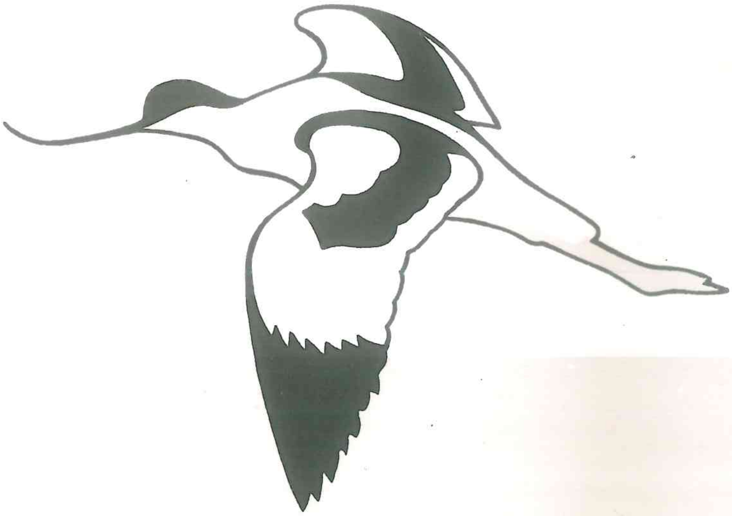
ISSN
0404-4266



AVOCETTA

Journal of Ornithology

CISO
Centro Italiano Studi Ornitologici

Volume 26 2002 N. 1

AVOCETTA

Journal of Ornithology
Published by the CISO

CISO

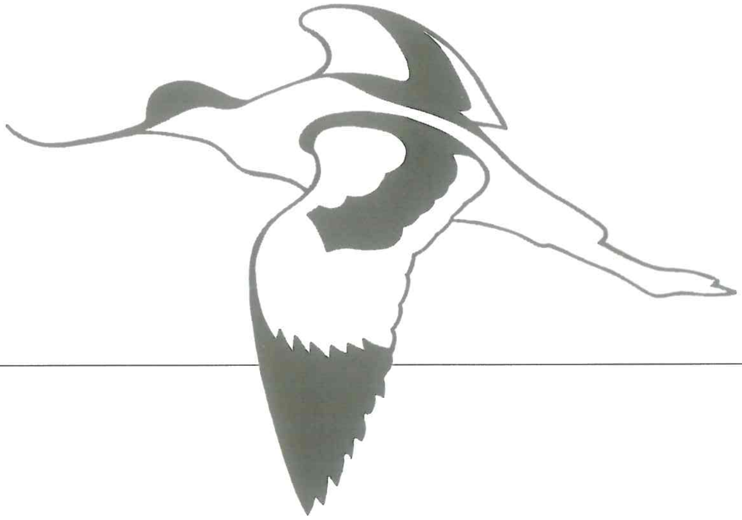
Centro Italiano Studi Ornitologici
Sito Internet: HTTP://www.ciso-coi.org.

The CISO has the aim to stimulate and organize the ornithological research in Italy. All paid-up members of the CISO are entitled to receive Avocetta free. Applications for membership are welcome.
The journal appears in 1 volume per yeat, normally 2 issues per volume.
Subscription price for 2002 is Euro 26.00, post free.
Please for any further information, write to the Secretary, Francesco MEZZAVILLA, via Malviste, 4, 31057 Silea (TV), Italy - E-mail: f.mezza@libero.it.

Il CISO ha lo scopo di promuovere e organizzare la ricerca ornitologica in Italia. Tutti i membri del CISO in regola con il pagamento della quota associativa ricevono la rivista Avocetta. Per nuove richieste di associazione, abbonamenti alla sola rivista, arretrati ecc., scrivere alla Segreteria, Francesco MEZZAVILLA, via Malviste, 4, 31057 Silea (TV), Italy - E-mail: f.mezza@libero.it.
La rivista viene pubblicata in 1 volume ogni anno, normalmente con 2 numeri per volume.
La quota di iscrizione per il 2002 è di Euro 26.00, comprese le spese postali. Il pagamento deve essere inviato alla segreteria: Francesco MEZZAVILLA, via Malviste, 4, 31057 Silea (TV) - c.c.p. 34325308.

Avocetta viene pubblicato con il contributo finanziario di:
Dipartimento Scienze e Tecnologie Avanzate, Alessandria
Dipartimento di Biologia Animale, Torino
Dir. Resp. S. Frugis, Autorizzazione Tribunale Parma n. 698, 11.4.1984.
Stampato dalla Tipolitografia Luxograph s.r.l. - Palermo

ISSN
0404-4266



AVOCETTA

Journal of Ornithology

CISO
Centro Italiano Studi Ornitologici

Volume 26 2002 N. 1

Avocetta N° 26 (1): 3-6 (2002)

The Corncrake (*Crex crex*) in Friuli-Venezia Giulia (North-eastern Italy)

Gianluca Rassati[1], Christopher Paul Tout[2]

[1] *Via Udine 9, 33028 Tolmezzo (UD), Italy*
[2] *Via Trieste 29, 34013 Duino (TS), Italy*

Abstract - The following article is a summary of the current levels of knowledge available for the Corncrake in the Region Friuli-Venezia Giulia, especially with regard to studies carried out from the middle of the 1980's onwards.

This rail species has been the subject of continuous study since the end of the 1980's in certain sample areas of Upper Friuli both through the collection of general data and, from 1993 onwards, breeding censuses carried out at least twice in each nesting season. During the 1995 nesting season a breeding survey was carried out covering the entire territory of the Region.

The studies have enabled us to establish that in Friuli-Venezia Giulia the species is a regular migrant and nesting species that is occasionaly present even in the autumn and winter when one occasionally encounters individuals that for various reasons (injuries, handicaps or disease) are unable to migrate.

The regional population censussed in 1995 yielded 203 calling males largely located in the central-north part of the Region at an altitude between 100m a.s.l. and 1600m a.s.l. (68,8% of the calling males were found between 500m a.s.l. and 999m a.s.l.). In Upper Friuli, for the period 1993-1999, the majority of the calling males (51,3%) were located between 200m a.s.l. and 399m a.s.l..

The bird is almost completely absent below 200m a.s.l. as a result of the high levels of human impact on the environment and the subsequent absence of suitable habitats for the species. The increasing rarity of the species above 1100m a.s.l. is due to the lack of broad valley bottoms and human settlements with their regularly cut hay meadows. The upper altitudinal limit for the species is determined by the disappearance of grassland habitats which are replaced by krummholz scrub, screes and bare rock.

The environment favoured by the species in Friuli-Venezia Giulia seems to consist of relatively humid hay meadows with good vegetational cover which are regularly cut in areas with at most a slight slope.

The authors hope that concrete protection measures for the species will be taken with regular monitoring over the years with a view to gathering information on the habitats used by the birds so that appropriate conservation projects can be undertaken.

Introduction

The information regarding the presence, distribution and current status of the Corncrake in Friuli-Venezia Giulia and the rest of Italy is sparse. Only recently has there been a increase in scientific interest in the species and there have been some contributions which have improved, if only slighty, the current state of knowledge.

According to Vallon (1907) the bird in Friuli was "common in summer, departing in October when they are very numerous". Following on from this, until the 1980's, there is an almost total absence of published data even though the bird was well known to ordinary people, in particular to farmers, livestock owners and hunters. In the Friulan language there are in fact a some names for the Corncrake still in use, for example "Coiot da la cultura" in the municipality of Forni di Sopra and both "Crac" and "Coiat" in the municipality of Lauco (Rassati and Cescutti 1999).

Following on from this, thanks largely to some investigations of the Region's avifauna, the species was "rediscovered" and there are nesting records classified as "probable" for the Provinces of Pordenone and Udine (Parodi 1987; Utmar and Parodi 1990; AA.VV. 1991; Rassati 1997) and a confirmed nesting attempt for the Province of Udine (Utmar and Parodi 1990; Rassati 1997).

From the second half of the 1980's one of the authors (G. Rassati) undertook studies aimed at collecting as much information as possible on the Corncrake throughout the Region with a view to clarifying the current status and distribution of the species together with some notes on the habitats frequented by the birds.

Accepted 10 May 2001

Materials and Methods

From the end of the 1980's certain populations of Corncrakes have been continuously monitored in some sample areas (250-1450m a.s.l.) located in the Tagliamento, Lumiei and Degano valleys in Upper Friuli. Initially only information on the distribution of calling males, records of other individuals and data on the sites frequented by the species during the breeding season was recorded but from 1993 onwards censuses using transect routes from 21:00 onwards were carried out during which calling males were identified. These transects were repeated at least twice in the period from late May to early July with some visits (carried out both at night and during daylight hours) during which further data on the environment in which the birds were located was collected together with information on the exact location of the birds. From 1995 onwards further sample areas were added in Upper Friuli both in the valleys already mentioned and in the But and Resia valleys in order to obtain a more detailed picture for the species.

During the 1995 breeding season the entire north-central parts of the Provinces of Pordenone and Udine were divided into 28 districts divided from each other by natural or man-made barriers such as rivers, mountain ridges, roads or railways. Each district was the responsibility of a different team of observers which had to travel along a transect within the district in the course of a visit designed to take in most of the habitat suitable for Corncrakes available in order to locate the maximum number of calling males possible which were recorded on specially designed recording sheet together with a sketch-map of the route followed. Usually it was necessary to carry out a daytime reconnaisance of the route in order to locate suitable habitat to visit later and check for problems of access.

The weather conditions in summer 1995 were very wet and affected the research, often limiting the accuracy of the data and sometimes rendering them impossible in the case of very heavy rain, not a rare event in Upper Friuli in June.

The visits (two where possible) were carried out between the end of May and the end of June from 9 p.m. onwards.

Efforts to question local farmers, livestock rearers and gamekeepers were also made but these proved to be a poor source of information.

Results

In the course of the 1995 breeding season a maximum of 203 calling male Corncrakes were censussed in Friuli-Venezia Giulia. 181 of which were in the Province of Udine and 22 in the Province of Pordenone. These were located in 65 "leks" (sites with at least one calling Corncrake within earshot) located within the territories of 28 municipalities (Fig. 1).

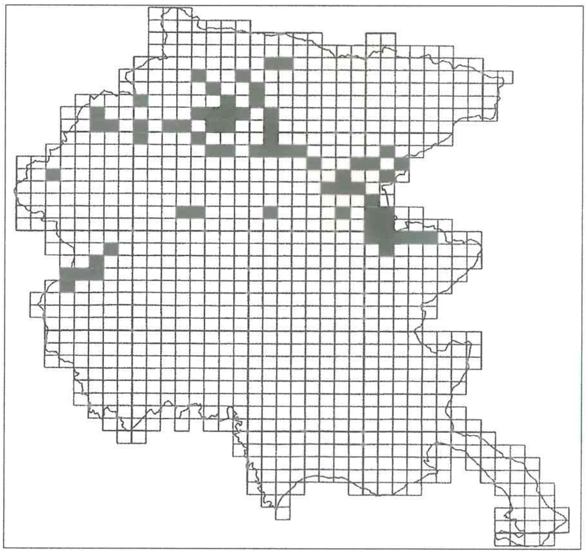


Figure 1. Distribution of singing male Corncrakes in Friuli-Venezia Giulia in 1995. The base map is that of the Regional Technical Map wich consists of 981 rectangular quadrats of 3.2 Km by 2.7 Km, each therefore covering an area of 8.64 Km^2.

The majority of the calling males were found between 500m and 999m above sea-level (68.8%). Only one male was found at an altitude of between 100m and 199m a.s.l. (in the municipality of Osoppo, Udine), above 1100m a.s.l. the birds were scarce and localised. The altitude at which the highest birds were found were both in the municipality of Budoia (Pordenone) and were heard between 1500m and 1599m a.s.l. (Fig. 2).

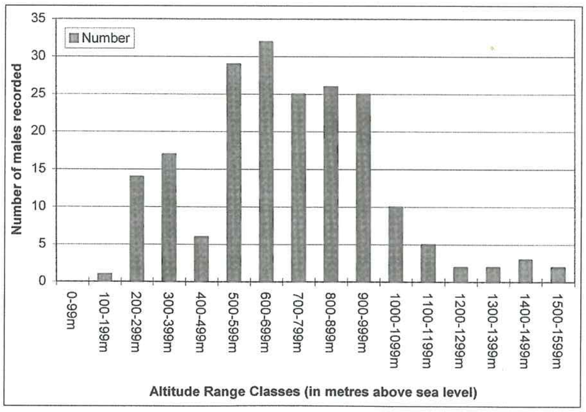


Figure 2. Distribution of singing male Corncrakes by altitude in Friuli-Venezia Giulia in 1995.

In the more representative sample areas in Upper Friuli which were studied for several years the number of calling males varied from a minimum of 12 individuals (minimum number accertained) in 1996 through to a maximum of 26 calling males (minimum number accertained) in 1999 (Fig 3).

In Upper Friuli the majority of individuals (51,3%) were counted between 200 and 399 metres above sea-level (Fig. 4). From 400m to 1099m a.s.l. the number of individuals is variable and rather low. Only 10 individuals were located between 1100m and 1399m a.s.l. The highest calling bird was found at about 1400m in the municipality of Sauris (Udine).

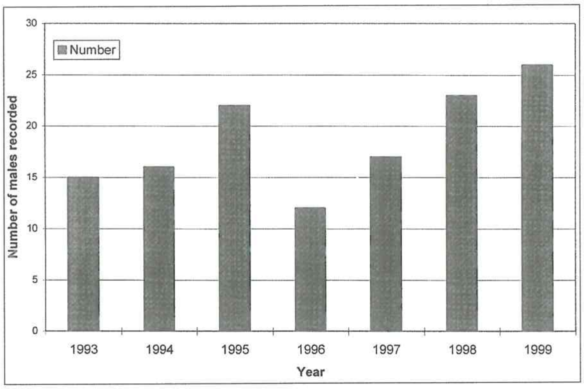


Figure 3. Number of singing male Corncrakes in some representative areas of Upper Friuli in the period 1993-1999.

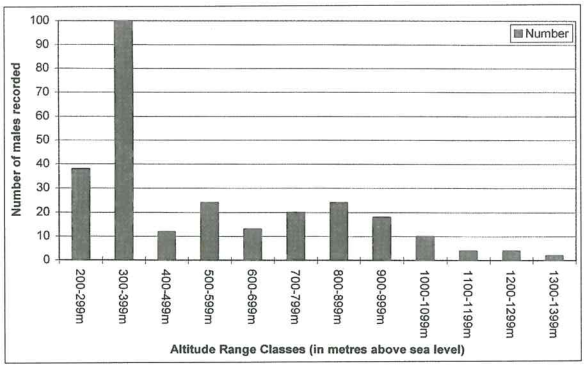


Figure 4. Distribution of singing male Corncrakes by altitude in the sampling areas of Upper Friuli in the period 1993-1999.

When one considers these numbers it is remarkable that in recent years there have been only three proven cases of nesting by Corncrakes in Friuli-Venezia Giulia: two in the municipality of Socchieve (Carnia) 15th June 1988 and in the course of the 1995 breeding season (Rassati 1997) and another near the village of Monteaperta in the municipality of Taipana (in the valley of the river Cornappo) in July 1990 (Utmar and Parodi 1990).

Discussion

The research carried out from the second half of the 1980's onwards has enabled us to establish that the Corncrake in Friuli-Venezia Giulia is a regular migrant and breeder which is occasionally present in autumn and winter though these records probably refer to individuals which for various reasons (injuries, handicap or disease) have found it impossible to migrate. We are also able to state that the bird is more widely distributed in the Region than previously thought and quite common in certain circumscribed areas.

The preferred environment during the breeding season consists of fairly humid hay meadows with good vegetational cover, cut regularly and in areas which are level or only a slight slope.

The Corncrake is rare and localised during the breeding season in the central and southern parts of the Region while it seems quite uniformly distributed in the central-north part (Fig. 1), particularly in the Province of Udine, with the exception of two areas: Upper Pordenone and the Canal del Ferro-Valcanale. This is probably the result of vast areas of habitat unsuitable for the species (woods, bare rock, scree and river beds) and because of a lack of observer coverage. Carnia is the area with the largest concentration of birds with the species found in every municipality. In the 1995 breeding season 71.5% of the municipalities of Carnia held approximately half of the subjects heard in the entire Region.

The altitudinal distribution shown in figure 2 can be explained in that the areas situated below 200m a.s.l. are subject to heavy human influence and that areas potentially suitable for the species are occupied by urban areas, industrial complexes, and especially intensive agriculture creating a highly degraded environment in which there is no space for the species. Beyond 1100m a.s.l. the species becomes rarer because the areas of broad valley bottoms are absent as are villages and hamlets with their regularly cut hay meadows. The upper limit for the species is determined by the disappearance of grasslands and their replacement with scrub, scree and bare rock.

The altitudinal distribution for the species shown in figure 4 is due to the wide valley bottoms present along the Tagliamento between 200m and 399m a.s.l. occupied by hay meadows on level ground which are cut annually. Higher up fewer birds are found for the same reasons indicated at a regional level.

Figures 2 and 4 illustrate some differences in the presence of the birds in the two respective study areas but at the same altitude. This is due to the different timeframe of the two studies and the availability of many areas suitable for Corncrakes between 500m and 999m above sea level at a regional level.

From the study carried out over a number of years it can be seen that the variation in the number of calling males in the sample areas in Upper Friuli, although varying quite widely in percentage terms has not varied greatly overall (Fig. 3) but at the level of a single sample site one year may produce 8-10 calling males while the following year only 1 or 2 are present (and vice versa). This is probably due to the fact that the males seem to gather to call around the first individual(s) to arrive. Males arriving later seems to be irresistibly drawn by the calls of conspecifics and gather in clusters around him, forming leks where up to ten individuals can be found in a relatively limited area.

The number of calling males (a maximum of 203) located at a regional level during the 1995 breeding season is certainly an underestimate given the fact that some suitable areas were not visited. This figure represented approximately 5% of the population for the species of European Union (c.4000 calling males according to Tomialojc 1995 even after the addition of "Corncrake-rich" countries such as Austria, Sweden and Finland in the mid-1980's). This significant point highlights the importance of concrete protection measures for the species at a regional level where it is the only nesting species classified as "Globally Endangered" (Grimmett R.F.A. and Jones T.A. 1989) and in accordance with recent directives of the European Union. This can be achieved through regular monitoring and the gathering of information on the habitats frequented by the species with a view to developing appropriate conservation projects. Recent changes in the Common Agricultural Policy and possibilties offered under regional rural development legislation offer perhaps the best hope for the saving of this species for posterity.

Acknowledgements - The authors wish to thank the Provincial Hunting Committee and the Faunistic Observatory for the Province of Udine for funding the coordination of the 1995 breeding census as well as all 42 of the voluntary fieldworkers, especially Remo Peressin who was without equal in his energy and selflessness.

Riassunto - Viene proposta una sintesi delle conoscenze sul Re di quaglie in Friuli-Venezia Giulia in relazione, soprattutto, ad alcuni studi effettuati dalla seconda metà degli anni '80 in poi. Il rallide è stato costantemente indagato dagli ultimi anni '80 in alcune aree campione dell'Alto Friuli sia tramite assunzione di informazioni generali che di censimenti (dal 1993 in poi) compiuti almeno 2 volte nel corso del periodo riproduttivo. Durante la stagione di nidificazione 1995 è stata condotta una ricerca su tutto il territorio regionale.

Le indagini svolte hanno permesso di stabilire che la specie in Friuli-Venezia Giulia è migratrice regolare e nidificante e può essere presente pure nel periodo autunno-invernale grazie ad individui impossibilitati per varie cause (ferite, menomazioni, malattie) a migrare.

La popolazione regionale nel 1995 è risultata ammontare a 203 maschi cantori situati perlopiù nella zona centro-settentrionale della Regione ad un'altitudine compresa fra 100 m s.l.m. e 1600 m s.l.m. (il 68,8% di essi cantava fra 500 m s.l.m. e 999 m s.l.m.). Nell'Alto Friuli, considerando il periodo 1993-1999, la maggior parte (51,3%) dei maschi in canto è stata contattata fra 200 m s.l.m. 399 m s.l.m..

L'uccello è quasi totalmente assente al di sotto di 200 m di quota a causa dell'elevata antropizzazione del territorio con conseguente degrado degli ambienti idonei alla specie. La diminuzione degli effettivi oltre 1100 m s.l.m. si deve alla mancanza di ampie zone di fondovalle ed alla rarefazione degli abitati e conseguentemente delle aree a prato regolarmente falciate. Il limite superiore è determinato dalla scomparsa degli ambienti prativi e pascolivi a favore di arbusteti, ghiaioni e rocce.

L'ambiente prediletto in Friuli-Venezia Giulia sembra essere costituito da prati abbastanza umidi, ad elevata copertura erbacea, regolarmente falciati e posti in aree a scarsa pendenza o pianeggianti.

Si auspica l'adozione di concrete misure di protezione della specie tramite un monitoraggio ripetuto negli anni, finalizzato soprattutto all'assunzione di informazioni relative agli ambienti frequentati, in modo da poter stilare appropriati progetti di salvaguardia.

References

AA.VV., 1991. Inventario Faunistico Regionale Permanente. Primi risultati relativi al periodo riproduttivo 1986-1990. Reg. Aut. Friuli-Venezia Giulia, Dir. reg. delle foreste e dei parchi, Udine.

Bibby C.J., Burgess N.D. and Hill D. A., 1992. Bird Census Techniques. Academic Press, London.

Cramp S. and Simmons K.E.L., 1980. Handbook of the Birds of Europe, the Middle East and North Africa. The Birds of Western Palearctic, Vol. II. Oxford University Press, Oxford.

Grimmett R.F.A. and Jones T.A., 1989. Important Bird Areas of Europe, ICBP Technical Publication No. 9, Appendix 2, p. 27.

Parodi R., 1987. Atlante degli uccelli nidificanti in Provincia di Pordenone (Friuli-Venezia Giulia) 1981-1986. Mus. Civ. di Storia Nat., Pordenone.

Rassati G., 1997. Studio sull'avifauna dell'alto bacino del Tagliamento (Alpi Carniche). Università di Padova. Fac. Agraria. Ist. di Entomologia Agraria, Tesi di Laurea, A.A. 1996/97.

Rassati G. and Cescutti M. C., 1999. I nomi friulani della fauna nella variante carnica di Lauco. In Alto, Cronaca della Società Alpina Friulana, 81: 83-88.

Tomialojc L., 1995. In Tucker G.M and Heath M.F. (with corrections). Birds in Europe: their conservation status. Cambridge, U.K.: BirdLife International Conservation Series n. 3, pp. 228-229.

Tout P., 1995. The status and distribution of Corncrakes (*Crex crex*) during 1995 in Friuli-Venezia Giulia (North-east Italy). Unpublished report for the Osservatorio Faunistico, Province of Udine.

Utmar and Parodi, 1990. Primi dati sull'avifauna dell'alta Val Torre (Italia nord-orientale, Prealpi Giulie). Gortania, Atti del Mus. Friul. di Storia Nat., 11: 207-240.

Vallon G., 1907. Avifauna friulana. Boll. Soc. Adr. Sc. Nat., 23: 93-232.

Avocetta N° 26 (1): 7-9 (2002)

Age-dependant adult survival in the Cory's Shearwater (*Calonectris diomedea*)

J.-L. Mougin, Chr. Jouanin and F. Roux

Muséum national d'Histoire naturelle, Laboratoire de Zoologie
(Mammifères et Oiseaux), 55 rue Buffon, 75005 Paris, France

Abstract - In the Cory's Shearwater *Calonectris diomedea* of Selvagem Grande (30°09'N, 15°52'W), the annual survival rate of the adult is age-dependant. After having remained almost constant during the first breeding years, it begins to decrease shortly after the 15th when the bird has not much passed its 25th year. Such a trend having also been observed in other seabird groups, it is likely to be widespread. The scarcity of the related data published is thus likely to be only a consequence of the length of the studies necessary to get them.

The results of long-term studies have shown only recently that, in Procellariiformes, the annual survival rate of the adults decreased with ageing (Bradley *et al.* 1989, Robertson 1993, Sagar *et al.* 2000, Warham 1996, Weimerskirch 1992). Having studied for more than 20 years the Cory's Shearwater *Calonectris diomedea* of Selvagem Grande, we have tried to know: 1. if such a decrease existed in that species; and 2. if so, when (age, experience) did it began to appear.

Material and methods

The work has been carried out on Selvagem Grande (30°09'N, 15°52'W), Portuguese island situated between Madeira and the Canary Islands. The population of Cory's Shearwaters, after many vicissitudes caused by exploitation and poaching, numbers now about 36,000 breeders (Mougin *et al.* 1996). Four colonies are studied, grouping now about 500 nests in all. All the breeding adults are ringed or recaptured – and all the nests marked or checked – during yearly visits, in June-July, during incubation. Adults have been ringed every year since 1977, capture-recapture data thus collected allowing the estimation of the annual survival rate using a Cormack-Jolly-Seber model (Cormack 1964, Jolly 1965, Seber 1965). Almost all the adults being ringed during their first breeding year, the number of years after banding represents in fact the breeding experience of the birds. Chicks have been ringed shortly before they fledge, in September-October, every year from 1968 to 1971 and, after a break, every year again since 1977. In the following pages, they are taken into account since their 13th year, when all the surviving birds have returned to land and have begun to breed (Mougin *et al.* 1992). In all, the work has concerned 1274 birds ringed as adults during 8 years – respectively 70 (1977), 133 (1978), 332 (1980), 121 (1981), 204 (1982), 115 (1985), 161 (1988) and 138 (1989) – and 178 birds ringed as chicks during 7 years and having reached their 13th year – respectively 31 (1968), 31 (1969), 22 (1970), 30 (1971), 20 (1977), 18 (1978) and 26 (1979).

