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CHANGES IN THE PROPORTION OF BRIDLED MURRES IN NORTHERN LABRADOR

T. R. BIRKHEAD

AND

A. R. LOCK

The Common Murre (*Uria aalge*) occurs in two forms in the North Atlantic, normal and bridled, the latter being distinguished by its white eye ring and auricular groove. There is evidence that the bridled condition is a recessive variant of the normal form, carried by a single gene on one of the autosomes (Jefferies and Parslow 1976). The distribution of bridled birds in the North Atlantic is now well known (Southern 1962, Brun 1970): a cline exists with less than 1% bridled birds in the south, to over 50% in some northerly populations. In fact, the cline in ratio of bridled birds is stepped from west to east across the Atlantic under the influence of the slanting course of the North Atlantic Drift (see Southern 1962).

The highest proportion of bridled murres ever recorded was at Nunarsuk (now Nunaksuk) Island, in northern Labrador, where Tuck (1961) recorded 71% bridled in 1953. Since Nunaksuk is close to the northern limit of the Common Murre's distribution in eastern North America (Brown et al. 1975), a high figure was not unexpected. However, because the Labrador colonies are remote and difficult to reach, there have been no counts of bridled birds at Nunaksuk, and few elsewhere in Labrador since 1953. In 1978 and 1979, the Canadian Wildlife Service conducted a survey of seabird populations, from the Bird Islands in southern Labrador, north to the Pyramid Islands, a latitudinal distance of some 430 km. During the surveys the proportion of bridled individuals was recorded at each murre colony.

Sample sizes for counts of bridled birds varied from colony to colony, according to size and accessibility of breeding ledges. In the more northerly colonies populations are small and relatively inaccessible, and so birds are difficult to observe closely, hence the small sample sizes for these colonies. The proportion of bridled murres in different colonies varied between 10.7% and 35.0% (Table 1); this difference being significant ($\chi^2 = 26.23$, 10 df, $P < 0.01$). However, there was no clear-cut trend for a higher proportion of bridled birds at more northerly colonies. We examined this using a Spearman Rank correlation in two ways. First, we combined the three most northerly colonies, which lie within 10 km of each other ($r_s = 0.425$, n = 9, $P > 0.05$); second, we omitted the Castle and Pyramid islands from the analysis ($r_s = 0.367$, n = 9, $P > 0.05$). Either way the trend is not a strong one.

For colonies that were composed of several small islands close together, the proportion of bridled birds was recorded separately for each island (Table 1). At the Herring Islands there was a significant difference between islands ($P < 0.05$), but this was not the case at either the Gannet Clusters ($P > 0.1$) or Bird Islands ($P > 0.1$). An analysis of the non-random distribution of bridled murres within the Gannet Clusters colony is presented elsewhere (Birkhead et al. 1980).

The most important finding of this survey is the decrease in the proportion of bridled murres at two colonies that Tuck (1961) had sampled in 1953. Tuck recorded 32% bridled birds at the Gannet Islands (i.e., Outer Gannet and Gannet Clusters combined), and 71% at Nunaksuk. The situation in the latter colony is qualitatively supported by Austin's (1932:132) statement that in 1927 of the few Common Murres he saw there "most were ringed (= bridled) birds." Figures for 1978 and 1979 (Table 1) indicate that the proportion of bridled birds at Nunaksuk has decreased by 44% and at the Gannet Islands by 15%. Unfortunately, Tuck's raw data are not available to make more precise comparisons, but he informed us (pers. comm.) that the Gannet Islands figure was derived from counts of about 1,000 birds in total, and that at Nunaksuk almost the entire population was counted, i.e., ca. 300 birds. If we assume that the totals counted were 1,000 and 300 respectively, a chi-square test indicates that in both cases the decrease is highly significant ($P < 0.001$). Farther south, however, at Funk Island, the proportion of bridled birds has remained unchanged since Tuck's counts in the 1950's (1956: 21%, 1958: 17.3% and 1959: 19.9%—each based on ca. 1,000 individuals). A count at Funk Island in 1978 showed that, of the 1,112 birds examined, 17.3% were bridled (I. Kirkham, pers. comm.).

Southern (1962) has demonstrated that, over the North Atlantic as a whole, the proportion of bridled birds increases from south to north. Tuck's (1961) figures for Newfoundland and Labrador in the 1950's show that the proportion of bridled birds increased from about 19% at Funk Island to 71% at Nunaksuk (a difference of 52%) over only eight degrees of latitude. This was probably the steepest change in frequency recorded in any part of the Common Murres' range (Southern 1962, Brun 1970). In the present survey, 25 years later, the south-to-north trend within Labrador was not significant.

The change in the proportion of bridled birds recorded in Labrador may be part of a more general decline of this morph. For example, Brun (1971) recorded a decrease at Bear Island, north of Norway, between 1948 and 1970, and drew attention to the decreasing trend documented by Southern (1962). One must be cautious, however, in interpreting such figures, because, as Southern (1951) pointed out, discrepancies among observers can be substantial and in some cases may account for the difference between two counts. Nevertheless, the magnitude of the decline in Labrador is probably too large to be accounted for in this way.

