

Population dynamics of lice (Mallophaga) on auks (Alcidae) from Newfoundland¹ELDON S. EVELEIGH² AND WILLIAM THRELFALL

Department of Biology, Memorial University of Newfoundland, St. John's, Nfld, Canada A1C 5S7

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Two hundred and seventy alcids representing six species from Newfoundland, Canada, were examined for Mallophaga. A total of 12 species belonging to three genera (*Saemundssonina*, *Cummingsiella*, *Austroromenopon*) were recovered. Each host species and the parasites recovered from it are discussed separately. Details of prevalence and intensity of parasitism are given, as are seasonal and annual data. Differences between the burdens of adults and chicks are recorded and the prevalence and intensity of infestation is related to the ecology of the hosts.

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On a cherché des mallophages chez 270 alcidés appartenant à six espèces de Terre-Neuve, Canada; on en a trouvé un total de 12 espèces et trois genres (*Saemundssonina*, *Cummingsiella*, *Austroromenopon*). Chaque hôte et les parasites qui l'habitent sont considérés séparément. On examine en détail la prédominance et l'intensité du parasitisme, de même que les données saisonnières et annuelles recueillies. On tient compte des différences entre l'abondance des parasites chez les adultes et l'abondance chez les oisillons: la prédominance et l'intensité de l'infestation sont reliées à l'écologie des hôtes.

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Introduction

While many papers have been written on the taxonomy and distribution of Mallophaga, few papers deal with their biology. Some of the more recent works concerning the biology of these organisms are those of Ash (1960), Kalamarz (1963a, 1963b), Touleshkov (1965), Baum (1968), Foster (1969), and Nelson and Murray (1971). To date no detailed studies have been undertaken on the ecology of the Mallophaga of auks (Alcidae).

A study of the ectoparasites of auks in Newfoundland was, therefore, initiated in 1972 to determine the parasite species present, the degree of host infestation, frequency of occurrence of each parasite species within the host population, their distribution on the host, and their population dynamics. It was also anticipated that the examination of chicks and adults would provide phenological data on adult-to-chick transfer of Mallophaga, the effect of this transfer on the

¹This paper consists largely of material submitted by the senior author in partial fulfillment of the requirements for the degree of M.Sc., Memorial University, St. John's, Nfld.

²Present address: University of Toronto, Department of Zoology, Ramsay Wright Zoological Laboratories, 25 Harbord Street, Toronto, Ont., Canada M5S 1A1.

populations of lice on the adult hosts, and changes in the mallophagan fauna with increasing age of the host. The study was made possible by the presence of a large, accessible auk colony about 19 mi (1 mi = 1.609 km) south of St. John's, Newfoundland, and by the presence of large numbers of auks, samples of which could easily be obtained by hunting, around the province's coastline during winter.

Materials and Methods

The birds examined in the present study (Table 1) were collected in two main areas (the Witless Bay Sea Bird Sanctuary (W.B.S.S.) (47°15' N, 52°47' W) and Hillgrade, New World Island, Notre Dame Bay (N.D.B.) (49°32' N, 54°47' W) (Fig. 1)) using a variety of trapping techniques and by shooting.

Most of the birds were euthanized upon capture and, like those shot, placed in individual plastic bags to prevent ectoparasite migration between hosts, labelled, and frozen for future examination. To determine the distribution of the ectoparasites on hosts, the body was arbitrarily divided into 12 regions (Fig. 2).

