

NEWSLETTER OF THE BIOLOGICAL SURVEY OF CANADA (TERRESTRIAL ARTHROPODS)

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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 Fall 2008 issue is July 31, 2008.

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 is available on the Survey's website at:
<http://www.biology.ualberta.ca/bsc/bschome.htm>*

To receive this newsletter via email (as an Adobe Acrobat file) instead of a paper copy please send an email message to the Editor.

News and Notes

BSC BioBlitz 2008

Bruce Peninsula National Park, 19–23 June

Bruce Peninsula National Park and the closely associated Fathom Five National Marine Park (http://www.pc.gc.ca/progs/np-pn/index_E.asp; <http://www.castlebluff.com/bffscience/index.html>) together comprise an impressively diverse protected area at the tip of the Bruce Peninsula and archipelago. Long famous for its floristic diversity (especially its 43 species of orchids), the Parks are part of the largest remaining area of natural environment in southern Ontario. It offers a variety of easily accessible ecosystems including: alvars, old fields, hardwood forests, mixed forests, conifer forests, cliffs, fens, marshes, swamps, ponds, streams, and lakes. Studies of insect diversity in the Park began in the early 1990s with a study of biodiversity on the islands of Fathom Five National Marine Park (results published in 2001 by S. Marshall, C. Buddle, B. Sinclair, and D. Buckle). Following hot on the heels of that relatively small study, Park ecologist Scott Parker arranged a contract to do extensive insect inventory work in the Bruce Peninsula National Park. Although that contract ended in 2001, I have continued to spend my weekends and holidays on the Peninsula, building up our insect collection and adding further taxa to the Park list. Park insect inventory efforts were further enhanced last summer though another contract awarded to Steven Paiero to initiate an aquatic insect monitoring program in the park (Steve worked with me on the initial Bruce survey, after which he did an extensive arthropod inventory of Ojibway Prairie as his MSc). Thanks largely to ongoing development of the Bruce component of the University of Guelph insect collection, we now have an extensive list of over 3,300 species of insects, regularly updated on the University of Guelph Insect

Collection web site: <http://www.uoguelph.ca/debu/brucepeninsula.htm>.

The opportunity to engage Canada's top insect systematists in a BSC BioBlitz on the Bruce represents an opportunity to test and expand the Bruce arthropod inventory. Some groups are relatively poorly handled on our list because some techniques (light traps, for example) have been underutilized; other groups are incompletely treated because nobody involved with the survey has had the specialized taxonomic expertise to deal with them. Treat our list as a challenge, and please help us make it better!

Objectives of the bioblitz:

This will be a bit different from previous BioBlitz efforts because there is a substan-



The rocky shore of Dunks Bay, Bruce Peninsula National Park. (photograph by S.A. Marshall)

tial existing inventory, and one of our major objectives is to tap your specialized expertise to make it better. A look at the current species list should give participants a good idea of how close our list is to the expected fauna; if it is short of the mark, please come and fill in the gaps. If it includes some rare things you would like to see, let us try to show you where to look. Many of you identified specimens as part of the original inventory – this is an opportunity to see where they came from. Come and apply your specialized techniques.

In addition to the primary objective of bringing your skills to bear on an advanced arthropod inventory project, we would like to turn this into a positive public relations exercise for both BSC and the Park. We deliberately chose a period when the Park will not be too crowded (before school is out), but you should still be prepared to explain your activities at least on an informal basis to curious park visitors. If you are willing to participate in more formal interpretive activities such as talks, walks, or activities in the interpretive centre, please let us know.

Logistics:

Park Ecologist Scott Parker has kindly offered to help us out with logistics, including the provision of a building and a campsite on Emmett Lake. The building is an old junior ranger station now used as researcher accommodation, and it is private and rustic. For those preferring to camp there is the National Park campground at Cyprus Lake and a variety of nice private campgrounds in the area. Of the latter, I prefer Tobermory Village Campground right on Highway 6 coming in to Tobermory, because you can get campsites backing right into Tobermory Bog (a fantastic place, and the only true bog on the upper Bruce – I have

always wanted to camp and night light there). Tobermory also has a wide range of hotels and motels, all likely to have lots of space that early in the season. Once we have a better idea of how many people are coming, and how many want to be based at Emmett Lake, we can make arrangements for evening get-togethers and suggested group collecting events. I will be based at a cottage in Tobermory.

Bits and pieces:

You will need a vehicle, as the Emmett Lake cabin is well off the beaten track and most good collecting sites are widely separated.

Scott Parker has also offered to provide some boat drop off/pick ups to the islands. This is weather permitting and requires prearrangement.

All specimens must be retained in a recognized institution, and technically remain Parks Canada property. It would be most helpful if specimens or identifications linked to detailed specimen information could be provided to us for deposition in the University of Guelph Insect Collection or inclusion in the Bruce Arthropod Database. I will coordinate a Parks Canada research and collection permit that includes all participants.

Send me your email address if you want to be kept informed as our plans gel a bit more, and the sooner you can confirm your participation the sooner those plans will gel.

Steve Marshall

Selected reference

Marshall, S.A., C. Buddle, B. Sinclair, and D. Buckle. 2001. Spiders, flies and some other arthropods of the Fathom Five Islands and the upper Bruce Peninsula, pp. 191-229. In: S. Parker and M. Munawar (eds.) *Ecology, Culture and Conservation of a Protected Area: Fathom Five National Marine Park, Canada*. Backhuys, Leiden, The Netherlands.

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The first curation blitz: the Biological Survey of Canada tackles the collections in Saskatoon

The first Biological Survey of Canada Curation Blitz took place on 1 October 2007 during the Entomological Society of Canada annual meetings in Saskatoon. The participants included eight visiting entomologists, who descended on an undergraduate biology lab at the University of Saskatchewan for the event. Bob Randell, retired professor from the University of Saskatchewan and volunteer curator of both the university and Agriculture and Agri-Food Canada collections, with help from Keith Moore of AAFC and Shelley Fisher a University of Saskatchewan graduate student, moved about 35 drawers of specimens into the lab. The interests of the attendees were catered to with drawers of scarabs, dytiscids, cerambycids, coccinellids, siricids, miscellaneous Hymenoptera and lots of moths available.

For almost two hours the room was relatively quiet, only the occasional, “Mmm did not expect this in Saskatchewan” or “Ahhh, first record from west of Quebec.” Some focused on identifying species in groups they knew well (e.g. *Dytiscus*, Siricidae, scarabs), while others sorted material to family and organized it in the collection.

All realized there was more interesting material than they expected. Much of the material in both collections was from the 1940s



Jason Dombrowskie sorts through the moth collection. John Huber and Rob Roughley are in the background. (photograph by Greg Pohl)



David McCorquodale and Clayton D'Orsay examining the Coleoptera holdings. (photograph by Greg Pohl)

to the 1960s, mostly from Saskatchewan, but a good representation from Manitoba, Alberta, and BC in some groups. For many groups, species level identifications had been done in the 1950s and 1960s. In addition there were drawers of unidentified specimens (notably Culicidae and Lepidoptera).

The curation blitz had three main goals. One was to provide some curatorial assistance to the Saskatoon collections. Most of us would have preferred to stay for a few more days to make more headway, but we did make significant progress towards improving the level of curation in the collections during the short time available. The second goal was to have an understanding of what the collections had to offer. Henri Goulet appeared to be ecstatic with finding the first record of *Sirex cyaneus*, an introduced siricid that feeds on firs (*Abies* spp.). He has been unraveling the complexities of siricid systematics and these collections added a few pieces to the puzzle. Perhaps not as dramatic, but the rest of us added to our understanding of the distribution of insects in Canada too. The third goal was to learn from each other about insect identification, other important regional collections, and approaches to studying the systematics and faunistics of insects. An added bonus was again seeing how cooperative and friendly entomologists are in Canada.

Thanks to Bob Randell, Keith Moore, Shelley Fisher, and the following participants for making this event a success:

Jason Dombrowskie, University of Alberta,
Microlepidoptera

Clayton D'Orsay, University of Prince Edward
Island, Coleoptera

John Huber, CNC, Natural Resources Canada,
Hymenoptera

Henri Goulet, CNC, Agriculture and Agri-
Food Canada, Siricidae

David McCorquodale, Cape Breton
University, Cerambycidae

Greg Pohl, Northern Forestry Centre, Natural
Resources Canada, Microlepidoptera

Bob Randell, University of Saskatchewan,
Insecta

Rob Roughley, University of Manitoba,
Dytiscidae

Andrew Smith, Biological Survey of Canada,
Canadian Museum of Nature, Scarabaeoidea

D.B. McCorquodale



The participants in the first Biological Survey of Canada Curation Blitz at the University of Saskatchewan, from left to right: David McCorquodale, Clayton D'Orsay, Andrew Smith, John Huber, Henri Goulet, Rob Roughley, Jason Dombrowskie, Bob Randell, and Greg Pohl (photograph by Shelley Fisher)

Biological Survey of Canada Symposium

Starting this year in Ottawa, the Biological Survey of Canada is organising an annual symposium at the Entomological Society of Canada annual meetings. Plans have already solidified for the 2008 meeting in Ottawa (19–22 October) and the 2009 meeting in Winnipeg (18–21 October) with the goal of turning this symposium into a recurring annual tradition. Topics will broadly cover BSC projects and activities but other presentations on systematics and faunistics research on Canadian arthropods will also be welcome. If you are interested in participating, please contact Andrew Smith <asmith@mus-nature.ca>. More information on Entomological Society of Canada annual meetings can be found at: <http://www.esc-sec.org/agm.htm>

Summary of the Meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), October 2007

The Scientific Committee met in Saskatoon, Saskatchewan on 3–4 October 2007.

Scientific Projects

1. *Canadian Journal of Arthropod Identification*

The Bee Genera of Eastern Canada was published in the *Canadian Journal of Arthropod Identification* (CJAI) in September. The Bee Flies of Eastern Canada and the Vespids of North America are well along in the review process and should be the next issues published. There are at least eight other manuscripts in process. Discussions will soon begin as to the feasibility of eventually transferring the technical production of the CJAI from the University of Guelph to the Biological Survey Secretariat.

Mr. Dave Cheung, University of Guelph has spent considerable time providing technical services for the CJAI. The Committee debated the necessity to charge authors for these services in the future.

There have been some trials using the Open Journal System service offered by the University of Alberta Library but the file size of the image-rich CJAI issues are creating technical difficulties. The University of Alberta Library staff are continuing to investigate ways of resolving this issue.

