Pugettia producta

A kelp crab

Phylum: Arthropoda, Crustacea
Class: Malacostraca
Order: Decapoda
Section: Brachyura
Family: Epialtidae

Taxonomy: *Pugettia producta* was originally described as *Epialtus productus* by Randall in 1840, but was later moved to the genus *Pugettia*. Current synonyms for *P. producta* include *E. products*, and *P. productus* (Ng et al. 2008).

Description

Size: *Pugettia producta* is the largest of the kelp crabs (Wicksten 2011) and the largest individual, on record, was 93 mm in width and 107 mm in length. Oregon specimens are larger than those in southern California. The average male carapace is 71 mm in length and 62 mm in width, female carapace is 69 mm in length and 59 mm in width (Wicksten 2011).

Color: Body color highly dependent on season, molting stage and ingested macroalgal pigments (Hultgren and Stachowicz 2008) and ranges from light olive green to dark brown or black. Ventrally, females and juveniles are often yellow and males bright red (see Wicksten 2011).

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**). The abdomen and associated appendages are reduced and folded ventrally (Decapoda, Kuris et al. 2007).

Cephalothorax:

Eyes: Eyes small and distance between them less than one third carapace width (adults).

Antennae:

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).

Carapace: Carapace remarkably smooth and mature specimens are practically hairless (Garth 1958). Sides of carapace are almost parallel with prominent posterolateral teeth (*Pugettia,* Carlton and Kuris 1975). Posterior margin convex medially (Garth 1958) and carapace decidedly longer than wide (Wicksten 2011).

Frontal Area: Rostrum deeply notched and bifid, small and with horns bearing hooked setae (Garth 1958; Wicksten 2011) (Figs. 1, 2).

Teeth: Dorsal surface smooth with small pre- and post-orbital teeth (Fig. 2). Large anterolateral (hepatic) teeth. Large hepatic tooth is joined to postorbital tooth. A large tooth is also present between anterolateral tooth and posterior margin.

Pereopods: Almost cylindrical (Rathbun 1925) and decreasing in length posteriorly with slender dactyls that bear spinules (Fig. 1) (Garth 1958; Wicksten 2011). Legs shorter and stouter than in other *Pugettia* species.

Chelipeds: Large and well developed, especially in mature males, where they are stout and shorter than the first walking legs. The hand long and narrow (sometimes inflated), fingers (dactyls) are slender, pointed posteriorly and curved inward, inner margins are dentate and often gaping (males). Female chelipeds, on the other hand, are slender (Fig. 3) (Rathbun 1925). Female cheliped more slender than male (Wicksten 2011).

Abdomen (Pleon): Abdomen narrow in male, broad in female (Fig. 4). Consists of seven segments (Fig. 4).

Telson & Uropods:

Sexual Dimorphism: Male and female brachyuran crabs are easily differentiable. The most conspicuous feature, the abdomen, is narrow and triangular in males while it is

