Amphipoda of the Northeast Pacific (Equator to Aleutians, intertidal to abyss): XVIII. Pardaliscoidea - a revised review Donald B. Cadien, LACSD
22 July 2004 (revised 9Dec2014)

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 Pardaliscoidea

The superfamily Pardaliscoidea is represented by three families in the Northeast Pacific, Pardaliscidae, Stilipedidae, and Vitjazianidae, with the bulk of both genera and species in the first. It is among the natant groups of Bousfield and Shih (1994), along with the lysianassoids, the phoxocephaloids, stegocephaloids, dexaminoids, ampeliscoids, pontoporeoids, eusiroids, oediceratoids, melphidippoids, and the synopioids. They also include the hyperiids here. All these groups share some common morphological elements, as they have adopted some common approaches to life. All are callynophorate, at least in the males, and most bear calceoli, although these are lacking in the pardaliscoids, stegocephaloids, dexaminoids, synopioids, and ampeliscoids. Berge et al (2000) placed pardaliscids in their clade 10, which also contained Hyperiopsidae, Vitjazianidae, Hyperiidae, Nihotungidae, Didymocheliidae and Lafystiidae. In their analysis the stilipedids were more closely related to the iphimedioids than to the pardaliscoids. All such analyses are preliminary, and both the composition of the superfamilies and their interrelationships remain largely speculative.

The three families composing the superfamily all occur primarily in the deep sea. Brandt et al (2012) characterized all three as occurring primarily at depths below 2000m, being three of the seven families to be so distributed.

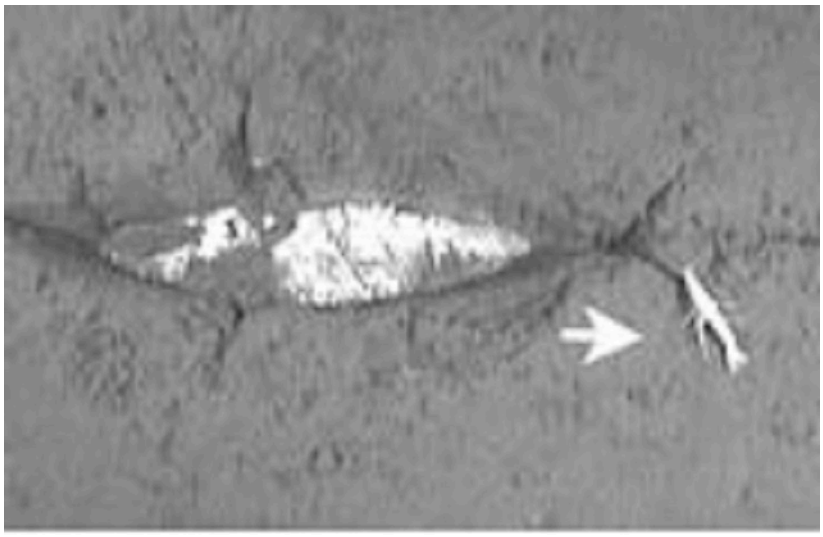
Diagnosis of the Pardaliscoidea

"*Plesiomorphic, weakly rostrate, abdominally processiferous, pelagic marine gammarideans with dimorphic terminal male stage; conjoint flagellar segment of antenna 1 and peduncle of antenna 2 bearing brush setae; accessory flagellum usually strong, occasionally vestigial or lacking; eyes (when present) deep reniform, lateral; mouthparts modified; upper lip with distal notch, lobes asymmetrical; lower lip broad, inner lobes well developed or fused; mandibular molar vestigial or lacking, incisor (and lacinia) strong, palp slender, terminal segment often short; inner plates of maxillae sparsely setose, outer plate of maxilla 1 with 7-8 apical spine teeth, palp often greatly enlarged; maxilliped inner plate reduced, outer plate large, palp strong; coxal plates shallow, 4th not strongly excavate behind; coxae 5-7 equi- or anteriorly lobate; gnathopods 1 and 2 non-amplexing, subsimilar, subchelate or simple, occasionally enlarged and raptorial; peraeopods 3 and 4 tend to be raptorial; peraeopods 5-7 elongate, homopodous or heteropodous, bases not broadly expanded; brood plates broad; coxal gill on peraeopod 7; pleopods powerful; uropods lanceolate, tips weakly*

spinose, rami unequal; uropod 3 lanceolate, foliaceous, outer ramus 2-segmented; telson lobes deeply separated (apices with notch and spines)."(from Bousfield 1978).

Ecological Commentary

The pardaliscoids are mostly deep-sea creatures, found from the bathyal into the abyssal and/or hadal zones. Some species occur at shelf depths, but these are the exception. In the deep sea some members of the Pardaliscidae have been observed to be attracted to baited traps, and are in consequence part of the scavenging guild. While most of the deep-sea scavengers are lysianassoids, the pardaliscoids also share this feeding mode. Jamieson et al (2011 present observational evidence that members of the pardaliscid genus *Princaxelia* are bait-attracted scavengers in trenches. This nutritional mode does not seem to be active at slope and shelf depths for pardaliscoids. In an extensive review of the scavenger guild in Australian waters at those depths, Lowry and Smith (2003) reported no pardaliscoids in any of the hundreds of deployed baited traps.



Princaxelia (arrow) circling bait at 7703m in the Japan trench (from Jamieson et al 2012)

Many pardaliscoids swim actively, and some are true bathypelagic forms (Birstein & Vinogradov 1958, 1960, 1964, 1970; Thurston 1976). Sainte –Marie and Brunel (1985), in their investigation of swimming amphipods from shelf depths in the NW Atlantic, reported Pardalisca cuspidata as being taken in the suprabenthos. Since most pardaliscoids are not found at shelf depths this quantitative investigation underestimated swimming in the group. Perhaps because of their swimming habit some pardaliscoids have extraordinarily broad distributions, being reliably reported from wide spread points on the globe (see for instance Hendrycks and Conlan 2003). Such swimming is typical of non-mate guarding species that do not engage in prolonged precopula (Conlan 1991). It also places pardaliscoids in the "natant" group of families of Bousfield and Shih (1994). The superfamily lacks calceoli, but bears a well developed sensory callynophore (Lowry 1986). This structure may be present in both sexes, or absent in females, depending on genus. If present in both sexes it is generally better developed in the male, arguing for

involvement in mate search as well as prey location. Other sexual differences are variable, with males and females almost identical in some pardaliscoids, while differing substantially in others. Where differences are marked, they usually involve differences in ornamentation of the pleosome or urosome. The two described species in the pardaliscid genus *Parpano*, for instance are believed to perhaps be male (with urosomal teeth) and female (lacking them) of a single species (J. L. Barnard 1964). In other genera such ornamentation is constant between the sexes.

Key to NEP Pardaliscoid genera

Biswas et al (2009) have provided a key to all the genera of the Pardaliscidae. I will provide only a key to the families in the NEP. There are two regional genera in the Stilipedidae, which will also be keyed.

1. Coxa 4 posteriorly excavate……..Stilipedidae..2
   Coxa 4 not excavate, anterior and posterior margins subparallel……..…3
2. P7 longer than P6 or P5, dactyl as wide as propod……..*Stilipes*
   P7 subequal to P5 and P6, dactyl more slender than propod…….*Astyra*
3. Mandibular molar large, triturative……..……....Vitjazianidae *Vemana*
   Mandibular molar absent……..……..Pardaliscidae

NEP Pardaliscoidea from McLaughlin et al. (2005) augmented by known provisionals

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

Valid taxa **bolded**, synonyms not.

