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# *Pinnixa faba*

The pea crab

Phylum: Arthropoda, Crustacea

Class: Multicrustacea, Malacostraca, Eumalacostraca

Order: Eucarida, Decapoda, Pleocyemata, Brachyura,  
Eubranchyura, Thoracotremata

Family: Pinnotheroidea, Pinnotheridae,  
Pinnotherellinae

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## Description

**Size:** Female *P. faba* are much larger than males. Females are about 20 mm in width while males are 10 mm wide (Fig. 1). Average first true crab size is 1.54 mm (Pearce 1966).

**Color:** Grayish tan with orange or rust colored markings. Immature crabs are white, eggs orange and female cheliped tips are white. Individuals are bright orange just after molting (Pearce 1966).

**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:** Orbits oval and eyestalks very short. In males, the eyes fill orbits (Fig. 4) (Rathbun 1918).

### Antenna:

**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). In *P. faba*, external maxillipeds have a large, separate merus (the arm) and ischium (the first large article of the maxilliped). The carpus articulates at the outer angle of the merus and a palp

articulates at the inner proximal end of the merus. Exognath is with several joints and is hidden (Rathbun 1918).

**Carapace:** Carapace is smooth, rounded, swollen and oblong with no strong post- or anterolateral ridges. Carapace is 1.6–1.9 times wider than long and sides are truncate, slope steeply and meet at an angle (Fig. 1) (Zmarzly 1992). Male carapaces sometimes have a vertical, compressed lobe at the anterolateral angle (Fig. 4).

**Frontal Area:** Narrow, slightly advanced in males and strong medial groove in females (Figs. 4, 1).

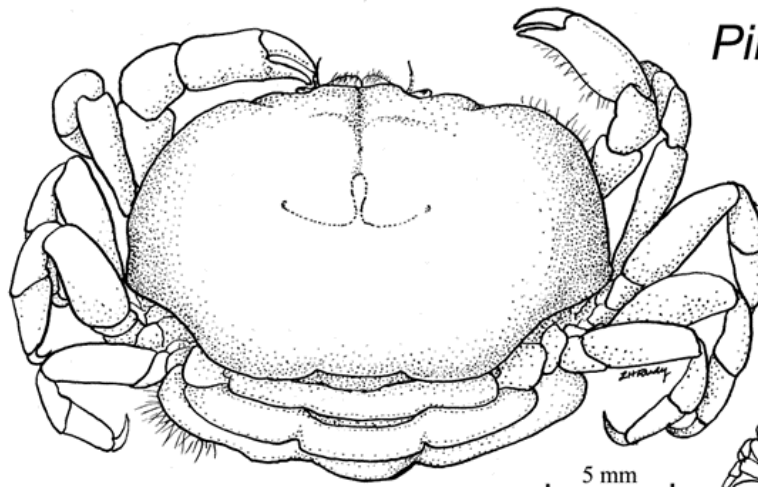
**Teeth:** No anterolateral teeth.

**Pereopods:** The merus of males third walking leg is more than twice as long as wide (Fig. 4). Dactyli of both sexes are short and strongly curved (less so in fourth dactyl) (Zmarzly 1992). The third walking legs are longest and all legs are similar in shape, except the merus of the first leg in males, which is concave above, not convex as are others. Female legs more alike than in males.

**Chelipeds:** Chelae are large, smooth and about 2/3 width of carapace (Zmarzly 1992). Pollex (thumb or fixed finger) straight and a little shorter than movable dactyl, which is curved (Fig. 3). Dactyls of female are white-tipped and not gaping (Rathbun 1918) (Fig. 3a). Male chelae manus (palm) are almost oblong, widening at tip, pollex shorter than dactyl, which is curved, and has a tooth at its base (Fig. 3b). The male dactyl is hairy within (Fig. 3b) (Zmarzly 1992).

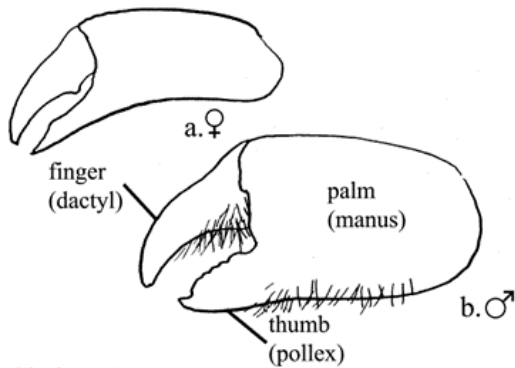
**Abdomen (Pleon):** Consisting of seven free somites in both sexes (Zmarzly 1992). Male abdomen is narrow with last segment rounded