Results

Evolution of the survival rate as a function of the breeding experience

Figure 1A shows, for the 5 cohorts taken into account, a survival rate relatively stable during the 15 years or so following ringing (12-16 years according to the cohort), then decreasing rapidly and consequently. The period of stability gives an average value of 0.9403 ± 0.1546 (0.8123-0.9904, $n = 75$), significantly higher ($t = 2.72$, $P < 0.01$) than that of the period of decrease, 0.8531 ± 0.1067 (0.5000-0.9211, $n = 17$). The mortality rate for that second period (14.7%) is thus almost 2.5 times higher than that of the first period (6.0%). None of the cohorts taken into account having completely disappeared at the end of our study, the mortality rate calculated for the period of decrease is thus likely to be under-estimated.

Accepted 29 November 2001

One could object that the decrease of the survival rate observed during the last years of study could be a consequence of the scarcity of subsequent years of control – the birds not recaptured because absent or overlooked being not likely to be observed later on because there will be so few occasions, they would thus be taken as dead. However, if that assumption was founded, such a decrease should be observed in all cohorts, independently of the number of years following ringing. This is not the case, no decrease occurring in the cohorts studied since 1985, *i. e.* during less than 15 years (Fig. 1B) - respectively 0.9213 ± 0.0461 (0.8502-0.9899, $n = 17$) for the first breeding years *versus* 0.9082 ± 0.0978 (0.8056-09980, $n = 15$) for the last ($t = 0.47$, n.s.).

Evolution of the survival rate as a function of age

A similar work carried out on known-age breeders has given similar results (Fig. 2A). The survival rate is almost stable until about 25 years of age (23-26 years according to the cohort), then it decreases rapidly. For the 4 cohorts studied, the average values given by the period of stability and by the period of decrease are 0.9609 ± 0.1108 (0.8145-0.9942, $n = 51$) and 0.7733 ± 0.0937 (0.6462-0.9524, $n = 11$) respectively ($t = 5.82$, $P < 0.01$). In that sample, the mortality rate is thus 6.0 times higher during the second period (22.7%) than during the first (3.9%). The decrease being not observed among birds less than 23 years old (Fig. 2B), it cannot be taken as an artefact.

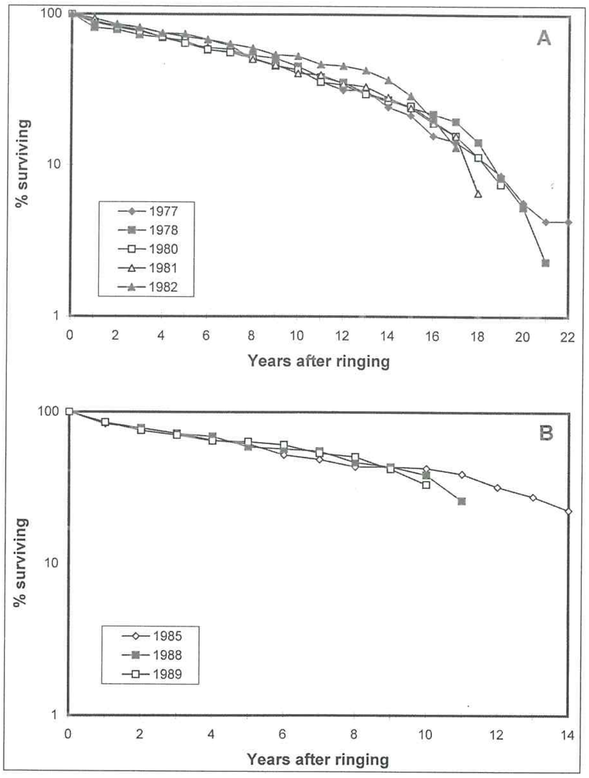


Fig. 1. The survival of adults Cory's Shearwaters as a function of their breeding experience. A: five cohorts of birds ringed as breeders between 1977 and 1982. B: three cohorts of birds ringed as breeders between 1985 and 1989.

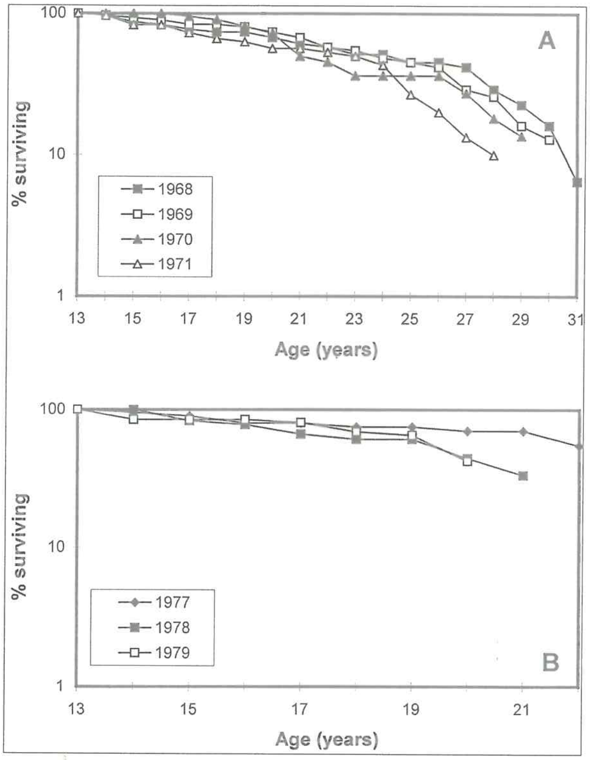


Fig. 2. The survival of adults Cory's Shearwaters as a function of their age. A: four cohorts of breeders ringed as chicks from 1968 to 1971. B: three cohorts of breeders ringed as chicks from 1977 to 1979.

Discussion

In the Cory's Shearwater of Selvagem Grande, the annual survival rate of the adult is age-dependant. After having remained almost constant during the first breeding years, it begins to decrease shortly after the 15th when the bird has not much passed its 25th year. Few results allowing comparisons have been published. However, after having detected decreasing survival with age in the Fulmar *Fulmarus glacialis* (Dunnet and Ollason 1978), Dunnet (1982, 1991) has seemed to change his mind, although reluctantly. The annual survival rate of the Short-tailed Shearwater *Puffinus tenuirostris* begins to decrease about 20 years on average after the first breeding (Bradley *et al.* 1989). In the Diomedeids, the survival of Wandering Albatrosses *Diomedea exulans* more than 27 years old (Weimerskirch 1992) and of Royal Albatrosses *D. epomophora* more than 25 years old (Robertson 1993) is lower than that of younger birds, as well as, in the Buller's Albatross *D. bulleri*, the survival of the birds with more than 25 years of experience compared to that of less experienced birds (Sagar *et al.* 2000). Finally, among Hydrobatids, survival decreases in the Leach's Petrels *Oceanodroma leucorrhoa* more than 25 years old (Huntington *in* Warham 1996). Such a phenomenon having also been observed in other seabird groups, Phalacrocoracids (Harris *et al.* 1994), Larids (Aebischer and Coulson 1990) and Alcids (Harris *et al.* 1997), it is probably widespread. The scarcity of the related data published is thus likely to be only a consequence of the length of the studies necessary to get them.

Résumé - Chez le Puffin cendré *Calonectris diomedea* de Selvagem Grande (30°09'N, 15°52'W), le taux de survie annuel des adultes est dépendant de l'âge. Après être resté presque constant pendant les premières années de reproduction, il commence à décroître peu après la 15ème, quand les oiseaux ont dépassé de peu leur 25ème année d'existence. Une telle tendance ayant également été observée dans d'autres groupes aviens, on peut penser qu'elle est très répandue et que la longueur des études nécessaires à leur obtention est l'unique cause de la rareté des données publiées à ce sujet.

References

Aebischer, N. J. and Coulson, J. C. 1990. Survival in the Kittiwake in relation to sex, year, breeding experience and position in the colony. J. Anim. Ecol. 59: 1063-1071.

Bradley, J. S., Wooller, R. D., Skira, I. J. and Serventy, D. L. 1989. Age-dependant survival of breeding Short-tailed Shearwaters *Puffinus tenuirostris*. J. Anim. Ecol. 58: 175-188.

Cormack, R. M. 1964. Estimates of survival from the sighting of marked animals. Biometrika 51: 429-438.

Dunnet, G. M. 1982. Ecology and everyman. J. Anim. Ecol. 51: 1-14.

Dunnet, G. M. 1991. Population studies of the Fulmar on Eynhallow, Orkney Islands. Ibis 133, suppl. I: 24-27.

Dunnet, G. M. and Ollason, J. C. 1978. The estimation of survival rate in the Fulmar, *Fulmarus glacialis*. J. Anim. Ecol. 47: 507-520.

Harris, M. P., Buckland, S. T., Russell, S. M. and Wanless, S. 1994. Year- and age-related variation in the survival of adult European Shags over a 24-year period. Condor 96: 600-605.

Harris, M. P., Freeman, S. N., Wanless, S., Morgan, B. J. T. and Wernham, C. V. 1997. Factors influencing the survival of Puffins, *Fratercula arctica*, at a North Sea colony over a 20-year period. J. Avian Biol. 28: 287-295.

Jolly, G. M. 1965. Explicit estimates from capture-recapture data with both death and immigration stochastic model. Biometrika 52: 225-247.

Mougin, J.-L., Granadeiro, J. P. and Oliveira, P. 1996. L'évolution des effectifs des reproducteurs chez le Puffin cendré *Calonectris diomedea borealis* de Selvagem Grande (30°09'N, 15°52'W) de 1992 à 1995. Bol. Mus. Mun. Funchal 48: 171-178.

Mougin, J.-L., Jouanin, Chr. and Roux, F. 1992. L'âge d'établissement de la reproduction chez le Puffin cendré *Calonectris diomedea borealis* de l'île Selvagem Grande (30°09'N, 15°52'W). C. R. Acad. Sc. Paris 315, 3: 27-30.

Robertson, C. J. R. 1993. Survival and longevity of the Northern Royal Albatross *Diomedea epomophora sanfordi* at Taiaroa Head 1937-93. Emu 93: 269-276.

Sagar, P. M., Molloy, J., Weimerskirch, H. and Warham, J. 2000. Temporal and age-related changes in survival rates of Southern Buller's Albatrosses (*Thalassarche bulleri bulleri*) at the Snares, New Zealand, 1948 to 1997. Auk 117: 699-708.

Seber, G. A. F. 1965. A note on the multiple-recapture census. Biometrika 52: 249-259.

Warham, J. 1996. The behaviour, population biology and physiology of the Petrels. London, Academic Press, 613 p.

Weimerskirch, H. 1992. Reproductive effort in long-lived birds. Age-specific patterns of condition, reproduction and survival in the Wandering Albatross. Oikos 64: 464-473.

Avocetta N° 26 (1): 11-18 (2002)

Distribution patterns of snow finches (genus *Montifringilla*) in the Tibetan Plateau of China

QU YAN-HUA - LEI FU-MIN* - YIN ZUO-HUA - STEFANO FABRIZIO DE RITIS°

(Institute of Zoology, Chinese Academy of Sciences,
Beijing 100080, CHINA. E-mail: leifm@panda.ioz.ac.cn)
*(*Correspondence author: Lei Fu-Min)*
(°Centro Abruzzese di Ricerche Faunistiche,
C/o WWF Abruzzo c.p. 317 65100 Pescara E-mail: stefanofabr@tiscalinet.it)

Abstract - We used data from specimen collection records and field expeditions in the Tibetan Plateau and Xinjiang to assess distribution patterns of six *Montifringilla* species. By plotting specimen localities with latitude, longitude and elevation, we found that six species overlap greatly on the Tibetan plateau, with a limited distributed area at elevations from about 2500m to 5500m, latitudes from about N26° to N38° and longitude from E 75° to E115°. At 28 of 71 localities, more than one species has been collected. However, in Xinjiang, only four species occur and they have parapatric complementary distributions. The species whose distribution ranges overlap occur in different habitats and develop different ecological and behavioral characteristics. While some breed and roost in rock crevices, others nest in Pikas (*Ochotona curzoniae, Ochotona ladacensis, Ochotona alpina, Ochotona daurica)* burrows. Those species sharing similar habitats show significant variations in body traits. It seems that the species with similar body traits are less likely to share similar habitats than are species with rather different body traits.

Keywords: Snow Finches, *Montifringilla*, Distribution Pattern, Tibetan Plateau, China

Interpreting why some birds are limited to a particular geographic area is one of the most difficult questions in ornithological studies. The reason is that bird distribution is often influenced by many inter-related factors. When these factors shape ecological and behavioral characteristics of species, it needs the complex knowledge of the influence of history on bird ecology for determining which factors are, which are not, modified in response to distribution limitation (Vuilleumier and Simberlogg, 1980). It will be a more difficult case when most species in the genus or other higher taxa are restricted in similar limited areas. If the overlap in distributions occurs, suggesting that more competition pressure occurs and makes these congeners likely competitors. Their similarity in role and habitat use patterns makes it more difficult to determine which ecological and morphological characteristics modified in response to change demands, and how far the changes go in the way of convergence and divergence evolution. Nevertheless, still a lot of work has been done to determine the relationship between restricted distribution areas and their influence on the adaptation of species (Remsen & Graves, 1995a; 1995b, Keast *et al*, 1995). The comparative analyses of distribution patterns maybe help us to understand the determinants of the limited distribution and their influence to the adaptation of congeners (Remsen & Cardiff, 1990; Remsen & Graves, 1995). *Montifringilla* is an interesting group for such a study due to its distribution, in fact, is characterized, by relatively uniform elevational range. Of currently seven species, only *M. nivalis* is distributed throughout the range of genus, which is along the chain of mountains from Asia to Europe. Other six species are limited on the Tibetan plateau and adjacent areas and have similar distribution areas. On their studies the birds on Tibetan plateau, Kozlova (1959) and Cheng (1981) proposed that most species of *Montifringilla* shared remarkably similar longitudinal, latitudinal and elevational ranges. Although Cheng (1976) and Fu (1998) previously mapped latitudinal and longitudinal distributions of these birds, they did not map elevational distributions of them. Without the added dimension of elevation, "the true" overlap distribution was difficult to assess. Here, we try to determine the distribution patterns of *Montifringilla* species through using data from specimen collection records, when considering on the longitudinal, latitudinal and elevational distribution for

---

Accepted 30 January 2002

assessing the extent of overlap distribution. We also with the aim determine the influence of these distribution patterns for ecological and morphological adaptation of congeners and possible divergence evolution.

Methods

We collected specimen data from museums in Institute of Zoology, Northwest-Highland Institute of Biology, Chinese Academy of Science for all *Montifringilla* species. Some information on geographic distributions and ecological characteristics was obtained from published papers (Demen'ev & Cladron 1970, Cheng 1981, Fu 1998, and Zhang 1999) and our field expeditions from 1999 to 2001.

Longitude-elevation-latitude plots

Following the methodology of Remsen and Graves (1995), latitude and longitude were inferred primarily from the gazetteers of China and elevation was taken from specimen labels. If a specimen label did not include elevation, the gazetteers were used to determine whether the elevation could be ascertained with reasonable precision. Many specimen localities could not be used because their elevations were uncertain. A simple plot of longitude-elevation-latitude was used to show the distribution patterns of *Montifringilla* species on the Tibetan Plateau and in the Xinjiang.

Field surveys

Our field surveys were conducted in different field sites of Tibetan plateau (Haibei: N 37°34´ E 101°22´ A 3268 m., Tianjun: N 37°18´ E 99°45´ A 3413 m., Heimahe: N 36°45´, E 99°37´, A 3366 m., Huashixia: N 35°06´ E 98°52´ A 4257 m., Maduo: N 35°06´ E 98°51´A 3886 m., Tuotuo river: N 34°13´ E 92°26´ A 4598 m., Naqu: N 31°24´E 92°00´ A 4480 m., Changdu: N 31°06´ E71°06´ A 3339 m., Bangda: N30°12´ E97°12´ A 4358 m., Langkazi: N29°11´ E90°33´A 4498 m., Dingri: N 28°35´ E 86°37´A 4798 m.) from May to October from 1999 to 2001. Data on the ecological and behavior characteristics of these birds were collected. The field surveys were also conducted to find the sites where two or more species were observed to occur.

Ecological and morphological adaptations of congeners

If overlap distribution occurs, interspecific competition could be expected. For species whose distribution ranges overlapped, their body traits were analyzed and the differences were tested.

The original data were consisted of skin measurements of 337 congeners individuals (*M. nivalis*: n = 15, *M. adamsi*: n = 95, *M. taczanowskii*: n = 89, *M. ruficollis*: n = 109, *M. blanfordi*: n = 28, *M. davidiana*: n = 9). On skin we measured, body length, body mass, wing length, tail length, bill length and tarsus length, provided the input for determining the differences among congeners. Body traits of male and female represented no significant difference (All species, ANOVAS, $P > 0.05$). Therefore in the analysis male and female were pooled.

For help to understand which traits express in a better way the body dimension, the principal component analysis was used to find the most important indicative characteristics and the relationship among body traits. PCA analysis was based on the correlation matrices of the log-transformed variables. Results presented for analyses were correlation (loading) of body traits with orthogonally rotated multivariate factors (varimax rotations of the principal components).

Positions (factors scores) of individuals were ranked and the ranks of each individuals were clustered. This was to test whether the body traits loading strongly in components could separate the six species.

The indicative body traits of congeners were analyzed for the difference in means with one-way ANOVAS. The significance was determined at 0.05 level.

Results

Distribution patterns

In Xinjiang (35°-N44°) (Fig. 1), four species were found with a little complementary elevational distribution and minor segregation. In this area, *M. nivalis* was found in 10 localities with elevations below 3500m, and *M. blanfordi* in 4 localities with elevations above 4500m. *M. taczanowskii* and *M. ruficollis* occurred at an elevation ranging from 3500m to 4500m. However, they overlapped slightly in longitudinal and latitudinal ranges. In Xinjiang, 2 localities out of 18 had more than one species.

Six species occurred on the Tibetan Plateau (Fig. 2), where they seemed to overlap greatly in elevational, longitudinal and latitudinal ranges. These species occupied a limited distribution range (latitude from about N26° to N38°, longitude from E 75° to E105° and elevation from about 2500 m to 5500m). *M. davidiana* inhabited in the lower elevations from about 2500 to 3500 m and with a narrow altitude range between N 34° and N 40°. Its range scarcely overlapped with those of the other five species. Ranges overlap on Tibetan Plateau appeared to be higher than in Xinjiang. Four species were collected in 13 localities out of 71, three species were collected in 18, and two species were collected in 28.

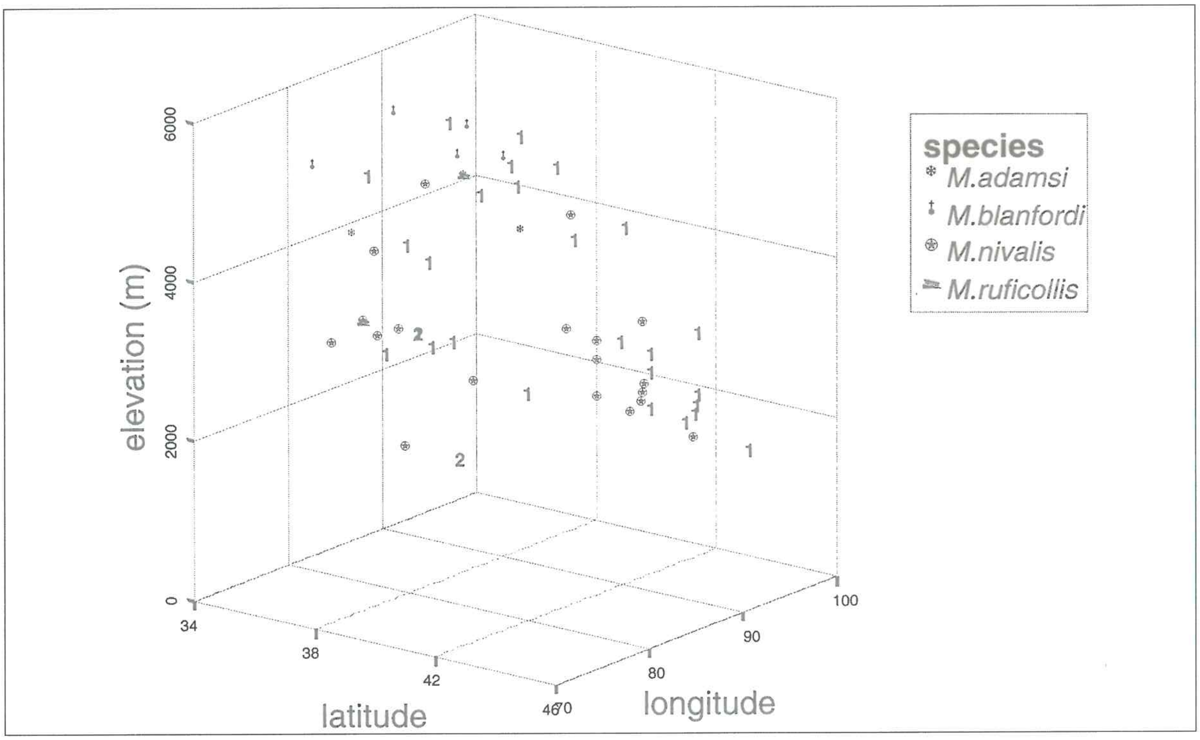


Fig. 1 Distribution of four *Montifringilla* species in Xinjiang. Each point represents the specimen collection site from which one or more species were collected (indicated by labels). In this and other figure (represented in Fig.1-2), lower limit of distribution is about 2500m, and upper limit usually is about 5500m.

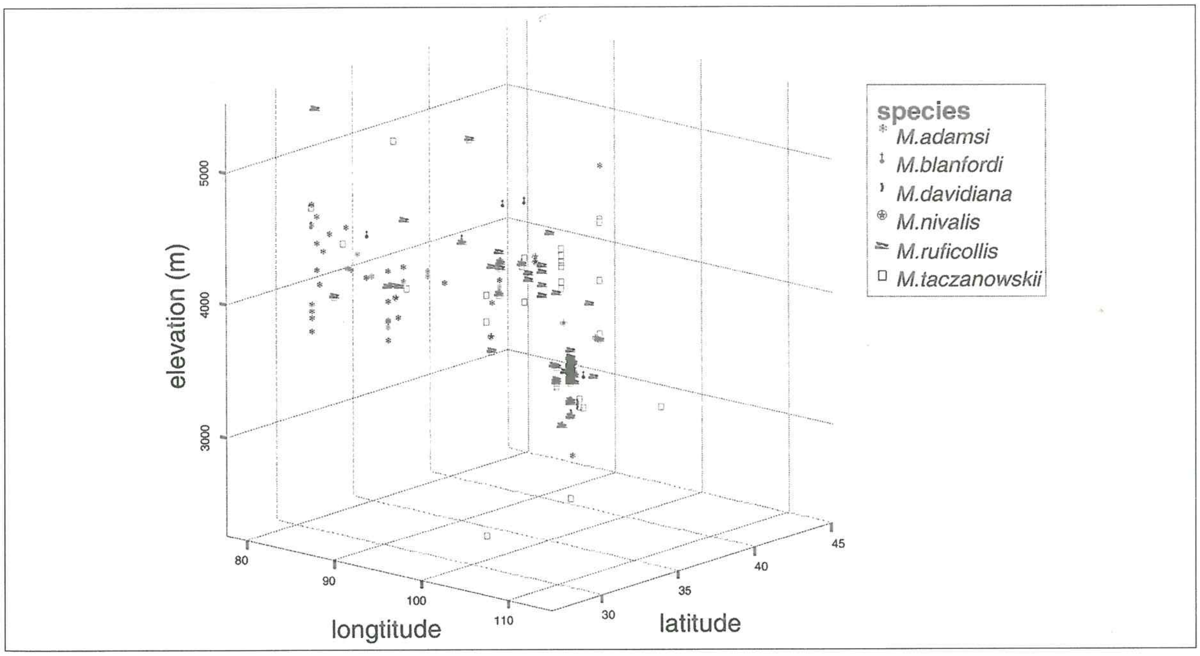


Fig. 2. Distribution of six species of *Montifringilla* in the Tibetan Plateau. Each point represents the specimen collection site from which one or more species were obtained.