2. *Grasslands*

The editorial committee (Dr. Joe Shorthouse, Dr. Kevin Floate, Dr. Rose De Clerck-Floate) for the first grasslands volume on *Arthropods of Canadian grasslands: ecology and interactions in grassland habitats* asked authors to submit their updated chapters by the end of September 2007. The goal is to have all material ready to go to the publisher by March 31, 2008. The Committee discussed options for how to publish the volume.

The second grasslands volume is intended to deal with altered or changing grasslands,

while the third volume will be a taxonomic work. Some discussion on the distinction between the second and third volumes ensued. The Committee directed the editor, Dr. Floate, to proceed as planned with the second volume with possible minor changes such as the addition of a chapter on conservation of arthropods of the prairies, global warming, invasive species, and/or some aspect of national parks. Dr. Floate had already contacted a number of people about contributing to the second volume and he planned to update them in October.

3. *Insects of the Arctic*

The Committee renewed its support for a subcommittee to pursue a large northern insect survey that will measure changes in biodiversity using a century of data on arctic and boreal species. Funding possibilities were discussed.

Dr. Currie reported that this past year he was only able to spend one week in the arctic but that trip reinforced how little is known of the fauna of northern latitudes which underscores the need for further arctic work. He will be attending a meeting of the Polar Barcode of Life Initiative (PolarBOLI) project in Norway and will report back on potential opportunities with that group.

4. *Terrestrial arthropods of Newfoundland and Labrador*

The Curculionoidea of Newfoundland and Labrador should be ready for submission to CJAI in early 2008. Financial support has been received from the Newfoundland and Labrador Department of Environment and Conservation to put together lists of species, illustrated keys, and databases mainly for Curculionoidea, carabids, and staphylinids. The focus next year will be Lepidoptera with the assistance of Mr. Doug Macaulay and Mr. Greg Pohl. Another proposal has been submitted to facilitate a modest collecting expedition to Labrador. Two publications on the staphylinids of Newfoundland are expected to be completed soon. The full

staphylinid key should be complete by late 2008 or 2009. Extraction of Newfoundland species records from literature continues to contribute to a comprehensive bibliography and database.

5. Forest arthropods

Dr. Langor reported that the forest arthropod database that is on the BSC web site continues to be updated with 2-3 new projects a year. Volume 3 of the Arthropods of Canadian Forests newsletter was published in both English and French in May.

The seven synthesis papers stemming from a BSC-sponsored symposium entitled "Maintaining Arthropods in Northern Forest Ecosystems," held in 2005, should be published in *The Canadian Entomologist* in early 2008.

The Cerambycidae of Canada and Alaska project is proceeding well. All the major collections have been visited and databased. The majority of keys have been produced by Dr. Yves Bousquet. Some of the taxonomic work that was needed has been completed. Mr. Klaus Bolte has been contracted to do the photographs for the publication.

6. Invasions and reductions

The proceedings of the symposium on Ecological Impacts of Non-Native Insects and Fungi on Terrestrial Ecosystems will be published as a special volume of the journal *Biological Invasions*. Springer will also publish 200 hardbound copies of that special issue which NRCAN will buy and distribute. The date for submission to the publisher is 1 December 2007.

Progress on capturing data for the coccinellid project continues. The tree-feeding species part of the list of non-native terrestrial arthropods is largely complete but it is hoped that some funding will be received next fiscal year to extract information from other collections. These data will be available through the Canadian Forest Service's alien invasive species web site. Work on the larger database of 1900 species continues.

7. Arthropods and Fire

Due to a lack of commitment from some authors, the proposed series of papers on the topic of arthropod conservation and fire planned for the *Journal of Insect Conservation* has been cancelled. These papers originated from the BSC-sponsored symposium on Arthropods and Fire held in 2005.

8. BioBlitzes

The 2007 BioBlitz was held at Riding Mountain National Park, Manitoba, 16-20 July 2007. A report was published in the Fall issue of this newsletter. Although beneficial in many respects, the attendance had been low. The Committee discussed the efforts and benefits of holding an annual BioBlitz. Among other benefits, the BioBlitzes have opened the doors to collecting in national parks and have provided Parks Canada with valuable data. The Committee agreed that the BioBlitz project should continue but that it need not be an annual event. Nonetheless, there will be a BioBlitz organized in 2008 at Bruce Peninsula National Park (see also p. 1). The Committee also discussed the feasibility of doing a future BioBlitz in a northern park, especially given the proposal to organize a large northern insect survey.

The first Curation Blitz was held at the University of Saskatchewan on 1 October 2007. Eight visiting entomologists provide some curatorial assistance to the Saskatoon collections, gained some understanding of what is contained in those collections, and learned from each other about insect identification. (see also article on p. 3). Discussions have begun on options to hold a similar event at the 2008 Entomological Society of Canada annual meeting in Ottawa.

9. Arthropods of the Gulf of St. Lawrence Islands

This project started with more of a focus on the Gulf islands but has broadened somewhat to include more of the Maritimes. Dr. McCorquodale and Dr. Giberson had students this past summer working on aquatic hemiptera,

bumblebees, and coccinellids. They are currently advertising for a masters student.

10. Databasing

Dr. Sperling spoke about database initiatives at the Canadian University Biodiversity Consortium and potential opportunities for the Biological Survey to work in parallel with the Consortium.

Technical details of the BSC database of collecting localities were discussed. This database will be posted on the BSC web site.

11. BSC web site

The BSC web site continues to be updated on a regular basis and the number of visitors remains steady at a daily average of 172. The IT personnel at the Department of Biological Sciences at the University of Alberta (where the web site is hosted) continue to be supportive.

12. Endangered species

Dr. Sperling, Dr. Scudder, and Dr. Marshall agreed to participate in the Monarch Butterfly Advisory Group, which was established to meet requirements of the Species at Risk Act. Other species at risk initiatives were reported. COSEWIC has requested input from the BSC on which groups COSEWIC should concentrate on in the future.

The main purpose of this agenda item is to consider a proposal for a publication dealing with endangered species in Canada. However, Committee members who might lead this project were not able to attend this meeting.

Liaison and exchange of information

1. Canadian Museum of Nature

Dr. Mark Graham, Director, Research Services reported that the Canadian Museum of Nature has experienced a funding shortfall for at least the last 5 years, largely because of increased operating costs of both of the Museum's buildings. Dr. Graham emphasized these financial uncertainties remain in effect and he would advise the Committee when there is any budget news that will affect the BSC.

Dr. Smith reported that he and Dr. Steve Marshall had attended the Museum's strategic planning retreat the week prior to the Scientific Committee meeting. The two-day meeting was a business-oriented session where many ideas were discussed and to be forwarded on for further considerations at another level of the Museum.

2. Entomological Society of Canada

Dr. Terry Shore, President of the Entomological Society of Canada reported that *The Canadian Entomologist* lost money for the first time. Dr. Paul Fields will be heading up an ad-hoc committee to look at various options to remedy that situation. Otherwise the new editors of the Bulletin and *The Canadian Entomologist* are firmly entrenched in their roles and everything is going smoothly with those publications.

Dr. Smith proposed ensuring that an annual symposium at the ESC annual meeting is organized by the BSC to present BSC-related research and projects. He endeavoured to organize such a symposium at the ESC/ESO joint annual meeting in Ottawa in 2008.

3. Barcode of Life / Polar Barcode of Life Initiative (PolarBOLI)

The Committee discussed pursuing some sort of collaboration with the Barcode of Life project. Dr. Currie plans to attend a meeting of the PolarBOLI in Norway and will report at the spring meeting on potential opportunities with that group.

4. Council of Canadian Academies

Dr. Graham explained that the Council of Canadian Academies is a newly formed scientific advisory body to the federal government. One of the issues that they will be exploring deals with the level of systematics expertise in Canada and whether Canada is prepared to answer questions about biodiversity. The Council may investigate in various ways including consulting experts such as the Biological Survey of Canada.

Other items

1. Regional developments

Because many Committee members were either not able to attend or not able to stay for the entire meeting, reports on regional developments and liaison and exchange of information were curtailed. However, information of potential interest from some regions was reported, including work being carried out by graduate students and others (not noted here), and the following examples.

In Alberta, there is an initiative at the Canadian Forest Service to have the curators formulate a department-wide collections policy. The Royal Alberta Museum renovation and expansion is on hold because of the increase in construction costs. A lot of data were generated this past summer at the Alberta Biodiversity Monitoring Institute, although not at the species level. There are many biodiversity studies ongoing in Alberta that are now in the longer-term phases.

In Ontario, a special D.H. Pengelly tribute volume of the *Journal of the Entomological Society of Ontario* was published last year, with another planned for 2007 and included systematic, taxonomic, or faunistic papers from former students.

In the Maritimes, Mr. Chris Majka continues with much Coleoptera research and has recently published several papers on the beetle fauna of the Maritime provinces, with 7 new

species and more than 50 new Canadian records, 260 new records from the Maritimes region as a whole, and more than 1000 new provincial records in several families. Mr. Reggie Webster is also very active in the Maritimes, especially in collecting many new species of staphylinid beetles (over 640 morphospecies now) and will collaborate with Dr. Jan Klimaszewski on a publication of new species records for New Brunswick. The Acadian Entomological Society's annual meeting was held in June and included a faunistics symposium with interesting presentations on aquatic insect biodiversity studies in the Maritimes, insects of forensic importance, maritime beetles, and arachnids.

2. BSC Transition / Planning for the future

Given funding pressures the CMN, considerable discussion revolved around the future direction of the BSC. Over the next few months, the Committee will be focussing on reviewing the BSC's vision and goals, a promotion and fundraising strategy and a proposal for a large collaborative research project. (See also p. 9 for a summary of the BSC's vision statement as devised by the Committee).

3. Other matters

The Committee also discussed other matters such as Survey publications, possible price reductions of some Biological Survey Foundation publications, the BSC scholarship, Survey publicity, and membership of the Scientific Committee.

Insects of the Yukon price reduced

The price of the remaining volumes of the *Insects of the Yukon* has been reduced in order to clear out the remaining stock. For more details on the contents and how to order please visit the Biological Survey's web site at <http://www.biology.ualberta.ca/bsc/english/publications.htm> or contact the Entomological Society of Canada <entsoc.can@bellnet.ca>.

Price:

Orders from Canada: \$22.00 plus G.S.T. (shipping included)

Orders from U.S.A.: \$37.00 (shipping included)

Orders from all other countries: \$57.00 (shipping included)

10% discount on orders of 5 or more copies

Specifications:

Hardbound, 6 1/2" x 9 3/4". x + 1,034 pp., 224 illustrations, 102 tables.

Published by the Biological Survey of Canada (Terrestrial Arthropods), 1997. ISBN 0-9692727-8-2.

