

## Insect Collections in Canada Series: Royal British Columbia Museum, Victoria, BC

Rob Cannings  
Curator of Entomology

### History

The Royal British Columbia Museum sits on an impressive site on Belleville Street adjacent to the Inner Harbour and the Legislative Buildings in downtown Victoria, British Columbia (Figure 1). The Entomology collection occupies most of the sixth floor of the Fannin Building in the museum complex.



Fig. 1. The Royal British Columbia Museum, Victoria, BC. The entomological collection is housed in the Fannin Building, the tall structure on the right. Photo: RBCM.

First founded by the provincial government in 1886 as the Provincial Museum of Natural History and Anthropology, the museum's first public displays occupied a single small room in the original wooden Capitol Buildings. Over the next 12 years, the Museum was relocated twice, first to the original Supreme Court building nearby then, in 1898, to the East Wing of the newly constructed Legislative Buildings. The Museum remained there for the next 60 years (Corley-Smith 1989). Across Government Street, most of the present museum buildings were opened in 1968 and the institution was renamed the British Columbia Provincial Museum (BCPM). In 1986 it became the Royal British Columbia Museum (RBCM) and, in 2003, with the addition of the BC Archives, it was designated a crown corporation -- the Royal BC Museum Corporation (RBCM 2010).



According to Gunder (1929), the entomological collections were founded in 1892 by donations from W.H. Danby and Charles DeB. Green, both well known BC collectors, especially of Lepidoptera. For decades after, butterflies and moths were the focus of the provincial collection. In the first decades of the century, the collection benefitted from its close association with the Entomological Society of BC (founded 1901). BC insect enthusiasts were well organized and active. The frequent publications of BC entomologists that appeared in museum publications and the Proceedings of the Society impressed early chroniclers of Pacific Northwest entomology (Hatch 1949, 1953). Over the years, most collection growth resulted from gifts and bequests from a variety of sources and from concerted but sporadic collecting by a meagre staff. Well into the 1930s and 1940s, in addition to the Director, the Museum's staff consisted of only one or two people involved in biology. Some years there were none. The first full-time entomologist was not hired until the early 1970s and, as a result, the collection has had a desultory past.

Ernest M. Anderson, Assistant Biologist from 1903 to 1916 (Corley-Smith 1989, Guppy and Shepard 2001), was the first staff member to make significant collections of insects. He made several major trips, during which he collected plants and vertebrates as well as insects – for example, to the Okanagan Valley in 1913 (Anderson 1914), the Atlin district in 1914 (Provincial Museum 1916), and the Lillooet region in 1916 (Provincial Museum, 1917). Others, such as J.A. Munro and C.B. Garrett, later well-known BC biologists in their own right, acted as Anderson's field assistants or collected on contract for the Museum before and during World War I. Based on his museum work, Anderson (1904) published the first provincial list of Lepidoptera (Hatch 1949) and, although it contained many misidentifications (Guppy and Shepard 2001), it served as a basis for future work. Anderson was dismissed for misconduct in 1916; among other things, he was accused of attempting to sell insects that he'd collected for the Museum to other institutions, such as the Smithsonian (Corley-Smith 1989).

Ernest H. Blackmore, perhaps the most significant of the early lepidopterists in the province, was a post office employee in Victoria who, from about 1913 onward, collected and published extensively on butterflies and moths. In the 1920s he focussed on microlepidoptera. He acted as a kind of research associate in the Museum, donating and curating specimens in his spare time (Gunder 1929, Guppy and Shepard 2001) and, after Anderson's departure, he was paid for this work. For a number of years after 1917 he contributed the entomology section in the detailed annual reports of the Museum, including photographs of Lepidoptera specimens of particular interest (e.g., Blackmore 1920). He summarized his studies and collections of macrolepidoptera in a new list (Blackmore 1927), which corrected and updated Anderson's 1904 version. Blackmore's untimely death at 47 years of age in 1929 was a severe setback to the Museum's Lepidoptera collection, which at this time numbered about 5000 specimens (Guppy and Shepard 2001). Gunder (1929) noted that "there are two large, plate glass exhibition cases of nicely arranged and mounted



lepidoptera representing local material on view to the public; one of butterflies and the other of moths. The study collection of insects amounts to about twenty glass-topped drawers." Gunder considered the Museum's holdings one of the 16 best collections of North American Lepidoptera (Guppy and Shepard 2001). When Blackmore died, a few months before the onset of the Great Depression, the Museum could not afford to purchase his personal collection of 12,000 specimens. But George Spencer, recently arrived at the University of British Columbia, found sufficient money and the Blackmore material now resides in the University's Beaty Biodiversity Museum.

