OREGON ESTUARINE INVERTEBRATES

An Illustrated Guide to the
Common and Important Invertebrate Animals

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Table of Contents

Introduction				
CNIDARIA	Hydrozoa		*Aequorea aequorea*	6
			Obelia longissima	8
			Polyorchis penicillatus	10
			Tubularia crocea	12
	Anthozoa		*Anthopleura artemisia*	14
			Anthopleura elegantissima	16
			Haliplanella luciae	18
			Nematostella vectensis	20
			Metridium senile	22
NEMERTEA			*Amphiporus imparispinosus*	24
			Carinoma mutabilis	26
			Cerebratulus californiensis	28
			Lineus ruber	30
			Paranemertes peregrina	32
			Tubulanus polymorphus	34
			Tubulanus sexlineatus	36
ANNELIDA	Polychaeta	Arenicolidae	*Abarenicola pacifica*	38
		Capitellidae	*Capitella capitata*	40
		Glyceridae	Glycera *robusta*	42
		Goniadidae	*Glycinde armigera*	44
		Lumbrineridae	*Lumbrineris zonata*	46
		Nephtyidae	*Nephtys caeca*	48
		Nereidae	*Nephtys caecoides*	50
			Nereis (Hediste) limnicola	52
			Nereis (Neanthes) brandti	54
			Nereis (Nereis) vexillosa	56
		Ophelidae	*Armandia brevis*	58
			Euzonus mucronata	60
			Ophelia assimilis	62
		Phyllodocidae	*Eteone lighti*	64
			Eteone pacifica	66
		Polynoidae	*Halosydna brevisetosa*	68
			Hesperonoe complanata	70
		Sabellidae	*Eudistylia vancouveri*	72
		Spionidae	*Boccardia proboscidea*	74
			Polydora nuchalis	76
		Terebellidae	*Pista pacifica*	78
			Thelepus crispus	80
ARTHROPODA	Crustacea	Cirripedia	*Semibalanus cariosus*	82
			Balanus crenatus	84
			Balanus glandula	86
			Balanus nubilus	88
		Tanaidacea	*Leptochelia dubia*	90

		Isopoda	*Idotea (Pentidotea) resecata*	92
			Idotea (Pentidotea) wosnesenskii	94
			Gnorimosphaeroma insulare	96
			Ligia pallasii	98
			Limnoria tripunctata	100
			Ianiropsis kincaidi derjugini	102
			Detonella papiliicornis	104
		Amphipoda	*Ampithoe lacertosa*	106
			Corophium brevis	108
			Corophium salmonis	110
			Corophium spinicorne	112
			Allorchestes angusta	114
			Eogammarus confervicolus	116
			Traskorchestia traskiana	118
			Megalorchestia pugettensis	120
	Crustacea	Caridea	*Lissocrangon stylirostris*	122
			Crangon franciscorum	124
			Crangon alaskensis	126
			Heptacarpus paludicula	128
			Heptacarpus pictus	130
		Brachyu ra	*Pugettia producta*	132
			Cancer antennarius	134
			Cancer magister	136
			Cancer oregonensis	138
			Cancer *productus*	140
			Rhithropanopeus harrisii	142
			Pinnixa faba	144
			Hemigrapsus nudus	146
			Hemigrapsus oregonensis	148
			Pachygrapsus crassipes	150
		Mac ru ra	*Callianassa californiensis*	152
			Upogebia pugettensis	154
		Anomu ra	*Pagurus hirsutiusculus*	156
			Petrolisthes cinctipes	158
MOLLUSCA	Bivalvia		*Clinocardium nuttallii*	160
			Adula californiensis	162
			Mytilus edulis	164
			Protothaca staminea	166
			Saxidomus giganteus	168
			Transennella tantilla	170
			Tresus capax	172

		Macoma balthica	174
		Macoma inquinata	176
		Macoma nasuta	178
		Siliqua patula	180
		Mya arenaria	182
		Cryptomya californica	184
		Hiatella arctica	186
		Penitella penita	188
		Zirfaea pilsbryi	190
		Bankia setacea	192
		Entodesma saxicola	194
	Gastropoda	*Collisella digitalis*	196
		Collisella pelta	198
		Tegula funebralis	200
		Littorina scutulata	202
		Littorina sitkana	204
		Lacuna porrecta	206
		Assiminea californica	208
		Nucella emarginata	210
		Nucella lamellosa	212
		Olivella biplicata	214
		Ovatella myosotis	216
	Opisthobranchia	*Alderia modesta*	218
		Onchidoris bilamellata	220
ECHINODERMATA	Asteroidea	*Pisaster brevispinus*	222
		Pisaster ochraceus	224

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Oregon Estuarine Invertebrates

Intended for the biological field worker, this guide has been developed as a descriptive vehicle based on the common important estuary animals. It is not a key.

One full page of illustration is given to insure a thorough, visual description of each invertebrate. Facing each illustrated plate is a full page of verbal DESCRIPTION, including size, color, and particular characteristics of each animal. A section on POSSIBLE MISIDENTIFICATIONS with other similar species follows. ECOLOGICAL INFORMATION, covering the animal's range, habitat, salinity and temperature tolerances, usual tidal level and associates is also covered. QUANTITATIVE INFORMATION (the anirnal's weight and abundance) is given. LIFE HISTORY information includes reproduction, growth rate, longevity, usual food, predators and typical behavior. A representative but not all-inclusive BIBLIOGRAPHY with a few notes is included for each animal. A space has been left for the user's notes (see blue cards in back).

The reader will note some blanks, where information is not available. This guide is intended to be "open-ended", and to be updated as new information becomes known. We encourage users of the guide to contact us with additional data or corrections.

The guide was designed primarily for use in Oregon's estuaries, but it should work well as far south as Humboldt Bay, California, and up into Washington. Local Oregon distribution records are included where known. Use of northern California (Light) and Puget Sound (Kozon) keys has not been totally successful: neither covers our area completely. The reader will recognize the particularly heavy "leaning" on *Light's Manual,* an invaluable, accurate accumulation of invertebrate information. Interestingly, its invertebrates seem to match Oregon's more closely than do Kozloff's Puget Sound animals. Morris, Abbott and Haderlie's impressive *Intertidal Invertebrates of California* came out just as we went to press and is referred to only generally. It is extremely valuable for current, though not directly referenced information. Tidal heights are expressed in feet, based on the mean of the low low water (MLLW).

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Aequorea aequorea
a large common hydromedusa (Forskal, 1775)

PHYLUM: *Cnidaria*
CLASS: *Hydrozoa*
ORDER: *Hydroida, Leptomedusae*
FAMILY: *Aequoreidae*

Description

Medusa Stage

COLOR-transparent aqua blue with whitish radial canals.

SIZE-up to 15 cm diameter4.

BELL-relatively flat, except when contracted in swimming; thick, gelatinous, large, rigid; with ring canal around margin and radial canals from mouth to margin (fig. 1).

RADIAL CANALS-about 60[6] around bell margin; (fig. 1, 2) simple, not branched in two°. Gonads are suspended from radial canals. Excretory pores open at the canal bases near the tentacles4.

GONADS-not finger-like; attached to radial canals (fig. 1).

TENTACLES-numerous (over 50)[5]; hollow, not branched; on a single whorl around bell margin [12] on ring canal. Can be very long and extended. Have stinging bodies (nematocysts) for protection and food-gathering.

MOUTH-part of tubular manubrium large, surrounded by numerous frilled lips (fig. 2).

VELUM —a flap of tissue, barely visible inside bell rim; used for swimming[4] (Figure. 1).

Hydroid stage (polypoid, or attached stage)

Very small (fig. 3, 4, 5); simple or slightly branched colonies, with rarely more than two polyps; hydrocaulus (stem) up to 2.5 mm; hydranth with about 20 tentacles, a mouth, and a web with nematocysts. Some stems have gonophores (fig. 5) which release medusae. Tiny planular larvae, embryos from sexual products of the medusa, settle on their sides (fig. 3) and become new polyps (fig. 4, 5).13

Possible Misidentifications

Aequorea is very large for a hydroid medusa, and it is the only Leptomedusa with more than 24 radial canals (most have only four)[12]. The Scyphozoa, or true jellyfish, are large, have fringed mouth lobes, scalloped margins, no velum, and a complex pattern of radial canals[12]. Some have prominent, pendant oral arms.

Very young *Aequorea,* up to 4 mm, can look very like *Polyorchis* in shape", even to lacking the numerous radial canals of the adult.

"The species are more or less doubtful"': thus some writers would call it *A. forskalea"* or "sp."' [2] (i.e., *Aurelia).* The nomenclature is further confused by separate naming of polypoid stage by early workers, *ie. Campanulina".*

Ecological Information

RANGE-in many temperate waters, northern and southern hemispheres; well known in northwest: Puget Sound, British Columbia.

LOCAL DISTRIBUTION -Oregon bays, and nearshore waters.

HABITAT--medusae are found floating in the plankton, and often in harbors as well. The attached, or hydroid forms are often encountered in the intertidal [12]. Specific information on *Aequorea* hydroids is not available.

SALINITY-collected at 30 0/00. Cannot tolerate unusual amounts of fresh water, as from storms8.

TEMPERATURE-a cold to temperate species.

TIDAL LEVEL-medusae are found only floating; hydroids are intertidal.

ASSOCIATES — small anemone *Bucidium aequorea* in sometimes parasitic on lower side of *Aequorea* (Puget Sound)8.

Quantitative Information

WEIGHT-

ABUNDANCE-most common large medusa; it can occur in great numbers locally at the right time of year.

Life History Information

REPRODUCTION-an interesting life cycle, with a good example of alternation of generations: the attached, polypoid colony is delicate and plant-like. From the buds, medusae develop asexually and become free swimming. All medusae from a single colony are the same sex. Medusae discharge sperm or eggs into the water and the embryos produced become planula larvae which settle and develop into new polypoids.

GROWTH RATE-very fast. especially as compared to anemones[8]; egg to polyp (in lab), less than 6 days13.

LONGEVITY-probably only a few months. Found April through September (Puget Sound)[5]; (medusae).

FOOD-crustaceans and their larvae; polychaetes, ctenophores, medusae, cannery refuse[4]. Feeding response mostly tactile.

PREDATORS-well protected by nematocysts (stinging cells). Giant sunfish (Mo/a mo/a) eat them, as do some nudibranchs.

BEHAVIOR-small polypoid stage needs well-sheltered place to attach. Usual stage seen in floating medusa (figs. 1, 2). Often high mortality after a storm or sudden presence of fresh water8. Medusa is luminescent when stimulated.

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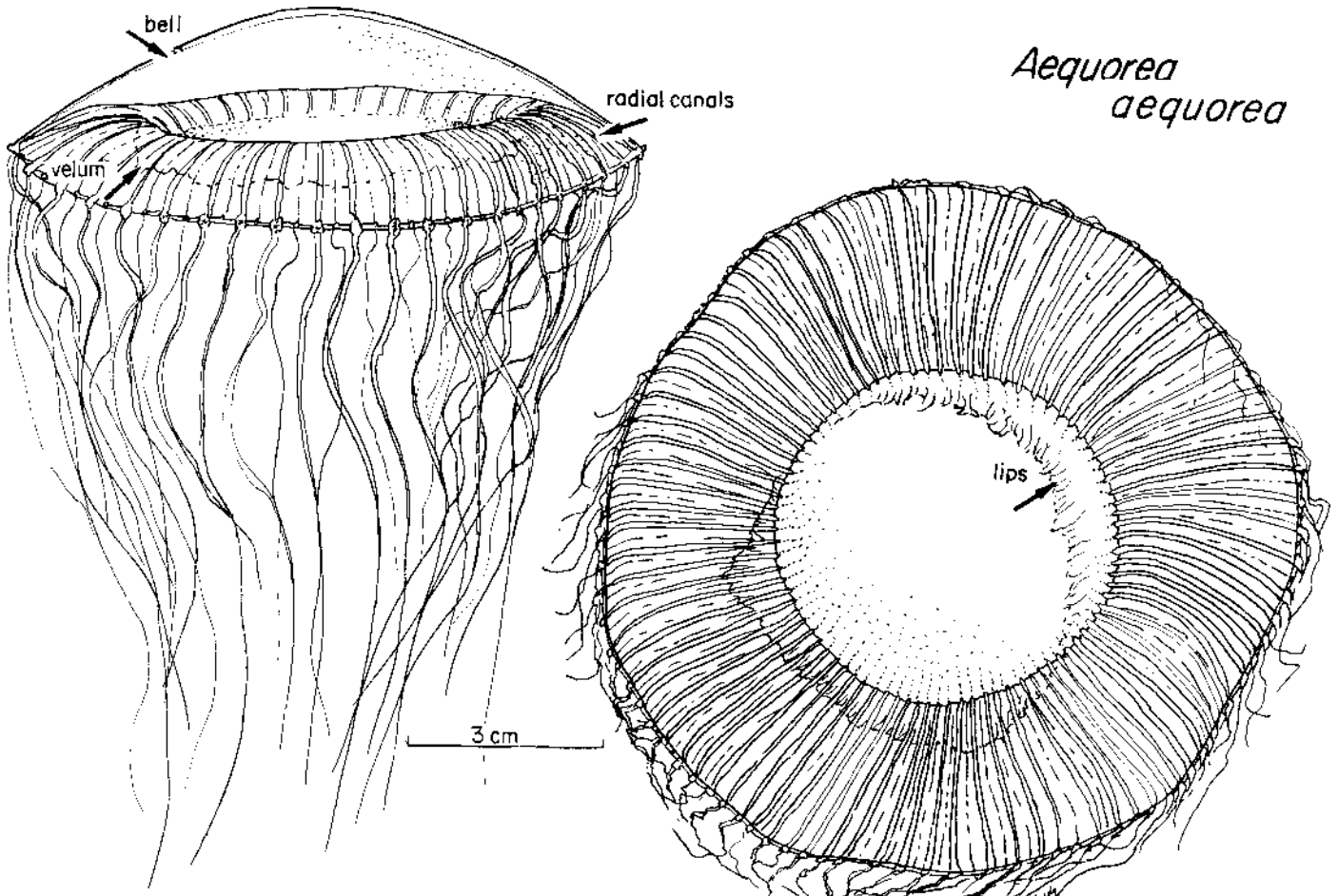
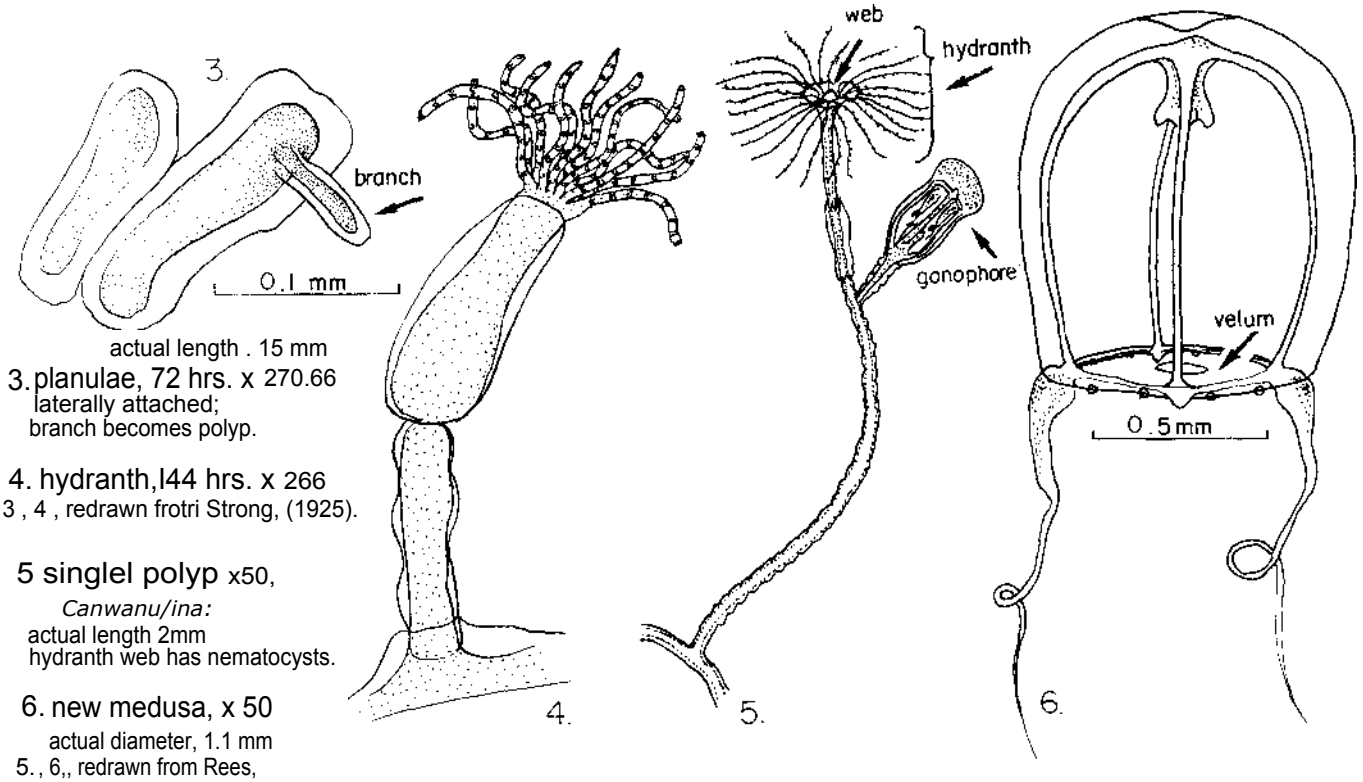


Aequorea aequorea

l *Aequorea aequorea* x l ! medusa,
rather flat, heavy bell with about 60 racial canals
wide mouth; over 50 tentacles on ring canal;
gonads along radial canals.

2. medusa, dorsal view
mouth with fringed lips



actual length . 15 mm

3. planulae, 72 hrs. x 270.66
laterally attached;
branch becomes polyp.

4. hydranth,l44 hrs. x 266

3 , 4 , redrawn frotri Strong, (1925).

5 singlel polyp x50,
Canwanu/ina:
actual length 2mm
hydranth web has nematocysts.

6. new medusa, x 50
actual diameter, 1.1 mm

5. , 6,, redrawn from Rees,
(1938).

Obelia longissima
a floating dock hydroid

Pallas, 1766

PHYLUM: *Cnidaria*
CLASS: Hydrozoa
ORDER: *Hydroida, Leptomedusae*
FAMILY: *Campanularidae*

Description

Hydroid (polypoid form)

COLOR-transparent white when young, main stems "horn" colored; old, mature colonies look dirty.

SIZE-colony can be up to 60 cm") (fig. 1).

GONOTHECA-medusae-producing buds (fig. 2c) also called "gonangia"[8]; axillary, ie. grow out of the angle between the stem and the hydrotheca; "ovate, smooth, with raised central aperture"'.

HYDROTHECAE-bell-like, large, and deep; margin toothed; borne on long, ringed "pedicels" (fig. 2d, f).

STEMS-thread-like, many-branched, ringed at joints, branches alternate, stalks short, (fig. 2).

Medusa (sometimes called 0. *lucifera)*

COLOR-clear; some color at tentacle bases, on mouth, gonads.

SIZE-when "new", .5 mm; grows to 5 mm[2]; full size. 2.5 –6 MM.

BELL-very thin, flat; small stomach, no peduncle, rudimentary velum (fig. 3); mouth with four lips.

RADIAL CANALS-four; straight; each containing globular gonads (fig. 3).

RING CANAL-narrow; with eight statocysts (balance structures); no ocelli, (fig. 3)

TENTACLES-numerous, solid, short; 20-24 in newly hatched medusae; 46-90 in *"0. lucifera"* (Browne, in Russe117).

Possible Misidentifications

There are two very closely related species of *Obelia* (fig. 4)

0. geniculata has a central zig zag stem, thickened at the joints; its hydrothecae are rather conical, slightly longer than wide, with plain margins and borne on short stalks with 4-6 rings; its gonothecae are axillary (in the joint), urn-shaped, with a raised center, and attached by a short stalk with 3-4 rings (fig. 4a).

0. dichotoma has slender, nearly straight, ana irregularly branched, annulated stems; its branches are often long, giving a "whitish, fuzzy appearance"[3]; the colony can be up to 2 cm[2]. Its hydrothecae are alternate, broad, bell-shaped, the tops are many sided, with slightly sinuated margins; its gonothecae are axillar, slender, smooth, widening from the base, and ending in a "raised, somewhat conical aperture"[9] (fig. 4b).

Other hydroids which have stalks, and thecae within which their hydranths can be retracted (fig. 2b) include those of the families Campanulinidae and Phialellidae[10], which are very small and have tubular thecae with a pointed operculum. Other Campanularidae (bell-shaped hydrothecae) include *Phialidium* sp. and *Campanularia* sp. both of which have colonies of less than 2 cm in height, and are rarely branched.

The genus most closely related to *Obelia* is *Gonothyraea,* which does not release free medusae, but retains them within the gonotheca.

Cornelius[2] has preferred 0. *longissima* to *Obelia bidentata* Clark, the Atlantic species.

Ecological Information

DISTRIBUTION-worldwide *(Obelia sp.);* 0. *longissima* Alaska to San Pedro, California.

RANGE-all three closely related species (0. *geniculata, 0. dictotoma)* are found in northern California and Puget Sound; other species may be present as well, some of them introduced10.

HABITAT-hydroids like docks, kelp, and floats in Days; healthy colonies are found on exposed pilings, particularly where water is clean and fast-moving. Medusae are found floating, probably not far from their hydroid parents. They probably are not light dependent for vertical distribution'.

SALINITY-collected at 30 0/00; an Atlantic species, 0. *bidentata* was found to have a wide distribution across the estuarine gradient, down to 0.5 0/00; 0. *dichotoma* was found down to 12 0/002.

TEMPERATURE-found in cold temperate waters; settling may occur in cooler temperatures during the year11.

TIDAL LEVEL-most abundant in middle intertidal and lust below.

ASSOCIATES-caprellid amphipods, garnmarid amphipods, asellote isopods, copepods, diatoms, sea slug *Eubranchus,* nudibranchs *Dendronotus frondosus, Phidiana crassicornis* (Bodega Bay[11]), pycnogonid *Halosoma veridintestinale;* with medusae: pycnogonid larvae of *Anaphia* (England). Barnacle larvae cannot settle where *Obelia* growth is heavyll.

Quantitative Information

WEIGHT —

ABUNDANCE- particularly common in harbors in northern California"), and in British Columbian.

Life History Information

REPRODUCTION-like other Hydroida, *Obelia* has both a sexual reproduction and an asexual one. The medusae are producers of eggs and sperm the larvae of which settle and become hydroids. The production of medusae by the hydroid is apparently tied to lunar periodicity: to the third week of the moon (Elmhirst, 1925, in Russell[s]). The complete life cycle (swimming larvae to hydroid colony discharging medusae): takes one month[s]. Lab reared medusae are sexually mature six days after emergence (Browne in Russell[s]). *Obelia* are present all year, but are most numerous in spring to late summer. Settling of 0. *dichotoma* (northern California) found in May, June, not in July[9]. Another worker (Boyd in Standing[s]) found settling in winter, spring and early summer, corresponding to low water temperatures. Budding, release of medusae only below 12 °C (lab)6.

Asexual reproduction, budding by the hydroid to form medusae, is the other stage of duplication.

GROWTH RATE-several generations possible in a year; 0. *dichotoma* grow to 2.5 mm in 19 days (from 1 mm): Browne in Russell[s]. Growth: direct correlation with temperatures of 8-20 °C6.

LONGEVITY-about one month (complete life cycle).

FOOD-crustaceans and their larvae, arrowworm *Sagitta* (England), young fish.

PREDATORS- Op i sthobranch *Eubranchus* eats hydroid buds3

BEHAVIOR-medusa noted for quick movements; often found inverted (fig. 3).

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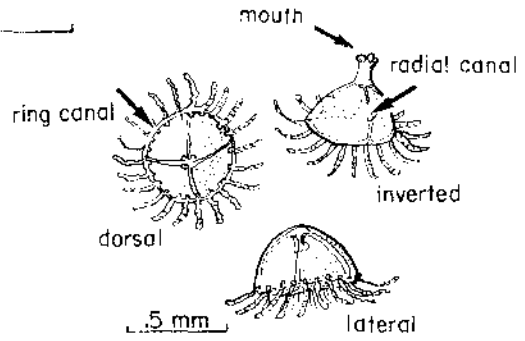
Obelia longissima

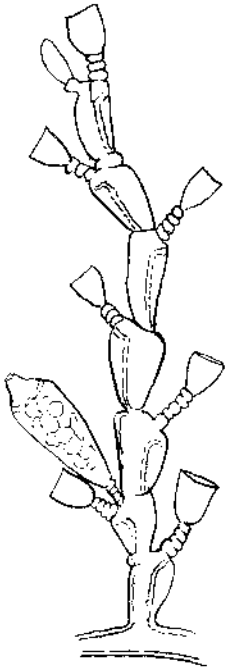
hydroid

l. *Obe//a long/Ss/ma* x
white, many-branched colonies

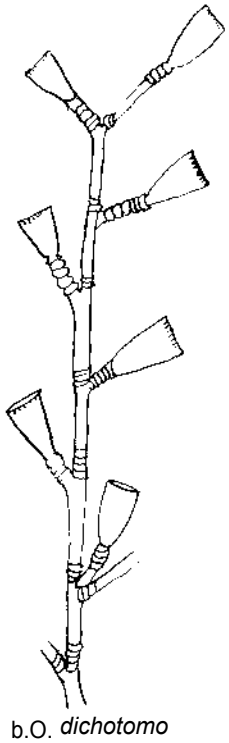
2.closeup, single branch x 30
a. buds
b. hydranth, tentacles retracted.
c. gonotheca, showing medusae buds.
d. hydrotheca ,(covering young polyp).
e. hydranth ,tentacles exfendea.
f. empty hydrotheca.



3. medusae, x 30
actual diameter .5 mm



3.0. *geniculoto*



b.O. *dichotomo*

4. other species
(from Russell 1953, after Hincks 1868).

Polyorchis penicillatus
a bell-shaped hydromedusa (Eschscholtz, 1829)

PHYLUM: *Cnidaria*
CLASS: *Hydrozoa*
ORDER: *Hydroida, Anthomedusae*
FAMILY: *Polyorchidae*

Description — Medusa

COLOR-transparent white with purple eyespots; gonads and other organs variable (yellow brown to purple)5.

SIZE-taller than wide: to 60 mm high, 40 mm wide[2]; averages over 25 mm wide5.

BELL-higher than wide; thin, delicate, not gelatinous.

MANUBRIUM- extends from short, pronounced gelatinous *gastric* peduncle (fig. 1); as long as bell cavity; with four oral lips densely set with nematocysts which form a distinct marginal band (fig. 1).

RADIAL CANALS-four, each with 15-25 pairs of short diverticula (blind side branches), (fig. 1)3.

GONADS-four to eleven (average: eight); sausage shaped, hanging from each radial canal as it joins manubrium (fig. 1). They produce either eggs or sperm.

TENTACLES-up to 160, in a single whorl along bell margin on ring canal; not in clusters. Number of tentacles increases rapidly with ages.

RING CANAL-simple, contains tentacles; ocelli on extensions at bases of tentacles (fig. 2).

OCELLI--pigmented eyespots suspended from ring canal; "abaxial": not on canal (fig. 2).

NEMATOCYSTS-stinging organelles (fig. 4) found on manubrium, each containing a poison sac and a stinging thread. Produced by cnidoblast, specialized cells (fig. 3).

HYDROID-unknown.

Possible Misidentifications

Several other Polyorchidae occur in our area: P *montereyensis,* a small (to 40 mm high) species with up to 45 gonads on each canal, has 25-30 pairs of lateral diverticula and up to about 80 tentacles[6]. P *haplus* is very small (15-20 mm high), has 20-25 gonads on each canal, and only knob-like diverticula on its radial canals. It has up to 24 tentacles6. *Scrippsia pacifica,* the largest of the family, is 75 mm high, with a long peduncle reaching halfway down the bell, numerous gonads, and about 256 tentacles in 7 'cycles', some attached on the bell above the radial canal.

Other tall, bell-shaped medusae are either very small (like new *Aequorea),* or have greatly different tentacles or manubrium: *ie. Coryne, "Sarsia",* etc.

Ecological Information

DISTRIBUTION-California to Hawaii[4]; northwest waters[3]; type locality probably San Francisco Bay.

RANGE-in plankton in bays, seasonally, in Oregon.

HABITAT- medusae: floating in plankton near the surface: often found in bays, around docks, in summer and into fall. San Francisco Bay: December-April. Polypoid stage: a single hydroid colony was growing on a sponge on the upper surface of the rock scallop *Hinnites giganteus,* in 15 m. of water off Vancouver Is.'

SALINITY-collected in full seawater: 30 0/00 (medusa).

TEMPERATURE-found from cold waters (Vancouver) and temperate waters (San Francisco). A specimen from the Gulf of California is considered doubtful (Bigelow in Skogsberg6).

TIDAL LEVEL-Throughout water column.

ASSOCIATES-

Quantitative Information

WEIGHT-

ABUNDANCE-the most common large Anthomedusa in our area.

Life History Information

REPRODUCTION-like other Hydrozoans, *Polyorchis* has a two-layered reproductive cycle, involving both asexual and sexual processes. Efforts to raise *Polyorchis* in the lab have produced planula larvae; these would not settle, however (authors). A single colony of P *penicillatus* has been described.'

GROWTH RATE-

LONGEVITY-

FOOD-

PREDATORS-Aequorea.

BEHAVIOR-

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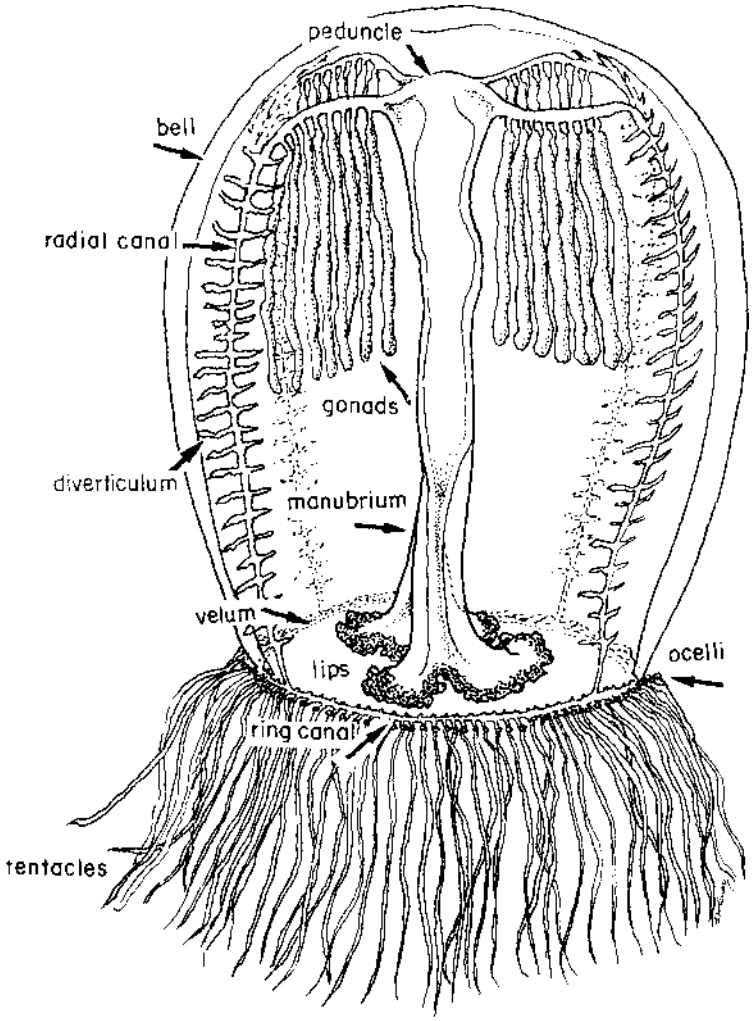
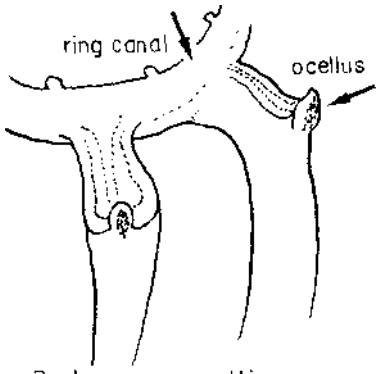
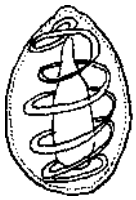
Po/yore/7/s pen/cactus



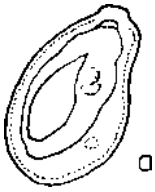
I. *Polyorchis penicillotus* x2
actual size of bell 5 cm high
four radial canals, each with 15-25 pairs
diverticula;
long manu brium ; nematocyst-banded lips;
4-11 sausage-shaped **gam*** up to 160 tentacles
on ring canal.

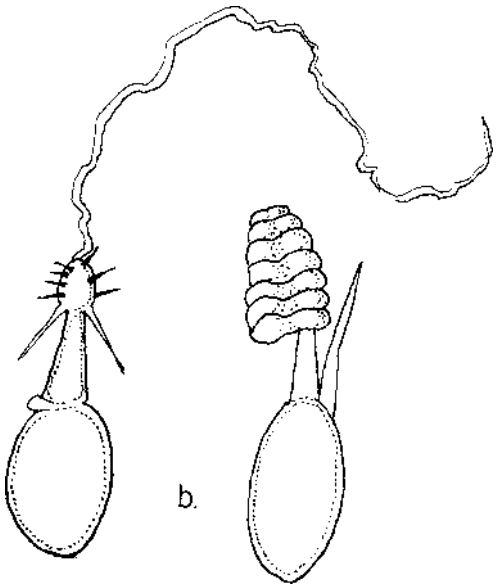


2.closeup, ocelli



3.cnidoblast





4. generalized nematocysts
a.undischarged
b. exploded

Tubularia crocea
a floating dock hydroid (Agassiz, 1862)

PHYLUM: *Cnidaria*
CLASS: *Hydrozoa*
ORDER: Hydroida, Anthomedusa
FAMILY: *Tubularidae*

Description

COLOR-stem (hydrocaulus) white to light tan: feeding tentacles (proximal and distal) transparent white; gonophores light pink and dark coral: manubrium pale yellow-orange.

SIZE-colony in large bushy clusters to 15 cm; stems to 2 cm long': "flowers" (hydranth) up to 1 cm when extended. "largest athecate hydroid – (genus), Puget Sound'.

STEM-(hydrocaulus) unbranched, crooked, covered with fine "hairs" (diatoms).

HYDRANTH-without theca: suborder Anthomedusa (fig. 2). (Theca is present in Leptomedusan hydroids).

TENTACLES-filiform (thread-like), simple, in two whorls: proximal-long, extended feeding tentacles at the base of the hydranth, and distal-short, tentacles usually contracted around mouth (figs. 2, 3). Usually close to the same number of distal and proximal tentacles: species crocea. Older specimens have more tentacles than do young ones, which will have only 10 proximal tentacles when "new".

MOUTH-(manubrium); simple, circular; on a cone (fig. 3).

GONOPHORES-"abortive medusae"', or gonomedusae in clusters on stalks (racemes) between the two whorls of tentacles. Within the gonophores develop the planulae which become tentaculate, crawling larvae, the actinulae (fig. 5).

ACTINULA-larval stage which attaches to substrate and becomes new polyp. Up to 10 capitate (knobbed) tentacles containing nematocysts'; visible inside are manubrium, distal tentacle buds (fig. 5). In T *lamyx,* tentacles can vary from 6 to 13. Most have 107.

Possible Misidentifications

The other common local species, *Tubularia marina,* is a small, solitary athecate hydroid of the outer coast. Its stalk is usually about 2.5 cm. long, it has fewer distal tentacles than proximal ones, and it is less showy than *T.* crocea, as it does not occur in clumps as the latter does. It does live in estuarine habitats in Puget Sound'.

Other athecate (without a cup-like theca) hydroids often have some capitate (knobbed) tentacles as adults, *ie. Cladonema, Hydrocoryne.* Of those with only threadlike tentacles, some like *Hydractinia* and *Eudendrium* have only a single whorl of tentacles, not two whorls as in *Tubularia.* Others, such as *Turritopsis* and Clava have tentacles in scattered patterns rather than in whorls".

Other Pacific species of *Tubularia* in the literature, but about which there is little information, are T. *prolifer* and *larynx* (England)7.

Ecological Information

RANGE-north temperate seas, Atlantic and Pacific (introduced to the Pacific from the Atlantic".)

LOCAL DISTRIBUTION — Oregon and California estuaries. Coos Bay: South Slough, Charleston, Fossil Point. T *marina* seems to be a more northern species.

HABITAT-likes cold water with good movement; often found on undersides of floating docks. Not bothered by strong light [3]. One of the invertebrate organisms most resistant to such poisons as copper (Barnes, 1948, in 7).

SALINITY-collected at 30 0/00.

TEMPERATURE-responds badly to warm water in lab: loses hydranths. Regression occurs with summer temperatures3.

TIDAL LEVEL-low intertidal; subtidal to 40m.6

ASSOCIATES- suctorian protozoans, diatoms (especially in fall. darkening stems'); caprellid and tube-building amphipods, isopods, copepods, mussels. A pycnogonid, *Anoplodactylus erectus,* is parasitic in the digestive tract of *Tubularia* in southern California, distending the polyps abnormally [8]. Some amphipods (Stenothoe) are immune to *Tubularia's* nematocysts [3]. The colonial *Tubularia* and its substrate constitute a rich microecosystem on the floating docks.

Quantitative Information

WEIGHT-

ABUNDANCE-colonies can be quite dense under the night conditions of water and movement.

Life History Information

REPRODUCTION-sexual colonies dioecious. Asexual: new hydranths can grow from stolons (subsurface runners); sexual: actinulae, formed in gonophores. correspond to the medusae stage in other hydroids; these produce eggs and sperm while still attached to hydranth, then crawl away and attach to substrate and form new polyps. There is no swimming stage. One polyp can produce over 100 gonomedusae (not simultaneously) [5]. The gonomedusae most distal on the racemes (stalks) mature soonest [3]. Mature male gonomedusae are white. the immature have a red stripe [8]. Each polyp is sexually separate: clusters of polyps will be grouped in the colony by sex because of asexual reproduction from stolons. Release mechanisms for spawning and larvae release are not known [8], but possibly could be due to a change in light intensity [7] and in water speed. In one area, only one species of *Tubularia* will be sexually active at a time.

GROWTH RATE-two weeks to maturity; 6-8 days from ripe female gonads to liberation of viable actinulae [3]. Settlement of actinulae to first generation of new larvae takes 24 days'. Stolon growth rate: a steady 1 mm/day [3]. Settlement of actinulae begins after about 24 hours'. Easily grown in the lab.

LONGEVITY-

FOOD-copepods, chaetognaths, portunid zooae, small mysids. siphonophores, eudoxids, salps: rejects pteropods. pycnogonids.

PREDATORS- pycnogonids; nudibranchs *Cratena* and *Dendronotus* feed on polyps (England)'.

BEHAVIOR — most unusual is the actinula stage. "The colony is the unit, not the polyp"7.

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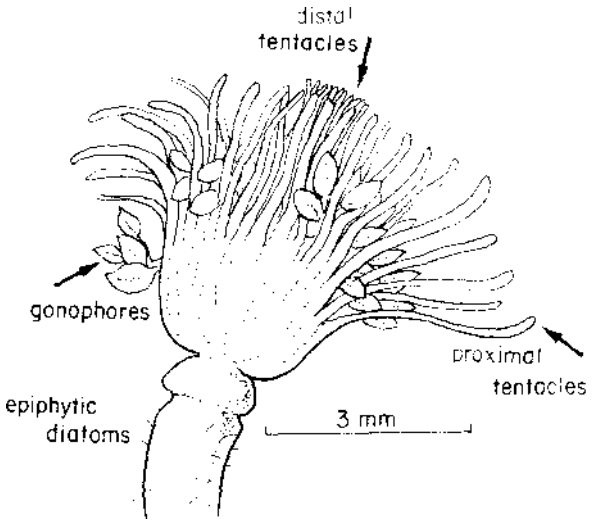
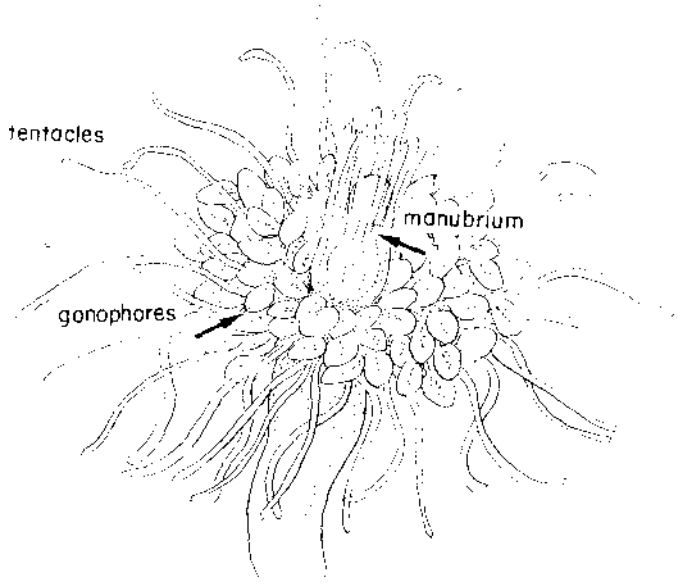
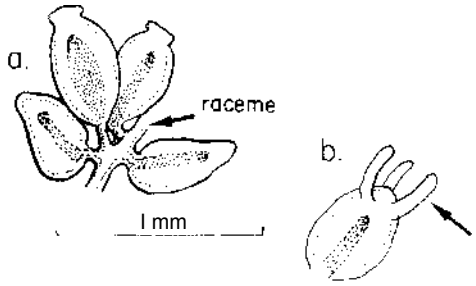
1. *Tubularia croceo* colony x 4
actual polyp height c. 2 cm,



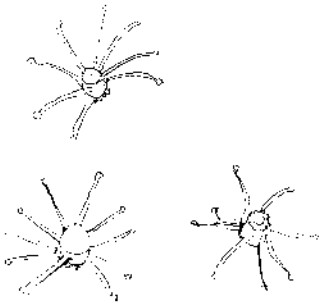
2. hydranth, x 10
actual diameter 3mm
two whorls of tentacles, distal and proximal;
gonophores between whorls.



3. hydranth, extended x 10



4. gonophores, x 30
a.showing racemes (stems)
b, with developing marginal lappets,



5. actinulde x 30

Anthopleura artemisia (= *Evactis*)
a burrowing anemone (Pickering in Dana, 1848)

PHYLUM: *Cnidaria*
CLASS: *Anthozoa, Zoantharia*
ORDER: *Actiniaria*
TRIBE: *Thenaria, Endomyaria*
FAMILY: *Actiniidae*

Description

SIZE—most around 25 mm diameter, 60-70 mm long; largest observed (California): 90 mm long, 25 mm column diameter.' This specimen 20 mm long, 25 mm crown diameter, 15 mm column diameter.

COLOR—oral disc can be red, brown, gray, black (solid or concentric patterns); this specimen: brown disc, tan spots, light tan mouth. Tentacles brightly colored and/or patterned: red, white, black, blue, or orange; species *artemisia.*[8] This specimen: "day glo" and pink tentacles, pink spots on oval disc. Column: top (distal) third black, brown, or gray shading to white or pink at proximal third (this specimen: gray). Verrucae on collar tend to be white-tipped.' Mesentery insertions can be visible on bottom third of column, showing as vertical white lines (not on this specimen). Acrorhagi white (fig. 2).

SHAPE—can be quite elongate (not figured); long column, with tubercules near top; slender, tapering tentacles; broad flat oral disc. Prominent collar and acrorhagi (spherules). *A. artemisia* can also contract into a crevice with only its crown showing. When contracted, it forms a low round-topped pillar' (fig. 1). Adherent shell and debris are typical of this solitary species.

BASE—circular to irregular; well attached to substrate; often wider than column; no physa (bulb) at base.

COLUMN—can extend to five times diameter; well-developed collar; longitudinal rows of verrucae, especially on uppermost (distal) third of column (fig. 1), rarely any verrucae on proximal third of column: species *artemisia.'*

COLLAR (PARAPET)—well-developed, separated from tentacles by deep fosse (groove) in which there are acrorhagi (spherules). Collar covered with compound verrucae (fig. 3).

ACRORHAGI (SPHERULES)—round, hollow white inconspicuous structures in fosse, just under tentacles (fig. 2, 3): genus *Anthopleura;* contain nematocysts.'

VERRUCAE (TUBERCULES)—rounded, wart-like structures; adherent, collect shell, debris for protection; also contain cinclides (pores) (see fig. 4, *A. elegantissima).* Verrucae on collar (where they are compound, with 3-6 vesicles each (fig. 3); well-developed, in longitudinal rows on upper third of column, sparsely spaced and single in middle third of column; usually none on lowest third of column: species *artemisia?* Verrucae near acrorhagi sometimes white-tipped.

MESENTERIES—interior vertical partitions; up to 24 pairs in some adults; often irregular due to asexual longitudinal fission. Mesenterial insertions often visible on proximal third of column in elongated specimens, as white lines (not shown).

NEMATOCYSTS (CNIDAE)—tiny stinging cells; many kinds, differing in size, distribution from other species (not shown).

ACONTIA—(thread-like defensive structures expelled through column wall); none.

TENTACLES—numerous, slender, tapering; about ½ as long as oral disc diameter; rarely; more than 5 orders.' Arrangement sometimes irregular due to longitudinal fission of animal.

ORAL DISC—broad, usually flat, about 1 ½ x column diameter when expanded. Radial lines (mesenterial insertions) (fig. 2). Open central area (tentacle-free) sometimes with radial pattern.

LIPS—not ribbed; do not protrude above disc surface; usually with siphonglyphs (ciliate grooves) but can have 1 or 3. Mouth commonly an elongate slit (Fig. 2).

Possible Misidentifications

There are other more common estuarine anemones (*Metridium, Hatiplanella,* etc.), but none of them have acrorhagi inside the fosse at the collar edge, or adherent tubercules on the column. *Anthopleura* species have both of these, as well as a well-developed pedal disc (base), and a flat broad oral disc with a clear central area.

Anthopleura xanthogrammica is usually an open coast species, large, green solitary and unicolored; its column is completely covered with verrucae (they are not in rows). It is found occasionally in the lower reaches of the most marine estuaries.

Anthopleura elegantissima, the aggregating anemone, can be solitary, like *A. artemisia,* and is often found in like habitats, *i.e.* rock substrate with sand and mud over the rock. *A. elegantissima* has verrucae in longitudinal rows on the entire column. not just on the upper part; the column is green or whitish, not black or gray fading to pinkish. The tentacles in *elegantissima* are pink, white, purple, blueish or green, not brightly colored red, orange or patterned, as in *A. artemisia. A. elegantissima,* when solitary, is usually larger than *A. artemisia,* which never has symbiotic algae in its endoderm. *A. artemisia* is the only species of the genus whose verrucae do not extend down to the base.

Small *artemisia* can be confused with *Metridium* when contracted, for their bright tentacles are hidden and they are plain gray or greenish.'

Ecological Information

RANGE—Alaska to southern California; possibly Japan.'

LOCAL DISTRIBUTION—Coos Bay Pigeon Point.

HABITAT—in estuaries, attached to a solid substrate, often in a crevice or pholad burrow; column often buried in mud or sand, with only crown exposed; withdraws into its burrow when disturbed or at low tide. Also on pilings, floats, and on open coast.

SALINITY—collected at 30 o/oo salt.

TEMPERATURE

TIDAL LEVEL—distribution centers around mean lower low water', but also found occasionally quite a bit higher.

ASSOCIATES

Quantitative Information

WEIGHT—

ABUNDANCE

Life History Information

REPRODUCTION—sexual: separate sexes; gonads borne on directive mesenteries attached to siphonoglyphs, asexual reproduction by longitudinal fission.

GROWTH RATE

LONGEVITY

FOOD—small crustaceans.

PREDATORS—not one of the preferred foods of coelenterate predator *Aeolidia.9*

BEHAVIOR—retracts completely into "burrow" when disturbed.

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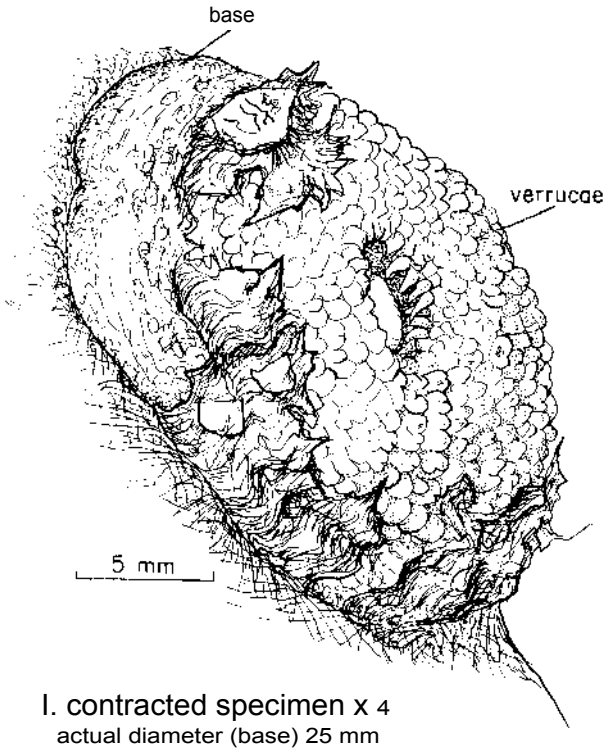
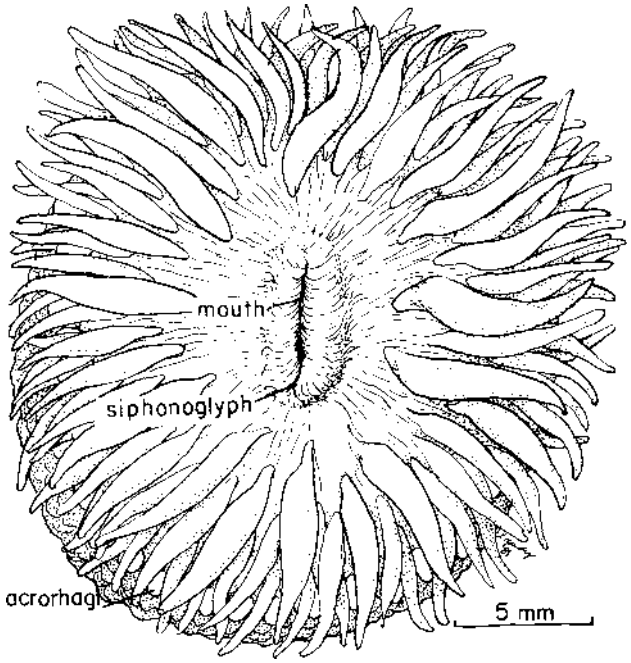
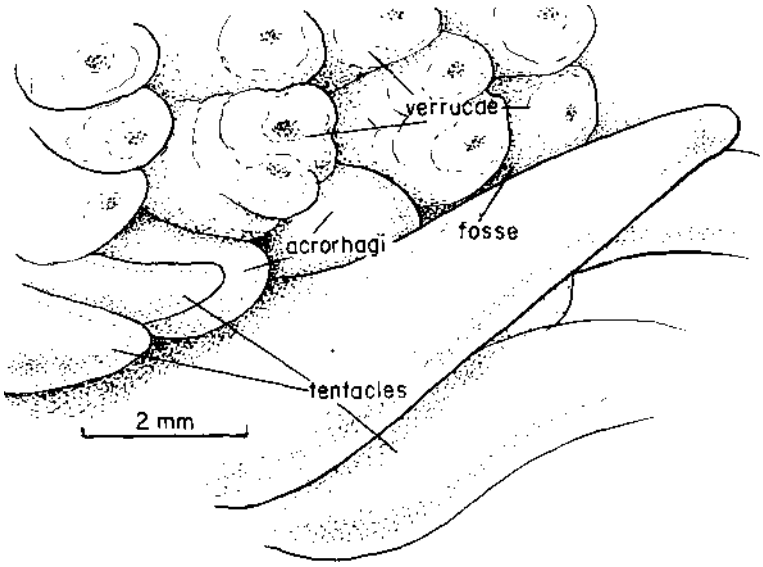
Anthopleura orternisia



I. contracted specimen x 4
actual diameter (base) 25 mm
algae, shell adhere to verrucae on upper third, sand particles near base; column gray: many verrucae on upper third, sparse on middle third, none near base.



2. *Anlhop/eura oriemisio* x 4 crown
width 25 mm; brightly colored tentacles, slender, tapering, about 5 rows, broad oral disc; lips not grooved, mouth a long slit; 1-3 siphonoglyphs.
acrorhagi: round, white, under tentacles.



3. verrucae, acrorhagi (collar) x 12
verrucae compound; acrorhagi round, white, in single row in fosse under tentacles.

base-------

4. verrucae, mid-column x 12
simple, sparsely spaced; none near base.

PHYLUM: *Cnidaria*
CLASS: *Anthozoa, Zoantharia*
ORDER: *Actiniaria*
TRIBE: *Thenaria, Endomyaria*
FAMILY: *Actiniidae*

Anthopleura elegantissima *(Bundodactis)*
the aggregated anemone Brandt, 1835

Description

SIZE—small to medium-sized: a large specimen about 65 mm diameter. Crown can be to 90 mm across (solitary specimens); aggregated individuals common size about 25-40 mm. Usually larger in bays than on open coast.' This specimen 35 mm high, 45 mm disc diameter.

COLOR—tentacles tipped with pink, purple or other colors; this specimen with white, green, maroon tentacles. Disc green with maroon radial lines (this specimen). Column usually green: genus *Anthopleura":* green caused by symbiotic algae cells.' Collar green, acrorhagi white (figs. 2, 3). Puget Sound forms often red and green.'

SHAPE—strong collar, broad flat disc, slender pointed tentacles; column with longitudinal rows of tubercules, attached shell and debris. Body walls soft, thin.' Becomes a hemispheric glob when contracted (fig. 3)

BASE—attached to substrate; well-developed pedal disc. Genus *Anthopleura* Outline circular to very irregular: species *elegantissima.'* Base usually same diameter as column. No physa (bulb) at base.

COLUMN—twice as high as diameter when extended; hernispherical when contracted. Entire column covered with round verrucae (tubercules) in longitudinal rows: species *elegantissima.'*

VERRUCAE—simple tubercules, adherent: collect gravel, shell, debris. Tubercules on collar are forked, compound (see *A. artemisia,* fig. 3). Verrucae in rows, not densely packed, become fewer toward base ("limbos").'

COLLAR (PARAPET)—strong: well-developed fosse (groove) (fig. 2).

ACRORHAGI (SPHERULES)—round, hollow bodies covered with nematocysts; inconspicuous at top of column just outside tentacles (fig. 2): genus *Anthopleura.'*

DISC—broad, flat, with radiating lines (mesenterial insertions); large central area tentacle-free. Disc slightly wider than column, or of similar width.

MOUTH—lips may be swollen or flush with surface of disc. Lips not ribbed.

TENTACLES—more than 24; pointed; no oral inner ring of tentacles. Tentacles about as long as diameter of disc (fig. 3) usually more than 5 orders (rows) present.

CINCLIDES—(temporary or permanent pores at tips of verrucae): many, on column (fig. 4).

MESENTERIES—vertical body partitions: from 6 in young specimens to more than 24 pairs in mature adults. Visible at high magnification as vertical lines on column, particularly near base. Can be irregular, due to asexual fission (not shown).

ACONTIA—(thread-like defensive structures expelled through column wall): none.

NEMATOCYSTS—several kinds, in tentacles, column, acrorhagi, actinopharynx and filaments (not shown); see *Metridium '*

Possible Misidentifications

The genus *Anthopleura* can be distinguished from other estuarine anemones *(Metridium, Haliplanella, Diadumene)* by their acrorhagi inside the fosse under the tentacles, and by the verrucae on their columns. *Anthopleura* always have a well-developed pedal disc and a flat, oral disc with a clear central area.

Two other species of Anthopleura occur here:

Anthopleura xanthogrammica is a large open coast species occasionally found in the most marine parts of our estuaries. It is very large, solitary (not aggregating), with uniformly colored disc and tentacles (not pink-tipped or with radial lines on the disc). The tentacles are in 6 or more rows.' Its verrucae completely cover the column (they are not in rows).

Anthopleura artemisia has tubercules on the upper 2/3 of its column only; the column is white or pink below and usually gray or black above; its tentacles are brightly colored and patterned (red in Coos Bay). *A. artemisia* is more likely to be found burrowing in a sandy or muddy substrate than *A. elegantissima,* which can live close by.

Other sand-dwelling anemones might include *Flosmaris,* a southern form, which is elongate and has a translucent or white column. Most other elongated or tube-dwelling forms, *i.e. Cerinatharia,* are not intertidal in our area.

Ecological Information

RANGE—Alaska to southern California.

LOCAL DISTRIBUTION—Coos Bay: Pigeon Point.

HABITAT—on rocky substrates, often in full sun, where it aggregates in beds of up to 60 ft.,' 100,000 animals. Often in sand, but attached to underlying rock. Can survive in polluted waters:8

SALINITY—collected at 30 o/oo salt.

TEMPERATURE

TIDAL LEVEL—from 0 to +4.5 feet above mean lower low water level.'

ASSOCIATES—green algae (zoochlorellae) and dinoflagellates (zooxanthellae) in gut tissue; amphipod *Allogaussia* in digestive cavity.

Quantitative Information

WEIGHT-

ABUNDANCE—most abundant anemone on coas '6: most abundant *Anthopleura* in Coos Bay.

Life History Information

REPRODUCTION—sexual: spawning in September (San F rancisco).:' Asexual: longitudinal fission, producing aggregations of "clones" common to this species (all are similar in coloration and sex').

GROWTH RATE-

LONGEVITY—reputed to be very long lived"; especially successful as an aquarium animal.

FOOD—largely crustaceans: copepods, amphipods, isopods." Food preference seems to be genetically determined."

PREDATORS—seastars; nudibranch *Aeolidia papillose* attacks the column.'

BEHAVIOR—anemones at edges of clonal groups will "attack.' neighboring (and different) clonal individuals with their acrorhagi, causing wounds, a corridor between clonal groups is thus maintained.' Symbiotic green algae may aid anemone in modifying phototaxis' and in averting starvation.' Anemones. contract, inflate, expel nematocysts or detach and move when column attacked by nudibranch *Aeolidia*

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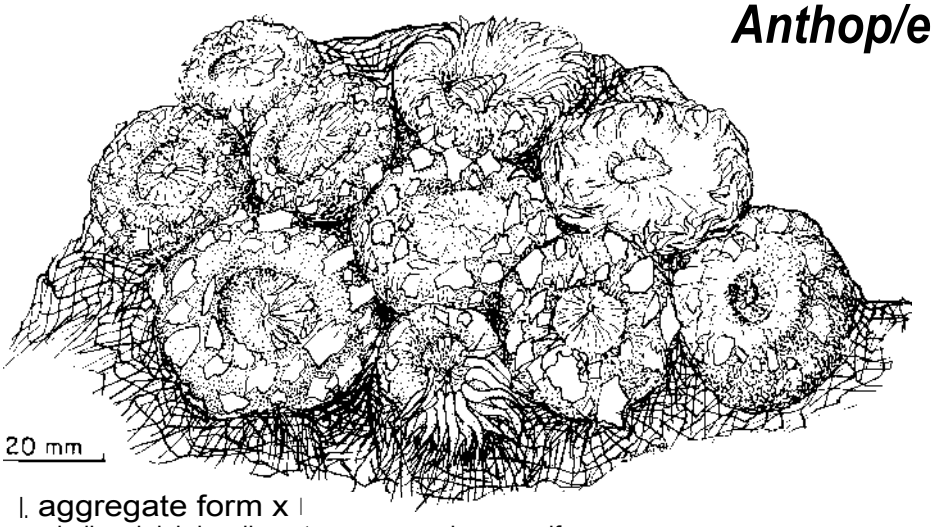
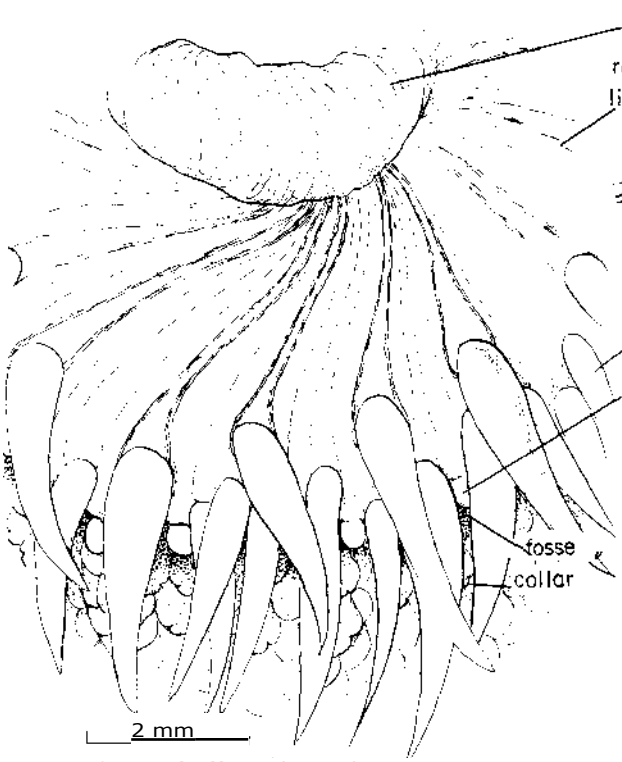
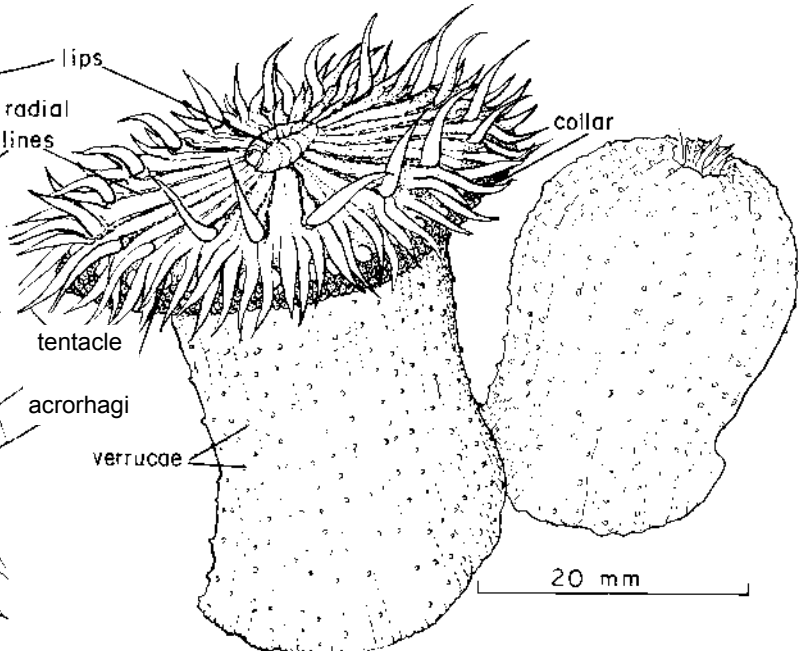
Anthop/euro e/egantissima



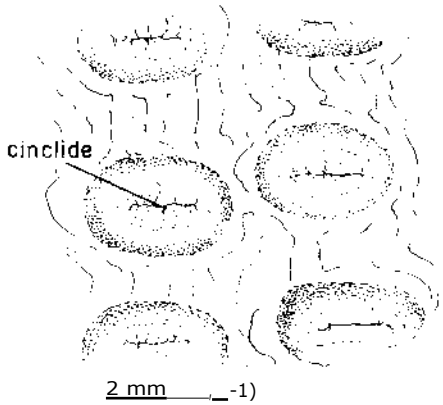
|. aggregate form x |
shell and debris adhere to verrucae; clones: uniform.



2.oral disc (part) x (2
radial lines from mouth to tentacles;
white marginal spherules inside collar.



3. *Ai* thopleuro elegont:ssirno x 2 solitary form
actual height 35 mm, crown width 45 mm; tentacles short, pointed, in about 5 rows, pink, green and white; collar green; collar green/white, with vertical rows of verrucae.



4. verrucae (tubercules) x 12

Haliplanella luciae (= *Sagartia luciae*)
a small piling anemone (Verrill, 1898)

PHYLUM: *Cnidaria*
CLASS: *Anthozoa. Zoantharia*
ORDER: *Actiniaria*
FAMILY: *Haliplanellidae*

Description

COLOR-variable: usually green with vertical orange, white or yellow stripes, but can have a brownish or olive column; pink or orange gonads may be visible on the lower column; mesenteries appear as dark vertical lines: tentacles usually colorless, can be gray to light green with white flecks (nematocysts); oral disc transparent, can appear dark because of dark interior, lips dark gray.

SIZE-largest, fully expanded: 31 mm high. 22 mm diameter, average (California): 15 mm high, 11 mm diameter.

SHAPE tow and cylindrical with many fine long tentacles (fig. 1)

BASE-distinct "pedal disc", circular, attached to substrate.

COLUMN-smooth, tapering, usually a low cylinder, with 4-48 (often 7-19[5]) vertical stripes: dark mesenteries showing through, surface smooth: "cinclides", portholes through which acontia can protrude, can be visible to naked eye; column often scarred by longitudinal fission (asexual reproduction)2.

CAPITULUM--(top of column): separated from column by parapet (collar) (fig. 2); transparent, usually light green, without cinclides: tentacles around the even margin.

PARAPET-collar (fig. 2): noticeable only when anemone is fully extended.

MOUTH dark; ribbed (corresponding to number of mesenteries); 0-3 siphonoglyphs (none figured).

ORAL DISC-(area surrounding mouth, fig. 4): with radiating rows of white flecks on endocoels[2]; margin plain, not frilled or lobed; large area of disc tentacle-free. (Endocoels are the spaces between the pairs of septa (fig. 4).

MESENTERIES-vertical internal partitions (usually six in this species) visible as dark vertical lines; usually more mesenteries distally than near base[2]. Gonads appear as thickened bands on rnesentery filaments.

TENTACLES-up to 100; retractile, smooth, not capitate (knobbed), only one kind. No oral ring of tentacles; short and blunt when contracted. Typically with two pairs of "directives", close to the ends of mouth, but this can vary[2]. Can have up to 18 "catch" tentacles, short, blunt and opaque, near mouth.l°

ACONTIA-threadlike defensive structures which are discharged through column wall when animal is disturbed.

NEMATOCYSTS-stinging organelles: several types present: three kinds on the acontia (fig. 5): Haliplaneilidae2,

Possible Misidentifications

Metridium senile, a large anemone also found on floating docks, is deeply frilled and lobed, with short tentacles.

The anemone most likely to be confused with *Haliplanella* is *Diadumene franciscana,* which *can* be cream to light green with *white* stripes. It has one pair of directive tentacles (expanded, long, retractible and pointing toward the mouth), and they are yellow at their bases (*Haliplanella's* are clear). *D. franciscana* usually has two siphonoglyphs, has pink lips, a rough column, and often an irregular base. Its parapet is poorly developed compared to *Haliplanella's.* The Puget Sound *Diadumene* is not green but orange, yellowish, grayish, reddish, cream or brown. Other *Diadumene* species are not greens.

If the specimen is orange striped "it can only be *H. luciae"2.*

Ecological Information

RANGE-cosmopolitan: Europe, New England coasts. Asia. Pacific coast: Puget Sound south to California: probably introduced from Asia with oyster spat (Carlton in 8).

DISTRIBUTION-Oregon estuaries: Coos Bay: Charleston docks, South Slough.

HABITAT-"on or under rocks or on pilings in estuarine situations; never found on the outer coast.

SALINITY-"euryhaline"[7] adapts to variations in salinity.

TEMPERATURE-cold and temperate waters; "eurythermal"? also found in the Suez Canal and Pt. Aransas, Texas'. Contraction and encystment can occur with exteme high temperatures (East Coast).1°

TIDAL LEVEL-shallow waters.

ASSOCIATES Metridium; also found on *Mytiius edulis* with its accompanying fauna.

Quantitative Information

WEIGHT-

ABUNDANCE-can completely cover surface of log or piling.

Life History Information

REPRODUCTION-can be sexual or asexual. the latter by longitudinal fission of the column or pedal laceration[s] Its success is largely due to its ability to colonize quickly3.

GROWTH RATE-

LONGEVITY-

FOOD- small crustaceans and annelids3.

PREDATORS –in San Francisco Bay, the opisthobranch mollusc *Trinchesia* sp.8.

BEHAVIOR-Catch tentacles, used only for stinging, not feeding, serve to keep anemones separate.' °

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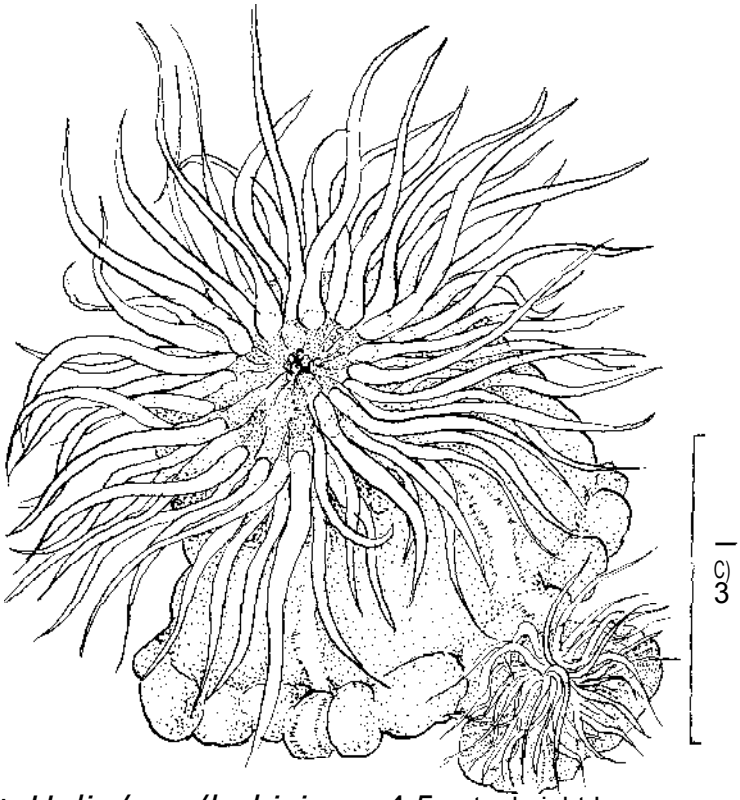
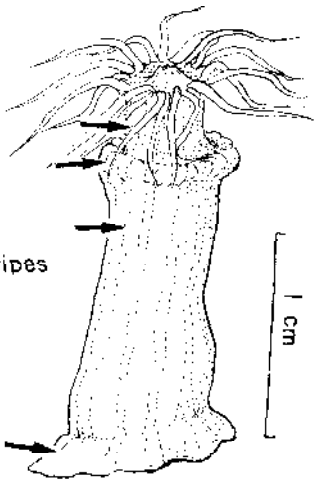
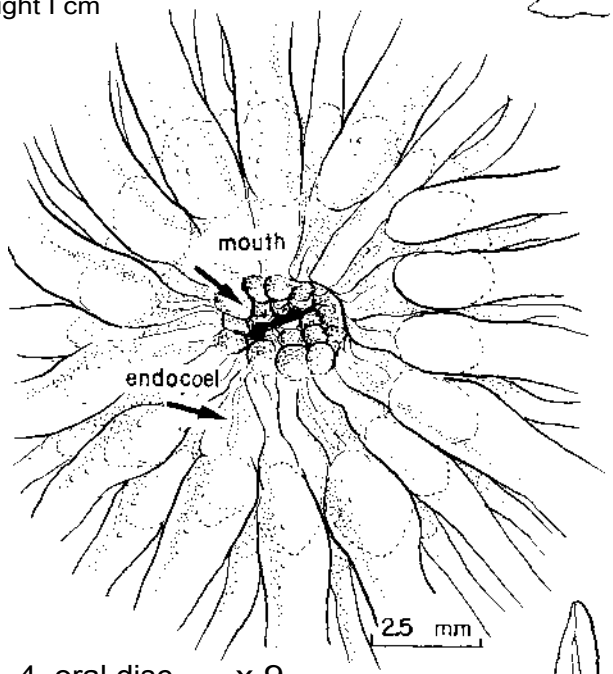


L *Halip/one/la kiciae* x 4.5 actual eight I cm

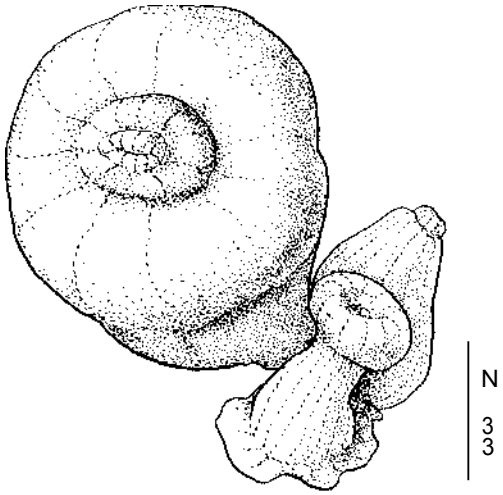
up to 100 clear,tapered tentacles;
low, cylindrical column attached to substrate;
oral disc with tentacle-free area
column smooth,green,striped white,yellow
or orange.
margin not frilled or lobed.

2.smal I anemone,
lateral view x 3
(extended)

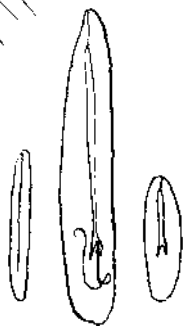




4. oral disc, x 9
radiating white endocoels;
large tentacle-free area
dark, ribbed mouth.



3, contracted anemones, x 8
tentacles completely retracted.



5 nematocysts
from acontia x too°
L 01 mm

from Hand,1955, p. 215.

Nematostella vectensis
a solitary marsh anemone Stephenson, 1935

PHYLUM: *Cnidaria*
CLASS: Anthozoa, *Zoantharia*
ORDER: Actiniaria
FAMILY: *Edwardsiidae*

Description

COLOR-white; transparent when expanded; internal color can depend on food.

SIZE-column (fig. 1) up to 15 mm long; can be up to 2.5 mm in diameter at base near bulb. Crown of tentacles up to 8 mm diameter. Column at tentacles' base about 4 mm5.

SHAPE-radially symmetrical, consisting of a tall cylinder and a crown of tentacles. Aberrant forms, i.e. two headed, tentacleless, are found as well13.

TENTACLES-retractile, cylindrical, tapered, not "capitate": knobbed. Number 12-18, usually 16 [11]; can be as many as 204. 6-7 outer (exocoelic) tentacles longer than inner (endocoelic) ones, and are often reflexed down column; (they can be longer than column). Inner tentacles can be raised above the mouth (fig. 1), and can have white spots on their inner edges [3]. Nematosomes can be seen moving inside the tentacles.

COLUMN-long, cylindrical, worm-like, transparent. The eight mesenteries are visible through its walls.

PHYSA-a swollen, bulb-like burrowing structure at the base of the column (fig. 1), which replaces the pedal disc of other anemones. It is covered with rugae (ridges) which secrete mucus and aid in digging and climbing12.

ORAL DISC-no inner ring of tentacles or siphonoglyphs, only a single ventral siphonoglyph12.

MESENTERIES-vertical partitions (eight in this species) below gullet, visible through column. Gonads appear as thickened bands on filaments [8] (fig. 3). Eggs are produced from these filaments. The mesenteries can be green. brown, black, etc.; depending on food12.

NEMATOSOMES- rather mysterious spherical, ciliated bodies, sometimes found in the coelenteron (digestive cavity) and in tentacles (fig. 2). Their function is not known.

Possible Misidentifications

This is the only species of the genus *Nematostella* known in the temperate northern hemisphere. N. *polaris,* a similar Arctic anemone, lives under conditions which *N. vectensis* could tolerate, but they are not believed to be the same species [5]. There is certainly no other very small, muddwelling burrowing anemone in our area which could be confused with *N. vectensis.*

Flosmaris grandis is another elongate, mud-burrowing, translucent anemone, but it is usually very large (to 46 cm), has over 24 tentacles, and instead of a physa, has a basal disc attached to something solid. *Diadumene* sp. are often long and pale. but have pigmentation of some sort and don't burrow. Only N. *vectensis* of these anemones has nematosomes.

Ecological Information

DISTRIBUTION-north temperate shallow estuarine pools: England, New England, northern California. Type locality-Isle of Wight (where it probably doesn't exist now, due to destruction of habitat)12.

RANGE-in Oregon: five sites in Coos Bay: South Slough, near downtown Coos Bay, mouth of Coos River.

HABITAT-soft muds of *Salicornia* marshes; pondweed masses (New England: *Ruppia, Cladophora, Chaetomorpha* [18], Coos Bay: in *Enteromorpha, Vaucheria.* Sensitive to pollution13).

SALINITY-can tolerate a wide range: from less than 50% seawater to over 100% in Coos Bay[s] it has been found at from 8 o/oo to 38 °too: an osmoconformer, it is very adaptable to salinity changes'.

TEMPERATURE — lives in a wide range (northern California): 0-30 ^{0} 0^{5}. Has been kept for long periods in the lab at 21-22° C. Coos Bay (South Slough) range 6-18 °C7.

TIDAL *LEVEL-Nematostella* is generally found in salt marsh tide pools above + 3 ft.

ASSOCIATES- plants: *Distichlis, Salicornia, Enteromorpha, Vaucheria,* diatoms; invertebrates: nemerteans, polychaete larvae, harpacticoid copepods, ciliates, sphaeromid isopods, gammarid amphipods.

Life History Information

REPRODUCTION-probably has separate sexes; gonads on mesenteries produce gametes; planula larvae settle as new polyps; no medusoid stage. Asexual reproduction also possible (by elongation of column, constriction, and breaking off of a transverse section) [8]. Animals found with developed gonads summer and fall [13]. Egg production can be induced in lab by lowering salinity (Crowell, in [8]). Egg to planula: 3 days: to four knobbed juvenile, 5 days.14

GROWTH RATE-

LONGEVITY-kept in lab for up to five years'".

FOOD--like other anemones, it is an active predator, using tentacles with stinging nematocysts to capture prey. Diet largely snail *Hydrobia* (New England. Nova Scotia) [4]; harpacticoid copepods; only anemone known to eat insect larvae4.

PREDATORS-

BEHAVIOR-usually buried to tentacles, but also found extended over the mud. Can move by short. peristaltic-like movements, or by throwing itself [8]. Secretes mucus "tube ⁻ to protect its epidermis3.

Quantitative Information

WEIGHT-

ABUNDANCE-a rarely occurring animal, it can be very abundant over a small area where it does occur.

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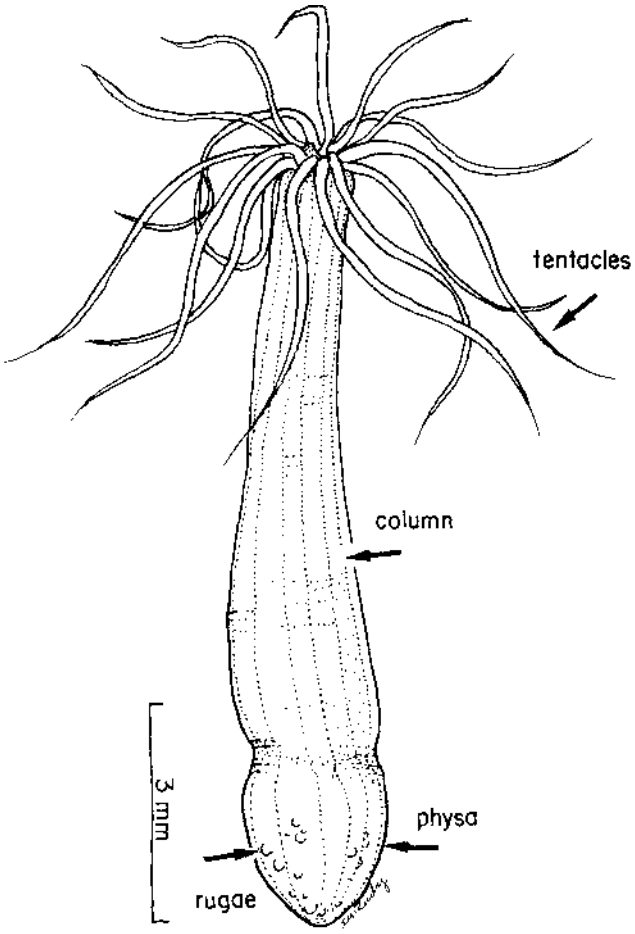
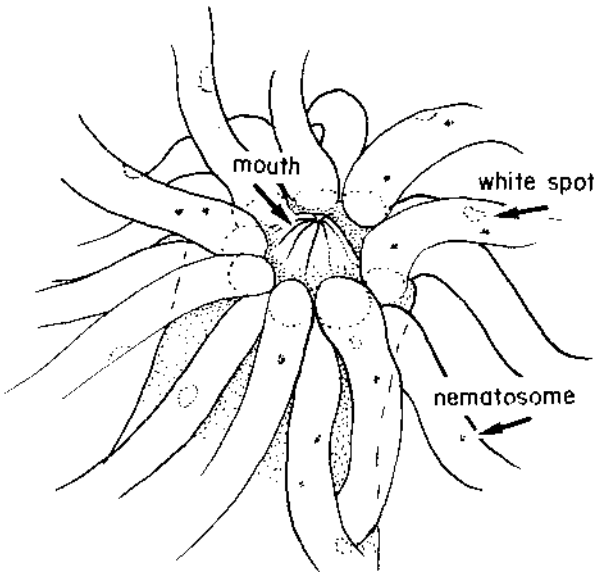
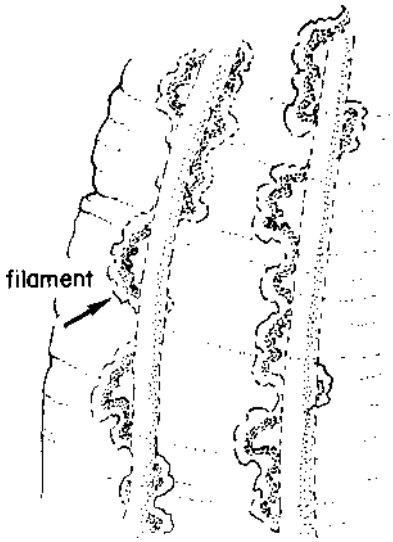
Nematosiella vectensis



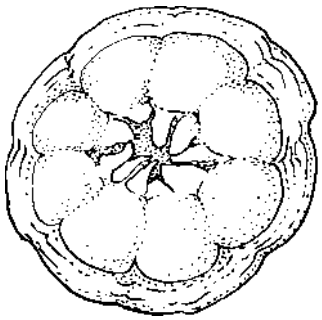
Nematostella vectensis x 10
cylindrical column; physa with rugae;
12-18 transparent tentacles, white spotted;
actual size 11 mm,



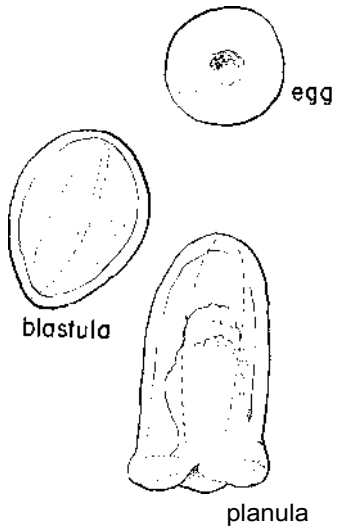
2.crown of tentacles x 30
usually 16 white-spotted tentacles; nematosomes visible; mouth cone-shaped.



3. mesenteries (seen through column wall) x 30
8 vertical partitions; filaments contain eggs.



4. dorsal view,
tentacles retracted x40



5. development

2 cm

Metridium senile fimbriaturn
a piling anemone (Verrill, 1865)

PHYLUM: *Cnidaria*
CLASS: *Anthozoa, Zoantharia*
ORDER: *Actiniaria*
FAMILY: Met *ridiidae*

Description

COLOR-white when young: adult can be brown, orange. tan. Because of asexual reproduction, all animals in one area may be same color.

SIZE-piling specimens average about 5 cm (2 inches) in diameter (tentacles); can be up to 6 inches; subtidal animals can be "10 gallon" sizes.

COLUMN-stout, compact in young specimens, often long in old ones; usually over 5 cm long [8]; not striped. A parapet (collar) is seen beneath the crown of tentacles (fig. 2).

BASE flat, attached to hard surface.

TENTACLES fine. short. not knobbed. Number of tentacles increases with age: old ones can have hundreds[5]. Tentacles arranged in lappet-like groups or lobes [5] (fig. 1). Can have up to 1 8 "catch" tentacles, short, blunt and opaque, near mouth4.

ORAL DISC-very little tentacle-free area around mouth. Siphonoglyphs (ciliated grooves) vary from 0-3, one usual'.

MESENTERIES-vertical body cavity partitions: 3-15 pairs: not visible, as animal is opaque.

ACONTIA-threadlike structures. found in lower part of mesenteries. which are discharged through lower column wail when animal is disturbed. They are probably used for defense2.

NEMATOCYSTS severalkinds present' ; (fig. 3a, b). Contain a toxin with a protein fraction, dialyzable material with aromatic arnines1°.

Possible Misidentifications

Anthopleura artemesia, an estuarine anemone with a white stalk, can be confused with young *Metridium.* It lives in fine sand however, not on pilings, and when extended, its tentacles are pink or green, and heavy. The only other local species of *Metridium* is *M. exilis,* a small, open coast animal with fewer than 100 tentacles, and a yellow, orange or red column[7]. No other anemone besides M. *senile* in the area has over 200 tentacles. M.s. *fimbriatum* is the name given the Pacific Ocean specimens'.

Ecological Information

RANGE-circumpolar, northern hemisphere; harbors and bays or Atlantic and Pacific Oceans' ; Pacific Coast: Sitka to Santa Barbara, California': type locality: San Francisco Bay'.
LOCAL DISTRIBUTION-protected pilings in larger Oregon estuaries: Coos Bay.

HABITAT-likes bare, shaded pilings; can also attach to dead shells. tunicate *Styela,* kelp crab Pugettia, barnacles6.

SALINITY-collected at 30 0/00, Coos Bay; at 27 0/00, Puget Sound (communication, R. Boomer). Tolerates brackish conditions: to 68% seawater in San Francisco Bay' °.

TEMPERATURE-temperate to cold waters'. Metabolic rate often positively correlated with temperature: acclimates well,10

TIDAL LEVEL-can tolerate limited exposure found between 00 and --1.0 to low water on pilings, especially in surnmet3 Flourishes well subtidally. even in deep water do 60 fathoms) Most abundant at slightly above mean low low water' Largey specimens are "well out from shore1

ASSOCIATES-in Puget Sound: *Halplanella luctae.* a Japanese anemone: on protected pilings, sea star *Pisaster,* tunicates *Styela, Ciona,* and *Cnemidocarpa6.*

Quantitative Information

WEIGHT-

ABUNDANCE-"common on pilings, floats, and jetties of bays and harbors, as well as subtidally"[7]. Especially abundant in dark quiet corners9.

Life History Information

REPRODUCTION-sexual: oviparous. separate sexes, discharges eggs or sperm from mouth into water. Sperm have wedge shaped heads; eggs are pinkish, about 0.1 mm diameter[10]; planular larvae settle as young anemones. Asexual reproduction: by "pedal laceration", small amount of tissue is left on substrate as anemone moves about; each small clump forms new anemone. Other asexual reproduction may be by "longitudinal fission", laceration, and budding'. Asexual reproduction accounts for the often irregular siphonoglyphs and septa (mesenteries), which make *M. senile* a poor choice for lab use2.

GROWTH RATE--

LONGEVITY-survives well in small aquaria with running seawater.

FOOD--an active predator and carnivore. it eats very small organisms. unlike many anemones which manage larger L)1 ey3 Also eats algae *Enteromorpha intestinalis* and *Desmarestia viridis*[5]. Large specimens may be exclusively microplankton feeders while small ones closer to shore eat macrofood and perhaps some plankton'.

PREDATORS-

BEHAVIOR- In dense groups of small animals, catch tentacles, used only for stinging, not feeding, serve to keep anemones separate.[4] At low tide they can be seen on the sides of pilings hanging "fully relaxed and pendulous"6.

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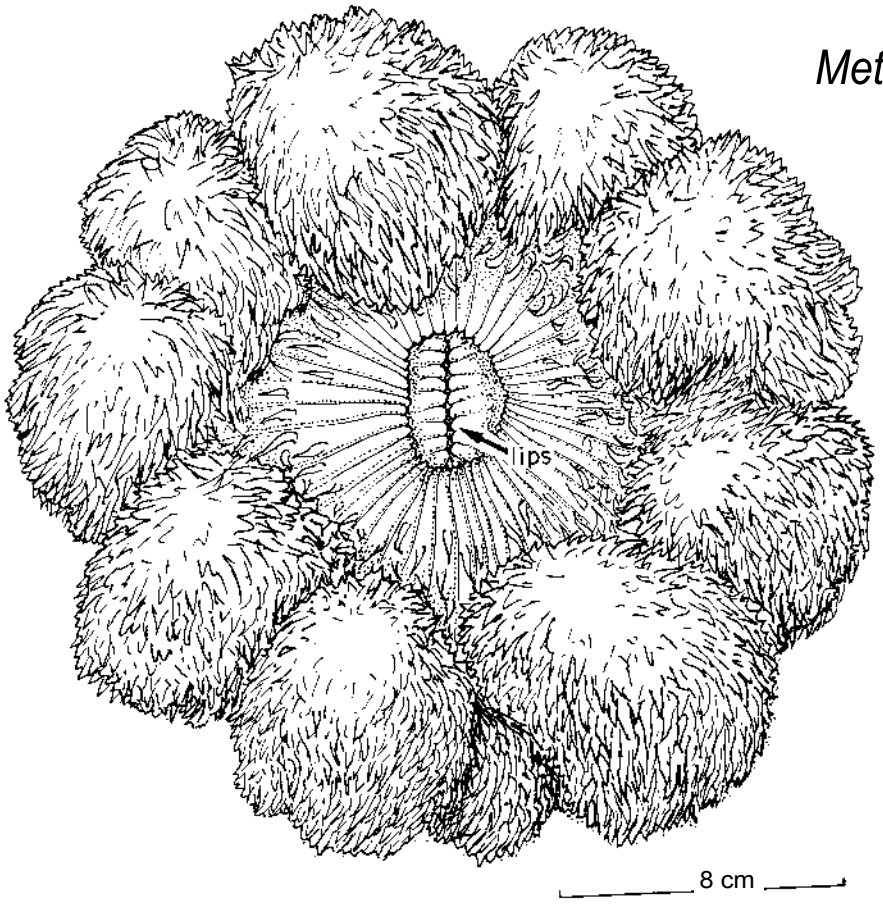
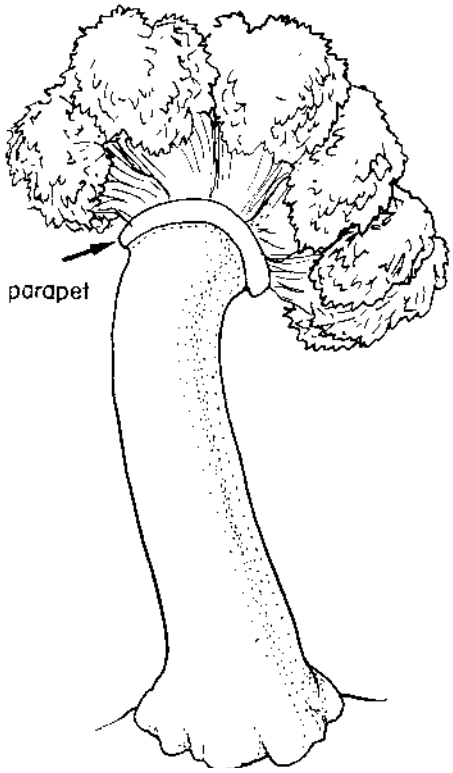
Metticfrum senile fimbriatum



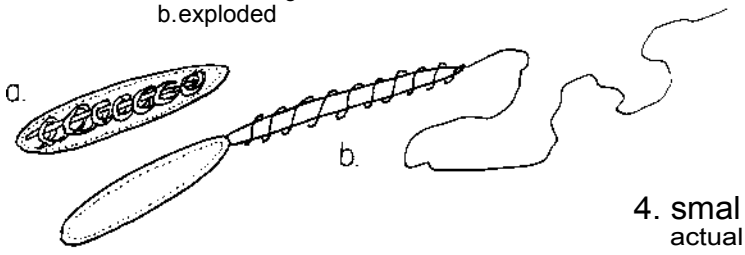


I. Metridium senile fimbriolum ,dorsal view
large subtidal specimen
many small tentacles in lobe-like groups;
column stout, not striped; base flat, attached;
oral disc with obvious lips

actual diameter 24 cm

2. subtidal specimen, lateral x I

3 (generalized) nematocysts
a. undischarged
b.exploded



4. smal I piling specimen x I
actual size 6 cm

Amphiporus *imparispinosus*

Griffin,1898

PHYLUM: *Nemertea (Rhynchocoela)*
cLASS: Enopla
ORDER: *Hoplonemertea, Monostylifera*
FAMILY: *Amphiporidae*

Description

COLOR-solid. opaque white; sometimes pale reddish or yellowish tinge, or pale yellow, flesh-colored; brain area pinkish, intestinal canal brownish tinge4.

SIZE-mature at about 25 mm; usually 25-50 mm; very slender4.

HEAD--not strongly differentiated from rest of body.

°CELLI-- many, small; in two groups on each side of the head anterior to brain: also an elongated anterior group of 6-15 ocelli along the mar[9]in, and a posterior, internal group of about the same number, (but it can be up to 30); fewer in younger animals (fig. 2).

MOUTH-anterior to brain: class Enopla; opens into proboscis pore (not figured)6.

PROBOSCIS -very long: contained within sheath (rhynchocoel) almost as long as body: genus *Amphiporus;* armed with one stylet: suborder: Monostylifera, in which the proximal end of the basal segment is rounded and wide (fig. 3)[6]; with three pouches of accessory stylets. (The proboscis must be everted or the worm dissected to see the stylet and pouches.)

BODY--soft, elongate, non-segmented: Nemertea; long and slender, especially for the family Amphiporidae; slightly flattened posteriorly (fig. 1); no caudal cirrus (tail).

Possible Misidentifications

Other Hoplonemerteans (free-living Enoplans without a sucker disc at the posterior), with a central proboscis stylet (suborder *Monostylifera),* can be divided into five families. The Ototyphlonemertidae have no ocelli; the Emplectonometatidae have a short proboscis, usually numerous ocelli, and the mouth and proboscis pore usually united; the Prosorhochmidae have a very long, slender proboscis and usually two pairs of large ocelli. The Tetrastemmatidae usually have four ocelli. Most Amphiporidae are relatively short and broad [s]; *A. imparispinosus* is unusual in this respect.

There are as many as 17 species of *Amphiporus* in the Pacific Northwest; (five are included in the Puget Sound keys). *A. formidabilis* is the only other slender species, and it has 6-12 pouches of accessory stylets, not 2-3. It is also much larger than *A. imparispinosus:* 1 0-30 cm[12]. The other three species are rather stout and more strongly colored: *A. rubellus* is a uniform red or orange with no pattern and 10-20 ocelli on each side of its heads.

A. punctulatus is a dark brown, irregularly blotched on its dorsal surface, and with a lighter head marked with two dark spots.

A. bimaculatus gets its name from the same sort of strong spots (which are not ocelli) on its light-colored head. Its general coloration is homogenous, not blotchy as in *A. punctulatus. A. bimaculatus* secretes great quantities of mucus when disturbed'.

A variety of *A. imparispinosus (A. similis,* Coe, 1905) varies only by having two pouches of accessory stylets not three [s]. It is often found with the typical form.

Because of the many identifying characteristics which are internal and not visible, it is sometimes very difficult to distinguish among Nemerteans without dissecting them. Ways in which the worms flatten, contract, and coil are useful as aids to identification of live specimens.

Ecological Information

RANGE-northeastern Pacific from Siberia, Bering Sea, south to Ensenada, Mexico: found at very many collection sites'. genus rare in the tropics.

LOCAL DISTRIBUTION CoosBay: several stations in South Slough;

HABITAT- "among algae. mussels, and other growths on rocks and piles"[5]. can be on very exposed surfswept shores. also under stones, among shells in red alga *Corallina vancouyeriensis."*

SALINITY —

TEMPERATURE- latitudinal range would indicate a wide temperature toleration; ie. 50-70°F (San Pedro, Calif.) to just above freezing (Bering Strait).

TIDAL LEVEL-intertidal and below: down to 50 m6.

ASSOCIATES-

Quantitative Information

WEIGHT-

ABUNDANCE-one of the most common *Amphiporus* species."

Life History Information

REPRODUCTION--- dioecious (separate se;:es) [4.] (some Hoplonemertes are hermaphroditic): eggs and sperm released at same time.

GROWTH RATE- –

LONGEVITY —

FOOD- predatory, killing prey with armed proboscis; secretes a toxic slime[2] which kills prey before ingestions.

PREDATORS---

BEHAVIOR--can't swim or roll up spirally: genus *Amphiporus4.*

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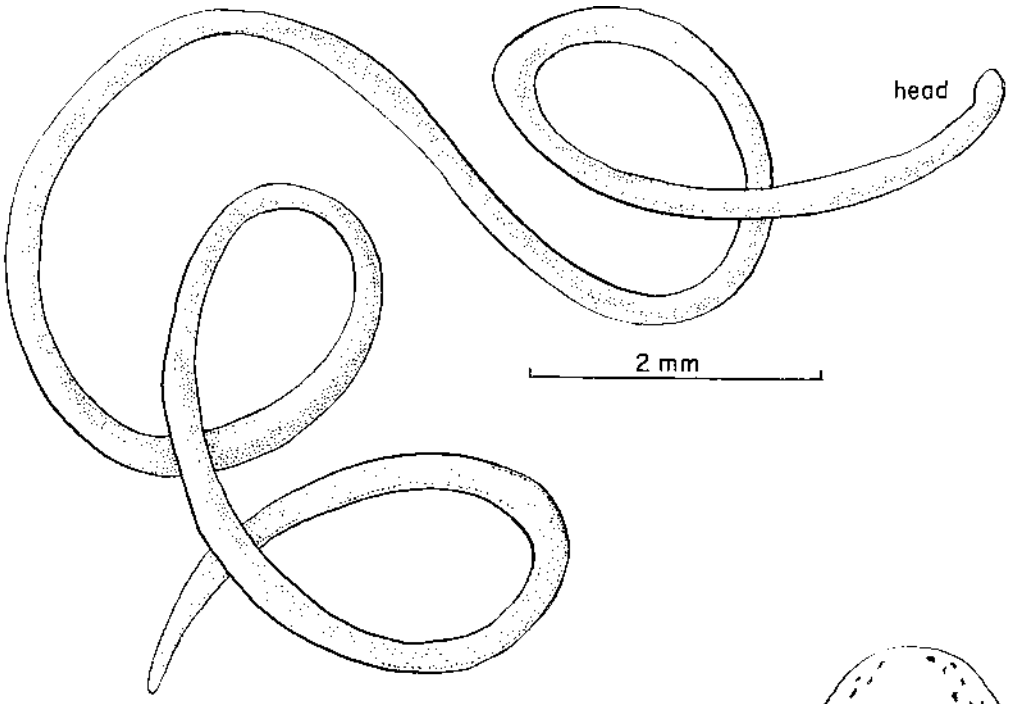
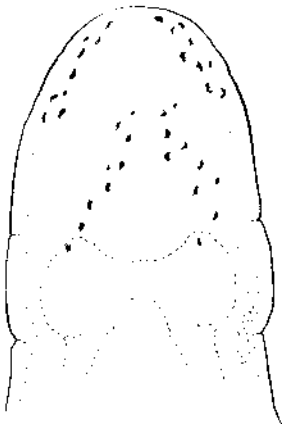
Amphiporus imparispinosus



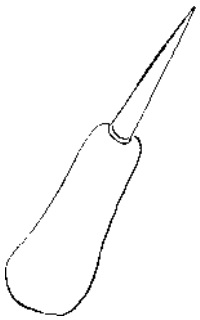
1. *Amphiporus imparispinosus* x 20
actual length 30 mm
body long and slender, head not set off from body;
solid color, whitish; dark intestinal area;
no caudal cirrus.



mm

2. head x 35
ocelli grouped along anterior margrn, interior.

(from Coe, 1905)



x 200

3. sty let and base (proboscis)
basal segment rounded.

(from Coe, 1905)

Carinoma mutabilis

a ribbon worm Griffin,1898

PHYLUM: *Nemertea (Rhynchocoela)*
CLASS: *Anopla*
ORDER: *Paleonemertea*
FAMILY: *Carinornidae*

Description

COLOR-- homogeneous (dorsal and ventral the same); anterior a solid white mottled with brown pigment[8]: head milk white, not translucent: intestinal region cream or brownish; internal organs show as transverse dark lines: dark yellow or orange in the male, reddish in the female (fig. 1).

SIZE-great variation: from 2.5 cm to 50 cm; few over 20 cm on the California coast, and average size much less [3]: largest diameter: 3-5 mm.

HEAD-shape changes constantly; can be rounded or emarginate: is wider than neck, and not distinctly marked off from the body. No ocelli, no cephalic grooves order Paleonemertes.

MOUTH-just behind brain: class Anopla.

PROBOSCIS-no stylets (can be seen only when proboscis is everted): pore (opening to rhynchocoel) almost terminal.

BODY-soft, elongate, nonsegmented: phylum Nemertea. Thickened, rounded anteriorly; very flattened posteriorly (fig. 1) and slightly from behind head; tends to coil posteriorly [3]: no caudal cirrus (tail).

Possible Misidentifications

C. *mutabilis* is the only species of its family on the Pacific coast. The Tubulanidae, another primitive nemertean family. are similar in having no ocelli or cephalic grooves: they however, do not flatten posteriorly as does *Tubulanus polymorphus.*

There are no other free-living, solidly colored nemerteans lacking caudal cirrus, ocelli and cephalic grooves in the northwest. One Heteronemertean which might cause confusion is *Baseodiscus punnetti,* which has many very minute eyespots, and slight, oblique cephalic grooves; it can retract its head, however, which *Carinoma* cannot, and it does't flatten posteriorly.

One of the difficulties of identifying nemerteans is that they are differentiated partly by interior muscle layer arrangements which are not visible superficially.

Ecological Information

RANGE-worldwide (Europe, New England, Magellan Straits3): genus *Carinoma,* but only three species. This species: from British Columbia to Gulf of California.

LOCAL DISTRIBUTION-in Coos Bay, several stations: South Slough, Pony Slough, North Spit.

HABITAT-sand, sandy mud, clay'°, wharf pilings7.

SALINITY-

TEMPERATURE -latitudinal range would indicate a wide temperature toleration.

TIDAL LEVEL-intertidal and below (to 40 m5).

ASSOCIATES-

Quantitative Information

WEIGHT-

ABUNDANCE-

Life History Information

REPRODUCTION -sexually mature in August. California and Puget Sound[3]. Dioecious (separate sexes): many eggs released at once, fertilized by male sperm.

GROWTH RATE--

LONGEVITY-

FOOD-a predator. capturing prey with eversible proboscis.

PREDATORS —

BEHAVIOR-

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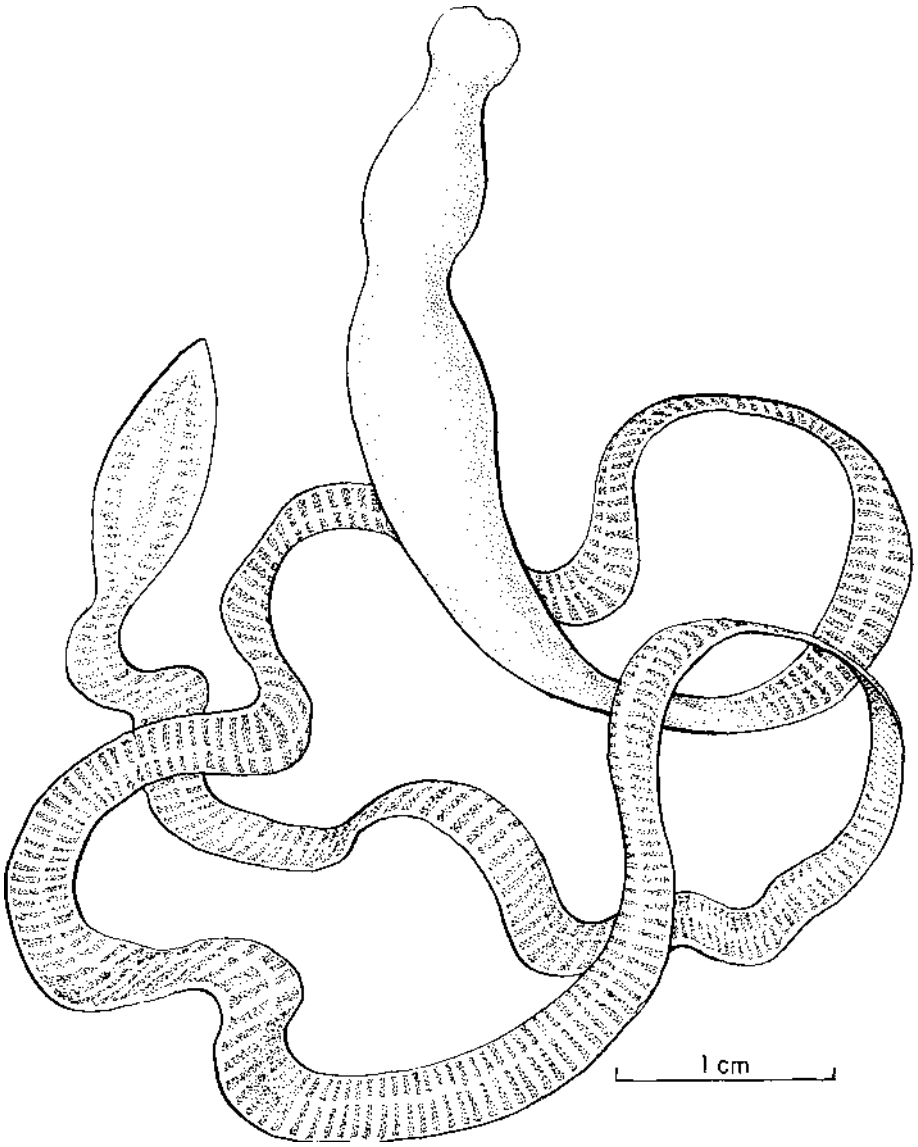
Carinoma *mutabilis*



Connomo mutobills X3 actual length 27cm
head changes shape constantly; no ocelli or cephalic grooves;
internal organs show as transverse lines;
body thickened anteriorly, flattened posteriorly, coiled.

(from Coe, 1940).

Cerebratulus califomiensis

a ribbon worm **Coe,1905**

PHYLUM: *Nernertea (Rhynchocoela)*
CLASS: *Anopla*
ORDER: *Heteronemertea*
FAMILY: *Lineidae*

Description

COLOR-pale orange, posterior with transverse white stripes, white head and tail areas. Can vary to yellow or brown.

SIZE-to one meter or more, this specimen 3.5 cm.

HEAD-with deep cephalic grooves (fig. 1), no eyes; medium sized proboscis with sticky surface.

BODY-anterior, firm, rounded: posterior-with transverse stripes. flat, ribbonlike, sharp edged for swimming.

CAUDAL CIRRUS-thin, tail-like appendage (fig. 1). Easily lost in collecting.

Possible Misidentifications

Among Nemerteans which are slender, free-living and without strong pigment patterns or contrasting dorsal and ventral surfaces, only *Micrura alaskensis* has cephalic grooves and a caudal cirrus. But it lacks the flattened posterior section for swimming, and its cephalic grooves are shallow, its head pointed, and it has no transverse bands. Several other species of *Cerebratulus* exist, especially farther north', but they are all large, dark in color, and only one, C. *montgomeryi* has the white tipped head of C. *californiensis.*

Ecological Information

RANGE-Gulf of California to Puget Sound.

DISTRIBUTION--several stations South Slough of Coos Bay.

HABITAT: SUBSTRATE-"sand and mudflats of bays and harbors", [12] "sand of exposed beach"[8] mud or sand; South Slough of Coos Bay: mud, chips.

SALINITY-

TIDAL LEVEL-mid-tide or lower.

ASSOCIATES- polychaetes, tanaidaceans *(Leptochelia),* amphipods.

Quantitative Information

WEIGHT-

ABUNDANCE-

Life History Inforamtion

REPRODUCTION-mature sexually July. Monterey[2]: some nemerteans are noted for regeneration from one small piece into a new, small worm.[9] Development includes a larval stage.

LONGEVITY-

GROWTH RATE-

PREDATORS-

FOOD-preys on polychaetes

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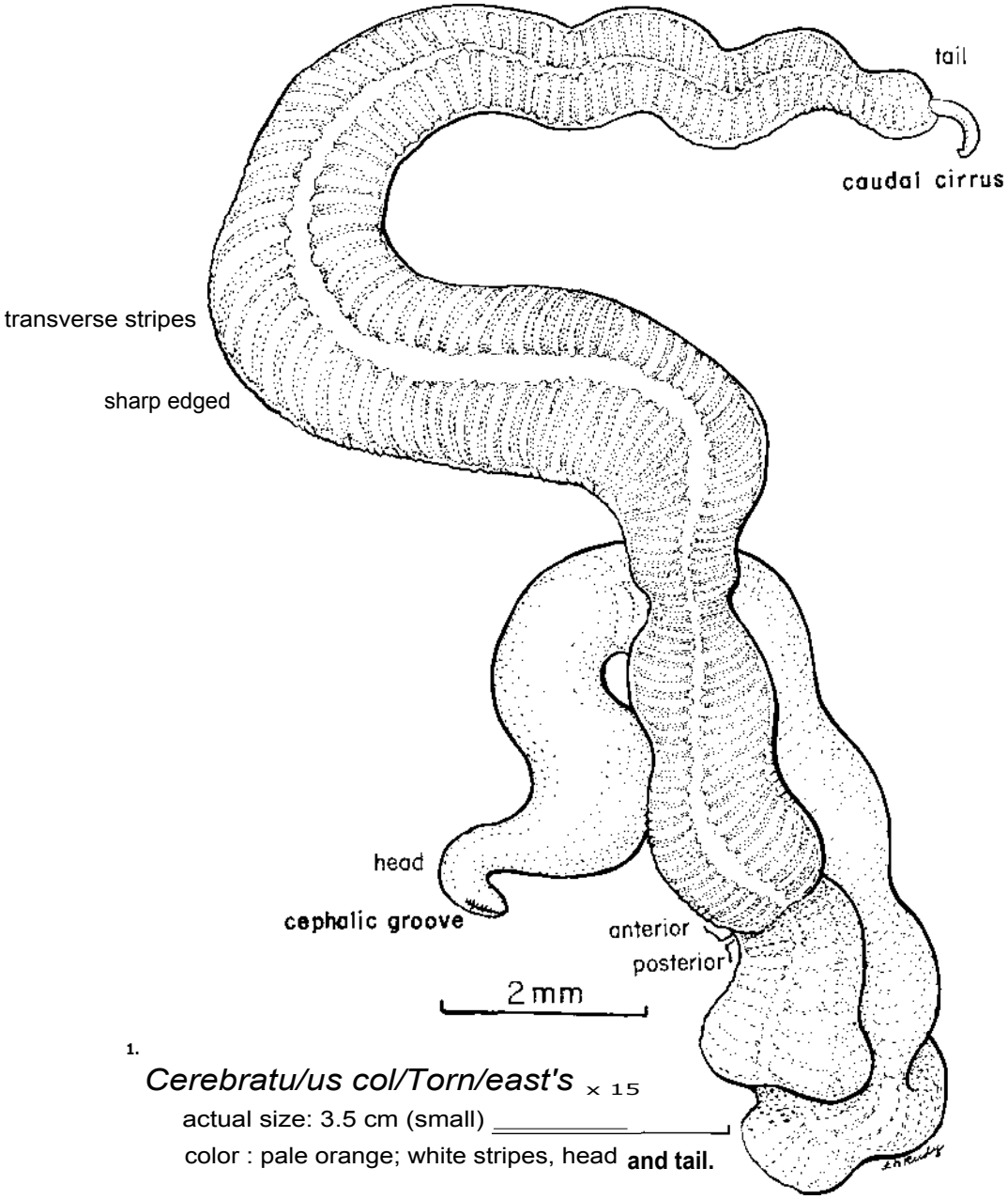
NEMERTEA

AN OPLA

Heteronemertea

Cerebratu/us californiensis



1.

Cerebratu/us col/Torn/east's × 15

actual size: 3.5 cm (small)

color : pale orange; white stripes, head **and tail.**

Lineus ruber
(0.F. Muller, 1771)

PHYLUM: *Netnertea (Rnynchocoele)*
CLASS: *Anopla*
ORDER: *Heteronemertea*
FAMILY: *Lineidae*

Description

COLOR-solid, no pattern, reddish brown, dark brown, or greenish brown, commonly paler ventrally.

SIZE-large for a nemertean: to 20 cm; "about 8 cm long, 1 mm wide[4]. Mature at 10 cm8.

HEAD--deep cephalic grooves: order Heteronemertea: head slightly wider than body, oval, snake-like13.

°CELLI- rows of four to eight small ocelli (eyespots) on each side of the head: (4-5:4).

PROBOSCIS -very long, unarmed (with stylets): class Anopla: not visible-coiled inside cavity (rhynchocoel), and everted to catch prey.

BODY soft, contractile, non-segmented: phylum Nemertea: elongate, without a posterior sucker or a caudal cirrus (tail): contracts by thickening and shortening, doesn't coil: species *ruber.*

Possible Misidentifications

L. ruber is the only member of its genus known from Coos Bay. Several other species do occur in the northwest:

L. rubescens, a small (10-15 mm) species from Puget Sound, usually has only 2-4 eyespots on each side of its head, and white spots at the tip of the head above and below [11]: it is pinkish, sometimes with a blue tinge: it is not included in the primary California key13.

L. vegetus, known to have extraordinary regenerative abilities; can be red like *L. ruber* (or green, or brown [11]); can have faint light lateral longitudinal lines. and faint rings around the body [11]. It has the same number of eyespots as *L. ruber,* and is chiefly distinguished from it by its regenerative powers and its ability to coil in a spiral, which *L. ruber* does not do. It is included in the Puget Sound key, while *L. ruber* is not", it extends south to Mexico4.

L. pictifrons. about 12 cm long, and 3 mm wide, is soft and flattened. with a head which is narrower than its body. It is deep brown or reddish all over. with a paler posterior end, it has numerous yellow rings and longitudinal yellow lines, as well as two orange spots on the snout[4]. Its range is from Puget Sound to Mexico4.

L. bilineatus is dark brown or olive with a yellow or white stripe and no transverse markings: low-water mark and below, range: Europe. Africa: local distribution-Alaska to San Diego4.

L. torquatus is dark reddish brown or purple with a single narrow whitish band connecting the posterior ends of its cephalic furrows: it is intertidal. and occurs from Alaska to San Francisco, California4.

L. flavescens is small (8-120 mm), yellowish, pale yellow and orange. or ochre with pale head margins. and 3-7 irregular red, purple or black ocelli. the largest being most anterior: it is more southern and in deeper water.

Systematically, the *Lineus* group of *viridis, sanguineus. pseudo-lacteus,* and *ruber,* is considered as a "complex-7.

As with other nemerteans, many of the identifying characteristics are internal, rather than external and visible.

Ecological Information

RANGE-circumpolar. also South Africa: Pacific coast Alaska to Monterey Bay. California4.

LOCAL DISTRIBUTION -in Coos Bay: several stations in South Slough, Airport Island.

HABITAT-a wide range of habitats in bays as well as on the open coasts: beneath stones, among algae, in sand and mud13' habitat determined by substrate, predator density, angle of slope (Eason, in'), salt marsh pools[8]: bay muds.

SALINITY -can tolerate great changes[3]: down to 8 0/00 (Remane 1958, in[s]); typically found in brackish water [13]. Very sensitive to toxic substances. strong chemical changes6.

TEMPERATURE--a wide range of toleration possibir' car survive seven days at variations of troni() · a,0°C;('

TIDAL LEVEL--intertidal, but also found down to 10 meters*

ASSOCIATES--

Quantitative Information

WEIGHT-

ABUNDANCE -"uncommon" (northern California)[4], but best known and most widespread nemertean on the Atlantic coast: also common in Britain8.

Life History Information

REPRODUCTION -sexes separate: worms come together in pairs during season, secrete a mucus layer into which female deposits her eggs (fig. 4); male fertilizes them as they are laid. Embryos have a larval stage within this gelatinous mass. and so avoid the usual planktonic larval stage of most marine nemerteans, emerging as a crawling stage[8]. *L. ruber* is not adept at the asexual fission managed by some other of the genus. particularly *L. vegetus.*

GROWTH RATE-

LONGEVITY-

FOOD-living or dead oligochaetes, polychaetes. small crustaceans: detects prey chemotactically up to 8 cm away[6]. Feeds mostly at night[9]: can withstand long periods of starvation.9.

PREDATORS-

BEHAVIOR -movement sluggish; creeps over substrate. can move on water's surface, but can't swim. Doesn't have superior regenerative properties of *L. vegetus.*

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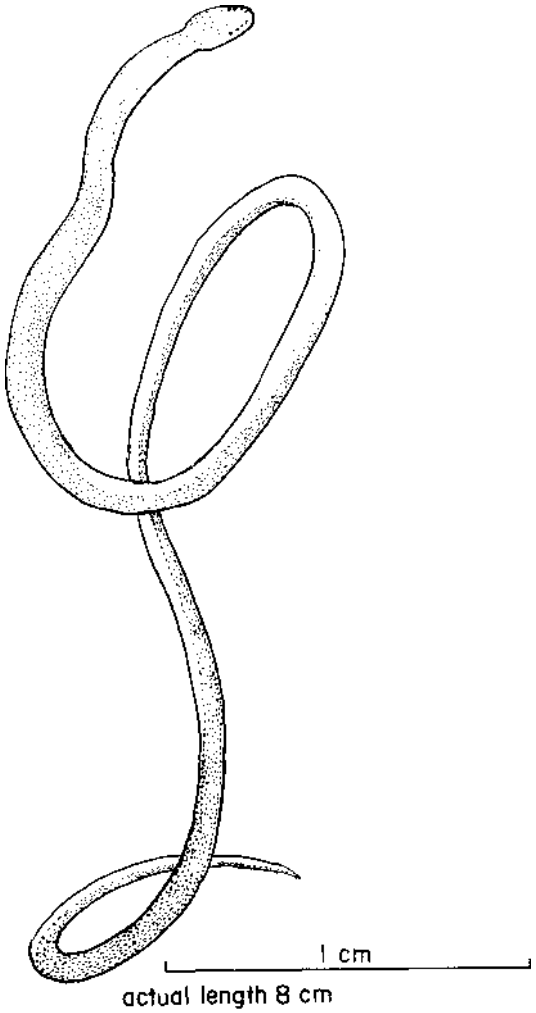
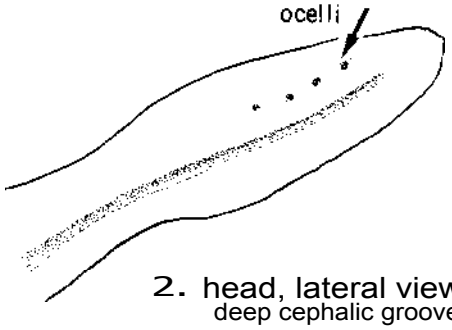
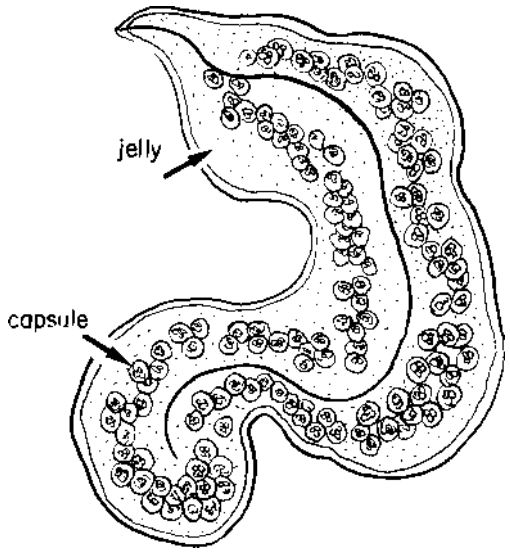


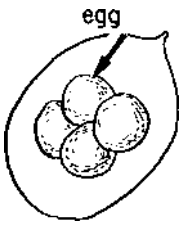


2. head, lateral view x20
deep cephalic grooves.

I. *Lineus ruber* x 5
solid, brownish, lighter ventrally;
head snake-like; 4-8 pairs ocelli;
body contracts, thickens, doesn't coil;
no caudal cirrus.



3. egg string
from Hyman, 1951,af ter Schmidt,l934.



a. capsule

Paranemertes peregrina
"the wanderer" Coe,1901

PHYLUM: *Nemertea (Rhynchocoela)*
CLASS: *Enopla*
ORDER: *Hoplonemertea, Monostylifera*
FAMILY: *Emplectomenatidae*

Description

COLOR-dark dorsally, including head: brown, purple or olive green: lighter ventrally: white or pale yellow: midventral section sometimes lighter than the rest: no lines or other patterns, except V-shape behind head.

SIZE-more northern specimens (var. *alaskensis)* larger than southern ones (var. *californiensis):* 40 cm vs. 10 cm[2]: long and slender

HEAD usuallytruncate, a little larger than body: no cephalic grooves; striking markings: a narrow V-shaped marking just back of the head (sometimes quite faint), a pair of white transverse lines on the lateral margins[2] (fig. 2).

PROBOSCIS-eversible. usually enclosed in sheath (rhynchocoel) halt to three quarters body length: genus *Paranemertes:* whitish; one short, straight stylet (order Monostylifera). with spiral grooves (southern variety): fig. 4. Stylet can be .09 mm long in iarge specimen[2]. Two *(californiensis)* to four *(alaskensis)* pouches of accessory stylets, each pouch with 6-10 stylets (fig. 3). Proboscis can be everted with fresh water or dilute acetic acid."

MOUTH infront of brain; united with proboscis pore: suborder Monostylifera, (not figured).

OCELLI-two groups on each side of head, of 5-12 large ocelli in an irregular row: the same number of small ocelli is found in an irregular group near the brain (fig. 2).

BODY-elongate, contractile, non-segmented; Nemertea; soft loct muscular: can lengthen and shorten easily[8]: no caudal cirrus (tail).

Possible Misidentifications

There are five genera of the family Emplectonematidae on the Pacific coast, all of which have a short proboscis, numerous ocelli, and a long, slender body: *Carcinonemertes* is parasitic on crabs; *Emplectonema* is very slender with 12-14 eyes in each of two rows; *Nemertopsis* and *Dichonemertes* have only four ocelli3.

Of the four known Pacific species of *Paranemertes,* none is as common as P. *peregrina: P. pallida* has been found only in Alaska.

P. carnea with six accessory stylet pouches, is whitish, pink or flesh-colored, and is reported only from Alaska to Puget Sound.

P. californica, pale gray or orange anteriorly and gray or salmon posteriorly, which exterior pigmentation is often obscured by its green digestive tract, has not been found north of Monterey Bay.

Ecological Information

RANGE-4000 miles: Bering Sea to southern California: widely distributed in many habitats.

LOCAL DISTRIBUTION-in Coos Bay, several stations: Barview, North Slough, Haynes Inlet, Kentuck Inlet, South Slough, Charleston.12

HABITAT-found under a great variety of conditions: rocky shores, mussel beds, seaweeds, coralline algaes, mudflats. Avoids bright light.

SALINITY-collected at 30 0/00.

TIDAL LEVEL-intertidal and below.

TEMPERATURE-the wide distribution range would indicate a tolerance of very cold to temperate conditions.

ASSOCIATES-

Quantitative Information

WEIGHT-

ABUNDANCE-common in many habitats: a maximum average density of 14 worms/m_2, usually less[15]. Easily the most common mudflat nemertean at Charleston.

Life History Information

REPRODUCTION --deposits of single or gelatinous clusters of many eggs can be found in the warmer months[3]. Spawning in spring and summer; eggs take up to 6 months to mature. Eggs hatch third day. Females may outnumber males in some populations (Washington) Roe, 1970 in."

GROWTH RATE--

LONGEVITY-to 1 3/4 years; may spawn 3 times.'1

FOOD-diet consists almost entirely of nereid worms. although it occasionally will take the polychaete *Polydora;* prefers the small, timid *Platynereis bicanaficulata* which lives in tubes in *Ulva* (Puget Sound); also eats *Nereis vexillosa.* Some Syllid polychaetes are partly immune to *Paranemertes'* venom' 4.

PREDATORS-crabs will eat nemerfeans only if very hungry and after first cleaning off the mucus with their claws (Eason in5).

BEHAVIOR-a diurnal feeder. *P. peregrina* is well known as a voracious, aggressive hunter. It conducts its haphazard searches when the tide is out and nereids are unable to escape'. on cloudy days (it stays in on rainy days!) It has a temporary burrow_ to which it retreats on its slime track[8]. Its predatory attacks involve little chemoreception, its proboscis wraps around the nereid, emits a venomous mucus (the toxin anabaseine[15]), which stuns the prey for just 20 minutes". withdraws and draws the prey into its mouth. Worms of a great length can be eaten by P *peregrina,* but not those of a large diameter.

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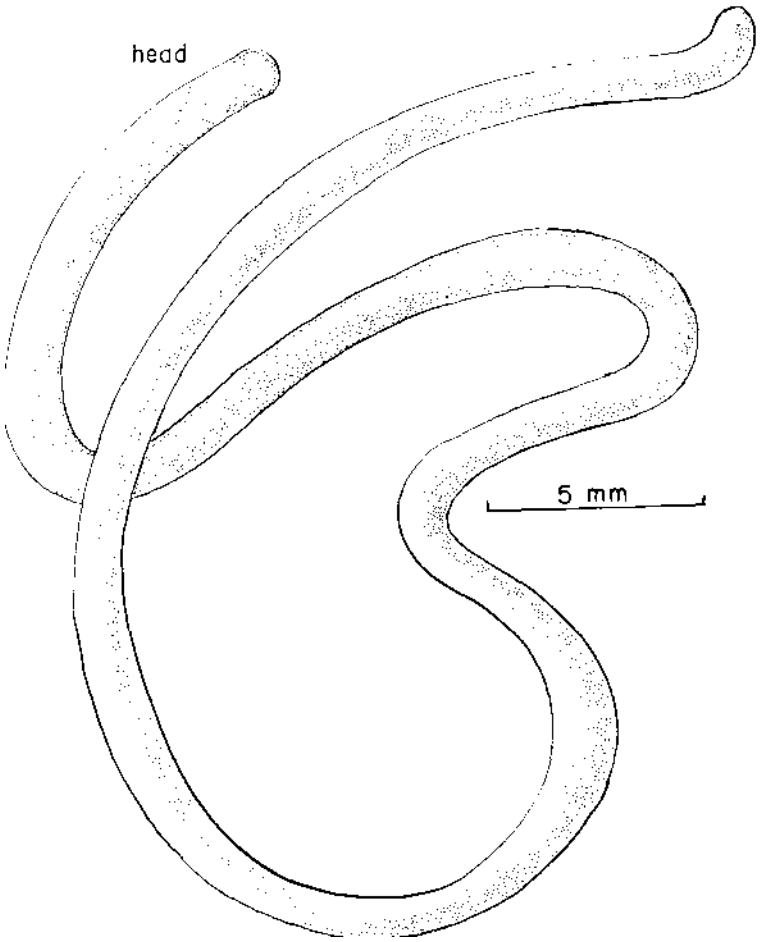
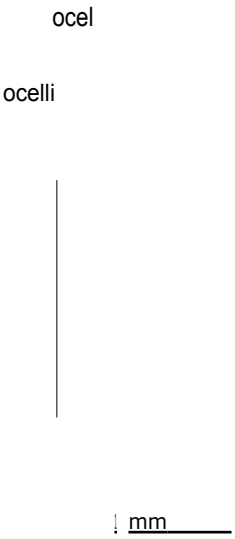
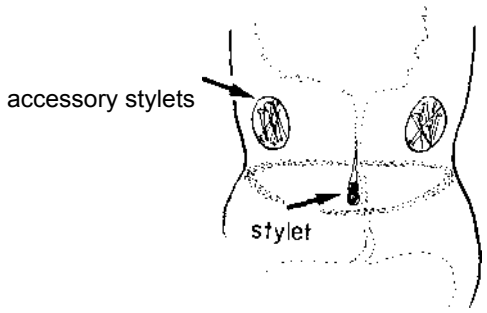
Poranemertes peregrine



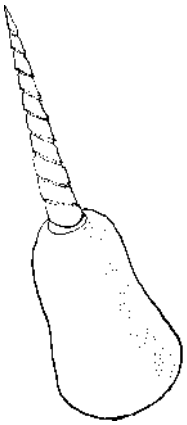
1. *Paronemertes peregrine* × 6
actual size 8 cm
long, slender; dark dorsal ly;
no cephalic grooves or caudal cirrus;
solid color, no patterns;
narrow V-shaped marking behind head.



2. head, dorsal view x 25
a pair of transverse lateral white markings;
two groups of 5-12 ocelli near anterior edge,
two groups farther back;
light ventral color shows at edges.



3. stylet area, proboscis (everted)
central stylet and two pouches of
accessory stylets.
(from Coe, 1905)



4. centra l stylet and base
showing spiral grooves.
(adapted from Coe, 1905 and Gibson,1973)

Tubulanus polymorphus

an orange ribbon worm **Renier,1804**

PHYLUM: *Nemertea, Rhynchocoela*
CLASS: *Anopla*
ORDER: *Paleonemertea*
FAMILY: *Tubulanidae*

Description

COLOR—usually boldly colored: red. brown, or orange: solid, no patterns, no dorsal or ventral color differences.

SIZE—large, up to three meters when extended: long and thin: very soft

HEAD—rather broad. set off from body, flattened, no ocelli, no cephalic grooves: order Paleonemertea But with lateral transverse grooves (fig. 2a), not capable of being completely withdrawn into bodyb.

MOUTH—a long slit-like opening (fig. 2c); behind brain, separate from proboscis pore[s] (fig. 2c) just behind transverse furrows.

