

NEWSLETTER OF THE BIOLOGICAL SURVEY OF CANADA (TERRESTRIAL ARTHROPODS)

Table of Contents

General Information and Editorial Notes	(inside front cover)
News and Notes	
Brief on the role of voucher specimens published	37
Newsletter distribution goes electronic	37
Second grasslands field trip	37
Summary of the meeting of the Scientific Committee, April 2003	38
Arthropod Species Specialist Subcommittee for COSEWIC.....	45
Guide to the identification of the spiders of Quebec published	46
Federal Biodiversity Information Partnership (FBIP) established	46
Members of the Scientific Committee 2003	46
Lessons from threatened cuts at the University of Nebraska Museums	47
Project Update: Arthropods of Canadian Grasslands	48
Opinion Page: DNA Barcoding: Deus ex Machina	50
Review of Scientific Priorities 2003	53
Biological Survey of Canada: Taking Stock after 25 Years	54
The Quiz Page	59
Arctic Corner	
Fourth arctic field trip	60
Alaska Insect Survey project.....	60
Arctic entomology course.....	60
Predaceous water beetles from Keewatin and Mackenzie	61
Index of Past Articles	66
Selected Publications associated with the Biological Survey	73
Selected Future Conferences	78
Answers to Faunal Quiz	79
Quips and Quotes	80
Requests for Material or Information Invited	81
Request for Cooperation (form)	82

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.

Editor: H.V. Danks

Head, Biological Survey of Canada
(Terrestrial Arthropods)
Canadian Museum of Nature
P.O. Box 3443, Station "D"
Ottawa, ON K1P 6P4
Tel. 613-566-4787
Fax. 613-364-4022
Email: hdanks@mus-nature.ca

Queries, comments, and contributions to the Newsletter are welcomed by the editor. Deadline for material for the Spring 2004 issue is January 30, 2004.

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

Brief on the role of voucher specimens published

Despite the existence of voluminous literature emphasizing the importance of voucher specimens there is still inadequate deposition of such vouchers. The Survey has published a brief that reviews the nature, preparation and deposition of voucher specimens, as well as the benefits of observing recommended practices and the potential costs of not doing so.

The abstract from the brief reads as follows:

Voucher specimens deposited in natural history collections are the only reliable means to verify the identity of species used in biological studies. However, despite their importance in confirming the results of research, deposition of vouchers is still the exception rather than the rule, especially in non-taxonomic studies. Furthermore, many journals do not require or even recommend deposition of vouchers. This brief reviews the nature of voucher specimens and sample policies

on vouchers in systematic, faunistic and ecological research. The advantages of having vouchers available for subsequent study, and the pitfalls of not designating and depositing vouchers, are discussed using examples from the literature. Recommendations as to best practices in voucher policy are given for funding agencies, agencies that issue research permits, university departments, journal editors and natural history collections.

Paper copies of the brief are available from the Survey Secretariat. It is also available on the Survey's website in the Publications section.

Wheeler, T.A. 2003. The role of voucher specimens in validating faunistic and ecological research. A brief prepared by the Biological Survey of Canada (Terrestrial Arthropods). Biological Survey of Canada (Terrestrial Arthropods) Document series no. 9, ISBN 0-9689321-2-6. 21 pp.

Newsletter distribution goes electronic

Beginning with this issue we are offering Canadian and American subscribers of this newsletter the option of receiving the newsletter in electronic format (Adobe Acrobat (pdf)) rather than as a paper copy. Foreign subscribers have already been advised that they will receive only the electronic version.

Email messages were sent this past spring and summer to readers with known email addresses offering this option. If you wish to receive the newsletter electronically and have not yet responded please send a message to sgoods@mus-nature.ca.

Subscribers who do not specifically request the electronic option will continue to receive the paper version by mail. The newsletter is also posted on the Survey's website (<http://www.biology.ualberta.ca/bsc/english/newsletters.htm>), within a few weeks of publication.

Second grasslands field trip

The second Survey-sponsored grassland Arthropod collecting expedition took place in July in the Peace River grasslands. Base camp was in the Dunvegan Provincial Park and Historic Site, Alberta. The trip was organized by Margot Hervieux, Rob Roughley and Felix Sperling. Approximately 15 people participated.

For an update on the Grasslands project see Project update on p. 48.

Summary of the meeting of the Scientific Committee, April 2003

The Scientific Committee met in Ottawa on April 24–25, 2003. Much of the meeting was devoted to a review of the Survey and of its scientific projects, the results of which are summarized elsewhere in this newsletter [see pp. 53–58]. Other work at the meeting was as follows.

Scientific Projects

1. Grasslands

Dr. Wheeler reported that letters of invitation have been sent out for 19 chapters of the volume on ecology and interactions in grassland habitats. Fourteen chapters have been confirmed so far. New members are required for the grasslands subcommittee. Dr. Floate reported on some efforts to secure funding for the project. Another attractive issue of *Arthropods of Canadian Grasslands* had been produced by the Secretariat.

Dr. Sperling outlined the planned Biological Survey grasslands field trip July 18–21. The local contact person is Ms. Margot Hervieux, a biologist and president of the Peace Parkland Naturalist Society, who is keen to draw attention to the disappearing Peace River grasslands. The site will be Dunvegan Provincial Park and Historic Site, at the heart of the Peace River region. The area is a significant focus for the Alberta Natural Heritage Information Centre and the Alberta Conservation Association, which has funded surveys along the Peace River for a swallowtail butterfly and a number of plants.

2. Family keys

Dr. Scudder reported that the apterygote and exopterygote keys are nearly completed. The British Columbia version is in the layout stage for printing. He expects the BC keys should be complete in the next 6 to 8 months. The plan is to use those figures with some additions to complete the Canadian key. Plans for doing anything beyond the keys to apterygotes and exopterygotes are uncertain. Dr. Scudder encouraged others to consider taking over the project for the endopterygotes.

3. Seasonal adaptations

Dr. Danks reported that papers on mitochondrial work derived from the cooperative project based in Victoria and on “Studying insect photoperiodism and rhythmicity: components, approaches and lessons” are now in press.

Dr. Danks presented a paper in January on “Seasonal adaptations of Arctic Insects” at a symposium on Biology of the Arctic, at the meeting of the Society for Integrative and Comparative Biology. The paper was also submitted for the Society’s journal *Integrative and Comparative Biology*. The symposium was interesting, but he was the only entomologist participating.

Dr. Danks reported that *The Encyclopedia of the Arctic* (in which he has short entries on Insects, Insect larvae, and Mosquitoes) had been delayed but is now moving forward again with Routledge as the new publisher. Bankruptcy or takeover of publishers is a common theme these days that impacts on authors.

Dr. Danks is planning to attend the international symposium on animal and plant cold hardiness in the Czech Republic in August, and he is preparing a paper about the role of insect cocoons in cold conditions. He has also agreed to prepare a paper about seasonal adaptations for a symposium at the 2003 ESC/ ESBC meeting.

Dr. Danks reported that he had been considering whether it is feasible to prepare a definitive book treating insect seasonal adaptations. Because he had addressed many elements of that subject in earlier books and papers on dormancy, diapause, life-cycle pathways, life-cycle duration, cold hardiness, dehydration resistance, habitat conditions and relationships, including some regional – especially arctic – linkages, a comprehensive synthetic treatment should be feasible. However, he had decided against doing so. The literature is now so vast that it is impossible to strike the

right balance: a more or less exhaustive monograph is impracticable and publishers would not accept the lengthy book required to cover such a wide scope; but a streamlined treatment would amount to rather unsatisfying “hill-topping”. Another limiting factor is the increase in demands on his time, including increased “corporate” requirements within the Museum.

4. *Insects of the Arctic (formerly ‘Insects of Keewatin and Mackenzie’ and ‘Arctic invertebrate biology’)*

Dr. Currie reported that the fourth instalment of this project is a planned trip in 2003 to the western Hudson Bay region, specifically Arviat (formerly Eskimo Point), Rankin Inlet and Baker Lake. An article on last year’s trip on the Thelon River appeared in the Fall newsletter. Dr. Giberson gave a talk about two of the previous trips at the Canadian Museum of Nature. Dr. Currie noted that the same number of species of black flies (30) were collected on both the Horton River and the Thelon River, but only half of those species were shared. Dr. Currie deduced that patterns across the arctic are much different than previously supposed. Tentative plans are to move across Hudson Bay into Ungava, another poorly collected area, or perhaps Labrador, for a future trip. Before this project started the number of black fly species known from arctic Canada was 19; that number has now reached about 53. Dr. Giberson reported some data on the mayflies, stoneflies and water beetles [see p. 61], including a few new territorial records and many range extensions.

5. *Forest projects*

Dr. Winchester and Dr. Langor agreed to consider – for discussion at the next meeting – how best to develop existing Survey interests in the faunas of boreal forests, ancient forests, saproxylic habitats, and other appropriate topics.

Other scientific priorities

1. *Invasions and reductions*

Dr. Roughley noted current work using coccinellids as a signal group for invasions and reductions. He circulated an article about new records of coccinellid species from the Province of Manitoba. All the coccinellids in the J.B. Wallis Museum were examined, revealing 11 species not recorded from the province before. Other members reported on a range of work with invasive species, including lady beetles, forest beetles, bugs, and other insects.

Two aspects of interest to the Survey were identified – an interest in coccinellids, and a synthesis for which the Survey would expect to develop a symposium or publication eventually. The coccinellid sub-group will be chaired by Dr. McCorquodale. This coccinellid project might be amenable to cooperation with the CMN, to help broaden linkages with a wider audience. A number of other threads relating to invasions and reductions would be discussed further at the fall meeting, with the goal of convening a symposium, with proceedings, in 3 or 4 years time. The symposium would address the various aspects of invasive species in a cohesive and scientifically valid way.

2. *Endangered species*

The status report to the Committee on the Status of Species at Risk in Ontario (COS-SARO) on an endangered halipid beetle was shown as an example of the kinds of information needed and the amount of work it takes to develop such a report. Several members of the Committee are members of similar provincial or national bodies. Other information about rare or endangered species was circulated. Dr. Marcogliese speculated that now that the Species at Risk Act has been passed substantial funding will be available at least for vertebrates.

Dr. Scudder expressed concern about the potentially serious consequences of listing endangered species. He reminded the Committee that when COSEWIC was considering broadening its mandate to include invertebrates this

Committee recommended that they consider only Lepidoptera, dragonflies and freshwater molluscs because in these groups populations can be estimated and the species can be identified in the field. However, if attention is drawn to other groups it may impede collecting. For example, a need to obtain permits will preclude scientists from doing research because the applicants have to identify what and how many species they plan to collect, which cannot be done for most insect groups. Dr. Scudder thought that there should still be a concern about learning where endangered insects are, but rather than adding groups to the COSEWIC interest he would use butterflies, dragonflies and freshwater molluscs as the surrogates for invertebrate groups. A status report for every species is not practical, and "listing" species would stop research and require recovery plans. Not enough is known about most groups to allow this and to gather enough information would be very costly.

Dr. Marshall, who is involved with COS-SARO, said that there is some sensitivity on that committee to the issues raised by Dr. Scudder. A suggestion that funding is needed to do both taxon and region reviews was well received. He is not as concerned as Dr. Scudder about the prospect that many species will be put through the regulatory process because to get something listed and devise a recovery plan is very expensive and inefficient. For example, the Ontario committee has recognized that there is a need for a different approach for arthropods, which in effect would involve family-level rather than species-level status reports.

3. Survey web site

Dr. Danks reported several recent additions to the Survey's website including the abstracts from the Grasslands symposium, updated Scientific Committee listings, and French text for some pages that were formerly only in English. Complete French translations were posted for several briefs. Other publications posted were recent Survey and Grassland newsletters. Minor updates are ongoing including the time-

consuming process of ensuring that links have not become out of date.

With respect to usage of the site, Dr. Danks explained that the site meter had logged about 8400 hits over the first couple of years but recently as a test a counter was added to every page. This system showed that the existing counter was logging only visitors to the home page, and so missed many people coming in (e.g. via search engines) to other pages. Using counters on every page for a few months revealed that annual visits may number closer to 18,000 than to 4,000, showing that the site is well used, even if many visitors are not specific Biological Survey clients.

4. Voucher specimen brief

Dr. Wheeler said that a draft of the voucher specimen brief was circulated to Committee members. Comments on the brief led to suggestions about numbers of specimens, costs, and depositories for the final version, which will be prepared after the meeting and published by the Secretariat [see page 37].

5. Monitoring of continuing priorities for work on Canadian faunas

Updated information on earlier or currently less active Survey projects was reviewed. Selected items concerned Les Îles de la Madeleine (Magdalen Islands), a geographically interesting area, which might eventually prove suitable for a Survey project. Several projects on arthropod ectoparasites of vertebrates are ongoing, including one to test flies, fleas and ticks for *Wolbachia*, and a survey of feather mites. Under agroecosystems, it was reported that funding is available for a masters student for a project related to chemical residues in cattle manure. Faunistic work on parasitoids of filth flies and on pollinators is under way. It was also noted that small regional projects would be an excellent way to publicize the work of the Survey and to produce smaller shorter term items consistent with the Survey's objectives. The Committee also received detailed information about the developing situation with West Nile virus and the vector mosquitoes.

6. Other priorities

The Committee also considered faunal analysis, Survey publicity, naturalist publications, arthropods and fire, the cost of insect identifications (no further action on this complex topic was deemed feasible), databasing (the Survey will keep actively informed on this matter), and other issues.

Liaison and exchange of information

1. Canadian Museum of Nature

Mr. Roger Baird, Director, Collection Services, expressed his pleasure at now representing the Museum on the Scientific Committee.

The CMN has undertaken the development of a strategic vision for where it wants to be in 2008. The planning process started last fall and the operational plans were put into effect beginning April 1, 2003. The major focus has been to build a strategic plan around issues that are of relevance to Canadians. As a result of public surveys the issue of environmental change came to the forefront, leading to three main points of focus for all of the Museum's activities – 1. Factors that influence environmental change, 2. The place in the environment and role of the dominant species (humans) and its positive or negative influences on the environment, 3. Preserving a record of baseline data and scientific knowledge. There is also a strong focus on increased international outreach and demonstrating the relevance of Museum's work by working closely with other organizations such as the BSC, the university community and other museums.

