On the Breeding Biology of the Guillemot (*Uria aalge* (Pont.)).

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(Med et dansk resumé: Om Lomviens (*Uria aalge* (Pont.)) ynglebiologi).
Hertil Tavle I–II.

Introduction.

During a stay in the Faroes in the summer of 1957 I spent the time from May 22nd to July 29th on the island of Mykines. In 1951 on the same island I visited a ledge occupied by guillemots, which might be accessible, if a rope was laid permanently onto the ledge.

This summer I did so, and I visited the ledge at various times of the day during most of the time spent on Mykines. My first observations were made from a distance of about 25 meters, but later I moved my blind nearer to the colony, to about 10 meters from the nearest incubating bird.

I had the misfortune to visit Mykines just at the same time as an engineering firm was busy building a new bridge to the Mykinesholmur. The constant hammering and shooting at a distance of about 350 meters caused very much disturbance in the colony. Many times during a day the guillemots were flushed by some sudden sound, and very often the resulting turmoil made some eggs roll off the ledge. In one week preceeding June 3rd I marked 32 eggs with figures, but by July 1st not one was left on the ledge or had hatched.

Out of more than 200 eggs counted in a certain section of the ledge no more than about 30 young hatched. Thus, it was not possible for me to state anything about normal mortality as had been my intention.

At first I rather often went into the ledge in order to count and mark eggs and to catch adults for individual marking. Soon it was found that this caused too much disturbance, and I had to give it up. Six birds were stained with various colours, but only two were seen again. Only one bird was followed for about a month.

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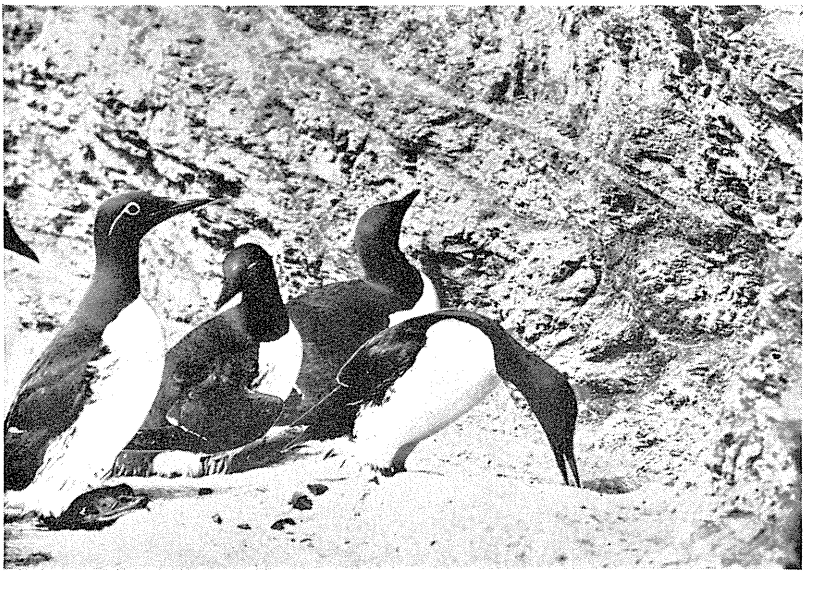
Fig. 1. A pair of guillemots preening each other in feathers of the head and neck.
Et par Lomvier piller hinanden i hoved- og halsfjer.

Fig. 2. When a guillemot has lost its egg it often plays with small objects that are picked up on the ledge.
Hvis en lomvie mister sit æg, giver den sig ofte til at lege med små genstande, den samler op fra hylden.



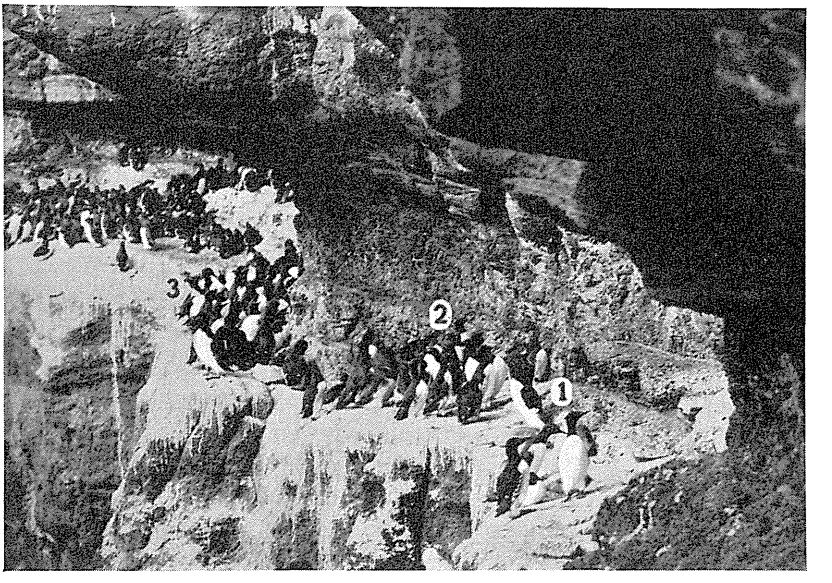


Fig. 1. The ledge as seen from the hide. Sections numbered.
Hylden set fra skjulet. Iagttagelsesområderne er numereret.

Dr. FINN SALOMONSEN for help concerning literature, to Prof. HANS JOHANSEN for help with Russian literature and to Dr. HOLGER POULSEN for critically reading through the manuscript.

Territory and site recognition.

When I visited the ledge for the first time on June 24th no eggs had been laid at the section 2 at fig. 1. The guillemots in this section were vigorously fighting each other. Some birds had already occupied a small part of the ledge and were obviously defending it against any other bird. The turmoil was great and the courses of the fights could not be followed.

When eggs had been laid, the fights were few, and were obviously caused by the promiscuity which will be discussed later.

It was evident that the guillemot knew the place, where the egg had been laid, as it would at once return to that place, even if the egg had rolled away. When no egg was found on the site, the guillemot turned its eye to the surroundings, obviously in search of it. The eggs were often displaced back to the site in a way, which will be discussed later.

A curious paradox, however, is that territory seems more attached to the egg than to the nesting-place as very often a bird defended a new territory about the egg that had rolled away. During the above mentioned displacement back to the old site, a territory was defended both in the new site and during the moving act.

Curiously, a bird would not defend its territory against another incubating bird. The birds might lie so tight that they touched each other, no fights being observed. However, when a non-incubating bird entered a territory about 15 cm from the incubating bird, the latter at once defended its territory.

When alighting on its own section of the ledge a bird will usually assume threat-posture. Obviously the bird is then accepted by the sitting birds, as usually no attacks takes place. In some cases it will force its way till the inner wall of the ledge through the crowded birds. During this the threat-posture is retained.

Very often, however, the birds may alight on a different section of the ledge than their own. Usually they will be attacked by the birds sitting. During the first part of the egg-stage, one of the sitting males will very often try to copulate with the alighting bird, regardless of its sex.

