Lamprops quadriplicata

Phylum: Arthropoda, Crustacea
Class: Malacostraca
Order: Cumacea
Family: Lampropidae

Description

Size: The holotype, described from Vancouver Island, was 11 mm in length (Hart 1930). The illustrated female (from Coos Bay) was 6 mm long (Fig. 1).

Color: Light brown, with dark brown on carapace and chromatophores (Hart 1930). However, Procter (1933) describes that the carapace can be divided by a diagonal line that is just posterior to the antero-ventral notch, with the anterior a greenish color and the posterior a deep brown (in Zimmer 1980). Descriptions of color in the Cumacea are difficult as many species were described based on preserved material, where the color fades.

General Morphology: Cumaceans are easily recognizable by a large and inflated carapace and a (relatively) slender, flexible thorax and abdomen (Kozloff 1993; Gerken and Martin 2014). Their bodies can be divided into these three major regions: the **cephalon** (head) that is covered by a **carapace** and includes the first five pairs of appendages (antennae, mandibles, maxillae, collectively the **mouthparts**). Posterior to the cephalon is the **pereon** (thorax), usually consisting of five thoracic somites, followed by the **pleon** (abdomen) with consistently six pleonites. The fifth pleonite is usually the longest and the pleonites are lacking **pleopods** in female individuals. The cumacean family Lampropidae is characterized by a freely articulating telson with three or more terminal setae (Watling 2007).

Cephalon: A carapace covers the cephalon and first three thoracic somites and is expanded on either side to form a branchial chamber (Watling 2007).

Carapace: Carapace is with four oblique parallel lines on each side (hence the name, *quadriplicata*) (Smith 1879) (Fig. 1). (Note: Fig. 3 is a close-up of *L. fasciata,* with only three parallel lines, for comparison.)

Rostrum: Two pseudorostral lobes (together called a pseudorostrum), or extensions of the carapace, extend anteriorly but do not fuse in front of the head in cumaceans (Watling 2007). The pseudorostrum in female *L. quadriplicata* is short and obtuse (Sars 1900) (Fig. 1), while in males, it does not extend beyond anterolateral corners (Hart 1930) (Fig. 3).

Eyes: Female lacks eyes, as in most cumaceans (Fig. 1). Males, on the other hand, have well developed eyes (*Lamprops,* Sars 1900) (e.g. Fig. 3).

Antennae: The first antenna is well developed in females with 4–5 articles (Lampropridae, Fage 1951) (Fig. 1). The second antenna is short in females (not visible in Fig. 1). In males, the second antenna is with articulated flagellum that is rather prehensile, but is generally concealed and used for clasping in copulation (Sars 1900).

Mouthparts: Siphon of maxilliped clearly visible (Figs. 1) (other mouthparts not figured.)

Pereon: Consists of five thoracic somites, each with paired appendages (**pereopods**).

Pereopods: Female with exopodites on pereopods one and two and rudimentary exopodites on pereopods three and four (Fig. 1). Male exopodites on all five pereopods (Lampropridae, Watling 1979) (Fig. 3).

