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AN EXPERIMENT ON THE ENDING OF AUTUMN MIGRATION IN STARLINGS

by

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INTRODUCTION

Although the causation of the onset of migration has been the object of many studies, little if anything seems to be known about the factors impelling a bird to terminate its journey. The recognition of familiar surroundings is presumably of great importance at the end of the spring migration, when the birds are returning to a known area. The same may well hold for the autumn migration of adult birds, in species which have a more or less fixed wintering area. But a juvenile bird, migrating for the first time in its life to an unknown place, needs other stimuli to stop. Innate knowledge of a certain area can be discarded, since all experiments with displaced juveniles indicate that they cannot perform goal orientation to the winter quarters of the population (PERDECK 1958).

Principally, therefore, two groups of factors might come into question:

1. *external factors*, such as certain characters of the landscape,
2. *internal factors*, e.g. the time passed since the migration was started.

These two possibilities can be compared against each other in a simple experiment: catch birds when they are migrating and release them quickly in an area suitable for wintering. If they continue their migration, internal factors are of importance, if not, external factors are significant.

After completing the displacement of starlings (*Sturnus vulgaris*) to Switzerland (PERDECK 1958) an opportunity arose to carry out this

other experiment. We were in the position to catch large numbers of starlings during the autumn migration and we had learned the technique of transporting them. As release point the airport of Barcelona was chosen. Some 150 km southwest of Barcelona the Ebro valley begins, a favourite wintering place for starlings (BERNIS 1960). After release, if not stopping in the Ebro valley, the birds will (with their SW-W standard direction) pass the unsuitable central part of Spain and will encounter good wintering grounds in the southwestern part of the country: Estramadura and the valley of the Guadalquivir. Birds moving along the Mediterranean coast meet good wintering places near Alicante, or, if they take into the sea, in the Balearics. In this way, the geographical situation is likely to eliminate dubious cases, i.e. birds wintering half way between the Ebro valley and southern Spain.

MATERIAL

The starlings used for the experiments were caught during October and November near The Hague. For details about the origin of these birds, as well as techniques, see PERDECK 1958. In four years (1959-1962) 2703 juvenile birds were released at Barcelona.

The cited displacements to Switzerland showed that adult birds strongly tended to fly back to their previous winter quarters. For the problem under discussion these birds are therefore useless. But we did send 885 of them along with the juveniles to Spain in order to get more data about their orientation. Further only the recoveries of displaced juveniles in December and January after their displacement could be used as indications of where they ended their migration, since in November they might be still under way, while in February spring migration has already started (as is indicated by two recoveries from the Riviera and one from Sardinia).

In a future paper an analysis will be given of all recoveries outside December and January of the first season, as well as the recoveries of adults displaced to Barcelona, and this will contain also the complete list of recoveries.

29 recoveries were obtained in the first winter (Dec., Jan.). This rather low figure is partly due to the fact that the date or the locality of recoveries in Spain are often unknown. 15 recoveries had to be discarded for this reason.

Dr. F. BERNIS, director of the Spanish ringing scheme, wrote about this as follows: "Many starling recoveries in Spain are reported by professional bird catchers, who travel each winter across the whole

country. These people have no idea about the importance of the exact date and locality of each recovery. They simply mix the rings from starlings taken e.g. in the Ebro valley with those from southern Spain and retain the rings for months before reporting them. Attempts are made to train them in this respect, but the result is still meagre" (pers. comm.).

