A Comparison of the Bird Migration Recorded by Radar and Visible Field Observations in the Middle of Sjælland, Denmark, Spring 1971

By
JØRGEN RABØL and OLE HINDSBO

(Med et dansk resumé: Sammenlignende radar og feltobservationer af fugletrækket over Midtsjælland i foråret 1971.)

INTRODUCTION

In the spring of 1971 simultaneous radar and visible field observations were carried out in the middle of Sjælland, Denmark.

The purpose of this investigation was to compare the daily migratory directions and intensities recorded by the two alternative methods of registration.

Similar investigations have previously been presented or discussed by e. g., ALERSTAM and ULFSTRAND (1972), EVANS (1966), GAUTHREAUX (1971), GEHRING (1963), MASCHER et al. (1962) and WILCOCK (1964).

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MATERIAL AND METHODS

The visual field observations

The observation site was at Hvalsø (Fig. 1) in the middle of a 400×400 meters glade. The glade was situated approximately in the centre of a wood covering abt. 4 km^2. The migration was recorded on 49 days in the period March 1 to May 7, 1971. The daily observation period was always 4 hours. The observations always started 15 minutes before sunrise. For every migrating flock the following data were recorded: species, number, direction and altitude. The altitude was estimated to be within one of the following intervals: A) 0–10 m, B) 10–25 m, C) 25–50 m, D) 50–100 m, E) 100–200 m, F) 200–400 m, and G) more than 400 m. Several weather factors were noted: wind direction, wind strength, temperature, visibility, cloudiness, snowcover, and precipitation.

On days with at least 5 migrating flocks, a mean vector was calculated with one *bird* as the unit and without regard to the altitude (Figs 2-4). Daily mean vectors were calculated for 1) all species, 2) finches *(Fringilla* sp.), and 3) Skylark *(Alauda arvensis)*.

In other cases (Figs 5, 7-8) one *flock* was the unit in the mean vector calculation or directional frequency distribution.

Mean vectors calculated on the basis of flocks or birds are very similar concerning the direction, whereas the dispersion normally is greater in the flock mean vector.

The calculation of the mean vectors follows BATSCHELET (1965). Irrespective of dispersion and probability for coincidence with a uniform circular distribution (a zero vector) the daily mean directions are included on Figs 2–5.

In Figs 2-4 and 6 the daily mean directions are expressed as a function of the daily wind directions. The resulting mean vectors deviate more or less from the head or downwind. These deviations might be systematic or due to random fluctuations. A test for randomness is proposed by BATSCHELET (1965, p. 29-32). Due to large sample sizes this test was not normally adequate for the present material. In these cases a one sample chi square test or a binomial test (p = q = 0.5) was applied. The number of daily mean directions to the left and right of the head or downwind (and within 90°) was compared.

The radar observations

The material was collected on a RDAF radar station in the southern part of Sjælland (Fig. 1). This radar operates in the L-band.

The day from sunrise to sunset was divided in three equidistant periods: I, II, and III. It was always I which was compared with the contemporary visible field observations.

The number of echoes were estimated to directions and intensities in a counting area around Hvalsø (Fig. 1). The method is described by RABØL et al. (1971). A summary should be given: First, the total intensity (scale 0–9) was estimated. Then the sectional intensities in 16 directions (N, NNE, NE – – – NNW) were deduced. Only 1–4 simultaneous directions could be separated in each daily sub-period. Finally, a mean direction was estimated.

Due to the great distance (60–80 km) from the radar station – and the intermediate woody and hilly country – flocks flying below 50 m are probably going undetected by the radar to a fairly high degree. Details are, however, not yet known.

