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Initial orientation in two species of doves (*Streptopelia senegalensis* and *Turtur abyssinicus*) displaced from their home site

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ABSTRACT

The authors report data on initial orientation of laughing doves (*Streptopelia senegalensis*) and black-billed wood doves (*Turtur abyssinicus*) displaced to sites, on land and at sea, 1-40 km from their home ground which was near the coast, in the area of the ORSTOM Ornithological Station of Mbour, Senegal. On the whole, the birds did not show the stereotyped directional tendencies often reported in studies on wild birds, but tended to be oriented in directions appropriate for reaching the ground area; this was especially the case of the black-wood dove.

KEY WORDS: Homing - Orientation - *Streptopelia senegalensis* - *Turtur abyssinicus* - Birds.

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INTRODUCTION

Homing pigeons, when released at sites distant from their loft, tend to fly in the homeward direction when still in sight of the observer. Vanishing bearings, together with homing performance, are the most important parameters on which studies of the homing mechanisms of these birds are based (references in Papi, 1989).

Many other species of birds exhibit homing ability when captured at their breeding or wintering site and released in distant areas; investigations on homing mechanisms, however, may be hampered by difficulty in obtaining homeward oriented vanishing bearings in experiments with wild species. In many cases the released birds tend to land soon after the toss or to fly toward relevant topographical features. In other cases vanishing bearing distributions are not different from random ones, or are oriented in the direction of the wind or towards constant compass directions having no apparent relationship with the home direction (see examples in Matthews, 1968; Fiaschi *et al.*, 1974; Wallraff & Hund, 1982; Baldaccini *et al.*, 1989). Reports of homeward directedness of displaced birds belonging to wild species are therefore quite rare in the ornithological literature.

We report here a study on the initial orientation in two species of doves (*Streptopelia senegalensis* and *Turtur abyssinicus*) captured and released far from their home site. This investigation is the continuation of a preliminary study carried out by Baillon & Benvenuti (1990).

MATERIALS AND METHODS

The birds and capture methods

The birds were captured in the area of the ORSTOM Center (Observatoire Geophysique, Station d'Ornithologie et de Mammalogie), 2 km SE of Mbour, Senegal (14° 23' N, 16° 58' W). Both species of doves used in our study – the laughing (L) dove (*Streptopelia senegalensis*) and the black-billed wood (BbW) dove (*Turtur abyssinicus*) are quite common in this area, where they breed nearly all the year round. Some of the birds were trapped in mistnets, 15 m long and 3 m high, which were set up from sunrise to late afternoon at four capture stations, although these were not kept in action simultaneously or every day (for details, see Baillon & Benvenuti, 1990). Others were captured at other sites in the same area, where they were attracted by food and water placed in cage traps.

Release experiments

The captured birds, banded for individual identification and checked for wing length and body weight, were usually placed in an outdoor aviary, within the capture area, supplied with food and water, until we a had a sufficient number of birds, or the proper weather conditions, for carrying out an experimental release. While some of the birds were released the same day as they were captured, others were tested after a period of residence (1-7 days) in the aviary.

Each bird was placed in a separate cloth bag and carried by car or motorboat to the release site; six different release sites were used: 1 km W and SSW (both at sea: the coast being clearly visible), 13 km SEE, 25 km NNW, 28 km E (all three on land), 40 km WSW (at sea, where the coast was not visible, with the exception of a small spot

– a hill – at 30°). As birds tossed at sea sometimes tend to alight on water, we first carried out releases at sea, close to the coast, in order to verify the behaviour of the birds, before transporting them greater distances. Releases at 13 and 25 km were accomplished in autumn 1988 and 1989; the other sites were used only in 1989.

All releases were carried out in sunny conditions, with light or moderate wind; the birds were released singly, alternating the two species of doves and following them to vanishing with 10 × 40 binoculars. Vanishing times and vanishing bearings were recorded using a stopwatch and a compass, according to the standard procedures used in investigations on homing pigeons (references in Papi, 1989).

Statistical methods

Directional data were treated by vector analysis as reported in earlier papers on homing pigeons. Vanishing bearing distributions were tested for randomness using the Rayleigh and the V test. The Watson U^2 test was used to compare the bearing distributions of the two species of doves (Batschelet, 1981).

RESULTS

Initial orientation

Only 60 out of 104 released L-doves (57.7%) and 67 out of 136 BbW-doves (49.3%) produced useful vanishing bearings; the other birds landed soon after release, or were lost behind trees or other nearby objects. Almost all the birds released at sea produced useful vanishing bearings; the exceptions were 9 BbW-doves (out of 58) which alighted on water or landed in the motorboat and were transported back home.

When considering only the birds which were released on land, there was a drastic difference between 1988 and 1989 data, with respect to the tendency to alight on land. In 1988, 26 out of 45 L-doves (57.8%) and 16 out of 36 BbW-doves (44.4%) released on land produced useful vanishing bearings, whereas only 2 bearings out of 27 (7.4%) and 2 out of 42 (4.8%) were recorded, respectively, in 1989. This difference is probably due to the fact that the time of residence in the aviary between capture and release was longer in 1989 (mean time: 3 days) than in the previous year (1 day).

