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NOTES ON BANDING OPERATIONS ON THE NORTH SHORE OF THE GULF OF ST. LAWRENCE IN 1929

By HARRISON F. LEWIS

IT was on the morning of July 31, 1929, that we dropped anchor in the little harbor at St. Mary Islands Bird Sanctuary on the north shore of the Gulf of St. Lawrence, prepared to begin our bird-banding activities for the season. We were late. We had more than a thousand bands to place and had intended to commence banding about ten days earlier, but, as often happens in that region, had suffered various delays. By the end of July many young Gulls could fly and many Razor-billed Auks and Common Murres had young so large that they would very soon be abandoning their breeding-places and taking to the water. In order to place all our bands it was necessary to act promptly, so, after a hurried breakfast, we went ashore, assembled a staff, and began the circuit of the Middle St. Mary Island, searching the holes and cracks in the rocks for our prey.

Throughout the banding operations of 1929 I was ably assisted by George Jones, while E. C. Abbe and Hiram and Charles Osborne rendered yeoman service whenever possible. As a result of the joint efforts of so many workers we succeeded in placing 601 bands in the first four days at St. Mary Islands, while, after some interruptions, our bird-banding for the season ended on August 18th, when the last of our supply of 1046 bands was put on the tarsus of a young Razor-billed Auk. This does not indicate a high rate of speed as compared with that attained in some of the large Tern colonies farther south, but nevertheless it really represents a great deal of scrambling about over rough rocks and compares very favorably with similar work in this same region in previous years. Large, concentrated colonies of Ring-billed Gulls or Double-crested Cormorants, when the young are at just the right age, provide

fairly rapid banding, but most of the rest of our banding work requires the expenditure of a good deal of energy per bird banded, and anything higher than 100 a day is reckoned a creditable score. The highest number of bands that we placed in one day last summer was 187, on August 3d.

The banding at St. Mary Islands, as at many other points along the north shore of the Gulf of St. Lawrence, is of a "mixed" type. That is, several species, such as Puffins, Razor-billed Auks, Common Murres, Black Guillemots, Herring Gulls, and Great Black-backed Gulls, occur on the same island, generally more or less intermingled, and as the banding crew works over the breeding-areas none of these birds of suitable age that may be obtainable are refused, so that continuous operations on any one species are rare.

Most of the Alcidæ breeding here have their eggs or their young in some protected place, such as a crack or crevice in the granitic bed rock, or a position under or among boulders, or (in the case of the Puffin) a nest at the end of a burrow in the soil, so that in the majority of cases they cannot be reached, but, on the other hand, in many cases the old birds may be surprised and cornered in their retreats, and both old and young may be banded. Indeed, with these species (except the Black Guillemot), we commonly band more adults than young, for the adults in suitable places may be captured from the time the eggs are laid until the young take to the water, while the young leave their birthplaces soon after they are large enough to band, and so are available to the bander for a short time only.

Because of the capture of considerable numbers of adult birds for banding purposes, we obtain every year a fair number of interesting return records of Alcidæ, since banded birds, as well as those not banded, are taken in the cracks. Up to the present these returns on the breeding-grounds, whether secured by others or by me, have been, so far as I know, returns of birds that were banded as adults. I do not know of the recapture, at any breeding-ground, of any Alcidæ banded when juvenile, although several birds so banded have been reported from other points, such as places in the winter range.

There are probably two reasons for this state of affairs. In the first place, when once a Puffin, Razor-billed Auk, Common Murre, or Black Guillemot has laid an egg in a certain place, it seems to return to that place with great fidelity in succeeding years. A shift to another place is seldom made unless it is forced upon the bird by ice or snow covering the chosen place

so late in the season that egg-laying must be done elsewhere, if at all. Because of this fidelity to a breeding-place once used, we obtain a much higher proportion of returns from birds banded as adults than we should do if the breeding population shifted about or exchanged places each year, for birds incubating in places where they are readily captured may be taken again and again, while great hosts of others, in inaccessible places, are never taken at all. When birds banded as juveniles begin to breed, they presumably may select any available sheltered place in the colony, or perhaps in a group of colonies, and many of them will be in the places inaccessible to us or so open that the birds cannot be cornered there. The chance that a bird banded as a juvenile and arrived at breeding age will breed in a place where we shall capture it is therefore much less than is the chance that an adult that has already been captured and banded as such will breed in a place of that character.