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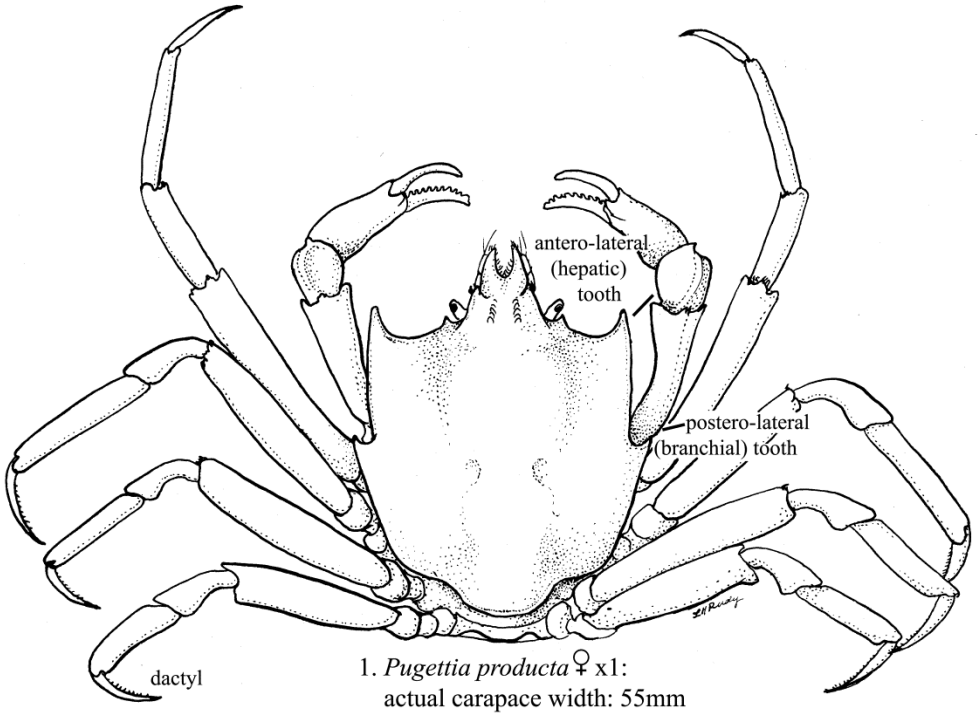
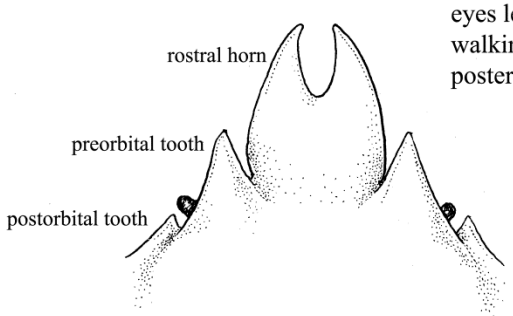
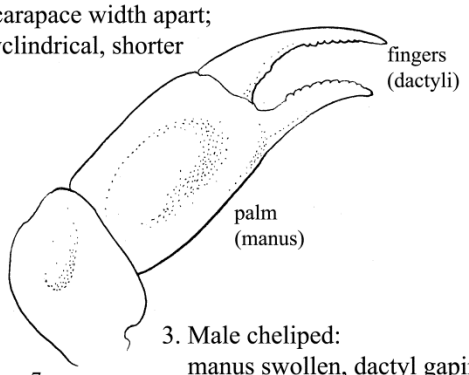
Pugettia producta



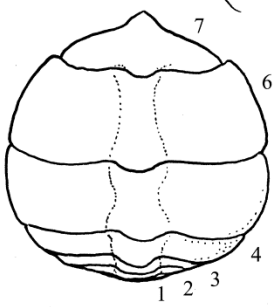
1. *Pugettia producta* ♀ x1:
actual carapace width: 55mm
carapace smooth, sides subparallel;
strong hepatic and branchial teeth;
eyes less than 1/3 carapace width apart;
walking legs subcyclindrical, shorter posteriorly.



2. Frontal area:
rostrum bifid: two horns;
small pre- and post- orbital teeth.



3. Male cheliped:
manus swollen, dactyl gaping;
often long, stout.



4. Abdomen ♀ (ventral view):
seven segments.
(1&2 dorsal)

wide and flap-like in females. Additionally, males have one large chela (see **Chelipeds**) and two pleopod pairs specialized for copulation however, the third and fourth pleopods are absent. Females, on the other hand, have all four pleopod pairs, each with long setae for egg attachment (Brachyura, Kuris et al. 2007).

Possible Misidentifications

Among the Epialtidae, there are four local species, three of which belong to the genus *Pugettia* (Kuris et al. 2007). Besides *P. producta*, *Pugettia gracilis* and *Pugettia richii* are two smaller species found in the northwest. Both are smaller and have a greater distance between the eyes (about half the carapace width) than *P. producta.* Additionally, both have tuberculate carapace surfaces, constrictions between the hepatic and branchial teeth and long walking legs (Garth 1958, Wicksten 2011). Neither *P. gracilis* nor *P. richii* have the smooth surface or straight carapace sides of *P. producta. Pugettia gracilis* can be similar in color to *P. producta*, but *P. richii* is usually red with legs banded (Wicksten 2011). Members of the local epialtid genus *Mimulus* lack posterolateral spines.