A number of birds were examined for ectoparasites in the field. These birds were placed in a large, transparent glass bottle equipped with a stopper on which was fastened several gauze pads moistened with ether. After several minutes, or when the bird was sedated, it was removed and examined for ectoparasites by deflecting the feathers with forceps and removing any organisms seen. The bird was then weighed (OHAUS, Model 8014)

TABLE 1. Details on species of birds examined during the study

| Species | No.* of: | | Locality | Date caught | Method of capture | |
|--|----------|--------|-----------|-------------|-------------------|-------------------|
| | Chicks | Adults | | | Chicks | Adults |
| Razorbill (<i>Aica torda</i> L.) | 3 | 1 | W.B.S.S.† | Jul. 1972 | By hand | By hand |
| | | 1 | N.D.B.‡ | Dec. 1972 | | Shot |
| | 1 | 2 | W.B.S.S. | Jul. 1973 | By hand | By hand |
| Common murre (<i>Uria aalge</i> (Pont.)) | 6 | 12 | W.B.S.S. | Jul. 1972 | By hand | Salmon dip net |
| | | 1 | N.D.B. | Dec. 1972 | | Shot |
| | | 16 | W.B.S.S. | Jul. 1973 | | Noose pole |
| Thick-billed murre (<i>Uria lomvia</i> (L.)) | | 32 | N.D.B. | Nov. 1972 | | Shot |
| | | 20 | N.D.B. | Dec. 1972 | | Shot |
| | 2 | 1 | W.B.S.S. | Jul. 1973 | Salmon dip net | Salmon dip net |
| Dovekie (<i>F. autus alle</i> (L.)) | | 1 | N.D.B. | Nov. 1972 | | Shot |
| Black guillemot | | 17 | N.D.B. | Dec. 1972 | | Shot |
| | | 2 | N.D.B. | Nov. 1972 | | Shot |
| (<i>Cephus grylle</i> (L.)) | | 8 | N.D.B. | Dec. 1972 | | Shot |
| Common puffin (<i>Fratercula arctica</i> (L.)) | | 7 | W.B.S.S. | May 1972 | | 20-f herring net‡ |
| | | 2 | W.B.S.S. | Jun. 1972 | | 20-f herring net |
| | 1 | 11 | W.B.S.S. | Jul. 1972 | By hand | Shot |
| | 5 | 10 | W.B.S.S. | Aug. 1972 | By hand | 20-f herring net |
| | 6 | 6 | W.B.S.S. | Sep. 1972 | By hand | Shot |
| | | 2 | N.D.B. | Dec. 1972 | | Shot |
| | | 7 | W.B.S.S. | May 1973 | | 20-f herring net |
| | | 14 | W.B.S.S. | Jun. 1973 | | 20-f herring net |
| | | 18 | W.B.S.S. | Jul. 1973 | | 20-f herring net |
| | 3 | 2 | W.B.S.S. | Aug. 1973 | By hand | Shot |

*† does not include birds examined and released (common puffin, 48; black guillemot, 2).

† W.B.S.S. = Witless Bay Sea Bird Sanctuary.

‡ N.D.B. = Notre Dame Bay.

§ Fishom (f).

measured (according to Godfrey (1966)), banded, and released. This method proved to be effective in that it immobilized the parasites, making their removal easier and it also allowed examination of all body regions.

Birds that were examined in the laboratory were placed in a white enamel dish (39 cm x 31 cm) under an overhead fluorescent lamp equipped with a 12-cm diameter magnifying lens. Forceps were used to deflect the feathers, exposing the ectoparasites. Each region was examined individually and any ectoparasites seen were removed and placed in 70% alcohol, their location being recorded. The birds were weighed, measured, and sexed after examination to avoid accidental loss of ectoparasites during handling. At a later date the ectoparasites were separated on the basis of species, sex, and stage of development and counted. The results were analyzed using standard statistical methods. Permanent mounts were made of representatives of each species of ectoparasite recovered using Rubin's fluid (Rubin 1951).

Results and Discussion

Adults and nymphs of *Saemundssonina* spp., *Cummingsiella* spp. (Ischnocera: Philopteridae), and *Austroromenopon* spp. (Amblycera: Menoponidae), representing two suborders and two families, were recovered from the 270 alcids of six species examined. Specimens of *Saemund-*

sonia and *Cummingsiella* were recovered from all species of alcids examined; *Austroromenopon* was recovered from all except *Cephus grylle*. A search of the literature revealed that, to date, no *Austroromenopon* spp. have been recorded from the latter host. Taxonomic designations follow the works of Clay (1959), Emerson (1972), and Timmerman (1949, 1954a, 1954b, 1957, 1963, 1974).

