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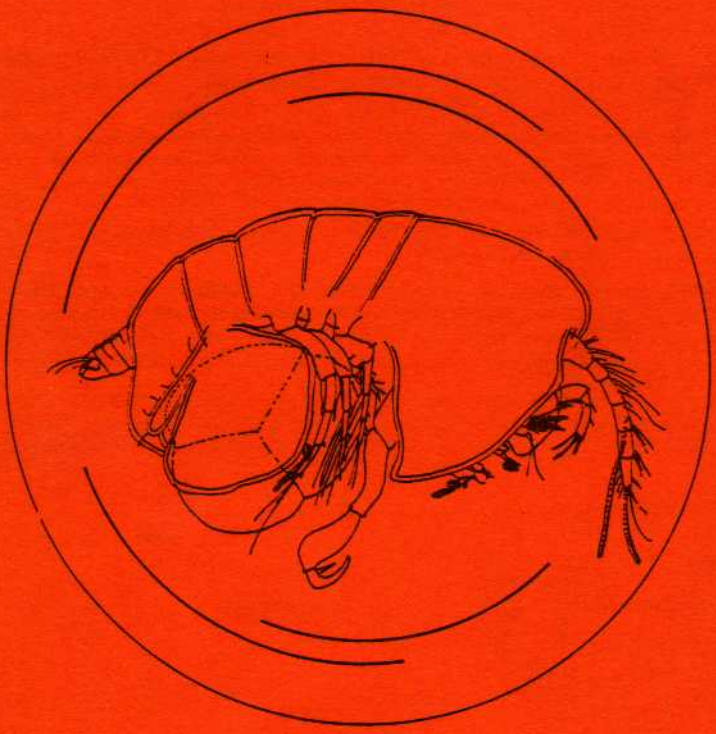
MONOCULUS

Copepod Newsletter



Nr. 20 **June 1990**

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MONOCULUS

Copepod Newsletter

Number 20 June 1990

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Gerd Schriever, Institut für Hydrobiologie und Fischereiwissenschaft, Universität Hamburg, Zeiseweg 9, 2000 Hamburg 50, W. Germany.

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This issue has been typed by: Angelika Sievers, Fachbereich 7 (Biologie), Universität Oldenburg.

Birthdays this year:

80 Helmut Kunz

75 Siegfried Husmann

Died:

Tatsunori Ito
(May 1990)

Deadline for the next issue of *MONOCULUS*: 15 October 1990

Editorial

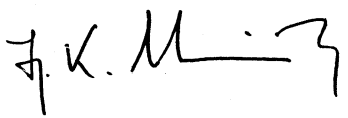
We enter a year of special events. Firstly, in Japan our colleagues are awaiting us for our Fourth International Conference on Copepoda and they hope to see us arriving in great numbers. An account further below of the copepodological achievements (past and present) in our host country is meant as a prelude to this event in order to stimulate our interest and curiosity. It is an excellent introduction to those who are awaiting us. Have you returned the registration form joined to the last issue of *MONOCULUS*?

Secondly, you have enjoyed our newsletter for 10 years now. Do you really? The first issue appeared in October 1980. Therefore the next will be the 10th anniversary issue. We feel, this would be a good opportunity to assess the value of the newsletter. What does it mean to you? Is it a pleasure to receive it or is it a silly publication? Have you benefited from it and in what respect? What are its strengths, what its weaknesses? Is it time to change the editors? What do you read first? Is there anything you miss or find superfluous? In short, what are your feelings when you receive it? We would be glad to read in a few lines your personal and critical opinion.

For ten years now we have benefited from and enjoyed the help of several people in producing the newsletter. In this way it has become our newsletter and we hope this loyalty will extend also to the years to come. One person, however, has indicated that this will be her last newsletter: Angelika Sievers. She is to leave Oldenburg later this year. Since No. 7 in 1983 she has typed the newsletter. Our thanks and good wishes accompany her to her new position. For help with this issue we also have to thank P. Bodin, F. Ferrari, R. Hamond, A. Humes, H. Juhl, S. Motoda, S.I. Uye who sent us literary contributions and B. Schumacher together with M. Pottek to whom we owe the graphi-

cal component. Nameless as it still is our little copepod sets our for new adventures.

Looking forward to meeting you in Karuizawa,



THE WORLD ASSOCIATION OF COPEPODOLOGISTS

WAC WAC ..... WAC WAC

WAC - TREASURER'S REPORT 1988/1989

1. The financial situation

	01.01. - 31.12.88	01.01. - 31.12.1989
Balance forward	**5.671,97 DM**	**7.807,82 DM**
Deposits	1.637,18 DM	3.385,71 DM
Interests	124,70 DM	193,44 DM
Donation of the 3rd Conf.Cop. London	1.313,17 DM	--
Total	3.075,05 DM	3.579,15 DM
Expenses		
Support of MONOCULUS 87/88	883,30 DM	673,20 DM
Account dues	55,90 DM	89,00 DM
Total	2.135,85 DM	2.816,95 DM
Balance	**7.807,82 DM**	**10.624,77 DM**

2. General remarks

By the end of 1989 dues had been received from 148 out of 260 members of WAC, viz. we have to thank 57 % of our members for punctual payment. Apart from these loyal members many of which have paid their dues even for more than one year there are 34 others who have paid once to become a founder member. This must have exhausted them so much that I have never heard of them again. Another few are in arrears only for 1988 or/and 1989. A reminder will be sent in June to all those who are two and more years behind and they will be asked to make their payments by the end of August at the latest. In Karuizawa/ Japan we shall have to discuss what to do with lazy and indifferent payers.

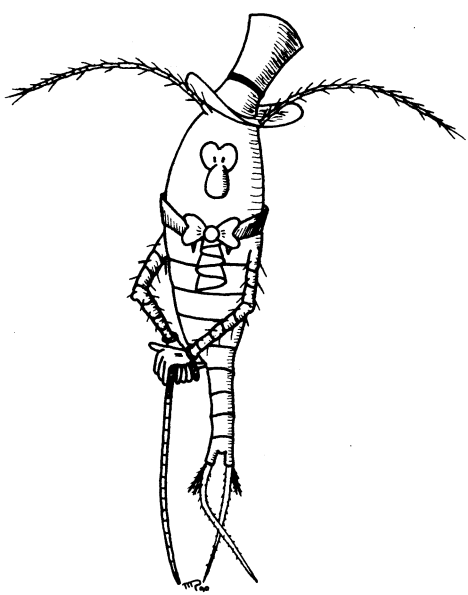
3. Dues

Dues are still at 7 US $ (or 13.00 DM) per annum.
Europeans may send their personal eurocheque in German Marks. Americans and Canadians should send their personal cheques, while all others should use international money orders or bank drafts in US $ and make them payable to the following account:

No. 7233190, Commerzbank Kiel
mark "WAC, c/o Dr. G. Schriever"

Please note my address:

Dr. Gerd Schriever
c/o Zoologisches Institut
Biologie-Zentrum
Universität Kiel
Olshausenstr. 40
D-2300 Kiel 1
F.R. Germany



Those who want to pay by postal money order may use the following account:

No. 346508-303, Postgiroamt Hannover
"WAC, c/o Dr. H.K. Schminke"

Please check your files and send your annual dues for WAC as soon as possible. Thank you very much.

4. Cheques without names

Please ask your bank not to forget to put your name on the money order when it is sent directly to the account in Kiel. In *MONOCULUS* 18 (June 1989) I had asked for four unknown cheques. One is still without response, so please WAC-members from France check your files:

- 14,- US $ from France, close to Paris by Commerzbank New York, for Abonnement revue, received in December 1988-.

G.S.

N N E
A N U C M N S
O E T

FOURTH INTERNATIONAL CONFERENCE ON COPEPODA

16th-20th September 1990
Karuizawa Seminar House of Nihon University
Karuizawa, Japan

We have no major change of schedule to prepare the Conference. As of 1st April, a total of 93 colleagues finished the preliminary registration. We believe the number will increase. We look forward to welcoming all participants at the Fourth International Conference on Copepoda in September 1990.

Programme

Half-day Symposia

1. **Copepod distributions in coastal zone waters (chaired by B.P. Bradley, University of Maryland, USA)**

   Ueda, H. (University of Ryukyus, Japan): Copepod distribution in embayments and reef waters.

   Wellershaus, S. (Institute for Polar and Marine Research, FRG): Planktonic copepods in very low salinity mixing zones.

   Kimmerer, W.J. (Biosystems Analysis, Inc., USA): Predatory influences on copepod distributions in Australian and North American coastal zones.

   Moreira, G.S. (University of Sao Paulo, Brasil): No title yet.

   Williams, R., S.A. Poulet and M. Jordan (R.W., Plymouth Marine Laboratory, U.K.): Vertical distribution of copepods in coastal waters in relation to light and food.

2. **Copepod feeding and behaviour in environments with low food concentrations (chaired by M.J. Dagg, Louisiana Marine Consortium, USA)**

   Bamstedt, U. (University of Bergen, Norway): No title yet.

   Conover, R. (Bedford Institute of Oceanography, Canada): No title yet.

Paffenhofer, G.-A. (Skidaway Institute of Oceanography, USA): Characteristics of abundant subtropical copepods in estuarine, shelf, and oceanic waters.

Dagg, M.J. (Louisiana Marine Consortium, USA): Neocalanus plumchrus: life in the nutritionally-dilute subarctic Pacific Ocean and the phytoplankton-rich Bering Sea.

3. The role of copepods in fisheries (chaired by M.M. Mullin, Scripps Institution of Oceanography, USA)

Kiorboe, T. (Danish Institute for Fisheries and Marine Research, Denmark): Pelagic fisheries and spatio-temporal variability in zooplankton productivity.

Poulet, S.A. (Station d'Oceanologie et de Biologie Marine de Roscoff, France) and Williams, R. (Plymouth Marine Laboratory, U.K.): Composition and properties of copepods affecting the recruitment of fish.

Matsushita, K. (University of Tokyo, Japan): How do fish larvae encounter copepod nauplii in the sea?

One speaker is not determined yet.

4. Symbiotic copepods of invertebrates (chaired by A.G. Humes, Boston University Marine Programme, USA)

Bresciani, J. (Royal Veterinary and Agricultural University, Denmark): The males in parasitic copepods, especially those associated with invertebrates.

Gotto, V. (The Queen's University of Belfast, Northern Ireland): Aspects of host- and mate-finding in the symbiotic copepods.

Ho, J.-S. (California State University, USA): Phylogeny of the Poecilostomatoida, a major order of associated copepods.

Ooishi, S. (Mie University, Japan): North Pacific copepods (Cyclopoida: Ascidicolidae) associated mostly with compound ascidians.

Mini-Symposium

How copepodologists use larval development to infer copepod phylogeny (chaired by F. Ferrari, Smithsonian Institution, USA, tentative)

Ferrari, F. (Smithsonian Institution, USA): A weighing game: inferring copepod phylogeny from patterns of appendage development.

Izawa, K. (Mie University, Japan): Evolutionary trend toward reduction of body segments in the poecilostome Cyclopoida.

Dahms, H.-U. (University of Oldenburg, FRG): Usefulness of postembryonic characters for the reconstruction of phylogenetic relationships within Harpacticoida (Crustacea: Copepoda).

Maxilliped Lecture

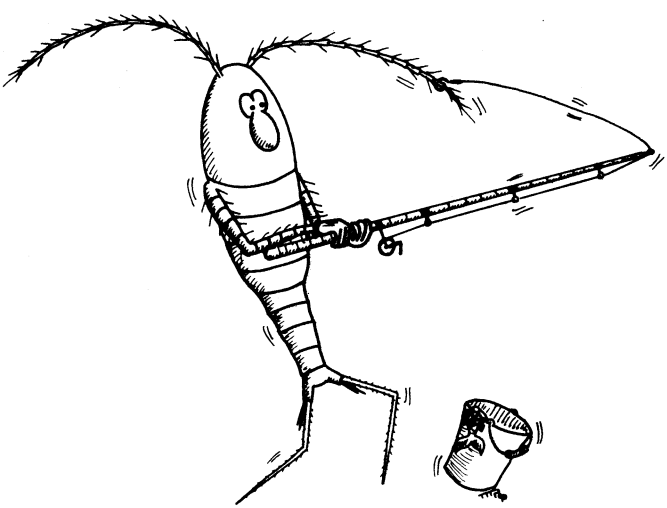
Stock, J.H. (University of Amsterdam, The Netherlands): Some reflections on the antiquity of copepod lineages.

ON COPEPOD RESEARCH IN JAPAN

Sigeru Motoda

In every text of marine planktonology so far published in Japan, pelagic copepods are of great concern because of their importance in species diversity as well as large biomass in marine ecosystems. Seiji Kokubo (1922) published the first text book entitled "Fuyûseibutsu Gaku (Planktonology) which was largely based on Steuer's Planktonkunde (1910). Kozo Akatsuka (1930), who was a phycologist, wrote a short text "Fuyûseibutsu Gaku Gaisetsu" (Outline of Planktonology), and Hiroaki Aikawa (1942) then published "Kaiyô Fuyûseibutsu Gaku" (Marine Planktonology) referring to the recent knowledge of this field. Sigeru Motoda (1944) wrote a small book on marine plankton entitled "Umi to Plankton" (Sea and Plankton).

Volume 10 of the fourteen volumes of "Kaiyô Gaku Kôza" (Oceanographic Course), University of Tokyo Press (1974 - 1975), was devoted to the marine planktonology in which Masateru Anraku presented a review of copepod feeding behaviour. Volume 6 of



the ten volumes of "Kaiyô Kagaku Kiso Kôza" (Course of Fundamental Marine Science), Tokai Univ. Press (1970 - 1976), is entitled "Marine Biology" and in which "Reproductive Ecology of Zooplankton" by Akira Taniguchi is contained. A book entitled "Dôbutsu Plankton Seitai Kenkyûhô" (Methods of Study of Zooplankton Ecology), Kyôritsu Shuppan, Tokyo, 1976, was published by Makoto Omori and Tsutomu Ikeda. The English edition, "Methods in Marine Zooplankton Ecology" Wiley Interscience, N. Y. was issued in 1984. These text books have greatly contributed to our increased knowledge of marine plankton, especially marine copepods, helpful to the general public and those beginning research on marine copepods.

Several illustrated books on marine plankton organisms have been published which have given great advantages to students and amateur workers seeking the identification of plankton. Many species of copepods are illustrated in these books. Seiji Kokubo (1932) published "Fuyûseibutsu Bunruigaku" (Classification of Plankton) in which 121 species of copepods are shown. Isamu Yamazi (1966) published "Nihon Kaiyô Plankton Zukan" (Illustrations of the Marine Plankton of Japan) in which 142 species of Calanoida, 61 species of Cyclopoida and 4 species of Harpacticoida are illustrated. A book of similar title, "Nihon Kaiyô Plankton Zukan" (Illustrated Marine Plankton in Japan), was published in 1965 - 1967 (Vols. 1, 3, 5, 7), of which Copepoda Vol. 3 was written by Otohiko Tanaka, and containing illustrations of 89 species of Calanoida, 23 species of Cyclopoida and 10 species of Harpacticoida.

Takamochi Mori (1937) published a monograph of Copepoda entitled "The Pelagic Copepoda from the Neighbouring Waters of Japan" which has been widely used in Japan. In this monograph, 121 species of Calanoida, of which 8 are new species, 41 species of Cyclopoida, of which 3 are new species, and 6 species of Harpacticoida are described. Mori was unfortunately killed by the atomic bombing of Hiroshima on 6 August 1945.

Another planktonologist at Kobe Marine Observatory, Tadami Yanagisawa, was also killed during an air bombing raid at the observatory on 17 March 1945.

Comprehensive works on the clasification of pelagic copepods, mostly in Sagami Bay and Suruga Bay, accomplished by Otohiko Tanaka were published between 1935 until the Second World War. His works were supplemented after the war by Kenzo Furuhashi and Makoto Omori. In 1965 he registered copepod species occurring in the surrounding waters of Japan as follows: 399 species (3 species added later) and one subspecies of Calanoida, including his 62 new species; 82 species of Cyclopoida, including one new species; 9 species of Harpacticoida, and 3 species of Monstrilloida.

In the early stages of copepod research in Japan, Tadao Sato (1913) reported on the Calanoida Copepoda in the sea adjacent to Hokkaido, with descriptions of three new species: Pseudodiaptomus marinus, Centropages abdominalis and Eurytemora pacifica. In this study, he collected many specimens of a large sized Calanoida from shallow layers which was considered probably to be a new species, but they were all copepodids; adult specimens were not found in the samples. Later, Hisatosi Marukawa (1921) described a new species, Calanus plumchrus, based on a similar immature specimen that was mentioned by Sato. Mature females and males were found for the first time by Tetsuo Yamada (1938) from the stomachs of young Welleye Pollock caught at 90 - 180 metres. It is now known that adults of this species are widely distributed below 200 metres in the subarctic North Pacific. The generic name of this species was replaced by Neocalanus, and the species now called Neocalanus plumchrus (Marukawa, 1921). Another large Calanoida Copepoda in the subarctic North Pacific, Calanus cristatus, was also renamed Neocalanus cristatus (Kröyer, 1848).

Detailed morphological studies on the shape of the cephalon, appendages, genital segment, etc. have resulted in some revisions of the systematic positions of Calanus species. It has long been believed that Calanus finmarchicus (Gunnerus, 1756) and Calanus helgolandicus (Claus, 1863), which are the most well-known calanoid copepods in the North Atlantic, are also distributed in the North Pacific. Japanese planktonologists have customarily used these species' names for two similar Calanus species distributed in Japanese waters, but it is now agreed that Calanus finmarchicus and Calanus helgolandicus do not inhabit Japanese waters. Brodsky (1957, and successive works) established a new series of Calanus fauna in the Subarctic North Pacific (ref. Kadota 1975 a,b; Kidachi 1979 a,b; Nishida 1984; Toda 1986). It is now recognized as:

Calanus glacialis Jaschnov, 1954, Arctic Sea, East Bering Sea
Calanus marshallae Frost, 1974, Subarctic North Pacific, Bering Sea
Calanus pacificus Brodsky, 1948, Japan Sea, Subarctic North Pacific
Calanus pacificus pacificus, Sakhalin, Kurile Chain
Calanus pacificus oceanicus, Kurile Chain, Okhosk Sea
Calanus sinicus Brodsky, 1965, Japan Sea, North Pacific

Advanced studies of the cephalic dorsal hump, integumental organs, etc. have thrown new light on the morphological characteristics of Calanidae (Mauchline and Nemoto 1977, Nishida 1985, 1989).

Some topics dealing with the classification of copepods will be mentioned below:

Acartia clausi has been frequently reported in Japanese waters, but it is no longer believed that this species occurs in Japanese waters. Bradford (1976) reported a new species, Acartia omorii, from Tokyo Bay. Ueda (1986a) made taxonomic studies on Acartia clausi collected from a Japanese inlet

water and he (1986b) redescribed Acartia japonica and the closely related species Acartia australis (from New Caledonia). He (1986c) also has discussed reproductive isolation between Acartia omorii and A. hudsonica. A new species, Acartia tropica, was proposed by Ueda and Hiromi (1987).

Hiromi (1981) gave a detailed description of three species of Paracalanidae from coastal waters of Japan, i.e., Pavocalanus crassirostris (=Paracalanus crassirostris), Pavocalanus elegans and Delius nudus.

Ohtsuka (1987) described a new species of Pontella from Inland Sea and a new species of demersal copepod, Pseudocyclops lepidotus.

Hirakawa (1981) reported a new species, Pseudodiaptomus nihonkaiensis from Niigata, Japan Sea coast. He mentioned that among 50 species of Pseudodiaptomus known in the world, 3 species, P. cornutus, P. inopinus (=P. japonicus) and P. marinus, are known from Japanese waters.

Ohtsuka et al. (1987) described a new species, Pontella rostratcauda from Inland Sea.

Furuhashi (1975) mentioned that Temora stylifera has been reported from Japanese waters, but no adults were found. He suggested that Temora stylifera reported in Japan might be the immature form of Temora discaudata.

Hiromi (1986) reported Cyclopina kiraensis, n. sp.

Nishida et al. (1977) reported that 24 species of Oithonidae are listed from Japanese waters including 3 new species, Oithona australis Tanaka, Oithona curalis Tanaka and Oithona longispina Nishida. Nishida and Ferrari (1983) redescribed Oithona brevicornis and Oithona aruensis.

Ito, Tatsunori (1968, 1969, 1970, 1972) reported marine harpacticoids from Hokkaido. In 1982 he reported abyssal harpacticoids of Cerviniidae off Mindanao.

It is not unusual that marine copepods are living in association with other animals, e.g., bivalves (Yamaguchi, Hoshina, Nakamura, etc.), echinoderms, compound ascidians (Oishi), solitary ascidians (Matsuzaki and Ogawa), and so on. Oishi published extensive studies of Haplostominae (Cyclopoida) associated with compound ascidians. Epizoic diatoms are also rather frequently found on pelagic copepods (Nagasawa, Hiromi and Takano).

In the study on freshwater copepods Kokubo (1911) reported two new species and a new subspecies of Cyclops and (1913) a new species and two new varieties of Diaptomus from Sapporo. Kikuchi, K. (1937) studying the plankton in lakes, experimented on phototaxis of crustacean plankton in connection with diel vertical migration. Kokubo (1944) reviewed all the data of freshwater plankton in Japan in "Plankton of Japanese Lakes", Advance. Biol. 2: 1-454.

Acanthodiaptomus pacificus (Burckhardt), which is an allied species of European Acanthodiaptomus denticornis (Wierzejski), was first recorded by Marukawa (1909) as Diaptomus denticornis from Lake Shikotsuko and other lakes. When Burckhardt (1913) examined the specimens from Lake Chuzenjiko he proposed a new species, Diaptomus pacificus. On the other hand, Kokubo (1913) proposed Diaptomus denticornis var. yezoensis for the specimens from Lake Shikotsuko, and Brehm (1925) proposed Diaptomus pacificus var. yamanacensis from lake Yamanako. Kiefer (1932) established a new genus Acanthodiaptomus, and considered that there are two species in Japan, i.e. Acanthodiaptomus pacificus and A. yamanacensis. Ito (1949, 1950) studied specimens statistically and came to the conclusion (1953) that the above two species could be referred to one species, Acanthodiaptomus

pacificus (Burckhardt) which is widely distributed in Siberia, Sakhalin, Northeast China, Korea, Kamchatka, Kuriles and Japan Islands.

Acanthodiaptomus pacificus inhabits various types of lakes, especially abundantly oligotrophic volcanic lakes, and also dystrophic bog waters. In its body it contains reddish pigments called alpine colour in allusion to the colour of Acanthodiaptomus in alpine lakes in Europe. In Lake Shikotsuko adults are seen from summer to autumn in the shallow layers. They display remarkable diel vertical migration in the upper 25 metres (Motoda 1958). Hibernating eggs remain on the bottom until next spring. This species is a favourable food of landlocked sockeye salmons in Lake Shikotsuko. However, population size of Acanthodiaptomus greatly fluctuates in the lake. It almost completely disappeared after 1977 with the effect that the salmon population decreased in number and the individual fish grew smaller.

Research on freshwater copepods in Japan became active in the 1970s. Kikuchi, Y. (1970, 1972, 1984, 1988) worked at Lake Hinuma and other lakes, reporting a new species of Parastenocaris (Harpacticoida) from Lake Hinuma. Kadota (1971) mentioned plankton of alpine lakes in Japan. Tomikawa (1971a, b, 1972, 1989, 1990) published papers on the biology of Sinodiaptomus valkanovi. Ishida (1987) worked on harpacticoids from north Hokkaido lakes and in 1989 reported 14 species of freshwater copepods from mountain lakes in Honshu. Biology of the brackish-water copepod, Sinocalanus tenellus, was studied by Kimoto et al. (1986a,b), Hada et al. (1986), Semura et al. (1986) etc. Narita and Okamoto (1984), and Kawabata (1987) mentioned an endemic species, Eodiaptomus japonicus from Lake Biwa. Ban and Minoda (1989) reported Eurytemora affinis from Lake Ohnuma, Hokkaido.

Preliminary List of Copepodologists in Japan

Biologists partaking more or less in copepod research are listed. In joint papers only first author is listed.

Name	Born-Died	Field of study
Hisatosi Marukawa	1882-1958	Taxonomy, distribution
Kozo Akatsuka	1884-1957	Phycologist, author of plankton text
Tadao Sato	1887-1984	Taxonomy, distribution
Seiji Kokubo	1889-1971	Taxonomy, distribution, author of plankton text
Masuzo Ueno	1900-1989	Limnology
Kenzo Kikuchi	1901-1949	Limnology, phototaxis
Zinziro Nakai	1901-1984	Distribution, chemical composition
Otohiko Tanaka	1902-	Taxonomy
Takamochi Mori	1902-1945	Taxonomy
Hiroaki Aikawa	1903-1962	General plankton, author of plankton text
Tetsuo Yamada	1906-1976	Taxonomy, distribution
Sigeru Motoda	1908-	Distribution, diel migration
Tadami Yanagisawa	1910-1945	Distribution
Takuo Chiba	1911-	Taxonomy, distribution, reproduction
Isamu Yamazi	1916-	Distribution, author of illustrated book
Takashi Ito	1918-	Taxonomy (freshwater)
Arao Tsuruta	1924-	Distribution
Tetsuo Tomikawa	1926-	Morphology
Masateru Anraku	1926-	Distribution, diel migration
Shigeko Oishi	1927-	Taxonomy (Ascidicoles)
Teruo Ishida	1927-	Freshwater (Harpacticoida)
Koji Honjo	1927-	Distribution
Rei-ichiro Hirota	1929-	Distribution, mercury content
Sadami Kadota	1929-	Taxonomy (Calanidae)
Hideo Iwasaki		Culture experiments
Kenzo Furuhashi	1930-	Taxonomy, distribution

Tsutomu Kitajima		Mass culture
Fumihiko Koga	1931-	Morphology, biology, development
Toshio Saisho	1931-	Distribution
Kazuko Odate	1932-	Distribution, current indicators
Takashi Minoda	1932-	Distribution
Takashi Kidachi	1935-	Taxonomy (Calanidae), distribution
Makoto Omori	1937-	Taxonomy, distribution, author of text
Akito Kawamura	1938-	Distribution
Yasuhiro Morioka	1939-	Distribution
Katsuhiko Ito		Morphology
Kunihiko Izawa	1940-	Ontogeny
Yoshiyuki Kikuchi	1941-	Taxonomy (freshwater)
Sachiko Nagasawa	1942-	Epibiont
Akira Taniguchi	1942-	Author of text
Hideo Sekiguchi	1944-	Biology
Tsutomu Ikeda	1944-	Metabolism
Makoto Terazaki	1945-	Abyssal copepods
Tatsunori Ito	1945-1990	Marine Harpacticoida
Mitsuo Fukuchi	1947-	Polar research
Kazumasa Hirakawa	1948-	Taxonomy (Pseudodiaptomus), biology
Megumu Kamba	1949-	Distribution
Shin-ichi Uye	1950-	Biology, population
Shuhei Nishida	1950-	Taxonomy (Oithonidae), morphology
Hiroshi Ueda	1950-	Taxonomy (Acartia), rearing
Hiroshi Hattori	1951-	Vertical distribution
Atsushi Tanimura	1951-	Polar copepods
Yutaka Matsuo	1951-	Rearing, diel migration
Kaichi Kawabata		Freshwater Calanoida
Juro Hiromi	1952-	Taxonomy (Paracalanidae, Acartiidae), respiration
Mitsuaki Uchima	1952-	Behaviour, predation
Takeshi Kasahara		Rearing
Hitoshi Semura	1954-	Freshwater Neodiaptomus
Katsunori Kimoto	1955-	Reproduction, growth

Kousei Kodama	1957-	Distribution
Akio Hada	1958-	Seasonal Cycle
Atsushi Tsuda	1958-	Feeding
Shuhei Ban	1959-	Freshwater Eurytemora
Susumu Ohtsuka	1959-	Taxonomy
Tatsuki Toda	1960-	Taxonomy
Kanae Matsuzaki		Lichomolgid copepod

Sigeru Motoda, Tokyo, Japan

GROUP FLIGHT TO JAPAN FROM EUROPE

My offer to organize a group flight to Japan has not attracted enough people to make the effort worthwhile. Everybody must therefore make own arrangements. Looking through the offers I have received I found the one by SABENA the most reasonable. But there are others that are not much more expensive. Sorry to have to let you down, but my echo cannot be stronger than the sum of the voices that reached me. I know many more are going than those who have indicated their interest in a group flight. We then all go separately. As long as we go this does not matter.

Kurt Schminke

ANTONIO FREDERICO CAMPANER
1945-1989

Antonio Frederico Campaner was 44 years old on August 18, 1989, when he died on that day from complications of a stroke. He had suffered an initial stroke on November 4, 1988, which

paralysed the right side of his body, although by mid-1989 he had recovered enough coordination to send hand-written notes and letters.

Antonio Frederico Campaner was born in Brazil and raised in Ribeirao Bonito (Sao Paulo State). His curiosity about the world of biology developed by the time he had finished his secondary courses. At the University of Sao Paulo he became

interested in the classification of arthropods while receiving a Licenciado in Biological Sciences from its Faculty of Philosophy, Science, Letters, and Humanities in 1969, and later a bachelor degree in Biological Sciences from the university's respected Institute of Biosciences in 1970. Fred became a copepodologist as a post-graduate while studying the plankto-benthic copepods from the Brazilian continental shelf. He completed a master's degree on that subject in 1975, and for his PhD thesis, he concentrated on calanoid copepods of the families Aetideidae and Phaennidae in his continental shelf samples. Throughout his research career Fred continued his education in biology and biological oceanography through formal courses and personal study.

After receiving his PhD in 1976, Fred successfully competed for a position as Assistant Professor at the University of Sao Paulo. There he taught courses in general biology, invertebrate biology and zooplankton. Fred was active among the group of copepodologists associated with the University of Sao Paulo, and a member of national and international societies including the World Association of Copepodologists.

Fred's research reflected his interests in systematics of calanoid copepods and the ecology of zooplankton, especially copepods. His contributions to the first subject grew out of his work with plankto-benthic samples from the continental shelf which brought him in contact with rare and incompletely characterized species associated with that habitat. His descriptions of new calanoids attend to subtle morphological detail; strong, clear lines are the signature of his illustrations. In a relatively short period of time he described 6 species new to science: Parapseudocyclops giselae (in 1977), Bradyidius plinioi, Parcomantenna magalyae, Xanthocalanus marlyae, Brachycalanus bjornbergae (all in 1978), Scolecithricella pseudoculata (in 1979), and later Gaussia asymmetrica (in 1989 with Tagea K.S. Björnberg).

Fred's work with these species stimulated his interests in several incompletely defined calanoid genera: among aetideids, Bradyidius, Bryaxis, Comantenna, Parcomantenna; the phaennids, Brachycalanus, Talacalanus, Xanthocalanus, and scolecithricids, Scaphocalanus, Scolecithricella, with their beautifully modified sensory setae on maxilla 2; and the arietellid genera - Arietellus, Metacalanus, Paraugaptilus, Paramisophria, Parapseudocyclops, Rhapidophorus, Scottula, Scutogerulus. In his published studies he contributed to careful redefinitions of these genera, established Parapseudocyclops and removed the genus Phyllopus to its own new family Phyllopidae.

Fred's research on zooplankton ecology focused on copepods of both plankto-benthic and open-water communities on the Brazilian continental shelf. He documented which species inhabited the two communities, and compared spatial and seasonal variability as well as community structure. More recently he began to examine copepod predation by relating occurrences of the common herbivore, Calanoides carinatus, to larvae of the commercially important fishes, Engraulis anchoita and Sardenella brasiliensis. Sadly these and many other interesting lines of research on copepods must now be brought to a close.

Fred's stroke of November 4, 1988 was a terrible physical shock; yet he was able to keep his emotional equilibrium. In a letter from Sao Paulo, 3 March 1989, he accepted the challenge of recupretive physical therapy with this simple story: "My niece, 7, and I used to play at being teacher (she) and a scholar (me). I deliberately made mistakes, but she always gave me good marks. Now I am doing similar lessons, but my mistakes are not created for fun!" Antonio Frederico Campaner was an excellent copepodologist and a very gentle man.

Frank D. Ferrari, Washington, D.C.

Scientific Publications:

CAMPANER, A.F. - 1972: Distribuiçao de copépodos em águas de plataforma de fundo. Res. V Congresso Bras. Zool.: 62-63

AVELAR, W.E.P. et al. - 1973: Contribuiçao ao conhecimento das comunidades bênticas da Ilha Porchat e arredores (Estado de Sao Paulo). Ciência e Cultura, Sao Pualo 25(6): 353 (Número especial)

CAMPANER, A.F. - 1977: New definition of the Arietellidae (Copepoda, Calanoida), with the description of a new genus and species and separation of the Phyllopidae fam. n. Ciência e Cultura, Sao Paulo 29(7): 811-818

BJÖRNBERG, T.K.S., A.F. CAMPANER & H. NOGUTI - 1977: Distribuiçao de copépodos (Crustacea) em águas de plataforma continental ao largo do Brasil. Resumenes IV Simp. Latino Americano de Oceanogr. Biol., Univ. Guayaquil, Ecuador: 51-52

CAMPANER, A.F. - 1978: On some new planktobenthic Aetideidae and Phaennidae (Copepoda, Calanoida) from the Brazilian continental shelf I. Aetideidae. Ciência e Cultura, Sao Paulo 30(7): 863-976

CAMPANER, A.F. - 1978: On some new planktobenthic Aetideidae and Phaennidae (Copepoda, Calanoida) from the Brazilian continental shelf II. Phaennidae. Ciência e Cultura, Sao Paulo 30(8): 966-982

CAMPANER, A.F. - 1979: On a new planktobenthic scolecithricid copepod (Calanoida, Crustacea) from the Brazilian continental shelf. Boletim de Zoologia, Univ. de Sao Paulo 4: 81-87

CAMPANER, A.F. - 1981: Resultados preliminares sobre a ocorrencia e distribuiçao de copépodos ao largo de Cabo Frio, Brasil. Seminários de Biologia Marinha. Rio de Janeiro, Academia Brasileira de Ciências: 261-282

BJÖRNBERG, T.K.S. et al. - 1981: Copepoda. In: BOLTOVSKOY, D. (ed.) Atlas del zooplancton del Atlantico Sudoccidental y métodos de trabajo com zooplancton marino. Mar del Plata, Inst. Nacional Invest. Desarrollo Pesquero: 603-679

CAMPANER, A.F. - 1984: Some taxonomic problems within the Arietellidae (Calanoida). Crustaceana, Leiden, Suppl. 7: 102-109

CAMPANER, A.F. - 1984: Scaphocalanus and Scolecithricella (Copepoda, Calanoida, Scolecithricidae) from the epipelagial off southern Brazil: a taxonomic and distributional survey. Boletim de Zoologia, Univ. de S. Paulo 8: 165-188

CAMPANER, A.F. - 1985: Occurrence and distribution of copepods (Crustacea) in the epipelagial off southern Brazil. Boletim do Instituto Oceanográfico, Sao Paulo 33(1): 5-27

CAMPANER, A.F. - 1986: Planktobenthic copepods from the southern Brazilian continental shelf. Syllogeus, National Museums of Canada 58: 259-266

CAMPANER, A.F. - 1986: Are Gaetanus and Gaidius a single genus? Boletim de Zoologia, Univ. Sao Paulo 10: 95-98

CAMPANER, A.F. - 1988: On Gaussia Wolfenden (Copepoda, Calanoida, Metridinidae). Hydrobiologia 167/168: 351-356 (written in coauthorship with T.K.S. BJÖRNBERG). In: G.A. BOXSHALL and H.K. SCHMINKE (eds.) Biology of Copepods. Kluwer Academic Publishers

CAMPANER, A.F. - 1989: Supplementary description of Macandrewella chelipes (Giesbrecht, 1896) from the Gulf of Elat (Copepoda: Calanoida: Scolecithricidae), and comments on its relationships with Scottocalanus Sars and Scolecocalanus Farran. Israel Journal of Zoology 35 (1988/1989): 229-235

BJÖRNBERG, T.K.S. & A.F. CAMPANER - 1990: On the genus Gaussia and the species G. asymmetrica (Copepoda, Calanoida). Crustaceana 58(1):

The l e t t e r box

D. DEFAYE (Paris, France) rejoins us:

I am happy to inform you of my new address, as I now return to the copepodologist's world, thanks to my recent position in the Museum National d'Histoire Naturelle in Paris in charge of the Non-Decapoda Crustacea including copepods, of course.

R. HIPEAU-JACQUOTTE (Marseille, France) has to quit copepodological research:

Here enclosed my last papers on Pachypygus. Unfortunately, my works on Copepoda are finished. Now, I definitely work on Drosophila. I don't think that my last papers on Pachypygus have been cited in MONOCULUS. I enclose the corresponding list.

HIPEAU-JACQUOTTE, R. - 1986: A new cephalic type of presumed sense organ with naked dendritic ends in the atypical male of the parasitic copepod Pachypygus gibber (Crustacea). Cell Tissue Res. 245: 29-35

HIPEAU-JACQUOTTE, R. - 1987: Ultrastructure and presumed function of the pleural dermal glands in the atypical male of the parasitic copepod Pachypygus gibber (Crustacea: Notodelphyidae). J.Crust.Biol. 7: 60-70

HIPEAU-JACQUOTTE, R. - 1988: Environmental sex determination in a Crustacean parasite. Intnatl.J.Invert.Reprod.Dev. 14: 11-24

HIPEAU-JACQUOTTE, R. & F. COSTE - 1989: Reproductive system of the parasitic copepod Pachypygus gibber: Spermiogenesis and spermatophore formation in dimorphic males and discharge in female tracts. J.Crust.Biol. 9: 228-241

B. JONES (Wellington, New Zealand) informs us:

Gordon Hewitt handed over all his parasitic copepod specimens to me when he left Victoria University and subsequent examination of the material revealed that the collection included a number of types. These have since been handed on to Geoff Hicks at the New Zealand National Museum in Wellington. All Hewitt's types should now be at the Museum and, as far as I can establish, there are no types left at Victoria University.

While on the subject of types many (if not all) of Thomson's parasitic copepod types from the 1890's are held in the Otago Museum, Dunedin, New Zealand.

E. OLAFSSON (Stockholm, Sweden) introduces himself:

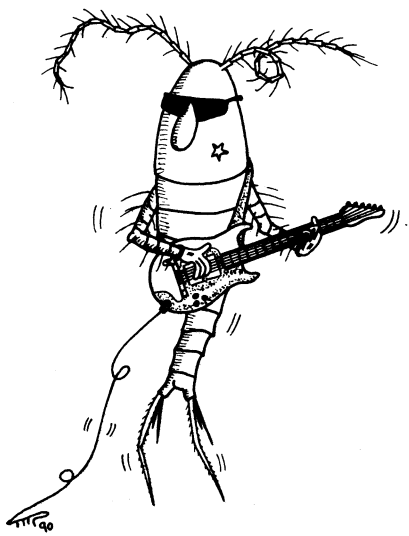
I finished my Ph.D. study last summer under the supervision of Dr. Colin G. Moore in Scotland. The title of my thesis is: The control of meiobenthic community structure by macrofauna in a subtidal muddy habitat. During the course of the study I came across 140 odd species of harpacticoid copepods, some of them new to science other to the British copepod fauna.

Now I am doing a post-doc with Professor Ragnar Elmgren in Sweden. This time a laboratory experiment has been applied to evaluate the effects of one of the most common macrofauna species in the Baltic, the amphipod Pontoporeia affinis, on the assemblages of nematodes and copepods.

A. OLSEN (Charlottenlund, Denmark) makes her entry as well:

I am a biologist/parasitologist employed at the Danish Bilharziasis Laboratory in Denmark. DBL is an institution which is involved in teaching, research and consultancy activities connected with water-related diseases, primarily schistosomiasis, filariasis and dracunculiasis.

My area of interest regarding research is related to the intermediate hosts of dracunculiasis, cyclopoid copepods.



MODEL DESCRIPTION *Reactions* **MODEL DESCRIPTION**

I am disappointed with the discussions about Model Descriptions for copepods. Several contributors ask that all traditional characters of adult copepods - somites, and appendages, with armament of each appendage segment - be discussed and illustrated for each species which is described. The reason

given for this level of detail is that it is needed for phylogenetic analyses. Phylogenetic analyses are an important use for general descriptive morphology, but not the only use. Descriptive morphology of the copepod exoskeleton also is applied to the differentiation of species and other taxa. For this purpose the amount of detail need not be nearly as exhaustive. For example Fleminger and Hulsemann's analysis of four species of the calanoid genus Pontellina (1974, Fishery Bulletin 72: 63-120) is not compromised because several appendages of each of the sibling species are unfigured or undescribed. The morphology of those unfigured structures is well-known from other published descriptions; it is enough that the authors state that no variation exists among the four species. Copepodologists who might wish to varify this statement can do so by requesting to examine representative specimens of the species from the authors, or a museum that received the types or an identified series.

MONOCULUS readers may ask what is wrong with requiring the more demanding Model Description even if it includes detail not needed for species differentiation. Should we not facilitate the extinction of Kurt Schminke's "living fossils"? The answer is no because the proposed Model Descriptions are time-consuming to prepare and the numerous illustrations are expensive to produce and print. In the immediate future copepodologists may anticipate a continuing need to document more carefully numerous unreported, rare, or poorly known copepods that undoubtedly will be collected from many well-known aquatic habitats. In addition significant new habitats in both marine waters (deep-sea vents) and in fresh waters (wet campos) continue to be discovered and with them their inhabitant new copepods. These discoveries will place a demand on taxonomists for descriptions which differentiate these species. Model Descriptions will confound this more immediate taxonomic demand by adding time and expense to the descriptive process.

The argument being advanced in *MONOCULUS* that Model Descriptions also are needed for phylogenetic analyses is a bit misleading. A more fastidious copepodologist might suggest that these Model Descriptions represent an arbitrary standard for phylogenetic analyses because they focus on the adult exoskeleton. The value for phylogenetic analyses of the morphology of nauplii and immature copepodids continues to be recognized by many evolutionists. Can a Model Description be considered useful without complete descriptions - somites, and appendages, with armament of each appendage segment - of all of these stages? And should we include the morphology of nonskeletal systems - digestive, nervous, musculature and reproductive? Depending upon the state of knowledge of a particular group of copepods, these characters may provide valuable phylogenetic information.

Here is a question about illustrative detail that I have always wanted to ask - what do good taxonomic analyses have to do with an ability to draw well? The illustrations of Huys, which accompany the descriptions by Boxshall (*MONOCULUS* 18), reflect a contemporary trend in copepod taxonomy (apparently endemic among harpacticoidologists) for unanalysed illustrative detail; Hamond (1988, Invertebrate Taxonomy 1: 1023-1247) is an egregious example. Incredible displays (including anterior and posterior views) of setulate pinnules, pinnulate denticles, denticulate spinules, and spinulate setules should stimulate the following questions by perceptive *MONOCULUS* readers; is there any indication in the text that the describer: 1) attempted to redraw that segment or appendage a week or so later to determine if the initial drawing could be reproduced accurately? 2) drew the same segment or appendage from a second or third specimen in an attempt to discover a degree of intraspecific variation of the proposed character? 3) understands this variability and its relation to interspecific variation? I am particularly concerned that the exposition of unanalysed illustrative detail is being confused with the scientific goal of understanding how the variability

of morphology is organized in nature. The latter understanding is essential to good taxonomic research; the former exposition is not necessarily essential. The existence of a morphological structure does not define its importance for taxonomic analyses, nor does its degree of complexity. Morphological structure only becomes important to taxonomic analyses when comparative studies of its variation have established that importance.

Finally I suggest that copepodologists interested in good descriptions for taxonomic purposes also should be concerned about the future impact of a detailed descriptive formalism that is being proposed in the Model Descriptions. In the world of Model Descriptions important morphological structures will be overlooked because they have not been sanctified by the Model's high priests, and studies of variability will be avoided because they will consume time and add to expenses. I believe this will inevitably lead copepod taxonomy into a Medawaran sterility whose symptoms are studies in which no one would ever be the wiser if they were published a decade earlier, nor conscious of any great loss if they were published a decade later.

I suggest that copepodologists instead consider these concepts:
(1) In the immediate future, discoveries of new species of copepods will provide the primary taxonomic challenge; differentiation of groups of animals, especially into species, will be the work in greatest demand from taxonomists.
(2) The amount of descriptive detail needed to differentiate a new species of copepod should depend upon its similarity to previously described groups.
(3) The amount of descriptive detail needed to undertake phylogenetic analyses is acknowledged to be much greater, but how much greater also is relative to our present state of knowledge.

(4) "Living fossils" have been with us since the beginning of taxonomy and will be with us for years to come, simply because Kurt's idea of a complete description for a copepod may not be mine. "Living fossils" are awkward but as long as they contain a reference to specimens available for further study, we will be able to advance.
(5) Authors of taxonomic works should deposit as many specimens as possible in several recognized depositories so that a non-written, historical record of their work can be maintained. Should this "stamp-collection" enthusiasm fail them, authors should be encouraged by their editors and reviewers.
(6) Taxonomists, like practitioners of any biological discipline, must be careful about demands for any descriptive formalism.

Frank D. Ferrari
Smithsonian Oceanographic Sorting Center

After much thought I have decided not to comment directly on any form of model description, because (a) anyone who takes the trouble to study my 1988 paper carefully will soon discover the features which I think should be incorporated in a description and its accompanying drawings; and (b) the 1988 paper deals only with members of one rather specialised family; equivalent studies would need to be carried out on all the other families before we can attempt to construct a final version of the model description, which at this stage must be regarded as the hoped-for product of future evolution rather than as an accomplished fact. What one can most certainly do at present is to issue a stern reprimand to any author who neglects to figure any aspect of the specimen that he is trying to describe, or who bases his complete set of figures for one sex upon more than one specimen <u>without</u> making it clear in the captions to his figures which figure is drawn from which specimen; these are two of the most common abuses which it gives me great pleasure to denounce! Equally necessary, but perhaps less abhorrent, is the failure of authors to use interference-contrast or phase-contrast on their microscopes, and

their failure to state whether or not such methods were in fact used.

Further to the question of ideal working practices, to which all who describe copepods should aspire, could I criticise two items on page 23 of *MONOCULUS* 19?

(1) The French text suggests that we should draw, not only what we can see, but what we ought to be able to see. I most strongly disagree, and see this as a licence for fraudulent misrepresentation which, if indulged in, will create a horrible mess that will take an awful lot of putting right, and do immense harm to the reputation, as well as to the practice, of taxonomic studies, whether of copepods or of any other organisms. Every taxonomist has experienced the frustrating situation in which the specimen to be drawn, perhaps the only one of its kind that he or anyone has ever seen, is found to have (say) one of its legs missing or abnormal; let him, in that case, draw only what is there, exactly as he sees it, and if possible abstain from drawing it at all, unless it is quite impossible to get any more specimens from anywhere. No reasonable person would ever blame the author for making the best of defective specimens, as long as he confines himself strictly to telling the truth.

(2) The drawing, amusing as it is, shows one perfectly atrocious malpractice - the artist is screwing up his free eye while looking down the microscope with the other. This may be all right for a monocular copepod, but it is positively harmful for a binocular human being, leading quicker to eyestrain than almost any other biological activity. The trick here is to keep both eyes open but to think through only one, if necessary shielding the free eye in such a way that it can be kept open without causing distraction. Best of all, however, is a microscope with a binocular or trinocular head and a "drawing arm" (a body-centred camera-lucida, which is a vast improvement over the older kind of camera-lucida (see my 1969 paper on methods of studying the copepods) that had to be attached to the eyepiece).

R. Hamond
Morston, Holt, Norfolk, U.K.

Modified or transformed parasitic poecilostomatoids and siphonostomatoids

For those copepods parasitizing invertebrates, a good description should follow in so far as possible that of free-living forms. The basic requirements of such a description include both dorsal and lateral views of the body and detailed drawings to scale of all appendages, rostrum, labrum, and caudal rami. Sexually dimorphic features should be emphasized. Variations encountered should be described. Avoid saying that a species is "like others in the genus", but tell why it is similar or different. Special ornamentation on the body and the colour should be noted.

At least 10 specimens of both sexes, if available, should be measured (length, width, and dorsoventral thickness).

The host name and particular information on the location of the copepod in the host should be given. The locality should be stated with sufficient detail, preferably by latitude and longitude.

Telegraphic style is used, unless the editor's preference indicates otherwise.

The description of Xarifia scutipes Humes and Dojiri, 1983, parasitic in the scleractinian coral Goniopora in the Moluccas, may serve to show an adequate treatment of a modified poecilostomatoid. (Journal of Natural History 17: 257-307. 1983.)

Xarifia scutipes

(Figs. 18a-h, 19a-j, 20a-h, 21a-i)

Type material. 5 ♀♀, 9 ♂♂ from 1 colony of Goniopora tenuidens (Quelch), in 3 m, Karang Mie, east central Halmahera, Moluccas, 00°20'07"N, 128°25'00"E, 19 May 1975. HOLOTYPE o, ALLOTYPE, and 6 PARATYPES (1 ♀, 5 ♂♂) deposited in the NMNH; the remaining paratypes (dissected) in the collection of the first author.

Other specimens. 2 ♀♀, 5 ♂♂ from 1 colony of Goniopora pedunculata (Quoy and Gaimard), in 2 m, same locality and date.

Female. Body (Fig. 18a,b) stout, about 4.5 times longer than wide. Length (measured with tips of caudal rami turned upward) 2.03 mm (1.93-2.09 mm) and width 0.45 mm (0.41-0.46 mm), based on 8 specimens. External segmentation fairly well marked in lateral view. Region dorsal to fifth legs with 3 equal posteriorly directed recurved processes (fig. 18c). Genital and postgenital segments together about 15 % of body length. Genital areas located dorsolaterally. Caudal ramus (fig. 18d) 97x49 µm, turned upward, ratio approximately 2:1, bearing 1 lateral seta, 1 subterminal seta, and 4 terminal setae. Ornamented with small spinules. Surface of body with numerous spinules. Egg sac (fig. 18e) with 10 eggs varying from 115-161 µm in diameter.

Rostrum (fig. 18f) subquadrate with posteroventral margin slightly rounded. First antenna (fig. 19a) 122 µm long and 6-segmented. Lengths of segments (measured along posterior side): 18, 31, 12, 11, 17, and 13 µm, respectively. Armature: 3, 11, 7, 4+1 aesthete, 2+1 aesthete, and 7+1 aesthete. All setae naked. Second antenna (fig. 18g) 4-segmented, slender, 200 µm long without claw. Formula: 1, 1, 2, and 1,1 plus 3 setules and minute spinule. Terminal claw 36 µm and adjacent long seta 17 µm (fig. 18h).

Labrum (fig. 19b) with straight posteroventral margin indented medially and having small conical lateral lobes. Mandible (fig. 19c) falcate, bilamellate, terminating in minute recurved hook. Paragnath (fig. 19c) a small lobe with long hairs. First maxilla (fig. 19e,f) with 2 terminal setae and 1 small inner seta. Second maxilla (fig. 19g,h) 2-segmented, first segment unarmed, second segment with 2 very unequal inner setae, 1 proximal spinelike process, and lamellate distal part having small proximally directed process. Maxilliped (fig. 19i,j) 3-segmented. First segment unarmed but having outer lobe. Second segment with 2 inner setae and rounded lobe. Third segment with minute spinule, dentiform process, and terminal blunt seta (process?).

Legs 1-4 (fig. 20a,b,c) with 3-segmented exopods and 2-segmented endopods (segments of endopods incompletely separated). Spine and setal formula as follows:

P_{1+2}	Coxa 0-0	Basis 1-0	Exp 1-0; 1-0; 1,3
			End 0-0; 2
P_{3+4}	Coxa 0-0	Basis 1-0	Exp 1-0; 1-0; 1,2
			End 0-0; 0

Inner margin of basis in all 4 legs with group of hairs. Outer spines on second and third segments of exopods much longer than spine on first segment of exopod. Endopods with outer and inner marginal hairs, extending on posterior surface as shown in figures. Endopod of leg 2 (fig. 20b) with 2 terminal setae almost equal in length.

Leg 5 (fig. 20d) with large, nearly round, flat, shieldlike free segment 288x259 µm, bearing 2 setae 47 µm and 32 µm. Adjacent dorsal seta 51 µm.

Colour in life in transmitted light dense opaque grey, eye red, egg sacs dark grey.

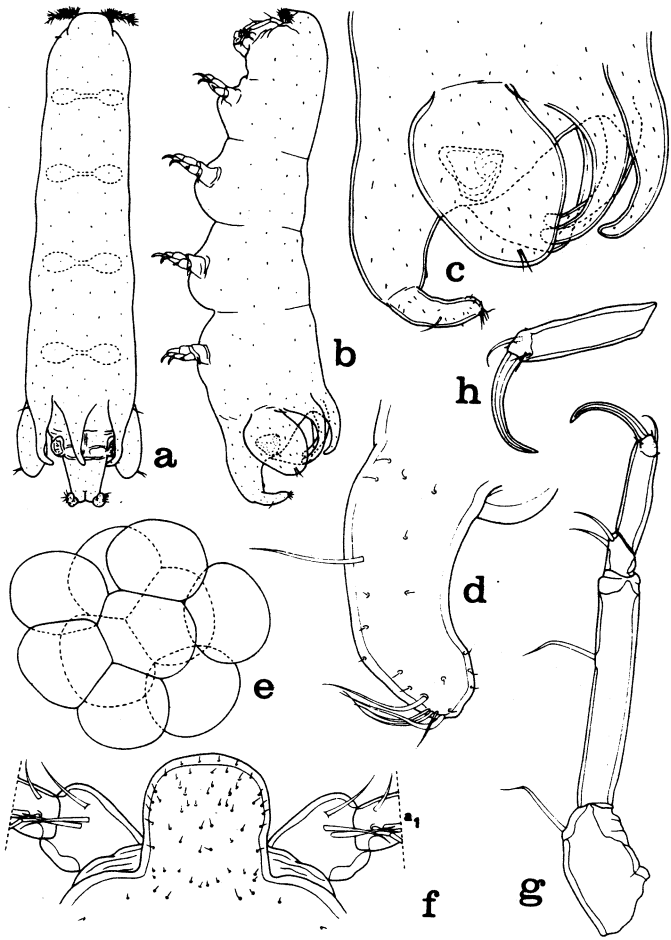


FIG. 18. *Xarifia scutipes* sp. nov., female. *a*, dorsal (K); *b*, lateral (K); *c*, urosome, lateral (M); *d*, caudal ramus, lateral (F); *e*, egg sac, lateral (M); *f*, rostrum, dorsal (F); *g*, second antenna, dorso-inner (F); *h*, fourth segment of second antenna, dorso-inner (C).

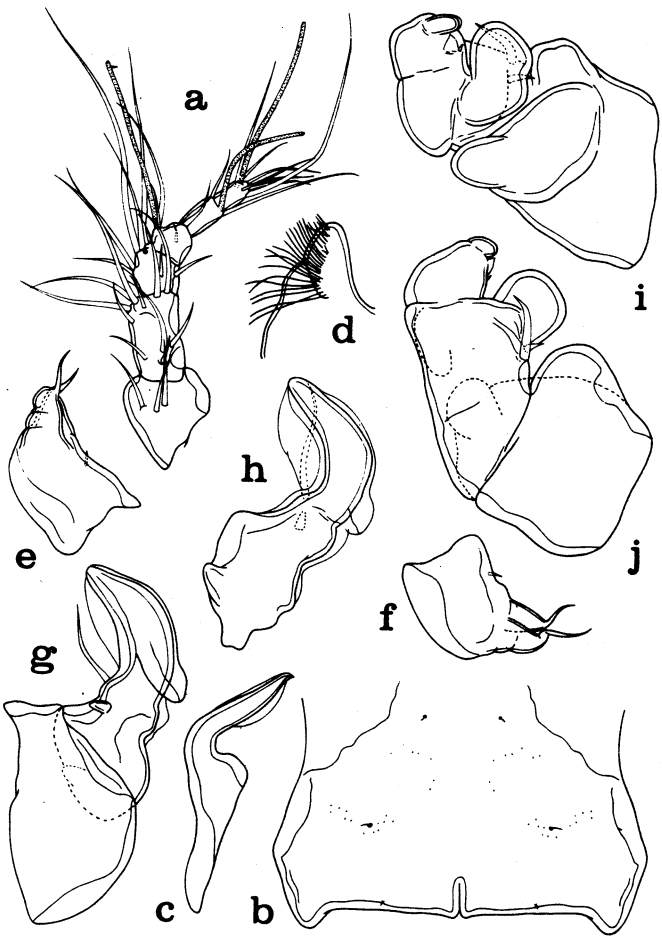


FIG. 19. *Xarifia scutipes* sp. nov., female. *a*, first antenna, dorsal (F); *b*, labrum, ventral (F); *c*, mandible, ventral (F); *d*, paragnath, ventral (C); *e*, first maxilla, posterior (C); *f*, first maxilla, postero-outer (C); *g*, second maxilla, antero-inner (C); *h*, second segment of second maxilla, postero-outer (C); *i*, maxilliped, antero-outer (C); *j*, maxilliped, antero-inner (C).

Male. Body (fig. 20e,f) fairly stout, about 5.6 times longer than wide. Length 2.02 mm (1.96-2.09 mm) and width 0.37 mm (0.35-0.43 mm), based on 10 specimens. Caudal ramus (fig. 20g) short, fused with anal segment, bearing 5 setae.

Rostrum as in female. First antenna similar to that of female, but 1 aesthete added on third segment (at point indicated by dot in fig. 19a). Second antenna resembling that of female, but fourth segment (fig. 20h) with claw 36 µm and adjacent long seta 35 µm.

Labrum, mandible, and paragnath as in female. First maxilla (fig. 21a) with outer process not present in female. Second maxilla (fig. 21b,c) 2-segmented, first segment unarmed, second segment with 2 inner setae and outer proximal spiniform process. Maxilliped (fig. 21d) 4-segmented. First segment with inner setiform process. Second segment with 2 inner setae. Small third segment unarmed. Claw (fourth segment) short, 103 µm, with 2 unequal proximal setae, having 5 or 6 cusps on tip, and bearing hyaline excrescence on concave margin (fig. 21e).

Legs 1-4 segmented and armed as in female, though endopods less distinctly 2-segmented (fig. 21f,g,h).

Leg 5 (fig. 21i) lacking free segment and represented only by 3 small setae.
Leg 6 (fig. 21i) a posteroventral flap on genital segment bearing 2 setae.

Spermatophore not seen.
Colour as in female.

Etymology. The specific name scutipes, from Latin scutum, a shield, and pes, a foot, refers to the shieldlike form of leg 5 in the female.

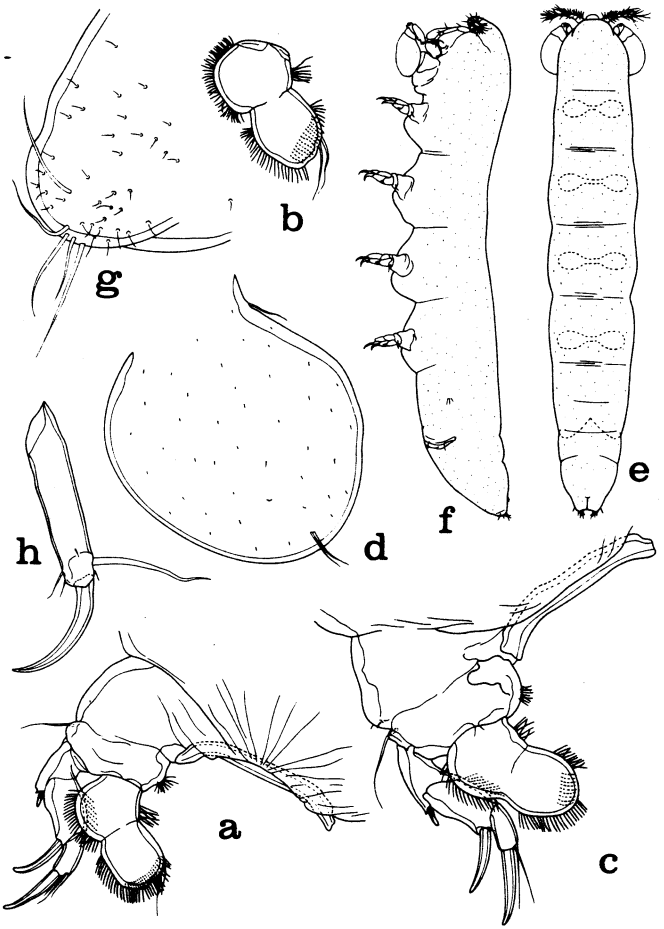


FIG. 20. *Xarifia scutipes* sp. nov., *a–d*, female. *a*, leg 1 and intercoxal plate, anterior (G); *b*, endopod of leg 2, anterior (G); *c*, leg 3 and intercoxal plate, anterior (G); *d*, leg 5, lateral (B). *e–h*, male, *e*, dorsal (K); *f*, lateral (K); *g*, caudal ramus, lateral (F); *h*, fourth segment of second antenna, dorso-outer (C).

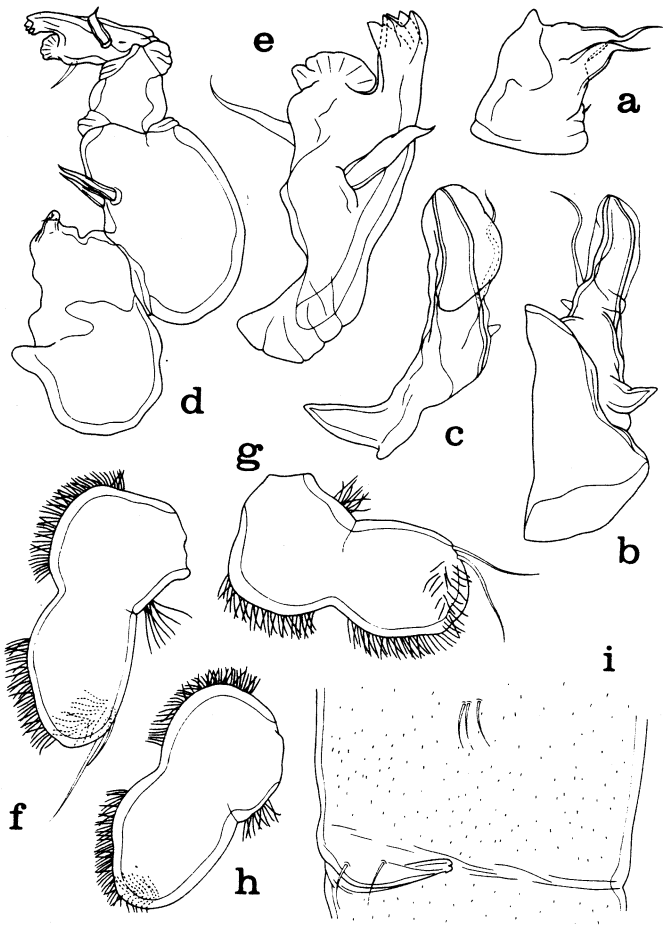


FIG. 21. *Xarifia scutipes* sp. nov., male. *a*, first maxilla, postero-outer (C); *b*, second maxilla, postero-outer (F); *c*, second segment of second maxilla, posterior (C); *d*, maxilliped, inner (G); *e*, claw of maxilliped, inner (C); *f*, endopod of leg 1, anterior (F); *g*, endopod of leg 2, posterior (F): *h*, endopod of leg 3, anterior (F); *i*, leg 5 and leg 6, lateral (B).

Remarks. Xarifia scutipes may be distinguished easily from all congeners by the broad shieldlike leg 5 in the female and by the form of the claw of the maxilliped in the male (with a large hyaline excrescence on the concave margin).

For highly transformed siphonostomatoids, the example of the nicothoid Diexanthema ritchiei Boxshall and Harrison, 1988, parasitic on a deep-sea isopod, may be cited. In the female there are no apparent appendages on the swollen prosome or small urosome, and oral rootlets extend into the host. Obviously, the available characters for the determination of species are limited. (Bulletin of the British Museum (Natural History), Zoology 54: 285-299. 1988.)

Diexanthema ritchiei

Postmetamorphosis female. Body highly transformed, comprising a swollen, globular prosome and an unsegmented, slightly dorsoventrally flattened urosome (Fig. 4A). Todal body length in ventral view 426 µm, maximum width 307 µm. Urosome length 61 µm, maximum width 108 µm. Prosome without recognisable mouthparts or legs. Irregular branching structure present anterior to oral area may represent antennae as in other species of Diexanthema. Conical structure present in oral region interpreted as broken base of oral rootlets. Urosome bearing leg 5 anteroventrally. Leg 5 a simple lobe bearing 3 spines distally. Gonopores on posterolateral surface, each armed with 2 tiny setules. Posterior margin of urosome slightly concave, without trace of postgenital segments or caudal setae.

Material examined. Holotype ♀, parasitic on juvenile female of the ischnomesid Hapomesus tenuispinus Vanhöffen. Locality: Discovery Stn 50604 # 1 in the Porcupine Seabight (50°6.2'N 13°52'W), depth 3490-3550 m, 04.vii.1979. Holotype stored in BM(NH). Reg.No. 1987.440.

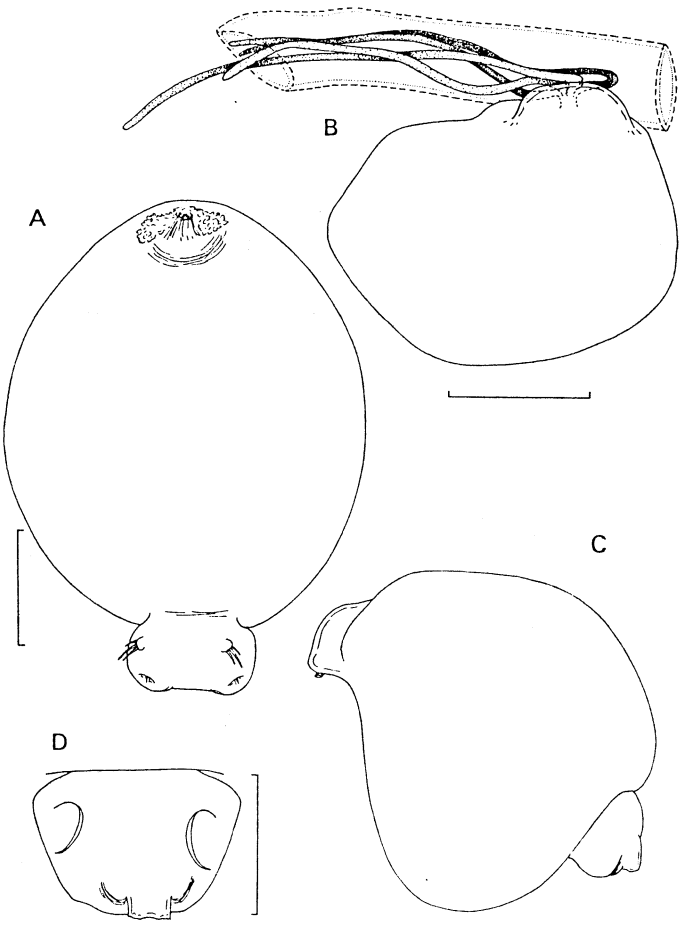


Fig. 4 *Diexanthema ritchiei* sp. n., Holotype female. A, Ventral view. *Diexanthema apoda* sp. n., Holotype female. B, Dorsal view of female attached to pereopod of host, showing 4 oral rootlets inside limb; C, Lateral view; D, Urosome, ventral. Scale bars A, D = 100 μm, B, C = 200 μm.

Etymology. The species is named after the late Larry Ritchie, who established the genus Diexanthema.

Remarks. The new species is placed in Diexanthema because of the gross body form, a swollen prosome and an unsegmented urosome. It possesses no obvious appendages on the prosome. The irregular branching structure anterior to the oral area is found in all other Diexanthema species except D. desistoma. D. ritchiei differs from other species in the structure of the feeding apparatus. D. desistoma, D. bathydiaita, and D. nudum all possess a typical nicothoid mouth cone containing stylet-like mandibles. The oral region of D. corrugatum was obscured (see above). The conical structure in the oral region of this species was not a typical oral cone. It appeared to be the broken stump of a rootlet system, as found in genera such as Rhizorhina, Choniorhiza and Nicorhiza. No rootlets were found in the host although this was in poor condition. The generic concept of Diexanthema is considerably broadened by the inclusion of this species as it now contains species with an oral cone and species with oral rootlets. The evolution of a rootlet system appears to have occurred independently several times within the Nicothoidae and, in our opinion, the presence of rootlets alone is insufficient to justify generic separation when the gross body morphology is the same.

The host, H. tenuispinus, was described from the Davis Strait and from off the south coast of Greenland (Hansen, 1916). In the present study 228 specimens were examined from depths of 1993 to 2925 m in the southern Rockall Trough. None was infected. Only the specimen taken in the Porcupine Seabight was infected.

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VIII. France

To answer your request about visiting scientists in France, I think the best they have to do is to write to the directors of laboratories listed below, and to have an agreement with them. Conditions, length and dates could be different from one case to the other.

French Marine Laboratories addresses

Chanel (Manche):

Université de Caen, Laboratoire d'Algologie Fondamentale et Appliquée
(microbiology, benthos, plankton, ecology)

Mme le Professeur P. GAYRAL
39, rue Desmoueux
F-14000 CAEN

Laboratoire Maritime du Muséum National d'Histoire Naturelle
(benthos, ecology)

M. C. RETIERE
17, avenue Georges V
F-35801 DINARD Cedex

Station Biologique
(microbiology, benthos, algae, biochemistry)

M. le Professeur P. LASSERRE
B.P. 74
Place G. Teissier
F-29682 ROSCOFF Cedex

Laboratoire de Biologie Marine du Collège de France
(fish, chromatography, physiology, ecology)

M. le Professeur Y. LE GALL
B.P. 11
F-29110 CONCARNEAU

Université de Brest, Faculté des Sciences
Laboratoire d'Océanographie Biologique
(benthos (macrofauna, meiofauna), ecology, pollution)

M. le Professeur M. GLEMAREC
6, avenue Le Gorgeu
F-29287 BREST Cedex

Université de Brest, Faculté des Sciences
Laboratoire de Chimie Marine
(organic and mineral elements in the water)

M. le Professeur P. TREGUER
6, avenue Le Gorgeu
F-29287 BREST Cedex

Atlantic Ocean:

Université de Nantes, Laboratoire de Biologie Marine
(benthos, plankton, sedimentology, ecology, pollution)

M. le Professeur J.-Y. ROBERT
2, Chemin de la Houssinière
F-44072 NANTES Cedex

Musée Océanographique de la Rochelle
(mammals, turtles)

M. R. DUGUY
28, rue Albert Ier
F-17000 LA ROCHELLE

Université de Bordeaux I
Département de Géologie et Océanographie
(sedimentology)

M. le Professeur M. VIGNEAUX
351, Cours de la Libération
F-33405 TALENCE Cedex

Université de Bordeaux I
Institut Universitaire de Biologie Marine
(benthos (macrofauna, meiofauna), microbiology, fish, lagoons)

M. le Professeur C. CAZEAUX
2, rue du Professeur Jolyet
F-33120 ARCACHON

Mediterranea:

Laboratoire Arago
(benthos (macrofauna, meiofauna), plankton, ecology)

M. le Professeur A. GUILLE
F-66650 BANYULS-SUR-MER

Laboratoire de Biologie Marine
(fish)

M. le Professeur J. BRUSLE
Avenue de Villeneuve
F-66025 PERPIGNAN Cedex

Faculté des Sciences St. Jérôme
Laboratoire de Biologie Marine
(sedimentology, pollution, ecotoxicology)

M. le Professeur N. VICENTE
Rue Henri Poincaré
F-13013 MARSEILLE

Station Marine d'Endoume
(benthos, plankton, fish, biology, ecology, physiology, pollution)

M. le Professeur F. BLANC
Rue de la Batterie des Lions
F-13007 MARSEILLE

Fondation Océanographique Ricard
(microbiology, plankton, aquaculture, pollution)

M. le Professeur N. VICENTE
Ile des Embiez, Le Bruscq
F-83140 SIX FOURS LES PLAGES

Station Marine de Villefranche-sur-Mer
(plankton, biochemistry)

M. le Professeur J. SOYER
B.P. No. 28
La Darse
F-06230 VILLEFRANCHE-SUR-MER

P. Bodin, Brest, France

Business ssenisuB

1. *MONOCULUS*-Library/Bibliography

We are almost back to normal. The new computer has learned its lessons and sharpened its memory. Two colleagues have offered their help in tracing overlooked or hidden titles. We are overwhelmed. The stream of reprints of recent publications reaching the *MONOCULUS*-Library becomes thinner and thinner. Wishes for help become more numerous. There is an imbalance that causes frustration.

We are in our last year with financial support for our bibliography project. In Karuizawa Jürgen Sieg and Kurt Schminke will demonstrate its possibilities. To make both the Library and the bibliography optimal tools help is constantly needed. The previous issues of the newsletter contain all the information necessary in this respect.

2. Survey of Copepodologists of the World

After some new complications this publication is finally in print! It consists of four parts. Part I: List of copepodologists and their fields of interest (in tabular form), Part II: Taxonomic and subject index to Part I (cross-reference in tabular form), Part III: Directory of copepodologists of the world (with 650 addresses), Part IV: National list of copepodologists. This publication will be mailed to the members of WAC and to those who have paid extra for it.

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BOOK

DUSSART, B. & D. DEFAYE - 1990: Répertoire mondial des Crustacés Copépodes des eaux intérieures III. Harpacticoides. Crustaceana Suppl. 16: 1-384

1988

FIERS, F. - 1988: Proboscíphontodes n.gen., a new genus of the family Ancorabolidae, with the description of two new species (Copepoda, Harpacticoida). Bull.Inst.Roy.Sci.Nat. Belgique (Biologie) 58: 75-83

FUKUCHI, M., H. HATTORI, H. SASAKI & T. HOSHIAI - 1988: A phytoplankton bloom and associated processes observed with a long-term moored system in antarctic waters. Mar.Ecol.Prog. Ser. 45: 279-288

GOODING, R.U. - 1988: The Saphirella problem. Hydrobiologia 167/168: 363-366

HIPEAU-JACQUOTTE, R. - 1988: Environmental sex determination in a crustacean parasite. Internatl.J.Invert.Reprod.Dev. 14: 11-24

SASAKI, H., H. HATTORI & S. NISHIZAWA - 1988: Downward flux of particulate matter and vertical distribution of calanoid copepods in the Oyashio water in summer. Deep-Sea Res. 35(4): 505-515

ZEDDAM, J.-L., P. BERREBI, F. RENAUD, A. RAIBAUT & C. GABRION - 1988: Characterization of two species of Lepeophtheirus (Copepoda, Caligidae) from flatfishes. Description of Lepeophtheirus europaensis sp. nov. Parasitology 96: 129-144

1989

BARBIERI, R., M.S.R. IBANEZ, F.J. ARANHA, M.M.F. CORREIRA, J.W. REID & P. TURNER - 1989: Plancton, producao primaria e alguns fatores fisico-quimicos de dois lagos da Baixada Maranhense. Rev.Brasil.Biol. 49(2): 399-408

CAMPANER, A.F. - 1989: Supplementary description of Macandrewella chelipes (Giesbrecht, 1896) from the Gulf of Eilat (Copepoda: Calanoida: Scolecithricidae), and comments on its relationships with Scottocalanus Sars and Scolecocalanus Farran. Isr.J.Zool. 35: 229-235

CASTRO ROMERO, R. & H. BAEZA KUROKI - 1989: Neobrachiella anisotremi (Copepoda: Lernaeopodidae), a new species parasitic on an inshore fish, Anisotremus scapularis, off the Chilean coast. Proc.Biol.Soc.Washington 102(1): 106-108

Excerpt from the literature

From: WEISMANN, A. - 1876: Das Thierleben im Bodensee. Schr. Ver.Gesch.Bodensees 7: 159

Wenn uns aber das unablässige gegenseitige Zerstören moralisch niederdrückend und entmuthigend erscheinen wollte, dieser stete Sieg der rohen Gewalt über die Schwäche, dann mögen wir uns erinnern, in wie schöner Weise Carl Ernst von Bär vor Kurzem diesen Eindruck niederschlug, als er meinte, es sei doch ein versöhnlicher Gedanke, daß auch "die Nahrung selbst eine Zeitlang lebendig ist und sich des Daseins freut".

CASTRO ROMERO, R. & H. BAEZA KUROKI - 1989: Characters for the Pennellidae taxonomy, based on Peniculus, Metapeniculus, Trifur, Lernaeenicus and Lernaeocera specimens study with SEM. Estud.Oceanol. 8: 21-44

CITARELLA, G. - 1989: Les copépodes du détroit de Northumberland: distribution et potentiel producteur. Hydrobiologia 183: 123-131

COULL, B.C., M.A. PALMER & P.E. MYERS - 1989: Controls on the vertical distribution of meiobenthos in mud: field and flume studies with juvenile fish. Mar.Ecol.Prog.Ser. 55: 133-139

DAHMS, H.-U. - 1989: Antennule development during copepodite phase of some representatives of Harpacticoida (Copepoda, Crustacea). Bijdr.Dierk. 59(3): 159-189

DIBBERN, S. & G. ARLT - 1989: Post-embryonic development of Mesochra aestuarii Gurney, 1921 (Copepoda, Harpacticoida). Crustaceana 57(3): 263-287

ELLIS, M.J. & B.C. COULL - 1989: Fish predation on meiobenthos: field experiments with juvenile spot Leiostomus xanthurus Lacépède. J.Exp.Mar.Biol.Ecol. 130: 19-32

FERRARI, F.D. & J.H. DEARBORN - 1989: A second examination of predation on pelagic copepods by the brittle star Astrotoma agassizii. J.Plankton Res. 11(6): 1315-1320

FOSSHAGEN, A. & T.M. ILIFFE - 1989: Boholina, a new genus (Copepoda: Calanoida) with two new species from an anchialine cave in the Philippines. Sarsia 74: 201-208

GLATZEL, T. - 1989: Eine Bestandsaufnahme der Grundwasserfauna Nordwest-Niedersachsens unter besonderer Berücksichtigung der Crustaceen. Drosera '89(1,2): 11-22

GLATZEL, T. - 1989: Comparative morphology of Chappuisius inopinus Kiefer and C. singeri Chappuis (Copepoda, Harpacticoida). Zool.Scr. 18(3): 411-422

HATTORI, H. - 1989: Bimodal vertical distribution and diel migration of the copepods Metridia pacifica, M. okhotensis and Pleuromamma scutullata in the western North Pacific Ocean. Mar.Biol. 103: 39-50

HATTORI, H. & M. FUKUCHI - 1989: Distribution of Nano-, Micro- and netplankton chlorophyll in the surface water of the Indian sector of the Southern Ocean, 1985/86. Proc.NIPR Symp. Polar Biol. 2: 16-25

HIPEAU-JACQUOTTE, R. & F. COSTE - 1989: Reproductive system of the parasitic copepod Pachypygus gibber: spermatogenesis and spermatophore formation in dimorphic males, and discharge in female tracts. J.Crust.Biol. 9(2): 228-241

HUYS, R. & K.A. WILLEMS - 1989: Laophontopsis Sars and the taxonomic concept of the Normanellinae (Copepoda: Harpacticoida): a revision. Bijdr. Dierk. 59(4): 203-227

HUYS, R. & D. THISTLE - 1989: Bathycamptus eckmani gen. et spec. nov. (Copepoda, Harpacticoida) with a review of the taxonomic status of certain other deepwater harpacticoids. Hydrobiologia 185: 101-126

Excerpt from the literature

From: HERDMANN, W.A. - 1898: Eleventh Report of the Liverpool Marine Biology Committee and their Biological Station at Port Erin. Proc.Trans.Liverpool.Biol.Soc. 12: 124

It is equally instructive and inspiring to have a day at the microscope with, say, our authority on Copepoda, studying the nature and ways of animals which are probably of greater economic importance to the world than the wheat plains of Manitoba or the gold of Klondike.

MARCOGLIESE, D.J. & G.W. ESCH - 1989: Experimental and natural infection of planktonic and benthic copepods by the Asian tapeworm, Bothriocephalus acheilognathi. Proc.Helminthol. Soc.Wash. 56(2): 151-155

MARCOGLIESE, D.J. & G.W. ESCH - 1989: Alterations in seasonal dynamics of Bothriocephalus acheilognathi in North Carolina cooling reservoir over a seven-year period. J.Parasitol. 75 (3): 378-382

MARCOGLIESE, D.J., G.W. ESCH & R.V. DIMOCK JR - 1989: Long-term comparison of zooplankton communities between thermally-altered and ambient areas of a North Carolina cooling reservoir. J.Elisha Mitchell Scient. Soc. 105(1): 1-13

MARTEN, G.G., R. ASTAIZA, M.F. SUAREZ, C. MONJE & J. REID - 1989: Natural control of larval Anopheles albimanus (Diptera: Culicidae) by the predator Mesocyclops (Copepoda: Cyclopoida). J.Med.Entomol. 26(6): 624-627

MIELKE, W. - 1989: Amphiascus discrepans sp. n., a new benthic copepod (Crustacea) from Iquique (Chile). Zool.Scr. 18(4): 501-508

NELSON, A.L. & B.C. COULL - 1989: Selection of meiobenthic prey by juvenile spot (Pisces): an experimental study. Mar. Ecol.Prog.Ser. 53: 51-57

PLESA, C. - 1989: Etude préliminaire des Cyclopides (Crustacea, Copepoda) de la grotte "Pestera de la Movile", Mangalia (Roumanie). Misc.speol.Rom. 1: 39-45

PLESA, C. - 1989: Cyclopides (Crustacea, Copepoda) de Cuba. Supplément (biométrie). Misc.speol.Rom. 1: 113-119

RAMA DEVI, C. & Y. RANGA REDDY - 1989: The complete postembryonic development of Paradiaptomus greeni (Gurney, 1906) (Copepoda, Calanoida) reared in the laboratory. Crustaceana 56(2): 141-161

RAMA DEVI, C. & Y. RANGA REDDY - 1989: The complete postembryonic development of Allodiaptomus raoi Kiefer, 1936 (Copepoda, Calanoida) reared in the laboratory. Crustaceana 56(3): 246-266

RANGA REDDY, Y. & C. RAMA DEVI - 1989: The complete postembryonic development of Heliodiaptomus contortus (Gurney, 1907) (Copepoda, Calanoida) reared in the laboratory. Crustaceana 57(2): 113-133

RANGA REDDY, Y. & S. VENKATESWARLU - 1989: A new species of Phyllodiaptomus Kiefer (Copepoda, Calanoida) from South India. Hydrobiologia 184: 133-142

ROUSSET, V. & A. RAIBAUT - 1989: Peculiar cases of intracardiac parasitism in the pilchard Sardina pilchardus (Walbaum), by a pennellid copepod belonging to the genus Lernaeenicus. J.Fish Diseases 12: 263-268

SANTOS SILVA, E.N., B.A. ROBERTSON, J.L.W. REID & E.R. HARDY - 1989: Atlas de copépodos planctonicos, Calanoida e Cyclopoida (Crustacea), da Amazonia Brasileira. I. Represa de Curuá-Una, Pará. Revta brasil.Zool. 6(4): 725-758

SCHULZ, K. - 1989: Notes on rare spinocalanid copepods from the eastern North Atlantic, with descriptions of new species of the genera Spinocalanus and Teneriforma (Copepoda: Calanoida). Mitt.hamb.zool.Mus.Inst. 86: 185-208

VIJVERBERG, J. - 1989: Culture techniques for studies on the growth, development and reproduction of copepods and cladocerans under laboratory and in situ conditions: a review. Freshw.Biol. 21: 317-373

WALTER, T.C. - 1989: Review of the New World species of Pseudodiaptomus (Copepoda: Calanoida), with a key to the species. Bull.Mar.Sci. 45(3): 590-628

1990

FERRARI, F.D. & L.-A.C. HAYEK - 1990: Monthly differences in distributions of sex and asymmetry in a looking-glass copepod, Pleuromamma xiphias, off Hawaii. J.Crust.Biol. 10(1): 114-127

HULSEMANN, K. & A. FLEMINGER - 1990: Taxonomic value of minute structures on the genital segment of Pontellina females (Copepoda: Calanoida). Mar.Biol. 105: 99-108

ISHIDA, T. - 1990: Copepods in the mountain waters of Kyushu, Tsushima and Ryukyu Islands, southwestern Japan. Sci.Rep. Hokkaido Salmon Hatchery 44: 39-51

KLEIN-BRETELER, W.C.M., N. SCHOGT & S.R. GONZALEZ - 1990: On the role of food quality in grazing and development of life stages, and genetic change of body size during cultivation of pelagic copepods. J.Exp.Mar.Biol.Ecol. 135: 177-189

LINDLEY, J.A. - 1990: Distribution of overwintering calanoid copepod eggs in sea-bed sediments around southern Britain. Mar.Biol. 104: 209-217

RAMA DEVI, C. & Y. RANGA REDDY - 1990: The complete postembryonic development of Tropodiaptomus informis Kiefer, 1936 (Copepoda: Calanoida) reared in the laboratory. J.Plankton Res. 12(1): 55-75

REID, J. - 1990: Redescription and new records of Trichodiaptomus coronatus (G.O. Sars) (Copepoda; Calanoida; Diaptomidae) from Brazil.Proc.Biol.Soc.Washington 103(1): 140-150

Thesis

FRAILE, L. - 1989: Recherches sur les taxies des copepodes parasites de poissons. Le modèle Caligus minimus Otto, 1848 parasite buccal du loup, Dicentrarchus labrax Linné, 1758. Ph.D. thesis, Université des Sciences et Techniques du Languedoc, Montpellier II

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