

Amphipoda of the Northeast Pacific (Equator to Aleutians, intertidal to abyss): X.
Hadzioidea – an expanded and updated review
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Preface

The purpose of this review is to bring together information on all of the species reported to occur in the NEP fauna. It is not a straight path to the identification of your unknown animal. It is a resource guide to assist you in making the required identification in full knowledge of what the possibilities are. Never forget that there are other, as yet unreported species from the coverage area; some described, some new to science. The natural world is wonderfully diverse, and we have just scratched its surface.



Maera sp an undescribed species from Guana Island, British Virgin Ids. (Photo Yale Peabody Museum)

Introduction to the Hadzioidea

The superfamily was originally constituted as the Melitoidea (Bousfield 1977). This concept was critiqued by J. L. Barnard and Karaman (1980), and in response Bousfield renamed the group Hadzioidea without changing its composition (Bousfield 1983). Following the revisionary analysis of Lowry and Myers (2013), the superfamily belongs in its own Infraorder within the Subclass Senticaudata. It contains eight families (Horton 2014), of which five are represented in the NEP. The taxonomic position suggested by Bousfield (2001) is largely used here, but Barnard and Karaman and others retained them as several groups within the gammaroids s. l.. The discussion of the hadzioids in J. L. Barnard & C. M. Barnard (1983, pp. 137-140, and as “Melita Group” pp. 147-151) may help show how members of this superfamily differ from other gammaroids, and from each other.

The hadzioid families not represented in the NEP include the Crangoweckeliidae, the Metacrangonyctidae, and the Nuuanuidae. The first and second of these are entirely freshwater with representatives in the Caribbean and North Africa, respectively. The

Nuuanuidae are cosmopolitan and marine, but have no representatives within the covered area.

The families Eriopisidae, Gammaroporeidae, Hadziidae, Maeridae, and Melitidae all have NEP representatives and are covered below

Diagnosis of the Hadziioidea – “*body not carinate nor rostrate, toothed on abdomen only (rarely on peraeon): urosome dorsal spine groups weak or lacking; sexual dimorphism strongly expressed in body size and in gnathopods, and in antenna 2 and peraeopods; antennae 2 lacking calceoli; antennae strongly developed, 1 usually much the longer, peduncular segment 2 elongate; accessory flagellum prominent (occasionally very reduced or lacking); inferior antennal sinus small or sharply incised; eye (when present) basically small, rounded, occasionally reniform. Mouthparts basic: mandibular palp slender, weakly armed, occasionally lacking, segment 3 not greatly shortened; lower lip, inner lobes variously developed, often strong; maxillae, plates often small, setose apically; maxilla 1, outer plate with 11-7 apical spine-teeth; maxilliped plates moderately strong, marginally spinose, palp dactylate,. Coxal plates 1-4 medium deep to shallow, contiguous, weakly setose; coxae 5-7, posterior lobe not deeper than anterior. Gnathopods 1 and 2 subchelate, 2 much the larger and more powerful (especially ♂) and of different form (especially in carpus and propodus); peraeopod 3 larger than 4, not sexually dimorphic; peraeopods 5-7, bases variously expanded, often sub-linear, 7 usually longest; pleopods usually well developed, peduncles slender; epimeral plates posteriorly acute. Uropod 1, peduncle with baso-facial spine strongly developed; uropod 3, rami variably developed, spinose, seldom setose; telson variously bilobed, lobes usually divergent, apices acute, spinose in apical notch. Coxal gills simple, often pedunculate, lacking on peraeon 7; sternal gills lacking; brood plates linear, often small, margins few- and short-setose.*”(Bousfield 1977).

Ecological Commentary

Hadzioids are epifaunal animals, often found among algae or in fouling community masses. They do not construct even temporary tubes, living instead a fully mobile life in their chosen habitat, or exceptionally in burrows of their own construction in deeper offshore bottoms. While such epifauna typically have high oxygen demand, and are found in unimpacted areas, some hadzioids are more tolerant of polluted conditions. Sagasti et al (2000) found *Melita nitida* to be tolerant of low oxygen episodes in the York River. While they did not observe full anoxia, hypoxic conditions, with oxygen saturation as low as 0.5% occurred periodically during their study. As this species is a known invasive (Chapman 1988), and has demonstrated abilities to survive under hydrocarbon pollutant stress (Borowsky et al 1997), its tolerance of low-oxygen is not surprising. The animals must have good swimming ability, as they disperse primarily as adults, nearly 97% of the population colonizing new substrate arriving as adults. Of these, the majority were females and 50% were gravid at time of arrival. (Munguia et al 2007).

Hadzioids were among the groups considered by Saint-Marie (1991) in his review of reproductive behavior in the gammaroids. Most of the taxa for which evidence was available were judged to produce more than one brood per year. In an investigation of the biology of the eriopisid *Victoriopisa chilensis* Aravind et al (2007, as *Eriopisa*

chilkensis) found it had 4-7 broods per year, lived less than one year on average. The amazingly prolific *Melita zeylandica* was estimated to bear 22 broods per year by Krishnan and John (1974)! The only NEP hadzioid considered was the introduced *Melita nitida*, which was suggested to bear an indeterminate number of broods per year, but more than one.

Members of the maerid genus *Elasmopus* are frequently present in large numbers among algae on intertidal rocks. Their taste in hosts is catholic, and the same species may be found on green algae such as *Ulva*, on filamentous red algal masses, on branching reds, and on calcareous reds. They are also found among surf-grass, and on larger brown algae such as *Egregia* and *Macrocystis* (J. L. Barnard 1969). These animals tend to have pigment patterning on their bodies, and especially on their legs. Unlike amphitoid corophioids that resemble the host plant in color, the patterning of the *Elasmopus* is not obviously cryptic. They do not seem to derive their pigments from the algae they are associated with, and probably do not feed directly on them. It is more likely they are either grazing on epiphytic diatoms on the algae, or harvesting detritus from within the algal interstices. One commensal melitid is known to feed on detritus along with its ophiuroid host (Lowry and Springthorpe 2005). Similar detrital feeding is reported for *Melita obtusata* which lives as a commensal between the tube feet of asteroids (Reibisch 1927). Enequist (1950) also observed this animal without its host in his aquaria, and saw it teasing detrital aggregates from chinks and crevices under shell debris and other objects. No sifting such is observed in burrowing forms was employed.

Some NEP hadzioids are apparently specialized as lignivores, living and feeding on sunken wood. These deep-water forms such as *Bathyceradocus* and *Melita lignophila* (J. L. Barnard 1961) process sunken trees, branches, cocoanuts, etc.



Bathyceradocus stephenseni from near hydrothermal vents at 13°N (Photo Todd Haney)

While hadzioids are often found on fully submerged substrates, such as on the community fouling docks, pilings and other structures, they are also found in the intertidal. Algal density tends to increase as one moves lower in the intertidal, but even the mid-intertidal frequently has considerable growth, among which these amphipods are found. These forms tend to have a fairly waxy cuticle (Chapman 2007) which may help retard water loss during emersion at low tide. A number of the habitat records for melitids listed by J. L. Barnard (1969) did not mention algae or other growth. He instead recorded animals as “on the undersides of rocks”, a habit I have often observed in the intertidal zone of the SCB, especially when the rock is bedding in coarse sand. Overturned rocks will often have numbers of amphipods attempting to flee exposure by scooting along on their flat sides within the film of moisture coating the rock. These are often melitoids, although other groups are also represented.

In some cases such under-rock habitat is shared with other organisms, particularly ophiuroids. Lowry and Springthorpe (2005) describe a new species of *Melita* found to live commensally on the oral surface of a large ophiuroid under rocks in Australia. The species is well adapted to this habitat, having color patterning which matches the host, and having reduced sexual dimorphism compared to other melitids. The authors suggest that this results from the constant association of the amphipods in male-female pairs on the ophiuroid. This association would make precopulatory mate guarding unnecessary, and render secondary sexual differentiation unneeded.

In her review of sexual dimorphism and behavior in amphipods Conlan (1991) classifies the melitid *Elasmopus levis* as an attending mate-guarder, but noted that attending of the female by the male is very limited. She also indicates *Melita nitida* as a mate-guarder carrier, engaging in precopulatory grasping of the female. There is apparently a range of sexual behavior in the family, which is accompanied by a range in sexual dimorphism. This is primarily expressed in the male first and second gnathopods, but in some groups of *Melita* is also expressed in the structure of the basis of the sixth pereopod of the female, which is grasped by the male gnathopod 1 in pre-amplexus (Krisnan and John 1974, Borowsky 1984).

Direct observations of the activities of two genera of hadzioids were made by Enequist (1950). He observed aquarium maintained *Maera loveni* and *Eriopisa elongata*. While his observations were made on individuals from the Northeast Atlantic, these same species also occur in the NEP. Both are apparently deposit feeding detritivores, that simultaneously burrow and feed. When offered bits of fish flesh, they would initially bury them, then consume them later when encountered in the burrow. They thus are also facultative scavengers on small decaying masses. This behavior suggests that they do not engage in opportunistic feeding on moribund animals, but require the appropriate bacterial flora on the tissue before it is found palatable by the amphipod.

The methods of burrowing used by the two are described at length by Enequist (1950), which should be consulted for additional detail. Both species are very agile burrowers, and reverse field within the burrows with ease. Given the extreme elongation of rami in *Eriopisa* this is rather astonishing. The burrows are double ended, with apertures at both ends providing for a slow respiratory water exchange. Movement of water by pleopods is not involved in feeding, which is performed by the sifting of organics from the sediment excavated by the animal. This is done primarily by the gnathopods, with some assistance from the second antennae. Both these forms are found

on offshore soft bottoms of mixed silt and sand. The local *Maera nelsonae*, which lives in similar habitat, is presumed to share similar burrowing behavior, although this has not yet been observed.

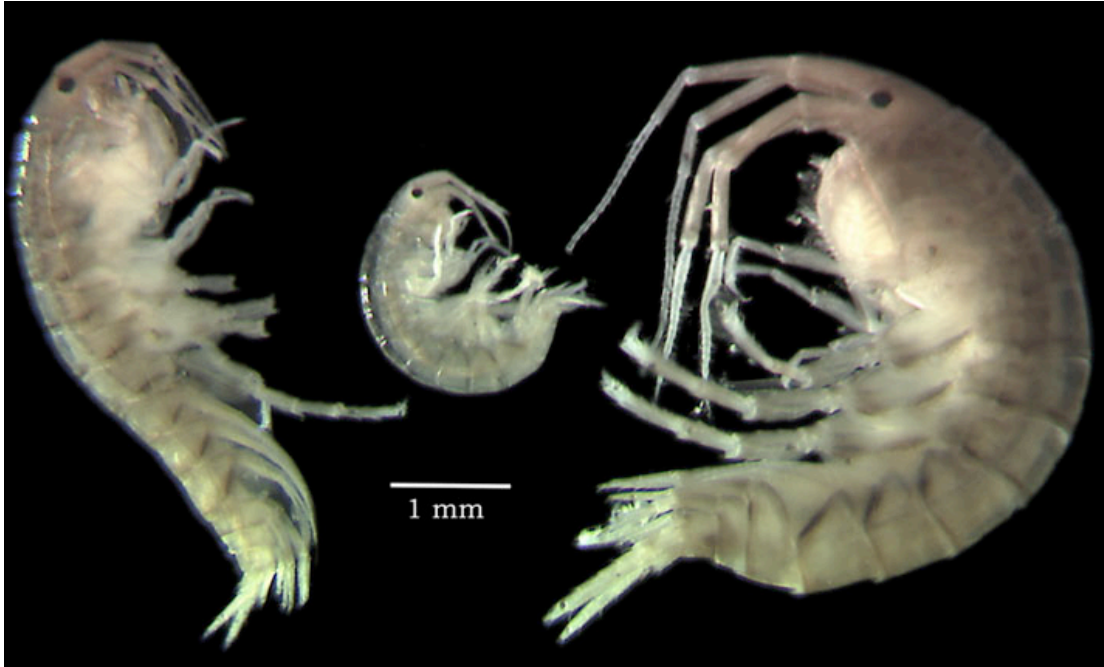
Swimming in these two burrowers is clumsy, and may differ significantly from that in non-burrowing motile epifaunal hadzioids. Enequist records their swimming as anterior posterior flexion, as used by caprellids. Swimming excursions were of short duration.

Another hadzioid was also observed by Enequist, which excavate furrows without forming domiciliary burrows; *Melita othonis* (now *Othomaera othonis*, see Krapp-Schickel 2000). The taxon were active at the surface, digging up the sediment and resuspending its finer portion by vigorous beating of the pleopods. This particle cloud was then harvested by the strongly setose gnathopods, which were used to strain out the organic particulates. These were then removed from the gnathopod setal comb by the mouthparts and ingested.

The habits of hadzioids are well suited to allow transport by human agency, and several species have been introduced to the NEP by man. *Melita rylovae* Bulycheva 1955 has been introduced from the Northwest Pacific, and become established in San Francisco Bay. Similarly, *Melita nitida* Smith 1874, a western Atlantic species, is now frequently found in samples from San Francisco Bay. Although both these taxa appear to be here to stay, it is uncertain if they will disperse outside the Bay, and become established at other points along the coastline of the NEP. *Melita nitida* has already been detected in samples collected from the tidal prism of the San Gabriel River in Orange County, but whether the population persists only time will tell.



