Heptacarpus paludicola

A broken back shrimp

Phylum: Arthropoda, Crustacea

Class: Multicrustacea, Malacostraca, Eumalacostraca

Order: Eucarida, Decapoda, Pleocyemata, Caridea

Family: Alpheoidea, Thoridae

Taxonomy: Local *Heptacarpus* species (e.g. *H. paludicola* and *H. sitchensis*) were briefly considered to be in the genus *Spirontocaris* (Rathbun 1904; Schmitt 1921). However members of *Spirontocaris* have two or more supraorbital spines (rather than only one in *Heptacarpus*). Thus a known synonym for *H. paludicola* is *S. paludicola* (Wicksten 2011).

Description

Size: Individuals 20 mm (males) to 32 mm (females) in length (Wicksten 2011). Illustrated specimen was a 30 mm-long, ovigerous female collected from the South Slough of Coos Bay.

Color: Variable across individuals. Uniform with extremities clear and green stripes or speckles. Color can be deep blue at night (Bauer 1981). Adult color patterns arise from chromatophores under the exoskeleton and are related to animal age and sex (e.g. mature and breeding females have prominent color patters) (Bauer 1981). Five morphs were described by Bauer (1981) for both *H. sitchensis* and *H. paludicola*, including four color morphs and one transparent morph. Adults may exhibit camouflaging colors based on surrounding algae (Bauer 1981), but color patterns may be more or less fixed (genetically) and variably expressed in different environments (Bauer 1982).

General Morphology: The body of decapod crustaceans can be divided into the **cephalothorax** (fused head and thorax) and **abdomen**. They have a large plate-like carapace dorsally, beneath which are five pairs of thoracic appendages (see **chelipeds** and **pereopods**) and three pairs of maxillipeds (see **mouthparts**) (Kuris et al. 2007). The abdomen and associated appendages are outstretched in *Heptacarpus* species and the abdomen usually has a sharp bend ("broken-back shrimp" Kozloff 1993).

Cephalothorax:

Eyes:

Antenna: Antennal scale never much longer than rostrum. Antennular peduncle bears spines on each of the three segments and stylocerite (basal, lateral spine on antennule) does not extend beyond the first segment (Wicksten 2011).

Mouthparts: The mouth of decapod crustaceans comprises six pairs of appendages including one pair of mandibles (on either side of the mouth), two pairs of maxillae and three pairs of maxillipeds. The maxillae and maxillipeds attach posterior to the mouth and extend to cover the mandibles (Ruppert et al. 2004). Third maxilliped without expodite and with epipods (Fig. 1). Mandible with incisor process (Schmitt 1921).

Carapace: No supraorbital spines (*Heptacarpus,* Kuris et al. 2007; Wicksten 2011) and no lateral or dorsal spines.

Rostrum: Well-developed, longer than carapace, extending beyond antennular peduncle (Fig. 2). Rostral teeth include both dorsal (6–8, seven in current specimen, Fig. 1) and ventral (2–4, two in current specimen, Fig. 1). Dorsal edge of rostrum straight, not curved with anterior teeth.

Teeth: Rostral teeth present (see **Rostrum**).

