Bird Behaviour, Vol. 10, pp. 45–48 © Cognizant Comm. Corp. 1994 Printed in the USA 1056-1383/94 $5.00 + .00

Water-Crossing Behavior of Black Kites (*Milvus migrans*) During Migration

NICOLANTONIO AGOSTINI[1] AND ANTONINO DUCHI[2]

[1]*Dipartimento di Ecologia, Universitá della Calabria, 87036 Rende (CS), Italy*
[2]*Instituto di Zoologia, Universitá degli Studi di Parma, 43100 Parma, Italy*

AGOSTINI, N. and A. DUCHI. 1994. Water-crossing behavior of Black Kites (*Milvus migrans*) during migration. *Bird Behaviour* **10**: 45–48.
We observed Black Kite (*Milvus migrans*) spring migration at Cap Bon (Tunisia) from 14 to 27 April 1992. There were 270 individuals that left the coast northeast bound, 90% of which were observed on only 4 days. Neither heavy winds nor observation times exercised any significant influence on the migratory flow. The average size of the Black Kite flocks that left the coast was significantly greater than the size of those that interrupted migration.

Black Kite *Migration* *Water crossing*

Introduction

The Black Kite (*Milvus migrans*) uses three principal routes to cross the Mediterranean basin on migration, the most important of which is across the Strait of Gibraltar, where in the autumn of 1972, 39,099 individuals were counted (6). Much less important is the far eastern route across the Bosphorus, where in the autumn of 1971, 2770 were counted (6). The third principal migratory route crosses the Sicilian Channel, about 150 km wide, in the central Mediterranean, between Italy and Tunisia.

During the springs of 1974 and 1975 on the Cap Bon promontory, in Tunisia, 4208 individuals were observed from the end of March up until the first half of April, and 2400 were observed during the first half of May on a migratory front not much wider than 2 km (15,16).

During the observations conducted at the Straits of Messina in springs 1984 through 1990 no count ever exceeded 400 individuals (1–3,7,8).

The aim of this study is to broaden the knowledge of the migratory pattern of this species in the central Mediterranean, by observing Black Kites at the Cap Bon promontory in Tunisia, which seems to be this species' primary migratory site.

Methods

The observations were made between 14 and 27 April 1992, the high peak of springtime migration for this species in the central Mediterranean (6). A single observation point was situated at about 400 m above sea level, the promontory's highest point. From here the birds' flight behavior could be easily observed above water as well as over land.

Eighty-eight observation hours were completed. Observation days were subdivided into three periods: morning (0900–1159), midday

(1200–1459), and afternoon (1500–1800) using standard time. Binoculars (10 × 50) were used for the observations. The Kelibia weather station provided weather bulletins for the extreme north of the Tunisian peninsula, recorded at 1-h intervals.

Results and Discussion

It was impossible to make an exact count of the individuals observed at the promontory. They rarely began the Sicilian Channel crossing. In most cases, the raptors flew along the coast only to disappear inland towards the south.

Moreover, individuals seen flying above the sea in a southeasterly direction were later observed returning to the southern coast.

We were able to recognize a few individuals due to their particular plumage characteristics and several groups due to their particular interspecific association, so we avoided recounting migrants.

Analogous situations were observed during the Honey Buzzard (*Pernis apivorus*) migration at Cap Bon (1) and during numerous other raptor migrations on Lake Superior and Cap May, NJ (10,12). This seems to support the observation that the estimate of raptors in migration for 1974 and 1975 at Cap Bon (16) should be considered untenable (4,5). Consequently, only the individuals that clearly undertook the sea crossing in a northeasterly direction were counted; their total number amounted to 651; of these, 271 were Black Kites.

During the observation period the migratory flow shows that the majority of Black Kites (over 90%) left the coast on 4 days (Figure 1); it is worthwhile to note that from 17 to 19 April not one individual was observed. This period was characterized by frequent rain and west northwesterly winds that averaged more than 45 km/h.

Considering the strength (<20 km/h to ≥20 km/h) of the NW and SSE prevailing winds, which crossed the raptors' path, there was no significant influence on the number of individuals crossing ($F = 4.53$, $p > 0.05$), even though there was a greater number of individuals that, for each observation hour, left the coast in a northwesterly direction with weak winds [8.24 ± 4.0 (SEM); 3.2 ± 1.7].

It is interesting to note that wind strength did not significantly affect the migratory flow of the other two most numerous species observed (Figure 2): Montagu's Harrier (*Circus pygargus*) ($F = 0.9$, $p > 0.05$), and Marsh Harrier (*Circus aeruginosus*) ($F = 2.1$, $p > 0.05$).

