protein composition caused by increased heat. Ankney (1974) reported that oven-drying at 105°C and freeze-drying did not remove significantly different amounts of water from snow goose (*Chen caerulescens*) muscle.

There were no differences in the mean FAT extracted among the drying treatments for either the house sparrow ($p > 0.5$, Table 2A) or the meadow vole ($p > 0.5$, Table 2B). This is similar to what Jones (1979) found in a study of great white pelican (*Pelecanus onocrotalus*) egg composition where the amount of lipid extracted from egg dried at 100°C did not differ from the amount reported by Ricklefs (1977*a*, 1977*b*) who used 40°C.

We conclude that small birds and mammals can be safely oven-dried at high temperatures without changing the relative fat content of the tissues. However, care must be taken to avoid burning the sample and hence changing the protein composition. Freeze-drying is faster than oven-drying at low temperatures (Table 1) and does not change tissue composition. Therefore, it is preferable to oven-drying.

Acknowledgements

We would like to thank D. Ogilvie, J. E. Steele, and S. Johnson for their assistance during this study. M. H. Turnbull and J. O. Schieck helped with tissue preparations. Special thanks to C. J. Surveyer, D. J. Fraser, D. M. Scott, and P. E. Slattery for reading and making suggestions on early drafts of this report.

ANKNEY, C. D. 1974. The importance of nutrient reserves to breeding blue geese, *Chen caerulescens*. Ph.D. thesis, University of Western Ontario, London.

ANONYMOUS. 1980. Official methods of analysis. *Edited by* W. Horwitz. Association of Official Analytical Chemists, Washington, D.C.

BLEM, C. 1976. Patterns of lipid storage and utilization in birds. Am. Zool. **16**: 671–684.

DOWGIALLO, A. 1975. Chemical composition of an animal's body and its food. *In* Methods for ecological bioenergetics. *Edited by* W. Grodzinski, R. Z. Klekowski, and A. Duncan. IBP Handbook No. 24. Blackwell Scientific Publications, Oxford.

GRODZINSKI, W. 1975. Energy flow through a vertebrate population. *In* Methods for ecological bioenergetics. *Edited by* W. Grodzinski, R. Z. Klekowski, and A. Duncan. IBP Handbook No. 24. Blackwell Scientific Publications, Oxford.

GORECKI, A. 1975. Calorimetry in ecology studies. *In* Methods for ecological bioenergetics. *Edited by* W. Grodzinski, R. Z. Klekowski, and A. Duncan. IBP Handbook No. 24. Blackwell Scientific Publications, Oxford.

JONES, P. J. 1979. Variability of egg size and composition in the great white pelican (*Pelecanus onocratulus*). Auk, **96**: 407–408.

KLIEBER, M. 1961. The fire of life—an introduction to animal energetics. J. Wiley and Sons Inc., New York.

ODUM, E. P. 1960. Lipid deposition in nocturnal migrant birds. Proceedings of the XII International Ornithology Congress, Helsinki. pp. 563–578.

RICKLEFS, R. E. 1977*a*. Variation in size and quality of the starling egg. Auk, **94**: 167–168.

——— 1977*b*. Composition of eggs of several bird species. Auk, **94**: 350–356.

SOKAL, R. R., and E. J. ROHLF. 1969. Biometry. W. H. Freeman and Co., San Francisco.

YOUNG, R. A. 1976. Fat, energy and mammalian survival. Am. Zool. **16**: 699–710.

Host and geographic records of ectoparasites from Alaskan seabirds (Charadriiformes: Alcidae and Laridae)

ERIC P. HOBERG
College of Forest Resources AR-10, University of Washington, Seattle, WA, U.S.A. 98195

AND

D. H. S. WEHLE
Department of Biology, University of Alaska, Fairbanks, AK, U.S.A. 99701

Received June 11, 1981

HOBERG, E. P., and D. H. S. WEHLE. 1982. Host and geographic records of ectoparasites from Alaskan seabirds (Charadriiformes: Alcidae and Laridae). Can. J. Zool. **60**: 472–475.