I have never seen such an attempt result in copulation as the assaulted bird will rise its head and neck to threat-posture. It is interesting to note that a female after copulation will rise to the same posture.

The appeasement-gesture may in some cases stop such assaults.

Recognition of egg.

From the preceeding it is evident, that egg-recognition does not play any significant role in the guillemot. In fact guillemots have accepted any guillemot-egg, when this was placed at exactly the same point as the bird's own egg. This was used at the section 2 (cf. fig. 1), as all eggs laid before June 4th had disappeared. Eggs which had begun hatching were removed from section 3 and placed in section 2, where they were at once accepted by the birds breeding here. Eggs from section 2 were likewise removed to section 3 and were obviously accepted here.

When the egg had rolled, there might be some recognition of it, as the bird nearly always takes the right egg. This may, however, be caused by the fact, that the bird first seeks for the egg at the site, not looking for it in other places until after some time. This leaves time for the other birds in that section to sit down on their respective eggs so that the only eggs left are those that have rolled off their place.

Three different birds have been seen sitting on the same eggs during one hour. Another time, however, an egg was lying uncovered for about half an hour. This egg, however, was lying more than one meter from the other eggs, while the first-mentioned egg was lying close to several other eggs.

From my observations it appears that the guillemot knows the nest site but not their egg. Only when the egg has roled away from the site the bird may be able to recognize it among other displaced eggs. Further observations in this respect no doubt would reveal interesting facts and are highly desireable.

Recognition of young.

There seems to exist recognition between young and supposed parents. During the first days after hatching the young seeks shelter at the first adult that arrives at the ledge[1]). Thus two young or one egg and one young may be brooded by the same adult bird, although the second young will usually be refused.

After about four days the young, however, will remain where it was left, until some adult is coming up to it to brood it. Recognition between young and adult is now evident, the adult cautiously preening the young at the top of the head on coming up to it. Sometimes the young seeks under the wing of the adult at once. At other times it pecks at the bill of the adult, evidently not allowing the adult to preen its head downs. In some cases observed the adult went away.

It is just as evident that the adult knows its young. For photographic purposes I had fastened two young near my

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[1]) This may, however, be somewhat modified by further study, as unbrooded young have been seen to run against an alighting bird even when other unbrooding adults were standing around and although the young was not accepted by the alighting adult.

hide, and only one adult per young was greatly upset by the piping notes of the young.

Recognition of mate.

Although a certain promiscuity exists in a guillemot colony, the birds usually stick together in pairs. Recognition of mate often seems to take place already when it is arriving at the ledge. At one occasion a female lay down for copulation before the mate had alighted at the ledge. At other occasions mutual preening has taken place immediately and without any recognition ceremony.

Very often, however, two birds may begin a quarrel, the bills fencing, and with noisy squeaks. The bills clasp and one of the pair—usually, but not always, the female—will turn its bill away catching the slashes from the male on cheeks and neck. During this procedure the head is shaken from side to side and the neck much wringed. The male usually answers to this by preening the female in head and neck after another two or three slashes; cf. plate I, fig. 2.

It may well be that the pair have recognized each other long before the ceremony takes place. But as the start of the procedure seems a real fight, this is not easy to see.

Laying of eggs.

The main laying period was found to be between May 25th and June 5th. The Faroese state this, and the main *ræning*, i.e. taking of eggs, takes place on June 5th. Usually the first eggs are laid in the middle of the colony and the last eggs always seem to be either at the edges of the colonies or in smaller colonies newly established. Thus a certain colony consisting of some twenty pairs was found with eggs on June 15th, whereas there had been no eggs a week before. This colony was established the same year and seemed to consist of young birds breeding for the first time, as some were taken for food and their ovaries examined by me.

Losses of eggs.

As mentioned in the introduction there was a heavy shooting in the vicinity of the colony during the first part of the incubation-period. Very many eggs rolled off the ledge. At

the edge of the colony, where I was watching the guillemots, 32 marked eggs disappeared before the exact incubation-period could be determined. In the middle of the colony about 200 eggs were counted on July 5th, whereas only about 30 young hatched. It was evident, however, thas losses were heavier in the edges of the colony than in the middle. Nothing can be told about mean mortality.

The causes of the losses were mainly the shots. All the birds rushed off the ledge and some eggs were jostled off each time. The birds grew nervous and took off very easily, and the carelessness of the birds to the egg was astonishing. Birds placing a foot on or under an egg without any other birds crowding around was a common sight, and often one or two eggs were pushed off by one bird shuffling around on the ledge.

A bird which happened to push an egg off might look after it as it would do after any subject falling down from the ledge.

A bird which had lost an egg usually went to the nest-site in search for it. After having looked around for a while it very often went to the nest-site, took a small stone in its bill and began fondling with it as if it were an egg; cf. plate I, fig. 2. It took the stone in the tip of the bill and in a long arch passed it under the belly dropping it there. It might sit for a while on the stone, sometimes fondling with it again, or it might take another stone and in the same way place it under the belly. It is important to notice that only occasionally a shaking of the head followed as described for the lost-fish-movement described p. 65–66.

Pirating of eggs was never observed, whereas the common promiscuity might allow a bird which had lost its egg to breed another egg—but usually only for a shorter time.

No other reasons for loss of egg than rolling off the ledge was observed. Predating gulls were never seen to ascend to the ledges.

Incubation of egg and young.

When a guillemot is sitting on its egg, it normally sits with its head turned to the cliff, away from the sea; cf. plate II, fig. 1. Birds lying head-tail along the ledge have been seen, but seldomly.

The egg is placed between the tarsi and the single brood-spot on the belly is brought in contact with the egg by raising the feathers on the belly. During incubation the egg is almost always placed with the pointed end towards the tail of the bird. Three or four times, however, birds were seen incubating an egg, which lay with the pointed end away from the tail of the bird. JOHNSON's (1941) statement that the pyriform of the egg is an advantage during incubation bringing a larger surface of the egg into contact with the brood-spot, is no doubt right, but it may be noticed that the semi-upright attitude assumed during incubation makes it the only form comfortable to the bird.

During incubation the bird is mostly doozing or sleeping. One of the preferred attitudes is that of the head and neck bent half-way back so that the bill points somewhat into the air. This attitude is often seen in resting birds which have no egg, too. At other times the incubating bird has been really asleep the head put "under the wing" and the eyes closed. The wings are normally not hanging in a bird sitting on the egg except during the egg-rolling, which will be treated further.

During the last part of the incubation period some of the sitting birds appeared very uneasy. Some of them collected small stones laying within reach, and placed then under the breast. In some cases they pecked out objects lying imbedded in the excrement layer which covered the ledges. It may be noticed that the stones were not actually put under the egg, but only near it. This may well be interpreted as the first beginning of nest-building in birds, as mentioned by JOHNSON (1941) and PALUDAN (1947).

