Documenting the invertebrate diversity of British Columbia

Web Description

The immense size of British Columbia, coupled with its rich biological diversity, poses a challenge to our understanding of the invertebrate species that inhabit the province. Despite long-term efforts to catalogue this biodiversity, many species remain undescribed or poorly known. The objective of this project is to document the invertebrate diversity of British Columbia. To achieve this objective, our research team, comprised of several taxonomic experts, is studying a variety of invertebrate groups, ranging from sponges to molluscs to tunicates. The team uses a combination of traditional taxonomic approaches and novel genetic techniques to identify and describe new species and to characterize species distributions. Through fieldwork and sampling, this research will add significant material and data to the RBCM Invertebrates collection. In addition, this work will generate multiple publications, including manuscripts in peer-reviewed scientific journals and publicly available species checklists and identification keys. Collectively, our work will lead to the discovery of new species, an increased awareness of rare and threatened species, and a better grasp on the general distribution and ecology of invertebrates throughout the province.

Rationale/Full description:

The immense size of British Columbia, coupled with its rich biological diversity, poses a challenge to our understanding of the invertebrate species that inhabit the province. Despite long-term efforts to catalogue this biodiversity, many species remain undescribed or poorly known. The following research, based on traditional taxonomy and novel genetic techniques, is expected to greatly enhance our knowledge of the invertebrate fauna in BC. Collectively, our work will lead to the discovery of new species, an increased awareness of rare and threatened species, and a better grasp on the general distribution and ecology of invertebrates throughout the province. Through fieldwork and sampling, this research also will add significant material and data to the RBCM Invertebrates collection.

Detailed Project Description:

The aim of this project is to document the invertebrate diversity of British Columbia. To achieve this objective, our research team, comprised of several taxonomic experts, is studying a variety of invertebrate groups, ranging from sponges to tunicates. The team uses a combination of traditional taxonomic approaches and novel genetic techniques to identify and describe new species and to characterize species distributions. The project is composed of three components:

1. Describing species and distributions – As we investigate the invertebrate fauna of British Columbia, we continue to discover new species and gain a deeper understanding of species distributions throughout the province. Our research group studies a wide variety of taxa, with special emphasis on hexactinellid sponges (glass sponges), decapods (crayfish, crabs, shrimp), molluscs (chitons,
bivalves, gastropods, cephalopods), and echinoderms (sea stars, sea urchins, sea cucumbers). Over the following year, we plan to sample a variety of habitats along the Central Coast, Vancouver Island, and South-central BC. Collected material will be identified using traditional morphological approaches. All specimens and associated data will be accessioned into the RBCM Invertebrates collection. In addition to manuscripts already in progress, findings of new and rare species will be communicated through publications.

(2) Barcoding marine invertebrates – Based on the concept that each species is characterized by a unique genetic code, DNA “barcoding” is a relatively novel approach designed to identify species using a standard genetic marker. By comparing the genetic code of an unknown species to a comprehensive reference library, researchers may be able to accurately identify taxa down to species level. To this end, we plan to develop a genetic library for marine invertebrates in British Columbia, using the standard barcoding gene cytochrome oxidase I (COI). Each resulting COI “barcode” will be linked to a vouchered specimen that can be used for additional morphological or molecular study. Initially, we will focus on taxonomically well-known groups (e.g., gastropods, decapods, and tunicates); and to resolve problematic cases (e.g., cryptic species), we will supplement barcoding results with morphological findings. This work is designed to be on-going, and will continue to enhance the RBCM Invertebrates collection.

(3) Creating online taxonomic keys – As part of this project, we are designing several online taxonomic keys. The goal of this initiative is to create taxonomic resources for both researchers and the public, allowing users to identify invertebrates of interest. To date, we have produced identification keys for BC sponges (deep-sea glass sponges), polyplacophorans (chitons), brachiopods (lamp shells), decapods (crayfish, mud shrimps, and prawns), echinoderms (sea urchins and crinoids), and tunicates (sea squirts). Shrimp and cephalopods (octopods and squids) are currently in development. The keys are designed to be user-friendly and freely accessible (see below links).

By studying a variety of taxonomic groups using multiple approaches, our research will greatly enhance the existing knowledge of the marine, freshwater, and terrestrial invertebrate fauna in the province. Through fieldwork and sampling, the above research also is expected to yield approximately 500 miscellaneous invertebrate specimens, representing over 100 unique species; this material and data will contribute significantly to the RBCM collections. Ultimately, this work will generate multiple publications, including manuscripts in peer-reviewed scientific journals and publicly available species checklists and identification keys.

Curator: Melissa Frey, Curator of Invertebrates

Other participants:

James Boutillier, Fisheries and Oceans Canada (DFO)
Robert Forsyth, Research Associate, Royal BC Museum (RBCM)
Graham Gillespie, Fisheries and Oceans Canada (DFO)
Paul Hebert, Canadian Barcode of Life (CBOL)
Blair Johnson, University of Victoria and Royal BC Museum (RBCM)
Elaina Jorgensen, NOAA Alaska Fisheries Science Center (NOAA)
Karl Kuchnow, Royal BC Museum (RBCM)
Phil Lambert, Curator Emeritus, Royal BC Museum (RBCM)
Henry Reiswig, Research Associate, Royal BC Museum (RBCM)
Julia Sigwart, Research Associate, Royal BC Museum (RBCM)

Schedule: Short-term (year)

2012: Conduct fieldwork along North-central Coast and Vancouver Island in participation with G. Gillespie, DFO (Frey, May-August); identify and curate specimens and associated data (February-December); process and organize samples for barcoding study (February-August); complete online taxonomic keys for shrimp, crabs, and cephalopods (Kuchnow, Johnson, Jorgensen); publication of manuscripts on various BC invertebrates (Frey, Forsyth, Gillespie, Lambert, Reiswig, and Sigwart).

Schedule: Long Term (multiple years)

2013-Ongoing: Conduct fieldwork to acquire additional specimens for collections and barcoding study. Additional processing of samples in lab; begin to compile and analyze barcoding data; write manuscript for peer-reviewed journal. This long-term project is ongoing, and designed to continually enhance the RBCM collections and our understanding of invertebrate diversity in British Columbia.

Community outreach:

Public outreach will take place at the Royal BC Museum via museum programs (e.g., lectures and fieldtrips) and at other local natural history clubs (e.g., Victoria Natural History Society and the Pacific Northwest Shell Club). These talks will focus on various topics related to BC invertebrates, including the diversity of specific taxonomic groups, how historical events have impacted biological diversity throughout the province, the importance of taxonomic research, and how genetic techniques can lead to new discoveries. The online taxonomic identification keys will be available on the RBCM website, free for public use.

Planned publications and other products:


Frey, M.A., G. Gillespie, J. Boutillier, and P. Hebert. 2015. DNA barcoding the marine invertebrates of the Northeast Pacific. For submission to *Marine Biology*.


Forsyth, R.G. 2012. Land Snails of British Columbia. Submissions to E-fauna.bc.ca


Lee, W.L., H.M. Reiswig, W.C. Austin, and L Lundsten. 2012. A new extraordinary carnivorous sponge, Chondrocladia lyra (Porifera: Demospongiae, Cladorhizidae), from off northern California, USA. For submission to Invertebrate Biology.

