Amphipoda of the Northeast Pacific (Equator to Aleutians, intertidal to abyss): XXV. Stenothoidea: a review Donald B. Cadien, LACSD
22July2004 (revised 13 Feb 2015)

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.

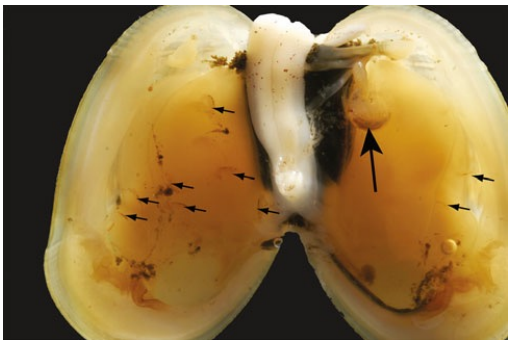
Introduction to the Stenothoidea

Bousfield (1978,1983, 2001) considered the stenothoids as a family within the superfamily Leucothoidea. Berge et al (2000) also found Leucothoidae and Stenothoidae to fall into the same clade, with Amphilochidae separated widely in another. Here the Amphilochidae and Stenothoidae are considered to form a superfamily Stenothoidea. They, along with the Iphimedioidea and the Leucothoidea are considered to belong to Infraorder Leucothoida. The entire infraorder has yet to be subjected to the revisionary examination which produced the Senticaudata (Lowry & Myers 2013). It falls among the non-Senticaudates at the moment, a convenient unofficial holding place for groups that have yet to be addressed at the suborder level. The Stenothoidea, and in particular the Amphilochidae are viewed as plesiomorphic compared to other parts of the infraorder.

Ecological Commentary

Amphilochids have been reported as associates of echinoderms (Vader 1978). A species identified as *A. neapolitanus* in the tropical west Atlantic, which may prove to not belong to that cooler water species, was observed on the spines of *Lytechinus variegatus*. When dislodged, it would return to the host rapidly, readopting the original position near a spine tip (Parker 1936). A species of the amphilochid genus *Cyclotelson* has been observed in association with free living crinoids in the tropics (Potts 1915). Other members of the family have been observed in association with medusae (Vader 1972) or pagurid crabs (Myers 1974). In the later species the propod and dactyl of the leg are modified to form a prehensile organ for grasping the setae of the host. The structure is very similar in design to that of *Commensipleustes commensalis*, with the dactyl closing along the anterior margin of the propod, which is studded with stout setae. While the legs are modified for position keeping, the mouthparts are unspecialized, and are presumed to indicate that the amphipod feeds on food incompletely consumed by the crab (Myers 1974). The amphipod appears to be an obligate associate of the hermit crab *Dardanus megistos*.

Several members of the Stenothoidae are also associated with other invertebrates. Thomas and Cairns (1984) report the association of *Stenothoe symbiotica* with a majid crab host. Vader (1971) reports that Shoemaker (1955) found *Metopa glacialis* living within the mantle cavity of the small clam *Musculus discors* (see also Tandberg et al 2010a, Just 1979, Vader & Beehler 1979).



Metopa glacialis (arrows) inside the opened valves of *Musculus discors* (from Tandberg et al 2010a)

Tandberg et al (2010b) also record another amphipod, *Metopa alderii*, from the same clam species. *Metopa groenlandica*, in addition to living within the mantle cavity of the clam *Pandora glacialis*, has been found in the branchial cavity of several tunicates (Stephenson & Thorson 1936). Vader (1978) reported an association between a stenothoid and the starfish *Crossaster papposus*. Association with hydroids has been reported for several stenothoids, which cluster in sediment at the base of the polyps of *Tubularia* [now *Ectopleura*] *crocea* (Watling 1976). Vader & Krapp-Schickel (1996) describe the association of *Stenothoe brevicornis* with a sea anemone. Gut analysis had earlier demonstrated that the amphipod feeds on the anemone tissues, not just on secretions (Moore et al 1994), and as such is a micro-predator. A similar association is reported for *Parametopella antholobae* in Chile (Krapp-Schickel & Vader 2009).In reviewing literature reports of stenothoid associations Vader & Krapp-Schickel (1996) found additional reports of stenothoids in ascidians (Pirlot 1933, Vader 1984b, Krapp-Schickel 1976).

The stenothoid *Parametopella antholobae* sitting on the oral disc of its host anemone (from Krapp-Schickel & Vader 2009)

Other reports pointed to associations between stenothoids and sponges (Chevreux & Fage 1925, Pearse 1934, J. L. Barnard 1962, Vader 1984a).

Stenothoids do not seem to swim as often or as vigorously as many other amphipod groups. They are primarily adapted for inquiline lifestyles on other invertebrates, or as clinging epibionts of seaweeds. Their main concern is to avoid dislodgment rather than in swimming. They are capable of swimming, however, and if dislodged from their substrate buzz back in short order with rapid flexion of their urosomes. Even so Sainte-Marie and Brunel (1985) listed both Stenothoidae and Amphilochidae among the families for which some swimming excursions occurred. During their several year investigation in the Gulf of St. Lawrence in the Northwest Atlantic they caught 8 species of stenothoids, and one amphilochid in their hyperbenthic net samples. There was not sufficient evidence for Conlan (1991) to view members of either family as among either non-mate guarding or mate guarding groups or with either pelagic or benthic mate seeking behavior.

Sexual differences in stenothoids are primarily reflected in the size and structure of the gnathopods. Major differences in antennae, and possession of elaborate sensory organelles on them for mate location are not a feature of the group. As inquilines, symbionts and algal epibionts these animals have males and females located in close proximity. The enlargement of one pair of gnathopods in males is usually interpreted as functioning for territorial defense and intra-sex agonistic encounters (Lewis 1992, Schiecke 1973).

Key to NEP Stenothoid genera

Since the external similarities between most genera are so strong, previous keys have involved mouthpart details. These will be avoided where feasible. Condition of the mandibular palp, which can be viewed without dissection, will be used. There can be difficulties in resolving mouthpart articulations, including articles of the mandibular palp (Krapp-Schickel & Koenemann 2006). If the articulations between articles of the palp are unclear in a given specimen, it may be necessary to mount the entire animal for examination at higher power. In some cases the answer will only be clear once the mandible has been excised and mounted separately.

Stenothoid genera reported from the NEP – dbcadien 12Feb2015

1a. Pereopod 7 basis rectolinear.....2
1b. Pereopod 7 basis posteriorly expanded into a lobe.....6
2a. Antenna 1 peduncle bearing distal nasiform process.....3
2b. Antenna 1 peduncle lacking nasiform process.....4
3a. Urosomite 1 with large laminar dorsal keel; pereonite 4 lacking dorsal swelling, antenna 1 with nasiform process on art1 .....Zaikometopa
3b. Urosomite 1 keel low; pereonite 4 with dorsal swelling; antenna 1 with nasiform process on art 1.....Hardametopa
3c. Urosomite 1 lacking ornament; pereonite 4 lacking dorsal swelling; antenna 1 with nasiform process on art 1 and 2.....Parametopa
4a, G2 chelate.....Pycnopyge
4b. G2 subchelate.....5
5a. A1 with accessory flagellum, mandibular palp present.....Metopella
5b. A1 lacking accessory flagellum, mandibular palp absent.....Parametopella

6a. P6 basis linear or less expanded than P7 basis.....7
6b. P6 basis posteriorly as expanded as P7 basis.....8
7a. Mandibular palp absent or uniarticulate.....Stenothoides
7b. Mandibular palp of 2-3 articles.....Mesometopa
8a. Mandibular palp absent or uniarticulate.....9
8b. Mandibular palp of 2-3 articles.....Metopa/Propoloides*.....10
9a. Mandibular palp absent.....Stenothoe
9b. Mandibular palp uniarticulate.....Stenula
10a. With prominent eyes.....go to Metopa key
10b. Blind, lacking eyes.....11
11a. Telson lacking dorsal stout setae.....Proboloides pacifica
11b. Telson bearing dorsal stout setae.....12
12a. Pleonal epimeron 3 posteriorly produced.....Proboloides tunda
12b. Pleonal epimeron 3 posteriorly quadrate.....Metopa samsiluna

*These two genera can be distinguished by the number of articles in the palp of maxilla 1. Rather than force dissection of mouthparts, they are keyed together here. Aside from the difference in maxilla 1 palp and the setation of the telson Metopa samsiluna and Proboloides pacifica are virtually identical.

NEP Stenothoidea from McLaughlin et al. (2005) augmented with known provisionals.
* = Taxa on SCAMIT Ed. 9 List (Cadien & Lovell 2014). Valid taxa **bolded**, synonyms not.

