

The bodotriids are primarily shallow water sand associated forms, although a few such as *Bathycuma* and *Cyclaspoides* have penetrated the deep-sea. At least 19 species in 6 genera are known from the NEP from the Gulf of California to the Arctic. It is likely that additional undetected species remain uncollected, especially from sandy sediments in the south. Three of our local provisionals are known only from the very coarse iron-stained relict red sands found off Imperial Beach south of San Diego. The family was not represented in the collection described by Watling and McCann (1997), and is consequently not discussed there. Only four species in this family are listed by McLaughlin et al (2005) as from the Pacific coast of North America. Bodotriids are more diverse in the Western North Pacific, with 21 species in 8 genera described by 1967 (Gamô 1967). Although there is considerable known NEP diversity in the genus *Cyclaspis*, most of it remains to be described. In the list provided below 5 described and 12 undescribed forms are placed in *Cyclaspis*. Materials from a light trap collected in Bahia Kino in the Gulf of California by Todd Haney have provided 3 apparently undescribed species in this genus, as well as material of several provisional forms previously collected by Donath – Hernandez on the Gulf side of Baja California.. Two new species described from Pacific Coasta Rica (Petrescu and Heard 2004) are included, although one of them is known only from the female. Similarly large diversity in the genus is known from the western coast of South America (Pilar Haye, personal communication), and numerous additional undescribed species in the genus have been collected from the Caribbean.

Despite good diversity of *Cyclaspis*, other genera with numerous species in other areas are not represented in our fauna. These include the genera *Bodotria*, *Iphinoe*, *Symphodomma*, and *Eocuma*. The genus *Glyphocuma*, which is unrepresented in the NW Pacific, has two quite similar undescribed species in our area. The genus is otherwise only known from Australian waters, where it was erected by Hale. Bodotriids in general are well-represented in Australia, and this is probably the area of origin of the family, although this remains to be determined. The genus *Coricuma* was placed in the Bodotriidae when originally proposed, but was later transferred to the Leuconidae (Watling 1991b). The family is distributed worldwide, and has endemic genera in many areas (Băcescu 1988). It is divided into three subfamilies, the Bodotriinae, the Mancocumatinae, and the Vaunthompsoniinae, based on combinations of numbers of pereopods bearing epipods, and number of pleopods in the male.

Secondary sexual characters in this group are relatively easy to see in most cases. The male pleopods, in particular, are usually prominently displayed. In a few species, however, among them *Cyclaspis nubila*, the adult male holds the pleopods tight against the underside of the abdomen. As the abdomen is slightly concave in these species, the pleopods are effectively hidden in lateral view. Subadult male pleopods are considerably easier to see. The marsupium of the female is also relatively easy to see, if developed, even prior to the carrying of a brood. While the elongation of the male second antennae is very noticeable, the antennae themselves are often not. Under most circumstances they are carried along the underside of the carapace, thorax and abdomen, tightly appressed to the main body. They can usually be found, but it may take concerted looking to ferret

them out. Only in the full adult will they sometimes be long enough to show near the last abdominal segment, even while hidden from lateral view. Even if the antennal flagellum is not readily evident, the males have strongly enlarged antennal peduncles, which must be muscular and more robust than those of the females to handle these long antennae. Examination of the antennal peduncle is usually easier than finding the rest of the antenna.

Determination of sex is as important in bodotriids as in any other cumacean. The pattern of sexual dimorphism characteristic of the group as a whole holds for this family; females are larger than males, but usually by 30% or less in total length. They also have more inflated carapaces posteriorly, which typically slope more towards the eyelobe than in the male. Where only a single sex is known, the appearance of the other can be partially predicted by these trends, which seem to vary little within the family. For instance, the two described species from the Gulf of California, *C. bituberculata* and *C. conceptionis* were initially believed to also occur in the Bahia Kino material. Only males of “*C. bituberculata*” were found however, which were undescribed by Donath-Hernández. The males at hand proved to be several times the length of the females they were believed to belong to. This is so contrary to the established pattern that it was concluded that this was a closely related but different species, and not the males of the described species. Similarly both males and females which bore good resemblance to *C. conceptionis* were taken in Bahia Kino. Again, they were substantially larger (3 times the size indicated in the original description) and cannot belong to the same taxon. They are now treated as another undescribed species with close affinity to *C. conceptionis*.