When sitting on the small young the attitude is the same as in egg-brooding. In some cases, however, the wings are hanging a little. When brooding young older than three or four days of age, the wings (or one wing) is always hanging. This is obviously caused by the fact, that the small young is brooded on the brood-spot exactly as an egg. Whereas the older young is usually sitting between wing and body.

The attitude of the young sitting under the wing is always the same the bill pointing into the shoulder-feathers of the adult. When the young creeps under the wing its bill is always

seen to push through the shoulder-feathers of the adult three to five times.

There has been some discussion on the position of the brood spots in the auks, the two guillemots (Brünnich's and Common) and the Great Auk having one brood spot, while the Puffin, Black Guillemot and the Razorbill possess two of them. It has been argued that the possession of two brood-spots may be a relic of an earlier period, where the mentioned species had two eggs (the Black Guillemot still has). Probably the brood spots have evolved as a result of the most convenient position of the egg. Guillemots and the Great Auk nest openly, where a semi-upright position during incubation could be assumed, while the species breed under talus and in crevices, where such an attitude will often be impossible or most inconvenient.

Changing-over of nest duties.

Both parents—and sometimes other birds, too—brood egg and young. There seems to be no changing-over-ceremony. A bird might leave the egg deliberately and after a little the egg was annectated by another bird without the first bird taking any further interest in it.

Sometimes one bird was seen taking a great interest in an egg brooded by a certain bird. It bowed and pointed to the egg with the bill, the brooding bird following this movement as in the prepreening ceremony. No immediate changing-over was observed, but rather often the sitting bird left the egg soon after this ceremony, so that it may be called a changing-over-ceremony after all.

Egg-rolling.

When an egg—as often happens—rolls off the site, the guillemot always rolls it some way back, at least when it has rolled near to the edge of the ledge. The procedure of egg-rolling is always the same: The birds sits behind the egg stretching its bill towards the egg. The bill is put on the outer side of the egg and with nibbling movements the bird rolls it onto the feet so that the tarsi are on either side of the egg and the

toes before it. In this position one foot is moved at a time, the bird turning round on the spot.

In some cases the bird remained on the spot, the head turned against the inner wall, but often it shuffled slowly along with the egg in brooding position until it had reached the old nest site. As mentioned above the territory instinct seems connected with the egg rather than with the nest site, this causing a steady displacement of the eggs. Generally, however, eggs were not displaced more than twenty or thirty centimeters, but in a crowded colony this implies an interchange of territories.

In one or two cases a bird was seen nibbling near an egg without actually rolling it. In one case it was later stated that the bird had lost its own egg.

It must be pointed out in this connection that the placing of small stones between the feet may well be a certain adaption of the egg-rolling movement, since in this case no head-shaking follows as in the lost-fish-movement.

It had been my intention to measure the degree at which lost eggs were replaced. This plan had to be given up. In some birds 16 days appeared to pass from the egg was lost until it was replaced for the first time. In one case a replacement of an egg lost for the second time took place 14 days after the loss.

Contraction of colony.

The ledge studied consisted of several smaller units parted by places too narrow for a nest-site. Birds sitting in section 2 could not look very far into section 3.

During the replacement a curious contraction of the colony was seen mentioned by FISHER and LOCKLEY (1954). The birds in section 2 gathered near section 3, and the nearest part of section 3 was nearly empty of eggs as the guillemots had moved against the centre of the colony, this lying opposite to section 2.

This is a further indicium for that the territory, as previously mentioned is not a matter of the situation but rather of the actual egg.

Conditions on ledge.

As mentioned above the ledge consisted of several smaller colonies. In the more crowded parts there was very slippery with slime so that one had to move about with the greatest caution. In the less crowded parts, however, the ledge was dry and not at all slippery. This was stressed by the unusually dry weather. Under normal weather conditions the ledge would have been slippery everywhere although at a lesser or higher degree.

During the first days of the incubation period heavier losses were stated than later when replacements had taken place. This was found to be caused by the slime being absent during the first period. Later the ledge gradually grew fouled with slime. On the dry ledge the eggs rolled very easily, while the sticky slime so to say glued the egg to the ledge.

Thus there seems to be an advantage in the slime originating from the excrements of the birds. The birds are seen defaecating at random on the ledge; the more the birds are crowded, the more slime is produced, thus causing less losses in the more crowded parts of a colony, according to the findings of KAFTANOVSKI (1938).

Mutual preening.

Between mates mutual preening very often takes place. There are certain behaviour patterns that are usually traversed before the act of preening. One of these has been described above; an imaginary fight is carried out between the mates, one of them—usually the female—retreating for it. This behaviour may lead to mutual preening, although another behaviour pattern usually precedes this procedure.

One of the birds, usually standing somewhat in front of its mate, makes a fondling movement at its own toes. This movement is followed up by the other bird, the latter stretching its head in front of the former (fig. 2). This induced movement is usually seen one to four times. At last both birds raise their heads and the bird which began the procedure turns its head a little thus exposing the neck to the mate(?). Then the mutual preening follows. The birds which first made the bowing and fondling movement is usually first preened by the other bird;

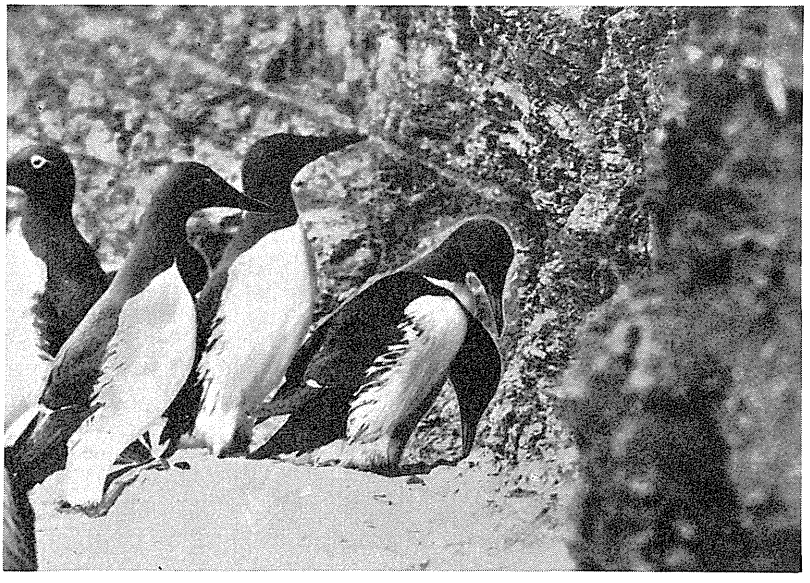


Fig. 2. Before mutual preening one bird bows to its own toes and this movement is followed by the mate. Other birds often take a great interest in this procedure. *Når fuglene udfører forspillet til gensidig pillen af hinanden (pillen ved sine egne tæer), er de andre fugle meget interesserede.*

cf. plate I, fig. 1. A reversion of the process may be induced by the second bird now making the bowing and fondling movement, this being followed up by the first bird.