Family Amphilochidae

Amphilochus litoralis Stout 1912 (=Apolochus litoralis)
Amphilochus neapolitanus Barnard 1962 non Della Valle 1893 (=Apolochus barnardi)
Amphilochus picadurus Barnard 1962 (= Apolochus picadurus)
***Apolochus barnardi** Hoover and Bousfield 2001 – Central California to Baja California: 0-80m
***Apolochus litoralis** (Stout 1912) – SE Alaska to SCB: 0m
***Apolochus picadurus** (Barnard 1962) – SCB to Bahia Concepcion, Gulf of California, Mexico: 4-41m
Apolochus staudei Hoover and Bousfield 2001 – British Columbia: 0-60m
***Gitana calitemplado** Barnard 1962 – SCB to Baja California: 20-84m
Gitana ellisi Hoover and Bousfield 2001 – British Columbia: 10-20m
Gitanopsis baciroa Barnard 1979 (= Hourstonius baciroa)
Gitanopsis pusilloides Shoemaker 1942 (= Hourstonius pusilloides)
Gitanopsis vilordes Barnard 1962 (= Hourstonius vilordes)
Hourstonius baciroa (Barnard 1979) – Gulf of California to Galapagos: 0-1m
Hourstonius pusilloides (Shoemaker 1942) – Baja California to Bahia de Los Angeles, Gulf of California, Mexico: 0-9m
***Hourstonius vilordes** (Barnard 1962) – SE Alaska to SCB: 0-27 m

Family Stenothoidae

Hardametopa nasuta (Boeck 1871)- Artic to ?Central California; 10-183m
Leucothoe glacialis Krøyer 1842 (=Metopa glacialis)

Mesometopa esmarki (Boeck 1871) – San Francisco; depth?
+**Mesometopa neglecta roya** Barnard 1966 – SCB; 221m
Mesometopa sinuata Shoemaker 1964 – Oregon to Monterey; 0-2m
Metopa cistella Barnard 1969 – Central California; 0-2m
***Metopa dawsoni** Barnard 1962 – SCB to Bahia San Cristobal, Baja California, Mexico; 12-200m
Metopa esmarki Boeck 1871 (=Mesometopa esmarki)
Metopa glacialis (Krøyer 1842) – Arctic Alaska to North Atlantic; 6-275m
Metopa nasuta Boeck 1871 (=Hardametopa nasuta)
Metopa nordmanni Stephensen 1931 (=Stenula nordmanni)
Metopa pacifica Holmes 1908 (=Proboloides pacifica)
Metopa samsiluna Barnard 1966 - SCB to Baja California; 1026-1620m
Metopa sp Barnard 1966 – Monterey Submarine Canyon: 168m
***Metopella aporpis** Barnard 1962 – Monterey to Bahia San Cristobal, Baja California, Mexico; 24-591m
Metopelloides erythrophthalmus Coyle & Mueller 1981 (=Zaikometopa)
Parametopa alaskensis (Holmes 1904) – Pribilof Islands, Alaska; 0m
***Parametopella ninis** Barnard 1962 – SCB; 57-183m
Parametopella sp 1 Thomas & McCann 1996§ - Central California; 92m
Proboloides pacifica (Holmes 1908) – Monterey; 1326-1396m
Proboloides tunda Barnard 1962 – Cascadia Abyssal Plain, Oregon to San Diego Trough; 558m-2820m
Prothaumatelson carinatum Shoemaker 1955 (= Pycnopyge carinatum)
Pycnopyge carinatum (Shoemaker 1955) – Arctic Alaska; 37-66m
Stenothoe alaskensis Holmes 1904 (= Parametopa alaskensis)
***Stenothoe estacola** Barnard 1962 – SCB; 0-62m
***Stenothoe frecanda** Barnard 1962 – Monterey to SCB; 64-92m
Stenothoe marina Bate 1857 (introduced?): 0-5m
Stenothoe valida Dana 1853 (introduced to SCB embayments), to Bahia San Quintin, Baja California, Mexico; 0-15m
***Stenothoides bicoma** Barnard 1962 – Central California to SCB; 12-120m
***Stenothoides burbanki** Barnard 1969 – Central California to SCB; 0-60m
Stenula incola Barnard 1969 – Central California; 0m
***Stenula modosa** Barnard 1962 – Central California to SCB; 60-100m
Stenula nordmanni (Stephensen 1931) Arctic Alaska; 6-30m
Zaikometopa erythrophthalmus (Coyle & Mueller 1981) – Alaska; 0m

Comments by Family

Family Amphilochidae – The family presently consists of fifteen genera (Horton & De Broyer 2014) and is of worldwide distribution. All species in the family are small, and often must be examined on a compound microscope to discern important detail. Although primarily intertidal and shallow sublittoral, a few representatives can range down into the bathyal. Only three of the genera have representatives in the NEP. The group was recently regionally reviewed by Hoover and Bousfield (2001).

Description: "***Head*** *free, not coalesced with peraeonite 1; exposed; as long as deep, or longer than deep, or deeper than long;* ***anteroventral margin straight or oblique****, anteroventral corner subquadrate; rostrum present, short or moderate or long; eyes present, well developed or obsolescent; not coalesced; 1 pair; not bulging. Body laterally compressed; cuticle smooth.*

Antenna 1 shorter than antenna 2, or subequal to antenna 2; 3-articulate; peduncular articles 1-2 not geniculate; accessory flagellum present, or absent; antenna 1 callynophore present, or absent. Antenna 2 present; short; articles not folded in zigzag fashion; without hook-like process; flagellum shorter than peduncle, or as long as peduncle; 5 or more articulate; not clavate; calceoli absent.

Mouthparts well developed. Mandible incisor dentate; accessory setal row without distal tuft; molar present or absent, medium, triturative; palp present or absent. Maxilla 1 present; inner plate present, weakly setose apically; palp present, not clavate, 1 -articulate or 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, very large or 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, overlapping, coxae not acuminate. Coxae 1-3 not successively smaller, coxa 1 reduced or coxa 1 vestigial or coxae 1-2 vestigial. Coxae 2-4 none immensely broadened.

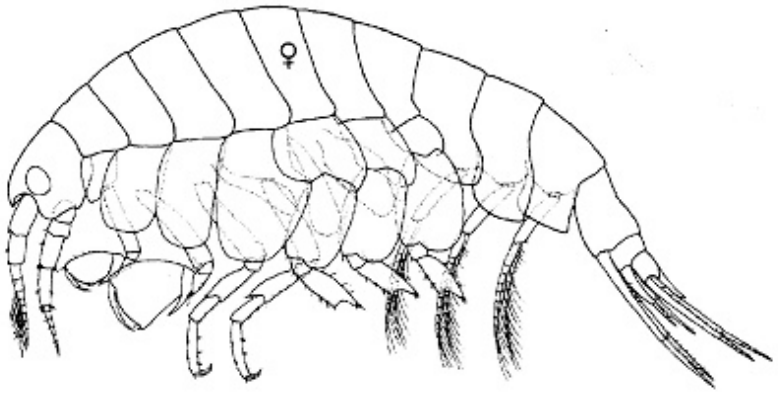
Gnathopod 1 *not sexually dimorphic; smaller (or weaker) than gnathopod 2, or subequal to gnathopod 2;* ***vestigial, hidden or partially hidden by coxa 2****; gnathopod 1 merus and carpus not rotated; gnathopod 1 carpus/propodus not cantilevered; shorter than propodus, or subequal to propodus, or longer than propodus; gnathopod 1 strongly produced along posterior margin of propodus, or slightly produced along posterior margin of propodus, or not produced along posterior margin of propodus; dactylus large.* ***Gnathopod 2*** *not sexually dimorphic; subchelate;* ***coxa*** *smaller than and mostly hidden by coxa 3, or 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 or longer than propodus,* ***strongly produced along posterior margin of propodus or slightly 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 larger than coxa 3, not acuminate, with well developed posteroventral lobe; carpus not produced. Peraeopods 5-7 with few robust or slender setae; dactyli without slender or robust setae. Peraeopod 5 well developed; subequal in length to peraeopod 6; coxa subequal to coxa 4, without posterior lobe; basis expanded, subovate, without posteroventral lobe; merus/carpus free; carpus linear; setae absent. Peraeopod 6 subequal in length to peraeopod 7; merus/carpus free; dactylus without setae. Peraeopod 7 with 6-7 well developed articles; subequal to peraeopod 5; similar in structure to*

peraeopod 6; with 7 articles; basis expanded, without dense slender setae; dactylus without setae.

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

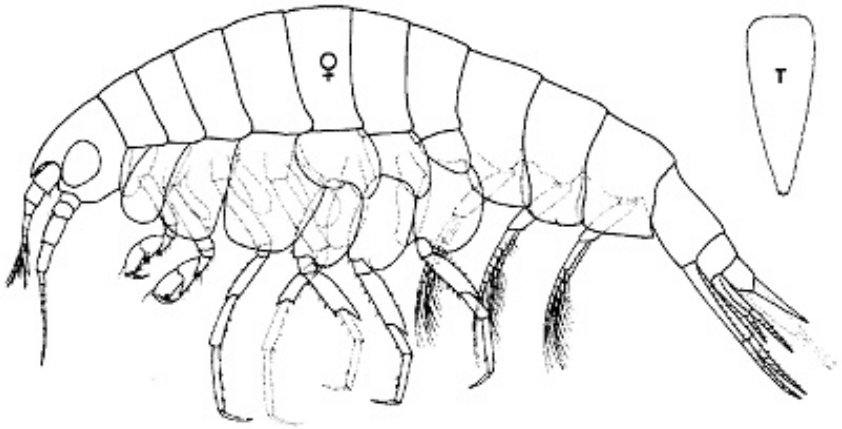
Urosome not dorsoventrally flattened; urosomites 1 to 3 free; urosomite 1 longer than urosomite 2, or much longer than urosomite 2; urosome urosomites not carinate; urosomites 1-2 without transverse dorsal serrations. Uropods 1-2 apices of rami without robust setae. Uropods 1-3 similar in structure and size. Uropod 1 peduncle without long plumose setae, without basofacial robust seta, without ventromedial spur. Uropod 2 well developed; without ventromedial spur, without dorsal flange; inner ramus longer than outer ramus. Uropod 3 not sexually dimorphic; peduncle elongate; outer ramus longer than peduncle, 1-articulate, without recurved spines. Telson laminar, or weakly thickened dorsoventrally; emarginate, or entire; longer than broad; apical robust setae absent." (from Lowry and Springthorpe 2001).