Ecological and behavioral characteristics

In field observations, we found these species were year-around residents across the mountain steppe zones at the high elevation (above 3000m). *M. taczanowskii, M. ruficollis, M. blanfordi, M. davidiana* occurred in solitary pairs on flatter and more arid grassy areas and bred inside the Pikas (*Ochotona curzoniae, O. ladacensis, O. alpina, O. daurica*) burrows. These species showed strong long-term territoriality during breeding and brooding season. *M. nivalis* and *M. adamsi* preferred more heterogeneous and humid environments, and bred in rock crevices and fed mainly on alpine grassland rich in vegetation. They bred in loose colonies or solitary pairs and shared communal feeding at any stage of nesting. Their territoriality ceased after pair formation.

In June, 2000, we found that *M. davidiana, M. ruficollis, M. taczanowskii* and *M. davidiana* made nests in *O. ladacensis* burrows in Heimahe, Cuona and Wenquan sites. We also found *M. nivalis* and *M. adamsi* juveniles in crevice rock in Maduo and Huashixia sites. In July, 2001, we found two nests of *M. davidiana* juveniles (five and six respectively), three nests of *M. ruficollis* juveniles (two, four and five respectively), two nests of *M. taczanowskii* juveniles (three and five respectively) and three nests of *M. davidiana* juveniles (four, five and six respectively) in *O. curzoniae* burrows in Huashixia, Maduo and Heimahe. Two nests of *M. nivalis* juveniles (four and five respectively) and *M. adamsi* juveniles (three and four respectively) in crevices rock.

Those results were based on observations carried out at field sites and here we also observed two or more species to occur in the same habitats: in Heimahe (*M. ruficollis, M. taczanowskii* and *M. davidiana*), in Huashixia and Maduo (*M. ruficollis, M.taczanowskii, M. blanfordi, M. nivalis*), in Tuotuo river (*M. ruficollis, M. taczanowskii, M. blanfordi*), Dingri (*M. ruficollis, M. taczanowskii, M. adamsi*), in Haibei, Naqu, Bangda, Changdu (*M. taczanowskii* and *M. ruficollis*) and Langkazi (*M. ruficollis* and *M. adamsi*).

Variations in body traits of species with the same habitats

PCA result showed component 1 accounted for 49.70% of the total variances and loaded strongly for all length traits, including body length, wind length, tail length, bill length and tarsus length. The component 2 accounted for 30.25% of the total variances and loaded strongly for the mass characteristic (Tab. 1). Along the two components, all individuals separated into six clusters, which much followed the six species assemblages (Fig. 3). Along component 1 axis, all six

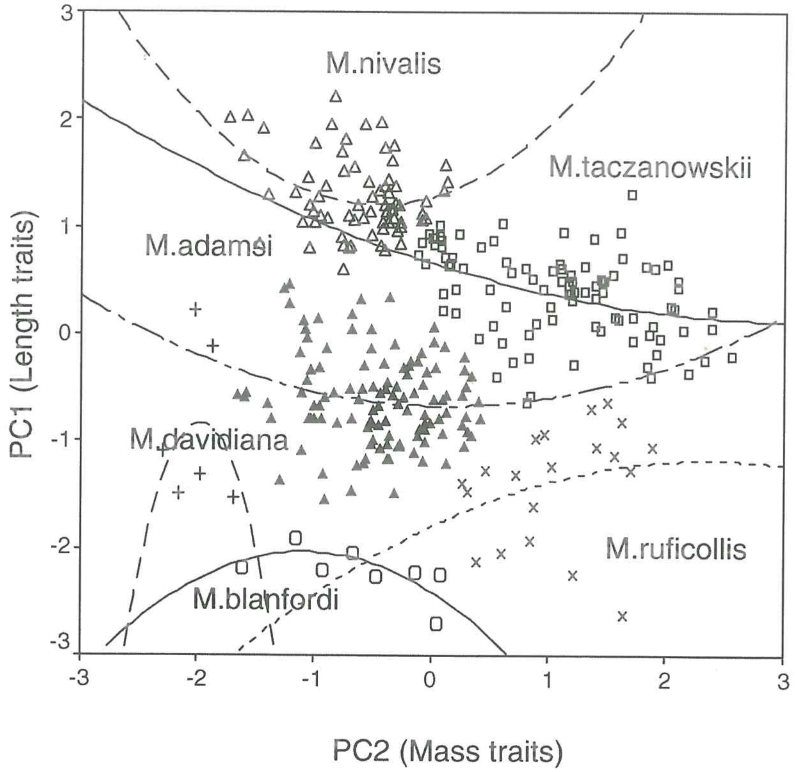


Fig. 3. Plot of factors (PCs) resulting from principal components analyses comparing six *Montifringilla* species for six body traits.

species were separated into two mainly assemblages, while *M. nivalis*, *M. adamsi* and *M. taczanowskii* tightly clustered by longer length traits, other three species fell into one group by shorter length traits. Along component 2, each group was separated by difference in body mass. *M. taczanowskii* was a special cluster by its higher body mass and longer length traits.

As suggested by PCA result, all six traits contributed strongly to the variances in body traits of six species (Tab. 1). Therefore, all six traits were used to test for the differences among co-existing species.

As suggested by literature and our field observations, these *Montifringilla* species occurred in different habitats. We hypothesized it was a kind of ecological divergence for decreasing competition pressure. During ANOVAS analyses, we treated those co-existing species as a group of compared units.

One-way ANOVAS used to test for differences in body traits among co-existing species showed significant variations in most body traits between *M. adamsi* and *M. nivalis* (Tab. 2), which occurring in the same habitat. They differentiated significantly in body mass ($F_{1,93}$ = 17.11, P < 0.001), wing length ($F_{1,93}$ = 4.89, P < 0.05), bill length ($F_{1,93}$ = 4.08, P < 0.05) and tarsus length ($F_{1,93}$ = 11.1, P < 0.01), but no significant differences in body length and tail length (P > 0.05, ns).

Other four species (*M. taczanowskii*, *M. ruficollis*, *M. blanfordi* and *M. davidiana*) showed significant variations in body traits (Tab. 3, ANOVA, all, P < 0.001). *M. taczanowskii* differentiated significantly with other three species in all of body traits (P < 0.001). *M. ruficollis* and *M. blanfordi* accounted for a significant amount of variations in body length ($F_{1,131}$ = 6.8, P < 0.001), tail length ($F_{1,131}$ = 4.9, P < 0.05), bill length ($F_{1,131}$ = 32.08, P < 0.001) and tarsus length ($F_{1,131}$ = 151.3, P < 0.001). However, body mass and wing length did not show statistically meaning (P > 0.05). The body traits of *M. davidiana* differentiated significantly from *M. ruficollis* in body length ($F_{1,110}$ = 4.3, P < 0.05), body mass ($F_{1,110}$ = 4.21, P < 0.05), tail length ($F_{1,110}$ = 7.89, P < 0.01), bill length ($F_{1,110}$ = 11.2, P < 0.01) and tarsus length ($F_{1,110}$ = 190.8, P < 0.001) and from *M. blanfordi* in body length ($F_{1,29}$ = 11.33, P < 0.01), body mass ($F_{1,29}$ = 14.72, P < 0.001), tail length ($F_{1,29}$ = 10.28, P < 0.003) and tarsus length ($F_{1,29}$ = 11.5, P < 0.01). It showed no significant differences in wing length with *M. blanfordi* (P > 0.05 ns) and *M. ruficollis* (P > 0.05, ns), and also no significant differences in bill length with the latter (P > 0.05, ns) (Tab. 4).

Table 1 The correlations of body traits with Varimax rotated multivariate for six *Montifringilla* apecies

Body traits	Correlation with	
	Component 1	Component 2
Body length	0.864	0.016
Body mass	0.620	0.646
Wing length	0.870	0.366
Tail length	0.874	0.346
Bill length	0.837	0.142
Tarsus length	0.708	0.500
Percent explained	49.705%	30.242%

Table 2. Comparison of body size of *M. nivalis* and *M. adamsi* (mean ± SD) by ANOVA

Body size	*M. nivalis* (n = 15)	*M. adamsi* (n = 95)	anova result (*F*) Df = 1 and 93
Body length	160 ± 9.97	161 ± 10.93	0.94ns
Body mass	32 ± 2.11	28 ± 3.06	17.1***
Wing length	111 ± 3.66	107 ± 5.12	4.89*
Tail length	70 ± 3.32	71 ± 5	0.76ns
Bill length	13 ± 0.61	13 ± 0.91	4.08*
Tarsus length	21 ± 1.79	22 ± 1.12	11.1**

* P < 0.05, ** P < 0.01, *** P < 0.001, ns P > 0.05

Table 3. Comparison of body size of *M. taczanowskii*, *M. ruficollis*, *M. blanfordi* and M. *davidiana* (mean ± SD)

Body size	*M. ruficollis* (n = 109)	*M. blanfordi* (n = 28)	*M. taczanowskii* (n = 89)	*M. davidianan* (n = 6)	ANOVA result (*F*) Df = 3, 231
Body length	139 ± 9.73	134 ± 8.65	160 ± 11.15	124 ± 4.55	42.09***
Body mass	26 ± 2.82	26 ± 2.12	32 ± 3.52	22 ± 1.64	45.64***
Wing length	90 ± 4.57	90 ± 4.58	100 ± 3.51	89 ± 0.54	38.17***
Tail length	56 ± 5.83	54 ± 5.57	65 ± 5.86	46 ± 5.57	21.55***
Bill length	11 ± 0.78	10 ± 0.62	13 ± 0.98	11 ± 0.47	30***
Tarsus length	21 ± 0.85	17 ± 1.17	24 ± 1.68	19 ± 1.4	47.60***

* P < 0.05, ** P < 0.01, *** P < 0.001, ns P > 0.05

Table 4. Variation of body traits in *M. taczanowskiii*, *M. ruficollis*, *M. blanfordi*, and *M. davidiana* by A NOVA analysis

Taxon	Body traits (ANOVA, F)						
	Df	Bodylength	Bodymass	Winglength	Taillength	Billlength	Tarsullength
M.t & M.r	1,192	180.5***	177.6***	458.3***	162***	212***	502***
M.t & M.b	1,123	84.7***	8.14***	33.32***	29.94***	140.2***	264.7***
M.t & M.d	1,100	31.5***	36.97***	10.16**	14.5***	32.53***	95.75***
M.r & M.b	1,131	6.8*	0.6ns	0.05ns	4.9*	32.08***	151.3***
M.r & M.d	1,110	4.3*	4.12*	1.48ns	7.08**	11.2**	190.8***
M.b & M.d	1,29	11.33**	14.72***	1.49ns	10.28**	1.29ns	11.5**

- P < 0.05, ** P < 0.01, *** P < 0.001, ns P > 0.05
- *M. t* (*M. taczanowskii*), *M.r* (*M. ruficollis*), *M.b* (*M. blanfordi*), *M.d* (*M. davidiana*)

Discussion

On the Tibetan Plateau, six *Montifringilla* species are distributed in the similar longitudinal, latitudinal and elevational regions. Whilst in Xinjiang, where is a part of adjacent areas of Tibetan plateau, the distribution of these species shows some longitudinal, latitudinal overlap and a slight elevational segregation. For example, in 28 collection sites of Tibetan plateau, two or more species are found to occur in the same habitat. Six species occur in the same ranges that span from 3000 m. to 5000 m in the elevation, E 70° to E105° in longitude and N 30° to N 38° in latitude. In contrast, in Xinjiang, only two collection sites were found to have more than one species to share same habitat. Four species overlap in their distribution with a longitudinal range between E 75° and E 100° and a latitudinal range between N 36° and N 44°. Nevertheless, these species are found to occur on the different elevational gradients. The *M. nivalis* occupies on the elevation below 3500 m., and *M. blanfordi* occupies on the elevation above 4500 m. The elevation gaps between the distribution of *M. nivalis* and *M. blanfordi* are for the most part filled by *M. adamsi* and *M. ruficollis*.

Compared to the highly overlap distribution on Tibetan plateau, the complementary elevationial segregation of these species in Xinjiang seems to provide evidence for their dispersal from inner plateau outward adjacent areas. *M. davidiana* is distributed to northeast Ningxia of China and to Mongolia, while *M. nivalis* has the widest distribution, from eastern part of the plateau to the north part of Europe.

The Tibetan Plateau is the region inhabited by six out of the seven *Montifringilla* species. The relative uniformity in longitude, latitude and elevation limits supports the hypothesis that congeners share similar distribution ranges. When most species of *Montifringilla* are distributed in similar restricted areas, this distribution pattern might have enhanced habitat segregation and differences in eco-ethology.

As our field observations suggested, *M. nivalis* and *M. adamsi* are active in rocky habits during both the breeding and wintering seasons. Both species use rock crevices as roosting and nesting places. These birds don't select burrows of pikas or small rodents as nest site. On the other hand, *M. taczanowskii*, *M. ruficollis*, *M. blanfordi* and *M. davidiana* prefer short grass, flatter, steppe-like habitats. Their nest sites mostly select burrows of Pikas or other small rodents, where they also use for roosting and refuge.

Besides that, these birds also develop other ecological characteristic divergence. *M. nivalis* and *M. adamsi* are not well adapted to ground living as other four *Montifringilla* species. They often are found flying more and better than the latter. Moreover, they are social birds defending relatively small territories with few specialized social display movements. They sing relatively seldom, but have a rich call repertoire that shows differences in function and structure with other four *Montifringilla* species.

Other four species are well adapted to ground living. They are able to burrow with their legs and bill, and fly less than *M. nivalis* and *M. adamsi* do. They are often found spending much more time in hopping, walking and climbing than latter. They are less social and some species are very aggressive in intraspecifically and interspecifically. All four species have marked territorial and pair display behavior with different visual movements. They sing with a specific repertoire of calls and perform song types different from *M. nivalis* and *M. adamsi* do (Gebauer, 1994).

Our field surveys results further corroborate the findings of previous studies of Ivanitskii (1992) and Gebauer (1994) that *Montifringilla* species share different habitats and develop different ecological and behavioral adaptations. Occurring in the same restricted areas, the overlap in niches makes these *Montifringilla* species shape different ecological, behavior characteristics and habitat choice. This maybe suggests that interspecific competition govern characteristic shape and divergence for decreasing potential competition pressure.

For the species with the same distribution ranges, the similarities in shape, plumage, and foraging behavior might promote interspecific competition and make them potential competitors. The ecological differences might have decreased some competition pressure. However, for species sharing the same habitat, interspecific competition might be an important factor in influencing food and territory acquisition. In our study, species sharing similar habitat (vegetated alpine meadow), *M. adamsi* and *M. nivalis*, showed divergence in some body traits (body mass, wing length, bill length and tarsus length), The other four co-occurring species (*M. taczanowkii*, *M. ruficollis*, *M. blanfordi* and *M. davidiana*) were also differentiated in some body traits.

The bill size or body size is frequently used by ecologists as indicator of prey size. Large bodied or large billed individuals would select larger food items than do smaller bodied or smaller billed ones (Pulliam & Enders 1971, Brown & Lieberman 1973). There is the positive correlation between bill or body size and prey size (Lederer, 1975; Smith & Zack, 1979). Generally, a larger bill or larger bodied individual favors taking prey of a larger size of items than a smaller bill or smaller bodied individual does (Grant, 1968; Herrera, 1978). For co-existing species of *Montifringilla*, the difference of bill length and body length maybe indicates the differences in preying size.

Long tails and long pointed wing promote long-distance fly. The two characteristics are closely related fly ability. These characteristics can be applied to *M. nivalis*, *M. adamsi*. The slightly longer tails and wings would predict that they are more adaptive to fly living.

Some researches have proposed that the difference in body traits of co-existing species is a strategy for decreasing potential competition among interspecific or intraspecific (Hutchinson, 1959; Schoener, 1984; Letcher, 1994). Generally, species with more similar body traits seem to be more likely to compete for resources and therefore would have more ecological overlap than species with differences in body traits. Some same examples can be found in studies on other co-existing birds. Three species of *Grallaria* differ in body traits when they overlap widely in elevational distribution and are syntopic species elsewhere in their ranges. *Xiphorhynchus ocellatus* and *X. Guttatus* with difference in body traits are syntopic species (Terborgh *et al*, 1984). Graves (1985) also pointed to that, in addition to the *Cacicus* and *Grallaria* examples, two other sets of congeners (*Coeligena* and *Thripadectes*) noted by Terborgh as having overlapping distributions in the Vilcabamba also differ in their body traits.

For these co-existing species, the basic question posed is that we hypothesize there is ecologically and morphological divergence for decreasing competition pressure from sharing similar restricted areas. As suggested by studied results, there would seem to be scope for the hypothesis. Nevertheless, we still need more studies to develop a comprehensive data set on just which characteristics are modified in response to the ecological and morphological divergence and precise functions and significance of these characteristics.

Acknowledgement - Many thanks to Xu Yan-Gong and Zhang Yin-Sun for their comments to the manuscript. The research is supported by the Project of Knowledge Innovation Program (KSCX2£–1–06A), and by NSFC (No. 39730080, No. 30170126) to Lei Fu-Min, and also supported by the talent scholar training program from NSFC to Qu Yan-Hua. Thanks also to Augusto De Sanctis, Dr. Massimo Pellegrini and Dr. Axel Gebauer for their help and collaboration.

References

Brown, J. H. & G. A. Lieberman. 1973. Resource utilization and coexistence of seed-eating desert rodents in sand dune habitats. Ecology 54: 788-797.

Cheng, T. H. 1976. A synopsis of the avifauna of China. (Translated from Chinese). Science Press, Beijing. 942-948.

Cheng, T. H. 1981. The study on fauna and evolution of terrestrial vertebrate of Tibet plateau. (In Chinese). Natural Museum of Beijing. 9: 1-17.

Dement'ev ,G. P. & N. A. Gladkon.1970. Birds of Soviet Union. V. 5. (Translated from Russian). Israel program for Science Translations, Jerusalem. 367-379.

Fu, T. S. 1998. Fauna Sinica. Ave. Vol. 14. Passeriforms Ploceidae, Fringillidae. (In Chinese). Science Press. 31-47.

Gebauer, A. & K. Martin. 1994. Biology and behavior of central Asiatic snow finches (*Montifringilla*) and mountain-steppe sparrows (*Pyrgilauda*). J. Ornithol. 135 (1): 55-71.

Grant, P. R. 1968. Bill size, body size, and the ecological adaptations of bird species

Graves, G. R. 1985. Elevation correlates of speciation and intraspecific geographic variation on plumage in Andean forest birds. Auk 102: 556-579.

Herrera, C. M. 1978. Individual dietary differences associated with morphology in Robins *Erithacus rubecula*. Ibis. 120: 542-545.

Hutchinson, G. E. 1959. Homage to Santa Rosalia or why are there so many kinds of animals? Am. Nat. 93: 145-159.

Ivanitskii, V. V. 1992 On the social behavior of David's snow finch and snow finch. Zool. Zh. Zo. 70 (9): 104-117.

Keast A., L. Pearce and S. Saunders 1995. How convergent is the American Redstart (*Setophaga ruticilla*, Parulinae) with flycatchers (Tyrannidae) in morphology and feeding behavior? Auk. 112 (2): 310-325.

Kozlova, E. B. 1959. Distribution, relationship and history of birds of Tibet plateau. (In Chinese, with Russian summary). Acta.Zoologica Sinica. 5 (1): 25-36.

Lederer, R. J. 1975. Bill size, food size, and jaw forces of insectivorous birds. Auk 92: 385-387.

Letcher, A. J., P. N. Purvis. & P. H. Harvey. 1994. Patterns of overlap in the geographic range of Palearctic and British mammals. J. Anim. Ecol. 63: 871-879.

Pulliam, H. R. 1971. Coexistence of sparrows: a test of community theory. Science 189: 474-476.

Remsen, J. V., JR., and S. W. Cardiff. 1990. Patterns of elevational and latitudinal distribution, including a "niche switch" in some guans (Cracidae) of the Andes. Conder 92: 970-981.

Remsen, J. V. & W. S. Graves. 1995. Distribution patterns of Buarremon Brush-finchs (Emberizinae) and Interspecific competition in Andean Birds. Auk 112: 225-236.

Schoener, T. W. 1984. Size differences among sympatric, bird-eating hawks: A worldwide survey. In Strong, D.R., Simberloff, D., Abele, L. G. & Thistle A. B, (eds) Ecological communities: conceptual issues and the evidence. Princeton, N. J.: Princeton University Press. 254-281.

Smith, J. N. M. and R. Zack. 1979. The geography of evolution. Heritability of some morphological characters in a Song Sparrow population. Evolution. 33: 460-467.

Terborgh, J., J. W. Fitzpatrick, and L. emmons. 1984. Annotated checklist of bird and mammal species of Cocha cashu Biological Station, Manu National Park, Peru. Fieldiana (Zool.) no. 21.

Zhang, R. Z. 1999. Zoogeograpgy of China. (In Chinese). Science Press. Beijing, China. 159-160.

Avocetta N° 26 (1): 19-24 (2002)

Spring migration of raptors on Conero Promontory

Marco Gustin[1], Alberto Sorace[2], Daniele Ardizzone[2] and Marco Borioni[3]

[1]*Via Gobbi 8, 42027 Montecchio Emilia (Re) - e-mail: m.gustin@libero.it*
LIPU, Settore Conservazione, via Trento 49 - 43100 Parma
[2]*SROPU, c/o oasi WWF "Bosco di palo", via Pale Laziale 2 - 00055 Ladispoli - Roma*
[3]*via Monte Vettore 32, 60131 Ancona*

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 Paleartic, 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 Willis1968, 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

---

Accepted 28 February 2002

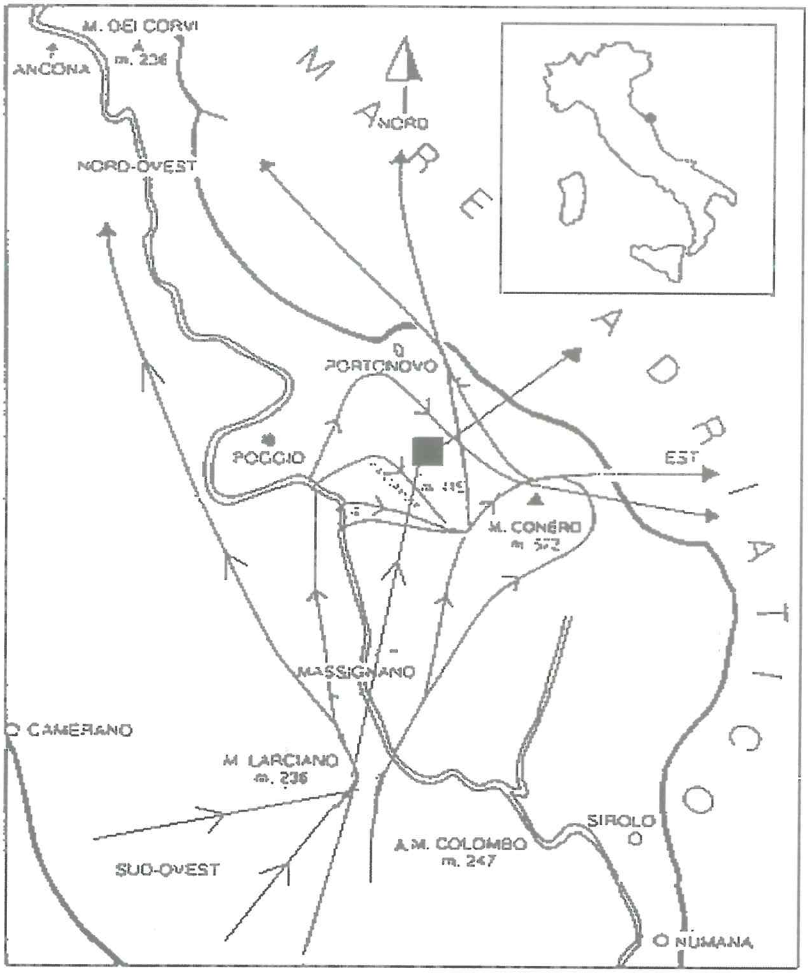


Figure 1. The Conero promontory. The square points out the site in which the study was carried out.
The arrows shows the north and east, preferential out-going flights directions of raptors.

