

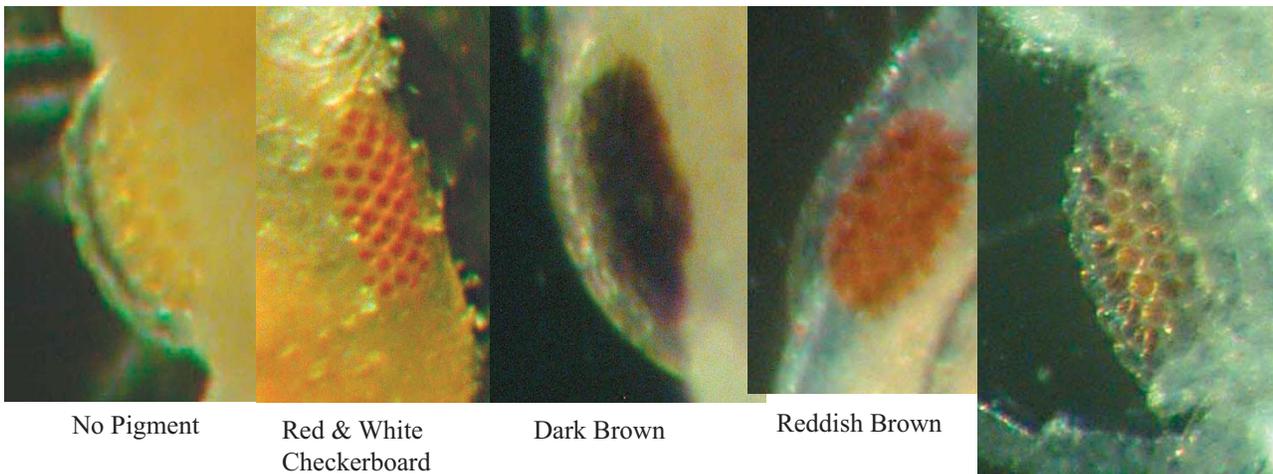
**S**OUTHERN  
**C**ALIFORNIA  
**A**SSOCIATION OF  
**M**ARINE  
**I**NVERTEBRATE  
**T**AXONOMISTS



March/April, 2006

SCAMIT Newsletter

Vol. 24, No. 6



No Pigment

Red & White  
Checkerboard

Dark Brown

Reddish Brown

Golden or Amber

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### MARCH 06 MINUTES

The March meeting on Sponges was held so long ago that your Secretary can no longer remember much of what was discussed. We spent most of the day musing over photos of animals and their spicules. Attempts were made at identification using available literature. A protocol was established for handling animals sampled in the field: All specimens are to be photographed live and entire. After photographic documentation of the animal, a piece of tissue should be removed (should be large enough/deep enough to contain both external and internal spicules) and fixed for further study back at the lab. Unfortunately there seems to be few among us at the monitoring agencies who are willing to don the hat of sponge expert, so these animals will remain a struggle, at best.

### APRIL 06 MINUTES

Kelvin Barwick convened the meeting by passing out reprints of "Pacific Coast Nudibranchs. Supplement I. RADULA." He then gave a humorous and informative description of the San Diego Shell Club's annual auction/fund-raiser. It sounded like a good time was had by all and plenty of money was raised for the shell club's coffers. This money is used to support the publication of the "Festivus" as well as student grants.

With that it was time for Angel Valdez to give his talk entitled: "The Beauty within the Shell". The talk began with the interesting question: Which came first, shell loss or chemical defense? Angel looked at many animals and the revealed trend was even animals that retained a fairly robust shell, such as *Bulla gouldiana*, had chemical defenses. The theory, therefore, is that chemical defenses came first and shell loss, in some groups, is secondary.

### CRUSTACEA REQUEST

I would like to obtain 25-50 *Neotrypaea californiensis* from each of several locations in California for a population genetics project. In particular, I'm looking for shrimp from Orange Co. (1-2 sites), LA Co.(1-2 sites), Oxnard-Santa Barbara (1-2 sites), Morro Bay (1 site), Morro Bay-Monterey Bay (1-2 sites), Mendicino-Ft Bragg (1 site), Humboldt Bay (1 site), Arcata-Crescent City (1site). I am interested in learning of the locations of collecting sites in each of these areas, assistance in collecting the ghost shrimp, or leads to other people who might be able to help me.

Thanks for your help!

Ted DeWitt

US EPA Office of Research & Development, NHEERL Western Ecology Division



### Upcoming Meetings

**September 11** - Nucleulanidae Paul Valentich-Scott and Kelvin Barwick at SBMNH

**Sept 22nd** - Lumbrineridae Luis Carrera-Parra (ECOSUR, Mexico) and *Loimia* Mario Londono-Mesa (ECOSUR, Mexico) at LACM. Please bring specimens.

**October 16** - Aorids with Lisa Haney and Dean Pasko at CSD Lab

**November 16** - *Brisaster* and other heart urchins, Rich Mooi, CSD Lab.

**November 17** - Shrimp, Sammy DeGrave at LACM

**December** - No meeting scheduled (Holiday break)

**January 8 - 9** - Nemerteans, Jon Norenburg (NMNH) at LACM

**February 12** - Oedicerotids with Dean Pasko and Ron Velarde at CSD Lab

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### **SUPPLEMENT TO VOLUME 24**

Below you will find an extensive tome on the Gnathiid Isopods of the NEP by Lisa Haney (LACSD). Due to its thorough nature we decided to have it as a supplement to the SCAMIT NL Volume 24. Thanks to Lisa for putting such effort into sorting out the difficulties of Gnathiid Isopod taxonomy.

A note to the hard copy members - we always print the Newsletter in black and white (with the exception of the cover page) for financial considerations so many of Lisa's beautiful color images have lost some of their "oomph" in this printing. However, the images displaying the various eye colors need to be seen in color to be of any use and so they grace the cover of this newsletter. To see any of the other images in color go to the SCAMIT website and look in the Taxonomic Tools Section, or view the Newsletter on-line.

### **LITERATURE CITED**

Behrens, David W. 1991. Pacific Coast Nudibranchs. Supplement I. RADULA.



Please visit the SCAMIT Website at: [www.scamit.org](http://www.scamit.org)

### SCAMIT OFFICERS

If you need any other information concerning SCAMIT please feel free to contact any of the officers at their e-mail addresses:

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Back issues of the newsletter are available. Prices are as follows:

Volumes 1 - 4 (compilation).....	\$ 30.00
Volumes 5 - 7 (compilation).....	\$ 15.00
Volumes 8 - 15 .....	\$ 20.00/vol.

Single back issues are also available at cost.

The SCAMIT newsletter is published every two months and is distributed freely through the web site at [www.scamit.org](http://www.scamit.org). Membership is \$15 for the electronic copy available via the web site and \$30 to receive a printed copy via USPS. Institutional membership, which includes a mailed printed copy, is \$60. All new members receive a printed copy of the most current edition of "A Taxonomic Listing of Soft Bottom Macro- and Megainvertebrates ... in the Southern California Bight." The current edition, the fourth, contains 2,067 species with partial synonyms. All correspondences can be sent to the Secretary at the email address above or to:

SCAMIT

C/O The Natural History Museum, Invertebrate Zoology

attn: Leslie Harris

900 Exposition Boulevard

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## Pairing Northeast Pacific Gnathiid Isopods. Which Females go with what Males?

Lisa Haney, LACSD  
lhaney@lacsds.org

Ten genera and approximately 172 species of Gnathiid isopods are recognized worldwide. These animals are diversely distributed in marine habitats. Free-living adults are recorded from a wide range of benthic environments, whereas the juveniles are found either parasitizing teleost and elasmobranch fishes during the praniza stage or hiding in shells or worm tubes during the zuphea stage. Generally, the female and juvenile stages cannot be identified to species level. The majority of species descriptions for this family are based solely on the morphology of the male. Male gnathiids are somewhat ornate with specific characters that help distinguish them rather easily. Conversely, the identification of females and juveniles is difficult because they lack such obvious characters and share similar gross morphologies. Routinely, identifications of females and juveniles are left as “Gnathiidae sp.”. The identification of females and juveniles could potentially increase species abundance records, show greater overall species diversity, and provide important ecological information. This is especially true in regards to the parasitic juvenile stage (praniza). Gnathiids were recently determined to be one of the most abundant parasites on teleost fishes in southern California and we have yet to be able to identify this stage to the species level or understand their host specificity or lack thereof. This stage can devastate fishery catches and is also hypothesized to be a vector of a blood virus found in some teleost fishes. It is undetermined if specific gnathiid species are responsible for transmitting such diseases and whether or not they prefer to parasitize certain fishes over others or are purely opportunistic.

There are eight described, and at least four undescribed species of Gnathiidae (in two genera) collected from the northeast Pacific (NEP); California to Washington State. The two genera represented in the NEP are *Gnathia* and *Caecognathia*. All NEP species were initially described as *Gnathia*. However, Cohen and Poore (1994) reviewed the family and resurrected the genus *Caecognathia* listing *Caecognathia crenulatifrons* and *C. sanctaerucis* as the only two NEP representatives of this genus. Three of the four new species herein described are added to the genus *Caecognathia*. The boundaries of this genus have been revised as new character states are encountered. Svavarsson (1999) made

modifications to include species without eyes and an additional modification is proposed herein to remove the presence/absence of a dorsal sulcus as a viable character that separates the two genera.

Although there is strong evidence presented by Cohen and Poore (1994) to illustrate that *Gnathia* and *Caecognathia* are indeed distinct (sister) groups, the defining characters are attributable only to males. The two genera are likely valid, however the diagnostic characters used to distinguish males between the two genera are fairly subjective making it extremely difficult for most taxonomists to determine correct placement of encountered individuals. Performing a cladistic analysis on NEP species using characters that are more representative of all morphologies found in a single species, as well as choosing character states that are more definitive in nature, could be a useful exercise in clarifying the boundaries of these two genera. Currently a DELTA database is being constructed with a total of eighty characters for each NEP gnathiid species for that purpose, modeled after Cohen and Poore (1994). A re-diagnosis of *Caecognathia* and *Gnathia* cannot be written, however, until a more comprehensive study across many regions of the world is complete. This preliminary regional analysis, with new characters, may, however, be a good starting point in determining more definitive means of separating these genera.

It is unfortunate that specimens of all forms of each of the twelve NEP species have not been attainable for this current effort. Six species pairs have been reviewed and clear trends within the family are apparent. A suite of characters, when used in combination, are found to reliably identify females to species level and link them to associated males. Eye color and shape are consistent characters uniting sexes (as well as adults with juveniles). This character is most useful when material is fresh or recently preserved. Eye color, in some species, fades after just a few years in alcohol, though does not disappear entirely. In such cases, the pigment, although faded, remains after 30 years. In other species, the eye color is not affected by preservation at all. The morphology of the female frons is also a character useful for distinguishing species. Differences in frons morphology are subtle but consistent and are herein described. Unlike the situation for males, female frons morphologies are not unique to species, so this character must be used in combination with other defining characters to separate individuals accurately. Characters of the pleonal epimeres, pleopods, pleotelson, overall body setosity, and body pigmentation are also similar between males and females. In addition, males and females consistently have the same pleotelson shape in roughly the same proportions. Species with distinctly T-shaped pleotelsons have double pairs of laterally expanded pleonal epimeres. Taxa with distinctly triangular pleotelsons have single (dorsal) epimere pairs. Those with arrowhead shaped pleotelsons

have either single (dorsal) epimeres or double (dorsal & ventral) epimeres. These details of the epimeres are consistent between sexes. For example, a species in which the males possess subequal, non-expanded, single dorsal epimeres, has corresponding females that express the same configuration. If the epimeres are laterally expanded in the male, they also are in the female. If the epimeres of males become more laterally expanded towards the posterior, the same holds true in females. If the epimeres are double or only ventrally expanded in the male, the same configuration occurs in the associated female. Additionally, in all species observed, males and females have pleopods of the same shape (long and narrow, or short and paddle-shaped). These characters and others are presented in an accompanying character table, where the commonalities among sexes can be traced. With such high fidelity between males and females in abdominal and pleotelson features, it is anticipated that these characters will be useful in making future links among other species. Further work is needed to find independent juvenile characters allowing linkage to adults in all species.

