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SIL news

Volume 67 - December 2015

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In This Issue

Material for the June 2016 issue should be sent to the Editor by:

1 APRIL 2016

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Contributions on PC formatted disk, in any standard word processor or DOS (ASCII) text, or as e-mail attachments, will assist the Editor.

Editor's Foreword

SILnews 67 should be on our SIL Website in about two weeks from now. I must at the outset tell our readers that Ms Rosalind Maberly of the FBA, who used to make our Newsletter publication ready, has left us; and from now on she will be working for SIL journal, the Inland Waters. My first reaction on getting this news about two weeks ago was one of some disappointment, if not displeasure. During the email exchange, Rosalind was quite reassuring as she offered to help Michelle Jordan in taking over her the work of the SIL news. It is incumbent on me to thank you Rosalind for doing an excellent job for the SIL news until the last issue, and helping the six-monthly newsletter to appear in time. We will certainly remember you and ask for help if needed. I now welcome Ms Michelle Jordan, and I look forward to working with Michelle in the same resolute spirit as with her predecessor.

I think the contents of the present SILnews are quite interesting. As usual, there is an Announcement, from our Secretary/Treasurer, Tamar Zohary**,** about the "activities behind the scenes". Tamar is a great source of inspiration for many of us as she has worked hard to both inspire and get young limnogists to become SIL members and participate actively in the SIL activities. Roberto Bertoni from Italy announces the progress they have made to host the next SIL Congress at Torino (Italy) in August 2016. It is heartening to note that Roberto has promised to keep the Registration fee for the SIL at Torino relatively low to encourage more members to participate. There are Reports in this newsletter from Germany, Brazil, Mexico, and the USA of the studies in progress. There is even some hotnews. Rob Wallace (USA) retrieved and collated the news for us. Rob got permission from the CNN and Nikon to use the selected photos of aquatic animals for the SILnews. Of the twenty photos of aquatic organisms selected by the CNN and Nikon, for their natural beauty and splendour, five are acquatic animals. Our thanks to the both CNN and Nikon for allowing us to use their published material.

I am very sorry to inform our readers that three eminent limnologists passed away in 2015: Lyudmila Kutikova (Russia), Oscar Ravera (Italy) and Leonid Kudersky (please see their obituaries in this newsletter). Despite their ripe ages they all were quite active academically. It was also a great personal loss for me in the case of Kutikova and Ravera because I had known them both personally. On behalf of the SIL, I convey our feelings of deep sadness and grief to the bereaved families and friends.

There are two extended book reviews by me in this news letter: 1). Lake Kinneret, Ecology and Management by Zohary et al. (Eds.); and 2). Lakes, Loughs and Lochs by Brian Moss (author). I greatly enjoyed reading these monumental works, and I recommend to our readers to read the reviews so as to help you make up your minds to purchase personal copies or to recommend the books to their libraries.

Finally, I take the opportunity to wish you a Merry Xmas, a happy holiday period and a happy new year, 2016, which is on the threshold now.

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The SIL desk behind the scenes, a report from the SIL General Secretary

Dear SIL members,

Since the beginning of 2015 - 55 people have joined SIL. Of those, 47 are students and early career professionals. This adds to 69 new SIL members in 2014, of which 43 are students and early career members. This marks a crucial turning point for SIL, that has been aging for the last 25 years or so, with its membership shrinking as members became old and many of them retired, whereas young people simply didn't join the society.

With the motivation to encourage this new trend of increased membership due to young members, the SIL executive committee has agreed that a student representative should be added to the SIL board. This requires making changes in the statutes, which should be confirmed during the next SIL Congress in Torino, Italy , and where hopefully, a student representative will be elected. If you are a student, and consider being nominated to the SIL board, please let me know!

Two initiatives probably led to the renewed recruitment of young people to SIL: (1) the special highly reduced annual membership fee of $5/ year that student members are charged now - compared with $93/year for regular members; (2) the announcement last year of the SIL student competition.

This competition, of the best limnological paper published, based on a recent M.Sc. or Ph.D. thesis attracted much attention. The winner of this competition will be invited to present his/her published article in a plenary lecture in the next SIL Congress at Torino in August 2016. The first stage of this competition, of submission of individual applications to the national representative – ended on 15 October 2015. Thirty two (!) applications from 16 (!) countries were submitted, They included submissions from: Argentina, Australia, Austria, Belgium, Brazil, Finland, Hungary, Ireland, Italy, Mexico, Netherlands, New Zealand, Poland, Spain, UK and USA. We should recognize this as a great success!

At this stage, countries with more than a single candidate have organized a national committee to elect the one or two candidates that will continue to the next stage of the competition. By 15 December this year, each country will have to submit its one or two best candidates to the international competition. Most countries are entitled to send only one national competitor, but the countries with > 50 SIL members can send two competitors. Judit Padisak will chair an international committee that will choose the first three competition winners. The names of winners will be announced in March 2016, the awards will be given at Torina. Updates regarding the competition are advertised on the SIL Facebook page and SIL website (under "News"), you are advised to check these websites from time to time.

Maciej Bartosiewicz, a student member, initiated the SIL Facebook page in December 2014 and administers it voluntarily since then. He received a travel grant to participate in the 2013 SIL Congress at Budapest, and chose to express his appreciation by contributing to the SIL in another way. The SIL Facebook page is easily found when you search in Facebook for 'SIL' and it attracts quite a bit of web traffic. If anyone is interested in posting there information with limnological relevance – please go ahead.

Another major SIL activity taking place behind the scenes is the designing of a new website for SIL, with a totally new look (see Fig. 1) and user-friendly environment. The SIL membership database is becoming an integral part of the new website, so on-line forms and different modes of payment of fees/memberships will replace hardcopies, e-mails, etc.

Much time and effort go into our journal, *Inland Waters.* Many thanks to Jack Jones, our dedicated chief editor, for his focused and professional control that makes this journal what it is. The quarterly issues of IW seem to be appearing ahead of the schedule. 5(4), the last issue for 2015, was published already in October, and the first issue for 2016, 6(1) is now under preparation. In addition to Jack, the team of associate editors is doing a great job, as well as Janice Faaborg, the copy editor, and Simon Pawly from the FBA, our Publishers.

Our newsletter 'SILnews' continues to be SIL's primary window to news in Limnology, from reports on lakes or other water bodies with matters attracting public attention, to announcements of pending meetings, reports from previous meetings, obituaries on colleagues that passed away recently, book reviews and a lot more. We are grateful to Ramesh Gulati for his continued, voluntary and professional management of this publication, twice a year i.e. a summer and a winter issue.
Enjoy reading SILnews !!

Tamar Zohary
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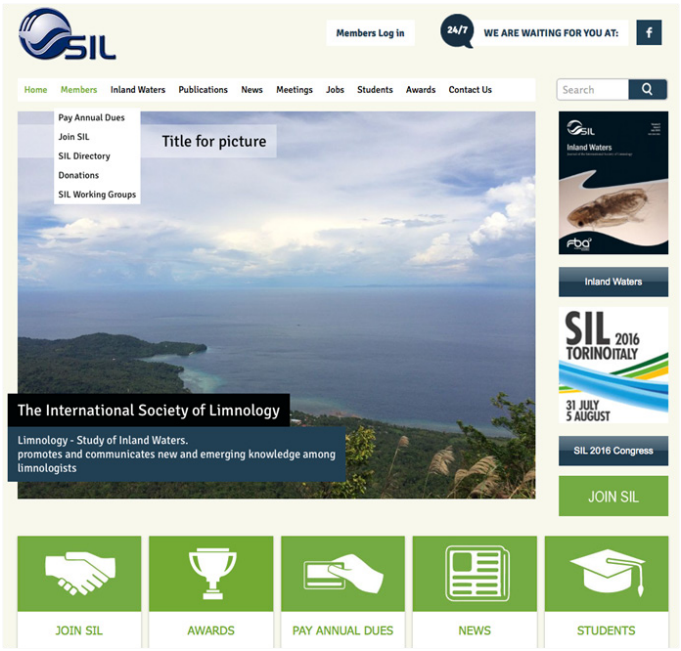

Fig. 1. The home page of the new SIL Website, to be launched early in 2016.

Announcements

SIL 2016: the expectation of novelty

The 33rd SIL Congress (Torino, Italy) is now almost on the threshold. The effort to make the Congress scientifically attractive, as well as interesting in terms of costs and cultural and touristic aspects has forced us to introduce some innovations. I hope you will find them attractive in different respects.

The Congress at Torino has revived the organization of special sessions, which were discontinued after the Congress at Montreal (Canada) in 2007. The response to call for special sessions at Torino that closed on September 30th this year, was particularly successful. Thirty special sessions were proposed, now being evaluated by both scientific and organizing committees. The regular and special sessions list will be posted on the SIL Congress Website, before the Announcement of the call for Abstracts.

Another novel aspect of the Congress programme is the international competition launched by SIL. The winning young limnologist will present his/her study as a plenary lecture funded and supported by the SIL. The other plenary lecturers will see and listen to outstanding limnologists and ecologists offering their important take on topics. The two memorial lectures will be given by Rick Battarbee who will give the Baldi lecture and Ole Seehausen who will give the Kilham lecture. Six other plenary lectures will be given by, Esteban Balseiro, Thomas Bell, Núria Bonada, Kendra Spence Cheruvelil, and Frances R. Pick.

Furthermore, the conference will begin with a kick-off plenary lecture, open to the public. The lecture will be delivered by Christian Greco, Director of the Museum of Egyptian Antiquities of Torino. This is the only museum in the world, in addition to the Cairo Museum, devoted solely to Egyptian history and culture. Professor Greco will give an historic overview of inland waters management in ancient Egypt. We think that a listening to the applied limnology in the past can be both intriguing and attractive for the limnologists of today, but also for the larger public.

To promote the participation of young scholars, SIL and various national limnological associations offered contributions to cover travel or registration fees, or both (see the list at www.sil2016.it in the sections sponsorship and awards).

We think the SIL 2016 Congress will be a "low-cost" meeting, with registration fee much lower than at previous recent congresses, despite the ongoing economic crisis and the rising costs. The fees, including VAT tax, are 450 € for regular and 200 € for student SIL members. To cut the rental costs of the congress center, the mid congress excursion will be replaced by city tours during the conference days.

We will thus also take advantage of the great artistic and cultural resources offered by the town of Torino.

We are confident that you will attend the conference in large numbers, and contribute to make the next SIL 2016 Congress a high quality event.

Arrivederci a Torino.

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Block Course in Physical Limnology (Physics of Lakes) Heidelberg University, April 4-8, 2016

A block course on physical limnology (physics of lakes) will be held at the **Heidelberg University (Germany)** during the **spring break 2016 from 4th to 8th of April.** The course is part of the Physics Master Program and will be held at the Institute of Environmental Physics.

This block course aims at presenting the basics about physical processes in lakes, such as stratification, internal waves, currents, turbulence, mixing and matter transport. The course will consist of 14 lectures of 90 minutes each accompanied by short exercise sheets. Lectures will be held in English. Lectures will be presented by **Dr. Bertram Boehrer** (UFZ, Priv. Doz. Univ. Heidelberg) and **Prof. Andreas Lorke** (Univ. Landau), but we will complement our competence by inviting active scientists in the field physical limnology to present their specialty.

A more detailed programme will be issued closer to the block course. Students and scientists interested in attending the course are requested to contact us by email no later than the 31st Jan 2016. For further information, please address Bertram.Boehrer@ufz.de .

http://www.ufz.de/index.php?de=18470
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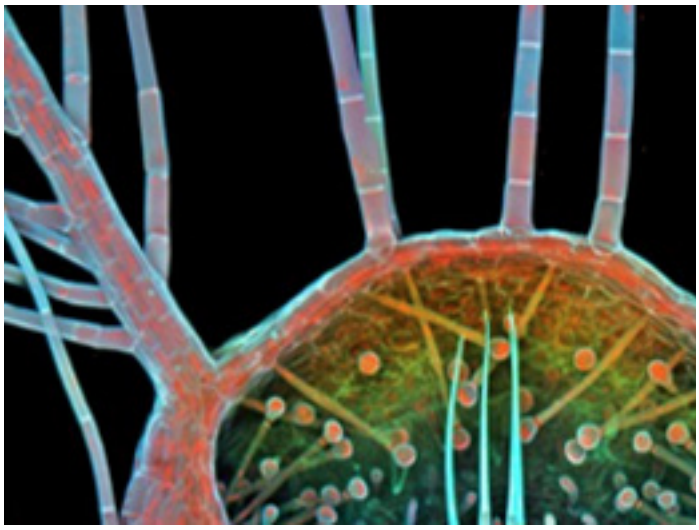
HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

SIL hotnews

Notatio naturae, et animadversio perperit artem.
(Art is born of the observation and investigation of nature), Cicero

Five striking photomicrographs of interest to aquatic scientists are among the 20 top winners of the 2015 Nikon® Small World photo competition. The committee comprising scientists and science new reporters chose the winning images based on several factors including composition, detail, and scientific relevancy.



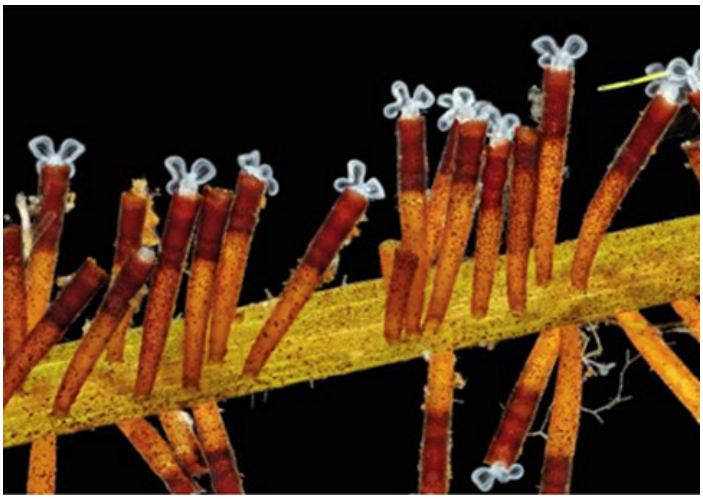
3rd place: Dr. Igor Siwanowicz; in false color, the trap door of a bladderwort, Utricularia gibba. (Taken at the Howard Hughes Medical Institute, Virginia, USA.)

10th place: Ian Gardiner; a live clam shrimp, Cyzicus mexicanus. (Taken in Calgary, Alberta, Canada.)

Images of Distinction included a colony of the ciliate *Carchesium* (Arturo Agostino), a cross section of a bud of the water lily, *Nupha lutea* (Dr. David Maitland), Stentor (Rogelio Moreno Gill), and a dark field image of the planktonic rotifer, *Synchaeta* sp. (Dr. Bernd Walz).

Images for all of the 2015 winners, as well as information about winners from other years and instructions to aspirate entrants for the Nikon® 2016 contest may be found at: www.nikonsmallworld.com/

— Robert (Bob) Wallace, Ripon College, Ripon, WI, USA



16th place: Charles B. Krebs; a small group of the sessile Floscularia ringers attached to a tiny bit of plant. (Taken in Issaquah, Washington, USA.) The 2014 winning photomicrograph was of the corona (ciliated apical end) of another sessile rotifer, Lacinularia sp.

18th place: Roland Gross; a gastrotrich (Chaetonotus sp.) and an alga (Micrasterias sp.). (Taken in Gruenen, Bern, Switzerland).

20th place: Frank Reisser; the suction cup on the foreleg of a diving beetle (Dytiscus sp.). (Taken at Nassau Community College, Garden City, New York, USA.)

The winning images also were posted by CNN®:
www.cnn.com/2015/10/14/world/nikon-small-world-photomicrography-bees-2015/

Piero Guilizzoni – Announcement of Lifetime Achievements Award

During the 13th International Paleolimnology Symposium (Lanzhou, China, 4-7 August 2015), Dr Piero Guilizzoni received from the International Paleolimnology Association (IPA) the Lifetime Achievements Award. Guilizzoni had worked as researcher at the CNR-Institute of Ecosystem Study (the former Istituto Italiano di Idrobiologia) for more than 40 years. He is the last one as Director of the Institute.

His career began with the study of aquatic macrophytes and their eco-physiological role in the environment. Together with Mike S. Adams from the Department of Botany, Madison, WI, USA he published papers on the photosynthetic activity and inorganic carbon use by macrophytes in several Italian lakes. Soon after of this work, he was attracted by the fascinating world of paleolimnology and the study of lake sediments. In particular, he was attracted to what could be learned from the analyses of sedimentary photosynthetic pigments He has made numerous contributions to paleolimnology in the past 37 years, largely using sediment geochemistry, fossil algal pigments and other biological remains to infer lake pH in the past. He also worked on phosphorus concentration in water, primary productivity and heavy metals pollution. Then his research focus changed to a much earlier goal of 1980 to try to define the baseline or pre-anthropogenic lake trophic conditions. Recently, he collaborated on a new research paper on cyanobacteria – detected by their characteristic carotenoids - and their evolution and quantitative expansion in lakes worldwide during the Anthropocene.

During his long standing career, Dr Guilizzoni has worked on sediment cores from lakes in Italy, Switzerland, Austria, the United Kingdom, the United States, high mountain regions of Tibet, Patagonia, the Alps, Himalayas, and remote sites such as Arctic (Svalbard), Lapland, and Antarctica. His diverse research activities are an important contribution to the research and history of paleolimnology in Italy and much beyond.

Although officially retired, Piero continues to conduct paleolimnological research, publish in the peer-reviewed journals and serve the paleolimnology community at large. Since 2008, he has been a conscientious and dedicated Associate Editor of the Journal of Paleolimnology.

As underlined by Dr Guilizzoni in his speech at the Symposium in China in August, 2015, this award is also an acknowledgement to the numerous colleagues he met and worked with and also to his colleagues at the Institute at Pallanza for promoting research in the fascinating field of Paleolimnology.

Piero Guilizzoni during the award ceremony at the Lanzhou University with Mark Brenner (L) and John Smol (R).

Selected Publications of Piero Guilizzoni

Guilizzoni P, Bonomi G, Galanti G, Ruggiu D (1983) Relationship between sedimentary pigments and primary production evidence from core analyses of twelve Italian lakes. Hydrobiologia 103: 103-106.

Guilizzoni P, Lami A, Marchetto A (1992) Plant pigment ratios from lake sediments as indicators of recent acidification in alpine lakes. Limnol Oceanogr 37: 1565-1569

Guilizzoni P, Oldfield F (Eds) (1996) Palaeoenvironmental analyses of Italian crater lake and Adriatic sediments (PALICLAS). Mem Ist Ital Idrobiol 55: 357 pp

Guilizzoni P, Marchetto A, Lami A, Gerli S, Musazzi S (2011) Use of sedimentary pigments to infer past phosphorus concentration in lakes. J. Paleolimnol 45: 433-445

Taranu ZE, Gregory-Eaves I, Leavitt PR, Bunting L, Buchaca T, Catalan J, Domaizon I, Guilizzoni P, Lami A, McGowan S, Moorhouse H, Morabito G, Pick F, Stevenson MA, Thompson PL, Vinebrooke RD (2015) Acceleration of cyanobacteria dominance in north temperate-subarctic lakes during the Anthropocene. Ecology Letters 18: 375–384

Guilizzoni P (2012) Palaeolimnology: An Introduction. In: Limnology Of Rivers And Lakes, [Ed. Brij Gopal] In Encyclopedia Of Life Support Systems (Eolss), Developed Under The Auspices Of The Unesco, Eolss Publishers, Oxford, Uk, [Http://Www.Eolss.Net] [Retrieved] January 15, 2013]. Doi: 10.13140/2.1.5123.7766.

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Reports

14th International Rotifer Symposium: A Report

The prestigious triennial International Rotifer Symposium was held at the University of South Bohemia, České Budějovice, Czech Republic. Dr. Miloslav Devetter of the Institute of Soil Biology (Biology Center, CAS) was the main organizer of the event. About 120 participants representing 28 nations attended the meeting (Fig. 1).

As has been the tradition from the 1st International Rotifer Symposium, there were no parallel sessions and all oral sessions were held at the spacious auditorium of the university. As in previous symposia, the meeting consisted of invited talks, and both oral and poster presentations, in addition to a mid-conference excursion. In addition, the meeting also had both pre- and post-conference workshops on topics related to rotifers. The trend of contributions from multiple authors, from multiple institutions was continued in this meeting (Sharma et al. 2014).

Prior to the start of the symposium, a special, 1.5 daylong, pre-conference, short course on ordination of rotifers was held (29–30 August). At the end of this course the process of registration for the full conference was begun; a welcoming party held in the early evening following the registration period. The official conference was inaugurated on 31st August at about 9:00am by Dr. Miloslav Šimek, Director of the Biological Centre, Czech Academy of Science, while Dr. Libor Grubhoffer, Rector of the University of South Bohemia, spoke about the teaching and research programs and the scientific achievements of the university.

After this brief inauguration, technical sessions began with an invited talk on "Rotifers as model systems for the study of rapid micro-evolutionary adaptation and its ecological implications" (Emanuel Bartoš Invited Lecture) by Dr. Steven Declerck (Netherlands Institute of Ecology, Wageningen). In this presentation, Dr. Declerck mentioned the importance of rotifers as excellent model organisms, even better than cladocerans, due to their short generation time, high population growth rates and rapid responses to stress. Taking *Brachionus calyciflorus* as test species, Dr. Steven cited numerous works from his laboratory and from literature on the micro-evolutionary adaptation. Following this talk, were the first two oral sessions on Organism Functioning 1 and 2, where each presentation lasted 20 min. duration including questions and comments. There were also two post-lunch sessions on the first day: Oral: Integrative and Applied Research and Poster session 1: Organism functioning, Ecosystem functioning, Resting eggs, dormancy and egg banks, Bdelloid rotifers. The presenting authors of the posters highlighted the importance of their work (Fig. 2).

The second day of the meeting began with an excellent talk on "The phylogeny of Syndermata (= Rotifera sensu lato) and its implications for the evolution of acanthocephalan endoparasitism" by Prof. Holger Herlyn (Institute of Anthropology, University of Mainz, Germany). In this invited talk, Dr. Holger compared the basic biological features (life cycle, living habitats, food and feeding habits) as well as genetic characteristics including molecular-based phylogenetic analyses of both Rotifera and Acanthocephala. Using the available molecular data, Dr. Holger opined that seisonids are a sister group to acanthocephalans

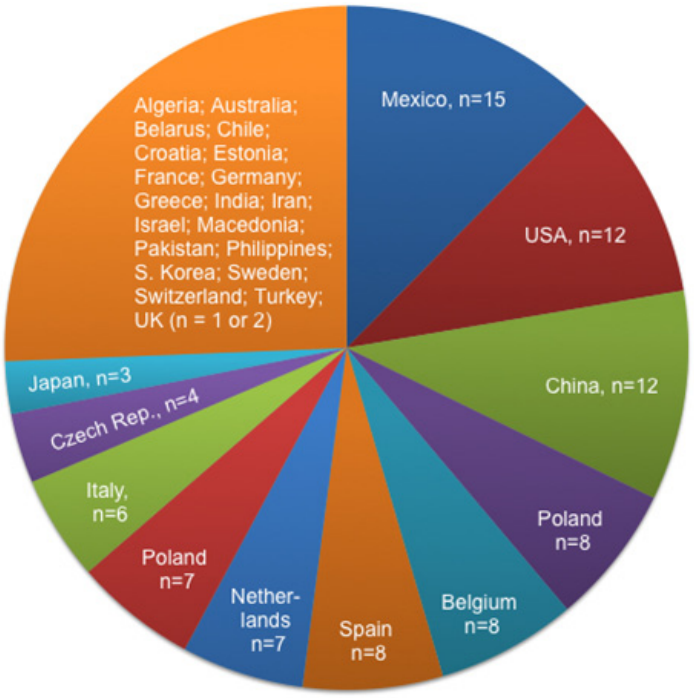

Fig. 1. Country of origin for registrants of the 14th International Rotifer Symposium.

(Pararotatoria) and Eurotatoria are paraphyletic and bdelloids are a sister group to Pararotatoria. Dr. Holger's talk was followed by two more oral sessions related to Ecosystem Functioning 1 and 2. Post-lunch session of the second day was a Workshop on Dormancy and Resting Eggs. This session included a series of short (15 min.) presentations spread over 3 sub-sessions. The first of this was a summary of present knowledge about the resting eggs (diapausing embryos) in the entire phylum Rotifera (jointly presented by Drs. EJ Walsh and RL Wallace) and the last presentation of this workshop consisted of group discussion. The highlight of this session was the inclusion of a talk by a non-rotiferologist, but a well-known colleague who works on anostrocans, a group known for their dormancy through cysts formation.

Day 3 was dedicated to the mid-conference excursion, where the participants witnessed the Třeboň region with a series of fishponds that were developed during the 16th and 17th centuries. The invited talk and oral presentations of the fourth day were mostly dedicated to bdelloid rotifers. Prof. Karine Van Doninck presented a synthesis of various works under the title "Genomic evidence for ameiotic evolution and genetic exchanges in the bdelloid rotifer *Adineta vaga.*" She presented the evidence of ameiotic evolution and genetic exchange in bdelloids using *A. vaga* as an example. She emphasised the role of anhydrobiosis in the evolution of genome. In *A. vaga* during desiccation the genome is broken into hundreds of fragments and yet get repaired upon hydration of these rotifers. This talk was followed by three other oral presentations on the molecular evolution of bdelloids. Two other sessions on this day were on

population studies. Post lunch session was devoted to poster presentations. As in the previous poster session authors of the posters presented a two-minute summary of their main findings. The posters of the two poster sessions remained until the end of the conference so that interested participants could leisurely go through them.

The last day of the meeting began with an invited talk by our long-term colleague, Prof. Claudia Ricci from Italy. Wallace presented a short sketch of her lifetime achievements. Later Prof. Ricci presented data on bdelloid rotifers from a historical perspective under the interestingly anthropomorphic title "How and why to fall in love with bdelloid rotifers." At the end of her presentation she thanked the "rotifer family" (in Dr. HJ Dumont's terms) for its generous support and kindness over her career. The conference hall was filled with applause for several minutes towards at the conclusion of her talk. Following this were two more oral sessions concerning Patterns in Biodiversity. The Conference ended with a few additional presentations mainly on nomenclature.

After the concluding session on Friday afternoon the rotifer family was treated to a guided tour of Hluboká nad Vlyavou Chateau, music (piano, violin, and voice), and a gala dinner within the art gallery. On Saturday after the conference two options for post conference tours were offered: sightseeing in Český Krumlov and a canoe trip on Vltava River. On Sunday (6 September) there also was a one-day, post conference workshop on bdelloid rotifers.

There were many salient features and outstanding peculiarities of this meeting. First of all, it is only in this meeting where as many as eight prominent rotiferologists (including Drs. Esther Lubzens, A. Hagiwara, Manuel Serra, and Terry Snell) were immortalized by naming new species after them within the genus Brachionus. This was done during the oral presentation by Dr. Scott Mills on "Cryptic speciation in Brachionus plicatilis: steps towards unravelling a complex web of evolution." This presentation was the product of a workshop held in El Paso (TX, USA) about a year ago.

The symposium website was less user-friendly than at some larger meetings: e.g., the full program as a single file and the book of abstracts were not available on the website. Thus the participants relied on the printed documents supplied at registration.

Fig. 2. Poster presentation. Presenters gave a 2-minute, 'elevator speech' as an invitation for participants to visit their poster for in-depth discussions.

30 August – 4 September 2015

Ceske Budejovice, Czech Republic

Scientific Topics:

1. Patterns in biodiversity (Taxonomy, Biodiversity, Zoogeography & Barcoding)
2. Organism functioning (Molecular Biology, Phylogeny, Genetics & Biochemistry)
3. Population studies
4. Ecosystem functioning (Feeding, Trophic Interactions, Behaviour and Autecology & Population Ecology)
5. Integrative and applied research (Aquaculture, Ecotoxicology & Indicator Organisms)
6. Bdelloid Rotifera as models in evolutionary research (Special Session)
7. Resting eggs, dormancy and egg banks (Special Session)

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Literature Cited

Sharma, B. K., H. J. Dumont & R. L. Wallace, 2014. Rotifer biology: A structural and functional approach – Preface. International Review of Hydrobiology 99(1-2): 1–2. DOI:10.1002/iroh.1111.

"Banter See": A five year project to solve cyanobacterial problems

In the summer of 1990, a bloom of toxic cyanobacteria (nitrogen fixing species) was detected for the first time in Banter See – a brackish lake (during World War II a submarine harbor, average water depth 10m, area 1.15*106m2) close to Wilhelmshaven, Germany.

These problems occurred several times over the years – but not every year. In the years before the project started, there were only *Nodularia* and *Anabaena* spp. in the lake. In 2009, *Microcystis* sp. was found. From 2010 on, also other cyanobacteria species were present – especially *Oscillatoria species.*

Free jets are well known in chemical engineering and other technical fields for mixing low viscosity fluids in large environments. In the literature one may find the advantages compared with other mixing technologies. Details for an application of the free jet technique in a lake are given in Michele, J. and Michele, V. (2002). There, the various methods are also discussed that may mitigate the cyanobacterial bloom problems. Destratification was considered as a reasonable solution to overcome harmful algal blooms (HABs). Especially the aspect of delivering oxygen to the hypolimnion was recognized to be very helpful – thereby expanding the habitable volume for the fauna. Biomass would be

transferred in the foodchain from phytoplankton to *Daphnia* and other zooplankters and further up the food chain to fish population. In the literature the destratification is done by the recommended technique of a *bubble curtain*. This method is believed to be the most effective and also economical way to destratify large lakes. But the method of vertical jet mixing is relatively ineffective.

In a poster presentation – Michele, J. (2009) – we showed why vertical jet mixing is relatively ineffective. Vertical jets and also bubble plumes entrain themselves, creating a short-circuit in a short time. Mixing with the surrounding water is reduced.

Nevertheless, some successful results reported in the literature actually can be assumed to be due to the fact that in lakes there is always some cross flow to help mixing. But inclined jets have a long way to accumulate oxygen rich water, and feed it downwards into wind driven backflow. There is no short-circuiting!

A YouTube video (Michele, J.: YouTube video (2012) - flow simulation in a small aquarium) is available, which shows the right way of doing jet mixing in a stratified environment.

The results of the project are discussed in the detailed report: available at "Research Gate"; Lücking, P. and Michele, J. (2015). Two inclined propellers were installed (only 1500W and 2500W energy consumption, respectively) a minimal invasive attempt.

Destratification was accomplished, oxygen level was brought down to the lake ground at 10m depth, species changed: HABs were considerably reduced, higher oxygen levels made decomposition (odor problems) of accumulated wind driven algal masses a minor problem, phosphorus was reduced, and the lake was on the way to recovery.

The propellers were removed from the lake in 2013 providing an "off – on – test" for the destratification project. This showed the sustainable effectiveness of the applied minimal invasive method.

Just recently a new look at phosphorus revealed that 5400 kg of Phosphorus were "removed" from the water column during the project. Literature points to an effect of high oxygen concentration at the sediment surface.

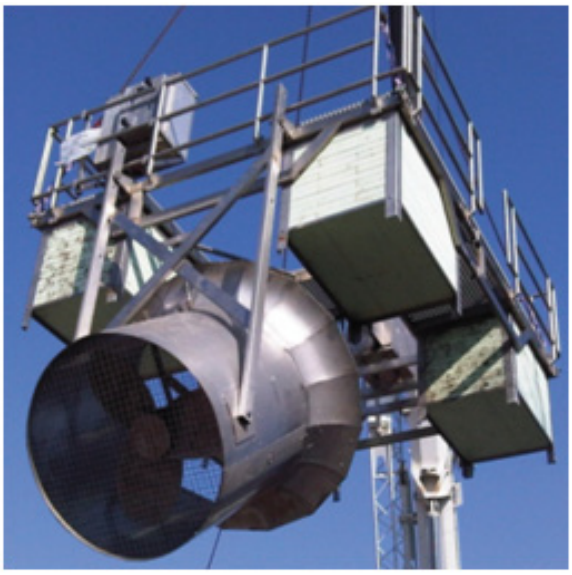
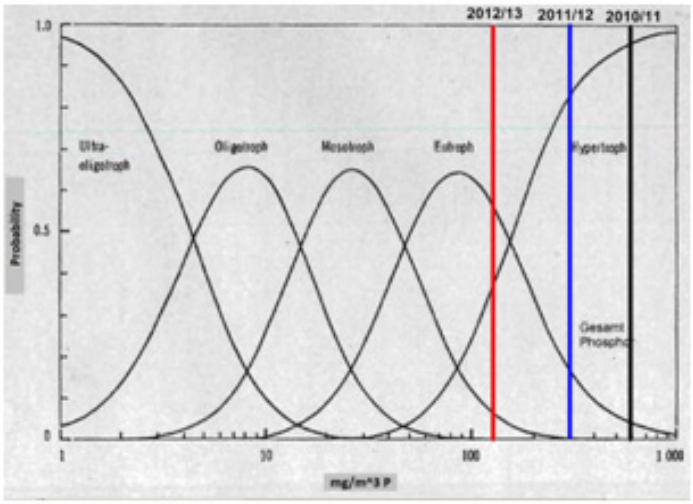


Figure 1 Propeller 1 – diameter 1.3m, speed 110 rpm

Figure 2 Flow simulation: Michele, J.: YouTube video (2012)



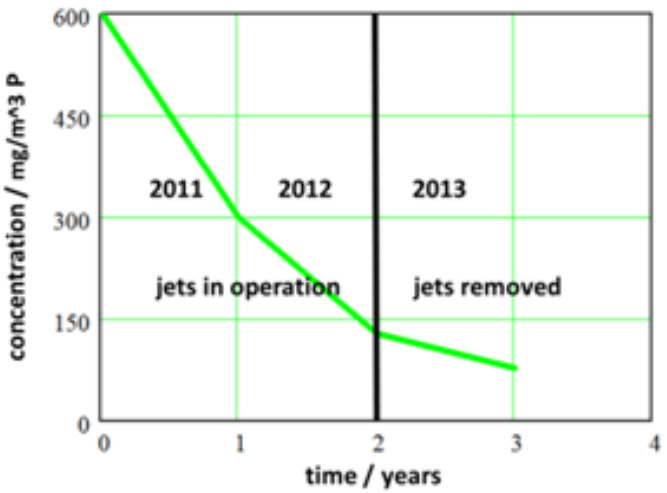


Figure 3a Phosphorus reduction during project years, Liebezeit, G. (2013), processed by the authors; this phosphorus reduction meant a reduction of 5400 kg from the water column.

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© The Author(s) 2014. This article is published with open access at Springerlink.com, www.kva.se/en 123, AMBIO, DOI 10.1007/s13280-014-0524-9

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Solar Saltworks Ecosystems

An Initial Step for your Valuation by Ecosystems Services in Brazil

In Brazil, evaporitic/hypersaline environments have been described only in the coasts of the states of Sergipe and Rio de Janeiro, but recent studies report extensive tidal floodplains in the states of Rio Grande do Norte and Ceará (**Figure 1**). These areas are of particular importance during the period of colonization, and are being used for construction of solar saltworks, mainly because of the characteristics of this type of soil, such as high salinity and waterproofness (Costa *et al* 2014).

However, along the Brazilian coastline, the largest salt companies in the country are located on the northern coast of the state of Rio Grande do Norte (**Figure 2**), mainly on the banks of the estuaries (Costa, 2013). These saltworks account for 97% of sea salt produced and exported, directly affecting the local and regional economies through the creation of jobs and payment of taxes (De Medeiros Rocha et al., 2009).

Figure 1 - Aerial view of larger coastal hypersaline floodplain of Brazil – Laguna Lagamar, at Porto do Mangue-RN. Photographer: Diógenes Costa (2012).

As for the total area, Brazilian saltworks are large artificial ecosystems (~ 150 km2) used for sea salt extraction, consisting of a series of shallow ponds (20-200 cm), interconnected, in which sea/estuarine water is abstracted and transferred from one pond to another by gravity or by pumping (**Figure 3**). Along this circuit, this water evaporates gradually, increasing the saturation of salts until achieving brine saturation of 240 gL-1 salt in the crystallizer pond, where the final stage of crystallization of sodium chloride takes place (Costa, 2013).

When evaluated in an integrated manner, solar saltworks are presented as a forced system (Margalef, 1973), whose management provides many ecosystem services. Nevertheless, this management can be exactly a key factor in such an ecosystem, balancing direct human benefits (higher salt production) with the need to preserve the ecosystem and ensure its balance. Thus, CICES considers the pathway from ecosystems and biodiversity to human well-being, by considering the flows between the environment and the social economic system, and those services can have both social and economic value (Haines-Young and Potschin, 2013).

Figure 2 - Landscape mosaic with solar saltworks, salt flats, islands and mangroves ecosystems in semi-arid coast (Porto do Mangue-RN).
Photographer: Diógenes Costa (2012).

Figure 3 - View of Salina Miramar, Areia Branca-RN. Photographer: Diógenes Costa (2014).

Indeed, one of the main ecosystems services provided by solar saltworks regards the conversion of hypersaline plains into productive aquatic ecosystems. This approach is grounded on the view that, against a scenario of widespread human settlement in the coastal zone, the conversion of inósticas areas into ecosystems represents an alternative for biodiversity conservation, since the construction of saltworks does not imply any geo-technical or ge-omorphological changes in the region, nor any chemical soil amendment. Further, these artificial ecosystems represent sites for refuge, nesting and feeding for migratory waterfowl species (Costa, 2013).

By abstracting water from estuaries or directly from the sea, the biodiversity of the initial evaporators is composed mostly of species typical of these environments. In the specific case of fauna, it is composed mainly of fish (e.g. *Anchovia* sp., *Elops saurus* Linnaeus, *Tachysurus* sp.), crabs (e.g. *Goniopsis cruentata* Latreille, *Callinectes exasperatus* Gerstaecke, *Ucides cordatus* Linnaeus) and shrimps (e.g. *Penaeus aztecus subtilis* Perez-Farfant, *P. brasiliensis* Latreile), which are captured during the larval or juvenile phase by strong uptake pumps. Due to the large area flooded by these initial evaporators, the advanced age of most of these ecosystems (some are >50 years old), and also due to the constant salinity, it becomes clear that these environments may be considered stable habitats for the development of populations of brackish water fish and crustaceans (Costa, 2013).

This biota is exploited by artisanal fisheries in Brazilian solar saltworks, representing, in many cases, the only source of income for many families. In addition to this financial aspect, fish is also an important source of animal protein for needy households. With the development of the aquaculture of fish and crustaceans, the use of *Artemia* (Branchiopoda, Anostraca) in the diet during the larval stage of many of these farmed species has become widespread due to the ease of obtaining and high nutritional value of *Artemia* (De Medeiros Rocha et al., 2012).

Evaluating the series of ecosystems services provided by solar saltworks in Brazil, it can be concluded that, in addition to the main service provided by such ecosystems, the production of salt without additional production costs, other associated services are of paramount importance to humans. After this analysis, it is clear the need for constant maintenance and management of biodiversity, which is directly related to greater control/increase of the production process.

This is observed because, on the one hand there is the hypersaline ecosystem, composed of a mosaic of integrated habitats (salt ponds), whose salinity is one of the main regulators of the biodiversity found in each habitat. Meanwhile, the logistics of sea salt production that implies in this spatial segmentation of habitats, which have as immediate response this spatial gradient of salinity, until the final sector of production (crystallizers). From this analysis, it was found that the saltworks are integrated systems, both from an ecological standpoint, but also in a broader approach, as they are one of the rare examples in which man can indeed integrate ecology with economy.

Acknowledgements

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Progress of Limnology in Mexico

Expert lectures on Limnology: Twenty-first century limnology and beyond, issues and principles (Jan. 26 - 30 January 2015).

Dr. Brian Moss, Emeritus Holbrook Gaskell Professor of Botany, University of Liverpool, United Kingdom and former SIL president, was invited by the National Autonomous University of Mexico (Facultad de Estudios Superiores Iztacala, FES-I) and the Postgraduate program of Limnology and Marine Sciences (PCMyL)) to give a series of lectures on recent advances in limnology. Prof. Moss, accompanied by his wife, arrived in Mexico a few days before his teaching programme began.

Photo 1. Dr. Brian Moss explaining the students how to improve their communication skills during a practical session.

Dr. Ignacio Peñalosa Castro (Academic Secretary, FES-I) and Dr. Juan Manuel Mancilla Díaz (Head of Research and Postgraduate studies, FES-I) officially inaugurated the Course on 26th Jan. 2015. During the programme, Dr. Moss delivered a series of talks concerning the following five themes:

- Limnology: What is really important?
- The catchment principle
- Freshwaters as disturbed systems
- Community determination, ecological assessment and legislation
- Climate change, conservation and the future.

The course was a very successful programme organized by the Laboratory of Aquatic Zoology (UMF, FES-I, UNAM, Mexico). The participants were from different Mexican universities including UAM Xochimilco, Instituto Politécnico Nacional (IPN), Faculty of the postgraduate program in Limnology and Marine Sciences and FES-I. In all, 55 participants attended this course. Dr. Patricia Dávila Aranda, the Director of the FES-I extended the administrative support for the course. Michael Anai Figueroa and Rosa Martha Moreno Sánchez Gutiérrez, both Master´s students of PCMyL (UNAM) helped the undersigned organize this event.

Stressing the importance of limnology, Dr. Moss discussed in a historical context the paradigms that have emerged in recent decades and how they influence our limnological research. For example, the relationship between freshwater systems, soil, climate, diversity and variability in communities, micro-evolution, predation and adaptations to disturbance of freshwater systems and their restoration and new techniques using molecular biology and analysis of stable isotopes, were all considered. Dr. Moss also developed the idea of seeing the freshwater systems as the blood of the earth. Evolution and development of aquatic systems in pre-human conditions, such as heterotrophic freshwater systems and the role of large vertebrates in these processes were discussed.

The other study aspects covered during this workshop were the relationships between the evolution of aquatic organisms and traits associated with disturbance and stability, biodiversity in relation to other systems, colonization and development of new water bodies, stability and endemism. The importance of ecological assessment and legislation, climate change, conservation and the future of freshwater systems were also discussed.

The participants found the course very useful because a comprehensive legislation on different types of freshwater systems, such as European Directive on Waters is not available in Mexico. With this basic information, considerable interest was generated among the participants. Both post graduate students and doctorate level researchers had the opportunity to benefit from the lectures and improve their research projects with ideas and suggestions made by Dr. Brian Moss.

Photo 2. Dr. Brian Moss commenting on oral presentations by the participants

In addition to lectures, there was a practical part, which was attended mostly by both postgraduate and doctoral students. Unlike regular limnological practical work, Dr. Moss suggested that the participants improve their communication skills for presentation at conferences. Therefore, students presented results of their ongoing research using power-point software. After each presentation, Dr. Moss suggested to the individual students to improve the style and structure of their presentations (e.g., letter size) (see photos 1 & 2 for discussion during the practical sessions).

Dr. Brian Moss, in addition to teaching the course, visited the potential sites for organizing the IX International Congress of Shallow Lakes, which will be hosted by us in Mexico in 2017. Different sites in Tlalnepantla (State of Mexico), Queretaro (Queretaro) and Merida (Yucatan) were shortlisted. Based on his observations he sent a list of the advantages and drawbacks of each site, to the organizers of the previous Congresses. At present Merida has been selected as the best option. A website for Shallow Lakes 2017 will be soon made and it include provisionally the programme for the next Shallow Lakes meeting. This will be reported in an issue of SILnews next year.

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Randomness tests to understand the populations and community dynamics in inland water.

The population and community studies are based on the existence of structured patterns, nevertheless in this scenario, there are error risks, because it is possibly prone to Type I errors (falsely rejecting the null hypothesis)(Tiho & Johens, 2007).

In this scenario, the null models are proposed assuming that communities are random; this means the absence of regulator factors that would be a robust statistical analysis (Tiho & Johens, 2007).

The randomness tests have applications in population studies, mainly in spatial distribution or in temporal occurrences, for example for the presence of birds in a temporal gradient in a lagoon (Zar, 1999).

For populations studies, the randomness tests have been applied for benthic populations, e.g. for amphipod crustaceans (De los Ríos-Escalante et al., 2011), or for commensalism interactions (De los Ríos-Escalante et al., 2014). The first step is to determine the presence of any kind of spatial distribution pattern (random, uniform or aggregated) and, in accordance with this pattern, verify the potential probabilistic model such as Poisson, binomial or negative binomial (Fernandes *et al*, 2003; De los Ríos-Escalante *et al*, 2011).

Other randomness potential applications would be the use of non-parametric run test (Zar, 1999), for study on occurrence of aquatic birds in a lagoon or wetland for birds watching observations, or zooplankton daily migrations.

On communities structures, the null models included, species co-occurrence, niche sharing, size overlap, guild structure, and macroecology. These models have been applied to understand ecological patterns in zooplankton in Chilean lakes, but did not agree with studies based on structured communities presumptions (De los Ríos-Escalante et al., 2013; Muñoz-Pedreros et al. 2013). A possible cause would be the low species number with many repeated species in sites that would have as main determinant characteristic of Chilean inland water communities (De los Ríos-Escalante et al., 2011).

On this scenario, the randomness would understand community and population ecology in Chilean inland waters would need more studies to explain other study interpretations and application of other ecological statistics that would improve data analysis perspective.

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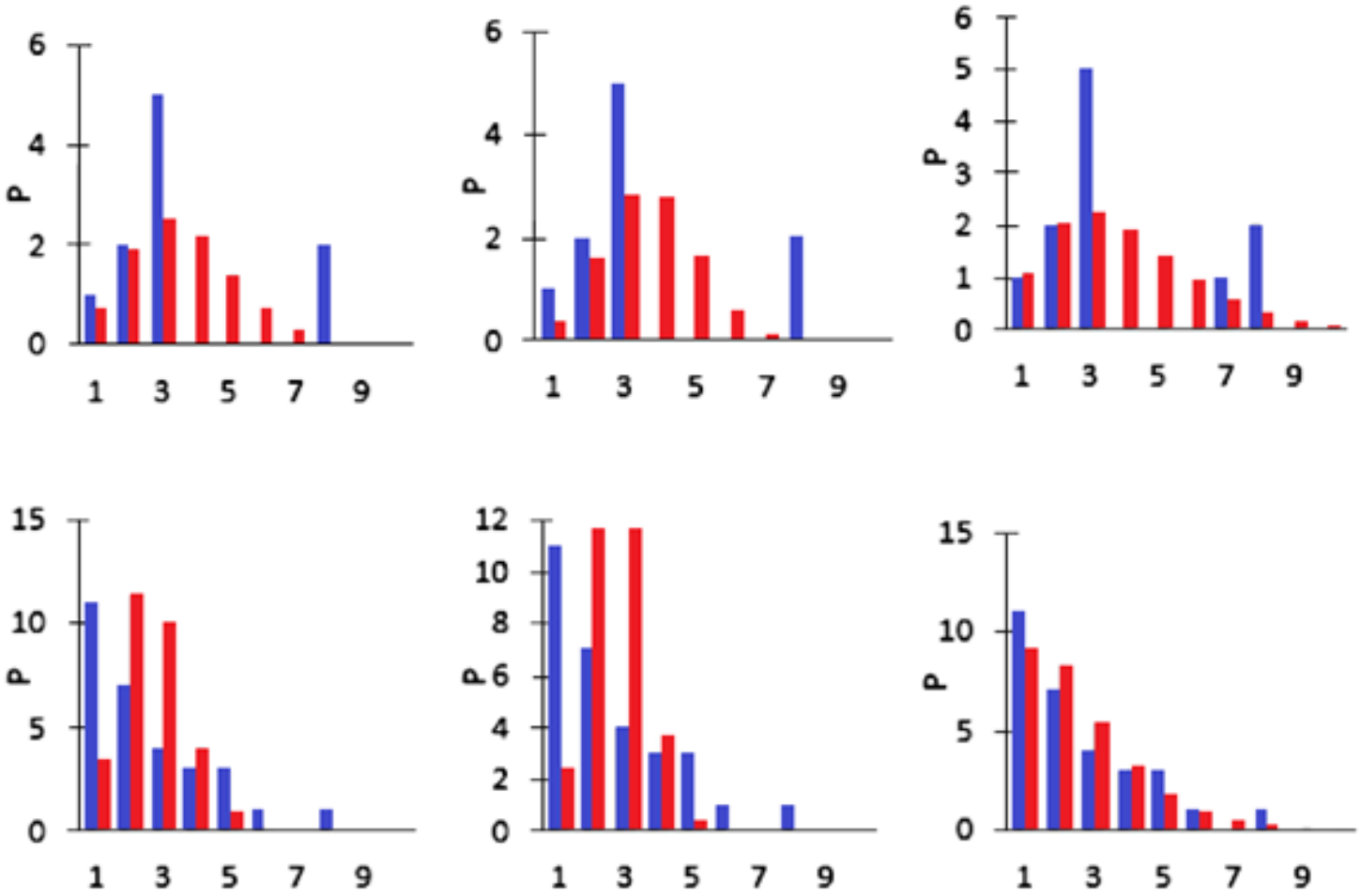

Figure 1. *Results of spatial distribution: Poisson (left), binomial (centre) and negative binomial (right) for H. patagonica (first row) and A. cholchol (second row). (Blue bars: observed frequency red bars: expected frequency).*

Figure 2. *Aegla sp., (top) and Hyalella sp. (bottom)*

Acknowledgements: Projects MECESUP UCT 0804, Tides Foundation (Grant TRF13-03011), and M.I. for her valuable comments and suggestions for improve the present manuscript.

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Obituaries

Dr. Lyudmila A. Kutikova (1928 – 2015)

Dr. Lyudmila Kutikova passed away on 20 October 2015 at her home in St. Petersburg, Russia. She was 86 years of age. In her we lost one of the greatest, world-renowned zoologists, whose works relate to many aspects of rotiferology. These include from classical taxonomy and phylogeny of rotifers to studies in present day limnology. She was both gentle and remarkable. We bow our heads in recognition of her skills, capacities, and outstanding achievements in Science.

Lyudmila was born on 22 November 1928 in Leningrad, USSR (now St. Petersburg, Russian Federation). The second half of her schooling period was during the years of the World War II, both severe and hard, but there was no hiatus in her secondary school education: in 1941-1943 Lyudmila was with her parents and with her younger sister; they were first evacuated and then moved to Moscow where Lyudmila continued to study.

In 1946, Lyudmila graduated from the secondary school in Leningrad, now St Petersburg, and became a biology student at the Department of Invertebrate Zoology at the Biology and Soil-Studies Faculty of the Leningrad State University (named after A.A. Zhdanov in those days). She was fascinated by the brilliant and passionate lectures of her first university teachers – the outstanding professors in zoology [Valentin A. Dogel, George (Yuri) I. Poljansky, Artemiy V. Ivanov], ichthyology (Nikolai L. Gerbil'sky), embryology (Boris

Lyudmila Kutikova in 1958 (photo from the family archive).

P. Tokin) and marine biology (Evpraksiya F. Gurjanova). However, Lyudmila's first steps into systematics were achieved by plodding through parasitological research. While still a student, she investigated the parasitic fauna of the polar cod (*Boreogadus saida)*. During this research, she discovered a new sub-species of Monogenea (Plathelminthes): originally described as *Gyrodactilus arcuatus proximus* by Kutikova (1950), this group was later raised to species status and renamed *Gyrodactilus kutikovana* by Malmberg (1964).

Professor, Dr. Lyudmila Kutikova (in the center, sitting) celebrating her 80-th anniversary with friends and colleagues from the Zoological Institute RAS (2008, photo from the archive of the Laboratory of Freshwater and Experimental Hydrobiology, Zoological Institute RAS, St. Petersburg).

The University Diploma of Lyudmila Kutikova was based on her studies on fish breeding (*Salmo trutta*) in the fertilized fish-ponds in Ropsha (the suburbs of Leningrad).

Recalling her studentship, Lyudmila described herself as a theatre-lover and frequent attendee of the performances and concerts at the Philharmonic Hall. She once said that a real biologist who studies natural objects (e.g. organisms, their habitats and environment) cannot remain indifferent to the beauties of Art *sensu lata.* [This idea echoed in my soul, I share it completely; for me also the word "beautiful" has always been a synonym to "natural"].

Lyudmila liked reading and tried herself in creating poetry; enjoyed the classical music concerts conducted by Kurt Sanderling, Yevgeny Mravinsky and Alexander Gauk; she was also fond of music by Aram Khachaturian and other luminary classics (composers and performers) of the musical world. This artistic attitude of her was later transmitted to her passion for scientific research and publications. She participated in several sports with great enthusiasm as well; she tried gymnastics, skating, skiing and cycling.

After graduation from the Leningrad State University in 1951, Lyudmila became a Ph.D.-student at the Zoological Institute of the USSR Academy of Sciences under the supervision of Professor Ivan I. Sokolov at the Department of Hydrobiology. Professor Vladimir I. Zhadin (the Head of the Department) directed her to rotifer studies. This was not an easy task, particularly because there were no specialists in rotifer taxonomy in Russia in those times.

Lyudmila had to learn rotifers rotifers by herself and she succeeded in this hard work. In 1954, Lyudmila defended her first dissertation – the Ph.D. Thesis entitled '*Materials on systematics and biology of rotifers of the fauna of USSR (Family Brachionidae and Family Euchlanidae)'*. From 1955 onwards and during the next 52 years, Lyudmila worked permanently at the Laboratory of Freshwater and Experimental Hydrobiology of the Zoological Institute of the USSR Academy of Sciences in Leningrad (now St. Petersburg) and went through all steps of a typical research career: from Junior Scientist, to Senior Scientist, to Principal Scientist.

Lyudmila Kutikova investigated rotifers from all over the world, from tropical latitudes to the Antarctic; she studied rotifer fauna in the Aral, Caspian and Baltic seas, the lakes Baikal, Issyk-Kull, Peipsi, Onega and Võrtsjärv, Rybinsk and Irkutsk reservoirs, the rivers Neva and Tyup, fish ponds and many other small and large water bodies. Lyudmila Kutikova was the initiator of using the morpho-functional approach for the development of systematics and unveiling the evolution of rotifers. Her pioneering fine research of the corona and mastax as the key morphological features of rotifers provided the basics for the future ultrastructural investigations of rotifers.

In 1970, she published her fundamental work "*Rotifers of the fauna of the USSR*", a 744 pages-thick book, which immediately became a classical edition, and is still used by the rotiferologists worldwide. For the publication of this monograph, in 1973 Lyudmila earned a doctoral degree, the second (highest) scientific degree in Russia – the Degree of Doctor of Sciences (D.Sc.). For her outstanding research, she was given several awards, medals, diplomas, recognitions and letters of gratitude, including the Certificate of Achievement that she received from the International Rotifer Family at the Symposium Rotifera VIII at St. John's University in Collegeville, Minnesota, USA (1997); she valued this latter Certificate immensely.

Lyudmila generously shared her knowledge with younger researchers on the training courses where she taught how to identify rotifers. Such courses were regularly organised by Lyudmila at the Zoological Institute of the Russian Academy of Sciences in the 1970s through 1990s. In 1993, she was conferred the Title of a Professor for her pedagogical achievements. Keen to learn and use the new technologies. she created an electronic resource: a Catalogue of the freshwater rotifers (Rotifera) of the North-Western Russia, which was published at the web page of the Zoological Institute RAS (**www.zin.ru/books/rotcatalog/index.html**).

In addition to taxonomy, she paid much attention to the research on ecology of rotifers in different waterbodies and to the role of rotifers in the water purification processes. Starting in 1981 and in the subsequent 18 years, Lyudmila excelled at balancing research, teaching and heading the Leningrad (St. Petersburg) Branch of the All-Union (Russian) Hydrobiological Society. She was brave enough to withstand not only the intensive research work, expeditions, lecturing and conferences, seminars and Russian Hydrobiological Society' meetings, but even survived the major hardship in her life – the irreparable loss of her still-young daughter. In those hard days, her strong character and work on the beloved rotifers provided her the 'life vest'.

Lyudmila's responsive and poetic nature was always lightening her from inside. Even in her 80s, this gracious lady with marvelous (natural!) hairdo and dark eyes twinkling with humor in a beautiful face, shone with endless charm and deep intellect.

In the more recent years, Lyudmila wrote an ingenious essay 'A Fairytale of the Amazonian Kingdom' (in Russian) – a witty allegorical story about the role of rotifers in the evolution of life on the Earth.

Kutikova's true scientific heritage comprises five books (containing basic information on rotifer taxonomy, phylogeny and evolution, guidebooks for identification of rotifers including Bdelloidea, rotifers in the fauna of aeration tanks etc.; some are listed below) and more than 120 research publications. She was editor of 10 books and several collections of papers written by different authors. Among other colleagues who were working closely with Lyudmila, I was a lucky one to learn from her not only the methods of treating and identifying rotifers but, even more importantly, had an excellent example of devotion and purposefulness, immense capacity to work, and the endless creative enthusiasm which this strong though graceful woman possessed.

Lyudmila Kutikova, the outstanding zoologist-rotiferologist will be always remembered by her family, colleagues and followers in Russia, as well as by the members of the International Rotifer Family.

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Professor, Dr. Lyudmila Kutikova in 2008 (photo from the archive of the Laboratory of Freshwater and Experimental Hydrobiology, Zoological Institute of the Russian Academy of Sciences, St. Petersburg).

Oscar RAVERA (1925-2015)

Oscar Ravera was one of the most lively and active protagonists in the field of ecology. A man of great culture, Oscar had a genuine interest in knowledge, an interest fed by his insatiable childlike curiosity. Arriving young, at Pallanza, he found fertile ground to develop his passion for aquatic ecology, a passion that led to both important scientific achievements and very large-scale initiatives.

Those who had the good fortune to work with him soon learned of his uncommon inclination to include students and young researchers in his many discussions on original projects. He had the ability to translate ideas into practice through the design and construction of novel field and laboratory instruments. Oscar, not only conceived innovative research projects, but he also developed many new study techniques. He embodied the profile of the perfect researcher, skilled both in the field (those who saw him at work on the lakes were filled with admiration) and in the laboratory.

Thanks to the sweet memories of the years of his youth spent at Pallanza, we had the opportunity to host Oscar again at the Institute during his last fifteen years.

Gone with him, is not only an important piece of our limnological history but also gone is the history of the ecological thought.

We have lost a friend, a teacher, and a colleague, who contributed greatly to the growth of the scientific community he pioneered.

Oscar started his career in 1949 at the Istituto Italiano di Idrobiologia, under the Direction of Prof. Edgardo Baldi. He stayed until 1956, performing basic research in limnology, which gave him a basis for further studies on theoretical and applied problems in fresh and brackish water ecology. After two years working as a Chief , Micropaleontological Service, Dept. of Mining, Edison Company, he went on to 30 years of scientific activity at the Joint Research Center (JRC) of the Commission of the European Communities (CEC). His scientific activity made the JRC one of the most important reference centres in Europe for aquatic ecology. After his retirement from the JRC, he held the Chair of Ecology, University of Venice (Ca' Foscari) until 1997. In 1998, his passion for research brought him back to his origins, at the Italian Institute of Hydrobiology (presently the Institute for Ecosystem Studies).

Out of many ecological topics he pioneered during his long career, four relevant ones were:

- contamination of lake ecosystems by radioisotopes and the biological effects of ionizing radiation
- eutrophication processes and the search for corrective strategies and interventions
- accumulation of heavy metals by freshwater mussels, and the effects of heavy metals on the planktonic community
- evaluation of the state of the Venice canals and the production and decomposition of macroalgae in the Lagoon of Venice.

May 2010, Oscar, with his wife Nicoletta, searching for Anodonta in Lake Trasimeno with Lucio Castagnolo and Karl-Otto Nagel

His discovery of the great accumulation by freshwater mussels of Mn^{54} 100,000 times the concentration in lake water from fall-out was one of the most convincing demonstrations for modifying the European radioprotection rules on the risk of the bioconcentration of radioisotopes.

The same methods used in the study of radio-contamination were transferred to the study of heavy metal pollution, producing important results in the assessment of the fate and the biological effects of low concentrations of toxic metals. His best results were obtained by applying, as a pioneer in Italy, the "mesocosms'" method in tackling ecological and pollution problems. As an example, these experiments provided a better insight into the role of lake trophic conditions as an amplifier or as a minimizer of the biological effects of toxic metals.

He was also the first to use fall-out radioactivity for dating lake sediments. He used short-life zooplankters as "sentinels" of radioactive contamination and the fate of radionuclides in lakes, and long-lived mussels as bioaccumulators of radioisotopes over time.

In addition to his scientific research, Ravera had broad involvements as adviser to the CEC, Bruxelles in formulating environmental research programmes (1971-1990). He was a member of the Technical Bureau of the OECD International Programme on Eutrophication (1972-1980); a member of the Technical-Scientific Committee of the International Commission for the protection of Italian-Swiss waters (1972-1987); the scientific coordinator of the UNESCO International Expert Group on the Lagoon of Venice (1997-1999); a member of the "Special Programme Panel Ecosciences" of NATO, Bruxelles (1979-1983) and several others. In addition, he collaborated with the International Expert Commission, coordinated by Prof. Ph. Bourdeau, on the environmental impact of the mobile flood barriers on the Venice Lagoon (1998).

He numbers, among his major achievements, the promotion of ecology in Italian universities, the training of many Italian and foreign students, and helping to raise the consciousness of the general public as regards ecological concepts and the principles of environmental ethics. He was co-founder, president and emeritus member of the Italian Society of Ecology (S.It.E.).

In collaboration with Prof. A. Moroni (Parma), he brought ecology to a firm footing in the academic community of Italy,

As national representative of the European Ecological Federation (EEF) and of the Societas Internationalis Limnologiae (SIL), he was awarded as Global 550 Laureate in 2001.

Between 1949 and 2012, Oscar authored more than 240 scientific papers, of which the 10 listed below represent only a small part of the breadth of the ecological topics that he addressed.

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Prof. Leonid Kudersky (1927 – 2015)

The State Research Institute of Lakes and Rivers Fisheries is sad to announce that Prof. Leonid Kudersky, honored Scientist of the Russian Federation, and honored worker of Russian Fisheries, died on September 12, 2015, at the age of 87.

Leonid rose in 17 years from the job of an assistant at the State Research Institute of Lakes and Rivers Fisheries to its Director. In recent years, he worked at the Institute of Limnology, Russian Academy of Science, St. Petersburg.

Despite a considerable administrative burden, he was actively involved in the research on hydrobiology and ichthyology, and was at very active in aquaculture research. Theoretical and applied fisheries issues made up a significant part of the creative heritage of Leonid Kudersky.

He authored over 600 scientific papers, together considered as "The selected works of research on ichthyology, fisheries and related sciences" (Kydersky L.A. "The selected works. Volume 1. The research on ichthyology, fisheries and related sciences" St-Petersburg-Moscow, 2011. 425p. Kydersky L.A. "The selected works. Volume 2". The research on ichthyology, fisheries and related sciences" // St-Petersburg-Moscow, 2012. 411p. Kydersky L.A. "The selected works. Volume 3. The research on ichthyology, fisheries and related sciences" // St-Petersburg-Moscow, 2013. 524p.).

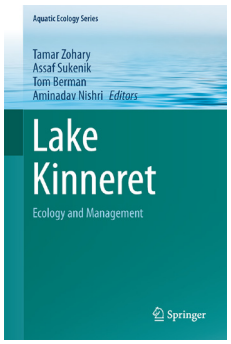
Prof., Dr. Leonid Kudersky in his study room in at the Institute of Limnology Russian Academy of Science

Leonid Kudersky was characterized by the highest professionalism, impeccable honesty, selfless dedication and organizational skills. In memory of loved ones and colleagues he was not only a research scientist and teacher, but also a man of exceptional intelligence and friendliness.

Book Reviews

Lake Kinneret: Ecology and Management

Tamar Zohary, Assaf Sukenik. Tom Berman and Ami Nishri (Eds.). 2014. Aquatic Ecology Series (Series Editor, Jef Huisman), Springer Publishers. 683 pages. (Hard Cover) ISBN: 978-94-017-8943-1 (Print) ;978-94-017-8944-8 (Online). Price 158, 99 €



The book makes a head-on start with Chapter 1 that provides the reader with the *General Background of Lake Kinneret* by Berman *et al.* The authors present a short historical resume of the lake research and the lake region, including how man-made changes have impacted the lake's ecosystem. The lake seems to have existed in its present form for nearly 18000 years. A map of the lake and its surroundings shows bathymetry and location of sampling sites, etc. Anthropogenic changes in the lake are traced back from 1927 to up to 2012. Chapter 2 is also a multiauthor chapter by Ben-Avraham et al. It deals with *Structure and Tectonic Development of Lake Kinneret Basin* , obviously because the lake is located in an area of tectonic complexity.

The lake has two sub-basins, with Kinneret Valley to the south. The tectonic activity takes place across the lake's basin. This is evident from the lake's morphological features and recent seismicity. A short chapter but a lot of literature is cited (nearly 4 pages of reference list). Mordechai Stein (single author) provides us the lake's limnological history from the late quaternary period. This short 20-page *Late Quaternary: Limnological History* is reflected in the sedimentary sequences. It seems that mechanism of discharge and contributions of brine (Ca-chloride) have been a controversial issue among the researches. A table on page 46 compares chemical composition and isotope ratios of 87Sr/86Sr. These ratios are compared with those of freshwaters and saline waters in Dead Sea and Lake Kinneret.

The Chapter 4 is by Tibor et al. and it deals with lake's *Bathymetry and Bottom Morphology*, both of which are influenced by the lakes' complex tectonic structure and by high annual sedimentation in the last 50 years in the southern lake part, making it significantly shallower between two depth measurements within 21 years. Interestingly, the lake lies 209 m below the mean sea level. Chapter 5 on *Geomorphology* is a two-author chapter and it among the shortest chapter in the book. It describes Physical, Geological and Geomorphic processes. The lake seems to have highly variable geology, geomorphology, soils, climate and vegetation. It seems the human impact on the land degradation began with the appearance of human beings about 1.5

million years ago. In the past 90 years or so, several natural disasters have afflicted the lake basin.

Part II contains the following 4 chapters (chapters 6-9). Among these, Chapter 6 is headed as *Meteorology*; it is stated that high temperature (annual mean 21°C) and wind regime (~10mS^{-1}) are the key factors in the climate. The water balance is controlled by the rain on lake's watershed. Interestingly, the rainfall on the lake self is lower than the surroundings.

This is attributed to unique topography of the lake which lies about 210 m below the sea level. Since the mid-1970s the global mean temperature has increased in the area. The rate of increase for the maximum temperature (June-August) in 10 years, 0.6°C, is higher than for the minimum temperature.

Chapter 7 (authors Rimmer and Givati) deals with *Hydrology*. The lake's watershed (2730 km^2) is divided among Israel, Lebanon and Syria. Thus, in this respect the lake Kinneret may be considered an international lake. The expected hydrological changes in the Lake Kinneret basin following the trend of global warming are significantly smaller than the direct anthropogenic changes affecting the amount of water in the basin. It seems despite that both the watershed and the lake are relatively small (area 1687 km^2) it is difficult to regulate the lake's water balance.

Salinity is the subject of Chapter 8 by Rimmer and Nishri. The salinity in Lake Kinneret fluctuates between 190 and 280 mg l^{-1} chlorides, derived mainly from groundwater that emerges from both on shore and offshore springs. Salinity for the future is predicted using a complete mixing type model. Finally, in addition to introduction to the salinity, history of salinity, hydrogeological set up and chemical sources of salinity are discussed. Also discussed is the lake salinity model. Apparently, the mentioned salinity levels do not much affect the flora and fauna since there is no mention of it.

Chapter 9 *The Seasonal Hydrodynamic Habitat* is authored by Imberger and Marti from Australia. The chapter deals mainly with annual thermal regime of the lake based on high resolution thermistor chain and meteorological data for the period April 2007—April 2008. All changes are described on the basis of seasonal changes divided into five regimes, each with one or more months. The part from April to July is most detailed because of the increased warming up and wind effects in this period.

Part III (pages 160-306) deals with *Pelagic Communities*, starting with Chapter 10 on *Phytoplankton* by Zohary et al. (6 authors). Dinoflagellates (*Peridinium gatunense*), as most of us interested in Lake Kinneret know from the publications, were until about 20 decades ago the most dominant phytoplankton in the lake. *P. gatunense* bloomed regularly in spring until the mid1990s but thereafter its blooms were limited to only rainy periods. Also cyanobacteria, chlorophytes and diatoms form secondary phytoplankton. Starting in1994, the dinoflagellates decreased along with some other changes in the lake, apparently in response to "increase stress at the ecosystem level" and to the appearance of toxin producing cyanobacteria.

There was a substantial loss of species due to a regime shift, and a change to less edible phytoplankton species. Remote sensing of Chl *a* – a proxy of algal mass indicates that phytoplankton concentration extremes at the lake surface mostly do not exceed a ratio of 1:2. The Chl *a* levels are generally higher in the northern part, i.e. close to the Jordan River inflow and nutrient availability is relative higher at the point where the river water enters the lake. Blooms of *Peridinium gatunense* are now an exception rather than a rule as was the case about 20 years back.

Since 2006, information on the underwater light in the lake is being acquired from MERIS for use to map the spatial distribution of lake's phytoplankton. Interestingly, sub-chapter authors are indicated and a long Table 10.1 occupies five full pages on the species that are categorized depending on the chronology of their occurrence in the lake. An impressive section deals with long-term changes at the species level. Several of the phytoplankton illustrations (photos and graphs) are in colour. Strikingly, though this chapter comprises about 30 pages, the reference list is just two pages.

Next, Chapter 11 has three authors, including Zohary the senior author. It deals exclusively with *Peridinium gatunense,* which was the most important species until the shifts in species composition occurred in mid 1990s. Zohary et al. call this dinoflagellate as "ecosystem engineers"- a model organism for studying freshwater dinoflagellate blooms. The chapter further tells us about the historical aspects as well as about the pigments. A sub-section is devoted to the annual life cycle of *Peridinium* (Fig. 11.3; page 196). It seems we know little of the sexual component of its life cycle. The authors discuss growth and physiological characteristics at some length, along with photosynthesis, respiration and diel vertical migration. Also P and N uptakes and metabolism are discussed and followed by half a dozen relatively less important study aspects. There is 1.5 page summary, which sums up all the study aspects—not all chapters offer this sort of expediency, unfortunately.

A brief Chapter 12 reports on *Cyanobacteria* in Lake Kinneret: although many species of cyanobacteria are on record since 1969, their first bloom of *Aphanizomenon ovalisporum* was observed in 1994. This species seems to have a unique mechanism of phosphate assimilation as reported in literature. The chapter discusses most important cyanobacterial species in Lake Kinneret, as well as their impact on lake's water quality and management.

Gal and Hambright deal with *Metazoan Zooplankton* in the next 21 pages (Chapter 13). The zooplankton is described on temporal and spatial scales with seasonal patterns along with description of patchy distribution of various zooplankton groups. The shifts observed in the lake since mid-1990s relate to the increasing dominance of cyanobacteria and unpredictable occurrence of *Peridinium* sp. A modelling study links changes in lake water level but zooplankton abundance is an important study aspect. The changes in zooplankton imply that nutrient recyclers, especially for microzooplankton account for about 85% of daily mineralization of P and N in the lake. The chapter provides a short summary before the short references list, which covers just a little more than one page.

The Chapter 14 briefly deals with *Protozoa* (unicellular zooplankton): *Ciliates and Flagellates* (authors Hadas et al.). Both heterotrophic and mixotrophic protozoa are an important constituent of the microbial food web since the 1990s. Ciliates and flagellates are of great significance in mineralizing the organic matter and cycling of macronutrients, C, N and P. Ciliates are critical food source for copepods. However, routine monitoring of ciliates was started more recently, in 2006, but it is already become clear that these protozoans are the drivers of carbon flux and nutrient cycling.

Berman et al. (Chapter 15) describe the role of *Heterotrophic and Anoxigenic Photosynthetic Bacteria* in Lake Kinneret. The chapter reviews the work on these bacteria and then deals with their morphological and phylogenetic diversity of both these bacteria and Archea. More recently, 2001-2011, the bacterial productivity seems to have significantly decreased. The most abundant among the phototrophs is the

green sulphur bacterium *Clorobium phaeobacteroides* Pfenning. This species is described as a major contributor (27%) to the sedimenting organic matter to the lake bottom. *Fish Biology and Ecology* (Chapter 16) by Ostrovsky et al. is a short chapter but with five pages of references. The lake has 19 native species of fish species, of which three species are endemic to the Jordan Valley System. Some species can breed in the lake, three others cannot and need regular stocking. The authors present growth rate data and L:W relationships (Table 16.2; page 278) for the dominant cyprinids, cichlids, grey mullet and catfish. Introduction and invasion of fishes, changes in fishing intensity and other changes in the lake have led to long-term changes in the fish community composition.

Changes in the littoral of the lake due to water level fluctuations Decreases in level) have also affected many fish species adversely. Chapter 17, *The Pelagic Food Web,* is the concluding chapter in Part III. The work in the last four decades was designed to get more information on our understanding of the food web of Lake Kinneret. Diverse techniques (see section 17.1 on page 294), including feeding experiments, gut content analyses, stable isotopes and modelling, were used to understand the food web functioning, The obtained results are presented in Figs 17.1 and 17.2. Micrograzers (ciliates, heterotrophic flagellates and rotifer) have a central role in the food web scheme. These studies have led to revision of our understanding the lake's food web as updated in Fig. 17.2. Last but not least, it seems that role of cormorants and catfish at the higher trophic levels could be important but so far we know little.

Part IV *Nutrient Sources and Biogeochemical Processes* has eleven chapters (Chapters 18-28). Chapter 18 by Rom et al. deals with *Material Loads from the Jordan River.* This river is a major source of both water and allochthonous particulate matter to the lake. The river thus impacts the lake's ecosystem. The authors base their work using data on material loads for over 40 years (1971-2012; Table 18.2), based on discharge measurements at a point downstream and the Hula Valley. The measurement system was fully automated by 1996 and derived by data analyses to a single coherent record. There were significant long-term declines in the loads of N and P but the ratios of these two nutrients in the discharge remained constant. The data do also reflect anthropogenic activities in the watershed, including both increasing population and effluents in the 1970s. However, pollution sources were all removed by 1994. Interestingly, this paper has a short discussion on the material loads from Jordan River to the lake, corrections of data, etc.

External Sources of Nutrient is the caption of Chapter 19 written by Nishri and Leibovici. It is interesting to learn that the primary source of N is dissolved inorganic nitrogen (DIN) originating in southern Europe and carried over the Mediterranean Sea by the rain clouds. The authors present evidence that N is cycled in the aquifers in the mountains before enter it the Jordan River and the lake. Nearly half of the N comes from this source and the remaining 50% from the lake's own watershed. The main sources of P to Lake Kinneret are the river and dust. The former source predominates in winter while the dust is more important in the dry season. In the latter case, P in the dust originates from P fertilization of cultivated soils. It is an interesting and important piece of work that needs a lot of national and international cooperation. A job well done by the authors!

The Chapter 20 deals with *The Phosphorus Cycle* and is authored by Eckert and Nishri. At the first look both the previous chapter and this one could have formed one chapter but the insiders know better to keep it the way it is. The chapter gives us a 40-year overview on the subject. At present, the load of bioavailable P from dust exceeds of the riverine load. Long-term trends indicate dramatic changes in the TP inventory. In the 20 years between the early1980s and early 2000s, TP content of Lake Kinneret dropped by 30%. This is linked to changes in man-made perturbations in the watershed. The paper further discusses the relationship between the observed changes in P loading rates and changes observed in the Lake Kinneret ecosystem. This is also an interesting piece of work see e.g. Fig. 20.10 (on page 361) that shows a model of P mass balance in Lake Kinneret.

We are back to nitrogen again in next Chapter 21 in which Nishri describes *Quantitative Aspects of the Nitrogen Cycle*, including the sources as awell as sinks. Discussion is also devoted to internal flux of ammonia from the deeper layers to epilimnion. A schematic pattern of nitrogen cycling in the lake is illustrated in Fig. 21.6 (page 378). It seems the riverine inputs are rich in nitrate, which supports all the biological activities in epilimnion, producing PON that subsequently settles and is mineralized to form NH4, which may be transported upwards to photic zone. In summer, the DIN levels in epilimnion become very low. This enables appearance of N2 fixing cyanobacteria, which contribute a considerable amount of external or atmospheric N to the epilimnion. There is a brief reference list.

Hadas is the author of a short Chapter 22, *Microbial Processes within the Nitrogen Cycle.* Obviously, biological processes within the nitrogen cycle in Lake Kinneret are mediated by microbial population. They are seasonally divided changes into stratification, DIN and in O2 concentration in epilimnion and hypolimnion and external N sources such as inputs of nitrate and organic N via the Jordan River and the atmosphere, all have an impact on microbial diversity and activity.

Nishri and Stiller are co-authors of Chapter 23 on *Dissolved Inorganic Carbon* (DIC). Spring, CO_2–only users such as *Peridinium gatunense* often predominate and develop a bloom even though levels of ambient aqueous CO_2 are rather low. Authors claim massive precipitation of calcite which occurs if the bloom supplies CO_2 needed for algae to develop and maintain the bloom. Low winds seem to restrict gas exchange and facilitate the gradual accumulated deficiency in $CO_{2(aq)}$ in surface water leading to higher pH and rise in omega calcite such that calcite precipitation occurs. About one-third of the autochthonous calcite precipitating from the epilimnion dissolves in the lower water mass. However, only 22.5% of the seasonal accumulation of DIC (~90% HCO3) in the deeper water originates from calcite dissolution and the rest 77.5% from direct biodegradation process. *Aphanizomenon ovalisporum* that appeared in the lake about 2 decades ago uses HCO_3 as carbon source.

Clay minerals form a significant load of autochthonous material that dilutes the sedimenting calcite concentration. In other words, such a mechanism allows that an important part of DIC stays in suspension as calcite and can become a source of carbon on its dissolution. *Primary Production* is the heading of Chapter 24 written by Yacobi et al. The production measurements are based on Radiocarbon uptake technique since 1972. The average daily primary production amounts to 1.66g C $m^{-2}day^{-1}$. This average value is certainly high but it is probable because the lake is deep. There is a marked seasonal pattern with high PP values occurring in April and May, i.e. the period of spring maximum. The lake has a chemosynthetic microbial activity; it is fuelled by H_2S oxidation in the zone of chemocline is estimated to contribute 20-30% of the total annual primary production in the lake. This is important for assessing the lake's carbon budget.

Tom Berman and his colleagues are authors of Chapter 25, *The Fate*

of Organic Carbon—obviously in Lake Kinneret. All the photosynthetically produced organic matter is apparently cycled through the microbial loop. Bacteria, including their production, respiration and oxygen demand account for about two-thirds of the gross primary production that averaged about 2.3 g C m^{-2} day^{-1} during the last decade (2001-2011). Bacteria and phytoplankton alone accounted for 80% of the carbon for their respiration and zooplankton the rest. This is then 100% but the authors in their Abstract further say that most of it (~83%) of the Organic Carbon (OC) is eventually respired while some 15% of the OC is transferred annually to sediments. After depletion of oxygen in the sediment sulphate becomes the dominant oxidant. Sulphate reduction was the dominant anaerobic terminal decomposition process in Lake Kinneret. It seems sulphate reduction was triggered by decline and decomposition of *Peridinium*. The sulphate reduction, and the sulphide thus formed accumulates in the hypolimnion to concentrations of up to 400 µM. Methanogenesis is restricted to sediment layers that are free of sulphate 3-5 cm below the surface sediment. Seasonal profiles and signatures of dissolved methane in the sediment pore water indicated anaerobic methane oxidation in the deeper sediments. All in all, it is an interesting chapter with useful information that is well illustrated with good quality Figs. and Tables which mostly contain long-term data of 2001-2011. Chapter 26 is entitled S*eston and Organic Matter* authored by Parparov and three more. The study was undertaken during 2000-2010 both on Lake Kinneret and River Jordan. Phytoplankton was the largest (24.7%) component of the live part of seston. But this % could increase to up to 90% if a dinoflagellate bloom appeared. Detrital part on the average contained 60% of seston mass. Seston sources and sinks were nearly balanced and there was a long-term stability of seston dynamics.

Sedimentation Processes are discussed by Ostrovsky et al. in a short Chapter 27. Gross sedimentation rates using sedimentation traps have been in operation in Lake Kinneret since 1999. To date the material captured in these traps ranges from 1.9 to 6.0 g m^{-2} day^{-1} at the lake centre. The accumulation there is in accord with the sediment core dating. About one-third to 42% of the material in traps is organic matter with algae as the main component. It seems the peripheral stations where sedimentation was also measured, the sedimented amounts are lower. The fate of the dominant algal phyla was followed over time. The authors argue that large sized algae in the traps have better chances to survive in the deeper layers. Changes in the sedimentation rates over the course of time are attributed by the authors to load fluctuations from the watershed and water level fluctuations. Chapter 28 concerns *Dynamics of Redox- Sensitive Elements* and is written by Nishri and Halicz. This is also a concise chapter, the last one in Part IV. The authors assume among several other assumptions by them that turbulent convection sweeps down the epilimnetic Fe and Mn oxides forming an assemblage of both reducing and oxidising agents in the metalimnion where both biodegradation and mineralization of these particles form a redox gradient zone. Both depletion of oxygen and reduction of Fe and Mn are shown to occur. In both oxic and anoxic layers there are indications for the removal of soluble Molybdenum, Uranium and Antimony, followed by sedimentation of particulates. Frankly, I found the contents very technical for a non-professional as me but I believe it is a useful data for a fuller understanding of the processes that go on in the sediment water interphase but also in the layers above. Both the Abstract and detailed Summary will go a long way to help those interested in the chapter contents.

Part V *The Littoral* comprises only Chapter 29: *The Littoral Zone*, which has 16 pages. As in other large lakes, littoral part of Lake Kinneret comprises only a small part of the lake area. However, the role it plays in the lake's economy, better the lake ecosystem, is disproportionately important as it provides resources, which are otherwise not available to the lake ecosystem. Shoreline vegetation provides a "window of opportunity" (I quote the authors) for the fish to reproduce, feed and find refuge. To an extent, pelagic zone partly reflects the littoral. Water Level Fluctuations (WLFs), especially the drawdowns may lead during years of high water level to a decline of the rocky littoral, limiting the biota that dwell in this habitat. The opposite is the case when the water level goes up. But then the endemic cyprinid *Acanthobram (Microgrex)* uses this for spawning, thus impacting also the zooplankton.

Finally, according to the authors, Lake Kinneret underscores the importance of WLFs. The last but one part, Part VI, deals with *Integrated Lake-Watershed Management* has seven chapters (Chapters 30-36), The opening chapter (Chapter 30) relates to S*ocial and Economic Background.* This five-page chapter gives a short introduction to the population and social characteristics of the Lake Kinneret watershed that serves as a setting for subsequent chapters dealing with watershed management as well as for future development of this region.

Chapter 31 is about *Operational Management of Lake Kinneret and its Watershed.* Lake Kinneret is considered as the national water supply system. The water in the watershed is used in the watershed itself and from the lake it is supplied to central and southern regions of the country and to the Kingdom of Jordan. A healthy lake economy and its recreational amenities and important fisheries are essential.

Some projections indicate that by 2030, when the country's population would have increased by about 50%, an expansion of infrastructure will be required for greater consumption of water and expansion of treatment facilities will be needed for more sewage and its disposal.

The Monitoring Program (Chapter 32 by Sukenik et al) was established ca. 40 years ago with the objective to follow the quantity and quality of the water to observe and predict long-term changes. The recent application of early water monitoring systems and application of advanced techniques for high resolution data collection of water quality parameters are outlined in this chapter. Thus, there is room for greater involvement of information technology experts for communication with water managers and with the general public, using advanced web technologies.

Chapter 33: *Water Pollutants*, by Sukenik et al. has nine authors of this chapter that is 31 pages thick—thus showing how important water pollutants are, which originate from anthropogenic resources and impair the ability of lakes, and water bodies in general, to support human use of these waters. Algal blooms, toxic algae and cyanobacteria are also water pollutants that cause major changes in water quality. Major pollutants described are pesticides originating from agriculture and faecal indicators from domestic and urban pollution, in addition to toxic compounds produced and excreted by several phytoplankton species, including cyanobacteria.

Chapter 34 on *Water Quality Assessment* is authored by Parparov et al. Water quality index was quantified identifying the permissible ranges of quality parameters using a modified "Delphi expert panel method".

Frankly speaking I know little of how the index is derived or operates. The authors used Composite Water Quality Index (CWQI), which gives weighted values for the entire set of water quality indices. The bad news is that since 1991, annual average values of CWQI show a trend of deteriorating water quality. This trend is confirmed also by

increases in chloride concentrations and in cyanobacterial biomass in more than two decades, when the aggregate values of CWQI has decreased since late 1990s to values of < 60 on a Rating scale of 0-100 (Fig. 34.3c; page 613). A rating of 60 is a limit below which the Index values are not acceptable. Strength and weakness of the index are not sorted out yet.

Gal et al. are the authors of *Modeling the Kinneret Ecosystem* (Chapter 35). Efforts to model the Kinneret ecosystem go back to 1980. The efforts to model have included a range of approaches from entire ecosystem to certain components of the ecosystem. The plans ranged from statistical approach, to data mining, to flux models, bioenergetics, nutrients-phytoplankton-zooplankton types of models, as well as complete ecosystem models.

The models have not only to enhance our understanding but also provide resource managers with improved management tools. We have to be constantly aware that uncertainties in the models are invariably introduced by the inadequacy of available information/data. This is because we often do not know the complete model requirements.

Next, Ostrovsky et al. tell us about *Fishery Management* (Chapter 36) in Lake Kinneret. Availability of long-term data of the fish catches of commercially important fish species, stocking of the fingerlings and lake water level allows the fishery managers to know key factors affecting the fish populations, fishing pressure and mass of the landed fish. Long term decrease in water level negatively affected reproduction and survival of the natural/stocked fingerlings of cyprinids and cichlids. Overfishing resulted in lowering of reproductive cichlids leading to decrease in their reproductive capacity and collapse of their standing stock. Biomanipulation was carried by harvesting the endemic bleak (*Mirogrex* sp.), a pelagic zooplanktivore, to suppress its abundance in critical years. However, since it created a lot of controversy their biomanipulation was stopped in 2006. *Mugil cephalus*, grey mullet, was considered as a good fish for stocking because of its low mortality, higher growth rate, a larger adult size and therefore a higher market value. The authors contend that fish stock management in Lake Kinneret should focus on restoration of native fish populations for their sustainable fishery. The authors derive certain conclusions as well as provide recommendations among which reduction of overfishing is the foremost.

Part VII provides the book's Overview with only last chapter (Chapter 37; Authors are Zohary et al. It is headed as *Lake Kinneret: Current Understanding and Future Perspective*.The Abstract is very short and contains little information, unlike the previous chapters. I enjoyed reading the subsequent sections that summarise the book's important parts. Some sections of this last chapter, e.g. Lake Stability and Prospects for the Future offer interesting information for the reader. It is very rightly remarked that current identification techniques for plankton rely on morphology-based classical taxonomy, which has proved to be insufficient and needs to be supplemented with more robust and modern molecular tools. I was also impressed to learn DNA bar coding of all plankton, both phyto- and zooplankton species is already underway.

Although I found the book with its 683 pages and 37 book chapters too long, it does offer the reader a choice to read more specifically the section or chapter he/she likes to read. The book is very well written and very well edited, too. Here and there I came across some change of style in addressing the issues. I came across hardly any spelling errors but for 'remainder' spelt as 'reminder' in one place.

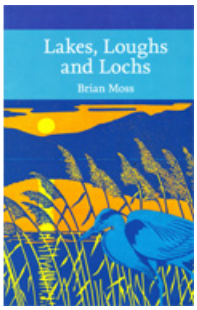
Also, in Chapter 36 the Abstract has some errors that could have been avoided during proof reading. Such errors, minor though, involve fusion of adjacent words, absence of space after the comma, etc.

My congratulations to Tamar Zohary and her team of authors for producing this handsome and useful treatise on Lake Kinneret. My review is an extended one but I also enjoyed reading and reviewing the book.

I am happy to possess now a *gratis* copy of the Lake Kinneret book. The price of hard copy indicated above shows that the book prices have not increased much lately. This makes it attractive for the reader to possess their own copy. I highly recommend the book also for the aquatic libraries all over. The book is also a must on the desks of young limnologists.

Ramesh D. Gulati (r.gulati@nioo.knaw.nl)

Lakes, Loughs and Lochs



*Brian Moss (author). S. Corbet, D. Streeter, J Flegg, J. Silvertown and B. Short (**Eds.**) 2015. William Collins (An imprint of Harper Collins Publishers, London, UK. ISBN 978-0-00-751139-6 (soft cover). 452 pages. Price £ 35*

This 10-Chapter book starts with the Editors' Preface, Author's Foreword and acknowledgements. *Romance and Reality: Limnology in Britain and Ireland* (Chapter 1). The chapter heading says it all about nature of this book. It is rather difficult, if not impossible to review the book contents that are at places too romantic for a limnologist to review. On page 2 we see the wetlands locations on a map of Great Britain in the prehistoric period, about seven thousand years ago. A comparison with the present day situation in another map leaves one shocked because these wetlands are alarmingly fewer in numbers and much smaller in the areas they occupy now. The source of these on maps is made by Wetland Vision. It seems perch had not reached Ireland before the rising seas had cut it off as an island 6000 years earlier. To the south, in what was to be called England later, a warmer and drier landscape harboured fewer lakes and wetlands. Human settlements were drawn by need to lakes and rivers, springs and streams. The story is seemingly built on the logical settings created by an experienced and imaginative limnologist going several thousand years back in time to visualise the situation then. The stories goes on, illustrated as it is with pictures, including a Monster Soup, a cartoon comment in 1828 by William Heath on the state of water in River Thames, as seen through a microscope (Fig. 6; page 5). The next section in this chapter describes "life in lakes and rivers" title of the famous book by Macan and Worthington. Already the scientific effort in understanding freshwaters ecology in general, started with the improvement of microscope lenses by Antonie van Leeuwenhoek in Delft, Holland. This was also a period in which Charles Darwin and Alfred Russel Wallace had revealed in 1858 the main mechanism of evolution and process of speciation. It was also the time (1877) when Stephen Forbes in the US produced the famous paper "Lake as a microcosm". It was nearly also the time (1872-1876) that Challenger expedition took place under the direction of Charles Wyville. It is then also later in 1897 that interest was developing in the Scottish sea lochs thanks to John Murray. By 1909, bathymetric maps of more than 550 lochs had been made. One such map of a Sottish loch is given (Fig. 9; page 10).

About the opening of Freshwater Biological Association in late

1920s, there was a contact between John Murray, Scottish Scientist who was then interested in ocean plankton, and Danish scientist Prof. Wesenberg Lund, to review the state of limnology and where it was heading to. Prof. Lund believed that water temperature was the cause of the changes in the two *Daphnia* spp. And that these changes were induced chemically by the presence of fish predation. On page 15, Dr. Moss tells us about formative period for both the laboratory and field. Total costs of such a venture with lab, a botanist and a zoologist with lab equipment was < 5000 £ Sterling. It was in this period that the idea of FBA was launched despite some opposition from Robert Gurney. Dr. W.H. Pearsall was appointed part- time, unpaid Director, maintaining contacts with the University of Leeds where he was a Reader in Botany. At the outbreak of World War in 1939 FBA had a staff of seven people. One war time project was to catch and can perch from the lake (Windermere?) as food. From here on the FBA continued for 40 years as research lab for Britain and Ireland. There were four Fellows of the Royal Society, including John Lund and J. F. Talling, Geoffrey Fryer and Winifred Pennington who worked at Windermere. Mortimer, who earlier had worked with Lund, left to work in the USA. The post -war period also saw a regulator conservation organisation in which National River Authority and Nature Conservancy became important. There was a general decline of funds following the political changes in the 1980s with funds reduced and reallocated so that the organisations related to water research faced financial constraints. A further reorganisation in 1996 led to combining the National River Authority (NRA) with the Environmental Agency. Subsequently, the European Union Directives did good to improve habitats and waters. The Water Framework Directive in 2000 promised a revolution in the freshwater and coastal habitats in the European Union. The bad news in Britain since the 1970s was the decline of number of people working in Freshwaters and in universities declined and interference of Govt. since 1980 in the research and university affairs also contributed to the continuing decline. The FBA was taken over by the Govt. in the 1980s and renamed the Institute for Freshwater Ecology.

Happily, the situation has since then changed and science has become more international and communication between scientists is much easier since the computers arrived to ease the tasks of data retrieval and library work. Hereafter, Moss compares the life as a limnologist then and now. There is now less emphasis on fundamental, and more on applied works. Raising and managing funds has become important—although most of the applications for project funding fail. There is more pressure to publish in quality journals.The referees are much more critical, so that there are more resubmissions and revisions. Now statistics and mathematics figure prominently in biology.

Chapter 2 is headed *The Nature of Lakes.* Here Brian talks of all that has to do with lake formation, including rocks, islands and glaciation. He traces back the history and origin of lakes, telling us about the role played by Hutchinson in such studies. Hutchinson laid out numerous ways in which the lakes originate. Of these some 25 are summarized with examples in Table 1 (pages 30-31). The lake basins differ in their depth, light penetration, local weather conditions and water chemistry. Now, the limnologist needs to have command of geology, physics, chemistry and hydrology. We are told about the peculiarities of the water molecule with an illustration in Fig. 30. Water molecules link to one another, the slightly negative hydrogen of one molecule being attracted to the slightly positive oxygen of the next, thus forming a network. On the other hand, ice network is orderly, with a low tendency to move apart at low temperature. Moss explains the role of density changes in response to water temperature leading to stratification, etc. He mentions about the nature of circulation annually and how the dimictic lakes differ from the monomictic ones (one circulation per year). He then tells us that the concentration of dissolved substance in water is low but their variety is immense. The development of new analytic techniques since the 1970s is discussed. Following this, the Brian describes the major ions and chemistry of rain and lake waters (Table 2; page 47), organic matter and the key limiting nutrients, N and P. Influence of climate on water chemistry is described. Ecological lake zones and the fate of lake basin are described and well-illustrated (Fig. 38; page 59). The last section of Chapter 2 deals with profundal lake sediment. It is headed as *The Theatre Closes*. Sediment is laid down chronologically and is undisturbed after a few years. In the sediment top, one invariably encounters benthic animals, their head capsules, exoskeletons of crustaceans, resting eggs cysts, spores, spores of some algae and walls of diatoms. Examples are given how small lakes tend to fill in with sediments and peat and succeed through different sorts of wetlands. The chapter ends with the author's observation that all lakes are ultimately ephemeral...

Chapter three *Dramatis Personae: The Small Cast-Members and the Big Roles.* The title was for me difficult to comprehend until I read a part of the chapter contents. Brian traces the developments in science what he calls revolutions. He starts with the structure of DNA, discovered in 1953. He then switches to bacteria, viruses and prokaryotes. He considers bacteria as more versatile than other organisms because they can obtain their energy from breaking down the organic molecules produced by other organisms. He mentions how in the 1960s there name was changed from blue green algae to cyanobacteria. He then mentions about the origin of eukaryotic cells that appeared on earth about 1.5 billion years ago. A new group of Prokaryotes, the Archaea that differ from bacteria, now called Eubacteria is mentioned. Summarised here are the most abundant phyla of bacteria in freshwater lakes (Table 5; pages 72-73). He says that among the variety of bacteria; some 1 to 10 million or more bacterial species are expected with merely 5400 bacteria species described so far. The last part of this chapter deals with Biogeography of Microorganisms. In Fig. 62, the mean size (mm) of the organisms including all organisms from protozoa to fish (X) is put against % of total number of known species of various groups (Y) that have been recorded.

The Chapter four is relatively short and is headed: *Animal: The Names in Bright Lights.* Here invertebrates and vertebrates are introduced. Considering that Oceans of the world have 50000 times more water than freshwater, the 10 % share of freshwater in terms of total animals in the world is much higher than in the oceans. In particular, there are more fish and amphibians and to a lesser extent the Crustacea. There was apparently also an easy movement from salt to freshwater. All this explains a higher diversity in freshwater than in oceans. Here the differences between freshwater animals and oceanic animals are further described with respect to temperature, dissolved oxygen and external salt concentration. Using examples of freshwater fish, their external salt concentration is only 0.1 to 0.5 g per litre but this external salt concentration of marine fish is 35 g per litre—thus it is 70 to 350 times higher in marine fish. The migrants from land to water face a general problem of getting enough oxygen. Many insects face such problems in their aquatic larval stages. Freshwater animals have also to cope with drought and freezing. A problem for all aquatic animals is of stickiness or viscosity of the medium. The larger the surface area in relation to the volume, the greater is the drag force. Further, in this chapter the effects of glaciation

on sea level are discussed. But in that period England and Ireland were a part of mainland Europe. The Freshwater Fauna of Britain and Ireland are compared with that of the world. The role of some aspects of freshwater invertebrate fauna of Britain and Ireland are summarized in a four and a half pages (Table 8). Researches on birds, mammals, amphibians and reptiles have been strongly species-orientated.

On the Edge of the Land: The Littoral Zone (Chapter 5) deals with the Littoral, the richest part of the lake. In a mountain region, the littoral may be narrow and wave beaten. In the lowlands, it is more like to be wide and muddy with sheltered bays backed by reed beds. All natural lakes have some sort of littoral. There is an interesting section on evolution of freshwater plants. It tells that charyophytes, or larger stoneworts, have ancestors that entered freshwaters directly from the ocean. While a series of other plants, liverworts, ferns and flowering plants, have come from the land. The Fig. 76 illustrates how the plants evolved. Here several groups of aquatic plants are indicated. Interestingly, out of some 14 000 species of flowering plants only about 17% are aquatic and of the 18 000 mosses and liverworts < one % are aquatic. We generally do not realise that waterlogged habitats are stepping stone to aquatic existence. The change from carr and bog forest to submerse vegetation reflects evolutionary colonisation of the lakes. Some sections in this chapter are devoted to water plants of lakes in Britain and Ireland (Table 12). Problems of photosynthesis underwater by aquatic plants and the issue of obtaining CO_2 are very interesting and simple to read but most of us do not think of such issues. Next, Dr. Moss tells us about the commonest animals; snails and corixids and chironomids. He calls them the grazing herds. Other small animals are largely cladocerans and water fleas. He says that some (e.g. *Eurycercus lamellatus*) 'are bigger than we are' (I did not quite understand this part.) Some others are tiny ones. The most common of these is *Chydorus sphaericus*. We are here told about mayflies, and other animal including a shrimp *Gammarus lacustris* scudding around the rock and then under it. We switch from "Measuring Chemistry" to Fish Predation and Smell of Water, and how the water fleas are better protected in vegetation than in open water. With help of Fig. 93 we are told how vulnerable the submerged plants are to suppression by periphyton. The importance of detritus and the general omnivory of many other components is evident but is also confirmed by stable isotope studies (Fig. 94). In the concluding part of chapter five we are asked what would happen were they not there. Brian means here birds. Their abundance is related to environmental factors but rarely is there a single factor that determines a bird's abundance but there are a variety of influences. The chapter on littoral aroused a lot of interest in me, because it can be very useful in understanding interactions with the open waters, especially in shallow lakes.

Chapter 6 *The Plankton: Hazards and Survival*. Here Moss calls open water s a shifting habitat of great danger for the highly adapted phytoplankton and zooplankton that have evolved ways to survive in it. The bigger you are the faster you can sink. There are several hazards: low nutrients, low light availability, sinking, grazing and washout. These aspects are discussed one by one on the following pages. The section on zooplankton biology deals with copepods, water fleas, rotifers, zooplankton communities and predation on the zooplankton. Fish and Production are also described, followed by open-water fish communities in Britain and Ireland. The three coregonid species of fish in the British waters are mentioned. Frankly, I did not realise the popular name of one of these is *powan*. Two of these three species have taken to feed to some extent in the benthic habitat, only the *vendace* is a strict planktivore, all other planktivorous species are generalist, combining planktivory and bottom feeding, or piscivory and bottom feeding. The necessary versatility of temperate lakes is also well seen in generalist planktivores, with perch, trout, pike and Arctic charr, which is described further in some detail. The fish generally become piscivorous as they grow. The real top predators are the birds, primarily the cormorants (see photo on page 204) goosander, merganser, terns, etc. They all predate on small fish. From this point on, Moss tells us about plankton and the effect of wind induced mixing that makes the horizontal distribution in water more uniform. The general pattern of seasonal changes in plankton in British waters is described in relation to physical conditions, nutrient dynamics and decomposers (Fig. 111; page 206), with special emphasis on spring and early summer. Other seasons are also described. The last part in this chapter is devoted to a five-page overview, with also a mention to the works in the early 1970s on Canadian Experimental Lake Area. This is quite an interesting part to read.

The Deep, the Old, the Dark and the Cold. (Chapter 7) relates to all that happens in the deeper water and in lake sediments. The lake sediment that comes from the lake catchment can be more inorganic and clayey as in many mountainous regions or more organic where catchments are rich and fertile. The next part deals with life in the hypolimnion, which is invariably entirely dark. In the extreme cases, the hypolimnion will be quite acidic and oxygenless. Even if the hypolimnion remains oxygenated, the bottom community is less rich than that in the littoral. The water temperature in the hypolimnion is low, invariably about 4°C. Despite the fact that this is an uncompromising habitat, several thousand animals will occupy the top few cm of sediment but their numbers are still not as high as in a rich littoral. Here sampling techniques for the profundal benthos are illustrated (Fig. 119; page 222). *Chironomus* species are common inhabitants of the profundal of lakes. Another invertebrate predator here is *Chaoborus* species. In the anaerobic sediment a few cm below the top sediment are anaerobic ciliates only. Carbon isotope studies of the *Chaoborus* larvae reveal that that methane-producing bacteria might be perhaps the major indirect source of their food. Moss cites the studies done in Bay of Quinte, the northern shore of Lake Ontario in Canada to explain the effect of the both quality and quantity of sedimenting material in determining the productivity of bottom-living animals. In the section dealing with natural lake development, Brian cites the classical studies of Naumann and Thienemann (photos of the two legendary limnologist are given in Fig. 128; page 235), These limnologists added to the categories of lake productivity oligotrophic (deep lakes) and Eutrophic (shallow), and a third category "dystrophic" to accommodate the brown water lakes; they are low in Ca and other nutrients. Interestingly, we note the long period of oligotrophication, the converse of eutrophication, recorded in Windermere. Further, the effects of human activity were to herald a major expansion in the work of palaeolimnologists in the late twentieth century. Fig. 134 illustrates that using 210 lead method dates back to about 150 years. Lastly in this chapter, Brian touches upon the problem of lake acidification of surface waters in the 1970s and the approach to understand the problem using indicator diatoms species in relation to pH.

Chapter 8 *People and Lakes in Britain and Ireland* all that is connected to people of the land and how they affect lakes. It partly deals with farming practices and drainage of the fens, etc. Starting with acidification on page 259 it becomes more interesting for a reader that coal was the fuel that powered much of the machinery, and burning it

produced ammonia and sulphur oxides. From the 18th century onwards the incidence of smogs and bronchitis was so high that legislation was passed to ban the domestic burning coal in favour of less damaging anthracites that produced less sulphur dioxide and smoke. The most obvious effect was death of fish and there were wide spread fish kills in Norway and Sweden cause by the drift in the prevailing wind conditions. Such conditions with fish kills meant better survival of low pH tolerant zooplankton grazers, thus the lower phytoplankton crops, while aluminium ions flocculated particles from the water that remained crystal clear. The P concentration of the water was very low. It is a different situation now with all the control measures and use of alternative sources of energy. The present situation with high lake eutrophication has to deal with not coal but nitrate in abundances due to different sources of pollution. It seems leaching losses from farmland wastes give N concentrations 10 to 100 times greater than in the runoff from intact natural vegetation. Such losses are the cause of diffuse pollution. The purification techniques and development of trickling filters on which a film of bacteria coating small stones removes the organic matter. However, with all the ongoing measures, it was not until 1940 when it was realised that these products caused problems of eutrophication, formally documented in 1947. According to Brian, the principles of lake biomanipulation can reduce its effectiveness as symptom treatment. It is possible to reduce algal crops by biomanipulation in which planktivorous fish are (completely) removed or piscivorous fish are added. There is a section dealing with catchment nutrient control, to reduce the amount of nutrients entering the lakes. The incoming nutrients can be easily removed before they are discharged to rivers (or lakes). The author deals with management of nutrients, and considers nitrate levels to be ten times too high to create any conservation benefit. *A case of Windermere* discusses problems relating to human population increase in the area, tourism, installation of P removal facility at waste water treatment plant, recreation and angling to replace commercial fishing. These are some of the important measures taken. However, the problem of introduced species is still another serious issue next to acidification and eutrophication. It seems that in Great Britain and Ireland the process is accelerated by people and trade links with the mainland. There are about 200 freshwater introductions (see Tables 16 and 17) mostly since 1800, which is about 12% of the total animal and plant species. There is a separate section dealing with Bird, Mammal and Water Plant Introductions. In addition, there are sections on Reservoirs, Ponds and Gravel Pits and on Fisheries and Angling. The last part of the chapter concerns Ecosystem Goods and Services and is based roughly on general idea that ecosystems contribute to the human economy by provisioning services such as wetland plants and fish.

Chapter 9 *Moss's Tour: An Itinerary Among the Lakes of Britain and Ireland*. The Itinerary for Moss's tour of the British lakes seems a very good idea. It is illustrated using a map of Britain and N. Ireland. The trip starts with Orkney, Lochs of Stennes and Harar and then we goes from Loch Ness to Loch Lomond—I quote Brian "a lake that we would never be forgiven for not visiting". To the East Coast of Scotland is Loch Leven. And then to Ireland via the North Channel visit to the Irish Loughs to experience what is happening there before re-entering Britain along the western coast and down to southern part of England to Slapton Ley . To make the long story short, Brian takes us northwards to The Cumbrian Lake District. It is an area where most research has been carried out by the British. These lakes are not immune to the hands of man. Indeed, the lakes of Windermere catchment are most influenced. Here, all the main lakes are much cherished by visitors and walkers. In the next few pages we visit and see the English manmade lakes, northwards of the Cumbrian Lake District. I did not know that such waterbodies are about 300, most of such constructed lakes in Scotland and Northern Ireland, with some 70 in Wales. Coming down the eastern coast of South England we arrive in the Broads, or the Norfolk Broads. These are the man-made lakes, rather than that they were former estuaries dammed by plugging. I am proud of having visited this man-made but picturesque area nearly 25 years ago. There I met Brian who was on a field trip with his students. Broads are pits that were dug out of the peat for fuel between the ninth and the thirteenth centuries. Finally, read and enjoy the contents of this chapter more than reading a review from a non-British book reviewer, as I am. I want the reader to read the details at leisure and enjoy it.

The Chapter 10 is the closing episode, a very interesting one with a lot of information on what has been happening to freshwater bodies at the European level. This chapter relates to T*he Future of the Lakes of Britain and Ireland*. Even though it is a short chapter, it tells us how the climate change is going to affect the lakes. I strongly feel that Brian's fears for the future are vindicated. The average temperature has risen by 0.8°C since 1850s and it may further rise-- in the polar latitudes it rise the most (by up to 10°C). Glaciers are melting and rainfall patterns are changing with more rains in winter. Water levels are rising but droughts in some areas are getting frequenter. This is also true for the extreme weather events such as floods and typhoons. Moss illustrates these trends for central England, whereas the summer rainfalls have increased by up to 20%. However, there was a corresponding shortage in winters, in the period between 1961 and 1990 winters events. Some of these changes due to warming and precipitation are going to result in increased eutrophication as depicted in Fig. 198 (page 382). Meanwhile there are changes in European legislation: The European Union has passed a series of Directives over the past thirty years. These are intended to deal with high nitrate levels and reduction of nutrients in wastewater discharges. The legislation was strengthened with the ratification of Water Framework Directive. This radical change covers all of fresh, coastal and estuarine waters. River basins are considered as a units for management just as the standards set for chemical water quality and reference standards. Europe has been divided into river groups, with 20 such basins in Britain and Ireland alone. Countries like Denmark and the Netherlands have attempted to restrict the amounts of diffuse nutrients from farms by regulating fertilizer usage. Brian also provides classification schemes for the referenced standards.

The next 18 pages (pages 400-417) provide notes for different chapters, some of terms used, reference and books, and scientific facts mentioned in the previous chapters are explained and elaborated. The next 17 pages are devoted to References cited in the text. Last, we have a detailed index that runs into 18 pages.

Concluding, I enjoyed reviewing the book throughout but I admit I could not have provided a more detailed review than the present one. I understand that the book is very reasonably priced so that many young researchers, students and others interested in freshwaters can buy the book for their personal possession and use. This book is also a must for libraries specialized in aquatic science. Last but not least, I congratulate Brian for his romance with the British freshwaters, and for presenting the reader with book in a very readable format and content.

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