

The nannastacids are a very diverse group, with Băcescu listing over 300 species in 20 genera (1992). This number of described species has continued to grow, and forms known locally also include a relatively large number of provisionals. Despite the diversity of genera known world-wide, there are only four present in the NEP, and only two of these are speciose: *Campylaspis* and *Cumella*. Both these genera are found from the deep-sea to the intertidal (Jones 1969). Both also have many representatives in shallow and deep waters, but periodic major descriptive works (i.e. Gamô 1964; Jones 1974, 1984; Petrescu and Iliffe 1992; Petrescu et al 1994) continually change the balance of deep vs shallow species.

The nominate genus *Nannastacus* literally means ‘tiny crayfish’. Attempting to recognize any similarity with crayfish in this genus quickly leads one to the conclusion that the original name was ill-conceived. Nannastacids are typically rather globose carapaced animals, usually higher posteriorly and sloping towards the pseudorostrum. There are, of course, no chelae or claws as might be suggested by the family name derivation. While most are small, a few of the *Campylaspis* are relatively large. *Cumella* species are nearly uniformly small.

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

Family Nannastacidae

- ***Campylaspis biplicata** Watling and McCann 1997 – Puget Sound to San Diego; 47-1372m
- ***Campylaspis blakei** Watling and McCann 1997 – Eureka to San Diego; 92-914m
- ***Campylaspis canaliculata** Zimmer 1936 – Fort Bragg to San Diego; 10-644m
- ***Campylaspis hartae** Lie 1969 – Puget Sound to San Diego; 7-207m
- ***Campylaspis maculinodulosa** Watling and McCann 1997 - Central California to San Diego; 25-154m (note: the synonymy of C. sp B Myers & Benedict with this species indicated in Watling and McCann is based on a misidentification. The two taxa differ in several respects)
- Campylaspis papillata** Lomakina 1952 – NWP, Oregon to SCB; 143-1150+m
- ***Campylaspis rubromaculata** Lie 1969 – Puget Sound to San Diego; 7-588m
- ***Campylaspis rufa** J. F. L. Hart 1930 - Vancouver Island to San Diego; 98-565m
- ***Campylaspis sp A** SCAMIT 1995§ - San Pedro Sea Shelf; 150-307m
- Campylaspis sp B** Myers & Benedict 1974§ - off Pt. San Luis, Central California to Los Angeles Harbor; 20-405m
- Campylaspis sp BAP1** Cadien 2001§ - Baja Abyssal Plain; 3880-3950m
- Campylaspis sp BAP2** Cadien 2001§ - Baja Abyssal Plain; 3880-3950m
- Campylaspis sp BAP3** Cadien 2001§ - Baja Abyssal Plain; 3880-3950m
- ***Campylaspis sp C** Myers & Benedict 1974§ - Sta. Cruz Island to San Diego; 12-27m

- Campylaspis* sp CS1 see *Campylaspis biplicata*
Campylaspis sp CS2 Cadien 2004§ - Oregon; 1372m
Campylaspis sp CS3 Cadien 2004§ - Oregon; 732-950m
Campylaspis sp CS4 Cadien 2004§ - Oregon; 1372m
Campylaspis sp CS5 Cadien 2004§ - Oregon to San Diego; 542-1372m
Campylaspis sp CS6 Cadien 2006§ - Oregon; 1372m
Campylaspis sp F Myers & Benedict 1974§ - San Diego; 10m
Campylaspis sp J Given 1970§ - SCB; shelf depths
Campylaspis sp N MBC 1985§ - Oregon to San Gabriel Submarine Canyon; 107-950m
Campylaspis sp O MBC 1985§ - Pt. Estero; 403m
Campylaspis sp TB1 Cadien 2004§ - Tanner Basin; 1150+m
Cumella bruinensis Gerken 2005 – Gulf of Alaska; 0-1m
***Cumella californica** Watling and McCann 1997 – Soquell Submarine Canyon to Todos Santos Bay, western Baja California; 3-305m
Cumella morion Watling and McCann 1997 – Central California to San Diego; 15-154m
Cumella vulgaris J. F. L. Hart 1930 – Vancouver Island to San Diego; 0-18m
**Cumella* sp B Myers & Benedict 1974§ (see *Cumella morion*)
Cumella sp E Phillips 1998§ - Santa Monica Bay;
Cumella sp F MBC 1985§ - slope of San Pedro Sea Shelf; 305m
Cumella sp G MBC 1985§ - Central California to San Pedro Sea Shelf; 102-197m
Cumella sp J Paquette 1994§ - Goleta; 26-37m
Cumella (*Cumewingia*) sp 1 Donath-Hernandez 1985§ see *Cumella californica*
Elassocumella sp SD1 Nesler 2005§ - San Diego; 110-112m
Platycuma sp CS1 Cadien 2004§ - Oregon; 1372m
***Procampylaspis caenosa** Watling and McCann 1997 – Cape Mendocino to San Diego; 11-200m
Procampylaspis sp CS1 Cadien & Martin MS – Oregon to Tanner Basin; 732-1150+m

Because so much of the NEP diversity of this family is in the genus *Campylaspis*, its members will be separately keyed. A key to genera occurring in the NEP, and to species in genera other than *Campylaspis* is provided below. If you arrive at the genus *Campylaspis* in the key, please proceed to the separate key to that genus which follows.

Key to Genera and non-*Campylaspis* species of Nannastacidae known from the NEP (based on Jones 1969)dbcadien – 17 November 2006

- 1a. Carapace flattened, plate-like; gut coiled.....*Platycuma* sp CS1
- 1b. Carapace rounded, tubular to bulbous; gut not coiled.....2
- 2a. Second maxilla dactyl strongly toothed, forming a rake; carapace invested in organic coat of sediment grains.....*Procampylaspis* 3
- 2b. Second maxilla not strongly toothed or rake-like; carapace not invested in organic coating, although may be strongly setose, retaining some debris.....4

- 3a. Second maxilla with two basal teeth of rake coalesced into an incised hump, followed by an elongate tooth, a very short tooth and the terminal tooth; ocular lobe bearing two spinules.....*Procampylaspis* sp CS1
- 3b. Second maxilla with first four teeth separate, and declining in length towards long strong terminal tooth; ocular lobe lacking spinules.....*Procampylaspis caenosa*
- 4a. Carapace bulbous (especially in females) and extending back over free thoracic somites; eye poorly developed or, if well developed, occurring as a single ocular group.....*Campylaspis* (see key to genus)
- 4b. Carapace flattened oval to tubular in both males and females, not covering any thoracic somite; eye(s) well developed, usually separated into a medial cluster of ocular elements (males with more, females with fewer).....5
- 5a. Females lacking exopods on third maxilliped and pereopods 1-3.....*Elassocumella* sp SD1
- 5b. Females with exopods on third maxilliped and on pereopods 1-3.....*Cumella* 6
- 6a. Uropodal peduncles shorter than last abdominal somite.....*Cumella* sp J
- 6b. Uropodal peduncles equal to or longer than last abdominal somite.....7
- 7a. Abdominal somites 1-4 with paired dorsal spines.....*Cumella* sp G
- 7b. Abdominal somites lacking paired dorsal spines.....8
- 8a. Uropodal peduncles more than twice length of last abdominal somite.....*Cumella* sp E ♂ (♀ unknown)
- 8b. Uropodal peduncles no more than 1 ½ length of last abdominal somite.....9
- 9a. Pseudorostrum anteriorly serrate.....*Cumella vulgaris*
- 9b. Pseudorostrum anteriorly smooth.....10
- 10a. Thoracic pleura laterally flaring.....*Cumella californica*
- 10b. Thoracic pleura not flared laterally.....11
- 11a. Carapace with strong mid-dorsal crest; females with inflated posterior carapace.....12
- 11b. Carapace lacking strong mid-dorsal crest; female with uninflated tubular carapace as in the male.....*Cumella* sp F
- 12a. Abdominal somites 1-4 with dorsally directed middorsal processes (but not paired spines).....*Cumella morion*
- 12b. Abdominal somites 1-4 without dorsal ornament.....*Cumella bruinensis*

Campylaspis – The genus *Campylaspis* has, if anything, too many bold characters on the carapace. The problems encountered in construction of descriptions and keys to these animals generally revolve around a non-standardized descriptive language for the types of ornamentation found on carapaces. Spines, bumps, pebbles, granules, tubercles, prickles, ridges, carinae, knobs, pits, troughs, grooves, sinuses, and setae (simple or plumose) are intertwined on the carapaces of these animals in a bewildering array of intergrading variations. Fortunately sexual dimorphism is not usually expressed in the types of ornamentation, although the strength of expression of individual features may vary between males and females of a species. In this genus the males are generally as large as or larger than the females, with a flatter more tubular carapace.

Jones (1974) gave a key to the 98 species known at that time, but subsequently added five additional species. Additional species have been described by others since,

and there is no current key to the genus worldwide. We can adopt the six major species groups used by Jones (1974) in lieu of subgenera to help segregate these species into morphologically related clusters. They are as follows, with the NEP species belonging in them listed:

1. the *rubicunda* group

Members of this group have smooth carapaces, without lateral depressions, and with at most a pair of low rounded protuberances or with small granulations. Includes: *rufa*, sp BAP2, sp O, sp. CS5

2. the *sulcata* group

Members of this group have a depression on either side of the carapace (a sinus, groove, or trough). If distinct ridges are present they do not extend to the dorsal hind end of the carapace. Some spines or a few low protuberances may be present, but not conical, subcylindrical or rounded tubercles. Includes: *blakei*, *canaliculata*, sp B, sp F



Campylaspis canaliculata male and female: a member of the *sulcata* group

3. the *costata* group

These have one or more, usually two or three, distinct ridges running horizontally or obliquely backwards on either side of the carapace, of which at least one extends onto the dorsum. Depressions may be present between the

ridges, but they are not defined posteriorly. Tubercles are not present.
Includes: *biplicata*, *hartae*, sp. C, sp CS6

4. the *verrucosa* group
With moderate or large numbers of tubercles on the sides and dorsum of the carapace. These may or may not be organized into tuberculate ridges.
Includes: *maculinodulosa*, *rubromaculata*, *papillata*, sp BAP1, sp BAP3, sp CS3, sp CS4, sp. N, sp A
5. the *rostrata* group
A small group in which the pseudorostrum is prominent and enlarged. No currently known NEP species belong here.
6. the *spinosa* group
A residual group not fitting into any of the above clusters. Includes: sp CS2, , sp TB1, sp J

Despite their differences, *Campylaspis sp B* of Myers and Benedict and *Campylaspis biplicata* Watling and McCann are frequently confused. The former species is larger; both sexes of *C. biplicata* are mature at 2mm, while mature *C. sp B* are 3mm long. Females of *C. sp B* do not have the defined ridges shown by females of *C. biplicata*, but have the sulcus melding into the surrounding surface without a ridge at it's margin. Uropodal peduncles of *C. sp B* are medially crenulate, those of *C. biplicata* are smooth. Males are more difficult to distinguish, but the sinus in *C. sp B* tapers anteriorly, while that of *C. biplicata* broadens anteriorly. Male uropodal endopods and peduncles are more strongly setose in *C. sp B*, only weakly setose in *C. biplicata*.

Many *Campylaspis* species have pigment, sometimes in chromatophore like spots or splotches on the carapace, thorax, abdomen, or appendages; sometimes as a tint or color diffused throughout the integument. Several of the local species have characteristic pigmentation, but it cannot always be relied upon. *Campylaspis rufa*, for instance, was described and named for its red integument. Unfortunately, specimens morphologically indistinguishable can be found in the same range which are pure translucent white. This same dichotomy is seen in *C. canaliculata*, which has both red and white forms.

Key to the species of *Campylaspis* known from the NEP – dbcadien 12December06

- 1a. Carapace smooth, without tubercles, ridges, or lateral depressions (sulci).....2
- 1b. Carapace ornamented with granules, ridges, tubercles, spines, or a combination of these features: if these are lacking, lateral depressions (sulci) are present.....5
- 2a. Carapace pyriform, low, setose, especially near eyelobe*Campylaspis sp CS5*
- 2b. Carapace globose, inflated, lacking setae, smooth.....3
- 3a. Uropodal rami and peduncle subequal in length.....*Campylaspis sp O*
- 3b. Uropodal peduncle much longer than rami.....4
- 4a. Uropodal peduncle tapered to base, distally flattened.....*Campylaspis rufa*
- 4b. Uropodal peduncle uniform width over length.....*Campylaspis sp BAP2*
- 5a. Carapace with ridges, tubercles, papillae, or spines.....9

- 5b. Carapace lacking ridges, tubercles (low granules may be present), or spines, but bearing lateral depressions (sulci) extending back from antennal sinus.....6
- 6a. Last two thoracic and first three abdominal somites bearing dorsolateral spikes
.....*Campylaspis blakei*
- 6b. Thoracic and abdominal somites lacking dorsolateral spikes.....7
- 7a. Carapace with two roughly parallel sulci laterally.....*Campylaspis sp F*
- 7b. Carapace with a single sulcus extending posteriorly from antennal sinus.....8
- 8a. Lateral sulcus long and narrow ($l/w=8+1$).....*Campylaspis canaliculata*
- 8b. Lateral sulcus broad ($l/w=4/1$).....*Campylaspis sp B*
- 9a. Carapace with lateral ridges, either smooth or tuberculate; may also bear tubercles or spines.....10
- 9b. Carapace lacking lateral ridges but bearing some combination of spines, tubercles granules, bumps; lateral sulci may also be present.....19
- 10a. Ridges form a reticulate anastomosis, not separable into individual ridges; ridges smooth, lacking tuberculations.....*Campylaspis hartae*
- 10b. Ridges separate, although two may join (or one bifurcate).....11
- 11a. Ridges smooth, lacking tuberculations.....12
- 11b. At least one ridge tuberculate or formed from a confluent row of tubercles.....15
- 12a. Two ridges on each side.....13
- 12b. Three ridges on each side.....14
- 13a. Pseudorostrum blunt, carapace blocky, not tapering anteriorly; lateral ridges barely raised above general surface, vertical, extending from ventral to dorsal over the carapace; no tubercles dorsally.....*Campylaspis sp CS2*
- 13b. Pseudorostrum pointed, not blunt; carapace inflated posteriorly and tapering to ocular lobe; lateral ridges sharply defined, raised considerably above general surface, oblique, extending from anterior to posterior of carapace; tubercles dorsally above lateral ridges..... *Campylaspis sp BAP3*
- 14a. With three ridges, all of which are of similar length and reach onto the dorsal carapace; thoracic somites without tubercles dorsally [shelf depths].....
.....*Campylaspis sp C*
- 14b. With three ridges, none of which reach the dorsal carapace; the first two much shorter than the third; thoracic somites bearing paired flattened granulate tubercles dorsally [bathyal depths].....*Campylaspis sp CS6*
- 15a. With 4 ridges, all reaching the dorsal carapace; ~~body orange-red with darker spots and chromatophore clusters; uropodal peduncles quadrangular in cross-section~~
.....*Campylaspis sp A*
- 15b. With fewer than 4 ridges, ~~integument not orange-red~~; uropodal peduncles either round, oval, or flattened in cross-section.....16
- 16a. With 3 tuberculate ridges, the middle one shorter.....*Campylaspis rubromaculata*
- 16b. With 2 ridges on each side.....17
- 17a. Ridges tuberculate in both male and female.....18
- 17b. Ridges tuberculate in female, smooth in male.....*Campylaspis biplicata*
- 18a. Last 3 thoracic and all abdominal somites with paired pointed dorsal tubercles; carapace strongly tuberculate, ridges with flattened tubercles; ivory white, with no pigmented chromatophores.....*Campylaspis sp CS4*
- 18b. Thoracic and abdominal somites lacking dorsal tubercles; carapace granulate to

- weakly tuberculate; ridges with low tuberculations only; carapace with numerous small reddish-purple chromatophores.....*Campylaspis maculinodulosa*..
- 19a. Carapace with a lateral sulcus as well as bearing tubercles dorsally; sulci short, not reaching more than ½ carapace length, curved.....*Campylaspis sp J*
- 19b. Carapace lacking lateral sulci; bearing spines, papillae, bumps, granules, or tuberculations.....20
- 20a. Pseudorostrum blunt, strongly upturned; carapace with paired rows of spines (sharply pointed tubercles) along dorsal margins.....*Campylaspis sp TB1*
- 20b. Pseudorostrum obtusely pointed, horizontal, not strongly upturned; carapace with surface ornament scattered over surface, not arranged in longitudinal rows along dorsal margin, lacking sharply pointed tubercles (spines).....21
- 21a. Carapace bearing very small low pimple-like tubercles scattered evenly over carapace surface; anterior ventral margin strongly dentate; uropods short, with relatively stubby rami.....*Campylaspis sp CS3*
- 21b. Carapace bearing larger bumps or papillae arranged in rows across or along length of carapace, but not defining dorsolateral carapace margins.....22
- 22a. Uropodal peduncle broad and flattened; broader than the combined width of the uropodal rami; carapace tuberculations somewhat flattened, not globose or conical eyelobe prominent.....*Campylaspis papillata*
- 22b. Uropodal peduncle not broad and flattened; narrower than the combined width of the uropodal rami; carapace ornaments either conical bumps or globose papillae, not flattened tubercles; eyelobe absent or obscure.....23
- 23a. Carapace bearing large globose papillae; no chromatophore concentrated pigment; posterior margin of abdominal somites bearing ring of 4-5 teeth on each; uropodal peduncle with 4-5 small spines on mesial margin.....*Campylaspis sp BAP1*
- 23b. Carapace bearing smallish conical bumps; red pigmented chromatophores scattered over carapace surface on and between bumps, and on abdominal somites; dorsal spines present on abdominal somites, but no posterior marginal teeth; uropodal peduncles bare mesially.....*Campylaspis sp N*

Cumella - The genus *Cumella* is particularly diverse, especially in the tropics and subtropics, with many species described recently from the tropical West Atlantic (Băcescu 1992, Băcescu and Iliffe 1991, Băcescu and Muradian 1977, Petrescu 1996, Petrescu and Heard 2004, Petrescu and Sterrer 2001). NEP diversity in this group remains poorly investigated, and many additional species are likely to be detected in temperate to tropical Eastern Pacific areas. All the members of the genus are very small, and this tends to complicate the detection and definition of species. Live collected material often has pigmentation cues for separation of closely related congeners (based on personal observations in the British Virgin Islands, where 13 *Cumella* species were separated based on live appearance), but these are immediately lost in preservation. Another set of character states based on eye configuration can be separatory within a fauna. These states are sex specific, however, so must be used with caution, and with adequate material available to provide both sexes of encountered species. *Cumella* species are often quite abundant when their particular habitat is sampled, and frequently both sexes will be taken, allowing use of sex specific characters. Habitats for the

members of this genus are diverse, ranging from clean coarse coral sand, through fine silts to algal association. Sediment preferences in one local species have been investigated (Wieser 1956).



One of the undescribed *Cumella* species from Guana Island, British Virgin Islands. Unpreserved specimen to show pigment pattern of white dots and brown splotch on carapace, and rings of dark pigment on abdomen (Photo – Leslie Harris).

In at least one deep-water species a scavenging opportunist strategy is used by the organism to coverge on, and feast upon, food falls (Smith 1986). Similar behavior has not, to my knowledge, been observed in shallow water members of the genus. Mouthpart structure suggests that a more frequent nutritive mode is that of filtering deposit feeder.

Elassocumella – Was erected to house *Cumella micruropus* from the Tropical Western Atlantic. Aside from the shortness of the uropodal peduncles, the distinguishing character is the lack of exopods on either the third maxilliped or any of the pereopods of the female. This strongly distinguishes this genus from all others in the family. The local species is very similar to *Cumella californica* in most respects, but lacks the female exopods, placing it in *Elassocumella*. It is possible that this is a variable expression which is somehow related to growth or environmental parameters, and that the genus is consequently ill-founded.

Platycuma – The genus is primary known from the Atlantic (5 species listed in Băcescu 1992), the present provisional is the first known representative from the Pacific. The carapace is greatly flattened and plate-like in these species, all from deep bathyal to abyssal depths. The local provisional species, from the Cascadia Slope at 1372m, is known from a single specimen.

Procampylaspis – Like the preceding genus, nearly all species of *Procampylaspis* are known from bathyal and abyssal depths. Of our two local species, one is known from continental shelf depths (*P. caenosa*), and the other from the lower bathyal (*P. sp. CS1*). Most species in this genus, including the two local representatives, envelope themselves in an organic matrix filled with fine sediment grains. This forms an adherent coating which is very difficult to remove and obscures details of the carapace surface. The composition of this material and its method of formation are both unknown.

While generally like *Campylaspis* in carapace formation and external appearance, members of *Procampylaspis* all bear a specially modified clawlike dactylar rake as the

distal article of the second maxilliped. The spine formula of this differs between the species, and is diagnostic for the local forms. Stebbing (1912) considered this genus to form a family of its own.

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