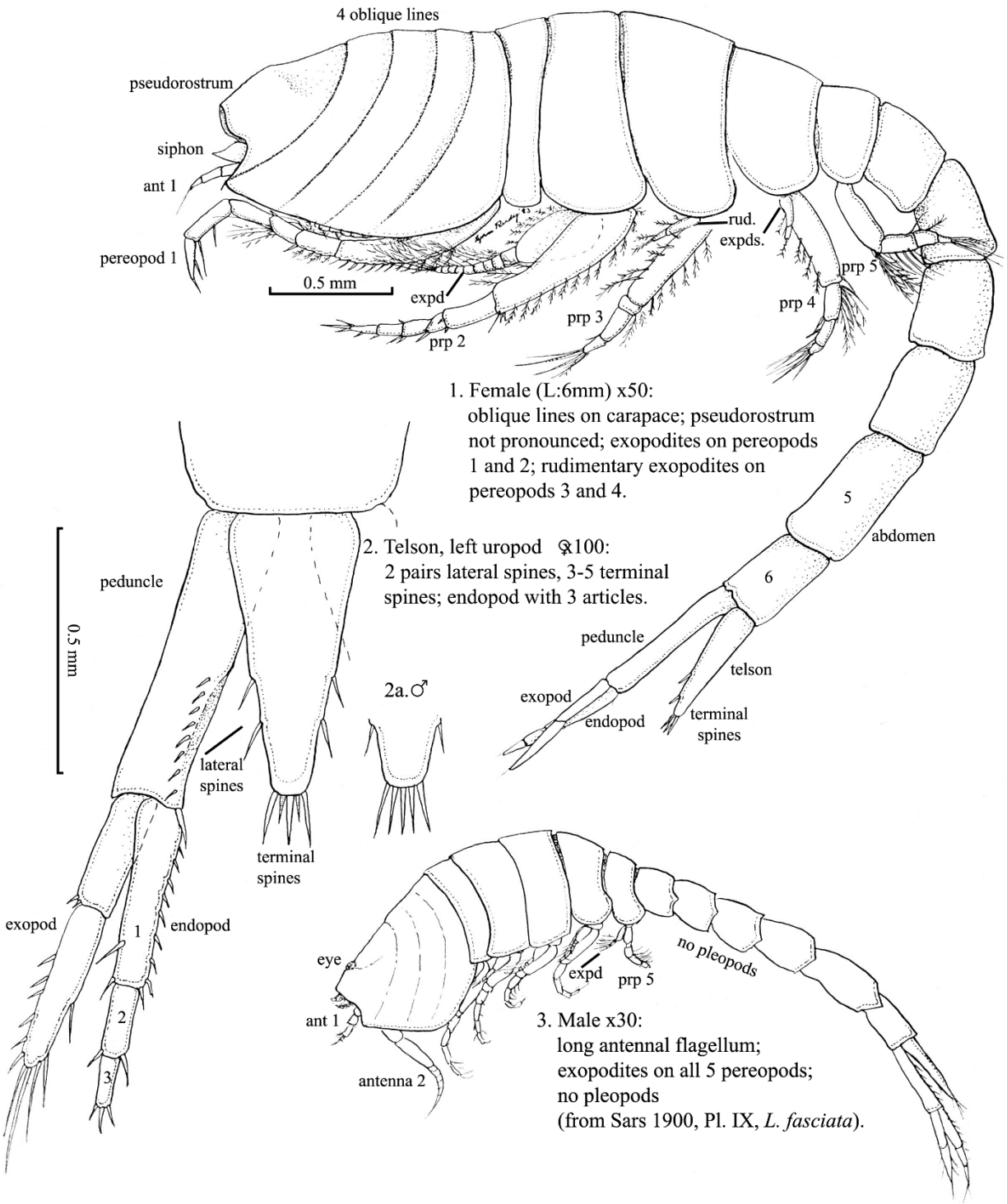
Pleon: Consists of six segments (Fig. 1).

Pleopods: All female cumaceans lack pleopods (Fig. 1) and males in the genus *Lamprops* are also lacking pleopods (Kozloff 1974) (Fig. 3).

Telson: Telson is free and distinct (compare to Leuconidae and Nannastacidae). Male telson has five terminal spines of about equal length (Watling 1979) (Fig. 2a) and females have 3–5 terminal spines, but they are not all equal in length (Kozloff 1974). The telson also has two to three pairs of lateral spines (two pairs in most females, Given 1965). The

Hiebert, T.C. 2015. *Lamprops quadriplicata. In:* Oregon Estuarine Invertebrates: Rudys' Illustrated Guide to Common Species, 3rd ed. T.C. Hiebert, B.A. Butler and A.L. Shanks (eds.). University of Oregon Libraries and Oregon Institute of Marine Biology, Charleston, OR.

Lamprops quadriplicata



1. Female (L:6mm) x50:
oblique lines on carapace; pseudorostrum not pronounced; exopodites on pereopods 1 and 2; rudimentary exopodites on pereopods 3 and 4.

2. Telson, left uropod ♀x100:
2 pairs lateral spines, 3-5 terminal spines; endopod with 3 articles.

2a.♂

3. Male x30:
long antennal flagellum; exopodites on all 5 pereopods; no pleopods
(from Sars 1900, Pl. IX, *L. fasciata*).

telson length is equal to or slightly longer than uropod peduncle (Smith 1879) and is truncate (Fig. 2).