A guillemot will only occasionally scratch its own head with the foot. The bend of the wing may be used to rub cheek and bill region. This can be seen in Razorbill and Puffin, too.

Mutual preening has only been observed to comprise head and neck, and thus its seems as if the bird's own preening of head and neck has been replaced by mutual preening.

Sometimes the two mates have been seen to preen each other at the same time.

Courtship.

The mutual preening may serve as courtship display. This is usually the case, but in some cases the courtship may be the recognition-of-mate procedure, the female turning the head away.

The courtship preceding mating may be short or prolonged.

As a typical example may serve this quotation from my note-book:

"Prelude to mating: very prolonged. One bird started making the bowing and fondling movement at its own toes. This movement was followed up by a second bird. After some time of mutual preening (ca. 30 seconds) they preened themselves. The ♀ now made the bowing and fondling at her own toes, but her movement was now followed up by a third bird (the following copulation showing that this bird was a male). After a few second's mutual preening between bird no. 1 and no. 3 bird no. 2 stretched its bill upwards and forwards and rose to its toes (threat-position). Bird no. 3 now pecked at no. 2 which went away.

Later no. 2 walked past the couple and was vigorously attacked by bird no. 3.

Birds no. 1 and 3 preened each other for a long time. Mostly the male preened the female. Once or twice they fenced with bills half opened and crosswise. The bills were also seen to pass each other so that they touched the partner's cheek or throat.

At last the male was seen to stretch it bill forward as a threat keeping it there, the female trying to avoid it. Suddenly she leaned forwards . . . ." and copulation followed.

At one occasion no courtship was seen, the female leaning forwards as the male alighted on the ledge. In other cases the mere threat-position or recognition fight was the only courtship preceeding a mating. In some cases copulation was attempted also with incubating birds, the position during incubation obviously being mistaken for the copulation position of the female.

Copulation.

Matings were never seen to take place elsewhere than on the ledge.

After courtship described above the female leans her breast forwards against the ledge and the rump somewhat lifted. Head and bill is stretched somewhat forwards and upwards. The male mounts her from one side, using his wings. During copulation the wings of the male are usually hanging to either

side of the female, only in sloping places, where the back of the female is sloping, too, the male beats his wings vigorously during copulation.

During this the female at intervals throws her head backwards, uttering a special short, hoarse sound which may be called copulation call. At the same time she opens her bill, clearly showing her brilliant yellow mouth to the male. Immediately after the sound has been uttered the head is drawn back to the position normal for the copulation.

While the female attends a flattened couching attitude, the male is standing semi-upright on her back, the neck bent and the bill usually pointing somewhat downwards. The male may be *arrr*-ing a lot during copulation, but often he is silent.

The copulation is always concluded by the female rising so that the male glides off her back (only once a male has been seen to descend deliberately from the female). In some cases the male may be sitting quietly on the back of the female. In such cases the female often utters the copulation call, which will usually revive the copulation movements of the male.

The female rises to threat-position, and usually this position is assumed by the male, too. This is only kept for a few seconds when the birds begin to bow in a gesture very much like the alarm-signal, only the raising of the head appears somewhat more prolonged. At the same time both birds show unease, and often they walk to the edge of the ledge. In some cases both birds have been seen to leave the ledge immediately after copulation showing panic evidently without any external cause.

Sometimes males have been seen fighting other birds, standing on the back of the female. Attempts of mounting were often prevented by the assaulted bird keeping an upright position, this in some cases being accentuated by assuming the threat-position. During the first stages of incubation time such assaults were mainly leveled at birds alighting on the ledge, as mentioned above.

Very often one mating released mating in several other couples of birds. Such periods of mating alternated with more passive periods, thus causing the mating activity to form a fluctuating pattern.

Promiscuity.

As mentioned above the guillemots often take to promiscuity although they will usually stick together in pairs. Some observations will state that this includes several if not all stages of the nesting life of the guillemot:

One female was mounted by three different males in twenty minutes. One egg was brooded by three different birds during one hour. Several—at least four—different adults brought food to one young. One female was preened by two different males in succession as described under courtship. One adult was seen brooding one egg and one young at the same time.

The promiscuity finds expression, too, in the general interest taken in all affairs on the ledge. The birds wander leisurely about on the ledge looking at each other, at eggs, and at young. Several birds may crowd around a parent bird with its young. When two birds are playing the bowing and fondling act two or three other adults may be standing around them (fig. 2). Several other examples of this kind could be mentioned.

Threat-posture.

In the threat-posture the guillemot rises to its toes. Usually it sits or walks on the whole foot. Further it stretches head and neck upwards. This position is usually assumed when alighting on own part of the ledge. During walking on the ledge among other birds—sitting or brooding—this position may be assumed, but only on its own section of the ledge.

As mentioned above the threat-position is assumed by the female after copulation and in most cases by the male, too.

Appeasement-gesture.

One must distinguish between three different appeasement-gestures in the guillemot.

(1) A bird that alights on the ledge will very often be attacked by the surrounding birds. This is prevented by the alighting bird moving its head sidewards to a preening of its shoulder feathers (fig. 3). Usually a bird alighting on another part of the ledge than its own will assume this

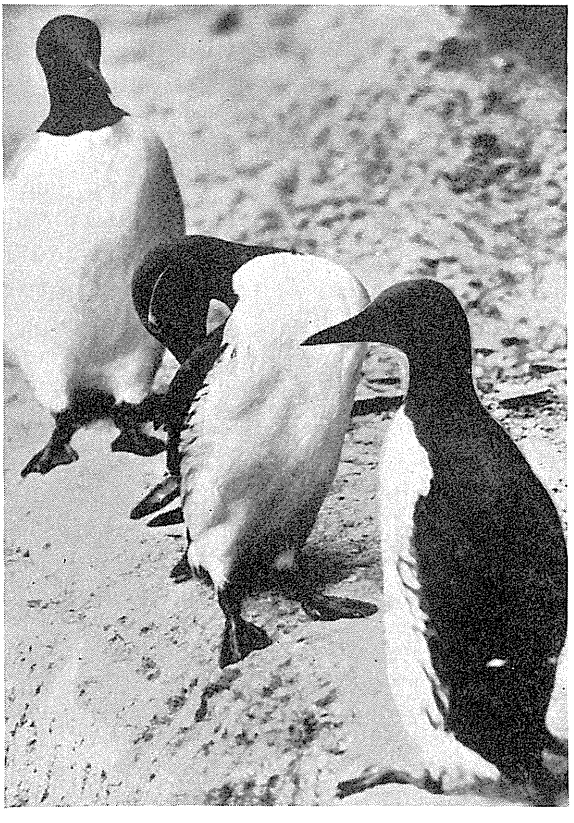


Fig. 3. The appeasement gesture consists of preening of the shoulder feathers. *Afværgebevægelsen består af pillen ved skulderfjerene.*

position. It will not usually be assaulted when raising the head from this appeasement-gesture.

