The Influence of the Wind on the Migration of Swallows

Ottenby Bird Station Report No. 26

CLAES RAMEL

University of Stockholm, Sweden

Migratory movements in birds normally occur at more or less restricted periods outside the breeding season. The Swift *(Apus apus)* constitutes an exception to this rule. In this species such movements seem to occur during any time of the year, including the breeding season, as has been shown by KOSKIMIES (1950) and SVÄRDSON (1951). The selective advantage of such behaviour is indicated because Swifts depend entirely upon the number of airborn insects, which vary in abundance with changes in weather conditions. Sedentary habits may seriously jeopardize these birds during extended periods of bad weather. KOSKIMIES has shown that Swifts avoid the bad weather of a cyclone by a »weather flight». The birds then fly against the wind, thus moving away from the center of the cyclone.

Even if the dependence of air plankton is stronger in the Swifts than in other birds, the adaptation of the swallows has followed the same general trend. Their sensitivity to the weather may be illustrated by the »swallow catastrophes», resulting from a sudden outbreak of bad weather (see *i. e.* LORENZ 1932). Although swallows seem to be sedentary during the breeding season, some observations indicate that weather movements comparable to the ones found in Swifts might occur (LACK 1956). This is supported by the following observations made at Ottenby Bird Station in Sweden in the fall 1947. During a period of observation of one month from August 16th to September 15th there was an almost constant northern wind from August 18th to September 4th. General migrational activity practically closed. The only species flying in large numbers were swallows and Swifts. 10,000 birds of these species were recorded flying northwards against the wind during this period. This flight was observed every day except one, reaching a maximum on August 22nd and 23rd, when close to 2,000 individuals were recorded per day. The majority were House Martins *(Delichon urbica)*, which constituted over 90 per cent of the total records; 4 per cent were Swallows *(Hirundo rustica)*, 3 per cent Sand Martins *(Riparia riparia)* and 2 per cent Swifts *(Apus apus)*. During the same period only 200, still mainly House Martins, were observed migrating in the »correct» southward direction with

a tail wind. This occurred at the end of the period, September 2nd. Before and after the period of northern winds, that is, August 16th and 17th and September 5th to 15th, the prevailing winds were from a direction between south and west. A southward migration of swallows was then observed. 5,200 birds were recorded, 36 per cent *Hirundo rustica*, 33 per cent *Delichon urbica* and 31 per cent *Riparia riparia*. With the exception of a few individuals, no Swifts took part in this migration.

On August 18th there was a cold front along the Baltic from Finland to Denmark and a low pressure area over western Russia east of Finland. A stationary area of high pressure in the western part of Scandinavia and the passage of cyclones southeast of the Baltic were the cause of the following period of northern winds. During the period in question the weather was clear, showing the characteristics of the »back» of cyclones. This weather situation influenced a large part of Sweden and in fact similar northward movements of swallows were reported elsewhere (SVÄRDSON 1948).

In the Swift, northward flights, according to KOSKIMIES, have been observed predominantly in the northwestern sector of the cyclones, when the birds were returning to their summer localities after a weather flight. The observations at Ottenby indicate that similar behaviour may occur in swallows during ordinary migration. The northward movement in this case was presumably caused by the reaction of the birds to the winds.

Recognizing the difficulties in determining the direction of the flight of swallows and Swifts, observations were made as accurately as possible by using class intervals of 22° or N — NNE — NE etc. There was a marked correlation between the direction of the flight and the wind, as can be seen in fig. 1, illustrating deviations of the flight of the swallows from the wind direction.

