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NEWSLETTER OF THE BIOLOGICAL SURVEY OF CANADA (TERRESTRIAL ARTHROPODS)

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Canadian Museum of Nature / Musée canadien de la NATURE

General Information

The Newsletter of the Biological Survey of Canada (Terrestrial Arthropods) appears twice yearly. All material without other accreditation is prepared by the Secretariat for the Biological Survey.

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Queries, comments, and contributions to the Newsletter are welcomed by the editor. Deadline for material for the Spring 2003 issue is January 31, 2003.

Editorial Notes

The Biological Survey of Canada (Terrestrial Arthropods) develops and coordinates national initiatives in taxonomic and ecological entomology on behalf of the Canadian Museum of Nature and the Entomological Society of Canada. The Newsletter communicates information about systematic and faunistic entomology that may be of interest in Canada, and reports especially on activities relevant to the Biological Survey.

This newsletter will also be available soon on the Survey's website at:

http://www.biology.ualberta.ca/bsc/bschome.htm

News and Notes

Summary of the meeting of the Scientific Committee, April 2002

The Scientific Committee met in Ottawa on April 18-19, 2002.

Scientific projects

The scientific projects of the Survey were considered, including the following progress or information.

1. Grasslands

The grasslands newsletter and grasslands prospectus had been produced and also are posted on the web. These high-quality products are designed to help stimulate the project and demonstrate the professionalism of those involved. There is a report of last year's trip to Onefour in the Grasslands newsletter. Dr. Wheeler noted that the symposium on Ecology and interactions in grassland habitats is set for Tuesday, October 8, 2002 at the ESC / ESM annual meeting in Winnipeg. The contributions at the symposium will be part of the set of planned chapters for the first grasslands volume on Ecology and interactions of grasslands habitats. Dr. Wheeler reported that grasslands-related work continues, including papers in press. Information about potential funding was briefly reviewed, pending more detailed discussions by the grasslands subcommittee. A PowerPoint presentation with an overview of Canadian grasslands as well as the prospectus are available to assist this effort. Dr. Shorthouse pointed out that the symposium on grasslands at the CSZ meeting might provide an opportunity to discuss the grasslands symposium planned for the ESC/ESM meeting.

Plans for the second grasslands focus site are covered in the grasslands newsletter. The trip would be held at the Tall Grass Prairie Preserve in Manitoba in July, a time which is at the juxtaposition of early-flowering and summer-flowering plants. The site includes a diverse range of habitats. Grasslands sampling is also proceeding in southern Ontario with a number of studies. However, although University of Guelph researchers had funding from the World Wildlife Fund to sample on Walpole Island, they were denied permission to do so by the band council. [see also p. 49]

2. Arctic invertebrate biology

The former Arctic Insect News was incorporated into the Survey newsletter as "Arctic Corner" to deal with some aspects of arctic invertebrate biology. For example, the spring 2002 newsletter included an article about the proposed Alaska Insect Survey project, inspired in part by the Biological Survey of Canada, as well as an account of the 2001 European Workshop on Invertebrate Ecophysiology. A new monograph on the ecology of Greenland, edited by Dr. Jens Böcher, includes a chapter on insects and insect ecology. A field guide to the western arctic is due to be published this year and includes a chapter on insects. A book had been produced as a result of an expedition organized by the governments of Denmark and Sweden. That expedition had hired a Canadian coast guard icebreaker to study ecology in the Canadian arctic. This example demonstrates that other countries are expending more resources than Canada to study Canada's geography and biota. Therefore, there is little active entomological work to report. [see also p. 64]

3. Seasonal adaptations

Papers on dormancy and allied responses in insects have been published recently or are in press. Other invited work is in preparation, including a paper on circadian rhythmicity and photoperiodism for an international Japanese-Czech meeting on this subject, to be held in

the Czech Republic in August 2002. A paper on insect seasonal adaptations is also planned for a conference on Biology of the Arctic, to be held in Toronto early next year at the meeting of the Society for Integrative and Comparative Biology (formerly the American Society of Zoologists). In summary, the seasonal adaptations project continues especially in synthetic mode. [see also p. 51]

4. Insects of Keewatin and Mackenzie

In summer 2001, Dr. Doug Currie and Dr. Peter Adler undertook a 3-week trip in the Northwest Territories. Their sampling increased the number of known blackflies in NWT from 18 to 52 species. This year 5 researchers plan a trip on the Thelon River within the Thelon Game sanctuary, including the use of Malaise traps and other sampling methods. The group has received about half of the necessary permits to date, and the permit process seems to be easier this time than for the Horton River trip in 2000. Interesting results are expected. [see also p. 59]

Other scientific priorities

1. Arthropod fauna of soils

A special issue of the Canadian Journal of Soil Science featuring soil biodiversity papers is planned for 2002. It includes papers on mites, Collembola, and beetles in Canadian agricultural systems. The Grasslands newsletter contains an article about an unexpected mite found at Onefour, known from dune systems in other parts of the world but never recorded from North America prior to 2001. A number of relevant publications and conferences were noted. The 11th International Congress of Acarology (held this year in Mexico during September) is developing a directory of acarologists of the world.

The Committee discussed the global litter invertebrate decomposition experiment, which is part of the International Biodiversity Observation Year (IBOY) projects. This project provides uniform litter bags to participating countries. The results are to come from extracting invertebrates and putting up digital images of morphotaxa on the web to elicit taxonomists' support in identifications; and to see how rapid biodiversity assessments can be done without the need for taxonomists' input. The question being posed is what is the rate of invasion and what are the taxa that invade; the same major groups seem to be invading litter bags irrespective of the habitat. The first year's samples are being sorted. Some committee members expressed reservations about a design without local plant material as controls and including rapid biodiversity assessment ideas.

2. Old-growth forests

Various committee members reviewed projects, especially by graduate students, in old-growth forests in various provinces. One study comparing old-growth forest with similar looking but younger forest demonstrated the difficulties with rapid assessment techniques using higher taxa and morphospecies. For example, the number of specimens and morphospecies were the same and even species richness did not show much difference, but there were differences, depending on family, in dominant species. These results lead to the conclusion that only reliable species-level identification can confirm this sort of information. Initiatives are also underway to preserve, or to try to establish infrastructures, for canopy sampling in other places, though funding is difficult to secure. Federal government funding for the Long Beach Model Forest on the west coast of Vancouver Island has been withdrawn.

3. Invasions and reductions

The theme for the annual meeting of the Entomological Society of Ontario in October 2002 is Invasive Species and Biodiversity. The Société d'entomologie du Québec's meeting in 2003 will deal with invasive species in agricultural and forestry systems. Several invading species have drawn recent attention, including

the soybean aphid and the West Nile virus vector. Several members reported concern about species such as the multicoloured Asian lady beetle. The possibility of a Survey project on invasive lady beetles was discussed and will be considered further in the light of available collection and other information, difficulties with an earlier Canadian Nature Federation Survey, identification issues, and so on.

4. Survey web site

The ESC has reorganized its web site and did not plan to retain the BSC component after the change. However, the Survey's site was able to stay on the University of Alberta site, with a modified URL (http://www.biology.ualberta.ca/bsc/bschome.htm) and all files were transferred to the new directory in December 2001. A site with direct access is proving convenient. Recent updates to the site include the grasslands prospectus (in pdf and html), BSC newsletters, Requests for material or information, and a "What's new" page. Various problems with the database for the list of workers and their interests have been solved by a revision of the database. The web database now includes an alphabetical list of entries (corresponding to the earlier hard-copy "List of Workers …") as well as a search feature for names, taxa, ecological groups, cities and projects. Efforts are now underway to update entries in the database. Generally favourable comments on the Survey's site continue to be received. The site meter logged about 6700 hits in the first 18 months. [see also p. 56]

5. Voucher specimens

The direction for the Survey's proposed publication is still being decided. Additional publications pointing out the importance of voucher specimens continue to be discovered. The importance of voucher specimens is not well understood by those who do ecological studies. Another problem is the cost of having voucher specimens deposited and maintained. Members of the Committee drew attention to further articles and examples, including a rating scheme for the quality of specimens sent in for identification or voucher purposes, how to ensure that vouchers from graduate work are kept, and how to confirm that vouchers cited in journal articles have actually been deposited. A trend towards lower taxonomic resolution in some large-scale ecological projects was also recognized, leading to general reference collections rather than to effective voucher specimens.

6. NSERC reallocations exercise

The Committee discussed the NSERC reallocations exercise (a draft document had been published by Grant Selection Committee 18 on the NSERC website). Although GSC18 seems to have done well under the reallocation, there is still a feeling that funding among the GSC's is not equitable. The Committee commented on perceived structural and other problems with GSC18. However, systematics support seems to be better than it had been a few years ago, although still not at the necessary level. Dr. Shorthouse reported on some initiatives to help promote appropriate joint efforts by societies such as the Society of Zoologists and the Canadian Botanical Association.

7. Monitoring of continuing priorities

Updated information on earlier or currently less active Survey projects was reviewed, including notes about work in peatlands, freshwater wetlands, springs, large rivers, Queen Charlotte Islands (Haida Gwaii), special habitats, and about studies on ectoparasites of vertebrates, climatic change, environmental appraisal and agroecosystems.

8. Other priorities

The Committee also discussed actions and information on endangered species, damaged ecosystems, faunal analysis, survey publicity, funding for biodiversity projects, naturalists publications, arthropods and fire and other topics.

Liaison and exchange of information

1. Canadian Museum of Nature

Ms. Anne Breau, Chief, Canadian Centre For Biodiversity – Policy, Networks, and Biodiversity Coordination reported on behalf of Dr. Mark Graham and Ms. Joanne DiCosimo that the CMN is planning to coordinate a network of natural history museums in Canada, to help add to the capacity of the museum community in developing collections, conducting research and producing educational programs and exhibits.