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

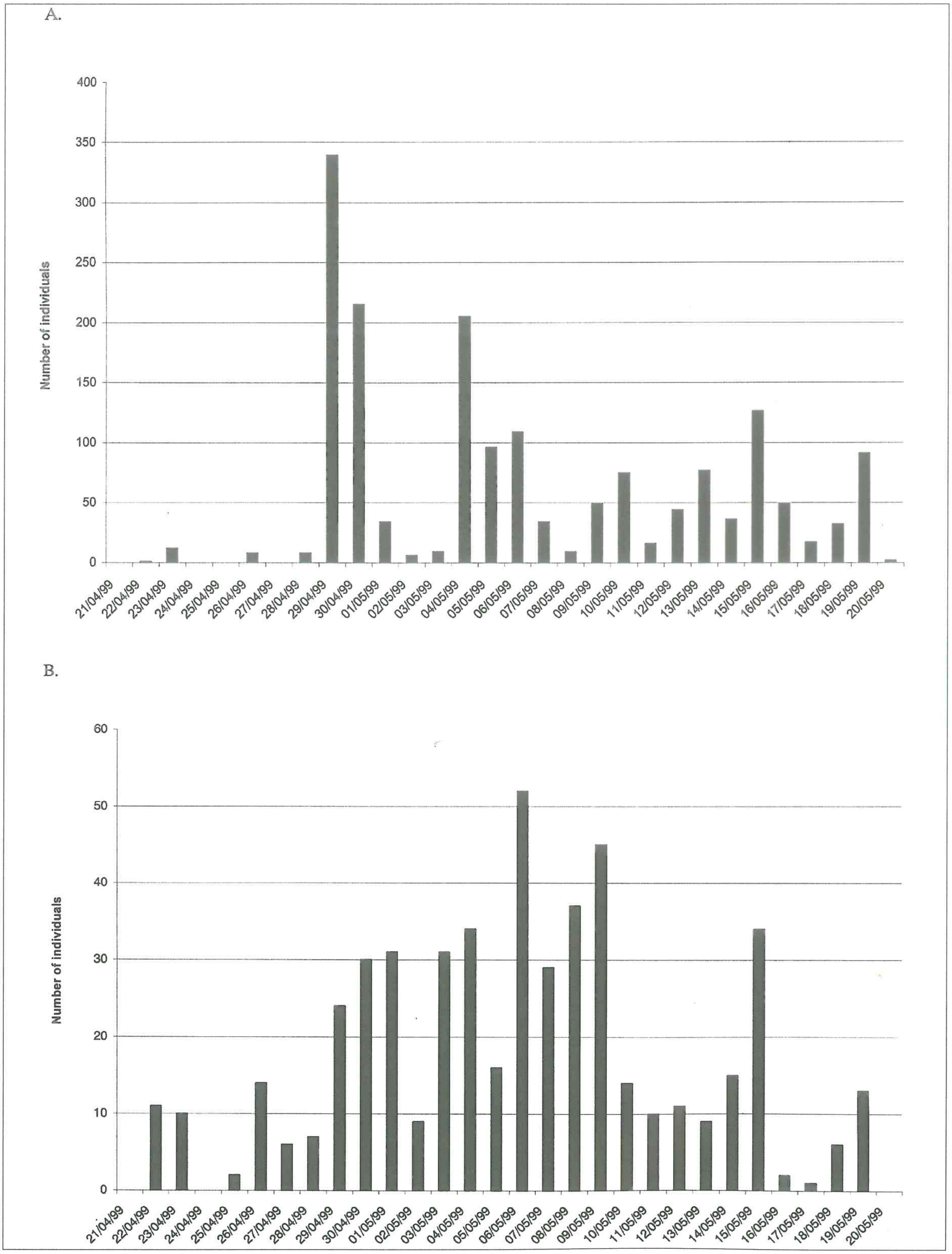


Figure 2. Migration fenology of two raptors species at Pian Grande on Conero promontory in spring 1999 (21 april - 20 may). A. Honey Buzzard. B. Marsh Harrier.

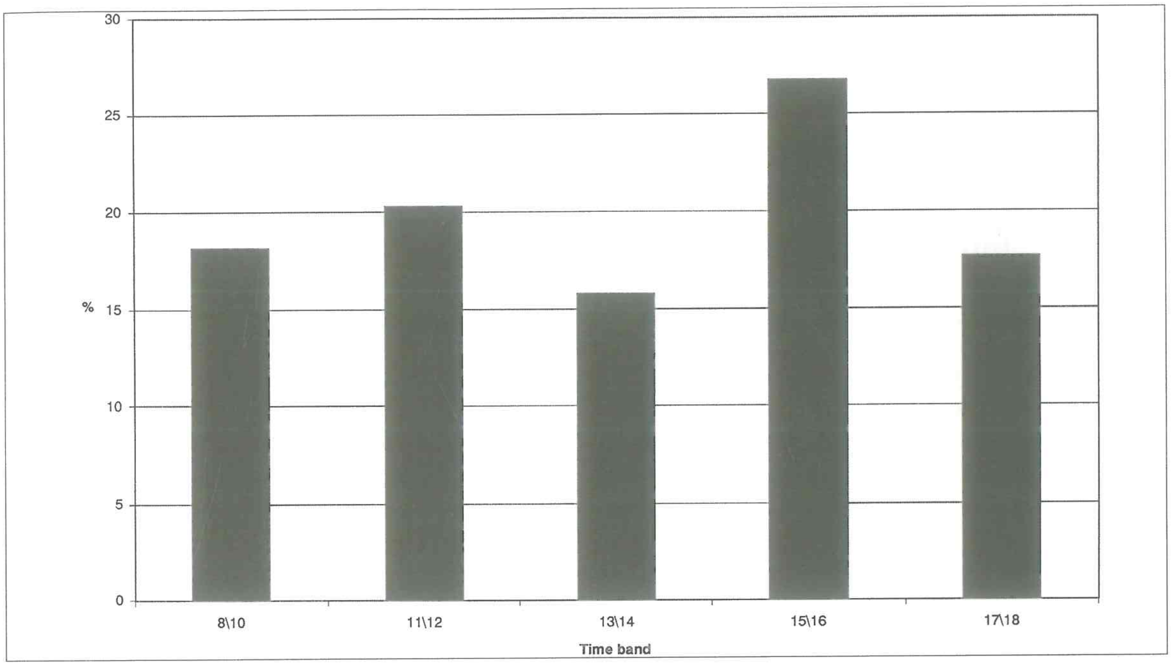


Figure 3. Percentage of migrating raptors observed in different time periods on Conero promontory in spring 1999.

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 *Circaetus 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.

Aknowledgements - 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 Acciptriformi 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 prénuptiale 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 Mediterranee 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).

Avocetta N° 26 (1): 25-31 (2002)

Nesting and Feeding Habits of the European Bee-eater (*Merops apiaster* L.) in a Colony next to a Beekeeping Site

Bruno Massa, Maria Concetta Rizzo

Stazione di Inanellamento, c/o Sezione Entomologia, Acarologia e Zoologia, Dipartimento SENFIMIZO, viale delle Scienze 13, 90128 Palermo, Italy. E-mail: zoolappl@unipa.it

Abstract - Authors carried out a study on a population of bee-eaters colonising a former sand quarry next to a beekeeping site. Data were collected to estimate population size, evaluate microclimate differences inside and outside nest tunnels, calculate bill length and weight variation in relation to nest excavation and nest attendance by bee-eaters, and to analyse their feeding habits, in particular in relation to bee availability. Population size was estimated as much as 100-110 pairs. Bill length resulted to decrease during the nest excavation, growing again after one month. Weight on the contrary was increasing during egg laying and brooding, and decreasing during nestlings' attendance. Temperature outside nests resulted on average lower than inside the nest tunnel, which in turn resulted much more constant. Bee-eaters are specialized in hymenopterans predation, and considered in some countries a pest for beekeeping. The analysis of the relationships between availability of bees and bees preyed upon by bee-eaters in the study area consented to consider bee predation incidence actually acceptable to the bee colony for its future survival.

Introduction

Breeding biology of the European bee-eater (*Merops apiaster*) is well known (cf. Fry 1984); nevertheless, there are some aspects of nesting and feeding habits which show adaptation to local resources, that deserves further investigations. Consideren "declining" in Europe (Heath *et al.* 2000), in the Mediterranean countries, their populations are generally fluctuating, with an evident recent increase only in Spain (Fry in Tucker and Heath 1994) and Italy (Fraissinet and Mastronardi 1997; Grenci *et al.* 1997) (cf. also Heath *et al.* 2000). Bee-eaters are important predators of Hymenoptera and, in some instance, domestic bees may play an important role in their diet. For this reason, in some Mediterranean countries, they have sometimes been regarded as a rather serious nuisance or even a pest (Fry 1983, 1984; Galeotti and Inglisa 2001 and references therein). In the European countries there are currently estimated to be about 500,000 beekeepers, very unevenly distributed; for many of them beekeeping is a hobby (up to 15 hives) or a part-time source of income (up to about 150 hives). Although statistics on this topic are few reliable, beekeeping is reported as an essential source of income for only 18,000 of the European beekeepers (4% of the total), who have more than 150 hives each. Between 1960' and 1996 beehives increased very much: in the European Union in 1968-71 there were 5,841,000 hives, which increased to 7,550,000 in 1992; a remarkable increasing occurred since 1980s, particularly in Mediterranean countries, as France, Greece, Italy, Spain and Portugal (Zappi Recordati 1956; F.A.O. 1989; Williams *et al.* 1991; Barbattini 1998).

Since 1995, we began a research on the breeding biology of bee-eaters in a colony established on a former sand quarry next to a beekeeping site. We report here the main results regarding: a) the population size of the colony; b) temperature differences inside and outside nest tunnels; c) bill length and weight variation in relation to nest excavation and nest attendance by bee-eaters; d) feeding habits, particularly in relation to beekeeping next to the bee-eater colony.

Materials and methods

The study site (Campofelice di Roccella, Sicily) is located on a former sand quarry, deserted since 1994, when it was colonised by a few pairs of bee-eaters, which were increasing to reach in 1996 50 pairs (Grenci *et al.* 1997). Each year they arrived on the middle of April, leaving on the second half of August, thus attending the area for a total of 120-130 days. A static beekeeping site, holding 140 hives is located at c. 1.5 km from the breeding site. As bee-eaters hunt-

Accepted 28 February 2002

ing range is 1-12 km (Tostain 1978; Fry 1984; pers. obs.) and forager bees flight range is 0.5-1.1 km (Free and Williams 1974; pers. obs.), we assume that in our study site hunting area of bee-eaters overlaps bees foraging area.

Bee-eaters 4-6 times a day regurgitate from their perches or nests a blackish pellet, 10-35 mm long, containing indigestible sclerites, including heads and wings of insects preyed upon; microscopic examination of these parts allows an accurate qualitative and quantitative analysis of prey. The diet of adults was analysed through the examination of pellets collected from June to August 1997 and from April to July 1998. Hymenoptera were identified comparing the heads recovered in the pellets with specimens previously identified and preserved in the collections of the Palermo University. The monthly number of bees as prey of bee-eaters was estimated by **N** = (**a** x **b** x **c** x **d**), where **a** is the mean number of bees (workers and drones) per pellet, **b** the total number of pellets regurgitated each day by a bee-eater, **c** the number of days per month, **d** the total number of bee-eaters in the colony (Inglisa *et al.* 1995). We assumed the mean daily number of pellets produced by an adult bee-eater to be five (Galeotti and Inglisa 2001).

Between 15 June and 15 July 1997, 1998 and 2001 food delivered to chicks was observed from c. 8-10 m with a Leitz 10 x 40 binocular. Observations were carried out between 9:00 a.m. and 6:00 p.m. on different nests and day times for a total amount of 28 hours; this let us to know the mean number of visits to chicks per hour by adults with prey and the occurrence of each prey item. When prey was not identifiable, only its size was estimated compared with bee-eater head size. Besides, 45 prey items delivered to chicks, lost by adults, were collected under the hole-nests and identified. The incidence of honeybees in the young diet was estimated by **N** = (**a** x **b**), where **a** is the number of bees daily brought to chicks by breeding pairs (estimated as reported above), and **b** is the number of days between the first bee-eater hatching and the last fledging (= 30).

The possible impact on apiculture was estimated as follows. A hive in spring-summer generally holds c. 40,000 workers and 500-700 drones; workers life expectancy in spring-summer is c. 40 days (Free 1993; T. Rinderer, pers. comm.) and consequently their daily turnover within a hive consists of c. 1000 individuals (2.5% of workers population). Besides, workers become foragers from the 2nd-3rd-life week, later flying out of the hive (Free 1993) and undergoing a predation risk. Drones are present in the hive from April to August, the mating occurring from April to June (Galeotti and Inglisa 2001). In the study-site, where there are 140 hives, the total amount of bees in summer could be estimated as much as 5,600,000 workers and 84,000 drones, whose daily turnover results to be c. 140,000. Since workers spend c. 1/2 of their life as foragers, the number of the latter estimated to be subjected to predation in 140 hives is 1/2 of 5,600,000, that is 2,800,000, whose daily turnover is 1/2 of 140,000 (not including drone mortality).

During the breeding season 1999, from May to July, two small data loggers able to record the temperature every three hours were placed outside and inside one nest cavity, obtaining on the whole 720 measures from each thermometer, downloaded on a table format by the OTLM Software; afterwards data were plotted on a graph and their best curves were built by the algorithm described by McLain (1974). The depth to place the thermometer inside the nest cavity (c. 60 cm) was established measuring 28 nest cavities by a flexible feeler.

In 1998 and 1999, bee-eaters were captured by mist-nets, measured and ringed. Sexes were identified following Baker (1993). Bill length (to forehead) and weight of males and females of bee-eaters measured in different dates of the breeding season were compared using 1-way ANOVA (SAS 1987). Population was estimated by the weighted mean applied to Petersen Lincoln method (Begon 1979):

$$\mathbf{N} = \frac{\sum \mathbf{M_i}\,\mathbf{n_i}}{(\sum \mathbf{m_i}) + 1},$$

where $\mathbf{M_i}$ is the number of marked individuals in the population which are available for sampling immediately before the day **i** sample, $\mathbf{n_i}$ is the number of individuals caught on day **i**, $\mathbf{m_i}$ is the number of marked individuals caught on day **i**.

Results and Discussion

Population estimate

In 1998, we ringed 45 individuals, in 1999 another 113, recovering 20 ringed in 1998. According to Petersen-Lincoln method, we may estimate a whole population of 243 individuals, possibly including some helpers (first year young helping adults in the nest attendance). In 1999 we carried out five ringing sessions, capturing a higher number of males compared with females (96 vs. 62); then we estimated separately male and female populations, obtaining the values of 120 males and 85 females. The estimate of 100-110 pairs in 1999 is consequently reliable. It doubled from 1996, when was estimated as much as 50 pairs (Grenci *et al.* 1997). This agrees with the general increasing of Italian populations, recorded by some authors (e.g.: Fraissinet and Mastronardi 1997), also noticeable in Sicily, where the whole population in 1993 was estimated less than 50 pairs (Lo Valvo *et al.* 1993), in 1996 as much as 500 pairs (Grenci *et al.* 1996) and in 2001 at least 1000 pairs (Massa, unpublished data).

Bill length and weight variation in relation to nest excavation and chicks attendance

Bee-eaters nest in tunnels excavated by themselves on sand cliffs, using bill and legs. Bill is worn out by this continuous activity, which begins at their arrival to nesting site and takes 10-20 days (Fry 1984; pers. obs.). We measured the bill length of newly arrived individuals on 20 April, obtaining both from males and females a measure (males: 45.3 ± 3.9 mm; females: 43.0 ± 3.4: Table 1) matching that obtained from a sample captured in Sicily during spring migration (males: 44.8 ± 3.7 mm; $t_{73} = 0.58$, $P = 0.56$; females: 43.3 ± 3.6; $t_{24} = 0.22$, $P = 0.82$), just longer than that recorded by Cramp (1985). The same measure, performed on 1st May, 10th May, 10th June and 20th June revealed an evident trend, with the smallest values on 20th May (males: 30.5 ± 2.6; females: 28.8 ± 1.8: Table 1), around the end of nest excavation; the bill reached nearly previous length on the middle of June (males: 41.5 ± 2.1; females: 40.0 ± 1.7: Table 1). ANOVA analysis let us to find significant differences among the subsequent dates (Table 2). In particular, bill length, both of males and females, resulted significantly different almost all over the different dates from April to June, when we measured it (Table 3). Even if bill wear of bee-eater during nest excavation could have been easily foreseen, its variation was not previously measured.

Conversely, the weight shows an opposite trend, possibly due to the energy request during nestling attendance (Table 1). It increases, more in females than in males, peaking on the middle of May, when egg laying is starting (males: 57.7 ± 4.6; females: 63.6 ± 5.4: Table 1); this value is maintained to the first decade of June (males: 56.0 ± 2.8; females: 60.3 ± 5.6: Table 1). In these days, bee-eaters are involved in the chicks' attendance, which brings about a weight loss in the following days, mainly in females (48.4 ± 1.8, c. 20% of loss), less so in males (51.4 ± 2.0, c. 8% of loss) (Table 1). Differences among the subsequent dates were significant (ANOVA analysis, Table 2); in particular, the increase and the following decrease of male and female weight resulted significant (Table 3). Variation of bee-eater weight during reproduction was hitherto unknown.

Table 1. Bill length from forehead to tip (in mm) and weight (in grams) of bee-eaters measured in different dates of the breeding season.

Bill length/males	MEAN	S.D.	n	**Bill length/females**	MEAN	S.D.	n
20 April	45.3	3.9	36	20 April	43.0	3.4	10
1st May	35.1	3.3	14	1st May	35.7	4.2	11
10 May	31.9	3.4	12	10 May	32.5	1.8	8
20 May	30.5	2.6	39	20 May	28.8	1.8	12
10 June	37.3	2.8	11	10 June	36.1	5.5	6
20 June	41.5	2.1	18	20 June	40.0	1.7	23
Weight/males	MEAN	S.D.	n	**Weight/females**	MEAN	S.D.	n
20 April	54.0	3.7	23	20 April	54.1	3.1	17
1st May	54.4	2.1	14	1st May	54.6	1.8	11
10 May	57.3	2.2	12	10 May	59.1	3.2	8
20 May	57.7	4.6	38	20 May	63.6	5.4	12
10 June	56.0	2.8	11	10 June	60.3	5.6	6
20 June	51.4	2.0	18	20 June	48.4	1.8	23

Table 2. Summary of the 1-way ANOVA analysis of differences in bill length and weight (males and females separately) among six different dates through the breeding season

	fd	F	P
Bill length males	5	79.57	< 0.0001
Bill length females	5	36.22	< 0.0001
Weight males	5	10.08	< 0.001
Weight females	5	38.71	< 0.0001

Nest tunnels

The mean length of nest cavities resulted 57.5 ± 22.2 cm (min. 40, max 110), shorter than that recorded by Fry (1984) (70-150 cm), probably depending on the soil type. Temperature outside nests resulted on average lower (26.9 ± 4.3°C; min 18.8, max 38.5) in comparison with that inside the nest cavity, which in turn was much more constant (28.2 ± 1.2°C; min

Table 3. Tukey's test applied to bill length and weight of males and females of bee-eaters measured in six different dates of breeding season. Values in bold are significant. Bill = bill length; W = Weight.

Date	Variable	1st May	10 May	20 May	10 June	20 June
20 April	Bill males	**P = 0.0001**	**P = 0.0001**	**P = 0.0001**	**P = 0.0001**	**P = 0.003**
	Bill females	**P = 0.0001**	**P = 0.0001**	**P = 0.0001**	**P = 0.004**	P = 0.08
	W. males	P = 0.99	**P = 0.04**	**P = 0.0001**	P = 0.51	P = 0.11
	W. females	P = 0.99	**P = 0.01**	**P = 0.0001**	**P = 0.003**	**P = 0.0001**
1st May	Bill males		P = 0.11	**P = 0.0002**	P = 0.49	**P = 0.0001**
	Bill females		P = 0.10	**P = 0.0001**	P = 0.99	**P = 0.002**
	W. males		P = 0.26	**P = 0.03**	P = 0.84	P = 0.17
	W. females		P = 0.06	**P = 0.0001**	**P = 0.02**	**P = 0.0002**
10 May	Bill males			**P = 0.0002**	P = 0.49	**P = 0.0001**
	Bill females			**P = 0.0001**	P = 0.99	**P = 0.002**
	W. males			P = 0.99	P = 0.95	**P = 0.0001**
	W. females			**P = 0.05**	P = 0.98	**P = 0.0001**
20 May	Bill males				**P = 0.0001**	**P = 0.0001**
	Bill females				**P = 0.0002**	**P = 0.0001**
	W. males				P = 0.75	**P = 0.0002**
	W. females				P = 0.39	**P = 0.0001**
10 June	Bill males					**P = 0.009**
	Bill females					**P = 0.005**
	W. males					**P = 0.007**
	W. females					**P = 0.0001**

26.3, max 30.7); differences between variances were significant (P < 0.001) (Fig. 1). Temperature inside nests of bee-eaters was previously recorded in southern Spain by White *et al.* (1978), who found a soil surface variation from 13° to 51°C, while the brood-chamber temperature was uniformly around 25°C. Hole nests have the invaluable function of providing their occupants with a stable microclimate and protection from wide temperature variation (Fry 1984). Thus, nesting inside a cavity should result in an advantage that certainly balances the energy costs for the nest preparation.

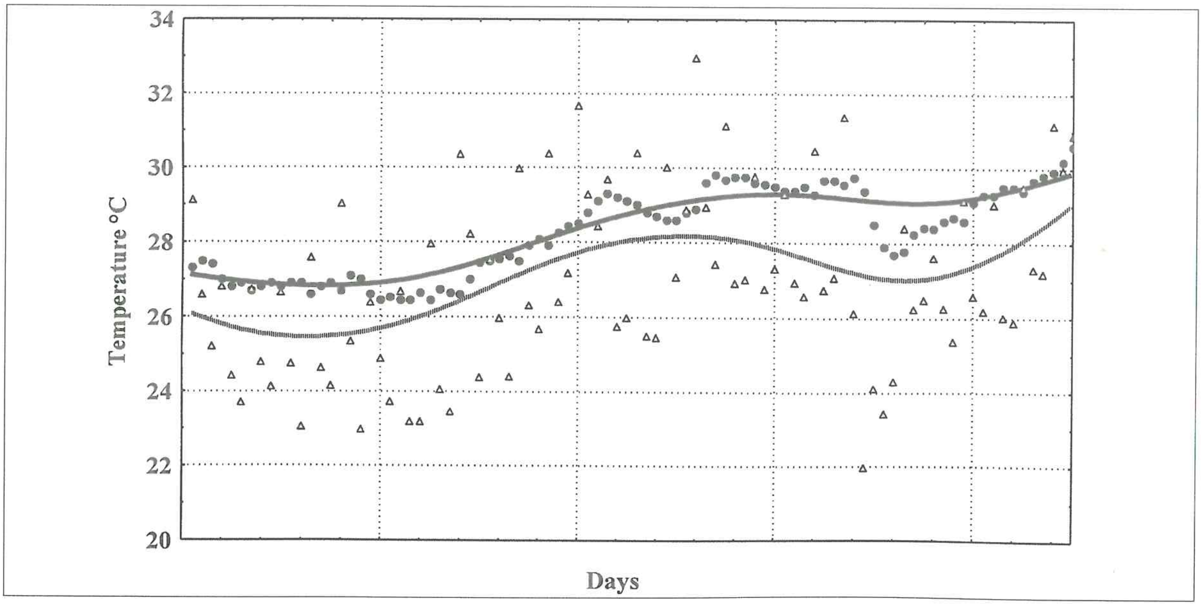


Fig. 1. Mean temperature, inside (black dots) and outside (white triangles) a nest tunnel, during 90 days of 1999 breeding season, and their best curves (black solid line: inside nest tunnel; grey solid line: outside). Differences between variances are significant (P < 0.001).

Feeding habits

Table 4 lists Arthropods preyed upon by bee-eaters in 1997 and 1998; the mean number of prey per pellet in 1997 ranged between 8.2 and 9.1, in 1998 between 7.9 and 11.1; the percentage of Hymenoptera in 1997 varied between 67 and 96%, in 1998 between 70 and 94%. Similar values were observed in 1996 in the same site (Grenci *et al.* 1997). In 1997 bees (both sexes) ranged between 34 and 51% of prey (mean number per pellet: 4.1), in 1998 between 30.5 and 69% (mean number per pellet: 5.1). Values exceeding over 50% have been recorded in Spain (Herrera and Ramirez 1974) and in Sardinia (Galeotti and Inglisa 2001); they are remarkably higher than the average of 15-25% reported by Fry (1983, 1984 and references therein). In the two years, we also noticed as prey good numbers of wild pollinators (e.g.: *Bombus* and *Megabombus*), and also of Dermaptera (mainly *Labidura riparia*) and Coleoptera (mostly dung-beetles and pollinators belonging to different families, like Cerambycidae, Buprestidae, Cleridae and Melolonthidae). Finally, we recorded also some aposematic prey and species certainly captured on the soil (e.g. Chilopoda and Coleoptera Tenebrionidae). We observed evident differences in the diet of young; among 300 identified prey, 21% were bees, 19% *Xylocopa* sp., 16% *Bombus/Megabombus*, 7% small Hymenoptera, 24% Odonata and 12% other prey. Among 45 prey collected under the nests 14 were *Xylocopa* sp., 18 *Bombus terrestris*, 7 *Halictus quadricinctus* and only 5 *Apis mellifera*. Prey size brought to chicks was significantly bigger than that consumed by adults ($\chi^2 = 62.1$, $P < 0.001$, $n = 600$); thus, adults chose smaller insects as their prey (among

Table 4. Incidence of Arthropods in the diet of the bee-eaters from June to August 1997 and from April to July 1998.

