Invertebrates from Caves on Vancouver Island

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ABSTRACT

Casual observation and collection of invertebrates in caves on Vancouver Island, B.C. have been conducted since the early 1960s. Two comprehensive and systematic surveys have been carried out: one in the 7 caves of Horne Lake Caves Park in 1986; and a second in 1997, which covered 15 caves of a wider geographic area on the island. A total of 192 taxa have been identified to date, including a number of new species, records, or rare species.

Key words: cave, invertebrate, Vancouver Island.

The fauna of caves in Canada is quite poorly known. Until recently, it was presumed that the active glacial history in Canada would have led to the extirpation of any obligate troglobites. As such, the present cave fauna would have immigrated from source areas beyond the southern ice limit.

Collections and discoveries in cave areas in the Rocky Mountains (Holsinger 1980, Bousfield and Holsinger 1981, Zacharada and Pugsley 1988), on Vancouver Island (Holsinger and Shaw 1988), and on Prince of Wales Island, Alaska (Carlson 1995) have proven this not to be the case. However, systematic studies of cave invertebrate communities in Canada have been only rarely conducted (Peck 1988) and the composition of the subterranean fauna in most areas of the country remains relatively unknown. Scudder and Cannings (1994) recognized this lack and identified caves as a priority for invertebrate inventory.

The composition of cave faunas on Vancouver Island is now relatively well studied compared to other karst areas in Canada. In addition to sporadic collections, 2 concerted studies of cave biota have been conducted. The first was a summer/winter survey of 7 caves in Horne Lake Caves Park in 1986. A second survey, conducted during the summer and fall of 1997, covered a variety of caves in 3 areas of the island. These covered a range of lengths, elevations, and settings, but were a tiny subset of the potential locations for study. Some preliminary observations are presented here as an introduction to the biology of west-coast caves, with a more complete assessment in preparation.

METHODS

General locations of the surveyed cave systems are shown in Figure 1. Efforts were made to cover a range of cave size, elevation, and geographic locales, with collections at regular to semi-regular intervals throughout systems. Field collections used a wide variety of techniques. Careful visual searches were conducted with aspirators and brushes. Pitfall traps baited with a variety of attractants and set for 3–10 days were important in the surveys. Aquatic fauna were collected by searching, Surber samplers, and drift net sets. Some surface springs were also sampled.

RESULTS

- A total of 191 taxa have been identified in collections thus far, including a minimum of 10 new species.
- The highest diversity occurs in the entrance area, and the composition is dominated by taxa that would likely be

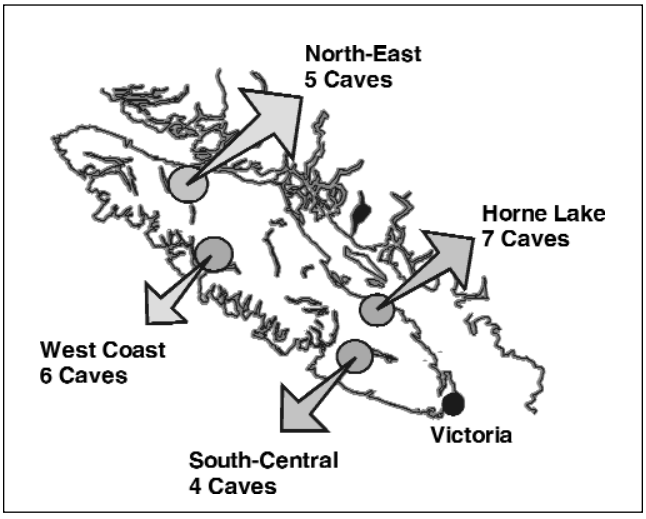

Figure 1. Map of Vancouver Island showing general cave areas sampled for invertebrates to date.

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found elsewhere in similar surface environments with conditions such as low light and high humidity (Fig. 2). The near-entrance fauna was dominated by a variety of Diptera, and associated predators such as Aranae and Coleoptera.

