Cancer productus

The red rock crab

Phylum: Arthropoda, Crustacea

Class: Multicrustacea, Malacostraca, Eumalacostraca

Order: Eucarida, Decapoda, Pleocyemata, Brachyura, Eubrachyura, Heterotremata
Family: Cancroidea, Cancridae

Taxonomy: Despite recent confusion regarding a variety of cancrid genera, the taxonomy of *Cancer productus* has remained stably within the genus *Cancer* (Harrison and Crespi 1999; Schweitzer and Feldmann 2000; Kuris et al. 2007; Wicksten 2012).

Description

Size: Carapace 97–174 mm in length and up to 157.5 mm in width (Schmitt 1921; Rathbun 1930). Females with carapace length up to 158 mm and males up to 200 mm (Puls 2001).

Color: Dark red dorsally, lighter ventrally, legs mottled red and juveniles striped (Fig. 3).

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: Eyestalks short, orbits small.

Antenna: Antennules folded lengthwise, antennal flagella short and hairy (Queen 1930).

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: Broadly oval, uneven and slightly convex. Widest at ninth antero-lateral tooth (Fig. 1) (Wicksten 2012).

Frontal Area: Markedly pronounced beyond eyes, with five nearly equal teeth (Fig. 2).

Teeth: Ten antero-lateral teeth (counting orbital tooth), nine large teeth that become more acute posteriorly.

Pereopods: Dactyls thickly fringed above and below.

Chelipeds: Dactyls dark-tipped and hands rough dorsally. Carpus wrinkled, with single tooth at inner angle (Queen 1930).

Abdomen (Pleon): Abdomen narrow in male, broad in female (e.g. see *Cancer magister*, Fig. 3).

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 wide and flap-like in females. Additionally, males have one large chelae 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

According to some authors, the genus *Cancer* comprises 23 species (Harrison and Crespi 1999 but see Schweitzer and Feldmann 2000). This genus is differentiated from other brachyuran genera by the broadly oval carapace, presence of five frontal teeth and antennules that fold back over carapace. Characters unique to *Cancer productus* in-

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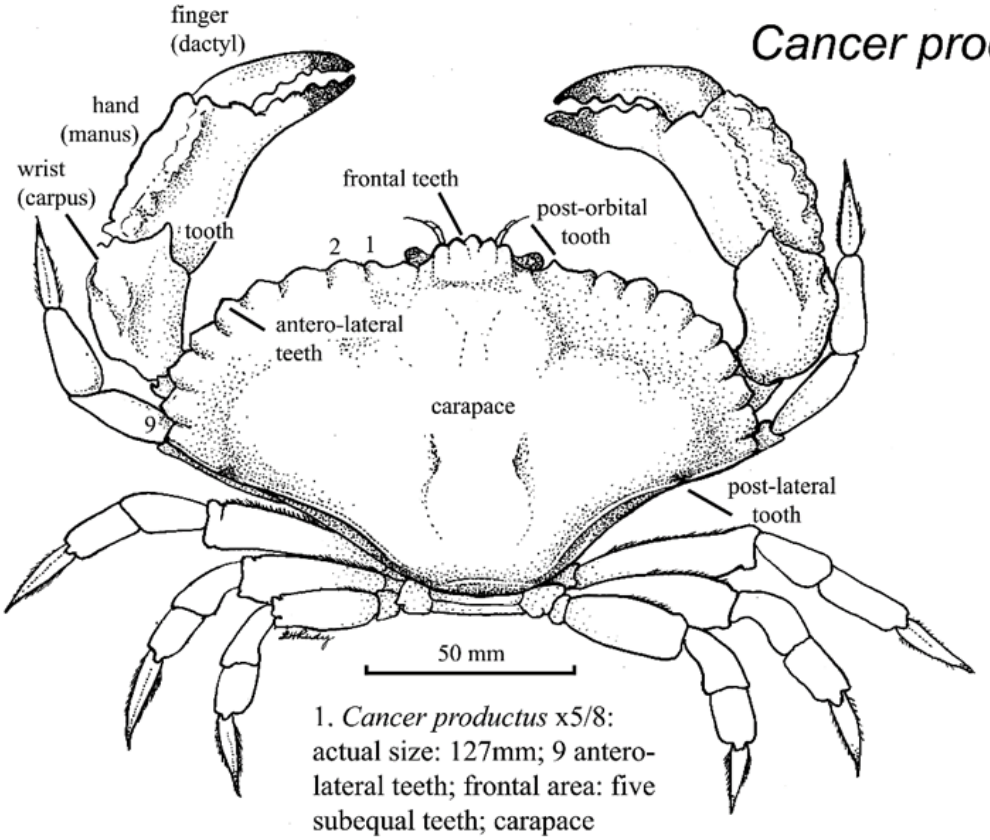
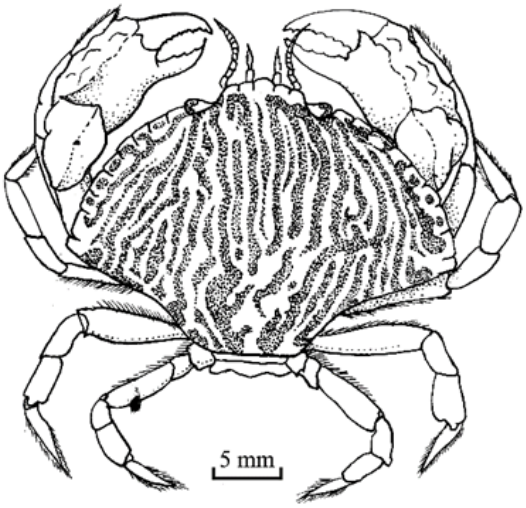


