WEIGHT RECORDS FOR SOME ATLANTIC ALCIDAE

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THE need for weight records of birds to show individual and geographical variation as well as yearly, daily, sex and age variations has been pointed out by Nice (1938). Amadon (1943 *a* and *b*) has discussed the mathematical analysis of weight data, particularly the relationship of egg weight to body weight and body weight to "general size."

During the breeding seasons of 1931, 1934, and 1938, while working on a general study of the Murre in the Cape Whittle region, I recorded weights of the various species of Alcidae nesting there. This region, on the north shore of the Gulf of St. Lawrence, offers the greatest concentration of alcid breeding colonies on the Atlantic coast of North America. In the vicinity of Wolf Bay, a few miles west of the Cape, and on the St. Mary Islands, a few miles to the east, a great number of small colonies and a few large ones occupy the favorable breeding sites on the small and rocky offshore islands. They are here well isolated from the dogs and other enemies on the mainland; also, many of these islands are within a Government sanctuary system which is excellently patrolled, and I believe it is largely due to this system that the main populations have survived. Weight data on five species—Razor-billed Auk (*Alca torda*), Atlantic Murre (*Uria aalge*), Dovekie (*Plautus alle*), Black Guillemot (*Cepphus grylle*), and Atlantic Puffin (*Fratercula arctica*)—are presented in this report. An attempt was made to secure a series of weights for each species: of the eggs, of the growing young, and of the adults. It is not possible to handle one of these birds frequently (Johnson, 1938:162); in fact, one such disturbance early in the incubation period may cause the entire colony to abandon the site. The weights of the growing young are especially affected by repeated fright of the adult colony, and I took great care to minimize this disturbance factor. Hence, much time is required to secure an adequate series of representative weights. It will be long before we have sufficient data to determine accurately the average weight or daily weight rhythm of these sea birds, or their geographical, seasonal, and other variations, and although my data are in some instances very meagre, it seemed wise to make them available to other students at the present time.

The weight data presented here should be considered in relation to feeding and incubating habits of the birds. Baldwin and Kendeigh (1938:463), for example, found a daily rhythm in the weight of birds they investigated, "with the greatest weights being reached in the late afternoon or early evening and the lowest weights early in the morning." But this conclusion is based chiefly on data from passerine species, which feed largely on insects and seeds and thus accumulate their daily

food requirements gradually over a feeding time of considerable length. Whereas fish-eating birds, such as the Alcidae, by consuming one or more whole fish at a feeding, greatly alter their total weight in a short space of time. Also, the feeding day in northern latitudes is much longer than in middle latitudes and needs to be considered as a factor in the study of weights. (I have observed Murres, for example, feed young until 9:30 P.M. and resume feeding at 3:00 A.M. And it is possible that adults feed at sea during any hour of the night.) Furthermore, some species, like the Murre, often remain on the eggs during incubation for many hours and are sometimes without food for 15 to 24 hours.

In considering the growth of the young it is well to note that the young of Guillemots and Puffins (both burrow nesters) remain at the nest site much longer than the young of the related Auks and Murres (both surface nesters). When we have adequate data on a larger number of species, we may find that the growth curve of one burrow nesting species is more closely comparable with that of another burrow nesting species, whether of the same or a different family, than with that of a surface nesting species of the same family. I believe that, during the time the bird spends at the nest site, its environment, behavior patterns, and growth curve are closely correlated.

The factor of evaporation from eggs was ignored in this study and records made regardless of the stage of incubation. Addled eggs were readily detected and were discarded. In making the growth-study, young birds were marked by colored glass beads in different combinations, strung on soft copper wire and placed around the tarsus, where they remained until the young were old enough to carry an aluminum band. To secure the weight record, birds were placed in a cloth bag and weighed on scales sensitive to one tenth of a gram. The weight of the bag fluctuated in the field and had to be redetermined frequently. Except for some of the data relating to adult Murres and Black Guillemots, it was not possible to distinguish sexes. Table 2 appears to indicate a sex difference in the weight of Murres. Wing measurements are also included in the table for the Murre.

All the species studied were well started in the incubation period. The general condition of all birds weighed appeared to be good and was probably typical of the average breeding season. Food was abundant during June and July of 1934 and 1938, when this study was made. No evidence of disease was noted in any of the colonies. However, young birds in the Murre and Auk colonies were sometimes parasitized by ticks and lice. Because the present study was, for the most part, conducted within the confines of a Government sanctuary, it was not possible to record significant data relating to the role of internal parasites in relation to the health of these birds. So far as the adults are concerned, probably only healthy birds would be found in the breeding colonies. But the growth curve of young birds may at times be affected by such parasites. I have found downy young of the Red-breasted Merganser

taken in the region heavily infested with tapeworm (Johnson, 1937). I am certain that a weakened condition of many young birds of these colonial species is followed by a greater incidence of ticks and lice. It is not possible to show that such a weakened condition is always a result of starvation—internal parasites may be a factor. In the Murre, the care of young, so far as food is concerned, is certainly after the first few days, dependent upon a vigorous ceremonial response from the young. A weakened condition due to internal parasites would inhibit this response and thus perhaps lead to the neglect of the young by the parent birds.