- In deep-cave habitats, collections were dominated by Collembola, Symphyla, and Diplura, with infrequent captures of other taxa, such as Acarina (*Robustocheles occulta*), Diptera, or Siphonaptera.
- At the order and family level, the composition of cave fauna on Vancouver Island is similar to that found elsewhere in North America (Holsinger and Culver 1988). Similarities, even at the species level, between Vancouver Island collections and similar sites in southeast Alaska are particularly remarkable.
- Few endemic troglobites have been found to date in the collections; however, many taxa are currently identified to genus or higher levels, and closer examination may yield further discoveries. This is particularly true of the Diptera, for which new species are certain, even in the present collections.
- Of particular interest in the collections have been the Crustacea, with 2 certain troglobites known.

Composition of Collections

The general composition of the collections is shown in Figure 3.

Coleoptera

Thirty-seven species have been identified in the collections. The majority (19 species) belonged to the Staphylinidae, a family of mostly predatory beetles. The next largest group (10 species) are the ground beetles (Carabidae), common in forest habitats in moist, dark places.

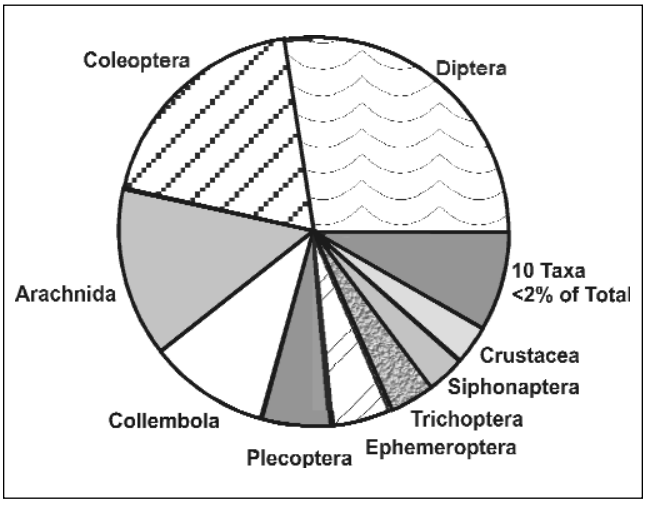

Figure 2. Overall composition of taxa collected during cave invertebrate surveys on Vancouver Island.

Arachnida

The collections include 17 species of Aranae, 10 opilionid species, and 1 identified predatory acarine (*Robustocheles occulta*). Nearly all are probable troglophiles/ trogloxenes. One common opilionid (*Nelima paessleri*) overwinters in dense hibernating-aggregations in mines and caves (Holmberg et al. 1984). The acarine diversity in the collection is grossly underestimated, since none of the aquatic taxa have yet been identified.

Collembola

Twenty taxa, many still to be identified to species. Collembola are the most common component of the deep-cave habitats. Several may be obligate troglobites, species of the genus *Arrhopalites* in particular.