1. *Cancer productus* x5/8: actual size: 127mm; 9 antero-lateral teeth; frontal area: five subequal teeth; carapace broadly oval; fingers dark-tipped; one post-lateral tooth, one post-orbital tooth.

2. Frontal area: markedly pronounced; five subequal teeth; post-orbital tooth.



3. Juvenile x2: actual size 2.5mm carapace like adult; striped; nine antero-lateral teeth.

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clude ten antero-lateral teeth, carapace widest at ninth tooth, bright red color and black-tipped cheliped dactyls (Kuris et al. 2007).

There are eight *Cancer* species known locally (Kuris et al. 2007). The most morphologically similar to *C. productus* is *C. magister*, which also has 10 antero-lateral teeth and five subequal frontal teeth (Kuris et al. 2007). However, the carapace of *C. magister* is widest at the tenth tooth, is more subtly pigmented and does not have black tipped dactyls (Wicksten 2012). The two species are often collected together in crab pots. *Cancer antennarius*, like *C. productus*, is dark red with spots ventrally and with black tipped chelae. However the carapace width in *C. antennarius* is widest at the eighth tooth and there are a total of 11 antero-lateral teeth (Wicksten 2012). *Cancer oregonensis* is a small, oval crab with 12–13 total teeth. The remaining four species have nine antero-lateral teeth (sometimes ten in older specimens, Wicksten 2012). *Cancer branneri* is a small species (35 mm) that is rare intertidally and recognizable by cheliped dactyls that are long, straight, black and spiny. *Cancer gracilis* is also small (27 mm) has white-tipped cheliped dactyls and *C. jordani* (25 mm) has a hairy carapace and sharp curving teeth. *Cancer anthonyi*, the yellow rock crab, is larger than the previous three at 52 mm and has black-tipped cheliped dactyls (Kuris et al. 2007; Wicksten 2012). Populations of *C. productus*, *C. anthonyi* (southern California) and *C. magister* support commercial fisheries (Kuris et al. 2007).

Ecological Information

Range: Kodiak, Alaska, to Magdalena Bay, Baja California (Schmitt 1921).

Local Distribution: Occurs in a variety of local Oregon estuaries including Coos, Yaquina, Umpqua, Coquille, Tillamook (Gaumer et al 1973) on semi-protected rocky shores (Garth and Abbott 1980).