[Listed provisional species are from thesis (Dickinson 1976), or consulting taxonomic investigations (Thomas in Blake et al 1992; Cadien in Lissner et al 1986) within the area. In nearly all cases they are not documented by voucher descriptions or available specimens. They are presented here to provide some idea of the potential undescribed diversity of the group within the NEP]

Family Pardaliscidae

Pardaliscidae sp G Dickinson 1976§ - Cascadia Abyssal Plain, Oregon: 2820m

Antronicippe serrata Stock and Iliffe 1990 – Galapagos Ids, Ecuador: 24m

Caleidoscopsis copal (J. L. Barnard 1967) – Cascadia Abyssal Plain, Oregon to Baja Abyssal Plain, Mexico: 2398-2816m

Caleidoscopsis tikal (J. L. Barnard 1967) – Cascadia Abyssal Plain, Oregon to off Northern Baja California, Mexico: 1720-2824m

Caleidoscopsis sp A (Dickinson 1976§) – Cascadia Abyssal Plain, Oregon: 2787-2820m

Caleidoscopsis sp B (Dickinson 1976§) – Cascadia Abyssal Plain, Oregon: 2800-2820m

Halice aculeata Chevreux 1912 – Northeast Atlantic, Indian Ocean, Southwest Pacific, NEP off Central California: 0-10,500m [4000m in NEP]

Halice cocalito J. L. Barnard 1964 – Gulf of Panama: 1749m

Halice hesmonectes Martin, France and Van Dover 1993 – East Pacific Rise, off southern Mexico; 2520m

Halice ulcisor J. L. Barnard 1971 – Oregon: 600-800m

Halice sp A Dickinson 1976§ - Cascadia Abyssal Plain, Oregon: 2787-2816m
Halice sp B Dickinson 1976§ - Cascadia Abyssal Plain, Oregon: 2816m
Halice sp W Dickinson 1976§ - Cascadia Abyssal Plain, Oregon: 2820m
Halice sp X Dickinson 1976§ - Cascadia Abyssal Plain, Oregon: 2820m
Halice sp Y Dickinson 1976§ - Cascadia Abyssal Plain, Oregon: 2815m
Halice sp Z Dickinson 1976§ - Cascadia Abyssal Plain, Oregon: 2813-2824m
Halicella halona J. L. Barnard 1971 (see Rhynohalicella halona)
Halicoides lolo (J. L. Barnard 1971) – Oregon: 800m
Halicoides synopiae (J. L. Barnard 1962) – Monterey, Central California to outer coast of Baja California, Mexico: 52-1720m
Halicoides sp 1 (Thomas 1992§) – Gulf of the Farallones: 2045-3085
Macroarthrus victoriae Hendrycks and Conlan 2003 – Central California: 4050m
Nicippe tumida Bruzelius 1859 – Northeast Atlantic to North Pacific circumboreal, to Bahia San Cristobal, Mexico: 34-1367m
Octomana hadromischa Hendrycks and Conlan 2003 – Central California: 1787-4050m
Pardalisca endeavouri Shaw 1989 – Explorer Ridge west of Vancouver Id., Canada: 1797m
Pardalisca marionis Stebbing 1888 – Gulf of the Farallones: 2045-3085m
Pardalisca tenuipes Sars, 1893 – North Atlantic, North Pacific to SCB: 32-1094m
Pardalisca sp J. L. Barnard 1967 – Santa Maria Basin, Central California to Cedros Trench, Baja California, Mexico: 590-1720m
Pardalisca sp A Dickinson 1976§ - Cascadia Abyssal Plain, Oregon: 2813-2820m
Pardaliscella symmetrica J. L. Barnard 1959 – Oregon to SCB: 92-1749m
Pardaliscella yaquina J. L. Barnard 1971 – Oregon to Santa Maria Basin, Central California: 145-409m
Pardaliscella sp A Dickinson 1976§ - Cascadia Abyssal Plain, Oregon: 2813-2820m
Pardaliscoides fictotelson J. L. Barnard 1966 – Santa Cruz Canyon, SCB: 218m
Pardaliscopsis copal J. L. Barnard 1967 (see Caleidoscopsis copal)
Pardaliscopsis tenuipalpa Chevreux 1911 – Northeast Atlantic, Central California off Pt. Conception: 4050-4380m
Pardaliscopsis tikal J. L. Barnard 1967 (see Caleidoscopsis tikal)
Pardaliscopsis sp A Dickinson 1976 (see Caleidoscopsis sp A)
Pardaliscopsis sp B Dickinson 1976 (see Caleidoscopsis sp B)
Pardisynopia synopiae J. L. Barnard 1962 (see Halicoides synopiae)
Pardisynopia sp 1 Thomas 1992§ (see Halicoides sp A)
Parpano sp. 1 Thomas 1992§ - Gulf of the Farallones: 2045-3085m
Princaxelia sp A MBC 1982§ - off Pt. Conception, Central California: 900m
Rhynohalicella halona (J. L. Barnard 1971) – Oregon to off Palos Verdes, southern California: 200-409mm
Tosilus arroyo J. L. Barnard 1966 – SCB to Northern Baja California, Mexico: 976-1095m

Family Stilipedidae
  Subfamily Silipedinae
    Stilipes distinctus Holmes 1908 – Sea of Okhotsk, Northwest Pacific to southern Alaska, SCB: 400-700m
  Subfamily Astyrinae
    Astyra abyssi Boeck 1871- North Atlantic, North Pacific both east and west, to SCB: 200-600m
    Astyra sp A Dickinson 1976§ - San Diego Trough, Southern California: 1244m
Family Vitjazianidae
    Vemana lemuresa J. L. Barnard 1967 – Baja Abyssal Plain, Mexico: 3718-3745m

Comments by Family

Family Pardaliscidae – A large and diverse family of primarily deep water species. The family currently contains 22 genera, but additions and removals have been common over the last 30 years. Most of these genera have few species, but *Halice* (15), *Halicoides* (10), and *Pardalisca* (10) together contain ½ the known species, with twelve of the genera monotypic. A comprehensive key to genera (as well as the erection of a new one) can be found in Biswas et al (2009). There has been no monographic treatment at family level for the pardaliscids since those of Karaman (1974) and J. L. Barnard and Karaman (1991), and information on the family is scattered in the literature. Many changes have occurred since Karaman's treatment, and it is no longer comprehensive. While the subsequent treatment by J. L. Barnard and Karaman (1991) contains little specific level information except for generic allocation and general distribution.

Frequently when presented with an unknown by a co-worker I respond "it's a pardaliscid". When asked the follow-up "Why?" I pause and generally respond, "it looks like a pardaliscid". The members of the family, while diverse, have an overall indefinable similarity in subtle features. J. L. Barnard used to have a great term for this, "jiz". He used this to refer to an overall concept of a group that was difficult to pin down to particular features. Cladisticly this translates into a group with no defining synapomorphies, only a series of trends and tendencies in morphology. With continued research this situation will probably be remedied, but for now a pardaliscid is a pardaliscid because it looks like a pardaliscid. Even experienced workers can be misled, however. J. L. Barnard himself originally described *Caleidoscopsis simplignathia* as a *Urothoe* in the Urothoidae rather than as a pardaliscid.

Diagnosis: "***Head*** *free, not coalesced with peraeonite 1; exposed; longer than deep, or deeper than long; rostrum present or absent, short or moderate; eyes present, well developed or obsolescent, or absent; not coalesced; 1 pair; not bulging.* ***Body subcylindrical****; cuticle smooth.*

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 longer than article 2; antenna 1 article 2 subequal to article 3, or longer than article 3; peduncular articles 1-2 not geniculate; accessory flagellum present; antenna 1 callynophore present, or absent. Antenna 2 present; 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, or smooth; accessory setal row without distal tuft; ***molar absent****; palp present or absent. Maxilla 1 present; inner plate present, weakly setose apically; 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 or reduced, separate; outer plates present, very 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; subequal to gnathopod 2; subequal to 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 slightly produced along posterior margin of propodus, or not produced along posterior margin of propodus; dactylus large. Gnathopod 2 not sexually dimorphic; simple, or 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 or elongate, shorter than propodus or longer 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 or broader than long or as long as broad; carpus shorter than propodus or longer than propodus, not produced; dactylus well developed. Coxa subequal to 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; shorter than peraeopod 6; coxa subequal to coxa 4, without posterior lobe; basis slightly expanded or linear, subrectangular, without posteroventral lobe; merus/carpus free; carpus linear; setae absent. Peraeopod 6 shorter than peraeopod 7, or subequal in length to peraeopod 7, or longer than peraeopod 7; merus/carpus free; dactylus without setae. Peraeopod 7 with 6-7 well developed articles; subequal to peraeopod 5, or longer than peraeopod 5; similar in structure to peraeopod 6; with 7 articles; basis expanded or linear, 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. Epimeron 2 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 carinate, or urosomites 1-2 carinate, or urosomites not carinate; urosomites 1-2 without transverse dorsal serrations. Uropods 1-2 apices of rami with robust setae. Uropods 1-3 similar in

