

Spring migration of raptors on Conero Promontory

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Abstract - A survey of raptor migration on the Conero promontory was carried out during spring 1999 (April 20 - May 20), in which the time of passage, and the direction of both in-coming and out-going flights were recorded. Some 2640 migrating raptors were observed, mostly Honey Buzzards (1699 individuals) and Marsh Harriers (503 individuals), altogether representing about 83.4% of total observations. In-coming flight direction was mostly WSW and WNW, while the direction of out-going flights was mainly ENE and ESE. Significantly more individuals were observed passing in the afternoon (15-1800). In addition, the present study, reveals an increase in the number of raptors observed (about 40% more) migrating over the study site compared to a similar survey carried out in spring 1994. The number of raptors observed in the present study being second only to the number of raptors recently observed migrating over the Straits of Messina. Together, our results confirm the importance of the Conero promontory as a site for raptor spring migration.

Introduction

During migration, raptors concentrate in a few sites (bottle-necks) to avoid long sea crossing (Kerlinger 1989). In the Palearctic, the Straits of Gibraltar and Bosphorus, in the westernmost and easternmost regions of the Mediterranean sea, are the two most important bottle-necks (Porter and Willis 1968, Evans and Lathbury 1973), involving the passage of 235,000 (Finlayson 1992) and 131,000 individuals (Cramp and Simmons 1980), respectively. However, other important bottle-necks have also been identified in the central Mediterranean i.e. Cap Bon (Thiollay 1975, 1977, Dejonghe 1980, Agostini and Duchi 1994, Agostini *et al.* 1994a, b), Malta (Beaman and Galea 1974) and Straits of Messina (Dimarca and Iapichino 1984, Giordano 1991, Agostini 1992, Agostini *et al.* 1993, Agostini *et al.* 1994a, b), indicating an alternative, less known, migration route across the central Mediterranean. Consistent with this idea, recent studies on spring raptor migration have revealed the importance of other Italian sites: Marettimo (Agostini and Logozzo 1998), Otranto Cap (Gustin 1989, Gustin and Pizzari 1998), Arenzano (Baghino and Leugio 1989, 1990, Baghino 1996) and Conero promontory (Borioni 1993, 1995, 1997). Migration studies in these latter sites are critical to understand patterns of raptor migration across the central Mediterranean.

The Conero promontory on the Adriatic coast of Italy, is well known for the passage of migrating raptors in spring (Borioni 1993, 1995, 1997).

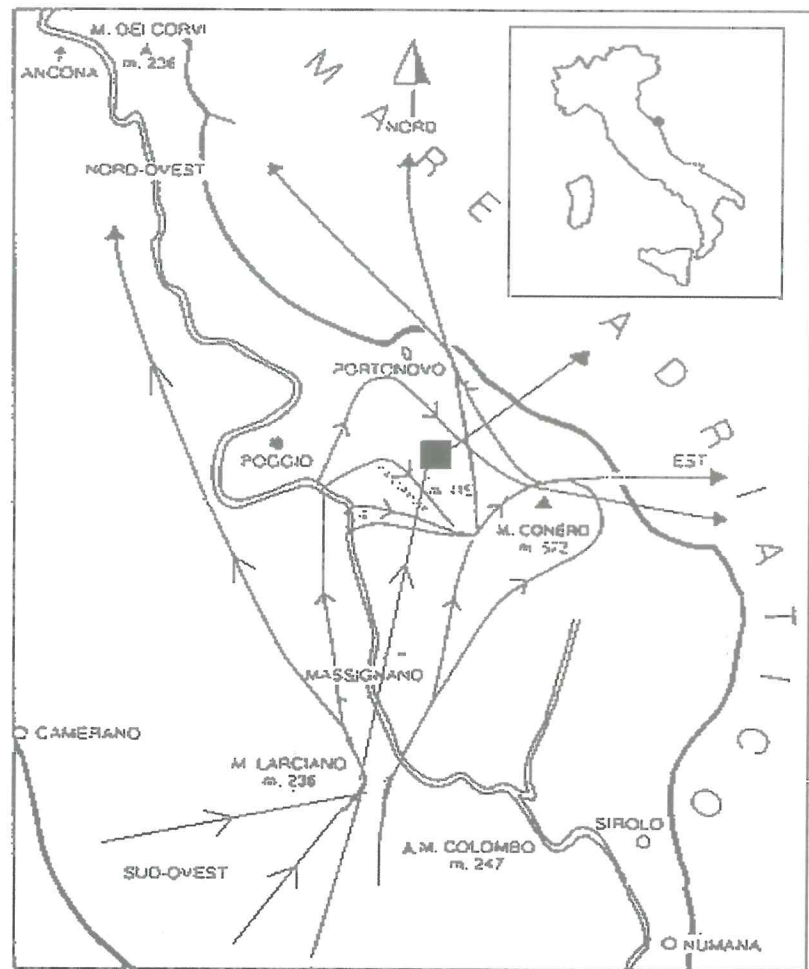
The aim of this study was to describe raptor passage over Monte Conero during spring migration and compare the observed patterns of migrations with those reported at the same site during a previous survey and with those observed in other Italian sites. In particular, we systematically recorded time of the day of the passage and flight direction.

