

THE WILSON BULLETIN

A QUARTERLY MAGAZINE OF ORNITHOLOGY

Published by the Wilson Ornithological Club

Vol. L

SEPTEMBER, 1938

No. 3

Vol. XLV (New Series) Whole Number 185

PREDATION OF GULLS IN MURRE COLONIES

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The destruction of large numbers of eggs of the Atlantic Murre (*Uria aalge*) by gulls has been reported by many observers and usually credited to the extreme stupidity of the murre. In eastern North America the Great Black-backed Gull (*Larus marinus*) is the species responsible for the damage and in western waters the Western Gull (*Larus occidentalis*) appears to be the culprit. Methods to check the gull as a predator have been proposed and in some cases introduced without knowledge of the inherent behavior patterns involved in the murre-gull relationship. This procedure may very possibly result in the acceleration of the damage which it is intended to check.

To better understand the relationship of these birds on the nesting ground let us consider some of their adaptations to food getting and to natural enemies and thus learn in what way their interests clash as neighbors in restricted areas during the nesting season. The gull is normally a scavenger in its feeding habits. It can not dive for food as can the murre, and is therefore subject to periods of starvation in a way that the murre is not. But the gull is at home in the air, escapes the approaching enemy easily and depends upon its own faculties to recognize safety. The gull is very useful to the murre to warn it of approaching enemies. The warning cry of the gull elicits an immediate response from the murre. As long as man stays out of sight of the nesting murre and the population of the gulls is within reasonable limits, the gull gets for the most part only a scavenger's share of the murre eggs—mostly the abandoned ones. But, if the murre's vigil becomes weakened by any influence, such as disturbance, the former scavenger has little trouble in securing many eggs. Quickly the gull becomes an aggressive predator and takes the first unguarded egg. The adjoining murre missing her accustomed neighbor becomes uneasy and falters at the wrong moment so the gull gets her egg too, and then another and another. Meanwhile the non-incubating group of murre is increasing—a condition which adds to the general restlessness in a way to accelerate the loss of eggs. If the disturbing factor

soon desists these unoccupied murrens will likely soon produce another egg and incubation pertinacity may be re-established. On the other hand, I found while studying the Atlantic Murre in relationship to the Great Black-backed Gull, that if the colony is accessible to gulls and it is disturbed more than about three times by man during the early incubation period it is likely to be mostly or entirely lost. In cases where the murre colony is relatively small and exposed to gull attack (gulls will not go down into caves or deep crevices), and gull food is otherwise scarce, progressive loss of the murre colony may occur without being in the first place initiated by the disturbance of man. Some of the birds may join another breeding colony elsewhere and lay again.

THE FEAR RESPONSE IN THE MURRE

The development of a fear complex in the murre of which I have spoken and which appears to become quickly contagious is at first elicited through three or more serial responses, which may be observed when the breeding colony is first visited by man. The three responses to which I would call attention are as follows: (a) Response to gull warning cries by slight initiating movements—lifting of the head by those birds in exposed positions or by those to the least degree preoccupied by the incubation urge. (b) More intense raising and lowering of the head combined with vocal utterances from the incubating birds upon sight of the approaching enemy. (At this point all unoccupied birds move away from the locality of the breeding colony). (c) A flapping withdrawal of certain birds upon close approach of the enemy or after actual predation, and immediate stampeding of that part of the incubating colony composed of birds in position to see the flapping exit of their companions. Birds so located that they can not view the flapping exit of their companions will often remain and continue to incubate while the main body of the colony is being captured for banding purposes. Herein is evidence that the wing flapping of birds in a stampede is the actual stimulus which elicits the same response from their companions.¹

This entire series of responses may be observed in a breeding colony of Atlantic Murrens which has not previously been disturbed but as already stated, the birds so soon become conditioned that they readily all leave their eggs when they hear the gull warning. Furthermore they seem to lose any power to differentiate in their response to different meanings in gull vernacular. After this sequence of stimuli

¹I believe that the white tipped secondaries in the murre have a function as releasers to the flight response. I have already shown that this character does not occur in plumage of young birds. (Auk, July, 1938).



FIG. 23. Colony of the Atlantic Murre near Fog Island, Quebec.

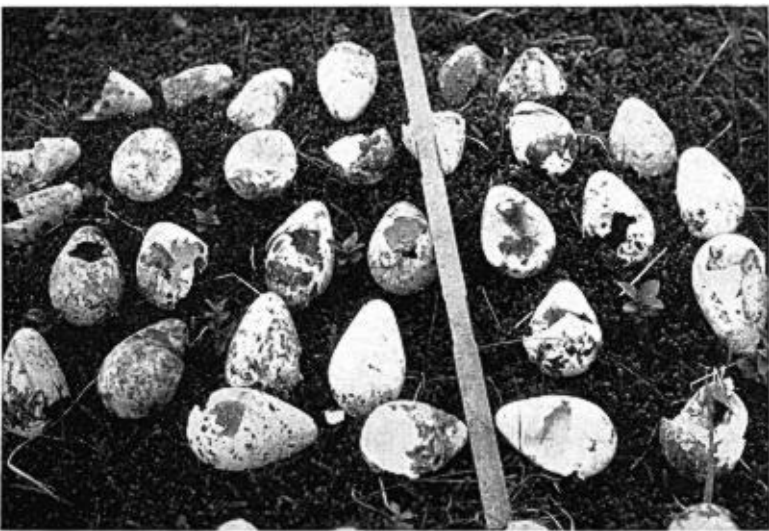


FIG. 24. Collected shells of Murre eggs showing the destruction by the Great Black-backed Gull.

and responses has been experienced two or three times the colony becomes so conditioned that it will respond to a nearby gull cry by stampeding in the middle of the night. Such a conditioned colony is subject to progressive loss of all eggs accessible to the gulls and if the entire colony is accessible the murrens are likely to all abandon after a thirty to fifty per cent loss. The final loss may take place several days after the initiating disturbance which caused the fear conditioning has disappeared.

To understand the behavior of the murre in this fear response one should be aware of certain other characteristics of the bird. Some of these I shall list: (1) The murre normally guards its egg continuously during incubation; (2) murrens which incubate in close proximity in colonies respond to the loss of a neighbor by showing great uneasiness, especially if the loss leaves their territory altered markedly; (3) among the birds which I have observed the murrens never seemed to recognize the Great Black-backed Gull as an enemy, and they never indicated any objection to the presence of the gull working around the colony to collect any egg which was not being hovered; (4) I never saw a murre show the slightest interest in any egg except its own;² (5) once an entire colony has left the eggs each individual fears to be the first to return, so the eggs may be left unprotected for hours—returning Auks and Puffins which nest among the murrens frequently are of great influence in leading the murrens back to their eggs; (6) an egg left unattended is likely to be pushed into some inextractible position in mud or filth by the movements of the crowded birds; (7) while a murre can move her egg readily and she usually does insist on holding to the original location as a place to incubate.

FIELD OBSERVATIONS

Large colonies nesting on the surface of islands where there is little or no natural cover find the needed sense of security in their very numbers. A disturbing force which endangers this security may be easily introduced yet halted only after the entire unprotected portion of the colony has been lost. Something like this appears to have continued on the Farallone Islands since the birds have been protected from the human element. If we consider the report, for example, of Taylor (1887), with that of Chaney (1924), relative to the effect of the Western Gulls on the murrens of the Farallones, we find that the murre population has continued to decrease. Taylor says, "The California Guillemot (*Lomvia troile californica*) lays its large pear-shaped

²In the summer of 1938 I saw one adult adopt an abandoned egg after the original one was lost to a gull.

egg on the bare rocks in any position and colonies of them are to be seen sitting together covering their eggs. . . . Their great enemy is the Western Gull (*Larus occidentalis*) for the latter is a ruthless pirate and steals and eats the eggs of other birds, especially the Guillemots at every opportunity. A murre is sometimes attacked by the gulls one on each side, and so harrassed, until one of the gulls gets the egg which he divides with his fellow pirate."

Chaney (1924) after visiting the Farallones in 1923 reports conditions after the birds had been protected from human robbers for many years showing that the murrees have continued to decrease. He states, "Only three small groups were actually seen to be breeding. In each case they laid their eggs in crevices large enough to accommodate from seven to fifteen birds. . . . According to the lighthouse keeper the small number of nesting murrees become discouraged, after one or two attempts at nesting, because of the attacks of the gulls. The selection by the murrees of crevices in the rocks as breeding places suggests that they have felt the need for protection. . . . It seems probable, therefore, that the small number of breeding murrees is indeed to be largely charged to interference by the gulls whose numbers are said to be greatly on the increase."

In this report Chaney gives us a sad picture of what has happened to a group of breeding birds which as late as 1885 (Wheelock, 1912) produced three hundred thousand eggs for the market.

Keading (1903) gives his observations of the gull damage at the Farallones as follows: "It is no uncommon sight to see a flock of gulls hovering over a nesting colony of murrees in an effort to drive them from their eggs, and seizing every egg that is exposed. Should another cause drive the murrees from their eggs, the gulls reap a harvest. This is perhaps as potent a factor as any in the destruction of the murrees. For, while the human egggers took only the fresh eggs, they disturbed the whole colony of murrees and the gulls took every thing in sight."

In this paper I wish to point out that by the very nature of the murre's responses to fear, the gradual disappearance of that great Farallone breeding population nesting in a location exposed to gull damage was an inevitable consequence of the disturbance by human egggers. They struck the vital blow at this great colony.

On the north shore of the Gulf of St. Lawrence where I made a study of the Atlantic Murre nesting on the islands where there were Great Black-backed Gulls nesting I could call attention to the following points in their relations: (1) On islands where both species are

nesting out in the open, the gulls take a certain percentage of the eggs regardless of disturbance. (2) If the murrens are disturbed the damage may be anything up to complete loss of the murre colony. (3) On islands where the two birds are both found nesting, and the murrens are protected by being down in crevices, caves, or faults in the rocks, the gulls are not likely to get many of the murre eggs; however, if the murrens are disturbed a few times by man they may abandon, even at later dates because of gull cries to which they have become conditioned. ((4) Gulls which have lost their eggs by accident or because man has destroyed them as an attempt to control the gull population do not appear to leave their nesting territory any earlier than those gulls which rear young. As a result of general commotion which they set up because of the loss of the first set of eggs, the fuss they make in rebuilding the nest, and the general lack of demands on their time which the feeding of young birds would preclude, they are, at times, more serious enemies to other nesting birds than individual pairs of gulls which are allowed to breed normally. A pair of these gulls with young to feed appear to spend most of their time searching for food along the tide flats, whereas one without young spends most of its time watching from some crag or high rock in the nesting colony ready to take any unguarded egg or young bird of another species which may appear. It is this unoccupied group of gulls that I found were taking the greater portion of the unguarded murre eggs and newly hatched Eider ducklings. (5) On large islands where the gulls are nesting somewhat away from the murrens any amount of disturbance among the gulls does not appear to affect the murrens so long as they are never visited by man. They only become sensitive to the gull restlessness after they have been frightened two or three times.

RECORDS OF EXPERIMENTS

At Wolf Bay in 1931, while studying the birds on Murre Island I discovered that there were about thirty pairs of Great Black-backed Gulls with their territories scattered about among six small nesting groups of murrens. All the murre groups were more or less accessible to full attack. One colony was studied almost continuously over a period of several days from a blind placed in a fault in the rock nearby. This blind was completely concealed from murrens and from gulls. It was entirely below the level of the surrounding surface of the island and was thatched over the top with weeds and fir boughs so that the birds walked across the cover without recognizing any change in the surroundings. In this blind I had a bed and food so that I could remain there for two-day periods. After a few hours in

the blind the birds were unconscious of my presence. The long stays were sufficient to allow them to settle down and to be studied under nearly normal conditions. The murre colony near this blind had 123 eggs originally. A few yards to one side of the murre colony was the nest site of a pair of blackbacks. The gulls had lost their eggs and, although it was past egg-laying season for them, the male repeatedly, each day, would get on the old nest and call the female. Usually she would stand nearby while he worked at the nest materials for some time. Then he might stand on the rocks by the female for several minutes. After this he would walk the twenty yards or so to the murre colony which he would approach along the highest ridge of the island. From the edge of the shallow, wide crevice in which the murres were located he would look all around to see if any egg was exposed. If he saw an egg exposed he would walk around to approach it without flying directly down among the incubating murres. I never saw the gull attempt to take an egg while a murre was incubating it, or approach a murre closely enough to receive a thrust from the sharp beak. When the gull was near one could sometimes hear a low guttural sound from a murre which sounded like "auw", but no murre (not even the unoccupied ones) ever showed any inclination to drive the gull away from the colony. This colony was conditioned to fright because of my appearance when getting into the blind. As the more timid birds delayed the return to their eggs the gull feasted upon these. Thus progressive loss of the colony continued until there were eighty-two eggs remaining. At this time I left the island. When I returned a week later nothing remained but the empty shells of the murre eggs. Apparently the abandonment had been precipitous after a certain point.

The following notes taken from the blind described above will give a picture of the activities of these birds:

"July 14. I am in the blind at 'I colony to observe the murres, 108 remain. Six egg shells were picked up this morning from the rocks here. One entire section of the colony containing fifteen eggs in an exposed position has disappeared.

"4:15 p. m. A Great Black-backed Gull came and took a murre egg. It ate the contents and left the shell on the rocks. 5:30 p. m. The murres are back on their eggs; this pair of gulls which have an empty nest nearby have finished the fourth murre egg in an hour. All the shells are on the rocks in front of the blind. 6:45 p. m. The gull chattered once and several murres left their nests, but a few stayed. The old gull calls his mate to their nest site in the same manner as

when he has food for her. Then he gets on the empty nest and turns about cooing in a way that reminds me of a pigeon. The female gives little attention, but he remains on the nest for some time. 7:15 P. M. The gull has been on his empty nest for half an hour while his mate stood alongside. 7:30 P. M. The gull got off his nest, called to his mate and walked along to the murre colony, picked at three shells which he had left earlier on the rocks and then went down after another egg which, finally, he could not reach. Then he cleaned up around the fourth shell left earlier in the evening. 4:30 A. M. July 15. All is quiet about the murre. The gulls have just taken another egg and left the shell on the rocks. 8:35 A. M. The gulls on the island gave a series of calls which caused most of the murre to leave their eggs. Some have not flown but are standing on the rocks looking about. It is always the male gull of the same pair which comes to this colony. 11:10 A. M. The gull got excited about something which frightened the murre. Most of them flew away from the colony. Some are coming back. 11:20 A. M. The gull is back. He went part way down in this wide crevice and came out with the shell which he left there this morning when I could not see what he was doing."

It should be noted that in connection with the above study that a pair of Great Black-backed Gulls which had three large young at a distance of not more than forty yards never approached or appeared interested in the murre colony. Other murre colonies on the same island were destroyed, however, in the progressive manner as indicated by the notes above. Of the several pairs of gulls living there most of them had been robbed of their chance to rear young. Human robbers had taken the gull eggs.