Apolochus littoralis (from Hoover & Bousfield 2001)

Apolochus – A genus whose members, except for *A. neapolitanus*, are from either the NEP, or the Gulf/Caribbean regions. *A. neapolitanus* is a Mediterranean species, which has been reported from broadly disparate locations. It is likely that many of the records, such as those from the Caribbean, are not of that species, but undiagnosed congener(s). A key to the known species is provided by Hoover & Bousfield (2001).

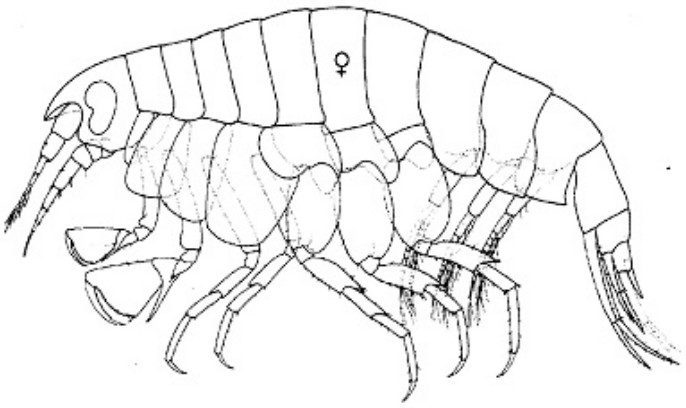
Diagnosis: *"Anterior head lobe rounded. Antenna 1 short to medium, peduncular segments 1 & 2 slightly broadened posteriorly; accessory flagellum l-segmented, rarely lacking. Upper lip, apical lobes asymmetrical. Lower lip, inner margins variously "notched". Mandible, molar reduced, apically with few triturating ridges, setae, or none; spine-row weIl developed; palp segment 3 little longer than segment 2. Maxilla 1, outer plate spines regular; palp segment 1 enlarged. Maxilla 2, setation of plates tending to reduction. Maxilliped outer plate broad, palp regular. Coxae 2-4 weakly or not serrate below. Gnathopod 2, carpus short to medium in length, posterior lobe well developed; palmar margin of propod distinct, steeply oblique or nearly vertical, palmar angle defined by 1-2 spines. Peraeopods 3 & 4, dactyls short to medium, shorter than those of peraeopods 5-7. Telson linguiform, apex sharply rounded or subacute. Brood plate (P5) short, with 5-6 marginal setae."* (from Hoover & Bousfield 2001)



Gitana ellisi with inset of the acuminate telson that characterizes the genus (from Hoover & Bousfield 2001)

Gitana – A 10 member genus of primarily boreal affinities, but with tropical/subtropical representatives. No comprehensive key to the genus exists, although that provided by Hoover & Bousfield (2001) treats ½ the species, including the two forms known from the NEP.

Diagnosis: *"Anterior head lobe acute or rounded. Antennae unequal in length: accessory flagellum lacking or very minute. Upper lip, lobes symmetricaI. Lower lip, inner shoulders with sharp notch. Mandibular molar large, cushion- shaped, triturative; spine row moderate, 5-9 blades; palp segment 3 not elongate. Maxilla 1, palp 1 segmented. Maxilla 2, inner plate stout. Maxilliped, inner plate with two stout medially curved spines; inner margin of outer plate weakly excavate; palp segment 1 equal to segment 2. Coxae 2 weakly serrate posterodistally. Gnathopods 1-2 small, weakly subchelate or simple; palm very oblique, dactyl often pectinate posteriorly. Peraeopods slender; dactyls relatively long. Pleome side plate 2, bind corner squared or obtuse. Uropod3, rami short, margins bare or nearly so. Telson long, tapering, apex acute, usually minutely tridentate. Coxal gills small. Brood plates variable, usually large on peraeopods 2 and 3."* (from Hoover and Bousfield 2001)

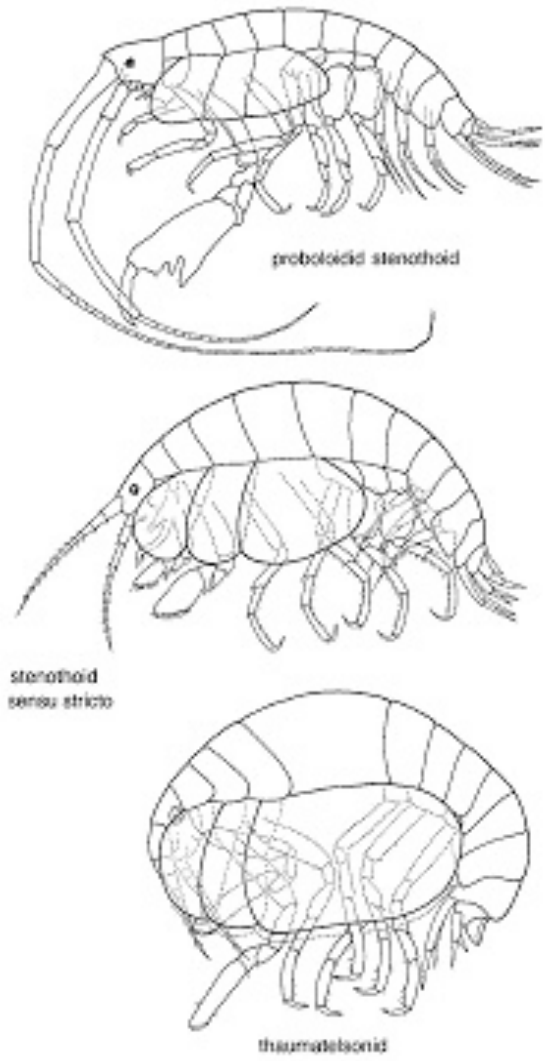


Hourstonius vilordes (from Hoover & Bousfield 2001)

Hourstonius – A good sized genus of 15 species distributed largely in the boreal to temperate North Pacific, but with tropical members in the Pacific (Hawaii), the Caribbean/Gulf of Mexico, and the tropical southeast Atlantic. Nearly half the species are from the Northwest Pacific, with a smaller contingent in the Northeast Pacific. Lowry

(2014a), omits *H. koreana* Kim and Kim 1992 in the listing for the genus in WoRMS. A key to the genus is provided by Kim et al (2010)

Diagnosis: "*Anterior head lobe generally rounded. Accessory flagellum I-segmented or minute. Upper lip notched, lobes asymmetrical; lower lip, inner marginal "notch" weak or lacking; mandible, molar distinct, outer triturating ridge with raised spines; maxilla 1, palp slightly modified; maxilliped, palp segment 3 short; coxa 2, lower margin smooth (not serrate); gnathopods 1&2 strongly subchelate, propod with paired spines at posterodistal angle demarcating palm; gnathopod 2, carpus narrow, posterior lobe elongate; Epimeral plate 3, bind corner squared or rounded; telson linguiform, medium to long, apex broadly or sharply rounded (acute in H. japonica).*" (from Hoover & Bousfield 2001)



Three body types of stenothoids (from Krapp-Schickel & Koenemann 2006)

Family Stenothoidae – Based on a cladistic analysis the family was divided into two subfamilies by Krapp-Schickel and Koenemann (2006). The Stenothoinae contain most of the genera in the family (31 of 45), and are widely distributed; the Thaumatelsoninae

are primarily austral, and consists of fourteen genera, only one of which occurs in the NEP. Twelve of the genera in the Stenothoinae have representatives in the NEP.

Description: *"**Head** free, not coalesced with peraeonite 1; exposed; **as long as deep**; rostrum present or absent, short; eyes present, well developed or obsolescent; **not coalesced**; 1 pair; not bulging. Body laterally compressed, or subglobular; cuticle smooth and dorsally carinate.*

Antenna 1 shorter than antenna 2, or 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, or absent; 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, or longer than peduncle; 5 or more articulate; not clavate; calceoli absent.

Mouthparts well developed. Mandible incisor dentate; accessory setal row without distal tuft; molar present, medium; palp present or absent. Maxilla 1 present; inner plate present, weakly setose apically; palp present, not clavate, 1-2 -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 or reduced, separate; outer plates present or absent, vestigial; 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. Overlapping, coxae not acuminate. Coxae 1-3 not successively smaller, coxa 1 reduced or coxa 1 vestigial. ***Coxae 2-4 coxa 4 immensely broadened, or immensely broadened**.*

Gnathopod 1 sexually dimorphic, or not sexually dimorphic; smaller (or weaker) than gnathopod 2, or subequal to gnathopod 2; vestigial, hidden or partially hidden by coxa 2, or vestigial; gnathopod 1 merus and carpus not rotated; gnathopod 1 carpus/propodus not cantilevered; shorter than propodus, or subequal to propodus, or longer than propodus; gnathopod 1 strongly produced along posterior margin of propodus, or not produced along posterior margin of propodus; dactylus large. Gnathopod 2 sexually dimorphic, or not sexually dimorphic; subchelate, or chelate; coxa smaller than but not hidden by coxa 3, or 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.

