# Chapter 9C5. Focal Taxonomic Collections: Copepod Crustaceans

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## Methods

Copepods were identified from three types of samples. The first method consisted of sweeps that were made through algal and fouling assemblages on the underside of docks, using a small hand-held net consisting of 130 µm mesh material attached to a stainless steel hoop of approximately 15 cm diameter. An effort was made to disturb algal and bivalve holdfasts in order to capture copepods from those microhabitats. The second type of samples taken were vertical water column plankton hauls made either off a dock or from a small boat in the harbor with a 0.25 m diameter 250 µm mesh plankton net. The net was lowered to the bottom, and after waiting approximately 1 minute for disturbance to dissipate, the net was slowly pulled to the surface. The third type of samples were taken from settling plates used for collecting fouling macro-invertebrates by briefly soaking plates in 5% formaldehyde solution in a plastic tub and washing the residue through 130 µm mesh.

In the laboratory, each sample was examined under a dissecting microscope, and several representatives of each species of copepod were removed. Each species was then further examined under a compound microscope. Identification was made as far as possible without dissection of individuals (with the exception of occasional removal of the abdomen to facilitate viewing the fifth leg).

## Results and Discussion

We identified 68 species of harpacticoid copepods, six calanoids, four cyclopoids, and several unidentified poecilostomatoid species (Table 9C5.1). Of these, none is a confirmed introduced species.

For harpacticoids, our results were similar to those of Kask et al. (1982) for the Nanaimo estuary in southern British Columbia in both the number of species found (75 in B.C.) and in that most of the species that were identified were either northern Pacific, broadly distributed boreal species (i.e., Pacific and Atlantic records), or probably undescribed species. Kask et al. (1982) speculated that the presence of many of the species that they found might have been the result of introductions from ship fouling communities. Harpacticoid copepods may be particularly likely to be transported and introduced because as a group they have successfully occupied almost all benthic and epibenthic habitats. Also, many species have multiple life history modes (e.g., resting and planktonic stages) that may also increase their chance of being transported and introduced. However, these same factors may also explain wide natural distributions. The paucity of studies of harpacticoid taxonomy in the northeastern Pacific makes it nearly impossible to determine whether or not a given species has been introduced without extensive distribution or genetic studies. Many of the species described in Lang's monograph on the harpacticoids of central California (Lang, 1965) occur in Puget Sound (J. Cordell, unpublished data) and southern British Columbia (Kask et. al., 1982), and Lang's species that also occur in Prince William Sound (Table 9C5.2) probably have continuous distributions. Other species that we encountered have Arctic and circumboreal distributions. An example of this is the important

**Table 9C5.1. Copepoda**

**Order Harpacticoida**
**Fam. Ameiridae**
*Ameira longipes* Boeck, 1865
*Ameira* sp. 1
*Ameira* sp. 2
Ameiridae, unid. sp. 1
**Fam. Ancorabolidae**
*Arthropsyllus serratus* Sars, 1909
**Fam. Canthocamptidae**
*Mesochra pygmaea* (Claus, 1863)
*Mesochra* sp. 1
**Fam. Canthocamptidae**, incertae sedis
*Leimia vaga* Willey, 1923
**Fam. Cletodidae**
*Acrenhydrosoma* sp.
**Fam. Danielsseniidae**
*Danielssenia typica*
**Fam Diosaccidae**
*Diosaccus spinatus* Lang, 1965
*Diosaccus* sp. 1
*Amphiascopsis cinctus*
*Amphiascus minutus*
*Amphiascus* sp. 1
*Amphiascoides cf. debilis*
*Amphiascoides* sp. 1
*Amonardia perturbata* Lang, 1965
*Amonardia normani*
*Robertsonia* sp.
*Stenhelia peniculata* Lang, 1965
**Fam. Ectinosomatidae**
*Ectinosoma* sp.
*Halectinosoma* sp. 1
*Halectinosoma* sp. 2
*Halectinosoma* sp. 3
*Microsetella norvegica*
**Fam. Tachidiidae**
*Microarthridion littorale* (Poppe, 1881)