(2) In fights between mates, as discussed under recognition of mate, the female may turn her neck and cheeks to the male, this movement appeasing the male. Often mutual preening or mating follows this movement.

(3) In real fights one bird may turn its head away, thus exposing the neck to the combattant. At the same time it usually bows to the opposite side. After this it usually rises its head with a heavy shaking. This procedure always stops the fight immediately. In some cases the "winning" bird may do the same movement, in other cases not.

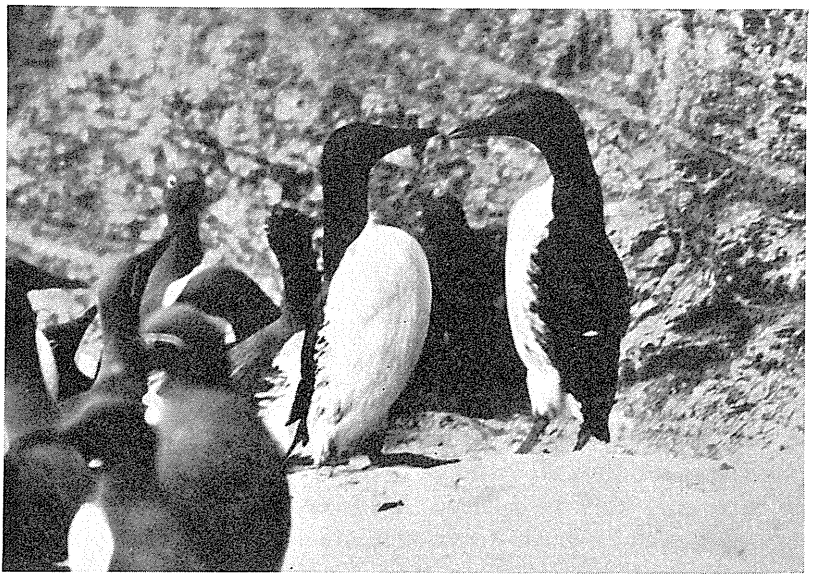


Fig. 4. During fight the birds often rise to their toes.
Under kampe rejser fuglene sig ofte på tæerne.

Fights.

Fights may be imaginary, such as courtship fight, or they may be real. In the latter case the first stage is usually the threat-posture. This position may be assumed by one or by both birds. From threat-position the bill is moved a little downwards (fig. 4) and both birds then move the bills in small vertically circling movements. These movements may pass into real slashes by the bills. During this stage of the fight very loud and prolonged sounds are uttered, one *arrr*-ing often breaking into another.

In the final stages the wings are often used for heavy blows. These blows can be heard very far and when a fight has come to this stage it may be very prolonged.

Fights may, however, stop at any stage, one bird doing the appeasement-gesture 3 (and seldomly 1).

A brooding bird was never seen to attack another brooding bird, whereas stragglers to the territory would be attacked vigorously by the bird sitting on the egg. Many of the fights were obviously territorial fights.

Fishing.

Guillemots have been seen fishing near land and far into the sea. Usually, however, the birds were seen fishing on fishing-grounds near land. Puffins usually fished further out.

The fishing guillemots scattered on the water along the coast and they were seen to put half of the head under water. Actually, just the eyes were put under the surface. This is easily understandable since a bird swimming in the water will not be able to look into the water without putting the eyes under water. The birds do not dive at random; they spot their prey before diving. They were often seen to put the head under water several times before diving. The dipping movements are carried out while swimming around at random.

These dipping movements were seen in puffins and razorbills, too. It may be noticed, however, that these movements are also seen in birds frightened by for instance a boat. In such cases the movement may be considered an intention movement.

Thus, it seems that the dipping movements of the fishing birds have been stereotypized into intention movement before a dive.

Fish-carriers. Lost-fish-movement.

Birds carrying fish in their bills have to fight for a foothold on the ledge, just as the other birds. This is always done by assuming the threat-posture. This may be caused by the fact that the birds is carrying a fish in its bill so that it is unable to preen its shoulder feathers in the appeasement gesture. Fish-carriers have often been seen to withstand heavy attacks from neighbouring birds, but in some cases even a fish-carrier is driven away again.

Fish-carriers are by no means a phenomenon met with only in the young period. They are seen from the beginning of the nesting period; cf. plate II, fig. 2.

Johnson (1941) considers the fish-carrying to be part of courtship. From my observations it is evident, however, that it cannot be a very important part. During more than a hundred hours of observation on a ledge containing more than two hundred pairs no more than about 25 fish-carriers have been observed during the egg stage.

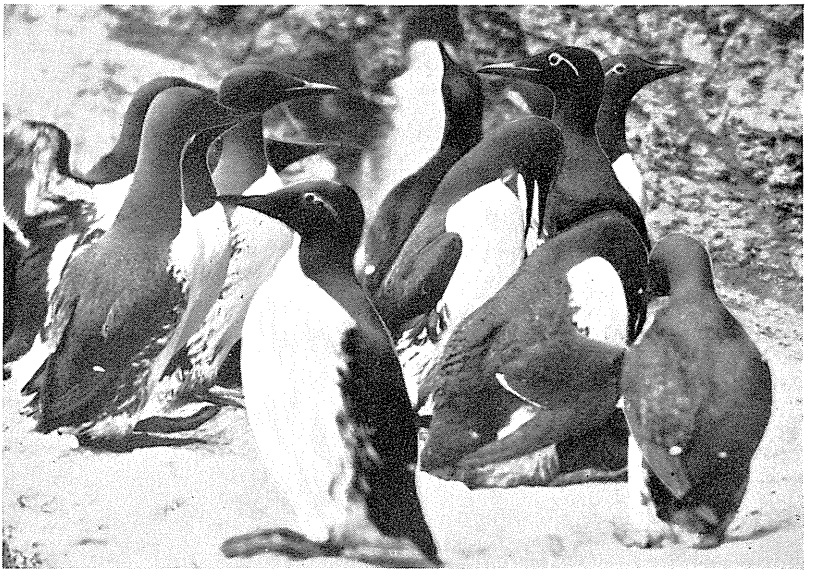
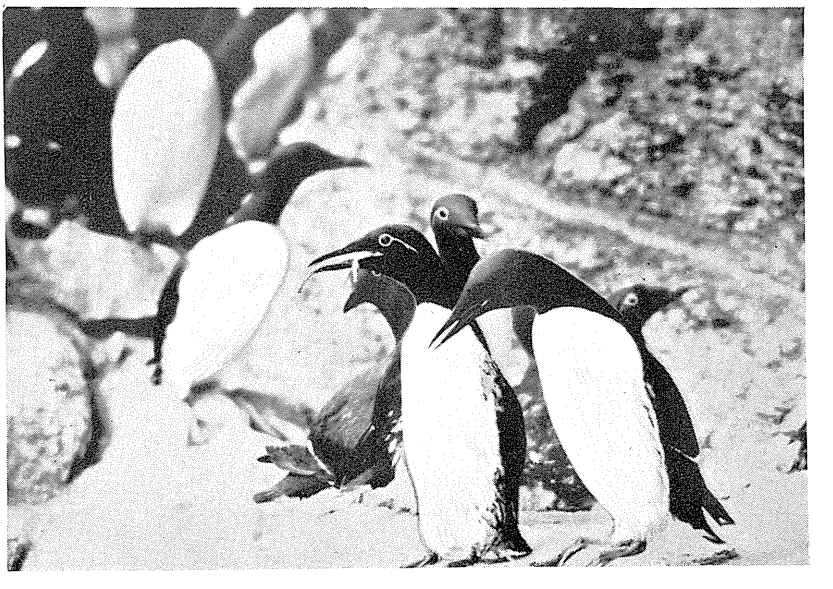


Fig. 1. Two birds are brooding young (centre right). They bow to the young to push them under the wing.
I midten til højre ses to fugle, der bøjer sig mod ungerne for at skubbe dem bedre tilrette.