Host and geographic records are presented for ectoparasites collected from seabirds in Alaska. Ectoparasites of three major groups were recovered: Mallophaga, represented by the genera *Saemundssonia* (*S. fraterculae*, *S. montereyi*, and *Saemundssonia* sp.) and *Quadraceps* (*Q. antigua*, and *Quadraceps* sp.); Siphonaptera, represented by a single specimen of

0008-4301/82/030472-04$01.00/0

Ceratophyllus v. vagabundus; and Acari, represented by the genus *Ixodes* (*I. uriae* and *I. signatus*). These ectoparasites along with specimens of unidentified free-living oribatid mites were found infesting species of Alcidae and Laridae (Charadriiformes) at localities in the Gulf of Alaska and the Bering and Chukchi seas.

HOBERG, E. P., et D. H. S. WEHLE. 1982. Host and geographic records of ectoparasites from Alaskan seabirds (Charadriiformes: Alcidae and Laridae). Can. J. Zool. **60**: 472–475.

On trouvera ici la liste des ectoparasites recueillis chez des oiseaux marins en Alaska. Les ectoparasites recueillis appartiennent à trois groupes: les Mallophages, *Saemundssonia* (*S. fraterculae*, *S. montereyi* et *Saemundssonia* sp.) et *Quadraceps* (*Q. antigua* et *Quadraceps* sp.), les Siphonaptères, représentés par un seul individu de *Ceratophyllus v. vagabundus* et les Acariens, représentés par le genre *Ixodes* (*I. uriae* et *I. signatus*). Ces ectoparasites de même que des acariens oribates libres non identifiés ont été trouvés chez des Alcidae et des Laridae (Charadriiformes) du golfe d'Alaska, de la mer de Bering et de la mer de Chukchi.

[Traduit par le journal]

Ancillary to other ecological studies of marine birds in Alaska from 1974 to 1977, numerous ectoparasites were collected from a variety of seabirds of the families Alcidae and Laridae. Some of the Mallophaga, Acari, and the single specimen of Siphonaptera collected represent new host and (or) geographic records for these ectoparasites and are designated as such when appropriate in the following note.

Methods and materials

Ectoparasites were removed from either live or recently killed birds, stored in 70% ethanol, and sent to colleagues for identification.

Results and discussion

Representatives of three major groups of ectoparasites (Mallophaga, Siphonaptera, and Acari) were present in the collection. Geographic localities for these collections are shown in Fig. 1. Each host name is followed in parentheses by the number of birds on which parasites were found and by the numbers of parasites recovered along with their sex and stage of development (N = nymph, L = larvae) (not determined for some of the Mallophaga).

These data are presented only to indicate host and geographic distribution and do not indicate relative intensity nor prevalence of infestation. All hosts were adults unless stated otherwise.

Mallophaga

Lice of the genera *Saemundssonia* Timmermann, 1935 (3 species) and *Quadraceps* Clay and Meinertzhagen, 1939 (2 species) were collected from alcids. *Saemundssonia fraterculae* (Overgaard, 1942) is reported for the first time from horned puffins, *Fratercula corniculata* (Naumann) at Buldir Island (3) (1 ♀; 1 ♂, 3 ♀♀; 3 ♀♀) and Kodiak Island (1) (1). This is the first record of *S. fraterculae* from the North Pacific, all records subsequent to its description by Overgaard (1942) from the common puffin, *F. arctica* (Linnaeus) in Iceland having been from the type host. This represents both a new geographic and host distribution for *S. fraterculae*; its range is thus holarctic and it is probably host specific for birds of the genus *Fratercula*.