The CMN is preparing two travelling exhibits. One explores the diversity and vulnerability of Canada's native plants, and the other will feature genetics and genomics. The Centre for Biodiversity (CCB) has received funding to develop an outreach educational programme to enhance understanding of native plant diversity and foster best practices in environmental stewardship.

Ms. Breau reported that candidates are being reviewed for the NSERC graduate supplement for systematics research now in its fourth year. Several CMN staff members were involved in the recent EMAN National Conference. The Museum also hosted a special workshop on community-based ecosystem monitoring at its Aylmer site. The CMN took advantage of the conference to launch the Rideau River Biodiversity website and Ms. Breau invited everyone to visit www.nature.ca/rideau. A needs assessment of biosystematics and bioinformatics within science-based departments and agencies is being completed by the Federal Biosystematics Partnership. The CMN will be hosting the 17th International Diatom Symposium in late August 2002. It will be the first time the Symposium is held in Canada.

Later in the meeting, Mr. Kieran Shepherd, Acting Director of Collection Services, discussed the draft CMN's Collections Development Plan. Responses to the draft showed that the community wants the CMN to be a leader in collections development and care although – as long as the collection remains accessible and taxonomically and scientifically relevant – the community is less concerned about internal Museum workings. Members of the Committee noted a great deal of emphasis in the draft plan on collections care and much less emphasis on research, perhaps reflecting the division in the CMN between collections care and research. Mr. Shepherd noted that the division between research and collections occurred some 10 years ago. He believes that it has evolved nicely since then.

2. Eastern Cereal and Oilseed Research Centre

Dr. Lianne Dwyer, Acting Director ECORC explained that there have been few recent changes or new retirements. However, there is an agreement at the branch level to staff three new entomologists, likely specializing in Coleoptera, Hymenoptera and Diptera. Although there is no new funding the process to recruit the first of these positions is underway. She reminded the Committee that the Department is moving from vertical structure to horizontal themes. One of the main themes is Environmental Health – a departmental team and also one of the four main programs within the research branch. Two of the sub-themes of Environmental Health are biodiversity and integrated pest management. The majority of the biological resources work will be under these themes. Biodiversity will house all the systematics work done at ECORC. She believes that the realignment of the programs is giving more visibility to the biological resources work.

Dr. Dwyer announced the publication of the book on biological control programmes 1981-2000. She noted that many newly funded projects are on invasive pests. There has also been interest in the biological resource capacity of the collections, including higher level interest in the systematics program. The office of the Auditor General is considering performing

an audit note of the research management and collections.

3. Entomological Society of Canada

Dr. Foottit reported on behalf of the Society's president Dr. Bernard Roitberg. He reminded the Committee that the Society is still looking for a new editor for The Canadian Entomologist. There is some discussion about trying a new structure with divisional editors for different disciplines such as systematics, ecology, and pest management. If this structure is adopted the current editor might stay on for a time to manage the transition. The Society is also continuing to investigate the issues, including copyright, associated with electronic publication. The Bulletin is also moving towards electronic publication. The annual meeting will be held in October 2002 in Winnipeg.

4. Canadian Forest Service

Dr. John Huber, on behalf of Dr. Ben Moody, reported that there has been another reorganization within the Canadian Forest Service. The 10 networks have been reduced to 5 to correspond with the 5 regional laboratories. All the taxonomists and collection managers in the CFS are now in the Biodiversity and Forest Health Network, with network management based in Fredericton, New Brunswick. Staff have been reduced at the headquarters in Ottawa. The three remaining CFS taxonomists, Dr. Huber, Dr. Peter Dang, and Mr. Klaus Bolte, will have a new director in mid-May.

CFS science research has been streamlined because CFS was trying to do too many things with too few people. As a result 13 projects have been identified. One is entitled "Impacts of forestry practices on biodiversity", led by Dr. David Langor in Edmonton, and includes most of the department's taxonomists. Another project entitled "Alien species" involves cooperation with the Canadian Food Inspection Agency. A CFS group working on needs assessment for alien species as part of the Federal Biosystematics Partnership.

Dr. Huber mentioned a number of biodiversity and biosystematic activities with which CFS headquarters is involved, including the Biosystematics Partnership (FBP), the Canadian Biodiversity Information Facility (CBIF), the Biodiversity Knowledge and Innovation Network (BKIN), NatureServe Canada (which involves the various Conservation Data Centres across the country), and the Canadian Information System on the Environment (CISE). A book on old growth forests in Canada is in preparation.

5. Parks Canada

Mr. Rob Alvo, Conservation Biologist/ National Database Manager, Species at Risk, Ecological Integrity Branch, Parks Canada spoke about his work on managing the Parks Canada species database. This database has information on the plant and animal species in each national park. Currently, several small databases, including one butterfly database, are being combined into one large database available via intranet so that each region can manage its own data. Mr. Alvo reported that NatureServe Canada (formerly the Association for Biodiversity Information) is developing a consistent methodology for the provincial Conservation Data Centres. Mr. Alvo also spoke of the working group on the General Status of Wildlife project, which is charged with producing a complete report every five years on the conservation status of all species in Canada.

In response to queries about what kinds of initiatives are underway to standardize monitoring, Mr. Alvo reported that Parks Canada recently hired Dr. Donald McLennan as the new National Ecological Monitoring Coordinator and he will be charged with this issue. Members of the Committee drew attention to the issue of quality control for data entry once each Park can enter data; Mr. Alvo said that the issue has not yet been resolved. In response to further questions about future work, Mr. Alvo commented that despite the ecological integrity report Parks has received no new funding to

fulfil this mandate and therefore there is no time or resources to deal with invertebrates.

6. Parasitology module, Canadian Society of Zoologists

Dr. Marcogliese reported that the protocols for monitoring parasites of vertebrate groups in biodiversity studies are still in progress. These are to be posted on the EMAN website and therefore have to be bilingual, leading to significant delays. He added in response to queries that many public documents that are available in Environment Canada's documentation resource centre (including scientific papers) had been posted on the web but most have had to be removed because they were not available in both languages. He reported that the stickleback project proceeds despite having no funds. However, there are now 33 participants in the project from 12 countries. Dr. Marcogliese noted that many interesting papers are scheduled for the biodiversity symposium at the International Congress of Parasitology during August in Vancouver. Dr. Marcogliese noted that the parasite symposium at the Canadian Society of Zoologists meeting (Lethbridge, May, 2002) is entitled Evolution and Ecology of Arthropod/Host Interactions. Talks of interest include a public lecture by Mr. John Acorn and a plenary session on Prairie Biodiversity: Processes, Patterns and Practice.

Dr. Terry Dick at the University of Manitoba has been awarded a NSERC northern research chair to study food webs and parasites in the north. Three young parasitologists have found jobs recently but all in the U.S.A. A new initiative headed by Dr. Eric Hoberg and others is trying to put together a network of biodiversity of parasites in birds across the arctic. Dr. Marcogliese reviewed a number of databases (e.g. the European Register of Marine Species), publications (e.g. the new online journal for taxonomy, Organisms, Diversity and Evolution) and other items of interest. In response to questions, Dr. Marcogliese reported that the parasitologists will continue to work on the development of a parasitology module for the Survey at the CMN despite a current lack of recognition and tangible support.

Secretariat activities

Ongoing operations of the Biological Survey Secretariat were reviewed, including clearing-house and coordination roles, research and other items, and Dr. Danks travels to entomological centres on behalf of the Survey to exchange information about relevant work. In 2001 and early 2002, visits were made to Victoria, BC; Edmonton, AB; Winnipeg, MB; Niagara Falls, ON; and Ste.-Anne-de-Bellevue, QC. Seminars and lectures presented, in addition to more-or-less informal treatments of the Biological Survey, included Insect fauna of the Yukon; How to assess insect biodiversity; Measuring insect life cycle duration: pitfalls and solutions; Are the life cycles of polar arthropods flexible or programmed?; Entomology in parks: General values and needs; and Dehydration in dormant insects.

Other items

1. Regional developments

Members of the Committee summarized information from different regions of the country. For example, in British Columbia, Dr. Ring reported that the provincial government has alienated many professional societies and has cut many programs. Laboratories have been closed and entomologists dismissed. At the Royal B.C. Museum many of the curators have been reassigned to do public exhibit work. The entomology collections manager position has been eliminated. The archives at the RBCM have been closed and attempts are being made by individuals to retrieve some old field notes and manuscripts. No entomological expertise remains at the B.C. Conservation Data Centre. Dr. Floate commented that the effect of these cuts should not be underestimated: work based in Alberta with B.C. cooperators has also been compromised. On a positive note, Dr. Robert

Duncan received one of the last FRBC grants to produce a manual for the biology and identifications of major forest defoliators. The Journal of the Entomological Society of British Columbia published a volume in honour of the 100th anniversary of the Society, including 14 invited papers, mainly historical reviews of the last 50 years. Some changes in University staffing were reported.

In the prairies, Dr. Kevin Floate reported that changes in Alberta Agriculture have led to cuts especially in extension services. 145 jobs were cut including those of entomologists. The number of offices has been reduced from 52 local to 18 regional and a call centre, changes that will likely lead to the wider use of private crop scouts. An entomologist with a term position at the Lethbridge Research Centre has been made permanent. The 50th anniversary of the Entomological Society of Alberta will be celebrated in October 2002. Dr. Sperling announced that the University of Alberta is facing a 3% cutback in its budget but in spite of that has hired three entomologists, working in Agriculture, in mite systematics and in integrated pest management, chiefly replacing recent retirements. Other entomological activities continue at the University of Alberta and elsewhere. Dr. Roughley reported that in Manitoba there are neither university nor governmental crises. The ESC/ESM joint meeting will be held there in October. Databasing and renovation of the insect museum at the University of Manitoba supported by a CFI grant is proceeding.