Host species will be discussed individually.

Common Puffin (Fratercula arctica (L.))

Eighty-four (67%) of 125 adults from the W.B.S.S. were infested with Mallophaga (mean 7 per infested bird; range 1-56) and 12 (80%) of 15 chicks (mean 35; range 2-135). *Saemundssonina fraterculae* (Overgaard, 1942) (65% infested), *Cummingsiella helgovauki* Timmermann, 1974 (13% infested), and *Austroromenopon nigropleurum* (Denny, 1842) (3% infested) were recovered.

The frequency distribution is of the "hollow curve" type (Fig. 3) described by Williams (1964) in which most of the hosts have a few parasites, and most of the parasites are on a few hosts.

It is of interest to note that the two most closely related species (*U. aalge*, *U. lomvia*) shared two of the four species recovered from these hosts (*C. obliqua* ssp., *S. calva*). Furthermore, a close similarity existed between the incidence of these parasites on both hosts. Species of each mallophagan genus on the various adult hosts showed differences in population structure. *Saemundssonina* spp. were dominant only on *F. arctica*, *Cummingsiella* spp. on *U. lomvia* and *P. alle*, while *Austromenopon* spp. were not dominant on any of the hosts. On different hosts each mallophagan species preferred certain body regions with overlap occurring between different species in certain of these regions. Interestingly, this overlap always occurred between an ischnoceran and an amblyceran, hence, no competition existed between genera on hosts.

Chicks had a higher infestation than adults in all cases except *A. torda*, indicating that active breeding occurs on immature hosts. The most active Mallophaga were the first to transfer to chicks, although they may not be dominant on adult hosts. An example of this is seen in *F. arctica*.

Nymphs were not the dominant age class of any of the species on adult hosts, although nymphal *Cummingsiella* were higher in winter on *U. lomvia* and *P. alle*. In contrast, on most of the chicks, nymphs dominated the population. The sex ratio of each species varied with the host, females being generally present in higher numbers on hosts in winter and on immature hosts.

The prevalence and intensity of infestation of adult alcids with Mallophaga also appears to be related to the nesting habits of the hosts. *F. arctica*, a burrow nester with relatively little contact with other *F. arctica*, have low incidence (67%) and low intensity (seven lice per infested host) of infestation. *A. torda* (75% infested with an average of six lice per infested host) and *C. grylle* (42% infested with an average of two lice per infested host), both being mainly crevice or boulder nesters with little contact with others of its species, showed similar results. However, *P. alle*, mainly crevice nesters, were 100% infested with Mallophaga with an average of 42 lice per host. This high infestation could be due to their occurrence in enormous colonies in the north (Dement'ev and Gladkov 1951; Salomonsen 1951) with high chances for contact with others of its species on cliffs and in crevices. *U. aalge* and *U. lomvia*, ledge nesters with

frequent contact between individuals were highly infested (82% infested with an average of 10 lice per infested host and 85% infested with an average of 19 lice per infested host respectively). Post and Enders (1970) compared the infestation of two *Ammospiza* spp. occupying the same habitat, noting that the species occupying the wetter area of the marsh and feeding closer to the ground had a higher incidence and intensity of infestation with Mallophaga. Hence, it appears that the habits and habitat of the hosts affect the mallophagan burden of the hosts.

It is evident from this study that the Mallophaga of seabirds provide excellent material for a study of changes in parasite fauna, the distribution on the hosts, and the dynamics of the parasites. Before the data collected can be fully interpreted and its significance understood, it is essential that we endeavour to learn more about the life cycles of the creatures we are studying.

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