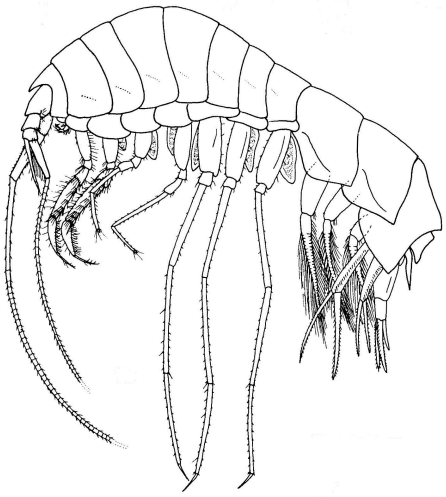
structure and size. Uropod 1 peduncle without long plumose setae, without basofacial robust seta, without ventromedial spur. Uropod 2 well developed; without ventromedial spur, without dorsal flange; inner ramus subequal to outer ramus, or longer than outer ramus. Uropod 3 not sexually dimorphic; peduncle short or elongate; outer ramus longer than peduncle, 1-articulate, without recurved spines. Telson laminar; deeply cleft, or moderately cleft, or weakly cleft, or entire; longer than broad, or as long as broad; ***apical robust setae present****.*" (Lowry and Springthorpe 2001)

Antroniccipe – Stock and Iliffe (1990) created the genus to house a new cave dwelling pardaliscid from the Galapagos. No differential diagnosis is available, although the characters which separate it from the Atlantic cave genus *Speleonicippe* are outlined in the original description. The single species is known only from the type locality off Isla Santa Cruz.

Caleidoscopsis – The genus was created by Karaman (1974) to house the two species of *Pardaliscopsis* described by J. L. Barnard 1967 from deep water off Baja California. To this was added *C. simplignathia*, described as an aberrant *Urothoe* from abyssal depths off Angola by J. L. Barnard (1962). These three described species constitute the genus, although provisional species from the NEP add an additional 2 members. There is currently no key to these species. The two species from off Baja California can be distinguished by the strong posteroventral tooth on the 3rd epimeron of *C. copal*, and its lack in *C. tikal*. Dickinson's provisionals are indeterminate.

Diagnosis**: "***Rostrum small. Eyes absent. Ratio of peduncular articles on antenna 1 = 23:7:4, base of primary flagellum narrow, articulate, article 1 of flagellum scarcely longer than article 3 of peduncle, article 2 of peduncle short; accessory flagellum present. Mouthparts forming quadrate bundle below head. Principal flagella of antennae 1-2 unusually short. Upper lip scarcely and asymmetrically incised below. Mandibles asymmetrical, incisor on left weakly toothed, on right strongly toothed, palp fully developed. Inner lobes of lower lip coalesced. Palp of maxilla 1 expanded apically. Maxilla 2 well developed, plates weakly diverse. Inner plates of maxilliped small to obsolescent, outer plates medium; palp more than 2 times as long as medial edge of outer plate. Coxae 1-5 quadrate, alike, even, longer than broad. Gnathopods simple, slightly stout, article 6 of both gnathopods slightly longer than article 5, carpus not lobate; dactyls normally claw-shaped, without inner teeth. Pereopods simple. Urosomal teeth moderate. Telson elongate, deeply cleft.*" (From J. L. Barnard and Karaman 1991)

Halice – A 15 member genus represented by four described species in the NEP. Most members are from the northern hemisphere with both Atlantic and Pacific representatives. A few are austral, with two species reported from the vicinity of New Zealand. All NEP species are bathyal to abyssal, but *H. sublittoralis* is known only from shallow shelf depths at Steward Island near New Zealand. *Halice aculeata* has also been taken in surface tows while swimming, but is abyssal to hadal in normal distribution. John Dickinson also established six provisional *Halice* species from the Cascadia Abyssal Plain in his thesis. These remain undefined and unidentifiable. There is no comprehensive key to the genus currently available. The most complete is that of Birstein and Vinogradov (1962), which does not contain *H. cocalito*, *H. hesmonectes*, *H. sublittoralis*, and *H. ulcisor*. Since three of these four are NEP species, a key to NEP species is offered below:



Halice hesmonectes (From Martin et al 1993)

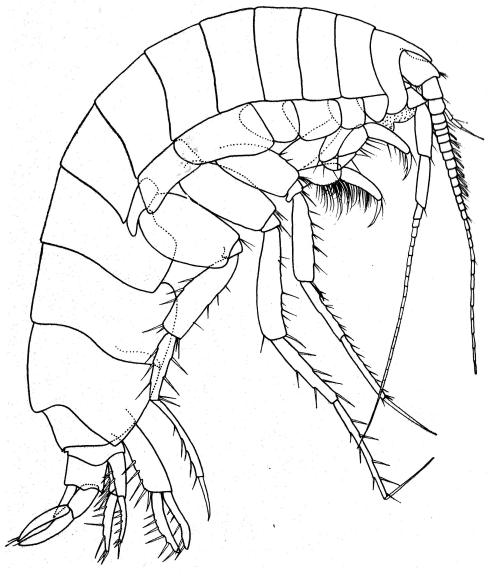
Key to Northeast Pacific Halice species (modified from Birstein and Vinogradov 1962) – dbcadien 18Nov2014

1. First peduncular segment of antenna 1 with rostriform lobe…….*H. aculeata*
   First peduncular segment of antenna 1 not produced……...….2
2. Pereopod coxae 1/3 or less of pereopod basis length ……...3
   Pereopod coxae ½ or more the length of pereopod basis length…...*H. cocalito*
3. Pereopods 3 and 4 with normal dactyli, 25% or more the length of the propods ……..*H. ulcisor*
   Pereopods 3 and 4 with minute vestigial dactyli, 5% or less the length of the propods and constricted at mid-length…….……*H. hesmonectes*

Diagnosis**: "***Rostrum well developed. Eyes absent.* ***Ratio*** *of peduncular articles on antenna 1 = 23: 10:7, base of primary flagellum inflated in male, narrow in female, callynophore in both sexes, article 1 of flagellum almost as long as peduncle, or longer, article 2 of peduncle short; accessory flagellum present. Mouthparts forming quadrate bundle below head. Upper lip weakly and asymmetrically incised. Mandibles symmetrical, incisor on left scarcely toothed, on right smooth, palp fully developed, but article 3 very short. Inner lobes of lower lip [? coalesced]. Palp of maxilla 1 not apically expanded. Maxilla 2 well developed, plates equal. Inner plates of maxilliped obsolescent, outer plates large; palp about 1.5 times as long as medial edge of outer plate. Coxae 1-4 quadrate, alike, even, broader than long. Gnathopods simple, slender, articles 5 and 6 of both gnathopods subequal in length, carpus not lobate; dactyls normally claw-shaped, without inner teeth. Pereopods simple. Urosomal teeth strong. Telson elongate, deeply cleft.*" (From J. L. Barnard and Karaman 1991)

Halicoides – A moderately sized genus of 9 or 10 members. *Pardisynopia walkeri* Ledoyer 1973 is carried as both *Halice walkeri* and *Halicoides walkeri* on WoRMS, and final placement is unclear. Two species, *H. lolo* and *H. synopiae* occur in the NEP, along with one provisional. *Halicoides synopiae* is known from both shelf and slope depths (as shallowly as 52m) while *H. lolo* is known only from the bathyal off Oregon. As pointed out by the current status of *H. walkeri*, the distinctions between

Halice and *Halicoides* are not entirely reliable. The supposed presence (in *Halicoides*) and absence (in *Halice*) of a long seta on the first urosomite may not be a reliable indicator of genus as it is subject to loss during collection (Hendrycks and Conlan 2003). The two NEP species can be separated by the relative lengths of the basal articles of the accessory flagellum; subequal in *H. synopiae*, and with article 1 twice article 2 in *H. lolo*.



