# ARCTIC INSECT NEWS

No. 1

1990

**IN THIS ISSUE:**



## INTRODUCTION TO *ARCTIC INSECT NEWS*

This newsletter has been started by the Biological Survey of Canada (Terrestrial Arthropods) to focus recently renewed interests in the study of arctic insects. The newsletter will consist mainly of items of current interest, such as accounts of ongoing studies, proposed or completed field work, and available field sites, together with some items intended to provide background information or entertainment. Readers are invited to submit items to the newsletter. No exhaustive listing of publications is proposed, in order to avoid a common tendency among special-interest newsletters to become dominated by the endeavour to provide full bibliographies. Rather, only selected publications, such as those of special interest or those appearing in unusual places, may be included among the items of current interest.

This newsletter has its origins in a project recently begun by the Biological Survey of Canada (Terrestrial Arthropods), an organization that is charged with catalyzing and coordinating work on the terrestrial arthropod fauna of Canada, and that is organized jointly by the Canadian Museum of Nature and the Entomological Society of Canada. The Survey's arctic project was introduced in a 1989 brief: "Arctic Invertebrate Biology: Action Required", published as a supplement to the Bulletin of the Entomological Society of Canada, vol. 1, no. 3 [available from the Biological Survey on request]. The brief

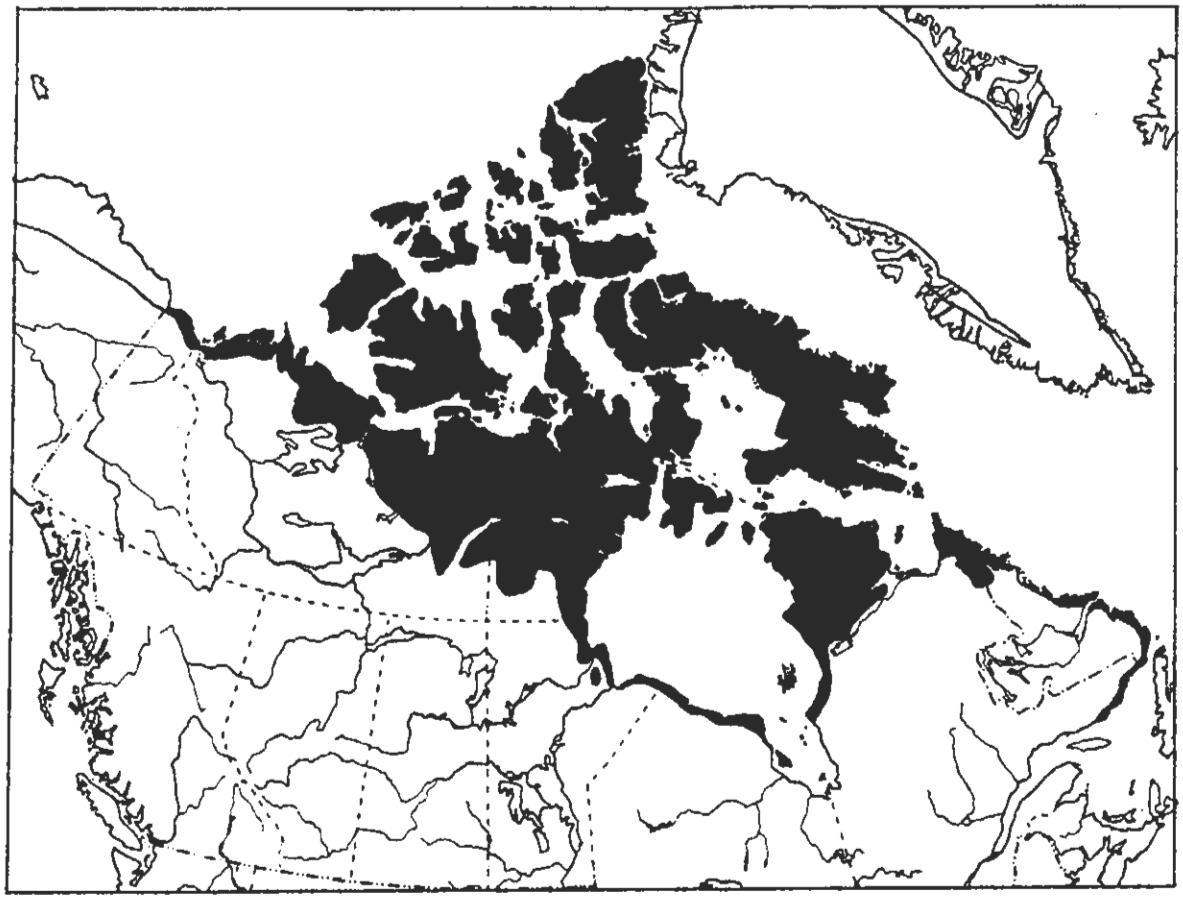
*Arctic Insect News*, distributed free of charge, is available on request from the Secretariat, Biological Survey of Canada (Terrestrial Arthropods), Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ontario, K1P 6P4