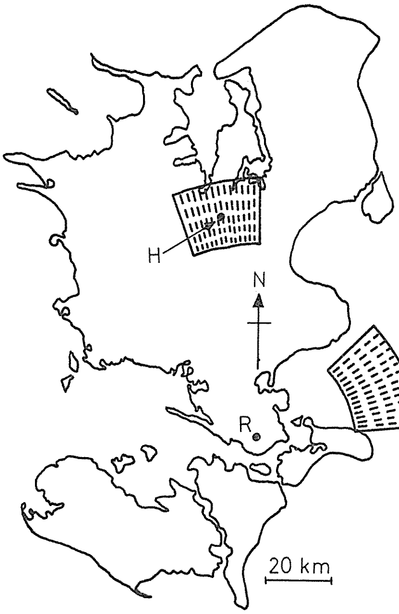


Fig. 1: The situation of the visible observation post at Hvalsø, the radar station, and the two radar counting areas.

Fig. 1. Kort over Sjælland med observationsposten ved Hvalsø, radarstationen og de to radar optællingsområder vist.

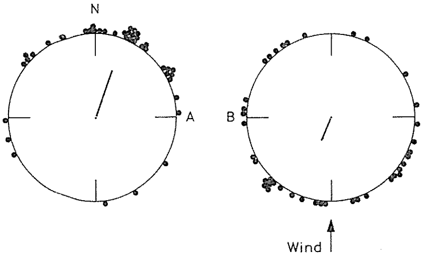


Fig. 2. Visible migration, Hvalsø. All species and all altitudes included. The dots show the directions of the daily mean vectors (unit = one bird). The daily mean vector is only calculated for days with at least 5 migrating flocks.

The figure to the left (A) shows the daily mean vectors in compass direktions. The polar coordinates of the total mean vector are 20° and 0.611 ($p < 0.01$).

The figure to the right (B) shows the daily mean vectors as a function of the daily wind directions. The total mean vector is directed 24° to the right of true head wind (the deviation is not significant), ($p > 0.10$) and the mean vector length is 0.294 ($0.01 < p < 0.05$).

Fig. 2. Synligt træk, Hvalsø. Alle arter og alle trækhøjder inkluderet. Hver prik står for retningen af en daglig gennemsnitsvektor, udregnet med en fugl som enhed – og for dage med mindst 5 trækkende flokke.

Gennemsnitsretningen for de daglige gennemsnitsretninger er NNE (20° – figuren til venstre (A)). På figuren til højre (B) er de daglige gennemsnitsretninger afsat som funktion af de daglige vindretninger. Gennemsnitsvektoren for dette forhold er rettet 24° til højre for modvinden – og afviger ikke signifikant fra denne, dvs. der er en klar tendens til modvindstræk.

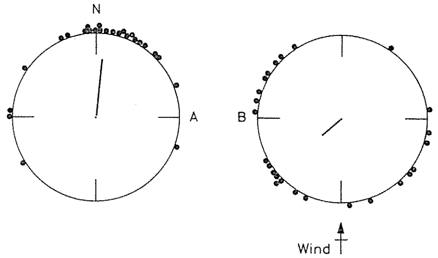


Fig. 3. Visible migration, Hvalsø. Finch sp. *(Fringilla* sp.), all altitudes. Same procedure as in Fig. 2.

The figure to the left (A) shows the daily mean vectors in compass direktions. The total mean vector is 6° and 0.712 ($p < 0.01$).

The figure to the right (B) shows the daily mean vectors as a function of the daily wind directions. The total mean vector is 50° to the right of true head-wind and 0.313 ($p > 0.05$).

Fig. 3. Synligt træk, Hvalsø. Finke sp. (Fringilla *sp.), alle trækhøjder inkluderet.*

Samme fremgangsmåde som Fig. 2. Den totale gennemsnitsretning er 6° (N–NNE). Tendensen til modvindstræk (B) er svag og ikke signifikant.

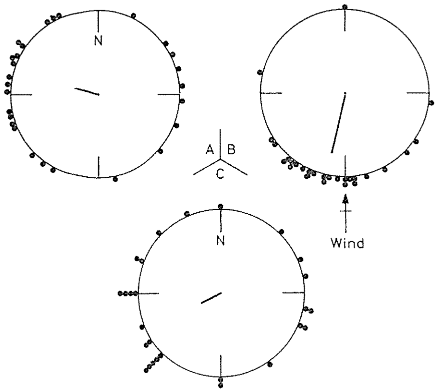
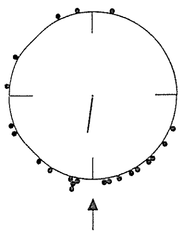


Fig. 4. Visible migration, Hvalsø. Skylark *(Alauda arvensis)*, all altitudes. Same procedure as in Fig. 2.

