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Editorial

Some sad news but also good news!

I suppose by now many of you heard the tragic news about the deaths in August '09 of two of our very distinguished limnologists: Dr. Stanley Dodson (University of Wisconsin, USA) and Dr. W.John O' Brien (University of N. Carolina, USA). This Newsletter contains their obituaries (taken with permission from *Hydrobiologia* and *Journal of Fundamental and Applied Limnology,* respectively), as well as the obituaries of Dr. Thomas Nogrady (Kingston, Ont. Canada) who died in July '09 and Dr. Roger Pourriot (France) who had died in August '08. I convey on behalf of the SILNews Letter, the SIL Secretariat and on my own behalf our heartfelt condolences to the bereaved families.

The good news is that our SIL Working Groups are quite active and many of them have sent their brief research activity reports or of their planned studies. Also, I am happy to inform you that one of the pioneer SIL working groups, the WG Plankton Ecology Group (PEG), has virtually woken up from a long siesta and will hold a SIL-sponsored, 3-day meeting "Predictability Of Plankton Communities In An Unpredictable World" from 7 to 9 April, 2010, in Amsterdam, The Netherlands (see first Announcement in this Newsletter).

The response of our readers from several parts of the word to contribute to our SILNews is inspirational. Also encouraging are the reports of limnological studies in progress in China, South Africa, UK, Germany, Hungary and Russia. China seems to have been the epicenter of the goings-on in limnology this last half year: a "SIL Symposium" was held in Nanjing, during 24-27 October 2009 and an ILEC- sponsored biennial World Lake Conference in Wuhan during 2-5 November 2009. I report both these meetings briefly in this Newsletter as I had the privilege of participating in both these meetings. My impression based on a visit to Lake Taihu and talking to scientists, is that lake restoration and pollution abatements are high up on the agenda of the Chinese limnologists, and civil administrators.

Ramesh Gulati, December 2009

Lastly, you may have noted that already since December 2008, we have done away with the distribution of hard-copy version of the SILNews letter to our SIL members. In addition to economic reasons, this is I think an environment-friendly decision of the SIL. For easy reading, the electronic version from this issue onwards will be printed in two columns instead of the three earlier. As the next triennial SIL Meeting at Cape Town, South Africa (August 2010 draws closer; see announcment of page 6 of theis Newsletter.), I expect for June 2010 issue of the Newsletter (last date of submissions is 1 April 2010), our readers will contribute more on their studies in Africa but also on other regions of the world. I wish you all a happy holiday period.

Ramesh D. Gulati
Editor *SILnews*

Obituary
W. John O'Brien: 1943-2009

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A Distinguished Limnologist and Ecologist, and a Wonderful Story-Teller

Photo: W. John O'Brien near Toolik, Alaska in summer 1997 (photo courtesy J. Elser).

W. John O'Brien, aquatic ecologist and Professor of Biology at the University of North Carolina at Greensboro, died at his home on 15 August 2009. John is survived by his wife, Marion; his son, Connor, and family, Beth (Calvet) and Rowan; and his daughters, Shay and Lia.

John's career was spent in academia as a scientist and teacher with a passion for ecological research. He accepted a position as an Assistant Professor at the University of Kansas in 1971. He quickly rose through the ranks to Professor in 1982, where he served twice as a Department Chair, as well as one term as Associate Vice Chancellor for Research and Public Service. John remained at the University of Kansas until 2001, and then moved to North Carolina to accept a position as Professor of Biology at the University of North Carolina at Greensboro. John was a central fi gure in the study of freshwater zooplankton and fish, as well as an ardent experimentalist who delighted in devising ingenious experiments. Throughout his career, John divided his research energy between studying aquatic ecology both in north temperate reservoirs and in arctic lakes and ponds, training students in both venues. In Kansas, 19 graduate students seven Ph.D. and 12 masters students received degrees under his direction, along with two postdoctoral fellows. In North Carolina, another five students received masters degrees and two more will complete their degrees under the direction of his colleagues.

John completed his undergraduate degree at Gettysburg College in Pennsylvania, and then entered graduate school at Cornell University to work with his major professor, Donald J. Hall. Although the majority of his graduate work was done at Cornell, he transferred to Michigan State University when Don moved there, and it was at Michigan State that he completed his Ph.D. degree in 1970. His graduate research focused on food resource and predator controls of zooplankton communities in experimental ponds, in collaboration with his close friend and lifelong collaborator Jerry deNoyelles. John's doctoral research resulted in seven publications that launched his highly acclaimed career as an aquatic ecologist, and he soon achieved a national and international reputation in that fi eld. While at Michigan State, John was also strongly influenced by Bob Wetzel's limnology course, which soon served as a model for John's own limnology course at KU, and later for his aquatic biology course at UNCG. John's research in Kansas reflected its landscape: because there are almost no natural lakes, John studied the limnology of turbid reservoirs. His early research program at KU focused on factors limiting phytoplankton production, and led to a well-cited publication in Science (O'Brien 1972). He also studied the effects of nutrients on diverse waterbodies in the Alaskan landscape, resulting in multiple papers (Bettez et al. 2002, Lienesch et al. 2005, O'Brien et al. 1975, 1992, 2005).

However, John soon shifted the focus of his research interests to zooplankton and fish, and their ecological interactions, refl ecting his boyhood curiosity about aquatic animals, inspiration from an undergraduate course at Gettysburg College in invertebrate biology with Robert Barnes, and a sense of an opportunity to contribute to the development of a new emerging area of ecology. Historically, the fi elds of limnology and fisheries operated independently, but the separation between these two fields of science began to diminish when research showed that fish predation caused shifts in the body size and identities of species present in zooplankton communities. Beginning in the 1970s, John and his students explored zooplankton planktivorous fish interactions by decomposing the act of predation into a series of discrete sequential events location, pursuit, attack and capture. The probability that the predation act will be completed is a multiple of the four separate event probabilities. John felt that this approach offered an incisive and fascinating way to investigate the interactions between zooplankton prey and their planktivorous predators. Each of the four events could be viewed first from the perspective of planktivorous fish and then from the perspective of the zooplankton prey. John's pioneering research on fish feeding led to the publication of 28 papers on the fish and zooplankton behaviors underlying fish feeding selectivity, including an infl uential paper on apparent size as the determinant of prey selection by bluegill sunfish (O'Brien et al. 1976). This line of research culminated in two highly-cited review papers published in *American Scientist* (O'Brien 1979, O'Brien et al. 1990). Thus, through the insight of his approaches and the resulting publications, John's research spanned the historic divide between the fields of limnology and fisheries biology, and helped to develop a more detailed and comprehensive understanding of the predator- prey interactions shaping the plankton community structure of lakes.

The largest portion of John's research career was spent studying the zooplankton of arctic lakes and ponds in the vicinity of Toolik Lake, Alaska. Approximately 60 of his nearly 100 journal articles and book chapters relate directly to his work there, and he edited a book volume on the limnology of Toolik Lake and surrounding lakes and ponds. During his 34-year tenure at Toolik, he trained 2 postdocs, 15 graduate students, and mentored nearly as many undergraduates in arctic limnology. His research at Toolik Lake also focused on the predator-prey ecology of zooplankton, including both fish and invertebrate predators. In this work, he maintained and further developed his interest and contributions to fish foraging behavior, while also making very signifi cant contributions to the ecology of zooplankton communities from several perspectives. Along with his students, John unraveled many of the secrets of helmets and invisible armor in cladocerans; studied prey selection by the large predaceous copepod Heterocope; studied control of pigmentation in arctic zooplankton; and developed an understanding of why moderately large zooplankton can coexist with fish. Collectively, these works and related papers tell a story of zooplankton communities in arctic lakes and ponds, but each of John's research contributions also provided important lessons for the broader field of zooplankton ecology.

A significant component of the discipline of zooplankton ecology focuses on the evolutionary responses of zooplankton to predators,

and how these responses are refl ected in the structure and function of plankton communities. A few examples show some of the major contributions John and his students made to this body of work based on their arctic studies. An early paper on helmets and invisible armor (O'Brien et al. 1979) set the stage for this research direction by showing that body protuberances increased apparent size of cladocerans to tactile-feeding invertebrate predators without increasing visibility to visual-feeding fish, suggesting that their body shapes refl ected a response to competing selective pressures from a community of predators. Other work examined additional details of zooplankton response to predators. For example, O'Brien & Schmidt (1979) found that the small cladoceran Bosmina evolved an ability to change body shape in the presence of the large predaceous copepod, Heterocope septentrionalis. In another study, Luecke & O'Brien (1983) found that the low diversity of zooplankton species available to colonize ponds was further restricted by this same predator; species that coexisted with Heterocope in ponds were far less vulnerable to that predator than species that did not cooccur with Heterocope, resulting in two distinct pond community types, depending on Heterocope occurrence. John was also interested in how such selective forces translated into landscape-scale patterns in species distribution. In more recent work, he found that despite important direct effects on presence or absence of very large-bodied zooplankton species, fish species distribution among lakes was not an important factor explaining the diversity of zooplankton communities, whereas lake area and depth were major determinants (O'Brien et al. 2004).

John and his students were also interested in how the morphological responses of zooplankton to predators interacted with other environmental factors, such as phototoxicity. Luecke & O'Brien (1981) discovered that a dark red form of Heterocope, which occurred in ponds lacking fish, was due to a photoprotective pigment that conferred higher survivorship for individuals inhabiting shallow sunlit ponds. In deeper lakes that were populated by fish, the concentration of the photoprotective pigment in Heterocope was reduced and combined with a protein to produce a pale green coloration. This pale green morph had poor survivorship in bright sunlight, but was less susceptible to fish predation, and thrived in the deeper lakes. The legacy of John's work goes well beyond the number and quality of papers that he published, however. John and colleagues at other universities in nearby states recognized the unique and important ecology of reservoirs. In 1974 this group helped to found the Great Plains Limnology Association, an informal group without dues, officers, or bylaws. This groups annual meeting has since been held for 35 years, rotating among several regional universities, to promote study of Great Plains reservoirs and the differences between these ecosystems and the natural lakes of the northern United States. John was also one of the founding members of the Toolik Lake arctic research community, and played a leadership role in lentic research there for most of his career. John's early research on arctic lakes contributed to the establishment of Toolik Lake as one of the initial Long-Term Ecological Research sites within the network of this National Science Foundation program. In addition to the scientifi c productivity of that facility, he left a huge mark on its spirit, sense of community, and future promise. He was a colleague and friend to a family of arctic researchers, who will sorely miss him.

John also provided very strong and active personal support for the building of diversity and inclusiveness in science. For example, John participated in the very first Multicultural Program (MP) offered by the American Society of Limnology and Oceanography in the summer of 1990. John donated his weekend just before the ASLO meeting at the College of William and Mary to spending time with minority students at Hampton University. Two years later, when the practice of having a noted scientist provide a formal presentation to the ASLO MP group was begun, John agreed to give the very first keynote address. John served as a meeting mentor for students in the ASLO MP program several times. He also reached out to minority students at both Kansas and UNCG, bringing those individuals into his lab, as well as to ASLO meetings. In the last few years of his career, he had a regular following of minority students on a weekly basis, often taking them on field trips to local reservoirs.

As noted by Ben Cuker, the best metrics of a life well-lived are perhaps the number of people whom a person touches, and the quality of those interactions. John clearly scored a 100 on both accounts. John was justly proud of the accomplishments of his students and he was keenly aware that, beyond his own research, a large part of his legacy would lie in the lives and work that his students would do when they left his lab. He was also dearly loved by his family, friends, and colleagues as a wonderful story-teller. No one imagined that pancreatic cancer would steal his life away so early, before he had a chance to retire to a quieter private life, but one whose adventures might still be punctuated by storytelling and reminiscing sessions with his lifelong colleagues. We will still tell those stories, laugh and cry, and celebrate his life. A new endowment fund, the W. John O'Brien Award for Ecological Field Research, is being created in John's memory at UNCG. This award will be used to assist graduate students who are conducting fi eld-based work, and contributions to this fund can be made out to the UNCG Excellence Foundation with the notation, John O'Brien Award, and sent to Judy Piper at jrpiper@uncg.edu, UNCG Development Offi ce, PO Box 26170, Greensboro, NC 27402-6170.

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Val H. Smith, Anne E. Hershey and **Ray W. Drenner**

Obituary: Stanley I. Dodson, 1944-2009

Stanley I. Dodson, aquatic ecologist and recently-retired Professor of Zoology at the University of Wisconsin, died on August 23, 2009, following a cycling accident at the Colorado National Monument. Stanley is survived by his wife Ginny, his daughter Sarah, and two grandchildren (Kate and Henry).

Stanley grew up in Illinois and Colorado, and completed his undergraduate degree at Yale. Here he had the opportunity to do undergraduate research with John Brooks, work that was published in a paper in *Science* and has been widely read by limnologists. Stanley then completed his Ph.D. work at the University of Washington, where he was supervised by Tommy Edmondson.

Stanley was a professor at the University of Wisconsin in Madison for his entire 40-year professional career. Here, he supervised and completed 22 Ph.D. and 24 Master's students, as well as four postdoctoral fellows and countless environmental interns. Stanley taught undergraduate courses in limnology and general ecology, and graduate courses in plankton ecology. He wrote a widely-used textbook for limnology, co-wrote and edited two books in ecology, and co-authored monographs on zooplankton of the Laurentian Great Lakes and insects of Rocky Mountain streams. Stanley was locally famous for his imaginative teaching techniques, and offered many suggestions to others on presentation methods.

Stanley had broad research interests and made major contributions in five topic areas. He is best known for his research on the role of predation in shaping the size structure of zooplankton communities. His undergraduate research with John Brooks examined the importance of size-selective planktivorous fish in selecting for small-bodied communities, and proposed the *Size-Efficiency Hypothesis* for explaining why large-bodied communities dominate in the absence of fish. The latter hypothesis was tested during Stanley's graduate research on high-elevation pond communities and was largely rejected in favor of the invertebrate predation hypothesis. A second area of Stanley's research was his work on cyclomorphosis and the role of predator chemical cues (kairomones) on anti-predator defenses of their prey. He proposed an hypothesis early in his career at Wisconsin and later he and his graduate students tested it with a series of clever experiments. We now know that such chemical signaling is widespread in nature and affects not only development of morphological traits but also antipredator behaviors as well.

A third theme of Stanley's research corresponded to the factors that influence biodiversity in lakes. He and his students and collaborators examined the importance of lake area, age, and productivity on species richness. All these factors proved important. Nevertheless, watershed land use, particularly the conversion of littoral zones to manicured lawns, was a dominant influence on diversity in aquatic communities. Over the years, Stanley also became increasingly interested in chemical contamination of lake communities. Much work was done to shed light on the interaction of anthropogenic and natural chemicals on the invertebrate community structure. The influence of endocrine disruptors extended to *Daphnia* sex ratios and Stanley received a U.S. patent for the bioassay method.

Stanley was an excellent taxonomist. He is well known by both cladoceran and copepod taxonomists for his careful and imaginative work. He and his students described new species and helped sort out prob-

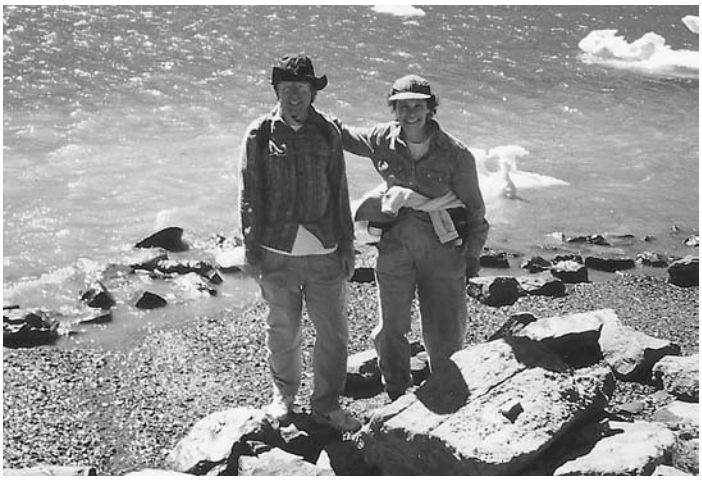

Photo 1: Stanley Dodson, with his wife Ginny.

Photo 2: Stanley as a teacher.

lematic groups in both taxa. At the time of his death, Stanley had been working on taxonomic revisions of two copepod genera (*Diaptomus* and *Eurytemora*), combining painstaking measurements of 30+ morphological features with multivariate and phylogenetic analyses. Given his expertise in both ecology and systematics, Stanley was the natural choice for lead author of the cladoceran chapter in Thorp and Covich.

Perhaps Stanley's greatest legacy was his continuous mentorship of graduate students at all phases of their professional careers. He was truly a friend to many and his impacts are lasting. Stanley also provided extensive service to the professional community, including terms on the boards of editors for *Ecology* and *Hydrobiologia*. His service to *Hydrobiologia* is noteworthy both for its length (15 years) and for his patient work with writers whose first language is not English.

Stanley Dodson had a major influence on aquatic ecologists, with imaginative approaches to some of the major questions that continue to fascinate us. He loved what he did and enjoyed sharing his insights with others. The limnology community has lost a creative scientist and a loyal friend.

John Havel
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John E. Havel was a graduate student mentored by Stanley Dodson (Ph.D. 1984) and is currently Professor in the Department of Biology, Missouri State University, Springfield, Missouri 65897 USA.

