Some Observations on the Behaviour of the Little Auk *(Plotus alle)* on the Breeding-Ground, with Special Reference to Voice Production

By
LORENZ FERDINAND

(From the Bioacoustic Laboratory, Natural History Museum, Århus)

(Med et dansk resumé: Nogle iagttagelser af Søkongens (Plotus alle) *adfærd på ynglepladsen – særligt med hensyn til stemmegivning.)*

INTRODUCTION

During two periods of 1964, May 5th to June 6th, and June 19th to June 23rd, I had the opportunity of making observations and tape recordings and of taking photographs at a breeding-ground of the Little Auk (*Plotus alle*) in the Thule District in North Greenland. My observations were made on the mountain side facing the coast near Cape Atholl, the southwest point of Northern Greenland. The investigations were made during a journey to North Greenland for the Commission for Ornithological Investigations in Greenland, and the tape-recorder used was placed at my disposal by the Danish State Research Foundation.

In both periods the weather was cold and highly unsettled. Thus during the first period there were only about 10 hours of calm weather. Most of the time the temperature was 4 to 8 degrees C. below zero. During the second period the day temperature was about freezing point and the night temperature below that. On most days there were spells of high wind.

Because of the weather and because of the diurnal rhythm of the Little Auk I thus had only about thirty hours of watching the birds. Most observations were made on a rocky cliff facing south, about 60 m above sea level (Fig. 10).

The cliff was about 150 m high with ledges rich in vegetation, vertical sides and deep ravines alternating with large snow drifts. During both periods the hinterland was completely wintry.

The observations made at close-quarters on or about June 20th were made from a tent which was pitched on a mountain side immediately below a steep snow drift and immediately above a vertical rock; this place was selected after I had found that the birds were most numerous and active there.

In support of the observation material I took about a hundred photographs and made tape-recordings of the calls of the birds of altogether $1^1/_2$ hrs. duration.

LITERATURE ON THE LITTLE AUK

The breeding-grounds of the Little Auk have been visited by many ornithologists, especially in Greenland, Spitzbergen, and Franz Josef Land (SALOMONSEN 1950, LØVENSKIOLD 1964). However, only short descriptions of the behaviour of the species on the breeding-ground are available, presumably because of the difficulties of climate and travelling conditions involved in visiting the breeding-grounds of the Little Auk. NORDERHAUG (1964), however, has started investigations in Spitzbergen of the Little Auk during the latter part of the breeding season.

The time of arrival of the birds at the breeding-grounds and the waters around them varies very much from place to place. Thus they may arrive at the waters around Franz Josef Land as early as the last ten days of February and early in March (KOZLOVA 1957). In Northern Greenland the first birds arrive during the first half of the month of May (SALOMONSEN 1950) and in Spitzbergen during the first half of April, whereas the breeding-grounds are not occupied until the first half of May. BENT (1946), SALOMONSEN (1950), and LØVENSKIOLD (1964) state that before the egg-laying season the birds behave very irregularly at the breeding-grounds, only being there at certain times and then mostly at night.

The time of laying seems to be more constant than the time of arrival at the breeding-ground – after the middle of the month of June (SALOMONSEN 1950, KOZLOVA 1957, LØVENSKIOLD 1964). The only reasonably precise information available concerning the behaviour of the Little Auk on the breeding-ground has been given by FOSTER *et al.* (1951), who have observed how the birds stand in pairs facing each another, shaking their heads and touching each others' beaks. BATESON (1961) has drawn attention to the absence of knowledge of the breeding biology of the Little Auk.

The voice of the Little Auk is described very differently by the various authors. Thus it is desribed by SALOMONSEN (1950) as »*pirrr rirrr rirrr*«, by COLLETT (1921) as »*trr^r trr^r tet tet tet trrr^r*«, by HANTZSCH (1905) as »*gä gä gä*, and by WITHERBY (1947) as »*krääk ääk ak ak ak ak ak ak*«.

Presumably all these calls refer to the calls heard from the individual bird during its circling flight, so that these verbal descriptions in different languages actually refer to the same call.

CIRCLING FLIGHT (LANDNAM FLIGHT)

From previous observations (i.a. SALOMONSEN 1950) it is known that at the beginning of the breeding season the Little Auk flies over the breeding-grounds in large flocks, a great part of the breeding population of an area flying to the land together. Then, singing, they circle over their breeding-grounds for hours.

According to information which I obtained from the Eskimos of the Thule District, the first »landnam flights« in most years were made in the middle of May. In 1964 the first birds were observed near the breeding-ground at Siorapaluk on the 15th of May. Furthermore, I was told that the presence of the birds on the breeding-ground before the laying-season might be interrupted for shorter or longer periods dependent on the weather. The flocks mostly arrive in calm, sunny weather, and immediately after midnight.

After I had stayed for two days in the breeding area without seeing any Little Auks, the weather turned calm during the night between the 2nd and the 3rd of June and large flocks of Little Auks then arrived. On the preceding days, however, *Alcidae* had been observed in thousands

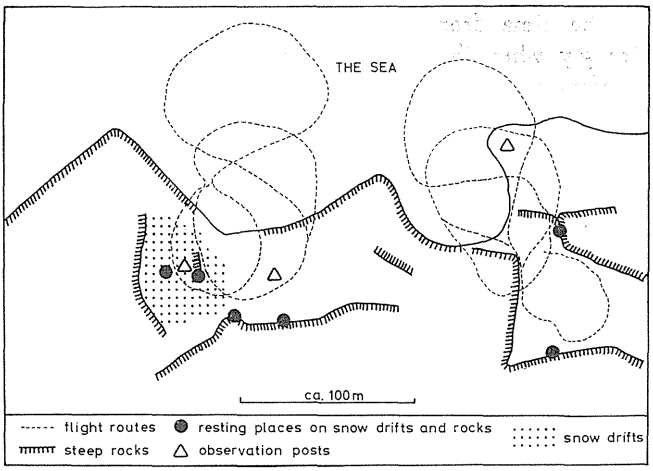


Fig. 1. Sketch of the circling flight of Little Auks around two areas of colonies at Cape Atholl.

Fig. 1. Skitse af Søkongens kredsflugt omkring to koloniområder ved Kap Atholl.

resting on the water about 1 km from the shore, but because of the great distance the determination of species was rather doubtful. The birds in question may have been Brünnich's Guillemots (*Uria lamvia*).

In flocks of thousands the birds circled over the sea, slowly approaching the coast. At a distance the voices of the birds were heard as something between the protraced scream of a gull and the hoot of a deep siren. The number of flocks gradually increased for one or two hours. According to my estimate there were tens of thousands of birds. It was an experience and a sight of such beauty and intensity as to defy description (Figs. 11–12). The sizes of the flocks changed incessantly. They flew at an altitude of 200–300 m, i.e. at the same altitude as the highest points on the coast. As the flocks circled round the individual groups of rocks, the circles and the flocks became smaller and smaller. The diameters of the circles of the birds which thus flew over the breeding-grounds, were 400–500 m. The birds had arrived at the coast from the sea in a few, very large flocks, and were then split up into many smaller flocks, which then flew around the future nesting territories. For certain periods the birds flew at very high speed, especially when opposite the breeding-ground. At the same time their calls and trills were heard particularly loudly.

At 4,00 a.m. the first birds settled on the overhangs at the very top of the mountain side. Somewhat later other birds settled farther down – about 300 birds were seen to be sitting. They sat on the very outermost overhangs quite close together and with their heads facing the sea, and from there they answered the calls of the flying birds when their circling brought them close to the sitting birds. It was not possible to distinguish any difference between voices of the sitting and the flying birds. The sitting birds continuously looked from one side to the other with small quick jerks of their heads, and when the flying birds passed them, they turned their heads towards them. After 8,00 a.m. a larger number of the birds returned to the sea, but some birds remained on the breeding-ground, staying there until at any rate 9,00 a.m., when the watching had to be interrupted because af my departure. – On my visit about the 20th of June the place where the birds mentioned were observed on the 3rd of June, proved to a breeding-ground for the birds.

A similar circling flight – in much smaller flocks – was observed during the days about the 20th of June, this flight being mainly performed by the paired-up birds.

A tendency for the birds to fly in pairs was never observed in the flocks. In circling flight the »trilling call« was heard

all the time from the flock, especially strongly when the birds passed over the breeding-grounds. In the case of other kinds of flight a short, weak call was heard.

DIVISION INTO COLONIES

At both visits to the colony of Little Auk on Cape Atholl I received the definite impression that the flights and circling of the birds over the breeding-grounds took place in a regular way, as at a definite point of the coast only a small part of the total number of circling birds were observed, as well as an almost constant number of circling birds.

By following the individual flocks during a period it could be seen that it was the same birds which alternately flew in circles and sat on the rock ledge. These facts were observed in three or four different places on the coast at a distance of some 400 m. In Fig. 1, the flying routes observed have been sketched in for two flocks with indication of the approximate breeding-grounds. The two groups of birds sketched in frequented the sides of two V-shaped canyons that stretched 200–300 m up from the coast, and neither by observation of the manner of flying of the birds nor in any other way was it established that there was any »connection« between the two groups of birds (there were 400–500 individuals in each group).

Several times between 11 and 13 a.m., flocks from »other« places on the coast were seen to pass the area under observation on their way towards the sea without these flocks »gathering up« birds from the colony or influencing their behaviour. This also suggested that the various populations of birds along the coast had been divided into sections which had no observable relation to one another.

On the basis of these two observations it is therefore assumed that the breeding area of the Little Auk is divided into a number of greater or smaller subcolonies determined by the topographical conditions of the place, so that in the breeding season and in the time before it the birds keep together in flocks in which the individuals belong to the same subcolony. Perhaps the flocks on the sea are also composed of birds from the same area, for on several occasions I observed that the flocks which were flying towards the sea from the colony originated from the area under observation. This observation has been confirmed by Norwegian ringing investigations in Spitzbergen (Norderhaug 1964).

THE DIURNAL RHYTHM IN THE COLONY AND FLIGHT TO THE SEA

During my observations in the Thule District a distinct diurnal rhythm in the activities of the birds was noticed. Thus the birds came ashore one or two hours after midnight, and then there was great activity during the whole night and early in the morning (a fact which was known to the Greenlanders). This activity decreased slowly late in the morning and about 1 p.m. all the visible birds had left the breeding-ground.

