

## Short communication

# The autumn migration strategies of adult and juvenile short-toed eagles *Circaetus gallicus* in the central Mediterranean

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**Riassunto** - Le strategie di migrazione autunnale di adulti e giovani di biancone *Circaetus gallicus* nel Mediterraneo centrale. Durante la migrazione autunnale, i bianconi nidificanti in Italia centrale utilizzano una rotta "ad arco", attraversando il Mediterraneo sullo Stretto di Gibilterra. Inizialmente questa rotta prevede una migrazione verso NNW, lungo il versante occidentale dell'Italia centrale. In questo studio abbiamo analizzato la migrazione autunnale del biancone nelle Alpi Apuane (Italia centrale), in relazione alle differenti classi di età. Nel periodo 15-26 settembre 2001 sono stati contati 351 individui in 108 ore di osservazione, ed è stato stimato il passaggio di 272 adulti, 23 immaturi e 56 giovani. I bianconi tendevano a migrare in gruppi, comprendenti in media 3.5 individui ( $N = 77$  gruppi); almeno in 17 casi i gruppi contenevano sia adulti che giovani. La bassa percentuale di giovani riportata sulle Alpi Apuane, unitamente al tardivo passaggio di decine di questi attraverso il Canale di Sicilia, sembra suggerire che solo parte dei giovani appartenenti alla popolazione nidificante in Italia centrale apprenda la rotta "ad arco" seguendo gli adulti.

The short-toed eagle *Circaetus gallicus* is a summer resident in Europe, wintering in tropical Africa (Cramp and Simmons 1980). In Italy, a breeding population of about 400 pairs has been estimated, mostly distributed in the Alps, pre-Alps, Ligurian Apennines and along the western slope of central Italy (Cattaneo and Petretti 1992, Cattaneo 1998). During migration, this species uses mostly soaring flight over land, avoiding long sea crossings (Kerlinger 1989, Meyburg *et al.* 1998). In the Mediterranean basin, the greatest concentration of migrating individuals is observed at the Strait of Gibraltar, both during autumn and spring movements (Finlayson 1992).

On the other hand, spring movements appear to be virtually non-existent over the central Mediterranean area (Beaman and Galea 1974, Agostini and Malara 1997, Agostini and Logozzo 1998, Agostini 2001). Individuals breeding in central Italy use a circuitous route both during autumn and spring migration, crossing the Mediterranean at the Strait of Gibraltar and migrating along the Ligurian Apennines (northwestern Italy), where the greatest concentration of migrat-

ing short-toed eagles occurs (Baghino and Leugio 1989, 1990, Baghino 1996, Agostini and Malara 1997, Agostini *et al.* 2002a, b, Premuda 2002, Baghino 2003). They limit the flight over water (only 14 km across the Strait of Gibraltar), probably favouring a safe migration, as a result of a conservative strategy (Agostini *et al.* 2002b).

During autumn, in southern continental Italy the migratory flow of this species is very limited, similarly to that observed during spring at the Strait of Messina (between southern continental Italy and Sicily; Giordano 1991, Agostini and Logozzo 1995a, 1995b, 1997); some birds are also observed over the islands of Malta during the second half of September and early October (Beaman and Galea 1974, Sultana and Gauci 1982, Agostini *et al.* 2002a), and occasionally in late autumn (late October-November) (Coleiro 1999 and C. Coleiro, pers. comm.).

The aim of this study was to provide information on the autumn migration of the short-toed eagle along the western slopes of central Italy, through systematic observations on the Apuane Alps (Tuscany, central



Figure 1. The study area (C = Capri, M = Marettimo, MC = Mount Colegno; the established breeding areas of the short-toed eagle in central Italy, according to Cattaneo and Petretti (1992) are shown in black, the supposed breeding areas in grey; solid arrow: mostly adults; broken arrow: mostly juveniles; dotted arrow: hypothetical route).

Italy), focusing on the passage of birds belonging to different age classes.

Observations were made between 15 and 26 September 2001, the peak of the autumn migration of the short-toed eagle in this area (Agostini *et al.* 2002a, Baghino 2003). Age classes were determined according to Forsman (1999) and Clark (1999). The overall number of adults, immatures and juveniles was estimated according to the proportions recorded in the sample of aged individuals (Kjellén 1992, Agostini *et al.* 2002a). A total of 108 h of observation was made, aided by telescopes and binoculars, using a post located at an altitude of about 400 m along the southern slopes of Mount Colegno (approx. 43°58'N, 10°16'E) (Fig. 1, Agostini *et al.* 2002a, b, Premuda 2002).

We counted a total of 351 short-toed eagles (3.3 ind/h), with an evident peak on 22 September, when 150 individuals were reported (Fig. 2). It was possible to determine the age of 165 birds, usually when they were very close (< 150 m) overhead. Most birds were adults (272 individuals, 78%), while 23 (6%) were immatures and 56 (16%) juveniles. The short-toed eagle showed a strong tendency to migrate in flocks, although 81 (23%) individuals were observed alone. On average, groups were comprised of  $3.5 \pm 0.2$  (SE) birds, and 69% of flocks ( $N = 77$ ) contained 2 (39% of flocks) and 3 (30% of flocks) birds. We recorded at least 17 flocks (22%) containing both adults and juveniles, confirming previous observations made on the