Month-year	VI-97	VII-97	VIII-97	IV-98	V-98	VI-98	VII-98
N. pellets	13	29	20	21	20	20	14
N. prey	118	238	208	212	202	159	156
Chilopoda	1 (0.9%)	0	1 (0.5%)	0	0	0	0
Odonata	1 (0.9%)	0	1 (0.5%)	0	0	0	0
Dermaptera	13 (11%)	0	7 (3.4%)	0	19 (9.4%)	7 (4.4%)	0
Orthoptera	1 (0.9%)	1 (0.4%)	0	0	1 (0.5%)	2 (1.2%)	5 (3.2%)
Heteroptera	1 (0.9%)	2 (0.8%)	3 (1.4%)	2 (0.9%)	4 (2%)	3 (1.9%)	1 (0.6%)
Lepidoptera	0	1 (0.4%)	1 (0.5%)	0	0	0	0
Coleoptera	22 (19%)	6 (2.5%)	27 (13%)	15 (7%)	38 (19%)	15 (9.4%)	3 (1.9%)
Hymenoptera	79 (67%)	228 (96%)	168 (81%)	195 (92%)	140 (70%)	132 (83%)	147 (94%)
Apis mellifera workers	21 (18%)	82 (34%)	52 (25%)	132 (62%)	40 (20%)	59 (37%)	74 (47%)
Apis mellifera drones	19 (16%)	39 (16%)	41 (20%)	15 (7%)	33 (16%)	14 (9%)	7 (4.5%)
Ichneumonidae	3 (2.5%)	24 (10%)	6 (2.9%)	0	0	0	0
*Polistes*sp.	2 (1.7%)	4 (1.7%)	8 (3.8%)	0	1 (0.5%)	1 (0.6%)	1 (0.6%)
Paravespula sp.	5 (4.2%)	35 (15%)	11 (5.3%)	1 (0.5%)	7 (3.5%)	2 (1.2%)	6 (3.8%)
Vespa sp.	0	0	0	0	1 (0.5%)	0	2 (1.2%)
Anoplius viaticus	2 (1.7%)	5 (2%)	0	2 (1%)	6 (3%)	4 (2.4%)	0
Cerceris sp.	1 (0.8%)	0	0	9 (4.2%)	0	2 (1.2%)	0
Holandrena decipiens	3 (2.5%)	20 (8.4%)	10 (4.8%)	0	4 (2%)	1 (0.6%)	5 (3.2%)
Seladonia gemmea	0	0	0	0	1 (0.5%)	0	0
Halictus sp.	8 (6.8%)	0	5 (2.4%)	0	10 (5%)	10 (6.3%)	35 (22%)
Anthidium sp.	0	0	0	0	0	0	1 (0.6%)
Eucera nigrescens	1 (0.8%)	1 (0.4%)	5 (2.4%)	19 (9%)	1 (0.5%)	1 (0.6%)	11 (7%)
Xylocopa sp.	2 (1.7%)	7 (2.9%)	2 (1%)	0	5 (2.5%)	1 (0.6%)	2 (1.2%)
Bombus terrestris	3 (2.5%)	3 (1.3%)	1 (0.5%)	10 (4.7%)	15 (7.5%)	16 (10%)	0
Megabombus ruderatus	9 (7.6%)	8 (3.4%)	27 (13%)	7 (3.3%)	16 (8%)	21 (13%)	3 (1.8%)
Bees/pellet	3.1	4.2	4.6	7.0	3.8	3.6	5.8
Prey/pellet	9.0	9.1	8.2	10.1	10.0	7.9	11.1
Bees estimated to be preyed on monthly by ad. bee-eaters	93,000	126,000	138,000	210,000	114,000	108,000	174,000
Bees estimated to be delivered monthly to young bee-eaters	134,200	134,200	0	0	0	134,200	134,200

which huge numbers of bees), while preyed on bigger insects to deliver to young, coherently with what Fry (1984) presumed. Feeding frequency in the period 15 June-15 July consisted of 35.5 ± 21.3 prey brought to chicks per hour (min. 11, max. 69); frequency in the morning and in the afternoon did not differ statistically (Student test: $t_{23} = 0.239$, P = NS). Inglisa (1991) in July in Sardinia obtained a similar value (26.9).

Possible impact on apiculture

Considering at least 12 hours of predatory activity in the breeding season, a pair of adults in our study area delivered to chicks a mean daily number of 426 prey (range: 170-682). From the average bee number brought daily to chicks (21% of 426 = 89.5), we obtained 268,380 bees (= 89.5 x 30 days x 100 nests) as food delivered to young during nestlings' attendance (between 15 June and 15 July). We added this value to the total amount of bees estimated to have been preyed upon by 100 pairs of bee-eaters during their permanence in the site (from 15 April to 15 August). On the whole, in the two years the monthly bee-eater predation ranged from 114,000 to 308,200 bees (Table 4).

Fig. 2 reports the total number of foragers' population monthly estimated to be preyed upon by bee-eaters in our study area and their percentage compared to the whole bee colony. The predation incidence ranged from 2.0 to 5.5%, higher than that (0.27 to 0.58%) recorded in Sardinia from Galeotti and Inglisa (2001). However, it was only between 1 and 2.8% of whole forager population, and between 2.7 and 7.3% of the bees monthly subjected to turnover. We would point out that in the Mediterranean area most hives contain up to 60-80,000 workers, with a mean of 30,000 foragers. The loss percentage here estimated has to be regarded as the average risk of predation next to a beekeeping site housing c. 150 hives. In fact, even if bee predation by bee-eaters should not bee density dependent (Galeotti and Inglisa 2001), small numbers of hives (50-60) may undergo a lower percentage of predation from bee-eaters. Additionally, in spring, there is a lower turnover of bees than in summer, and a 5-10% loss of foragers in summer probably may be acceptable to the bee colony for future survival. Although the loss of drones due to bee-eaters seems important, it is inversely density-dependent, so that it decreases at high bee-densities (Galeotti and Inglisa 2001).

Part-time (up to 150 hives) often is static beekeeping and grouping hives could minimize bee-eater predation. Nevertheless, grouping hives may be unrealistic from the hobby beekeeper's standpoint. In the Mediterranean region, migratory beekeeping is practised to exploit transient nectar sources for honey production or to pollinate particular crops (Williams *et al.* 1991). If the bees are being used for pollination, it may be impractical to arbitrarily group 50 colonies into an apiary, whereas, if the bees are being used for honey production, then groups of 50 or more colonies may over saturate the available forage and make honey production impractical.

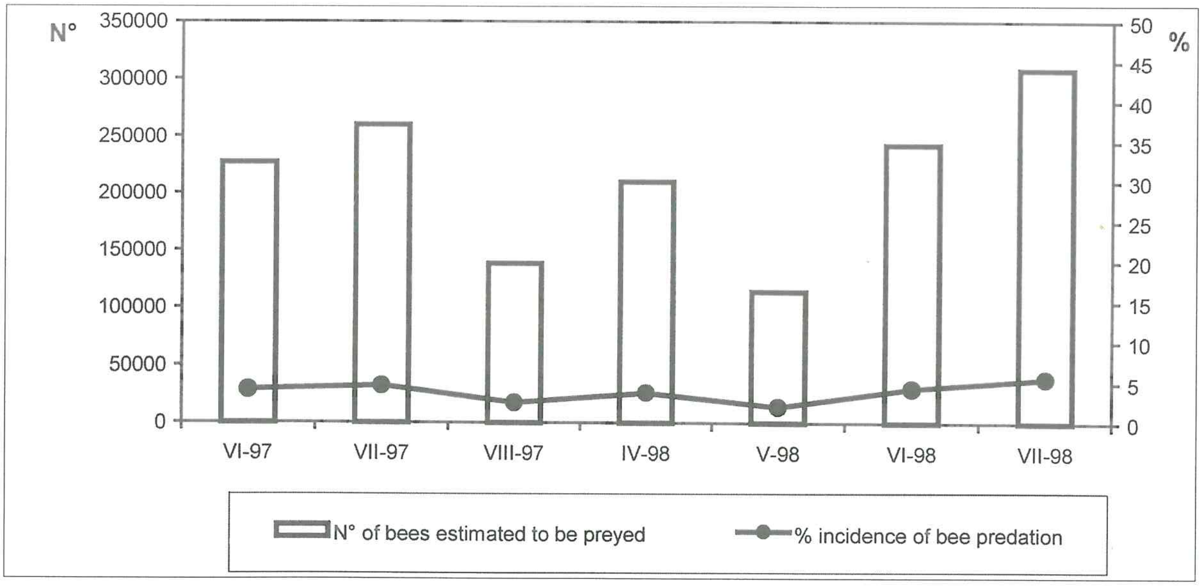


Fig. 2 - Total amount of bees estimated to be preyed on each month by the bee-eater population and its incidence on the whole bee colony in 1997 and 1998.

Acknowledgements - We thank very much Paolo Galeotti (University of Pavia), who critically reviewed the first draft of the manuscript, Thomas E. Rinderer (International Bee Research Association, Louisiana), who provided interesting information on bee biology, Vittorio Nobile (University of Catania), who identified some Hymenoptera, Fabio Lo Valvo and Natalino Cuti (Stazione Inanellamento, Palermo), who provided some biometrics of bee-eaters, Mario Lo Valvo (University of Palermo) and Giulia Casamento, for assistance during collecting and processing of data loggers. This research was funded by Assessorato Agricoltura e Foreste Regione Sicilia to Stazione di Inanellamento.

Riassunto – Tra il 1996 ed il 2001 è stata studiata una popolazione di Gruccioni che ha colonizzato una cava di sabbia abbandonata, situata in provincia di Palermo (Sicilia). Il numero totale di coppie nidificanti è stato stimato con il metodo della cattura-ricattura ed è risultato pari a circa 100-110, in incremento nel corso degli anni. Inoltre, mediante l'uso di due termometri, è stata misurata la temperatura all'interno di una tana-nido ed all'esterno per tutto il periodo riproduttivo; sebbene sia risultata una temperatura media più alta all'interno del nido, questa si è mantenuta significativamente più costante di quella esterna. Al momento dell'arrivo nel sito, è stata misurata la lunghezza del becco ed è stato rilevato il peso degli individui; le misurazioni sono state quindi ripetute periodicamente. Il becco si consuma in entrambi i sessi durante l'escavazione della tana-nido, ricrescendo nel corso del mese successivo. L'andamento del peso ha mostrato differenze nei due sessi, crescendo dal momento dell'arrivo nella colonia, soprattutto nelle femmine, con un picco in maggio, quando ha inizio la deposizione delle uova; questo valore si è mantenuto fino alla prima decade di giugno, ma subito dopo, quando gli adulti sono stati impegnati nell'allevamento dei piccoli, è avvenuta una perdita di peso, più consistente nelle femmine (c. 20%) che nei maschi (c. 8%). I Gruccioni sono specializzati nella predazione di insetti, soprattutto Imenotteri, e considerati in alcuni Paesi nocivi all'apicoltura. L'analisi del rapporto tra disponibilità di api e loro predazione da parte dei Gruccioni nell'area di studio ha permesso di concludere che l'incidenza del prelievo di api è accettabile per la futura sopravvivenza degli alveari.

References

Baker K. 1993. Identification Guide to European Non-Passerines. BTO Guide 24. British Trust for Ornithology, Thetford.

Barbattini R. 1998. Il settore apistico. In: Sillani S. *et al.* (red.), La comparsa di un nuovo prodotto alimentare. Il caso del miele di melata di *Metcalfa pruinosa*. Agribusiness Landscape & Environment Management, 2: 236-242.

Begon M. 1979. Investigating Animal Abundance: capture-recapture for biologists. E. Arnold, London.

Cramp S. (ed.) 1985. The Birds of the Western Palearctic. IV. Oxford Univ. Press, Oxford, UK.

F.A.O. 1989. Production Yearbook (1965-1989). Food and Agriculture Organization of the United Nations, Rome, Italy.

Fraissinet M. and Mastronardi D. 1997. Evoluzione dell'areale del Gruccione, *Merops apiaster*, in Italia nel corso del ventesimo secolo. Riv. ital Orn., 66 (1996): 155-169.

Free J. B. 1993. Insect pollination of crops. Academic Press, San Diego, USA.

Free J. B. and Willams I. H. 1974. Influence of the location of honeybee colonies on their choice of pollen sources. J. Appl. Ecol., 11: 925-935.

Fry C. H. 1983. Honeybee predation by Bee-eaters, with economic considerations. Bee World, 64: 65-78.

Fry C. H. 1984. The Bee-eaters. T. & A. D. Poyser, Calton, UK.

Galeotti P. and Inglisa M. 2001. Estimating predation impact on honeybees *Apis mellifera* L. by European Bee-eaters *Merops apiaster* L. Rev. Écol. (Terre Vie), 56: 373-388.

Grenci S., Massa B., Nobile V. and Rizzo M. C. 1997. Importanza degli Imenotteri (Insecta Hymenoptera) nella dieta del Gruccione, *Merops apiaster* L. (Aves Meropidae). Naturalista sicil., 21: 287-307.

Heath M., Borggreve C. and Peet N. (eds.), 2000. European Bird Populations. Estimates and Trends. BirdLife International Conservation Series n. 10.

Herrera C.M. and Ramirez A. 1974. Food of Bee-eaters in southern Spain. Brit. Birds, 67: 159-164.

Inglisa M. 1991. Attività giornaliera del Gruccione (*Merops apiaster*) nel periodo riproduttivo. In: SROPU (red.), Atti V Conv. ital. Orn., Suppl. Ric. Biol. Selvaggina, 17: 107-110.

Inglisa M., Galeotti P. and Strosselli S. 1995. Il Gruccione (*Merops apiaster*) e l'apicoltura in provincia di Oristano. In: Cossu S., Onida P. and Torre A. (red.), Studio, gestione e conservazione della fauna selvatica in Sardegna. Ed. del Sole and Amm. Prov. Oristano, Italy, pp. 429-432.

Lo Valvo M., Massa B. and Sarà M. (red.) 1993. Uccelli e paesaggio in Sicilia alle soglie del terzo millennio. Naturalista sicil., 17 (suppl.): 1-373.

McLain D. H. 1974. Drawing contours from arbitrary data points. The Computer Journal, 17: 318-324.

SAS. 1987. SAS/STAT User guide version 6. SAS Inst. Inc., Cary NC U.S.A.

Tostain O. 1978. Nidification du Guêpier d'Europe *Merops apiaster* et observations de la Cisticole des joncs *Cisticola juncidis* en Seine-et-Marne. L'Oiseau Rev. Fr. Orn., 48 : 184.

Tucker G.M. and Heath M.F. 1994. Birds in Europe: their conservation status. BirdLife Int., Cambridge, UK.

White F. N., Bartholomew G. A. and Kinnery J. L. 1978. Physiological and ecological correlates of tunnel nesting in the European Bee-eater, *Merops apiaster*. Physiol. Zool., 51: 140-154.

Williams I. H., Corbet S. A. and Osborne J. L. 1991. Beekeeping, wild bees and pollination in the European Community. Bee World, 72: 170-180.

Zappi Recordati A. 1956. Facts about beekeeping in Italy. Bee World, 37: 229-237.

Avocetta N° 26 (1): 33-39 (2002)

Note sulla biologia riproduttiva del Cannareccione (*Acrocephalus arundinaceus*) in zone umide dell'Italia Centrale

ALESSIO QUAGLIERINI

Via S. Alessandro, 57, 56019 Vecchiano - Pisa

Riassunto - È stata studiata per nove anni una popolazione nidificante di *Acrocephalus arundinaceus* in una vasta palude d'acqua dolce e in una piccola zona umida artificiale dell'Italia Centrale. Sono stati raccolti dati sull'ubicazione del nido e sui principali parametri riproduttivi con la finalità di correlare tali parametri alla differente struttura del fragmiteto, per far luce sui motivi della diminuzione numerica della specie dal 1992 in poi. Il nido viene mediamente appeso a 5 steli, a 91 cm di altezza sull'acqua e a 78 cm di distanza dalle acque libere. Sotto al nido l'acqua è profonda in media 51 cm e la densità del fragmiteto è di 497 steli/m^2. Vengono utilizzati per l'ancoraggio steli alti in media 238 cm e dal diametro di 0,56 cm. Le uova sono leggermente più piccole rispetto ai principali dati italiani ed europei. Similmente, rispetto ai principali dati bibliografici, la dimensione media della covata completa – 4,39 uova – è inferiore del 7-8%. I dati hanno confermato il regolare compimento di due deposizioni – la prima tra il 29 aprile e il 6 giugno, la seconda tra il 10 giugno e il 28 luglio – nonché diversi episodi di covate sostitutive alla prima. Il tasso di schiusa è del 77,8%; ha lasciato il nido il 90,2% dei nidiacei (almeno 2,78 giovani per nido); il successo riproduttivo complessivo è risultato così del 70,2%. Il 25,7 % dei nidi costruiti ha subìto predazione, è stato abbandonato o parassitato da *Cuculus canorus*. Il Cannareccione utilizza per la riproduzione diverse tipologie di fragmiteto, e non sembra influenzato dai parametri valutati. Uno dei parametri importanti è forse il recente aumento di livello delle acque nel Massaciuccoli e la conseguente crescita ritardata del fragmiteto, che sembra avere una influenza negativa nella fase di occupazione dei territori da parte dei maschi.

Introduzione

Nel corso di una ricerca pluriennale (1992-1999) sulla comunità ornitica nidificante nella palude del lago di Massaciuccoli, Lucca-Pisa (Quaglierini in stampa), il Cannareccione *Acrocephalus arundinaceus* è risultata specie in netto declino (570-650 maschi cantori nella stagione riproduttiva 1992; 300-350 nel 1999). Nel medesimo arco temporale, in altre zone umide toscane – soprattutto nel padule di Fucecchio, Pistoia-Firenze (Quaglierini 1998, oss. pers.) e nell'alveo del lago di Porta, Massa Carrara-Lucca (Quaglierini 2000, oss. pers.) – la specie è invece rimasta stabile in diffusione e consistenza. Questo fatto ha dato impulso alla raccolta, nel triennio 1997-1999, di dati sull'ubicazione del nido e sui parametri riproduttivi, in modo da riuscire a correlare tali parametri alla differente struttura del fragmiteto in aree diverse della palude, considerate anche le continue variazioni ambientali dovute a sfalci e incendi dolosi. Tutto ciò per far luce sui motivi della diminuzione del Cannareccione, specie attualmente in fase di espansione territoriale in Europa settentrionale e orientale, ma diminuita numericamente in molte aree del Paleartico Occidentale (Cramp e Brooks 1992); intorno al 50% nella maggior parte dei paesi europei e dal 20 al 50% in Italia tra il 1970 e il 1990 (Schulze-Hagen 1997). In Italia gli studi sulla biologia riproduttiva di questa specie sono rari e risalenti ad oltre due decenni fa (Fracasso 1978, Petretti 1979). I risultati di questo studio – confrontati con quanto rilevato nel frattempo in altre aree italiane ed europee (Beier 1981, Dyrcz 1981, Realini 1984, Pazzuconi 1997) – costituiscono una integrazione degli scarsi dati italiani; inoltre permettono la formulazione di suggerimenti in funzione di una oculata gestione delle zone umide interessate.

Area di studio e metodi

Lo studio è stato condotto principalmente nella palude del Lago di Massaciuccoli (Toscana, Italia Centrale), vasta (910 ha di palude, 1025 ha di acque libere profonde oltre 1 m) zona umida d'acqua dolce situata a 4 km dal mar Ligure e a 1 m di altezza s.l.m.,

---

Accepted 11 March 2002

caratterizzata dalla presenza di vasti falascheti (area a *Cladium mariscus*) e fragmiteti (area a *Phragmites australis*), e da circa 100 ha occupati da "chiari" e vasche poco profonde. La palude è inoltre attraversata da molti canali lunghi anche 3 km e larghi fino a 80-100 m.

La maggior parte delle rive – sia del lago sia degli altri corpi idrici – è bordata dal fragmiteto per una profondità variabile da 2 a 6 m. Sono presenti anche fragmiteti maturi estesi per alcuni ettari. Nel complesso la superficie occupata da *Phragmites australis* è estesa per circa 340-360 ha. Per una più approfondita descrizione dell'area si veda Quaglierini (1999). È stato preso in esame anche un "chiaro" (laghetto artificiale) ad uso venatorio, nel quale per quattro anni (1992, 1994, 1995, 1998) l'acqua è stata mantenuta ad un livello massimo di 80 cm per tutta la primavera-estate. Il "chiaro" è situato nella Bonifica di Vecchiano (PI) a circa 2 km in linea d'aria dalla fascia palustre meridionale del Massaciuccoli. Il fragmiteto borda le sue rive per una profondità di 2-3 m, e solamente in un settore limitato copre il corpo idrico per una profondità di 6-10 m. La superficie coperta dal fragmiteto è pari a 0,16 ha su un totale di 0,43 ha.

Lo studio si è protratto per 9 anni (1992-2000). All'interno della palude sono state individuate quattro aree campione, con diversi caratteri vegetazionali, per complessivi 562 ha. Nelle aree campione sono state effettuate – tra il 25 marzo e il 15 agosto – 316 escursioni per complessive 1270 ore di osservazione.

Sono stati raccolti dati anche sulla piccola popolazione del "chiaro", in modo da confrontarli con quelli di Massaciuccoli. La popolazione esaminata, infatti, vista la tranquillità di cui gode l'area da aprile a luglio, e soprattutto la stabilità delle componenti ambientali – livello delle acque, consistenza e dimensione del fragmiteto – è senza dubbio rappresentativa per quanto riguarda un ottimale svolgimento della fase riproduttiva.

Il fragmiteto è stato suddiviso in tre classi di età (giovane, maturo e intermedio) e la sua struttura è stata ricondotta a tre tipologie (ciuffo isolato o flottante, fragmiteto esteso in profondità, fragmiteto perimetrale) che più frequentemente si presentano nella palude; tutto ciò per meglio valutare le preferenze ambientali nell'ubicazione del nido.

Complessivamente, per le misure e le elaborazioni, sono stati esaminati 233 nidi e 386 uova appartenenti a 88 covate complete.

Risultati

Nido

Per le misure vedi la Tabella 1. I nidi rinvenuti hanno forma cilindrica, talvolta emisferica. La coppa, invece, è generalmente di forma ovalizzata. Gli abbozzi di nido sono sempre risultati composti da materiale vegetale umido, confermando quanto affermato da Géroudet (1984).

Ubicazione del nido

Per le misure vedi la Tabella 2. Per quanto riguarda la tipologia del fragmiteto (n = 210), quello perimetrale è risultato occupato nel 48,6% dei casi; i ciuffi isolati, anche flottanti lungo le rive del lago e dei canali secondari, sono stati invece occupati nel 40,0 % dei casi; i fragmiteti estesi in profondità sono stati scelti in minor misura (11,4%). Per quanto riguarda l'età del fragmiteto (n = 210), quello giovane dell'annata – spesso in fase di ricrescita dopo un taglio o un incendio (steli verdi) – è stato occupato nel 48,6% dei casi; il fragmiteto di uno-due anni all'interno del quale sono cresciuti nuovi steli (intermedio, steli misti) è stato invece scelto nel 37,1% dei casi; infine il fragmiteto maturo (steli secchi) è stato occupato solamente nel 14,3% dei casi.

Il 78,0% dei nidi è ubicato tra 66 e 110 cm sul livello dell'acqua, mentre nel 70,1% dei casi la profondità dell'acqua sotto al nido è compresa tra 36 e 65 cm.