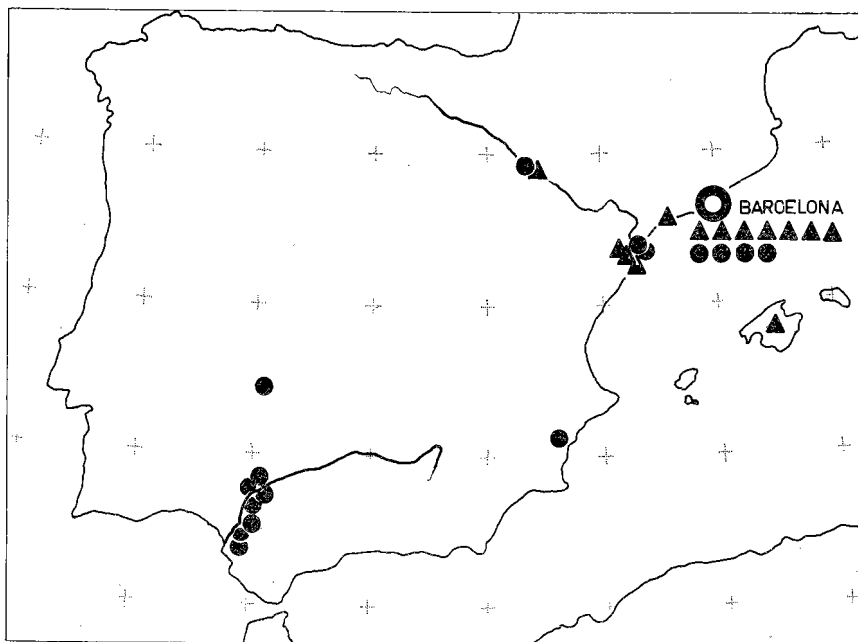


FIGURE 1. Recoveries of juvenile Starlings (*Sturnus vulgaris*) released at Barcelona, caught in Holland during autumn migration. Only the recoveries from December and January following the displacement are shown.

Dots: Caught 1-23 October

Triangles: Caught 24 October-8 November

RESULTS

The recoveries are mapped in Figure 1. They are divided in two groups, those of birds ringed 1-23 October and those ringed 24 October-8 November.¹⁾ The first group (further on called the *early migrants*) breed mainly in the western part of the breeding area (Denmark, Germany, and Holland) and winter in the most western part of the winter area (West England, Ireland). These birds were therefore caught when still in the first half of their migration period. The second group, the *late migrants*, breed mainly in Sweden, Poland, Finland, and the U.S.S.R., but they

¹⁾ Compare PERDECK 1958, Fig. 2.

winter near where they have been caught (Low Countries, Northwest France). These birds were displaced when they had already completed the greater part of their journey.

The figure shows that the early birds for the greater part moved on and reached the outermost SW-part of Spain to spend the winter. The late birds, however, stopped at the Ebro valley or even stayed quite near to the release point (one reached the Balearics).

For a more exact interpretation, these data may be compared with the recoveries of juvenile birds caught and ringed on the same place and in the same period, but released at once without displacement. It is of interest to take into consideration also the recoveries of starlings transported to Switzerland. The ringing years of both groups are different from the Barcelona birds, but they cover at least 10 different years each.

Thus, of the migrant starlings passing through Holland three sets of data are available:

1. Birds continuing their journey to the wintering grounds in the British Isles and the coastal areas of northern France. Before reaching these places they probably pass an area that is more or less intermediate between a bad and a good place for wintering. The starling populations breeding here are only partially migratory. Migrating in their standard direction, the maximum distance that these bird can travel is about 1000 km (West Ireland).
2. Birds displaced to Barcelona. As said above they find a place that is ecologically suitable for wintering in the vicinity of the point of release. The maximum distance that could be covered is about 1000 km (Southwest Spain).
3. Birds displaced to Switzerland. Here the starlings encounter a landscape that does not seem very attractive for them to stay in.

Starlings breeding in Switzerland migrate to Spain and North Africa. It has been observed that some of the local birds try to stay during the winter in Switzerland. They survive, however, only in mild winters (SCHIFFERLI 1948). Recoveries in Switzerland during the winter of starlings ringed abroad are rare, even from populations for which Switzerland lies just in between the normal breeding and wintering area, e.g. those breeding in Central Poland (RYDZEWSKI 1960).

The starlings released in Switzerland might go on to SW Spain, having covered then a distance of about 1800 km.

Each of these 3 groups can be divided into the early and the late birds (see above). Of the six groups thus formed the distance of the recoveries

is given in Table 1. For the birds released at Barcelona the distance class 0-300 km includes the Ebro-delta. The following conclusions can be drawn from this table.

TABLE 1
DISTANCE OF FIRST WINTER RECOVERIES (DECEMBER, JANUARY) OF STARLINGS
FROM PLACE OF RELEASE

| Distance (km) | "early migrants" ringed 1-23 October | | | "late migrants" ringed 24 October-8 November | | |
|----------------------------|---|------------------------------|------------------------------------|---|------------------------------|------------------------------------|
| | not displaced (group 1) | displaced Spain (group 2) | displaced Switzerland (group 3) | not displaced (group 4) | displaced Spain (group 5) | displaced Switzerland (group 6) |
| 0-300 | 10 = 36% | 7 = 44% | 5 = 14% | 43 = 64% | 13 = 100% | 2 = 6% |
| 300-600 | 8 | 1 | 5 | 19 | 0 | 9 |
| 600-900 | 7 | 8 | 20 | 5 | 0 | 14 |
| 900 or more | 3 | 0 | 7 | 0 | 0 | 8 |
| Mean distance | 450 | 480 | 700 | 290 | 80 | 720 |
| Total number of recoveries | 28 | 16 | 37 | 67 | 13 | 33 |