Plecoptera/Ephemeroptera/Trichoptera

These orders were represented by a total of 25 species, mostly

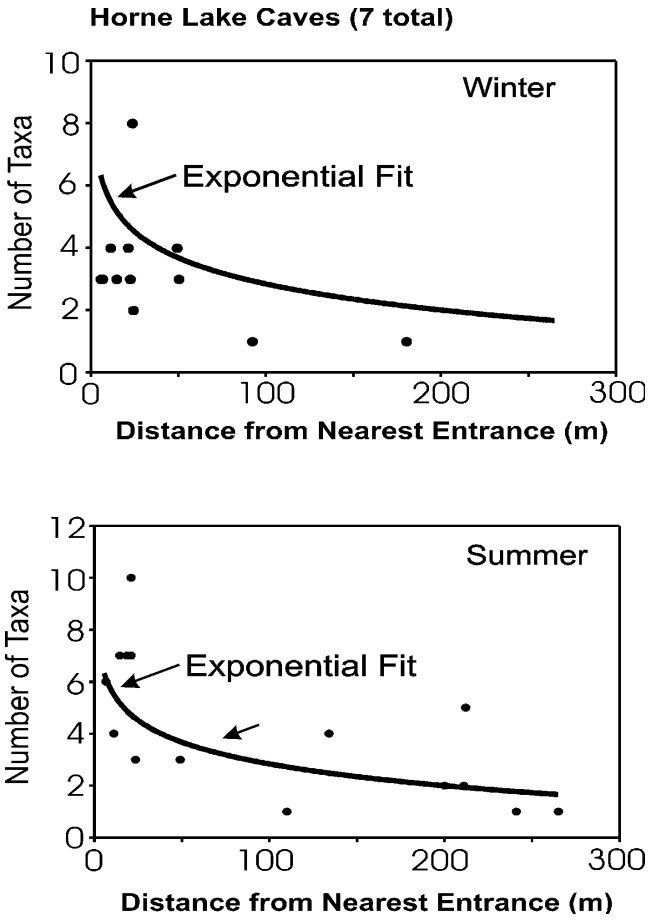

Figure 3. Comparison of summer (August–September) and winter (February) pitfall collections in 7 caves in Horne Lake Caves Provincial Park, Vancouver Island.

as aquatic larvae. All of the "EPT" taxa are probably "accidentals," washed into the cave through surface streams.

Siphonaptera
Seven species have been collected underground. Most are parasites of wood mice (*Peromyscus* spp.), which make extended excursions into caves and were attracted to pitfall trap sets. One species was collected from *Myotis* spp. during bat studies.

Crustacea
Two troglobites: the amphipod *Stygobromus quatsinensis* (Holsinger and Shaw 1988); and an undescribed bathynellid of the genus *Pacificabathynella*. Collections have shown that *S. quasinensis* is widely distributed on Vancouver Island and, surprisingly, has been recently collected from cave habitats in the offshore islands of southeast Alaska (Carlson 1995). In addition, there are several probable new copepod species in the genus *Acanthocyclops*.

Diptera
Fifty taxa have been collected, many of which have as yet been identified only to genus. In the collections is a particularly strong dominance (19 taxa) of Mycetophilidae and closely related families. One mycetophilid genus alone (*Speolepta*) is probably represented by 2–3 undescribed species (A. Borkent, Royal British Columbia Museum, 1998, pers. comm.). A key discovery in 1997 was that of an extremely rare simuliid (*Parasimulium meleanderi*; Borkent and Currie in prog.), which probably has a groundwater-dwelling larva. Most species are apparently restricted to areas near the cave entrances, from full light to twilight regions. There are probably few true troglobites, although study of the life-history of some of the mycetophilids would probably yield some important information.

Other Taxa
Amongst the remaining 15 taxa are representatives of 10 orders or phyla. Two common species of Lepidoptera (*Triphosa haesitata*, *Scoliopteryx libatrix*) are represented, as are a species of symphylan, and >3 species of aquatic oligochaetes. At least 4 species of myriapods were collected, including a probable new genus of Conotylidae (W. Shear, Hampden-Sydney College, VA, 1999, pers. comm.).

CLOSING REMARKS AND RECOMMENDATIONS

- These are very preliminary studies and the observations thus far are suggestive of the potential for further discoveries.
- Collections thus far have focused on coastal karst; there needs to be further (or similar) effort in karstic terrains elsewhere in British Columbia and Canada.
- Both high endemicity and extreme scarcity of some fauna collected in caves on Vancouver Island (such as *P. meleanderi*) may be a function of collection effort; additional collections need be done to establish the full geographic extent of many of these species.
- Surface environs in karst areas, particularly in coastal areas, are subject to massive change through timber harvesting. While this probably most strongly affects the entrance zone, particularly with respect to humidity and temperature regimes, the influence may extend deep into the cave through water flow and evapotranspiration changes. Careful environmental and faunal studies of caves before and after timber harvest could assess the effect of these changes.
- There is a surprisingly high faunal similarity between cave taxa collected on Vancouver Island and in similar environs on coastal islands in Alaska. Genetic studies of local populations on Vancouver Island and Alaska (and probably the Queen Charlotte Island) would establish the time of dispersal and provide important information on colonization of offshore islands.

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