Pereopods: Pereopods 1–2 with epi-

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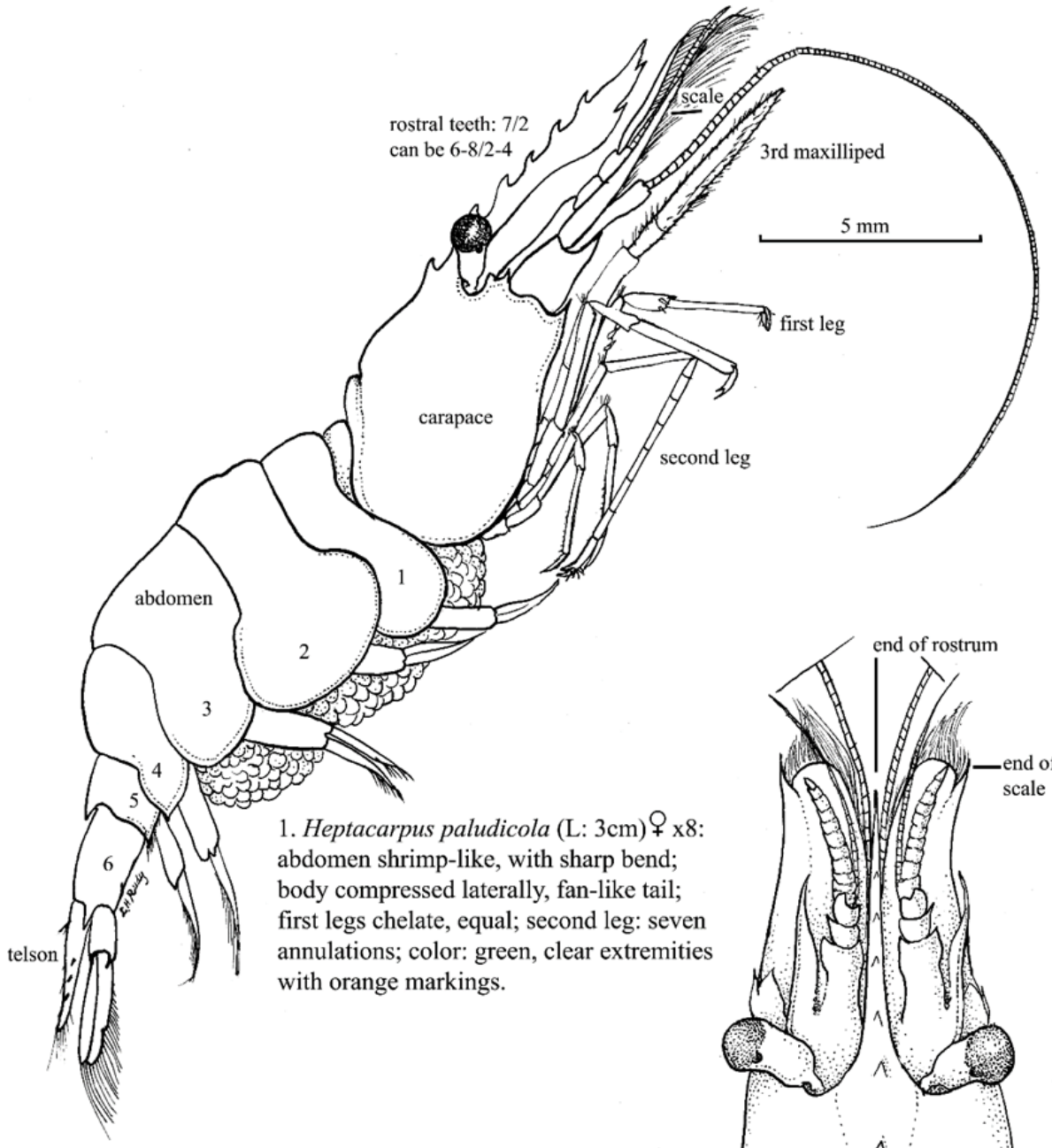

1. *Heptacarpus paludicola* (L: 3cm)♀ x8: abdomen shrimp-like, with sharp bend; body compressed laterally, fan-like tail; first legs chelate, equal; second leg: seven annulations; color: green, clear extremities with orange markings.

2. Frontal region (dorsal view): rostrum almost as long as antennal scale; rostrum longer than carapace (from orbit).

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pods. Epipod morphology is particularly relevant to the genus *Heptacarpus* and species with a higher number are considered ancestral to the group (Bauer 1984b). Pereopods 3–5 with bifid dactyls with spines arranged as follows: merus of pereopod three with five spines, pereopod four with four spines and pereopod five with 2–4 spines (Wicksten 2011). Second legs chelate, nearly equal, with seven annulations on carpus (Fig. 1).

Chelipeds: Equal, chelate (Fig. 1).

Abdomen (Pleon): Shrimp-like, with fantail, body laterally compressed. Side plates of second segment overlap those of first with sharp bend (Fig. 1). The third segment without hump and the sixth segment is shorter than telson (Fig. 1). Segments 1–3 with pleura that is rounded, fourth segment with tooth and fifth with spine (Wicksten

Telson & Uropods: Telson bears 4–5 pairs of dorso-lateral spines (Wicksten 2011) (Fig. 1).

Sexual Dimorphism: Females often have broader and larger bodies than males, which have compressed and squat bodies (Wicksten 2011).

Possible Misidentifications

The family Hippolytidae was split into three families following a cladistic analysis by Christoffersen (1987) that are currently recognized by some (e.g. Wicksten 2011), but not all authors (e.g. Kuris et al. 2007). These three families include the Lysmatidae, Hippolytidae and Thoridae. The Lysmatidae are characterized by very long antennular flagella. The three families can further be distinguised by the number of carpal articles on the second pereopod: 22 or more in Lysmatidae, three in Hippolytidae and seven in Thoridae. In addition, Thoridae and Hippolytidae can be differentiated by their supraorbital spines, one in the latter and 0–4 in the former family (Wicksten 2011). The Lysmatidae is represented by a single species locally, *Lysmata californica* (Kuris et al. 2007; Wicksten 2011). When following the above taxonomy (Christoffersen 1987; Wicksten 2011), local members of the Hippolytidae include *Hippolyte californiensis* and *H. clarki.* Meanwhile, the genus *Heptacarpus*, with eleven local species, falls within the Thoridae, as do the local species *Lebbeus lagunae* and *Spirontocaris prionota* (Kuris et al. 2007; Wicksten 2011).