PROBOSCIS---eversible (usually coiled inside rhynchocoel (cavity): short: sheath usually one third body length: without stylets, pore almost terminal (tig. 2c).

BODY—soft. elongate, non-segmented: phylum Nemertea: cylindrical, can be flattened posteriorly (fig 1).

Possible Misidentifications

The genus *Tubulanus* is slender, soft, extensible_ without ocelli or cephalic grooves[4], and with flattened head with transverse lateral grooves. Seven other species of *Tubulanus* are found on the Pacific Northwest beaches. T *polymorphus* can be distinguished from the others by its large size and strong color, lack of pattern and free-living habit.

Some of the other species are

pellucidus, a small (to 2.5 cm). white translucent tube-dweller estuarie&

cingulatus. deep brown with white rings and four long stripes: to 15 cm: subtidal and lower:

sexilineatus. to 50 cm, chocolate brown with white rings and 5-6 long lines: a tube dweller

captstratus, slender and brown, up to one meter. with many narrow white rings and three long lines: a tube dweller. Two other species are subtidal, or southern.

Ecological Information

RANGE—Aleutian Islands south to Monterey, California. Europe and Mediterranean coasts.

LOCAL **DISTRIBUTION** —more exposed parts of Oregon estuaries, as well as rocky outer shores, where it is very obvious. Coos Bay: Charleston, Barview, Pony Slough.

HABITAT— under heavy boulders, among mussels, in mud', on both open coast and in bays. It is the common large red nemertean of the outer coastal rocky intertidal.

SALINITY-

TEMPERATURE—found in cold and temperate waters.

TIDAL LEVEL—intertidal[4]; low intertidal and subtidal zones.6

ASSOCIATES —

Quantitative Information

WEIGHT-

ABUNDANCE—"rather common'[4]; quite common on the outer coast. Oregon.

Life History Information

REPRODUCTION—sexually mature in July, August[e]. can produce great numbers of eggs which are often used for experimental studies3.

GROWTH RATE

LONGEVITY

FOOD—a predator.

PREDATORS —

BEHAVIOR —can be found at low tide searching for food

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Morris. Abbott & Haderlie. 1980. P 85
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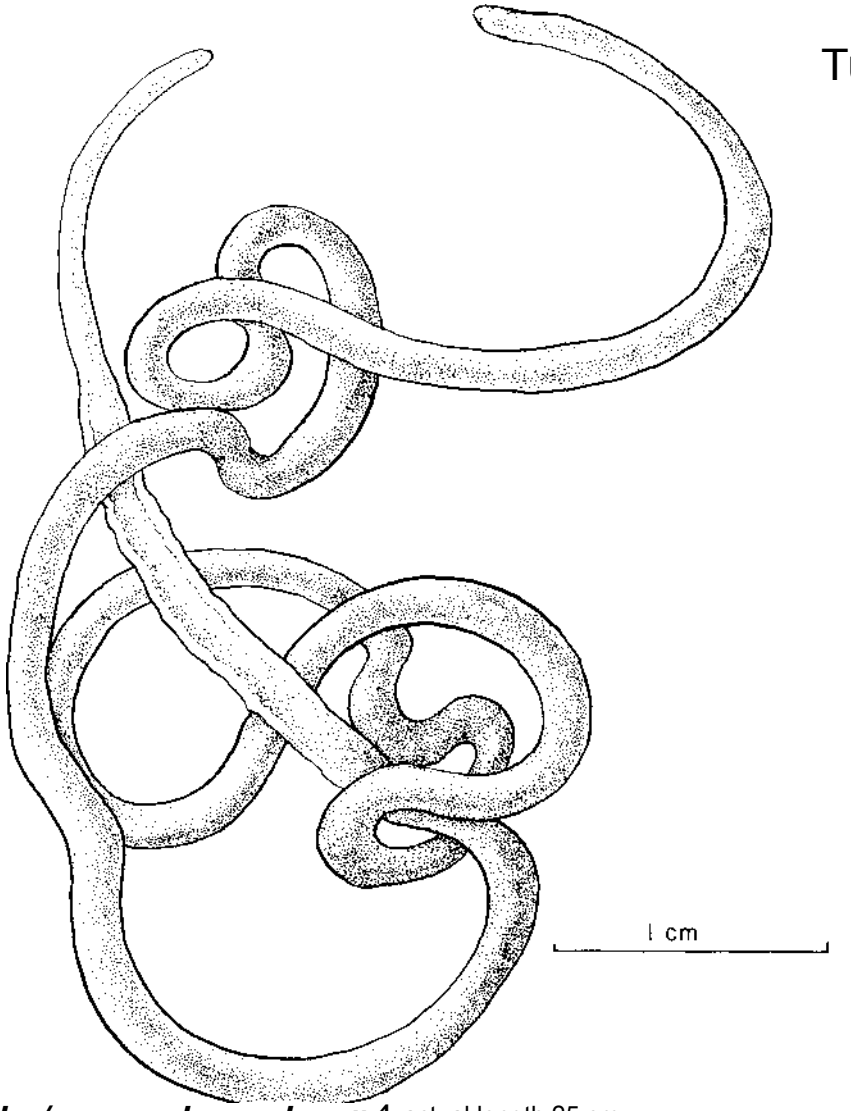
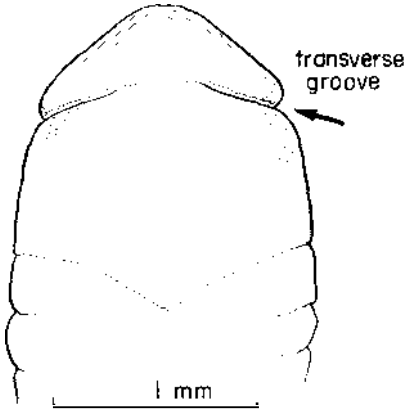
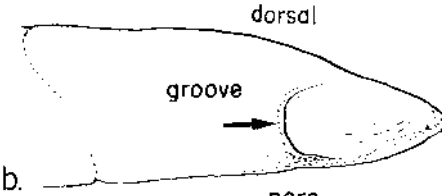
Tubulanus polymorphus



1. ***Tubu/anus polymor hus*** x 4 actual length 25 cm
body soft, cylindrical; can be flattened posteriorly;
color solid orange red or brown; no pattern;
head flattened,without ocelli or cephalic grooves.



C.



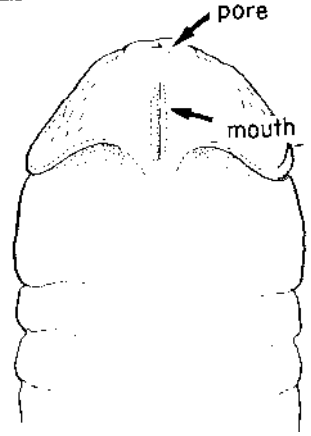
b.

2. head x 30

O. dorsal view, showing transverse grooves; no ocelli or lateral cephalic grooves;

b. lateral view showing flattening, transverse groove;

C. ventral view, showing proboscis pore, long, slit-like mouth, grooves.



C.

Tubulanus sexlineatus
the six-lined ribbon worm (Griffin, 1898)

PHYLUM: *Nemertea*
CLASS: *Anopla*
ORDER: *Paleonemertea*
FAMILY: *Tubulanidae*

Description

SIZE—average length 20 cm; can extend to 1 meter[7]; (this specimen 25 cm long, 1.5-2 cm wide).

COLOR—orange to dark brown ground with many regular horizontal bands and 5-6 longitudinal lines. One of these is mid-dorsal, two dorso-lateral. Two are ventral, dividing ventrum into 3 parts (fig. 2b). (If six lines are present, the sixth will be a faint mid-ventral line.) Horizontal bands begin at the tip of the head; only about half of them continue down through the lateral edge to the ventrum (fig. 3). Bands sometimes very wide in midsection.[6]

BODY—soft, elongate, non-segmented: Phylum Nemertea. Cylindrical, can be slightly flattened posteriorly: Order Paleonemertea (Heteronemertea are often flat, ribbonlike; see *Cerebratulus).*

HEAD—blunt, not snake-like: Paleonemertea. Often flattened dorsoventrally; disc-like, wider than trunk, from which it is separated by a constriction (fig. 2b). Distinct dark cephalic furrows extend from subterminal proboscis pore (figs. 25, 2c), but no *lateral* cephalic grooves are present: Order Paieonemertea. (For lateral grooves, see *Lineus ruber,* fig. 2). No ocelli: Order Paleonemertea. Head not completely retractible into body.

MOUTH—directly behind brain: Class Anopla[7]; not connected to proboscis pore; situated ventrally just behind transverse grooves (fig. 2b).

LATERAL TRANSVERSE GROOVES—just above constriction which separates head from trunk (fig. 2b).

PROBOSCIS--short, without stylets: class Anopla (not figured); proboscis sheath less than 1/2 body length (not figured). Proboscis pore subterminal (fig. 2b).

LATERAL SENSE ORGAN (NEPHRIDIOPORE)—a flat, shallow, orange-colored pit in lateral area just next to fifth horizontal ring: family Tubulanidae[2]; (fifth ring is wider than any more posterior ring (figs. 1, 3).

POSTERIOR END—flattened, light-colored around anal pore; no caudal cirrus (fig. 1).

TUBE—long, white, rather transparent, papery; open at both ends (fig. 4); secreted by worm's epidermis.'

Possible Misidentifications

The brown color of *T. sexlineatus,* with both vertical and horizontal markings, is quite distinctive, especially in nemerteans without ocelli or lateral cephalic grooves. There are several other species of *Tubulanus* in our area. Those with possible confusing surface patterns include:

Tubulanus cingulatus, which is deep brown with white rings, but has only four longitudinal lines, not 5-6; it is subtidal;

Tubulanus capistratus, is slender and brown with many narrow white rings but only three longitudinal lines; it is up to 1 meter long;

Tubulanus albocinctus is deep red with many narrow white rings, but without any longitudinal lines.

Ecological Information

RANGE—Alaska to southern California.'

LOCAL DISTRIBUTION—Coos Bay: spoil islands of lower bay.

HABITAT—in tubes among algae, mussels; under rocks and on pilings.

SALINITY—collected at 30 o/oo salt water.

TEMPERATURE

TIDAL LEVEL—intertidal' ; collected at about + 1.0 ft.

ASSOCIATES—found with terebellids, polynoid polychaete *Halosydna brevisetosa.*

Quantitative Information

WEIGHT

ABUNDANCE—" rather common".'

Life History Information

REPRODUCTION

GROWTH RATE

LONGEVITY

FOOD—predatory on polychaetes.

PREDATORS

BEHAVIOR

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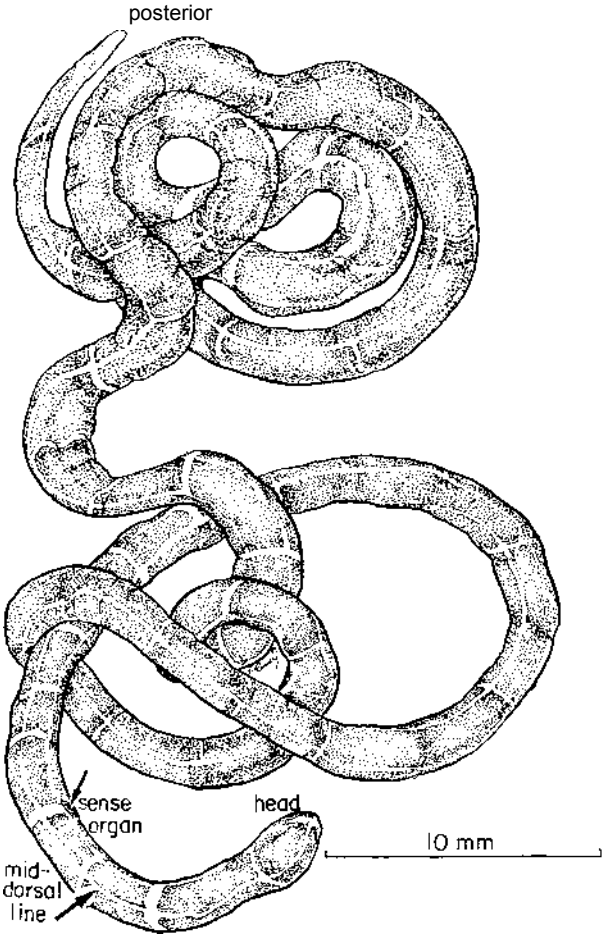
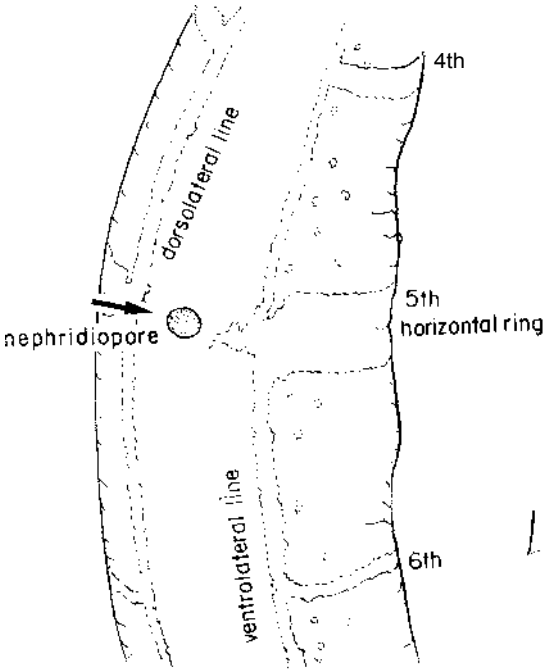
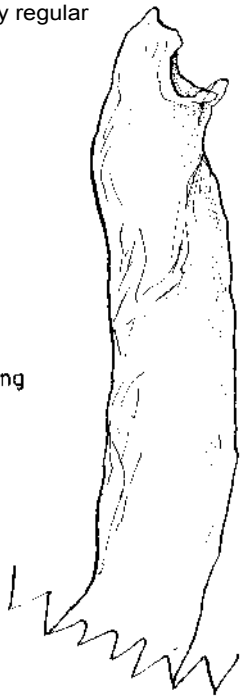
Tubulanus sex/Meatus



I. Tubulanus sex/ineolus x 4 actual length 25 cm
delicate, extensible posterior flattened;
5-6 thin white longitudinal lines, many regular horizontal rings on brown ground.

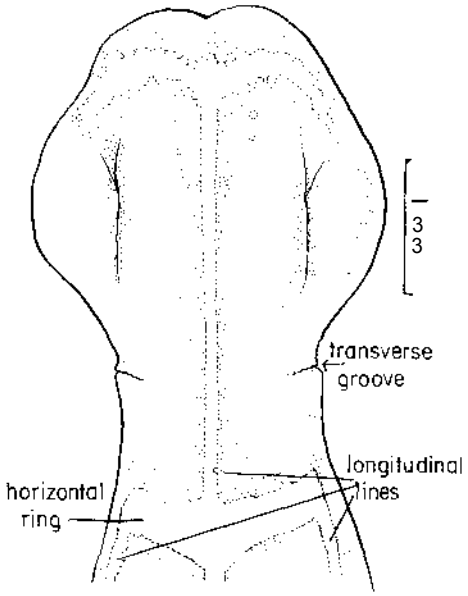


3. lateral sensory organ

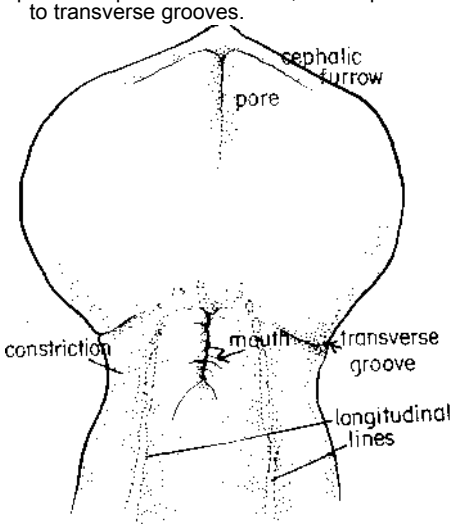


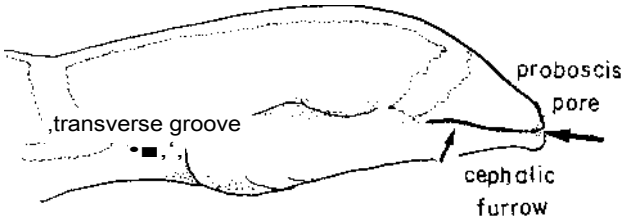
4.part of tube x 4
whitish,clear, papery.

2.a. head,dorsal view x 20
flattened,eyeless; constriction between head and trunk; three longitudinal lines; lateral transverse grooves just anterior to constriction.



2b. head, ventral
proboscis pore subtermina l ; mouth posterior to transverse grooves.





2 c. lateral view
cephalic -furrow; no ocelli.

Abarenicola pacifica

the lugworm, or sand worm **Healy and Wells,1959**

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER:
FAMILY: *Arenicolidae*

Description

SIZE-often over 10 cm long, 1 cm wide: present specimen small: 4 cm (South Slough of Coos Bay), west coast family average 6 "(15 cm).13

COLOR- head. abdomen orange. parapodial areas. branchiae red

PROSTOMIUM- non-retractile. naked. eyeless (fig. 2).

PROBOSCIS-"a large. eversible sack [-4] with mucus glands. (fig. 1).

BODY CHARACTERISTICS-divided into three sections: 1) anterior of six setigers, without branchiae and with strong chaetigerous annuli: 2) medial branchial region (setigers 7-19: 13 prs. large branchial gills), 3) posterior apodous, achaetous, Epidermis "very thick. strongly aeroloated-1.

PARAPODIA--noto- & neuropodia segments 1-19. reddish, well separated (far from ventral line), (fig. 3).

NEPHRIDIOPORES-naked (without hoods). five pairs, on segments 5-9 (fig. 2): sometimes difficult to see.

BRANCHIAE--prominent. thickly tufted. segments 7-19 (13 pairs), with bunched setae.

ESOPHAGEAL CAECA onelarge anterior pair, 3-6 smaller pairs [13]: seen by dissection only (fig. 4).

Possible Misidentifications

Other Arenicolidae have the same bushy gills in the middle third of the body: only genus *Abarenicola* has well-separated neuropodia. a non-retractile prostomium, more than one pair 0f esophageal caecae, and five pairs of nephridiopores. Both *Arenicola marina* and *pusilla* have been found in Oregon estuaries. Other *Abarencola* are *A. (claparedd i) oceanica,* which has hooded nephridial pores and 7-9 smaller pairs of esophageal caecae; *A. vagabunda,* from Puget Sound, (but possibly from Oregon") is usually larger, and dark brown; it, too, has hooded nephridial pores, and from 11-18 smaller esophageal caecae. Its burrows, less permanent than *A. pacifica's,* are found in deep sand, and may be more subtidal5.

Ecological Information

RANGE-Humboldt Bay. California, to Alaska. Japan. Holotype: Pu [9] et Sound.

DISTRIBUTION-a north Pacific form: most common lugworm in Puget Sound area intertidally [5]. Found in Coos Bay from estuary mouth to Coos River mouth (marker 15). and at Sunset Bay outside "

HABITAT-SUBSTRATE-builds a substantial L- or J- [8] shaped tube in sand and mudflats: mixed, gravelly sediments: mud and chips (South Slough of Coos Bay). Tolerates a muddier, less permeable, more poorly sorted sediment than does A.c. *vaga-* fc/a'. but does not live in very sott mud.'

TUBE-firm, mucus impregnated. up to 40 cm, with typical fecal castings at tail end: head end is collapsed as worm consumes mud [4] Water is pumped through burrow by worm.

SALINITY-does not live in waters of low salinity. or in heavily polluted anaerobic conditions. [12] but is a conformer. and can tolerate a wide range of salinities: (lower limit: 5006 seawater)".

TEMPERATURE-

Quantitative Information

ABUNDANCE-often to 50/sq. meter [s]: very dense in specialized habitats. Probably second most abundant macroscopic animal in Coos Bay [12]. up to 100/sq. meterm

Life History

REPRODUCTION eggs and sperm discharged from nephridiopores. into water. while both sexes are in their burrows Fertilization occurs in female's borrow, where eggs accumulate into a tube.

GROWTH RATE-

LONGEVITY-

FOOD-detritus, picked up from surface by mucus of proboscis (fig. 1), digested out of sand and mud, which is defecated

PREDATORS man. for fish bait: birds, fish.

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ANNELIDA

POLYCHAETA

Arenicolidae

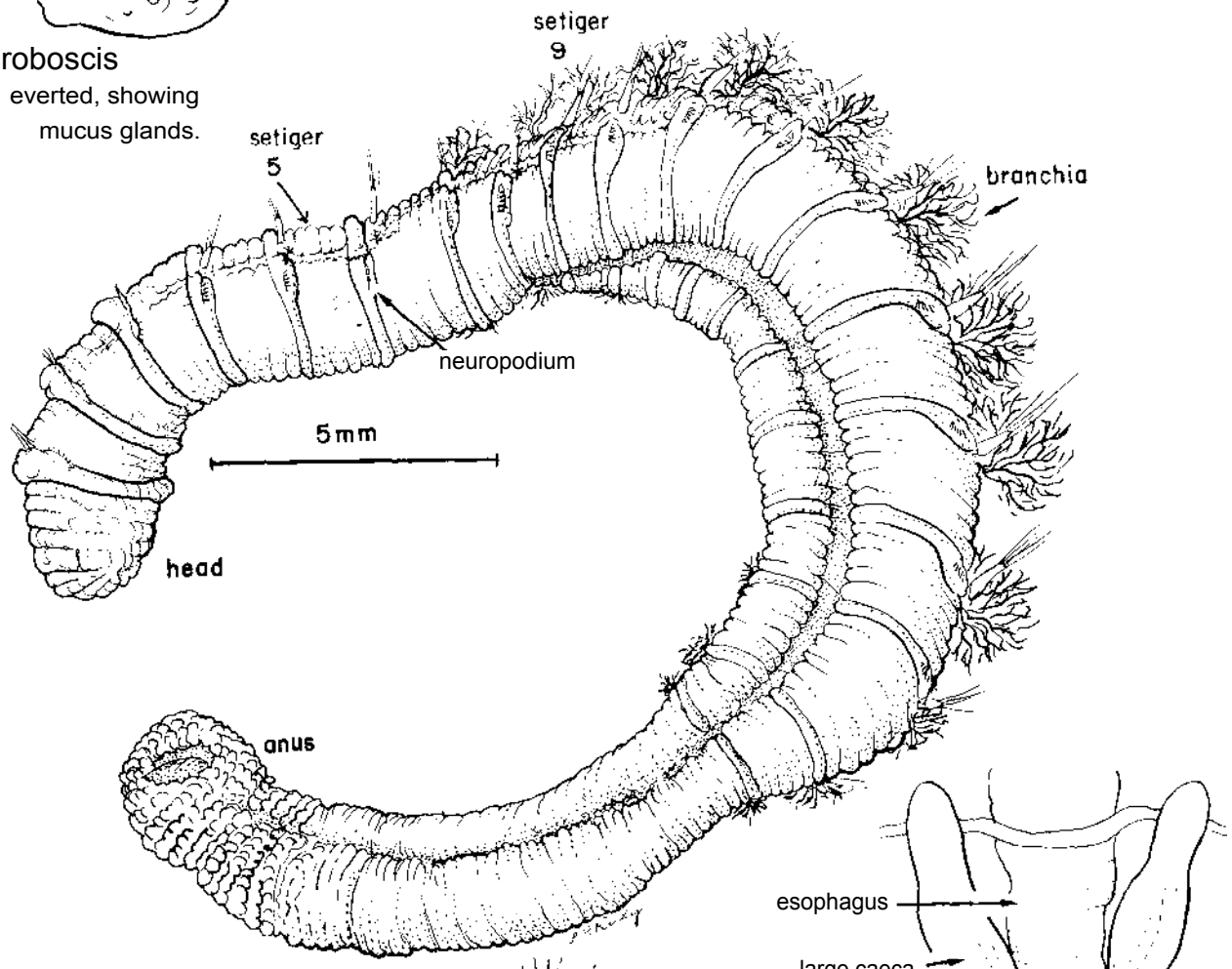
Aborenicola pacific°

the lugworm

proboscis

everted, showing

mucus glands.



actual size: 4 cm

2. *Abarenicola pacifica* x8

nineteen setigers;

color: orange head, abdomen; red parapodial areas.

three body sections: medial one with branchiae,

nephridiopores

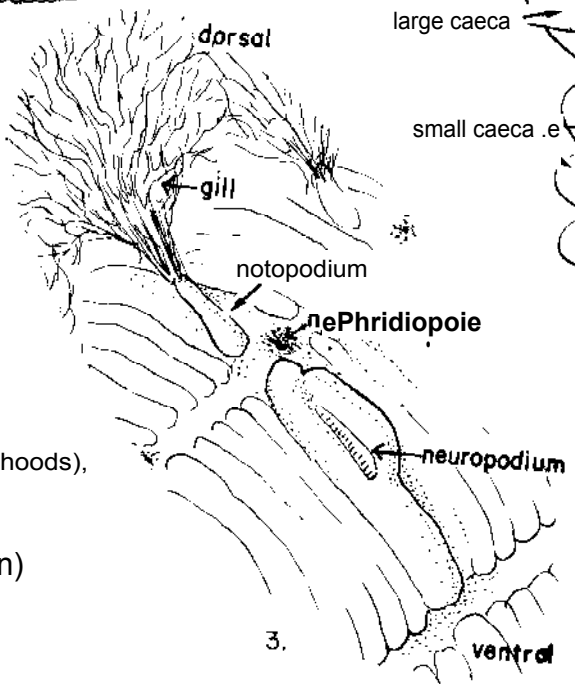
exposed nephridial pores (without hoods), setigers five to nine

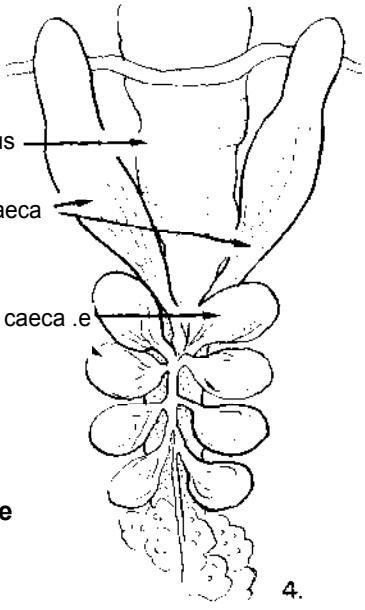
fan-like gills, thirteen pairs.

4. esophageal structure (dissection)

one pair large caecae,

three to six pairs small caecae.





Capitella capitata
a thread worm (Fabricius, 1780)

PHYLUM: *Annelida*
CLASS: *Polychaeta*
FAMILY: *Capitellidae*

Description

SIZE-20-100 mm long, 1-2 mm wide.

COLOR-dark red or brownish.

BODY-earthworm-like'; cylindrical, slender, threadlike, without obvious parapodia or peristomial appendages. Lacks a circulatory system." Body divided into thorax of nine segments, abdomen of about 90 segments[6]; posterior is a simple flange. (Fig. 1: drawing done from somewhat compressed specimen.)

PROSTOMIUM-a depressed triangular lobe,[6] without eyes, appendages, palps, etc. (fig. 2).

PROBOSCIS-eversible, but rarely seen everted.'

PARAPODIA-biramous (neuropodium and notopodium), without branchiae (long, gill-like structures); first seven thoracic setigers with long, fine setae in both notopodia and neuropodia,[2] (fig. 2). Setigers 8 and 9 with long yellow spines in notopodia (male, fig. 4a), only stout hooks in neuropodia; abdominal parapodia (from setiger 10) with hooks only in both branches (fig. 2).

SETAE-ail simple (not jointed): anterior parapodia (first seven thoracic) with long, fine capillary spines (fig. 5a); abdominal segments (and 8th and 9th neuropodia) with stout hooks with transparent hoods (fig. 5b). 8th and 9th neuropodia (male) each with two stout yellow copulatory spines (fig. 4a).

GENITALIA-males with lateral generative pore between setigers 7 and 8; two yellow copulatory spines in each notopodium of setigers 8 and 9 (fig. 4b). Females with middorsal pore between setigers 8 and 9[6] (fig. 3).

Possible Misidentifications

There are other mud-dwelling genera of Capitellidae; *Capitella* is the only one with hooks as we!! as capillary setae on the last two thoracic setigers,[6] as well as genital spines on setigers 8 and 9. C. *capitata* is the only species with setae on the first segment.' Three subspecies of C. *capitata* are included in Hartman, 1969[6]; they are not likely to be found in estuarine intertidal situations.

Other fairly common Capitellidae in Oregon's estuaries are

Mediomastus californiensis, with a thorax of 10 setigers, not 9, only capillary setae on setigers 1-4 (not to setiger 7 like *Capitella);* it has long-handled hooks on setigers 5-10;

Heteromastis filobranchus and *H. filiformis* has 11 setigers in the thorax, of which the first five have only capillary setae, and the 5th to 11th have hooks. *H. filobranchus* has spaghetti-like filamented branchiae on its posterior parapodia, *H. filiformis* lacks these branched branchiae.

Ecological Information

RANGE-chiefly northern: western Canada to California6; cosmopolitan.15

LOCAL DISTRIBUTION-in Coos Bay: South Slough, several stations; North Spit, Barview. Netarts Bay, several stations,16

HABITAT-mudflats: muddy sand to pure mud"; can be found in fish wastes, sulfurous sediments, etc. where it may be a pollution indicator, if found in great numbers and in the absence of many other invertebrate species.[3 12] (This does not hold true in Coos Bay, where it is not found in the polluted areas, (but *Heteromastis* is[11]). Found in vertical, dirt-encrusted, black, membranous tubes[14]; in the mud of *Salicomia* marsh channels, Coos Bay." No real preference for substrate, but likes quiet intertidal conditions3.

SALINITY-can tolerate low saline conditions'[1]; collected at 14 o/oo, San Francisco Bay, where it is reported to prefer saline conditions.3

TEMPERATURE-cold waters to tropics, more commonly in temperate waters.' °

TIDAL LEVEL-collected at ±3.-4. ft.; particular about depth. not substrate. Also found down to 30 fathoms.3

ASSOCIATES-Coos Bay: other polychaetes-Abarenicola; *Mediomastis* (Netarts Bay); tanaids *(Leptochelia),* amphipods.; pea crabs *Pinnixa.1°*

Quantitative Information

WEIGHT-

ABUNDANCE- common; cosmopolitan in mudflats[15]: if found in great numbers in an area with few other invertebrates, heavy pollution of the habitat may be indicated.[13] Found in great beds of many acres on the Berkeley, California mudflats.14

Life History Information

REPRODUCTION specialcopulatory setae (fig. 4): definite separate sexes. Active all year (California) with mild peaks summer and winter. Males transfer spermatophores (packets) to females which can store them until eggs are ripe. Eggs laid. early development occurs in female's tube. Larvae emerge in 5 days as metatrochophores, or hatch in 7-14 days as juveniles. Sexual maturity attained within 1 month at 20 'C.[11]

GROWTH RATE-

LONGEVITY-

FOOD-a direct deposit feeder.

PREDATORS-

BEHAVIOR-

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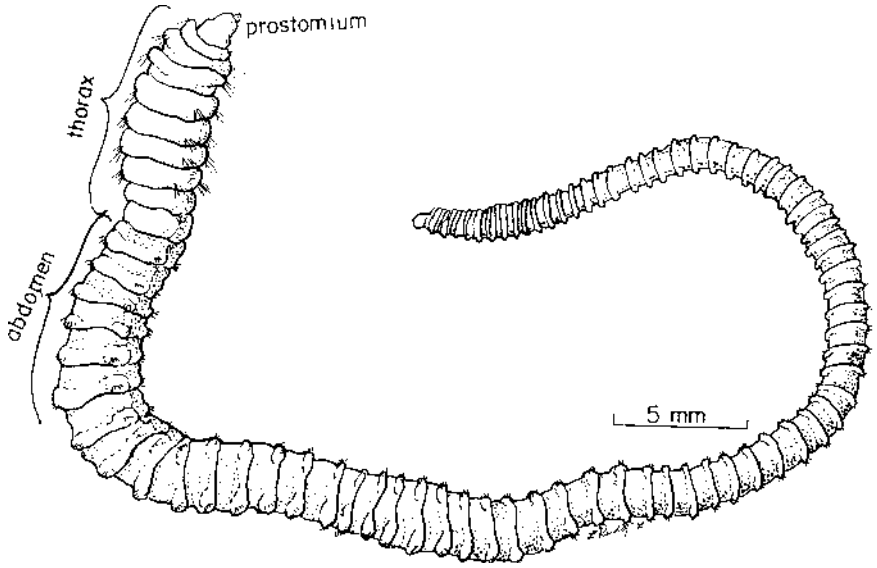
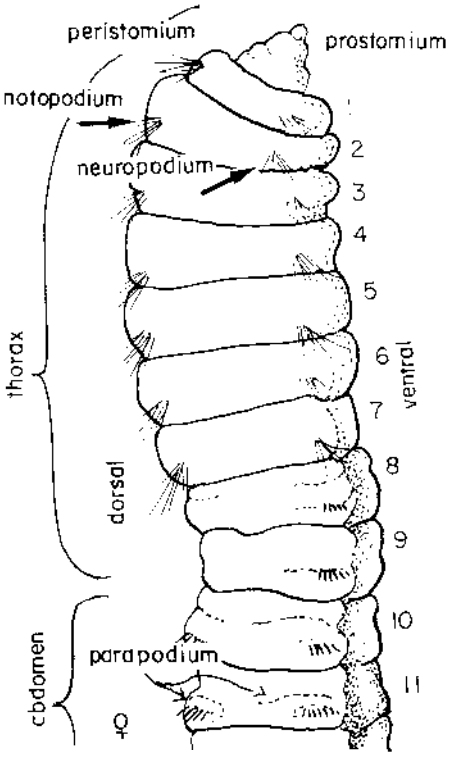
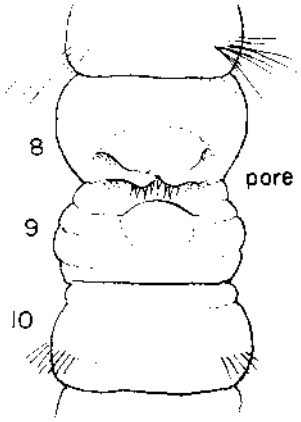


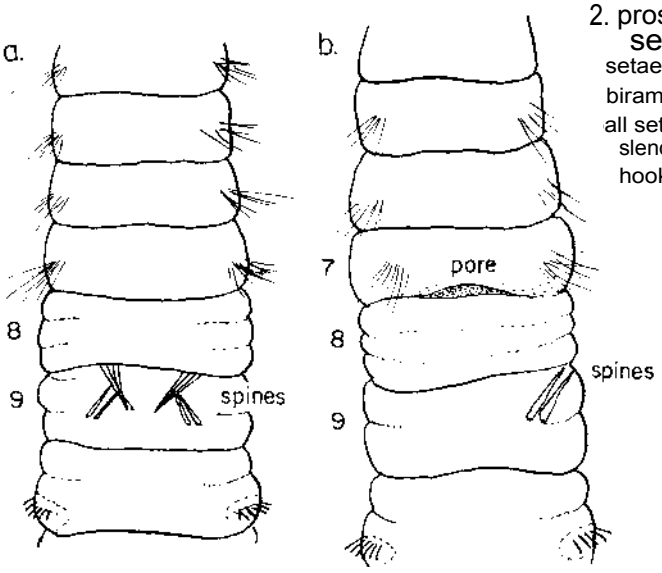
1. ***Cop/tell capitate*** lateral view ×4 9
dark red body,threadlike, with 9 thoracic and about 90 abdominal setigers;
actual length 20 mm, width I mm;
prostomi um a depressed triangular lobe, without eyes or appendages.



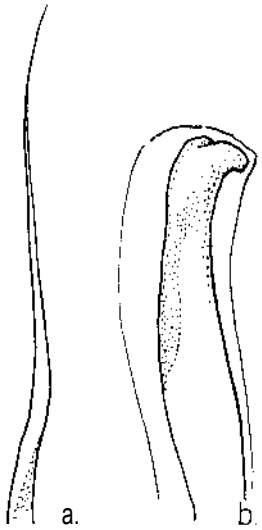
2. prostomi um and anterior setigers, lateral view x 30
setae begin on peristomium;
biramous parapodia,no branchiae;
all setae simple•. thoracic: long, slender; abdominal: stout, hooded hooks.



3.genital area, female
dorsal view, showing genital pore between setigers 8 and 9.



4.genital area, male
G. dorsal view,showing two copulatory spines on each notopodi um, setigers 8 and 9,
b. lateral view, generative pore between setigers 7 and 8.



5. setae
Q. long, fine capi llary seta (thorax);
lastout, hooded hook (abdomen).

Glycera robusta
the large proboscis worm — Ehlers, 1868

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: *Phyllodocida*
FAMILY: *Glycendae*

Description

SIZE—the largest of the Glyceridae, up to 700 mm[5], this specimen, from South Slough of Coos Bay' 500 mm (20 inches), 20 mm diameter, can be up to 300 segments4.

COLOR—dark red; can be yellow brown.

BODY bi annulate segments. Family lacks a separate circulatory system; coelemic fluid contains hemoglobin6.

PROSTOMIUM—conical with ten biannulate (two per segment) rings, the first being a third of the total length (fig. 2); four small terminal cirri; no visible eyespots, no antennae.

PROBOSCIS large.. powerful, can be 26 mm long[4], four terminal black jaws: simple surface papillae. (fig. 3).

PARAPODIA—biramous, notosetae simple. neurosetae composite (fig. 6); parapodia with two post-setal lobes; branchiae like shall blisters[8] (fig. 4); preacicular lobes are equally bifid, like ventral cirrus (fig. 4).

ANAL END—tapering, narrow; with a pair of small cirri (fig. 1).

Possible Misidentifications

The other proboscis worm family, the Goniadidae, have bodies divided into three parts by different types of parapodia. They, however. have two jaws. not four. and a row of denticles on the proboscis. Five other species of Glycera in our area are:

C americana, with four-lobed parapodia and branched. retractile branchiae5,

G. *capitata,* another large species (but only up to 100 mm), with two presetal parapodial lobes. and one post-setal lobe. but no branchiae:

G. *convoluta* has a single non-retractile branchia. and 14 to 16 annulations in the prostomium;

G. *dibranchiata* has two finger-like branchiae, one above and one below the setal lobe;

G. *tenuis* has but one presetal parapodial lobe on its posterior setigers and is only 80 mm when mature.

Ecological Information

RANGE—Japan; Washington to southern California, but not in Puget Sound Keys, (Kozioff).

DISTRIBUTION—Coos Bay: many stations in the bay including South Slough. Fossil Point, and outside in Cape Arago sands.

HABITAT—substrate: "beds of black mud[7]; gravelly sand4: sand and cobble sediments[8]; blood well-supplied with a coelomic cell hemoglobin and body wall with abundant myoglobin.9

SALINITY

TEMPERATURE

TIDAL LEVEL—intertidal and shelf depths4.

ASSOCIATES

Quantitative Information

WEIGHT—

ABUNDANCE

Life History Information

REPRODUCTION—in summer, epitokous stage6.

LONGEVITY

GROWTH RATE

FOOD

PREDATORS

BEHAVIOR— burrows very quickly with proboscis.

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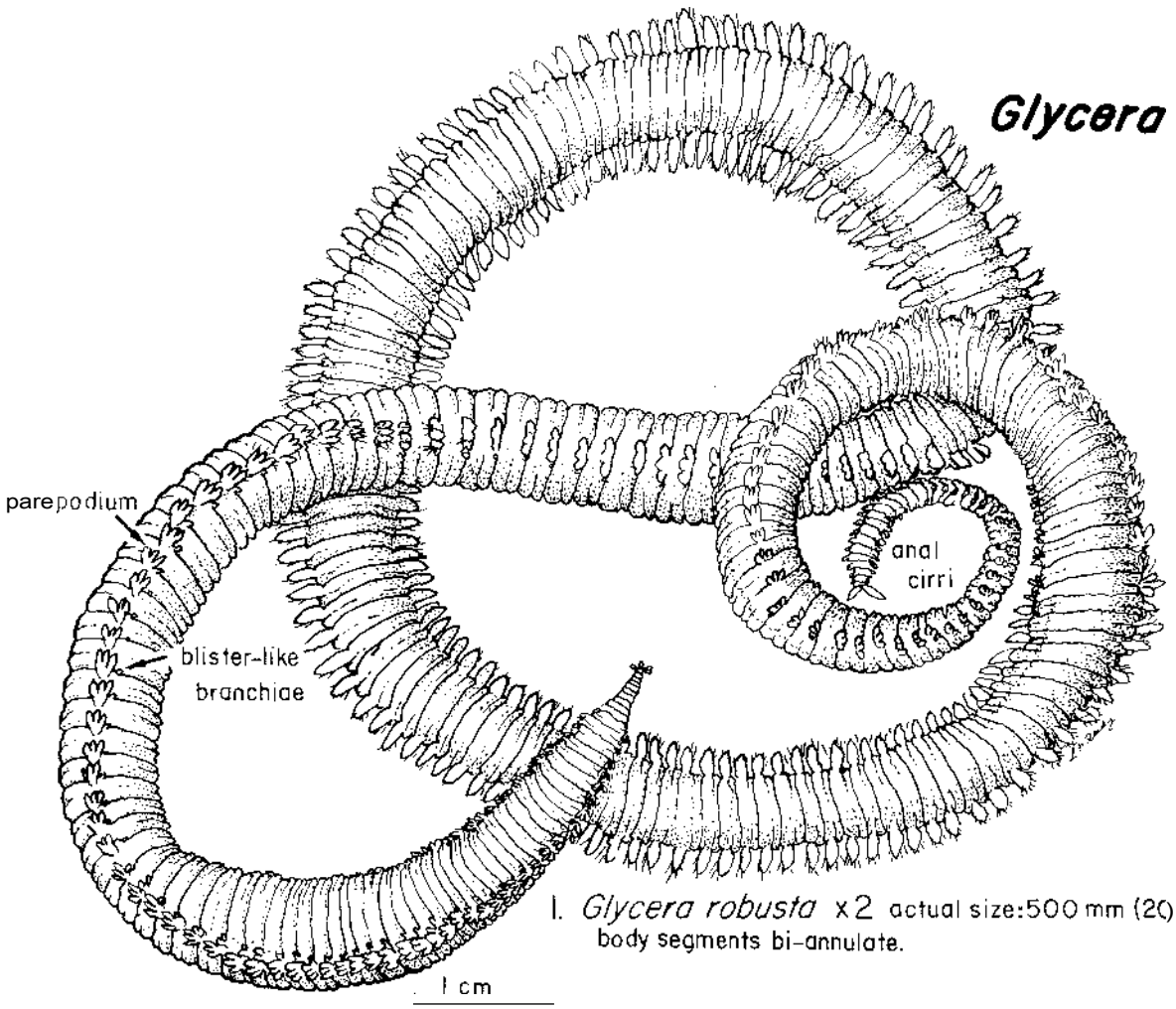
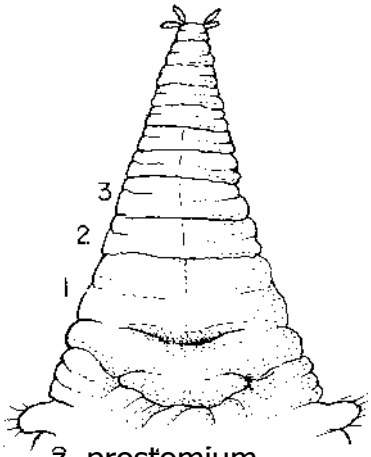
Glycera robusta



1. *Glycera robusta* x2 actual size:500 mm (20 inches)
body segments bi-annulate.



2. prostomium
ten bi-annulate rings,
four small terminal cirri.

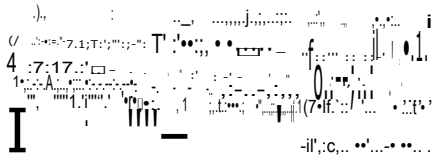
ventral
cirrus

post-setal
lobe

pre-
setar
lobes

St-

bronchia



papillae

3. proboscis, everted
four terminal blackjaws,
simple surface papillae.

4. an anterior parapodium
equul ly bitid pre-ecicular lobes;
biramous, notosetae simple,
neurosetae composite;
blister-like branchia;
ventral cirrus;
two post-setal lobes.

5. composite neurosetu

Glycinde armigera

proboscis worm Moore, 1911

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: *Phyllodocida*
FAMILY: *Goniadidae*

Description

SIZE-3 cm.

COLOR-pale orange, slightly iridescent.

PROSTOMIUM- an annular cone with eig ht to nine annulations, ending in four small antennae, fused with peristomium (fig 2).

PROBOSCIS-"large, powerful", [11] when everted: large, chitinized spines, circle of denticies, two large. toothed jaws (fig. 3). Used for propulsion?

BODY CHARACTERISTICS-divided into three regions: anterior (27-30 segments) with uniramous parapodia (fig. 4a) a transitional area (47 + segments) in which notopodia gradually develop: posterior area (25-60) with biramous parapodia (fig. 4a): 100-144 segments.

PARAPODIA- both dorsal and ventral cirri are conical to fingerlike; dorsal not incised; pre-setal lobes of 25th parapodia are heart-shaped (fig. 4a).

Possible Misidentifications

Closest to G. *polygnatha,* whose anterior dorsal cirri are incised (fig. 4b), and whose proboscidial armature is lacking ventrally" (p. 195, fig. 154). Other similar Goniadidae are *Goniada brunnea,* large, dark brown, and with distinct chevrons on the sides of the proboscis: *Glycinde picta,* from British Columbia north has 5-6 yellow, simple hooded hooks on elongate dorsal cirri, presetal lobes of 25th parapodia narrow distally, not heart-shaped.

Other "proboscis worms": family Glyceridae--all parapodia similar: proboscis with four horny jaws with supports.

Ecological Information

RANGE-Western Canada to Panama.

LOCAL **DISTRIBUTION** off Reedsport, Depoe Bay, Oregon 20-74 fms'. South Slough of Coos Bay, intertidally: (dredged from stations 1-6 South Slough of Coos Bay10).

HABITAT: SUBSTRATE-"muddy & mixed sand flats" [6], intertidally: mud, eelgrass.

SALINITY-

TEMPERATURE-

TIDAL LEVEL-"low intertidal to 275 fathoms [-6]: South Slough: + 0.5 feet.

ASSOCIATES-other polychaetes, amphipods grass shrimp, barnacles.

Quantitative Information

WEIGHT-

ABUNDANCE-widespread but in low numbers in Coos Bay1°.

Life History Information

REPRODUCTION-

GROWTH RATE-

LONGEVITY-

FOOD —

PREDATORS —

LOCOMOTION-very active; proboscis used in burrowing and feeding.

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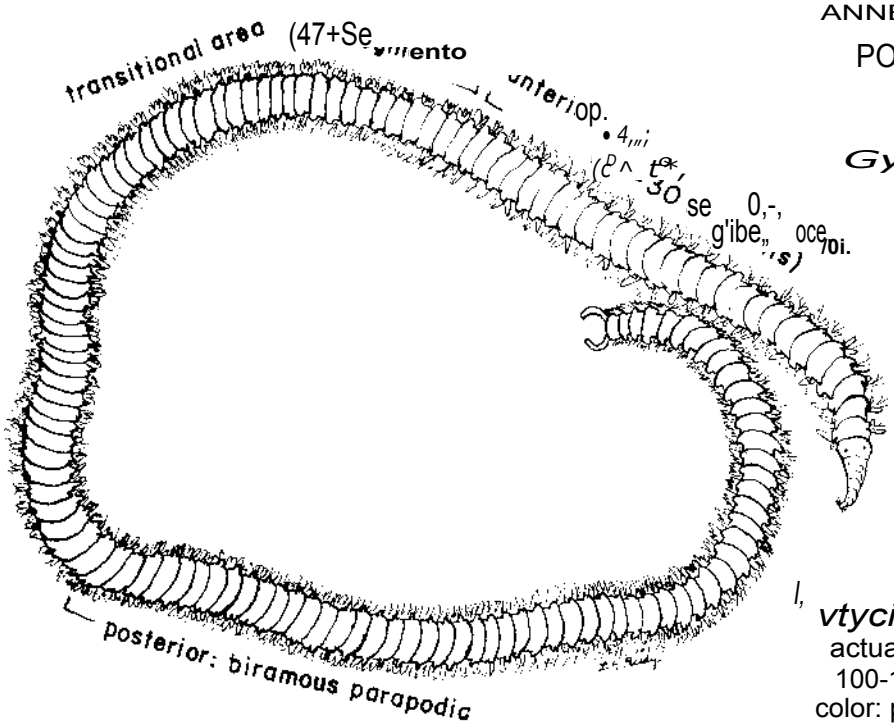
ANNELIDA

POLYCHAETA

Goniadidae

Gyancle orm/gero

a proboscis worm



vtycince ormigera x 15

actual size: 3 cm

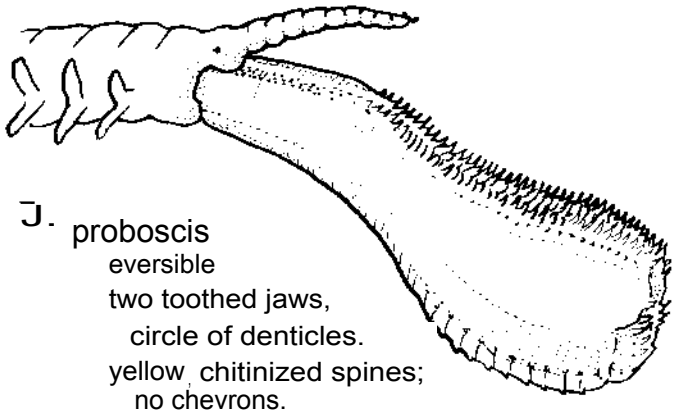
100-144 segments

color: pale orange, slightly iridescent; darker under parapodia (interior blood).

2. prostomium

eight or nine annulations

basal eyes (distal not shown))



3. proboscis

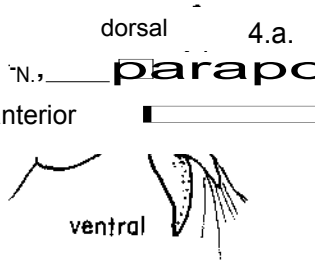
eversible

two toothed jaws,

circle of denticles.

yellow chitinized spines;

no chevrons.



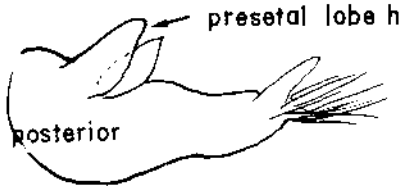
4.a. parapodia

dorsal and ventral cirri conical.

dorsal cirri not incised.

4.b. dorsal cirrus

anterior: dorsal incised.



Lumbrineris zonata
(Johnson, 1901)

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: Phyllodocida
FAMILY: *Lumbrineridae*

Description

SIZE-"often exceeding 20 cm':" 16-20 cm[4], this specimen (South Slough).16 cm.

COLOR-light red orange, highly iridescent.

PROSTOMIUM-simple, bluntly conical. eyeless (fig. 2).

BODY SEGMENTS-first two achaetous. apodous: more than 200 segments body smooth, elongated, cylindrical. earthworm-like[1°]. no ventral groove (fig. 1).

PARAPODIA- small

anterior: limbate setae, simple falcigers, no branchiae: postsetal lobes shorter than presetal lobes (fig. 3):

posterior: postsetal lobes only slightly longer than presetal: simple falcigers, with mullidentate tips, yellow acicula (fig. 4a, 4b).

Possible Misidentifications

Five local *Lumbrinens*[1°]; seven in Puget Sound', none red orange, iridescent like *L. zonata. L. luti,* with yellow acicula, is very small (under 5 cm) and has very long posterior postsetal lobes; *L. latreilli,* pale red to brown also has yellow acicula; some of its anterior parapodia have composite hooded hooks.

Others with long posterior postsetal lobes are *L. erecta,* on which these lobes stand erect, and which is iridescent bronze, and the rare *L. japonica.* reddish-brown and iridescent. and with black acicula.

L. bicirrata. also found in Oregon[5]. has bilabiate posterior parapodial lobes. black acicula, and like *L. zonata,* naked first and second body segments. *L.,* near *sarst,* is very like *L. zonata,* except for its long postsetal lobes on the posterior[4] parapodia.

Ecological Information

RANGE --Alaska to western Mexico, intertidal to 46 fms,

DISTRIBUTION-most common lumbrinerid in northern California[10]: common in Puget Sound and in Coos Bay area intertidally in mud, and in mussel and barnacle beds and rocks (outer coast); in holdfasts and mudflats of protected outer coasts1°.

HABITAT: SUBSTRATE-mud and chips (Metcalf tide flat, South Slough): eelgrass areas9.

SALINITY-found in area that varies 10-30 o/oo for surface water (Coos Bay).

TEMPERATURE-found in area that varies 8-18 °C for surface water (Coos Bay).

TIDAL LEVEL-high intermediate.

ASSOCIATES-other polychaetes. *Abarenicola,* amphipods, ;anaidaceans.

Quantitative Information

ABUNDANCE--most common lumbinerid in northern California and in intertidal or northeast Pacific[a]: common in seaward half of Coos Bay9.

Life History Information

REPRODUCTION

GROWTHRATE-

LONGEVITY-

FOOD- ingests mud for detritus: no animal remains in *L.* sp guts'

PREDATORS-

LOCOMOTION — an active burrower, but does not build permanent burrow (as some *Lumbrineris* do)'.

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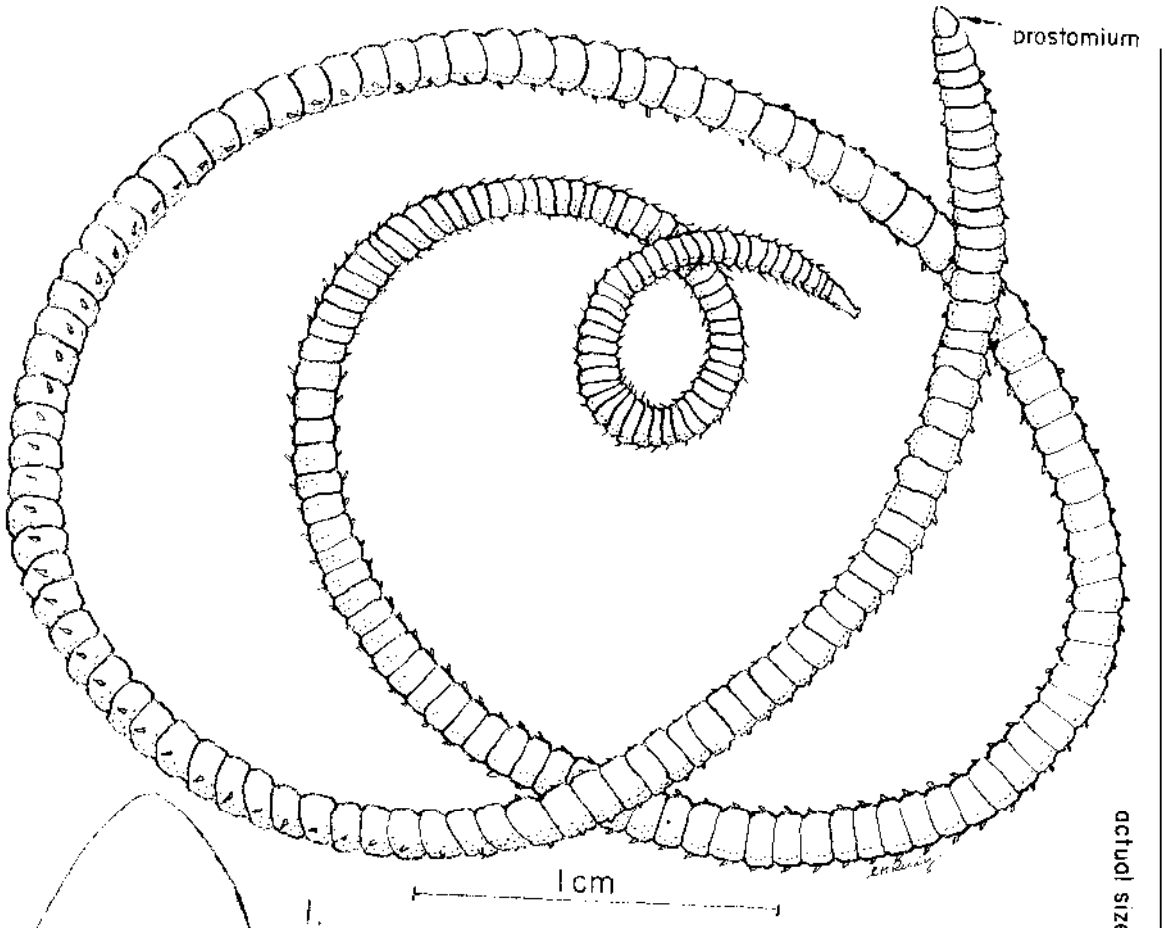
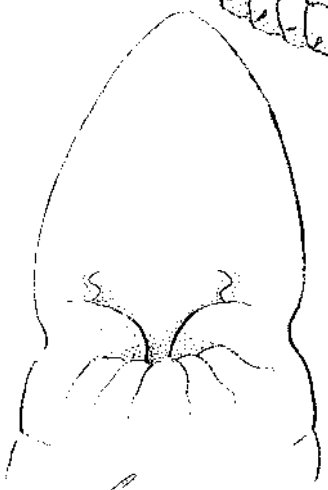
I umbrineris zonoto



1.

7. urni7rineris zonal° 5x
actual size: 16 cm over 200 seti'gersi
color light red orange, iridescent.

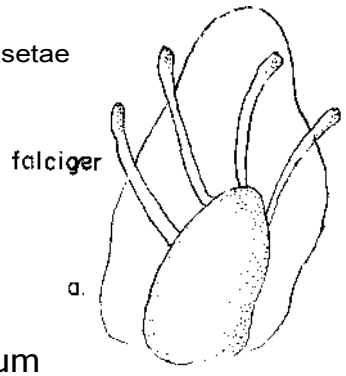


prostomium, ventral
bluntly conical,eyeless.
first two segments: no setae
or porapodia.

9 - r3oe'

S^Y" \doe

3- anterior parapodiurn
imbate setae;
no branchiaes
short post-setal lobes,



4. a posterior parapodium
with multidentate falcigers.

b. si mple falciger
enlarged;
(from Hartman,I968, p.777).

Nephtys caeca
a sand worm (Fabricius, 1780)

PHYLUM: *Annelida*
CLASS: *Polychaeta*
FAMILY: *Nephtyidae*

Description

SIZE-to 20 cm long, 10-15 mm wide.'

COLOR-pale pink; can be light to dark green or brown', no pigment patterns. Iridescent proboscis.

PROSTOMIUM-pentagonal, flattened, no pigment pattern; with four small simple (unforked) antennae; eyeless (fig. 2).

PROBOSCIS-when everted: globular, with 22 rows of paired distal papillae forming a crown-like structure; also 22 rows of subdistal papillae with five small papillae in each row (fig. 1). Proximal (basal) surface of proboscis rough, and covered with minute wart-like papillae (fig. 1).

PARAPODIA-fleshy flaps extending laterally off the segments: biramous (two-lobed): family Nephtyidae. Each lobe with a notopodium and a neuropodium, each broad and rounded; post-acicular lobes becoming "foliaceous" posteriorly' (fig. 5).

INTERRAMAL CIRRI-long, recurved, between the two parapodial lobes (figs. 3, 5).

SETAE-fan-like bunches of neuro- and notosetae on the parapodial lobes. Post-acicular setae (fig. 5) long and fine, with single lateral barbs (fig. 4a); preacicular setae short and with transverse bars (figs. 4b, 5).

BODY-90-150 segments'; long, slender, quadrangular in cross-section.

Possible Misidentifications

There are many other species of *Nephtys* in the northwest. The chief intertidal species are

N. caecoides, averaging slightly smaller than *N.* caeca, with dark bands of color pattern on its anterior end, and a shiny proboscis, not a rough one. It is probably the closest morphologically to *N. caeca,* but is usually a more southern species; it is one of the most common sand worms in California.' The two worms overlap in Coos Bay."

N. californiensis is a large, pale sand worm, usually found in coarse, clean sand in marine environments, rather than in bays. It has a unique "spread eagle" pigment pattern dorsally on its prostomium.

N. parva is a small, pale mud dweller without a prostomial pigment pattern except for one dark spot. It has a proboscis with a smooth proximal end without an unpaired median papilla. On the third segment of its body is a pair of eyespots; the interramal cirri begin on the fourth setiger, and are short and only slightly recurved [2]. Its long postacicular setae are transversely serrated, with many fine spines. It is found in California bays, but not in Washington.

N. ciliata, from Puget Sound (and not found in California) has a rough proboscis; it has a fingerlike dorsal papilla on its proboscis.

N. *cornuta cornuta* has branched second prostomial antennae; *N. cornuta franciscana* is a small subtidal species (to 7.5 mm) with only 21-28 segments, branched second prostomial antennae, and eyespots on setiger three.

N. *assignis* is found below two fathoms, and has expanded parapodial and interramal cirri which begin on the sixth setiger.

Ecological Information

RANGE-Alaska to northern California; type locality, Greenland; Arctic and circumboreal.

LOCAL DISTRIBUTION-Coos Bay: many stations; especially South Slough. Distribution much like that of the polychaete *Lumbrineris zonata.*

HABITAT-sand, mud or mixed sediments; with eeigrass, likes more mud than *Lumbrineris."*

SALINITY-collected at 30 0/00. Can tolerate low salinities, i e. freshwater of stream beds."

TEMPERATURE-a coldwater animal doesn't extend far into California.

TIDAL LEVEL-found at + 0.5 feet.

ASSOCIATES-barnacles; the large polychaete, *Pista pacifica.*

Quantitative Information

WEIGHT-

ABUNDANCE-not common.

Life History Information

REPRODUCTION-

GROWTH RATE-

LONGEVITY-

FOOD-

PREDATORS-

BEHAVIOR-can move rapidly through loose sand'°: makes temporary burrows. A good swimmer.

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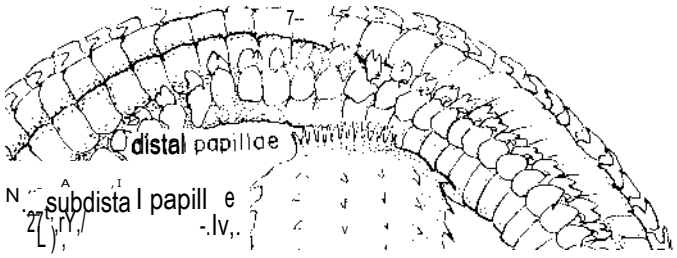
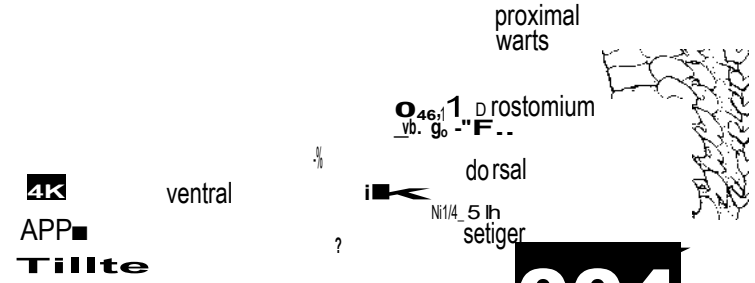
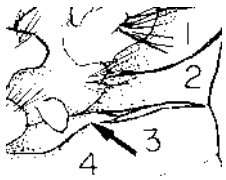
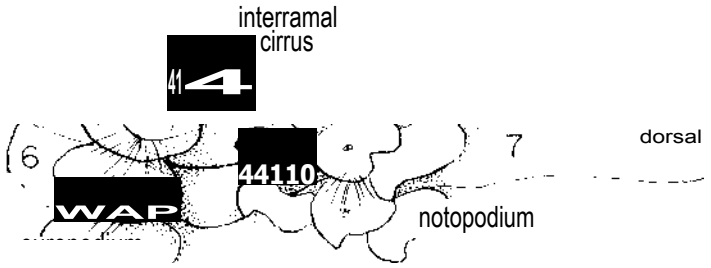
Neohtvs caeca



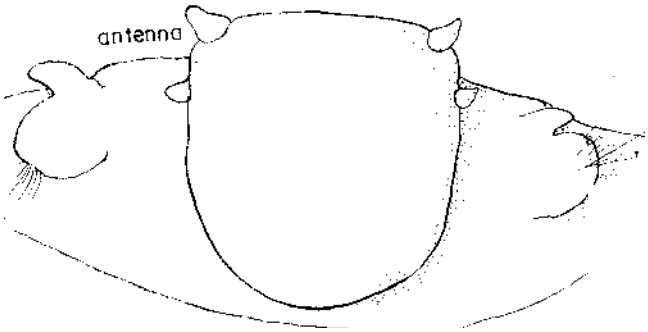


Vephtys caeca x 4
proboscis everted, lateral view
actual length 12 cm;tol50 segments;
everted proboscis with 22 rows of distal papillae;
subdistal papillae: 22 rows of 5;
proximal proboscis surface rough;
body: cross section rectangular.

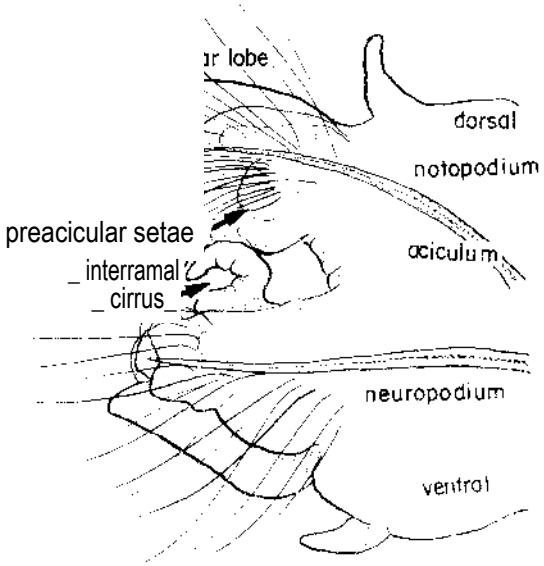




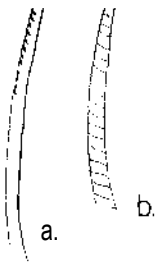
3. anterior parapodia, lateral view x 30
interramal cirri begin on 5th setiger;
parapodia bl lobed: neuro - and rotopodia



2. prostomium, dorsal x 30
pentagonal, eyeless; four small antennae.



4. setae, tips
a. a long,barbed postacicular seta,
b. a transversely barred preacicular seta (notopodial),



5. 90th parapodium x 30
biramous; postacicular lobes large, foliaceous;
recurved interramal cirrus beginning on fifth segment.
long,finenoto- and neurosetaei
shorter, barred **pre-acicular notosetae.**

Nephtys caecoides

a sand worm Hartman, 1938

PHYLUM: *Annelida*
CLASS: *Polychaeta*
FAMILY: *Nephtyidae*

Description

SIZE-to 10 cm; width 5-8 mm'; segments, about 120.

COLOR---a strong pigment pattern on prostomium and first few segments (fig. 2) persists through preservation. body usually steel- to dark gray.'

BODY-trim, stiff, slender in appearance': rectangular in cross section': first segment incomplete dorsally' (fig. 2).

PROSTOMIUM -four small simple antennae on a trapezoidal "head (Fig. 2).

PROBOSCIS-globular, with 22 rows of papillae at the end (distal), and 22 rows near the end (subterminal); distinct medial unpaired papilla (fig. 3).

PARAPODIA-bilobed: family Nephtyidae; both noto- and neuropodia are rounded in the posterior end of the animal (fig. 5b). The acicular lobes are incised in the middle of the animal (fig. 5a).

INTERRAMAL CIRRI-beginning with the fourth setiger (segment with setae), and continuing to near the end of the worm, there is a recurved cirrus between the parapodial lobes (fig. 5). In juvenile specimens, this can be nearly straight. [5] The interramal cirrus is larger than the dorsal cirrus, except in the last nine segments.8

SETAE-three types: a bunch of short, slender barred setae (preacicular) fig. 4b); simple, capillary barbed setae (fig. 4c) (post-acicular); and short, barbed setae (fig. 4a).

Possible Misidentifications

Worms of the family Nephtyidae can be distinguished by their rather rectangular bodies (in cross section), well-developed bi-lobed parapodia and interramal cirri, four small prostomial antennae, and eversible globular proboscis with terminal rows of papillae.

There is some confusion in the *Nephtys caeca* group: several species are distinguished from each other by very fine morphological details. The other closely related species of *Nephtys* include

N. caeca, slightly larger, iridescent, with no prostomial pigmentation, a rough proboscis with no unpaired medial papilla, and interramal cirri beginning on the 5th or 6th setiger, not the 4th. This is a northern species, rare in California.

N. *califomiensis,* while very like the other two of the *N. caeca* group, is found mostly on the outer coast, or if in bays, only in very clean coarse sand. It has a "spread eagle" pattern of pigmentation on the lower end of the prostomium, a smooth proboscis usually without a medial papilla, soft silky flowing setae. and interramal cirri beginning on the third setiger.

Three other *Nephtys* species, not so easily confused with the above, are

N. *cornuta,* whose second antennae are forked;

N. punctata, much like *N. caeca* in size and form,[6] but with interramal cirri beginning on the 8-10th setiger, and with incised acicular lobes in the anterior parapodia;

N. *parva,* colorless except for a dark spot in the middle of its prostomium[8], and a smooth proboscis proximally, no medial papilla, eyespots on its third setiger, and interramal cirri beginning on the 4th setiger;

N. ciliata, a Puget Sound polychaete, has a rough proboscis with an unpaired medial papilla at the end, and long setae.

Ecological Information

RANGE-western Canada to southern California; type locality, Tomales Bay, California.

LOCAL DISTRIBUTION-Coos Bay: many stations, especially South Slough. Distribution very close to *Lumbrineris zonata* but occurs in sandier mud.12

HABITAT-mud, sand, and mixed sediments of bays and lagoons; eelgrass flats[6]; not found in areas with large amounts of silt.° Likes a fine, stable substrate.°

SALINITY-distribution more a function of protection from exposure, than of salinity. [4] Can tolerate low salinities, (i.e. freshwater stream beds).12

TIDAL LEVEL-intertidal; also found at littoral depths (one specimen from 25-58 fathoms[9]). Densest populations at Bodega Bay at + 1.04 feet and at -1.70 feet MLLW.4

ASSOCIATES-Nephtys caeca has much the same habitat:2

Quantitative Information

WEIGHT-

ABUNDANCE-one of the most common nephtyids in California"; San Francisco Bay at densities of 130/m^2 [10]; greatest density at Bodega Bay: 32/m^2 [4]; most commonly found in nephtyid in Coos Bay.

Life History Information

REPRODUCTION-

GROWTH RATE-

LONGEVITY-

FOOD-a carnivore.'

PREDATORS-

BEHAVIOR-very active, a good swimmer and burrower.

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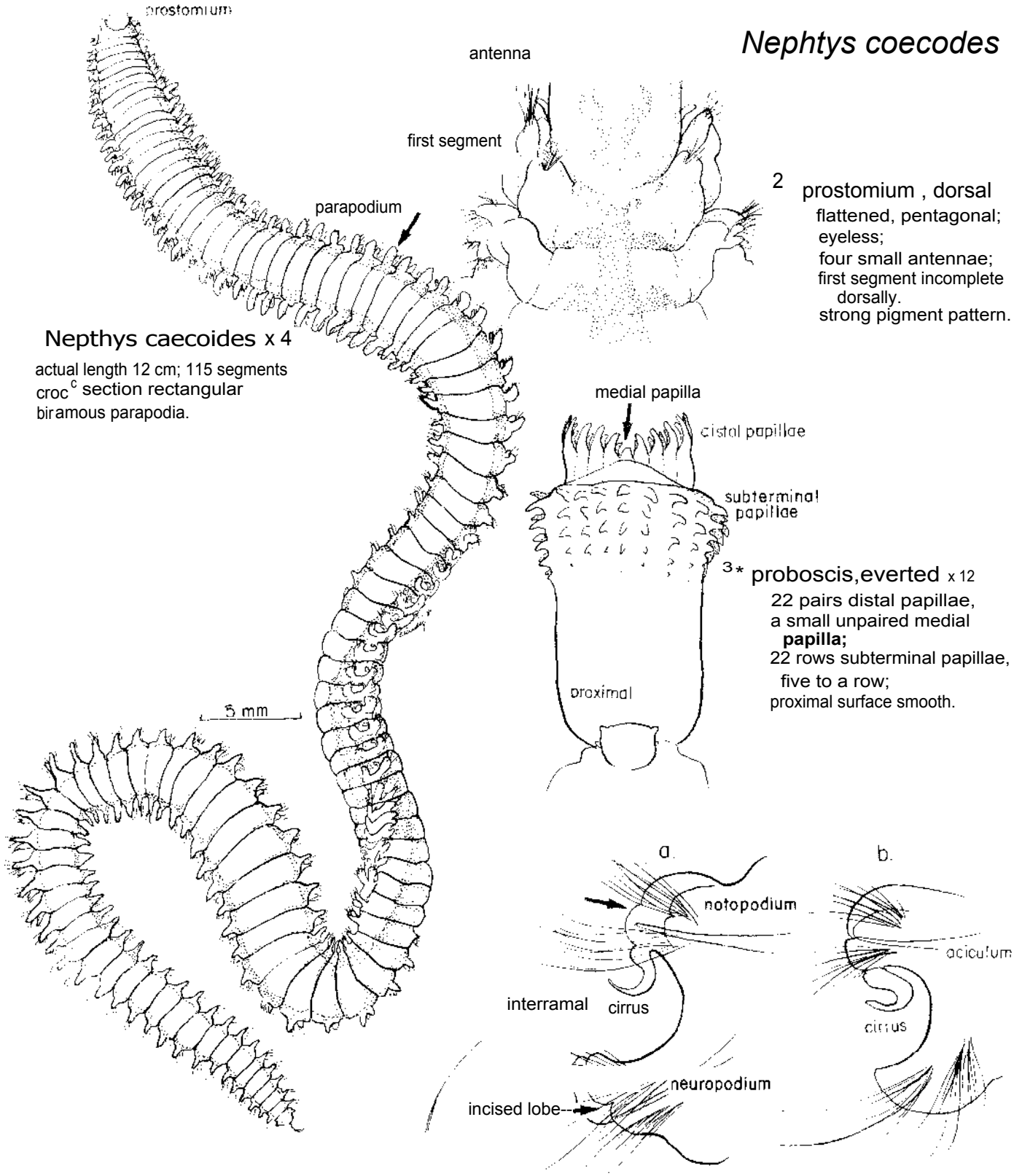
13 Ricketts and Calvin. 1971. Ed Hedgpeth P. 294.

¦4. Smith and Carlton. 1975. P 197.

Nephtys coecodes



Nepthys caecoides x 4

actual length 12 cm; 115 segments
croc[c] section rectangular
biramous parapodia.

2 prostomium , dorsal
flattened, pentagonal;
eyeless;
four small antennae;
first segment incomplete dorsally.
strong pigment pattern.

3* proboscis,everted x 12
22 pairs distal papillae,
a small unpaired medial **papilla;**
22 rows subterminal papillae,
five to a row;
proximal surface smooth.

4. parapodial setae
0. short, barbed;
b pre-acicular setae: transversely barred-,
C. post-acicular seta: single lateral barbs.

paropodio , medial (a.) and posterior (b.)
x
biramous, well separated;
long, recurved interramal cirri begining on setiger five;
noto- and neurosetae in **fan-shaped** fascicles (bunches);
acicular lobes incised.

3 1-i

b.

Nereis (Hediste) limnicola (= Neanthes limnicola) PHYLUM: *Annelids*
a mussel worm (Johnson, 1903) (=*lighti* Hartman 1938) YNereidae

Description

SIZE-25-45 mm long'; this specimen 25 mm; width 2.5 mm to 4 mm without parapodia; 45-82 segments.

COLOR—pale, translucent: pale yellow green (this specimen, Coos Bay).

RROSTOMIUM—trapezoidal, wider than long, with a longitudinal depression (fig. 2b).

OCELLI—four, large: family Nereidae (fig. 2b).

ANTENNAE—a small frontal pair, separated at their bases (fig. 2b).

PALPI—a pair of stout, cylindrical processes, with small hemispherical palpostyles at the distal ends (fig. 2b).

TENTACULAR CIRRI—four pairs, family Nereidae: second of dorsal pairs longest (fig. 2b), ¹ others, including a more ventral pair, quite short for a nereid.

PROBOSCIS—when everted, shows horny jaws with teeth (figs. 3a,b), and conical paragnaths. In genus Nereis. paragnaths occur on both oral and maxillary rings. whose sections are numbered for identification (the even-numbered areas occur in pairs). In this species Area I usually has one tooth: Area !I has the largest teeth, about 12 in a crescent: Area III has a broad patch of 20-25: IV has broad crescents of 30-35: V usually has no paragnaths'; VI has three small points. Areas VII and VIII have two continuous rows: (figs. 3a,b).

PARAPODIA—biramous, with a distinct notopodium and neuropodium (figs 1, 5). Both branches also have medial triangular lobes, or ligules, the notopodral riddle is always smaller than the neuropodial one. The paraoodial lobes are conical, not leaf-like or globular as in the family Phyllodocidae. (A parapodium should be removed and viewed under a high powered microscope (100x) for certain identification).

NOTOPODIA or dorsal lobe) fig 5. only one kind of seta—nomogomph spinigers (fig. 4a), notopodial lobes at posterior end of animal are normal. not elongate, but smaller than anterior lobes 3

NEUROPODIA—(ventral lobes of parapodia) fig. 5: contain several each of three kinds of setae: homogomph and heterogomph spinigers, and heterogomph falcigers (fig. 4a,b,c) There is also a single, unusual faiciger in the upper bundle of the neuropodium. It has its appendage completely fused to the shaft (fig. 4d), and is the sole indicator of the subgenus *Hediste.'*°

SETAE—all composite, subgenus *Nereis (Hediste)* has only one kind of seta in its notopoora: homogomph spinigers—long, sharp composite spines (spinigers) with even bases (homogomphs) fig. 4a The neuropodia have two kinds of spinigers, homogomph and heterogomph. (uneven bases, fig. 4b). They also have heterogornph and homogomph falcigers, blunt, short, curved setae with uneven bases (fig. 4c) *N. (Hediste) hmnicola* has one special fused falciger in the supracicular neuropodium (figs. 4d. 5)' (Differentiation among these setae must be made with a high-powered microscope after placing the parapodium in glycerin or mounting medium, on a slide.)

ACICULA—heavy. black spines al the base of each parapodial lobe (fig. 5).

CAUDAL CIRRI—two: styliform. as long as last seven segments (fig. 1).3

TUBE—builds thin, pale brown, loosely constructed tubes in vertical burrows': Y-shaped, mucus-lined." Newly hatched young build protective tubes of sand grains and mucus "

Possible Misidentifications

The prostomia of nereid worms are quite alike, with four eyes, a pair of frontal antennae and biarticulate palps, and 3-4 pairs of tentacular cirri. - The genus Nereis has subgenera *Hediste* (with 1-3 fused falcigers on the supra-acicular bunch of posterior neuropodial setae) *Neanthes* (with only homogomph spinigerous setae in the posterior notopodia, a trait it shares with *Hediste* but without the fused falcigers): *Nereis* sensu stricto with homogomph falcigers as well as spinigers in its medial and posterior pa rapodia ¹ˢ (based on Kinberg. 1866). Other writers use a new definition of *Neanthes.'*

The genus *Nereis* is further distinguished by having only con ical paragnaths on both proboscis rings, and biramous parapodia with composite setae.' Other closely related species of *Nereis* include

Nereis (Neanthes) brandti with a great many cones on its proboscis, rather than a few like *N. (H.) limn/cola.* It is very large and green, and occurs in more saline areas than does N (H) *limmcola* its posterior notopodial lobes are broadly expanded and leaf-like. It is sometimes considered to be the same species as N. (N.) *wrens* (see desorption N. *brandti).*

Nereis (Neanthes) sirens, a very large (50-90 cm), cold wale, form, has small eyes, massive parpi, and large, leaf-like posterior notopodra.

Nereis (Neanthes) succinea has very enlarged posterior notopodial lobes, on which the dorsal cirrus is carried distally, not dorsally. It has a heteronereid form, *N (H.) iimnicola* does not. N. *succinea* is thought to be a more southern form (although it has been reported from Netarts

Nereis (Hediste) diversicolor, sometimes synonymized with *N. (H.) 1* is an Atlantic form with a different reproductive life; it has fused falcigers in its posterior neuropodia. It is reddish brown with a pale ventrum..

Nereis (Nereis) vexillosa, olive green or brown, is found abundantly in mussel beds and rocky substrates. It has long, strap-like notopodial lobes on its posterior parapodia. It has a swarming or heteronereid form.

Ecological Information

RANGE—Salinas River, California, north to Vancouver Island, B.C. ⁹ Type locality, Lake Merced, California..

LOCAL DISTRIBUTION—Coos Bay estuary: South Slough, Charleston, Cooston, Kentuck Inlet, Coos River mouth.

HABITAT—in isolated populations in loose burrows in sand and clay/sand banks; likes soft mud; in channels with *Salicomia."* Not limited much by substrate; can survive in mud if not entirely dry.,

TEMPERATURE—from cool and temperate waters; warmth affects reproduction. does not cause fatalities (30°C).'

SALINITY—adapts to a wide range (115% down to 2% salt water") but is usually found in areas of reduced salinity (LC. Oglesby, personal communication). In Coos Bay, usually 90% of seawater, or less in interstitial water; highest salinity in which found: 25.2 o/oo. Can survive in unstable environment (Salinas River).12

TIDAL LEVEL—shallow water.

ASSOCIATES--Salinas River: isopod *Gnorimosphaeroma oregonensis,* amphipods *Corophium spinicome, Anisogammarus confervicolus."* Does not overlap with other *Nereis* species *vexillosa* or *brandti* (Coos Bay, 1970 study).

Quantitative Information

WEIGHT-

ABUNDANCE—abundant at Cooston, east side of Coos Bay (L.C. Oglesby, communication), irregularly distributed in shallow water (Salinas River, California)" Tends to occur in isolated populations.'3

Life History Information

REPRODUCTION—viviparous; hermaphroditic, no copulatory organs. Animals spawn in burrows; some adults survive spawning." Eggs self-fertilized internally: larvae escape from coelom at a size (about 20 segments) to withstand osmotic environmental conditions'

GROWTH RATE—Several hundred eggs may be produced. and develop in coelom by typical spiral cleavage. Rapid growth leads to ciliated trochophore larva. Birth is by rupture of the body wall of the parent." Total development time 21-28 days. Breeding in late winter through spring and summer, when high temperatures and salinity suppress sexual activity.,

LONGEVITY-

FOOD—algal and diatomaceous scum", and detritus from the surface of the bottom.

PREDATORS—

BEHAVIOR—tree-living, constructs burrow somewhat Y-shaped and mucus lined." Worm is above fork of Y: can escape down into burrow during dry periods. Can swim well." Newly hatched young immediately build protective tubes of sand grains and mucus."

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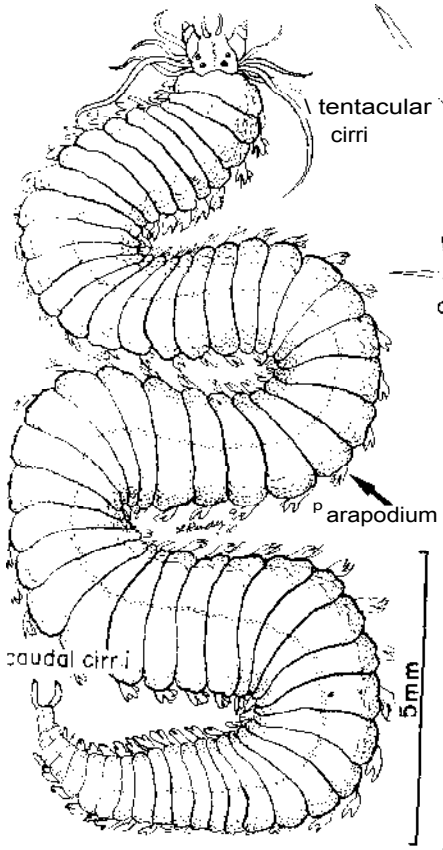
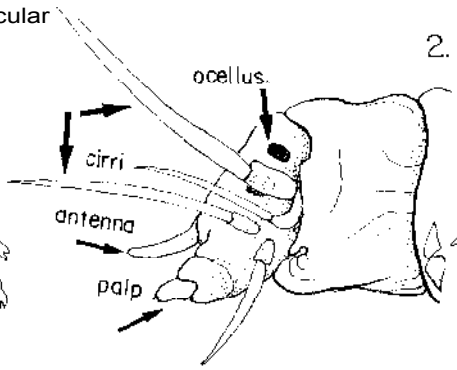
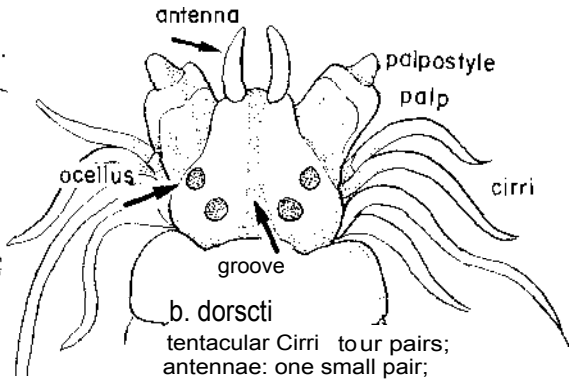
Nereis Nediste) limnico/ o



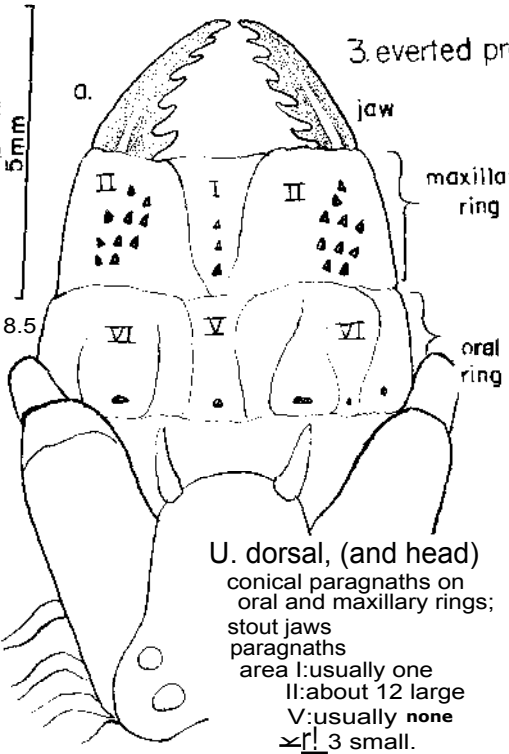
I. Nereis *(Hediste)limnicola* x 8.5
typical Nereid tentacular cirri;
body 25- 45 mm long,
45-82 segments;
pale, translucent.
cauci.al cirri two



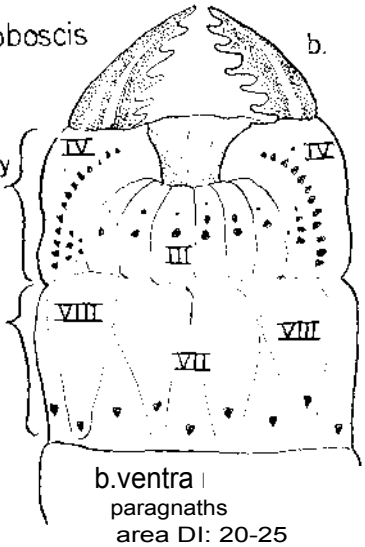
2. prostomium x 30
a. lateral



b. dorscti
tentacular Cirri tour pairs;
antennae: one small pair;
palpi : one pair, with palpostyles
ocelli : four
prostomium trapezoidal , grooved_

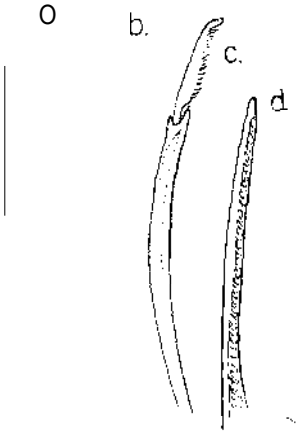


U. dorsal, (and head)
conical paragnaths on
oral and maxillary rings;
stout jaws
paragnaths
area I:usually one
II:about 12 large
V:usually none
r! 3 small.

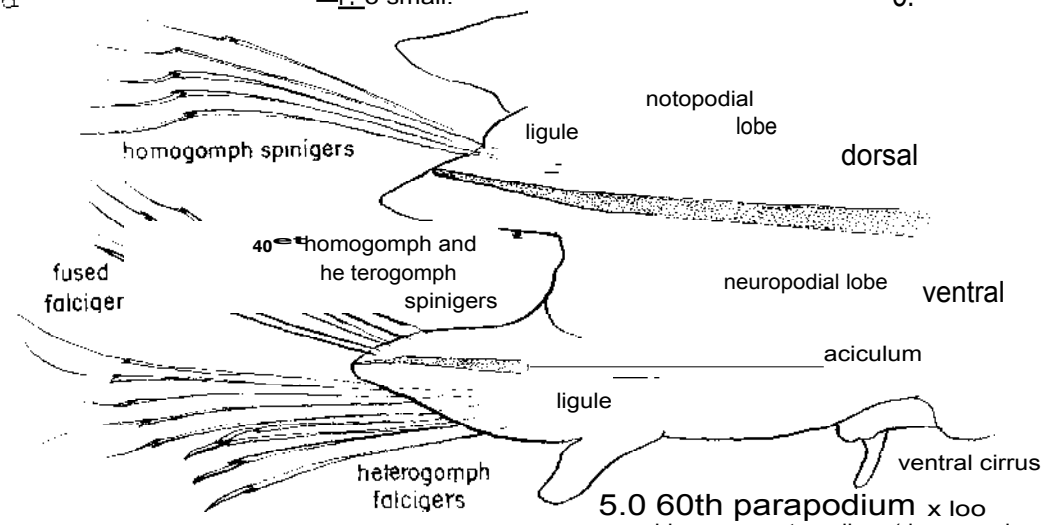


b.ventra l
paragnaths
area DI: 20-25
Et: crescent,30- 35
2tE: continuous rows
1:1Th continuous rows.

4.



4. setae
C. homogomph spiniger
b. heterogomph spiniger
C heterogomph falciger
d. fused falciger



5.0 60th parapodium x loo
biramous: notopodiurn (dorsapand
neuropodium (ventral);
all lobes conical;smal I dorsal ligule;

Nereis (Neanthes) brandti
a clam bed worm (Malmgren, 1866)

PHYLUM: *Annelida*
CLASS: *Polychaeta*
FAMILY: *Nereidae*

Description

SIZE—atokous or sexually immature individuals up to 185 mm long, 166 segments; epitokous, or "heteronereids" to 520 mm long, 18 mm wide, 230 segments.[4] Rather wide for length (Fig. 1.).

COLOR—usually a dark iridescent green— brownish or blueish, with a paler ventrum.4

BODY—rather wide for length (fig. 1); flattened dorso-ventrally; extremely active.

PROSTOMIUM—short, broad; not as long as peristomiurn (fig. 2).4

PALPI—at sides of prostomium; thick at bases, each with a small style (fig. 2).

OCELLI—four: family Nereidae[5]; in trapezoidal arrangement' (fig. 2).

TENTACULAR CIRRI—four pairs, second dorsal pair longest.4

ANTENNAE—two: short, conical (fig. 2).

PROBOSCIS—horny jaws with six to eight teeth; many conical paragnaths in all areas of both oral and maxillary rings: most important species characteristic.' In area I: three cones in tandem; area II, Ill, IV: each with many cones in dense patches; V: one, sometimes none', VI: a median row of 4 to 5 large cones; VII, VIII: each with a broad band of many cones" (at least 4 to 5 rows: species *brandti')* (figs. 3, 4).

PERISTOMIUM—first segment, asetigerous: a long ring, longitudinally ridged (fig. 2).

PARAPODIA—begin on second segment; biramous: family Nereidae[5]; posterior notopodial lobes broadly expanded, leaf-like. All other lobes small (fig. 6).

DORSAL CIRRUS—short; inserted half way along dorsal (notopodial) lobe (fig. 6).

NOTOSETAE— medial and posterior notopodia with composite spinigers only" (fig. 5).

NEUROSETAE—both composite spinigers and short shafted falcigers (fig. 5). (Subgenus *Neanthes* lacks the special fused falciger in the upper bundle of the neuropodium.)

CAUDAL CIRRUS—two slender cirri (Fig. 1).

Possible Misidentifications

N. brandti has been at times considered a subspecies of *Neanthes virens,* the large, coldwater form. This latter species, however, has only a few paragnaths on its proboscis rings, *(ie.* 2-3 rows in VII, VIII), not many as in *N. brandti* (4-5 rows in VII, VIII). The prostomium of *N. virens* is small and triangular; its eyes are small and on the posterior half of the prostomium. It has short antennae, and massive palpi.

Nereis (Hediste) succinea has very enlarged posterior notopodial lobes, with the dorsal cirrus attached at the end of the lobe; its distribution is possibly too southern for Oregon estuaries.

Nereis (Hediste) limnicola is usually pale and translucent, not dark green; its posterior parapodial lobes are not expanded like those of *N. brandti.*

Other common nereid worms include the very abundant *Nereis vexillosa,* found in many diverse marine environments, especially in mussel beds. It has greatly elqpgated, strap-like notopodial lobes in the posterior parapodia. And like all representatives of the subgenus *Nereis,* it has homogomph falcigers on its posterior notopodia as well as on its neuropodia; *Nereis (Neanthes)* has only composite spinigers on its posterior notopodia, not falcigers.

Other species of *Nereis* in Oregon estuaries include N. *eakini,* from rocky habitats, with a long prostomium. and proboscis rings covered with small round paragnaths: the bright green *N. grubei (= mediator)* with greatly expanded posterior notopodial parapodial lobes and no paragnaths in area V of the proboscis. N. *procera* is subtidal in sand, has tiny eyes, a very long body, and unusually inconspicuous paragnaths on its proboscis.'

Ecological Information

RANGE—northeast Pacific to southern California.°

LOCAL DISTRIBUTION—Coos Bay: South Slough, Charleston.'

HABITAT—variable: found in sand bars, stiff mud,' *Enteromorpha* beds[9]; largest specimens in fine mud, eelgrass beds rather than in pure sand; disappears near sulfite-polluted areas:2

SALINITY— saline areas near seawater.'[2]

TEMPERATURE --

TIDAL LEVEL—low and below tidal lirnits[4] burrows deeply in sand.

ASSOCIATES---

Quantitative Information

WEIGHT

ABUNDANCE-- most abundant nereid (Coos Bay, 1970), otter most abundant in eelgrass beds.12

Life History Information

REPRODUCTION—provides observers with one of the mos spectacular displays of nereid swarming ''i The sexually mature (epitokous) animals swim wildly at night on the water's surface, their medial parapodial lobes having developed and swollen for swimming. After expelling sperm and eggs, the distended worms will die.

GROWTH RATE—

LONGEVITY

FOOD—castings similar to the lug worm *Arenicola's,* but smaller, contain seaweed. Immature worms appear to eat *Ulva, Enteromorpha,* although their relatives are predaceous.9

PREDATORS

BEHAVIOR--- very fast swimmers speeds of 50-80 mm/sec. recorded.'0

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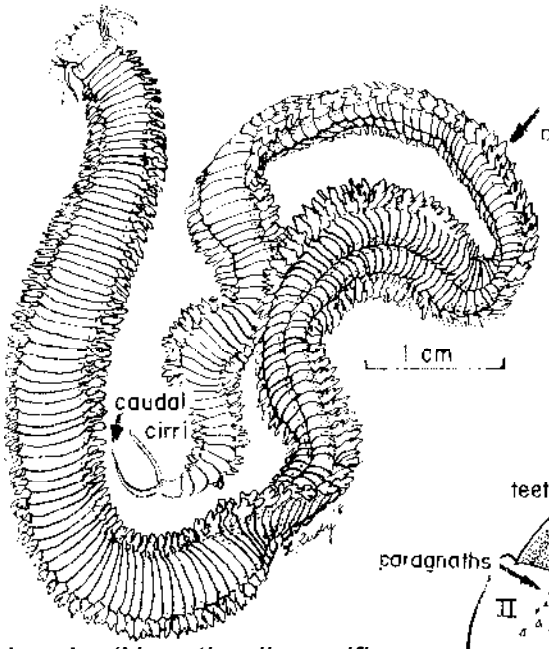
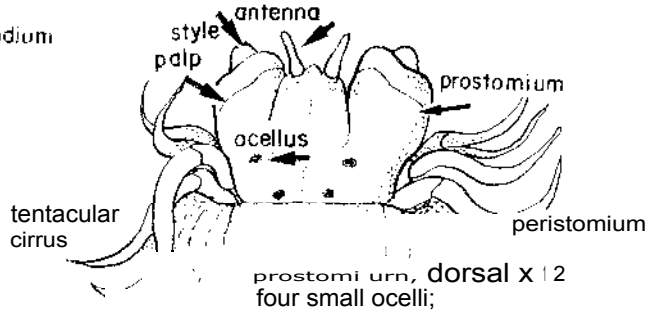
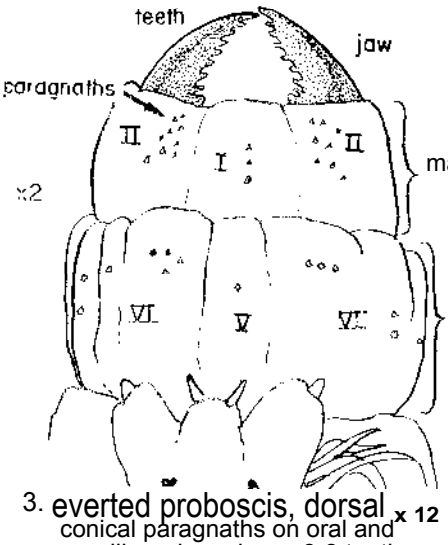
Nereis (Necnthes) brandti



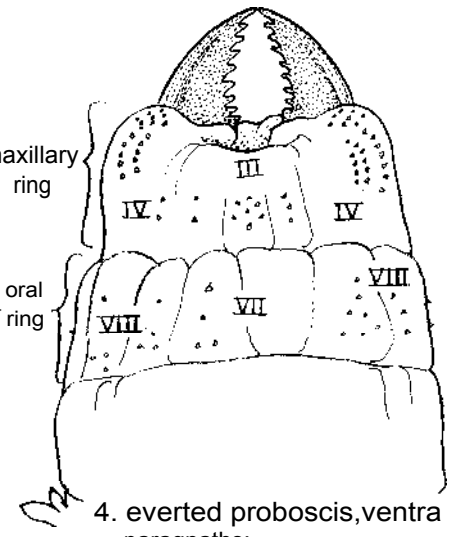
Nereis *(Neantheslbrancifi*
actual size 18cm,rnm wide;
color darh green; about 155 segments;
hirar:71ous paropodio; caudal cirri.



prostomi urn, dorsal x I 2
four small ocelli;
antennae : one small pair;
tentacular cirri:four pairs;
large pulps, small styles.

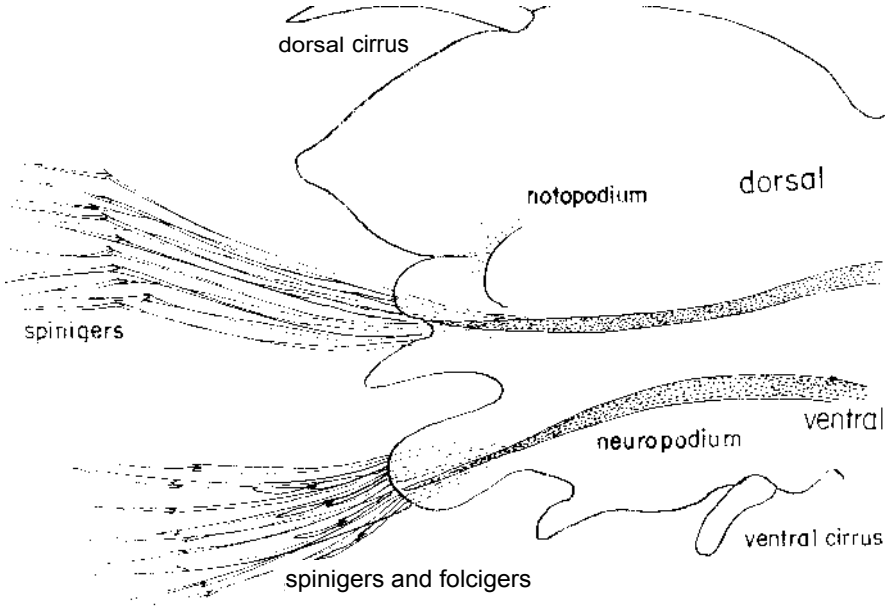


3. everted proboscis, dorsal x 12
conical paragnaths on oral and
maxillary rings; jaws: 6-8 teeth:
paragnaths :
area I: 3, in tandem
7-8(or more)in patch
3t: one (sometimes none)
VI:median band,4-5 rows.



4. everted proboscis,ventra l x 2
paragnaths:
area: DI dense patch
Br :several rows (patch)
V. broad band, 4-5 rows
)7all: broad band,4-5 rows.

5. setae x 300
0. heterogomph spiniger
b. homogomph spiniger
C. heterogomph falciger
d.. hxriogorn ph falciger



spinigers and folcigers

6,a posterior parapodium
biramous: notopodial (dorsal) and neuropodial lobes;
notopodial lobe leaf--like; dorsal cirrus medial,

Nereis (Nereis) vexillosa
the large mussel worm Grube, 1851

PHYLUM: *Anne/ida*
CLASS: Polychaeta
FAMILY: *Nereidae*

Description

SIZE—to 13cm[9]; to 30 cm in Puget Sound'; individuals living in gravel are larger than those on pilings.' Segments: more than 100[3]; this specimen: 105.

COLOR—in life: olive green.

PROSTOMIUM—two small antennae, massive palpi with small styles; four small ocelli. Four pairs of tentacular cirri, two dorsal pairs are longest (fig. 2).

PROBOSCIS—horny jaws with 6-8 teeth, visible when everted. Paragnaths (conical teeth) on both oral and maxillary rings (fig.3). Area I: several small cones in tandem; Area II (paired): an oblique, small transverse patch, (fig. 3). Area III: a circular patch; Area IV (paired) with an oblique patch of several rows; both are ventral; Area V: no paragnaths; Area VI with a mass of 6-9 or more; both are dorsal (fig. 3). Areas VII and VIII both have continuous bands of many paragnaths, those anterior being largest; both are ventral (fig. 4).

PARAPODIA—typical nereid birarnous structure (figs. 5, 6, 7); notopodia (dorsal branch) with falcigers as well as spinigers: genus *Nereis.*[3] Posterior notopodial lobes gradually change into long straplike ligules (fig. 6), with dorsal cirrus inserted terminally: most important species characteristic.

NOTOPODIAL SETAE—composite spinigers only in anterior segments (fig. 8d), posterior notopodia have a few homogomph falcigers (stout curved blades on an even base): (fig. 8a).

NEUROPODIAL SETAE—both anterior and posterior neuropodia have both composite spinigers—about 20 hetereogomph (or uneven based) (fig. 8c), and falcigers—about 5 heterogomph (fig. 8b).

ACICULA—(heavy internal black spines): on all noto- and neuropodia (figs. 5, 6).

CAUDAL CIRRI—four, fine, with accessory lobes (fig. 1): often broken in collecting.

TUBE—newly hatched animals build flimsy mucus and sand tubes.'

Possible Misidentifications

All nereid worms have a prostomium with four eyes, 2 or 4 pairs of tentacular cirri,[2] a pair of frontal antennae, and biarticulate palps. Most identifications must be done on proboscis teeth and parapodial setae and lobe differences. The other common Oregon nereids are

Nereis (Neanthes) brandti, possibly a subspecies of *N. virens,* a large, sand-dwelling worm, iridescent and green in color like *N. vexillosa.* It is usually paler ventrally. In contrast to *N. vexillosa,* it has many teeth on *all* areas of the proboscis; its posterior parapodial lobes are leaf-like, not long and strap-like; it has no falcigers in the posterior notopodia; its ecological niche is different: it does not live in mussel beds or on pilings.

Nereis (Hediste) limnicola, from sand or mud habitats, is pale and translucent, not dark green; its posterior parapodial lobes are conical, not strap-like.

Nereis eakini, an inhabitant of rocky areas, has a long prostomium and both proboscis rings covered with minute round paragnaths. It has large eyes, and jaws with only 3-5 teeth.1°

Nereis grubei (= mediator) is bright green like *N. vexillosa,* and found in mussel beds, so is sometimes confused with it, especially in its southern range. This worm is small, 5-10 cm,' with large and expanded posterior notopodial parapodial lobes, not strap-like lobes. Like *N. vexillosa,* it also lacks paragnaths on Area V. However, characteristic *N. vexillosa* egg masses have not been found in the California areas where *N. grubei* occurs,[6] so the two territories probably do not overlap.

An annelid of the family Orbinidae, *Nainereis dendritica,* while not resembling *Nereis vexillosa* at all in prostomium, is bright green and occurs in the same sorts of gravel beds with *N. vexillosa.* It is collected for bait.

Ecological Information

RANGE—Eastern Siberia to Alaska and south to central California.' (Specimens from southern California are probably *N. mediator (-=grubei).*[9] Type locality, Alaska and Siberia.

LOCAL DISTRIBUTION—Coos Bay, many stations: Yaquina Bay.°

HABITAT—among heavy algae, eelgrass, under rocks; cobblestones, or bark with muddy sand or sandy substrate': in mussel beds, barnacle clusters on intertidal pilings.'

SALINITY—strictly marine.,

TEMPERATURE—essentially a cold water form.'

TIDAL LEVEL—intertidal and shallow water,'

ASSOCIATES—with *Nereis (Neanthes) virens*[5], in mussel beds. scaleworm *Halosydna,* porcelain crab *Petrolisthes,* isopod *Cirolana.9*

Quantitative Information

WEIGHT-

ABUNDANCE—"ubiquitous [-9]; most abundant large annelid of the Pacific Northwest[6]; unusual because of its abundance throughout wide geographical range.9

Life History Information

REPRODUCTION—has heteronereid (swarming) form characterized by modified parapodia (fig. 7). Swarming at night (June, Coos Bay[4]): males appear first on water's surface. then females. After producing eggs, females sink with males to bottom, where eggs are dislodged. Both adults then die. Eggs in a firm, irregular, gelatinous mass, 1-3 inches (2.5-7 5 cm) in diameter, translucent; and blue green. green or brown when freshly laid; each egg 0.22 mm in diameter. Eggs can withstand strong wave action. *N. vexillosa* is the only nereid with a solid egg mass. The heteronereids observed were about one year old,[6] and at least 56 mm longs

GROWTH RATE—varies greatly': at 4 [1]/2 months and 60 segments, species characteristics obvious, including strap-like parapodial lobes.'

LONGEVITY-

FOOD—omnivorous; prefer fresh animal food, and reject dead food. Not a scavenger by preference.6

PREDATORS—sometimes preyed upon by nemertean *Paranemertes peregrina* (Roe, 1971). Widely used by man for fish bait.

BEHAVIOR—very active, can bite human collector.' Young build flimsy mucus and sand tubes, and rarely leave them completely to feed.'

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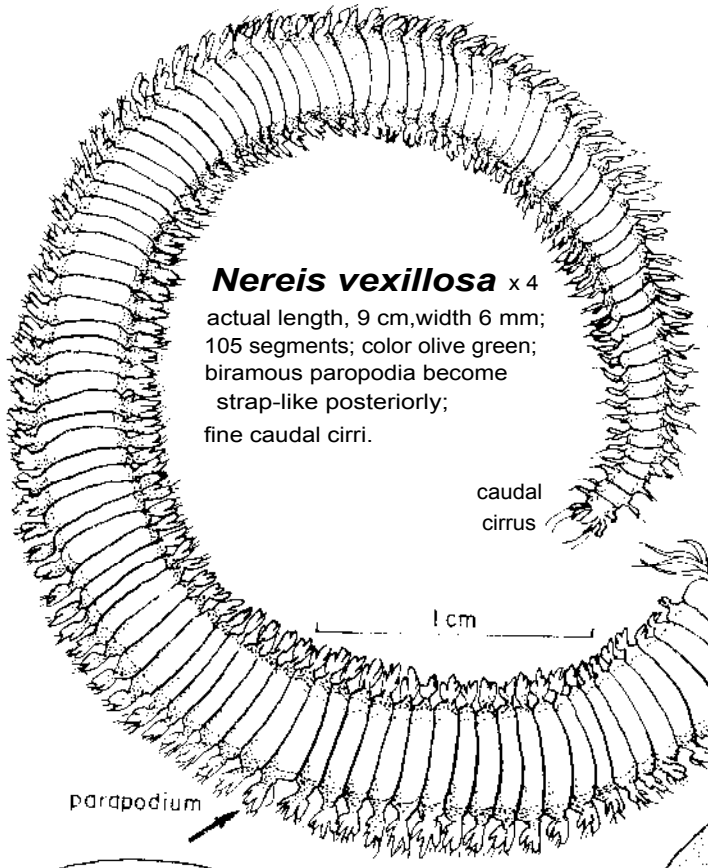
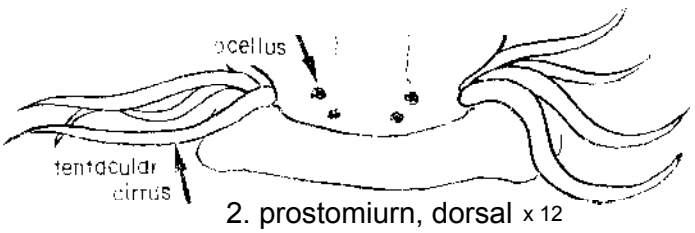
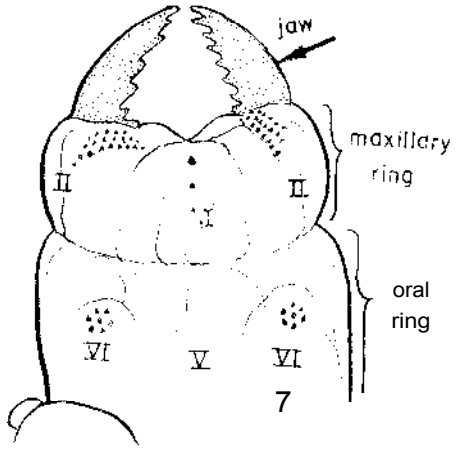
Nereis vex/MSG



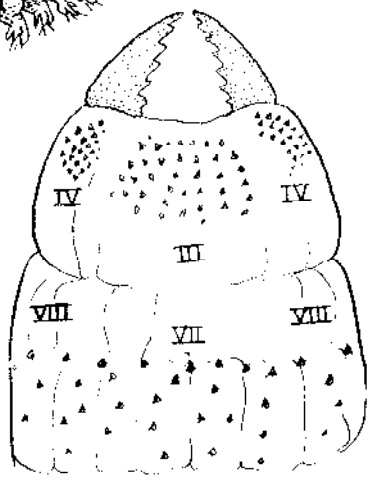
Nereis vexillosa x 4
actual length, 9 cm,width 6 mm;
105 segments; color olive green;
biramous paropodia become
strap-like posteriorly;
fine caudal cirri.



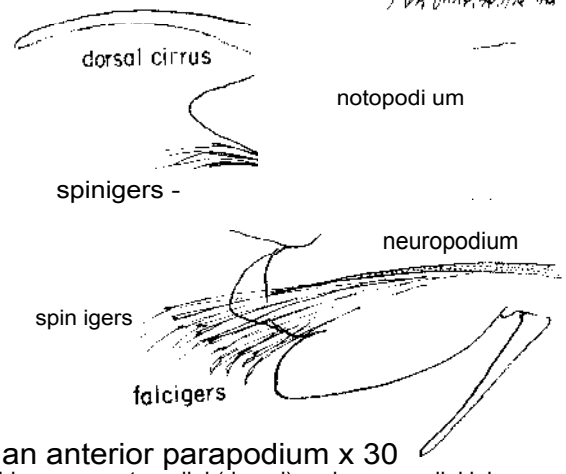
2. prostomiurn, dorsal x 12
tour small oselli;
one pair antennae;
massive palps, small styles;
four pairs tentacular cirri.



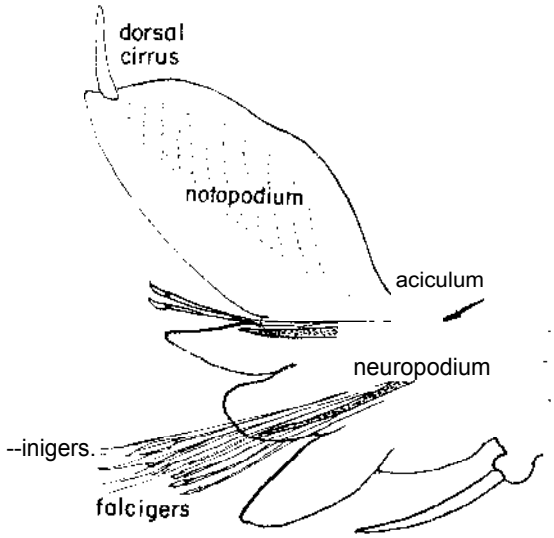
3.everted proboscis, dorsal x 12
conical paragnaths, oral and maxillary
rings; jaws: 6-8 teeth
paragnaths:
area I :several small cones in tandem
llan oblique, small transverse patch
: none
VT. 6- 9 or more in a mass.



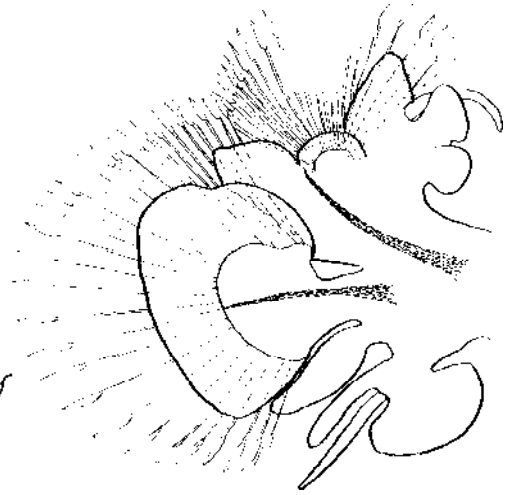
4.everted proboscis, ventral x 12
paragnaths:
area 111: circular patch
IY :oblique patch, several rows
many, continuous band
MIL • anterior cones largest.



5.an anterior parapodium x 30
biramous: notopodial (dorsal) and neuropodial lobes
"normal not strap-like.



6. a posterior parapodium x 30
notopodial lobe long, strap-like;
dorsal cirrus attached terminally.



7 heteronereia parapodium,
(from Johnson,l943).

d.

8. setae
a. homogomph falciger (notopodial)
b. heterogomph falciger (neuropodial,
c. heterogomph spiniger
d. homogomph spiniger.

Arrnandia brevis (=*A. bioculata* Moore, 1906[7]Hartman, 19381)

PHYLUM: *Annelida*
CLASS: Polychaeta
ORDER: *Opheliida*
FAMILY: *Opheliidae*

Description

SIZE-present specimens: 1-2 cm.

COLOR--pale "flesh" to red orange, with eleven pairs of dark eyespots on segments.

PROSTOMIUM-sharply tapered, with small terminal palpode. nuchal organs (fig. 3a) probably olfactory. and palps (fig. 3b) for food gathering.

PARAPODIA-on 29 setigers. Branchiae. present from the second segment. are cirriform. (fig. 2).

EYESPOTS-lateral, on segments 7 through 17: dark. paired, near branchiae (fig. 2).

BODY CHARACTERISTICS-29-30 segments, "soft-bodied... often grub like" : rather transparent. Body somewhat stiff (personal communication, R. Boomer).

VENTRAL GROOVE-well defined, running the entire body length. (fig. 1).

Possible Misidentifications

Only local species in the genus. *A. bioculata* Hartman, once thought to be separate[3], now included with *brevis9.*

Ecological Information

RANGE-originally described from Alaska, ranges to California.

DISTRIBUTION--found in South Slough of Coos Bay and at Cape Arago4.

HABITAT -sandy mud (Metcalf Preserve, South Slough) "loose sand"8.

SALINITY-

TEMPERATURE-

TIDAL LEVEL-shore to 40 fathoms, (Alaska); + 1.2 feet: (South Slough of Coos Bay and Puget Sound1°).

ASSOCIATES othersmall polychaetes, and *Pista pacifica,* amphipod *Corophium brevis.*

Quantitative Information

WEIGHT-

ABUNDANCE-720/m^2 (Mitchell Bay, San Juan Islands. Wash)10.

Life History Information

REPRODUCTION-free spawner: settlement after 3-4 weeks of planktonic development[s] Spawns April-Nov. (Wash.)10

GROWTH RATE-2-3 generations per summer possible5

LONGEVITY-six weeks to maturity, then spawning and deaths

FOOD-a deposit feeders

PREYED UPON BY-Cancer *magister:* escapes by burrowing.1°

PREDATORS-Cancer *magister;* escapes by burrowing.'°

BEHAVIOR-a burrower, not a tube builder'°; usually within 3 cm of surfaces.

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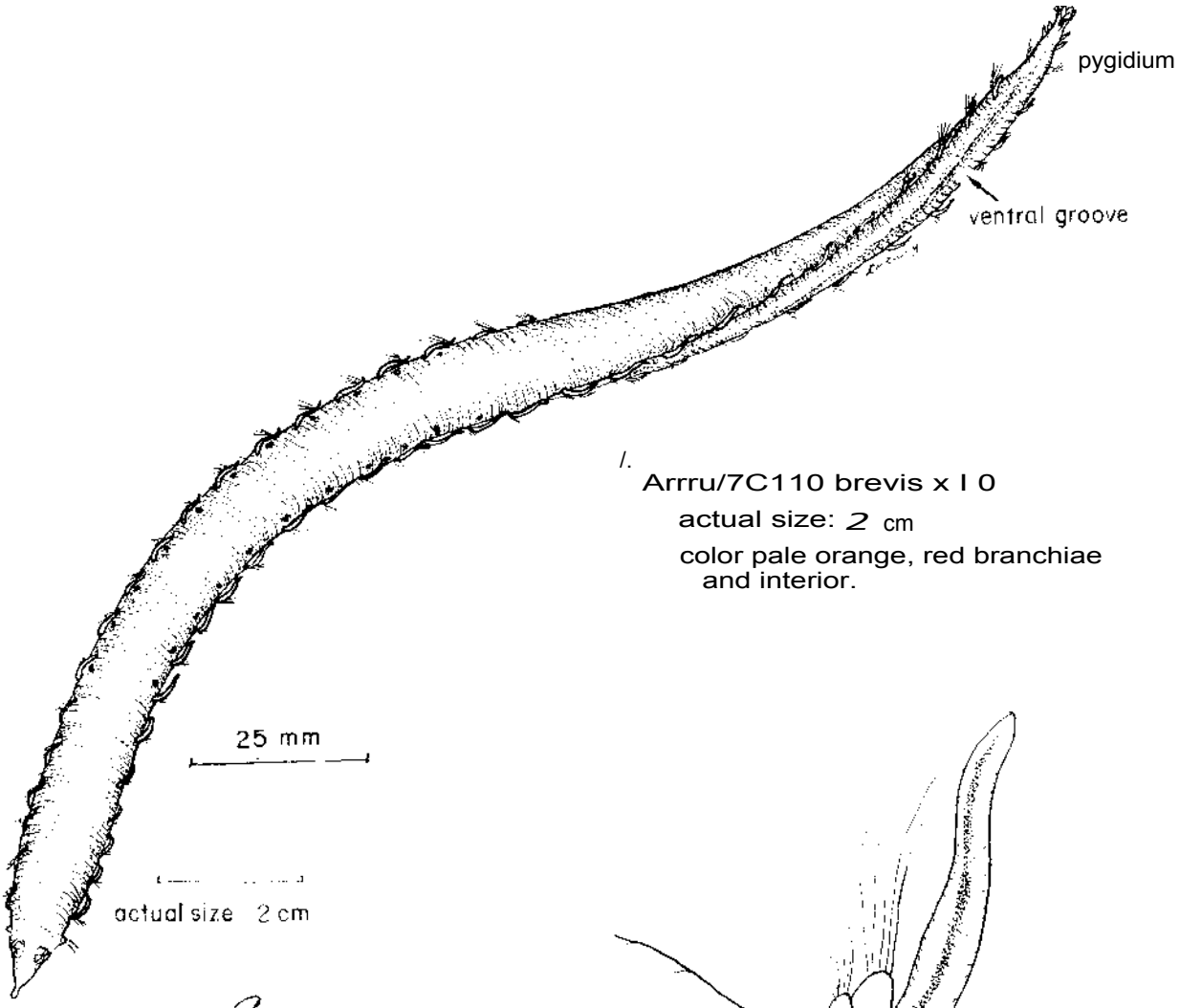
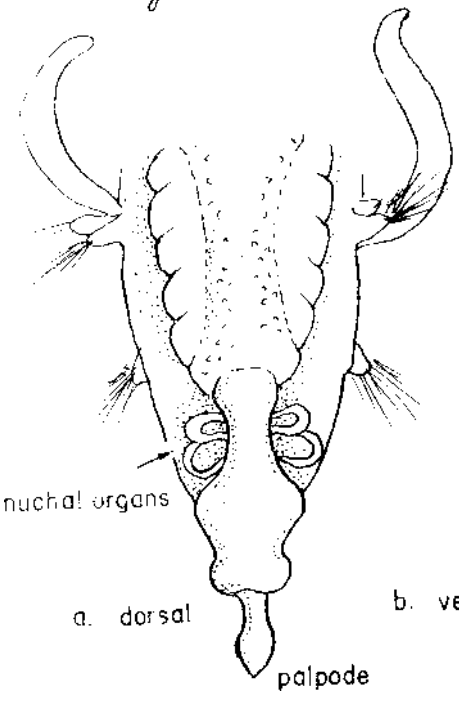
AN N ELI DA
POLYC HAETA
Opheh dae

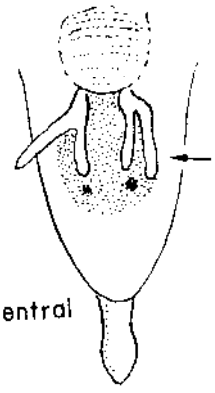
Armandia brevis



/.
Arrru/7C110 brevis x I 0
actual size: 2 cm
color pale orange, red branchiae and interior.

2.
parapodium
showing eyespot, branchiae.





3. a., b.
head
showing palps.

4. pygidium, dorsal
with long cirri,

Euzonus mucronata (=Thoracophelia mucronata)
a bloodworm (Treadwell, 1914)

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: *Opheliida*
FAMILY: *Opheliidae*

Description

SIZE—to 50 mm (two inches).

COLOR—iridescent, a shimmering dark blue to dark red. Some specimens have a pebbly surface.

ANTERIOR—"head", including setigers one and two, is set off from the thorax by a constriction (fig. 1) three asymmetrical ¯eyes¯ in the brain area.

THORAX—a mantle covers the first eight segments. The setigers are distinctly marked, with several muscle bands between them.

BRANCHIAE—parapodial branchiae are two-branched and simple, without "pinnules" (feather-like branches) (fig. 2).

POSTERIOR—a well-defined ventral groove, limited to the posterior area (fig. 1).

Possible Misidentifications

In the genus *Euzonus,* the anterior region (with first two setigers), is set off by a constriction. Other species of *Euzonus* to be found on sandy beaches include *E. williamsi,* whose two or three branched branchiae have a few lateral pinnules; *E. dillonensis* has single, not double branchiae, each with 15-20 pectinate divisions5.

Ecological Information

RANGE--British Columbia to northern Baja California.

DISTRIBUTION—clean sand of outer shore beaches, bays: Coos Bay: Crown Point, Fossil Point and North Bay, Cape Arago beaches.

HABITAT—clean sand; the "inhabitant *par excellence"* of the protected beaches.9

SALINITY

TEMPERATURE

TIDAL LEVEL middlelevel.

ASSOCIATES

QuantitativeInformation

ABUNDANCE—often found in dense mats of many hundreds or thousands of worms.

Life History Information

REPRODUCTION

GROWTH RATE

LONGEVITY

FOOD—micro-organisms filtered from the fine sands in which they burrow much as do earthworms.

PREDATORS —

BEHAVIOR —

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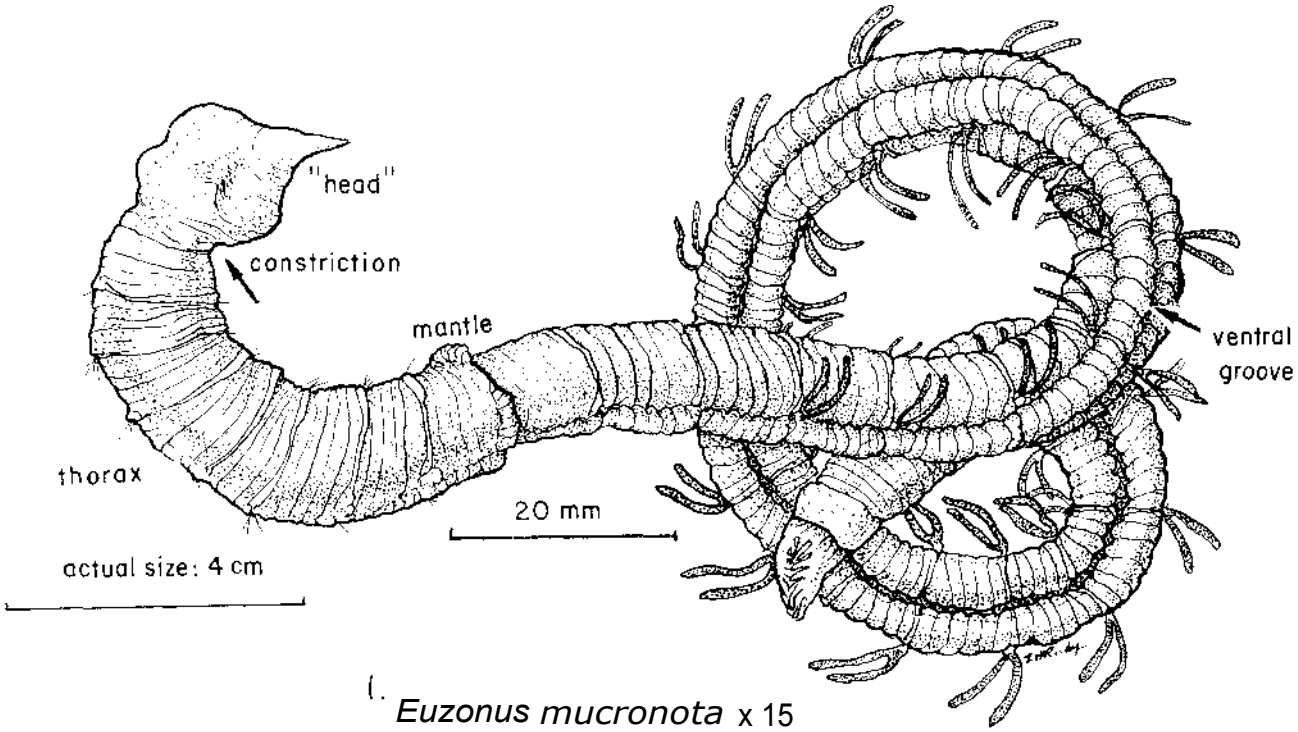
9 Ricketts and Calvin, 1971 See pages 174, 224, 473, 551, for brief ecological notes and references.

10 Smith and Carlton, 1975. Good key, Ophelidae, pp. *222-224.*

ANNELIDA
POLYCHAETA
Ophelidoe

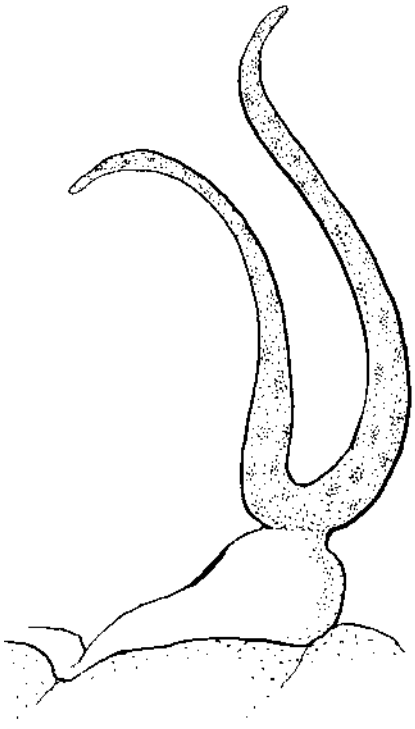
Euzonus m ucronotus

the bloodworm



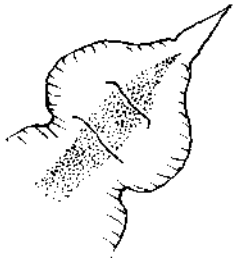
1. *Euzonus mucronota* x 15
   actual size 2-4 cm.
   color: iridescent, shiny
   dark red, dark blue.
   constriction between anterior
   region ana thorax.
   ventral groove: posterior.

2-parapodial brancria
   two-branched
   simple, without pinnules.



3. mouth
   extended.

4. "head"
   ventral.



Ophelia assimilis
a sand worm Tebble, 1953

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: *Opheliida* [2]
FAMILY: *Ophelidae*

Description

SIZE—to 33 mm long, 4 mm wide[3]; this specimen 22 mm.

COLOR—white, or pink iridescent (Coos Bay specimens).

PROSTOMIUM (HEAD)—a small triangular lobe; eyeless; prostomium not set off from body by constriction', head simple: without appendages, palps, etc. Nuchal organs present but invaginate, not visible.'

PROBOSCIS—eversible, sack-like (not figured).

BODY—fusiform (cigar-shaped); weakly segmented. 33 setigers (segments with setae); first setiger small, with biramous parapodia (fig. 1). A mid-ventral groove from setiger 8 to posterior: genus *Ophelia*[2] (fig. 2). Anterior with a ventral depression, not a true groove. Last three setigers with paired prominent dorsolateral ridges' (fig. 3). Body not clearly regionated[2]; inflated anteriorly.

PARAPODIA—low folds; biramous (neuro- and notopodia); small on first setiger, larger from second, with interramal pore (not figured); middle parapodia ventrolateral, with crenulated branchiae (fig. 4).