The statistical significance was tested by the method of the *hypergeometric distribution*. The results are summarized in the table below.

| Conclusion (compare number on p. 138) | Comparison between groups (n = not displaced) (d = displaced) | | Proportion within 300 km in displaced group as compared with non-displaced group | Value of P |
|---|--|-------|--|------------------|
| | n | d | | |
| one | 1 | and 2 | no difference | 0.42 |
| two* | (1+2) | and 3 | lower | 0.01 |
| three | 4 | and 5 | higher | < 0.01 |
| four | 4 | and 6 | lower | < 0.001 |

* group 1 and 2 are taken together since there is no statistically significant difference between them.

A. *Early migrants* (group 1-3).

If we compare the birds displaced to Spain with the non-displaced ones, no clear difference is apparent in the distance subsequently travelled. Both the percentage recovered within 300 km and the mean distance are about equal. The early migrants do not seem to be influenced by the Ebro valley.

The early birds displaced to Switzerland, however, migrated further than both the birds displaced to Spain and the controls. This is not merely

due to the fact that they have a larger stretch of land in front of them, for those staying within 300 km of the point of release are proportionally less frequent than in the other two groups.

B. *Late migrants* (group 4-6).

The late starlings displaced to Spain remained within the range of the Ebro valley (apart from one from the Balearics). Both the percentage remaining within 300 km and the mean distance travelled indicate that they were attracted by the surroundings of the release point. They travelled less far than the controls released in Holland.

The late starlings displaced to Switzerland migrated much further than the non-displaced controls and about as far as the early ones displaced to Switzerland. Hence the displacement to Switzerland obscured any difference between early and late birds.

These results indicate that starlings in the middle of their migration period cannot be stopped by presenting them a suitable wintering area. But, although external factors cannot induce a premature termination of the journey, they can, when unfavourable, produce a longer migration route than usual.

Starlings at the end of their migration period, however, can be induced to stop earlier than normal by presenting favourable surroundings to them, though they keep travelling when released in an unfavourable area. These four conclusions can be summarized as follows:

| | favourable area | unfavourable area |
|----------------|---|--|
| early migrants | no influence (conclusion one) | migration prolonged (conclusion two) |
| late migrants | migration shortened (conclusion three) | migration prolonged (conclusion four) |

The conclusions are based on statistical significant differences in the proportion of birds staying within 300 km (see, Table 1, bottom).

DISCUSSION

We started this study with the simple question: what factors induce a bird to stop its migration, internal or external? As might have been expected, the answer was less simple than we first supposed.

Internal factors are clearly important in the first part of the migration. They drive the bird on, even away from a favourable area for wintering.

This ensures that the birds migrate, which is necessary if one accepts the survival value of migration. But near the end of the journey external factors become important: if they are unfavourable migration is stimulated, if they are favourable a halt is induced. In this way the bird is likely to stop only when it has reached a suitable area for wintering. The function of this behaviour is, then, clear enough. However a discussion about its precise causation would not be appropriate at the moment as this would involve unravelling both the internal and external factors involved, for which our present knowledge is too limited. As far as the external factors are concerned, a careful study of the ecological distribution of starlings in their winter quarters might enable us to learn more about it.

SUMMARY

Displacement experiments with migrant starlings to Spain and Switzerland indicate that external factors cannot induce a juvenile starling to end its autumn migration, unless it has already migrated for a certain length of time after which a favourable area inhibits further migration. Unfavourable surroundings, however, induce a prolongation of its journey.

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SAMENVATTING

Verplaatsingsproeven met Spreeuwen naar Barcelona en Zwitserland tonen aan, dat uitwendige factoren, die gunstig zijn voor het overwinteren, een jonge spreeuw er niet toe kunnen brengen zijn herfsttrek te beëindigen. Dit geldt alleen voor het begin van de trektijd. Heeft de vogel reeds een zekere tijd getrokken, dan kan een gunstig gebied de trek doen ophouden. Ongunstige gebieden veroorzaken een verlenging van de trekweg.

LITERATURE

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