Saemundssonia montereyi (Kellogg, 1896) infested an ancient murrelet, *Synthilboramphus antiquus* (Gmelin) at Petrel Island (1) (4). This species was described by Kellogg (1896) from ancient murrelets, marbled murrelets, *Brachyramphus marmoratus* (Gmelin), and Cassin's auklets, *Ptychoramphus aleuticus* (Pallas), collected at Monterey Bay, California, during December. Ancient murrelets wintering on Monterey Bay probably acquired their infestations on the breeding grounds, which extend from British Columbia, through coastal Alaska, to the Aleutian Islands. Consequently, even though *S. montereyi* had not been previously reported from a northern locality such as Petrel Island, the present record cannot be regarded as a true range extension.

Saemundssonia sp. infested a tufted puffin, *Lunda cirrhata* (Pallas), at Buldir Island (1) (3), and a marbled murrelet at Chiniak Bay, Kodiak Island (1) (2). Lice of the genera *Saemundssonia* are not considered to be specific parasites of these birds (Emerson 1972*a*, 1972*b*), but *S. montereyi* was reported from the marbled murrelet by Kellogg (1896). This is the first record of members of the genus from the tufted puffin.

Quadraceps antigua (Timmermann, 1974) was found on an ancient murrelet at Petrel Island (1) (1). Timmermann (1974) described this species from ancient murrelets at Langara Island, British Columbia.

Quadraceps sp. infested a horned puffin at Ugaiushak Island (1) (3 ♂♂, 2 ♀♀), and a horned puffin (1) (20) and a marbled murrelet (1) (2) at Kodiak Island. There are no prior records of *Quadraceps* sp. from these birds (Emerson 1972*a*, 1972*b*).

Siphonaptera

A single specimen of *Ceratophyllus v. vagabundus* (Boheman) (♀) was collected from a thick-billed murre, *Uria lomvia* (Linnaeus) at Cape Lisburne or Cape Thompson (the specific locality as recorded in the field was unclear). This flea has a holarctic distribution and is

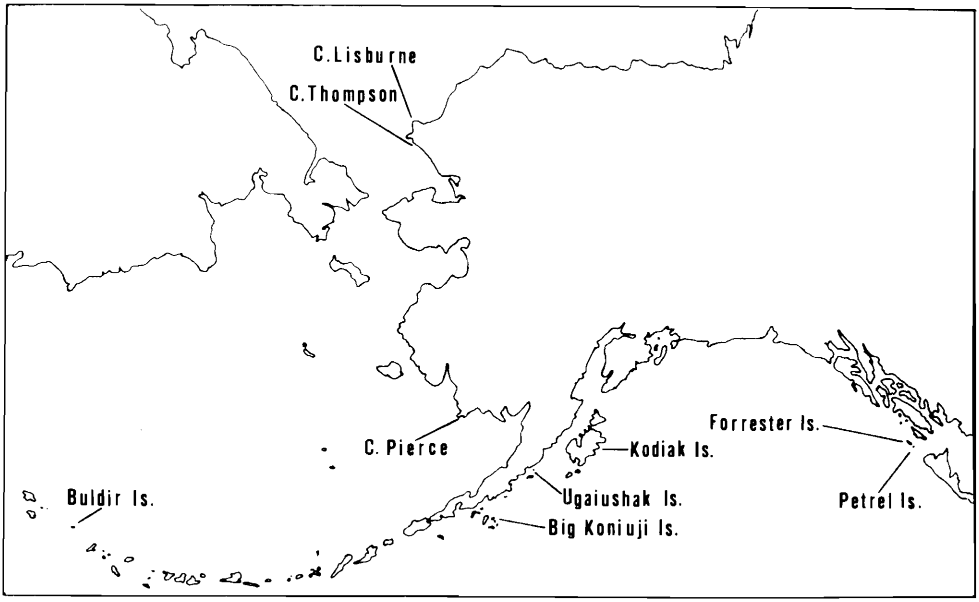

FIG. 1. Geographic localities where ectoparasites were collected from seabirds in Alaska.

a parasite of numerous species of seabirds and their predators, but has not previously been reported from *U. lomvia* (G. P. Holland, personal communication, 1979).