In Ontario, Dr. Currie announced that the Royal Ontario Museum has received $30 million from the Ontario government for the renovation of the building. The Museum is hoping for matching funds from the federal government. There will be a large increase in gallery space and hopefully provision for research space too. Several entomologists, including graduate students, are active in Toronto. Dr. Marshall reported that work continues with survey projects in southern Ontario – grassland oak savannah and dune sites at Ojibway Prairie and small other small grassland sites. A new chair is being recruited for the Department of Environmental Biology at the University of Guelph. A group of individuals at the University of Guelph interested in biodiversity in a very broad way have applied for a grant, which if successful will allow expansion and curation of the insect collection. Dr. Shorthouse reviewed activities at Laurentian University.

In Quebec, Dr. Roy reported that the joint meeting of the 5e Conférence Internationale Francophone d'Entomologie and Société d'entomologie du Québec will be held in Montréal in July. Entomological work continues at McGill University. A position in forest insect ecology at McGill University is in the process of being recruited.

In Newfoundland and the Maritimes, Dr. Giberson reported that an entomologist position at the Agriculture Research Station in Charlottetown has now been made permanent. A proposal is being submitted for funds to train people in identifying aquatic insects and to produce user-friendly family keys. The annual meeting of the Acadian Entomological Society will be held in Maine this year, and will include a ground beetle workshop. PEI riparian zone legislation came into effect on April 1, 2002, requiring a minimum of 10 metres to be left around potato fields anywhere near water courses. Another new law requires a mandatory 3-year rotation for row crops. Dr. McCorquodale reported that he has been working at some of the small regional collections in the Maritimes, which are very important because they contain material not found anywhere else. He reviewed persons active in entomology in the area.

For the arctic, Dr. Ring reported that he will not be going to the arctic this year because he did not receive any logistic support. It appears there is a 20% reduction in funds for northern logistic support for university research. Six

new research chairs for northern science were recently announced. Other recommendations of a recent report to appoint post-docs and provide student scholarships have not been acted upon. Dr. Ring reported that two Canadian students won awards for their presentations at the meeting of the Arctic Research Council of the United States. The Canadian Polar Commission continues to publish glossy pamphlets, along with holding meetings. Most other polar nations have polar institutes where actual work is supported. Other non-Canadian examples of polar research include the University of the Arctic which will be based in Finland. The president of Iceland goes to scientific meetings to explore and support northern research. Dr. Giberson mentioned that when she was applying for permits to Nunavut she was required to provide a statement that no insects will be sold for profit. She was told that such activities are a big problem and others confirmed that this is a real concern.

2. Other matters

The Committee also considered recent Survey publications, notably the Survey and grasslands newsletters, the annual report to the Canadian Museum of Nature, liaisons with organizations outside Canada, insect encyclopaedias in preparation, and information on various publications and meetings. The Annual General Meeting of the Biological Survey Foundation also took place.

Members of the Scientific Committee 2002

(Contact and other information about Committee members can be found at http://www.biology.ualberta.ca/bsc/english/personnel.htm)

Dr. Douglas Currie
Toronto, Ontario

Dr. Jean-Marc Deschênes
Director, ECORC

Ms. Joanne DiCosimo
President, Canadian Museum of Nature

Dr. Kevin Floate
Lethbridge, Alberta

Dr. Robert Foottit
Ottawa, Ontario

Dr. Donna Giberson
Charlottetown, Prince Edward Island

Dr. Mark Graham (CMN)
Ottawa, ON

Dr. David Larson
St. John's, Newfoundland

Dr. Steve Marshall
Guelph, Ontario

Dr. David McCorquodale
Sydney, Nova Scotia

Dr. Richard Ring
Victoria, British Columbia

Dr. Bernard Roitberg (ESC)
Burnaby, British Columbia

Dr. R.E. Roughley
Winnipeg, Manitoba

Dr. Michèle Roy
Ste.-Foy, Québec

Dr. Geoffrey Scudder
Vancouver, British Columbia

Dr. Joseph Shorthouse (Chair)
Sudbury, Ontario

T.B.A. (ECORC)
Ottawa, Ontario

Dr. Felix Sperling
Edmonton, Alberta

Dr. Terry Wheeler
Ste.-Anne-de-Bellevue, Québec

(one position vacant)

Honorary / Founding Members:

Dr. G.E. Ball
Edmonton, Alberta

Mr. J.A. Downes
Ottawa, Ontario

Grasslands project active

The Survey's project on arthropods of Canadian grasslands reported in the Spring issue of this newsletter remains active.

The Grasslands Prospectus is now available on the Survey's website (see http://www.biology.ualberta.ca/bsc/english/propsectus.htm).

A symposium entitled "Ecology and diversity of grassland arthropods" has been organized for the October 8 afternoon session of the 2002 Joint Annual Meeting of the Entomological Society of Manitoba and the Entomological Society of Canada. Speakers include

- J.D. Shorthouse: Attributes of Canada's diverse grasslands
- T.A. Wheeler and S. Boucher: Trophic guilds of higher Diptera in xeric Yukon grasslands
- D. Wade: Spiders (Araneae) collected in a tallgrass prairie in southern Manitoba and their importance to prairie conservation
- R.E. Roughley: The use of fire as a biodiversity and conservation management tool on tallgrass prairie
- M. Alperyn: Ponds in prairie habitats: a changing dynamic illustrated by predaceous water beetles
- D. L. Johnson: Temporal changes in the grasshopper (Orthoptera: Acrididae) fauna of Alberta grassland, in response to fire, weather and vegetation changes

Unfortunately, the 2002 grasslands field trip that had been planned for the Tall Grass Prairie Preserve near Gardenton, Manitoba in July was cancelled due to unfavourable conditions. Heavy rains in June resulted in little insect activity in that area during the proposed trip dates in July. It is hoped that a grasslands field trip can be organized for 2003.

Nature Discovery Fund: Call for applications for 2003

The Nature Discovery Fund (NDF), administered by the Canadian Museum of Nature, invites applications for funding in support of "discovering and naming Canada's insect biodiversity". Established in December of 1998, NDF is a non-profit fund seeking to provide resources to recognized entomologists in support of field-based scientific exploration and research in systematics within Canada. The NDF is financed through individual donations in support of Biodiversity research.

Projects which will document the fauna by field work in previously unexplored or poorly explored areas or habitats are preferred. Support is also available for the completion and publication of already existing projects with a similar focus, but for which additional field work is not necessary. Recipients of NDF financing will be encouraged to support the continuation of the program by recognizing NDF donors in the naming of newly discovered species.

This year's recipient of a Nature Discovery Grant was Dr. Donna Giberson of the University of Prince Edward Island. Donna's proposal was entitled "Biodiversity of Aquatic Insects in the Central Canadian Arctic", and is part of a group effort to explore the insect fauna of the Thelon River in Nunavut and the Northwest Territories. Hopefully, Donna and her colleagues will make some exciting discoveries in this very poorly known part of Canada. (See page 59 for a report from their expedition.)

All applications will be assessed by a review panel composed of 3 Canadian systematists. Various levels of funding are possible (generally $500-$3000), but the number and level of awards are contingent upon resources available within the Fund.

Deadline for receipt of applications is December 31, 2002.

Results will be made known to applicants by April 1, 2003.

Application materials and more information can be obtained from Robert Anderson, Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, ON. K1P 6P4, or via email: randerson@mus-nature.ca

R.S. Anderson

Project Update: Seasonal Adaptations in Insects

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The Survey's project on seasonal adaptations has continued since the last newsletter update (Newsletter of the Biological Survey of Canada (Terrestrial Arthropods) 19 (1): 13-14). This project focusses on how insects meet the need to cope with the cold winters, short seasons and other aspects of northern climates characteristic of Canada. This need is reflected too, of course, in the composition of the Canadian fauna, in which groups of northern affinity and buffered habitats tend to predominate.

The project has continued to emphasize the theme that dormancy is not a static alternative to continuous development, but rather a dynamic process with many possible elements. These elements include variations in the type of developmental delay and its control, varying sensitivity to conditions, and complex life-cycle pathways that are built up from multiple integrated components.

Recent reviews have highlighted several aspects of insect dormancy that have commonly been overlooked. For example, dormancies have multiple purposes, helping to ensure both that individuals survive adverse seasons and that their activity and development take place at favourable times of year. Dormancy and related responses can be either "active" (development continues unless signalled otherwise) or "passive" (development stops unless signalled otherwise), a difference that has led to much confusion about the nature of so-called "obligate" diapause. Much ecological theory about life cycles relies on the existence of trade-offs (e.g. size versus time), but trade-offs are not forced when certain resources are surplus, and also resources cannot be traded off if they are in very short supply. Programmed life-cycle components occur frequently even at the highest latitudes, where flexibility in response to unpredictable temperatures often has been claimed instead.

In addition, recent papers have examined wider adaptations that are linked with dormancy to a greater or lesser degree, including water balance, cold hardiness, and direct modifications of the habitat by such means as burrows, shelters or galls, and by parental actions. Recommendations have also been made as to how information about life cycles should be recorded, because much of the recent literature on insect development is unusable for the wider purpose of understanding life cycles. These difficulties stem chiefly from flawed or singular modes of design, analysis or presentation.

Titles and abstracts of recent papers

(For some earlier titles see BSC Newsletter 19: 13-14)

Modification of adverse conditions by insects. Danks, H.V. 2002. *Oikos* in press.