An Alliance of Natural History Museums of Canada has been formed to work with 11 other museums with significant natural history collections to define some broad common goals and to unite in addressing those goals collectively. One fundamental goal will be to enhance the capacity to share and exchange information and knowledge. To that end some recent collections activities have contributed to similar projects on a modest scale. For example, the Birds of Canada database has been supplemented with all bird-nest records for the

province of Quebec. In response to questions, Mr. Baird explained that the group intends to open up participation to other Museums and Conservation Data Centres.

With other federal departments a pre-proposal was put together for the Global Biodiversity Information Facility (GBIF) to bring a range of data together around the issue of West Nile virus. Direction was received to redevelop the proposal and submit it as a demonstration project with GBIF. The project hopes to show what is possible with distributed databases and mapping and modelling.

Mr. Baird announced that recently the Assistant Deputy Ministers representing science departments in the federal government have confirmed a \$600,000 start-up budget for a federal biodiversity information partnership (FBIP). The longer range objective is to develop a Canadian Biodiversity Information Facility (CBIF), created out of the partnership. The Conservation Data Centres are represented in this initiative. Some of the objectives would be the creation of common standards and the elimination of duplication of efforts. The partnership also wants to influence policy to ensure that digitisation of collections and specimen data is a priority for funding within government programs. Funding has been guaranteed for one year for a secretariat.

Members of the Committee commented that the FBIP initiative does not involve the whole community that was originally involved in initial meetings about the concept, and the community as a whole is not being kept informed as to what is happening.

2. Agriculture and Agri-Food Canada

Dr. Landry commented that he would normally be representing the scientists at Agriculture but no management representative is available to attend this meeting. Dr. Landry reminded the Committee that the department has been undergoing a reorganization for the last 2 years, and there are new national programs and themes. Program and theme leaders may reside anywhere in Canada and oversee and super-

wise people and programs across the country. In Ottawa most entomologists are under the auspices of the Biodiversity theme being led by Dr. Christiane Deslauriers based in Charlottetown. One good result of the reorganization is that biodiversity research is now being encouraged. Unfortunately, resources are still tight, and budgets have been delayed.

A positive development is that Agriculture has just hired three new taxonomists – Dr. Pat Bouchard (weevil systematics), Dr. Andy Bennett (Ichneumonidae), and Dr. Jeff Skevington (pest Diptera). These hirings are the first at the CNC in 13 years. However, these additions will not be sufficient to maintain current professional staffing levels in the long term, because in the next five years about five retirements are scheduled. For example, Dr. Don Bright is scheduled to retire this year.

Dr. Floate added that all future research will be directed by the Agricultural Policy Framework. The federal government is trying to implement this framework with the provincial governments. It involves best practices, farm plans, and other elements. Anyone not in AAFC who is looking at the possibility of collaborative projects should be tailoring their proposals with that framework in mind.

3. Entomological Society of Canada

Dr. Sandy Smith, President of the Entomological Society of Canada, reported that the Society is financially sound. A big issue in the past year has been the Society's move to electronic publishing. NRC has taken over electronic publishing of *The Canadian Entomologist* although the Society handles the scientific editing. The editorial structure now has one editor-in-chief and three division editors who deal directly with manuscripts and revisions.

The fee structure for membership is changing slightly because there is a small decline in the number of subscribers. As of 2002 the ESC holds copyright for all material it publishes. The ESC's position on endangered species has been posted on its web site. The Society is putting more emphasis on the use of the web, and

the webmaster is now an official member of the Governing Board of the ESC. The Society recognizes the importance of getting information out to the public in an accessible way. The Bulletin is now posted on the web site. The Society will continue to post employment positions available there. Dr. Smith announced the recipients of the Society's 2003 awards.

Finally, Dr. Smith commented that now that she is President of the ESC she appreciates the Society's role in supporting the Biological Survey.

4. Canadian Forest Service

Dr. John Huber reported that changes continue at the Canadian Forest Service. As of April 1 the new Director of Science within the CFS headquarters is Dr. Claude Barraud. The five CFS research networks are being restructured, although a new structure has not been decided. The Director General, Mr. Gordon Miller, is taking charge of forest science. Previously the Director Generals in the five regional laboratories led scientific research in their laboratories. The Canadian Forestry Innovation Council has recently been formed. A boreal forest workshop is planned for the end of May in Ottawa. Various representatives of agencies and industries are being invited to bring forward their priorities for forestry research.

Dr. Huber reminded the Committee that CFS is part of the FBIP and is contributing to its support. A contribution has already been paid for membership to the Global Biodiversity Information Facility (GBIF). A contribution for a 1-year pilot project to develop an on-line database for native, alien and invasive forest insects, beginning with Scolytidae, is planned.

Dr. Tony Hopkin explained that he is in charge of the Forest and Insect Disease Survey (FIDS) at Sault Ste. Marie. The organization has 12 field technicians. Some routine surveys are still carried out in Ontario but the main activities are related to major forest disturbances like spruce budworm, jack pine budworm and more recently to invasive species. There is some interest to make the Forestry Centre's

collections available through online access. As in other organizations there is insufficient taxonomic expertise for both insects and diseases, and there is concern about the constant reduction in the status of taxonomy. He pointed out that FIDS is constantly dealing with new species and often struggles to find people even to make preliminary identifications.

Members of the Committee wondered if there is any attempt to update the FIDS database, which contains many identification errors, for example in the Hemiptera and certain beetles. Dr. Hopkin explained that the database is being updated in order to bring the synonymy up to date. Whether re-identification is made depends on the particular database. Specimens are not always linked to the FIDS database which includes chiefly data from Ontario and B.C. The plan is not to revise the entire database, but rather to work on it group by group where people have an interest or as requested.

Members noted that the situation with validation of identification is an example of a bigger problem. The problems with the data are science problems, not management problems. If the data in the collections are not accurate and being checked, then web sites of organizations such as CBIF to display the data will not be useful. The lack of attempts to address the real scientific problems is a source of frustration.

5. Association des entomologistes amateurs du Québec

Dr. Landry explained that he has been involved with this society for a number of years and the society has become more active in publishing its entomological journal *Fabries* and its Supplement series. The most recent Supplement is a guide to the identification of the spiders of Quebec [see page 46].

6. Parasitology module, Canadian Society of Zoologists

Dr. Marcogliese explained that funding has not been available for the Parasitology module. Nevertheless, it continues to function and has produced a directory of parasitologists,

an evaluation of systematics expertise and a number of other products despite being a very small community with no support. Scientific projects include those on perch parasites and on the biodiversity of stickleback parasites, with many participants. This project does not seem to have received the same recognition in Canada as it does internationally. The Canadian Society of Zoologists has a standing committee on biodiversity which may start to develop links with other groups of overlapping interests, such as the Biological Survey. Environment Canada is implementing a metadatabasing project, following the NBII model. The main biological data from Environment are from birds and mammals. Most of the data are chemical and it is striking that a taxonomic database has been adopted. Dr. Marcogliese also spoke about state budget cuts in the United States, in particular at the University of Nebraska which holds a major collection of parasites [see page 47]. He circulated a variety of information and publications related to taxonomy and biodiversity. Finally, he declared that parasitology is now appreciated as a way to address environmental issues, even though the number of parasitologists is dwindling.

7. National Parks

At the October meeting a decision was made to prepare a letter to send to appropriate politicians and officials at Parks Canada to encourage support for research in national parks, given the recent establishment of new parks. The response was interesting; 7 out of 25 politicians responded and two heads of national parks. Some politicians forwarded the letter and in particular a longer response was received from The Hon. Peter Adams, Chair of Government Caucus on Post Secondary Education and Research. Dr. Shorthouse suggested that sending letters in the future on similar issues would be worthwhile.

Members of the Committee commented about Parks policies. One member had just returned from 5 months in Costa Rica and was struck by the difference in official attitude in the national parks in Costa Rica. For example,

as a scientist there he was given a permit allowing access to all parks and protected areas and was encouraged to collect anywhere. He contrasted the level of bureaucracy in Canada as an impediment to legitimate scientific research that is frustrating and counter productive. Other members thought that efforts with individual Parks are the best way to proceed. It was also pointed out that there are relatively little data from national parks, primarily because of restrictions on collecting and study.

Other items

1. Regional developments

Information of interest to the Survey from different regions of the country included the following.

In British Columbia, Dr. Wayne Maddison will begin work at the University of British Columbia on July 1. "Hot spots" of biodiversity do not coincide with any of the protected areas in B.C. Dr. Richard Ring is nearing retirement the University of Victoria. It does not seem that he will be replaced. A symposium in honour of Dr. Ring entitled "Adaptations and constraints" will be held at the joint ESC/ESBC meeting in November 2003. Entomology projects at the University were reviewed. Some of them exploit material collected some time ago, leading to publications that would not have been possible unless information in Survey briefs about collecting and preparing specimens properly had been followed. The situation with the pest management program at Simon Fraser University remains in limbo.

In the Prairies, Dr. Danica Baines is a new entomologist at the Lethbridge Research Centre. A field ecology course has been developed to foster greater communication between the Blood tribe and the University of Lethbridge. The Blood Tribe preserve contains much pristine grassland. Entomological work at the University of Alberta continues to thrive. Dr. Maya Evenden is a new entomologist studying pheromones of Lepidoptera. A CFI proposal is being developed to database natural science collections across Alberta. The Annual Meet-

ing of the Lepidopterists' Society in Olds, AB, during July includes a survey trip into the Caribou Mountains, an extreme northern boreal region. The Virtual Museum of the Strickland Museum at the University of Alberta is rapidly expanding. The systematics of curculionids and braconids is a focus of work at the Canadian Forest Service. An annotated checklist of the Lepidoptera of Alberta has been produced as well as a checklist of the Microlepidoptera of North America. There is much work on biodiversity in forested ecosystems to assess arthropod responses to anthropogenic and natural disturbances. Collections databasing is continuing.

In Ontario, the Renaissance ROM project to renovate the Royal Ontario Museum continues; the current galleries will start to be taken down in May. The ROM is seeking a new Vice-President of Collections and Research. The ROM's initial application for CBIF funding was accepted in the first stage and is now being revised. Studies by students at the ROM / University of Toronto were outlined. The Blackflies of North America book is scheduled to be published in 2003. At the University of Guelph survey activities are focused on extreme southern Ontario, including a study of Ojibway prairie with over 100 new Canadian or provincial records. Activities will also be focused on Rondeau Provincial Park, Point Pelee, Pelee Island and Middle Island and the Bruce Peninsula. A site for the Ontario Biodiversity Institute there has been identified. Projects at Laurentian University include studies of water beetles and galls.

In Quebec, many studies are underway at McGill University, including research on saproxylic arthropods, saprophagous beetles, and systematics of muscids, dolichopodids, and sarcophagids. The applied zoology department at McGill has undergone a program revision and now has an entomology option. The Université de Montréal attempted for a second consecutive year to fill a position in systematic entomology; a position will again be advertised in the fall.

In Newfoundland and the Maritimes, an examination of beetles in the University of Prince Edward Island collection revealed 239 species, 48 newly recorded from PEI. A list of the beetles of Nova Scotia is being developed. Work is underway to database dragonflies in the PEI collections and New Brunswick Museum. Other entomological work is in progress at UPEI and at the University College of Cape Breton. The ESC annual meeting will be held in Charlottetown in 2004 in mid-October. A major collection of forest insects from Acadia University has been saved by the Nova Scotia Museum.

For the Arctic, information was provided about the Northern Regional Impacts and Sensitivity to Climate Change (Northern RiSCC) project, a multi-agency network incorporating university and government researchers to elucidate the linkages among ecosystems in the face of global warming. N-RiSCC is proposing a Canadian research expedition on an icebreaker up the east coast of Hudson Bay to northern Ellesmere Island. Associated with the January SICB meeting was a letter-writing campaign to the Prime Minister urging support of Arctic research, which received reaction in the press. The Arctic symposium at the SICB was deemed very worthwhile. The only entomological work done in the Arctic last year was that under the Survey's arctic project. An arctic and boreal entomology course will be held in Churchill for two weeks in August 2003 [see page 60].

2. Other matters

The Committee also considered recent Survey publications, the annual report to the CMN, developments at the University of Nebraska collections [see page 47], and additional information on publications of interest.

Arthropod Species Specialist Subcommittee for COSEWIC

COSEWIC is currently mandated to cover only two groups of invertebrates, the molluscs and butterflies. Last spring a COSEWIC working group chaired by Gerry Mackie and including Sherman Boates, Dick Cannings, Jim Duncan, Theresa Fowler, Henry Lickers and Marco Festa-Bianchet prepared a proposal recommending a new species specialist subcommittee (SSC) that would cover arthropods, including the lepidopterans that are currently covered by the Molluscs and Lepidopterans SSC. This proposal was accepted by the Canadian Wildlife Directors in May 2003. A working group must now develop a plan for the Arthropoda SSC, decide on the co-chair expertise required and on the number and expertise of SSC members. Once it is formed the Arthropoda SSC will develop a prioritization scheme based on probable risk and available information on Canadian species. The proposal reads in part "For the most part, our understanding of most insect groups would result in rankings reflecting inadequate data and poor knowledge of life histories. Consequently, those groups and species would be unlikely to be considered by COSEWIC, at least in the immediate future. We emphasize that the new Arthropoda SSC will avoid commissioning reports on species for which available information is insufficient to evaluate conservation." The proposal suggested that the following arachnid and insect taxa listed as species at risk in BC could be among the first to be recommended for evaluation by COSEWIC:

Arachnids:

Sun Scorpion (*Eremobates gladiolus*)

Insects:

Parowan Tiger Beetle (*Cicindela parowana*)

Vivid Dancer (*Argia vivida*)

Ground Mantid (*Litaneutria minor*)

Apiocerid Fly (*Apiocera barri*)

Robber Fly (*Megaphorus willistoni*)

Scoliid Wasp (*Campsomeris pilipes*)

Guide to the identification of the spiders of Quebec published

A guide to the identification of the spiders of Quebec was recently published as a supplement to the journal *Fabrerics*. It includes diagnostics of all the species recorded in the province, illustrated keys to genera for each family, sections on morphology, collecting and preparation techniques, and 2700 illustrations.