John F. (Jack) Gates Clarke, born and schooled in Victoria, was mentored by Blackmore at the Museum between 1920 and 1928 and developed a lifelong passion for moths. After Blackmore's death in March 1929, Gates Clarke was hired as Assistant Curator of Entomology and, for the next two years mainly studied microlepidoptera. After 1930 he began university in the United States but, to some extent, continued his association with the Museum; for example, he authored the entomology section of the Museum's 1933 annual report (Gates Clarke 1934), as he had done in 1929 and 1930 (Gates Clarke 1930). He went on to a long and distinguished career in entomology at the Smithsonian Institution in Washington, DC; he died in 1990.

George A. Hardy (1888-1966) (Figure 2), as Assistant Biologist from 1924 to 1928, curated all plant and animal collections. His greatest entomological contribution during this period was the development of a collection of Vancouver Island beetles, especially of the Cerambycidae (Hardy 1926, Downes 1951) and Buprestidae (Hardy 1927). He rejoined the Museum in 1941 as Botanist, but also was responsible for the entomological collection. While most of his work time was occupied in the herbarium, he continued his research into his first love, the Long-horned Wood-boring beetles, but more and more began collecting and rearing butterflies and moths, particularly the Noctuidae and Geometridae. He published many papers on the life histories of Lepidoptera from southern Vancouver Island, especially during his retirement (Carl 1966). His last paper was published two years before his death (Hardy 1964).

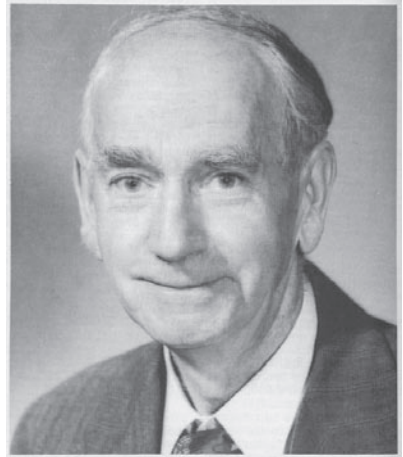


Fig. 2. George A. Hardy (1888-1966). Photo: Proceedings of the Entomological Society of BC 63: 44 (1966).

In a letter to Dan Bonnell of Oregon State College in April 1942, Hardy noted that the provincial collection amounted to 52,000 specimens of all orders. He went on to say: "Since 1930, apart from brief notes and identification of specimens



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by specialists, little progressive entomological work has been accomplished excepting the constant influx of very desirable local collections and odd species of all sorts sent in for clarification."

Thus, through most of the 1930s and after Hardy's retirement in 1953, right through to the early 1970s, there was little entomological activity in the provincial collection, except the deposition of Hardy's own material. Indeed, after Hardy became inactive, and especially after his death, the collection was neglected. In 1963 at the centennial meeting of the Entomological Society of Canada held in Ottawa, George Spencer, that powerhouse of BC entomology, gave the plenary address on 100 years of Canadian entomology. How embarrassing to the BC Provincial Museum that, while discussing all the important insect collections across the land, he could omit any mention of the Museum's collection! Its reputation had sunk that low.

In 1970 when the museum moved from the legislative buildings to the new curatorial tower (Fannin Building), the insect collections were fumigated and stored in this new facility. Bob Carcasson, when Curator of Entomology a few years later, noted that these collections, "consisting of some 100,000 specimens housed in an assortment of storeboxes, shoeboxes, cigar boxes and in a few poorly designed home-made cabinets, were in a bad state... they had been stored in a damp basement and many had been damaged by carpet beetles and mildew." (Carcasson 1974). Douglas A. Ross (Canadian Forest Service) spent some time in 1970 sorting the material but, beginning in June 1972, Brian D. Ainscough, a Victoria acarologist, handled much of the early curation. He made a brief inventory of the material, in which he outlined eight separate collections based on their manner of storage (Ainscough 1972, Carcasson 1974). Carcasson (1974) observed that "...no attempt had been made to amalgamate and to arrange the specimens in any kind of systematic order.. Much of the material was damaged or without data and had to be discarded. The coverage of the Coleoptera (beetles) and Lepidoptera (butterflies and moths) of southern Vancouver Island was reasonable, but the representation of other orders and the coverage of other areas was ... deplorably inadequate."