Fig. 2. A fish-carrier attended by other birds imitating its movements.
Fiskebærer ledsaget af andre fugle, der efterligner dens bevægelser.



Apparently, no particular part of the day is preferred for the fishing-carrying.

A fish-carrier may sit for hours with the fish in its bill. One has been seen to incubate an egg carrying the fish in its beak. This bird, however, was very uneasy, obviously without any external cause.

Mostly the fish-carriers play with the fish, and a single other bird often takes part in the play. Mostly this appears to be the mate. The fish-carrier bows and fondles with the fish before its own feet and the other bird follows up the movement. The fish may be shifted between the birds during the fondling.

Once a fish-carrier stood long beside a certain incubating bird wihtout giving the fish away. Finally it ate the fish itself.

The play with the fish may be more complicated, which the following notes from my note-book will demonstrate. These notes also show some common and typical traits of guillemot breeding behaviour:

"The individual *A* came with a fish, assumed threat-position, took part in a common alarm by giving the alarm-signal— all with the fish it its bill—. It went towards the wall with the neck bowed and the bill pointing downwards. It bowed the bill under the belly. Another bird, *B*, followed up the movement. *A* bowed and placed the fish between its tarsi, from where *B* took it. While *B* was turning the fish round in the bill it was snapped by *C*. *C* nearly swallowed the fish and assumed threat-position. The fish was given to *D* exactly as from *A* to *B*. *D* dropped the fish and *C* and *D* went behind a projection, where they could not be watched. *E* took the fish, carried it away and dropped it in front of an incubating bird, *F*. Both *E* and *F* protected the fish against another bird, *G*, which tried to take it up. *F* nibbled at the fish after *E* had bowed to it. *F* did the snapping movement (see p. 67). Finally *F* took the fish and placed it under its breast, but not under the feathers.

B was seen to play with a small stone placing it under its breast. This was followed by the lost-fish-movement."

The lost-fish-movement consists of an energetic shaking of the head after a bow to the feet, sometimes to under the belly.

The lost-fish-movement was mostly seen, whenever an object had been lost, this mostly being a fish.

Usually the fish was carried lengthwise in the bill, but three or four times I saw fish being carried across the bill. This may be compared to the way of fish-carrying in the other auks.

Feeding of young.

During my study on the guillemot ledge I only once saw a young take active part in some kind of feeding-ceremonial. It went to the fish-carrier, piped, and pecked at the fish. The adult bent down and placed the fish on the ground, the young following the movement up; eventually the young devoured the fish.

In most cases the fish was dropped in front of the young with the lost-fish-movement. This may, however, be a result of the common promiscuity in connection with the heavy losses of offspring. Several adults carried fish to the same young, and a satisfied young is not likely to take active part by showing begging movements.

Alarm-signal. Snapping.

Whenever a disturbance occurs near or in the colony the alarmsignal is seen. The neck is bent and the head held almost straight. The danger may at first be recognized by one bird. This carries out the alarm-signal bowing almost to the feet. Most often the head is turned to the direction from where the danger is coming. The bowing is accompanied by a low cooing. Immediately the alarm is transmitted to the neighbouring birds. They carry out the alarm-signal, too, but in a less pronounced fashion until they have recognized the danger themselves. Then the alarm-signal is performed at full strength.

In some cases the alarm-signal does not release any escape reaction, but in cases where the danger may seem immediate it causes panic in the colony. The birds scramble to the edge of the ledge. The alarm-signal is now mingled with the flight-intention-movement. The head is lowered in small jerks, the neck being contracted a little. One bird taking off at this time will usually be followed by several others.

Very often a curious vacuum activity was seen, especially in incubating birds. The head is thrown backwards, the bill opening and presently closing during this movement. The whole movement appears as a snapping over the back.

Only in one case this snapping was seen in connection with any display activity (see p. 65).

The attention must be drawn to the curious fact that the snapping appears as a "silent" female copulation call.

Flight of the young to the sea.

The flight of the young guillemot has been described by KAY (1947) but the procedure on the ledge has obviously never been witnessed before. Therefore I describe this in full detail.

On the evening of July 15th I was situated on the Mykinesholmur as I heard the noisy calls of the parent guillemot calling its young off the ledge. At once I went to the ledge and I watched 8–10 young leap on that evening.

The procedure as seen from rather far away is that the young seems to be very uneasy. It walks around on the ledge and always goes to the edge. The parent bird constantly tries to keep beside the young. Suddenly the young leaps and the adult follows.

I had given up the hope of seeing the procedure at close range and was sitting behind my blind in order to take up some sounds as suddenly one young and later in the evening another one came to the nearest point of section 3, leaping to the sea from there.

The first young came easily walking along the ledge. The parent bird used a special call which was very shrill and prolongated. Whenever the adult uttered this sound the young began to pipe and tried to bill the adult. During this the movements were very much like those of mate-recognition, the young turning its head away after a while of billing.

The young grew steadily more uneasy. Sometimes it sat for a while in rest-position, the bill pointing forwards and a little upwards and the neck somewhat contracted. But whenever the parent bird uttered the "leap-sound" the young went to the adult in order to bill it. At long last the adult uttered

the leap sound sitting on the edge with the head pointing to the sea. The young went to it and now remained sitting on the edge. The young previously had gone to the edge several times but had retired.

When the adult and the young were standing side by side on the edge the adult began doing the flight-intention movement, and these movements were induced to the young. The parent bird strengthened the movements by leaning forwards, and as the young did so, too, it suddenly leapt deliberately. During the flight the young had its legs hanging backwards as have the adults, and it beat the wings quickly. While it fluttered it piped all the way down.

The parent bird followed it and landed beside the young, immediately after it had struck the surface. The two birds billed on the sea and swam outwards tightly side by side.

The second young came to the nearest point of section 3 somewhat later, followed by one adult. The young went to the edge by itself, but the adult seemed to prevent the young from returning to the ledge by standing behind it. The young leapt off the ledge after the parent bird had carried out the flight-intention movement.