To order the book contact the Association des entomologistes amateurs du Québec, 302 Gabrielle-Roy, Varennes, Québec, J3X 1L8. info@aeaq.ca. Cost is \$45 Cdn plus \$8 shipping.

[Paquin, P. and N. Dupérré. 2003. Guide d'identification des Araignées (Araneae) du Québec. *Fabrerics* Supplement 11. 251 pp.].

Federal Biodiversity Information Partnership (FBIP) established

In April 2003 several federal departments and agencies (Agriculture and Agri-Food Canada, Canadian Museum of Nature, Environment Canada, Natural Resources Canada, Department of Fisheries and Oceans, Parks Canada, Canadian Food Inspection Agency and Health Canada) established a coordinating mechanism for federal biological science and information management – the FBIP. The Partnership's first order of business will be to demonstrate the power of joining forces to share data and link it to decision making in areas of common interest such as invasive species, wildlife diseases, species at risk, environmental assessments or climate change.

For further information contact Mark Graham, Chair, Management Board, Federal Biodiversity Information Partnership at 613-566-4743 or Peter Hall, Executive Director, Federal Biodiversity Information Partnership at 613-759-6517.

Members of the Scientific Committee 2003

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

Mr. Roger Baird (CMN)
Ottawa, ON

Dr. Jeffrey Cumming
Ottawa, ON

Dr. Douglas Currie
Toronto, ON

Ms. Joanne DiCosimo
President, Canadian Museum of
Nature, Ottawa, ON

Dr. Lianne Dwyer
Acting Director, ECORC
Ottawa, ON

Dr. Kevin Floate
Lethbridge, AB

Dr. Donna Giberson
Charlottetown, PE

Dr. Jean-François Landry
(ECORC)
Ottawa, ON

Dr. David Langor
Edmonton, AB

Dr. David Larson
St. John's, NL

Dr. Steve Marshall
Guelph, ON

Dr. David McCorquodale
Sydney, NS

Dr. Rob Roughley
Winnipeg, MB

Dr. Michèle Roy
Ste.-Foy, QC

Dr. Geoffrey Scudder
Vancouver, BC

Dr. Joseph Shorthouse (Chair)
Sudbury, ON

Dr. Sandy Smith (ESC)
Toronto, ON

Dr. Felix Sperling
Edmonton, AB

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

Dr. Neville Winchester
Victoria, BC

Honorary / Founding Members:

Dr. George Ball
Edmonton, AB

Lessons from threatened cuts at the University of Nebraska Museums

Earlier this year, in response to funding cuts from the State as a result of severe budget shortfalls, the administration at the University of Nebraska proposed eliminating the research portions of the University of Nebraska State Museum, one of the three largest comprehensive university museums in the country with very valuable collections in several disciplines including entomology. The cuts included the elimination of 8 tenured faculty curators and 15 support staff in the research areas of the Museum. After a series of hearings, the university's Academic Planning Committee recommended that the Museum's research staff and research functions be retained, but the recommendation was ignored.

The proposed cuts led to an extraordinary outcry from the scientific community, including large numbers of letters sent from across the world to various officials in the university and the state government. As a result of this outcry and the efforts of the Museum staff, and following negotiations with the university administration, it has now been determined that the 5 faculty curators in Entomology, Parasitol-

ogy, Zoology, and Vertebrate Paleontology will be retained as well as the 4 collections managers for each of these areas, together with some secretarial, scientific illustration and preparator staff, although other staff were lost. Therefore, Entomology and its programs and collections are safe and the majority of the University of Nebraska State Museum was saved.

Several more general lessons might be drawn from these events. For example, the worldwide systematics community can work together and have an effective voice. Centralized research facilities may be vulnerable unless widely connected elsewhere in the institution and in the community. One ongoing role of scientists associated with collections therefore is to reaffirm their long-term value within the organization so that it is more widely understood. Finally, the history of developments such as this (though apparently not in this instance) suggests that threatening valuable facilities sometimes is a ploy to garner attention or to make less spectacular cuts more palatable.

Watch for the drift on dragonflies



Many resources are now available for the study of dragonflies in Canada. A summary of these resources, prepared by Rob Cannings, will appear in the next issue of the newsletter (Spring 2004).



Project Update: Arthropods of Canadian Grasslands

Terry A. Wheeler

Department of Natural Resource Sciences, McGill University,
Macdonald Campus, Ste-Anne-de-Bellevue, QC, H9X 3V9
wheeler@nrs.mcgill.ca

In recent months parts of western Canada have experienced drought, plagues of grasshoppers, a beef backlog and forest fires that threaten to convert considerable portions of southwestern Canada's forests into new grassland. Despite these upheavals, progress on the Arthropods of Canadian Grasslands project continues on several fronts.

Grasslands Subcommittee

Turnover in the membership of the BSC Scientific Committee has led to gradual depletion in the membership of the Grasslands Subcommittee over the past 2–3 years. Accordingly, a membership review was held at the April 2003 meeting of the subcommittee and some new members appointed. Because many of the people actively involved in grasslands research are not necessarily members of the Scientific Committee, a decision was made to include both "internal" and "external" members on the subcommittee in order to ensure broad regional and disciplinary representation. The current membership of the Grasslands Subcommittee is as follows: K.D. Floate (Co-chair), T.A. Wheeler (Co-chair), V.M. Behan-Pelletier, R.A. Cannings, J.M. Cumming, H.V. Danks, J.-F. Landry, D.J. Larson, R.E. Roughley, G.G.E. Scudder, J.D. Shorthouse and F.A.H. Sperling.

Grasslands Publications

The first volume arising from the Grasslands project will be entitled *Arthropods of Canadian Grasslands: Ecology and Interactions* in Grassland Habitats, and will be edited by T.A. Wheeler, R.E. Roughley and H.V. Danks. Sixteen chapters have been confirmed to date, with authors still being sought for one or two

additional chapters. The volume will be loosely divided into three sections. Introductory chapters will describe the attributes of major grassland types in Canada, and present an overview of climate, weather, postglacial history and abiotic characteristics of Canada's grasslands. A second set of chapters will examine ecology and interactions of particular target taxa in selected habitats (The mite fauna in grassland soils, Diversity of spiders in tallgrass prairies, Aquatic Hemiptera in grassland ponds, Ecology of dytiscid beetles in prairie ponds, Trophic guilds of Diptera in xeric Yukon grasslands, Gall-forming arthropods and their distributions in overlap and hybrid zones of cottonwoods on the Canadian prairie, The component community of arthropods associated with cynipid galls on wild roses, Grassland insects as food for birds). The final section of the volume will include chapters on the use of grassland arthropods in habitat management or as indicators (Use of fire as a conservation and management tool in tallgrass prairie, Arthropods in identifying hotspots for grassland conservation, Leafhoppers as indicators of grassland habitat types, Temporal changes in the grassland grasshopper fauna), together with a concluding overview chapter. Publication of this volume is planned for late 2004.

In addition to progress on Volume 1, co-ordinators were appointed to begin identifying potential authors and chapters for future volumes. Kevin Floate is the co-ordinator for a volume on arthropods and altered grassland ecosystems, which will be the next major publication of the Grasslands Project. Jeff

Cumming and Felix Sperling will co-ordinate planning for the final volume on biodiversity of arthropods in Canadian grasslands.

2003 Grasslands Project Key Site Field Trip

The 2003 Grasslands key site field trip was held during July 18–21 in conjunction with a field meeting of the Alberta Lepidopterists Guild at Dunvegan Provincial Park in Alberta's Peace River Valley. The trip was organized by Margot Hervieux (Grande Prairie, AB) who has been studying Lepidoptera diversity in the region, and by Felix Sperling (University of Alberta). An overview of the locality and the butterfly survey at the site was published in *Arthropods of Canadian Grasslands* 9: 17–18. Although the weather was not particularly cooperative, attendees came from as far away as Denmark, Maryland and Montreal to collect on the isolated dry grassland slopes that surround the park. Several attendees at the field trip also took advantage of collecting opportunities at nearby grassland sites including the Kleskun Hills near Grande Prairie and Hillview Park near Fairview.



Terry Wheeler on grassland slope at Dunvegan
(photo by R. Roughley)

Grasslands Project Web Page

As usual, information on activities relevant to the Grasslands Project is posted on the project web page [www.biology.ualberta.ca/esc.hp/bsc/english/grasslands.htm]. The web page contains the Project Prospectus, information on the objectives of the project, a summary of research projects in grasslands and on-line copies of all issues of the Grasslands Newsletter.



Some of the participants in the 2003 Grasslands Project Key Site Field Trip at Dunvegan (photo by R. Roughley)

Opinion Page

—The Opinion Page is a forum for views and ideas of potential interest to readers—
Contributions should be sent to the editor.

DNA Barcoding: Deus ex Machina

Felix Sperling

Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9;
felix.sperling@ualberta.ca

DNA taxonomy (Tautz et al. 2003) and DNA barcoding (Hebert et al. 2003a) have captured considerable attention during the first half of this year, with feature articles appearing in publications ranging from *The Economist* (4 Jan. 2003) and *Der Spiegel* (21 May 2003) to *Nature* (Blaxter 2003) and *Science* (Pennisi 2003). In a nutshell, the proponents of DNA taxonomy advocate the use of DNA sequences as the central “scaffold of a taxonomic reference system” (Tautz et al. 2003). Hebert et al. (2003a) go further in proposing reliance on a DNA “barcode”, which is the sequence for a 658 base pair fragment of the cytochrome oxidase subunit I (COI) gene of mitochondrial (mt) DNA, as a substitute for species diagnoses by traditional methods. Such barcodes are described as “the sole prospect for a sustainable identification capability” that will allow biologists to cope with the “harsh burden” of the diversity of life.

By themselves, such strong claims would be sure to capture public attention. Hebert has also shown astute media management skills in obtaining coverage from *The Economist* and *Nature* as simultaneous publicity for the appearance of his barcode article. Moreover, it is clear that numerous scientists are taking these claims seriously, whether they agree with their merits or not. In casual discussions with colleagues, any mention of DNA taxonomy soon raises the question: Is traditional morphology-based taxonomy on its way out? At least one geneticist has bet me \$100 that classical taxonomy will wither away. He predicts that, within 15 years, all routine pest and border identifications will

be done using DNA, and morphology-based investigations will be relegated to structure/function studies and accessory documentation of new species. Others among my colleagues worry that a rapid increase in funding for DNA taxonomy will inevitably be at the expense of traditional taxonomy. They fear that once classical taxonomists have been used to provide names for a specimen or two of the currently available species, further funding for their line of work will dry up. However, I think we have confused biological, practical, and sociological issues in a haze of hype and apprehension.

At the biological level, we need to ask whether DNA barcodes really work to identify species? The answer is a clear yes – in all except the kinds of identifications that matter most, which is the level of closely related sister species that cannot readily be distinguished by traditional morphological characters. As Hebert et al. (2003b) conclude in a follow-up study, in which they survey GenBank and compile COI divergences among congeneric species across 11 animal phyla, even the least informative DNA barcodes (in the Cnidaria) allow identification to the genus level and above. However, neither the local faunal sample of moths used in their first paper (2003a) nor the more general GenBank survey (2003b) constitute a rigorous test of the effectiveness of COI DNA barcodes for species identifications. That is because the most closely related species tend not to have overlapping ranges, and hence surveys from a geographically limited area will only rarely include the most recently diverged pairs. Also sequences represented in GenBank

are biased toward the more distinct species within a genus. Based on a series of projects in my lab over the last decade, in which we have used COI sequences to document divergences between closely related species in five insect orders, I would estimate that up to a quarter of species will prove resistant to easy characterisation using DNA barcodes.

There are several reasons for an artificially dispersed distribution of congeneric sequences in GenBank. First, many sequences have not been deposited in GenBank if they are very similar to other haplotypes. Instead, this kind of minor variation is usually documented in the form of a condensed table in the paper publication (e.g. Sperling et al. 1995). Such cases will be missed by later data mining of GenBank. Second, there has been relatively little documentation of geographic variation in mtDNA sequence within species. In fact, those cases that have been studied show that that species frequently contain polymorphic haplotypes with deep divergences that predate species divergences (e.g. Sperling and Hickey 1994; Nice et al. 2002; Wahlberg et al. 2003). Thus many species cannot be characterised by either monophyletic mtDNA clades or distinct phenetic clusters based on percent sequence divergences, and the effectiveness of DNA barcodes for species identification is not properly tested by sequencing two or three specimens from the same location, as in Hebert et al. (2003a). Third, although studies where variations in mtDNA sequence confirm prior species designations have been easy to publish, it has become increasingly more difficult to publish studies that don't confirm such preconceptions. In such cases, reviewers increasingly expect that other (presumably nuclear) gene sequences should be compared to mtDNA, and in the process they betray their assumption that morphological characters are by themselves not worthy of comparison with DNA. The problem is that, after mtDNA has been characterized, it is much harder to find nuclear genes that provide informative sequences at the level of closely related species. The genes commonly

used in phylogenetic work, wingless and elongation factor 1a, and even non-coding internal transcribed spacer (ITS) sequences, are simply too slow-evolving to be very informative. Also random amplified polymorphic DNAs are unreliable, and allozymes require completely different equipment and skills. So we have a substantial backlog of unpublished studies in which polymorphic mitochondrial DNA is not providing the simple picture portrayed by Hebert et al.'s (2003b) GenBank survey, where "the clear delineation of most congeneric species pairs indicates a surprising ferocity of lineage pruning".