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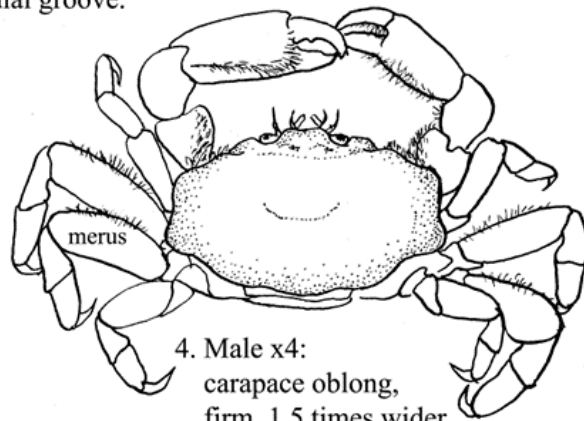


1. *Pinnixa faba* (female) x4:  
actual size 2 cm; carapace rounded,  
swollen; eyes, orbits small and oval;  
frontal area: medial groove.

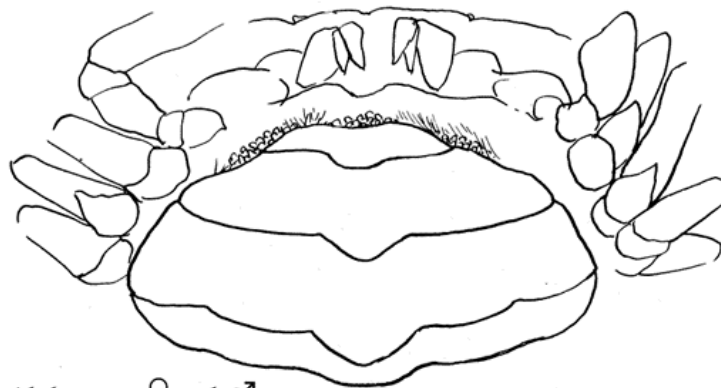
2. Immature x4



3. Chelae x7:  
a. female: white, not gaping  
b. male: thumb straight; dactyl curved,  
toothed; fingers hairy; palm widens distally.

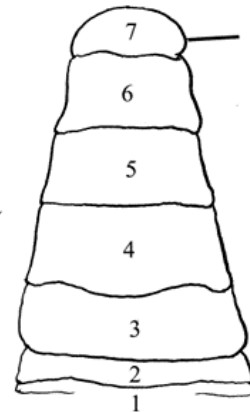


4. Male x4:  
carapace oblong,  
firm, 1.5 times wider  
than long; sides slope steeply, antero- and  
post-lateral margins meet at angle; merus  
long (third walking leg).



5. Abdomens, ♀ and ♂:

a. female: seven-jointed, very wide



b. male: narrow; last  
segment rounded.

and the next to last segment constricted in middle (Fig. 5b). Female abdomen is very broad (Fig. 5a).

### **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 (Brachyura, Kuris et al. 2007). Female *P. faba* are larger than males, have slightly different general body shape and chelae morphology (see above).

### **Possible Misidentifications**

All members of the Pinnotheridae are small, have a wide, rounded carapace, small eyes and short eyestalks. Pea crabs are very particular to a specific habitat and/or host. There are 15 pinnotherid species reported from central California to Oregon and most of them are in the genus *Pinnixa* (Kuris et al. 2007). A thorough key to local members of the genus *Pinnixa* was published by Zmarzly (1992). The genus is characterized by a carapace wider than long, frontal margin with median groove, short eyestalks with orbits ovate and filled by eyes, third maxillipeds with small ischium, large merus and large palp, third walking leg longer and more robust than others and abdomen with seven free somites (Zmarzly 1992). There are 11 local species (Kuris et al. 2007). *Pinnixa faba* can be differentiated by chelae morphology where the pollex in males is straight with an inner dactyl margin bearing a single triangular tooth (Fig. 3b). Female chela morphology also has straight pollex and opposing fingers that meet tightly, with no gape (Zmarzly 1992).

The closely related *Pinnixa littoralis*, is often found in the clam *Tresus capax*, as is *P. faba*. *Pinnixa littoralis* is distinguishable by its carapace, which is pointed at the sides and the merus of its

third walking leg is twice as long as wide (in males), but not longer as in *P. faba*. The female fingers gape, her walking legs are rather alike and the male pollex is deflexed (bent down) and the movable finger (dactyl) has no tooth at its base. The two species also differ in color: *P. littoralis* females are greenish-yellow. Both these species are found in pairs, not singly as with most pea crabs (Pearce 1966).