SETAE—all capillary, simple: family Ophelidae'; noto-setae longer than neurosetae[3] (fig. 4).

BRANCHIAE—(capillary structures on parapodia, fig. 4): none on first 10 setigers, then 19 branchiate and 4 post-branchiate setigers; (branchiae often disintegrate in preservation).

NEPHRIDIOPORES—six pairs, on setigers 11-16 (branchial segments 2-7) (not figured).

PYGIDIUM—a pair of large ventral lobes and about 11 smaller subglobular lobes in 2 crescents above anal pore' (fig. 3).

Possible Misidentifications

Ophelidae are sand or mud dwellers, having a limited number of segments, with a simple blunt or rounded prostomium, and biramous parapodia with capillary setae. Some have a ventral groove, branchiae, and/or eyes.' At least six genera are found in our area:

Travisia sp. are cigar shaped, without a ventral groove but with branchiae; their posterior parapodia have large lobes. *gigas* is stout and up to 85 mm long; it has a 'garlic-Ilike odor' (Kozloff) and is found on sandy mudflats. Also called *pupa,* or *T. foetida.3*

Polyophthalmus sp. have a ventral grove along the whole body, no branchiae, but lateral eyes. They have a short anal tube with small anal cirri.' *P. pictus* lives in rocky habitats with algae.'

Ammotrypane (Ammotrypanella)[2] have a ventral groove along the whole body, cirriform branchiae only on the posterior setigers, no lateral eyes, and a long narrow anal tube with two internally attached ventral cirri.' *A. aulogaster,* a mud dweller, is relatively slender and has 42-50 setigers.

Armandia sp. have a ventral groove along the whole body, cirriform branchiae, lateral eyes, and a long slender anal tube with paired long, internally attached ventral cirri and shorter dorsal cirri. The abundant estuarine polychaete *A. brevis (= bioculata)* is the only local species, living in sandy mud and silt. It is slender, 15-17 mm long, with 29 setigers.

Euzonus sp. live on clean sandy beaches and have three distinct body regions—an inflated head with a constriction setting it off from the inflated anterior (thorax) region, and a narrow posterior with branchiae and a ventral groove. Three species occur in our area:

E. dillonensis has unbranched branchiae with fine, comb-like divisions. This species is purple, 50-70 mm long, with 38. setigers.

E. mucronata (= Thoracophelia), the bloodworm, has simple two-branched branchiae, is iridescent blue to red color, up to 97 mm long and has 38 setigers.

E. williamsi is also dark red and iridescent with 38 setigers. It is smaller than *E. mucronata* (34-60 mm), and has branchiae with two or three branches, each with a few lateral pinnules on it.

The species of *Ophelia* are differentiated from other genera of Ophelidae by the fusiform body, inflated anterior, and posterior ventral groove. They generally have branchiae on setigers 8-10. Two other species of *Ophelia* occur in our area:

Ophelia limacina, a cosmopolitan species, has 39 setigers (not 33 like *0. assimilis).* It is rose to purple, with red branchiae,[3] 15-40 mm long, with a long, conical prostomium (not short and triangular); it lives intertidally in sand. It has been found in Coos Bay.4

Ophelia pulchella, with 38 setigers, 19-23 mm long, has 9 abranchiate anterior setigers (not 10 like the other two).[3] It has a long conical prostomium and long flowing tufts of setae: it is found in sandy mud sediments.

None of the *Euzonus* or *Ophelia* species above has been included in Kozloff's or Berkeley's Puget Sound work.

Ecological Information

RANGE—(Oregon) and northern California': type locality: Pacific Grove, California.

LOCAL DISTRIBUTION—Coos Bay: near bay mouth; Netarts Bay.'

HABITAT—clean sand; on spit near bay mouth in nearly marine conditions (Coos Bay); often where current is strong.'

SALINITY—collected at 30 o/oo saltwater.

TEMPERATURE—range would indicate temperate conditions preferred.

TIDAL LEVEL—intertidal; found at 1/2 tide level where it is uncovered several hours each tide (England)."

ASSOCIATES—razor clam *Siliqua patula,* olive snail *Olivella.*

Quantitative Information

WEIGHT-

ABUNDANCE—not common, but can be abundant locally.

Life History Information

REPRODUCTION—eggs and sperm spawned into water. In similar species *0. bicornis:* ripe eggs dark green/brown; larvae attached to substrate by four anal papillae and parapodial lobes; pelagic life short, metamorphosis by 19th day.'

GROWTH RATE

LONGEVITY

FOOD

PREDATORS

BEHAVIOR—proboscis unarmed, probably used for digging.'

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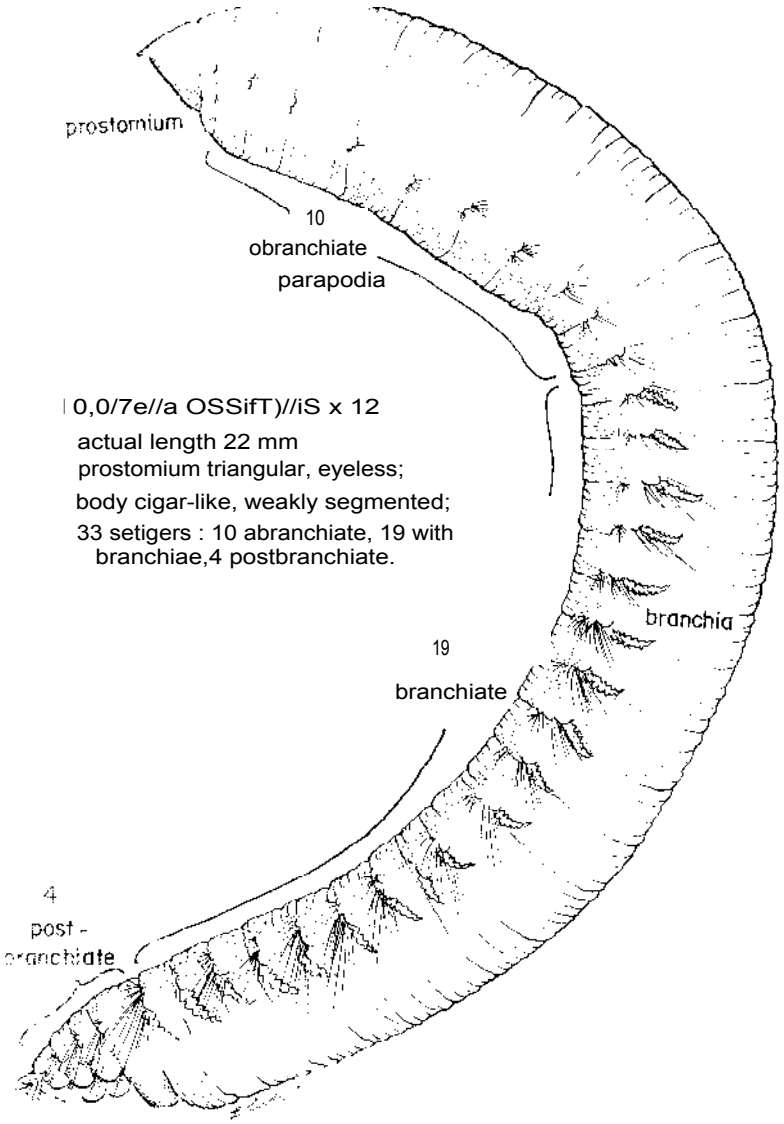
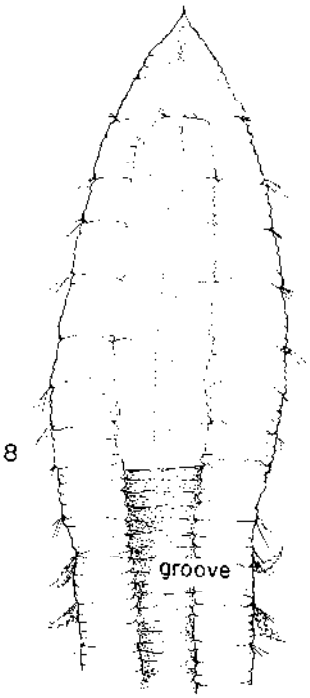
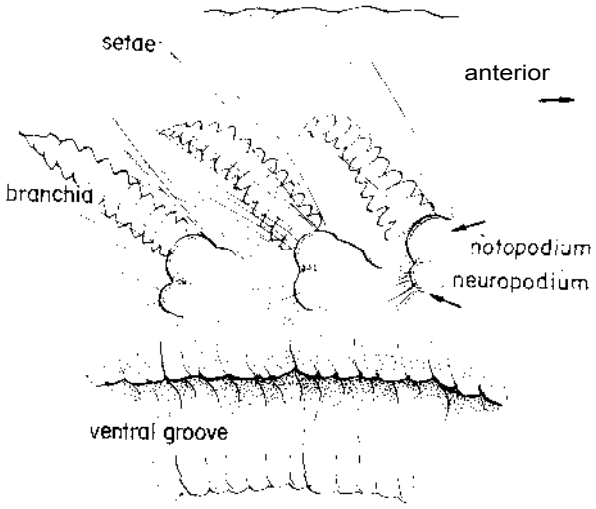
Ophella ass/mills



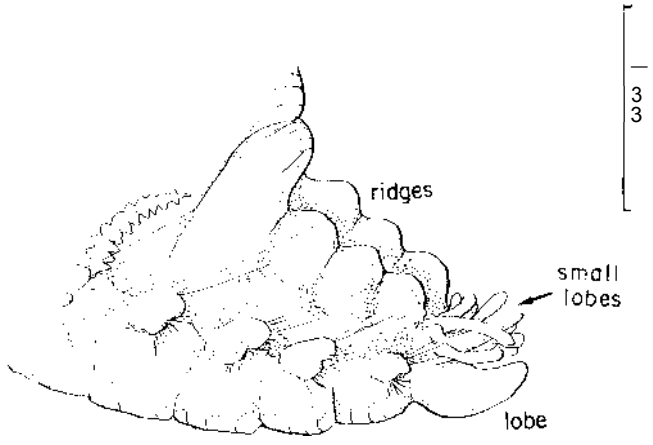
0,0/7e//a OSSifT)//iS x 12
actual length 22 mm
prostomium triangular, eyeless;
body cigar-like, weakly segmented;
33 setigers : 10 abranchiate, 19 with branchiae,4 postbranchiate.



2 anterior, ventral x 12
deep groove from setiger 8.



4.some medial parapodia x 30
biramous parapodia, long notosetae;
crenulated branchiae.



3. pygid i um, lateral x 30
3 dorsolateral ridges;
a pair of ventral lobes;
smaller lobes above.

Eteone lighti
a paddleworm

Hartman, 1936

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: *Phyllodocida*
FAMILY: *Phyllodocidae*

Description

SIZE—to 30 mm long, 1-1.5 mm wide, with parapodia.5

COLOR—pale or white, deep yellow dorsal transverse stripes', dorsal cirri tipped with deep yellow.

BODY-75-100 segments (fig. 1); first segment incomplete dorsally: genus *Eteone,* where it expands into tentacular cirri (fig. 2a).

PROSTOMIUM—trapezoidal, wider than long, with a median longitudianl groove (fig. 2a); with two pairs of short, conical antennae, and two pairs of short, slender tentacular cirri: genus *Eteone.* Two eyes on posterior third of prostomium, no nuchal papilla.

PROBOSCIS—can be smooth or wrinkled, but lacks papillae,' (fig. 1).

PARAPODIA—uniramous: neuropodia only. All but first segment with a flat triangular dorsal cirrus, about as wide as long (fig. 3), these become longer and narrower farther back[s]; the ventral cirrus has a broad base tapering to a blunt tip and is shorter than the neuropodial lobe (fig. 3). Note: parapodium should be viewed in plane (side) view to check for flatness, inflatedness, etc.

SETAE—compound: family Phyllodocidae[9]; long, fine, colorless spinigers[6] (fig. 4a,b).

ANAL CIRRUS—one pair, cirriform, attached laterally (figs. 1, 5); about twice as large as peristomial cirri (fig. 2)6.

Possible Misidentifications

Other polychaetes of the family Phyllodocidae can have flattened, leaflike paddlelike or globular parapodial cirri', they all have four frontal antennae on the prostomium (and occasionally a medial one), 2-4 pairs of tentacular cirri, uniramous parapodia and compound setae. Other similar families are Syllidae and Nereidae, although neither has uniramous parapodia. The genus *Eteone* has only two pairs of short tentacular cirri, and short prostomial antennae [3] (fig. 2a).

The species closest to *E. lighti* in our area is *E. pacifica,* which has no (or inconspicuous) eyes, a prostomium longer than wide, flat broadly rounded asymmetrical dorsal cirri, irregularly spaced black spots on its yellowish body. It can be more than 50 mm long.' A variety, *E. p. spetsbergensis,* has parapodial setae with two large, equal teeth at the end of the shaft *(E. pacifica sensu stricto* has setae with two unequal teeth at the end of the shaft2).

Other species of *Eteone* include *E. californica,* which also has a broad prostomium, but has a nuchal papilla between its eyes, and wide, dorsal parapodial cirri. Its ventral cirri are very short in the posterior parapodia, [2] and it has small brown pigment spots on its body.

E. longa, found in the Puget Sound literature, [27] but not in California, has a long, symmetrical conical dorsal cirrus, and a ventral cirrus almost as long as the parapodial lobe; its anal cirri are broad and spheroidal.2

E. dilatae is a long, slender worm with up to 250 segments; it is found on sandy beaches of the outer coasts.'

E. tuberculata has a prostomium with a narrow base, a prominent nuchal papilla, and a long parapodial dorsal cirrus.2 This species, with *E.* p. *spetsbergensis* which also has anatomical differences, seems to be a more northern animal.

E. balboaensis is an eyeless species from southern California.'

Ecological Information

RANGE—central and southern California' extends inIc Oregon, but probably not to Washington.

LOCAL DISTRIBUTION—Coos Bay, several stations, includ,ittl South Slough, and particularly North Slough.8

HABITAT—mudflats; muddy sediments rather than sandy rr (Coos Bay).8

SALINITY-20-30 o/oo (North Slough, Coos Bay, summer)

TEMPERATURE

TIDAL LEVEL-

ASSOCIATES---eelg rass.

Quantitative Information

WEIGHT—a Coos Bay specimen: 0.17 gms. wet weight 25 mm worm.'

ABUNDANCE-- in upper Coos Bay, this can be one of the mus! common and widespread mudflat worms: up to several hundred/m^2 in part of North Slough.8

Life History Information

REPRODUCTION

GROWTH RATE

LONGEVITY

FOOD

PREDATORS—in Tillamook Bay, *Hypomesus pretiosus* (stir' smelt) and *Parophrys vetulus* (English sole) prey on a species of *Eteone.4*

BEHAVIOR—utilizes paddle shaped parapodia for swimming

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3 Fauchald. K 1977 Pp 47, 49. to genus

4 Forsberg, Brent 0 John A Johnson, and Stephen M Kir,n Tillamook Bay. Oregon Ore Dept Fish K Wildlife Research Secs Tillamook. Ore

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6 968 Key lo genera p 223. species Se'e'kzT,',

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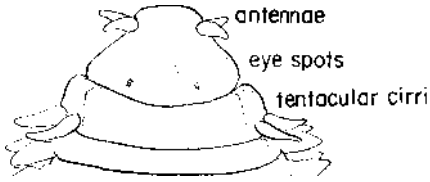
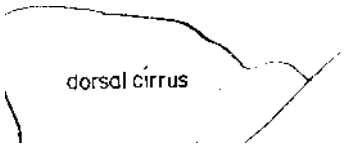
9 Smith and Carlton. 1975 Pp 17882

Eteone fight/



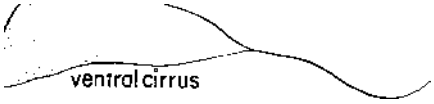
2. prostomium x 30
a. dorsal
trapezoidal,wider than long; first segment with tentacular cirri only; two pairs short frontal antennae; two eyes. medial groove .

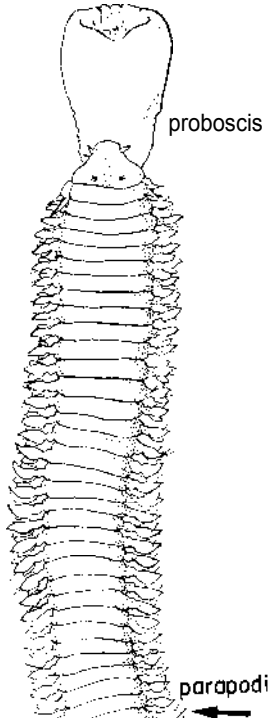
b. ventra
showing proboscis opening.



3. 10th parapodium
(setae not shown)
triangular dorsal cirrus; broad-based ventral cirrus.

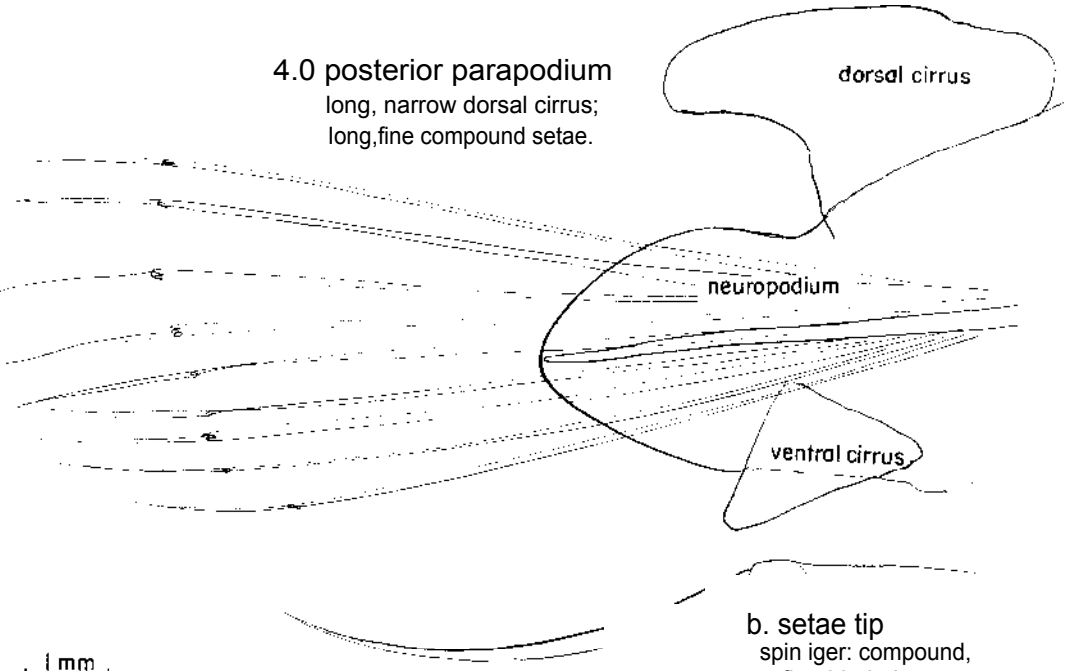
neuropodium





parapodium

4.0 posterior parapodium
long, narrow dorsal cirrus; long,fine compound setae.



b. setae tip
spin iger: compound, fine-bladed.

1 mm

anal cirri

5.anal cirri x 30
one pair.

I. ***Eteone lighti*** x 12 , proboscis everted
actual length 25 mm; about 100 segments;
prominent uniramous parapodia;
proboscis without papillae;

Eteone pacifica

a paddle worm **Hartman, 1936**

PHYLUM: *Annelida*
CLASS: Polychaeta
ORDER: *Phyllodocida*
FAMILY: Phyllodocidae

Description

SIZE-50 to 75 mm; 200-300 segments.

COLOR-pale yellow green with small black spots.

PROSTOMIUM-definitely trapezoidal, longer than wide (fig. 2): two pairs of small frontal (prostomial) cirri, eyes inconspicuous.

PROBOSCIS-fleshy, smooth, no paragnaths (side teeth), (fig. 3).

BODY CHARACTERISTICS-first segment with two pairs of thick, conical cirri, the ventral pair being the larger; 200-300 body segments, (fig. 1).

PARAPODIA-uniramous, with short, rounded dorsal cirri, (fig. 4); setae: composite, spinigerous.

ANAL APPENDAGES-one pair, lateral (fig. 1).

Possible Misidentifications

Four other local species of *Eteone,* all smaller than 50 mm: differ from *E. pacifica* in several ways. *E. lighti* is closest in appearance, but has a broad prostomium, becoming very narrow, with triangular dorsal parapodial cirri, (not round). It is pale, or white in color. *E. californica* has a broad truncate prostomium, inflated dorsal parapodial cirri, only 80-95 body segments, and a prostomial nuchal papilla above and between the "eyes". It is pale with brown pigment spots. *E. dilatae* is pale green like *E. pacifica,* but its prostomial antennae are long and slender, and its first body segment is twice as long as the second. *E. longa,* from Puget Sound, is much like *E. californica,* but without the nuchal palp. It has thick, conical dorsal parapodial cirri.

Ecological Information

RANGE-western Canada to central California.

LOCAL DISTRIBUTION-Oregon: Cape Arago, Sunset Bay (outer shore)', South Slough of Coos Bay.

HABITAT- intertidal muddy sand; littoral depths[6]; common in large muddy areas, upper Coos Bay9.

SALINITY-surface water salinity where *E pacifica* was collected in Coos Bay varies from 10-30 0/00.

TEMPERATURE-surface water temp. where *E. pacifica* was collected in Coos Bay varies from 8-18°C.

TIDAL LEVEL-collected at about the +4.0 foot level-Coos Bay.

ASSOCIATES-other polychaetes, tanaidacean *Leptochelia dubia,* amphipod, *Corophium brevis,* and clam, *Macoma* sp. (South Slough of Coos Bay).

Quantitative Information

WEIGHT-

ABUNDANCE-highest in Coos Bay: several hundred/rneter2. (North Slough)9.

Life History Information

REPRODUCTION-eggs laid overnight in refrigerated seawater. February.

GROWTH RATE-

LONGEVITY--

FOOD-

PREDATORS-Hypomesus *pretiosus* (surf smelt) on *Eteone* sp.: lower Tillamook. *Parophrys y etulus* (English Sole): mid Tillamook Bay.3

BEHAVIOR-"paddle" shaped cirri adapted for swimming.

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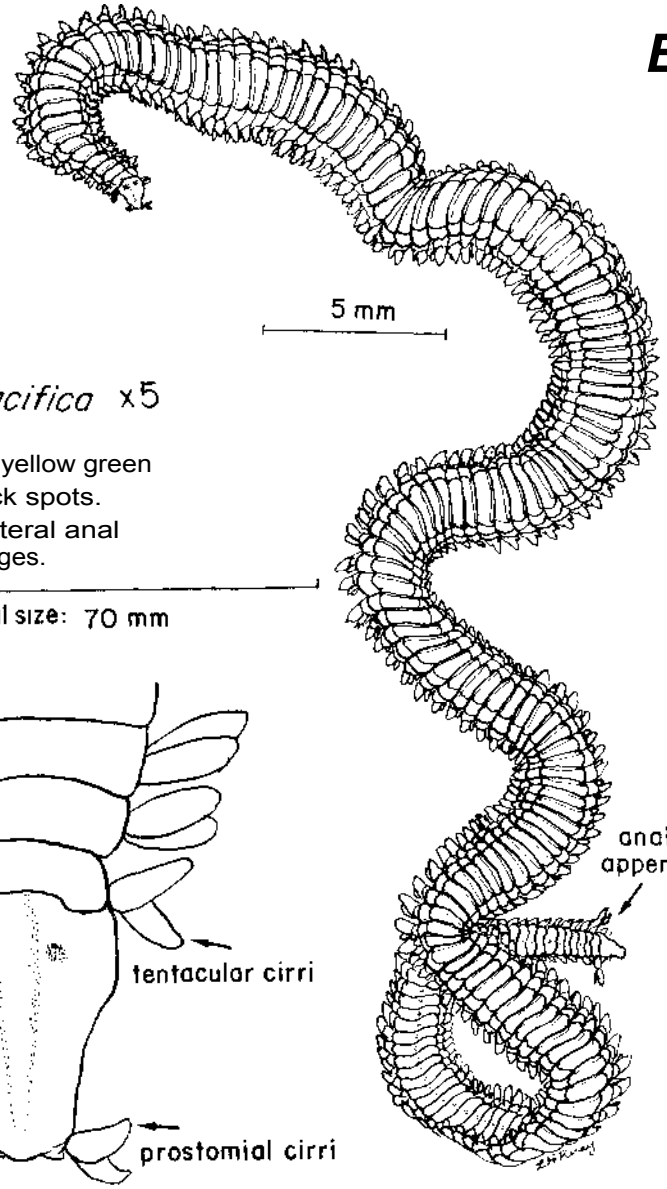
ANNFLIDA
POLYCHAE TA
Phyllodocidae

Eteone pacific°

a paddleworm

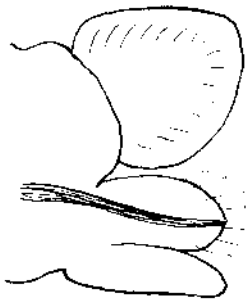


1. *Eteone pacifica* x5

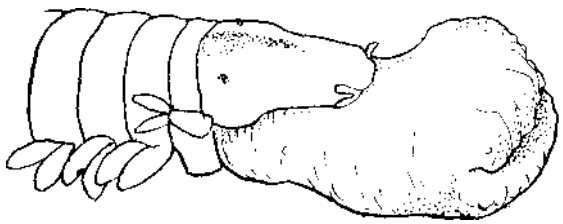
color: pale yellow green with black spots.
one pair lateral anal appendages.

actual size: 70 mm

2.
prostomium
two pairs of short tentacular cirri;
small eyes.
two pairs small prostomial cirri.



4 medial uniramous
• parapodium
dorsal cirri rounded, thin.



3.
proboscis
everted: fleshy, smooth; no paragnaths.

Halosydna brevisetosa (= *H. johnsoni* Kinberg, 1855 Darboux, 1899)

short-haired scaleworm

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: *Phyllodocida*
FAMILY: *Polynoidae*

Description

SIZE-40 to 100 mm[3]; this specimen: 22 mm. Commensal specimens larger than-free-living7.

COLOR-variable; this specimen: mottled brown scales, with black and white spots.

PROBOSCIS-strongly developed, four-jawed (not figured).

PROSTOMIUM-broadest behind four eyes, frontal antennae attached terminally, one central frontal antenna. (fig. 2).

PARAPODIA-notopodia small, with short serrate setae; neuropodia large with many simple falcate neurosetae (fig. 3): all setae simple.

ELYTRA-eighteen pairs; occur on segments 2. 4, 5, 7...and alternately on odd segments; after 23, they occur on every third segment; elytra reniform to ovate, varied in color, a few tubercuies.

BODY SEGMENTS-37.

Possible Misidentifications

The number of pairs of elytra make identifications easy in this family; closest are *Harmothoe, Lepidatheoia,* and *Arctonoe* sp. with fifteen pairs of elytra. *H. johnsoni,* a southern California species with distally bifid neuropodial setae. is treated as a separate species[3], or as the same[9]. Other species of the genus *Halosydna* do not occur in the Northwest.

Ecological Information

RANGE-southern California to Alaska: type locality. Sausalito, California.

LOCAL DISTRIBUTION-as commensal with terebellied worms, hermit crabs, moon snails; free-living in mussel beds, under stones. Very common in South Slough4.

HABITAT-free-living: in rocks or on pilings; as commensal: with mud-dwelling forms. Prefers clean waters; seldom occurs where dissolved oxygen levels drop below 2.5 mg/l.7

SALINITY-

TEMPERATURE -

TIDAL LEVEL-intertidal; South Slough, at 0.5 ft.

ASSOCIATES-hosts: *Pista pacifica,* (South Slough); hermit crab *Paguristes,* living in shell of moon snail *Polinices6.*

Quantitative Information

WEIGHT-

ABUNDANCE-most common scaleworm in central, northern California[9]; also very abundant in Oregon and Washington.

Life History Information

REPRODUCTION-sexes separate; gonads in segments 12-34; larvae found Tomales Bay, Sept. and Oct.; newly settled juveniles 0.9 mm long, with 11 segments'.

GROWTH RATE-

LONGEVITY-

COMMENSALISM-animals not chemically attracted, possible tactile responses'.

FOOD-voracious eaters (cannibals in captivity) probably share food of host when commensal.

PREDATORS-

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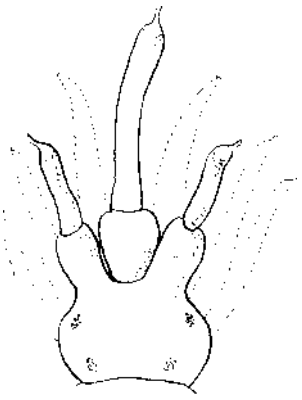
ANNELIDA POLYCHAETA Polynoidae

Holosydila brevisetoso

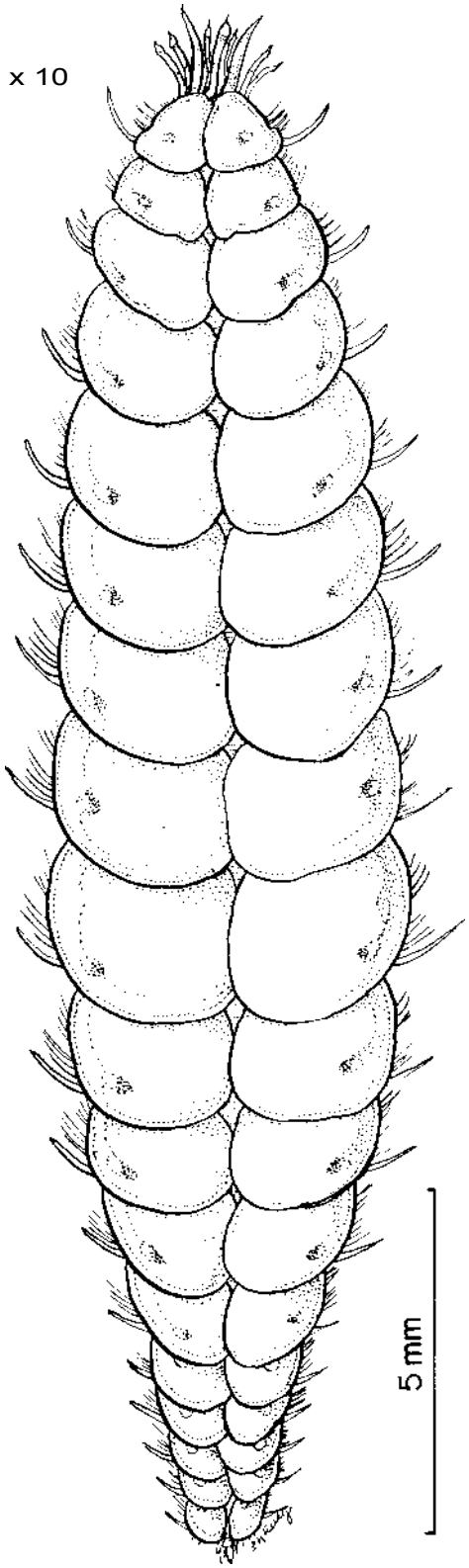
the short-haired scale worm



C. Ha/osydna brev/Sei0S0 x 10

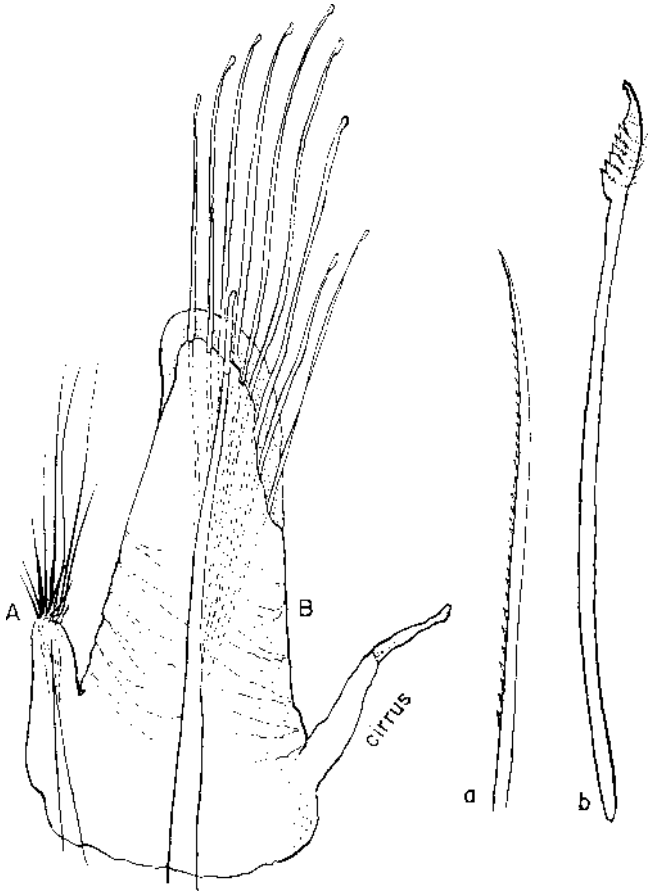
18 pairs of elytra.

actual size 22 mm;



2. prostomium

broadest behind **four eyes;**
central frontal antenna
antennae attached terminally;
(from Hartman,1968, p. 63).



3. parapodic

notopodia small, with short, serrate setae; (A,a);
neuropodia large; simple falcate setae,(B, b).

Hesperonoe cornplanata
a commensal scale worm (Johnson, 1901)

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: *Phyllodocida*
FAMILY: *Po/ynoidae*

Description

COLOR-"flesh"; reddish around head; elytra pale, translucent; setae clear.

SITE-to 1 1/2 inches[9]; (21 mm), width to 6 mm including setae'.

SHAPE-flattened dorso-ventrally; almost all covered with 15 pairs of scales (elytra) (fig. 1); 36-38 segments.

1ROSTOMIUM-six-sided, as long as wide, deeply incised; four ocelli (fig. 2); large medial antenna, two small prostomial biarticulate antennae (inserted below lateral lobes of prostomium) (fig. 3). Lateral palpi: one pair, longer than medial antenna, red. Two pairs tentacular cirri (figs. 2, 3).

PARAPODIA-distinct noto- and neuropodia; notopodia short, with two kinds of simple setae; long dorsal cirrus, easily detached (fig. 1, 5), alternate with elytra (fig. 1). Neuropodia long, with one kind of long setae (although lower ones can be thicker than upper ones)[2]; ventral cirrus (fig. 5).

SETAE-notosetae, two kinds: many, stout, blunt, minutely sarrated, both short and long (fig. 5a); a few (4-5) slender, pointed and serrate: genus Hesperonoe[2] (fig. 5b). Neurosetae, one kind: curved, simple, with lateral serrations (fig. 6), although upper neurosetae can be more slender, lower ones stouter.

ELYTRA-15 pairs, reniform (kidney-shaped)[5], covering most of body. Thin, delicate easily detached; with widely spaced low papillae (fig. 4). Species with relatively smooth elytra, like this one, are often commensal2.

Possible Misidentifications

Hesperonoe complanata is the only scale worm known to be commensal with the ghost shrimp *Callianassa* (which see). Another species, *H. adventor,* lives with the echiuroid *Urechis.* It is larger (to 40 mm), has short, ciliated palpi, antennae, and dorsal cirri; its roundish elytra have dark crescents on their posterior thirds. The third Pacific species, *H. laevis,* is found in deep water off Santa Barbara, California, with another echiuroid.

The genus *Hesperonoe* can be distinguished from other polynoids by its 15 pairs of smooth elytra covering almost the entire body as well as by its prostornial antennae, which are inserted ventrally, not terminally (fig. 3), and by the two kinds of simple notosetae.

Of other common intertidal scale worm genera, *Polynoe* has fifteen pairs of elytra, but they are only on the anterior end of the body. and it has more than 50 segments, not 36-38; *Arctonoe* has 20 or more elytra pairs; *Halosydna* has eighteen pairs of elytra.

Ecological Information

RANGE-western Canada to southern California[6]. Type locality: Puget Sound.

LOCAL DISTRIBUTION-in many *Callianassa* burrows in larger Oregon estuaries; *Callianassa* is found in Alsea, Nestucca, Netarts, Umpqua, Tillamook, and Yaquina estuaries, Coos Bay.

HABITAT-the burrows of the ghost shrimp *Callianassa* are large, sloppy, permanent, with side tunnels. They occur in the sandy mud of low mudflats in extensive beds; also among oyster beds. The juvenile *Hesperonoe* are found lying on the abdomens of *Callianassa;* the adults are free-living in the burrow`.

SALINITY-collected at 30 o/oo, Coos Bay; southern Puget Sound, 27 o/oo (communication, R. Boomer).

TEMPERATURE-quite a variant: from cold temperate to warm temperate.

TIDAL LEVEL-intertidal; *Callianassa* occurs from "upper to mid-intertidal-19.

ASSOCIATES--other commensals with the ghost shrimp can include the pea crabs Sc/erop/ax and *Pinnixa,* copepods *Hemicyclops* and the red *Clausidium,* the goby *Clevelandia,* the shrimp *Betaus* (farther south), and the clam *Cryptomya* with mud shrimp *Upogebia* in California.

Quantitative Information

WEIGHT-

ABUNDANCE-MacGinitie found them in one fifth of the *Callianassa* burrows, but thought some might have escaped detection. Only one adult is found in a burrow, and no other polychaete will be resident there9.

Life History Information

REPRODUCTION

GROWTHRATE--

LONGEVITY--

FOOD-eats particles brought in with current or trapped in Callianassa burrow, and which are too big for the shrimp; occasionally it nibbles on the mucus lining of the burrow as well, which would make it parasitic, not just commensal9.

PREDATORS-

BEHAVIOR-

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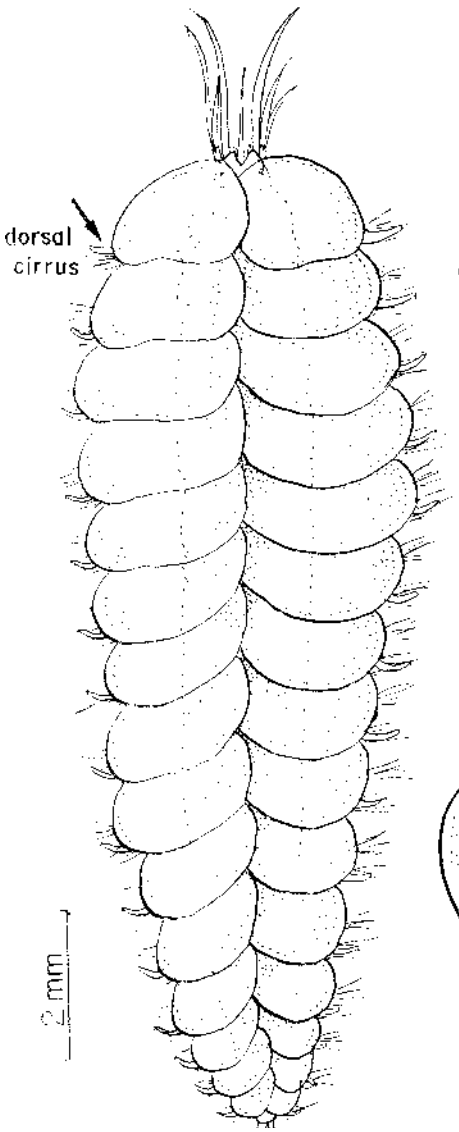
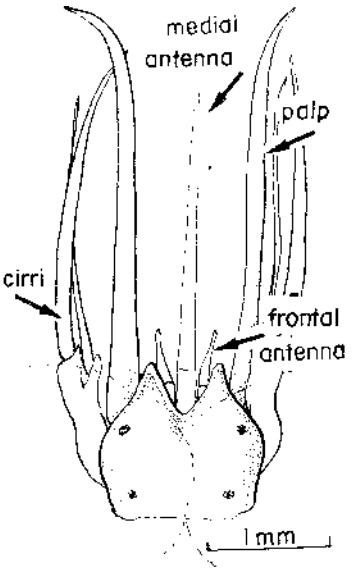
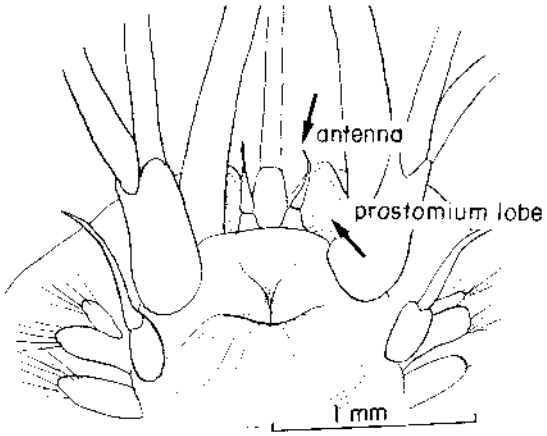
Hesperonoe comp/ono/a

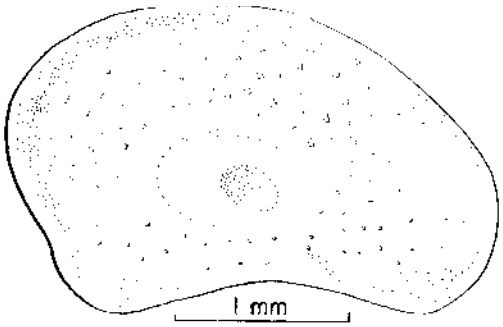




2. head, dorsal x18
two pairs of eyes;
prostomium deeply incised;
short frontal antennae, tong medial one; one pair palps,
ttwo pairs tentacular cirri



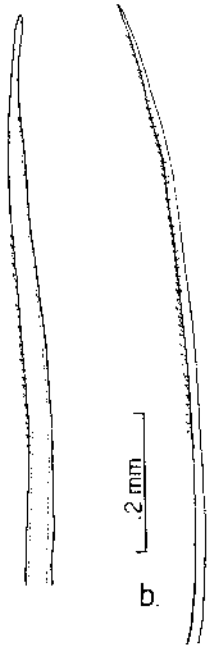
3. head, ventral x 30
antennae inserted ventral to prostomium, not terminal.



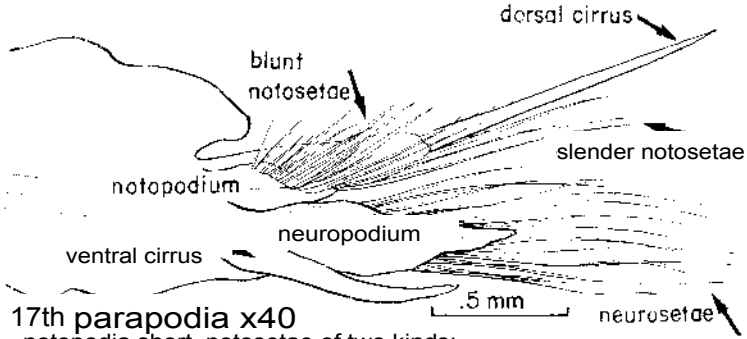
4.elytron x 25

1. ***Hesperono e compionoto*** x II

actual length 1.3 cm
15 pairs smooth elytra;
body flattened;
dorsal cirri alternate with elytra



6.ends of notosetae, x 100
a.stout, blunt, minutely serrate (both short and long)
b. long, slender, serrate.



5. 17th parapodia x40
notopodia short, notosetae of two kinds:
many stout, blunt serrate;
a few slender, pointed; serrate.
neuropodia long
neurosetae long, slender, serrate.
dor s,71 and ventral cirrus.

7.neuroseta,tip x1001
curved, simple; lateral serrations.

Eudistylia vancouveri

a feather duster worm (Kinberg, 1867)

PHYLUM: *Annelida*
CLASS: *Polychaeta*
FAMILY: *Sabellidae, Sabellinae*

Description

SIZE—one of the largest sabellids: 300-480 mm long, 15-20 mm diameter, tube up to 10 mm diameter.'

COLOR—dark red and green radially striped (5-8 stripes) crown of tentacles'; (dark red and orange or yellow in California)", some tentacles white-tipped; body buff colored, with light green markings, white spots (Coos Bay specimen); tube buff or gray.

CROWN—made up of two equal parts composed of many radioles (fig. 1), each part: base spiralled about twice; characterizing genus *Eudistylia;* crown conceals mouth and head. Edges of crown are smooth, not incised (fig. 5): distinguishes *E. vancouveri* from *E. polymorpha.*

RADIOLE—also called cirrus or tentacle: individual branch of crown; single, undivided; has forked, simple side branches or pinnules (fig. 2), and dark eyespots along the lower edge, especially near bases of radioles (fig. 2).

PROSTOMIUM—or head: reduced and indistinguishable.

BODY—thorax of eight segments, abdomen of many segments; tapers to slender pygidium (fig. 1).

THORACIC COLLAR—with four lobes (fig. 4), visible on ventral side; no long thoracic membrane. Collar is used to build tube: by incorporating sand grains with exuded mucus and attaching this "rope" to top of tube.

PARAPODIA—biramous, (figs. 1, 6) except for first, or collar segment, which has only notopodia[4]. In thoracic setigers (2-8), the notopodia have bundles of long and short slender setae (figs. 7b,c), the neuropodia have pairs of short uncini (hooks) (fig. 7a) encased in zipper-like, raised ridges called tori (fig. 6). This arrangement is inverted or reversed in the abdomen, where the notopodia contain hooks in the abdominal segments, and the neuropodia have long spines (fig. 6).

SETAE--thoracic— notopodia: two kinds: genus *Eudistylia:* long, slender, bilimbate (fig. 7b); and spatulate, not scimitar-like' (fig. 7c);
neuropodia: two kinds, in torus: pennoned or flagged setae, and avicular (bird-like) hooks or uncini (fig. 7a) arranged in a long row of about 20 pairs,
abdominal–notopodia: short avicular uncini (fig. 7e),
neuropodia: long pointed setae (fig. 7d).

TUBE—long, cylindrical, flexible, permanent, tough, leathery, membraneous; of mucus and cemented sediment, not calcareous as in Serpulidae; without operculum: animal can completely withdraw into tube (Terebellidae cannot).

Possible Misidentifications

Characteristics of the family Sabellidae are the tentacular crown of bipinnate radioles, lack of gills in the body segments, and setal types inverted in abdominal region (see *parapodia,* above). These characters they share with the Serpulidae; the family differs in having a leathery tube of mucus and sand. it lacks an operculum or trap door (serpulids have a calcareous tube and a stalked operculum like a golf tee). A serpulid example would be the introduced *Merceriella enigmatica,* a cosmopolitan fouler of brackish waters '°

Other tube worms include Terebellidae, which have soft cirri which cannot be completely retracted into the tube; they sometimes have gills on their anterior segments, and their setal types are not inverted.'

A family with an easily confusing name is the Sabellaridae, which builds sand tubes. These have 2-3 rows of palae (flattened setae) forming highly modified cephalic structures (not crowns); their bodies have easily defined thorax, abdomen and long caudal section.

Within the family Sabellidae, the subfamily Sabellinae is noted for its avicular uncini in the thoracic neuropodia, and for its permanent, tough leathery tubes_ Other genera of this subfamily include

Schizobranchia, or split branch, common in Puget Sound; a smaller worm occurring in great masses on floats; its radioles are branched, not single; it is often tan colored with a bright red crown (not striped)';

Megalomma, usually deepwater, but sometimes intertidal, with composite eyes spiraled around the ends of some of its radioles'°:

Pseudopotamilla, including three species of small, rare tube worms which share with *Eudistylia* the simple pinnate crown of radioles, but the bases of whose two crowns of tentacles are curved in a semicircle, not spiralled;

Sabella, with two lobes on its thoracic collar, not four; *S. crassicornis* has paired eyespots in deep red bands on its radioles; *S. media* lacks eyespots, and is pale colored, with red and white mottled radioles.'"

The subfamily Fabricia differs from the Sabellinae in its small size and in its temporary, fragile mucus tubes. Several northwest genera exist, including

Chone, a tiny worm with a membrane partly uniting its radioles, and a thoracic collar which is entire, not lobed; local species have 15 or fewer pairs of radioles'°,

Fabricia species have few segments and sparse radioles; they are quite small; *Oriopsis* is very like *Fabricia,* but with 7-8 abdominal segments, not 3.1°

A third subfamily of Sabellidae, the Myxicolinae, represented by the genus Myxicola, has a thick mucus sheath covering its body; its radioles are joined by a web by most of their length.

E. vancouveri and *E. polymorpha,* may in fact be the same species[9]; some believe hybridization occurs. [1°] There are two obvious differences between them: *E. polymorpha* does not have striped radioles, they are solid dark red with light tips. and the dorsal edge of its crown of radioles is not entire (fig. 5), but notched. *E. polymorpha* was originally described and figured by Johnson, 1903, as *Bispira polymorpha.* Puget Sound keys do not include this species: it may be a southern species or morph.

Ecological Information

RANGE—Alaska to central California', type locality Vancouver Island, B.C.

LOCAL DISTRIBUTION—Coos Bay—floating docks.

HABITAT—wharves, floats, sandy mudflats, as well as vertical rock faces in heavy surf.'

SALINITY—collected at full sea water in an area of heavy flushing; doesn't tolerate reduced salinity.'

TEMPERATURE—range would indicate a cold to temperate environment is best.

TIDAL LEVEL—collected on floats just below water surface: intertidal.°

ASSOCIATES—copepod *Gastrodelphys dalesi* (at Tomales Point, California); worm tubes form a complex microhabitat in which many animals and plants survive.

Quantitative Information

WEIGHT-

ABUNDANCE—gregarious: the principal sabellid in rocky habitats (Puget Sound)'; grows in large clumps, in "shrub-like masses.'"s

Life History Information

REPRODUCTION—asexual: some regeneration possible: sexual: dioecious (two sexes). Free spawners: green eggs or white sperm produced, move out through abdominal nephridial pore to ventral groove (fig. 4) and out of tube.

GROWTH RATE

LONGEVITY

FOOD—a filter feeder: plankton particles trapped by funnel of pinnules, driven by beating cilia, carried down to radiole base. sorted and ingested.

PREDATORS—used by man for fish bait.

BEHAVIOR

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3 _____ 1944 Polychaetous annelids from California, including the descriptions of two new genera and nine new species. A Hancock Pan Exped. 10 239-310 Pp 2845.

4 [1]969. Pp. 655-6, key to genera: p. 685, description and D.J. Reish, 1950 Pp 45-6.

6 Kozloff, 1974a, Pp. 74, 168. plate VI
_____ 1974b. P 114. key.

8 0 Donoghue, C.H.1924 A note on the polychaetous annelid *Eudistylia yugantea* Bush. Contr. Canad. Fish. Toronto, 1.443-53

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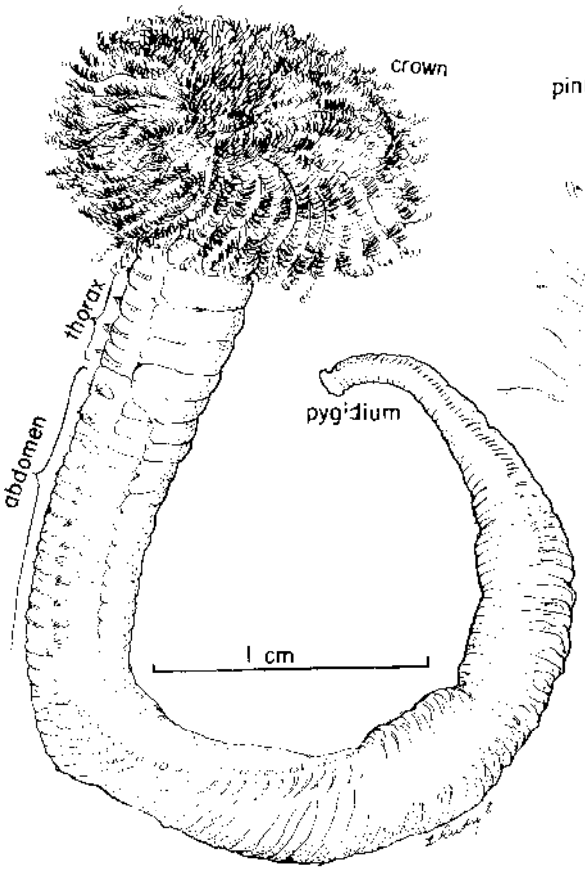
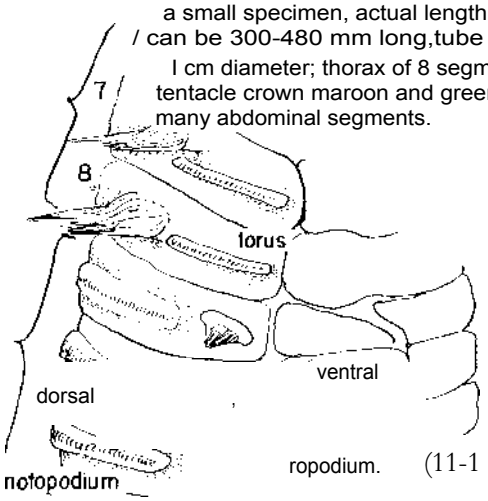
Eudistyllo vancouveri

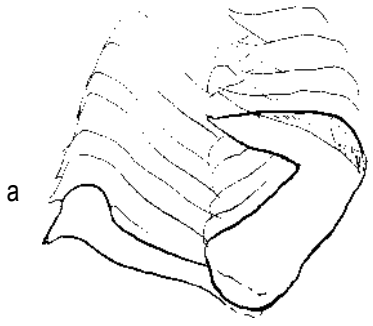


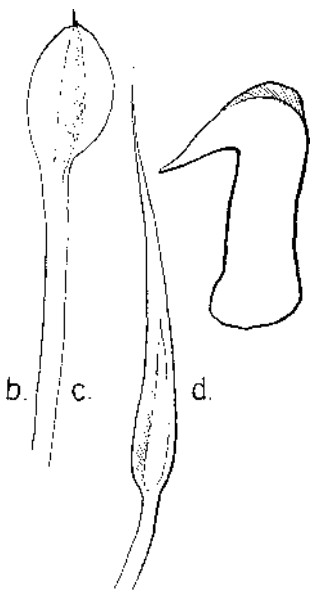
l. *Eudistylla vancouveri* x 4 {out of tube)
a small specimen, actual length 6 cm / can be 300-480 mm long,tube to l cm diameter; thorax of 8 segments; tentacle crown maroon and green striped; many abdominal segments.

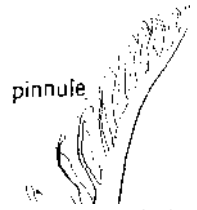


ropodium. (11-1

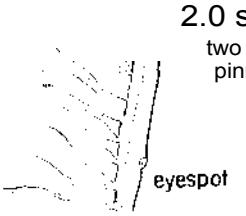
6. parapodia,.lateral x 12
thoracic: neuropodial setae in bundles, . notopodial uncini on tori ;
abdominal: notopodial setae in bundles, neuropodia l uncini on tori.

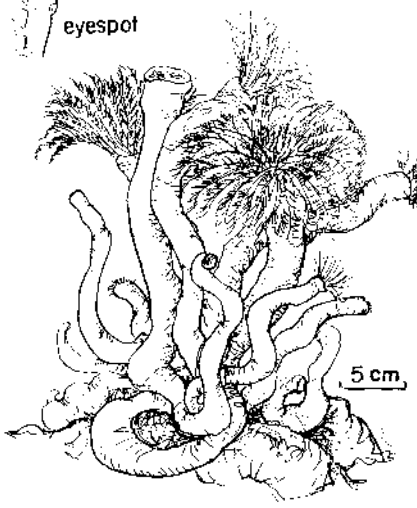




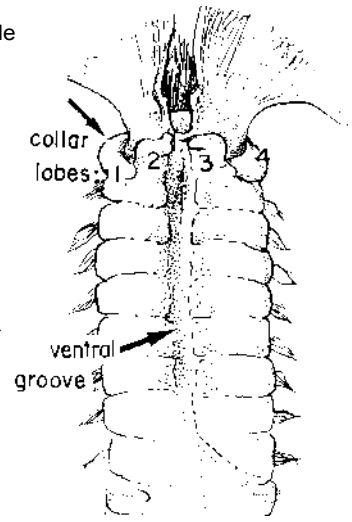


2.0 single radiole (cirrus)
two rows of side branches: simple pinnules; eyespots along rib.

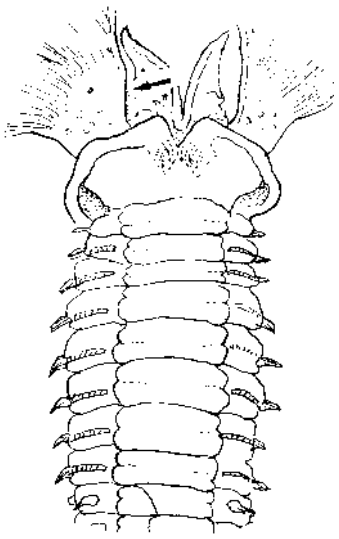




3.worms in situ x 1/5
dense,shrub-like growth.



4.anterior ventral
thoracic collar with four lobes.



5.anterior, dorsal
dorsal edge of crown without cleft.

7 setae
G. pennoned setae and avicular uncini (thoracic)
D. long, bilimbate seta} (t oracic)
C. spatulate seta h
0. pointed seta.
e. avicular uncmus (abdominal)

Boccardia proboscidea
a burrowing spionid worm Hartman, 1940

PHYLUM: *Annelida*
CLASS: *Polychaeta*
FAMILY: *Spionidae*

Description

SIZE—to 30-35 mm long, 1.5 mm wide; can extend in life.' Segments: 120-130, (fig. 1).

COLOR—yellow orange, with red branchiae; dusky areas around prostomium and parapodia.6

BODY—long, depressed, somewhat flattened, tapering posteriorly.' First setiger (segment with setae) small, with insignificant bunches of capillary setae in bunches (fig. 5a). Setiger 5 modified, with two kinds of dark, strong setae in notopodia; this setiger almost twice length of setiger four (figs. 2, 3).'

PROSTOMIUM—long, rounded, without medial groove: "snout-like," thus *proboscidea.'* 4-6 eyespots between palpal bases; caruncle (sensory organ) present (fig. 3).

PALPI—long, simple, longitudinally grooved tentacle-like structures, characteristic of family Spionidae (fig. 1).

PARAPODIA—biramous from first setiger (not lobed, small and inconspicuous); second setiger's parapodial lobes become twice as large as first's, and continue large to posterior of animal.

SETAE—all simple; include bunches of short, capillary spines to setiger six (except for modified setiger five) (figs. 5a, b). A transverse row of about 8 neuropodial uncini (hooded hooks) with bifid (two-pronged) tips begins on setiger seven and continues to posterior end (fig. 5e), with bunches of a few capillary setae below them (to the 11th setiger, where they disappear). Dorsal setae of setiger 5 are heavy, dark, and arranged vertically in two rows of five: pairs of long, falcate spines (fig. 5c), and shorter brush-topped clubs (fig. 5d). All noto-setae are capillary except for those of setiger 5.

BRANCHIAE—(gill-like structures, in this species a long, single vascular process), present on setigers two to four, and from setiger seven to near posterior end (figs. 2, 3).

PYGIDIUM—(anal end): a round, flaring disc with four unequal lobes (dorsal lobes smaller): (fig. 4).6

Possible Misidentifications

Spionid polychaetes are distinguished by their long palps. Two other families have long palps—Magelonidae, with adhesive palps, not long and flowing ones, and with flattened spade-like prostomiums; Chaetopteridae have palps, but their bodies are very obviously divided into three quite different sections.

The genus *Boccardia* is distinguished by having branchiae on the setigers anterior to five. Of these, two species have only one kind of setae on setiger five, not two kinds as in *B. proboscidea.*

B. hamata (= uncata) has recurved spines, not straight bifid uncini, on its posterior parapodia; its pygidium has two lappets. It is common in oyster beds.

B. truncata is green in color, has a saucer-like pygidium and a truncate anterior end. It is not usually estuarine.

Of those *Boccardia* species with two kinds of setae on setiger five

B. tricuspa has falcate and tridentate (not bruso-topped) setae on setiger 5; its branchiae anterior to setiger 5 are small and inconspicuous; it bores in molluscs and is usually a more southern species than *B. proboscidea.*

B. polybranchia has a notched not an entire prostomium. Its first setiger lacks notosetae; it has only 60-80 segments, and a pygidium like a thick ring. It is green and lives in estuarine mud.

Two species of *Boccardia* have both falcate and brush-topped setae on setiger five as in *B. proboscidea:*

B. berkeleyorum has no notosetae on setiger one, only neurosetae. Its bristle-topped setae (on setiger 5) have a small accessory tooth at the distal end; its posterior notopodia have acicular setae. [m] This species bores in coralline algae, hermit crab shells and the jingle shell *Pododesmus.*

B. columbiana is closest to *B. proboscoidea.* Its chief difference is that the fascicles of fine setae on setiger one are long and fanned forward; they are short on *B. proboscidea.* This species is reddish brown, and bores into wood pilings and coarse algae.

B. proboscidea was the only one of its genus found in Oregon by Hartman and Reish (1950).'

Ecological Information

RANGE—Western Canada south to southern California.'

LOCAL DISTRIBUTION—Coos Bay, several sites; outer rocky coast and offshore as well.'

HABITAT—builds vertical, U-shaped burrows in rocky shale; in *Mytilus* (mussell) colonies. Inhabits a variety of niches.'

SALINITY—collected in full sea water (30 o/oo); great toleration for salinity variation.'

TEMPERATURE—residence in tidepools evidence of temperature toleration.'

TIDAL LEVEL—high rocky intertidal pools, in crevices; sandy mudflats.'°

ASSOCIATES— Mytilus and its accompanying organisms; in rocky crevices: small, red harpacticoid copepod, *Tigriopus.'*

Quantitative Information

WEIGHT-

ABUNDANCE—the only *Boccardia* found in Oregon by Hartman and Reish, 1950'; most common member of a common family.'

Life History

REPRODUCTION—larval stages, or chaetosphaeres, found in plankton in the summer.' Eggs, in five or more capsules of 50 eggs each, are deposited in a tube, and aerated while developing by adult's rhythmic movement.'

GROWTH RATE—egg development rapid; eggs easily developed in lab; capsules in same tube often at different development stages. Settlement after some weeks as plankton.'

LONGEVITY-

FOOD—spionids feed by sweeping tentacles across surface of substrate; particles collected and wiped on underside of prostomium.' Also eats small copepods'; a voracious predator on algal particles, Bryozoa, Hydrozoa, other attached and free-swimming animals.'

PREDATORS-

BEHAVIOR—a burrower; colonial'; can be seen with tentacles protruding from burrow.'

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12 1963a Taxonomic revision of two polydond species (Annelida Polychaeta, Spionidae) Proc. Biol. Soc. Wash.. 76.209 16

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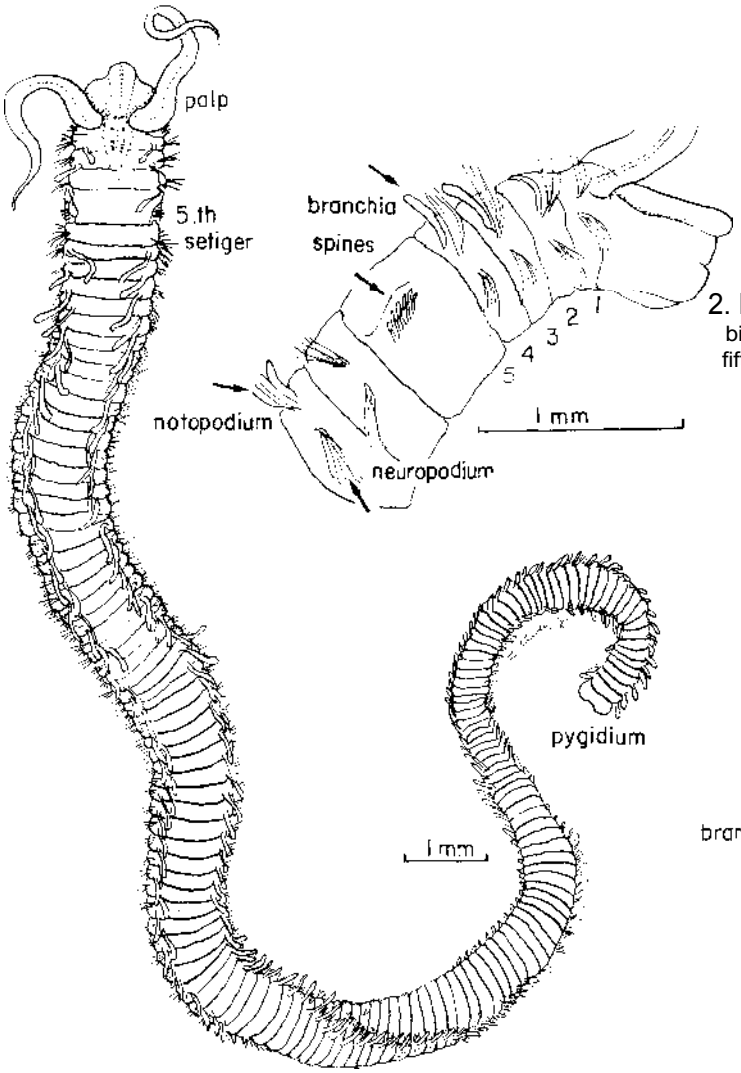
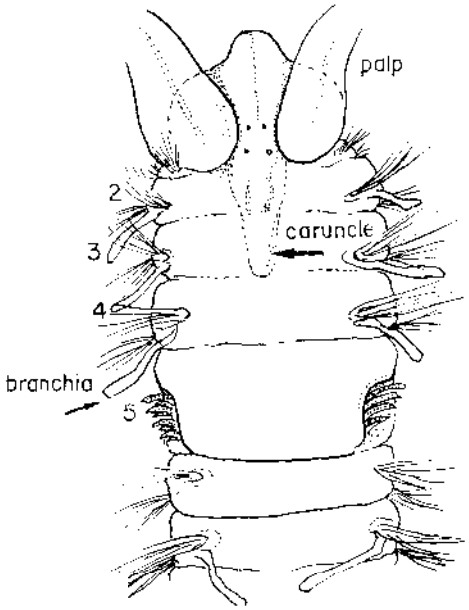
f3occardia proboscides



2. lateral view,anterior x30
biramous parapodia with branchicre,
fifth setiger wide, modified, with stout dorsal spines.

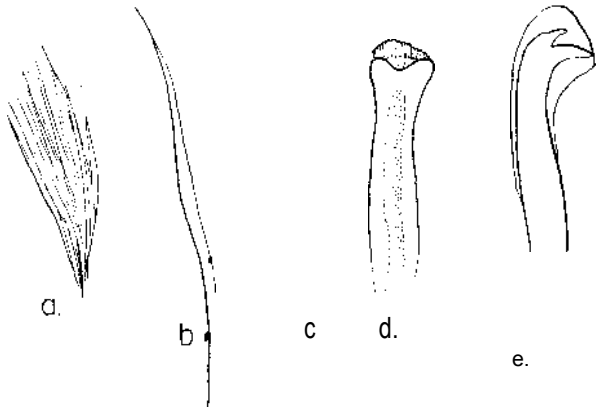


3. dorsal view, anterior x 30
prostomiurn rounded, snout-like; 4-6 **eyes;**
inconspicuous parapodia on first setiger;
setiger 5 with dorsal spines; caruncle obvious.

Boccardia proboscides x 12
actual length 30 mm, width 1.5 mm;
typical Spionid palps; body flattened,depressed;
pygidium a flaring disk.

dorsal

4. pygidium, posterior view, x 40
dorsal lobes smaller



5. setae
a rieuropodial fascicle
b. capillary from 0.
C.falciger from setiger 5
d. brush-lopped club, setiger 5
e.neuropodial hooded hook.

Polydora nuchalis
a spionid worm Woodwick, 1953

PHYLUM: *Annelida*
CLASS: Polychaeta
ORDER:
FAMILY: *Spionidae*

Description

SIZE-28 mm.

COLOR--pale orange, this specimen with a broad red vertical dorsal stripe, red cirri and in palps.

PROSTOMIUM-obvious nuchal (olfactory) tentacle, dorsally (fig. 1): prostomium blunt, tri-lobed, with two eyespots: caruncle to third segment10.

SETIGER FIVE-modified, with special setae, no post-setal lobe, a crescent shaped row of spines (fig. 4). two types of spines: simple, falcate (A) and plumose (B), fig. 3.

SETIGER SEVEN-beginning of hooded hooks on neuropodia and of strap-like branchiae (fig. 4).

BODY CHARACTERISTICS-80 segments; pygidium lacking papillae (fig. 2).

TENTACULAR PALPS-long, coiling, reaching to 25 segments (fig. 2).

Possible Misidentifications

Numerous group: 13 in genus locally, 36 in family[9]: *P. ligni,* the closest species, also has a nuchal tentacle; its branchial gills also begin on setiger 7. Its heavy spines on setiger five have an accessory tooth; its companion setae are feather-like. Its habitat is mud or water-logged wood; it is also an oyster borer[3]. All *Polydora* species have modified fifth setigers: see key[s], note habitat differences. P *elegantissima,* a boring species, has very short branchiae beginning on the eighth setiger, but rarely on the seventh, and its nuchal caruncle extends back over several segments (fig. 1). P *socialis,* common in San Francisco, also has branchiae beginning on the eighth setiger.

Ecological Information

RANGE-type locality Puget Sound.

LOCAL DISTRIBUTION -Coos Bay: South Slough.

HABITAT-SUBSTRATE-"mudflats of estuaries and bays"9; orange tubes, 2 cm long, bottom of a drainage channel, *Salicornia* marsh; (South Slough of Coos Bay); "non-calcareous substrates" 3.

SALINITY-area of collection; 10 o/oo surface waters-Coos Bay, Oregon.

TEMPERATURE-area of collection; 8°C-18°C surface waters-Coos Bay, Oregon.

TIDAL LEVEL- + 4.5 feet (South Slough of Coos Bay).

ASSOCIATES-amphipods, sphaeromid isopods, the gastropod *Ovatella,* alga *Fucus.*

Quantitative Information

WEIGHT-

ABUNDANCE-June, in plankton collections under South Slough bridge. Spionid larvae: 300/m^3: February. 4000/m3.

Life History Information

REPRODUCTION-up to 100 eggs are kept in transparent mucous capsules in chains, attached to tube walls. Only 1-8 larvae (of 100) will survive. Larvae develop 9-12 segments before they are freed to be plankton[10]. Some spionid larvae remain in plankton as long as 3 months4.

GROWTH RATE-

LONGEVITY-Po/ydora *ligni* completes life cycle in 30 days.

FOOD-detrital, collected by long palps.

PREDATORS-

BEHAVIOR-

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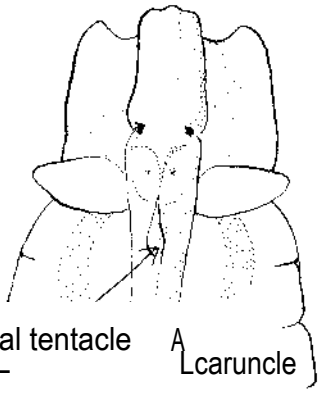
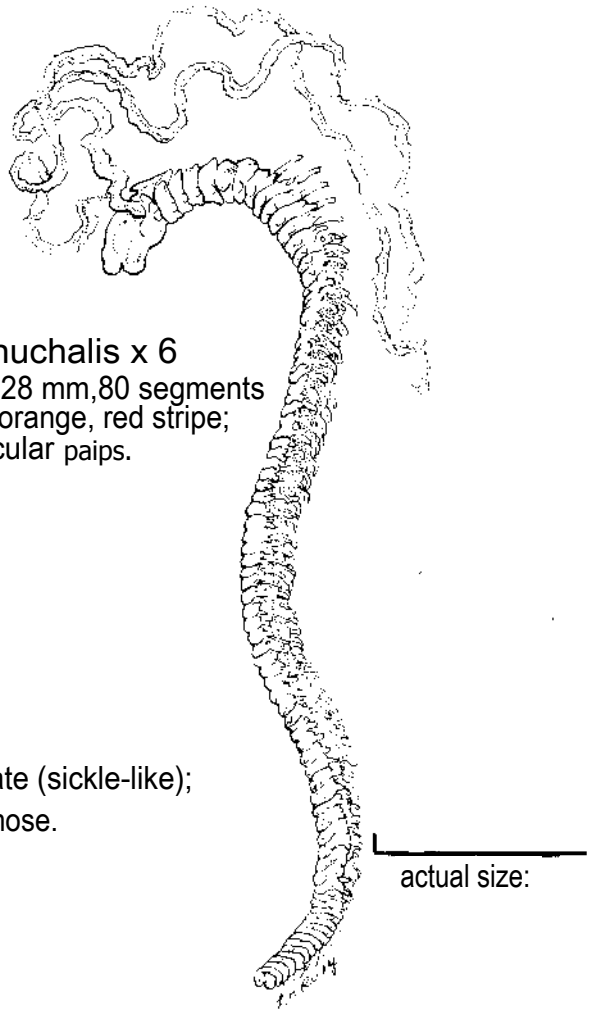
Po/yefora nucha/is

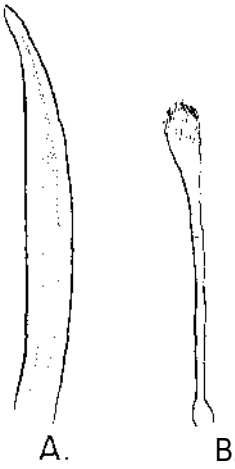


prostomium,dorsal view



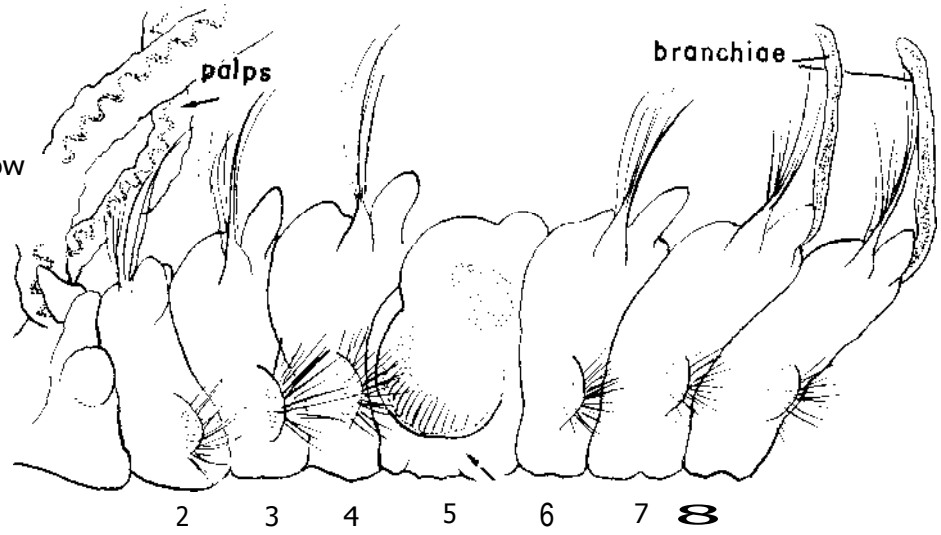
2. Po/ydoro nuchalis x 6
actual size 28 mm,80 segments
color• pale orange, red stripe;
long,tentacular paips.

actual size:



3. spines of setiger five
A. heavy spines; simple, falcate (sickle-like);
B. companion setae: fine, plumose.

4. first eight setigers, lateral view
showing modified fifth setiger with crescentic row of spines, no post setal strap-like branchiae beginning setiger seven.



Pista pacifica

Berkeley and Berkeley, 1942

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: *Terebellida*
FAMILY: *Terebellidae, Amphitritinae*

Description

SIZE-up to 15 inches (39 cm); (diameter 1.4 cm).

COLOR-anterior segments light red to brownish pink; 12 tongue-shaped maroon lobes. -scules⁻, on the first segments; ventral surface gray with ochre and light yellow spots: posterior pink and blackish; dark red branchiae, white tentacles with light gray and brown stripes.

PROSTOMIUM-a simple fold. with a hood-like membrane (fig. 2).

TENTACLES-Hong, filamentous, while. with light stripes; mucus covered.

BRANCHIAE-three pairs of dark, red, branched gills. plumose and spreading; arising dorsally from segments 2-4 [5]. Branchiae contain vascular hemoglobin which transfers oxygen to coelomic hemoglobin".

PARAPODIA-first setae on segment four (small fascicles at cuter bases of branchiae [5]); thorax with zipper-like neuropodia containing double rows of uncini (fig. 3) which are "avicular⁻ (beak-like) on first few segments, and become short-stemmed posteriorly; notopodia (fig. 2) contain capillary notosetae which are long, slender, "limbate" (winglike).

THORAX-17 setigers, (16 uncinigers) with biramous parapodia; tongue-shaped lobes, or scutes, through tenth setiger [5]; lappets: 2nd & 3rd branchial segments.

ABDOMEN-about 300 segments, with reduced neuropodia only. no notopodia: Terebellidae [2]; prominent ventral groove (fig. 2).

TUBE-Hough, large anterior overlapping membrane (often broken when animal is taken); posterior end of tube with "star of *Pista":* characteristic pattern (fig. 1).

Possible Misidentifications

The closest species is *P. elongata,* which has lappets on the second segment, but not on the third; it has no tongue-shaped lobes on the fourth segment; its tube has a sponge-like, reticulated top. Its tubes are in crevices among rocks, not in estuarine mud. *Pista cristata* (Puget Sound) has gills which form a globular mass, and is only up to 9 cm. *P. fasciata,* also from Puget Sound, has prominent prostomial lobes.

Ecological Information

RANGE-California to western Canada.

DISTRIBUTION-Oregon estuaries: (South Slough of Coos Bay), also Cape Arago coves.

HABITAT-deep mud and sand of estuaries, where it makes large tubes; eelgrass areas9.

SALINITY-

TEMPERATURE-

TIDAL LEVEL- + 0.5 to subtidal.

ASSOCIATES-commensals: polynoid worm *Halosydna brevisetosa* in tube, white "nodding heads" (entroprocts) on worm midsection.

Quantitative Information

WEIGHT-

ABUNDANCE-3.5/m^2 in eelgrass areas of South Slough'2.

Life History Information

REPRODUCTION-

GROWTH RATE-

FOOD-detritus. picked up by thread-like tentacles passed to mouth by cilia and mucus glands.

PREDATORS-

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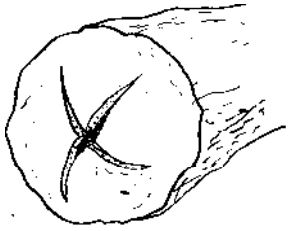
ANNELIDA

POLYCHAETA

Terebelli doe-

Pista pacifica



end of tube

2. n. 4 *pacifica* x4

tube building worm, with distinct thorax, abdomen;
long white non-retractile tentacles; three pairs red branchiae;
16 uncinigerous neuropodia, notopodia with capillary setae;
lappets on segments 2,3.

3. uncini

Thelepus crispus
a terebellid worm — Johnson, 1901

PHYLUM: *Annelida*
CLASS: *Polychaeta*
ORDER: *Terebellida*
FAMILY: *Terebellidae, Thelepinae*

Description

SIZE—length 70-200 mm[3]; greatest body width at segments 10-16: 13 mm; 88-147 segments. This specimen 120 mm.

COLOR--pinkish orange and cream; bright red branchiae, gray tentacles and periostomium, dark pink prostomium (this SpeCircen, Coos Bay).

BODY SHAPE---rather stout; two distinct sections: a distinct tiora.x neuro- and notopodia, and a tapering abdomen with only neuropodia.

PROSTOMIUM ---head reduced, with ample dorsal flap transiersely corrugated dorsally; no eyespots (fig. 5).

PERISTOMIUM—(segment 1): with circlet of strongly grooved, unbranched tentacles (fig. 5) which cannot be retracted fully2: as in Ampharetidae, for example).

THORAX—well over 25 segments': anterior end not greatly enlarged. Thoracic ventral plates not clearly distinguishable (as in *Pista)* and do not extend into "lappets."

BRANCHIAE------present: subfamily Thelepinae[3]; three pairs, filiform; on segments 2_ 3, and 4; each with many slender single fila ments.

NOTOSETAE —lrom second branchial segment (third body segment): continuing almost to end of body (to 14th segment from end in mature specimens). Notosetae appear as groups of long capillary setae in raised parapodia (figs. 1, 5); each seta is limbate (winɡ-shaped), with smooth margins (fig. 2).

NEUROSETAE—ali short handled, avicular (bird-like) uncini, imbedded in a single row on oval-shaped tori (neuropodia) (figs. 3, 5). Single row curves into a hook, then a ring in latter segments (fig. 3). Each uncinus a thick, short fang surmounted by a few small teeth (2 in this specimen) (fig. 4). Uncini begin on fifth body segment (third setiger). (Authors differ: Johnson' and Hartman" have uncini beginning on setiger *2).*

TUBE--of coarse sand and gravel over a chitinized base: attached to shell or rock, or within empty pholad burrows.

Possible Misidentifications

The Terebellidae are one of a number of tube-building polychaete families with soft tentacles for deposit feeding and with gills on their anterior segments.'° Many terebellids occur in our Northwest bays. All of them have bodies with numerous segments and two distinct regions, a tapering abdomen wan neurosetae only and both capillary setae and uncinigerous tori on the thorax.' They all have a modified and reduced head with the prostomium and periostomium at least partly fused, and many non-retractible filiform tentacles emerging from the folded orostomium.

The subfamily Thelepinae always have branchiae[3] and uncini which occur in single rows which may curve around into a circle Other genera in this subfamily include *Streblosoma* and Ilarfieva. The !atter does not occur in our area.

Streblosoma has uncini arranged in single straight rows throughout the body, not changing into a depressed ring as in *Thelepus crispus.* It, too, has three pairs of branchiae; its notosetae begin on the first branchial segment, not on the second This species has many eyespots (T *crispus* does not): its tube is tightly coiled, and it has a small number of tentacles its ventral plates are conspicuous.

Streblosoma ba/rdi, reported from Puget Sound," is small (to 80 mm), with only 30-40 setigers, a fragile posterior, notosetae beginning on Me first branchial segment, and uncinal tori which become projecting rectangular

There are three other species of *Thelepus* which might occur in our area:

Thelepus hamatus is a small, delicate terebellid, about 50 mm long, with only a few thick, deeply grooved tentacles. it has only two pairs of branchiae, with few filaments. It is orange and probably subtidal and below in distribution.

Thelepus setosus, a cosmopolitan terebellid, is distinguished from T. *crispus* chiefly because all of its uncini are in single rows which do *not* curve into rings as in T. *crispus;* the uncini are on projecting rectangular pinnules as in T. *harratus* ' *setosus* has three pairs of branchiae, and capillaries beodsdng on the third segment as in T. *crispus.* T. *setosus* has conspicuous black eyespots behind the tentacle bases, noticeable ventral plates (about 20): and a long narrow posterior it is yellow to brown, with red branchiae and orange-brown tentacles.

Thelepus cincinnatus (Fabricius, 1780), found in Puget Sound,' has capillary setae beginning on the third segmeiii'. and only two pairs of gills. No other references can be found for this animal.

Ecological Information

RANGE--Alaska south to California.

LOCAL DISTRIBUTION--Coos Bay: Pigeon Point: also at many stations inside and outside the bay, and from Yaquina Bay.'

HABITAT—attaches its tube to undersides of rocks, shells: found in Coos Bay in empty pholad burrows.

SALINITY—collected at 30 o/oo salt: found in lower parrs of bays where salinity is not likely to be reduced.

TEMPERATURE

TIDAL LEVEL—intertidal.

ASSOCIATES—nearly all specimens had the polynoid polychaete *,Halosydna brevisetosa* inside the tube (Coos Bay). In its under-rock habitat in mudflats of bays: *Cancer* orecor)ensis, burrowing clams *Aduia. Penitella.*

Quantitative Information

WEIGHT-

ABUNDANCE—can be fairly abundant within its narrow requirements. One of the most common intertidal terebellids.1'

Life History Information

REPRODUCTION--

LONGEVITY--

FOOD—a deposit feeder, trapping detritus particles with its tentacles, passing food in a mucus film along tentacle gi doves and into the mouth.

PREDATORS--

BEH AVIOR

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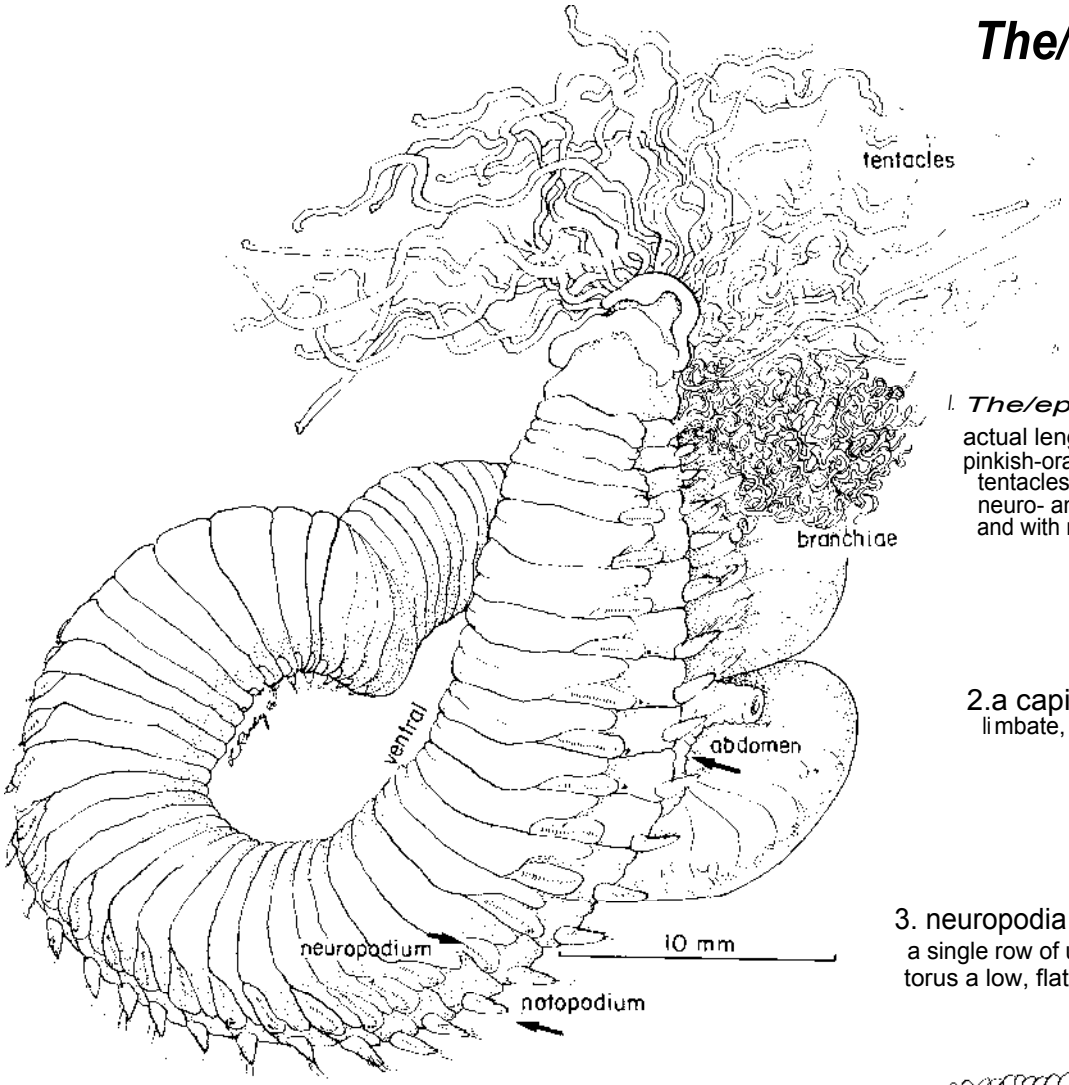
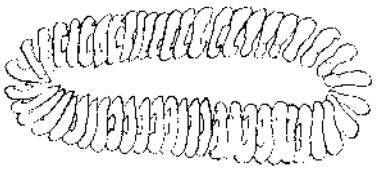
The/epus crispus

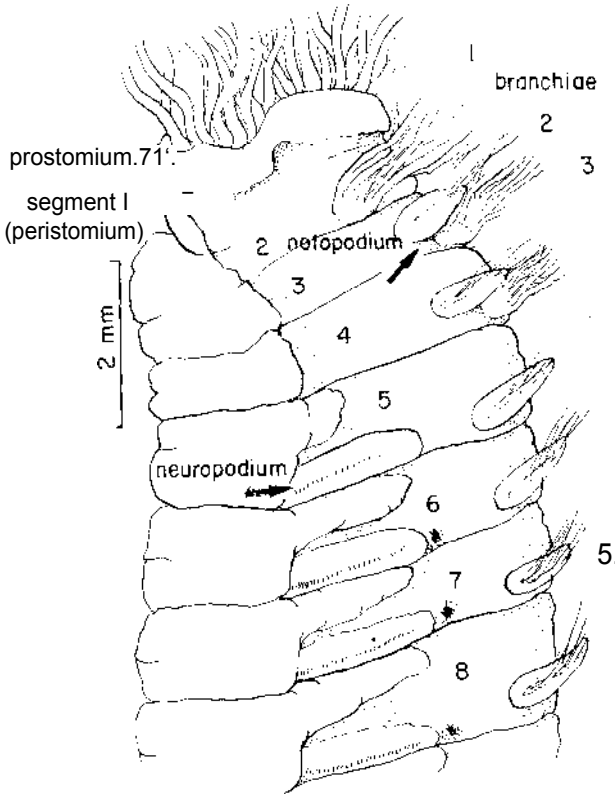


1. *The/epus crispus* x 4
actual length 120 mm; 130 segments; pinkish-orange, red branchiae, whitish tentacles; many thoracic segments with neuro- and notosetae; abdomen short and with neuropodia only.

2.a capillary notoseta
limbate, on thoracic setigers.

3. neuropodia I torus, medial x 90
a single row of uncini curved into a ring; torus a low, flat oval.





4 single uncinus
large avicular fang with small teeth above it; short handled.

5. anterior segments x 12
branchiae: 3 pairs beginning segment 2; capillary notosetae begin segment 3; unainigerous tori begin segment 5.

Semthalanus cariosus (= Balanus cariosus)
a thatched barnacle (Pallas, 1788)

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Ciropedia*
ORDER, *Thoracica, Balanomorpha*
FAMILY: *Archaeobalanidae*

Description

SIZE—largest: to 75 mm diameter,' 80 mm high; variable, especially in cylindrical specimens on vertical surfaces. Can grow to 100 mm high and only 15 mm wide (Puget Sound).12

COLOR----dirty white, gray: round or uncrowded specimens chalky white: tergum beak can be purple", cirri brown to almost black.

SHAPE—normally conical (fig. 2); can be cylindrical if crowded.

BASE—membraneous, in contrast to most barnacles which have calcareous bases (and the only North American *Balanus* thus") Base forms starry pattern (fig, 3), especially in juveniles'

PLATES—six, unequal, calcareous, with narrow longitudinal spines, giving it a unique thatched appearance (fig. 1). Crowded, cylindrical specimens often lack spines.' Rostrum overlaps adjacent lateral plates family Balanidaa [8] Radii narrow.'

WALL---formed by plates (parretes): thick when normal, thin when crowded: internal surface usually with faint ribs, or wrinkled' (fig. 41

ORIFICE—small in conical specimens, large in cylindrical ones'; can be deeply toothed (fig. 1).

LONGITUDINAL TUBES—in walls: irregular (fig. 4); with cross-septa.. sometimes filled with powder.12

OPERCULAR PLATES (TERGUM, SCUTUM)—thin' (figs. 5, 6):

SCUTUM—exterior with low growth ridges, the lower ridges fringed with membrane, usually with a weak longitudinal striation. Interior: a small, well-reflexed articular ridge, which is continued as a sharp, high, curved adductor ridge (in some specimens, adductor ridge is very weak). Depressor muscle pit deep and rather large, often divided by one or two ridges: occludent margin with 3-5 oblique coarse teeth' (fig, 5a, 6a).

TERGUM--very narrow, beaked; furrow narrow; articular ridge long and acute, spur very narrow and long, [12] continuing as a raised ridge on the inside, strongly developed depressor muscle crests (figs. 5b. 6b)

BODY--six pairs of feeding cirri: brown or almost black.

JUVENILES--usually up to 10 mm: star-shaped; 2-3 prominent ribs on Carina, 1 on carinolateral, 3 or 4 on lateral and rostrum. orifice very small.'

Possible Misidentifications

The southern thatched barnacle, *Tetraciita,* is superficially much like *B. cariosus,* but it has only four plates, and is found only in warm seas, one species, T *squamosa,* lives as far north as San Francisco."

In its 'normal' form. and in an isolated specimen, *B. cariosus,* with its splinter-like spines, is not likely to be confused with another barnacle However, where it is crowded or eroded. these spines may be worn off or not developed, and the barnacle would have to be identified by its tergum and Scutum, and by its unusual membraneous base, which is unique *B. cariosus* is often found with *B crenatus,* and especially with *B. glandula,* as well as with *Chthamalds daTh.*

Juvenile *B. cariosus* will show a typical heavy ribbing and starry outline, which would distinguish it from young *B. crenatus* or *B. glandula.* Adult *B. cariosus* have terga with a long pointed spur, quite different from either *B. crenatus* or *B. glandula.* Generally, these latter two species are found higher in the intertidal than is *B. cariosus,* which occurs mostly subtidally

The giant barnacle, *Balanus nubilus,* would be most likely to be confused with *B. cariosus* at subtidal levels. Both species. as juveniles, have strong ribs: *B. cariosus* has the characteristic starry border, however, that *B. nutrilus* lacks. Both species have a tergal plate with a long spur, but that of *B. cariosus* is pointed, *B nubilus's* is truncate. The cirri of *B. cariosus* are conspicuous for being almost black.

Ecological Information

RANGE—Bering Sea south to Morro Bay, California [10]: Japan. Type locality: Kuril Islands.

LOCAL DISTRIBUTION—outer rocky coast and protected sites in Oregon Bays; Coos Bay: floating docks near Charleston,

HABITAT—hard surface needed for attachment: ie. rock, shell, wood. Southern specimens prefer protected spots: deep crevices, overhanging ledges, but like strong current.' [3] Puget Sound animals live exclusively in oceanic conditions; Coos Bay floating docks (under water). Maintains itself under nearly identical conditions everywhere."

SALINITY—collected at 30 0/00; prefers full sea water.

TEMPERATURE—occurs in temperate waters.

TIDAL LEVEL—from high in splash zone in outer bay with wave action (Coast Guard Boat House, Coos Bay) to more protected areas farther up bay: also found in low zone and subtidally. Predation be sea stars may determine lower limit of range', possibly incapable of handling dessication at higher tide levels'

ASSOCIATES--commonly grows below *B. giandula,* but this barnacle often found growing on *B. cariosus.* Often grows on *Mytilus californianus,* with *Littorina scututata* (outer coast); with *B. crenatus* and goose barnacle *Lepas pectinata pacifica:* also with *Chthamalus dalli* and goose barnacle *Pollicipes polymerus* (outer coast).' In Coos Bay, with masses of tube worm *Eudistylia.*

Quantitative Information

WEIGHT--

ABUNDANCE— commonest barnacle of estuarine low zone": 'lead pencil' (tall, crowded) variety can be as dense as 15,000/m [2] [13]: highest density at Coast Guard Boat House, Coos Head: 270 20/cm'.9

Life History Information

REPRODUCTION---breeding mostly spring and summer; hermaphroditic. cross-fertilization occurs in usual crowded sites: self-fertilization probably occurs in isolated individuals." Young reieased as nauplii, which have six stages, developing into the nonfeeding cyprid larvae, which settle and attach, then develop into adults,'

GROWTH --

LONGEVITY--may live to 10-15 years.i°
about three years at low intertidal".

FOOD—plankton, detritus, strained by cirri

PREDATORS--heavily preyed upon by sea star *Pisaster,* particularly in its lower range': other predators include gastropod *Thais,* nemertean *Emplectonerna gracilus* birds

BEHAVIOR—unusual life cycle for a crustacean. building a calcareous shell, settling on its head and kicking food into its mouth with its feet.

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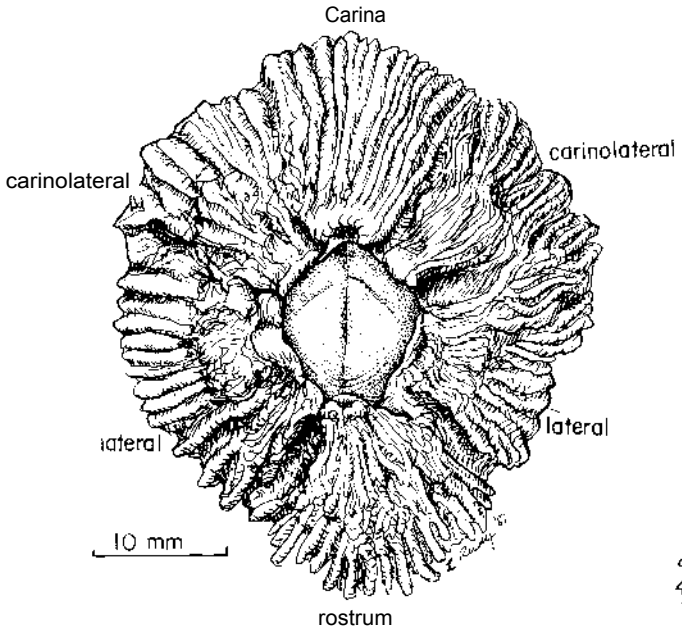
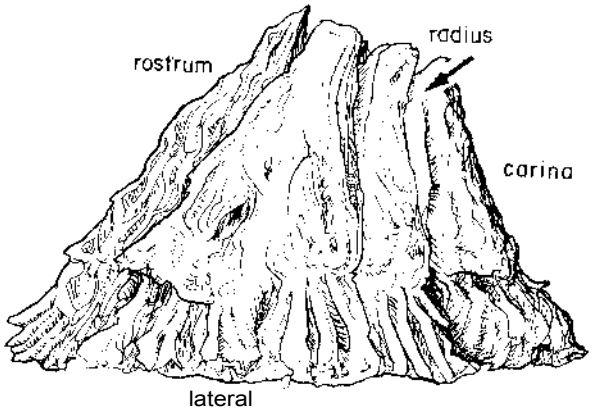
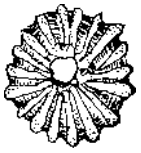


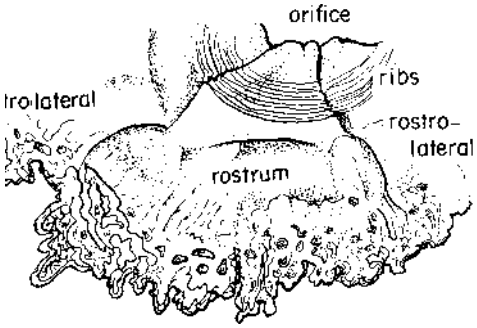
1. Semiba/anus cartosus x 2, dorsal
actual diameter: length 40 mm, width 35 mm; many long spines:thatch-1 ike,• six plates: rostrum overlaps laterals; small orifice.



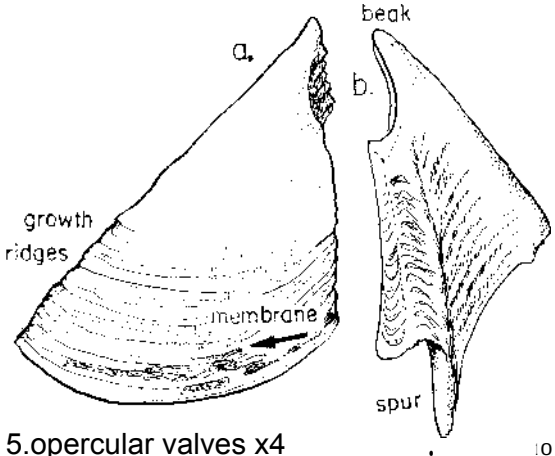
2. lateral
conical shape; thick wall; narrow radii.



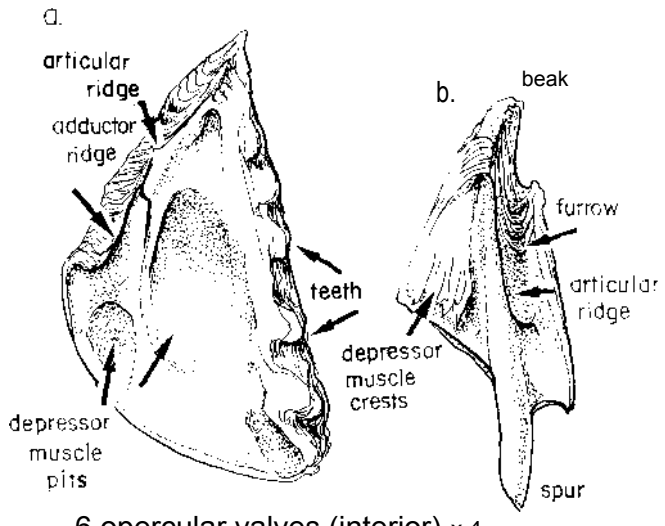
3.young, dorsal x 2
star-shaped border; prominent ribs,few in number.



4. wall, interior (posterior view)
basal edges: rostra! and lateral plates



5.opercular valves x4 (exterior) right
ascutum
low growth ridges, lower ones membranous; weak longitudinal striations.
b.tergum
narrow, beaked; long spur.



6.opercular valves (interior) x 4
a. scutum
small, reflexed articular ridge; sharp, high adductor ridge; deep depressor muscle pit; coarse teeth on occludent margin.
b.tergum
narrow furrow; long, acute articular ridge; spur a raised ridge; strong depressor muscle crests.

Balanus crenatus
the crenelated barnacle Bruguiére, 1789

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Cirripedia*
ORDER: *Thoracica, Balanornorpha*
FAMILY: *Balanidae*

Description

SIZE-small, rarely more than one half inch diameter', average about 14 mm.[2] Largest found 28 mm.4

COLOR--white with yellowish epidermis[3]; exterior without colored markings'[1]; can be rough or smooth; varies g reatly4

SHAPE--Alaskan species are generally rugose, Oregon animals smooth. Conical, but can be cylindrical if crowded.

BASE-calcareous, attaching animal to substrate: sessile-suborder Balanomorpha.

PLATES-calcareous; six plates with rostrum overlapping adjacent lateral plates (fig. 3a, *Balanus glandula):* family Balanidae.

WALL-formed by six unequal plates; carinai edge of wail projects forward over base (fig. 3); radii narrow; internal surface of wall ribbed horizontally (fig. 4); lower inner wall can be ribbed, smooth, rough, or plicated.4

ORIFICE-large, rhomboidal (fig. 1); internal edge projects inward in some specimens: Darwin, in 10.

LONGITUDINAL TUBES-in parietes (walls), visible if wall is broken (fig. 4): in single row, uniformly sp3cer1.[1] ' Sc,rne specimens can have cross-septa in upper part of wail.

OPERCULAR VALVES (TERGUM, SCUTUM)-seen in orifice (fig. 1): one pair of scuta opposite rostrum, a pair of terga at carinal end of orifice; growth lines in both valves are not highly prominent.

SCUTUM-lacks adductor ridge; small, flattened beaks (not peaked), and a shallow adductor muscle pit, a well-developed articular ridge (fig. 5b).

TERGUM--a short spur wider than long which occupies at least '/2 of basal margin"; a long, high, articular ridge and a deep furrow beside it (fig. 5a).[5] A narrow tergal spur is characteristic of *B.* c. *curviscutum* from Alaska and Washington.2

BODY-six pairs of cream-colored feeding cirri, penis (fig. 2); body rust-colored.

Possible Misidentifications

Balanus crenatus is a difficult barnacle to identify, even for a barnacle: " Not only does every external character vary greatly in most species, but the internal parts very often vary to a surprising degree; and to add to the difficulty, groups of specimens not rarely vary in the same manner": Charles Darwin, in [2]. *B. crenatus* is generally found in the intertidal at a lower level than the ubiquitous and easily confused *B. glandula.* This latter has no longitudinal wall tubes (except when young!), and its terga and scuta are different (see *B. glandula,* opercular valves): the terga have shorter spurs, the scuta have an adductor ridge.

Balanus improvisus shares many of the same characteristics of *B. crenatus."* Its scuta, however, have a long spur. It is an introduced species, found only in brackish water.

Balanus cariosus, another northwest species, is large and has a thatched appearance; *B. nubilis,* subtidal and very large, has a ribbed surface and usually some surface coloration. *B. hesperius,* a northern species, has wide radii, H.rond interior ribbing, and no wall tubes. *B. balanus pugete^sis* small and smooth: it has wide radii and shingle-like sod a.1 ridges. *B. rostratus alaskensis,* another Puget Sound species. is much like *B. balanus pugetensis;* it has a small orifice. and t a verse septa in its longitudinal wall tubes; its tergurn is beaked t can be brown, and may be over 5 cm in diameter.'

Ecological Information

RANGE-North Atlantic; Pacific from Bering Sea to Santa Barbara, California. Type locality: English coast; common in the fossil record.

LOCAL DISTRIBUTION --protected waters of most Northwest bays; Coos Bay: many stations.

HABITAT-pilings, worm tubes, mollusc and crab shells boat bottoms; amid eelgrass and debris. Light does not affect growth, fertilization or embryo development. [8]

SALINITY-collected at 30 0/00; usually in full seawater. but found once on Vancouver Island in brackish water."

TEMPERATURE--found in cold and temperate waters.

TIDAL LEVEL-low intertidal down to 90 fathoms; but from shallower waters in Pacific.10

ASSOCIATES-B. *glandula, B. cariosus* (British Columbia3), *Chthamalus dalli* (Puget Sound).[4] In mud and eelgrass: amphipods, littorine snails, isopods, *B. glandula, Mytilus adults* (South Slough),

Quantitative Information

WEIGHT-

ABUNDANCE- quite common[2]; sessile barnacles: most common of all invertebrate animals on rocky shores:2

Life History Information

REPRODUCTION-internal fertilization: usually hermaphroditic. but some writers question whether self-fertilization possible.' (See *B. glandula* reproduction) Has two broods year even at southern edge of range,' Larvae spend 2-3 weeks Hi the plankton [8]

GROWTH-

LONGEVITY-

FOOD--

PREDATORS-

BEHAVIOR-

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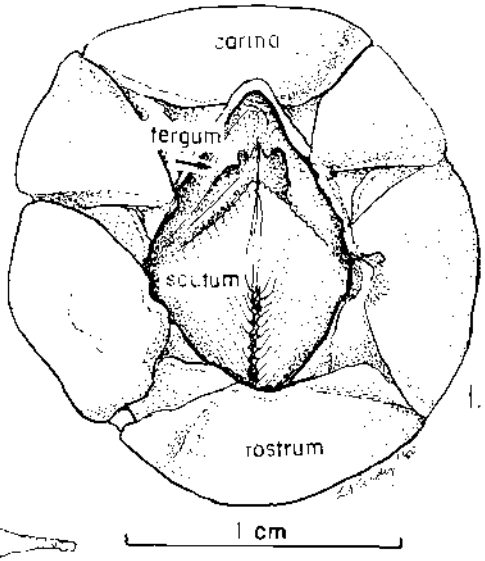
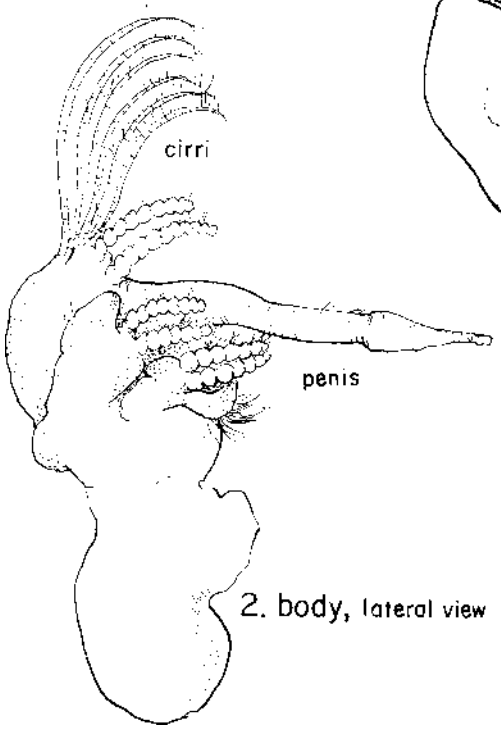
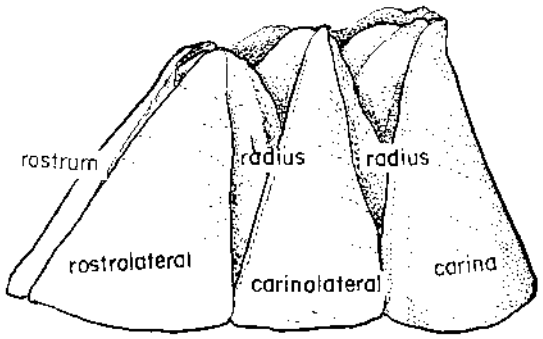
Bo/anus crenatus



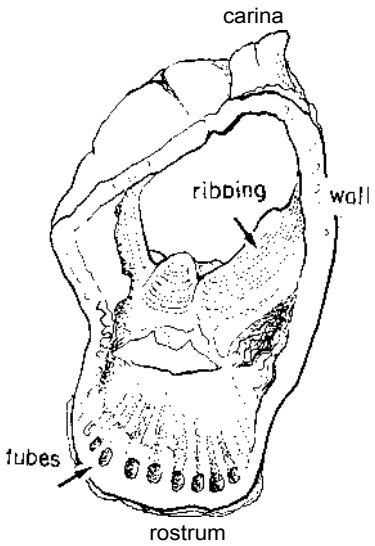
1. *Ba/anus crenatus* x 4
actual diameter 17 mm
six plates;rostrum overlaps rostrolaterals;
orifice large, rhomboidal; opercular valves
(tergum, scutum) in pairs; exterior smooth.



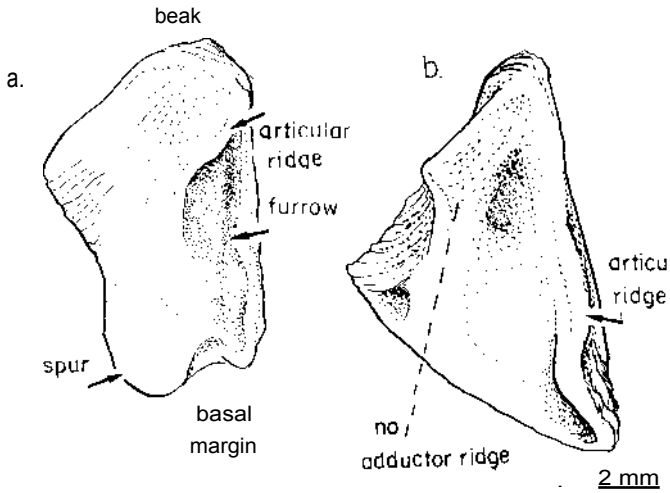
2. body, lateral view



3. lateral view, x 4
narrow radii



4. posterior view, x 4
walk single row longitudinal tubes
horizontal ribbing, upper walls.



5. opercular valves, x 12
a. tergum, right, interior
beak flat; spur half width basal margin;

b. SCUIUM, right, interior
strong articular ridge, no adductor ridge

Balanus (Balanus) glandula
common acorn barnacle Darwin, 1854

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Cirripedia*
ORDER: *Thoracica, Balanomorpha*
FAMILY: *Balanidae*

Description

SIZE-up to 1.5 cm in diameter: usually less than one half inch12.

COLOR-usually white, often irregular, eroded

,SE--calcareous, attaches animal to substrate, making it a or attached barnacle: the Balanomorpha.

PLATES-calcareous, nearly conical, columnar. Six in family Ba-'alidae. each plate composed of the paries (pl. parietes), the exnised triangular part (fig. 3a, 3b): edges are called ala (pl. alae) Alhen they are over-lapped by an adjacent plate, or called *radius* ·,hen the edge is marked off from the paries by a definite change direction of growth lines (fig. 3b)[13]. The plates themselves are ailed the *rostrum* (which has radii, not alae), opposite it, the 6ariiia, which has alae. Between carina and rostrum are four she P lates, the *carinolateral* and *rostrolateral* plates.

WALL-forrned by the six plates (fig 2), composed of irregular, vetcal, filled tubes, giving the exterior the appearance of rough ribbing.

01 **ERCULAR VALVES-two** pairs of movable plates inside the well. which close the aperture, and are called the *tergum* (pl. tEr.ija), at the carinai (posterior) end of the animal, and the *sof:turn* (pl. scuta) toward the rostral (anterior) end (fig. 3a). ,)e terga are the upper, smaller plate pair. Each tergum (in *E:7 1anus glandula)* has a short spur at its base (fig. 4), deep c,ests for depressor muscles, a prominent articular ridge, ash an articular furrow". The scuta (Latin: shield), have a pit on either side of a short adductor ridge (fig. 5), fine growth ria;ges, and a prominent articular ridge.

LtODY--six pairs of black and white cirri (feeding appendages) tfe! noticeable, (fig. 1).

.itiVENILES--wall consists of empty vertical tubes, which only cec,orne filled and irregular in adult.

Possible Misidentifications

Juvenile *Balanus glandula* and *Chthamalus dalli,* often found together, are very alike. The genus *Chthamalus* has aloe on its rostra) plates, not radii *(ie.* the rostral plate is overlapped by the rostrolateral plates). *Chthamalus* are usually brown.

Balanus crenatus is found at lower tide levels than is *B. c/Qndula.* It differs in structure of terga and scuta: the tergal spur is very wide, the scutum has no adductor ridge13.

B. cariosus has a thatched appearance, being irregularly ribbed: its wails have uneven, longitudinal tubes'".

Ecological Information

RANGE--Alaska to Baja California.

CISTRIBUTION--ubiquitous[6]: open rocky shores, salty bays of the Ore g on coast.

HABITAT-very adaptable: rocks, pilings, wood; on crustaceans, -Tl-kscs, other barnacles. Often in conditions of extreme expo- ure to sun, wind, rain[12]. Can tolerate estuarine quiet as well, ncluding conditions of poor water circulation, low oxygen, and little wave action12.

3ALINITY-- collected at 30 o/oo. Can survive at low salinities Si-,elforrf)[12]. Resists desiccation better than other *Balanus9.*

TEMPERATURE--survives at a wide range.

TIDAL LEVEL-one of the most important zonation indicators; very small barnacles often settle high in the dry uppermost zone, below *L.Worina [12],* most common from high to mid-tide3.

0=CES--Collisella *digitalis* (limpet) at high tide levels; mussels. other limpets. Sometimes found on the larger Balanus cariosus: red algae *Endocladia* is found in the well-known association above the *fvlytilus* zone, with almost 100 multicellular organisms9.

Quantitative Information

WEIGHT —

ABUNDANCE-one of the most abundant single animals on the coast; can be like cells in a honeycomb [12]; up to 70,000 per square meter12.

Life History Information

REPRODUCTION-2-6 broods/year, winter and spring s, internal fertilization *(ie.* copulation) necessary; hermaphroditic. Self fertilization possible[13]; hut: not self-fertilizing and thus isolated individuals sterile [14]. Eggs, embryos retained within parent's shell, discharged as nauplius after four months'". Animals from upper tidal levels spawn during second year; those from lower areas the first year'". Few spawn in very sheltered waters. Ascorbic acid in water stimulates copulation (communication R. Boomer).

GROWTH-six nauplius stages"; last is the cypris, a non-feeding stage which attaches to a substrate by its antennae, secretes a cement, and begins building calcareous she1112. Molts like other crustaceans by shedding thin exoskeleton of animal, not shell. Cypris needs rough surface, shade. for settlement".

GROWTH RATE---those which settle lowest grow fastest first year, but after that, those higher lead in growth". Basal diameters 7-12 mm 1 yr., 10-16 mm in 2 yrs.. 14-17 mm in 3 yrs.9

LONGEVITY-- 8-10 years

FOOD--to paraphrase T H. Huxley, they stand on their heads and kick food into their mouths [14]. Food is strained from incoming currents by several pairs of cirri (fig. 1), it consists of plankton, some detritus.

PREDATORS-snail *Nucella,* at low tide levels. Starfishes, worms (on juveniles); birds; occasionally man: Northwest Indians[9]; plankton feeders, including fish, feed on the larvae.

BEHAVIOR-entire life cycle unusual tor a crustacean. from settlement on its head to building an exterior calcareous shell. to feeding behavior. Young cyprids can search out settling area.

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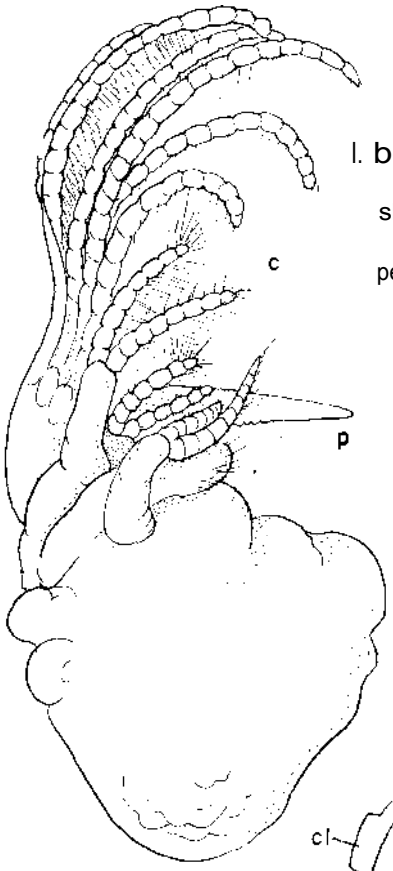
ARTHROFODA, Crustacea

Cirripedia, Thoracica,

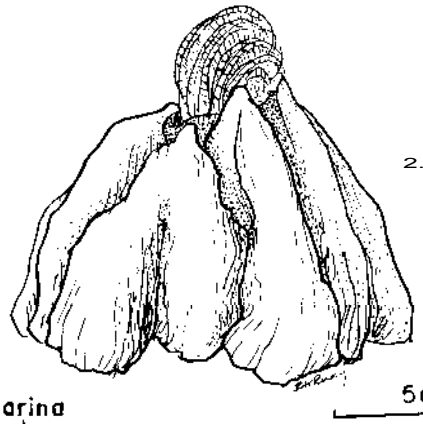
Balanomorpha, Balanidae

Bedanus glanduba

common acorn barnacle

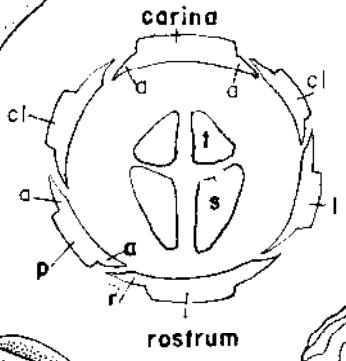


l. body
lateral view,
showing six pairs
cirri=c,
penis= pi,

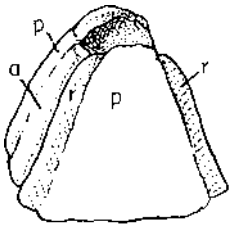


2. Bo/onus q/andu/a 5x
size to 1.5 cm; six plates;
color: white, walls eroded,
black and white cirri.

5cm

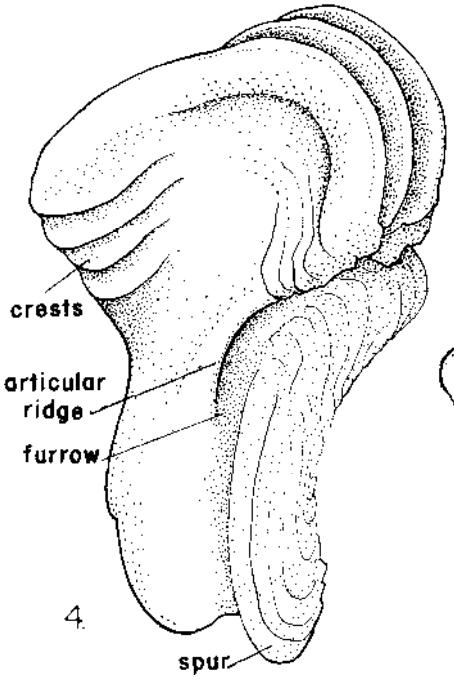


A.

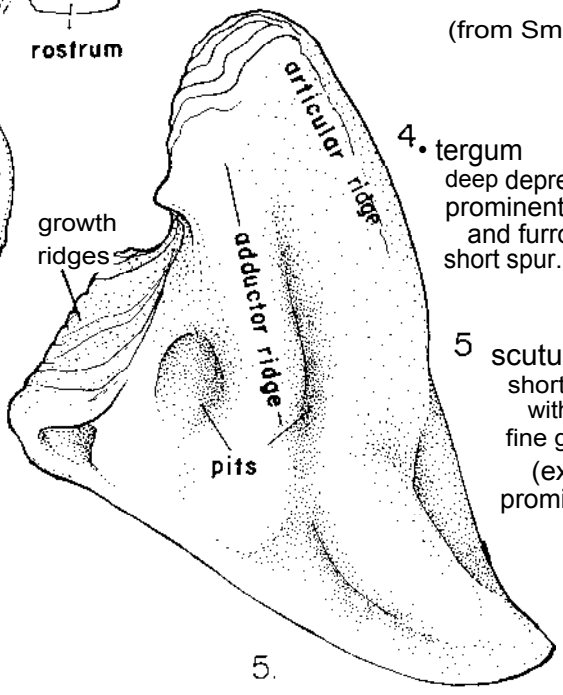


3 plate arrangement
(schematic cross-section)
in Bolanidae, rostrum
overlaps lateral plates;
t=tergum, s=scutum,
r= midi us, a= a la, p= ponies
cl = carinolateral, l =1lateral.

(from Smith and Carlton, 1975).



4.



5.

4. tergum
deep depressor muscle crests;
prominent articular ridge
and furrow;
short spur.

5 scutum
short adductor ridge
with pit on each side;
fine growth ridges,
(exterior)
prominent articular ridge.

ru S nubilus
the giant barnacle — Darwin, 1854

PHYLUM. *Arthropoda*
CLASS: *Crustacea. Cirripedia*
ORDER: Thoracic:a, Balarrcrmorc!1 u
FAMILY: *Balanidae*

Description

SIZE---up to 100 mm in diameter, and nearly as high: illustrated specimen. Coos Bay: 90 mm. Largest barnacle on Pacific coast. probably in world.' 2

COLOR .-dirty white; interior of scuta and terga, buff; tergal :deaf odrple tipped.2

BASE - --caicareous. attaching animal to substrate: sessile' . 9 er Ealanomorpha. Base thick., porous at edges. thin at

PLATES-- -six. unequal, with rostrum overlapping rostrolateral plates. family Balanidae (see *B. glanduta plates* for definitions). !Iir er-nal furfac,es with fine horizontal ribbing above, smooth hear base (older specimens) " Radii rather narrow.4

SHAPE-- - steeply conical; like other barnacles, they can be- ohne cylindrical when crowded. Young specimens can also be cylindrical.' Exterior rugged, worn; well-developed ribs become eroded in older animals, 3 (fig. 1. 2).

ORIFICE— large. flared"; with a jagged edge.3

LONGITUDINAL TUBES---single row, uniform, in walls.12

OPERCULAR VALVES (TERGUM, SCUTUM)—thick and yellowish, buff on interior, never white.' Tergal beaks project above orifice edge":

TERGUM—beak triangular, often purple (fig. 4a). especially in older specimens': external growth ridges narrow and regular, with narrow, shallow longitudinal furrow. Internal: numerous depressor muscle crests; spur wide at base, tapers to narrow truncate end; moderate articular ridge with shallow broad articular furrow (fig. 4a).

SCUTUM--external surface with prominent growth lines, a deep canal from apex down in old eroded specimens (fig. 4b). Internal' low articular ridge, very narrow articular furrow prominent adductor ridge: large, shallow adductor pit.

BODY— six pairs of cirri (feeding appendages).

JUVENILES — often cylindrical.

Possible Misidentifications

No other barnacle approaches *B. nubilus* is size, although the following are fairly large:

B. rostratus alaskensis, not reported south of Puget Sound, can be up to two inches across. Its radii are glossy and partly covered with brown epidermis; its longitudinal wall tubes have cross-septa from base to apex' (which *B. nubilus* lacks). Like *B. nubilus,* it is subtidal; it also occurs in deep water; *B. nubilus* does not.

B. balanus, up to 1% inches in diameter (35 mm), is usually strongly ribbed. Its opercular valves are white interiorly, not buff: it has hollow longitudinal wall tubes, but without cross septa. It is very like *B. rostratus* above.

B. aquila, a large southern form, with a beaked tergum and longitudinal striations on both opercular plates, has a small unflared orifice; it is rare north of San Francisco.13

Pilsbry's *B. n. flos* and Cornwall's *B. altissimus* are probably only varieties of *B. nubilus,* not different species.[2,3] Darwin's original description dealt with smaller specimens than are now known. and Pilsbry described the larger animals.6

Ecological Information

RANGE—west coast of North America[2]; southern boundary of Alaska to mid Baja California coast. Type specimen: Monterey Bay.

LOCAL DISTRIBUTION—Coos Bay: South Slough: P ford. [11]

HABITAT—pilings in bays with strong tidal action[2]; rocks. "shelly bottoms""; holdfasts of kelp. [3] Reaches its greatest development on fairly exposed wharf pilings; can grow on too of each other to make accretions a foot high.12

SALINITY—collected at 30 oioo; no known collections from brackish water.

TEMPERATURE—from temperate waters.

TIDAL LEVEL— frorn low water to shallow waters (10-20 feet) occasionally to 30 fathoms.'

ASSOCIATES---often encrusted with other barnacies *B. rostratus alaskensis, B. Oa/anus pugetensts,* and *B engberqi* (Puget Sound): with sea stars and anemones on overhanging rocks (British Columbia"). boring sponges erode shells," Found on boat bottom with mussels and *B. tintinnaboium callicnianum.*[8] Often covered with brown furry mats of entoocrt *Barentsia."*

Quantitative Information

WEIGHT

ABUNDANCE second commonest barnacle of low zone (most abundant: *B. cariosus").* More common in Puget Sound and north"; characteristically grows in large clumps on rocky bottoms.5

Life History Information

REPRODUCTION—barnacles are usually hermaphroditic cross-fertilization is the rule in gregarious types like *B. nubilus.*

GROWTH

LONGEVITY

FOOD—filter feeder.

PREDATORS—other *Balanus* species preyed upon mainly by the sea star *Pisaster,* and by the nemertean *Emplectonema.'*

BEHAVIOR—growth habit: accretion into deep cluster often creates a heavy clump which falls off substrate (*ie.* piling) and sinks to bottom where animals cannot live": unusual in ability to increase capacity by deepening base, rather than extending compartments."

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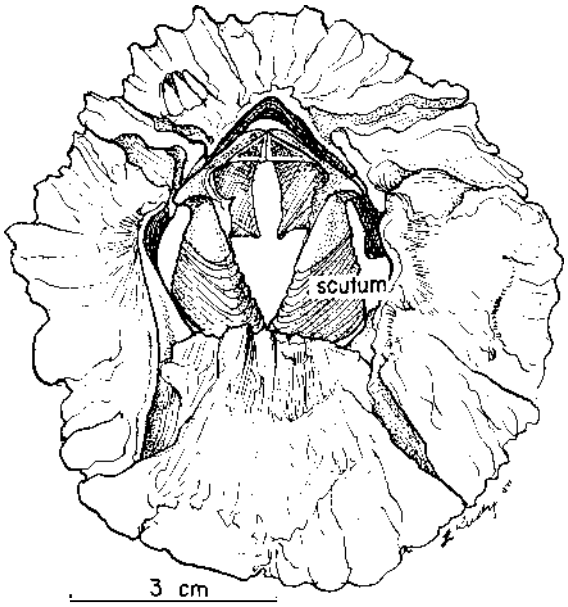
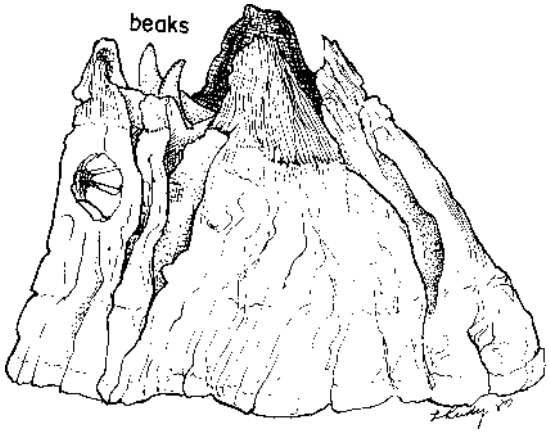
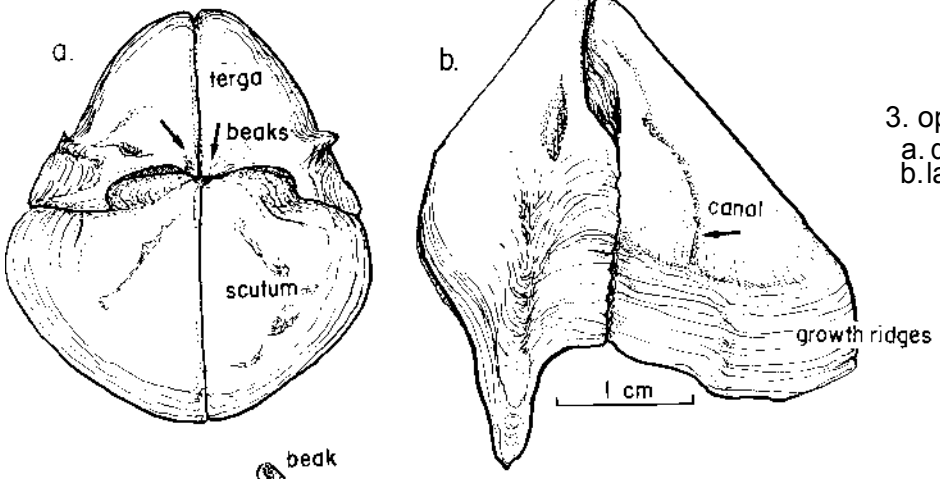
Bo/anus nubiks



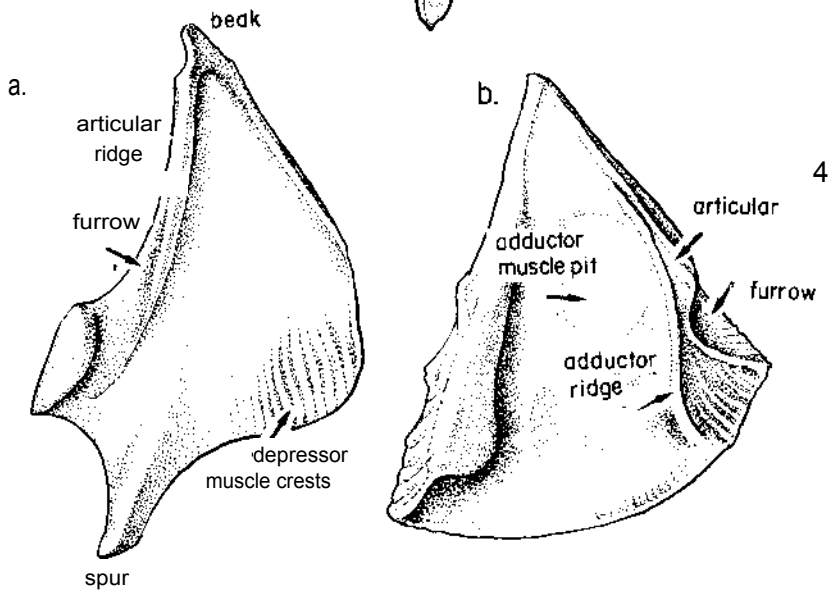


l. *Bo/anus nubi/us* x l
six plates; ribs eroded;
very large: up to 10 cm diameter.