At that time the collection consisted of about 100,000 pinned specimens -- about 50,000 beetles, 35,000 butterflies and moths and 15,000 in other groups. The alcohol collection contained about 30 spider specimens and some miscellaneous material in addition to Ainscough's mite collection, estimated at 10,000 slides and 90,000 specimens in vials. According to Carcasson (1974), most of this mite material was on loan from other institutions. Ainscough (1972) noted that "the only satisfactory nucleus for a properly integrated main collection... was about 2500 specimens of BC Lepidoptera, Coleoptera, Hemiptera and Odonata ...housed in glass-topped drawers in five modern USNM-type cabinets... All the specimens are in apparently excellent condition, properly labelled and determined." Among other things, this probably contained the Hardy beetle specimens, mostly from his work in the 1920s. The vast majority of the pinned



collections, comprising about 72,000 specimens of all the major orders, were housed in a variety of boxes and trays and showed signs of earlier dermestid and mechanical damage. This likely included most of the collections donated in the distant past, such as those of A.W. Hanham, R.V. Harvey and J.K. Jacob. G.H. Lardner's 4200 specimens, mostly Coleoptera, and Hardy's fine collection of 8300 BC Lepidoptera were in addition to this material; both of these collections were housed separately and were labelled and mostly identified. Five large display cases (2.5' x 7.5') containing an assortment of BC insects, presumably those exhibited in the former museum building, were also inventoried. No record was kept of the number of specimens discarded when much of this material was sorted and amalgamated into recently acquired storage cabinets -- in 1973 the Friends of the BCPM bought 200 insect drawers and an additional 124 were obtained from the University of BC and other sources (Carcasson 1974).

In February 1973 the Entomology Division was established with the appointment of the first Curator of Entomology, Robert H. Carcasson and an Associate Curator, Brian Ainscough. Alexander Mackie joined the staff in 1974 as a technician but resigned late in 1975; unfortunately, he was not replaced. Carcasson retired in 1979 and died in 1982. Born in Britain, he studied tropical agriculture in Italy and served as entomologist at the National Museum of Kenya in Nairobi from 1955 and as director from 1961 to 1968. His specialties were biogeography and African Lepidoptera, notably moths of the Sphingidae. He came to Canada as chief curator at the Centennial Museum in Vancouver (1969-1971). At the BCPM most of his efforts focused on tropical and Old World Lepidoptera. Ainscough's specialty was the fauna of the soil, especially tortoise mites (Uropodina). When he retired in 1983, most of the mite collection was sent to the Canadian National Collection of Insects, Arachnids and Nematodes in Ottawa, where it could be curated and studied by the active acarological group there.

I replaced Carcasson as Curator in January 1980. My entomological degrees are from the University of BC and the University of Guelph. Although I publish on a wide range of insect groups, my research has focused on dragonflies and damselflies (Odonata) and robber flies (Diptera: Asilidae). Since the 1980s the collection has grown considerably in size, in the quality of storage and data and, in some taxa, in geographical scope. For example, the Odonata collection has increased from a few hundred BC specimens (mainly from the Frank Whitehouse collection) to over 40,000 from around the world.

At three separate times during this period, the RBCM has been fortunate to have had dynamic entomology collection managers on staff -- Crispin Guppy (1987-1993), David Blades (half-time, 1997-2003) and Claudia Copley (half-time, 2004-September 2010; full-time, September 2010-present). A highlight of Guppy's tenure was the influx of funds for new storage cabinets and for specimen databasing that accompanied a massive collections move precipitated by the removal of asbestos from the collection building. All old wooden cabinets were replaced with new steel storage. He implemented the collection's first



computerized data management system and oversaw the initial databasing of the collection. At that time, every specimen received a unique acquisition number and complete data records were produced for butterflies and Odonata. Cris is well known as an author of *Butterflies of British Columbia* (Guppy and Shepard 2001), a significant book extensively based on RBCM collection data which was published by the museum after he left the RBCM. Among many other contributions, both Blades and Copley aggressively expanded and improved the database; added tens of thousands of specimens to the collection and identified thousands; reordered and relabelled pinning trays, drawers and cabinets; and expanded and relabelled the alcohol collection, converting it to screw-cap vials. David developed the ziplock polyethylene envelope and unit box system to house the Odonata collection (Figures 3 and 4). This replaced older systems that used cellophane or mylar envelopes and smaller unit boxes.