BSC vision document

At the Fall 2007 BSC Scientific Committee meeting, it was decided that a vision document should be produced for the Biological Survey of Canada. The purpose of this document is to promote the BSC by articulating the goals of the organization while giving a brief overview of accomplishments, capabilities, and credentials. The text of the vision document is reproduced below and the full formatted version can be downloaded in the Overview section of the BSC web site.

The Biological Survey of Canada (BSC) is a network of scientists who discover, synthesize, and freely share knowledge about Canada's biological diversity. The BSC is a high-quality source of expert scientific advice for biodiversity science, and provides national and international leadership in this field.

Objectives

- 1) Discover, survey, and inventory Canada's biological diversity and provide universal access to biodiversity information;
- 2) Detect, measure, and predict changes in Canadian biological diversity, and provide science-based advice for sustaining native biodiversity in Canadian ecosystems;
- 3) Promote the importance of taxonomic research and provide access to taxonomic expertise;
- 4) Promote awareness of the values and vulnerabilities of Canada's biological diversity by inspiring, educating, and engaging Canadians.

What drives the need for our research?

The BSC directly addresses the shortage of fundamental research about Canada's biological diversity, thereby providing the information and knowledge synthesis necessary to inform policy decisions around issues such as: environmental change (climate change, water quality, pollution, habitat destruction, invasive species, species at risk), health and biosecurity (clean air and water and the protection of crop production and food supplies), sustainable resource development, Canadian sovereignty and international responsibilities (including the arctic), and ensuring market accessibility. Understanding species, their ecological bound-

aries, and their changes through time are crucial to dealing with these issues effectively.

Strength through collaboration

With a secretariat based at the Canadian Museum of Nature, our network forges collaborations among federal and provincial departments and museums, academic institutions, and concerned citizens to increase knowledge about Canadian fauna and flora. The BSC has a 30-year history of scientific credibility and of high productivity of scientific publications about Canadian biological wealth, especially with respect to arthropods. We have a diverse national composition that works effectively and efficiently to address emerging issues. Members of the BSC have a long history of undertaking collaborative field expeditions to study Canada's biodiversity, and of documenting biological diversity through the archiving of specimens and critical baseline data.

Activities and projects

The BSC maintains a diverse and dynamic project portfolio. Current projects include:

- 1) publication of a new electronic journal – *The Canadian Journal of Arthropod Identification*;
- 2) a northern insect survey that measures changes in biodiversity using a century of data on arctic and boreal species;
- 3) production of a multi-volume publication on the arthropods of Canadian grasslands;
- 4) development of specimen databases of Canadian arthropods based on museum specimens;
- 5) arthropod inventories of several Canadian biodiversity hotspots; and
- 6) monitoring species at risk and invasive alien species.

Project Update: The *Canadian Journal of Arthropod Identification* is on a roll

Andrew B.T. Smith

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The *Canadian Journal of Arthropod Identification* (CJAI) has quickly become the flagship periodical of the Biological Survey of Canada. Four new issues have been published in the past few months on bees, mosquitoes, vespid wasps, and bee flies. These four image-rich identification guides combine to almost 700 pages covering dozens of Canadian genera and hundreds of Canadian species of insects. Looking ahead, the editors report that there are manuscripts in the works for many other taxa, including: orthopteroids, heptageniid mayflies, Psocoptera, and the Diptera families Tephritidae, Stratiomyidae, and Clusiidae. The first two issues on Mecoptera and blood and tissue feeding mites were published in 2006.

The purpose of the CJAI is to provide a widely distributed, freely accessible publication outlet for researchers who would like to disseminate identification guides that include Canadian taxa. The journal is peer-reviewed, has a 14-member editorial board, and provides technical editing for images and digital keys. The CJAI has financial and technical support of the Biological Survey Foundation, the Canadian Museum of Nature, the University of Guelph, and the University of Alberta. This support will allow the CJAI to publish without page charges for the foreseeable future.

The CJAI is broad in scope, and manuscripts dealing with any group of Arthropods with species occurring in Canada will be considered for publication by the editors. The focus of individual manuscripts, however, need not be

solely on the Canadian species. Identification guides to taxa in North America, the northern hemisphere, the world, etc. are all welcomed. Manuscripts with a more regional focus on Canada or parts of Canada have formed the core of the journal so far and are highly encouraged. It should also be noted that new taxa cannot be described in the CJAI, but this may change in the future. Other taxonomic and classification changes (such as synonymies, subspecies elevations, etc.) are permitted.

In December of 2007, Editor in Chief Steve Marshall was invited to the Entomological Collections Network annual meeting in San Diego, California to give a presentation on the CJAI. His presentation was part of a symposium on the future of entomological and other scientific publications. The CJAI was showcased as an example of the future of scientific publications with electronic distribution and open access to everyone through the Internet. The journal was very well received by the attendees of this meeting and by the greater entomological community in North America. Many entomologists would like to see more scientific publications emulate the CJAI and other open access electronic journals.

If you have questions or ideas about manuscripts for the *Canadian Journal of Arthropod Identification*, please contact Steve Marshall <samarsha@uoguelph.ca>, the Editor in Chief. More information on the CJAI and all of the published issues can be found at: <http://www.biology.ualberta.ca/bsc/ejournal/ejournal.html>.

Summary of the recently published issues:

CJAI 3: The bee genera of eastern Canada

by Laurence Packer, Julio A. Genaro, and Cory S. Sheffield



Abstract. The 39 genera of bees found in Canada east of Manitoba are keyed in dichotomous format with all key features illustrated. Habitus photographs of males and females of representatives of all genera are provided. The biology of bees in general, and outlines of the biology of each genus are summarized.

CJAI 4: Photographic key to the adult female mosquitoes (Diptera: Culicidae) of Canada

by Aynsley C. Thielman and Fiona F. Hunter

Abstract. There are currently 82 species of mosquitoes (Diptera: Culicidae) in 10 genera known from Canada. Dichotomous keys to the adult females are provided in two formats (HTML and PDF). Photographs of diagnostic characters accompany the text descriptions in each couplet for ease in identification. Included are: an introduction to mosquito identification, instructions for using this particular key, anatomical diagrams, and a glossary of terms. Descriptions of recently introduced and potential species are also provided.



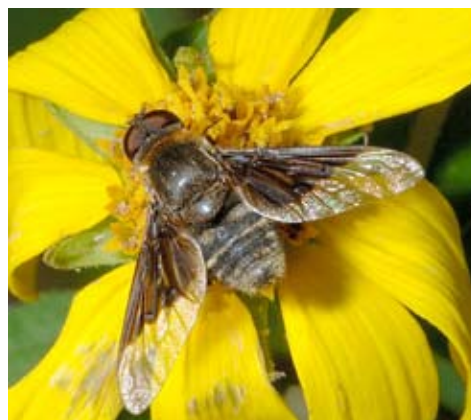
CJAI 5: Identification atlas of the Vespidae (Hymenoptera, Aculeata) of the northeastern Nearctic region**by Matthias Buck, Stephen A. Marshall, and David K.B. Cheung**

Abstract. The Vespidae of the northeastern Nearctic region are reviewed to include 92 established and four adventitious species. Six undescribed species (two each in *Ancistrocerus*, *Euodynerus* and *Polistes*) are recognised for the first time. Three former subspecies, *Euodynerus blakeanus* Cameron (subspecies of *E. foraminatus* de Saussure), *Ancistrocerus albophaleratus* de Saussure (subspecies of *A. catskill* de Saussure) and *A. albolacteus* Bequaert (subspecies of *A. adiabatus* de Saussure) are re-instated as or elevated to good species. *Parancistrocerus vogti* (Krombein) is synonymized with *P. fulvipes* (de Saussure). A brief introduction to the morphology, biology and distribution of

Vespidae is given. Keys to subfamilies, genera and species are provided, and illustrated with 60 photographic plates (437 images) showing most diagnostic characters. All species are illustrated on 287 separate plates by means of (i) a set of standard photographs of pinned specimens (habitus lateral and dorsal, head of male and female; 537 images), and, where available, (ii) photographs of live specimens in the field (99 images). The variation (especially colour) of most species is described in detail and supplemented with brief information on distribution and biology. Twenty-two species (including five adventitious species) are recorded for the first time from Canada and numerous new state records for the U.S. are given.

CJAI 6: The bee flies (Diptera: Bombyliidae) of Ontario, with a key to the species of eastern Canada**by Joel H. Kits, Stephen A. Marshall, and Neal L. Evenhuis**

Abstract. Illustrated dichotomous keys to the 73 bee fly species of 25 genera occurring in or adjacent to eastern Canada are presented. Thirty-two of these species represent new or previously unrecognized records for Ontario. We review the distributions of these species in Ontario, focusing on rarely collected and habitat-restricted species, and summarize host use when known.



The first record of the terrestrial isopod *Armadillidium vulgare* from Quebec (Isopoda: Oniscidea)

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The terrestrial isopod *Armadillidium vulgare* (Latreille) is generally believed to be a native of Europe and a widespread alien in North America (Jass and Klausmeier 2000). It had been recorded in several states in the U.S. by the early 20th century (Richardson 1905). The published Canadian records of *A. vulgare* have been from British Columbia and Ontario (Jass and Klausmeier 2001).

During the rainy night of 6 October 2007, the first author photographed and collected isopods in the backyard of a private residence on Prince Albert Avenue, Westmount, Quebec (45° 28' 44"N, 73° 36' 17.7"W). Subsequently, we identified one of the specimens as *A. vulgare* (Fig. 1). The specimen in alcohol has been deposited in the Milwaukee Public Museum (MPM IZ231107-1).

Also present at the same location was another European immigrant isopod *Porcellio spinicornis* Say, which has been recorded from Quebec before (Jass and Klausmeier 2001). *Armadillidium vulgare* and *P. spinicornis* had

probably been brought to the yard where they were found with plants that had originated in greenhouses. Eighty years ago, Walker (1927) noted that *A. vulgare* had been found in Ontario only in greenhouses and in their immediate vicinity. It remains to be determined whether *A. vulgare* has permanently established itself outdoors in Quebec.