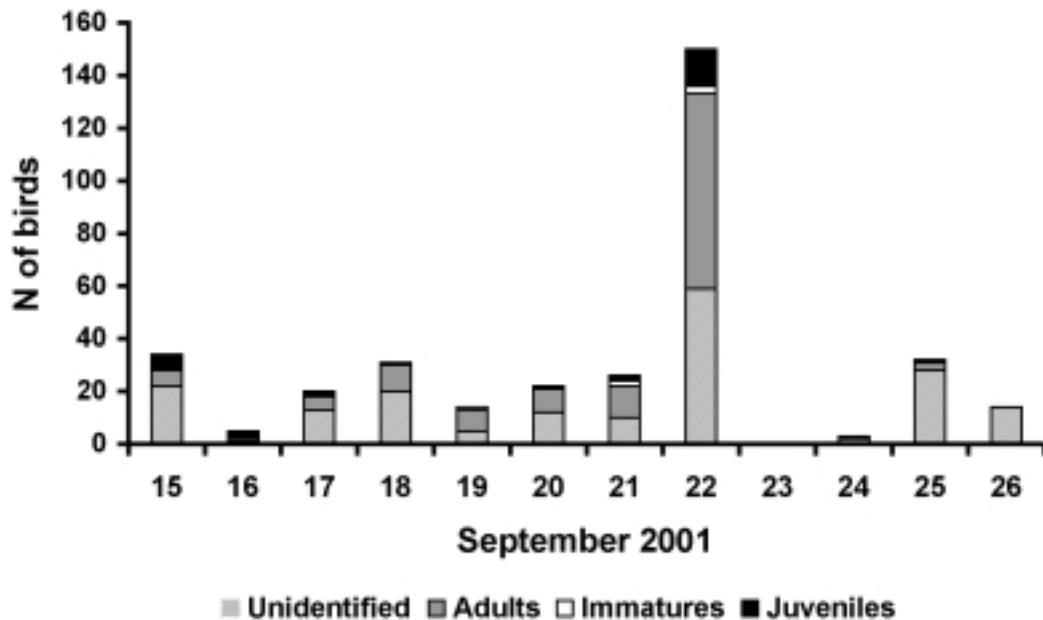


Figure 2. Migration pattern of migrating short-toed eagles over the Apuane Alps between 15 and 26 September 2001, in relation to age classes.

Ligurian Apennines (Agostini *et al.* 2002a). The breeding success of this species recorded in central and northern Italy (0.75 juveniles per pair, Ferguson-Lees and Christie 2001) does not agree with our observations, which suggest a breeding success of only 0.41 juveniles per pair (136 pairs and 56 juveniles estimated). Therefore, only a fraction of juveniles belonging to the population breeding in central Italy may learn this route by following the adults. As mentioned above, few short-toed eagles are observed in southern Italy and Malta during the second half of September (Agostini and Logozzo 1997, Agostini *et al.* 2002a). However, recent observations performed on the island of Marettimo (off the western coast of Sicily) in 2000-2002 suggest that a substantial migration towards Tunisia, involving tens of individuals, takes place there peaking during the first half of October (e.g., a peak of 49 individuals on 8 October 2002) (N. Agostini and G. Campo, pers. obs.). Apparently, based on a sample of 43 aged individuals, most (79%) were juveniles, the remaining ones being adults and immatures (N. Agostini, pers. obs.). Finally, Jonzén and Pettersson (1999) recorded some short-toed eagles leaving the island of Capri toward SW. This island is located 5 km off the coast of southern Italy and about 330 km NE of Marettimo. It is also interesting to note that, at Gibraltar, a significant passage of short-toed eagles, which account for about 15% of all individual counted each autumn, takes place during the first half of October (Finlayson 1992).

Taken together, these observations suggest that the southward autumn movements of short-toed eagles along the Italian peninsula may involve mostly juveniles, and that an unknown fraction of these birds may follow a migration route across open water over the central Mediterranean (Fig. 1). Because short-toed eagles fly at a speed of 13.5 m/s during flapping-gliding flight (Bruderer and Boldt, 2001), birds leaving the coast of southern Italy at Capri should take about 7 h to reach Marettimo (Fig. 1).

Recent studies on honey buzzard *Pernis apivorus* showed that, with rare exceptions (Agostini and Logozzo 1997, Agostini *et al.* 1999), juveniles tend to migrate about two weeks later than adults during autumn (Kjellén 1992, Agostini and Logozzo 1995c). While adult honey buzzards cross the Mediterranean at its narrowest points, showing true navigational abilities, juvenile birds migrate on a broader front concentrating in many island of the Mediterranean (Rebassa 1995, Agostini *et al.* 1999, 2000, 2002c, in press, Schmid 2000, Hake *et al.* 2003). To explain these results, Agostini *et al.* (2000) suggested that, since juveniles (i.e. inexperienced individuals) cannot have previous experience of the narrowest points to cross the Mediterranean, they probably tend to fly along a

NE-SW axis, which may be “genetically” defined, resulting in a broad front of migration. This axis of migration (NE-SW) is also shown by juvenile sparrowhawks *Accipiter nisus* during their first migration (Drost 1938). In short-toed eagles, a similar pattern of orientation in relation to age classes, together with the partial overlap in the migration periods between juveniles and adults, could explain both the low percentage of juveniles migrating northwest with adults along the Apuane Alps during the second half of September, and the late movement of tens of juveniles towards SW observed across the central and southern Mediterranean.

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