Study site and methods

The Conero promontory is a calcareous mountain about 580 m high that stretch out the sea. Observations were carried out from "Pian Grande" site (43°35'N - 13°37'E) at 415 a.s.l., on North sector of the promontory (fig. 1). This site was selected to: (i) collect data comparable to those recorded by earlier studies in the same area (Borioni 1993, 1997), and (ii) maximise visibility, this site allowing to detect raptors flying over both, the sea and the promontory.

Daily observations were carried out from 21 April to 20 May 1999, by a minimum of two observers and a maximum of ten observers, using 10-40x binoculars and 20-60x telescopes. This period was selected because it coincided with the highest intensity of

Figure 1. The Conero promontory. The square points out the site in which the study was carried out. The arrows shows the north and east, preferential out-going flights directions of raptors.



raptor passage in previous years (Borioni 1993, 1995, 1997). Ten daily hours of observation, from 8.00 to 18.00, were divided in five time periods: 8-10; 10-12; 12-14; 14-16, 16-18.

For each observed raptor we recorded: (i) date, (ii) hour, (iii) species, and (iv) flight direction.

We compare our data with the data collected at the same site in spring 1994 (16 April - 15 May; Borioni 1997). In addition, we compared our data with the data collected in five other Italian bottle-necks: Arenzano (Baghino and Leugio 1990), the Straits of Messina (Zalles and Bildstein (2000) Marettimo (Agostini and Logozzo 1998), Cape Otranto (Gustin 1989), and S. Bartolo promontory (Pandolfi ined.).

To avoid pseudoreplication problems we did not consider raptors flying around the study area early in the morning which may have roosted in the area overnight and may have been counted in the evening of the previous day. In addition, each raptor was followed as long as it was visible from the view point.

Results

A total of 2640 raptors of 15 species were observed (Table 1). High numbers of passing individuals were recorded on 29-30 April (386 and 261 individuals respectively), on 4-6 May (259, 127 and 191 individuals respectively) and on 15 May (170 individuals), the peak occurring on 29 April when 14.6% of the individuals were observed. In 17 days out of 30 (57%) more than 50 raptors were observed.

The ratio *Accipitriformes/Falconiformes* was 9.2 to 1. The most common species were Honey Buzzard (*Pernis apivorus*) and Marsh Harrier (*Circus aeruginosus*) with 1699 and 503 individuals respectively (Table 1).

The passage median of Honey buzzard was on 4 May, with three noticeable migration peaks over the study period (Fig. 2A). Honey buzzards passed over the study site in typically small groups (mean group size = 2.43 ± 2.59 individuals): many birds passed singly

(52% of the observations) and flocks larger than 6 individuals accounted for about 9% of the observations. Honey buzzards were significantly more likely to pass between 1400 and 1700 (45% of the observations, $X^2 = 85.9$, $df = 2$, $p < 0.001$), with no tendency for larger flocks to be observed late in the day ($X^2 = 0.93$, $df = 4$, $p = NS$).