This result differs from observations on Honey Buzzards (*Pernis apivorus*) that, like the Sharp-Shinned Hawk (*Accipiter striatus*) above Lake Superior and Cap May (9,12), tend to cross the Sicilian Channel more frequently with weak lateral winds, probably to minimize "drifting" (1).

Black Kite, Marsh Harrier, and Montagu's Harrier have relatively long wings (6,13); such a characteristic renders the raptors more adapted to long surface water crossings, diminishing induced drag and therefore lowering the energy cost of powered flight (10).

Moreover, raptors migrating towards the northeast with strongwinds (≥20 km/h) from the SSE adopted a flight position similar to that employed by the Honey Buzzard with strong south winds; in fact, they let themselves be carried by the wind, holding the longitudinal axis of their bodies perpendicular to the migration direction and flapping the wings (4).

The number of individuals crossing did not vary significantly throughout the day ($F = 2.1$, $p > 0.05$).

Black Kites showed a strong tendency to migrate in flocks; in only four cases did we observe solitary individuals. The average size of a flock initiating a crossing toward the NE was 16.4 ± 5.4 and the average flock size that interrupted the migration was 8.8 ± 1.1; this difference is statistically significant ($F = 5.9$, $p < 0.05$), in a similar manner to Honey Buzzards (4).

The importance of flocking behavior during raptor migration is related to the location of thermals (11). However, such rising hot air currents are very weak above the water surface, which means that the majority of the raptors are obliged to undertake a long powered flight during their crossing (12).

Studying the autumn Honey Buzzard migration

Erratum in Bird behav. Vol. 11 : 53

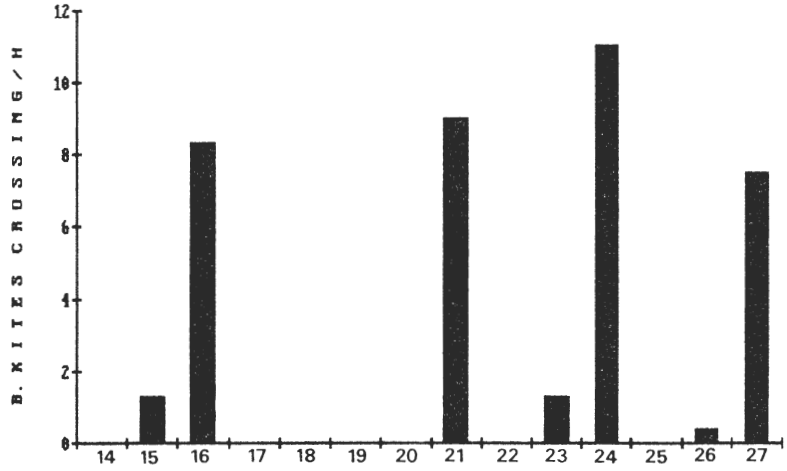

Figure 1. The migratory flow variation during the observation period (only the individuals that crossed the Sicilian Channel were considered).

above Malta, Thake (14) hypothesized that flocking behavior can also be utilized to diminish orientation errors by way of information transmission. Such a hypothesis would imply a contemporaneous migration of adults (expert individuals) and the young (inexpert individuals). This, however, does not occur among long-distance migrating raptors because the adults precede the young during the spring migration (11); during our observation we counted only two young.

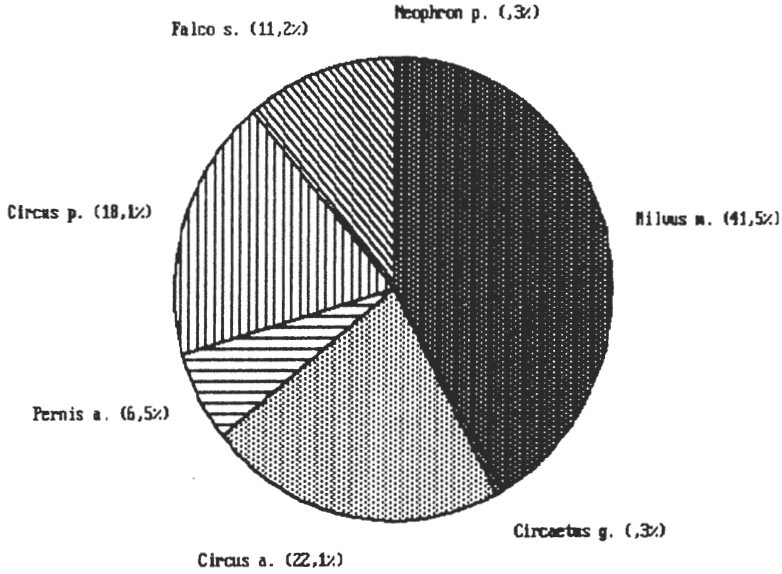

Figure 2. Frequency of the observation of the species (only the raptors that crossed the Sicilian Channel were considered).

