MARINE INTERSTITIAL POECILOSTOMATOIDA AND CYCLOPOIDA (COPEPODA) OF AUSTRALIA

Tomislav Karanovic

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Author's address:
Dr. T. Karanovic, School of Zoology, University of Tasmania, Private Bag 5, Hobart, Tasmania 7001, Australia; e-mail: tomislav.karanovic@utas.edu.au

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Cover: A collage of fig. 82, the map of Australia, and of fig. 65H, *Neocyclops tropicus* n. sp., female, see pp. 293 and 241, respectively.

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PREFACE AND SUMMARY

The Australian marine interstitial was sampled in 2002 and 2003 at 103 different beaches, all around mainland Australia, and the results for poecilostomatoid and cyclopoid copepods are presented here. A total of 26 species was recorded and classified into 14 genera and seven families.

A new cyclopoid family is established (Abrsiidae n. fam.) to accommodate a single new genus and species from New South Wales: *Abrsia misophrioides* n. g. et sp. This new free-living family is characterized by a misophridiform habitus (with enormously inflated cephalothorax and first pedigerous somite, and the rest of the body cylindrical and relatively slender), conical caudal rami, disproportionately large mouth appendages, absence of aesthetascs on the antennula, two-segmented endopod of the maxillula, two chitinous beak-like structures on each side of the copulatory pore, first and second swimming legs with both rami one-segmented, third and fourth legs positioned laterally and lacking intercoxal sclerites, and third and fourth legs without endopod and with one-segmented exopod, the latter with fused coxa and basis. Gorging as a feeding strategy was postulated for this strange cyclopoid which, due to its primitive mouth appendages, shows many similarities with the primitive families Archinotodelphyidae Lang, 1949, Cyclopinidae G. O. Sars, 1913, Mantridae Leigh & Sharpe, 1934, and with the most primitive genera of the Notodelphyidae Dana, 1853.

A second species of the family Polyankyliidae Ho & Kim, 1997 was found in South Australia and is herein described as a new species. This family was previously known only from a tidal pool on mud-flats in Korea. One new poecilostomatoid genus (*Cemihyclops* n. g.) was established in the family Clausidiidae Embleton, 1901, for a newly described South Australian species. It seems closely related to the genera *Hemicyclops* Boeck, 1873 and *Giardella* Canu, 1888, but could be distinguished by a combination of apomorphic and plesiomorphic character states.

No cyclopoid or poecilostomatoid copepods have previously been reported from the Australian marine interstitial, so all species are new records for this environment. Two poecilostomatoid and one cyclopoid species found are well-known planktonic marine animals, apparently buried in the sand by the wave action, and two other cyclopoid species were known previously from Australian continental waters, but 21 species are new to science and ascribed

to the following 12 genera: *Hemicyclops* (one new species), *Cemihyclops* n. g. (one species), *Polyankylis* Ho & Kim, 1997 (one), *Cyclopinella* G. O. Sars, 1913 (one), *Hemicyclopina* Herbst, 1953 (one), *Allocyclopina* Kiefer, 1954 (one), *Cyclopina* Claus, 1862 (six), *Heterocyclopina* Pleşa, 1968 (one), *Cryptocyclopina* Monchenko, 1979 (one), *Abrsia* n. g. (one), *Neocyclops* Gurney, 1927 (six), and *Halicyclops* Norman, 1903 (one new species).

As a result of taxonomic analyses of various genera and families, some new taxa are established and others synonymized. The following three species are described as new: *Neocyclops plesai* n. sp. [syn. *Neocyclops* sp. of Pleşa (1981)], *Neocyclops monchenkoi* n. sp. [syn. *Eurycyclops remanei vicinus* (Herbst, 1955), cf. Monchenko (1974)], and *Neocyclops dussarti* n. sp. [syn. *Neocyclops affinis* nov. sp. of Dussart (1974)]. The genus *Heterocyclopina* Pleşa, 1968, which was regarded as a synonym of the genus *Procyclopina* Herbst, 1955, is reinstated. In addition, five genera are synonymized: *Muceddina* Jaume & Boxshall, 1996 and *Barathricola* Humes, 1999 are synonymized with the genus *Cyclopinella*; *Glareolina* Huys & Boxshall, 1990 with *Hemicyclopina*; and *Troglocyclopina* Jaume & Boxshall, 1996 and *Heptnerina* Ivanenko & Defaye, 2004 with *Cyclopina*. The subgeneric division of the genus *Neocyclops* is abandoned and the subgenus *Protoneocyclops* Petkovski, 1986 established as its junior synonym. *Oithona attenuata* Farran, 1913 is synonymized with *O. nana* Giesbrecht, 1893, while the following five species are here established as synonyms of *Halicyclops* (*H.*) *thermophilus* Kiefer, 1929: *H. spinifer* Kiefer, 1935; *H. japonicus* Itô, 1956; *H. latus* Shen & Tai, 1964; *H. dedeckeri* Brownell, 1983; and *H. antiguaensis* Herbst, 1983. *Cyclopina heterospina* Shen & Bai, 1956 is formally excluded from the genus *Cyclopina* and placed as incertae sedis in the family Cyclopinidae, while two former members of the genus *Procyclopina* Herbst, 1955 are transferred to the genus *Hemicyclopina*: *P. feiticeira* Lotufo, 1995 and *P. uguaipuku* Lotufo, 1995. An overview of 17 cyclopoid families is given when justifying the new family and, also, copepod orders are discussed and listed with their corrected authors. The Poecilostomatoida Thorell, 1859 and Cyclopoida Rafinesque, 1815 are treated as separate orders, and the Thaumatopsylloida G. O. Sars, 1913 are also accepted as a valid order.

A key to species worldwide is provided for the genus *Neocyclops*, while further keys are given for the Australian representatives of *Cyclopina* and *Halicyclops*. The genera *Polyankylis*, *Cyclopinella*, *Hemicyclopina*, and *Cryptocyclopina* are reported for the first time from the Southern Hemisphere, while the current study provides the first Australian records of *Allocyclopina*, *Cyclopina*, and *Heterocyclopina*. *Neocyclops petkovskii* De Laurentiis, Pesce & Halse, 1997 is reported for the first time from South Australia.

While vicariance was recognized as the most acceptable hypothesis for explaining zoogeographic connections of the Australian freshwater subterranean copepods with disjunct distribution patterns, dispersal seems to be a much more important mechanism in the marine interstitial. For example, dispersal, facilitated by the West Wind Drift, seems the most plausible explanation for the current distribution of the species of *Allocyclopina*. However, most genera reported here are either cosmopolitan or very widely distributed in marine habitats, and the zoogeographic connections of the Australian marine interstitial with other regions of the world are not very obvious. The importance of looking at small-scale patterns when inferring Gondwanan biogeography is emphasized, and a number of zoogeographic regions are becoming apparent in Australia, even when only copepods are analysed. This contrasts to the recognition of no more than two Australian regions for marine interstitial and subterranean inland waters, as proposed in "Stygofauna Mundi", a widely used reference work (Botosaneanu, 1986). The division of Australia into nine distinct biogeographic regions, based on mangroves, is the most suitable model for marine interstitial copepods, although, using copepods, Shark Bay in Western Australia as well as eastern South Australia are additionally recognized as separate regions. The very distinct freshwater copepod fauna of two neighbouring Western Australian regions, the Pilbara and the Murchison, is reflected in distinct marine interstitial faunas on their shores. The genus *Halicyclops*, the most speciose cyclopoid genus in the world's marine interstitial, is barely represented in this habitat in Australia, although many species are known from Australian continental waters. The diversity and abundance of the genus *Neocyclops*, which is probably competing for the same resources and may be a relatively recent arrival, is suspected as a possible explanation for the near absence of *Halicyclops* in the marine interstitial of Australia.