Experiments on the Orientation of Nightmigrating Passerines in Denmark, Autumn 1969. Comparison of the Reactions at 6 Different Sites

By
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(Med et dansk resumé: Eksperimenter med nattrækkende spurvefugle i Danmark, efteråret 1969. Sammenligning af reaktionerne på 6 forskellige steder.)

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INTRODUCTION

The results of some orientation experiments carried out in the autumn 1969 at Skagen, Southern Langeland, Hanstholm and Dueodde were presented by Rabøl (1970a). This material is here compared with simultaneous experiments performed by B. G. Hansen, O. Tønder and F. D. Petersen at Blåvand and Hesselø (Fig. 1).

Earlier experiments (Rabøl 1969 and 1970a) have rendered a »goal area« model fairly probable, but this model is, of course, only the first (although significant) step towards a further analysis of details in the migratory programs.

The purpose with the present paper is to elucidate the following two questions: 1) Does the migration in a short period proceed broadfrontet in the same direction all over Denmark?, and 2) do any directional shifts as the season proceeds occur?

MATERIAL AND METHODS

Most of the experimental birds were trapped in mistnets close to the experimental sites. Birds used at Dueodde and Langeland were, however, trapped at Hanstholm and Skagen respectively. Most of the experiments were carried out during the night following the trapping in the morning hours.

We used the Emlen orientation technique (Emlen and Emlen 1966). Concerning our modifications, statistics (Batschelet 1965), and transformation of »colour degree« to number of jumps (jumps = $1{,}7^{\text{c.d.}\div 1}$) see Rabøl (1970a and 1970b).

In the earlier papers we have presented all the *individual mean vectors*. The present material is however presented in another way. In different periods the total number of jumps of all the birds in each of the 16 sectors are found. The mean vector of these vectors is then called the *population mean vector*. In Table 1 comparable periods at the different sites are set off.

The advantage of using the population rather the individual mean vectors is rather obvious. It takes much lesser time to calculate, and many individual mean vectors are rejected solely due to small activity. The population mean vector could, of course, be rejected if the test statistic $z = n \times r^2$ is too small, but as Table 1 shows, this is not often the case. Index 24 is thus rejected, but of the 11 individual mean vectors from 14-15.9. only 3 are significantly different from an uniform distribution at the 0.05 level. Further they are widely spaced (54°, 202° and 233°). The population mean vector of index 14 is directed towards 164°. 5 out of 10 individual mean vectors from 14-19.9. are considered statistically significant. These are close to each other (141°, 157°, 173°, 181° and 190°), and their mean is 169° – very close to the population mean vector.

The use of the population mean vector could of course also be disadvantageous, especially if

Index	Species *Art*	Place *Sted*	Period *Periode*	Number of Birds *Antal fugle*	Average Jumps per Bird per Hour *Gennemsnitlige antal opspring pr. fugl pr. time*	Mean Vector *Middel Vektor*		P
1	S. a.	Bl.	7–19.9.	8	37	134°	0,291	++
2	–	La.	9–14.9.	4	153	75°	0,107	+
3	–	Sk.	17.9.	6	46	189°	0,279	++
4	–	Bl.	5.10.	7	43	152°	0,254	++
5	–	Bl.	10.10.	5	132	213°	0,298	++
6	S. b.	He.	12–17.8.	15	29	292°	0,247	++
	–	Ha.	17–18.8.	5	431	44°	0,176	++
8	–	Ha.	21–23.8.	6	234	169°	0,213	++
9	–	Du.	24.8.	8	188	249°	0,434	++
10	–	Bl.	6– 9.9.	5	32	110°	0,316	++
11	–	Sk.	5– 7.9.	7	84	130°	0,206	++
12	–	La.	9.9.	4	58	27°	0,192	++
13	–	He.	4– 9.9.	28	15	178°	0,143	++
14	–	Bl.	14–19.9.	10	42	164°	0,310	++
15	–	Sk.	12–17.9.	10	121	158°	0,354	++
16	–	La.	14.9.	3	44	22°	0,210	+
17	–	He.	14–15.9.	13	34	178°	0,248	++
18	P. p.	Sk.	5– 7.9.	9	359	83°	0,104	++
19	–	La.	9.9.	3	41	88°	0,131	÷
20	–	He.	4– 9.9.	18	20	149°	0,138	++
21	–	Bl.	7– 8.9.	4	4	340°	0,330	÷
22	–	Sk.	12–17.9.	9	73	178°	0,191	++
23	–	La.	14.9.	5	50	59°	0,112	(+)
24	–	He.	14–15.9.	11	21	148°	0,050	÷
25	–	Bl.	14–19.9.	14	64	179°	0,114	++