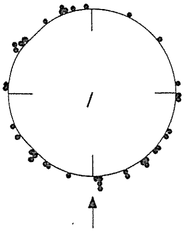
A shows the daily mean vectors in compass directions. The total mean vector is 285° and 0.286 ($p > 0.05$). B shows the daily mean vectors as a function of the daily wind directions. The total mean vector is directed 13° to the right of the true head wind (the deviation is insignificant, $p = 0.076$, binomial test) and the mean vector length is 0.745 ($p < 0.01$). C shows the daily wind directions in compass directions. The total mean vector is 234° and 0.276 ($p > 0.05$).

Fig. 4. Synligt træk, Hvalsø. Sanglærke (Alauda arvensis), *alle trækhøjder inkluderet.*

Samme fremgangsmåde som Fig. 2. Den totale gennemsnitsretning (A) er 285° (WNW – og kan i modsætning til de tilsvarende retninger i Fig. 2–3 ikke godtages som artens normaltrækretning). B viser en meget klar tendens til modvindstræk, og endelig viser C de daglige vindretninger. Gennemsnitsvindretningen er rettet mod 234° (SW–WSW).



Visible, altitudes ⩾50 m



Visible, all altitudes

Fig. 5. The daily radar mean directions as a function of the daily visible mean directions.

The figure below is based on visible mean directions calculated with one bird as the unit, and including all altitudes. The total radar mean vector is 19° to the right of the visible direction and 0.185 ($p > 0.05$).

The figure above is based on visible mean directions with one flocks as the unit, and inclu ding only migratory altitudes above 50 m. Now the total radar mean vector is 8° to the right of the visible direction and 0.455 ($p = 0.01$).

Fig. 5. De daglige radarretninger som funktion af de daglige synlige gennemsnitsretninger.

På den nederste figur er alle (synlige) trækhøjder inkluderet, og korrelationen er insignifikant, omend den går i den rigtige retning. På den øverste figur er blot (synlige) trækhøjder over 50 m medtaget, og korrelationen er nu langt bedre og signifikant.

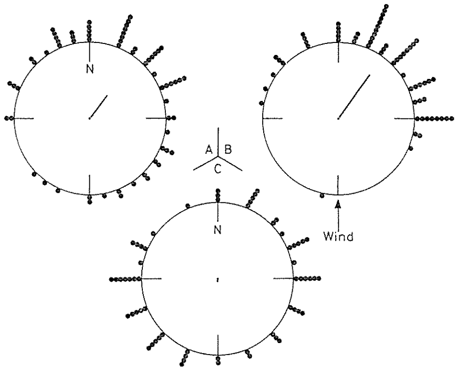


Fig. 6. Daily mean radar directions. Also days with no contemporary visible migration included.

A shows the daily radar directions in compass directions. The total mean vector is 37° and 0.393 ($p < 0.01$). B shows the daily radar directions as function of the daily (ground) wind directions. The total mean vector is 36° to the right of true downwind (the deviation from the downwind is highly significant, p far below 0.001, X^2-test) and the mean vector length is 0.714. C shows the daily wind directions in compass directions. The total mean vector is 188° and 0.029 ($p > 0.05$).

Fig. 6. Daglige radar retninger. A viser disse i kompasretninger. Gennemsnitsretningen er 37° (NNE–NE, sammenlign med Figs. 2 og 9. B viser radar retningerne som funktion af vindretningen. Der er en klar tendens til medvindstræk, omend afvigelsen fra rent medvindstræk er udtalt. C viser de daglige vindretninger. Gennemsnitsvindretningen er rettet mod S, men er ganske lille og ikke signifikant.