A key to the California bodotriids was prepared in 1996 for SCAMIT presentation. This is updated below, with the addition of the Donath-Hernández species, two Costa Rican species, three provisional forms from the Gulf of California, and *Glyphocuma sp LA1* first taken in 1998. A key to all genera in the family world-wide is provided by Jones (1969, pp. 102-103).

NEP Bodotriidae from McLaughlin et al (2005) augmented by known provisional taxa.  
\*= Taxa on the SCAMIT Ed 4 list + addenda. Valid taxa bolded, synonyms not.

#### Family Bodotriidae

**Bathycuma longicaudatum** Calman 1912 – Mediterranean, Japan, NEP to San Diego, Chile; 1174-3950m

**Cyclaspis bituberculata** Donath-Hernández 1988 – Laguna Ojo de Liebre, outer coast of Baja California to Bahia Bocochoibampo, Sonora, Mexico; shallow

**Cyclaspis breedyae** Petrescu and Heard 2004 – Gulf of Nicoya, Costa Rica; 1-2m

**Cyclaspis conceptionis** Donath-Hernández 1988 – Bahia Concepción, Gulf of California; shallow

\***Cyclaspis nubila** Zimmer 1936 – SCB to Bahia Kino, Gulf of California; 0- 27m

**Cyclaspis vargasae** Petrescu and Heard 2004 – Los Islas Murcielagos, Costa Rica; 35m

\***Cyclaspis sp A** SCAMIT 1995§ - Pt. Conception to Bahia Kino, Gulf of California; 0-48m

- \***Cyclaspis sp B** SCAMIT 1989§ - Oxnard to La Jolla; 8-18m  
 \***Cyclaspis sp C** SCAMIT 1986§ - Pt. Conception to La Jolla; 5-15m  
**Cyclaspis sp D** Cadien 1996§ - Huntington Beach; 0-1m  
**Cyclaspis sp E** Cadien 1996§ - Imperial Beach; 20m  
**Cyclaspis sp F** Cadien 1996§ - Imperial Beach; 20m  
**Cyclaspis sp G** Cadien 1996§ - Imperial Beach; 20m  
**Cyclaspis sp J** Cadien 2005§ - Bahia Kino, Sonora, Mexico; 1-10m  
**Cyclaspis sp K** Cadien 2005§ - Bahia Kino, Sonora, Mexico; 1-10m  
**Cyclaspis sp N** Cadien 2005§ - Bahia Kino, Sonora, Mexico; 1-10m  
**Cyclaspis sp 3** Donath-Hernández 1985§ - Puerto Peñasco and Bahia Kino, Gulf of California; 1-10m  
**Cyclaspis sp 4** Donath-Hernández 1985§ - Bahia de Los Angeles and Bahia Kino, Gulf of California; 1-10m  
**Cyclaspoides sp BAP1** Cadien 2001§ - Baja California; 3880-3950m  
 \***Glyphocuma sp A** SCAMIT 1989§ - San Miguel Id. to San Diego; 71-108m  
 \***Glyphocuma sp LA1** SCAMIT 2000§ - Santa Rosa Id.; 84m  
 \***Leptocuma forsmanni** Zimmer 1943 – SCB to Bahia Kino, Sonora, Mexico; 1-10m  
**Vaunthompsonia cristata** Bate 1858 – South Africa, Mediterranean, N. Atlantic; Indonesia; Japan to Puget Sound; 0-36m  
 \***Vaunthompsonia pacifica** Zimmer 1943 – NWP to SE Alaska; SCB; 0-96m

Key to the Bodotriidae of the NEP from the (Modified from Cadien 1996 to include all currently recognized provisional and described species known from the equator to the Arctic Circle in the Eastern Pacific)