Melita rylovae specimen from San Francisco Bay (www.calacademy.org/research/izg/sfbay2k)



Melita nitida specimens from San Francisco Bay (www.calacademy.org/research/izg/sfbay2k)

Key to NEP Hadzioid genera (modified from Jarrett and Bousfield 1996 and Krapp-Schickel and Jarrett 2000)

1. Inner ramus of U3 strongly reduced ("melita group").....2
 Inner ramus of U3 subequal to outer ramus ("maera/ceradocus groups").....12
2. Pleon segments 1-3 usually posteriodorsally toothed; urosome segments 1-2 with dorsal teeth.....3
 Pleon segments 1-3 smooth or weakly toothed; urosome segments 1 and 2 often lacking dorsal teeth.....6
3. U3 outer ramus rod-like, slender; maxilla 1 inner plate with tuft of apical setae, otherwise bare; one gnathopod 2 much enlarged (♂).....*Dulichchiella*
 U3 outer ramus normal; maxilla 1 inner plate inner margin setose; second gnathopods subequal in size and shape in both sexes.....4
4. Pleon segments 1-3 with posterodistal teeth; urosome segment 1 with 3+ posterodistal teeth.....*Megamoera*
 Pleon segments 1-3 lacking posterodorsal teeth; urosome segment 1 usually with single stout posterodistal tooth.....5
5. G2 (♂) dactyl strongly setose on outer margin; carpus broader than deep; coxa 1 anterolobate.....*Quasimelita*
 G2 (♂) dactyl lacking outer marginal setae; carpus narrow, deeper than broad; coxa 1 anteriorly subquadrate to rounded.....*Desdimelita*
6. G1 (♂) propod and dactyl usually strongly differing from female; anterior lobe of coxa 6 (♀) modified, usually hook-like.....*Melita*
 G1 (♂) dactyl and propod normally sub-chelate, showing little or no sexually dimorphism in structure; coxa 6 (♀) with little or no anterior modification.....7
7. Uropod 3 outer ramus uniarticulate.....8

Uropod 3 outer ramus biarticulate.....	10
8. Pigmented eyes present.....	<i>Netamelita</i>
Pigmented eyes absent.....	9
9. Uropod 3 outer ramus nearly twice as long as peduncle.....	<i>Anchialella</i>
Uropod 3 outer ramus equal to or slightly longer than peduncle.....	<i>Galapsiellus</i>
10. Uropod 3 outer ramus terminal article much shorter than first article, both together less than ¼ body length.....	<i>Dulzura</i>
Uropod 3 outer ramus terminal and basal articles subequal in length, together nearly ½ body length.....	11
11. Article 3 of mandibular palp much longer than article 2.....	<i>Eriopisa</i>
Article 3 of mandibular palp shorter than article 2.....	<i>Psammogammarus</i>
12. With pigmented eyes.....	14
Lacking any trace of eyes.....	13
13. Pleonites and urosome 1-2 posterodorsally dentate.....	<i>Bathyceradocus</i>
Pleonites and urosomites lacking teeth, cusps or denticles.....	<i>Wimvadocus</i>
14. Article 3 of mandibular palp strongly falcate.....	<i>Elasmopus</i>
Article 3 of mandibular palp not falcate.....	15
15. G2 dactylus outer margin setose; palmar angle ≈ 120°.....	<i>Maera</i>
G2 dactylus with single seta on outer margin; palmar angle various.....	16
16. G2 propodus quadrangular, palmar angle 90°.....	<i>Quadrimaera</i>
G2 propodus oval, palmar angle exceeds 90°.....	17
17. U3 rami shortened, 1.5 times longer than wide, slightly longer than peduncle; antennal flagella reduced.....	<i>Lupimaera</i>
U3 rami not shortened, 2-3 times peduncle length; antennal flagella not reduced	<i>Ceradocus</i>

NEP Hadziioidea from McLaughlin *et al.* (2005) augmented by known provisional taxa.

*= Taxa on the SCAMIT Ed 9 list (Cadien and Lovell 2014).

Valid taxa **bolded**, synonyms not.

Family Eriopisidae

Eriopis elongata Bruzelius 1859 (see *Eriopisa elongata*)

Eriopisa elongata (Bruzelius 1859) – Boreal North Atlantic, North Pacific to
Oregon: 100 -1200m

Eriopisa garthi J. L. Barnard 1952 (see *Psammogammarus garthi*)

Netamelita cortada J. L. Barnard 1962 – Pt. Conception to Gaviota: 22m

Psammogammarus garthi (J. L. Barnard 1952)

Family Gammaroporeidae

Gammaroporeia alaskensis (Bousfield and Hubbard 1968) – Olsen Bay, Alaska
To Vancouver Id., British Columbia; 0m

Micruropus alaskensis Bousfield and Hubbard 1968

Family Hadziidae

Dulzura gal J. L. Barnard 1979 – Galapagos; 0-1m

Dulzura sal J. L. Barnard 1969 – California, Corona del Mar to La Jolla; 0m

Family Maeridae

Bathyceradocus stephensi Pirlot 1934 – Indo-Pacific, Madagascar,
Philippines;

NEP East Pacific Rise to Gulf of Panama; 1500-4930m

Bathyceradocus wuzzae Larsen and Krapp-Schickel 2007 – Juan de Fuca Ridge, Escanaba Trough, and Gorda Ridge off Oregon; 2213-3232m

Ceradocus paucidentatus J. L. Barnard 1952 – Pacific Baja California to Gulf of California: 0m

***Ceradocus spinicauda** (Holmes 1908) – British Columbia to San Diego; 0-82m
Ceradocus torelli (see *Wimvadocus torelli*)

Elasmopus antennatus (Stout 1913) – California, Carmel to Cabo San Lucas: 0-18m

***Elasmopus bampo** J. L. Barnard 1979 – SCB to Gulf of California: 0-3m

Elasmopus ecuadoriensis Schellenberg 1936 – Galapagos Ids.: 0m

Elasmopus gracilis Schellenberg 1938 – NEP, Clipperton Id.; Indo-Pacific, Fiji and Ellice Islands: 0m

Elasmopus holgurus J. L. Barnard 1962 – SCB: 0m

Elasmopus mayo J. L. Barnard 1979 – Gulf of California to Galapagos: 0m

***Elasmopus mutatus** J. L. Barnard 1962 – Central to Southern California; 0m

Elasmopus ocoroni J. L. Barnard 1979 – Galapagos Ids.: 0m

Elasmopus rapax Costa 1853 – Mediterranean; introduced to NEP, occurring in bays between Central California and Gulf of California: 0-100m

Elasmopus serricatus J. L. Barnard 1969 – Carmel California to Panama: 0m

Elasmopus spinidactylus Chevreux 1907 – NEP, Clipperton Id.; Indo-Pacific, Tuamotu and Gilbert Islands: 0m

Elasmopus temori J. L. Barnard 1979 – Galapagos Ids.: 0m

Elasmopus tiburoni J. L. Barnard 1979 – Gulf of California: 0m

Elasmopus tubar J. L. Barnard 1979 – Cabo San Lucas to Galapagos Ids.: 0m

Elasmopus zoanthidea J. L. Barnard 1979 – Galapagos Ids.: 0m

Gammarus loveni Bruzelius 1859 (see *Maera loveni*)

Gammarus torelli Goës 1866 (see *Wimvadocus torelli*)

Leptothoe danae Stimpson 1853 (see *Maera danae*)

Lupimaera lupana (J. L. Barnard 1969) – SCB: 3m

Maera bousfieldi Krapp-Schickel and Jarrett 2000 – British Columbia: to 196m

Maera caroliniana Bynum & Fox 1977 (see *Maera diffidentia*)

Maera chinarra J. L. Barnard 1979 (see *Quadrimaera chinarra*)

Maera danae (Stimpson 1853) – Bering Sea to Gulf of Alaska: 0-110m

Maera diffidentia (see *Meximaera diffidentia*)

Maera fusca (Bate 1864) – Bering Sea to Washington: 0m

***Maera jerrica** Krapp-Schickel & Jarrett 2000 – SE Alaska to La Jolla: 0-61m

Maera loveni (Bruzelius 1859) – North Atlantic; NEP, Puget Sound: 20-300m

Maera lupana J. L. Barnard 1969 (see *Lupimaera lupana*)

***Maera nelsonae** Krapp-Schickel & Jarrett 2000 – Bering Sea to SCB: 75-732m

Maera reishi J. L. Barnard 1979

***Maera similis** Stout 1913 – British Columbia to Sinaloa, Mexico: 0-221m

Maera spinicauda Holmes 1908 (see *Ceradocus spinicauda*)

Maera vigota J. L. Barnard 1969 (see *Quadrimaera vigota*)

Meximaera diffidentia J. L. Barnard 1969 - NEP, Gulf of California to Galapagos Ids.; South Carolina to Florida: 0-125m

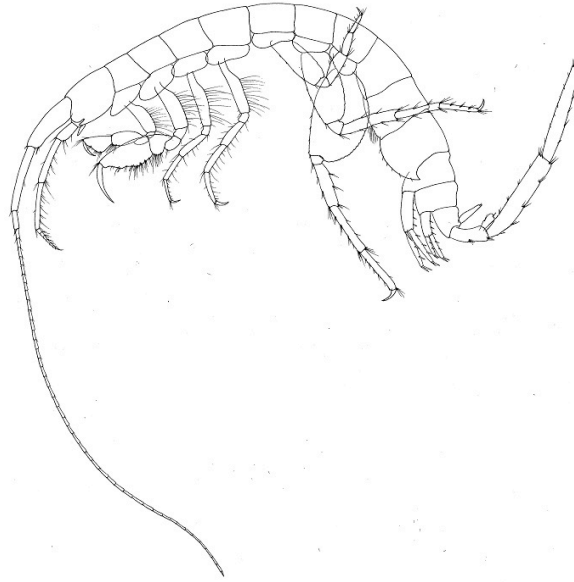
Neogammaropsis antennatus Stout 1913 (see *Elasmopus antennatus*)
 ***Quadrimaera carla** Krapp-Schickel & Jarrett 2000 – British Columbia to Venice, California; 27-33m
Quadrimaera chinarra (J. L. Barnard 1979) – Cabo San Lucas, Baja California to Galapagos Ids.: 0m
 ***Quadrimaera reishi** (J. L. Barnard 1979) – SCB to Galapagos: 0-10m
 ***Quadrimaera vigota** (J. L. Barnard 1969) - Gulf of Alaska to Central California: 0m
Wimvadocus torelli (Goës 1866) – Bering Sea to British Columbia: 0-57m
 Family Melitidae
Anchialella vulcanella J. L. Barnard 1979 – Galapagos anchihaline pool; 0
Caliniphargus sulcus Stout 1913 (see *Melita sulca*)
Desdimelita barnardi Jarrett and Bousfield 1996 – Vancouver Id.: 0m
Desdimelita californica (Alderman 1936) – Aleutians to Central California: 0-37m
 ***Desdimelita desdichada** (J. L. Barnard 1962) – SE Alaska to SCB: 0-120m
Desdimelita microdentata Jarrett and Bousfield 1996 – SE Alaska to Central Oregon: 0-35m
Desdimelita microphthalma Jarrett and Bousfield 1996 – SE Alaska: 0m
Desdimelita transmelita Jarrett and Bousfield 1996 – Vancouver Id.: 16-30m
Desdimelita sp A (Cadien 2007§) - Moss Landing, Central California: 0-3m
 ***Dulichieilla spinosa** Stout 1912 – California, Goleta to Laguna Beach: 0-27m
Galapsiellus leleuporum (Monod 1970) – Galapagos Ids.: 0-29m
Gammarus dentatus Krøyer 1842 (see *Megamoera dentata*)
Gammarus subtener Stimpson 1864 (see *Megamoera subtener*)
Megamoera borealis Jarrett and Bousfield 1996 -Aleutian Ids. to British Columbia: 0-66m
Megamoera bowmani Jarrett and Bousfield 1996 – SE Alaska to British Columbia: 0-25m
Megamoera dentata (Krøyer 1842) – Western North Atlantic; Bering Sea to Sea of Japan; NEP, Aleutian Ids.: 0-672m
Megamoera glacialis Jarrett and Bousfield 1996 – Aleutian Ids. to Prince William Sound, Alaska: 0m
Megamoera kodiakensis (J.L. Barnard 1964) – Gulf of Alaska: depth not recorded, but bathyal (200+m)
Megamoera mikulitschae (Gurjanova 1953) – NWPacific, Chukchi Sea; NEP, Aleutian Ids.: 0-10m
Megamoera rafiae Jarrett and Bousfield 1996 – SE Alaska: 0m
 ***Megamoera subtener** (Stimpson 1856) – Prince William Sound Alaska to Central California: 0-10m
Megamoera unimaki Jarrett and Bousfield 1996 – Aleutian Ids.: 0m
Melita alaskensis Jarrett and Bousfield 1996 – SE Alaska: 0m
Melita californica Alderman 1936 (see *Desdimelita californica*)
Melita dentata (Krøyer 1842) (see *Megamoera dentata*)
Melita desdichada J. L. Barnard 1962 (see *Desdimelita desdichada*)
Melita kodiakensis J. L. Barnard 1964 (see *Megamoera kodiakensis*)

Melita lignophila J. L. Barnard 1961 – Gulf of Panama: 915m
 Melita mikulitschae Gurjanova 1953 (see Megamoera mikulitschae)
Melita nitida Smith 1874 – NW Atlantic; Introduced to NEP, British
 Columbia to San Gabriel River: 0-10m
Melita oregonensis J. L. Barnard 1954 – British Columbia to Northern
 California: 0m
 Melita quadrispinosa Vosseler 1889 (see Quasimelita quadrispinosa)
Melita rylovae Bulycheva 1955 – NWPacific; NEP, introduced to San
 Francisco Bay: 1-10m
 ***Melita sulca** (Stout 1913) – British Columbia to Baja California 0-101m
 Melita valida Shoemaker 1955 (see Melitoides valida)
 Melita sp A of Cadien – see Desdimelita sp A
 Paraniphargis lelouporum Monod 1970 (see Galapsiellus lelouporum)
Quasimelita quadrispinosa (Vosseler 1889) - Chukchi Sea NWPacific to
 SE Alaska: 0m

COMMENTS ON NEP HADZIOIDS BY FAMILY

Family Eriopisidae – The family is characterized as marine, epigeal and hypogean, cosmopolitan by Lowry and Myers (2013). They list nineteen genera in the group, of which three have NEP representatives.