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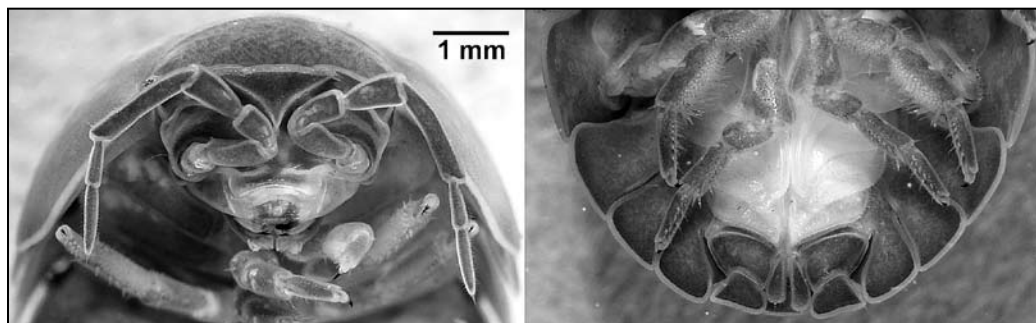


Fig. 1. The head (left) and the posterior end (right) of the *Armadillidium vulgare* specimen from Westmount, Quebec

Web Site Notes

BioBlitzes

The BSC BioBlitzes began in 2001 as an initiative of the Arthropods of Canadian Grasslands subcommittee, although they were not called BioBlitzes at that time. It was envisaged that a series of field excursions to different prairie ecozones would be made by entomologists with interests in prairie insects and related arthropods. The main, long-term goal of these gatherings was to generate collections of arthropods in selected prairie habitats to help to document the fauna. It was also hoped that participants would exchange and share information and observations about various taxonomic groups, field tactics and techniques. The annual BSC BioBlitz is no longer exclusively associated with a specific project of the Survey but the location is now chosen

in a more general framework to help increase the scientific knowledge of the arthropods of an area. The idea of Collection Bioblitzes to encourage members of the entomological community to gather at an under-curated collection and assess and identify the material began in 2007 with the first Curation Bioblitz held on 1 October 2007 during the joint annual meeting of the Entomological Society of Canada and the Entomological Society of Saskatchewan.

Reports from all of the BioBlitzes have now been amalgamated onto one web page. See <http://www.biology.ualberta.ca/bsc/english/bioblitz.htm> or follow the link on the Scientific Projects Summary page.

Database of entomologists

The Biological Survey facilitates cooperation among entomologists is by maintaining a list of personnel on individuals interested in the systematics and faunistics of the terrestrial arthropods of Canada. This information is available as a searchable database on our website. We solicited updates earlier this year from those who have entries in the database. If you have not yet replied, or if you would like to submit a new entry we encourage you to use the online form provided on the web site or simply provide the relevant information via email or regular post.

Biological Survey of Canada
Terrestrial Arthropods

Database of Entomologists

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The introduction to the database and links for the listings can be found at <http://www.biology.ualberta.ca/bsc/english/listofworkers.htm>

The Biodiversity of Beetles in the Maritime Provinces

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Understanding invertebrate biodiversity is a tall order, something apparent to anyone who has attempted to bite off even a minute slice of this very large pie. As many investigators have pointed out there is a “taxonomic deficit” in the biological community today as universities and training institutions gravitate towards molecular and genetic studies, and government funding for taxonomic, systematic, and biodiversity studies remains very meager. Yet being able to identify organisms and determine the species composition of environments is not only an important activity per se, but is also pivotal to the understanding of ecology, endangered species, climate change, introduced and invasive species, and the environmental impacts of anthropogenic activities. If we don’t accurately know the composition of biological communities, how can we conserve them or ascertain if they are changing or being affected by human activities?

Knowledge of the biodiversity of terrestrial invertebrates has lagged behind that of vertebrates or even vascular plants. There are many species, some require detailed microscopic examination (even of genitalia) to identify them, the taxonomy of many groups is poorly understood, there are long and difficult learning curves to acquire technical proficiency in identification, taxonomic expertise is in short supply, and much of the primary literature is scattered in scientific journals published around the world over the past couple of centuries in a potpourri of languages. Such obstacles have proved daunting to many who have contemplated aspects of this undertaking.

Beetles (Coleoptera) are thought to be the most species-rich order of organisms in the world. Estimates vary of how many there may be, however, Terry Erwin, a coleopterist working with the Smithsonian Institution has estimated that as many 20 million species exist worldwide (Erwin 1991), perhaps a quarter of the ~ 80 million species of insects. Only some 350,000 species of beetles have been described, of which ~ 25,160 have been recorded in North America (Marske and Ivie 2003).

A major step in understanding the beetle fauna of Canada was the publication in 1991 of the *Checklist of Beetles of Canada and Alaska* (Bousquet 1991). This enumerated 7,447 species in Canada including 1,365 from New Brunswick, 1,320 from Nova Scotia, and 340



Euvira micmac Klimaszewski and Majka, 2007
(photograph by Klaus Bolte)

from Prince Edward Island. This compendium was an important synthesis of information (some published and some not), however, from the standpoint of the Maritime Provinces, the coverage it was able to provide was meager. The authors of the various chapters relied, for the most part, on the holdings of the Canadian National Collection of Insects, Arachnids, and Nematodes (CNC) in Ottawa (as well as published sources). Although there are many collections of insects in the Maritimes, some dating to the latter part of the nineteenth century, most have remained little known. The quality of determinations (if the specimens were identified at all) varied greatly, and even when names had been attached to specimens, they often reflected dated nomenclature and taxonomy. Consequently the holdings of most of these collections were not at a level where they could usefully contribute to an understanding of the region's beetle fauna.

In 2000 I became interested in understanding the beetle fauna of the Maritime Provinces. As an ecologist I am interested in ecological perspectives on the natural world, and in order to take a step in this direction, and not be reliant on scarce taxonomic expertise of "experts," I embarked on the slow path of understanding Coleopteran taxonomy. Only in this way would it be possible discern the biodiversity of beetles in the region, itself a necessary prerequisite to ecological, environmental, evolutionary, and other studies of the fauna. In so doing I discovered both that there were extensive collections of Coleoptera at organizations such as Agriculture Canada (Kentville, NS; Charlottetown, PEI; Fredericton, NB); the Nova Scotia Department of Natural Resources (Shubenacadie, NS); the Canadian Forest Service (CFS) (Fredericton, NB; Corner Brook, NF); many universities (Cape Breton (CBU), Acadia, Dalhousie, St. Mary's, University of Prince Edward Island, Memorial University, and the Université de Moncton); at institutes such as the Nova Scotia Agricultural College (NSAC); the New Brunswick and Nova Scotia provincial museums; and in the hands of private collectors.

Furthermore there were a number of researchers in the region interested in Coleoptera. David McCorquodale (CBU); Søren Bondrup-Nielsen (Acadia); Peter Duinker and Tatiana Rossolimo (Dalhousie); Doug Strongman (St. Mary's); Donna Giberson (UPEI); David Larson (Memorial); Gaetan Moreau (Moncton); Jean-Pierre Le Blanc (NSAC); Jeff Ogden (NS DNR); Christine Noronha, Mary Smith, Susan Westby, and Gilles Boiteau (Agriculture Canada); Patricia Baines and Jon Sweeney (CFS); and collectors such as Ken Neil, Dwayne Sabine, Gary Selig, David Webster, Reggie Webster, and others, who proved enthusiastic supporters of initiatives that would better define the beetle fauna of the region. Students such as Kathleen Aikens, DeLancey Bishop, Chantelle Cormier, Philana Dollin, Clayton D'Orsay, Rebecca Ewing, Daniel Kehler, Sean LeMoine, Heather Love, Andrew MacDonald, and Sheena Townsend deserve special credit for a series of excellent studies that have contributed much contemporary knowledge about the beetle communities of the Maritimes. Moreover, this enthusiasm was not just confined to the region. Many Coleoptera researchers at the Canadian National Collection (Pat Bouchard, Yves Bousquet, Anthony Davies, Serge Laplante, Laurent Lesage, and Ales Smetana) and the Canadian Forest Service (Jan Klimaszewski, David Larson), and the countless taxonomic experts around the country, continent, and world assisted the initiative through their determinations of species and expertise. Consequently I've been able to assemble a team of investigators on the ground who have collected material and supplied specimens, and a "virtual" team that have supported these initiatives. What has been the result?

Since 2004, together with various "team" members, I have published 54 scientific papers in peer-reviewed publications pertaining to the beetles of Atlantic Canada. Nine additional papers are in press, five are being reviewed, and eight others have been completed and will shortly be submitted for publication, a total of 76 studies. Some have been surveys of aspects

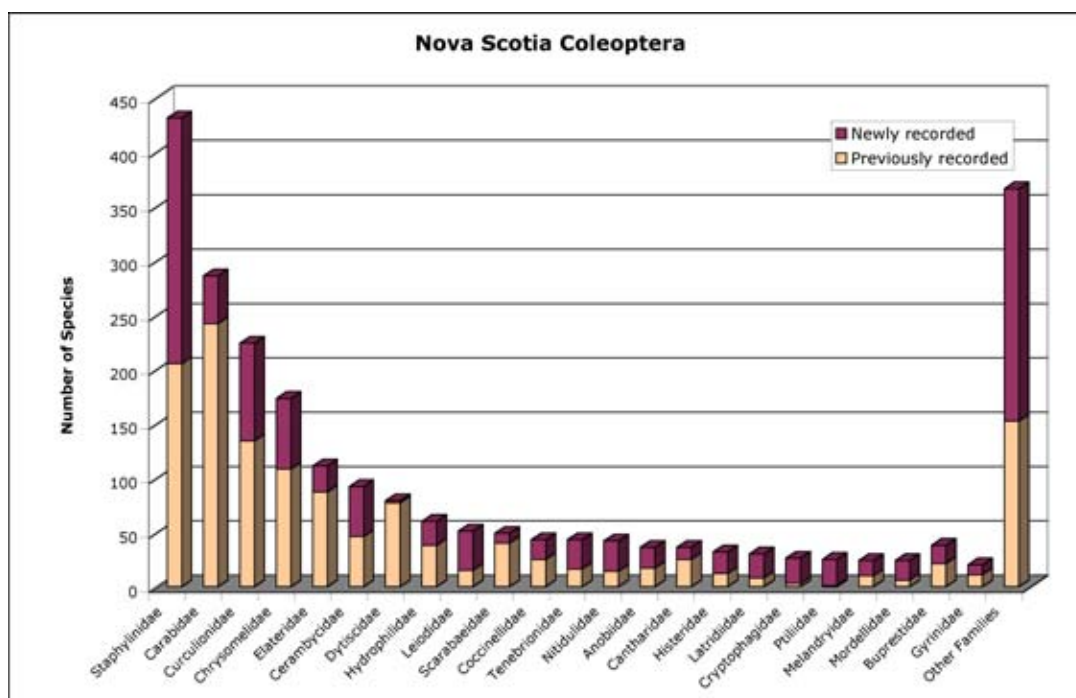


Fig.1. The beetle fauna of Nova Scotia; composition and newly recorded species.