Fig. 3. Drawer from the Odonata collection showing arrangement of unit boxes and envelopes. Photo: RBCM.



Fig. 4. Unit box and ziplock polyethylene envelopes from the Odonata collection. The specimen data are printed directly from the database. Photo: RBCM.



## Scope of the collection

The collection consists of 72 steel cabinets (25 glass-topped drawers each), organized with Cornell foam-bottomed pinning trays; 18 steel cabinets (17 glass-topped drawers each), organized with cardboard unit boxes for holding enveloped adult dragonflies; 31 wooden/arborite cabinets (10 open-topped drawers each), organized with plastic trays and grids for holding screw-top vials of ethanol (Figure 5). Our standard vial is 4 drams. All cabinets, drawers, pinning trays and vials are purchased from BioQuip Products. In both the pinned and alcohol collections, specimens are arranged phylogenetically to order and family, and to subfamily and tribe in larger groups. Genera and species are in alphabetical order within this scheme.



Fig. 5. Curator Rob Cannings examining vials of Odonata larvae in the RBCM alcohol collection. Photo: RBCM.

As of this writing, the research collection database contains 243,903 accessioned specimens/lots, each having a unique accession number. This total consists of 191,096 pinned specimens, 35,159 in polyethylene envelopes (predominantly Odonata, but also some butterflies) and 14,823 specimens or lots of material in vials or jars of 70% ethanol (especially Odonata larvae and Araneae). There are a few lots of material in 95% ethanol for use in molecular analyses. The microscope slide collection is tiny – only 174 slides. About 150,000 specimens are unaccessioned and not databased at all. Even 110,163 of the 243,903 accessioned specimens have no collection data entered; only a name and accession number are databased. Much of the collection is unidentified -- only 162,833 specimens are determined to genus and 151,318 specimens (62% of the total accessioned collection) are identified to species.

In addition to the main collection, some other sources of material exist. An education collection of material (both BC and foreign) lacking data, is unaccessioned and not databased; it is used for teaching and display. Several hundred insect fossils, mainly material from BC Eocene and Oligocene shales, are held in the RBCM paleontological collection. The collection has an associated small library of entomological books, journals, reports and reprints for the use of staff, volunteers and visitors.



The ethanol collection is comprised of different life stages, immatures being particularly predominant. Spiders (mostly adults) and immature and adult aquatic insects (especially Ephemeroptera, Plecoptera, Trichoptera and immature Odonata) are mainstays of the ethanol collection. For example, there are 3318 specimens or lots of Odonata larvae accessioned, most in ethanol, representing about 10% of the dragonfly collection.

The type specimen collection is small and predominantly consists of paratypes. I have routinely deposited the primary material of my own descriptions to the Canadian National Collection or other major institutions rather than maintaining it in our small provincial collection. The following numbers are of species and subspecies only, not numbers of specimens. Holotypes – Coleoptera (species -1), Lepidoptera (subspecies -7), Mecoptera (species -1). Paratypes – Coleoptera (species -10, subspecies -5), Hemiptera (species -11), Diptera (species -13), Hymenoptera (species -4, subspecies -3), Lepidoptera (species -11, subspecies -11), Mecoptera (species -1), Odonata (species -9). “Types and Cotypes” – Coleoptera (species -1), Lepidoptera (species -3).

Most specimens are from BC localities; 111,736 specimens of 141,743 (almost 80%) with localities databased are from the province. In some groups, active research has resulted in the accumulation of significant material from around the world (e.g., Odonata, Lepidoptera, Diptera: Asilidae).

The main collectors represented in the collection, in order of the number of accessioned specimens collected are: Robert Cannings (16,705), Crispin Guppy (12,631), George Hardy (7622), Gordon Hutchings (7145), David Blades (5689), Harold Foxlee (5472), Sydney Cannings (5165), Gerald Straley (4547), Jon Shepard (4359) and Abdiel Hanham (3572).

Strengths of the collection at the provincial level include adult Odonata, macro-Lepidoptera, Vespidae, Apidae (especially bumble bees), some Coleoptera (especially Carabidae and Cerambycidae), Hemiptera (at least Heteroptera), Orthoptera, some families of Diptera (at least Asilidae) and Araneae (spiders).