Habitat: Individuals appear to prefer gravel, rock, and hard bottom – *C. productus* does not burrow and lacks straining apparatus for sand removal (Ricketts and Calvin 1971). Also found in rocky tidepools and among eelgrass (Ricketts and Calvin 1971; Garth and Abbott 1980). Adults tend to bury themselves into soft sand as is seen in *C. magister,* although less frequently (McGaw 2004).

Salinity: Collected at 30. In San Francisco Bay salinity tolerance ranges from 21.7 to 33.3 (Schmitt 1921).

Temperature: Collected at 11–17°C in the San Francisco Bay area (Schmitt 1921).

Tidal Level: Intertidal to about 79 m and occurs closer to shore than *C. magister* (Puls 2001).

Associates:

Abundance: Common (Carlton and Kuris 1975).

Life-History Information

Reproduction: In *C. productus*, mating occurs June–August (Puget Sound) (Knudsen 1964; Jaffe et al. 1987). When the female is about to molt, male *C. productus* clasps the female and copulation takes place after molting (i.e. female shell is soft). Fertilization is internal and egg deposition occurs months later in December–January, at which point eggs are bright orange. 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). Eyespots and chromatophores are easily visible in advanced embryos and make them appear gray when ready to hatch. Zoea larvae hatch by early April (Knudsen 1964). A second brood is sometimes produced (Jaffe et al. 1987).

Larva: The larvae of *C. productus* have been described (Trask 1970; Roesijadi 1976). Lar-

val development proceeds via a prezoea (Roesijadi 1976) followed by a series of zoea (five total, telson with single lateral spine at each fork, Lough 1975) and megalopae stages, each marked by a molt. The zoea and megalopae of cancrid species are difficult to distinguish. The larvae of *C. productus, C. oregonensis* and *C. magister* are morphologically similar (Puls 2001), but can be differentiated (e.g. variation in setal morphology, see Trask 1970). *Cancer productus* zoea are planktotrophic and have large compound eyes and four spines: one each dorsal and rostral and two lateral (see Fig. 1, Trask 1970; Martin 2014), which are lacking in prezoeae (Roesijadi 1976). Larval size (measured from tip of rostrum to tip of telson) proceeds from 2.5 mm (Zoea I and telson with pair of lateral exospines) to approximately 6 mm (Zoea V) (Trask 1970; Puls 2001). The megalopae of *C. productus* are about half the size of *C. magister* megalopae (3.4–3.6 mm from rostrum to posterior carapace and approximately 2 mm at wides point) (Trask 1970). Larvae have been observed swarming in May (Friday Harbor, Jaffe et al. 1987). Hatching zoea to the megalopa stage requires 97 days in the lab (Trask 1970). The megalopae of *C. oregonensis* and *C. productus* were described by DeBrosse et al. 1989 (see Fig. 1-2, 3-4, DeBrosse et al. 1989).

Juvenile: Juveniles are often brightly colored and possess several to many spots (see Krause-Nehring et al. 2010). Interestingly, the wide variety of juvenile color morphs does not correspond to environmental background colors or food (Krause-Nehring et al. 2010). The carapace is widest at ninth tooth, naked and often spotted or striped. Frontal and antero-lateral teeth are flat, rounded and fairly uniform (Fig. 3).

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). Research has shown, however, that regenerated limbs handicap C. productus foraging and predatory abilities (Brock and Smith 1998).

Food: *Cancer productus* individuals are scavengers and predators on other crustaceans, especially barnacles and other crabs (Knudsen 1964) as well as molluscs and polychaete worms. Zoea reportedly ingest *Dendraster excentricus* pluteus larvae, but their efficiency reduces with pluteus size and age (Rumrill et al. 1985).

Predators: Adults are commercially and recreationally harvested for food. Additional predators include octopus, fish and birds (Knudsen 1964). Larval forms are predated by filter and plankton feeders (herring, salmon, and other fishes).

Behavior: Individuals are dominant and stalk prey in tidepools at night (Ricketts and Calvin 1971). They are also active in daylight and individuals can aggregate by sex and age, depending on egg-laying and molting cycles (Knudsen 1964).

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T.C. Hiebert