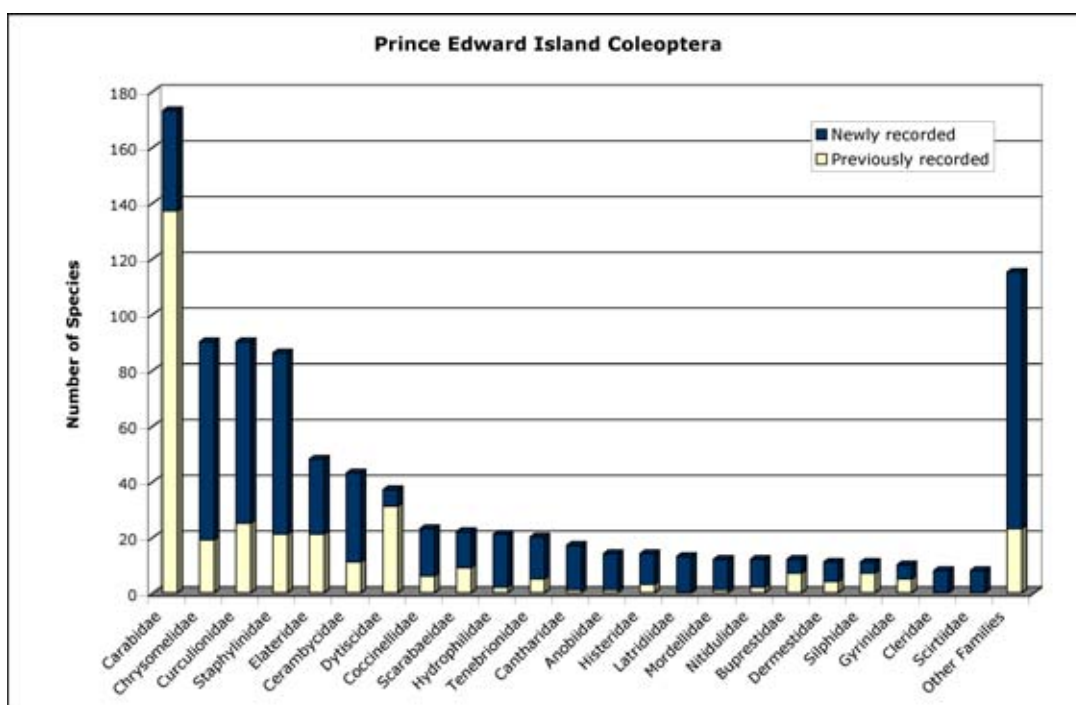


Fig. 2. The beetle fauna of Prince Edward Island; composition and newly recorded species.

of the fauna, contributing new provincial, national, and continental records; others have been ecological studies, reviews of the biology of particular species, systematic reviews and descriptions of new species, studies of island faunas, studies of saproxylic species associated with decaying wood, reviews of particular habitats such as coastal faunas, and theoretical and methods papers.

Through a careful examination of historical specimens in regional collections, and availing ourselves of the results of contemporary studies, these studies have substantially increased the known beetle fauna of the region. Using as a point of departure the data presented in Bousquet (1991), the beetle fauna of Nova Scotia has increased from 1,320 to 2,352 (+ 1,032) species (Fig. 1). The known beetle fauna of Prince Edward Island has increased from 340 to 895 (+ 555) species (Fig. 2). Comparable statistics in relation to New Brunswick are currently being compiled which will further allow us to examine the complete regional fauna of the Maritime Provinces. Even a quick glance at these graphs yields certain insights. The most speciose family in NS is the Staphylinidae, whereas on PEI it is the Carabidae. The Leiodidae, Cryptophagidae, Ptiliidae, and Melandryidae are important com-

ponents of the NS fauna, but are much less represented on PEI. Are these differences reflective of different environmental circumstances between the two provinces, or are they simply indicative of differential collection efforts? Only further research can resolve such questions. The graphs also reveal past emphases on families such as the Carabidae and Dytiscidae, which have historically received more attention (consequently fewer new species have been discovered), and (for example) the Ptiliidae, Cryptophagidae, and Latridiidae in Nova Scotia, and the Hydrophilidae, Cantharidae, Anobiidae, Latridiidae, Mordellidae, Nitidulidae, Cleridae, and Scirtidae (amongst others) on PEI about which almost nothing was previously known. Within these overall patterns is a large number of interesting topic areas:

- **Introduced Species** such as *Ptinus sexpunctatus* (Anobiidae); *Dinoderus minutus* (Bostrichidae); *Sphaeroderma testaceum* (Chrysomelidae); *Orchidophilus aterrimus*, *Ceutorhynchus pallidactylus* (Curculionidae); *Dermestes undulatus* (Dermestidae); *Cephennium gallicum* (Scydmaenidae); *Atheta celata*, *Phloeocharis subtilissima*, and *Quedius fuliginosus* (Staphylinidae) have all been newly recorded in North America from collections made in the Maritime Provinces.



Christopher Majka sweeping for beetles in a salt marsh at Mary's Point, New Brunswick.
(Photograph by Yves Poussart)

• **Native Species** such as *Ernobius filicornis*, *Ernobius granulatus*, *Urochroa marmoratum* (Anobiidae); *Hyperaspis brunnescens*, *Naemia s. seriata* (Coccinellidae); *Clypastrea lunata*, *Clypastrea fuscum*, *Rypobius marinus*, *Gloeosoma hesperus* (Corylophidae); *Listronotus dietzi*, *Corthylus columbianus* (Curculionidae); *Mordellistena indistincta*, *Mordellistena rubrifascia*, *Mordellistena rubrilabris* (Mordellidae); *Acrotrichis haldemani*, *Acrotrichis josephi*, *Pteryx* sp. (Ptiliidae); *Atheta irrita*, *Meotica exilis*, and *Myrmecopora vaga* (Staphylinidae) have all been newly recorded in Canada and/or eastern North America from specimens collected in the region.

• **Newly described species** such as *Bembidion iridipenne* Bousquet and Webster (Carabidae); *Hadromychus chandleri* Bousquet and Leschen (Endomychidae); *Gnathonus barbatus* Bousquet and Laplante (Histeridae); *Atheta brunswickensis* Klimaszewski, *Atheta acadensis* Klimaszewski and Majka, *Atheta pseudocrenuliventris* Klimaszewski, *Atheta savardae* Klimaszewski and Majka, *Euvira micmac* Klimaszewski and Majka, *Leptusa jucunda* Klimaszewski and Majka, *Leptusa pseudopaca* Klimaszewski and Majka, *Proteinus acadensis* Klimaszewski, and *Proteinus pseudothomasi* Klimaszewski (Staphylinidae) have recently been described, in whole or in part based on specimens collected in the Maritime Provinces.

• The biology, dispersal, and early timelines of **introduced leaf beetles** such as *Chrysolina staphylaea*, *Crioceris asparagi*, *Crioceris duodecimpunctata*, *Cassida flaveola*, *Cassida rubiginosa*, *Lilioceris lili*, *Oulema melanopus*, *Sphaeroderma testaceum*, and *Pyrrhalta viburni* has been examined in detail.

• The **Coleoptera families** Anthribidae, Apionidae, Attelabidae, Boridae, Bostrichidae, Byrrhidae, Carabidae, Cerambycidae, Ciidae, Cleridae, Coccinellidae, Colydiidae, Corylophidae, Curculionidae, Dermestidae, Derodontidae, Elateridae, Endomychidae, Erotylidae, Eucnemidae, Histeridae, Kateretidae, Latridiidae, Leiodidae, Melandryidae,



Rypobius marinus LeConte
(photograph by Christopher Majka)

Melyridae, Mordellidae, Mycetidae, Nem-onychidae, Nitidulidae, Ptiliidae, Pyrochroidae, Pythidae, Ripiphoridae, Salpingidae, Scraptiidae, Synchronidae, Tenebrionidae, and Tetratomidae in the Maritime Provinces have all been surveyed in recent publications (some of these studies are still in press or in review). This includes 39 of the 93 families found in the region and represents 50% of the beetle fauna of the Maritime Provinces. A few specific highlights:

- *Hyperaspis brunnescens*, one of the rarest lady beetles in North America, previously known from Illinois, Iowa, and Minnesota, was discovered in a Leach's Petrel burrow on Scatarie Island, NS, a range extension of some 2,100 km (Majka et al. 2007). How widely distributed is this species? Does it represent a relict population? Is it regularly found in subterranean habitats?
- *Quedius s. speleaus* is a cave-dwelling rove beetle found from BC to Saskatchewan in Canada and north to NY in the USA. An apparently disjunct population is found in caves in Nova Scotia (Moseley et al. 2006) together with *Gennadota canadensis*, another cavernicolous rove beetle previously known from only Pennsylvania and Québec (Majka et al. 2006b).
- Majka et al. (2006a) investigated the beetle faunas of owl nests in Nova Scotia finding the first North American records of the Palearctic rove beetle *Atheta celata*,

as well as *Atheta irrita*, a rove beetle previously known only from its type locale in southwestern Nevada. Finding *A. celata* in remote Boreal Owl nest in Cape Breton (in addition to six other introduced species) is an interesting indicator of how adventive species have colonized native habitats. Is *A. irrita* a regularly occurring co-inhabitant of owl nests (whose fauna has seldom been studied in North America)?

- Majka and McCorquodale (2006) newly recorded two species of lady beetles in Canada, *Diomus amabilis* and *Naemia s. seriata*, from collections made in Nova Scotia. Both are coastal species found in the USA north to New England. *Naemia seriata* inhabits salt marshes feeding on *Spartina* pollen. Both likely represent disjunct populations in Nova Scotia and work on the genetics of *N. seriata* is presently being carried out by Natalia Vandenberg at the Smithsonian Institution.

- Klimaszewski and Majka (2007) described a new species of rove beetle, *Euvira micmac*, which is an inquiline in oak apple galls known from Nova Scotia, Ohio, and Michigan.

- *Hadromychus chandleri* is probably the rarest species of endomychid (handsome fungus beetle) in North America. It was described by Bousquet and Leschen (2002) on the basis of seven specimens from New Hampshire, Nova Scotia, Ontario, and Québec. Majka (2007a) reported five additional specimens from Nova Scotia, the apparent population “centre” of this species.