Although there is still a lack of female material for some NEP species, it is possible to predict what to expect based on the trends described above. In an attempt to provide useful information, the unknown females are herein tentatively described based on predicted character states and serve as hypotheses to be tested. The reliability of these predictions for hypothesized females will be tested by continued examination of material in museums and by others who may have collected specimens. As mentioned previously, agencies and researchers have not attempted to identify females to species because of the difficulty described above. Females and juveniles in a majority of cases remain as an unidentified residue; "Gnathiidae sp." or "unidentified gnathiid". There is still much of this material that is unevaluated and can now be reexamined, and potentially identified, using the characters described herein. For all NEP species, representative males were available, examined, and described. In addition, character tables and keys for male and female gnathiid NEP species are included.

A DELTA database, once complete, will be posted on the SCAMIT webpage ([www.scamit.org](http://www.scamit.org)) and will serve as an online key to species of the Northeast Pacific. To utilize the key, the user must first download IntKey software to access DELTA programs. This can be downloaded free of charge from [www.crustacea.net](http://www.crustacea.net). All known NEP species have been photographed and are available on the SCAMIT webpage under taxonomic tools. Pictures are compiled by individual species, female groups, juvenile groups, and male groups so that comparisons can be readily made. Species of NEP gnathiids, both described and provisional, are presented below along with current diagnoses of the two genera. By next year I hope to suggest more definitive diagnoses for *Gnathia* and *Caecognathia*.

**Caecognathia** Dollfus, 1901

*Caecognathia* Dollfus, 1901: 240. Tattersall, 1906: 61.

*Gnathia* (*Perignathia*) Monod, 1922: 645 (type species: *Anceus abyssorum* Sars, 1872 or *Gnathia fallax* Monod, 1926. See Remarks under *Gnathia*).

*Heterognathia* Amar and Roman, 1974: 569 (type species: *Heterognathia adeliensis* Amar and Roman, 1974).

Not *Gnathia* (*Perignathia*). Monod, 1926: 554-555

**Type species:** *Anceus stygius* Sars, 1877 (original designation).

**Diagnosis:** Eyes present or absent. Frontal margin of cephalon (frons) produced, without frontal processes. Mandibles with smooth or crenulate mandibular blade. Cephalon with or without pericocular ornamentation or dorsal sulcus. Pereonite 1 immersed in cephalon. Pylopod 2- or 3-articled, operculate, article 1 enlarged, article 3 small or absent.

**Remarks:** The genus *Caecognathia* is stated to differ from *Gnathia* in the morphology of the male frons, which in *Caecognathia* is variably expanded, but has no processes along the frontal border, expressing a smooth or crenulate anterior margin. This particular character is highly subjective in nature and is difficult for most taxonomists to use. It was also found that three of the four NEP species, designated to this genus, possess a dorsal sulcus suggesting that this character is also not diagnostic in use. Without these two characters there is no definitive way to separate the two genera from one another. New characters must be found to maintain the validity of *Caecognathia* and *Gnathia* as separate genera. Svavarsson (1999) emended Cohen and Poore's 1994 diagnosis of *Caecognathia* to accommodate species lacking eyes; pointing out that *C. stygius*, the type, does not have eyes.

**Local Species:** *Caecognathia crenulatifrons* (Menzies and Barnard, 1959); *C. sanctaerucis* (Schultz, 1972) [= *Gnathia hirsuta* Schultz, 1966 not G. O. Sars, 1870], *C. sp A* (Haney, 2005§), *C. sp CSI* (Cadien and Haney, 2004§), *C. sp SDI* (Haney and Stebbins, 2006§)

**Caecognathia crenulatifrons**

**Mature Adult Males and Females:** Overall size of mature adults 3.5 mm – 4.75 mm. Obvious brown mottling pigment present on dorsal surface from head to pleotelson, most prominent on the pleon. Body setosity very light, a few setae along the edges of head and pereon. Mandibles in males with a very weak outer tooth and without central articulation; mandibular blade microcrenulate. Eyes sessile, dark brown in live specimens, color fades in preservation; eyes oblong in shape and flattened, not three-dimensional, and without tuberculations on the male lens; no noticeable supraocular ornamentation. Dorsal sulcus present on male anterior cephalon; sensory pit absent. Cephalon with minor tuberculation and no posterior median carina. Male frons extended, transverse, with micro-crenulations along margin; female frons greatly extended, narrowing apically, with rounded tip. Male pleopods without setae; female pleopods with few fine setae; male and female pleopods paddle-like in shape. Epimeres single, dorsal only, laterally expanded, subequal in size while widely tapering. Pleotelson length distinctly greater than pleotelson width at base; pleotelson wide and distinctly triangular in shape.

**Zuphea/Praniza Notes:** Both juvenile forms have the same color of eyes as the adults, however, the structure of the eye is much larger and bulging in appearance. Juveniles also possess the same body pigmentation found in mature adults. The epimeres have the same configuration as the adults but are not as laterally extended. The pleopods are the same shape but have long sweeping plumose setae. The pleotelson also matches the adults in ratio and overall shape, but is smaller. Juveniles possess most of the characters listed above for the adults; they are, however, slightly less developed. Total body lengths range in size and depend on instar.

**Live/Recently Preserved Species Comparison Notes:** Eye morphology and color, in combination with body pigmentation, epimere configuration, and pleotelson length, width, and shape distinguish this species from others. Males are easily identified by the slightly produced, crenulate, transverse frons, the dark brown oval eyes, and the length-width ratio of the triangular pleotelson. Females and juveniles of this species have the male eye shape and color, as well as the body pigmentation, epimere configuration and triangular pleotelson.

Females and juveniles of this species might be confused with a few other species. They are similar to *Gnathia steveni*, in having brown eyes and a triangular pleotelson. However, adult *G. steveni* are small (2.2 mm), and adult *C. crenulatifrons* females are much larger (3.5 – 4.75 mm) and differ in the length-width ratios of the pleotelson. *C. crenulatifrons* has laterally expanded epimeres, unlike those hypothesized for *G. steveni* females. *G. steveni* females are also expected to have a short pleotelson like their male counterparts, where the base of the pleotelson is wider than the pleotelson is long. This is not the case for *C. crenulatifrons* females, which have a long pleotelson (pleotelson length is distinctly greater than width at base).

Other similar species to female *C. crenulatifrons* are *C. sp. A* and *G. tridens*. (Males are easily differentiated based on frons structure alone.) Females of *C. sp. A* are predicted to have brown mottling much like *C. crenulatifrons*. *C. crenulatifrons* has a wide triangular pleotelson while that of *C. sp. A* is thought to be narrow, as in the male. Males and females of *G. tridens* lack body pigmentation, unlike *C. crenulatifrons*. *G. tridens* also has a medium pleotelson (pleotelson base as wide as pleotelson length) whereas *C. crenulatifrons* has a long pleotelson (pleotelson length distinctly greater than width at base).

**Long Preserved Species Comparison Notes:** Eye color in fresh material of *C. crenulatifrons* is dark brown. However, depending on how the animal was preserved, color can fade in 6-12 months. Although the pigment fades, it does not completely disappear, and depending on the length of time in alcohol the eyes may be reddish brown to golden in color. The pigment also constricts and in such instances looks very similar to *G. productatridens*. Eye shape, male and female frons shape, epimere configuration, and pleotelson characters make males and females of *C. crenulatifrons* easy to identify despite fading eye color over time.

### **Caecognathia sp. A**

**Mature Adult Males:** Overall size of mature benthic male adult 2.6 mm based on one known specimen. No females as yet encountered. Obvious brown mottling pigment present on dorsal surface of animal from head to pleotelson, most prominent on the pleon. Body setosity high but not hirsute. Mandibles in males with strong, distinct, outer tooth and with single articulation at mid-line (only known species to have this feature); mandibular blade crenulate. Eyes sessile, reddish brown when preserved, live coloration unknown; eyes round, convex and without tuberculations on the male lens; supraocular ornamentation present, with several grouped tubercles forming a ridge above the eye. Dorsal sulcus present on male anterior cephalon; sensory pit absent. No noticeable tuberculation on the cephalon and no posterior median dorsal carina. Male frons extended; two lateral narrow lobes with a large extended spatulate lobe centrally; the central lobe has minor crenulations and setal groups. Male pleopods setose and paddle-like in shape. Epimeres single, dorsal only, laterally expanded, subequal in size while widely tapering. Pleotelson length is subequal to pleotelson width at base; pleotelson narrow and distinctly triangular in shape.

**Predicted Females:** Based on trends observed in this family, it is expected that female's will have similar character configurations as seen in male's, which include the following: Brown mottling pigment across the body, concentrated on the abdomen. Eyes reddish-brown when preserved. Frons shape unknown and not possible to predict. Female pleopods thought to be lightly setose and paddle-like in shape. Epimeres likely to be single, dorsal only, laterally projected, sub equal in size while widely tapering. Pleotelson length expected to be subequal to pleotelson width at base; pleotelson likely narrow, as seen in the male, and predicted to be distinctly triangular in shape.

**Zuphea/Praniza Notes:** Juvenile stages are yet to be examined.

**Live/Recently Preserved Species Comparison Notes:** Not able to comment on live or recently preserved material.

**Long Preserved Species Comparison Notes:** The male of this species is highly distinguishable from all of the of the NEP species. This is the only species in the region that possesses a mandible composed of two distinct articles, others have a single non-articulated mandible. The articulation occurs at the mid-line and appears to be socketed, possibly allowing the tips of the mandibles to move toward the center. The mandible shape is unique as well, in being very "showy". It is long, but wide in the central part with a large incisor and very large curvy inner lobe. The apices of the mandible are long and slender, while the blade is crenulate. The other notable feature is the produced frons. Instead of being transversely produced as in *C. crenulatifrons*, the frons is made up of three widely spaced projections. The central part of the frons is spatulate in form extending forward, making it look like a *Rhepoxynius* rostrum. This structure is depressed in the middle with the sides raised and the frontal tip crenulate with many setae. The two widely spaced lateral projections extending forward are found on either side of the central structure. For these reasons alone, it would be rather difficult to confuse the male of this species with another. This single male was found among *G. tridens* lots from the LA Natural History Museum. Females and larvae, if present in the collections, have not been located.

Based on the predicted condition of the female, one might be able to discern it from other female species by the combination of the following characters: eye color, brown mottling pattern, single, dorsal epimeres that are laterally extended, pleotelson long and narrow; and a pleotelson that is distinctly triangular in shape. Females might be most confused with *C. crenulatifrons* females who also have a brown mottling pattern. But again, there should be representative differences between the overall shape of the triangular pleotelson (whether it is long and wide versus long and narrow) and eye color. Until we come across female specimens of *C. sp. A*, this is the best advice I can offer to discern the two species.

The single male specimen described above was collected in 1984. After twenty years of preservation the eyes are reddish brown. Eye color when fresh was not recorded. We expect the female of this species might be confused with preserved specimens of *C. crenulatifrons* and/or *G. tridens*, which also have brown/reddish eyes and triangular pleotelsons. As discussed earlier it is suspected that female *C. crenulatifrons* and *C. sp A* would differ in eye color and the width of the pleotelson. The lack of brown mottling pigment and the length of the pleotelson would likely be characters that could distinguish *C. sp. A* from *G. tridens*.