Diagnostic description: “Body laterally compressed, subcylindrical or vermiform. Eyes well developed, poorly developed or absent, if present then round or ovoid. *Antennae 1–2 calceoli absent. Antenna 1 longer than antenna 2*; peduncular article 1 shorter than, subequal to, or longer than article 2; article 2 longer than article 3; article 3 shorter than article 1; peduncular articles 1–2 not geniculate; accessory flagellum short or minute. *Antenna 2 peduncular article 1 not enlarged*. Mandible molar triturative; palp symmetrical. Maxilla 1 basal endite setose along medial margin; palps symmetrical. Maxilla 2 basal endite with oblique setal row. Labium inner lobes present. Coxal gills [not known]; sternal gills absent; sternal blisters absent; oostegites fringing setae simple. Gnathopod 1 subchelate; smaller (or weaker) than or similar in size to gnathopod 2; propodus palm without robust setae along palmar margin. **Gnathopod 2** subchelate; **similar in males and females (not sexually dimorphic)**; carpus not produced along posterior margin of propodus, projecting between merus and propodus. Pereopods 3–4 not sexually dimorphic. Pereopod 4 without posteroventral lobe. Pereopod 5 shorter than pereopod 6; coxa with posterodorsal lobe or with large anteroventral lobe or without lobes. Pereopod 7 longer than pereopod 5. Pleonites 1–3 without dorsal carinae. *Urosomites 1–3 free; without slender or robust dorsal setae*. Urosomite 1 without large distoventral robust seta. Urosomite 2 without dorsal setae. Uropod 1 with or without basofacial robust setae. *Uropod 3* not sexually dimorphic; *biramous*, without plumose setae; *endopod minute or shorter than exopod. Telson deeply cleft*; dorsal or lateral robust setae present or absent; apical robust setae present.” (from Lowry and Myers 2013)

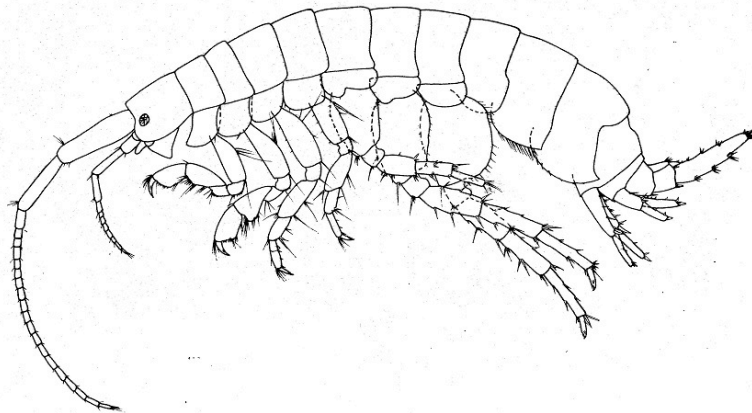


Eriopisa elongata (from Lincoln 1979)

Eriopisa – While many species have been placed in this genus in the past it has been restricted; eight species are still retained here (Horton & Lowry 2014a). *Eriopisa elongata*, a widely distributed form in the Northern Hemisphere, is reported from boreal waters in the NEP. It is a bathyal species, taken from 100-800m (Gurjanova 1951). It is extremely magniramous, with the third uropods reaching nearly $\frac{1}{2}$ the length of the body.

The species is a burrower, and a selective deposit feeder on the sediment it excavates in burrowing (Enequist 1950).

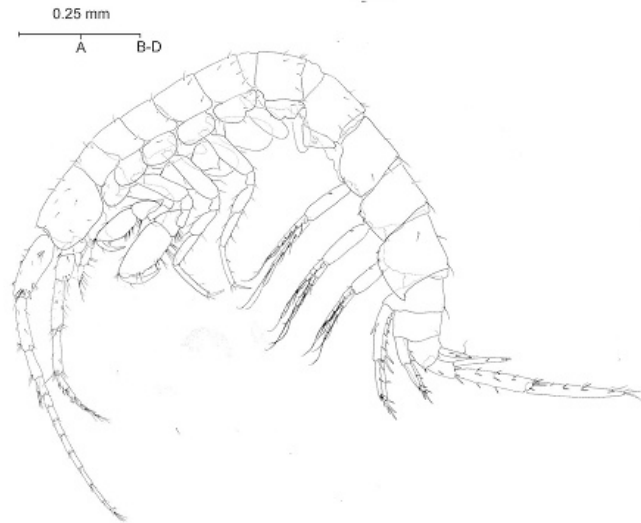
Diagnosis: “Body very elongate and slender, without dorsal teeth or spines, smooth. Coxal plates very short and scarcely contiguous. Antenna I much longer than 2; accessory flagellum extremely small, 1 or 2-articulate. Lower lip with small inner lobes; mandible with large molar, palp 3-articulate. Maxilla 1 and 2 inner plate densely setose medially. Maxilliped well developed. Gnathopods 1 and 2 subchelate. Pereopods slender. Uropods 1-2 biramous, spinose; uropod 3 extremely elongate and dominating urosome, outer ramus 2-articulate with articles subequal length, inner ramus very small and scale-like. Telson cleft to base.” (from Lincoln 1979)



Netamelita cortada (from J. L. Barnard 1962)

Netamelita - Jarrett and Bousfield (1996) include *Netamelita* in the Melitidae, while Bousfield (2001) listed it among the hadziids. It is here placed in the eriopisids, with its closest affinities judged to be with the eriopisellids as suggested by J. L. Barnard and C. M. Barnard (1983). The genus has five members (, but only one is known from the NEP, *Netamelita cortada* (J. L. Barnard 1962). It can be distinguished from related taxa using the generic key provided above.

Diagnosis: “*Uropod 3 extending well beyond end of uropods 1 and 2, the inner ramus short; scale-like; accessory flagellum uniarticulate; gnathopod 2 as small as gnathopod 1, its article 6 subequal to or shorter than article 5; mandibular palp slender, the articles linear; inner plates of maxillae 1 and 2 bearing only terminal setae.*” (from J. L. Barnard 1962)



Psammogammarus wallacei (from Vonk et al 2011)

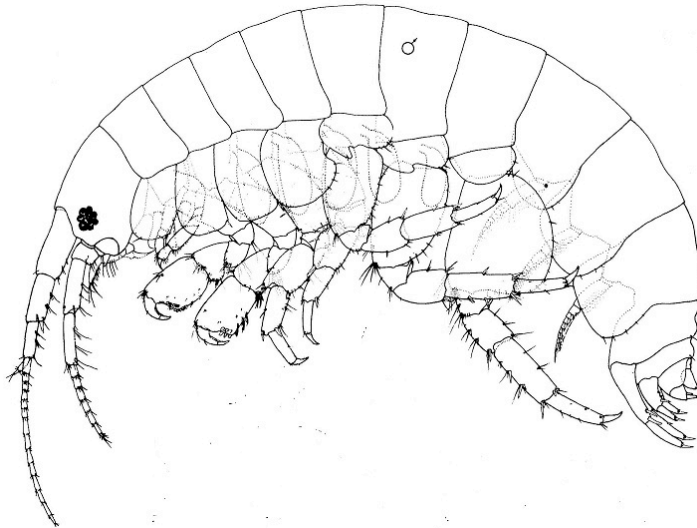
Psammogammarus – The genus, with 15 members (Horton & Lowry 2014b) is distributed widely. A single species in this genus occurs interstitially in the intertidal along the outer coast of Baja California. It has not been reported since its original description as an *Eriopisa* by J. L. Barnard (1952b). It was explicitly removed from that genus by Karaman & J. L. Barnard 1979 (largely reiterated in J. L. Barnard & C. M. Barnard 1983), and placed in a revised *Psammogammarus*. The genus would key out to the *Eriopisa* complex in the generic key to the *Melita* group in Jarrett & Bousfield. Vonk et al (2011) provide a tabular key to the members of the genus.

Diagnosis: “*Body smooth, urosomites free. Head without distinct ventroanterior sinus. Antenna 1: peduncular segments 1-2 nearly subequal long, segment 3 short; accessory flagellum 2-segmented. Antenna 2 with free all flagellar segments. Labrum entire, emarginate distally, subrounded. Labium with well developed inner lobes, normal. Mandible molar strong, triturative, incisor toothed; palp 3-segmented, first segment short, second segment remarkably longer than third one, both linear, poorly setose. Maxilla 1 inner plate triangular, with a row of distolateral plumose setae, outer plate with 9 spines, palp 2-segmented (? symmetric to each other). Inner plate of maxilla 2 with well developed dorsal oblique row of setae. Maxilliped inner plate almost reaching outer tip of first palp segment, with distal spines; outer plate with row of distinct distolateral spines, palp 4-segmented, segment 4 falciform.*”

Coxae 1-4 short, contiguous, coxa 1 unproduced, coxa 4 unlobed, coxa 5 not shorter than 4. Gnathopod 1 segment 5 as long as or shorter than segment 6, palm of segment 6 oblique. Gnathopod 2 segment 5 short, segment 6 large, palm oblique.

Pereopods 3-4 with slender linear segment 2, Pereopods 5-7 with subequal-lobed segment 2; segment 4 of pereopod 7 narrow. Uropods 1-2 biramous, rami with lateral and distal spines; peduncle of uropod, with ventrofacial spines. Uropod 3 long, inner ramus remarkably longer than peduncle, reaching 2/5 to 4/4 of first segment of outer ramus, tapering distally; second segment 'of outer ramus long. Telson incised' nearly to the basis, lobes with distal and lateral spines. Oostegites narrow, coxal gills normal, ovoid. Sexual dimorphism present. (from G. Karaman 1984)

Family Gammaroporeidae – Diagnosis (as gammaridean family group 10): “Body form sub-fossorial, with broadened and setose coxal plates and appendages; eye sub-rotund, few-faceted; antennae short, accessory flagellum small; mouthparts about normal: lower lip lacking inner lobes; maxilla 1, inner plate with 11 (not 9) apical spine-teeth; gnathopods medium, subchelate, 1 larger than 2, palmar margins with blunt peg-spines (♂ only); peraeopod 4 of different form than peraeopod 3 (both sexes); peraeopods 5-7 (especially 7) with strongly expanded basis; pleopods weak, inner ramus shorter; outer margin of peduncle plumose-setose; urosome dorsally weakly armed; uropods 1 and 2 short; uropod 3 rami very short, unequal, lacking armature; telson small, bilobed, weakly armed. Coxal gills simple, lacking on peraeon 7. Brood plates broadly expanded.” (Bousfield 1977).



Gammaroporeia alaskensis (from Bousfield 1979)

Gammaroporeia – A highly specialized mid- to upper intertidal genus. Bousfield (1979) reports it favors muddy to muddy gravel beaches subject to the outflow of cold creeks. Gills are reduced in this genus, presumably because it is always found in well oxygenated waters. The urosome is compact, with short uropods and resembles that of some talitroids. The animal is fossorial, and elongate uropods would be a liability in the sediments it favors. The type and only species *Gammaroporeia alaskensis* is found only from the Gulf of Alaska south to British Columbia in appropriate habitats, so the

genus and family are endemic to the NEP. It is well described and illustrated in Bousfield 1979, and in Bousfield and Hubbard 1968, where it was originally described as *Micruropus alaskensis*. While sharing some similarities with *Micruropus* in the Micruropidae, that group is almost exclusively distributed in Lake Baikal and the Ponto-Caspian area of the Old World (Bazikalova 1962). *Gammaroporeia* could be considered a New World ecological analogue.

Diagnosis: “*Pleosome deep, noncarinated and unarmed dorsally. Urosome segments short, deep, unarmed except for paired dorsolateral setae. Antenna 1 longer than 2, peduncular segments 1, 2, and 3 successively shorter, each with few groups of posterior marginal setae of medium length; accessory flagellum 2-segmented. Antenna 2, peduncular segments 4 and 5 subequal, posterior margins with 3 groups of medium setae. Upper lip broad, minutely pilose below. Lower lip, inner lobes narrow, completely defined, not separated from outer lobes. Mandible, palp segment 2 with strong mediolateral setae only, segment 1 unarmed; accessory blades few. Maxilla 1, palp with 1 marginal seta; inner plate with 10-12 marginal setae. Maxilla 2, inner plate with 18 plumose setae. Maxilliped, inner and outer plates long, subequal in length, palp slender. Gnathopods (<3) subsimilar in form and size (1 larger); dactyls with heavy unguis and short heavy posterior accessory blade. Gnathopods of ~ dissimilar (not markedly), 1 larger; dactyls and unguis less massive, and posterior accessory blade shorter, than in <3. Coxal plates deep, with slender spine at posterior angle. Peraeopod 4, segment 4, anterior margin spinose. Peraeopod 5 with barely discernible posterodistal lobe; basis of peraeopods 5-7 increasingly expanded, posterior margins sparsely stiff setose. Coxal gills small, saclike, shortest on peraeopod 6. Pleon side plates 1-3, hind corners rounded or obtuse, posterior margins sparsely setose, lower margins not spinose; pleopods short, peduncles broadened, outer margins plumose-setose, inner margin with 2 retinacula. Urosome segments 1 and 2 with a pair of single stiff dorsolateral setae. Uropods 1 and 2 short, rami of 1 extending little beyond 3, margins nearly bare. Uropod 3, inner ramus very small, outer ramus 1-segmented, margins bare, apex with few stiff setae. Telson lobes fused in proximal half, each with apical and distolateral setal groups.*” (from Bousfield 1979)

Family Hadziidae – Organization of the family was laid out by J. L. Barnard in 1976, providing a general guide to the distribution of genera within informal groupings. These groupings were further refined and often well defined by J. L. Barnard and C. M. Barnard (1983). The first group in the family Hadziidae (the weckeliids) is, like the Allocrangonyctidae, restricted to freshwater (see Bousfield 2001). The second group (the hadziids s.s.) contains both freshwater and marine species, but only two of the latter (*Dulzura sal* and *D. gal*) are from the NEP. Although Bousfield (2001) lists *Netamelita* species as members of the family Hadziidae, they more properly belong among the *Eriopisella* group of the Melitidae. The third group of the family Hadziidae, the nuuanids, only occur along the margins of the Gulf of Mexico, and are thus outside our area of coverage. The family was reviewed by Stock (1977), who explored its zoogeography. Like the members of the family Bogidiellidae, hadziids show a zoogeographic distribution that reflects their origin in the Tethys Sea.

Diagnosis: “**Head free, not coalesced with peraeonite 1; exposed; as long as deep, or longer than deep; anteroventral margin weakly recessed or rounded or straight**

or oblique, anteroventral margin shallowly excavate or not excavate, anteroventral corner rounded or subquadrate or absent; rostrum absent; eyes absent. Body laterally compressed, or subcylindrical; cuticle smooth.

Antenna 1 longer than antenna 2; peduncle with sparse robust and slender setae; 3-articulate; peduncular article 1 subequal to article 2, or longer than article 2; antenna 1 article 2 longer than article 3; peduncular articles 1-2 not geniculate; accessory flagellum present, or absent; antenna 1 calypophore absent. Antenna 2 present; short; articles not folded in zigzag fashion; without hook-like process; flagellum shorter than peduncle; less than 5-articulate; not clavate; calceoli absent.