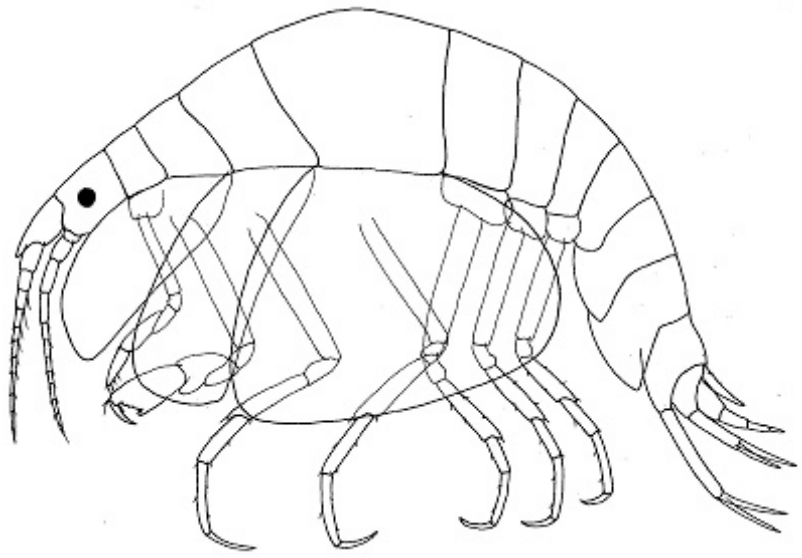
Peraeopods heteropodous (3-4 directed posteriorly, 5-7 directed anteriorly), some or all prehensile or none prehensile. Peraeopod 3 well developed. Peraeopod 4 well developed. 3-4 not glandular; 3-7 without hooded dactyli, 3-7 propodi without distal spurs. Coxa well developed, longer than broad; carpus shorter than propodus, not produced; dactylus well developed. Coxa larger than coxa 3, not acuminate, 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; subequal in length to peraeopod 6; coxa smaller than coxa 4, without posterior lobe; basis linear, subrectangular, with posteroventral lobe or without posteroventral lobe; merus/carpus

free; carpus linear; setae absent. Peraeopod 6 subequal in length to peraeopod 7; merus/carpus free; dactylus without setae. Peraeopod 7 with 6-7 well developed articles; subequal to peraeopod 5; similar in structure to peraeopod 6; with 7 articles; basis expanded or linear, with long dense slender setae or without dense slender setae; dactylus without setae.

***Pleon**. Pleonites 1-3 without transverse dorsal serrations, pleonite 3 with dorsal carina or without dorsal carina; 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, or 1 to 3 coalesced; urosomite 1 longer than urosomite 2, or much longer than urosomite 2; urosome urosomites not carinate; urosomites 1-2 without transverse dorsal serrations. Uropods 1-2 apices of rami without robust setae. Uropods 1-3 similar in structure and size. Uropod 1 peduncle without long plumose setae, without basofacial robust seta, 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 sexually dimorphic, or not sexually dimorphic; peduncle short; without recurved spines. Telson laminar, or vaulted; entire; longer than broad; apical robust setae absent." (from Lowry and Springthorpe 2001).

Subfamily Stenothoinae – All but one of the stenothoids reported from the NEP fall within this subfamily.



Hardametopa nasuta (from Lincoln 1979)

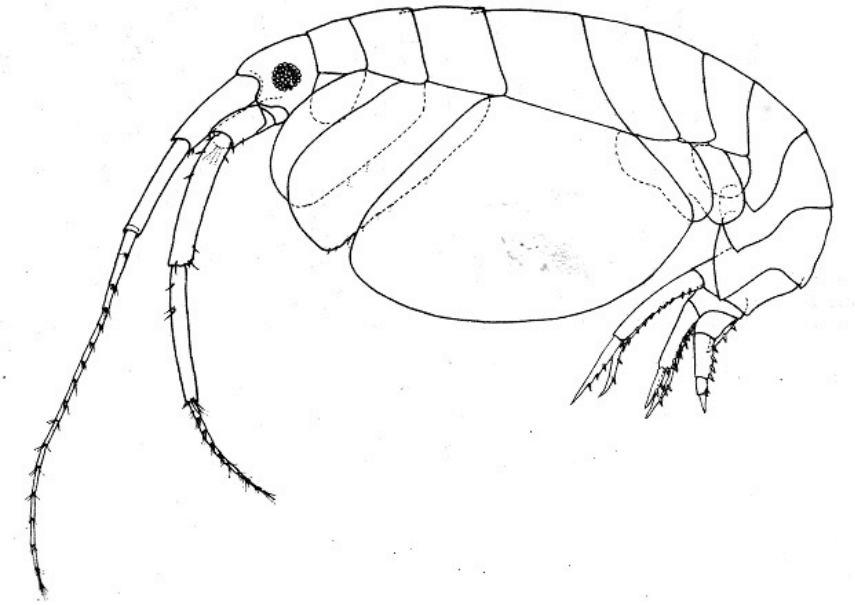
Hardametopa – A small genus of two species, one from the North Atlantic, and one with a circumarctic distribution in the Atlantic and Pacific. This latter species, *H. nasuta*, was reported from Alaska by Shoemaker (1955). It is one of three genera reported locally that bear a nasiform process on the peduncle of antenna 1. There is also a low process on urosomite 3 not clearly visible above, but clearly illustrated by Sars (1895). This is much smaller than the tall lamella of *Zaikometopa*.

Diagnosis: ***"****Antenna 1 bearing nasiform process on article 1. Accessory flagellum absent. Palp of mandible 2 to 3-articulate; palp of maxilla 1 l-articulate. Inner plate of maxilla 2 ordinary. Inner plates of maxillipeds well separated. Gnathopod 1*

small, simple, article 4 incipiently chelate; article 5 elongate, . unlobed; article 6 linear. Gnathopod 2 scarcely enlarged, palm strongly oblique, article 5 short, lobed. Pereopods 5-7 with rectolinear article 2. Pereonite 4 elongate and tumid. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 weakly extended posterodorsally. Telson ordinary, flat." (from J. L. Barnard & Karaman 1991)

Mesometopa – A five member genus with representatives in the North and Arctic Atlantic, and in the NWP and NEP. The three species reported from the NEP are all very little known. *Mesometopa esmarki* was described early on from off the California Coast (Boeck 1871), and the species remains unreported from elsewhere and unillustrated (a brief description is provided by Stebbing 1906). *Mesometopa sinuata* (Shoemaker 1964) is both more widely distributed and more completely described. The last is a regional subspecies of a North Atlantic species, *Mesometopa neglecta*; *M. neglecta roya*. This last was described from four individuals taken in a submarine canyon within the SCB, and has not been retaken to my knowledge. It can be separated easily from the two other species in the genus locally by the restricted posterior lobe on the basis of P7. In the other two species this extends the full length of the basis; in *M. n. roya* it tapers strongly distad, leaving no lobe on the ventral portion of the basis. Distinctions between *M. esmarki* and *M. sinuata* are few, but in the former the posterior lobe of article 4 on P6 and P7 extends to full length of article 5, while it reaches only ½ the length of article 5 in the latter.

Diagnosis: **"***Antenna 1 lacking nasiform process on article 1. Accessory flagellum absent. Palp of mandible 2 to 3-articulate; palp of maxilla 1 l-articulate. Inner plate of maxilla 2 [?ordinary]. Inner plates of maxillipeds [?well separated]. Gnathopod 1 small, simple, article 4 incipiently chelate; article 5 elongate, unlobed; article 6 linear, dactyl long. Gnathopod 2 scarcely enlarged, palm oblique; article 5 short, lobed. Pereopods 5-6 with rectolinear article 2, pereopod 7 with basally expanded article 3, without posteroventral lobe. Pereonite 4 ordinary. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 not weakly extended posterodorsally. Telson ordinary, flat."* (from J. L. Barnard & Karaman 1991)



Metopa dawsoni (from J. L. Barnard 1962)

Metopa – A large genus, currently viewed as having 55 valid taxa, of which four are reported from the NEP. The genus tends to occur deeper than many stenothoid genera, with numerous representatives from the outer shelf and bathyal, and some from the abyss. No comprehensive key to this genus exists. While J. L. Barnard provided comments to assist in separating his species from others on several occasions, these are also not comprehensive. In the description of *M. cistella*, for instance, he differentiates that species from none of the three other species reported from the NEP, only from those more morphologically similar from other seas. A key is provided below to remedy this situation. J. L. Barnard also recorded a *Metopa* sp similar to *M. pusilla* (1966), which is included here.