RESULTS

The migration intensities

1) Without consideration to the migratory directions the daily total radar intensities and the daily number of visible counted birds or flocks were compared. A Spearman rank correlation test, SIEGEL (1956), was applied ($n = 44$).

The visible migration was divided in four groups depending on unit and migratory altitude:

1) Unit = bird, all altitudes:
   $r_S = + 0.37$
   ($0.01 < p < 0.02$).
2) Unit = flock, altitudes 0–25 m:
   $r_S = + 0.34$
   ($0.025 < p < 0.05$).
3) Unit = flock, altitudes 25–50 m:
   $r_S = + 0.47$
   ($0.001 < < 0.01$).
4) Unit = flock, altitudes above 50 m:
   $r_S = + 0.53$
   ($p < 0.001$).

Regardless of unit and altitude all correlations were thus positive and statistically significant. The correlation becomes, however, better with increasing visible altitudes. Probably, the very low flying birds are not detected by the radar in the Hvalsø counting area, and the median migratory altitude is somewhat varying from day to day.

2) Figs 7-8 show the directional frequency distributions in different altitudes in »following« and »opposed« winds (»following« and »opposed« compared with the presumed N–NE »standard directions«). The number of high altitude flocks are clearly more abundant in »following« winds. In »following« winds the number of migrating flocks in the three altitude intervals: 0–25 m, 25–50 m, and more than 50 m were 311, 1128 and 413 – compared with 237, 471 and 63 for »op-

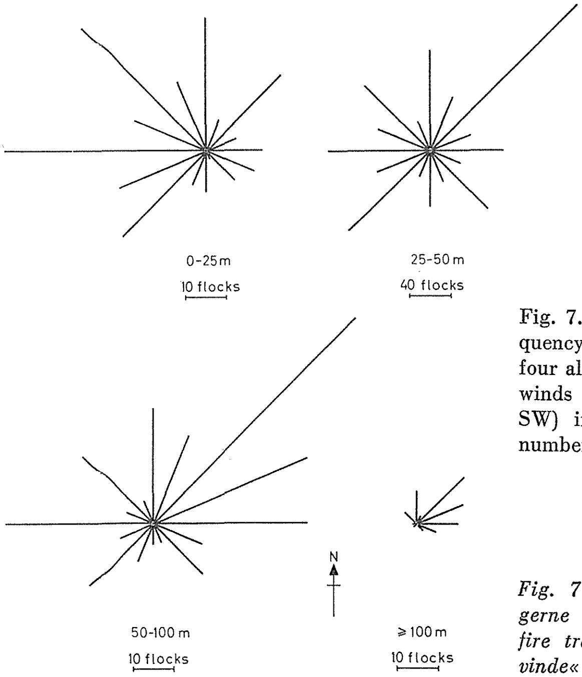


Fig. 7. Visible migration, Hvalsø. Directional frequency distributions of the number of flocks in four altitude intervals. Only days with »following« winds (SE to W incl., mean wind direction abt. SW) included. The following altitude intervals, number of flocks, and mean vectors were found:
0– 25 m, $n = 311$, 301° and 0.328
25– 50 m, $n = 1128$, 3° and 0.129
50–100 m, $n = 351$, 41° and 0.321
above 100 m, $n = 62$, 54° and 0.680.

Fig. 7. Synligt træk, Hvalsø. Retningsfordelingerne baseret på antallet af trækkende flokke i fire trækhøjdeintervaller. Kun dage med »medvinde« (SE til W incl.) er medtaget.

Fig. 8. Same procedure as in Fig. 7, but now only days with »opposed« winds (NW to E incl., mean wind direction abt. N) included. The following altitude intervals, number of flocks and mean vectors were found:

0–25 m, n = 237, 10° and 0.493
25–50 m, n = 471, 20° and 0.494
above 50 m, n = 63, 12° and 0.253.