2. lateral view
walls a steep cone, steeply conical;
orifice large,flarmg.



3. opercular plates, exterior x 2
a. dorsal
b. lateral



4. opercular plates, interior

Leptochelia dubia

green tanaid (Kroyer, 1842)

PHYLUM. 4rthropoda
CLASS. Crzistacea
ORDER: *Tanaidacea (Chelifera)*
FAMILY: *Paratanal dae*

Description

COLOR—transparent to light green. Brightly colored females found in early spring (South Slough of Coos Bay) had red striped antennae. Males, found in August were almost transparent.

SIZE —to 1 tarn: South Slough of Coos Bay specimen: 6 mm British Canadian species to 4 5 min'

FIRST ANTENNAE male: long, flagellum with seven articles dig 2): female short, three articles (figs. 1, 4); both uniramous: Suborder Disonophora.

SECOND ANTENNAE--male. shorter than basal article of first antennae. 4 articles (fig. 2): female longer than that of male. also wltf four articles (fig. 1).

HEAD-narrowed anteriorly.

EYES --stalked *(unlike those of Isopods):* large, antero-lateral.

MOUTHPARTS--fused and metamorphosed in males, can be dissected in females. Mandible (female) without palp (fig. 3).

GNATHOPODS--chelipeds very prominent in both sexes: but very different: Males: long arid slender, carpus longer than basal article of first antenna, propodus shorter than fingers, which have two teeth on inner side (fig. 5): Female: short, heavy chela (figs. 1, 6).

CARAPACE—head and first two segments fused:

BODY SEGMENTS thorax: six uniform segments: abdomen: five similar segments and telson (fig. 1).

PEREOPODS—six pairs beside the chelate gnathopods. A small penal process is attached between the last pair of these legs in the male. (and is very difficult to see).

PLEOPODS— five parts, two-branched leaf-like.

UROPODS— both sexes: biramous: exopodite very small, endopodite of five articles (fig. 7).

Possible Misidentifications

Leptochelia savignyi from Puget Sound, with four segments in the endopodite of the uropod[4], (or six[6]) also has larger eyes and stubbier first antennae than does *L. dubia.* In *L. savignyi* the first free thoracic segment is shorter than the others: they are fairly equal in *L. dubia.* The male chelipeds of the two species are almost identical.

Leptochelia Blum, another Puget Sound species. is small (2.5 mm). white, and found in 20 fathoms, sand—a quite different habitat from that of *L. dubia.* The endopodite of the uropod in this species has three to four articles, not five as in *L. dubia.*

Ecological Information

RANGE—cosmopolitan: first described off Brazil. Northwest: British Columbia to northern California.

DISTRIBUTION—Metcalf preserve, South Slough of Coos Bay; Tillamook Bay: (species2).

HABITAT—flimsy slime tubes much like those of *Corophium,* in a substrate of mud and chips. (Metcalf Preserve); also dead coral[8], sponge bed at 25 fathoms', at strand line (sand) at low tide[3]. and near the surface on hydroids and algae'; upper limit of sand grain size: 200 pc".

SALINITY—collected at 30 o/oo.

TEMPERATURE--

TIDAL LEVEL— +3 feet (Metcalf Preserve) to 25 fathoms'.

ASSOCIATES amphipod *Corophium,* small polychaetes, clam *Macoma nasuta.*

Quantitative Information

WEIGHT--

ABUNDANCE—the dominant animal where collected (Metcalf Preserve).

Life History Information

GROWTH RATE-

FOOD—detritus and associated micro-organisms.

LONGEVITY-

PREDATORS—Pawl-10/s *vetulus* (English sole). *Plattc.?Itys stet latus* (starry flounder), and *Oncorphynchus* tschavvyt.scha (chic nook salmon) in Tillamook Bay2.

REPRODUCTION-------ovigerous females and nests of young found in February; many more males in evidence n August (Metcalf Preserve), indicative of breeding period6.

BEHAVIOR--

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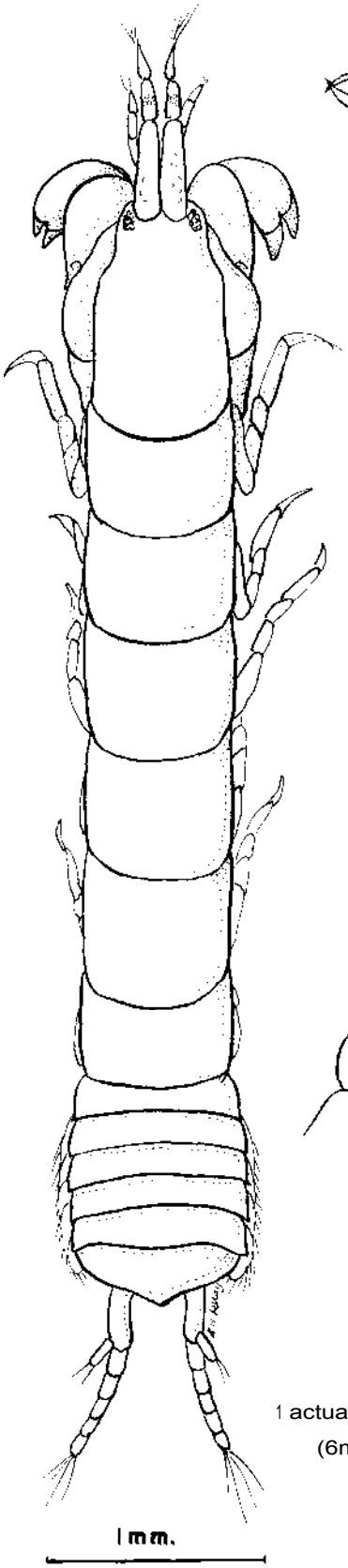
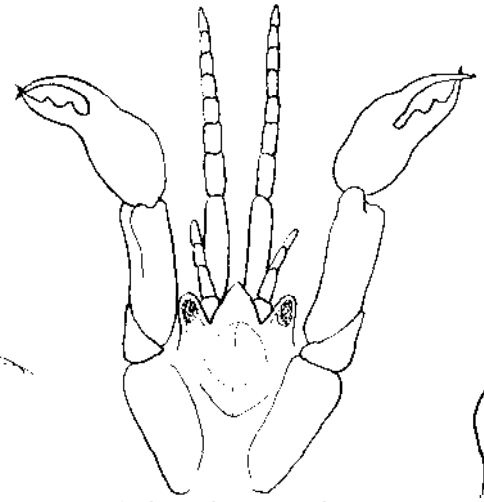
Leptochello dubia



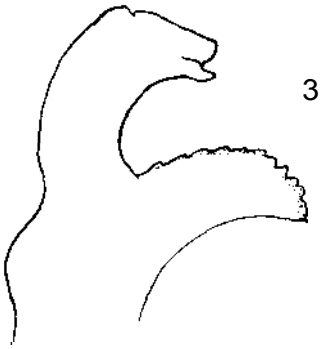
1 actual size
(6mm)

1 mm.

1. Leptochella dublo **x32**
carapace: head, first two segments fused,
six thoracic segments,
five abdominal segments, and telson.

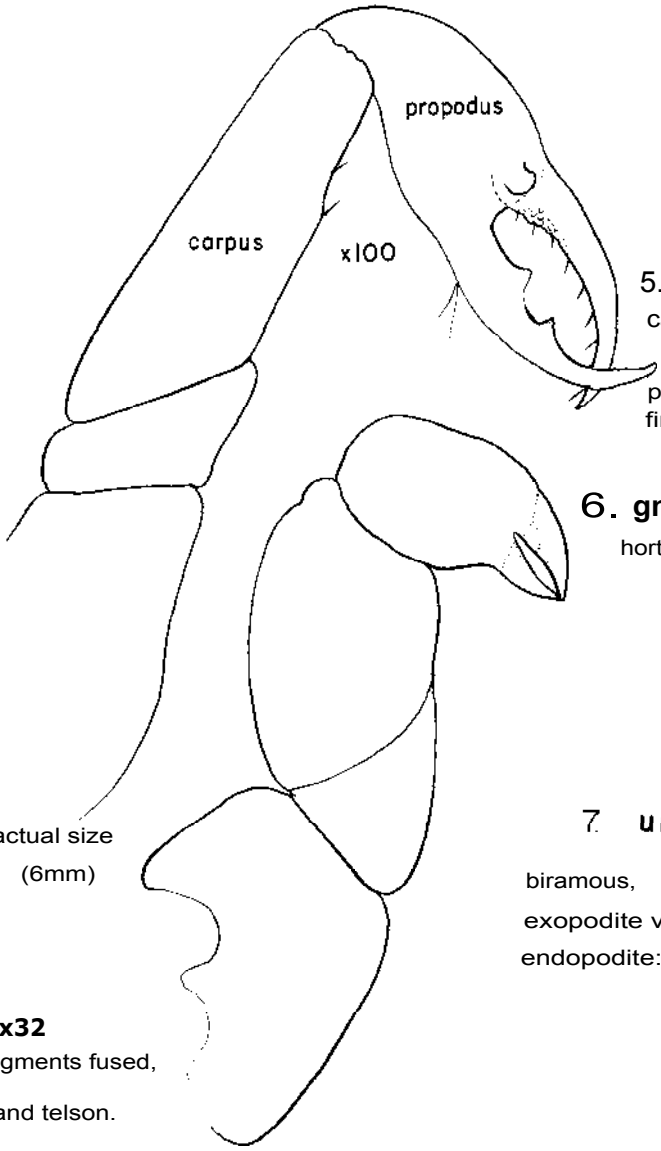


2. head, ventral *efi*
long first antenna, with
seven articles in flagellum,
eyes separate from head,
long chelipeds.



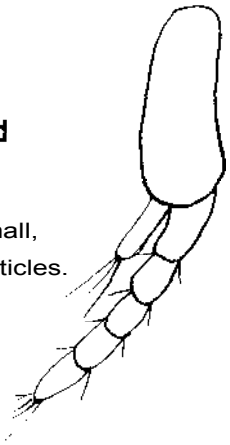
3. mandible
without palp.

4. first antenna 9
uniramous, three articles.



5. gnathopod
carpus longer than basal
article of first antenna,
propodus shorter than fingers,
fingers with two teeth.

6. **gnathopod**
hort, heavy chela.



7. **uropod**
biramous,
exopodite very small,
endopodite: five articles.

Idotea (Pentidotea) resecata

valviferan isopod Stimpson, 1857

PHYLUM: *A rthropoda*
CLASS: Crustacea
ORDER: isopoda: *Vaivif era*
FAMILY: /doteicie

Description

SIZE-this species grows to 39 mm' 1.2 cm; four and one half times longer than wide8.

COLOR -light green, black chrornatophores when on *Zostera:* brown on keip: varied',

HEAD -- entire, not notched, sides of head straight. sligni 'ustram (fig. 3), frontal process narrow. pointed and exceeding frontal lamina -- visible from ventral side (fig 2) Eyes oval. not markedly elongate transversely

MOUTHPARTS -maxilliped with five article pulp. one coupling 'ook (fig 4k *(Pentidotea).*

THORACIC **SOMITES-** body elongate depressed. all seven oracic somites (pereonites) free: (Idoteidaei all Put first sornite yith ecimeral sutures visible dorsally (fig 1)

ABDOMEN (PLEON)-two complete, one partial horizontal suture (fig. 1): *(Idotea).*

PLEOTELSON--large. shieldlike: *Idotea,* posterior border with ancave margin. keels (fig. 1).

UROPODS-ventral, not visible dorsally. and forming opercular or "valves* Valvifera

PEREOPODS-seven pairs of ambulatory and nearly similar yialking legs

Possible Misidentifications

I resecata is the only member of the genus to have a concave pleotelson; this should distinguish it from other light green idoteids, (/. (P) acu/eata, / *montereyensis).*

Ecological Information

RANGE-Alaska to Baja California'; common in Puget Sound.

LOCAL **DISTRIBUTION** belowCharleston Bridge, west side (South Slough of Coos Bay).

HABITAT oneelgrass *Zostera,* also on *Macrocystis1°.*

SUBSTRATE- mud.

TUBES -

SALINITY-can survive one hour in fresh water'.

TEMPERATURE-scarce if surface temperature exceeds 18 °C7.

TIDAL LEVEL- + 0.5 (South Slough of Coos Bay); surface to 3.5 fathoms8.

ASSOCIATES-gastropod *Littorina,* hermit crab Pa gurus, amphipods.

Quantitative Information

WEIGHT-

ABUNDANCE

Life History Information

REPRODUCTION- -- ovlgerous July. central California

GROWTH RATE-- -

LONGEVITY-..

FOOD-kelp and *Zoslera taiacjes.:*

PREDATORS- more than 20 spp. of marine fishes

BEHAVIOR --always orients along kelp hiades

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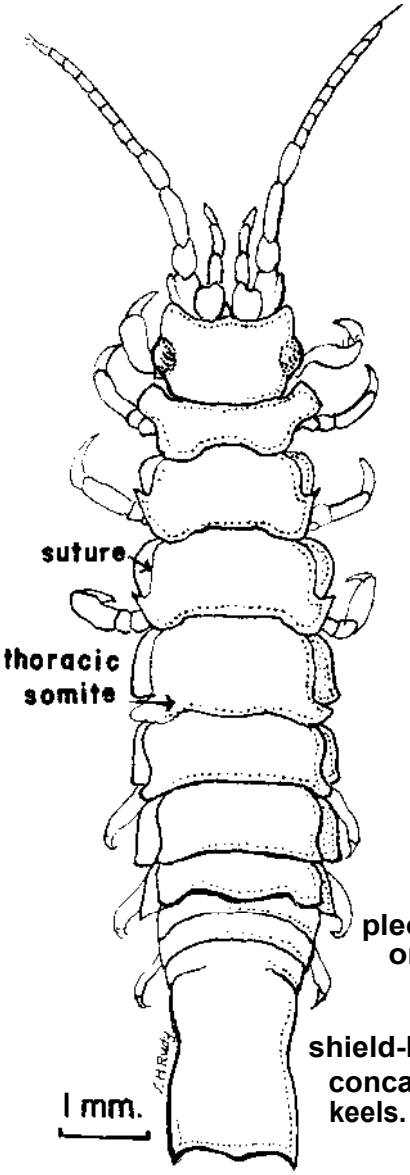
/dotea (Pentidotea) resecata

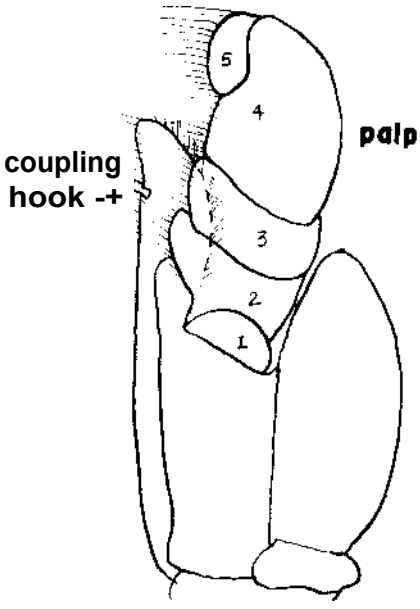


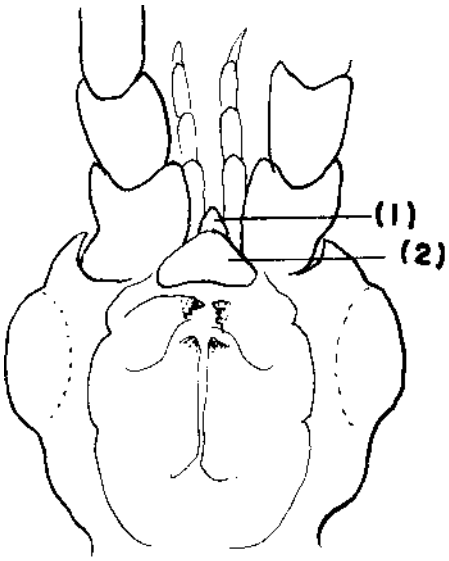
pleon: two complete, one partial suture

shield-like pleotelson concave margin; keels.

Idottio (Pentidotea)resecato x 12

I doteidae: body elongate, depressed, legs nearly alike, ambulatory; seven free thoracic segments

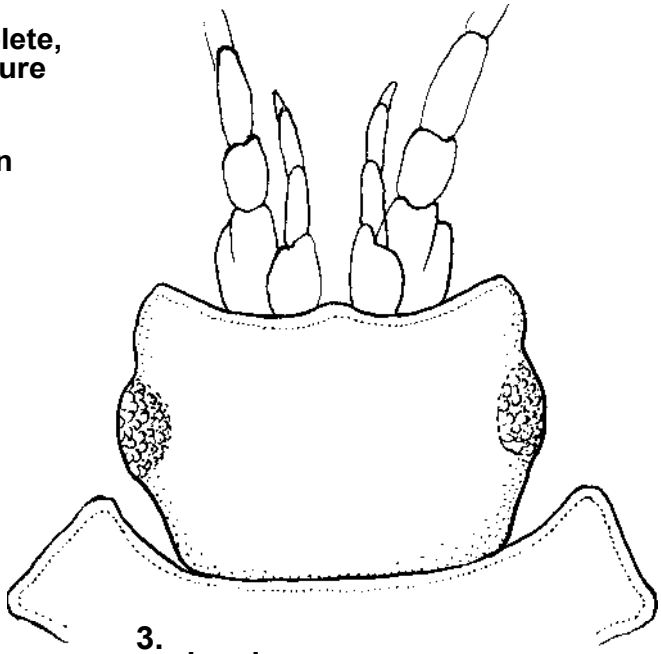




2.

head (ventral) it36

frontal process (I)narrow, pointed, and exceeds frontal lamina (2).



3.

head

entire, not notched.

eyes not elongate or pear-shaped but oval)

sides of head straight.

4.

maxilliped

one coup)ihg hook

five article palp

Idotea (Pentidotea) wosnesenskii
(Brandt, 1851)

PHYLUM: *Arthropoda*
CLASS: *Crustacea*
ORDER: *Isopoda; Valvifera*
FAMILY: *Idoteidae*

Description

SIZE-to 35 mm'; '/4 to v3 as wide as long', this specimen (male) 22 mm long.

COLOR-dark green or light olive: some living in red algae are dark red and gray.' Males tend to be larger and paler than females.'

BODY--robust, not tapered; elongate, depressed.

FRONTAL PROCESS---widely angulate, hidden by and not ex-:ending beyond trontal lamina which is triangulate (dorsal view) !f/g. 2).

HEAD-wider than long; frontal margin slightly concave': posterior portion somewhat wider than anterior portion [5] Head narrower than pleon."

EYES--reniform (kidney-shaped): species *wosnesenskii"* (fig 4). Eyes small. compound, transversely ovate, situated at extreme lateral margins, about halfway between the anterior and posterior margins (fig. 1).

ANTENNAE-first antennae (antennules) with four articles, basal one large and flattened. Second antennae with peduncle of 5 articles, flagellum of 12-16 articles (fig. 1).

MOUTHPARTS-maxilliped with 5 article palp, 1 coupling hook: subgenus *Pentidotea.'* Maxillipeds same in both sexes.

THORACIC SOMITES--- all seven thoracic somites (pereonites) free: family Idoteidae. [12] All but first somite with epimeral sutures visible dorsally (fig. 1). Posterolateral border of last pereonite acute (fig. 1).

ABDOMINAL SOMITES-(pleonites)-pleon with 2 complete, one partial intersegmental suture dividing it into 3 divisions-2 small anterior pleonites and a large shield-like pleotelson with an incompletely fused pleonite near its base (fig. 1): genus *idotea."* First pleonite with acute lateral borders: species *wosnesenskii"* (pleonite is shorter laterally than medially [6]) (fig. 1). Pleon wider than head."

PLEOTELSON--large, shield-like. broadly rounded': ends in large blunt point (fig. 1).

UROPODS-ventral, not visible dorsally, forming opercular [P]lates or valves: suborder Valvifera (not shown).

PEREOPODS-(legs)-seven pairs, ambulatory and nearly similar: all with small sharp claws. Male pereopods with coarse hairs (figs. 1, 4); females with hair only on propodi.

SEXUAL DIMORPHISM-males larger, paler, and have hairy legs; females are slightly broader with ooestegites (brood pouches).

YOUNG-with most of adult characteristics, but antennal flagellae shorter than in adult (fig. 3). This specimen found in female brood pouch.

Possible Misidentifications

Idotea sp. isopods have visible epimeral sutures along the last 6 pereonites a pleon with 2 complete and 1 partial sutures and a large shieldlike pleotelson. The genus is divided into subgenera *Idotea (4* articles on the maxilliped palp) and *Pentidotea* (5 articles). Other *Pentidotea* similar to (P.) *wosnesenskii* include the following:

I. (P.) aculeata, a reddish idoteid with a strong projection on its narrowing pleotelson, oval eyes (not reniform), long antennae and blunt lateral borders on the first pleonite (not acute borders as in *wosnesenskii).* It may be too southern for Oregon.

(P) *stenops,* olive green to brown, found on brown algae: with narrow eyes, a slender pointed telson, 2-3 coupling hooks on its maxillipeds, not 1.

I. (P.) tnontereyensis, slender and small (to 16 mm); red, green brown, or black and white; found on *Phyllospadix* and red algae. It has a telson much like *wosnesenskii's, i.e.* rounded and with a projection; it differs chiefly in the frontal process, which is narrow, pointed and projects much beyond the frontal lamina: the frontal lamina is triangulate (contrast *wosnesenskii---frontal process* and fig. 2). Males are long and slim; females are broader, more like *wosnesenskii* in outline.

I. (P.) kirchanskii, bright green and found on *Phyllopspadix:* with a rounded telson, oval eyes, epimera of pereonal somites visible dorsally only on segments 5-7.

I. (P) *resecata,* with a very distinctive concave pleotelson. not a rounded. convex one.

Ecological Information

RANGE-Sea of Okhotsk, U.S.S.R.: Alaska, scut"-- ro San Luis Obispo Co , Calif.

LOCAL DISTRIBUTION-Coos Bay: Pigeon Point. Tillamook Bay.'

HABITAT-docks and pilings (Puget Sound°); under rocks on gravelly or sandy substrates and lots of vegetative debris. Also in mussel beds, on *Ulva* and *Porphyra.'* More typical of outer rocky coast than of estuaries 6

SALINITY-tolerates salinity changes' better than i. (P) *resecata8.*

TEMPERATURE-

TIDAL LEVEL-upper middle intertidal zone to 16 m deep; this specimen collected at 0.0 ft,

ASSOCIATES-gastropod *Tegula,* brachyurans *Hemigrapsus, Cancer oregonensis,* carnivorous gastropod *Nucella.*

Quantitative Information

WEIGHT-a 22 mm male: 0.3 gr; a 20 mm female, 0.2 gr. (wet).
ABUNDANCE-common°/[6]: probably the most common idoteid isopod, Coos Bay.

Life History Information

REPRODUCTION-little known: females found ovigerous July (California)[e]; a few advanced (8 mm) juveniles found in female obestigites in April (Coos Bay).

GROWTH RATE-

LONGEVITY —

FOOD —

PREDATORS-fish.

BEHAVIOR-swims well: clings to vegetation with sharp claws.

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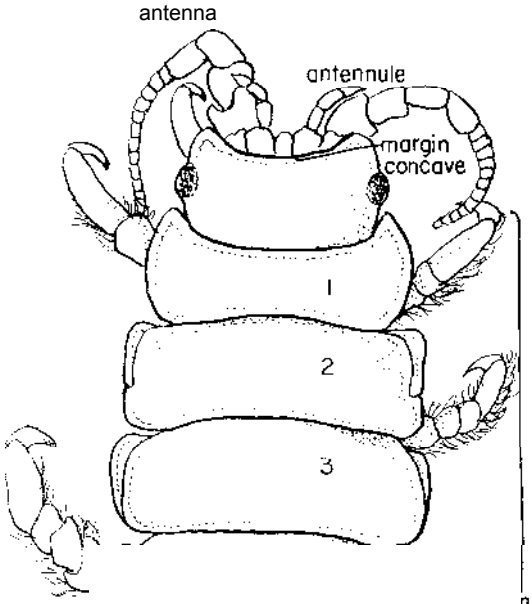
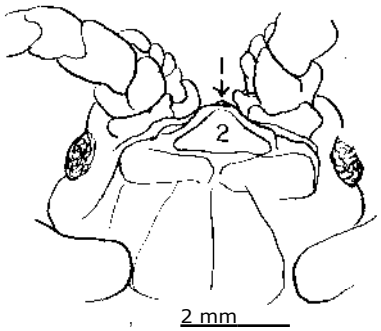
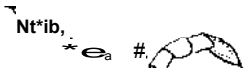
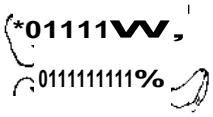




2.head, ventral x 12
frontal process (I) hidden by frontal lamina (2).

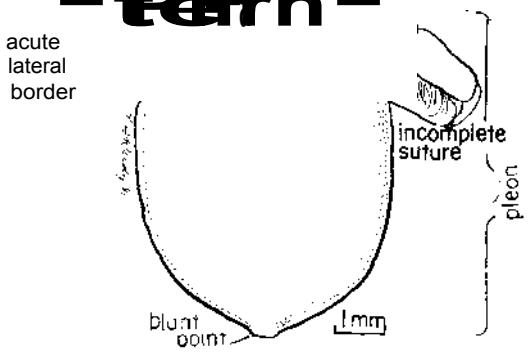


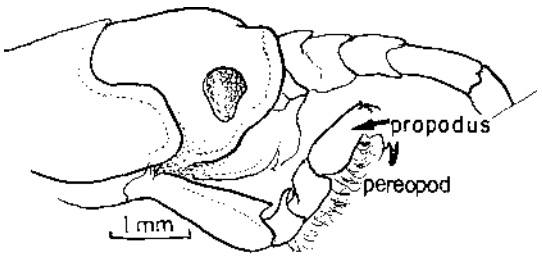


3. young, x 7. 5
actual length 8.25
short antennalflagella

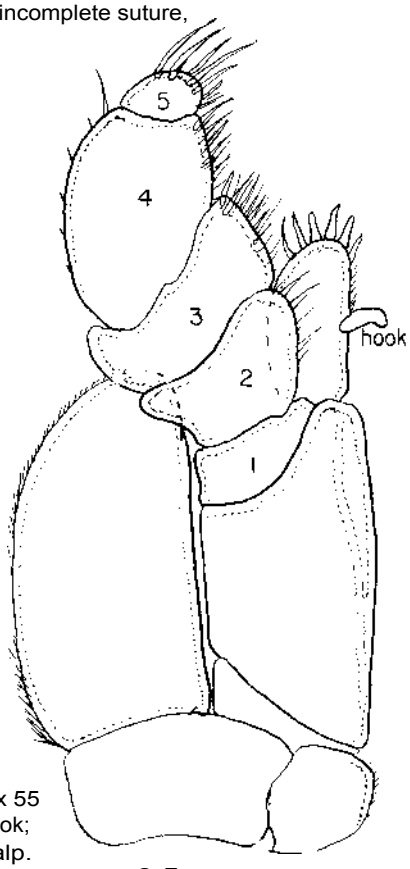
l mm

Idoteo (Pent/doted wosnesenskii x 7.5
actual length 22 mm, width 6.6 mm; body elongate, not tapered; dark green; head narrower than pleon, frontal margin concave; eyes at lateral margins.
Seven free pereonites, six visible epimera; last pereonite with acute posterolateral border. Pleon with 2 pointed pleonites, shield-like pleotelson, an incomplete suture, and a blunt terminal point.





4. head, lateral x 12
eyes reniform; pereopods hairy.



5.maxilliped x 55
one coupling hook; five-articled palp.

Gnorimosphaeroma insulare (formerly *lutea)*

Van Name, 1940

PHYLUM: A *rthropoda*
CLASS: *Crustacea*
ORDER: *Isopoda*
SUBORDER: *Flabellifera*
FAMILY: *Sphaeromatidae*

Description

SIZE-males up to 8 mm [13], about 1.7 to 2 times longer than wide.

COLOR-white, with small black chromatophores: surface smooth.

FIRST ANTENNA-longer than second: basal articles separated by the rostrum (fig. 3).

HEAD-frontal border smooth (fig. 3),

MOUTHPARTS-mandible with a palp rnaxilliped: four articles of pale produced. hairs on antero-lateral edge of articles 2, 3, and 4 less than half the length of the article

PEREOPODS-seven pairs: basis (of first pereopod) hairless; distal extremity with one hair or hairless (fig. 6).

BODY SEGMENTS-able to roll into a ball: characteristic of most Sphaeromatidae; eight flattened segments (head and seven free Pereonites) from cephalon and pereon; pleon of three parts: first concealed under last pereonite. second of several coalesced pleonites often with partial sutures (fig. 1); third of large pleotelson.

PLEONITES-only two of three reach lateral margin; third pleonite under second (figs. 1, 4).

TELSON-rounded, convex (fig. 1).

UROPODS-two branched visible dorsally; endopod rigid, exopod movable (fig. 5).

PLEOPODS-five pairs: first pair not widely separated at base, similar in size to second; first three pairs with marginal plumose setae: fourth with bent exopod; fourth and fifth fleshy, but without transverse folds (fig. 2, 1-v).

Possible Misidentifications

Two other *Gnorimosphaeroma* species occurring in our area should first be separated by habitat. G. *oregonensis,* a marine form, is found above the mid-tide line, in full salt water, and usually under stones. G. *rayi.* so far found only in Tomales Bay and in Japan, is an estuarine species found also above the mid-tide line, and also under stones. G. *oregonensis* is stouter than G. *insulare,* being 1.5 to 1.75 times longer than wide; all its three pleonites reach the lateral margin (fig. 4b) and the frontal border of its head has several curves. The exopod of the uropod is only $^{2}/_{3}$ as long as the endopod. [9] G. *rayi* also has three pleonites reaching the lateral margin; the basis of the first pereopod is setose. It is stout like *aoregonensis,* and has longer antennae than either G. *oregonensis* or G. *insulare.*

Ecological Information

RANGE-Alaska to California7.

DISTRIBUTION-Medcalf Preserve (South Slough of Coos Bay); Cox Island, Siuslaw estuary.

HABITAT-estuarine intertidal; among *Fucus* and under logs of *Salicomia* marsh and in mud or drainage channels, Metcalf Preserve; in Tomales Bay on bay bottom.

SALINITY-estuarine waters to fresh water. Can tolerate salinities of 0.6-135% seawater9.

TEMPERATURE-

TIDAL LEVEL-Metcalf Preserve: -4.5 feet; to subtidal3.

ASSOCIATES-alga *Fucus,* amphipod *Orchestia,* littorine snail *Ovatella* (Metcalf Preserve); amphipod *Anisogammarus* (Siuslaw estuary).

Quantitative Information

WEIGHT-

ABUNDANCE-tendency to congregate.

Life History Information

REPRODUCTION--not known. G. *rayt* reproduces in spring only, on a one year cycle; G. *oregonensis* has young in spring and fall3.

LONGEVITY--G. *rayl:* one year, G. *oregonensis:* 2.3 years=

GROWTH RATE-

PREDATORS-

FOOD-detritus a scavenger.

BEHAVIOR-

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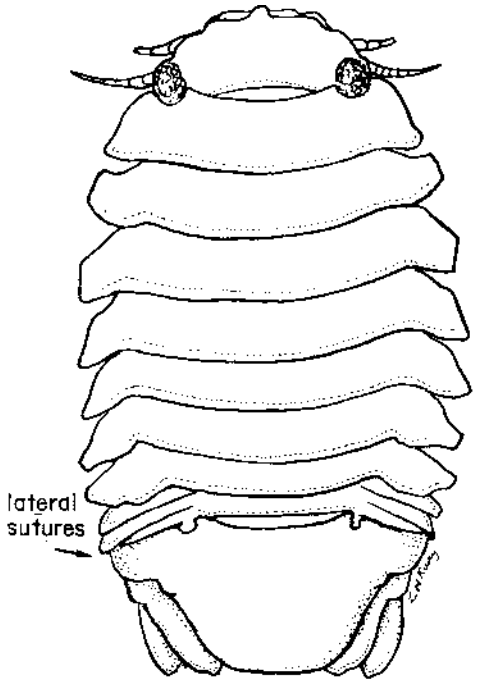
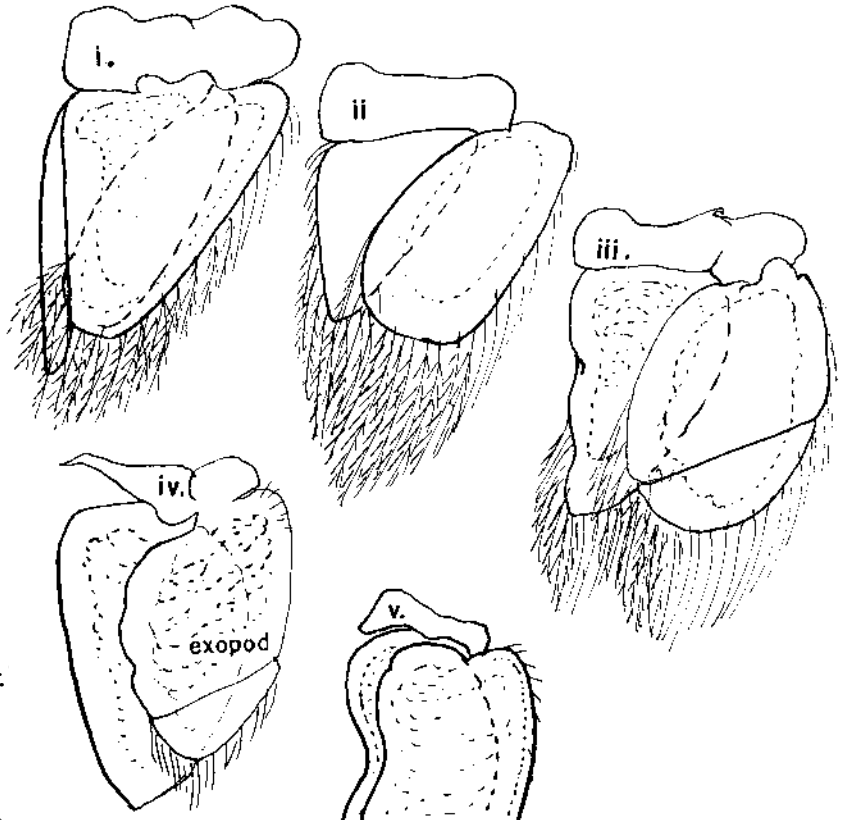
Gnorimosphaeroma insulate



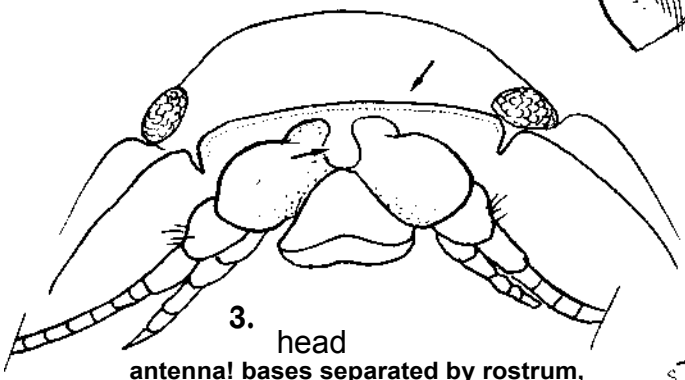
actual sizes 8mn

2 mm

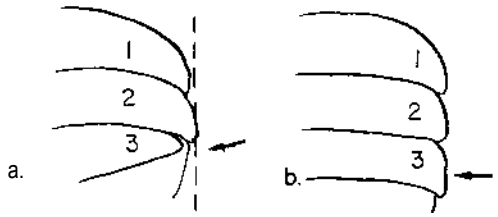
1. *Griorfinosphaeromo Insular.*
x12.5



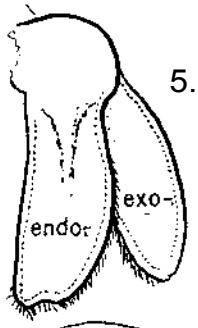
2. pleopods
i, ii similar in size, i not separated at base.
i, ii, iii with marginal plumose setae.
iv bent. iv, v fleshy, without transverse folds.



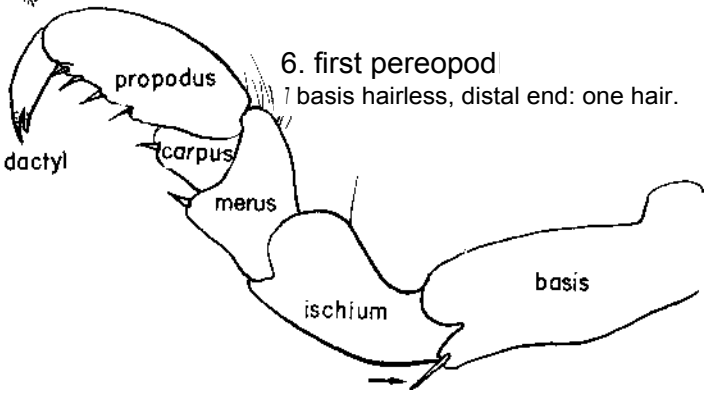
3. head
antenna! bases separated by rostrum,
frontal border smooth.



4. pleonites
a two pleonites reach margin, third visible beneath: G. insulare.
b. **three pleonites reach lateral margin: G. oregonenslja,** G. rayi.



5. right uropod
biro mous,
endopod rigid,
exopod movable



6. first pereopod
basis hairless, distal end: one hair.

Ligia (Ligia) pallasii
a rock louse, or shore isopod Brandt, 1833

PHYLUM: *Arthropoda*
CLASS: *Crustacea*
ORDER: *Isopoda, Oniscoidea*
FAMILY: *Ligiidae*

Description

SIZE—to 35 mm long, including uropods[2]; about 11 mm wide, uropods 3 mm long. This specimen (Coos Bay): 22 mm.

COLOR—mottled gray, surface granular. Often brown.

ANTENNAE—first antennae vestigial: suborder Oniscoideal°: second antennae with peduncle of five articles, the first two short, the third twice as long as the second, the fourth 1 ′/2 x longer than the third, the fifth 11/2 x length of fourth.' Flagellum of 15 articles.' Second antennae reach to middle of fourth thoracic segment (fig. 1).

HEAD—more than twice as wide as long, rounded anterior margin, without lobes: family Ligiidae (fig. 1).10

EYES—large, round, composite, close to lateral margin' (fig. 1). Separated in front by twice the length of the eye: subgenus *(Ligia).*

MOUTH PARTS--in order from outside of buccal cavity.
maxillipeds—with palp of five articles (fig. 8);
second maxillae—with two plumose processes on inner side of lobe (fig. 5);
first maxillae—three plumose processes on inner lobe (fig. 4);
mandible—with large, broad molar surfaces, no palp (fig. 3).

THORAX—first segment, or thoracomere, fused with head; seven free pereonites. First four subequal, last three somewhat shorter along medial line, extending downward laterally. Epimera (flattened lateral extensions to pereonites) form broad plates, especially in males, indicated by distinct lines (figs. 1, 4).

ABDOMEN--(pleon) as wide as thorax: with five free pleonites and a short pleotelson (fig. 1): suborder Oniscoidea. First two pleonites narrow and without downwardly produced lateral edges which mark last three segments.

PLEOTELSON—rounded on middle of posterior edge; postlateral projections: genus *Ligia;* not quite as long as middle (fig. 1).

PLEOPODS—paired breathing appendages beneath pleonites: whitish tissue showing aerial adaptation. Male genitalia, paired but not fused, on 2nd pleopods (fig. 7).

UROPODS—terminal, styliform; bases about as long as wide: subgenus *(Ligia).* No process at inner distal margin of basal joint (fig. 6), uropod rami equal, about twice length of peduncle; (less than ′/2 body length: genus *Ligia').*

PEREOPODS—seven pairs of delicate walking legs. Carpus and merus of first leg swollen, not grooved (not figured).'

SEXUAL DIMORPHISM—males with penial processes on 2nd pleopods, and with wide epimera (fig. 2). Females with odstegites when ovigerous.

Possible Misidentifications

The terrestrial isopods have vestigial first antennae, thoracic epimera, a pleon of five segments and a pleotelson, terminal uropods, seven pairs of walking legs, and pleopods for aerial respiration [2] Of these Oniscoidea, the Ligiidae are usually littoral. They can swim,' but in our area are restricted to the upper littoral (spray) zone.'

Ligiidae can be distinguished from the other Oniscoidean families by having more than tour articles in the flagellum of the second antennae, and by their lack of anterolateral head lobes. The other genus of Ligiidae, *Ligidium,* is a river dweller, not a littoral marine isopod. It has uropods with a process at the inner distal margin, to articulate the endopod, *Ligia* does not. It lacks the posterolateral projections on the telson which *Ligia* has.1°

The species closest to *L. pallasii* on the northeastern Pacific shore is *Ligia (Megaligia) occidentalis,* an inhabitant mostly of rocky outer shores, which shares *L. pallasii's* liking for freshwater seeps." It can tolerate greater extremes of dryness than *L. pallasii. L. occidentalis* is a narrower animal than *L. pallasii,* being over twice as long as wide; its eyes are closer together: about an eye's length apart. Its uropod bases are several times longer than broad *(L. pallasii's* are almost square [9]. Its second antennal flagella are longer, to the sixth thoracic segment, and contain 29 articles, not 15. This species is not known to live north of the California border.

Ligia exotica is a tropical species with very long uropods and second antennae.

Ecological Information

RANGE—western Aleutians south to Santa Cruz Co., California.'

LOCAL DISTRIBUTION—Coos Bay, Depoe Bay, Florence,' as well as outer shores.

HABITAT—outer shore: deep crevices, under ledges; likes freshwater seeps. Estuaries: hard-packed beaches, pilings, docks, as well as rocks. Cannot tolerate extreme wetting or drying for very long," but must alternate with periods of each; with cool, moist condition being the prevalent one.

SALINITY—found near full salt water, but where there are fresh water seeps. It is able to hyperregulate well in its prolonged periods of hyposaline conditions, and to hyporegulate in seawater of over 100% concentrations, to avoid body water loss. Found in fluctuating, hyposaline conditions."

TEMPERATURE --does not tolerate extended heat or drying: lives permanently in cool moist habitats.'1

TIDAL LEVEL—al Moss Beach, California, animals live on cliffs 5-20 ft, above tide; on estuarine beach (South Slough, Coos Bay), they are found at about 5.0 ft.

ASSOCIATES—in beach wrack and wood debris: gribble *Limnone,* amphipods *Orchestia, Orchestoidea.*

Quantitative Information

WEIGHT-

ABUNDANCE—most common *Ligia* species on extreme northern California coast.)

Life History Information

REPRODUCTION—females carry young in brood pouch; found with young in early spring through summer (prime April-May) Coos Bay. Average brood size: 48 ±11 young'.

GROWTH RATE

LONGEVITY— 1.5-2 years (Carefoot (1973) in ')

FOOD—scavenger, feeding mostly on decayed algal material[4]: also animal detritus.' Food gathering restricted to cool. humid periods."

PREDATORS—birds, man: for fish bait; *Pachygrapsus crassipes7.*

BEHAVIOR—males shield females and young with large epimeral plates during drying periods.' Species slow-moving." Uropod rami are dipped into pools to obtain moisture for gills (pleopods).'

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5 '974b Key. p 152.

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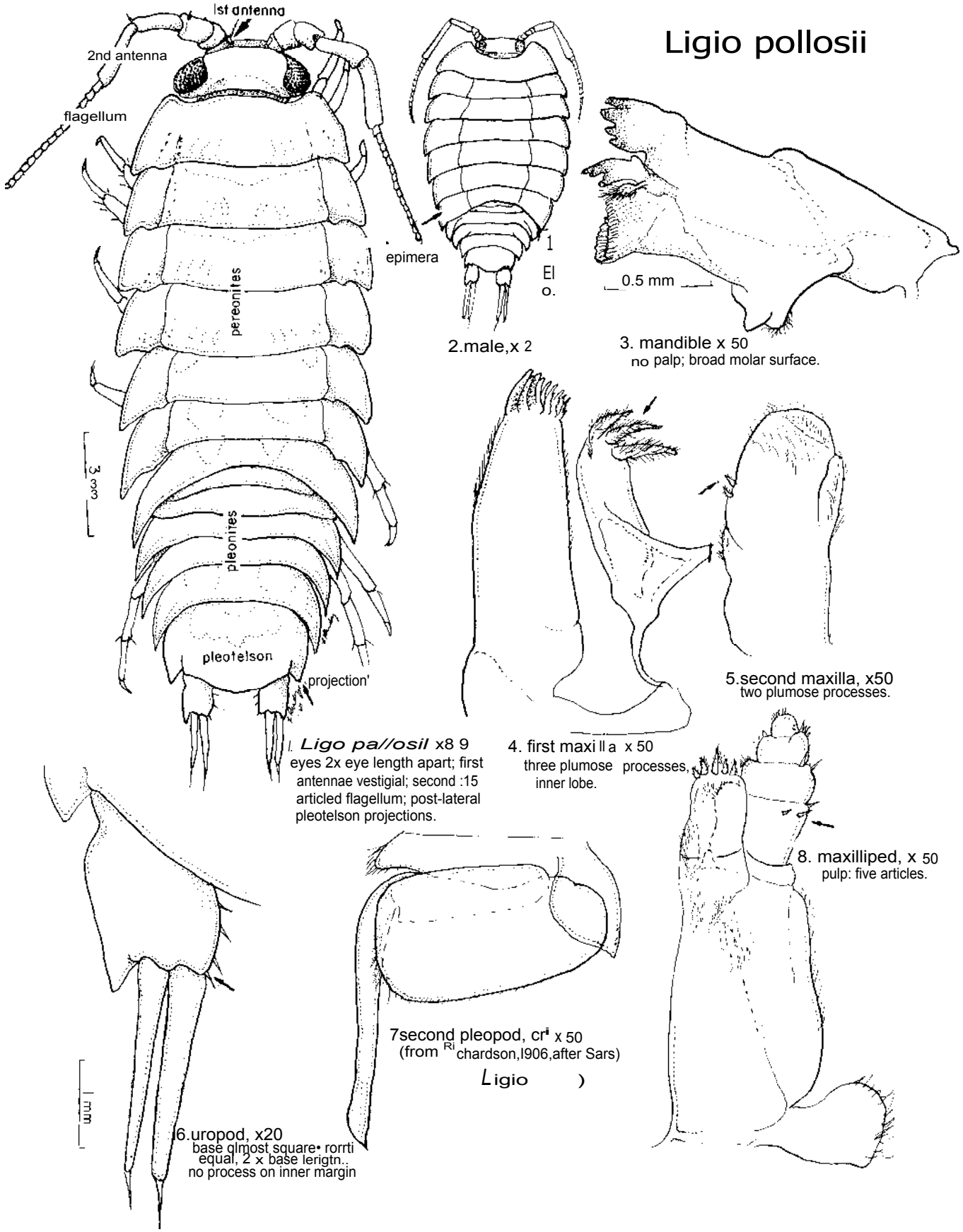
Ligio pollosii



1. *Ligo pallosil* x8 9
eyes 2x eye length apart; first antennae vestigial; second :15 articled flagellum; post-lateral pleotelson projections.

2.male,x 2

3. mandible x 50
no palp; broad molar surface.

4. first maxilla x 50
three plumose processes, inner lobe.

5.second maxilla, x50
two plumose processes.

6.uropod, x20
base almost square• rorrti equal, 2 x base lerigtn..
no process on inner margin

7second pleopod, cr[i] x 50
(from [Ri]chardson,l906,after Sars)
Ligio)

8. maxilliped, x 50
pulp: five articles.

Limnoria (Limnoria) tripunctata

a gribble Menzies, 1951

PHYLUM: *Arthropoda*
CLASS: *Crustacea*
ORDER: *Isopoda; Flabellifera*
FAMILY: *Limnoridae*

Description

SIZE-to 2.5 mm.

COLOR-light tan, whitish; often encrusted with debris.

ANTENNA-flagellum with four articles (fig. 3): both antennae reduced, separated at midline: in a nearly transverse line (fig. 1).

SECOND ANTENNA-flagellum with five articles (fig. 4).

HEAD-smooth, rounded, modified for boring; eyes lateral (fig. 1).

MOUTHPARTS -mandibles with file-like ridges (right) and rasping surface (left), not figured.

PEREOPODS-in mature females a leaf-like ooestegite at base of each of first four pairs of legs forms a broodpouch (not figured. but see fig. 6, *Corophiurn spinicorne).*

THORAX -seven segments, the first being widest (figs. 1, 2): can roll into a ball.

ABDOMEN-five free pleonites, ornamented pleotelson; fifth somite with three tubercules (fig. 1).

TELSON-with three anterior tubercules (fig. 1): posterior and lateral borders tuberculate (fig. 5).

UROPODS-branches dissimilar: exopod sHert, claw-like; endopod long, apically blunt (fig. 6).

Possible Misidentifications

There are only four known Limnoridae on the north Pacific coast. One, *L. (Phycolimnoria) algarum,* bores into algal holdfasts, not wood; its mandibles lack the rasp and file of the woodborers. There are three wood-boring west coast Limnorians: *L. lignorum,* the cosmopolitan coldwater gribble, white, with a X-shaped carina on its telson, not tubercules; L. *quadripunctata,* sometimes found with L. *tripunctata,* with four anterior tubercules on its telson, which has smooth posterior borders. So far, it has been found only as far north as Humboldt Bay.

Ecological Information

RANGE-Atlantic and Pacific coasts in temperate and tropical waters (44-12° N). Type specimen: San Diego.

LOCAL DISTRIBUTION -upper bays: Coos, Yaquina, Tillamook estuaries; British Columbia.

HABITAT--docks and pilings, chiefly in bays and estuaries, where it burrows into wood. (The wood serves as both food and protection).' Reputed to attack creosoted wood.

SALINITY toleratessalinity fluctuation: found in warm, often salty upper bays. Other *Limnoria* species (i.e. *L. lignorum)* can't tolerate low salinity (15%) or dissolved oxygen content below 1.6 ppm; animals can stand periodic oxygen depletion, however'.

TEMPERATURE-15° and 30°C. (mean); reproduction seriously impaired below 6°C.7

TIDAL LEVEL-mostly shallow water: surface to 60 feel. Only limited data available. Prefers lower depths when salinity is low or tidal fluctuation is great. Animals prefer area near estuary bottom: thus the heavy attack at the bases of pilings

ASSOCIATES- Limnoria burrows can be inhabited by the commensal isopod, *Caecijaera,* the sphaeromid isopod, *Gnorimosphaeroma,* the amphipod *Chelura* arid the copepod *Donsiella*[7]. None is a borer. The boring mollusk Teredo can attack the same wood where *Limnoria* H.-rows.

Quantitative Information

WEIGHT-

ABUNDANCE-

Life History Information

REPRODUCTION peakbreeding time April, May (Friday Harbor, WA)[8]. Lowest temperature for breeding, 14 °C.[2]; total egg development time 17 days (at 20°C.), 15 days (at 220), 13 days (at 26°). 11 days (at 30°. but numbers greatly reduced)2.

GROWTH RATE-Average number eggs female 228.

LONGEVITY-

FOOD-wood and probably the fungi on it: reportedly can enter creosoted woods. Gut sterile, lacking resident mtroorganisms8.

PREDATORS- polychaete worms9.

BEHAVIOR -Dispersal by swimming and crawling young and adults. (In *Teredo,* dispersal is by larvae only; adults burrow but do not swim or crawl). *L. tripunctata* may represent a resistant strain of gribble which developed in response to creosote

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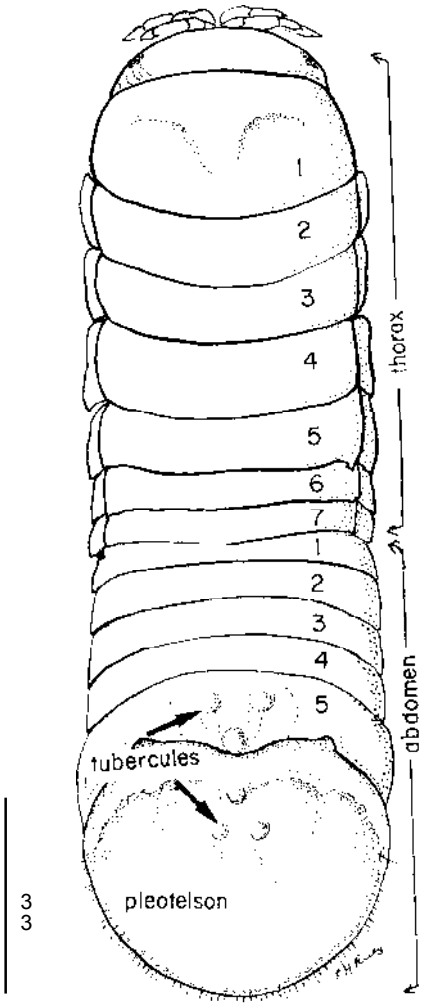
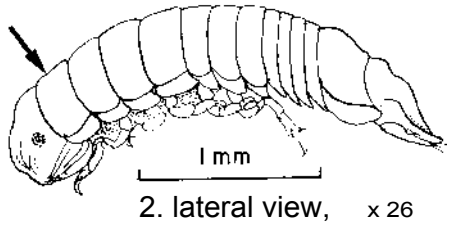
Limnorio tripunctato

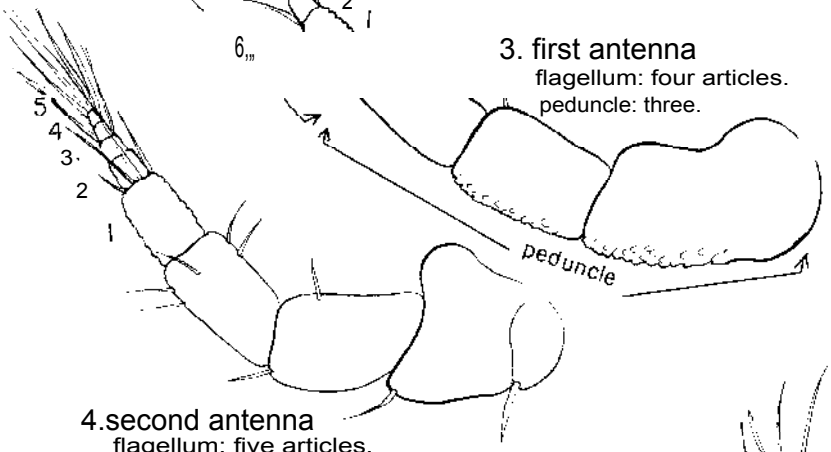


l. Limnorio tripunclalo x 56 actual size 2.5 mm
head smooth;antennae reduced, transverse;
fifth abdominal somite: three tubercules;
telson: three tubercules.

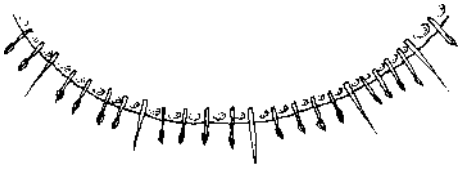


2. lateral view, x 26
eyes lateral; .head rounded for boring;
first thoracic segment widest.

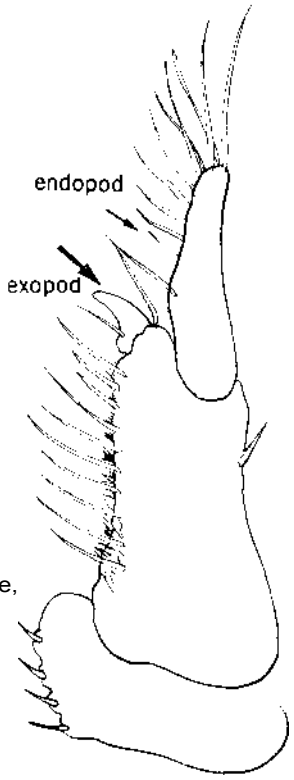
3. first antenna
flagellum: four articles.
peduncle: three.



4.second antenna
flagellum: five articles.



5.pleotelson: distal border
small tubercules.



6. uropod
exopod short, claw-like,
endopod long.

Ianfropsis kincaidi **derjugini**

an asellid isopod **Gurjanova,** 1933

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
ORDER: *Isopoda, Asellota*
FAMILY: *Paraselloidea, Janiridae*

Description

SIZE-to 4 mm[4]; this specimen (Charleston, Coos Bay): 3 mm.

COLOR--white, with brown chromatophores.

HEAD-without rostrum: *Janiropsis* (sic) (Sars)[7], no anteriorly projecting anterolateral angles, (fig. 1) as opposed to I. *k. kincaidi:* sp. *derjugini8.*

EYES-well developed, reniform (fig. 1).

FIRST ANTENNA--quite short, flagellum of eight articles (fig. 2) (?), ten articles in (3 flagellum'.

SECOND ANTENNA-with "squama", or scale, on third article of base (fig. 3)[8]; about [2]/3 length of body; flagellum with many segments and fine setae; peduncle, six articles: A.sellota2.

MOUTHPARTS-maxilliped palp with articles *2,* 3 much wider than endite (not figured)8.

FIRST PEREOPODS-inferior edge of propodus smooth, not serrated, on proximal third (fig. 4): *laniropsis8.*

BODY SEGMENTS-seven thoracic segments with variably shaped epimera (fig. 1), no lateral spines.

PLEOTELSON-shieldlike, lateral borders spineless (fig. 1); post-lateral angles at insertion of uropods (fig. 1): *derjugini8:* (no other *isniropsis* has this characteristic); three posterior segments not differentiated: *laniropsis2.*

UROPODS- two branched; inner branch a little longer than outer total length less than [1]/2 pleotelson[8]: (fig. 5).

Possible Misidentifications

ianiropsis kincaidi kincaidi (Richardson, 1904) has longer uropods. between half and one times as long as pleotelson. Its first antennae are elongate; it lacks the posterolateral angles of I. *k. derjugini* Habitats of the two subspecies are different: I. *k. kincaidi* lives in small pools created by wave splash, and is subject to wide temperature variation4.

Eight known species of *la,niropsis occur in the Pacific coast* area *covered by Light's Manual. analoga, I. epilittoralis* and *I. tridens* have spine-like serrations on the sides of the pleotelson8: *rnagnocula, I. minuta,* and I. *montereyensis* lack these serrations, but have other differences: I. *magnocula* has spine-like projections on its head: I. *minufa* has evenly rounded head margins, and, like the others lacks the postero-lateral angles of the telson; *montereyensis* has uropods longer than the telson.

Ecological Information

RANGE---Komandorskie Islands, Bering Sea to Monterey County, California5.

LOCAL **DISTRIBUTION** CoosBay: Charleston small boat basin.

HABITAT-under rocks of middle and lower intertidal zones[4]; on hooys from the surface to 1.8 meters[5]; this specimen in decayed 'oat with shipworm *Bankia setacea.*

SALINITY-collected at 30 0/00.

TEMPERATURE-apparently not adaptable to extreme temperatures as is I. *k. kincaidi5.*

TIDAL LEVEL-middle and lower intertidal zones'', surface to 1.8 meters deep': this specimen near water's surface.

ASSOCIATES--Bankia *setacea;* harpactacoid copepods.

Quantitative Information

WEIGHT-

ABUNDANCE-fairly common in wood with *Bankia.*

Life History Information

REPRODUCTION-ovigerous specimens collected February, May and June

GROWTH RATE -

LONGEVITY-

FOOD-

PREDATORS-

BEHAVIOR -

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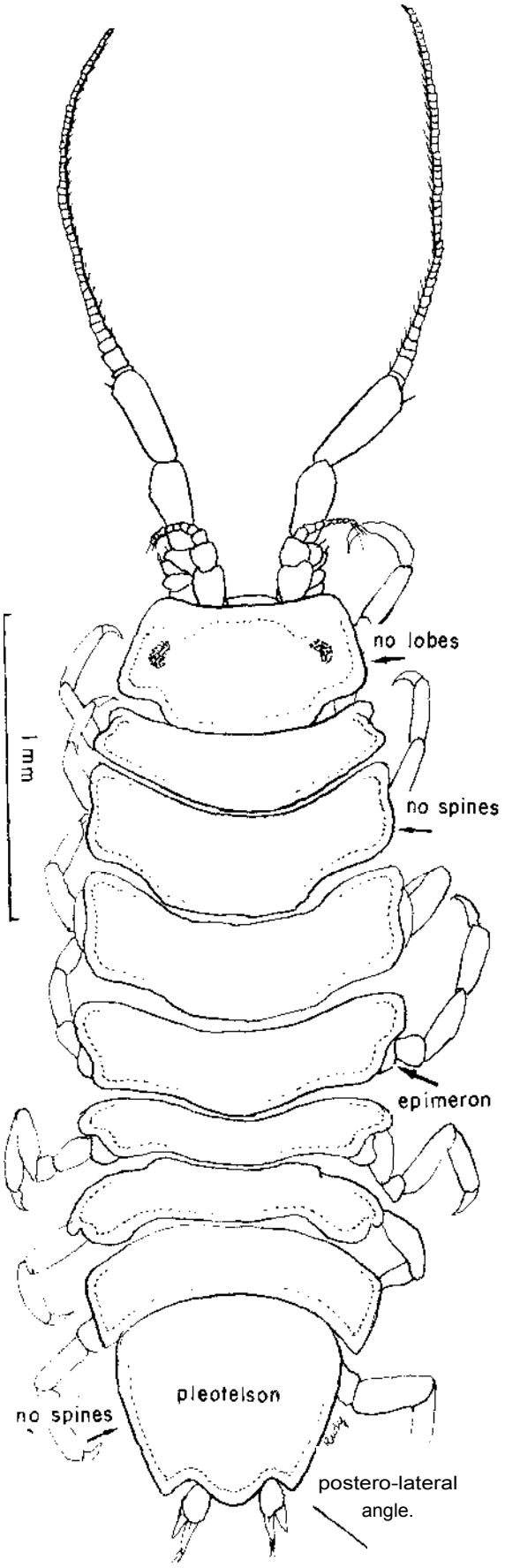
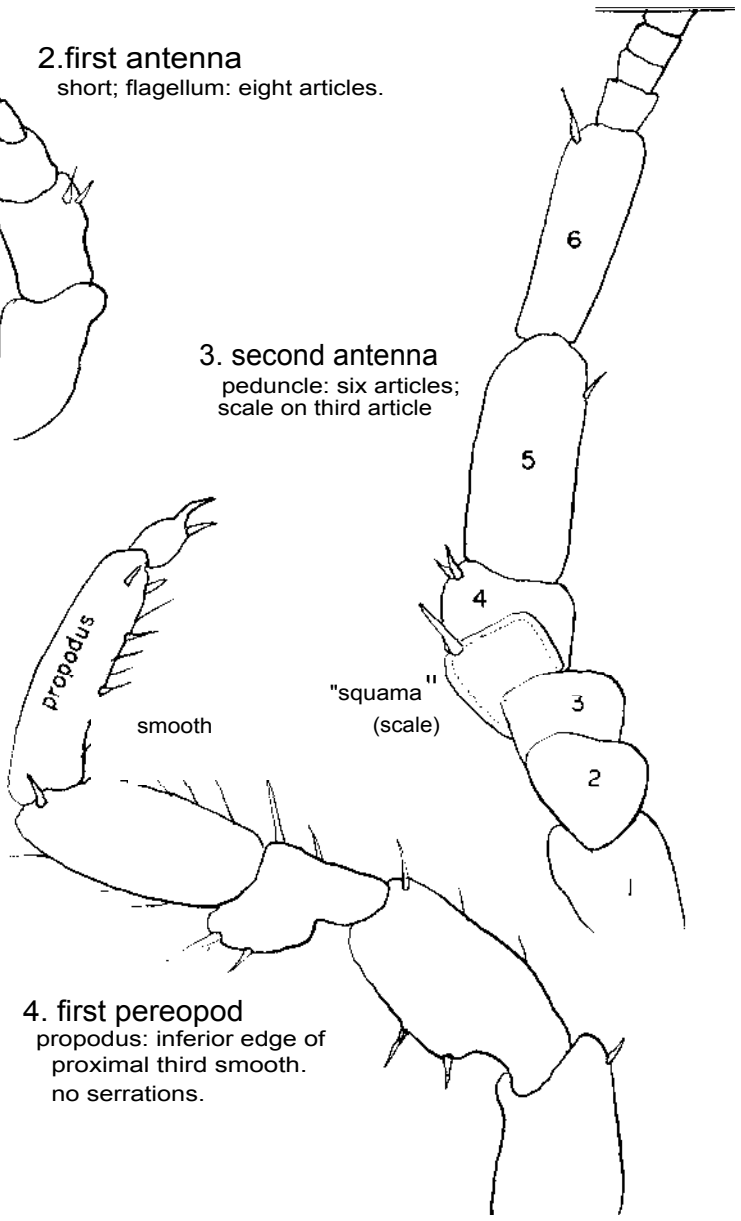
knfropsis kincoidi derfugini



lanironsis kincaidi deriugin/ x 50
actual size: 3 mm
head without lobes or rostrum;
thoracic epimera, pleotelson without spines;
second antenna 2/3 body length.

2.first antenna
short; flagellum: eight articles.



3. second antenna
peduncle: six articles;
scale on third article

4. first pereopod
propodus: inferior edge of
proximal third smooth.
no serrations.

5. right uropod
two branches: inner longer;
length : less than pleotelson.

Detonella papillicomis (*Trichoniscus papillicomis*)
a sow bug (Richardson, 1904)

PHYLUM: *Arthropoda*
CLASS:
ORDER: /sopoda
SUBORDER: On/scoidea
FAMILY: *Scyphacidae*

Description

SIZE-6 mm (South Slough of Coos Bay); to 3.8 mm2,

COLOR—dark red and white mottled; "light brown - (preserved?),

HEAD—no rostrum, but slightly produced and with concavity at apex (fig 2): large lobes at antero-lateral angles: eyes with about eight ocelli, ("about six -4)

FIRST ANTENNA—vestigial. Oniscoidea.

SECOND ANTENNA—peduncle of six (five[s]) joints, last three with setose tubercuies, (fifth joint with distal process) (fig. 3): flagellum of four articles.

THORAX—thoracic segments about equal, each with two rows of tubercules[4]: postlateral angles produced backwards.

ABDOMEN—pleon narrower than pereon, but not abruptly so: Scyphacidae, five free pleonites.

TELSON--spatulate (fig. 4); variable: more triangular in original descriptions.

UROPODS—styliform. extend beyond body: outer branch stouter, longer than inner branch: inserted postero-laterally, base not expanded, (fig. 4).

Possible Misidentifications

Other Scyphacidae resident in upper beach litter are of the genus *Armadilloniscus,* which have a definite rostrum and an oval body with no narrowing of the pleon. The uropods have expanded bases and all four branches (which are small) are near the center line. *D. sachalina,* the same or a closely related species is reported from Kurile Islands. eastern Russia.

Ecological Information

RANGE—Southern Alaska, to Washington; not included in northern California keys; essentially an Arctic and Antarctic species4.

DISTRIBUTION—Day's Creek, South Slough of Coos Bay.

HABITAT—beach debris, substrate: sand.

SALINITY

TIDAL LEVEL—upper levels of beaches.

TEMPERATURE-

ASSOCIATES—amphipod *Orchestra;* other Oniscoidea *Armadilloniscus tuberculatus. Philoscia richardsonae2.*

Quantitative Information

WEIGHT-

ABUNDANCE—rather sparse

Life History Information

REPRODUCTION--

GROWTH RATE—

FOOD -

LONGEVITY --

PREDATORS

BEHAVIOR -

Bibliography

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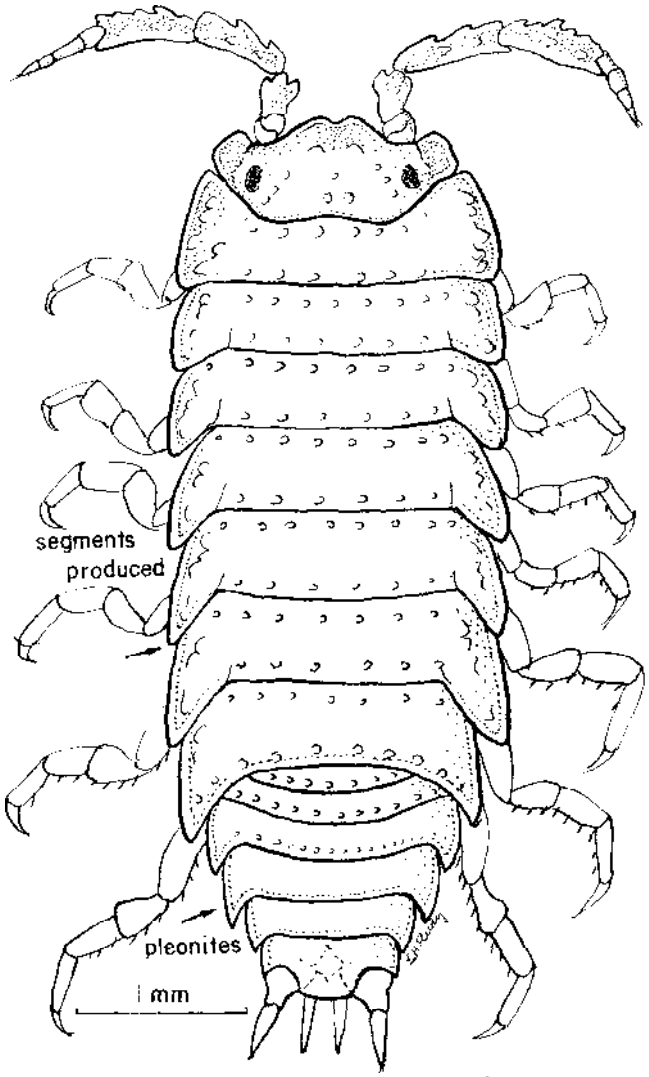
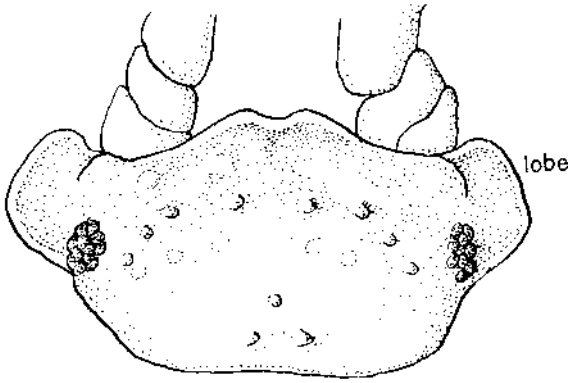
2 Hatch. M. H. 1947. The Chelifera and Isopoda of Washington and adjacent regions. Univ. Wash. Publ. Biol.. 10:155-274. Description and notes. pp 191-192.
3. Kozloff, 1974b. Key. pp. 152-153.
4. Lohmander, Hans 1927. On some terrestrial isopods in the Unifeu States National Museum. Proc. U. S. Nat. Mus. 72 1171:1-18 6 figs New genus. *Detonella.* Extensive description. figures of parts.
5. Richardson. Harriet. 1905. Original description as *Tochoni.scu:3 papiilicornis.* pp. 695-6.
6 Smith and Carlton. 1975. Keys to family only. pp. 303-304.
7. Van Name. VV. G. 1936. The American land and fresh-water isopod Crustacea. Bull. Amer. Mus. Nat. Hist. 71:1-535. Description and localities. pp. 100-101.

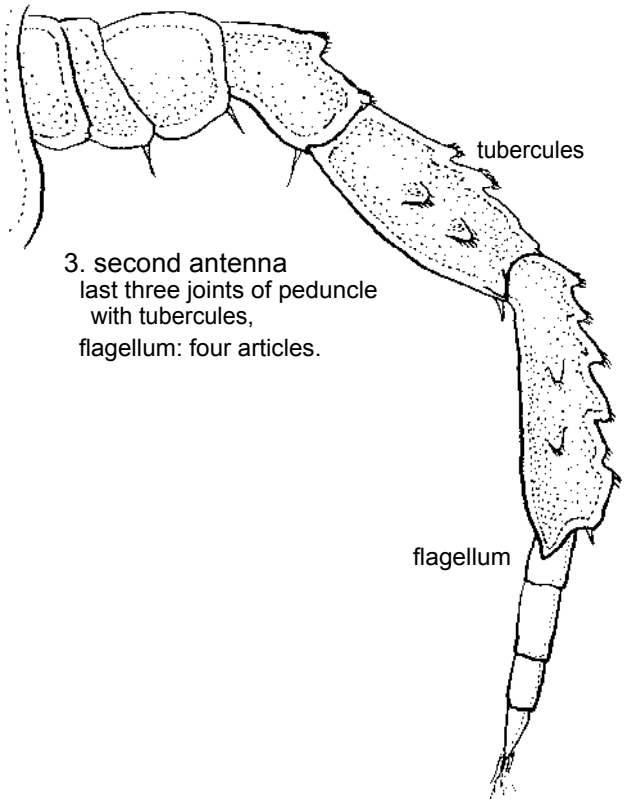
Defonella popillicornis



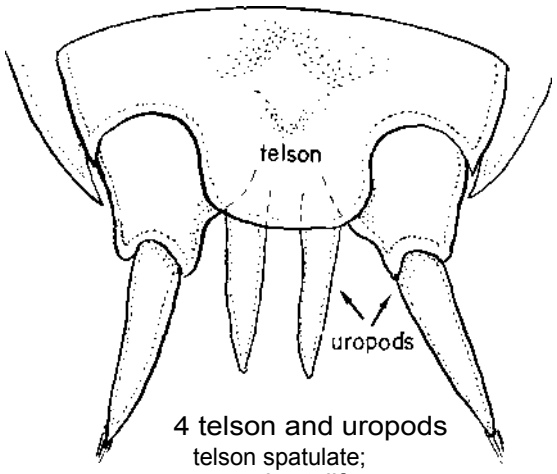
1. *Detonella papillicornis* x 25
thoracic segments produced backwards;
abdomen with five free pleonites.
actual size : 6 mm



2. head
no rostrum, simple eyes;
large lateral lobes.



3. second antenna
last three joints of peduncle
with tubercules,
flagellum: four articles.



4 telson and uropods
telson spatulate;
uropods styliform;
bases not expanded.

Ampithoe lacertosa
gammarid amphipod Bate, 1858

PHYLUM, Arthropoda
CLASS: *Crustacea*
ORDER: *Amphipoda: Gammaridea*
FAMILY: *Ampithoidae*

Description

SIZE--1.5 cm (South Slough of Coos Bay).

COLOR—pale green, large red eyes, small black spots.

HEAD—lateral lobes, eyes oval, red.

FIRST ANTENNA—flagellum twice as long as that of second antenna: 42 articles (fig. 1) (Barnard: 48-52[1]): no accessory flagellum. Flagellum about as long as body.

SECOND ANTENNA----flagellum 16 articles; (Barnard: 301).

MOUTHPARTS— lower lip has a gap between the sub-lobes of its outer lobes (fig. 2).

FIRST GNATHOPOD— male, article 5 equal to or smaller than article 6: palm angle oblique (fig. 5), female: article 5 longer than 6 in mature. large females: can be shorter in younger ones2: palm oblique.

SECOND GNATHOPOD—mature males with transverse. sinuous palm (fig. 4): females with oblique palm (fig. 6).

PLEONAL EPIMERON—two and three with small point at posterior corner (fig. la).

UROPODS—first uropod without interramal tooth (fig. 1 b); uropod three with flat, setose inner ramus, two curved hooks on outer ramus (fig. 7).

TELSON—fleshy, uncleft, rounded, two small spines laterally (fig .7).

Possible Misidentifications

The most similar species is *Ampithoe valida,* which also has the transverse palm in the second male gnathopod, but which has shorter antennae, and compressed lower lips. *A. valida* is an important estuarine species existing well up into brackish waters, on alga *Enteromorpha* (E. L. Bousfield communcation). *Ampithoe simulans* is also similar, except for the male second gnathopod, which is oblique and concave, not transverse. A northern species; subtidal and rare in southern California3.

Ecological Information

RANGE—Japan, Alaska, Washington, South to Magdalena Bay, Baja California.

LOCAL DISTRIBUTION—Coos Bay: Cape Arago, (North Bay), Charleston, South Slough.

HABITAT—builds tubes in alga *Macrocystis*[5]*;* in eelgrass on mudflat, South Slough.

SALINITY—collected at 30 o/oo.

TIDAL LEVEL— + 0.5 feet.

TEMPERATURE

ASSOCIATES

Quantitative Information

WEIGHT—

ABUNDANCE

Life History Information

REPRODUCTION—

GROWTH

FOOD--

LONGEVITY--

PREDATORS

BEHAVIOR

Bibliography

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2. 1965. Marine Amphipoda of the family Ampithoidae from Southern California. vol. 118. no. 3522, pp. 1-46 proc. U. S. Nat. Mus.. Washington, D. C. Description, pp. 9-12, with figures.
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4. Bate. C. S., 1858, An. Mag. Nat. Hist., ser. 3, vol. 1. p. 362: original description.
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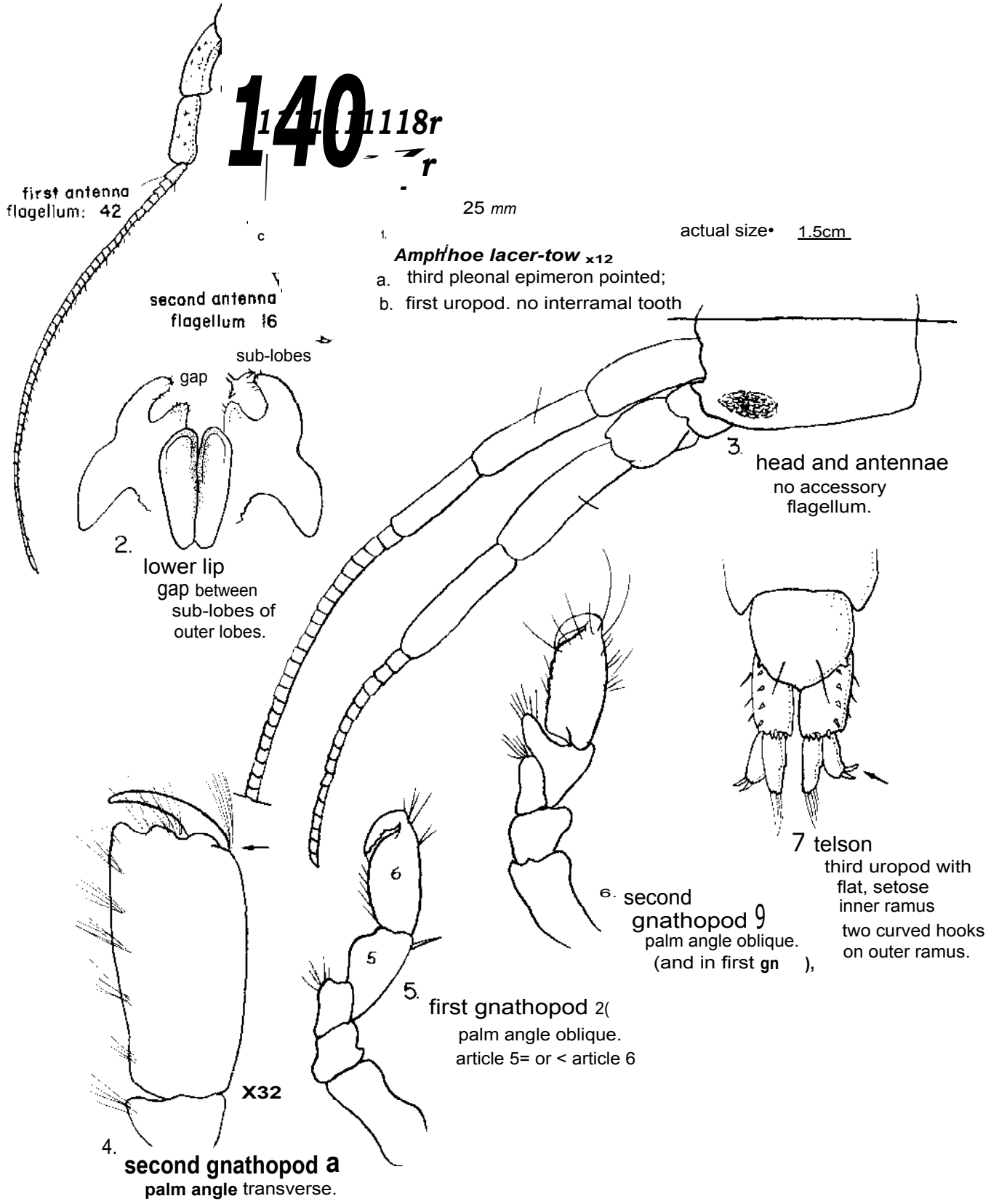
Ampithoe


140
first antenna
flagellum: 42
second antenna
flagellum 16
sub-lobes
gap
25 mm
actual size• 1.5cm
Amphithoe lacer-tow x12
a. third pleonal epimeron pointed;
b. first uropod. no interramal tooth
2. lower lip
gap between
sub-lobes of
outer lobes.
3. head and antennae
no accessory
flagellum.
4. second gnathopod a
palm angle transverse.
X32
5. first gnathopod 2(
palm angle oblique.
article 5= or < article 6
6. second
gnathopod 9
palm angle oblique.
(and in first gn),
7 telson
third uropod with
flat, setose
inner ramus
two curved hooks
on outer ramus.

Corophium brevis

Shoemaker, 1949

PHYLUM: *Arthropoda*
CLASS: *Crustacea*
ORDER: *Amphipoda, Garnmandea*
FAMILY: *Corophiidae*

Description -male: (Sexes described separately because of strong differences).

SIZE3 mm (South Slough of Coos Bay): 3.5 mm6.

COLOR transparent, with brown mottled markings especially on large second antenna.

FIRST ANTENNA reachesa little beyond fourth article of second antenna: flagellum with about 11 articles: estuary specimens): 9-14; (fig. 1). Base not expanded laterally,

SECOND ANTENNA-with groups of setae. large: almost as long as body, fourth article with a large. distal tooth forming a halt moon, and with an accessory tooth within it (lig, 2); fifth article with two small teeth, one distal, one proximal (fig. 2).

ROSTRUM-small central triangle shorter than sharp ocular !Ones (fig. 1).

SECOND GNATHOPOD--"filtering type, with fine. long setae: both sexes (fig. 3).

PEREOPODS-quite setose.

UROSOME-three segments separate and distinguishable (fig. 4): both sexes.

TELSON--posterior rounded. convex: parallel rows of spines (Jd 4)

FIRST UROPODS-lateral edge of peduncle with about eight short, blunt spines (fig. 4).

THIRD UROPODS-a few fine setae on distal end only, both sexes (fig. 4).

Description -female:

SIZE-4 mm[6]: Siuslaw estuary: 4.5 mm.

COLOR sameas male's.

FIRST ANTENNA-flagellum of 7-8 joints almost as long as second antenna (fig. 6).

SECOND ANTENNA-not massive like male's, instead of half moon tooth, and accessory tooth: three pairs of equally spaced, heavy spines on the lower margin (fig. 5).

SECOND GNATHOPOD, UROSOME, THIRD UROPOD, ROSTRUM-like male's.

Possible Misidentifications

All *Corophium* species have filtering-type second gnathopods and long setae on the third uropods. "Section A" *Corophium6* have separate segments on the urosome (fig. 4). Of these species, sexual dimorphism is strong in three Pacific northwest animals and especially marked in the fourth articles of the *second antenna.* These are C. *brevis,* C. *salmonis,* and C. *stimpsoni.* (Check also *first antenna, telson, first uropods* and *third uropods* for species differences, particularly between C. *brevis* and C. *salmonis).*

C. *stimpsoni,* principally a northern California species, does not seem to have been found in Oregon. Its chief key characteristic is a prominent male rostrum, almost as long as the ocular lobes. The females are much like those of C. *salmonis.*

C. *spinicome,* another prominent northwest species, has less sexual dimorphism: both males and females have the half moon tooth on the fourth article of the second antenna, but *without* the small acessory tooth. Is strongly euryhaline: often found in freshwater habitats.

Ecological Information

RANGE-Alaska to San Francisco Bay; Type specimen, Puget Sound6.

LOCAL DISTRIBUTION estuariesSouth Slough of Coos Bay several locations'; Siuslaw estuary,

HABITAT-SUBSTRATE mud: in South Slough mud and chips: a tube builder.

SALINITY--

TEMPERATURE

TIDAL LEVEL- high intermediate.

ASSOCIATES---tanaidaceans. small polychaetes, other Corophiidae.

Quantitative Information

WEIGHT —

ABUNDANCE- populations often very dense sometimes it can be the only obvious animal.

Life History Information

REPRODUCTION females in evidence and ovigerous in summer: European species. C. *volulator;* breeds in February (Overwintering population), again in July, August by spring age class: young in brood pouch four weeks: four broods per year possible3.

GROWTH RATE-

LONGEVITY--

FOOD-organic detritus, sorted by filtering gnathopods.

BEHAVIOR-females often in tubes. males out in mud and preyed upon by fishes, especially young salmon for whom male *Corophium* seem to be a major food.

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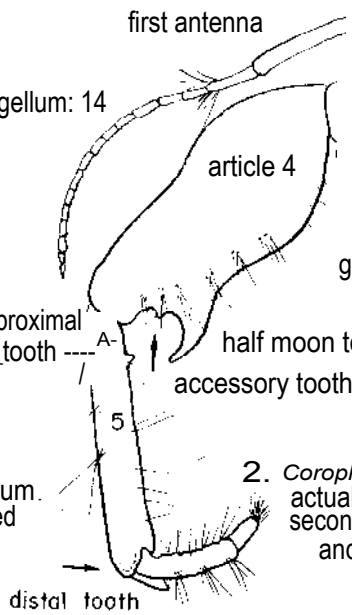
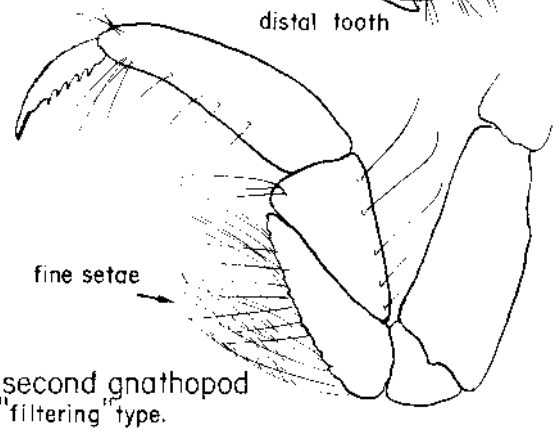
7. Smith and Carlton, 1975. pp. 333. 339, 340, 359. Good reference for most species.

Corophium brevis

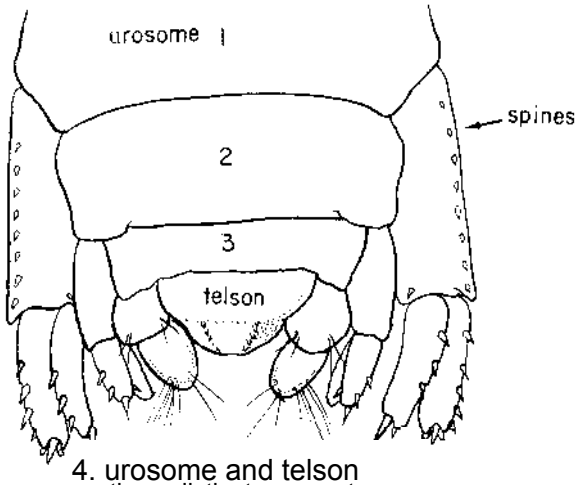
1. head, dorsal
small, low, triangular rostrum.
anten.ial bases not expanded laterally.



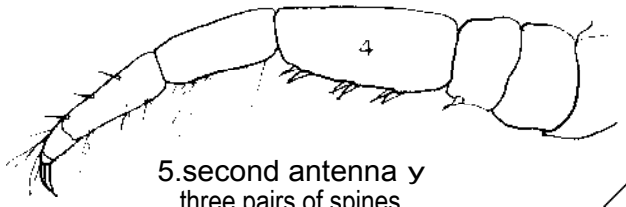
2. *Corophium brevis* cl' x 6C.
actual size: 4 mm
second antenna with large halt moon tooth and smail tooth; groups of setae.



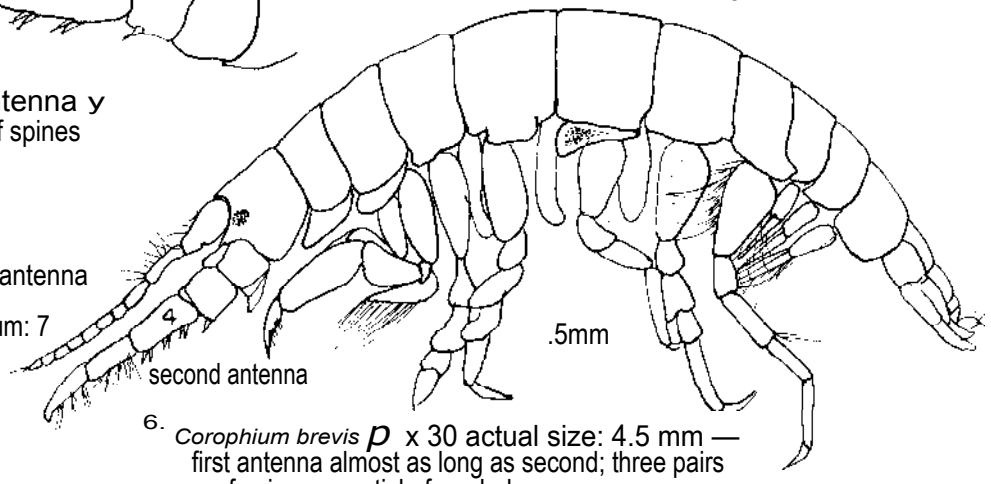
3. second gnathopod
"filtering" type.



4. urosome and telson
three distinct segments;
telson convex, with rows of small spines;
first uropods with eight small spines.



5. second antenna y
three pairs of spines



6. *Corophium brevis* p x 30 actual size: 4.5 mm —
first antenna almost as long as second; three pairs of spines on article four, below.

Corophium salmonis

Stimpson, 1857

PHYLUM: *Arthiopoda*
CLASS: *Crustacea*
ORDER: *Amphipoda; Gammarida*
FAMILY: *Ccrophiloac*

Description — male: (Sexes described separately because of strong differences)

SIZE—largest males, 6 mm from rostrum to end of uropods; South Slough of Coos Bay, 4-6 mm; Siuslaw estuary, 7.5 mm.

COLOR--transparent, with brown mottling, especially on large second antenna (fig. 3).

FIRST ANTENNA—reach to middle of article four of second antenna: flagellum of 14-16 articles[5], but occasionally 11-12; first article of peduncle flat, greatly expanded laterally (fig. 1).

SECOND ANTENNA—much longer than body in mature specimens[5]. fourth article with large distal tooth, forming half moon, with small tooth within it (fig. 3); fifth article with two teeth below, at distal end and near proximal end (fig. 3); proximal tooth lies below flexed half moon tooth. Gland cone on second article below, two lobed, elaborate (fig. 2).

ROSTRUM—straight, slightly convex, or with low central projection[5]; (fig. 2).

SECOND GANTHOPOD—"filtering type", both sexes, (fig. 3, C. *brews).*

UROSOME—posterior margin straight, slightly concave, with a spine in each corner, two spines on each lateral edge, two inside edge (fig. 5).

FIRST UROPODS—three to six slender spines along outside edge of peduncle; two to three small, blunt spines at distal corner, (fig. 5).

THIRD UROPODS— many slender setae, on all edges (fig. 5).

Description —females:

SIZE—about 7 mm[5]; South Slough of Coos Bay, specimens 6 mm.

COLOR—like other *Corophium sp:* clear, with brown mottling, especially on second antennae.

FIRST ANTENNA—(about as long as the second): flagellum of about 10 joints[6]: first articles not expanded.

SECOND ANTENNA—not as massive as male's, fourth article without large half moon tooth and accessory but with two single spines on the lower edge and two on the third article (fig. 4); gland cone simpler than on male, without lobes (fig. 8).

ROSTRUM—broad, low triangle (fig. 7).

SECOND GNATHOPOD, UROSOME, THIRD UROPOD—same as male, see above for "typical" *Corophium* characteristics.

SETOSE LAMELLAE—pairs of brood plates, attached to bases of coxae 2-5 on females only, for holding eggs and young. (Do not confuse with fleshy gills, also attached to coxae: (fig. 7. C. *spinicorne).*

Possible Misidentifications

Males: Of the *Corophium sp.* males which have separate urosome segments. C. *stimpsoni,* C. *brevis,* and C. *salmon's* all have a half moon and accessory tooth on the fourth article of the second antenna.

Rostrum—C. brevis and C. *salmonis* have often similar rostrums, but that of *C. stimpsoni* has a prominent central lobe nearly as long as the ouclar lobes. *First antenna —C. salmonis* and C. *brew's* can be distinguished by length: that of C. *brevis* longer and reaches to the middle of tr e fifth article of the antenna. In C. *salmonis* it reaches only to fne middle of the fourth article. C. *brevis* does not have the flat expanded first articles of the first antenna. C. *salmonis* usually has 14-16 articles in the flagellum, (though occasional specimens will have 11-12): En C. *brevis* the males "about" 11 articles in the flagellum of the first antenna. *Uropods—C. salmon's* and C. *brevis* are quite dissimilar: In C. *salmon's,* the peduncle of the first uropod is armed on the outside edge with three to six long slender spines, and at the distal edge with two to three short, blunt spines. C. *brevis* has instead only eight short blunt spines. The third uropods of C. *salmonis* have many more and longer setae than those of C. *brevis.* Telson—shape and spination of the two species are quite different (see fig. 4, C. *brevis,* and fig. 5, C. *salmon's).*

Female: C. *salmon's* and C. *stimpsoni* are very much alike, with no strong distinguishing characteristics, so the species shouldn't be differentiated solely by females. The only *Corophium* female of this "cluster" to have the half moon hook is C. *spinicorne,* so this species is easily distinguished. C. *brew's,* instead of having two single spines on the underside of the fourth article of the second antenna, has three pairs of spines, as well as a spine on the gland cone. Its first antenna has eight joints in the flagellum; that of C. *salmon's* has ten.

Ecological Information

RANGE—Coos Bay' to Puget Sound and Alaska.

LOCAL DISTRIBUTION—mudflats of South Slough of Coos Bay; Cox Island, (Siuslaw estuary); Tillamook Bay[2]: Sixes River, Ten Mile Creek; Columbia River.

HABITAT—SUBSTRATE—mud. sometimes with algae. *Ulva.*

SALINITY

TEMPERATURE

TIDAL LEVEL

ASSOCIATES —

Quantitative Information

WEIGHT-

ABUNDANCE—often "swarm"; also see C. *brevis.*

Life History Information

REPRODUCTION—only ovigerous females and young found in October (Ten Mile Creek).

GROWTH RATE

LONGEVITY

FOOD—organic detritus.

PREDATORS—young fish, especially chinook salmon2

BEHAVIOR

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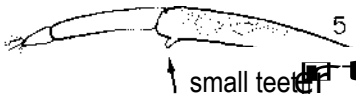
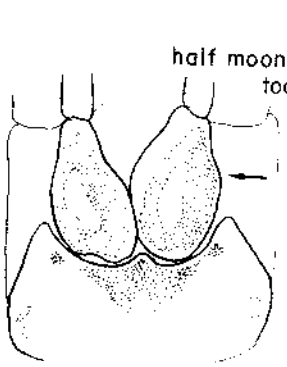
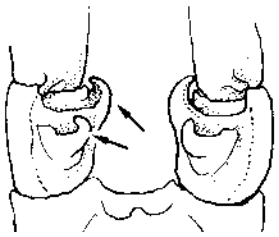
5. Shoemaker, C. R., 1949. The amphipod genus *Corophium* on the west coast of America. J. Wash. Acad. Sci., 45:1-59. First modern description of species. pp. 66-68.



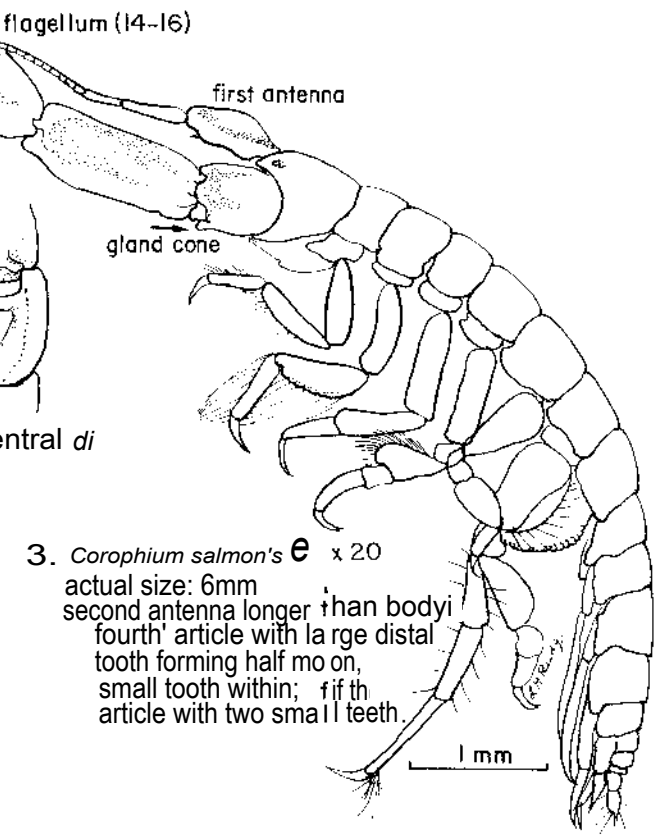
Corophium so/moms



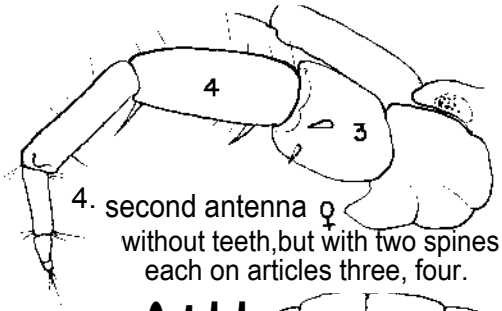
1. head (dorsal) e
rostrum with low projection or straight;
first articles flat, expanded.



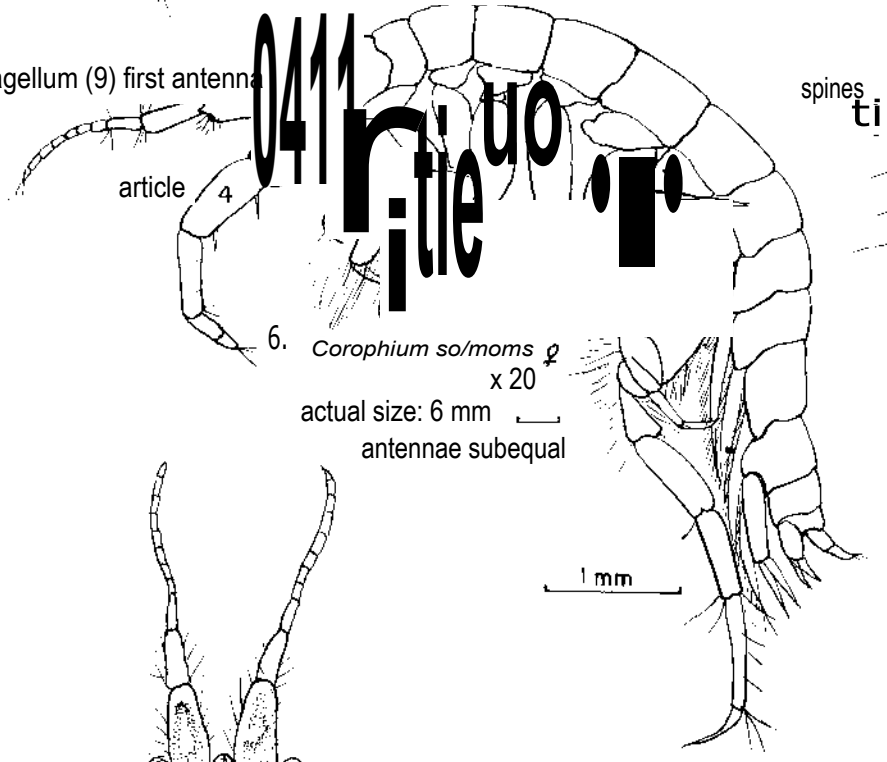
gland cones, ventral *di*
two lobes



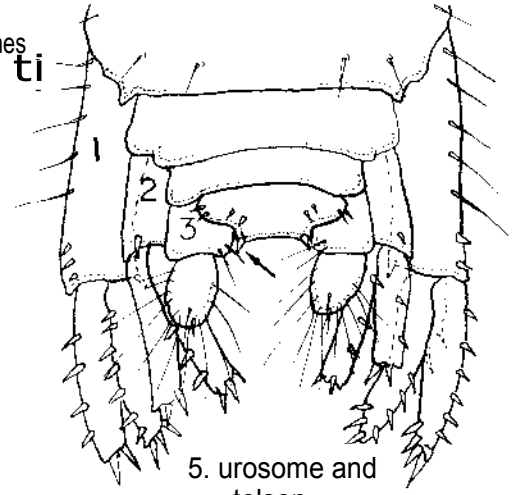
3. *Corophium salmon's* e x 20
actual size: 6mm
second antenna longer than body
fourth article with large distal tooth forming half moon, small tooth within; fifth article with two small teeth.



4. second antenna ♀
without teeth,but with two spines each on articles three, four.



6. *Corophium so/moms* ♀
x 20
actual size: 6 mm
antennae subequal



5. urosome and telson
first uropods with slender, blunt spines;
telson margin straight, two spines

7. head, dorsal
rostrum broad, low;
first antenna! articles not expanded.

gland cones, ventral ♀
simple, lobeless.

Corophium spinicome

Stimpson, 1857

PHYLUM: *Arthropoda*
CLASS: Crustacea
ORDER: *Amphipoda, Gammaridea*
FAMILY: Corophiidae

Description

SIZE—largest species of *Corophium* on the west coast: to 8 mm[6], females, 10 mm, South Slough of Coos Bay. males, 6 mm, females, (largest) 8.5 mm.

COLOR—clear, with dark brown markings on antennae and thoracic segments.

FIRST ANTENNA—reaching to middle of fifth segment of second antenna: flagellum of 14-16 joints (male) or 11 (female) Female may have one to three spines on first and second joints of peduncle, (fig. 5).

SECOND ANTENNA—in males as long as or longer than body: fourth joint with large distal half moon tooth; no small accessory tooth; fifth joint with distal spine, and proximal spine which is well within tooth when joint is flexed (fig. 1). Females have similar toothed fourth joint (fig. 5), with spines also on the fifth joint; the fifth joint proximal spine. however, opposes the large half moon tooth when the joint is flexed. Both sexes have prominent gland cones on the second article (figs. 1, 5), but that of the female is acute and curves forward sharply (fig. 5).

ROSTRUM—both sexes: rounded (fig. 3b, 4)[6]; but males sometimes straight (fig. 3a).

SECOND GNATHOPOD, UROSOME, THIRD UROPOD—"typical" *Corophium* types: (see C. *brevis,* (figs. 3.4).

SETOSE LAMELLAE—pairs of broodplates attached to bases of coxae (fig. 6) on females only. (Do not confuse with fleshy gills, present on both sexes.)

Possible Misidentifications

None of the other *Corophium* in this "cluster" have the large tooth on the second *antenna* without the small accessory tooth inside it. First. it is important to determine that the segments of the urosome are separate. not fused. Males and females of C. *spinicorne* can be separated by the second antennal features (see above), and by lamellae and/or eggs in the females.

Ecological Information

RANGE—estuaries and brackish waters from Santa Cruz. California. to Alaska; also in freshwater.

DISTRIBUTION—Oregon estuaries and lakes; South Slough of Coos Bay, Tillamook Bay; Floras Lake.

HABITAT—Substrate—mud: beach and log boom' areas of heavy silting: prefers sand2.

SALINITY brackish to freshwater: 0.02-33.6 0/002.

TIDAL LEVEL-

TEMPERATURE-10.-22.8°C.2

ASSOCIATES

Quantitative Information

WEIGHT-

ABUNDANCE—in excess of 100/m22.

Life History Information

REPRODUCTION

GROWTH RATE--

LONGEVITY

FOOD

PREDATORS— young chinook,.

BEHAVIOR

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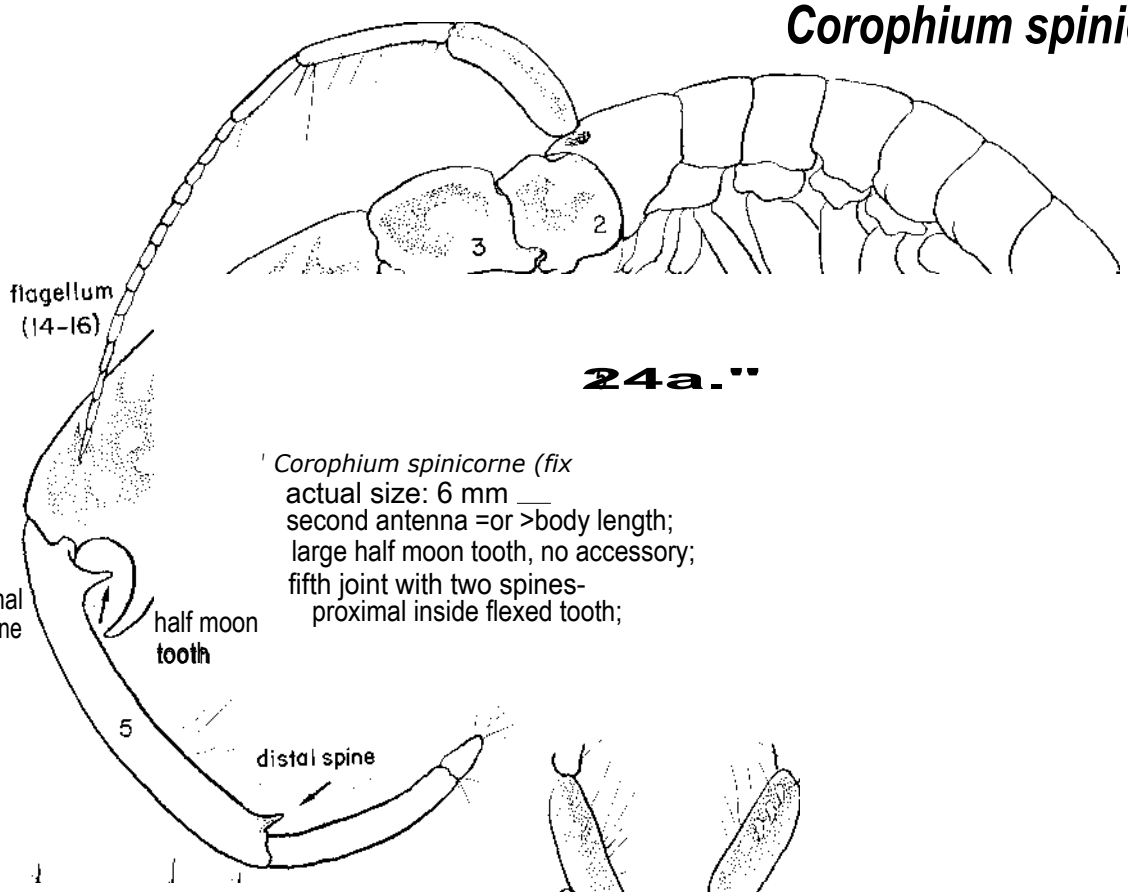
Corophium spinicorne



24a."

' *Corophium spinicorne (fix*
actual size: 6 mm
second antenna =or >body length;
large half moon tooth, no accessory;
fifth joint with two spines-
proximal inside flexed tooth;

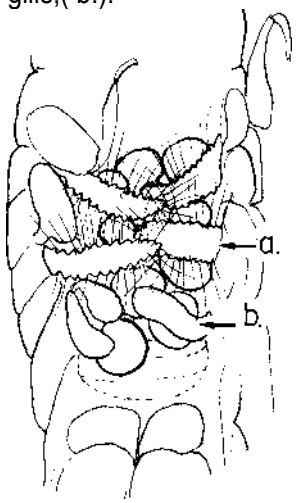
2. gland cones d'

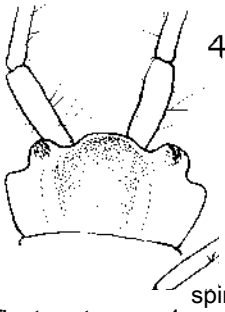
b.

411

3. head,dorsal **d**
straight (a.),or rounded,(b.).

6. broodplates
pairs of setose lamellae,(a.);
gills,(b.).



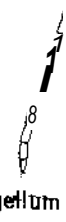


4. head, dorsal ♀
rostrum rounded,

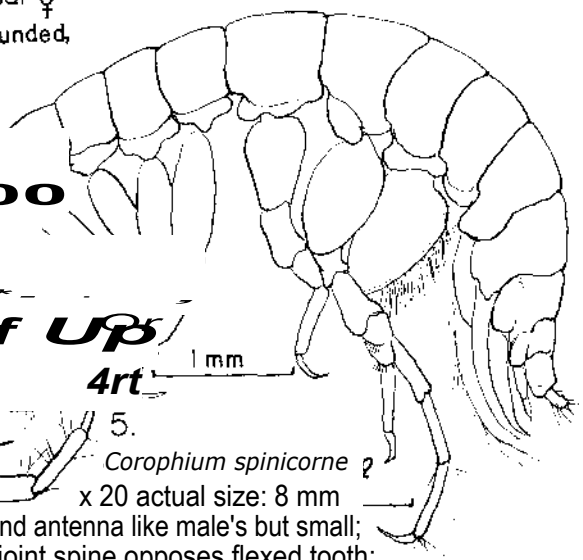
1%400

spines

first antenna 1



flagellum (11)



16-
?f UP
4rt
1 mm

5.

Corophium spinicorne ♀
x 20 actual size: 8 mm
second antenna like male's but small;
fifth joint spine opposes flexed tooth;
gland cone acute.

Allorchestes angusta

Dana, 1854

PHYLUM: *Arthropoda*
CLASS: *Crustacea*
ORDER: *Amphipoda, Gammaridea*
SUPER FAMILY: *Talitroidea*
FAMILY: *(Hyalidae)3*

Description

SIZE-6 mm; 8 mm (South Slough of Coos Bay) male; female smaller.

COLOR-bright green, dark red eyes and spots, yellow-green antenna; females splotchy brown.

FIRST ANTENNA-shorter than second antenna (male); female's antenna subequal.

SECOND ANTENNA-longer than first five body segments' (fig. 1).

HEAD-small rostrum, eyes large, red, latero- anterior; lateral lobes broadly subtruncatedl.

MOUTHPARTS-mandible with well developed rasping surface on molar (fig. 2); 2-3 spines, 5 teeth, no palp. Maxilli ped-tip of inner plate with three stout spines, setae: article four developed (fig. 4).-First maxilla with minute palp (fig. 3)8.

FIRST GNATHOPOD-stout, article five produced (fig. 1).

SECOND GNATHOPOD-very large, article five produced, article six oval, tapering, palm oblique; dactyl large, curved, fitting palm (fig. 5), article 4 larger than 3.

PEREOPODS -three and four with short setae; five longer than four.

UROPODS-third with one small, flexible ramus, one spine (fig. 6).9

TELSON-rectangular, cleft halfway; compressed laterally in cross section (fig. 7a, b).9

FEMALES-smaller, antenna subequal, first gnathopod palm transverse, not oblique; second gnathopod just slightly larger than first.

Possible Misidentifications

Parallorchestes ochotensis, a similar species, does not have the produced article five on the second gnathopod, and has a small inner ramus on the third uropod. Its telson has two triangu:ar lobes.

Ecological Information

RANGE-Japan; Northwest Pacific waters to Laguna Beach, California; rare south of Monterey3.

LOCAL DISTRIBUTION-Coos Bay area: North Bay of Cape Arago, Bay channel[3]; South Slough of Coos Bay: Metcalf Preserve.

HABITAT-algae and eelgrass; substrate (Metcalf Preserve) mud, chips: also in plankton haul2.

SALINITY-

TEMPERATURE-

TIDAL LEVEL-high intermediate (Metcalf Preserve): + 2-4 feet.

ASSOCIATES-other amphipods, tanaid *Leptochelia,* polychaetes.

Quantitative Information

WEIGHT-

ABUNDANCE-one of the common amphipods along the outer coast.

Life History Information

REPRODUCTION- ovigerous female found in July2,

GROWTH RATE--

LONGEVITY-

FOOD-

PREDATORS-

BEHAVIOR-

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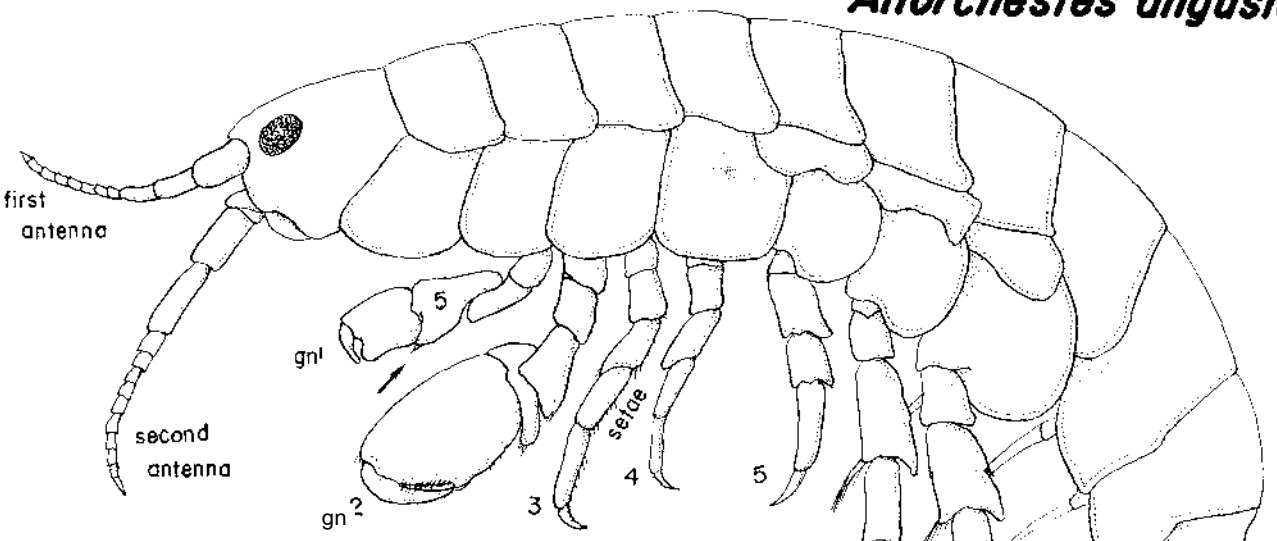
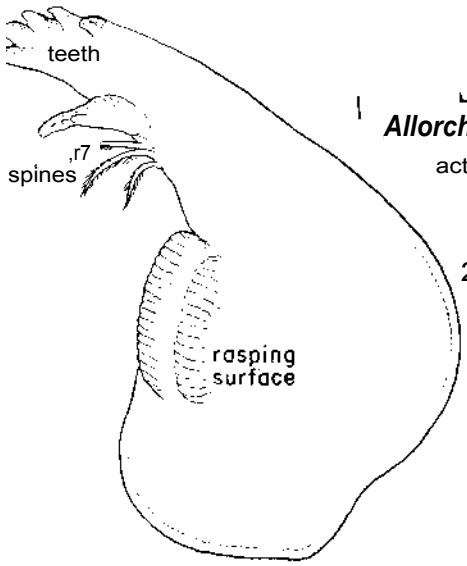
Allorchestes angusta



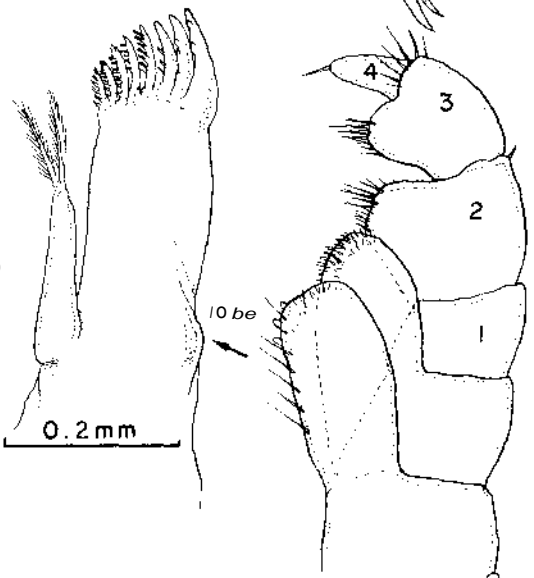
1 mm.

Allorchestes ongusto **di** x30

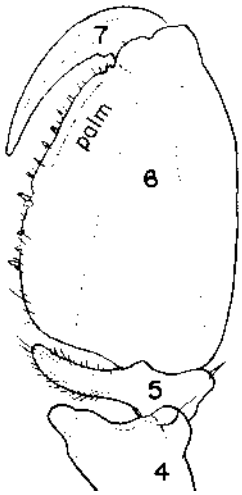
actual size: 8 *mm.*



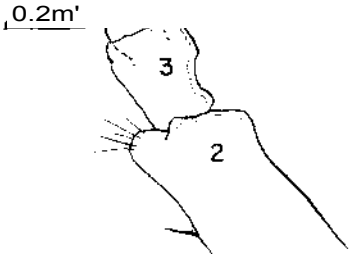
2. mandible
5 teeth,3 spines;
strong rasping surface,
no palp.



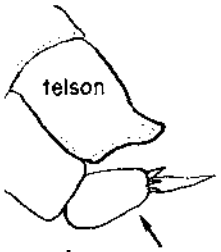
3. first maxilla x 130
inner plate: 2 setae;
outer plate:3 spines.
minute pal p or lobe.



5 second gnathopod cr x 55
article five produced;
article three short.
article 7 curved



4. **M0Xii/iped**
wilds four developed.
(from Bousfield, in press)5



6.
third **uropod**
one **ramus, flexi ble and rudimentary;**
no minute inner ramus.

urosome

cross-section
urosome compressed laterally.

b. telson
rectangular, cleft halfway.

Eogammarus confervicolus
(Stimpson, 1857)

PHYLUM: *Arthropoda*
CLASS: *Crustacea*
ORDER: *Amphipoda, Gammaridea*
FAMILY: *Gammaridae*

Description

SIZE-to 21 mm; South Slough of Coos Bay largest (males) 12 mm: Siuslaw estuary, 16 mm (males).

COLOR-white with dark brown mottling brown stripes on first and second antenna.

FIRST ANTENNA-almost half body length; an accessory flagellum of 5 articles (fig. 1). Longer than (or subequal to) 2nd antenna; usually with posterodistal spine on peduncle: genus *Eogammarus.2*

SECOND ANTENNA-stout, shorter than 1st, with 14 articles; peduncles 4, 5 with 2 (rarely 3) posterior marginal groups of setae (in addition to terminal group)2.

ROSTRUM vestigial.

MOUTHPARTS-mandible with palp, molar large, with rasping surface.

FIRST GNATHOPOD (gn[1])-slightly smaller than second gnathopod: article 6: palm oblique, 9 peg-like teeth, dactyl curved, (fig. 2a).

SECOND GNATHOPOD-much like first gnathopod, but larger; palm with seven stout pegs (fig. 2b).

COXAE-first four plates become gradually larger: fourth is rounded (fig. 1): fifth, sixth and seventh quite small.

PEREOPOD-strong and well spined; becoming larger posteriorly.

PLEONITES-no dorsal spines; only 0-2 posterior marginal setae (fig. 1).

UROSOMITES-urosome 1 with 4 dorsal groups of 3 spines each; urosome 2 with dorsal spines in 2 groups; no prominent median tooth[2] (fig. 3): primary key character.

UROPODS-uropods 1 and 2 with 2-4 groups of spines; uropod 2: rami extend beyond peduncle of uropod 3 (fig. 1)2; uropod 3: inner margin of outer ramus usually with 4 groups of strong spines, but less than 10 isolated plumose setae[2]; inner ramus less than half length outer ramus (fig. 4)2.

TELSON- split, with connected lobes; each lobe with 2 spines, only one apical (at the tip): fig. 3.

SEXUAL DIMORPHISM-very little. Females are smaller, have smaller gnathopods, and shorter antenna than do the males.

Possible Misidentifications

A closely related genus is *Anisogammarus,* whose members have 1st antennae shorter than the 2nd antennae. In *Anisogammarus* each of the urosomites has a prominent median tooth and a smaller pair of dorsolateral teeth, not 2-4 groups of spines as in *Eogammarus.* Finally, on uropod 3, the rami are subequal, not disparate in size as in *Eogammarus.* There are three species of *Anisogammarus:*

Anisogammarus ramellus has its urosomite spines arranged in horizontal rows; *Anisogammarus pugettensis* has a prominent fixed median spine on its 2nd urosomite, and no rows of spines. Its 3rd uropod has an inner ramus 3/4 as long as the outer one.

Another closely related genus is *Ramellogammarus,* characterized by dorsal groups of spines on its pieon segments[2]; spines in groups of 1-3 on urosomes 1 and 2, urosome 3 with 2 posterodorsal groups of (or single) spines: 1-4 groups of posterior marginal setae on peduncle segments of both 1st and 2nd antennae[2]. *Ramellogammarus* oregonensis is strongly armed on pleonites 1-3. It has been reported only from Coos Bay[6], on alga *Cladophora.*

Other species of *Eogammarus* in the Northeastern Pacific Region include *Eogammarus oclairi,* a pelagic estuarine form very like *E. confervicolus.* Its 2nd antenna have 4th and 5th peduncles with 3-4 groups of posterior marginal setae (in addition to the terminal group); each of its telson's lobes has two terminal setae, not one as in *E. confervicolus2.*

Ecological Information

RANGE-San Diego, California to Alaska.

DISTRIBUTION-Sa/icornia marsh (South Slough. Metcalf Preserve); on log boom, in mud, Siltcoos River; South Slough of Coos Bay[1], Siuslaw estuary.

HABITAT-Substrate-mud: gets name from the "conferva-, or long green algae in which it lives: *Salicornia. Cladophora. Fucus,* among others.

SALINITY fullsalt to brackish.

TEMPERATURES-

TIDAL LEVEL in South Slough of Coos Bay: in drainage channels at +4.5 feet.

ASSOCIATES- isopod *Gnorimosphaeroma insulare,* (South Slough of Coos Bay); *Corophium slamonis* (Siuslaw estuary).

Quantitative Information

WEIGHT-

ABUNDANCE-often occurs in great numbers: to 25,000/m^2 [4]; 5% of benthic fauna, beginning of June, 17% August (Sixes River)4.

Life History Information

REPRODUCTION-

GROWTH RATE-

LONG EVITY-

FOOD-- detritus.

PREDATORS-fish, birds.

BEHAVIOR-

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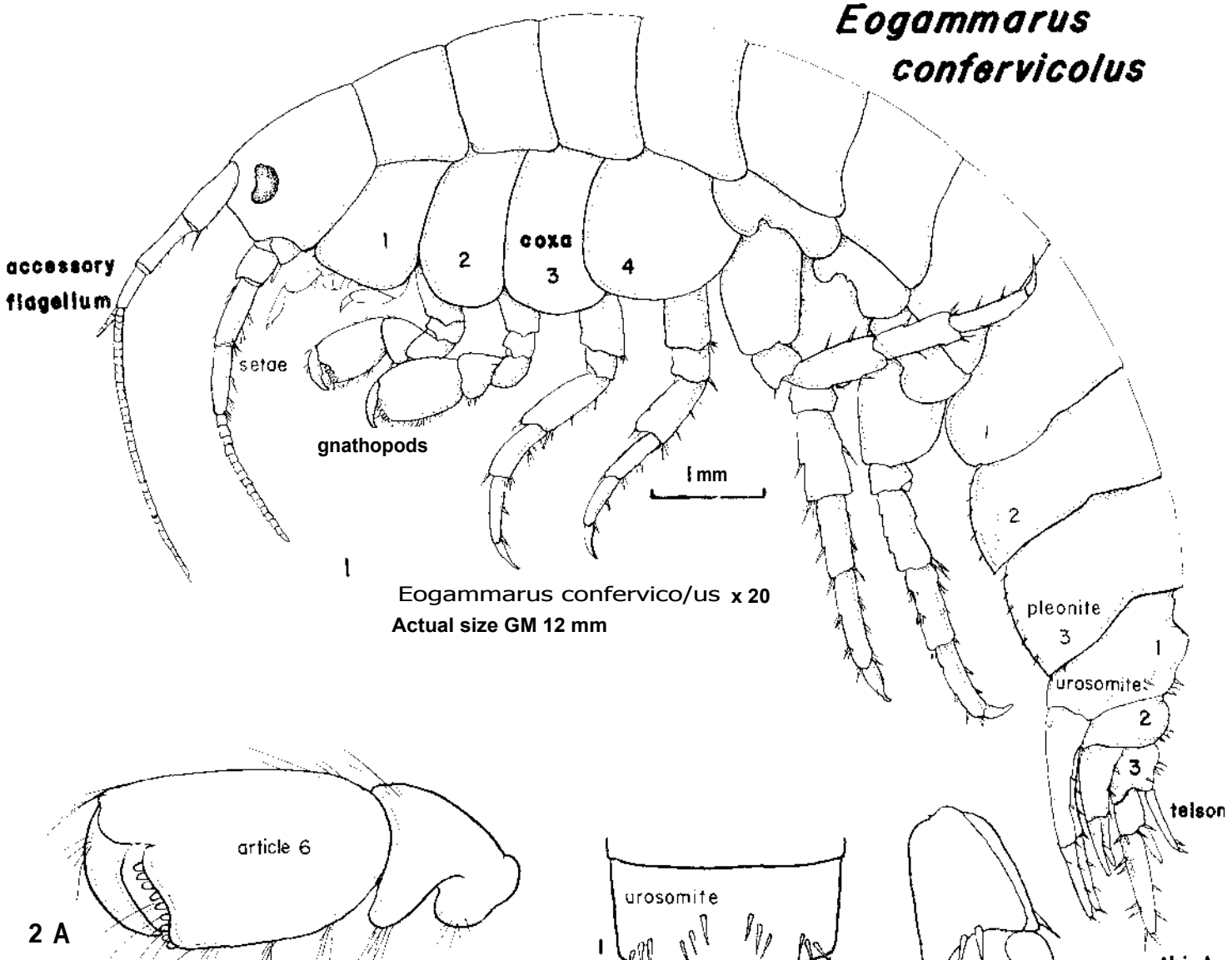
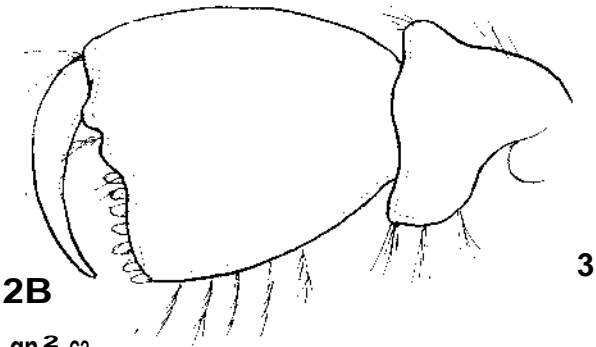
Eogammarus confervicolus



2 A

gn¹ *cl*

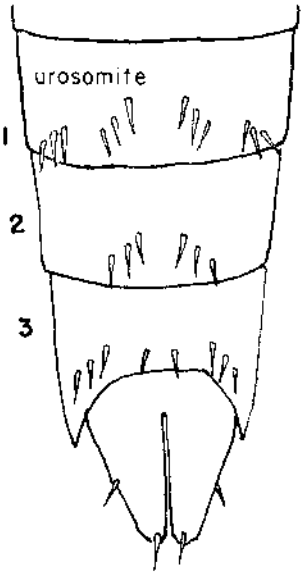
9 pegs,
strongly curved dactyl.



2B

gn² C?

7 pegs,
5 fascicles
narrow dactyl.



3 "BASlegammarid split telson,
connected lobes, each with two spines.

urosomites

stout spines aligned anterior to posterior in vertical bunches.

4

third uropod with small inner branch.

Traskorchestia traskiana 4
a beach hopper (Stimpson, 1857)

PHYLUM: *Arthropoda*
CLASS: *Crustacea*
ORDER: *Amphipoda, Gammaridea*
FAMILY: *Talitridae*

Description

COLOR-pale brown, orange antennae; dull green or gray-brown, slight blue legs7.

SIZE-2 cm (South Slough of Coos Bay); 1/2 inch or a little mores.

FIRST ANTENNA-very short, five articles (fig. 1). Stebbing: 9

SECOND ANTENNA-peduncle not thickened; short; flagellum or 16 articles; (Stebbing-16: male, 12: female 9); both antennae less massive than in those beach hoppers of the more open coast'

.HEAD- rostrum simple, eyes large, oval (fig. 1).

MOUTHPARTS- mandible without palp (fig. 2): Talitridae; maxilliped with four articles, fourth not developed' (fig. 4).

FIRST GNATHOPOD-dactyl slender, subchelate, not simple as in *Orchestoidea,* especially in mature males: *Orchestia:* translucent process on article four (fig. 5).

SECOND GNATHOPOD-smooth convex palm; no spine at hinge of articles 6 & 7 (fig. 6).

COXAE--plate one about half as large as plate two 5 (fig. 1).

PLEONITES-five and six not fused 8, (fig. 1).

PEREOPODS-seven longer than six: *Orchestia8.*

PLEOPODS-"strong", biramous; first three about equal in size; branches with 7-10 segments (not figured).

TELSON-puffy, split, with several spines: Talitridae 8 (fig. 3) (split not visible in lateral view).