Halicoides synopiae (From J. L. Barnard 1962)

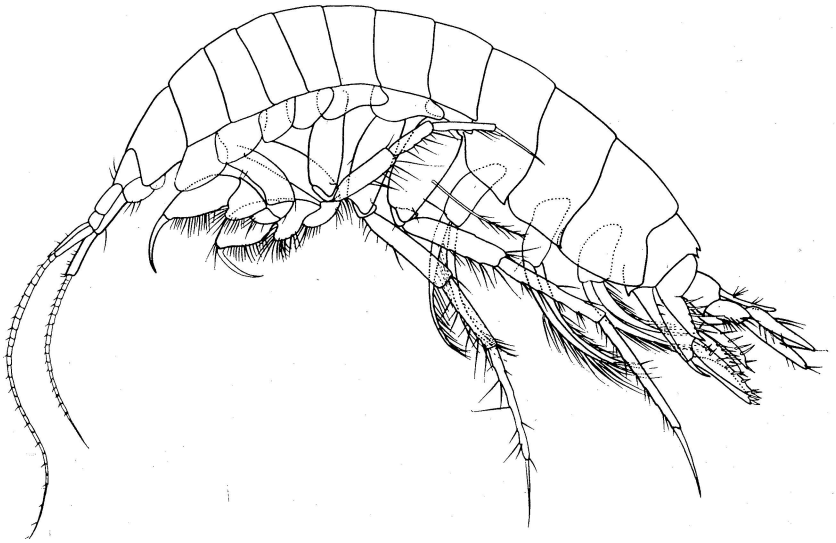
Diagnosis**: "***Rostrum well developed. Eyes absent. Ratio of peduncular articles on antenna 1 = 13:5:4, base of primary flagellum inflated with callynophore in male only, article 1 of flagellum much longer than article 3 of peduncle. Article 2 of peduncle short; accessory flagellum present (aberrant in holotype of type species, see Thurston, 1976b). Mouthparts forming quadrate bundle below head. Upper lip rounded below. Mandibles symmetrical, incisors smooth, palp fully developed, article 3 about one third as long as 2. Inner lobes of lower lip coalesced, with raphus. Palp of maxilla l not expanded apically. Maxilla 2 well developed, plates equal. Inner plates of maxilliped small, outer plates medium; palp more than 1.5 times as long as medial edge of outer plate. Coxae 1-4 subquadrate, alike, even, broader than long. Gnathopods simple, slender, article 6 of gnathopod 1 much longer than article 5, equal on gnathopod 2, carpus not lobate; dactyls normally claw shaped, without inner teeth. Pereopods simple. Urosomal teeth absent. Telson elongate, deeply cleft*." (From J. L. Barnard and Karaman 1991).

Macroarthrus – A unique genus endemic to the NEP. Described from settling bottle collections around Station M off Central California, it is known from the unique holotype female. It can be distinguished from other pardaliscid genera with the key in Biswas et al 2009.

Diagnosis: "*Eye absent; rostrum short, acute; antenna 1 elongate, about 1.5×length of body, peduncle 3 very short, accessory flagellum very long, about 0.3×length of primary flagellum; antenna 2 about 0.3×length of antenna 1, flagellum short; upper lip, weakly incised, symmetric; mandible, incisors slightly asymmetric, palp strong, three articulate; maxilliped, inner plate not reaching base of palp, outer plate nearly reaching base of article 2 of palp, palp four-articulate, powerful; gnathopods dissimilar, gnathopod 1 large, propodus strongly tapering, stout, weakly subchelate;*

gnathopod 2, propodus small, subchelate; peraeopods 3–4 gracile, ischium extremely elongated, almost as long as basis; peraeopods 5–6 subequal; peraeopod 7 dissimilar to peraeopods 5–6, very long, slender, about as long as body; epimeron 2–3 with a posteroventral tooth; urosomite 1, with a posterodorsal, bidentate tooth; urosomite 2, with a slender, posterodorsal tooth; uropods 1–2, lanceolate, very long, more than 2×length of the urosome and strongly spinose; uropod 3, rami elongate, subequal, outer ramus two-articulate, article 2 minute; telson short, slightly longer than wide, lateral margins parallel, cleft v-shaped about 55%, lobes acute." (From Hendrycks and Conlan 2003)

Nicippe – Currently a small genus of three species, one with a suspiciously broad distribution. Two of the species are extremely narrowly distributed. *N. buchi* is known only from a lava tunnel in the Canary Islands in the tropical East Atlantic, while *N. unidentata* is known only from the Antarctic . The third and type species, *Nicippe tumida* is reported from the North Atlantic, Mediterranean, NEP, and South Africa. It will probably be resolved as a complex of several siblings. Since the major difference between it and *N. unidentata* is the number of urosomal teeth, the two have occasionally been synonymized in the past. While the genus can be separated using the key of Biswas et al (2009), *N. tumida* stands out among NEP pardaliscids for its very robust body, and strongly conjoint first antennal peduncle. It is commonly taken at shelf depths in the SCB, but ranges into the bathyal, reaching depths of up to 1369m off Iceland (Thomas and McCann, 1995).



Nicippe tumida (from J. L. Barnard 1959)

Diagnosis**: "***Rostrum small. Eyes present, weak pigment only. Ratio of peduncular articles on antenna **I** = 12:9:3, base of primary flagellum narrow, articulate. article 1 of flagellum scarcely longer than article 3 of peduncle, article 2 of peduncle short; accessory flagellum present. Mouthparts forming quadrate bundle below head. Upper lip almost symmetrically incised Mandibles asymmetrical, incisor on left weakly toothed, on right strongly toothed, palp fully developed. Inner lobes of lower lip coalesced. Palp of maxilla 1 expanded apically. Maxilla 2 well developed, thin, plates equal. Both plates of maxilliped small; palp almost 3 times as long as medial edge of outer plate. Coxae 1-4 subquadrate, alike, even, broader than long. Gnathopods weakly*

subchelate, stout, article 6 of both gnathopods longer than article 5, carpus with long, broad, lobe; dactyl normally claw-shaped, without inner teeth. Pereopods simple. Urosomal teeth moderate to weak. Telson elongate, deeply cleft." (From J. L. Barnard and Karaman 1991)

Octomana – A unique NEP endemic, described from sediment trap samples taken around Station M off Central California. It is unprecedented among gammarids in having pereopods 3 and 4 bearing gnathia very similar to the two gnathopods. Known only from slope to abyssal depths, but described from numerous specimens.

Diagnosis: "*Eye absent; rostrum slender; peduncular article 1 large with a strong, acute, anterodistal process reaching midpoint of peduncular article 3; upper lip very weakly incised, lobes asymmetric; mandible, incisors broad, symmetric, smooth, palp strong, three-articulate, article 2 strongly curved; gnathopods 1–2 and peraeopods 3–4 strongly setose, stout, subsimilar, carpus and propodus expanded, propodus ovoid, laterally compressed, strongly subchelate and raptorial, posterior margin of dactyls denticulate; peraeopods 3–4, merus strongly expanded; peraeopod 6 longer than peraeopod 5 or 7; urosomite 2 with a dorsal tooth (male); uropod 3, rami elongate, outer ramus two-articulate; telson long, lobes slender, cleft nearly to base.*" (From Hendrycks and Conlan 2003)

Pardalisca "*abyssi*" (from WoRMS)