The flight to the sea began in the days around the 20th of June about 11 a.m., and during the period from about 11 a.m. to 1 p.m. the birds were seen to leave the breeding-grounds in larger or smaller flocks and fly out to sea. At the same time on two of the days birds were seen flying parallel to the coast against the wind before they flew out to sea. Conceivably by going against the wind the birds succeed in finding foraging areas which are situated particularly favorably to them in relation to the ice conditions so that in this

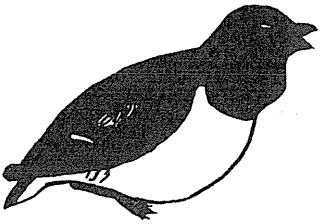


Fig. 2. Sketch from photo of sitting, »singing« Little Auk, which is emitting the »trilling call«.

Fig. 2. Skitse efter fotografi af siddende, »syngende« Søkonge, der kommer med det »trillende kald«.

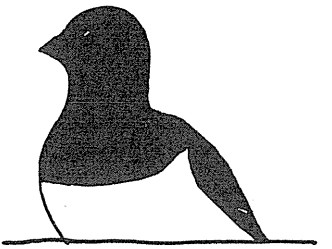


Fig. 3. Sketch from photo of resting Little Auk with stretched neck.

Fig. 3. Skitse efter fotografi af hvilende Søkonge med strakt hals.

way they find the »calm« areas behind icebergs and drift ice. In the whole of the month of June there were large numbers of icefloes and icebergs off Cape Atholl, and this ice and the icefree areas of water alternated very quickly with the force and direction of the wind. Thus on the 19th and 20th of June between 11 a.m. and 1 p.m. a »passage« of flocks of many thousands of birds was seen flying westward along the coast, and during these days the birds were not seen to be resting on the sea off the area, so the foraging areas must have been situated at a considerable distance from the breeding-ground. Only on a single occasion (the 20th of June) the Little Auk was seen flying to the sea outside the period of activity (from about 1 a.m. to 1 p.m.), two birds flying independently of each other from the scree direct towards the sea (incubating birds?) about 4 p.m.

During the »landnam flight« and during the circling flight around the breeding place the individual bird moves with very rapid wing-beats. Most of all the flight of the Little Auk reminds of that of a wader with the size of a Golden Plover (*Pluvialis apricaria*). The rhythm of the wing-beats may be synchronous in the flocks (Fig. 12), this was seen in circling flocks, whereas photos of flocks swooping down over the breeding-ground show that the rhythm of the individuals was not synchronous. At this stage a single bird might even fly with its underparts turned upwards (see Fig. 11).

On a single occasion (the 19th of June) a bird was seen to fly with a slow rhythm of the wing-beats – at a distance of about 100 m – when it left the perch on one side of the »breeding valley« and flew to another resting-place on the opposite side of the canyon.

When the birds alighted on the cliff they flew in over the landing place relatively slowly, and then suddenly dropped down with legs stretched out and wings stretched slightly upwards. In flying up, the birds »threw« themselves out over the side of the cliff, stretching their wings out at the same moment that they took off with their legs, thereby losing height.

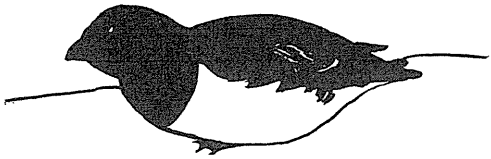


Fig. 4. Resting Little Auk which is ducking, either because of the passage of gull or because of much wind.

Fig. 4. Hvilende Søkonge, der dukker sig, enten på grund af en måges forbiflyven eller på grund af megen vind.

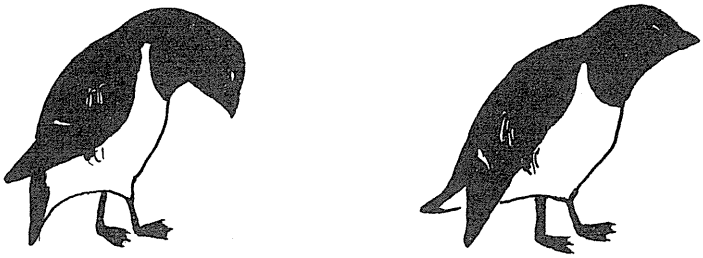


Fig. 5. Sketch from photo of the »jogging gait« of the Little Auk, showing one bird walking behind the other. The bird on the left is probably the male.

Fig. 5. Skitse efter fotografi af Søkongens »luntegang«, hvor man ser den ene fugl gå efter den anden. Fuglen til venstre er sandsynligvis hannen.

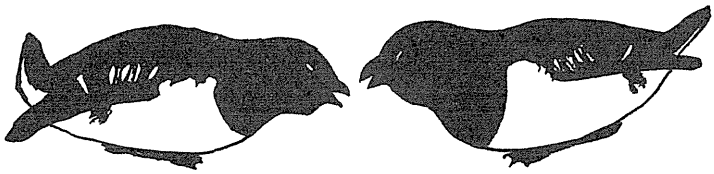


Fig. 6. Sketches from photos of the pair of Little Auks while arrived with the »aggressive call«. Note the positions of the tails and the wings, as well as the way in which they rest with the whole of the tarsus on the ground.

Fig. 6. Skitser efter fotografier af Søkonge-parret, medens det kommer med »det aggressive kald«. Bemærk halens og vingernes stilling, samt hvorledes de hviler med hele tarsus på underlaget.

Fig. 7 and 8. Sketches from photos of copulation of the Little Auk on the snow drift on the 21st of June 1964.

Fig. 7 og 8. Skitser efter fotografier af Søkongens parring på snefanen den 21.6.1964.

Fig. 9. Sketch from photo of Little Auk carrying a pebble in its bill immediately before searching for a nesting-site.

Fig. 9. Skitse efter fotografi af Søkonge, der bærer en sten i munden umiddelbart før den leder efter rede.

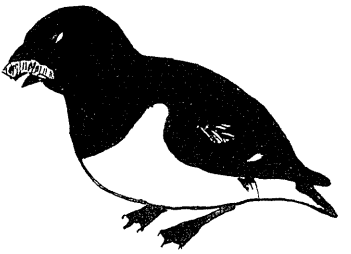


Fig. 10. The breeding-ground of the Little Auks (June 20th 1964). With a view of the sea full of ice and icebergs.

Fig. 10. Fotografi fra den 20.6.1964 fra Søkonge ynglepladsen med udsigt over det isfyldte og isbjergfyldte farvand.

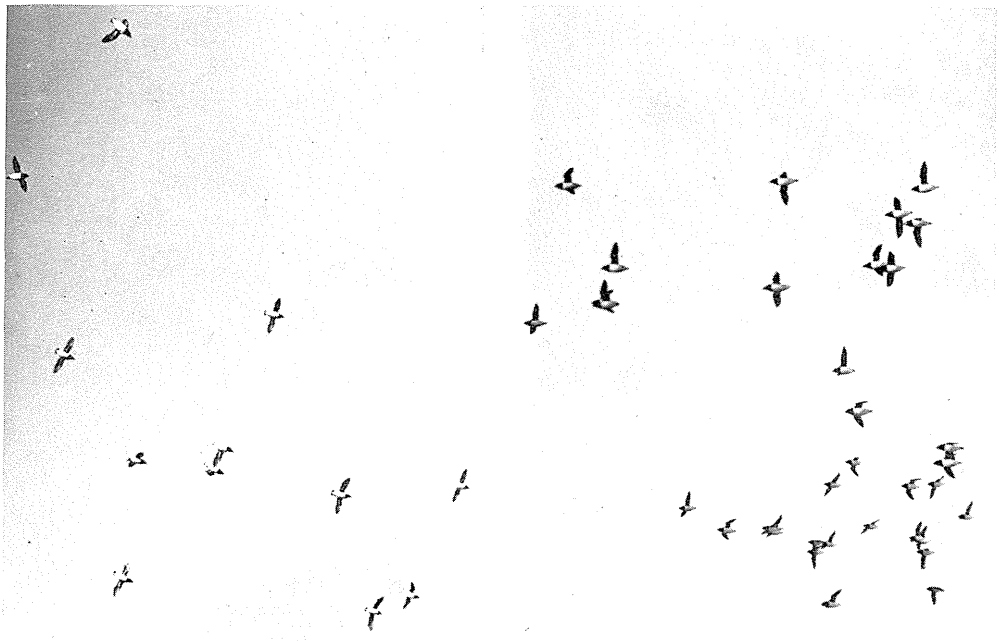


Fig. 11. Little Auks in circling flight around the breeding ground (June 1st 1964). The various birds fly out of »time« with one another and some of the birds even fly with their underparts upwards.

Fig. 11. Fotografi af Søkonge i kredsflugt omkring ynglepladsen den 1.6.1964. De enkelte fugle flyver på dette billede ude af »takt« med hinanden, og nogle af fuglene flyver endog med bugen opad.

Fig. 12. Flock of Little Auks on their way to the sea. Note that the position of the wings is more uniform (synchronous).

Fig. 12. Fotografi af Søkonge-flok på vej til havet, bemærk at vingestillingen er mere ensartet (synkron).

Fig. 13. Three pairs of Little Auks on stones on the snow drift at Cape Atholl (June 21st 1964). The bird on the extreme left has assumed the posture described under the head of »jogging gait«.

Fig. 13. Fotografi af 3 par Søkonger på sten på snefanen den 21.6.1964, Kap Atholl. Fuglen yderst til venstre indtager den stilling, som er beskrevet under luntegangen.

Fig. 14. Section of birds sitting on the snow drift on Cape Atholl (June 21st 1964).

Fig. 14. Udsnit af fuglene siddende på snefanen Kap Atholl den 21.6.1964.