Tabella 1. Misure nido (mm; peso in g). Misure effettuate durante la deposizione delle uova oppure (peso) a nidificazione conclusa. La lunghezza della struttura è stata misurata con calibro di precisione 0,1 mm ma con arrotondamento a 1 mm. Il diametro esterno e interno della coppa risulta dalla media aritmetica delle misure dei due assi (la forma è grossolanamente ovale). La profondità della coppa è stata misurata al centro del nido. Lo spessore delle pareti risulta dalla media di 4 misure in altrettanti punti del nido. Il peso è stato rilevato con bilancia di precisione 0,01 g ma arrotondato a 0,1 g causa la presenza, anche dopo la "ripulitura", di steli e pagliuzze usate per il sostegno ma non appartenenti alla struttura del nido.

	media	d. s.	min.	max.	n
Lunghezza	109,2	15,0	78	162	70
Diametro esterno	94,7	5,8	82	112	70
Diametro interno	65,6	5,0	54	82	70
Profondità	71,1	6,8	49	86	70
Spessore pareti	14,8	3,2	9	22	70
Peso	29,3	7,7	19,7	54,2	70

Tabella 2. Parametri ubicazione nido (misure in cm; densità = n. steli per m^2); MAS = Massaciuccoli. Le misure sono state effettuate su nidi appena completati oppure nei quali fosse in corso la deposizione delle uova. L'altezza sul livello dell'acqua del limite inferiore della struttura è stata misurata con asta graduata in cm e apprezzamento di 1 cm. La profondità dell'acqua sotto al nido è stata apprezzata di 1 cm. La distanza da acque libere e canali è stata apprezzata di 5 cm. Per gli steli inglobati nel nido sono stati considerati quelli che effettivamente sostenevano il nido e non quelli, sempre di diametro trascurabile (meno di 2 mm), "accoppiati" ai precedenti. Per la densità degli steli intorno al nido è stato considerato un quadrato di 25 cm di lato ed è stato calcolato il numero di steli per m^2. Queste misure sono state effettuate solamente nel Massaciuccoli, nel triennio 1998-2000. Il diametro degli steli è stato ottenuto come media aritmetica delle misure dei singoli steli di sostegno. L'altezza degli steli di sostegno risulta dalla media di 3 misure effettuate considerando la distanza tra la superficie dell'acqua e il culmo estremo della cannella. Queste misure sono state effettuate, come per l'altezza sul livello dell'acqua, su nidi appena terminati.

	media chiaro	min chiaro	max chiaro	media MAS	min MAS	max MAS	media totale	d. s.	n totale
Altezza su H2O	93	66	148	91	37	160	91	21,3	141
Profondità H2O	42	0	65	53	10	116	51	22,4	107
Distanza da acque libere	172	30	600	50	15	100	78	96,3	110
N° steli	5,0	3	8	5,0	3	11	5,0	1,4	153
Altezza steli	259	210	300	236	150	315	238	36,4	71
Densità steli	–	–	–	497	176	816	497	172,5	74
Diametro medio steli	0,56	0,53	0,61	0,55	0,40	0,76	0,56	0,08	71

L'80,9% dei nidi del Massaciuccoli dista dalle acque libere tra i 25 e i 60 cm. Nel chiaro, invece, il 78,9% dei nidi costruiti nel fragmiteto perimetrale (n = 19) sono distanti da 30 a 70 cm; il 61,5 % di quelli costruiti nel fragmiteto maturo ed esteso in profondità (n = 13) sono distanti tra 300 e 400 cm. Per quanto riguarda la distribuzione percentuale del numero di steli inglobati nel nido, si riportano per esteso i dati: 3 steli nel 6,5% dei casi, 4 steli nel 34,0%, 5 steli nel 35,3%, 6 steli nel 11,8%, 7 steli nel 7,2%, 8 steli nel 2,0%, 9 steli nel 2,0%, 10 steli nello 0,6%, 11 steli nello 0,6%. L'altezza media degli steli inglobati nel nido, è compresa nell'81,7% dei casi tra 200 e 285 cm; la densità è invece compresa nel 78,4% dei casi tra 300 e 700 steli/m^2. Infine il diametro medio degli steli inglobati nel nido è compreso nel 74,6% dei casi tra 0,46 e 0,65 cm. In assoluto il diametro minimo misurato è stato di 0,20 e quello massimo di 0,97 cm.

Uova

Per le misure delle dimensioni (dati raccolti su 47 covate complete) vedi la Tabella 3. Come per la varia-

Tabella 3. Dimensioni (mm) e volume calcolato (cm^3) delle uova. Le misure e i dati raccolti vengono messi a confronto con quelli più significativi della letteratura. La lunghezza e la larghezza sono state misurate con calibro di precisione 0,1 mm e apprezzamento di 0,1 mm (0,01 mm per le medie in tabella). Il rapporto fra gli assi, indicante l'allungamento dell'uovo, è stato arrotondato al secondo decimale. Il volume è stato calcolato applicando la formula di Hoyt (1979), ovvero 0,51 x (lungh.) x (largh.)^2.

	media	d. s.	max	min	n	
Lungh.	22,13	0,87	24,2	19,8	201	Massaciuccoli/Vecchiano, Toscana
Largh.	16,25	0,46	17,4	15,0	201	(Quaglierini, questo studio)
Volume	2,98	0,23	3,52	2,42	201	
Rap. assi	1,36	0,06	1,55	1,25	201	
Lungh.	22,4	0,82	25,2	20,9	59	Italia
Largh.	16,2	0,41	17,1	15,2	59	(Pazzuconi 1997)
Volume	3,0	0,17	3,4	2,6	59	
Lungh.	22,73	–	26,8	19,5	1174	Europa
Largh.	16,34	–	18,0	14,2	1174	(Makatsch 1976)
Lungh.	22,9	–	25,2	20,4	336	Germania
Largh.	16,4	–	17,5	15,1	336	(Schönwetter 1979)
Lungh.	22,3	–	24,8	20,8	15	Lombardia
Largh.	16,5	–	17,5	15,7	15	(Realini 1984)
Rap. assi	1,35	–	–	–	15	

bilità nella colorazione, talvolta nella medesima covata si notano evidenti differenze di forma e dimensioni; ad esempio in una covata di 5 uova rapporto assi compreso tra 1,27 e 1,42; in un'altra covata di 5 uova volume compreso tra 2,90 e 3,41 cm^2.

Covate

Per le dimensioni delle covate vedi le Tabelle 4 e 5. La dimensione media della covata del Massaciuccoli (4,51) è risultata più alta di quella (4,08) del chiaro. In pratica nel Massaciuccoli prevalgono le covate con 5 uova (54,0%) e nel chiaro quelle con 4 (56,0%); le covate di 3 uova invece si equivalgono. La differenza si nota soprattutto nelle covate appartenenti al secondo periodo di deposizioni – in media 4,30 uova a Massaciuccoli e 3,80 nel chiaro. Le dimensioni delle covate appartenenti al primo periodo di deposizioni (4,64) sono più elevate rispetto a quelle (4,05) del secondo periodo. La dimensione delle covate di sostituzione alla prima è nettamente più bassa delle precedenti: 3,00 uova nel chiaro, 3,67 a Massaciuccoli, 3,44 in media. La frequenza percentuale totale del numero di uova nella covata completa, è risultata la seguente: 1,1% due uova, 12,5% tre uova, 36,4% quattro uova, 46,6% cinque uova, 3,4% sei uova.

Deposizione e incubazione

Per le date di deposizione del primo uovo vedi la Tabella 6. L'uovo viene deposto giornalmente (oss. pers., Cramp e Brooks 1992). Le deposizioni avvengono ininterrottamente per 13 settimane, ma sono concentrate in 4 (praticamente tutto il mese di maggio; 68,4% del totale). Su 165 inizi di deposizione, il 70,3% apparteneva al primo periodo, il 9,7% era di sostituzione al primo, il 20,0% apparteneva al secondo periodo. Escludendo due casi nel chiaro (nidi appena abbozzati, costituiti da materiale umido, il 19 luglio 1994), non si sono mai avuti indizi di covate di sostituzione alla seconda. Tra le prime e le seconde deposizioni intercorrono mediamente 48

Tabella 4. Dimensione delle covate complete. I dati raccolti vengono messi a confronto con quelli più significativi della letteratura, e riguardano solamente i nidi nei quali è stata seguita la deposizione e le fasi successive.

media	min	max	n	
4,39	2	6	88	Massaciuccoli/Vecchiano, Toscana (Quaglierini, questo studio)
4,62	3	6	42	Val Padana (Pazzuconi 1997)
4,67	4	5	15	Maccarese, Lazio (Petretti 1979)
4,8	4	6	26	Lombardia (Realini 1984)
4,88	4	6	232	Europa (Makatsch 1976)
4,8	3	6	251	Milicz, Polonia (Dyrcz 1981)
4,73	3	6	406	Bayern, Germania (Beier 1981)
4,6	2	6	138	Rep. Ceca (Havlin in Cramp e Brooks 1992)
4,9	4	6	30	Grecia (Akriotis in Cramp e Brooks 1992)

Tabella 5. Dimensione media delle covate complete.

	media totale	d. s.	prime deposizioni	d. s.	seconde deposizioni	d. s.	sostituzione 1° covata	d. s.	n° totale
chiaro	4,08	0,76	4,58	0,51	3,80	0,42	3,00	1,00	25
Massaciuccoli	4,51	0,78	4,66	0,73	4,30	0,82	3,67	0,52	63
Totale	4,39	0,79	4,64	0,69	4,05	0,69	3,44	0,73	88

Tabella 6. Date di deposizione del primo uovo (n totale = 165). Il periodo di deposizione è stato calcolato elaborando le date di deposizione del primo uovo e determinando l'appartenenza al primo o al secondo periodo di deposizioni (cfr. Quaglierini 1999). Le covate di sostituzione sono state accertate rinvenendo i nidi ricostruiti, dopo pochi giorni, vicino a quelli predati o distrutti.

	prime deposizioni	giorno medio	n	seconde deposizioni	giorno medio	n	sostituzione 1° covata	giorno medio	n
chiaro	29/4 - 2/6	14/5	13	18/6 - 23/7	4/7	14	5/6 - 11/6	8/6	4
Massaciuccoli	29/4 - 2/6	14/5	94	10/6 - 24/7	30/6	30	19/5 - 10/6	2/6	10
Totale	29/4 - 2/6	14/5	107	10/6 - 24/7	1/7	44	19/5 - 11/6	4/6	14

giorni (47 a Massaciuccoli e 51 nel chiaro). L'incubazione delle uova è risultata durare, in media, 14,3 giorni (12-17; n = 15).

Successo riproduttivo

Su 447 uova deposte in 113 nidi (386 uova di 88 covate complete e 61 in altri 25 nidi), si sono schiuse 348 uova (77,8%) e hanno lasciato il nido 314 giovani (90,2% dei nati), per un successo riproduttivo complessivo del 70,2% e almeno 2,78 giovani allevati per nido (3,57 considerando solamente i nidi con covata completa). Il 7,1 % dei nidi controllati ha subìto predazione (in due casi *Coluber viridiflavus* è stato sorpreso sul nido; in un caso sono stati osservati sotto al nido due *pulli* ancora implumi, probabilmente già morti, mentre venivano divorati da *Arvicola terrestris amphibius*) oppure perdita dei *pulli* (cfr. Fracasso 1978), il 2,6% è stato distrutto dal maltempo prima della nascita dei *pulli*, l'8,0% è stato abbandonato per cause sconosciute, infine l'8,0% è stato parassitato dal Cuculo *Cuculus canorus* (il 15 giugno 2000 rinvenuto un nido con 3 uova di *Acrocephalus arundinaceus* e 2 di *Cuculus canorus*). Dunque, nel 25,7% dei nidi costruiti non sono stati allevati i nidiacei.

Discussione

Nel Massaciuccoli, oltre il 48% dei nidi del Cannareccione è stato rinvenuto nel fragmiteto giovane; solo in 37% in quello intermedio. In Polonia, Dyrcz (1981) ha invece trovato il 58% dei nidi attaccato a steli misti e il 35,5% a steli verdi. Confrontando ancora i dati di Dyrcz (1981), si può rilevare come mediamente i nidi del Massaciuccoli siano attaccati ad un minor numero di steli e come il diametro medio di questi sia nettamente inferiore. L'altezza media del nido sull'acqua è più alta rispetto alla maggior parte dei dati bibliografici (Realini 1984, Petretti 1979, Kluiver 1955, Dyrcz 1981) ma è molto simile a quella rilevata da Pazzuconi (1997).

La lunghezza media dell'uovo è inferiore del 3 % a quella ottenuta analizzando i principali dati della bibliografia (Realini 1984, Pazzuconi 1997, Makatsch 1976, Schönwetter 1979). Anche la dimensione media della covata è risultata inferiore (–8%) a quella europea ed italiana. Ciò è spiegabile con la raccolta, durante questo studio, di molti dati riguardanti le seconde deposizioni e le covate di sostituzione (30% del totale), nelle quali la dimensione della covata è notoriamente più bassa.

La maggior parte delle deposizioni avviene durante l'intero mese di maggio e non solo nella prima quindicina come riportato da Cramp e Brooks (1992). Ben il 20% delle coppie effettua una seconda deposizione. Il dato è molto interessante, considerando che in Europa tale percentuale varia tra 5 e 10 (Cramp e Brooks 1992, Dyrcz 1981).

Mediamente, la popolazione di Cannareccione oggetto dello studio effettua le deposizioni e la conseguente attività riproduttiva quasi senza interruzione. Infatti, tra le prime e le seconde deposizioni intercorrono in media 48 giorni, quando il periodo compreso tra la deposizione del primo uovo e lo svezzamento dei giovani fuori dal nido è di 42-46 giorni (oss. pers.).

A Massaciuccoli il successo riproduttivo è risultato molto alto rispetto ai principali dati europei (Beier 1981, Cramp e Brooks 1992, Dyrcz 1981), i quali sono compresi tra il 44 e il 61%, con 2-2,7 giovani involati per nido.

Interessante risulta il confronto tra la situazione del Massaciuccoli e quella del chiaro per quanto riguarda la dimensione della covata e il successo riproduttivo. La stabilità ambientale del chiaro ha indubbiamente favorito un'alta concentrazione di maschi riproduttori (7-9 su 1600 m^2 di fragmiteto, ovvero 50 maschi/ha; oss. pers.) e di nidi in attività; d'altro canto è aumentata la competizione territoriale e alimentare, e soprattutto sono stati attirati intorno ai nidi numerosi predatori (*Coluber viridiflavus*, *Arvicola terrestris amphibius*, *Rattus norvegicus*). La ridotta dimensione della covata e l'effettuazione di covate sostitutive, sembrano dunque rappresentare i principali adattamenti della specie ad una situazione sicura per alcuni versi ma rischiosa per altri. Nel Massaciuccoli, invece, la bassa densità di maschi e la limitata competizione alimentare hanno probabilmente influito in maniera positiva sulla dimensione della covata; anche l'incidenza negativa dei predatori, vista l'ubicazione dei nidi in aree difficilmente raggiungibili via terra, è risultata inferiore.

Nelle aree prese in considerazione, il Cannareccione non sembra prediligere, per la costruzione del nido, una particolare tipologia del fragmiteto e tantomeno una sua determinata età; una minore preferenza sembra esistere solamente per i fragmiteti maturi ed estesi in profondità. Si può quindi concludere che i fattori limitanti la specie (almeno dopo la fine di aprile, periodo di costruzione dei primi nidi) potrebbero essere legati ad altri parametri non valutati durante il presente studio.

Uno dei parametri importanti è forse il recente aumento di livello dell'acqua del lago. Esso ha sicuramente avuto influenza negativa in una fase preliminare, cioè quella di occupazione dei territori da parte dei maschi (intero mese di aprile). Infatti, negli ultimi anni la crescita degli steli e delle foglie di cannella è in quel periodo notevolmente ritardata, con conseguente diminuzione delle aree – storicamente occupate da consistenti "gruppi" riproduttori – idonee alla costruzione di un nido sicuro e ben nascosto. Ciò potrebbe aver indotto molti maschi ad abbandonare la palude poco tempo dopo l'arrivo, alla ricerca di località più adatte, magari nelle vicine paludi di Fucecchio e Porta. Considerata l'alta filopatria della specie (Noll 1953, Beier 1981) si può ipotizzare che negli anni successivi questi maschi non abbiano più abbandonato le nuove località, disertando definitivamente il Massaciuccoli. Nel periodo interessato dallo studio (1992-2000) la popolazione di Cannareccione nidificante nel Massaciuccoli è diminuita del 54% (Quaglierini in stampa e oss. pers.); negli ultimi quattro anni – dopo il 1997 – la diminuzione è stata del 33%.

La maggiore profondità dell'acqua sotto al nido potrebbe avere una influenza negativa anche nella fase di realizzazione del nido stesso. Il Cannareccione, infatti, costruisce il nido in aree né troppo allagate né troppo asciutte, con acqua profonda in media mezzo metro (vedi Tabella 2). Al momento delle prime deposizioni, fragmiteti perimetrali idonei fino a pochi anni prima, adesso possono essere sfruttati solamente costruendo il nido verso l'interno, ma in molti casi la cannella non è cresciuta abbastanza – o almeno non presenta una adeguata densità (meno di 200 steli/m^2). Migratori transahariani più tardivi, come *Ixobrychus minutus* e *Acrocephalus scirpaceus*, hanno meno problemi al riguardo poiché mediamente costruiscono il nido 15-20 giorni dopo il Cannareccione (oss. pers.).

Analizzando i rapporti fra i parametri considerati nello studio, si rileva come l'altezza del nido sia legata alla profondità dell'acqua sottostante: nelle aree di studio i nidi delle prime covate sono risultati alti in media 82 cm con l'acqua profonda 53 cm, nelle seconde covate e in quelle di sostituzione (da giugno in poi) 95 cm con l'acqua profonda 43 cm. Il nido viene quindi costruito più in alto allorché si abbassa il livello dell'acqua, probabilmente per una maggiore difesa nei confronti di potenziali predatori, ed anche perché dal 20 giugno in poi le condizioni atmosferiche migliorano sensibilmente; in particolare diminuiscono gli episodi di vento forte, probabile causa della perdita di molti giovani nel nido (Fracasso 1978). L'affermazione di Dyrcz (1981), per cui l'altezza del nido aumenta durante la stagione seguendo la crescita della cannella, deve essere in questo caso integrata con le precedenti.

Considerato che le recenti modificazioni ambientali nel Massaciuccoli hanno danneggiato diverse altre specie nidificanti – *Rallus aquaticus*, *Gallinula chloropus* e, in parte, *Botaurus stellaris* e *Locustella luscinioides* (oss. pers.) – si suggerisce all'Ente gestore (Parco Naturale Migliarino - S. Rossore - Massaciuccoli) di porre attenzione alla questione, risolvendo definitivamente il problema dell'eccessivo livello dell'acqua in primavera.

I dati raccolti durante questo studio permettono infine di fornire suggerimenti sulla gestione del fragmiteto in funzione della salvaguardia di questa specie e degli Acrocefali in genere. Considerando che i maschi occupano i territori riproduttivi fra il 10 e il 15 aprile (primi canti 28-30 marzo); (oss. pers.) che il soggiorno dei *pulli* al nido risulta in media di 12,2 giorni (11-14; n = 13); (oss. pers.) e che i giovani fuori nido vengono imbeccati nell'area riproduttiva ancora per 12-14 giorni (Noll 1953), si può concludere che il Cannareccione occupa il fragmiteto dall'inizio di aprile ai primi di settembre. Si raccomanda pertanto di evitare in tale periodo lo sfalcio del fragmiteto perimetrale, non soltanto nel Massaciuccoli ma anche lungo le rive dei canali delle contigue bonifiche, dove purtroppo si assiste sempre più spesso a sfalci indiscriminati in estate. Vista invece la preferenza del Cannareccione per il fragmiteto giovane e/o intermedio (1-2 anni), all'interno della palude si raccomanda di effettuare lo sfalcio da ottobre alla metà di febbraio, almeno nei settori in cui il fragmiteto esteso in profondità tende a prendere il sopravvento su associazioni vegetali di pregio naturalistico (*Cladietum marisci, Typhaetum angustifolium*). Nelle aree in cui sono consentite attività antropiche che prevedono sfalcio e trinciatura della vegetazione, si consiglia di rispettare almeno le date previste dal Regolamento CEE 2078/92 già applicato in Emilia-Romagna (Tinarelli 1999), di evitare quindi interventi tra il 20 febbraio e il 1 agosto, considerando altresì che alla fine di luglio almeno l'85% delle coppie di Cannareccione ha compiuto il ciclo riproduttivo.

Ringraziamenti - Ringrazio mio padre Luciano per l'aiuto sul campo e per i consigli forniti. Ringrazio inoltre la Direzione del Parco Naturale Migliarino-S.Rossore-Massaciuccoli, in particolar modo Paolo Dall'Antonia, per aver concesso i permessi di accesso nelle Riserve Naturali del Lago di Massaciuccoli.

Abstract - During nine years, a study was carried out on the nesting population of *Acrocephalus arundinaceus* in a large marsh of fresh water and in the small artificial wetland of Central Italy. Data about location of nest and main reproductive parameters were collected with the main purpose of analysing Great Reed Warbler habitat relationships in an attemp to clearify the reasons for numerical reduction of the species from 1992 on. Nest is averagely hanged up in five stems, 91 cm from water height and 78 cm far from open waters. Under the nest, water is averagely deep 51 cm and reed density is of 497 stems/m^2. For anchorage, 238 cm stems high are used each of which is 0,56 cm diameter. Eggs are lightly smaller than other italian and european ones. Similarly, compared with literature, the average of a complete clutch – 4,39 eggs – is inferior of 7-8%. Informations confirmed regular accomplishment of two broods. First brood between april 29 th and june 6 th, second one between june 10th and july 28th, with various episodes of sostitutive first brood. Hatch rate was 77,8%; 90,2% of nestlings have left nest (at least 2,78 each nest are youngs); the total reproductive outcome has thus resulted of 70,2%. 25,7% of builted nests have been plundered or abandoned or parasited by *Cuculus canorus*. The Great Reed Warbler for reproduction uses different types of reeds and it doesn't seem to be influenced by

any specific parameter. The recent increase of water level in Massaciuccoli – with the consequent delayed growth of reeds – seems to have a negative influence on the territorial occupation phase for what concerns males.

Bibliografia

Beier J. 1981. Untersuchungen an Drossel - und Teichrorsänger (*Acrocephalus arundinaceus*, *A. scirpaceus*): Bestandsentwicklung, Brutbiologie, Ökologie. Journ. f. Orn. 122: 209-230.

Cramp S. e Brooks D.J. (eds.) 1992. The Birds of the Western Paleartic. Vol. VI. Oxford University Press, Oxford.

Dyrcz A. 1981. Breeding ecology of Great Reed Warbler *Acrocephalus arundinaceus* and Reed Warbler *Acrocephalus scirpaceus* at fish-ponds in SW Poland and lakes in NW Switzerland. Acta Orn. 18: 307-334.

Fracasso G. 1978. Sulla biologia del Cannareccione *Acrocephalus arundinaceus*. Avocetta 1: 3-18.

Géroudet P. 1984. Les Passeraux II. Délachaux et Niestlé, Neuchâtel.

Hoyt D. F. 1979. Practical method of estimating volume and fresh weight of bird eggs. The Auck 96: 73-77.

Kluiver H. N. 1955. Das Vehalten des Dosselrohrsängers, *Acrocephalus arundinaceus* am Brutplatz mit besonderer Berücksichtigung der Nestbautechnik und der Revierbehauptung. Ardea 43: 1-50.

Makatsch W. 1976. Die eier der Vögel Europas. Vol. II. Neumann Verlag, Leipzig, Radebeul.

Noll H. 1953. Beringungsergebnisse von Rohrsängern, insbesondere des Drosselrohrsängers, im Unterseegebiet. Orn. Beob. 50: 36-41.

Pazzuconi A. 1997. Uova e nidi degli uccelli d'Italia. Calderini, Bologna.

Petretti F. 1979. Osservazioni su una popolazione di Cannareccione *Acrocephalus arundinaceus*. Avocetta 3: 29-46.

Quaglierini A. 1998. Indagine preliminare sull'avifauna palustre nidificante nel Padule di Fucecchio (Pistoia-Firenze). Riv. Ital. Orn. 68: 191-195.

Quaglierini A. 1999. Biologia riproduttiva del Forapaglie castagnolo *Acrocephalus melanopogon* nella palude del Lago di Massaciuccoli (Lucca-Pisa). Picus 25: 5-24.

Quaglierini A. 2000. L'avifauna palustre nidificante nell'alveo del Lago di Porta (Massa-Carrara, Lucca). Riv. Ital. Orn. 70: 43-51.

Quaglierini A. in stampa. Censimento dell'avifauna acquatica nidificante nella palude del Lago di Massaciuccoli (Lucca-Pisa). Picus.

Realini G. 1984. Gli uccelli nidificanti in Lombardia (zone umide). Ed. Alma, Varese.

Schönwetter M. 1979. Handbück der Oologie. Vol. II. Berlin.

Schulze-Hagen K. 1997. Great Reed Warbler *Acrocephalus arundinaceus*. In: Hagemeijer W.J.M. e Blair M.J. (eds). The EBCC Atlas of European breeding birds. Their distribution and abundance. T. e A.D. Poyser, Calton.

Tinarelli R. 1999. Considerazioni su alcuni metodi per la creazione e la gestione di habitat per specie ornitiche rare e minacciate in Emilia-Romagna attraverso l'applicazione del Regolamento CEE 2078/92. Avocetta 23: 74.