Obituary: Roger Pourriot, 1932-2008

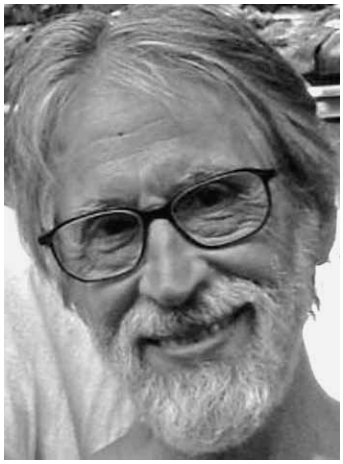

Photo: Dr. Roger Pourriot

Roger Pourriot, born in 1932 in Sologne (France) left us after suffering from a cancer on 24th August 2008; he was retired and living in Sologne, his birthplace. With his passing away Limnology has lost one of its best scientific experts. His treatise "Limnologie Générale", which he edited together with M. Meybeck, will long remain as a reference in the field. With this loss, limnology has also lost, an internationally recognized specialist of the systematic and the biology of Rotifers.

The Zoological Society of France (SZF) and the French Association of Limnology (AFL) organised a Scientific Meeting in Roger Pourriot's memory on the18th May 2009 at the National Museum of Natural History, Paris. This meeting was mainly focused on three topics: (1) Ecology of fresh-waters with its fundamental and applied dimensions; (2) aquariophily, domain in which Roger Pourriot was also an expert, particularly in culture of Cichlids and (3) Rotifers. This last part that contained several international contributions to rotifers, included a new species *Pourriotia carcharodonta,* biology of rotifers and a comparison between Rotifers and Gastrotrichs. The projection of photos of Rotifers (Michel Verolet) and of the movie made by Roger Pourriot with Pierre Clément ("Biologie des Rotifères d'eau douce," are available on the web (www.CNRS.fr).

The proceedings of this meeting in May at Paris will be published before the end of 2009 in the *"Bulletin de la Société Zoologique de France*" (it has papers both in English and French with extended English summary).

One of the communication was entitled, *"Roger Pourriot, l'humilité du philosophe qui a raison" (the humility of a philosopher who is right),* and all the participants agreed to recognize the deep humility of this great scientist, an ecologist who was pessimistic but right. Roger Pourriot's scientific and human qualities were unanimously appreciated and his image will be always associated to a man who was kind, generous and exactly right.

Roger Pourriot was an authentic naturalist in the both field and the laboratory, a complete fresh water ecologist and planktologist, a great scientist and a true humanist. He was also a remarkable fish breeder. As Director of Research at the CNRS, he successively worked at several places: CNRS in Gif-sur-Yvette, ENS rue d'Ulm (Paris), University Paris VI Pierre et Marie Curie, and finally at the National Museum of Natural History (MNHN) in Paris.

We cite here a passage of Roger Pourriot: *"Like the notion of selection, the notion of competition acquires a different meaning when one passes from the biological domain to the human social domain. For the 'western' man, the question is no longer that of assuring the survival of our species, but of gaining power sometimes derisory, often vain the final aim of which he no longer understands and is no longer synonymous with the greater good. In our industrial society, it appeared very early to me that 'competition' was harmful and in any event had little to do with my personality. Whenever I could, and despite my errors, I always favoured cooperation, which is more fruitful and rewarding."* (Roger Pourriot, in "Ecologie du plancton des eaux continentales", Paris: Masson, 1982).

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Obituary: Thomas Nogrady, 1925–2009

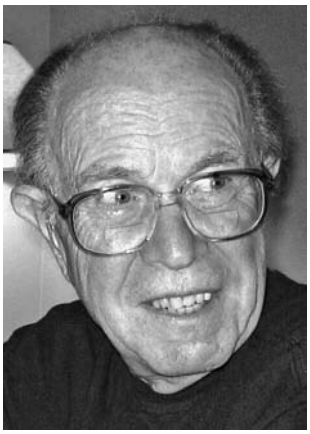

Photo: Dr. Thomas "Tom" Nogrady

Professor, Dr. Thomas "Tom" Nogrady, chemist, consultant, educator, and noted rotifer biologist passed away on July 23rd 2009 in Kingston Ontario, Canada, just three weeks before the start of the XIIth International Rotifer Symposium. His wife Dr. Heather Nogrady and his son Adam survive him.

Thomas Nogrady (Tamás Schödl) was born in Budapest on 16th October 1925. Tom's academic training was as a chemist, receiving a B.Sc. in Chemistry (1947), and then his MSc Chemistry Physics and Plant Physiology (1948) from Pázmány Péter University, Budapest (today Eötvös Loránd University), and a Ph.D. Organic Chemistry (1950) from the Technical University of Budapest. From 1950 to

1956 he worked as a research chemist at the State Research Institute for Medical Chemistry in Budapest. After the Hungarian revolution in 1956 Tom immigrated to Austria, where he worked in the Department of Chemistry at the University of Vienna, on a prestigious Rockefeller Scholarship. In 1957 Tom moved to Canada and became a Canadian citizen and joined the faculty of the Chemistry Department of Loyola College in Montréal (Loyola later became part of the newly formed Concordia University) and rose through the academic ranks to Full Professor. At Concordia, Tom taught and did research in medical chemistry, neuroendocrinology, biochemistry, organic chemistry, and aquatic ecotoxicology. It was during this phase of his career that Tom wrote his classic work on Medicinal Chemistry[1], which subsequently was revised in two further editions. During his long career Tom advanced scientific understanding through nearly 70 publications and was awarded numerous research grants. He served as chair of the *Division of Medicinal Chemistry* of the *American Chemical Society*, and was a member of several international societies, including *SIL, ASLO,* and the *ASC*.

Although formally trained as a chemist, Tom's passion included the ecology and taxonomy of rotifers, as well as a general interest in invertebrate physiology. Tom's love of rotifers was no passing fancy and he had the pedigree to prove it. He began his studies at 13 years of age by saving up an allowance from his family to purchase a small microscope. Equipped only with this simple instrument and his imagination, Tom began investigating the waters near his home. These efforts led to his first publication[2] on rotifers at the age of 14. However, the difficulties in identifying rotifers led him to contact the famous Hungarian rotifer taxonomist, Dr. Lajos Varga, who became his mentor when Tom was 16.

After retiring from the Chemistry Department of Concordia in 1990, Tom returned to his original passion, rotifers, and continued his work at Queen's University (Kingston, Ontario) as an Adjunct Professor of Biology. During this period his research interests included invertebrate physiology, limnology, and the ecology and numerical taxonomy of rotifers and he made some of his major contributions to the field as an author and editor of the *Guide Series*. He was first author on the introductory volume on rotifer biology[3] and editor of several volumes of the *Guide Series*: Volume 2: Lecanidae; Volume 3: Notommatidae and Scaridiidae (and also was 1st author on the Notommatidae section); Volume 4: Proalidae; Volume 5: Dicranophoridae and Ituridae; he was co-editor with Hendrik Segers on: Volume 6: Asplanchnidae, Gastropodidae, Lindiidae, Microcodidae, Synchaetidae, Trochosphaeridae and *Filina*. When the introduction to the Guides was revised, Tom was a contributing author[4].

On retirement, Tom also took up art as a hobby and became an accomplished painter, and as a member of a local artists' group, Tom exhibited and sold his work at a local gallery and numerous art shows. We knew Tom through our interests in rotifer biology and one of us (KS) also because of national connections. Just as Tom never lost his accent, he never lost his love of Hungary and all things Hungarian. The international family of rotiferologists will miss him and his infectious enthusiasm for rotifers.

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The 31st Congress of SIL

The 31st Congress of SIL will be held from 15 to 20 August 2010 in Cape Town, also referred to as the Mother City of South Africa. Overlooking the city is Table Mountain from where the best views of the city and surrounds are seen. The area is a national park and encompasses the incredibly scenic Table Mountain Chain stretching from Signal Hill in the north to Cape Point in the south and the seas and coastline of the peninsula. The narrow finger of land with its beautiful valleys, bays and beaches is surrounded by the waters of the Atlantic Ocean in the west and the warmer waters of False Bay. The Park is recognised for its extraordinarily rich, diverse and unique fauna and flora - with rugged cliffs, steep slopes and sandy flats. It is a truly remarkable natural, scenic, historical, cultural and recreational asset and although debatable, nowhere else in the world does an area of such spectacular beauty and such rich biodiversity exist almost entirely within a metropolitan area.

Some 2 200 species of plants are found on the mountain and has been declared a World Heritage Site, with many members of the famous Proteaceae family. The dassie (rock hyrax) is the most common animal not to forget the porcupines, mongooses and even snakes. Five dams have been built before 1907 to supply the city of Cape Town with water. They have been the subject of several limnological investigations. The world famous Kirstenbosch botanical gardens are situated on the eastern slopes of the mountain, not far from the University of Cape Town and Groote Schuur hospital where the world's first heart transplant was done by Dr. Chris Barnard.

Visits to Kirstenbosch and Table Mountain will be options for the mid-congress excursions during the 31st SIL Congress in 2010.

Diarise the dates and visit http://sil2010.ufs.ac.za

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Regional Limnology: Reports On Lakes and Reservoirs

Access to South African Water Quality and Flow Data

Delegates to SIL2010 who wish to find out more about South Africa's water quality and hydrology are invited to visit the following 3 sites:

1. Department of Water Affairs web site, www.dwa.gov.za;
2. the Resource Quality Services site, www.dwa.gov.za/iwqs; and
3. the Hydrological Services site, www.dwaf.gov.za/Hydrology

The Department's Water Resources Information Management section maintains a valuable inventory of water quality data going back three or four decades, and hydrological data dating from the early 1900s. The spatial and temporal complexity of these data sets is intimidating, so Resource Quality Services has developed a utility based on the Google Earth platform to help users to navigate through the data, both in space and time. To try out the system, visit www.dwa.gov.za/iwqs and follow the "Google Earth Monitoring Sites" link. Note that the system shows a subset of the water quality data, and that further information is available on enquiry.

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Aquatic Conservation Planning in KwaZulu-Natal, South Africa

Because river systems have strong linear linkages, innovative solutions to capture these linkages are required from aquatic conservation planners. Central tenets of conservation planning are that priority areas (or planning units) are identified to ensure representative samples of biodiversity types within a given area, and to enable persistence of these patterns by preserving ecological processes. Although lagging behind terrestrial conservation planning, freshwater conservation planning is beginning to be implemented in a complementary manner to the former. Ezemvelo KZN Wildlife is currently preparing an aquatic conservation plan for the freshwater systems of KwaZulu-Natal. The development of a freshwater conservation plan requires an initial understanding of the broad characteristics of the resource and associated biodiversity. Within KwaZulu-Natal, which is water-rich relative to the remaining provinces in South Africa, there are approximately 585 000 ha of mapped freshwater wetlands, 17% of which fall within protected areas. Perennial and ephemeral rivers mapped at the 1:500 000 scale exceed 18 400 km in length and of these only about 1 000 km (5.6%) of these fall within existing formal protected areas. The river systems feed into 79 estuaries covering a mapped area of over 30 600 ha, of which 41% (almost 12 400 ha) are found largely within protected areas, although this does not reflect the actual number protected. These freshwater resources provide over 28% of South Africa's total average mean annual rainfall. Protection of this resource requires the protection of freshwater biodiversity, and the processes which maintain these ecosystems. Currently the greatest threats to this resource are river regulation and land transformation.

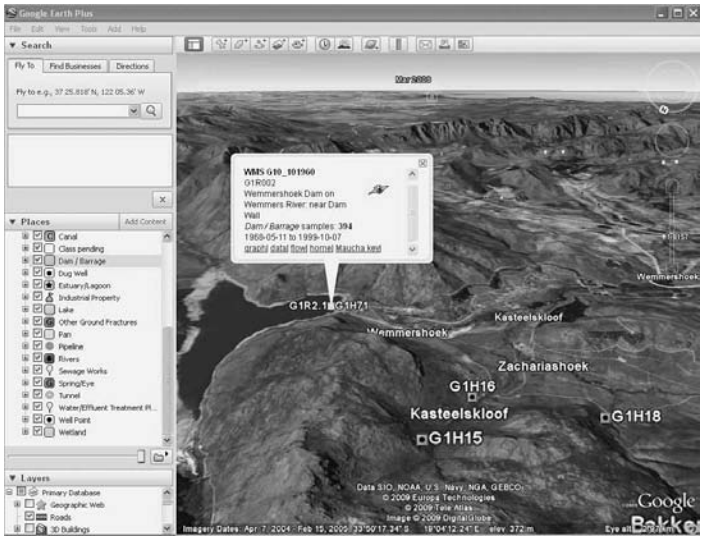

Photo: The figure shows monitoring sites in the headwaters of the Berg River, near Cape Town.

In order to be appropriate at a riverscape level, a suitable river type classification, equivalent to a land or vegetation type classification is initially required for setting river length targets for different ecosystem types. A three-level hierarchical river type classification for the province has been developed as the basis for a freshwater conservation plan: it begins a with large spatio-temporal scale (river basins) at its first level, followed by river segments based on their position in the landscape at the second scale, and finally incorporates inter-annual flow characteristics for the third level. Being based on spatio-temporal scaling relationships, this classification can be refined further. Seventy four of the potential 264 river types were spatially defined, based on aquatic biogeographic region, topography and flow type (Figure 1).

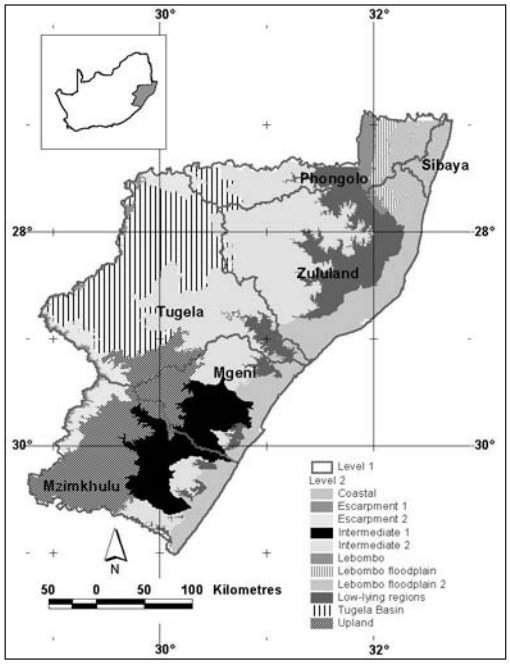

Figure 1. Level I and level II river types for KwaZulu-Natal. Boundaries for KwaZulu-Natal's six aquatic biogeographic zones (Level I river types) are shown as grey lines, with fill shading showing the eleven level II topographic zones.

A two-step, hierarchical process was used to capture catchment- and local-scale dynamics, where priority primary

catchments were first identified, and then used at a second level for selecting priority sub-catchments, which served as planning units at a finer scale. Quantitative targets were set for defined freshwater biodiversity features, which included landscape level surrogates for biodiversity types (primary catchment types, river types and wetland types) as well as individual species from a range of phyla based on location data (22 species including macroinvertebrates, wetland plants, birds and reptiles all associated with aquatic systems). Weighted "discounts" and "penalties" (including the presence of priority estuaries and free-flowing rivers, planning units falling within priority primary catchments, planning units identified as important in an existing terrestrial conservation plan, and the degree of catchment degradation) were used to distinguish between planning units with similar features but potentially different conservation values. Ecological processes (such as connectivity in the hydrological cycle, nutrient flows and energy fluxes) are important to include in a conservation plan because they help to ensure biological community persistence. However, spatially representing such processes are not easy, and it is typically pragmatic to select surrogates for these processes, which can be mapped; in the case of this exercise, surface and groundwater yield zones were incorporated into the conservation plan by discounting planning units where these zones exist.

Being scattered over different river systems, planning units present a problem of mitigating or controlling both upstream and downstream impacts because of increase in costs increase with length. To reduce these externalities, upstream-downstream connectivity was achieved by linking adjoining sub-catchments associated with main rivers and wetlands, and enhanced by setting high targets for sub-catchments through which eels (Anguilla mossambica) must migrate. Eels were chosen as a practical way of explicitly building connectivity into the plan for a number of reasons. Firstly, the sampling of eels within the province has been extensive so that good locality data exists. Secondly, because migratory habits of eels are known, the uppermost point for locating them in any river system indicates the minimum level of system connectivity required for eels to complete their lifecycle. The current version of the plan identified 1445 planning units out of a total of 4600 for the province which are important focal areas for future aquatic conservation efforts (Figure 2).

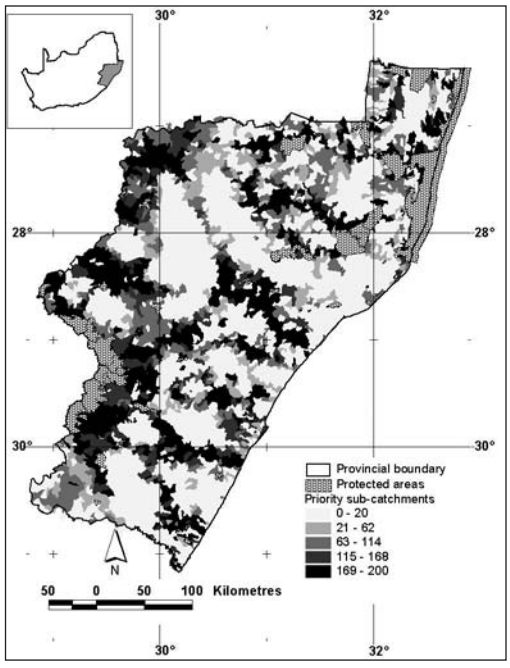

Figure 2. Summed solution output from MARXAN conservation planning software to achieve targets for a freshwater conservation plan in KwaZulu-Natal, with water management zones incorporated, where the higher the summed solution is, the greater the conservation priority.