Key to species of *Metopa* reported from the NEP – dbcadien 9Feb2015

1a. Lacking eyes.....*M. samsiluna**
1b. With prominent pigmented eyes.....2

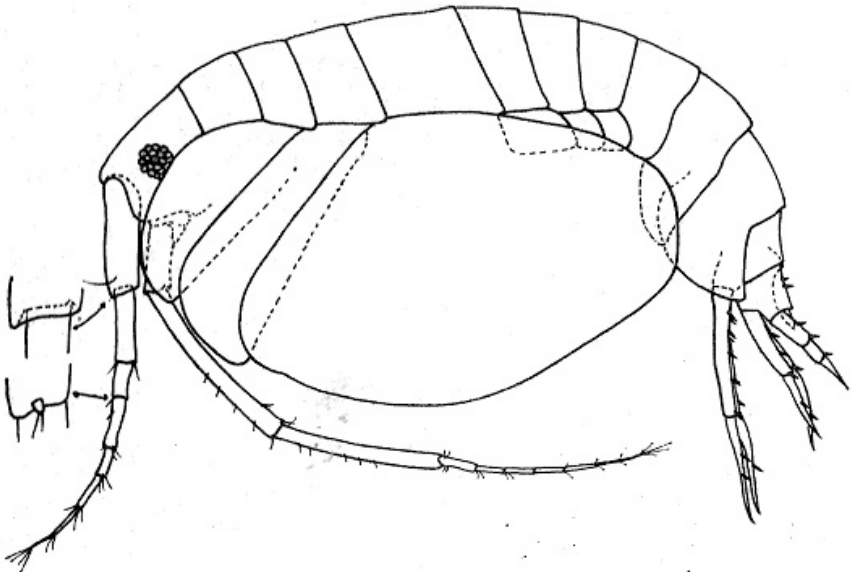
2a. G1, propod longer than carpus, dactyl much shorter than propod.....3
2b. G1, propod and carpus subequal, dactyl more than ½ the propod length..... .....*M.* sp of J. L. Barnard 1966
2c. G1, propod shorter than carpus, dactyl much shorter than propod..... .....*M. dawsoni*

3a. P7 with posterior lobe on basis.....*M. glacialis*
3b. P7 lacking posterior lobe on basis.....*M. cistella*

[proportions apply to both sexes, although the comparable articles in the male are thicker than in the female] * - also keyed in generic key

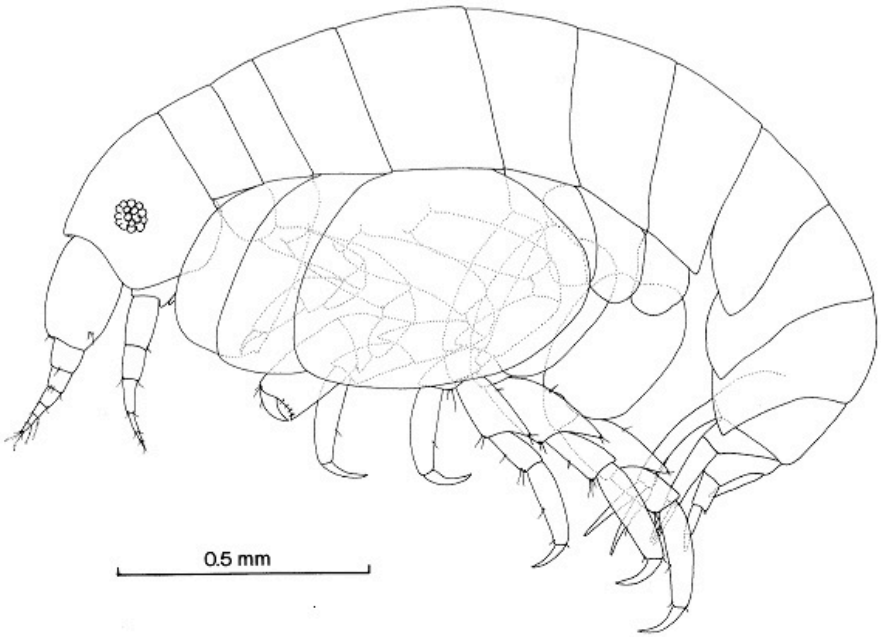
Diagnosis: **"***Antenna 1 lacking nasiform process on article 1. Accessory flagellum absent or vestigial. Palp of mandible 2 to 3-articulate; palp of maxilla l-articulate. Inner plate of maxilla 2 ordinary. Inner plates of maxillipeds mostly fused together or well separated (type). Gnathopods 1-2 subchelate, different from each other in size and shape: gnathopod 1 small, almost simple (variable), article 4 incipiently chelate; article 5 elongate, barely lobed; article 6 scarcely expanded, almost linear. Gnathopod 2 enlarged, palm oblique; articles 4-5 short, 5 lobed. Pereopod 5 with rectolinear article 2, pereopods 6-7 with expanded, lobate article 2. Pereonite 4 short. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 not extended posterodorsally. Telson ordinary, flat."* (from J. L. Barnard & Karaman 1991)

Metopella – Although many species have been placed in the genus over the years, it currently contains seven valid species (Lowry 2014b). An equal number have been transferred to other genera. Only *M. aporpis* J. L. Barnard 1962 occurs in the NEP, with the remainder being either Arctic, Atlantic, of NWP in distribution.



Metopella aporpis with detail of the minute accessory flagellum (from J. L. Barnard 1962)

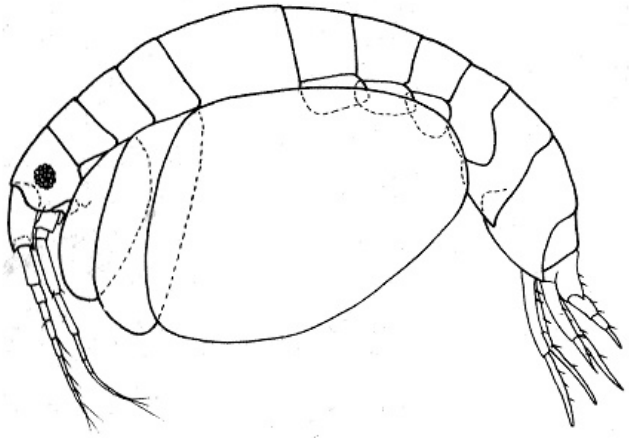
Diagnosis: **"***Antenna 1 lacking nasiform process on article I . Accessory flagellum present. Palp of mandible 2 to 3-articulate; palp of maxilla l l-articulate. Inner plate of maxilla 2 ordinary. Inner plates of maxillipeds well separated. Gnathopods 1-2 different from each other in size and shape, gnathopod 1 small, simple, article 4 incipiently chelate; article 5 elongate, unlobed; article 6 linear. Gnathopod 2 slightly enlarged, palm weakly oblique, articles 4-5 short, 5 lobed. Pereopods 5-7 with rectolinear article 2 but article 2 on pereopod 7 broader than on pereopods 5-6 (variable). Pereonite 4 ordinary. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 not extended posterodorsally. Telson ordinary, flat."* (from J. L. Barnard & Karaman 1991)



Parametopa crassicornis, an Arctic Atlantic species (from Just 1980)

Parametopa –The one member of this genus reported from the NEP has had its affinities questioned (J. L. Barnard & Karaman 1991) as it seemed convergent with members of *Parametopella*. Reexamination of the type by Krapp-Schickel & Vader (2009) demonstrated that the placement of *P. alaskensis* by Shoemaker was correct. The two other species in the genus are Northeast and Arctic Atlantic.

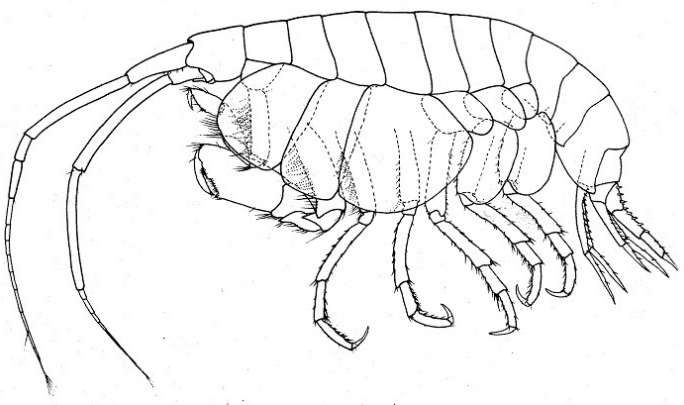
Diagnosis: ***"****Antenna 1 bearing nasiform process on articles 1-2. Accessory flagellum absent. Palp of mandible absent; palp of maxilla 1 1-articulate. Inner plate of maxilla 2 ordinary. Inner plates of maxillipeds well separated. Gnathopods 1-2 subchelate, scarcely different from each other in size and shape, gnathopod 1 small, weakly subchelate, palm oblique and shorter than posterior margin of propodus; article 4 incipiently chelate; article 5 short, lobed; article 6 almost linear. Gnathopod 2 slightly enlarged, palm almost transverse, articles 4-5 short, lobed. Pereopod 5 with rectolinear article 2, pereopods 6-7 with expanded and lobate article 2. Pereonite 4 short. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 not extended posterodorsally. Telson ordinary, flat."* (from J. L. Barnard & Karaman 1991)



Parametopella ninis (from J. L. Barnard 1962)

Parametopella – A genus of six described species, with only *Parametopella ninis* reported from the NEP. A provisional species was erected by Thomas & McCann (1996) for specimens very similar to *P. ninis*, but lacking telsonic robust setae. Several members of the genus are known from inquilinous associations with other taxa, but not all. One species is known from the NWP, one from Chile, one from the NEP, and the other three from the Western Atlantic/Gulf of Mexico.