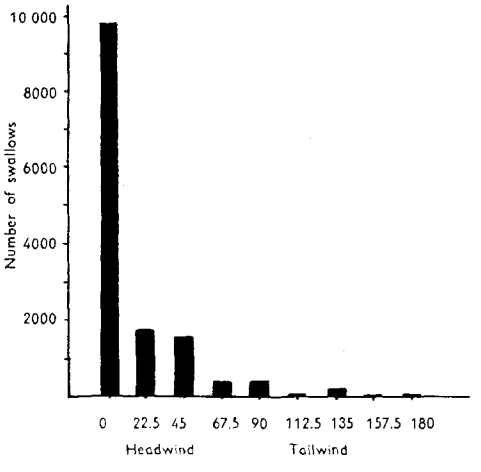

Fig. 1. Deviation (in degrees) of the flight of swallows from the direction of the wind. Ottenby August 16th to September 15th 1947.

In order to study to what extent this reaction towards the wind is a general feature under ordinary circumstances, studies were made the following year at Falsterbo Bird Station at the southern point of Sweden from July 31st to August 15th. The topographical conditions are somewhat better here for such a study than at Ottenby, where the narrow tip with the coast lines, running in a north-south direction, may restrict the choice of direction of the birds by means of the guiding line effect. The direction of the wind varied considerably and the weather situation was in general more normal than at Ottenby the preceding year.

During the period at Falsterbo 6,600 swallows and Swifts were observed. The proportions of the various species were different from those observed at Ottenby 1947, the Swifts being in the majority with 64 per cent, whereas *Riparia riparia* occurred to the extent of 20 per cent, *Hirundo rustica* 10 per cent, and *Delichon urbica* 6 per cent. The preference for flying against the wind was still marked, as can be seen in Fig. 2, where the deviation of the direction of the flight from the wind is recorded.

The hour of the day when migration of swallows and Swifts occurs seems in general to be less restricted than for most other birds, the time being determined to a large extent by the occurrence of favourable winds. Assuming an average direction of flight towards the southwest at Falsterbo, there were only four days which showed a complete lack of winds giving a head wind component. The only return migration of noticeable magnitude occurred on one of these four days. 460 birds, mainly Swifts, took part in this flight.

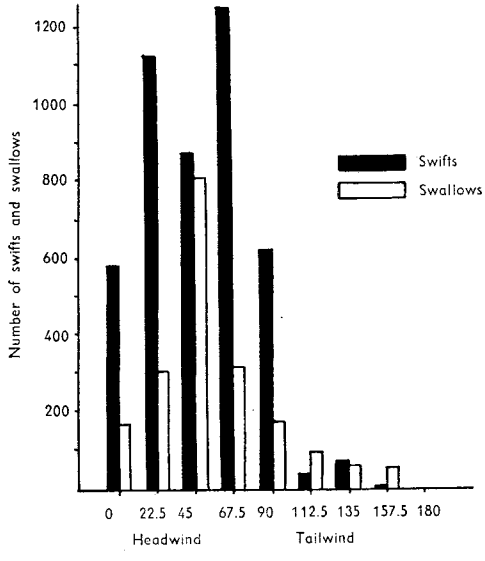

Fig. 2. Deviation (in degrees) of the flight of swallows and Swifts from the direction of the wind. Falsterbo July 31st to August 15th 1948.

The reaction of the Swifts and the swallows towards the wind could be interpreted as an adaptation to avoid areas of low pressure, as has been suggested by KOSKIMIES for the Swifts. It seems, however, likely that the wind exerts a direct aerodynamical influence on the flight, as a similar reaction in fact does occur in other bird species as well. At Ottenby the birds of prey showed a reaction to the wind, which was somewhat similar to that of the swallows. 188 birds of prey were recorded during the whole period from August 16th to September 15th. The direction of their flight was as follows:

	Southward	Northward
Falco peregrinus	6	1
» *subbuteo*	1	7
» *columbarius*	17	4
» *tinnunculus*	18	25
Accipiter nisus	33	33
Circus aeruginosus	7	2
» *pygargus*	2	—
Pernis apivorus	8	—
Pandion haliaetus	23	1
Total	115	73

Of the 73 observations of northward flight, 69 occurred during the period of northern winds. During the same time only 21 migrated southwards.