Fig. 8. Synligt træk, Hvalsø. Retningsfordelingerne i tre trækhøjdeintervaller. Kun dage med »modvinde« (NW til E incl.) er medtaget.

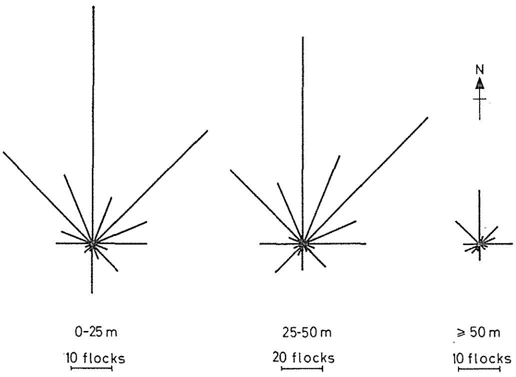
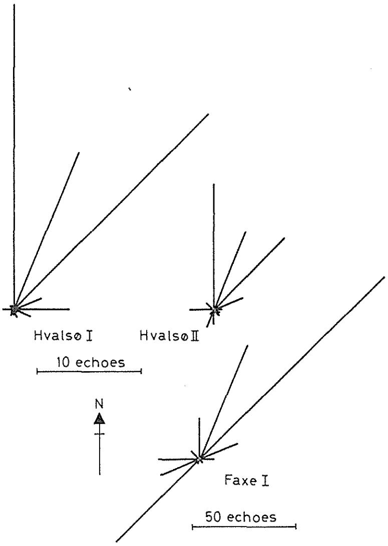


Fig. 9. The radar migration March 1 to May 7, 1971, in the middle of Sjælland (Hvalsø) and in Faxe Bay (Fig. 1). The daily mean intensities in 16 directions are calculated for the sub-periods I and II (Hvalsø) and I (Faxe). I covers roughly the first 4 hours, and II the next 4 hours. The daily mean intensities for Hvalsø I, Hvalsø II and Faxe I are 6–6.5., (5)–5.5., and 8–8.5., respectively. The corresponding mean vectors are 28° and 0.81 (cf. Fig. 6), 24° and 0.63, and 24° and 0.40.

Fig. 9. Radartrækket i perioden 1. marts til 7. maj 1971 ved Hvalsø og i Faxe bugt. De daglige gennemsnitsintensiteter i 16 retninger er udregnet. I betyder trækket i de første (ca.) 4 dagtimer, II i de næste 4 timer.



posed» winds. The difference is highly significant (p far below 0.001, x^2test).

The migratory directions

The results are presented in Figs 2–9. The following tendencies were found:

1) Apart from the Skylark (Fig. 4) the three other visible and radar categories (Figs 2–3, 6 and 9) show a N–NE »standard migratory tendency«.

2) The radar directions are clearly associated with downwinds, although there seems to be a systematic deviation from true downwind (Fig. 6). The general clockwise rotation of the wind with increasing altitude could be the cause of this deviation.

3) Contrary, the visible directions are associated with head-winds (Fig. 2–4), especially in the Skylark, whereas the headwind component in the Finches is not statistically significant.

4) In Fig. 5 is shown the correlation between the daily radar mean directions and the daily visible mean directions. The visible mean directions are calculated in two ways: 1) unit = one bird, all altitudes

and 2) unit = one flock, altitudes above 50 m. The positive correlation between 1) and the radar directions is weak and insignificant, whereas the positive correlation between 2) and the radar directions is pronounced and statistically significant. This finding should be compared with the convincing correlation between the visible high altitude intensities and radar intensities.

5) In »following« winds (Fig. 7) a roughly 180° bimodal distribution occurs in the altitude intervals 25–50 m and 50–100 m. The peaks are in the presumed »standard direction« (N–NE) and in the »reverse« direction. The component of »reverse« migration is clearly decreasing with the altitude. In the very low altitudes (0–25 m) the »standard component« is more or less turned into the wind (cf. Fig. 4).

6) In »opposed« winds (Fig. 8) the degree of »reverse« migration is on the contrary slightly increasing with the altitude.