Abstract: Many insects modify their environments directly, rather than merely choosing available sites that are already favourable. The modifications are carried out by making excavations in soil and other substrates, constructing feeding or resting shelters, inducing plant responses such as galls, aggregating, building colonial nests, and through

parental actions. Such environmental modifications are briefly reviewed and related to the conditions that they modify. Some of the modifications offset physical factors such as dryness or flooding and cool or freezing temperatures. Others reduce the effects of natural enemies or enhance food resources. These effects have seldom been quantified and much of the evidence is anecdotal, but preliminary generalizations are made from existing information. Although potential roles often overlap, excavations and shelters protect especially against physical factors, while aggregations, colonies and parental actions more often influence the acquisition of resources. How modifications affect the impact of natural enemies differs among different kinds of enemies and is especially difficult to test. In any event, adaptive local modifications of the environment by insects are shown to be widely distributed and important. However, their specific roles have often been assumed rather than tested, or have been overlooked along with the potential interdependence of different effects. Therefore, environmental modifications should be considered explicitly and examined with greater rigour during the study of insect life cycles.

The range of insect dormancy responses. Danks, H.V. 2002. *European Journal of Entomology* 99(2): 127-142. [An extended abstract (same title and author) is in Kipyatkov, V.E. (ed.), IVth European Workshop of Invertebrate Physiology, St. Petersburg, Russia, 9-15 September 2001. Abstracts: 24-27]

Abstract: Insect dormancy responses, in the broad sense of modifications of development, are examined from a general perspective. The range of responses is extraordinarily wide because environments are diverse, different taxa have different evolutionary histories, adaptations are needed for both seasonal timing and resistance to adversity, and not only development but also many other aspects of the life-cycle must be coordinated. Developmental options are illustrated by examining the wide range of ways in which development can be modified, the fact that each individual response consists of several components, and the different potential durations of the life-cycle. The concepts of alternative life-cycle pathways (chosen according to current and likely future environmental conditions) and of active and passive default responses are treated. Also introduced are aspects of variation and trade-offs. Some general conclusions that help in understanding dormancy responses emerge from such an examination. Many options are available (cf. Table 1). The nature of the habitat, especially its predictability, determines the potential effectiveness of many of the developmental options. Any particular set of responses reflects evolutionary history and hence depends on past as well as current environments. It is not necessarily obvious what kinds of selection, especially requirements for timing versus resistance to adversity, explain a particular life cycle. Life-cycle pathways have multiple components, so that components cannot be analyzed in isolation. A given feature, such as delayed development, can have multiple roles. Default responses can be either active (development continues unless signalled otherwise) or passive (development stops unless signalled otherwise), making necessary a broad approach to understanding the action of environmental cues. Even relatively minor effects that fine-tune dormancy responses enhance survival, but may be difficult to detect or measure. Trade-offs are not inevitable, not only when certain resources are surplus, but also because resources in very short supply (constraints) cannot be traded off. Life-cycle components are widely, but not universally, coordinated. These conclusions confirm that the range of dormancy responses is wider, more complex and more integrated than has often been recognized.

The nature of dormancy responses in insects. Danks, H.V. 2001. *Acta Societatis Zoologicae Bohemicae* 65(3): 169-179.

Abstract: This paper takes a deliberately broad view of the ultimate purposes, the structures and the controls of dormancy responses in insects. Dormancies have multiple purposes (Table 1); in particular, they serve not only to survive adverse seasons but also to ensure that activity and development take place at favourable times of year. Many elements can contribute to the structure of the responses (Table 3) including different types and different extents of delay, control, sensitivity, default conditions, components, pathways and variability. Control options come from a range of internal and external factors (Table 4). The multiplicity, complexity and integration of the various facets of dormancy confirm that responses are dynamic and hence are by no means

equivalent to simple on-off devices. Consequently, dormancy responses are best understood by considering whole life cycles in the context of whole environments, normally requiring studies that go beyond the simple approaches that are still prevalent.

Measuring and reporting life-cycle duration in insects and arachnids. Danks, H.V. 2000. *European Journal of Entomology* 97(3): 285-303.

Abstract: Some previous work on arthropod development is insufficiently detailed or incompletely reported. Much of the published information in this area is of limited use for the general analysis of life cycles. These difficulties arise primarily because many experiments do not control fully for the strain of the material (and even its specific identity) nor for rearing conditions, do not adequately take account of the complexity of life cycles and their stages, or are restricted to only part of the life cycle. For example, such factors as variable numbers of instars, sexual differences, abbreviated or hidden stages and dormancies may mean that the "average durations" reported apply to an unknown mixture of developmental types. Nor are experiments always designed or results reported and analysed in a logical and transparent manner. Undefined terms may obscure what actual developmental intervals were measured. Highly derived developmental or demographic measures may obscure core data. Statistical information may be inadequate. Such pitfalls are reviewed here, suggesting ways to ensure that results on the duration of development are both valid for specific studies and more widely useful. General experimental difficulties, recommended background information that should be provided, recommended life-cycle intervals and their terminology, and recommended ways to report numerical and statistical information are briefly summarized in tabular form.

Insect cold hardiness: A Canadian perspective. Danks, H.V. 2000. *CryoLetters* 21(5): 297-308.

Abstract: The cold climates and diverse environments of Canada have allowed key studies of insect cold hardiness that developed and widened the understanding of this subject. For example, freezing tolerance, chilling tolerance, freezing resistance, supercooling, cryoprotectants and other features can be combined in many different ways, reflecting a wide range of adaptations. Many other factors interact with and influence cold hardiness, such as habitats and their selection, and water and energy balances. These findings suggest several topics that

would be especially fruitful for further study in northern Canada.

Dehydration in dormant insects. Danks, H.V. 2000. *Journal of Insect Physiology* 46(6): 837-852.

Abstract: Many of the mechanisms used by active insects to maintain water balance are not available to dormant individuals. Physiological and biochemical mechanisms of dehydration tolerance and resistance in dormant insects and some other invertebrates are reviewed, as well as linkages of dehydration with energy use and metabolism, with cold hardiness, and with diapause. Many dormant insects combine several striking adaptations to maintain water balance that - in addition to habitat choice - may include especially reduction of body water content, decreased cuticular permeability, absorption of water vapour, and tolerance of low body water levels. Many such features require energy and hence that metabolism, albeit much reduced, continues during dormancy. Four types of progressively dehydrated states are recognized: water is managed internally by solute or ion transport; relatively high concentrations of solutes modify the behaviour of water in solutions; still higher concentrations of certain carbohydrates lead to plasticized rubbers or glasses with very slow molecular kinetics; and anhydrobiosis eliminates metabolism.

The diversity and evolution of insect life cycles. Danks, H.V. 1999. *Entomological Science* 2(4): 651-660.

Abstract: Insect life cycles and their control are extremely diverse and complex. They can be studied in several ways, including the analysis of ecological correlations (according to habitat, region and species), trade-offs and modelling. Many existing studies of all of these types are available, and a number of generalizations about how life-cycle adaptations evolve can be drawn from them: similar environmental challenges can be solved in many different ways; similar responses can evolve independently; responses evolve in combination; a single response may contribute to many functions; the same response may serve different functions; each species has a unique set of responses; life cycles structure different resources; expected trade-offs are not inevitable; selection is a long-term process; and the nature of environments is the key to understanding life cycles. These generalizations show especially the great extent of complexity, parallel evolution and overlap in the responses of different species, as well as the great importance of environmental resources and conditions in structuring the responses. Although some such generalizations ought to be self-evident, they have often been overlooked. Enumerating them helps to demonstrate that great care is necessary for planning relevant studies. In particular, the generalizations suggest that future work on insect life cycles will be most fruitful if it is done in a broader context than most previous studies: by analyzing genetic and environmental components and their interactions at the same time; by assessing how life cycles structure the resources of time, space and energy; by measuring natural environmental conditions and their variation in more detail and in relation to specific life cycles; by conducting comprehensive work on individual species; and by developing long-term multifaceted studies rather than doing further elementary experiments.

Life cycles in polar arthropods - flexible or programmed? Danks, H.V. 1999. *European Journal of Entomology* 96(2): 83-102.

Abstract: Climate features that influence life cycles, notably severity, seasonality, unpredictability and variability, are summarized for different polar zones. The zones differ widely in these factors and how they are combined. For example, seasonality is markedly reduced by oceanic influences in the Subantarctic. Information about the life cycles of Arctic and Antarctic arthropods is reviewed to assess the relative contributions of flexibility and programming to life cycles in polar regions. A wide range of life cycles occurs in polar arthropods and, when whole life cycles are considered, fixed or programmed elements are well represented, in contrast to some earlier opinions that emphasized the prevalence of flexible or opportunistic responses. Programmed responses are especially common for controlling the appearance of stages that are sensitive to adverse conditions, such as the reproductive adult. The relative contribution of flexibility and programming to different life cycles is correlated with taxonomic affinity (which establishes the general life-cycle framework for a species), and with climatic zone, the habitats of immature and adult stages, and food.

The Quiz Page

—test your knowledge of Canada and its fauna—

1. Is the highest point of land in Manitoba higher than that in Saskatchewan?

2. What is a braided stream?

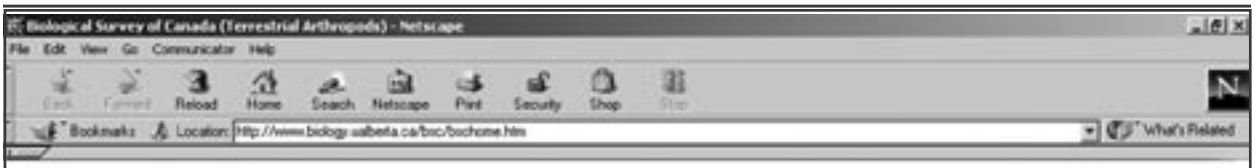
3. Among parasitoid wasps that occur in Canada, name 20 families in which all or nearly all members are parasitoids of other insects or other kinds of terrestrial arthropods.

4. How many species of cockroaches occur in Canada and how many of these species are introduced?

5. A specimen is returned after identification by a specialist with the following report. Describe the meaning (in terms of the maximum information it provides) of that report.

