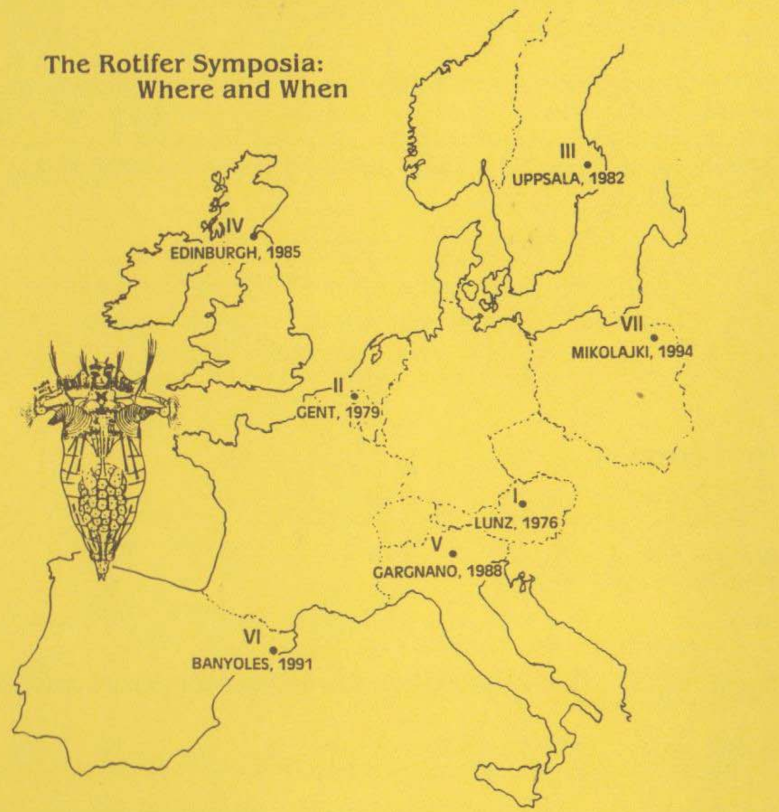
ROTIFER NEWS

A newsletter for rotiferologists throughout the world

The Rotifer Symposia: Where and When



ISSUE 24: JUNE 1994

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PRODUCED AT

The Murray-Darling Freshwater Research Centre

ROTIFER NEWS

Rotifer News is a newsletter for professional and amateur investigators of the Rotifera. The newsletter is not part of the refereed scientific literature (e.g. *Limnol. Oceanogr., Freshw. Biol., Oecologia* etc) and should not be so cited. It is a means of informal communication between widely dispersed workers with a common interest, where news, abstracts, work in progress, requests, recent publications and so on can be advertised or circulated.

Rotifer News is produced at The Murray Darling Freshwater Research Centre once or twice a year, depending on contributions from readers and regional editors. Regional editors are listed below. Back issues of the newsletter are available from Bob Wallace or Russ Shiel on request. Assistance with production and mailing cost is always appreciated!

> If you know of anyone who may wish to receive *Rotifer News* who is not presently on the mailing list, please pass on their address to the nearest regional editor

* * * * * *

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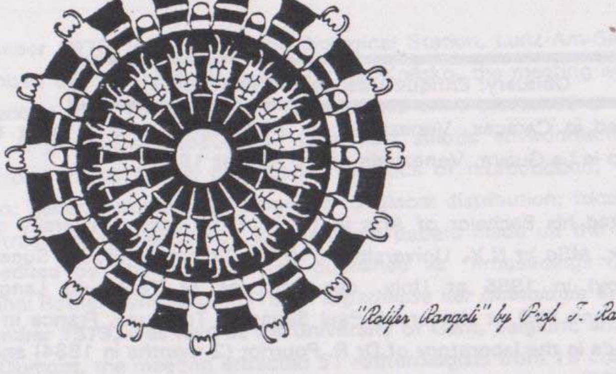

"Rotifer Rangoli" by Prof. T. Ramakrishna Rao Univ. of Delhi

Editorial

This issue has been delayed to coincide with the VIIth International Rotifer Symposium in Poland, at which copies will be distributed to attendees. Non-attendees will receive their mailed copies in July, after the meeting. This issue is mostly recent publications - everybody must have been too busy preparing for the Mikolajki meeting to send their contributions to their regional editors.......(!)

To remind you all (yet again!!) *Rotifer News* 24 is the fifth issue prepared 'Down Under', at the Murray-Darling Freshwater Research Centre. I volunteered to take on the duties of production editor from Bob Wallace at the VIth meeting in Banyoles, with the expectation that there would be a steady stream of contributions of newsworthy nature, and maybe even the odd subscription to cover production costs. Neither have eventuated, so the newsletter has had a strong Australasian bias (which may not be of great interest to non-Australasian rotifer workers), with production subsidized by MDFRC.

Unfortunately, as mentioned by Jolanta in the 3rd Circular for the Mikolajki meeting, it is no longer possible to produce *Rotifer News* unsupported at MDFRC. From 1994 the Centre has been subsumed into a Cooperative Research Centre with a suite of Australian Universities and State and Federal agencies, losing its autonomous status. There is no longer an available funding source from which a non-viable newsletter can be supported - all funds have to be applied for, each $ accounted for. Fortunately, "anonymous" contributions from some of our subscribers well above their annual contribution mean we have at least 2 issues reserve funds.

In any event, the Mikolajki meeting will have to decide on the interest in, or need for continuation of, the newsletter. I am happy to offer the position of Production Editor if anyone else would like to harass the multitudes for 3 years! Otherwise I would be willing to keep going, but with a more global input/content.............

Russ Shiel

Obituary: Enrique Vasquez 1953-1993

Enrique Vasquez died in Caracas, Venezuela, on 24 December 1993, after a short illness. He was born in La Guaira, Venezuela on 26 August 1953.

Dr Vasquez completed his Bachelor of Arts in 1977 at the State University of New York at Stony Brook, MSc at N.Y. University in 1978, Diplome d'Etudes Superioures Specialisées (Ecology) in 1985 at Univ. des Sciences et Tech. du Languedoc, Montpellier, France, and PhD at Université Paul Sabatier, Toulouse, France in 1991. He spent short periods in the laboratory of Dr R. Pourriot (2 months in 1984) and Dr J. Rey (2 months in 1985).

He was head of the Hydrobiological Station of Guayana, Venezuela 1978-1988, and head of the Fundacion La Salle, Natural Sciences, Caracas, Venezuela from 1989 until his death. He was a scientist full of enthusiasm, devoting his short but fruitful life to study of the Orinoco River, including organization of the Int. Symposium on Major Latin American Rivers in 1990, attended by prominent European and North American limnologists. He began a series of intensive studies on the Orinoco plankton, and contributed to the understanding of the different limnological features of the Orinoco floodplain lakes. His major interest was the Rotifera of the Orinoco. More than 40 papers were published during his research career. His passing is a sad loss for 'rotiferology'!

Susana José de Paggi

Rotifer I-VII: The 1976-1994 meetings

[This issue's cover story]

In the 20 years since a rotifer meeting was proposed at the 1974 SIL Congress in Winnipeg, the global study of rotifers, their taxonomy, ecology, genetics, biochemistry, pharmacology, evolution, physiology, among other aspects, seems to have expanded enormously. Certainly the rotifer meetings themselves have aided this growth process by promoting collaboration and communication. Increased political freedoms, financial aid to students from underdeveloped countries, improved technology - all have contributed. A primary benefit of the smaller 'single-study' meeting (compared to the several thousand-attendee SIL meetings) is that we all get to see what everyone else is doing - the sessions are a single stream, not 10 (!), and there is opportunity for people of like interests (or even unlike!) to sit, or walk, and talk. It seems appropriate to include a brief summary of our meetings to date, for the newer entrants into the study of our favourite animals. Some of the topics presented over the 18 years since Rotifer I are included to demonstrate research directions:

Rotifer I: September 1976, was held at the Biological Station, Lunz-Am-Sêe, Austria, and organized by the late Prof. Agnes Ruttner-Kolisko, the meeting attracted 38 rotifer workers from 15 countries. Ten reviews were presented on: sampling; migration & patchiness; population dynamics; abiotic environmental factors; biotic factors; mictic female production; genetics of reproduction, variation & adaptation; general problems of taxonomy & global distribution; food & feeding habits; ultrastructural research. 42 additional papers made up the symposium volume, edited by Charles King, and published as "Proceedings of the First International Rotifer Symposium" (1977) *Ergebnisse der Limnologie* 8, 1-315.

Rotifer II: September 1979, was held at the University of Gent, Belgium, and organized by Henri Dumont, the meeting attracted 51 rotiferologists from 16 countries. 42 papers made up the symposium volume, covering all the areas of the first meeting, with the addition of scanning electron microscopy, more detailed transmission EM work, chromosomes, and a workshop on taxonomy & biogeography. Edited by H.J. Dumont and J. Green, "Rotatoria. Proceedings of the 2nd International Rotifer Symposium" was published in 1980 by Dr W. Junk bv as a volume of *Hydrobiologia* (73) and also as the first hard-bound volume of a new series, *Developments in Hydrobiology* (1, 1-263).

Rotifer III: September 1982, was held at Sunnersta Herrgård, Uppsala, Sweden, and organized by Birger Pejler. Some 70 rotiferologists from 22 countries attended. 52 papers were given, 35 of them on rotifer ecology, the rest covering taxonomy & evolution, biogeography, culturing and biochemistry. The proceedings, "Biology of Rotifers", edited by B. Pejler, P.L. Starkweather and T.

Nogrady, appeared in 1983, again in two guises, *Hydrobiologia* 104, 1-396 and the hard-bound *Developments in Hydrobiology* 14.

Rotifer IV: August 1985, was held at the Pollock Halls of Residence, Edinburgh, and organized by Linda May, of the Institute of Terrestrial Ecology. Participation was creeping up by the Edinburgh meeting, as the word spread.......68 attendees from 21 countries. >30% of participants had attended the first meeting in Lunz-am-See, with nearly 20% present at all four meetings. Taxonomy & biogeography was significantly expanded from the earlier meetings (15 of 57 papers, 26%), bdelloids finally received their own section (3 papers, 5%), colonial rotifers also (2, 4%), population dynamics (11, 19%), aquaculture & feeding (9, 16%), reproduction (5, 9%) and ultrastructure, bichemistry & methodology (5, 9%). The proceedings, "Rotifer Symposium IV", edited by L. May, R. Wallace and A. Herzig, appeared in 1987 as *Hydrobiologia* 147, 1-381 and the hard-bound *Developments in Hydrobiology* 42.

Rotifer V: September 1988, was held at a villa on the shore of Lake Garda, at Gargnano, Italy, and organized by Claudia Ricci of the University of Milan, this meeting attracted 83 rotiferologists from 20 countries. 52 papers were presented: Tommy Edmondson's "Rotifer study as a way of life", 30 on ecology (58%), 7 on taxonomy & morphology (14%), 7 on physiology (14%), 2 on genetics (4%) and 5 on aquaculture 10%). The published volume in 1989, "Rotifer Symposium V", edited by C. Ricci, T.W. Snell and C.E. King, ran to 433 pages, as *Hydrobiologia* 186/187, and *Developments in Hydrobiology* 52.

Rotifer VI: June 1991, was held at a Benedictine monastery in Banyoles, Catalonia, Spain, organized by Maria Miracle and Eduardo Vicente from the University of Valencia. 107 attendees from 25 countries presented 72 papers, broken up by category: biochemistry, ecotoxicology & histochemistry (7, 10%), aging, development & behaviour (7, 10%), reproduction, population dynamics & culture (11, 15%) genetics (5, 7%), feeding, trophic webs & behaviour (9, 17%), autoecology, interactions and bdelloid ecology (6, 8%), community ecology (11, 15%), taxonomy & biogeography (8, 11%), phylogeny (7, 10%) and history of rotifer research (1, 2%). The symposium volume, "Rotifer Symposium VI", the largest and most comprehensive to date, was edited by J.J. Gilbert, E. Lubzens & M.R. Miracle, and was published in 1993 as *Hydrobiologia* 255/256, 1-572, and *Developments in Hydrobiology* 83.

Rotifer VII: June 1994, is to be held at the Hydrobiological Station on the shore of Lake Mikolajki, Poland, organized by Jolanta Ejsmont-Karabin of the Polish Academy of Sciences. More than 100 participants are expected. Watch this space fot news of the Mikolajki meeting............

Abstracted from the Proceedings ~~volumes~~

by R.J. Shiel

New faces

New contributors to Rotifer News since the last issue:

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Prof. Johanna Laybourn-Parry
Dept of Zoology, La Trobe University
Bundoora, Vic. 3083, Australia
Interests: protists, processes, microfaunal interactions

Prof. Peter A. Tyler
Aquatic Sciences, Deakin University
Warrnambool, Vic. 3280, Australia
Interests: protists, particularly green ones; rotifers that eat them; videography; taxonomy of steam locomotives.

News, Notes and Requests

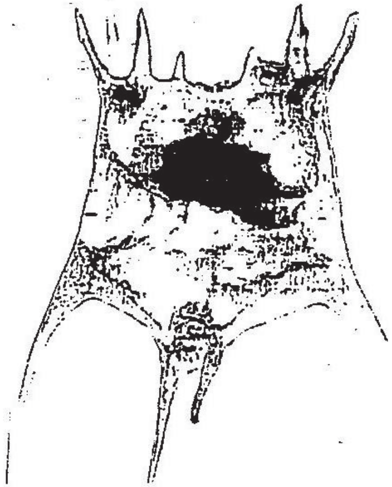
A summary of communications from global rotifer workers. Please communicate anything of interest - methods, work in progress, requests for material, literature, etc. Help to make this a Newsletter.

1: Our hostess for the VIIth International meeting, Jolanta Ejsmont-Karabin, advises that she, Stanislaw Radwan and Irena Bielanska-Grajner are embarking on a Guide to Rotifers of Poland, the first of its kind. Like many of us, they have problems obtaining literature, particularly from journals that are not common, or not obtainable, in Poland. They request that colleagues dealing with taxonomy, ecology and behaviour of rotifers send reprints of their papers. *[Ed. note: see back issues of Rotifer News for reprint holdings for those hard-to-get papers]*

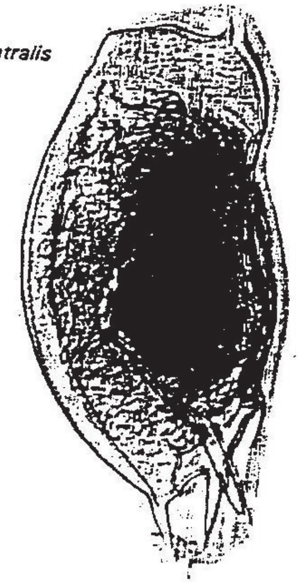
2: Taxonomic aid by fax or e-mail?! This comes from Ian Duggan, a graduate student at the Department of Biological Sciences, University of Waikato in Hamilton, New Zealand. He needed assistance in identifying some of his local rotifers, and the quickest way was to fax electronic images of them to his nearest taxonomist (RJS in Australia). Had the latter had e-mail, they could be sent that way also. It works, too - both whole animals and trophi 'grabs' can travel by wire (or satellite), and be quite identifiable at the other end. For those of you with access to computers and video equipment, and again, unfortunately not all of us have such equipment, some of the software we have found useful is IPLab (Mac) or ImagePro (PC) and TARGA+ (Mac or PC). There are other image capture programs available. Images captured from a video frame can be printed as a standard printout, the quality determined by the quality of the printer, e.g. a 1200 d.p.i. laser printer gives an almost black & white picture quality. A couple of examples of varieties of faxed images are reduced onto the following page - they have lost some clarity in photocopying, but their identity is clear.

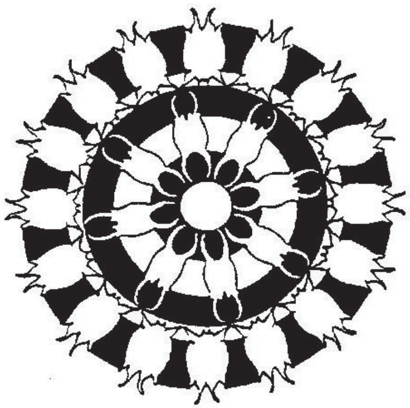
Electronic images

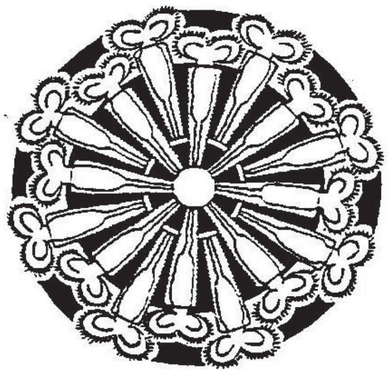
Laser prints, *Plationus*



Mytilina ventralis







More "Rotifer Rangoli" by Prof. T. Ramakrishna Rao
Univ. of Delhi

RECENT PUBLICATIONS

Recent rotifer-related publications provided by regional editors, by rotifer workers or abstracted by CSIRO Search Party, Melbourne (from BIOSIS, Current Contents & Streamline), are listed alphabetically. A brief summary is given where possible. Although care is taken to transcribe bibliographic information, errors may occur, particularly when poor copy faxes have been received. If errors in mailing addresses are noted, please advise one of the regional editors or Russ Shiel at MDFRC (addresses on front cover). Your assistance in communicating your publications would be appreciated!!

Ed. note: In multi-authored papers, only the address for reprints is included. Every effort has been made to include a summary, however some lists sent by authors did not contain summaries, so these papers remain unseen. The major subject areas in each citation are categorized below - many papers include several topics.

¡¡NB: If your paper(s) are not here, you didn't advise a regional editor - if not a copy of the paper, the publication details with an abstract will suffice!!

Topics and reference numbers:

Aging/Biochemistry/Genetics/Pharmacology: 25, 44, 66, 90;

Aquaculture: 14, 35, 36, 46, 50, 51, 58, 62, 64, 75, 76, 77, 79, 89, 91, 93;

Behaviour/Reproduction: 8, 31, 33, 53, 65, 75;

Biogeography/taxonomy: 12, 17, 24, 26, 29, 30, 32, 39, 47, 49, 52, 55, 56, 57, 70, 71, 72, 73, 78, 80, 83, 88, 92;

Biomanipulation/Eutrophication/Perturbation: 15, 28, 34, 63, 67, 74;

Ecology/Population dynamics/Food webs: 2; 3, 4, 5, 6, 7, 11, 13, 16, 17, 18, 19, 20, 26, 29, 32, 40, 42, 43, 52, 55, 56, 59, 60, 61, 63, 68, 69, 81, 82, 84, 85, 87;

Toxicology: 9, 10, 21, 22, 23, 27, 34, 37, 38, 41, 45, 48, 54, 86;

Ultrastructure/Morphology: 1,.53, 56.

1. AHLRICHS, W. 1993. Ultrastructure of the protonephridia of *Seison annulatus* (Rotifera) II. *Zoomorphology* (Berlin) 113, 245-251. <Zool. Inst. und Mus. der Univ. Goettingen, Berliner Str. 28, D-37073 Göttingen, Germany.> Each of the two protonephridial systems of *S. annulatus* consists of three sections which are separated by cell borders with septate junctions: (a) a terminal syncytium with eight terminal organs and a capillary canal, (b) a canal syncytium which is divided into a multiciliary canal region and a main canal region, and (c) a nephroporus cell. The terminal syncytium is branched and linked, twice to the canal syncytium. The supporting structure of each filtration barrier is a hollow cylinder which is perforated by pores and lacks microvilli (pillars). A protonephridial spine is situated in the multiciliary canal region and stabilizes the neck region. The pored, hollow cylinder and the protonephridial spine are new characteristics for the Rotifera.

2. ARFI R. & D. GUIRAL, 1994. Chlorophyll budget in a productive tropical pond: Algal production sedimentation, and grazing by microzooplankton and rotifers. *Hydrobiologia* 272, 239-249. <Centre Recherces Oceanographiques, BP V18 Abidjan, Côte d'Ivoire.> The experiment started from an azoic state (the pond was dried, limed and progressively filled with ground water). Chlorophyll a reflected the algal biomass, and degradation pigments were considered as an index of grazing by zooplankton (here, protozoans and rotifers). The first algal bloom, with a large picoplankton participation, was mainly regulated by microzooplankton (increase of the peak) and rotifers (decrease of the peak). The second bloom (exclusively nanoplankton) was regulated by rotifers (increase) and by sedimentation of living cells (decrease). For an optimal exploitation of the natural resources of an aquaculture pond, a study of the equilibrium nutrients-phytoplankton-zooplankton would provide a basis for artificial intervention, with a view to limit the impact of this mode of natural regulation.

3. ARNOTT, ~~S.E.~~ &* M.J. VANNI, 1993. Zooplankton assemblages in fishless bog lakes: Influence of biotic and abiotic factors. *Ecology* (Tempe) 74, 2361-2380. <Center Limnology, Univ. Wis., Madison, WI 53706, USA.> The importance of biotic and abiotic factors in preventing the successful invasion of small zooplankton species into fishless lakes was determined using a series of field manipulations. Abiotic and/or resource conditions suppressed the population growth rate of 70% of the small zooplankton species introduced into enclosures in the fishless lakes relative to those introduced into enclosures in their resident lake (a lake with fish). Manipulations of large herbivores and invertebrate predators showed that predation was more important than competition in restricting the distribution of small species. Predation by *Chaoborus* primarily reduced the densities of crustaceans while predation by *Diaptomus* reduced the densities of rotifers. Competitive suppression of small zooplankton by *Daphnia* was not detected. The results suggest that both predation by *Chaoborus* and *Diaptomus* and abiotic conditions, including pH, are important factors determining zooplankton community structure in these fishless bog lakes.

4. BELSARE D K; GAUTAM A; PRASAD D Y; GUPTA S N 1992. Limnological studies on Bhopal lakes 2: Numerical and volumetric variation in plankton population of a polymictic tropical lake. Proc. Natl. Acad. Sci. India Sect. B (Biol. Sci.) 62, 521-533. <Biochem. Lab. Sch. Biol. Sci., Barkatullah Univ., Bhopal, India.> Seasonal and vertical distribution of phyto and zooplankton is reported in the Upper lake which is polymictic in nature. The observation are based on ten years study. Chlorophyceae is a dominant group of phytoplankton, followed by Bacillariophyceae, Cyanophyceae and Xanthophyceae. The rotifers constitute the largest group of zooplankton during January to June, whereas cladocerans are comparatively less in number during this period. The copepods are predominant from July to December. The vertical distribution of phytoplankton follows thermal stratification. The biomass of zooplankton is distributed on the basis of availability of food. The distribution of planktonic organisms in this lake does not give the correct trophic status.

5. BERNINGER, U.-G., S.A. WICKHAM & B.J. FINLAY, 1993. Trophic coupling within the microbial food web: A study with fine temporal resolution in a eutrophic freshwater ecosystem. *Freshw. Biol* 30, 419-432. <Max-Planck Inst. Mar. Microbiol., BITZ, Fahrenheitstr. 1, D-28359 Bremen, Germany.> Time series analysis helped identify the trophic relationships within the planktonic community of Priest

Pot, a small freshwater pond. There were strong predator-prey relationships between both ciliates and large rotifers and the total nanoplankton, between rotifers and small ciliates and between the total microzooplankton community and phytoplankton. Nanoplanktonic (2-20 μm) heterotrophic protists appear to be the main grazers of bacteria. Rotifers are the major metazoan zooplankter. Bacterial production probably reaches rotifers via a variety of pathways: a three-step link from bacteria to bacteriovorous nanoplankton, to ciliates and then to rotifers. Furthermore, a strong correlation between the nanoplankton and rotifers suggests a direct link between these components, implying a much shorter pathway. Some of the rotifers in the pond can graze directly on bacteria, and many of the larger planktonic organisms (large ciliates and rotifers) are algivores. The latter two predator-prey relationships suggest an efficient transfer of bacterial and primary production to higher trophic levels.

6. BETSILL, R.K. & M.J. VAN DEN AVYLE, 1994. Spatial heterogeneity of reservoir zooplankton: A matter of timing? *Hydrobiologia* 277, 63-70. <Tex. Parks Wildl. Dep., Heart of the Hills Res. Stn., HCO7, Box 62, Ingram, TX 78025, USA.> Spatial and temporal patterns of zooplankton abundance were monitored during the spring of three consecutive years in a large, southeastern United States reservoir. The amount of spatial variation in zooplankton abundance exceeded temporal variation for most taxa. The differences among sites were not fixed - but rather ephemeral, in that they changed over the course of each season. Significant spatial variation was detected on most sample dates for rotifers and crustacean zooplankton. Spring peaks in zooplankton abundance occurred later at the upstream sites than at downstream sites. This phenomenon could not be explained by either differential rates of warming in the two regions or by temporal variation in inflow rates. This difference in timing of population peaks was the basis of heterogeneity in this reservoir and the determinant of the ephemeral nature of spatial variation observed in this study.

7. BUCKA, H., R. ZUREK & H. KASZA, 1993. The effect of physical and chemical parameters on the dynamics of phyto- and zooplankton development in the Goczalkowice Reservoir (southern Poland). *Acta Hydrobiol.* 35, 133-151. <Pol. Acad. Sci., Inst. Freshwater Biol., ul. Slawkowska 17, 31-016 Krakow, Poland.> A highly significant dependence was found between the number of rotifers and the abundance of euglenoids and green algae. The total number of zooplankton depended on that of green algae, euglenoids, and desmids. No significant relation was found between Cladocera and 8 groups of the phytoplankton. The prevalence of small algal species was correlated with a greater content of phosphorus. In the case of euglenoids, green algae, desmids, and Chrysophyceae significant negative dependencies upon $N\text{-}NO_3$ were observed. An increase in the number of desmids was associated with low concentrations of silicon in the environment.

8. BUSKEY, E.J., C. COULTER & S. STROM, 1993. Locomotory patterns of microzooplankton: Potential effects on food selectivity of larval fish. *Bull. Mar. Sci.* 53, 29-43. <Marine Sci. Inst., Univ. Texas, Port Ave., Austin, TX 78373, USA.> Using a video-computer system for motion analysis, the swimming behaviors of a wide variety of microzooplankton species have been quantified. Swimming patterns of microzooplankton include the smooth helical patterns of some dinoflagellates, tintinnids and rotifers, the jerky swimming of some copepod nauplii and the stop-and-go patterns of other copepod nauplii and some ciliates. By comparing prey of similar size and visibility contrast, and correcting for differential encounter rates between

fish larvae and their prey, it may be possible to evaluate the importance of prey motion patterns in determining the attack rate on different microzooplankton species and the importance of escape behavior in determining capture rates.

9. **CALLEJA, M.C., G. PERSOONE & P. GELADI, 1994.** Human acute toxicity prediction of the first 50 MEIC chemicals by a battery of ecotoxicological tests and physicochemical properties. *Food Chem. Toxicol.* 32, 173-187. <Lab. Biol. Res. Aquatic Pollution, Univ. Ghent, 22 J. Plateaustr., B-9000 Ghent, Belgium.> Five acute bioassays consisting of three cyst-based tests (with *Artemia salina, Streptocephalus proboscideus* and *Brachionus calyciflorus*), the *Daphnia magna* test and the bacterial luminescence inhibition test (*Photobacterium phosphoreum*) are used to determine the acute toxicity of the 50 priority chemicals of the Multicentre Evaluation of In Vitro Cytotoxicity (MEIC) programme. Prediction of HLD appears to be dependent on the phylogeny of the test species: crustaceans, for example, appear to be more important components in the test battery than rotifers and bacteria. For HLC prediction, one anostracan and one cladoceran crustacean are considered to be important. When considering both ecotoxicological tests and physicochemical properties, the battery based on the molecular weight and the cladoceran crustacean predicts HLC substantially better than any other combination.

10. **CALLEJA, M.C., G. PERSOONE & P.GELADI, 1994.** Comparative acute toxicity of the first 50 multicentre evaluation of in vitro cytotoxicity chemicals to aquatic non-vertebrates. *Arch. Environm. Contam. Toxicol.* 26, 69-78. <Lab. for Biol. Res., Aquatic Pollution, Univ. Ghent, 22 J. Plateaustraat, B-9000 Ghent, Belgium.> The acute toxicity data of the first 50 chemicals of the Multicentre Evaluation of In Vitro Cytotoxicity (MEIC) programme is compared for three "cyst-based toxicity tests" (Artoxkit M with *Artemia salina*, Streptoxkit F with *Streptocephalus proboscideus*, and Rotoxkit F with *Brachionus calyciflorus*), and two other tests (the *Daphnia magna* and the *Photobacterium phosphoreum* Microtox tests) commonly used in ecotoxicology. The difference in sensitivity for the 50 chemicals was as high as 19 orders of magnitude (on a molecular weight basis) between the most and least sensitive species. This study supported the use of a selected battery of tests to evaluate ecotoxicity and suggests its possible importance for screening of biologically-active compounds from natural sources.

11. **CHOWDHURY, A.N., S. BEGUM & N. SULTANA, 1992.** Physico-chemical and biological parameters affecting the occurrence and seasonal variation of ostracods in a tropical fish pond. Bangl. J. Zool. 20, 315-323. <Dept Zoology, Univ. Dhaka, Dhaka-1000, Bangladesh.> Investigation of a semi-intensively managed fish pond in Dhaka citybetween May, 1986 and April, 1987 showed the highest number of ostracods (5.03 .times. 104/litre) in April, 1987, and the lowest (0.35 .times. 104/litre) in February 1987. A highly significant correlation of ostracods with H_2CO_3 and rotifers was recorded. A significant correlation between, ostracods and air temperature, depth, pH, free CO_2, Bacillariophyceae, Chlorophyceae, copepods, crustacean larvae and protozoa were recorded, whereas an inverse relationship was recorded between the ostracods and water temperature, and CO_2. No significant correlation was found between ostracods and Cyanophyceae.

12. **CHUNG, C.E., H.B. YOO & S.Y. KIM, 1992.** Rotifera from Korean Inland waters V. Keratella and Notholca of Brachionidae (Rotifera: Monogononta). *Kor. J. Syst. Zool.* 8, 211-222. <Dep. Biol. Education, Chonnam National Univ., Kwanguj 500-757, South Korea.> The systematic study of freshwater rotifers was conducted with the materials collected from 205 sites in South Korea. As a result, 4 subspecies, 3 forms of Family Brachionidae (Keratella, Notholca) were identified; of which, 1 form is new to the Korean fauna: Keratella quadrata f. testudo. Total 135 species, 15 subspecies, 9 varieties and 10 forms representing 14 families 40 genera are now recorded from Korea by adding the 1 form newly described in the present paper.

13. **CHUNG, C.E., H.B. YOO, S.Y. KIM, K.S. LEE, 1993.** A study on the diurnal migration and vertical distribution of rotifers in Lake Naju. *Kor. J. Limnol.* 26, 83-92. <Address above.>

14. **CULVER, D.A. & M.C. GEDDES, 1994.** Limnology of rearing ponds for Australian fish larvae: relationships among water quality, phytoplankton, zooplankton, and the growth of larval fish. Aust. J. Mar. Freshw. Res. 44, 537-551. <Ohio State University, Department of Zoology, Ohio, USA.> Four earthen ponds were surveyed. Fertilization of the ponds resulted in phytoplankton blooms dominated by the cyanobacterium *Anabaena*. This was followed by a zooplankton succession of rotifers, *Moina, Boeckella, Mesocyclops* and *Daphnia*. There was sufficient zooplankton forage, supplemented by chironomid larvae in the later stages of the rearing ponds, for fish growth.

15. **DE LEO G A; FERRARI I, 1993.** Disturbance and diversity in a river zooplankton community: A neutral model analysis. Coenoses 8 (2). 1993. 121-129. <Dipartimento Elettronica, Politecnico di Milano, Italy.> Caswell's neutral model of community structure can be considered a useful tool for the analysis of biological interactions and disturbance. We examined the zooplankton data collected during two daily sampling cycles in the Po River, near Viadana, in the summer of 1985 and 1988. Rotifers were the most important group in all the samples examined. The rotifer community shows a marked structural stability during low water phases. In the summer of 1985 dominance is high, while in 1988 evenness increases in response to conditions of moderate disturbance (higher turbidity). Floods act as "catastrophic" events, which destroy community organization and bring diversity to the values predicted by the neutral hypothesis. The results are discussed according to Connell and Huston's theories on diversity and disturbance.

16. **DE MEESTER, L. & W. VYVERMAN, 1993.** The vertical distribution of rotifers in a coastal meromictic lake of Papua New Guinea (Lake Nagada, Madang Province). *Belg. J. Zool.* 123 (Suppl. 1), 20. <Univ. Gent, Belgium.>

17. **EGBORGE, A.B.M. 1994.** Salinity and the distribution of rotifers in the Lagos Harbour-Badagry Creek system, Nigeria. *Hydrobiologia* 272, 95-104. <Dep. Zool., Univ. Benin, Benin City, Nigeria.> The waters of Lagos Harbour have a salinity variation of 30 permill , as a consequence of the annual rainfall regime and of the influx of Atlantic Ocean waters. We made monthly plankton hauls at 10 stations for 11 months starting in October 1986, and found 51 species of rotifers, with *Brachionus baylyi* Sudzuki & Timms, *Keratella hispida* Lauterborn, *Colurella obtusa* Gosse, and *Filinia pejleri* Hutchinson recorded for the first time in Nigeria. In distribution, species numbers decreased with increasing salinity. *Brachionus plicatilis, B. rubens, Hexarthra intermedia, Keratella americana, K. cochlearis* and *K. tropica* were classed as euryhaline. Stenohaline species were *Anuraeopsis fissa, Ascomorpha ovalis, Filinia longiseta, F. opoliensis, Gastropus* sp., *Lecane curvicornis* and

Monostyla stenroosi. All other monogononts were restricted to waters of salinity below 1 permill .

18. EJSMONT-KARABIN, J., T. WEGLENSKA & R.J. WISNIEWSKI, 1993. The effect of water flow rate on zooplankton and its role in phosphorus cycling in small impoundments. *Wat. Sci. Technol.* 28, 35-43. <Hydrobiol. Station, Inst. Ecol., Polish Academy Sci., ul. Lesna 13, 11-730 Mikolajki, Poland.> [Not seen.]

19. ELENBAAS, P.F.M. & C. GRUNDEL, 1994. Zooplankton composition and abundance in two impoundments in Zimbabwe. *Hydrobiologia* 272, 265-275. <Centre Developmenht Cooperation Serv., Free Univ. Amsterdam, De Boelelaan 1115, 1081 HV Amsterdam, Netherlands.> The composition and abundance of the main zooplankton groups in Cleveland dam (less eutrophic) and Lake Chivero (more eutrophic) were studied. Samples were taken at two-month intervals. Rotifers were the most diverse zooplankton group in both reservoirs. Together with the copepods they formed the bulk of the zooplankton during summer. Cladocerans were particularly present in winter although still at relatively low densities.

20. FABBRO, L. & G. WATSON, 1993. Freshwater zooplankton of the lower Fitzroy River. Proc. Fitzroy Catchment Symposium., 12-13. Nov. 1992: 1-2. <Dept. Biol., Univ. Central Qld., Rockhampton, Qld, Australia.>

21. FERNANDEZ-CASALDERREY, A., M.D. FERRANDO & E. ANDREU-MOLINER, 1993. Effect of the insecticide methylparathion on filtration and ingestion rates of *Brachionus calyciflorus* and *Daphnia magna*. *Science of the Total Environment* (Suppl.. Part 2), 867-876. <Dep. Animal Physiology, Faculty Biological Sciences, Univ. Valencia, Dr Moliner 50, E-46100 Burjassot, Valenica, Spain.>

22. FERRANDO, M.D. & E. ANDREU, 1993. Feeding behavior as an index of copper stress in Daphnia magna and Brachionus calyciflorus. *Comparative Biochemistry and Physiology C Comparative Pharmacology and Toxicology* 106, 327-331. <Lab. Ecotoxicol., Dep. Anim. Biol., Fac. Biol. Sci., Univ. Valencia, Dr. Moliner 50, E-46100 Burjasot, Valencia, Spain.> 1. The effect of short-term exposure to the fungicide copper sulfate, on the feeding behavior of two freshwater zooplankters, the rotifer *Brachionus calyciflorus* and the cladocera *Daphnia magna*, was studied. Rates of filtration and ingestion declined on *B. calyciflorus* and *D. magna* with increasing toxicant concentrations. The effective copper sulfate concentration at which feeding rate was reduced to 50% of that in controls (EC-50) was 0.043 and 0.090 mg/l for *B. calyciflorus* and *D. magna*, respectively.

23. FERRANDO, M.D.. C. JANSSEN, E. ANDREU & G. PERSOONE, 1993. Ecotoxicological studies with the freshwater rotifer *Brachionus calyciflorus*: resource competition between rotifers and daphnids under toxic stress. *Science of the Total Environment* (Suppl. Part 2), 1059-1069. <Lab. Ecotoxicology, Dep. Animal Biology, Faculty Biological Sciences, Univ. Valencia, Dr. Moliner 50, 46100 Burjasot, Valencia, Spain.>

24. FERNANDO, C.H. 1994. Zooplankton, fish and fisheries in tropical freshwaters. *Hydrobiologia* 272. 1994. 105-123. <Dep. Biol., Univ. Waterloo, Waterloo, ON N2L 3G1, Canada.> About 40% of all fish species occur in freshwater, although only 1% of the globe is occupied by freshwaters. The tropics harbour a high percentage of

these fishes. Freshwater zooplankton on the other hand is far less diverse than its marine counterpart and the tropics do not harbour a markedly high percentage of freshwater species either. Branchiopoda frequently co-existing with fishes (Cladocera) have their size composition strongly influenced by fish predation. Circumstantial evidence indicates that pelagic zooplankton (Cladocera, Copepoda, Rotifera) appear to provide a relatively scarce food supply relative to the littoral region for the early stages of fishes. Tropical freshwaters have a relatively high primary production but a low zooplankton/phytoplankton ratio. Zooplankton is kept small in size and biomass by continuous predation. Understanding food chain strategies will assist both in fish culture and management of freshwater fisheries. Lake communities like all biological communities are moulded dynamically by complex interactions. In temperate regions long-term studies are beginning to clarify some of these but in the tropics one can only make broad generalizations based on anecdotal evidence and speculation at the present time.

25. FU, Y. A. HAGIWARA & K. HIRAYAMA, 1993. Crossing between 7 strains of the rotifer Brachionus plicatilis. *Nippon Suisan Gakkaishi* 59, 2009-2016. <Natl. Res. Inst. Aquaculture, Nansei, Watarai, Mie 516-01, Japan.> Cross-mating experiments were carried out using seven S- and L-type strains of the rotifer *Brachionus plicatilis* O. F. Muller, to determine the probability of sexual recombination. The results suggest that whether the strains can be crossed successfully depends on the differences in their genetic constitution. Isozyme analysis on rotifers from resting eggs produced in the cross-matings indicated that classical sexual recombination occurred in S- or L-type rotifers. S- and L-type rotifers exhibit differences not only in morphological and physiological characteristics but also in genetic constitution and karyotypes. In addition, the current study has demonstrated reproductive isolation between the two types. From these facts, S- and L-type rotifers should be classified as different species.

26. GEE, J.H.R. & C. DUIGAN, 1993. The limnology of Lac d'Ifni (High Atlas Mountains, Morocco), an unusually productive mountain lake. Freshw. Biol. 30, 447-462. <Inst. Biol. Sci., Univ. Wales, Aberystwyth, Dyfed SY23 3DA, UK.> The open water faunal assemblage consisted of *Brachionus calyciflorus* and *Filinia longiseta* (Rotifera), *Cyclops abyssorum* (Copepoda), and stunted *Salmo trutta* (Pisces). The high level of productivity may be sustained by nutrient addition through contamination by dust originating outside the catchment, aided by efficient nutrient recycling in the euphotic zone.

27. GIDDINGS, J.M., R.C. BIEVER , R.L. HELM, G.L. HOWICK & F.J. DENOYELLES JR., 1994. The fate and effects of guthion (azinphos methyl) in mesocosms. In R.L. Graney, J.H. Kennedy & J.H. Rodgers Jr (Eds) SETAC Special Publications Series: *Aquatic mesocosm studies in ecological risk assessment; Symposium on Utilization of Simulated Field Studies in Aquatic Ecological Risk Assessment* at the 11th Annual Meeting of the Society of Environmental Toxicology and Chemistry, Arlington, Virginia, USA, November 11-15, 1990. CRC Press/Lewis Publishers Inc.: Boca Raton, Florida, USA: 469-495. [Not seen].

28. GONZALEZ, M.J. & T.M. FROST, 1994. Comparisons of laboratory bioassays and a whole-lake experiment: Rotifer responses to experimental acidification. *Ecological Applications* 4, 69-80. <Dep. Biol. Sci., Wright State Univ., Dayton, OH 45435, USA.> We test whether data from laboratory bioassays can be used to predict

zooplankton responses during a whole-lake experiment using two rotifers, *Keratella cochlearis* and *Keratella taurocephala*. In situ experiments revealed that food conditions in the treatment basin lowered reproduction by *K. cochlearis*, indicating that a combined effect of food and pH caused its population decline. Neither food nor pH could explain the increase in *K. taurocephala*, which appeared to be linked to a reduction in its predators at lower pH. Overall, our analyses revealed substantial discrepancies between laboratory bioassays and in-lake responses. This was particularly the case for *K. taurocephala*, for which assays predicted no changes or a decline in abundance rather than the marked increase that actually occurred. Our results suggest that caution should be used in extending results from laboratory assays to natural ecosystems.

29. **GREEN, J. 1993.** Zooplankton associations in East African lakes spanning a wide salinity range. *Hydrobiologia* 267,. 249-256. <17 King Edwards Grove, Teddington, Middx. TW11 9LY, UK.> The zooplankton of 38 East African lakes has been analysed in terms of species richness and dominance. The conductivities of the lakes range from 48 to 72 500 µS cm-1 20 °C. The lakes generally contain more species of rotifers than either Copepoda or Cladocera. The number of species of rotifers begins to decline at a conductivity below 1000 mu-S cm-1, and falls to 2 or 3 species above 3000 µS cm-1. Similar reductions occur in the Copepoda and Cladocera. Many species can be dominant at conductivities below 1000 µS cm-1, but the range is restricted progressively with increasing salinity. The dominant species of Rotifera, Copepoda and Cladocera change independently along the salinity gradient, but there are indications of interactions and modifications of community structure by predation and competition.

30. **GREEN J. 1994.** The temperate-tropical gradient of planktonic protozoa and rotifera. *Hydrobiologia* 272, 13-26. <17 King Edwards Grove, Teddington, Middx. TW11 9LY, UK.> Many flagellates, ciliates and rhizopods appear to be cosmopolitan, at least when considered at the morphospecies level. There are indications of tropical endemics among the ciliates and the rhizopods, but the percentage of endemics appears to be low. Among the rotifers there is a well marked latitudinal gradient, but the picture is complicated by the occurrence of warm water species during hot summers in temperate regions. A further complication has been introduced by the artificial development of heated water associated with power stations. The characteristic rotifer associations of the tropics are governed largely by temperature and salinity. A study of the altitudinal distribution of rotifers in Africa reveals an interplay between latitude and altitude in determining the similarities of the associations to those found in the temperate Old World.

31. **GUISANDE, C., M.D. GALINDO, F.M. GALAN & F. OLIVEROS. 1993.** The cost of reproduction in the rotifer *Brachionus calyciflorus*. *Int. Rev. ges. Hydrobiol.* 78, 493-499. <Dept Ecologia, Fac. Biologia, univ. Sevilla, Aptdo. 1095, 41080 -Sevilla, Spain.> At high food densities there was an increase in offspring number but the reproductive investment remained constant - a smaller amount of energy was expended on egg volume. A reduction in lifespan was observed.

32. **HABERMAN J. 1993.** Zooplankton of Lake Yaskhan. *Limnologica* 23,. 215-225. <Vortsjarv Limnol. Stn., EE2454 Rannu, Tartu District, Estonia.> In April, July and November 1988 the species composition, abundance and biomass of zooplankton were studied in Lake Yaskhan in the Kara-Kum desert (Turkmenia). Rotifers dominate in April and July, copepods in November. The abundance of zooplankton is great (231,200-2,075,400 ind.m^{-3}), biomass medium (0.321-5.501g.m^{-3}), production great (4,800-280,700 mgC.m^{-2}.day^{-3}). Zooplankton feeds mostly on detritus and detritus-related bacteria; the detrital type of food chain prevails in the waterbody. About 3.3% of the phytoplankton energy reaches fishes. The development of zooplankton is effected most of all by water temperature and Cl- content as abiotic factors, and by the phytoplankton production and the Chl a content as biotic factors.

33. **HALKOWSKAYA, H.A. 1993.** The speed of population growth of rotifers in a food concentration gradient. *Vyestsi Akademii Navuk Byelarusi Syeryya Biyalahichnykh Navuk* 1993, 95-99. <Inst. Zool., Acad. Sci. B., Minsk, Belorussia.> [In Belorussian, not seen.]

34. **HAVENS, K.E. & T. HANAZATO, 1993.** Zooplankton community responses to chemical stressors: a comparison of results from acidification and pesticide contamination research. Environ. Pollut. 82, 277-288. <Dept Res., South Fla., Water Management District, West Palm Beach, FL 33416, USA.> The response of freshwater zooplankton communities to two chemical stressors, acidification and pesticide contamination, were investigated in a review of published research results. The objective was to test Odum's predictions (Odum, 1985) that in response to stress, both the average body size of organisms and their efficiency in utilizing resources are reduced. Acidification and pesticide contamination were both found to favor dominance by small cladocerans and rotifers, the smallest zooplankton taxa. This finding was consistent with Odum's predictions, however, there were exceptions to the trend. The dominance of small taxa may be due to rapid reproductive rates, physiological tolerance, development with few transitions through sensitive stages (e.g., post-molting), or to the great richness of small species. Regardless of the mechanism, there is evidence that when acidification and pesticide contamination result in small zooplankton dominance, the efficiency of carbon and energy transfer from algae to zooplankton is reduced. This finding is also consistent with Odum's predictions.

35. **HAYASHI, M., K. TODA, T. YONEJI, O. SATO & S. KITAOKA S, 1993.** Dietary value of rotifers and *Artemia* enriched with *Euglena gracilis* for red sea bream. *Nippon Suisan Gakkaishi* 59, 1051-1058. <Tsukuba Res. Lab., Harima Chem. Inc., Tokodai, Tsukuba, Ibaraki 300-26, Japan.> Rotifers and Artemia were enriched with *Euglena* that accumulated docosahexaenoic acid (DHA). Rotifers and *Artemia* enriched with *Euglena* contained much more DHA than those enriched with *Nannochloropsis* or methyl esters of n-3 HUFA. The larval red sea bream fed on living feed containing more DHA showed higher activity in the activity test. Thus, the dietary value of rotifers and *Artemia* to red sea bream was effectively improved by enrichment with *Euglena*. *Euglena* is expected to be profitable feed for the DHA enrichment of rotifers and *Artemia*.

36. **HOLT, G.J. 1993.** Feeding larval red drum on microparticulate diets in a closed recirculating water system. *J. World Aquacult. Soc.* 24, 225-230. <Univ. Tex. Austin, Mar. Sci. Inst., P.O. Box 1267, Port Aransas, TX 78373, USA.> A feeding protocol was developed for red drum larvae based on combining a commercial micro-particulate diet (Kyowa Fry Feed) with live prey (rotifers) in a closed, water reuse system. The most satisfactory combination was feeding live food and microdiet together for the first five days and then completely discontinuing live prey,

eliminating the need to feed brine shrimp to the larvae. Growth rates of larvae fed progressively larger sizes of the microdiet were as good as larvae reared on live prey. Both groups metamorphosed to the juvenile stage at less than one month. Survival rates on the five day live food and microdiet combination were a remarkable 60% from egg to the juvenile stage. The successful weaning of red drum to microdiets paves the way to produce a semipurified diet to test nutrient requirements of larval fish.

37. **JOAQUIM-JUSTO, C., J.P. THOME, V. GOSSELAIN & J.P. DESCY, 1993.** Establishment of the PCB contamination by the trophic pathway of a freshwater planktonic rotifer species, Brachionus calyciflorus. *Belg. J. Zool.* 123 (Suppl. 1), 37-38. <Univ. Liege, Belgium.>

38. **JOHNSON, P.C., J.H. KENNEDY, R.G. MORRIS, F.E. HAMBLETON & R.L.GRANEY, 1994.** Fate and effects of cyfluthrin (pyrethroid insecticide) in pond mesocosms and concrete microcosms. pp. 337-371 In R.L. Graney, *et al.* (see Ref. #27). [Not seen].

39. **JORGENSEN, I. & J.A. EIE, 1993.** The distribution of zooplankton, zoobenthos and fish in lakes and ponds of the Mosseif peninsula, Svalbard. *NINA (Norsk Institutt for Naturforskning) Forskningsrapport* 0 (45), 1-25. <Boks 1037 Blindern, N-0315 Oslo, Norway.> [In Norwegian.] A freshwater investigation of 9 lakes, 8 ponds and 3 rivers/streams was carried out in summer 1977. The zooplankton communities were simple and 4 species of rotifers, two species of cladocers and one species of copepods were common.

40. **JOSE DE PAGGI, S. 1993.** Composition and seasonality of planktonic rotifers in limnetic and littoral regions of a floodplain lake (Parana river system). *Rev. Hydrobiol. Trop.* 26, 53-63. <Inst. Nac. Limnol., Macia 1933, 3016 Santo Tome, Santa Fe, Argentina.> The rotifer communities of limnetic and littoral zones (with different macrophyte species) were compared in an annual cycle. Significant differences between both areas are given at species level. The limnetic assemblage was characterized by the predominance of the genera *Keratella*, *Filinia* and *Polyarthra* and lower species richness. In the littoral community, the genera *Lecane*, *Lepadella*, *Trichocerca* and *Testudinella* predominated, and species richness was highest. The seasonal patterns of richness, diversity and abundance of rotifers were similar in both areas, but the seasonal changes were more attenuated in the littoral stations. Although hydrologic factors are a major cause of seasonal patterns, other factors may also be involved.

41. **JUCHELKA, C.M. & T.W. SNELL, 1994.** Rapid toxicity assessment using rotifer ingestion rate. *Archives of Environmental Contamination and Toxicology* **26**, 549-554. <Sch. Biol., Georgia Inst. Technol., Atlanta, GA 30332-0230, USA.>. Techniques were developed to quantify ingestion rate in the freshwater rotifer Brachionus calyciflorus in 1 h, using fluorescently labeled latex spheres. The number of spheres ingested in a fixed feeding interval is directly proportional to the intensity of fluorescence in the gut. Gut fluorescence was quantified in individual females using an image analysis system. The effects of several types of toxicants on ingestion rate are reported and compared to acute and chronic values from whole animal tests.

42. **KENNEDY, A.D. 1993.** Water as a limiting factor in the antarctic terrestrial environment: A biogeographical synthesis. *Arctic and Alpine Research* **25**, 308-315. <British Antarctic Surgery, Natural Environment Res. Council, High Cross, Madingley Road, Cambridge CB3 0ET, ENG, UK.> The question is posed: "what limits the presence, distribution, and abundance of life in Antarctica?" At the microhabitat level, the abundance of nematodes, tardigrades, rotifers, and microarthropods is directly proportional to microvariations in relative humidity. Upward migration of soil microalgae in response to water availability, together with seasonal population peaks of bacteria, algae, and protozoa at snowthaw, suggest moisture limitation on vertical and temporal scales. It is concluded that, in Antarctica, many of the limiting effects previously attributed to low temperature may in fact operate through the water balance of organisms. Although Antarctica is the coldest place on Earth, water appears to be the primary limiting factor.

43. **LAAL, A.K. & M. KARTHIKEYAN, 1993.** Rotifers - pollution or productivity indicators? *Current Sci.* 65, 874-875. <Reservoir Division, CICFRI (ICAR), 1st Main, 4th Block, Rajajinagar, bangalore 560-101, India.> Correlation and multiple regression analyses were used to test the indicator potential of rotifers in the river Ganga at Bhagalpur. Rotifers were most influenced by chloride, which is an indicator of pollution.

44. **LI, W., X. WANG & Y. ZHANG, 1993.** Study on kinetics of glucose uptake by some species of plankton. *Chin. J. Oceanol. Limnol.* 11, 8-15. <Dep. Oceanography, Xiamen Univ., Xiamen 361005, China.> [Not seen.]

45. **LIBER, K. & K.R. SOLOMON, 1994.** Acute and chronic toxicity of 2,3,4,6-tetrachlorophenol and pentachlorophenol to *Daphnia* and rotifers. *Arch. Environm. Contam. Toxicol.* 26, 212-221. <Lake Superior Res. Inst., Univ. Wis.-Superior, 1800 Grand Avenue, Superior, WI 54880-2898, USA. > The toxicities of 2,3,4,6-tetrachlorophenol (TeCP) and pentachlorophenol (PCP) were determined in standardized, single-species laboratory toxicity tests using daphnids and rotifers. For *Daphnia magna*, 48-h LC50 estimates with neonates indicated that PCP was more toxic than TeCP. *Daphnia galeata* mendotae was more sensitive to TeCP than *D. magna* displaying a mean 48-h LC50 value of 0.58 mg/L. Rotifer tests, conducted with a commercially available species (*Brachionus calyciflorus*) and a field collected species (*Keratella cochlearis*), also indicated that PCP was more acutely toxic than TeCP. In general, *B. calyciflorus* was less sensitive to TeCP and PCP than *D. magna* and *D. g. mendotae*. Assays with *K. cochlearis* were only marginally successful, but the mean 12-h LC50 estimate for TeCP of 0.96 mg/L suggested that this species may be more sensitive to TeCP than *B. calyciflorus*.

46. **LIM, L.C. 1993.** Larviculture of the greasy grouper *Epinephelus tauvina* F. and the Brown-marbled grouper *E. fuscoguttatus* F. in Singapore. *J. World Aquacult. Soc.* **24**, 262-274. <Freshwater Fish. Sect., Primary Production Dep., 17 Km, Sembawang Rd., Singapore 2776, Singapore.> This paper reports the larviculture of two grouper species, and examines the technical feasibility of breeding the fish. Based on the spawning and larval characteristics, brown-marbled grouper is considered a better potential species for large scale fry production than the greasy grouper.

47. **LOPEZ,C. 1993.** New rotifers for inland waterbodies of Venezuela. *Rev. Hydrobiol. Trop.* **26**, 65-70. <Dep. Biol., Fac. Exp. Cien., Univ. Zulia, Apdo. 526, Maracaibo,

4011-A, Venezuela.> Samples from northwestern Lake Maracaibo Basin provided eight new records to Venezuelan rotifer fauna. Of these, *Lecane ludwigi* f. *laticaudata* Hauer is recorded for South America for first time. The new taxa recorded are illustrated and some aspects on their taxonomy and biogeography are discussed.

48. LUCASSEN, W.G.H. & P. LEEUWANGH, 1994. Response of zooplankton to Dursban 4E insecticide in a pond experiment. In R.L. Graney *et al.* (see Ref #27) [Not seen.]

49. MAAS, S. & H. SEGERS, 1993. Zoogeography of the Copepoda and Rotifera of the Seychelles. Belg. J. Zool. 123 (Suppl. 1), 48. <Dept Animal Ecology, Univ. Gent, Ledeganckstraat 35, Gent, B-9000 Belgium.>

50. MAROZAW, A.M. 1993. Species specificity of rotifer adaptive reactions to feed concentration. *Vyestsi Akademii Navuk Byelarusi Syeryya Biyalahichnykh Navuk* 1993, 100-102. <Inst. Zool., Acad. Sci. B., Minsk, Belorussia.>

51. MARUYAMA I; HIRAYAMA K, 1993. The culture of the rotifer *Brachionus plicatilis* with *Chlorella vulgaris* containing vitamin B-12 in its cells. Journal of the World Aquaculture Society 24 (2). 1993. 194-198. <*Chlorella* Ind. Co. Ltd., Chikugo, Fukuoka 833, Japan.> The rotifer *Brachionus plicatilis* requires vitamin B-12. Freshwater *Chlorella*, which is produced by traditional culture, cannot support rotifer growth under bacteria-free conditions. However, *Chlorella* enriched with vitamin B-12 can support rotifer growth. The authors conducted mass production of the rotifer with baker's yeast and refrigerated concentrated *Chlorella* containing vitamin B-12. Rotifer culture with vitamin B-12 was more stable and showed 1.3 times higher production than with normal *Chlorella*.

52. MATSUBARA, T. 1993. Rotifer community structure in the south basin of Lake Biwa. *Hydrobiologia* 271, 1-10. <Div. Aquatic Ecol., Cent. Ecol. Res., Kyoto Univ., Shimosakamoto Otsu, Kyoto 520-01, Japan.> Seasonal changes in abundance and species composition of rotifers were surveyed at five locations under different physical and chemical conditions in the south basin of Lake Biwa during July 1987-June 1988. The difference in composition during July-October suggests a difference of trophic state between the northern and southern areas in the south basin of Lake Biwa. However, the dominance of *Polyarthra* and the difference in the composition during April-May 1988 could not be explained by such a difference in trophic state. The results suggest that physical and chemical conditions were not effective in controlling the rotifer community structure in the south basin of Lake Biwa.

53. MELONE, G. & M. FERRAGUTI, 1994. The spermatozoon of *Brachionus plicatilis* (Rotifera, Monogononta) with some notes on sperm ultrastructure in rotifera. *Acta Zoologica* (Copenhagen) 75, 81-88. <Dip. Biologia, Universita di Milano, 26 via Celoria, I-20133 Milano, Italy.> Ulstrastructure of *B. plicatilis* sperm is detailed. The general organization of the cell, including the absence of an evident acrosome, resembles that of the other known monogonont sperm types.

54. MORRIS, R.G., J.H. KENNEDY, P.C. JOHNSON & F.E. HAMBLETON, ~~1994~~. Pyrethroid insecticide effects on bluegill sunfish in microcosms and mesocosms and bluegill impact on microcosm fauna. In R.L. Graney, *et al.* (see Ref #27). [Not seen].

55. NAUWERK, A. 1994. A survey on water chemistry and plankton in high mountain lakes in northern Swedish Lapland. *Hydrobiologia* 274, 1994. 91-100. <Limnological Inst., Austrian Acad. Sci., A-5310 Mondsee, Austria.> A helicopter survey was carried out on 56 water bodies in the Abisko mountains, Swedish Lapland, in August 1981. Water chemistry was found to be highly correlated with bedrock quality in the drainage area of the lakes. Low pH values (down to 5.1) appeared in the neighbourhood of sulphuric iron-ores. Natrium and chloride concentrations showed large scale patterns which can be explained by orographic rainfall. Biologically, northern high mountain conditions are reflected in species composition rather than in biomass or possibly in diversity. Small chrysomonades and dinoflagellates, as well as Keratella hiemalis and Cyclops scutifer characterize the most 'arctic' waters. A comparison with data from earlier investigations did not confirm expected signs of acidification.

56. NOGRADY, T. 1993. Rotifera, Vol. 1. Biology, ecology and systematics. *Guides to the Identification of the Microinvertebrates of the Continental Waters of the World* 4. 1-142. SPB Academic Publishing bv: The Hague, Netherlands. ISBN 90-5103-080-0. This work deals with the general biology of rotifers and outlines their taxonomy. It also includes a guide to the literature and current classification schemes. The chapters include the techniques of collecting, culturing and preserving, morphology and internal organization, physiology, population ecology, community ecology, evolution of rotifers, systematics and taxonomy, classification, identification, and a brief history of rotifer research. Photographs, diagrams, line-drawings, graphs, maps, and cladograms illustrate the text. references and an index are provided.

57. ONWUDINJO, C.C. & A.B.M. EGBORGE, 1994. Rotifers of Benin River, Nigeria <Dep. Zool., Univ. Benin, Benin City, Nigeria.> *Hydrobiologia* 272, 87-94. Plankton hauls were made with 55 μm Hydrobios nets at one Jamieson and six Benin River stations at monthly intervals for 12 and 24 months during 1981/82 and 1986-1988, respectively. In all, a 100 km stretch of the Benin River and its tributary, the Jamieson, were covered. Fifty species of Rotifera were recorded. About 80% were cosmopolitan. The turbulent nature of the river is reflected in a diversity of Lecanidae found, although the dominant species were *Keratella tropica* (Apstein) and *Keratella cochlearis* (Gosse) (Brachionidae). Spatial investigations revealed the euryhaline nature of *Brachionus plicatilis* (O.F. Müller), and showed most Benin River rotifers to be freshwater inhabitants.

58. OTTERA, H. 1993. Feeding, growth, and survival of atlantic cod (Gadus morhua) larvae reared in replicate plastic enclosures. *Can. J. Fish. Aquat. Sci.* 50,. 913-924. <Inst. Marine Research, Dep. Aquaculture, P.O. Box 1870, Nordnes, N-5024 Bergen, Norway.> Larval cod, at an initial stocking density of 10 larvae/L, were fed rotifers (*Brachionus plicatilis*) and natural zooplankton collected from the sea. Larval mortality was low during the first month, with a mean mortality rate (Z) of 0.02/d. Growth, however, was very slow and mortality increased significantly after about 4 wk, possibly due to starvation. *Brachionus plicatilis* dominated the gut content during the first 3-4 wk. Most of the larvae were distributed in the upper parts of the rearing enclosures, while rotifers were distributed deeper. This, together with the high larval density, inadequate rotifer enrichment, and low temperature probably amplified the unfavourable feeding conditions.

59. PEJLER, B. & B. BERZINS, 1994. On the ecology of *Lecane* (Rotifera). *Hydrobiologia* 273, 77-80. <Inst. Limnology, P.O. Box 557, 751 22 Uppsala, Sweden.> A material consisting of 49 taxa of Lecane (Rotifera), from diverse waters in south and Central Sweden, was analyzed to reveal their relationships to substrate and habitat. Most species did not show any pronounced preference for any substrate, occurring in several diverse substrates, and especially in periphytic environments. Only a few species seemed to specialize in bog substrates. Some taxa were found, sometimes at a high frequency, on an artificial substrate, white cotton, indicating a high degree of mobility.

60. PEJLER, B. & B. BERZINS, 1993. On the ecology of mire rotifers. *Limnologica* 23, 295-300. <Limnol. Inst., Norbyvagen 20, 752 36 Uppsala, Sweden.> The rotifer fauna of ten mires in south Sweden was investigated. 328 taxa were found, some of which having a wide ecological spectrum, others being mire specialists. Among ecological factors, moisture and pH were shown to be particularly important for determining the occurrence of separate species.

61. PUJIN, V. 1992. Comparative data on the composition of zooplankton in the part of the River Danube and the River Tisza in Vojvodina,Yugoslavia. *Tiscia (Szeged)* 26, 49-57. <Inst.. Biol. Univ.. Novi Sad, 21000 Novi Sad, Yugoslavia.> 187 species and varieties were ascertained: 31 Protozoa, 119 Rotatoria, 26 Cladocera and 11 Copepoda. The number of species in the Danube was higher than in Tisza and we also observed differences depending on locality, that could be attributed to a great extent to the anthropogenic influences. Rotifers were the most diverse group, with most common genera *Brachionus, Keratella, Cephalodella, Colurella, Lecane* and *Trichocera*. On the basis of similarity index according to Sorensen (1948), the dendrograms show two complexes, one in Danube and the other in Tisza, which are linked through a locality downstream from the mouth of Tisza into Danube. The saprobity index according to Pantle and Buck (1955) in Danube, through all three years, indicates a betamesosaprobic pollution stage, while in Tisza in most cases a betaalfamesosaprobity.

62. RAMIREZ-SEVILLA, R., R. RUEDA-JASSO, J.L ORTIZ-GALINDO & B. GONZALEZ-ACOSTA, 1991 (1193). Methodology for the experimental culture of the rotifer *Brachionus plicatilis*. *Invest. Mar. CICIMAR* (Cent. Interdiscip. Cienc. Mar.) 6, 287-290. <Centro Interdisciplinario de Ciencias Marinas, Apdo Postal 592, La Paz, BCS. Mexico 23000.> The rotifers of the genus *Brachionus* have been broadly used as food stuff for studies on the early life of crustaceans and fish, and have also been applied in aquaculture. This paper describes the isolation of a local strain of *Brachionus plicatilis* and the procedures that allows its extensive culture under controlled conditions. The use of this strain has enabled us to obtain the development of the early life stages of three species of crustaceans and 19 species of marine fish.

63. RICHARDSON, W.B. & S.T. THRELKELD, 1993. Complex interactions of multiple aquatic consumers: An experimental mesocosm manipulation. *Can. J. Fish. Aquat. Sci.* 50,. 29-42. <National Fisheries Res. Cent., PO Box 818, La Crosse, WI 54602-0818, USA.> In 7-m^{-3} outdoor tanks filled with lake water, the presence/absence of omnivorous young-of-the-year *Micropterus salmoides*, zooplanktivorous *Menidia beryllina*, and herbivorous larval *Hyla chrysocelis* was experimentally manipulated. A cross-classified design was used to assess the interactive effects of these vertebrate consumers on the experimental food webs. Large zooplankters and large, actively swimming macroinvertebrates (*Ceriodaphnia, Simocephalus*, Corixidae, Notonectidae, and Dytiscidae) were particularly susceptible to depletion by both fish species. The primary effects of the experimental manipulations on food web components were two-and three-way interactions in which the effect of a given treatment was dependent on the presence of another treatment. Results suggest that the addition or removal of consumers may not cause linear, additive changes in food webs.

64. RODRIGUEZ, C.; J.A. PEREZ, M.S. IZQUIERDO, J. MORA, A. LORENZO & H. FERNANDEZ-PALACIOS, 1994. Essential fatty acid requirements of larval gilthead sea bream, *Sparus aurata* (L.). *Aquaculture and Fisheries Management* 25, 295-304. <Dpto. de Biol., Fac. Ciencias del Mar, Univ. Las Palmas, 35017 Las Palmas, Spain.> Two experiments were carried out to study the effect of n-3 HUFA levels in rotifers on survival, growth, activity and fatty acid composition of gilthead bream, Sparus aurata (L.), larvae. From the third to the 15th day after hatching, gilthead bream larvae received one of the three kinds of rotifers containing different percentages of n-3 HUFA. A good correlation was found between larval growth and n-3 HUFA levels in rotifers. Larval survival was also significantly improved by the elevation of the n-3 HUFA levels in rotifers. A high occurrence of hydrops was registered in larvae fed with EFA-deficient rotifers. The n-3 HUFA levels in the larvae were increased by the elevation of n-3 HUFA contents in rotifers. However, n-9 fatty acids in the larvae remained almost constant, regardless of the different 18: 1 n-9 contents in rotifers. Therefore, the ratio of oleic acid to n-3 HUFA, known to be an indicator of the EFA deficiency in fish, was reduced by the elevation of the n-3 HUFA levels in rotifers.

65. SANOAMUANG, L.-O. 1993. The effect of temperature on morphology, life history and growth rate of *Filinia terminalis* (Plate) and *Filinia* cf. *pejleri* Hutchinson in culture. *Freshw. Biol.* 30,. 257-267. <Dep. Biol., Fac. Sci., Khon Kaen Univ., Khon Kaen 40002, Thailand.> 1. Experiments on the influence of temperature (5-25 °C) on morphology, life history and growth rate of *Filinia terminalis* and *F.* cf. *pejleri* were performed in replicated individual cultures with *Oocystis* sp. as food. 2. Some morphological characteristics previously used for the identification of both species were found to be affected by temperature and also by life cycle stage. However, numbers of unci teeth were not affected. 3. Body and setal lengths, life spans, all stages of development, and growth rates of both species decreased with increasing temperature. 4. Offspring number per female of both rotifers was highest at 20 degree C. Maximum growth rate of *F. terminalis* was at 25 °C, whereas that of *F.* cf. *pejleri* was at 20 °C.

66. SCHNEIDER S; W. KLEINOW, 1993. Comparison of proteins from the lorica of rotifers and from wool keratin. *Biological Chemistry Hoppe-Seyler* 374, 785. <Zoologisches Inst., Univ. Koeln, Weyertal 119, W-5000 Koeln 41, Germany.>

67. SCHUMAKER, R.J., W.H. FUNK & B.C. MOORE, 1993. Zooplankton responses to aluminum sulfate treatment of Newman Lake, Washington. *J. Freshw. Ecol.* 8, 375-387. <State Washington Water Res. Cent., Washington State Univ., Pullman, WA 99164-3002, USA.> Pelagic zooplankton were sampled prior to and following the whole-lake aluminum sulfate (alum) treatment of Newman Lake, Washington, to determine zooplankter responses. Signs of perturbation such as pronounced declines in zooplankton numbers, biomass, and species diversity were exhibited within two weeks after the treatment. These observations may be attributed to a combination of

physical action of the settling alum floc, removal of and change in primary food sources, predation by planktivorous fish, and toxicity of aluminum ion. Declines were only temporary, and substantial zooplankter proliferation was evident in the following months due to the abundance of small algae and other food particles. Subsequent monitoring of the zooplankton for 2½ years showed that the community composition changed after the treatment. Rotifers became more abundant, while biomass dominance shifted from cladocerans and copepods to copepods. Long-term compositional changes may also be attributed to a shift in zooplankter food resources. No long-term decrease in zooplankton species diversity was observed.

68. **SCHMID-ARAYA, J.M. 1993.** Spatial distribution and population dynamics of a benthic rotifer, *Embata laticeps* (Murray) (Rotifera, Bdelloidea) in the bed sediments of a gravel brook. *Freshw. Biol.* 30, 395-408. <Biol. Stn. Lunz, Seehof 4, A3293 Lunz am See, Austria.> Three temporal peaks of population density occurred during Oct. 1991-Oct. 1992 at the sediment surface differing in their timing from the density peaks detected within the bed sediments. Higher abundances were found between 10 and 20 cm depth in the pool and between 20 and 30 cm in the riffle area. In these two sites a significant effect of surface discharge (estimated 1 week before. Overall mean values of population increase were higher in the pool habitat than in the riffle and at the sediment surface. In addition, population growth fluctuated more strongly at the sediment surface than within the hyporheic interstitial. A clear trend in population growth of E. laticeps over time could not be demonstrated in this gravel stream.

69. **SCHMID-ARAYA, J.M. 1993.** Benthic Rotifera inhabiting the bed sediments of a mountain gravel stream. *Jber. Biol. Stn Lunz* 14, 75-101. <Address above.> Micro-meiofauna, Bdelloidea, Monogononta.

70. **SEGERS, H. 1993.** Report on Rotifera from Papua New Guinea. *Belg. J. Zool.* 123 (Suppl. 1), 66-67. <Dept Animal Ecology, Univ. Gent, Lededgankstraat 35, Gent, B-9000 Belgium.>

71. **SEGERS, H. & H.J. DUMONT, 1993.** Zoogeography of Pacific Ocean Islands: comparison of the rotifer faunas of Easter Island and the Galapagos Archipelago. *Hydrobiologia* 255/256, 475-480. <Address above.> Comparison of species lists from the two areas shows a faunal poverty for Easter Island. Reasons suggested include: large source-to-target distance for dispersal, small target size, uniformity of ecosystems and limited age of aquatic biotopes.

72. **SEGERS, H., D.K. MBOGO & DUMONT, H.J. 1994.** New Rotifera from Kenya, with a revision of the Ituridae. *Zool. J. Linn. Soc.* 110, 193-206. <Address above.> *Brachionus africanus* and *Itura symmetrica* are described from Kenya. The Ituridae are revised with a key to species. Endemism in Africa is discussed.

73. **SEGERS, H., E.N.D. SANTOS-SILVA & A.L.D. OLIVEIRA-NETO, 1993.** New and rare species of *Lecane* and *Lepadella* (Rotifera: Lecanidae; Colurellidae) from Brazil. *Belg. J. Zool.* 123, 113-121. The taxonomy and distribution of some new or rare species of the rotifer genera *Lecane* and *Lepadella* are discussed. *Lecane braziliensis* n. sp. and *Lepadella amazonica* n. sp. are described. The presence of *Lecane dumonti* Segers, *L. uenoi* Yamamoto, *Lepadella lindaui* Koste, *L. bicornis* Vasisht & Battish and *L. pterygoida* (Dunlop) in the neotropical region is reported or confirmed.

74. **SELLNER, K.G., D.C. BROWNLEE, M.H. BUNDY, S.G. BROWNLEE & K.R. BRAUN, 1993.** Zooplankton grazing in a Potomoc River cyanobacteria bloom. *Estuaries* 16, 859-872. <Benedict Estuarine Res. Lab., Acad. Nat. Sci., Benedict, MD 20612 USA.>

75. **SERRA, M., M.J. CARMONA & M.R. MIRACLE, 1994.** Survival analysis of three clones of *Brachionus plicatilis* (Rotifera). *Hydrobiologia* **277**, 97-105. <Area d'Ecologia, Univ. Valencia, 46100-Burjasot, Valencia, Spain.> Lifespan showed the expected decrease with increasing temperature, but a general trend with salinity or genotype was not observed. Probability of death increased with age, as tested by polynomial regression analysis of the survival curve and using theoretical mortality distributions. Three two-parameter models (linear-exponential model, Weibull model, and Gompertz model) were fitted to the survival data. Fitting of these models to data was rather poor, but the Gompertz model and, to a lesser extent, the Weibull model fitted the data better than the linear-exponential model. Parameters obtained from the survival curve analyses were related to other demographic parameters. A significant relationship between the shape parameter of the Gompertz model and the cohort generation time was detected, suggesting, but not proving, an effect of reproductive effort on aging.

76. **SHAMSUDIN, L. 1993.** Biochemical composition of various food organisms used in Malaysia for mass propagation of fish larvae. *Acta Hydrobiol.* 35, 231-241. <Pertanian University Malaysia, Faculty Fisheries and Marine Science, Mengabang Telipot, 21030 Kuala Terengganu, Terengganu, Malaysia.> The mass production of live food organisms *Brachionus plicatilis* and *Artemia salina* are important and necessary for the rearing of sea bass larvae in Malaysian aquaculture. The food organisms under investigation contained the necessary w-3 highly unsaturated fatty acid (HUFA) series necessary for growth and survival rates of fish larvae.

77. **SIDDIQUI, M.J., S.M. TRIPATHI & A. SADRI, 1993.** Abiotic conditions, plankton and fisheries prospect in two lakes of Mitihari (Bihar). *Biological Memoirs* 19, 29-39. < P.G. Dep. Zool., M.S. Coll., Motihari, India. > Plankton population was low during rainy season. Fisheries prospect in these lakes were studied by observing the fish fauna and annual production of fish. More than 30 economically important fish species were recorded but the production rate was remarkably low (about 22-25 kg/acre/year). Though abiotic conditions and plankton position were not quite favourable, the low rate of fish production was probably due to submerged weeds (100%), chance occurrence or accidental introduction of small size uneconomic fishes (weed fishes) with carps, spawn etc. Culture of air - breathing fishes may enhance the production rate. Certain pre-requisites for fisheries have also been suggested.

78. **SILVA-BRIANO, M. & H. SEGERS, 1992 (1993).** A new species of the genus Brachionus (Rotifera: Monogononta) from the State of Aguascalientes, Mexico. Rev. Hydrobiol. Trop. 25, 283-285. <Univ. Autonoma Aguascalientes, Centro Basico, Av. Univ. s/n, Aguascalientes, Ags. C.P. 20100, Mexico.> A new species of *Brachionus*, *B. josefinae* n. sp., is described from a temporary pool in the State of Aguascalientes, Mexico. The n. sp. belongs to the group of *B. urceolaris*, and is diagnosed by its lorica being stiff only anteriorly, and by its relatively long and broad foot.

79. **SKARAMUCA, B.S. 1994.** An approach to the construction of a simple and low-cost aeration system for rotifer culture. *Aquacultural Engineering* 13, 153-161. <Biological Inst., 50001 Dubrovnik, Croatia.> The design and construction of a new aeration system for *Brachionus plicatilis* M. is detailed. The research was carried out in a 500-litre flat-bottomed ring-shaped plastic tank. The air diffuser for the aeration of the entire tank surface was fixed at the bottom. Thereby, the 'dead angle' was avoided and a quicker development of the rotifer population achieved. Some 11 million individuals were produced in the tank every day, i.e. 27.5/ml new rotifer individuals daily, which is enough to feed approximately 2 million postlarval fish. All parts of the diffuser and the tank were made of plastic. The system is simple, inexpensive and very practical; it contributes to the increased production of rotifers and a more rotational use of the hatchery space; it shortens the period of phytoplankton culture while reducing the working effort.

80. **SONG, M.-O. & W. KIM, 1992.** Three Brackish water rotifers from Korea. *Kor. J. Syst. Zool.* 8, 325-330. <Dep. Mol. Biol., College Natural Sci., Seoul National Univ., Seoul 151-742, South Korea.> One species and two subspecies of rotifers inhabiting several brackish water lakes on the east coast of Korea are redescribed and illustrated. *Keratella cruciformis eichwaldi* and *Dipleuchlanis propatula propatula* are the known species, and *Notholca liepetterseni* is newly reported from Korea.

81. **SOETAERT K; VAN RIJSWIJK P, 1993.** Spatial and temporal patterns of the zooplankton in the Westerschelde estuary. Marine Ecology Progress Series 97 (1). 1993. 47-59. <Netherlands Inst. Ecol., Cent. Estuarine and Coastal Ecol., Vierstraat 28, 4401 EA Yerseke, Netherlands.>The invertebrate zooplankton fauna of the Westerschelde (Belgium and The Netherlands) was investigated during 2 yr by means of monthly samples along a salinity gradient. Copepods were usually the most abundant holoplanktonic metazoans except in the freshwater zone where Rotifera were most numerous. The combination of a classification technique and an ordination-regression technique proved to be a valuable tool for the analysis of such an extensive data set. A canonical correspondence analysis revealed 2 major environmental axes. The salinity gradient (mainly spatial) explained most of the variance. Strongly correlated with this factor were dissolved oxygen content and secchi disc visibility. The temperature gradient (mainly temporal) was almost perpendicular to the salinity axis, indicating little or no correlation. Of lesser importance was the load of suspended matter, which was highest in the brackish area in autumn-winter. Chlorophyll content of the water was unimportant in explaining community structure. Copepod dry weight was maximal in spring in the brackish part (500 mg m^{-3}); a lower maximum (260 mg m^{-3}) was observed in summer in the marine part of the estuary.

82. **STONE, L., T. BERMAN, R. BONNER, S. BARRY & S.W. WEEKS, 1993.** Lake Kinneret: A seasonal model for carbon flux through the planktonic biota. *Limnol. Oceanogr.* 38, 1680-1695. <Yigal Allon Kinneret Limnological Lab., Israel Oceanographic and Limnological Res., P.O. Box 345, Tiberias 14102, Israel.> Carbon standing stock distribution in the euphotic zone of Lake Kinneret and the immediate fate of primary-produced carbon are very different during late winter-early spring (with the occurrence of the annual dinoflagellate bloom) than they are in late summer (when nanophytoplankton are the dominant primary producers). We used a linear programming model to construct balanced carbon flow charts for these two seasons based on measured primary productivity; on carbon standing stocks of algae, bacteria, flagellates, ciliates, cladocerans, rotifers, and fish; and on data on

turnover times, respiration, and grazing rates obtained in 1989. We used the model to examine the extent to which individual intercompartmental flux rates were free to vary while the mass-balance and biological constraints were enforced. The model was also capable of generating different yet feasible flow-chart scenarios; it thus proved useful in suggesting alternative hypotheses concerning the role of the microbial food web in the euphotic waters of Lake Kinneret.

83. **SUDZUKI, M. 1993.** Rotifera and strange testacean from the new territories of Hong-Kong in February. *Zool. Sci.* (Tokyo) 10 (Suppl.), 172. <Biol. Lab., Nihon Daig. Univ., Omiya, Japan.> [Not seen.]

84. **TAYLOR, B.E., A.E. DEBIASE & D.L. MAO, 1993.** Development of the zooplankton assemblage in a new cooling reservoir. *Arch. Hydrobiol.* 128, 129-148. <Savannah River Ecol. Lab., Drawer E, Aiken, SC 29802, USA.> Our 3-year study began nine months after the reservoir filled. The reservoir received thermal effluent from a nuclear reactor during cooler months of the first two years of the study. The effluent increased water temperatures by 10-15 °C and sharply reduced zooplankton populations, mainly rotifers, at the upper end of the reservoir. At the lower end, the thermal effluent increased temperatures by 3-5 °C, but had little detectable effect on the zooplankton. Crustacean zooplankton initially dominated the assemblage at the lower end of the reservoir. A year before reactor operation ceased entirely, their abundances began to decline as populations of threadfin shad (Dorosoma petenense) and other pelagic planktivorous fish increased. We infer that fish predation caused the decline of the crustaceans. Fish predation may indirectly have allowed the rotifer populations to increase by suppressing invertebrate predation or by reducing competition from crustacean grazers for algal food resources.

85. **TICKU, A. & D.P. ZUTSHI, 1993.** The distribution and abundance of epiphytic rotifer populations on submerged macrophytes in Dal Lake, Srinagar. *J. Indian Inst. Sci.* 73, 237-245. <Cent. Res. Dev., Univ. Kashmir, Srinagar 190 006, India.> [Not seen.]

86. **TIETZE, N.S., M.A. OLSON, P.G. HESTER & J.J. MOORE, 1993.** Tolerance of sewage treatment plant microorganisms to mosquitocides. J. Amer. Mosquito Control Assoc. 9, 477-479. <John A. Mulrennan, Sr. Res. Lab., Florida A and M Univ., 4000 Frankford Ave., Panama City, FL 32405-1933, USA.> Beneficial protozoa and rotifers collected from a wastewater treatment plant in Panama City, FL, were tested for tolerance to 11 commonly used mosquito larvicides and adulticides in the laboratory. The acute effects were assessed using selected concentrations of the adulticides fenthion, malathion, naled, permethrin, and resmethrin; and the larvicides Bacillus thuringiensis israelensis, Bacillus sphaericus, diflubenzuron, larviciding oil, methoprene, and temephos for the following microorganism taxa: ameoboids, flagellates, free-swimming ciliates, stalked ciliates, and rotifers.

87. **UKU, J.N. & K.M. MAVUTI, 1994.** Comparative limnology, species diversity and biomass relationship of zooplankton and phytoplankton in five freshwater lakes in Kenya. *Hydrobiologia* 272, 251-258. <Dep. Zool., Univ. Nairobi, Nairobi, Kenya.> *Thermocyclops oblongatus* (Copepoda) was dominant in all the lakes. *Ceriodaphnia cornuta* and *Diaphanosoma excisum* (Cladocera) dominated in lakes Naivasha and Oloiden, whereas in Ruiru, Masinga and Nairobi reservoirs, *Brachionus angularis* and *Hexarthra mira* (Rotifera) were the dominant zooplankters. Phytoplankton biomass as

chlorophyll a was lowest in Ruiru dam 5.64 +- 4.0 mu-g l-1 and highest in the eutrophic Nairobi dam 71.5 +- 12.02 mu-g l-1. The endorheic lakes Naivasha and Oloidien showed medium values of 24.5 + 4.0 mu-g l-1.

88. **VIRRO, T. 1993.** Rotifers from Lake Yaskhan, Turkmenistan. *Limnologica* **23**, 233-236. <Inst. Zool. and Botany, 21 Vanemuise St., EE2400 Tartu, Estonia.> 29 rotifer taxa, 19 of which are new records, were identified in the pelagial of Lake Yaskhan, Turkmenistan. *Brachionus plicatilis* (represented by 3 forms), *Hexarthra fennica*, *Keratella quadrata* (4 forms) and *Synchaeta oblonga* were dominating. In addition to eurytherms, the presence of thermophilic *Hexarthra fennica* and *Brachionus* spp. is characteristic of the lake. The occurrence of *Notholca acuminata* and *N. squamula salina* is noteworthy. The rotifer community in Lake Yaskhan can be characterized as a complex of euryhaline and halophilic species. The typical halophilic assemblage, consisting of *B. plicatilis* and *H. fennica*, is present.

89. **WATANABE, T. 1993.** Importance of docosahexaenoic acid in marine larval fish. *J. World Aquacult. Soc.* **24**, 152-161. <Lab. Fish Nutr., Tokyo Univ. Fish., Konan 4, Minato, Tokyo 108, Japan.> Marine finfish require n-3 HUFA such as eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) as essential fatty acids (EFA) for their normal growth. But it remained unclear as to which of the n-3 HUFA, either EPA or DHA, was important. Unlike the freshwater species, the EFA efficiency of EPA and DHA may vary in marine fish. The developing eggs rapidly utilize DHA either for energy or for production of physiologically important substances like prostaglandin. This report reveals that in marine larval fish Red seabream, fed rotifers incorporating EPA and DHA or an n-3 HUFA mixture prevented many of the ill-effects observed when the rotifers were low in n-3 HUFA. Apart from the best growth and survival in an activity test for the larvae fed on DHA-rotifer, the incidence of hydrops seemed to be totally prevented dietetically by DHA. There seems to exist a functional difference between EPA and DHA.

90. **WETHMAR, C. & W. KLEINOW, 1993.** Characterization of proteolytic activities stimulated by SDS or urea and two-dimensional gel electrophoresis of proteins from Brachionus plicatilis (Rotifera). *Comp. Biochem. Physiol.* **106B**, 349-358. <Univ. Köln, Inst. Zool., Lehrstuhl Tierphysiol., Weyertal 119, W-5000 Köln 41, Germany.>

91. **WHYTE, J.N.C., W.C. CLARKE, N.G. GINTHER, J.O.T. JENSEN & L.D. TOWNSEND, 1994.** Influence of composition of *Brachionus plicatilis* and *Artemia* on growth of larval sablefish (*Anoplopoma fimbria* Pallas). *Aquaculture* **119**, 47-61. <Dep. Fisheries and Oceans, Biological Sciences Branch, Pacific Biological Station, Nanaimo, BC V9R 5K6, Canada.> Contents of constituent fatty acids in rotifers, but not *Artemia*, were the major differences in dietary plankton fed to fish larvae. *B. plicatilis* contained 15% 20:5n-3 (EPA) and 0.3% 22:6n-3 (DHA) when reared on N. oculata, 3.3% EPA and 5.2% DHA when reared on *I. galbana* (T-Iso) and 5.6% EPA and 3.0% DHA when reared on *C. salina*. The failure to rear the larvae beyond day 60 from first feeding and the observed 50% n-3 HUFA in lipid of sablefish eggs and pelagic zooplankton, suggests that the dietary HUFA levels used to feed larvae in this study were too low to meet the apparent HUFA requirement.

92. **WILSON, R.E., E.F. KLAUS, R.K. WILLIAMS, S.H. DAVIS & J. SHOEMAKER, 1994.** The occurrence of the genus *Brachionus* Dallas, 1766 (Rotatoria), in

northeastern Texas reservoirs. Texas Journal of Science 46, 35-43. <Dep. Biol. Sci., East Tex. State Univ., Commerce, TX 75428, USA.> [Not seen.]

93. **YAMAUCHI, S. 1993.** Effect of antibacterial substances on the growth of Rotifer Brachionus plicatilis. *Nippon Suisan Gakkaishi* **59**, 1001-1006. <Shizuoka Prefectual Fish Farming Cent., Kuchino, Numazu, Shizuoka 410-01, Japan.> [In Japanese] The effect of an antibacterial substance on the growth of rotifer Brachionus plicatilis was investigated using various conditions for culture. Among the four antibacterial substances used (chemical substances for aquaculture on open sale), oxtetracyclin hydrochloride had the most significant effect when it was initially added into the culture medium at 20 ppm. It is highly possible that increasing rotifer density in the batch culture was influenced by bacterial density due to the effects of antibacterial substances. This effect was confirmed in the mass batch culture, i.e. the maximum density reached, 620 individuals per ml by the 11th day after the addition of oxytetracyclin hydrochloride into the medium at 20 ppm.

NEW TAXA REPORTED

New taxa of Rotifera described in papers listed in this issue are given below. Country and reference from the above list are given in parentheses. Classification changes above the level of genus, or synonymy below the level of genus, are not included, but can be found in the relevant papers.

New species

Brachionus africanus (Kenya, 72)
Itura symmetrica (Kenya, 72
Lecane braziliensis (Brazil, 73)
Lepadella amazonica (Brazil, 73)

THIRD ANNOUNCEMENT

VII International Rotifer Symposium

6 - 11 JUNE, 1994
MIKOŁAJKI, POLAND

Organized by
Institute of Ecology
Polish Academy of Sciences
&
Rotifer Section of
Polish Hydrobiological Society

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TRAIN CONNECTIONS

Trains leave Warszawa Centralna Railway Station at 0 05, 6.55, 17.10 E and 22.45 and arrive in Olsztyn: 3.40, 10.15, 20.20, 1.40, respectively). There is train change in Olsztyn (at 3.38, 8.55, 15.30 and 21.10).

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PRACTICAL REMARKS

You are kindly asked to make your return ticket O.K. BEFORE LEAVING TO POLAND

Money exchange is possible in banks and exchange offices; an exchange point will be also arranged at the Hydrobiological Station ;WARNING: DO NOT EXCHANGE MONEY IN THE STREETS!

The present exchange rate is about 21700 zl per 1 US$. Remember - PERSONAL CHEQUES and CREDIT CARDS cannot be used to pay any bills at the station. Please have CASH with you.

ROTIFER NEWS ! Please take into account that 3-year subscription to the newsletter will be collected during the VII Rotifer Symposium. It is the only way the newsletter can continue beyond 1994!

TELEPHONE - in case of problems you may contact the organizers by phone 0-878-16051 (Hydrobiological Station, Mikolajki).

LIABILITY AND INSURANCE - the organizers of the symposium are unable to take any responsibility for damage to persons or property during the conference. Medical, accident and travel insurance would be prudent.

MEDICAL ASSISTANCE - First Aid will be available through the symposium on the second floor of the main station building.

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ACCOMODATION AND FOOD SERIVICE

On your personal sheet you will find the indication of your accomodation. Lunches and dinners will be served in the canteen (see the enclosed plan) at the symposium site. Breakfasts will be served in all places of your accomodation. There will be a drink-bar working at the station (in the "Fireplace Room") between 20.00 - 24.00.

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WEATHER

The weather is expected to be pleasantly warm (about, 20 ^{0}C), sunny and dry, but warm clothes, sport shoes and, raincoats would be desirable.

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