Of course, an alternative solution might be to define species primarily on the basis of DNA barcodes, perhaps using the 3% divergence rule advocated by Hebert et al. (2003a). However that would only conceal incongruent character distributions without solving the underlying biological problems. Close sister species are usually the most important ones to identify correctly, whether they are pests, disease vectors, or ecological indicators. There can be little doubt that DNA sequences, in conjunction with morphology, are a rich source of characters for identification and classification of species. However it will take sampling across the full range of each species to establish the credibility of DNA barcodes, one species at a time, and assumptions about ferocious lineage pruning are no substitute for such legwork. At least, however, Hebert et al.'s claims have provided new incentive to publish complex results, and I predict a surge in studies that show that many mtDNA-based delineations of species are not as simple as hoped.

In addition to biological issues that challenge the value of DNA barcodes, insufficient attention has been paid to several practical problems raised by reliance on DNA-based identifications. I have participated in the progress of various DNA sequencing methods over the last two decades, and although the advances are inspiring, we are a long, long way from having a tool that will work with the rapidity of the "tricorder" depicted in Star Trek

shows. Regular species identifications using DNA are practical now for some economically important taxa, just as they are in the identification of criminals. A portable device, perhaps using DNA chips, that will give sequence in an hour or so and only require a few minutes of direct interaction by the user, might be widely available within this decade. It would be realistic to use this device in circumstances where taxonomists now do dissections of genitalia. But such a device would have to be orders of magnitude faster and more flexible than current technology for it to compete effectively with a trained entomologist who knows insects by eye and can identify them in seconds, as is currently expected for extension entomologists for most insect pests in a given geographic area. I'm sure that we won't have a practical device that will rival the efficiency of such people for many decades.

In fact, voucher specimens and sight-based identifications will remain necessary far into the distant future. GenBank is already rife with errors (Harris 2003), with more than half of all published human mtDNA studies containing sequencing mistakes. Problems with switched or contaminated samples are likely to be even worse for insects. Current hand-held calculators provide an insightful comparison, in that they allow calculations that are much faster than by other means, but their results need to be constantly checked with mental math to save embarrassments due to errors in data entry. I am firmly convinced that quick (if rough) identification by eye will always remain crucial to weeding out the most egregious mistakes due to misuse of technology like DNA barcodes. It would be a serious loss if unrealistic expectations about the accuracy and efficiency of DNA barcodes were to diminish training in traditional insect classification.

Finally, I think it is important to consider DNA barcoding at a sociological level, in order to understand why this issue has so effectively captured the public imagination. If biological and practical criteria were the sole grounds on which the value of DNA-based identifica-

tion was being judged, I would expect that it would develop gradually but unremarkably as a valued component of normal taxonomic identifications and delineations. Other technologies, such as scanning electron microscopy, have allowed access to rich new series of characters across a great range of taxa, and have been absorbed without controversy into the repertoire of working taxonomists. The basic idea of rapid, automated identification based on COI sequences has been around for many years. The opportunities for using "universal" polymerase chain reaction primers to amplify mtDNA from a vast array of taxa were already obvious in more than one lab in the late 1980's, including the Wilson lab at Berkeley (Kocher et al. 1989), and the Harrison lab at Cornell, where fellow graduate students and I embarked on sequencing COI across a large variety of insects. Later, as a postdoc in the Hickey lab at the University of Ottawa in the early 1990's, we speculated on how long it would be before our automated sequencer could be efficiently attached to a miniaturized DNA extractor at one end, and a voice synthesizer at the other end, to give a functional tricorder. It seemed only a few years away, and now more than a decade later we are incrementally closer, with no obvious breakthroughs except that people are talking about it more. Even the idea of sequencing a limited, standard set of genes (including COI) across half of the known biodiversity of the planet (the insects) is not new. My postdocs and I published a review paper structured around this idea three years ago (Caterino et al. 2000), which Hebert et al. (2003a) neglected to cite. But none of us took the final step that was required to make DNA-based identification using a standard gene region into the hot issue of the year – it needed energetic and adept marketing.

Hebert has shown real insight into what DNA taxonomy represents to popular culture. By coining the term DNA barcodes, he has given DNA-based identification an immediacy, practicality, and comprehensibility that anyone can relate to. By encouraging comparisons with Star Trek tricorders he has unleashed memories

of optimism about the beneficial power of technology, deus ex machina (god from a machine), beneath the accumulated cynicism of the last decades. And by explicitly invoking the “harsh burden” of the diversity of life, rather than Darwin’s more uplifting sense of “grandeur in this view of life”, Hebert has bluntly reminded us of our daily struggle to come to grips with relentlessly expanding amounts of information and complexity. Like Martha Stewart, J.K. Rowling, and Oprah Winfrey, Hebert has identified and capitalized on a latent yearning for something that is missing from our daily lives: DNA barcodes hold out the promise of a simplifying elegance that is both broad and deep, and tames the confusion of life.

Too bad it won’t be able to deliver the goods.

References

- Blaxter, M. 2003. Counting angels with DNA. *Nature* 421: 122-124.
- Caterino, M.S., S. Cho, and F.A.H. Sperling. 2000. The current state of insect molecular systematics: a thriving Tower of Babel. *Annual Review of Entomology* 45: 1–54.
- Harris, D.J. 2003. Can you bank on GenBank? *Trends in Ecology and Evolution* 18: 317–319.
- Hebert, P.D.N., A. Cywinska, S.L. Ball, and J.R. deWaard. 2003a. Biological identifications through DNA barcodes. *Proceedings of the Royal Society of London B* 270: 313–322.
- Hebert, P.D.N., S. Ratnasingham, and J. deWaard. 2003b. Barcoding animal life: cytochrome c oxidase subunit 1 divergences among closely related species. *Proceedings of the Royal Society of London B (Supplement)*: online 15.05.03
- Kocher, T.D., W.K. Thomas, A. Meyer, S.V. Edwards, S. Paabo, F.X. Villablanca, and A.C. Wilson. 1989. Dynamics of mitochondrial DNA evolution in animals: amplification and sequencing with conserved primers. *Proceedings of the National Academy of Sciences of the United States of America* 86: 6196-6200.
- Nice, C.C., J.A. Fordyce, A.M. Shapiro, and R. Ffrench-Constant. 2002. Lack of evidence for reproductive isolation among ecologically specialised lycaenid butterflies. *Ecological Entomology* 27: 702–712.
- Pennisi, E. 2003. Modernizing the tree of life. *Science* 300: 1692–1697.
- Sperling, F.A.H. and D.A. Hickey. 1994. Mitochondrial DNA sequence variation in the spruce budworm species complex (*Choristoneura*: Lepidoptera). *Molecular Biology and Evolution* 11: 656–665.
- Sperling, F.A.H., J.-F. Landry and D.A. Hickey. 1995. DNA-based identification of introduced ermine moth species in North America (Lepidoptera: Yponomeutidae). *Annals of the Entomological Society of America* 88: 155–162.
- Tautz, D., P. Arctander, A. Minelli, R.H. Thomas, and A.P. Vogler. 2003. A plea for DNA taxonomy. *Trends in Ecology and Evolution* 18: 70–74.
- Wahlberg, N., R. Oliveira, and J.A. Scott. 2003. Phylogenetic relationships of *Phyciodes* butterfly species (Lepidoptera: Nymphalidae): complex mtDNA variation and species delimitations. *Systematic Entomology* 28: 257–273.

Review of scientific priorities 2003

The scientific projects of the Biological Survey are selected on the basis of their scientific value, and also on the feasibility of doing them, given the necessary resources especially of expertise. At its meeting of April 2003, the Scientific Committee reviewed all Survey projects to confirm which ones should remain fully active, to review other categories of projects and to suggest any changed priorities.

Current projects

The following projects were confirmed as the active current ones:

Arthropod fauna of Canadian grasslands, remaining as the Survey’s major current project.

Illustrated keys to the families of arthropods in Canada

Insects of the arctic. The ‘Insects of Keewatin and Mackenzie’ project continues under this title, combining a former project on arctic invertebrate biology.

Insect fauna of Newfoundland and Labrador, undergoing development.

Forest insects. The content of current and other potential projects on forests, including boreal fauna, ancient forests and saprophagous fauna are being considered by a subcommittee.

Modes of seasonal adaptation in the insects

Other current initiatives

Other major Survey interests, some of them being evaluated for development as full scientific projects are as follows:

Invasions and reductions

Endangered species

Faunal analysis

Arthropods and fire

Naturalists publications

Survey website

Survey publicity

General interests

Three general topics that have been the subject of several Survey briefs over the years were retained and one was added:

Collections and collections policies (including voucher specimens, etc.)

Systematics and entomology

Study of biodiversity

Databasing

Monitoring of ongoing interests

A large number of topics remain of interest but are not the focus of specific current activities, including some topics, such as soil faunas, recently transferred from Other current initiatives:

Arthropod fauna of Canadian soils

Arthropod fauna of aquatic habitats

Arthropods of Les Îles de la Madeleine

Arthropod ectoparasites of vertebrates (including biting flies)

Small regional projects

Agroecosystems

Other past projects and initiatives

Many other past projects or major components of projects have been completed:

Spatial and temporal changes in the Canadian insect fauna

Arctic arthropods review

Arctic invertebrate biology

Arthropods from glacial refugia in Canada

Arthropods of the Yukon

Environmental appraisal

Aquatic insects of freshwater wetlands in Canada

Arthropods of Canadian peatlands

Arthropod fauna of freshwater springs in Canada

Origins of the North American fauna

Ecological review of insect dormancy

Insects of Canada

Funding for biodiversity projects

Damaged ecosystems

Other potential projects

Finally, many other projects have been considered over the years but priorities or resources have been placed elsewhere.

Biological Survey of Canada (Terrestrial Arthropods): Taking stock after 25 years

At its meeting of April 2003, the Scientific Committee undertook a wide review of the Survey's activities. This summary outlines

the nature and status of the Survey and also incorporates changes and ideas resulting from the review.

Introduction

The Biological Survey of Canada (Terrestrial Arthropods) helps to coordinate scientific research among specialists on the Canadian fauna of insects, mites, and their relatives. To do so it synthesizes knowledge and ideas, focuses available expertise on to topics that are particularly significant, and acts as a clearing-house for information. It thereby serves as a catalyst for more efficient scientific progress and provides national direction for work on Canada's insect fauna. This organization is productive and well recognized nationally and internationally in the scientific community.

Organization

The day-to-day work of the Survey is done by a small Secretariat based in Ottawa, supported by the Canadian Museum of Nature (CMN). Broader consultation is done through an advisory Scientific Committee, established by the Entomological Society of Canada (ESC), and by regular contacts with the scientific community.

Activities

The Survey organization establishes priorities and produces synthetic scientific works and briefs and other commentaries on subjects of particular faunal interest. Research on the fauna is done chiefly by cooperating scientists who bring their interests into projects of a scope and scale that would not be possible without the catalysis, organization, coordination, and planning that the Survey provides for fieldwork, publication and other needs. The Survey also produces newsletters, a web site and other vehicles to assist coordination.

History

The Biological Survey was started in 1977 as a Pilot Study (through an unsolicited proposal to the Department of Supply and Services) by the Entomological Society of Canada. After a series of contracts – including one primarily for production of a book about the insects of the arctic – the Survey was established in 1980 at the Museum (at that time called the National

Museum of Natural Sciences) under a continuing partnership with the ESC.

Scientific Committee membership

The Committee comprises 15 individual members appointed by the ESC, the President (or delegate) and one other representative of the CMN, the Director (or delegate) and one other representative of the CNC-AAFC organization [the home of the Canadian National Collection of Insects and Arachnids at Agriculture and Agri-food Canada, currently named the Eastern Cereal and Oilseed Research Centre (ECORC)], and the President of the ESC (or delegate).

Individual members: The Survey tries to balance representation from different parts of the country, different institutions and organizations (e.g. governments, universities), different interests in systematic and faunistic entomology, potential interest and involvement in Survey priorities especially the current scientific projects, and the need for some turnover of members. Membership is constrained by the availability of potential members with these characteristics. Members of the Committee serve for one or more three-year terms. On average about half of the members whose terms end in a given year are replaced. The possibility of including postdoctoral fellows, with interest in one of the Survey's projects, as members is being considered.

Government representatives: The Survey welcomes and encourages input from other government agencies, in an attempt to learn about issues of concern and to disseminate information about the Survey's work. Efforts are being made to provide representatives with a clearer statement of what benefit they might reap by attending meetings of the Committee, including the relevance of the Committee's expertise and work.

Scientific Committee meetings

Survey meetings are normally held in Ottawa twice per year (April and October). Consideration is being given to holding meet-

ings in association with the annual meeting of the ESC, to try to favour attendance in the fall when some members have difficulty attending two separate meetings. To test this option, the 2003 meeting will be held in Kelowna after the ESC/ESBC meeting there.

Secretariat

The Secretariat is responsible for general operation of the Survey in addition to any general CMN responsibilities. The Secretariat obtains information about personnel, monitors activity in the scientific community, and acts as liaison with individual scientists and government contacts. It publishes newsletters (e.g. BSC and Grasslands), briefs, leaflets and other documents, acts as editor for these and some other Survey publications, maintains a content-rich web page, and contributes reports to the ESC Bulletin. Meeting displays have also been prepared from time to time. The Secretariat is responsible for the organization of Scientific Committee meetings and necessary preparations and follow-up, and assists the chair with other matters. The head of the secretariat travels widely to discuss and promote the Survey and its projects, giving lectures or seminars at many of the institutions visited.

In addition, it is important that the head of the secretariat have scientific credibility in order to hold effective discussions with the scientific community, to catalyze scientific projects, and to prepare lectures of potential interest. Consequently a research scientist heads the Survey, rather than a policy specialist or coordinator. Therefore, in addition to general Survey tasks, the head of the Secretariat conducts research of international standard (especially in the synthesis of information) and undertakes other professional activities (refereeing papers, etc.).

The original recommendations for the Survey called for a second Secretariat biologist to spread out this work load, but the recommendation was never followed, chiefly for financial reasons.