   Inventidae: *Neocoronus* (*mediatus* Thompson gp.) sp. 3 [n. sp. nr. *pallidus* (Johanson)]

[Answers on p. 74]



Biological Survey of Canada
Terrestrial Arthropods français

Web Site Notes

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One role of the Biological Survey is to act as a clearing-house or coordinating office, through current knowledge of relevant people and their individual projects, and other information. We are using our website increasingly to assist this goal. This issue of the newsletter highlights two sections of the website for your attention.

The Survey Secretariat maintains a *list of requests for cooperation*, which encourages the exchange of information and specimens from locations across the country. Previously this was updated on an annual basis and published in the Spring issue of this newsletter. The list continues to be published in the newsletter, but it is now also posted on our website where regular updates are available. If you would like assistance in studying the Canadian fauna or can provide cooperation to others please see this section of our website. Go to http://www.biology.ualberta.ca/bsc/english/listofrequests.htm or follow the menu item 'Requests for material or information' or 'Demande de matériel ou d'information'.

Another tool available on the website for learning about people and their projects is a *list of personnel interested in the systematics and faunistics of the terrestrial arthropods of Canada*. Each entry indicates name, position, contact information; taxa and/ or ecological groups of interest; primary subjects of taxonomic interest, primary ecological approaches, and current projects. The information can be browsed through alphabetical name listings or by searching for specific taxa, ecological groups, cities where individuals are located and by keywords in the project field. Although the database has been updated whenever new information is received, many entries had not been revised since 1996, so we are currently undertaking a major update, including attempts to contact all those on the current list. We therefore invite you to look at your entry on our website and let us know what needs to be changed. An online form is available to submit updates or you can contact us through the usual methods (see inside cover). If you know of others who should appear in the list (such as students) we would be pleased to learn about them too. To find the database go to http://www.biology.ualberta.ca/bsc/english/listofworkers.htm or follow the menu item 'List of workers (database)' or 'Liste des travailleurs (base de données)'.

The home page of the Biological Survey of Canada is at:
http://www.biology.ualberta.ca/bsc/bschome.htm (English) or
http://www.biology.ualberta.ca/bsc/cbchome.htm (Français)

The University of Guelph Insect Collection

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The University of Guelph Insect Collection has its roots in the insect collection of the Entomological Society of Ontario, founded in 1863. It is the oldest insect collection in Canada and was, in effect, Canada's national insect collection before there was a Canada and before the establishment of the Canadian National Collection in Ottawa. Although our current collection of well over a million specimens is relatively small by world standards, the University of Guelph Insect Collection remains one of North America's most important heritage insect collections, and is Canada's third or fourth largest insect collection. It is the best collection of Ontario insects, including many irreplaceable specimens of extirpated species. Furthermore it houses an excellent collection of Diptera from around the world, with a particularly good collection of neotropical Brachycera. The collection of Sphaeroceridae is particularly extensive and by far the largest one in the New World.

There are about fifty large (over 10,000 specimens) collections of insects in Canada, of which only ten or eleven house over 100,000 insects, and only four house over one million. The University of Guelph Insect Collection is housed in state-of-the-art facilities provided by the Department of Environmental Biology. Before November 1999 curation was done on a spare-time basis by students and Dr. Steve Marshall, the faculty member in charge of the collection. Since 1999 Dr. Matthias Buck is curator of the collection.

Research at Guelph has various different goals. Perhaps most importantly Guelph is contributing through systematic research and taxonomic revisions to the knowledge of insects, mostly Diptera. Since the 1980's Dr. Marshall has published a long series of papers on the systematics of Sphaeroceridae (Diptera), a group that is also the main research interest of Dr. Buck. Under the supervision of Dr. Marshall studies on many other groups of Diptera have been conducted by graduate students, e.g. Asilidae (R. Cannings), Phoridae (B.V. Brown), Pipunculidae (J. Skevington), Sphaeroceridae (T.A. Wheeler, I.P. Smith), Chamaemyiidae (K.N. Barber), Clusiidae (D. Caloren, O. Lonsdale), and Tachinidae (X. Sun). Currently the Guelph group is involved in various chapters of the *Manual of the Diptera of Central America* which will include the first published key to Neotropical families of Diptera.

Another important field of research is the study of the distribution of insects and faunal change in Ontario. In the past Guelph has conducted insect surveys in different Provincial and National Parks such as Point Pelee National Park, Bruce Peninsula National Park, Algonquin Provincial Park, Pinery Provincial Park and currently Ojibway Prairie Provincial Nature Reserve. The long-term involvement with Ontario Parks has been formally recognised in recent years through the annual provision of a province-wide collecting permit and an agreement that sees the Guelph collection as the major repository for specimens from Provincial Parks and Nature Reserves.

Besides systematic and faunistic research there is a strong interest in developing insect identification guides for a broader public. This includes the development of photographic field guides, interactive keys and web pages.

The Guelph Collection is rapidly growing by approximately 50,000 specimens per year. About half of this increase is derived from active local surveys and includes insects of most orders. The other half is collected on research trips abroad (especially to the Neotropical region) and includes mostly Diptera, especially Sphaeroceridae, Micropezidae and other acalypterate families. A smaller but nonetheless very significant part is sorted out from trap residues kindly lent by entomological colleagues.

Since November 1999 locality and collection data of all material newly incorporated into the collection is stored in a central database (BIOTA) and every specimen is provided with a unique identifier. Currently, the available resources allow retrospective data basing of older material only to a minor extent (e.g., for areas currently under survey). Likewise, identifications of specimens are only databased if they belong to a survey.

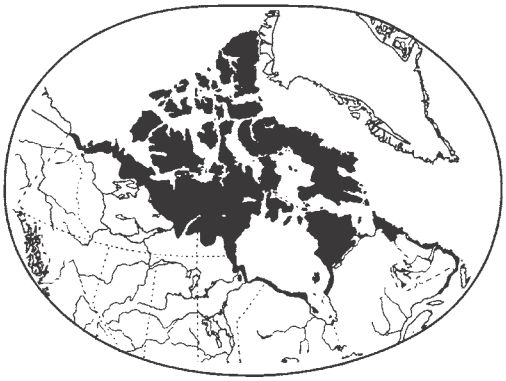
Because of our strong holdings of Ontario insects and certain Diptera families the Guelph Collection is potentially of high interest to any entomological systematist and faunistic researcher. Material from the Guelph collection has been used extensively in revisions, taxonomic works and faunistic studies. We welcome loan requests from the systematic community and encourage visits from scientists who want to study our collections. The number of type specimens is relatively low in the Guelph collection, mostly because its future seemed uncertain during certain periods in the past and type material was routinely deposited in other collections (often the Canadian National Collection).

The Guelph Collection also plays an important role in the identification of pest species. In the last couple of years two major new introductions of insect pests to Ontario, the Pea Leaf Miner (*Liriomyza huidobrensis*) and the Swede Midge (*Contarinia nasturtii*), were either identified here or identification was facilitated through establishing contact to experts. The collection is also used by the Pest Diagnostics Clinic of the Ontario Ministry of Agriculture and Rural Affairs (OMAFRA) to verify identifications and for consultation in taxonomically difficult groups.

The Insect Collection is also heavily involved in both undergraduate and graduate teaching. Outside the University the collection is used in museum displays, school tours, special interest groups such as naturalist societies, extension services, and a myriad of other ways.

Russian guests in the University of Guelph insect collection

(Photo by S.A. Marshall)



ARCTIC CORNER

News about studies of arctic insects

Introduction

Arctic Corner provides a forum for news of particular arctic interest, replacing the Biological Survey's newsletter *Arctic Insect News* (1990-2000). Contributions to *Arctic Corner* are welcomed by the Editor (see inside front cover).

Insect biodiversity in the Thelon Wildlife Sanctuary

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Introduction

The Biological Survey of Canada's *Insects of Keewatin and Mackenzie Project* was initiated in 2000 to focus attention on the inadequately surveyed territory between the Mackenzie River and Hudson Bay. A project dedicated to documenting entomological diversity in this region, which encompasses all of mainland Northwest Territories and Nunavut, was viewed as a logical extension of the Survey's efforts in the Yukon Territory (cf. Danks and Downes 1997). In the summer of 2000, Scientific Committee members Doug Currie (Royal Ontario Museum and University of Toronto) and Donna Giberson (University of Prince Edward Island), along with Peter Adler (Clemson University), Brian Brown (Natural History Museum of Los Angeles) and Malcolm Butler (North Dakota State University), embarked on a 700-km collecting expedition along the Horton River between Horton Lake and the Beaufort Sea. Collections along the river revealed that the insect fauna of northwestern Northwest Territories was much richer than previously supposed, underscoring the need for further study (Currie et al. 2000, Currie and Adler 2000). The Horton River was surveyed during the first year of the project because of its close proximity to the eastern boundary of Beringia — the primary source area for organisms that repopulated the north following deglaciation. Our goal was to compare species richness in a recently glaciated area with that of the nearby Beringian refugium. Additionally, one

of us (D.G.) studied aspects of energetics and food web dynamics in a large arctic river. And because the Horton River flowed north towards the Beaufort Sea, we were able to sample in a south-to-north transect from approximately 67°30′ to 70°00′ north latitude. Given the success of our initial survey we resolved to mount a similar expedition farther south and to the east. A number of potential study sites were considered, but ultimately we settled on the Thelon River within the confines of the Thelon Wildlife Sanctuary.