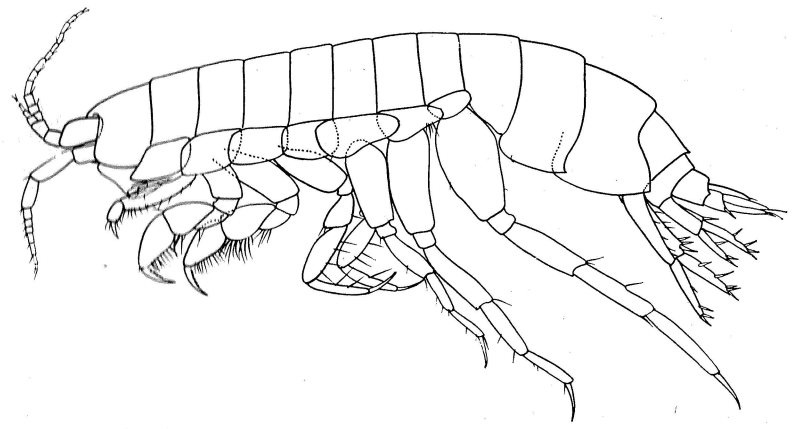
Pardalisca – A moderate sized genus of ten described species with 2 described and two provisional species from the NEP. One of the provisionals is undefined, while the second was described as Pardalisca sp by J. L. Barnard (1967). Originally taken in the shallow portion of the Cedros Trench off Baja California, it was retaken off Central California during the Santa Maria Basin study at mid-slope depths (Thomas and McCann 1995). Two of the three described species are from lower slope to abyssal depths off Vancouver Id., British Columbia (*P. endeavouri* Shaw 1989) , or the Gulf of the Farallones in Northern California (*P. marionis* of Thomas in Blake et al 1992). The last reaches into shallower shelf waters (*P. tenuipes*) and ranges broadly through the North

Atlantic and North Pacific. There is no comprehensive key to the genus. A key to the forms reported from the NEP is provided below:

Key to NEP *Pardalisca* – dbcadien 15 Nov 2014

1. Eyed……..*P. tenuipes*
   Blind……..……2
2. Dactyls of G1 and G2 nearly as wide as long……...*P. marionis*
   Dactyls of G1 and G2 much longer than wide…….……..3
3. Telson terminating in 3 teeth, with an additional subterminal tooth laterally….
   ……..…..*P. endeavouri*
   Telson terminating in 2 teeth, no lateral teeth on telson .*P.* sp of Barnard 1967

Diagnos**is: "***Rostrum small. Eyes present or absent. Ratio of peduncular articles on antenna 1 = 11:8:3 down to 11:5:3, base of primary flagellum in female narrow, articulate, in male callynophore present, article 1 of flagellum much longer than article 3 of peduncle in male, shorter in female, article 2 of peduncle short; accessory flagellum present. Mouthparts forming quadrate bundle below head. Upper lip grossly and asymmetrically incised below. Mandibles asymmetrical, incisor on left weakly toothed, on right strongly toothed, palp fully developed. Inner lobes of lower lip separate. Palp of maxilla 1 expanded apically. Maxilla 2 well developed, thin, plates equal. Inner plates of maxilliped small to obsolescent, outer plates large; palp just as long as medial edge of outer plate. Coxae 1-4 quadrate, alike, even, scarcely broader than long. Gnathopods simple, slender, but carpus stout, not lobate, article 6 of both gnathopods much shorter and thinner than article 5; dactyls either stubby or claw-shaped, with many inner teeth. Pereopods simple. Urosomal teeth strong. Telson elongate, deeply cleft*." (From J. L. Barnard and Karaman 1991)



Pardaliscella symmetrica (From J. L. Barnard 1959)

Pardalicella – A small genus of six described species, two of which occur in the NEP. While bearing serrated gnathopodal dactyls like *Pardalisca*, in the present genus these are restricted to the mesial margin of the dactyl and are much smaller than in *Pardalisca*. Occurring in shallower water than many pardaliscid genera, both described forms from the NEP are taken as shallow as the mid-shelf and extend to the upper or middle slope. Northern Hemisphere, except for P. inermis from the western Indian Ocean

(Madagascar). The genus is represented in the Northeast Atlantic, and the Russian Arctic, as well as in the NEP. A provisional species, unfortunately undocumented, was established from the Cascadia Abyssal Plain off Oregon (Dickinson 1976). The two described NEP forms can be distinguished by the proportions of the peduncular articles of antenna 1: article 2 much longer than article 1 in *P. symmetrica*, much shorter than art 1 in *P. yaquinae*. The telson is also more deeply cleft in *P. yaquinae*, but this is difficult to reliably judge.

Diagnosis**: "***Rostrum small. Eyes absent. Ratio of peduncular articles on antenna 1 = 24:14:7, base of primary flagellum narrow, with weak callynophore, article 1 of flagellum longer than article 3 of peduncle, article 2 of peduncle short; accessory flagellum present. Mouthparts forming quadrate bundle below head. Upper lip even or asymmetrically incised. Mandibles asymmetrical, incisor on left smooth, weakly toothed, on right strongly toothed, palp fully developed. Inner lobes of lower lip coalesced. Palp of maxilla 1 apically expanded. Maxilla 2 well developed, thin, plates equal. Inner plates of maxilliped small, outer plates medium; palp about 1.5 times as long as medial edge of outer plate. Coxae 1-4 subquadrate, even, broader than long. Gnathopods simple, moderately stout, article 6 of both gnathopods about as long as 5, carpus not lobate; dactyls normally claw-shaped, with 1-2 inner teeth. Pereopods simple. Urosomal teeth absent. Telson scarcely elongate, partly cleft*." (From J. L. Barnard and Karaman 1991)

Pardaliscoides – A small genus of four species, one from the NEP. Widely distributed in the deep sea, with representatives in the Mediterranean, the south Pacific, and in the Philippine and Kermadec Trenches. All except the NEP species are abyssal or hadal. *P. fictotelson* is known from outer shelf depths in the SCB. The genus can be keyed using Biswas et al (2009).

Diagnosis**: "***Rostrum well developed. Eyes absent. Ratio of peduncular articles on antenna 1 = 17:20:9, base of primary flagellum narrow, callynophore present, article 1 of flagellum scarcely longer than article 3 of peduncle, article 2 of peduncle elongate; accessory flagellum present. Mouthparts forming quadrate bundle below head. Upper lip [?grossly and asymmetrically incised, ?rounded below]. Mandibles symmetrical, incisors moderately toothed, palp fully developed. Inner lobes of lower lip [?separate. ?coalesced. ?with raphus]. Palp of maxilla 1 not expanded apically. Maxilla 2 well developed, plates equal. Both plates of maxilliped small; palp more than 3 times as long as medial edge of outer plate. Coxae 1-4 quadrate, alike, even, broader than long. Gnathopods simple, gnathopod 1 slender, gnathopod 2 stouter, article 6 of both gnathopods much shorter than article 5, carpi, on gnathopod 2 with broad, shallow lobe; dactyl normally claw-shaped, without inner teeth. Pereopods simple. Urosomal teeth vestigial. Telson elongate, deeply cleft*." (From J. L. Barnard and Karaman 1991).

Pardaliscopsis – A monotypic genus known from the Northeast Atlantic and the NEP. The NEP material came from abyssal collections in sediment traps around Station M off Central California. The only known male of the species was taken in those collections and described by Hendrycks and Conlan (2003). Other species originally placed here have been removed to *Caleidoscopsis* (Karaman 1974). Identify with the generic key of Biswas et al (2009).

Diagnosis**: "***Rostrum small. Eyes absent. Ratio of peduncular articles on antenna 1 = 23:17:11, base of primary flagellum narrow, articulate, article 1 of flagellum shorter than article 3 of peduncle, article 2 of peduncle short; accessory flagellum present.*

Mouthparts forming quadrate bundle below head. Upper lip grossly and asymmetrically incised. Mandibles asymmetrical, incisor on left weakly toothed, on right strongly toothed, palp fully developed. Inner lobes of lower lip coalesced. Palp of maxilla 1 apically expanded. Maxilla 2 well developed, plates equal. Both plates of maxilliped ordinary; though outer plate broad, palp about as long as medial edge of outer plate. Coxae 1-4 quadrate, alike, even, broader than long. Gnathopods simple, medium-stout, article 6 of both gnathopods subequal to article 5, carpus not lobate; dactyls normally claw-shaped, without inner teeth. Pereopods simple. Urosomal teeth weak. Telson not elongate, deeply cleft." (From J. L. Barnard and Karaman 1991)

Parpano – A provisional member of this genus was recorded from the Navy Deep Water Dumpsite investigation in the Gulf of the Farallones in Central California (Blake et al 1992). No description was prepared and the specimen remains unavailable, so the record is questionable. The two described members of the genus are Caribbean and may eventually prove to be male and female of the same species (see J. L. Barnard 1966). It is rather similar to *Tosilus*, which was described from the SCB, and will perhaps prove to be misallocated to *Parpano* if a description or specimens can be found.