Migration pattern of Marsh Harriers is described in Fig. 2B. Migrating marsh harriers were mainly juvenile birds: only 49 (9.7%) out of 503 observed individuals were adults. The 84% of adults were females. Marsh harriers passed mainly singly (78% of the observations, mean 2.15 ± 2.45 individuals), and late in the day: 46.5% of the observation occurring between 15-1800 ($X^2 = 39.1$, $df = 2$, $p < 0.001$).

Also taking into account all species, the highest of raptors was recorded in the afternoon ($\chi^2 = 95.4$, $df = 4$, $p < 0.001$; Fig. 3). Most of raptors arrived from inland: 50.5% reached the promontory from WSW, 48.5% from WNW and 1.5% from north ($X^2 = 229.3$, $df = 2$, $p < 0.001$). The birds reaching the study site by

gliding and soaring flight left the coast toward ESE (66.5%) or ENE (28.8%). Only 4.7% turned back inland.

The migratory flow showed a significant variation throughout the day, with the highest number of raptors recorded in the afternoon.

When comparing our results with those recorded in 1994, a higher number of raptors was observed in 1999 with an increase of 40% of observations (table 1). In particular, the increase regarded the most abundant species: Marsh Harrier (+ 17%), and Honey Buzzard (+ 71%)

Raptor passage over Conero promontory was intense relative to other Italian sites (i.e. Arenzano in Liguria, Straits of Messina and Marettimo in Sicily and Cape of Otranto in Apulia, S. Bartolo, 60 Km north of Conero on the Adriatic coast; table 1). Marsh harrier and Honey Buzzard were the most common species in all sites, except Cape Otranto in Apulia where Kestrel and Marsh Harrier were the most abundant (Table 1).

Table 1. Number of raptors censused in a few Italian bottle-necks: Arenzano (data from Baghino & Leugio 1990), Strait of Messina (data from Zalles & Bildstein 2000), Marettimo (data from Agostini & Logozzo 1998), Cape Otranto (data from Gustin 1989) Conero (data from Borioni 1997), and S. Bartolo promontory (data from Pandolfi unpublished). Partial total refers to the classified individuals, general total includes also unclassified raptors.

	Arenzano	Strait of Messina	Marettimo	Cape Otranto	Conero	Conero	S. Bartolo
Years	1988-89	1989-98	1998	1989	1994	1999	1998
Period	March-May	April-May	March and May	March-May	April-May	April-May	March-May
n. days	40.5§	49§	29	34	30	30	64
n. hours	169.2§	–	232	291	300	300	496
n. species	17	50	6	13	17	15	16
Osprey	2	12	1	–	9	8	6
Short-toed Eagle	50	5	–	–	3	2	–
Red Kite	3	5	–	2	1	4	1
Black Kite	54	519	136	19	12	15	11
Hen Harrier	4	43	1	–	1	1	9
Marsh Harrier	33	1436	447	332	416	503	162
Montagu's Harrier	26	375	17	132	57	27	12
Pallid Harrier	–	16	–	72	–	–	–
Long-legged Buzzard	–	4	–	7	–	–	–
Common Buzzard	1	36	–	–	57	18	10
Honey Buzzard	1822	19273	1009	217	488	1699	589
Sparrowhawk	12	–	–	–	82	18	10
Kestrel	20	583	–	350	106	146	51
Lesser Kestrel	6	40	–	5	9	5	5
Red-footed Falcon	34	1017	–	38	31	38	27
Hobby	30	140	–	18	72	65	32
Partial total	2077	23533	1651	1192	1380	2598	921
General total	2194	23546	1651	1205	1581	2640	1093