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Impact on Ecotourism by Water Pollution in the Olifants River Catchment, South Africa

Ecotourism has developed rapidly in recent years to become one of South Africa's largest income generator. State and private game reserves have become global players in attracting tourists from around the world. In addition to possessing two of the world's most renowned wildlife reserves, the Kruger National Park and the Kgalagadi Transfrontier Park, South Africa contains over 20 National Parks, about 30 smaller regional parks and numerous private game reserves and game lodges. The Olifants River, often described as one of the most "hard-working" rivers in South Africa, is one of the main river basins in the Mpumalanga Province and is regionally important to the ecotourism industry as source of water. Lake Loskop, a reservoir situated in the Mpumalanga Province is fed by the Olifants and Wilge Rivers, and serves as a large repository for pollutants from the upper catchment of the Olifants River system. Lake Loskop forms part of the 25,000 ha Loskop Nature Reserve, which is situated in the upper Olifants River catchment. The total area of the catchment draining into Lake Loskop is 11,464 km2. Land use in the catchment is dominated by extensive coal mining in the Witbank Coalfields, which are located in the headwaters of the Olifants River, upstream of Lake Loskop, as well as mineral processing (Oberholster et al., 2009a) (Fig 1).

Over the past fifteen years isolated incidents of fish mortality have been recorded in Lake Loskop and such incidents have become

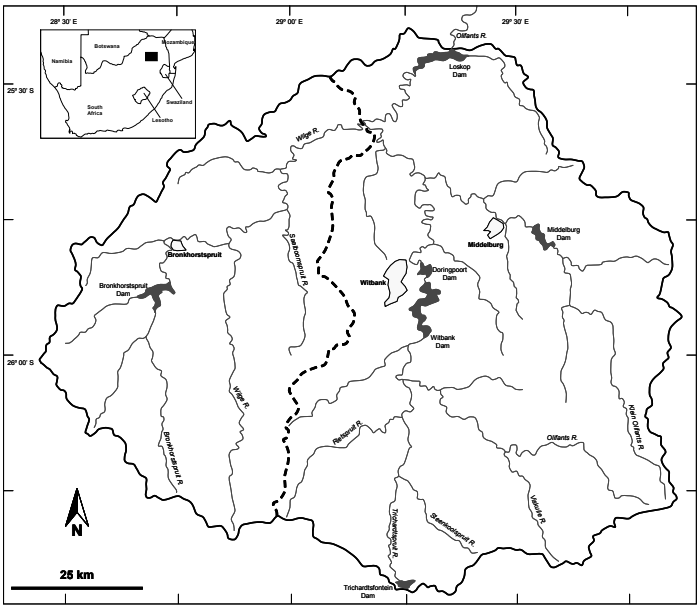

Figure 1. Sketch map showing the Upper Olifants River catchment with Lake Loskop. Inset map shows the area within South Africa; the dashed line separates the Wilge sub-catchment from the Olifants sub-catchment.

more frequent during the past five years. There was a 14 tonne fish die-off during October 2007 (Driescher, 2008). Such fish die-offs have coincided with mortalities of Nile crocodiles and serrated hinged terrapins. The crocodile population in Lake Loskop has declined from about 80 animals in 2003 to just 4 in 2009; the mortality was ascribed to pansteatitis, i.e. the intake of rancid fish fat after a fish die-off resulting in reduction in mobility and inability to swim (Fig 2) (Myburgh & Botha, 2009). The fish die-offs in Lake Loskop were due to both sporadic incidents of acid mine drainage, nutrients flowing into the Lake, and large mixed blooms of Microcystis aeruginosa and Ceratium hirundinella (Oberholster et al. 2009a). In July 2008, at least 160 crocodile carcasses were counted in the Olifants River Gorge 300 km downstream of Lake Loskop in the Kruger National Park.

The Kruger National Park is one of the largest conservation areas (19,485 km2) in Africa (Oberholster et al., 2009b). In this area the total number of crocodile population declined due to pansteatitis from over a 1000 in 2008 to only 347 in 2009. Interestingly, a large bloom of Microcystis sp. as well as low numbers of Ceratuim sp. were reported to coincide with the period of crocodile mortalities.

The situation has aggravated even more due to decline of water-bird numbers along the Olifants River down to Kruger National Park. White-breasted cormorants numbers declined in this area compared with 20 years ago. In the Kruger National Park downstream of Lake Loskop there was recently a 35 % decline of in African fish eagle numbers comparing with reports from 1992. The number of White-crowned lapwings also dropped from 104 birds counted in 1992 to only 67 birds, while Goliath heron are rare nowadays. Scientists are speculating that the reduction in Goliath heron can possibly be caused by pansteatitis (Myburgh & Botha, 2009).

The lack of continuous assessment of surface waters for the appearance of cyanobacterial blooms, as well as the limnological drivers behind the development of cyanobacterial blooms in national parks is major problem. Death of wildlife due to cyanobacteria has a negative impact on the growing economy of South Africa, as ecotourism rely on wildlife (i.e. game farming) as the main tourist attraction.

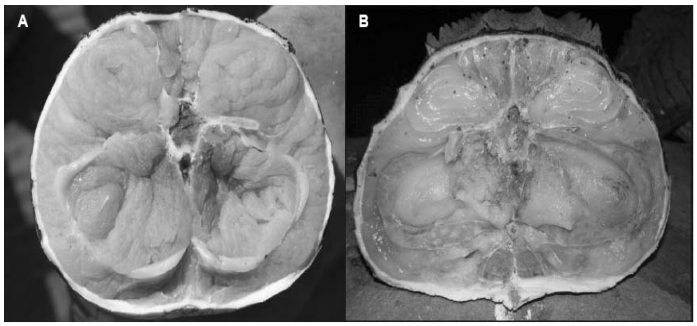

Figure 2. Cross section of crocodile tails from, (A) a healthy crocodile, and (B) a crocodile with pansteatitis (Photos: Jan Myburgh).

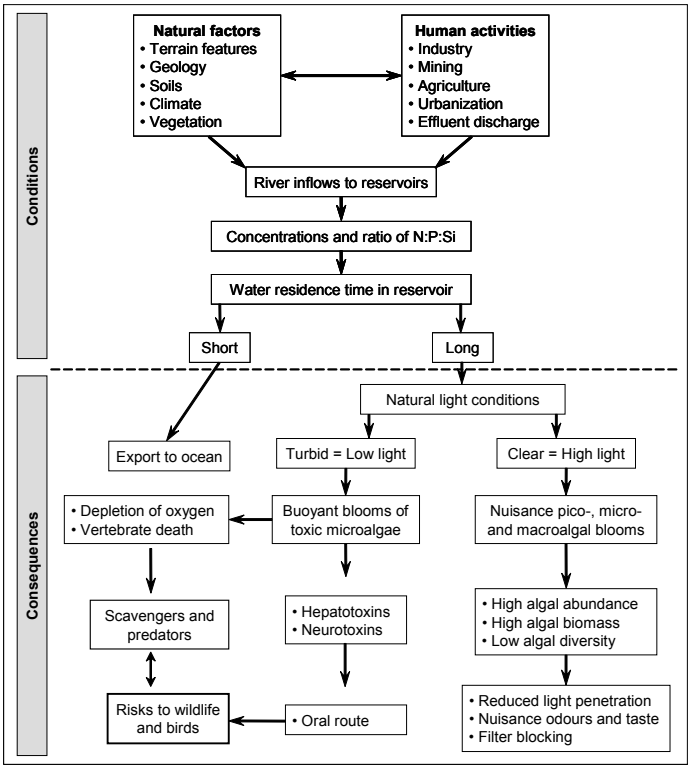

Figure 3. Overview of the sequence of interacting factors and the potential consequences of nutrient enrichment of freshwater in man-made impoundments and rivers.

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Inter-Basin Water Transfer Between the Modder and Caledon River Systems, South Africa

South Africa is a semi-arid country where the mean annual precipitation for the subcontinent is 497 mm (40% below the world average). Sixty-five percent of the country receives < 500 mm of rainfall annually and 21% receives < 200 mm . The western part of the country is more dry (Department of Water Affairs and Forestry (DWAF), 1994). Of the annual rainfall, only 8.6 % is converted to runoff. The remainder is lost through evaporation and groundwater sources. In fact, South Africa has one of the lowest conversions of rainfall to runoff in the world, with a total surface run-off of only 51-53 km3 per annum. Owing to the variability and the high evaporation losses from dams, only about 62% (33 km3) of the average annual runoff can

be used cost-effectively (DWAF, 1994). In addition, the distribution of water across the sub-continent is spatially skewed. Rivers of the eastern escarpment yield 66 % of the total runoff, while 33 % of the land mass yields just 1 %. Also, the bulk of South Africa's population is located in the Gauteng area, where evaporation exceeds precipitation and river flow can be extremely erratic (Davies et al., 1992).

Water availability is a challenge for South Africa and a part solution is inter-basin transfers. Water transfers by canals can be traced back to at least 4000 years ago in Egypt (Lake Qarun). The Romans built aqueducts in 200-300 BC up to 90 km in length , which delivered > 100 litre per capita per day to Rome (Overman, 1968). There are several definitions of inter-basin water transfers and they all imply: "the artificial withdrawal of water by ditch, canal or pipeline from its source in one basin for use in another". Long-distance-, inter-regional-, inter-river-, large-scale-, inter-catchment- and inter-basin water transfer are all terms that have been used to describe this transport of water from an area of surplus to one of deficiency. Since water resources are in short supply in southern Africa, several inter-basin water transfer schemes have been constructed throughout the region to augment the supply of freshwater. A total of 26 major inter-basin water transfer schemes have been completed and these include the; Eastern National Water Carrier (Okavango - Swakop), Komati Scheme, Usuthu Scheme Maputo, Vaal - Crocodile, Orange River Project (Orange - Great Fish basin), and the Lesotho Highlands Water Project. Extensive tunnelling is often an integral part of these transfer schemes and the longest one in South Africa is the Orange-Fish River tunnel, 82.8 km long with a diameter of 5.3 m, which delivers at peak 54 m3 s-1 (DWAF 1994).

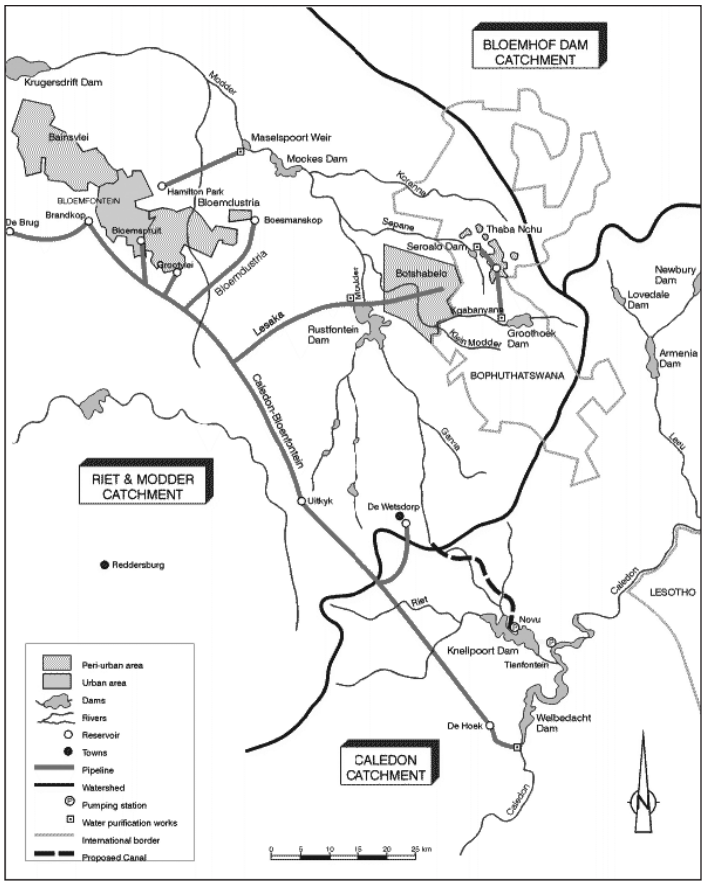

Figure 1: The Novo Water Transfer scheme.

Any transfer of water within or between basins will have physical, chemical, hydrological and biological implications for both donor and recipient systems, as well as for their estuaries and local marine environments (Davies et al., 1992). In view of this background, the inter-basin transfer scheme between the Modder and Caledon Rivers (Novo Transfer Scheme) was investigated and impacts identified and assessed (Fig. 1). The total catchment of the Modder River is about 17 360 km2 and orders larger for the Caledon River. The scheme essentially entails the transfer of water from the Caledon to the Modder River to augment the water supply to several cities and communities. Both the Welbedacht and Knellpoort Dams form part of the transfer scheme, where the main pumping station transfers water from Knellpoort Dam to the upper reaches of the Modder River (Fig. 1).

The Modder River catchment lies within a geological area classified as the Molteno, Red Beds and Cave Sandstone Stages of the Stormberg Series and the Beaufort Series, both of the Karoo system (Grobler & Davies, 1981). The Caledon River originates in basalt of the Lesotho region and then flows through Cave Sandstone and because of the steep relief this river carries a large sediment load. Because of this, siltation has decreased Welbedacht's gross storage capacity from the original 115 million m3 to ca.30 million m3 in only nine years.

Both negative and positive impacts of the Novo Transfer Scheme were envisaged. These included:

a. The effect of water withdrawal on disrupting the River Continuum, as in the case of dams
b. Changes in flow regimes and subsequent impacts on fish and invertebrates in the system. The diversion could promote ecological instability in rivers, while channelization can remove/ disadvantage some flora and fauna
c. Increase in turbidity levels
d. Changes in nutrient concentrations
e. Possible accelerated erosion rates
f. The transfer of species

From the study we found that:

a. Since the withdrawal of water from the Caledon River will only take place during the high flow season, it should not have a significant impact on this River Continuum. In addition, the high turbidity limited algal growth as well as invertebrate abundance.
b. The release of significant volumes of water from Knellpoort into the Modder River resulted in a change in the flow of the river, with a subsequent change in the algal and invertebrate communities.
c. The transfer resulted in a change in the turbidity of Knellpoort Dam, but since the abstraction point to the Modder River is on the opposite side of the impoundment, it did not influence turbidity levels in the Modder River.
d. Results suggested some nutrient enrichment of Knellpoort Dam, because of the inflow of more nutrient-rich water from the Caledon River.
e. No differences were found in the zooplankton, phytoplankton and fish populations.

This study clearly stressed the importance of impact assessments prior to the building of inter-basin transfer schemes in order to mitigate possible negative environmental consequences. For example the transfer of Schistosomiasis into several river systems in South Africa (and elsewhere) has been attributed to water transfer schemes.

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SEDEC: Social and Ecological Drivers of Ecosystem Change in Lake Victoria, Tanzania,

SEDEC is an integrated research program that started a bit more than a year ago. Lake Victoria's ecosystem has changed drastically in the past century. Its fish community shifted in the 1980s from a very diverse haplochromine dominated system to one dominated by four species, the introduced Nile perch and tilapia, and the native cyprinid dagaa and shrimp Caridina nilotica. In the past decade, further changes have been observed, including the return of some haplochromine species, many of which are considered extinct (Goudswaard et al., 2008).

Figure 1. Nile perch stomach contents–not a single shrimp. We were surprised to find haplochromines were again a dominant part of perch diet, leading us to re-think about the results of our food web experiments.

The idea behind the SEDEC program is that two major processes in concert drive changes in Lake Victoria's ecosystem: increasing fishing pressure and continued eutrophication. Both drivers pose major threats to the resource base and livelihoods of the people around Lake Victoria. The local authorities, scientists and fishermen agree about a decrease in stocks of the introduced Nile perch, stating they do not catch the same size or number of fish they used to, and they attribute this to over-fishing (Matsuishi et al., 2006). However, experimental fisheries' surveys on the lake suggest that fluctuations in Nile perch stocks are not those expected from increased exploitation (Kolding et al., 2009). A potential explanation is that the productivity of the lake has increased because of eutrophication, the level of which seems unprecedented in the history of the lake (Verschuren et al, 2002) and further shifts may result from hypertrophication. Also, long-term studies on native haplochromines continue to reveal unexpected changes in abundance, diversity, morphology and behaviour of these fish (Katunzi et al., 2003; Kishe-Machumu et al., 2008). Four Ph.D. students, based in Mwanza, Tanzania, and in the Netherlands, carry out the study: Modesta Medard studies social factors that drive decision-making processes of fishers; Happy Peter analyses ecological factors that drive Nile perch distribution and spatial effort allocation by fishers; Ilse Cornelissen works on the impact of eutrophication and Nile perch predation on food web structure; and Andrea Downing models the interactions and feedbacks resulting from eutrophication and fishery. SEDEC's first season of field work is nearly over and already we observe that stocks, population interactions and the environment are changing fast. For instance, where recent report state that small sized Nile perch mainly feeds on Caridina. Preliminary stomach content analyses of this fish caught in Mwanza gulf and the Speke gulf showed that fish measuring 17-30 cm in length mainly fed on fish, including small Nile perches and haplochromines. Our results suggest that Nile perch benefit from the resurgence of the Haplochromines. Furthermore, we found that ecosystem mass-balances based on published and survey data suggest that resurging haplochromines are occupying a different

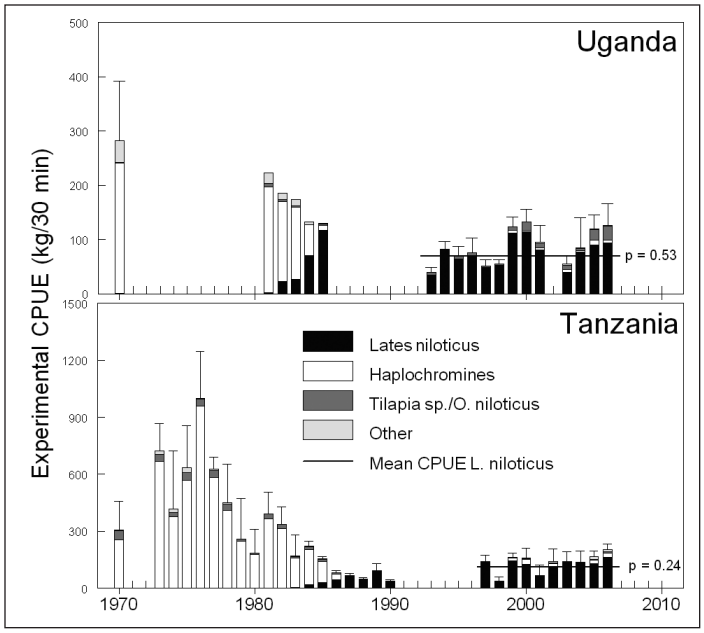

Figure 2. Standardized catch per unit effort (kg·30min^{-1}) in experimental trawls in Uganda and Tanzania for all stations less than 40 m depth. Experimental trawlers do not catch Rastrineobola or Caridina, hence the apparently low relative abundance of the total stocks following the collapse of the haplochromines. p-values indicate the significance of the trend line: as trends are non-significant the mean over the time series is shown (From: Kolding et al 2009).

niche than the one they used to dominate. Lastly, while hypoxia is reported to be continuous from depth of 25m downwards to anoxia below 50m depth, the August September survey in the Speke Gulf and Mwanza Gulf? saw a reasonably oxygenated water column (>2 mgl^{-1}) at depths up to 45m and hypoxia was only observed at at the bottom. Size-structure and distribution of Nile perch is expected to be affected by low oxygen levels, but now Nile perch was found all over the water column. Scientists from Tanzania Fisheries Research Institute (TAFIRI), the Lake Victoria Fisheries Organisation (LVFO), and the Ugandan Fisheries Research Institute (NAFIRRI) keep us updated with recent (unpublished) data on fish stocks and fishing patterns. Such knowledge has already prompted us to modify some of our experiments. The fisheries-oriented perspective that has so far dominated research and the view that fish community changes were largely responsible for the lake's changes at all trophic levels on Lake Victoria is slowly being supplemented by an increase in studies emphasizing effects of eutrophication and the interactions between top-down and bottom-up ecosystem processes. The SEDEC project is also helping shift the current emphasis by combining different fields of study to identify perspectives for an integrated ecosystem approach to managing the lake's fish stocks and environment.