Uropods: Uropod peduncles about equal to telson in length (Watling 2007; Smith 1879) and uropod endopods have three articles each (Lampropidae, Watling 1979) (Fig. 2). Cumacean uropod exopods are always biarticulate (Watling 1979).

Sexual Dimorphism: Females lack eyes and mature individuals can be recognized by the presence of a brood pouch. Female and immature individuals of both sexes have 3–5 apical telson spines, while males have five subequal spines. Five exopodites occur on pereopods in males compared to two exopodites, in addition to two rudimentary ones, in females. Males also have long second antennal flagella.

Possible Misidentifications

Cumaceans are very small (range 1 mm–1 cm) shrimp-like crustaceans. Their heads and thorax are fused to form a carapace, the abdomen is tubular and the uropods are slender and biramous. There are 1500 species worldwide, approximately 50 of which occur on the Pacific coast of the United States (Watling 2007; Gerken and Martin 2014). Cumaceans belong to the Malacostraca, and are characterized by a carapace that covers the first three or four thoracic somites. They also have an anterior extension (pseudolobes), a telson that is present or reduced and fused with the last pleonite, eyes that are united dorsally, a second antenna that is without an exopod and pleopods that are absent in females and can be absent or reduced in males (Watling 2007).

The superorder Peracarida includes cumaceans, mysids, isopods, tanaids and amphipods. Cumaceans can be separated from mysids by their single compound eye (particularly in the males), as mysids have large stalked eyes. Mysids have a carapace which covers the entire thorax, while cumaceans have several posterior segments exposed. Euphausiids belong to the superorder Eucarida (along with decapods) and are pelagic and marine, but might occasionally be found in estuaries. They have biramous thoracic appendages (cumacean pereopods are uniramous, with some thoracic exopodites). Additionally, euphausiids have strong pleopods for swimming and cumacean pleopods, when present, are small.

The four local cumacean families can be divided into those with a freely articulated telson and those without, the former comprise the Lampropidae and Diastylidae, while the latter comprise the Leuconidae and Nannastacidae (Watling 2007). Cumacean families that lack an articulated telson are consistently monophyletic on molecular phylogenies and are likely derived within the Cumacea (Haye et al. 2004). However, morphological characters used to differentiate cumacean families (e.g. number of pleopods in males) may be homoplasious (see Haye et al. 2004). The Lampropidae have three or more terminal setae on the telson while the Diastylidae have only 0–2. Diastylidae males can have two or zero pairs of pleopods and the Lampropidae can have three or zero. Uropod endopods in diastylids can have two or three articles and in lampropids there are always three.

In the Diastylidae there are five local species in three genera including *Anchicolurus* and *Diastylopsis* (one local species each) and *Diastylis* (three local species) (Watling 2007). The Lampropidae includes six local species in the genera *Hemilamprops* and *Mesolamprops* (each with one local species) and the *Lamprops* (four local species, see *L. quadriplicata,* this guide).

Hemilamprops californiensis occurs from northern California to Vancouver Island (Lie 1969). This genus is noted for its long, slender body and small carapace with a rounded anterolateral edge. *Hemilamprops* species lack the four carapace folds of *L. quadriplicata,* although *H. californica* has one recurved fold on its carapace. *Hemilamprops californiensis* also has three pairs of male pleopods, and 3–4 pairs of lateral telson spines, while *L. quadriplicata* has 0 and 3–5, respectively. *Mesolamprops dillonensis* is characterized by its two pairs of male pleopods (Given 1964), while *Lamprops* males have no pleopods. *Mesolamprops dillonensis* has been found in northern California.

There are several other species of *Lamprops* in the northeastern Pacific including *L. obfuscatus*, *L. triserratus* and *L. tomalesi*. The two former species were previously members of the genus *Diastylis* (Watling 2007). *Lamprops triserratus* has a carapace with oblique lateral ridges, while *L. obfuscatus* and *L. tomalesi* have carapaces without any ridges. *Lamprops tomalesi* was described from Dillon Beach, California. It has large chromatophores on its carapace, especially in the ovigerous females and the carapace lacks the four oblique folds of *L. quadriplicata.* It has five terminal telson spines, but no lateral ones.