Ecological Information

Range: Type locality is northern California. Known range includes Prince of Wales Island, Alaska to Point Asuncion, Baja California (Garth 1958; Wicksten 2011).
Local Distribution: Coos Bay distribution in South Slough. Oregon distribution includes various protected outer shores and estuaries.
Habitat: Off hard substrate and amongst eelgrass and kelp (*Egregia,* Ricketts and Calvin 1971). Also occurs in tidepools on *Fucus*, on pilings in bays and in *Enteromorpha*, but prefers *Zostera* (juveniles) (Garth and Abbott 1980).
Salinity: Collected at salinities of 30. Does not osmoregulate or tolerate brackish water (Garth and Abbott 1980).
Temperature:
Tidal Level: Intertidal to 80 meters (Garth 1958; Wicksten 2011).
Associates: Sometimes hosts parasitic barnacle, *Sacculina.* Eggs parasitized by nemertean worm *Carcinonemertes epialti* (Garth and Abbott 1980; Coe 1902; Kuris et al. 2007).
Abundance: Most common kelp crab in Coos Bay estuary.

Life-History Information

Reproduction: All decapod crustacean females attach recently laid gelatinous egg masses to their pleopods. The outer embryo membrane thickens and a strand develops that attaches each embryo to pleopod setae (Decapoda, Kuris et al. 2007). Ovigerous females have been observed year-round in Monterey Bay, California, although rarely during some months. In Puget Sound, Washington largest broods are observed in November to January. Brood numbers range from 34,000 to 84,000 with an average of 61,000 embryos that are yellow early in development and become orange-red to brown at more advanced stages (Jaffe et al. 1987). Developmental timelines are variable with latitude from 28–31 days in Monterey, California to almost a year in Puget Sound, Washington (Knudsen 1964; Jaffe et al. 1987). Females produce broods regularly and some authors suggest as often as monthly (Hines 1981; Jaffe et al. 1987). *Carcinonemertes epialti* is a nemertean predator of *P. producta* eggs (Coe 1902). Up to 100 nemerteans were found on a single crab (Monterey, California, Coe 1902). The reproduction and life-cycle of *C. epialti* is dependent upon and corresponds to that of its host species. However, this nemertean is not host specific (unlike *Carcinonemertes errans* on *Cancer magister*) and occurs amongst egg masses of other species including *Hemigrapsus oregonensis*, *H. nudus*, *Pachygrapsus crassipes* (Roe et al. 2007). Interestingly, it may be more common on *H. oregonensis* than *P. producta*, for which it was described (Kuris 1993; Kuris et al. 2007).
Larva: The larval development of *P. product* has not been described in detail. Development consists of zoea (two) and megalopa stages (Hines 1981). The zoea of members of the family Majidae (now Epialtidae) can be recognized by the presence of a rostral spine only, lack of lateral spines and an antenna protopod that is nearly equal in length to the rostrum. The carapace of megalopae are 1.6 mm in length and 1.2

mm in width and is larger than its congener, *P. gracilis* (Puls 2001). Recruitment of newly metamorphosed individuals is mostly in intertidal and shallow subtidal eelgrass and surfgrass zones (Jaffe et al. 1987).

Juvenile: Juveniles (about 3 mm long) can be constricted at the sides like *P. richii* (Garth 1958). Newly settled individuals bear tufts of setae on the lateral margins of the carapace and are yellow in color, ventrally (Wicksten 2011).

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: *Pugettia producta* is primarily herbivorous, preferring brown algae, but will eat barnacles, mussels and fish pieces in the laboratory (Knudsen 1964). Ontogenetic changes from red intertidal algae to brown algae (kelp) has been reported by Hines (1982).

Predators: Fishes (especially juveniles), larger crabs and sea otters (Grossman 1986; Hultgren and Stachowizc 2008). Adult *P. producta* are aggressive with a strong pinch and thus, few predators. Additionally, color camouflage effective in reducing predation (Hultgren and Stachowicz 2008).

Behavior: A nocturnal feeder, *P. producta* is an active species, particularly those in rocky tide pools (Rathbun 1925). Individuals occasionally attach pieces of algae, which will be consumed later, to their rostrum (Wicksten 2011).

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