Table 1. The population mean vectors of Blackcap (S. a.), Garden Warbler (S. b.) and Redstart (P. p.) at Blåvand (Bl.), Langeland (La.), Hesselø (He.), Hanstholm (Ha), Dueodde (Du.) and Skagen (Sk.). The following populations show bimodal activities, 2 (NE and SSE), 19 (NE and S) and 23 (NE and SSW).
++ and + denote P less than 0.01 and 0.05 respectively for $z = \frac{1}{2} \times n \times r^2$. (+) and ÷ are P less than 0.05 and greater than 0.05 respectively for $z = n \times r^2$. To be considered as statistically sufficient the P's should be at least (+).

Tabel 1. Populations gennemsnitsvektorer for Munk (S. a.), Havesanger (S. b.) og Rødstjert (P. p.) ved Blåvand (Bl.), Langeland (La.), Hesselø (He.), Hanstholm (Ha.), Dueodde (Du.) og Skagen (Sk.). For følgende populationer er aktiviteten totoppet: 2 (NE og SSE), 19 (NE and S) and 23 (NE and SSW).

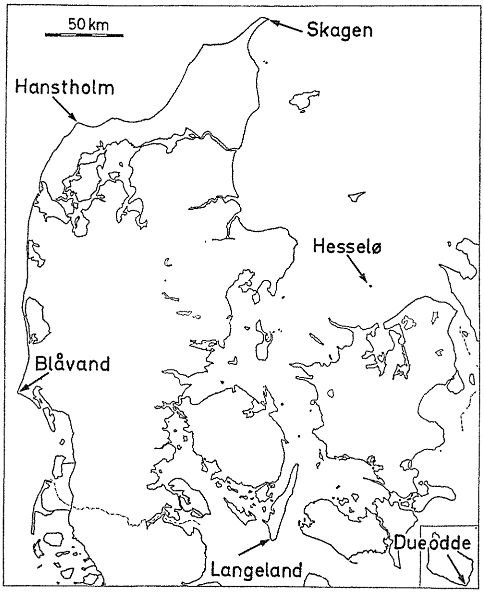

Fig. 1. The six experimental sites.

Fig. 1. De seks forsøgssteder.

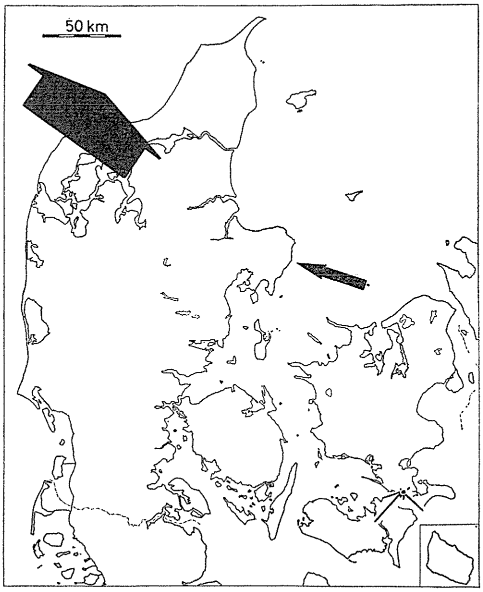

Fig. 2. Garden Warbler *(Sylvia borin)* Medio August 1969 (Table 1 indices 6-7). The lenghts of the arrows are proportional to the populations mean vectors (expressed in ratio of the unit circle radius). The widths of the arrows are proportional to the average number of jumps per bird per hour. The streaks in Southern Zealand show the contemporary nocturnal radarpicture of Chats and Warblers.