*Mouthparts well developed. Mandible incisor dentate; lacinia mobilis present on both sides; accessory setal row without distal tuft; molar present, medium, triturate; palp present. Maxilla 1 present; inner plate present, strongly setose along medial margin; palp present, not clavate, 2-articulate. Maxilla 2 inner plate present; outer plate present. **Maxilliped** inner and outer plates well developed or reduced, palps present, well developed or reduced; **inner plates** well developed, separate; **outer plates** present, **large or small**; palp 4-articulate, article 3 without rugosities. Labium smooth.*

***Peraeon.** Peraeonites 1-7 separate; complete; sternal gills absent; pleurae absent.*

Coxae 1-7 well developed, none fused with peraeonites. Coxae 1-4 longer than broad or broader than long, overlapping, coxae not acuminate. Coxae 1-3 successively smaller, none vestigial. Coxae 2-4 none immensely broadened.

Gnathopod 1 not sexually dimorphic; smaller (or weaker) than gnathopod 2; subequal to coxa 2; gnathopod 1 merus and carpus not rotated; gnathopod 1 carpus/propodus not cantilevered; subequal to propodus, or longer than propodus; gnathopod 1 not produced along posterior margin of propodus; dactylus large. Gnathopod 2 sexually dimorphic; subchelate; coxa subequal to but not hidden by coxa 3; ischium short; merus not fused along posterior margin of carpus or produced away from it; carpus/propodus not cantilevered, carpus short, shorter than propodus, slightly produced along posterior margin of propodus or not produced along posterior margin of propodus.

*Peraeopods heteropodous (3-4 directed posteriorly, 5-7 directed anteriorly), none prehensile. Peraeopod 3 well developed. Peraeopod 4 well developed. **3-4 not glandular**; 3-7 without hooded dactyli, 3-7 propodi without distal spurs. Coxa well developed, longer than broad or expanded distally; carpus subequal to propodus, not produced; dactylus well developed. Coxa subequal to coxa 3 or larger than coxa 3, not acuminate, with well developed posteroventral lobe; carpus not produced. Peraeopods 5-7 with few robust or slender setae; some or all dactyli with slender or robust setae. Peraeopod 5 well developed; shorter than peraeopod 6; coxa smaller than coxa 4, with posterodorsal lobe; basis expanded or slightly expanded, with posteroventral lobe; merus/carpus free; carpus linear; setae present along margin or setae absent or with a few subterminal setae. Peraeopod 6 subequal in length to peraeopod 7; merus/carpus free; dactylus with setae along margin, or without setae, or with a few subterminal setae. Peraeopod 7 with 6-7 well developed articles; longer than peraeopod 5; similar in structure to peraeopod 6; with 7 articles; basis expanded, without dense slender setae; dactylus with setae along margin or without setae or with a few subterminal setae.*

Pleon. Pleonites 1-3 with transverse dorsal serrations or without transverse dorsal serrations, without dorsal carina; with slender or robust dorsal setae, or without slender or robust dorsal setae. Epimera 1-3 present. Epimeron 1 well developed. Epimeron 2 without setae.

Urosome not dorsoventrally flattened; urosomites 1 to 3 free; urosomite 1 longer than urosomite 2; urosome urosomites not carinate; urosomites 1-2 without transverse dorsal serrations. Uropods 1-2 apices of rami with robust setae. Uropods 1-3 radically dissimilar in structure and size, or similar in structure and size. **Uropod 1 peduncle** without long plumose setae, **with 1 or 2 basofacial robust setae**, without ventromedial spur. Uropod 2 well developed; without ventromedial spur, without dorsal flange; inner ramus subequal to outer ramus, or longer than outer ramus. Uropod 3 not sexually dimorphic; peduncle short; outer ramus longer than peduncle, 1-articulate or 2-articulate, without recurved spines. Telson laminar; deeply cleft; longer than broad, or as long as broad; apical robust setae present.” (Lowry and Springthorpe 2001).

Dulzura – Originally established by J. L. Barnard (1969) to house a single intertidal form from Central California, a second species was described from the Galapagos (J. L. Barnard 1979), and two Hawaiian species originally described in *Eriopisa* (J. L. Barnard 1970) were transferred to *Dulzura* by J. L. Barnard and C. M. Barnard (1983). All of these forms are closely related siblings from the Pacific. An additional species was added by Stock and Vonk (1991) from the Atlantic, one from Australia (Springthorpe & Lowry 2009), and two from Madagascar (Ledoyer 1979, 1983). An additional western Atlantic species (*D. schoenerae*) was also transferred from *Eriopisa* to *Dulzura*. The genus now contains eight species, as one of the two Hawaiian forms has since been transferred to *Metaniphargus* (Lowry 2014b).

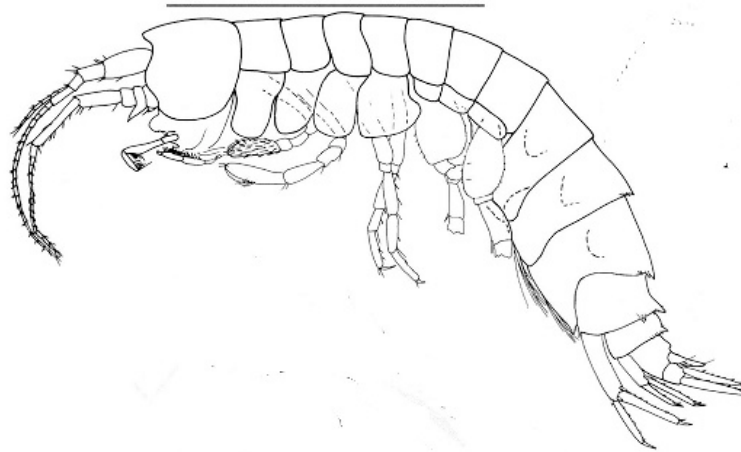
Only *D. sal* from Central California and *D. gal* from the Galapagos fall within the NEP coverage area. The two can be distinguished most easily by the relative lengths of the telsonic terminal spines. These equal or exceed the telson length in *D. gal*, but are only about ½ telson length in *D. sal*. J. L. Barnard (1979) mentions that *D. gal* is nearly identical to *D. hamakua* from Hawaii, and may prove to be only subspecifically differentiable once more material is examined. Although not mentioned in the family description by Lowry and Springthorpe, the presence of a setal comb on the distal portion of the peduncle of uropod 2 was suggested as a unifying character of the hadziid group within the Hadziidae by J. L. Barnard and C. M. Barnard (1983, p. 146). The absence of eyes in these animals is unusual in an intertidal form, and reflects their affinities with other hadziid taxa occupying subterranean freshwaters.

Diagnosis: “Accessory flagellum 2-articulate; lower lip lacking inner lobes; mandibular palp article 3 slender, slightly longer than article 2, very slightly falciform; inner plates of maxillae 1 and 2 densely setose medially; gnathopod 1 subchelate, gnathopod 2 of either sex small, poorly subchelate; coxae short, overlapping, quadrate, coxa 4 not excavate posteriorly; pleonites 1-3 neither toothed nor spined; uropod 3 of melitid form, outer ramus greatly elongated, Particulate, article 2 short, inner ramus very short, scale-like; telson deeply cleft, short. Generic name feminine, contrived, its root having basis in *Icitas*, sweetness, referring to the possibility that the blind, albinid genus has origins in freshwater aquifers or has the appearance of organisms living in sweet waters of caves.”. (from J. L. Barnard 1969)

Family Maeridae – Members of this family were usually considered to be melitids following the establishment of the Melitidae by Bousfield (1973). Prior to that time they had been considered an unnamed group with the Gammaridae s.l. Krapp-Schickel (2008) erected the Maeridae to house a cohesive group of Bousfield's melitids. As currently defined (Krapp-Schickel et al 2014) the family contains 44 genera, of which 8 occur in the NEP.

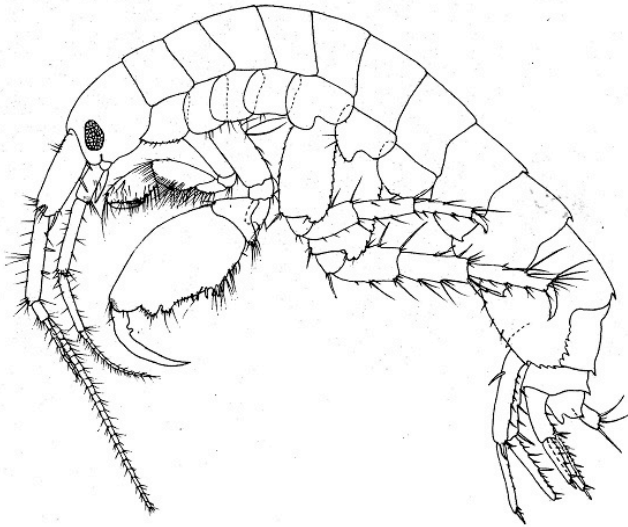
Diagnostic description: “**Body laterally compressed or subcylindrical.** Eyes well developed or absent, if present then round, ovoid, reniform, lageniform or subrectangular. **Antennae 1–2 calceoli absent.** Antenna 1 subequal in length to, or longer than antenna 2; peduncular article 1 shorter than, subequal to, or longer than article 2; article 2 longer than article 3; **article 3 shorter than article 1;** peduncular articles 1–2 not geniculate; accessory flagellum long, short or minute. **Antenna 2 peduncular article 1 not enlarged.** Mandible molar triturative; palp symmetrical or absent. Maxilla 1 basal endite setose along medial margin or apically setose; palps symmetrical. Maxilla 2 basal endite with or without oblique setal row. Labium inner lobes present, vestigial or absent. **Coxal gills on pereopods 2–6, not stalked;** sternal gills absent; sternal blisters absent; oostegites fringing setae simple. **Gnathopod 1** subchelate; **similar in males and females (not sexually dimorphic);** smaller (or weaker) than or similar in size to gnathopod 2; **propodus palm without robust setae along palmar margin.** Gnathopod 2 **Gnathopod 1** subchelate; **dissimilar in males and females (sexually dimorphic);** carpus not produced along posterior margin of propodus, projecting between merus and propodus. Pereopods 3–4 not sexually dimorphic. Pereopod 4 with well developed posteroventral lobe or with small posteroventral lobe or without posteroventral lobe. Pereopod 5 shorter than or subequal in length to pereopod 6; coxa with posteroventral lobe or with large anteroventral lobe or with small anteroventral lobe or without lobes. Pereopod 7 subequal in length to, or longer than pereopod 5. Pleonites 1–3 without dorsal carinae. **Urosomites 1–3 free;** with or without slender or robust dorsal setae. **Urosomite 1 without large distoventral robust seta.** Urosomite 2 with pair of dorsal concavities each with 1–3 small setae or without dorsal setae. Uropod 1 with 1 or 2 basofacial robust setae or without basofacial robust setae. **Uropod 3** sexually dimorphic or not; **biramous,** without plumose setae; **endopod shorter than or subequal to exopod. Telson deeply cleft to entire;** dorsal or lateral robust setae present or absent; apical robust setae present or absent.” (from Lowry & Myers 2013)

Bathyceradocus – Two member of this genus are reported from the NEP; *B. stephenseni* taken in deep water in the Gulf of Panama (J. L. Barnard 1961) and near vents on the East Pacific Rise at 13°N, and *B. wuzzae* off Oregon. The former species has been reported from several other deepwater collections in the Indo-Pacific between Panama and Madagascar. *Bathyceradocus stephenseni*, is a wood eater, and analyses of specimens recovered from a sunken log showed finely chopped cellulose in the gut. *B. wuzzae* is also apparently a wood eater, although Larsen and Krapp-Schickel (2007) raise the possibility that it feeds only on the bacteria coating the wood it swallows. The two NEP species can be separated from each other most easily by the relative lengths of the antennae, with A2 longer in *B. stephenseni*, and A1 and A2 subequal in *B. wuzzae*. Another species was described from the deep Northeast Atlantic by Andres (1977).



Bathyceradocus wuzzae, scale bar 5mm (from Larsen & Krapp-Schickel 2007)

Diagnosis: “Eyes lacking. Pleon and urosome with dorso-lateral teeth as well as articulated robust setae near the margin of the epimeral plates. Head lacking rostrum. C4 on posterior margin excavated (only weakly in *B. iberiensis*), clearly much higher than C5. Antennae subequal, slender; accessory flagellum long, shorter than peduncle. Labium with shallow excavation, inner lobes moderately setose. Mandible robust, incisor dentate; lacinia mobilis on the left side slender and bifurcated, on the right side bigger; molar very well developed; palp article 3 less falciform than in *Metaceradocus*. Mx1 with inner plate ciliated; palp of both sides not symmetrical. Mx2 with marginal oblique setae. Maxilliped inner plate (= basal endite) very long, with four apical teeth; palp robust. G1 of female small, weakly chelate, with transverse palms. G2 larger and longer, subcheliform. P5–7 long and slender. U1 and 2 with strong apical spines. U3 biramous and uniarticulated; inner rami slightly longer than outer, with terminal robust setae. Telson deeply cleft, with apical robust setae. Gills on pereonites 3–7, oostegites on pereonites 2–5.” (from Larsen & Krapp-Schickel 2007)

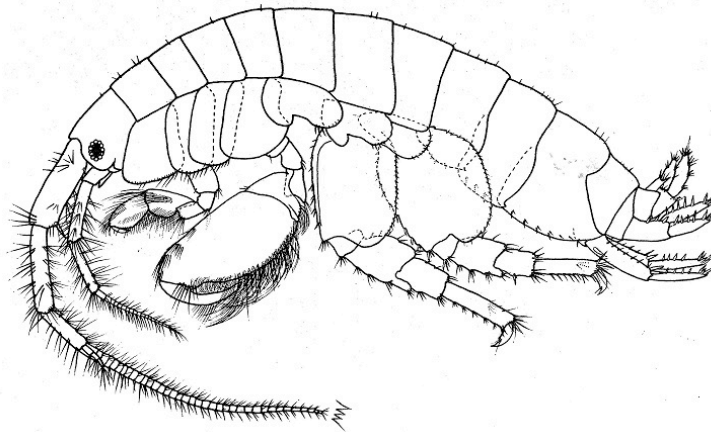


Ceradocus spinicauda (from J. L. Barnard 1962)

Ceradocus - Prior to creation of the above comprehensive key to hadzioid genera in the NEP, the only way to key to *Ceradocus*, was in a general key to species such as that of Staude in Kozloff 1987 or J. L. Barnard in Light's Manual (1975), or in the key to hadzioids provided by Chapman (2007, pp. 607-610). These keys will take you pragmatically to *Ceradocus spinicauda* (Holmes 1908), the only locally reported species in the genus. A second species is known from Baja California; *Ceradocus* (*Denticeradocus*) *paucidentatus* (J. L. Barnard 1952a). This has not yet been reported from north of Baja California. J. L. Barnard & C. M. Barnard (1983) recommended abandoning use of the subgenus as meaningless.