Acari

Ticks of two species, *Ixodes uriae* White, 1852, and *I. signatus* Birula, 1895, both characteristic of marine birds and their nesting sites, were recovered. *Ixodes signatus* was found on a tufted puffin at Buldir Island (1) (1 ♀). All developmental stages of *I. uriae* were found with records as follows: (Buldir Island) horned puffin (10) (2 N; 1 N; 1 N; 1 N; 1 N; 4 N; 3 N, 1 L; 1 L; 4 ♀♀, 3 N, 1 L; 1 ♀, 4 N, 3 L), tufted puffin (3) (1 N; 2 N; 1 ♀), thick-billed murre (1) (1 ♀), and black-legged kittiwake, *Rissa tridactyla* Ridgway (1) (1 ♀); (Ugaiushak Island) horned puffin chick (1) (7 ♀♀), tufted puffin chicks (6) (14 N; 14 N; 10 N; 3 N; 1 ♀, 2 N; 1 ♀), and black-legged kittiwake chick (1) (4 ♀♀); (Cape Thompson) from the head of a common murre, *Uria aalge* (Pontop.) (1) (1 ♀); (Cape Pierce) common murre (1) (1 ♀); (Big Koniuji Island) parakeet auklet, *Cyclorrhynchus psittacula* (Pallas) (1) (1 ♂); (Forrester Island) rhinoceros auklet, *Cerorhinca monocerata* (Pallas) (1) (13 N), and Cassin's auklet chicks (2) (4 N; 4 N). The nymphs from auklet chicks occurred on the plantar surfaces of the webs. The horned puffin, rhinoceros auklet, Cassin's auklet, and parakeet auklet have not been reported as hosts for *I. uriae*. There are also no prior records of *I. signatus* from tufted puffins, but Yamaguti et al. (1971) reported *I. uriae* from this bird in Japan.

Ixodes uriae was most abundant during July and August on Buldir, Ugaiushak, and Big Koniuji islands. This was attributable chiefly to the greater numbers of nymphs present at that time, which coincided with the hatching and nestling periods of most alcids and larids. The importance of nestling seabirds in the life cycle of *I. uriae* has been discussed by Flint and Kostyrko (1967), Karpovich (1970), and Eveleigh and Threlfall (1975).

Nonparasitic oribatid mites were found on tufted and horned puffins at Buldir Island. The presence of these soil mites on puffins might be expected in light of the underground nesting habits of these birds.

Specimens of the Mallophaga and Acari have been deposited in the collections of the United States National Museum of Natural History and of Dr. Nixon Wilson. The specimen of Siphonaptera has been retained by Dr. G. P. Holland for the Canadian National Collection of Insects, Biosystematics Research Institute, Ottawa, Canada.

Acknowledgements

Collections were conducted while studying ecological relationships of marine birds for the United States Fish and Wildlife Service; Aleutian Islands National Wildlife Refuge, Adak, Alaska (1974, 1975), and the Office of Biological Services Coastal Ecosystems, Anchorage, Alaska (1976, 1977). Specimens of Mallophaga were identified by Drs. K. C. Emerson and N. Wilson, and Mr. C. H. C. Lyall; Siphonaptera by Dr. G. P. Holland; Acari by Drs. H. Hoogstraal and N. Wilson and Mr. G. Haas. In addition we should like to thank the following persons for providing specimens: D. G. Roseneau, A. M. Springer, A. R. DeGange, M. R.

Petersen, D. Forsell, M. H. Dick, J. L. Trapp, G. V. Byrd, R. E. Gill, Jr., and R. H. Day. Earlier versions of this manuscript were reviewed by Drs. K. C. Emerson, N. Wilson, G. P. Holland, H. Hoogstraal, and R. L. Rausch.

EMERSON, K. C. 1972*a*. Checklist of the Mallophaga of North America (North of Mexico). Part IV. Bird host list. Desert Test Center, Dugway, Utah.