Further information: http://www.afi.wur.nl/UK/Research/Projects_SEDEC/

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Insights into the Contribution of Cyanobacteria to the Resilience in a Tropical Shallow Brazilian Reservoir

Many studies have demonstrated that, because of the artificial eutrophication process, *Cyanobacteria* proliferate in many lakes all over the world, contributing significantly to equilibrium phases. These steady-states are of short duration at temperate latitudes due to the sharp seasonality, and tend to be longer in subtropical and tropical regions persisting sometimes over years (e.g. Becker et al., 2008).

Garças reservoir (23º38'08"S and 23º40'18"S) is an urban hypertrophic ecosystem located in the city of São Paulo (southeastern Brazil) (Fig. 1). The reservoir is a shallow, warm polymictic discontinuous ecosystem, i.e. it has stratification periods varying from days to weeks, i.e. more than one circulation period per year. Its maximum depth is 4.7 m, surface area 88,156 m^2, volume 188,785 m^3 and its maximum length is 512 m. It has seven tributaries, of which four are non-treated water and just one is oligotrophic. The reservoir has a single outlet and a water retention time of 71 days.

From a 12 years (1997-2008) data series analysis, the effects of mechanical removal of *Eichhornia crassipes* on the limnological characteristics and algal biomass were recognised. Cyclic anoxic periods previously observed during springs and summers before the water hyacinth removal (phase I) were replaced, after the macrophyte outbreak (phase III), by extended periods of anoxic conditions in the sediment overlying water. The long-term P dynamics initially driven by allochthonous nutrient loadings was replaced by internal ecological processes. Feedback mechanisms led to a switch to a more turbid state (Bicudo et al., 2007). *Cyanobacteria* were identified as playing a key role in the feedback mechanisms, enhancing stratification and resilience, anoxia at the bottom, and increasing suitable conditions for internal P loading. Since the end of 2007, the reservoir has been under a recovery program, which included diversion of three untreated sources from the zoo to a sewage treatment plant. Gradual cooler summer temperatures also contributed to the decrease of the water column stability. Under this scenario, changes in the bloom pattern were observed.

After water hyacinth removal, several cyanobacterial equilibrium phases (Sommer et al., 1993) were identified, i.e., a few species contributed with at least 80% of total biomass during some months (Fig. 2), and a bad ecological status and a significant decrease on the biodiversity were observed (Crossetti et al., 2008). Absence of external disturbance enough to change the phytoplankton community structure and dynamics led to an autochthonous driven succession. Then, seasonal patterns played a deterministic role in the bloom-type selection, under no nutrient limitation. Stratified periods with anoxic hypolimnion benefited *Cyanobacteria* with migration capacity (assemblage M: *Microcystis aeruginosa, M. panniformis*), leading to biomass increase and higher thermal stability, meanwhile mixed periods with low light availability selected shade adapted species (assemblages SN, S1, H1: *Cylindrospermopsis raciborskii, Planktothrix agardhii, Anabaena planctonica*). In the case of external loading reduction (especially N) and lesser thermal stability in the ecosystem, as evidenced in 2008, ecological attributes of species capable of N fixing or P uptaking and storing adapted to mixed environments were extremely important (SN). Under any of these circumstances, the biomass increment was quite evident, increasing the light limita-

tion that led to a highly selective environment, with no submerged macrophytes or periphyton. The end of this scenario is a self induced steady state and extreme resilient and degraded ecosystem, with almost 9 years of equilibrium period.

These findings have important implication for management plans since feedback mechanism in tropical shallow lakes seem to be stronger than in the temperate ones, as stratification events are more likely to occur over the year, intensifying system resilience to restoration strategies. Moreover, N limitation may turn this ecosystem into an N-fixing monoculture, indicating the key role of P loading reduction for the reservoir's ecological status improvement.

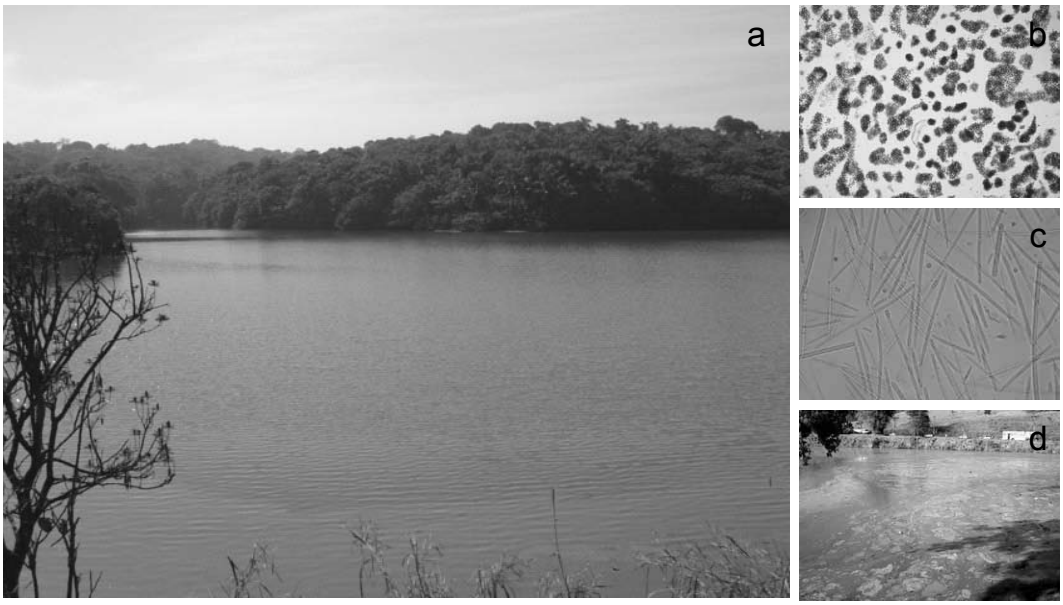

Fig. 1. Garças Reservoir after hyachinth removal (a), cyanobacterial bloom species Microcystis aeruginosa and M. panniformis (b), Cylindrospermopsis raciborskii, Aphanizonemon gracile and Planktothrix agardhii (c) and cyanobacterial bloom at margin of reservoir (d). Photos: Barbara Fonseca (a), Luciane Crossetti (b-c), Fernanda Ferrari (d).

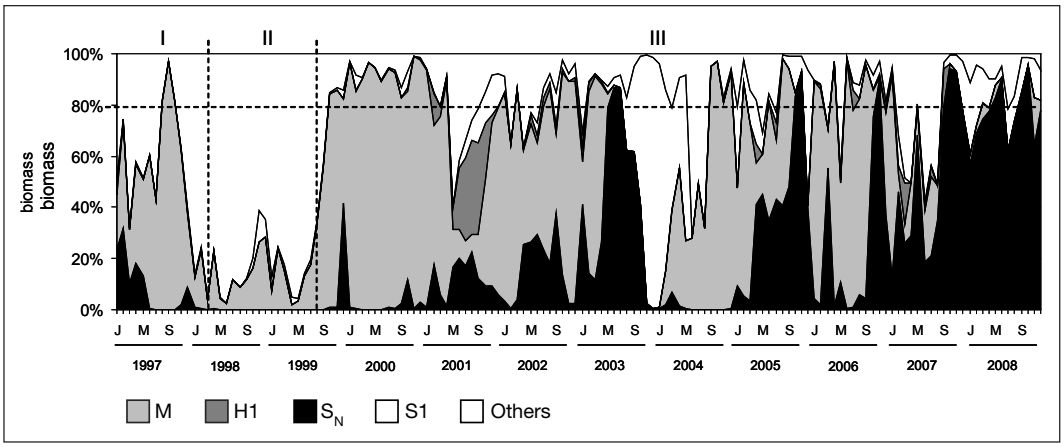

Fig. 2. Relative biomass of cyanobacteria functional groups sensu Reynolds et al. (2002) over twelve years (1997-2008) in Garças Reservoir. Legend: I = before macrophyte dominance; II = during macrophyte coverage; III = after macrophyte removal.

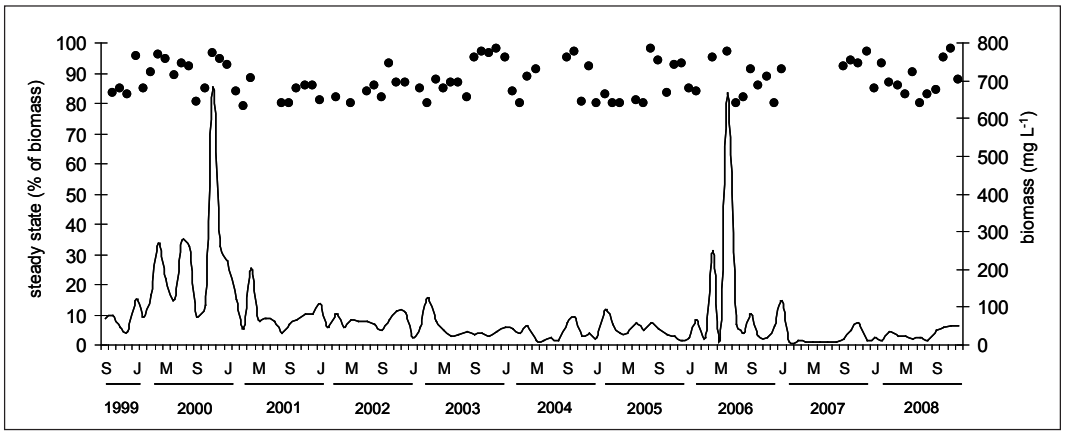

Fig. 3. Steady state periods (% biomass) and total biomass after macrophyte removal in Garças Reservoir. Legends: black balls = steady state period; line = biomass.

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Limnology in South China

Only if you lived on a remote island for the past five years or so you might have missed the recent spectacular breakthrough of Chinese limnology on the international scene. I would not be surprised if Chinese limnology were growing even faster than the Chinese economy! There are two major centers of limnology in Wuhan and Nanjing, but research groups are building up in countless universities elsewhere. That limnology is expanding so fast, probably even more rapidly than other sciences, is not without good reasons. Water quality (and quantity) problems in China are simply enormous: many major rivers are grossly polluted, and the vast majority of lakes and reservoirs are eutrophicated. In the subtropical south of the country that includes the province of Guangdong, *Cyanobacteria* (blue-green) blooms are now perennial, and most are composed of nasty, toxic strains. Control of water quality is therefore high on the agenda, the more so as Chinese people, with their sense of esthetics, are extremely fond of clear, clean water. If you want to gain a quick idea on the magnitude of the water supply problems facing the Chinese, take a look at the recent book on Lake Taihu, the large, shallow lake supplying most of the drinking water of the megacity of Shanghai! (B. Qin, editor, 2008, Lake Taihu. Monographiae Biologicae volume 87, Springer, Dordrecht).

At Jinan University, one of the several universities of Guangzhou (also known as Canton), a city of over ten million people, situated a mere two hours drive from Hong Kong, two young professors have been working hard to try and produce the mix of fundamental and applied limnology that is required to cope with the environmental problems of South China. Boping HAN was trained in the Czech Republic by the late Milan Straskraba. Originally a modeler, he soon converted to aquatic ecology. Zhengwen LIU, the second professor, was trained as a fish ecologist by Alois Herzig and colleagues in Austria. Each of these two limnologists now has its own group of students doing thesis work, with several Ph.D.'s already finished. Zhengwen Liu's team is mainly attempting lake manipulation, to restore the water quality and scenery of some city lakes and reservoirs. Restoration of Xihu Lake ("West" lake) can even be seen as a model for tropical shallow lakes in general. Still murky and smelly a few years ago, it is now a focus of local tourism! As stated above, Chinese are quite fond of boating and strolling along lake shores, and people protest the disappearance of macrophytes and the dull green colour of the water. Boping Han has a broad interest in reservoir and river ecology. Besides his central lab at the Institute of Hydrobiology at the Jinan University campus, he operates three field labs in cooperation with various reservoir authorities, and his students work and live there for longer periods of time. I was surprised how well equipped these labs are, and how quickly their equipment gets upgraded. Money is clearly not an issue here! In contrast, space is, and in the central lab on campus, students have to work in shifts. The Jinan students, as students elsewhere in China as well, are highly motivated. Through a complex system of selection, they get recruited China-wide. Many come from thousands of kilometers away, and only see their homes once or twice per year. They subsist on a small budget, yet all have a personal laptop, and their degree of computer-literacy is impressive (they often taught me " tricks" that are new to me). I have been associated with Boping Han's lab for five years now, and it has been a most rewarding exercise. Besides learning the basics of Chinese language, which I thoroughly enjoy, I discovered a series of fascinating limnological problems, now studied in depth by some of Boping's students, that may soon throw a new light on some aspects of tropical limnology. In the Reservoir of Liuxi He, not far from Guangzhou, we found that the plankton is occasionally structured by a pelagic flatworm. In particular, it manages to knock out the local *Daphnia.* Also unusual is the co-occurrence of about four *Difflugia* spp. in pelagia. At least two of them are carnivores, that actively catch rotifer prey. And the large pelagic cladoceran *Leptodora* has a good population in the reservoir too. Among other things, this is the only known population that extends as far south as the Tropic of Cancer!

Figure 1. Liuxi He Reservoir, Guangdong Province, China, seen from the large enclosure platform used by Professor Boping Han for experimental studies. The picture was taken in July 2009, during monsoon, and heavy clouds float around the magnificent lake.

In these five years, I have also seen the lab progress in an impressive manner. Visitors from outside China abound, and have included Martin Dokulil, Alois Herzig and Fritz Schiemer from Austria, Erik Jeppesen from Denmark, Luigi Naselli-Flores from Sicily, Ramesh Gulati from Holland, and the late Stanley Dodson and Paul Hansen from Wisconsin, USA. All have contributed to the growth of the research group by their advice. Of late, in situ experimental ecology using large enclosures (see photograph) and molecular ecological methods have been the latest additions to the work at the lab. In fact, I see one weak point only: lack of (older) taxonomic literature, and lack of proper taxonomic training. Chinese people have a Chinese name for every plant and animal and promptly invent names for new species, and I found that these names are structured exactly like Linnean names. Unfortunately, Chinese students find Latin very difficult, and tend to ignore mainstream scientific names. At times, that makes communication difficult. Fortunately, there is the search engin Google, and its Chinese counterpart Baidu, that helps us to sort out scientific names. I also find myself quite often teaching the students how to pronounce these long and complex names!

However, few things I know are nicer than a day of field work on Boping's giant enclosure in the reservoir of Liuxi He! At least, if it doesn't rain.

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Welcome to the FBA

Since Alan Hildrew wrote his article on the Freshwater Biological Association in SILNEWS 49 (December 2006) there have been a lot of more positive developments and the Association is now in a much healthier position. Although the iconic Ferry House was sold, FBA's headquarters at Windermere has moved next door to the Pearsall building on the same lakeshore site, now known as Ferry Landing. The Association also still owns the River Laboratory in Dorset, including its fluvarium and other facilities, including access to the River Frome, and a Reference Site of the Water Framework Directive. This article is intended to update SIL members on the facilities and opportunities the FBA can now offer you and your colleagues for research, training, conferences, and many other activities. Detailed information about our facilities is available on the FBA website (www.fba.org.uk) and in the FBA's most recent Annual Report, a pdf copy of which can be downloaded from the website (www.fba.org.uk/index/about.html)

Research facilitiesThe FBA's two centres offer immediate access to a range of freshwater field sites close to laboratory facilities. Scientists from the Centre for Ecology and Hydrology at Edinburgh, our former tenants, still require access to some facilities and our Honorary Research Fellows continue with their research, but there is now capacity to accommodate visitors to use the facilities. The Association would therefore welcome any members of SIL who might wish to spend some time as visiting researchers at FBA, and can provide indicative costs for facilities on request. In addition to the direct access to Lake Windermere from Ferry Landing, the Association also has access to a number of other lakes, tarns, streams and wetlands in the Lake District, details of which are given on the website (www.fba.org.uk/index/facilities). As well as laboratory space, there is an indoor aquarium, outdoor tanks and boats on our jetty that are available for the use of visiting scientists.