Other *Pinnixa* species are *P. longipes*, with exceptionally large third walking legs, commensal with tube worms; *P. barnharti*, which is commensal with a holothurian; *P. occidentalis*, with cylindrical fourth and fifth walking legs, found in echiuroid worm burrows and associated with *P. franciscana*, *P. tubicola*, and *P. schmitti*, species also found in worm burrows and tubes. The carapace has a granular cardiac ridge, curved teeth along the anterolateral margin and a conspicuous subhepatic tooth in *P. scamit*. Little is known about the final species, *P. weymouthi* (Kuris et al. 2007).

The other local pinnotherid genera include *Pinnotheres* (symbiotic with oysters), *Parapinnixa* (symbiotic with polychaetes *Terebella californica* and *Loimia*), *Fabia* (symbiotic with bivalves, especially *Mytilus*) *Opisthopus* (symbiotic with various molluscs including *Tresus*, and some holothurians). *Scleroplax granulata*, found usually with mud and ghost shrimp, has a wide carapace like *P. faba*, but its antero- and posterolateral margins curve gradually, not forming an angle.

### **Ecological Information**

**Range:** Type locality is Puget Sound, Washington. Known range includes Alaska to Mexico (Fig. 1, Zmarzly 1992).

**Local Distribution:** In clams found in bay mud, or mud and sand.

**Habitat:** Heavily infests *Tresus capax*, the gaper clam, (nearly 100% in Puget Sound individuals). Adult *Pinnixa* are rarely found in *Tre-*

*sus nuttalli* when *T. capax* and *T. nuttalli* co-occur, however, south of *T. capax*'s range *P. faba* occupies *T. nuttalli*. *Tresus capax* is likely preferred because female *P. faba* attach to the visceral fold of their host which is present in *T. capax* and not in *T. nuttalli* (Zmarzly 1992). *Pinixia faba* inhabits *Tresus* in pairs. The large female clings to the visceral fold in the mantle cavity of the clam and remains there, immobile, and permanently close to the food supply. Smaller males and immature crabs are found throughout the mantle cavity and around the incurrent siphon, although they are often close to the female. The young crabs seem to be free-living. The clam, *Tresus*, is found in mud or sandy mud, 25–60 cm below the surface. *Pinnixa faba* individuals are also found in *Saxidomus*, *Mya*, *Tapes*, *Macoma*, and as immature crabs, in *Clinocardium* (Rathbun 1918). It is found in the invasive manila clam (*Venerupis philippinarum*) and invasive varnish clam (*Nuttalia obscurata*) (Marshall et al. 2003). Individuals also reported in non-bivalve hosts such as abalone, sea cucumbers, limpets, sea hares, and tunicates (Schmitt 1921; Hart 1982).

**Salinity:** Host, *Tresus capax*, found at salinities from 30.5–33.5 (Humboldt Bay, California).

**Temperature:**

**Tidal Level:**

**Associates:** Female *P. faba* are never free-living and the males (and immature individuals) move about only occasionally. The pea crab is always found living parasitically in a bivalve. Very occasionally an immature crab of another species (*P. littoralis*) will inhabit the same clam (Pearce 1966). Blisters and irritation of the clam's viscera are noticeable where the female is lodged (Kozloff 1993). The crab is parasitic, not commensal – it steals food from the clam, and apparently gives nothing in return.

Fossils from Cape Blanco, Oregon suggest that *P. faba* and *T. capax* have had a symbiotic relationship for at least 33,000 years (Zullo and Chivers 1969).

**Abundance:** Can be very prevalent in certain clam populations (almost 100% infestation) but prevalence varies with season (Pearce 1966).

## 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). *Pinnixa faba* can have two broods per year (occurring one month later than in *P. littoralis*), the first in late spring to summer and the second in winter to early spring. The period between the two broods may or may not be punctuated by a molt (Pearce 1966; Jaffe et al. 1987). Copulation occurs within the clam, as the female is sessile. Males are usually found on or next to females. One to five immature crabs of both sexes have been found resident in the clam (particularly in summer and falls), presumably waiting to assume adult roles at the death of either of the adult pair. Each female brood contains 7,000–8,000 embryos that hatch between August and September, having a 47-day pelagic duration in the lab (Washington, Jaffee et al. 1987).