——— 1972*b*. Checklist of the Mallophaga of North America (North of Mexico). Part I. Suborder Ischnocera. Desert Test Center, Dugway, Utah.

EVELEIGH, E. S., and W. THRELFALL. 1975. Bionomics of *Ixodes* (*Ceratixodes*) *uriae* White, 1852 on auks (Alcidae) from Newfoundland. Can. J. Zool. **53**: 82–86.

FLINT, V. B., and I. N. KOSTYRKO. 1967. On biology of the tick *Ixodes putus* (Pick. Camb.). Zool. Zh. **46**: 1253–1256. (In Russian, English summary.)

KARPOVICH, N. V. 1970. Properties of *Ceratixodes putus* (Pick. Camb.) parasitism on birds. Parazitologiya, **4**: 345–351. (In Russian.)

KELLOGG, V. L. 1896. New Mallophaga I, with special reference to a collection made from maritime birds of the Bay of Monterey, California. Proc. Calif. Acad. Sci. Ser. 2, **6**: 31–168.

OVERGAARD, C. 1942. Mallophaga and Anoplura. Vol. III. Part. 42. Zoology of Iceland. pp. 1–22.

TIMMERMANN, G. 1974. Gruppenrevisionen bei Mallophagen 10. Die *Cummingsiella* (Früher *Quadraceps*) Arten der Alcidae. Mitt. Hamb. Zool. Mus. Inst. **70**: 165–180.

YAMAGUTI, N., V. J. TIPTON, H. L. KEEGAN, and S. TOSHIOKA. 1971. Ticks of Japan, Korea, and the Ryukyu Islands. Brigham Young Univ. Sci. Bull., Biol. Ser. **15**: 1–226.

Misuse of orientation statistics

STEPHEN B. CHILDS AND EDWARD R. BUCHLER[1]
Department of Zoology, University of Maryland, College Park, MD, U.S.A. 20742
Received April 5, 1981

CHILDS, S. B., and E. R. BUCHLER. 1982. Misuse of orientation statistics. Can. J. Zool. **60**: 475–477.

Improved statistical techniques for the analysis of circular data have increased our awareness of certain invalid procedures in earlier orientation research. Even now, however, the current literature contains many examples of inappropriately analyzed data sets. In experiments where a number of individuals are each observed more than once, second-order statistics must be used. Twice repeated, first-order statistics do not allow valid conclusions in experiments of this type.

CHILDS, S. B., et E. R. BUCHLER. 1982. Misuse of orientation statistics. Can. J. Zool. **60**: 475–477.

La modification de techniques statistiques d'analyse de données augulaires a mis en lumière l'invalidité de certains procédés utilisés au cours de recherches d'orientation animale. Même actuellement, la littérature récente contient plusieurs exemples d'analyses inappropriées de groupes de données. Dans les expériences où un nombre d'individus sont observés plus d'une fois, il faut des statistiques inter-groupes (second-order). Répétées deux fois, les statistiques intra-groupe (first-order) ne conduisent pas à des conclusions justes dans les expériences de ce genre.

[Traduit par le journal]

Prior to 1965 discussions of techniques for analyzing circularly arrayed data were scattered and not readily accessible. Batschelet (1965) then produced a functional monograph, written for the biologist, summarizing many of the then current methods for the analysis of animal orientation. Subsequent advances have been similarly gathered and reported by Batschelet (1972, 1978). Two categories of statistical methods are apparent: first-order statistics which are based on one observation per animal and second-order statistics which are based on multiple observations per animal resulting in a mean vector for each animal. First-order analysis of mean vectors is inappropriate, resulting in a loss of information and causing the validity of the conclusions to be questionable. We note that the current literature contains an alarming number of papers dealing with orientation that are based on such incorrectly analyzed data. This problem persists even though the available methodological literature treats the two basic orders of analysis.

Researchers are often selecting the inappropriate statistical technique. When the results from first-order

[1]Author to whom reprint requests should be addressed.

0008-4301/82/030475-03$01.00/0