§ mean value

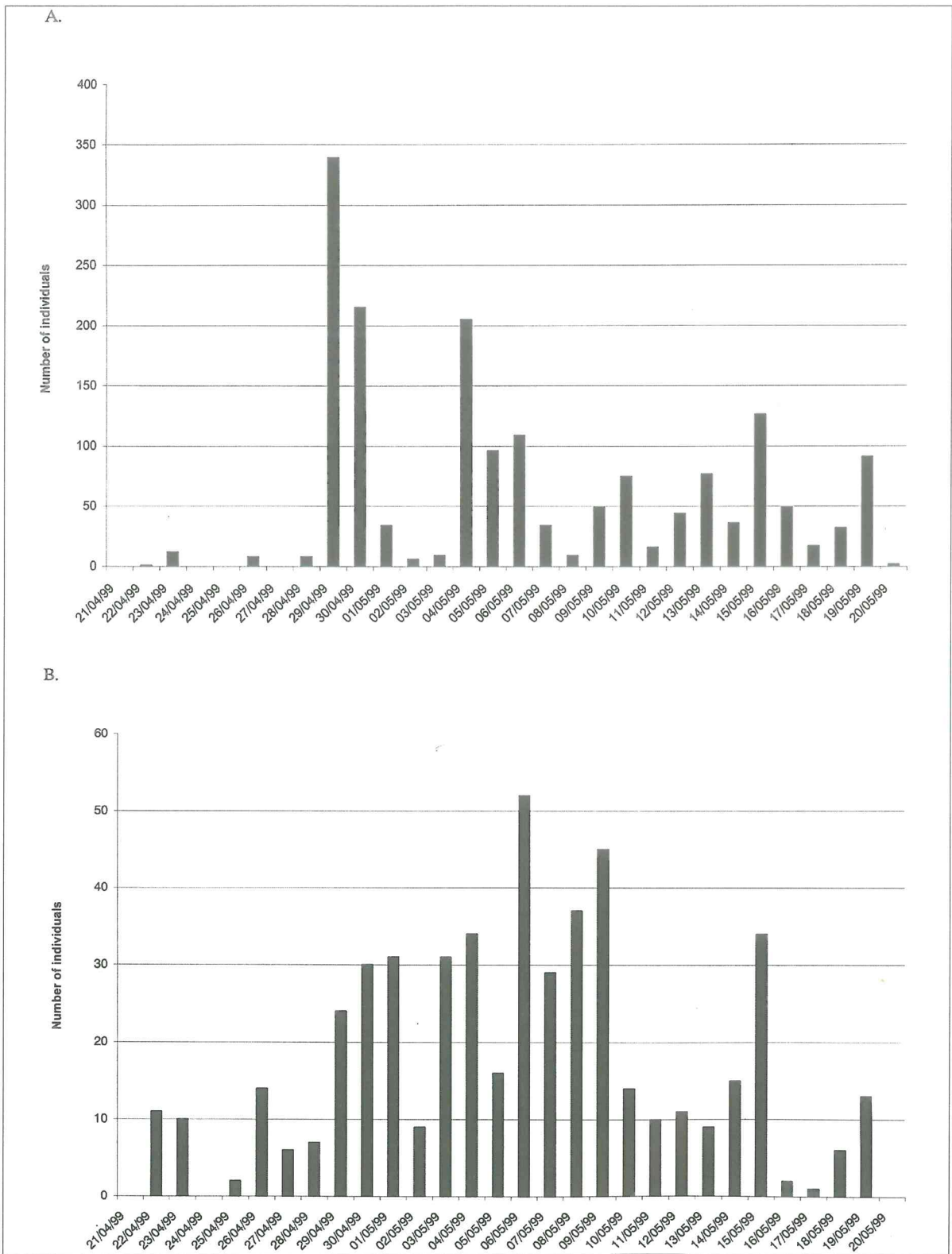


Figure 2. Migration phenology of two raptors species at Pian Grande on Conero promontory in spring 1999 (21 april - 20 may). A. Honey Buzzard. B. Marsh Harrier.