The Thelon Wildlife Sanctuary

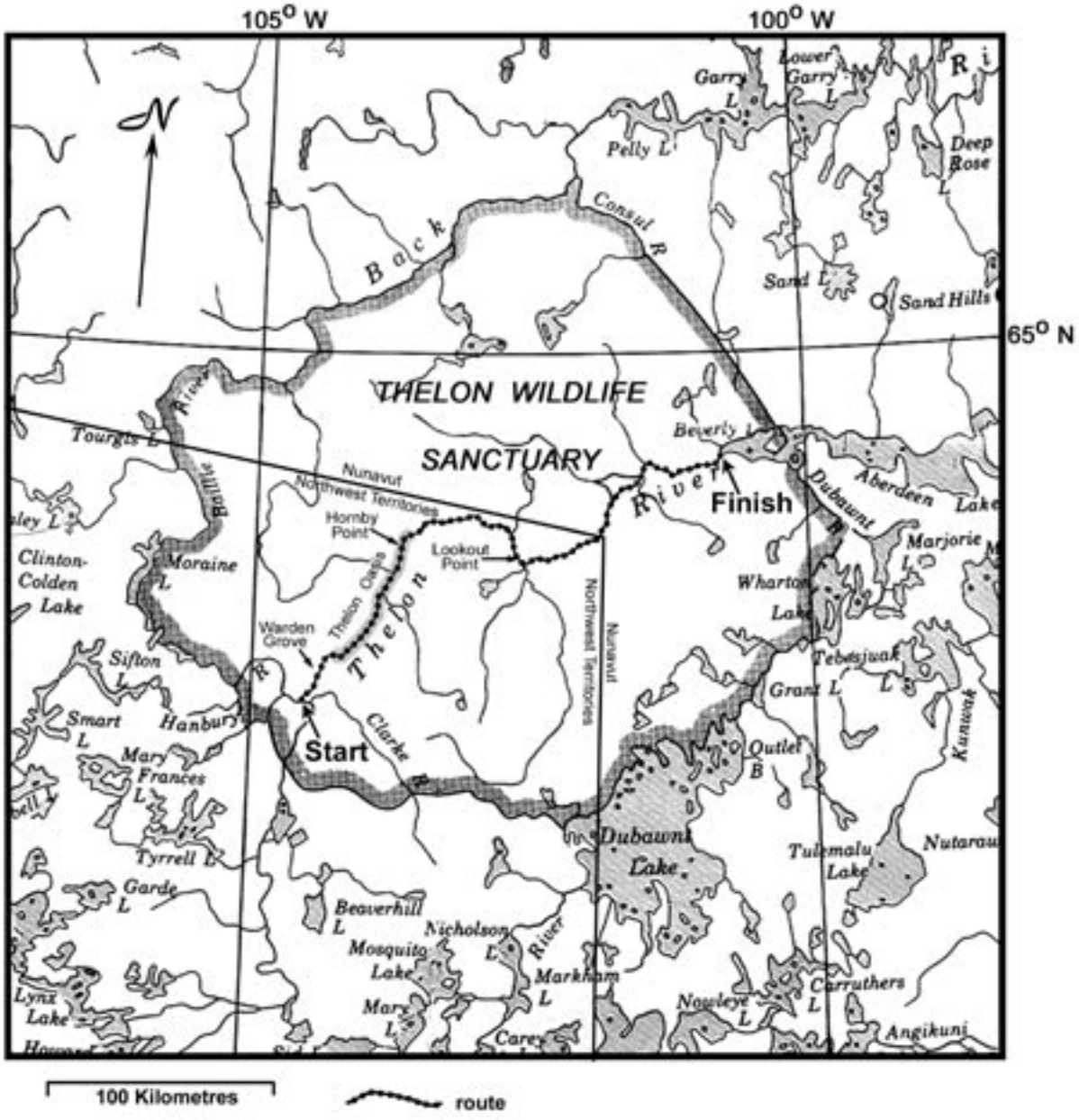
The Thelon Wildlife Sanctuary ranks among the largest and most remote protected areas in the world. Straddling the boundary between Northwest Territories and Nunavut, the sanctuary is renowned for its pristine nature and legendary history*. One of the outstanding features of the preserve is a stretch of the Thelon River between the confluence of the Hanbury River and Hornby Point, referred to as 'the Thelon Oasis'. Dense groves of spruce trees line the river valley along this stretch — hundreds of kilometers north of treeline. This northern oasis supports a rich assemblage of plants and animals, many of which occur far north of their typical range, including raspberry, currant, columbine, and moose. The sanctuary is perhaps best known as a refuge for the last remaining populations of mainland muskox, as well as for the 330,000 strong Beverly caribou herd.

Although renowned as a preserve for plants and mammals, virtually nothing is known about the insect fauna of the sanctuary. Indeed, the vast swath of the Canadian arctic between Yellowknife and Baker Lake remains virtually unexplored for insects owing to the absence of roads and human settlements. It is this lack of knowledge, coupled with the opportunity to prospect for insects in an 'arctic oasis', that inspired us to mount a two-week expedition along the Thelon River during the summer of 2002.

Logistics and river travel

A disadvantage of the proposed route is that two separate applications were needed for scientific research licenses: one each for Northwest Territories and Nunavut. Fortunately, the process proved to be far less cumbersome than experienced when planning for the Horton River expedition, and it turned out that a formal license for Nunavut was not even needed given our innocuous collecting techniques. As with the 2000 expedition, we engaged a wilderness travel company to outfit and guide our party. The three of us, along with guide Tim Gfeller and graduate students Lisa Purcell (University of Prince Edward Island) and Amanda Roe (University of Alberta), gathered in Yellowknife on June 28, 2002. Early the following morning we loaded approximately 320 kg (700 lbs) of food and gear, plus three canoes, onto two float planes in preparation for the three and a half hour flight to the Thelon Wildlife Sanctuary. We were dropped off on the Thelon River just below its confluence with the Hanbury River (63°38′N 104°32′W). Over the next two weeks we paddled our 5.2-m (17-foot) canoes about 300 km downstream, to a point where the river widens into Beverly Lake (64°32′N 100°58′W). Terrestrial and aquatic insects were sampled along the entire route using a combination of aerial and dip netting, malaise traps, and hand collecting. Specimens were pinned or variously fixed in ethanol or Carnoy's solution, depending on taxon or method of analysis.

*David Pelly's (1996) book on the Thelon Wildlife Sanctuary provides a fascinating account about history of the Thelon River, including the ill-fated attempt by John Hornby and his two young companions to spend the winter of 1926-1927 in the arctic oasis.



The route from the Hanbury River to Beverly Lake included many points of historical, geological, and anthropological interest. Early in the trip, near the beginning of the Thelon Oasis, we passed Warden's Grove, a cluster of cabins established in 1928 by the first custodians of the sanctuary — W.H.B. "Billy" Hoare and A.J. "Jack" Knox. Farther downstream near the end of the oasis, we found the ruins of the cabin where John Hornby and his two companions starved to death in the spring of 1927. The grave of the legendary trapper, along with those of nephew Edgar Christian and Harold Adlard, are marked by simple wooden crosses bearing their initials.

A geographical point of interest is a prominence known as Muskox Hill — the only pingo known to occur within the Thelon

Wildlife Sanctuary. River banks, eskers, and drumlins provided the only other relief in an area crushed flat by Laurentide Ice. One of the few sites that afforded extensive views of the Thelon River valley is an old Inuit encampment called Lookout Point. Numerous archaeological remnants including tent rings were scattered along a prominent ridge. Inuit artifacts were also common along the Thelon Bluffs, a steep-sided reach of river near the eastern boundary of the sanctuary. The river narrowed markedly as it passed through the bluffs, providing the only stretch of river with technically challenging flow.

Although the sanctuary is renowned for its wildlife, relatively few large mammals were encountered. Muskox, caribou, moose, and wolves were sighted sporadically, and it was not until we reached the vicinity of Beverly Lake that large numbers of caribou were seen travelling along ridge tops. Canada geese were abundant in areas where the Thelon River widened to lake-like conditions. Rough-legged hawks and bald eagles were the most commonly seen raptors.

Preliminary Results

Black Flies (Diptera: Simuliidae)

Peter Adler and Doug Currie made 37 collections of immature black flies from the Thelon River and its tributaries, plus numerous collections of adults. Morphological and chromosomal examination of approximately 4,700 specimens yielded 29 species, matching closely the total number of species (30) collected from the Horton River and its valley. However, only about half of the species (17) are shared between the two drainages. These results suggest that simuliid community structure is far from homogeneous across northern Canada. Collectively, the Horton and Thelon expeditions yielded a total of 42 black fly species — far exceeding the 22 species recorded previously from arctic Canada east of the Mackenzie River (cf. Danks 1981).

The 29 species collected from the Thelon Wildlife Sanctuary were divided among 8 genera as follows: *Gymnopais* (1), *Helodon* (1), *Prosimulium* (1), *Greniera* (1), *Stegopterna* (2), *Cnephia* (1), *Metacnephia* (3) and *Simulium* s.l. (19). At least one species, a member of the *Simulium arcticum* complex, is new to science. Another species, a member of the *Simulium* subgenus *Hellichiella*, was previously known only from a single locality in Norway. Nearly half of the species (14) exhibit a Holarctic distribution, underscoring the close association between the Nearctic and Palearctic simuliid faunas at northern latitudes. Surprising absences from the Thelon collections included S*imulium rostratum*, *Simulium venustum* cytospecies CC3, and representatives of the *Simulium aureum* complex. The absence of *S. rostratum* is especially puzzling given that this Holarctic species was among the most frequently collected simuliids on the Horton expedition. Indeed, it is among the most common and frequently collected species in all of Canada.

The timing of the expedition was ideal, both for assessing the simuliid fauna and for avoiding the ravages of the Barrren Lands black fly, Malcolm Waldron's (1931) "cruel parasite" of the tundra. Although larvae of both early- and late-season species were present, the adults of the principal human biters — members of the *Simulum venustum* complex — had not yet begun their massive emergence. The team members, consequently, were spared the suffocating attacks by black flies that had been experienced on the Horton expedition. The ever-present mosquitoes, however, attested to the prominent role of biting flies in northern lands.