Avocetta N° 26 (1): 41-43 (2002)

Short communications

Water-crossing tendency of juvenile Honey Buzzards (*Pernis apivorus*) during migration

Nicolantonio Agostini[1], Charles Coleiro[2], Ferdinando Corbi[3],
Giuseppe Di Lieto[3], Fabio Pinos[3], Michele Panuccio[4]

[1] *Via Carlo Alberto n. 4, 89046 Marina di Gioiosa Jonica (RC), Italy.*
[2] *St. Michael Flat 2, Paris Street, Zebbug, Malta.*
[3] *Gruppo Pontino Ricerche Ornitologiche, Via Ticino n. 12, 04100 Latina, Italy*
[4] *Via Mario Fioretti n. 18, 00152 Roma, Italy.*

The Honey Buzzard is a summer resident in Europe wintering in west-central equatorial Africa (Cramp and Simmons 1980). This species mostly uses soaring flight over land during migration, although, having high aspect ratio (long) wings, it is able to cross large bodies of water (Kerlinger 1989). During their first migration in the Mediterranean basin, juvenile Honey Buzzards tend to migrate on a broader front than adults; while the latter cross the sea at its shorter points, the Straits of Gibraltar (Meyer *et al.* 2000, Schmid 2000), the Channel of Sicily (between Sicily and Tunisia via the island of Marettimo; Agostini *et al.* 2000) and the Bosphorus (Schmid 2000), concentrations of juvenile Honey Buzzards have been reported in many islands of the Mediterranean as Cabrera, Capri, Malta and Cyprus (Frost 1994, Agostini and Logozzo 1995, Rebassa 1995, Jonzén and Pettersson 1999). In the central Mediterranean area, adult Honey Buzzards tend to follow the Italian peninsula and after the crossing of the Straits of Messina (between southern continental Italy and Sicily) deviate westwards using the same spring route and concentrating over the island of Marettimo (Agostini *et al.* 2000). Only juveniles migrating in flocks of adults seem to be able to learn this route by information transmission (Fig. 1; Agostini *et al.* 1999). However, since juveniles of this species tend to migrate later than adults, moving about two weeks later (Kjellén 1992, Agostini and Logozzo 1995, Schmid 2000), groups containing individuals belonging to the two age classes are rarely recorded. In particular, in the Mediterranean basin, adults migrate between the end of August and the beginning of September, while juveniles concentrate their passage after the second week of this month (Agostini and Logozzo 1995, 1997, Schmid 2000). Juveniles passing in southern continental Italy in this period, concentrate along the slope of Mount Covello as the adults do, but they cross the sea at its widest point, between Sicily and Lybia (425 km), passing over Malta probably moving along a NE-SW axis genetically defined (Fig. 1; Agostini and Logozzo 1995). Since north of Mount Covello the peninsula has a NW-SE orientation, Honey Buzzards should deviate southeast during migration through central Italy. Along the western coast of central Italy hundreds of juvenile Honey Buzzards have been observed at the Circeo promontory (Fig. 1; Corbi *et al.* 1999). At this site, however, birds do not follow the peninsula but, apparently, cross the Tyrrhenian Sea moving towards western Sicily via Ponza, an island located about 30 km south of the promontory (Fig. 1). The aim of this study was to test the hypothesis that these birds reach Tunisia via western Sicily passing over the island of Marettimo (Agostini *et al.* 2000); this mountainous island should attract Honey Buzzards migrating across the Channel of Sicily.

Observations were made from 15 to 29 September 2000, the peak of the autumn migration of juvenile Honey Buzzards in the Mediterranean basin. Each day, observations were carried out from 9.00 h until dusk aided with telescope and binocular. The Circeo promontory is located in the southernmost point of the Pianura Pontina reaching 541 m. a.s.l. The observation post was located along its southern slope at the altitude of c. 400 m. This post was chosen to detect birds really undertaking water-crossing. Here no monitoring was made on 20 September because of heavy rainfalls. Marettimo is a mountainous island (12 km^2), about 30 km off western Sicily and 20 km west of the islands of Levanzo and Favignana, over which the greatest concentration of raptors through Italy occurs during post-reproductive movements (Agostini *et al.*

2000). This island is located at the narrowest point of the central Mediterranean, about 130 km NE of the Cap Bon promontory (Tunisia, Fig. 1). Monte Falcone is its highest relief, reaching 686 m. Up to now, at this site, no observations were carried out after mid September. The observation post was located at the altitude of c. 500 m. The Maltese Islands are situated about 90 km south of Sicily and 335 km north of Libya. Raptors concentrate along the cliffs on the western side of the Island of Malta (Beaman and Galea 1974). The observation post was situated in this area, on one of the highest points of the island (250 m a.s.l.).

At the Circeo promontory a total of 500 Honey Buzzards was counted. During the 15 days of observation the migratory flow showed two bouts of movement lasting two days each with the second (21-22 September) including 46.7% of all Honey Buzzards counted (Fig. 2). In 182 (36%) cases it has been possible to age birds; of them 163 (89.6%) were juveniles and 19 (10.4%) adults. Nearly all adults were seen from 15 to 17 September. Honey Buzzards showed a strong tendency to undertake the water-crossing: they left the coast flying south, heading apparently towards western Sicily via the island of Ponza. Only 13 birds were seen flying back inland. About 90% of Honey Buzzards migrated in flocks; groups were comprised on average of 4.8 birds and 74% (*N* = 95) of them contained fewer than 5 individuals. Only one flock, recorded on 21 September, contained more than 20 individuals (87).

Over the island of Malta a total of 564 Honey Buzzards was counted with a maximum of 279 birds on 23 September. By comparing daily variations in the migratory flow with those of the Circeo promontory, it is possible to note a considerable correspondence between the two sites (Fig. 2). Among 456 birds aged (81%) in Malta not one adult has been reported. 48 (8.5%) birds migrated alone while on average groups were comprised of 5.9 individuals (*N* = 87). Also over Malta only one flock, recorded on 23 September, contained more than 20 individuals (50).

Over the island of Marettimo a total of 45 Honey Buzzards were counted; among 15 (33.3%) birds aged 13 (86.7%) were juveniles and two adults (13.3%).

The strong tendency to undertake the sea-crossing showed by juveniles Honey Buzzards at the Circeo promontory is surprising if compared to the behaviour of adults recorded at the Cap Bon promontory (Tunisia; Fig. 1) during spring migration (Agostini *et al.* 1994a, 1994b). There, once they reach the coast near the promontory, Honey Buzzards rarely undertake the crossing of the Channel of Sicily and, although motivated by reproduction, they hesitate along the coast being affected by wind, flock size, physiological conditions and, probably, previous bad experience during water crossing. Juveniles, during their first migration, do not have experience about the higher energetic cost of flight over water. Moreover, since some individuals probably belong to the population breeding in central Italy (Agostini and Logozzo

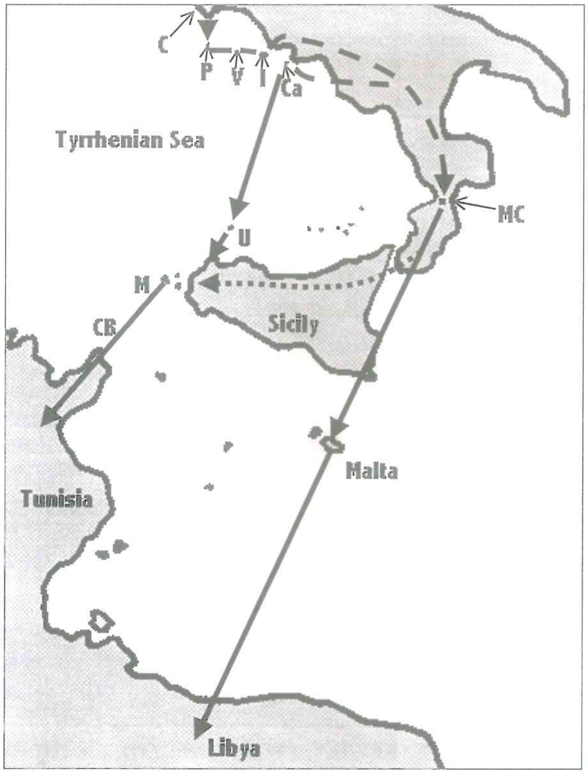


Figure 1. Study area and routes used by juvenile Honey Buzzards during the autumn migration on the central Mediterranean (sketched arrow: supposed route; doted arrow: only when migrating in flocks of adults. C = Circeo, P = Ponza, V = Ventotene, I = Ischia, Ca = Capri, MC = Mount Covello, U = Ustica, M = Marettimo, CB = Cap Bon).

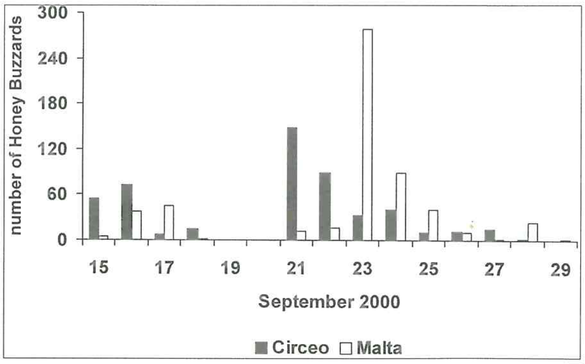


Figure 2. Occurrence of migrating Honey Buzzards between 15 and 29 September 2000 over the Circeo promontory and Malta.

1995), they are strong and fat being at the beginning of migration. However, the notable correspondence between data recorded at Circeo and over Malta, considering both the variations of the migratory flow and the size of flocks, do not agree with the hypothesis that juvenile Honey Buzzards cross the Tyrrhenian Sea reaching Tunisia via the island of Marettimo. A powered flight for some tens of km over water could be enough to change their decision; once they leave the Circeo promontory, they probably deviate east towards the Italian peninsula, perhaps via the islands of Ponza, Ventotene and Ischia, reaching Malta about two days later (Fig. 1). In southern continental Italy and southern Sicily they have no alternative to water-crossing. An alternative hypothesis concerning the existence of a direct route between Ponza and Tunisia seems to be, after this study, the least probable.

The small migratory flow observed over Marettimo could be related, perhaps via the island of Ustica, with a passage recorded over the island of Capri (Fig. 1; Jonzén and Pettersson 1999). On this island, located c. 5 km off Sorrentine peninsula and c. 110 km east-south-east of Ponza (Fig. 1), during autumn 1994 and 1995, Jonzén and Pettersson (1999) observed tens of juvenile Honey Buzzards. The median date of this passage was on 23 September. Most birds were seen leaving the island apparently towards Sicily, a few showing a very strong western component (> 215 degrees). However, if part of juveniles passing over Capri deviated eastwards over sea flying back to the mainland (Fig. 1), this would explain the greater number of individuals recorded over Malta during our study.

Acknowledgements -This research has been partially made within the activities of the Stazione di Inanellamento of Palermo, funded by the Assessorato Agricoltura e Foreste of the Regione Siciliana. We are grateful to B. Massa and A. Rolando for their useful comments to an earlier draft of the manuscript, and to the Aeronautica Militare Italiana for the permission to entry in a military zone.

Abstract - The autumn migration of juvenile Honey Buzzards was studied from 15 to 29 September 2000 at three sites of the central Mediterranean: the Circeo promontory (central Italy) and the islands of Marettimo (western Sicily) and Malta. The aim of this study was to test the hypothesis that juvenile Honey Buzzards leaving the Italian peninsula from the Circeo promontory, reach Tunisia via the island of Marettimo. At the Circeo promontory a total of 500 individuals was counted with the peak on 21 and 22 September. Juvenile buzzards showed a strong tendency to undertake the sea crossing flying south apparently towards western Sicily via the island of Ponza. 13 birds were seen flying back inland. On average flocks contained 4.8 birds and only one, observed on 21 September, contained more than 20 individuals (87). Over the island of Malta 564 Honey Buzzards were counted with a maximum of 279 on 23 September. There was a notable correspondence between data recorded in these two sites, both concerning the variations of the migratory flow and the size of flocks. Over Marettimo, a total of 45 buzzards were seen in the whole period. These results do not agree with the hypothesis tested in this study; on the contrary they seem to suggest that birds avoid the crossing of the Tyrrhenian Sea deviating east towards the Italian peninsula and passing over Malta about two days later.

References

Agostini N. and Logozzo D. 1995. Autumn migration of Honey Buzzards in southern Italy. J. Raptor Res. 29: 275-277.

Agostini N. and Logozzo D. 1997. Autumn migration of Accipitriformes through Italy en route to Africa. Avocetta 21: 174-179.

Agostini N., Logozzo D. and Coleiro, C. 1999. The orientation/navigation hypothesis: an indirect evidence in migrating Honey Buzzards. Riv. ital. Orn. 69: 153-159.

Agostini N., Logozzo D. and Panuccio M. 2000 The island of Marettimo, important bird area for the autumn migration of raptors. Avocetta 24: 95-99.

Agostini N., Malara G., Neri F. and Mollicone D. 1994a. La migrazione primaverile del Falco pecchiaiolo (*Pernis apivorus*) a Cap Bon (Tunisia) e sullo Stretto di Messina. Atti VI° Conv. ital Ornit.: 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.

Beaman M. & Galea C. 1974 Visible migration of raptors over the Maltese Islands. Ibis 116: 419-431.

Corbi F., Pinos F., Trotta M., Di Lieto G. and Cascianelli D. 1999. La migrazione post-riproduttiva dei rapaci diurni nel promontorio del Circeo (Lazio). Avocetta 23: 13.

Cramp S. and Simmons K.E.L. 1980. The birds of the western palearctic. Vol.II. Oxford Univ. Press, Oxford, UK.

Frost R. 1994. Observations of autumn raptor migration at Akrotiri salt lake, Cyprus 19 September-9 October 1992. RAF Ornithol. Soc. J. 23: 65-73.

Jonzén N. and Pettersson J. 1999. Autumn migration of raptors on Capri. Avocetta 23: 65-72.

Kjellén N. 1992. Differential timing of autumn migration between sex and age groups in raptors at Falsterbo, Sweden. Ornis Scand. 23: 420-434.

Kerlinger P. 1989. Flight strategies of migrating hawks. Univ. Chicago Press, Chicago, IL, USA.

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.

Rebassa M. 1995 La migraciò postnupcial de rapinyaires diurns a l'Illa de Cabrera: trets generals. A.O.B. 10: 11-17.

Schmid H. 2000. Getrennte Wege: Der Herbstzug von juvenilen und adulten Wespenbussarden *Pernis apivorus* - eine synthese. Ornithol. Beob. 97: 191-222.

Avocetta N° 26 (1): 45-47 (2002)

Nest site and Breeding Biology of the red-footed falcon (*Falco vespertinus*) in northern Italy

STEFANO SPONZA[1], DAVIDE LICHERI[2], LAURA GRASSI[3]

[1]*Dipartimento di Biologia - Università degli Studi di Trieste, Via L. Giorgieri, 9 I-34127 Trieste, Italy.*
[2]*Istituto Nazionale per la Fauna Selvatica "A. Ghigi", Via Ca' Fornacetta, 9*
I-40064 Ozzano Emilia (BO), Italy.
[3]*Riserva Naturale Regionale "Foce dell'Isonzo" - I-34070 Staranzano (GO), Italy.*

The Red-footed Falcon *Falco vespertinus* is a migratory raptor, whose main winter quarters are in Angola, Namibia, Botswana, Rhodesia and South Africa (Glutz *et al.* 1971, Moreau 1972).

Within the usual breeding area, the Red-footed Falcon is a colonial breeder, although solitary pairs are sometimes recorded (Kève and Szitt 1957, Cramp and Simmons 1980, Haraszthy and Bagyura 1993). It breeds in old corvid nests, mainly in exploiting colonies of Rook *Corvus frugilegus*, although Hooded Crow *Corvus corone* ssp. *cornix*, Carrion Crow *Corvus corone* ssp. *corone* and Magpie *Pica pica* nests are sometimes used.

Suitable breeding habitats includes open steppe, wooded steppe and cultivated fields (Cade 1982). Such landscapes support high densities of large insects, mainly from the order *Orthoptera*, which feature prominently in the Red-footed Falcon's diet. Other prey types which are especially important during the chick-rearing phase include small mammals and amphibians (Haraszthy *et al.* 1994).

According to the most recent censuses (Hagemeijer and Blair 1997) the core breeding area is in Hungary (2200 pairs) and the southern regions of the former Soviet Union (15 000 - 40 000 pairs). Small numbers also breed in Romania (200 - 600 pairs), Moldova (120 - 200 pairs) and Ukraine (400 - 600 pairs).

Reports of the Red-footed Falcons breeding to the north and west of their traditional range have become increasingly frequent over the past three decades: in Germany (1976), Austria, Finland, Poland and France (1993) (Hagemeijer and Blair 1997). Breeding was first confirmed in Italy in 1995 in the Province of Parma, although Red-footed falcons may have bred in Tuscany before this date (Brichetti *et al.* 1996, Romè and Quaglierini, 1979).

This paper describes some details of the nesting biology of the small population of Red-footed Falcons which has since established itself on the Parma Plain. Data on the Red-footed Falcon's nesting behaviour and success on the fringes of its expanding geographical range will help us to inform local conservation efforts to maintain and encourage the growth of populations in recently settled areas.

The study area comprised 17 Km^2 located near the town of Busseto (44°59'N - 10°04'E). Although 63% of the land was devoted cereal production, average field size was relatively small (mean field surface = 0.0276 Km^2; min. = 0.0181 Km^2; max. = 0.0534 Km^2). The main crops grown in the area were maize (*Zea* sp.), wheat (*Triticum* sp.) and barley (*Hordeum* sp.). Altitude ranged between 20 and 40 m above sea level, annual rainfall range of 600-900 mm and temperature varied between approximately 13 and 26 °C over the course of the year.

Observations have been carried out over three alternate days per week, from 15 April to 15 August. Data were collected by means of 8 x 42 binoculars. In winter 1997/98, a census of corvid nests was made in and around the area in which Red-footed Falcons had bred. All corvid nests in an area of 160 Km^2 were located and the following information recorded for each one: tree species, tree height, canopy height and nest height.

The density of breeding Red-footed Falcons in the study area was estimated in accordance with the "Nearest-neighbour distance" method (Newton *et al.* 1977, Court *et al.* 1989). Statistical significance was set at $P < 0.05$ and statistics were computed using SPSS 8.0 statistical package for PCs.

The lengths of the incubation and nestling periods were similar to those reported in Cramp and Simmons (1980):

22 - 23 days from the onset of incubation to hatching, and 27 - 30 days between hatching and fledging.

Therefore, whenever it was not possible to have a record of the incubation date or the fledging date, these were estimated by assuming the periods reported by Cramp and Simmons (pairs 6 and 9; Table 1).

In the study area nesting occurred in 1997 and 1998. About the pre-breeding migration data in the study area (Fig. 1), the first observation of Red-footed Falcon was recorded on the 18th of April in 1997 and on the 28th of April in 1998. Instead the last observation was recorded on the 16th of May in 1997 and on the 1st of June in 1998. The daily max number of individuals was 11 in 1997 and 40 in 1998. Finally the daily mean (± se) number of individuals was 5 ± 2.27 in 1997 and 15.2 ± 3.45 in 1998.

In 1997 four out of seven pairs successfully fledged chicks, and in 1998 two out of four pairs were successful (Table 1). The mean number of fledglings/successful nest, was 2.67 ± 0.88 se (n = 3) in 1997 and 1.5 (n = 2) in 1998. The minimum distance between nests was 579 ± 149 m in the first breeding season and 750 ± 298 m in the second one. Density values were 1.99 pairs/km^2 in 1997 and 2.09 pairs/km^2 in 1998.

All but one nest (90.9 %), were on poplars *Populus nigra* and in all cases Hooded Crow nests were used (Table 1). In each reproductive season none of the nests occupied by the Red-footed Falcons was on the same tree. In 1997 an adult female/subadult male pair bred successfully and fledged one young. This observation confirms that sexual maturity is reached in the first year (Dementiev and Gladkov 1951, Horváth 1955). In 1998 breeding occurred in two nests utilised the previous year by Red-footed Falcons.

The height of the trees with at least one corvid nest in the study area does not differ from that in the neighbouring area (n = 1344; two-sample Kolmogorov-Smirnov Z = 0.909; ns).

Nest height differ in the two areas only in 16-20 m class of trees (n = 1344; Z = 1.408; $P < 0.05$). The Red-footed Falcon consequently manifests a preference for nests situated at 11-15 m high and this on trees 16-20 m high (Table 1).

In the study area, nests on the top of tree crown were predominant (79.71%). On the contrary, nests of Red-footed Falcons had some foliage covering in the 81.82% of the cases. Nests with at least 5 m canopy overhead were preferred by Red-footed Falcons (n = 80; df = 1; log-likelihood $G^2 = 15.95$; $P < 0.01$). These preferences could be the consequence of a compromise between nest height and the foliage covering above the nest, as a probable defence against solar radiation and bad weather.

The length of settlement and fledging period was very similar in the two seasons (settlements: 32 and 31 days; fledgings: 11 and 11 days) (Fig. 1). The ten days shift in 1998 settlement remains equal through all phases. The synchrony is probably due to the colonial nature of this Falcon. The synchronous patterns would be kept also in solitary or semi-colonial pairs, as observed in the study area (Table 1). In conclusion the low number of pairs is probably related to the absence in our territory of colonial corvids and the lability is probably because these pairs are on the border of their customary breeding range.

Table 1. Features of Red-footed Falcon: nest in 1997 and 1998.

Year	Pair	Species of tree	Height of tree (m)	Height of nest (m)	Settlement date in the nest	Start of Incubation	Hatching date	Fledging / brood size	Fledging date	Nest deserting date
1997	1	Ulmus campestris	= 10	= 10	22 Apr	30 May	23-24 Jun	0/3	–	9 Jul
	2	Populus nigra	16-20	11-15	26 Apr	–	–	0/0	–	3 Jun
	3	»	16-20	11-15	3 May			?/2		
	4	»	16-20	11-15	3 May	19 May	13-14 Jun	4/4	9 Jul	
	5	»	16-20	11-15	9 May	30 May	21-22 Jun	0/0	-	30 Jun
	6	»	16-20	11-15	23 May	31 May	22-23 Jun[a]	3/3	19 Jul	
	7[b]	»	16-20	11-15	23 May	31 May	22-23 Jun	1/1	19 Jul	
1998	8	»	16-20	11-15	11 May	9 Jun	–	0/0	–	13 Jun
	9	»	16-20	11-15	20 May	5 Jun	27-28 Jun[a]	1/3	27 Jul	
	10	»	11-15	= 10	5 Jun	17 Jun	9-10 Jul	2/3	6 Aug	
	11	»	11-15	11-15	10 Jun	–	–	0/0	–	1 Jul

[a] Estimated data; [b] Age of the male = 5 (cod. EURING)

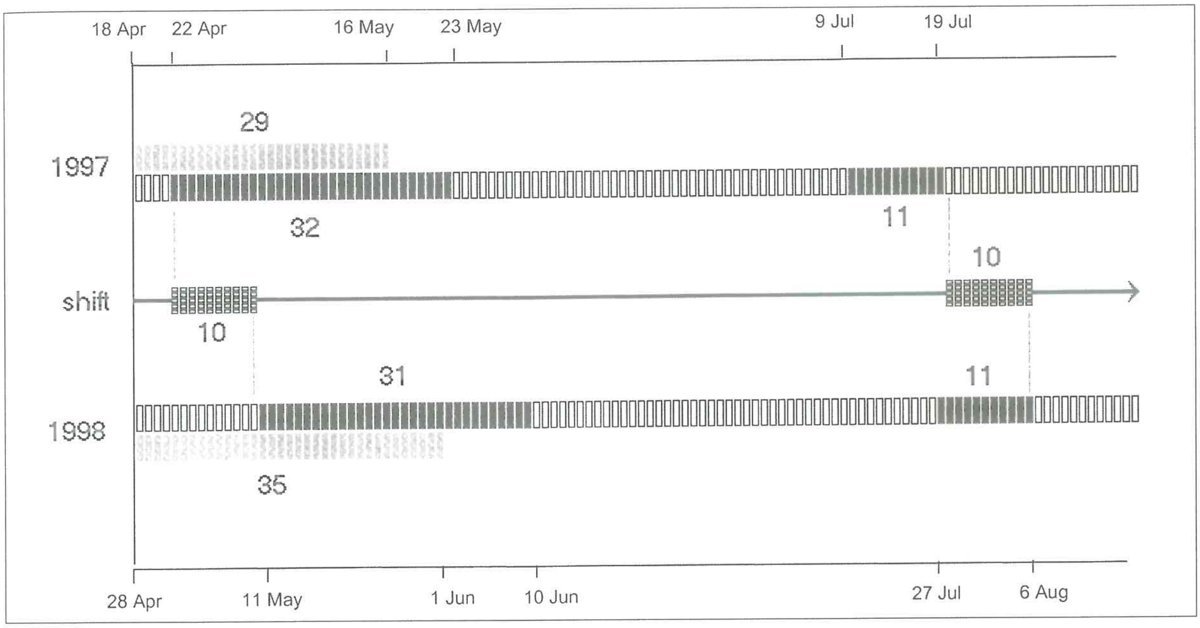


Fig. 1. Settlement and fledging periods (black bar) in relation to the days of the pre-breeding migration of the species (grey bar), in 1997 and 1998.

Acknowledgements - We are grateful to Enrico Ferrero and Lorenzo Serra for valuable discussion of the work. We thank Chiara Corradini and Lara Cattini for assistance in the field. We also thank Antonio Scotti and Fernando Spina for commenting on an earlier draft of the manuscript.

Riassunto - Una popolazione di Falco cuculo di sette coppie nel 1997 e di quattro nel 1998 si è stabilita nella pianura padana, in provincia di Parma. Le coppie hanno utilizzato nidi di Cornacchia grigia, posti su alberi di 16-20 m d'altezza e con una copertura fogliare perlomeno di 5 m di spessore. In entrambe le stagioni riproduttive è stata riscontrata un'elevata sincronia tra le diverse coppie, malgrado l'assenza di vere e proprie colonie, caratteristiche nell'areale riproduttivo tipico della specie.

References

Brichetti P., Arcamone E. and C.O.I. 1996. Comitato di omologazione italiano (C.O.I.) 10. Riv. ital. Ornitol. 65: 147-149.

Cade T.J. 1982. The Falcons of the World. Comstock/Cornell University Press, Ithaca, New York.