pointed out that although invertebrates are the most common and diverse animals in arctic ecosystems, no concerted efforts are being made to study their biology in the North: despite wide interest, studies there are not integrated. However, arctic invertebrates not only offer instructive cases of adaptations to northern conditions, and lessons about food-chain function and other ecological processes in a tractable but not over-simplified ecosystem, but also they provide information to address broad questions of great long-term environmental importance, such as climatic change and pollution.

The brief concluded by recommending three avenues by which relevant arctic work can be encouraged: international cooperative field ventures to develop key active studies; scientific workshops to address broader themes; and coordination among those interested in arctic work. The early results of some of these initiatives are described below. Indeed, this newsletter itself has been stimulated by such recent developments. *Arctic Insect News* will continue to report progress in studying various aspects of the fascinating insects of the important Arctic life zone.

H.V.D.

---

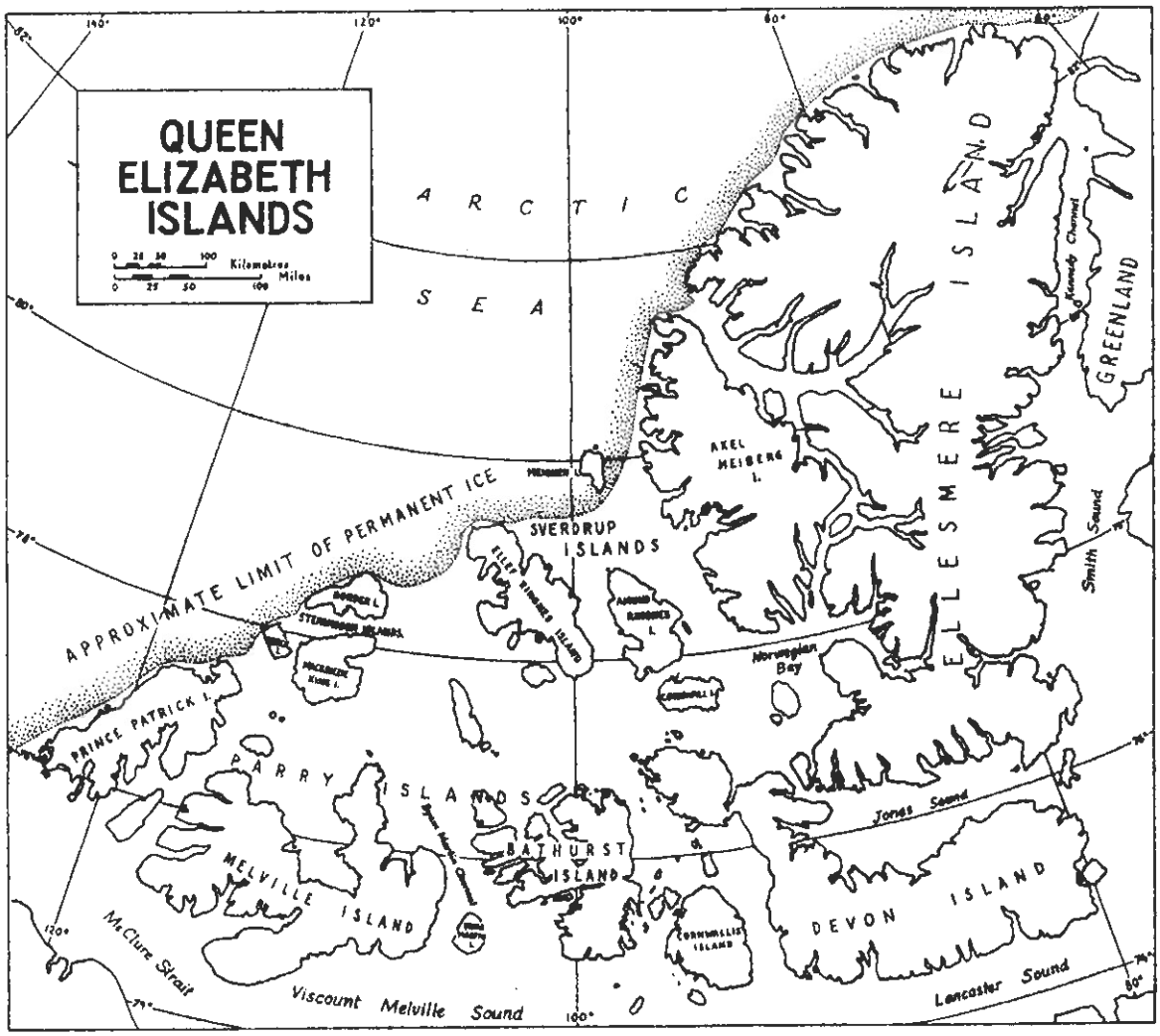


Arctic Regions of Canada

# THE CANADIAN ARCTIC

The arctic is one of the most characteristic zones in Canada. More than two and a half million square kilometres of northern Canada, or more than a quarter of the total area of the country, are treeless. Similar habitats are also found farther south in the mountains that dominate the western part of North America. Especially in areas of little relief in the east, the tree line transition from open forest to tundra is abrupt, whereas the more complex topography of the west produces a less clear transition from boreal to arctic habitats.

About half of the arctic areas of Canada are made up by the Canadian Arctic Archipelago. The channels of the cold arctic ocean between these islands normally are free of ice for only part of the year, and for ever shorter periods farther north. The arctic islands range in size from very large land masses like Baffin Island (507,000 km²), Victoria Island (215,000 km²), and Ellesmere Island (198,000 km²) to very small islets off the shores of larger islands. The northernmost islands, the Queen Elizabeth Islands (north of about 74½ °N), provide a convenient "high



arctic" comparison with more southern sites, even though the Queen Elizabeth Islands are not all equally rigorous. Parts of the eastern arctic, including the northernmost island, Ellesmere, are mountainous, like the western mainland, but much of the Canadian arctic has relatively little relief.