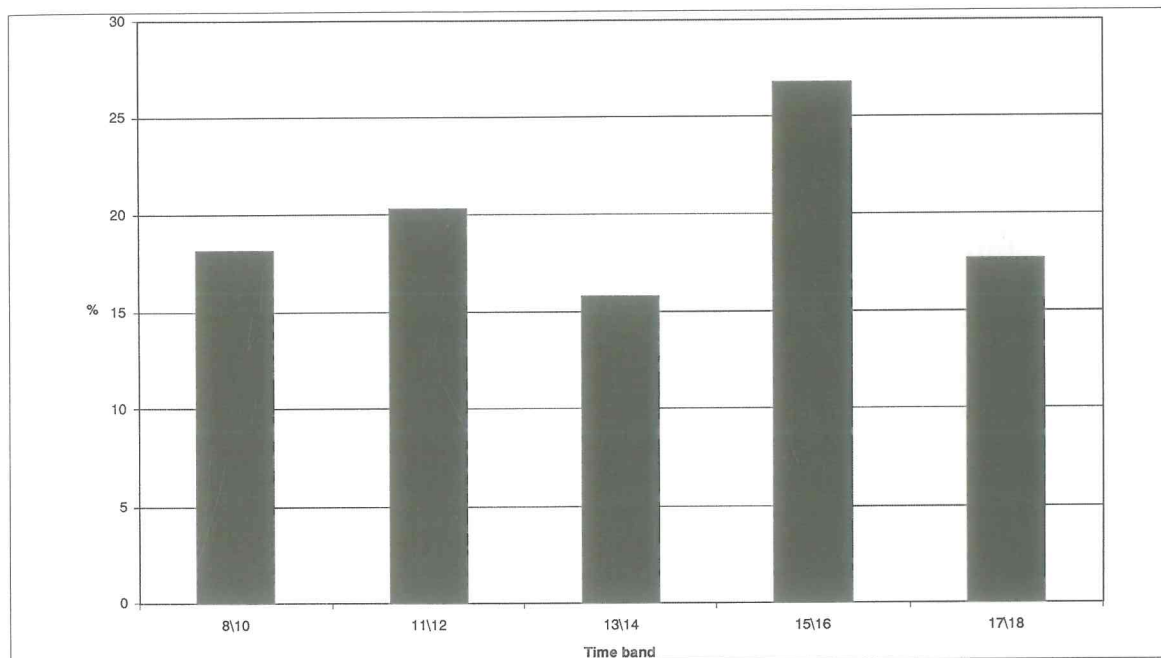


Figure 3. Percentage of migrating raptors observed in different time periods on Conero promontory in spring 1999.

Discussion

Number of migrating raptors observed in a bottle-neck may change dramatically over the years. For example, numbers recorded at the Straits of Messina varied in the 1984-1990 period between 3198 and 12302 individuals (Giordano 1991). Subsequently, in 1989-98 period the mean value was equal to 18.494 individuals (Zalles and Bildstein 2000).

On Conero promontory, 792 raptors were recorded in 1987 and 2351 in 1990 (Borioni 1993, 1995, 1997). Compared to the survey of spring 1994, our data indicate a clear increase of raptors migrating over the Conero promontory, particularly Marsh Harrier and Honey Buzzard. This positive trend for these two species should be confirmed by future studies in situ. The observed raptors were not individually recognisable and thus our results are potentially biased by pseudoreplication (Agostini and Duchi 1994; Meyer *et al.* 2000). However, although we cannot exclude it, this possibility is unlikely to bias our results for the following reasons. First, we minimised the possibility of re-counting birds that may have remained in the area (see methods). Second, other studies of migrating raptors in the same and in other study areas are typically and similarly prone to pseudoreplication problems. The comparison of different studies is therefore unlikely to be differentially affected by pseudoreplication. Third, migrating raptors are unlikely to remain by bottle-necks and thus to be re-counted (Lind pers. com.).

However, the reported comparison with other bottle-necks may have been biased in two ways: (i) the period of observation were to some extent different, and (ii) surveys conducted in different years might be differently affected by climatic conditions (Agostini *et al.* 1993, 1994a). Nevertheless, the present study strongly suggests that the Conero promontory is a very important site for the spring passage of raptors throughout central Mediterranean (Baghino and Leugio 1989, 1990, Gustin 1989, Giordano 1991, Agostini and Logozzo 1998). Consistent with previous studies in the same study site (Borioni 1993, 1997) and in other bottle-necks (Arenzano and Strait of Messina), we found that Conero promontory is mainly interested by the passage of Honey Buzzard and Marsh Harrier, whereas the movement of *Falconiformes* and other species of diurnal raptors (*Milvus sp.*, Osprey *Pandion haliaetus*, Buzzard, *Aquila sp.*, *Accipiter sp.*, Short-toed Eagle *Circus gallicus*), is less intense.