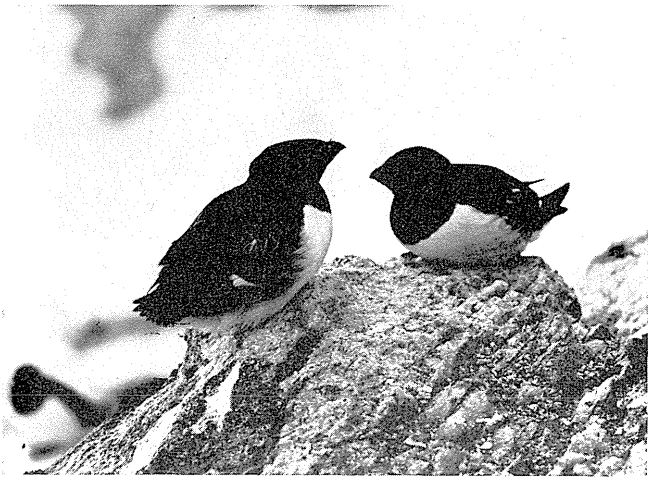


Fig. 15. Resting pair (June 22nd 1964), the birds turning away from the rocks towards the canyon.

Fig. 15. Fotografi af et hvilende par den 22.6.1964, hvor fuglene vendte front væk fra klipperne ud imod kløften.

Fig. 16. Little Auk with »jogging gait«. June 22nd 1964. See Fig. 5.

Fig. 16. Søkonge i luntegang. 22. juni 1964. Se fig. 5.

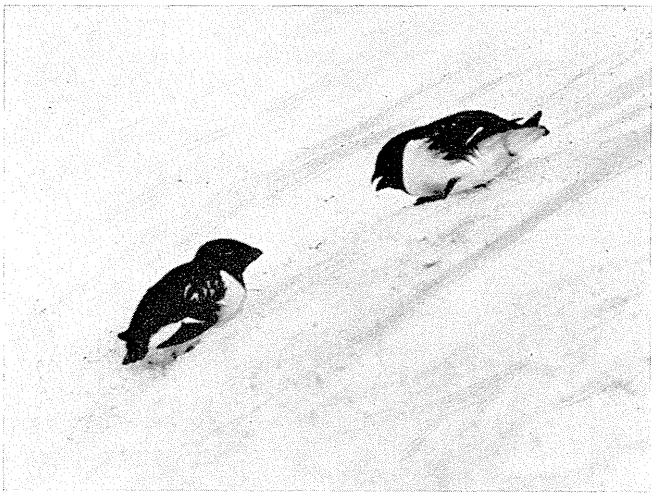


Fig. 17. Pair during aggressive call on the snow drift (June 20th 1964). See Fig. 6.

Fig. 17. Fotografi af et par under aggressivt kald på snefanen den 20.6.1964. Se fig. 6.

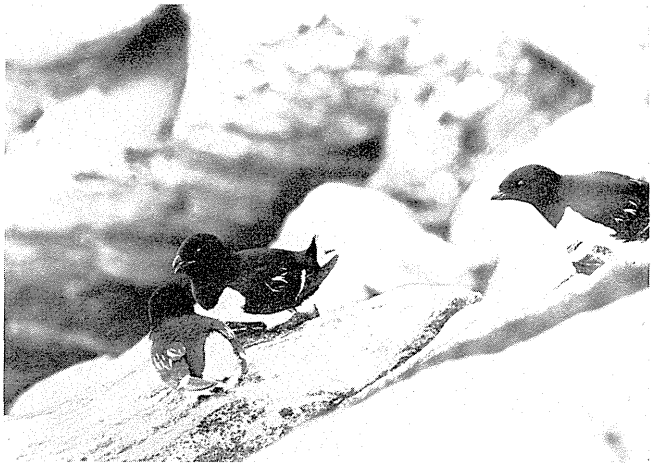


Fig. 18. Pair during aggressive call from the rock ledge (June 21st 1964). Note the position of tail and wings.

Fig. 18. Et par i aggressivt kald fra klippeafsatsen den 21.6. 1964. Bemærk halen og vingernes stilling.

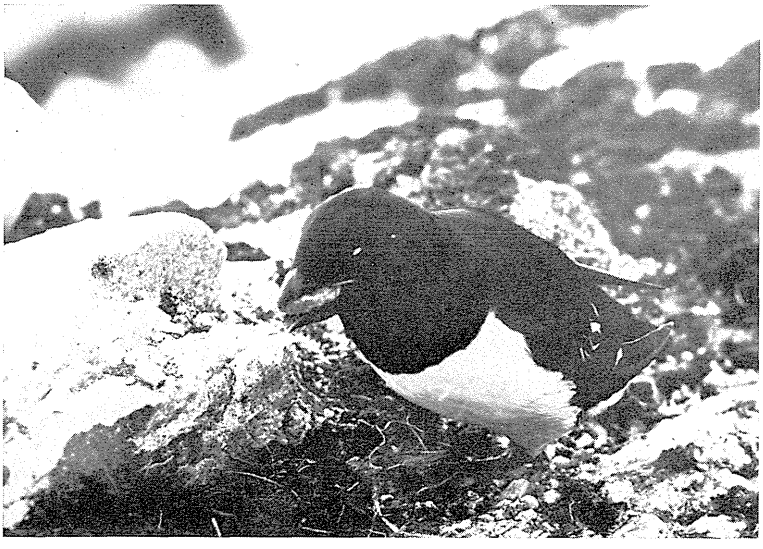


Fig. 19. Birds carrying a pebble in its bill (June 22nd 1964).

Fig. 19. En fugl, der bærer en sten i næbbet den 22.6.1964.

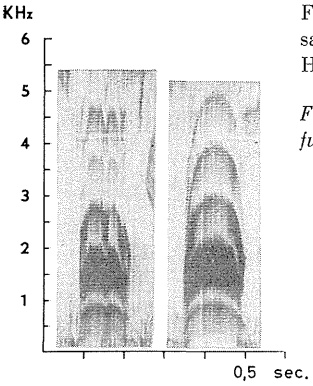


Fig. 20. Spectrogram of two single calls from the same bird, Cape Atholl on the 1st of June 1964. H. S. Wide M. L. 8.5.

Fig. 20. Spektrogram af to enkeltkald fra samme fugl, Kap Atholl 1.6.1964. H. S. Wide M. L. 8,5.

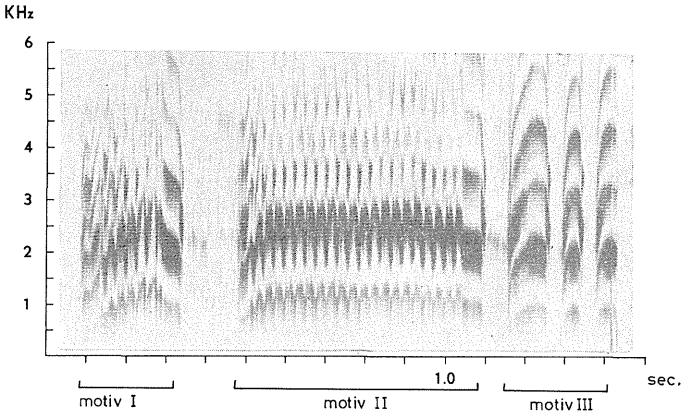


Fig. 21. Spectrogram of the »trilling call« from perched Little Auk, Cape Atholl on the 19th of June 1964. H. S. Wide M. L. 8.5.

Fig. 21. Spektrogram af det »trillende kald« fra siddende Søkonge, Kap Atholl 19.6.1964. H. S. Wide M. L. 8,5.

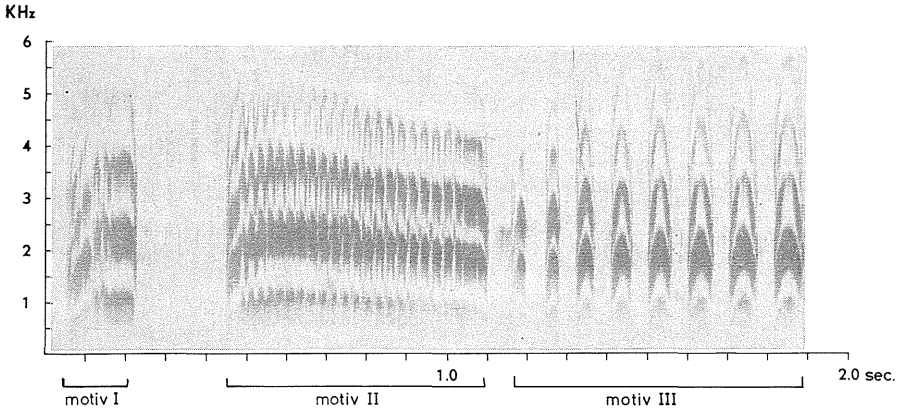


Fig. 22. Spectrogram of the »trilling call«, Cape Atholl on the 22nd of June 1964. H. S. Wide M. L. 9.0.

Fig. 22. Spektrogram af det »trillende kald«, Kap Atholl 22.6.1964, H. S. Wide M. L. 9,0.

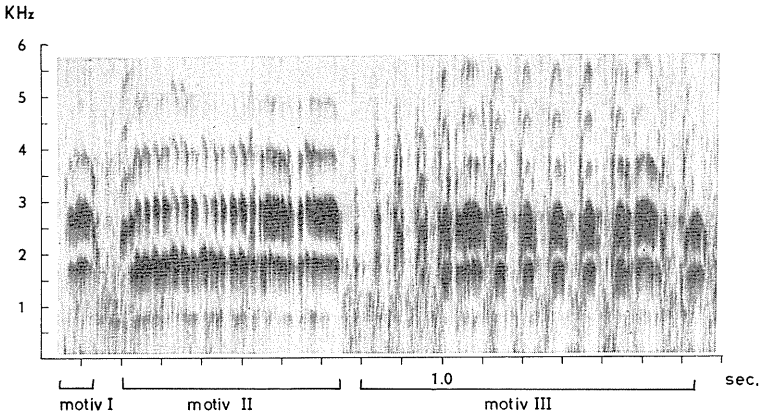


Fig. 23. Spectrogram of the »trilling call« of perched bird, Cape Atholl on the 22nd of June 1964. H. S. Wide M. L. 8. – Compare figs. 21 and 22 and note the great variation of the »trilling call« in length as well as the appearance of the various figures.