Ceradocus paucidentatus can be distinguished from *C. spinicauda* by: the shape of epimeron 3. In *C. paucidentatus* it is posteriorly subquadrate, with denticulations only along the posterior border. In *C. spinicauda* it is upswept to an acute point, with denticles both on the posterior border above, and on the ventral border below this point. Both species, and other members of the *Maera-Ceradocus* clade can be separated from the *Melita* group by their equiramous 3rd uropods.

Diagnosis: "Metasome and urosome segments partially or completely serrate or toothed posteriorly. Rarely smooth. Lateral cephalic lobes rounded. ventroanterior incision. eye, present. Md palp art 1 distally toothed. art2 medially enlarged, .longest, .art3 reduced. not shorter than art 1. linear. with distal setae only. Mx 1 inner plate triangular •margin densely setose. Mx2inner plate with lateral and dorsal oblique row of setae. A1>A2.Access. flagellum well developed, A2 long gland cone. Gn 1, 2 dissimilar. On 1 carpus long . Gn 2 carpus short. P5-7 basis posterodistally angular or lobed, U3 biramous, subequal, 1 segmented, lanceolate. Telson incised. lobe, distally notched with short spine." (from Krapp-Schickel & Jarrett 2000)



Elasmopus antennatus (from J. L. Barnard 1962)

Elasmopus - Five species of *Elasmopus* are recorded from California, two of which are currently on the SCAMIT list. A number of additional species are known from southern waters, bringing the NEP total for the genus to 15. While not discussed comparatively in Krapp-Schickel & Jarrett (2000), most of the reported species (exceptions being *E. gracilis* and *E. spinidactylus* of Schellenberg) were discussed in J. L. Barnard 1979. Males were keyed in that paper, but not females. J. L. Barnard (1969) provides a key to California *Elasmopus* species including both male and female character states. His nomenclature differs from present usage in listing *mutatus*, and *serricatus* as

subspecies of *E. rapax*, and in treating *E. bampo* as the “*Elasmopus rapax* of Alamitos Bay, California”.

The SCB species can be distinguished (at least as mature males) by details of the gnathopod and telson. The second species on the SCAMIT list, *E. mutatus* can be easily separated from *E. bampo* by lacking a tooth at the posterior distal corner of epimeron 3. All *Elasmopus* species in the NEP are shallow-water, often intertidal, species associated with algae and/or fouling communities.

Diagnosis: “*Similar to Maera sensu stricto, except in the shape of Md palp art3, but the generally stouter and more well pigmented appearance of Elasmopus is helpful too. Ai, 2 moderate to elongate; A1 much > A2, acc. Flagellum 1 or more arts. Md palp art 3 strongly falciform, with D and E setae. Inner lobes of lower lip present. MX1, 2 not or weakly setose on inner margins, MX1 inner plate ovate, MX2 without oblique row of setae, only few setae medioapically. GN1, 2 different in size and shape, palms oblique, in Gn2 usually sculptured with specific tooth formulas, dactylus elongate or short, sometimes riding onto inner face of propodus. P5-7 generally short, stout. Uropods 1, 2 subequal rami, peduncle U1 with basofacial spine. U3 scarcely extended, magi- to parviramous, at least outer ramus broad, short, strongly spinose; art 2 vestigial or lacking. T deeply cleft (but Shoemaker 1933 reported fused mutants), apically spinose, each lobe of tel apico-medially excavated.*” (from Krapp-Schickel & Jarrett 2000)

Lupimaera - A monotypic genus erected (J. L. Barnard & Karaman 1982, p. 174-176) to house a small shallow-water form from the SCB. It was originally described from a kelp holdfast collected at Goleta. The genus is keyed from other members of the *Maera* group in Krapp-Schickel & Jarrett (2000, p. 28). *Lupimaera lupana* has not yet been added to the SCAMIT list. The specialized structure of this form, with antennae and uropods as well as pereopods condensed from the norm for the family is viewed as modification for life within interstices between the kelp haptera, or alternatively, crevice dwelling.

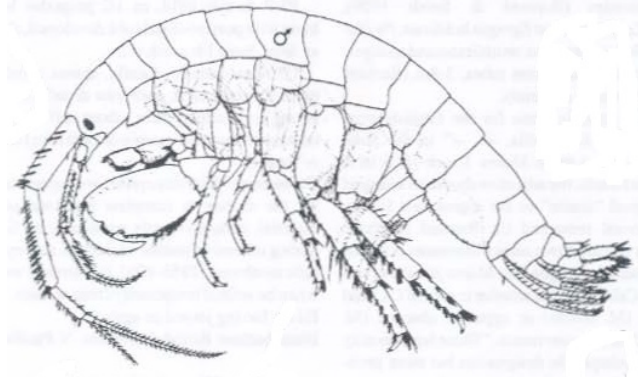
Diagnosis: “*Body slender, urosomites free, naked. Rostrum obsolescent, lateral cephalic lobes mammilliform. Antennae medium to short, antenna 1 scarcely longer than 2, ratio of peduncular articles = 16:8:3, primary flagellum not longer than peduncular article 1, with 5 articles, accessory flagellum 3-articulate, more than half as long as primary flagellum. Antenna 2 also short, flagellum 4-articulate, not longer than article 5 of peduncle. Ratio of mandibular palp articles = 2:7:5, article 3 linear, setae = DE. Inner lobes of labium present. Maxillae not setose medially, inner plate of maxilla 1 rectilinear, with 3 apical setae, outer plate with 9 spines, palps symmetrical. Inner plate of maxilla 2 with 2 medial and 1 facial setae. Outer plate of maxilliped medially spinose, palp article 3 unlobed, dactyl shorter than 3, very short, unguiform, with nail.*

Coxae of ordinary dimensions, poorly setose, coxa 1 weakly expanded and lobed anteroventrally, coxa 4 not lobate, coxa 5 as long as 4. Gnathopods diverse, not sexually dimorphic, gnathopod 1 small, wrist elongate, unlobed, hand subrectangular, palm short, slightly oblique; gnathopod 2 enlarged, wrist short, lobed, hand large, subrectangular, palm oblique, short, sculptured.

Pereopods 3-4 ordinary. Article 2 of pereopods 5-7 weakly expanded, weakly lobate, posterior margins poorly setose, weakly convex; article 2 of pereopod 5 not longer than coxa 5 (distinction from Maera); pereopods short.

Outer rami of uropods 1-2 slightly shortened, all rami marginally densely spinose, spines small, peduncle of uropod 1 with 1-2 basofacial spines. Uropod 3 not extended, very short, magniramous, almost aequiramous, rami short, scarcely longer than peduncle, spinose, spines short (distinction from Maera). Telson short, almost fully cleft, lobes tapering, apices weakly spinose, notched.

Coxal gills 2-6, ovate. Oostegites [?narrow].” (from J. L. Barnard & Karaman 1982)



Maera jerrica (from Krapp-Schickel & Jarrett 2000)

Maera - Seven species are reported from the NEP by Krapp-Schickel & Jarrett (2000), but only three are recorded for California. Several other species historically identified as *Maera* have now been transferred to related genera (e.g. *Maera reishi*, *Maera vigota* – both moved to *Quadrimaera*; and *Maera lupana* – moved to *Lupimaera* by Karaman & J. L. Barnard 1979).

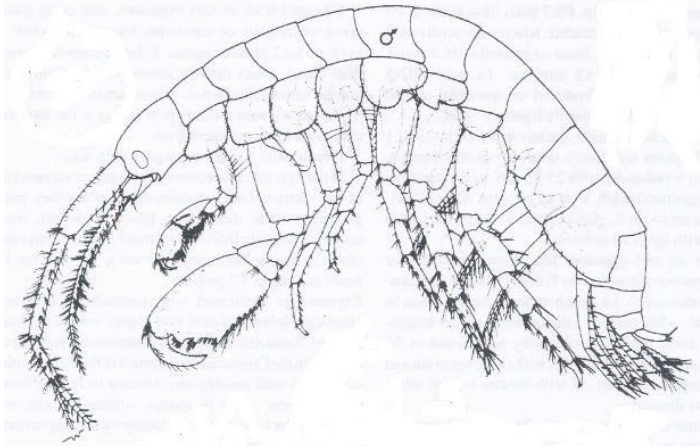
None of the three taxa is particularly well represented in the SCB. *Maera nelsonae* Krapp-Schickel & Jarrett 2000 has been taken only once, at 305m, in July 2003 on the south flank of the Redondo Submarine Canyon. A single individual was collected, photographed (see above), and vouchered. This would have been called *Maera loveni* earlier, and was illustrated as that in J. L. Barnard 1962. *M. loveni* remains a good species, but occurs only in the north, reaching its southern limit in Puget Sound. It is also known from the north Atlantic. SCB material of *M. nelsonae* marks its southernmost reported occurrence, with the type from



Maera nelsonae from off Palos Verdes, 305m (Photo John Miller, LACSD)

Monterey Submarine Canyon, and additional material from Mugu Submarine Canyon. At least in this portion of its range it seems associated with canyons. The species also was taken off Oregon at 732m by OSU, with no apparent connection with a submarine canyon.

There are a number of SCB records of *Maera similis*. When initially described by Stout 1913, and in later treatments by J. L. Barnard, this species name was rendered *M. simile*. Krapp-Schickel & Jarrett show that the gender of *Maera* is feminine, and thus the appropriate gender ending for the adjective “similar” is the Latin “similis”. The “e” ending used previously is only appropriate for a neuter name.



Maera similis (from Krapp-Schickel & Jarrett 2000)

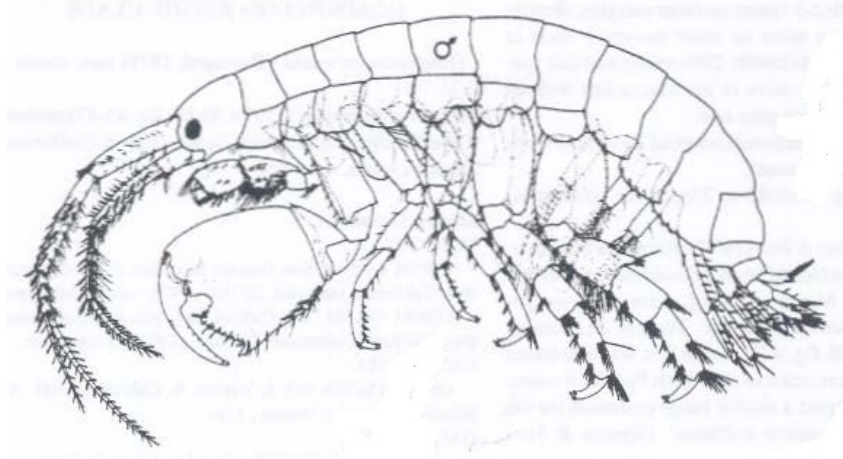
This species, and the next (*Maera jerrica*) are very closely related, and fall out in the same couplet of the key provided by Krapp-Schickel & Jarrett. They were considered to be the same species by J. L. Barnard, who noted the two forms but didn't name them. *Maera jerrica* (a patronym for J. L. “Jerry” Barnard) has been taken on numerous occasions within the SCB. When *M. jerrica* is taken, there are generally several specimens (up to 10). These three species can be distinguished using the key in Krapp-Schickel & Jarrett (2000).

Diagnosis: “Eyes oval to reniform (vs. round in *Quadrimaera*). A1 acc. Flag <0.5 length of flagellum (vs. >0.5 in *Quadrimaera*). Md palp art 1 distally obliquely lengthened, often pointed and toothed, (vs. rounded in *Quadrimaera*), art 3 < art 2. Gn2 propodus palm oblique, palmar corner defined, about 120-150° (vs. 90° in *Quadrimaera*, 180°=undefined in *Othomaera* Krapp-Schickel, 2000). Gn2 dactylus on outer margin beset with many setae; never excavated on inner margin. P3-7 dactyli simple or bifid. U3 with long and slim or short rami, at least outer ramus distally truncate, not pointed (vs. lanceolate and pointed in *Othomaera*). Telson deeply cleft.” (from Krapp-Schickel & Jarrett 2000)

Meximaera – A small genus of only five species, which was at one time synonymized with *Maera*. It was treated as valid in Krapp-Schickel (2008) and is still considered so (Lowry 2014). Only a single species is known from the NEP, *M. diffidentia*, the type.

Diagnosis: “Antenna 1 with 4-articulate accessory flagellum; article 2 of mandibular palp longer than either articles 3 or 1, article 3 slender, linear (not falcate); lower lip bearing inner lobes; inner plate of maxilla 1 setose only terminally; inner plate

of maxilla 2 scarcely setose on medial edge, considered primarily to be setose terminally; article 4 of maxillipedal palp not claw-shaped, short, bearing several long, distal spine-setae; gnathopods small but distinctly subchelate; uropod 3 with subequal rami, outer minutely biarticulate; telson cleft." (from J. L. Barnard 1969)

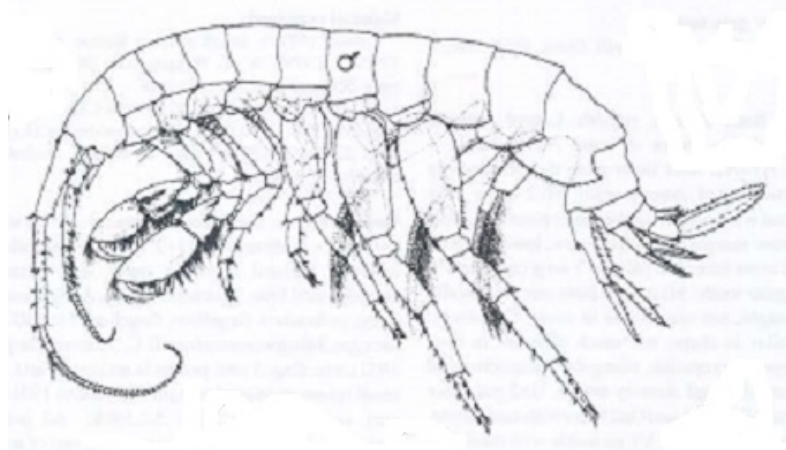


Quadrimaera carla (from Krapp-Schickel and Jarrett 2000)

Quadrimaera - Three species of the genus occur in California waters; *Q. carla*, *Q. reishi*, and *Q. vigota*. The last species is an intertidal form known from Central California to southeast Alaska (Krapp-Schickel & Jarrett 2000), questionably placed in this genus. It is the only species with simple rather than bifid dactyls of P5-P7, and can be easily recognized by this atypical character. See the original description (J.L. Barnard 1969).