**Larva:** The larvae of pinnotherids proceed through planktonic prezoaea, zoea (two stages) and megalopa stages. The zoea have large compound eyes and four spines: one each dorsal and rostral and two lateral (see Fig. 54.5, Martin 2014). The most definitive feature of pea crab zoea is the fifth abdominal segment, which is expanded laterally (see <http://invert-embryo.blogspot.com/2012/04/identifying-pinnotherid-larvae.html>; Puls 2001). Megalopae have an oval carapace that is wider than long, granular and 1.4 mm

wide and 1.1 mm in length. The posterior pereopods of megalopae and juvenile instars have dactyls that lack setae (Jaffe et al. 1987; Puls 2001).

**Juvenile:** Post-megalopae, development proceeds via a series of in-star stages, which are not free-swimming, that were described by Pearce (1966) (Schneider 1993). At the first in-star stage, the carapace width is approximately 1.5 mm and by the terminal in-star stage it is 20 mm (females at 23–24th in-star) and 10 mm (males at fifteenth in-star) (Pearce 1966). Juvenile *P. faba* and *P. littoralis* are indistinguishable (Zmarzly 1992).

**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:** Female steal food from host (diatoms, etc.) using mucus strings. Male feeding habits are unknown (Kozloff 1993).

**Predators:**

**Behavior:** Young (first true crab stage) crabs infest young *Tresus* when they have just settled out, and remain permanently. Other immature crabs may be found later with this pair. Neither sex is adapted for permanent free-living, nor is the immature crab, which is white, thin and fragile (Pearce 1966).

**Bibliography**

1. HART, J. F. L. 1982. Crabs and their relatives of British Columbia. British Columbia Provincial Museum Handbook: 1-267.
2. JAFFE, L. A., C. F. NYBLADE, R. B. FORWARD, and S. SULKIN. 1987. Phy-

lum or subphylum Crustacea, class Malacostraca, order Decapoda, Brachyura, p. 451-475. *In:* Reproduction and development of marine invertebrates of the northern Pacific coast. M. F. Strathmann (ed.). University of Washington Press, Seattle, WA.

3. KOZLOFF, E. N. 1993. Seashore life of the northern Pacific coast: an illustrated guide to northern California, Oregon, Washington, and British Columbia. University of Washington Press, Seattle, WA.
4. 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.
5. MARSHALL, W. L., S. M. BOWER, and G. R. MEYER. 2003. A comparison of the parasite and symbiont fauna of cohabiting native (*Protothaca staminea*) and introduced (*Venerupis philippinarum* and *Nuttalia obscurata*) clams in British Columbia. *Journal of Shellfish Research*. 22:185-192.
6. MARTIN, J. W. 2014. Brachyura, p. 295-310. *In:* Atlas of crustacean larvae. J. W. Martin, J. Olesen, and J. T. Høeg (eds.). Johns Hopkins University Press, Baltimore, MD.
7. PEARCE, J. B. 1966. On *Pinnixa faba* and *Pinnixa littoralis* symbiotica with the clam, *Tresus capax*, p. 565-589. *In:* Some contemporary studies in Marine Science. H. Barnes (ed.). Allen & Unwin, London.
8. PULS, A. L. 2001. Arthropoda: Decapoda, p. 179-250. *In:* Identification guide to larval marine invertebrates of the Pacific Northwest. A. Shanks (ed.). Oregon State University Press, Corvallis, OR.
9. RATHBUN, M. J. 1918. The grapsoid crabs of America. *Bulletin of the United States Natural Museum*. 97:128-145.
10. RUPPERT, E. E., R. S. FOX, and R. D.

BARNES. 2004. Invertebrate zoology: a functional evolutionary approach. Thomson Brooks/Cole, Belmont, CA.

11. SCHMITT, W. L. 1921. The marine decapod crustacea of California. University of California Publications in Zoology. 23:1-470.
12. SCHNEIDER, J. A. 1993. The Crab *Pinnixa faba* (Pinnotheridae), in the bivalve *Clinocardium* (Keenocardium) *californiense* (Cardiidae). Bulletin of Marine Science. 52:842-843.
13. ZMARZLY, D. L. 1992. Taxonomic review of pea crabs in the genus *Pinnixa* (Decapoda: Brachyura: Pinnotheridae) occurring on the California shelf, with descriptions of two new species. Journal of Crustacean Biology. 12:677-713.
14. ZULLO, V. A., and D. D. CHIVERS. 1969. Pleistocene symbiosis: Pinnotherid crabs in Pelecypods from Cape Blanco, Oregon. Veliger. 12:72-73.

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