Relationship with the Entomological Society of Canada

The ESC, which initiated the Survey through an unsolicited proposal in the 1970s, continues to support the Survey and remains involved in several ways. The Society appoints the individual members of the Scientific Committee (a committee of the society) through the President, following recommendations made by the Chair, and processes claims and invoices for meetings of the Scientific Committee (under an annual contract with the CMN overseen by the ESC Treasurer and administered by the ESC administrative assistant). The President of the Society (or delegate) is a member of the Committee. The President submits the Survey's Annual Report (prepared by the Secretariat and approved by the Committee) to the CMN.

The ESC acts as sales agent for those Survey publications produced through the Biological Survey Foundation for which a fee is charged, a role administered by the ESC's administrative assistant. The Survey submits a brief report of highlights twice yearly, to the ESC Executive and Board. A report about the Survey's work (prepared by the Secretariat) appears twice yearly in the ESC Bulletin. The Survey's web site was part of the ESC web site until 2002. It is now represented by a link on that site. The Survey is also considering the possibility of an ESC award sponsored by the Survey. The Survey's relationship with the ESC therefore is very important.

Biological Survey Foundation

The Biological Survey Foundation exists to help develop and fund selected publications of the Biological Survey and to ensure that they become widely available. The Foundation was registered in 1988 as a charitable organization by Revenue Canada (now Canada Customs and Revenue Agency), and from time to time solicits donations for certain proposed publications. Publications are also funded by sales of previous publications, interest earned on investments built up through earlier activities, and publication fees such as page charges.

The Foundation publishes items relevant to the fauna of Canada – and typically associated directly with Survey projects – in three series: a Monograph Series of major works (e.g. Insect Dormancy, Insects of the Yukon); a Taxonomic Series (keys to families of terrestrial arthropods in Canada); and a Document Series of miscellaneous publications (certain briefs, bibliographies, etc.).

Members of the Foundation are the members of the Scientific Committee for the Biological Survey, and the organization is administered by 5 Directors drawn from the membership.

Survey projects and priorities

A typical individual scientific project is organized by a subcommittee (led by a chair), appointed by the Committee. Other topics may chiefly be treated by particular individuals. Subcommittee roles include explicit promotion of projects in the scientific community. Choice of projects is based on decisions by the Scientific Committee about key priorities among potential subjects, especially on the basis of a periodic review. Decisions are based chiefly on scientific relevance, focus and feasibility. A full project review takes place relatively infrequently (every 6 years), reflecting the fact that rapid changes are not feasible or desirable, given the relatively limited resources of personnel and funding available for the work.

Funding

Support for the core operations of the Survey, including the Secretariat and the Scientific Committee, is provided by the CMN. This funding is assigned annually by the Museum as part of its work-planning process. It is used, for example, to run the Secretariat office, pay expenses for the Scientific Committee (through the annual contract with the ESC), support Secretariat travel, and produce newsletters and briefs.

The scientific research done for Survey projects is funded chiefly through specific funding obtained by co-operating individu-

als for their own work, from various sources. However, smaller sets of funding or sponsorships are handled through the Biological Survey Foundation, which can also act as a source of seed funding especially for publications. Large-scale funding for a particular Survey project (e.g. from a Foundation) has sometimes been sought, but with little success.

The Pilot Study recommended that a pool of funds be available for support of students undertaking specific projects to move forward Survey priorities (and it would also allow dedicated “Survey” postdoctoral fellows to be established, who could rapidly move specific projects forward), but this pool of funds was never made available. Moreover, given the way activities in the CMN are funded from year to year, it is unlikely that this could be achieved by internal rearrangement of funds assigned to the Survey.

The Survey has regularly considered funding, but has concluded that existing avenues (from co-operating individuals, Biological Survey Foundation) are the preferred ones. It has continued to reject such methods as tailoring projects to facilitate funding at the expense of content relevant to characterizing the fauna, or establishing a continuing subcommittee to seek funding and develop Survey applications on behalf of a group of cooperators.

General strengths of the Survey

Strong points among the activities of the Survey that are widely appreciated in enhancing coordination, communication and visibility include:

- Major scientific projects and reviews
- Wide regional representation on the Scientific Committee
- Sponsorship of symposia and workshops at entomological society meetings
- National annual Secretariat tours of entomological centres, including seminars and connections with students as well as established entomologists

- The BSC Newsletter, in paper and web forms, including detailed reports of Survey activities

Productivity

Over the 22-year period since its early contract-supported stages, in the scientific arena the BSC has produced 13 major books (averaging 312 pp. each, and many containing multiple refereed chapters) and 53 additional papers as well as 15 briefs, and has contributed to or stimulated many other papers not so directly produced by the Survey. In a more general context, over this same period the BSC published 61 newsletters (averaging 77 pp. per year), convened 11 workshops, and prepared numerous reports and letters to officials. An extensive web site was developed recently, and currently contains about 1½ million words, including scientific and other documents. Effort has increased recently for the web site and for newsletters, partly associated with a current major project on grasslands. The quality of publications and similar outputs is high as confirmed by reviews and other commentaries.

The output of major publications fluctuates from year to year because Survey projects characteristically produce large publications at infrequent intervals in addition to the ongoing production of smaller documents. The completion and the aftermath of major books (1981, 1986–87, and 1993–94) suppressed some other activity. The book *Insects of the Yukon* (1997: 1034 pp.) was especially disruptive.

Impact

The Survey has had great influence on the direction and quality of Canadian entomology. The Survey identifies gaps in knowledge at a national level and its projects draw in participants, thereby attaining a scope that would not be possible otherwise. The Survey's interests are integrated nationally with those of the ESC. Synthetic publications underpin future work and are widely cited. Numerous graduate students have been steered towards Survey projects and carry on these interests later. The Survey's briefs are widely used and influence

the way that research is done. Survey briefs are also used by wider audiences, such as managers or biologists charged with local biodiversity assessments, and its web site has a very wide reach, extending well beyond entomologists.

Efficiency

The Survey is efficient because it relies on a small Secretariat, steered by wider disciplinary expertise, to catalyze and coordinate major projects. Therefore, it does not require large new infrastructures or staffing.

Broader context

It was concluded by the Pilot Study, and recently confirmed by the Scientific Committee, that the CMN is the logical home of the Survey because the CMN alone has the mandate for the acquisition and dissemination of knowledge on the Canadian biota (unlike "mission-orientated" departments). The CMN has continued to support the Secretariat despite a long period of fiscal constraint. Even so, it has not been able to expand it beyond the core operation, with another secretariat entomologist (as recommended by the Pilot Study) nor modules for further taxa.

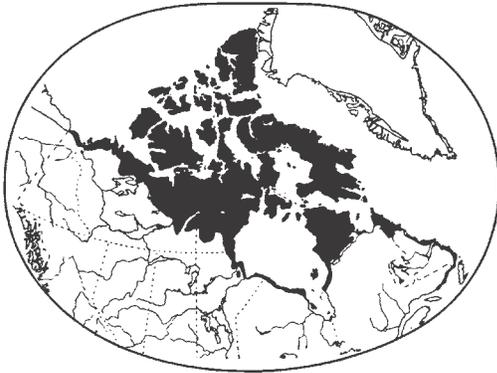
The Survey is efficient and has a high level of scientific productivity because it is a bottom-up, individually driven entity that focusses the efforts of individual scientists, coordinating that work with a very small central organization. The ground-level work on faunas undertaken by the BSC differs from the top-down "strategic" initiatives favoured by most other organizations that have developed recently under the general umbrella of biodiversity. The Survey continues to favour the approach of generating and analysing data about the fauna rather than, for example, simply collating existing data through internet platforms.

The Quiz Page

—test your knowledge of Canada and its fauna—

1. Name five rivers longer than a thousand kilometres that are entirely or almost entirely within Canada. Also name two rivers longer than a thousand kilometres that originate in Canada but have their outflow in the United States.
2. What is the significance of the Canadian hamlet of Taloyoak?
3. Name five Canadian insect species with life cycles that normally last for more than one year.
4. Name 3 families of Coleoptera for which more than 100 species have been reported from the Yukon Territory alone.
5. Concentration corner
145,000 adults of one common univoltine species of chironomid emerge in spring from a small shallow eutrophic pond. 50% of the females deposit their first batch of 500 eggs in the same pond, 80% of which hatch, but 99% of the resulting larvae do not survive to adulthood. How many chironomids emerge from the pond the next season?

[Answers on p. 79]



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).

Fourth arctic field trip

The fourth installment of the Survey's Insects of the Arctic project (formerly 'Insects of Keewatin and Mackenzie') took place July 8 to 22, 2003 in the form of a collecting trip to the western Hudson Bay region (Arviat, Rankin Inlet and Baker Lake) by Doug Currie, Donna Giberson and Peter Adler. Unlike previous trips where travel was primarily by canoe, a variety of means was used to access prospective collecting sites including trucks, all-terrain-vehicles, motorboat, and foot. Inuit guides were hired in Arviat and Baker Lake for guidance to remote collecting sites.

Dr. Currie and Dr. Adler made a total of 48 simuliid collections while Dr. Giberson made a

similar number of collections of aquatic insects – primarily mayflies, stoneflies, caddisflies, and predaceous diving beetles. The researchers' preliminary impression is that the faunal assemblage in the 3 communities matches closely that encountered along the Thelon River in 2002.

For other reports on this project see the article on page 61, and Project Update: Insects of Keewatin and Mackenzie, Vol 22(1): 12–13; Insect biodiversity in the Thelon Wildlife Sanctuary, Vol 21(2): 59–64; Insects of Keewatin and Mackenzie, Vol 19(2): 48–51 and Update on a survey of the black flies (Diptera: Simuliidae) from the Northwest Territories and Nunavut Project. *Arctic Insect News* 11: 6–9.

Alaska Insect Survey Project

The Spring 2002 issue of this newsletter reported on a proposal for an Alaska Insect Survey Project. Unfortunately, sufficient funding did not materialize to support the project. Moreover, the University of Alaska will not be hiring a systematic entomologist in the near future and the University of Alaska Museum is unable to support a curator of entomology. Nevertheless, Dr. Kruse and other unpaid Research Associates remain active in the survey, and are planning some publications in the future.

Arctic Entomology Course

Another generation of arctic entomologists attended a course in arctic and boreal entomology at the Churchill Northern Studies Centre from August 9–24, 2003. The general scope of the course included interactions of the northern entomofauna with biotic and abiotic elements, behavioural adaptations of the northern entomofauna and effects of disturbances. Instructors were Dr. Peter Kevan and Dr. Rob Roughley. A more detailed account will appear in the Spring issue of this newsletter.



Update on the survey of aquatic insects from Keewatin and Mackenzie project: The predaceous water beetles (Coleoptera: Adephaga: Dytiscidae and Gyrinidae).

Donna J. Giberson

Department of Biology, University of Prince Edward Island, 550 University Ave., Charlottetown, PE C1A 4P3 dgiberson@upei.ca

Helena V. Shaverdo

Institute of Zoology of the National Academy of Sciences of Belarus, Akademicheskaya Str., 27, 220072 Minsk, Belarus shaverdo@mail.ru

Introduction

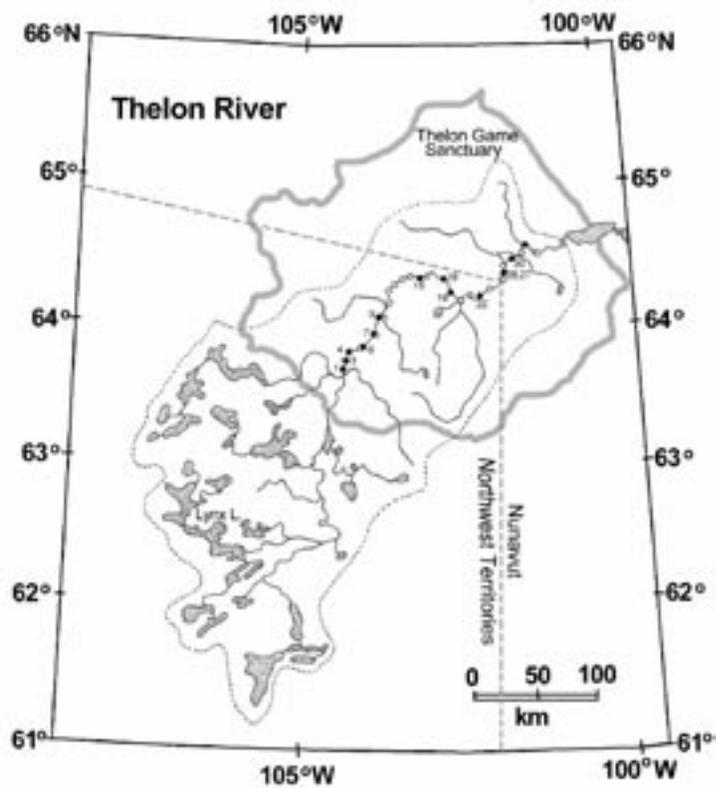
The *Insects of Keewatin and Mackenzie Project* was initiated in 2000 to focus attention on the poorly surveyed part of the arctic zone of the Canadian mainland. The goal of the project was to document insect diversity in and near major rivers in the region between the Mackenzie and Hudson Bay, and the project was considered to be a natural extension of the Survey's Insects of the Yukon initiative (see Danks and Downes 1997). The project has so far consisted of a three collecting expeditions. In the summer of 2000, Survey Scientific Committee members Doug Currie (Royal Ontario Museum) and Donna Giberson (University of Prince Edward Island) were joined by Peter Adler (Clemson University, North Carolina), Brian Brown (Natural History Museum of Los Angeles), and Malcolm Butler (North Dakota State University) on a collecting trip down the Horton River. Team members flew into Horton Lake (see map), paddled 30 – 40 km each day, setting up in a new location nearly every night, and collecting aquatic and terrestrial insects along the river corridor (Currie et al. 2000). In the summer of 2001, Doug Currie and Peter Adler traveled north from Edmonton to Yellowknife and collected black flies from streams along roads in southern NWT. Then in the summer of 2002, we assembled a team for another river trip, this time to the Thelon River (NWT and NU; Currie et al. 2002). Donna Giberson, Doug Currie, and Peter Adler were joined

for this trip by two new team members, MSc students Lisa Purcell (University of Prince Edward Island) and Amanda Roe (University of Alberta) (Currie et al. 2002). Because of the short collecting periods for each trip, the focus of each survey reflected the interests of the individual participants, but specimens captured from mass collecting methods (e.g. aquatic kick and dip sampling, malaise trapping, sweep netting, beating) have been shared with the general entomological community. Here, we report on the predaceous water beetles (Dytiscidae and Gyrinidae) collected along the Horton and Thelon Rivers.