- 1a. Exopods on only the first pair of pereopods.....2  
 1b. Exopods on more than one pair of pereopods.....19  
 2a. First three pedigerous segments fused with carapace.....*Cyclaspoides sp A*  
 2b. All five pedigerous segments free.....3  
 3a. Carapace with one or more teeth on the dorsal midline.....4  
 3b. Carapace lacking teeth on dorsal midline.....5  
 4a. Carapace with a single pair of ridges extending from dorsal midline to join the ventral margin below the level of the antennal notch; eyes divided into 11 ommatidea.....*Cyclaspis breedyae*  
 4b. Carapace with a single pair of ridges extending from the dorsal midline forward to the back of the eyelobe; eye undivided into separate lensed ommatidea.....  
 ..... *Cyclaspis sp A*  
 5a. Antennal sinus absent; both margins of uropodal peduncle setose in female.....  
 .....*Cyclaspis sp D*  
 5b. Antennal sinus evident; peduncle of uropods lacking setae along both margins in female (but inner margin may be serrate.....6  
 6a. Carapace smooth, without pits, tubercles, surface ornament, or anteriodorsal.....  
 depressed areas in either sex.....7

- 6b. Carapace strongly pitted and/or sculptured, with or without depressions ]  
 anteriop dorsally in both sexes.....8
- 7a. Paired horn-like tubercles dorsally on last two thoracic segments.....*Cyclaspis sp 3*
- 7b. Thoracic tubercles lacking.....*Cyclaspis sp B*
- 8a. Carapace bearing lateral ridge(s) extending from mid-dorsal carina towards base  
 of the carapace.....9
- 8b. Carapace lacking lateral ridge(s) extending down from the mid-dorsal carina.....12
- 9a. Carapace bearing a single lateral ridge extending from the dorsal carina about 2/3  
 the distance to carapace base which forms the posterior boundary of a complex  
 anterior-dorsal sinus.....*Cyclaspis sp G♂*
- 9b. Carapace bearing two or more lateral ridges.....10
- 10a. Mid-dorsal carina very strong on anterior half of carapace, weak posteriorly; two  
 strong lateral ridges; carapace with stellate purple pigment spots..*Cyclaspis sp F♂*
- 10b. Mid-dorsal carina moderately strong on entire carapace; 3-6 delicate lateral ridges  
 on carapace.....11
- 11a. Carapace lacking definite spots of pigment in juveniles, but both sexes  
 increasingly pigmented with age; with 5-6 thin sloping ridges running obliquely  
 across the carapace.....*Cyclaspis sp 4*
- 11b. Carapace with a few indistinct non-stellate pigment spots posteriodorsally; 3  
 delicate lateral ridges on carapace.....*Cyclaspis sp. E♀*
- 12a. Carapace with well marked anteriop dorsal depression extending from dorsal carina  
 to base of eyelobe in both male and female.....13
- 12b. Carapace lacking anteriop dorsal depression in either sex.....14
- 13a. Carapace with smooth trough-like depression extending obliquely back from the  
 antennal sinus in both sexes.....*Cyclaspis sp C*
- 13b. Carapace lacking smooth trough-like depression behind the antennal sinus in both  
 sexes.....*Cyclaspis nubila*
- 14a. Carapace lacking either obtuse or acute anteriolateral tubercles.....15
- 14b. Carapace bearing one pair of large anteriolateral tubercles, either obtuse or edged  
 with an acute ridge, between eyelobe and antennal sinus.....17
- 15a. Carapace strongly pitted, but lacks longitudinal strigillate sculpture.....  
 .....*Cyclaspis vargasae*
- 15b. Carapace with strigillate longitudinal sculpture on sides of carapace.....16
- 16a. Uropodal exopod longer than endopod and both rami lacking long terminal spines  
 on rami in both sexes; mature at about 7mm.....*Cyclaspis sp J*
- 16b. Uropodal rami subequal, both tipped with long (1/3 ramal length) terminal spines;  
 mature at less than 2.5mm.....*Cyclaspis conceptionis*
- 17a. Carapace surface sculpture alveolate; anterior tubercles either obtuse or edged by  
 an acute ridge.....18
- 17b. Carapace surface sculpture not alveolate; anterior tubercles obtuse; mature at less  
 than 3mm.....*Cyclaspis bituberculata*
- 18a. Dorsal flanges present on thoracic somites T2 and T5; anterior tubercles edged  
 with a sharp ridge; ventral margin strongly flared below the antennal sinus, and  
 edged with another sharp ridge; mature at less than 2.5mm.....*Cyclaspis sp N*
- 18b. Dorsal surface of all thoracic somites lacking lobes or flanges; anterior tubercles  
 obtuse, not edged by acute ridge; ventral margin not flared below antennal sinus;