Fig. 23. Spektrogram af det »trillende kald« fra siddende fugl, Kap Atholl 22.6.1964, H. S. Wide M. L. 8. – Sammenlign figur 21 og 22 og bemærk den store variation, der er i »det trillende kald«. Både i længden og de enkelte figures udseende.

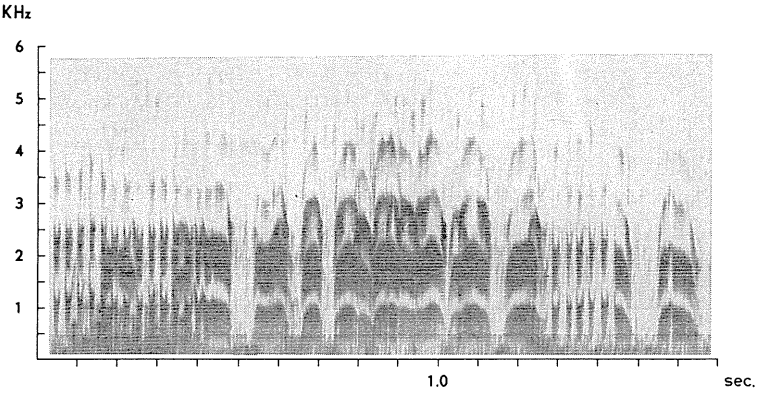


Fig. 24. Spectrogram of call of flying flock of Little Auks, about 15 individuals, at the time when the calls were loudest. – Compare this figure with the spectrograms 21, 22, and 23. The calls of the flying birds consist of »single calls« and »trilling calls«. Cape Atholl on the 1st of June 1964. H. S. Wide M. L. 8.5.

Fig. 24. Spektrogram af kald fra flyvende flok af Søkonge på ca. 15 stk. på det tidspunkt, hvor kaldene var kraftigst. – Sammenlign med spektrogrammerne 21, 22 og 23. De flyvende fugles kald består af »enkeltkald« samt af »det trillende kald«. Kap Atholl 1.6.1964, kl. 2.30, H. S. Wide M. L. 8,5.

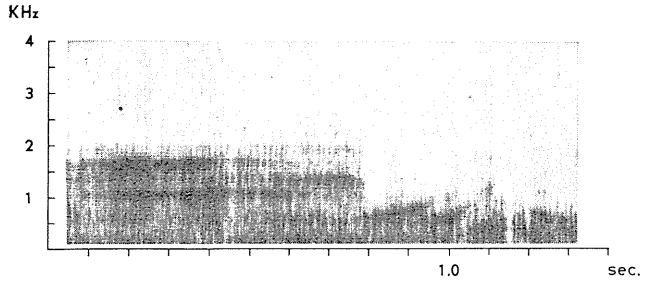


Fig. 25. Spectrogram of a large flock of Little Auks from a distance of half a mile to one mile. Note the great jump in frequency. Cape Atholl on the 2nd of June 1964. H. S. Wide, M. L. 8.

Fig. 25. Spektrogram af en stor flok Søkonge på 1–2 km afstand. Bemærk det store spring, der er i frekvensen. Kap Atholl 2.6.1964, H. S. Wide, M. L. 8.

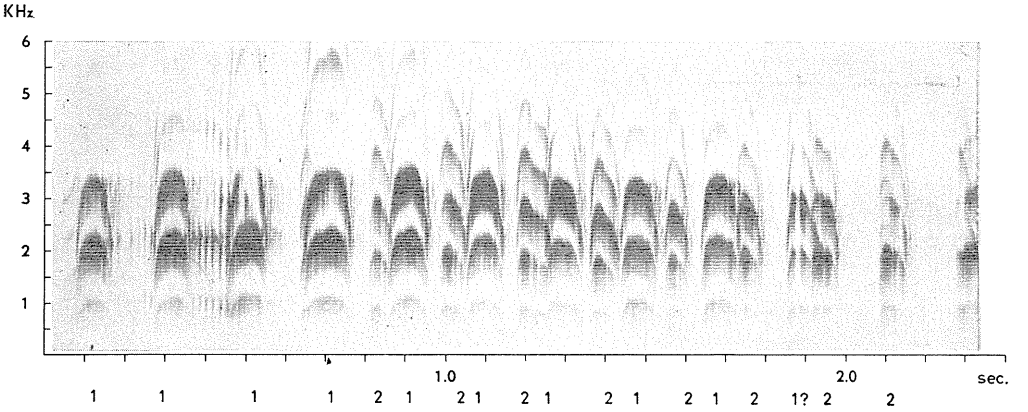


Fig. 26. Spectrogram of the »aggressive call« from a pair of Little Auks. The figures 1 and 2 in the spectrogram indicate the birds from which the various figures are assumed to originate. Cape Atholl on the 20th of June 1964. H. S. Wide M. L. 8,5.

Fig. 26. Spektrogram af det »aggressive kald« fra et Søkonge-par. Tallene 1 og 2 på spektrogrammet angiver, hvilke af fuglene de enkelte figurer antages at stamme fra. Kap Atholl 20.6.1964. H. S. Wide M. L. 8,5.

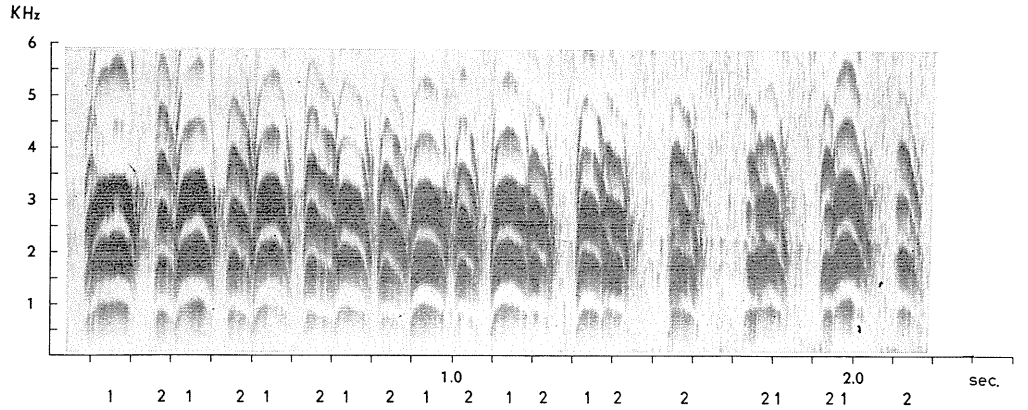


Fig. 27. Spectrogram of the »aggressive call« from a pair of Little Auks. Cape Atholl on the 19th of June 1964. H. S. Wide M. L. 7.5. The figures 1 and 2 indicate the birds from which the various figures are assumed to originate.

Fig. 27. Spektrogram af det »aggressive kald« fra et Søkonge-par. Kap Atholl 19.6.1964, H. S. Wide M L. 7,5. Tallene 1 og 2 angiver hvilke af fuglene de enkelte figurer antages at stamme fra.

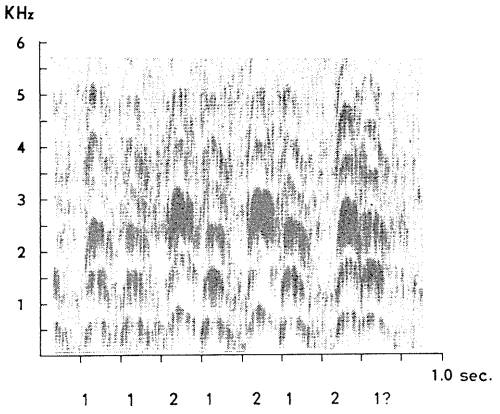
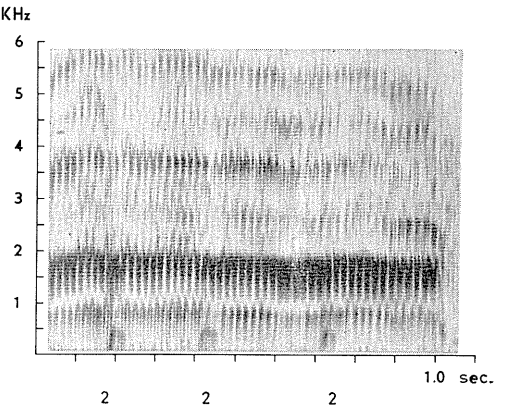


Fig. 28. Spectrogram of the »clucking call« of a pair of Little Auks. Cape Atholl on the 20th of June 1964. H. S. Wide M. L. 8. The figures 1 and 2 indicate the birds from which the various figures are assumed to originate.

Fig. 28. Spektrogram af det »klukkende kald« hos Søkonge-par Kap Atholl 20.6.1964, H. S. Wide M. L. 8. Tallene 1 og 2 angiver, hvilke af fuglene de enkelte figurer antages at stamme fra.

Fig. 29. Spectrogram of the »snarling call« of a pair of Little Auks which are searching for a nesting site. The serrated figures originate from one bird and those marked with 2 are figures from the other. Cape Atholl on the 23rd of June 1964. H. S. Wide M. L. 8.5.

Fig. 29. Spektrogram af Søkonge-pars »snerrende kald«, de er ved at søge efter rede. De takkede figurer er fra den ene fugl og de med 2 mærkede er figurer fra den anden fugl. Kap Atholl 23.6. 1964, H. S. Wide M. L. 8,5.



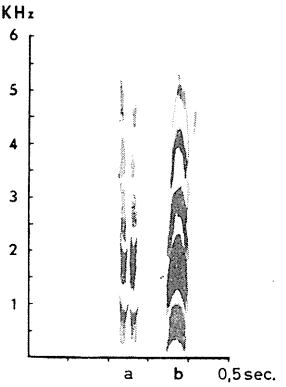


Fig. 30. Schematic drawing of the two types of figures found in all the spectrograms of the Little Auks.
a. The short, serrated figure.
b. The broad glissando figure.

Fig. 30. Skematisk tegning af de to figur-typer, der findes i alle Søkongens spektrogrammer.
a. Den korte, takkede figur.
b. Den brede glissando figur.