The Rivers

We selected the Horton River for the first expedition because it was located close to the eastern boundary of Beringia and the relatively well-sampled Mackenzie River valley. In addition, the river flows mainly from south to north, giving us a good latitudinal gradient from 67°30' to 70°00' north latitude. Although the river is usually depicted on maps as being at the edge of the tree line, most of the land around the river had only scattered clumps of stunted spruce, and most of the river flowed through arctic tundra. The Horton River rises to the west of Horton Lake, NWT (see map) and has a drainage basin area of approximately 26,680 km² and a total length of \approx 800 km. Expedition members collected over a \approx 600 km stretch from Horton Lake to the Arctic Ocean. The river was clear and swift-flowing for most of

Maps of the Horton and Thelon River watersheds, showing sampling sites. Closed circles represent sites where predaceous water beetles were found, and open circles represent sampled sites where no beetles were collected.



its length but became muddy and meandering in its lower portion. In the upper reaches, the river was characterized by high pH (> 8.0) and relatively high specific conductance where it flowed over limestone-dominated substrates. In its lower reaches (in the far northern part of the river), the pH of the river declined to near neutral where it flowed through the region known as the Smoking Hills. This region has lignite and magnesium deposits which spontaneously ignite when exposed to air (for example, during bank slumping in summer), resulting in “smoke holes” as smoke pours from places where the coal is burning underground. The water draining these areas is profoundly affected by the geology, so that the tributaries and ponds in this region can be very acidic (some with pH values < 2.5). Thirty-seven sites on or near the river were sampled with a D-frame aquatic net between July 17th and August 8th, 2000, and aquatic invertebrates were picked from the debris on site and preserved in 80% ethanol.

The Thelon River arises near Lynx Lake, to the east of Great Slave Lake (see map). It drains a huge part of the central barrens east of

Great Slave Lake (total area of $\approx 240,000 \text{ km}^2$) and, in contrast to the south-to-north pattern of the Horton River, it flows generally easterly across the main central barrens area. Despite being located several hundred km north of the tree line, a 65 km stretch of the river flows through a dense spruce forest known as the “Thelon Oasis”. Most of the rest of the river flows through open tundra, with a few scattered clumps of spruce dotting the landscape. The river flows $\approx 900 \text{ km}$ from Lynx Lake to Baker Lake (which drains via Chesterfield Inlet to northern Hudson Bay to the east (see map)). The part of the river covered during this survey (i.e. upstream of Beverly Lake, NU) drains an area of $71,470 \text{ km}^2$. Expedition members flew into the junction of the Hanbury and Thelon Rivers and collected along a 325 km stretch of the Thelon located within the bounds of the Thelon Game Sanctuary. Upstream of our sampling area, the river was characterized by large numbers of lakes, waterfalls and rapids, but in the study area, the river meandered over an ancient glacial lake bottom. At this point, the river was wide, slow moving, and dominated by sandy



Paddling on the Horton River past a “smoke hole” in the Smoking Hills

or sand/silt-embedded cobble substrates. Surrounding relief was very low except in a few spots, where low hills, boulders and more rapid flow could be found. The pH and specific conductance of the water in the Thelon River were low, with pH values near 6 and conductivity $\approx 10 \mu\text{S}/\text{cm}$ for all main river sites. The pH and conductivity values of tributaries and tundra ponds, however, were more variable. Sampling was carried out at 34 sites on or near the river between June 29th and July 11th, 2002.

Predaceous water beetle collections

Predaceous water beetles were collected from kick samples and dip samples in the river and pool sites of the two rivers. They were collected from only 5 of the 37 sites along the Horton River (corresponding to sampling sites 8, 11, 14, 18 and 23 of the larger Horton River survey; see map); all located in the section of the river which was clear and relatively swift moving. All beetles were collected from the main branch of the Horton River, since no tundra ponds were sampled in this first survey. Predaceous water beetles were also collected from 15 of the 34 Thelon River sites (corresponding to sites 1, 3, 4, 6, 7, 9, 13, 16, 18, 19, 22, 26, 27, 30, and 32 of the larger Thelon River survey; see map). These represented a variety of habitats, from small and large tributaries to the main branch of the river, and also including tundra ponds near the river.

A total of 61 predaceous water beetle specimens were collected during the two expeditions. We recorded 12 species in 6 genera in the family Dytiscidae, including *Oreodytes* (2 species), *Stictotarsus* (1 species), *Hygrotus* (1 species), *Hydroporus* (3 species), *Agabus* (3 species), *Ilybius* (1 species), and *Rhantus* (1 species). Nine of these are holarctic in distribution, and all have also been collected west of the MacKenzie River. There was one individual of one species of the family Gyrinidae (*Gyrinus*) collected from a tundra pond above the Thelon River. These collections

represent an extension of distributions of four species to the northeast within the Northwest Territories and two species to the northwest in Nunavut. For most of the species, though, our collections have allowed us to fill in some apparent distributional gaps between eastern and western populations (based on records given in Larson et al. 2000). Three species were territorial records; one for NWT and two for NU. One of the species collected, *Oreodytes laevis* (Kirby) made up nearly half of the specimens collected, and was found throughout both river systems. This is a lotic species that is known to inhabit mineral substrates along river and lake margins (Larson et al. 2000). Most of the species, however, were collected quite rarely and were represented by single specimens or found only in a single location. It should be noted that predaceous water beetles were only collected incidentally during sampling for other aquatic insects, and this pattern for different species collected in nearly every site examined suggests that intensive collection of aquatic Adephaga in this region would produce many more species than we found.

References:

- Currie, D.C., D.J. Giberson, and B.V. Brown. 2000. Insects of Keewatin and Mackenzie. Newsletter of the Biological Survey of Canada (Terrestrial Arthropods) 19: 48–51.
- Currie, D.C., D.J. Giberson, and P.H. Adler. 2002. Insect biodiversity in the Thelon Wildlife Sanctuary. Newsletter of the Biological Survey of Canada (Terrestrial Arthropods) 21: 59–64.
- Danks, H.V. and J.A. Downes (Eds.) 1997. Insects of the Yukon. Biological Survey of Canada (Terrestrial Arthropods), Ottawa. 1034pp.
- Larson, D.J., Y. Alarie, and R.E. Roughley. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with emphasis on the fauna of Canada and Alaska. NRC Research Press, Ottawa, Ontario, Canada. 982 pp.





Donna Giberson and Amanda Roe paddling on the Thelon River



Lisa Purcell sampling the Thelon River (at Thelon Site 4)
for benthic invertebrates

Index of Past Articles

Earlier in this issue we reported on a review of the first 25 years of the Biological Survey, so it seems appropriate to look back too at the first 22 years of this newsletter. Below is a list of titles from back issues.

Regularly occurring features such as List of Requests for Material or Information (each Spring issue), The Quiz Page (each issue starting 1988), Quips and Quotes (each issue), Selected Publications (each Fall issue), Selected Future Conferences (each issue starting Fall 1995), and the list of Members of the Scientific Committee (each Fall issue) are not listed.

In 1997 the newsletter was also posted on the Survey's website, where the Fall 1997 and subsequent issues are still available. For information about back issues prior to that please contact the Survey Secretariat.

Vol. 1, No. 1, Spring 1982, 17 pp.

Introduction to the Biological Survey of Canada
A statement from the National Museum of Natural Sciences

News and Notes:

Symposium on the Origins of the North American Fauna
Scientific projects of the Biological Survey
Aquatic insects of freshwater wetlands
Information available
Visits to entomological centres
Northern entomology

Vol. 1, No. 2, Fall 1982, 11 pp.

Development of the Biological Survey

News and Notes:

Survey activities at entomological societies' meeting
Biological Surveys in the U.S.A.
More on northern entomology
Arthropod fauna of the soil
Initiatives by the Entomological Society of Canada
Participation by amateurs
Information available
Project update: Aquatic insects of freshwater wetlands

Studies in the Queen Charlotte Islands
The Fate of the Collections

Vol. 2, No. 1, Spring 1983, 30 pp.

Development of the Biological Survey

News and Notes:

Soil arthropods
Springs project launched
Queen Charlotte Islands
Insect identification
Biological Survey logo
Summary of the meeting of the Scientific Committee for the Biological Survey, Oct. 1982
Project Update: Arthropod fauna of the Yukon
Communication among entomologists
Survey activities at the Entomological Societies Meeting

Vol. 2, No. 2, Fall 1983, 21 pp.

News and Notes:

1984 Soil arthropods conference announced
1984 Wetlands conference announced
Summary of the meeting of the Scientific Committee for the Biological Survey, April 1983
Project Update: Arthropods of Canadian grasslands
Letters to the editor: Yukon fauna, List of requests
Insect identification
Endangered species

Vol. 3, No. 1, 1984, 34 pp.

News and Notes

Forthcoming conferences
Entomologist appointed at Provincial Museum of Alberta
Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1983
Another entomological newsletter
Another northern newsletter
Students of aquatic Coleoptera
Ancient advice
Project update: Aquatic insects of Newfoundland
Letters to the editor: Research in U.S. National Parks
More on insect identification

Vol. 3, No. 2, Fall 1984, 21 pp.*News and Notes:*

- A second Grasslands newsletter
- International Congress of Entomology 1984
- Biological Council of Canada Canadian Congress of Biology, 1985
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1984
- Project update: Arthropod fauna of soils in Canada: A conference on faunal influences on soil structure
- Canadian perspectives: the arctic life-zone
- The Forest Insect and Disease Survey

Vol. 4, No. 1, Spring 1985, 34 pp.*News and Notes:*

- Forthcoming conferences
- Brief on environmental disturbance published
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1984
- Project update: Aquatic insects of freshwater wetlands
- Letter to the editor: arctic expedition reports available
- The XVIIth International Congress of Entomology
- Biological Surveys (abbreviated version of a paper published in proceedings of the XVIIth International Congress of Entomology)

Vol. 4, No. 2, Fall 1985, 21 pp.*News and Notes*

- Grasslands newsletter
- Progress with the United States Biological Survey
- Biological Survey of Canada active at the Biological Council of Canada Congress
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1985
- Project update: Arthropod fauna of freshwater springs
- Handling techniques for soil invertebrates
- Biological Council of Canada Canadian Congress of Biology

Vol. 5, No. 1, Spring 1986, 41 pp.*News and Notes:*

- Soils conference proceedings published
- Scientific projects of the Biological Survey (leaflet published)
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1985
- Biosystematics services in Entomology (an International Advisory Council for Biosystematic Services in Entomology)
- Hymenoptera Workshop Announcement
- New project on the arthropods of Canadian peatlands
- New project on arthropods of the boreal life-zone
- Grassland sites reviewed
- Soil conservation: biological input to the Senate hearings
- Letter to the Editor: Canadian National Collection of Hymenoptera for anatomical studies, Taxonomic problems of another kind

Vol. 5, No. 2, Fall 1986, 17 pp.*News and Notes:*

- Biosystematics Research Centre (new name)
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1986
- Biological Survey Discussions available
- Hymenoptera Workshop 1987
- Project update: Arthropod fauna of the Yukon
- Guidelines for sampling terrestrial arthropods in peatlands
- Canadian perspectives: the family Chironomidae

Vol. 6, No. 1, Spring 1987, 35 pp.*News and Notes:*

- Dormancy book published
- Importance of insects in environmental impact assessment (paper published)
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1986
- International Congress of Entomology 1988
- Carleton University and the goals of the Biological Survey of Canada
- Project update: Arthropods of Canadian grasslands
- Invertebrate biodiversity in north temperate peatlands
- The Entomofauna of Quebec project

Vol. 6, No. 2, Fall 1987, 19 pp.*News and Notes:*

Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1987
 First Quebec entomofauna Bulletin published
 Project update: Arthropods of Canadian peatlands: the Wagner peatland
 Publications contributed to the Biological Survey of Canada
 Canadian perspectives – Insect Dormancy

Vol. 7, No. 1, Spring 1988, 30 pp.*News and Notes:*

Wetlands volume published
 Systematics in support of entomology
 Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1987
 Symposium on grassland insects in Saskatchewan
 Meeting on the Canadian Arctic Islands
 Project update: Family keys
 Quiz page
 Separates available
 Ecological collections and long-term monitoring with respect to the Wagner peatland
 Publications contributed to the Biological Survey of Canada

Vol. 7, No. 2, Fall 1988, 24 pp.*News and Notes:*

Biological Survey Foundation established
 Survey's database modernized
 Insects of Canada booklet available
 Les insectes du Canada : document disponible
 Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1988
 Insect stamps issued
 Project update: Arthropod fauna of Canadian springs
 The XVIIIth International Congress of Entomology
 Publications contributed to the Biological Survey of Canada
 Canadian perspectives: arthropod cold-hardiness

Vol. 8, No. 1, Spring 1989, 38 pp.*News and Notes:*

Family keys published
 Origins of the North American insect fauna (proceedings published)
 Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1988
 Personnel and projects studying the Canadian fauna
 Natural history of Bistcho Lake Region
 Northern field stations
 Association of Systematics Collections to hold workshops on Collection Management and Preservation, and on Education of Systematists
 Project update: Illustrated keys to the families of arthropods in Canada

