Homing of Cory's shearwaters (Calonectris diomedea) carrying magnets

Article *in* Italian Journal of Zoology · January 1991

DOI: 10.1080/11250009109355760

4 authors, including:

Bruno Massa
Università degli Studi di Palermo
169 PUBLICATIONS **862** CITATIONS
SEE PROFILE

Mario Lo Valvo
Università degli Studi di Palermo
89 PUBLICATIONS **450** CITATIONS
SEE PROFILE

Italian Journal of Zoology
Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t741771159

Homing of Cory's shearwaters (*Calonectris diomedea)* carrying magnets

Bruno Massa [a]; Silvano Benvenuti Paolo Ioalè [bc]; Mario Lo Valvo [d]; Floriano Papi [a]
[a] Istituto di Entomologia Agraria, Università di Palermo, Palermo, Italy [b] Dipartimento di Scienze del Comportamento Animale e dell'Uomo, Universita di Pisa, Pisa, Italy [c] Centro di Studio per la Faunistica ed Ecologia Tropicali del C.N.R., Firenze, Italy [d] Istituto di Zoologia, Università di Palermo, Palermo, Italy

To cite this Article Massa, Bruno, Ioalè, Silvano Benvenuti Paolo, Valvo, Mario Lo and Papi, Floriano(1991) 'Homing of Cory's shearwaters (*Calonectris diomedea)* carrying magnets', Italian Journal of Zoology, 58: 3, 245 — 247
To link to this Article: DOI: 10.1080/11250009109355760
URL: http://dx.doi.org/10.1080/11250009109355760

Boll. Zool. 58: 245-247 (1991)

Homing of Cory's shearwaters (*Calonectris diomedea*) carrying magnets

BRUNO MASSA
Istituto di Entomologia Agraria, Università di Palermo, v.le delle Scienze 13, I-90100 Palermo (Italy)

SILVANO BENVENUTI
PAOLO IOALÈ
Dipartimento di Scienze del Comportamento Animale e dell'Uomo, Università di Pisa, via A. Volta 6, I-56126 Pisa (Italy) and Centro di Studio per la Faunistica ed Ecologia Tropicali del C.N.R., via Romana 17, I-50125 Firenze (Italy)

MARIO LO VALVO
Istituto di Zoologia, Università di Palermo, via Archirafi 18, I-90123 Palermo (Italy)

FLORIANO PAPI
Dipartimento di Scienze del Comportamento Animale e dell'Uomo, Università di Pisa, via A. Volta 6, I-56126 Pisa (Italy) and Centro di Studio per la Faunistica ed Ecologia Tropicali del C.N.R., via Romana 17, I-50125 Firenze (Italy)

ABSTRACT

Cory's shearwaters, equipped with magnets on their bodies and wings, were released far from their nesting-place. The homing performances of experimental specimens did not differ from those of controls. The results do not support the suggestion that magnetic information plays an essential role in the homing of Cory's shearwaters.

KEY WORDS: Cory's shearwater - Homing - Magnets.

ACKNOWLEDGEMENTS

We are grateful to Mr S. Bonadonna for his precious help in the field. This work was supported by the Consiglio Nazionale delle Ricerche (C.N.R.) and by the Ministero dell'Università e della Ricerca Scientifica e Tecnologica.

(Received 6 February 1991-Accepted 14 March 1991)

INTRODUCTION

Birds of the families Procellariidae, Diomedeidae and Hydrobatidae are oceanic long-range fliers and some of their representatives are able to home from hundreds or thousands of kilometers. The transoceanic homing flights of displaced Manx shearwaters (*Puffinus puffinus*), Laysan albatrosses (*Diomedea immutabilis*) and Leach's petrels (*Oceanodroma leucorhoa*) have often been mentioned (Matthews, 1953; Kenyon & Rice, 1958; Billings, 1968). Recently, recordings of foraging flights have shown that the Wandering albatross (*Diomedea exulans*) has a fantastic ability to pinpoint its small home island after flights of thousands of kilometers (Jouventin & Weimerskirch, 1990). The mechanisms underlying these performances are unknown, but results obtained with other birds suggest that sensitivity to the earth's magnetic field might be involved. Migratory passerine birds use the magnetic field to orientate their escape attempts from cages or funnels (Wiltschko & Wiltschko, 1990, and references therein), while homing pigeons carrying magnets are reported to be disorientated under overcast skies, at least in some experimental series (Keeton, 1971; Ioalè, 1984; Moore, 1988). In general terms, birds are believed to rely on the magnetic field for direction finding, whereas it is very doubtful whether they use it to fix their position with respect to a goal (Wiltschko & Wiltschko, 1988). In the former case, birds would be disturbed in their navigation by alteration of the magnetic field around their body unless they could switch to an alternative directional/navigational system. The present paper, which reports observations on the homing performance of Cory's shearwater (*Calonectris diomedea*) after application of magnets, is an attempt to test the role of magnetic information in this bird.