In the second place, there is doubtless with these, as with most birds, a comparatively high mortality in the juvenile and adolescent stages of their existence, when they are inexperienced and not at full strength, so that the proportion of banded juveniles surviving one year after banding is much less than the proportion of banded breeding birds so surviving. It has often been pointed out that the average mortality rate of a species is equal to, and therefore readily obtainable from, its average rate of reproduction. From either of these facts may be derived the average age of an individual of the species, which then commonly appears surprisingly low. More useful for many purposes would be a knowledge of the rate of replacement of the breeding stock, which would be correlated with the average age reached by those individuals that arrive at breeding age. That the average age reached by such individuals would, in many cases, surprisingly exceed the average age reached by the entire species I do not doubt. For the purpose of obtaining such information a sharp distinction should be made between mortality suffered prior to reaching breeding age and mortality suffered later in life. The fact that the Puffin, Auk, and Murre hatch only one young bird *per annum* for each breeding pair, and the Black Guillemot only two young *per annum* for each breeding pair, indicates a comparatively low mortality rate for these species, all ages included, and if, as is probable, a rather high percentage of this is suffered in juvenile and adolescent life, the mortality rate for adults would be expected to be markedly low, and some of them should reach a considerable age. Some of the data ob-

tained by bird-banding are beginning to furnish support for this view.

On July 24, 1923, at St. Mary Islands, Saguenay County, Quebec, (north shore of the Gulf of St. Lawrence, the particular island in the St. Mary group unfortunately not recorded) I captured an adult Puffin and banded it as No. 210439. This bird was recaptured, on June 28, 1927, in a burrow on Western Island, of the St. Mary Islands group, by Mr. C. H. Watson, of Andover, New York, who photographed it and released it. On July 24, 1927, I recaptured it at the same place, and, because its band was badly abraded, I rebanded it as No. 497520. On July 31, 1929, this bird was again captured by me on Western Island, examined, and released. It was then at least seven years old.

Another Puffin, recaptured by me on the island called "The Black Land," in Wolf Bay Bird Sanctuary, Wolf Bay, Saguenay County, Quebec, on August 9, 1929, wore a band that could be read only as No. 2265—, the last two figures being worn off. Examination of the hundred records of birds banded with numbers in the 2265— series shows that only two of them, Nos. 226504 and 226505, were Puffins, and that both of these were banded as adults by me on The Black Land on July 20, 1924. The bird recaptured this year was therefore at least six years old at the time. It was rebanded as No. A606218 and released.

An adult Common Murre that I recaptured on Eastern Island, of the St. Mary Islands group, on August 2, 1929, carried a badly worn band that could be read only as No. 20—89, for the two central digits had been rubbed off. It was rebanded as No. A701694 and released. Fortunately, on searching the Canadian bird-banding records in the head office at Ottawa, I find that only one Common Murre has received a band corresponding to the readable figures on this old one. That bird is No. 204689, which was banded as an adult by me on July 21, 1923, at St. Mary Islands. It was therefore at least seven years old when recaptured in 1929.

It may also be noted here that the 483 Common Murres banded as adults by me prior to 1929 (1923 to 1928) have so far yielded 14 "dead" recoveries, or 2.9 per cent of the total. The 152 Common Murres that I banded as juveniles during the years 1923 to 1928 have so far yielded 14 "dead" recoveries, too, but two of these deaths took place two years after banding and one took place three years after banding, leaving 11 that took place within one year of banding and that may be reckoned as adolescent mortality if we assume that these birds

begin to breed in their second summer. This is 7.2 per cent of the total number of juveniles banded. While these figures cannot be taken as indicating the entire mortality for the birds in question at the ages given, they may be considered as roughly comparable, each with the other, and, used in this way, they show a mortality in the eleven months or so of first-year adolescence that is about two and one half times as high as the mortality of the adults over a period averaging three and a half years per bird. To the "adolescent" mortality should be added the strictly "juvenile" mortality of the first month after hatching. There are no data available on this, for ordinary banding methods are not suitable for marking newly hatched young, and, so far as I know, the detailed, daily observations of a definitely limited group of Common Murres on their breeding-ground that would be necessary to obtain such information have not been made. The need for the making of such observations is just one example of the many existing opportunities for advancing ornithology by persistent concentration on a single problem for a few weeks or months. I cannot personally undertake the solution of this particular one because my duties require me to move from place to place frequently when I am in the region where these Murres breed. However, I know that the juvenile mortality rate of Common Murres is generally low as compared to that of other species, for the single chick of a pair is very solicitously cared for, and is generally either in some secure crevice in the rock or in the midst of a fairly compact group of its species, capable of warding off the usual enemies other than man. Let us assume that the mortality for these birds in the month of juvenile life is three fifths of the adolescent mortality of the succeeding eleven months, or is one and a half in the scale in which the latter is two and a half. Then the total mortality of the first year is the sum of these two, that is, four times the adult mortality of a similar number of birds over a period averaging three and a half years per bird, or fourteen times the mortality of the adult birds in one year. This is probably a reasonable comparative figure, which shows that the assumptions so far made are fairly reasonable.