Fig. 2. Havesanger (Sylvia borin) *medio august 1969. Pilenes længde er omvendt proportional med spredningen omkring gennemsnitsvektoren, og tykkelsen proportional med den gennemsnitlige aktivitet pr. fugl pr. time. Stregerne i Sydsjælland viser det samtidige nattræk af småfugle.*

one individual shows very gerat activity in different directions than the other birds.

The time of the experiments and the weather at Blåvand and Hesselø should be given (concerning the other 4 sites see RABØL 1970a).

Blåvand: 6.9. 2235-2335, 1/8, NW 3-4 – *7.9.* 2235-2350, 3-2/8, NNW-N 2 – *8.9.* 2120-2220, 0/8, NNE 1, stars a little obscured – *9.9.* 2130-2230, 0-2/8, ESE 2-3, stars a little obscured – *13.9.* 2115-2220, 0/8, ENE 1, stars a little obscured – *14.9.* 2135-2235, 3-4/8, SSE-SE 1-2, stars somewhat obscured – *15.9.* 2135-2245, 0/8, ENE-NE 1-2 – *16.9.* 2205-2305, 0/8, NE 1-3 – *17.9.* 2225-2340, 0/8, ENE-NE 1-2 – *19.9.* 2230-2340, 2/8, N 2-3 – *5.10.* 2200-2305, 0-7.8., ENE-NE 1, stars a little to much obscured – *10.10.* 2025-2135, 0/8, SW 1-2.

Hesselø: 12.8. 2200-2400, 2-0/8, E 3 – *14.8.* 2200-2400, 1/8, N 3 – *17.8.* 2315-0115, 4/8, NE 1 – *4.9.* 2130-2245, 8/8, W 3-4 – *5.9.* 2130-2245, 2/8, W 4-5 – *6.9.* 2130-2245, 0/8, W 2-3 – *7.9.* 2130-2245, 0/8, W 2 – *9.9.* 2130-2345, 0/8, SE 3-4 – *14.9.* 2130-2245, 0/8, SE 3-2 – *15.9.* 2100-2215, 1/8, NE 2-3.

Blackcap *(Sylvia atricapilla)* were used at *Blåvand* 7.9. (1), 13.9. (2), 15.9. (1), 19.9. (4), 5.10. (7) and 10.10. (5).

Garden Warbler *(Sylvia borin)* were used at *Blåvand* 6.9. (1), 7.9. (3), 9.9. (1), 14.9. (1), 15.9. (1), 16.9. (1), 17.9. (5), 19.9. (2). At *Hesselø* 12.8. (3), 14.8. (3), 17.8. (9), 4.9. (7), 5.9. (6), 6.9. (5), 7.9. (6), 9.9. (4), 14.9. (2) and 15.9. (11).

Redstart *(Phoenicurus phoenicurus)* were used at *Blåvand* 7.9. (3), 8.9. (1), 14.9. (3), 15.9. (1), 16.9. (2), 17.9. (6), 19.9. (2). At *Hesselø* 4.9. (1), 5.9. (2), 6.9. (7), 7.9. (4), 9.9. (4), 14.9. (7) and 15.9. (4).

RESULTS

In the same periods we might compare the population mean vectors in Table 1 two and two. Here we should omit the reactions of the displaced birds at Dueodde and Langeland (these are discussed in RABØL 1970a).