In Dorset too there is direct access to a number of running water and associated wetland habitats. The River Laboratory has been renovated and some of the laboratories are now leased to universities, environmental consultancies and long-term projects, but visiting scientists would always be welcome. There are good photographs of the outdoor channels and of the large, indoor fluvarium on the website.

The outdoor facilities at both Windermere and Dorset include sets of large circular tanks for experimental purposes. Some of those at Windermere are currently being used by Dr Roger Sweeting to culture freshwater pearl mussels (Margaritifera margaritifera) in support of a project to conserve this species, which is in danger of disappearing from British waters. We are particularly keen to welcome more conservation-related activities of this sort, using the tanks.

Information: Publications, Library, Archives and Long-term Data

The FBA's very comprehensive library is mainly at Windermere, with a satellite facility at the River Lab. The library holds a vast range of materials from all over the world, including journals that are not widely accessible, received on exchange with other research institutions. There is already a list on the website of the periodicals held which, in due course, will be made more searchable. The library also contains a large collection of reprints from journals to which it has not subscribed, enhancing its coverage. We shall be seeking funding to eventually put the full catalogue of the library and details of the unpublished collections on-line. The latter include a number of important long-term data sets, field notebooks, correspondence and the archives of individual scientists, as well as a rich collection of material on African lakes and rivers. There are also large collections of specimens and samples. These include invertebrate specimens used for creating identification keys; many of T.T. Macan's prepared slides; zooplankton and phytoplankton samples from the long-term surveys of Windermere and surrounding lakes, some dating back to the 1940's; a few even older samples, including phytoplankton samples from Windermere collected in 1903; and an odd mixture of samples from around the world, including water samples collected in Lake Titicaca in the 1920s. Anyone interested in working with this historical data should get in touch.

The Fritsch Collection of Algal Illustrations is also housed at Windermere. With a recent grant from the Pilgrim Trust about half of the desmid collection (7000 sheets, covering 1750 species) has already been scanned and conserved. Funding is now being sought to scan the remaining desmid sheets and those of other groups (an

Photo 1. Wet grassland around the River Frome in East Stoke with the church in the background

Photo 2. The FBA lab at Windermere during an invertebrate ID course.

estimated 100,000 sheets in total), to put them all on-line so that, eventually, the whole collection will be available. In the meantime, of course, they can still be accessed in the usual way. For more information go to the Fritsch collection website: (www.fritschalgae.info).

A major recent development is our new journal Freshwater Reviews edited by Professor Colin Reynolds. Each paper is first published on-line and is freely available to members of FBA and by subscription, with the abstracts accessible to all browsers. The journal is published twice per year as printed issues. Please have a look at it (www.fba.org.uk/journals) and perhaps you can persuade your institution to subscribe. Our Scientific Publication series (www.fba.org.uk/index/books.html) is still going strong, with an average of one new or revised identification key produced per year, and we are looking to expand the geographical coverage of our guides, as well as catering for less experienced users.

FreshwaterLife

FreshwaterLife (www.freshwaterlife.org) is an on-line portal providing news and information on freshwater events, keys for identification of freshwater organisms and aims to be a universal source of information and a forum for discussion among those involved in our science. The FBA was a founding partner of FreshwaterLife and it is now based at our Windermere site.

Conferences and Courses

Each year the Association organises its Annual Scientific Meeting, held in different parts of the UK. A major international Conference in Aquatic Biology is held every two years, with the next in April 2010. The Association is also a key supporter of SEFS – Symposium for European Freshwater Sciences – the most recent of which was held this summer (2009) in Romania. For our own and external meetings, the FBA has rooms at both its centres; these can be hired for small conferences or meetings of any sort.

The FBA also organises various training courses for both professionals and amateur enthusiasts. Many of them are concerned with the identification of various groups of freshwater organisms, others with survey techniques used by organisations such as the UK Environment Agency. A number of universities use our facilities for student field courses and more of these would be welcome.

Summary

After a very difficult period the Freshwater Biological Association is now able to look forward positively and can offer facilities and services to a wide range of users within the network of freshwater biologists. It is 80 years since the Association was founded to support research in freshwater science. Now that we are coming out of a period of uncertainty, we are actively exploring ways in which we can work closely with SIL for our mutual benefit and for the benefit of freshwater science globally. We hope SIL members who are not already members of FBA will consider joining us and those of you who might have the possibility of working with us, even if only for a short period, will always be welcome.

I am most grateful to Dr Mike Dobson, Director of FBA for his help with writing this article.

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Historic River Data Archives: Protecting the Future by Mining the Past

Biological monitoring of rivers in England began in earnest during the 1930s when Drs R.W.Butcher and F.T.K. Pentelow carried out surveys on polluted rivers in the Midlands and the west of England. They used diatoms, filamentous algae and invertebrates as indicators. In the 1950s, Mr. H.A.Hawkes and Mr. F.S.Woodiwiss began regular surveys of some of England's most polluted rivers. Woodiwiss also included some of the cleaner rivers. In the US and Europe biological surveys of rivers had been in progress since the turn of the 20th century and historic data from the Illinois and the Rhine reach back to that era. By 1960, Dr. H.B. Noel Hynes had published his keynote book, "The Biology of Polluted Rivers" (Liverpool University Press) and river biologists were beginning to be appointed to the staff of several regulatory bodies. As biologist to the Lincolnshire River Board in Eastern England in 1961, I was one of these early pioneers, carrying out chemical and invertebrate surveys and fish studies.

In 2000 it occurred to me that many of the data from surveys in the 1950s had not been published and must be perhaps languishing in old files. A short article in the Newsletter of the Freshwater Biological Association brought a contact from Mr.Woodiwiss that he still had most of his early data in storage ,all 22,000 paper sheets dating from the 1950s. Having heard from others about paper records still in existence, my wife and collected some hundreds of other datasheets from various sources (including my own early data) and a collection of data cards and paper recording chemical data from the River Thames Tideway reaching back to 1913 and before. All of these data are now stored and recorded in the Archives and Special Collections Unit at Southampton University under the care of Professor Chris Woolgar and Miss Karen Robson. Over the past few years, working with far sighted people from the Environment Agency, we have collected further records and are hoping eventually to house the official collection of original paper-based raw biological river data, from before 1980.

The early 1950s and 1960s data come from a time when many kilometres of river in England (and in other countries) were black, foul-smelling and completely fishless and some reaches contained no invertebrates at all. Long reaches also contained a pollution fauna comprising only Oligochaetes and the hog-louse Asellus aquaticus. By 1980,however, many English rivers were clean with thriving fish populations thanks to a combination of factors including new laws, economic evolution, industrial migration, recession, new effluent treatment technologies. by public opinion. With the data from current surveys,

Fig. The River Trent in 2008, clean with a thriving fishery and diverse invertebrate fauna. In 1965, this reach was black, grossly polluted and foul-smelling, with no fish. The only invertebrates present were Oligochaete worms.

held by the Environment Agency from around 1981-82, there is now more than 50 years worth of raw biological data from some rivers, a most valuable and important database. Although some of the data may not be of the high quality of later data collections, the records provide a background that can be standardised and calibrated to present day standards. Working with specialists from the Environment Agency and the Centre for Ecology and Hydrology, the team at Southampton University is analysing datasets to try to evaluate causes of improvement in various rivers and the extent to which recovery has occurred and might occur in the future. This work, we hope will help protect the future of rivers by showing the effects of various factors and events and by tracking the relationships between chemistry and biology. The database is open to all scientists, with the agreement of the Environment Agency, and we hope that more detailed analysis will help regulators and industry in their future plans for maintaining and improving ecological quality of rivers in the UK and other countries By providing generic models.

We would like to be in contact with environmental agencies in other countries which have long runs of historic records and perhaps arrange a Symposium or a session in a Symposium to compare the data and their values. In parallel with this Archive, the Freshwater Biological Association in the UK has long archived datasets on lakes and on some streams in the north of England. At the same time, the Environmenal Change Network in the UK has a set of relatively new sites which are being used to monitor climate change effects.

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Sustainable Energy Production from Geothermal Sources qnd Possible Effects to Groundwater Ecosystems

Subsurface energy production currently faces a dilemma. On the one hand, geothermy promises to be an infinite source of energy capable of meeting humanity's needs in an environmentally more sustainable way than many alternatives. On the other hand, changing temperature regimes of subsurface environments and introducing dynamics into habitats characterized by extremely constant conditions poses potential threats to these ecosystems and their services. The subsurface water is, after all, our most important source of drinking water. In this controversy, at present, legal authorities have to regulate various geothermal technologies often purely by technical experience and 'rule of thumb', and international as well as regional authorisation practice is highly variable. This is the foundation of a new and exiting field of research.

It is by now considered possible to produce up to 8.3% of the total world electricity with geothermal resources. However, using geothermal energy to generate electricity requires large amounts of cooling water either from surface sources or aquifers. Cooling water is typically returned into the environment at significantly increased temperatures. A similar effect is connected to surface-near groundwater thermal use. The application of ground-source heat pumps (GSHP) allows utilising groundwater thermal energy for both heating and cooling almost anywhere in the world. Annual increases of 10 to 15% in GSHP sales have been reported from Europe, North America and China. Two types of GSHPs are distinguished: (A) In closed loop systems, pipes circulating a water-antifreeze solution are placed either horizontally at a depth of 1-2 m (ground heat collector) or vertically down to 50-250 m (borehole heat exchanger, BHE). In contrast, groundwater is directly extracted from a well to the heat exchanger and returned to the aquifer via injection wells in open loop systems.

GSHPs typically extract heat from the ground in winter, which means cooling the aquifer while discharging heat into the subsurface in summer for the cooling of buildings. Thus, operation causes pronounced groundwater temperature dynamics from as low as 4°C in winter to >20°C in summer. Even some large open loop systems aiming at high temperature heat storage (30-90°C injection temperature) are already operational in Germany (e.g. the Reichstag in Berlin).

Groundwater systems are not only abiotic reservoirs of water and thermal energy, but they harbour an almost untapped diversity of microorganisms and meiofauna. Living conditions in groundwater are considered harsh. Indeed, temperatures are usually low, and food and energy sources are scarce. However, these conditions are usually stable and predictable even over geological time scales. This has facilitated a perfect adaptation of intrinsic organisms. Aquifer microbes are generally low in numbers and small in cell size, with doubling times in the range of days to weeks rather than hours. Groundwater invertebrates, e.g. both amphipods and isopods have very low metabolism, and

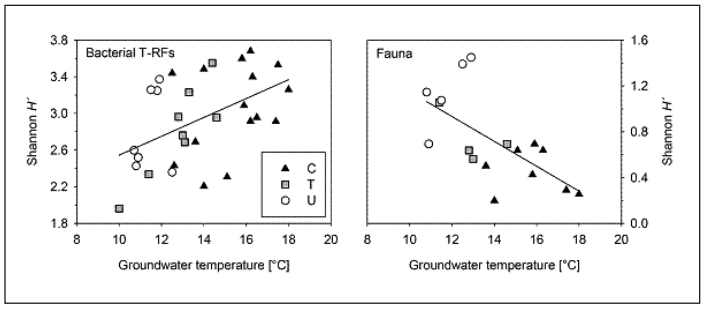

Fig. 1: Shannon-Wiener diversity of bacterial T-RFLP fingerprints and fauna in relation to groundwater temperature. The ordination discriminates wells unaffected (U in white), temporally affected (T in grey) or continuously affected (C in black) by heat discharge (modified from Brielmann et al., 2009).

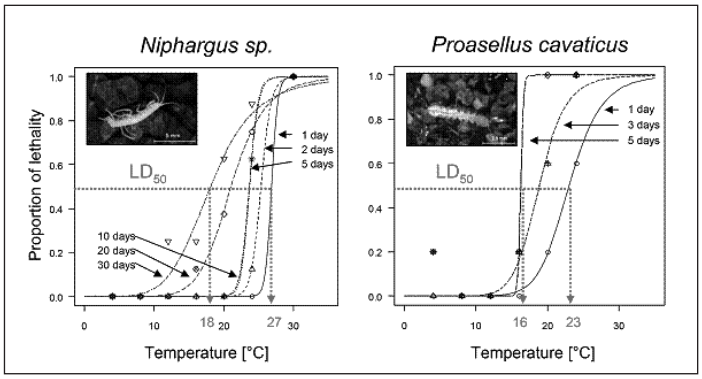

Fig 2. Non-linear dose-response curves (Logit) for Niphargus sp. and Proasellus cavaticus. LD50 values range from 18-27°C and 16-23°C, respectively, strongly determined by the total time of incubation. Long-term exposure to elevated temperatures results in high mortality of groundwater invertebrates. Data on Niphargus sp. are from Weber (2009), data on Proasellus cavaticus from Ferraro (2009).

slower reproductive cycles than their above-surface counterpart. They, however may live for 15 years and longer, i.e. an order of magnitude longer than their surface relatives. Some may even survive periods of more than one year without food.

So the question is what impacts are to be expected for groundwater biota when they have to cope with sudden and chronic temperature changes? Since temperature changes impact both aquifer hydro- and geochemistry, they can influence the composition and activity of aquifer microbial communities and thus the self-purification capacity and the stability of the ecosystem. When cooling an aquifer, GSHPs may reduce or inhibit important biogeochemical functions. Conversely, increasing temperatures may increase microbial activities and thus mineralization processes. This could even be a beneficial side-effect of heat discharge especially in polluted urban areas. However, elevated temperatures impose a potential hygiene problem. Groundwater fauna is expected to emigrate from warm to cold areas. Therefore, high temperature storage of water in aquifers (>50°C) will certainly cause severe shifts in aquifer (micro-)biota and biogeochemistry.

To date, only a few scientific studies have aimed to monitor temperature effects on indigenous groundwater microbes and fauna. Using classical plate counting methods, shifts towards thermophilic and Gram-positive bacteria were reported only at higher temperatures (up to 60oC). For the fauna, Glatzel (1990) showed that the increase of temperature from 8°C to 16.5-24°C shortened the total developmental time of a groundwater copepoda (egg-laying to adult) to one-fourth, but mortality above 19°C was very high. Issartel et al. (2005) hinted at the presence of stenothermal as well as eurythermal species within the stygobiontic genus Niphargus, suggesting severe knowledge gaps on the ecology of groundwater fauna.

The Life Science Foundation (http://www.life-science-stiftung.org) has been funding our pioneering project AQUITHERM since 2005. Our study has aimed at unravelling temperature-induced changes in aquifer ecosystem characteristics and functioning. A comprehensive field investigation of an aquifer downstream of an industrial GSHP facility with considerable heat discharge for cooling purposes was conducted in the area of the city of Freising near Munich, Germany. An integrated study approach comprised hydrogeochemical analyses, monitoring of microbial activities, profiling bacterial community and investigation of groundwater faunal assemblages for studying the heat plume (max. 18°C). Surprisingly, increased temperatures did not affect aquifer microbes in terms of total cell numbers, enzyme activities and carbon production (Brielmann et al., 2009). However, bacterial diversity clearly increased with the observed temperature increase (Fig. 1A), with appearance of distinct bacterial lineages and disappearance of others. On the contrary, faunal diversity decreased with temperature (Fig. 1B), highlighting the temperature sensitivity of groundwater invertebrates. These results may be representative only for energy limited oligotrophic and oligoalimonic aquifers, but aquifers receiving more inputs of organic carbon and nutrients, typical for urban and agricultural areas, can differ. This investigation is still in progress.

Long–term temperature tolerance experiments with selected groundwater invertebrates show that while some are quite tolerant to temperatures >20°C for a few days, their mortality increases with exposure time (Fig. 2).

In conclusion, geothermal energy is generally recognised as a climate-friendly and sustainable source of energy with low CO_2-emission. It is, however, a technology that impacts groundwater ecosystems, one of mankind's most valuable natural resources.. Further intensive and interdisciplinary research is needed to pave the way for a knowledge-driven authorization practice and a sustainable use of geothermy.

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The Three Outstanding Hungarian Limnologists and Hydrochemists of the 20th Century

Professor Lajos W. Winkler (1863-1939) as young chemist studied the solubility of gases in water. His most important contribution to limnology was the invention of a new and easy method to determine dissolved O_2 in water. Before this determination of oxygen dissolved in water was done by very complicated and in certain respect not completely reliable gasometric technique. Winkler elaborated in the 1880s his simple and accurate titrimetric method. This method quickly became widespread all over the world. Winklers method to determine dissolved O_2 in freshwaters was the only used technique for several decades in oceanology and limnology. Without this technique even the typology of freshwaters based on the oxygen conditions would have been impossible. In additions Lajos Winkler worked out several other hydrochemical methods to determine many other compounds dissolved in water. All these new methods facilitated an almost complete chemical analysis of fresh and salt waters.

Lajos worked successfully to solve many other technical and pharmaceutical problems too. At the turn of the century (1900) he became world-wide famous hydrochemist.

Professor Rudolf Maucha (1884-1962) was student and collaborator of professor L. Winkler. As hydrochemist and hydrobiologist he studied the chemical and limnological characteristics of different aquatic environments as lakes, fishponds, polluted waters, etc. Using the Winkler's methods to obtain exact and reliable limnochemical data affecting several important processes in the frequently changing aquatic biotopes, he worked out a simple, the so called semi-micro field methods to analyse small water samples. These are very handy means for the field studies, by using only small shaped glassware (pipettes, test tubes) and previously prepared very highly diluted calibrated standard solutions. These methods were in widespread use before electronic equipment became available. Maucha demonstrated several important chemical components qualitatively and quantitatively by his very demonstrative, the so called, star diagrams (see figure). By this way Mauchas methods are suitable to characterize different biotopes within a single waterbody as well as to compare conditions of different natural waters. Similarly, Maucha achieved important results by studying the energy flow in aquatic environments. He expressed the quantitative data in calories, starting from the irradiance of the Sun, to primary and secondary production to the decomposition of organic matter produced, and utilized energy unity to describe different aquatic life processes. This very valuable work is of pioneering character. Together with A. Thienemann, E. Naumann, F. Lenz and F. Ruttner, Maucha was one of the founders of the S.I.L. and became its lifelong vice-president.