An ongoing important area of interest and investigation are saproxylic beetles (those associated with the decomposition of wood), and several major studies on this topic are presently in press or in review. A number of the survey papers published to date have dealt with saproxylic families and Fig. 3 illustrates one

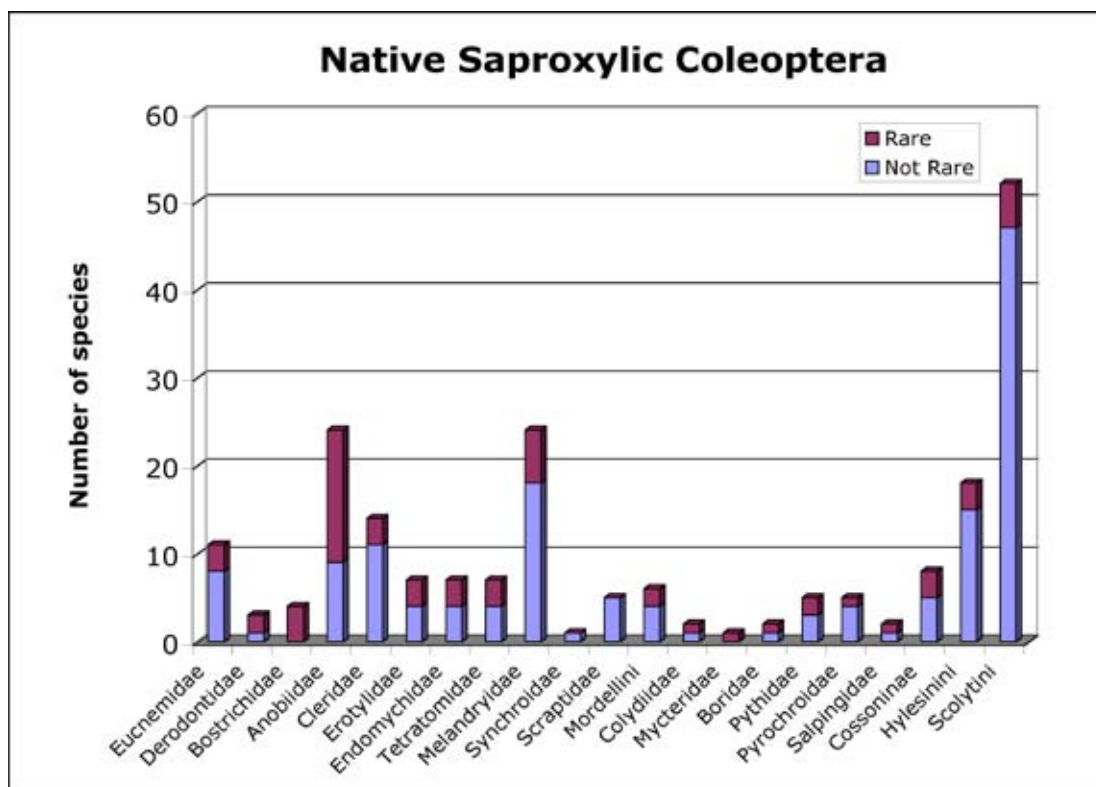


Fig. 3. Native saproxylic beetles of the Maritime Provinces. Rare species are those represented by ≤ 5 specimens of $\leq 0.005\%$ of specimens examined.



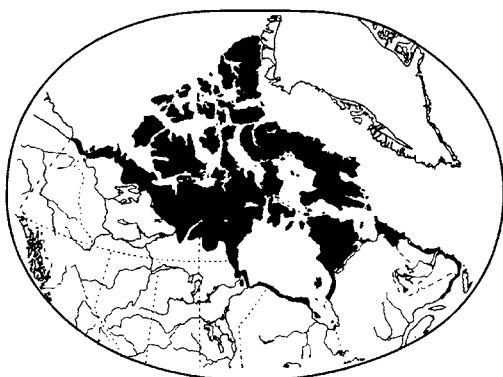
Hyperaspis brunnescens (Dobzhansky)
(photograph by Christopher Majka)

important result of these studies. Several papers summarized in Majka (2007b) have found sizeable fractions of the fauna that are apparently rare, i.e., those represented by ≤ 5 specimens (or $\leq 0.005\%$ of specimens examined). Fifty-nine of 208 species (28%) investigated thus far fall into this category, a result which may at least in part be attributable to the long history of forest management practices in the region.

Although we have learned a very considerable amount about the beetle fauna of the region, it is nonetheless clear that much remains to be done. It is to be hoped that a basic understanding of the biodiversity of the region, and a sense of the origins and distribution of its fauna, will serve as springboards for further ecological, physiological, genetic, environmental, and other studies.

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ARCTIC CORNER

News about studies of arctic insects

Introduction

Arctic Corner provides a forum for news and updates on research involving arctic arthropods. Contributions to *Arctic Corner* are welcomed by the Editor (see inside front cover).

Historical changes in the biodiversity of northern Muscidae and Fanniidae (Diptera: Muscoidea) of the Churchill region (Manitoba)

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Anaïs Renaud is an entomology student pursuing a master's degree at the University of Manitoba. She is co-supervised by Dr. Jade Savage (Bishop's University) and Dr. Rob Roughley (University of Manitoba). Anaïs spent the summer of 2007 sampling Diptera in Churchill, Manitoba.

Churchill, Manitoba: a fascinating site for researchers

Known as the polar bear capital of Manitoba, Churchill is located on the west coast of Hudson Bay at the level of the 58 parallel. In this area, three biomes meet: marine, tundra, and boreal forest. It is a rich and dynamic environment where researchers have a unique opportunity to conduct field work, as well as enjoy an extraordinary experience. Easy to access by train or plane from Winnipeg, the area of Churchill can be explored with a vehicle on its paved and gravel roads.

The "Churchill" that older entomologists have known is different from the one of today. Between 1942 and 1980, an important United States Air Force military base was located about 8 km east from the actual town of Churchill. The seaport has also changed; today there is more activity with increased grain exports to Russia. Tourists are more numerous and frequent. With



Anaïs Renaud emptying a Malaise trap at Twin Lakes.
(photograph provided by A. Renaud)



the increase of tourism in the area, human activity has changed as has the landscape.

The research project: objectives and hypothesis

The research project aims to provide a new baseline for the muscid and fanniid flies of Churchill. The last inventories of these flies in Churchill were carried more than 40 years ago and they yielded 113 species of Muscidae and 6 species of Fanniidae (Webb 1956, Hockett 1965). Under current trends of global warming, the temperature of most arctic localities has risen twice as fast as in most other areas of the world over the last decades (Hassol 2004). Since temperature is one of the most important factors affecting insect distribution (Battisti et al. 2005), we expect the distribution of the muscids and fanniids of Churchill to have changed over the last decades.

The Muscidae is a dominant group in northern ecosystems, while Fanniidae are less diverse and abundant. The 2007 inventory will provide an estimation of the species composition and abundance of both Muscidae and Fanniidae of this region. After compiling data from the literature and visiting various insect museums of North America to record specimens collected in Churchill before 2007, past and recent data will be compared. Changes in species composition for the area will be recorded and we expect trends such as the absence of northern specialists and northern range expansions from southern taxa. DNA sequences of all recorded species will be submitted to the database associated with the Polar Barcode of life initiative (PolarBol). DNA barcoding may also enable us to assign some ambiguous females to the proper species, as many muscid females are notoriously difficult to identify based on morphology alone.

The inventory

For 12 weeks, from mid-June to the end of August, approximately 20,000 specimens of muscid and fanniid flies were collected using Malaise traps, pan traps, and sweep nets at a



Along the half frozen coast of Hudson Bay.
(Photo provided by A. Renaud)

total of 34 sites. Eight permanent and six temporary sites were chosen to set up Malaise and pan traps while 20 other sites were chosen for sweeping. Wapusk National Park (Broad River and Lap  rousse Bay) and the Prince of Wales Fort National Historic Site were part of the survey. Flies were collected in various habitats like the tundra, coniferous forest, Hudson Bay shores, Churchill River bank, regenerating forest, poplar plantation, and fen. So far, 5,000 specimens have been mounted and labeled and the remaining material is currently being processed. Preliminary identifications have already provided two new records of muscids for Churchill. Taxonomic identification will be completed in the upcoming year in Dr. Savage's laboratory in Sherbrooke, Quebec.

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Impacts to the invertebrate community structure of aquatic systems in Nunavut: Stream benthos project

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Climate change is expected to have wide-ranging impacts on the ecology of aquatic systems in the Canadian Arctic. However, there is a poor understanding of the realized impacts of climate change on the community structure and food webs of these systems. Accurately detecting, measuring, and projecting impairment in arctic aquatic systems is complicated by the fundamental lack of knowledge of the baseline conditions of “undisturbed” arctic aquatic systems. As there are no measures of what a “pristine” habitat is, a reference condition approach is necessary to determine the baseline conditions of the benthic invertebrate communities of undisturbed streams. Without this proper understanding of the baseline biodiversity of invertebrate communities within these systems, it would be difficult to accurately determine the current biological status (or health). Since there is a strong demand for research on how various disturbances (includ-

ing climate change) may impact arctic aquatic ecosystems, investigations into the current composition and function of these systems is necessary. It is also equally important to have this understanding of the current biota in order to develop proper, biologically sound biomonitoring programs to evaluate impacts resulting from anthropogenic activities. Previous baseline studies conducted by industry-led environmental impact assessments to characterize arctic freshwater ecosystems prior to development rarely include rigorous benthos sampling programs. Consequently, our ability to detect impairment at lower trophic levels in arctic aquatic systems is limited.

Benthic monitoring programs are commonly used to assess the health of streams and rivers in temperate systems, but the low diversity and unique physical habitat conditions of arctic tundra streams prevents the effective use of



Andrew Medeiros, Jamal Shirley, and Andrew Dunford discussing impacts to the Airport Creek System, Iqaluit, NU, June 2007. (Photograph by Milissa Elliott)



these sampling protocols and assessment measures. However, Bailey et al. (1998) were able to successfully distinguish disturbed streams (due to mining contamination) from pristine environments in the Yukon with the creation of predictive model based upon a Reference Condition Approach (RCA) (Bowman and Somers 2005). While this approach has the potential to outline major disturbances to benthic communities, less extreme disturbances (e.g. climate warming) are expected to be much more difficult to quantify under current protocols. It is therefore necessary to create an index based upon a meaningful measure of diversity, such as the ecological characteristics of the dominant families specifically found within the undisturbed habitat of the tundra streams characteristic of Nunavut.

Our approach involves focusing on the Chironomidae (Insecta: Diptera) in order to quantify disturbances to streams in Nunavut. Within this family, there are wide differences in the ecological preferences and environmental constraints between genera. Thus, the identification of specimens to the genus (and possibly species) level of organization is necessary as a rapid bioassessment protocol that is sensitive to biological impairment. The focus on the genus-level diversity of the Chironomidae will allow for the identification of changes in abundance as well as compositional changes to their communities in response to ecological disturbances. Therefore, a biogeographic approach across Nunavut is being undertaken to examine multiple streams within multiple regions of Nunavut. While an RCA for each region will require a large sampling commitment for the initial assessment phase, it will facilitate the selection of ecologically significant parameters to use in an index using the predictive model developed from the reference conditions of “pristine” tundra streams. Thus, comparing “pristine” and “disturbed” benthic invertebrate communities in Nunavut streams will require a model and indices to distinguish the threshold values for qualitative labels of health.