If the recorded change is real, several explanations are possible. First, it could indicate differential emigration by bridled birds, or differential immigration by normal birds. Rockwell and Cooke (1977) recorded this effect in Lesser Snow Geese (*Anser caerulescens*). Second, it could indicate strong selection against the bridled form: given the population characteristics of Common Murres (i.e., low reproductive rate, high adult survival, deferred maturity and a strong tendency for young to return to their natal colony; Birkhead and Hudson 1977) and the rate of change in proportion of bridled birds, the factor most likely to be responsible for the change would seem to be an increase in adult mortality of the bridled form. A third possibility is that both emigration or immigration plus selection may have operated to produce the change. Further studies

TABLE 1. Names and locations of Common Murre colonies in Labrador at which the proportion of bridled birds was recorded in 1978 or 1979.

Colony name	Location	Population[a]	Bridled murre observations		
			Sample counted	No. bridled	Percent bridled
Pyramid Islands	56°26′N, 60°36′W	300	25	3	10.71
The Barbican	56°22′N, 60°39′W	170	74	15	20.27
The Castle	56°21′N, 60°40′W	220	20	7	35.00
Kidlit Island	56°13′N, 60°28′W	700	182	40	21.98
Nunaksuk Island*	56°03′N, 60°28′W	200	59	16	27.11
Quaker Hat	54°44′N, 57°20′W	650	303	53	17.49
North Green Island	54°24′N, 57°19′W	190	40	7	17.50
Herring Islands[b]	54°20′N, 57°06′W	4,140	1,073	255	23.76
Island 1	—	590	213	60	28.17
Island 2	—	2,030	474	120	25.32
Island 3	—	1,520	386	75	19.43
Outer Gannet	54°00′N, 56°32′W	ca. 20,000	694	150	21.61
Gannet Clusters	53°56′N, 56°32′W	ca. 20,000	1,495	260	17.39
Island 1	—	9,050	428	67	15.65
Island 3	—	9,370	442	73	16.51
Island 4	—	1,770	588	113	19.22
Island 5	—	ca. 250	37	7	18.92
Bird Islands	53°44′N, 56°15′W	3,130	569	103	18.10
Little Bird	—	1,850	269	48	17.84
Big Bird	—	1,280	300	55	18.33

[a] Population size; all figures refer to approximate number of pairs.
[b] Comparing the proportion of bridled birds within colonies: Herring Islands: $\chi^2 = 6.91$, 2 df, $P < 0.05$. Gannet Clusters: $\chi^2 = 2.56$, 3 df, $P > 0.1$ (n.b. we did not sample the very small population on Island 2). Bird Islands: $\chi^2 = 0.02$, 1 df, N.S.
* Addendum: A second count at Nunaksuk was made in July 1980 by A. R. L., which gave 47 bridled out of 196 birds (24.00%), not significantly different from that in the table ($\chi^2 = 0.24$, 1 df, N.S.).

are necessary to determine which of these explanations is correct.

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LITERATURE CITED

AUSTIN, O. 1932. The birds of Newfoundland Labrador. Mem. Nuttall Ornithol. Club 7:1–229.

BIRKHEAD, T. R., AND P. J. HUDSON. 1977. Population parameters for the Common Guillemot *Uria aalge*. Ornis. Scand. 8:145–154.

BIRKHEAD, T. R., J. D. BIGGINS, AND D. N. NETTLESHIP. 1980. Non-random, intra-colony distribution of bridled Guillemots *Uria aalge*. J. Zool. Lond. 192:9–16.

BRUN, E. 1970. Dimorph-ratio cline of bridled guillemots (*Uria aalge*) in Norway. Astarte 3:45–50.

BRUN, E. 1971. Change in the dimorph-ratio of bridled guillemots (*Uria aalge*) on Bear Island. Astarte 4:1–6.

BROWN, R. G. B., D. N. NETTLESHIP, P. GERMAIN, C. E. TULL, AND T. DAVIS. 1975. Atlas of eastern Canadian seabirds. Canadian Wildlife Service, Ottawa.

JEFFERIES, D. J., AND J. L. F. PARSLOW. 1976. The genetics of bridling in guillemots from a study of hand-reared birds. J. Zool. Lond. 179:411–420.

ROCKWELL, R., AND F. COOKE. 1977. Gene flow and local adaptation in a colonially nesting dimorphic bird: the Lesser Snow Goose (*Anser caerulescens caerulescens*). Am. Nat. 111:91–97.

SOUTHERN, H. N. 1951. Change in status of the bridled guillemot after ten years. Proc. Zool. Soc. Lond. 121:657–671.

SOUTHERN, H. N. 1962. Survey of bridled guillemots, 1959–60. Proc. Zool. Soc. Lond. 138:455–472.

TUCK, L. M. 1961. The murres. Can. Wildl. Serv. Monogr. No. 1.

Zoology Department, The University, Sheffield, S10 2TN England. Address of second author: Canadian Wildlife Service, Bedford Institute of Oceanography, P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2, Canada. Accepted for publication 12 June 1980.