UROPODS-third uniramous: Talitridae'; ramus narrowing distally, shorter than peduncle 5. (fig. 3).

SEXUAL DIMORPHISM-males larger than females, have larger gnathopods.

Possible Misidentifications

Orchestoidea sp. are larger than *Orchestia* and found on exposed beaches. *Talitroides* are small introduced species of high water drift line. Two other *Orchestia* species can occur in Oregon: *0. chiliensis* is an introduced species found under debris on sandy beaches; it has a long, inflated second antenna, and the second gnathopod has a sinuous dactyl and a triangular tooth near the hinge. *0. georgiana* has weak pleopods with 4-6 segments on the rami; its first gnathopod lacks the process on the fourth article (male) found on 0. *traskiana.*

Ecological Information

RANGE-Washington to Magdalena Bay, Baja California'.

LOCAL DISTRIBUTION-several locations in Coos Bay, and at North Bay, Cape Arago'.

HABITAT--rocky beaches, sandy beaches with algae, salt n-',Irshes (under debris and boards) 8; in driftwood, on high protected beaches; inner *Sallicornia* marsh, Metcalf Preserve, Coos Bay.

SALINITY-from brackish slough 7, high beaches of salty bays 6. outer coast'-

TEMPERATURES--

TIDAL LEVEL-usually along the wrack line, but also found more than 20' above tidewater'.

ASSOCIATES-in Metcalf Preserve. Coos Bay: other amphipods, sphaeromid isopods, and the gastropod, *Ovatelia.*

Quantitative Information

WEIGHT-

ABUNDANCE-often in hundreds under debris.

Life History Information

REPRODUCTION-some females ovigerous March, (Coos Bay).

GROWTH RATE-

LONGEVITY-

FOOD-scavenges in debris for detritus.

PREDATORS-

BEHAVIOR-probably completely nocturna16.

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7 Ricketts and Calvin, 1971. pp. 20-21.

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9. Stabbing, p. 530, 534-5 Matches description, except for perepods three and four.

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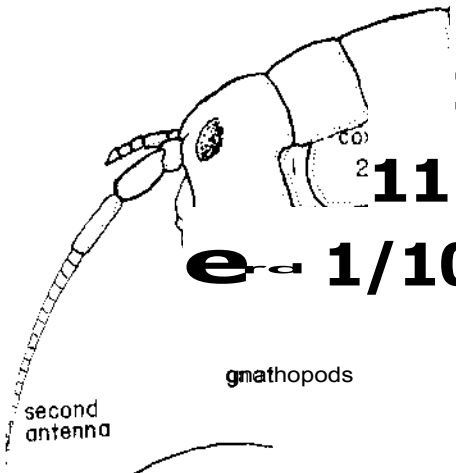
Traskorchestia traskiana

111 11111%

111 · IIIP aa Ike

e-- 1/10 4 0- WO IPA

'1 tr a a i s



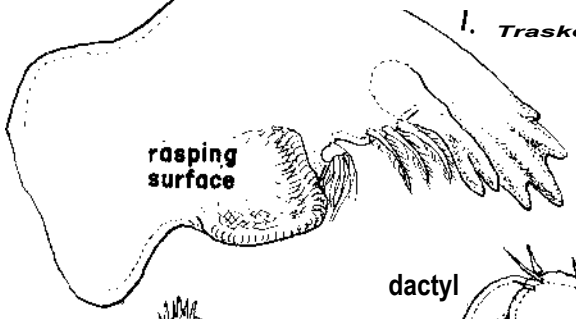
actual size: L 2 cm

A 4 1

2mm

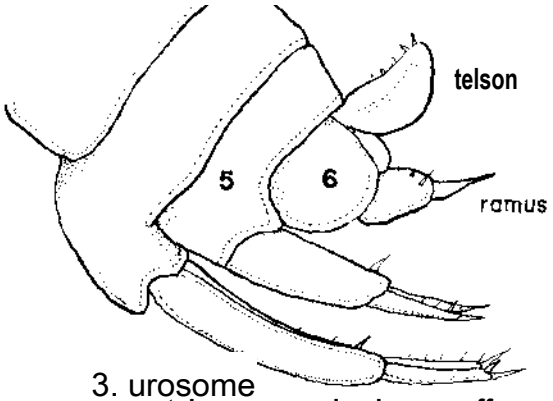
L

1. *Traskorchestia traskiana* (Stout, 1912)
pereopod seven longest.
both **antennae short.**

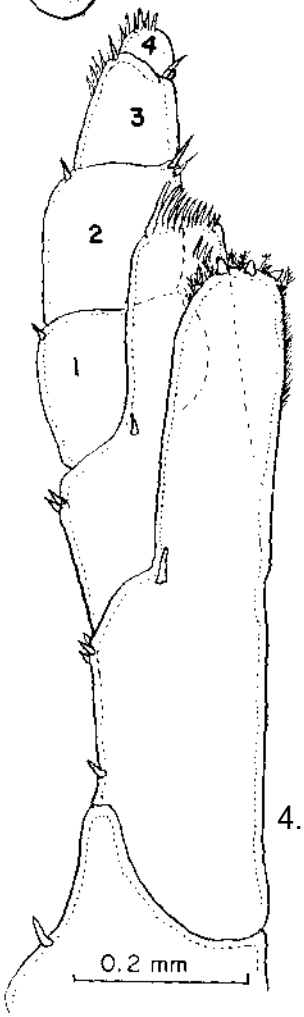


2. mandible
no palp.

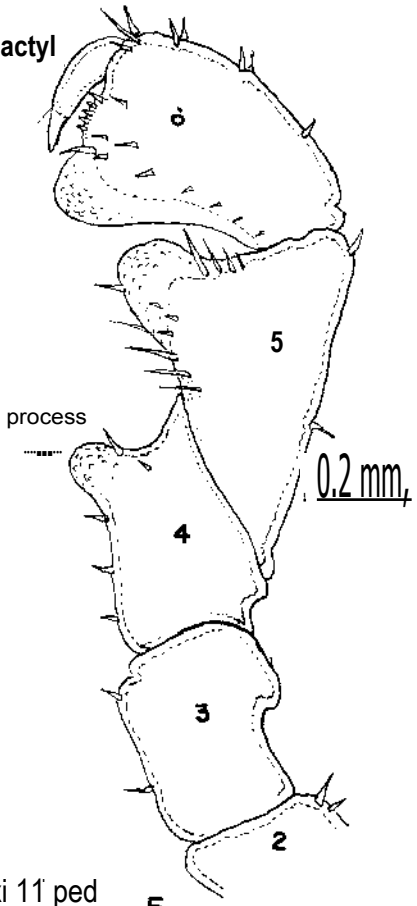
(411



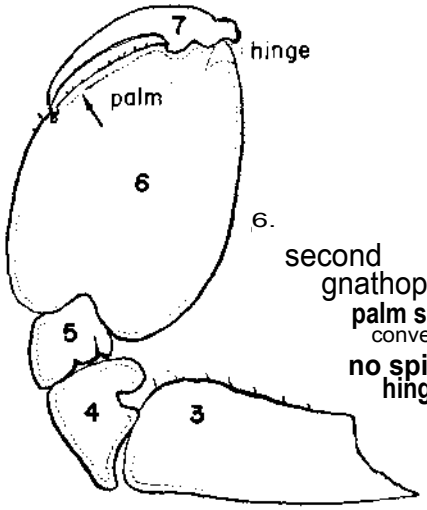
3. urosome
telson: several spines,, puffy;
third uropod: ramus narrowing, shorter than peduncle:



4. maxi 11 ped
four articles.



5 •first gnathopod on
subchelate, dactyl slender,
process on fourth segment.



6. second gnathopod c71
palm smooth,
convex
no spine at hinge.

Megalorchestia pugettensis
a beach hopper (Dana, 1853)

PHYLUM: *Arthropoda*
CLASS: *Crustacea*
ORDER: *Amphipoda, Gammaridea*
FAMILY: *Talitridae*

Description

SIZE-to 18 mm[5]; this specimen 17 mm, without antennae.

COLOR-white; usually with three spots on last three coxae.6

FIRST ANTENNA-short; not quite to middle of third article of longer than flagellum, especially in males'° (fig. 1). Flagellum of about 20 articles.

SECOND ANTENNA--massive peduncle of three articles is longer than flagellum, especially in males'° (fig. 1). Flagellum of about 20 articles.

HEAD-rostrum rounded, simple; eyes large, oval (fig. 1).

MOUTHPARTS-mandible without palp: family Talitridae. (Mouthparts not figured, see *Orchestia traskiana).* Maxilliped article four not well developed.

FIRST GNATHOPOD-simple, not subchelate, in both sexes: genus *Orchestoidea*[10]*;* strong dactyl adapted for digging (fig. 2). Translucent blister on article 6: species *pugettensis.* Also a blister on article 3.

SECOND GNATHOPOD-large, subchelate in male (fig. 1, 3); simple in female (not figured, more like gnathopod one).

COXAE-(first article of pereopod): first plate *1/2* as large as second (fig. 1).

PLEONITES-5 and 6 separate, not fused: Talitridae; anteroventral margin of pleonite 1 with 1-7 spines: species *pugettensis,* (fig. 1).

PEREOPODS-6 longer than 7: genus *Orchestoidea* (fig. 1).

PLEOPODS-(small breathing organs within pleosome): 3, biramous; third about equal in size to first and second (not figured).

TELSON-spinose, notched at tip (fig. 7). See figs. 1, 6 for position. Often lost in collecting.

UROPODS-three pairs:

ONE-outer branch with marginal spines (fig. 4); no interramal spine (not figured). Inner branch: double row of spines.

TWO-outer branch without spines on inner margin (figs. 5, 6).

THREE-one branch: Talitridae; ramus broad distally, about as long as peduncle: genus *Orchestoidea'°* (fig. 6).

SEXUAL DIMORPHISM -males with very large powerful second gnathopods; simple in females and young.

Possible Misidentifications

Beach hoppers (Talitridae) are obvious dwellers in damp sands, where they live on seaweed. They survive well in air. Talitridae have a single branched third uropod (figs. 1, 4), and a mandible without a palp (not figured, see *Traskorchestia traskiana).*

Within the Talitridae, the genus *Megalorchestia* are found on exposed beaches and are usually larger than *Orchestia.* Or*chestia* sp. have subchelate first gnathopods (like male second gnathopods), not simple ones; slender first gnathopod dactyls, not heavy ones; 7th pereopods longer than the 6th, not the reverse as in *Orchestoidea;* and narrowing 3rd uropod branches, not broad ones.

Other species of *Megalorchestea* include

Orchestoidea californiana, the largest species (in the Puget Sound area, Kozloff, 1974a), is found on beaches high in the intertidal. It has a second antenna with a long flagellum (males), spines on the inner margin of the outer ramus of the 2nd uropod. The females have a translucent process on article 5 of the first gnathopod; the rami of the pleopods are short.

Orchestoidea corniculata, another large species found on coarse sand beaches with lots of protection, seaweed and a steep slope, has short second antennal flagella and spineless inner margins on the outer rami of its second uropods, like *0. pugettensis.* However, it has an entire, not a notched telson, and no spines on the margin on its first pleonites.

Orchestoidea columbiana, found on coarse sand beaches with little seaweed, has long second antennal flagella, and no spines on the margins of its pleonites. Unlike *0. californiana,* it has no translucent process on the females' gnathopod 1, and its pleopod rami are *1/2* to *3/4* the length of the peduncle. It can be as large as 22 mm long.'

0. benedicfi is small (9-13 mm), and is found on fine sand beaches; its pleonites have 1-5 spines on their posterior margins, which might confuse it with *0. pugettensis.* Its telson is notched, however, and it lacks the characteristic blister on the 6th article of the male gnathopod of *0. pugettensis.*

Other genera of Talitridae include *Talitroides* and *Talitrus,* small introduced amphipods of the highwater drift line, mostly terrestrial. These have been found in the San Francisco Bay area.

Ecological Information

RANGE-

LOCAL DISTRIBUTION-Coos Bay: South Slough, several stations.

HABITAT-under debris on coarse sand beaches with little seaweed.'°

SALINITY-

TEMPERATURE-

TIDAL LEVEL-above tide levell, likes dampness, but avoids immersion in seawater.

ASSOCIATES-

Quantitative Information

WEIGHT-

ABUNDANCE-not as common as *Traskorchestia traskiana* (Coos Bay).

Life History Information

REPRODUCTION-pairing occurs in spring: in *0. californiana* and *0. corniculata;* young carried until 3 mm.5

GROWTH RATE-

LONGEVITY-possible two years maximum life span for *0. califomiana.5*

FOOD-scavenges detritus from beach debris. The closely related *0. californiana* and *0. corniculata* are omnivorous, macrophzgrous, and partial to seaweed, wet cardboard and the bodies of other arthropods. They avoid putrefied matter.,

PREDATORS-shorebirds

BEHAVIOR-nocturnal: to avoid diurnal birds, for better moisture and temperature conditions for feeding, and because they are sensitive to light.'

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   _____ 1958. Distributional ecology of the terrestrial Talitridae (Crustacea: Amphipoda) of Canada. Proc. 10th Internat. Congr. Entomology. 1.883-98.
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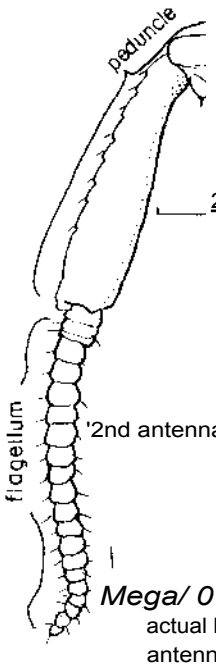
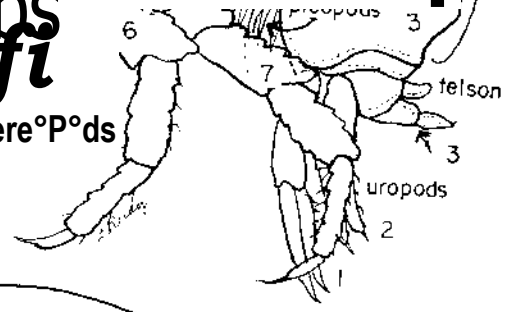
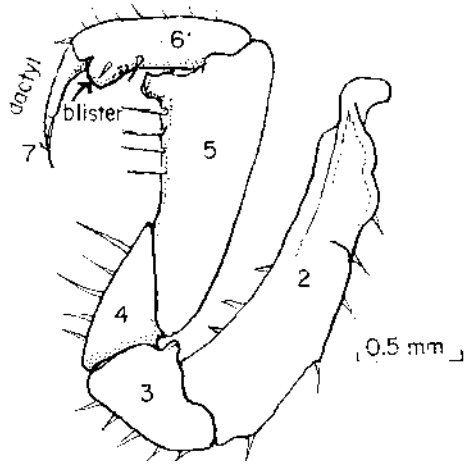
9. Kozloff, 1974b. Key to genera only, pp. 155-7.
10. Smith and Carlton, 1975. By E.L. Bousfield, pp. 352-64.

Megolorchestio pugettensis

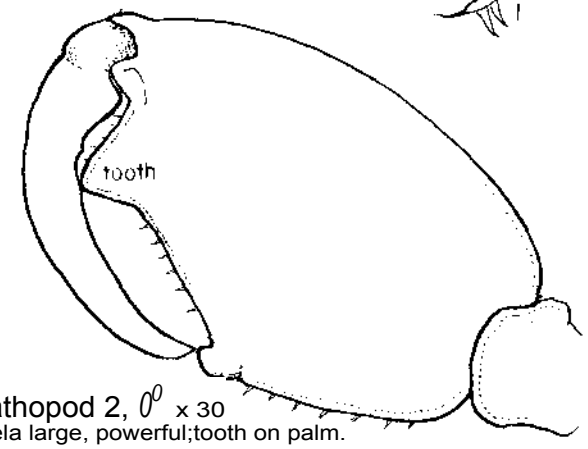


Mega/ 0 (-chest/ a pagetlensis
actual length(w/o antennae): 17 mm;
antennae I short; antennae 2: flagellum<peduncle;
pereopods: 6 >7; smal l spines on pleon it e l .

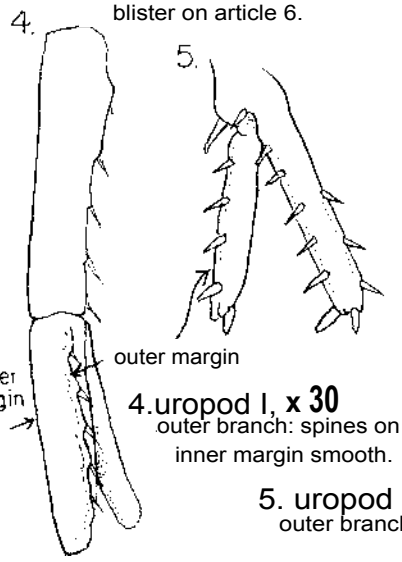




agnathopod 1,0 x 30
dactyl simple, strong;
blister on article 6.

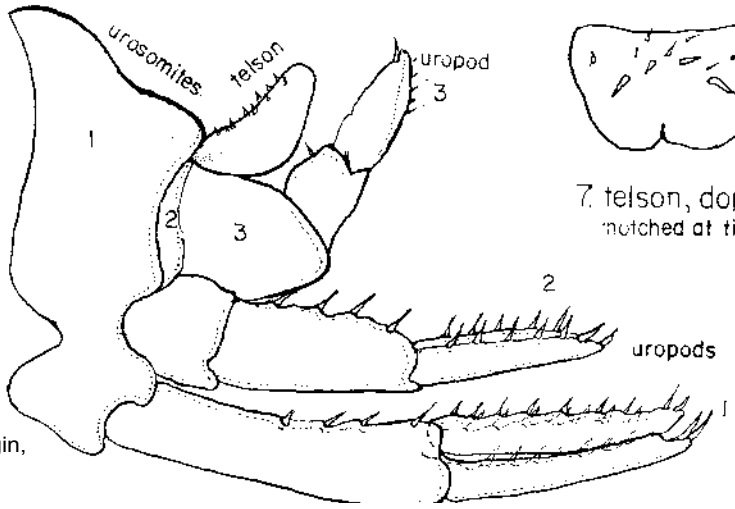


3. gnathopod 2, 0^0 x 30
chela large, powerful;tooth on palm.



4.uropod I, **x 30**
outer branch: spines on outer margin,
inner margin smooth.

5. uropod 2 x 30
outer branch: inner margin smooth.



6. urosome x 30
uropod 3: ramus broad, as long as peduncle.

7. telson, dorsal
notched at tip.

Lissocrangon stylirostris

formerly *Crangon stylirostris*[3]

common shrimp Holmes, 1900

PHYLUM: Arthropoda
CLASS: *Crustacea,* SUBCLASS: *Malacostraca*
ORDER: *Decapoda, Natantia*
TRIBE: *Caridea*
FAMILY: *Crangonidae*

Description

SIZE-type: 5.5 cm, average 3-47 mm[5]; this specimen (Coos Bay): 5.5 cm.

COLOR-white with black and brown chromatophores, giving gray appearance.

ROSTRUM-narrow and pointed downward, grooved; (without dorsal teeth); acute tip.

EYES--free, not covered by carapace.

ANTENNAL SCALE-short, just a little over half length of carapace; blade with oblique inner margin; spine longer than blade (fig. 2).

CHELIPEDS-hands (manus) subchelate, slightly widened distally, and about twice as long as wide (Fig. 3).

CARAPACE-without medial spine: *Lissocrangon*[2]*;* ("lisso": smooth); a pair of hepatic (lateral) spines (fig. 1).

ABDOMEN-shrimplike, with typical Caridean bend[s]; sixth segment not grooved ventrally5.

TELSON-distinctly shorter than uropods (fig. 4).

Possible Misidentifications

Lissocrangon stylirostris is the only local species of the family without the medial carapace spine. This distinguishes it from the other genera which have one or more medial spine. (The common local intertidal and shallow water genus is *Crangon,* with one spine).

Ecological Information

RANGE-Alaska to Santa Cruz, California. Type locality: Trinidad, California.

LOCAL DISTRIBUTION Coos Bay: Pt. Adams beach at the mouth of South Slough.

HABITAT-often along high energy sandy beaches[2]; a bottom-dweller, preferring hard sands.

SALINITY-collected at 30 0/00; range 17 o/oo-33 o/oo4.

TEMPERATURE-8.7°-16°C4.

TIDAL LEVEL-collected at -1.0; can be found as deep as 80 meters.

ASSOCIATES-infested by Bopyrid isopod *Argeia pugettensis* Dana3.

Quantitative Information

WEIGHT-

ABUNDANCE-"common in surf zone of semiprotected sandy beaches"6.

Life History Information

REPRODUCTION-

GROWTH RATE —

LONGEVITY-—

FOOD —

PREDATORS-fish.

BEHAVIOR-

Bibliography

1 Butler, TH. 1980. *Shrimps of the Pacific Coast of Canada* Can. Bull Fish & Aqua. Sci. No. 202. 280 pp. pp. 98-9. as Crangon.

2 Kuris, Armand M. and James T. Carlton, 1977. Description of a new species, *Crangon handi,* and new genus, *Lissocrangon,* of crangonid shrimps (Crustacea: Caridea) from the California coast, with notes on adaptation in body shape and coloration. Bio. Bull. 153:540-559.

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4 Morris, Abbott & Haderline. 1980. P 574. pl 166

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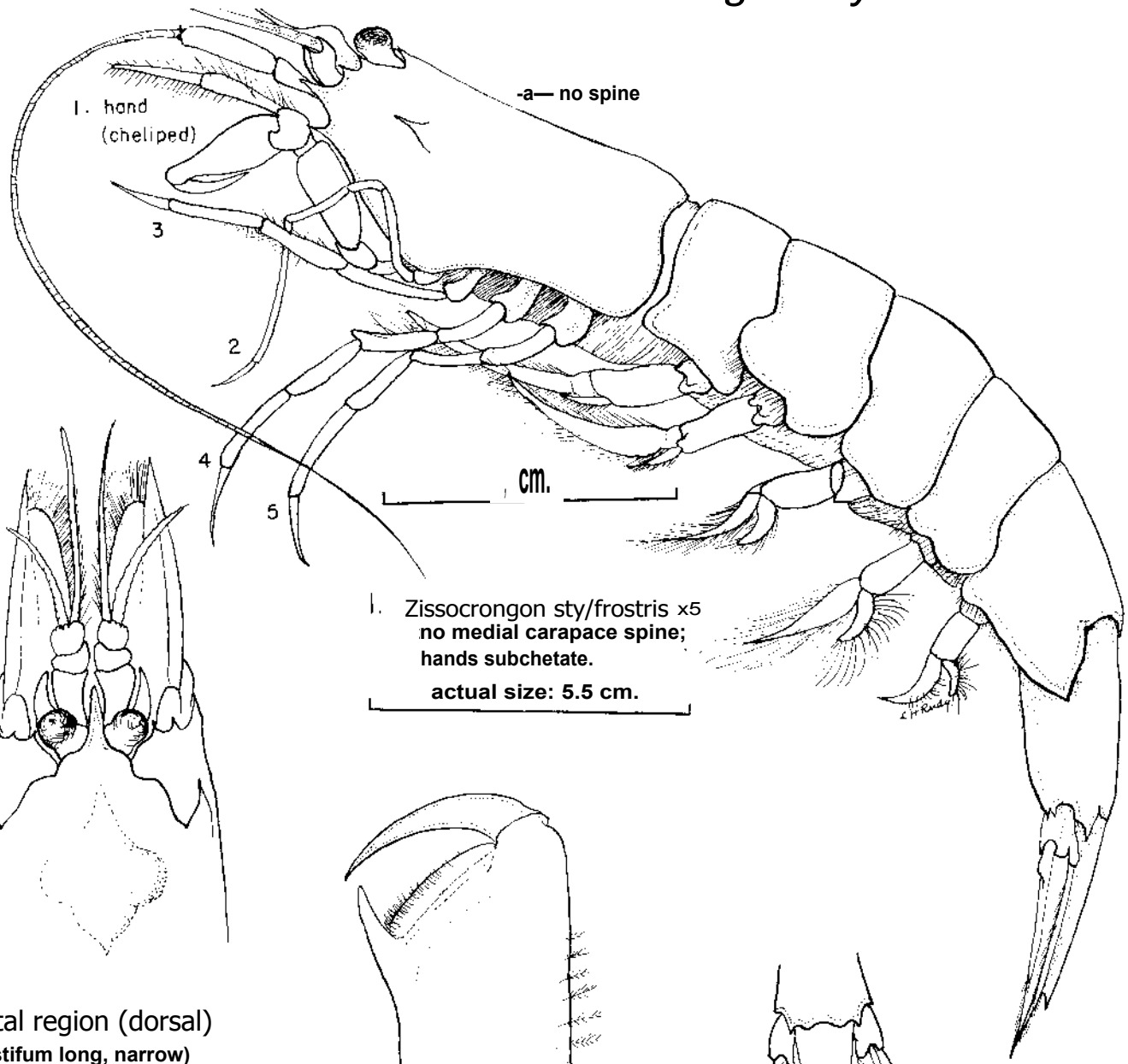
Lissocrongon styfirostris



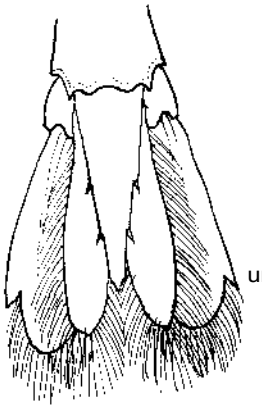
1. Zissocrongon sty/frostris x5
no medial carapace spine;
hands subchetate.
actual size: 5.5 cm.

2.
frontal region (dorsal)
rostifum long, narrow)
pointed down;

carapace: no medial spine.

antenna' scale: short; blade with oblique inner angle; spine longer than blade.

3. cheliped, manus
x12



4. telson
telson shorter
than uropods.

Crangon franciscorum

common gray shrimp **Stimpson,** 1856

PHYLUM: *Arthropoda*
CLASS: *Crustacea,* SUBCLASS: *Malacostraca*
ORDER: *Decapoda, Natantia*
TRIBE: *Caridea*
FAMILY: *Crangonidae*

Description

SIZE-type: about 7.6 cm[6]; South Slough (of Coos Bay) specimen, female: 6.5 cm.

COLOR-white, mottled with small black spots, giving gray appearance; eyes salmons.

ROSTRUM-short, flattened, rounded (fig. 2): unornamented.

EYES-free, not covered by carapace' *Crangon*[7] and *Lissocrangon.*

ANTENNAL SCALE-about 3/4 the length of the carapace: blade broad, rounded and shorter than spine (fig. 2).

CHELIPEDS-hands subchelate: *Crangon*[6] and *Lissocrangon;* hand (propodus) at least four times as long as wide; finger closed nearly longitudinally (fig. 3).

CARAPACE-with a single medial spine: *Crangon*[5] and *Lissocrangon;* a pair of lateral spines as well.

ABDOMEN-shrimp-like, with typical Caridean bend; second segment overlaps first (fig. 1).

TELSON- nearly equal in length to uropods; sp. *franciscorum.*

Possible Misidentifications

Other northwest *Crangon* species with only one medial carapace spine are C. *nigricauda,* C. *nigromaculata,* C. *alaskensis,* and C. *handi.*

C. *nigricauda,* the "black tailed shrimp". has antennal blade and spine of nearly equal length, its fingers of the chelipeds close almost transversely.

C. *nigromaculata* has a striking round marking on the side of the sixth abdominal segment; its fingers also close transversely, and it may not range north as far as Oregon.

C. *alaskensis* is a small shrimp, with a slender rostrum, and, in common with all these closely related species, without C. *franciscorum 's* very long propodus.

C. *handi,* from the outer coast, has a very short, stout antennal scale, and a short sixth abdominal segment[8]. Butler' calls this species *Crangon franciscorum franciscorum,* to distinguish it from C.f. *angustimana* Rathbun 1902, the long-clawed crangon. This latter species lives in deeper water, and within a narrower range of temperatures than does C. *f. franciscorum.*

Ecological Information

RANGE-southeastern Alaska to San Diego, California; type locality, San Francisco6.

LOCAL DISTRIBUTION-Yaquina Bay[4]; South Slough (Collver Point, channel).

HABITAT-"sandy coves"[6]; in bay channel, substrate of mud, rock (South Slough); also offshore.

SALINITY-collected at 300/00; determines distribution, see4.

TEMPERATURE-great toleration of temperature variation; prefers warmer water than C. *nigricauda.*

TIDAL LEVEL-down to 29 fathoms[6] (91 meters).

ASSOCIATES-collected in trawl with *Cancer jordani, Hermissenda* sp., *Rostanga pulchra,* sponges. Can be infested with Bopyrid isopod *Argeia pugettensis* Dana'.

Quantitative Information

WEIGHT-

ABUNDANCE-"common to abundant"'; with C. *nigricauda,* comprise the major decapod shrimp epifauna, Yaquina Bay4, caught commercially, San Francisco2.

Life History Information

REPRODUCTION-spawning December to August' (Yaquina Bay); ovigerous female collected April; eggs hatch in water of high salinity: larval stages occur floating in the plankton: earliest post-larval shrimp found in brackish water of shallow tidal flats; maturing animals move into deeper water2.

GROWTH RATE-differential growth rate: large females and males, (see4).

LONGEVITY-females live a maximum 11/2 years, males up to one year 4.

FOOD-

PREDATORS-sport and food fishes-important food item of young striped bass in upper Coos Bay[4]; primary food shrimp in San Francisco Bay.

BEHAVIOR-

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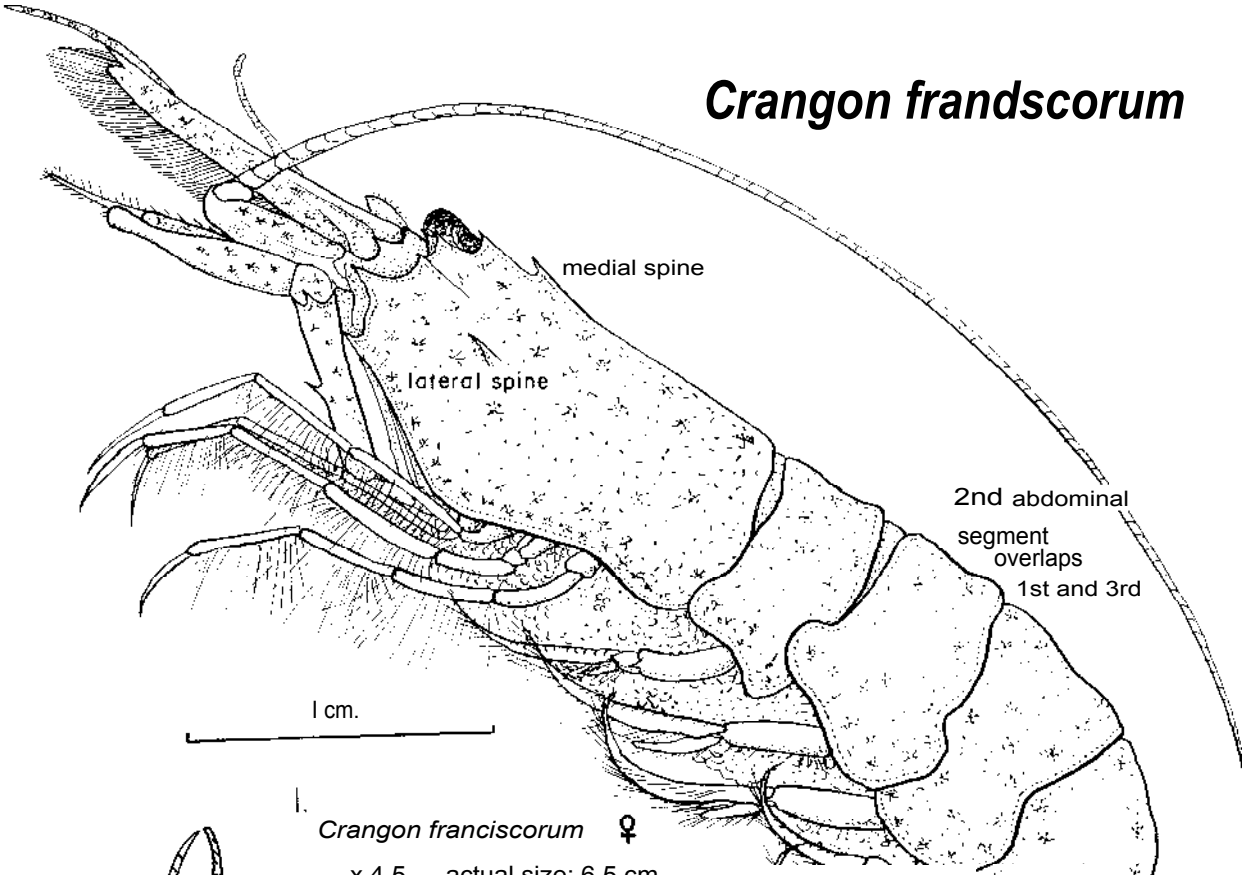
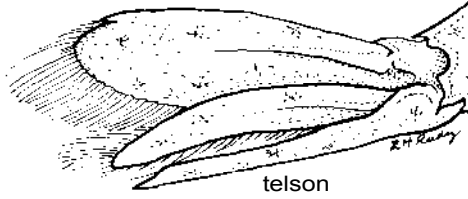
Crangon frandscorum

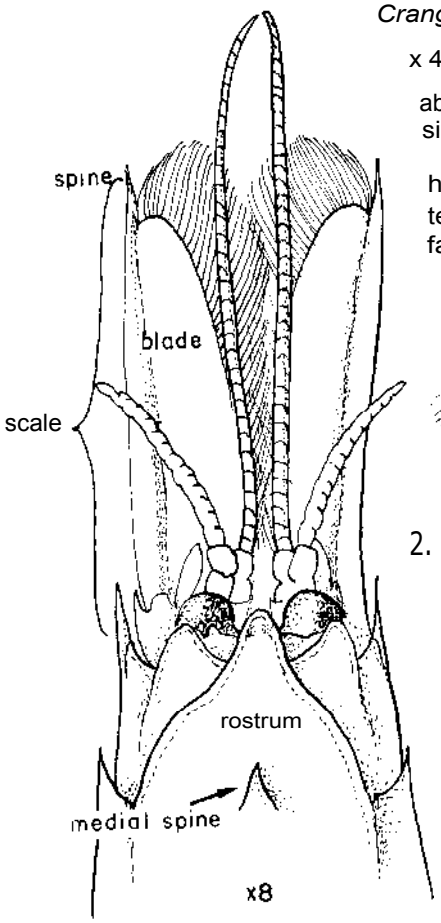


1. *Crangon franciscorum* ♀

x 4.5 actual size: 6.5 cm.

abdomen compressed, shrimp-like;
side plates of second abdominal segment overlap first;
hands subchelate;
telson, uropods nearly same lengths
fan-like tail.

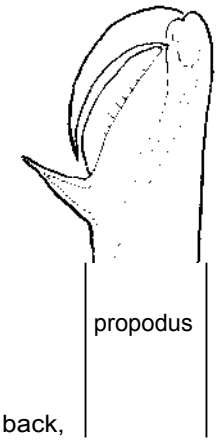




3 mm

2. head

antehnal scale 3/4 length of carapace;
blade broad,rounded; spine long;
rostrum short,flattened; rounded;
eyes free;
carapace with medial spine,



3. first cheliped

hand slender, finger turned back, nearly longitudinal;
propodus at least four times as long as wide.

Crangon alaskensis

Lockington, 1877

C. alaskensis elongata Rathbun, 1902)

PHYLUM: *Arthropoda*
CLASS: *Crustacea,* SUBCLASS: *Malacostraca*
ORDER: *Decapoda, Natantia*
TRIBE: *Caridea*
FAMILY: *Crangonidae*

Description

SIZE--about 3 cm: South Slough of Coos Bay; 5.7 cm (San Francisco)5.

COLOR--rnot'ied brown and white, black chromatophores; dark r&,

ROSTRUM-slender, not rounded; short, somewhat flattened; without dorsal teeth: *Crangon*[6]*;* reaches beyond posterior edge of cornea, (fig. 2).

ANTENNA----two-thirds body length.

EYES---free, not covered by carapace: *Crangon*[6]*,* and *Lisso-crangon.6*

ANTENNAL SCALE-nearly as long as carapace (fig. 1); spine longer than blade; blade not produced on antero-internal angle, but narrow.

CHELIPEDS- hands subchelate, finger folds across palm, forming 45 °angle (fig. 3); hand (propodus) 21/2 to 3 times as long as wide5.

CARAPACE-with one medial spine: *Crangon*[3]*,* as well as a pair of lateral spines (fig. 2).

ABDOMEN-shrimplike, with typical Caridean bend[s]; fifth segment with slight median keel (fig. 1)[5]. Ventral surface of sixth segment grooved3.

TELSON- nearly as long as uropods (fig. 1); with slight medial keel (fig. 2).

Possible Misidentifications

Other northwest *Crangon* species with one medial carapace spine are C. *franciscorum,* C. *nigricauda,* C. *nigromaculata,* and C. *hancli*[3]*.* C. *franciscorum* has a very long propodus on the first leg (nearly four times as long as wide'); C. *nigricauda,* "black tailed", has an antennal blade as long as the spine, and a short, rounded rostrum; it is the most nearly similar species, although larger than C. *alaskensis.* C. *nigromaculata* has a bright "bullseye" on the side of the sixth abdominal segment, the finger folds transversely across hand[s]; its range is north only to northern California[5]. C. *handi* has a very short, stout antennal scale, and a very short sixth abdominal segment[3]. C. *alaskensis elongata* was once considered a southern range variety; having a longer rostrum and antennal scale[s]; this nomenclature is no longer used3.

Ecological Information

RANGE-British Columbia to Mexican border'.

LOCAL DISTRIBUTION SouthSlough of Coos Bay, west side, below Charleston Bridge.

HABITAT-SUBSTRATE--mud in eelgrass: "in shallow water of bays on soft bottoms"6.

SALINITY-collected at 30 0/00.

TEMPERATURE-

TIDAL LEVEL-collected at + 0.5 feet; "habitat generalist", found in sand, mud, with a wide depth range3.

ASSOCIATES-in South Slough, polychaetes, broken back shrimp, *Heptacarpus* sp., Talitroid amphi pods. Can be infested with Boyprid isopod *Argeia pugettensis* Dana'.

Quantitative Information

WEIGHT-

ABUNDANCE -"common"[6]; common in South Slough, Coos Bay.

Life History Information

REPRODUCTION

GROWTHRATE —

LONGEVITY —

FOOD-

PREDATORS-

BEHAVIOR-

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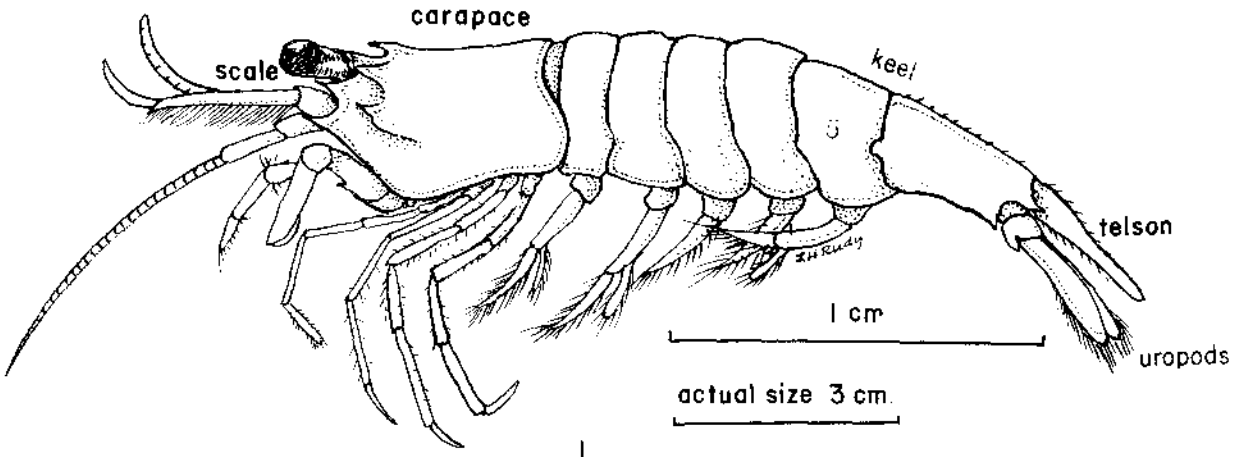
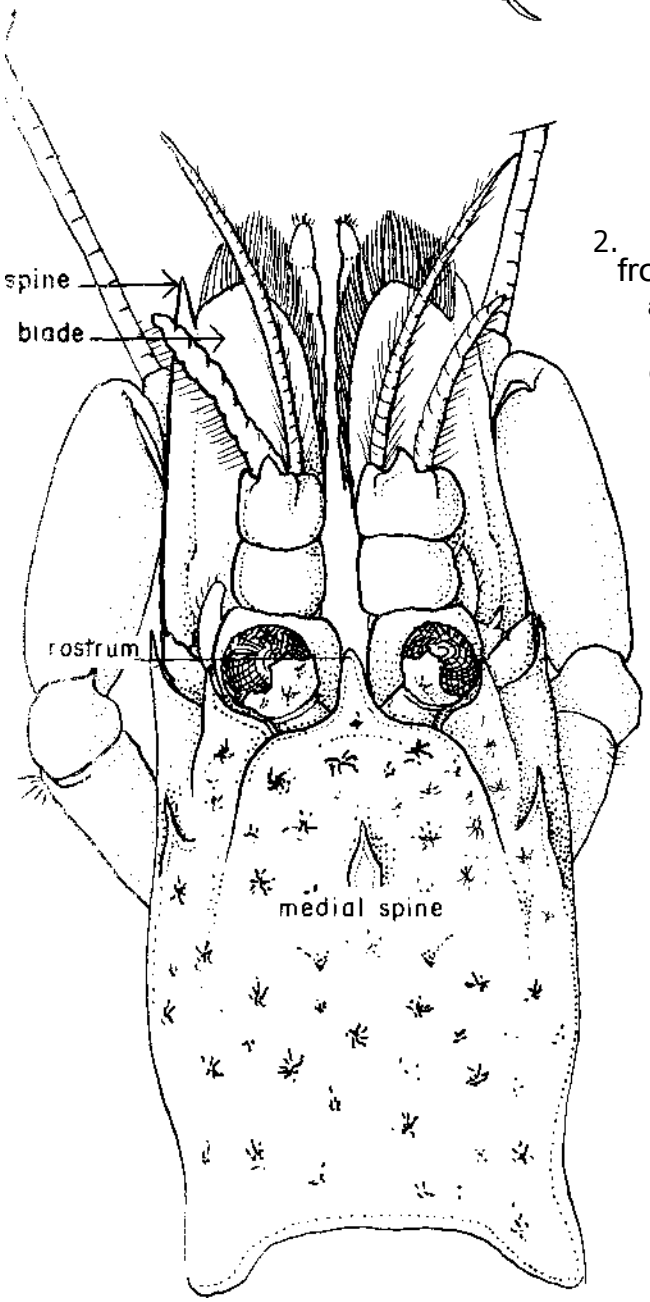
Crangon easkensis



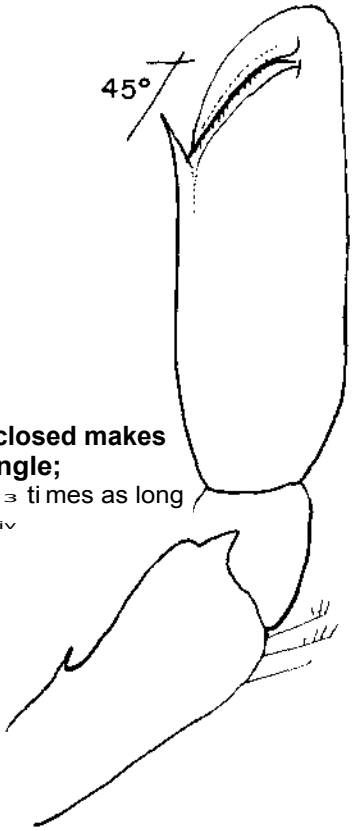


1. *crangon cdoskensis* x5

antennal scale almost as long as, arapace;
telson almost as long as uropods;
hands of first legs subchelate;
eyes free.

2. frontal region (dorsal)

antennal spine longer than blade;
rostrum slender;
carapace: one medial spine.



3. hand

finger closed makes 45° angle;
2 1/2 - 3 times as long cr, wiriv

Heptacarpus paludicola

Formerly *Spirontocaris*

a broken back shrimp Holmes, 1900

PHYLUM: *Arthropoda*
CLASS: Crustacea
ORDER: *Decapoda, Natantia*
TRIBE: *Caridea*
FAMILY: *Hippolytidae*

Description

SIZE-3 cm, ovigerous female (South Slough of Coos Bay).

COLOR-uniform; extremities clear, with orange or brown markings.

ROSTRUM-well-developed, longer than carapace; dorsal teeth 4-8, ventral teeth 1-5 (adults); rostrum almost as long as antennal scale (fig. 2); dorsal edge of rostrum straight, not curved[5]; some teeth anterior.

ANTENNAL SCALE-never greatly longer than rostrum.

SECOND LEGS-chelate, nearly equal, with seven annulations on carpus (fig. 1).

MOUTHPARTS-third maxilliped without expodite; reaching beyond the end of the acicle of the antenna[s] (fig. 1); mandible with incisor process, palp of two segments9.

CARAPACE-no supraorbital spines[10]. *Heptacarpus;* no lateral or dorsal spines.

ABDOMEN-shrimplike, with fantail, body laterally compressed, side plates of second segment overlap those of first, abdomen with sharp bend"· (fig. 1); Caridea. Third segment without hump, sixth segment shorter than telson[5] (fig. 1).

FIRST LEGS-equal, chelate (fig. 1).

Possible Misidentifications

Very close in color, morphology, and habitat is *Heptacarpus pictus,* whose adult rostral teeth are 6-7/2-4, 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 rostra] teeth are closer together on *H. pictus* and the rostrum is more slender[9], as well as being only equal to or shorter than the carapace. (Our *H. pictus* specimens were only 1.5 cm, half the size of the female *H. paludicola.)*

Heptacarpus pictus is the most commonly found transparent shrimp in rockpools[9], while *H. paludicola* is more common in mudflats and in eelgrass. *H. pictus* is not included in the Puget Sound Keys[5]; Schmitt listed its southern extensions as Monterey (It does occur in southern California). Also see this section under *H. pictus.*

Ecological Information

RANGE-Alaska to San Diego, California. Type locality: Humboldt Bay, California9.

DISTRIBUTION-south of Charleston Bridge, South Slough of Coos Bay.

HABITAT-South Slough; mud and eelgrass *(Zostera);* also in *Ova,* on pilings, floats, and in rocky pools of outer coasts10.

SALINITY-collected at 30 o/oo.

TEMPERATURE-

TIDAL LEVEL-collected at + 0.5.

ASSOCIATES-

Quantitative Information

WEIGHT-

ABUNDANCE-"common to abundant"9.

Life History Information

REPRODUCTION-ovigerous female found in March, South Slough, Coos Bay.

GROWTH RATE-

LONGEVITY-

FOOD-carnivorous4.

PREDATORS-fish.

BEHAVIOR-propel themselves backward by flexing their tails forward4.

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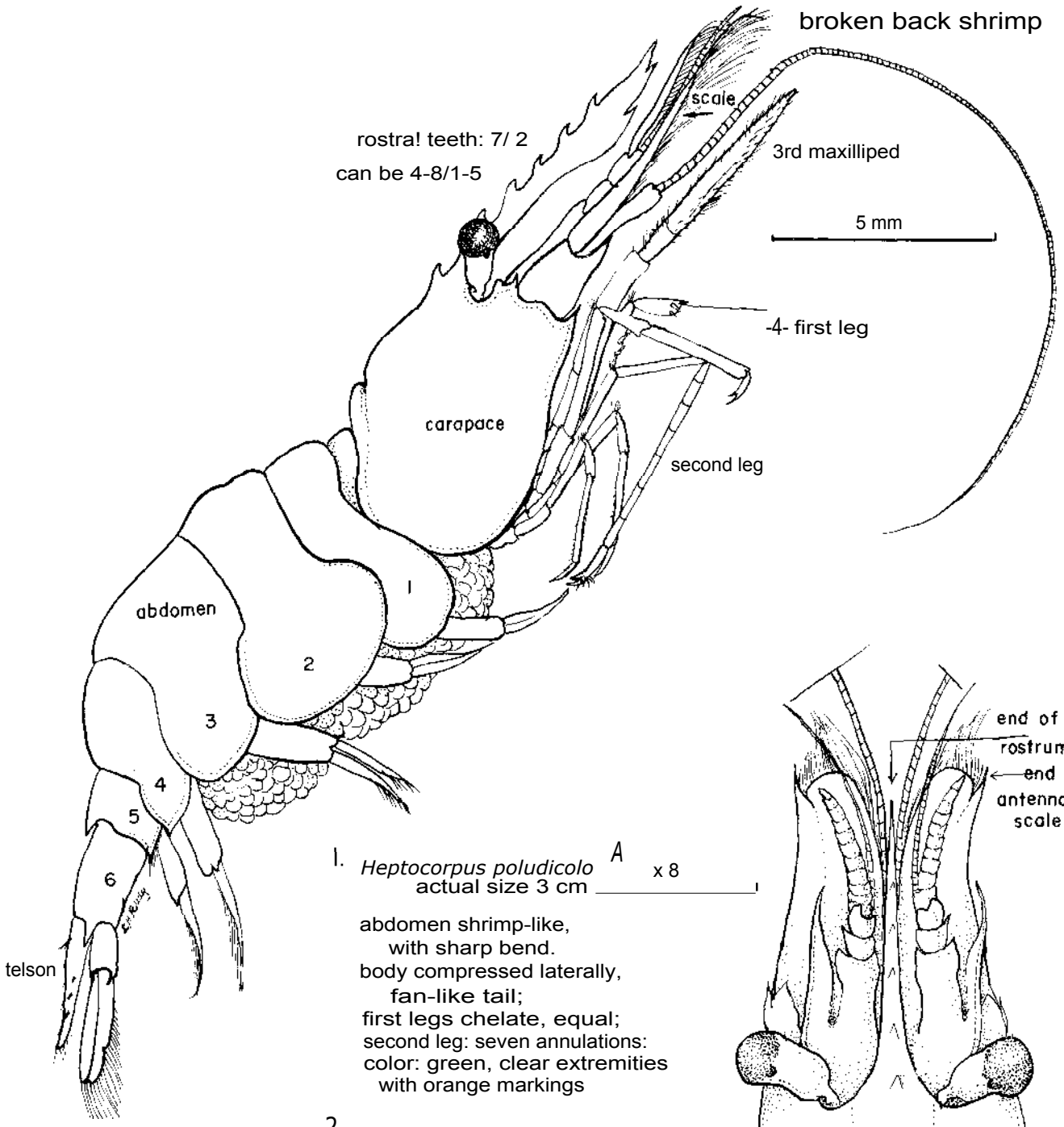
Natantia

HIPPOLYTIDAE

Heptocarpus pa/wilco/a

broken back shrimp



1. *Heptocorpus poludicolo* A x 8
actual size 3 cm

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

ros,*rlirn almost as long
as antenna! scale;
rostrum longer than
carapace (from orbit).

Heptacarpus pictus
broken back shrimp, glass shrimp (Stimpson, 187O)

PHYLUM: *Arthropoda*
cuss: *Crustacea*
ORDER: *Decapoda*
SUBORDER: *Natantia*
TRIBE: *Caridea*
FAMILY: *Hippolytidae*

Description

SIZE-2-3 cm'; this specimen (South Slough of Coos Bay): 1.5 cm.

COLOR-transparent, with orange lines; green at leg bases, black eyes. Four major color patterns.5

ROSTRUM-well developed, shorter than carapace; dorsal teeth 6-7, ventral teeth 2-4 (fig. 1); slender, teeth close together'; rostrum reaches only about two thirds length of scale (fig. 4).

MOUTHPARTS -third maxilliped without exopodite: *Heptacarpus;* mandible with incisor process, two-segmented palp".

CARAPACE-no supraorbital or other spines.

ABDOMEN-shrimplike, with fan tail, laterally compressed body; side plates of second segment overlap those of first, abdomen with sharp bend, but third segment without hump; sixth segment shorter than telson (fig. 1).

FIRST LEGS-equal, chelate (fig. 2).

SECOND LEGS-chelate, nearly equal, with seven annulations on carpus (fig. 3).

Possible Misidentifications

This species is very like the green *Zostera* dweller *Heptacarpus paludicola,* with a difference chiefly in the length of the rostrum (see *H. paludicola).* Other short-rostrumed *Heptacarpus* species are *H. taylori,* often brightly colored and with a rostrum reaching just to the eye, and

H. cristatus, with rostral teeth 5-8/1-3, and long, slender dactyls on the walking legs;

H. brevirostris, whose rostrum (without lower teeth) reaches only the first segment of the antennal peduncle;

H. palpator, very like *brevirostris,* but with a longer rostrum and longer antennal scale;

H. stimpsoni, from Puget Sound, whose rostrum reaches only the second segment of the antennal peduncle; *(H. sitchensis, H. decorus,* and *H. kincaidi* are other Puget Sound species);

H. tridens, flexus, and *tenuissimus* have a hump on the third abdominal segment;

H. carinatus is a long-rostrumed shrimp, its rostral teeth are all distal;

H. gracilis has a very narrow rostrum with 4-5 teeth below, and a long sixth abdominal segment;

H. franciscanus, from San Francisco Bay, has a rostrum longer than the antennal scale, and on its lower edge, six or seven teeth.

Ecological Information

RANGE-"Monterey Bay to San Diego, California"'; type locality, Monterey, California. Not included in Kozloff's Puget Sound work; appears to be a more southern species: common in southern California'.

DISTRIBUTION-Coos Bay: near Charleston Bridge, South Slough.

HABITAT-most commonly found transparent shrimp in rock pools[6]; also in *Zostera* beds, on floats[5]; in South Slough in *Zostera* on mudflats. .

SALINITY-collected at 30 0/00.

TEMPERATURE-

TIDAL LEVEL-collected at +0.5 ft; "middle and lower tidepools of rocky coasts"8.

ASSOCIATES-polychaetes.

Quantitative Information

WEIGHT-

ABUNDANCE-"abundant to common"8.

Life History Information

REPRODUCTION-

GROWTH RATE-

FOOD-

LONGEVITY-

PREDATORS-fish.

BEHAVIOR-

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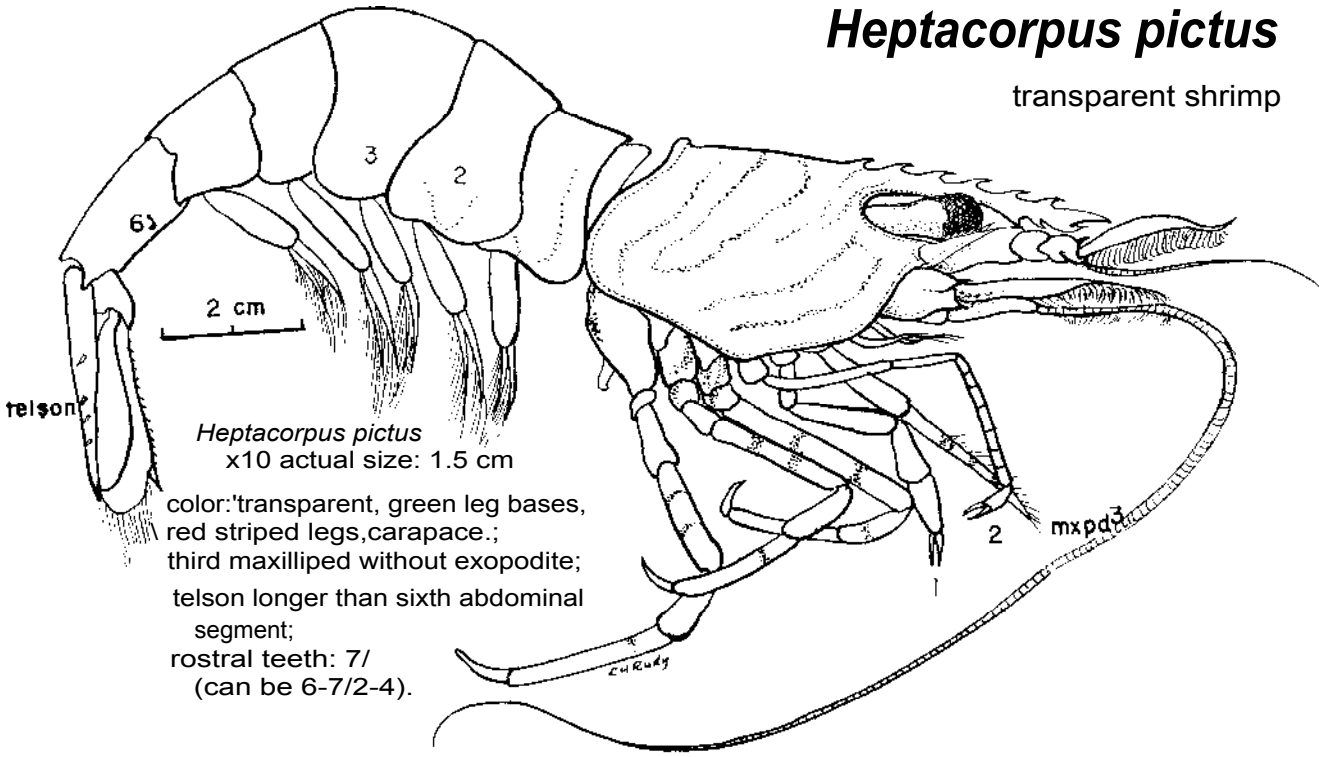
Natanti

HI PPOLYTIDAE

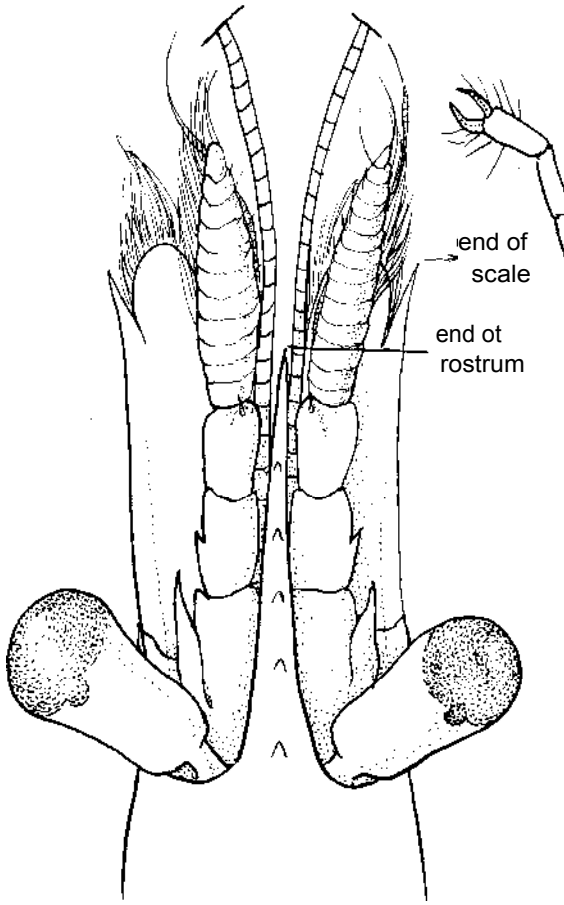
Heptacorpus pictus

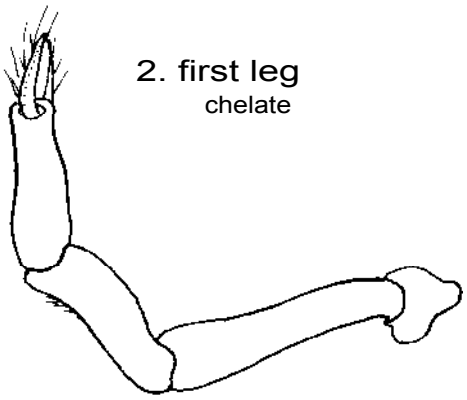
transparent shrimp



Heptacorpus pictus
x10 actual size: 1.5 cm

color:'transparent, green leg bases, red striped legs,carapace.;
third maxilliped without exopodite;
telson longer than sixth abdominal segment;
rostral teeth: 7/
(can be 6-7/2-4).





2. first leg
chelate

3. second leg
chelate; carpus with seven annulations.

4. frontal region, dorsal
rostrum narrow at eyes;
rostrum more than half length of scale, but not to end;
rostrum (from posterior of orbit)shorter than carapace.

Pugettia producta (= Epialtus productus)

a kelp crab (Randall, 1839)

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: *Decapoda, Reptantia*
SECTION: *Brachyura*
FAMILY: *Majidae (Inachidae)*

Description

SIZE-largest on record 93 mm wide, 107 mm long; largest of the kelp crabs[3]; Oregon specimens larger than southern California animals.

COLOR-dark brown or olive green, sometimes with red or orange; ventral surface often bright red. Exterior smooth, rarely with attached seaweeds, bryozoans, etc., although wharf specimens do have attached barnacles, anemones'; mature specimens practically hairless'.

ROSTRUM-bifid (two-branched) small, with horns separated by sinus', (figs. 1, 2).

CARAPACE-sides almost parallel; prominent posterolateral (branchial) teeth: genus *Pugettia";* surface smooth; small pre- and post-orbital teeth (fig. 2); large anterolateral (hepatic) teeth; posterior margin convex'; carapace decidedly longer than wide.

EYES-distance between eyes less than one third width of carapace (adults)[16]; eyes small.

ABDOMEN-seven segments (fig. 4).

CHELIPEDS-large and well developed, especially in mature males, where they can be longer than walking legs; chelae enlarged; manus (palms) swollen, dactyls (fingers) gaping (males)[7] (fig. 3).

WALKING LEGS-almost cylindrical[7]; decreasing in length posteriorly; dactyls slender' (fig. 1); legs shorter, stouter than in other *Pugettia* species.

JUVENILES-small specimens (about 3 mm long) can be constricted at the sides like *P. richii1.*

Possible Misidentifications

Pugettia gracilis and *Pugettia richii* are two smaller species found in the northwest. Both have a greater distance between the eyes than does *P. producta* (about half the carapace width). Neither has the smooth surface or straight carapace sides of *P. producta:* both have tuberculate carapace surfaces and constrictions between the hepatic and branchial teeth'. Both have long walking legs. *P. gracilis* can be similar in color to *P. producta,* but *P. richii* is usually red. Other majid crabs *(Oregonia, Scyra, Loxorhynchus, Mimulus,* etc.) lack posterolateral spines.

Ecological Information

RANGE-Alaska to Asuncion Point, Baja California'; type locality, "California." Replaced below Pt. Conception, Calif., by *Taliepus nuttalii.*

LOCAL DISTRIBUTION-Oregon: various protected outer shores; Coos Bay; South Slough; probably estuaries where salinities are high.

HABITAT-up off the substrate in eelgrass, and in kelp *Egregia*[8]*;* in tidepools on *Fucus;* in kelp, outer coast; on pilings in bays, especially in winter; in *Enteromorpha,* but prefers *Zostera* (juveniles)6.

SALINITY-collected at 30 o/oo. Does not tolerate brackish water; does not osmoregulate6.

TEMPERATURE-somewhat tolerant, considering its range.

TIDAL LEVEL-to 40 fathoms, but most common intertidally'.

ASSOCIATES-sometimes has parasitic barnacle, *Sacculina6,* eggs parasitized by nemertean worm *Carcinonemertes epialti6.*

Quantitative Information

WEIGHT—

ABUNDANCE-most common kelp crab in Coos Bay estuary.

Life History Information

REPRODUCTION-gravid females in Coos Bay, June and July'. copulation by hard-shelled pairs; yellow to red orange eggs.

GROWTH RATE-

LONGEVITY-

FOOD-a vegetarian, scraping brown algal growth off *Zostera4;* eats barnacles, mussels, hydroids and bryozoans when algae is not available[2]; keen visual sense2.

PREDATORS-fishes (on young). Few predators as adult, as crab is aggressive, and has strong pinch.

BEHAVIOR-nocturnal feeder[4]; active, particularly those in rocky tidepools7.

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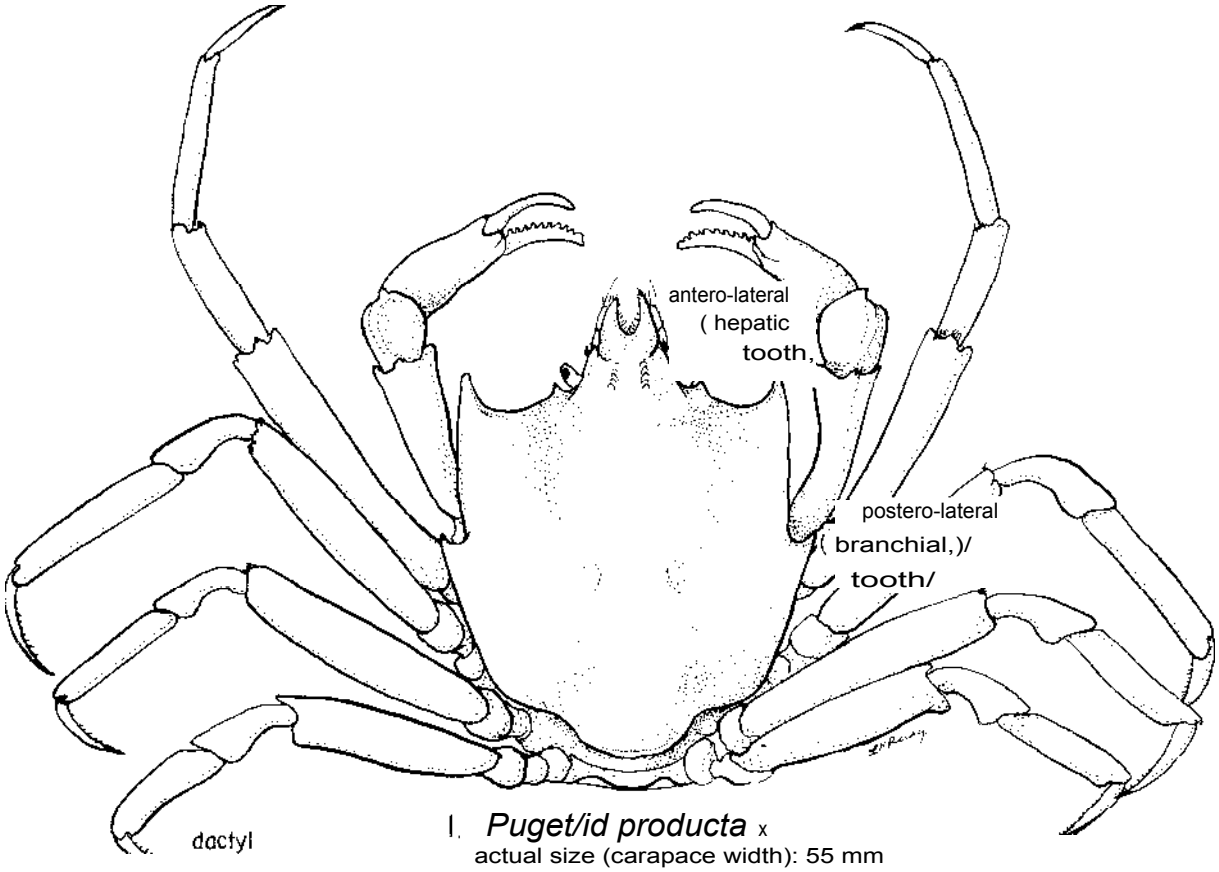
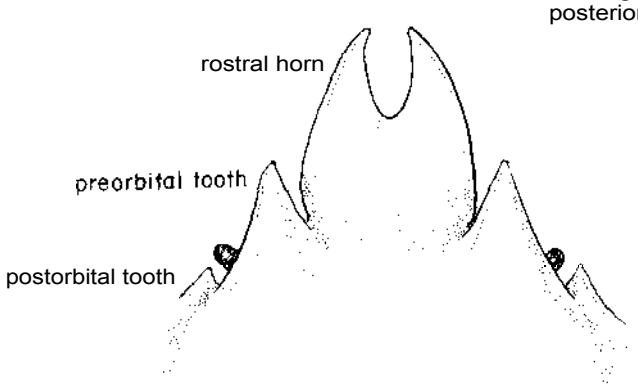
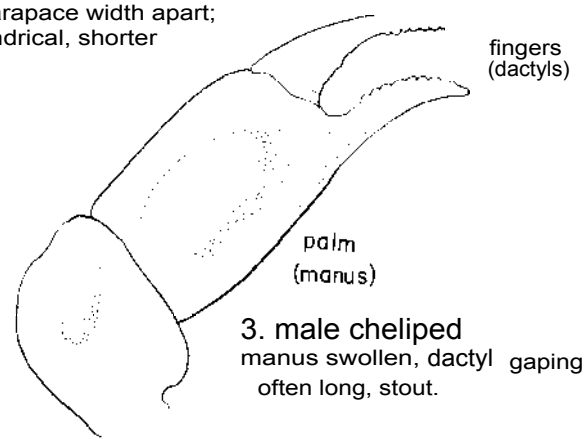
Pugettio product°



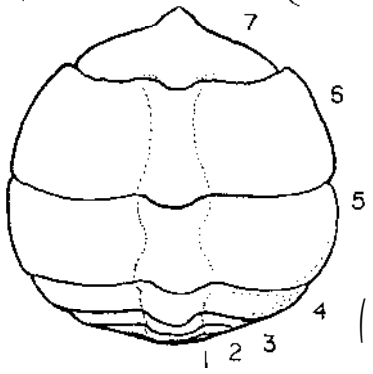
1. *Puget/id producta* x
actual size (carapace width): 55 mm
carapace smooth, sides subparallel;
strong hepatic and bronchial teeth;
eyes less than 1/3 carapace width apart;
walking legs subcylindrical, shorter posteriorly.



2. frontal area
rostrum bifid: two horns;
smallpre- and post- orbital, teeth ;



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



4. abdomen 9 (ventral)
seven segments.
(a 2 dorsal)

Cancer antennarius

a rock crab **Stimpson, 1856**

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: *Decapoda, Reptantia*
SECTION: *Brachyura*
FAMILY: Ca ncridae

Description

SIZE-carapace usually not over 5 inches (13 cm)[4]; type: 11.8 cm (41/2 inches)3.

COLOR-unique among Cancer: red spots on a light yellow undersurface, especially frontally'.

EYES-eyestalks short, orbits small; eyes frontal; a small supra-orbital tooth (fig. 1).

FRONTAL AREA-not produced; five medial teeth, of which the outer pair is the largest; center tooth small, below its flanking pair (fig. 2).

CARAPACE-oval; widest at eighth tooth (eleven teeth total); antero-lateral and post-lateral margins meet at distinct angle; surface lumpy, uneven, finely granulated (fig. 1).

CARAPACE TEETH-eleven antero- and post-lateral teeth, curved forward; carapace widest at eighth tooth (fig. 2).

CHELIPEDS-black-tipped; heavy, nearly smooth; inner carpus (wrist) with single sharp spine.

LEGS-rough and hairy; dactyls with five longitudinal rows of bristles3.

SEXUAL DIMORPHISM-females smaller, show usual wide abdomen of *Cancer* species (fig. 3b, C. *magister).*

JUVENILES-may have second small spine on carpus; carapace with crowded granules; manus of cheliped light, fingers with dark blotch, extreme tips light-colored; carapace widest at ninth tooth, tenth (and last) prominent and spiny (not figured). Prezoea, third zoea, see fig. 3 a, b.

Possible Misidentifications

In color, C. *productus* is much alike in color (dark red, black-tipped chelae), but never has red spots on its underbody, though its legs may be mottled; it has ten teeth, not eleven. C. *antennarius* is smaller than C. *productus,* and lacks its obviously produced frontal area; they can inhabit the same ecological niche. *Cancer magister* is larger than either and is colored very differently from them.

Ecological Information

RANGE-British Columbia to Baja California; type specimen: San Francisco; not common in Puget Sound, or in keys.

LOCAL DISTRIBUTION-Coos Bay (and probably other Oregon estuaries); most common on protected outer coast.

HABITAT-often buried in the sand, under rocks'.

SALINITY-in San Francisco, found at 26.6 to 33.3 0/00[6]. Cannot tolerate brackish conditions; cannot osmoregulate2.

TEMPERATURE-San Francisco Bay: collected at 8.7 to 14.3° C6.

TIDAL LEVEL-characteristic of the lower tide poor; "in two or three fathoms..." (Stimpson)[6] to 40 m.2

ASSOCIATES-often encrusted; iphitimid polychaetes in branchial cavities (southern California)'.

Quantitative Information

WEIGHT-

ABUNDANCE-common in California, becomes rarer farther north.

Life History Information

REPRODUCTION-females ovigerous November to January4; in the lab males stimulated to pre-mating behavior by release of molting hormone by *Pachygrapsus crassipes'.*

GROWTH RATE-one prezoeal, five zoeal, one megalops stage[s]; larvae reared at 13.8°C. averaged 36 days (hatch to megalops)[5]; shorter than C. *magister* or C. *productus.* Prezoea (fig. 3a) much like those of other *Cancer* species; zoeae and megalops much smaller and with fewer setae than other two.

LONGEVITY-

FOOD-a scavenger and predator; likes hermit crabs.2

PREDATORS-occasionally man, for food; juveniles preyed upon by filter and plankton feeders (herring, salmon, etc.); octopus.

BEHAVIOR-male reacts to crustecdysone (molting hormone) by searching behavior'.

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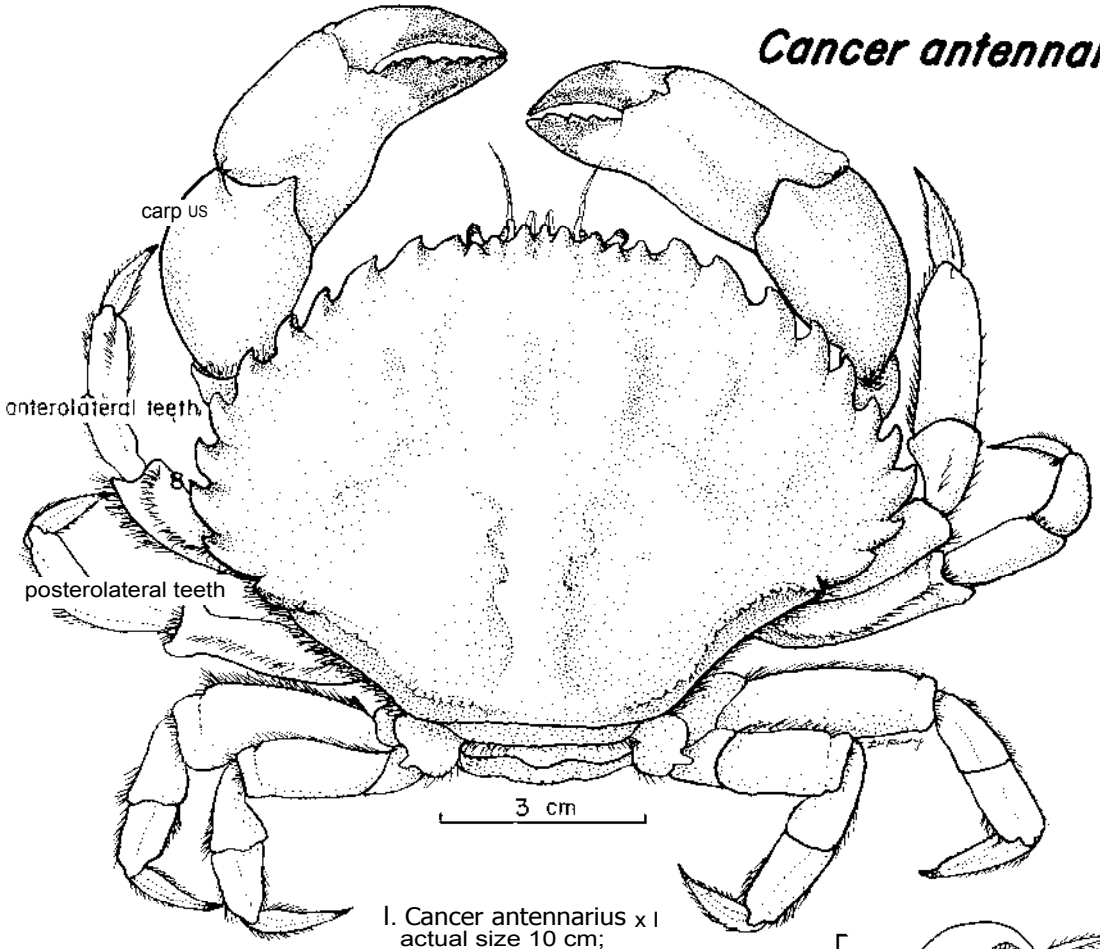
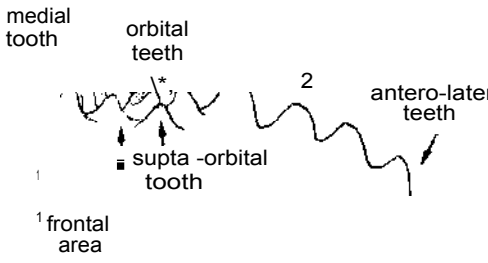
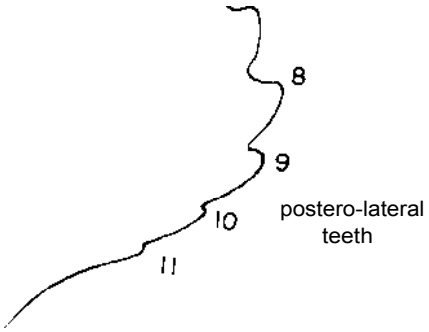
Cancer antennarius

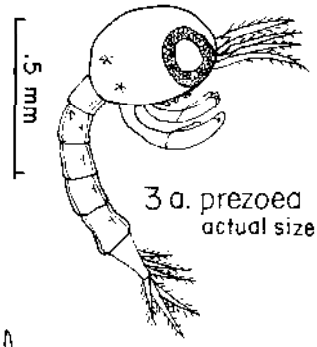


1. Cancer antennarius x 1
actual size 10 cm;
dark red; black-tipped claws;
red spots on light underbody;
widest at eighth tooth.

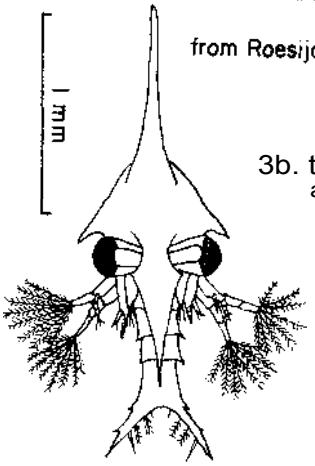


2. carapace (right front)
eleven antero- and post-lateral teeth;
frontal area not produced;
eyes small, frontal;
supra-orbital tooth;
small medial tooth (below).





3 a. prezoea x45
actual size 1.65 mm.
from Roesijadi (1976).



3b. third zoea x3o
actual size 2.25 mm

Cancer magister

Dungeness, or market crab **Dana, 1852**

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: *Decapoda, Reptantia*
SECTION: *Brachyura "true crabs"*
FAMILY: *Cancridae*

Description

SIZE-type: carapace 120.7 mm long, 177.8 mm wide.

COLOR-light reddish brown, darkest anteriorly, often light orange below[10], sometimes gray-purple, light below; inner sides of anterior dactyls and propodi crimson, fingers not dark10.

EYES-eyestalks short, orbits small.

ANTENNAE-antennules folded lengthwise; antennal flagella short, more or less hairy10.

CARAPACE-broadly oval, uneven but not highly sculptured; granular. Widest at tenth tooth; no rostrum (fig. 1).

FRONTAL AREA-narrow with five unequal teeth, not markedly produced beyond outer orbital angles; middle tooth largest, more advanced than outer pair; outer pair form inner angles or orbit, (fig. 2).

TEETH-(antero-lateral) ten, counting orbital tooth; widest at tenth tooth, which is large and projecting; all teeth pointed, with anterior serrations.

POSTERO•LATERAL MARGIN-unbroken, entire, without teeth; meets antero-lateral margin with distinct angle.

ABDOMEN-narrow in male, broad in female (fig. 3).

CHEUPEDS-dactyls not dark; dactyl spinous on upper surface; fixed finger much deflexed; hand (Propodus) with six carineae on upper outer surface; wrist (carpus) with strong inner spine.

WALKING LEGS-rough above; broad and flat (especially propodus and dactylus of last pair).

JUVENILES-antero-lateral and postero-lateral margins meet at distinct angle; carapace widest at tenth tooth; postero-lateral margin entire; carpus of cheliped with single spine above, dactyls light colored[10]; carapace not as broad as adult's.

Possible Misidentifications

Cancer productus also has ten antero-lateral teeth; its frontal teeth are subequal, (not equal) and the frontal area is markedly produced beyond outer orbital angles[13]; its cheliped dactyls are black. Its carapace is widest at the eighth large tooth.

Cancer *antennarius*, like C. *productus,* is dark red with black tipped chelae; it is widest at the eighth tooth, and red-spotted below. C. *oregonensis,* a small, oval crab, has twelve teeth. Two rather rare species, C. *gracilis* and C. *jordani*, both have nine teeth.

Ecological Information

RANGE-Alaska to Monterey Bay, California", type locality, San Francisco Bay12.

DISTRIBUTION-Northwest estuaries and offshore waters; near shore and bays in summers".

HABITAT-found in many substrates, from mud to sand, gravel and rock[12]; prefers sand[16], in mud with eelgrass in bays5.

SAUNITY-Coos Bay: collected from 15-30 o/oo; smaller crabs more tolerant to low salt'.

TEMPERATURE-a cold and temperate water animal.

TIDAL LEVEL-low water to 50 fathoms; most abundant 2-20 fathoms; found in depths of 90 fathoms8.

ASSOCIATES-barnacles on carapace and legs, nemerteans.

Quantitative Information

WEIGHT-to 3 lbs. (1.36 k.) (Ore. Fish & Wildlife figures).

ABUNDANCE-commercial catch cyclic in nature: has ranged from a high to 16,202,659 lbs. (1976-77) to a low of 3334,909 lbs. (1974-75)-Ore. Fish & Wildlife records.

Life History Information

REPRODUCTION-late spring to fall when female is about to molt, male clasps her and copulation takes place after several days[14]; internal fertilization takes place after molting, while female is soft; females carry the eggs (up to 1.5 million) usually from October to December in Oregon; the young hatch in the spring[15]. Larval forms occur in nearshore waters and progressively move offshore. They return to bays, estuaries and nearshore waters for metamorphosis, often hitching rides with *Valetta,* the "by the wind sailor".

YOUNG-megalops of genus *Cancer* difficult to differentiate.

GROWTH RATE-"first crab" stage: 80 days, at 11 °C[1]; matures at 4-5 years[11]. Size, age one: male and female: 30 mm; age two: m. and f.: 95 mm; age three, male: 150 mm, female, 120 mm; age four, male: 175 mm. Sexual maturity at 1 3/4 years'.

LONGEVITY-average age eight years, maximum probably ten11.

FOOD-largely small clams[5], crustaceans; also a scavenger.

PREDATORS-man, for food; larval forms eaten by filter and plankton feeders (herring salmon, other fishes).

BEHAVIOR-

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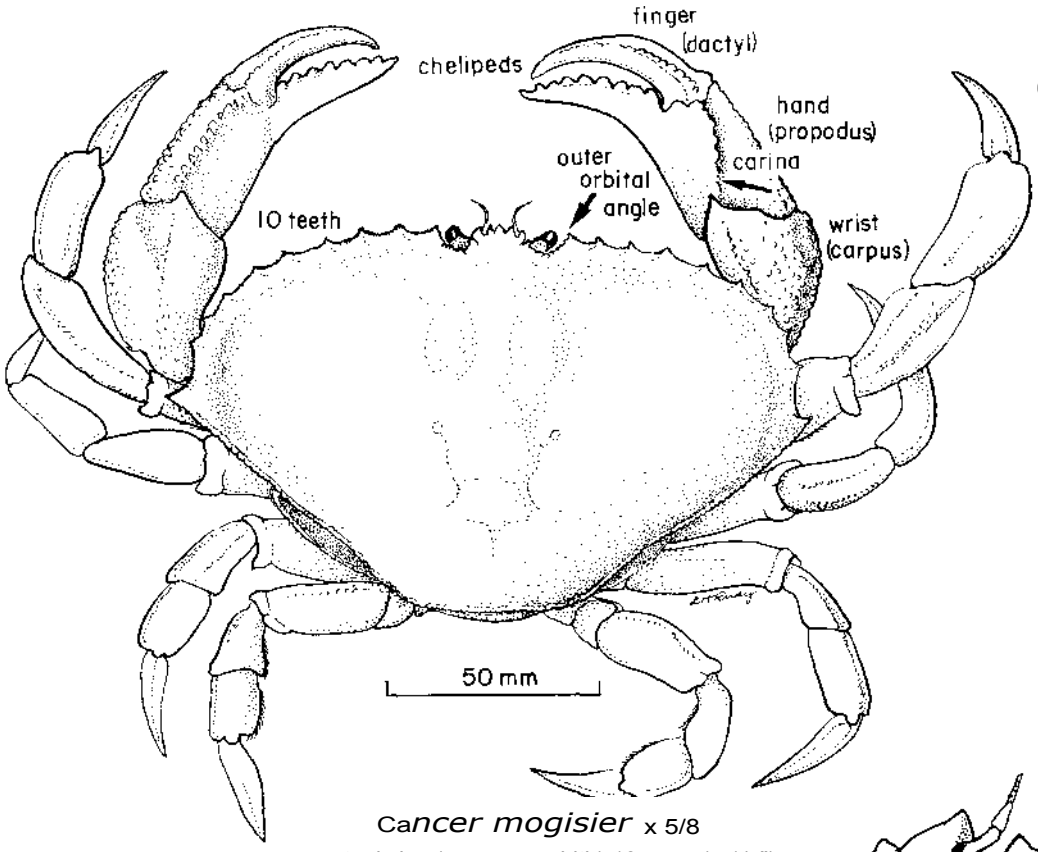
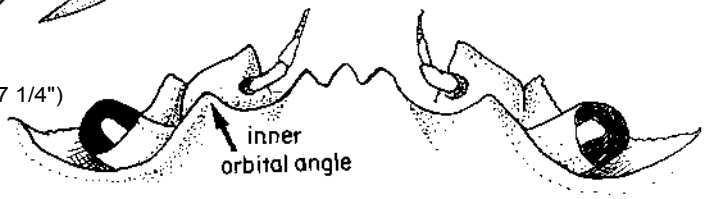
Cancer mogis/er

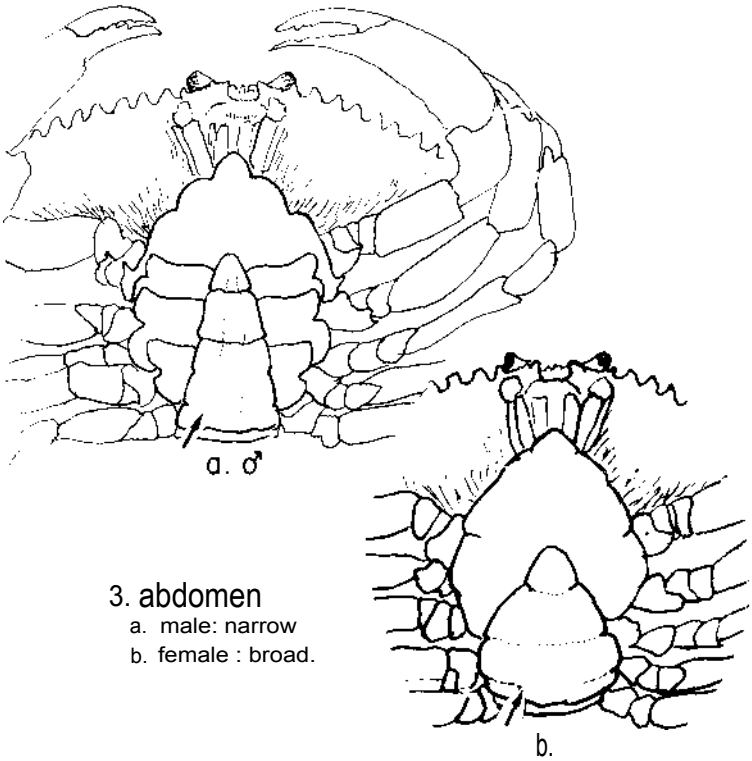


Cancer mogisier x 5/8

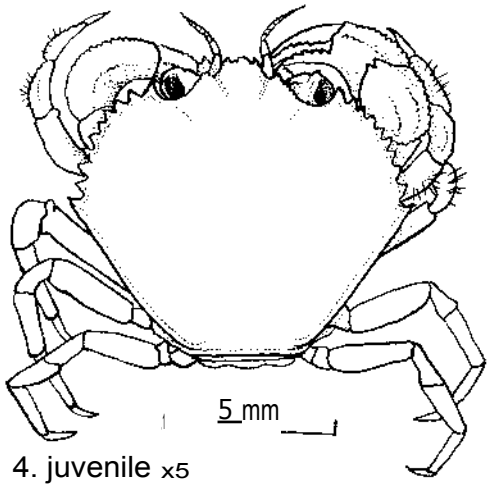
actual size (carapace width) 185 mm (7 1/4")
ten antero-lateral teeth;
postero-lateral margin entire;
front: five unequal teeth;
carapace: broadly oval , widest at
tenth tooth;
fingers light.



2. front
not markedly produced;
middle tooth largest, most advanced;
outer pair form inner orbital angles.



3. abdomen
a. male: narrow
b. female : broad.



4. juvenile x5
actual size (carapace width)l0 mm (3/8")
carapace rectangular;
ten teeth;
fingers light.

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Euca rida*
ORDER: *Decapoda, Reptantia*
SECTION: *Brachyura (true crabs)*
FAMILY: *Cancridae*

Cancer oregonensis
the Oregon cancer crab Dana, 1852

Description

SIZE—type: 23 mm wide, 18 mm long; a large female 47.1 mm wide, 36.5 mm long.' This specimen 15 mm wide, 11 mm long. Usually not over 40 mm wide.2

COLOR—carapace reddish, flesh-colored; fingers dark red, almost to tips; legs flesh with small red spots; ventral side light. Considerable variation: yellow or orange bands; sometimes gray.

EYES—short eyestalks.

ANTENNAE—antennules folded lengthwise (down), (fig. 3); short hairy flagella.

CARAPACE—broadly oval, subelliptical[3]; widest at teeth 7-8; aerolated; anterior-lateral and posterior-lateral margins do not form a distinct angle: species *oregonensis.3*

FRONTAL AREA—wide: about *1/2* width of carapace. Five truncate frontal teeth slightly produced beyond outer orbital angles. Three central teeth lobed: species *oregonensis.*[3] Outer pair of teeth form inner orbital angles (fig. 3).

MOUTHPARTS—outer maxillipeds: merus is produced at antero-external angle (fig. 2).

ANTERO-LATERAL TEETH-12-13, of which the first nine are prominent, equal, large, forward curving. Numbers 3-9 have spines; numbers 10-13 are small, obscure or absent; carapace widest at 7-8.

POSTERIOR—lateral margin—unbroken, entire, without teeth; does not meet antero-lateral margin with a strong angle (fig. 1).

ABDOMEN—narrow in males, wide in females (see *Cancer magister,* fig. 3).

CHELIPEDS—similar; fingers dark nearly to tips (fig. 4); carpus (wrist) tuberculate above, short spine at inner angle with tooth below it; hand (propodus) thick and high, with two rows of tubercules above, 5 granulate lines on outer surface (fig. 4). Chelae rougher in females than in males.3

WALKING LEGS—hairy, light colored.

SEXUAL DIMORPHISM—females often with more uneven, lumpier carapace; sometimes with high, flattened elevations, and rougher chelae.

JUVENILES—very much like adults.'

Possible Misidentifications

True crabs of the family Cancridae can be distinguished by the generally oval carapace with several frontal teeth and one medial tooth; antennules which fold lengthwise, with short hairy flagella. The genus *Cancer* have subelliptical carapaces, usually aerolate, a five-lobed frontal area, and short eyestalks.

Other *Cancer* species include three whose adult forms are much larger than those of C. *oregonensis:*

Cancer antennarius, a small feisty crab of the intertidal, dark red above and red-spotted below. Adults have black fingers; juveniles' fingers are light with a dark splotch. C. *antennarius* is widest at the 8th tooth (as C. *oregonensis* can be) but it has a prominent 10th tooth and a strong angle at the postero-lateral margin. It is typically 100 mm wide.

Cancer magister juveniles are widest at the 10th and last tooth; the hands are light-colored, the fingers without dark color. It has a rather hexagonal, angular profile, rather than an elliptical one. Few adults are less than 30 mm wide.' *Cancer productus* juveniles have a markedly produced frontal area like the adults, a fan-shaped carapace with sharp antero-posteriorolateral angles, dark fingers, and variable coloring, often striped. Adults are over 20 mm wide.'

Three *Cancer* species are small in the adult form:

Cancer gibbulosus[6] (or = *branneri')* whose adults are to 35 mm long, has a fan-shaped carapace much like that of C. *antennarius,* with 11 teeth, the first 9 being strongly curved; it is widest at the 9th tooth. The carapace surface is strongly aerolated rather like C. *oregonensis,* but its hairiness extends to the chelipeds and carapace, not just to the walking legs, as in C. *oregonensis.* It has dark fingers like C. *oregonensis,* but its carapace shape is distinctly different. Adults can be from 11 to 35 mm wide.'

Cancer gracilis can be to 40 mm wide and is much like a smooth C. *magister:* olive with reddish spots. The carapace is very convex, widest at the 9th tooth with a strong projecting 10th tooth and the usual (except for C. *oregonensis)* sharp antero-lateral angle. Its fingers are light. Adults can range from 3-76 mm wide.'

Cancer jordani, with adults to 33 mm wide, is hairy-carapaced, widest at the 9th tooth and with a rudimentary 10th tooth. The teeth alternate large and small in size. The fingers of this crab are dark, the extreme tips are light, as in C. *oregonensis.* The carapace shape is strongly attenuated posteriorly, as in most of the *Cancer* species. This is a southern crab and occurs only rarely in Oregon.' Adults can be as narrow as 19.5 mm.5

Cancer oregonensis is the only member of the genus with a distinctly elliptical carapace, without a distinct angle at the posterior-anterior margin. It is smaller than most of the other adult *Cancer* species, but can be confused with their juveniles, which incidentally will be found only seasonally, not all year, as will C. *oregonensis.* The key characteristics of the rounded, not angled carapace shape, 4 being widest at the 7-8th teeth, not the 9th or 10th, should make identification easy. C. *oregonensis* occupies a very particular niche: in the under-rock habitat, often found nestled in a well-fitting discarded mollusc or barnacle shell.

Ecological Information

RANGE—extreme range Aleutian Islands to Lower California': rare south of Oregon'

LOCAL DISTRIBUTION—Coos Bay: Fossil Point, Pigeon Point.

HABITAT—rocky low intertidal areas of quiet bays; well embedded rock and mud. Likes closely fitting shells, crannies.

SALINITY—found at lower (saltier) end of bays.

TEMPERATURE—a cold and temperate water dweller (by geographical range).

TIDAL LEVEL—low intertidal (and down to 238 fathoms3).

ASSOCIATES—the under-rock low intertidal of bays: burrowing clams (Pholadidae), terebellid polychaete *Thelepus* (and its associate *Halosydna).* Subtidally, the large barnacle *Balanus nubilis,* whose discarded shell is often home to C. *oregonensis.* A parasitic barnacle (Rhizocephalan) becomes prevalent in Alaskan animals.'

Quantitative Information

WEIGHT-

ABUNDANCE—occurs fairly often in its own particular habitat.

Life History Information

REPRODUCTION—females ovigerous (orange eggs) December (Coos Bay).

GROWTH RATE

LONGEVITY

FOOD—predator and scavenger on other small invertebrates.

PREDATORS—larger crabs, fish.

BEHAVIOR—reclusive.

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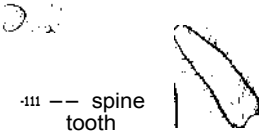
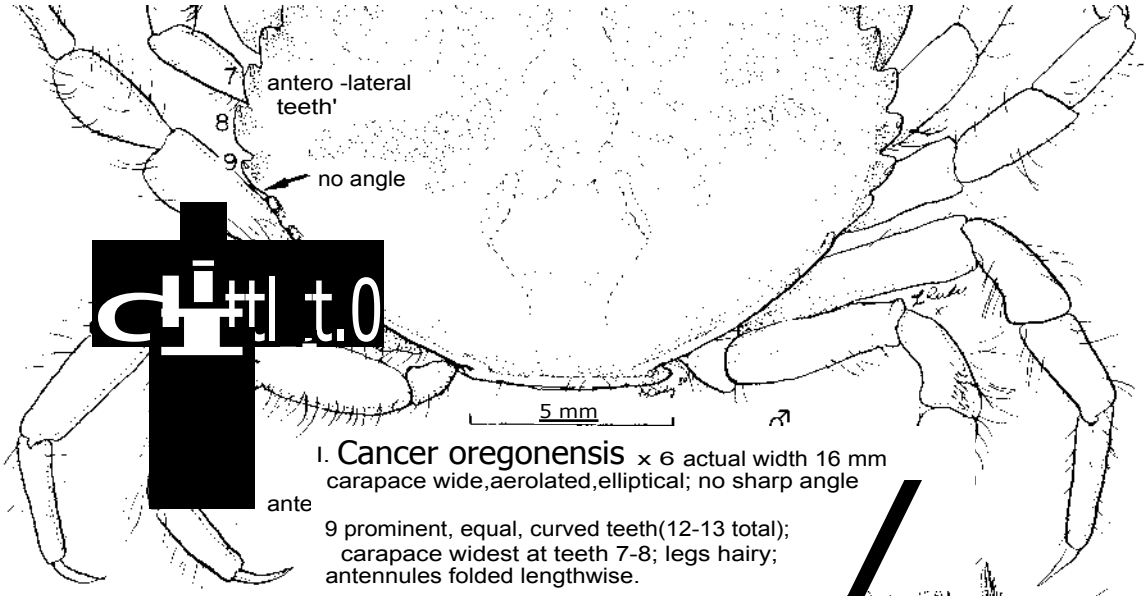
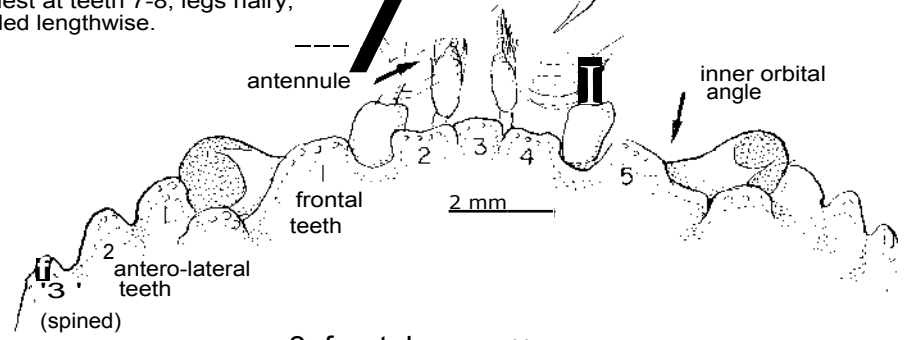
Cancer oregonensis



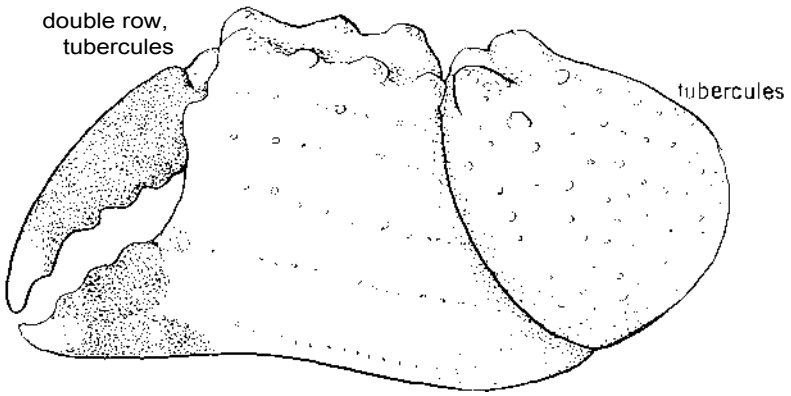


1. Cancer oregonensis x 6 actual width 16 mm
carapace wide,aerolated,elliptical; no sharp angle
9 prominent, equal, curved teeth(12-13 total);
carapace widest at teeth 7-8; legs hairy;
antennules folded lengthwise.

2. maxi l l i ped (ventral view) x
produced at antero-external angle
of merus.



3. frontal area x l l
truncate, slightly advanced beyond orbital angles;
5 lobed teeth: 3 central, 2 at inner orbital angles;
eyestalks short; antero-lateral teeth 3-9 spined;
antennules fold down.



4. left cheliped x it (outside)
double row of tubercules, 5 rows fine granulate lines: hand;
fingers dark almost to tips; wrist tuberculate.

Cancer productus

the red rock crab **Randall, 1839**

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: *Decapoda, Reptantia*
SECTION: *Brachyura*
FAMILY: Ca ncridae

Description

SIZE-width to 157.5 mm'; length 97 mm: can be up to 173.5 mm9.

COLOR-dark red above, light below, legs mottled red; juveniles striped (fig. 3), or otherwise colored.

EYES-eyestalks short, orbits small.

ANTENNAE-antennules folded lengthwise; antennal flagella short, hairy6.

CARAPACE-broadly oval, uneven, slightly convex. Widest at eighth antero-lateral tooth (fig. 1).

FRONTAL AREA-markedly produced beyond eyes, with five nearly equal teeth (fig. 2).

ANTERO-LATERAL TEETH-ten (counting orbital tooth); nine large teeth, becoming more acute posteriorly; ninth tooth smaller; a small, acute orbital tooth; one obscure post-lateral tooth.

ABDOMEN-typical Cancroid: narrow in male, wide in female.

CHEUPEDS-dactyls dark-tipped[6]; hands rough above, carpus wrinkled, with single tooth at inner angle.

WALKING LEGS-dactyls thickly fringed above and below.

JUVENILES-often brightly colored with a few or many spots; carapace widest at ninth tooth (first tooth rudimentary); teeth (frontal and antero-lateral flat, rounded, fairly uniform; carapace naked, smooth, often spotted or striped; shaped like adult (fig. 3).

Possible Misidentifications

While Cancer *productus* is often taken in crab nets with C. *magister,* it is easily distinguished from it by its bright red color. Another red dark-handed crab is *Cancer antennarius,* with eleven teeth, (but widest at the eighth tooth), and with red blotches on its underside, the only *Cancer* so marked.

Ecological Information

RANGE-Kodiak, Alaska, to Magdalena Bay, Baja California9.

DISTRIBUTION-Oregon estuaries: Coos, Yaquina, Umpqua, Coquille, Tillamook[2]; and on semi-protected rocky shores5.

HABITAT-prefers gravel, rock, hard bottom (as it does not burrow, and lacks "straining apparatus" for sand removal)s; rocky tidepools[5], and among eelgrass5.

SAUNITY-collected at 30 o/oo; S. F Bay, range of 21.7 to 33.3 o/oo°.

TEMPERATURE-collected at 11° to 17°C., S. F Bay area9.

TIDAL LEVEL-intertidal to about 19 fathoms; closer to shore than C. *magister.*

ASSOCIATES-often netted with C. *magister.*

Quantitative Information

WEIGHT —

ABUNDANCE- common10.

Life History Information

REPRODUCTION-most mating occurs June-August (Puget Sound)[3]. Mating occurs while female is soft. Most eggs extruded in December or January. Most hatching by early April [3]. Eggs are bright orange when deposited and become gray when ready to hatch.

GROWTH RATE-

LONGEVITY-

FOOD-a scavenger and predator on Crustacea, especially barnacles and other crabs[3], molluscs and polychaete worms.

PREDATORS-man; (use for food limited, as proportion of meat, to shell is small); octopus, birds; adults can hide from large fish3.

Larval forms, by filter and plankton feeders (herring, salmon, other fishes).

BEHAVIOR-stalks the tidepools at night, a dominant animals; also active in daylight[3]. Aggregation by sex and age, depending on egg-laying and molting cycles[3]; possibly has a vertical or offshore migration like C. *magister.*

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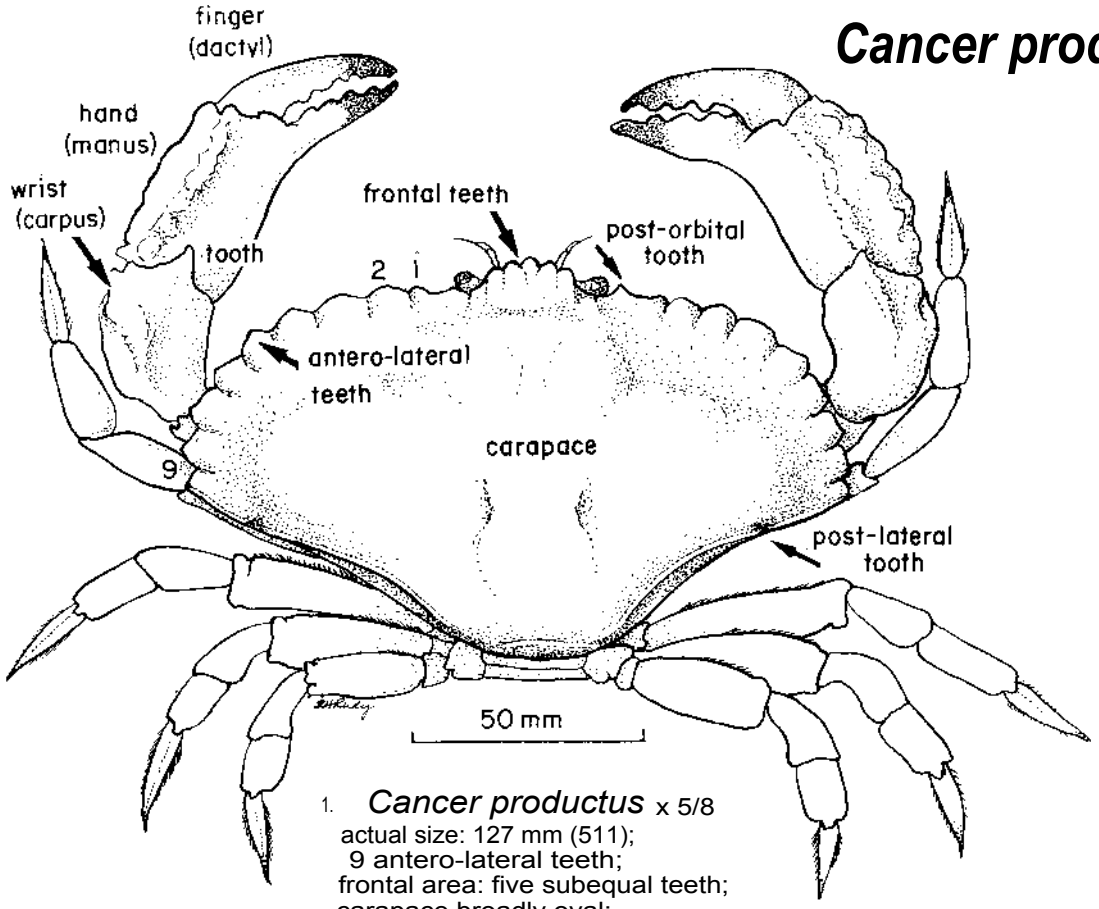
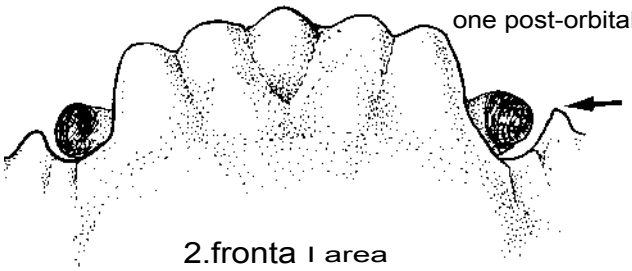
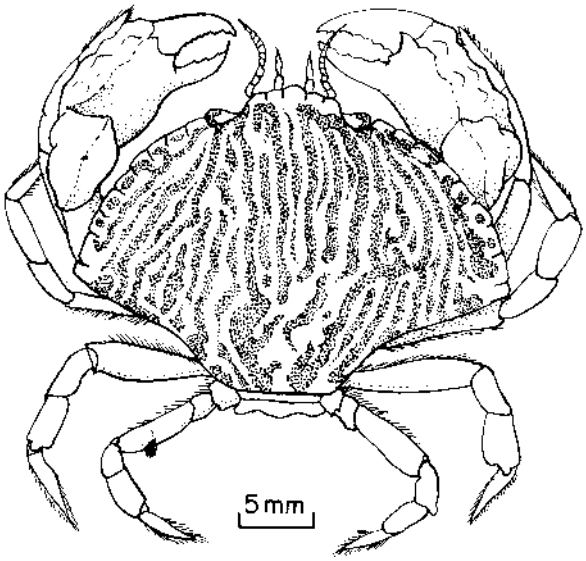
Cancer productus



1. *Cancer productus* x 5/8
actual size: 127 mm (511);
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 produced;
five subequal teeth;
post-orbital tooth.



3. juvenile x2
actual size (carapace width)2 5 mm,1 1);
carapace like adult; striped;
nine antero-lateral teeth.

Rhithropanopeus harrisii

a mud crab **Gould, 1841**

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: *Decapoda, Reptantia*
FAMILY: *Xanthidae*

Description

SIZE-type: 19 mm[7]; Coos Bay specimens: the greatest number of both sexes measured 6 mm (36%) [5]; males larger than fernales9.

COLOR-dull green; white underside; whitish dactyls7.

CARAPACE-almost trapezoidal; wider than long; sides converge slightly; front truncate, posterior broad; greatest width at fourth lateral tooth[9]; prominent horizontal dorsal ridges[7] or "rows of granules"[9] (fig. 1).

EYES-frontal; fill orbits.

FRONTAL AREA-front truncate; less than a third as wide as carapace; edge straight; channeled, thick: double-edged margin; a triangular median notch (figs. 1, 2).

CARAPACE TEETH-five, but first two coalesced; last three dentate, pointing forward; last tooth smaller (fig. 2).

CHELIPEDS-whitish, unequal, heavy; smooth in the old, but with lines and granules in the young (fig. 4); no large basal tooth on dactyls.

WALKING LEGS-long, slender compressed; fine hairs.

ABDOMEN-male five segmented, narrow; third segment not contiguous with coxa of last pair of legs[7] (fig. 3); terminal segment a rounded rectangular.

JUVENILES-have granulated chelae.

Possible Misidentifications

R. harrisii is the only member of the genus world-wide. It can be mistaken for a small *Hemigrapsus oregonensis,* but for the strong dorsal ridges and three side spurs[8] (last three pointed anterio-lateral teeth) and its slightly convergent sides and long, slender legs. *R. harrisii* sometimes competes for food with *H. oregonensis* in the lower parts of bays, and their territories can overlap.

Ecological Information

RANGE-east coast of America, New Brunswick to N. E. Brazil; also Holland, northern Europe; west coast: San Francisco to Yaquina Bay.

DISTRIBUTION-probably introduced to San Francisco with eastern oyster spat *(Crassostrea virginia)* 1940[11]; since found in Coos Bay: South Slough (by Dr. James McNab, 1950), Haynes Inlet, Coos River[s], Netarts Bay[12]; Yaquina Bay6

HABITAT-sloughs, under rocks in mud banks of estuaries, where it burrows", under many diverse conditions; likes some kind of shelter, including oyster beds, debris, (Chesapeake Bay)9.

SALINITY-euryhaline; range: 0-1.6[5]; usually brackish to fresh'; larval development normally (in lab) at salinities of 5-35 o/oo; at 1 o/oo no larvae survived[2]. Salinity seems to be the limiting factor which keeps this crab in the upper reaches of estuaries, where salinity is reduced; it can lower its water permeability in conditions of lowered external salinity.10

TEMPERATURE-can tolerate a range of from 7° to 35 ° C13, "eurythermic" (adults)[13]; also larvae[2]; upper and lower temperature (and salinity) limits unknown for larvae in plankton[2]. Found Coos Bay at from 9 ° to 16 ° (October to December)5.

TIDAL LEVEL-intertidal and above: not found in lower reaches of bays or in deep water[s]; to 30 feet (Chesapeake Bay)9.

ASSOCIATES-none known; in similar but separate niche: *Hemigrapsus oregonensis*[5]. But: in Coos River: some overlap.

Quantitative Information

WEIGHT-rarely over 4 grams (San Francisco Bay).1°

ABUNDANCE-can be the dominant species (upper bay) and is found in nearly every arm of Chesapeake Bay[9], but is only in widely scattered patches in upper Oregon estuaries.

Life History Information

REPRODUCTION-does not migrate to more saline waters to shed larvae[2]; zoeae found in salinities of 4-23.5 0/00, greatest number at 15 0/00[1]. Females ovigerous in summer, early fail (Chesapeake Bay)9.

GROWTH RATE-maturity probably reached second summer, total number of "instars" (moults) not known9.

LONGEVITY-

FOOD-algae; small crabs, including its own young; a nocturnal feeder; in Chesapeake Bay, it lives in oyster beds, where it probably feeds.

PREDATORS —

BEHAVIOR-hides under rocks; seems less active than *Hemigrapsus oregonensis* with which it is found.

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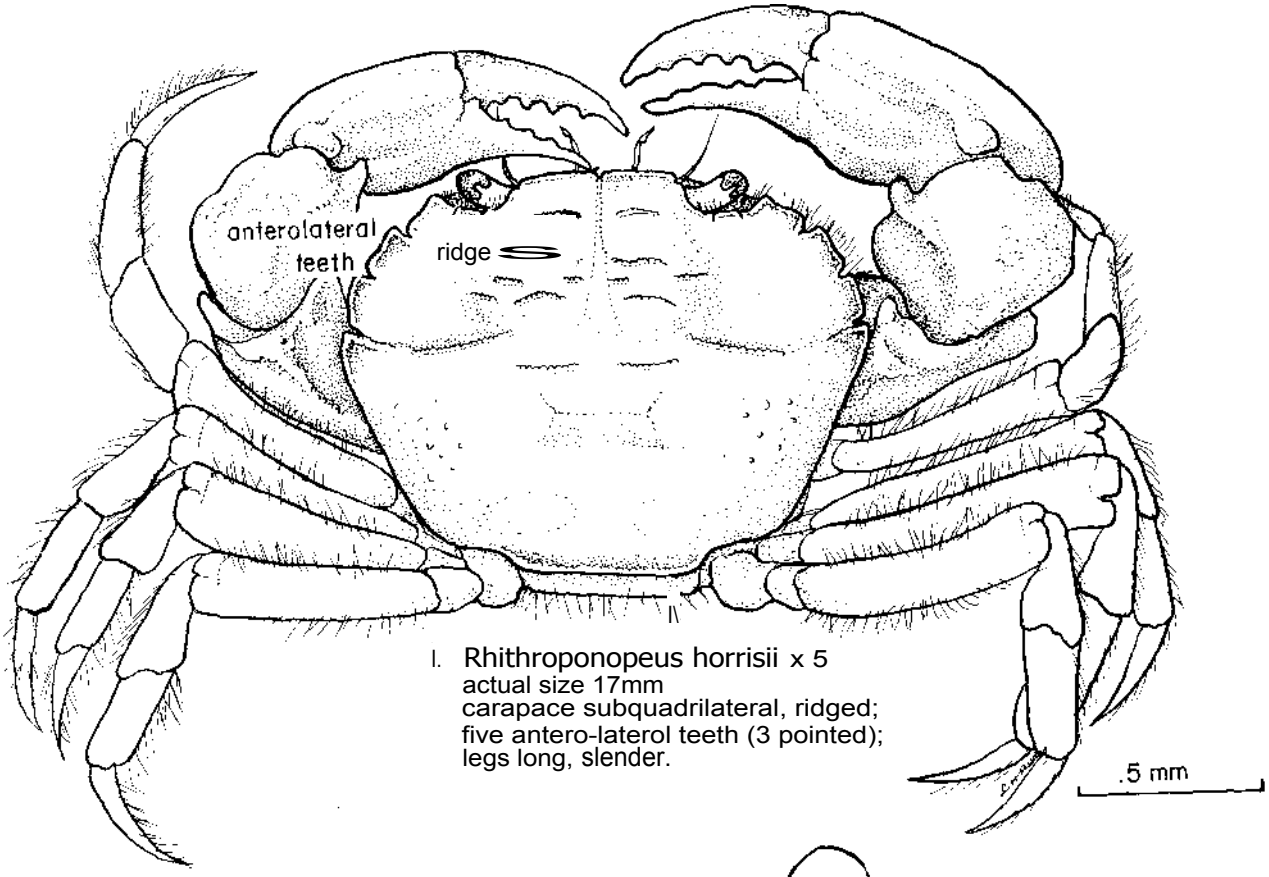
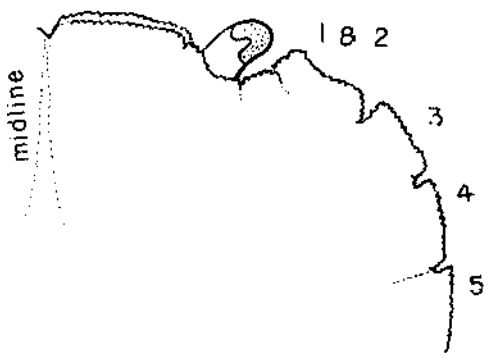
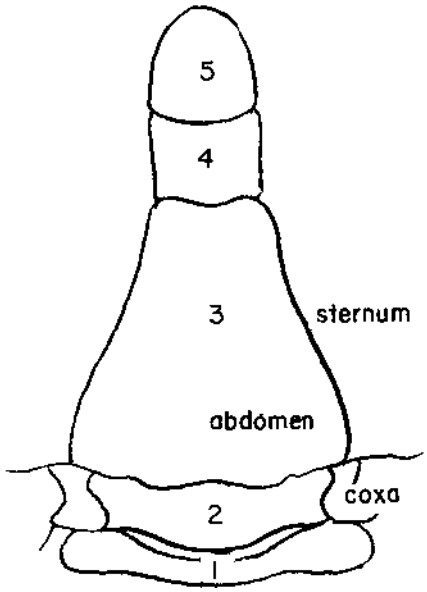
Rhithroponopeus harrisil



1. Rhithroponopeus horrisii x 5
actual size 17mm
carapace subquadrilateral, ridged;
five antero-laterol teeth (3 pointed);
legs long, slender.



2. carapace (right frontal)
frontal edge straight,double-edged,
triangular median notch;
eye fills orbit;
teeth 1, 2 coalesced; 3,4,5 dentate.



3. abdomen (male)
narrow; segment three not contiguous with
coxae of legs.

4.chelae, male (after Benedict, Rathbun)
heavy, unequal;
white, smooth.

Pinnixa faba

a pea crab (Dana, 1851)

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: Decapoda, *Reptantia*
SECTION: *Brachyura,*
FAMILY: *Pinnotheridae*

Description

SIZE-female much larger than male: about 2 cm wide; male 1 cm wide (fig. 1): average first true crab size 1.54 mm5.

COLOR-grayish tan, orange or rust markings; variable [s]; immature crabs white[s], eggs orange; female cheliped tips white. Crabs bright orange just after molting5.

CARAPACE-female: smooth, rounded, swollen, oblong; no strong poster- or antero-lateral ridges, but sides truncate, slope steeply, meet at an angle; no antero-latral teeth (fig. 1). Male: about 11/2 times wider than long[s]; same general shape as female, but sometimes has vertical, compressed lobe at anterolateral angle (fig. 4).

EYES-orbits oval, eyestalks very short; male: eyes fill orbits (fig. 4)6.

MOUTHPARTS-(not figured) external maxilliped has large, separate merus and ischium; carpus articulates at outer angle of merus; palp articulates at inner proximal end of merus; exognath with several joints, hidden6.

FRONTAL AREA-narrow, slightly advanced, (male); strong medial groove (female) (figs. 4, 1).

CHELIPEDS-pollex straight, a little shorter than movable dactyl; dactyls of female white-tipped, not gaping [6]. Male: manus almost oblong, widening at tip, pollex shorter than dactyl, which is curved, and has a tooth at its base; dactyl hairy within (fig. 3a, b).

WALKING LEGS- merus of third walking leg of male more than twice as long as wide (fig. 4); dactyli of both sexes short, strongly curved; third walking legs longest; legs similar in shape, except merus of first leg of male, which is concave above, not convex as are others; female legs more alike than male's.

ABDOMEN-seven jointed, both sexes; male's narrow, last segment rounded, next to last segment constricted in middle (fig. 5b); female abdomen very wide, to hold egg mass (fig. 5a).

Possible Misidentifications

The pea crab group is one of the most difficult to identify. Each species is specific to its host, however. The closely related *Pinnixa littoralis,* for instance, is often found in the clam *Tresus capax,* as is *P faba. P littoralis* is distinguishable by its carapace, which is pointed at the sides; the merus of its third walking leg (male) is twice as long as wide, not longer as in *P faba.* The female fingers gape, her walking legs are rather unlike; the male pollex is deflexed (bent down) and the movable finger (dactyl) has no tooth at its base. The two species are different in color: *P littoralis* females are greenish-yellow. Both these species are found in pairs, not singly as with most pea crabs5.

Other *Pinnixa* species are *P. longipes,* with exceptionally large third walking legs, commensal with tube worms; *P. bamharti,* from a holothurian; *P. occidentalis,* with cylindrical fourth and fifth walking legs, in echiurid worm burrows and *P. franciscana, P. tubicola,* and *P. schmitti,* also from worm burrows and tubes.

The *Pinnixa* can be distinguished from other genera of pea crabs by the very wide carapace, large third legs and by differences in the external maxilliped. Other local genera are *Pinnotheres* (with oysters), *Fabia* (with bivalves, especially *Mytilus) Opisthopus* (from various molluscs including *Tresus,* and from holothurians). *Scleroplax granulate,* found usually with mud and ghost shrimp, has a wide carapace like *P faba,* but its antero- and postero- lateral margins curve gradually, not forming an angle.

Ecological Information

RANGE-Alaska to Humboldt Bay, California. Type locality: Puget Sound.

DISTRIBUTION-in clams in bay mud, or mud and sand.

HABITAT-heavily infests *Tresus capax,* the gaper clam, (with P *littoralis,* nearly 100% in Puget Sound[s]); but adult pinnixids never found in *Tresus nuttalli;* also found in *Saxidomus, Mya6, Tapes, Macoma,* and as immature crabs, in *Clinocardium* [1]. P *faba* inhabits *Tresus* in pairs. The large female clings to the visceral fold in the mantle cavity of the clam; it remains there immobile and permanently, close to the food supply. The smaller male 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.

SALINITY- host *Tresus capax* found at 30.5-33.5 o.ob (Humboldt Bay).

TEMPERATURE-

TIDAL LEVEL-

ASSOCIATES-as the female is never free-living, and the males and immatures move abut 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[s]. Blisters and irritation of the clam's viscera are noticeable, where the female has lodged'. The crab is parasitic, not commensal: it steals food from the clam, and apparently gives nothing in returns.

Quantitative Information

WEIGHT-

ABUNDANCE-can be very prevalent in certain clam populations: almost 100% infestation (by two species)[5]; percentage varies with season.

Life History Information

REPRODUCTION-ovigerous twice a year (and a month later than P *littoralis),* with winter period being most successful5. Copulation occurs within the clam, as the female is sessile. Th3 male and resident imutures are usually found on or next to the female. One to five immature crabs of both sexes have been found resident in the clam (particularly in summer and fall5). Apparently they are waiting to assume adult roles at the death of either of the adult pair. Unusual in this species is the presence of the male; this could insure that at the death of the female, a new female would be P *faba,* not another species5.

GROWTH RATE- molting occurs in summer; 23- 24 molts to average size (19.7 Tim). female; 15 molts for average male'. (13.1 mm).

LONGEVITY-

FOOD-female steals food from host (diatoms, etc.) by use of mucus strings; food of male not known'.

PREDATORS-

BEHAVIOR-young (first true crab stage) crabs infest young *Tresus* when they have just settled out, and remain in this habitation permanently. Other immature crabs may be found later vvith this pair. Neither sex is adapted for permanent free-living, nor is the immature crab, which is white, thin, and fragile5.

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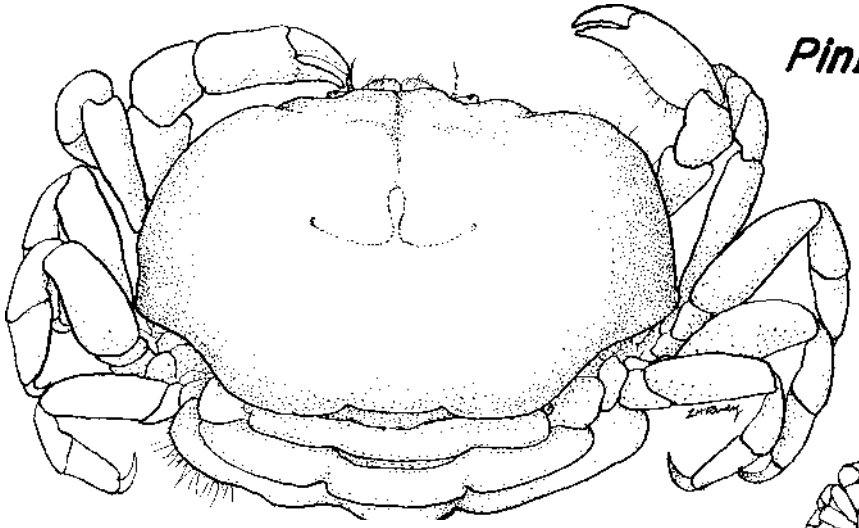
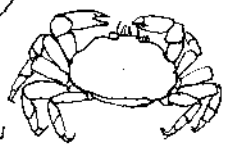
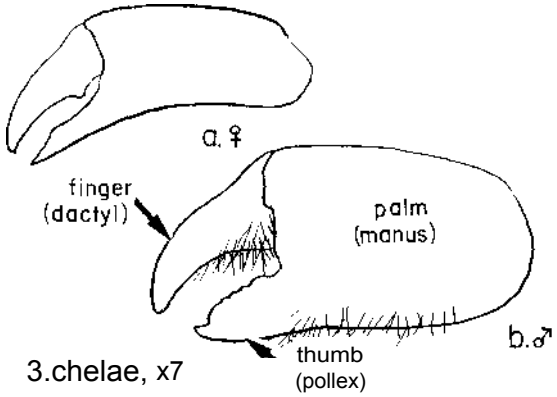
Pinnixa faba



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

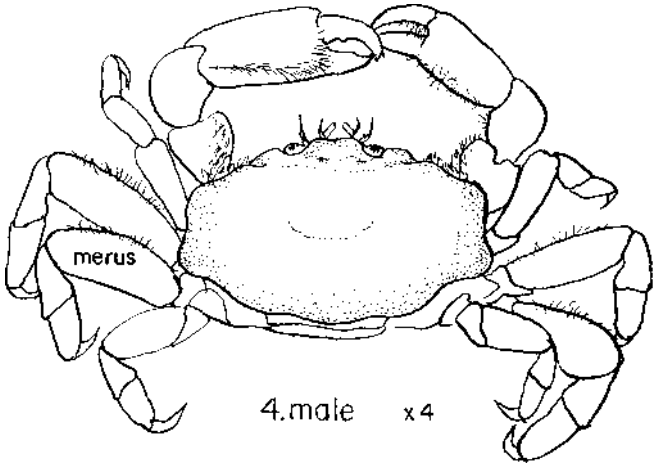


2. immature x4



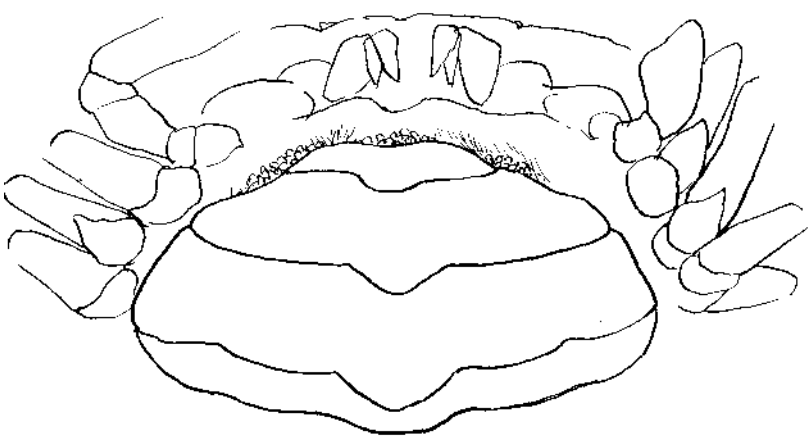
3.chelae, x7

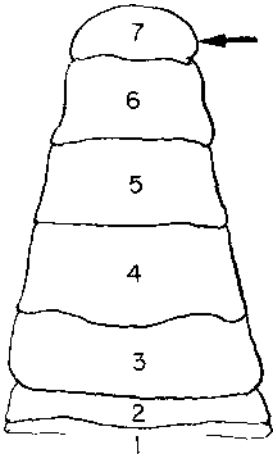
a. female: white, not gaping
b. male : thumb straight; dactyl curved, toothed; fingers hairy; palm widens distally.



4.male x4

carapace oblong,firm, I 1/2 times wider than long; sides slope steeply; antero- and post-lateral margins meet at angle; merus long (third walking leg).





5. a bdomens, and

a. female

seven-jointed, very wide

b. male

narrow; last segment rounded.

Hemigrapsus nudus

the purple shore crab (**Dana, 1851**)

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: *Decapoda, Reptantia*
SECTION: Brachyura
FAMILY: Grapsidae

Description

COLOR-red, purple, or whitish; chelipeds red-spotted10.

SIZE-carapace width 56.2 mm, length 48 mm7.

CARAPACE-flat, smooth and punctate[9]; quadrate with rounded antero-lateral margins[7]; no transverse lines (fig. 1).

EYES-eyestalks and eyes of moderate size; eyes at antero-lateral angles (fig. 2).

FRONTAL AREA-very slightly rounded, without prominent lobes (fig. 2).

CARAPACE TEETH-two (below the orbital tooth); lateral; last tooth small (fig. 2).

CHELIPEDS-smooth, equal or almost equal, stout; mottled above with small round red spots (fig. 1); male with inflated palms, patch of fine hair on inner surface.

WALKING LEGS-naked (without hair) rather short[9]; dactyls short (fig. 1).