- mature at 7+mm.....*Cyclaspis sp K*
- 19a. Carapace lacking teeth or denticles dorsally.....20
- 19b. Carapace bearing at least one, and usually many denticles or teeth on carina.....21
- 20a. Lateral margins of 3<sup>rd</sup> (♀) or 4<sup>th</sup> (♂) thoracic segment overlapping those of adjacent segments.....*Leptocuma forsmanni*
- 20a. Lateral margins of 3<sup>rd</sup> or 4<sup>th</sup> thoracic segments not overlapping those of adjacent segments.....*Vaunthompsonia* and *Glyphocuma* (♂♂) 25
- 21a. Abdominal somites ridged laterally.....*Bathycuma longicaudata*
- 21b. Abdominal somites not ridged laterally.....22
- 22a. Dorsal teeth or denticles in two parallel rows flanking carapace midline.....23
- 22b. Dorsal teeth in a single row along midline.....*Glyphocuma* ♀ and juvenile ♂ 24
- 23a. Eyelobe lacking denticle pair distally; carapace evenly rounded dorsally.....  
.....*Vaunthompsonia pacifica*♀
- 23b. Eyelobe bearing denticle pair distally; carapace slightly excavated dorsally just before posterior margin.....*Vaunthompsonia cristata*♀
- 24a. Dorsal crest with well marked denticles; anterior ventral carapace border finely serrate.....*Glyphocuma sp A*
- 24b. Dorsal crest with only one or two poorly marked denticles; anterior ventral carapace border lacking serrations.....*Glyphocuma sp LA1*
- 25a. Anteriorly projecting lobe at the distal end of the basis of the third maxilliped.....  
.....*Glyphocuma* (adult males of both local species unknown)
- 25b. Lacking lobe distally at end of third maxilliped basis.....*Vaunthompsonia* (adult males unknown for both reported species in the genus from the NEP)

**Bathycuma** – Only eight species are described in the genus (Băcescu 1988), to which a ninth must now be added (Mühlenhardt-Siegel 2005a). One additional undescribed form is known from the hadal zone of the Bougainville Trench (Wolff 1970). Only one species is from the NEP, the remainder are from the North Atlantic, South Atlantic, or Indian Oceans. Only two specimens are known from off our area; the type, from off San Diego, at 1174-1218m, and one in my possession from the Baja Abyssal Plain at 3800-3950m. It has also been taken from off Japan, and Gamô (1967) describes and illustrates it well, and the description and illustrations of Petrescu (1995) should also be consulted. Day (1975) provides a key to the genus up to that time, which includes all but the one recently described species (Mühlenhardt-Siegel 2005a) and Wolff's hadal provisional.

**Cyclaspis** – An extremely large genus of shallow-water (predominantly) bodotriids, with species found worldwide. Well over one hundred species are currently described, and many forms await formal description, at least in the Western Hemisphere. Over 60 years ago Hale recognized a large number of forms from around Australia, and a single species from the NEP (Hale 1944a). Since then a number of additional species have been described world-wide (Băcescu lists 93 in 1988). If the diversity evident in the Australian region is echoed elsewhere in the world, the eventual number of described *Cyclaspis* species may reach nearly 200. This sort of large genus, while not

unprecedented, fairly easily lends itself to subdivision. At a minimum one would expect that a series of subgenera would be erected, each housing a more manageable subset of the total. It is also possible that the genus will be exploded, with the description of a number of genera from this large one. There is ample morphological diversity in carapace shape (see Hale 1944a) to support such subdivision, but boundaries may prove elusive. In several faunas I have examined similar species exist in several size ranges, I suppose related to the diversity of different sized sediments the animals must burrow through. A large muscular species would be required to move large sand sized particles, while more gracile and smaller forms might occupy more uniform fine sands, or perhaps live among grains in coarse well-mixed sediments with shell debris or other biogenic components.