Permafrost is continuous throughout the arctic region, and only a relatively shallow active layer at the surface thaws in summer. Soils therefore are cold and impoverished, and tend to be disturbed by freeze-thaw processes. In this and many other ways, low temperatures are the major force that shapes arctic environments. In particular, the long cold winters and short, cool summers hinder biological activities. Moreover, year-to-year variations in summer weather while temperatures are close to the limits of development and activity make the suitability of each season unpredictable. Winds blow unhindered over the terrain, which in many areas is relatively flat and rounded from glacial action. Conditions above the ground therefore are unsuitable for insect activity on many days even during summer in the far north. Most of the Canadian arctic, especially in the north east, is also arid; precipitation is so low at higher latitudes that the region is a polar desert, and only certain lowlands are well supplied with water by snowmelt held above permafrost.

In this generally cold and arid zone, therefore, local modifications of climate are especially important. Locally, sites sheltered from the wind but exposed to warming solar radiation, and valleys subject to warm Föhn winds from adjacent mountains, are especially favoured. Where these features coincide with adequate water supply, arctic "oases" are produced among the arctic barrens. These oases, typically low-lying, sedge-moss meadows in moist, sheltered valleys, comprise less than 2% of the land area, but support most of the insect species. Where some favourable features are offset, as in the northwestern arctic where the open sea between smaller islands increases cloud cover and so reduces solar radiation in summer, temperatures are lower and growing seasons shorter. On a still smaller scale, some microsites are especially favourable because they have features such as a southern aspect or substrates that warm up rapidly and remain warm.

At lower arctic latitudes the vegetation is continuous and relatively diverse, and it includes shrubs. In the high arctic, however, the vegetation is low and discontinuous, and although several hundred species of vascular plants occur in the Canadian arctic islands, the flora of the arctic barrens comprises especially perennial, dwarfed and often clump-forming herbs. Most plants grow in the more favoured oases and on south-facing slopes.

Relatively few animals survive in the arctic relative to temperate regions, but nonetheless a surprising diversity of forms occurs there. Most of the terrestrial species are insects, but birds (including many that migrate to the arctic in summer to breed, relying on the temporary abundance of insects) and a few species of mammals (that are important because they are relatively large in size and winter-resident) can be found. Several species of molluscs, and many nematodes, enchytraeid annelids, crustaceans, and other invertebrates also live in arctic Canada. Many of these invertebrate species have holarctic distributions, but taxonomic, distributional and ecological information is disappointingly meagre compared with information for the much smaller number of vertebrate species. Some of the smallest invertebrate animals appear to be more-or-less cosmopolitan generalists that live in widely distributed microsites such as soil, moss, or shallow water.

The terrestrial arthropod fauna of arctic Canada, as might be expected, is impoverished relative to temperate regions,

and only about 2000 species have been reported, three quarters of them insects; most of the rest are mites. The actual total is probably about 4000 species. The fauna of the high arctic is smaller still: about 380 species have been named from the Queen Elizabeth Islands, about 1% of the corresponding total for Canada as a whole, and less than 2% of the faunas of temperate regions of comparable area.

Reductions in the fauna of the arctic are highly selective, however, at all taxonomic levels. For example, beetles comprise only a few percent of the high arctic insect fauna, compared with two fifths of world species; on the other hand, flies, one tenth of the world's total insect species, constitute at least half of arctic insects.

Many arctic species are widely distributed across the continent. About half of the reported species are holarctic (though the proportion differs widely from group to group), a much higher fraction than in more southern faunas. Such broad ranges correspond with the fact that there are large areas of comparable terrain in the north, separated (at least at times in the past) by less formidable barriers than lands to the south. However, a number of arctic species have more restricted ranges.

Northern, and often southern, range boundaries of individual species belonging to various taxonomic and ecological groups tend to be at tree line and at the level of the northern mainland and southernmost arctic islands; there they coincide with changes in vegetation, temperature, or growing season. The northwestern high arctic is especially impoverished, lacking the butterflies, bumble bees, and mosquitoes found elsewhere. Such impoverishment accords with the cooler, cloudier climate of this region compared with other high arctic sites. Such findings suggest that ecological influences on distribution are most important. However, east - west range limits of arctic species on the mainland most often coincide at the Mackenzie River and at Hudson Bay. These places, a forested river valley and a cold sea, are dispersal barriers for tundra forms, suggesting historical influences on distribution.

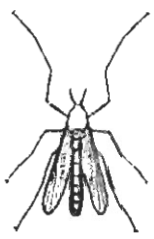
Our knowledge of the ecology and adaptations of these terrestrial arthropods will be summarized in the next issue of *Arctic Insect News.*

[Key references: Danks, H.V. 1981. Arctic Arthropods. A review of systematics and ecology with particular reference to the North American fauna. Entomological Society of Canada, Ottawa. 608 pp; Danks, H.V. 1984. Canadian perspectives: the arctic life zone. Newsletter of the Biological Survey of Canada (Terrestrial Arthropods) 3(1): 46-48.]

H.V.D.

---

Chironomid midges are among the most characteristic insects of arctic regions, and about 150 species have been named from the North American Arctic. In high arctic sites, chironomid species comprise over half of the fauna. Arctic chironomid larvae are abundant in aquatic sites (ponds, lakes), semi-aquatic habitats (marshy ground above permafrost), and even some moist terrestrial sites.



## CANADIAN AND INTERNATIONAL RESPONSES TO THE ARCTIC BRIEF

The message of the Biological Survey's Brief on arctic invertebrate biology was carried to meetings of the Society for Cryobiology/Insect and Plant Cold Tolerance Symposium at SUNY Binghamton, New York, in June, 1990, and of the Entomological Society of Canada at Banff, Alberta, in October, 1990. Hugh Danks introduced key topics in a general way and Richard Ring followed up with discussion of logistic support for northern studies and some examples of ongoing, as well as proposed research projects.

In Binghamton, about 30 people attended the Special Interest Group meeting and an international perspective was provided in the ensuing discussion. For example:

- Norwegian initiatives in Spitzbergen (with input from Denmark and West Germany)
- Danish initiatives in Greenland
- British initiatives in establishing an arctic ecology programme in Northern Scandinavia (and perhaps Canada). A glossy brochure on this topic, "Britain in the Arctic", is available on request from the Natural Environment Research Council in the U.K.

In Banff, about 24 people attended the Discussion Group meeting and much valuable discussion arose. The wide range of suggestions that were provided included the following:

- Studying insect-plant interactions would provide useful information in monitoring climatic change in the arctic. Candidate interactions are willows/galls/parasitoid complexes; *Pedicularis*/stem insects; and aphids/host plants.
- Modelling of insect communities in conjunction with existing climatic models obtainable from the Atmospheric Environment Service.
- Focussing on local, rather than global, climatic changes and their effects on northern communities.
- Other participants stressed the need for collaborating with entomologists and ecologists from other countries and identifying the opportunities that may exist for cooperation with existing polar research programmes.
- Several ideas for project orientation, political support and funding also emerged from the discussion.

Copies of the Arctic Brief were also sent to over 50 national and international contacts in the field of northern insect biology. Many positive, encouraging replies were received from scientists in several different countries, particularly those in the USSR, U.K., and Norway. About 20 of these scientists expressed a desire to participate in some joint international projects in the near or not too distant future.

R.A.R.

---

## CURRENT ARCTIC RESEARCH

**Entomologists in the North this summer (1990)**

Four parties were involved in arctic insect research this past summer. Dr. *Richard Ring* and Dr. *Tony Dixon*, an aphidologist from the University of East Anglia, U.K., investigated arctic aphids and their life cycle strategies, particularly their host alternation and dispersal. Almost 50 batches of specimens from both herbaceous and shrubby plants in the Western Arctic (collected mainly within a 100 km radius of Tuktoyaktuk) have been sent to Dr. Bob Foottit in Ottawa for identification. His first impression is that there is great diversity, with a lot of interesting material which may also help to put the Yukon aphids into perspective. Dr. *Olga Kukal*

(now a P.D.F. at the University of Victoria) and her husband, Mr. *Tom Allen* spent the summer at Alexandra Fiord, Ellesmere Island, continuing her long-term studies of the biology and extreme freezing tolerance exhibited by the caterpillar of *Gynaephora groenlandica*. Ms *Sharron Meier*, an M.Sc. student working under the supervision of Dr. Joe Shorthouse, Laurentian University, was at Princess Marie Bay on Ellesmere Island where she has initiated a study of insect relationships with *Pedicularis* spp. She has identified 3 species of Diptera and one species of Lepidoptera living within the capitulum, stem and roots of these louse-worts, and is attempting to elucidate their inter-relationships as well as their effects on host growth and development. Dr. *Fenja Brodo*, Research Associate at the Canadian Museum of Nature, also spent the summer on Ellesmere Island, but at the GSC observatory on the Fosheim Peninsula. There she compiled an inventory of the arthropods of Hot Weather Creek, and preliminary results indicate that there are close to 200 different species of insects and related arthropods in that locality.

**Proposed projects for the summer of 1991**

*Richard Ring, Olga Kukal* and *Sharron Meier* are planning some joint projects at Tuktoyaktuk and Alexandra Fiord next summer. *Joe Shorthouse* has also expressed an interest in accompanying them on the western leg of the field trip in order to collect *Diplolepis* galls on *Rosa* spp. Dr. *Andrew Pullin*, University of Keele, England, may also be joining the group to study diapause and cold tolerance in Pieridae if financial resources become available to him.

Another prospect still in the planning stages is to invite Dr. *Yuri Chernov* and Dr. *Tamia Rossolimo*, USSR Academy of Sciences, Moscow, to join the group either this summer (1991) or next on Ellesmere Island. Dr. Chernov, who is interested in the biology of polar deserts, wishes to visit the high arctic in Canada which is more barren than the northern USSR. Dr. Rossolimo is interested in insect cold-hardiness.

R.A.R.

## OTHER ITEMS OF INTEREST

- Dr. *Monty Wood*, Biosystematics Research Centre, Ottawa, spent several weeks this past summer in northern USSR as a guest of Dr. Chernov and his group. It is hoped that this, along with Dr.Chernov's proposed visit to Canada, will lead to continued reciprocity between entomologists in both countries.

- The Boreal Institute, University of Alberta, Edmonton has been replaced by the *Canadian Circumpolar Institute*. Its library has been moved to the main university library, the Cameron Library.

- *Indian and Northern Affairs Canada* has circulated a form asking for biographical and research information which will assist them in compiling the "*Directory of Arctic Science and Technology in Canada*". The purpose of this directory is to **1**) enhance the knowledge of the current state of arctic science and technology, **2**) facilitate exchange of ideas and information, and **3**) promote international cooperation with the scientific community. All of these objectives are identical to the aims and goals of the Brief on Arctic Invertebrate Biology.

- The *Polar Continental Shelf Project*, EMR, has donated its collection of over 3,600 papers, reports, theses, etc. to the *Arctic Institute of North America*, University of Calgary.

- Dr. *Steve Marshall*, University of Guelph, is planning a collecting trip in 1991 to the Altai, USSR, with Dr. *Anatolij Barkalov*, USSR Academy of Sciences, Novosibirsk.

- The Association of Canadian Universities for Northern Studies (ACUNS) is gathering information which would help support the idea of having a Canadian ship-based research station in Antarctica.

R.A.R.

## HISTORY CORNER

One of the first expeditions that collected high arctic insects in the Canadian arctic was the voyage of Captain W.E. Parry in 1819 - 1820. This voyage included eleven months spent at Winter Harbour on Melville Island. The difficulties of collecting meant that Parry's voyage brought back only six species, identified by the well known British entomologist William Kirby. We now know that several hundred species occur in the high arctic, but the collection from Winter Harbour in fact included several species that are widespread and characteristic of the high arctic. Kirby reported the geometrid moth *Psychophora sabini* [recorded as *Bombyx sabini*], the lymantriid moth *Gynaephora groenlandica* [*Laria* caterpillars], the bumble bee *Bombus polaris* [*B. arcticus*], the crane fly *Prionocera ominosa* [*Ctenophora parrii*], and the chironomids *Chironomus pilicornis* [*C. polaris*] and "*Chironomus*" sp. [*C. melvillensis*].

The introduction to Kirby's account illustrates the state of knowledge at the time, and the context Kirby was able to provide.

"Otho Fabricius in his *Fauna Groenlandica* (if we exclude the *crustacea*,) has described only 79 species of insects and *Arachnidae*, and of *insects proper* only 63, which he collected during a residence of six years in West Greenland; and Professor Hooker speaks of those of Iceland as being very few in number [*Recollections of Iceland*, 1st edit. 272.]; it was therefore to be expected that in a station more than ten degrees to the northward of the theatre of their researches, the numbers of the insect world would be very greatly reduced; and it will not excite much surprise, that only six species should have been collected in that high latitude, from the beginning of September to the beginning of August, the period during which the Expedition remained in Winter Harbour. It is probable, however, that some may have escaped observation, and others might possibly make both their annual appearance and retreat during the month of August. The birds also that frequent the island have, doubtless, their parasites, and the rein-deer would be annoyed, it is not unlikely, by its peculiar winged pest, *Oestrus Tarandi*.

"In Greenland, every *order* of insects has its representatives, except *Orthoptera* and *Hemiptera*; but in Melville Island, besides these, no *Coleopterous* or *Neuropterous* species was observed, and even the mosquito (*Culex*, Linn.) the torment of the Laplander and Greenlander, as well as the native of tropical regions, appears not to have extended there its annoying reign."

[Kirby, W. 1824. Land invertebrate animals. pp. ccxiv-ccxix in W.E. Parry, Supplement to the Appendix of Captain Parry's voyage for the discovery of a northwest passage, in the years 1819-20, containing an account of the subjects of natural history. Appendix X. Natural history. pp clxxx-cccx.]

H.V.D.

## CONTRIBUTORS TO THIS ISSUE

R.A.R. Richard A. Ring is a professor in the Department of Biology at the University of Victoria, British Columbia, V8W 2Y2, and is the chairman of the subcommittee for the Biological Survey's arctic project. He has particular interests in insect cold-hardiness, and he and several students have worked on features of insect biology, especially in the western arctic.

H.V.D. Hugh V. Danks is Head of the Secretariat for the Biological Survey of Canada (Terrestrial Arthropods) in Ottawa. He has broad interests in the Canadian and arctic insect faunas, and in modes of seasonal adaptation in insects, such as diapause.

Canadian Museum of Nature
Musée canadien de la nature

*Arctic Insect News* is published annually by the Biological Survey of Canada (Terrestrial Arthropods) to support the Survey's aim of encouraging further work on arctic invertebrates. Editor: H.V. Danks, Biological Survey of Canada (Terrestrial Arthropods), Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ontario, K1P 6P4, Tel: (613)-954-2648; Fax: (613)-954-6439. **Items of interest to those studying arctic insects are welcomed by the editor.** Copy deadline for the 1991 issue, to be published in November, is October 15, 1991.