The other two species are closely related siblings. Both were identified as *Maera inaequipes* in J. L. Barnard & Reish 1959. J. L. Barnard later recognized that this was not the same as Costa's Mediterranean taxon and renamed it *Maera reishi* (J. L. Barnard 1979, p. 83-86). In the process he pointed out differences between southern and northern populations. Krapp-Schickel & Jarrett (2000) divided the Barnard concept of *M. reishi* along his southern and northern lines, creating a second sibling species (*carla*) from within it. Both were included in the newly erected genus *Quadrimaera* (Krapp-Schickel & Ruffo 2000). While no key to the genus is presented in Krapp-Schickel & Jarrett (2000), a table (p. 49) compares a series of character states in three closely related sibling species; *Q. reishi*, *Q. chinarra* (from Mexico), and *Q. carla*. Probably the easiest character to use in separating *Q. reishi* and *Q. carla* is the relative length of the gland cone vs. article 3 of antenna 2. A key to the genus world-wide is provided by Krapp-Schickel (2000). The possibility that hybrids between some members of the genus have been seen is discussed among other topics by Krapp-Schickel et al 1996.

Diagnosis: "*Md palp art1 ventro-distally (in situ; in relation to mandible-body disto-interior corner) not lengthened, never produced into acute ventral tooth; art3 narrow, usually equally long or longer than art2 (only in few species shorter). Gn2 dactylus with one single seta on outer margin, inner margin often with humps, teeth or excavations; palmar corner of Gn2 propodus = or < 90°; dactyli of pereopods with a second tip on outer margin, thus seemingly bifid.*" (from Krapp-Schickel & Ruffo 2000)



Wimvadocus torelli (from Krapp-Schickel and Jarrett 2000)

Wimvadocus – Krapp-Schickel and Jarrett (2000) created this genus to house *Ceradocus torelli*, and it remains monotypic. It is differentiated from *Ceradocus* by (among other characters) the setation of the outer margin of the gnathopod dactyls; a character it shares with *Maera* (s.s.). This is the first record of the species in the sub-arctic NEP, having identified specimens from British Columbia. This is another offshore deeper water genus, blind, and assumed to be a burrower. Vader and Krarup Leth (1990) suspect that this species lives in deeply excavated galleries in clayey substrate.

Diagnosis: “*Body slender, smooth. Lateral cephalic lobe rounded. No traces of eyes. A1 peduncle > flagellum. A1 > A2. MX1 inner plate slender, densely setose about half of inner margin; Mx2 outer plate distoexternal with plumose setae, inner plate with short setae on inner margin and oblique row; lower lip with developed inner lobe; Md palp art 1 long (art 1 ≥ art 3!), with triangular tooth; Mxp inner plate narrow, distally ending straight, not concave as in many Ceradocus. Gn1, 2 similar in shape, not much different in size; Gn1, 2 carpus < propodus, triangular; propodus hind margins rounded and densely setose. Gn2 palm not defined, dactyli in Gn1 and Gn2 beset with many setae. P5-7 basis narrow-ovoid. U1 peduncle with midfacial strong spine, U3 rami lanceolate, distally pointed, l:b > 4, with short spines on all margins. Telson deeply cleft, distally pointed, notched with one strong, short spine.*” (from Jarrett & Bousfield 1996)

Family Melitidae – The fifth NEP hadzioid family is the Melitidae, well represented in our area by a number of species in several genera. It has been recently revised by Jarrett & Bousfield (1996) and Krapp-Schickel & Jarrett (2000). These revisions have not yet extended to the genus *Elasmopus*, which was most recently treated in some detail by J. L. Barnard (1979). The most complete treatment of the melitids was by J. L. Barnard and C. M. Barnard (1983). They broke the family up into several component groups with no nomenclatural standing, but useful for discussion of evolution within the family and relationships between genera. They identified the prime group as melitids ss., which include the regional genera *Melita*, *Galapsiellus*, *Dulichella*, and *Anchiaella*. They considered *Megamoera* to be a synonym of *Melita*, but it was resurrected by Jarrett and Bousfield (1996), who added *Desdimelita* as a new genera related to the melitids. Krapp-Schickel & Jarrett added *Wimvadocus*, a new genus with affinities to *Megamoera* in the melitid group, but belonging in the maerids.

Jarrett & Bousfield provide a nice introduction to the family (used in the older sense of a combination of melitids and maerids), touching on its history and current status, in the first part of their paper. They then lay out the group memberships within the family (p. 5) without providing a key. They do provide a key to the genera and species in the *Melita* group known to occur in the NEP (p. 7). Krapp-Schickel & Jarrett (2000), in a follow-up article, address the *Maera* group as laid out by Jarrett & Bousfield but only deal with a part of it. Since then the maerids have been restored to family level separate from the melitids. The genus *Elasmopus* is mentioned, and one species is discussed (*Elasmopus* cf. *antennatus*), but is neither fully treated or included in their key to *Maera* group genera from the northern Pacific (pg. 28). The genus *Ceradocus* is also considered, but other members of the *Ceradocus* group in the NEP are not. There is, therefore, no comprehensive key to the melitids from the NEP at genus level, or at group level. The currently accepted groups are not the same as those employed by J. L. Barnard and C. M. Barnard (1983), but they do provide a key to the hadzioids that includes all of the groups we are concerned with (pg. 612). Most of the California genera are covered in Jarrett & Bousfield's key to the *Melita* group (1996, p. 7). With the exceptions of *Elasmopus* and *Bathyceradocus*, the genera of the *Maera* and *Ceradocus* groups are keyed by Krapp-Schickel & Jarrett (2000, p. 28).

Description: “**Head** free, not coalesced with peraeonite 1; exposed; as long as deep, or longer than deep; **anteroventral margin notched (not complete)**, anteroventral corner rounded or subquadrate or hooked; rostrum present or absent, short; eyes present, well developed or obsolescent, or absent; not coalesced; 1 pair; not bulging. Body laterally compressed; cuticle smooth. Antenna 1 subequal to antenna 2, or longer than antenna 2; peduncle with sparse robust and slender setae; 3-articulate; peduncular article 1 shorter than article 2, or subequal to article 2, or longer than article 2; antenna 1 article 2 longer than article 3; peduncular articles 1-2 not geniculate; accessory flagellum present; antenna 1 callynophore absent. Antenna 2 present; short, or medium length; articles not folded in zigzag fashion; without hook-like process; flagellum shorter than peduncle; 5 or more articulate; not clavate; calceoli absent.

Mouthparts well developed. Mandible incisor dentate; lacinia mobilis present on both sides; accessory setal row without distal tuft; molar present, medium, triturative or non-triturative; palp present. Maxilla 1 present; inner plate present, strongly setose along medial margin; palp present, not clavate, 2-articulate. Maxilla 2 inner plate present; outer plate present. Maxilliped inner and outer plates well developed or reduced, palps present, well developed or reduced; inner plates well developed, separate; outer plates present, large or small; palp 4-articulate, article 3 without rugosities. Labium smooth.

Peraeon. Peraeonites 1-7 separate; complete; sternal gills absent; pleurae absent. Coxae 1-7 well developed, none fused with peraeonites. Coxae 1-4 longer than broad or broader than long, overlapping, coxae not acuminate. Coxae 1-3 not successively smaller, none vestigial. Coxae 2-4 none immensely broadened.

Gnathopod 1 not sexually dimorphic; smaller (or weaker) than gnathopod 2, or subequal to gnathopod 2; subequal to coxa 2; gnathopod 1 merus and carpus not rotated; gnathopod 1 carpus/propodus not cantilevered; subequal to propodus, or longer than propodus; gnathopod 1 not produced along posterior margin of propodus; dactylus large. **Gnathopod 2 sexually dimorphic**; subchelate; coxa subequal to but not hidden by

coxa 3; ischium short; merus not fused along posterior margin of carpus or produced away from it; carpus/propodus not cantilevered, carpus short, shorter than propodus, slightly produced along posterior margin of propodus or not produced along posterior margin of propodus.

Peraeopods heteropodous (3-4 directed posteriorly, 5-7 directed anteriorly), none prehensile. Peraeopod 3 well developed. Peraeopod 4 well developed. 3-4 not glandular; 3-7 without hooded dactyli, 3-7 propodi without distal spurs. Coxa well developed, longer than broad; carpus subequal to propodus, not produced; dactylus well developed. Coxa subequal to coxa 3 or larger than coxa 3, not acuminate, with well developed posteroventral lobe or with small posterior lobe or without posteroventral lobe; carpus not produced. Peraeopods 5-7 with few robust or slender setae; dactyli without slender or robust setae. Peraeopod 5 well developed; shorter than peraeopod 6; coxa smaller than coxa 4, without posterior lobe; basis expanded, with posteroventral lobe or without posteroventral lobe; merus/carpus free; carpus linear; with a few subterminal setae. Peraeopod 6 subequal in length to peraeopod 7; merus/carpus free; dactylus with a few subterminal setae. Peraeopod 7 with 6-7 well developed articles; longer than peraeopod 5; similar in structure to peraeopod 6; with 7 articles; basis expanded, without dense slender setae; dactylus with a few subterminal setae.

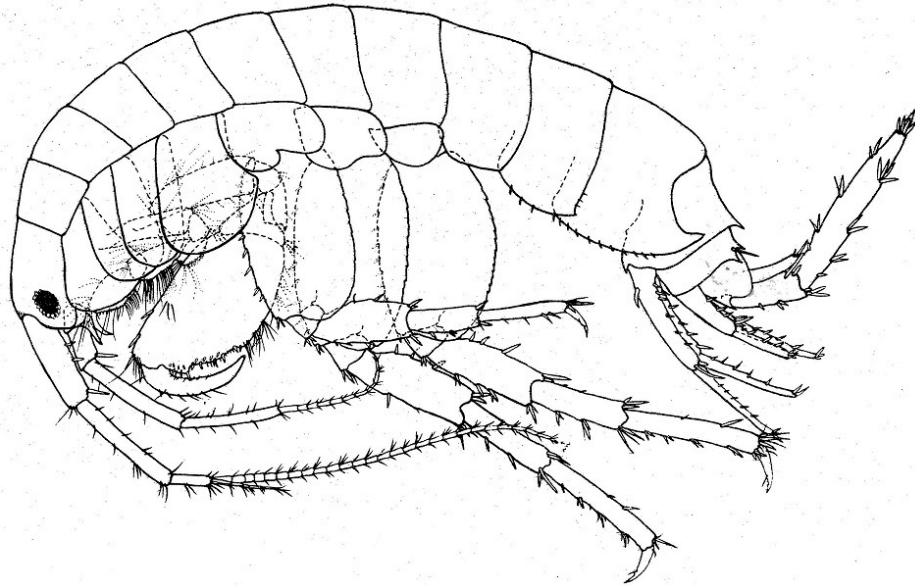
Pleon. *Pleonites 1-3 with transverse dorsal serrations or without transverse dorsal serrations, without dorsal carina; without slender or robust dorsal setae. Epimera 1-3 present. Epimeron 1 well developed. Epimeron 2 setose, or without setae.*

*Urosome not dorsoventrally flattened; urosomites 1 to 3 free; urosomite 1 longer than urosomite 2, or much longer than urosomite 2; urosome urosomite 1 bicarinate, or urosomites not carinate; urosomites 1-2 without transverse dorsal serrations. Uropods 1-2 apices of rami with robust setae. Uropods 1-3 radically dissimilar in structure and size, or similar in structure and size. **Uropod 1 peduncle** without long plumose setae, **with 1 or 2 basofacial robust setae**, without ventromedial spur. Uropod 2 well developed; without ventromedial spur, without dorsal flange; inner ramus subequal to outer ramus, or longer than outer ramus. Uropod 3 not sexually dimorphic; peduncle short; outer ramus longer than peduncle, 1-articulate or 2-articulate, without recurved spines. Telson laminar; deeply cleft; longer than broad, or as long as broad; apical robust setae present.” (Lowry and Springthorpe 2001).*

Anchialella – A monotypic genus based on an anchihaline species from the Galapagos Islands, where it was taken in a mangrove tidepool some distance from the shoreline. (J. L. Barnard 1979). It appears to be transitional between an *Eriopisa*-like ancestor and the apomorphic *Galapsiellus*, also found in anchihaline habitat in the Galapagos. *Anchialella vulcanella*, like *Galapsiellus* and the hadziid genus *Dulzura*, is blind despite its shallow habitat. Stock and Iliffe (1990) suggest that the differences between *Anchialella vulcanella* and *Galapsiellus lelouporum* are not of generic value, but that the two species can easily be distinguished on the basis of the length of the gnathopodal meri. If this proves true, with additional specimens demonstrating that the supposed generic boundaries are more a function of sexual dimorphism, as suggested by Stock and Iliffe, *Galapsiellus* will have priority and *Anchialella* will drop into synonymy.