The following short list (Table 1) gives those orders represented by more than 400 accessioned specimens. Large orders that contain families having more than 2000 specimens in the collection have those families and their numbers included.





**Table 1. Specimen numbers in each order possessing at least 400 accessioned specimens.**

Order/Family	No. of accessioned specimens	
	Order	Within Family
<b>Neuroptera</b>	<b>412</b>	
<b>Trichoptera</b>	<b>447</b>	
<b>Orthoptera</b>	<b>2787</b>	
<b>Homoptera</b>	<b>3761</b>	
<b>Araneae</b>	<b>4276</b>	
<b>Hemiptera</b>	<b>7753</b>	
<b>Hymenoptera</b>	<b>25,605</b>	
<b>Formicidae</b>		4500
<b>Diptera</b>	<b>35,373</b>	
<b>Tachinidae</b>		2262
<b>Syrphidae</b>		2672
<b>Asilidae</b>		5242
<b>Odonata</b>	<b>38,309</b>	
<b>Lestidae</b>		3586
<b>Corduliidae</b>		3771
<b>Aeshnidae</b>		8570
<b>Libellulidae</b>		10,069
<b>Coenagrionidae</b>		10387
<b>Coleoptera</b>	<b>57,864</b>	
<b>Scarabaeidae</b>		2248
<b>Buprestidae</b>		2316
<b>Curculionidae</b>		2544
<b>Coccinellidae</b>		2670
<b>Staphylinidae</b>		2702
<b>Chrysomelidae</b>		3072
<b>Elateridae</b>		4021
<b>Cerambycidae</b>		8577
<b>Carabidae</b>		9183
<b>Lepidoptera</b>	<b>61,165</b>	
<b>Pieridae</b>		2503
<b>Hesperiidae</b>		3131
<b>Lycaenidae</b>		4502
<b>Nymphalidae</b>		4780
<b>Geometridae</b>		14,008
<b>Noctuidae</b>		20,207

Recent collections growth can be shown by the numbers of specimens accessioned in each of the last few years:

2008/09 – 7996

2007/08 – 2622

2006/07 – 3189.

These figures represent accessions from the databasing backlog as well as those from material collected or donated that year. Donations from external sources account for some increases. The following figures illustrate collections growth based on recent donations; the donations are recorded in the years that they were accessioned. In 2009/10, 3578 specimens were donated, 308 by the public and 3270 by scientists and colleagues. Two donations making up the latter figure were from insect inventories made by UBC entomologists and both came with full identifications and associated databases. The figures for 2008/09 are 17 and 1513, including one collection of 1500 lots of spiders from a research survey. In 2007/08 there was 1 specimen from a public donation and 4814 from the entomological community. The main accession was a collection of about 4800 duplicate specimens from the Spencer Collection at UBC; most are parasitic Hymenoptera, a group which is poorly represented in the RBCM collection. We regularly receive material from surveys in the Yukon facilitated by Syd Cannings (Canadian Wildlife Service), which nicely augments our collections from northern BC and puts them into biogeographical perspective. At the moment we are processing 21,000 lots of specimens in ethanol donated by Geoff Scudder (UBC) representing a decade of pitfall trapping in threatened Okanagan Valley grasslands. Grasshopper and cricket material has already been extracted and contains much new and valuable material.

Unlike some medium and large insect collections in Canada, the RBCM collection is not associated with a university department training graduate students in systematics. Undergraduate entomology courses in the Biology Department at the University of Victoria have periodically used the collection and lab for taxonomic and curatorial training, and small amounts of material from student collections have been donated over the years, but the benefits of graduate student collection and curation have not been part of our history. Neville Winchester of UVic has donated collections from his forest canopy research on Vancouver Island.

We are fortunate to have several research associates that regularly help with identifications and donations of important specimens: Robb Bennett (spiders), Geoff Scudder (true bugs), Syd Cannings (miscellaneous groups, northern insects), Jeremy deWaard (moths) and James Miskelly (grasshoppers and crickets). Other research associates include Richard Ring, Art Borkent and Leah Ramsay. A dedicated group of seven volunteers helps in collections management.



## Collection services

RBCM Entomology offers the usual services of an entomological collection – specimen loans, identifications and information. In the period 2006-2010 we have averaged 11 loans a year to researchers preparing taxonomic revisions. The average number of specimens loaned per year is about 2500.