CONDITIONS OF BREEDING

There is no reason to suppose that the birds were paired up at my first visit to the breeding-ground in the beginning of June, as neither copulation nor any of the ceremonies described below were observed. On my second visit to the breeding-ground about the 20th of June many birds were heard from the nests in the scree and in the crevices in the rock. The greater part of the population was probably incubating at that time. Besides the incubating birds, I observed at the same time a very »active« group of birds, which were not incubating. These birds seemed partly to be pairing up, partly to be circling, partly to be searching for a nesting site.

One nest situated in old scree was examined the 19th of June. The tunnel to the nest was about 60 cm long. The nest was 30 cm below the surface of the ground and contained one egg. Contrary to an earlier description (SALOMONSEN 1950), maintaining that the Little Auk did not make a bed underneath the egg, it seems that in this nest pebbles were used as a bed as all the pebbles found under the egg were of almost the same size as the pebbles which the birds were seen to carry during their search for a nesting site (see Fig. 9 and 19), i.e. about $^1/_2 \times 1 \times 2$ cm.

BEHAVIOUR OF INDIVIDUAL BIRDS ON THE BREEDING GROUND

During the stay around the 20th June the activities and behaviour of the individual birds on the breeding-ground was studied. On the last two days observations were made from a hide, the other days without one, but in the same colony in the canyon seen to the left in Fig. 1.

In order to systematize these observations I have grouped and described the behaviour and the calls of the birds in the following sections:

Behaviour

- Peeping birds
- Behaviour of pairs
- Jogging gait
- Aggressive billing
- Copulation
- Collecting stones
- Behaviour when looking for a nesting site

Calls

- Single call
- Trilling call
- Flock singing

Calls of the pair

- Aggressive call
- Clucking call
- Snarling call

Peeping birds and resting birds

Both when the birds had settled on the rock ledges during the period of »landnam flights«, and when they were unpaired, they were seen to sit in a characteristic posture with the tarsus resting on the rock, the longitudinal axis being kept at an angle of 45° to the horizontal plane, and the neck being stretched to the maximum. The bird turned its head quickly and spasmodically from side to side, especially when other birds were passing. In this posture only the »trilling call« was heard, the bird then stretching its bill upwards at an angle of 45°, opening it a few degrees, and moving its throat rhythmically before the call (Fig. 2). I have not observed that birds perched in pairs should have assumed this posture and called in this way.

Behaviour of pairs

During observations about the 20th of June the birds in pairs was noticed more and more frequently every day. There also seemed to be a tendency for more birds to appear in pairs late than early in the morning. At that time more than half of the visible birds were distributed in pairs. They then either sat paired in groups on

a definite part of the snow drift or several together on rock ledges (resting-places) – (Figs. 13 and 14) – or they perched scattered on the rocks or in the scree. Copulation was only observed on the snow drift.

When the birds were resting on the ledges in pairs, they mostly perched side by side, turning their bills away from the mountain side (Fig. 15). In the resting position the birds either sat with their heads stretched in continuation of belly and tarsus on the support (Fig. 4), or they sat in a position in which their heads were raised, but their necks curved (Fig. 3). When the pair was sitting like this a weak, clucking sound could be heard at intervals at a short distance.

When there was a strong wind or when the birds had been scared (e.g. by Glaucous Gulls (*Larus hyperboreus*)), they particularly frequently assumed the position in which the head was stretced in continuation of the body (Fig. 4). These positions were interrupted for short periods by »aggressive billing« when the birds were sitting in pairs (Fig. 6). I did not observe sleeping birds.

Jogging gait

In the group of Little Auks which was watched in activity from the tent on the snow drift from the 20th to the 22nd of June, a very characteristic gait, pictured in Figs. 5, 13, and 16, was seen 30–40 times.

In this manner of walking, which was slow, jogging, the body wriggled from side to side in time with the walk, the head and bill pointed towards the ground, and the bird moved slowly forward. It only took some four or five steps in this posture. The body was kept either quite or almost vertical. The wings hung down so that the wing tips were in front of the tail head, and the tail was either stretched in continuation of the body or bent a little upwards.

These jogging birds were only observed on the snow drift, and the posture was seen when the »jogging« bird approached another bird, which might react in two ways: it either turned away as was commonest, or it moved in the same gait, but with its tail bent upwards (the female?). As far as I could hear, the birds were silent during this kind of walking.

»Agressive« billing

The commonest voice heard from the breeding-ground was the »trilling call«, but almost as frequently a loud, short, hoarse call was heard which mostly (always?) came from birds which were sitting in pairs on the ledges or on the snow drift. The throat moved in and out in time with these sounds.

Frequently the birds had sat side by side for a considerable time in a resting position before they behaved in this way. They had their open bills turned towards each other and seemed to touch each other with their bills (Fig. 6 and Figs. 17–18). Body and neck were held in continuation of one another in a horizontal position, and the birds rested on their tarsi. On a single occasion, however, they stood on tiptoe. The wings were held in a downward position so that the tips were in front of the tail head and the tail was bent upwards. They stood opposite to each other like that for up to somewhere between a half and a full minute, finally head and bill being moved in the posture spasmodically from side to side.

This behaviour was the initial proceeding all the copulations observed. It is difficult to state how often this posture was seen (or heard), but it was hundreds of times. It must be this behaviour which has been described by FOSTER *et al.* (1951). Once this behaviour was observed in a single bird which was perched on a rock ledge. It walked towards another bird with this behaviour, which caused the other to fly away.

On the snow drifts the birds in pairs

were seen to make movements with their bills in the surface of the snow, the head being moved spasmodically from side to side so that the bill just touched the surface of the snow. The movements were so fast that the snow was spattered away from the birds. This behaviour was seen before or after aggressive billing, the pair then facing one another. One cannot preclude the possibility that they had snow in their bills or their laryngeal pouches before or after this behaviour, partly because the bills were open a few degrees when moved in the snow, partly because the laryngeal pouch seemed to be especially distended in the case of this posture. – This behaviour was observed 40–50 times.

Copulation

During my stay on the breeding-ground on the 19th to the 23rd of June I observed about 10 completed copulations and a similar number not completed. Copulation was only seen on the sloping surfac of the snow drift and on the stones lying on it, the birds being seen to copulate on the stones on two occasions. Copulation was performed after the birds had been sitting for some time together in the position of rest. It was introduced by their performing »aggressive billing« two or three times (Fig. 6). Then the male slowly mounted the back of the female from behind or obliquely from behind (Figs. 7–8). The wings of the male were stretched down along the sides of the female, and the male pressed his tail against the underparts of the female, which were bent upwards and a little aside. For some seconds the heads were turned towards each other, the female turning her bill towards the male so that their bills touched. The male stood on the female's back for about 30 seconds. During one copulation the male was seen to make flying movements with its wings, obviously in order to keep its balance.

Immediately after the copulation they again performed »aggressive billing« twice or three times. Then the birds walked about rather restlessly for some moments, and finally they perched and preened themselves. – I heard no sounds during the copulation, which may be due to the fact that I only saw copulation at distances of more than 20 m.

Collecting stones

On five or six occasions on the 22nd of June I saw two birds »presenting stones« to one another, the stones being held fixed with the bill, so that most of the stone was in the oral cavity (Figs. 9 and 19). On the 21st of June a pair was seen which had been resting on a rock behind the tent for a considerable time. First, the birds two or three times performed »aggressive billing«, after which one of them (the male?) stepped down from the rock in the »jogging« posture and picked up a stone. Then it went up again in order to »present« the stone to the female, but immediately afterwards it dropped the stone. A few minutes later the same performance was repeated, and a little later I saw the birds walking together between the big stones looking into the spaces between them (search for a nesting site?).

On the other occasions on which I saw birds with stones in their bills, this was observed (and photographed) for a few moments, after which the birds flew away or disappeared. However, one bird of the pair described below (see chapter »Behaviour during the search for a nesting site«), was seen with a stone in its bill for five to ten minutes before the search for a nesting site was observed.

Behaviour during the search for a nesting site

On one occasion I had an opportunity to watch the behaviour of the birds while searching for a nesting site, a pair which were staying in front of the tent on the 23rd of June between 0730 and 0830 hours. They were resting most of the time,

and at intervals of about five minutes they performed »aggressive billing«. Once I saw one of the birds with a pebble in its bill (Fig. 19), and somewhat later I heard a very weak, snarling sound, which was later repeated many times, particularly after the pair had disappeared in between the stones immediately in front of the tent. For a moment I saw the birds while this sound was being produced, one bird was lying on the ground with the feathers of the underparts spread and the other was standing beside it. The lying bird made some quivering movements of the whole body while the snarling sound was heard. It was as if it had settled on an egg. Immediately after this behaviour the pair disappeared between the rocks in front of the tent, so that I was not in a position to observe what they were doing, but the snarling sound was still heard.

VOICES OF THE LITTLE AUK

With a portable tape recorder, Uher Report 4000, I made records of the calls of the Little Auk on the breeding-ground of altogether about an hour and a half in duration during both my stays there, about the June 2nd and about 20th. I used a Sennheiser microphone MD 405, which during most of the recordings was placed in a 70 cm parabolic screen. This was used i.a. because there were many disturbances during the recordings, the noise of the wind, of running water, of the lapping of waves, etc. Only when the recordings were made from the observation tent the microphone was used without a screen.

During the recordings, dictated notes about the postures and other behaviour of the birds were recorded simultaneously. In this way and on the basis of my notes it has been possible to identify five audibly different utterances of the Little Auk. These types have been spectrographically analyzed and are described in the following sections. I have endeavoured to have at least three recordings of each of the types of voice spectrographically analyzed in order in this way to eliminate the errors arising from the possibility that a single spectogram should not show the »typical« call. The selection of the calls which were spectrographically analyzed was made auditively by my first listening to all the records and then selecting the technically best and auditively most typical calls.

The analyses were made with a Kays spectograph, the apparatus having been used in accordance with the instructions supplied by the manufacturer. The technique used for each analysis is indicated on each spectrogram.

The nomenclature used for describing the spectrograms is that compiled by BONDESEN & DAVIS (1966).