Now to obtain from these data the rate of replacement of the breeding stock and the average age reached by those individuals that reach breeding age, assuming that the total population of the species is stationary from year to year:

Let x = the number of deaths in one year among 200 breeding adults.

Let y = the number of deaths in one year (the first) among the 100 offspring of these 200 birds.

Since the mortality among the young is, in the year, fourteen times as great as the mortality among a like number of adults, but the number of the parents is twice as great as the number of their young,

$$(1) \quad 14\left(\frac{x}{2}\right)=y$$

And since these 300 birds will be reduced to 200 when the breeding-season comes around again, the total number of deaths in the entire group in one year will be 100, that is

$$(2) \quad x+y=100$$

Solving these two simultaneous equations we find that the number of deaths in the year among the 100 young is 87.5; that is, their mortality for the year is 87.5 per cent; and the number of deaths in the year among the 200 adults is 12.5; that is, their mortality is 6.25 per cent a year. The rate of replacement of the breeding stock is the same as the mortality, or 6.25 per cent per year. Of any 100 birds just arrived at breeding age an average of 6.25 will die annually, and all will be dead at the end of 16 years. The average number of years that they will have lived after reaching breeding age will be, if the mortality among the breeding birds is evenly distributed, just half of 16 years, that is, 8 years. By adding to this the 1 year that they required to reach breeding age, we find that, *on this basis*, the average length of life of those Common Murres that reach breeding age is 9 years.

In considering this result it must not be forgotten that we have *assumed* that Common Murres begin to breed when one year old, that the "juvenile" mortality in the first month after hatching is three fifths as great as the "adolescent" mortality of the succeeding eleven months, that eggs lost are soon replaced, that the species is stationary in numbers from year to year, that all birds of breeding age actually breed, and that the mortality among the breeding birds is evenly distributed. When we have *facts* with which to replace *reasonable assumptions* on all these points, we can replace our tentative results with positive ones.

All of the 14 recoveries obtained by banding young Common Murres are those of birds killed by man, and 12 of the 14 recoveries obtained by banding adults of this species are those of birds killed by man or man's dog. The 2 other recoveries

from birds banded as adults are from birds reported as "found dead," which may or may not have been killed or wounded by shooting. Almost all the Murres reported as shot were killed around the coasts of Newfoundland, where birds of this species are esteemed as food and are not protected by law. Of course, the Common Murres banded are also providing, as has been pointed out, many useful return records at the breeding-grounds, where the birds are caught and released uninjured.

The most southern recovery so far reported for any of the Common Murres banded by me is that of No. 334184, which was banded as an adult at Wolf Bay, Saguenay County, Quebec, on July 27, 1925, and was found dead and floating on an arm of the sea at Comeau's Hill, Yarmouth County, Nova Scotia, about the middle of April, 1927.[1]

I have already published[2] the statement that of 172 adult Common Murres banded by me in 1925, without any attempt to select a particular form, 27, or 15. 7 per cent, were of the "Ringed" form, with white eye-ring and white line behind the eye. Using the larger number of similar data now available, I find that, of 724 adult Common Murres that I have caught and banded on the north shore of the Gulf of St. Lawrence in the years 1923 to 1929, inclusive, 128, or 17.7 per cent, were "Ringed" Murres. These are well scattered among the other other Common Murres, some being present in every breeding group of any size. For example, on August 3, 1929, we found on the Eastern Island, St. Mary Islands, in a small cavern with small outlets, a group of breeding Common Murres that was new to me, and that, from the nature of their breeding-place, we were able to pen in and capture very successfully, so that we banded nearly all the adult Murres that were within the place when we arrived there. From that one breeding group of Murres we banded 50 adults, which is the largest number that I have ever succeeded in banding from one group at one time, and among those 50 there were 8 "Ringed" individuals, which thus formed 16 per cent of the adults handled there. The data given are adequate, I think, to justify the general conclusion that, along the north shore of the Gulf of St. Lawrence, "Ringed" Murres form 16 to 18 per cent of the total population of adult Common Murres. Recaptures of Common Murres of both phases from time to time have never shown an instance where one phase had altered into the other. Each appears to be constant throughout life.