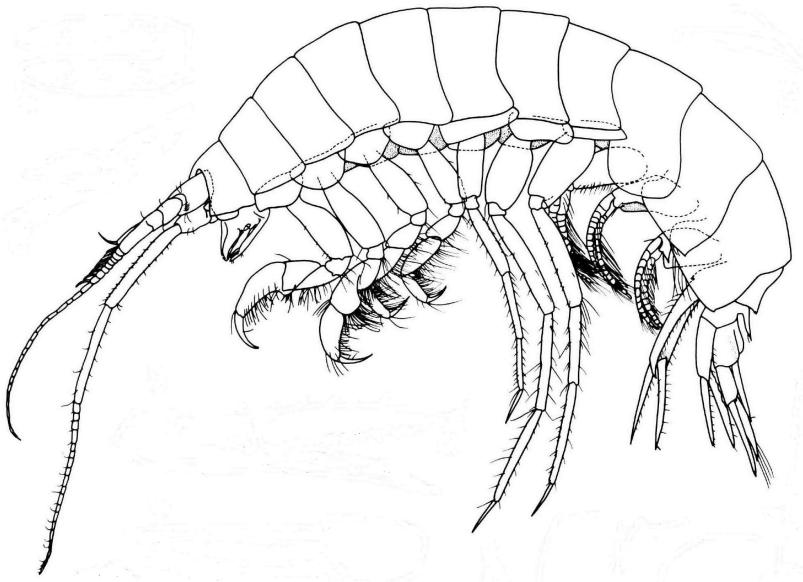
Diagnosis**: "***Rostrum absent. Eyes absent. Ratio of peduncular articles on antenna 1 = 8:6:3, base of primary flagellum with callynophore in male, narrow and articulate in female, article 1 of flagellum in female scarcely longer than article **3** of peduncle, almost as long as peduncle in male, article 2 of peduncle short; accessory flagellum present. Mouthparts forming quadrate bundle below head. Upper lip weakly and symmetrically incised. Mandibles asymmetrical, incisor on left weakly toothed, on right strongly toothed, palp fully developed. Inner lobes of lower lip coalesced. Palp of maxilla 1 expanded apically. Maxilla 2 well developed, plates diverse. Both plates of maxilliped small, palp more than 2 times as long as medial edge of outer plate. Coxae 1-4 quadrate, alike, even, longer than broad. Gnathopods simple, slender, article 6 of both gnathopods much longer than article 5, carpus with narrow, shallow lobe: dactyls normally claw-shaped, without inner teeth. Pereopods simple. Urosomal teeth strong in male, absent in female. Telson short, entire*." (From J. L. Barnard and Karaman 1991)

Princaxelia jamiesoni male and female (from Lōrz 2010)

Princaxelia – The single report of this genus from the NEP is based on few specimens of an upper slope animal, not a trench resident. Other members of the genus are found much deeper and are abyssal or hadal in habit. The provisional species was

based on a few small specimens, and should probably be viewed as an unknown juvenile pardaliscid rather than an authentic *Princaxelia*. The specimens are currently deposited in the Smithsonian Institution along with others in the primary voucher set from the Santa Maria Basin study (Lissner et al 1986). No description was prepared at the time, although notes on the animals are presented in Thomas and McCann (1995). Lōrz (2010) provides a history of taxonomic activity in the genus, describes a new taxon, and provides a key to the known species.

Diagnosis**: "***Rostrum small. Eyes present. Ratio of peduncular articles on antenna 1 = 9:5:2. base of primary flagellum with callynophore in male, article 1 of flagellum much longer than article 3 of peduncle, article 2 of peduncle short; accessory flagellum present. Mouthparts forming quadrate bundle below head. Upper lip weakly and asymmetrically incised. Mandibles slightly asymmetrical, incisor on left almost smooth, on right weakly toothed, palp fully developed. Inner lobes of lower lip coalesced. Palp of maxilla 1 expanded apically. Maxilla 2 well developed, plates equal. Inner plates of maxilliped small, outer plates large; palp more than 3 times as long as medial edge of outer plate. Coxae 1-4 quadrate, alike, even, broader than long. Gnathopods simple, stout, article 6 of both gnathopods much shorter and narrower than article 5, carpus with broad, shallow lobe; dactyls normally claw-shaped, without inner teeth. Pereopods simple. Urosomal teeth strong. Telson elongate, deeply cleft.*" (From J. L. Barnard and Karaman 1991)



Rhynohalicella halona (From J. L. Barnard 1971)

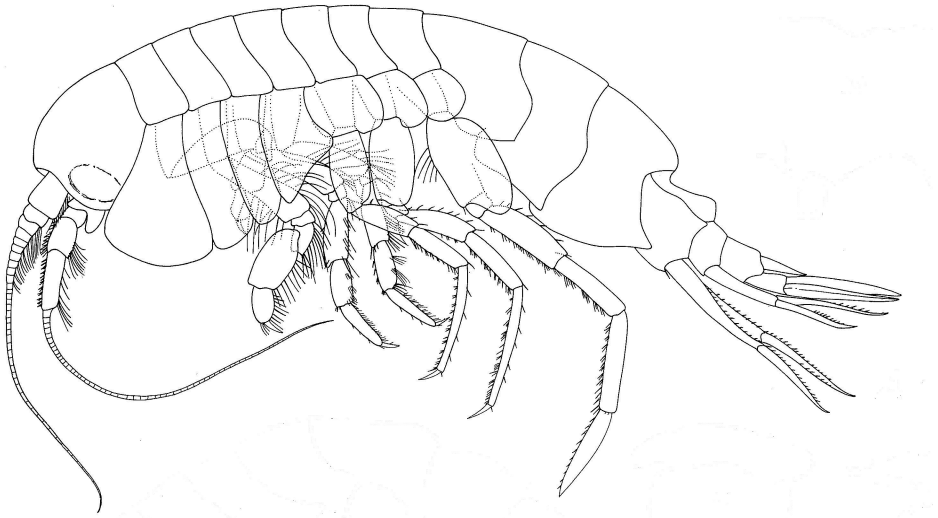
Rhynohalicella – A monotypic NEP endemic genus. Erected by Karaman because the species *halona* differed from other *Halice* in the mouthparts, particularly the upper lip and palp of maxilla 1. The single species is known from outer shelf to upper slope depths, and is a relatively shallow dwelling pardaliscid.

Diagnosis**: "***Rostrum well developed. Eyes absent. Ratio of peduncular articles on antenna l = 30:10:9, base of primary flagellum with callynophore, article l of flagellum much longer than article 3 of peduncle, article 2 of peduncle short; accessory flagellum present. Mouthparts styliform, forming conical bundle below head. Upper lip evenly*

incised. Mandibles symmetrical, incisors smooth, palp represented by tubercle with 2 setae. Inner lobes of lower lip separate. Palp of maxilla 1 not expanded apically. Maxilla 2 represented by single elongate plate. Inner plates of maxilliped absent; outer plates large; palp only as long as medial edge of outer plate. Coxae 1-4 softly subtriangular or trapezoidal, weakly diverse, broader than long. Gnathopods simple, of medium stoutness, article 6 of gnathopod 1 much longer than article 5, carpus with short, broad, shallow lobe; gnathopod 2 simple. article 5 elongate and more broadly lobate; dactyls normally claw-shaped, without inner teeth. Pereopods simple. Urosomal teeth strong. Telson elongate, deeply cleft." (From J. L. Barnard and Karaman 1991)

Tosilus – A monotypic genus from bathyal depths in the NEP. *Tosilus arroyo* is known only from slightly above or slightly below 1000m depths between the Southern California Bight and northern Baja California. There have been very few reports of the species. As discussed previously the report of *Parpano* from the NEP may eventually prove to be another member of *Tosilus* as yet undescribed. It can be separated from other NEP pardaliscids with the key of Biswas et al (2009).