Honey Buzzard follows three main routes in the Mediterranean area with as many main bottlenecks: the Strait of Gibraltar (Evans and Lathbury 1973, Finlayson 1991) Bosphorus (Porter and Willis 1967, Cramp and Simmons 1980), and Channel of Sicily (Thiollay 1975, 1977, Dimarca and Iapichino 1984, Giordano 1991, Agostini 1992). The movement along the last route throughout the central Mediterranean may be resumed in the following manner. Migrants, arriving from Africa, concentrate on the Straits of

Messina and secondly on Marettimo island (Giordano 1991, Agostini and Logozzo 1998). After crossing the Strait, part of population crosses the Apennines probably in more sectors (not still known), subsequently concentrating on Conero promontory, which appears to be the most important site along the Adriatic coast. From the Conero promontory Honey buzzards are then likely to cross the Adriatic sea towards North-Eastern Europe. The afternoon increase of the observations of Honey Buzzard and other raptors might be related to the presence of the best condition of flight in terms of upward currents.

It must be noted that some species which migrate earlier in spring, such as Buzzard, Sparrowhawk (Cramp and Simmons 1980), and Marsh Harrier (Agostini and Logozzo 2000), may have been underestimated by our study. If this is the case, the role of the Conero promontory may be even more important for these species than it is currently appreciated. In conclusion, the Conero promontory allows an important number of raptors to cross the Adriatic sea and reach North-eastern breeding areas.

Acknowledgements - The "Monte Conero" Park and the Italian League Protection Birds (LIPU) promoted this research. We are grateful to all participants to the activity of monitoring raptors on Conero promontory and in particular: Andrea Aimi, Luca Baghino, Adriano Gabrielli, Luisa Parodi, Massimo Pontecorvi, Vincenzo Rizzi, Enzo Savo, Corrado Teofoli.