The single individual was collected from a rock by submarine during the MMS Santa Maria Basin Reconnaissance program. The station is located off Pt. Conception in the Western Santa Barbara Channel at a depth of 110-126 m.

### Caecognathia SD1

**Mature Adult Males and Females:** Overall size of mature benthic adults 2.76 mm – 3.36 mm. No pigmentation present. Body hirsute. Mandibles in males lacking outer tooth and without central articulation; mandibular blade microcrenulate. Eyes sessile, golden/amber in live and preserved material; eyes oblong, convex and without tuberculations on the male lens; supraocular ornamentation present, long, pointed, with several grouped tubercles forming a ridge above the eye. Slight dorsal sulcus present on male anterior cephalon; sensory pit absent. Male cephalon with large distinct tubercles and posterior median carina present. Male frons slightly extended as a broadly rounded structure with a medial carina and small knob at the central apex; female frons extended greatly into broadly rounded, slightly tapering, but medially cleft structure. Male pleopods aetose; female pleopods with few fine setae; male and female pleopods paddle-like in shape. Epimeres single, dorsal only, laterally expanded, subequal in size while widely tapering. Pleotelson length is distinctly greater than pleotelson width at base; pleotelson narrow and arrowhead-shaped, not distinctly triangular or T-shaped.

**Zuphea/Praniza Notes:** Juvenile stages are yet to be examined.

**Live/Recently Preserved Species Comparison Notes:** The golden/amber eye color of both the male and female is striking all by itself but in combination with the pleotelson shape, should be fairly diagnostic. It seems unlikely to confuse this species with any of the others. There are only three species with arrowhead-shaped pleotelsons in the NEP, and of those, *C. SD1* is the only one with single dorsal epimeres and golden/amber eyes. There are a couple of species that lack pigmented eyes and may appear golden with under lighting from a microscope, but the arrowhead-shaped pleotelson of *C. SD1*, should again, be a clear give away for either sex.

Males have a characteristic rounded frons with a medially carinate knob at the tip and this structure is unlike any of the other species currently recognized.

Females may initially be confused with specimens of *G. trilobata* because they both have golden/amber colored eyes. *G. trilobata* has a distinctive pattern of double epimeres though. The only other species with an arrowhead-shaped pleotelson and single dorsal epimeres that are laterally expanded, is *G. productatridens*. This species has the unique red and white checkerboard eye color that does not fade even after years of preservation and should be a key marker in distinguishing between the females of the two species.

**Long Preserved Species Comparison Notes:** Preservation did not seem to affect identification of males or females and even after years in alcohol the golden/amber eye color seemed to remain the same.

This species is currently recognized only from samples collected by the City of San Diego as part of their ongoing monitoring program. Specimens examined were collected from various stations and ranged from 116 m – 153 m in depth. For more specific ecological information, please contact Dr. Tim Stebbins from the City of San Diego.

### **Caecognathia sanctaecrucis**

**Mature Adult Males and Females:** Overall size of mature benthic adults 4.4 mm– 4.6 mm. Obvious black pigment dots present on dorsal surface of animal from head to pleotelson, particularly noticeable on the cephalon, pereonites 1 & 2 as well as on the pereon. Body hirsute. Mandibles in males lacking outer tooth and without central articulation; mandibular blade microcrenulate. Eyes sessile, dark brown in live material; color fades with preservation; eyes round and convex, with noticeable three-dimensional tuberculation on the male eye lens; supraocular ornamentation present, long, pointed, with several grouped tubercles forming a ridge above the eye. Dorsal sulcus absent; sensory pit absent. Cephalon with tuberculation and no posterior median carina. Male frons extended as distinctly triangular lobe with slightly rounded edges and no processes; female frons extended, wide, non-tapering and tri-lobed. Male pleopods aetose; female pleopods with few fine setae; male and female pleopods paddle-like in shape. Epimeres double (dorsal & ventral), both laterally expanded; male dorsal epimeres slightly bi-fid, tapering to spines; female dorsal epimeres broad and serrate with last set tapering to a spine; ventral epimeres larger and tapering to points in both sexes; ventral and dorsal epimeres

becoming more pronounced posteriorly in both sexes. Pleotelson length subequal to pleotelson width at base; pleotelson narrow and distinctly T-shaped.

**Zuphea/Praniza Notes:** Juvenile stages are yet to be examined.

**Live/Recently Preserved Species Comparison Notes:** This is the only species in the NEP that has brown eyes in combination with the distinct T-shaped pleotelson. This holds true for both males and females and makes them easily distinguishable. *C. sanctaecrucis* also has a characteristic color pattern of small black pepper spots evenly distributed over the entire body. This color pattern is seen in both sexes, and in combination with the brown eye color, immediately identifies specimens as *C. sanctaecrucis*.

Males of *C. sanctaecrucis* are characteristically hirsute. Males may be grossly similar to *C. sp CSI* and also *G. clementensis*, in being hirsute with distinctly T-shaped pleotelsons, however, both of those species have unpigmented eyes.

Females, though not hirsute, have more setae on the body than other gnathiid female species. Also, the black pigment spots in combination with eye color and pleotelson shape, will help distinguish females of this species from all others.

**Long Preserved Species Comparison Notes:** Although eye pigment in fresh specimens is dark brown, it fades in preserved material. *C. sp CSI* and *G. clementensis* are the most likely species to be confused for preserved individuals of *C. sanctaecrucis*. Individuals of *C. sp CSI* are similar in epimeral spination and tubercles on the male eye lens, but, they lack the tiny black spots found over the entire body (apparent in *C. sanctaecrucis*). Pigmentation also separates members of *C. sanctaecrucis* from *G. clementensis* as do shape and setosity of the pleopods and lack of eye tuberculation in males. Additionally, the shape of the frons in the male is distinctive, should pigment patterns and eye color fade over time.

In females that have been preserved for many years, there may be the potential for body pigmentation and eye color to fade away. I have not seen this to occur in specimens that I have examined, however, the potential may exist. Other characters that will distinguish females of *C. sanctaecrucis* from other females are: the tri-lobed shape of the female frons, the dimensions of the pleotelson (medium and narrow versus any other combination), and body setosity. Females of this species also seem to be significantly wider in the body than many other females.

**Caecognathia sp CS1**

**Mature Adult Males and Females:** Overall size of mature benthic adults 4.1 mm – 5.0 mm. No pigment pattern present. Body hirsute. Mandibles in males lacking outer tooth and without central articulation; mandibular blade smooth. Eyes sessile, without pigment in preserved material; live coloration unknown; eyes round and convex, with noticeable three-dimensional tuberculation on the male eye lens; supraocular ornamentation present, long, pointed, with several grouped tubercles forming a ridge above the eye. Slight dorsal sulcus on male anterior cephalon; sensory pit present. Cephalon with tuberculation and no posterior median carina. Male frons extending medially as small rounded lobe with no processes; female frons slightly extended, wide, not tapering and tri-lobed. Male pleopods asetose; female pleopods with few fine setae; male and female pleopods paddle-like in shape. Epimeres double (dorsal & ventral), both laterally expanded; male dorsal epimeres slightly bi-fid, tapering to spines; female dorsal epimeres broad and serrate with last set tapering to a spine; ventral epimeres larger and tapering to points in both sexes; epimeres becoming more pronounced posteriorly in both sexes. Pleotelson length is distinctly greater than pleotelson width at base; pleotelson narrow and distinctly T-shaped.

**Zuphea/Praniza Notes:** Both juvenile forms have the same color of eyes as seen in the adults, however, they are much larger and bulging in appearance. They also lack any body pigmentation, which is also the case in both adult forms. In addition, they have the same double epimere configuration as the female adults, but are not as laterally extended or developed. The ventral epimeres are slightly tucked in and sometimes difficult to see but are developed and present. The individual must be turned on its side in the presence of under lighting to make out this second set of epimeres. The juvenile epimeres become larger more posteriorly, just like the adults, and as seen in the female, the last dorsal epimere tapers to a spine. This configuration is seen even at molt stage one in both the zuphea and praniza. The pleopods are the same shape but have long sweeping plumose setae. The pleotelson also matches the adults in ratios and overall shape except for one modification. Both juvenile forms of *C. sp CS1* have pleotelsons that are strongly bifid distally that separate them from other juveniles described in the NEP to date. Overall they possess most of the characters listed above for the adults, but express them as slightly less developed. Total body lengths range in size and are dependant on molt cycle.

**Live/Recently Preserved Species Comparison Notes:** Males of this species are discernable from all other *Caecognathia* in the region by the combination of eye color, presence of tuberculation on the male lens cover, and characters relating to the epimeres and pleotelson. Unpigmented eyes are found on both genders and all life-stages of this species. There is only one other species in the Northeastern Pacific that has unpigmented eyes (*G. clementensis*), but males of those species lack eye tuberculation. *C. sp CS1* males are also distinctive from *G. clementensis* males due to the presence of a produced frons.

It is believed that females of *G. clementensis* and *C. sp CSI* can be distinguished by pleonite characters. Pleopods in *G. clementensis* are likely to be long and narrow, whereas *C. sp CSI* has lightly setose paddle shaped pleopods. The dorsal epimeres in *C. sp CSI* are all slightly bifid, whereas we would expect at most the last dorsal epimere in *G. clementensis* to be bifid (the condition seen in the male).

**Long Preserved Species Comparison Notes:** In overall morphology and setosity, *C. sp CSI* is most like preserved specimens of *C. sanctaerucis*. However, male *C. sp CSI* have a distinctive frons morphology in having a small rounded central lobe and lacking any body pigmentation what so ever.

Preserved females are likely to be confused with preserved *C. sanctaerucis* in that they share almost all the same characters. *C. CSI*, however, does not have pronounced setae on the cephalon or pereon nor the body pigmentation seen in *C. sanctaerucis*. The female frons in *C. CSI* is also expanded forward slightly less than what has been seen for females of *C. sanctaerucis*. Females of *C. CSI* may also be mistaken for *G. clementensis*. As mentioned above, it is predicted that pleopod shape may be able to help distinguish these two species. Although, *G. clementensis* individuals do overlap in size with *C. CSI*, most have been recorded as unusually large in size (greater than 5.5 mm). This size discrepancy may also be a helpful character when trying to make an identification.

*Caecognathia sp CSI* was found in epibenthic sled samples from bathyal waters off Oregon. Nearly all the specimens came from a sample at 732 m, which supported a diverse assemblage dominated by crustaceans and ophiuroids. Only scattered bits of hard substrate were found there, and this species is clearly not restricted to rocks or reefs. A few specimens were taken as deep as 1372 m, making this a denison of the mid- to lower slope. Adult males, adult females, and juveniles of all three growth cycles are available (see Cadien and Haney 2004).

**Gnathia Leach, 1804**

*Gnathia* Leach, 1814: 386, 402. ---Monod, 1926: 326-329 (part).

*Anceus* Risso, 1816: 8 (type species: *Anceus forficularius* Risso, 1816).

*Praniza* Latreille, 1817: 54 (type species: *Oniscus marinus* Slabber, 1778).

*Zuphea* Risso, 1826: 104 (type species: *Zuphea sparicola* Risso, 1826).

*Gnathia* (*Gnathia*) s.s. --- Monod, 1926: 329 (part).

*Gnathia* (*Perignathia*). --- Monod, 1926: 554-555 (not *Perignathia* Monod, 1922).

**Type species.** *Gnathia termitoides* Leach, 1814 (= *Cancer maxillaris* Montagu, 1804) (monotypy)

**Diagnosis:** Eyes usually present. Frontal margin of cephalon (frons) generally transverse, with frontal processes. Mandibles usually with dentate mandibular blade and mandibular incisor. Cephalon may possess periorcular ornamentation and/or a dorsal sulcus. Pereonite 1 immersed in cephalon. Pylopod 2- or 3-articled; operculate, article 1 enlarged, generally with dense external margin of plumose setae; article 3 small or absent.

**Taxonomic Remarks:** The genera *Anceus*, *Praniza*, and *Zuphea*, are all based on European gnathiid juvenile stages whose specific identities are impossible to confirm (Monod 1926). They have therefore traditionally been treated as junior synonyms of *Gnathia*. For a more detailed discussion on the history of the genus *Gnathia*, consult Cohen and Poore (1994)

Although, species within the genus *Gnathia* are characterized as having dentate mandibles, we found that most of the NEP species were actually not distinctly dentate. Only two out of the seven species that are currently recognized from our region exhibited distinctly dentate blades (*G. sp* MBC 1 and *G. steveni*). Clearly the diagnoses for *Caecognathia* and *Gnathia* do not work well. For further discussion on how to differentiate between *Gnathia* and *Caecognathia*, please review the remarks under *Caecognathia*.

**Local species:** *clementensis* Schultz 1966, *coronadoensis* Schultz 1966, *productatridens* Menzies and J. L. Barnard 1959, *steveni* Menzies and J. L. Barnard 1959, *tridens* Menzies and J. L. Barnard 1959, *trilobata* Schultz 1966, *sp MBC1* Haney 2005§

**Gnathia sp MBC1**

**Mature Adult Males:** Overall size of mature benthic adult male very small (2.2 mm). No body pigmentation present. Body setosity light, small setae along the edges of head and pereon. Mandibles in male with strong distinct outer tooth and without central articulation; mandibular blade dentate. Eyes sessile; reddish brown once preserved, live coloration unknown; eyes round, convex, and without tuberculation on the male lens; supraocular ornamentation present, long, pointed, with several grouped tubercles forming a ridge above the eye. Slight dorsal sulcus present on anterior cephalon; sensory pit absent. Cephalon without tuberculation, smooth, with obvious setal tuft groupings with posterior median carina present. Male frons not extended; one three-dimensional cubed process located centrally with two large setae extending from it centrally. Male pleopods setose and paddle-like in shape. Epimeres single, dorsal only, not laterally expanded and difficult to see, all subequal in size. Pleotelson length is shorter than pleotelson width at base; pleotelson is wide and distinctly triangular in shape.

**Predicted Female:** Based on trends observed in this family, it is expected that the female's will have similar character configurations as seen in male's, which include the following: No body pigmentation. Eyes reddish brown when preserved. Frons shape is unknown and not possible to predict. Female pleopods thought to be lightly setose and paddle-like in shape. Epimeres likely to be single, dorsal only, not laterally expanded, subequal in size and difficult to see. Pleotelson length expected to be shorter than pleotelson width at base; pleotelson likely wide, as seen in the male, and predicted to be distinctly triangular in shape.

**Zuphea/Praniza Notes:** Both juvenile forms have the same color of eyes as seen in the adults, however they are much larger and bulging in appearance. They also have no body pigmentation, just like the adults. The epimeres are also like the adults in that they are single, dorsal, not laterally expanded, and barely visible. The pleopods are the same shape but have long sweeping plumose setae. The pleotelson also matches the adults in ratios and overall shape, but is smaller. Overall they possess most of the characters listed above for the adults, but express them as slightly less developed. Total body lengths range in size and are dependant on molt cycle.

**Live/Recently Preserved Species Comparison Notes:** Not able to comment on live or recently preserved material.

**Long Preserved Species Comparison Notes:** Two other species in the NEP have reddish brown eye color, *Caecognathia sp. A* and *Gnathia tridens*. In either case, *G. MBC1* can be distinguished based on epimere characters alone. Of the three, *G. MBC1* is the only one with single dorsal epimeres that are not laterally expanded.

*G. MBC1* is most similar morphologically to *G. steveni*, with which it was confused. This species is small (mature adult male roughly 2.2 mm) like *steveni*, and has the same pereonite and telsonic characters. The material comes from MBC collections and includes several males, a zuphea and a praniza. The eyes are a reddish brown color after nearly 30 years of preservation. Characters that differentiate this new species from *G. steveni* are: male frons distinctly bifid, lacking the characteristic notched triangular process found in *G. steveni*; lack of body pigmentation; stronger supraocular ornamentation; and lack of cephalic tuberculation.

I hypothesize that, like other species in the region, the female will have similar pereonite and telsonic characters to the male. *G. sp MBC1* females should be readily identified by: small body; only dorsal epimeres present (not laterally expanded); pleopods lightly setose and paddle-shaped; pleotelson short, wide, and distinctly triangular. Female *G. sp MBC1* are predicted to differ from female *G. steveni* by lack of body pigmentation, and by eye color.

*Gnathia sp MBC1*, was originally identified as *Gnathia steveni*, and with good reason, it is very similar. There were several males, one zuphea, and one praniza in the lot, but unfortunately no females. The specimens were collected from Pequetot's Reef, Corona del Mar on 22 June 1979 in 35 feet of water from a white sponge. This reef supported few macroalgae, but was heavily overgrown with a dense invertebrate turf of mixed ectoprocts, sponges, ascidians, attached mollusks, and cnidarians.

### **Gnathia steveni**

**Mature Adult Males:** Overall size of mature benthic adults very small (1.2 mm - 2.2 mm). Obvious brown mottling pigment present on dorsal surface of animal, most prominent on last three pereon segments. Body setosity light, small setae along the edges of head and pereon. Mandibles with strong distinct outer tooth and without central articulation; mandibular blade dentate. Eyes sessile, dark brown in live and preserved material; color does not seem to fade with time; eyes round, convex, and without tuberculation on the male lens; slight supraocular ornamentation present. Slight dorsal sulcus present on anterior cephalon; sensory pit absent. Cephalon with numerous tuberculation and setae with posterior median carina present. Male frons not extended; three central processes, the middle process is distinctly triangular with step-wise undulations on the side margins. Male pleopods setose and paddle-like in shape. Epimeres single, dorsal only, not laterally expanded and difficult to see, all subequal in size. Pleotelson length is shorter than pleotelson width at base; pleotelson is wide and distinctly triangular in shape.

**Predicted Female:** Based on trends observed in this family, it is expected that the female's will have similar character configurations as seen in male's, which include the following: Obvious brown mottling pigment present on the dorsal surface. Eyes dark brown in preserved and live material. Frons shape is unknown and not possible to predict. Female pleopods thought to be lightly setose and paddle-like in shape. Epimeres likely single, dorsal only, not laterally projected, subequal in size and difficult to see. Pleotelson length expected to be shorter than pleotelson width at base; pleotelson likely wide, as seen in the male, and predicted to be distinctly triangular in shape.

**Zuphea/Praniza Notes:** Both juvenile forms have the same color of eyes as seen in the adults, however they are much larger and bulging in appearance. They also have the same characteristic body pigmentation, just like the adults. The epimeres are also like the adults in that they are single, dorsal, not laterally expanded, and barely visible. The pleopods are the same shape but have long sweeping plumose setae. The pleotelson also matches the adults in ratios and overall shape, but is smaller. Overall they possess most of the characters listed above for the adults, but express them as slightly less developed. Total body lengths range in size and are dependant on molt cycle. The published description of a juvenile by Menzies was instrumental in helping to link this life-stage to the mature adult. Menzies describes the frontal border of the praniza as truncated and provides a good illustration. The pranizas found with San Diego's material of *G. steveni* exactly matched this description. The truncated border of the praniza is unique among known NEP species.

**Live/Recently Preserved Species Comparison Notes:** Although live material has not been examined, it is expected that the eye color would be dark brown as seen in recently preserved material and material that has been preserved for thirty years. Two other species in the NEP have dark brown eye color, *Caecognathia crenulatifrons* and *Caecognathia sanctaerucis*. Of the three, *G. steveni* is the only one with single dorsal epimeres that are not laterally expanded.

Females of *G. steveni* are expected to have brown mottling patterns across the body, especially on the pereonites and in recently preserved or live material have very dark eyes. These characters should help separate them from the hypothesized females of *G. sp MBC1*.

**Long Preserved Species Comparison Notes:** The original description for *G. steveni* by Menzies was short but provided key pieces of information. A more complete description is needed as many features were left undescribed. I am working on generating a more complete description through coding of characters with the use of DELTA software. The original description of the frons was relatively complete and allowed recognition of the species in examined material. "Frons produced into a small acute triangular process bearing stout long setae marginally and minute marginal denticles." Under the microscope specimens look exactly as described. The original description lacked details on texture of the cephalon. Menzies mentions that the body itself is

scarcely tuberculate and sparsely setose, which is true. This is not the case with the cephalon. There are distinct setae placement patterns on the head and the entire cephalon is covered with tubercles. This is a key character in distinguishing males of *G. steveni* from males of *G. sp MBCI* as it is a much easier character to see than the frons.

The holotype for this species was deposited in 1962 and after being preserved forty-four years, the specimen still retained dark eye pigment and noticeable body pigmentation. Additional specimens that were examined had been preserved 4-6 years and also had very strong body pigmentation and eye color, with no signs of fading. This would lead me to believe that these characters, in this species, may be stable and reliable. Currently the only way to distinguish *G. steveni* from *G. MBCI* is through the difference in body pigmentation and eye color. Although females of both species have not yet been encountered, we can predict that they will have the same character states as the male in these instances and these characters will be just as useful in separating females as they are in separating the males. For some species the shape of the female frons has been helpful in separating out closely related species. Perhaps the females of these two species will have morphological distinctions related to the frontal margin.

### **Gnathia tridens**

**Mature Adult Males and Females:** Overall size of mature benthic adults relatively small (2.35 mm – 3.35 mm). No body pigmentation present. Body setosity high but not hirsute. Mandibles in males with outer tooth present and without central articulation; mandibular blade crenulate. Eyes sessile, reddish brown in preserved material; live or recently preserved condition unknown; eyes are circular and flat, not three dimensional, and without tuberculation on the male lens; no noticeable supraocular ornamentation. Slight dorsal sulcus on male anterior cephalon; sensory pit absent. Cephalon lacking setae and tuberculation and no posterior median carina present. Male frons not extended; three central subequal processes; female frons extended, narrowing with rounded apex. Male pleopods setose; female pleopods with few fine setae; male and female pleopods paddle-like in shape. Epimeres single, dorsal only, laterally expanded, becoming slightly more pronounced posteriorly. Pleotelson length shorter than pleotelson width at base; pleotelson wide and distinctly triangular in shape.

**Zuphea/Praniza Notes:** Both juvenile forms have the same color of eyes as seen in the adults, however they are much larger and bulging in appearance. They have no body pigmentation, just like the adults. The epimeres are also like the adults in that they are single, dorsal, and laterally expanded. The pleopods are the same shape but have long sweeping plumose setae. The pleotelson also matches the adults in ratios and overall shape, but is

smaller. Overall they possess most of the characters listed above for the adults, but express them as slightly less developed. Total body lengths range in size and are dependant on molt cycle.

**Live/Recently Preserved Species Comparison Notes:** Not able to comment on live or recently preserved material.

**Long Preserved Species Comparison Notes:** *G. tridens* is most similar to *C. sp. A*. Males of both species have setose pleopods, bodies that are setose but not hirsute, reddish-brown eyes when preserved, and the presence of a strong incisor. The one character that helps separate *G. tridens* from other species, is the dimensions of the pleotelson. Pleotelson basal width and length are subequal. Many of the other species with triangular pleotelsons have either long or short pleotelson dimensions rather than sub equal width/length pleotelson measurements. An additional character that separates male *G. tridens* from *C. sp. A* is the presence of a non-produced frons with three subequal processes and a non-articulated mandible (articulated in *C. sp. A*). Males can also be separated from *C. sp. A* by lack of body pigmentation.

Females of *G. tridens* are also likely to resemble *C. sp. A*. As in the male, the lack of body pigmentation and dimensions of the pleotelson (short and wide in *G. tridens* versus medium and narrow in *C. sp. A*) should prove useful in separating the two similar species.

### **Gnathia coronadoensis**

**Mature Adult Males:** Overall size of mature benthic male adults 2.45 mm – 3.5 mm. No females as yet encountered. No body pigmentation present. Body lacking setae. Mandibles lacking distinct outer tooth and without central articulation; mandibular blade crenulate. Eyes lacking (only NEP species to have this character); no supraocular ornamentation present. Dorsal sulcus present on anterior cephalon; sensory pit present. No noticeable tuberculations on the cephalon and no posterior median dorsal carina. Male frons not extended; three central processes; lateral processes greater than middle process. Male pleopods setose and paddle-like in shape. Epimeres single, dorsal only, laterally expanded, subequal in size while widely tapering. Pleotelson length greater than pleotelson width at base; pleotelson wide and distinctly triangular in shape.

**Predicted Females:** Based on trends observed in this family, it is expected that female's will have similar character configurations as seen in male's, which include the following: No body pigmentation. Eyes absent. Frons shape is unknown and not possible to predict. Female pleopods thought to be setose and paddle-like in

shape. Epimeres likely single, dorsal only, laterally projected, and subequal in size. Pleotelson length expected to be greater than pleotelson width at base; pleotelson likely wide as seen in the male and predicted to be distinctly triangular in shape.

**Zuphea/Praniza Notes:** Juvenile stages are yet to be examined.

**Live/Recently Preserved Species Comparison Notes:** Not able to comment on live or recently preserved material.

**Long Preserved Species Comparison Notes:** *G. coronadoensis* is one of four species that have a sensory pit present on the cephalon in male specimens. It is the only one of the four though, that lacks setae on the body. The others are either setose, but not hirsute, or hirsute. In general, *G. coronadoensis* would be difficult to confuse with any other NEP species due to its lack of eyes.

Though a female was not encountered in any of the samples, it is expected that the female would lack eyes as well. Females are expected to be void of body pigmentation, have single, dorsal, laterally expanded epimeres, and a distinctly triangular pleotelson (as seen in the males). *G. coronadoensis* is also typically a deep-water animal, taken from 344 m – 812 m. Location and ecology in combination with the afore mentioned suite of characters should help distinguish this species from others.

### **Gnathia clementensis**

**Mature Adult Males:** Overall size of mature benthic male adults large (4.6mm – 8.5 mm). No females as yet encountered. No body pigmentation present. Body hirsute. Mandibles lacking distinct outer tooth and without central articulation; mandibular blade crenulate. Eyes peduncular (only NEP species known to have this character); eyes without pigment in preserved material, live or recently preserved condition unknown; eyes round, convex and without tuberculations on the male lens; supraocular ornamentation present, with several grouped tubercles forming a ridge above the eye. Dorsal sulcus present on anterior cephalon; sensory pit present. Cephalon with tuberculations and setae and no posterior median dorsal carina. Male frons not extended; with many processes; two large lateral processes with four subequal central processes. Male pleopods aetose and long and narrow in shape. Epimeres double (dorsal and ventral), both laterally expanded; dorsal epimeres narrow and expanded into large tapering spines; ventral epimeres larger than dorsal and also tapering acutely into spines; ventral epimeres becoming more pronounced posteriorly and forming larger spine process

on the last segments. Pleotelson length greater than pleotelson width at base; pleotelson narrow and distinctly T-shaped.

**Predicted Females:** Based on trends observed in this family, it is expected that female's will have similar character configurations as seen in male's, which include the following: No body pigmentation. Eyes stalked as seen in the male and without pigment. Frons shape is unknown and not possible to predict. Female pleopods thought to be lightly setose and long and narrow in shape. Epimeres are likely to be double (dorsal and ventral), laterally projected; dorsal epimeres most likely to be wider and less tapering than seen in the male; ventral epimeres likely larger than dorsal epimeres and becoming more pronounced posteriorly. Pleotelson length expected to be greater than pleotelson width at base; pleotelson likely narrow as seen in the male and predicted to be distinctly T-shaped.

**Zuphea/Praniza Notes:** Juvenile stages are yet to be examined.

**Live/Recently Preserved Species Comparison Notes:** Not able to comment on live or recently preserved material.

**Long Preserved Species Comparison Notes:** This species is large compared to others in the NEP. Several males of various molt stages were examined. The final male molt seems to be striking in size. The holotype male was 8.5 mm, suggesting that this species as a whole may be significantly larger than others in our region. *G. clementensis* is the only NEP *Gnathia* with a distinct T-shaped pleotelson. It is also the only NEP species to have peduncular or stalked eyes.

*C. sanctaecrucis* and *C. sp CSI* are the two most similar species to the males of *G. clementensis* in overall body form, pleotelson shape, and in being hirsute, however, the structure of the frons (non-produced with four sub equal central processes) distinguishes males of this species from males of the other two. Characters found to distinguish males from most other species include: long, narrow pleopods and double epimeres laterally extending into fairly narrow projections. In males, the eye lens is compound but smooth (lacking tubercles).

Females are predicted to be large, like the males. They are also predicted to have the distinctive T-shaped pleotelson and may likely be confused with females of *C. sanctaecrucis* and *C. sp CSI*. As in the males, the females will probably best be distinguished by their long narrow pleopods and double epimeres that laterally extend into fairly narrow projections (as seen in the males). Eyes are likely to

be non-pigmented and the female is unlikely to have any body pigmentation. These characters should rule out any confusion with *C. sanctaerucis*. The shape of the pleopods (long and narrow versus paddle-shaped) is the only character that would help separate female *G. clementensis* from female specimens of *C. CSI*. The frontal margin of the cephalon for the female of *C. CSI* has been described in this article and perhaps, when a female *G. clementensis* is found, this character will help to distinguish the two species further.

### **Gnathia trilobata**

**Mature Adult Males:** Overall size of mature benthic male adults 3.15 mm – 3.6 mm. No females as yet encountered. No body pigmentation present. Body setose but not hirsute. Mandibles with outer tooth and lacking central articulation; mandibular blade crenulate. Eyes sessile, golden or amber in recently preserved material; live or long preserved condition unknown; eyes oblong, convex and without tuberculations on the male lens; slight supraocular ornamentation present, with several grouped tubercles forming a small ridge above the eye. Dorsal sulcus present on anterior cephalon; sensory pit present. Cephalon with tuberculations and setae and no posterior median dorsal carina. Male frons not extended; with three subequal central processes. Male pleopods asetose and long and narrow in shape. Epimeres double (dorsal and ventral); both laterally expanded; male dorsal epimeres widely tapering and subequal; ventral epimeres larger than dorsal and becoming more pronounced posteriorly, forming a larger spine process on the last segments. Pleotelson length greater than pleotelson width at base; pleotelson narrow and arrowhead-shaped, not distinctly triangular or T-shaped.

**Predicted Females:** Based on trends observed in this family of isopods, it is expected that the female's will have similar character configurations as seen in male's, which include the following: No body pigmentation. Eyes sessile and golden/amber in color. Frons shape is unknown and not possible to predict. Female pleopods thought to be lightly setose and long and narrow in shape. Epimeres likely double (dorsal and ventral); laterally projected; dorsal epimeres subequal and widely tapering; ventral epimeres likely larger than dorsal epimeres. Pleotelson length expected to be greater than pleotelson width at base; pleotelson likely narrow as seen in the male and predicted to be arrowhead-shaped.

**Zuphea/Praniza Notes:** Both juvenile forms have the same color of eyes as seen in the adults, however they are much larger and bulging in appearance. They have no body pigmentation, just like the adults. The epimeres are also like the adults in that they are double (dorsal and ventral) and laterally expanded. The pleopods are the same shape but have long sweeping plumose setae. The pleotelson also matches the adults in ratios and overall

shape, but is smaller. Overall they possess most of the characters listed above for the adults, but express them as slightly less developed. Total body lengths range in size and are dependant on molt cycle.

**Live/Recently preserved Species Comparison Notes:** Not able to comment on live or recently preserved material.

**Long Preserved Species Comparison Notes:** *G. trilobata*, *G. productatridens* and *C. SDI* are unusual in that their pleotelsons are neither distinctly triangular nor T-shaped. For lack of a better descriptor the term “arrowhead” is being used to describe this condition. Although *G. trilobata* and *C. SDI* have similar eye color, males of both species can be separated by the following characters: frons shape, setosity of the body, presence/absence of a mandibular incisor, presence/absence of a posterior median carina on the cephalon, pleopod shape, epimere shape, and pleotelson dimensions.

*G. trilobata* is most often confused with *G. productatridens*. Both are similar to one another in many ways, but what makes each distinctive is the color of the eyes. In looking through numerous lots of *G. trilobata* from several institutions it was noted that all preserved material had uniform amber/golden pigment in the eye. It should be noted, though, that the intensity of the eye color was seen to fade over time and in older specimens may initially look as if color is lacking altogether. *G. productatridens*, however, has a very unique eye color and pigment pattern. In both genders, as well as in the juvenile life-stages, *G. productatridens* was seen to have a red and white checkerboard pattern. This color and pattern were retained no matter how long individuals had been stored in preservative. Please refer to the description of *G. productatridens* below for more information on eye color pigment and pattern. In addition to eye color differences, *G. trilobata* also has an incisor on the male mandible, which is lacking entirely in males of *G. productatridens*, and has double epimeres unlike *G. productatridens*. These characters in combination should prove useful in separating out species.

Females of *G. trilobata* are also likely to be confused with females of *G. productatridens* and *C. SDI*. The characters mentioned above to separate out males of these three species should also be equally effective for separating out females. Females of both *C. SDI* and *G. productatridens* have been examined and described in this article and both have different frons structures that will help in the identification process. The frons structure for *G. trilobata* is yet to be described but in the future may prove to be a beneficial character. Although the female for *G. trilobata* is yet to be described it is predicted that they will share the same character states as described for males above and that this combination of characters will be useful for distinguishing species.

**Gnathia productatridens**

**Mature Adult Males and Females:** Overall size of mature benthic adults 2.75mm – 3.75 mm. No body pigmentation present. Body setosity high but not hirsute. Mandibles in males lacking outer tooth and without central articulation; mandibular blade crenulate. Eyes sessile, red and white with checkerboard pattern in preserved, recently preserved, and live material; eyes oval and flat, not three dimensional, and without tuberculations on the male lens; no noticeable supraocular ornamentation. Slight dorsal sulcus present on male anterior cephalon; sensory pit absent. Cephalon with setae and tuberculation; lacking posterior median carina. Male frons not extended; three central subequal processes; female frons extended, wide, not narrowing apically, and with rounded apex. Male pleopods asetose; female pleopods with few fine setae; male and female pleopods long and narrow in shape. Epimeres single, dorsal only, laterally expanded, subequal, and widely tapering; pleotelson length greater than pleotelson width at base; pleotelson narrow and arrowhead-shaped, not distinctly triangular or T-shaped.

**Zuphea/Praniza Notes:** Both juvenile forms have the same color of eyes as seen in the adults, however they are much larger and bulging in appearance. They have no body pigmentation, just like the adults. The epimeres are also like the adults in that they are single and laterally expanded. The pleopods are the same shape but have long sweeping plumose setae. The pleotelson also matches the adults in ratios and overall shape, but is smaller. Overall they possess most of the characters listed above for the adults, but express them as slightly less developed. Total body lengths range in size and are dependant on molt cycle.

**Live/Recently Preserved Species Comparison Notes:** As mentioned previously, this species has an arrowhead-shaped pleotelson; not distinctly T-shaped or distinctly triangular, somewhere in between. In addition to this unusual character, this species also has a unique eye color pigmentation. The best way to describe it would be as red and white checkerboard (two-toned light and dark). This pattern seems to be a result of alternating non-pigmented and red-pigmented omatidia in the compound eye. This pigment pattern is striking and found in both genders and juvenile stages. Eye color and pattern seem unaffected by length of time in preservation. This eye color and pattern is unique among NEP species and should help identify animals of this *G. productatridens* in live, recently preserved, or long preserved material.

**Long Preserved Species Comparison Notes:** *G. productatridens* is most like *G. trilobata* (see the discussion under that species). Although the difference in color and pigment pattern of the eyes in these two species is striking. Another helpful character is the state of the epimeres. *G. productatridens* has only single dorsal epimeres, whereas *G. trilobata* has double (dorsal and ventral) epimeres. No matter what the condition of the

eyes, the epimere character will help distinguish these two similar species. This is true for both male and female specimens.

### Conclusion

The number of recognized gnathiids in the NEP has now been increased from the nine, discussed by Cadien and Haney (2004), to twelve. It is likely that still more species may be found in the NEP, especially if one were to work up the unidentified lots found in museums up and down the California coast. The concept of the hypothesized female is brought forward for the purpose of providing testable hypotheses to predict the female condition for already described males. Please test this concept as you are able and perhaps additional females can be recognized and the trends that are described here can be refuted or verified. Additional effort is also required to test characters that will help link juveniles to adults. The most critical need is a method of separating pranizas and zupheas of *Gnathia* and *Caecognathia*. If a reliable generic level character is found for these, the often numerous larvae could be identified to genus. This would benefit both benthic studies, and host-parasite fisheries investigations.

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## Tabular Key to Male Gnathiid Isopods from the North East Pacific

Characters	<i>Caecognathia crenulatifrons</i>	<i>Caecognathia Sp. A</i>	<i>Caecognathia SD1</i>	<i>Caecognathia sanctaerucis</i>	<i>Caecognathia CS1</i>	<i>Gnathia MBC1</i>	<i>Gnathia steveni</i>	<i>Gnathia tridens</i>	<i>Gnathia coronadoensis</i>	<i>Gnathia clementensis</i>	<i>Gnathia trilobata</i>	<i>Gnathia productatridens</i>
<b>Overall Body Size</b>	Average (3.5 – 4.75) mm	Small (2.6 mm)	Small (2.76 – 3.36) mm	Average (4.4 – 4.6) mm	Average (4.1 – 5.0) mm	Very Small (2.2 mm)	Very Small (1.2 - 2.2 ) mm	Small (2.35 – 3.35) mm	Small (2.45 - 3.5) mm	Large (4.6 - 8.5) mm	Average (3.15 – 3.6) mm	Average (2.75 – 3.74) mm
<b>Body Pigmentation</b>	Brown Mottling	Brown Mottling	None	Tiny Black Dots	None	None	Brown Mottling	None	None	None	None	None
<b>Overall body setosity</b>	Light	Setose but not hirsute	Hirsute	Hirsute	Hirsute	Light	Light	Setose but not hirsute	Asetose	Hirsute	Setose but not hirsute	Setose but not hirsute
<b>Mandibles with distinct outer tooth</b>	Present	Present	Absent	Absent	Absent	Present	Present	Present	Absent	Absent	Present	Absent
<b>Mandibles 1 or 2 articles</b>	One article	Two articles	One article	One article	One article	One article	One article	One article	One article	One article	One article	One article
<b>Mandibular blade</b>	Microcrenulate	Crenulate	Microcrenulate	Microcrenulate	Smooth	Dentate	Dentate	Crenulate	Crenulate	Crenulate	Crenulate	Crenulate
<b>Eyes</b>	Sessile	Sessile	Sessile	Sessile	Sessile	Sessile	Sessile	Sessile	Absent	Peduncular	Sessile	Sessile
<b>Eye Color</b>	Dark Brown	Reddish Brown	Golden or Amber	Dark Brown	No Pigment	Reddish Brown	Dark Brown	Reddish Brown	No eyes	No Pigment	Golden or Amber	Red and White Checkerboard
<b>Eye Shape</b>	Oblong and Flat	Round and Convex	Oblong and Convex	Round, Convex	Round, Convex,	Round and Convex	Round and Convex	Round and Flat	No eyes	Round and Convex	Oblong and Convex	Oval and Flat
<b>Eye Lens Texture</b>	Compound but smooth	Compound but smooth	Compound but smooth	With many tuberculations	With many tuberculations	Compound but smooth	Compound but smooth	Compound but smooth	None	Compound but smooth	Compound but smooth	Compound but smooth
<b>Eye Lens Supraocular Ornamentation</b>	No	Yes	Yes	Yes	Yes	Yes	Slight	No	No	Yes	Slight	No
<b>Dorsal Sulcus</b>	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>Sensory Pit</b>	No	No	No	No	Yes	No	No	No	Yes	Yes	Yes	No
<b>Cephalon</b>	Tuberculate	Setose but Smooth/No Tubercles	Setose, Tuberculate with spines	Setose and Tuberculate	Setose and Tuberculate	Setose but Smooth/No Tubercles	Setose and Tuberculate	Asetose and Smooth	Asetose and Smooth	Setose and Tuberculate	Setose and Tuberculate	Setose and Tuberculate
<b>Cephalic Dorsal Carina</b>	No	No	Spine crown	No	No	Yes	Yes	No	No	No	No	No
<b>Frons</b>	1 transverse lobe with minute crenulations	1 extended narrow lobe with crenulations	1 broad truncate lobe w/ medial carina	1 large triangular lobe	1 extended, narrow lobe	One extended box process	3 processes medial triangular	3 processes all subequal	3 processes laterals longer than middle	2 lrg laterall & 4subequal central processes	3 processes all subequal	3 processes all subequal
<b>Pleopods (setosity)</b>	Asetose	Setose	Asetose	Asetose	Asetose	Setose	Setose	Setose	Setose	Asetose	Asetose	Asetose
<b>Pleopods (shape)</b>	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Long, Narrow	Long, Narrow	Long Narrow

## Tabular Key to Male Gnathiid Isopods from the North East Pacific

Characters	<i>Caecognathia crenulatifrons</i>	<i>Caecognathia Sp. A</i>	<i>Caecognathia SD1</i>	<i>Caecognathia sanctaerucis</i>	<i>Caecognathia CS1</i>	<i>Gnathia MBC1</i>	<i>Gnathia steveni</i>	<i>Gnathia tridens</i>	<i>Gnathia coronadoensis</i>	<i>Gnathia clementensis</i>	<i>Gnathia trilobata</i>	<i>Gnathia productatridens</i>
<b>Epimeres (condition)</b>	Laterally projected	Laterally projected	Laterally projected	Laterally projected with spines	Laterally projected with spines	Not laterally projected	Not laterally projected	Laterally projected	Laterally projected	Laterally projected	Laterally projected	Laterally projected
<b>Epimeres single or double</b>	Single, Dorsal only	Single, Dorsal only	Single, Dorsal only	Double Ventral larger	Double Ventral larger	Single, Dorsal only	Single Dorsal only	Single, Dorsal only	Single, Dorsal only	Double Ventral larger	Double Ventral larger	Single
<b>Dorsal epimeres prominent posteriorly</b>	No, subequal Visible Tapering acutely	No, subequal Visible Tapering acutely	No, subequal Visible Tapering acutely	Yes, each epimere is bifid with two small spines on each side	Yes, each epimere is bifid with two small spines on each side	No, subequal, very small not easily seen	No, subequal very small not easily seen	Slightly, Epimeres Visible Tapering acutely	No, subequal Visible Tapering acutely	No, subequal Visible Tapering acutely	No, subequal all small not easily seen	No, subequal, Visible Tapering acutely
<b>Ventral epimeres larger</b>	N/A	N/A	N/A	Yes, each as one large spine	Yes, each as one large spine	N/A	N/A	N/A	N/A	Yes, each as one large spine	Yes, each as one large spine	N/A
<b>Ventral Epimeres prominent posteriorly</b>	N/A	N/A	N/A	Yes	Yes	N/A	N/A	N/A	N/A	Yes	Yes	N/A
<b>Pleotelson extends beyond the endopod</b>	No	No	No	No	No	No	No	No	No	No	Yes	No
<b>Pleotelson Size</b>	Long and wide	Medium and narrow	Long and wide	Medium and narrow	Long and narrow	Short and wide	Short and wide	Short and wide	Long and wide	Long and narrow	Long and narrow	Long and narrow
<b>Pleotelson Shape</b>	Triangular ▼	Triangular ▼	Arrowhead-shaped	T-Shaped	T-Shaped	Triangular ▼	Triangular ▼	Triangular ▼	Triangular ▼	T-Shaped	Arrowhead-shaped	Arrowhead-shaped

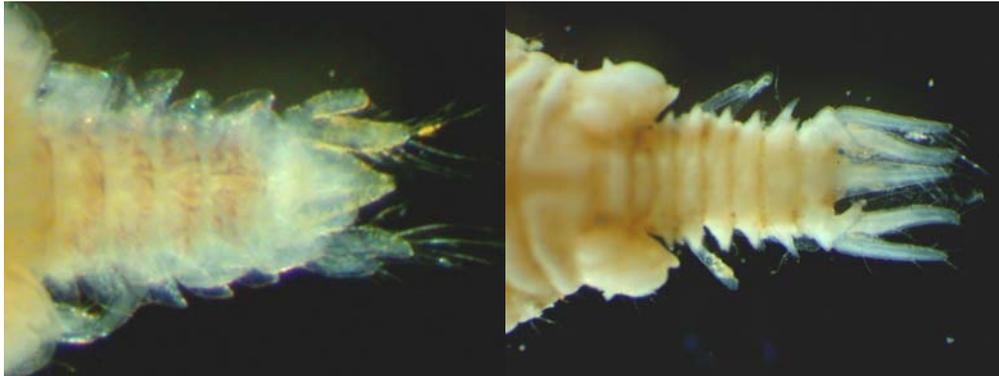
# Key to Male Northeastern Pacific Gnathiid Isopods

All males have been observed; please refer to the species photo comparison on last page as a reference

- 1) Eyes present.....2  
Eyes absent (frons with three central processes, laterals larger than middle; epimeres single, dorsal only, and laterally projected; telson distinctly triangular in shape).....**Gnathia coronadoensis**
- 2) Pleotelson distinctly triangular.....3  
Pleotelson arrowhead shaped or T-shaped (see diagram below).....7
- 3) Epimeres not laterally expanded, barely visible.....4  
Epimeres laterally expanded, highly visible.....5
- 4) Eyes dark brown; body mottled with brown pigment; cephalon with setae and tuberculations; frons with three processes (median process largest of the three and shaped as a step-wise pyramid).....**Gnathia steveni**  
Eyes reddish brown; body with no pigmentation; cephalon with setae but lacking tuberculations; frons with central 3-dimensional expansion in the shape of a box, with two large setae extending out from it centrally.....**Gnathia MBC1**
- 5) Eyes reddish brown; body with numerous setae but not hirsute; frons not transverse (lobes or processes present); pleopods with setae.....6  
Eyes dark brown; body without numerous setae; frons transverse with crenulations (without lobes or processes); pleopods without setae .....**Caecognathia crenulatifrons**
- 6) Body mottled with brown pigment; mandibles split into two articles; frons forms centrally extended narrow lobe with crenulations.....**Caecognathia sp A**  
Body with no pigmentation; mandibles not split into two articles (single article only); frons with three central subequal processes .....**Gnathia tridens**

- 7) Pleotelson distinctly T-shaped.....8  
Pleotelson arrowhead-shaped.....10
- 8) Eyes sessile; eye lens with tuberculations; pleopods ovate, paddle-like; dorsal epimeres not subequal, last pair prominent and formed into spine.....9  
Eyes pedunculate; eye lens without tuberculations; pleopods long and narrow; dorsal epimeres subequal (eyes without pigment; frons with two large medial lateral processes with four central subequal processes).....**Gnathia clementensis**
- 9) Eyes dark brown; dorsal sulcus absent; frons extended/produced into distinct large triangular lobe; body speckled with tiny black dots..... **Caecognathia sanctaecrucis**  
Eyes present but without pigment; dorsal sulcus present; frons extended/produced as long, rounded lobe; body with no pigmentation.....**Caecognathia CS1**
- 10) Epimeres single (dorsal only) .....11  
Epimeres double (dorsal and ventral) [eyes golden or amber; body with numerous setae but not hirsute; frons with three central processes, all subequal]..... **Gnathia trilobata**
- 11) Eyes golden/amber; body hirsute; cephalic dorsal carina present; frons as one broad truncate lobe with medial carina.....**Caecognathia SD1**  
Eyes with red and white checkerboard pattern (see photo below); body with numerous setae but not hirsute; cephalic dorsal carina absent; frons with three central subequal processes.....  
.....**Gnathia productatridens**

# Epimeres



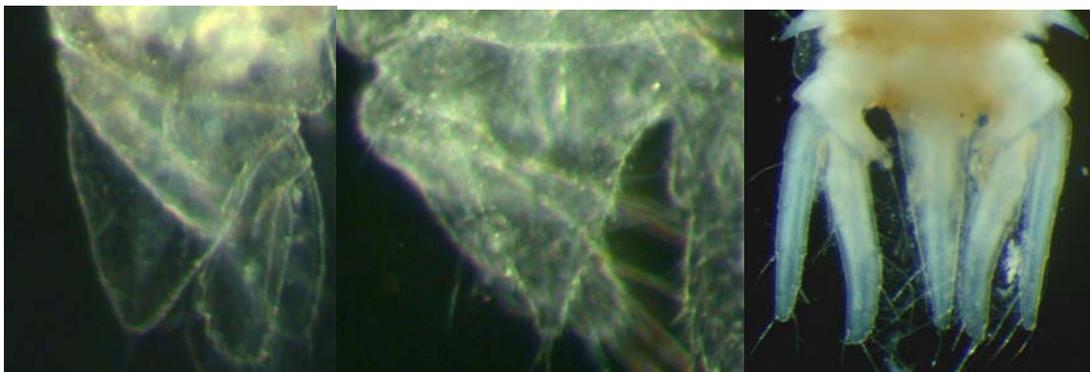
**Single Dorsal Epimeres**  
Laterally expanded

**Double Epimeres (Dorsal & /Ventral)**  
Laterally expanded



**Single Dorsal Epimeres Barely Visible**  
Not Laterally expanded

# Pleotelson Shape (Males)

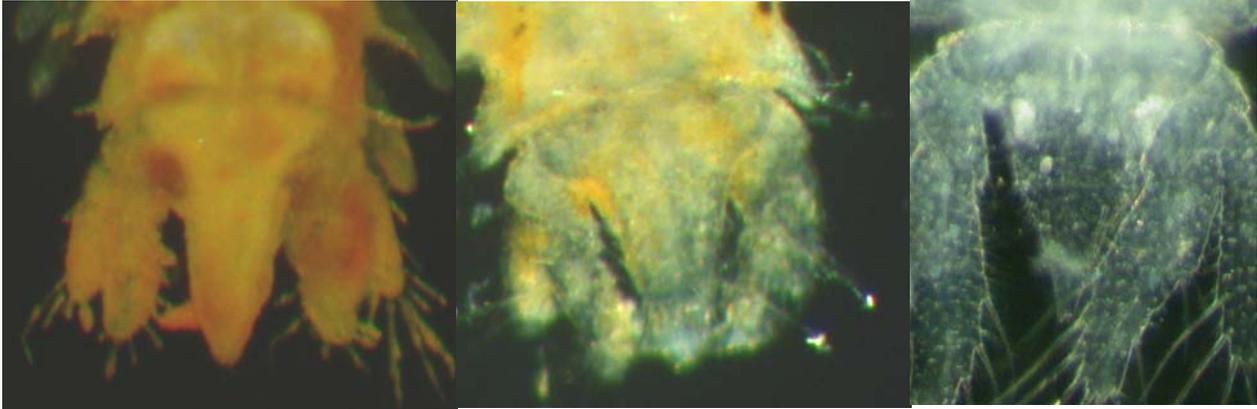


**Triangular**

**Arrowhead-shaped**

**T-shaped**

## Arrowhead Shaped Pleotelsons (Males)

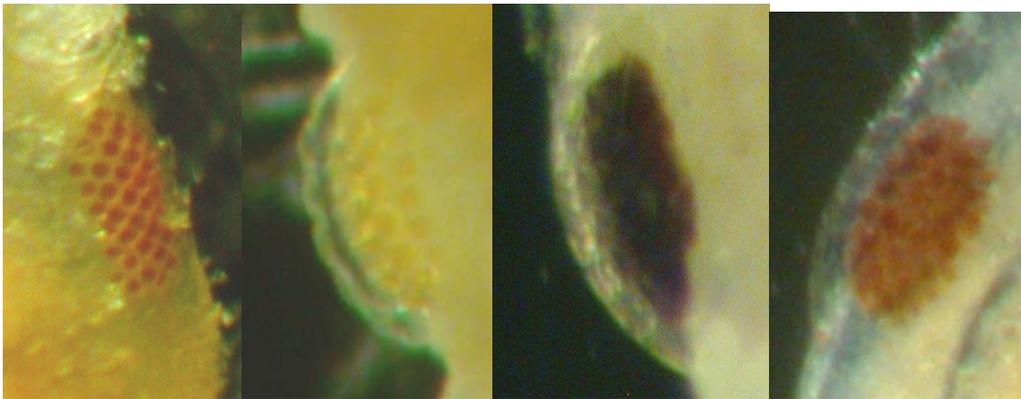


**Gnathia trilobata**

**Gnathia productatridens**

**Caecognathia SD1**

## Eye Color



**Red & White  
Checkerboard**

**No Pigment**

**Dark Brown**

**Reddish Brown**



**Golden or Amber**

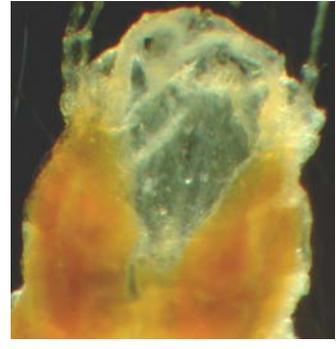
## Frons Shape (Males)



**Caecognathia sp. A**



**Caecognathia crenulatifrons**



**Gnathia coronadoensis**



**Caecognathia CS1**



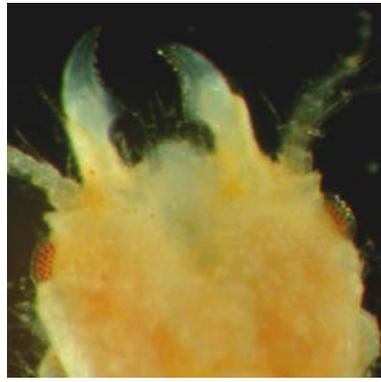
**Gnathia clementensis**



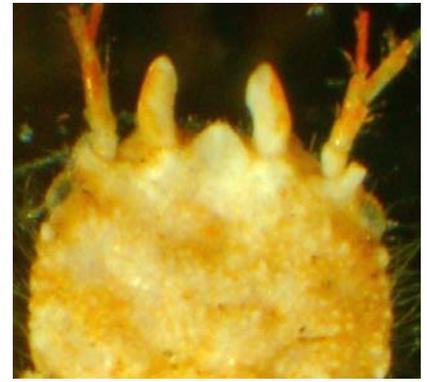
**Gnathia MBC1**



**Gnathia steveni**



**Gnathia productatridens**



**Caecognathia sanctaecrucis**



**Gnathia tridens**



**Gnathia trilobata**



**Caecognathia SD1**

# Tabular Key to Known and Hypothesized Female Gnathiid Isopods from the North East Pacific

Characters	<b>Caecognathia crenulatifrons</b>	<b>Caecognathia Sp. A</b>	<b>Caecognathia SD1</b>	<b>Caecognathia sanctaecrucis</b>	<b>Caecognathia CS1</b>	<b>Gnathia MBC1</b>	<b>Gnathia steveni</b>	<b>Gnathia tridens</b>	<b>Gnathia coronadoensis</b>	<b>Gnathia clementensis</b>	<b>Gnathia trilobata</b>	<b>Gnathia productatridens</b>
Overall Body Size	Average (3.5 – 4.75) mm	Small (2.6 mm)	Small (2.76 – 3.36) mm	Average (4.4 – 4.6) mm	Average (4.1 – 5.0) mm	Very Small (2.2mm)	Very Small (1.2 – 2.2) mm	Small (2.35 – 3.35) mm	Small (2.45 –3.5mm)	Large (4.6 – 8.5) mm	Average (3.15 -3.6) mm	Average (2.75 - 3.75) mm
Body Pigment	Brown mottling	Brown mottling	None	Tiny black dots	None	None	Brown mottling	None	None	None	None	None
Overall body setosity	Asetose	?	Setose	Setose	Asetose	?	?	Slight	?	?	?	Asetose
Eyes	Present	Present	Present	Present	Present	Present	Present	Present	Absent	Present	Present	Present
Eye Color	Dark Brown	Reddish Brown	Golden or Amber	Dark Brown	No Pigment	Reddish Brown	Dark Brown	Reddish Brown	No Eyes	No Pigment	Golden or Amber	Red and White Checkerboard
Eye Shape	Oblong and Flat	Round and Convex	Oblong and Convex	Round and Convex	Round and Convex	Round and Convex	Round and Convex	Round and Flat	No Eyes	Round and Convex	Oblong and Convex	Oblong and Flat
Frons shape	Long, Narrowing, Apex rounded	?	Long, Medially Cleft	Medium, Wide Trilobed	Short, Wide Trilobed	?	?	Medium, Narrowing, rounded apex	?	?	?	Medium, non-narrowing rounded apex
Epimeres (condition)	Laterally projected	Laterally projected	Laterally projected	Laterally projected	Laterally projected	Not projected	Not projected	Laterally projected	Laterally projected	Laterally projected	Laterally projected	Laterally projected
Epimeres single or double	Single Dorsal only	Single Dorsal only	Single Dorsal only	Double	Double	Single Dorsal only	Single Dorsal only	Single Dorsal only	Single Dorsal only	Double	Double	Single Dorsal only
Dorsal Epimeres prominent posteriorly	No, subequal Visible Ends tapering acutely	No, subequal Visible Ends tapering acutely	No, subequal Visible Ends tapering acutely	Yes, Visible Ends tapering acutely	Yes, Visible Ends tapering acutely	No, subequal Not easily seen	No, subequal Not easily seen	No, Visible subequal Ends tapering acutely	No, subequal Visible Ends tapering acutely	Yes, Visible Ends tapering acutely	No, subequal Not easily seen	No, subequal Visible Ends tapering acutely
Ventral Epimeres larger	N/A	N/A	N/A	Yes	Yes	N/A	N/A	N/A	N/A	Yes	Yes	N/A
Ventral Epimeres prominent posteriorly	N/A	N/A	N/A	Yes Spine-like	Yes Spine-like	N/A	N/A	N/A	N/A	Yes Spine-like	Yes Spine-like	N/A
Pleopods (setosity)	Very lightly setose	?	Very lightly setose	Very lightly setose	Very lightly setose	?	?	Very lightly setose	?	?	?	Asetose
Pleopods (shape)	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Paddle-like	Long-Narrow	Long-Narrow	Long-Narrow
Pleotelson extends beyond the endopod	No	No	No	No	No	No	No	No	No	No	Yes	No
Pleotelson Size	Long and wide	Medium and narrow	Long and wide	Medium and narrow	Long and narrow	Short and wide	Short and wide	Short and wide	Long and wide	Long and narrow	Long and narrow	Long and narrow
Pleotelson Shape	Triangular ▼	Triangular ▼	Arrowhead Shaped	T-Shaped	T-Shaped	Triangular ▼	Triangular ▼	Triangular ▼	Triangular ▼	T-Shaped	Arrowhead Shaped	Arrowhead Shaped

**Taxa in black bold have been directly observed. The remaining taxa are what we would expect females to look like based on males. Characters with a ? are potentially variable.**

# Key to the Known and Hypothesized Females of the Northeastern Pacific Gnathiid Isopods

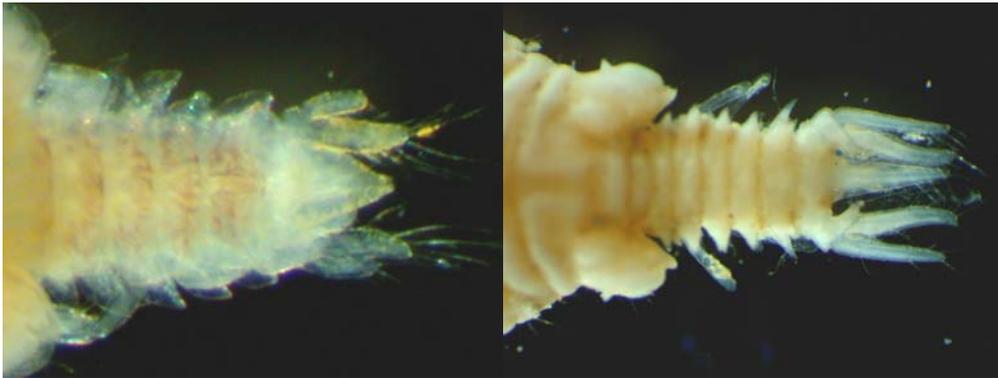
Lisa Haney LACSD

Species in parentheses and underlined represent females of species that have not yet been observed but are thought to follow character patterns represented by the males of that species. This trend holds true for female's of species that have been observed (noted in bold lettering).

- 1) Epimeres single (dorsal pairs only).....**2**  
     Epimeres double (dorsal and ventral pairs).....**9**
  
- 2) Pleotelson shaped like an arrowhead (not distinctly triangular or T-shaped).....**3**  
     Pleotelson distinctly triangular .....**4**
  
- 3) Eyes golden or amber; body with numerous setae; frons long, distally narrowing and medially cleft.....**Caecognathia SD1**  
     Eyes red and white checkerboard (see photo below); body without numerous setae; frons not long but wide, with a non-narrowing rounded apex.....**Gnathia productatridens**
  
- 4) With pigmented or unpigmented eyes.....**5**  
     Without eyes [frons shape unknown].....(G. coronadoensis)
  
- 5) Epimeres laterally projecting, easy to observe; mature female normal size (significantly larger than 2.5 mm).....**6**  
     Epimeres not laterally projecting, difficult to observe; mature female very small (not larger than 2.5 mm).....**8**
  
- 6) Body with brown mottling pigment pattern (especially on pleon) .....**7**  
     Body with no pigment pattern [frons medium in length, distally narrowing with rounded apex; eyes reddish brown].....**Gnathia tridens**

- 7) Eyes dark brown, oblong and flat; pleopods with just a few setae; pleotelson wide [frons long, distally narrowing, with rounded apex].....**Caecognathia crenulatifrons**
- Eyes reddish brown, round and convex; pleopods very setose; pleotelson narrow [frons shape unknown].....(Caecognathia sp. A)
- 8) Body with brown mottling; eyes dark brown [frons shape unknown].....  
.....(Gnathia steveni)
- Body with no pigment; eyes reddish brown [frons shape unknown].....  
.....(Gnathia MBC 1)
- 9) Pleotelson distinctly T-shaped; dorsal epimeres spine-like and becoming more prominent posteriorly.....**10**
- Pleotelson arrowhead shaped (not distinctly triangular or T-shaped); dorsal epimeres not noticeably more prominent posteriorly, subequal (eyes golden/amber; frons shape unknown).....(Gnathia trilobata)
- 10) Pleopods ovate, paddle-like, and lightly setose.....**11**
- Pleopods long and narrow, lacking setae [frons shape unknown; probably lacking eye pigment].....(Gnathia clementensis)
- 11) Body sprinkled with tiny black dots and setae; eyes dark brown; pleotelson medium (pleotelson base subequal to pleotelson length) [frons medium in length, wide and tri-lobed].....**Caecognathia sanctaecrucis**
- Body without pigmentation and without setae; eyes present but pigment absent; pleotelson long (pleotelson base shorter than pleotelson length) [frons short, wide, and tri-lobed].....**Caecognathia CS 1**

# Epimeres



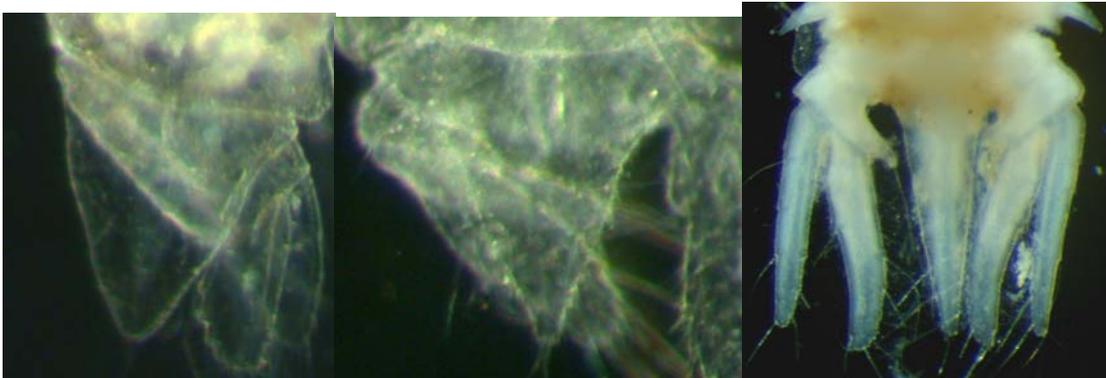
**Single Dorsal Epimeres  
Laterally expanded**

**Double Epimeres (Dorsal & /Ventral)  
Laterally expanded**



**Single Dorsal Epimeres Barely Visible  
Not Laterally expanded**

# Pleotelson Shape (Females)

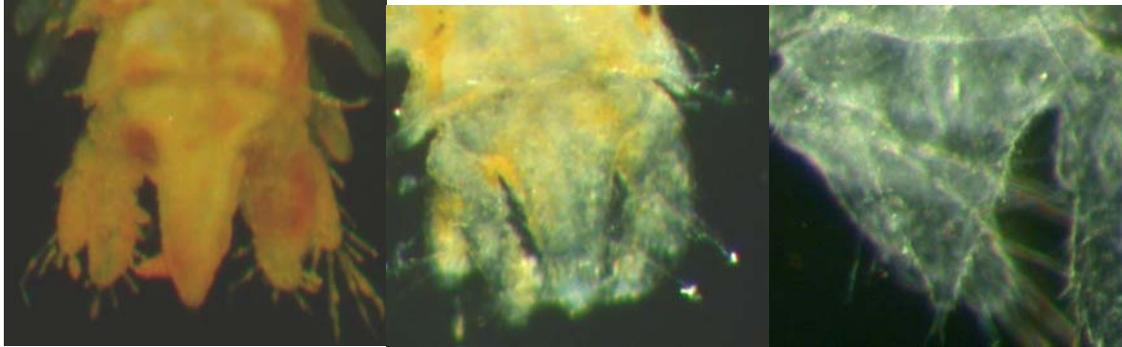


**Triangular**

**Arrowhead-shaped**

**T-shaped**

## Arrowhead Shaped Pleotelsons (Females)

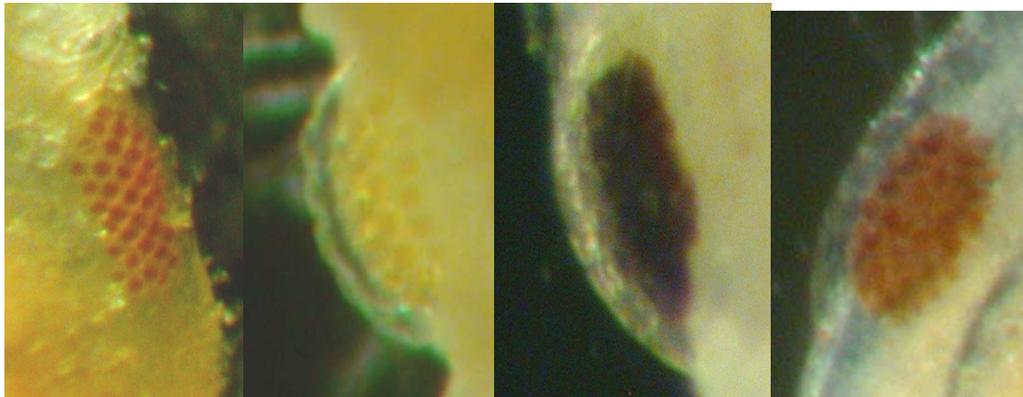


**Gnathia trilobata**

**Gnathia productatridens**

**Caecognathia SD1**

## Eye Color



**Red & White  
Checkerboard**

**No Pigment**

**Dark Brown**

**Reddish Brown**



**Golden or Amber**

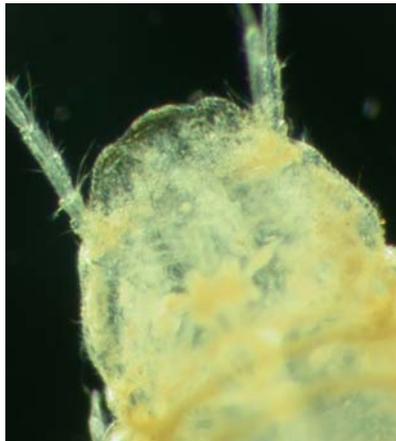
## Frons Morphology of Known Females



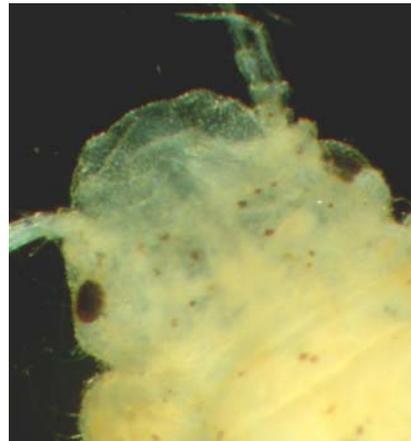
**Caecognathia crenulifrons**



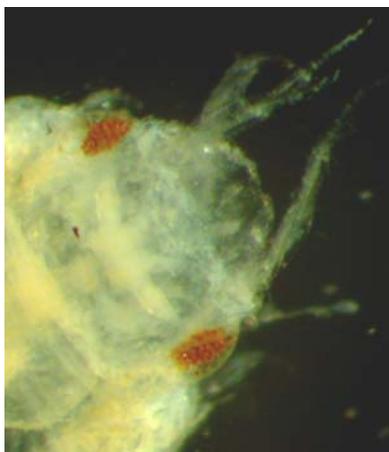
**Gnathia productatridens**



**Caecognathia CS1**



**Caecognathia sanctaerucis**



**Gnathia tridens**



**Caecognathia SD1**