SEXUAL DIMORPHISM-male has narrow abdomen, exposing the sternum at the base (fig. 3, *H. oregonensis);* palm of male cheliped with a patch of long, fine hair. Female has a wide abdomen, hiding sternum (fig. 3, *H. oregonensis),* and only a few isolated bristles on the palm of the cheliped.

JUVENILE-on frontal area is a shallow depression, not a notch; lateral spines not terribly sharp or clearly separated from the side; eyes large (fig. 3); dactyls short, dactyl of leg four quite flat[10]; both sexes with narrow abdomens.

Possible Misidentifications

The other northwest *Hemigrapsus, H.* oregonensis, is smaller, brownish-green, hairy-legged, and lacks the spots on the chelipeds. Its frontal area is strongly bi-lobed. Another small grapsid is *Pachygrapsus crassipes,* dark green with dark red transverse lines, a straight frontal margin and one lateral tooth, not two.

Ecological Information

RANGE-Sitka, Alaska, to Gulf of California[7]; type locality: Puget Sound'. Uncommon in Southern California.6

DISTRIBUTION-rocky outer coasts, rocky estuarine areas and salt marshes; Coos, Siletz, Tillamook, and probably other Oregon estuaries with rocky, brackish habitats.

HABITAT-"semiprotected and protected rocky coasts and bays. ..prefers coarse sand to gravel substrates overlain with large rock cover"[9]; in more exposed situations than *H. oregonensis,* withstands desiccation better (large specimens); in salt marshes, but not as common as *H. oregonensis;* in burrows and under driftwood (Puget Sound)[5]; dominant grapsid in middle tide pool region[6]; only grapsid found in areas of swift water and large boulders (Puget Sound)4.

SALINITY-in full salt (outer shores), brackish and hyper-saline (estuarine marsh) waters. Can endure low salinities better at high temperatures".

TEMPERATURE-survival poorest with low temperature combined with low salinity" smallest animals most resistant to temperature extremes".

TIDAL LEVEL-strictly littoral/[3]; found higher than *H. oregonensis,* but both species are found from high to low levels"; rockweed belt; sand below rocks; commonly found just below high-tide level (Monterey)[2]; often found with *Pachygrapsus* which extends higher into the intertidal and prefers larger rocks.

ASSOCIATES-territory overlaps with *Pachygrapsus crassipes* over whom it is dominant[s]; occasionally with *H. oregonensis.* Can be host to nemertean *Carcinonemertes epialti.* Parasitic isopod *Portunion conformis* in perivisceral cavity of some individuals6.

Quantitative Information

WEIGHT-an adult male, 32 mm wide weighed 17.5 grams (wet).

ABUNDANCE-locally abundant8.

Life History Information

REPRODUCTION-females with eggs through fall to January (Puget Sound); 70% ovigerous late January, 98.6% with fertilized eggs early April; hatching from early May to middle June; a second brood is rare; copulation similar to *Pachygrapsus4.*

GROWTH RATE-

LONGEVITY-

FOOD--primarily detritus, algae infrequently[3]; forages in large numbers on tops of rocks[4]; stomach contents reveal amphipods and other crustaceans provide a small part of the diet4.

PREDATORS-Pachygrapsus, on newly molted animals; fish, raccoons, probably great blue herons.

BEHAVIOR- sluggish; sometimes feigns death when surprised[2]; a nocturnal feeder[s]; males more aggressive than females; (fight when attacked); females autotomize easily in order to escape. See wel16.

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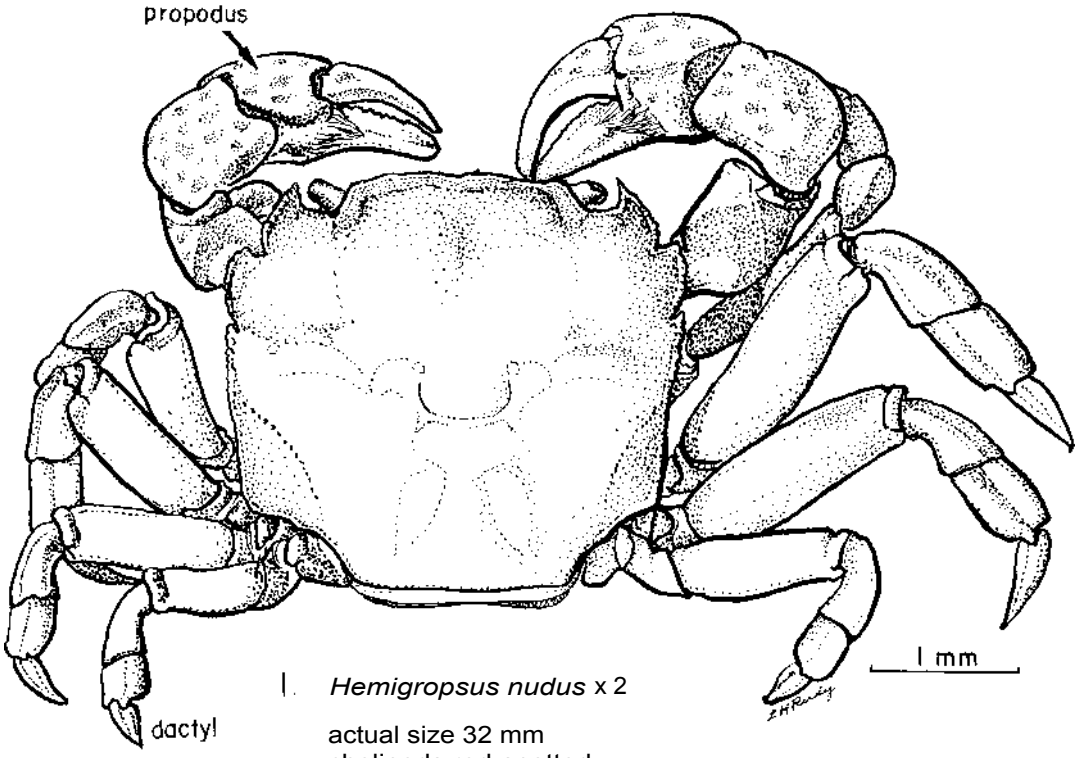
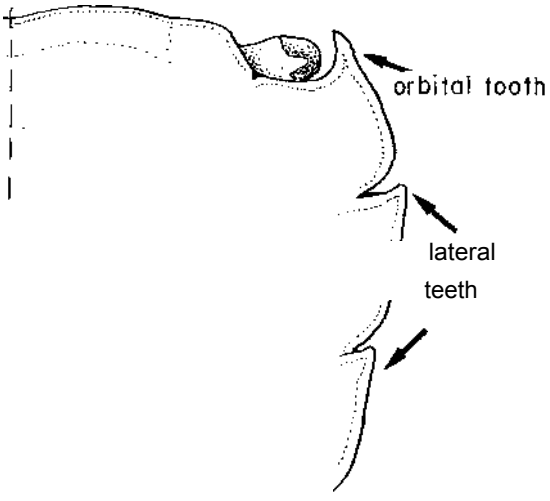
Hemigropsus nudus

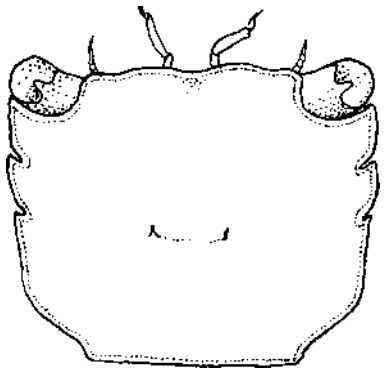


1. *Hemigropsus nudus* x 2

actual size 32 mm
chelipeds red-spotted;
male palms inflated, hairy;
carapace flat, quadrate;
legs hairless.,
frontal area slightly rounded.



2.carapace (right frontal)
eyes moderate, at antero–lateral angle;
two lateral teeth (one small).



3. juvenile x to
actual size 5 mm;
shallow frontal depression;
slight lateral spines;
eyes large.

Hemigrapsus oregonensis

the hairy shore crab (Dana, 1851)

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucanda*
ORDER: *Decapoda, Reptantia*
SECTION: *Brachyura*
FAMILY: *Grapsidae*

Description

COLOR-dull brownish green, no red spots on chelipeds [7]; dull gray, mottled[4]; uniform light gray or muddy yellow, underside white5.

SIZE-carapace width 34.7 mm, length 28.4 mm4.

CARAPACE-rectangular, wider than long; antero-lateral margins rounded, toothed; surface smooth, (fig. 1).

EYES-eyestalks and orbits moderate-sized[4]; eyes at anterio-lateral angle (fig. 2).

FRONTAL AREA-less than half the width of carapace: genus *Hemigrapsus;* two prominent frontal lobes.

CARAPACE TEETH-two lateral teeth (below outer orbital tooth); deep sinuses (fig. *2).*

CHELIPEDS-equal or almost equal, stout; dactyls hollowed in shallow groove; male with a mat of fine hair on propodus.

WALKING LEGS-more or less hairy (fig. 1).

SEXUAL DIMORPHISM-male has narrow abdomen, exposing sternum at base: genus *Hemigrapsus* (fig. 3); males with hairy palms (chelipeds); females has a wide abdomen, no hairy patch on the palm (only a few bristles).

JUVENILES-very small animals have a marked frontal notch, sharp lateral spines, long dactyls (on walking legs 1-3) [7]; both sexes with narrow abdomens.

Possible Misidentifications

The only other species of *Hemigrapsus* in the Northwest is the larger purple shore crab, *H. nudus,* which is "naked", *ie.* not hairy, on its walking legs. The chelipeds in *H. nudus* have conspicuous red spots; the lateral teeth of the carapace are not as deeply cut as those of *H. oregonensis,* and its front is straight or slightly convex, not prominently bilobed. *H. nudus* lives mostly on the rocky open coast, but is also found in salt marshes'. *H. oregonensis* has been called a small, bleached edition of *H. nudus5.*

Another small grapsid, *Pachygrapsus crassipes,* is dark green and has many transverse dark red striations on its legs and carapace; (*H. oregonensis* is smooth); its frontal margin is straight, it has one lateral tooth, not twos.

Rhithropanopeus harrisii, an introduced Xanthid mud crab, is sometimes found with *H. oregonensis.* It has slightly convergent sides, strong dorsal ridges on its carapace, and three sharp carapace teeth.

Ecological Information

RANGE-Alaska to Baja California; type locality, Puget Sound *("in Oregoniae freto Puget")4.*

DISTRIBUTION-the common form in Oregon bays[5]; Yaquina, Siletz, Tillamook, Netarts, Coos, Coquille, etc.; less often in quiet parts of open rocky shores.

HABITAT-quiet water... rocky habitats within estuaries, on gravel shores, but prefers mud; [5] on muddy bottoms of estuaries and on eelgrass and in *Enteromorpha.* Also in muddy spots on the open rocky coast.

SALINITY-range (San Francisco Bay): 17.5 to 31.6 0/006; likes fresh water seeps[2]; cannot tolerate much desiccation2.

TEMPERATURE-small animals most tolerant to temperature extemes9.

TIDAL LEVEL-found at very high and very low levels, but most are lower than *H. nudus*[9]*;* higher tidal reaches of the mudflats5; mid and low intertidal of bays and sublittorally7.

ASSOCIATES-in gravel: isopods *Idotea* and *Gnorimosphaeroma;* occasionally *H. nudus*[2]*;* alga *Ulva* (sublittorally), pickleweed. *Salicornia* (in marshes)'. Parasitic isopod *Portunion conformis* is sometimes in perivisceral cavity[3]. Can be a host to nemertean *Carcinionemertes epialti.*

Quantitative Information

WEIGHT —

ABUNDANCE-in great numbers on estuary bottoms[2] usually plentiful in gravelly substrates2.

Life History Information

REPRODUCTION-

GROWTH RATE-

LONGEVITY-

FOOD-primarily an herbivore; scraping *Ulva* or *Enteromorpha* off the rocks; uses tactile, visual and chemical senses to find food'.

PREDATORS-birds: willet3.

BEHAVIOR-probably nocturnal'. A good digger3.

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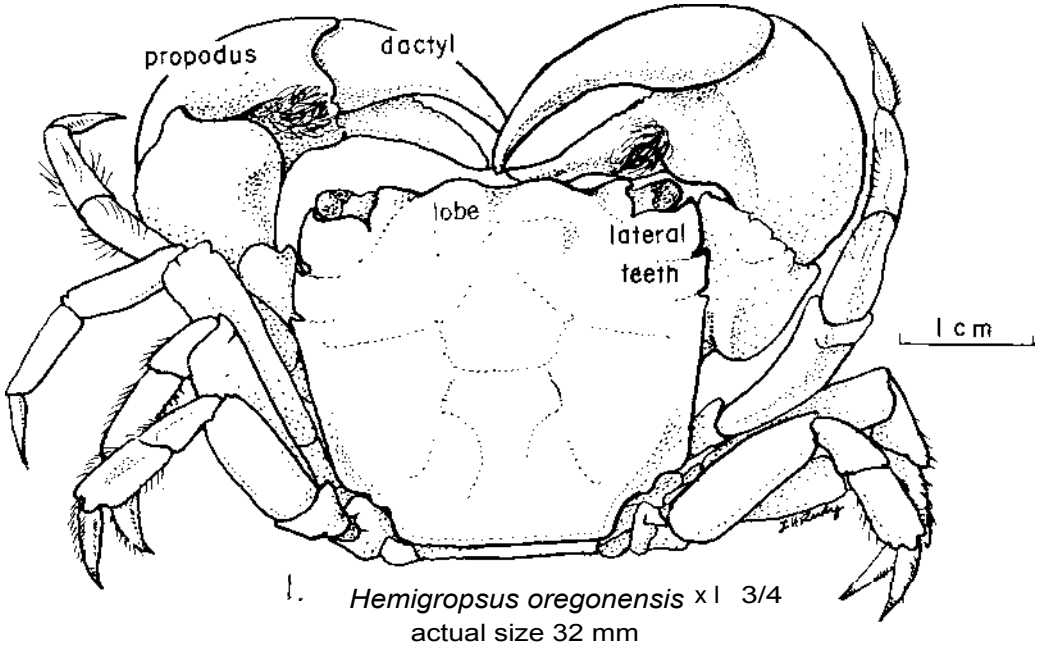
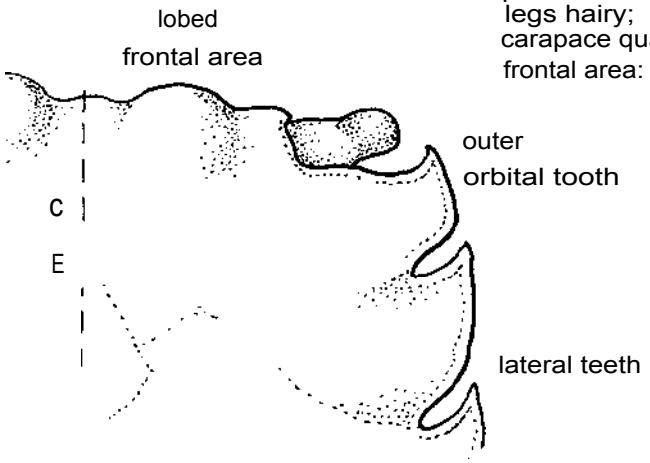
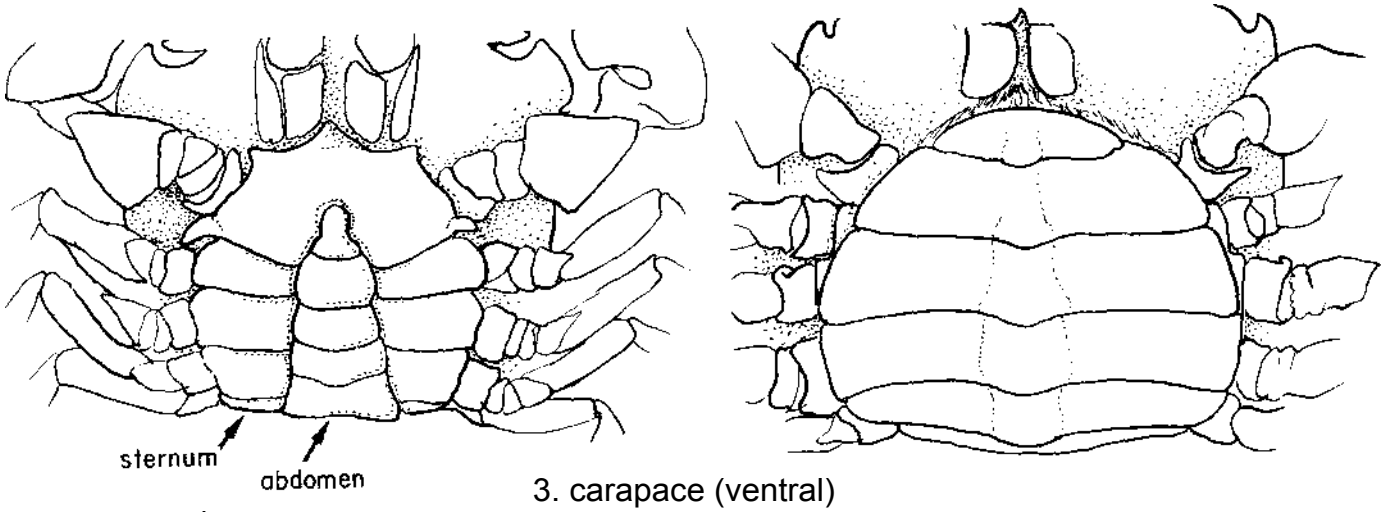
Hemigropsus oregonensis



1. *Hemigropsus oregonensis* x 1 3/4
actual size 32 mm
patch of fine hair on male chela,
legs hairy;
carapace quadrate, smooth-,
frontal area: two lobes.



2. carapace (right frontal)
eyes moderate, at antero-latera l angles;
two deep lateral teeth,



3. carapace (ventral)

a. male
abdomen narrow, sternum visible at sides.

b.female
abdomen wide, sternum not visible.

Pachygrapsus crassipes

the lined shore crab **Randall, 1839**

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: *Decapoda, Reptantia*
SECTION: *Brachyura*
FAMILY: Grapsidae

Description

SIZE-carapace about 40 mm wide; sexual maturity: females, 15 mm, males, 12 mm[4]; adult males larger than females4.

COLOR-dark green carapace, with dark red or blue transverse lines; some light markings.

EYES-at antero-lateral angle, eyestalks of moderate size; orbits deep, oblique (fig. 2).

FRONTAL AREA-broad margin; smooth, slightly arched, half as wide as carapace; four slight lobes below margin- small lobes at outer corners (fig. 2).

CARAPACE-quadrate, a little broader than long, transverse lines on anterior; one strong lateral tooth (below orbital tooth); carapace sides nearly parallel, but arched (fig. 1).

CARAPACE TEETH-one strong lateral tooth (and one post-orbital), fig. 2.

CHELIPEDS-usually subequal, massive; chela almost smooth, arm and wrist striated7.

WALKING LEGS- merus of fifth (last) pair smooth at distal end: no sharply distinct teeth (fig. 3); legs broad, compressed, bristled7.

SEXUAL DIMORPHISM-male abdomen narrow and triangular, exposing sternum at sides (as in *Hemigrapsus* sp.) Female abdomen rounded, wide, hiding sternum in adult. Dimorphism obvious when animals only 6 mm wide4.

JUVENILES-alert and quick; especially long-legged, large eyes4.

MEGALOPS-much larger than that of *Hemigrapsus:* 5.6 mm long, 2.7 wide; transparent; telson with two long medial spines, several short ones (fig. 4)4.

Possible Misidentifications

P. crassipes might be confused with the slower *Hemigrapsus nudus,* but the latter has obvious red spots on its chelipeds, and lacks *P. crassipes'* dark green color and transverse striations. *Hemigrapsus oregonensis* (when adult) is smaller, and like *H. nudus* has two lateral teeth and a smooth, square carapace.

The only other species of *Pachygrapsus,* the smaller *P. transversus,* occurs only as far north as California.

Ecological Information

RANGE-Oregon to Gulf of California; type: probably Oregon (erroneously Hawaii)4.

DISTRIBUTION-northernmost boundary 45° (Newport, Oregon), probably due to cold winter temperatures[4]; found on protected rocky beaches, and in southern Oregon estuaries.

HABITAT-prefers hard substrates, especially rocks and boulders with crevices and crannies and algal growth[4]; or *Salicomia* marshes whose roots provide burrows; also found on rock jetties.

SALINITY-osmo-regulatory adaptations indicate movement toward terrestrial habitat[4]; can regulate against salt concentrations in the body during periods of exposure, and thus maintain a constant body salinity[5]. Occurs less frequently in brackish water than does *Hemigrapsus4.*

TEMPERATURE-northern limit of range apparently determined by low winter temperatures; can tolerate greater temperature fluctuation than can *Hemigrapsus4.*

TIDAL LEVEL-lives over an extensive vertical range: mean low water to plus eight feet[4]; found highest in intertidal of all Pacific Northwest crabs, and is especially abundant at the higher levels: upper intertidal"; progressing toward terrestrial habitat4; (but, as blood concentrations of potassium, calcium, and magnesium increase more than sodium when animal is dessicated, this may inhibit terrestrial adaptation[2]). Also, efficiency of animal's vascular system, affected by osmotic stress, further limits ecological range3.

ASSOCIATES-virtually no parasites in western American specimens; with *Hemigrapsus oregonensis* in bays, and with *H. nudus* on rocky outer shores, with both of whom it competes for hiding places", but not for food. *Fucus* (alga) and *Salicornia* (pickleweed) often provide protection. Can be infested by Bopyrid isopods (Southern California)."

Quantitative Information

WEIGHT-15 grams considered mature weight3.

ABUNDANCE-"ubiquitous in upper intertidal of rocky areas12; more abundant on outer shores than in bays.

Life History Information

REPRODUCTION-no pre-nuptial pairing or exhibitionism; copulation when females are soft, males hard; females usually ovigerous April to September (Pacific Grove, California)[4], but off-season mating occurs[8]; impregnation to extrusion of eggs-16 to 25 days; incubation period (average)-29 days; to megalops stage about six weeks; mating occurs once a year, occasionally twice4.

GROWTH RATE-females to sexual maturity in 11-12 months (to 15 mm wide); males in 7 months (about 12 mm)4.

LONGEVITY-probably about three years4.

FOOD-mostly herbivorous; scrapes off algal film *(Fucus, Ulva)* with excavated chelae[4]; also eats detritus (dead animal and plant tissue), other live animals; perception of food by visual, chemical and tactile stimuli, not by odor[4]; feeds diurnally as well as nocturnally[4], and chiefly in pools'.

PREDATORS--gulls, rats, other *Pachygrapsus* (while soft), large anemones *(Bunodactis, Anthopleura),* which can snare small animals. Because they are nocturnal and fast, *Pachygrapsus* are not much bothered by most birds4.

BEHAVIOR-mud dwellers seldom more more than 4-5 feet from hole[4]; pugnacious, solitary, active; move easily and quickly in any direction; poor swimmer[4]. Aggregate in crevices well above the water in daylight'.

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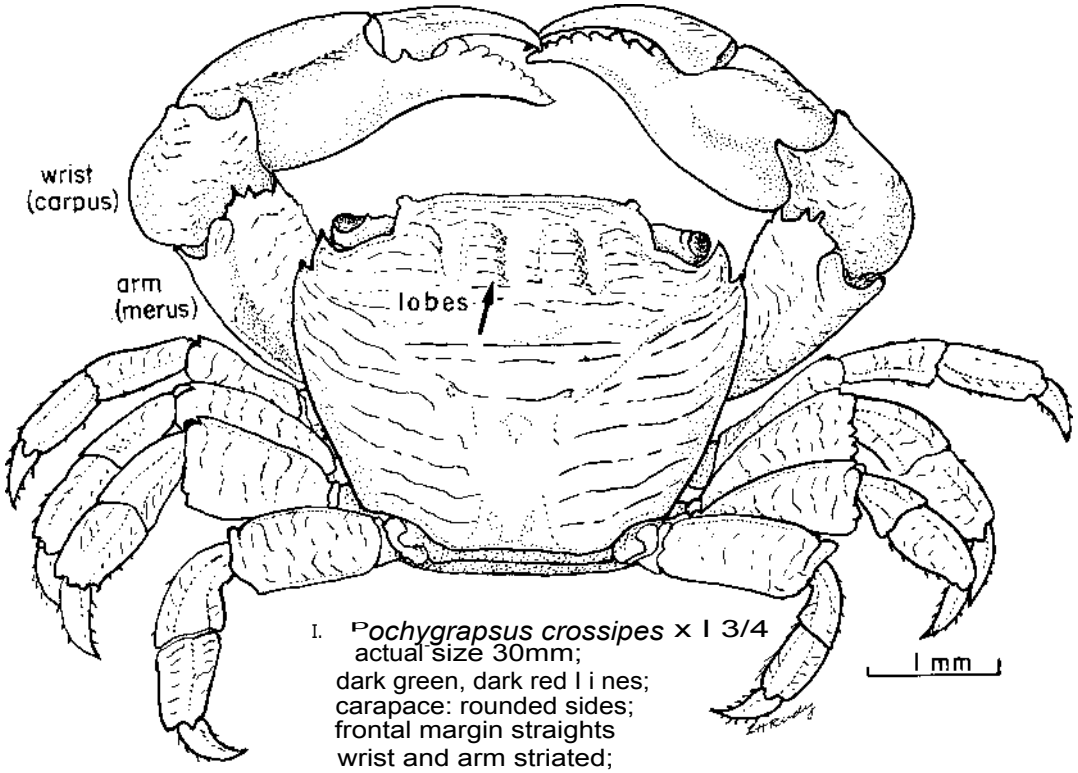
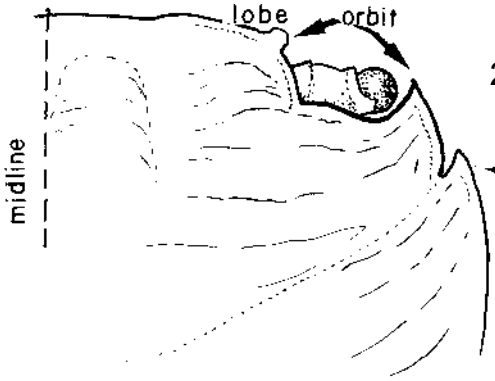
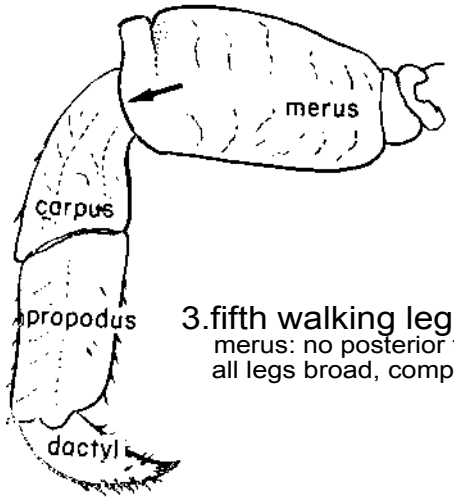
Pachygrapsus crossipes



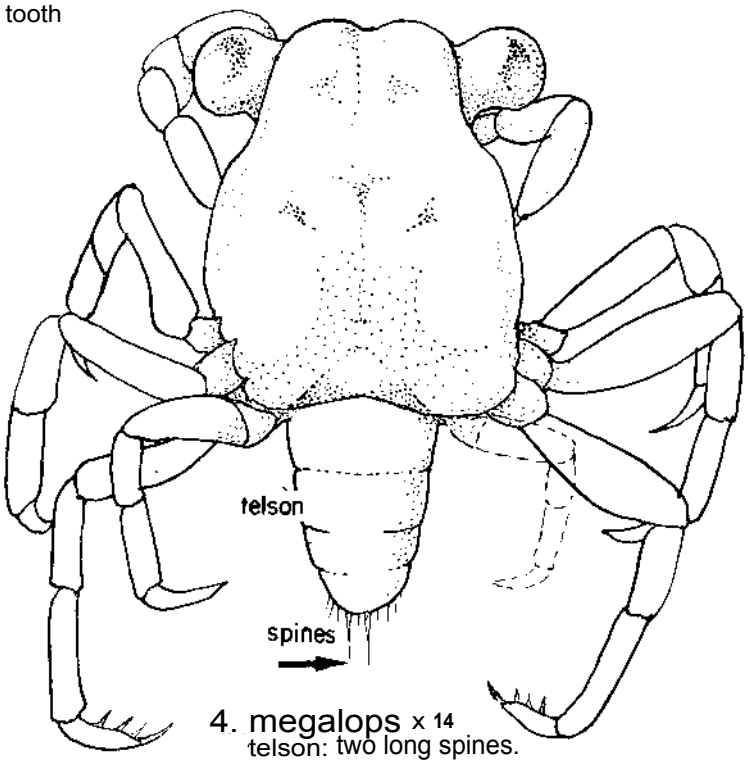
1. *Pachygrapsus crossipes* x 1 3/4
actual size 30mm;
dark green, dark red l i nes;
carapace: rounded sides;
frontal margin straights
wrist and arm striated;
four lobes below frontal margin.



2.carapace (right front)
one lateral tooth, one post-orbital;
deep orbits.



3.fifth walking leg
merus: no posterior teeth.
all legs broad, compressed.



4. megalops x 14
telson: two long spines.

(trom Hiatt, 1948)

Callianassa californiensis

the ghost shrimp Dana, 1854

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: *Decapoda, Reptantia*
SECTION: *Macura*
TRIBE:
FAMILY: *Thalassinidea, Callinassidae*

Description

SIZE-to 90 mm76.

COLOR-can be white to red "ghost-like"; figured specimen pale pink, abdomen light orange; hairless.

ROSTRUM-not prominent; a small blunt tooth, not acute°.

EYES-eyestalks falttened, corneas dorsal (fig. 2): *Callianassa* (genus).

FIRST LEGS-chelate and unequal (fig. 1); large cheliped broad, serrate, with an obvious gap in dactyls; carpus almost square; dactyl with recurved hook distally. Either propodus may be larger; more marked in males9.

SECOND LEGS-both chelate; propodus, dactyl equal in width (figs. 1, 3).

WALKING LEGS-third and fourth pairs; fifth pair subchelate' 7.

BODY-shrimp-like[1] 6.

PLEOPODS-three pairs, fan-like (fig. 1): *Callianassa* (genus).

TAIL-FAN-well developed; formed by telson and uropods (fig. 1).

ABDOMEN-elongate, not reflexed but extended; symmetrical, externally segmented: *Callianassidae* (family).

Possible Misidentifications

Upogebia pugettensis, the blue mud shrimp, is often found with *Callianassa. Upogebia* is larger, its color is strikingly different; its burrows are firm and substantial. The most noticeable morphological difference is its first pair of legs both of which are small, subchelate and equal. Its rostrum is hairy; its color is never reddish.

The only other local intertidal species of *Callianassa* is C. *gigas* (= longimanus), a larger (to 125 mm), rarer animal of the sandy sublittoral, with a prominent flattened tooth on the inner edge of the dactyl of the large male cheliped and a curved, wide propodus on the second pereopod. Its rostrum is sharp, and its first chela closes without a gap. It is more abundant farther north geographically and lower in the tidal zone"'. It is the more commonly found species found in Humboldt Bay CA.

Ecological Information

RANGE-Alaska to Baja California. Type: "California".

LOCAL DISTRIBUTION-Coos Bay; Alsea River[a], Nestucca estuary[2], Netarts Bay", Umpqua estuary[21], Tillamook Bay°, Yaquina Bays.

HABITAT-builds large sloppy permanent burrows with side tunnels; a tireless digger, it turns over acres of northwest oyster beds[1417], burrows can be to 30 "deep'°. Can survive anoxia for nearly 6 days12.

SALINITY-collected at 30 0/00. Lower lethal limit-25-30% seawater; an osmotic conformer". Upper limit tolerated-125% seawater12.

TEMPERATURE-

TIDAL LEVEL-collected at medium high zone (+4 ft.); upper to mid-intertidal; most shoreward burrowing shrimp: 0.0- + 1.0 foot14.

ASSOCIATES-the blue mud shrimp, *Upogebia pugettensis,* is found overlapping *Callianassa's* territory, though it is generally lower and in muddier sediments. Common commensals in ghost shrimp burrows include a polynoid worm *Hesperonoe,* pinnotherid crabs, copepods *(Hemicyclops, Clausidium),* the shrimp *Betaeus,* the bopyrid isopod *lone cornuta,* the goby C/eve*landia* ios, and the clam *Cryptomya califomica.*

Quantitative Information

WEIGHT-

ABUNDANCE-common in Oregon's estuarine mudflats.

Life History Information

REPRODUCTION-continuous in Central California, optimum June and July[14]. Larvae are flushed into nearby ocean by tides, where they spend most of larval period in plankton; exchange between bays probably common6.

GROWTH RATE-

LONGEVITY-

FOOD-detritus, obtained by ingesting mud as it burrows the top (richest) layer'° also filter feeds by pumping water through burrow".

PREDATORS-adult: man (for fish bait); keeps to its burrow to prevent predation. Juveniles: larval forms eaten by plankton eaters, (salmon, etc.).

BEHAVIOR-constant digger, fastidious self-groomer. See McGinitie[9,10]. Digging activities smother young oysters. Pesticide Sevin tried, Willapa Bay WA.

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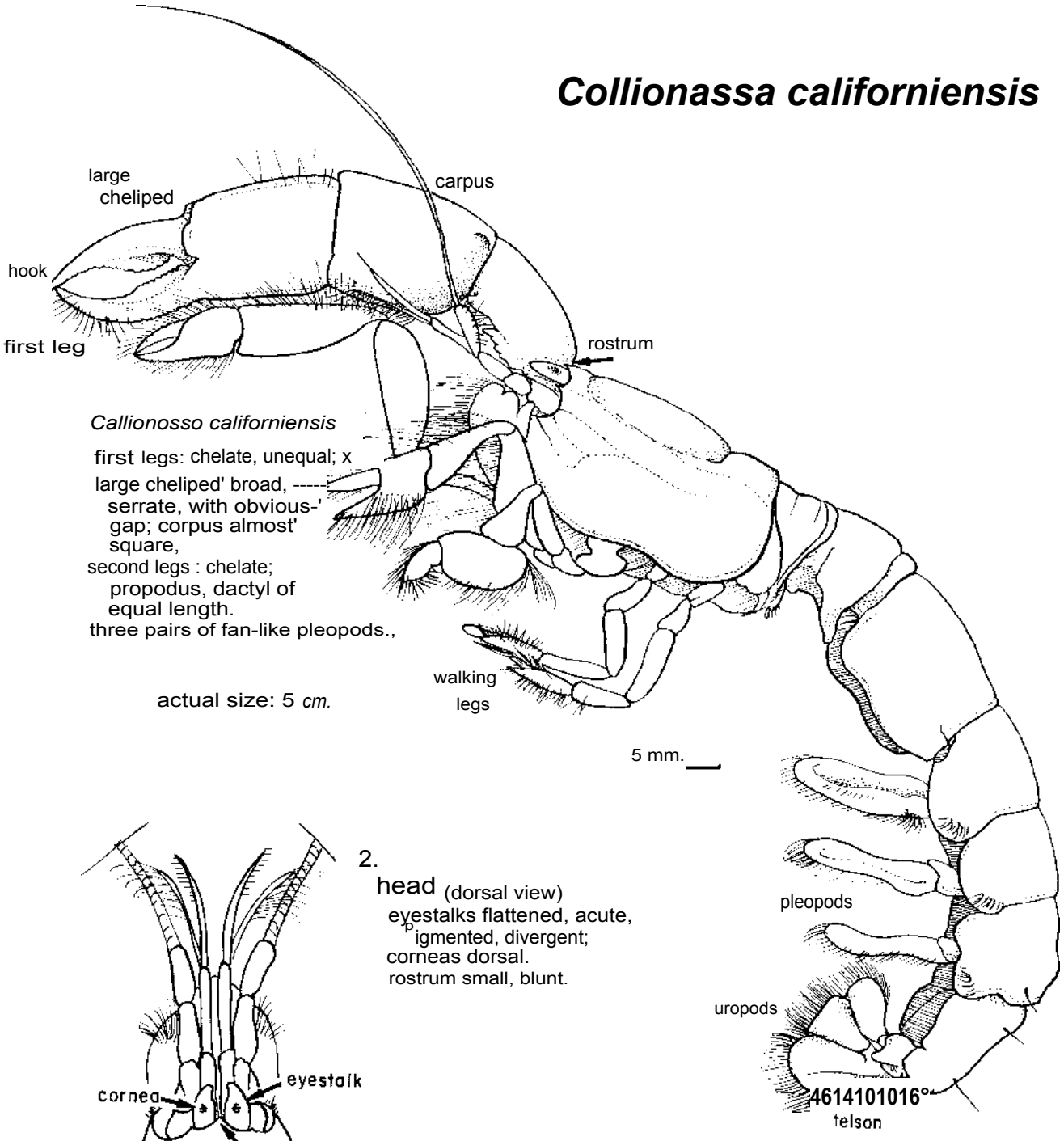
Collionassa californiensis

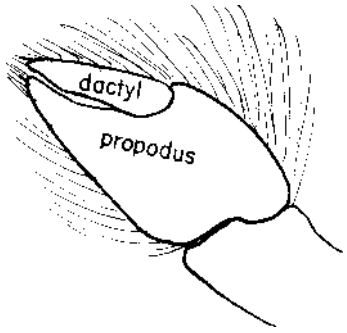


Callionosso californiensis

first legs: chelate, unequal; x
large cheliped' broad, ----- serrate, with obvious-' gap; corpus almost' square,
second legs : chelate; propodus, dactyl of equal length.
three pairs of fan-like pleopods.,

actual size: 5 *cm.*

2.
head (dorsal view)
eyestalks flattened, acute, pigmented, divergent;
corneas dorsal.
rostrum small, blunt.



3.
second pereopod
dactyl (top) closes to propodus without a gap;
dactyl, propodus same width.

Upogebia pugettensis

the blue mud shrimp **Dana, 1851**

PHYLUM: *A rthropoda*
CLASS: *Crustacea, Malacostraca*
DIVISION: *Eucarida*
ORDER: *Decapoda, Reptantia*
SECTION: *Macrura*
TRIBE:
FAMILY: Thalassinidea, *Upogebi.*

Description

SIZE-type: 50.8 mm; figured specimen, ovigerous female South Slough of Coos Bay 90 mm; often larger: to 10 cm (four inches)[6]; northern animals larger than those of southern California°.

COLOR-light blue green, brown fringes on pleopods and pleuron.

ROSTRUM-good sized, tridentate, rough, and hairy".

EYES-peduncle cylindrical", corneas terminal12.

FIRST LEGS (CHELIPEDS)- approximately equal, subchelate (fig. 1).

WALKING LEGS-(2-5) simple.

BODY-shrimplike.

ABDOMEN-elongate, not reflexed, but extended; symmetrical, externally segmented: Callianassidae.

PLEOPODS-four pairs, fan-like (fig. 1).

TAIL-FAN-formed by telson, uropods fan-like, adapted for swimming.

Possible Misidentifications

The ghost shrimps, *Callianassa* sp., do occur in the same general territory as *Upogebia,* but their coloration is very different, being white to red, never bluish. They have only three pairs of pleopods, a reduced rostrum, and one very large cheliped. *Upogebia* is "firmer, larger and more vigorous than Cal*lianassa"9.*

RANGE-Alaska to Baja California, including Gulf of California; type locality, Puget Sound.

LOCAL DISTRIBUTION-Oregon estuaries and sloughs: Alsea, Nestucca, Netarts, Yaquina, Coos.

HABITAT-estuarine mudflats, substrate: mud or sandy mud, often with some gravel, "on muddy beaches free from *Zostera"*[3]. Survives anoxia less well than *Callianassa8.*

BURROWS-U or Y-shaped, firm; permanent, little branched; vertically about 18 ", then horizontally 2-4 feet and to surface10, often the entrance will have a gravel plug if the tide is out13; walls smooth, mucus lined°.

SALINITY-collected at 30 doo; lower lethal limit: 10% seawater; a strong hyper-osmotic regulator below 75% seawater8.

TIDAL LEVEL-mid to lower intertidal of bays[12]; usually lower than *Callianassa;* occasionally small ones quite high (north)10, "at about mean low tide"13.

ASSOCIATES-many commensals, as with *Callianassa: Hesperonoe;* pinnotherid crabs; copepods *Hemicyclops, Clausidium;* shrimp *Betaeus;* isopod *Phyllodurus abdominalis;* clams *Orobitella rugifera* and *Cryptomya;* goby *Clevelandia ios.* Ghost shrimp *Callianassa* can live nearby.

Quantitative Information

WEIGHT-

ABUNDANCE-can be locally common12.

Life History Information

REPRODUCTION-each burrow inhabited generally by one pair; ovigerous females found January and February, Elkhorn Slough. California[6]; early April, South Slough. Eggs carried under abdomen on pleopods.

GROWTH RATE-

LONGEVITY-"probably moderately long lived"' °.

FOOD-detritus, obtained by filtering water through the burrow as it sits near an entrance: it makes a "basket" with its first and second pereopods, which are long-haired.

PREDATORS-man, for fish bait (adults); larvae food for plankton eating fishes.

BEHAVIOR-can occasionally be found walking about mudflat; like *Callianassa,* a prodiguous digger, and a menace in oyster beds, where its disturbance of the surface buries the oysters. Pesticide Sevin tried, Willapa Bay, WA.

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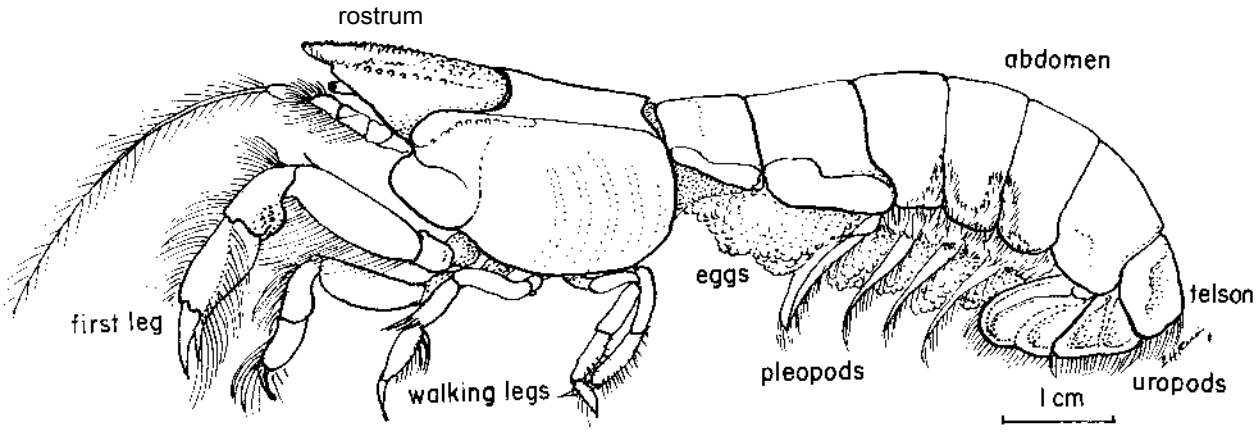
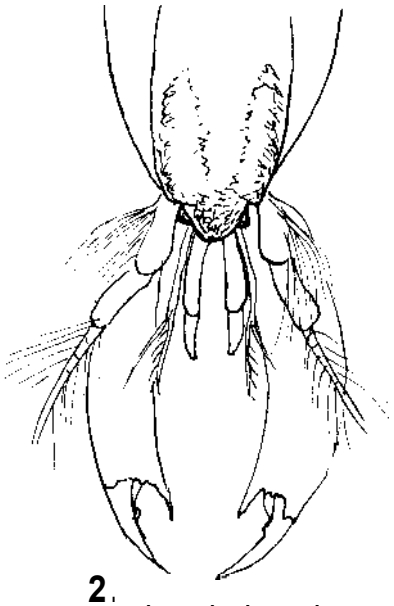
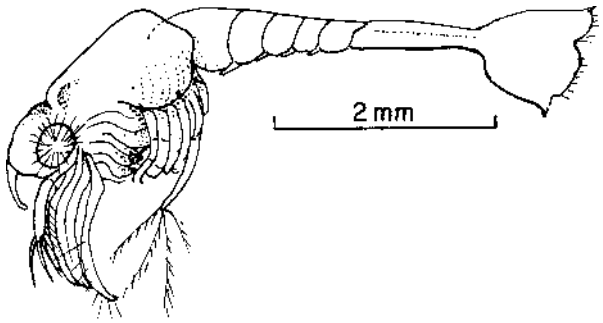


1. *Upogebia pugettensis* ovigerous ♀ x 1 1/2
actual size, 9 cm.
first legs equal and subchelafe;
legs 2,3,4,5 simple;
four pairs of fan-like pleopods.



2. head ,dorsal
hairy surface.
rostrum: three teeth,
eyestalks cylindrical, short;
corneas terminal.



3. **a larval form** x15
first stage, about 5 mm.

Pagurus hirsutiusculus

hairy hermit crab (Dana, 1851)

PHYLUM: *Arthropoda*
CLASS: *Crustacea*
ORDER: *Decapoda, Reptantia*
SECTION: *Anomura*
TRIBE: *Paguridea*
FAMILY:

Description

SIZE-carapace length to 3.2 cm; males usually larger than females[9]; Puget Sound to 2 inch (body)19.

COLOR-tan; antennae dark green with white stripes. Propodus of walking legs tipped with white or pale blue; dactyls with vertical red stripes, blue spots at base of dactyl, propodus; generally hairy.

YOUNG-antennae dark green, white stripes; walking legs white-striped, never blue; merus of both chelipeds dark brown, other leg segments light brown'.

ROSTRUM-triangular, acute.

EYESTALKS-short, stout.

LEFT CHELIPED-(small hand)-surface granular, slightly hairy; wider than deep (fig. 2).

RIGHT CHELIPED-(large hand)-rounded, twice as wide as small hand, granular, slightly hairy; one large tubercule on ventral surface (not figured).

WALKING LEGS-(two pairs) hairy: dactyls about as long as propodi; propodi banded with white. Two pairs of small posterior legs are adapted for holding shell.

PLEOPODS-small, unpaired.

TELSON-with slightly asymmetrical lobes, shallow cleft.

CARAPACE-shield (hard, anterior portion) wider than lone.

ABDOMEN-asymmetrical, elongate, twisted, soft, not externally segmented: hermit crabs.

ANTENNAL ACICLE--(antennal scale) usually exceeds eyestalk in length. Chemoreceptors on antennuie hairs".

Possible Misidentifications

The hermit crabs of the genus Pagurus are hard to tell apart. Of those without red antennae, *P. beringanus,* found on rocky substrates and sublittorally, has light, orange antennae, a whitish body and red banded walking legs, as well as inverted V-shaped tubercules on its hands. P. *samuelis, P. hemphilli,* and *P. granosimanus* all have red antennae, as well as other differences.

Ecological Information

RANGE-Siberia, Pacific Northwest to southern California, where it is replaced by P *h. venturensis*[8]; type locality Puget Sound.

LOCAL DISTRIBUTION -inland and coastal waters[6]; South Slough of Coos Bay: in channel at Collver Point, and in mudflat of Metcalf Preserve.

HABITAT-tidepools, under rocks (with coarse gravel), under seaweed[6]; South Slough specimens from channel bottom, and from *Zostera* bed in mudflat; prefers algal cover"; prefers sandy tidepools13.

SHELLS-in bays, usually inhabits *Nassarius fossatus* or *Nucella lamellosa* (this specimen)[16]. *Nucella emarginata,* or *Littorina* sp.[6], moves to a larger shell as it grows; innate selection of shells, depending on specific weight".

SALINITY-collected at 30 o/oo. Tolerates brackish conditions".

TEMPERATURE-

TIDAL LEVEL-intertidal to depths of 110 m[8]; in South Slough at +0.5 feet and -15 feet.

ASSOCIATES-in eelg rass: Littorine snails, amphipods (South Slough), barnacles and other sessile animals live on the shell; polynoid worms *(Halosydna),* and limpets *(Crepidula)* often live inside with the crab[9]. Polydorid worms can infect hermit crabs heavily *(Polydora commensalis).* A parasitic isopod *Pseudione giardi* found with Puget Sound specimens."

Quantitative Information

WEIGHT-

ABUNDANCE-usually abundant in tide-pools[6]; the common hermit crab9.

Life History Information

REPRODUCTION-male deposits sperm on female's abdomen. after her molting. She later uses the sperm to fertilize the eggs when they are laid.

GROWTH RATE-

LONGEVITY-

FOOD-detritus; scavenge for dead plant, animal materia16. some estuarine types filter plankton with their mouthparts9.

PREDATORS-other crabs.

BEHAVIOR-lively, and active (especially shallow water varieties, deepwater animals are more sluggish)[9]; will abandon shell in quiet waters'[5]. Many papers on behavior, see 12, 13, 14.

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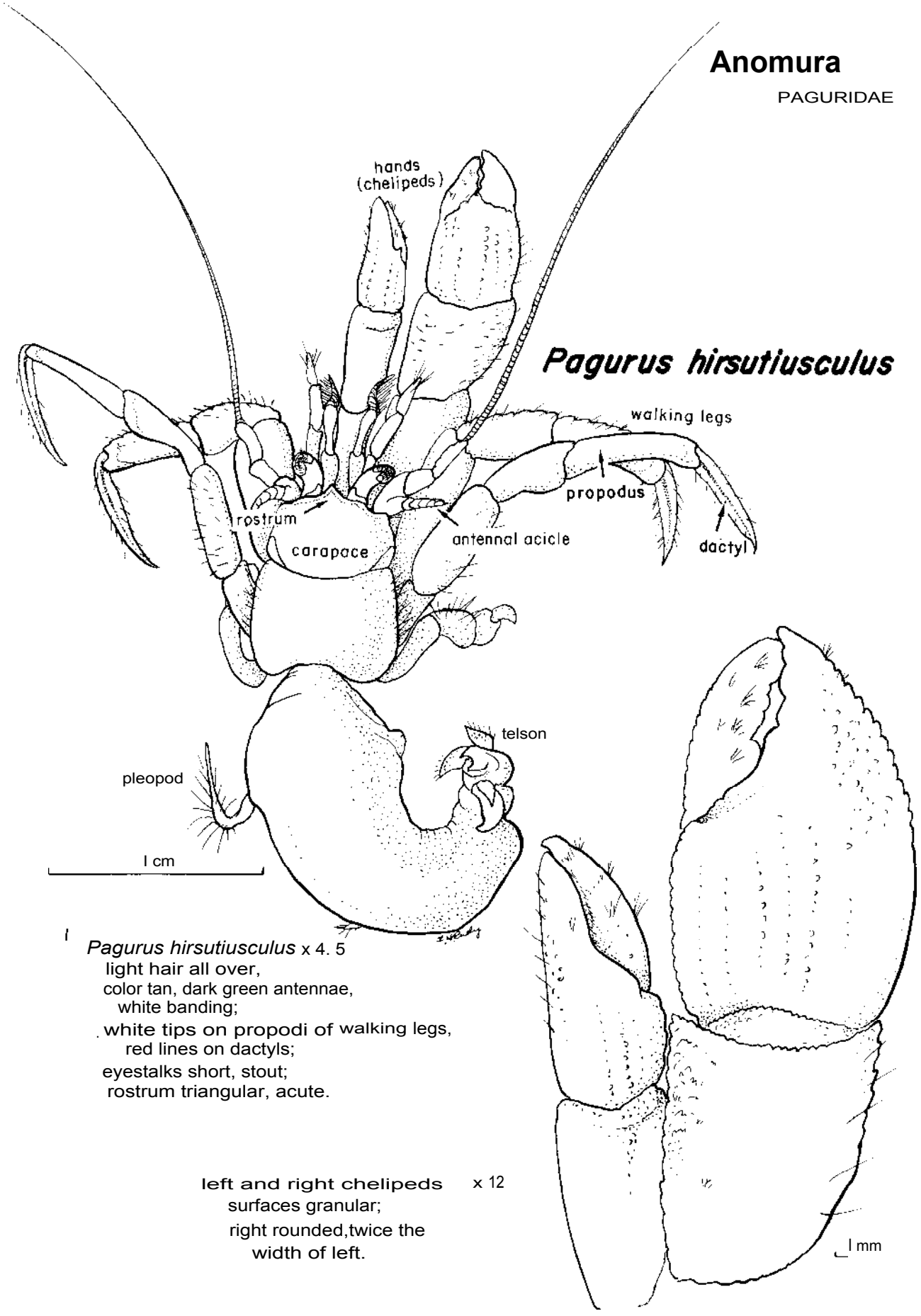
Anomura

PAGURIDAE



Pagurus hirsutiusculus x 4. 5
light hair all over,
color tan, dark green antennae,
white banding;
white tips on propodi of walking legs,
red lines on dactyls;
eyestalks short, stout;
rostrum triangular, acute.

left and right chelipeds x 12
surfaces granular;
right rounded,twice the
width of left.

PHYLUM: *Arthropoda*
CLASS: *Crustacea, Malacostraca*
ORDER: *Decapoda, Reptantia*
SECTION: *Anomura*
SUPERFAMILY: Gaiatheidea
FAMILY: *Porcellanidae*

Petrolisthes cinctipes
the flat porcelain crab (Randall, 1839)

Description

SIZE-to 24 mm long (across carapace); this specimen 14 mm.

COLOR-dark blue-brown, somewhat iridescent in life; antennae dark red; maxillipeds bright red-orange; legs blue banded with white."

BODY-crab-like- Porcellanidae; convex longitudinally; small fifth legs resting on carapace (fig. 1): most Anomura.

CARAPACE-round, abdomen symmetrical, short and permanently folded under thorax: family Porcellanidae" ; carapace front triangulate: genus *Petrolisthes.*[3] Surface: finely granulate, not rough: genus *Petrolisthes.* No epibranchial (anterolateral) spines; epimera and lateral portions of carapace entire. 7 abdominal plates: (nearly always) *Petrolisthes* (figs. 1, 2).

TELSON-7th plate forms tail fan (fig. 2); uropods attached to abdominal segment 5.

ANTENNAE-very long; first (basal) joint of antennal peduncle short, not reaching upper margin of carapace.

MOUTHPARTS-2nd maxillipeds highly developed for filter feeding: long fine hairs, specialized shaped for channeling water currents (fig. 4). Color: bright red-orange: species cinctipes.12

CHELIPEDS-equal, or almost: genus *Petrolisthes,* broad and flattened, not thick and rough: genus *Petrolisthes";* carpus almost invariably 1 1/2 times longer than wide" (fig. 1). Carpus margins converging anteriorly, not parallel; prominent lobe at inner angle: species *cinctipes"* (fig. 1). A short tuft of hair between fingers on underside, but chelae are generally hairless (figs. 1, 2).

WALKING LEGS-(2, 3, 4) with a few coarse spines on dactyl, propodus. carpus, not on merus: sp. *cinctipes.* (Fifth legs small, elevated, rest on carapace (figs. 1, 3).

SEXUAL DIMORPHISM-not obvious superficially. Inside telson, males have single pleopods on abdominal plate 2; females have long, branched pleopods on plates 3, 4, 5 (not shown).

YOUNG-pelagic zoea is like a "preposterous unicorn"'°: with a long spine to discourage predators from swallowing it (not shown).

Possible Misidentifications

There are two genera of porcelain crabs in our area, *Petrolisthes* and *Pachycheles.* The latter has a thick, rough body and chelae; its chelae are unequal and tuberculate or granular, and hairy, not smooth; the carpus of the chela is as long as broad, not longer than broad as in *Petrolisthes."*

One other species of *Petrolisthes* may be found commonly in Oregon: *Petrolisthes eriomerus* is superficially quite like *P. cinctipes.* This crab lives under rocks in gravelly substrates; it is a little smaller than *P, cinctipes.* The carpus of the chelipeds in P. *eriomerus* is twice as long as wide (not 1 ,Z times as long); the carpus margins are parallel, not converging; there is no prominent lobe at the inner angle; the carpus has scattered tubercules, not a finely granulated surface. The merus of the walking legs is hairy, not naked. The outer edge of the maxillipeds in this species is bright blue, not red orange.12

Other *Petrolisthes* described in Smith and Carlton, *P. manimaculis* and *P. rathbunae,* are found only from northern California south.'

Ecological Information

RANGE-British Columbia to Pt. Concepcion, California; also offshore islands of southern California, and Baja California.'

LOCAL DISTRIBUTION-outer, more marine portions of large estuaries: Coos Bay-Pigeon Point; Netarts Bay.

HABITAT-protected, semi-protected rocky coasts under rocks", mussel beds.'° Prefers open shores and clear waters.'

SALINITY-collected at 30 o/oo salt.

TEMPERATURE-

TIDAL LEVEL-mid- and upper levels. Found only at shore stations, not by dredging (San Francisco Bay, Schmitt"); almost exclusively littoral.'

ASSOCIATES-mussels, tunicates, sponges; nudibranch *Onchidoris,* chiton *Mopalia,* shore crabs *Hemigrapsus, Cancer oregonensis,* predatory gastropod *Nucella,* sea star *Pisaster ochraceus.*

Quantitative Information

WEIGHT-wet: 1.7 gr.

ABUNDANCE-very common' (up to 860/m2, Monterey8). Usually where it occurs at all, it is abundant: MacGinitie.

Life History Information

REPRODUCTION-found with eggs every month but April, May, September, October.' Coos Bay, found with developing young, March; these hatch as prezoeae.[3] Eggs a little over 0.8 mm diameter, deep scarlet to maroon when extruded, becoming brownish red.' Two carnivorous zoeal larval stages and a filter feeding megalops.

GROWTH RATE-

LONGEVITY-

FOOD-filter feeder: fans plankton and detritus from water with fan-like second maxillipeds. Feeding behavior evoked by presence of amino acids, sugars.°

PREDATORS-

BEHAVIOR-autotomizes claws very easily when disturbed.

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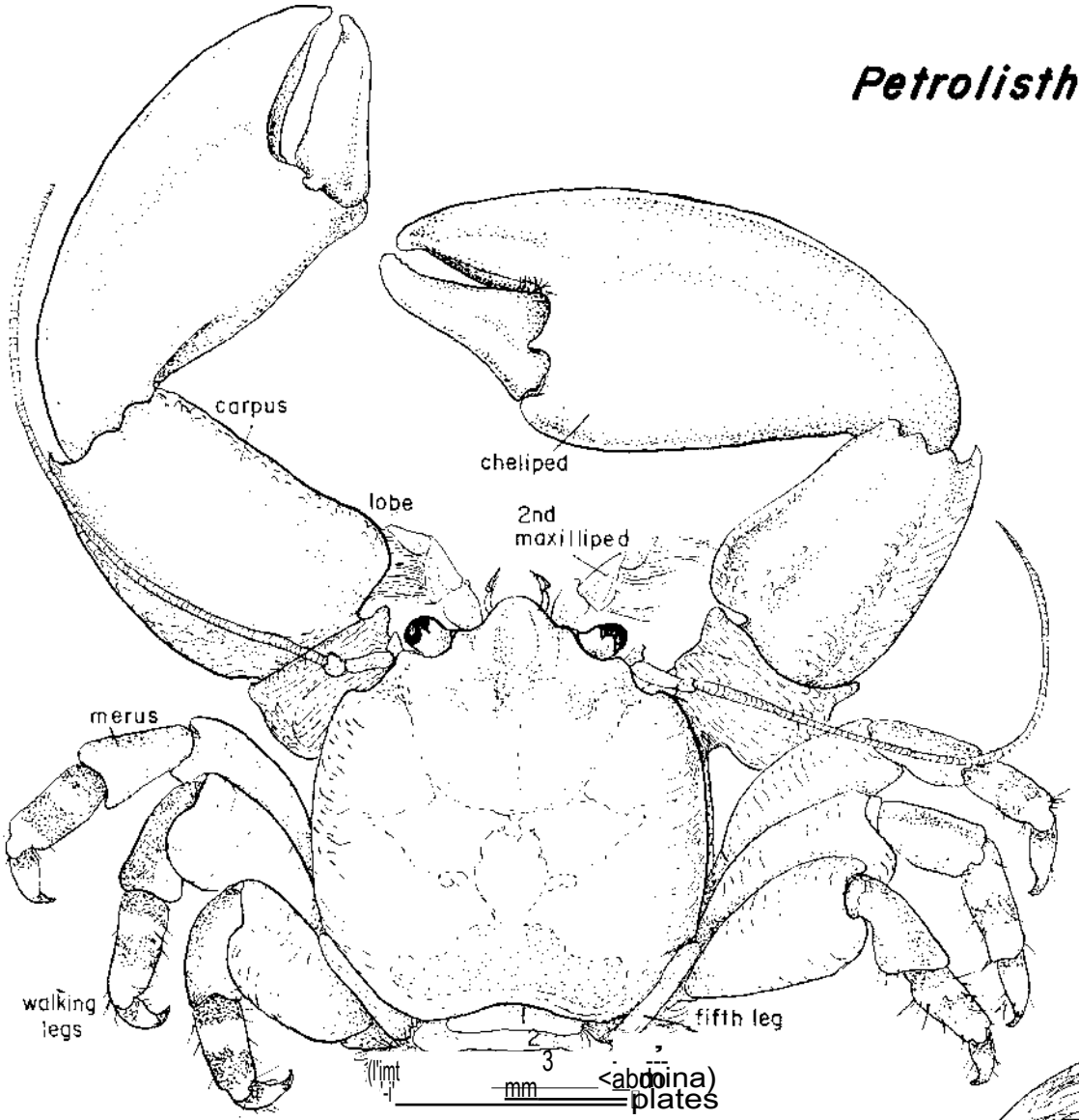
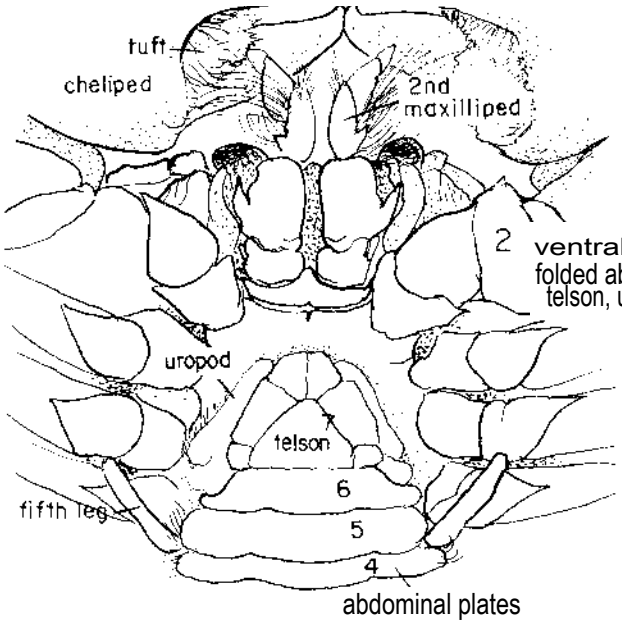
Petrolisthes cinctipes

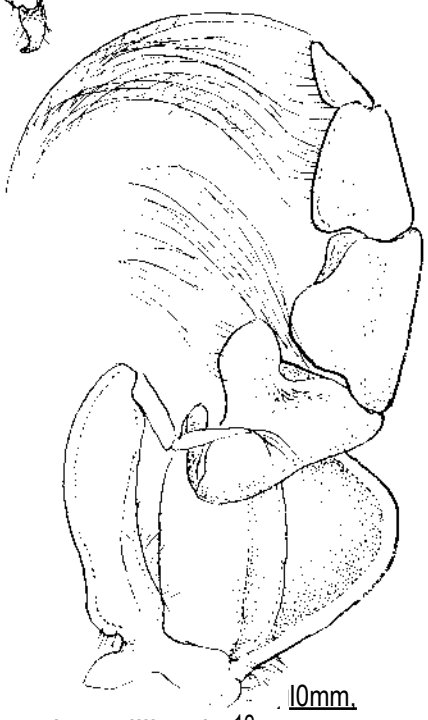


1. *Petro/isthes anctipes* x 4.5 actual carapace width 14 mm
body flat, smooth, crab-like; carapace round, abdomen folded under;
color blue-brown, iridescent, 2nd maxillipeds red-orange;
walking legs striped, merus naked; fifth legs small, elevated.



2 ventral view, x 4.5
folded abdominal plates (4-7 shown)
telson, uropods visible; che l i peds with

abdominal plates



3. second maxilliped x 12
highly developed articles;
long, fine hairs; bright red orange

Clinocardium nuttallii
basket or heart cockle (Conrad, 1837)

PHYLUM: *Mo//usca*
CLASS: *Heterodonia*
ORDER: *Veneroida*
FAMILY: *Cardiidae*

Description

SIZE-up to 72 mm[8], but often grows to greater size, particularly on northern beaches[2]; up to 100 mm5.

COLOR-warm brown when young, mottled; adults light brown.

EXTERIOR-shell as high as long[s], or higher; longer than wide during first year[2] (Length: anterior to posterior). Valves alike; shell inflated, triangular, with rounded corners[5]; end profile heart-shaped (fig. 3). About 35 strong, squarish, ridged ribs radiating from umbo (fig. 1). Shell thick, rather brittle; posterior end evenly rounded, smooth. Umbones prominent', beaks nearly central, directed anteriorly[3] (fig. 2).

INTERIOR-white, not pearly; anterior and posterior muscle scars equal in area; pallial line simple. Known for its great foot, short siphon.

HINGE AREA-hinge central, with one strong cardinal tooth, a posterior and an anterior lateral tooth in each valve (fig. 2); ligament entirely dorsal, not internal.

EYES numerous, tiny, on optical tentacles on mantle margin7.

Possible Misidentifications

There are at least two other species of *Clinocardium* in the Puget Sound area, although other members of the family have not been reported from Oregon. Both species are longer than high, subtidal, and less than 4 cm high. C. *ciliatum* has 40 ribs, C. *californiense* has 45-50, or more[s]. Several other species are listed by older authors, but most are subtidal, arctic or southern species.

No family other than Cardiinae family has such an inflated shell and central beaksi".

Ecological Information

RANGE-Japan, Alaska and south along Pacific coast to San Diego12.

LOCAL DISTRIBUTION-near bay mouths on tideflats in most Oregon estuaries; also on exposed beaches in the south12.

HABITAT-beaches of uniform, not very coarse sand[2], "corn meal" sand[8]. Often exposed. Diverse habitats: can be found in fine sand[2], and large populations often found in eelgrass/mud areas[5].

SALINITY-not found in upper bays where salinities vary greatly.

TEMPERATURE-

TIDAL LEVEL-from high intertidal to deep waters.

ASSOCIATES-small specimens often infested with young *Pinnixa faba* or P *littoralis*[9], (pea crabs).

Quantitative Information

WEIGHT-

ABUNDANCE-not as abundant as *Saxidomus, Protothaca,* (formerly *Paphia),* at least in British Columbia where they are most common[2]. This species is the most abundant of its family on the west coast4.

Life History Information

REPRODUCTION-hermaphroditic; ova and sperm shed during much the same period: June and July (British Columbia)[2]; spawning time varies with current, temperature, free-swimming larvae probably settle sublittorally, and move inshore as they grow Fraser, in[9]. Animals mature at two years.

GROWTH RATE-regular; relative rate falls throughout postlarval life; "northern forms, in contrast to southern, show a slower initial but more sustained growth, and reach the greater age and larger size"[12]. Annual growth rings obvious, especially in northern specimens with cold winters, when growth is very slow.

LONGEVITY-none found over seven years[2]; but: maximum. fifteen years12.

FOOD-they strain material through their gills: suspension feeder.

PREDATORS-sea stars *(Pycnopodia),* birds, man; easy prey, as it often is found on the surface of the tideflat. As larvae, preyed upon by planktonic predators and suspension feeders.

BEHAVIOR-can be very active: flips itself with large muscular foot; digs quickly but does not burrow deeply or laterally.

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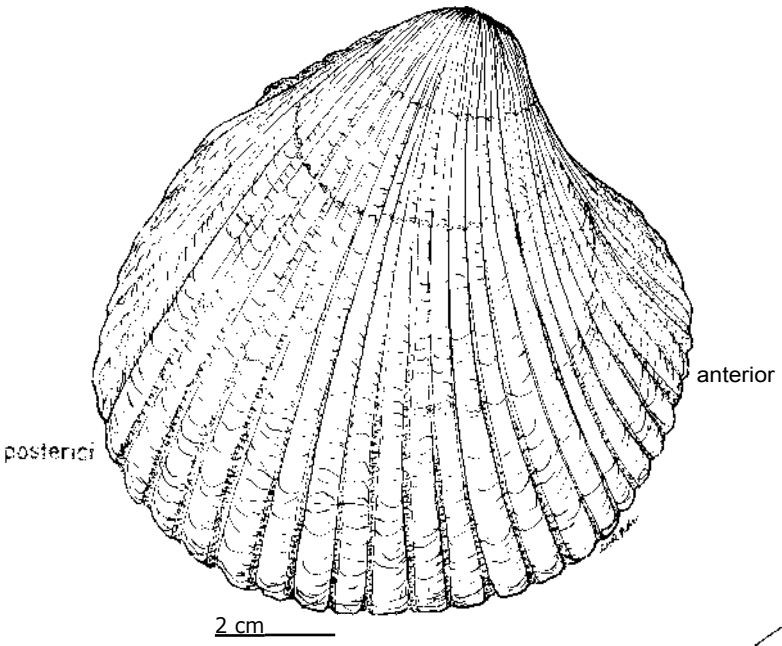
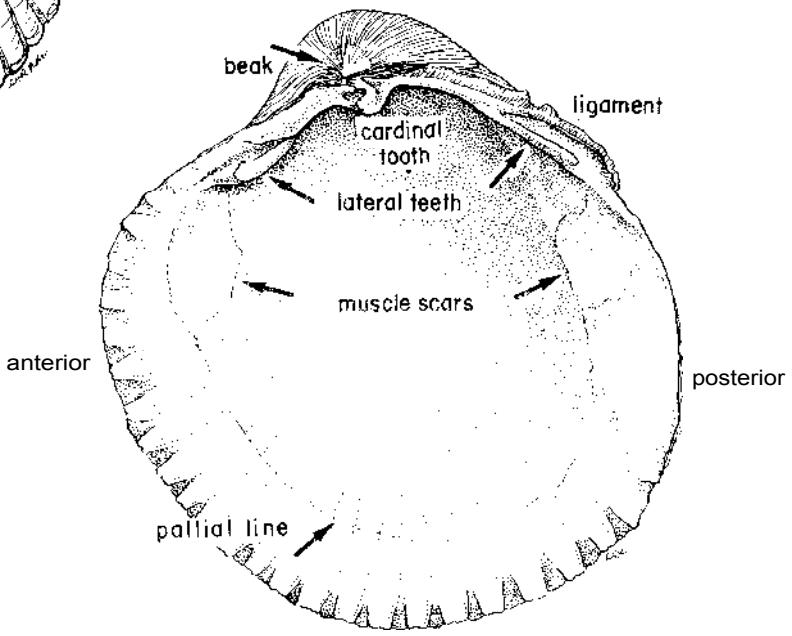
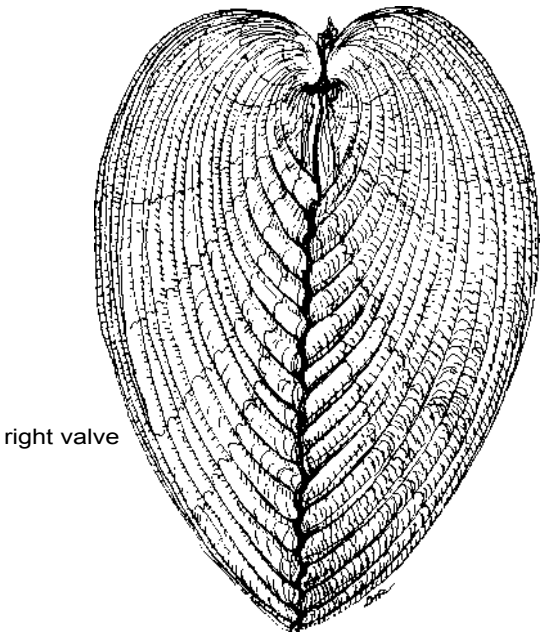
Clinocordium nuttailli



l. Chiwcardium nu/to//ix 11/2 right valve
actual size: 5.8 cm
about 35 strong radial ribs;
height greater than width;
shell inflated, rounded.



2. interior, right valve
beaks nearly central ,directed anteriorly; surface white;
scars equal, pallial line simple;
one cardinal,two lateral teeth;
li gament external.



3. profile, anterior end
heart-shaped.

Adula californiensis

the pea pod borer = Botula) (Philippi, 1847)

PHYLUM: *Mollusca*
CLASS: *Bivalvia; Pteriomorpha*
ORDER: *Mytiloida*
FAMILY: *Mytilidae*

Description

SIZE-40 mm long; 10 mm high7.

COLOR-exterior brown to black: family Mytilidae[9]; interior white, sub-nacreous, posterior edge tinged with blue[s]. Worn beaks show white; periostracum thin, brown, lacquer-like. Byssus appears as a hairy post-dorsal slope (fig. 1). No chalky incrustations on shell: genus *Adula9.*

SHELL SHAPE-deep, angular valves are subequal, cylindrical, not much tapering, thin and fragile. Dorsal and ventral margins parallel for at least 1/2 their length.' Umbones 1/4 of way from anterior end ('sub-terminal'), not prominent, but higher than posterior end.[9] Surface with some radial sculpture, particularly at anterior end, but no patches of vertical file-like striations: species *califomiensis*[9] (fig. 1).

INTERIOR-muscle scars very unequal in size: family Mytilidae[9] (posterior scar much larger than anterior) (fig. 2).

HINGE PLATE-without a chondrophore, or true teeth: family Mytilidae,[9] although faint crenulations appear on dorsal anterior margin (fig. 2); hinge about 1/4 of way from anterior end.

SIPHONS-white, fused almost to end; incurrent siphon with feathery oakleaf-shaped tentacles (Coos Bay specimen) (fig. 4).

BYSSUS-hairy threads which attach mussel to substrate; appear on *Adula* as a large hairy posterior patch encrusted with mud and debris (fig. 1).

YOUNG-'typically modiolform',[7] *ie* flaring posteriorly rather than being cylindrical.

Possible Misidentifications

Several cylindrical bivalves are found in our estuaries, including *Siliqua* and *Solen* spp. which are sand dwellers, not boring molluscs. The mussels, family Mytilidae, include several northwest genera *(Mytilus, Septifer, Modiolus)* but none is cylindrical.

The genus closest to *Adula* is *Lithophaga,* the 'date shell,' a boring mussel with a cylindrical shell and roughly parallel margins. It lacks the hairy posterior of *Adula,* and bores in hard rock. It has peculiar feather-like wrinkling on the posterior of the shell.9

Three species of *Adula* can be found on the west coast, although one of these, *A. diegensis,* probably occurs only as far north as San Francisco. It is small, (19 mm long), with a slightly arched shell which becomes higher posteriorly, and is sometimes quite stout. It is polished and dark blue interiorly.

Adula falcata, the hooked pea-pod shell, bores deep into hard rock as well as into clay. It has an entirely wrinkled periostracum, not a smooth one, as well as vertical striae to assist in boring. Its shell is more angular and proportionally longer than the more cylindrical A. *californiensis,* and tapers posteriorly. Its beaks are at about the anterior eighth of the length, and are strongly involute (closely wound), with a depression in front of them. Its northern limit is probably Coos Bay'; it is found abundantly on outer rocky shores around San Francisco.8

Ecological Information

RANGE-Vancouver Island, B.C. to San Diego, California.7

LOCAL DISTRIBUTION-Coos Bay: Pigeon Point.

HABITAT-burrowing in soft, muddy shale; or free-living[10]; in Coos Bay, in old pholad burrows.

SALINITY-collected at 30 0/00 salt, in the lower bay where salinity is generally high and constant.

TEMPERATURE-found in temperate waters.

TIDAL LEVEL-intertidal to sublittoral.9

ASSOCIATES-the terebellid polychaete *The/epus,* pholad *Penitella,* brachyuran *Cancer oregonensis.*

Quantitative Information

WEIGHT-

ABUNDANCE-not common.

Life History Information

REPRODUCTION-dioeceous, discharging sperm and eggs into water. Ripe eggs (Oregon) June to October.5

GROWTH RATE-In lab, 1st and 2nd cleavages at 1.5 and 2.5 hours after fertilization, at 15°C., 95% seawater. Trochophore stage is reached at 15 hours, shell gland visible at 31 hours. Soft parts enclosed by shell at 72 hours. Trochophores swim in all directions; veligers do not swim horizontally. Larvae settle out of the plankton 3 days after fertilization.5

LO N G EVITY-

FOOD-a suspension feeder.

PREDATORS-

BEHAVIOR-probably more of a nestler than a borer.'

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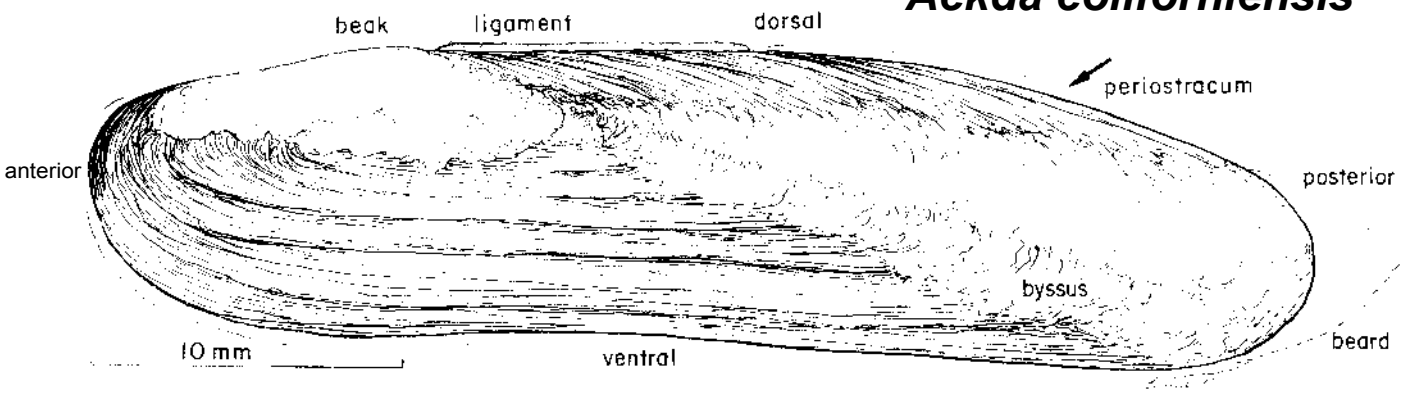
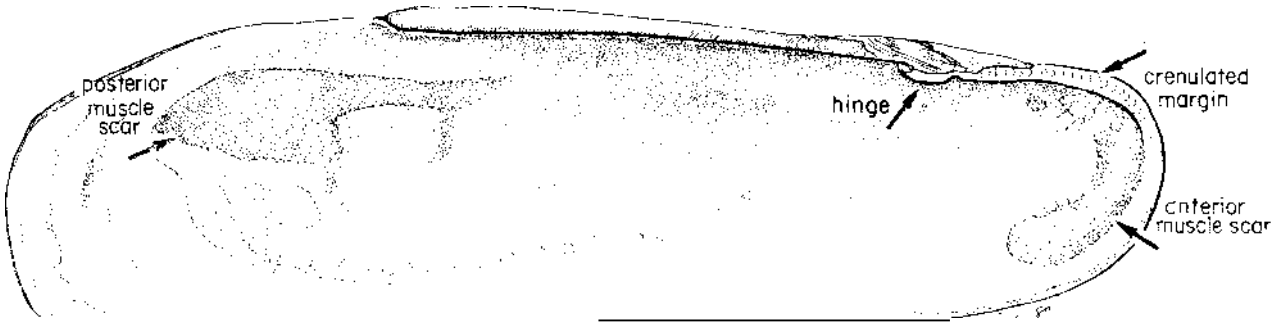
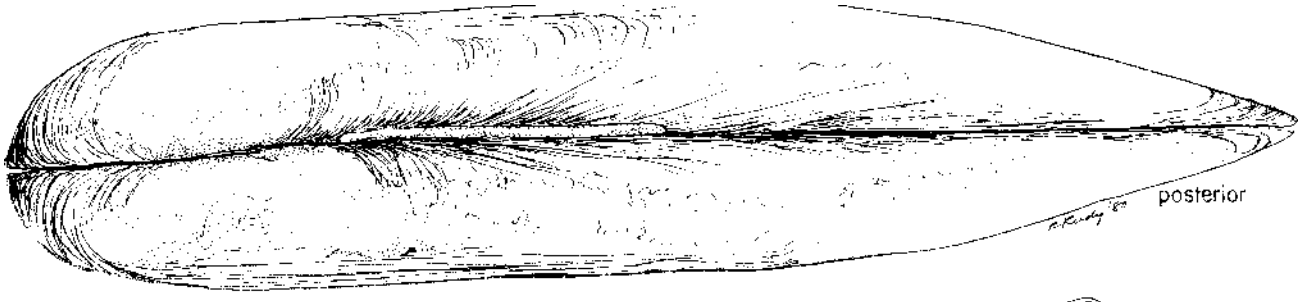
Ackda coliforniensis



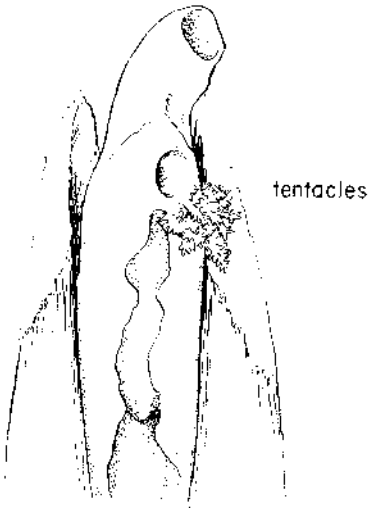
l. *Adula ca/iforniensis* x 4.5 actual size 40 x 10
cylindrical shells, valves subequal;dorsal and ventral margins roughly parallel; smooth periostracum; posterior slope hairy; worn beaks **1/4** of way from rounded anterior; ligament external; radial sculpture.



2. left valve, interior
posterior muscle scar much larger than anterior scar; color white, sub-nacreous, posterior tinged with blue anterior margin slightly crenulate; hinge without teeth.



3. dorsal view
posterior pointed; beaks not prominent.



4. siphons
white, fused almost to ends; incurrent siphon with oak-leaf li ke tentacles.

Mytilus edulis

bay mussel Linnaeus, 1758

PHYLUM: *Mol/usca*
CLASS: *Bivalvia; Pteriomorpha*
ORDER: *Mytiloida*
FAMILY: *Mytilidae*

Description

COLOR-blue violet and white, shiny brown-black periostracum; animal more tan than orange.

SIZE-about two inches: (7 cm[9]); largest found 11.4 cm,.

EXTERIOR-variable, valves similar: wedge shaped longer than high, tapering to pointed anterior; regular, smooth, with concentric growth lines, but no radial ribs (fig. 1); fine byssal threads attach to substrate; beaks terminal (anterior); no siphons, but openings between mantle edges (posterior); foot reduced (and internal).

INTERIOR-large posterior muscle scar, small anterior scar near beak on anterior ventral margin (fig. 2); blue-black color around ventral (posterior) margin; pit-like byssal gland at base of foot produces liquid which hardens into byssal threads, visible on ventral edge (fig. 1).

HINGE AREA-no hinge teeth or chondrophore but small dentides near beak; no shell-like septum (or shelf) at anterior end; beaks terminal, (fig. 4).

Possible Misidentifications

Mytilus edulis is often found with *Mytilus californianus,* the larger, coarser "common mussel" of the West Coast. Internally *M. californianus* is orange. Externally, the most dependable distinguishing characteristic is the presence of radial ridges, particularly posteriorly, in M. *californianus,* lacking entirely on the smoother *M. edulis.* When small, the two are more difficult to distinguish. *M. edulis* has sharper edges, a thinner profile (fig. 3), finer byssal threads, more delicate concentric rings than does *M. californianus.* It also can be found higher in the intertidal, in more protected spots, not on exposed rocks with heavy surf and turbulence.

Other rarer mussels include *Modiolus* sp . the horst mussel, it has subterminal beaks, largely subtidal, brown and hairy and found in clumps in the mud; it has external beaks; *Septifer bifurcatus* is found under rocks, black outside, purple within, and with definite radiating ribs and shell-like septum across the anterior end.

Ecological Information

RANGE-north temperate waters, Arctic Ocean to lower California on Pacific west coast.

LOCAL DISTRIBUTION-probabiy all Oregon estuaries as well as on outer coast (with *M. californianus).*

HABITAT-extremely adaptable: will attach to rock, wood and fiberglass, firm mud; likes pilings (especially if harbor is polluted"); quiet waters. An excellent indicator for lead in environment."

SALINITY-larvae can't survive at over 45 oioo or under 17 doo[3]; adults prefer 2.30-33.92 doo; needs periods of desiccation; requires less oxygenation than does M. *californianus.*

TEMPERATURE--a temperate and cold-water animal, it becomes more abundant farther north'°. Optimum temperature for growth: 10-20 °C".

TIDAL LEVEL-from mean low low to mean higher low (0-3), but can be from -1. to 5 ft.; found around the edges and both higher and lower than *M. californianus."*

ASSOCIATES-in bays it is the dominant member of a community (of which it's the climax animal and longest lived) and which can include the barnacle, *Balanus glandula* (on the shell); nematodes: Sabellid, Serpulid, Nereid, and Syllid worms, the limpet *Acmaea,* ectoproct *Bugula,* anemone *Metridium senile;* the gastropod *Nucella,* red algae; tunicates; bryozoans; hydrozoans. Some *Mytilus edulis* is found in all *M. californianus* beds which constitute a well-studied community"'. Parasites which can be present in *M. edulis* include the copepod *Modiolicola gracilis* (gills), *Myticola orientalis* (rectum). Not parasitized by pea crabs".

Quantitative Information

WEIGHT-adjusted mean-dry body weight: 7 grrt5.

ABUNDANCE-become more abundant farther north[14]; a community can reestablish in three years and is subject to greater fluctuations in numbers than is M. *californianus:* Hoshiai in 14.

Life History Information

REPRODUCTION-eggs and sperm discharged into water and fertilized there;[3] spawns N. California in April': "dioecious-, (separate sexes); colonization over wide area: planktonic phase long, distances moved can be great'.

GROWTH RATE-grows fastest first five months', especially second and third months after settling; growth fastest when water warmest (to July) when dinoflagellate population high', growth lower after 2-3 years'. Animals highest in the intertidal grow slowest'. Animals continuously submerged are larger and grow faster than those exposed by tides."

LONGEVITY-longest lived animal in its community (Southern California)".

FOOD-eats organic detritus more than phyto- or zoopiankton2; eats by continual intake of ciliary currents, selective feeding with mucus secretions[4]; digestion intracellular2.

PREDATORS-"preferred" by *Pisaster, Nucella, Ancanthina, Ocenebra, Ceratostoma, Cancer antennarius,* and *Pachygrapsus crassipes*[5]; also birds; man for bait and food (found in Pleistocene midden"). Gastropod *Nucella emarginata* elicits escape response."

BEHAVIOR-"crawls" to outside of community clump, to avoid silt deposits'. Considerably more mobile than *M. californianus.* More byssal threads formed at night, when crowed or with certain temperatures and salinities".

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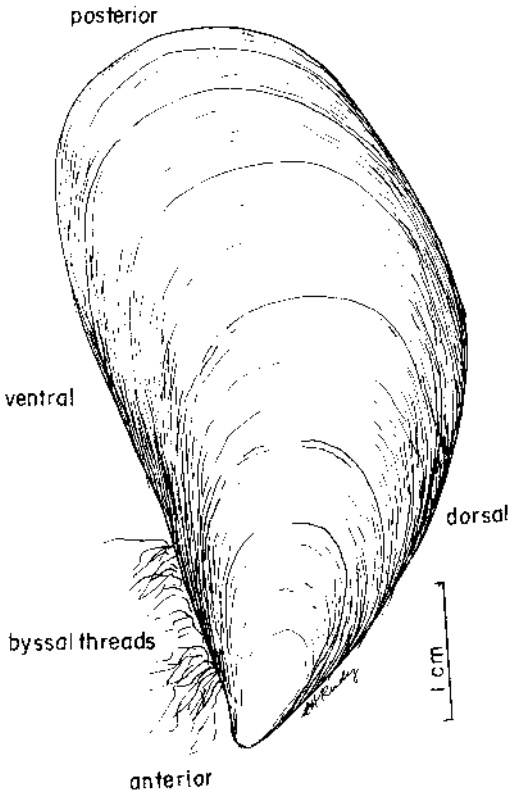
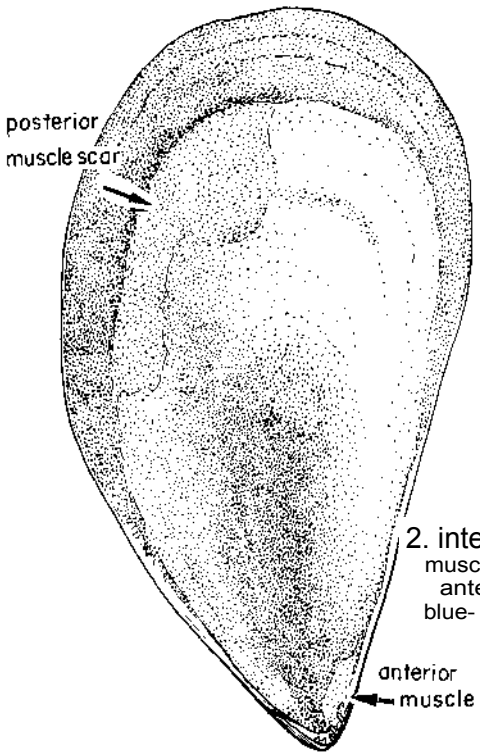
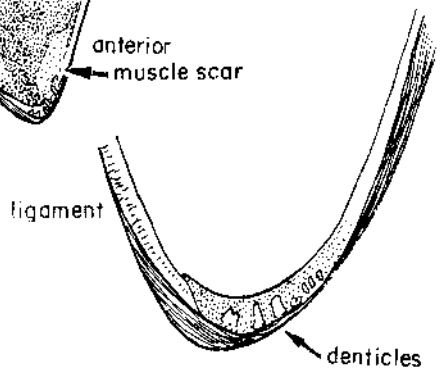
My/i/us edu/is



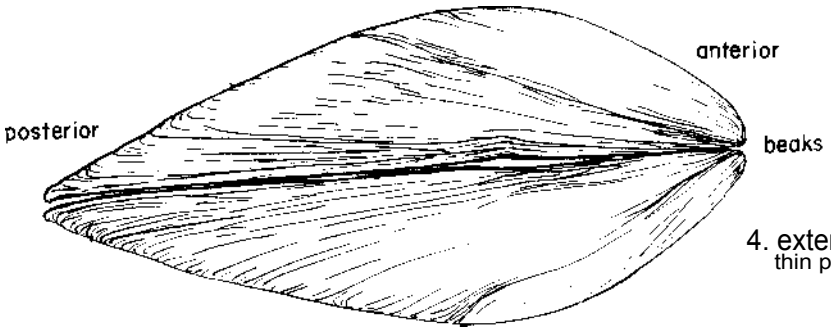
I. Mytilus edu/is x2; actual size 5 cm
right valve, exterior
stooth ,tapering, like valves,
concentric lines only; beaks terminal;



2. interior, right valve
muscle scars unequal: posterior large,
anterior small, near beak;
blue- black around margin.



3. hinge area
no teeth, only small denticles
no shel l-like septum.



4. exterior, lateral (ventral)
thin profile; terminal beaks.

Protothaca staminea [t] (Conrad, **1837)**
rock cockle, littleneck or hardshell clam

PHYLUM: *Mollusca*
CLASS: *Bivalvia,. Heterodonta*
ORDER: *Veneroida*
FAMILY: *Veneridae*

t(= Venerupsis staminea, = Paphia staminea),. var. *ruderata* (Deshayes) and *orbella* (Carpenter)

Description

SIZE-2-75 mm; average 25-50 mm (1-2 inches7).

COLOR-variable; young with brown markings, adults uniform brown, pinkish, orange; interior white.

EXTERIOR-shell suboval, heavy; fine, numerous radiating ribs as well as concentric ridges. Radial ribs are stronger in "nestling" forms, ie. those found in pholad borings [12], different shell shapes in different localities'.

INTERIOR-porcelaneous; ventral margin with fine crenulate sculpture (fig. 2); muscle scars almost equal, pallial line broken by deep pallial sinus (fig. 2); siphons short, fused.

HINGE AREA-three compressed cardinal teeth, no lateral teeth; ligament external on nymph (projection); hinge plate wide, set at angle, (fig. 2).

Possible Misidentifications

A closely related Venerid, *Tapes japonica* (fig. la), has been introduced from Japan, and is common in mud of bays [12]. It is elongate, oval, and has a prominently elevated ligament. Its radial ribs are quite strong and its color pattern distinctive. Its internal ventral margin is smooth, not crenulate, and its pallial sinus only moderately deep. Its internal color is yellowish with a purple stain. It lives at slightly higher elevations than does *Protothaca. Tapes* can grow to 50 mm long; it may hybridize with *Protothaca* (Washington)6.

Other bay clams of the same size and habitat as *Protothaca* do not have both the radial and concentric sculpture which it has.

Ecological Information

RANGE-Aleutian Islands to Socorro Islands, Mexico (all varieties); north of San Francisco only: var. *ruderata* (on beaches), and *orbella* (in pholad borings).

DISTRIBUTION--common in most of the larger Northwest estuaries and bays, and around rocky ocean outcrops.

HABITAT-likes coarse sand; also found in fine gravel or with mud, stones or shell[4]; seldom found in fine, pure sand'. Subspecies *orbella* found in boring holes of pholad clams. As it is a poor digger, *Protothaca* does not do well in shifting sand, but prefers packed mud, clayey gravel[s]. Usually found 3-8 cm below surface.

SALINITY-collected at 30 0/00.

TEMPERATURE--

TIDAL LEVEL-from below half tide to lowest tideline (Puget Sound)[4]; found 2.5-15 cm (1-6 inches) below surface of mud or sand'; also found subtidally2.

ASSOCIATES-often found with the cockle, *Clinocardium nuttallii,* and particularly with the butter clam, *Saxidomus giganteus;* a resident larval tapeworm is harmless to man[s]; often bored by drilling gastropods.

Quantitative Information

WEIGHT-

ABUNDANCE-common, most abundant clam of the lower intertidal in Puget Sound[4]. Coos Bay, 1975: estimate, 843,000 (genus); 32.6 metric tons[2], Yaquina, 1977: 197 clams, 49 pounds. Also common in Tillamook Bay. Density light in Alsea, Siuslaw, Netarts2.

Life History Information

REPRODUCTION dioecious (separate sexes); some hermaphrodism occurs', probably half begin spawning their second year; eggs and sperm released February, March (Puget Sound); clams were in poor condition during this period'.

GROWTH RATE-determined by examination of "rings ¯ caused by winter "checks" or disturbance checks; different growth rates in different localities; often slow in early years on exposed beaches, due to movement, storms, etc.; and grow more quickly in later years. Reverse can be true in protected sites'. Size at end of second year: 25 mm; end of third year: 35 mm'.

LONGEVITY-a few over seven years [10]; death rate greatest before sexual maturity (60%), and in old age'°; few clams over ten years'.

FOOD-a suspension feeder; short siphons necessitate feeding close to sediment surface.

PREDATORS-birds, man, drilling gastropods. As larvae, preyed upon by planktonic predators and other suspension feeders.

BEHAVIOR- a poor digger, it does not burrow vertically; siphons and foot short: it stays close to surface of substrate. Burrows easily horizontally: especially (in lab) small adults. juveniles (communication H. Van Veldhuizen).

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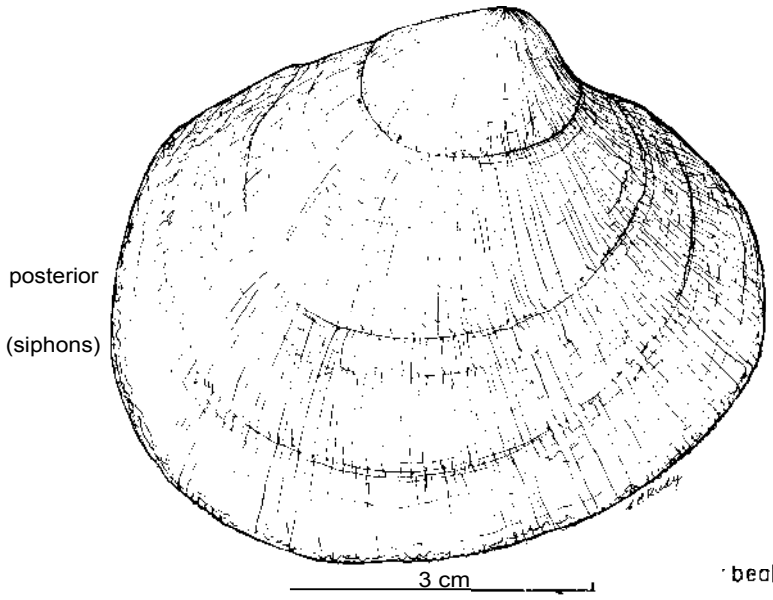
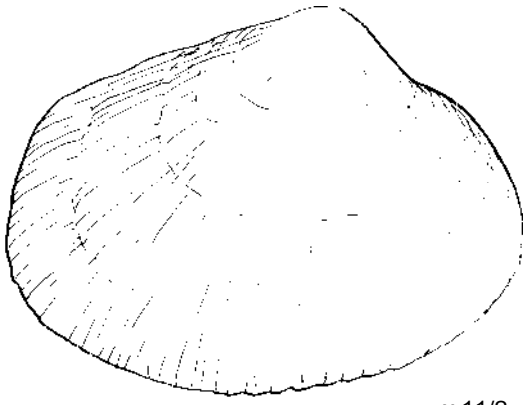
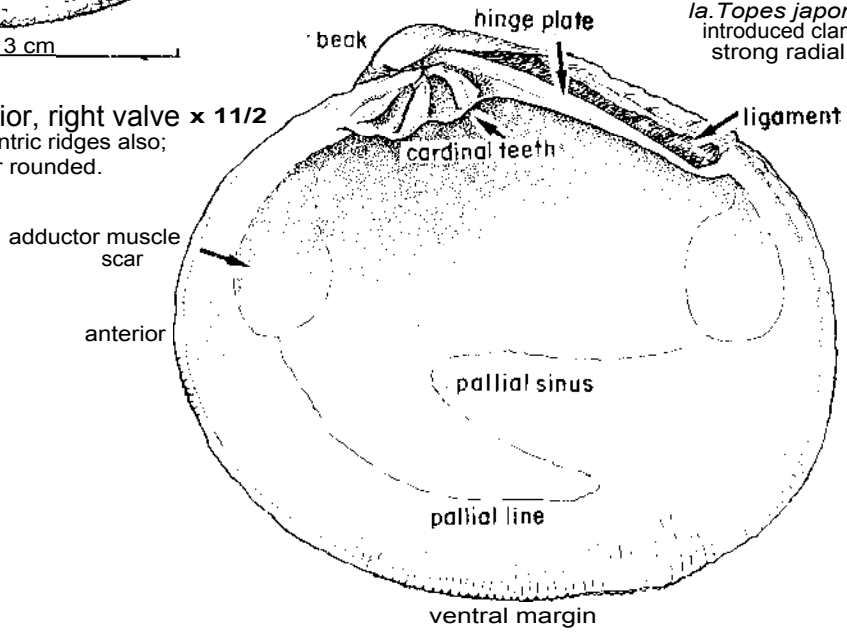
Protothoca staminea



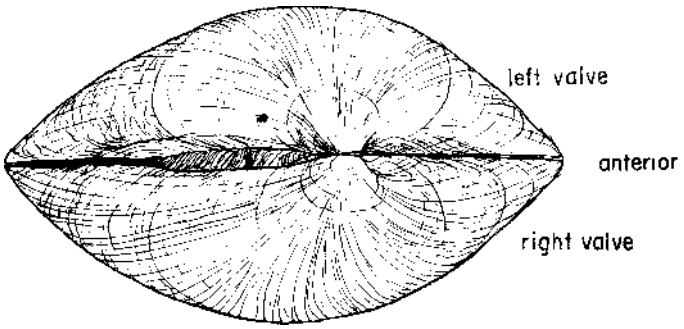
Prolothoca staminea exterior, right valve **x 11/2**
many fine radiating ribs; concentric ridges also;
shell suboval, heavy; posterior rounded.



Ia. Topes japonica x 11/2
introduced clam; elongate,
strong radial ribs.



2.interior, right valve
chalky, porcelaneous;
ventral margin crenulate;
muscle scars subequal;
pallial sinus deep
hinge plate angled;
ligament external, on nymph;
three cardinal teeth, no lateral teeth.



3. dorsal view

Saxidomus giganteus (Deshayes, 1839)

beefsteak clam, butter, or Washington clam

PHYLUM: *Mol/usca*
CLASS: *Bivalvia,* Heterodonta*
ORDER: *Veneroida*
FAMILY: *Veneridae*

Description

SIZE-adults average 3 inches, can be 4 (10 cm).

COLOR-whitish; can have blackish discoloration; interior white; exterior sometimes tan, particularly young specimens.

EXTERIOR-shell oval", posterior truncate[3]; concentric, rough ri bs close together, no radial lines (fig. 1); valves gape only slightly at posterior end (gape less than 1/4 shell width)'; can retract siphon, but not foot[s]; valves very similar; shell thick, heavy: deep (fig. 2).

INTERIOR-valves similar: inner ventral margin smooth[3], inner surface white "porcelaneous"; with subequal darker muscle scars. Pallial line continuous, not a series of scars[5], (but broken by a sinus), fig. 3. Flesh often red: "beefsteak" clam.

HINGE-very heavy, posterior, external.

LIGAMENT-external, seated on a long, massive nymph (or chondrophore) (fig. 4).

TEETH-three cardinal hinge teeth, flanked by long lateral tooth in each valve (fig. 4).

Possible Misidentifications

Saxidomus nuttalli, the larger, more southern species, is found in California in the same habitat as *S. giganteus,* but apparently does not extend into Oregon. *(S. nuttalli* is the only *Saxidomus* in Humboldt Bay, however.) Its shell is more elongate, the ribs heavier, rougher and more conspicuous"; the interior is often marked posteriorly with purple. There are no other large ovate bivalves here with concentric ribs and without radial ribs.

Panopea generosa, the deep-burrowing geoduck, is quadrate, and gapes widely. *Tresus capax,* the gaper clam, (family Mactridae), is also quadrate, fairly smooth and chalky white outside. The truncated posterior gapes moderately. Its ligament is partly internal; its cardinal teeth are "A" shaped; the shell has a dark, eroded partial covering.

Ecological Information

RANGE-Aleutians to Monterey, California; but rare in the southern range.

DISTRIBUTION-bays and estuaries, rarely on open coast or inlets with oceanic influence9.

HABITAT-mud or sand"; gravelly beaches (Puget Sound)^; cigar-shaped or deflated figure eight-shaped hole, 1/2-3/4 inch long[8] (1.2-2 cm).

SALINITY-

TEMPERATURE-prefers colder waters (see range).

TIDAL LEVEL-can be found down to 30 cm, (about 12 inches) from surface, but frequently closer to surface4.

ASSOCIATES-occasionally infested whin immature specimens of commensal pea crab *Pinnixa littoralis;* but usually free of parasites10.

Quantitative Information

WEIGHT-

ABUNDANCE-the "most abundant clam on suitable beaches of the Northwest""; exploited commercially (Puget Sound)^.

Life History Information

REPRODUCTION-pelagic larvae distributed by tidal currents much variation in spawning times, even in neighboring beds' spawning water temperatures: 11.5°C-18°C: two weeks to veiliger stage, four weeks to settle. Spawning in late summer, fall (Puget Sound)1.

GROWTH RATE-little growth in young after settling, until foliowing spring2.

LONGEVITY-lives to 20 years or more'.

FOOD-feeds by straining material from the current of water that they pump through the gills: filter feeder.

PREDATORS-sting rays, man, fishes, shore birds, drilling snails. Gulls will scavenge discards. Most important food clam in British Columbia7.

BEHAVIOR-

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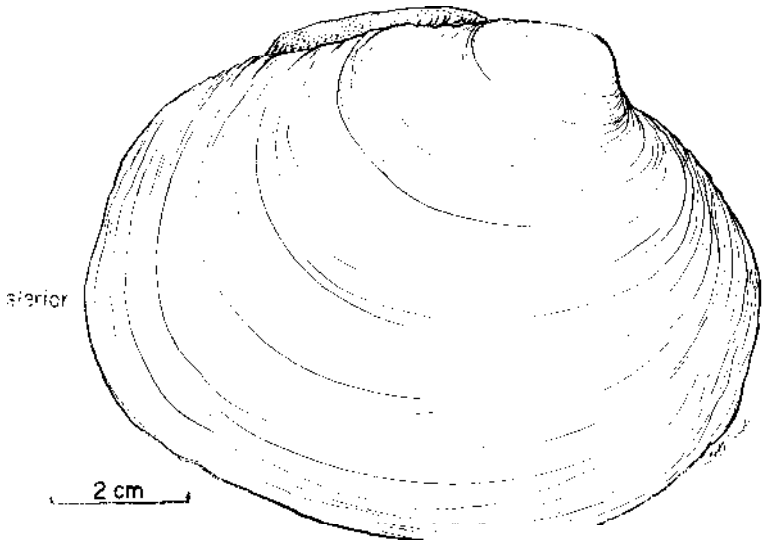
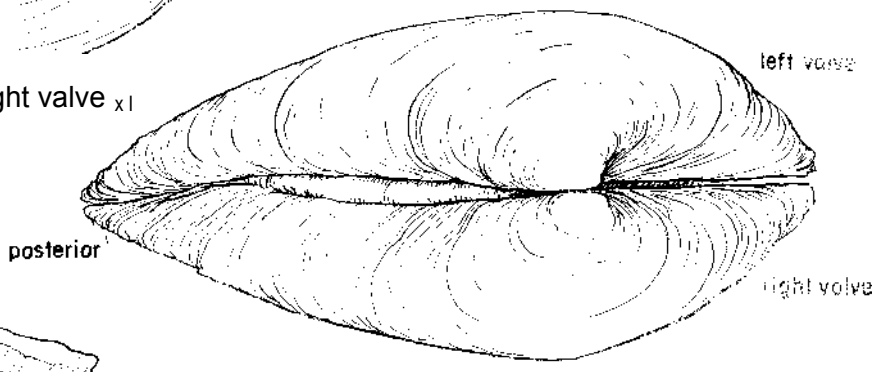
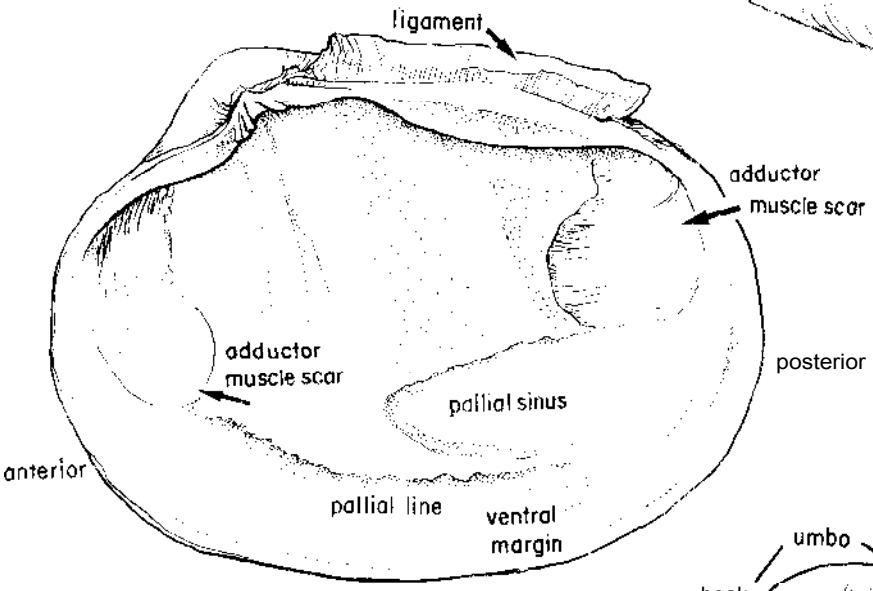
Saxidomus gkrenteag



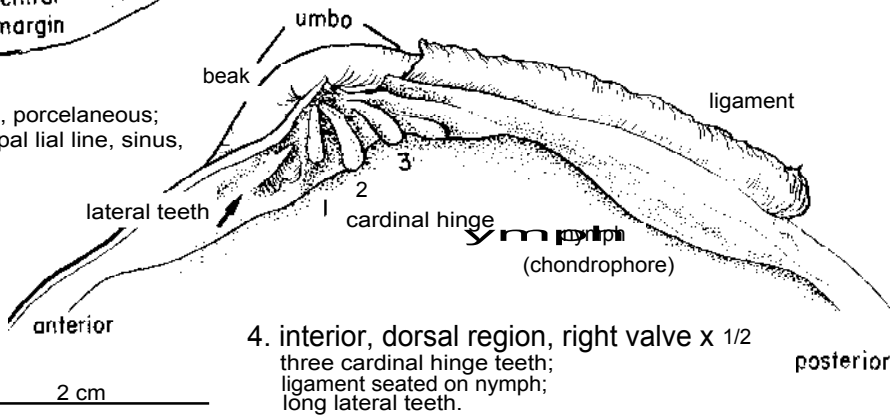
Soxidomus gigonteus exterior, right valve x l
shell whitish, oval , posterior truncate;
concentric, rough ribs close together;
valves similar,thick, heavy.



2. exterior,. dorsal view
valves similar, deep;
hinge heavy, ligament external.



3. interior, right valve
margin smoath ,surface white, porcelaneous;
muscle scars similar; strong pal lial line, sinus,



4. interior, dorsal region, right valve x 1/2
three cardinal hinge teeth;
ligament seated on nymph;
long lateral teeth.

Transennella tantilla

Gould, 1852

PHYLUM, *Mollusca*
CLASS: *Bivalvia; Heterodonta*
ORDER: *Veneroida*
FAMILY: *Veneridae (Meretricinae)*

Description

SIZE—to 6 mm long (1/4 "); this specimen 3.5 mm long, 3.0 mm high, 1.6 mm diameter (figs. 1, 2).

COLOR—cream, with one third of shell a purple brown ,at posterior end, radiating from beak (fig. 1). Interior creamy white with same purple or brown coloration; occasionally a radial strip anteriorly" (figs. 3, 4).

SHELL SHAPE—a rounded isosceles triangle°; elongate or oval; heavy, solid, slightly longer than high, but definitely triangular. Anterior and posterior dorsal margins straight. Beaks almost central. barely anterior to midline, often eroded.' Surface with fine concentric grooves only, no other sculpture.' Valves equal, not gaping. No rough periostracum, but byssal attachments may cover part of surface.

INTERIOR—ventral margin smooth, not crenulated. (Margin with a few oblique grooves on inner ventral margin, but these are visible only with very high magnification).

LIGAMENT—external: no resilifer or internal ligament (fig. 2).

HINGE AREA—three divergent cardinal teeth in each valve (figs. 3, 4); lateral teeth conspicuous; anterior teeth in both valves: genus *Transennella.* Socket for lateral tooth in right valve (fig. 3).

PALLIAL SINUS--rounded, bent anteriorly, parallel to ventral margin, not bent sharply upward: genus *Transennella,* (fig. 3).

BYSSUS—byssal threads for attachment to substrate (sand grains); rare in Veneridae; fine, clear (fig. la); byssal threads also join young in brood pouch. Byssal gland in middle of foot.

SIPHONS—short, sensitive, extend only a few mm from body. Excurrent and incurrent siphons fused proximally; tentacles long, flexible: 9-12 in excurrent. 10-14 in incurrent'°: species *tantilla* (fig. 1b).

FOOT—large, can bury quickly.

YOUNG—development takes place in parent's mantle cavity; up to 300 young per adult. Size of adult determines number of young. Young without velum, or pelagic stage.'

Possible Misidentifications

Transennella is much smaller than most adult bivalves, but juveniles of other clams might be confused with it. Some other Veneridae have concentric sculpture, like *Transennella,* but have predominately radial sculpture:

Mercenaria mercenaria (= Venus), the round, inflated introduced Atlantic quahog;

Protothaca tenerrima, flattened, with sharply ridged concentric rings, and inconspicuous beaks;

Protothaca staminea (= Venerupsis), (= Paphia), the rock cockle, with fine radiating ribs and weak concentric ridges, a crenulated inner margin and entirely fused siphons; (neither of the *Protothacae* has anterior lateral teeth),

Tapes japonica, the introduced Japanese cockle, with strong radial ribs and a prominent ligament, elongate oval shell and, like *Transennella,* a purple stain in the interior,

Saxidomus nuttalli and *Saxidomus giganteus,* the Washington clams, are ovate, with heavy concentric rings and a pronounced gape to the valves; both have anterior lateral teeth. *S. nuttalli* has an interior marked with purple, but is rare as far north as Oregon.

Two small venerid clams are quite close to *Transennella:*

Gemma gemma, the small (about 2.5 mm) purple-marked Atlantic bivalve, can be common in bay mud. It is triangular, and no longer than high; its left hinge lacks the characteristic anterior lateral tooth of *Transennella;* its ventral margin is finely crenulate, not smooth; its pallial sinus is bent sharply upward. not rounded and angled anteriorly. Like *Transennella,* it has 3 cardinal teeth in each valve. *Gamma* often has *Enteromorpha* attached to its posterior; it can be found in the same habitat as *Transennella* (Puget Sound) but in California (Tomales Bay) it occupies a different niche',

Psephidia, the pebble shell, is a subtidal inflated venerid clam of the same size and same general appearance as *Transennella.* It has three cardinal hinge teeth, but no anterior lateral teeth in either valve, as *Transennella* does. Its beak is more prominent than *Transennella's,* and its internal ventral margin, under magnification, is finely crenulated. 11 can be white or olive, but has no purple posterior third. There are two species, *P. ovalis* and *P. lordi.*

Mysella (= Rochefortia) is a small white clam with the beaks near the anterior end, and no cardinal teeth. It is found in Puget Sound, but has not been reported from Oregon.

Current confusion exists about the two species of *Transennella.*[8] *T. tantilla* has purple markings, an eroded beak, clearly marked concentric lines on its shell. Its hinge plate is wide, its anterior tooth well-developed. It has split siphons (for $^1/_2$ their length), with flexible tentacles (9-12 on the excurrent, 10-14 on the incurrent siphon).

Transennella _____ the other species, is all white, without purple on the posterior, with only an occasional brown slot anterior to its beaks; the beaks are prominent, not eroded; the shell sculpture is faint, of numerous fine lines. The hinge plate is narrow, the anterior tooth thin and lamellar. This species has siphons fused for almost their whole length, short stiff siphon tentacles, with 10-14 tentacles on the excurrent siphon, 11-16 on the incurrent one) · The two species sometimes occur together.

Ecological Information

RANGE—Sitka, Alaska, to Lower California,"

LOCAL DISTRIBUTION—Coos Bay: South Slough channel edge (Coastal Acres).

HABITAT—sand or sandy mud in protected bays". this specimen in clean sand at channel edge; often in other shells, where it attaches by its byssal threads. (Presence of byssus may limit its ability to spread geographically9. Also found in eelgrass roots *(Zostera, Phyllospadix),"* and in firm mud, or sandy graveP Nearly always in top cm of substrate.' · Can tolerate turbidity, remain shut for long periods to avoid deleterious effects of some substrates, re. clay, or simply ingest clay and process through its system..

SALINITY—full seawater, collected at 30 o/oo salt.

TEMPERATURE—cold to temperate waters, as indicated by geographical range.

TIDAL LEVEL—low intertidal as well as offshore down to 35

ASSOCIATES—Macoma *inquinata.* Heavily infested by trematode *Telolecithus pugetensis,* for which it is the first intermediary and sometimes the second intermediary host. *tantilla* ingests trematode eggs, which as sporocysts destroy much of its visceral mass and gonads: infected adult then becomes sterile' Tomales Bay: infested by trematode *Rarvaterma."*

Quantitative Information

WEIGHT—mean dry weight of largest-sized individuals: 30.2 mg2° Weight can be determined by length of clam. log weight (mgs)= —0.85598+3.09033 log length (mm)."

ABUNDANCE—densest at mean lower low water in troughs between sandbars. where they are one of the numerically dominant animals (Puget Sound). [ie] Density 1500-2500 rn' (South Slough, Coos Bay').

Life History Information

REPRODUCTION—protandrous hermaphrodite. viviparous. Broods young within shell: eggs and young of all stages can be found in adult brood chamber between inner gill and body wall'. nearly all large clams (which are mostly female) will have young at all times of year. No clear spawning period, but young leave mother only in summer. Among smallest clams, males and females are found in equal numbers.' Fecundity affected by sterilizing effect of trematode sporocysts.'

GROWTH RATE—to 4 mm in four months' From 2.6 mg (Jan.) to 3() mg (Sept.): total weight gain/animal 0.953 mg/mo. " Ripe egg diameter 0.25 mm; oldest stage of young. 0.65 mm': smallest adults with eggs, 3.2 mm,"

LONGEVITY—probably a little over one year'

FOOD—a suspension feeder on small particles, without special adaptations", not a deposit feeder. Diatoms *Navicula. Bidulphia, Coscinochscus,* as well as *Nitzschia* and *Melosira* Probably feeds at night's

PREDATORS—fish. *Cymatogaster* (surf perch) is the host to the adult trematodes', also shorebirds, [2] some gastropods.

BEHAVIOR—can bury itself in less than a minute if disturbed": but is on or near surface when feeding.

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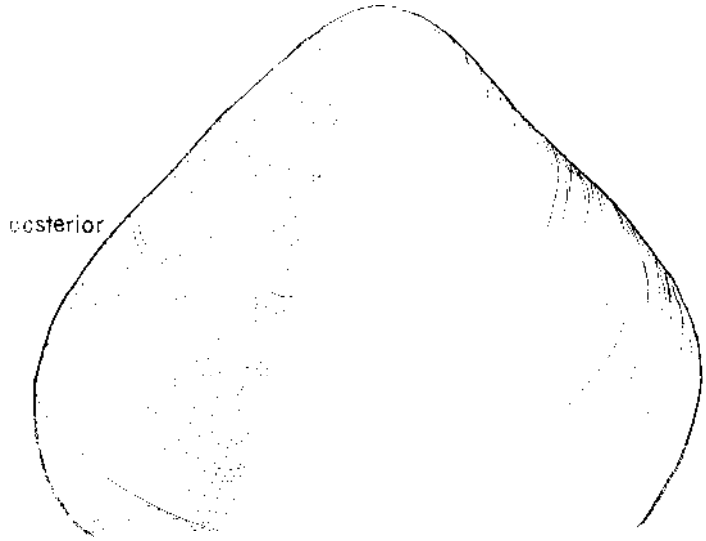
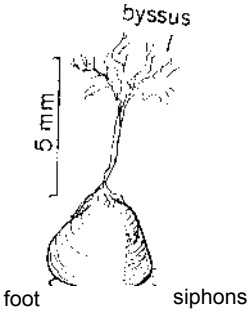
Tronsennella tantilla





I a, live clam x4

excurrent

incurrent

9-12

tentacles 4.1U)-7

-jWt/ 10-14

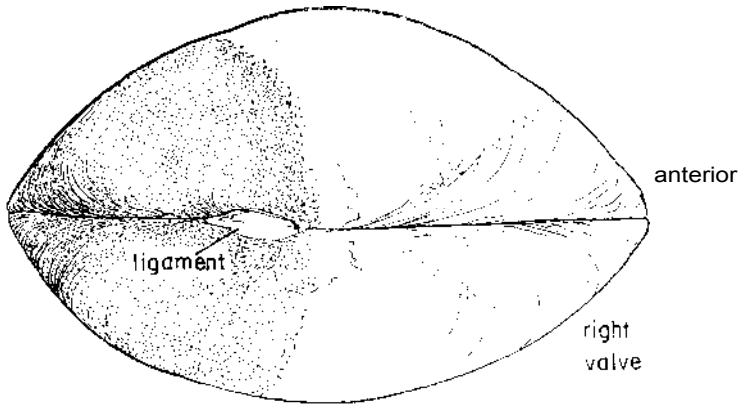
fused /

lb. siphons

MM

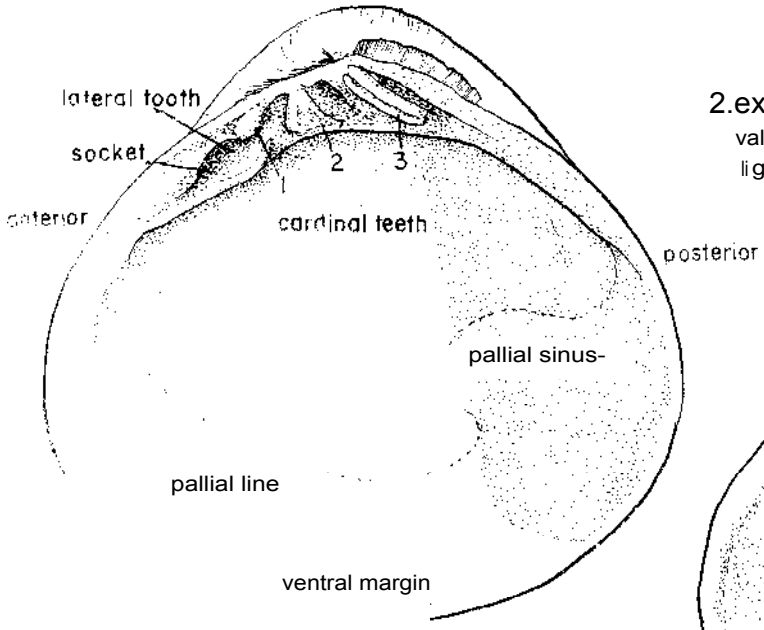
Trornennello tani^{9} */a* right valve x 28

actual length 3.5 mm, height 3.0 mm,diameter 1.6 mm;
shell solid, triangular; posterior third purple;
tine ooireritric sculpture; no periostracum;



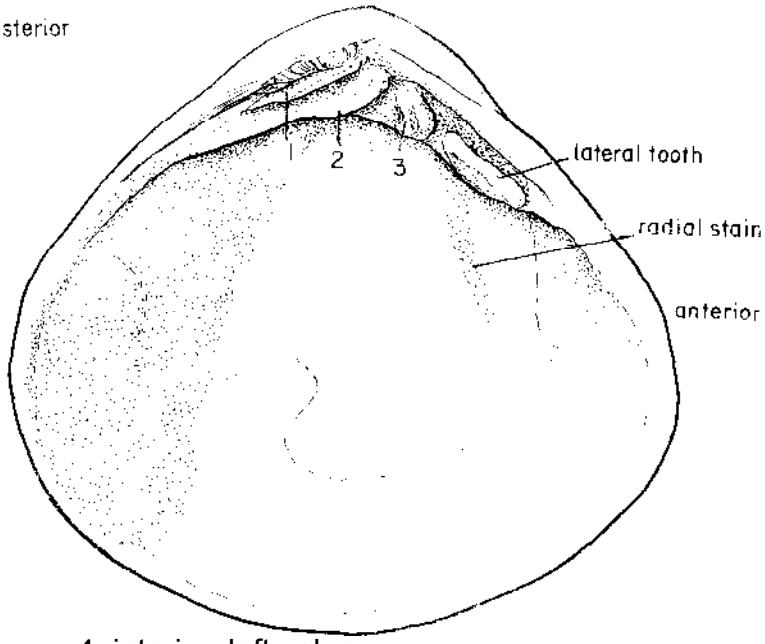
2.exterior, dorsal view

valves equal; beaks almost central.
ligament external. no gape to valves;



3. interior, right valve

3 divergent cardinal teeth, one anterior
^{q}teral tooth, socket; pallial sinus rounded;
purple stair) posteriorly; smooth ventral margin,



4. interior, left valve

3 cardinal teeth, one anterior lateral tooth;
anterior radial purple stain.

Tresus capax (= *Schizothaerus capax*)
the gaper clam or horseneck clam (Gould, 1850)

PHYLUM: *Mollusca*
CLASS: *Bivalvia; Heterodonta*
ORDER: *Veneroida*
FAMILY: *Mactridae*

Description

SIZE-up to 20 cm (8 inches)[5]; average 4-5 inches.

COLOR-chalky white, brown flaking periostracum.

EXTERIOR-valves similar: smooth, with only concentric rings; some periostracum; beaks one third way from anterior end; shell oval, larger ones quadrate; posterior end truncate, gaping widely. Large, fused siphons (retractible), with rather leathery tips. but without prominent, hard, horny plates.

INTERIOR-porcelaneous, white; muscle scars similar; long pallial sinus (fig. 2); a visceral "skirt", a fold along the edge of the mantle tissue, often gives a home to the commensal pea crab, *Pinnixa.*

HINGE AREA-valves alike: small cardinal tooth, J-shaped, socket-like chondrophore (fig. 2); left valve with A-shaped tooth (fig. 2a) ligament in chondrophore.

Possible Misidentifications

Tresus nuttallii, the southern gaper clam, occasionally occurs in our area, but is common only from Tomales Bay, California, south. It is more elongate than T. *capax,* and has prominent horny plates on its siphon, not just leathery tips. Its periostracum is more extensive and its beaks closer to the anterior end (1/4 way) than those of T *capax*[12]. *I nuttallii* lacks the visceral "skirt" of mantle tissue found in T. *capax* (and its attendant pea crabs).

Young *Tresus* of both species can be easily confused with Mya *arenana,* the softshell clam. Mya, however, has a chondrophore in only one valve, its posterior is rounded, not truncate; its siphons lack the leather-like flaps of *Tresus.*

Ecological Information

RANGE-Kodiak, Alaska, to San Francisco; uncommon below Humboldt Bay', where it is replaced by *Tresus nuttallii.*

LOCAL DISTRIBUTION-heavily dug in Oregon's larger estuaries: Coos, Netarts, Tillamook, Yaquina. Not found in Siletz, or Nestucca, possibly because of strong currents there3.

HABITAT-on sheltered intertidal flats, in sand, mud, mud with gravel and shell; also in stiff clay down to 30 cm[5]. In eelgrass; few found with mud or ghost shrimp presumably because of the unstable substrate these create3.

TEMPERATURE-found in cool waters of Northwest; in Humboldt Bay at 9-15 ° C.7.

TIDAL LEVEL --found from 25-60 cm (10 "down to 24 ") below the surface.

ASSOCIATES-often parasitized by pea crabs, *Pinnixa faba* or P *littoralis*[1 °]; also by *Opisthopus transversus*[12]. Casually inhabited by nemertean worm *Malocobella'* and by tapeworm larvae (tetraphyllids)11.

Quantitative Information

WEIGHT-to four pounds (T. *nuttallii)".* Intertidal clams heavier than subtidal, and with a higher moisture content3.

ABUNDANCE-very abundant and heavily dug by man in Northwest estuaries; uncommon south of Humboldt Bay. Constitutes nearly all of Coos Bay's commercial clam catch, and up to 60% of Oregon's total commercial catch[3]. Can be found at densities of over 108/m[2] (Yaquina downbay subtidal flats)3.

Life History Information

REPRODUCTION-dioecious (separate sexes); spawning January to March (Humboldt Bay), when waters coldest[7]; peaks in March to April (Yaquina)[3]. Gonads most active August to October when temperatures highest; sex ratios, 1:1[7]. Spawn sets sporadic, spawning periodicity influenced by lunar cycles3.

GROWTH RATE-subtidal clams over four years old larger than intertidal specimens, and grow faster[3]. Growth occurs mainly in late spring and summer when planktonic food is most plentiful; reserves are stored as fat and glycogens.

LONGEVITY-Optimum harvest age (Yaquina): five years[3]; best aging technique: counting annuli on chondrophore under strong light3.

FOOD-a suspension feeder: feeds on planktonic organisms and detrital particles.

PREDATORS-birds, man, snail *Polinices,* crab C. *magister,* sea star *Pisaster;* parasites. As larvae preyed upon by planktonic predators and suspension feeders.

BEHAVIOR-a weak burrower, it is still found quite deep in the substrate.