The single call (The warning call)

In the night between 1st and 2nd June I recorded a call which I have heard only once. A single bird during a one to two minutes' stay on the surface of the water about 20 metres from the observation tent emitted a hoarse, unmelodious call twice. The bird seemed very restless and perhaps for some reason had got separated from the flock, so that what I heard was probably a warning call (or distress call).

The spectrogram (Fig. 20) appears as a single glissando figure of 0.15 and 0.12 seconds in length.

The frequency of the fundamental is between the lowest tone recordable and 1 kc., and it is possible to show the presence of up to 12 harmonics. The second harmonic has the greatest intensity, an intensity greater than that of the fundamental. The third harmonic is as loud as the fundamental. The spectrographic figure for this warning call is of the same type, but of varying duration, as that found in nearly all the calls of the Little Auk.

The trilling call

The predominant utterance on the breeding-ground at the beginning of the breeding-season is the trilling call. It is heard from both sitting and flying birds, and there can be little doubt that it is this voice which is described in the literature as the voice of the Little Auk (see p. 20). On my visit about the 1st of June I heard this call from the circling and sitting birds. During my visit on the 20th of June this call was only heard with certainty from single birds, which were sitting either on the nests or unpaired on the rocks. In the spectrograms (Figs. 21, 22 and 23) this call has been analyzed. The spectrograms were recorded from calls of birds sitting on rock ledges and, one of them, from a bird sitting on eggs. On one occasion a bird emitting the trilling call was watched at close range. It was sitting alone at the extreme edge of a ledge with its neck stretched to its maximum, the bill being directed upwards by 45° and about 30° open. At the same time that the voice was heard, the throat was moved synchronously with the rhythm of the call (Fig. 2).

The spectrographical analysis of this call (Figs. 21, 22 and 23) shows that the call consists of a phrase with three motifs. These motifs, again, are composed of a number of figures. The lengths of the calls range from 1.15 to 3 seconds, measured in 8 different spectrograms. The three motifs were heard to be clearly distinct. In figs. 21, 22 and 23 it is indicated how the spectrograms of this call have been divided.

The first motif is the shortest, ranging from 0.18 to 0.32 seconds in 6 analyses. It consists of a number of figures with rapidly rising and falling frequencies, the highest points of these ranging from 1.1 to 1.8 kc. The figures are reminiscent of the figure in the following motif, but in this first motif there is greater variation in the frequency of the figures than in the second motif. Furthermore, there is in most of the spectrograms, at both the beginning and at the end of the motif, a broader figure, which is glissando-shaped.

The second motif, which is heard as a loud, snarling sound, follows between 0.08 and 0.2 second after the first motif. It consists of segments of the same structure, frequency, and rhythm as those of the first motif. – The length of the motif in six spectrograms has been measured to range from 0.55 to 0.65 second. The segments appear in a regular thythm of about 19 in 0.5 second. – In one of the spectrograms (Fig. 22) these figures show a slightly rising curve, so that the middle figures have a higher frequency than the first and last in the motif. In the same way as in the first motif this second motif begins and ends with a broader figure, which is reminiscent of the figures in the following motif.

The third motif consists of 3 to 13 figures (in 5 spectrograms). These figures appear at constant time intervals of 0.04 to 0.05 second between each two figures.

The various figures range in length from 0.01 to 0.1 second. The form of the figures must be described as a glissando figure with many harmonics, – up to some 8 to 10. The frequency of the fundamental is somewhat lower than that of the first and second motif, so that the frequencies of the figures range from the lowest one measureable to 1 kc.

The various figures thus recall in frequency as well as in form the figures described under the heading of »The single call«. A comparison of the »trilling call« which have already been examined and which must be assumed to originate from different birds, shows that there is a very wide range of variations, especially as regards the length of the call and the duration of the various motifs and also the appearance and lenth of the various figures. The pitch (frequency) of the fundamental (0.1 – 0.2 kc.), however, seems to vary but little, and all spectrograms show that the second harmonic is louder than the third one.

Fig. 22 shows the spectrogram of a »trilling call« of a bird of which two other spectrograms have been examined. The spectrograms for this bird have much in common and seem to be very different from the others, which would seem to indicate beyond any doubt that each individual has its own characteristic calls. The agreement between calls from the same bird is especially evident by the fact that the calls are of the same length. The appearence of the figures is of the same character, and the number of figures in the motifs is almost the same.

Flock singing

During my stay on the breeding-ground about the 1st of June, the singing of the flocks of Little Auks, as described in a previous chapter, was heard and tape-recorded. These flocks circled over the breed-

ing-ground while the same voice was heard as those heard from the single birds on the rock ledges (»The trilling call«). At a distance the flock singing was heard as something between the screams of gulls in the distance and a siren, there being a sudden change of frequency and of force in the singing, which was clearly audible. At closer quarters this rise and fall was not heard, as it was to a higher degree possible to distinguish the utterance of the various individuals. In the tape-recordings of the flock singing at a distance of about one mile the calls of presumably tens of thousands of birds were recorded. When the various flocks of Little Auks were heard at closer quarters, the components of the flock song were heard, it being possible to distinguish the »trilling call« of the various birds. There does not seem to be any system in this call other than that the various individuals took it in terms to emit the call all the time.

Fig. 24 shows a spectrographical analysis of the calls from a flock of 10–15 birds passing at a height of 20–25 m. above the microphone. The spectrogram is composed of many figures which often are coincident, and the same figures have been found as those which have been described and pictured from the »trilling call« (Figs. 21, 22, and 23), as well as some single calls. In a single record it was possible to count about 20 »trills« in 72 seconds from a single flock. Unfortunately the exact size of this flock is unknown, but at any rate there were much less than a hundred individuals. I did not succeed in observing the apperance of the birds when emitting the call during the flight.

The spectrogram in fig. 25 shows an analysis of some of the flock song at a distance of about one mile, in which thousands of birds were heard. In the spectrogram it is seen how the flock song manifests itself by sudden jumps of frequency every second. When the sound of the birds was loudest, the frequency was between the lowest one recordable and about 2 kc., and when it was weakest it was between the deepest one recordable and about 1 kc. It cannot, however, be decided whether the birds were silent in the »weak« periods or their voices merely were deeper so that what was recorded in the spectrogram was »noise« during these periods.

I am unable to decide what the reason is for this periodicity and these »jumps of frequency«, but there seem to be the following possible of explanations of the phenomenon:

1) That the large numbers of birds have a periodicity in their calls whith cannot be heard at close quarters, e.g. by the fact that they are capable of varying the relative force of the second and the third harmonic, as might be suggested by the possible shift of frequency (from 1 kc. to 2 kc.). However, it seems hardly possible that ten thousands of birds should be able to change in fractions of seconds in this way.

2) The second possibility is that it is a case of a physical phenomenon arising from the fact that the flocks are circling regularly and that the birds thus periodically turn their heads away from the listening post.

3) The third possible explanation is that it is a case of interference because of the flying speed, so that the frequency becomes higher when the birds are approaching, and lower when the birds are flying away from the listener.

As far as I can see, the fact that the frequency changes so fast tells against the third explanation. The facts are probably explained best by the possibilities indicated in (2), even though the fact that the change of frequency takes place regularly every second does not fit in well with the circling flight of the birds.

Calls of the pair

On the many occasions when I saw and listened to the Little Auk during the days around the 20th of June, I noted that the birds when paired at any rate used the following three types of calls: the aggressive call, the clucking call, and the snarling call.

The aggressive call

During the »aggressive billing« (see p. 34)

a number of calls were heard which were by far the most predominant sounds during my last stay on the breeding-ground. These sounds were almost only heard from birds which appeared in pairs, whether on the snow drift, on the rock ledge, or perhaps in the nesting holes, and they were not heard from flying birds. Furthermore, the call was heard in connexion with copulation. As described above, this utterance sounds like a number of hoarse, unmelodious calls of a few seconds' duration.

During the first and last sections of this series of calls, the individual call is mostly shorter and appears at longer intervals than in the middle section. By listening both to the tape-recording and in nature I found that two individuals were mostly heard together, so that the call was a duet. At the beginning and the end of the series of calls the voices of the individuals were heard separately, while the middle part of the series of calls were coincident, which would give a strong auditive impression.

The spectrographical analyses of seven series of calls, two of which are indicated in figs. 26 and 27, show that these series have a very characteristic appearance, and furthermore the analyses confirm that it is the voices of two different individuals which are being heard. The lengths vary from 2.1 to 3.7 seconds in five series of calls. Each series consists of 20–30 figures, and the individual figures are of the same type as the figures described above under the heading of »The single call« and in the third motif of the »trilling call«.

The figures in the series of calls are turned upwards in glissando shape with a fundamental that has frequencies from the lowest measurable one to about 1.2 kc., and with a large number of harmonics – up to *10*.

The second and the third harmonics of these figures are louder than the fundamental, and in several spectrograms even the fourth and the fifth harmonics are as loud as the fundamental, in a single spectrogram even louder. At the beginning and the end of the spectrogram there is a longer distance between the figures than between those in the middle of the spectrogram, the figures themselves are also shorter at the beginning and end. In the middle the figures are in a regular timing with the same time interval between them.

In the spectrogram (figs. 26 and 27), the figures which are presumed to belong to two different individuals have been marked 1 and 2 respectively; with the figures for which it does not seem possible to decide from which bird the call derive, this is indicated by a question mark.

In determining from which bird the individual figures derive, I have made use of details in the appearance of the spectrogram which it has been possible to recognize from figure to figure. In fig. 27 it is seen particularly clearly that the aggressive call can be a duet between two individuals in which their calls alternate regularly or are coincident. The »coincident« figures are especially seen in the middle of the series of calls, where the call is heard most intensely.

The clucking call

When the pair of Little Auks were sitting quietly together on the rock ledges, I often heard some weak, clucking calls of the same force as the taking-off call. These clucks, however, could only be heard at a distance of a few metres, in contrast to the call described in the preceding chapter, which could be heard up to a distance of 100–200 m. The spectrographic records of these clucks are shown in fig. 28. They consist of a series of figures the appearance of which is somewhat reminiscent of the figures in the preceding section, but the figures in these calls are of shorter duration – they are weaker – and the fundamental is relatively louder by comparison with the harmonics than in the previously described figures of the same glissando type. A closer analysis of the figures shows two types, which is proably due to the fact that the two birds call alternately. In fig. 28 I have marked the figures which I suppose to derive from one bird with 1, those from the other bird with 2. In a single one of the spectrograms this alternation between the calls of the birds appears as a duet in the same way as described in the preceding section. On several occasions I have heard these clucking calls gradually change into the series of loud, hoarse calls described in the preceding chapter.

