# ROTIFER NEWS

A newsletter for rotiferologists throughout the world

ISSUE 25: DECEMBER 1994

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Returnable address/fax/e-mail card

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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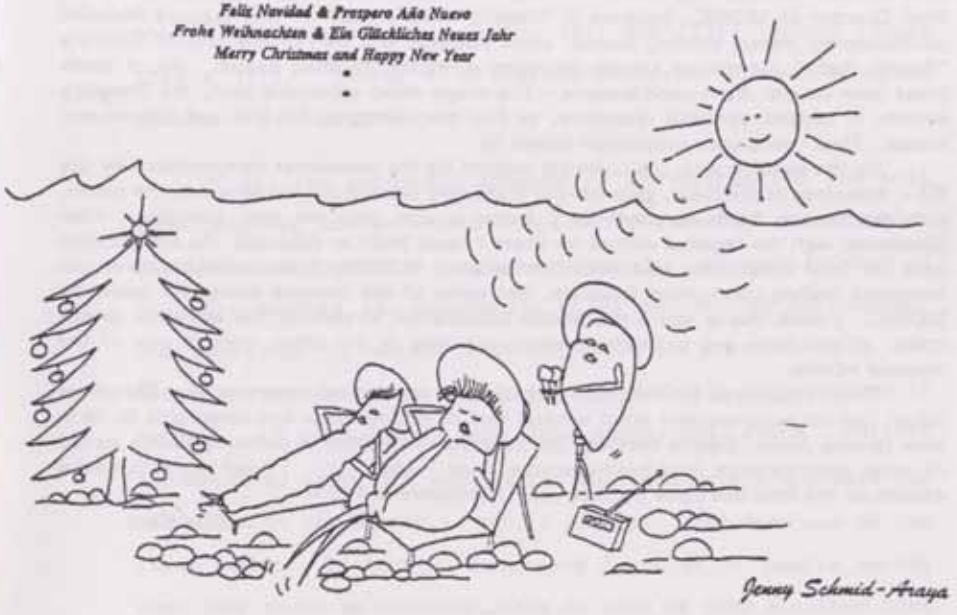
*Rotifer News* Issue 25: DECEMBER 1994

*Felix Navidad & Prospero Año Nuevo*
*Frohe Weihnachten & Ein Glückliches Neues Jahr*
*Merry Christmas and Happy New Year*



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*The cover: Plationus patulus* from a River Murray billabong [Hitachi SEM, Waikato Microscope Unit, N.Z.]

## Editorial

After the euphoria of the Mikolajki meeting (see below), catching up with our far-flung comrades and then dispersing to the far corners of the globe, it seems that deadlines, and yet more deadlines, have limited contributions to our only newsletter. Once again I must ask for items of news, ongoing work, requests, and particularly current publications, to be sent to a regional editor or directly to me at MDFRC.

Significant changes occurred at our "production office" while the Mikolajki meeting was on....as noted in the editorial for Issue 24, MDFRC was integrated with a larger co-operative research group in mid-1994, complete with a business manager. Said business manager has withdrawn support for *Rotifer News* previously given by the then Director of MDFRC, because it "doesn't make money". This support included photocopying, paper, printing covers, some postage, and part of the cost of CSIRO's "Search Party" abstracting service providing a regular literature search. All of these must now be met from contributions. The single most expensive item, the literature search, is beyond available resources, so has been dropped for this and subsequent issues. Thus - send your publication details in!

On the positive side, the universal support for the newsletter demonstrated by the 90+ attendees at Mikolajki, with several significant anonymous donations to the cause, provided enough funds to continue 2 issues a year until the next meeting. After discussion with the regional editors (or those I could find!) at Mikolajki, the subscription cost for new subscribers has been increased to $US10/yr, principally to cover the increased mailing costs from Australia, and some of the charges previously borne by MDFRC. I think this is still a reasonable subscription in view of the economy airmail rates. If you have any particular feelings one way or the other, contact one of the regional editors.

Finally, apologies for the delay (yet again) in posting what was to be a Christmas issue. Our not-quite-resident artist worked hard to get our page one cover girls to us in time (thanks Jenny, they're terrific!), but the production editor is suffering from a surfeit of other commitments (and bean-counters, need I add?.....) . I hope it's still festive season by the time this issue reaches you! A prosperous 1995!

*Russ Shiel*



## Mikolajki - Rotifer VII

Well, the family did it again; had another reunion that is! This time at the Hydrobiological Station of the Institute of Ecology, Polish Academy of Sciences, Mikolajki, Poland. In attendance were 93 rotiferologists from 26 countries (Fig. 1). Also present were 11 accompanying persons. We met for 5 days of papers, workshops, great food, collegial discussions, and to feed more than a few mosquitoes. As in the past the host country had one of the largest numbers of participants with 13. The complete head count of participants from the symposium follows: *ASIA* [Australia (1), China (1), India (4), Japan (2), Thailand (1)]; *EUROPE* [Austria (4), Belarus (1), Belgium (5), Denmark (1), Estonia (2), France (2), Germany (7), Israel (1), Italy (2), Norway (3), Poland (13), Portugal (2), Russia (4), Spain (9), Sweden (1), The Netherlands (3), United Kingdom (7)]; *NORTH AMERICA* [Canada (2), Mexico (1), USA (13)]; *AFRICA* [South Africa (1)]; [TOTAL = 93 participants; + 11 accompanying persons; 26 countries].

Of all the wonderful aspects of the symposium, the most important was the excellent hospitality shown by our hostess, Jolanta Ejsmont-Karabin and her colleagues. No want or need of the participants was unattended to by our Polish colleagues. And certainly no better setting could be possible then the shores of Lake Mikolajskie, where the hydrobiological station is located. Of course there were those mosquitoes, which I believe attempted to carry off some of the rotiferologists who were not tied down at the moment -- but, I digress. The food was of the first order. In fact, I overheard a number of people saying that they would be starting diets as soon as they returned home

to shed the pounds that they gained at the meetings.

The last evening presented the participants with an excellent opportunity for the participants to practice the various rotifer behaviors first demonstrated during the talks. Prominent among these new dances was the *Cupelopagis*. Providing background music for these antics was a local band, but of course, everyone insisted (no Eric, not encysted) that Russ and Wai sit in on the gig. They obliged us and did an excellent job.

The post conference excursions included visits to Frombork (Monastery and Church where Copernicus worked) and Malbork Castle (Teutonic Knights, 1398-1457). Starting off the entire trip was a stop at a nearby church where we heard an organ concert that included *Toccata and Fugue in D minor* by J.S. Bach and a beautiful rendition of *Ave Maria*.

Two significant aspects should be noted about the meetings, One is rather sad, so I shall address it straight away. This was the first meeting since the unfortunate passing of Dr. Agnes Ruttner-Kolisko. She was sorely missed by one and all who knew her. Also absent from the meetings other very familiar faces: Pierre Clément, Charles King, and Walter Koste (a.k.a. Uncle Walter).

The other important feature of the meetings is very pleasing. Many new faces were present, including workers from both sides of the Atlantic Ocean and other parts of the globe. This simple fact means that the discipline is alive and thriving; for the ecologists or aquaculturists one can say that "little-r" is positive!



In summary, I want to say that these meetings were held at a fine institution with excellent facilities and exquisitely hosted by an marvelous friend and her colleagues. We could not hope for better, and one should not have expected less.

The next meetings are tentatively scheduled for the summer of 1997 (ca. 23-27 June) at the institution of Dr. Elizabeth Wurdak (Department of Biology, St. John's College, Collegeville, MN, U.S.A. 56321-3000). People who wish to offer suggestions may write Liz at that address or at her e-mail address which follows.

EWURDAK@tiny.computing.csbsju.edu

As has been the tradition for my summary of the rotifer meetings I wrote this essay while high in the clouds immediately after leaving the meetings. This time however, I did not head directly home to the states, but stopped to visit and work with Claudia and Giulio in Milano for about 10 days (more pseudocoelomate phylogeny). During my stay in Italy the VIIth International Rotifer Symposium meetings were reconvened when Russ and Wai came to visit for an evening.

Best wishes to the community of Rotiferologists from your *Ad Hoc* recording secretary,

Bob Wallace
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P.S. If you gave me your e-mail address at Mikolajki, but have not heard from me (ca. 5 colleagues) it is because I have been unable to break through the barriers of your particular system. I urge you to contact me so that I can get a working address for you on RotiNET -- *the unofficial international e-mail network of rotiferologists throughout the world.*

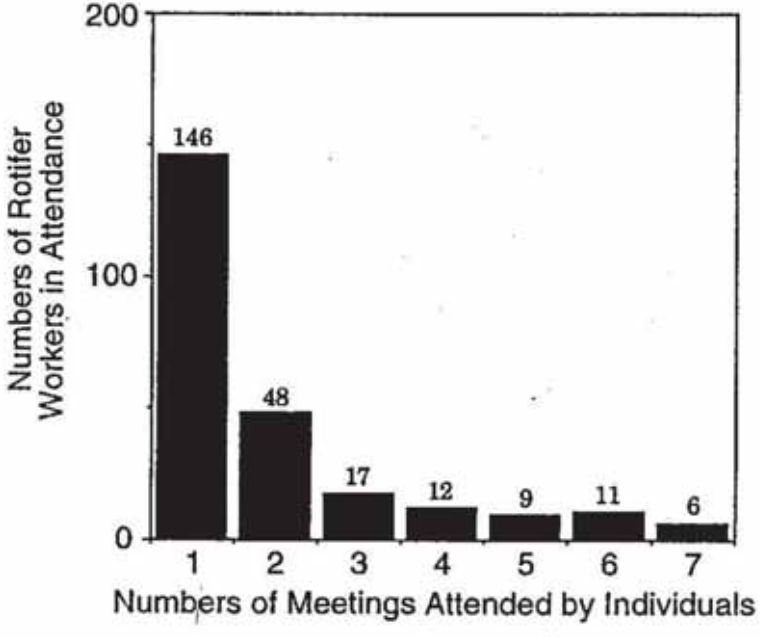



**Fig. 1**



## VII$^{th}$ International Rotifer Symposium Quiz

Multiple choice questions:

1. Which of the following best estimates the number of steps in Malbork Castle?
   a. The number of new subscriptions to Rotifer News.
   b. The number of mosquitoes present in the Round Hall at any one time.
   c. The number of species that Eric has seen in his travels.

2. The Boat Captain Award goes to our colleagues _____.
   a. Andersen and Langley
   b. Langley and Andersen

Essay question:

For those on the post conference trip.

*What exactly was that vinegar smell anyway?*

For all in attendance at the meetings.

*Provide the name and the secret ingredient, and discuss its effects on Rotiferologists of the famous Polish spirit served on the sightseeing boat.*

## The Gallagher Bibliography

The following notice was received just after the Mikolajki meeting. For the convenience of rotifer workers who may want to obtain this useful bibliography, a copy of the flyer received from the Carnegie Museum of Natural History is included.

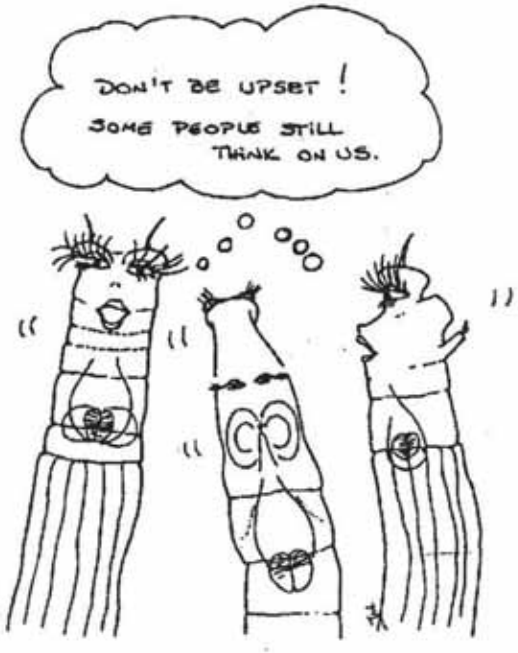
### — Advance Notice —

Bibliography and Species Citation Index
of World Literature on Rotifera
in the John J. Gallagher Collection

Carnegie Museum of Natural History
Special Publication no. 19

Available November 1994
Watch your mail for further information

**Rotifer News is an equal opportunity newsletter .."All rotifers are considered equal, although some are more equal than others"** ***Who said that?***






## New faces

The last listing of global rotifer workers was in Issue #20, Jan 1992. A list of respondees to a questionnaire was included in Issue #22 (Jan 1993). The following are recent additions to the *Rotifer News* mailing list - mostly new faces from the Mikolajki meeting, with some changes of address for 'old faces' (*). If there is enough interest, an updated global listing of rotifer workers, including e-mail addresses, could be prepared for the next issue (#26, June 1995). Reply cards are included in this issue for anyone who wants to amend their details. If you are not on one of the above lists, or you know someone else who is interested in receiving Rotifer News, please return the card to a regional editor or directly to Russ Shiel.

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## Newsn'Views

1. Bob Wallace, Claudia Ricci, and Guilio Melone have been working on a cladistic analysis of the pseudocoleomates and have presented a paper at the meetings of the Italian Zoological Society (30 Sept - 1 Oct) at the University Centre in Varese, Italy. These meetings were focused on a single theme: "Body Cavities: structure and function." A very preliminary presentation of their work was presented at the VII th International Rotifer Symposium in Poland in June. According to Bob, the surprising thing about the research is that two independently derived data sets produced nearly identical trees. Workers interested in receiving reprint of this paper (when it becomes available) should write to one of the authors, either the Wisconsin or the Italian connection.

2.
**LOW-MAINTENANCE CULTURES**

What does one do with commerically prepared cultures of microcrustaceans, rotifers, gastrotrichs, and protozoans when the laboratory is finished? One possibility is to start a low-maintenance culture in a 1-gallon (ca. 4 liters) glass jar or a 5 to 20-gallon fish tank. Such microcosms can be maintained for years with little effort and cost.

Begin with a tank half-full of aged tap or spring water and add leftover cultures as they become available. [Old cultures from your research materials also can be added; really anything goes.] Keep the tank covered to reduce evaporation and place it near a natural light source. North-facing windows are preferred, but in the frigid north (e.g., Wisconsin) south-facing windows are better in the winter. If a south-facing site is used, you may wish to reduce the light with a sheet of gauze, translucent plastic, or similar barrier for the summer months.

If you begin your culture with phytoflagellates and add other spent cultures as your invertebrate zoology (or etc.) course progresses you may end up with an interesting community. Leaving out certain organisms from one culture, while adding them to another also might prove interesting. I have kept several cultures, each in 1 gallon, glass jars since the fall of 1986. Although both are usually dominated by microcrustaceans, they are very different. One is often a nearly pure culture of a Daphnia species, while the other contains mainly ostracods. Other cultures include such interesting invertebrates as amphipods, isopods, and, of course, rotifers.
Low-maintenance cultures can be a source for generating student interest in independent projects in invertebrate zoology. I often use them when I need some live material for students to examine.

Happy gardening!

Bob Wallace
Ripon, Wisconsin

3. Aydin Örstan recently found, and Paul Turner verified, a record of the rare *Brachionus incertus* Hauer, 1953 from a dried-up coastal lagoon in Puerto Rico.



4. Yoshi Kobayashi (AWT EnSight, Sydney) is finding diverse rotifer assemblages in the much maligned Hawkesbury-Nepean River system, including several new taxa. These will be sorted out at a later date in collaboration with Russ Shiel. Early 1995 will see Yoshi extending his resource-partitioning work on calanoid copepods to rotifers, with selective feeding on flavoured micronic beads under investigation in River Murray billabongs.

5. Lor-Wai Tan, she of Mikolajki guitar-playing fame and recent author on floodplain rotifers, is abandoning our favourite animals (temporarily we hope) to take up a PhD scholarship at La Trobe University. She will be working on the genetics and systematics of testate amoebae.

More new is required to support Rotifer News' newsletter function - please send all items of interest you, your students, family, friends, distant aquaintances....may be finding related to rotifers

## Updated Bibliography

***Ed. note: We have abandoned the use of a professional abstracting service because of the increasing cost. To maintain a comprehensive list of recent publications means that authors should remember to pass on copies, or at least publication details, to one of the regional editors, or directly to Russ Shiel at MDFRC.***

***In the list below, 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. Some papers include keywords in lieu of a summary. The major subject areas in each citation are categorized below - many papers include several topics.***

**Aquaculture:** 10, 23, 24, 25, 27, 29, 36, 39, 42, 43, 44, 46, 47, 48, 49, 60, 64;

**Biochemistry/Genetics/Pharmacology/Reproduction:** 5, 8, 37, 38;

**Biogeography/taxonomy:** 2, 7, 11, 12, 13, 14, 19, 34, 35, 53, 54, 55, 56, 57, 63;

**Biomanipulation/Eutrophication/Perturbation:** 1, 3, 15, 52;

**Ecology/Population dynamics/Food webs:** 1, 3, 9, 15, 17, 18, 20, 21, 22, 26, 28, 30, 41, 50, 51, 58, 59, 61, 62, 65;

**Toxicology:** 4, 6, 8, 16, 31, 32, 33, 40, 45.

1. **ARNDT, H., M. KROCKER, B. NIXDORF & A. KOHLER, 1993.** Long-term annual and seasonal changes of metazooplankton and protozooplankton in Lake Muggelsee (Berlin) - effects of eutrophication, grazing activities, and the impact of predation. *Int. Rev. Ges. Hydrobiol.* 78, 379-402. <<Inst. für Ökologie, Ernst-Moritz-Arndt Universität Greifswald, Schwedenhagen 6, 18565 Kloster, Hiddensee, Germany.>> Seasonality of rotifers was included in this study for the period 1908-1990. Only rotifers and *Epistylis* increased in proportion to increasing food resources during eutrophication. The paper discusses grazing pressure of the various groups in the zooplankton.

2. **BALVAY, G. 1994.** First record of the rotifer *Kellicottia bostoniensis* (Rousselet, 1908) in France. *J. Plankt. Res.* **16**, 1071-1074. <<INRA, Inst. Limnol. Hydrobiol. Lacustre Stn, BP 511, F-74203 Thonon les Bains, France.>> The record of this species in France further enlarges its European/North American distribution.

3. **BOON, P.I., S.E. BUNN, J.D. GREEN & R.J. SHIEL, 1994.** Consumption of cyanobacteria by freshwater zooplankton: Implications for the success of "top-down" control of cyanobacterial blooms in Australia. *Aust. J. Mar. Freshw. Res.* **45**, 875-887. <<St Albans Campus, Vic. Univ. of Technol., PO Box 14428 MMC, Melbourne, Vic. 3000, Australia.>> Rotifers get a brief mention as cyanobacteriovores, however this paper deals with the nature of Australian copepod-dominated zooplankton communities and their potential for controlling cyanobacterial blooms. In the absence of large herbivorous cladocerans in appreciable numbers in these habitats, grazing control is unlikely. Control of nutrients has greater potential.

4. **BURBANK, S.E. & T.W. SNELL, 1994.** Rapid toxicity assessment using esterase biomarkers in *Brachionus calyciflorus* (Rotifera). *Env. Toxicol. Wat. Qual.* **9**, 171-178. <<Georgia Inst Technol, Sch Biol, Atlanta, GA 30332 USA.>> We have developed biomarkers of sublethal toxicity in the freshwater rotifer *Brachionus calyciflorus* based on the reduction of enzyme activity. Esterase activity was localized in the gut and phospholipase A2 activity in the corona of females. Quantitation of enzyme activity demonstrated that toxicant stress reduced activity in a dose-dependent manner. Obtaining test animals by hatching cysts, their sensitivity to toxicants, and the rapid results make the rotifer esterase and phospholipase A2 tests good candidates for inclusion in a test battery for rapid toxicity assessment.

5. **CARMONA, M.J., M. SERRA & M.R. MIRACLE, 1994.** Effect of population density and genotype on life history traits in the rotifer *Brachionus plicatilis* O.F. Müller. *J. Exp. Mar. Biol. Ecol.* 182, 223-235. Culturing isolated females at two different population densities did not provide general support for the dependence of mictic response on population density.. Interclone differences in the mictic response were detected. The age of the parent is a significant internal factor affecting the production of mictic daughters

6. **CENTENO, M.D.F., L. BRENDONCK & G. PERSOONE, 1993.** Influence of production, processing, and storage conditions of resting eggs of *Streptocephalus proboscideus* (Crustacea, Branchiopoda, Anostraca) on the sensitivity of larvae to selected reference toxicants. *Bull. Environ. Contam.Toxicol.* **51**, 927-934. <<State Univ. Ghent, Biol. Res. Aquat. Pollut. Lab., J Plateaustr 22, B-9000 Ghent, Belgium.>> K/W: chronic toxicity tests, *Daphnia magna*, rotifers, reproduction, temperature, ration, food,

7. **CHIAMBENG, G.Y., J.C. NJOCK & H. SEGERS, 1994.** Rotifera from south west, central and north provinces of Cameroon. *Biol Jb. Dodonaea* **61**, 154-160. <<Fisheries Res. Stn Batoke, PMB 77 Limbe, Cameroon>> 51 rotifer species are listed, 30 are new records for Cameroon.

8. **COCHRANE, B.J., Y.D. MATTLEY & T.W. SNELL, 1994.** Polymerase Chain Reaction as a tool for developing stress protein probes. *Env. Toxicol. Chem.* **13**, 1221-1229.



<<Univ S Florida, Dept Biol, Tampa, FL 33620 USA.>>We determined the nucleotide sequence of the product obtained from the rotifer *Brachionus plicatilis* and determined by phylogenetic analysis of the inferred protein product that the product obtained is most likely derived from a rotifer DNA template. This product can be used to detect changes in abundance of homologous mRNA in heat-stressed rotifers. This approach may prove useful in the context of development of hybridization probes for stress proteins, and also for designing peptides to be used for generation of specific antibodies, as well as for obtaining probes for other stress-regulated genes that are less conserved than the classical stress proteins

9. **CONDE-PORCUNA, J.M., R. MORALES-BAQUERO, L. CRUZ-PIZARRO, 1994.** Effects *of Daphnia longispina* on rotifer populations in a natural environment - relative importance of food limitation and interference competition. J. Plankt. Res. 16, 691-706. <<Univ Granada, Fac Ciencias, Dept Biol Anim & Ecol, E-18071 Granada, Spain.>> A depletion in food abundance by *Daphnia* feeding should be reflected in the birth rates of rotifers susceptible to exploitative competition, while interference should produce direct negative relationships between the number of individuals of the interacting species. Significant relationships between food (chlorophyll- a) and birth rates of rotifers are found when the ratio chlorophyll-a/herbivorous zooplankton biomass is used as a measure of food availability. In our study, *Anuraeopsis fissa* was only affected through exploitative competition by *Daphnia*, while *only Synchaeta oblonga* showed evidence of being suppressed through interference competition by this cladoceran.

10. **CONNAUGHTON, V.P., A. SCHUUR, N.M. TARGETT & C.E. EPIFANIO, 1994.** Chemical suppression of feeding in larval weakfish (*Cynoscion regalis*) by trochophores of the serpulid polychaete *Hydroides dianthus*. *J. Chem. Ecol.* **20**, 1763-1771. <<Univ. Texas, Ctr Sensory Sci, 6420 Lamar Fleming, Houston, TX 77030 USA.>> When experiments were conducted in filtered seawater, ingestion of rotifers (*Brachionus plicatilis*) was always greater than ingestion of trochophores. However, consumption of rotifers was depressed when water from *H. dianthus* cultures (= trochophore water) was the experimental medium. The same effect was noted whether we added trochophore water from polychaete cultures that were two or five days postfertilization. However, no effect was noted when we used water from rotifer cultures. We concluded that *H. dianthus* trochophores release a water-soluble compound that inhibits feeding in weakfish larvae.

11. **DE MANUEL, J. 1994.** Taxonomic and zoogeographic considerations on Lecanidae (Rotifera, Monogononta) of the Balearic Archipelago, with description of a new species, *Lecane margalefi*, n. sp. *Hydrobiologia* **288**, 97-105. <<Univ. Barcelona, Dept. Ecol. Avg Diagonal 645, E-08028 Barcelona, Spain.>> A new lecanid and zoogeographic aspects of the Balearic Lecanidae.

12. **DE SMET, W.H. 1994.** *Proales christinae* (Rotifera, Proalidae) - A New Species from the Littoral of the North Sea. *Belg. J. Zool.* **124**, 21-25.<<Univ Antwerp, Ruca, Dept Biol, Groenenborgerlaan 171, B-2020 Antwerp, Belgium.>> A new rotifer collected from hydroids washed ashore on the beach of the North Sea, Belgium, is described.

13. **DE SMET, W.H. & E.A. VAN ROMPU, 1994.** Rotifera and Tardigrada from Some Cryoconite Holes on a Spitsbergen (Svalbard) Glacier. *Belg. J. Zool.* **124**, 27-37. <<address above.>>Seven species of rotifer (2 bdelloids and 5 monogononts), and two species of tardigrade were identified in 8 cryoconite holes from a Spitsbergen glacier.

14. **DUMONT, H.J., S. MAAS & H. SEGERS, 1994.** Zooplankton of Kikayu, South Somalia. *Biol. Jb. Dodonaea* **61**, 168-171. <<Animal Ecology, Univ. Gent, Ledeganckstraat 35, Gent, Belgium>> 19 new records of rotifers are included in 11 zooplankton samples collected from Somalia.

*[Abstract not given in RN #24]*

15. **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. <<Polish Acad Sci, Inst Ecol, Hydrobiol Stn, Ul Lesna 13, PL-11730 Mikolajki, Poland.>> Formation of stagnant environments together with the increasing time of water exchange in impoundments created good conditions for development of zooplankton communities. As a result, the rate of phosphorus regeneration was higher and the turnover time of the total and seston phosphorus was shorter in impoundments than in streams above impoundments. A hypothesis that the stations with a long time of water exchange could be a kind of a trap for nutrients excluded from cycling in running waters is validated.

16. **FERNANDEZ-CASALDERREY, A., M.D. FERRANDO & E. ANDREU-MOLINER, 1994.** Effect of sublethal concentrations of pesticides on the feeding behavior of *Daphnia magna*. *Ecotoxicol. Environ. Safety* **27**, 82-89. <<Univ Valencia, Fac. Biol. Sci., Dept Anim. Biol. Anim. Physiol., Ecotoxicol. Lab, Dr Moliner 50, E-46100 Burjassot, Spain.>> *Daphnia magna* was exposed to sublethal levels(1/4, 1/2, and 2/3 LC(50)) of endosulfan and diazinon to determine the effect of these pesticides on filtration and ingestion rates. Rates of filtration and ingestion declined with increasing toxicant concentrations after a short exposure of 5 hr. The effective concentration at which feeding rates were reduced to 50% of those in controls (EC(50)) was calculated for both pesticides. These values were 0.44 and 0.61 mg/liter for filtration and ingestion rates, respectively, in the case of endosulfan and 0.47 and 0.60 mu g/liter, respectively, in the case of diazinon.

17. **FISCHER, J.M. & M.V. MOORE, 1993.** Juvenile survival of a planktonic insect - effects of food limitation and predation. *Freshw. Biol.* **30**, 35-45. <<M.V. Moore, Wellesley Coll, Dept Biol Sci, Wellesley, MA 02181, USA.>> Rotifers were a food item in this study of juvenile survival of *Chaoborus*. Survival is influenced more by copepod predation than by starvation in a productive environment, and food limitation and predation interact to affect survival. Results suggest that predation by copepods may limit recruitment of juvenile *Chaoborus* in productive lakes.

18. **FLYNN, K.J., K. DAVIDSON & J.W. LEFTLEY, 1993.** Carbon-nitrogen relations during batch growth of *Nannochloropsis oculata* (Eustigmatophyceae) under alternating light-and dark. *J. Appl. Phycol.* **5**, 465-475. < Univ Coll Swansea, Sch. Biol. Sci., Algal Res. Unit, Singleton Pk, Swansea SA2 8PP, Wales.> Not seen. 'Rotifers' given in keywords.



19. **GALINDO, M.D., L. SERRANO, H. SEGERS & N. MAZUELOS, 1994.** *Lecane donyanaensis* n. sp. (Rotifera, Monogonanta, Lecanidae) from the Donana National Park (Spain). Hydrobiologia 284, 235-239. <<Univ. Sevilla, Dept Ecol., POB 1095, E-41080 Seville, Spain.>> The new species belongs to the family Lecanidae (Monogononta), is related to *Lecane ungulata* and superficially resembles *Lecane leontina*. Two specimens of this species hatched after two days incubation of pond sediments in the laboratory.

20. **GILBERT, J.J. 1994.** Jumping behavior in the oligotrich ciliates *Strobilidium velox* and *Halteria grandinella*, and its significance as a defense against rotifer predators. *Microb. Ecol.* **27**, 189-200. <<Dartmouth Coll, Dept Biol Sci, Hanover, NH 03755 USA.>> The jumping behavior of *Strobilidium velox* and *Halteria grandinella* was analyzed videographically. Both ciliate species initiated jumps after encounters with rotifer predators. Only 3% of 93 *S. velox* cells contacted by *Asplanchna girodi* were captured, and only 12% of 92 *H. grandinella* cells contacted or closely approached by *S. pectinata* were captured; all other cells jumped away. A predation experiment showed that *A. girodi* was about twice as, and significantly more, likely to ingest *Paramecium tetraurelia* as *S. velox* in a mixture of equal numbers of these ciliates.

21. **GILBERT, J.J. 1994.** Susceptibility of planktonic rotifers to a toxic strain of *Anabaena flos-aquae*. *Limnol. Oceanogr.* **39**, 1286-1297. <<Address above.>> Reports differential sensitivity to the cyanobacteria by species of *Asplanchna, Brachionus, Keratella* and *Synchaeta*. Size and morphology of cyanobacterial colonies was seen as significant in the effects on zooplankton communities. Rotifers are more likely to be inhibited by small colonies or filaments than by large colonies.

22. **GLOCKLING, S.L. & M.W. DICK, 1994.** Five new species of Rotiferophthora isolated from dung. *Mycol. Res.* 98, 833-844. <<Univ. Reading, Sch. Plant Sci, Dept Bot, 2 Earley Gate, Reading RG6 2AU, England.>> Describes additions to the flora of these fungal parasites of rotifers (Diheterospora).

23. **GULBRANDSEN, J. 1993.** Prey consumption of Atlantic Halibut (*Hippoglossus hippoglossus* L.) larvae - selectivity or availability. *Aquaculture* **116**, 159-170. <<Akvaforsk, Inst Aquaculture Res, N-6600 Sunndalsora, Norway.>> Prey consumption of Atlantic halibut larvae was investigated in two experiments involving six distributions of *Brachionus plicatilis* and two size classes of *Artemia* sp. over 2, 4 and 6 days. Larvae are essentially non-selective in their first 2 days of feeding and the ingestion of larger prey increases slightly after 6 days. It was also indicated that the larvae may have a handling problem with the largest prey. The energetic return to the larvae was, however, found to increase when higher proportions of large prey were offered. It was further shown that halibut larvae are able to ingest inert feed.

24. **HAGIWARA, A. 1994.** Practical use of rotifer cysts. *Isr. J. Aquacult. - Bamidgeh* **46**, 13-21. << Nagasaki Univ, Grad Sch Marine Sci & Engn, Bunkyo 1-14, Nagasaki 852, Japan.>> The availability of marine rotifer *Brachionus plicatilis* cysts for aquaculture has long been suggested. Only a few studies, however, reported trials of mass formation of rotifer cysts as well as their application to aquaculture. The current paper summarizes our works relating to those topics, which are based on

accumulated fundamental information on *B. plicatilis* cyst formation. These include the selection of preferable rotifer clones, use of preserved diets for cyst formation, bacterial effect on rotifer sexual reproduction, actual trials of cyst formation and application of rotifer cysts for larval rearing practices.

25. **HAGIWARA, A., K. HAMADA, S. HORI & K. HIRAYAMA, 1994.** Increased sexual reproduction in *Brachionus plicatilis* (Rotifera) with the addition of bacteria and rotifer extracts. *J. Exp. Mar. Biol. Ecol.* **181**, 1-8. <<Address above.>> K/W: resting egg formation, asexual reproduction, temperature, salinity, culture, food.

26. **HARTMANN, H.J., H. TALEB, L. ALEYA & N. LAIR, 1993.** Predation on ciliates by the suspension-feeding calanoid Copepod *Acanthodiaptomus denticornis*. *Can. J. Fish. Aquat. Sci.* **50**, 1382-1393. <<Univ Clermont Ferrand, Zool & Protistol Grp, CNRS, UA 138, F-63177 Clermont Ferrand, France.>> Not seen. 'Rotifers' given in key words. Results suggest that ciliates can be a significant part of the diet of some suspension-feeding freshwater copepods in situ, confirming the importance of ciliates as mediators of energy transfer from the microbial loop to higher trophic levels.

27. **HERNANDEZ, C.M., M. SALHI, H. FERNANDEZ-PALACIOS & M.S. IZQUIERDO, 1994.** Improvements in the culture of *Sparus aurata* L. larvae in relation to the use of antibiotics, phytoplankton and the rearing system. *Aquaculture* **124**, 269-274. <<Inst. Canario Ciencieas Marinas, Cabildo Insular Gran Canaria, Aptdo 56, E-35200 Telde , Spain.>> K/W: dietary value, fatty acids, rotifers, bacteria, turbot.

28. **HLAWA, S. & R. HEERKLOSS, 1994.** Experimental studies into the feeding biology of rotifers in brackish water. *J. Plankt. Res.* **16**, 1021-1038. <<Univ. Rostock, Fachber. Biol., Wb Exptl Ökol., Freiligrathstr. 7-8, D-18055 Rostock, Germany.>> Not seen.

29. **HOUDE, E.D. & C.E. ZASTROW, 1994.** Ecosystem- and taxon-specific dynamic and energetics properties of larval fish assemblages. *Bull. Mar. Sci.* **53**, 290-335<<Univ Maryland, Chesapeake Biol Lab, Ctr Environm & Estuarine Studies, POB 38, Solomons, MD 20688 USA.>> Not seen. 'Rotifers' given in keywords.

30. **HURLBERT, S.H. & M.D. WHITE, 1993.** Experiments with freshwater invertebrate zooplanktivores - quality of statistical analyses. *Bull. Mar. Sci.* **53**, 128-153 <<San Diego State Univ, Dept Biol, San Diego, CA 92182 USA.>> K/W includes 'rotifer'. We examined the statistical analyses of experimental data in 95 papers published during 1966-1990 on the ecology, physiology, and behavior of freshwater invertebrate zooplanktivores. Serious statistical errors were found in 51% of the papers. The frequencies of particular types of errors were as follows: sacrificial pseudoreplication (31%), simple pseudoreplication (11%), temporal pseudoreplication (7%), pseudofactorialism (5%), misuse of one-tailed tests (4%), and failure to use log-transformation in multi-way ANOVA when appropriate (9%). We hope that this exhaustive review of a very specific but important area of plankton research will create a positive feedback network among this core group of researchers. This could so improve the use of statistics in future plankton studies that this field could serve as a model for other areas of biology equally plagued by improper statistical analysis.



31. **HUTCHINSON, T.H. & T.D. WILLIAMS, 1994.** Culturing of fathead minnow (*Pimephales promelas* L.) larvae for aquatic toxicity testing - an observational note. Environmental Toxicology and Chemistry 13, 665-669. <<Zeneca Ltd, Brixham Environm Lab, Freshwater Quarry, Brixham TQ5 8BA, Devon, England.>> Rotifers were included in dietary studies to improve the survival of fathead minnow larvae for aquatic toxicity testing purposes. Data are presented that suggest that feeding fish larvae both protozoa and *Artemia* nauplii may produce more consistent levels of larval survival and growth when compared with fish larvae fed *Artemia* nauplii only.

32. **JANSSEN, C.R., M.D. FERRANDO & G. PERSOONE, 1994.** Ecotoxicological studies with the freshwater rotifer *Brachionus calyciflorus* .4. Rotifer behavior as a sensitive and rapid sublethal test criterion. *Ecotoxicol. Environm. Safety* **28**, 244-255.<<State Univ Ghent, Biol. Res. Aquat. Pollut. Lab., J Plateaustr. 22, B-9000 Ghent, Belgium.>> The swimming behavior of the freshwater *rotifer Brachionus calyciflorus* exposed to copper (Cu), pentachlorophenol (PCP), 3,4-dichloroaniline (DCA), and lindane, for periods ranging from 5 min to 5 hr, was examined. For all four toxicants a clear dose-response was observed, with the swimming activity decreasing with increasing toxicant concentrations. The results of the swimming activity assays were compared to those of acute and chronic toxicity tests performed with the same test species. The potential use and relevance of this behavioral test criterion were evaluated and discussed.

33. **JANSSEN, C.R., G. PERSOONE & T.W. SNELL, 1994.** Cyst-based toxicity tests .8. Short-chronic toxicity tests with the freshwater rotifer *Brachionus calyciflorus*. *Aquatic Toxicol.* **28**, 243-258. <<State Univ Ghent, Biol. Res. Aquat. Pollut. Lab., J Plateaustr. 22, B-9000 Ghent, Belgium.>> The development and potential use of a 4-day static renewal test [4-day Life Table (LT) test] and a 3- day static test [3-day Population Growth (PG) test] with the freshwater rotifer *Brachionus calyciflorus* are described. For both bioassays, test animals are obtained by hatching cysts which eliminates the need for the culturing and maintenance of the organisms. Considering the increasing need for relatively short toxicity tests, the two described short-chronic bioassays could be valuable new tools for routine toxicity evaluations. The major advantages associated with these tests are: they are less labour-intensive than existing chronic tests, they can be completed within one work week, and do not require stock culturing of test organisms.

34. **JERSABEK, C.D. 1994.** *Encentrum* (*Parencentrum*) *walterkostei* n.sp., a new dicranophorid rotifer (Rotatoria, Monogononta) from the high alpine zone of the central Alps (Austria). *Hydrobiologia* **281**, 51-56. << Univ Salzburg, Inst Zool, Hellbrunnerstr 34, A-5020 Salzburg, Austria.>> The new species was abundant in the psammolittoral of the 'Unterer Schwarzhornsee', 2543 m above sea level. The main distinguishing taxonomic features of the new species are long, sword-shaped toes and only four vitellary nuclei. Its known occurrence in the sandy substrate of only one lake suggests a stenobiontic nature of this apparently oligothermic new species. Taxonomic problems associated with the *Encentrum/Dicranophorus* group are briefly discussed.

35. **JERSABEK, C.D. & W. KOSTE, 1993.** Additional Notes on Taxonomy and Ecology of Anuraeopsis miracleae Koste, 1991 (Rotatoria, Monogononta) from an Austrian Alpine Lake.

lake. *Hydrobiologia* **264**, 55-60. <<Address above.>> Although closely resembling *Anuraeopsis fissa*, *Anuraeopsis miracleae* constitutes a well defined species, being more highly adapted to microaerobic, cold environments. Our observations on the Austrian population are compared with information available on specimens from the type locality in Spain. Morphological discrepancies, especially concerning characteristics of Weber's organ and shape of the eggs are described and discussed. General ecological features indicate that the species is not restricted to meromictic or stratified lakes. To agree with the provisions of the International Code of Zoological Nomenclature the original spelling of *A. miraclei* Koste, 1991 is emended to *A. miracleae* Koste, 1991.

36. **KESKIN, M., M. KESKIN & H. ROSENTHAL. 1994.** Pathways of bacterial contamination during egg incubation and larval rearing of turbot, *Scophthalmus maximus*. *J. Appl. Ichthyol. Zeitschr. Angew. Ichthyol.* **10**, 1-9. <<Christian Albrechts Univ Kiel, Inst Meereskunde, Dustembrooker Weg 20, D-24105 Kiel, Germany.>> Rinsing of food organisms (rotifers) prior to feeding them to turbot larvae significantly reduced bacterial numbers, thus reducing the number of cross-contaminations. Several species of *Aeromonas*, *Pseudomonas* and *Vibrio* among others, were identified in the eggs and larvae, or in the water in which these were incubated. Scanning electron microscopy shows that the surface of unfertilized turbot eggs is a breeding ground for bacteria; the removal of these eggs from incubation jars is therefore recommended. The epidermis of turbot larvae was virtually free of microorganisms.

37. **KING, C.E. 1993.** Genetic influences on the niche breadth and temporal distribution of rotifer populations. *Actas VI Congresso Español de Limnologia* 1993, 1-10. <<Dept. of Zoology, Oregon State University, Corvallis, OR 97331-2914, USA>> Not seen.

38. **KING, C.E. & L . ZHANG, 1993.** The impact of genetic structure on the dynamics of zooplankton populations. *Limnologia* **9**, 51-59. <<address above>> Not seen.

39. **KOLKOVSKI, S., A. TANDLER, G.W. KISSIL& A. GERTLER. 1993.** The effect of dietary exogenous digestive enzymes on ingestion, assimilation, growth and survival of gilthead seabream (*Sparus aurata*, Sparidae, Linnaeus) larvae. *Fish Physiol. Biochem.* **12**, 203-209. <<Israel Oceanog & Limnol Res, Natl Ctr Mariculture, POB 1212, IL-88112 Elat, Israel.>> The success of microdiets commonly used in the cultivation of marine fish larvae is limited to serving as partial replacements for live food. It is our opinion that successful development of microdiets for *Sparus aurata* must be based on diets improved both in digestibility and attraction to the larvae. Further studies are now underway to determine the nutritional requirements of gilthead seabream larvae using the experimental method developed in the present study.

40. **LIBER, K. & K.R. SOLOMON, 1994.** Acute and chronic toxicity of 2,3,4,6-tetrachlorophenol and pentachlorophenol to *Daphnia* and rotifers. *Arch. Environ. Contam. Toxicol.* **26**, 212-221. << Univ Wisconsin, Lake Super. Res. Inst., 1800 Grand Ave, Superior, WI 54880 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. Rotifer tests, conducted with a



*Contam. Toxicol.* **26**, 212-221. << Univ Wisconsin, Lake Super. Res. Inst., 1800 Grand Ave, Superior, WI 54880 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. Rotifer tests, conducted with a commercially available species (*Brachionus calyciflorus*) and a field collected species (*Keratella cochlearis*), indicated that PCP was more acutely toxic than TeCP. LC50 estimates for *B. calyciflorus* were highly variable depending upon the source of resting eggs (cysts) and the test conditions. LC50 estimates (24-h) ranged from 2.09 to 7.76 mg/L for PCP and from 2.31 to > 16.00 mg/L for TeCP. In general, *B. calyciflorus* was less sensitive to TeCP and PCP than *Daphnia 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*.

41. **MARCUS, N.H., R. LUTZ, W. BURNETT & P. CABLE, 1994.** Age, viability, and vertical distribution of zooplankton resting eggs from an anoxic basin - evidence of an egg bank. *Limnol. Oceanogr.* **39**, 154-158. <<Florida State Univ, Dept Oceanog, Tallahassee, FL 32306 USA.>> Seabed cores to a sediment depth of 24 cm were obtained by divers from an anoxic basin in the Pettaquamscutt estuary. The cores were processed to determine the age, viability, and vertical distribution of zooplankton resting eggs in the bottom sediments. Zooplankton eggs were found throughout the upper 24 cm. Copepod nauplii emerged from sediments as deep as 22 cm that were incubated in the laboratory. Based on Pb-210 analyses of the sediments, we calculated that the viable eggs ranged in age from < 1 yr in the surface layers of the seabed to > 40 yr in the deepest portions. These data provide conclusive evidence for the existence of an egg bank. 'Rotifers' in keywords.

42. **MUNRO, P.D., A. BARBOUR & T.H. BIRBECK, 1994.** Comparison of the gut bacterial flora of start-feeding larval turbot reared under different conditions. *J. Appl. Bacteriol.* **77**, 560-566. <<Univ. Glasgow, Dept. Microbiol. Glasgow G12 8QQ, Lanark, Scotland.>> A stable microflora was present during the rotifer feeding stage, possibly reflecting a stable flora in the rotifer culture. The bacterial flora probably plays an important role in determining the survival of larval fish.

43. **NORSKER, N.H. & J.G. STOTTRUP, 1994.** The importance of dietary HUFA's for fecundity and HUFA content in the harpacticoid *Tisbe holothuria* Humes. *Aquaculture* **125**, 1-2. <<N. Sea Centre, Danish Inst. Fish. & mar. Res., POB 101, DK-9850, Hirtshals, Denmark.>> Includes the rotifer Brachionus plicatilis in this study of dietary pathways.

44. **PADROS, F. G MINKOFF, R SALA, S CRESPO, 1993.** Histopathological events throughout the development of turbot (*Scophthalmus Maximus* L.) larvae. J. Comp. Pathol. **109**, 321-334. <<Univ Autonoma Barcelona, Fac Vet, Unitat Biol, E-08193 Barcelona, Spain.>> Not seen; 'rotifers' in keywords.

45. **PORTA, A.A. & A.E. RONCO, 1993.** Cu(II) acute toxicity to the *rotifer Brachionus calyciflorus*, as affected by fulvic acids of freshwater origin. *Environ. Pollut.* **82**, 263-267. <<Univ. Nacl La Plata, Fac. Ciencias Exactas,Ctr Invest Medio Ambiente, Calle 47, Esquina 115, RA-1900 La Plata, Argentina.>> The effect of the interaction

parameters and acute toxicity inhibition, it was possible to predict the effect of dissolved organic matter on the toxicity of copper in this surface freshwater body.

46. **RAINUZZO, J.R., K.I. REITAN, L. JORGENSEN & Y. OLSEN 1994.** Lipid composition in turbot larvae fed live feed cultured by emulsions of different lipid classes. *Comp. Biochem. Physiology A - Physiology* **107**, 699-710. <<Sintef, Ctr Aquaculture, N-7034 Trondheim, Norway.>> The larvae were fed on rotifers and *Artemia* fed on various lipid emulsions. The lipid class compositions of the emulsions affect the fatty acid composition of the rotifers. Ethyl ester-based emulsion exhibited the highest assimilation by the rotifers and *Artemia* and were possibly incorporated in their triacylglycerol fraction. The amounts of polyunsaturated fatty acids in the phosphatidylethanolamine fraction of the larvae are suggested to be of particular importance in turbot pigmentation.

47. **REITAN, K.I., J.R. RAINUZZO, G. OIE & Y. OLSEN, 1994.** Nutritional effects of algal Addition in first feeding of turbot (*Scophthalmus maximus* L.) larvae. *Aquaculture* **118**, 257-275. <<Sintef, Ctr Aquaculture, N-7034 Trondheim, Norway.>> Addition of the microalgae *Isochrysis galbana* or *Tetraselmis* sp. together with rotifers *Brachionus plicatilis*, grown on yeast and oil emulsion, and *Artemia* greatly improved rearing success, whereas short-term enrichment of the rotifers with *Tetraselmis* sp. gave only improved viability. Without algal addition, the lipid content of the rotifers decreased by 20% day-1 in the early phase, and their egg ratio became close to zero. In addition to improved nutritional conditions of the larvae, some other factor, e.g. some trigger mechanism or changed microbial or light conditions, also can operate to explain the increased early appetite of larvae with microalgae added and must be taken into consideration.

48. **ROSALESCASIAN, J.A. 1994.** The effect of rotifer (*Brachionus plicatilis*) density on the survival and growth of California grunion (*Leuresthes tenuis* Ayres) larvae. *Mar. Environ. Res.* **38**, 71-75. <<Ctr Invest Cientif & Educ Super, Ensenada Baja California, Apdo Postal 2732, Ensenada, Baja California, Mexico.>> Highest survival (69%), greatest final standard length mean (10.31 +/- 0.454 mm), bigger difference (3.79 mm) between final and initial mean standard length, and mean daily increase in length (0.271 mm day-1) were registered with 7 rotifers ml-1. Growth was significantly different between food treatments and controls, and the non-fed treatment exhibited a poorer survival than those which were fed.

49. **SAINTJEAN, L. & C.A. BONOU, 1994.** Growth, production, and demography of *Moina micrura* in brackish tropical fishponds (Layo, Ivory Coast). *Hydrobiologia* **272**, 125-146. <<Ctr Rech Oceanol, BP V18, Abidjan, Côte Ivoire.>> Not seen. 'Rotifers, *Brachionus plicatilis*' in keywords.

50. **SANDERS, R.W., D.A. LEEPER, C.H. KING & K.G. PORTER, 1994.** Grazing by rotifers and crustacean zooplankton on nanoplanktonic protists. *Hydrobiologia* **288**, 167-181. <<Acad. Nat. Sci. Philadelphia, 1900 Benjamin Franklin Pkwy, Philadelphia, PA 19103 USA.>> Metazoan zooplankton were found to be capable of removing the total standing stock of heterotrophic and phototrphic nanoplankton in < 1 day. Rotifers dominated the grazing in winter and spring, grazing up to 92% of the nanoflagellates. The relative importance of different groups of predators appears to



167-181. <<Acad. Nat. Sci. Philadelphia, 1900 Benjamin Franklin Pkwy, Philadelphia, PA 19103 USA.>> Metazoan zooplankton were found to be capable of removing the total standing stock of heterotrophic and phototrphic nanoplankton in < 1 day. Rotifers dominated the grazing in winter and spring, grazing up to 92% of the nanoflagellates. The relative importance of different groups of predators appears to vary seasonally. K/W: Fresh water, filter feeding, zooplankton, food webs, community structure, seasonal patterns, relative importance, bacterial production, monomictic lake.

51. **SANTER, B. 1993.** Potential importance of algae in the diet of adult *Cyclops vicinus*. *Freshw. Biol.* 30, 269-278. <<Max Planck Inst Limnol, Post Box 165, D-24320 Plon, Germany.>> The predation rate on the rotifer *Brachionus rubens* decreased if *Chlamydomonas reinhardii* was also available as food. Females which were allowed to feed on *B. rubens* and *C. reinhardii* produced more eggs. Egg production was also possible when rotifers were absent from the diet. Production efficiency was higher when *C. reinhardii* was the only food resource than on a diet containing rotifers only.

52. **SCHUMAKER,R.J., W.H. FUNK & B.C. MOORE, 1994.** Zooplankton responses to aluminum sulfate treatment of Newman Lake, Washington. *J. Freshw. Ecol.* **8**, 375-387. <<Washington State Univ, State Washington Water Res. Ctr., Pullman, WA 99164 USA.>> Signs of perturbation such as pronounced declines in zooplankton numbers, biomass, and species diversity were exhibited within two weeks after the treatment, and were 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. Monitoring of the zooplankton for 2 1/2 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.

53. **SEGERS, H. 1994.** On four new tropical and subtropical *Lecane* (Lecanidae, Monogononta, Rotifera. *Hydrobiologia* **287**, 243-249. << RUG, Inst. Anim. Ecol., KL Ledeganckstr. 35, B-9000 Ghent, Belgium.>> *L. albanica* (Saudi Arabia), *L. minuta*, *L. spiniventris* (Brunei) and *L. nelsoni* (Brazil) are added to the Lecanidae. Some details of trophi are included.

54. **SEGERS, H. & L. DE MEESTER, 1994.** Rotifera of Papua-New-Guinea, with the description of a new *Scaridium* Ehrenberg, 1830. *Archiv Hydrobiol.* **131**, 111-125. <<Address above.>> A total of 127 rotifer species is identified from 18 zooplankton samples collected in the North of Papua New Guinea. The description of a hitherto unknown *Scaridium* is presented, the taxonomy of *Lepadella biloba* Hauer (n. stat.) discussed. The majority of species found is cosmopolitan or cosmotropical, some (8 %) are restricted to the tropical and subtropical regions of the Old World and Notogaea, one was previously known from Australia only. Rotifer zoogeography is discussed in the light of contemporary taxonomic and faunistic knowledge.

55. **SEGERS, H. & L. SANOAMUANG, 1994.** 2 more new species of *Lecane* (Rotifera, Monogononta) from Thailand. *Belg. J. Zool.* **124**, 39-46. <<Address above.>> Two new species of *Lecane*, *L. shieli* n. sp. and *L. thailandensis* n. sp. are described from two localities in Thailand. *L. shieli* n. sp. is known from the type locality only, and occupies an isolated position in the genus, whereas *L. thailandensis* n. sp. is also known from China, and is close to *L. latissima*.

56. **SEGERS, H., S.S.S. SARMA, F.K. KAKKASSERY & C.K.G. NAYAR, 1994.** New records of Rotifera from India. *Hydrobiologia* **287**, 251-258. <<Address above.>> Fifteen rotifer taxa are recorded from India for the first time., They are mostly littoral cosmopolite/cosmotropical species: *Lecane acanthinula*, *L. aspasia*, *L. monostyla*, *L. ruttneri*, *L. simonneae*, *Lepadella costatoides*, *L. cf. favorita*, *L. minuta*, *L. triba*, *Notommata pachyura*, *N. saccigera*, *Sinantherina semibullata*, *Trichocerca chattoni*, *T. kostei* and *Taphrocampa selenura*.

57. **SEGERS, H., S.S.S. SARMA, S.I. OVIE & D.K. MBOGO, 1994.** Note on the taxonomy and distribution of *Brachionus durgae* Dhanapathi, 1974 (Rotifera: Brachionidiae). J. Afr. Zool. 108, 397-400. <<Address above.>> New distribution records, a redescription and new synonymies are given for this species. Previously considered an Oriental endemic, it is recorded from Africa and South America for the first time. *B. durgae isigakaensis* Sudzuki and *B. moronensis* Kuczynski are synonymized.

*[Abstract not given in RN 24]:*

58. **SELLNER, K.G., D.C. BROWNLEE, M.H. BUNDY, S.G. BROWNLEE & K.R. BRAUN, 1994.** Zooplankton grazing in a Potomac River cyanobacteria bloom. *Estuaries* **16**, 859-872. <<Acad Nat Sci, Benedict Estuarine Res Lab, Benedict, MD 20612 USA.>> Grazing rates were estimated for the rotifers *Polyarthra remata*, *Hexarthra mira*, *Asplanchna brightwelli*, *Brachionus angularis*, *Epiphanes* sp., *Trichocerca similis*, and the cyclopoid copepod *Cyclops vernalis*. Neither rotifers nor the copepod grazed heavily on *Microcystis*. Rotifer grazing rates on labeled cyanobacteria ranged from 4 to 1,650 nl . [individual . h]-1 while copepod rates ranged from undetectable to 135 mul . [copepod . h]-1. Grazing rates on labeled river phytoplankton assemblages were 4-100 times higher than noted for zooplankton feeding on cyanobacteria. Rotifer plus *C. vernalis* herbivory would have removed 1-5% and 49%, respectively, of the standing stock of the two autotroph pools each day. Data suggest that the majority of cyanobacterial production remains ungrazed and may be transported to the lower estuary for salinity- induced aggregation and sedimentation.

59. **SHIEL, R.J. 1994.** Death and life of the billabong. In K.J. Collier (Ed.) *Restoration of Aquatic Habitats*. Dept. Conservation, Wellington: 19-37. A review of human impacts on Murray-Darling (Australian) billabongs and their biota, this chapter includes a brief section on rotifer species diversity and population densities in these unique environments. Periodical albeit unpredictable inundation is a significant environmental cue triggering reproduction and hatching of resting eggs.

60. **TAKEUCHI, T., Z. FENG, K. YOSEDA, J. HIROKAWA & T. WATANABE, 1994.** Nutritive value of DHA-enriched rotifer for larval cod. *Nippon Suis. Gakk.* **60**, 641-652. [Japanese]. Discusses experimintal alteration of nutrient levels in rotifers fed to larval cod. Approx. 1% DHA is suitable, and vitamin E appears to be necessary.



61. **THORP, J.H., A.R. BLACK, K.H. HAAG & J.D. WEHR, 1994.** Zooplankton assemblages in the Ohio River: Seasonal, tributary and navigation dam effects. *Can. J. Fish. Aquat. Sci.* **51**, 1634-1643. <<Univ. Louisville, Dept Biol., Large River Program, Lousville, KY 40292 USA.>>Relative proportions of rotifers, cladocerans and copepods are given for the main stream and tributaries, e.g. rotifers were more abundant than other zooplankton, particularly in tributaries. Species richness was similar and pelagic and littoral areas. Densities per litre of 1.6-21.6 plankters are cited.

62. **VANZANTEN, B. & G.M. VANDIJK , 1994.** Seasonal development of zooplankton of the lower River Rhine during the period 1987-1991. *Water Sci. Technol.* **29**, 49-51. <<Dutch Natl Inst Publ. Hlth & Environm. Protect., Water & Drinking Water Lab, POB 1, 3720 Ba Bilthoven, Netherlands.>> During the study period the zooplankton composition showed an apparent seasonal pattern at both stations, characterized by low densities during the winter and higher densities during the summer with an obvious spring peak. Zooplankton was dominated by rotifers with *Brachionus angularis*, *B. calyciflorus*, *Keratella quadrata* and *K. cochlearis* as dominant species. The possible role of environmental factors (flow rate and chlorophyll-a content) as controlling factors for zooplankton dynamics is indicated.

63. **WILSON, R.E., E.F. KLAUS, R.K. WILLIAMS, S.H. DAVIS & J. SHOEMAKER, 1994.** The occurrence of the genus *Brachionus* Pallas, 1766 (Rotatoria), in northeastern Texas reservoirs. *Texas J. Sci.* **46**, 35-43. <<E Texas State Univ, Dept Biol Sci, Commerce, TX 75428 USA.>> Eleven species of *Brachionus* were identified in seven reservoirs. *Brachionus angularis*, *B. bidentata*, *B. havanaensis*, *B. rubens*, *B. quadridentatus*, and *B. caudatus* were present during all seasons. *Brachionus calyciflorus* occurred in the spring and autumn. *Brachionus budapestensis* was identified in March and June and from September to November. No patterns could be discerned for *B. urceolaris*, *B. rubens*, *B. variabilis*, and *B. zahniseri*. The smallest number of species occurred during the winter in all reservoirs.

64. **YOSHIMURA, K., C. KITAJIMA, Y. MIYAMOTO & G. KISHIMOTO, 1994.** Factors inhibiting growth of the rotifer *Brachionus plicatilis* in high density cultivation by feeding condensed *Chlorella*. *Nippon Suisan Gakkaishi* **60**, 207-213. <Fukuoka Mariculture Corp, Fukuoka 81135, Japan.> Rotifer growth rate increased as the culture temperature increased. In the cultivation system supplied with air, the maximum rotifer population did not exceed 4,000-5, 000 individuals/ml because oxygen levels were restricted due to the accumulation of undissociated ammonia. Feeding oxygen gas to the rotifer culture system enabled high density cultivation with a population of 20,000 individuals/ml. In such an oxygen-rich culture system, the concentration of undissociated ammonia is considered to be the main factor inhibiting the growth of rotifer.

65. **YOSHIOKA, T., E. WADA & H. HAYASHI, 1994.** A stable isotope study on seasonal food web dynamics in a eutrophic lake. *Ecology* **75**, 835-846. <Nagoya Univ, Inst Hydrospher Atmospher Sci, Chikusa Ku, Nagoya 46401, Japan.> Rotifers were

included in this study of a food web. It is suggested that intensive measurements of carbon and nitrogen isotope ratios of each species serve to effectively assess the yearly dynamics of the food web structure in eutrophic lakes where productivity and species composition of plankton change seasonally.

## New taxa reported

New rotifers described since the last issue of the newsletter, and the refence in which they are cited, are listed below:

*Lecane albanica* Segers, 1994; Saudi Arabia; #53
*Lecane donyanaensis* Galindo *et al.*, 1994; Spain; #19
*Lecane margalefi* De Manuel, 1994; Balearic Archipelago; #11
*Lecane minuta* Segers, 1994; Brunei; #53
*Lecane nelsoni* Segers, 1994; Brazil; #53
*Lecane shieli* Segers & Sanoamuang, 1994: Thailand; #55
*Lecane spiniventris* Segers, 1994; Brunei; #53
*Lecane thailandensis* Segers & Sanoamuang, 1994: Thailand; #55
*Encentrum* (*Parencentrum*) *walterkostei* Jersabek, 1994; Austria; #34
*Proales christinae* De Smet, 1994; Belgium; #12
*Scaridium elegans* Segers & De Meester, 1994; Papua-New Guinea; #54

## Internet?

Bob Wallace has been collecting e-mail addresses as the Internet expands, and more of us become connected to it. I have included a returnable card with this issue of *Rotifer News* - if you are connected to the Internet, please return the card with your address details. A list of e-mail addresses will be included in the next issue of the newsletter.

I have contacted the bionet manager to seek details of setting up a formal global information rotifer newsgroup - a general bionet.rotifera address to which questions on rotifers could be directed, similar to bionet.protista. The network requires two contact addresses - does anyone particularly want to be an address for a bionet.rotifera newsgroup? It would require fielding questions, but at this stage I cannot predict how many or what sort of questions the Internet will generate. MDFRC could be one 'node' if the readership is agreeable -*Rotifer News* is produced here, and there is active rotifer work much of the time. If anyone is particularly interested in taking on the responsibility, please contact me at MDFRC. If anyone wants to see the creation policy for bionet newsgroups, contact me <Shielr@mdfrc.canberra.edu.au> or Dave Kristofferson, the BIOSCI/bionet Manager <biosci-help@net.bio.net>

It is important that the reply card be returned if we are to facilitate communication between rotifer workers. There is a potential for rapid exchange of information - the global Internet provides a means for expanding our rotifer interests to outside 'user' groups.

*Russ Shiel*



The Mikolajki Program is reproduced here for those who were unable to attend the VIIth Rotifer Symposium

**MONDAY - 6 JUNE**
*(CHAIRPERSONS: A. Hillbricht-Ilkowska & H. Dumont)*

08.00 - 08.45 - *breakfast*
09.00 - 10.00 - opening ceremony
09.00 - 09.20 - prof. K. Dobrowolski & L. Kulki
09.20 - 09.40 - obituary notice on Agnes Fruitner-Kolisko
10.00 - 11.10 - morning session
Oral session 1 *(History of rotifer research)*
10.00 - 10.50 - **A. Hillbricht-Ilkowska** "Hundred years of Polish rotiferology - scientists and their work"
10.50 - 11.10 - **Hashiro Hirata** "Initial works on mass culture of rotifer, *Brachionus plicatilis*"
11.10 - 12.00 - *coffee break*
12.00 - 13.00 - morning session continued
Oral session 2 (Biogeography)
12.00 - 12.20 - **R.J. Shiel, J.D. Green & I. Duggan** "Biogeography of southern Australia - New Zealand rotifers: sweepstakes dispersal or Gondwanan connection?"
12.20 - 12.40 - **D.G. Jenkins** "Dispersal-limited zooplankton distribution and community composition in new ponds"
12.40 - 13.00 - **J. Ejsmont-Karabin** "Rotifer occurrence in relation to age of reservoirs originated in granite quarries"
13.00 - 15.00 - *lunch*
15.00 - 17.00 - afternoon session
Oral session 2 continued
15.00 - 15.20 - **I.V. Telesh** "Rotifer assemblages in the Neva estuary: principles of formation, present state and perspectives"
15.20 - 15.40 - **J. Green** "Associations of planktonic and periphytic rotifers in a Malaysian estuary and two nearby ponds"
15.40 - 16.00 - **A. Saunders-Davies** "Factors affecting the distribution of benthic and littoral rotifers in a large marine lagoon"
16.00 - 16.20 - **P. N. Turner** "Composition and distribution of rotifers in the interstitial of the Ninnescah River, Kansas, USA"
16.20 - 16.40 - **R.M. Pontin & R.J. Shiel** "Periphytic rotifer communities of an Australian seasonal floodplain pool"
16.40 - 17.00 - **R. Changsiath** "Distribution of littoral rotifer communities in Canadian freshwaters"
17.00 - 17.40 - *coffee break*
17.40 - 18.30 - video tape showing the capture of rotifers by the predaceous fungus *Zoophagus insidiens* Sommerstorff presented by **Erie D. Holloway**
19.00 - 20.00 - *dinner*
20.00 - *beer party in a fire-place room*

**TUESDAY - 7 JUNE**
*(CHAIRPERSONS: C. Ricci & S. Radwan)*

07.30 - 08.45 - *breakfast*
09.00 - 10.40 - morning session
Oral session 3 (Systematics and evolution)
09.00 - 09.20 - **C.K. Brain** "Recent studies on the early evolution of micro-invertebrates and their relevance to the phylogeny of rotifers"
09.20 - 09.40 - **S. Rico-Martinez & T.W. Snell** "Copulatory behavior and male recognition pheromone blocking of male receptors in *Brachionus Plicatilis* Müller (Rotifera)"
09.40 - 10.00 - **G. Melone & C. Ricci** "Observations on rotatory apparatus of Bdelloidea"
10.00 - 10.20 - **T. Nogrady & R.L. Wallace** "Numerical taxonomy of the genus *Notholca*"
10.20 - 10.40 - **H.J. Dumont, S.S.S. Sarma & H. Segers** "A S.E.M. Atlas of Rotifer floating Eggs"
10.40 - 11.20 - *coffee break*
11.20 - 13.10 morning session continued
Oral session 3 continued
11.20 - 11.40 - **H. Segers** "A reappraisal of the taxonomy and zoogeography of the Scaridiidae Manfredi, 1927 (Rotifera: Monogononta)"
11.40 - 12.00 - **Ch.D. Jersabek** "A study of the distribution and ecology of rotiferan communities from high altitude alpine sites".
Oral Session 4 (Genetics)
12.00 - 12.20 - **A. Gomez & M. Serra** "Crossmating experiments between sympatric strains of *Brachionus plicatilis* Müller 1786: insight into the status of this taxonomical species"
12.20 - 13.10 - **M. Meselson, D. Welch & J. Mark** "Heterozygosity in bdelloid rotifers: a test for ancient loss of sexual reproduction and genetic recombination"
12.20 - 12.40 - Part I by M. Meselson "The theoretical aspect and overall experimental approach to the problem"
12.40 - 13.10 - Part II and III by D. Welch and J. Mark "Experimental results"
13.10 - 14.40 - *lunch*
15.00 - 15.40 - afternoon session
Oral session 5 (Anatomy and morphology)
15.00 - 15.20 - **E.A. Kotikova** "Localization of catecholamines in the nervous system of Rotifera"
15.20 - 15.40 - **L. Kotikova** "Variations of metamorphosis in the sessile rotifers"
15.40 - 17.00 - "Bird" poster session
1. **M. Silva Briano** "The distribution of *Brachionus* species in Aguascalientes State, Mexico" [1]
2. **L. Sanoamuang, Segers H. & H.J. Dumont** "Additions to the rotifer fauna of South East Asia: new and rare species from South East Thailand" [1]
3. **I. Bielanska-Grajner** "Influence of temperature on morphological variation in population of *Keratella cochlearis* (Gosse) in Sylwek Dam Reservoir [1]
4. **W. De Smet & L. Beyens** "Rotifers from the Canadian High Arctic (Ellesmere Island, Northwest Territories)[2]
5. **K. Janicz** "Rotifer composition in freshwater environments on King George Island (Antarctica) and Hornsund (Spitsbergen) [2]
6. **B.E. Modenutti** "Distribution of planktonic rotifers in Patagonian lakes" [2]
7. **Tan Zhuge** "Species composition and long-term succession of rotifers with reference to some international impacts in Lake Donghu (China) [1]
17.00 - 17.30 - *coffee break*
17.30 - 19.00 - general discussion on rotifer phylogeny
19.00 - 20.00 - *dinner*
20.00 - 24.00 - party around a camp fire

**WEDNESDAY - 8 JUNE**

*(CHAIRPERSONS: M.Melzer & L. Hajek)*

07.3o - 08.45 - breakfast
09.00 - 10.3o - morning session

Oral session 6 (Metabolic processes)

09.00 - 09.4o - G.A. Galkovskaya - "The principles of aerobic metabolism of rotifers"

09.4o - 10.00 - C. Ricci " Energy allocation pattern and body size in bdelloid rotifer"

10.00 - 10.3o - N. Wais & S.S.S. Sarma "Egg size in relation to body size in rotifers: An indication of reproductive strategy?"

10.3o - 11.00 - coffee break
11.00 - 13.00 - morning session continued

Oral session 7 (Biochemistry)

11.00 - 11.3o - W. Kleinow, A. Röhrig & H. Wratil "SEM of inner structures and enzyme activity measurements on isolated organs of *Brachionus plicatilis* (Rotifera)"

11.3o - 11.4o - E. Lubzens et al. "Survival of rotifers (*Brachionus plicatilis*) at low temperatures"

11.4o - 12.00 - J. H. Rekis " Study of n-6 fatty acid elongation and desaturation by the rotifer *Brachionus plicatilis*"

Oral session 12 (Biotechnology)

12.00 - 12.3o - J. Konstad et al. "Use of swimming speed and egg ratio as predictors of the status of rotifer cultures in aquaculture"

12.3o - 12.4o - N. Singhai Ram "The effect of egg yolk on the production of planktonic rotifers in fish culture ponds"

12.4o - 13.00 - M. Yúfera, N. Navarro & L. Karamouzos "Population growth dynamic of the rotifer *Brachionus plicatilis* cultured in non-limiting food condition"

13.00 - 14.00 - lunch
14.00 - 16.00 - Mikołajki: sightseeing and shopping
16.00 - 18.45 - boat trip: Mikołajskie Lake, Śniardwy and Dobkary Lakes
19.00 - 20.00 - dinner
20.00 - 22.00 - small discussion groups to be organized ad hoc

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**THURSDAY - 9 JUNE**

*(CHAIRPERSONS: L. May & R. Sorbel)*

07.3o - 08.45 - breakfast
09.00 - 10.3o - morning session

Oral session 8 (Behaviour)

09.00 - 09.3o - P.L. Blackweather "Near -coronal fluid flow patterns and food roll manipulation in *Brachionus calyciflorus*"

09.3o - 09.4o - C. Cherey & P. Clément "Modifications of the swimming behaviour of *Brachionus calyciflorus* (Pallas) according to both food environment and individual nutritive state. Use of lures."

09.4o - 10.00 - E.J. Walsh "Substrate preferences and habitat-specific predation susceptibilities of the littoral rotifer *Euchlanis dilatata*"

10.00 - 10.3o - D.J. Bevington, Ch. White & R.L. Wallace " Foraging behavior of the ambush predator *Capelopnga sense* (Rotifera: Atrochidae) on protozoan prey"

10.3o - 11.00 - coffee break
11.00 - 12.4o - morning session continued

Oral session 9 (Ecophysiology)

11.00 - 11.3o - G. Vadstein & T. Olsen "Effect of growth rate and composition of food on C, N and P content and element ratios of the rotifer *Brachionus plicatilis*"

11.3o - 11.4o - R. Hesslein & S. Hawes "Experimental studies into the feeding biology of rotifers in brackish water"

11.4o - 12.00 - A.S. Fulcher "Rotifer community dynamics in a large oligotrophic lake - Loch Ness, Scotland"

12.00 - 12.3o - S. Banik & S. Ear "Effect of some limnological conditions on the production of mictic and amictic eggs in some asexual rotifers"

12.3o - 12.4o - A. Hagiwara et al. "Development of the marine rotifer *Brachionus plicatilis* resting eggs and irradiation effect on their hatching"

13.00 - 14.3o - lunch
14.4o - 16.3o - afternoon session

Oral session 10 (Ecotoxicology)

14.4o - 15.3o - C.R. Janssen & T.W. Snell "A review of the use of rotifers in aquatic toxicology"

15.3o - 15.4o - C. Joaquim-Justo et al. "Importance of the trophic pathway in the PCB contamination of a rotifer species *Brachionus calyciflorus*"

15.4o - 16.00 - T. Marneffe et al. "Impact of industrial and municipal discharges on rotifer populations in the river Meuse"

16.00 - 16.3o - S. Kett & J. Langley "[illegible] in urban ponds"

16.3o - 17.00 - coffee break
17.1o - 18.4o - "Gruzu" poster session

1. C.K.Brain, Shiel R.J. & Fourie I. "Rotifers of the Kruger National Park, South Africa" (1 1)
2. A. Ortan "Dessication survival of the eggs of the eggs of the bdelloid rotifer *Adineta vaga*" (1 1)
3. N. Iyer & T. R. Rao "The cyclic mode of life in *Brachionus rubens* as a deterrent against predation by *Asplanchna intermedia* (1 1)
4. R. Nawalla "Spring dynamics of periphytic rotifers on coral atoms" (1 1)
5. S. Radwan., A. Pelechog & S. Popielek "Density and qualitative composition of rotifers in lakes of different trophy" (1 1)
6. M.T. Alfonso et al. "Rotifers of spring pools in the Albufera of Valencia Natural Park (Spain)"
7. M.J. Carmona, A. Gomez & M. Serra "Mictic patterns of *Brachionus plicatilis* populations in small ponds" (1 1)
8. S.F. Timofeew "The size structure of rotifer community in the Izumrudny Lake (Kola Peninsula) in summer period" (1 1)
9. Haberman J. "Importance of rotifers (Rotatoria) in the zooplankton community of Lake Võrtsjärv ) Estonia) (1 1)
10. M.C. Crispim & M.J. Boavida "Comparison of Rotifera communities in Marmelos Reservoir (Portugal) before and after complete emptying" (poster 1 1)
11. N. Emir "The seasonal succession and population density of rotifer species in Akgölü Lake in Central Anatolia" (1 1)
12. M.J. Parra, Zoppi de Roa M. & W. Vasquez "Species assemblages of Rotifera in a floating meadow of Venezuela" (1 1)
13. A.K. Gorbunov & A.A. Kosova "Ecology of rotifers in the Volga Delta" (Ecotoxicology)
14.11. Rinnenberger et al. "Biomanipulation in lake Hennsee and the development of rotifers during this period" (Biotechnology)
15. R. Zarek "Size response of *Sphaerularia* sp. on *Asplanchna* salinus presence" (1 1)
16. B. Adamkiewicz-Chojnacka & R. Hesslein "Annual cycles of rotifer abundance and biomass in brackish coastal waters (Southern Baltic)" (1 1)

19.00 - 20.00 - dinner
20.00 - 22.00 - beer-party in a fire-place room

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**FRIDAY - 10 JUNE**

*(CHAIRPERSONS: J. Ejsmont-Karabin & R. Pejler)*

07.3o - 08.45 - breakfast
09.00 - 10.4o - morning session

Oral session 11 (Ecology)

08.00 - 08.4o - review by R. Pejler "Intrusion to habitat in rotifers"

09.4o - 10.00 - J.M. Schmid-Araya "Disturbance and population dynamics of rotifers in bed sediments"

10.00 - 10.3o - M.R. Miracle & X. Armengol-Díaz "Population dynamics of oligotrophic species in Lake Arcas-2"

10.3o - 10.4o - T.S. Kistler & A. Nauwerck "Planktonic rotifers temporal and vertical distribution in meromictic Western Uganda crater lake *Nyahirya*"

10.4o - 11.3o - coffee break
11.3o - 12.4o - morning session 11 continued

11.3o - 11.4o - J.J. Gilbert "Dispersing, amictic eggs in *Synchaeta pectinata*"

11.4o - 13.00 - R. Morales-Baquero, P. Carillo & L. Cruz-Pizarro "Effects of fluctuating temperatures on the population dynamics of *Hexarthra bulgarica* from high mountain lakes in the Sierra Nevada (Spain)"

13.00 - 13.3o - T. Virro "The genus *Polyarthra* in Lake Peipsi"

13.3o - 13.4o - C. Baldo & M.J. Boavida "Limnetic vs.littoral rotifer communities of shallow, eutrophic Divor Reservoir (Portugal)

13.00 - 14.3o - lunch
14.3o - 16.1o - afternoon session

Oral session 11 (Ecology) continued

14.3o - 14.5o - G. Weithoff & N. Wais "The influence of *Planktothrix agardhii* (Cyanobacteria) on population dynamics of the rotifer *Brachionus calyciflorus*"

14.5o - 15.1o - R.D. Gulati, G. Postema & K. Siewertsen "Rotifer dynamics in Dutch lakes of varying trophy: response to reoxygenation measures and changes in crustacean zooplankton"

15.1o - 15.3o - T. R. Rao & A. Kak "Effects of food and temperature on the interactions between the cladoceran *Moina macropa* and the rotifers *Brachionus calyciflorus* and *B. angularis*"

15.3o - 15.5o - S.C. Fradkin & J.J. Gilbert "Effects of interference and exploitive competition from large-bodied cladocerans on rotifer community structure"

15.5o - 16.1o - G. Pasemann "The influence of crustacean zooplankton on rotifers in two enclosure experiments"

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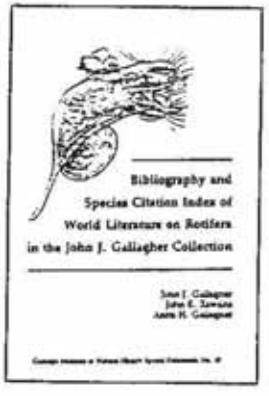


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