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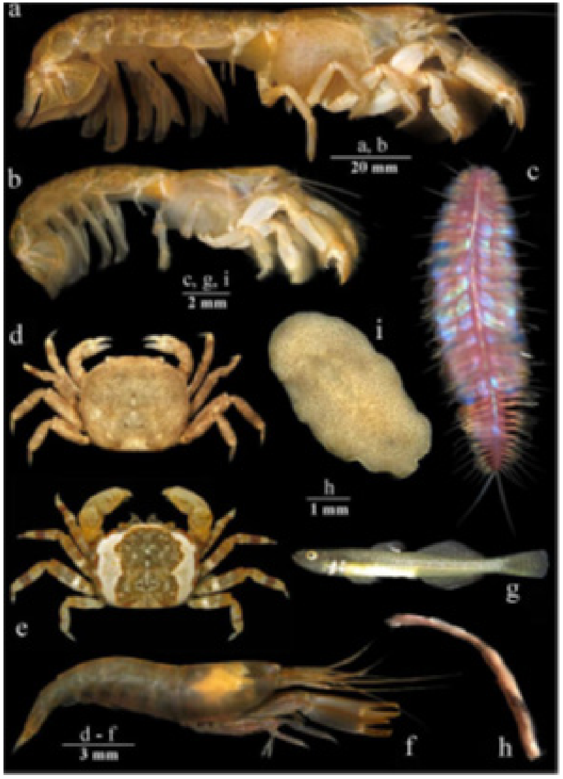

Burrow dwellers from a Upogebiid shrimp burrow from Marin and Antokhina 2020.

This Issue

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08 JANUARY 2024, MOLLUSCA – BIVALVIA PART 6, LEAD T. PHILLIPS

Attendance: Brent Haggin, Don Cadien, Wayne Dossett, Amber Von Tungeln (LACSD); Greg Lyon (CLAEMD); Tony Phillips, Kelvin Barwick (DCE); Ashley Loveland, Alison Fisher (SFPUC); Paul Valentich-Scott (Santa Barbara Museum of Natural History); Charlotte Seid (UC, San Diego); Dany Burgess (Washington State Dept. of Ecology)

UPCOMING MEETINGS

Visit the SCAMIT website at: www.scamit.org for the most current meetings announcements.

A reminder was made to those in attendance that officer nominations are still open so there is still time to get a name on the Ballot for the 2024 officers. A reminder was also made that the SCUM meeting will take place on Saturday January 27, 2024. Kelvin announced that WSM 2025 will take place in Sonora, Mexico in April of 2025. Time to start working on those travel requests.

After the business portion of the meeting, Tony began his presentation, Bivalvia of the SCB: Adult-Subadult-Juvenile (Part VI): Order Mytilida, Order Arcida, Order Ostreida, Order Pteriida, Order Pectinida, and Order Limida (as listed in SCAMIT Edition 14). This presentation concluded Tony's series of presentation on southern California Bivalves and the comparison of adult, subadult and juvenile growth series.

Tony began by discussing the Family Mytilidae in the Order Mytilida. Characteristics of the family include: 1) anterior beaks, 2) hinge plate edentate or with dysodont tubercles, 3) ligament external, frequently sunken into groove, attached to nymph, 4) periostracum usually thick, adherent, 5) sculpture of commarginal striae or mainly radial, and 6) adult byssate.
The first species to be discussed was *Brachidontes adamsianus* (Dunker, 1857), subfamily Brachidontinae. This species is typically found intertidally but Tony has found it in 20m off Avalon in gravelly sediment and in harbor Rip-Rap samples. This species ranges from Santa Cruz, CA to Peru. He compared this species to *Mytilisepta bifurcata* (Conrad, 1837), subfamily Septiferinae, to show the similarities in external morphology, and the internal structure to show the subumbonal shelf that is present in *M. bifurcata* but absent in *Brachidontes*. *Mytilisepta bifurcata* can be found intertidally to about 30m and can co-occur with *Mytilus californianus* Conrad, 1837.
Geukensia demissa (Dillwyn, 1817), subfamily Brachidontinae, was a species introduced to California in 1890. This species can be found locally from San Francisco to Newport Bay in the intertidal and was once common in the Newport Bay mudflats.

The discussion moved to the genus *Mytilus*: subfamily Mytilinae. The first species *Mytilus californianus* Conrad, 1837, can be found offshore, in higher energy environments. The next species was *M. galloprovincialis/trossolus* Cmplx. The species is currently listed as *M. galloprovincialis* Lamarck, 1819, in SCAMIT Ed. 14. The two species are distinct at the northern (*M. galloprovincialis*) and southern (*M. trossolus*) ends of their respective ranges but are hybridizing in the overlapping area of their ranges (where we collect them) and should be treated as a complex since molecular data is needed to differentiate the two species. This species complex can typically be found in lagoons and harbors. The name will be updated to *Mytilus galloprovincialis/trossolus* Cmplx in SCAMIT Ed. 15.

Next up were members of the subfamily Crenellinae. *Crenella decussata* (Montagu, 1808) can be found offshore and has broad ribbing while *Solamen columbianum* (Dall, 1897) can be found in the shallow subtidal and has very fine ribbing. *Solamen megas* (Dall, 1902) was not discussed.

Gregariella coarctata (Carpenter, 1857), subfamily Musculinae, was discussed next. This species can be found from the intertidal to about 90m. This species can occur in large bisal mats. *Gregariella semigranata* (Reeve, 1858), a Mediterranean species, was shown for comparison to the local species.
Musculus pygmaeus Glynn, 1964, was shown next. This species is not known to occur south of Morro Bay and was possibly added to the SCAMIT list in error. This species was discussed in the Micro-Bivalvia of Southern and Central California workshop hosted by Scripps Institution of Oceanography in 2004 but was likely brought by attendees from the Santa Cruz area. We will continue to attempt to track this species down but it will be removed from SCAMIT Ed. 15 if a local record cannot be confirmed.

Arcuatula senhousia (Benson in Cantor, 1842), subfamily Arcuatulinae, is an invasive species found in bays and harbors. It has been encountered locally from Callagues to San Diego and has been recorded as far south as Ensenada, Mexico. This species can occur in large bisal mats. *Xenostrobus* sp., also subfamily Arcuatulinae, is another introduced species. Members of this genus are also invasives in the Mediterranean Sea. This species has distinctive coloration and lacks anterior and posterior ribbing. Tony has found this species locally from Goleta Slough, Santa Barbara to Newport, and recently down to Batiquitos Lagoon in San Diego. He also recently found this species near the Chevron outfall in Santa Monica Bay so it appears that it is spreading offshore. *Dacrydium pacificum* Dall, 1916, subfamily Dacrydiinae, can also be found to occur in large bisal mats.

Members of the subfamily Lithophaginae were next to be discussed. *Adula diegensis* (Dall, 1911) is a non-boring, intertidal species. Not currently on the SCAMIT species list, *Adula californiensis* (R. A. Philippi, 1847), is a boring species that resembles *A. diegensis* but is more cylindrical. *Adula gruneri* (R. A. Philippi, 1851) is a soft-rock boring species that has been reported by SCAMIT members and is listed in SCAMIT Ed. 14. This species also has a cylindrical appearance.
Leiosolenus aristate (Dillwyn, 1817) is an intertidal species found from Avalon to Chile. This species is known to bore into shale, soft rocks and shells. *Leiosolenus plumula* (Hanley, 1844) can be found intertidally to about 40m, from Monterey to Ecuador.

Subfamily Modiolinae has six species represented locally on the SCAMIT list, but only four were discussed. *Amygdalum pallidulum* (Dall, 1916) has been reported from central California to Columbia from 40-400m. *Modiolatus neglectus* (Soot-Ryen, 1955) can be found from central California to Peru from 15-110m. This species has an anterior that protrudes quite a bit and has long, simple periostracal setae. *Modiolus capax* (Conrad, 1837) can be found intertidally and has an even anterior and serrate periostracal setae. *Modiolus sacculifer* (Berry, 1953) has an anterior that barely protrudes, short and simple periostracal setae and typically has adherent sand grains. *Modiolus modiolus* (Linnaeus, 1758) and *Modiolus rectus* (Conrad, 1837) were not discussed. Attendees were reminded of the SCAMIT protocol - specimens <2mm should be reported as Modiolinae.

The final species discussed in the Family Mytilidae was an unknown. This strange animal was originally reported and photographed by Kelvin Barwick from a station in San Diego and was

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later encountered again by Tony from the San Luis Rey River. The anterior ribs of this species differ from those found in *Arcuatula*. This species has ribs that start medially and extend dorsally while *Arcuatula* has ribs that start medially but extend ventrally. It was decided that this species should be given a provisional designation and it was named Mytilidae sp 1 Phillips, 2024 § during the meeting. This species has possibly also been encountered in ISS and LA/LB Rip-Rap samples but confirmation of this is still needed.

The discussion moved on to the Order Arcida, beginning with the Family Arcidae. *Anadara multicostata* (G. B. Sowerby I, 1833), Subfamily Anadarinae, can be found from San Diego to Panama while *Anadara tuberculosa* (G. B. Sowerby I, 1833) can be found from Mission Bay, San Diego to Peru. *Acar bailyi* Bartsch, 1931, Subfamily Arcinae was not discussed.

Next was the Family Glycymerididae. *Glycymeris septentrionalis* (Middendorff, 1849) has a less squared-off appearance when compared to *Anadara* species. In the Family Limopsidae, *Limopsis panamensis* Dall, 1902 has been reported locally from Anacapa Island. In the Family Philobryidae is *Philobrya setosa* (Carpenter, 1864) which has been reported from LA/LB Rip-Rap Samples. *Arcopsis solida* (G. B. Sowerby I, 1833), Family Noetiidae was not discussed.

Order Ostreida, Family Ostreidae. *Magallana gigas* (Thunberg, 1793) is an invasive species that has a west coast range from Alaska to Baja California, Mexico. This species lacks chomata. *Ostrea lurida* Carpenter, 1864, ranges from Alaska to Bahia Magdalena, Baja California Sur, Mexico. This species can be found in the intertidal to shallow subtidal and can be distinguished from *M. gigas* by the presence of chomata. Two recent papers were mentioned by Tony that discuss the re-instatement of *Ostrea lurida* as a valid species and restricting its range to north of central Baja California. The first is Polson M.P., Hewson W.E., Eernisse D.J., Baker P.K. & Zacherl D.C. (2009) You say Conchaphila, I say Lurida: Molecular evidence for restricting the Olympia Oyster (*Ostrea lurida* Carpenter 1864) to temperate western North America. *Journal of Shellfish Research* 28(1): 11-21. The second was Raith M., Zacherl D.C., Pilgrim E.M. & Eernisse D.J. (2015). Phylogeny and species diversity of Gulf of California oysters (Ostreidae) inferred from mitochondrial DNA. *American Malacological Bulletin.*3 3(2): 1-21.
Atrina oldroydii Dall, 1901, Family Pinnidae was not discussed.

Next up for discussion was the Order Pteriida, Family Pteriidae. *Pteria sterna* (Gould, 1851) is a warm-water species. Don Cadien (LACSD) mentioned that species has been found growing on Gorgonians in the shallow waters (<15m) off Palos Verdes. Family Isognomonidae, *Isognomon janus* Carpenter, 1857 can be found in the intertidal to about 20m and ranges from San Diego to Peru.

Next was the Order Pectinida. First of the Order discussed was the Family Anomiidae. *Anomia peruviana* d'Orbigny, 1846, has 3 attachment scars internally for the adductor muscle while *Pododesmus macrochisma* (Deshayes, 1839), has only 2 attachment scars.

The Family Pectinidae. See Coan, E. V. & Valentich-Scott, P. (2012), for detailed descriptions of the various genera of Pectinidae. *Delectopecten vancouverensis* (Whiteaves, 1893), Subfamily Camptonotinae, is a deeper water species and can sometimes be found attached to crab legs. Subfamily Pectininae is represented locally by *Euvola* cf *perulus* (Olsson, 1961) and *Leopecten diegensis* (Dall, 1898). *Leopecten diegensis* ranges from Bodega Bay to Cabo San Lucas, Mexico and has auricles that are "mostly" even. Tony has also encountered a currently unknown juvenile pectinid. He suspects it is either a juvenile *Leptopecten* or possibly introduced. This species has a "bubbled" valve and the denticles are longer and less rounded than local *Leptopecten*.

Members of the Subfamily Chlamydinae were discussed next. *Argopecten ventricosus* (G. B. Sowerby II, 1842) has broad radial ribs and variable pigmentation. *Chlamys hastata* (G. B. Sowerby II, 1842) is a shallower water species with uneven auricles. *Crassadoma gigantea* (J. E. Gray, 1825) can be found from the intertidal to around 80m and ranges from Alaska to Mexico. *Chlamys* and *Crassadoma* can be difficult to differentiate at smaller sizes. *Leptopecten latiauratus* (Conrad, 1837) is known from bays and harbors from Pt. Reyes to Cabo San Lucas, Mexico and can be found attached to kelp holdfasts in offshore environments. It is characterized by uneven, ribbed auricles.

The Family Propeamussiidae finished off the discussion of the Order Pectinida. *Cyclopecten catalinensis* (Willett, 1931) can be found in deeper waters (30-350m) and was compared to *Cyclopecten bistriatus* (Dall, 1916). *Cyclopecten benthalis* Grau, 1959 and *Cyclopecten zephyrus* Grau, 1959 were not discussed.

The final group to be discussed was the Order Limida, Family Limidae. *Limaria hemphilli* (Hertlein & Strong, 1946), Subfamily Liminae, the juveniles have smoother ribbing than the larger subadults and adults of the species.

After Tony's presentation Paul Valentich-Scott (SBMNH) mentioned that he currently has a Zotero database with around 800 references that he and Coan used for their 2012 manuscript and other resources. He has been adding pdfs of the papers to this database and offered to share the resource with interested parties. Send Paul an email, pvscott@sbnature2.org, to gain access. Zotero is a free-to-use bibliographic database similar to EndNote and will need to be installed on your computer to access this resource. Contact Paul for more information.

12 FEBRUARY 2024, ECHIURA AND SIPUNCULA REVIEW, OCSD

Attendance: Megan Lilly, Wendy Enright, Zoë Scott, CSD; Brent Haggin, Don Cadien, Norbert Lee, LACSD; Laura Terriquez, Ben Ferraro, OCSD; Greg Lyons, Jennifer Smolenski, Erin Oderlin, CLAEMD; Rod Velasquez, Angelica Zavala Lopez, MTS; Matt Hill, Ecoanalysts; Dany Burgess, WA Dept of Ecology; Robin Gartman, retired.

The Meeting was called to order and started with round-robin introductions including several people tuning in via Zoom.

The business meeting began with a reminder to submit nominations for SCAMIT officers. Erin wanted to let people who aren't on the Bight Benthics committee know that two subcommittees have been formed focusing on the BRI, SQO, and M-AMBI ecological health scores. One will be for taxonomic consistency (how and if we assign p-codes as new taxa are encountered or old taxa are modified) and one will be for programmatic calculation consistency. Discussion ensued regarding the history of BRI, touched on SQOs and the need to do these recalibrations more often than has been done in the past.

After a bit more digression regarding Megan's training style, we turned to the Echiura. Megan reviewed best practices for dissection, emphasizing the delicacy of the internal structures needed to identify these organisms.

- Look for external setae. If present, start your cut on the opposite side of the animal; OR, find the ventral nerve cord (VNC) and always cut on the opposite side of the animal
- If present, note the shape of the proboscis

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- Look externally for features such as a giant nephridiopore
- Once the animal is open, use a pipet to **gently** blow fecal pellets clear of the internal aspect of the animal
- Anal vesicles can be especially difficult to determine due to their fragile nature and tendency to “disappear”

Megan showed more photos of these important features and discussed the possibility of external morphological variability (i.e., smooth vs papillated) for some species. We reviewed how to look for setae and examined the nephridia and anal vesicle drawings from the MMS Atlas chapter on Echiura. Megan then demonstrated how to access resources on the SCAMIT website using the Newsletters and Tools. The Echiura character table in the toolbox was reviewed. In general, when unable to identify an animal, it is left at Echiura.

Moving on to the Sipuncula, Megan gave a quick review of their anatomy highlighting key characters.

- Retractor muscles (number and form)
- Microvilli presence/absence
- Introvert tentacles (if present)
- Nephridia form and quantity
- Body wall muscle bands (visible? If so, sometimes will need to count)

The Sipuncula character table is available in the Toolbox. Be sure to look at external characters before dissecting; note any papillae or hooks on the introvert (if present), body wall muscles if visible, length of the introvert compared to the rest of the body. When possible, cut opposite the ventral nerve chord. Tent the skin away from the internal structures before making the first cut. Determine the nephridia, retractor muscles, and microvilli. Although the spindle muscle may be diagnostic, it is often broken. Likewise, the body wall muscle structure is difficult to see. The counting convention for Sipuncula is slightly different than other animals as the body, rather than the feeding structures, is used.

Other than in-house notes and the Sipuncula table available in the Toolbox, Megan occasionally uses Cutler 1994 and The Light and Smith Manual (Carlton 2007) for assistance with identifying Sipuncula.

There was a brief side discussion on the invasion of *Grimothea planipes* (Stimpson, 1860) during the last major ENSO event in 2016 that lasted for several years. Presumably these animals impacted the benthos, either directly through predation and bioturbation or indirectly through displacement and competition for resources.

More side notes ensued regarding interesting critters brought up during the Bight ‘23 trawl activities of the previous summer.

That concluded the hybrid portion of the meeting as we broke for lunch and cake for Megan. A small celebration of Megan’s impending retirement ensued and she was very touched by the cards and gifts given to her by the taxonomists present.

After a convivial lunch, the group headed to the lab to examine specimens and practice dissections.

1. CLAEMD B23-12136 20m Long Beach Harbor; a stubby little Sipuncula with a spiny introvert but no tentacles. Megan demonstrated how to cut such a tiny animal (helpful to have 2mm iris scissors). This animal had no internal structures, so it was left at Sipuncula.
2. CLAEMD also brought their 1976 voucher of *Themiste (Themiste) hennahi* Gray, 1828, Paradise Cove (no depth given and apparently this locality has a wide range). Jen Smolenski practiced a dissection on the rather large animal, first noting the presence and form of the tentacles. Although the tentacles were distinctive enough to key out the animal using Cutler, the internal structures were also confirmed.
3. CSD B23-12284, Anaheim Bay, 8/18/2023, 9m; Zoë Scott took a turn with the iris scissors, opening up a large Echiura to reveal the dendritic anal vesicles of *Nellobia eusoma*.

There were a few random echinoderms that got snuck onto the teaching scope and with that, the meeting concluded.

11 MARCH 2024, POLYCHAETA – INTRO TO ANNELIDA, LEAD B. HAGGIN

Attendance: Brent Haggin, Cristina Fuentes, Mac Power (LACSD); Inez Mangino (UCSB); Erin Oderlin, Greg Lyon (CLAEMD); Kelvin Barwick (DCE); Ashley Loveland, Alison Fisher, Diane O'Donohue (SFPUC); Leslie Harris (LACNHM); Veronica Rodriquez, Ricardo Martinez, Adam Webb, Maiko Kasuya (CSD); Ernie Ruckman (OCSD); Rod Velasquez (MTS); Dany Burgess (Washington State Dept. of Ecology); Amanda Martinez.

A reminder was made to those in attendance that a SLRC meeting was scheduled for March 27 and that officer ballots were going out soon.

After the business portion of the meeting Brent began his presentation - Introduction to Annelida. This presentation was meant as an overview of the Phylum Annelida for the many new taxonomists across the various agencies.

The presentation began by loosely defining what an annelid is and their history throughout the fossil record. The presentation then moved into the many aspects of annelid biology including feeding, reproduction and growth, as well as the basic anatomy of an annelid worm. Also covered were various laboratory techniques, such as dissection and staining using different dyes to enhance different anatomical features. It finished with a taxonomic review of the Phylum Annelida, including the recently incorporated groups of Echiura and Sipuncula. While lacking obvious external segmentation and chaetae, the developmental affinities and molecular evidence for inclusion of the Sipuncula was discussed. The Sipuncula show developmental similarities to the Terebellida and molecular data shows support for the Sipuncula as a sister-group to the Amphinomida. The molecular evidence for inclusion of the Echiura within the Annelida was also discussed, and while there is strong support for the Echiura as the sister-group to the Capitellidae, the SCAMIT SLRC has left the Echiura as a subclass within the Polychaeta for now.

Though no longer identified to species, the characteristics of Class Clitellata (earthworms and leeches) were also discussed. The Hirudinea, or leeches, are often encountered as fish parasites, have suckers at each end and lack chaetae. The Oligochaeta typically have 1 – 2 pair of bifid chaetae and a clitellum in mature specimens. Some recent molecular evidence suggests that the Clitellata are a highly derived subtaxon of Polychaeta and should be placed within Sedentaria. This position has not yet been accepted by SCAMIT or WoRMS.

The bulk of the presentation focused on the taxonomy of the Class Polychaeta. It was presented based on the taxonomic groupings allowing similarities within the groups to be emphasized. Throughout the presentation, the type localities of the organisms were also discussed, bringing to light the vast number of polychaete species that were described from outside of the NEP (currently around 25%), but whose names are currently used in the literature and by SCAMIT.

Some of the key items that were discussed were the status of some of the locally used species names. Leslie Harris (LACNHM) mentioned that *Euchone incolor* Hartman, 1965 is not found locally. *Euchone incolor* was originally described from New England and has a different stain pattern than our local species. This species should be given a provisional designation (hopefully by SCAMIT Ed. 15). *Euchone barnardi* Reish, 1968 was described from Bahía de Los Angeles, Baja California, Mexico and was synonymized with *Euchone incolor* by Banse in 1970. This species should be looked at as a possible local replacement for *Euchone incolor*.

Leslie also suggested moving *Platynereis bicanaliculata* (Baird, 1863) into a complex. This organism shows a high degree of variability in the chaetae as well as in pigmentation. Also related to Nereididae, Leslie recommended making jaw dissections laterally rather than dorsally or ventrally to avoid damaging the jaw structure.

Moving forward, we should stop using *Scoloplos armiger* Cmplx and begin using *Scoloplos* sp LA2 Haggin, 2017 §; *Scoloplos* sp LA3 Haggin, 2017 § or *Scoloplos* sp LA4 Haggin, 2018 §. Voucher sheets for each species as well as the most up-to-date key can be found on the SCAMIT toolbox. *Scoloplos armiger* Cmplx will be removed from the SCAMIT species list beginning with Ed. 15.

Brent's list of recommended polychaete literature is attached to this newsletter.

27 MARCH 2024, SPECIES LIST REVIEW COMMITTEE

Attendance: Brent Haggin, Don Cadien (LACSD); Erin Oderlin, Jennifer Smolenski (CLAEMD); Kelvin Barwick, Tony Phillips, Dean Pasko (DCE); Leslie Harris (LACNHM); Andrew Davenport, Wendy Enright, Katie Beauchamp, Stephanie Smith, Zoë Scott (CSD).

Kelvin was nominated and elected as chair. While accepting this position, Kelvin expressed his desire to step away from the position as SLRC Chair after the completion of Ed. 15.

Phyla leads were chosen/volunteered and secondary assignments were made.

The timing of future Species List publications was decided. SCAMIT Ed. 15 will be published in 2026. Going forward, two species lists will be published every 5 years. Edition 16 will be published in 2028 and will be the naming basis for Bight '28. An interim list, Edition 17, will be published 3 years later in 2031. This will help to keep changes to a manageable number for each publication. This cycle will continue every 5 years, with even Species Lists Editions used as the basis for ongoing Bight sampling.

Erin Oderlin (CLAEMD) proposed moving the publication date up to June 1 rather than July 1 to allow database managers time to update their databases before the summer sampling begins. This proposal was adopted and will be implemented with Edition 15.

The use of the "§" character in the species list was clarified. The "§" character is used to denote a provisional authorship of an unpublished species. If a "cf" or "nr" is used in the species list, the original authority should be used, not SCAMIT. The "cf" or "nr" should not be italicized within the species list.

The next topic of discussion was that of the cosmopolitan species concept. This concept has changed recently, and it is now widely accepted that most cosmopolitan species are anthropogenic in nature and that very few truly cosmopolitan species exist. This is something that needs to be considered when adding new taxa and to question current and historic practices based on new information. A good way to assess this situation is to ask the question "If it was described from Greenland, how did it get here?" Leslie mentioned that deep-sea polychaetes have been found to be widely distributed due to "deep-sea storms" that can transport larvae great distances.

The species list database was discussed again and a bit of progress was made. It was discovered and decided that we can use the ITI structure (similar to how WoRMS handles things) for our database. This still leaves us with the problem of how to deliver the product, how to maintain the database with a volunteer staff, how to fund the database and can we get SCCWRP to host while we maintain control?

22 & 29 APRIL 2024, B'23 TRAWL INVERTEBRATE VOUCHERS REVIEW

The only minutes from 22 April is that an *Aphrodita castanea* Moore, 1910 voucher was verified for ABC and an *Aphrodita japonica* Marenzeller, 1879 was verified for CLAEMD. Some anthozoa vouchers were also examined.

At the April 29th meeting we found a good character to distinguish *Stylasterias forreri* (deLoriol, 1887) from *Sclerasterias heteropaes* Fisher, 1924. The color, typical habitat, and arm constrictions are decent secondary characters, but a reliable hard character that can be seen even on small specimens (with a hand lens) deals with the inferomarginal spines. See Fisher 1928 Part 2, page 94 & 95, the couplets at the very top of each page:

- For *Scleratserias*: only the outer of the 2 inferomarginal spines carries a cluster of crossed pedicellariae. There is a half circle of pedicellariae on the aboral half of the more aboral inferomarginal spine. It's not a full crown like the rest of the spines on the aboral surface.
- For *Stylasterias*: the inner **and** outer inferomarginal spines carry a cluster of crossed pedicellariae. There are half circles of pedicellariae on the aboral half of both inferomarginal spines.

As a reference point, the inferomarginal spines are the two spines on the last plate before the oral grooves. They appear to make a "V".

From SCAMIT newsletter Vol 41 no 5&6: *Sclerasterias heteropaes* are usually in shallow water on cobble/mixed bottoms (LACSD sees them commonly). They have a slight constriction to the arm just before the disc that CLAEMD uses as a quick character. *Stylasterias forreri* are more commonly found in association with kelp beds but CSD has found them associated with their thermistor anchor in 100m of water.

CONCRETE THEORY – DB CADIEN, WWTP, CARSON, CA., 10 OCT 2023

I have been fortunate to have a number of memorable experiences during my life. As a student of nature for nearly seven full decades I have observed many events over the years that others may not have experienced. One such took place in 1963, at age 17, on the north shore of Viti Levu Island, Fiji. I was traveling with my parents and we were staying at a sea-side hotel laid out as a central set of communal buildings surrounded by gardens studded with individual cabins. The gardens were lush and consisted of flower beds, shrubbery, and grassy areas. One evening we were scheduled to partake in a Kava Ceremony. I, as a non-drinker, quickly lost interest and wandered off into the warm humid night. There I discovered a rather remarkable scene. As do most such hotels, this one had a series of large electronic bug-zappers on the grounds to reduce the number of flying insects for patron comfort. The device was elevated on a pole about nine feet off the ground and was industrial-sized. As insects hit its energized wires they quickly sizzled then popped off into the night. Taking full advantage of this was a large group of cane toads (at the time *Bufo marinus*). The species is not native to the region and was introduced from the Caribbean to Fiji in 1936 as a biological control agent. It had strongly proliferated, and the many aggressive and poisonous cane toads were displacing the native amphibians. Such was the case here. Arrayed around the post in circles (three I could see, perhaps more) at increasing distances from the bug-zapper these toads sat, with only slight position jostling. They had organized themselves into a competitive hierarchy, with the largest toads in the first ring, medium sized toads in the second, and young toads relegated to the distant third. As the freshly toasted insects popped off the electrified grid they flew into the waiting maws of these toads, with the choicest and largest morsels being garnered by the first ring, and the size (but probably not the frequency) of toasted treats declining with increasing distance. I stood in wonder watching this spectacle, finding it much more engaging than the kava ceremony taking place some yards away. It was an almost perfect manifestation of a competitive dominance hierarchy, and one reestablished each night after sunset when the illuminated traps were turned on. The actual competition had transpired before my arrival but was probably quite fierce as the prize was a delicious hot meal of toasted highly proteinaceous bugs. It made ecological theory quite concrete for me, a lesson retained to this day and a treasured memory. The conceptual framework of such theory was recently reviewed by Tibbetts et al 2021(The establishment and maintenance of dominance hierarchies, Philosophical Transactions of the Royal Society B, 377(20200450): 11pp. While learning from published papers and books can be enjoyable, direct observation of nature is a better and more entertaining teacher.

ARTHROPOD PERSONALS PART 5

Attached, please see Don Cadien’s latest installment in his Arthropod personals series

CUMACEA OF THE NEP PART 4

Attached, please see Don Cadien’s latest on the Cumacea of the NEP

VOUCHER SHEET

Please see the attached voucher sheet on *Cumanotus fernaldi* by Barwick and Cadien

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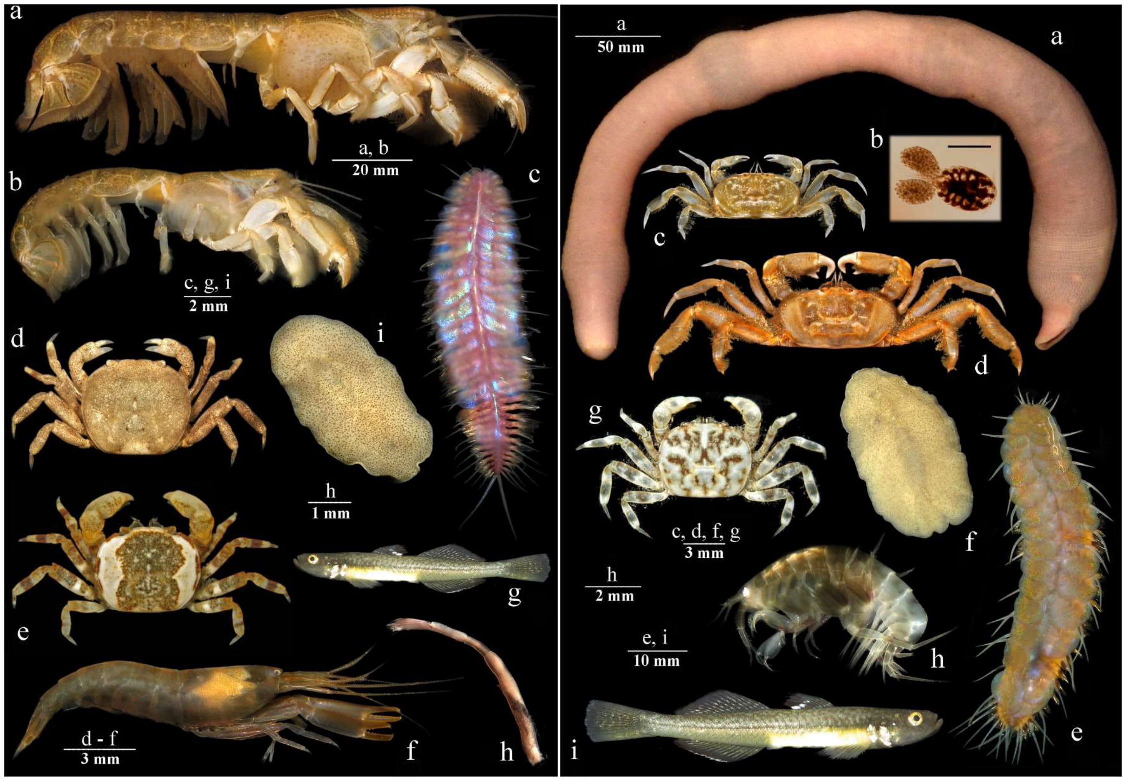
Arthropod Personals – Seeking Companion?

Part 5 – Gimme Shelter! Housing the homeless.- dbcadien. WWRF. Los Angeles County Sanitation Districts, 30Nov23

Biogenic structures such as coral reefs or *Sabellaria* reefs offer shelter to a myriad of other animals. So, on a smaller scale, do the burrows of animals. Among the most notable burrowers are thalasinid shrimps such as the ghost shrimps in the genus *Neotrypaea*. These 'ecosystem engineers' are vigorous and active, frequently providing the majority of the sediment turnover and mixing essential to elemental cycling in the benthos. They make burrows in soft sediments for their own use, but along the way manage to altruistically benefit a number of other organisms. The burrows may be quite complex (Nickell and Atkinson 1995), with design and function varying between different species in different genera. In the waters of the SCB we have several species of *Neotrypaea* who construct such burrows, primarily *N. californiensis*, but also *N. affinis* (now *N. biffari*) and *N. gigas*. Several of these species have fish associated with their burrows as well as various invertebrates. The arrow goby *Clevelandia ios* is frequently encountered in bay burrows of *N. californiensis* (Hoffman 1980, 1981), while the blind goby *Typhlogobius californiensis* is associated with *Neotrypaea affinis* (MacGinitie 1939). The shrimp benefits from the presence of *Typhlogobius*, which warns it of the approach of predators, creating a true mutualism with benefits to each associated species. The case of *Clevelandia* is less clear, as shrimp are known to chase the fish from their burrows, particularly when there is more than one resident shrimp. While the fish is in the burrow it is protected from predators, and thus benefits. Any benefits to the shrimp are unclear, and this is not apparently a mutualist symbiosis like the other local fish-shrimp one. A nutritional benefit to the shrimp is demonstrated in a similar fish/shrimp symbiosis between a goby and a burrowing alpheid shrimp (Kohda et al 2017) and this could potentially also occur in the *Clevelandia/Neotrypaea* relationship.

Thalassinid burrow openings and ejecta mounds on an intertidal mud-flat: the major source of structure in the habitat [inset is the responsible organism, *Callichirus kraussi*] (from Pillay 2019)

We have never encountered this fish/shrimp symbiosis in our sampling, but we frequently find other arthropods known to associate with thalassinids in their burrows in benthic grabs. These are cyclopoid copepods of the family Clausidiidae. Three species are represented on the SCAMIT Ed. 14 list, *Clausidium vancouverensis, Goodingius subadhaerens*, and *Hemicyclops thysanotus* (see Light and Hartman 1937, Gooding 1960 and Kim 2007). Females of all three species are illustrated on Plate 210 of Cordell (2007). While these copepods occur free within the burrow, they are more usually encountered on the surface of the shrimp, particular in the branchiae (Haddon 1912). Other large invertebrates also construct burrows which offer protection to other species, most prominently large echiuroid worms such as *Urechis caupo*, the 'innkeeper worm'. Both arthropod and other burrows in the waters around Japan, their makers and associates, have recently been examined (Marin and Antokhina 2020). The diversity in symbionts laid out by those authors are largely echoed in our own waters. For instance, Hoffman 1980 listed many species found in the burrows of *Neotrypaea* (then *Callianassa*) *californiensis*, largely paralleling the lists proved by Marin and Antokhina with the exception of polychaetes. A somewhat later list (Campos et al 2009) added additional burrow dweller records. Scaleworms seem to be a prominent component of the burrow associates of many large burrowing invertebrates, in some cases proving to be new taxa rather than known species which have chosen to live with the burrower.



Burrow dwellers from a upogebiid shrimp burrow (left) and an echiuran worm burrow (right)
Including crabs, alpheid shrimp, an amphipod, a copepod, fish, flatworms, polychaetes, and a phoronid
(from Marin and Antokhina 2020)

Helping the homeless and keeping the seafloor ‘neat’ are not the purposes of the burrows these organisms make. They are for their own protection, and in a number of cases, nutrition. Thalassinid shrimps such as *Neotrypaea* use their burrows in a number of different ways for food gathering (see Abed-Navandi and Dworschak 2005, and Abed-Navandi et al 2005).) These ‘societies’ living together within the boundaries of a relatively small space are complex. Symbionts no doubt react to each other as well as to the host. Some of the members of these symbiotic communities seem specialized, occurring only within them, or virtually always within them. In other cases more broadly ranging less specialized taxa are included among the members. In these multispecies symbiotic aggregations most of the interaction is probably between the large burrow constructing host and the smaller commensal symbionts. Whether or not the commensals interact either positively or negatively with each other as well is a complexity awaiting discovery. Within the narrow confines of many tubes or burrows, positional conflicts between commensals vying for space seem likely. They structures are almost never simple U shaped constructs, and physical attributes (particularly oxygenation) vary spatially within them. Physical tolerances likely differ between commensals, and they each may seek particular portions of the overall aggregation which are most favorable to them. Much research remains to be done before the systems are sufficiently understood to be modeled. New technologies are already playing a part, with burrow water being analyzed for eDNA to better catalog the species resident within. Our remote samplers only snatch a small portion of the whole, returning a glimpse into this communal world, but not a picture of the whole.

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Cumacea of the NEP: equator to Aleutians and intertidal to abyss

Part 4. The **Family Lampropidae**

dbcadien 6 November 2006 (revised 31 October 2011)

The cumacean family Lampropidae is the second of 5 families belonging to the clade of forms with articulated telsons. It, along with the families Diastylidae, Ceratocumatidae, and Gynodiastylidae form this clade. The Pseudocumatidae, the sister taxon to all other cumaceans, also has an articulated telson. The Lampropidae is smaller than the Diastylidae having only 58 species distributed among 13 genera in the Crustaceorum Catalogus treatment (Băcescu 1988). Gerken (2018) in a worldwide revision, added another 12 genera and 23 species. In the NEP only seven genera of lampropids are known to occur. with 20 species; a qyarter of which are provisionals. Like the diastylids, the lampropids are primarily a cool water and/or deep water group (Day 1978). Most of the local lampropids were in the genus *Lamprops*, which is a generally shallow-water genus of the northern Hemisphere (Day 1978). This genus was split into a number of genera by Gerken (2018), three of which occur in the NEP, *Lamprops (ss)*, *Alamprops*, and *Phallolamprops*.The genus *Mesolamprops* is also primarily shallow-water, while *Hemilamprops* and *Paralamprops* are deeper dwelling. The family is sexually dimorphic along the lines of most cumacean families. Unfortunately, the taxonomy at the generic level is dominated by separations based on adult male morphology. This makes it impossible to place females and juveniles of some species in the appropriate genus, although specific identity may be clear.

It should be noted that under ICZN Article 30.1.4.3. all generic group names ending in -ops are to be treated as masculine. In consequence, to retain agreement in gender, all species level names originally proposed as feminine or neuter must be recast in masculine. For species in this family, where most generic names end in -ops, the appropriate masculine ending for species level names is –us rather than –a. All names have been emended below to conform to this article.

NEP Lampropidae from McLaughlin et al (2005) augmented by known provisional taxa.
*= Taxa on the SCAMIT Ed 6 list. Valid taxa bolded, synonyms not.

Lampropidae

- **Alamprops augustinensis** (Gerken 2005) – Cook Inlet, Alaska; 0-1m
- ***Alamprops carinatus** (J. F. L. Hart 1930) – Arctic Alaska to SCB; 18-120m
- **Alamprops krasheninnikovi** (Derzhavin 1926)– NW Pacific to Puget Sound; 0-12 m
- **Alamprops obfuscatus** (Gladfelter 1975) – Tomales Bay; 18m
- ***Alamprops quadriplicatus** (S. I. Smith 1879) – NW Pacific; Alaska to Oxnard; 0-104m
- **Alamprops serratus** (J. F. L. Hart 1930) – Puget Sound; 20-95m
- ***Alamprops tomalesi** *Gladfelter 1975 – Tomales Bay to the Santa Barbara Channel; 6-10m
- **Alamprops triserratus** (Gladfelter 1975) – Tomales Bay to Oxnard; 7-16m
- **Bathylamprops sp F (**MBC 1985)§ - off Pt. Arguello to Tanner Basin; 954-1150+m
- ***Hemilamprops californicus** Zimmer 1936 – Japan, Puget Sound to San Diego; 13-177m

Hemilamprops gracilis J. F. L. Hart 1930 - Alaska to Puget Sound; 120-200m
***Hemilamprops sp A** MBC 1985§ - Oregon to Pt. Loma; 305-798m
***Hemilamprops sp B** Paquette 1985§ - Oregon to Pt. Loma; 185-732m
Lamprops augustinensis Gerken 2005 see Alamprops augustinensis
Lamprops beringi Calman 1912 – Arctic Alaska to Puget Sound; 0-129m
Lamprops carinatus J. F. L. Hart 1930 -see Alamprops carinatus
Lamprops fuscatus G. O. Sars 1865 – No. Atlantic; SE Alaska to Puget Sound; 2-121
Lamprops krasheninnikovi Derzhavin 1926 – see Alamprops krasheninnikovi
Lamprops obfuscatus (Gladfelter 1975) – see Alamprops obfuscatus
*Lamprops quadriplicatus S. I. Smith 1879 – see Alamprops quadriplicatus
Lamprops serratus J. F. L. Hart 1930 – see Alamprops serratus
*Lamprops tomalesi Gladfelter 1975 – see Alamprops tomalesi
Lamprops triserratus (Gladfelter 1975) – see Alamprops triserratus
*Lamprops sp D MBC 1985§ – see Phallolamprops californiensis
Lamprops sp E MBC 1985§ - off Pt. Arguello; 951m
Lamprops sp F - see Bathylamprops sp F
***Mesolamprops bispinosus** Given 1964 – Pt. Conception to San Diego; 30-100m
Mesolamprops dillonensis Gladfelter 1975 – Tomales Bay; 13-21m
Paralamprops sp BAP1 Cadien 2001§ - Baja Abyssal Plain; 3880-3950m
Phallolamprops californiensis Gerken 2018 – SCB – 20-157m

Key to the NEP Lampropidae (modified from Jones 1969) – dbcadien 6 November 2006

1a. Males with pleopods...2
1b. Males lacking pleopods...*Lamprops*+ (see key to genus)
2a. Male with two pleopods..*Mesolamprops* 3
2b. Male with three pleopods...4
3a. Uropodal exopod shorter than endopod; telson with two pairs of lateral setae or spines; carapace lacking incised sulcus around ocular lobe and pseudorostrum, smooth..*Mesolamprops bispinosus*
3b. Uropodal exopod as long as endopod; telson with 3-6 (usually 4-5) pairs of setae or spines laterally; carapace with incised sulcus around ocular lobe and pseudorostrum as in *Hemilamprops californicus*.......................*Mesolamprops dillonensis*
4a. Basal article of uropodal exopod subequal to or longer than distal article; basis of third maxilliped distally widened ....*Hemilamprops* 5
4b. Basal article of uropodal exopod much shorter than distal article; basis of third maxilliped not distally widened.......................................*Paralamprops* sp. BAP1
5a. Carapace with incised sinus enclosing pseudorostrum and eyelobe extending ½ carapace length then curving to dorsal midline............*Hemilamprops californicus*
5b. Carapace lacking incised sinus, but with other carapace sculpture......................6
6a. Carapace with serrate mid-dorsal crest on anterior ½..............*Hemilamprops* sp A
6b. Carapace lacking mid-dorsal crest...7
7a. Carapace with a single horizontal carina extending from position of antennal sinus posteriorly which sweeps up to the dorsal midline at the posterior carapace margin telson with three subequal terminal spines, and 4 pairs of lateral telsonic spines or setae...*Hemilamprops gracilis*
7b. Carapace with series of anastomosing ridges which divide it into several irregular

polygons of various sizes on each side of carapace; telson with three subequal terminal spines, and 2 pairs (♂) or 8-9 pairs (♀) of lateral setae or spines.............
....*Hemilamprops* sp B

[In the following discussion and tables wherever *Lamprops* is used, *Alamprop*s could be substituted. The same is not true of *Phallolamprops*, as will be discussed under that taxon].

Separating *Lamprops*, *Hemilamprops*, and *Mesolamprops* -If males are present the separation is fairly trivial, with differing numbers of pleopods in the three genera: *Lamprops* with 0, *Hemilamprops* with 3, and *Mesolamprops* with 2. Juvenile males, prior to full development of pleopods, may also prove difficult, but pleopod rudiments should be visible in all but the smallest specimens.

Females are much more difficult. Several recent papers have mentioned additional information separating *Lamprops* from the other two in females as well (Haye and Gerken 2005, Shalla and Bishop 2007). They both suggest females of *Lamprops* species have the basis of P1 longer than the remaining articles; that is, the basis comprises more than 50% of the entire limb.

Our current difficulty in separating *Lamprops* sp D from *Mesolamprops bispinosus* can perhaps be solved using this tool. Since we have not found males of *Lamprops* sp D to date, placement in *Lamprops* remains tentative. Since sex ratio is not particularly skewed in other *Lamprops* and in either *Hemilamprops* or *Mesolamprops*, the absence of males in *Lamprops* sp D is troubling. Comparison of the voucher sheet with females of *Mesolamprops bispinosus* yielded few differences other than the fine denticulations on the anterior carapace margin pointed out by Jim Roney. If the females attributed to *Lamprops* sp D do not have the elongate P1 basis characteristic of the genus, I suggest they are the same as *M. bispinosus*.

Comparisons of the type species of the three genera are required to validate the existence of the female character of P1. These are:

Hemilamprops – *H. roseus* (Norman 1864) by subsequent designation
Lamprops – *L. fasciatus* Sars 1863 by monotypy
Mesolamprops – *M. bispinosus* Given 1964 by monotypy and OD

This comparison suggests that the basis/limb ratio of P1 is a useful criterion for separation of females of *Lamprops* from females of the other two genera in the types. But variability in this measure in other members of the genera remained to be explored. This exploration is reported in the accompanying table. Fourteen species of *Lamprops*, 16 of *Hemilamprops*, and 6 of *Mesolamprops* were evaluated for the length ratios of the articles of their first pereiopods. This was done by measurement of published illustrations of the taxa by the original authors and subsequent reporters. Measurement of specimens would have been preferable, eliminating one source of potential error, but would have required unacceptable delay in comparison. The values reported in the table are dimensionless, being based on reproduced illustrations of varying size with no attempt to standardize by manipulation of measurements. Consequently ratios can only be determined within individual species. Absolute values cannot be compared for a single article between species, or even sexes of the same species. As can be seen from the table, it is not just the length of the basis that is important, but also the relative lengths of the propod and dactylus. These two articles are generally more elongate (sometimes by 3 or 4 times) when the bais/limb ratio is low.

In a number of cases data could be obtained for both males and females of a given species. Since Sars (1900) did not specify the sex of the illustrated pereiopods, it was useful to compare the degree of intraspecific variability in basis/limb ratio with that between species In all three genera males and females of a given species were usually within 10% of each other with regard to basis/limb ratio. Since we will be applying this measure only to females, it should not particularly matter, except in interpreting early reports with sex not reported. Since these appear to conform to the general trend, we can disregard sex in subsequent discussion.

The only *Lamprops* for which females had a basis/limb ratio less than 50% was *Lamprops tenuis*, a species from the northwest Pacific Arctic. The type species, *Lamprops fasciatus* had a ratio of 53%. All *Hemilamprops* species exhibited ratios well below 50%, some as low as 35%. The type had a ratio of 37% .*Mesolamprops* was a bit more varied, with *M. dillonensis* a clear outlier at a ratio of 71%. The rudimentary nature of the illustrated articles beyond the basis suggests that perhaps this was a regenerated individual. The distal portion of the first pereiopod is not infrequently lost, and the post basal portion of the *M. dillonensis* type may have suffered such damage. Alternatively, the drawing could be inaccurate. Other drawings in the same paper seem to conform to existing trends and look more appropriately proportional, so inaccuracy does not seem likely. Females of *M. japonicus* were also reported to have a basis/limb ratio of 50% by Harada (1959). This same species illustrated by Tzareva (1999) had a ratio of basis/limb length of only 43%, well within expectation. She also reported a male of the species with a ratio of 51%, however, so the ratio for the species is not yet confirmed. In general, however, the rule separating *Lamprops* from the other two genera seems to hold; *Lamprops* females show a ratio of more than 50%, while those of *Hemilamprops* and *Mesolamprops* have ratios of measurably less. That the type of *M. dillonensis* is aberrant (as suggested above) in this regard needs to be further investigated by measurements of more specimens of *M. dillonensis*.

Measurements of Pereiopod one article lengths in various species of Lamprops, Hemilamprops, and Mesolamprops

Species	Source	Basis	Ischium	Merus	Carpus	Propod	Dactyl	Total	B/T ratio	% basis
Lamprops augustinensis (M)	Gerken 2005	51	2	7	9	11	8	88	51/88	58%
Lamprops augustinensis (F)	Gerken 2005	47	2	7	10	10	9	85	47/85	55%
Lamprops fasciatus T (?)	Sars 1900`	49	3	8	9	13	10	92	49/92	53%
Lamprops flava (F)	Harada 1959	29	1	6	9	7	5	57	29/57	51%
Lamprops fuscata (?)	Sars 1900`	51	3	10	14	12	8	98	51/98	52%
Lamprops kensleyi (m)	Haye and Gerken 2005	52	2	10	13	14	12	103	52/103	51%
Lamprops krasheninnikovi (F)	Derzhavin 1926	36	2	6	8	9	8	69	36/69	52%
Lamprops lomakinae (F)	Tzareva and Vassilenko 1993	82	5	9	26	14	11	147	82/147	56%
Lamprops obfuscatus (M)	Gladfelter 1975	46	2	13	20	9	9	99	46/99	46%
Lamprops pseudosarsi (F)	Tzareva and Vassilenko 1993	109	10	16	28	20	13	198	109/198	55%
Lamprops pumilio (F)	Tsareva and Kepel 2001	42	3	8	14	8	8	83	42/83	51%
Lamprops sarsi (F)	Lomakina 1958	34	2	4	8	5	5	58	34/58	59%
Lamprops tenuis (F)	Tzareva and Vassilenko 2006	50	3	10	13	17	17	110	50/110	45%
Lamprops tomalesi (F)	Gladfelter 1975	41	2	7	13	7	6	76	41/76	54%
Lamprops triserratus (F)	Gladfelter 1975	45	4	6	14	9	7	85	45/85	53%
Lamprops sp D (F)	voucher sheet	39	2	9	11	11	10	82	39/82	48%
Hemilamprops assimilis (?)	Sars 1900	58	4	12	18	33	25	150	58/150	39%
Hemilamprops bigibba (F)	Gamo 1975	41	5	9	23	4	16	98	41/98	43%
Hemilamprops californicus (M)	Lee & Lee1998	35	1	8	10	19	12	85	35/85	41%
Hemilamprops californicus (F)	Harada 1959	29	1	7	8	12	10	68	29/68	43%
Hemilamprops cristata (?)	Sars 1900	53	3	12	14	27	32	141	53/141	38%
Hemilamprops diversa (M)	Hale 1946	91	5	15	20	48	44	223	91/223	41%
Hemilamprops diversa (F)	Hale 1946	67	4	15	20	44	39	189	67/189	35%
Hemilamprops gracilis (M)	Hart 1930	30	1	6	7	10	9	63	30/63	48%
Hemilamprops gracilis (F)	Hart 1930 (description est)	30	1	7	7	10	10	65	30/65	46%
Hemilamprops izuana (F)	Harada 1959	27	1	8	9	17	14	76	27/76	36%
Hemilamprops lata (M)	Hale 1946	58	3	13	16	22	16	128	58/128	45%
Hemilamprops lata (F)	Hale 1946	62	3	17	25	23	20	150	62/150	41%
Hemilamprops longiseta (F)	Corbera 2006	41	3	12	35	7	16	114	41/114	36%

Hemilamprops merlini (m)	Mullenhardt-Siegel 2005	54	3	7	22	22	10	118	54/118	46%
Hemilamprops pacificus (F)	Harada 1959	31	1	8	9	14	13	76	31/76	41%
Hemilamprops pellucidus (F)	Day 1978	21	1	4	7	9	8	50	21/50	42%
Hemilamprops pterini (F)	Shalla & Bishop 2007	48	2	13	11	21	18	113	48/113	42%
Hemilamprops roseus T (?)	Sars 1900	55	3	12	19	36	25	150	55/150	37%
Hemilamprops ultimaespei (M)	Mullenhardt-Siegel 2003	43	3	8	10	18	18	96	43/96	45%
Hemilamprops ultimaespei (F)	Mullenhardt-Siegel 2003	34	2	7	9	15	13	80	34/80	43%
Hemilamprops uniplicata (?)	Sars 1900	76	4	19	18	37	44	198	76/198	38%
Mesolamprops bispinosus T (M)	Given 1964	16	2	5	6	9	8	56	26/56	46%
Mesolamprops bispinosus T (F)	Given 1964	35	2	8	8	13	11	77	35/77	46%
Mesolamprops denticulatus (M)	Ledoyer 1983	43	2	12	11	22	19	109	43/109	39%
Mesolamprops dillonensis (M)	Gladfelter 1975	66	1	5	7	7	7	93	66/93	71%
Mesolamprops hartleyi (M)	Shalla & Bishop 2007	70	3	13	16	30	25	157	70/157	45%
Mesolamprops hartleyi (F)	Shalla & Bishop 2007	45	3	13	25	6	19	111	45/111	41%
Mesolamprops japonicus (M)	Tzareva 1999	41	2	5	8	12	11	79	41/79	52%
Mesolamprops japonicus (F)	Tzareva 1999	30	2	9	14	6	8	69	30/69	43%
Mesolamprops japonicus (F)	Harada 1959	44	1	8	10	13	12	88	44/88	50%

Other possible methods used in the past for separation of females of the three genera were discussed by Day (1978). Her comments are very apropos and I quote: " there is a small but usually distinct antennal notch in *Lamprops*; it may be present or absent in *Mesolamprops* and is usually absent in *Hemilamprops*. An eye is present in *Lamprops*, variable in *Mesolamprops* and usually absent from *Hemilamprops*." These characters are summarized in the table below for females only, since presence/absence requires no such sexually based comparison as was needed for the basis ratio character. She concludes her discussion of these differences, as well as the basis ratio with the following: "But it should be stressed that *only* the number of pleopods in the male is genuinely diagnostic."

Discriminitory Characters for Females of Lamprops, Hemilamprops, and Mesolamprops

Species	Source	notch*	eyes@	source
Lamprops augustinensis (F)	Gerken 2005	A	D	F/T
Lamprops beringi (F)	Derzhavin 1926	R	D	F
Lamprops carinatus (F)	Hart 1930	D	R	F
Lamprops fasciatus T (F)	Sars 1900	D	D	F
Lamprops flava (F)	Harada 1959	R	D	F
Lamprops fuscata (F)	Sars 1900	D	D	F
Lamprops kensleyi (F)	Haye and Gerken 2005	R	D	F
Lamprops krasheninnikovi (F)	Derzhavin 1926	R	D	F
Lamprops lomakinae (F)	Tzareva and Vassilenko 1993	R	A	F
Lamprops obfuscatus (F)	Gladfelter 1975	D	A	F
Lamprops profundus (F)	Reyss 1978	A	A	F
Lamprops pseudosarsi (F)	Tzareva and Vassilenko 1993	R	D	F
Lamprops sarsi (F)	Derzhavin 1926	R	D	F
Lamprops serratus (F)	Hart 1930	D	D	F
Lamprops tenuis (F)	Tzareva and Vassilenko 2006	A	R	F/T
Lamprops tomalesi (F)	Gladfelter 1975	R	A	F
Lamprops triserratus (F)	Gladfelter 1975	A	A	F
Hemilamprops assimilis (F)	Sars 1900	A	R	F
Hemilamprops bigibba (F)	Gamo 1975	A	R	F/T
Hemilamprops brenkei (F)	Muhlenhardt-Siegel 2005	A	A	F
Hemilamprops californicus (F)	Zimmer 1936	A	D	F
Hemilamprops californicus (F)	Harada 1959	R	D	F
Hemilamprops californicus (F)	Lee and Lee 1998	A	D	F/T
Hemilamprops cristata (F)	Sars 1900	A	D	F/T
Hemilamprops diversa (F)	Hale 1946	A	D	F
Hemilamprops glabrus (F)	Day 1978	A	A	F
Hemilamprops gracilis (F)	Hart 1930	A	A	F
Hemilamprops izuana (F)	Harada 1959	A	D	T/F
Hemilamprops lata (F)	Hale 1946	A	D	F
Hemilamprops longiseta (F)	Corbera 2006	A	A	F
Hemilamprops merlini (F)	Muhlenhardt-Siegel 2005	A	A	F

Hemilamprops pacificus (F)	Harada 1959	R	D	T/F
Hemilamprops pellucidus (F)	Day 1978	A	A	F
Species	Source	notch*	eyes@	source
Hemilamprops roseus T (F)	Sars 1900	R	D	F
Hemilamprops ultimaespei (F)	Mullenhardt-Siegel 2003	A	A	T/F
Hemilamprops uniplicata (F)	Sars 1900	A	D	F
Mesolamprops abyssalis (F)	Reyss 1978	A	A	F/T
Mesolamprops bacescui (F)	Gamo 1999	A	A	F
Mesolamprops bispinosus T (F)	Given 1964	A	D	F
Mesolamprops denticulatus (F)	Ledoyer 1983	A	A	T
Mesolamprops dillonensis (F)	Gladfelter 1975	R	D	T/F
Mesolamprops hartleyi (F)	Shalla & Bishop 2007	A	A	T
Mesolamprops japonicus (F)	Harada 1959	A	D	F

^ * A=absent, R=slight, D=distinct
^ @ A=absent, R=rudimentary, D=distinct
source is Text or Figure

Sadly, these methods seem not to be reliable. Perhaps there is a statistical difference in the frequency of antennal notch expression or eye condition among genera, but no reliable criterion based on these seems to be possible for separation of females specimens in the three genera.

With the confirmation of the value of the basis/limb ratio in separating female *Lamprops* from others in related genera we can revisit our problem of the day. Is *Lamprops* sp D actually a *Lamprops* based on the female ratio? Fortunately during the original preparation of the voucher sheet P1-P5 were illustrated for the female. It should be noted here that the illustration of P1 does not show a small ischium. This is true of some other species, and generally means that it was there, but considered as just the end of the basis. For the purposes of the present measurement the ischium was taken to extend from the end of the combined segments to the base of the distal-most seta shown for the basis. This seta normally sits at the end of the basis, and was assumed to mark the transition from basis to ischium in this case. Measurements were made from the voucher sheet, and added to Table 1. As can be seen, the ratio would suggest that this species is not actually a *Lamprops*, but rather either a *Hemilamprops* or a *Mesolamprops*. Its basis/limb ratio is 47.6%, below the *Lamprops* threshhold. [This problem has been resolved by Gerken 2018 by placing what was called *Lamprops sp D* above in a different and newly created genus *Phallolamprops*, and describing it as *P. californiensis*.]

Alampropos – Gerken (2018) removed all those taxa previously placed in Lamprops which lack short clasping antennae in the adult male. This is consistent with Sars initial usage. Over the years drifting practice had placed many species in *Lamprops* that differed significantly from the type. The current separation is a step to wards restricting *Lamprops* to species meeting the original criteria of Sars. Most, but not all of the NEP species previously placed in *Lamprops* move to *Alamprops*.

Bathylamprops – A single member of this genus, the provisional *B. sp F* is known from the NEP. The genus is relatively small (8 described species worldwide) found at slope to abyssal depths as shallowly as 346m and as deep as 3800m. While half the largest species come from the SW Pacific, it also has representatives in the North Atlantic, SW Atlantic (Florida), South Africa, East Africa (Gerken 2018) and the NEP. It can be readily differentiated from all other genera of lampropids in the NEP by the long slender acute rostrum.

Hemilamprops – *Hemilamprops californicus* is very common at shallow shelf depths in the SCB. It can be confused with individuals of *Mesolamprops bispinosus*, particularly in the female. Close attention must be paid to the number and position of the lateral setal pairs on the telson to distinguish females and juvenile males of these two taxa. Adult males can easily be distinguished by the number of pleopods; 2 in *Mesolamprops*, 3 in *Hemilamprops*. The condition of the carapace also differs in the two, with the cephalic shield (termed an incised sulcus in the above key) better developed and more defined in *H. californicus* than in *M. bispinosus*. The two taxa can co-occur, so species identity is specimen dependant, and not based on the identity of the males in the sample. *Hemilamprops gracilis* is known only from boreal seas to the north in the NEP, but could range further south than current reports indicate under La Niña oceanographic conditions.

The two provisional taxa in the genus locally are very different, and only one is known to range into the SCB. *Hemilamprops* sp A was taken several times in B'03 sampling at bathyal depths, and from the L.A. 3 Dump Site off Newport Beach. It was originally taken in Central California as part of the MMS Santa Maria Basin Study, and has since been recorded on the Cascadia Slope off Newport, Oregon. There are similarities to several described species (*taseiana* described from Sagami Bay, Japan; and *normani* from the North Atlantic), but the species is still deemed separable. It is the only member of the genus in the NEP with a serrated dorsal crest.

Hemilamprops sp B was originally noticed in one of the BLM RIP samples from near Anacapa Island reexamined during the MMS Santa Maria Basin Study. A single juvenile male was present at Station 24844 at 185m on the island shelf between Anacapa Island and the mainland. A female of the species was taken at 492m off Pt. Sal in Central California. These remained the sole known representatives of the species until examination of samples from the Cascadia Slope in 2002 revealed the species was quite common at one 732m station (over 260 specimens of juveniles, adult males, and adult females). Sexual dimorphism is relatively strong in this species. Both males and females have the same base arrangement of three longitudinal ridges running obliquely forward on the carapace, but the pattern of anastomosing secondary ridges is very different in the two sexes, and more complex in the female. The telsons also differ markedly. In the female the telson bears 8-9 pairs of lateral setae, while in the male there are only two. The female telson is also somewhat longer relative to the uropodal peduncles than is that of the male.

Lamprops – This was the major genus in the family in the NEP, with 10 described and three provisional members. After Gerken's 2018 revision it had dropped to two described and two provisional members. Most removals were placed in *Alamprops*, although one provisional was described in *Phallolamprops*.The occurrence of two provisional species in the vicinity of Pt. Arguello at nearly 1000 m depth is unusual. Both taxa are known from limited material, however, and additional material may show that they belong in other genera in the family, *Lamprops* being a predominantly shallow shelf genus (*Lamprops sp F* has already been moved to *Bathylamprops)*. The number of species in the genus in the small area of Tomales Bay suggests that there is much hidden diversity in the NEP fauna, and that lampropids are locally underdescribed. Records of *Lamprops quadriplicatus* and *Lamprops krasheninnikovi* from the NEP may be difficult to unravel. *L. krasheninnikovi* was originally described as a subspecies of *quadriplicatus*, and it is not certain which form is referred to in earlier records of *L. quadriplicatus* from the area. Lomakina (1958) presents the forms as subspecies, providing a table for their separation. Lie (1969) repudiated his earlier reports of *L. quadriplicatus krasheninnikovi* (Lie 1968), citing the observations of Given (1965) on Arctic material which suggested that the forms separated by Derzhavin were no more than variations, and not worthy of subspecific or specific separation. Hart (1987), however, continues to record *L. krasheninnikovi*, and no longer reports *L. quadriplicatus* from the Puget Sound area. McLaughlin et al (2005) do not offer a solution to this dilemma, listing *L. quadriplicata* only from the Atlantic, and not listing *L. krasheninnikovi* at all. In contrast Gerken (2005) expressed the belief that all the forms united under *L. quadriplicata* were probably separate species, as was the *L. quadriplicata longispina* identification of Gamô (1965) from Japan. Until the issue is further resolved, both taxa are presented here as being valid at the species level. They are, however, keyed together below. The provisional form *Lamprops* sp F is known only from females, so cannot be accurately placed in the absence of information on male pleopod count. Since the pseudorostrum is long and acute, and the telson is about equal in length to the urosomal peduncle, this may actually be a member of the genus *Pseudodiastyis* or of *Bathylamprops*. Ultimate placement awaits males, but based on materials presented by Gerken (2018) sp F appears to be a member of *Bathylamprops*.

Key to known NEP members of the genus *Alampropos, Bathylamprops, Phallolamprops,* and *Lamprops,(s.s.)* (all formerly *Lamprops*)
– dbcadien 12 June 2021

1a. Telson armed with terminal spines, but lacking lateral setae or spines..................2
1b. Telson armed with terminal spines and one or more pairs of lateral setae or spines 5
2a. Carapace with dorsal carina or keel for at least ½ length......................................3
2b. Carapace lacking dorsal carina or keel..4
3a. Thoracic somites T1-T3 each with anterior tooth on dorsal midline........................ ....*Alamprops triserratus*
3b. Thoracic somites T1-T3 lacking teeth on dorsal midline.........*Alamprops carinatus*
4a. Terminal telsonic spines with middle spine and outer pair subequal in length, intermediate pair only half as long.......................................*Alamprops obfuscatus*
4b. Terminal telsonic spines with middle spine and inner pair subequal in length, outer pair shorter (about 2/3 length of central 3)......................*Alamprops tomalesi*
5a. Telson bearing a single pair of lateral setae..............................*Bathylamprops* sp F
5b. Telson with 2 or more pairs of lateral setae..6
6a. Telson with 5-6 pairs of lateral setae..*Lamprops beringi*
6b. Telson with 2-4 pairs of lateral setae..7
7a. Carapace lacking carinae or ridges...........................*Phallolamprops californiensis*
7b. Carapace bearing one or more ridges or carinae..8

8a. Carapace with single horizontal or mid-dorsal carina..9
8b. Carapace with multiple oblique ridges..12
9a. Carapace with a single horizontal carina extending from the antennal sinus 2/3 of the distance to the posterior carapace edge....................................*Lamprops* sp E
9b. Carapace with a mid-dorsal carina...10
10a. Median telsonic terminal spine only about ½ length of the other four...*Lamprops fuscatus* (♂)
10b. Median telsonic terminal spine subequal in length to intermediate pair.............11
11a. Median telsonic terminal spine and intermediate pair subequal and about 2/3 the length of outer spine pair...*Alamprops serratus*
11b. Outer terminal spine pair slightly longer than median three spines..*Lamprops fuscatus* (♀)
12a. Carapace bearing partial ridges between the four major oblique carapace ridges; eyelobe reaching nearly to edge of pseudorostrum.......*Alamprops quadriplicatus* and *Alamprops krasheninnikovi*
12b. Carapace lacking partial ridges between the four major oblique carapace ridges; eyelobe separated by ½ its length from the pseudorostral margin..*Alamprops augustinensis*

Mesolamprops - Băcescu (1988) lists only four species in this genus, two of which occur in the NEP. The bathymetric distribution of these taxa is peculiar. Both of the local species are inner to mid shelf animals, while the Mediterranean *M. denticulatus* is upper bathyal, and *M. abyssalis* from the Tropical West Atlantic is abyssal (Băcescu 1988). Gladfelter (1975) provides a useful character table for the separation of the two local species in the genus, and adds *Hemilamprops californicus*, which can be confused with *M. dillonensis*. There should be little difficulty in applying this table in the SCB, as *M. dillonensis* is not known to occur south of Central California. While the cephalic shield is better expressed in *Hemilamprops californicus* males than in females, it is well-enough marked that separation of *H. californicus* from *M. bispinosus* females can be based on the carapace alone. It is wise, however, to also check the number of lateral setal pairs on the telson, which will also separate the two forms. As mentioned under *Hemilamprops*, the two species can and do occur together, with males of each species found with females of either, or both.

Paralamprops - The characters used in the above key to lampropids are those of the genus, and do not serve to separate *P.* sp BAP1 from others in the genus. Currently only one species in the genus is known from the NEP. The genus is composed of at least 15 species worldwide, distributed primarily in the Atlantic and Antarctic. While the majority of the species are known from bathyal depths, they also occur at abyssal and hadal depths (Băcescu 1988). Most of these taxa are keyed in Day (1978), but the three species of Reyss (1978), and that of Mühlenhardt-Siegel (2005a) are missing as is the local provisional. The local species is, like much of the genus, large. The single known specimen being a mature male over 2 cm long. *Paralamprops* sp BAP1 differs in carapace morphology from all other members of the genus, not fitting either half of couplet one in Day's key. It bears a single pair of dorso-lateral ridges, which are not marginal. It also has a very prominent crest like hump behind the obscure ocular lobe, The dorso-lateral ridges and the post-ocular hump are both rounded. Thoracic somites

T1-T5 all bear flattened lateral alae which are largest on T2. The lobe on T5 is not a flattened alar plate as are those on the preceding segments, but a short lateral swelling of the somite. The telson is nearly as long as the uropodal peduncles; the pre-anal portion very short, and the post-anal portion linear and not tapering.

Phallolamprops – The genus was created by Gerken (2018) to house two species, both of which live in the NEP. *Phallolamprops californiensis*, the type, occurs in the Southn California Bight, while *P. pribilofensis* is from the *Pribilof Islands*, just outside our coverage area 200 miles above the Aleutians in the Bering Sea. She provides a key to separate the two. More difficult is separating the genus from others in the family which occur in the NEP. Females can be distinguished from either *Mesolamprops* of *Hemilamprops* females by having the P1 basis well more than 50% of total length (although only listed as 48% in the above tabel as L. sp D). Separation from females of *Lamprops* (ss) can be based on lenth of basal article of uropodal exopod (< 50% of article 2 in *Lamprops*, well over 50% of article 2 in *Phallolamprops*).

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SCAMIT Voucher Sheet

Species: *Cumanotus fernaldi* Thompson & Brown 1984 Vol.42 No. 5-6

Group: Family Cumanotidae

Date examined: April 20, 2022 (revised 14OCT2025)

Prepared by: K. Barwick & D. Cadien

Synonyms: *Cumanotus beaumonti* of Turgeon et al. 1988
Cumanotus sp 1 of Behrens & Hermosillo 2005

Material Examined: 1 specimen OCSD Sta. 85; 02DEC2021; 58 m

Description: Filliform cerata in paired lateral rows (~11 rows each side) with 6-8 cerata per row and side. Cerata begin anterior to rhinophores; absent mid-dorsally. Rhinophores surface slightly granulated; joined at base. Foot corners and oral tentacles present. Radular formula: ~20x1.1.1. Oblong jaws without any visible serrations along cutting edge (not shown). Live coloration not known. (See page 2 for illustrations.)

Discussion: Radular tooth prep shows them as dead ringers for what Eliot depicted in 1906 in his description of *Cumanotus beaumonti* (Eliot 1906). Behrens (1992) illustrated the radula but for *Cumanotus fernaldi* Thompson and Brown 1984. When compared with the orginal description in Eliot 1906, the illustration of the whole live animal in Picton 1991 and the dorsal ventral in Thompson and Brown 1984, there are slight differences in numbers of denticles between *C. beaumonti* and *C. fernaldi*, but they are only slight. The two are otherwise sufficiently similar that they were confused by a number of workers until Thompson and Brown finally suggested the separation in 1984 and chose the replacement name C. fernaldi for the NEP animal. Cumanotus, as well as Piseinotecus also have the ceratal rows beginning in front of the rhinophores. In preservation this species resembles *Ziminella japonica* (Volodchenko, 1941) but lacks distinct denticles on the lateral teeth (Korshunova et al. 2017) found in the present specimen.

Habitus: These are specialist predators on Tubularia (now Ectopleura), and the animals bear a striking resemblance to the oral area of those hydroid zooids. Frequently taken from colonies of *Ectopleura crocea* (L. Agassiz 1862) on docks and pilings, but they probably will attack solitary zooids as well. They are very difficult to spot when they are sitting on the end of a hydroid stalk, replacing the hydroid anterior end, which they have devoured. Good mimics until they move. Their presence can be inferred, even when the animals are hidden, by the presence of tight coils of eggs laid by the nudibranch on the prey colony. These are pendent off the hydroids, hanging as free coils in the water column, and are quite distinctive. Although other aeolids may lay tangled skeins of egg string, no other local species forms these perfect tight spirals. Their form seems to be a generic character, as the European species also lays such egg 'springs'. There are drawings of these available in the literature, and adding an illustration of the typical spawn to the sheet might be helpful.

Distribution: Saturna Is., British Columbia to San Diego, California (Behrens 1991)

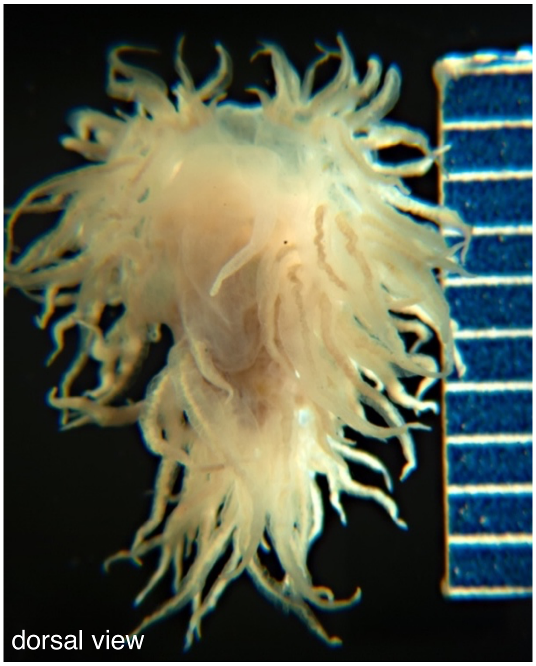
SCAMIT Voucher Sheet

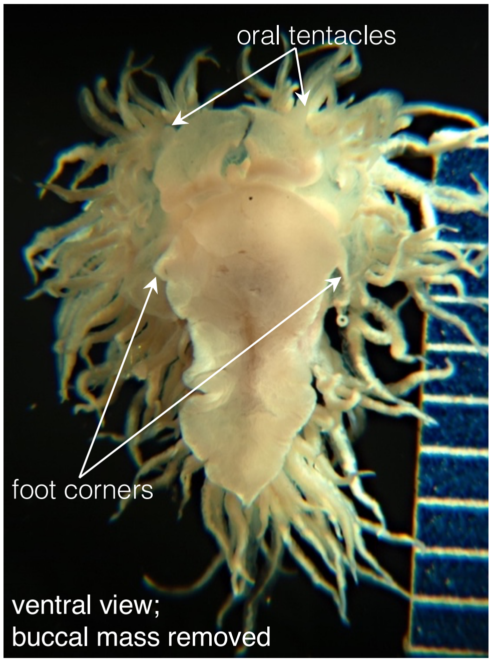
Species: *Cumanotus fernaldi* Thompson & Brown 1984 Vol. 42, No. 5-6

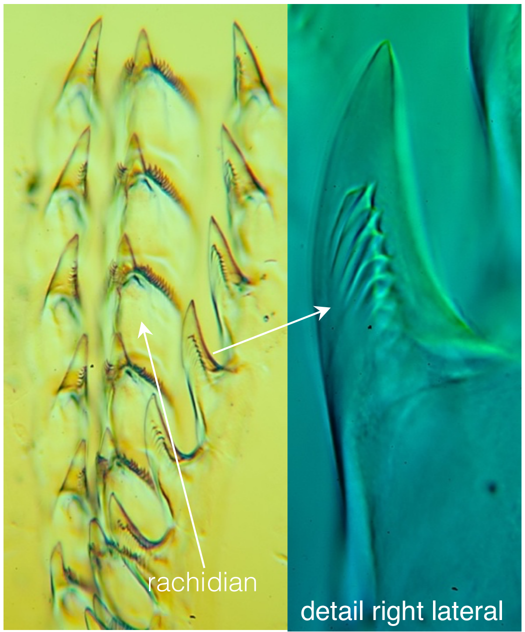
Group: Family Cumanotidae

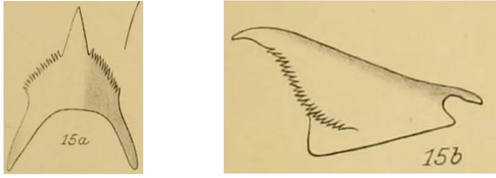
Date examined: April 20, 2022 (revised 14OCT2025)

Prepared by: K. Barwick & D. Cadien









Line drawings - 15a rachidian tooth,
15b lateral tooth (modified from Eliot 1906)

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