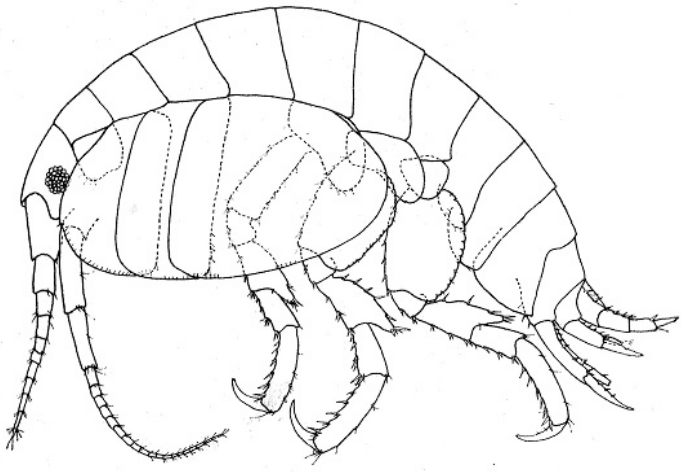
Diagnosis: ***"****Antenna 1 lacking nasiform process on article **1** (variable). Accessory flagellum absent. Palp mandible absent; palp of maxilla 1 l-articulate. Inner plate of maxilla 2 ordinary. Inner plates of maxillipeds partially l used together. Gnathopods 1-2 different from each other In size and shape, gnathopod 1 small, simple, article 4 incipiently chelate; article 5 short, lobed; article 6 expanded. Gnathopod 2 enlarged, palm strongly oblique, article 5 short, lobed. Pereopods 5-7 with rectolinear .article 2. Pereonite 4 ordinary. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 not extended posterodorsally. Telson ordinary, flat."* (from J. L. Barnard & Karaman 1991)



Proboloides tunda (from J. L. Barnard 1962)

Proboloides – The genus contains 13 described species (Lowry & De Broyer 2014), and seventeen other species placed here have now been removed to other genera. Two NEP species are reported, *P. tunda* Barnard 1966 and *P. pacifica* (Holmes 1908). As separation of *Proboloides* from *Metopa* is primarily based on the number of articles in the palp of maxilla 1, these two species are keyed, along with *Metopa samsiluna*, in the generic key above. Their general aspect differs from most other stenothoids in the NEP due to the extremely long peduncular articles of the antennae, and the overall length of the antennae.

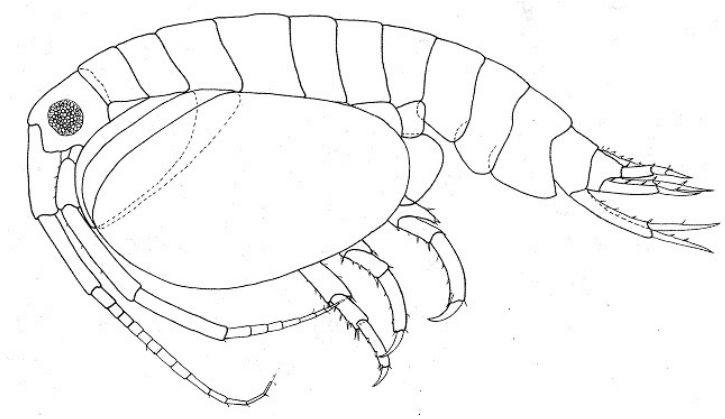
Diagnosis: ***"****Antenna* ***l*** *lacking nasiform process on article 1. Accessory flagellum 0 to l-articulate. Palp of mandible 2 to 3-articulate; palp of maxilla 1 2-articulate. Inner plate of maxilla 2 ordinary. Inner plates of maxillipeds well separated. Gnathopod 1 small, almost simple, barely subchelate, palm oblique and shorter than posterior margin of propodus; article 4 chelate; article 5 elongate, unlobed; article 6 short, barely expanded. Gnathopod 2 enlarged, palm strongly oblique, article 4 elongate, lobed, article 5 short, lobed. Pereopod 5 with non-lobate rectolinear article 2, pereopods 6-7 with expanded and lobate article 2. Pereonite 4 ordinary. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 not extended posterodorsally. Telson ordinary, flat."* (from J. L. Barnard & Karaman 1991)



Stenothoe estacola (from J. L. Barnard 1962)

Stenothoe – The most recent review (Krapp-Schickel 2006b) listed 55 valid taxa in the genus, and provided a key to them. Two additional taxa have since been described (Krapp-Schickel 2009) from Indonesia. The genus is distributed world-wide and is primarily intertidal to shallow sublittoral in distribution, with some members typically found further out onto coastal shelves. Most are associated with algae, although some are taken on soft bottoms with no algal association evident. Two endemic and two introduced species (J. L. Barnard 1953) are known from the NEP, all keyed by Krapp-Schickel (2006b).

Diagnosis: *"Antenna 1 lacking nasiform process on article 1. Accessory flagellum absent or 1-articulate. Palp of mandible absent; palp of maxilla 1 2-articulate. Inner plate of maxilla 2 unproduced. Inner plates of maxillipeds well separated. Gnathopods 1-2 subchelate, very different from each other in size and shape, gnathopod 1 small, subchelate, palm oblique and as long as posterior margin of propodus; article 4 incipiently chelate; article 5 shorter than 6, lobed; article 6 expanded. Gnathopod 2 enlarged, palm strongly oblique, article 4 elongate, lobed, article 5 short, lobed. Pereopod 5 with rectolinear article 2, pereopods 6-7 with expanded and lobate article 2. Pereonite 4 ordinary. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 not extended posterodorsally. Telson ordinary, flat."* (from J. L. Barnard & Karaman 1991)

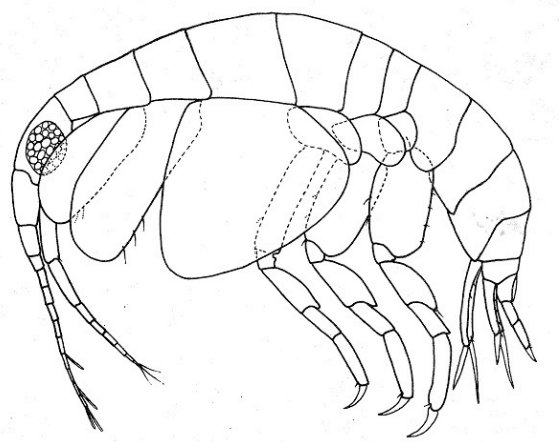


Stenothoides bicoma (from J. L. Barnard 1962)

Stenothoides – The type of the genus was collected in the Northwest Atlantic off Newfoundland, but all other members are from either the NWP (4 species) or the NEP (2 species). The type was collected in association with the asteroid *Crossaster papposus* in what Chevreux (1900) described as an obvious commensal relationship. Other members of the genus have not subsequently been reported as associates of other animals. J. L. Barnard (1969) reports *S. burbancki* as being taken from among sponges and tunicates, but without noting a particular association. The species is also collected in washes of eelgrass, and both fleshy and coralline algae.

Diagnosis: **"***Antenna 1 lacking nasiform process on article l. Accessory flagellum absent or l-articulate. Palp 4 mandible absent or 1-articulate; palp of maxilla 1 1-articulate. Inner plate of maxilla 2 ordinary. Inner plates of maxillipeds well separated. Gnathopods 1-2 subchelate, different from each other in size and shape, gnathopod small, subchelate, palm oblique and as long as posterior margin of propodus; article 4 incipiently chelate; article 3 long as 6, barely lobed; article 6 expanded. Gnathopod 2 enlarged, palm almost transverse, almost chelate; article 5 short, lobed. Pereopods 5-6*

with rectolinear article 2, pereopod 7 with slightly expanded and lobate article 2. Pereonite 4 ordinary. Pleonites 4- 6 free; pleonite 3 lacking dorsal process; pleonite 4 not extended posterodorsally. Telson ordinary, flat." (from J. L. Barnard & Karaman 1991)



Stenula modosa (from J. L. Barnard 1962)

Stenula – A moderate sized genus of fourteen species. Originally described from the North Atlantic, most of the members are known from the NWP (8 species), NEP (2 species), or Arctic Pacific (1 species). J. L. Barnard records *S. incola* from kelp holdfasts and algal turfs (1969), and *S. modosa* from muddy bottoms (1962).

