# ANALYSIS OF THE SPATIAL MIGRATION PATTERNS OF ADULT HONEY BUZZARDS (*Pernis apivorus*) DURING SPRING AND AUTUMN IN THE CENTRAL MEDITERRANEAN

**Nicolantonio Agostini and Michele Panuccio**

ABSTRACT

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In this paper we analyse the spatial migration patterns and the water crossing tendency of adult Honey Buzzards during spring and autumn migration in the Central Mediterranean region. In this area, during spring, these long-distance migrants wintering in western-central Equatorial Africa, concentrate crossing the sea between Africa and Europe through the Channel of Sicily, about 150 km wide, at least part of them *via* the islands of Pantelleria and Marettimo. When they reach western Sicily most of them fly east, along the mountain chain of northern Sicily, towards the Strait of Messina. Nevertheless, thousands of birds use a more direct route to reach the continental mainland undertaking the crossing of the Tyrrhenian Sea *via* Ustica and the Lipari Islands. During autumn the migration of adult Honey Buzzards is less consistent. They tend to follow the Italian Peninsula and northern Sicily reaching Africa through the Channel of Sicily while very few cross the Tyrrhenian Sea. On the contrary, during their first migration, large numbers of juveniles, moving about two weeks later than adults, cross the Central Mediterranean region on a broader front presumably along NE-SW innate axis. It is supposed that larger numbers of adult Honey Buzzards choose the central Mediterranean route during spring migration to reach earlier their breeding areas in east-central Europe. During post-reproductive movements most of them would circumfly the Mediterranean Sea crossing at the Strait of Gibraltar and at the Bosporus. In this picture the discovery of more direct routes between breeding and wintering areas made by juvenile birds during their first migration may have the adaptive value.

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Dr. N. Agostini (corresponding author), Via Carlo Alberto 4, 89046 Marina di Gioiosa Jonica (RC), Italy, E-mail: nicolantonioa@tiscalinet.it; M. Panuccio, Via Mario Fioretti 18, 00152 Roma, Italy;

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The western Honey Buzzard is a long-distance migrant wintering in west-central Equatorial Africa. During spring migration tens of thousands of birds reach their breeding grounds in Europe. Although this species mostly uses soaring and gliding

flight over land, thousands of birds undertake a long sea crossing through the central Mediterranean en route to east-central Europe (Cramp and Simmons 1980). In this paper we review and discuss results of recent studies concerning spatial migration patterns and the water crossing tendency of adult Honey Buzzards in the central Mediterranean area during spring and autumn migration.

During spring adult Honey Buzzards concentrate crossing the sea at the narrowest point (about 150 km wide), between the Cap Bon Peninsula (Tunisia) and western Sicily, at least part of them *via* Pantelleria and Marettimo islands (Fig. 1, Agostini *et al*. 1994, Agostini and Logozzo 1998, Gustin *et al*. 2005), peaking during the first half of May. After they reach western Sicily, most of them fly east along the mountain chain of northern Sicily reaching the Strait of Messina, between southern continental Italy and Sicily (Fig. 1). However, some of the migrants bypass the Strait of Messina and use alternative flyways reaching the Italian Peninsula undertaking a further long powered flight across the Tyrrhenian Sea *via* Ustica and the Li-