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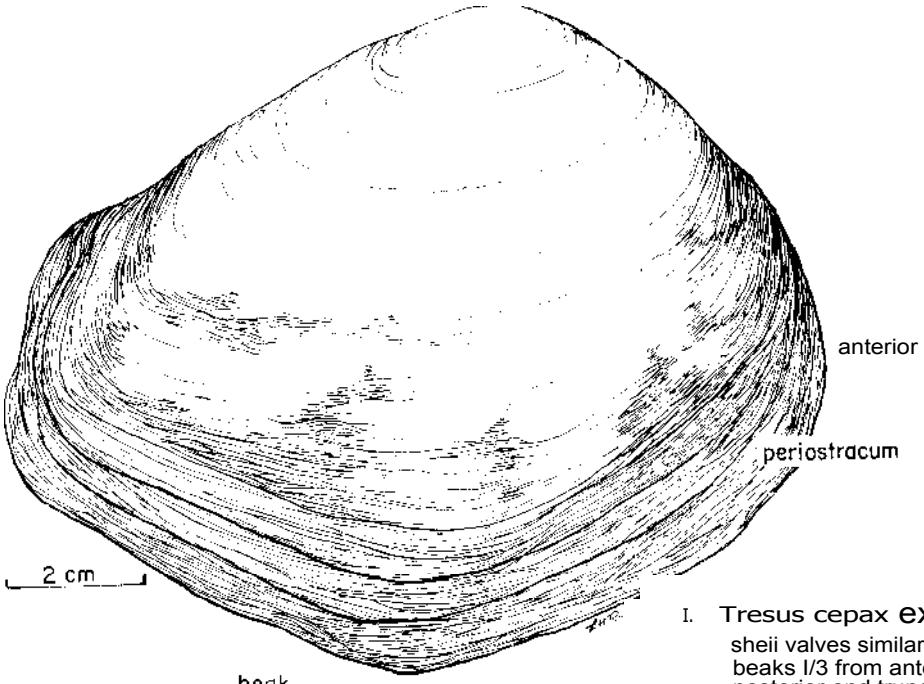
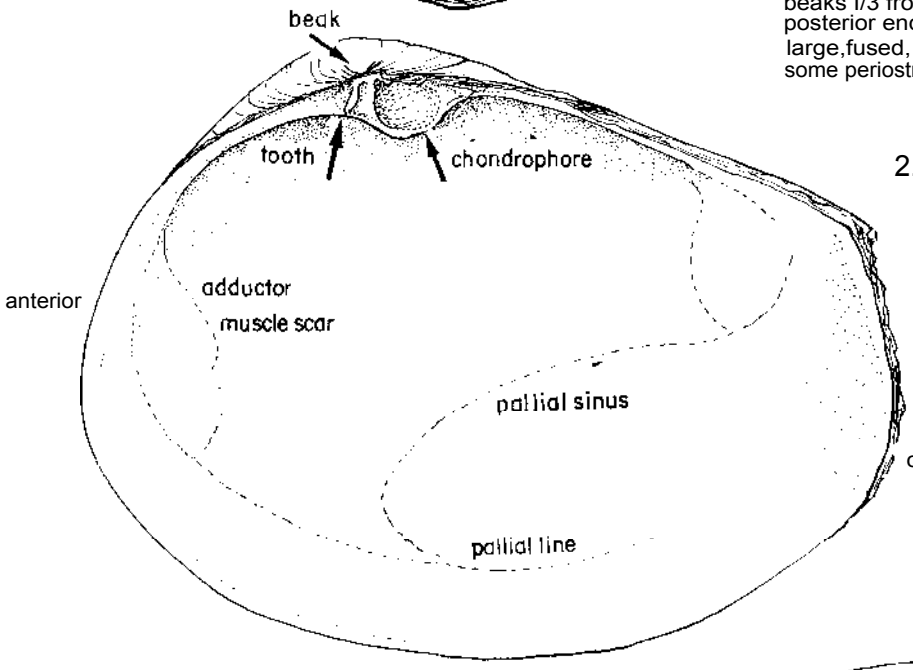
Tresus capcx



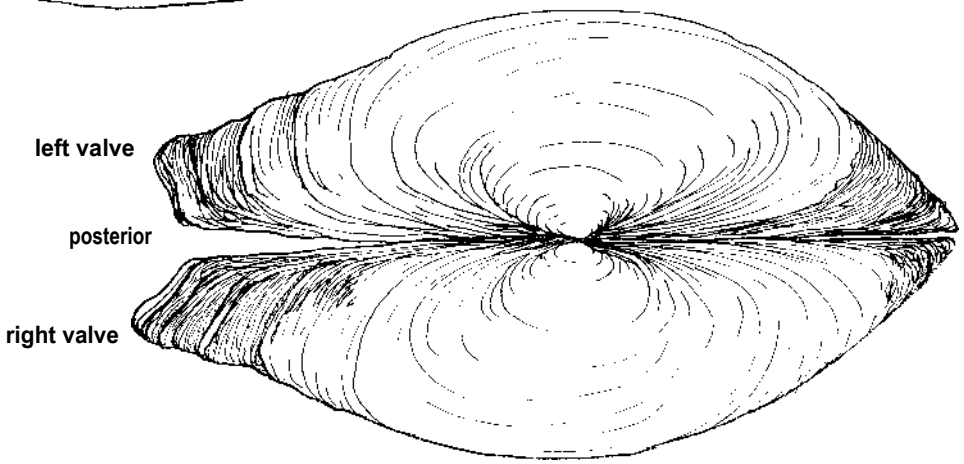
I. Tresus cepax exterior, right valve x
sheii valves similar, oval-quadrate;
beaks I/3 from anterior end;
posterior end truncate, gaping;
large,fused, leathery siphons;
some periostracum.



2. interior, right valve
muscle scars similar;
deep pallial sinus;
small, J-shaped tooth;
socket-li ke chondrophore.
containing ligament

chondrophore "497 toot,'

2a. hinge area,left valve
chondrop ore and A-shaped toot h



3.dorsal view

Macoma balthica *inconspicua)* (Linnaeus, 1758)

PHYLUM: *Mollusca*
CLASS: *Bivalvia; Heterodonta*
ORDER: *Veneroida*
FAMILY: *Tellinidae*

Description

SIZE---30-35 mm long"; usually under 30 Proportions, length 27, height 22, diameter 11 mm." Rarely to 45 mm'; smallest adults 2 mm This specimen (Coos Bay) 17.5 mm long.

COLOR—reddish: pale rose or white"; sometimes bluish or yellow (Puget Sound, British Columbia): Coos Bay specimens pink inside and out; British Columbia pink or yellow interiors [1-3] (Genus *Macoma,* generally white inside'). Late veligers with yellow shells, red umbones 3

PERIOSTRACUM—thin, silky, not shiny"; visible only as a ventral trace

SHELL SHAPE—regularly oval, rather round, thick, with a thick epidermis, valves equal, umbos low, almost central, usually worn (fig. 1). Sculpture fine concentric growth lines only' Dorsal margin arched, ventral margin slightly contracted"; no posterior dorsal flange (posterior to ligament). Valves do riot gape: family Tellinidaes Posterior end rounded. Shell usually heavy. but bay specimens sometimes thin'

LIGAMENT—short, but strong, partially sunken, seated on a stout callus,° but not on a nymph: family Tellinidae.•

INTERIOR-

PALLIAL LINE—narrow, faint

PALLIAL SINUS—large,' equal (valves); sinus ends ¾ of way to anterior adductor muscle scar in both valves (figs. 2a, 2b); pallial sinus does not reach muscle scar - (fig. 2b).

HINGE AREA--no lateral teeth: genus *Macoma.* [4,5] Cardinal teeth: two in each valve (figs. 4a, 4b): one stout, bitid, the other single. fragile.°

ANIMAL—siphons long, separate, mobile. Inhalant siphon when extended, 4 x shell length. Exhalant siphons held vertically above surface 1.5 cm. Large palps, for sorting fine particles' (fig 5).

VELIGERS—early veligers indistinguishable from other bivalves, but late veligers and early post-larval *M. balthica* have characteristic yellow shells and red uri-ibones.

Possible Misidentifications

Tellinidae can be distinguished from other small or young bay clams (ie. Mactridae- *Tresus,* Veneridae. *Protothaca, Saxidomus:* Myidae. *Mya,* Cryptomya) by their external ligament (never on a nymph or chondrophore), their cardinal hinge teeth (two in each valve), their wide sinuous pallial lines,' and because their shells never gape. Lateral teeth may or may not be present in the Tellinidae' Myidae have a hinge with a spoon-shaped chondrophore (left valve) and a projecting tooth (right valve) (see *Mya arenaria).* Veneridae have three cardinal teeth in each valve, Mactridae have an internal ligament, A-shaped cardinal teeth, and gaping valves. - Semelidae have a resilif er, a socket-like chondrophore holding the ligament. Mature *Macoma balthica* are rarely over 25 mm long,' but could be confused with the young of some of these larger clams.

Other genera of Tellinidae *(ie. Tellina* sp.) have lateral hinge teeth (at least in the right valve). *Macoma* do not. *Macoma* are generally more rounded. more inflated than *Tellina, Macoma* are smooth, white and chiefly northern. (Species characteristics in these clams can tend to be gradational, and are not always quantitative'). Most *Tellina* are elongate, relatively compressed, conspicuously sculptured. brightly colored, and usually warm water dwellers' There are four *Tellina* species in our area.

Of the almost 30 species of *Macoma* identified in the eastern North Pacific.° we need to consider only seven:

Macoma nasuta, the bentnosed clam is easily told (in the adult) by its bent posterior valves (see *M. nasuta)* It is white inside and out, with some dark periostracum; its pallial sinus reaches the anterior adductor muscle in the left valve but not in the right (that of *M. balthica* does not).

Macoma inqumata (= irus) is a common mud clam, with slightly inflated but not bent valves in which the pallial sinus almost reaches the anterior adductor muscle scar (see *M. tnquinata).* The shell is chalky white with a fibrous olive green periostracum! it is never pinkish as *M. balthica* often is.

Macoma secta, the sand clam, has a squared off, flanged posterior, although it is not bent like *M. nasuta's* posterior. It is white, with a yellowish epidermis; its right valve is more inflated than the left, and it can be large (to 120 mm). Its pallial sinuses meet the pallial lines at about a right angle' It is found in clean sand, not in bay mud. Closely related to *M. secta* are *Macoma expansa,* a rare, usually offshore species (to 50 mm) whose pallial sinuses are perpendicular to the pallial line, *Macoma indentate* found from Trinidad, California, south, and elongate, pointed posteriorly and with very unlike muscle scars. *Macoma elimata* is found only in 15-476 meters of water.

Macoma acolasta is a rare, sand-dwelling clam, elongate and occuring from Bodega Bay south.

Macoma yoldiformis is also elongate, inflated, and thin, with the pallial sinus detached from the pallial line. Although the range of this clam is from Vancouver south to Baja California, it is not included in Puget Sound or British Columbia work.. It can be found in silt in low intertidal of protected bays.'

Macoma incongrua is a generally northern species which can be found to 33° north latitude and intertidally to 20 fathoms. It has somewhat inflated valves, is usually 30-40 mm long, and almost round in outline!

Macoma catcarea is found from 20 fathoms and lower, and from 37' north. Other northern subtidal species include *elimata* and the large *M. brota* and *M. lipara°*

Macoma balthica is the name of the Atlantic specie', Our west coast clam was originally called *M. inconspicua* (Broderip and Sowerby, 1829); they are now considered by most workers to be the same species.

Ecological Information

RANGE—circumarctic: Alaskan coast to San Francisco, rarely to San Diego.' Possibly introduced to San Francisco from Atlantic coast.,

LOCAL DISTRIBUTION—Coos Bay: South Slough channel, airport spoil islands, etc.; Siletz, Nestucca, Siuslaw, Netarts, Tillamook Bays': bays that front on open coast.'

HABITAT--offshore and bay mud, often very fine, sometimes black, foul mud. Coarseness of soil not determining factor in distribution (various authors, in [1-3]). Currents determine distribution, as they affect sediment settlement and degree of shelter. Clams do not penetrate clay layer.

SALINITY—collected at 30 o/oo salt; found also in brackish water.'

TEMPERATURE---cold to temperate waters.

TIDAL LEVEL—found at + 0.3 m (Coos Bay, Coastal Acres) and down to 37m[3]; correlation between clam size and depth: smallest animals closest to surface' [5] (distance from surface determined by siphons length").

ASSOCIATES—San Francisco Bay: whelk *Busycotypua* gastropod *Nassarius;* polychaetes: capitellids, nereids: amphipod *Ampelisca;* bivalves *Gemma, Mya*..

Quantitative Information

WEIGHT

ABUNDANCE--- most abundant in the upper zone (1.3 to 2.6 m) (San Francisco Bay' [5]), where they compose 55% of animals in invertebrate community. Juvenile densities to 5000/m2 (June, Thames estuary, England') Density determined by currents. fineness of deposits and density of micro-organism populations and their surface area' Not very common in Puget Sound., Coos Bay quite common, many stations.

Life History Information

REPRODUCTION—spring spawning (March). and another in autumn with larger animals (England"). Planktonic life probably two to five weeks; spatfall 300-330p.

GROWTH RATE

LONGEVITY

FOOD—suspension feeder on plankton when tide is in'; deposit feeder on bacterial film and diatoms and other microorganisms in 'organic debris" [6] Competes with amphipod *Ampeltsca.'* Each clam feeds in a 4 cm area.'

PREDATORS—Ampellsca, on spat", shorebirds, on small clams within reach of their beaks (8 "); starry flounder's

BEHAVIOR—essentially static; a slower burrower than some other *Macomas'* [7], takes 21/2 minutes to bury itself.' U-shaped tracks in mud show movement toward and away from sun.'

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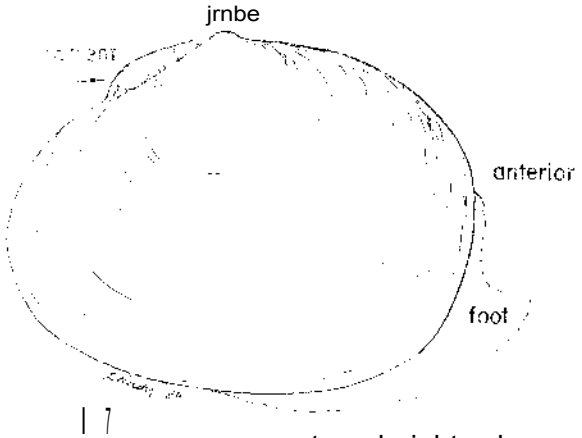
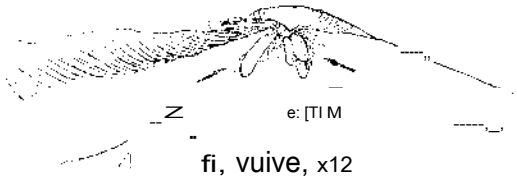
Macome balthica

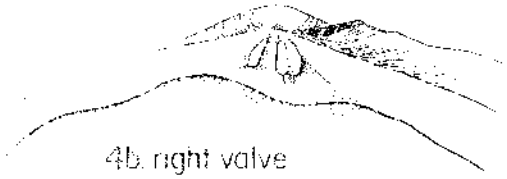


,..)6 /t77/C67 x 4, external, right valve
75 mrn, height 14 mm, diameter 7.5 mm;
vales umbos low, almost central;
Do ;ter ior ends rounded, no flange, bend or gape;
men': external, short, strong.

vi ew " 4
ic' or bent.

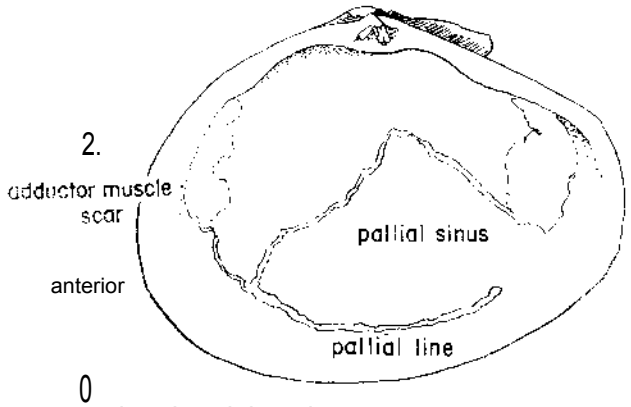


fi, vuive, x12
two cardinal teeth, no lateral teeth.

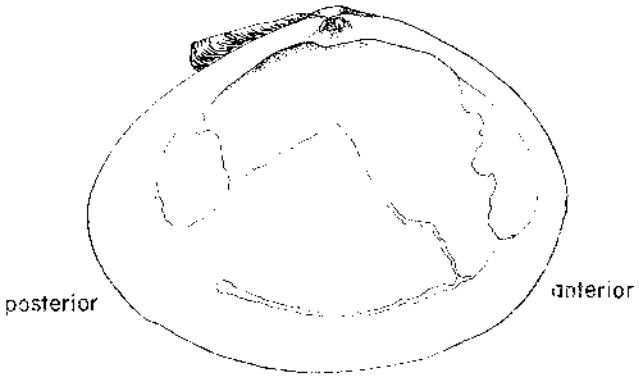


4b. right valve
two cardinal teeth, no lateral teeth;
gritnent not on nymph.

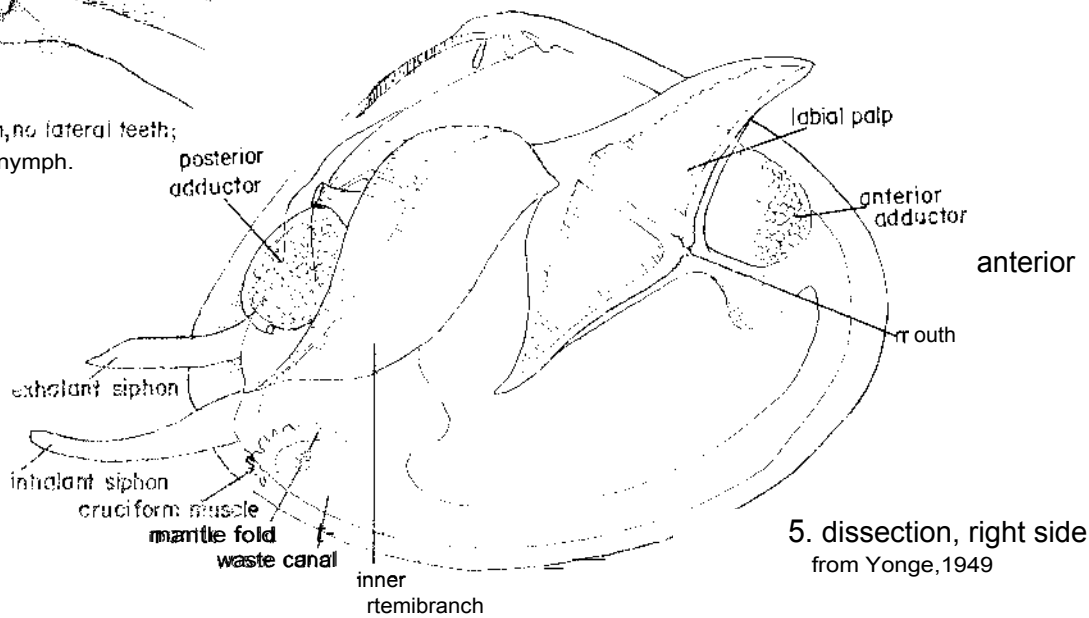
2.



interior, right valve
pal lial line narrow, fa int; pallial sinus ends 3/4 of way to anterior adductor muscle scar; sinuses in both valves similar interior pink



b. left valve



5. dissection, right side
from Yonge, 1949

Macoma inquinata (= irus)
irus clam (Deshayes, 1854)

PHYLUM: *Mollusca*
CLASS: *Bivalvia; Heterodonta*
ORDER: *Veneroida*
FAMILY: *Tellinidae*

Description

SIZE-up to 55 mm long' ; this specimen 44 mm long, 35 mm high, 18 mm diameter.

COLOR-dull white, dark opaque periostracum (not shiny). Interior porcellanous white, feebly polished.'

SHELL SHAPE-ovate or subovate, not circular. Posterior end narrower, less rounded than anterior end.[8] Shell heavy, not fragile. Inflated, equivalve, umbones subcentral. Can have slight gape and flex to right (posterior end)[2]; conspicuous concentric sculptural undulations (fig. 1).

LIGAMENT-long, strong, narrow, prominent (figs. 1, 4). Not seated on nymph, but entirely external: family Tellinidae."

INTERIOR-

PALLIAL LINE-not detached from anterior ventral end of pallial sinus (fig. 2). Pallial line longer in left valve (fig. 3).

PALLIAL SINUS-reaches almost to anterior adductor scar, or just to its base' in left valve (fig. 3); pallial sinuses similar in the two valves.

HINGE AREA-two cardinal teeth in each valve, no lateral teeth: genus *Macoma* (fig. 5).

SIPHONS-completely separate: family Tellinidae[18]; barely yellowish in color (fig. 1 a).

Possible Misidentifications

As *Macoma inquinata* can bend slightly posteriorly, it could be confused with the thinner M. *nasuta,* the bent-nosed clam. *M. nasuta* is not as round and heavy as *M. inquinata;* its pallial sinus reaches and joins the anterior adductor scar above its base (left valve). (Its right valve may be more like M. *inquinata's).* Its siphons are orange. (see plate, *M. nasuta).*

Macoma incongrua is the species closest to *M. inquinata.* It is quite circular in outline; its pallial sinuses are higher than in *M. inquinata,* and different in its two valves. (They are similar in *M. inquinata's* valves). M. *incongrua* is generally a northern species, and averages 30-40 mm in length.'

The name *Macoma irus* is more often used with the Japanese species.1•5

A shorter variety of M. *inquinata, M. arnheimi,* described by Dall, probably does not represent a true subspecies.'

See *Macoma balthica* for a complete comparison on *Macoma* species, genus and family characteristics.

Ecological Information

RANGE-Siberia, Aleutian Islands, British Columbia, south to Oregon; rare south of Santa Barbara, California.'

LOCAL DISTRIBUTION-Oregon bays: particularly Tillamook, Coos, Siuslaw, Yaquina; rarer in Alsea, Nestucca, Netarts.4

HABITAT-usually in soft muddy sand': in protected areas. Have been found also in coarse sand with shell, intertidal sand, and in fine sediment overlying flat rocks (British Columbia). Also in eelgrass (Puget Sound).'

SALINITY-**full seawater.**

TEMPERATURE-cold to temperate waters.

TIDAL LEVEL-intertidally to 48 meters offshore.'

ASSOCIATES-Macoma *nasuta* (South Slough of Coos Bay).

Quantitative Information

WEIGHT-

ABUNDANCE-common in bays"; can be locally abundant: over 6 million at one small Coos Bay site.'

Life History Information

REPRODUCTION-separate sexes; eggs and sperm discharged into water through exhalant siphon; fertilized eggs develop into veliger larvae which swim, metamorphose and settle as small clams.

GROWTH RATE-

LONGEVITY-

FOOD-chiefly a deposit feeder, cleaning film of diatoms, etc. from surface with siphon.

PREDATORS-shorebirds.

BEHAVIOR-

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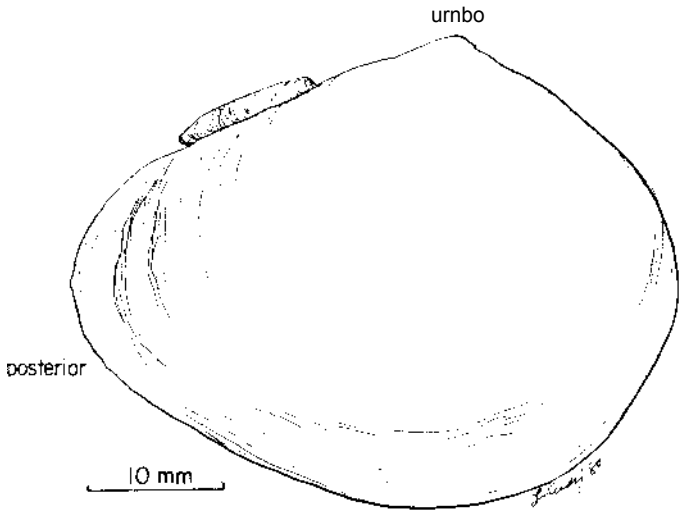
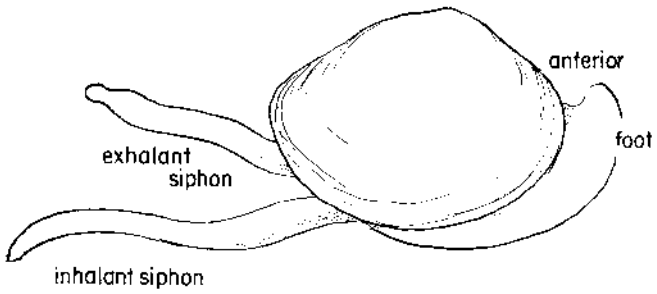
Macoma inquinoto

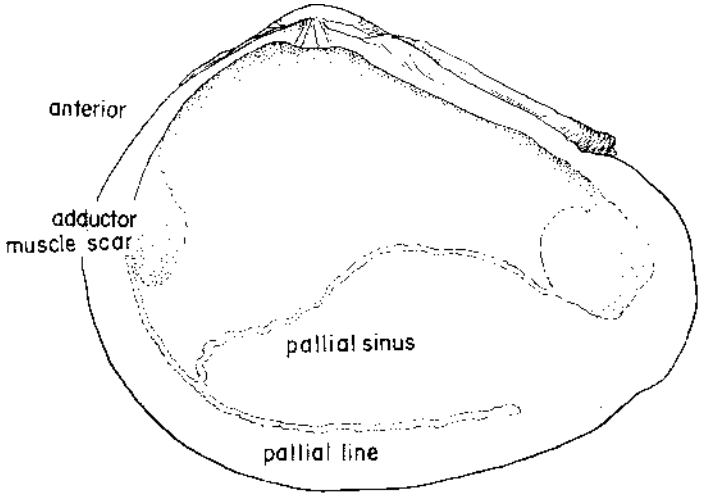


l. MGCOMG inquinoto x 2, right valve
actual length 44 mm, height 35mm, diameter 18mm
shell subovate: posterior narrow; valves equal, inflated;
um bones subcentra l ; color dull white.

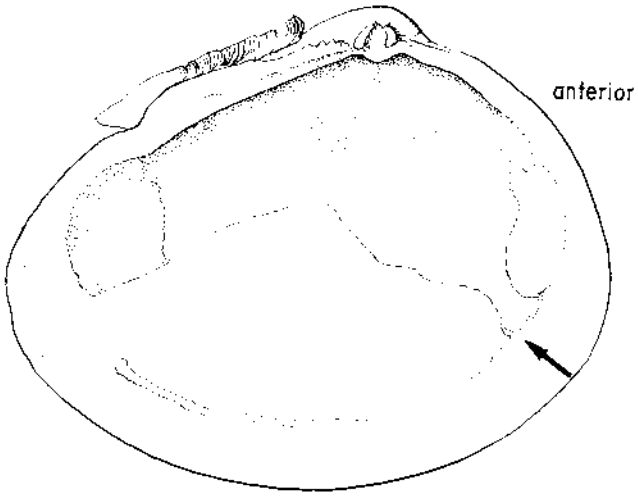


la. live clam, x

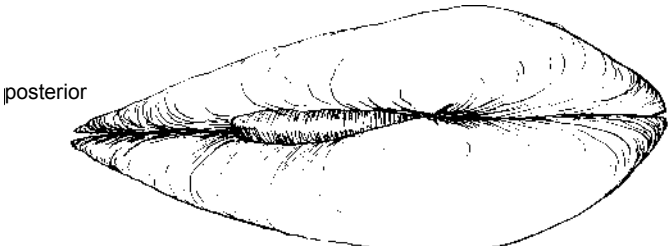
siphons separate.



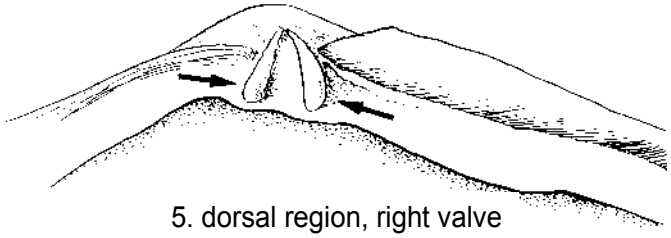
2. interior, right valve
pall ial sinus reaches almost to base
of anterior adductor muscle scar.



3. interior, lett valve
pallial sinus as in right valve.



4.dorsal view
ligament external;
valves slightly bent right posteriorly.



5. dorsal region, right valve
two cardinal teeth in each valve,
no lateral teeth.

Macoma nasuta
the bent nosed clam (Conrad, 1837)

PHYLUM: *Mollusca*
CLASS: *Bivalvia; Heterodonta*
ORDER: *Veneroida ("perfected teeth")*
SUPERFAMILY: *Tellinacea; Tellinidae*

Description

SIZE-"3 to 70 mm"[7]; "seldom reaching 2½ inches" [9]; in Coos Bay, largest are about 2¼ "(57.5 mm) which would classify it as a "medium" sized she114.

COLOR-white; chalky where eroded[5]; dark brown parchment periostracum especially near lower edge and near siphons on valves; often with black markings'; no interior shell color,4 (though siphons can be orange)5.

EXTERIOR-valves thin, smooth, but not polished; shells ovate; "posterior portions of valves distinctly bent to the right" [5] (fig. 4); shells thin, radial lines fine, sometimes blackish; anterior end rounded, posterior wedge-shaped, truncate not "flanged".

INTERIOR RIGHT VALVE-(hold closed shell in both hands with the hinged area up, the ligaments toward you: the right valve is in the right hand)[4]; pallial sinus doesn't reach anterior adductor scar; (fig. 3)"; adductor and posterior muscle scars similar in shape in both valves and overlaps but sinus patterns differ.

INTERIOR LEFT VALVE- pallial sinus reaches anterior adductor muscle scar, fuses and overlaps with it (fig. 2)[11]; clam lies on its left (rounded) side in the mud'.

HINGE-with ligament, entirely external"; cardinal hinge teeth: two (right valve) (fig. 5), one (left valve) (fig. 2); no lateral teeth (beneath ligament), (fig. 5).

LIGAMENT-entirely external end dorsal not on a "nymph" or projection (fig. 5).

BEAKS-"central, slightly prominent" [9] (fig. 5).

SIPHONS-completely separate; orange-coloreds.

Possible Misidentifications

There are four common species of *Macoma* in our area: *M. balthica,* often colored inside, is small; *M. inquinata (= irus)* is whitish and also small (only up to 5 cm); *M. secta,* the sand clam, has a quadrate, flanged posterior. None of them has a noticeably bent posterior. *M. identata,* a rare, small (to 2.5 cm) form, has a strongly produced posterior projection. *Macoma yolditormis.* small and found in sand or mud, has a long anterior end and a produced and expanded posterior".

The genus *Macoma* can be told from the similar *Tellina* by its lack of lateral teeth in either valve". *Macoma* are "more rounded than *Tellina,* more inflated, smooth, white, often chalky"2.

Ecological Information

RANGE--Kodiak, Alaska to Baja California' °.

LOCAL DISTRIBUTION-in bays as well as offshore below surf zone".

HABITAT-substrate; mud and muddy sand, about 10-15 cm below the surface. Very adaptable, it can live better in soft mud than any other *Macoma* species, and in the extremely stale waters of small lagoons'°; also found in eelgrass beds°.

SALINITY-adapted to a wide range of conditons.

TEMPERATURE-temperate and cold waters; not found in the Panamic province to the south.

TIDAL LEVEL mostcommon in bays at mid-tide"; low tide in California (communication Van Veldhuizen).

ASSOCIATES--occasionally infested with encysted larvae of the tapeworm *Anthobothrium* sp[7]. Also pea crabs *Pinnixa,* commensal nemertean *Malacobdellas.*

Quantitative Information

WEIGHT-

ABUNDANCE-on "every possible mud flat" [10]; often most common clam, (i.e. Elkhorn Slough), being replaced by immigrant, *Mya arenaria.*

Life History Information

REPRODUCTION-typically pelecypodan: separate sexes, eggs and sperm discharged into the water through excurrent siphon. fertilized egg develops into veliger larva which swims, metamorphoses, and settles as a small clam[7]. Oregon spawning reportedly spring, early summer°.

GROWTH RATE-

LONGEVITY-

FOOD-primarily a suspension feeder; also sucks surface film from mud surface with siphon, blows out coarse, inedible material7.

PREDATORS smallclams are fed upon by crabs. Snail *Polinices.8*

BEHAVIOR-unusual feeding mechanism (fig. 6).

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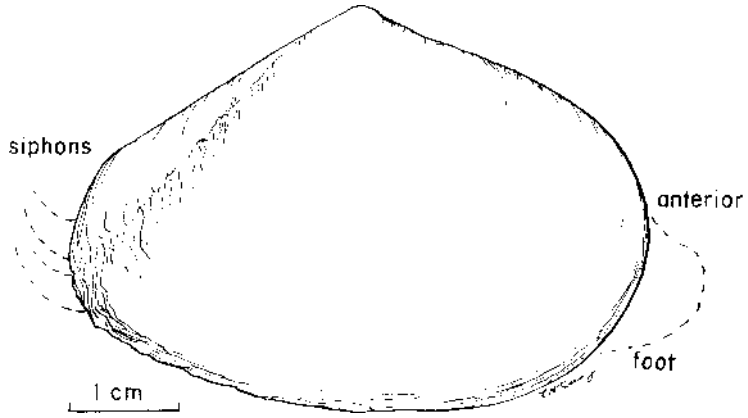
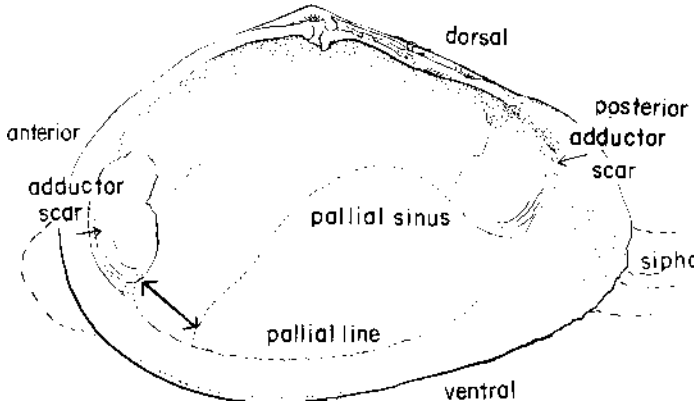
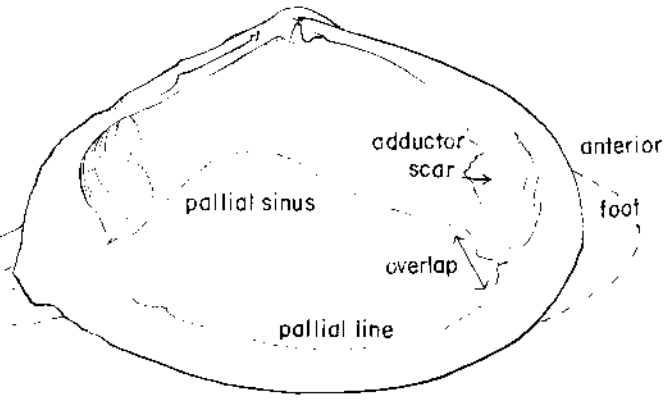


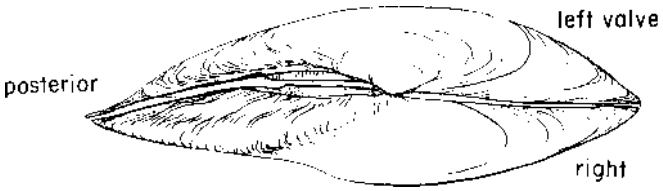
I. Mocomonosuto x 158 external, right valve
thin,white shell; bent right posteriorly;
finejadial lines;
anterior rounded; posterior truncate.



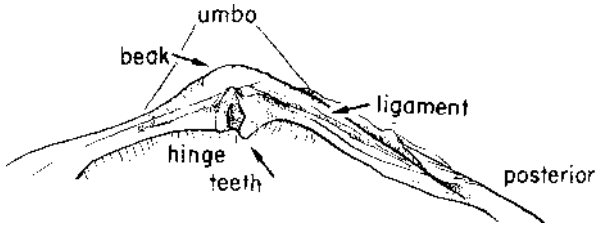
2. interior, right valve
pallial sinus doesn't reach anterior adductor scar;
muscle scars similar.



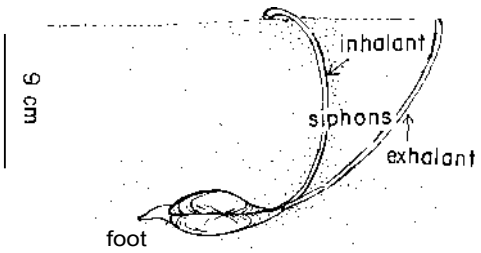
3. interior, left valve
pallial sinus overlaps anterior adductor scar;



4. exterior, dorsal view
posterior: valves bent right.



5.dorsal region, right valve
two cardinal hinge
hinge external; no lateral teeth;
ligament dorsal,external,noton
"nymph:'
beak central,slightly prominent.



6. clam burrowing x1/3

after MacGinitie,1949.

Siliqua patula
the flat razor clam (Dixon, 1789)

PHYLUM: *Mollusca*
CLASS: *Bivalvia, Heterodonta*
ORDER: *Veneroida*
FAMILY: *Solenidae*

Description

SIZE-to 150 mm (5 41") [10], average size 4 1/2 x 2' [1]; adults over 40 mm.16

COLOR-periostracum smooth, brown, shiny, lacquerlike. Exterior white, obscurely rayed, with faint violet coloration; interior white, tinged with violet and pink.

SHELL SHAPE-"smooth within and withour [2]; elongate, rather cylindrical; length about *21/2* times width. Valves similar, gaping at both ends. Beaks toward anterior end. family Solenidae [16]; (beaks in *Siliqua* sp. are subcentral, toward the anterior, but not close to it [s]). Posterior end round. shell very thin, sharp edged, profile thin (fig. 4).

HINGE AREA-left valve with two cardinal and two lateral teeth; right valve with one cardinal and one lateral tooth (fig. 2); a vertical or radial rib projects downward and anteriorly from hinge in both valves: genus *Siligua*[5] (fig. 2).

LIGAMENT-external, not on nymph (fig. 2).

ANIMAL-siphons short, fused except at very tips (fig. 4); exhalant and inhalant openings ringed by tentacles.

YOUNG-oval outline until about 2.5 mm long": (with central beak, not elongate).

Possible Misidentifications

Solenidae are cylindrical, about *212* times as long as high, and gape at both ends. One other local ,tttliy t h as beaks quite near the anterior end, not saboentraiii as in *Siliqua: Solen* sp. have an almost straight dorsal margin, a terminal beak, and one cardinal tooth in each valve.' *Solen sicarius,* the blunt razor shell, is found occasionally in permanent burrows in mud or muddy sand," both intertioally and subtidally' It is the species most likely to be contused with *Siliqua patula.* It lacks *Siliqua's* interior ver tical rib and mu tiple hinge teeth, and is 4 times as long as iot times '

One other species of *Siliqua* is found farther south (to Monterey Bay): *Siliqua lucida, a* small (to 40 mm) razor clam, lives in protected bay sands, has a truncate posterior end, a vertical internal radial rib and concentric brown bands on its exterior. Old books" list *S.* patula variation *nuttalli,* with a more oval shape, purple beaks and four hinge teeth in the left valve, not two.

There are other razor-shaped clams besides the Solenidae. The Mytiiidae (mussels) include some genera, *Adula* for instance, which are long arid cylindrical. *Adula* is usually a boring species, however; it has a hairy posterodorsal slope," a very small anterior adductor scar, and no hinge teeth., Hiatellidae, including the geoduck, Panope, are large, quadrate, gaping bivalves, without hinge teeth, and with nearly equal adductor muscle scars.'

One long, cylindrical bivalve of the family Psammobiidae, *Tagelus califomianus,* the jackknife clam, could be confused with *Siliqua.* It too has nearly central beaks, is about 2 1/2 times as long as wide, and gapes at both ends. It never has the internal strengthening rib of *Siliqua,* however, and its ligament is seated on a nymph or projection (as in *Protothaca staminea,* see plate). Tage/us is gray, has no lateral teeth," and has short siphons. It is found below Humboldt Bay, California, in mudflats.

Ecological Information

RANGE-Aleutian Islands to Pismo Beach, California [20]; but uncommon in California.

LOCAL DISTRIBUTION-Coos Bay: Pt. Adams spit near Bay mouth; usually on open coast.

HABITAT-flat, open beaches with fine, clean sand; in strong surf zone with aeration.' No permanent burrow. Niche assumed farther south by the Pismo clam, *Tnvela stultorum.15*

SALINITY-full seawater.

TEMPERATURE-lives in cold to temperate 'Natant

TIDAL LEVEL-about - 1.0 ft. and lower."

ASSOCIATES--olive snail *Olivella biplicata,* caprellid amphipods, polychaetes, including *Ophelia.* Commensal nemertean *Malacobdella grossa* occurs in up to 80%, of the clams (fig. 1a).

Quantitative Information

WEIGHT-

ABUNDANCE-can be very abundant in certain local areas; populations move and fluctuate, due partly to storms, surf. Once harvested commercially along northwest coasts. Unrestricted digging severely harmed populations": downward trend began around 1925. Densest near mean low water.' 1976 Oregon total harvest 2,211,000 clams.'

Life History Information

REPRODUCTION--high fecundity, high mortality.' Separate sexes; eggs and sperm discharged into sea, fertilization by chance; 6-10 million eggs can be produced by a female. Spawning activated by minimum water temperature of 13°C3. 86% of third year clams (10 cm long) mature or maturing (Queen Charlotte Island).° Mass spawning late May or June (Washington): occasionally huge sets of young. Larval stage 8 weeks; larvae free swimming but stay close to sand. After metamorphosis, size of wheat grain or smaller; to 1.5 cm by end of growing season (December, Washington).'

GROWTH RATE---3 1/2 years to legal size of 4 1/2 " (11.5 cm) (Washington), where animals grow rapidly, do not reach a large final size or live as long as they do in Alaska. [19] Growth rate slows after 10 cm size reached [2]"; growing seasons show as wide brown areas between rings, which are annual. Mortality in young probably 99%: greatest losses from storm movement'

LONGEVITY-

FOOD -a filter feeder of planktonic diatoms.

PREDATORS-man, probably the most highly prized food mollusk in the northwest; seagulls, ducks, perch, crab.'

BEHAVIOR-known for its quick, efficient digging ability: it can bury itself in less than 7 seconds, and moves especially rapidly in the second or "slosh" layer of sand.' Digging accomplished by ability of the anchor-shaped foot to change shape. Extraordinary muscle capacity and the displacement of body fluids are responsible for this." Digging is vertical, sometimes angled toward the sea; very little horizontal movement.

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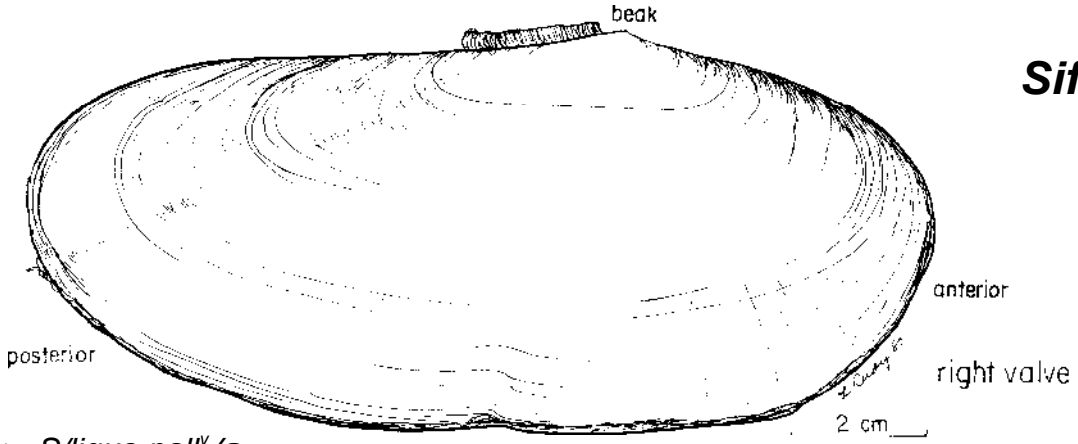
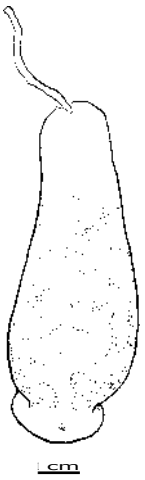
Sifiqua patuM

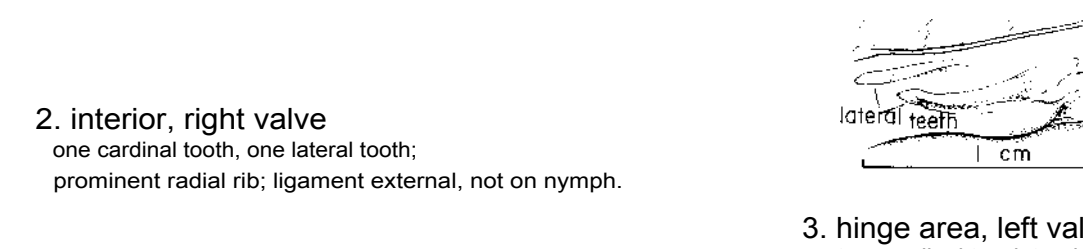


I. *S/liquo pall[y]/a* x I: 13 cm long, 5.5 cm wide (length about 2 (Rx width)
shell cylindrical, shiny, brown; beaks subcentral (slightly anterior);
posterior rounded.

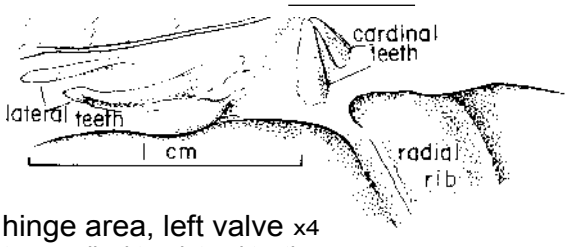


I A. commensal nemertear

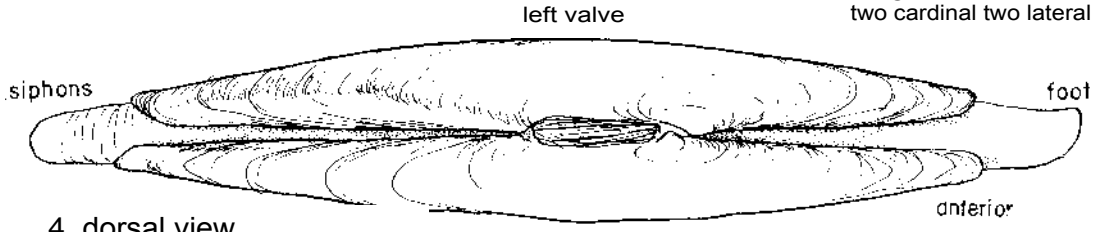
Ma/acobdeflo grosso x 2
actual size 2.5 cm
(from Smith & Carlton,1975)



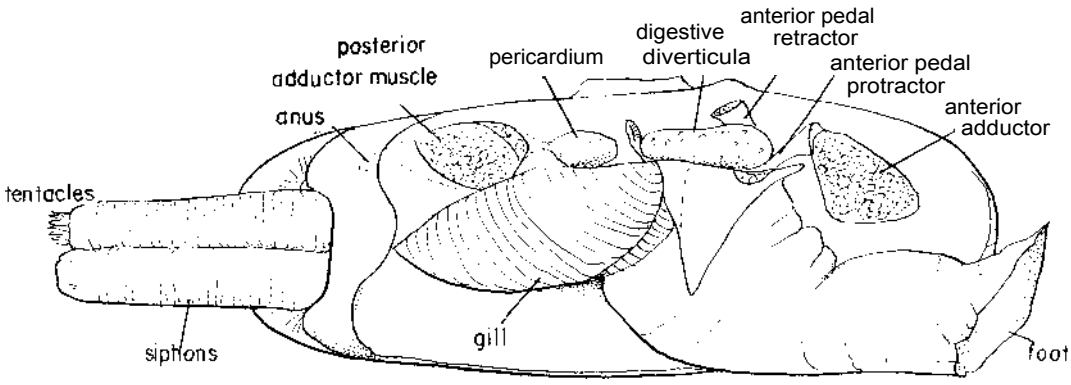
2. interior, right valve
one cardinal tooth, one lateral tooth;
prominent radial rib; ligament external, not on nymph.



3. hinge area, left valve x4
two cardinal two lateral teeth.



4. dorsal view
profile thin; both ends gaping.



5. a dissection, right valve removed
(after Poh lo, **1963,** fig.5)

arenaria
soft-shelled clam Linnaeus, 1758

PHYLUM: *Mollusca*
CLASS: *Bivalvia; Heterodonta*
ORDER: *Myoida*
FAMILY: *Myidae*

Description

SIZE-2-110 mm[7]; averages 5-10 cm (2-4 inches); can be up to 125 mm in some areas (Umpqua, Siuslaw estuaries).

COLOR-white with gray or dark periostracum (rough outermost layer).

EXTERIOR valvessimilar long, egg shaped, shell convex, thin, brittle, low concentric growth striae anterior and posterior ends different: both rounded. but anterior blunter. posterior pointed: both ends gaping[8]: beaks small, bent back, slightly anterior of center; siphons large, fused, non-retractible.

INTERIOR-white; strong internal ligament: deep pallial sinus, spoon-shaped chondrophore (support for ligament); adductor muscle scars same size but very different in shape (fig. 2).

HINGE AREA-valve areas dissimilar: spoon-shaped chondrophore in left valve, projection almost as great as width[s]; right valve with tooth in opposition to chondrophore. No hinge plate teeth (cardinal or lateral); ligament entirely internal, not visible from exterior.

Possible Misidentifications

One of the areas where Mya is abundant is in upper reaches of estuaries where salinity is reduced, and where *Saxidomus* and *Tresus,* which are slightly similar superficially, usually are not found. Neither of these, nor *Tellina* nor *Macoma* sp., has an internal ligament or a chondrophore in both valves. Small *Tresus* can otherwise be mistaken for Mya. Small Tellinid clams have an external ligament without a nymph, and lateral hinge teeth, which *Mya* lack. *Macoma* are very like *Tellina* but their shells are always a bit flexed. they have no lateral teeth, and no internal coloration.

Cryptomya, the false mya (which see) is a smaller (to 30 mm), less elongate clam. It is usually found close to the ghost shrimp *Callianassa.* Unlike *Mya, Cryptomya* has an inconspicuous pallial sinus.

Ecological Information

RANGE-Vancouver Island to San Diego. Probably introduced with oyster spat in 1869 in San Francisco, although it appears in the fossil record (Pliocene)", in California and Vancouver[8]. Common on the Atlantic Coast and Europe, it has crowded out the native *Macoma* on the Pacific coast in some areas3.

LOCAL **DISTRIBUTION** -Coos Bay, Yaquina Bay; Suislaw, Umpqua, Tillamook„Aisea and Columbia estuaries, and possibly others.

HABITAT-mud and sand of bays[12]; often in upper reaches where salinity is reduced; requires complete protection, as it cannot burrow or maintain itself in a shifting substratum"; very tolerant of extreme conditions: anaerobic or foul mud, lot.Ackish (though riot stagnant) water, temperatures below freezing".

SALINITY -tolerates brackish water and reduced salinity, as well as full salt water (can live at 23% seawater)6.

TEMPERATURE -range limited to cool areas; can also tolerate temperatures below freezing.

TIDAL LEVEL--found from 15-30 cm in the mud "littoral or adlittoral"8.

ASSOCIATES -can be parasitized by *Pinnixa .faba"* (see Pearce, 1966 under *Pinnixa).*

Quantitative Information

WEIGHT-

ABUNDANCE -abundant in Yaquina, Siuslaw. Umpqua estuaries, and in some parts of Coos Bay.

Life History Information

REPRODUCTION---dioecious (separate sexes); two periods of sexual maturation and spawning: fall, when temperatures - fall (primary maturation period) and spring (secondary mat-. uration): Chesapeake Bay; continuous period from April to October New England[9]. Eggs 60-80 *pm* diameters.

GROWTH RATE clams as small as 25 mm have been found to have mature gametes9.

LONGEVITY-

FOOD-a suspension feeder.

PREDATORS--birds. man, and as larvae, preyed upon by planktonic predators and suspension feeders.

BEHAVIOR-does not burrow as adult.

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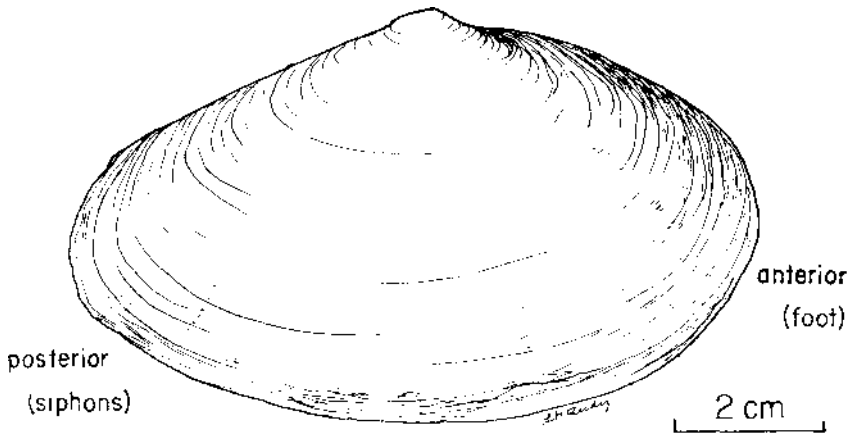
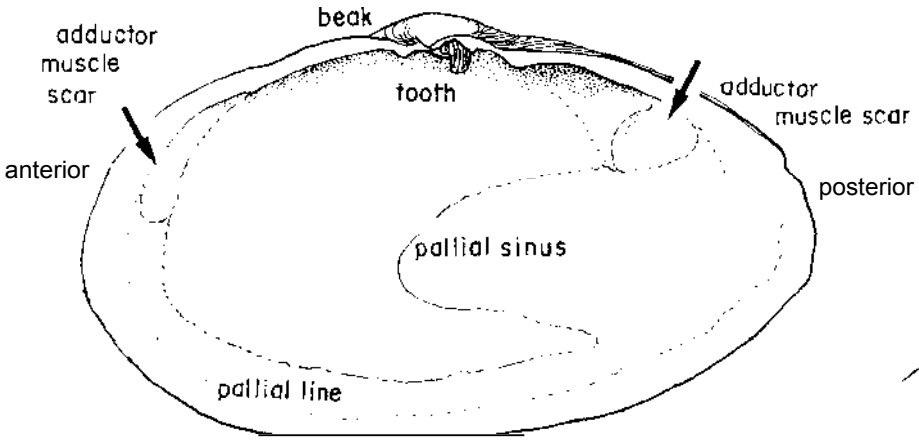
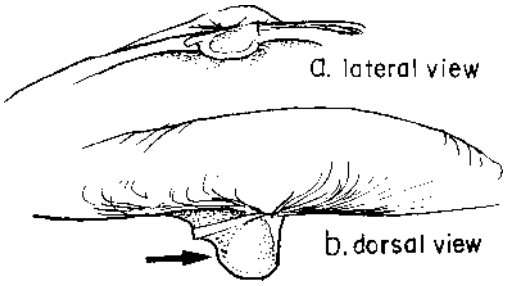
Mya arenotio



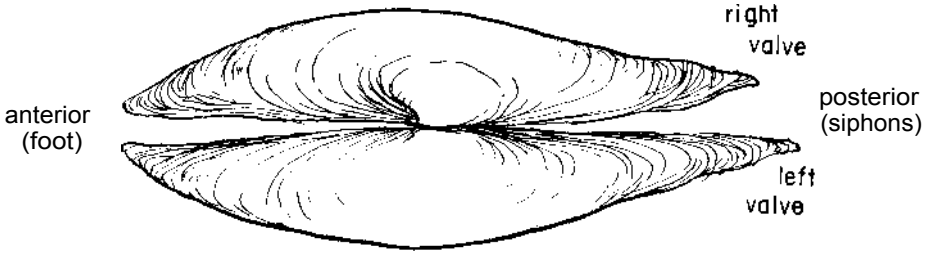
l. *Mya arenoria ,* exterior, right valve x l
shell egg-shaped thin, britt le";
cohcentric growth rings; small beaks;
both ends rounded, slightly gaping.



2. interior, right valve
white; muscle scars unlike;
pall ial sinus deep; no cardinal teeth;
ligament all internal; tooth
opposing chondrophore.



'3. hinge area, left valve
chondrophore spoon–shaped.



4 dorsal view

Cryptomya californica
false *Mya* (Conrad, 1837)

PHYLUM: *Mo/lusca*
CLASS: *Bivalvia; Heterodonta*
ORDER: *Myolda*
FAMILY: *Myidae*

Description

SIZE-to 30 mm long; this specimen 21 mm.

COLOR-exterior chalky and white, with dull reddish brown periostracum. Interior glossy white with spoon-shaped tooth (right valve): orange.

SHELL SHAPE-oblong, gaping posteriorly. Right valve more convex than left.' Shell thin, fragile, with external thick periostracum and light concentric sculpture. [13] Beaks central, fairly prominent (fig. 1).

LIGAMENT-internal; in right valve, orange, leathery, corresponds with chondrophore in left valve. Ligament seated in a shallow resilifer (pit) (figs. 3, 4).

INTERIOR-adductor muscle scars equal: family Myidae.

PALLIAL LINE-entire, forms a right angle posteriorly (fig. 3).

PALLIAL SINUS-absent (or inconspicuous"): genus *Cryptomya* (fig. 3).

HINGE AREA-no true teeth or hinge plate, except for chondrophore and resilifer: family Myidae.9

CHONDROPHORE-broad, horizontal, projecting; in left valve only. Right valve with resilifer to receive chondrophore.

SIPHONS-short, oval, surrounded by tentacles (incurrent). Excurrent siphon a short vase-like siphon (fig. 6).

Possible Misidentifications

Cryptomya can be distinguished from other small white clams, (*Macoma,* for instance), by its lack of any external ligament, the fragility of its shell, and internally, by its lack of hinge teeth, and presence of the chondrophore in the left valve. Mactridae, including the gaper clam, have a chondrophore in both valves. Mactridae adults are large, gape widely, and have small hinge teeth (which Myidae lack); their posterior edges are truncate, not rounded, and their siphons are leather-like at the tips.

The genus *Mya,* closely related, is quite common in the northwest, and be immediately distinguished internally by the presence of a deep pallial sinus *(Cryptomya* has no sinus). There is only one local species:

Mya arenaria, the soft-shelled clam in our area, grows to 120 mm. Like *Cryptomya,* it is thin-shelled, white and fragile, and lives in sandy mud. It is longer than *Cryptomya,* [3] however, and is found down to 30 cm deep, and not necessarily near *Callianassa* burrows.

Ecological Information

RANGE-Gulf of Alaska to northern Peru.'

LOCAL DISTRIBUTION-in bays where *Callianassa* or *Upogebia* beds are found: Coos Bay, airport extension site, Pigeon Point, South Slough, etc.; Tillamook Bay; Netarts; Nestucca. [2] Also offshore.

HABITAT-sand and sandy mud, nearly always within its siphons' reach of the burrow of *Callianassa,* the ghost shrimp, (which in turn often inhabits oyster beds).

SALINITY-collected at 30 o/oo salt.

TEMPERATURE-occurs over a wide range of water temperatures geographically.

TIDAL LEVEL-can be found down to 20 inches below surface [13]; as well as the upper to mid-intertidal range.

ASSOCIATES-the well-known association of *Callianassa* can include as well the polynoid polychaete *Hesperonoe,* three different pinnotherid (pea) crabs, and the goby *Clevelandia ios.* (Farther south the clam is found next to *Urechis* burrows[9]). It has also been found near the burrow of the mud shrimp *Upogebia.*

Quantitative Information

WEIGHT-

ABUNDANCE-can be very common: in some parts of Coos Bay, it is the most abundant bivalve (airport mudflat, North Bend').

Life History Information

REPRODUCTION-

GROWTH RATE-

LONGEVITY-

FOOD--filters material from water pumped in by *Callianassa* in the burrow. (Both *Upogebia* and *Urechis* are more effective detritus filterers than *Callianassa,* and *Cryptomya* does better at *Callianassa's* table.'

PREDATORS-protected by the burrow.

BEHAVIOR-stays not just below the surface as a short-siphoned clam of its size normally would, but deep in the substrate, where it burrows into *Callianassa* burrows.

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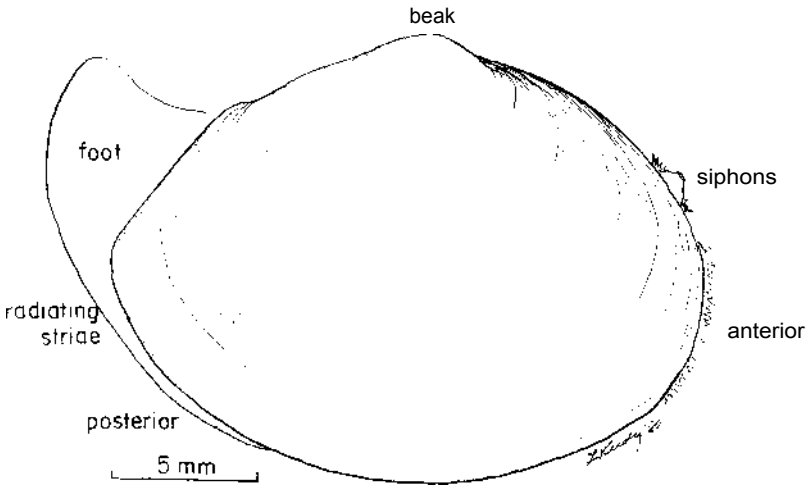
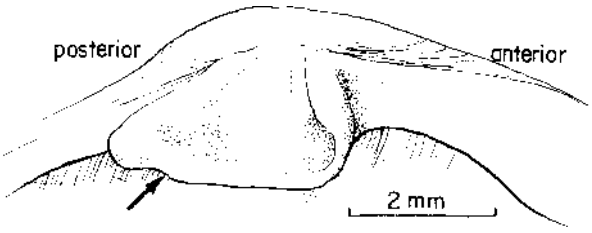
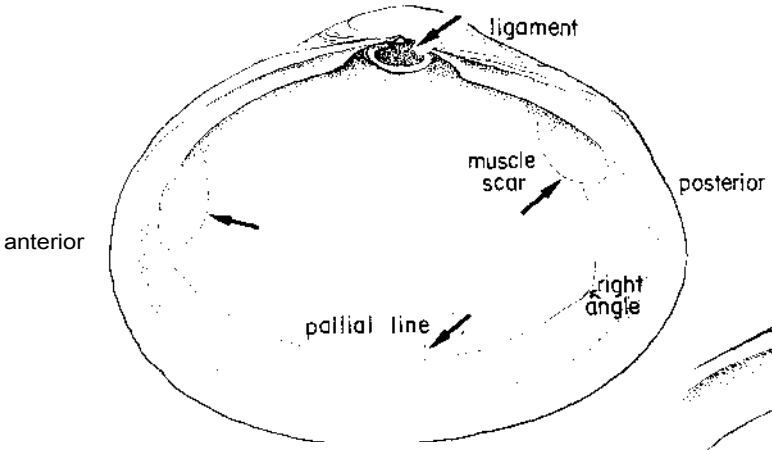
Cryptomyo californica



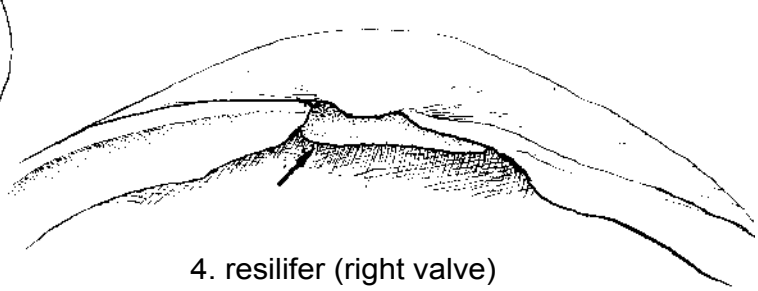
1. *Cryptomyo co/Worn/co* exterior, right valve x4.25
actual length 2 l mm; beaks central; anterior rounded, posterior truncate, gaping; concentric sculpture, some radial striae. shell thin, fragile, chalky white; siphons very short.



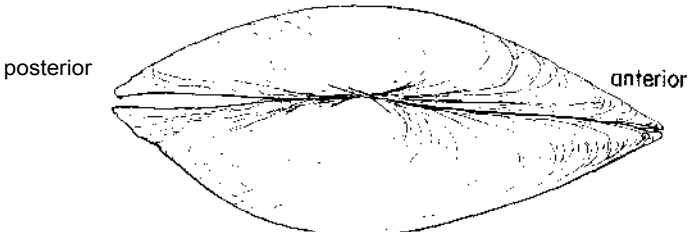
2. chondrophore (left valve) x II
spoon-shaped, broad, horizontal.



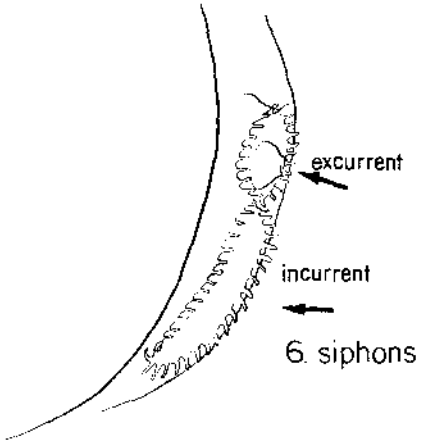
3. interior, right valve
glossy white; anterior and posterior muscle scars equal; no cardinal or lateral hinge teeth; no pal lial sinus, pallial line entire, forms a right angle posteriorly.



4. resilifer (right valve)
(ligament removed).



5. dorsal view
_posterior gapes slightly; no external ligament.



6. siphons

Hiatella arctica (= *Saxicava arctica*) (= *H. pholadis, H. gallicana*) (Linnaeus, 1767)

the nestling saxicave

PHYLUM: *Mollusca*
CLASS: *Bivalvia*
ORDER: *Myoida*
FAMILY: *Hiatellidae*

Description

SIZE-to 50 mm (2"[8]); this specimen (Coos Bay) 38 mm long.

COLOR-exterior white, chalky, granular, with tan, thin, ragged periostracum: genus *Hiateila*[2]*;* interior porcelain-like, white: family Hiatellidae.1°

SHELL SHAPE-variable: distroted by nestling habit. Valves equal, oblong, gaping: posterior and broader, more square than anterior end, broadly truncated (fig. 1). Elongate, boring specimens have been reported as *H. pholadis"* (fig. 1 a).

SCULPTURE-concentric only

INTERIOR -pallial line faint, broken into discontinuous scars (fig. 3): family Hiatellidae. [11] Adductor muscle scars approximately equal in size, (not shape). No pallial sinus.4

HINGE AREA-adult without hinge teeth (or worn) (fig. 3); young clams have 1-2 weak, peg-like cardinal teeth.

UMBONES-depressed, nearer anterior end than middle; do not touch each other (fig. 2).

LIGAMENT-external (figs. 2, 3): family *Hiatellidae.11*

BYSSUS--(attachment threads), present in nestling specimens, not in boring ones *(H. pholadis);* not figured. Long, single byssal thread spun by post-larval clams allows them to be moved by weak water currents5.

SIPHONS-fused; red tipped: genus *Hiatella'* (fig. 1).

PERIOSTRACUM-light tan, thin: genus *Hiatella*[2] (figs. 1, 2).

Possible Misidentifications

Burrowing and nestling clams, of which there are many genera, can be difficult to separate by shell shape; they tend to be variable and often quite distorted from the "norm." Useful characteristics are the hinge teeth, pallial line and siphons. Most Pholadidae can be distinguished by their two distinct shell sections (see *Penitella, Zirfaea);* all pholads have file-like denticulations and (except for *Netastoma)* an internal myophore.

The venerid clam *Protothaca staminea* var. *orbella,* like *Hiatella,* is white with an external ligament, and can be found nestling in old pholad burrows. It has radial as well as concentric striations, however, and interiorly has 3 cardinal hinge teeth and a strong pallial line and sinus.

Petricola carditoides is a nestling clam which (like *Hiatella)* has an external ligament and a chalky white shell. It has hinge teeth in the adult (2-3), not just in the young. *P. carditoides* has purple-tipped siphons, not red ones, and its shell has some radial sculpture.

Two myid clams could be confused with *Hiatella: Platyodon cancellatus* is a white borer with a heavy shell with fine, almost lamellar concentric exterior sculpture. Inside it has a chondrophore and tooth in its hinges, and a well-developed, deep pallial sinus. *Cryptomya californica* can nestle among rocks, although its usual habitat is sand or mud. It is small (to 30 mm), thin-shelled and has a chondrophore. Interiorly it has an entire pallial line, and an inconspicuous pallial sinus."

Entodesma saxicola is probably most likely to be confused with *Hiatella:* it is of a comparable size, shape and habitat. *Entodesma* has a dark, rough periostracum, not a pale, thin one, an external ligament like *Hiatella's,* and short, fused siphons, but without red tips. Inside the shell is very pink and pearly. *Entodesma* has no hinge teeth, but does have a large internal ligament and lithodesma; its pallial line is entire and there is a small pallial sinus.

The nomenclature of *Hiatella* sp. is rather confused: *Hiatella pholadis* is a large (to 50 mm), often very elongate, boring species strictly resident in pholad burrows' and without hinge teeth or red-tipped siphons. It has a prominent ridge from the beaks to the lower posterior angles Coan and Carlton" believe this name to be a probably synonym for a form of *H. arctica.*

Hiatella gallicana [9] is a small (to 25 mm) species which may be the same as *H. arctica.8*

Other northwest Hiatellidae include *Panopea generosa,* the geoduck, which is large. quadrate and not distorted. It has one cardinal tooth in either hinge. *P. generosa* is a very deep burrower with very long siphons; it is rarely found in Oregon.

Ecological Information

RANGE-Arctic Ocean to Panama[6]; circumpolar.

LOCAL DISTRIBUTION -Coos Bay: Pigeon Point.

HABITAT-nestles in old pholad burrow, or bores into smooth soft homogenous rock'°; also found in *Mytilus* beds, on pilings, and on open coasts in algal holdfasts. On hard, creviced surfaces it will attach byssally.1°

SALINITY-found in Coos Bay in lower, more saline parts of estuary: collected at 30 0/00.

TEMPERATURE-

TIDAL LEVEL-intertidal to 120 m deep; collected at 0.0 ft.

ASSOCIATES-other nestling and boring molluscs: *Entodesma, Penitella, Zirfaea.*

Quantitative Information

WEIGHT-

ABUNDANCE-not common.

Life History Information

REPRODUCTION-

GROWTH RATE-

LONGEVITY-

FOOD-suspension feeder.

PREDATORS-tooth snails *(Nucella,* etc.) can prey on small nestling clams.

BEHAVIOR -boring is mechanical, not chemical.'°

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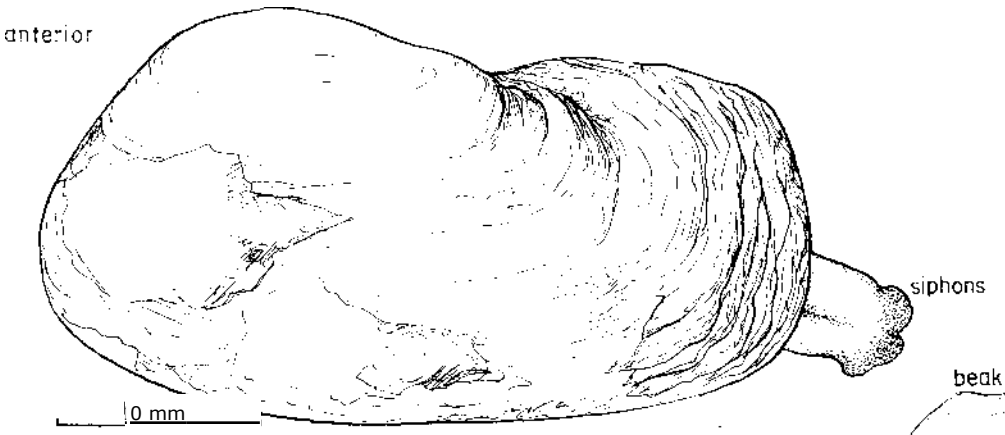
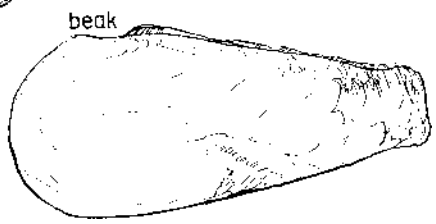
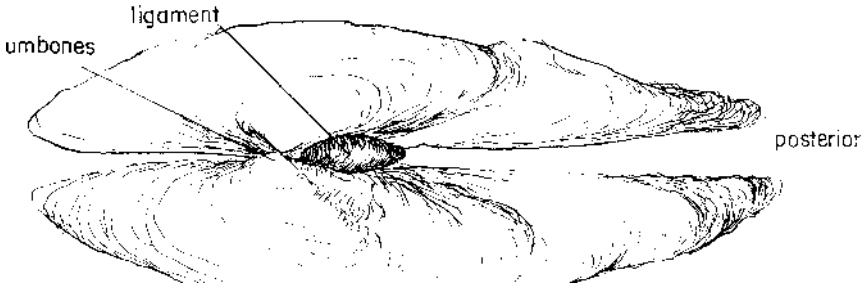
Hiatella arctica



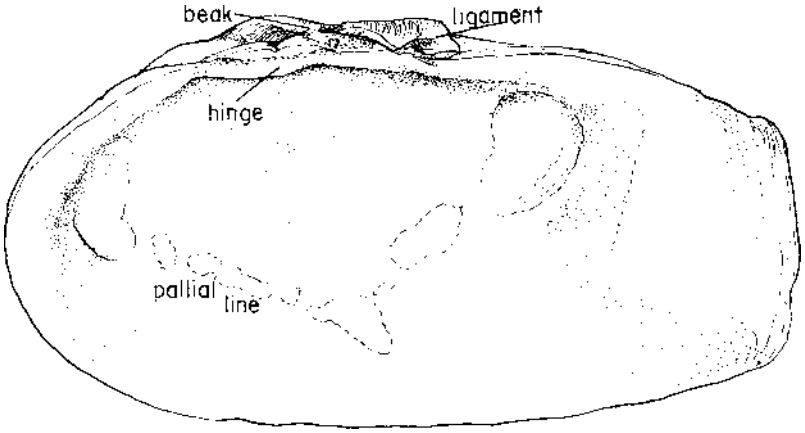
1. *Hiatella orctica*, exterior, left valve x3. actual length 38 mm
shell oblong, distorted; posterior truncate, beaks nearer anterior end than middle; concentric striations on rough, white surface; thin tan periostracum.



1a. *H. pholadis*, left valve x 2
elongate; beaks near anterior end.



2. dorsal view,
umbones depressed, not touching; ligament external; posterior gaping.



3 interior, right valve
white, porcelain-like; hinge without teeth; ligament external.
pallial line broken into scars.

Penitella penita (= Pholadidea penita)
common piddock Conrad 1837

PHYLUM: *Mot/used*
CLASS: *Bivalvia, Heterodonta*
ORDER: *Myoida, Pholadina*
FAMILY: *Pholadidae, Martesiinae*

Description

SIZE-to 95 mm long; 50 mm this specimen 40 mm long, 18 mm high (fig. 1).

COLOR-white, inside and out.

SHELL SHAPE-elongate, divided into two distinct parts:

ANTERIOR-rounded, bulbous, rasp-like radial and concentric striae of heavy file-like denticuiations on the triangular rasping section which covers less than 1/2 valve area' (fig.

POSTERIOR-wedge-shaped, with regular concentric striations only; end truncate. Gapes at end only, not to middle of shell: genus *Penitella'*

CALLUM (calcareous accessory plate)-present in adult at anterior end (fig. 1). Not present in young (fig. 5).

UMBONES-not prominent. Umbonal reflection (where urnbones turn back, fig. 1): closely appressed for entire length.'

MESOPLAX-small accessory plate on dorsal edge (fig. 2); (no accessory plates, *i.e.* protoplax metaplax, hypoplax, present). Mesoplax pointed posterioriy, truncate anteriorly, with swept back lateral wings: species *penita."*

SIPHONS-long, white, retractible; tips marked with small red spots, but not solidly red-tipped, smooth: without warts or orange chitinous patches. No pallets on siphon tips (as in boring mollusc *Bankia).* Incurrent siphons with 6 large, and several small branched cirri around aperture."

SIPHONOPLAX-brown, membranous, heavy, flexible flaps, not lined with calcareous granules: species *penita*

PERIOSTRACUM-none.

INTERIOR-divided into three areas by pallial lines. Pailial sinus posterior; large posterior muscle scar_ Anterior muscle scar and accessory unusually dorsal (fig. 4); ventral muscle scar present as well.

HINGE AREA-no hinge teeth or ligament.

APOPHYSIS (myophore)-short. narrow, spoon-shaped structure in each valve, which serves as an extra muscle attachment for powerful grinding muscles' (fig. 4); -weakly blade-like.""

BODY-foot and mantle white "

YOUNG-anterior end soft (minout callum), while animal is burrowing. Exposed foot eloped as a suction disc (fig. 5).

Possible Misidentifications

There are other burrowing clams in our area. i.e. *Hiatella. Entodesma, Barnea, Petricola, Bankia,* None of them have distinct body areas or the bulbous, denticulated anterior of *Penitella.* A similar pholad is *Zirfaea pilsbryi* (subfamily *Pholadinae)* a very large piddock to 150 mm; whose most noticeable characteristic is its lack of a callum protecting the anterior end; (it bores even as an adult). *Zirfaea* has very long, nonretractible siphons (and no siphonoplax), a posterior gape which extends to the middle of the animal; a broad apophysis, and a rasping surface which covers half the valve area.'

Other northeastern Pacific Pholadidae include

Netastoma rostrata (subfamily Jouannetiinae), a short, anteriorly truncate species without an internal apophysis, and with a tubular, calcareous siphonoplax. Its callum is only a fluted band, not a round enclosing plate.

Chaceia ovoidea (= Pholadidea) which bores into shale, has non-retractible siphons with orange chitinous patches and warty tips. It is oval, not elongate, and its callum does not completely cover the anterior aperture.'

Paraphoias califomica has no siphonoplax, and is divided into three well-marked regions, not two as is *Penitella.* It has two dorsal plates, a mesoplax and a metaplax, riot one; it can bore into hard rock.

Three other species of *Penitella* can be present:

Penitella conradi is usually found in *Mytilus* or abalone *(Haliotis)* shells. It is very small, to 33 mm, its siphonoplax is lined with coarse calcareous granules and its mesoplax is truncate posteriorly, pointed anteriorly (the reverse of *P. penita,* see fig. 2). The mesoplax is large: almost equal in area to the rasping surface.'

Penitella gabbi can be found with P. *penita,* but is much less common.' It is a cleancut, oval shell with a creamy-lemon siphon,' covered with warts. It has no siphonoplax; its callum extends very little beyond the beak, and the umbonal reflection is not attached anteriorly. *P. gabbi* can be up to 75 mm long and often has a gray-brown periostracum posteriorly."

A very closely related species, *Penitella turnerae,* was described from Coos Bay in 1966.[6] This is a much larger species than *P. penita,* (to 125 mm, Fossil Point, Coos Bay), stout and lacking a siphonoplax. Its siphons are white, long and red-tipped. Its mesoplax is reduced to a narrow crescent, rounded posteriorly and not sharply pointed as in *P. penita.*

Ecological Information

RANGE-Gulf of Alaska to Pta. Pequena, Baja California': type locality San Diego. Calif."

LOCAL DISTRIBUTION-Coos Bay, Pigeon Point, Fossil Point, Coos Head; Yaquina Bay, Netarts."

HABITAT--bores into mud and rock, burrows at least 3 x valve length. Prefers northeast surfaces, where algae and light are least (much like barnacles): also on cement Jetties: an important animal in erosion and concrete destruction.

SALINITY--collected at 30 0/00.

TEMPERATURE- geographical distribution is in cold to temperate waters.

TIDAL LEVEL-intertidal and subtidal': found as high as 0.6 m (Coos Bay)'; broad distribution vertically. Found as low as 91 m."

ASSOCIATES-other nestling and burrowing invertebrates; *i.e.* polychaetes *Thelepus, Halosydna,* clams *Hiatella, Entodesma, Zirfaea* (Coos Bay).

Life History Information

REPRODUCTION-dioecious, oviparous; sexual maturity postponed until growth stops.'

GROWTH RATE-average time to maturity-33 months.' Unusual in having determinate growth: at about 3 years metamorphoses into non-boring adult (about 55 mm long). Crowding may induce early metamorphosis' Animals mature at smaller size in soft rock than in hard rock.

LONGEVITY-lives until burrow erodes enough to make it subject to predators (i.e. less than 3 x valve length), erosion rate varies with rock hardness: at Fossil Point, erosion process takes about 6 years.

FOOD-a suspension feeder, using long siphons to feed.

PREDATORS-flatworms *Stylochop/ana, Notoplana inquieta* Worm enters the shell and eats the flesh, laying its eggs there.'

BEHAVIOR-pholads are the most efficient of the seven families of rock-boring bivalves.' Boring is mechanical, not chemical, and in this species is done only by the young animal, after which it metamorphoses into a non-boring adult. Grinding assisted by keeping algae out of burrow with sea water, by loosening rock grains, and by ciliary currents which flush out cavity.' Makes cone-shaped burrow.'

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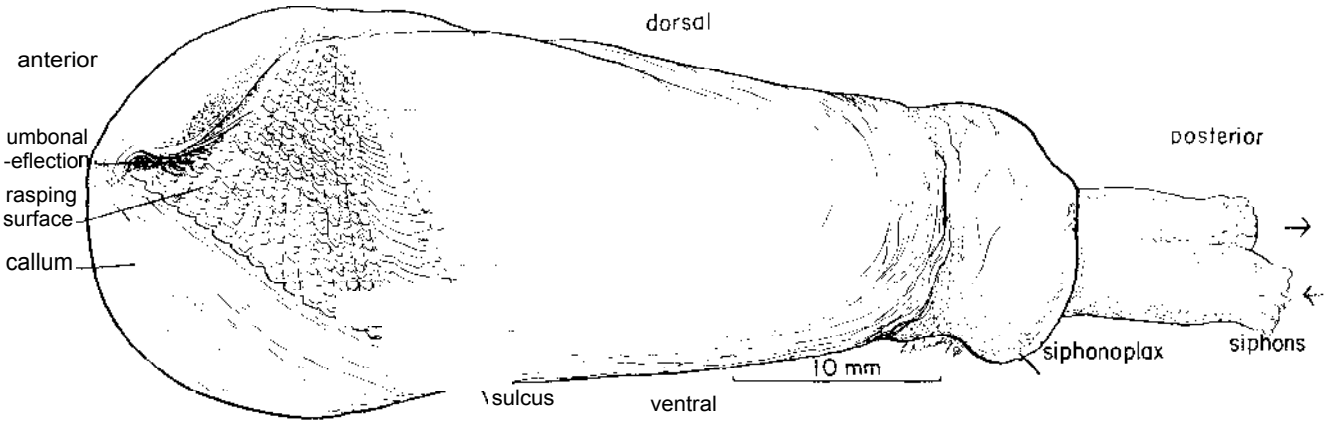
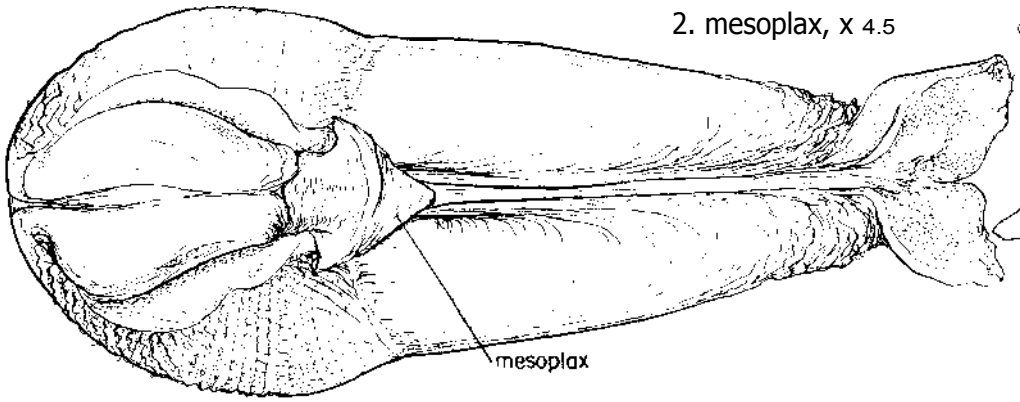
Penitello pen ito

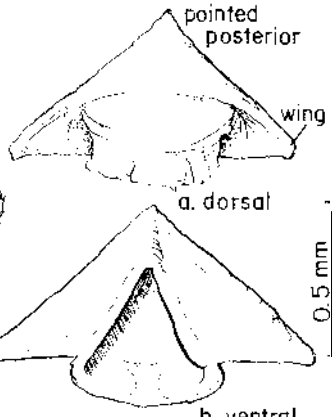


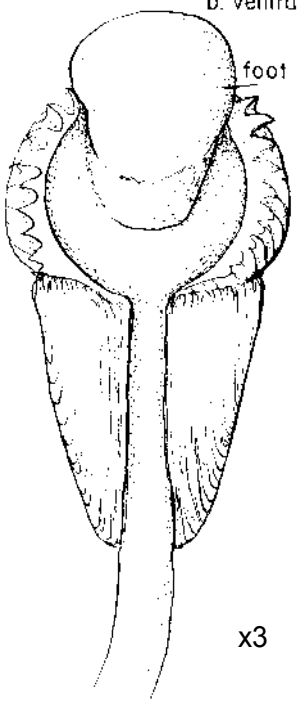
I. Penite//o penita x 3; actual length 40 mm, width 18 mm
elongate shell divided into two distinct parts by umbonal-ventral sulcus: bulbous anterior with callum and rasping surface, posterior with concentric striae, truncate end; siphonoplax: heavy, brown flaps; siphons long,white, smooth.

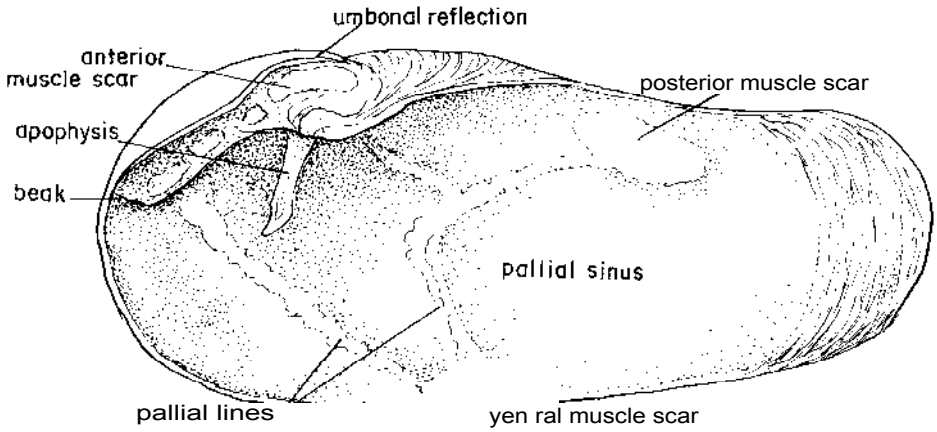


2. mesoplax, x 4.5

3. dorsal view







4. interior, right valve
white; divided into three sections by two pallial lines; three muscle scars; apophysis : long, spoon-shaped.

5.young (Penitella sp.), dorsal
no callum : foot exposed.

Zirfaea pilsbryi (= gabbi)
the rough piddock Lowe, 1931

PHYLUM. *Mollusc:a*
CLASS: *Bivalvia; Heterodonta*
ORDER: *Myoida, Pholadina*
FAMILY. *Pholadidae, Martesii*nae

Description

SIZE-to 115 mm (4 '/2 ")[14]. largest of the boring clams; to 150 mm (6 ") in hard clay.' Coos Bay (Fossil Point) specimens 75-125 mm (3-5").

COLOR-white exterior and interior. (Interior can be light salmon[16]). Siphons gray-white to ivory, speckled with very small (1.5·2 mm) orange chitinous spots; dark red around siphonal openings and incurrent cirri. Fool and mantle wry (preserved)."

SHELL SHAPE--hard, solid, elongate, oval, not globose Shells gape at both ends. Valves divided into two regions:

ANTERIOR--triangular with rough tile-like radial and concentric denticulations which can project into spines on anterior margin (fig. 1). Rasping portion covers half total valve area.' No callum (calcareous anterior accessory plate, see *Penitella);* only protective membrane. Umbonal reflection wide, attached for less than 1/2 length: species *Zirfaea.*[2] Anterior ventral edge of valve strongly angled (fig. 1).

POSTERIOR-with concentric striations only: rounded to truncate (fig. 1). Gapes to the middle of the shell.,

UMBONAL VENTRAL SULCUS -groove separating anterior and posterior sections of valve; conspicuous in juveniles, almost disappearing near ventral margin in older specimens.' (fig. 1)

MESOPLAX-small accessory dorsal plate: only one present in this species. Weak and reduced'; with transverse basal flange well-developed in juvenile (fig. 4a), becoming less obvious in adult (fig. 4b). (Mesoplax often lost in collecting).

SIPHONS-fused, very long (6-8 × shell length): species *Zirfaea.* Siphons non-retractible; covered with small chitinous discs, but without papillae or pustules. No siphonoplax (flaps around siphon, see *Penitella).* Periostracum extends from over Y3 shell posterior to cover part of siphons."

INTERIOR -strong muscle scars: no hinge or ligament: family PholadidaeJ[3] Pallial sinus broad and deep, nearly to urnbo (fig. 3).

APOPHYSIS (MYOPHORE)-broad, with rounded spoon-shaped end (fig. 3).

BODY--foot round, truncate.16

Possible Misidentifications

There are several burrowing clams; the Pholadidae can be distinguished by their distinctively marked body areas. The genus closest to *Zirfaea,* and most likely to be confused with it, is *Penitella. Penitella's* valves are also divided into two distinct sections; it differs in having a calcareous anterior callum, or accessory plate (in the adult); a posterior which gapes only at the end, not to the middle of the shell (it has no anterior gape); the apophysis is narrow, not broad. No *Penitella* species has a siphon longer than its body; all *Penitella* species have retractable siphons. There are four species of *Penitella* in our area:

Penitella conradi is very small and is found in *Mytilus* or *Haliotus* (abalone) shells; it has a siphonoplax lined with coarse granules *(Zirfaea* has no siphonoplax2).

Penitella gabbi is also small (up to 75 mm) with a warty, creamy-lemon colored siphon; it is not common.

Penitella penita, the common piddock, has a heavy membraneous siphonoplax, a calcified callum and a distinctive mesoplax. Its anterior rasping surface covers less than half the valve area.' It can be up to 70 mm long.

Penitella turnerae is larger than *P. penita* (to 125 mm), and less common. It is stout, and like *Zirfaea* lacks a siphonoplax. It has a distinctive, rounded mesoplax, however, and its long, white, retractable siphons are tipped with solid red. Like *Zirfaea,* it has a strongly angled anterior ventral edge; unlike *Zirfaea, P. turnerae* has a callum.

With adult specimens, it should be easy to tell *Zirfaea* from *Penitella* by its long, non-retractable siphon and by the membraneous covering of the anterior, instead of a calcareous callum. Small shells without the callum could be young *Penitella* as well as mature *Zirfaea:* size at maturity varies greatly with environmental condition.

Zirfaea crispata is a small Atlantic species without chitinous spots on the siphons. It may have been introduced into Humboldt Bay, California with eastern oyster spat *Crassostrea.Th*

Ecological Information

RANGE-Eastern Pacific: Bering Sea to San Diego, California; holotype: Bolinas Bay, California." Genus: Colder waters of northern hemisphere."

LOCAL DISTRIBUTION--Coos Bay: South n, Fossil Point; Tillamook Bay, Netarts Bay, Yaquina Bay': Sinsinyv River.,

HABITAT--bores into shale, clay, sand or mud, 9ift as soft rook, to depth of 10-14 ". [16] Found mostly in estuaries, often on open coasts where soft substrates do not survive'. goes i:or tit tightly into burrow as do some pholads.'

SALINITY----

TEMPERATURE-cold to temperate waters.

TIDAL LEVEL-intertidal to keep water."

ASSOCIATES-other nestling and burrowing clams: *Penitella, Hiatella, Entodesrna, Adula,* etc. Pea crab *Opisthobus,* flatworm Cryotophallus magnus.'

Quantitative Information

WEIGHT-

ABUNDANCE-can be quite dense in locally suitable conditions; third most abundant pholad at Fossil Point, Coos Bay, after *P. penita, P. gabbi.2*

Life History Information

REPRODUCTION-spawning (southern California) July.'

GROWTH RATE--animals grow throughout life, unlike *Penitella.* etc.

LONGEVITY-7-8 years.1°

FOOD-a suspension feeder.

PREDATORS-flatworms.

BEHAVIOR-burrowing achieved by attaching food by suction, rotating shells A, circumference of burrow, reattaching foot and scraping again. *Zirfaea* is unusual in pholads for its indeterminate growth: it grows and burrows during its entire lifetime.' Makes pear- rather than cone-shaped burrow.'

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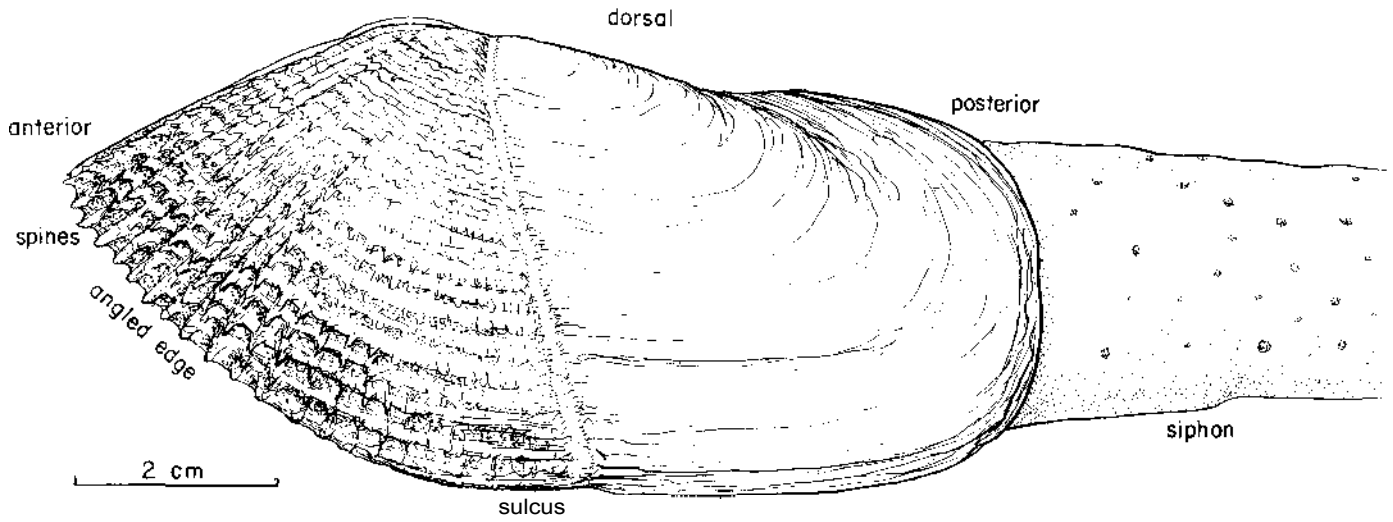
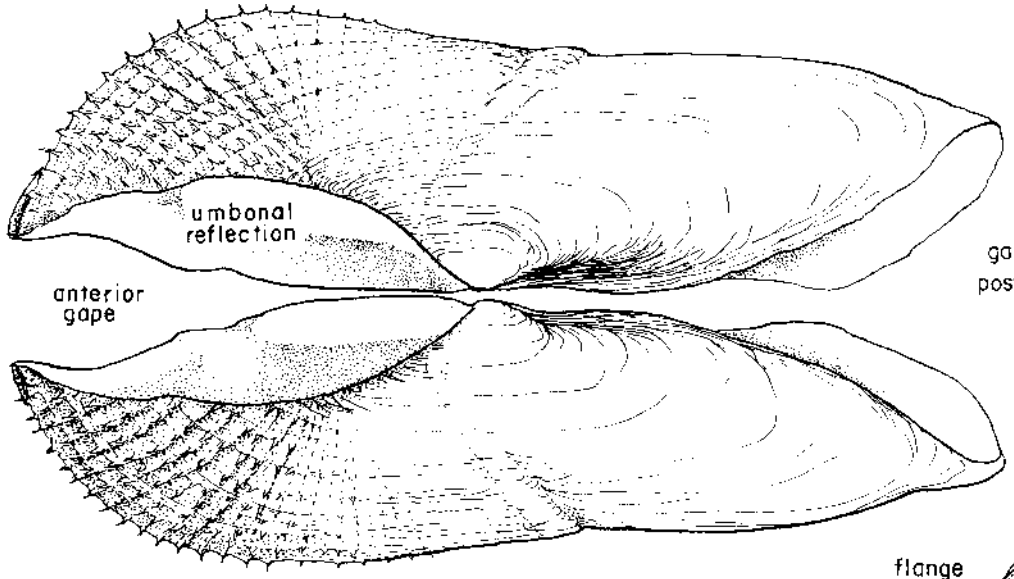
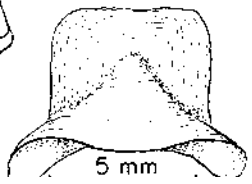
Zirfaeo pllsbryi



Zirfaeo pilsbryi **x1.5** actual length 93 mm
elongate shell divided by umbonal ventral sulcus into anterior: triangular rasping surface, spined angled edge without cal Juni; poster truncate,, with concentric striations only; siphons long, not retractible, with small chitinous patches.



2. dorsal view

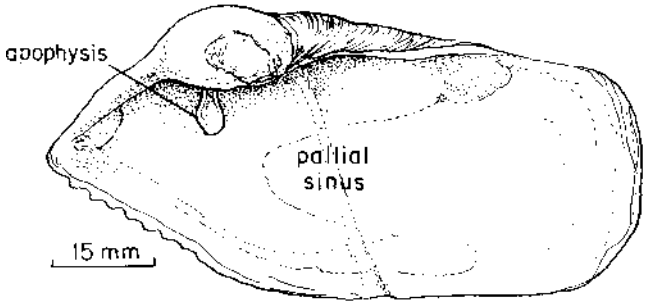


4a. mesoplax, juvenile x5.5
strong transverse basal flange.

Ea N111
5 mm

4b. mesoplax, adult x 3.5
flange obscure.

(both from Turner,l954)



3. interior, right valve x
pal I ial sinus broad, deep;
apophysis spoon-shaped.

Bankia setacea (formerly *Xylotrya)* the northwest shipworm (Tryon, 1863)

PHYLWA: *Mollusca*
CLASS: *Bivalvia; Heterodonta*
ORDER: *Myoida*
FAMILY: *Teredinidae*

Description

SIZE-the largest of the shipworms, its burrows can be one inch in diameter, three feet long in uncrowded conditions, 976 mm in length, 15 mm diameter' ; present specimens small: shell diameter, 5 mm.

COLOR-white. with brownish tinges.

SHELL-bizarrely modified bivalve: reduced, sub-globular, gaping widely in front for the foot, and behind for the body [2]; each small valve with three lobes: anterior, median (with three separate areas), and posterior, or auricle (figs. 4a, b, c). In *Bankia,* the anterior lobe is fairly small, and has many numerous, close-set ridges; auricle medium sized, rounded. Apophysis (fig. 4b); attachment for some foot muscles [2]. Articulating condyles (pivots) on ventral margins (not shown).6

BODY-can vary greatly, to 1m [6]; a long soft whitish tube connecting the calcareous shell and pallets (fig. 1).

PALLETS-two calcareous, feather-like structures, attached to the animal's posterior end under a fleshy collar (fig. 1); used to close the burrow when animal is disturbed; symmetrical, compound structures: come-in-cone segments with margins drawn out into slender projections connected by a membrane [2]: (fig. 2). Visible pallets are those of dead animals.

BURROW-sinuous, showing pattern of shell's grinding surface; sometimes with calcareous tube (made when animals stop boring'); burrows deep into wood, not just along surface.

Possible Misidentifications

Teredo navalis, the common cosmopolitan shipworm, was introduced to San Francisco around 1910[2]. It is rare in Puget Sound, and probably also in Oregon. Teredinidae are distinguished almost entirely by their pallets, there being such variation in shell shape. *Teredo* sp. has simple pallets, without the separate conical elements of *Bankia. Teredo* causes more damage than *Bankia,* being much more adaptable to extremes of temperature and salinity. *Teredo navalis* is usually much smaller than *Bankia setacea;* its burrows are nearer the surface: Other *Bankia* species are warm water animals, and do not range north of San Diego2.

Ecological Information

RANGE-Kodiak Island to San Diego: type locality: San Francisco Bay.

LOCAL DISTRIBUTION -Oregon's coasts and estuaries; Coos Bay: Charleston boat basin.

HABITAT -wood: floating or piles: great efforts have been made to discourage settlement; some of man's repellents slow, but do not completely deter the shipworm. Does not burrow in buried wood.6

SALINITY-prefers full strength sea water of open oceans. Doesn't tolerate reduced salt conditions. [8] Can live in waters above 50% seawater.6

TEMPERATURE -likes cold; eggs laid during coldest months; limits (Puget Sound): 7-12°C3.

TIDAL LEVEL-sea level down to "mudline"; as deep as 200 feet (Monterey Bay)'; densest one foot above mudlinel.

ASSOCIATES -small isopods: *Limnoria,* a borer, and non-boring species; sphaeromids, asellota; *laniropsis kincaidi der-jugini* was found in Charleston harbor with *Bankia.*

Quantitative Information

WEIGHT-

ABUNDANCE-as many as 240/sq. ft. at 200 ft. deep[2] fewer in shallower water2

Life History Information

REPRODUCTION all young are first males; about half develop into females later. [6] Eggs laid and fertilization occurs outside burrows during coldest temperatures; planktotrophic larvae have long pelagic life (can swim up to four weeks)'; many eggs,[2] few larvae. Larvae (0.25 mm long and looking like typical clams) must settle on wood or perish.6

GROWTH RATE-settlement greatest in fall. begins again in spring (Friday Harbor)[3], in Monterey. settlement greatest in February, numbers never high in any one month: initial boring done by larva; pin-sized hole enlarged within as animal grows. Growth rate temperature dependent: slowest under 10°C (a[y]. 50 mm/no.), fastest at over 10°C. (a[y]. 100 mm/mo.); greatest individual growth: 610 mm/5 mos; greatest burrow diameter, 12 mm Quayle, 56, 59, inl.

LONGEVITY -longest lived individuals 8-14 months in Monterey Bay study2.

FOOD-wood: shipworms are able to digest cellulose. Also eats plankton.6

PREDATORS-

BEHAVIOR -young *Bankia* follow grain of wood. Burrows are parallel and do not intersect. Can destroy untreated soft wood in less than a year.6

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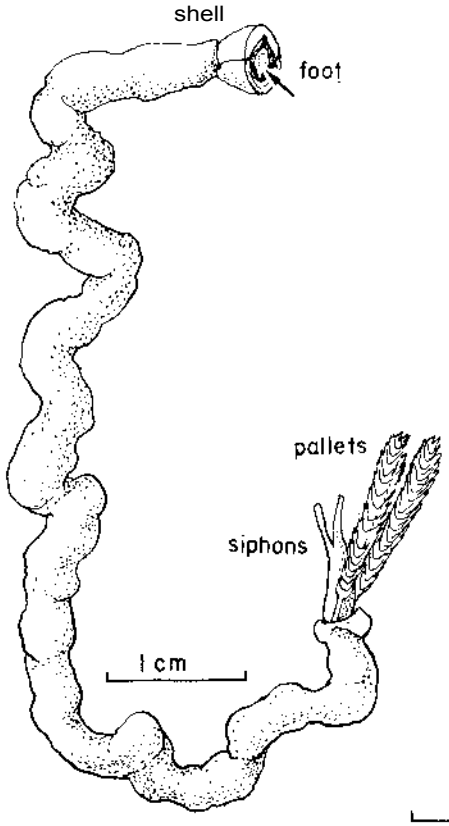
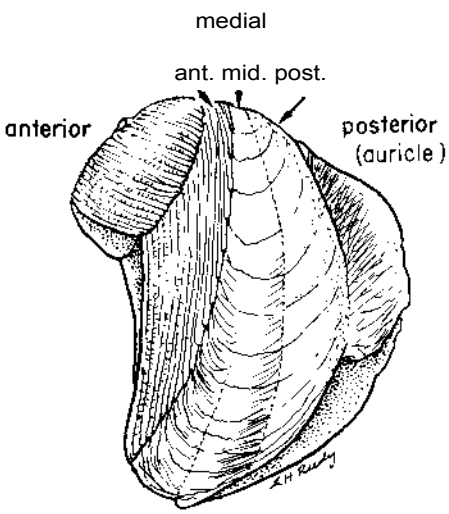
Bankia setacea

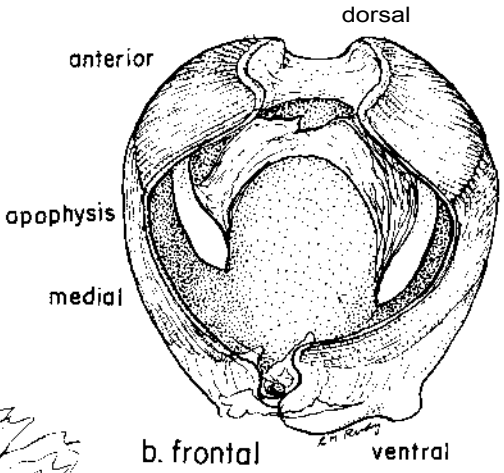


1 *Bankic setaceo* x2
actual shell diameter: 5 mmi
(can be up to 15 mm);

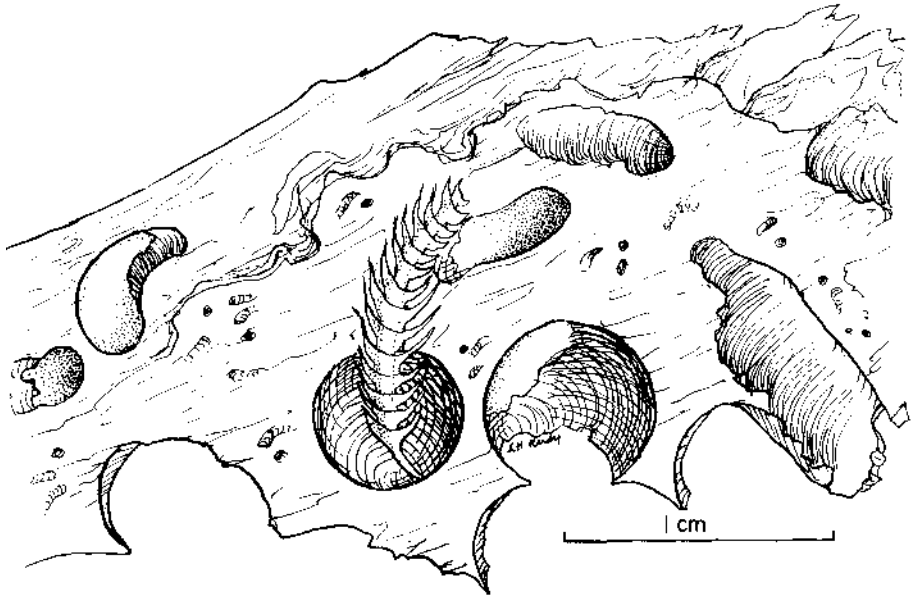
2. pallet x 12
cone-in-cone segments with slender projections, connecting membrane.



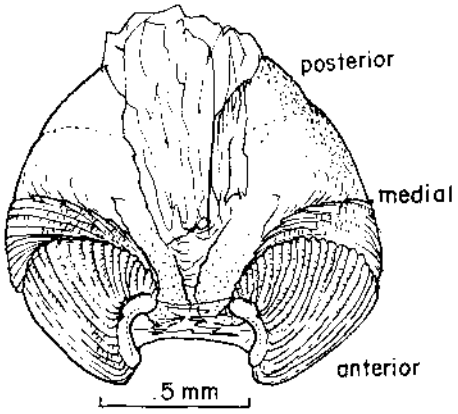
a. left lateral
showing lobes.



b. frontal



3.shipworm burrows x4
several sizes, some calcareous; pallet of dead animal.



c. dorsal

4.a.,b.,c., shell x

Entodesma saxicola (= Lyonsia)
the rock-dwelling entodesma (Baird, 1863)

PHYLUM: *Mollusca*
CLASS: *Bivalvia, Anomalodesmata*
ORDER: *Pholadomyoida*
FAMILY: *Lyonsiidae*

Description

SIZE-to 150 mm (6 inches)[8]; largest of family (Dall in [6]); (this specimen 60 mm long, 40 mm wide).

COLOR-exterior white but covered with abundant brown, transversely striated periostracum. Interior pink, nacreous (pearly): family Lyonsiidae.9

SHELL SHAPE-oblong (valves longer than high); posterior gaping, truncated; shells strongly deformed by nestling habit. Exterior rough, with concentric striations, coarse or irregular ribs,' or not radial ribs.' Ventral margins flex, gape; left valve slightly larger than right. [6] Shell brittle, breaks easily.

BEAKS-large, incurved [6]; close to anterior end (fig. 2); urn-bones do not touch" (fig. 2).

INTERIOR -pearly and iridescent; pallial line solid, not in patches[9]; pallial sinus obscure, angular[6]; two adductor muscle scars of equal size (different shapes) (fig. 3).

HINGE AREA-no true teeth or chondrophore (fig. 3).

LIGAMENT-internal: family Lyonsiidae. [9] Ligament is small, reinforced with a large lithodesma or ossicle, a calcareous plate (fig. 3).

PERIOSTRACUM-coarse, heavy, does not extend beyond shell posterior (not shown). Periostracum often cracks shell as it dries; this can be prevented in collecting by applying a lubricant like vaseline.'

SIPHONS-short, not red-tipped (not shown).

BYSSUS-(attachment threads): species characteristic [s] (not shown).

Possible Misidentifications

Of the nestling or burrowing clams of our estuarine rocky intertidal, most of the pholads can be immediately distinguished from *Entodesma* by their file-like denticulations anteriorly, and by the two distinct sections of each valve (see *Penitella, Zirfaea).* The nestling habit of some clams can distort shell shape and make identification difficult: *i.e. Protothaca staminea* var. *orbella).*

Hiatella arctica (= Saxicava) is a very similar, often deformed nestling clam. It can be most easily told from *Entodesma* by its white, porcelain-like interior' (not pink and pearly), and by its broken pallial line. It also has very distinctive red-tipped siphons, which *Entodesma* does not.

Petricola carditoides has an external ligament and 2-3 cardinal hinge teeth, as well as some radial sculpture. It is chalky white, with purple-tipped siphons,' and usually is narrower posteriorly than anteriorly. It lives in pholad burrows.

A myid clam, *P/atyodon cancellatus,* is another rock dweller, but it is a burrower, not a nestler. [8.9] It has a chondrophore and tooth in its hinges, fine, almost lamellar concentric exterior sculpture, and a white interior" with a well-developed pallial sinus.

Of *Entodesma's* family, Lyonsiidea, *Lyonsia* sp. is not distorted by nestling, and has fine radial lines and a pearly exterior. Two species, *L. californica* from mud and a northern one, *L. pugettensis* from sand, could be present.

There is another species of *Entodesma, E. inflatum,* smaller (up to 25 mm) and lighter in color than *E. saxicola.* It lives in compound ascidians[9] or in sponges (called *L. (E.) inflata* by Kozloff).

Ecological Information

RANGE-Aleutian Islands to San Diego, California.

LOCAL DISTRIBUTION-Coos Bay: Fossil Point.

HABITAT-among rocks in crevices and abandoned pholad burrows; also attached by byssus to floats, pilings.

SALINITY-collected at 30 o/oo salt.

TEMPERATURE-

TIDAL LEVEL-intertidal; subtidal to 45 fathoms.'

ASSOCIATES-other nestling and burrowing molluscs: *Hiatella, Zirfaea, Penitella,* etc.

Quantitative Information

WEIGHT-

ABUNDANCE-common (Puget Sound[8]); present but not common in Oregon.

Life History Information

REPRODUCTION-hermaphroditic, with external fertilization: eggs and sperm emitted alternatively.8

GROWTH RATE-

LONGEVITY-

FOOD-suspension feeder.

PREDATORS-

BEHAVIOR-adapts to its particular rocky niche by changing its shell shape as it grows.

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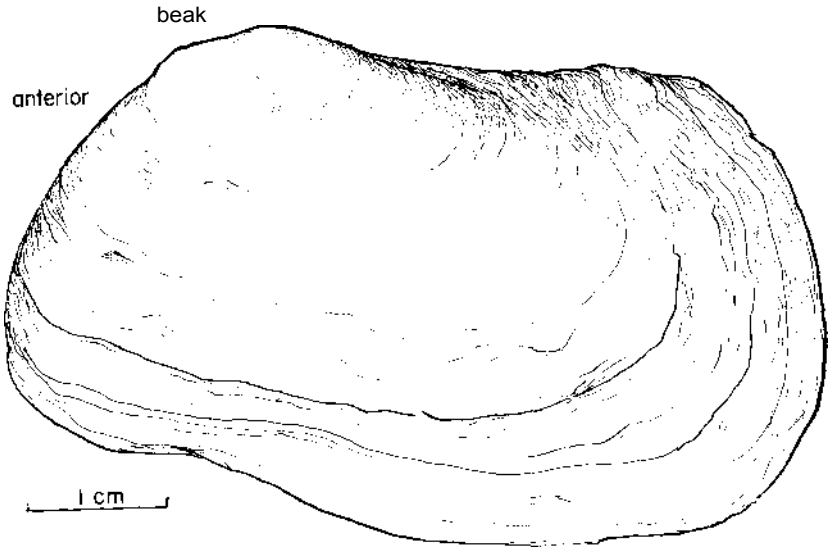
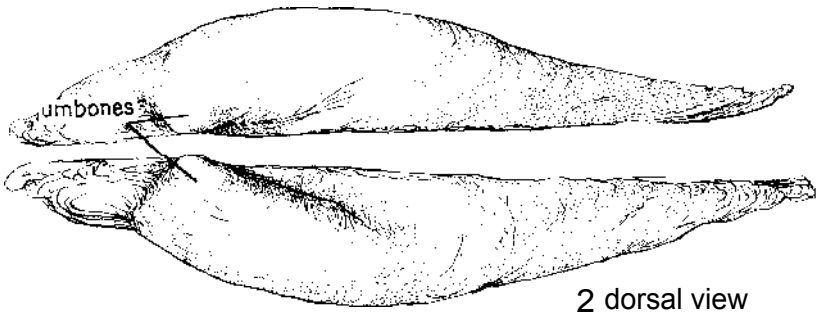
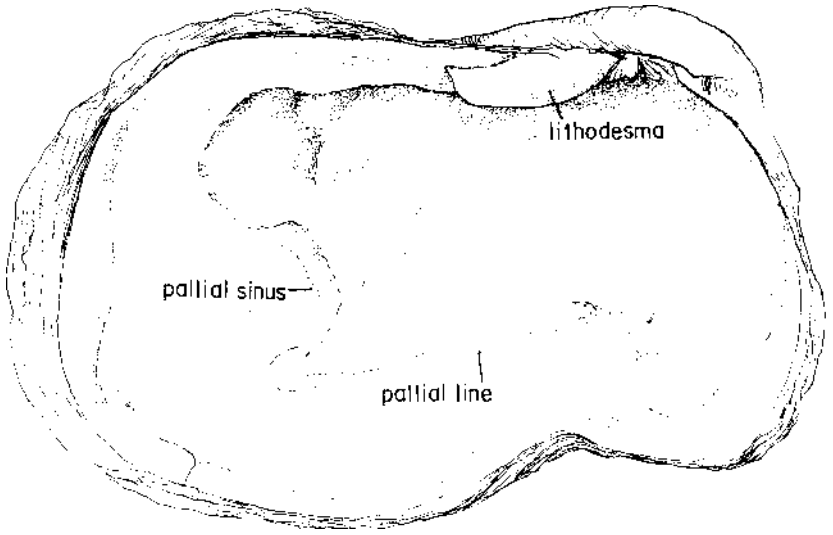
Entodesmo soxico/o

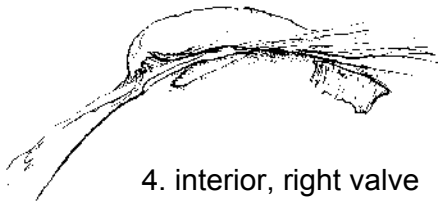


l. Entodesma soxicoto x 2. actual length 60 mm
shell oblong, deformed; concentric striations, rough periostracum; beaks near anterior ends posterior truncate.



2 dorsal view
beaks large, incurved; umbones not touching; posterior gaping.





4. interior, right valve

3. interior, left valve
pearly, iridescent; hinge area without teeth or chondrophore; lithodesma reinforces internal ligament, pal lial line solid, pallial sinus present but obscure.

Collisella digitalis (= *Acmaea*)
a fingered limpet (Rathke, 1833)

PHYLUM: *Molluscs*
CLASS: *Gastropoda, Prosobranchia*
ORDER: *Archeogastropoda, Pateltacea*
FAMILY: *Acmaeidae*

Description

SIZE-about 25 mm (one inch); largest 30 mm [4]; average under 15 mm [13]; this specimen 20 mm,

COLOR-greenish gray to dull brown; large solitary animals sometimes more brilliantly marked [13]; ribs usually not lighter than spaces between them"; always a solid brown spot 'owl-shaped' inside shell on the apex (fig. 3); a horseshoe-shaped muscle scar open at the anterior end (fig. 3)5

SHELL SHAPE-oval, caplike, fairly high elevation (but not all as high as this specimen, fig. 2); apex above or even overhanging anterior margin, forming hook. Strong rough ribs on posterior slope, forming moderately scalloped edge (fig. 1), may be absent on anterior slope. Posterior convex, anterior concave (fig. 2).

BODY-no dark spots on head or sides of foot: species characteristic; a pair of uncini (flap-like structures) on basal plate of radula (inside mouth), a remnant cf marginal teeth,: genus Coll/se/la. This characteristic observable only by a drying and staining lab preparation. (Not figured.)

Possible Misidentifications

There may be as many as 15 species of rocky intertidal limpets on our coast; few are as adaptable as C. *digitalis* in tolerating different habitats, especiaiiy in estuaries. (C. *digitalis* and C. *pelts* are the only limpets which penetrate very far into Coos Bay's estuary).

Collisella pelta, sometimes estuarine, has heavy ribs like C. *digitalis,* but lacks the concave anterior slof,e. et Inc: latter (its anterior slope is convex). Its apex is suhcentrai, not near the anterior margin; its ribs are usually equally developed on all slopes, and it is smoother than C. *digitalis.* It can have a pattern of radial bands or of white checks. It occurs at lower tidal levels than does C. *digitalis.*

The above limpets of the fan-illy Acmaeidae differ from the Patellidae in having only a single ctenidium ,leather-shaped gill): (figure 4). Other genera of Acinaeidae besices *Collisella,* above, cannot be keyed by shell atone: differences in radula are important as well.' General ways of distinguishing them by shell include the following:

Acmaea sp. have a nearly central apex, the shell is white to pink-rayed, and the radula is adapted for browsing on coralline algae. They are chiefly sublittoral. (The name *Acmaea* once encompassed those limpets now called *Collisella* and *Notoacmea.* These have now been divided' *Collisella* sp. have uncini (marginal teeth) on the radula; they have fine to heavy radial ribs and an apex anterior to the center as well as a convex posterior slope. *Notoacrnea* lack the uncini on the margin of the radula; they are not heavily ribbed, the apex can be subcentral to quite anterior.) *Notoacrnea persona,* a nocturnal limpet preferring shade and caves as a habitat, has an anterior apex directed anteriorly, and a straight anterior slope; the posterior slope is convex. The surface has fine regular striae, not strong ribs. *N. persona* can he large (53 mm) and is found above *Collisella* in the tidal zone.[3] It is chiefly an inhabitant of the open coast, but has been found in quiet waters in Puget Sound.,

Notoacmea scutum is a thick shelled, rather flat limpet with a subcentral apex, a coarse sculpture of flat ridges, (actual radial lines). It is occasionally found in bays (Puget Sound).'

Two other species of *Collisella* have heavy ribbing, and could be confused with C. *digitalis;* they also inhabit similar territory, at least on the outer coast. The chief inhabitant of the high splash zone is the rough limpet, C. *scabra,* with strongly projecting ribs, a strongly scalloped margin, low profile, and both posterior and anterior slope being convex. It has distinctive black spots on its head and on the sides of its foot. It prefers gently sloping or horizontal surfaces. Its range is generally too far south for Oregon.

C, *strigatella,* formerly C. *paradigitalis,* was once thought to be a 'hybrid' of *A. digitalis* and A. *pelta,"* It is the closest species to C. *digitalis,* but is smoother, has fine radial lines, but no ribs; a convex posterior, slightly concave anterior slope, and is only to 20 mm in length. its apex is often eroded. The interior is glossy, bluish white with brown stains, and with the outside pattern showing through.' The animal is completely white. This species is found with C. *digitalis* at Coos Head, just inside the bay entrance, under marine conditions.,

Ecological Information

RANGE-Unalaska Island south to Guadalupe Island, Baja California.

LOCAL DISTRIBUTION-outer coast; bays: Coos Bay-Coos Head, lower South Slough.

HABITAT-prefers steep slopes in upper (splash) zone°; pilings (in bays); tolerates 'variable and hazardous' conditions': mud, swirling sand, debris, industrial pollution, sewage, strong wave action. In lower levels (Ricketts' zone 2) lives among barnacles, algae on flat surfaces. This specimen on a log. Avoids dessication but tolerates and requires aerial conditions' Found on 'virtually all hard substrates."

SALINITY-tolerates a wide range, from concentrated sea water to fresh water."

TEMPERATURE-a cold water species; tolerates high temperatures less well than does C. *scabra."* Found more commonly in winter than summer (central California").

TIDAL LEVEL-oldest and largest animals are found highest', found from higher high tides up into splash zone (Ricketts' zone 1); adapted to dessication better than most limpets, and is never found permanently submerged"; lower limit: zone 2, at about mean high water.

ASSOCIATES-in flat areas of zone 2: algae, barnacles, amphipods *Orchestoidea, Orchestia;* gribble *Limnoria,* littorine snails, insects (springtails). On vertical rock surfaces, Coos Head: C. *paradigitalis (strigatella), Balanus glandula, Littorina scutulata, Collisella pelts* (at lower limit).' On pilings: *Balanus.* In California: *Collisella scabra, Lotto gigantea* (at lower limit).°

Quantitative Information

WEIGHT-

ABUNDANCE-most common upper intertidal limpet in Oregon'; within its range, common from Monterey north." Tends to aggregate."

Life History Information

REPRODUCTION-separate sexes; eggs and sperm shed into sea; length of planktonic life unknown.° Spawning winter and spring'; peak recruitment: spring,

GROWTH RATE-very consistent'; fastest fall and winter. stopped in summer; growth decreased by crowding.

LONGEVITY-occasionally six years.'

FOOD-encrusting microalgae: blue greens, diatoms.'

PREDATORS-sea stars, oyster catchers; shorebirds, *Pachygrapus.12*

BEHAVIOR-does not 'home' precisely like C. *scabra,* but has a home range' Has a seasonal vertical migration: higher in winter (with higher waves). Secretes mucus sheet between itself and substrate to aid in slowing dessication. and because it doesn't fit precisely into the rock. Can accumulate large concentrations of lead *(ie.* animals under Golden Gate Bridge).12

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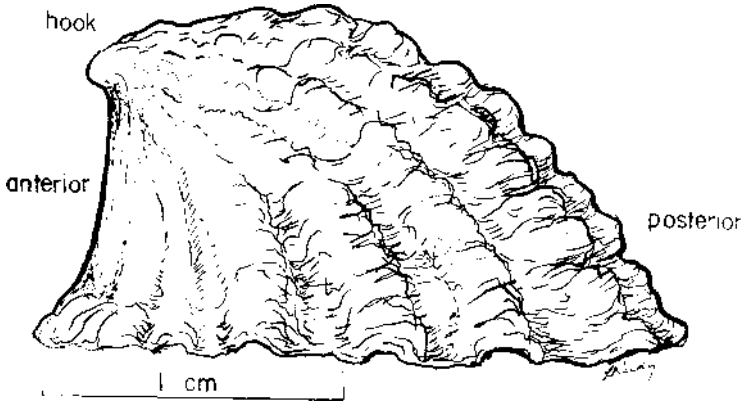
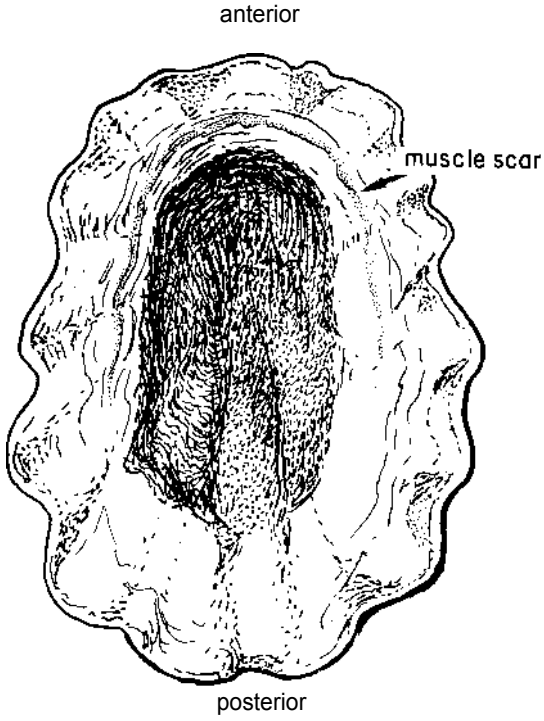
Colliseki digito/is

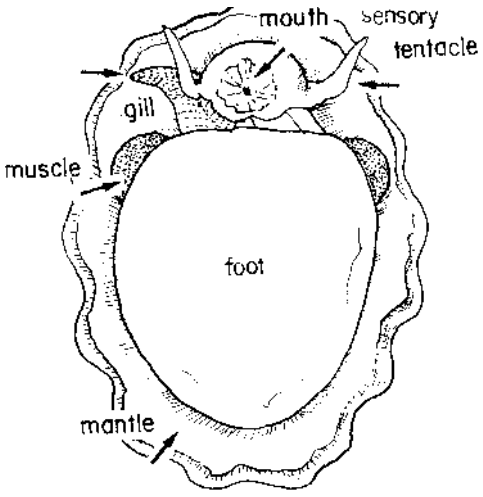
l. Co/lisello x 4 dorsal
actual length 2 cm; strong ribs; scalloped edge; rough surface.



2. lateral x 4
moderate elevation; apex hook-like, near anterior end, anterior slope concave; posterior slope convex.



3. shel l interior x 4
solid brown spot at apex)
horse-shoe shaped muscle scar



4.schematic of animal ,ventral

Collisella pelta (=Acmaea)
the shield, or helmet limpet (Rathke, 1833)

PHYLUM: *Mollusca*
CLASS: *Gastropoda, Prosobranchia*
ORDER: *Archeogastropoda, Patellacea*
FAMILY: *Acmaeidae*

Description

SIZE-25mm'; can reach 40 mm farther north': this specimen, 32.5 mm.

COLOR—extremely variable; called the brown and white shield limpet by Ricketts' [2]; gray, slightly raised ribs with white between them; some specimens without ribs, but with a checkered or striped pattern. Slightly hooked apex eroded.

SHELL SHAPE—elevated (height usually greater than 1/3 length' [3]; surface with fine regular ribbing; anterior space straight or very slightly concave: apex subcentral, very slightly directed anteriorly (fig. 2); posterior slope slightly convex, nearly straight.' Margin slightly scalloped.

INTERIOR—blue gray to white, with subapical brown spot (fig. 3), arid horseshoe-shaped muscle scar joined by a thin, faint line (fig. 3).6

YOUNG—some subadults (over 6 mm) with dark brown exterior, lustrous, smooth and with fine radial sculpture, living on alga *Egregia.* Interior light brown to gray, with postapical brown spot. *(Notoacmaea insessa,* to whom these subadult *peltas* are so similar, is dark brown inside.)

Possible Misidentifications

Although a very many species of limpets of the family Acmaeidae occur on our coast; only about four are found in estuarine conditions. These belong to two genera, *Collisella* and *Notoacmea,* both of which have a horseshoe-shaped muscle scar on the shell interior, joined by a thin curved line; an apex anterior to the center; and various coloration, but not pink-rayed or white. These two genera differ mainly in that *Collisella* has a pair of uncini or teeth on the radula (not figured), while *Notoacmea* does not. Also, *Notoacmea* sp. are usually not heavily ribbed, while *Collisella* species are.5

Collisella digitalis, the common fingered limpet, differs from C. *pelta* in having an apex very close to or even overhanging the anterior margin, which forms a strong hook; its anterior slope is concave. This species has strong raised ribs and a moderately scalloped edge; its rough ribs may show only on the posterior slope. It occurs higher in the tidal range than does C. *pelta.*

Collisella strigatella, once thought to be a hybrid of *Acmaea digitalis* and *A. pelta,* has been found just inside Coos Bay. Like C. *digitalis,* it has a hooked apex near the anterior margin, and a slightly concave anterior slope. It is small, growing only up to 20 mm, and smooth, with fine radial lines but no ribs.

A bay dwelling form of *Collisella limatula,* C. l. *moerchii,* has a higher elevation than fhe usual form of that species. It has buff and dark mottling, or greenish brown with white bands; its ribs are imbricated (set like tiles); its edges are serrated. It has not been found as far north as Oregon.

Notoacmea scutum, found only occasionally in bays, is thick shelled, rather flat, with a coarse sculptured surface.' It sometimes has radial lines quite like those of C. *pelta.* It has a subcentral apex and a low elevation and is often filmed with

Notoacmea persona is also found in hays. It is large, nocturnal and smooth. it has an anterior hooked apex and is dark brown with white checked edges.

Young C. *pelta* can resemble the limpet *Notcacmea insessa* which lives only on the marine alga *Egregia. N. insessa* adults are brown, translucent and smooth. (See *young,* above).

Ecological Information

RANGE—Aleutian Islands to Punto Santo Tomas, Baja California.12

LOCAL DISTRIBUTION—Coos Bay. South Slough.

HABITAT onrocks (locally), also with various algae in mussel beds [13], 'eurytopic'; South Slough: on floats, under rocks.

SALINITY--collected at 30 oleo seawater.

TIDAL LEVEL—just below C. *digitalis* and *N. persona* (Puget Sound); on rocks usually uncovered by the tide. On outer coast—upper mid- to lower mid-intertidal.'

ASSOCIATES—Collisella *digitalis;* in mussel/barnacles association on pilings. With algae *Egregia, Postelsia Laminaria, Endociadia.*

Quantitative Information

WEIGHT-

ABUNDANCE—not common in bays; relatively common on outer coast.'

Life History Information

REPRODUCTION—separate sexes; eggs and sperm shed into sea; length of planktonic life unknown.' Active throughout year; spawns at sea temperatures of 48.5°-60°F.3

GROWTH RATE— probably grow faster than C. *digitalis;* to 30 mm in 3 years."

LONGEVITY

FOOD—a grazing herbivore, especially on red and brown algae."