MATERIALS AND METHODS

The birds

The Cory's sherwaters used in our experiments were captured on the islet of Linosa (see Fig. 1), where a breeding colony of at least 10000 pairs was estimated by Massa & Lo Valvo (1986). Our manipulations and experimental procedures did not influence the breeding success of the birds. In shearwaters, the two partners alternate on the egg every 7th-10th day so that the experimental displacement of one of them does not interrupt the brooding behaviour of the other, which waits for its partner. Displaced shearwaters, in fact, exhibit a good level of homing success; it has been decided in our study to attribute a very conservative estimate to the rate actually achieved, to allow for the inevitable approximations in the census methods used (see below). Moreover, the local people, illegally collect shearwater eggs in the study area. It must, therefore, be supposed that some of the birds used in our tests had been deprived of their eggs; this deprecable practise, however, does not prevent shearwaters from remaining faithful to the empty nest for a period of 15 to 30 days, as we observed several times.

The captures were performed in an area of approximately 2000 m^2 by simply picking up individuals which had landed in the area during the night, having come from the sea to reach their nests, usually placed in deep burrows. Most shearwaters do not react to

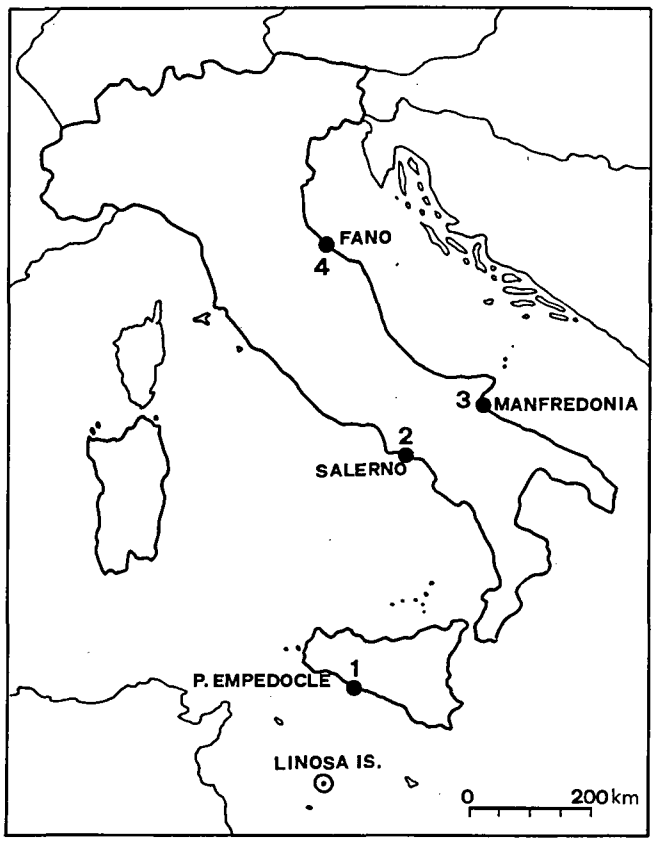

Fig. 1 - The position of the release sites (filled circles) and the islet of Linosa, where the breeding colony of Cory's shearwaters is located (dotted circle).

people approaching, and this simple method allowed us to capture 20-30 birds in a few hours. The captured birds were placed individually in cloth bags and subsequently transferred to wooden containers, which were subdivided into 14 boxes (15 × 40 × 25 cm); therefore, four containers of this kind, placed on top of a car, allowed trasportation of a maximum of 56 birds. All the birds were ringed for individual identification with rings supplied by the Istituto Nazionale di Biologia della Selvaggina, and checked for bill length and body weight. In addition, the breast and the neck of each bird was painted bright red.

The magnets

On the day subsequent the capture, experimental birds were equipped with bar magnets, and controls with brass bars. The magnets were identical to those used by Wallraff & Foà (1982) in experiments on homing pigeons. In experiments performed in 1988, two rectangular magnets («Vacomax 145», 3 × 8 × 5 mm, 0.95 g; at 1 and 2 cm distance 75 and 12 Gauss) were attached by means of quick-setting glue to the head and to the base of the neck, respectively. A larger round bar magnet («Alnico 500», diameter 4 mm, length 20 mm, 1.7 g; at 1 and 2 cm 60 and 20 Gauss) was attached on the upper part of each wing between the body and the forearm. In 1989 we followed a similar procedure, but only rectangular magnets were used. The North of the artificial fields was upwards for the rectangular bars, whereas in the round bars it was proximal in one wing and distal in the other. Four brass bars of the same weight and shape were similarly applied to each control bird. Many birds lost one or two magnets or brass bars during the homing flight.

Test releases

Release site 1 (see Fig. 1) was reached by ferry-boat within the day subsequent to that of capture. The trip to the other sites was much longer and experiments were performed two-three days after capture. All tests were carried out on the sea shore, during sunny days and stable weather conditions, with no wind or only moderate winds. The birds were released singly, alternating experimentals and controls, and followed by two observers up to vanishing with 10 × 40 binoculars. Vanishing times and bearings were recorded using a stop-watch and compass. Homing times were recorded by checking the ring of each «red» shearwater which landed in the capture area (whenever the observer was able to catch it!). The area was monitored for several nights after each experiment, although observations were not made on nights with unfavourable weather conditions (shearwaters do not approach the breeding colony when the moon is shining).