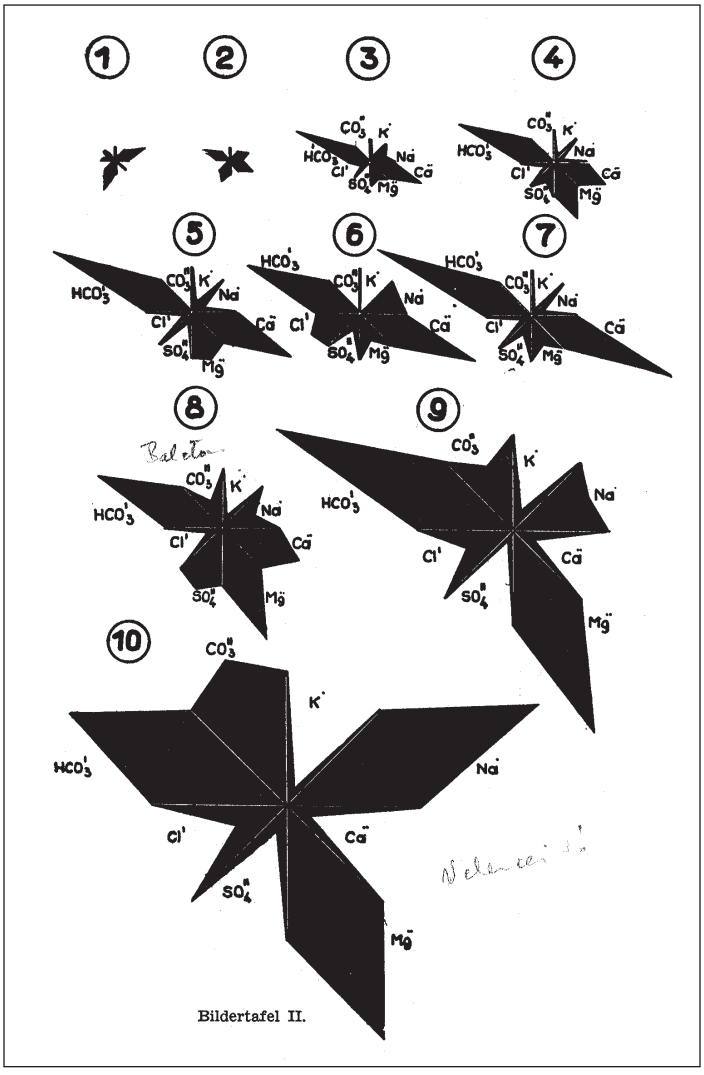

Figure: Star diagrams of Maucha that demonstrate the relative composition of major ions (both anions and cations) in lake water. By this way Maucha's method is suitable to characterize different biotopes as well as seasonal changes within single waterbodies

Professor Géza Entz (1875-1943) earned his doctorate in zoology and botany at the university in Budapest. He participated in several hydrobiological courses, among others at Naples, Bergen (Norway) and Den Helder, The Netherlands). Géza was a protistologist at the University of Utrecht (1920-1929). Obtaining detailed results regarding the fine structure of unicellular organisms, he became a pioneer in modern submicroscopic morphology of living cells and finally in molecular biology. Later, at the Hungarian Biological Research Institute in Tihany (1929-1943), he studied the limnology of Lake Balaton and quantitatively studies on plankton, and on benthic and littoral communities. Together with Miss Olga Sebestyén he established important relations among the main biocoenoses of Lake Balaton, with in its different biotopes. Entz summarized these works as a hand book "The life of Lake Balaton" in both Hungarian and German. This book provided a critical appraisal in the early 1940s of our knowledge of this shallow, large lake in Central Europe, and was widely used as a handbook of studies on Lake Balaton. Under the leadership of Géza Entz, the institute at Tihany became in 1930s a well known centre for limnology and comparative physiology in Central Europe.

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Bela Entz

Limnology on "The Sunny Side of The Alps"

"Country on The Sunny Side of The Alps" is a slogan advertising Slovenia as tourists' destination and refers to the position of Slovenia south of the Alps.

With an area of 20.000 km^2, Slovenia is among the smallest European countries, but at the same time it is among the most diverse in geographical regions and climate. Four geographical regions meet in Slovenia: the Alpine, Mediterranean, Pannonian and Dinaric regions, each with its characteristic climate and ecology. Over a distance of about 200 km, precipitation varies from more than 3200 mm per year in the west to lass than 800 mm in the east. The prevailing geology is carbonate rock (limestone and dolomite), which spreads over 44 % of Slovenia. The rest is mainly clastic rock and sediments.

The carbonate geology and high precipitation are reflected in the rather specific hydrological conditions. In the Alps on the north there are a lot of small streams and rivers with the characteristics of

headwaters. In the Dinaric region, in the central part of Slovenia, well developed surface and sub-surface karstic phenomena are present in the form of intermittent karstic lakes and large cave systems. Karst science, or speleology, had its birth in this area (Gams, 2003). The Mediterranean region, on the south-west, is rather small and characterised by contact between limestone and flysch, with some small and short surface rivers and rather large cave systems. The Pannonian region, on the south-east, is lowland where the main and large rivers come from the north (Austria).

Although very rich in rivers and streams, Slovenia has only two permanent lakes in the Alps, both of glacial origin. Lake Bled is 30 m deep with surface of 1.4 km^2 and lake Bohinj is 45 m deep with a surface of 3.3 km^2. On the high-mountain massif there are 14 small glacial lakes located on limestone, which gives them unique physical and chemical properties among the high-altitude lakes of Europe (Brancelj, 2002).

Before 1990 limnology was taught exclusively at the University of Ljubljana, namely by Darko Radinja, Rudi Rajer, Marjan Rejic and Danijel Vrhovšek, who studied physical, chemical and biological aspects of the two permanent lakes, while Boris Sket worked on karstic fauna in the Dinaric region.

Fig. 1.The most studied lake in Slovenia: high-mountain oligotrophic lake Jezero v Ledvicah (46o 20' 24.81" N, 13o 46' 56.58" E, alt. 1830 m).. The lake has been regularly monitored each autumn since 1991 (plankton, benthos, water quality). Within the EU project EMERGE (2000-2003) , palaeolimology of the lake has been studied for a period between 1600 and the present.

Fig. 2.Sampling groundwater along a river: The first systematic survey of groundwater fauna along the rivers in Slovenia was performed during the EU project PASCALIS (2002-2004). Since then study of groundwater ecology expanded, in both locations and technology.

After 1991, a new group for limnology was established at the National Institute of Biology in Ljubljana. In the very first years the group focused on high-mountain lakes in Slovenia, which were "terra incognita", in particular due to their difficult access. Within the next few years the lakes were included in three EU projects (AL:PE 2; MOLAR and EMERGE), which resulted in intensive studies of the physical, chemical and biological characteristics of the lakes, as they are today as well as in the past. Palaeolimnological studies revealed that fish-free lakes had undergone significant, negative, changes in their ecosystems after their introduction (Brancelj, 1999; Brancelj & al., 2000), resulting in intensive eutrophication. The lake sediments indicate intense long-distance pollution from industrial and transport activities in nearby lowland cities, as well as high levels of Cs-137 due to the Chernobyl accident in 1986. The lakes are now threatened by decreasing precipitation and increasing local air temperature, and by intensified tourist activities in the vicinity. Recent studies on lake Bohinj revealed that lowland lakes are also threatened by climate change, as mineralization processes there are accelerating (Simčič & Brancelj, in press).

Groundwater aquifers, both karstic and porous, are common in Slovenia. They are rich in both quantity of water and biodiversity. At present >200 strict groundwater dwelling taxa (i.e. stygobionts) are known, with *Copepoda, Amphipoda* and *Isopoda* as the most common taxa. *Copepoda* especially have been studied intensively over the last two decades, the 10 taxa that have been described are all endemic to Slovenia. Two out of three known stygobitic *Cladocera* were described from Slovenia (Brancelj, 1997). During the EU project PASCALIS, the group studied the ecology of meiofauna in hyporheic and phreatic zones of porous aquifers, and recorded new taxa of *Copepoda* but no new stygobitic *Cladocera.* After PASCALIS, research was focused on faunal composition in relation to environmental parameters such as temperature, oxygen concentration, conductivity, sediment structure and microbial activity (expressed in terms of activity of the electron transport system—ETS). As a special case study, the effects of gravel excavation from rivers were investigated. Strong effects on groundwater fauna were recorded. Currently, a study to define what constitutes the 'good' ecological status of groundwater, based on relations between hyporheic and phreatic fauna and water quality, is being conducted in parallel with activities already defined in EU Water Framework Directive (WFD) for surface water bodies.

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Spatial-Temporal Distribution of Iron in the Bottom Water and Sediment of the Mozhaisk Reservoir, Russia

Mozhaisk reservoir is located in upper stream of river Moscow. It has a drainage area of 1360 km^2, area is 30.7 km^2 , mean depth is 7.7 m, and maximum depth is 22.6 m. The reservoir has water renewal time of 1.8 years. About 60 % of reservoir bottom is covered by gray silts with organic matter content 6-8 %. The sampling station is located ~ 70 m from the shore, at depth varying from 12.6 to 17.0 m.

The bottom water (6 layers from the bottom 0–20 cm, 20–30, 30–40 etc., 60–70 cm) and a sediment column (length 25 cm, layers 0–2, 2–5, 5–10 cm etc.) were sampled monthly. Every four adjacent sediment strata were combined. Sediment centrifugation and filtration of the pore water were performed in the box filled with argon. The reactive Felab of solid phase was determined in triplicate one-hour extractions of air-dried sediment by 0.1 M H_2SO_4.

The three important peculiarities of iron distribution in the water-sediment system are:

- a high concentration of suspended Fe in the water layer 0 – 20 cm;
- a high content of Fe(III) in the anaerobic pore water; and
- a sharp decrease of Felab content in sediment layer 10 – 25 cm

The mean concentration of Fe-tot in unfiltered water, except in 0 – 20 cm stratum adjacent to the bottom, varied between 140 and 160 µg l -1, and in filtered water between 62 and 76 µg l^{-1}. In 0 – 20 cm layer, mean Fe-tot content was 596 µg l^{-1} in unfiltered water and 92 µg l^{-1} in filtered water with Fe (II) dominating. The Fe(II) concentration depends on O_2 concentration and varied from 0.3 to 11.2 mg l^{-1} in all the layers of bottom water. The ratio of suspended and dissolved forms of Fe decreased during overturn, while in the stratification periods it increase. I conclude that the main source of suspended and dissolved Fe in bottom water was related to sediments rather than to upper water layers. There is a certain "stagnation zone" in the deepest 0 – 20 cm stratum (Fig. a), which is maintained by mass exchange between water and sediments. The flux of Fe from sediment is accompanied by Fe(II) oxidation to Fe(III) as well as its sorption on colloidal iron hydroxide, which does not precipitate during long time. The flux from the bottom, estimated by the increase of Fe-tot concentration in the 0 – 20 cm stratum adjacent to bottom, amounted to 0.27 mg Fe m^{-2} d^{-1} in late December–February, 0.60 mg Fe m^{-2} d^{-1} in April–May, and 0.20 mg Fe m^{-2} d^{-1} in June–July. I assumed that Fe flux from bottom sediment occurs throughout the year.

The concentration of Fe-tot in pore water (annual range,1.2 – 1.7 mg l^{-1}) was 15-20 times higher than it in bottom water. Although dissolved Fe (II) dominates, there are some periods when the concentration of Fe(III) in pore water or sediment layers exceeded Fe(II) (Fig. b, c). For example in March, at the minimal reservoir level, and Eh ≤ – 110 mV in the 0 – 10 cm of sediment the concentration of Fe(III) was 2 – 3 mg l^{-1} and concentration of Fe(II) 1.2 – 2.2 mg l^{-1}. This seems to be caused by the anaerobic oxidation of Fe(II) by O_2 and NO_3^- and in deeper layers by Mn oxides) as by the discharge of ground water (Fe ~ 20 mg l^{-1}). Fe concentrations in solution tend to form complexes of dissolved Fe by dissolved organic matter, more for Fe(III), than for Fe(II). The ground water discharge increased during extremely low water level (March). Annual variations of NO_2^- +NO_3^- in the layer 0–5 cm was from 0.12 to 1.43 mg l^{-1}, and for Mn it was from 30 to 75 mg l^{-1}. The concentrations of O_2 and NO_3^- in bottom water (0–20cm) and content of Fe(III) and Fe(II)/Fe(III) relation in pore water (0–5 cm) were correlated. Fe(II)/Fe(III) and Mn concentrations in pore water were also related in deeper layers.

The range of the Felab content in solid phase of sediment was ≥40% of the mean annual Felab concentration in upper 5-cm layer and 7% only in the layer 10–25 cm. The annual variations of Felab content (Fig. d) lacked a correlation with variations in Eh of sediment; groundwater did not affect the accumulation of Fe in sediment layers ≥ at 10 cm deep from water-bottom interface.

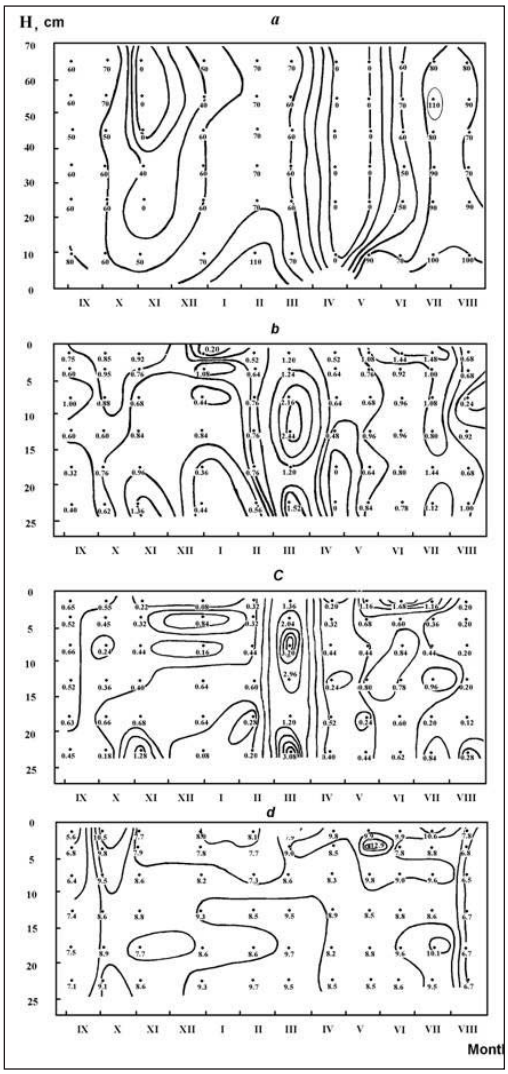

Fig. Variations of Fe compounds within water-sediment system: a) – Fe(II), µg l^{-1}, dissolved in water, isolines interval of 20 µg l^{-1}; b) – Fe(II), mg l^{-1} in pore water, isolines interval of 0.25 mg l^{-1}, (in February–April of 0.50 mg l^{-1}); c) – Fe(III), mg l^{-1} in pore water, isolines interval of 0.25 mg l^{-1} (in February–April of 0.50 mg l^{-1}); and d) - Felab mg g^{-1} of dry weight, isolines interval of 1 mg g^{-1}.

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Reports from SIL and SIL Working Group Meetings and Symposia

The Symposium of the International Society of Limnology (SIL)

24-27 October 2009, Nanjing,China

The SIL Symposium was held in Nanjing from 24 to 27 October 2009. It was organized by the Nanjing Institute of Geography and Limnology, Chinese Academy of Sciences and The International Society of Limnology (SIL). More than 200 scientists and students from 18 countries, including China, Japan, Korea, America, Austria Britain, Denmark, Germany,, Netherlands, New Zealand and Sweden participated in the four-day meeting.

The meeting focused on global change and freshwater environments with the aim to further the exchange of ideas and information and discuss the problems relating to the management of freshwater ecosystems and resources, both now and during the warmer climate in future. The main topics included:

- Global change and its impact on freshwater ecosystems;
- Algal blooms in freshwaters and the water quality;
- Resource use and conservation of freshwaters;
- The impact of Human activity and restoration of freshwaters;

In the opening ceremony, Jing-Hua Cao, the deputy director of the Bureau of International Co-operation, Chinese Academy of Science, delivered the welcome address. He said that he was very much honored to be delegated by Chinese Academy of Science to attend the meeting and welcome and give his heartiest congratulations to the Symposium participants. He introduced the audience to history of the Chinese Academy of Science and the support for International Conference from the Academy. Mr. Bing Xia, Deputy Director of Department of Science and Technology of the Jiangsu Province, gave a brief introduction to the research on lakes in the province and its problems. He expressed his wish to collaborate with the International Society of Limnology (SIL) further to protect and manage the freshwater ecosystem in the Jiangsu Province. Professor Dr. Brain Moss (University of Liverpool, UK), the SIL Chairman, and Professor Dr. Gene E. Likens (Cary Institute of Ecosystem Studies Millbrook, New York USA), Chairman of the Symposium in Nanjing, and former SIL Chairman, also delivered their animated addresses. The deputy director of the Institute of Geography and Limnology, Chinese Academy of Sciences, Mr. Ji Shen expressed his heartfelt welcome and thanks to all the attendees.