Diagnosis: “Coxal gills 2-6, ovate, scarcely pedunculate, not 2-articulate. Sternal gills absent. Only female known, sexual dimorphism unknown, oostegites elongate, evenly

slender, with 0-2 apical setae. Body subvermiform. Head unnotched. All coxae very short, of similar length. Uropod 3 greatly exceeding uropod 1, parviramous, outer ramus 1-articulate, peduncle weakly elongate, longer than urosomite 3 but shorter than rami of uropod 1. Telson cleft, lobes triangular, pointed, each bearing apicomedial spine. Female gnathopod 1 of ceradocin form, wrist weakly elongate, palm oblique, articles 4-6 pubescent. Female gnathopod 2 of melitin form, enlarged, palm well defined, oblique, armed with hooked setules, unsculptured, wrist weakly elongate and lobate, posterior margin of hand with hadziid-form, setal groups weakly developed, pubescence absent. Mandibular palp article 3 linear, shorter than article 2, bearing 1 D seta, 2 E setae (Stock, 1974:77). Lower lip with weak inner lobes marked as creases on outer lobes. Inner plate of maxilla 1 with 4 apical setae, of maxilla 2 weakly setose medially, lacking oblique facial row of setae. Outer plate of maxilla 1 with 7 spines. Dactyl of maxillipedal palp with well-developed nail. Pleopods biramous. Urosomites free, only urosomite 2 with dorsolateral spine on each side, no other ornamentation.” (from J. L. Barnard 1979)



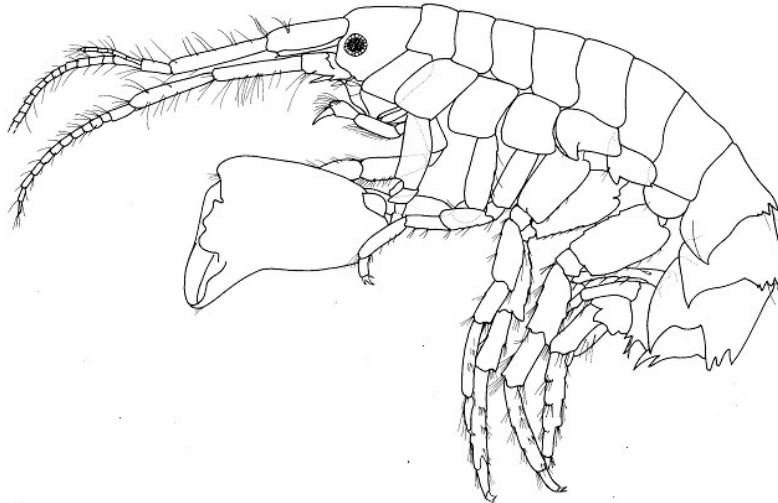
Desdimelita desdichada (from J. L. Barnard 1962)

Desdimelita - Key to genus provided by Jarrett & Bousfield (1996, p. 42). Two species reportedly occur in California. *D. desdichada*, the generotype, was described by J. L. Barnard (1962) from just north of the SCB; Monterey to Point Conception at 27-59fms. It has since been taken south of Pt. Conception, although the southern limit is not clear. Jarrett & Bousfield (1996) report it further north to Cordova Bay Alaska.

A second species, *Desdimelita californica*, is known from Central California north (originally described by Alderman 1936). The two can be separated using the key in Jarrett and Bousfield (1996, p. 42). Further north, however, four boreal *Desdimelita* species are reported. All are covered in the generic key mentioned above. An additional species, the provisional *Desdimelita* sp A, has been taken infrequently in fouling community samples in Central California (Moss Landing). It is characterized by differing armature of the urosome.

Diagnosis: “Male: Pleon smooth above. Urosome 1 usually with single dorsal tooth. Urosome 2 with paired dorsal teeth and single spine. Anterior head lobe broadly rounded, inferior antennal notch sharply incised. Antenna regular, not elongate. Upper

lip shallowly notched. Lower lip broad, processes normal; inner lobes well developed. Mandible, accessory blades few (6- 10); left lacinia 4-dentate, right 3-dentate; palp segment 1 with medial acute process; segment 3 not longer than 2. Maxilla 1, inner plate acuminate, medial margin setose; outer plate with 9 apical spines; palp segment 1 with few lateral setae, outer segment broadened distally. Maxilla 2, inner plate with submarginal facial row, and distal oblique facial row of setae; outer plate with angled outer shoulder. Maxilliped, inner and outer plates relatively short; palp segment 2 columnar; dactyl medium. Coxae 1-4 medium deep, rounded below, lacking posterior notch. Coxa 1 usually broadened distally. Gnathopod 1 weakly sexually dimorphic; palm oblique, margins finely spinose, dactyl normal. Gnathopod 2 (male), carpus short deep; propod, palm with hinge tooth variously developed; dactyl strong, with few (or none) outer marginal setae. Peraeopod 5-7, bases large, regular; segment 4 of peraeopod 6 larger than in peraeopod 7; dactyls short to medium. Pleon plate 3 produced acutely. Uropods 1 & 2, rami normally spinose, linear. Uropod 3, inner ramus very small, terminal segment or outer ramus small.. Telson lobes normal, slightly fused basally, proximal notch lateral; inner margins with weak spines. Coxal gills 2-5 large; gill 6 variously smaller. Female: Gnathopod 1, propod short, palm nearly vertical. Gnathopod 2, carpus medium short, hind margin setose; propod short, palm smooth. Coxa 6, anterior lobe normal or bifid (in *D. transmelita*.” (from Jarrett & Bousfield 1996)



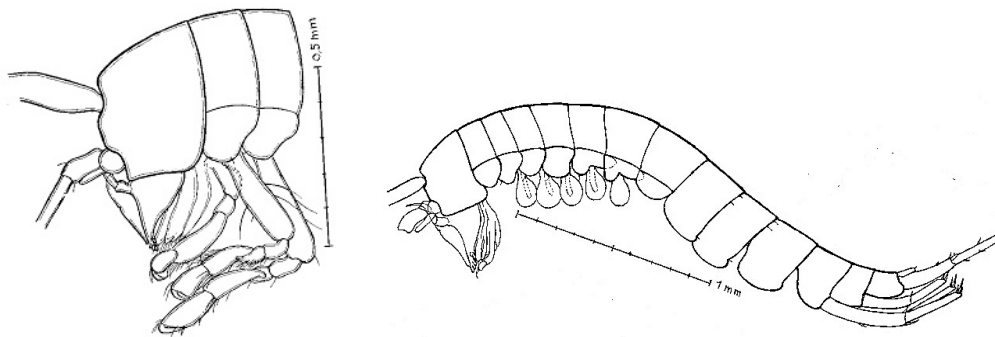
Dulichiella spinosa (from Lowry & Springthorpe 2007)

Dulichiella -This genus has a checkered history. It was originally established by Stout (1912) who believed the 3d uropods were lacking in the genus. They were in her type, but they had broken off. Prior to Karaman & J. L. Barnard 1979 the genus was viewed as a synonym of *Melita*. They resurrected it and redefined it. It was recently revised worldwide by Lowry & Springthorpe (2007).. Our local form was long considered to be *Dulichiella appendiculata*, a widely distributed Atlantic species redescribed and restricted by Lowry and Springthorpe (2007)(do not see Hirayama & Kikuchi 1979 for description of the taxon; the form they attribute to *D. appendiculata* was described as *D. tomioka* by Lowry and Springthorpe). The generotype, *Dulichiella spinosa* Stout 1912 has, however, been pulled from the synonymy of that species and is now viewed as the appropriate name of our local form (Lowry & Springthorpe 2007).

A very interesting genus, dorsally spinose on the posterior pereon, pleon, and urosome, and with profound sexual dimorphism in the second gnathopod. In adult males of *Dulichella* one of the G2 gnathopods is grossly enlarged, as in snapping shrimp chelae. Some are left-handed, some right-handed. In females the G2 pair is symmetrical. Small juvenile males have a largely female G2 configuration. In pre adult males disparity in G2 sizes increases with molt number. Stout's original description is lacking in particulars, and local material is redescribed by Lowry & Springthorpe (2007).

Members of the genus are usually algal associates. Material we have taken has come from algae in trawl samples, although it could easily have also been collected by divers from the rocky subtidal. The taxon does not occur on soft bottoms per se, and if encountered there, it will be on algal drift. The very small sprigs of algae that are attached to worm tube caps are not large enough to support a group of *Dulichella*. They appear to be gregarious. If found at all they tend to be taken in number (for instance the aggregations noted by Munguia, 2007, on empty pen shells on otherwise open bottom [probably the species pictured below]). Their food habits are not yet known.

Diagnosis: “Head anteroventral corner with several long, slender setae. Antenna 1 longer than antenna 2. Maxilla 1 inner plate long, narrow, tapering distally, with 2 well developed apical plumose setae. Maxilla 2 inner plate with oblique setal row. Gnathopod 2 male, asymmetrical, significantly unequal in size; palm in larger slightly obtuse; those of female equal in size. Pereopods 5–7 distal articles strongly to weakly setose; dactylar ungues with accessory spines. Pereopods 6 and 7 in males with bunches of long slender setae. Pereopod 7 basis in female fully expanded. Pleonites dorsally serrate. Uropod 3 inner ramus scale-like; outer ramus 4 to 5 x longer than wide, 2-articulate. Telson deeply cleft, lobes tapering distally to an acute point.” (from Lowry and Springthorpe 2007)

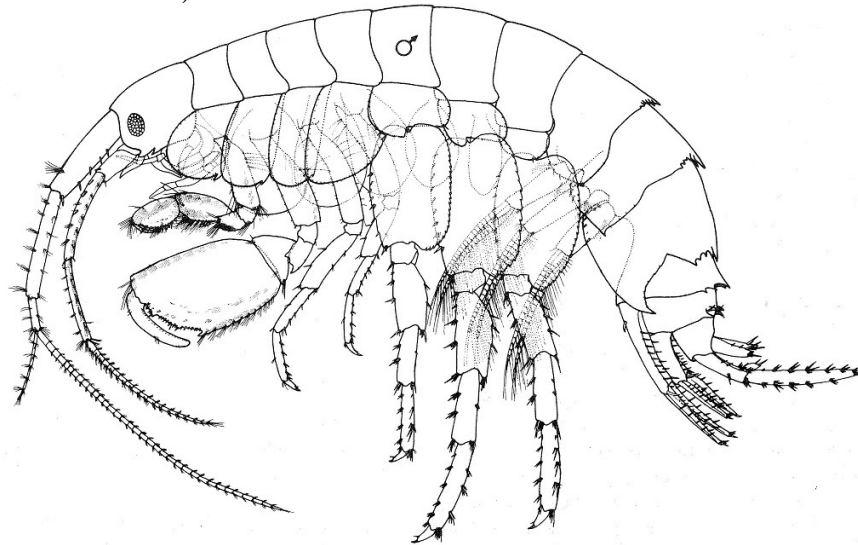


Head and lateral view of *Galapsiellus lelouporum* (from Monod 1970)

Galapsiellus – Erected by J. L. Barnard (1976) to house *Paraniphargus lelouporum* of Monod (1970). The single species is an anchihaline to phreatic form from mangrove associated pools and groundwaters of the Galapagos. It is an apomorph, apparently descended from a *Eriopisa*-like ancestor through *Anchialella* (J. L. Barnard 1976). Additional material was collected by Stock and Iliffe (1990), which added information on sexual dimorphism in the species. In the process they called into question several of the characters invoked by J. L. Barnard (1979) to differentiate his *Anchialella* from *Galapsiellus*. They felt that these were associated with sex rather than valid characters separating the genera, and suggested that *Anchialella* might be a junior synonym of *Galapsiellus*. They are retained here separately, although the suggestion of

synonymy is reasonably supported. There remain characters which seem to separate the two at more than specific level (see key to genera above). Additional material of both relatively rare forms should allow full resolution of the issue.

Diagnosis: “Coxal gills 2-6, ovate, weakly pedunculate, not 2-articulate. Sternal gills absent. Males and females almost identical except for penial processes of males and weak sausage-shaped oostegites 2-5 on female. Body subvermiform, all coxae very short, of similar length. Uropod 3 parviramous, outer ramus 1-articulate, peduncle greatly elongate, about as long as longest ramus on uropods 1-2 and nearly as long as outer ramus of uropod 3. Telson fully cleft, lobes apically turgid, each bearing apicomedial spine. Gnathopods of both sexes enfeebled, gnathopod 1 of melitid form, wrist elongate, anteriorly pubescent, hand weakly trapezoidal, palm scarcely oblique, short, article 4 swollen and pubescent. Gnathopod 2 broader and longer than gnathopod 1, wrist similarly elongate, not pubescent, article 4 similar, not pubescent, article 6 almost twice as long as article 6 of gnathopod 1, about 1.2 times broader, palm oblique. Palms of gnathopods sparsely setose, lacking spines except at defining corners. Wrists of gnathopods unlobate. Mandibular palp article 3 linear, bearing only E setae (apical). Lower lip with weak inner lobes. Medial setae on maxillae absent or sparse. Pleopods biramous. Urosomites free, naked, or with at most one dorsolateral setule on each side.” (from J. L. Barnard 1976)



Megamoera subtener (from Jarrett & Bousfield 1996)

Megamoera – The genus is speciose in boreal waters, with 9 species recorded from the NEP (Jarrett & Bousfield 1996). A single species of *Megamoera*, *M. subtener*, is recorded from California waters. This species was listed as *Melita dentata* in some earlier works based on an incorrect synonymy with that species, now known as *Megamoera dentata*. It has an Arctic distribution with extensions into the extreme northern West Pacific and the Western North Atlantic, and does not occur in our area. *Megamoera* is in the complex of melitid genera around *Abludomelita* Karaman 1981. In that work Karaman considered *Megamoera* still a synonym of *Melita*. It was resurrected as a valid genus and redefined by Jarrett & Bousfield (1996), who figure the differences in dorsal ornamentation, male gnathopod, and maxilla 1 configuration between the genera in the *Abludomelita* complex (keyed on pg. 8). All of the members of the genus are

boreo-arctic or Arctic in distribution except *M. subtener*, which ranges into the temperate zone. All ten species in the genus known from the North Pacific are included in the generic key in Jarrett & Bousfield (1996, p. 16).

Diagnosis. “Pleosome segments 1-3, postero-dorsal tooth usually present, usually with two or more accessory teeth on each side. Urosome segment 1, postero-dorsal tooth usually with 1-3 accessory teeth on each side. Urosome 2 with dorso-lateral pairs of teeth each astride single spine. Head, anterior head lobe rounded, lower margin often with small accessory process; inferior antennal sinus narrowly notched. Antennae regular, antenna 2 much shorter than antenna 1.