The research hypothesis is that the reactions are relatively more eastern in Western Denmark and vice versa. The research hypothesis is right 8 times, and the angle differences between the population mean vectors are: 14°, 20°, 20°, 45°, 48°, 66°, 68°, and 108°. Two times the hypothesis is wrong, but now the angle differences are very small: 1° and 6°. A Mann-Whitney U-test (SIEGEL 1956) gives a (one tailed) probability lesser than 0,0183 that these differences are accidental. Thus we accept the research hypothesis.

If we include radar datas from a PPI screen in Southern Zealand this picture is further reinforced. At Fig. 2-4 the major radar movements of Chats and Warblers are put in (RABØL et al. in print). The length of the streaks are proportional to the number of bird echoes.

From Table 1 can further be seen that there are rather obvious direction shifts towards the S-SW at the same site as the season proceeds. This happens 7 times, whereas only one time there is no direction shift (Garden Warbler, September, Hesselø). A binomial test (SIEGEL 1956) on 7:0 and 7:1 gives P's on 0,008 and 0,035 respectively. We therefore conclude the direction shift with time towards S-SW to be statistically significant. At Fig. 5 the reactions of Garden Warbler 4.9. to 15.9. fairly clearly indicate a direction shift towards S-SW – in opposition to Table 1 indices 13 and 17. By the way, it should be noted, that the population mean vector at 4.9. in total overcast is labelled sufficient.

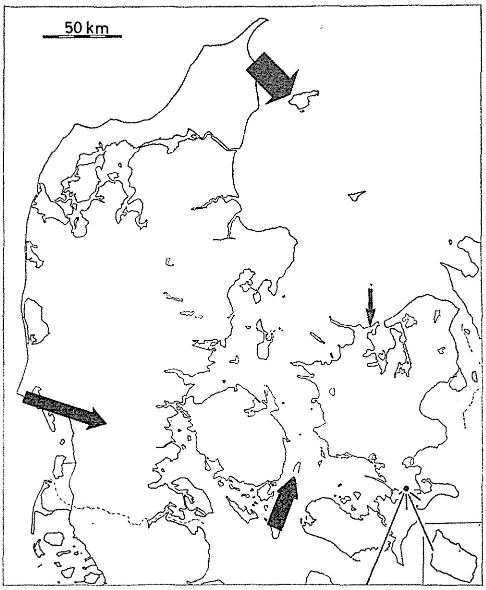

Fig. 3. Garden Warbler *(Sylvia borin)* Primo September 1969 (Table 1 indices 10-13). The Langeland-birds are trapped at Skagen.

Fig. 3. Havesanger (Sylvia borin) *pr. september 1969.*

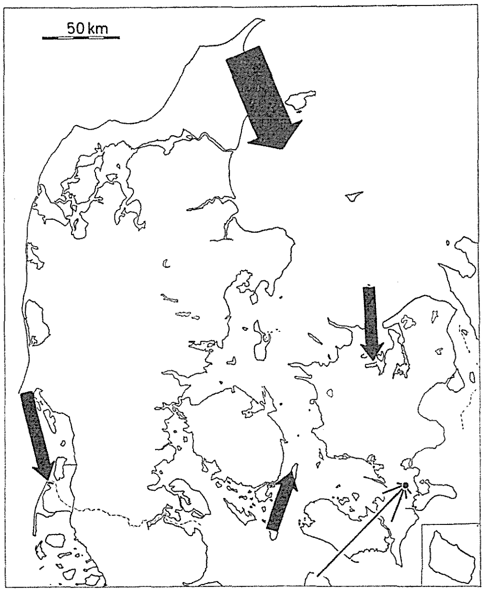

Fig. 4. Garden Warbler *(Sylvia borin)* Medio September 1969 (Table 1 indices 14-17). The Langeland-birds are trapped at Skagen.