Photo: The SIL Conference participants (most of those sitting in front row are from abroad. Flanked by Prof. Brian Moss and Professor Gene Likens in the middle is Mr Yafeng Shi, an Academician of the Chinese Academy of Science - the oldest conference participant)

Then Prof. Gene Likens and Prof.Erik Jeppesen gave Plenary lectures on: *Water: A challenging interface between scientific understanding and policy;* and *Shallow lake dynamics and restoration in a climate change perspective,* respectively.

After that 148 Symposium participants, including students gave oral lectures or poster presentations relating to *Global Change and Freshwater Environments* in different sessions some of them initiated by keynote lectures. During the mid conference excursion, the participants visited Taihu Lake Ecosystem Research Station and the Ecological Restoration Demonstration Area near the town of Wuxi some 175 km east of Nanjing. This project, Technology and Demonstration of Algae Bloom Reduction and Water Quality Improvement in Waterhead of Pumping Water Area, is supported by the Ministry of Science and Technology of China.

At the closing ceremony on 27 October, 2009, Dr. Likens expressed his appreciation, and thanked the Nanjing Institute of Geography and Limnology for their help in organizing a SIL-sponsored symposium in Nanjing. He hoped that in future limnology will develop further in China and other countries. Earlier, Dr. Brian Moss had appealed to the young limnologist, particularly those in China, to become SIL members; he offered gratis membership fee for the third year to all those who paid their new membership dues for two years. To encourage the young students to pursue limnology as a research discipline and improve their lecturing skills, 11 students (five oral lectures and six posters) were awarded for their excellent presentations. At a brief ceremony, the undersigned (a member of the Symposium's Scientific Committee, Ramesh D. Gulati) was asked by the organizers to present award certificates to the winning students.

There was a common consensus that conference will contribute to encouraging the Chinese scientists and students of limnology into a new position and strengthen the collaboration with the International Society of Limnology (SIL) and foreign scientists. Last but not least, I think we owe our thanks to Professor Zhengwen Liu, Chairman of the Conference Organising Committee, and to the Nanjing Institute of Geography and Limnology, Nanjing, for organizing this excellent meeting. Notably, it is after a very long time that a SIL-sponsored 'sandwich symposium' was organized between the two successive triennial SIL meetings. I will like our readers to recall that at the 30th SIL Congress in Montreal in August 2007, and the International Committee of the SIL encouraged initiation of a series of non-congress SIL meetings because such meetings are considered to serve the society at large. Thus, the Nanjing SIL Conference, very successfully fulfilled this objective of the SIL International Committee.

We thank Professor Zhengwen Liu for providing information that helped us write this Report for the SILnews.

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WG Physical Limnology Activities Since the SIL Congress in Montreal in 2007 and Future Plans

The members of Working Group Physical Limnology presented Tutorials in Physical Limnology for Biologists and Chemists at the 30th Congress of SIL in Montreal in 2007. Speakers included Carolyn Oldham, Andreas Lorke, Andrew Folkard, and Sally MacIntyre. The group intends to hold a similar session at SIL 2010, in Cape Town, South Africa, as well as to organize special sessions.

Since 2007, the WG members have had the opportunity for scientific exchange at several smaller meetings. These include two in Sept. 2009 at Lake Tahoe, USA. The first of these was the 12th International Workshop on Physical Processes in Natural Waters (PPNW), hosted by Geoff Schladow. The 2nd was the AGU Chapman Conference on Lakes as Sentinels, Regulators and Integrators of Climate Change, organized by Craig Williamson and Jasmine Saros. A special issue of Limnology and Oceanography resulted from the Chapman Conference and will appear in November 2009.

The 13th International Workshop on Physical Processes in Natural Waters convened in Palermo, Italy on September 1-4 2009. Talks on the morning of the first day, at the beautiful Mondello Bay, focused on meromictic lakes, double diffusion, and exchanges of gases, notably methane in lakes. The afternoon's talks were on hydrodynamic interactions with benthic organisms, including keynote speaker Heidi Nepf's (Massachusetts Institute of Technology, USA) presentation on flow and transport as affected by the spatial structure of vegetation. On the second day, the participants visited the Stagnone di Marsala lagoon, where keynote speaker Janos Jozsa (Budapest University, Hungary) discussed his work on wind-driven circulation in morphologically-complex lakes. This talk was followed by an excursion to some of Sicily's many fascinating archaeological sites. On the third and fourth day, the meeting was held at the Palazzo Steri in Palermo (formerly used by the Spanish Inquisition!) Talks featured keynote speaker Peter Davies (Dundee University, UK) who discussed his work using physical models to derive scalings of mixing processes in natural waters. Presentations were on CFD modelling, the impacts of water management and energy production strategies on surface waters, ice-covered lakes, internal waves, hydrodynamic influences on ecosystems, and developments in measurement technologies. The success of the meeting was facilitated by the excellent organization by Giuseppe Ciraolo and colleagues.

Next year's meeting is in Reykjavik, Iceland, June 28th to July 1st. For information, see http://vefsetur.hi.is/ppnw/. All those interested in physical processes in natural waters are welcome; please contact Hrund Andradottir (email: hrund@hi.is) to be added to the mailing list.

A special session related to lakes will be held at the AGU/ASLO Ocean Sciences Meeting in Portland Oregon in February, 2010: Integration of physical observations and modeling for improved understanding of biogeochemical phenomena in inland waters. Invited Speakers are Greg Lawrence, David Hamilton, Geoffrey Schladow, and Jason Antenucci.

Following several years of discussion and planning, ASLO is pleased to announce its new online journal, Limnology and Oceanography: Fluids and Environments. This new journal will explore the link between fluid dynamics and biological, chemical and geological processes in all types of aquatic environments. Josef Ackerman is the editor-in-chief. Submissions will be accepted beginning in January 2010.

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WG Ecohydrology "Floodplain Declaration"—Perspectives for Transdisciplinary Limnology

Introduction

River floodplains, due to seasonal dynamics of their hydrological cycle, are the most diversified and resilient ecosystems providing a plethora of ecosystem services for societies. Their role in providing food has been known from the beginning of human civilization. It is well recognized that reduction of extreme event impacts such as floods and droughts increases river purification processes. However, when considering more complex processes such as the role of river valleys in maintaining and restoring biodiversity in aquatic systems and catchment landscapes during changing climate conditions, our knowledge is still unsatisfactory. Most river floodplains have been exploited by Man creating what we term "novel ecosystems". In the face of global climate change and changes in land cover, socioeconomics and cultural processes, restoration and enhancement of novel ecosystem resilience, which are to various extents affected by human interventions in the landscape, become equally important for the conservation of pristine patches of the environment. The reversal of the world-wide degradation of floodplains by developing a methodology based on an understanding of the extremely high self-regenerating capacity of these systems that can sustainably provide ecosystem services for society should become a fundamental case for the formulation of a strategy of co-evolution of the ecosphere and anthroposphere.

The universal and important aspect of the Floodplain Declaration (http://www.erce.unesco.lodz.pl) is the recognition of the urgent need to accelerate progress in implementation of the UN MDGs - environmentally friendly solutions and improved cost efficiency of those measures by implementing progress from basic and integrative environmental science through education. However to set the stage for formulation of a strategy for global sustainability there is a need to recognize diversity in the hierarchy of problems to be solved and differences in advances in the UN MDGs, e.g., implementation especially such as reversing degradation of the biogeosphere, eradication of poverty on different continents, in regions and in countries of the world.

In some regions, especially where environmental consciousness of society is advanced, the critical mass of scientists is high and consequently there are well organized environmental management systems that make it easy to access advanced methodologies (e.g., US EPA) and even procedures for enforcement measures for reversing degradation are clearly elaborated (e.g., the environmental framework directives of the EU). In such regions the "Floodplain Declaration" will be supportive for gaining the attention of decision makers on, for example, the use of river valleys as biodiversity refugia in changing climatic conditions, and also on the extremely high regeneration potential of floodplain ecosystems where costs of restoration can be very low. With regard to the latter, it is only necessary to restore con-

nectivity of some river valley sections and leave it for flood pulses and ecological succession to do the job. In developing regions where demographic processes are still dynamic and where a need for ecosystem services from floodplains is growing, the rise of consciousness of new solutions and strategies based on transdisciplinary science is especially urgent. In such catchments with "novel floodplains" it is possible not only to restore ecosystems by applying ecological biotechnologies, it is also possible to increase resilience and ecosystem services for societies, e.g., conversion of floodplain sediments containing nutrient pollutants into bioenergy.

Problem-solving Limnology for Sustainable Water Ecosystems and Societies

The International Council for Scientific Unions (ICSU) defined science of the 21st century as integrative, problem-solving and policy oriented. It has to be agreed that limnology has recently become a problem-solving science by putting a plethora of information and advanced knowledge on processes in aquatic environments and their interfaces into a holistic framework for understanding the functioning of freshwater ecosystems. This is especially applicable to regulatory mechanisms and feedbacks between hydrology and biocenoses, which can be used for management (e.g., ecohydrology). From the catchment perspective of IWRM and the Water Framework Directive UE (achieving good ecological status of freshwater and costal ecosystems in Europe) this is especially important as societal dynamics (e.g., demography, form and intensity of resource use) are a major driver.

The fundamentals for development of this approach have to a great extent been established on the basis of classic limnological research (e.g., Hynes 1970, Likens 1988, Junk et al. 1989, Naiman & Decamps 1990). However, implementation still creates many problems, not only because costs of the long-term and large-scale measures required, but often because social processes and changes in major drivers of economic development are changing. That is why basin management plans should be developed not only on the basis of understanding the recent state and expected succession of ecosystems under recent human impacts but also on the basis of predicting large-scale, socio-technological problems faced by catchment dwellers. These involve energy, technology, living conditions, health and the biosphere. This can be done by using foresight methodology. "Foresight" is the methodology used by socio-economists for identifying optimal scenarios for economic development in given regions. It is a strong approach because catchment management is expensive and a long-term process. The first step should be "foresight" to see if the future economic development in given regions is tourism, industrial, agricultural or some combination of these along with population growth because different mitigation, conservation and adaptation measures have to be taken to achieve IWRM.

Sustainable, stable socioeconomic growth is attainable only by taking a systemic approach, targeted not only at predicting the future, but also at fostering it with the aim to shape a desirable vision of the future world. The exchanging of knowledge, experience and views between scientists, representatives of industry and business and public officials systematizes and integrates our awareness of the most important fields of science and the economy stimulating world development. Predictions and scenarios are jointly constructed not only by scientists but also by decision makers and all stakeholders involved in a given process. While systemic analysis does have its limitations stemming from the great complexity of the processes involved, its great advantage lies in bringing objectivism to the subjective process of decision making and a sense of balance to reconciling the frequently contradictory interests of various social groups anxious to solve a given problem.

The development of integrative science has honed our ability to forecast both microscale processes and megatrends. However, while the new approach has given us considerable capacity to predict the sustainable use of the natural resources of water, energy, raw materials, and space, predictions of the dynamics of socioeconomic systems are still characterized by randomness. Man as an unpredictable causative force, by making revolutionary scientific discoveries and irrational decisions (e.g., terrorism), can drastically alter how both local communities and global society function. The times we now live in have rightfully been dubbed the anthropocene – for the first time in history mankind has become the dominant force in shaping processes in the natural world. Nowadays competitiveness and sustainable development hinge not just on technologies, energy, and raw materials, but also on non-degraded natural space. Paradoxically even in highly industrialized countries with considerable economic potential a sectoral approach expressed by restrictive environmental conservation still prevails despite the fact that freshwater water ecosystems were shaped over a century or more ago due to the application of "over-engineering" principles that were focused on accelerating water transfers along river continuum in urbanized areas, impounding river sections for water transport, maximizing hydroenergy gains and reducing maintenance needs. Technological foresight is a system approach for evaluating new trends on the basis of knowledge of environmental and sociological processes and technologies from the point of view of the economy, quality of life and sustainable development.

Technological foresight methodology has three main goals (UNIDO 2005):

1. FORECAST THE FUTURE – enable the undertaking of adaptive attempts, preparing for unpredictable events, and reduction of negative consequences of events that can not be changed.
2. MANAGE THE FUTURE – means proactive (management of probable crises) and positive (management by goals) management.
3. CREATE THE FUTURE – means mainly the proactive creation of a needed vision of the future.

River Floodplains as an Optimistic Case For "Engineering Harmony" Between Water Ecosystemsand Societies

In the recent stage of the anthropocene, the Millennium Development Goals of the UN define problems to be solved by global society. The three main goals of the foresight approach should be the tools for applying modern systemic solutions to specific conditions for a given region with special emphasis on enhancing ecosystem carrying capacity and cultural heritage.

With catchments as a template for the hydrological cycle, our existing knowledge to a great extent allows us to identify and reduce pollutant emissions (i.e., CO2, chemicals) and to control point source pollution. However, due to the complexity of natural and anthropogenic processes, achieving sustainable development needs not only a courageous vision and sound methodology, but first and foremost realistic foresight and evaluation based on the best current

expert knowledge of potential pathways for development. New limits for pollutant emissions from economic growth are a key for reversing biospheric degradation combined with financing the enhancement of the robustness of "novel ecosystems" and using "ecohydrological dual regulation" (Zalewski 2000, 2006; Zalewski and Robarts 2003). This will restore catchment scale ecosystem connectivity in which a river valley should be the axis for the structure and process restitution, and by the identification of possible and optimal scenarios based on global "megatrends" such as the pattern of unequal population growth, increasing fossil fuel limitation, and shifts in focal points of economic activities. For efficient implementation of such a new approach, however, the legal framework has to be changed from one based on restrictive ecology to a new one that accepts the use of ecosystem properties as a management tool.

From a global perspective floodplains, due to their high resilience to cumulative human impacts, could provide optimistic demonstration cases on how to reverse global environmental degradation and inspire case studies that achieve sustainable coexistence of humanity and ecosystems. In the face of global environmental degradation that is reaching the carrying capacity of the planet, science has to provide answers to the question: How do we reverse the progressive degradation of the biogeosphere and achieve a sustainable future?

In line with Nelson Mandela's comment that "Action without vision is wasting time and resources" there is a necessity to formulate a vision on the basis of scientific methodology such as proposed by the foresight approach. It should consider the recent dynamic development of integrative, transdisciplinary science and the need to change societal attitudes through participatory education, e.g., learning alliances methodology (Moriarty at al. 2007), and active societal participation in a process of adaptive management (Olsson et al. 2006) to reverse degradation and achieve harmony between the water environment and society. This is especially important in the context of the recent report of the Stockholm Environmental Institute (Nilsson et al. 2009) that demonstrated that progress, economic market and politics were not sufficient to achieve sustainable development because they lead to societal disintegration, increased violence and poverty. Only scenarios that contain environmentally friendly values that will be accepted by society will lead toward sustainable development.

Development of such a transdisciplinary approach is fundamental for further progress in limnological development; we have to transition from a species/population process orientation toward a large scale system regulation approach.

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WGs Macrophytes and Wetlands International Symposium on Aquatic Macrophytes

24-28 August 2009, Jyväskylä, Finland

The 12th International Symposium on Aquatic Weeds, held in Jyväskylä (Finland) from August 24 to 28, 2009, was organised by the European Weed Research Society (EWRS) through its Working Group on Invasive Plants. Earlier, the EWRS WG Aquatic Weeds organised a series of symposia every four years between 1964 and 2002, with Dr Arnold Pieterse (Netherlands) as WG chairman. The Finnish Environment Institute (SYKE) and the SIL Working Groups on Aquatic Macrophytes (chair Prof. Jacques Haury) and Wetlands collaborated in the organization of the Symposium together with the University of Jyväskylä. Dr Arnold Pieterse and Dr Seppo Hellsten of SYKE were the key organizers of the symposium in Finland. The city of Jyväskylä, situated in the middle of Finnish lake district, and the University campus located on the shores of the lake Jyväsjärvi provided an ideal environment for the symposium deliberations. The symposium is supported by the Federation of Finnish Learned Societies and the Waterpraxis project of the Baltic Sea Programme of the European Union.

More than one hundred participants from 30 countries representing all continents attended the symposium with 86 oral and 95 poster presentations (see details in www.ymparisto.fi/syke/aw09). The Symposium was formally opened with a brief ceremony by Dr Roger Jones of the University of Jyväskylä. Two invited lectures were delivered by Dr Brij Gopal (chair, SIL WG on Wetlands) and Dr

Ricardo Labrada (formerly with FAO), respectively, on Impact of Invasive Species on Ecosystem Goods and Services of Wetlands, and on Management of Aquatic Weeds in the Tropics and Subtropics. The symposium sessions were organized to cover a variety of macrophyte aspects relating to: Biology, Ecology, Distribution; Indicator Value, Ecological Effects of Invasives; Environmental Relationships, Environmental Management and Management of Aquatic Vegetation.

A variety of anthropogenic disturbances, particularly the nutrient enrichment of the water bodies, result in excessive growth of many macrophyte species that have long been considered as 'weeds' because they interfere with navigation, recreation and fisheries, or are detrimental to human interests in various other ways explained Dr Arnold Pieterse in his introductory presentation of Aquatic Weed Management. Many aquatic plants have got introduced, largely through human agency, into non-native habitats where they have caused extensive degradation of the natural habitats and altered the native plant and animal communities drastically. Both native weeds and exotic invasive aquatic plants have received increasingly greater global attention for their impacts, biology and control, during the past many decades.

In recent years, the interest in aquatic macrophytes has grown further for their role in monitoring water quality, treatment of wastewaters, and also in climate change. There has been a shift in focus from the 'control' of 'weeds' to their management in a larger ecosystem perspective. Numerous papers of symposium cited the European Water Framework Directive and the role the macrophytes for the assessment and monitoring the status of waterbodies and meeting the goals of the WFD. A special benefit of the use of aquatic macrophytes as ecological quality element is their good indicator value related to hydromorphological alterations such as water level fluctuations and shore modifications. Several of these aspects were also met during a day-long field trip, which provided a memorable experience of a variety of oligotrophic to eutrophic Finnish lakes and rivers (Fig. 1).