References

- Agostini N., 1992. Spring migration of Honey Buzzards (*Pernis apivorus*) at the Straits of Messina in relation to atmospheric conditions. *J. Rapt. Res.* 26: 93-96.
- Agostini N., Malara G., Neri F. and Mollicone D., 1993. La migrazione primaverile del Falco pecchiaiolo, *Pernis apivorus*, sullo stretto di Messina: problemi di protezione. *Riv. Ital. Orn.* 63: 187-192.
- Agostini N. and Duchi A., 1994. Water-crossing behaviour of Black Kites (*Milvus migrans*) during migration. *Bird Behav.* 10: 45-48.
- Agostini N., Malara G., Neri F. and Mollicone D., 1994a. Spring migration of Honey Buzzard (*Pernis apivorus*) at cap bon (Tunisia) and at the Straits of Messina. VI Convegno Italiano di ornitologia, Atti: 451-452.
- Agostini N., Malara G., Neri F., Mollicone D. and Melotto S., 1994b. Flight strategies of Honey Buzzards during spring migration across the central Mediterranean. *Avocetta* 18: 73-76.
- Agostini N. and Malara G., 1997. Entità delle popolazioni di alcune specie di rapaci Accipitriformi migranti, in primavera, sul Mediterraneo centrale. *Riv. Ital. Orn.* 66 (2): 174-176.
- Agostini N. and Logozzo D., 1998. Primi dati sulla migrazione primaverile dei rapaci Accipitriformi sull'isola di Marettimo (Egadi). *Riv. Ital. Orn.* 68: 153-158.
- Agostini N. and Logozzo D., 2000. Migration and wintering distribution of the Marsh Harrier (*Circus aeruginosus*) in southern Italy. *Buteo* 11: 19-24.
- Baghino L. and Leugio N., 1989. La migration printanière des Rapaces à Arenzano (Genes-Italie). *Nos Oiseaux*, 416: 65-80.
- Baghino L. and Leugio N., 1990. La migrazione prenuziale degli Accipitriformes e Falconiformes in un sito della Liguria occidentale nel 1988 e 1989. *Avocetta* 14: 47-57.
- Baghino L., 1996. The spring migration of raptors over a site of western Liguria (Italia): results 1985 to 1994. In: Muntaner J. and Majol J. (Eds.). *Biologia y Conservacion de las Rapaces Mediterraneas*, SEO, Madrid.
- Beaman M. and Galea C., 1974. The visible migration of raptors over the maltese islands. *Ibis* 116: 419-431.
- Berthold P., 1973. Proposal for the standardization of the Presentation of data of annual events, especially of migration data. *Auspicium*, 5: 49-59.
- Borioni M., 1993. Rapaci sul Conero. Parco del Conero. Pp. 1-113.
- Borioni M., 1995. Studio sulla migrazione prenuziale dei rapaci diurni nel parco del Conero dal 1987 al 1990. In: Pandolfi M. U. F. Foschi (red.) - Atti del VII Convegno Nazionale di ornitologia. *Suppl. Ric. Biol. Selvaggina*, XXII: 517-518.
- Borioni M., 1997. Ali in un Parco. Parco naturale del Conero. Pp. 1-95.
- Cramp S. and Simmons K.E.L., 1980. Handbook of the birds of Europe, Middle East and North Africa. The birds of the Western Palearctic. Vol. II. Oxford University Press, Oxford.
- Dejonghe J.F., 1980. Analyse de la migration prénuziale des rapaces et des cicognes au Cap Bon (Tunisie). *L'Oiseau et R.F.O.* 50.
- Dimarca A. and Iapichino C., 1984. La migrazione dei Falconiformi sullo stretto di Messina. Primi dati e problemi di conservazione. LIPU (Lega Italiana protezione Uccelli).
- Evans P.R. and Lathbury G.W., 1973. Raptor migration across the straits of Gibraltar. *Ibis* 115: 572-585.
- Finlayson C., 1992. Birds of Strait of Gibraltar T. and A.D. Poyser Ltd, London.
- Galea C. and Massa B., 1985. Notes on the raptor migration across the Central Mediterranean. Pp. 257-261. In: I. Newton and R.D. Chancellor (EDS.), *Conservation studies of birds of prey*. Technical Publ. No. 5, Int. Council for Bird Protection.
- Giordano A., 1991. The migration of birds of prey and storks in the strait of Messina. *Birds of Prey Bulletin* 4: 239-250.
- Gustin M., 1989. Considerazioni generali sulla migrazione prenuziale dei falconiformi a capo d'Otranto (Lecce), durante la primavera 1989. In: S.R.O.P.U. (red.) - Atti V Convegno Italiano di Ornitologia. *Suppl. Ric. Biol. Selvaggina*, XVII: 457-460.
- Gustin M. and Pizzari T., 1998. Migratory pattern in the genus *Circus*: sex and age differential migration in Italy. *Ornis svecica* 8: 23-26.
- Kerlinger P., 1989. Flight strategies of migrating Hawks. Chicago Univ. Press, Chicago, Ill.
- Meyer S.K., Spaar R. and Bruderer B., 2000. To cross the sea or to follow the coast? Flight directions and behaviour of migrating raptors approaching the Mediterranean sea in autumn. *Behaviour* 137: 379-399.
- Porter R. and Willis I., 1968. The autumn migration of soaring birds at the Bosphorus. *Ibis* 110: 520-536.
- Thake M. A., 1980. Gregarious behaviour among migrating Honey Buzzard (*Pernis apivorus*). *Ibis* 122: 500-505.
- Thiollay J.M., 1975. Migration de printemps au Cap Bon (Tunisie). *Nos Oiseaux* 33: 109-121.
- Thiollay J.M., 1977. Importances des populations de rapaces migrateurs en Méditerranée occidentale. *Alauda* 45 (1): 115-121.
- Zalles J.I. and Bildstein K.L. eds., 2000. Raptor watch: A global directory of raptor migration sites. Cambridge, UK: BirdLife International; and Kempton, PA, USA: Hawk Mountain Sanctuary (BirdLife Conservation Series No. 9).