A small undescribed *Cyclops* from Caribbean Panama

Zimmer (1944) described *C. dolera* from material ostensibly taken in Salinas Bay on the Pacific coast of Costa Rica. The species was known to be distributed through the tropical Western Atlantic, but has not been seen since on the Pacific Coast. Based on the reasoning provided by Roccatagliata (1986) the species is now thought to be found only in the Atlantic, with the original labeling being an error for Salinas, Puerto Rico. It is not included here for this reason.

A small subset of the *Cyclops* species are deep-water animals, but the vast majority are found on sandy bottoms in the intertidal, and shallow sublittoral zones. We only take them at our shallowest stations, and then only a few individuals of two species (*C. nubila* and *C. sp A*). A broader spectrum is found in the relict red sand deposits off the coast south of San Diego, where four more provisional forms are currently known. These are all rare, however, and several are known from single specimens.

**Cyclospoides** – A small deep-sea genus, with two described species listed by Băcescu (1988), and additional species described by Petrescu (1995) and Mühlenhardt-

Siegel (2005a). At least two undescribed species are also known, our provisional from off Baja California, and a provisional known only from a single specimen off the Philippines (Calman 1905). The fusion of the thoracic segments with the carapace which characterize this genus makes it easy to separate from other deepwater bodotriids. Despite having few members, the genus is widespread, ranging from the deep North Atlantic, to the South Atlantic off Angola, the Indian Ocean off South Africa, the Philippines, Ecuador, and the NEP.

**Glyphocuma** – Hale (1944b) erected the genus and placed four species in it, three new. All were from the southern part of Australia. Since then Greenwood & Johnson (1967) have described a fifth species from Queensland in the north. They did not provide a key to the genus including their new species, preferring to differentiate it from the type in a table. Hale (1944b) provides a key to the four species known at that time. The two forms from the NEP are both provisionals, and are the only species in the genus known from outside Australia. The pattern of differences in carapace ornamentation is one of the primary differences between the two local provisional species. Since both sexes are not known for the species, the identification of the as yet uncollected sex remains problematic.

**Leptocuma** – Ten species are known in the genus (Băcescu 1988) only one from the NEP. Most members are austral, although several are known from the North Atlantic. Hale (1944b) provides a key to six species from Australia, which may point out some characters of interest in the taxonomy of the species. No comprehensive key to the members of the genus exists. This genus is much more elongate than other shallow-water bodotriids found in the NEP, and the overlapping of the thoracic pleura is a distinctive feature. While there is diversity in the genus in the SW Atlantic (Roccatagliata 1993), as yet only a single species is known from the NEP, with populations from temperate and tropical waters indistinguishable.

**Vaunthompsonia** – A widely distributed, if not large, genus of bodotriids. Eleven described species (one with two subspecies), and two provisionals are known (Băcescu 1988). The genus is predominantly shallow, with some members deeper on the shelf. A few species are known to occur more deeply. Surprisingly broad bathymetric distributions are ascribed to some species, particularly *V. cristata*, which is normally taken at 0-36m, but has one record at 2338m (Băcescu 1988). In another case, with a species similar to *V. cristata*, he suggests that the record (from 6475-6571m in the Kurile-Kamtschatka Trench) is either a misidentified *Bathycuma*, or an animal taken from the plankton incidentally (Băcescu 1988). In tropical climates the genus can occur quite shallowly, with *V. minor* taken amongst intertidal algae in Belize (personal collection). Neither of the two reported NEP taxa occur much south of the Arctic, penetrating into the boreal region as far as SE Alaska. Reports of these animals have been made previously (a number were identified in the BLM studies in the SCB), but these have proven to be erroneously identified *Glyphocuma* specimens. Remaining records of *V. pacifica* specimens in the SCB are questionable, and need to be verified.

Additional References (see Part 1 for Main reference list)

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