**Table 9C5.1. (continued) Copepoda**

**Fam. Harpacticidae**
*Harpacticus uniremis* Kröyer, 1842
*Harpacticus septentrionalis* Klie, 1941
*Harpacticus compressus* Frost, 1967
*Harpacticus* sp.- *uniremis* group 1
*Harpacticus* sp.- *obscurus* group 1
Harpacticus sp.- obscurus group 2
*Zaus* sp.
**Fam. Laophontidae**
*Echinolaophonte* sp.
*Heterolaophonte discophora* (Willey, 1929)
*Heterolaophonte longisetigera* Klie, 1950
*Heterolaophonte variabilis* Lang, 1965
*Heterolaophonte* sp. 1
*Laophonte elongata* Boeck, 1872
*Laophonte applanata*
*Laophonte* sp. 1
*Pseudonychocamptus spinifer* Lang, 1965
*Paralaophonte cf. congenera* (Sars, 1908)
*Paralaophonte pacifica* Lang, 1965
*Paralaophonte perplexa* (T. Scott, 1898)
*Paralaophonte hyperborea* (Sars, 1909)
*Paralaophonte* sp. 1
Laophontidae, unid.
**Fam. Longipediidae**
*Longipedia* sp.
**Fam. Parastenheliidae**
*Parastenhelia* sp. 1
*Parastenhelia* sp. 2
**Fam. Tegastidae**
*Tegastes* sp. 1
*Tegastes* sp. 2
**Fam. Thalestridae**
*Idomene* sp.
*Diarthrodes* sp. 2
*Parathalestris* sp. 1
*Parathalestris* sp. 2
*Parathalestris* sp. 3
*Dactylopusia vulgaris* Sars, 1905
*Dactylopusia glacialis* Sars, 1909
*Dactylopusia* cf. *glacialis*
*Dactylopusia paratisboides* Lang, 1965
*Dactylopusia* sp. 1
*Paradactylopodia* sp. 1

**Table 9C5.1. (continued) Copepoda**

**Fam. Tisbidae**
*Tisbe* cf. *furcata* (Baird, 1837)
*Tisbe* spp.
Scutellidium arthuri Poppe, 1884
**Order Cyclopoida**
**Fam. Cyclopinidae**
**Fam. Cyclopidae**
*Euryte* sp.
*Halicyclops* sp.
**Fam. Oithonidae**
*Oithona similis* Claus, 1863
*O. spinirostris* Claus, 1863

**Order Poecilostomatoida**
Unidentified spp.

**Order Calanoida**
**Fam. Acartiidae**
*Acartia cf. clausi* Giesbrecht, 1889
*Acartia longiremis* (Lilljeborg, 1853)
**Fam. Centropagidae**
*Centropages abdominalis* Sato, 1913
**Fam. Paracalanidae**
*Paracalanus* sp.
**Fam. Pseudocalanidae**
*Pseudocalanus* spp.
**Fam. Temoridae**
*Eurytemora herdmani* Thompson and Scott, 1897

**Table 9C5.2. Copepods Collected at 6 Locations in Southcentral Alaska in August 1999.**

| 1999 Copepoda | Homer | Whittier | Cordova | Valdez | Seward | Shotgun Cove |
|---|---|---|---|---|---|---|
| **Order Harpacticoida** | | | | | | |
| **Fam. Ameiridae** | | | | | | |
| Ameira longipes | x | | | | | |
| Ameira sp. 1 | x | x | x | | | x |
| Ameira sp. 2 | x | | x | | | |
| **Family Ancorabolidae** | | | | | | |
| Arthropsyllus serratus | | | x | | | |
| **Fam. Canthocamptidae** | | | | | | |
| Mesochra pygmaea | | x | | | | x |
| Mesochra sp. 1 | | | | | | x |
| **Fam. Canthocamptidae, incertae sedis** | | | | | | |
| Leimia vaga | | | x | | | |
| **Fam. Danielsseniidae** | | | | | | |
| Danielssenia typica | x | | | | | |
| **Fam Diosaccidae** | | | | | | |
| Diosaccus spinatus | x | | x | | | |
| Amphiascopsis cinctus | x | | x | | | x |
| Amphiascus minutus | x | x | x | | | x |
| Amphiascus sp. 1 | x | x | | | | |
| Amphiascoides sp. 1 | x | | | | | |
| Amonardia perturbata | x | x | | | | |
| **Fam. Ectinosomatidae** | | | | | | |
| Ectinosoma sp. | | | | | | |
| **Fam. Harpacticidae** | | | | | | |
| Harpacticus uniremis | x | x | x | | x | x |
| H. septentrionalis | x | | | | | |
| H. compressus | x | | | | | |
| H. unidentified sp. | x | | | | | |
| Harpacticus sp. A- uniremis group | | | | | x | |
| Harpacticus sp.- obscurus group 1 | x | | x | | | x |
| Harpacticus sp.- obscurus group 2 | | | | | | x |
| Zaus sp. | | | | | | |
| **Fam. Laophontidae** | | | | | | |
| Unidentified sp. | | | | | | x |
| Heterolaophonte discophora | x | x | | | | |
| Heterolaophonte longisetigera | x | x | x | | | |
| Laophonte elongata | x | | | | | |
| Pseudonychocamptus spinifer | x | x | | | | |
| Paralaophonte cf. congenera | | | x | | | |
| Paralaophonte pacifica | x | | | | | |
| Paralaophonte perplexa | x | | x | | | x |
| Paralaophonte sp. 1 | | | | | | x |
| **Family Parastenheliidae** | | | | | | |
| Parastenhelia sp. 1 | | | | | | x |
| Parastenhelia sp. 2 | | | | | | x |