Diagnosis: ***"****Antenna **1** lacking nasiform process on article 1. Accessory flagellum absent. Palp of mandible 1-articulate; palp of maxilla 1 1-articulate. Inner plate of maxilla 2 ordinary. Inner plates of maxillipeds well separated. Gnathopod 1 small, almost simple, article 4 incipiently chelate; article 5 elongate, unlobed; article 6 almost linear. Gnathopod 2 slightly enlarged, palm weakly oblique, article 5 short, lobed. Pereopod 5 with rectolinear article 2, pereopods 6-7 with expanded and article 2. Pereonite 4 ordinary. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 not extended posterodorsally. Telson ordinary, flat."* (from J. L. Barnard & Karaman 1991)

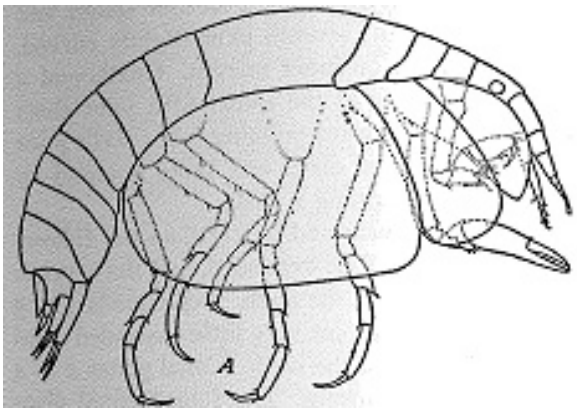
Zaikometopa – A monotypic genus endemic to the NEP. The sole species, *Z. erythrophthalma* (Coyle & Mueller 1981) has bright red eyes, coxa 2 hidden by coxa 3, and a lamellar keel on the first urosomite, and so is easily distinguished from other members of the family in the region. It is only known to occur intertidally.

Diagnosis: ***"****Antenna **1** bearing nasiform process on article 1. Accessory flagellum absent. Palp of mandible l-articulate; palp of maxilla l 2-articulate. Inner plate of maxilla 2 ordinary. Inner plates of maxillipeds mostly fused together. Coxa 2 small and hidden by coxa 3. Gnathopod 1 small, simple, article 4 incipiently chelate; article 5 short, unlobed; article 6 elongate, linear. Gnathopod 2 enlarged, palm parachelate, article 5 short, lobed. Pereopods 5-7 with rectolinear article 2. Pereonite 4 highly elongate. Pleonites 4-6 free; pleonite 3 lacking dorsal process; pleonite 4 strongly carinate posterodorsally* [pleonite 4 = urosomite 1]. *Telson ordinary, flat."* (from J. L. Barnard & Karaman 1991)

Subfamily Thaumatelsoninae – Created as a separate family by Gurjanova (1927) it was later recognized that the additionally discovered diversity of thaumatelsonines in the southern hemisphere bridged the gap between the families Stenothoidae and Thaumatelsonidae (Barnard 1972), and they were combined. Later cladistic analysis

demonstrated that there was a discrete clade within the stenothoids which could usefully be retained as a subfamily; the Thaumatelsoninae (Krapp-Schickel & Koenemann 2006).

Diagnosis: "*Antenna 1 peduncle article 1 or 2 with nasiform process; accessory flagellum 0-2 articulate. Mouthparts: mandibular palp 0-3 articles; maxilla 1 inner plate feeble, palp with 2 articles; maxilla 2 small, stout, poorly setose, inner plate much smaller than outer, next to or even riding on the outer one. Peraeopods 5-7 weak, basis narrow, slim, mostly hidden by the rectangularly broadened coxa 4. Uropod 3 with one usually 2-articulate ramus. Urosomites partially fused, sometimes protected by overlapping pleosomite 3. Telson three-dimensionally thickened, boat-shaped or vertically elevated.*" (from Krapp-Schickel & Koenemann 2006)



Pycnopyge carinatum (from Shoemaker 1955)

Pycnopyge – A monotypic endemic genus in the NEP erected by Krapp-Schickel in her revision of the subfamily (2000). It is not keyed in either of the thaumatelsonid keys provided by Krapp-Schickel: that for the spoon-shaped excavate telson species (2000), and those for the vertical-telsoned species (2006a). Pycnopyge belongs to neither group, with a horizontal free telson unfused to the third urosomite. It is easily separated from all other NEP stenothoids by the fully chelate G2.

Diagnosis: *"Antennae 1 and 2 ordinary; accessory flagellum of 1 rudimentary article. Mandibular palp lacking. Maxilla1 palp long, no articulation discernable, thus of 1 article. Maxilla 2 ordinary. Maxilliped outer plate vanishing, inner plate fused. Gnathopod 1 subchelate. Gnathopod 2 propodochelate-forcipate. Pereonite 4 very large. Urosomite 1 with dorsal fold, but not overlapping urosomite 2; thus uropod 2 lies over not after uropod 3. Urosomites 2 and 3 coalesced so that uropod 3 lies over, not after, uropod 3. Uropod 3 ramus article 2 well developed. Telson flat, horizontal, not coalesced with urosomite 3, not spoon-like or dorsally excavated."* (from Krapp-Schickel 2000)

Literature Cited

Barnard, J. L. (1953). "On two new amphipod records from Los Angeles Harbor." Bulletin of the Southern California Academy of Sciences **52**(3): 83-87.

---------. (1962). "Benthic marine Amphipoda of Southern California; 3. Families Amphilochidae, Leucothoidae, Stenothoidae, Argissidae, Hyalidae." Pacific Naturalist **3**(3): 116-163.

--------- (1966). "Submarine canyons of Southern California. Part V - Systematics: Amphipoda." Allan Hancock Pacific Expeditions **27**(5): 1-166.

--------- (1969). "Gammaridean Amphipoda of the rocky intertidal of California: Monterey Bay to La Jolla." United States National Museum, Bulletin(258): 1-230.

---------. (1972). "The Marine Fauna of New Zealand: algae-living littoral Gammaridea (Crustacea Amphipoda)." New Zealand Oceanographic Institute Memoir(62): 1-216.

--------- and G. S. Karaman (1991). "The Families and Genera of Marine Gammaridean Amphipoda (except Marine gammaroids)[parts 1 and 2]." Records of the Australian Museum **Supplement 13**: 1-866.

Berge, J., G. Boxshall, and W. Vader. (2000). "Phylogenetic analysis of the Amphipoda, with special emphasis on the origin of the Stegocephalidae." Polskie Archiwum Hydrobiologii **47**(3-4): 379-400.

Boeck, A. (1871). "Crustacea Amphipoda Borealia et Arctica." Forhandlinger i Videnskabs-Selskabet i Christiania: 83-280.

Bousfield, E. L. (1978). "A revised classification and phylogeny of amphipod crustaceans." Transactions of the Royal Society of Canada, series 4 **16**: 343-390.

---------. (1983). "An updated phyletic classification and palaeohistory of the Amphipoda." Crustacean Issues I. Crustacean Phylogeny: 257-277. Rotterdam, A. A. Balkema, 372pp.

---------. (2001). "An updated commentary on phyletic classification of the amphipod Crustacea and its application to the North American Fauna." Amphipacifica **3**(1): 49-119.

Cadien, D. B. and L. L. Lovell (2014). "A Taxonomic Listing of Benthic Macro- and Megainvertebrates from Infaunal & Epifaunal monitoring and research programs in the Southern California Bight." Los Angeles, California, USA**:** 186.

Chevreux, E. (1900). "Amphipodes provenant des campagnes de l'Hirondelle (1885-1888),." Results des Campagnes Scientifiques accomplies par le Prince Albert I. Monaco **16**: 1-195.

--------- and L. Fage (1925). "Amphipodes." Faunde de France **9**: 1-488.

Conlan, K. E. (1991). "Precopulatory mating behavior and sexual dimorphism in the amphipod Crustacea." Hydrobiologia **223**: 255-282.

Coyle, K. O. and G. J. Mueller (1981). "New records of Alaskan marine Crustacea, with descriptions of two new gammaridean Amphipoda." Sarsia **66**(1): 7-18.

Gurjanova, E. F. (1927). "To the fauna of the Kola-Fjord, Barents Sea, White Sea, Kara Sea and Novaja Semlja." Travaux de la Societe des Naturalistes Leningrad 57: 23-38

Holmes, S. J. (1908). "The Amphipoda collected by the U.S. Bureau of Fisheries Steamer 'Albatross' off the West Coast of North America in 1903-1904, with descriptions of a new family and several new genera and species." Proceedings of the United States National Museum **35**(1654): 489-543.

Hoover, P. M. and E. L. Bousfield (2001). "The amphipod superfamily Leucothoidea on the Pacific coast of North America: Family Amphilochidae: systematics and distributional ecology." Amphipacifica **3**(1): 3-28.

Horton, T. and C. De Broyer. (2014). Amphilochidae Boeck, 1871 IN: Horton, T., Lowry J., and De Broyer C. (2013 onward) World Amphipoda Database. http://www.marinespecies.org/aphia.php?p=taxdetails&id=101365

Just, J. (1979). "*Anonyx affinis* (Crust., Amphipoda: Lysianassidae), commensal in the bivalve *Musculus laevigatus*, with notes on *Metopa glacialis* (Amphipoda: Stenothoidae)." Astarte **12**: 69-74.

--------- (1980). "Amphipoda (Crustacea) of the Thule area, Northwest Greenland: Faunistics and Taxonomy." Meddelelser om Gronland, Bioscience **2**: 1-63.

Kim, C. B. and W. Kim (1992). "A new species of the genus *Gitanopsis* (Amphipoda, Amphilochidae) from Korea." The Korean Journal of Systematic Zoology **8**(2): 183-188.

Kim, Y.-H., E. A. Hendrycks, et al. (2010). "A new species and new record of the Amphilochidae (Crustacea: Amphipoda) from Korea." Zootaxa(2477): 21-36.