A significant amount of time and energy is spent identifying insects, spiders and other terrestrial arthropods and providing information to the general public, government agencies and universities. Large numbers of identification requests, especially of dragonflies, come as images via e-mail. From 2005 to 2009 I handled an average of 732 information requests each year.

Like many other collections, the RBCM is committed to public use of its information. We do not have anything as impressive as the *Virtual Museum* at the E.H. Strickland Entomological Museum (Department of Biological Sciences, University of Alberta) (<http://www.entomology.ualberta.ca/>; see also Vol. 19(1) of this Newsletter, featuring this museum; [http://www.biology.ualberta.ca/bsc/news29\\_1/bscspring2010.pdf](http://www.biology.ualberta.ca/bsc/news29_1/bscspring2010.pdf)), although our small entomological website ([http://www.royalbcmuseum.bc.ca/Natural\\_History/Insects-and-Relatives.aspx](http://www.royalbcmuseum.bc.ca/Natural_History/Insects-and-Relatives.aspx)) provides some limited information about BC insects and spiders. We have plans to produce species pages, much like those of the Strickland Museum, beginning with the Odonata. For example, we have produced distribution maps of BC species (Figure 6).

Our database is Oracle-based. The entomological data is accessible on the RBCM website at <http://objectdb.royalbcmuseum.bc.ca/>. Access is two-tiered: the public log-in gives only general information on a search; a researcher with user permission can see entire collection records. Unfortunately, database searches are limited in value because only a fraction of the specimens in the collection have full records. In addition, much curation of old material is required to correct and up-date species identifications. A new, more user-friendly relational SQL database is in production.

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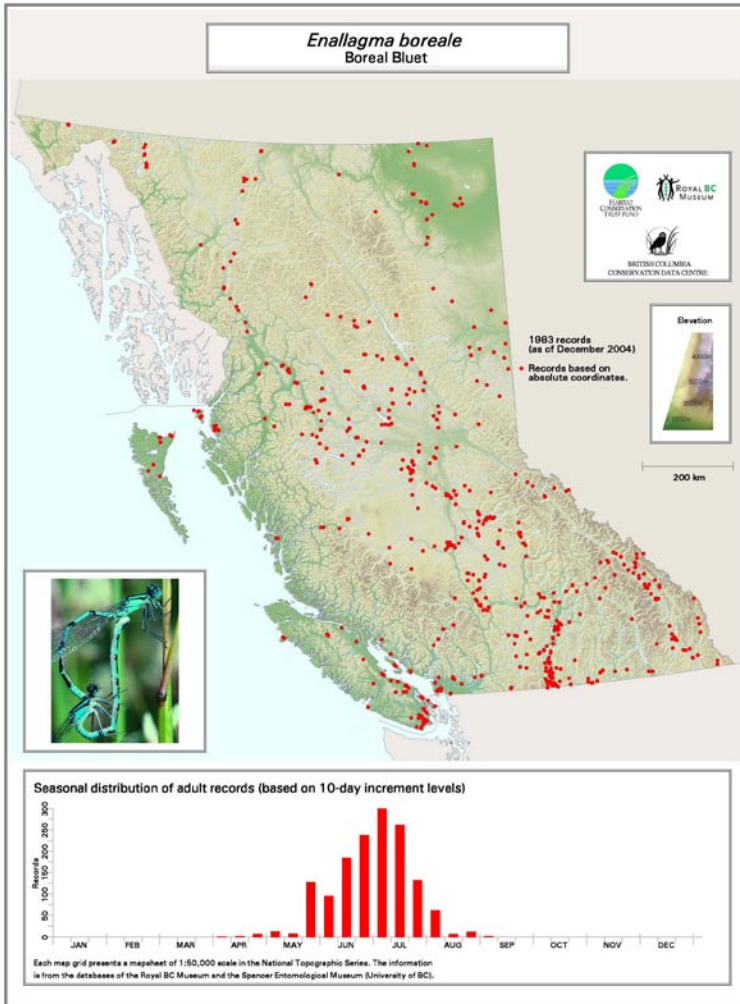


Fig. 6. Example of an RBCM Odonata distribution map (*Enallagma boreale*). This histogram below the map shows the temporal distribution of adult records. Photo: RBCM.

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