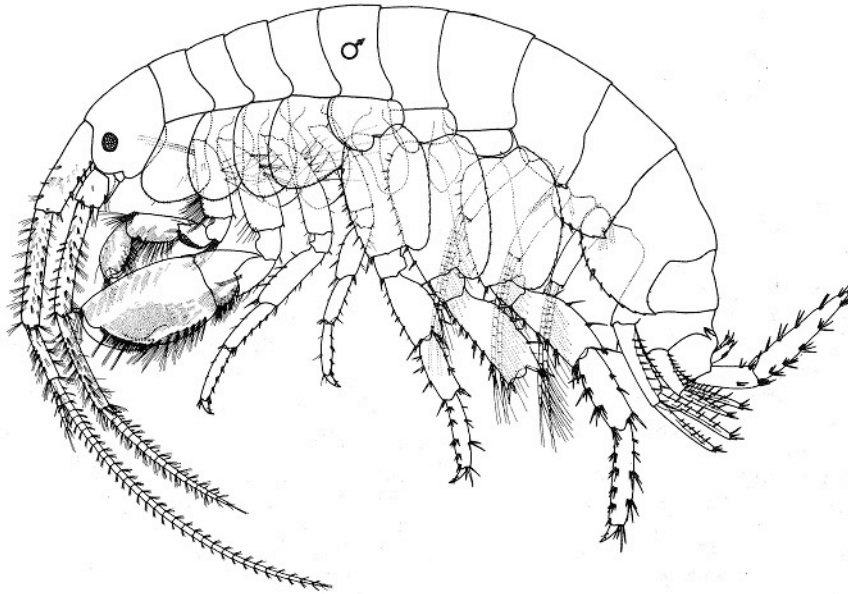
Mouthparts regular. Upper lip shallowly notched. Lower lip regular, inner lobes well developed. Mandible, spine row 4th numerous blades (8-14); left lacinia d-dentate, right lacinia 4-5 dentate; palp segment 3 usually longer than 2; segment 1 short, with acute medial process. Maxilla 1, inner plate triangular, tip not attenuated, inner margin 6-14 setose; outer plate with 9 apical spines; palp segment 1 usually with strong lateral setae; segment 2 moderately expanded distally. Maxilla 2, inner plate, facial setae variously reduced, closely marginal or submarginal. Maxilliped, outer plate medium large; palp segment 2 slightly broadened; dactyl medium.

Coxae 1-4 medium to shallow, 1-3 cusped behind. Coxa 1 variously expanded distally; coxa 4 excavate behind, not deeper than 3. Gnathopod 1 small, weakly sexually dimorphic; basis, antero-distal setae variously developed; carpus elongate, shallow; propod relatively narrow, shorter than carpus, palm and dactyl slightly modified; in female, posterior margin of dactyl often denticulate or microsetose. Gnathopod 2 (male), carpus generally short, hind lobe narrow, deep, apex (margin) setose; propod large, slightly broadening distally, palm oblique, usually toothed, with distinct hinge tooth, inner face with submarginal postero-distal spine cluster, posterior margin strongly setose (5-10 clusters); dactyl variously setose anteriorly, tip attenuated; in female, carpus relatively long but much shorter than propod, medium deep; propod relatively large (smaller than in male), slightly narrowing distally, palm regularly convex, with posterodistal tooth.

Coxa 6 (female), anterior lobe shallow, often subequally bifid. Peraeopod 4 slightly smaller than 3. Peraeopod 5, basis not grossly smaller than in 6 & 7; in all, bases regularly expanded, hind lobes normal; segment 4 slightly broadened; distal segments regular; dactyls typically medium short.

Pleon plates 1 & 2, hind corners squarish or acuminate, rarely produced; pleon plate 3, hind corner usually produced, acute, upper and lower margins not serrate. Uropod 1, peduncle with disto-lateral spine; rami sublinear, spinose, often shorter than peduncle. Uropod 2, rami shorter than peduncle, outer ramus the shorter. Uropod 3, outer ramus not elongate, terminal segment distinct. Telson lobes regular, separated almost to base, marginal spines subapical, set in lateral and medial notches.

Coxal gills 2-5 large, 6 often distinctly smallest. Brood plates sublinear, short.”
(from Jarrett & Bousfield 1996)

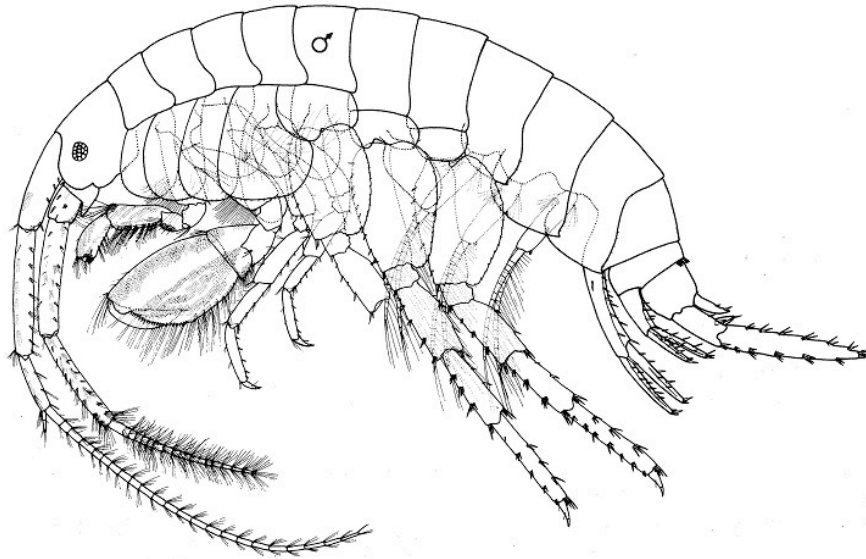


Melita oregonensis (from Jarrett & Bousfield 1996)

Melita -Three species of *Melita* s.s. are recorded from California, and two more from more boreal waters in the NEP. A sixth deep-water species is known from the Gulf of Panama, *Melita lignophila* (J. L. Barnard 1961), and a seventh is a newly recognized provisional from Central California. *Melita nitida* has been reported as introduced to San Francisco Bay and other areas to the north, from its base range of the Western North Atlantic (Chapman 1988). This introduction apparently occurred prior to 1933, when the species was reported as established in San Francisco Bay. Since then it has expanded its range northward, being reported as established as far north as Puget Sound (USGS Non-indigenous Aquatic Species website <http://nas.er.usgs.gov>). It has not yet been reported from southern California harbors, but specimens have been taken since 2002 in the estuary of the San Gabriel River in southern California (Carol Paquette, personal communication).

A second exotic *Melita*, *M. rylovae* Bulycheva 1955, introduced from the North West Pacific, is also known from San Francisco Bay. It was probably introduced in ballast water as it was in Australia (Williams et al., 1996).

Melita sulca (Stout 1912) is a widely distributed coastal species within the SCB. It occurs from the intertidal down to at least middle Continental shelf depths. This species can easily be separated from other NEP species by possessing a strong dorsal tooth on the first urosomal segment. *Melita* species reported to occur in the NEP except *M. lignophila*, and *M. rylovae*, are keyed by Jarrett and Bousfield (1996, p. 53). The lower slope species *M. lignophila* is blind, and will not easily be confused with the other regional *Melita* species. *Melita rylovae* has a small terminal segment on the outer ramus of the third uropod, unlike the other eyed west coast *Melita*. As it is likely that additional introductions of these animals will occur, the key to the forms known from the Northwestern Pacific provided by Jarrett and Bousfield (1996, p. 61) should be checked if problematic specimens are encountered.



Melita nitida (from Jarrett & Bousfield 1996)

Diagnosis: “Head, inferior antennal sinus variously incised, anterior and posterior lobes rounded. Pleon segments usually not (or very weakly) dorsally toothed. Urosome segment 1 with or without dorsal tooth. Urosome 2 with paired dorsal teeth and/or spine groups. Antennae strong; antenna 2, flagellar segments often ringed with “bottlebrush” setae

Mandible, right lacinia spike-like, multidenticulate; left lacinia 4-dentate. Maxilla 1, outer plate with 9 (occasionally 6-7) apical spines; inner plate subtruncate, distal margin 4-10 setose; palp segment 1 lacking shoulder setae (usually), segment 2 disto-medially broadened, apex (of right palp) dentate. Maxilla 2, inner plate, with distal marginal setae only. Maxilliped plates strong; palp segment 2 sublinear; dactyl stout, curved.

Coxae 1-3 lacking hind marginal cusps; coxa 4 squarish or evenly rounded below. Gnathopod 1 (male), carpus slender, longer than propod, antero-distal lobe usually finely pilose (both sexes); propod slender, dactyl short, highly modified, with basal bulge or swelling. Gnathopod 2, propod posterodistally broadened, unproduced, inner face often strongly setose and distally excavate to accommodate tip of large acute dactyl; palmar margin usually lacking hinge tooth.

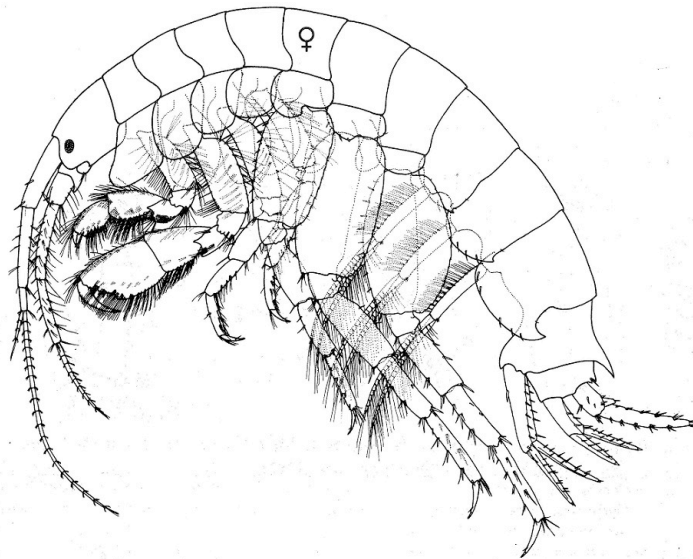
Peraeopods 3 & 4 variously unequal in size. Peraeopods 6 & 7 larger than 5, bases lobate; segment 4 variously broadened.

Coxa 6 (female), antero-ventral lobe modified, deep, often hook-like, pre-copulatory in function. Pleon plate 3, hind corner squarish, acuminate or moderately produced. Uropod 3, inner ramus small, outer ramus strong, terminal segment usually lacking. Telson lobes separated to base, apices and inner margins spinose.

Coxal gill 6 various, often small.” (from Jarrett & Bousfield 1996)

Key to the genus *Melita* in the NEP (modified from Jarrett and Bousfield 1996)
D. Cadien 7 March 2015

1. Urosome 1 with dorsal tooth.....*sulca*
Urosome 1 lacking dorsal tooth, but may bear marginal teeth.....2
2. Bearing pigmented eyes.....3
Lacking any trace of eyes.....*lignophila*
3. Uropod 3 outer ramus biarticulate.....*rylovae*
Uropod 3 outer ramus lacking terminal article.....4
4. Urosomite 2 posterior margin with spines, but lacking teeth.....*nitida*
Urosomite 2 posterior margin smooth, without teeth or spines.....*alaskensis*
Urosomite 2 posterior margin with pairs of acute teeth separated by thin setae, but lacking spines.....*oregonensis*



Quasimelita quadrispinosa (from Krapp-Schickel and Jarrett 2000)

Quasimelita – Erected by Jarrett and Bousfield (1996) to contain three species, one of which, *Quasimelita quadrispinosa* is recorded from the Gulf of Alaska. The other two are from the NWP/Arctic, and the North Atlantic. The genus is separated from other melitoids in the key to the *Abludomelita* complex (Jarrett and Bousfield 1996, p. 8). *Q. quadrispinosa* can be separated from the NW Pacific/Arctic *Q. formosa* by the anteriorly and posteriorly convex basis of pereopods 6 and 7 (vs. linear), by the more robust posterodistal tooth of epimeron 3, and by the much larger mediodorsal tooth on urosomite 1 which overarches urosomite 2 (vs. not overhanging urosomite 2 in *Q. formosa*).

Diagnosis: “Combining character states of *Melita* and *Abludomelita* but with distinctive features, especially of mouthparts and gnathopods. Pleon weakly toothed to smooth dorsally. Urosome segment 1 with dorsal tooth. Urosome 2 with dorsal teeth (usually paired) and usually single spines on each side. Anterior head lobe rounded; inferior antenna 1 sinus broadly incised. Antenna 1, peduncular segment 3 short.

Upper lip incised below. Lower lip, inner lobes large. Mandible, spine row short; palp weak, segment 1 lacking distal process; left lacinia 4-dentate, right lacinia 3-dentate; incisor irregularly dentate. Maxilla 1, inner plate triangular, weakly setose

medially; outer plate with 9 apical spines; palp segment 1 with lateral setae; segment 2 apically spinose and setose. Maxilla 2 & inner plate, with few facial setae, submarginally positioned. Maxilliped, inner plate tall; outer plate broad, apical margin setose; palp segment 2 very stout, dactyl short.

Coxae 1-4 medium to shallow and may decrease in size and depth posteriorly. Coxae 1-3, lower margin rounded or squared, hind corner lacking cusp. Coxa 1 slightly broadened distally. Coxa 4 small, posterior proximal excavation weak or lacking. Gnathopods 1 & 2 conspicuously sexually dimorphic. Gnathopod 1, propod shorter than carpus, margins strongly setose; palm and dactyl short. Gnathopod 2 (male), carpus large, with broadly setose lower margin; propod large, broadening distally, palm irregularly toothed, posterodistal process large; dactyl with outer marginal setae.

Peraeopods 3 & 4 unequal; segment 4 stout; dactyls well developed. Peraeopods 5-7, bases deep, variously narrowed, hind lobes reduced, small; dactyls well developed. Pleon segment 3, hind corner produced. Pleopods elongate; peduncles strongly setose laterally. Uropods 1 & 2 regular; distal peduncular spine weak; rami lanceolate, margins spinose. Uropod 3, outer ramus strong, 2-segmented. Telson lobes weakly (or not) fused basally, marginal notches closely subapical. Coxal gills 2-5 large, saclike; gill 6 small.” (from Jarrett & Bousfield 1996)

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