Water barriers seem, instead, to actually separate the young from the adults when there is overlapping in the migration periods: at Cap Bon in the month of May 1990, indeed, a flock of 60 Black Kites composed of 30 adults and 30 young was observed to divide itself above the coastline and while the first began the crossing in the NE direction, the second, after having moved along the coast, flew inland (Agostini, pers. obs.).

On the contrary, during our observations, only three Black Kites flew inland after the other individuals of flock had begun the sea crossing. We have observed entire flocks return, even after they had been so far away from the coast that they could not be observed without binoculars. Therefore, in the peak of spring migration, as in Honey Buzzard (4), there is a strong tendency to remain in a flock in front to a water barrier because the first individuals making a decision (crossing or not) are followed by the others. This suggests that flocking behavior is important for water crossings, because an increase in flock size increases the probability that the flock will contain one or more individuals with a pronounced tendency to continue migrating.

Acknowledgements

We would like to thank the Tunisian Ministry of Forests and Agriculture for having authorized the observations within the Cap Bon Natural Park. We are also indebted to the Tunisian National Meteorological Institute for their generous collaboration. Special thanks to Elizabeth de Young for the translation of the Italian manuscript and to Paul Kerlinger and Frank Moore for their useful comments on the manuscript.

References

1. Agostini, N., G. Malara, F. Neri, and D. Mollicone. 1991. Spring migration of Honey buzzard (*Pernis apivorus*) at Cap Bon (Tunisia) and at the Straits of Messina. VI Convegno Italiano di Ornitologia, Torino, Italy.
2. Agostini, N. 1992. Spring migration of Honey Buzzards at the Straits of Messina in relation to atmospheric conditions. *Raptor Research* **26(2)**: 93–96.
3. Agostini, N., G. Malara, D. Mollicone, F. Neri, N. Cavedon, D. Rossi, and F. Sartore. 1993. The Honey Buzzard (*Pernis apivorus*) migration across the Central Mediterranean: An ethological approach. Atti 14 Convegno della societá Italiana di Etologia. *Ethology, Ecology, and Evolution* **5**: 373.
4. Agostini, N. 1994. Flight strategies of Honey Buzzards during spring migration across the Central Mediterranean. *Avocetta*. in press.
5. Agostini, N. 1994. Spring migration of Honey Buzzards (*Pernis apivorus*) at the Straits of Messina: Problems concerning protection. *Rivista Italiana Ornitologia* **63(2)**: 187–192.
6. Cramp, S. and K. E. L. Simmons. 1980. *The Birds of the Western Palearctic*. Vol. II. Oxford, UK: Oxford University Press.
7. Dimarca, A. and C. Japichino. 1984. La migrazione dei Falconiformi sullo Stretto di Messina. IV Conferenza Internazionale sui Rapaci del Mediterraneo, Sant'Antioco, Italy.
8. Giordano, A. 1991. The migration of birds of prey and storks in the Straits of Messina. *Birds of Prey Bulletin* **N.4**: 239–249.
9. Kerlinger, P. 1984. Flight behavior of Sharp-shinned Hawks during migration. II: Over water. *Animal Behavior* **32**: 1029–1034.
10. Kerlinger, P. 1985. Water-crossing behavior of raptors during migration. *Wilson Bulletin* **97**: 109–113.
11. Kerlinger, P. 1989. *Flight Strategies of Migrating Hawks*. Chicago, IL: University of Chicago Press.
12. Kerlinger, P. and S. A. Gauthreaux, Jr. 1984. Flight behavior of Sharp-shinned Hawks during migration. I: Over land. *Animal Behavior* **32**: 1021–1028.
13. Porter, R. F., I. Willis, S. Christensen, and B. B. Nielsen. 1981. *Flight Identification of European Raptors*. Edited by T. and A. D. Poyser, London, UK.
14. Thake, M. A. 1980. Gregarious behaviour among migrating Honey Buzzards (*Pernis apivorus*). *Ibis* **122**: 500–505.
15. Thiollay, J. M. 1975. Migration des printemps au Cap Bon (Tunisie). *Nos Oiseaux* **33**: 109–121.
16. Thiollay, J. M. 1977. Importance des populations de rapace migrateurs en Mediterranee Occidentale. *Alauda* **45**: 115–121.