Diagnosis: "*Rostrum small. Eyes absent. Ratio of peduncular articles of antenna 1=a 28:18:10, base of primary flagellum narrow, articulate, article of flagellum scarcely longer than article 3 of peduncle, article 2 of peduncle short; accessory flagellum present. Mouthparts forming quadrate bundle below head. Upper lip weakly and asymmetrically incised below. Mandibles asymmetrical, incisor on left weakly toothed, on right strongly toothed, palp fully developed. Inner lobes of lower lip coalesced. Palp of maxilla 1 expanded apically. Maxilla 2 well developed, plates equal. Inner plates of maxilliped obsolescent, outer plates small; palp [?more than 2 times as long as medial edge of outer plate]. Coxae 1-4 quadrate, alike, even, longer than broad. Gnathopods simple, slender, article 6 of both gnathopods much longer than very short article 5, carpus not lobate; dactyls normally claw-shaped, without teeth. Pereopods simple. Urosomal teeth absent. Telson short, weakly cleft.*" (From J. L. Barnard and Karaman 1991)



Stilipes distinctus (From J. L. Barnard and Karaman 1991)

Family Stilipedidae – A small family with but 21 described species distributed among six genera in three subfamilies. Only two genera, *Stilipes* in the Stilipedinae and *Astyra* in

the Astyrinae are known from the coverage area. One described species from each genus, plus a provisional of *Astyra* constitute the regional fauna in the family. The family was reviewed by Holman and Watling (1983), who reached somewhat different conclusions from J. L. Barnard and Karaman (1991) or Coleman and J. L. Barnard (1991). Placement of some Antarctic forms inside or outside the family has been the most contentious issue (see for instance Andres and Lott 1986, or Berge and Vader 2005).

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

Antenna 1 shorter than antenna 2; peduncle with sparse robust and slender setae; 3-articulate; peduncular article 1 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 present, or absent. Antenna 2 present; medium length; articles not folded in zigzag fashion; without hook-like process; flagellum longer than peduncle; 5 or more articulate; not clavate; calceoli absent.

Mouthparts well developed. Mandible incisor dentate, or smooth; accessory setal row without distal tuft; ***molar absent****; palp present. Maxilla 1 present; inner plate present, weakly setose apically; 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, very large or large; 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, none vestigial. Coxae 2-4 none immensely broadened.

Gnathopod 1 not sexually dimorphic; subequal to gnathopod 2; larger than coxa 2; gnathopod 1 merus and carpus not rotated; gnathopod 1 carpus/propodus not cantilevered; longer than propodus; gnathopod 1 not produced along posterior margin of propodus; dactylus large. Gnathopod 2 not sexually dimorphic; simple, or subchelate; coxa larger than coxa 3; ischium short; merus not fused along posterior margin of carpus or produced away from it; carpus/propodus not cantilevered, carpus elongate, longer than propodus, 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 shorter than propodus, not produced; dactylus well developed. ***Coxa*** *larger than coxa 3,* ***acuminate ventrally****, 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; shorter than peraeopod 6; coxa smaller than coxa 4, with ventrally produced posterior lobe or without posterior lobe; basis slightly expanded, subrectangular, without posteroventral lobe; merus/carpus free; carpus linear; setae absent. Peraeopod 6 shorter than peraeopod 7, or subequal in length to peraeopod 7; merus/carpus free; dactylus without setae. Peraeopod 7 with 6-7 well*

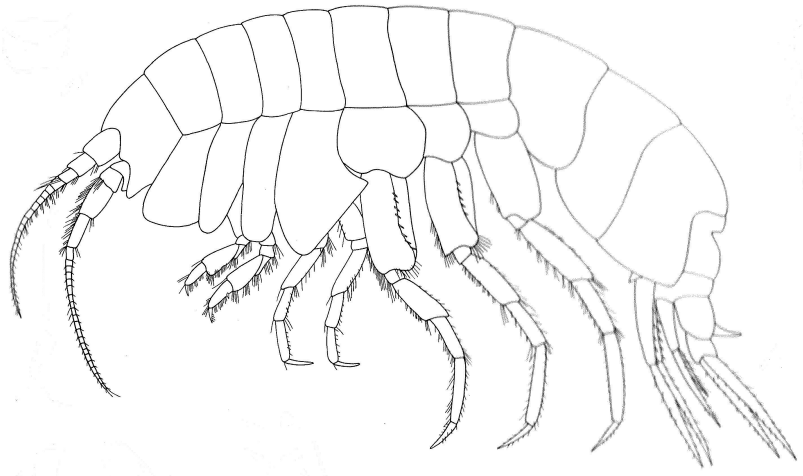
developed articles; longer than peraeopod 5; similar in structure to peraeopod 6; with 7 articles; basis expanded, without dense slender setae; dactylus without setae.

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. Epimeron 2 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 carinate, or 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 short; outer ramus longer than peduncle, 1-articulate, without recurved spines. Telson laminar; moderately cleft, or emarginate; longer than broad; apical robust setae absent."
(Lowry and Springthorpe 2001).

Stilipes – The genus was reviewed by Berge (2003) who provided a comprehensive key to the four known species. He also corrected the ending of the specific epithet from *distincta* to *distinctus* to comply with Code gender agreement rules. The local representative *S. distinctus* Holmes (1908), the generotype, was redescribed and the male illustrated by Shoemaker (1964).

Diagnosis: "*Labrum weakly incised, lobes asymmetrical. Mandibles very broad, very flat, incisor broad, smooth (scarcely notched), left lacinia mobilis present, right absent, raker row absent, molar absent. Maxillae 1-2 broadly expanded, palp of maxilla 1 2-articulate. Palp of maxilliped strongly exceeding apex of outer plate. Carpus of gnathopods not lobate, gnathopods smooth, narrow, mostly asetose, of pereopod 7 much broader, more deeply lobate, posterior margin excavate*." (From J. L. Barnard and Karaman 1991)



Astyra abyssi (From J. L. Barnard and Karaman 1991)

Astyra – Six species of *Astyra* are described. They are distributed from the Antarctic to the boreo-arctic North Atlantic and Pacific. Although taken as shallowly as 100m in a few places, most species are strictly bathyal-abyssal in distribution. Only *Astyra abyssi*,

the holotype, has been reported from the North Pacific, along the northern portions of both shores.

Diagnosis: "*Labrum scarcely incised. Mandibles narrow, very flat, twisted, incisor narrow, toothed, right lacinia mobilis absent, left present, raker row well developed, molar long, conical, simple, setose. Maxillae 1-2 almost ordinary, not immensely broadened though inner plate of maxilla 2 broader than ordinary, palp of maxilla 1 2-articulate. Palp of maxilliped exceeding apex of outer plate. Carpus of gnathopods weakly lobate or moderately carpochelate. Article 2 of pereopods 5-6 with setose lateral ridge extending ventrally to form weak posteroventral lobe; article 2 of pereopod 7 simple, lobate, lacking setose ridge, posterior margin straight*." (From J. L. Barnard and Karaman 1991)

Family Vitjazianidae – A very small family of pelagic species, with two genera and five species. A single member occurs in the NEP, although a second is from the NWP and could conceivably range into our coverage area.

Diagnosis: "*Peduncle of antenna 1 not longer than head, articles quite short (much as in the Lysianassidae); accessory flagellum very slender, composed of two or more long articles; gnathopod 1 simple, article 7 large, claw-like; gnathopod 2 with short third article; telson short, cleft; mandible bearing molar and triarticulate palp; first maxillae symmetrical on both sides, palps not geniculate; coxae not acuminate below; third uropods with lanceolate rami, not uncinate, lacking hooked spines; outer lobes of lower lip unnotched; plates of maxillae and maxilliped well developed; uropods all present, all biramous.*" (J. L. Barnard 1964)

Vemana lemuresa (From J. L. Barnard 1967)

Vemana – A small 4 species genus from deep-waters in several oceans. A single species, *V. lemuresa*, occurs in the NEP. Two species are known from the bathyal and abyssal Caribbean, and another from abyssal depths in the western Indian Ocean.