**Table 9C5.2. (continued) Copepods Collected at 6 Locations in Southcentral Alaska in August 1999.**

| 1999 Copepoda | Homer | Whittier | Cordova | Valdez | Seward | Shotgun Cove |
|---|---|---|---|---|---|---|
| **Fam. Tegastidae** | x | | | | | |
| Tegastes sp. 1 | | | x | | | x |
| Tegastes sp. 2 | | | | | | |
| **Fam. Thalestriade** | | | | | | |
| Diarthrodes sp. 1 | x | | | | | |
| Diarthrodes sp. 2 | | | | | | x |
| Parathalestris sp. 1 | x | | | | | |
| Parathalestris sp. 2 | | | | | | x |
| Parathalestris sp. 3 | | | | | | x |
| Dactylopusia vulgaris | x | x | x | | | x |
| Dactylopusia cf. glacialis | | | | | | x |
| Paradactylopodia sp. | | | x | | | |
| **Fam. Tisbidae** | | | | | | |
| Tisbe cf. furcata | | | x | | | x |
| Tisbe sp. | x | x | x | | | x |
| Scutellidium arthuri | x | | x | | | |
| **Order Cyclopoida** | | | | | | |
| **Family Cyclopinidae** | | | x | | | |
| **Family Cyclopidae** | | | | | | |
| Euryte sp. | x | | x | | | x |
| Halicyclops sp. | | | | x | x | |
| **Order Poecilostomatoida** | | | | | | x |
| **Total Number of Taxa** | 28 | 11 | 20 | 1 | 3 | 23 |

juvenile salmon prey species *Harpacticus uniremis*, which occurs in the arctic and as far south as the English Channel in the Atlantic (Kask et al. 1982) and La Jolla, California in the Pacific (Gunnill, 1982).

Settling plates appear to be a good way to sample the diversity of harpacticoid and other epibenthic/epiphytic copepods. In each case where we had dock sweep samples to compare with settling plate samples, more species were collected from the settling plates. Only one species, the algal blade dwelling *Scutellidium arthuri* was found only in the dock sweep samples. Reduced numbers of copepod taxa in the dock sweep samples was probably due to low and/or highly fluctuating surface salinities and/or temperatures. This assertion is supported by the fact that dock sweep samples taken in harbors with high freshwater input (e.g., Valdez, Seward) had extremely low taxa numbers, and those without much freshwater (Homer, Shotgun Cove) had the highest number of taxa.

One species of harpacticoid copepod that we found in dock sweep collections, *Leimia vaga*, may be regarded as "probably introduced". This species, which was described from Nova Scotia, is also abundant in many estuaries in Oregon and Washington, where it is restricted to brackish reaches (J. Cordell, unpublished data); however, this species was not reported from the Nanaimo estuary by Kask (1982). The fact that *L. vaga* has restricted habitat requirements and apparently disjunct populations on the Pacific coast may indicate that it has been introduced.

Although a number of Asian planktonic copepods have become established in California, Oregon, and Washington estuaries (e.g., Cordell and Morrison, 1996, Orsi and Ohtsuka, 1999), we found no introduced species in the vertical haul samples. In fact, overall planktonic copepod diversity was quite low, and almost all of the copepod numbers were made up of only three taxa: *Acartia longiremis*, *Pseudocalanus* spp., and *Oithona similis*. Also, we did not encounter several taxa that have been previously reported from ballast water arriving to Prince William Sound (Ruiz and Hines, 1997; Hines et al., 1998; Chapt. 3 Biological Characteristics of Ballast Water). As with dock-associated harpacticoids, our shallow sampling depths that were probably subject to large fluctuations in salinity and temperature may have decreased diversity of planktonic copepods in our samples.

**References**

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