RESULTS AND DISCUSSION

At all the releases, the birds flew offshore on a course perpendicular to the coastline, the vanishing bearings being included in a sector of 86° at most. Thus, the initial orientation appears to be based on local topography and does not depend on the bird's position with respect to home.

Data on birds which returned home are shown in Figure 2. As an accurate survey of returns was impossible

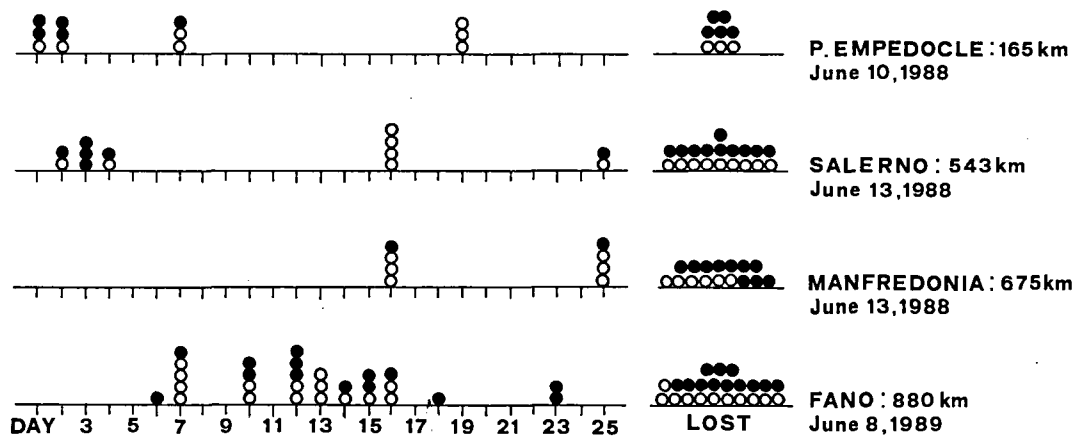

Fig. 2 - Homing times of experimental birds equipped with magnets (filled circles) and of control birds equipped with brass bars (open circles). Symbols are listed according to the time (days) elapsing between release and recovery. Birds which were never recovered are indicated as «Lost». Other explanations in the text.

following the three first releases, the related homing times are very approximate. It is remarkable, however, that two birds homed from Salerno (543 km) after only two days, whereas no birds were reported before 16 days after the Manfredonia release. Recordings of homing data from the Fano release were more accurate and show that the long homing flight was completed, in one case, in only six days.

The comparison of homing success in experimental specimens and controls does not lead to significance in any release, but the better performance of controls from Manfredonia is indicative ($P < 0.10$) of an effect of the magnets. However, in the release from Fano performed more northerly in the Adriatic sea and with a larger number of birds, this indication was not confirmed.

We conclude that the application of permanent magnets to wings and body does not produce a significant disturbance of homing ability in Cory's shearwater. While the present results do not support the suggestion that these birds use the magnetic field for position fixing, they might use it for finding the direction when other mechanisms (e.g., sun and star compass) are not working (which may explain the worse performance of experimental birds compared with controls, observed in one case). Further experiments on the homing mechanism of Cory's shearwater are in progress.

REFERENCES

Billings S. M., 1968 - Homing in Leach's Petrel. Auk, *85*: 36-43.

Ioalè P., 1984 - Magnets and pigeon orientation. Monit. zool. ital. (N.S.), *18*: 347-358.

Jouventin P., Weimerskirch H., 1990 - Satellite tracking of Wandering albatrosses. Nature (London), *343*: 746-748.

Keeton W. T., 1971 - Magnets interfere with pigeon homing. Proc. Natl. Acad. Sci., *68*: 102-106.

Kenyon K. W., Rice D. W., 1958 - Homing of Laysan Albatrosses. Condor, *60*: 3-6.

Massa B., Lo Valvo M., 1986 - Biometrical and biological considerations on the Cory's shearwater *Calonectris diomedea*. *In*: Medmaravis & X. Monbailliu (eds), Mediterranean Marine Avifauna, Springer-Verlag, pp. 293-313.

Matthews G. V. T., 1953 - Navigation in the Manx Shearwater. J. exp. Biol., *30*: 370-396.

Moore B. R., 1988 - Magnetic fields and orientation of homing pigeons. Experiments of the late W. T. Keeton. Proc. Natl. Acad. Sci., *85*: 4907-4909.

Wallraff H. G., A. Foà, 1982 - The roles of olfaction and magnetism in pigeon homing. Naturwissenschaften, *69*: 504.

Wiltschko W., Wiltschko R., 1988 - Magnetic orientation in birds. *In*: F. Johnston (ed), Current ornithology, vol. 5. New York, Plenum Press, pp. 67-121.

Wiltschko W., Wiltschko R., 1990 - Magnetic orientation and celestial cues in migratory orientation. Experientia, *46*: 342-351.