Vol. 8, No. 2, Fall 1989, 24 pp.*News and Notes:*

Leaflets about the Survey available
 Revised list of entomologists soon available
 Arctic invertebrate biology (brief)
 Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1989
 Project update: Arthropods of the boreal zone
 Entomology and systematics: Workshop on systematics held; Symposium on systematics planned for 1990

Vol. 9, No. 1, Spring 1990, 34 pp.*News and Notes:*

Grasslands Newsletter published
 Freshwater springs: a national heritage (brief published)
 The Outer Shores: a publication on the Queen Charlotte Islands
 Workshops at the 1990 meeting of the Association of Systematics Collections
 Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1989
 Project update: Arthropods of Canadian peatlands
 Logistic support for northern studies
 Canadian perspectives: arthropod habitats in northern regions
 The insect fauna of the Queen Charlotte Islands, British Columbia

Vol. 9, No. 2, Fall 1990, 20 pp.*News and notes:*

- Springs bibliography published
- Notice about newsletter mailings
- Change of name and new trustees for the National Museum
- Change of address for the ESC
- Book on status and needs of systematics of North American Arthropods published
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1990
- Project update: Arthropod fauna of spring habitats
- 1990 Alberta insect survey

Vol. 10, No. 1, Spring 1991, 30 pp.*News and Notes:*

- New Arctic newsletter published
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1990
- Project update: Arctic invertebrate biology
- 1990 Alberta Insect Survey: Results and discussion
- Survey-related activities at the 1990 Entomological Society meetings
- Canadian Biological Information System

Vol. 10, No. 2, 1991, 19 pp.*News and Notes:*

- Memoir on arthropods of springs published
- Brief on arthropod ectoparasites published
- Brief on the Importance of Collections Published
- Leaflet about Survey publications produced
- Survey input at the meeting of the Society for the Preservation of Natural History Collections
- Meeting of the Association of Systematics Collections: Workshop on Biodiversity and Collections
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1991
- Project update: A review of priorities
- The importance of research collections
- Publications contributed to the Biological Survey of Canada

Vol. 11, No. 1, Spring 1992, 24 pp.*News and Notes:*

- Paper on the problems of collections published
- News on arctic insects published
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1991
- A systematics priorities initiative
- 1992 meeting of the Association of Systematics Collections
- Newsletter on Biodiversity
- Progress toward legislation on biodiversity in the United States
- Project update: Results of the review of priorities
- Activities at the 1991 Entomological Societies Meeting
- Resolution concerning study of biodiversity of terrestrial arthropods

Vol. 11, No. 2, Fall 1992, 23 pp.*News and Notes:*

- Arctic insects and environmental change
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1992
- The XIXth International Congress of Entomology
- Project update: Arctic invertebrate biology
- Canadian perspectives: Major zones in Canada
- Publications contributed to the Biological Survey of Canada

Vol. 12, No. 1, Spring 1993, 25 pp.*News and Notes:*

- Activities at the 1992 Entomological Societies Meeting
- Activities at the 1992 meeting of the Entomological Society of Quebec
- Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1992
- Entomological research in National Parks
- Project update: Invasions and reductions
- Initiatives in systematics
- Resolution on biosystematics and biodiversity

Vol. 12, No. 2, Fall 1993, 25 pp.*News and Notes:*

- Memoir on Systematics and Entomology published
- Article on the Survey published

Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1993

Insects of Grasslands National Park, Saskatchewan

Proposals for Expansion of the Biological Survey of Canada

Project update: Seasonal adaptations in insects

Insect fauna of old-growth forests: how many projects are there?

Vol. 13, No. 1, Spring 1994, 29 pp.

News and Notes:

Activities at the 1993 Entomological Societies meeting

Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1993

Guidelines for Institutional Database Policies

Project update: Invasions and reductions in the Canadian insect fauna

Projects in old-growth forests

Biosystematic information in the computer age – databases and catalogs

Vol. 13, No. 2, Fall 1994, 25 pp.

News and Notes:

Brief on biodiversity sampling published

Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1994

RangeMapper 2.0 available

Adult beetle identification workshop May 1995

Project update: Arthropods of old-growth forests

Old-growth forests: arthropods and habitats of the H.J. Andrews Forest

Vol. 14, No. 1, Spring 1995, 29 pp.

News and Notes:

Peatlands memoir published

Activities at the 1994 Entomological Societies meeting

Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1994

Article about endangered species published

Biodiversity sampling brief still available

Guidelines for institutional policies and planning in natural history collections

Alberta Butterflies coming soon

New systematic entomologist at Macdonald campus

Project update: Arthropods of peatlands

An annotated summary of some of the legislation and proposed legislation affecting the collection, possession, or transportation of insects by Canadian entomologists

Vol. 14, No. 2, Fall 1995, 26 pp.

News and Notes:

List of personnel and their interests to be revised

Adult beetle identification workshop

Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1995

Maps available

Selected future conferences and annual meetings (new)

Project update: Arthropod fauna of soils

Vol. 15, No. 1, Spring 1996, 32 pp.

News and Notes:

Survey office has moved

Annotated list of workers in progress

Brief on the advantages of using arthropods in ecosystem management published

Activities at the Entomological Societies' meeting

Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1995

ASC change of address

Project update: Arctic invertebrate biology

Entomological fact

Selected acronyms

Vol. 15, No. 2, Fall 1996, 24 pp.

News and Notes:

Survey office moves again

Annotated list of workers delayed

Brief on how to assess insect biodiversity published

Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1996

Newsletter from Cuba

Cuban invertebrates

Project update: Arthropod fauna of the Yukon

Insect information, mailing lists and newsgroups

Vol. 16, No. 1, 1997, 34 pp.*News and Notes:*

Annotated list of workers published
 Activities at the Entomological Societies' meeting
 Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1996
 ASC 1997 annual meeting
 1997 meeting of the Lepidopterists' Society
 ASC surveys of research systematics collections and individual taxonomic researchers
 Some electronic updates
 Project update: Old-growth forests
 Forest arthropod inventory projects in Canada

Vol. 16, No. 2, Fall 1997, 30 pp.*News and Notes:*

Yukon book to be published this year
 Survey's home page established
 Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, April 1997
 Project update: Insects of the Yukon
 Arthropods of alvar habitats
 Directory of entomological education in Canada
 Profile of entomologists in the Survey's annotated list of workers
 Entomological mapping and gazetteers
 URL's of selected Diptera sites on the World Wide Web

Vol. 17, No. 1, Spring 1998, 32 pp.*News and Notes:*

Activities at the Entomological Societies' meeting
 List of the Lepidoptera of Québec and Labrador published
 Summary of the meeting of the Scientific Committee for the Biological Survey of Canada, October 1997
 Biodiversity and ecosystem functioning
 Species diversity in the mixedwood plains ecozone
 Entomological Society of Canada on the Web
 Project update: Arthropod fauna of soils and the Database of Ecology Research Projects

Vol. 17, No. 2, Fall 1998, 34 pp.*News and Notes:*

Update on the BSC Web page
 Insects of Canada on the web

Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), April 1998
 The Carmanah Canopy Project: Conservation of Arthropod Biodiversity in Coastal Sitka Spruce Forests
 Project update: Arthropods of Canadian grasslands

Vol. 18, No. 1, Spring 1999, 43 pp.*News and Notes:*

Activities at the Entomological Societies' meeting
 Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), October 1998
 EMAN National Meeting
 MacMillan Coastal Biodiversity Workshop (including a component on biodiversity of rainforest arthropods)
 Workshop on biodiversity Monitoring
 Project update: Family Keys
 Canadian spider diversity and systematics

Vol. 18, No. 2, Fall 1999, 25 pp.*News and Notes:*

Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), April 1999
 Biodiversity diversity
 Canadian National Collection of Insects, Arachnids and Nematodes on the Web
 The Northern Forestry Centre Insect Museum: Open for Business
 The Nature Discovery Fund
 Project update: Arthropods of Canadian grasslands
 Challenge Question

Vol. 19, No. 1, Spring 2000, 33 pp.*News and Notes:*

Activities at the Entomological Societies' meeting
 Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), October 1999
 Symposium on biodiversity at the 1999 Annual Meeting of the Entomological Society of Quebec
 Yukon book well received
 Project update: Seasonal adaptations in insects
 Jumping spiders of Canada

Vol. 19, No. 2, Fall 2000, 31 pp.*News and Notes:*

Grasslands conference at 2000 meeting
 Survey website expanding
 Biodiversity brief published
 Spider newsletter published
 New cone and seed insect web site launched
 Nature Discovery Fund makes first award
 Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), April 2000
 Comments on error rates in insect identifications
 Project update: Insects of Keewatin and Mackenzie
 The Website of the Biological Survey of Canada (Terrestrial Arthropods)

Vol. 20, No. 1, Spring 2001, 38 pp.*News and Notes:*

Activities at the Entomological Societies' Meeting
 Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), October 2000
 The Canadian Biodiversity Network Conference
 Biological Survey website update
 Web watch: The E.H. Strickland Entomological Museum
 Project update: Arthropods of Canadian grasslands
Arctic corner:
 Arctic insects, global warming and the ITEX program

Vol. 20, No. 2, Fall 2001, 31 pp.*News and Notes:*

Brief on label data standards published
 Field trip to the Onefour grasslands
 Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), April 2001
 Survey office disruption
 Second spider newsletter published
 Canadian Biodiversity Network
 Project update: Arthropod fauna of soils 2001
Arctic corner:
 University of the Arctic launched
 Recent Canadian publications

Vol. 21, No. 1, Spring 2002, 39 pp.*News and Notes:*

Activities at the Entomological Societies' meeting
 Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), October 2001
 Biological Survey website update
 The Alberta Lepidopterists' Guild
 Project update: Arthropods of Canadian grasslands
 Canadian perspectives: The study of insect dormancies and life cycles
 Virtual Museum of the Strickland Museum of Entomology
Arctic Corner:
 The Alaska Insect Survey Project
 European Workshop of Invertebrate Eco-physiology 2001

Vol. 21, No. 2, Fall 2002, 37 pp.*News and Notes:*

Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), April 2002
 Grasslands project active
 Nature Discovery Fund: Call for applications for 2003
 Project update: Seasonal adaptations in insects
 Web Site Notes
 The University of Guelph Insect Collection
Arctic corner:
 Insect biodiversity in the Thelon Wildlife Sanctuary
 Canadian research in arctic entomology is out in the cold

Vol. 22, No. 1, Spring 2003, 36 pp.*News and Notes:*

Spread your word
 Label data brief translated
 Biodiversity research website
 Benthic invertebrate monitoring
 Activities at the Entomological Societies' meeting
 Summary of a meeting of the Scientific Committee for the Biological Survey of Canada (Terrestrial Arthropods), October 2002
 Project update: Insects of Keewatin and Mackenzie
 Web Site Notes

Opinion Page: The real costs of insect identification

Database of people interested in terrestrial arthropods updated

Arctic Corner:

Arctic research notes

Funding for arctic studies

Vol. 22, No. 2, Fall 2003, 46 pp.

News and Notes:

Brief on the role of voucher specimens published

Newsletter distribution goes electronic

Second grasslands field trip

Summary of a meeting of the Scientific Committee for the Biological Survey of Canada, April 2003

Arthropod Species Specialist Subcommittee for COSEWIC

Guide to the identification of the spiders of Quebec published

Federal Biodiversity Information Partnership (FBIP) established

Lessons from threatened cuts at the University of Nebraska Museums

Project update: Arthropods of Canadian grasslands

Opinion page: DNA Barcoding: Deus ex Machina

Review of scientific priorities 2003

Biological Survey of Canada (Terrestrial Arthropods): Taking stock after 25 years

Arctic Corner:

Fourth arctic field trip

Alaska Insect Survey Project

Arctic entomology course

Update on the survey of aquatic insects from Keewatin and Mackenzie project: The predaceous water beetles (Coleoptera: Adepaga: Dytiscidae and Gyrinidae)

Selected publications associated with the Biological Survey

The biodiversity crisis, a national initiative: the Biological Survey of Canada (Terrestrial Arthropods)

1993. H.V. Danks. Association of Systematics Collections Newsletter 21(2): 17–23.

Systematics and entomology: diversity, distribution, adaptation and application

1993. G.E. Ball and H.V. Danks (Eds.). Mem. ent. Soc. Can. 165. 272 pp.

\$25 (includes shipping) from Entomological Society of Canada*

Environmental lip-synching in Canada

1993. G.E. Ball. Alternatives 20(1): 21.

Seasonal adaptations in insects from the high arctic

1993. H.V. Danks. pp. 54–66 in M. Takeda and S. Tanaka (Eds.), [Seasonal adaptation and diapause in insects]. Bunichi-Sogo Publ., Ltd., Tokyo. (In Japanese).