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[1] *Can. Field-Nat.*, XLII, No. 4, Apr., 1928, p. 110.
[2] *Bull. N. E. B. B. A.*, II, No. 1, Jan., 1926, pp. 2-3.

I have never found a group of breeding Murres composed solely of "Ringed" birds, nor have I any other observation, however slight, that would lead me to think that the "Ringed" individuals may constitute a separate species.[1]

It is a common thing for adult Murres, Auks, and Puffins, when released after banding, to take such hurried and ill-directed flight that they dash themselves headlong against some rocky projection and fall discomfited to the ground. The fact that when getting under way in flight they commonly lose altitude for at least a rod or two before they begin to rise is partly responsible for this. Usually, after such an experience, the bird is up and away again without a moment's loss of time, and, before it finally succeeds in getting safely out on or over the water, it may suffer several such terrific collisions without apparent harm. A "Ringed" Murre banded on August 2d last was more unfortunate than usual, for in its first flight after release, it crashed against the perpendicular side of a large boulder, fell to the ground, and was unable to rise again, for it had broken one wing. When its condition was seen, it was put out of its misery.

A juvenile Razor-billed Auk, No. A606034, banded on Middle Island, St. Mary Islands, on July 31, 1929, was peculiar in that its right foot, instead of being solid black, was albinistic distally for more than half of its extent. On the upper surface of the webs the albinistic area extended farther back, nearly all the way across the foot, than it did on the lower surface of the webs. There were a few small black pigmented spots on the upper surface of the webs, on the proximal part of the albinistic area.

During the summer's banding activities, we recaptured nine Razor-billed Auks that I had previously banded as adults in this region. Of these, four had been banded in 1925, four in 1926, and one in 1927. In each case, as far as could be determined, the banded bird was retaken at or near the place of banding. Eight of the nine had to be rebanded because of serious abrasion of the old band, which had generally obliterated some part of the number, in some cases rendering individual identification impossible, although the year of banding was determinable from the part of the number showing the series to which it belonged. It is a problem to prevent such

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[1]The photograph, taken by me on August 4, 1928, appearing on the cover of this number of *Bird-Banding*, is used by courtesy of the National Parks of Canada. It shows incubating Common and Ringed Murres on Egg Rock in Cape Whittle Bird Sanctuary, Saguenay County, Quebec. The editor states that the photograph has been somewhat reduced in size and that a partially shown Murre has been stippled out by the engraver.

defacement of bands on these birds, for they have the habit of standing with the entire tarsus flat on rough rock surface. However, their tarsi are somewhat flattened, and, by shaping the band carefully to the tarsus, it may be prevented from revolving about it, and thus the number may be kept uppermost, preventing at least the greater part of the damage.

An adult Black Guillemot, No. 362528, that I had banded on the Middle Island, St. Mary Islands, on August 3, 1926, was recaptured there by Edmund H. Fletcher on July 17, 1928, and was again captured there by me on July 31, 1929. When examined by Mr. Fletcher, this bird's band-number had lost two figures by abrasion, and when reëxamined this year, it had lost another figure, but it happens that it can still be identified individually by the three remaining figures, since the species is known with certainty, and the possibilities are therefore much restricted.

Of 101 juvenile Ring-billed Gulls that were banded on an island at the mouth of Kégashka River on August 10th, three have already been reported from the United States. No. A606369 was found dead at Franklin, Maine, on November 2, 1929; No. A606346 was found dead on the island of Chappaquiddick, near Edgartown, Massachusetts, on November 13, 1929; and No. A606294 was shot at East Moriches, Long Island, New York, on November 18, 1929.

The birds newly banded during 1929, are, by species:

Puffin (*Fratercula arctica arctica*)	41
Black Guillemot (*Cepphus grylle*)	50
Common Murre (*Uria troille troille*)	247
Razor-billed Auk (*Alca torda*)	224
Great Black-backed Gull (*Larus marinus*)	23
Herring Gull (*Larus argentatus*)	143
Ring-billed Gull (*Larus delawarensis*)	200
Coues's Caspian Tern (*Sterna caspia imperator*)	23
Common Cormorant (*Phalacrocorax carbo*)	4
Double-crested Cormorant (*Phalacrocorax auritus auritus*)	78
Total	1033