Court G.S., Bradley D.M., Gates C.C and Boag D.A. 1989. Turnover and recruitment in a tundra population of Peregrine Falcons *Falco peregrinus*. Ibis 131: 487-496.

Cramp S. and Simmons K.E.L. (Eds.) 1980. The Birds of the Western Palearctic, Vol. 2. Oxford University Press, Oxford.

Dementiev G.P. and Gladkov N.A. (Eds.) 1951. Birds of the Soviet Union, Vol. 1. Nauka, Moskow.

Glutz von Blotzheim U.N., Bauer K.M. and Bezzel E. 1971. Handbuch der Vögel Mitteleuropas, Vol. 4. Akademische Verlagsgesellschaft AULA-Verlag, Wiesbaden.

Hagemeijer E.J.M. and Blair M.J. (Eds.) 1997. EBCC Atlas of European Breeding Birds: their Distribution and Abundance. T & A D Poyser, London.

Haraszthy L. and Bagyura J. 1993. A comparison of the nesting habits of the Red-footed Falcon *Falco vespertinus* in colonies and in solitary pairs. In: Nicholls M.K. and Clarke N.R., Eds. Biology and Conservation of Small Falcons. Hawk and Owl Trust, London: pp. 80-85..

Haraszthy L., Rékási J. and Bagyura J. 1994. Food of the Red-footed Falcon *Falco vespertinus* in the breeding period. Aquila 101: 93-110.

Horváth L. 1955. Red-footed Falcons in Ohat-woods, near Hortobágy. Acta Zool. Acad. Scient. Hung. 1: 245-287.

Kève A. and Szitt J. 1957. Distribution, biologie et alimentation du faucon kobez *Falco vespertinus* en Hongrie. Alauda 1: 3-23.

Moreau R.E. 1972. The Palearctic-African Bird Migration Systems. Academic Press, London.

Newton I., Marquiss M., Weir D.N. and Moss D. 1977. Spacing of Sparrowhawk nesting territories. J. Anim. Ecol. 46: 425-441.

Romè A. and Quaglierini L. 1979. Osservazioni e considerazioni sulla possibilità di nidificazione del Falco cuculo nella zona del Lago di Massaciuccoli. Gli Uccelli d'Italia 4: 45-46.

Avocetta N° 26 (1): 49-51 (2002)

Book reviews

Del Hoyo J., Elliott A. e Sargatal J. (editori) 2001. *Handbook of the birds of the world.* Volume 6. Lynx Edicions, Barcelona, 589 pp.

Questo sesto volume dell'HBW è dedicato ai coliiformi (gli uccelli topo, coliidae), trogoniformi (i trogoni, trogonidae) e coraciformi. Tra i coraciformi, in particolare, vengono trattati uccelli esotici quali i todi delle Antille (todidae), i motmot dell'America centrale (momotidae), le coracie del Madagascar (brachypteraciidae), le upupe arboricole africane (phoeniculidae) e i buceri (bucerotidae), accanto a gruppi a noi un po' più familiari come i martin pescatori (alcedinidae), le ghiandaie marine (coraciidae) e i gruccioni (meropidae). Per completezza ricordiamo che vengono considerate anche l'Upupa *Upupa epops*, unico rappresentante della famiglia upupidae, ed il Curol *Leptosomus discolor*, unico rappresentante della famiglia leptosomidae.

Nelle intenzioni degli editori questo volume doveva comprendere anche i picchi, ma l'impressionante mole di materiale raccolto ha consigliato di ripartire la trattazione in due volumi distinti e indipendenti. I picchi saranno quindi trattati nel volume 7 e l'inizio della serie sui passeriformi slitta quindi al volume 8.

La prefazione dell'opera è un saggio sulla bioacustica curato da Donald Kroodsma e Luis Baptista, quest'ultimo prematuramente ed improvvisamente scomparso nel giugno del 2000. Il lavoro si configura come un'impeccabile introduzione a questa branca dell'ornitologia che è in piena ed entusiasmante crescita. Leggendolo ci si può immediatamente rendere conto di come la bioacustica ornitica non rappresenti affatto un argomento specialistico o "di nicchia". Al contrario, questo genere di studi permette di affrontare tematiche di interesse generale quali la zoogeografia e l'evoluzione della variabilità delle vocalizzazioni, la fisiologia dell'emissione vocale, i risvolti ecologici (territorialità) ed etologici (accoppiamenti preferenziali, apprendimento) legati alle funzioni del canto.

Le famiglie considerate in quest'opera presentano spesso caratteristiche di estremo interesse biologico. La socialità degli uccelli topo, ad esempio, è, per certi aspetti, assolutamente straordinaria. Questi animali sono fortemente gregari, sovente organizzati in clan familiari i cui membri si mantengono in stretto contatto canoro e fisico: gli uccelli topo posati sugli alberi costituiscono infatti dei gruppi compatti di individui che si schiacciano uno all'altro, ventre contro ventre. Inutile aggiungere che in questi animali i comportamenti tesi ad intensificare la coesione di gruppo (toelettatura reciproca, offerte di cibo ecc.) sono estremamente sviluppati. La colonialità dei gruccioni è ben nota, ma la costituzione di aggregati di centinaia ed anche migliaia di individui in nidificazione fa sempre un certo effetto: si veda, al proposito, la foto relativa al Gruccione carminio *Merops nubicus* a pagina 320. La schiusa delle uova delle ghiandaie marine è così regolarmente asincrona che anche l'abbandono del nido da parte dei piccoli avviene in tempi successivi. In queste condizioni, spesso padre e madre si spartiscono la nidiata: uno dei due si dedica ai pulli precoci accompagnandoli nell'esplorazione dell'ambiente, mentre l'altro continua a nutrire i piccoli tardivi, che ancora non hanno lasciato il nido (le immagini della Ghiandaia marina europea che imbecca un piccolo, a pagina 367, non sono assolutamente da perdere!). I buceri dal becco "cornuto" (hornbills in inglese) sono forse il gruppo di uccelli che presenta la maggior variabilità dimensionale poiché, accanto a specie relativamente piccole (100 g di peso) ci sono anche specie giganti (fino a 6 kg). La biologia riproduttiva di questi uccelli è alquanto peculiare poiché, prima di deporre le uova, la femmina si mura in una cavità-nido che comunica con l'esterno solo attraverso un piccolo orifizio; il maschio si incarica quindi di nutrire la compagna passandole il cibo attraverso l'apertura fino a quando, una volta cresciuti i piccoli, essa stessa deciderà di abbandonare la volontaria prigione. I vantaggi di un simile comportamento sarebbero di natura antipredatoria; la protezione ottenuta dal nidificare in una cavità protetta spiegherebbe, in parte, sia la muta simultanea delle penne caudali e timoniere della femmina la quale, per un certo periodo, è quindi incapace di volare, sia il ritardo con cui si sviluppano i piccoli che, nei primi dieci giorni di vita, sono ciechi e completamente nudi (si veda al proposito la foto del Calao maggiore *Bucero bicornis* a pagina 477). La spettacolare coda del maschio di Quetzal (lunga fino a 60 cm) e i suoi splendidi colori sono stati ammirati fin dall'antichità, tanto è vero che questo trogonide era sacro sia ai Maya sia agli Atzechi, ed è ora l'emblema nazionale del Guatemala. Il Quetzal *Pharomachrus mocinno*, contrariamente a quanto spesso erroneamente ritenuto, non è attualmente troppo minacciato e, anzi, nelle porzioni integre di foresta tropicale è ancora relativamente comune.

Anche in questo volume della serie HBW spicca la quasi totale assenza di riferimenti a lavori di ornitologi italiani (solo una dozzina di citazioni), ma questa volta il dato è parzialmente giustificato dal tipo di avifauna considerata, in larga parte estranea alla nostra penisola. Questo alibi, in realtà, regge fino ad un certo punto e, infatti, ho rilevato con piacere che la descrizione di alcune specie trattate in questo volume (perlopiù appartenenti alla fauna della Papuasia e delle Molucche) si deve proprio ad un ornitologo italiano, il grande Tommaso Salvadori a cui, inoltre, sono dedicate due sottospecie (*Merops apiaster salvadorii* e *Tanysiptera sylvia salvadoriana*).

Dati tecnici: 589 pagine, 45 tavole a colori, 385 fotografie, 270 mappe distributive, circa 6000 voci bibliografiche. Il volume, che costa 145 Euro, può essere acquistato direttamente dalle Lynx edicions, Passeig de Gràcia, 12, 08007 Barcellona, Spagna *(e-mail: lynx@hbw.com).*

Antonio Rolando

Maffei G., Pulcher C., Rolando A. e Carisio L. 2001. *L'avifauna della città di Torino: analisi ecologica e faunistica.* Museo Regionale di Scienze Naturali, Torino. Monografie XXXI. 255 pp.

Il Museo Regionale di Scienze Naturali ha una tradizione di pubblicazioni di grande pregio. Del ricco catalogo mi fa piacere ricordare a titolo personale, il volume edito con Lisa Levi sul convegno della società Alessandro Ghigi (1989), piccola società che negli anni '80 ebbe una sua funzione nel fare crescere la cultura zoologica di base e applicativa. Ma in questa occasione è più importante ricordare la continuità ornitologica di queste pubblicazioni, gli atti del convegno di Torino (1991), ma soprattutto due opere fondamentali quali l' Atlante degli uccelli nidificanti (1988) e quello degli uccelli svernanti (1996). Se a questa realtà editoriale regionale aggiungiamo l'apporto della Rivista Piemontese di Storia naturale (che non vede numero senza resoconti ornitologici e articoli di ecologia e di biologia), non si stenta a credere che il Piemonte sia all'avanguardia (una specie di contea inglese) nello studiare e monitorare i suoi uccelli.

L'avifauna della città di Torino è l'ennesima monografia di pregio in cui forma e sostanza sono curate al massimo, a partire dalla bella copertina di Xavier de Maistre e dai disegni di Dotti e Carisio inframmezzati nel testo. L'approccio descrittivo-quantitativo utilizza come unità dello sfondo tematico 61 zone del comune che appaiono a seconda dell'ecologia della specie in tre versioni: sfondo fluviale, vegetazionale e di urbanizzazione. Per le specie nidificanti troviamo doppia cartina con aree di nidificazione e frequenze di osservazione ma non si trascurano le specie accidentali irregolari, di cui si riportano congrui commenti basati su un' esauriente bibliografia. Laddove è possibile gli autori esprimono valutazioni sulle tendenze della popolazione anche in chiave conservazionistica. Lascio al lettore la soddisfazione di ricercare le specie predilette o di leggere gli interessanti capitoli introduttivi e le conclusioni. È forse superfluo ribadire l'interesse dell'ambiente antropico in chiave sia di prima fruizione dell'appassionato bird-watcher che di interesse scientifico. A questo proposito il volume ci fa riflettere sui diversi tempi di adattamento degli uccelli alla nuova realtà evolutiva della città: dal consolidato insediamento di rondoni e piccioni fino alle recentissime storie di uccelli acquatici in espansione invernale. Sono dati di interesse generale per la biologia evoluzionistica e che confermano il ruolo preminente dell'ornitologia in questo settore delle scienze naturali.

L'opera è acquistabile al prezzo di 36,15 euro presso il Museo Regionale di Scienze Naturali, via Giolitti 36, 10123 Torino.

Giorgio Malacarne

P.J. Dubois, P. Le Maréchal, G. Olioso e P. Yésou (2000). *Inventaire des Oiseaux de France. Avifaune de la France métropolitane.* Nathan, Paris, pp. 400.

A più di sessant'anni dalla pubblicazione della quasi omonima opera di Noel Mayaud, sulla quale si è appoggiata tutta la moderna ricerca ornitologica francese, esce ora un poderoso tomo destinato probabilmenbte a coprire un analogo ruolo per molti anni a venire. È in realtà ben più di un inventario delle 512 specie di uccelli note per la Francia. Dopo una breve premessa di Géroudet, per lungo tempo testimone dal 'posatoio ginevrino' dell'evoluzione dell'ornitologia europea, il libro inizia con due interessanti capitoli introduttivi, l'uno storico a firma di Cruon e l'altro biogeografico di Blondel. Segue un'introduzione tecnica, che fornisce le chiavi per interpretare correttamente la lunga serie di testi monografici che ad essa seguono. Questi, di lunghezza molto variabile, sono accompagnati ognuno da un piccolo ma gradevole disegno a colori di ciascuna specie nel suo abito più rappresentativo per l'area francese (riproduttivo, invernale o addirittura giovanile nel caso di alcuni limicoli e gabbiani), da cartine distributive riferite alla nidificazione e/o allo svernamento, e spesso anche da istogrammi che sintetizzano fenologie stagionali, evoluzioni numeriche delle popolazioni e frequenza delle segnalazioni occasionali. I testi sono molto concisi e terminano di solito con riferimenti bibliografici alle 3-4 pubblicazioni chiave esistenti per ciascuna specie. Non mancano appendici sulle specie escluse a vario titolo dalla lista ufficiale, e un elenco delle sottospecie presenti. Critiche: se ne potrebbero fare, di non costruttive, soprattutto nei casi in cui l'asciuttezza dei testi e le poche citazioni non consentono di risalire all'origine di singoli dati o affermazioni. Mi è difficile immaginare quale avrebbe potuto essere una soluzione alternativa, senza raddoppiare il numero di pagine di un volume che già così è tutt'altro che leggero. Ritengo che sia un libro molto utile agli ornitologici italiani che si interessano di faunistica. Costa 60, 82 Euro, e conviene ordinarlo tramite la LPO (Ligue pour la Protection des Oiseaux: *catalogue@lpo-birdlife.asso.fr*).

Nicola Baccetti

Avocetta N° 26 (1): 52 (2002)

Errata corrige

Avocetta N° 25: 313 (2001)

Errata

Svernamento di Mignattino *Chlidonias niger* sul Lago di Garda (Lombardia).

Corrige

Rinvenimento di Mignattino piombato *Chlidonias hybridus* sul Lago di Garda (Lombardia).

Notices

Società Italiana di Etologia
XX Convegno nazionale
Torino e Alessandria, 17-20 settembre 2002

Organizzatori:
Cristina Giacoma: Dipartimento Biologia Animale e dell'Uomo, Università di Torino, Torino.
Giorgio Malacarne: Dip. Scienze e Tecnologie Avanzate, Università del Piemonte Orientale, Alessandria.

Sede del Convegno:
Dipartimento Biologia Animale e dell'Uomo, via Accademia Albertina, 13 - Torino.

Simposi:
- Basi morfo-fisiologiche del comportamento;
- Meccanismo di orientamento;
- Evoluzione delle strategie riproduttive femminili;
- Comportamento sociale;
- Etologia e conservazione.

Relatori invitati:
- Tim Mousseau, University of South Caroline, Columbia
- Kurt Kotrschal, Konrad Lorenz Forschungsstelle für Ethologie, Grünau, Austria
- Jan ARAM van Hoof, Utrecht University

Per saperne di più: http://www.dba.unito.it/seminari/sie2002.html

Per contattarci: SIE2002@dba.unito.it

XLI colloquio ornitologico interregionale

Organizzato quest'anno in Svizzera da "Nos Oiseaux", in collaborazione con la "Société des sciences naturelles du pays de Porrentruy", avrà luogo a Porrentruy, nel canton Giura, nelle giornate del 22, 23 e 24 novembre 2002. Il tema prescelto riguarderà la situazione delle popolazioni dei rapaci diurni e notturni d'Europa. La giornata del 22 novembre sarà dedicata a varie animazioni pedagogiche, sul tema: "Incontro con ...", nel corso delle quali gli studenti giurassiani potranno dialogare con degli ornitologi affermati. Delle serate ricreative, con proiezioni di film, avranno luogo venerdì e sabato. Durante le giornate di sabato e di domenica si svolgeranno dei dibattiti scientifici. In quest'ambito, svariate personalità scientifiche che hanno contribuito allo studio e alla protezione dei rapaci d'Europa da parecchi anni riceveranno il titolo di Membro onorario del colloquio.
Tutti gli interessati sono cordialmente invitati a partecipare al colloquio. Le associazioni ornitologiche e della protezione della natura, le imprese specializzate così come i fotografi e gli artisti che si interessano al mondo animale avranno la possibilità di esporre e di vendere le loro opere nell'area della rassegna e di partecipare ai diversi concorsi che verranno organizzati.
Chiunque desideri partecipare al colloquio, presentare una relazione orale o affiggere i risultati delle proprie attività (manifesti) in relazione con il tema scelto può fin da ora rivolgersi alla direzione amministrativa del colloquio, presso Michel Juillard, Clos Gaspard, 2946 Miécourt, Svizzera - tel. 032/462.33.46 - fax 032/462.32.08 e-mail: m.juillard@freesurf.ch.

Norme per gli autori

AVOCETTA pubblica articoli originali, brevi note, sintesi di aggiornamento, commenti, corrispondenze e recensioni, su argomenti che coprono l'intero campo dell'ornitologia. Verrà tuttavia data la preferenza a lavori sperimentali sull'ecologia, l'etologia, la zoogeografia della fauna ornitica della regione mediterranea e delle zone alpine.
I lavori sottoposti saranno valutati da referees e, in conseguenza dei suggerimenti da loro effettuati, saranno accettati, rinviati agli autori con proposte di modifiche, o respinti. Tale decisione è competenza definitiva degli *editors*.
I lavori sottoposti in italiano, inglese o francese, devono essere dattiloscritti con interlinea 2, ampi margini, su una sola facciata e devono essere forniti in **tre** copie, complete di illustrazioni. L'autore indicherà a matita sul margine sinistro del dattiloscritto la posizione in cui illustrazioni e tabelle vanno inserite nel testo.
Il testo degli articoli dovrà essere diviso come segue:

- Titolo
- Nome e cognome dell'Autore
- Indirizzo dell'autore
- Testo del manoscritto, diviso nei seguenti capitoli: Riassunto, Introduzione, Metodi, Risultati, Discussione, Ringraziamenti, Riassunto in lingua diversa da quella dell'articolo, Bibliografia
- Tavole e figure

Il **riassunto** iniziale, di un massimo di 40 righe, elencherà schematicamente tutti i problemi trattati ed i risultati ottenuti senza riferimento diretto al testo e senza ripetere l'informazione contenuta nel titolo. Nel riassunto non devono comparire abbreviazioni e simboli specialistici.

Il problema principale affrontato nel lavoro va esposto chiaramente nell'**introduzione** senza eccessivi dettagli storici. La continuità con altre ricerche va posta in evidenza con gli opportuni riferimenti bibliografici evitando la ricapitolazione di questi stessi lavori. I metodi devono essere espressi con chiarezza ma senza introdurre dettagli particolareggiati, tranne quando si tratti di un lavoro metodologico innovativo.

I nomi di genere e di specie e le parole da evidenziare devono essere sottolineati (per il carattere corsivo). I nomi comuni di animali vanno scritti maiuscoli.

Le **citazioni bibliografiche** nel testo possono essere date come: Mayr (1963), Andrewartha e Birch (1984), Fasola *et al.* (1987) o alla fine della frase (Mayr 1963, Fasola *et al.* 1987).
Le citazioni devono conformarsi ai seguenti esempi:

Capitolo: Baldaccini N.E., Benvenuti S., Fiaschi V., Ioalé P. e Papi F. 1982. Pigeon orientation: experiments on the role of olfactory stimuli perceived during the outward journey. In: Papi F. e Wallraff H. G., Edits. Avian navigation. Springer, Berlin pp. 160-169.
Libro : Lack D. 1954, The natural regulation of animal numbers. Clarendon Press, Oxford.
Rivista : Papi F. 1986. Pigeon navigation: solved problems and open questions. Monit. Zool. ital. (N.S.) 20: 471-571.

I titoli delle riviste devono essere abbreviati secondo l'ultima edizione (quarta) del World List of Scientific Periodicals (1960) e i supplementi della British Union-Catalogue of Periodicals o le Serial Publications in the British Museum (Natural History) Library. Nel dubbio scrivere il riferimento in esteso. Non includere materiale non pubblicato tra le citazioni.

Le **Tavole** devono essere numerate consecutivamente con i numeri arabi e battute su un foglio separato con una chiara ed esauriente legenda.

Illustrazioni. Il massimo del formato (legenda inclusa) è 178x214 mm. Le illustrazioni devono essere 1.5-2 volte più grosse del formato definitivo. Anche le figure vanno numerate con numeri arabi. Scritte, lettere e numeri delle figure devono essere sufficientemente grosse da essere lette dopo riduzione del formato. Disegni, grafici e figure devono essere in formato TIFF o EPS, allegando con esse l'originale.
Sono richieste quattro copie di fotografie.
Legende di fotografie e figure vanno scritte su foglio separato.

I manoscritti vanno spediti a:
Redazione di AVOCETTA,
Dipartimento di Biologia Animale,
via Accademia Albertina 17 - 10123 TORINO.

Costo degli estratti:
Cost of the reprints:

no. estratti	no. pagine 1-4	5-8	9-12	13-16	17-20	21-30
50	21,00 €	31,00 €	41,00 €	62,00 €	72,00 €	83,00 €
100	26,00 €	36,00 €	46,00 €	67,00 €	77,00 €	88,00 €
150	31,00 €	41,00 €	52,00 €	72,00 €	83,00 €	93,00 €
200	36,00 €	46,00 €	62,00 €	77,00 €	88,00 €	98,00 €
250	41,00 €	52,00 €	67,00 €	83,00 €	93,00 €	103,00 €

Il costo include IVA e spedizione. È possibile richiedere estratti con copertina (esclusi quelli di 1-2 pagine). Il costo delle copertine è 0,36 Euro ognuno. Es. per 50 estratti con copertina, aggiungere 18,10 Euro al costo delle pagine.
This cost includes postage. Cost of cover is 0,36 Euro for each reprint. E.g.: for 50 reprints with cover add 18,10 Euro to the cost of the reprints.

Instructions to authors

AVOCETTA publishes original articles, short communications, reviews, surveys, comments and correspondence on all topic of ornithology. However, preference will be given to original works in the ecology, ethology and zoogeography of the ornithological fauna in the Mediterranean region and the Alpine area.
Manuscripts, conforming to the journal's scope, are subject to the review process, and the final decision concerning acceptance or rejection will be made by the Editors.
Manuscripts shoud be submitted in triplicate preferably in English (Italian and French are also accepted). They must be typewritten double spaced with wide margins. Position of figures and tables should be marked on the margin.
Manuscripts shoud be arranged as follows:

- Title
- Author's names and initials
- Address of author's institution
- Text of the paper, divided into the following sections: Abstract, Introduction, Methods, Results, Discussion, Acknowledgements, Abstract (in a language different from that of the text), References
- Tables and illustrations

The **abstract,** of max 40 lines, should give concise but exhaustive information on the problem and the results, and be intelligible without reference to the main text. Abstract need not repeat information given in the title. Abbreviations and special symbols must not appear in the abstract.

The main problem should be outlined briefly in the **introduction**, and detailed historical introductions should be avoided. Continuity with earlier work on the subject should be established by reference to recent papers, which need not themselves be summarized. Experimental methods must be clearly set out, but detailed descriptions of methods are of value only if they convey substantially new information.

Genus and species names and words to be emphasized should be underlined once (for italics). The common names of animals should be capitalized.

Literature citations in the text should be given as: Mayr (1963), Andrewartha and Birch (1984), Fasola *et al.* (1987) or, at the end of a sentence, (Mayr 1963, Fasola *et al.* 1987).

References at the end of the paper should be listed in alphabetical order by the first author's name; all work referred to in the text should be listed, and only those.
References should be conformed to the following examples.

Chapter:	Baldaccini N.E., Benvenuti S., Fiaschi V., Ioalé P. and Papi F. 1982. Pigeon orientation: experiments on the role of olfactory stimuli perceived during the outward journey. In: Papi F. and Wallraff H. G., Edits. Avian navigation. Springer, Berlin pp. 160-169.
Book :	Lack D. 1954, The natural regulation of animal numbers. Clarendon Press, Oxford.
Journal :	Papi F. 1986. Pigeon navigation: solved problems and open questions. Monitore Zool. Ital. (N.S.) 20: 471-571.

Titles of journals should be abbreviated according to the last (4th) edition of the World List of Scientific Periodicals (1960) and following supplementary lists issued by the British Union-Catalogue of Periodicals or the Serial Publications in the British Museum (Natural History) Library. If in doubt, give the title in full. Do not include unpublished material among the references.

Tables must be numbered consecutively in arabic numerals and typed on a separate sheet together with a clear descriptive legend.

Illustrations. The maximum dimensions of published figures (including the legend) are 178x241 mm. Authors are requested to submit illustrations 1.5-2 times larger than the final format. Illustrations should be numbered in Arabic numerals.
Lettering should be big enough to remain clearly visible after reduction. Drawing and figure should be in TIFF o EPS format. The original and three copies should be submitted.
Photographs should be submitted in quadruplicate.
The legend of both figures and photographs should be typed separately from the rest of the manuscript.

Manuscripts should be addressed to:
The Editors, AVOCETTA,
Dipartimento di Biologia Animale,
via Accademia Albertina 17 - 10123 TORINO, Italy.

AVOCETTA

N° 1, Vol. 26 - Luglio 2002

CONTENTS

Short communications