Diagnosis**: "***Palp article 3 of mandible expanded, clavate. Palp of maxilla 1 expanded apically. Dactyl of palp on maxilliped bearing nail. Coxae 1-4 of ordinary length, almost as long as broad but coxae 5-7 much shorter. Gnathopod 2 subchelate, article 5 not longer than 6. Pereopods 5-7 short, with short article 5 and elongate article*

2. Peduncle of uropod 1 barely reaching base of uropod 2, outer ramus shortened; outer ramus of uropod 3 2-articulate." (From J. L. Barnard and Karaman 1991)

Literature Cited

Andres, Hans Georg and Norbert Lott 1986. Where to place *Eclysis similis* K. H. Barnard, 1932? Hints at its relationships and remarks on the systematic position of the Astyridae (Crustacea: Amphipoda). *Mitteilungen aus dem Hamburgischen Zoologischen Museum und Institut* **83**: 131-137.

Barnard, J. Laurens 1959. The common pardaliscid Amphipoda of Southern California, with a revision of the family. *Pacific Naturalist* **1**(11/12): 36-43.

----------. 1962. Benthic marine Amphipoda of Southern California; 2. Families Tironidae to Gammaridae. *Pacific Naturalist* **3**(2): 73-115.

----------. 1964. Deep-sea Amphipoda (Crustacea) collected by the R/V 'Vema' in the Eastern Pacific Ocean and the Caribbean and Mediterranean Seas. *Bulletin of the American Museum of Natural History* **127**(1): 1-46.

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

----------. 1967. Bathyal and abyssal gammaridean Amphipoda of Cedros Trench, Baja California. *United States National Museum, Bulletin* (260): 1-205.

----------. 1971. Gammaridean Amphipoda from a deep-sea transect off Oregon. *Smithsonian Contributions to Zoology* (61): 1-86.

----------, and Gordan 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, Jørgen 2003. The taxonomy of the amphipod genus *Stilipes* (Crustacea: Amphipoda: Stilipedidae), with description of one new species. *Organisms Diversity and Evolution* **3**(Electronic Supplement 16): 1-10.

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

----------, and Wim Vader 2005. On the taxonomic status of the Antarctic amphipod crustacean genera *Eclysis* (Astyridae) and *Bathypanoploea* (Stilipedidae), with partial redescription of their type species and description of *Bathypanoploea polarsterni* n. sp. *Organisms Diversity & Evolution* **5**(Electronic Supplement 2): 1-15.

Birstein, Yakov A. E. and Mikhail E. Vinogradov. 1958. Pelagischesie gammaridy (Amphipoda, Gammaridea) severo-zapadnoi chasti Tikhogo Okeana, Akademiia Nauk SSSR. *Trudy Instituta Okeanologii* **27**: 219-257.

---------, and ---------. 1960. Pelagischesie gammaridy tropicheskoi chasti Tixogo Okeana, Akademiia Nauk SSSR. *Trudy Instituta Okeanologii* **34**: 165-241.

---------, and --------. 1964. Pelagischesie gammaridy severnoi chasti Indiiskogo Okeana, Akademiia Nauk SSSR. *Trudy Instituto Okeanologii* **65**: 152-195.

---------, and ---------. 1970. On the fauna of pelagic gammarids in the Kurile-Kamchatka area of the Pacific Ocean. *Academy of Sciences of the USSR, Proceedings of the Shirshov Institute of Oceanology* **86**: 419-438.

Biswas, Tapati, Charles O. Coleman, and Ed A. Hendrycks. 2009. *Andeepia ingridae* a new genus and species of Pardaliscidae (Crustacea, Amphipoda) from the Antarctic deep-sea and short redescription of *Nicippe unidentata* K. H. Barnard, 1932. *Zootaxa* **1977**: 21-38.

Blake, James A., JoAnn Muramoto, Brigitte Hilbig, and Isabelle P. Williams. 1992. Biological and Sedimentological Investigations of the Sea Floor at the Proposed U.S. Navy Ocean Disposal Site. July 1991 Survey (R/V Wecoma) Benthic Biology and Sediment characterization. Final Report.

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

---------, and C.-t. Shih 1994. The phyletic classification of amphipod crustaceans: problems in resolution. *Amphipacifica* **1**(3): 76-134.

Brandt, Angelika, Magdalena Blazewicz-Paszkowycz, Roger N. Bamber, Ute Műhlenhardt-Siegel, Marina V. Malyutina, Stefanie Kaiser, Claude De Broyer, and Charlotte Havermans. 2012. Are there widespread peracarid species in the deep sea (Crustacea: Malacostraca)? *Polish Polar Research* **33**(2): 139-162.

Cadien, Donald B. and Lawrence 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**:** 186pp.

Coleman, Charles Oliver, and J. Laurens Barnard. 1991. Revision of Iphimediidae and similar families (Amphipoda: Gammaridea). *Proceedings of the Biological Society of Washington* **104**(2): 253-268.

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

Hendrycks, Ed A. and Kathleen E. Conlan. 2003. New and unusual abyssal gammaridean Amphipoda from the north-east Pacific. *Journal of Natural History* **37**(19): 2303-2368.

Holman, Heather and Les Watling 1983. A revision of the Stilipedidae (Amphipoda). *Crustaceana* **44**(1): 27-53.

Holmes, Samuel 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.

Jamieson, Alan J., Anne-Nina Lörz, Toronobu Fujii, and Imants G. Priede. 2011. *In situ* observations of trophic behaviour and locomotion of *Princaxelia* amphipods (Crustacea: Pardaliscidae) at hadal depths in four West Pacific Trenches. *Journal of the Marine Biological Association of the United Kingdom* **92**(1): 143-150.

Karaman, Gordan S. 1974. Contribution to the knowledge of the Amphipoda. XLII. Revision of the Family Pardaliscidae with diagnosis of genera, distribution of species and Bibliography. *Acta Adriatica* **15**(7): 3-46.

Lissner, Andrew, Charles Phillips, Donald B. Cadien, Robert W. Smith, Brock Bernstein, Robert Cimberg, Thomas Kauwling, William Anikouchine. 1986. Assessment of long-term changes in biological communities of the Santa Maria Basin and Western Santa Barbara Channel - Phase I.

Lörz, Anne-Nina 2010. Trench treasures: the genus *Princaxelia* (Pardaliscidae, Amphipoda). *Zoologica Baetica* **21**: 65-84.

Lowry, James K. 1986. The callynophore, a eucaridan/peracaridan sensory organ prevalent among the Amphipoda (Crustacea). *Zoologica Scripta* **13**: 333-349.

---------, and S. D. A. Smith. 2003. Invertebrate Scavenging Guilds along the Continental Shelf and Slope of Eastern Australia - General Description. Sydney, Australia, Australian Museum**:** 59pp.

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

Martin, Joel W., Scott C. France, and Cindy Lee van Dover. 1993. *Halice hesmonectes*, a new species of pardaliscid amphipod (Crustacea, Peracarida) from hydrothermal vents in the eastern Pacific. *Canadian Journal of Zoology* **71**: 1724-1732.

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.

Sainte-Marie, Bernard and Pierre 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.

Shaw, D. Patrick. 1989. New amphipods from geothermal vent sites off the west coast of Vancouver Island, British Columbia, with a reappraisal of the amphipod family Sebidae. *Canadian Journal of Zoology* **67**(8): 1882-1890.

Shoemaker, Clarence R. 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.

Stock, Jan H. and Thomas M. Iliffe. 1990. Amphipod crustaceans from anchihaline cave waters of the Galapagos Islands. *Zoological Journal of the Linnean Society* **98**(2): 141-160.

Thomas, James D. and Linda D. McCann 1995. The Families Argissidae, Dexaminidae, Eusiridae, Gammaridae, Leucothoidae, Melphidippidae, Oedicerotidae, Pardaliscidae, Phoxocephalidae, Podoceridae, Stegocephalidae, Stenothoidae, Stilipedidae, Synopiidae, and Urothoidae. Pp. 21-136 IN: Blake, James A., Les Watling & Paul H. Scott (eds.). Taxonomic Atlas of the Santa Maria Basin and Western Santa Barbara Channel Vol. 12; The Crustacea Part 3, The Amphipoda. Santa Barbara, California, U.S.A., Santa Barbara Museum of Natural History.

Thurston, Michael H. 1976. New pelagic amphipods (Crustacea: Amphipoda) collected on the Sond Cruise. *Journal of the Marine Biological Association of the United Kingdom* **56**(1): 143-159.