Razor-billed Auk. Thirty-eight eggs of the Auk varied in weight from 73.5 grams to 100 grams (average: 85.4 grams). Two young Auks observed before their first feeding, weighed 57 and 60 grams. One juvenile, approximately three weeks old, leaving the nest site to go to the water (they do not return to the nest site as young birds), weighed 167 grams. The average weight of seven adult birds taken at the nest was 686 grams (extremes: 608 and 740 grams).

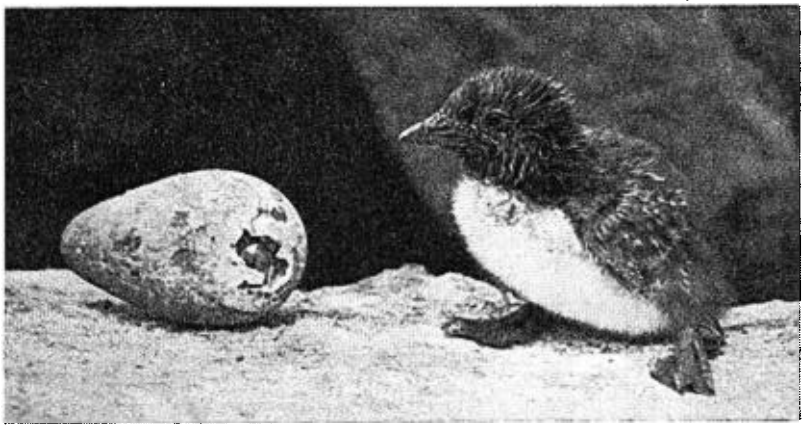

Figure 1. Young Murre and pipped egg.

Atlantic Murre. Fifteen eggs of the Murre varied in weight from 83 to 117 grams (average: 103.4 grams). One egg that weighed 113 grams when fresh lost 8 grams in weight in 10 days of incubation. (The incubation period, which I determined by giving Murre eggs to a domestic chicken to hatch, is 30 to 32 days.)

The true picture of the growth of the young Murre on the nest site is not easy to secure. Attempts to approach the breeding colonies more often than at three- to four-day intervals usually resulted in disturbing

TABLE 1
WEIGHTS (IN GRAMS) OF YOUNG MURRES

	1931														1934							
Bird	A	O	B	N	C	D	E	F	G	L	H	I	J	K	P	Q	R	S	T	U	V	W
Egg wt.	89												93									
1 day																72	80	75	80	80	75	
2 days			101					102													98	
3 days	116.5										116		115.5					92	115	105		92
4 days				124											120				110			
5 days				110			119			126											102	
6 days	134							127		147					145			104		118		
7 days				dead	143						168		dead						120			
8 days	140					160				dead											101	
9 days							168								180			133		116		113
10 days								196			191											
11 days					154							176.2								123		
12 days	148					169	187				192				187							
13 days								185	186					179							dead	
14 days					156		183	210												132		
15 days		156				186					gone	222			187							
16 days														227								
17 days														220	195							
18 days		187			199		gone	gone	213			222		187								
19 days						188			162											135		
20 days					170				190			235		205								
21 days						190								gone	235							
22 days		gone				gone			182			gone			230							
23 days					141				gone						gone							

the adult birds to the extent that the young were either abandoned or so neglected that the data could not be considered representative (Johnson, 1938). But by selecting small colonies which could be approached somewhat under cover, a series of weights of young birds was secured (Table 1).

The records of individual young birds show that some lose weight a few days before leaving the nest site. Some lose weight at an earlier age, and these usually die at the nest. Emaciated young birds in a colony are generally the result of the adults abandoning the nests. If a young bird has reached the age of 16 to 18 days before such starvation begins, it usually responds to the calls of the adults at sea and breaks away from the nest site.

TABLE 2

ADULT BREEDING MURRES: WEIGHT DISTRIBUTION AND WING LENGTH

No. of birds	Weight (in grams)	Wing length		Sex, when known	
		range	average	male	female
1	1100–1125	.....	225.0	?	?
1	1075–1100	.....	....	1	0
1	1050–1075	.....	214.0	1	0
7	1025–1050	197–222	211.0	2	1
15	1000–1025	203–246	215.3	2	4
16	975–1000	208–218	213.4	5	3
13	950– 975	203–246	213.3	4	7
8	925– 950	210–218	215.3	3	0
13	900– 925	200–212	206.5	2	4
6	875– 900	203–216	208.3	?	?
3	850– 875	.....	....	1	?
4	825– 850	205–212	208.0	1	3
1	800– 825	.....	....	0	1

Table 2 gives the data on 89 adult breeding Murres taken at the nest during banding operations. During the 1938 season I discovered that the sexes could be distinguished in living Murres by an examination of the vent, and the sex, when known, is given in the table. The average weight of the 89 adults was 964.7 grams. The heaviest bird (a male not included in the table) weighed 1,150 grams; the lightest breeding bird, a female, weighed 815 grams.