7) Fig. 9 shows the radar migration in Faxe Bay and in the middle of Sjælland (Hvalsø area). The degree of »reverse« migration is much more pronounced in the former. Probably (compare Fig. 7) »reverse« migration is proceeding in lower altitudes than the »standard« migration. »Reverse« migration then goes on relatively undetected by the radar in the Hvalsø area – contrary to the situation in the Faxe Bay where the migration could be registered down to the sea level (ships are seen). It should be noted that the degree of »reverse« migration in the Hvalsø area is increasing in the course of the day (II compared with I). This seems to be a general observation, e. g., GRYUS-CASIMIR (1965), HAARTMANN et al. (1945), MØLLER and RABØL (1967), RABØL (1967, 1969b) and SEILKOPF and WESTERNHAGEN (1965).

8) In summary, the low altitude migration is mostly going into the wind (contains a head-wind component), whereas the contemporary radar migration in higher altitudes is proceeding downwind. »Reverse« migration occurs in lower altitudes than the »standard« migration.

DISCUSSION

The low altitude head-wind component

During visible field observation the bird migration is recorded and expressed as the number of birds (flocks) in different directions passing the observation site per unit of time. If the birds pay no attention to the wind, the ground-speed of birds flying downwind should be higher than the groundspeed of birds flying head-wind. More flocks should then be recorded moving downwind than head-wind. However, the birds compensate to a certain degree for their lowered ground-speed by increasing their airspeed in head-winds (BELLROSE 1967, BRUDERER 1971, TUCKER and SCHMIDT-KOENIG 1971). This increased airspeed in head-winds is, however, certainly neither the only nor the most important explanation of the low altitude head-wind component. Seemingly, the (head) wind acts as an orientational cue – as a positive anemotaxis (KOCH 1934, RABØL 1967, 1969).

The high altitude (radar) downwind migration

Migration recorded by radar often contains a downwind component (e. g., LACK 1963). According to RICHARDSON (1971) at least part of this prevailing downwind migration (e. g., Fig. 6) might be due to MTI filtering of slow moving birds migrating in head-wind. The radar used in the present investigation makes use of MTI (weak wedges are often seen), but details are not yet known.

No excess downwind migration should occur in the present radar study. Contrary to the visible field observation the number of echoes in each direction is estimated in a counting area and *not* as the number of echoes passing a given point or line.

Because the visible migration in higher altitudes (Fig. 7–8) contains a downwind component, the radar downwind migration is probably not due to the MTI only but mirrors (maybe in an amplifying way) the migratory directions in higher altitudes.

Synthesis on the influence of wind direction on the migratory directions

If no attention is paid to the wind, the birds are drifting away from their desired track – unless the track coincides exactly with the direction of either the head or downwind. In order to reach a final goal – e. g., the breeding ground – the passive winddrift and the active compensation for winddrift have to counterbalance each other. The only other possible – and most unlikely – solution should be that the mean »winddriftvector« becomes either zero or proceeds in the line of connection from the starting position towards the final goal.

It seems like birds migrating in higher altitudes cannot compensate completely for the winddrift, whereas the contemporary (and/or subsequent?) low altitude migration on the contrary overcompensate for the winddrift (eg. g., Bergmann 1964, Rabøl 1964, 1967, 1969 a, and Gryus-Casimir 1965).

The degrees of head-wind migration in visible altitudes seems to be much species dependent. In the Finches the inland head-wind component is thus fairly insignificant (Fig. 3), whereas the tendency for coasting into the wind is very strong (e. g., Christensen and Rosenberg 1964, and the present investigation where simultaneous visible observations were carried out at the north and east coasts of Sjælland). In the Skylark the inclination to follow coastlines into the wind is much less notable and could be due to the pronounced overcompensation (head-wind component) inland (Fig. 4).