Krapp-Schickel, G. (1976). "Die Gattung *Stenothoe* (Crustacea, Amphipoda) im Mittelmeer." Bijdragen tot de Dierkunde **46**(1): 1-34.

--------- (2000). "Thaumatelsonine stenothoids (Crustacea: Amphipoda): Part 1." Memoirs of the Museum of Victoria **58**(1): 89-124.

--------- (2006a). "Thaumatelsonine stenothoids (Crustacea, Amphipoda), Part 2." Zootaxa(1165): 1-31.

---------. (2006b). "New Australian stenothoids (Crustacea, Amphipoda) with key to all *Stenothoe* species." Bollettino del Museo Civico di Storia Naturale, Verona **30**: 39-56.

---------. (2009). "New and poorly described stenothoids (Crustacea, Amphipoda) from the Pacific Ocean." Memoirs of the Museum of Victoria **66**(Special Issue): 95-116.

--------- and S. Koenemann (2006). "Cladistic analysis of the family Stenothoidae (Amphipoda, Crustacea)." Contributions to Zoology **75**(3-4): 169-188.

--------- and W. Vader (2009). "A new *Parametopella* species (Crustacea: Amphipoda: Stenothoidae) from *Antholoba achates* (Anthozoa: Actiniaria) from Coquimbo, Chile (With remarks on *Parametopa alaskensis* (Holmes))." Journal of the Marine Biological Association of the United Kingdom **89**(6): 1281-1287.

Lewis, J. B. (1992). "Abundance, distribution and behavior of a commensal amphipod *Stenothoe valida* Dana on the hydrocoral *Millepora complanata* Lamarch." Bulletin of Marine Science **51**(2): 245-249.

Lincoln, R. J. (1979). British Marine Amphipoda: Gammaridea. London, British Museum (NH), 658pp.

Lowry, J. K. (2014a). *Hourstonius* Hoover & Bousfield, 2001 IN: Horton, T., Lowry J. & De Broyer, C. (2013 onwards) World Amphipoda Database. http://www.marinespeciesorg/aphia.php?p=taxdetains&id=425487.

--------- (2014b). *Metopella* Stebbing, 1906 IN: Horton, T., Lowry J. & De Broyer, C. (2013 onwards) World Amphipoda Database. http://www.marinespeciesorg/aphia.php?p=taxdetains&id=101765.

--------, and C. De Broyer (2014). *Proboloides* Della Valle, 1893 IN: Horton, T., Lowry J. & De Broyer, C. (2013 onwards) World Amphipoda Database. http://www.marinespeciesorg/aphia.php?p=taxdetains&id=101769.

--------- and A. A. Myers (2013). "A phylogeny and classification of the Senticaudata subord. nov. (Crustacea: Amphipoda)." Zootaxa (3610): 1-80.

---------, and Roger T. Springthorpe (2001 onwards). Amphipoda: Families and Subfamilies. Version 1: 1 September 2001. http://crustacea.net/.

McLaughlin, P. A., D. K. Camp, M. V. Angel, E. L. Bousfield, P. Brunel, R. C. Brusca, D. B. Cadien, A. C. Cohen, K. Conlan, L. G. Eldredge, D. L. Felder, J. W. Goy, T. A. Haney, B. Hann, R. W. Heard, E. A. Hendrycks, H. H. Hobbs III, J. R. Holsinger, B. Kensley, D. R. Laubitz, S. E. LeCroy, R. Lemaitre, R. F. Maddocks, J. W. Martin, P. Mikkelsen, E. Nelson, W. A. Newman, R. M. Overstreet, W. J. Poly, W. W. Price, J. W. Reid, A. Robertson, D. C. Rogers, A. Ross, M. Schotte, F. R. Schram, C.-T. Shih, L. Watling, and G. D. F. Wilson. 2005. *Common and Scientific Names of Aquatic Invertebrates from the United States and Canada - Crustaceans*. Bethesda, Maryland, U. S. A.: American Fisheries Society. 565pp.

Moore, P. G., Rainbow, P. S. and Vader, W. (1994). "On the feeding and comparative biology of iron in coelenterate-associated gammaridean Amphipoda (Crustacea) from N. Norway". Journal of Experimental Marine Biology and Ecology, 178: 205-231.

Myers, A. A. (1974). "A new species of commensal amphipod from East Africa." Crustaceana **26**(1): 3-6.

Parker, G.H. (1936). "An inquiline gammarid on the sea-urchin *Lytechinus".* Ecology 17: 185-186.

Pearse, A. S. (1934). " Inhabitants of certain sponges at Dry Tortugas". Papers of the Tortugas Laboratory, 28 (1932): 117-124.

Pirlot, J. M. (1933). "Les amphpodes de l'expedition du Siboga. Deuxieme partie. Les amphipodes gammarides II. Les amphipodes de la mer profonde. I. – (Lysianassidae, Stegocephalidae, Stenothoidae, Pleustidae, Lepechinellidae)." Resultats des Explorations Zoologiques, Botaniques, Oceanographiques et Geologiques in des Nierlandaises orientales en 1899-1900 **120**(33c): 115-167.

Potts, F.A. (1915). "The fauna associated with the crinoids of a tropical coral reef: with Especial reference to its colour variations". Papers from the Department of marine Biology, Carnegie Institution, Washington. 8, 71-96.

Sars, G. O. (1895). "Amphipoda." An Account of the Crustacea of Norway, with short descriptions and figures of all the species **1**: 1-711.

Sainte-Marie, B. and P. Brunel (1985). "Suprabenthic gradients of swimming activity by cold-water gammaridean amphipod Crustacea over a muddy shelf in the Gulf of Saint Lawrence." Marine Ecology - Progress Series **23**: 57-69.

Schiecke, U. (1973). "*Ein Beigrag zur Kenntnis der Systematik, Biologie und Autokologie mariner Peracarida (Amphipoda, Isopoda, Tanaidacea) des Golfes von Neapel."* Unpub PhD Thesis, Christian Albrecht University, Kiel, 408 pp.

Shoemaker, C. R. (1955). "Amphipoda collected at the Arctic Laboratory, Office of Naval research, Point Barrow, Alaska, by G.E. MacGinitie." Smithsonian Miscellaneous Collections **128**(1): 1-78.

--------- (1964). "Seven new amphipods from the west coast of North America with notes on some unusual species." Proceedings of the United States National Museum **115**(3489): 391-430.

Stebbing, T. R. R. (1906). "Amphipoda. I. Gammaridea." Das Tierreich(21): 1-806.

Stephensen, K. & G. Thorson, (1936). "On the amphipod *Metopa groenlandica* H. J. Hansen found in the mantle cavity of the lamellibranchiate *Pandora glacialis* LEACH in East Greenland." Meddelelser om Gronland 118(4) :1-7.

Tandberg, A. H. S., W. Vader, and J. Berge (2010a). "Studies on the association of *Metopa glacialis* (Amphipoda, Crustacea) and *Musculus discors* (Mollusca, Mytilidae)." Polar Biology **33**: 1407-1418.

---------, F. Schander, and F. Pleijel (2010b). "First record of the association between the amphipod *Metopa alderii* and the bivalve *Musculus*." Marine Biodiversity Records 3: 5

Thomas, J. D. and K. D. Cairns (1984). "Discovery of a majid host for the commensal amphipod *Stenothoe symbiotica* Shoemaker, 1956." Bulletin of Marine Science **34**(4): 484-485.

--------- and L. D. McCann (1996). The Families Argissidae, Dexaminidae, Eusiridae, Gammaridae, Leucothoidae, Melphidippidae, Oedicerotidae, Pardaliscidae, Phoxocephalidae, Podoceridae, Stegocephalidae, Stenothoidae, Stilipedidae, Synopiidae, and Urothoidae. Santa Barbara, California, U.S.A., Santa Barbara Museum of Natural History.

Vader, W. (1971). "Associations between amphipods and molluscs. A review of published records." Sarsia **48**(1): 13-18.

---------. (1972). "Associations between gammarid and caprellid amphipods and medusae." Sarsia **50**(1): 51-56.

---------. (1978). "Associations between amphipods and echinoderms." Astarte **11**: 123-134.

--------- (1984a). "Notes on Norwegian marine Amphipoda 7. Amphipod associates of *Geodia* sponges in western Norway." Fauna Norvegica, series A **5**: 14-16.

---------(1984b). " Notes on Norwegian marine Amphipoda 8. Amphipod associates of sponges and ascidians. Fauna Norvegica, series A 5: 16-21.

---------. and C. L. Beehler (1979). "*Metopa glacialis* (Amphipoda, Stenothoidae) in the Barents and Beaufort Seas, and its association with the lamellibranchs *Musculus niger* and *M. discors s.l.*" Astarte **12**: 57-61.

--------- and G. Krapp-Schickel (1996). "Redescription and biology of *Stenothoe brevicornis* Sars (Amphipoda: Crustacea), an obligate associate of the sea anemone *Actinostola callosa* (Verrill)." Journal of Natural History **30**: 51-66.

Watling, L. (1976). "*Parametopella inquilinus*, new species from Delaware Bay oyster beds (Amphipoda: Stenothoidae)." Proceedings of the Biological Society of Washington **88**(39): 429-432.