Dovekie. In late fall and early winter many Dovekies come to these islands. Weights of eight wintering Dovekies, taken by Donald Osborne, of Harrington Harbor (Johnson, 1935), averaged 162.5 grams (extremes: 127 and 188 grams).

Black Guillemot. Twenty-three eggs of the Guillemot varied in weight from 42 grams to 65 grams (average: 49.2 grams). The difference in weight between the two eggs of single sets varied from .5

TABLE 3

WEIGHT DISTRIBUTION OF ADULT BLACK GUILLEMOTS

Weight range (in grams)	Graphic picture	Number of birds
470–480	★★	2
460–470	★	1
450–460		0
440–450	★★★	3
430–440	★★★★★	5
420–430	★★★★★★★★★★	10
410–420	★★★★★★★★★★★★	12
400–410	★★★★★★★	7
390–400	★★★★★★★★★★★★	12
380–390	★★★★★★★	7
370–380	★★★★	4
360–370	★★	2
350–360	★★	2
340–350	★	1
330–340		0
320–330		0
310–320	★	1

gram to 3 grams. Three newly-hatched birds had an average weight of 34.3 grams. Table 3 shows the weight distribution of 69 breeding adults. In 1938, I weighed seven Guillemots which were known to be four or more years of age. Their weights were: 437, 389, 358, 394.5, 404, 382, and 416 grams. The average for these seven birds was 398.5 grams, whereas the average weight for all breeding Guillemots was 419 grams.

TABLE 4

FLUCTUATIONS IN WEIGHT (IN GRAMS) OF INDIVIDUAL BLACK GUILLEMOTS WEIGHED ON DIFFERENT DAYS AND AT DIFFERENT HOURS OF THE DAY.

Interval between weighings	8 A.M.	10 A.M.	2 P.M.	4 P.M.	Difference
6 days	462			398	64.0
4 "	314	398.5			84.5
3 "	419		419		0
1 "		428			
		417			11.0
5 "	436	431	425		{5.0
3 "	416				{6.0
	403				13.0
3 "	380	394.5			14.5
2 "	396	406			10.0
11 "		416		415	1.0
5 "	399			399	0

Two birds known to be in their first breeding year weighed 414 and 417 grams, which is about the size of the average breeding bird of the species.

Table 4 gives data on daily and hourly fluctuations in the weight of individual Guillemots. The two weights (taken at 8:00 A.M. and 10:00 A.M. respectively) of the second bird recorded in the table show a difference of slightly over 26 per cent. This may have been due to an unusual quantity of food in the gullet at the second weighing, since no such extreme fluctuation was shown by the other birds recorded.

Atlantic Puffin. Thirty eggs of the Puffin varied in weight from 54.5 to 73.2 grams (average: 55.9 grams). One newly hatched young weighed 42 grams. Twenty-nine breeding birds of both sexes taken at the nest site varied in weight from 407 to 542 grams (average: 476.1 grams).

Summary

During the breeding seasons of 1931, 1934, and 1938, weight data were collected during field work on the north shore of the Gulf of St. Lawrence on four species of Alcidae: Razor-billed Auk (*Alca torda*), Atlantic Murre (*Uria aalge*), Black Guillemot (*Cepphus grylle*), and Atlantic Puffin (*Fratercula arctica*).

The average weight of 38 eggs of the Auk was 85.4 grams; for 15 eggs of the Murre, 103.4 grams; for 23 eggs of the Black Guillemot, 49.2 grams; for 30 eggs of the Puffin, 55.9 grams.

The average weight of adult breeding birds were as follows: Auk (7 adults), 686 grams; Murre (89 adults), 964.7 grams; Black Guillemot (69 adults), 419 grams; Puffin (29 adults), 476.1 grams.

Seven Black Guillemots known to be four or more years of age averaged 398.5 grams in weight, which is less than 5 per cent below the average of all adults weighed.

Adult banded Black Guillemots recaptured on different days and at different hours of the day showed great fluctuation in weight, obviously a reflection of their feeding habits. One bird showed a fluctuation of 26 per cent between the two weights listed.

The growth of young Murres is shown in relation to the length of time spent at the nest site. These young normally leave the nest between 18 and 24 days of age. They are likely to leave earlier if a food shortage comes after they are 14 days of age. If the shortage comes before that, the young die at the nest site.

The supply of food to the young is intimately tied up with feeding ceremony. When this relationship is not going well (possibly due to internal parasites weakening the young) the role of external parasites becomes significant to an undetermined degree.

Wing measurements of adult Murres showed no close correlation with weight.

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