PREDATORS—seastars: *Pisaster ochraceus* for which it has developed an escape mechanism.'°

BEHAVIOR --

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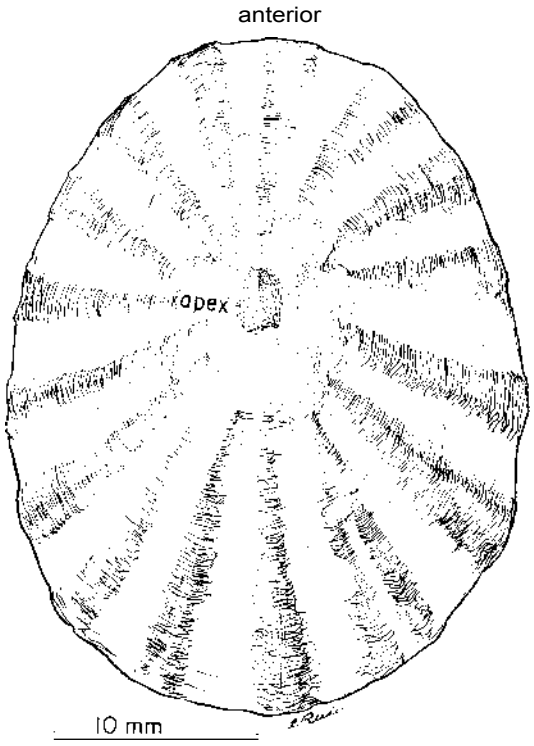
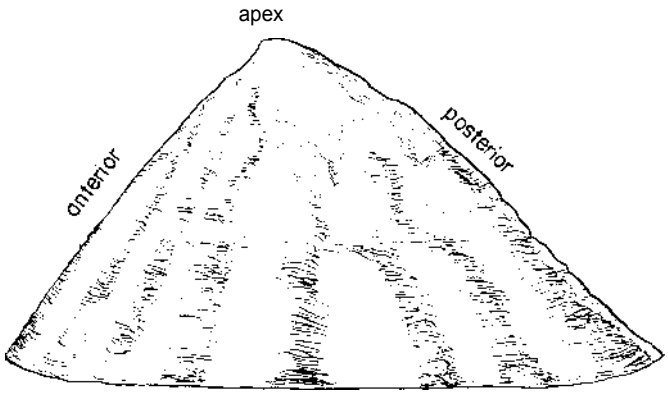
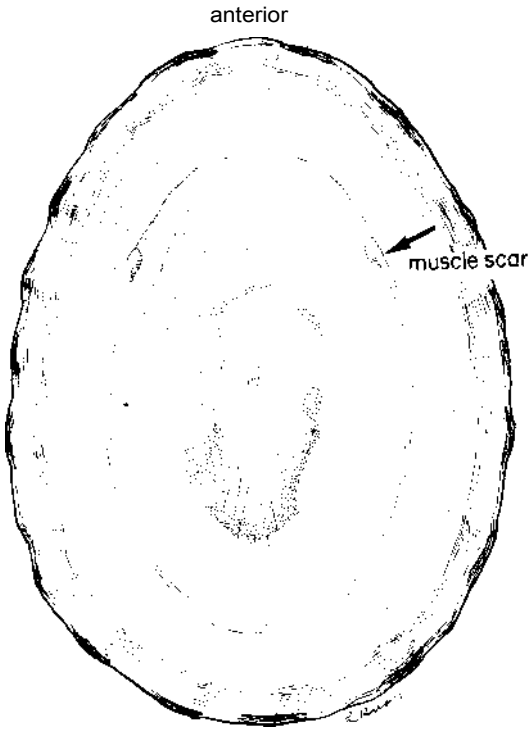
Co/lse/14a pelt°



1. *Coll/se/lc pe/ta* x 3
actual length 32.5 mm, width 24mm;
uniform gray. low ribs; apex subcentral;
margin slightly scalloped.



2. lateral view, x 3
actual height 17 mm
anterior slope straight, posterior
slope slightly convex.
apex subcentral, slightly hooked.



3. interior
horseshoe-shaped muscle scar
joined by thin line; subapica I brown spot.

Tegula funebralis
the black turban or top shell snail (A. Adams, 1855)

PHYLUM: *Mollusca*
cuss: Gastropoda, Prosobranchia
ORDER: *Archeogastropoda*
FAMILY: *Trochidae, Monodontinae*

Description

SIZE-to 50 mm or more high," usually less than 25 mm'; this specimen 20 mm diameter, 17 mm high.

COLOR-exterior purplish-black, not shiny; with white eroded apex. Gray when dry. Interior white with a black margin; a pearly or "rainbow" deep interior patch. White around columeila.' (fig. 1)

SHELL SHAPE-strong; four inflated whorls; rather top-shaped, (conical) with a flat base; round aperture, nearly round, horny operculum: family Trochidae.' Small snails are about as high as wide (figs. 1, 2); older ones become higher than wide.'

SCULPTURE-below the suture is an impressed line,' or a scaly band". "foliaceous incremental (Pilsbry, 1889 in ") (figs. 1. 2). Whorls "spirally lirate," *i.e.* having up to 17 thread-like spiral lines (figs. 1, 2); sometimes smooth except for base, or strongly sculptured above (fig. 2).

UMBILICUS-covered by a callus, nearly always closed " (fig. 3). Specimens with an open umbilicus do not have a flange between umbilicus and aperture.

COLUMELLA-spirally twisted,' with two denticles (nodes) near base (fig. 3), lower node worn or indistinct.

APERTURE-round, complete; no anterior notch or canal (fig. 3): aperture length less than shell length.

OUTER LIP-smooth, black-rimmed, without sculpture (fig. 3).

OPERCULUM- thin: round, numerous spiral lines; horny, not calcareous (fig. 4).

RADULA-with a single central tooth; 5-7 pointed lateral teeth, 8-10 marginal teeth (fig. 6).

FOOT-long, relatively narrow; with epipodal tentacles along sides: family Trochidae (four on each side: species *funebralis* (fig. 5).

Possible Misidentifications

The Trochidae are herbivorous, conical snails, pearly within, with round, entire apertures and thin horny circular opercula.' The Turbinidae, a similar family, are also conical, but they have a calcareous operculum, and are represented here only by *Astraea,* a large subtidal and offshore species.

The other common genus of the Trochidae is *Calliostoma,* a conical top shell, which is distinguished from *Tegula* chiefly by its lack of denlicles or nodes on the columella. Its whorls are not inflated like *Tegula's. Calliostoma* is found on the outer shores, not in bays; it has many spiral ribs, no umbilicus, and various distinctive colorations.

Snails of the genus *Tegula* have strong columellar nodes, a round, thin, horny operculum with many spiral lines, and a pearly interior. They sometimes have a periostracum. The three other species of *Tegula* found on the Pacific coast are not known to be estuarine:

Tegula montereyi probably does not occur above Bolinas Bay, north of San Francisco; it occupies the low intertidal offshore zone, often in kelp beds. This species is brown, with a strong, open umbilicus and a strictly conical (not inflated) profile.

Tegula pulligo, the dusky turban, occurs in the low intertidal in California; it is the dominant *Tegula* in Puget Sound,' where it occurs in open coasts and in protected situations.' *T. pulligo* has an open umbilicus with the inner lip produced into a flange (it is closed in T *funebralis).* It has a brown (not purple or black) periostracum; its basic color is brown or gray, sometimes with orange, white or brown spots on the edge. Its habitat is open rocky beaches.'

Tegula brunnea, the brown turban, is the closest to *T. funebralis* in Oregon; it does not seem to occur in Puget Sound,' and is very common on the outer shores in Oregon and around San Francisco." It has only one node on the columella, as opposed to *T. funebralis'* two; its shell is brown or orange brown, and it lacks the scaly subsutural band of *funebralis." T. brunnea* is found lower in the intertidal than *funebralis,* or in offshore kelp beds near the surface; probably never in estuaries.

Tegula gallina, the speckled tegula, is gray to green, lacks the scaly subsutural band, and is found south of Santa Barbara. It is closely related to *T. funebralis;* the radulae are quite

Ecological Information

RANGE-Vancouver, B.C.. to central Baja California.'

LOCAL **DISTRIBUTION**-marine portions of large Oregon estuaries; Coos Bay: Pigeon Point.

HABITAT-avoids exposed outer coast situations" although it is found in rocky protected outer tidepools; marine portions of estuaries in rocky situations amongst seaweed' Strongly built: can withstand surf. Females found in more exposed places than males at iow tide.' Species is negatively phototactic: seeks the light."

SALINITY-collected at 30 o/oo salt. Cannot withstand continued exposure to low salinity.

TEMPERATURE-found in temperate waters only. With black color can get quite warm during exposure to sun at low tides.

TIDAL LEVEL-on outer shores, most common at high intertidal (2-0 m'); found in midintertidal as well." In estuary found at 0- + 1 ft. Small snails settle high, live there 5-6 years, then migrate to lower levels (to +0.6- -0.2 m").

ASSOCIATES-on outer coast: slipper shell *Crepidula* and several limpets *(Collisella)* which can be predatory. Empty shells used by hermit crabs.

Quantitative Information

WEIGHT-this specimen 4 gr. wet, with shell.

ABUNDANCE-most abundant mid-intertidal grazer.'

Life History Information

REPRODUCTION-dioecious; eggs and sperm exuded into water. Sexes can be determined by color of foot sole: males are light, females darker; female gonad bright green from egg yolk. Egg masses gelatinous, about 3 mm diameter; several hundred eggs, about 0.19 mm diameter. Breeding probably once a year"; reproductive size of snails 14 mm." Planktonic veliger larvae emerge on 7th day, settle 12th day. Long life of T *funebralis* ensures increased lifetime reproductive effort.'

LONGEVITY-lives up to 30 years; average age may be 10 years.'

GROWTH RATE-young snails grow rapidly: from 4-5.6 mm and 27 mg. a^{y}. wt. (June) to 5.6-9.8 mm. 177.3 mg (following March)." California snails do not show growth rings of Oregon snails, which in older animals reveal an annual winter cessation of growth.'

FOOD-"a catholic feeder"': almost any common alga. Prefers *Macrocystis integrifolia, Nereocystis luetkeana, Rhodoglossum affine, Gigartina canaliculata: i.e.* fleshy forms. If not available, will eat encrusting green alga, *Ralfsia pacifica,* detritus.'

PREDATORS-Pisaster *ochraceus* in low intertidal. Although *Tegula* is not its preferred prey, *Pisaster* can consume over V4 the available snails. · Possibly limpet *Collisella;* carnivorous snail *Nucella;* crab *Cancer antennarius.*

BEHAVIOR-larger animals migrate to lower intertidal. Species is sedentary, aggregates at low tide, moves up to rock tops at nighttime high tides (not diurnal ones)." Territory: tends to live in a radius of about 1.5 m for months; a daily movement of about 1m.' Snails move well on rocks, are clumsy on sand. They place pebbles on the foot to alter balance." Escape predators by sensory perception (seastars), or by crawling onto top of predator's shell (carnivorous snails).

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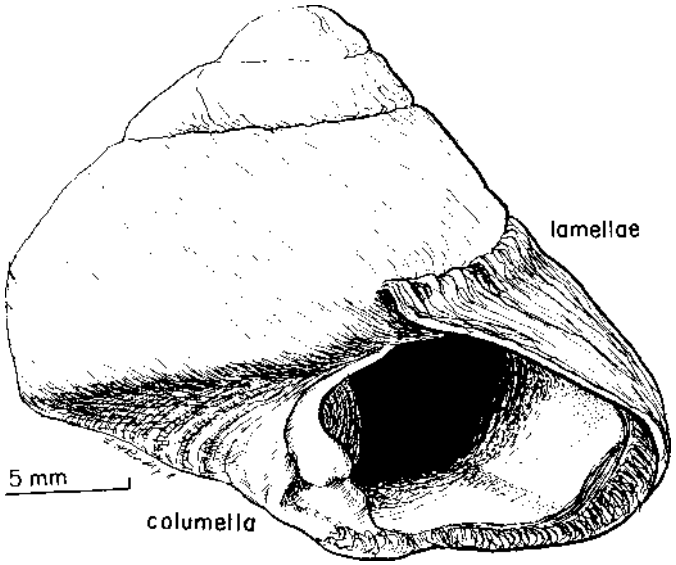
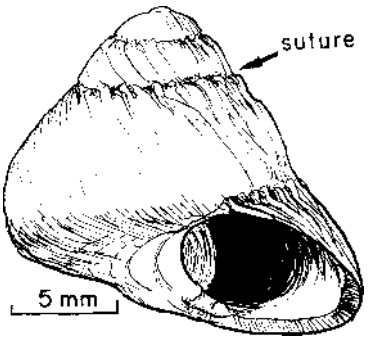
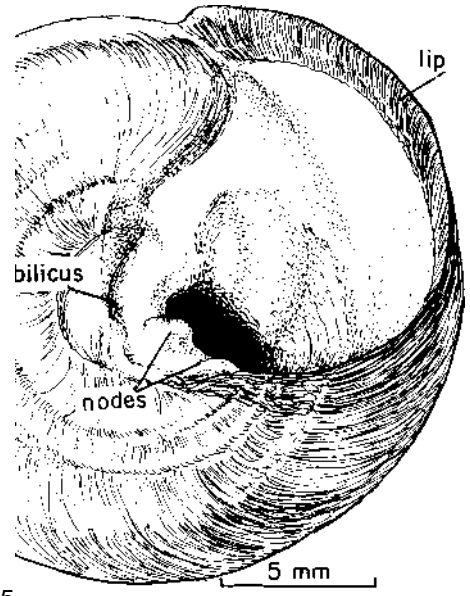
Tegulo funebrolis



l. *Tegula funebra/is* ventral x 5
actual height 17 mm, diameter 20 mm
4 whorls, inflated; eroded spire; elevated lamellae below suture; thread-like spiral sculpture on whorls. base fiat.



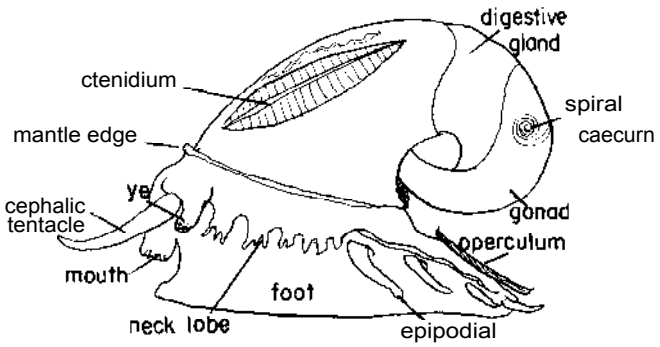
2. variation x 3
strong sculpture on sutures and on whorls.



3. anterior, x 4.5
aperture round, complete; columella white, interior pearly; umbilicus closed; 2 nodes near columella base,

4. operculum x 4
round, horny, thin; many spiral lines.

6.radular teeth xi°o
one large central tooth;
5-7 pointed lateral teeth.
8-10 marginal teeth, last ones serrated.
(from Fritchman,1963).



5.schematic dissection, left si detace
(from Macdonald a Maino,1964,Vel. Suppl.)

Littorina scutulata
the checkered littorine or periwinkle Gould, 1849

PHYLUM: *Mollusca*
CLASS: *Gastropoda, Prosobranchia*
ORDER: Mesogastropoda
FAMILY: *Littorinidae*

Description

SIZE-2-9 mm high, rarely over 10 mm. This specimen 9 mm (fig. 1).

COLOR-pattern of checks: dark brown, purple or black and white, on 'perfect' specimens; but many are eroded or encrusted with algae, etc. Pattern may be of checks, splotches, zig-zags or fine vertical and/or horizontal etched lines. Never with strong spiral sculpture. Interior nearly always purple.'

SHELL SHAPE-shell solid, not thin; taller than wide; conical, four whorls, No columellar groove (inner lip) or chink: growth lines of whorl come right to edge of inner lip (fig. 1).

OPERCULUM-horny, solid trap door, with spiral lines, covering aperture (fig. la).

ANIMAL-dissection, (fig. 3); *Littorina* sp. lack posterior or metapodial tentacles, have only cephalic tentacles.16

Possible Misidentifications

A similar but smaller genus of another family is *Lacuna,* the small 'chink' shell, which has a groove, or chink, between the large whorl and the columella; *Littorina* lacks this groove. The Lacunidae are often found in eelgrass, *(Littorina* is not), and are never in the upper intertidal area, as *Littorina* often is.9

Other species of the genus *Littorina,* sharing the solid shell, and the absence of columellar groove, include at least three other species:

Littorina planaxis is an inhabitant of the outer intertidal rocks, although found in Puget Sound, and occasionally in more marine parts of Oregon's estuaries. It is stout and globose, and usually larger than *L. scutulata,* [2] with a broad, flat, polished columella. [8] *L. planaxis* is essentially a southern form, although it does occur occasionally in Puget Sound, [10] and its niche is generally taken over northwards at about Cape Arago, Oregon, by *Littorina sitkana.15*

Littorina sitkana, a fat, globose littorine, has a rounded columella, and strong spiral ridges on its whorls; it can be white to black, but is often a yellowish brown. [9] A smaller variety was formerly called *L. rudis.* It can be strongly striped, or rough and striated. It is fairly common in salt marshes, and can be up to 15 mm high. [9] (See plate).

Littorina (Algamorda) newcombiana (= subrotundata) is a small, rare salt marsh littorine originally thought to be a freshwater snail. It is light colored, with four rounded whorls, usually striped; the shell is smooth, thin and covered with a brown periostracum; the aperture is almost circular. It is only about 5 mm long, and has a simple gap, (not a groove) between the whorl and the columella.' It is found quite high in the intertidal area of the marsh.

Littorina littorea, is an Atlantic species introduced into California bays 100 years ago; it is quite thick-shelled, globose and colored brown to black, with fine dark spiral bands.' It has not yet been reported from Oregon.16

Ecological Information

RANGE-Sitka, Alaska to Cabo San Lucas, Baja California.

LOCAL DISTRIBUTION-outer coast and bays; Coos Bay: South Slough; Siuslaw River, near Florence."

HABITAT-rocks, pilings; this specimen on rock on muddy beach; occasionally in salt marshes, but rarely if ever in eelgrass. [9] Very tolerant of near-terrestrial conditions.'

SALINITY-found near full sea water on the open coast, as well as in conditions of somewhat reduced salinity. [16] Doesn't penetrate upper (and fresher) parts of estuary (Coos Bay): tolerance level about 22-24 o/oo seawater."

TEMPERATURE-found over a wide range.

TIDAL LEVEL-never more than a few feet above high tide line; found at higher levels in salt marshes'"; "just above the reach of the waves, along the shores of the entire bay" (San Francisco). [14]

ASSOCIATES-barnacle *Balanus.*

Quantitative Information

WEIGHT-

ABUNDANCE-relatively common in rocky areas [2]; probably the most common littorine in bays, as well, at least in more open coastal habitats.

Life History Information

REPRODUCTION-dioecious (separate sexes); most copulation occurs in spring and summer-en masse. A similar European species *(L. littorea) will* lay up to 5000 eggs; one month later the fertilized eggs will be seen in small single or double capsules. [15] Egg cases are pelagic-gelatinous capsules float easily.

GROWTH RATE —

LONGEVITY —

FOOD-herbivorous; littorines rasp microscopic, and particularly macroscopic, algae from rocks.' Macro: *Cladophora, Pelvetia, Rhodoglossum;* micro: *Endocladia;* unicellular green and blue green algae; diatoms.4

PREDATORS-

BEHAVIOR-live in a 'home territory': they stay in a small area near a certain pool. "Emerge by night, and submerge by day."12

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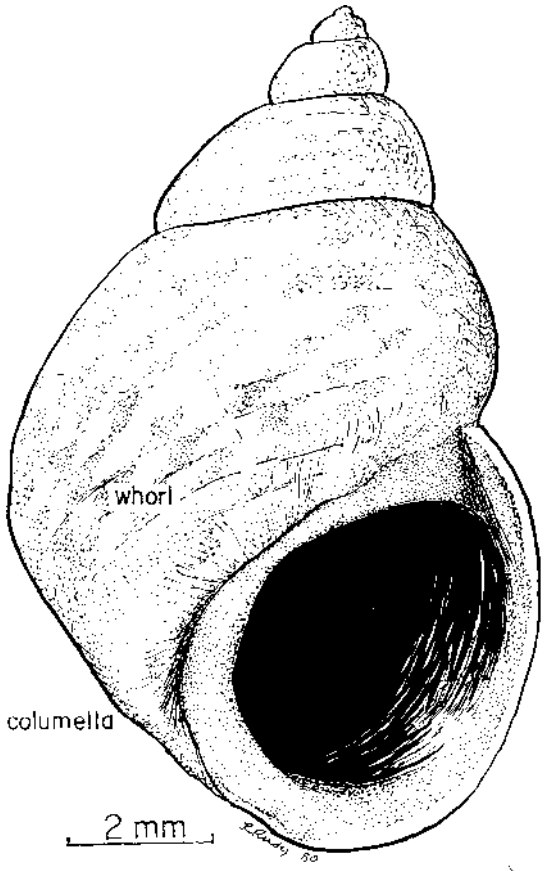
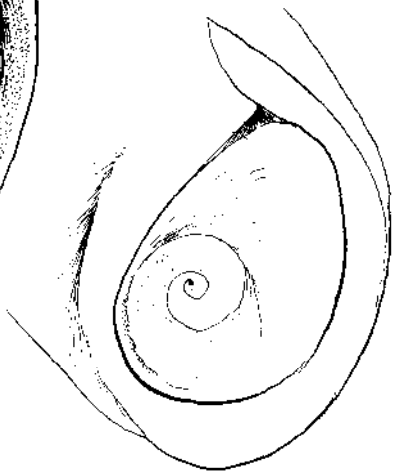
Littorina scutukita

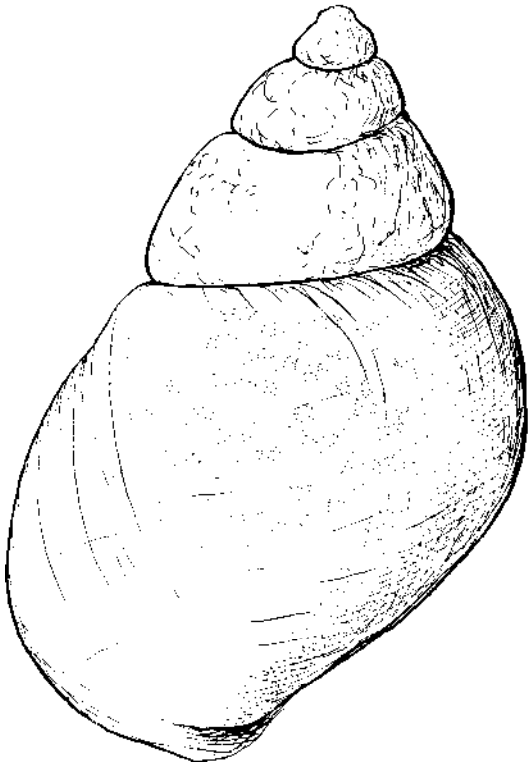


I. Li/tor/no scultdato anterior view x 12
actual height 9 mm
conical, four whorls;
no columella r groove
surface checkered, interior purple

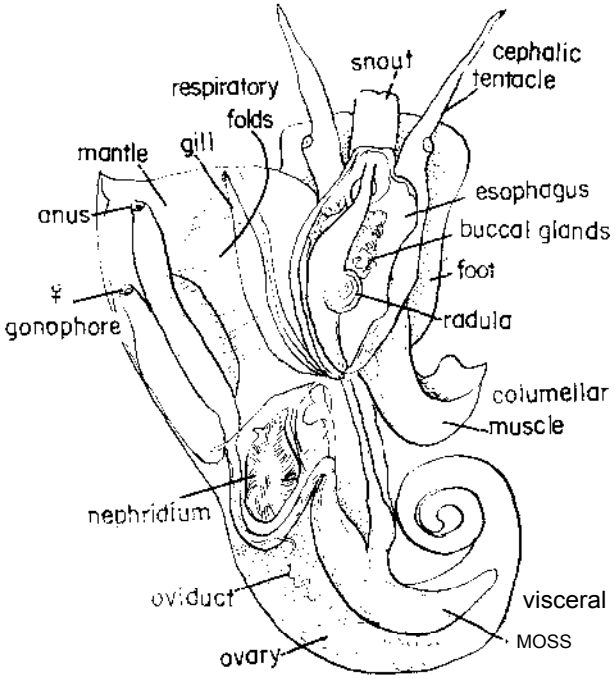
actual size



Ia. operculum



2. posterior view, xI2



3. dissection of a 1 Littorino sp.
(from Hyman,1967, after Sou leyet,1852)
mantle cut, turned over.

Littorina sitkana (= *rudis, sitchana, saxatalis*)

the Sitka littorine Philippi, 1845

PHYLUM: *Mollusca*
CLASS: *Gastropoda, Prosobranchia*
ORDER: *Mesogastropoda*
FAMILY: *Littorinidae*

Description

SIZE-to 15 mm[5]; but usually under 12.5 mm[9]; Coos Bay specimens: 4-9 mm, average about 7 mm.

COLOR-rough variety (fig. 1) can be solid colored: plain buff or gray. A smoother variety (figs. 2, 3), has strong spiral sculpture appearing as horizontal bands, especially on the largest whorl-brown to yellow or orange: these bands can be visible inside aperture and are usually fainter on upper whorls. Animal white, with black on tentacles and snout (fig. 4).

SHELL SHAPE-turbinate, thick, pointed, few-whorled (3-4); aperture rounded, outer lip acute: genus *Littorina.*[8] This species stout, globose, almost as wide as high (in contrast to L *scutulata,* for instance).

OPERCULUM-oval (paucispiral); a solid, horny, trap door (fig. 1).

COLUMELLA-rather flattened inner not perforated: genus *Littorina;* rounded, upper columella is flush with fourth whorl (fig. 2a): no gap between columella and whorl: genus *Littorina.*

ANIMAL-white, with cephalic tentacles only (fig. 4), no n,etapodial, or foot tentacles (see *Lacuna porrecta,* fig. 5).

Possible Misidentifications

Littorines are turbinate, thick, pointed and few-whorled, with a rounded aperture and an acute outer lip. The columella is rather flattened but flush (appressed) with fourth whorl, and lacks a columellar groove. There are three other species of genus which might be confused with *L. sitkana* in Oregon estuaries:

Littorina scutulata is taller than wide, with a purple interior and often with a checkerboard pattern on its whorls (never with a strong spiral sculpture). It is found on rocks ',Ind but rarely in saltmarshes, where *L. sitkana* predominates.

Littorina planaxis is stout, like *L. sitkana,* and usually quite a bit bigger; its surface is plain, without spiral sculpture; it has a white band inside the aperture, and a characteristic flat, roughened area between the columella and the fourth whorl. It is an outer coast, rocky shore species.

The introduced European periwinkle, *Littorina littorea,* has been found in San Francisco and Trinidad Bays. It is thick shelled, smooth, dark brown to black, with many very fine horizontal lines.

Littorina (Algamorda) newcombiana belongs to an unusual subgenus with a simple chink between the columella and the largest whorl. It is very small: to 6 mm, but averaging 3.5 mm, tall, with a smooth shiny surface covered with a brown periostracum. Its color is tan or white, with brown or black horizontal stripes at times on the largest whorl. Small specimens of *L. sitkana* can look very like *L. (A.) newcombiana;* the important differences are the simple chink next to the columella, the taller profile, small size and lighter base color of *L. (A.) newcombiana.* This latter, like *L. sitkana,* is a salt marsh inhabitant, although it is found very high in the tidal zone.

Another similar genus is *Lacuna,* the chink snail, quite tiny (2-4 mm) and distinguished from *Littorina* sp. chiefly by a definite groove or gutter between the columella and the whorl. Two species, *L. porrecta* (which see) and *L. marmorata,* have been found in our area, but usually in eelgrass, not in *Salicornia* marshes.

Ecological Information

RANGE-southern limit seems to be about Cape Arago, near Coos Bay. North to Bering Sea.' Not included in California keys.

LOCAL DISTRIBUTION -Coos Bay: South Slough.

HABITAT -quiet areas of *Salicomia* marshes under debris and marsh weed. Seems to need less protection than other thinner snails.' In Puget Sound, found with barnacle/mussel association on or under rocks, as well as in marshes.'

SALINITY-Littorinidae generally can withstand salinity changes well': conditions that can prevail in salt marshes. Prefers salinity of 24 0/00 or saltier; found at 23-30 o/oo.'

TEMPERATURE-intertidal saltmarsh temperatures can vary greatly: *L. sitkana* adapts well.

TIDAL LEVEL-near the high-tide mark.5

ASSOCIATES -sphaeromid isopods, amphipod *Traskorchestia traskiana,* pulmonate snail *Ovatella myosotis,* tiny snail *Assiminea californica,* other littorines, *L. scutulata, L. (A.) newcombiana.* On rocks (Puget Sound): *Balanus, Mytilus.*

Quantitative Information

WEIGHT-

ABUNDANCE -often the dominant small gastropod in salt marshes.

Life History Information

REPRODUCTION -dioecious (separate sexes); small egg capsules can be seen about one month after copulation *(Littorina* sp.).9

GROWTH RATE-

LO NG EVITY-

FOOD-herbivorous; scrapes algae from substrate with radula.

PREDATORS-

BEHAVIOR-

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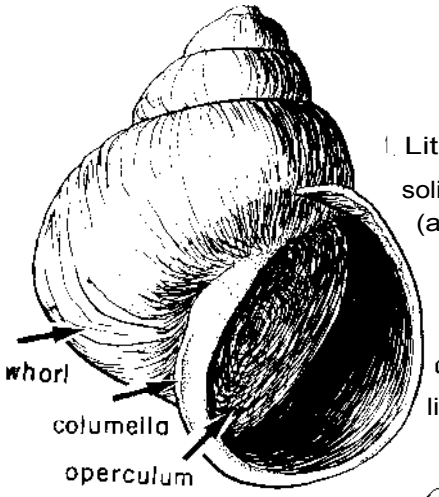
Littorino sitlama

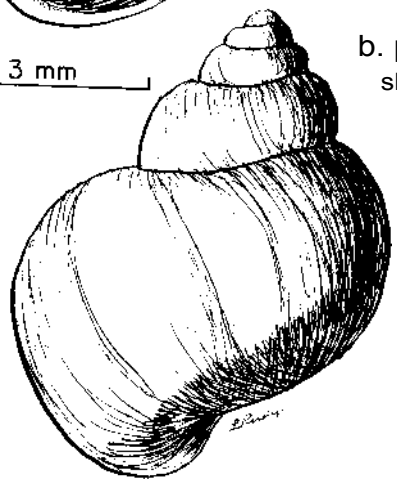


1. LitiOri/70 Siik0/70 X 10

solid, rough variety; actual height 6mm, width 5 mm: (almost as wide as high).

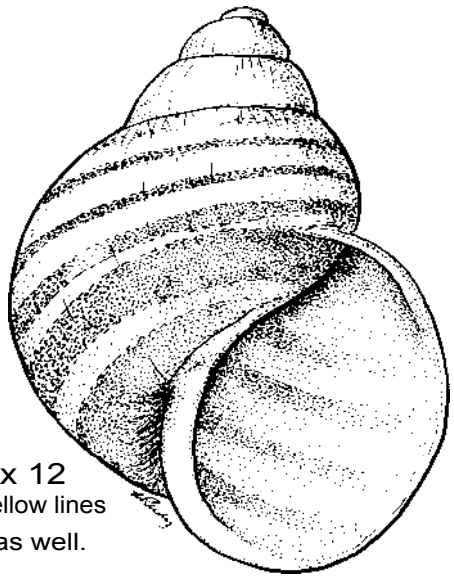
a. anterior view

solid color, ridged surface; rounded aperture; oval operculum; sharp outer lip; columella oppressed to fourth whorl.



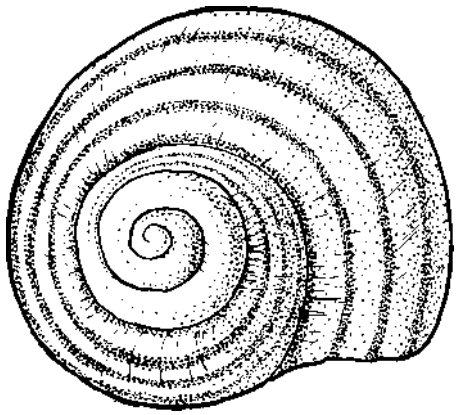
b. posterior

shel l thick, turbi nate; 3-4 whorls.

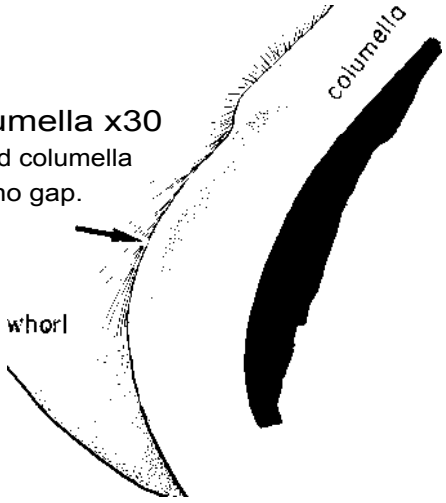


2. smooth variety x 12

strong brown and yellow lines visible on inside as well.



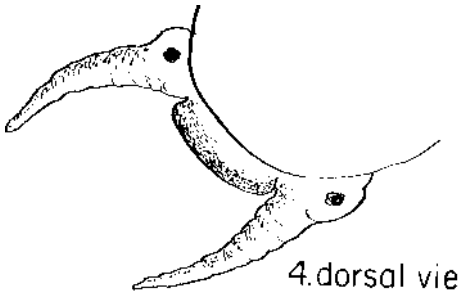
dorsal view, shel l



2 a. columella x30

whorl and columella flush: no gap.

mm



4.dorsal view, animal

Lacuna porrecta
the wide chink shell — Carpenter 1863

PHYLUM: *Mollusca*
CLASS: *Gastropoda*
ORDER: *Mesogastropoda*
FAMILY: *Lacunidae*

Description

SIZE--2-4 mm high; 1/4 to 1/2 size of *Littorina.*

COLOR-white to golden brown, with some spiral marking; surface wrinkled, with fine, wavy spiral striae (figs. 1, 4). No white band on inside of aperture; no carina (keel) on largest whorl.

SHELL SHAPE--broad, compact, globose, only three whorls (fig. 1); shell thin, outer lip 'effuse' (extended); aperture semilunar.

UMBILICUS-chink is large, with a sharp ridge (fig. 3); this groove between whorl and columella is an important key character of the genus *Lacuna.*

COLUMELLA-flattened (fig. 4): genus *Lacuna.*

OPERCULUM-'paucispiral'; flattened on one side (fig. 2).

ANIMAL-Lacuna species have metapodial tentacles which *Littorina* lack (fig. 5).

Possible Misidentifications

Adult Lacunidae can be differentiated from Littorinidae by their much smaller size, metapodial tentacles, and chiefly by their umbilical fissure or chink which Littorinidae lack. (Littorinidae have a columella flush with the large whorl). *Lacuna* are often found in eelgrass; *Littorina* almost never are.

There are several species of *Lacuna* on the Pacific coast:

Lacuna unifasciata is more turbinate than globose, and has a sharp carina or keel around its largest whorl. It is a southern species, its northern boundary being probably at Monterey Bay, California."

Two Puget Sound species have been identified. Both are larger than our Oregon species: *Lacuna vincta (= carinata, = solidula"),* is large, about 10 mm long, with 3-4 strong, smooth whorls, a small umbilicus, a white columella, and a strong carina on the last whorl. *Lacuna variegata* is a tall, high-spired form, up to 6 mm high, found in eelgrass *(Zostera);* not described in California keys. [1] ° *L. variegata* has a spreading outer lip, a wide chink, and zig zag markings

The species most like *L. porrecta* and often found with it is *Lacuna marmorata,* the marbled chink shell, usually brown and white, but with a carina on the large whorl, a narrow columeilar groove, and often with a white stripe inside the base of the aperture." It has been found in Coos Bay, [4] and hybridizes with other *Lacuna* spp., (Friday Harbor)'.

Ecological Information

RANGE-Bering Sea to San Diego, California.9

LOCAL DISTRIBUTION-Coos Bay, several stations: South Slough, also.°

HABITAT-in algae, eelgrass *(Zostera),* or around its roots; in tidepool algae at lower Littorine level.°

SALINITY-

TEMPERATURE-genus *Lacuna* essentially a cold water form; few tropical species.

TIDAL LEVEL-mid- and low intertidal levels and subtidally; never in upper reaches.6

ASSOCIATES-hermit crabs, amphipods, littorine snails; encrusted with bryozoans.

Quantitative Information

WEIGHT-

ABUNDANCE-not common.

Life History Information

REPRODUCTION-Lacuna *variegata* has eggs like life preservers: yellow, about 5 mm diameters

GROWTH RATE-

LONGEVITY-

FOOD-family is herbivorous.

PREDATORS-in eelgrass: seastar *Lepasterias.* Few fishes eat *Lacuna!*

BEHAVIOR-it waddles as it moves one side of foot, then the other.

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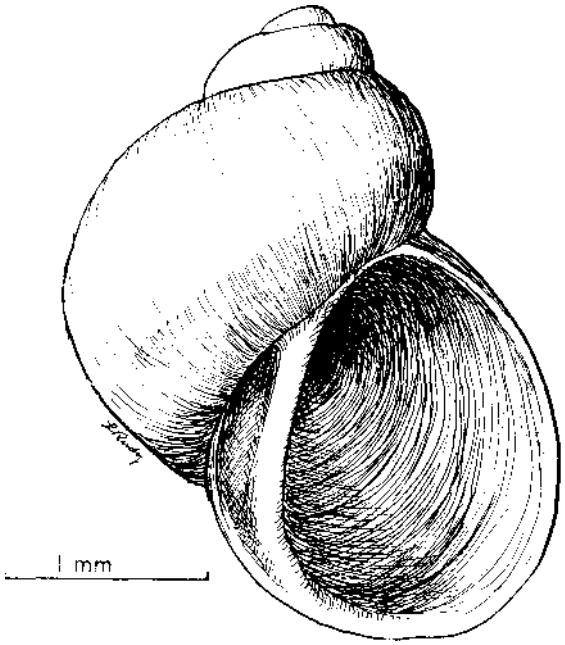
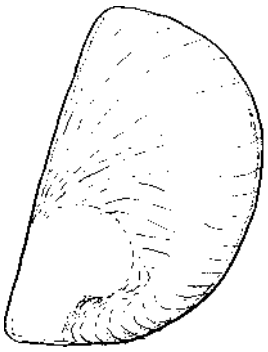
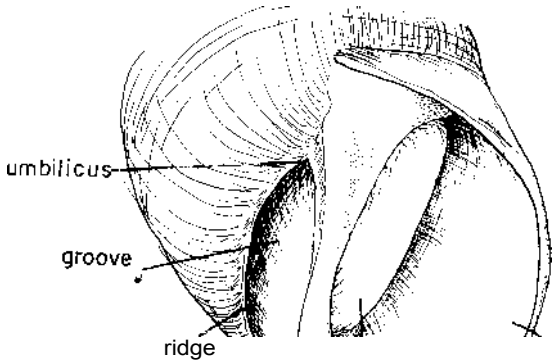
Lacuna porrecta



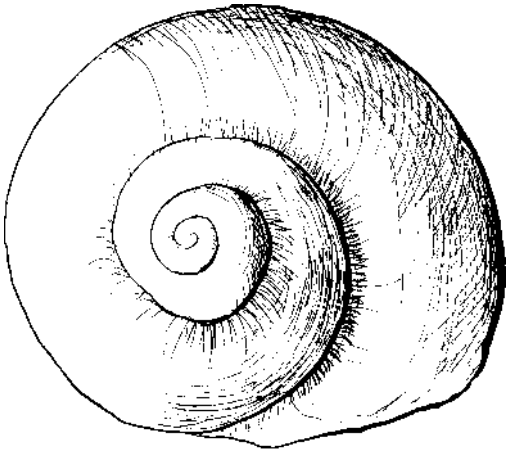
1. *Lacuna porrecta* anterior view x 30
actual height 4mm, width 3 mm:
3-whorled, globose shell with
fine, wrinkled striae; thin shel l;
chink between whorl and columella;
outer lip extended.



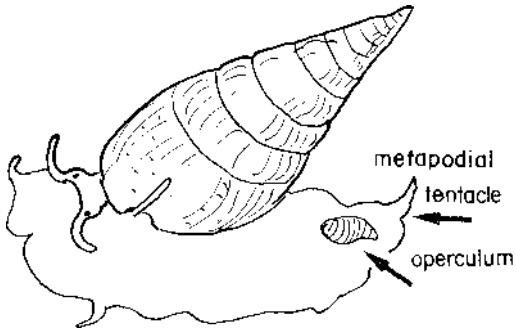
2. operculum x 30



3. close-up: shell aperture
umbilicus: sharp ridge, large groove,
flattened columella.



4. dorsal view



5. Nassa ri us, with metapodial tentacle.
from Hyman, 1967, after Adams
and Adams, 1858.

Assiminea califomica *(formerly Syncera translucens)*
a small salt marsh snail (Tryon, 1865)

PHYLUM: *Mollusca*
CLASS: *Gastropoda, Prosobranchia*
ORDER: *Mesogastropoda*
FAMILY: *Assimineidae*

Description

SIZE-less than 4 mm high; most specimens collected near 3 mm.

COLOR-glossy chestnut,' smooth, transparent (largest whorl); interior porcelain-like, not pearly; spire often almost black (Coos Bay specimens); animal white with black markings (fig. 4).

SHELL SHAPE-five whorls: rounded, convex; globose to turbinate,' taller than wide; aperture subcircular, without notch or canal; inner lip spread out as a small thickened callus' (fig. 3).

COLUMELLA-continuous with inner lip: no shelf, no folds, appressed to whorl. Spreads into callus. (fig. 3).

ANIMAL-eyes on short ocular peduncles, no tentacles: family Assimineidae' (fig. 4). Radula with three basal cusps on both sides of central plate: genus *Assiminea* (not figured).

OPERCULUM-very thin, transparent, subspiral, convex (fig. 2).

Possible Misidentifications

Assiminea califomica is one of a small association of salt marsh snails. Within our range it is often found with or near *Littorina (Algamorda) newcombiana.* This is a slightly larger littorine (to 6 mm) with four whorls, a nearly circular aperture, and with a simple chink between the large whorl and inner lip. The general shape and appearance of the two gastropods is quite similar. *L. (A.) newcombiana* does not have ocular peduncles.

A second snail common found in salt marshes is *Ovatella myosotis,* a pulmonate of rather olive shape, up to 8 mm long. It is subcylindrical, not turbinate, with a short spire, three columellar folds, and no operculum. (See plate)

Littorine snails are larger than *Assiminea,* but can be superficially similar: *Littorina sitkana,* often found in this association, is globose, almost as wide as long, and has either heavy striated sculpture or dark horizontal lines. The animal has long tentacles, not *Assiminea's* unusual ocular peduncles. *Littorina scutulata,* the checkered littorine, is occasionally found in the saltier parts of marshes. It is quite a bit larger than all the preceding snails, and is patterned on its exterior and purple inside.

Ecological Information

RANGE-Vancouver Island, British Columbia, to Cabo San Lucas, Baja California.'

LOCAL DISTRIBUTION-Coos Bay, many stations: South Slough, Haynes Inlet.

HABITAT-under driftwood, debris, *Salicomia,* in mud.

SALINITY-generally a wide toleration of salinities: to 24 0/00 seawater; possibly to 16 0/00.8

TEMPERATURE-varied (salt marsh temperatures).

TIDAL LEVEL-family Assimineidae are intertidal [4]; all live above the low tide level; this species likes upper, usually dry parts of the marsh, about 3-4 feet (South Slough, Coos Bay).

ASSOCIATES-littorines *L. sitkana, L. (A.) newcombiana,* pulmonate *Ovatella myosotis,* amphipod *Traskorchestia traskiana;* plants: *Salicornia, Distichilis, Fucus.*

Quantitative Information

WEIGHT-

ABUNDANCE-common in *Salicomia* marshes.1°

Life History Information

REPRODUCTION-

GROWTH RATE —

LONGEVITY —

FOOD —

PREDATORS-fish: many snails found in gut content analysis (Coos Bay).8.

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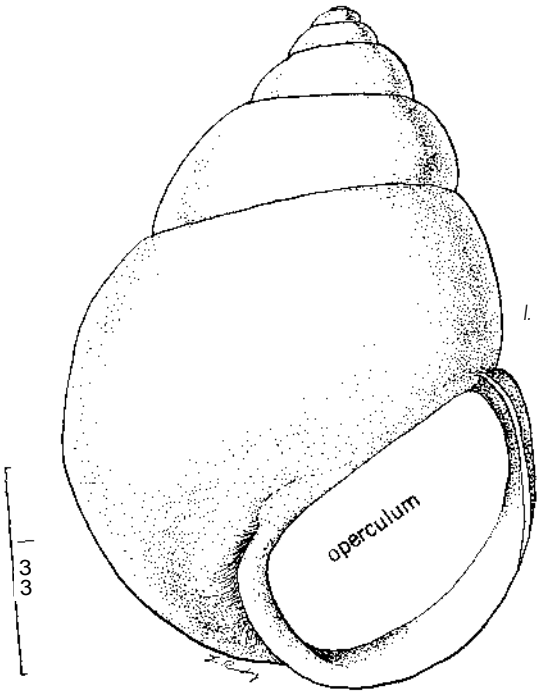
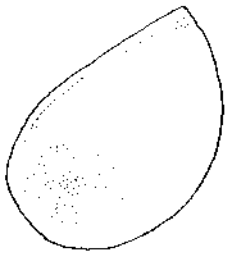
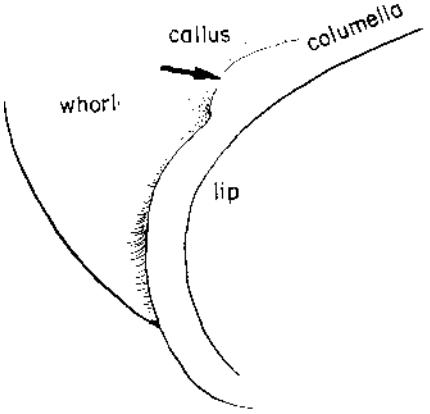


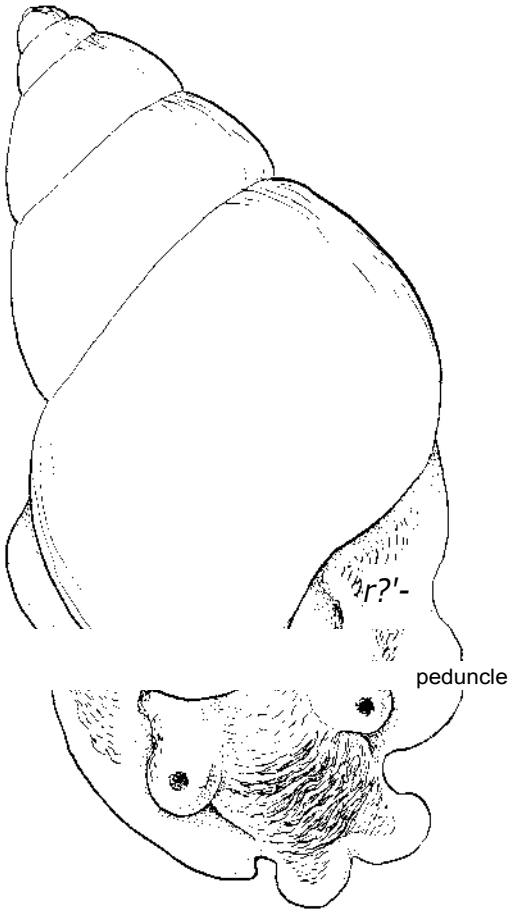
1. *Assirninea colifornico*
anterior view x.30
actual height 3.3 mm:
5 convex whorls; taller than wide



2. operculum x 30



3. Inner lip x5o
columella continuous with lip:
no shelf, a thick callus;
lip oppressed to whorl.



4. animal, dorsal view x 30
note eyes on ocular peduncles;
no tentacles.

Nucella emarginata (= Thais)

the rock-dwelling emarginate dogwinkle Deshayes, 1839

PHYLUM: *Mollusca*
CLASS: *Gastropoda, Prosobranchia*
ORDER: *Neogastropoda*
FAMILY: *Thaisidae*

Description

SIZE-rarely over 30 rnm, [9] usually up to 20 mm (Puget Sound); up to 40 mm, but rarely over 30 mm (California)"; this specimen (Coos Bay) 20 mm. Females slightly larger than males (average 18.9 and 17.8).'

COLOR-exterior brown and dingy white, dirty gray, yellow or almost black (if diet of mussels); yellow, black or gray periostracum in grooves between ridges; ridges sometimes white (black in this specimen). Interior: aperture and columella chestnut brown or purple.

SHELL SHAPE-fusiform; short spire, expanded whorl. Shell thin, not heavy. 3-4 whorls; nuclear whorl inconspicuous.

SCULPTURE-base and spire with similar sculpture: genus *Nucella'°:* alternating large and small spiral ridges over most of shell, can be nodulose; sometimes ridges are obscure and surface is fairly smooth. Axial sculpture wrinkled, not prominent.

OUTER LIP-thin, crenulate, not thick and layered: species *emarginata."* No denticles or anal notch on posterior (upper) end, no single strong tooth near anterior canal. No row(s) or denticles within lip.

COLUMELLA-excavated,' arched and flattened below: species *emarginata;* no folds, (fig. 1).

SUTURES-not deep (fig. 1).

ANTERIOR (SIPHONAL) CANAL-short: less than 1/4 aperture length: species *emarginate* (fig. 1); canal narrow, slot-like, not spout-like; not separated from large whorl by revolving groove.

APERTURE-wide; length more than 1/2 shell length.' Ovate in outline, with a short anterior canal but no posterior notch (fig. 1).

UMBILICUS-closed: species *emarginata."*

OPERCULUM-dark brown with nucleus on one side (fig. 2).

EGGS-pale yellow, vase-shaped, about 6 mm high, in clusters of up to 300 capsules" (fig. 4). Each capsule with 500-600 eggs. Each capsule with a longitudinal suture and a hard clear escape aperture.

VELIGER-4 stages: advanced shell measures 775p, long" (fig. 5).

Possible Misidentifications

Snails of the genus *Nucella* can be distinguished from other carnivorous estuarine gastropods by their sculpture (the same on both spire and whorls), by the large body whorl and by the large ovate aperture. Other genera with a siphonal notch, and generally fusiform shape include

Olivella and *Buccinum,* which have columellar folds;

Ocenebra and *Ceratostoma* which have a spout-like siphonal canal, not a narrow-slot-like one as in *Nucella;*

Nassarius and *Searlsla* which have a distinct revolving furrow or fossa setting off the anterior canal from the body whorl; *(Searlsla* has spiral sculpture only on the body whorl; the spire has both spiral and axial ribs);

Acanthina (also fo the family Thaisidae), which has a strong tooth on the anterior end of the outer lip.

There are three other species of *Nucella* in our area. Two are not likely to be found in estuarine conditions, but they do look quite a bit like *No. emarginata:*

Nucella lima, the file dogwinkle, is subtidal, short-spired, and fairly rare. It is whitish to brown, with about 15 alternating large and small file-like spiral ridges on the large whorl. It can be up to 43 mm, somewhat larger than *N. emarginata.*

Nucella canaliculata, the channeled dogwhelk, has a high spire and a prominent shoulder below the deep suture. It is light (white to orange), and sometimes banded Its 14-16 spiral ridges are very evenly shaped and spaced. It is an inhabitant of outer shore mussel beds. Larger than *N. emarginata,* it averages 26.5 mm (male) and 24.8 mm (female) (California).'

The third species of *Nucella* is quite likely to be found in bays: *N. lamellosa* (which see) is the most common dogwinkle in the northwest, and one of its many variations is very like *N. emarginata. N. lamellosa* can have strong axial ruffles, be quite smooth, or have strong horizontal ribs. In this last case, it must be carefully separated from *N. emarginata. N. lamellosa* has a higher spire (usually 5-7 whorls, including the tiny nuclear whorl); it is heavy, with a thick layered lip, not a thin crenulated one. There is usually at least one row of denticles inside the lip in *N. lamellosa;* its anterior canal is longer than that of *N. emarginata* (more than 1/4 aperture length). While *N. lamellosa* can have strong spiral ridges, the body whorl in this species is then often flattened and angled, not expanded as in *N. emarginata,* and the horizontal ridges themselves are not alternating large and small (compare fig. 2, *N. lamellosa). Nucella lamellosa* inhabits much quieter waters, as a rule, and a lower tidal range than does *N. emarginata.* Its color is usually lighter; it is rarely blackish.

Ecological Information.

RANGE-Bering Sea south to northern Baja California, but rare below Pt. Concepcion."

LOCAL DISTRIBUTION-Coos Bay: marine portions, i.e. near bay mouth up to Fossil Point.

HABITAT-almost entirely on rocky shores; in fairly heavy surf"; also in semi-protected areas.' Outer shores in mussel beds, on jetties.

SALINITY-full seawater; collected at 30 o/oo,

TEMPERATURE-cold to temperate waters: small animals high in tidal range show great thermal resistance': active at range of 0-30°C.2

TIDAL LEVEL-

ASSOCIATES - its primary prey, barnacles. especially *Balanus;* mussel *Mytilus: Pisaster ochraceus.* Commensal flatworm *Nexllis epichitonius* found in specimens on Coos Bay entrance jetty.'

Quantitative Information

WEIGHT-1.5 gm (wet).

ABUNDANCE-common to abundant'; much less common in inner bay than *N. lamellosa* (Coos Bay).

Life History Information

REPRODUCTION-spawn throughout the year (Bodega Bay, Calif.), but most activity is in November-February. Little hermaphroditism.' Spawning not salinity-, photoperiod- or temperature-related.' Females gregarious (groups to 20), deposit egg capsules in clusters. Each female lays 8-9 capsules; stalked capsules have about 200-300 eggs each,' many of which may be sterile nurse eggs which are consumed by developing larvae. Veligers swim in capsule fluid and metamorphose into snails about 1.1 mm long, emerging from plug at top of capsule.' Pacific northwest hatchlings number about 10-20 per capsule average; Bodega Bay about 5% hatch (10-15)'. 11.

GROWTH RATE-Pacific northwest: 2.5-3 months from egg deposition to hatching; possibly more rapid development farther south."

LONGEVITY-

FOOD-prefers mussels *Mytilus edulis* and *M. californianus,* also barnacles *Balanus, Pollicipes, Chthamalus,* limpets Co/-lisella, as well as herbivorous gastropods *Tegula funebralis* and *Littorina.* Feeding is by drilling with the radula. inserting the proboscis, and feeding on the soft body within. Species *N. emarginata* shows a wide food preference, but individuals seem to be consistent in diet."-"

PREDATORS-adult snails prey on eggs.

BEHAVIOR-presence of *N. emarginata* elicits several escape responses from prey *Mytilus edulis:* gaping, spontaneous valve closure, foot activity, byssal

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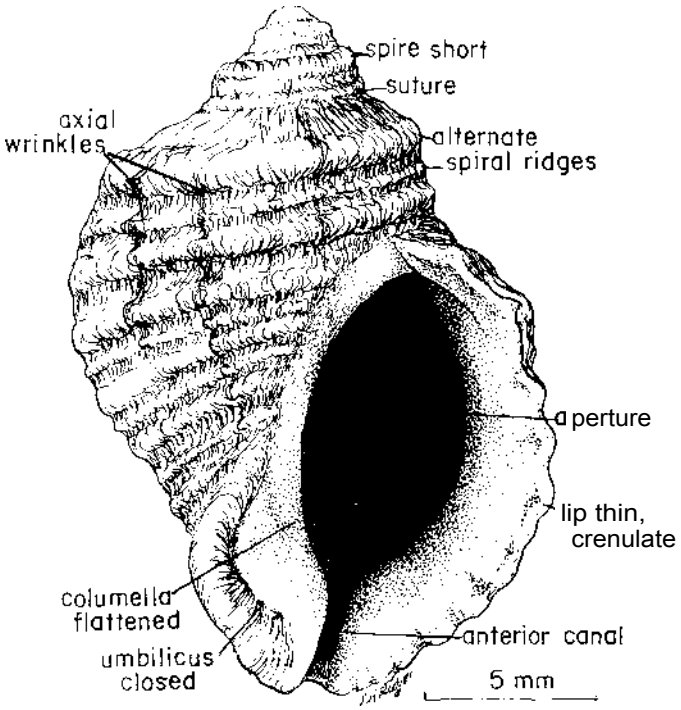
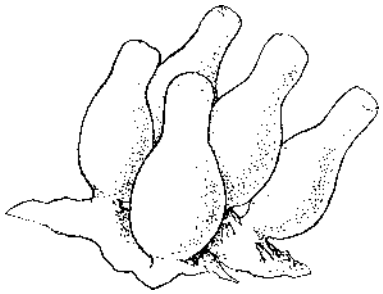
Nucella marginate

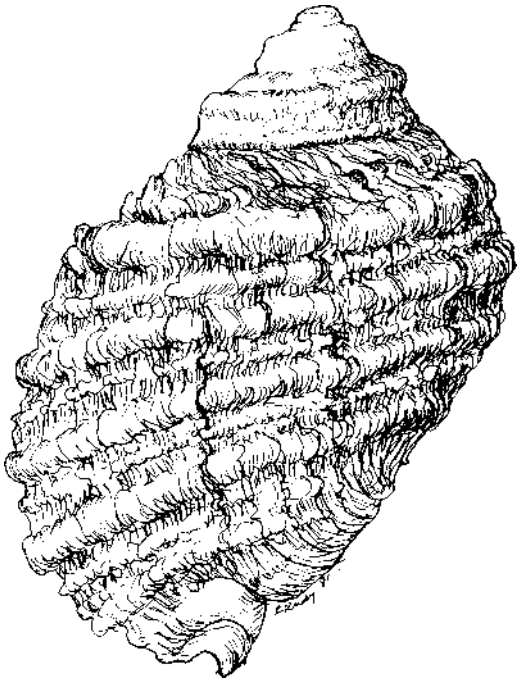


2 operculum

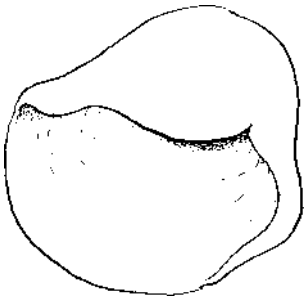
I. *Nucella emarginata* ventral x 4 actual height 21 mm
shell ovate, body whorl expanded, spire short; aperture ovate,wide; sculpture: alternating large a small nodulose spiral ridges, wrinkled axial folds; columel la flattened,unfolded; umbilicus closed; outer lip crenulate, thin, no denticles; short anterior canal.



4. egg capsules, x 4

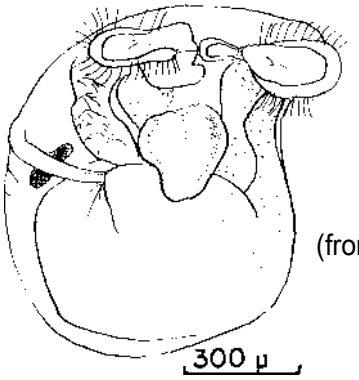


3 dorsal view, x 4



5 a. shell, advanced veliger
(from Le Boeuf, 1971)

175p



5 b. larva, advanced veliger (fourth **stage)**

(from Le Boeuf, 1971)

Nucella lamellosa (= *Thais*)
the wrinkled or frilled dogwinkle Gmelin, 1791

PHYLUM: *Molluscs*
CLASS: *Gastropoda, Prosobranchia*
ORDER: *Neogastropoda*
FAMILY: *Thaisidae*

Description

SIZE-to 50 mm (California)", 100 mm Puget Sound and north': largest specimen figured, 54 mm (fig. 1). Largest of the *Nucella.*

COLOR-white to brown, some are pink, lavender or orange tan; not highly polished. Inside whitish, sometimes with color showing through.

SHELL SHAPE-shell heavy, solid, strong; spirally coiled, fusiform (spindle-shaped). 5-7 whorls; nuclear whorl small, inconspicuous. Spire usually high; siphonal canal relatively long for genus; aperture ovate, almost '/2 shell length.

SCULPTURE-extremely variable. Spire and base have similar sculpture: genus *Nucella."*° Axial ribs present (fig. 1). Three chief variations with many gradations): lamellar variety with strong axial ribs, developed in quiet water specimens into frilly ruffles (fig. 4); (2) *Nucella* from rough conditions are smooth, with only faint axial sculpture (figs. 1, 3); and (3) strongly sculptured spirally with one to two strong horizontal ribs at top of each whorl and smaller ribs below; axial sculpture only between ribs. This variety has flattened and angled whorls' (fig. 2).

OUTER LIP-thickened, smooth, without denticles on posterior portion of aperture (near anal notch)'; no single strong tooth on edge near anterior canal (see **Possible Misidentifications).** Outer lips rounding smoothly to anterior end of shell. At least one row of denticles within lip (fig. 1).

COLUMELLA-(central pillar): without folds', incrusted, smooth.

SUTURE-(between whorls): impressed, distinct, but not a deep groove.

ANTERIOR (SIPHONAL) CANAL-short, but longer than other *Nucella* species; narrow, slot-like, not spout-like (i.e. with edges touching, making a closed tube: see **Possible Misidentifications).** Not separated from large whorl by revolving groove (fig. 1).

APERTURE-almost '/2 length shell; ovate to quadrate in outline, with a siphonal notch, but no anal notch (fig. 1). Widest part of aperture (generally near its middle) at least half as wide as shell.'

UMBILICUS-small, often closed (fig. 1).

OPERCULUM-usually large enough to close aperture; conspicuous, with strong spiral lines; with nucleus on one side (fig. 1 a).

EGGS-vase-shaped, yellow, about 10 mm long; in clusters on underside of rocks"; called "sea oats"; (fig. 1 b).

Possible Misidentifications

Nucella can be distinguished from other predatory estuarine snails by its sculpture, which is the same on the whorls and spire, by the large last whorl and by the ovate aperture (about '/2 the shell length). Unlike *Nassarius,* it has no distinct revolving furrow setting off the body whorl from the anterior canal.' It has no single strong tooth on the anterior margin of the outer lip, as in *Acanthina.* There are no columellar folds as in *Olivella, Buccinus,* etc. The siphonal canal is not spout-like, as in Ocenebra, and Ceratostoma.

There are several species of *Nucella* in the northwest:

Nucella lima, the file dogwhelk, is a subtidal snail with about 16 alternating large and small file-like spiral ridges on the large whorl. It is fairly rare, is whitish to brown in color, short-spired and somewhat smaller than *N. lamellosa* (to 43 mm).

Nucella canaliculata, the channeled dogwhelk, is white to or orange, sometimes banded. It has a high spire, a prominent shoulder below the deep suture, and rounded spiral ridges of equal size with axial lamellae between them. It is small, to just over 30 mm. Usually found in mussel beds, it is rare in bays.'

Nucella *emarginata* (which see) is the other *Nucella* most often to be found in estuaries; it usually occurs in heavier surf than N. *lamellosa.* Called the rock-dwelling dogwinkle, it is generally only up to 20 mm long. This snail has alternately large and small, often nodulose, spiral ridges over most of the shell. (These ridges are often obscure). It has no noticeable axial sculpture. Found in the mid- and high intertidal in mussel beds, it is easily confused with variation of *N. lamellosa* (fig. 2).

Nucella was previously called *Thais.* This name is now reserved for subtropical and tropical species.

Ecological Information

RANGE-Bering Strait to central California."

LOCAL DISTRIBUTION-Coos Bay: Pigeon Point, Empire; Umpqua estuary: Ziolkouski Beach *('/2* mile from mouth).

HABITAT-on rocks with mud, sand substrate; often in protected bays"; below mussel beds on outer shores.

SALINITY-collected at 30 o/oo salt: lower, more marine parts of bays with more constant saline concentrations.

TEMPERATURE-cold to temperate waters: geographic distribution would indicate a preference for cool temperatures. Lower part of bay does not generally have high temperatures. Smallest individuals have highest thermal limits', snails active at 0-30 °C.2

TIDAL LEVEL-found at low intertidal, below other species of the genus. Largest animals lowest in tidal range.'

ASSOCIATES-its primary prey: barnacle *Balanus;* the underrock community: porcelain crab *Petrolisthes,* brachyuran crabs *Hemigrapsus* and *Cancer oregonensis,* chiton *Mopalia,* isopod *Idotea,* anemones *Anthopleura elegantissima* and *A. artemesia,* nudibranch *Onchidoris,* gastropod *Tegula; Pisaster ochraceus.* Discarded *N. lamellosa* shells are often inhabited by the hermit crab *Pagurus hirsuitusculus.*

Quantitative Information

WEIGHT-largest collected (including shell) 28 gr. (wet).

ABUNDANCE-one of the most abundant intertidal snails of the northwest; becomes less abundant in California. By far the most common *Nucella* species in the Coos Bay estuary.

Life History Information

REPRODUCTION-breeding in winter and spring (California) by aggregations of snails; individuals become sexually mature in 4th year, when they often return to their hatching site and join a breeding group"; individuals tend to breed with same group. Egg capsules deposited synchronously by females; development varies with temperature: snails emerge after 140 days (at 6.8°C), after 67-91 days (9.6-11 °C). Capsules rarely contain "nurse eggs" (sterile eggs to be consumed by the developing snail larvae): nearly all eggs are fertile.' Just over half of eggs reach hatching stage; high mortality among young snails: of 1000 eggs (from one female, one year), probably fewer than 10 grow to 1 year of age.

GROWTH RATE-varies greatly with food supply. Shell growth, type, dependent on food: barnacle diet produced heavy, stout shells.

LONGEVITY-sexually mature at four years."

FOOD-primarily barnacles: *Balanus glandula* and *B. cariosus,* on which it is the primary predator (Puget Sound)." Mussels (outer shores), periwinkles and other mollusks. Radula penetrates shell of prey with aid of secretions from boring organ on foot."

PREDATORS-egg capsules and young snails heavily preyed upon by other *Nucella.*

BEHAVIOR-

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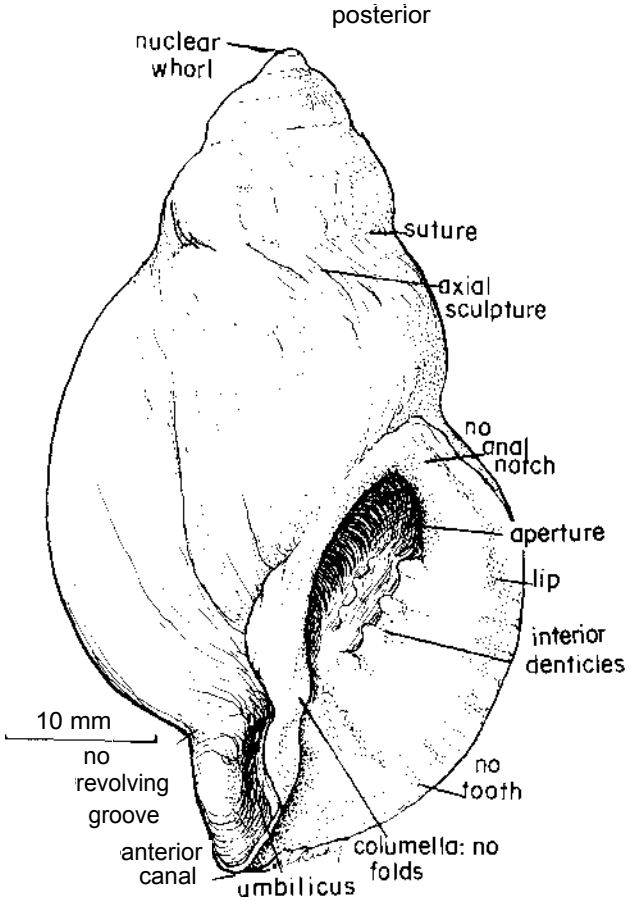
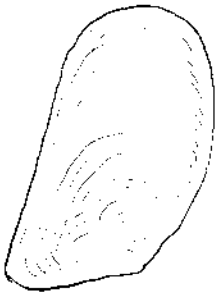
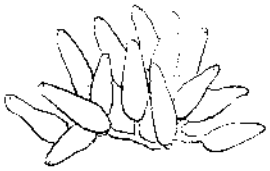
Nucella /omellosa



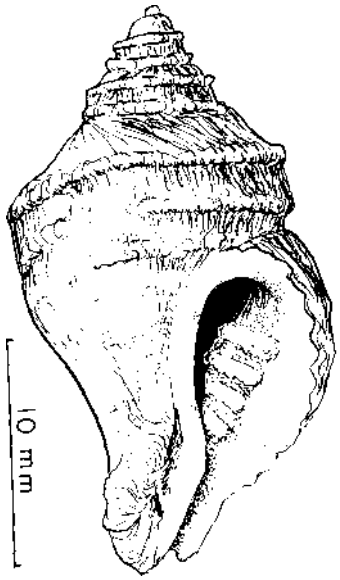


I a. operculum x2

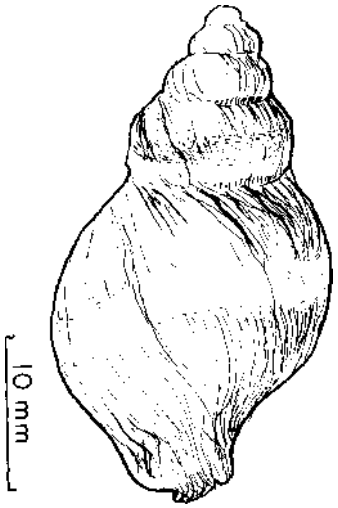


I b. egg cluster x

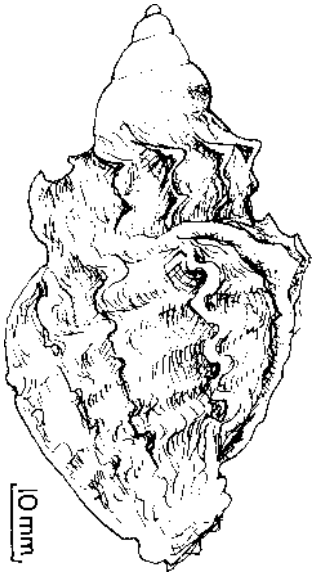
I Nuce//o lome//osa x 2 smooth variation actual height 54 mm
fusiform; 5 whorls (nuclear whorl inconspicuous); axial sculpture on both spire and body whorl; ovate aperture almost 1/2 shell length; narrow anterior canal; smooth outer lip without posterior denticles, anal notch or marginal tooth; columel la without folds; interior rows of denticles, umbilicus closed; suture not deep.



2 spiral ribbed variation x
1-2 strong horizontal ribs at top of each whorl, smaller ribs below; fine axial sculpture between ribs; whorls angled, flattened.



3 smooth, banded variatio x 2



4. frilly lamellar variation x I
axial sculpture strong.

Olivella biplicata

the purple olive **(Sowerby, 1825)**

PHYLUM: *Mollusca*
CLASS: *Gastropoda*
ORDER: *Neogastropoda (= Stenoglossa)*
FAMILY: *Olividae*

Description

SIZE-large for family: to 30 mm long' [3]; mature at 16 mm'; males larger than females. Width usually about twice as high as wide.' This specimen 18 mm high, 9 mm wide.

COLOR--gray, purple fasciole (band) at base offset with dark line (fig. 1); faint vertical striations, but surface otherwise polished, unsculptured: genus *Olivella.13*

SHELL SHAPE-stout, robust, sub-cylindrical; spire only slightly elevated; 5-6 whorls. Body whorl convex, nearly flat near thin straight outer lip; aperture elongate, triangular, with anterior notch (fig. 2).

COLUMELLA--strong callus, with a fold of two incised spiral lines or plications in lower portion: species *biplicata* (fig. 2).

OPERCULUM-small, horny, thin, half ovate, apical nucleus (not figured).

ANIMAL-eyeless; foot plow-shaped, for burrowing.' Long siphon for water intake (fig. 3). Radula with three teeth to the row: Neogastropoda (not figured).

EGGS AND YOUNG-egg like a dome-shaped hat, about 0.5 mm diameter (fig. 4a). Veliger 0.2-0.3 mm (fig. 4b).1

Possible Misidentifications

Olivella species are the only genus of the family Olividae in our north temperate waters; the larger *Oliva* is a warm water genus. The genus *Olivella* may be distinguished by its smooth surface, slight spire, elongate, notched aperture, clean sand habitat, and in *0. biplicata* by its columellar folds. At least three *Olivella* are found on the west coast:

Olivella baetica, slenderer than 0. *biplicata (2 1/2* x as high as wide), shell tan or cream with red, brown or purple markings and lines: it can be found on protected beaches and subtidally. It Is smaller than 0. *biplicata* --only up to 19 mm. It is found in Puget Sound as well as in California.6.'3

Olivella pycna, another small olive (to 19 mm), is stout, and has brownish zig-zag lines on its whorls. [13] It is not found in Puget Sound, but is a more southern species.

Characteristics of the family Olividae include a polished shell (indicating that the mantle often covers it), a subcylindrical, spired shell with an aperture greater than *1/2* the shell length. They are usually sand dwellers.

Ecological Information

RANGE-Vancouver Island to Magdelena Bay, Baja California: Oregonian and Californian shallow water marine faunal provinces.

LOCAL DISTRIBUTION-outer, marine portions of most bays and estuaries, including Coos Bay, Netarts.75

HABITAT-sandy beaches and spits of bays, as well as outer coast. Can concentrate metals in tissues, apparently without harrn.8

SALINITY-full sea water.

TEMPERATURE-

TIDAL LEVEL--low intertidal to subtidal waters: lives in quite a wide bands; found higher than and associated with the razor clam, *Siliqua patula.*

ASSOCIATES-Sit/qua *patula;* parasitic trematodes[2], in southern California, hydroids on spire.

Quantitative Information

WEIGHT-

ABUNDANCE-common intertidally.13

Life History Information

REPRODUCTION-dioecious (two sexes); mating behavior observed at every low tide, all year: no 'year classes in Oregon waters. Mate selection by chemosensory means; internal fertilization. Only sexual dimorphism observable is larger size of males. Sterility rate may be as high as 50% due to trematode infestation. Single egg cases deposited usually on empty shells; egg development time variable: 10-28 days.' Veligers nonpelagic: swim near substrate.'

GROWTH RATE-to maturity (16 mm) in one year: males grow faster than females and are larger. Growth rate varies from 0.1 mm to 9.7 mm/year. [14] Few young reach maturity; most populations of older animals, which have a low mortality rate.2

LONGEVITY-possibly several years: as many as ten.'

FOOD-family is carnivorous; scavengers animal matter; large *Olivella* will eat polychaetes.2

PREDATORS-Pisaster *brevispinus* (Coos Bay, North Spit)?: small *Cancer antennarius* and C. *magister;* shorebirds, particularly gulls; fish; man, for ornament [14] In southern California: mollusks *Octopus, Polinices, Conus,* echinoderm *Astropecten.15*

BEHAVIOR reactsto predator *Pisaster brevispinus* by crawling or by rapid upside down swimming. [2] Trails near surface. shell partly exposed. Larger animals active at night, hide from predators during the day.

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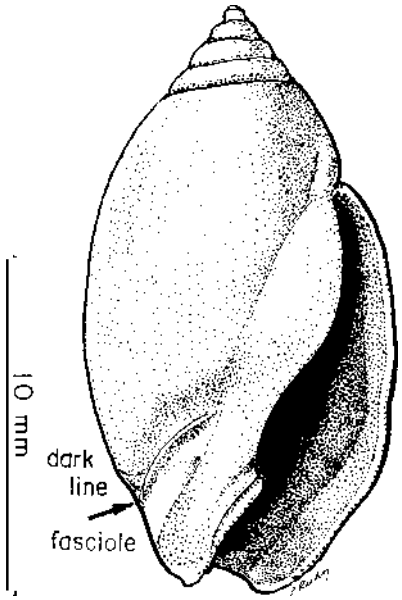
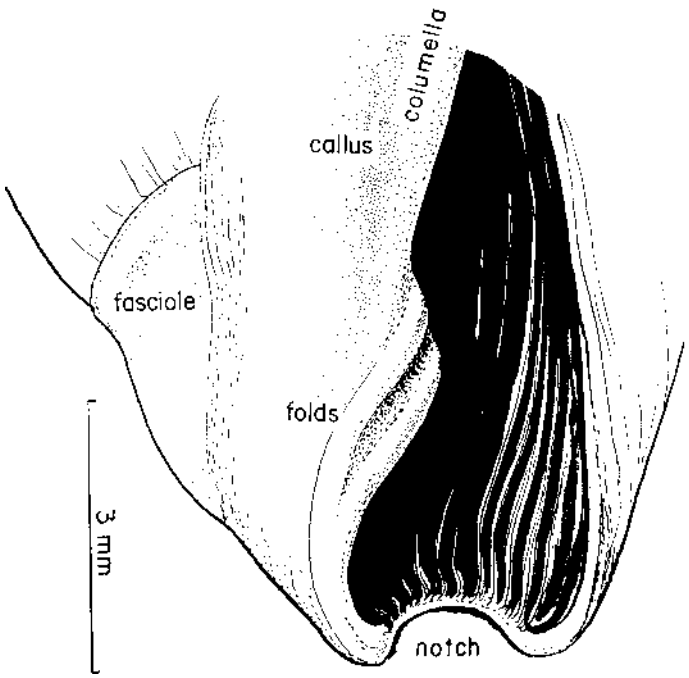
Olive//a biplicata



l. Olive//o biplicato

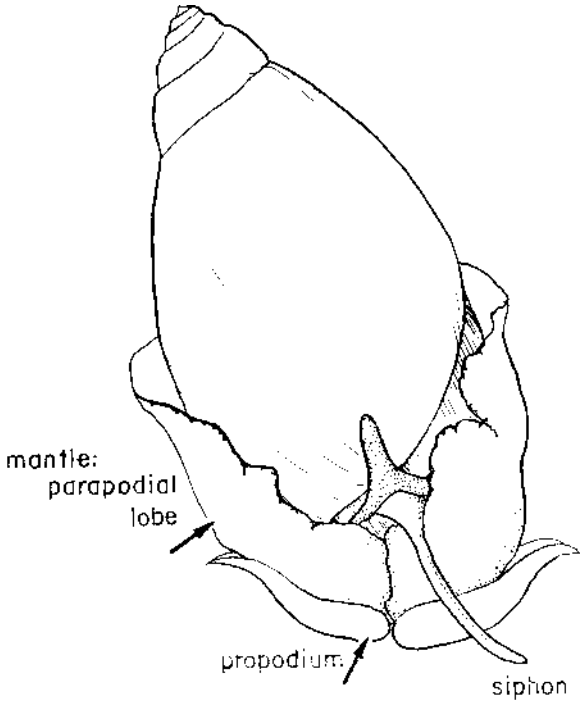
anterior view x 4.5 actual height 18 mm

about twice as high as wide; polished surface: gray with purple tascicie. stout, subcylindrical ; slight spire; 5-6 whorls; long aperture.

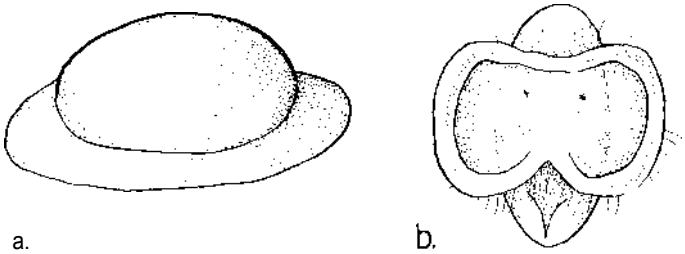


2.columel la and aperture x 12

columella with strong cal lus,two folds; aperture notched.



animal, dorsal view



4. egg and larva x 100

a. egg case

b. veliger, frontal view.

Edwards, 1968)

Ovatella myosotis (= *Phytia setifer,* Cooper, 1872)
a bristle-bearing ear shell (Draparnaud, 1801)

PHYLUM: *Mollusca*
CLASS: *Gastropoda, Pulmonata*
ORDER: *Basommatophora*
FAMILY: *Melampidae (= Ellobiinae)*

Description

SIZE-to 8 mm; this specimen, 4 mm.

COLOR-variable: chestnut, purplish or yellowish brown; black with striations. Interior porcelain-like.10

SHELL SHAPE-rather olive-like; higher than wide, no spiral ridges; spire pointed, elevated; five or more whorls (fig. 1). Aperture rounded, ear-shaped, about 1/2 shell length.

COLUMELLA-three folds above anterior end, one weakly developed (fig. 3).

EYES--at bases of cephalic (and only) tentacles: order Basommatophora[10] (fig. 2).

OPERCULUM-lacking in pulmonates.

JUVENILES-with small hairs on edges of sutures, disappear in adult (fig. 4); juveniles wider than adults (shells).'

Possible Misidentifications

Of the other salt marsh gastropods, Littorinidae and Lacunidae are stouter and larger than *Ovatella,* turbinate and without elevated spires. The somewhat similarly shaped *Olivella* sp. is much larger (to 30 mm) and has an anterior canal in its aperture; it lives in clean sand, not in salt marshes (see plate).

Assiminea californica is a tiny (about 3 mm) brown gastropod sometimes found with *0. myosotis.* It resembles *Littorina* in shape, being stout and convex; its inner lip is a small thickened callus, without folds.

The many species of the tiny Opisthobranch *Odostomia* spp. resemble *Ovatella* superficially, but lack columellar folds and a radula. They are parasitic.

None of the preceding snails is closely related to *Ovatella.*

Snails of the subclass Pulmonata, which includes the land snails, have a vascularized mantle cavity serving as a lung, in place of gills. There are no other similar pulmonates known in northwestern salt marshes. (*Melampus olivaceus* is found farther south).'

Ecological Information

RANGE-Puget Sound to Anaheim Bay, California.' Probably introduced from the Atlantic coast in the 19th century.'[9] *(Ovatella myosotis* is the Atlantic name; *Phytia setifer* or *myosotis* is a west coast equivalent name used by some authors2'6).

LOCAL DISTRIBUTION-Coos Bay: South Slough, many stations.'

HABITAT-Salicornia marshes, among debris, mud, crevices of docks, pilings.

SALINITY-brackish water: about 16 o/oo seawater; avoids immersion.' Tolerates all salinities including freshwater; well adapted: an air breather.

TEMPERATURE-

TIDAL LEVEL-near high tide line', at levels which are rarely inundated: it is often the only invertebrate at this high level.' South Slough (Coos Bay): found at + 6.0 'MLLW.

ASSOCIATES-ciliates in mantle cavity[4]; prosobranch gastropods *Assiminea california, Littorina sitkana, L. (A.) newcombiana, L. scutulata;* pulmonate *Melampus olivaceus* farther south. Amphipod *Orchestia,* isopods. Plants *Spergularia canadensis, Distichlis, Carex.*

Quantitative Information

WEIGHT-

ABUNDANCE-very common in marshes: often only invertebrate found at its tide level.

Life History Information

REPRODUCTION-hermaphroditic,

GROWTH RATE-

LONGEVITY-

FOOD-

PREDATORS-

BEHAVIOR-avoids immersion: an air breather, possessing a lung.

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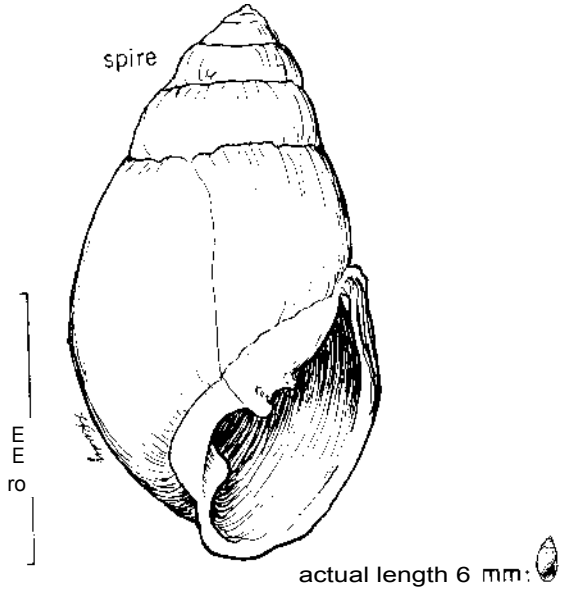
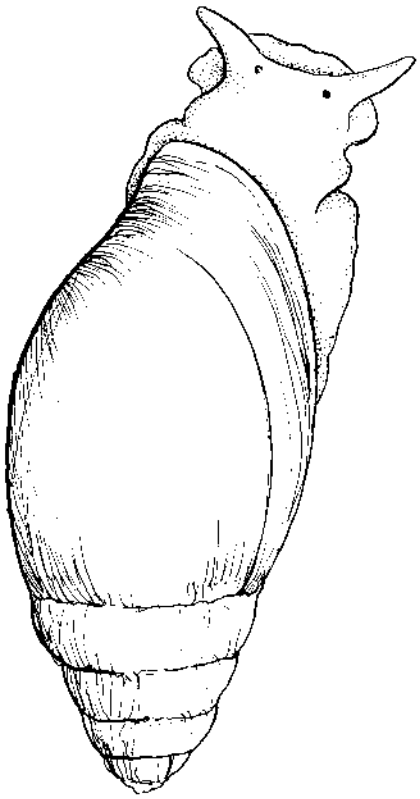
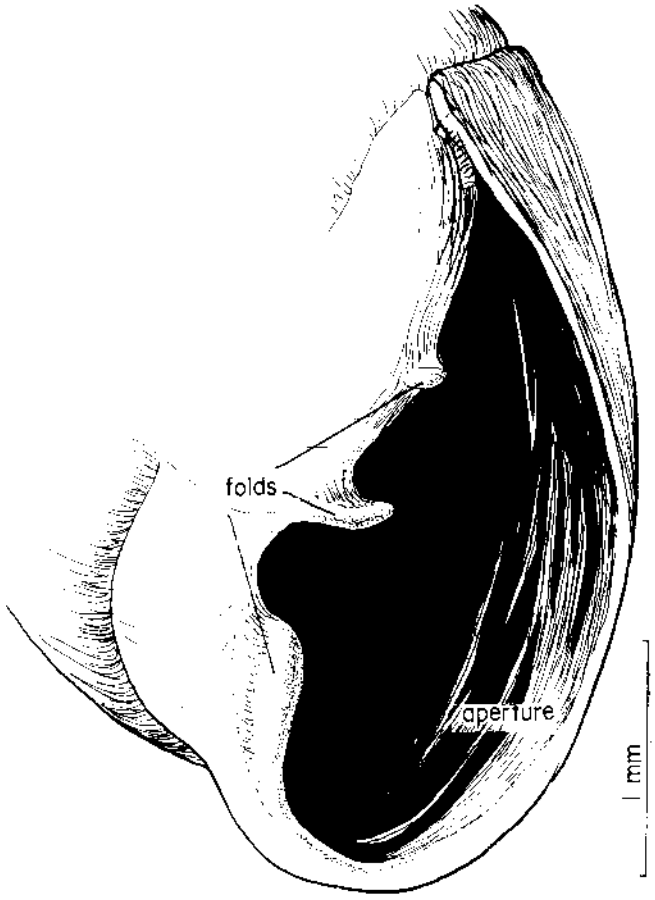
Ovate/la myosotis



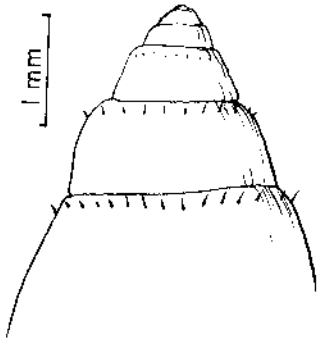
I. Ovate/lo myosolis anterior view xI2
higher than wide; 5 or more whorls; elevated spire;
aperture rounded, ear-shaped, half length of shell.



2. animal, dorsal view x !2
note eyes at tentacle bases.



3.columeiia and aperture
close-up anterior view x 32
three columellar folds, one weak;
no operculum.



4. juvenile, x 15
nairs on sutures

Alderia modesta
a sacoglossan sea slug (Loven, 1844)

PHYLUM: *Mollusca*
CLASS: *Gastropoda, Opisthobranchia*
ORDER: *Sacoglossa: 'shield tongue'*
FAMILY: *Hermaeidae*

Description

SIZE—to 8 mm long; Coos Bay specimens to 5 mm.

COLOR—greenish- to yellowish-tan, black markings, base ivory.

BODY—'aeolid': changing; an oblong, flat-bottomed form without tentacles or tail (figs. 1, 2).

RHINOPHORES—reduced, rolled not solid (fig. 1)[7]; (Kozloff calls these cephalic projections 'dorsolateral tentacles," not rhinophores).

FOOT—no parapodia (lateral flaps which could fold over dorsum); foot extends laterally beyond body.'

CERATA—dorsal projections, about 18 (fig. 1), in two loose branches on both anterior and posterior halves of dorsum.'

GILLS—none.

EYES—small, black (figs. 1, 2).

ANUS—a long tube originating on a medial line, resembling posterior ceratum.'

EGGS—light yellow, in clear skein (fig. 3).

Possible Misidentifications

Sacoglossans are a little known group of few species and small size, but which can occur in large numbers. *Alderia modesta,* like others of the order, feeds on a specific alga, has a wide distribution, and could probably not be confused with other Opisthobranchs.

Sacoglossans resemble superficially the more well known nudibranchs, but unlike them, most do not have a circlet of gills, solid rhinophores, or oral tentacles. (One exception, *Stiliger fuscovittatus,* has solid rhinophores; it is tiny (3 mm), transparent white with reddish brown patterns, and lives in *Polysiphonia,* a red alga.)

Other Sacoglossans with dorsal cerata and rolled rhinophores include, also in the family Hermaeidae

Aplysiopsis smithi (= Hermaeina), greenish to brownish black with white edges, bulbous cerata, up to 22 mm long; it lives in *Chaetomorpha, Rhizoclonium* (its preferred food), or *Enteromorpha*[1] It has prominent rhinophores and a tail.

Aplysiopsis oliviae (= Hermaea) has a Y-shaped mahogany line from the rhinophores to the head midline; it is pale yellow with a pink spot behind the eyes.

Hermaea vancouverensis is a small (to 5 mm) brown and white slug, more common in Puget Sound than in the south; its habitat is eelgrass *(Zoctera);* its food the diatom *Isthmia.9*

Placida dendritica (=Hermaea ornata) has a long, obvious tail, long cerata, and is pale yellow with dark green lines. It is usually on algae *Bryopsis* or *Codium* in the rocky intertidal, and is found in California and Puget Sound9.

Olea hansineensia (family Oleidae) has only about 10 elongate cerata on its posterior dorsum; it is gray, and is found commonly in bays in Puget Sound and probably not in California.

None of these is yellowish tan with small black markings, a tubular anus, and living in *Vaucheria.*

Ecological Information

RANGE—San Juan Island to Elkhorn Slough, Calif.; Europe.'

LOCAL DISTRIBUTION—Coos Bay: South Slough.

HABITAT—found only in mats of alga *Vaucheria in Salicornia* marshes.

SALINITY—prefers 1 6-1 7 0100 seawater; cannot survive in normal seawater or fresh water,' although eggs develop in either seawater or brackish water. Cerata pulsation rate varies with salinity.'

TEMPERATURE

TIDAL LEVEL—at higher levels of marsh (Coos Bay): about 4.0'.

ASSOCIATES—insects; alga *Vaucheria.*

Quantitative Information

WEIGHT-

ABUNDANCE—common in its particular microhabitat, *Vaucheria.'*

Life History Information

REPRODUCTION—hermaphroditic; eggs laid in September, Coos Bay (this specimen).

GROWTH RATE—to early veliger two days in lab (this specimen).

LONGEVITY-

FOOD—alga *Vaucheria,* exclusively.

PREDATORS—some sacoglossans emit nasty repellents.'

BEHAVIOR

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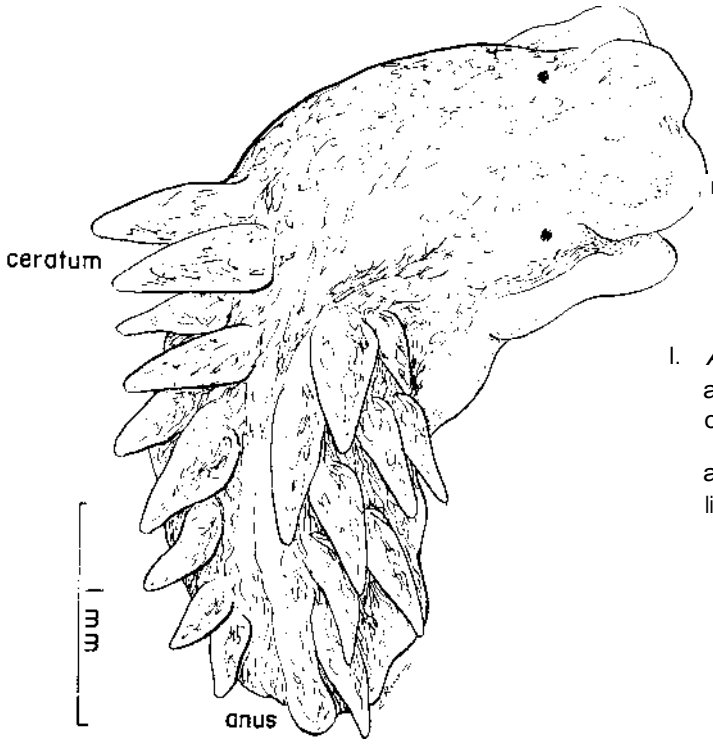
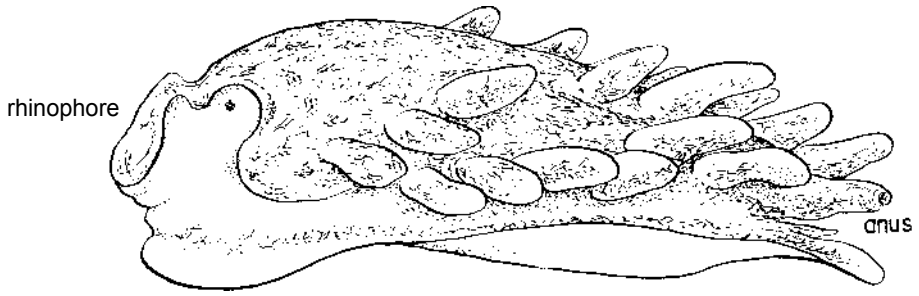
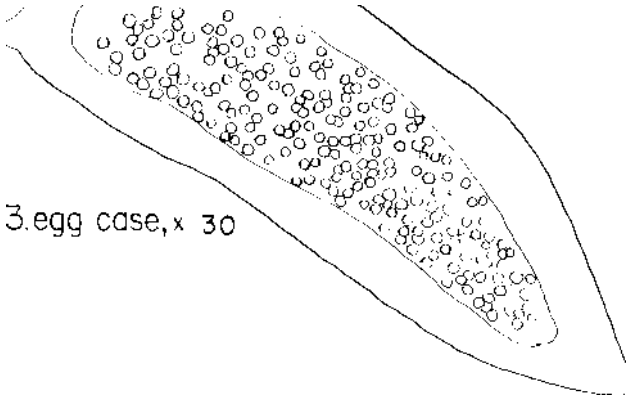
A/deria modesto

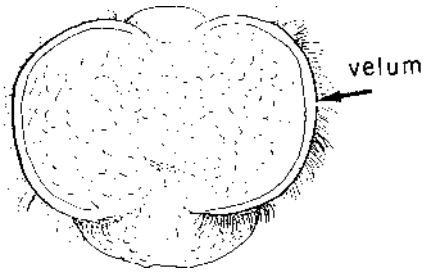


l. *Alo'erio modesto* x 30
actual length 4 mm:
oblong,changeable body; no tentacles,
tail, or parapodial lobes; dorsal cerata ;
anal Vibe; small rolled rhinophores;
light lan,biack markings, eyes.



2. lateral view





4. 2-day veiiger

Onchidoris bilamellata (-= fusca)
many-gilled onchidoris nudibranch (Linnaeus, 1767)

PHYLUM: *Mo//usca*
CLASS: *Gastropoda, Opisthobranchia*
ORDER: Nudibranchia
FAMILY: *Onchidoridídae*

Description

SIZE-usual length 15 mm[6]; this specimen 15.5 mm long, 11 mm wide, 6 mm high. Far northern and Atlantic specimens can reach 30 mm length.'

COLOR-translucent brownish-white with irregular dark or rusty brown splotches, sometimes as irregular longitudinal stripes. Commonly a light spot between the dark rhinophores; gills dull white, underside a dull white. "No yellow pigment, "[4] but some specimens without brown color.

BODY SHAPE-doridiform: oval; generally large, with a broad flat foot, thick fleshy mantle and conspicuous double circlet of ails dorsally (figs. 1, 2). Dorsum covered with many large round aciilae, becoming smaller at edges. Surface firm. No large processes except rhinophores, gills, papillae.

RHINOPHORES-a single pair, perfoliate: genus *Onchidoris* (fig. 1). Rhinophores not especially long.

GILLS-16-32 (or more: 36 this specimen); urtipinnate, almost erect branchial plumes arranged in two semicircles just anterior to anus: species *bilamellata.*[6] Gills not completely :it ctible[4] (fig. 1).

LABIAL TENTACLES-none; fused as an oral veil.

PAPILLAE--mushroom-shaped, with protruding spicules (fig. 3).

EGGS-type A': a short, stout spiral ribbon attached along one edge' (fig. 5); Capsules of 1-3 eggs, ribbons of 6,000 eggs (average).

VELIGER-shell average iength 146.9 x 95[2] (fig. 6).

Possible Misidentifications

There are other oval dorid nudibranch? '7'[th]e same general coloration and shape as *Onchidoris: Aqisodoris, Archidoris,* and especially *Acanthodoris brunnea* are all found in our area. None of these has 16-32 single, branchial plumes arranged in the unusual two semicircles. *Acanthodoris brunnea* can be distinguished immediately; by its very long rhinophores and conical papillae (not round ones), and by its but 7 branchial gills.

A pulmonate, resembling a small shell-less limpet, is colored quite like *Onchidoris:* it is *Onchidella borealis.* Close inspection reveals it to have stalked eyes, and only 20-24 papillae dorsally[5] (p. 342).

Ecological Information

RANGE-Aleutian Islands south to Morro Bay, California.'

LOCAL DISTRIBUTION-Coos Bay: Pigeon Point.

HABITAT-usually found with barnacle *Ba/anus;* at Pigeon Point on and under rocks; mudflats.

SALINITY-collected at 30 o/oo salt.

TEMPERATURE-

TIDAL LEVEL-intertidal to 250 m[6]; collected at mid-intertidal.

ASSOCIATES-Ba/anus, chiton *Mopalia,* crabs *Hemigrapsus, Cancer oregonensis,* gastropods *Tegula, Nuceila,* sea star *Pisaster ochraceus,* anthozoans *Anthopleura elegantissima, A. artemisia,* isopod *Idotea P. wosnesenskii.*

Quantitative Information

WEIGHT-wet: 0.7 gr.

ABUNDANCE-"freguent"[6]* seasonally common.

Life History Information

REPRODUCTION-hermaphroditic but not self-fertilizing; internal fertilization. Eggs laid in ribbons during February-March, and October-December (Puget Sound)[2]; May to mid June: British Columbia.'

GROWTH RATE-

LONGEVITY-most opisthobranchs live less than a yea [8]

FOOD-barnacles, mostly *Balanus.6*

PREDATORS-many opisthobranchs are toxic or bad-tasting; predators are mostly other nudibranchs.8

BEHAVIOR-

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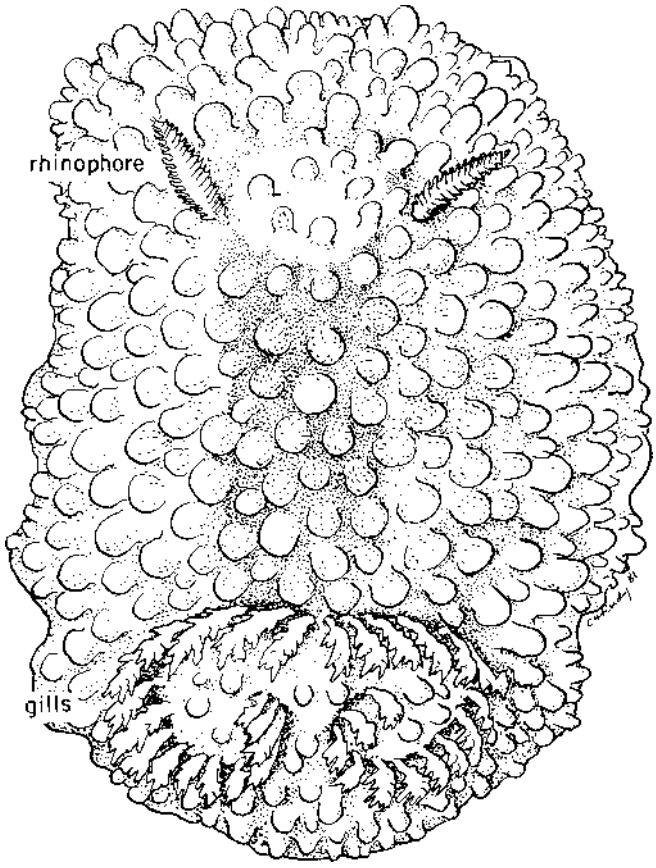
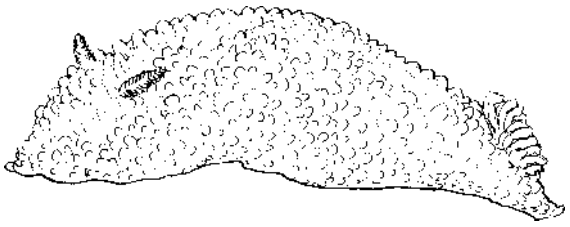
Onchidoris Moine/leo

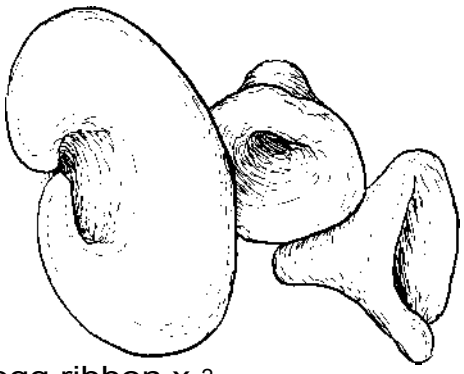


2 mm

I. *Onchidoris 61/G07e/iota* dorsal x 8
actual length 15.5 mm; solid oval dorid nudibranch covered with round papilla; a posterior double circle of 16 - 32 or more gills; bilamellate rhinophores,



2. lateral view, x 5

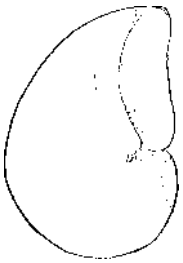


5.egg ribbon x 2
(from 0 Donoghue & O'Donoghue,l922)

3.a single papilla, x 40
spicules protrude.

.5 mm

4.a single bronchial plume, x 30
unipinnate gill.



.01 mm

6.a veliger, x 250
(from Hurst, 1967).

Pisaster brevispinus

the pink, short-spined sea star Stimpson, 1857

PHYLUM: *Echinodermata*
CLASS: *Asteroidea*
ORDER: *Forcipulata*
FAMILY: *Asteriidae*

Description

SIZE—one of the largest asteroids: to 320 mm diameter (2 ft.)'; this specimen (Coos Bay) 190 mm diameter.

COLOR—always pink. Keys sometimes indicate mottling with gray-green or maroon-purple; Oregon specimens are pink.

SURFACE PATTERN—spines do not usually form reticulated pattern or crescentic arcs; there is at least one straight r ow of spines down each arm (fig. 1). Spines occur singly or in ;mall groups of twos and threes or more, separated by areas of soft tissue: the spines in the center of the disc do not form a distinct star (fig. 1). Body is firm, not weak and flabby.

SPINES—DORSAL SURFACE: short ("brevi--), single or in groups of up to five on single plates, surrounded by areas of soft tissue' (fig. 3); large spines are often shaped like onion domes; a straight middorsal row (or rows) of spines down middle of each arm; species *brevispinus* (fig. 1).

SPINES—VENTRAL (ORAL) SURFACE: four rows of flattened (elliptical) blunt spines with small clustered pedicellariae at their bases, and one row of long thin spine-like adambulacral spines (fig. 4). A few clusters of pedicellariae occur at the bases of these spines, but there are no pedicellariae *on* the spines.

CENTRAL DISC—large, raised, but not set off from arms as in class Ophiuroidea (brittle stars); contains madreporite (fig. 1). Spines in disc center do not form a star.

RAYS (ARMS)—five, unless damaged. Tapering, broadest where they join disc. Not broad enough to give webbed appearance.

AMBULACRAL GROOVES—long furrows on oral surface of arms, which contain tube feet; class Asteroidea (fig. 4). Adambulacral spines line the groove.

PEDICELLARIAE—stalked or sessile appendages with pincers, used for cleansing surface of invaders. Two-jawed in Forcipulata.

DORSAL (ABORAL) SURFACE very small pedicellariae cluster around spines (fig. 3); no large sessile pedicellariae visible;

VENTRAL (ORAL) SURFACE:— two types: (1) small. clustered around bases of oral spines, and (2) a few strands of small clustered pedicellariae and large stalked pedicellariae on bases of adambulacral spines (fig. 4). No pedicellariae *on* the adambulacral spines: genus *Pisaster.*"

MOUTH—large, in center of ventral surface (fig. 2).

MADREPORITE—filter plate for water into the interior stone canal; raised, with channels, conspicuous on central disc (fig. 1),

TUBE FEET—on ventral side; four rows, staggered down each ambulacral groove (fig. 4).

Possible Misidentifications

Pisaster brevispinus is readily identifiable by its pink coloration, its seemingly soft appearance, and its unusual (for sea stars) occurence on soft substrates.

There are other five-armed Asteriidae with thick, low papillate dorsal spines and pedicellariae:

Evasterias troscelli is slender like *P. brevispinus*, but is generally orange-red or blue-gray (Coos Bay), not pink. Its clusters of oral pedicellariae are on the adambulacral spines, not just at their bases as in *P. brevispinus* (fig. 4). Like *P. brevispinus*, it is subtidal.' Its preferred range is Puget Sound, although it is known to northern California.

Orthasterias koehleri has large, sharp dorsal spines, each surrounded by a distinct ring of large *pedicellariae*. These spines are arranged in distinct radial rows. *Orthasterias* is often red with yellow mottling.

Two other species of *Pisaster* can be found:

Pisaster giganteus is bluish gray, with blunt, clubbed dorsal spines, each surrounded by a ring of blue flesh around which is a ring of pedicellariae. *P. giganteus* is a low intertidal sea star, and usually is more southern than Oregon. In spite of its name, it is smaller than *P. brevispinus* when fully grown.

Pisaster ochraceus is a common coastal sea star, and is only present in lower reaches of high salinity estuarine systems. It is red, brown, or ochre (juveniles are gray), never pink. It inhabits only hard substrates (rocks. pilings. etc.), not soft sand. The dorsal spines on *P. ochraceus* form reticulated patterns; the straight line(s) of spines down each arm typical of *P. brevispinus* are absent from *P. ochraceus.*

Fisher° describes two forms of *P.* breospir■u.i, *F. b. brevispinus*, from Puget Sound to Crescent City with an dance of abactinal (away from the mouth: dorsal) spines. spines are in large groups, up to 8-10, and can form radial bands. *P. b. oacispinus* has few spines, standing singly or in 2s and 3s; the spines are usually stout with subconical acorn-shaped grooved tips; papulae (respiratory surfaces) are numerous and conspicuous in this form (fig. 3)

Ecological Information

RANGE—Sitka, Alaska, to Santa Barbara, California.°

LOCAL DISTRIBUTION—typical form of offshore sand bottoms; also found in channel bottoms of large estuaries, *i e.* Coos.

HABITAT--only in quietest waters; also on wharf pilings, rocks; cannot tolerate exposure to air or to low salinities for long.' Note: these sea stars are sometimes transported into harbors by fishermen cleaning their nets.

SALINITY—collected at 30 0/00.

TEMPERATURE—found in cold to temperate waters.

TIDAL LEVEL—low intertidal to deep water: (many found at 60 fathoms, Monterey Bay, California"),

ASSOCIATES—on low pilings: *Pisaster ochaceus*, anemone *Metridium*, tunicates, mussels, barnacles.

Quantitative Information

WEIGHT—

ABUNDANCE

Life History Information

REPRODUCTION—reproductive cycle much like that of *P. ochraceus.* Separate sexes, breeding season January-May (Pacific Grove, California'); gonads ripe April. spawning soon after. Sexes indistinguishable during resting period.

GROWTH RATE

LONGEVITY

BEHAVIOR—can apparently sense and dig out clams *(Saxidomus, Protothaca)* from gravel.' Sand dollars escape by quickly burying themselves when *P. brevispinus* appears,'

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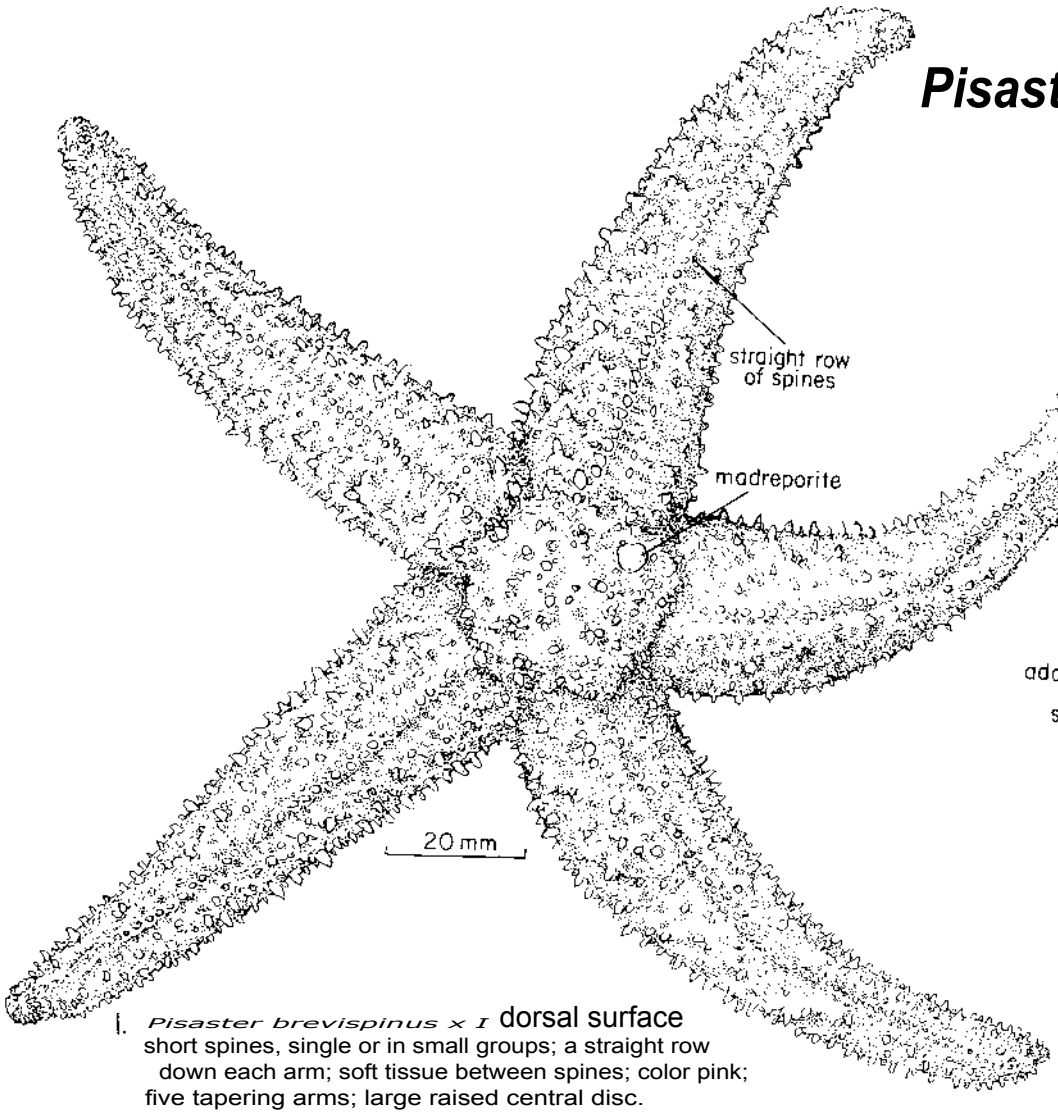
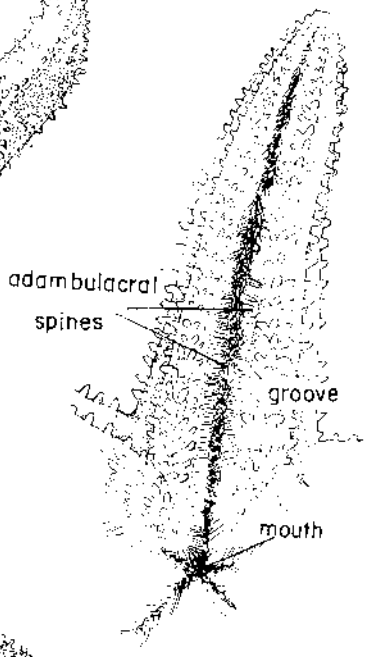
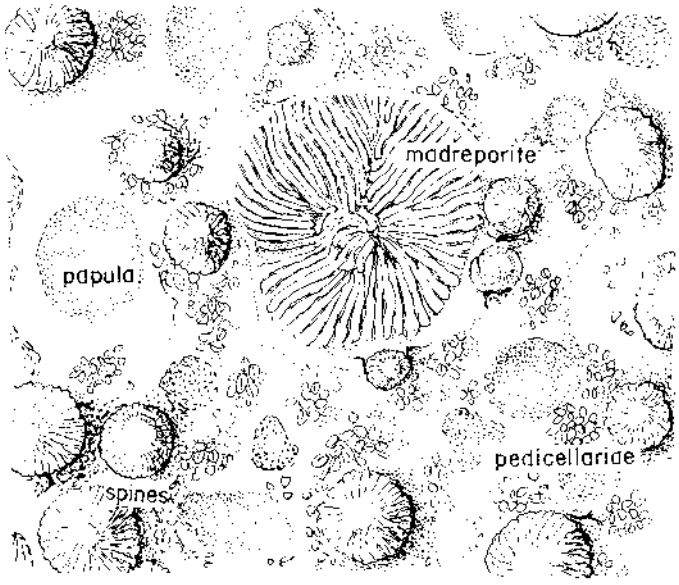
Pisaster brevispinus



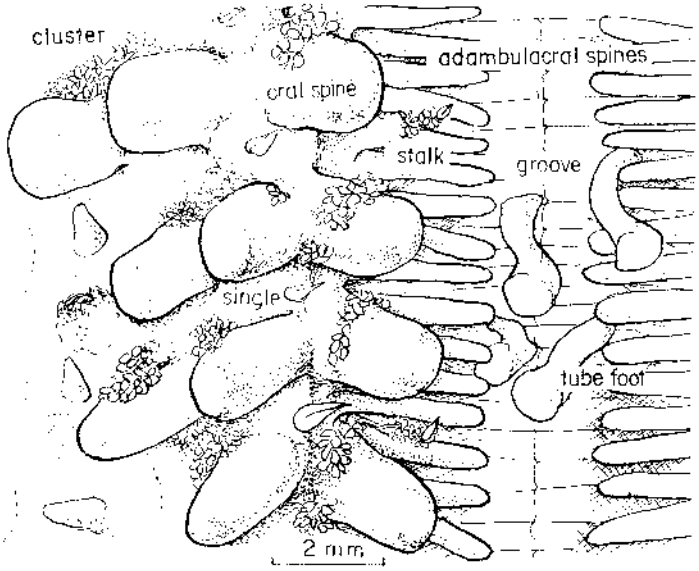
1. *Pisaster brevispinus x 1* dorsal surface
short spines, single or in small groups; a straight row down each arm; soft tissue between spines; color pink; five tapering arms; large raised central disc.



2.one ray, ventral x1
adambulacral groove with tube feet.



3. dorsal spines, madreporite x8
spines short, some onion-domed;' or in small groups; rounded madreporite; pedicel lariae clustered; dark papulae.



4.ventra l spines, groove x8
oral spines blunt, elliptical;
adambulacral spines along groove;
pedicellariae clustered, single or stalked.

Pisaster ochraceus

common Pacific sea star, ochre sea star Brandt, 1835

PHYLUM: *Echinodermata*
CLASS: *Asteroidea*
ORDER: *Forcipulata*
FAMILY: *Asteriidae*

Description

SIZE—average (Monterey, California): 140 mm diameter, each ray (arm) 40 mm; width of ray base 40 mm." This specimen 150 mm diameter. Puget Sound, regularly 250 mm.e

COLOR—aboral (dorsal) surface red, brown or ochre—the last especially on open coast; Puget Sound: purple; oral (ventral) surface ochre. Juveniles gray with brown aboral patches.'

SURFACE PATTERN—lateral and dorsal spines form reticulated pattern; spines at arm tips form series of separate crescentic arcs (fig. 1): species *ochraceus."* No long straight rows of spines down arms. Dark centers of reticulated patterns are respiratory surfaces (papulae).'° Surface stiff, harsh .6

SPINES—dorsal: low, small, serrated, rounded, bead-like or papillate (figs. 1, 3); formed into crescentic arcs at arm tips. No straight middorsal row of arm spines. Spines in center of disc form a distinct star (fig. 1). Ventral: spines serrated, blunt and heavy, more spine-like than bead-like (fig. 4). Adambulacral spines: (lining odes of ambulacral grooves) articulated, long, thin (fig. 4).

CENTRAL DISC—large, convex, arched, not distinct as in Ophiuroidea (brittle stars); contains madreporite, anus. Diameter of disc less than 'A, and more than /, total diameter genus *Pisaster.'*

RAYS (ARMS)—five, unless damaged; tapering, thick, large; not sharply demarcated from disc,' but broadest where they join disc_ Not broad enough to give a webbed appearance.

AMBULACRAL GROOVES—long furrows on oral surface of arms, which contain tube feet; class Asteroidea' (figs. 2, 4). Along each edge of groove are adambulacral spines intermixed with stalked clustered pedicellariae (fig. 4).

PEDICELLARIAE—stalked or sessile appendages used for cleansing surface of invaders, *i. e.* barnacles larvae: two-jawed in *Pisaster* species

VENTRAL SURFACE: stalked, three types: (1) small, clustered around bases of oral spines (fig. 4); (2) small pedicellariae clustered on expandable strands between adambulacral spines (fig. 4), and (3) large pedicellariae on these same strands (fig 4). There are no pedicellariae *on* the adambulacral spines: genus *Pisaster.6:'*

DORSAL SURFACE: two types: (1) small, clustered around dorsal spines (but not in raised rings around them); and (2) a few solitary, large, sessile pedicellanae scattered over dorsal surface (fig. 3).

MOUTH—large, in center of under or ventral side (fig. *2): Pisaster* can extrude its stomach through this opening to engulf food.

MADREPORITE—(mad-rep-or-ite): a sieve-like structure which serves as the water intake into the stone canal ‧ ; conspicuous about 'A of radius from center of disc (fig. 1, between arms numbered 1 and *2).*

ANUS—inconspicuous, near center of aboral surface; probably not functional', surrounded by small pedicellariae.

TUBE FEET—for locomotion, and part of water vascular system; on ventral side in ambulacral grooves; staggered in pairs, four rows across down each ambulacral groove (fig. 4)

Possible Misidentifications

Among the large five-armed sea stars, *Pisaster* sp. are noted for their thick arms, low, papillate dorsal spines, and for their pedicellanae. Two other Asteriidae share these characteristics:

Evasterias troschelii is a rather rare, low intertidal species with a small disc and slender arms compared to *Pisaster,* and a varied, though generally oranged-red coloration.' *Evasterias* has clusters of pedicellariae on its adambulacral spines, not just at their bases as in *Pisaster ochraceus.*

Orthasterias koehleri, another Asteriidae, has sharp dorsal spines, not blunt papillate ones; these spines are each surrounded by a distinct ring of large pedicellariae. *Orthasterias'* dorsal spines are arranged in distinct radial rows (those of *Pisaster* are not); *Orthasterias* is often red with yellow mottling", it occurs in the low intertidal and subtidally.

Two other species of *Pisaster* can be found: *Pisaster brevispinus* occurs not on rocks and pilings but on soft substrates, where it feeds on clams. Its aboral spines do not form reticulated patterns or arcs, but occur singly or in groups of 2 or 3, and are separated by areas of soft tissue. P. *brevispinus* appears to be weak; it is not. It has a straight, distinct row of middorsal spines on each arm. This sea star is nearly always pink: it can be mottled with gray-green or maroon-purple as well.' It is one of the largest asteroids, growing to 320 mm (2 feet) in diameter.'

Pisaster giganteus is bluish gray; its dorsal spines are blunt, clubbed, and each surrounded by a ring of blue flesh, and around that a ring of pedicellariae. If has tiny pedicellariae thickly scattered between the dense spines; its spines are not arranged in radial or concentric rows. *P. giganteus* is a low intertidal sea star usually found further south than Oregon. Despite its name, it is usually smaller than *P. ochraceus."*

Sea stars are extremely variable within species: Fisher, listed three definite forms of *P. ochraceus.* Although these names are not used in systematics, it should be noted that the Puget Sound and Oregon outer coast variety of P. *ochraceus* has a flatter, smoother surface ornamentation than does our Oregon bay form '°

Ecological Information

RANGE—Sitka, Alaska south to near Pt. Concepcion,

LOCAL DISTRIBUTION—typical form of the open sea coast; in bays on jetties and pilings only in marine parts of large bays, Le. Coos Bay.

HABITAT—jetties, rocks, pilings, bay mussel beds: hard substrates. Larger individuals can stand exposure to air.'

SALINITY—collected at 30 o/oo saltwater, cannot tolerate long-term reduced salinities.

TEMPERATURE—found in cold to temperate waters.

TIDAL LEVEL—a wide vertical distribution, being a hunter; intertidal to 3 meters deep (Monterey Bay).' Large sea stars usually found at low tide mark in Puget Sound, probably for warmth: they do not move down in Monterey.'

ASSOCIATES—mussels, barnacles, limpets and other snails: its prey. Other inhabitants of the mussel bed can include polychaetes, anemones, nematodes, etc. Pilings in quiet waters: barnacles, anemone *Metridium senile,* tunicates."

Quantitative Information

WEIGHT—(wet): range 37.8-834 gr. (28 animals).'

ABUNDANCE—"the most conspicuous sea star of rocky intertidal areas" (Puget Sound)° ; the common predator of the lower *Mytilus* beds,' where it is the most obvious member of the mussel community."

Life History Information

REPRODUCTION—separate sexes[6] ; ten gonads like feathery tufts, two in each ray, next to disc. Definite spawning period: March to June': eggs and sperm extruded from between rays and from dorsal surface into water. *Pisaster* does not brood its eggs or young as do some Asteriidae," *i. e. Lepasterias.* Embryos develop to swimming larvae, metamorphose and as new stars, measure less than 1 mm [6] Asexual regeneration of arms characteristic of the Asteroidea. (Regeneration of whole animal from an arm not possible without some of disc6).

GROWTH RATE—varies with food availability, roughness of waters, etc. With constant food supply, proper conditions, a sea star can feed continuously and increase its weight from 2 to 30 times in a year.' It can survive at least 20 months without feeding. Animal's size not related as much to age as to food availability. The more even conditions in a bay ensure greater opportunities for feeding than do open coast conditions.'

LONGEVITY-

FOOD—favorite prey seems to by *Mytilus,* on which it grows fastest: also east barnacles, clams, crabs, chitons, etc.: omnivorous.

PREDATORS—seagulls (on adults); school children and thoughtless beachcombers.

BEHAVIOR—can right itself vigorously when oral surface is detached from substrate; can evert stomach to envelope prey. Some invertebrates, *i. e.* limpet *Collisella* can avoid *Pisaster* by a special escape mechanism (see *Collisella pelta).*

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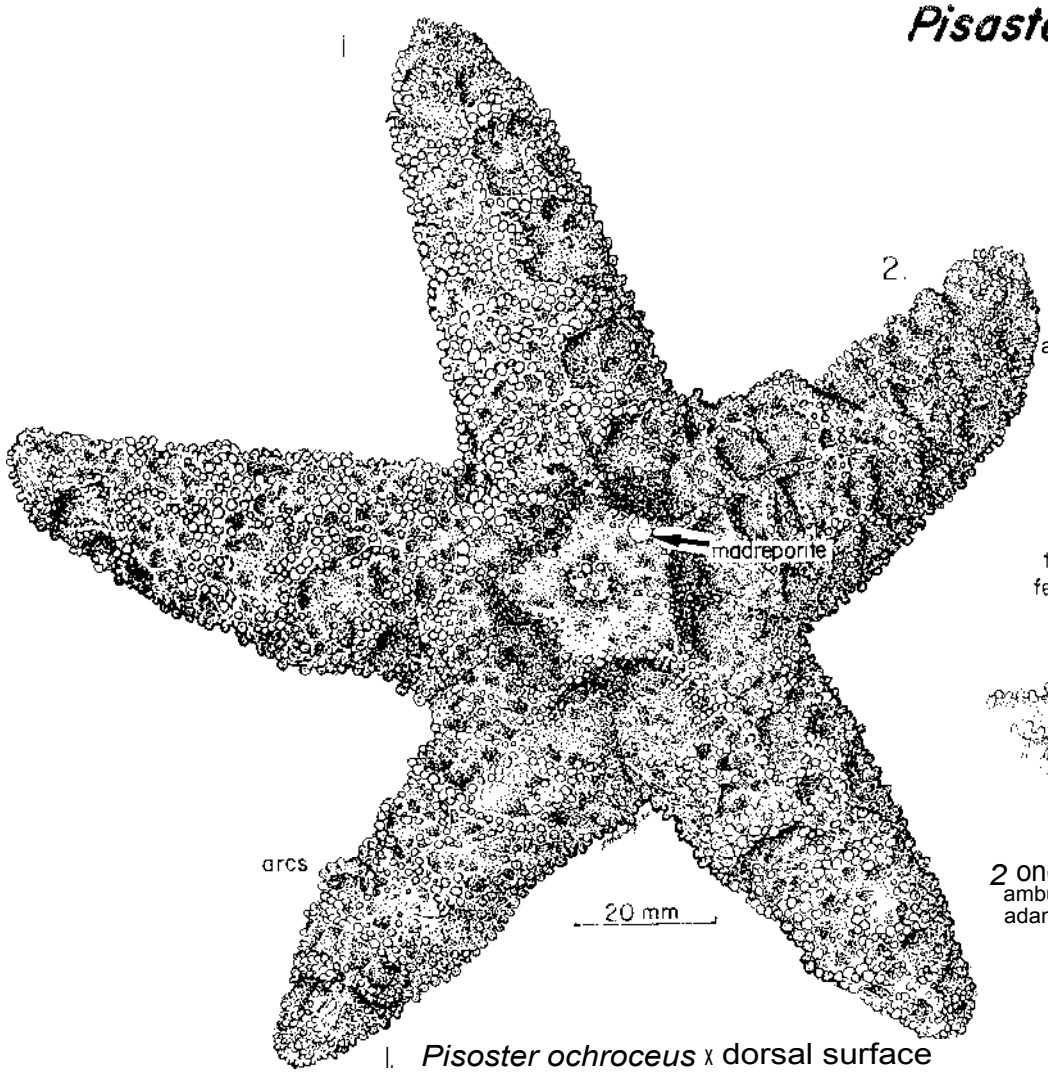
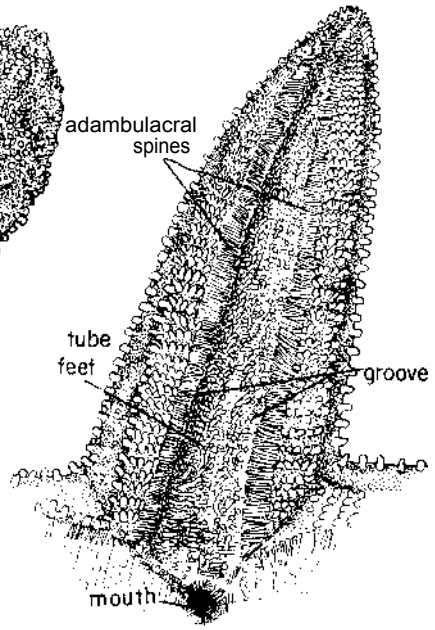
Pisaster ochraceus

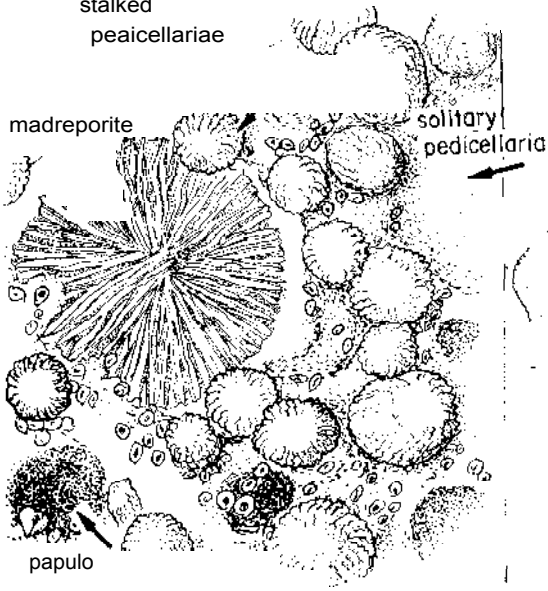


1. *Pisoster ochroceus* x dorsal surface

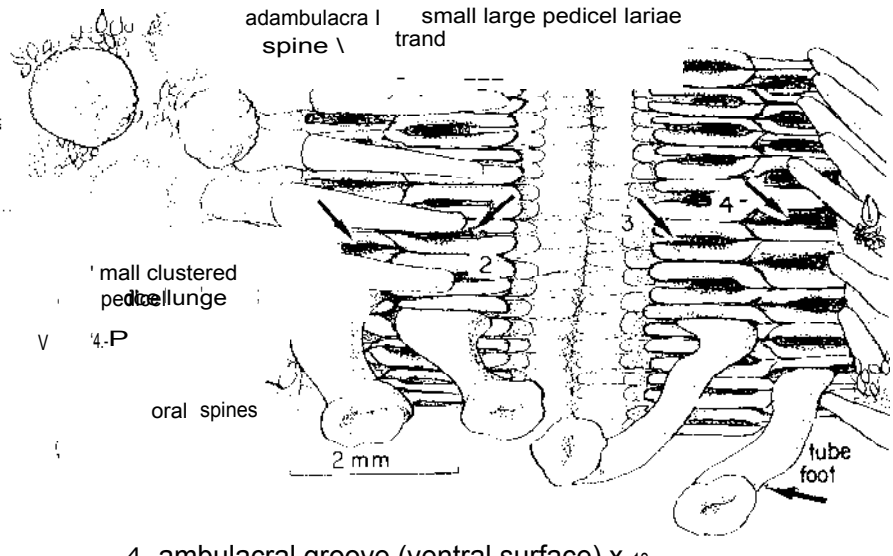
stiff, harsh surface; reticulated pattern, spines in arcs;
five thick,tapering arms; large arched central disc.



2 one ray, ventral surface
ambulacral groove with tube feet;
adambulacral spines.



3. madrepori te, dorsa r,r)ines x 12
madreporite large, flat, filter-like;
dorsal spines short, rounded, bead-like;
pedicel lariae: stal ked, small, clustered;
sessile, large, solitary.



4. ambulacral groove (ventral surface) x 12
all tube feet removed except four, to show four rows across groove.
adambulacral spines along groove;
pedicel lariae: small, clustered on expandqble strands with some large ones;
small and clustered at bases of oral spines.