Very close in color, morphology, and habitat preference is *Heptacarpus sitchensis*, whose adult rostral teeth are 4–8/0–5, but whose rostrum, while it can reach to the middle of the antennal scale, does not reach to the end of the scale as does that of *H. paludicola*. The rostral teeth are closer together on *H. sitchensis* and the rostrum is more slender (Schmitt 1921), as well as being only equal to or shorter than the carapace. Our *H. sitchensis* specimens were only 1.5 cm, half the size of the female *H. paludicola*. *Heptacarpus sitchensis* is the most commonly found transparent shrimp in tide pools (Ricketts and Calvin 1971), while *H. paludicola* is more common in mudflats and in eelgrass.

Heptacarpus taylori, also has a short rostrum, reaching just to the eye and is often brightly colored, with a series of teeth from anterior carapace margin to the apex. *Heptacarpus brevirostris*, with smooth rostrum (without lower teeth) that reaches only the first segment of the antennal peduncle. The merus of *H. brevirostris* has a single spine on pereopods 3–4. *Heptacarpus palpator* is similar to *Heptacarpus brevirostris*, but with a longer rostrum that can be di- or trifid, and a longer antennal scale (Wicksten 1986). *Heptacarpus stimpsoni*, from Puget Sound, has rostrum that extends over eye (only slightly), with dorsal teeth and pereopod (3–5) dactyls that are simple and curved. *Heptacarpus carinatus* is a long-rostrumed

shrimp, with distal rostral teeth (3–7 dorsal and 2–6 ventral) and epipods present on pereopods 1–3. *Heptacarpus franciscanus*, from San Francisco Bay, has a rostrum longer than the carapace. *Heptacarpus pugettensis, H. flexus*, and *H. tenuissimus* have a hump on the third abdominal segment. *Heptacarpus pugettensis* has epipods on pereopods 1–2 and a rostrum that just reaches the end of the first segment of antennular peduncle and not beyond. *Heptacarpus flexus* is morphologically similar to *H. carinatus*, but with epipods on pereopods 1–2 only and a narrow rostrum with teeth (4–5 dorsal and 5–8 ventral). *Heptacarpus tenuissimus* lacks teeth on the ventrum of the fourth abdominal pleon and also lacks an exopod on the third maxilliped (see dichotomous key in Wicksten 2011 for *Heptacarpus* species).

Ecological Information

Range: Type locality is Humboldt Bay, California. Known range includes Tava Island, Alaska to San Diego, California (Schmitt 1921; Wicksten 2011).
Local Distribution: Coos Bay distribution near, and south of, the Charleston Bridge in South Slough.
Habitat: South Slough amongst mud and eelgrass (*Zostera, Ulva*), also on pilings, floats and in tide pools of outer coasts (Kuris et al. 2007; Wicksten 2011).
Salinity: Collected at salinity 30.
Temperature:
Tidal Level: Collected at +0.15 m and is intertidal to 10 m depths (Wicksten 2011).
Associates:
Abundance: Common to abundant (Schmitt 1921; Kuris et al. 2007).

Life-History Information

Reproduction: Ovigerous female found in March, in South Slough, Coos Bay. Males and females may be (weakly) attracted to each other with sex phermones (Bauer 1979), but are generally only triggered to initiate copulation after physical contact (Bauer 2011). Little is known about the development in *Heptacarpus* species (Strathmann 1987; Puls 2001).
Larva: Larval development in *Heptacarpus* species proceeds via a series of zoea, and, a final, post-zoea (decapodid) stage, each marked by a molt (Puls 2001; Guerao and Cuesta 2014). The zoea are planktotrophic, have a narrow rostrum (without teeth), cylindrical eyestalks, antennule bases that are close together (but not touching), and abdomen with postero-lateral spines (Puls 2001; see Fig. 48.3, Guerao and Cuesta 2014).
Juvenile:
Longevity:
Growth Rate: Growth occurs in conjunction with molting. In pre-molting periods the epidermis separates from the old cuticle and a dramatic increase in epidermal cell growth occurs. Post-molt individuals will have soft shells until a thin membranous layer is deposited and the cuticle gradually hardens. During a molt decapods have the ability to regenerate limbs that were previously autotomized (Kuris et al. 2007).
Food: Carnivorous (Kozloff 1993). The majority of caridean shrimps are omnivorous (Chace and Abbott 1980).
Predators: Fish.
Behavior: Propel themselves backward by flexing their tails forward and often flip out of a collector's hand. Members of the genus *Heptacarpus* have been shown to exhibit body, gill and embryo grooming in response to microbial fouling and parasites. Grooming with specialized antennal brushes is found in members of the Stenopodidea, Caridea and Dendrobranchiata and suggests a common ancestor rather than evolutionary convergence (see Bauer 1989).

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