Andrew Medeiros and Jamal Shirley conducting a D-net kick and sweep sample, Iqaluit, NU, June 2007. (Photograph by Milissa Elliott)

In 2005 the Nunavut Research Institute (NRI) initiated a pilot study of the benthos of Peterhead Inlet, part of a river system west of Iqaluit. The Peterhead Inlet study, while useful in terms of a background study, did not allow for a full quantification of the biodiversity present due to the nature of the original protocols used. This background study also outlined several significant methodological problems associated with biomonitoring of arctic tundra systems. Therefore, our research program aims to address these problems by developing sampling protocols more appropriate for arctic stream systems and developing user-friendly reference materials and instructional guides for a community based Benthic Biomonitoring program for Nunavut streams and rivers.

York University and NRI are collaborating to develop protocols for a biomonitoring program as well as attempting to quantify current biodiversity within these systems. From June-September 2007 Andrew Medeiros (PhD. Candidate, York University), Jamal Shirley (Manager of Research Policy and Design), and Andrew Dunford (Manager of Scientific Services) initiated the first phase of this program to establish a baseline reference collection for the Iqaluit area. The benthic invertebrate community composition was sampled for Airport Creek and the Apex River in Iqaluit during this time. Samples were taken from multiple points



Andrew Medeiros and Jamal Shirley conducting a D-net kick and sweep sample of the mouth of Airport Creek, Iqaluit, NU, June 2007.
(Photograph by Milissa Elliott)

along each system at multiple times throughout the ice-free period. These systems are of key importance as Airport Creek has long been disturbed due to industrial contamination and sediment input along various points of the stream.

Although the reference samples collected during 2007 provide the first representation of current biodiversity within these environments, a much more detailed sampling regime will be necessary to fully quantify the current reference condition of these systems. However, among the samples collected in 2007 we can already see evidence that there are wide differences in richness and diversity as the season progresses from the initial ice-free period (early June) to the drier re-freeze period (mid-September). Complicating multi-year monitoring is the increasingly large variation in the onset of the ice-free period. Anecdotal evidence suggests that during 2006 the melt and breakup of ice occurred much earlier than in 2007. This variation in the ice-free season also corresponds with the timing and duration of high flow periods as well as the emergence times for the various biota. Future biomonitoring programs will require an understanding of the seasonal dynamics of the benthic community in order to compare changes across multiple years

We were able to adapt existing Ontario Benthic Biomonitoring Network collection protocols (Jones et al. 2005) for these systems by adjusting collection methods to better suit the environmental characteristics of tundra systems. Multiple adjustments to the protocols were made with each collection, and geared towards allowing for future community based sampling in these harsh environments. For example; depending on the time of year, it is difficult to obtain a minimum statistical representation of organisms per D-net sample. Sampling times are therefore greater per kick and sweep than recommended in current protocols. The use of a Marchant box is also not recommended due to the relatively high amount of particulate matter, and the lower relative abundance and diversity of organisms sampled in the study (which is also variable dependant on the time of year). Adjustments such as these are on-going and also depend on the localized environmental conditions of each reach. One drawback to this approach is the increased time necessary to key specimens to genus or species. This may require more training than would be necessary for southern temperate systems, but is necessary.



While we were able to make minor adjustments to currently available protocols, the development of a new set of protocols suitable for biomonitoring programs will take several more years to fully develop. In order to understand how the biota of these systems change throughout the multiple different spatial and temporal scales of arctic tundra systems, emphasis will need to be placed on comparing the biodiversity of multiple points along the reach of multiple streams and rivers throughout Nunavut. These protocols will be further developed, tested, and made available to various community groups and agencies (e.g. Parks Canada, Nunavut Arctic College) for further biomonitoring of arctic aquatic habitats upon the completion of this research program. The continued biomonitoring of these streams, as well as others across Nunavut will allow for a continuous assessment of the health of multiple stream systems across the territory.

While climate change is an important issue for arctic systems, monitoring the current health of streams and subsequent traditional food and water sources they sustain is viewed as critically important, if not more important, to local communities across Nunavut. It is our hope that this program will allow for local community groups to assess the health of their streams and rivers. This would allow for the continued monitoring of biological impairment not only for localized industrial source pollution, but also keep track of upstream climate impacts to the benthic invertebrate communities.

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- Flora of the Canadian Arctic Archipelago published***
- The *Flora of the Canadian Arctic Archipelago* is a comprehensive guide to the 349 ferns and flowering plants of the Canadian Arctic islands recently published on CD-ROM by the Canadian Museum of Nature and NRC Research Press. Each species is provided with a detailed morphological description, a distribution map, notes on taxonomy, distribution, ecology and indigenous knowledge.
- The text is complemented by an extensive bibliography. Characters useful for identification are defined and illustrated. More than 3,000 colour photographs and line drawings illustrate the habitat, habit, flowers and distinguishing characters of each species. The DELTA (Description Language for Taxonomy) format allows for interactive identification.
- Aiken, S., L. Consaul, and L. Gillespie. 2007. *Flora of the Canadian Arctic Archipelago*. Canadian Museum of Nature and NRC Research Press. Ottawa. ISBN 9780660197272
- Price: CAD \$34.95 (plus 15% shipping and handling, and GST)
- Available from:*
Canadian Museum of Nature, 1-888-437-6287
or
NRC's online bookstore (pubs.nrc-cnrc.gc.ca/eng/books/index.html)

Selected Future Conferences

Organization	Date	Place	Contact
ENTOMOLOGICAL CONFERENCES			
Entomological Society of Canada	2008 , 19–22 Oct.	Ottawa, ON	with the Entomological Society of Ontario http://www.canacoll.org/JAM2008/index.html
	2009 , 18–21 Oct.	Winnipeg, MB	with the Entomological Society of Manitoba
Entomological Society of America	2008 , 16–19 Nov.	Reno, NV	http://www.entsoc.org/am/cm/index.htm
	2009 , 13–17 Dec.	Indianapolis, IN	http://www.entsoc.org/am/fm/2009/index.htm
Entomological Collections Network	2008 , 15–16 Nov.	Reno, NV	http://ecnweb.org/
International Joint Meeting on Ephemeroptera and Plecoptera	2008 , 8–14 June	Stuttgart, Germany	http://www.jointmeeting08.naturkundemuseum-bw.de/index.html
International Congress of Entomology	2008 , 6–12 July	Durban, South Africa	http://www.ice2008.org.za/
OTHER SUBJECTS (especially those relevant to Survey projects)			
Natural Science Collections Alliance (NSC Alliance) and the Society for the Preservation of Natural History Collections (SPNHC) Joint Meeting	2008 , 13–17 May	Oklahoma City, OK	http://www.snomnh.ou.edu/nsca-spnhc/
Canadian Society of Zoologists	2008 , 19–23 May	Halifax, NS	http://www.csz-scz.ca/cszanglais/engmeeting.htm or Tamara.Franz-Odendaal@msvu.ca
North American Benthological Society	2008 , 25–30 May	Salt Lake City, Utah	http://www.benthos.org/Meeting/
IV International Colloquium on Soil Zoology	2008 , 25–29 August	Curitiba, Brazil	www.unicenp.edu.br/icsz
REGIONAL SOCIETIES			
Acadian Entomological Society	2008 , 15–17 June	St. John's, NL.	http://www.acadianes.org/

List of Requests for Material or Information Required for Studies of the Canadian Fauna 2008

This list is intended to facilitate cooperation among entomologists through the exchange of specimens. If you have collected material or can collect material that is superfluous to your research, check the list to see who might benefit from those specimens. If you have residues for offer or if you have a request for material that might be obtained in Canada please submit the relevant data for inclusion in this newsletter and for posting on the BSC web site. This list can also be found on the Survey's website at <http://www.biology.ualberta.ca/bsc/english/listofrequests.htm>. It is updated there as information is received.

Minimum data requested with all specimens are, of course, locality, date, collector, and habitat.

(**denotes address reference; listed from p. 36)

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
1	Acari (free living and parasitic terrestrial and aquatic mites)	Anywhere, but especially sub-arctic 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	1
2	Acari from family Uropodidae	Anywhere	Free living and parasitic terrestrial, preserve in 75% ethanol	C. Constantinescu	2
3	Adelgidae (conifer woolly aphids)	Anywhere	Preserve insects and bark, needles or galls in 70% ethanol. Specimen records and host plant records	R. Footitt	1
4	Aleyrodidae (whiteflies)	North America	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. Footitt	1

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
5	Anthomyiidae	North America	Specimens with biological data (especially reared specimens) in the genera <i>Fucellia</i> (seaweed flies), <i>Chiastochaeta</i> (Trollius flies), and <i>Botanophila</i> in the wide sense (incl. <i>Pegohylemyia</i>) [of diverse life histories, including groups whose larvae are saprophagous, phytophagous (mainly stem-borers or seed-feeders) or fungivorous (especially on <i>Epichloe</i> parasites of grasses)].	G.C.D. Griffiths	3
6	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	4
7	Aphididae (aphids)	Anywhere	Preserve in 70% ethanol. Specimen records and host plant records.	R. Footitt	1
8	Archaeognatha	North America and the north Pacific, especially Machilidae from Alaska, western Canada, and eastern Russia	Specimens should be preserved in 80-100% ethanol. Include collection data: location, date, and collector. Habitat information also desired.	M. Bowser	38
9	Asilidae (robber flies)	North America	Pinned adults	R.A. Cannings	5
10	<i>Bombus</i> , especially series or parts thereof. (End use: morphometric analysis of intraspecific variation)	Arctic	Any collecting method, but if collected into wet (soapy water or alcohol), then sent wet (in alcohol) is best.	M. Damus	39
11	Braconidae	Anywhere	Pointed or in ethanol.	M. Sharkey	6
12	Bumble bees	Anywhere in Canada	Include floral host if any. Collect and preserve dry (but specimens that have already been put into ethanol are acceptable).	R.C. Plowright	7