Fig. 4. Havesanger (Sylvia borin) *med. september 1969.*

DISCUSSION AND CONCLUSION

First it should be stressed, that the mean vectors at Blåvand and Hesselø (as shown in RABØL 1970a for the other sites) in generel are in accordance with the concept of »standard direction« for the season. Further, the »SE«-reactions at Blåvand are identically with the preferred directions at this place in the autumns of 1967 and 1968 (RABØL 1969).

When looking at Fig. 3-4 it is tempting to perceive the reactions of the displaced birds to Langeland as more or less stereotype and compensatory back in the displaced direction, without involving bicoordinate navigation. They could e. g. display inertial reactions. At the present moment we think, however, that these displaced reactions should not be considered basically different from the reactions obtained closely the trapping sites. As Fig. 2 shows these could also be directed »northerly« and out of context with the concept of »standard direction«. All the reactions could be perceived as directed towards »goal areas« (RABØL 1970a), the actual positions of which are functions of the season.

The differences in directions from Western to Eastern Denmark could be perceived as shown in Fig. 6. Different Norwegian and Swedish populations of a given species have slightly different migratory programs. These cause the migratory routes to converge through Denmark, probably in order to avoid the Baltic and especially the North Sea.

The directionshift towards S or SW is to be expected especially of these populations at first migrating SE from Norway to Jutland. Later in the autumn the migration (of the mentioned species) proceeds through Italy (especially Garden Warbler) and the Iberian Peninsula.

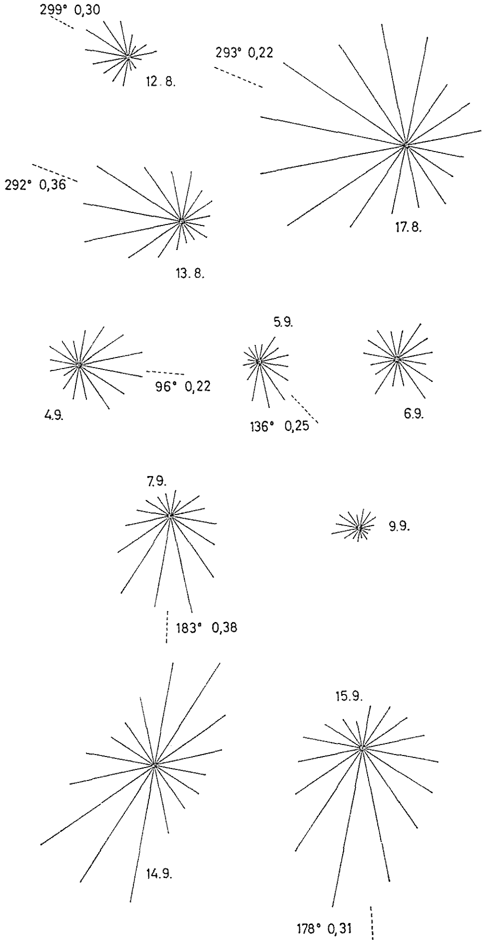

Fig. 5. Garden Warbler *(Sylvia borin)* Hesselø. The oriented activity between 12.8. and 15.9. The activities could easily be compared as they are reduced to number of jumps per hour. Dotted lines and vector parametres indicate population mean vectors which are different from a uniform circular distribution at the 0.05 level.

Fig. 5. Havesanger (Sylvia borin) *Hesselø. Aktiviterne mellem 12.8. og 15.9. Der er reduceret til antal opspring pr. time, og stiplede linier samt vektor parametre angiver populations gennemsnitvektorer, der er statistisk forskellige fra en ensartet cirkel fordeling.*

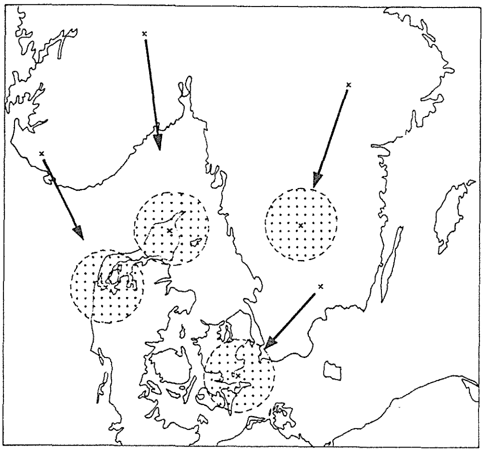

Fig. 6. The probable migratory program and progress of different Scandinavian populations of a given species.