The results of the release experiments show that the vanishing bearing distributions are different from random at each test site, with the exception of BbW-doves at 13 km SSE and 40 km WSW (Rayleigh test, $P > 0.05$) (Fig. 1). The test performed at 28 km E has not been taken into account, except for the homing performance, because we recorded only one vanishing bearing out of 16 released birds (6 L- and 10 BbW-doves; see Table I). With regard to the test at 40 km WSW, it is worth noting that it was carried out at sea and, due to the strong roll of the boat, it was impossible to follow the released birds with binoculars. This certainly increased the dispersion of the vanishing bearings. The released BbW-doves had a tendency to fly off the release site in various (often downwind) directions; after some time, however, they deviated clockwise or counter-clockwise so as to reduce the angular deviation of the bearings from the coast direction. L-doves were released in the same conditions as BbW-doves; their larger body size, however, allowed us to follow them for a much longer time, and the related bearing distribution is, therefore, more clustered than that of the other species (Fig. 1 E).

In releases performed on land, the BbW-doves showed an overall tendency to be southwestwards oriented (Fig. 1 A and B). After pooling the vanishing bearings with the home direction set to 0°, the bearing distribution was found not to differ from random (Rayleigh test: $P > 0.10$) (Table I); however, the V test, which estimates not only the scatter but also the angular deviation of the vanishing bearings from the expected (home) direction, reveals a significant clustering around the home direction ($P < 0.05$). In the test carried out at sea, however, all released birds showed an eastward orientation, both when the coast was visible and when it was not (Fig. 1 C, D and E).

The L-doves displayed a similar behaviour to that of BbW- doves (Fig. 1, Table I); in releases on the land, however, they revealed a strong tendency to fly southwards, even when the home direction was NNW. This difference between the BbW- and the L-dove is not significant; the Watson U^2 test did not reveal significant differences between the bearing distributions of the two species at any release site or in the pooled data ($P > 0.10$, in all comparisons).

Homing performance

Recaptures of released birds at the original banding station were quite infrequent. Only 6 out of 104 (5.8%) released L-doves, and 17 out of 127 (13.4%) BbW-doves were recaptured (9 BbW-doves which alighted on water were excluded from this computation). Thus, BbW-doves show better homing performance than L-doves; this difference is suggestive but not significant (χ^2, $0.05 < P < 0.10$).

DISCUSSION

Birds transported to, and released at sites distant from their home ground may reveal a tendency to fly in a constant compass direction with no apparent relationship to the home direction. This behaviour has been named «preferred compass direction» by Matthews (1968) and by Wallraff (1986), respectively. When test releases are carried out at sites where the home direction roughly coincides with the preferred compass direction, the initial orientation of the birds «simulates» homeward orientation, which may give rise to misleading interpretation of the data. This risk may be avoided by adopting an appropriate experimental procedure, which consists in releasing the birds at two or more sites symmetrically arranged around the home site. Unfortunately, we were not able to collect field data at the site east of home, altering our original experimental design which