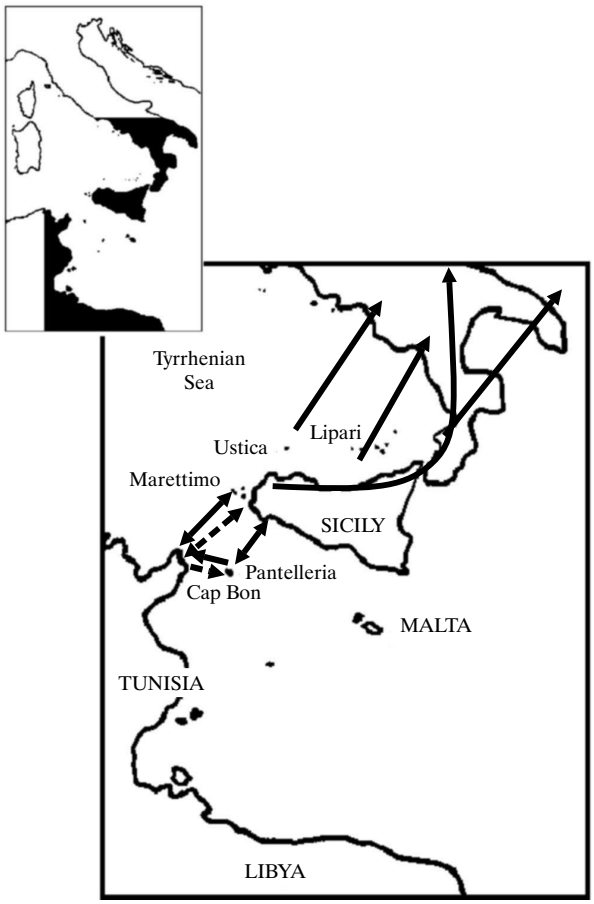


Fig. 1. Approximate migratory flyways used by adult Honey Buzzards during spring and autumn migration across the central Mediterranean

pari Islands (Fig. 1). In particular, during springs 2001-2002 a maximum of about 2000 Honey Buzzards were reported over Ustica (Panuccio *et al*. 2004, Agostini *et al*. 2005a) while between 20 April and 20 May 2004-2005 a maximum of 4420 birds were observed *via* the island of Panarea (the Lipari Islands; Fig. 1, Gustin 2005, Gustin *et al*. 2005). During spring 2004 more than 11 000 Honey Buzzards crossed the Strait of Messina at its narrowest point, and both at the Strait and over Panarea the peak of migration occurred on 11 May (Panuccio and Agostini 2005, Gustin *et al.* 2005); thus migrants showed a high degree of synchronism at these two sites as can be expected from this species which is well known for the condensed migration period of adults with males and females reaching together their breeding areas (Cramp and Simmons 1980, Gensbøl 1992).

During autumn migration adult Honey Buzzards cross the Central Mediterranean between the end of August and the first ten days of September (Agostini and Logozzo 1995, 1997). In this period their passage is less conspicuous: while an average number of 20 473 ± 1941 (*SE*) individuals was reported during springs 1996-2000 at the Strait of Messina (Corso 2001), on average 6714 ± 640 (*SE*) were counted at the same site during autumn 2002-2004 (Panuccio *et al.* 2005, Repaci and Morabito pers. obs.). Thus, as suggested by Agostini and Logozzo (1995), thousands of adults regularly use two different routes each year. Moreover, birds crossing the central Mediterranean during autumn avoid the long crossing of the Tyrrhenian Sea. In particular, few adult birds have been recorded leaving the western slope of the Italian Peninsula from the Circeo promontory and *via* the island of Capri, while over Ustica and Panarea their post-reproductive passage is virtually non-existent (Jonzén and Pettersson 1999, Agostini *et al*. 2003, Agostini *et al.* 2004a, Panuccio *et al.* 2005). In this period, adult Honey Buzzards follow the Italian mainland and northern Sicily concentrating at the Strait of Messina; they reach Africa through the Channel of Sicily, at least part of them *via* Marettimo and Pantelleria islands, like during spring migration (Fig. 1, Agostini and Logozzo 1997, Agostini *et al.* 2000, Agostini *et al.* 2004b, 2005b). It is interesting to note that adult Honey Buzzards passing *via* Pantelleria choose the shortest flyway over water to reach Africa, changing their orientation behaviour leaving the island heading WNW. They make a curvilinear migration over water applying true navigational abilities, Tunisia nearly always being out of sight. Unlike adults, large numbers of juvenile Honey Buzzards undertake sea crossings through the central Mediterranean during autumn migration, probably moving along NE-SW innate axis (Agostini 2004, Agostini *et al*. 1999, Agostini *et al*. 2002, Agostini *et al*. 2004a). Since juveniles tend to migrate about two weeks later than adults during their first migration (Kjellén 1992, Agostini and Logozzo 1995) they probably move along innate directions of migration and, with some exception, they cannot learn the shortest route over sea to cross the Mediterranean by following adults (Agostini 2004, Agostini *et al.* 1999, Agostini *et al.* 2000, Agostini *et al.* 2002, Agostini *et al.* 2004a).