Fig. 6. Det mulige program og forløb af trækket for forskellige skandinaviske populationer af samme art.

SUMMARY

The oriented activity of three nightmigrating Passerines are compared in simultaneous experiments at six sites in Denmark (Fig. 1).

In some selected periods all the birdjumps are put together in the construction of a population mean vector. In the table comparable periods are set off.

The experiments suggest:

1) A direction shift towards S-SW as the season proceeds.

2) More eastern directions in Western and Northern Denmark and more western directions in Eastern and Southern Denmark.

The purpose of these lastnamed reactions should be to compress the Scandinavian migratory stream through Denmark and thus avoiding migration over the Baltic and especially the North Sea.

DANSK RESUMÉ

Eksperimenter med nattrækkende spurvefugle i Danmark, efteråret 1969. Sammenligning af reaktionerne på 6 forskellige steder.

Denne artikel bygger delvis på nogle tidligere præsenterede forflytnings-forsøg ved Skagen-Langeland og Hanstholm-Dueodde (Rabøl 1970a). Reaktionerne fra disse steder er i Tabel 1 sammenlignet med forsøg udført omtrent samtidigt ved Blåvand (af Benny G. Hansen) og på Hesselø (af Ole Tønder og Finn Dalberg Petersen).

Forsøgsteknikken er tidligere beskrevet af Rabøl (1969 og 1970b).

Til sammenligning af reaktionerne de forskellige steder er her brugt en såkaldt *populations gennemsnitvektor*, der er udregnet på grundlag af samtlige opspring af samtlige fugle i nogle udvalgte perioder. Disse perioder er valgt, så de dækker omtrent de samme tidsrum.

Fra tabellen og fig. 2-5 kan ses to generelle tendenser:

1) Trækket bliver mere S-SW-ligt med tiden.

2) Trækket i V-Danmark er østligere end i Ø-Danmark.

Disse observationer – der er forenelige med måltrækhypotesen – kunne tydes derhen, at fugletrækket fra Skandinavien snævredes ind over Danmark for at undgå udtræk over Østersøen og især Vesterhavet (fig. 6).

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Iagttagelser over Bjergvipstjertens *(Motacilla cinerea)* træk og overvintring i Danmark

Af

OLE HAVE JØRGENSEN

(With a Summary in English: Observations on the Migration and Wintering of the Grey Wagtail (Motacilla cinerea) *in Denmark.)*

INDLEDNING

Kendskabet til Bjergvipstjertens *(Motacilla cinerea)* forekomst i Danmark uden for yngletiden har hidtil været ret fragmentarisk, men i kraft af de senere års øgede feltornithologiske aktivitet foreligger der nu et stort antal iagttagelser, der udbygger kendskabet til artens træk og overvintring.

I forbindelse med undersøgelsen over artens udbredelse som ynglefugl i Danmark (JØRGENSEN 1970) foretoges observationer på en række ynglelokaliteter året igennem. Desuden er landets ornithologer blevet opfordret til at indsende iagttagelser gjort uden for yngletiden i årene 1960-70, og i vintrene 1967-70 var flere ornithologer behjælpelige med en optælling på velegnede lokaliteter.

Det fremkomne materiale anvendes til en analyse af de danske Bjergvipstjerters træk- og overvintringsforhold samt en omtale af den skandinaviske ynglepopulations mulige indflydelse på de danske forekomster.