In 1934, while studying the birds on the east island of the St. Mary's group I found the murre were nearly all located in deep crevices where the gulls could not get the eggs. Here, too, most of the gulls had lost their nests. One pair of these gulls I knew particularly because it occupied a territory within sight of my tent. Most any time of the day one or both of the birds could be seen standing on a high rock overlooking the surf. Here was their territory and their perch. For the most part, they seem to wait there until food was in prospect and then go after it. When a brood of young eider ducks appeared these gulls were after them. They seemed always ready for such an occasion, but otherwise to have little to do with their time. Here, on the St. Mary Islands in 1934 I found the murre very readily became conditioned to gull warning as they did at Wolf Bay in 1931, although the gulls could not get to the murre eggs in most cases. Six

small colonies were studied by me during the two years, with as much caution as possible to prevent frightening but with a total record of ten to twelve visits for each colony, no handling of the adults being attempted. In these colonies there were originally 250 eggs. From these thirteen young were hatched of which five survived to go to the water (see Table 1). Murre colonies should be studied or observed for the most part by means of a concealed approach, especially if gulls are present to announce one's arrival.

TABLE 1. Showing the Effect of Disturbance on Colonies Which Were Visited Several Times During the Incubation Period, Although Precautions Were Taken to Prevent Frightening the Birds.

	Original No. of Eggs	No. Eggs Aban- doned and Lost	No. Eggs Hatched	No. Young to go to Water	No. Colonies
Gull Island, 1931.....	43	39	4	1	3
Murre Island, 1931 ¹	191	189	2	1	6
East Island, 1934 ²	16	3	7	3	1
Total	250	231	13	5	10

CONCLUSIONS

1. The murre normally nesting in colonies on remote islands or inaccessible cliffs, has not evolved a series of responses which permit it to adapt to repeated disturbances in a way to promote the preservation of eggs. The greater degree of adaptation appears to be in its ability to re-form a breeding colony and produce a new crop of eggs.

2. Breeding colonies of murres which are located in the range with Western Gulls or with Great Black-backed Gulls may be seriously affected either by a pressure from excessive numbers of gulls or from a fear conditioning resulting in gull predation of the eggs or the abandoning of them in locations not accessible to gulls.

3. This fear reaction is a colony response although it may start in one individual. At first the flight from the breeding site will not occur until the colony has experienced a series of stimuli ending in contact with a predator. After the conditioning the complete series of responses is set off by the warning stimulus.

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¹The colonies on Murre Island were located so that the gulls could take and they did take most of the eggs.

²The small colony on East Island in the St. Mary Islands which was studied during 1934 hatched a larger number of young than other colonies used in the study. There were no gulls nesting near this colony, a condition which made it possible to approach with less disturbance.

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GOOD LANTERN SLIDES OF BIRDS

BY GEORGE MIKSCH SUTTON AND OLIN SEWALL PETTINGILL, JR.

The making and painting of lantern slides is a somewhat neglected corner on the field of Bird-Art. Photography has advanced. Technique has developed. Never do we attend an ornithologists' convention these days without being thrilled by new camera bird-portraits brought from far and near. Yet we continue to see lantern slides of these very photographs that are less interesting than they should be, poorly composed, and badly painted.

We purpose to present here some suggestions regarding the making and painting of lantern slides of birds. Assuming that photographic methods are understood, we suggest first that slides be printed by projection rather than by contact. This permits the enlarging of the small bird-image on the negative to any desired size. It permits the elimination of details in foreground or background that are unnecessary or out of focus, or that tend to destroy the center of interest. And it permits a proper framing of the slide.

Enlarging is important not alone because we usually wish to see the bird first of all, but because the larger image of the bird itself gives us an opportunity to paint in details of feather-pattern that would otherwise be missed. The elimination or subordination of inconsequential parts of a picture is important unless we are interested primarily in showing the bird *in its habitat*.

The framing of our subject is important. Thus, if our bird is flying, we must remember to allow more space in front of it than behind. If a flying bird is exactly centered, the slide is likely to appear crowded unless the bird-image is kept small. If we are framing a flock of flying birds it is well to avoid cutting any bird in two; and it is extremely bad to leave on the slide the rear half of a bird. A bird that is standing still may be centered. An owl that faces us may be centered. But a bird that is walking must have plenty of space in front of it—at least as much space in front as behind. And if the whole bird is shown, the head or eye, and not as a rule the body, de-