Sometimes a species is said to *prefer* head, down- or sidewinds (e. g., Salomonsen 1972). Such claims do not contain general properties but depend on the way in which the material is sampled. According to Salomonsen (following Saxtorph 1917) Skylarks prefer downwind on spring migration in Denmark – because most Skylarks are killed at the Danish lighthouses during winds in the southwestern sector. According to the present study (and Rabøl 1964, 1967) the Skylarks migrating in visible altitudes can be said to »prefer« head wind. The contemporary high altitude Skylarks presumably »prefer« downwind as shown by the following example: On March 15, 1971, 251 Skylarks were recorded at Hvalsø. The mean vector of the movement was 62° (ENE) and 0.26. The Skylarks constituted 50 % of the birds (and abt. 80 % of the flocks) migrating that day. The same morning a huge radar migration towards N was recorded. Presumably most of the echoes were produced by Skylarks. The wind direction (at the ground) was SE-SSE. The low altitude visible migration thus contained a weak head wind component, whereas the high altitude radar migration contained a downwind component. Fig. 7 shows the same pattern.

The »standard direction« of the Skylark

The ringing recoveries of Skylarks given by Rendahl (1964) and Salomonsen (1972) indicate that the standard direction in the spring at Sjælland should be abt. NNE-NE. Thus the total mean vector towards 285° (Fig. 4) could not be regarded as the standard direction.

Now the head-wind component is very strong and the mean wind direction is 234° (SW-WSW). The mean vector towards 285° could thus be produced as a combination of a SW-WSW head-wind tendency and a »standard tendency« somewhere in the sector NW–NE. This last tendency could possibly be perceived as an expression of the standard direction. As shown by the following considerations this »standard tendency« is, however, much closer to NW than NE and thus not acceptable as a simple standard direction.

The daily mean direction might be perceived as a resultant between a head-wind vector (the direction of which is known) and a »standard« vector (either direction or relative strength is known). It is, however, obvious that on average the strength of the »standard« vector is less than the strength of the head-wind vector. If for each day the least possible »standard« vector is calculated, the mean »standard« vector becomes NNW-N (350° and 0.49). The other satisfactory extreme would be to give the daily headwind and »standard« vectors equal strength. This produces a mean »standard« vector towards NW (311° and 0.39). The sector between 311° and 350° could, however, hardly be perceived as containing the standard direction.

The NNW tendency might be called a »nonsense« direction (MATTHEWS 1968), but obviously this designation is a poor description and not at all an explanation. A very tentative explanation could be: in spite of the pronounced low altitude head wind component, the birds are displaced towards east by the prevailing SW-W-winds. The NNW tendency might then be perceived as navigation towards »goal areas« on the migratory route (RABØL 1969a, 1970, 1972). Clearly enough the »standard direction« cannot be perceived as a fixed operational compass direction in the sense of PERDECK (1970).

SUMMARY

Simultaneous radar and visible observations were carried out in the middle of Sjælland in the spring of 1971 in order to compare the migratory directions and intensities.

Positive correlations were found between the daily intensities and directions recorded visible and by radar, and the correlations improved with increasing visible altitudes.

The low altitude visible migration contained a head-wind component whereas the contemporary radar migration (including birds in higher altitudes) contained a downwind component.

The degree of »reverse« (»SW«) migration was more pronounced in the lower visible and lower radar altitudes.

The Skylark *(Alauda arvensis)* was treated more in details. It is by far the species with the strongest head-wind component inland. According to ringing recoveries the Skylark standard direction should be NNE-NE, but no traces of such a direction could be demonstrated. Otherwise there seemed to be a general NNW tendency, the nature of which is discussed.

DANSK RESUMÉ

Sammenlignende radar og feltobservationer af fugletrækket over Midtsjælland i foråret 1971.

I 10 ugers perioden fra 1. marts til 7. maj foretoges samtidige dagtrækobservationer på 3 poster, ved Hvalsø midt på Sjælland (Fig. 1), og på kystposterne Gilleleje og Nivå. Der observeredes i alt 50 dage. Samtidig med disse observationer af det synlige træk optoges radar film af trækket over Sjælland (vedrørende registreringen af dette radartræk se RABØL et al. 1971).