Lamprops quadriplicata is perhaps most similar to the large European *L. fasciatus,* which is also found in Alaska. In fact, the two are so similar previous researchers have thought them synonymous (Zimmer 1980). *Lamprops fasciatus* has only three oblique folds on its carapace, not four. Like *L. quadriplicata,* it has five apical telson spines, but they are unequal in length, the outermost and middle ones being the longest (Smith 1879). In addition, *L. fasciatus* has strong transverse brownish violet pigment bands, from which it derives its name and females can be up to nine mm in length (Sars 1900).

Ecological Information

Range: Type region is along the northeast Atlantic coast (Smith 1879). Range includes the Atlantic coast of North America as well as the Arctic coasts of Alaska and the Pacific coast from Alaska south to Oregon and central California. Range also includes the northwest Pacific including Kamchatka, the Kuriles and Peter the Great Bay (Given 1965).

Local Distribution: Oregon distribution in Coos Bay, Yaquina Bay, and the Columbia River Estuary.

Habitat: Sandy or muddy benthic habitats (Sars 1900). Prefers grains smaller than 200 µm in diameter (Wieser 1956). The abundance, small size and sensitivity make *L. quadriplicata* and other cumaceans the subject of sediment toxicity testing (e.g. Swartz et al. 1979)

Salinity:

Temperature:

Tidal Level: Subtidally, in the Alaskan Arctic from 13–67 m (Given 1965). Mid to outer continental shelf along the Atlantic (Watling 1979) and from +1.4 meters down to -0.8 meters in Puget Sound, Washington (Wieser 1956).

Associates:

Abundance: Most abundant in plankton samples (oblique, night time tows from sea surface to near bottom) in winter and spring months in the Gulf of Maine (Grabe 1996).

Life-History Information

Reproduction: Development in cumaceans is direct, where eggs hatch within a marsupium, and development is thought to be similar among cumacean genera (e.g. *Leucon*, *Lamprops* and *Pseudocuma,* Gerken and Martin 2014). Little is known about the development of *L. quadriplicata*, specifically. In *Manocuma stellifera,* an Atlantic intertidal cumacean, mating occurs at night in plankton (Gnewuch and Croker 1973; Watling 1979), during the short swarming period. Females molt 12–96 hours before oviposition (in the lab). Eggs are probably fertilized as they are released into the marsupium, where they are carried to nauplius larval stage. Some other intertidal species have two breeding generations per year, one in summer and in fall (see Corey 1969, 1976 in Watling 1979).

Larva: Cumacean development proceeds from an egg to two manca stages, a subadult and finally, an adult. The manca stage resembles the adult, but is defined by a lack of the fifth pair of pleopods (see Fig. 41.1F, Gerken and Martin 2014). The mancae of *M. stellifera* molt three times to manca stage and the young leave the marsupium, molt several more times into subadult morphology, with mature gonads and secondary sexual characteristics present (see Corey 1969, 1976 in Watling 1979).

Juvenile:

Longevity:

Growth Rate:

Cumacean growth occurs in conjunction with molting where the exoskeleton is shed and replaced. Post-molt individuals will have soft shells as the cuticle gradually hardens. During a molt, arthropods have the ability to regenerate limbs that were previously autotomized (Kuris et al. 2007).

Food: In muddy habitats, *L. quadriplicata* feeds on minute suspended particles (Foxon 1936; Kozloff 1993). Feeding occurs when animal is half-buried and sand grains are collected with the first pereopods, mouthparts then scrape off organic matter. The cleaned grains are then tossed away, up over carapace, burying animal more deeply. This "sand grain rolling" is a continuous process in *L. quadriplicata*, and they are rarely observed doing anything else (Foxon 1936).

Predators:

Behavior: Males often found swimming on the surface (Foxon 1936). Swimming is with thoracic exopodites and by rapid flexing of abdomen. Telson spines may be used to clean mouthparts while animal swims in an upward and curved position. Female *L. fasciatus* can swim at speeds up to 1 m per 90–100 seconds at 12 °C or 1 m per 65–75 seconds at 20 °C. Ovigerous females sink at rates of 1 m per 40 seconds at 12 °C and 1 m per 38 seconds at 20 °C. Non-ovigerous females, on the other hand, sink at rates of 1 m per 55 seconds. Individuals can bury themselves easily, using the three pairs of posterior pereopods (Foxon 1936).