During the whole evening some adults were constantly swimming under the bird-cliffs uttering the leap-sound. In a single case one adult was following the young in its leap while another bird joined the couple on the sea. A young was never seen to leave the ledge alone.

Also other young on the ledge showed unease, but the parent birds seemed to prevent them from coming to the edge by standing on the edge with the back turned to the sea, a most unusual position, the birds normally standing breast to the sea.

Induced and synchronized movements.

In the preceding some instances of induced movements already have been described. The bowing of one bird to its toes being followed up by another bird is just one. Another was that of matings being released by one pair copulating.

Several other instances have been watched: Mutual preening often takes place in waves. One bird carrying out the lost-fish movement may release this movement in several other birds.

Once a bird on seeing a fish-carrier took up a small stone. The alarm-signal is induced to the rest of the colony, too.

The induction of movement may in some cases be of value to the social life of the birds in the colony.

In some cases a courting pair has been seen to carry out absolutely synchronized movements. The pair was seen in mutual preening. After this they preened themselves, both preening the same feathers at the same time, raising their heads at the same time and continuing the preening at the same time. At last they fell asleep at the same time.

Comparison to Brünnich's Guillemot.

For various reasons I did not read the work of PENNYCUICK (1956) on Brünnich's Guillemot until after having prepared my own paper, and I am thus able better to make unprejudiced comparisons. We have, however, partly worked on entirely different lines.

We agree as to the lack of normal territorial behaviour.

The attitudes 4 and 5 of fig. 1 in PENNYCUICK's paper are found exactly alike in the Common Guillemot. My studies do not enable me to judge about the other attitudes.

Call no. one of PENNYCUICK is easily distinguished as very much like the copulation call of the male and the fight call. In the Common Guillemot there is a clear-cut difference between this call and the leap call, the latter being much more prolonged in the Common Guillemot.

Likewise, the female copulation call and the alarm signal must be almost identic in both species. Apparently, this applies also to the bowing-and-fondling movements.

According to the description of fights in Brünnich's Guillemot most elements are easily found in the Common Guillemot, too. I never saw fights proceed on the water.

Brooding of egg and chick are identical in the least details.

Of the "greeting ceremonies" of PENNYCUICK lost-fish-movement, mutual preening, and bowing-and-foundling-movement are easily realized as being identical.

The differences of degree of interest taken in various subjects seem to account for the apparent failing of some traits

found in the descriptions given by one of us, but not by the other.

In the descriptions of the departure of the chick there are many common traits. I never saw the "mobbing", and obviously PENNYCUICK never saw the billing of adult and young on the ledge, whereas this was seen on the sea by both of us.

I made no observations on the types of flight in the Common Guillemot.

The vestigial nestbuilding of PENNYCUICK is in my work divided into playing with small stones after having lost an egg and placing small stones around the egg during the last stages of incubation. This, however, may be a matter of interpretation.

PENNYCUICK asks for an explanation for the special method of defæcation in the Guillemots, which I have tried to give. I did not see any preference as to the direction of the squirts of fæces which partly is claimed by PENNYCUICK.

As to the minor rôle of predation we agree.

I have made no observations which may allow me to draw any parallels to the last parts of the paper on Brünnich's Guillemot.

Except for minor differences probably originating in different stress laid on the subjects studied, it appears that the behaviour patterns of Brünnich's and Common Guillemot seem very much alike.

DANSK RESUMÉ

Om lomviens (*Uria aalge* (Pont.)) ynglebiologi.

Under et 2 mdr.s ophold på Myggenæs, Færøerne, tilbragte forfatteren flere hundrede timer på en lomviehylde. Desværre blev ikke hele programmet fulgt, idet det havde været meningen at undersøge visse forhold vedrørende dødelighed og erstatning af mistede æg. Dette måtte opgives, da et ingeniørfirma var i færd med at bygge en bro lige i nærheden af observationsstedet; de gentagne stensprængninger på byggepladsen forårsagede megen uro og umuliggjorde sådanne undersøgelser.

Territoriet synes mest knyttet til ægget. Under et første besøg på hylden den 24. maj, hvor endnu kun få æg var lagt, var der stadig uro og kampe, medens fuglene faldt til ro få dage senere.

En Lomvie kender bedst stedet, hvor ægget ligger, idet den altid

leder på dette sted, hvis ægget er rullet bort. Først efter nogen tids forløb ser den sig omkring efter ægget. Her er der mulighed for genkendelse af ægget, da det næsten altid er det rette æg, der tages. Derimod erkender Lomvien ikke en ombytning af ægget, såfremt det nye æg ligger nøjagtig på det gamles plads.

Et territorium forsvaredes omkring ægget, selv om dette var rullet bort fra redestedet. Oftest rullede fuglen det tilbage og forsvarede da et territorium også under rulningen. Territoriet forsvares ikke mod andre rugende fugle.

En Lomvie, der lander på en anden del af hylden end sin egen, blev i begyndelsen ofte genstand for kopulations forsøg. Hovedet løftedes da i true-position (omtales senere). En hun rejser sig efter gennemført kopulation til den samme stilling.

Afværgebevægelse stopper også kopulationsforsøg.

På egen del af hylden antages true-position.

Den nyklækkede unge vil løbe til den første fugl, der lander på hylden for at blive varmet. To unger kan blive varmet af samme voksne fugl. Efter ca. fire dages forløb indtager ungen en passiv holdning og venter til den voksne kommer hen til den. Genkendelsesceremoni ved pillen af ungens hovedfjer. Den voksne fugl kender også sin unge.

Genkendelse af mage synes at kunne finde sted på afstand, idet en hun er set lægge sig til kopulation, lige inden hannen landede på hylden.

Af og til synes en genkendelsesceremoni at finde sted, idet fuglene kæmper med halvt åbne næb, hvorunder hunnen vil vende kinder og nakke til og optage hannens hug herpå. Hannen piller derefter i hunnens hovedfjer.

Det er dog ikke sikkert, at dette er en genkendelsesceremoni, idet fuglene muligvis har genkendt hinanden længe før skinkampen.

Æggene lægges hovedsagelig i perioden 25. maj–5. juni. Æg i midten af kolonien lægges først, i udkanterne sidst. En nyetableret koloni fandtes ikke at have fuldlagt den 15. juni.

Mange æg går tabt ved at rulle udover kanten. Ingen anden tabsfaktor er set, idet de store måger aldrig er iagttaget i lomviekolonierne. Lomvierne er meget skødesløse med æggene og sparker ofte et eller flere til søs.

En fugl, der har mistet ægget, vil ofte lege med en sten i stedet. Den lægger stenen ind under rugepletten og lægger sig på den, men er i det hele taget meget urolig.

Lomvierne sås aldrig røve æg fra hinanden, selv om en almindelig promiskuitet ofte forårsagede, at flere forskellige fugle rugede det samme æg efter hinanden.