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
13	Butterflies (see also 35, 36, 37)	Arctic	Preserve papered or pinned (collecting / preserving information supplied on request) [for Alaska Lepidoptera Survey]	K.W. Philip	8
14	Cerambycidae	Canada and Alaska	Adults pinned or in ethanol, host plant data if available	D.B. McCorquodale	9
15	Ceratopogonidae	Anywhere in Canada	Send in fully topped-up vials of 70% ethanol. Reared material is especially valuable; provide type of substrate or habitat if material is reared.	A. Borkent	10
16	Cercopidae (froghoppers, spittlebugs)	Canada and Alaska	Specimens (preferably not in ethanol if possible), records and host records.	K.G.A. Hamilton	1
17	Chalcidoids, especially Eupelmidae	Holarctic	Incl. sweep-net samples (see also 43) (collect into ethanol). Reared material is especially useful.	G.A.P. Gibson	1
18	Chironomidae: <i>Lar-sia</i> (Tanypodinae)	Nearctic and Palearctic fresh waters	Reared material preferred but will accept all stages in ethanol or on slides.	B. Bilyj	11
19	Chironomidae: <i>Eukiefferiella</i> , <i>Tvetenia</i> (Orthoclaadiinae)	All areas, especially Ontario	Include sampling method, habitat information	W.B. Morton	12
20	Chrysomelidae (leaf beetles)	Anywhere, but especially in Canada	Mounted or unmounted and preserved in acetic alcohol (70 ethanol: 25 water: 5 parts glacial acetic acid). Include accurate (species level) host plant information.	L. LeSage	1
21	Cicadellidae (leafhoppers)	Canada and Alaska	Specimens (preferably not in ethanol), records and host records.	K.G.A. Hamilton	1
22	Coccoidea (scale insects)	North America	Preserve insect and host plant material in 70% ethanol. Specimen records and host plant records.	R. Footitt	1
23	Cynipidae: insect galls from domestic and wild roses	Anywhere	Maturing to mature galls. Remove galls from plants and place in plastic bags. Try to segregate galls of different species. Preserve any emergents in 70% ethanol.	J.D. Shorthouse	13

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
24	Cynipidae: galls on oak	Anywhere	Collect mature galls (spring gen: most in June; autumn gen: late August – October) into plastic bags, separating gall species. Preserve emergents in 70% ethanol. Please note oak species (at least a guess at oak section - red or white oaks; leaf, bud and acorn samples also useful).	S. Digweed	14
25	Dermaptera: <i>Forficula auricularia</i> (perce-oreille européen / European earwig)	Amérique du Nord et autres régions si possible	A sec ou dans l'alcool	J.C. Tourneur	15
26	Diprionidae (diprionid sawflies)	North America	Living diprionid sawflies of any species, identified or unidentified. Record foodplant. Contact in advance about shipping.	L. Packer	16
27	Eupelmidae: <i>Anastatus</i>	North America	Reared materials with associated sexes are particularly important, regardless how few in number.	G.A.P. Gibson	1
28	Formicidae (ants)	Anywhere	Record type of habitat and nest site. Include brood if possible (preserve in ethanol).	A. Francoeur	17
29	Fungal pathogens of insects (esp. of deuteromycetes and ascomycetes)	Anywhere	Place any fungus-infected specimens in a vial. (Identification of the fungus available on request.)	D. Strongman	18
30	Halictidae (sweat bees) brown and black spp. only	North America	Particularly from blueberries. Pinned or preserved. Include flower record if available.	L. Packer	16
31	Hemiptera: Heteroptera (bugs)	Anywhere	Aquatic and semi-aquatic Heteroptera from acid waters (an indication of pH would be useful). Terrestrial Heteroptera from bogs. Preserve in ethanol.	G.G.E. Scudder	19
32	Insects on snow	Especially western mountains	<i>Chionea</i> (Tipulidae), <i>Boreus</i> (Mecoptera), Capniidae (Plecoptera): preserve in 70% ethanol.	S. Cannings	20
33	Isoptera (termites)	N. America incl. Mexico	Preserve in 75% ethanol; try to collect as many soldiers as possible.	T.G. Myles	21

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
34	Leiodidae (=Leptodiridae)	Northern forest and tundra areas; prairies and grasslands	Most easily collected by window traps or flight intercept traps; and car nets (<i>Can. Ent.</i> 124: 745, 1992) (collect into ethanol).	S.B. Peck	22
35	Lepidoptera (see also 13)	Arctic	For revisionary work on the hol-arctic fauna	J.D. Lafontaine	1
36	Lepidoptera	Manitoulin and surrounding islands	Records for use in monograph of the region. Information on old records from collections would be particularly welcome.	J.K. Morton	23
37	Lepidoptera	Areas not previously sampled in western Canada	Standard collecting methods	N. Kondla	24
38	Lygaeidae	Anywhere	Material can be collected in ethanol.	G.G.E. Scudder	19
39	Mallophaga	Anywhere	Preserve specimens in 70% ethanol; host species is extremely important.	T.D. Galloway	25
40	Microgastrinae (Hymenoptera: Braconidae)	Anywhere in Canada	Stored in alcohol or pinned specimens. Specimens will be returned to sender or duplicates can be deposited in the CNC.	J.L. Fernandez Triana	37
41	Microlepidoptera (excluding Pyralidae and Tortricidae)	North America, esp. west in dry/arid habitats and prairies (CNC deficient in all western species)	Include collecting method and time of day collected. Kill with ammonia fumes. Field-pin; instruction leaflet and field kit available on request.	J.F. Landry	1
42	Muscidae and Fanniidae	Churchill, MB; and surrounding area	Specimens mounted or preserved in ethanol. Include taxon, location of collecting site, method of collection, date, and collector	J. Savage / A. Renaud	40
43	Odonata (dragonflies)	North America	Include 2-3 word habitat description. Adults preferably in envelopes or papered, prepared by immersing in acetone for 24 hours, then dried; larvae in 70% ethanol.	R.A. Cannings	5

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
44	Odonata (dragonflies and damselflies)	Ontario, North-west Territories, Nunavut, Canadian prairies	Dried quickly in paper or glassine envelopes with or without prior immersion of envelope in acetone for one day to retain colour. Include habitat and collection notes and numbers observed in pencil on envelopes. Larvae in 70% ethanol.	P.M. Catling	26
45	Opiliones (harvestmen)	Canada and adjacent states	Preserve in 75% ethanol, especially adults with notes on habitats.	R. Holmberg	27
46	Parasitic Hymenoptera	Anywhere	Including selected unsorted Malaise, suction, pan or pitfall trap collections (pan trap kits and instructions supplied free on request).	L. Masner	1
47	Phoridae	Anywhere; especially boreal	Collect into 70% ethanol: especially interested in Malaise trap samples from boreal forest.	B.V. Brown	28
48	Pseudoscorpions	Canada	Preserved in 90% ethanol is preferred, please include collection information (method, habitat)	C. Buddle	29
49	Psyllidae	North America	Preferably preserve in glycerine or dried. Specimen records and host plant records	R. Footitt	1
50	Pteromalidae: <i>Pachyneuron</i>	North America	Reared materials with associated sexes are particularly important, regardless how few in number.	G.A.P. Gibson	1
51	Salticidae (jumping spiders)	Canada	Adult specimens preserved in 70% ethanol. Include habitat information, specific location of collection, collecting method.	D. Shorthouse C. Buddle	30 29
52	Scelionid egg parasites of Orthoptera	Anywhere	Especially from Grylloidea; preserve in ethanol.	L. Masner	1
51	Sciomyzidae	Anywhere	Preferably pinned	L. Knutson	31
52	Simuliidae (black flies)	North America, esp. western and northern species	Preserve larvae in Carnoy's solution (1 glacial acetic acid: 3 absolute ethanol). Reared adults with associated pupal exuviae preferred. Instructions available on request.	D.C. Currie	32

	Material Requested	Areas of Interest	Collecting Methods, Notes	Name of Requester	**
55	Siphonaptera (fleas)	Anywhere	Preserve specimens in 70% ethanol; host species is extremely important	T. D. Galloway	25
56	Solpugida (sun spiders)	Canada	Preserve in 75% ethanol, especially adults with notes on habitat.	R. Holmberg	27
57	Sphaeroceridae	Anywhere, esp. Arctic or high elevations	Collect into ethanol. Acalyptrate fraction of trap samples welcomed.	S.A. Marshall	33
58	Symphyta (sawflies)	Boreal and arctic Canada	Larvae and adults collected by Malaise trap, sweeping, etc. (collect into 70% ethanol). Identify larval food plant as far as possible.	H. Goulet	1
59	Thysanoptera (thrips)	North America	(Preserve in 70% ethanol). Specimen records, habitat, host plant records where applicable.	R. Footitt	1

Cooperation Offered

- | | | |
|---|--|--|
| a | Identification of groups of interest in return for a sample of duplicate specimens. | Most but not all of entries in list above. |
| b | Willing to sort material from certain residues, bulk samples, etc. | See entries 6, 17, 46, 58 above |
| c | Field kits or instructions available on request | See especially entries 41, 46, 54 above |
| d | Exchange of specimens | Several requesters, including entries 9, 40, 43, 55 above. |
| e | Limited collecting in Coppermine area, N.W.T., if particular material required. | A. Gunn (address 34 below). |
| f | Caterpillars, larval sawflies, aphids and mites available on request from trapnests for solitary bees and wasps [and see <i>Am. Bee. J.</i> 2001, pp. 133–136, 441–444]. | P. Hallett (address 35 below) |
| g | Insect material from grassland and adjacent habitats at Onefour, Alberta, is available for examination. | D.L. Johnson (address 36 below) |

List of Addresses

1. Agriculture and Agri-Food Canada, Central Experimental Farm, KW Neatby Bldg., 960 Carling Ave., Ottawa, ON, K1A 0C6
V.M. Behan-Pelletier behanpv@agr.gc.ca
E.E. Lindquist lindquiste@agr.gc.ca
I.M. Smith smithi@agr.gc.ca
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J.F. Landry landryjf@agr.gc.ca
L. Masner lmasner@gmail.com
H. Goulet gouleth@agr.gc.ca
 2. Natural History Museum of District Arges, Armand Calinescu Street, No. 44, Cod: 110047, Arges, Romania; cristinactinescu@yahoo.com
 3. P.O. Box 1380, Athabasca, AB, T9S 2B2; gcdgriff@telusplanet.net
 4. Canadian Forest Service, 1219 Queen St. E., Sault Ste. Marie, ON, P6A 5M7; kbarber@nrcan.gc.ca
 5. Royal British Columbia Museum, 675 Belleville St., Victoria, BC, V8W 9W2; rcannings@royalbcmuseum.bc.ca
 6. Department of Entomology, University of Kentucky, 5 – 225 Agricultural Science Center North, Lexington, KY 40546-0091, U.S.A.; msharkey@uky.edu
 7. 482 Montée de la Source, Cantley, QC, J8V 3H9
 8. University of Alaska, Institute of Arctic Biology, P.O. Box 757000, Fairbanks, AK, 99775-7000 U.S.A.; fnkwp@uaf.edu
 9. Dept. of Biology, Cape Breton University, 1250 Grand Lake Rd., Sydney, NS, B1P 6L2; david_mccorquodale@cbu.ca
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-
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