Why is the passage of adult Honey Buzzards across the central Mediterranean less conspicuous during autumn migration? Why do adults show a stronger ten-

dency to undertake water crossing during spring migration? On the base of the age of just six adult birds recovered in the central Mediterranean region during autumn migration, much lower than of adults recovered along the western and the eastern détour (Gibraltar and Bosporus), Schmid (2000) suggested that mostly less experienced individuals use the central Mediterranean route. In particular, the author concluded that with increasing age these birds will learn the more favourable but longer détours *via* Gibraltar and Bosporus. According to Schmid's hypothesis adults migrating in the central Mediterranean region during spring should be funnelled towards the Strait of Messina by their reluctance to cross the sea. However, since part of adults move towards the Strait of Messina while many others cross the Tyrrhenian Sea, are there among them individuals inexperienced to different degree? Are adults moving across the Strait of Messina, among inexperienced birds, more experienced than those moving across the Tyrrhenian Sea? Moreover, why do not large numbers of inexperienced individuals cross the Tyrrhenian Sea during autumn migration like juvenile birds? Since high degree of synchronization was found in the spring passage of adults using different paths it is unlikely that a clear segregation of thousands of raptors having different degrees of experience (inexperience?) occurs at the same time in the same area. Furthermore, during the crossing of the Channel of Sicily, how can inexperienced birds know the shortest flyway over water between Pantelleria and the Cap Bon Peninsula (Agostini *et al.* 2005b, Fig. 1)? During observations made at the Strait of Messina between 25 April and 31 May 2004, only a minority of birds with juvenile characteristics concerning plumage, cere and/or iris – presumably younger individuals – were reported (Panuccio and Agostini 2006). They migrated late in the season, mostly during the last ten days of May. Over Panarea, only five birds showing juvenile characteristics were observed between 25 April and 13 May 2004 (Agostini pers. obs.). In this regard, it is interesting to note that a late spring passage of "non adult" birds was also reported in Israel, thus along the eastern détour (Shirihai *et al*. 2000). In this picture, differently from Schmid (2000), we suggest that during spring migration higher numbers of adult Honey Buzzards breeding in east-central Europe, choose to cross the central Mediterranean region perhaps using a more direct path between wintering and breeding range. Moreover, as they reach this Mediterranean area, they make further decisions choosing among alternative flyways. Besides atmospheric conditions (Agostini *et al.* 2005a), the location of their breeding areas could also play a role in their decision (crossing or not the Tyrrhenian Sea): birds breeding in the southernmost European range may be less reluctant to cross the sea being at the end of their migration and flying in large numbers over wide water surfaces (see also Agostini *et al.* 2003). The observation of large numbers of Honey Buzzards seen undertaking further sea crossings between the Italian Peninsula and ex-Yugoslavia and Albania is consistent with this hypothesis (Gustin and Sorace 2004, Premuda *et al.* 2004). In conclusion, during spring birds could be strongly motivated by the approaching reproduction season to use more direct flyways to reach earlier their breeding areas in Europe, some of them flying over the sea also during the night (Agostini *et al.*

2005a) and moving on a broader front across the Mediterranean basin. During post-reproductive movements, although they apparently defend also winter territories and thus may benefit from an early arrival in Equatorial Africa (Hake *et al.* 2003), many of them would circumfly the Mediterranean Sea crossing at the Strait of Gibraltar and at the Bosporus while those crossing the central Mediterranean region avoid the longer crossing of the Tyrrhenian Sea. The discovery of more direct paths between breeding and wintering areas made by juvenile birds during their first migration (Hake *et al.* 2003) may have adaptive value.

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