In several spectrograms the same type of figures has been registered as described above, e.g. during taking-off and during flight in small flocks, but as the call in these situations has a very low intensity in relation to the background noise, the spectrogram is of poor quality.

The snarling call

The pair which I observed searching for a nesting site in the morning of the 23rd of June and the behaviour of which has been described in the chapter on searching for a nesting site, had, as mentioned above, a call which I heard on this occasion only. From this pair partly the clucking sounds were heard which were described in the preceding chapter, partly a snarling sound which was produced when the pair were searching for a nesting-site near the nest entrance, and when one of the birds lay down on the ground and made quivering movements with its body (the incubation movement?).

Fig. 29 shows a spectrographical analysis of the calls of the particular pair in this situation. By listening to the call and reading the spectrogram, I think it is safe to say that both birds were calling in the situation in question, one bird emitting the snarling call, which in the spectrogram has been recorded as a row or chain of segments, the other bird producing clucking call-notes like the figures described in the preceding chapter (in fig. 28).

The snarling sound consists of a number of uniform segments emitted in a constant rhythm. This sound shows on the spectrogram with harmonics. The force of the fundamental is the same as that of the third harmonic, and the various segments appear in a regular timing with 26–28 per second.

The highest frequency of the fundamental does not exceed 1 kc. The spectrographical picture reminds one rather of the snarling part of the trill in the 1st and the 2nd motif, but differs from it on several points; the sound is heard much more faintly and therefore is of much less acoustic intensity, and the frequency is lower.

DISCUSSION

The biological situations of the Little Auk as described in the present paper are based on so comparatively short an observation period that I shall omit a closer evaluation of these observations, e.g. by a comparison with other Alcidae. The utterances of the Little Auk seem both relatively and absolutely of such strength and frequency that probably no other Alcidae gives such loud vocal expression.

In spite of the great variation of the calls of the Little Auk the systematization and description of the various types of call did not present serious difficulties when the auditive impression was seen in relation to the »ethological« situation. There are certain indications that in the tape-recordings made at the beginning of the breeding season I have not obtained all the calls of the Little Auk and probably several of the types of call described above can be heard in other ethological situations than those I have been able to establish. Thus NORDERHAUG has informed me (in litt.) that at the end of the breeding season (July/August) in Spitzbergen, he has heard the aggressive call being used very frequently in situations which can hardly have any connection with the pairing-up. Both spectrographical and auditive analyses of the various types of call of the Little Auk show a very wide range of variations. The explanation of this fact may perhaps be the great individual differences in the utterances of the Little Auk (see e.g. figs. 21, 22, and 23). The most conspicuous variations in the different types of call have been described in the preceding chapters, and it seems that the variations occur particularly in the lengths of the individual calls and as in the apperance and lengths of the individual figures and, to a lesser degree, in variations of the frequencies.

From a perusal of the spectrographically analyzed calls of the Little Auk, it is found that all utterances can be divided into

two »types« of the smallest units (figures). In fig. 30 these two types of figures have been drawn. The broadest of these (fig. 30b; the »glissando figure«) is characterized its upward curved form, i.e. there is a gliding shift of frequency in the call. In all the spectrograms examined the second and the third harmonics are seen to be louder than the fundamentals.

The length of this glissando figure varies very much in the same individual, but the form of the figures according to the present material seems to have much about the same appearance for the various individuals.

The second unit (figure) which is a component part of the spectrographical picture of the voice of the Little Auk, is shown in Fig. 30 a. It is a figure and perhaps in some of the spectrograms a segment, in that it is not separated from the units near it. The appearance of this figure differs very much from the glissando figure partly by being much shorter and partly by having a different shape.

All the types of call described in the Little Auk are thus different variations of these two units. They vary in breadth and in the number and strength of the harmonics, but the frequencies are almost constant. A fact like this, viz, that the calls of a species of bird consist of two so simple figures on which the rest of the material of calls has been built up, has, to my knowledge, never previously been established in any species. (See i.a. BUSNELL 1963, THORPE 1961). It should, however, be noted that as yet no spectrographical analyses have been published of the complete or near-complete sound repertoire of any gull, wader, or Alcid. The duets which both auditively and spectrographically have been sung by the pair of Little Auks, (see figs. 28, 29, 26, and 27) are very interesting. They clearly and objectively give an impression of an »emotional« interplay between the two birds, at the same time, showing that the male and the female both use the same calls. These spectrograms also clearly show small differences in the forms of the figures produced by the various individuals.

SUMMARY

The author describes observations of the behaviour of Little Auks on a breeding-ground in the extreme Northwest of Greenland, Cape Atholl, in the Thule District, where a minor colony of Little Auks was visited during two periods, viz. from the 30th of May to the 2nd of June and from the 19th of the 23nd of June 1964. The behaviour of the birds was watched at close quarters in the part in the colony where they were most numerous. Extremely little has previously been known about the behaviour of the Little Auk, especially at the beginning of the breeding season. The author's observations and conclusions fall into the following sections:

1) A description of the behaviour of the birds at the beginning of the breeding season, including conduct during the pairing up, copulation, and the search for nesting sites.

2) A description of the »landnam« flight and circling at the beginning of the breeding season.

3) Using tape-recording and spectrograms as a basis a description is given of the various utterances of the birds heard in the various ethological situations; they are divided up into the following auditivele differents types: The trilling call, the aggressive call, the single call, the clucking call, and the snarling call.

4) There seem to be indications that the breeding-grounds of the Little Auks are divided into many minor colonies, no

doubt dependent on the topographical structure of the breeding-ground.

5) Pairing-up and copulation were watched a large nummer of times on a particular part of a very steep snow drift and on stones there.

6) Spectrographic analyses have shown the vocal utterances of the Little Auk to be relatively simple in that the elements of all the types of call examined proved to consist of one or other of two types of figures, variations being chiefly in time and timing or in number.

7) The aggressive and the clucking calls can auditively as well as spectrographically be shown mainly to be »duets« between pairs.

8) By spectrographical analyses it was shown both in details – in the various figures – and in length, rhythm, etc., of a single type of call that there are differences, which are interpreted as differences in voice in the various individuals. Only one of these differences can be distinguished by the human ear.

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DANSK RESUMÈ

Nogle iagttagelser af Søkongens (Plotus alle) *adfærd på ynglepladsen – særligt med hensyn til stemmegivning.*

Indledning

I maj og juni måned 1964 havde jeg i to perioder – 30.5. til 3.6. og 19.6. til 23.6. – lejlighed til at foretage iagttagelser, fotograferinger og båndoptagelser på en ynglepladsfor søkonge i Thuledistriktet i Nordvestgrønland. De fleste af iagttagelserne blev foretaget på en sydvendt klippeskrænt ca. 60 m over havet (fig. 10).

Litteratur

Søkongens ynglepladser har været besøgt af mange ornithologer og i særlig grad på Grønland, Spitzbergen og Frantz Josephs Land (SALOMONSEN 1950, LØVENSKIOLD 1964).

Der findes dog kun korte beskrivelser af fuglenes opførsel på ynglepladsen.

Kredsflugten

Efter at have opholdt mig to døgn i yngleområdet uden at have set nogle søkonger, blev det stille vejr natten mellem 2.6. og 3.6., og søkongen kom da til land i store flokke. I tusindsvis kredsede fuglene over havet, idet de langsomt nærmede sig kysten. På afstand hørtes flokkenes stemmer som en mellemting mellem langstrakt mågeskrig og en dyb sirene. Flokkenes antal steg langsomt i løbet af en til to timer, og jeg vil anslå, at det drejede sig om titusinder af fugle (fig. 11 og 12).

Flokkenes størrelser skiftede hele tiden. De fløj i en højde af 2–300 m, d.v.s. i højde med de højeste punkter på kysten. Efterhånden som flokkene kredsede om de enkelte klippepartier, blev kredsene mindre og flokkene mindre. Midt

på natten satte en del af fuglene sig på klippeafsatsen ved de kommende redeområder. Efter kl. 6 vendte en stor del af fuglene tilbage til havet, men en del blev tilbage på ynglepladsen, og disse opholdt sig her til i hvert fald kl. 9.

Koloniopdeling

Ved begge mine besøg i søkongekolonien på Kap Atholl fik jeg et bestemt indtryk af, at fuglenes flyvninger og kredsninger over ynglepladserne foregik på en »lovmæssig« måde. På fig. 1 har jeg skematisk indtegnet de iagttagne flyveruter for 2 flokke med angivelse af de omtrentlige ynglesteder. De to indtegnede grupper af fugle holdt til på siderne af to V-formede canyons, der strakte sig 200–300 m op fra kysten, og der blev hverken ved iagttagelse af fuglenes flugtmåde eller på anden måde konstateret, at der var »forbindelse« mellem de to grupper af fugle (der var 400–500 individer af hver).

På grundlag af disse iagttagelser vil jeg derfor antage, at søkongens yngleområde er opdelt i større eller mindre kolonier, bestemt af stedets topografiske forhold.

Døgnrytmen i kolonien

Under observationen i Thuleområdet blev der observeret en døgnrytme i fuglenes aktivitet på ynglepladsen, således at fuglene kom til land en eller to timer efter midnat, og herefter er der en stor aktivitet hele natten og tidligt om morgenen (et forhold der var grønlændere bekendt). Denne aktivitet aftog langsomt sidst på formiddagen, og ca. kl. 13 havde alle de synlige fugle forladt ynglepladsen.

De enkelte fugles opførsel på ynglepladsen

I dagene omkring 20.6. foretog jeg observationer af de enkelte fugles aktivitet og opførsel på ynglepladsen. De to sidste dage foretoges observationerne fra et telt, de andre dage blev der observeret uden telt, men i den samme canyon (fig. 1).