One of the major objectives of the expedition was to search for two enigmatic and little-known species of black flies. One of

these species, *Simulium giganteum*, is known in the Nearctic Region from a single specimen collected in the vicinity of Baker Lake — not far from the eastern boundary of the Thelon Wildlife Sanctuary. The other, an undescribed species of *Hellichiella* from the James Bay region of Quebec, is currently known only from a description of its chromosomes (Rothfels and Golini 1983). Unfortunately, neither species turned up in our collecting efforts along the Thelon River valley. It is clear that knowledge about simuliid diversity in arctic Canada is far from complete.

Ephemeroptera, Plecoptera, and Trichoptera

Donna Giberson and Lisa Purcell concentrated on the aquatic orders, with special reference to 'EPTs' — Ephemeroptera, Plecoptera and Trichoptera. The relatively early timing of the Thelon expedition proved much better than the Horton expedition in terms of material collected. The immature stages of aquatic insects were captured using a D-framed net and hand-sorted in the field. Adults were collected using a combination of aerial netting, Malaise trapping, and the use of a beating sheet. Many mature larvae were encountered, which greatly enhances the prospect of species-level identification. The plecopteran families Perlodidae, Chloroperlidae, and Nemouridae were well represented. The Ephemeroptera were more richly represented at the family level including the Leptophlebiidae, Heptageniidae, Baetidae, Ameletidae, Siphlonuridae, and Ephemerellidae. Commonly encountered Trichoptera included the Hydropsychidae, Brachycentridae, and Limnephilidae, to name a few. Specimens are in the process of being curated, and will be sent to specialists for species-level identification.

Lepidoptera

Amanda Roe collected Lepidoptera and operated a Malaise trap on behalf of the University of Alberta's Strickland Museum. No unexpected butterflies were encountered and most collections represented only minor range extensions. The moths have yet to be completely identified; however, preliminary results suggest a similar pattern to that observed for butterflies. Butterflies were common relative to large moths, such as noctuids, perhaps owing to the earliness of the season. The vagaries of weather, especially with respect to wind, resulted in a sporadic survey of lepidopteran diversity along the Thelon River valley.

Donna Giberson processing insects under the protection of a home-made mosquito shield. (photo by D.C. Currie)

Future Plans

Our expeditions along the Horton and Thelon Rivers reveal that there is still much to be learned about patterns of insect diversity in Arctic Canada. With processing of the 2002 collections still underway, there have been no formal discussions about our future plans for the *Insects of Keewatin and Mackenzie Project*. The Horton and Thelon Rivers both fall within the High Subarctic Ecoclimatic Region of

Canada (Ecoregions Working Group 1989), so one possibility is to select a more northerly destination in the Low Arctic Ecoclimatic Region. The Back, Burnside, and Hood Rivers are all possible venues in this particular region. Alternatively, the geographical terms of reference of the Project could be expanded to include the Hudson Bay Lowlands and Ungava, thus including the entire Arctic landscape of the mainland of Canada. Regardless of the destination chosen, the success of the Project depends ultimately on our ability to raise funds and acquire licenses. The high cost associated with conducting research in the far north continues to be a major stumbling block for future expeditions. As sharing fixed expenses such as chartered aircraft and guides represents the only viable option for this type of fieldwork, we look forward to hearing from anyone interested in participating in a future expedition to the Canadian Arctic.

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Canadian research in arctic entomology is out in the cold

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Since the publication of the brief "Arctic Invertebrate Biology : Action Required" by the Biological Survey of Canada (Terrestrial Arthropods) thirteen years ago (Danks and Ring 1989), very little has been accomplished in Canadian arctic entomology. This brief recommended ways in which studies of arctic invertebrate biology could be enhanced through (1) identifying and developing key study themes in fields already shown to be significant such as cold-hardiness, seasonality, modification and control of life cycles, ecosystem-level ecology, and the role of insects/invertebrates in predicted global change scenarios, (2) organizing a series of workshops to discuss topics of broad interest, to develop further avenues of enquiry, and to coordinate research, and (3) developing both national and international cooperative research ventures to help identify other key issues and encourage long-term commitment to an ongoing programme of cooperative research initiatives on arctic invertebrates. NONE of these objectives has been met, despite further exhortations by Danks (1992), Danks et al. (1994) and Ring (1994).

The halcyon days of Canadian arctic invertebrate biology was in the half-century

beginning in 1947 with the Northern Biting Fly Survey, followed by the Northern Insect Survey which was most active during the 1950s. During the 1960s and 1970s there followed a wide variety of studies by groups and individuals in the Canadian high arctic. What had started out, essentially, as a program for obtaining and publishing information on the taxonomy and distribution of northern insects was by now diversifying into studies of morphology, behaviour, ecology at all levels (population, community and ecosystem interactions), and eco-physiology. This body of work culminated in the publication of the invaluable book "Arctic Arthropods. A review of systematics and ecology with particular reference to the North American fauna" by H.V. Danks (1981). For the remainder of this 50-year period, most attention has been devoted to research on adaptations in the North (Kukal 1991; Ring 2001), although individual survey-type projects have also been carried out.

Over the last decade or so, financial support for arctic insect/invertebrate research has gradually dwindled in Canada. The result has been that I, along with many other arctic scientists, will not be going North this summer — the first time in over 25 years! This comes at a time when lip-service to "our northern peoples, our northern territories and our northern environment" has never been greater among Canadian government agencies. What is most galling to me is the fact that, in the interim, the U.S.A. has INCREASED its spending on polar research via National Science Foundation (NSF) initiatives; Sweden organized a two-way expedition through Canada's Arctic waters ("Tundra Northwest 99") to gather ecological data using the Canadian icebreaker Louis S. St-Laurent. Using this ship as a base for boat and helicopter excursions ashore, they gathered ecological data to compare with information from a similar project in Russia — the 1994 Swedish-Russian Tundra Ecology Expedition. Among the other Scandinavian countries, Norway has maintained a strong invertebrate biology programme at Svalbard (among other sites); Denmark continues to support Arctic research mainly through its new remote field station at Zackenburg, Greenland (indeed, a new book on the the Ecology of Greenland has just been published — Born and Böcher 2001) and Finland continues to play a unique role in northern studies and has a strong influence in the brand new " University of the Arctic". Even the U.K. (which does not have any Arctic territories of its own) mounted an expensive Arctic Ecology Programme based in Svalbard in the mid 1990s.

I would be remiss if I suggested that Canada is not actively involved in other fields of arctic biological research. The Northern Contaminants Program is still in full swing; the ITEX Program (International Tundra Experiment) continues to operate out of several sites in northern Canada; the Polar Continental Shelf Project (PCSP) supplies logistic support for Northern researchers (although it suffered a 20% decline in budget this year and has already been reduced to only one station); and the Canadian Polar Commission (CPC) acts as a clearing house for arctic information and encourages collaborative research projects — although it has no funding or mandate to initiate research endeavours itself. The Association of Canadian Universities for Northern Studies (ACUNS) along with the Northern Scientific Training Program (NSTP) of the federal Department of Indian and Northern Development (DIAND) are very actively involved in promoting arctic research among university faculty members and their students, and without these organizations and programs, arctic research in general would be in dire straits. Finally, one should not forget the wide array of research facilities and field stations scattered across Northern Canada which are available to bona fide Canadian researchers, but they too have been in decline over the last two decades.

The last paragraph suggests that the future looks bright for some disciplines in arctic research, and indeed that is true. But my major reservation here is that NONE OF IT relates directly to studies and research in arctic insect and/or invertebrate biology. The most insidious aspect to that observation, however, is not that there will be no Canadian entomologists in the arctic this summer for the first time in many years, but that with the demise of university-based research programs there will be NO ONE to teach the future generation(s) of young entomologists the delights, intricacies and complexities of the magnificent arctic tundra biome of Northern Canada! I have spoken to many students on this issue both here at my own institution as well as around the country, and the following sums up some of their prevailing concerns: "We should be leaders in arctic research. We should be at the forefront of developing an understanding of climate change. Such a sensitive and precious ecosystem that so little is known about will indeed suffer greatly from lack of research and scientific understanding. It is a sad day for Canadian science, a sad day for the young scientist and, indeed, a sad day for Canada's north".

To finish on a more optimistic note, it is encouraging to note that some of the recommendations of the Final Report to NSERC and SSHRC from the Task Force on Northern Research (entitled "From Crisis to Opportunity: Rebuilding Canada's Role in Northern Research", 2000) have already been implemented. On April 3, 2002 it was announced in Ottawa that the first six new University Chairs for Research in Canada's North had been appointed. This is the first phase in a plan that calls for 24 Northern Chairs over the next three years, along with 115 Graduate Scholarships and 100 Postdoctoral Fellowships. The total budget amounts to about $50 million over three years and is part of our national goals aimed at improving Canada's current 14th place to be one of the top five countries in the world for research and development. Although none of these six Chairs is in the area of arctic invertebrate biology, there is definitely some hope for the future. My fervent wish on my imminent retirement, therefore, is to see that Canadian research in arctic entomology has again come in from the cold — but I'm not sure I will be around that long!