I denne afhandling skal vi blot præsentere og sammenligne det synlige træk og radartrækket over Midtsjælland.

Både radartrækket og det synlige dagtræk blev observeret i de første 4 dagtimer. Foruden art, antal og retning noteredes trækhøjde på observationsposten ved Hvalsø.

For både det synlige træk og radartrækket udregnedes eller skønnedes der for hver dag en gennemsnitsretning, og antallet af trækkende fugle (eller flokke) og radar intensiteten blev også sammentalt eller bedømt for hver dag.

Som vist på Fig. 2–4 er det synlige træk delt i 3 kategorier, 1) alle arter tilsammen, 2) Finke sp., og 3) Sanglærke. Alle 3 kategorier – især Sanglærken – viser en tendens til modvindstræk. De daglige radarretninger (Fig. 6) viser derimod en tendens til medvindstræk.

Dette skyldes sandsynligvis, at højderne for visuel og radar registrering ikke er identiske: Man ser sjældent træk i over 100 m højde, medens radartrækket i denne undersøgelse rimeligvis foregår i over 50 m højde (radar optællingsområdet i Midtsjælland er 60–80 km fra radarstationen, så på grund af jordens krumning og især det mellemliggende bakkede og skovklædte landskab ligger de lave højder i »radarskygge«). Som ses af Fig. 5 og 7 er der også en tendens til, at det synlige dagtræk i større højder viser større lighed med radartrækket end det samtidige totaltræk og især det samtidige træk i lave højder. Hvis man korrelerer trækkets størrelse registreret ved hjælp af synlig observation og radar, er der også betydelig bedre overensstemmelse mellem det høje synlige træk og radartrækket. Der er kort sagt en jævn overgang fra et lavtgående modvindspræget træk til et højeregående træk, der mest forløber med vinden.

Hvis trækfuglene skal nå et eller andet mål (f. eks. yngleområdet), må de kompensere for den vinddrift, de modtager undervejs. Øjensynlig er trækfuglene ikke i stand til at kompensere fuldstændigt for vinddriften i større trækhøjder (her har trækket en medvinds-komponent). Til gengæld overkompenserer de for vinddriften i de lavere trækhøjder (her har trækket en modvindskomponent). Dette laveregående modvindstræk ytrer sig i øvrigt noget forskelligt fra art til art. På Figs. 1–4 ses, at indlands-modvindstrækket er langt mere udpræget hos Sanglærke end hos Finke sp. Til gengæld modvindstrækker finkerne i langt højere grad end Sanglærken langs kysterne.

Både på Figs. 7 og 9 ses et betydeligt islæt af omvendt træk – dvs. træk der er stort set modsat rettet den for årstiden forventede normal-trækretning (N–NØ). Det fremgår klart, at det omvendte træk forløber i gennemgående lavere trækrethøjder end »normaltrækket« mod N–Ø.

Til slut en diskussion af, om man kan sige, at en bestemt trækfugleart foretrækker med-, mod- eller sidevind. Et sådant synspunkt træffer man stadig i Salomonsen (1972), hvoraf det (på grundlag af fyrfald) fremgår, at Bogfinker foretrækker sidevinde og Sanglærker medvinde. Sådanne resultater afhænger imidlertid af registreringsformen: Ser man på fyrfaldne Sanglærker, »foretrækker« de medvinde (især hvis man ikke gør sig den ulejlighed at korrigere for de relativt hyppigere vindretninger mellem syd og vest). Ser man derimod på det laveregående dagtræk af Sanglærke – som i denne artikel – »foretrækker« Sanglærken modvinde, medens de samtidige højeregående Sanglærker »foretrækker« medvinde.

Man kan altså ikke bruge betegnelsen foretrække i forbindelse med trækfuglenes retningsbestemte reaktioner, undtagen måske hvis man specificerer, inden for hvilke rammer betegnelsen har mening.

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MS received 20th June 1972.

Authors' address: Zoological Laboratory, Universitetsparken 15, 2100 Copenhagen Ø.