Bibliography

1. FAGE, L. 1951. Cumacés. Faune de France:1-136.
2. FOXON, G. E. H. 1936. Notes on the natural history of certain sand-dwelling Cumacea. Journal of Natural History Series 10. 17:377-393.
3. GERKEN, S., and J. W. MARTIN. 2014. Cumacea, p. 216-218. *In:* Atlas of crustacean larvae. J. W. Martin, J. Olesen, and J. T. Høeg (eds.). Johns Hopkins University Press, Baltimore, MD.
4. GIVEN, R. R. 1964. The cumacean fauna of the southern California continental shelf: No. 2. the new family Mesolampropidae. Crustaceana. 7:284-292.
5. —. 1965. Five collections of Cumacea from Alaskan arctic. Arctic. 18:213-&.
6. GNEWUCH, W. T., and R. A. CROKER. 1973. Macrofauna of northern New England marine sand. 1. Biology of *Mancocuma stellifera* (Zimmer, 1943) (Crustacea, Cumacea). Canadian Journal of Zoology. 51:1011-1020.
7. GRABE, S. A. 1996. Composition and seasonality of nocturnal peracarid zooplankton from coastal New Hampshire (USA) waters, 1978-1980. Journal of Plankton Research. 18:881-894.
8. HART, J. F. L. 1930. Some Cumacea of the Vancouver Island region. Contributions to Canadian Biology. 6:23-40.
9. HAYE, P. A., I. KORNFIELD, and L. WATLING. 2004. Molecular insights into Cumacean family relationships (Crustacea, Cumacea). Molecular Phylogenetics and Evolution. 30:798-809.
10. KOZLOFF, E. N. 1974. Keys to the marine invertebrates of Puget Sound, the San Juan Archipelago, and adjacent regions. University of Washington Press, Seattle.
11. —. 1993. Seashore life of the northern Pacific coast: an illustrated guide to northern California, Oregon, Washington, and British Columbia. University of Washington Press, Seattle.
12. KURIS, A. M., P. S. SADEGHIAN, J. T. CARLTON, and E. CAMPOS. 2007. Decapoda, p. 632-656. *In:* The Light and Smith manual: intertidal invertebrates from central California to Oregon. J. T. Carlton (ed.). University of California Press, Berkeley, CA.
13. LIE, U. 1969. Cumacea from Puget Sound and off the northwestern coast of Washington with descriptions of two new species. Crustaceana. 17:19-30.
14. PROCTER, W. 1933. Biological survey of the Mount Desert region. Wistar Institute of Anatomy and Biology, Philadelphia.
15. SARS, G. O. 1900. An account of the crustacea of Norway. III: Cumacea. Bergen Museum, Bergen.
16. SMITH, S. I. 1879. The stalk-eyed crustaceans of the Atlantic coast of North America, north of Cape Cod. Transactions of the Connecticut

Academy of Arts and Sciences. 5:27-138.
17. SWARTZ, R. C., W. A. DEBEN, and F. A. COLE. 1979. Bioassay for the toxicity of sediment to marine marcrobenthos. Journal Water Pollution Control Federation. 51:944-950.
18. WATLING, L. 1979. Marine flora and fauna of the northeastern United States: Crustacea, Cumacea. NOAA Technical Report NMFS Circular, Washington.
19. —. 2007. Arthropoda: Cumacea. *In:* The Light and Smith manual: intertidal invertebrates from central California to Oregon. J. T. Carlton (ed.). University of California Press, Berkeley.
20. WIESER, W. 1956. Factors influencing the choice of substratum in *Cumella vulgaris* (Hart) (Crustacea, Cumacea). Limnology and Oceanography. 1:274-285.
21. ZIMMER, C. 1980. Cumaceans of the American Atlantic boreal coast region USA (Crustacea, Peracarida).Smithsonian Contributions to Zoology:1-29.