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The importance of research collections of terrestrial arthropods. A brief	1991. G.B. Wiggins et al. Bull. ent. Soc. Can. 23(2), Suppl. 16 pp.	Free of charge on request from the Survey; full text at http://www.biology.ualberta.ca/esc.hp/bsc/briefs/brimportance.htm
Winter habitats and ecological adaptations for winter survival	1991. H.V. Danks. pp. 231-259 in R.E. Lee and D.L. Denlinger (Eds.), Insects at Low Temperature. Chapman and Hall, New York. 513 pp.	Book available through booksellers
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Museum collections: fundamental values and modern problems	1991. H.V. Danks. Collection Forum 7(2): 95-111.	Reprints available on request from author
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La dormance et les cycles biologiques	1999. H.V. Danks. Antennae 6(2): 5-8.	See: http://www.seq.qc.ca
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Dehydration in dormant insects	2000. H.V. Danks. Journal of Insect Physiology 46(6): 837-852	Reprints available on request from author
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Measuring and reporting life-cycle duration in insects and arachnids	2000. Danks, H.V. European Journal of Entomology 97(3): 285-303.	Reprints available on request from author

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Selected Future Conferences

Organization	Date	Place	Contact
ENTOMOLOGICAL CONFERENCES			
Entomological Society of Canada	**2002**, 6-9 Oct	Winnipeg, MB	(with the Entomological Society of Manitoba) Organizing Committee Chair, Don Dixon (204-945-3861, ddixon@gov.mb.ca); Robert Lamb, Program Subcommittee Chair, rlamb@em.agr.ca
	2003	British Columbia	P. de Groot, pdegroot@nrcan.gc.ca
Entomological Society of America	**2002**, 17-20 Nov.	Fort Lauderdale, FLA	ESA, 9301 Annapolis Rd., Lanham, MD 20706-3115; meet@entsoc.org
	2003, 26-30 Oct.	Cincinnati, OH	ESA, see above
5th International Congress of Dipterology	**2002**, 29 Sept. - 4 Oct.	Brisbane, Australia	http://www.uq.edu.au/entomology/dipterol/diptconf.html
VIIth European Congress of Entomology	**2002**, 7-13 Oct.	Thessaloniki, Greece	Symposium Secretariat: Laboratory of Applied Zoology and Parasitology, Aristotle University of Thessaloniki, 540 06 Thessaloniki Greece; matilda@agro.auth.gr
3rd Worldwide Dragonfly Association International Symposium of Odonatology	**2003**, 8-13 January	Beechworth, Australia	John Hawking, Murray Darling Freshwater Research Centre, Cooperative Research Centre for Freshwater Ecology, CSIRO Land and Water, P.O. Box 921, Albury, NSW, 2640; John.Hawking@CSIRO.au http://powell.colgate.edu/wda/Australia/Home_page.htm
Annual Meeting of the Lepidopterists' Society	**2003**, July	Olds, AB	http://www.furman.edu/~snyder/snyder/lep/meet.htm
XXII International Congress of Entomology	**2004**, 15-20 Aug.	Brisbane, Australia	Jim Cullen, CSIRO Entomology, j.cullen@ento.csiro.au Myron Zalucki, University of Queensland, Australia m.zalucki@mailbox.uq.edu.au

Organization	Date	Place	Contact
PROVINCIAL SOCIETIES			
Entomological Society of British Columbia	**2002**, 24 Sept.	Victoria, BC	Dr. Lorraine Maclauchlan, BC Ministry of Forests, 515 Columbia Street, Kamloops BC V2C 2T7 Lorraine.Maclauchlan@gems3.gov.bc.ca http://esbc.harbour.com/
Entomological Society of Alberta	**2002**, 24-26 Oct.	Lethbridge, AB	http://www.biology.ualberta.ca/courses.hp/esa/esa.htm
Entomological Society of Manitoba	**2002**, 6-9 Oct.	Winnipeg, MB	(with the Entomological Society of Canada; see that entry)
Entomological Society of Ontario	**2002**, 18-20 Oct.	Ottawa, ON	Dr. Bruce Gill, gillbd@inspection.gc.ca http://www.utoronto.ca/forest/eso/eso2002.htm
COLLECTIONS / MUSEUMS / SYSTEMATICS			
Society for the Preservation of Natural History Collections Annual Meeting	**2003**, 15-19 June	Lubbock, Texas	http://mum202-2.musm.ttu.edu/spnhc2003/ Richard Monk, rich.monk@ttu.edu
Natural Science Collections Alliance Annual Meeting (formerly the Association of Systematics Collections)	**2003**, 5-7 June	Berkeley, California	http://www.ascoll.org/annualmeeting/2003
OTHER SUBJECTS (ESPECIALLY THOSE RELEVANT TO SURVEY PROJECTS)			
Society for Integrative and Comparative Biology Annual Meeting (includes symposium on Biology of the Canadian Arctic)	2003, 4-8 January	Toronto, Ontario	http://www.sicb.org/meetings/2003

Answers to Faunal Quiz

[see page 55]

1. The highest point of land in Manitoba (Baldy Mountain, 832 metres, in Duck Mountain Provincial Park) is lower than the Cypress Hills (1392 metres) in western Saskatchewan.

2. A braided stream is one flowing in several dividing and reuniting channels resembling the strands of a braid, a phenomenon caused by obstructions created by sediment deposited by the stream. Depending on the zone, such a habitat can support diverse insects.

3. There are many families of parasitoid wasps that attack insects and their relatives in Canada, well over 40 families in total. Well known examples include Braconidae, Ichneumonidae, the Aphelinidae and other chalcidoids, the Eucoilidae, Alloxystidae and other cynipoids, proctotrupoids such as Proctotrupidae, Diapriidae, Platygastridae and Scelionidae, as well as Ceraphronidae, Bethylidae and other families.

   For a list see *Mem. Ent. Soc. Can.* 108 (1979): 487-489 or http://www.biology.ualberta.ca/bsc/english/hymenoptera1.htm

4 31 species of cockroaches have been recorded in Canada, including 26 species thought to be introduced, of which only four are established in the country (as opposed to adventitious in heated buildings or laboratories). (Vickery, V.R. at http://www.biology.ualberta.ca/bsc/english/orthopteroids2.htm)

5. The report “Inventidae: *Neocoronus* (*mediatus* Thompson gp.) sp. 3 [n. sp. nr. *pallidus* (Johanson)]” means that the specimen is an undescribed species of the family Inventidae of the genus *Neocoronus*, within a recognized species group named after the species *mediatus* described by Thompson in *Neocoronus*. The specimen is recognized by the identifier as belonging to the species to which he has given the working label "species 3". That species is near the species *pallidus* that was described earlier by Johanson in another genus now treated as a synonym of *Neocoronus*.

Quips and Quotes

"Degradation of the oyamel fir-pine forest ecosystem in central Mexico is a threat to the overwintering and migratory phenomenon of the eastern North American population of the monarch butterfly. . . What in 1971 was a nearly continuous high-quality forest is now fragmented and severely degraded. Between 1971 and 1999, 44% of conserved forest (forest with >80% cover) was degraded, and the largest patch of high-quality forest was reduced from 27,115 ha to 5827 ha. The annual rate of degradation from 1971 to 1984 was 1.70%, and this increased to 2.41% during the next 15 years. . . A subset of the analysis quantified changes in a 6596-ha area . . . declared protected by presidential decree in 1986. Corresponding rates of degradation of these reserves more than tripled, from approximately 1.0% between 1971 and 1984 to more than 3% between 1984 and 1999."

[from Brower, L.P. et al. 2002. Quantitative changes in forest quality in a principal overwintering area of the monarch butterfly in Mexico, 1971-1999. Conservation Biology 16: 346-359.]

"A mathematician is a blind man in dark room looking for a black cat that isn't there."
(Charles Darwin)

"After the expected grumbling over this result . . . it was experimentally challenged and found to be thuddingly irreproducible . . ."

[from J.C. Hall. 2000. Current opinion in Neurobiology 10: 456-486]

"It was a book to kill time for those who like it better dead." (attributed to Rose Macaulay)

"The university brings out all abilities, including stupidity" (Chekhov)

Procrastination is fun. Just wait and see. (Anon.)

Requests for Material or Information Invited

Would you like assistance in studying the fauna?
The Biological Survey of Canada encourages cooperation in taxonomic and ecological studies of the arthropod fauna. Please complete and return the form on the next page if you have a request for material or information that might be obtained elsehere in Canada (compare the sample entries from a previous list of requests that are shown below). See also the Survey's website for the full list or an electronic version of the Request for Cooperation form.

Requests may be submitted anytime and will be posted on the web periodically. To have your entry included in the Spring 2003 newsletter please submit it by the middle of January.

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester
1	Acari (free living and parasitic terrestrial and aquatic mites)	Anywhere, but especially subarctic and arctic Canada, Canadian grasslands	Berlese-Tullgren funnel extraction from subaquatic substrates, from grasses and sedges, and from bird and mammal nests, would be especially fruitful (preserve in 75% ethanol +5% glycerine).	V.M. Behan-Pelletier; E.E. Lindquist; I.M. Smith
2	Adelgidae (conifer woolly aphids)	Anywhere	Preserve insects and bark, needles or galls in 70% ethanol. Specimen records and host plant records	R. Foottit
3	Aleyrodidae (whiteflies)		Preserve insects and host plant material in 70% ethanol. Adults may be dried. Specimen records and host plant records. (Canadian National Collection deficient in all species, including pest species)	R. Foottit
4	Anthomyzidae	New World	Adults from any habitat, but often associated with graminoids. Preservation in 70% ethanol preferred. Malaise and especially pan trap residues are acceptable and valuable. General description of herbaceous cover and soil moisture advantageous.	K.N. Barber
5	Aphididae (aphids)	Anywhere	Preserve in 70% ethanol. Specimen records and host plant records.	R. Foottit
6	Asilidae (robber flies)	North America	Pinned adults	R.A. Cannings

Request for Cooperation

Please complete and return to:

Biological Survey of Canada
(Terrestrial Arthropods)
Canadian Museum of Nature
P.O. Box 3443, Station "D"
Ottawa, ON K1P 6P4
email: hdanks@mus-nature.ca

Name: _____ Tel. : _____

Email: _____ Fax: _____

Address: _____

Material required (specify taxon, region, habitat, or other details, as appropriate):

Information required (describe in reasonable detail):

Cooperation offered - if there is anything specific you might be able to supply in return (e.g. identifications, material) please indicate it here: