous winter.

Spring migration

While the data collected during the project "Rapaci Migratori" in spring 2004 are in agreement with those reported in the previous years at the Strait of Messina (Corso 2001), the unusually high number of booted eagles observed in spring 2005 seems to be strongly related with the anomalous movements observed the previous autumn. The exceptional volume of the booted eagle autumn migration that occurred during 2004 (>500 individuals; Baghino and Premuda 2005) is also evident by a simple comparison with the overall number of records ($N=192$) collected in Italy from 1985 to 2003 (Premuda and Baghino 2004).

It's particularly interesting to note that a case of mass migration took place during autumn 1985 (Premuda and Baghino 2004), suggesting that such a phenomenon may occur recurrently under particular circumstances, and that in spring 1986, just after the first "influx" recorded in the autumn of 1985, many individuals of this species (35) were observed at the Strait of Messina (Iapichino and Massa 1989).

According to the known phenology of the booted eagle (Forsman 1999), the majority of birds migrating in late April and early May in both study seasons were immature (mainly 2y juveniles). On the contrary, individuals migrating in March would mostly concern adult birds, as it was partially shown by the raptor counts made at the Tuscan and Ligurian sites (Apuane Alps and Arenzano).

The predominance of pale morph among the booted eagles migrating through Italy is in agreement with the morph ratio existing in Spain and in the Western Europe, rather than in the Eastern European distribution range (Forsman 1999). The northward route taken by booted eagles crossing Southern Italy, then heading NW along the upper Tyrrhenian coast and finally SW along the Ligurian coast, with almost no birds along the Adriatic coast, validates the hypothesis of their West European origin, in agreement with the autumn observations made at Arenzano (Premuda and Baghino 2004). This suggests the occurrence of a case of spring circuitous migration: such a pattern has been documented in the short-toed eagle *Circaetus gallicus* across Italy, with the exactly opposite migration direction (SE in spring) (Agostini *et al.* 2002a, 2002b, 2004).

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