Although the effect of horizontal winds on bird flight has been a controversial matter, a number of observations recorded in the literature on the tendency of many species to fly against the wind, together with data on reverse migration against the wind, indicate that the wind direction is of aerodynamical importance. NISBETH (1955) has pointed out that the asymmetrical distribution of the velocity variations of the wind, with largest sudden changes in the downwind direction, makes flying safer against the wind, there being less danger of aerodynamical instability due to sudden falls of air speed below the stalling speed. A bird flying with a tail wind therefore ought to avoid high wind turbulence which often is found at low levels. This would explain the general tendency of birds to fly at higher altitudes with a tail wind. Of some interest in this connection is an observation by SCHWERDTFEGER (1942). He saw from an airplane a flock of geese migrating with the wind at an altitude of 2,600 m. The occurrence of the birds at this high altitude was explained by the fact that there were turbulent air currents at lower levels, which were avoided by the geese.

It is likely that soaring and gliding birds are especially sensitive to winds causing changes of air speed below the stalling speed. Such winds would force these birds to use a more energy-consuming type of flight, particularily over large areas of water, where no thermic up-currents are available.

The strong anemotactic behaviour of swallows and swifts may be explained by the following circumstances. The size of a bird constitutes a limiting factor for a gliding flight technique (LORENZ 1933). Swallows and Swifts show an extreme adapta-

tion to a gliding flight, being the smallest birds using such a technique, the consequence of which is that they probably are more sensitive to air currents than other species using a similar kind of flight. It is furthermore possible that a flapping flight technique interferes with their ability to catch insects. A gliding flight technique becomes increasingly more difficult the more often the air speed decreases below the stalling speed, which presumably occurs especially in wind gusts in the downwind direction.

An important factor in this connection may be the feeding behaviour of swallows and Swifts. While other birds on migration ordinarily feed while resting, these species feed to a large extent at the same time as they migrate (comp. HURRELL 1937). They therefore have to remain at an atmospheric level, within which there is an abundant supply of airborn insects, usually below 300 m. (see KOSKIMIES op. cit.). Their possibility of correcting the altitude of flight according to the distribution of different air currents is therefore restricted. Northern winds with a weather situation which releases the migration may thus force them to migrate in a direction opposite to the normal one, assuming an influence of horizontal winds outlined above.

It may be noted that several recoveries of ringed swallows and Swifts have been made north of the place of ringing the same autumn. DROST and DESSELBERG (1932) have interpreted such recoveries of *Hirundo rustica* as a result of »Zwischenzug». It seems, however, rather likely that such northward flights in most cases are a part of the true migration, although temporarily in a reverse direction. As a matter of fact both young and adult specimens of *Hirundo rustica* were observed at Ottenby on northward migration.

LITERATURE

DROST, R. and DESSELBERG, H. (1932). »Zwischenzug» bei Schwalben. Vogelzug. 3.
HURRELL, H. G. (1937). Influence of weather on dispersal of swifts and swallows after nesting. Brit. Birds 30.
KOSKIMIES, J. (1950). The life of the swift, *Micropus apus* (L.), in relation to the weather. Ann. Acad. Scient. Fenn. ser. A IV. Biologica 15.
LACK, D. (1956). Swifts in a tower. London.
LORENZ, K. (1932). Beobachtungen an Schwalben anlässlig der Zugkatastrophe im September 1931. Vogelzug 3.
—»— (1933). Beobachtetes über das Fliegen der Vögel und über die Beziehungen der Flügel- und Steuerform zur Art des Fluges. Journal f. Ornith. 81.
NISBETH, I. C. T. (1955). Atmospheric turbulence and bird flight. Brit. Birds 48.
SCHWERDTFEGER, W. (1942). Eine seltene Vogelzugbeobachtung über der Nordsee. Vogelzug 13.
SVÄRDSON, G. (1948). Verksamheten vid Ottenby fågelstation 1947. Vår Fågelvärld 8.
—»— (1951). Swift (*Apus apus* L.) movements in summer. Proc. X. Int. Orn. Congr.