Under rugningen vender Lomvien altid hovedet mod klippen. Den ruger i en halvt oprejst stilling. Pæreformen i ægget er derfor den mest behagelige for fugle, idet dette er placeret med den spidse ende ind under halen og i øvrigt hvilende mellem tarserne. Rugepletten

befinder sig under bugen. Fuglene døser oftest under rugning med næbbet lagt lidt tilbage eller af og til med hovedet under vingen.

Den nyklækkede unge varmes på rugepletten, medens den lidt ældre unge anbringes under den ene vinge ofte med næbbet pegende op gennem skulderfjerene på den voksne fugl.

I slutningen af rugeperioden sås fuglene ret ofte række ud efter småsten og lignende og lægge dem tilfældigt omkring og foran ægget.

Der sås aldrig en direkte afløsningsceremoni. Ofte sås en fugl interessere sig en del for ægget under en rugende fugl. En ombytning fandt af og til sted ret kort efter dette, men aldrig øjeblikkelig.

Et æg, der er rullet ud af stilling, rulles ofte på plads igen. Lomvien placerer sig inden for ægget, rækker ud efter det med næbbet og ruller det med nippende bevægelser ind under sig. Derefter vender den sig på stedet ved, at eet ben flyttes ad gangen, og yderligere bevæger den sig ofte tilbage til den gamle plads. Denne bevægemåde muliggøres af æggets fastklemte stilling mellem tarserne og bugen.

Æg synes at erstattes ca. 16 dage efter tabet. En fugl omlagde ægget anden gang efter 14 dages forløb. Efter som tabene tyndede ud i rækkerne blandt de rugende fugle i koloniens udkant, rykkede disse med deres æg nærmere ind til koloniens midte. Det slimede lag af ekskrementer på hylden synes at have tabsbegrænsende betydning, idet æggene ligesom klistres til hylden og kun ruller kort.

Lomvierne ses meget ofte pille hinanden i fjerene især på hoved og hals. Ofte går der en skinkamp forud for dette, men af og til ses følgende forspil: En af fuglene bøjer sig ned mod sine egne tæer og gør samtidig en pillende bevægelse med næbbet. Denne bevægelse følges op af den anden fugl, og når de rejser sig fra denne bevægelse, piller den anden fugl den førstes hals- og hovedfjer. Ofte ses de to fugle pille hinandens fjer samtidig. Den gensidige pillen synes at have erstattet fuglenes kløen sig selv i hovedet med benene. Ofte bruges også vingens bøjning til at gnide kinder og næbregion.

Forspil til parring er oftest den ovenfor omtalte bøjning til hinandens fødder. Denne bevægelse afløses af en skinkamp, der pludselig efterfølges af kopulationen, idet hunnen læner sig fremover og trykker brystet mod underlaget. Hannen bestiger hende, og under livlig arrr-en gennemføres parringen. Herunder bøjer hannen hovedet let nedad med åbent næb, medens hunnen med mellemrum kaster hovedet bagover med et skarpt skrig, hvorved også hendes kraftigt gule næbindre åbenbares for hannen.

Parringen afbrydes oftest ved, at hunnen rejser sig, så hannen glider ned fra hendes ryg. Hunnen rejser sig altid til trueposition, hvorefter begge fugle bliver urolige og med en bevægelse, der ligner faresignalet, bevæger sig ud til kanten. En enkelt gang sad hannen en tid uvirksom på hunnens ryg, til hun rejste sig.

Blandt Lomvierne hersker en ret stærk promiskuitet, der giver sig udslag i f. eks. flersidig parring, rugning, fodring og desuden i den almindelige interesse fugle udviser for hinandens handlinger.

I truepositionen rejser fuglene sig på tæerne og strækker næb og hals opad.

Afværgebevægelsen kan være 1) en pillen ved egne rygfjer, 2) hunnens venden kinder og nakke til hannens hug under skinkamp og 3) efter en rigtig kamp en bøjning bort fra modstanderen, hvorefter hovedet løftes med en energisk rysten.

Kampe indledes oftest med truepositon, går derefter over til kredsende bevægelser med næbbet i et lodret, fremadrettet plan og ender med rigtig kamp med både næb og vinger. Kampen kan på ethvert tidspunkt standses af afværgebevægelse 3 (sjældnere 1).

Fiskende lomvier ses ofte nær land. De dypper hovedet til over øjnene (for at kunne se ned i vandet?) før de dykker. Denne bevægelse ses også hos skræmte lomvier. En bevægelse, der har reel betydning under fiskeriet, er altså her blevet til en intentionsbevægelse.

Fiskebærere ses ofte på hylden, også i rugetiden. Tilsyneladende er denne opførsel uden betydning, idet fisken ofte kastes uden videre. Af og til ses dog en anden fugl tage del i en slags leg med fisken, idet denne under en bøjning af næbbene ind under bugen, videregives til den anden fugl. En enkelt gang sås mindst seks fugle deltage i leg med en enkelt fisk. Normalt bæres fisken på langs af næbbet, men 3–4 gange er det blevet iagttaget, at små fisk er blevet båret på tværs af næbbet. Fodringen synes ikke at foregå med nogen fodringsceremoni.

Faresignalet er en hastig bøjning af hovedet og hurtig rejsning. Denne bevægelse er mindre udpræget hos fugle, der endnu ikke har »opdaget« faren.

Ofte – især hos rugende fugle – ses en snappende bevægelse over ryggen, der kan karakteriseres som et »tyst« parringsskrig (hunligt).

Inducerede og synkroniserede bevægelser ses i adskillige tilfælde. Der kan skelnes mellem bevægelser induceret af sociale instinkter og af »courtship« instinkter.

Ungens spring fra hylden beskrives i detaljer: Moderfuglen (kaldt således af nemhedshensyn) udstøder et særligt skrig, der åbenbart får ungen til at ville næbbes med hende. Moderen stiller sig på hyldens kant og udstøder det særlige kald, medens hun holder næbbet ud mod havet. Derved tvinges ungen ud på kanten (for at næbbes). Den voksne fugl udfører nu intentionsbevægelsen til flugt, idet hovedet trækkes op og ned i små ryk. Bevægelsen forplantes til ungen, der bliver urolig. Til sidst springer den af sig selv ud fra hylden, medens den voksne fugl følger efter. Ofte ligger der en del voksne fugle under fjeldet og udstøder det særlige kald, men oftest ses ungen at blive fulgt til havs af een fugl, idet de svømmer tæt side om side.

Efter udfærdigelsen af denne artikel har forfatteren foretaget sammenligninger med de resultater, der af PENNYCUICK (1956) er opnået for den Kortnæbbede Lomvie (*Uria lomvia* (L.)).

Der påvises en række overensstemmelser i de to arters biologiske forhold, medens de forskelle, der tilsyneladende eksisterer, sandsynligvis skyldes, at iagttagelserne er gjort af to iagttagere.

Sammenlignende studier af samme iagttager er meget ønskværdige.

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