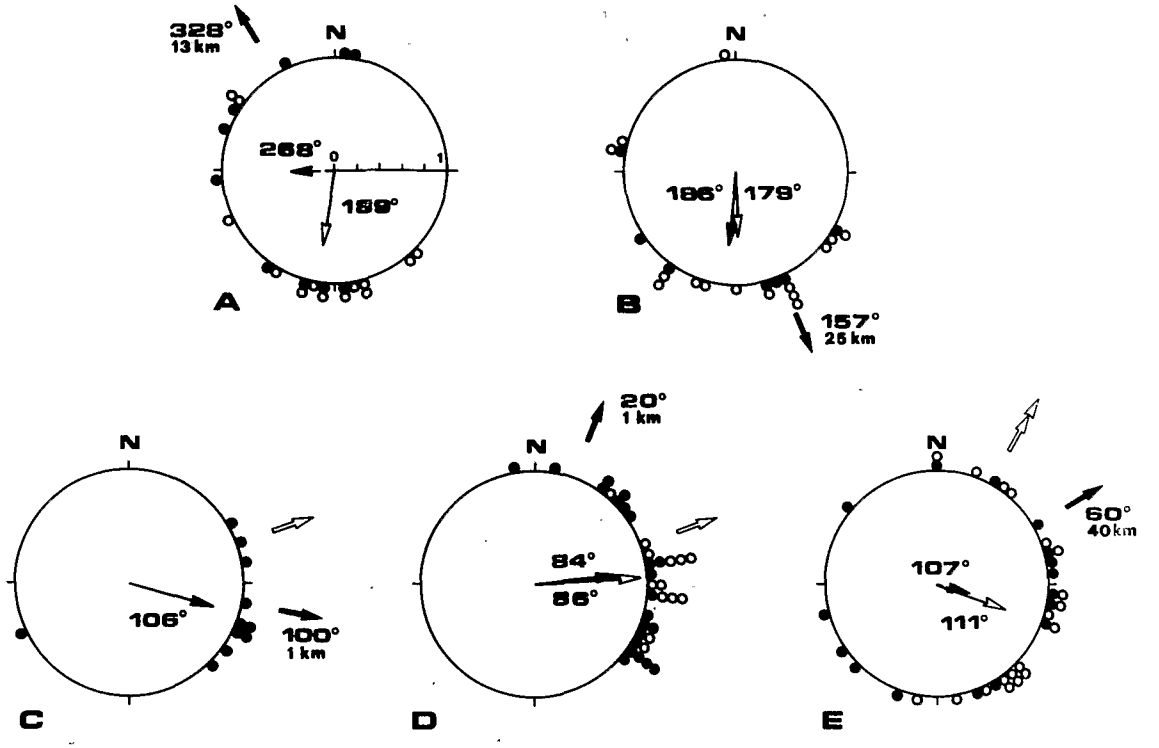

Fig. 1 - Initial orientation. Each symbol refers to the vanishing bearing of a single bird, approximated to the nearest 5 degrees (open and solid symbols refer to the laughing and to the black-billed wood dove, respectively). Inner arrows represent the related mean vectors, whose length can be read using the scale in the top left diagram. Dashed arrows are used when the related bearing distributions (diagrams A and E: solid symbols) are not different from random according to the Rayleigh test. Solid-headed external arrows indicate the home direction; home distance is also reported. Releases C, D, and E were carried out at sea: the external open-headed arrows in diagrams C and D indicate the direction roughly perpendicular to the coast, which was clearly visible; in release E the coast was not visible (direction perpendicular to it: 45°), with the exception of a very small spot (a hill) in the direction indicated by the double-headed arrow.

TABLE I - *Orientational behaviour of doves: pooled results with the home direction and the north direction set to 0°.*

S/L	n (N)	Home vector				Compass vector		Homing success
		r	a	Dh	Hc	r	a	
Streptopelia senegalensis								
L	28 (66)	0.11	299°	–61°	0.05	0.61***	184°	5-61
(L)	0 (6)	–	–	–	–	–	–	0-6
S	32 (32)	0.76***	058°	+58°	0.40**	0.75***	098°	1-31
Turtur abyssinicus								
L	17 (68)	0.35	349°	–11°	0.34*	0.37	223°	8-60
(L)	1 (10)	–	–	–	–	–	–	0-10
S	49 (58)	0.55***	046°	+46°	0.39***	0.60***	094°	9-49

S/L = releases carried out on land and at sea, respectively; (L) refers to tests performed at 28 km E (home direction: 261°) which had not been taken into account (only one vanishing bearing was actually recorded). n and (N) = number of recorded bearings and number of birds actually released. The length (r) and direction of the mean vector (a) is given. Dh and Hc = deviation of the mean vector from the home direction and Homeward component, respectively. Significance by the Rayleigh (r) and the V test (Hc) is indicated by asterisks: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$. Homing success: the 1st figure indicates the number of released birds that were recaptured at home; the 2nd figure indicates the birds which were lost. Other details in the text.

was intended to collect vanishing bearings at sites symmetrically arranged around the home ground. However, the home direction in the test we performed varies enough to allow us to draw some conclusions on the orientational strategies of the two species of doves.

The most interesting aspect of our study arises from the fact that our doves produced vanishing bearings which did not show a constant directional preference, but were oriented in different directions at different release sites. This is particularly true for the BbW-dove which showed overall southwestward orientation in releases on land and an eastward tendency in releases at sea, including the cases in which the coast was not visible. The L-dove showed similar orientational behaviour, with a stronger directional preference for the south in releases performed on land.

To explain the difference in the initial orientation between the releases carried out on land and at sea, we may note that the doves used in our experiments were captured in an area near the sea, where the coast runs from NNW to SSE. Thus, a compass orientation in direction close to WSW and ENE is the most appropriate to reach the coastal area from inland and from sea regions, respectively. This model of orientational ability approximately fits with the initial orientation of our doves, especially the BbW-doves. A similar orientational strategy has been reported for several littoral and river-bank inhabiting arthropods and other animals which show stereotyped oriented movements toward the direction of the water when they are released in dry environments, and viceversa (see Pardi & Scapini, 1987). Such a mechanism, however, would be surprising in birds, which tend to return to their specific home ground – the breeding or wintering territory – and are not simply attracted by any area characterized by appropriate ecological conditions.

In releases carried out on land, the BbW-dove appears to be better homeward oriented than the L-dove; this difference is based on a very weak statistical inference, but is corroborated by the fact that the homing performance agrees with directional data.

In conclusion, the main interest of the results derives from the fact that our doves produced oriented bearings showing different directional preferences at different sites. Though the BbW-dove showed better homing behaviour than the L-dove, true navigational ability cannot be proved, due to small sample sizes and lack of symmetrical arrangement of the release sites around the home ground. This calls for further investigation.

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