Copies of English version available on request from author

- | | | |
|---|---|--|
| La diversité des espèces d'insectes du Québec, vues dans une perspective nord-américaine | 1994. H.V. Danks. Revue d'entomologie du Québec 37 [1992]: 46–51. | Tirés-à-part disponibles sur demande. |
| Regional diversity of insects in North America | 1994. H.V. Danks. American Entomologist 40(1): 50–55. | Reprints available on request from author |
| Terrestrial arthropod biodiversity: planning a study and recommended sampling techniques. A brief | 1994. S.A. Marshall, R.S. Anderson, R.E. Roughley, V. Behan-Pelletier and H.V. Danks. Bull. ent. Soc. Can. 26(1), Suppl. 33 pp. | Copies available on request from the Survey;
full text at http://www.biology.ualberta.ca/esc.hp/bsc/briefs/brterrestrial.htm |
| Terrestrial arthropods of peatlands, with particular reference to Canada | 1994. A.T. Finnamore and S.A. Marshall (Eds.). Mem. ent. Soc. Can. 169. 289 pp. | \$32 (includes shipping) from Entomological Society of Canada* |
| Insect Life-cycle Polymorphism: Theory, Evolution and Ecological Consequences for Seasonality and Diapause Control | 1994. H.V. Danks (Ed.). Series Entomologica 52. Kluwer Academic Publishers, Dordrecht, Netherlands. 376 pp. | \$195 U.S. Available from Kluwer Academic Publ. Group, P.O. Box 358, Accord Station, Hingham, MS 02018-0358 |
| Insect cold-hardiness: insights from the Arctic. | 1994. H.V. Danks, O. Kukal and R.A. Ring. Arctic 47(4): 391–404. | Reprints available on request from author |
| Regional diversity of insects in the Pacific Northwest | 1995. H.V. Danks. J. ent. Soc. Br. Columb. 92: 57–71. | Reprints available on request from author |
| The advantages of using arthropods in ecosystem management. A brief from the Biological Survey of Canada (Terrestrial Arthropods) | 1996. A.T. Finnamore. 11 pp. | Limited number of copies available upon request from the Survey; full text at: http://www.biology.ualberta.ca/esc.hp/bsc/briefs/bradvantages.htm |
| The SAGE Project. A workshop report on terrestrial arthropod sampling protocols for graminoid ecosystem | 1996. A.T. Finnamore (Ed.) | Available on the Internet at http://www.cciw.ca/eman-temp/reports/publications/sage/intro.html |

-
- | | | |
|--|---|---|
| How to assess insect biodiversity without wasting your time. A brief | 1996. H.V. Danks. Biological Survey of Canada Document Series No. 5. 20 pp. | Copies available on request; full text at: http://www.biology.ualberta.ca/bsc/briefs/brassess.htm (Abridged version in Global Biodiversity (1997) (version française dans La biodiversité mondiale (1997)) |
| Comment évaluer la biodiversité des insectes sans perdre de temps | 1996. H.V. Danks. Commission biologique du Canada (Arthropodes terrestres) Série Documents No. 5 | Texte disponible à http://www.biology.ualberta.ca/bsc/briefs/brcommentevaluer.htm |
| The wider integration of studies on insect cold-hardiness | 1996. H.V. Danks. European Journal of Entomology 93(3): 383–403. | Reprints available on request from author |
| Annotated List of Workers on Systematics and Faunistics of Canadian Insects and Certain Related Groups | 1997. H.V. Danks and S. Goods. Third edition, 1996. Biological Survey of Canada Document series No. 6. 119 pp. | Free of charge on request from the Survey |
| Insects of the Yukon | 1997. H.V. Danks and J.A. Downes (Eds.). Biological Survey of Canada (Terrestrial Arthropods), Ottawa. 1034 pp. | \$95 (includes shipping) from Entomological Society of Canada* |
| Arctic Insect News | 2000. H.V. Danks (Ed.). No. 11. 31 pp. | Free of charge on request (Annual issues 1–10 also available). Volumes 9–11 available at http://www.biology.ualberta.ca/bsc/english/newsletters.htm#arctic |
| La dormance et les cycles biologiques | 1999. H.V. Danks. Antennae 6(2): 5–8. | See: http://www.seq.qc.ca |
| Life cycles in polar arthropods – flexible or programmed? | 1999. H.V. Danks. European Journal of Entomology 96(2): 83–102. | Reprints available on request |
| The diversity and evolution of insect life cycles | 1999. H.V. Danks. Entomological Science 2(4): 651–660. | Reprints available on request from author |
-

Dehydration in dormant insects	2000. H.V. Danks. <i>Journal of Insect Physiology</i> 46(6): 837–852	Reprints available on request from author
Terrestrial arthropod biodiversity projects – building a factual foundation. A brief from the Biological Survey of Canada (Terrestrial Arthropods).	2000. H.V. Danks and N.N. Winchester. <i>Biological Survey of Canada Document Series No. 7</i> . 38 pp.	Copies available on request from the Survey; full text at http://www.biology.ualberta.ca/bsc/briefs/brbioprojects.htm
Insect cold hardiness: A Canadian perspective	2000. H.V. Danks. <i>CryoLetters</i> 21(5): 297–308.	Reprints available on request from author
Measuring and reporting life-cycle duration in insects and arachnids	2000. H.V. Danks. <i>European Journal of Entomology</i> 97(3): 285–303.	Reprints available on request from author
Arthropods of Canadian Grasslands (Newsletter)	2001. H.V. Danks (Ed.). No. 7. 31 pp.	Free of charge on request or see http://www.biology.ualberta.ca/bsc/english/newsletters.htm#grasslands
Label data standards for terrestrial arthropods. A brief prepared by the Biological Survey of Canada (Terrestrial Arthropods)	2001. T.A. Wheeler, J.T. Huber and D.C. Currie. <i>Biological Survey of Canada Document Series No. 8</i> . 20 pp.	Copies available on request from the Survey. Full text at: http://www.biology.ualberta.ca/bsc/briefs/brlabelstandards.htm
Normes d'étiquetage pour les arthropodes terrestres. Mémoire préparé par la Commission biologique du Canada (arthropodes terrestres)	2001. T.A. Wheeler, J.T. Huber et D.C. Currie. Commission biologique du Canada (arthropodes terrestres) Série Documents no 8	Disponible sur demande de la Commission biologique du Canada. Texte disponible à http://www.biology.ualberta.ca/bsc/briefs/brnormesetiquetage.htm
The nature of dormancy responses in insects	2001. H.V. Danks. <i>Acta Societatis Zoologicae Bohemicae</i> 65(3): 169–179.	Reprints available on request from author
Information on Biodiversity Funding: Funding Sources for Graduate Students in Arthropod Biodiversity	2001. T.A. Wheeler	Available at http://www.biology.ualberta.ca/bsc/english/funding.htm

- | | | |
|--|--|--|
| Financement de la recherche en biodiversité : Sources de fonds disponibles pour les diplômés en biodiversité des arthropodes | 2001. T.A. Wheeler | Disponible à http://www.biology.ualberta.ca/bsc/french/frfunding.htm |
| Arthropods of Canadian Grasslands (Newsletter) | 2002. H.V. Danks (Ed.). No. 8. 41 pp. | Free of charge on request or see http://www.biology.ualberta.ca/bsc/english/newsletters.htm#grasslands |
| Arthropods of Canadian Grasslands. An Initiative of the Biological Survey of Canada (Terrestrial Arthropods). Prospectus | 2002. J.D. Shorthouse and T.A. Wheeler. Biological Survey of Canada (Terrestrial Arthropods). 31 pp. | See http://www.biology.ualberta.ca/bsc/english/propsectus.htm |
| The range of insect dormancy responses | 2002. H.V. Danks. European Journal of Entomology 99(2): 127–142 | Reprints available on request from author |
| Arthropods of Canadian Grasslands (Newsletter) | 2003. H.V. Danks (Ed.). No. 9. 35 pp | Free of charge on request or see http://www.biology.ualberta.ca/bsc/english/newsletters.htm#grasslands |
| The range of insect dormancy responses | 2002. H.V. Danks. European Journal of Entomology 99(2): 127–142. | Reprints available on request from author |
| Modification of adverse conditions by insects | 2002. H.V. Danks. Oikos 99(1): 10–24. | Reprints available on request from author |
| Studying insect photoperiodism and rhythmicity: Components, approaches and lessons | 2003. H.V. Danks. European Journal of Entomology 100(2): 209–221. | Reprints available on request from author |
| The role of voucher specimens in validating faunistic and ecological research. A brief prepared by the Biological Survey of Canada (Terrestrial Arthropods). | 2003. T.A. Wheeler. Biological Survey of Canada Document Series No. 9. 21 pp. | Copies available on request from the Survey; full text at http://www.biology.ualberta.ca/bsc/briefs/brvouchers.htm |

*To order publications from the Entomological Society of Canada contact the Society at 393 Winston Ave. Ottawa, Ontario K2A 1Y8; tel.: 613-725-2619, fax: 613-725-9349; email: entsoc.can@sympatico.ca [Orders from Canada pay the above-noted price in Canadian dollars; orders from other countries pay the above-noted price in U.S. dollars. Add 7% GST on all orders for Canada.]

Selected Future Conferences

Organization	Date	Place	Contact
ENTOMOLOGICAL CONFERENCES			
Entomological Society of Canada	2003 , 2–5 Nov.	Kelowna, BC	(with the Entomological Society of British Columbia) http://esbc.harbour.com/jam.html Terry Shore, tshore@pfc.forestry.ca
	2004	PEI	with the Acadian Entomological Society
Entomological Society of America	2003 , 26–29 Oct.	Cincinnati, OH	ESA, 9301 Annapolis Rd., Lanham, MD 20706-3115; meet@entsoc.org
	2004 , 14–18 Nov.	Salt Lake City, UT	ESA, see above
16th International Symposium of Odonatology	2004 , 26 July – 4 August	Schwerin, Germany	http://www.afn.org/~iori/oienevent.html#SIO2004
The 12th International Symposium on Insect-Plant Relationships	2004 , 7–12 August	Berlin, Germany	http://www.biologie.fu-berlin.de/sip12-berlin/index.html
XXII International Congress of Entomology	2004 , 15–20 Aug.	Brisbane, Australia	http://www.ccm.com.au/icoe/index.html Ashley Gordon, Congress Director; ashley@ccm.com.au Myron Zalucki, Chair ICE Executive M.Zalucki@zen.uq.edu.au
PROVINCIAL SOCIETIES			
Entomological Society of Alberta	2003 , 2–4 Oct.	Athabasca, AB	Robert Holmberg, Centre for Science, Athabasca University, 1 University Dr. Athabasca, AB T9S 3A3. robert@athabascau.ca ; http://www.biology.ualberta.ca/courses.hp/esa/esa2003.htm
Entomological Society of Manitoba	2003 , 24–25 Oct.	Winnipeg, MB	Mahmood Iranpour, iranpour@ms.umanitoba.ca ; http://home.cc.umanitoba.ca/~fieldspg/meet03.html
Entomological Society of British Columbia	2003 , 2–5 Nov.	Kelowna, BC	(with the Entomological Society of Canada; see that entry)
Société d'entomologie du Québec	2003 , 13–14 Nov.	Québec, QC	http://www.seq.qc.ca/accueil_fr.htm

Answers to Faunal Quiz

[see page 59]

1. Canadian rivers longer than 1000 kilometres are the:
Peace (Williston Lake, BC to Slave River, 1923 km),
Mackenzie (Great Slave Lake to the Arctic Ocean, 1738 km),
Churchill (Churchill Lake, SK to Hudson Bay, 1609 km),
South Saskatchewan (junction of Bow and Oldman Rivers to the Saskatchewan River, 1392 km),
Fraser (Mount Robson to the Strait of Georgia, 1370 km),
North Saskatchewan (Columbia Icefield to Saskatchewan River, 1287 km),
St. Lawrence (Lake Ontario to the Atlantic gulf, 1280 km),
Athabasca (Columbia Icefield to Lake Athabasca, 1231km),
Ottawa (Laurentian Highlands to the St. Lawrence River, 1271 km),
Liard (Pelly Mountains, YK to Mackenzie River, 1115 km),
Assiniboine (southeastern Saskatchewan to Red River, MB, 1070 km)

Long rivers that originate in Canada but have their outflow in the United States include the Yukon (3185 km) and the Columbia (2000 km).

2. Taloyoak (69° 32' 10" N, 93° 31' 15" W) is the northernmost community on the Canadian mainland. The hamlet sits at the foot of a series of rocky hills on the shores of a small body of water known as Stanners Harbour. Taloyoak means "large caribou blind" in Inuktitut and refers to a stone caribou blind traditionally used by Inuit of the area to corral and harvest caribou. The hamlet has an airport with scheduled passenger service from Yellowknife.
3. Many Canadian insects have life cycles that last for more than one year, but the best known examples are some (but by no means all) high arctic species such as the lymantriid moth *Gynaephora groenlandica* and several chironomid midges as well as other species from cool or depauperate habitats, such as some boreal wood-feeding beetles and cool-stream stoneflies.
4. More than 100 species of Carabidae, Staphylinidae, and Dytiscidae have been reported from the Yukon Territory (H.V. Danks and J.A. Downes (Eds.). 1997. *Insects of the Yukon*. Biological Survey of Canada (Terrestrial Arthropods), Ottawa).
5. Using the scenario described (invented from incomplete information in *Can. Ent.* 103: 1597–1606, 1971), 145,000 adults would emerge from the pond.

Quips and Quotes

“The age of material in a natural history collection is one of its most important attributes because the older the material, the better it reflects species presence before human-induced ecological degradation. The oldest confirmed date in the collection is 1860 for *Allocapnia roberti* Surdick, collected by Illinois’s first state entomologist, B.D. Walsh, in Rock Island, IL. Subsequent collecting efforts support the contention that this species is now extinct. . . These data have allowed the exploration of changes in the distribution of several species, documented a shift in prevalence of species assemblages of Plecoptera, and shown a dramatic change in species diversity between historical and modern collections.”

(Favret, C. and R.E. Dewalt. 2002. Comparing the Ephemeroptera and Plecoptera specimen databases at the Illinois natural History survey and using them to document changes in the Illinois fauna. *Ann. Ent. Soc. Am.* 95: 35–40.)

Proverbs and sayings

He that hath the worst cause makes the most noise. English

The hasty and the slow meet at the ferry. Arab

The old forget; the young don’t know. Japanese

Traveller, there is no path; paths are made by walking. Spanish

“Another damned, thick square book! Always scribble, scribble, scribble! Eh! Mr. Gibbon?”
(William Henry, Duke of Gloucester 1781, on receiving *Decline and Fall of the Roman Empire* vol. II).

“Be kind and considerate with your criticism . . . It’s just as hard to write a bad book as it is to write a good book” (Malcolm Cowley)

“Whatever is clearly expressed is well wrote” (Mary Wortley Montagu)

Bargain basement

Classified advertisement: Need co-author for a book on self reliance (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 elsewhere in Canada (compare the sample entries from a previous list of requests that are shown below). See also the Survey's website (<http://www.biology.ualberta.ca/bsc/english/listofrequests.htm>) 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 2004 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 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
2	Adelgidae (conifer woolly aphids)	Anywhere	Preserve insects and bark, needles or galls in 70% ethanol. Specimen records and host plant records	R. Footitt
3	Aleyrodidae (white-flies)		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
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. Footitt
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:

