Comments on Cumacea for LH – Part 5. The Family Leuconidae
dbcadien 13 November 2006

The Leuconidae is a moderately sized family (96 species in 1988, with a number described since, i.e. Mühlenhardt-Siegel 2005b) distributed primarily in polar and/or cold waters (Băcescu 1988). In the NEP the family is represented by 26 taxa distributed among 6 genera, one with 5 subgenera. Barysheva (1984) gives a useful account of cumacean distribution in the eastern Bering Sea, which deals for the most part with members of this family. A major revision of the entire family was performed by Watling (1991) who erected several new genera and subgenera. SCAMIT members generally avoid use of subgenera, except for a few groups where they appear to have utility in local waters. This is one of those groups. The genus *Leucon* has local members in five of the six available subgenera. In addition to the five subgenera listed by Watling (1991), Watling and McCann (1997) established the subgenus *Diaphonoleucon* (which remains monotypic) , based on the local *Leucon declivis*, formerly *Leucon* sp H. Boundaries of the subgenus *Epileucon*, which was originally proposed as a full genus (Jones 1969), appear to have been stabilized by Watling (1991). The locally occurring *Leucon bishop*i was originally placed in *Epileucon*, but was transferred to *L.* (*Crymoleucon*) upon its creation by Watling (1991). The genus *Coricuma*, originally placed in the Bodotriidae (Watling and Breedy 1988), was transferred to the Leuconidae as part of the revision (Watling 1991).Emended diagnoses of all genera and subgenera known at the time are provided by Watling in his family revision. Keys to females of each of the genera and subgenera are also provided. These will be modified to accommodate the additional provisional species known from the NEP.

Leuconids are not particularly abundant where they occur, but *Leucon (Leucon) falcicosta* (as Leucon sp A) was identified as a member of the recurrent group associated with *Amphiodia urtica*; key species in the most widely distributed community in southern California (Jones 1969). In the same analysis *Eudorella pacifica* (as Eudorella sp A) was associated with recurrent group III, a group consisting entirely of small crustaceans, which occurred along the entire coast of the SCB.

Despite the efforts of Given (1961) and of Watling and McCann (1997) the family has many undescribed provisional forms in the NEP. Since it is known to exhibit strong patterns of sibling replacement by depth along continental margins (see Bishop, 1982), the occurrence of numerous species in any geographic area is not unexpected. In the NEP most of the genera and subgenera in the family are apparently well-described, with no known provisionals in *Alloeoleucon*, *Eudorella*, *Eudorellopsis*, *Leucon (Crymoleucon)*, *Leucon (Diaphonoleucon)*, *Leucon (Epileucon)*, *Leucon* (*Macrauloleucon*) and *Nippoleucon*. Only in *Leucon (Leucon)* are there known but undescribed forms (5 of 11). It is likely that additional work with existing deep-water materials will indicate additional provisional taxa, at least in the genus *Eudorella*. Cadien provided a key to the species of *Leucon* known from southern California at a SCAMIT meeting in February of 1986.

Sexual dimorphism is variable in the family, with some species having males and females virtually identical in all respects except secondary sexual characters of antennal length, pleopod number, and epipod development. In others the non-sexually based morphology diverges significantly between males and females, usually in details of the

carapace and the uropod. Members of multiple species within a genus are seldom found in the same grab samples (epibenthic sled samples and other distance-integrating devices usually do have more that one species present), but one cannot immediately assume that males and females taken from a single grab or core are conspecific. Within the genus *Leucon* in local waters the only species where males and females are nearly always taken together is *Leucon* (*Leucon*) sp G. Virtually all collections of this animal have included both males and females where more than a single specimen was caught.

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

Alloeoleucon santamariensis Watling and McCann 1997 – Central California; 92-410m
Coricuma nicoyensis Watling and Breedy 1988 – Gulf of Nicoya, Costa Rica; 0-1m
Epileucon sp B see Leucon (Crymoleucon) bishopi
***Eudorella pacifica** J. F. L. Hart 1930 – Puget Sound to San Diego; 20-732m
Eudorella redacticruris Watling and McCann 1997 – off Pt. Conception; 430m
Eudorella tridentata see Eudorella pacifica
Eudorella truncatula Bate 1856 – Mediterranean, No. Atlantic; NEP from Alaska to Central California; 410-2816m
Eudorellopsis biplicata Calman 1912 – NW Atlantic to NWP, Arctic Alaska; 20-1514m
Eudorellopsis integra (S. I. Smith 1879) – NW Atlantic, Arctic, NWP, NEP to SE Alaska; 1.5-1500m
***Eudorellopsis longirostris** Given 1961 – Puget Sound to San Diego; 11-606m
Eudorellopsis ushakovi Lomakina 1955 – NWP to SE Alaska; 85-412m
Hemileucon comes see Nippoleucon hinumensis
Hemileucon hinumensis see Nippoleucon hinumensis
***Leucon (Crymoleucon) bishopi** Băcescu 1988 – Oregon to Gulf of Panama; 477-930m
Leucon (Crymoleucon) savulescui Petrescu 1992 – Baja Abyssal Plain to Peru-Chile Trench; 3880-4723m
***Leucon (Diaphonoleucon) declivis** Watling and McCann 1997 – Oregon to Huntington Beach; 367-952m
Leucon (Epileucon) bishopi see Leucon (Crymoleucon) bishopi
Leucon (Epileucon) tenuirostris G. O. Sars 1886 – So. Atlantic; NEP to Peru-Chile Trench; 300-4116m
Leucon (Leucon) armatus Given 1961 – Pt. Sur, Central California to Mugu Submarine Canyon; 107-222m
***Leucon (Leucon) falcicosta** Watling and McCann 1997 – Crescent City to San Diego; 90-410m
Leucon (Leucon) fulvus G. O. Sars 1864 – No. Atlantic, NWP to Puget Sound; shallow subtidal
***Leucon (Leucon) magnadentatus** Given 1961 – Crescent City to Tanner/Cortez Banks; 109-953m

Leucon (Leucon) nasica Krøyer 1841 – No. Atlantic, NW Pacific, NEP to Puget Sound; 4-659m

***Leucon (Leucon) subnasica** Given 1961 – Morro Bay, Central California to SCB; 15-1372m

Leucon (Leucon) sp G MBC 1985§ - Pt. San Luis, Central California to Western Santa Barbara Channel; 366 – 954m

Leucon (Leucon) sp I MBC 1985§ - off Morro Bay, Central California; 592m

Leucon (Leucon) sp J MBC 1985§ - off Diablo Canyon, Central California; 396m

Leucon (Leucon) sp L Cadien 1986§ - Baja Abyssal Plain; 3880-3950m

Leucon (Leucon) sp N Cadien 1990§ - Prince William Sound, Alaska; shallow shelf

Leucon (Macrauloleucon) spinulosus Hansen 1920 – No. Atlantic, NWP; NEP from Cascadia Abyssal Plain to Baja Abyssal Plain; Peru-Chile Trench; 698-5841m

Leucon sp A see Leucon (Leucon) falcicosta

Leucon sp B see Leucon (Crymoleucon) bishopi

Leucon sp H see Leucon (Diaphonoleucon) declivis

Leucon sp K see Leucon (Macrauloleucon) spinulosus

Leucon sp M see Leucon (Crymoleucon) savulescui

Nippoleucon hinumensis (Gamô 1967) – Japan, introduced to NEP bays, Puget Sound to San Francisco Bay; 2-40m

Key to the genera of Leuconidae in the NEP (adapted from Watling 1991) – dbcadien, 8 November 2006

1a. Distinct eye lens and/or pigment present.....*Coricuma*
1b. Eye lobe without lens or pigment.....2
2a. Efferent orifice anterior or anterodistal.....3
2b. Efferent oriface distinctly dorsal, pseudorostral lappets bent posterad and directed dorsally.....5
3a. ♂ without pleopods; ♂antenna 2 not reaching end of pereon (thorax).....4
3b. ♂ with 2 pairs of pleopods; ♂antenna 2 extending along pleon (abdomen).....*Leucon*
4a. ♂ lacking strong setal brush on antennal peduncle; ♂ antennal flagellum not modified for grasping (mid to outer shelf).....*Alloeoleucon*
4b. ♂ with strong setal brush on antennal peduncle; ♂ antennal flagellum modified for grasping (polyhaline bays and estuaries).....*Nippoleucon*
5a. Antennule (Antenna 1) geniculate between articles 1 and 2.....*Eudorellopsis*
5b. Antennule (Antenna 1) geniculate between articles 2 and 3.....*Eudorella*

Alloeoleucon – The genus remains monotypic, containing only the local *A. santamariensis*. It seems closely associated with *Nippoleucon*, being distinguished from it only by details of the adult male antenna, although the two genera are found in two different habitats. Female *Alloeoleucon* cannot be distinguished currently from female *Leucon* at the generic level, and differences between species must be recognized to properly place them as *Alloeoleucon.*

Coricuma - Another monotypic genus, housing only *C. nicoyensis* from Pacific Coasta Rica on intertidal mud flats. This genus along with the genus *Ommatoleucon*, bear

pigmented eyes; lacking in all other leuconids. It was initially placed in the Bodotriidae, and intergrades with members of that family in some respects. Watling (1991) reweighed the evidence, finding an error in the original characterization of the mandible as tapering rather than truncate. Truncate mandibles are a characteristic of leuconids. This reinterpretation, along with the description of the genus *Ommatoleucon*, another eyed leuconid, prompted his removal of the genus from the Bodotriidae and a relocation to the Leuconidae.

Eudorella – There are three valid taxa in the genus present in the NEP. A fourth, *Eudorella tridentata*, which was erroneously listed as valid in McLaughlin et al (2005), was synonymized with *E. pacifica* by Barnard and Given (1961), a judgment followed subsequently (Watling 1991, Watling and McCann 1997), although Hart (1987) continues to view it as valid. Variability in the genus was explored by Barnard and Given (1961), who documented significant variation in carapace morphology leading to synonymization of *Eudorella tridentata*. The potential for such variation elsewhere within the family must be considered, especially in deep-water forms where few individuals are often known. Once the variability was determined to be strong, members of this genus have nearly all been pigeon-holed into *E. pacifica* locally. It was not until Watling brought his broader experience from the North Atlantic into play that *E. truncatula* was recognized as occurring in the NEP (Watling and McCann 1998). Although it was mentioned from the NWP by Lomakina (1958), it was not detected by Hart or Lie in boreal NEP materials. The peculiar *E. redacticruris* has not been taken subsequent to its initial description, nor has it been recognized in preexisting materials.

Species of the genus are common in samples from deeper waters of the NEP, and require a more complete examination to determine their identity. Materials from the Baja Abyssal Plain seem grossly to differ from *E. pacifica* and *E. truncatula* (more closely resembling *E. fallax*), but have not been thoroughly analyzed. Similarly there appear to be several forms present in materials from bathyal and abyssal depths off Oregon currently under evaluation. At least one form from the Cascadia Abyssal Plain is reminiscent of both *E. hispida* and *E. hirsuta*, being covered with fine setae. It may however, belong to neither. As yet uncharacterized provisional *Eudorella* are to be expected from deeper NEP waters in future, but there are currently no recognized provisionals in the fauna. With the broad geographic ranges of deeper dwelling cumaceans, some of the species reported from western South America (Petrescu 1991) may be detected in NEP material. Three species not otherwise known from the NEP are recorded by him from Vema collections in the Gulf of Panama; *E. bacescui*, *E. fallax*, and *E. gracilior*.

Despite the demonstrated variability of *E. pacifica*, it may prove to house undetected siblings within that variability. Genetic examination of a broad spectrum of materials from the NEP is needed to clarify the genus, and allow better separation of its local members.

All local *Eudorella*, with the exception of *E. redacticruris*, are represented in Watling's 1991 key to females of the genus (p. 579-580). The key could easily be modified to include *E. redacticruris* by inserting the following couplet as couplet 0, and then following the existing key:

0a. Fifth leg lacking ..... *Eudorella redacticruris*
0b. Fifth leg present 1

Eudorellopsis – An engagingly strange carapace morphology defines this genus, with the pseudorostrum and anterior carapace strongly upswept, and the carapace strongly sculptured and calcified in many species. Four species are known in the NEP, but only one appears to be endemic to the area, *Eudorellopsis longirostris* . *E. ushakovi* and *E. biplicata* are species of trans-Pacific distribution, known from both the boreal NWP and the boreal NEP. *E. integra* is circum-Arctic in distribution and extends into the boreal regions of both the North Atlantic and North Pacific. The species can all be separated by use of Watling's key to the genus (1991, p.580). No provisionals in this genus are yet known from the NEP. Of these forms only *E. longirostris* has a distribution extending to the temperate waters of the SCB.

Key to species of *Leucon* in the NEP (based on keys in Watling 1991, but modified to include both sexes where known) – dbcadien, 13 November 2006

1a. Branchial siphon elongate, greatly exceeding pseudorostrum..... ..... *Leucon (Macrauloleucon) spinulosus*
1b. Branchial siphon normal length, protruding only slightly beyond pseudorostrum or no longer than pseudorostrum..... 2
2a. Pereonite 5 with ventral hook(s)..... *Leucon* (*Epileucon*) *tenuirostris*
2b. Pereonite 5 without ventral hook(s)..... 3
3a. Antenna 1 accessory flagellum extending at least to midlength of main flagellum 1st article..... *Leucon* (*Crymoleucon*) 4
3b. Antenna 1 accessory flagellum minute to short..... 5
4a. Carapace with paired spine rows posteriorly which join to form dorsal crest row on the anterior carapace..... *Leucon* (*Crymoleucon*) *savulescui*
4b. Carapace lacking dorsal crest spines..... *Leucon* (*Crymoleucon*) *bishopi*
5a. Pleopods of male reduced to short peduncle bearing nub-like rami; branchial siphon exceeding pseudorostrum, but not greatly longer than pseudorostrum ..... *Leucon* (*Diaphonoleucon*) *declivis*
5b. Pleopods of male with normal peduncles and setose rami; branchial siphon not or only slightly exceeding pseudorostrum..... *Leucon* (*Leucon*) 6
6a. Carapace with only a single tooth or denticle mid-dorsally..... 7
6b. Carapace bears several teeth along dorsal midline..... 8
7a. Carapace lacking well defined dorsal carina; anterior margin of pseudorostrum oblique, finely serrate; no teeth or denticles on underside of pseudorostrum; anterior ventral border of carapace smooth..... *Leucon* (*Leucon*) sp I ♂
7b. Carapace with well defined dorsal carina; anterior margin of pseudorostrum vertical, not serrate; strong teeth on underside of pseudorostrum, anterior ventral border of carapace serrate..... *Leucon* (*Leucon*) *fulvus* ♂
8a. Pereopod 1 basis with spines or denticles on posterior (ventral) margin..... 9
8b. Pereopod 1 basis at most setose, lacking spines or denticles on posterior (ventral) margin..... 13
9a. Pereopod 1 basis with a single tooth distally..... 10

9b. Pereopod 1 basis with multiple teeth.....11
10a. Pereopod 1 merus also bears a single distal tooth.....*Leucon(Leucon) nasica*
10b. Pereopod 1 merus lacking distal tooth.....*Leucon(Leucon) subnasica*
11a. Pereopod 1 basis with 3 large teeth.....*Leucon (Leucon) magnadentatus*
11b. Pereopod 1 basis with 5-6 teeth.....12
12a. Carapace bearing 2-3 spines laterally.....*Leucon* (*Leucon*) sp L
12b. Carapace lacking spines laterally.....*Leucon* (*Leucon*) sp N
13a. Uropodal endopods shorter than exopods.....14
13b. Uropodal endopods longer than exopods.....15
14a. Carapace bearing a tooth or denticle laterally below the dorsal crest spines; a well incised distinct curving ridge defining an anterior lateral carapace sulcus..... .....*Leucon* (*Leucon*) *falcicosta*
14b. Carapace without lateral tooth below dorsal crest; no defined lateral carapace sulcus.....*Leucon* (*Leucon*) sp J
15a. Anterior margin of pseudorostrum smooth.....*Leucon* (*Leucon*) sp G
15b. Anterior margin of pseudorostrum serrate.....16
16a. Uropodal endopod basal article four times length of terminal article; pereopod 1 article 3 with a single tooth.....*Leucon* (*Leucon*) *armatus*
16b. Uropodal endopod basal article less than twice the length of terminal article; pereopod 1 article 3 lacking tooth.....*Leucon* (*Leucon*) *fulvus* ♀

Leucon (Crymoleucon) – Currently represented in the NEP by two species, *L.* (*C.*) *bishopi*, which was originally characterized as an *Epileucon*, and *L. savulescui*. Watling and McCann (1997) provide a description and discussion of the former (although you may also want to examine the illustrations in Jones 1969), while *L. savulescui* is described by Petrescu (1992). The name *bishopi* is a replacement name for *Epileucon pacifica* of Jones 1969, a homonym of *Leucon pacificus* Zimmer 1937m proposed by Băcescu (1988). *L.* (*C.*) *savulescui* was known only from material from the Peru-Chile trench (Petrescu 1992), until it was recognized as identical to the provisional *Leucon* sp M from the Baja Abyssal Plain.

Leucon (Diaphonoleucon) – The length of the branchial siphon in this subgenus is intermediate, not nearly as long as the rolled tube of *L.* (*Macrauloleucon*), but longer than that of the remaining subgenera. It extends noticeably beyond the tip of the pseudorostrum. Only a single species is currently assigned to the subgenus, *L.* (*D.*) *declivis*, for which it was created (Watling and McCann 1997). The species appears to be adapted to low-oxygen conditions, and is distributed bathymetrically across the oxygen minimum zone of the NEP. It is possible that the longer branchial siphon aids in some way in increasing the efficiency of the respiratory current, allowing the species to utilize habitat difficult for other species. The species is relatively large for the group, perhaps reflecting a broader ambit in daily activities than in smaller congeners.

Leucon (Epileucon) – Represented in the NEP only by the abyssal *L.* (*E.*) *tenuirostris* from the Arctic. Watling (1991) rediagnosed the subgenus based in part on the criteria established by Bishop (1981) in his reevaluation of *Epileucon* as a genus. Watling agreed with Băcescu that full generic status is not warranted, however, and reduced it to a subgenus of *Leucon*. *L. bishopi*, which was initially placed in *Epileucon*, was transferred to *L.* (*Crymoleucon*) by Watling.

Leucon (Leucon) – Contains the type of the genus *L.* (*L.*) *nasica*, as well as a number of species distributed in the NEP. Several, like the type, are apparently circum-borearctic, and are distributed in the colder waters of both the Atlantic and Pacific as well as the Arctic Ocean. A number of the NEP species are provisionals, placed here pending further assignment to other subgenera. Many will probably stay in Leucon ss., but a few will move to other subgenera, most probably *Leucon* (*Crymoleucon*) and *Leucon* (*Diaphonoleucon*). As study materials become more numerous these reassessments should be increasingly possible. *Leucon* sp. M, initially placed here, has already been identified as *L.* (*Crymoleucon*) *savulescui* and removed. It is suspected that *Leucon* sp. N will eventually prove to be a *Diaphonoleucon*, but materials are not available for further study, leaving placement to be based on the original notes rather than specimens. Additional materials from deep water on the Cascadia Slope and Cascadia Abyssal Plain seem to contain several additional species, but most are likely to be placed in other subgenera and not *Leucon* ss., which is primarily distributed on coastal shelves. The local species are keyed in the *Leucon* key provided above. Important characters for specific determination are located on the carapace dorsal and ventral margins, on the pseudorostrum, on the maxilliped, on the basis of the first pereopod, and on the uropods.

Leucon (Macrauloleucon) – Originally established to receive three existing species by Watling (1991), the subgenus has grown considerably since to 8 described species (Ledoyer 1993; Mühlenhardt-Siegel 1994, 2005b). Mühlenhardt-Siegel (2005b) provides a character table comparing the eight described species, three newly described in the same paper. Most members of the subgenus are abyssal, but the two known Antarctic species are shelf to bathyal forms. It may be that the elongate tubular branchial siphon that characterizes this subgenus is helpful in the fine oozes which overlay abyssal plains and basins. There is considerable variability both between and within a sex of denticle and tooth counts and placement on the carapace. This is particularly true of the species recorded from the NEP, *L.* (*M.*) *spinulosus*. The variability was commented on by Hansen (1920) and later by Petrescu (1994). Two provisional species which differed slightly from the nominal pattern of *spinulosus* were created and later synonymized within a broader concept of that species' variability. The species has a very broad range, both in depth and zoogeographically. Subsequent comparisons of material may show that it is actually a complex of sibling species with higher endemicity.

Nippoleucon - The genus *Nippoleucon* is known to be non-native in the NEP. It was introduced from Japan, with the local representative, *N. hinumensis*, becoming a major constituent of some disturbed bay/harbor benthic communities. This species, when initially taken in Newport Bay, Oregon in the1980s, was believed to be *Hemileucon comes*, a native of New Zealand. *N. hinumensis* is a species tolerant of reduced salinities, and was originally described from oligohaline waters in Japan (Gamô, 1967). It has since spread both up and down coast to Puget Sound and San Francisco Bay. Some aspects of the ecology of this animal have recently been explored (Akiyama and Yamamoto 2004a,b) in populations within its home range. While males have distinctively modified antennae as well as differences in pleopod count, females cannot be distinguished from *Leucon* morphologically. *Nippoleucon* occur in different habitat from females of *Leucon* species, which are found nearly entirely on the open coastal shelf and slope.

Additional Literature Cited (see Part 1 for Main reference list)

Akiyama, T., and Masamichi Yamamoto. 2004a. Life history of *Nippoleucon hinumensis* (Crustacea: Cumacea: Leuconidae) in Seto Inland Sea of Japan. I. Summer diapause and molt cycle. *Marine Ecology Progress Series* 284: 211-225.

---------, **and** ---------. **2004b**. Life history of *Nippoleucon hinumensis* (Crustacea: Cumacea: Leuconidae) in Seto Inland Sea of Japan. II. Non-diapausing subpopulation. *Marine Ecology Progress Series* 284: 227-235.

Barysheva, K. P. 1964. Characterization of the Cumacean fauna of the eastern part of the Bering Sea. *Soviet Fisheries Investigations in the Northeast Pacific* 3: 197-207.

Bishop, John D. D. 1981. A revised definition of the genus *Epileucon* Jones (Crustacea, Cumacea), with descriptions of species from the deep Atlantic. *Philosophical Transactions of the Royal Society of London, B. - Biological Sciences* 291(1052): 353-409.

---------. **1982**. Three new species of the genus *Leucon* Krøyer, 1846 (Crustacea: Cumacea) from the continental slope off Surinam. *Zoological Journal of the Linnean Society* 74: 345-356.

Jones, Gilbert F. 1969. The benthic macrofauna of the mainland shelf of Southern California. *Allan Hancock Monographs in Marine Biology*, no. 4: 1-219.

Ledoyer, Michel. 1993. Cumacean (Crustacea) de la campagne EPOS 3 du R. V. *Polarstern* en mer de Weddell, Antartique. *Journal of Natural History* 27(5): 1041-1096.

Mühlenhardt- Siegel, Ute. 1994. *Leucon parasiphonatus*, a new species (Crustacea, Cumacea, Leuconidae) from Antarctic waters. *Helgolämder Meeresuntersuchungen* 48: 79-88.

---------. **2005b**. Cumacea species (Crustacea: Peracarida) from the deep-sea expedition DIVA-1 with RV "Meteor" to the Angola Basin in July 2000. Family Leuconidae. *Organisms, Diversity & Evolution* 5: 131-149.

Petrescu, Iorgu. 1991. Contribution to the knowledge of genus *Eudorella* Norman, 1867 (Crustacea, Cumacea, Leuconidae) with the description of two new species: *Eudorella bacescui* n.sp. and *Eudorella menziesi* n.sp. *Travaux Du Muséum D'Histoire Naturelle "Grigore Antipa"* 31: 375-385.

———. **1992**. *Leucon savulescui* n. sp. (Crustacea, Cumacea) from the Peru-Chile Trench. *Revue Roumaine De Biologie, Série De Biologie Animale* 37(2): 97-100.

———. **1994**. Contributions to the knowledge of *Leucon* genus (Crustacea: Cumacea) from the waters of South America. *Travaux Du Muséum D'Histoire Naturelle "Grigore Antipa"* 34: 325-345.