Følgende adfærdsformer blev iagttaget og delvis fotograferet:

Kiggende fugle. Både når fuglene havde sat sig på klippeafsatserne i »landnamsperioden«, og når de sad uparrede, sås de siddende i en karakteristisk stilling (se fig. 3). I denne stilling hørtes kun det »trillende kald«, idet fuglen så strakte næbet opad i en vinkel på 45° og åbnede det nogle få grader og bevægede struben rytmisk mod kaldet (fig. 2).

Parvis adfærd. Parvis optræden af fuglene sås hyppigere og hyppigere for hver dag i perioden omkring 20.6. De sad enten i grupper på et bestemt afsnit af snefanen eller flere sammen på klippeafsatser. Parring blev kun iagttaget på snefanen. Når fuglene sad, som vist på fig. 3, 4, 15, var disse stillinger på klippeafsatserne de foretrukne, og de blev i korte perioder afbrudt af kaldet: aggresiv næbning. På fig. 5, 13 og 16 ses fugle i en langsom gangart som kaldes luntegangen. Denne er sandsynligvis en adfærd der benyttes ved udparringen.

Den aggressive næbning. Den almindeligste stemme der blev hørt på ynglepladsen, var fuglenes trille, men næsten lige så hyppigt hørtes et kraftigt, kortvarigt, hæst kald, der oftest kom fra fugle der sad parvis på klippeafsatserne eller på snefanen overfor hinanden i en karakteristisk stilling. I takt med disse lyde bevægedes struben ud og ind. Fuglene havde det åbne næb vendt mod hinanden og de syntes at berøre hinanden med næbbet (fig. 6, 17 og 18).

Parring. Parring blev kun iagttaget på snefanens stærkt skrånende flade og på de sten der lå på denne. Parringen foregik efter at fuglene havde siddet sammen et stykke tid i hvilestilling. Den indledte med at de 2–3 gange foretog »aggressiv næbning« (fig. 6). Derefter gik hannen langsomt op på hunnens ryg bagfra, eller skråt bagfra (fig. 7, 8,) og parringen foregik.

Stentagning. Ved 5–6 lejligheder så jeg den 22.6. to fugle »præsentere sten« for hinanden, idet stenene holdtes fikseret med næbbet, så det meste af stenen var inde i mundhulen (fig. 9, 19). Denne adfærd skal sandsynligvis ses i sammenhæng med at parret søgte efter rede.

Stemmer

Med en transportabel båndoptager –Uher – optog jeg ialt 1½ times båndoptagelser af søkongens stemmer på ynglepladsen, både under opholdet omkring 2.6. og under opholdet omkring 20.6. Jeg benyttede en Sennheiser mikrofon MD 405, der under de fleste af optagelserne var anbragt i en 70 cm parabolskærm. Under optagelserne blev oplysninger om fuglenes stillinger og anden opførsel dikteret ind på nogle af optagelserne. Derved, og på grundlag af nogle af mine notater har jeg kunnet identificere 5 hørbart forskellige stemmeytringer hos søkongen. Alle disse typer er spektografisk analyseret og beskrevet. På figur 20 ses et spektogram af et kald fra en meget urolig fugl (advarselskald), det fremtræder som en enkelt glissandofigur af en længde på 0,15 og 0,12 sekunder.

Det trillende kald

Den mest dominerende stemme på ynglepladsen i begyndelsen af yngletiden er det trillende kald. Det hørtes både fra siddende og flyvende fugle, og det er sikkert denne stemme, som er beskrevet i litteraturen som søkongens stemme. Under besøget omkring 1.6. hørte jeg dette kald fra de

kredsende og siddende fugle. På spektogrammerne (fig. 21, 22 og 23) er dette kald analyseret, og på fig. 2 er der afbildet en fugl som kommer med dette kald, og struben bevægedes samtidig. Ved den spektografiske analyse af dette kald ses det, at den består af en frase med 3 motiver. Disse motiver er igen sammensat af en række figurer. Kaldets længde varierer fra 1,15 til 3 sekunder.

Floksangen

Under opholdet på ynglepladsen omkring 1.6. hørtes som beskrevet i et tidligere kapitel floksangen fra søkongeflokkene. Disse flokke kredsede over ynglepladsen samtidig med, at der hørtes den samme stemme som hørtes fra de enlige fugle på klippeafsatserne. På afstand hørtes floksangen som en mellemting mellem et mågeskrig og en sirene, idet der var et pludseligt frekvensskifte og styrkeskifte i sangen, som var tydeligt hørbar. Ved optagelserne af floksangen på ca. 2 km afstand den 1.6. er der formodentlig optaget stemmer af titusinder af fugle. På fig. 24 ses der en spektografisk analyse af kaldene fra en flok på 10–15 fugle, der passerer i en højde på 20–25 m over mikrofonen. Man finder de samme figurer som er beskrevet og afbildet fra det »trillende kald« på fig. 23. På spektrogrammet fig. 25 ses en analyse af en del af floksangen på 1–2 km afstand. På dette ses den foran nævnte periodiske frekvensskifte. Hvad grunden til disse frekvensspring er, er jeg ikke i stand til med sikkerhed at afgøre, men dette diskuteres i afhandlingen.

Parrets stemmer

Ved de mange lejligheder, hvor jeg så søkongen i dagene omkring 20.6., bemærkedes at fuglene parvist, i hvert fald anvendte følgende 3 typer af stemmer:

Det aggressive, klukkende og det snurrende kald.

Det aggressive kald

Ved den aggressive næbning hørtes en række kald som var langt den mest dominerende lyd under det sidste ophold på ynglepladsen. Denne lyd hørtes kun hos fugle der optrådte parvist, hvad enten det var på snefanen, på klippeafsatsen og evt. i redehullerne og hørtes ikke hos flyvende fugle. Desuden hørtes lyden i forbindelse med parringen. Denne stemme hørtes som en række hæse, umelodiske kald af nogle få sekunders varighed. Den spektrografiske analyse af syv kaldrækker, hvoraf 2 er angivet på fig. 26 og 27, viser at disse kaldrækker har et meget karakteristisk udseende, foruden at analysen bekræfter, hvad der kan høres på båndoptagelserne, at der er to forskellige fuglestemmer i disse.

På spektrogrammerne er de figurer markeret, der hører til den samme fugl – med tallene 1 og 2, og ved de figurer hvor man ikke mener at kunne afgøre, hvilken fugl kaldet stammer fra, er angivet et spørgsmålstegn. På fig. 27 ses det særligt tydeligt, at de aggressive kald kan være (og oftest er) en duet mellem to fugle, hvor deres stemmer skifter regelmæssigt eller er sammenfaldende.

Det klukkende kald

Når søkongeparret sad parvis stille på klippeafsatserne, hørtes der ofte nogle svage, klukkende kald af samme styrke som opflyvningskaldet. Disse kluk kunne imidlertid kun høres på få meters afstand. Den spektrografiske optagelse af disse kluk er angivet på fig. 28. De består af en række figurer, hvis udseende minder en del om figurerne i det foregående afsnit beskrevne kald. På fig. 28 har jeg mærket de figurer, som jeg mener stammer fra den ene fugl med 1. og fra den anden fugl med 2.

Det snurrende kald

På fig. 29 ses spektrogrammet af et svagt snurrende kald, som kun hørtes fra søkongeparret når de søgte efter rede ved observationsteltet.

På fig. 30 ses en skematisk tegning af de to mindste enheder (figurer) som alle de ovenfor beskrevne kald består af, og det påviser i artiklen, at da der ikke hos nogen fugl hidtil er beskrevet et så »enkelt« sammensat stemmerepertoire.

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Invasion af Silkehaler *(Bombycilla garrulus)* i Danmark 1966-67

Af
NIELS OTTO PREUSS

(With a Summary in English: Influx of Waxwings (Bombycilla garrulus) *in Denmark 1966–67.)*

Efter den store invasion af Silkehaler (*Bombycilla garrulus*) i 1965–66 var det overraskende, at der i oktober 1966 igen blev meldt om Silkehaleflokke i Danmark. Desværre blev jeg først ret sent klar over, at der var tale om en ny invasion under udvikling, hvilket medførte at der ikke blev agiteret særlig meget for at få oplysninger indsendt. Da der således er en vis forskel i de indsamlingsmetoder, der ligger til grund for tilvejebringelsen af materialet, kan man kun med varsomhed sammenligne »størrelsen« af invasionerne i 1965–66 og 1966–67.

Der er dog ingen tvivl om, at invasionen 1966–67 var betydelig mindre end invasionen i 1965–66. Medens der i 1965–66 ofte blev set meget store flokke, blev der i 1966–67 kun undtagelsesvis set flokke over 100 ex. Det er dog ikke muligt entydigt at opstille en fordelingskurve over flokstørrelserne, da meddelerne ikke altid har oplyst hvorvidt de opgivne tal dækker en eller flere flokke.

For i videst mulige omfang at undgå, at samme flok Silkehaler indgår mere end en gang i materialet, er der fra hver lokalitet kun medtaget en iagttagelse fra hver dag. Dersom det er opgivet, at der fra f. eks. 3. december og 14 dage frem blev set en flok på 12 individer, figurerer tallet 12 for alle 14 dage. Derimod er der ikke taget hensyn til, at en flok givet har været tilstede i f.eks. 14 dage, hvis der de facto ikke foreligger entydige oplysninger herom.

Rapporter er modtaget fra i alt 64 ornithologer: G. Andersen, H. J. L. Andersen, J. B. Andersen, T. Andersen, T. H. Andersen, P. Andersen Harild, L. Berthou, C. A. Blume, H. Boel, K. Bonde, S. Breiting, J. Bruun, P. V. Christensen, F. Christiansen, I. Clausager, R. Danielsen, O. D. Dantoft, T. Duch, J. Eskildsen, J. Fredfelt, K. Halborg, B. Hansen, E. Hansen, K. Hansen, K. O. Hansen, M. B. Hansen, P. M. Hansen, P. Hermansen, G. Hoffmann, M. Holme, S. Højager, J. R. Jacobsen, O. H. Jørgensen, K. Kromann, J. Larsen, P. E. Larsen, J. Larsson, J. Lilleør, T. Michaelsen, H. Miettinen, P. H. Mortensen,