Symposium proceedings including abstracts is available as Reports of Finnish Environment Institute 15/2009 http://www.environment.fi/default.asp?contentid=332257&lan=en . Selected papers from the symposium will be published in a special volume of Hydrobiologia. The Scientific Committee of the Symposium decided to hold the next broad-based 13th International Symposium on Aquatic Plants in Poland during in 2012.

Fig. 1. Aquatic Macrophytes Symposium participants during field excursion (Photo: Anne-Mari Rytkönen).

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WG Aquatic Birds
6th International Symposium, Limnology and Aquatic Birds, (Monitoring, Modeling and Management)

Huesca, Spain, 27-30 October 2009

The idea of forming the SIL Working Group on Aquatic Birds started in 1989 at XXIV SIL Congress in Munich, Germany, where a few papers dealing with waterbirds were presented. This prompted some participants to recognize the need to treat waterbirds in a limnological context. They approached the SIL Secretariat with a request to form this new Working Group. In the meantime an ad hoc Symposium, "Aquatic Birds in the Trophic Web of Lakes", was held in Sackville, New Brunswick, Canada, 1991 (The proceedings were published in Hydrobiologia and Developments in Hydrobiology (1994). The SIL approved the founding of new WG on Aquatic Birds during the XXV SIL Congress in Barcelona, Spain in 1992,.

The Working Group integrates ecological studies on waterbirds into Hydrobiology as well treats studies on these birds in a limnological context. The Working Group has so far organized five triennial conferences in different regions and the Proceedings of its 6th Conference, Huesca, Spain held in October, 2009, is in press (Hydrobiologia). We are proud that late Bob Wetzel, our former general secretery was a strong supporter of our Working Group. He encouraged one of his former students to send his pioneering work on nutrient addition to lakes by waterfowl (1969-1972) to be included in our first publication. Dr. SándorAndrikovics who passed away in 2009 was a founding member and a committed supporter of our Working Group. He was instrumental to organize in 1994 the first WG Conference in Sopron, Hungary. In 2006, he organized the 5th Congress as well. He died just after completing the editing of the of Proceedings of the Conference in 2009 Spain.

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WG Saline Inland Waters
Report on the 2009 Activities of the SIL Working Group on Saline Lakes

Inland saline lakes are widespread throughout the arid and sub-arid regions of the world and include a diverse array of aquatic ecosystems of considerable economic and ecological value. Traditionally defined as water bodies with >3 g/l salinity, they constitute ~45% (11% excluding the Caspian Sea) of the volume of inland waters, and in some areas are the dominant aquatic habitat.

Salinity is a primary determinant of the biotic communities and ecological values associated with any specific perennial salt lake. In marked contrast to freshwater lakes where changes in inflows are largely moderated by corresponding changes in outflows, relatively small changes in the water balance of salt lakes often result in large changes in volume and thus salinity. Indeed, many large perennial salt lakes became highly salinized and then disappeared entirely during the 20th century due to water diversions for irrigated agriculture and other consumptive uses. Although the highly publicized and much debated "freshwater crisis" includes many technical and socio-political factors, global climate change and population growth will increase water demand throughout most of the world's salt lake regions (Vorosmarty et al. 2002). Given ever-increasing demand, the scarcity and economic value of fresh water will certainly result in higher consumptive use of waters now sustaining perennial salt lakes.

During the past several decades the ecological importance of inland saline waters, especially to migrating and breeding birds, has become widely recognized and conservation efforts have been initiated by international, national, and local groups. African salt lakes, internationally renowned for their productivity and abundant bird populations, are increasingly threatened. The upcoming 31st SIL Congress in South Africa (2010) provides a unique opportunity to get together scientists, managers, and policy-makers to address management issues facing African salt lakes. We encourage working group members to attend and consider hosting a special session at the Congress.

In 1979, W. D. Williams initiated a series of triennial conferences on salt lake research, which have continued to the present. While these conferences have been held under the auspices of the International Society for Salt Lake Research (isslr.org) since 1994, SIL's Working Group on Saline Lakes has been chaired by directors of ISSLR and is largely constituted by its members. While papers on saline lakes were presented in a special session on inland saline waters and in other sessions at the 30th SIL Congress in Montreal (2007), many members of the working group focused on organizing and presenting research at the 10th International Conference on Salt Lake Research (isslr.org/GSL2008/files/ISSLRAbsPt2.pdf). This conference brought together 204 salt lake researchers and managers from 18 countries. Contributions from this conference including 28 papers and 23 extended abstracts were published by the Quinney Natural Resources Research Library (Logan, Utah) in "Saline Lakes Around the World: Unique Systems and Unique Values" (www.cnr.usu.edu/quinney/files/uploads/NREI2009online.pdf). The 11th International Conference on Salt Lake Research will be hosted by Enrique Bucher (buchereh@uolsinectis.com.ar) and Erio Curto (erio_curto@yahoo.com) (Universidad Nacional de Córdoba, Argentina) in Miramar, Cordoba, Argentina on the shore of Mar Chiquita, 8-16 May 2011.

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WG Winter Limnology (New)
Winter as a Neglected But Essential Period in Seasonal Dynamics of Water Bodies in Northern Latitudes

In case of temperate, Arctic and Antarctic lakes, the low elevation and short time of the sun over the horizon during winter together with the snow cover on the ice limit availability of light so that primary production is highly restricted. Further, the low temperature slows down biological activities so that organisms use less energy than at higher summer temperatures. Thus, in winter, lake ecosystems are assumed to be inactive and have hence received little attention. However, organisms experience winter in their life cycle in one significant way or another. Despite often low metabolism, winter can modify the structure and functioning of lake food webs during

Fig.. Conductivity, temperature and depth (CTD) measurement and sampling at Lake Kilpisjärvi (Finland) on a polar night (5 December 2004).

the subsequent summer period. This is an elemental feature in the dynamics of high latitude lakes that is to some extent comparable to lake-catchment interactions. The assumed triviality of winter for lake ecosystems may have been more a pretext about the inconvenience and practical difficulties hampering the field work under harsh and even dangerous winter conditions.

Recently, attention to winter phenomena in ice-covered lakes (e.g. Vincent & Laybourn-Parry 2008) and oceans has been fuelled by the increasing worries about climate warming to which high latitude lakes are predicted to be particularly sensitive. Indeed, dramatic and unidirectional regime shifts have been found to happen in many arctic lakes in the last 150 years (e.g. Smol et al. 2005) and the same processes are probably going on as well in temperate lakes with temporal ice cover.

In both lakes and running waters, the knowledge of winter limnology is still poor (Huusko et al. 2007; see also papers in Salonen et al. 2009). Little attention has been paid to four-dimensional (space and time) variability and its dynamics. Except ice isolates water from wind forcing, under-ice hydrodynamics is far from uniform between lakes and even between successive years. In winter, water temperature of large lakes regularly decreases below the maximum density temperature of ca. 4°C and even 0.5°C difference may result in completely different under-ice flow dynamics (Pulkkanen et al. 2007). Therefore, only the development of high resolution temperature loggers and CTD have made it feasible to reach the accuracy needed for the assessment of under-ice flow regimes. Automatic and robotic devices will further contribute to overcome the problems caused by weak ice periods and to promote achieving a four dimensional view of under-ice flow fields and distributions of organisms. Despite generally insignificant direct effect of small differences in under-ice water temperature on organisms, the consequent changes in flow regime may be extremely important and may further be amplified by accompanied oxygen depletion by the sediment.

Although scattered bacterial and primary production measurements have been made in ice-covered lakes, our knowledge of under-ice organisms is mostly limited to their temporal and vertical distributions. Even more rarely the observations have been related to under-ice hydrodynamics and hence the results generally remain descriptive. However, the situation is rapidly changing. Along with the development of molecular biological techniques, neglected studies of winter bacterioplankton are getting the much needed attention. For example in the ocean, the species and metabolic diversity as well as dynamics of bacteria have been followed (Sala et al. 2008).

There are also many other weak points in our basic understanding of the metabolism of ice covered lakes. Already more than a half century ago Rodhe (1955) suggested that, in the virtual absence of light, under-ice phytoplankton may rely on heterotrophic metabolism. Since then plenty of similar data have accumulated and, in the laboratory, it has been convincingly shown that some phytoplankton species have heterotrophic capacity. Despite that direct evidence of its importance under natural concentrations of organic matter is still lacking. Similarly feeding as well as predation on zooplankton under the ice is poorly understood. In winter, cladoceran zooplankton are generally scarce and rotifers can be prominent (e.g. Virro et al 2009), but there are many exceptions.

In under-ice weak and generally nonturbulent flow fields, the mobility and the behavior of organisms may play even greater role than in summer. Also small phytoplankton can effectively position themselves in vertical direction, which partly helps them to cope with low availability of light. Because mobility increases with size, fish probably have the highest possibilities to adapt to temporal and spatial gradients of environmental factors as well as food availability. In these days, exciting technical possibilities allow to study the distributions of populations or single individuals from phytoplankton to fish (e.g. Jurvelius & Marjomäki 2008; Blanchfield et al. 2009).

In addition to recent development of methods and other facilities, until now underexploited experimental approaches both in the field and in the laboratory, will facilitate progress in winter limnology. The research of ecological aspects is particularly supported by the generally simple under-ice food webs. Understanding of coupling between physical conditions and biological and other phenomena are likely to benefit immensely from approaches over the continuum from temperate to polar environments. Multidisciplinary research has potential to support the solution of many unresolved issues of winter limnology and to bestow winter limnology with its fundamental role in the seasonal succession of lakes so that our theoretical understanding of lake ecosystems can be extended to a more all-encompassing level.

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The International Symposium ROTIFERA XII

16-21 August, 2009, Berlin

The ROTIFERA XII held at the Humboldt University Berlin was organized by the Institute of Freshwater Ecology and Inland Fisheries Berlin (IGB) and the Natural History Museum Berlin. One hundred and thirty six participants from 30 countries, including 45 graduate students and Ph.D. students, attended the meeting.

ROTIFERA XII is an interdisciplinary triennial symposium, that was started in 1978 at Lunz (Austria) and is held in different countries (the more recent ones were held in Mexico, Austria, Thailand). The symposium in Berlin was opened with welcome address by Prof. Klement Tockner of the IGB and an invited lecture by Prof. Jens Krause (IGB) to "Collective Behaviour and Swarm Intelligence" with examples from fish, but also from humans.

Altogether, 58 scientific lectures and 93 posters were presented. Because there were no parallel sessions, all lectures were held in the main lecture hall. As in former meetings, invited speakers gave state-of-the-art lectures on four different rotifer disciplines: Terry Snell (Molecular Mechanisms of Rotifer Reproduction); Guntram Weithoff (Rotifers in Extreme Habitats); Gregor Fussmann (Evolution of Rotifers); and Hendrik Segers (Taxonomy and Morphology of Rotifers). Each of these four "Special Sessions" comprised 4 – 9 additional lectures, which thus comprised about 40% of all lectures during the symposium. The "Free Sessions" were devoted to Rotifer Genetics, Ecology, Biogeography and Environmental Indicators. Also two workshops were organised by Rainer Deneke, one on "Rotifer Metrics in Ecological Water Quality Monitoring", the other was a full-day pre-symposium Workshop on Taxonomy, with facilities for practical work.

The presentations were of generally of high quality and most important results of the symposium will be published in a special issue of *Hydrobiologia* by Norbert Walz, Rita Adrian, John Gilbert, Mike Monaghan, Guntram Weithoff and Heike Zimmermann-Timm as guest editors. All contributed manuscripts will be subject to a strict peer review with at least to reviewers per manuscript.

Photo: Attendees of ROTIFERA XII

The social program started on Sunday with a Welcome Party in the garden of the IGB and the participants had the opportunity to visit the institute. On Wednesday, a full-day excursion was arranged to visit Potsdam. In the Science Park Albert Einstein, Prof. Stock introduced the research of the Potsdam Institute of Climate Research, and later the participants visited several historic buildings as an old astronomic telescope and a sun observatory. The excursion comprised a boat trip, with lunch on board, to the Havel lakes around Potsdam, followed by a walk around Sans Souci, the historic castle of Frederick II. On Friday evening, there was a guided trip of the Natural History Museum, culminating in a gala dinner in the Dinosaurs Hall of this museum.

Thanks to the financial support of the German Research Foundation, many students could participate in the symposium. (For those interested, copies of symposium Program & lecture Abstracts can be ordered by e-mail (below).

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Nordic Benthological Society (NORBS) Meeting

7 - 10 September 2009, Tartu, Esotonia

The VII meeting of Nordic Benthological Society (NORBS) was held from 7 to 10 September 2009 in Tartu, South Estonia. These meetings form a forum for benthic freshwater ecologists from the both Nordic and the other countries. The present conference was organized by the Centre for Limnology of Estonian University of Life Sciences. The key theme was "A benthic perspective to restoration, mitigation and adaptation of freshwaters". The conference was attended by 31 participants who presented 18 oral presentations and 9 posters. The invited speakers were Dr. Morten Lauge Pedersen (Aalborg University, Denmark), Dr. Timo Muotka (Finnish Environment Institute/ Oulu University, Finland), and Dr. Kestutis Arbačiauskas (Vilnius University, Lithuania). The programme involved two days of scientific presentations and an excursion in South Estonia (Alam-Pedja Nature Reserve, Centre for Limnology near Lake Võrtsjärv).

The Centre constitutes a separate department of the Institute of Agriculture and Environment Protection of the Estonian University of Life Sciences (EULS). Its activity can be divided into three aspects: i) fundamental research in Estonian waterbodies; ii) teaching, including post-graduate students of Tartu University since 1992 and EULS since 1999; and iii) applied research including state environmental monitoring, fish management, environment impact assessment, lake restoration and nature protection.

Currently the Centre of Limnology is carrying out two large target-financed programs(2008-2013) : 1) "Will climate change alter the relative importance of catchment and in-lake processes in the carbon balance of shallow lakes?" ; and 2) "Effects of natural and man-induced pressures on the ecosystems of large lakes" . The national freshwater hydrobiological collections in Estonia are also stored and maintained at the Centre of Limnology.

In 2009, the staff, including the supporting department consisted of 65 persons. For more info, please see http://www3.hi.is/pub/lif/norbs/benthic.htm (on the conference), or http://www.limnos.ee/index.php?alam=2 (on the Centre).

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Russian Hydrobiological Academic Society: Laureates of The Honorary Winberg Medal 2009

Russian Hydrobiological Academic Society (RHAS) was organized in 1947 to unite hydrobiologists of the Former Soviet Union and enhance the exchange of scientific knowledge and ecological education*. Since 1993, the Society is hosted by the Zoological Institute of the Russian Academy of Sciences (address: Universitetskaya Embankment, 1, 199034 Saint Petersburg, Russia; telephone: 7(812)3281311 (ext. 249); fax: 7(812)3282941; http://www.zin.ru/societies/gbo/; E-mail: ecology@zin.ru).

The Society has more than 1000 full members and 19 research institutions and departments as members. It has 37 regional branches all over Russian Federation. The major goal of RHAS is coordination and promotion of the hydrobiological research and education in Russia. Priority is given to basic Hydrobiology as the ecological science, engaged in studying the structure and functions of aquatic ecosystems, autecology and population dynamics of aquatic organisms. The RHAS organizes seminars, training courses for young scientists, conferences and congresses. In the frames of RHAS, Russian hydrobiologists, guided by Prof. Georgy G. Winberg, had created the Scientific School on Production Hydrobiology.

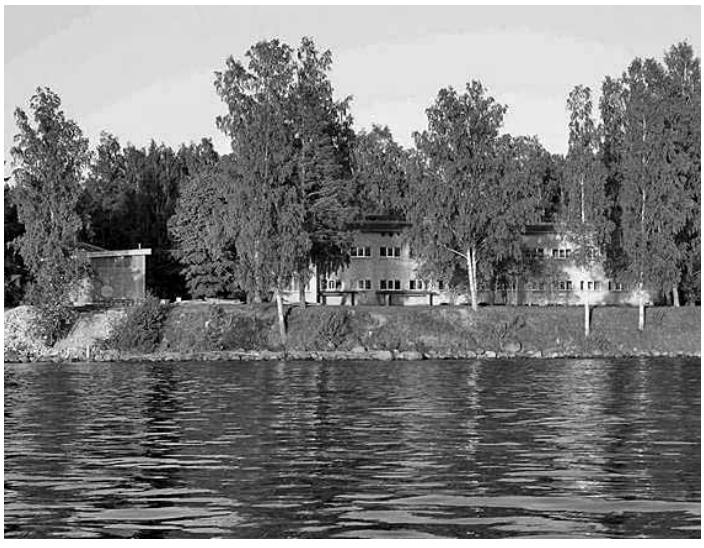

Photo: Centre for Limnology at Lake Võrtsjärv (South Estonia)

The Tenth RHAS Congress held in Vladivostok, in the Russian Far East (28 September - 2 October, 2009) was attended by 239 delegates from all regional branches of RHAS who presented 188 oral lectures and 98 posters. Six guest participants came from Byelorussia, 4 from Ukraine, and 1 from Lithuania. Topics from several major research directions in the field of general and applied hydrobiology were discussed at the Congress. Important among these are: structure and functions of populations and communities in aquatic ecosystems, biological resources of marine and inland water bodies, biodiversity and effects of invasive species in aquatic ecosystems, fish ecology, symbiotic relations and parasitism in aquatic communities, methods for assessment of anthropogenic loads and water quality evaluation, water toxicology, data bases and ecosystem modeling.

Earlier, at its IX Congress, 2006, Togliatti), the RHAS established the honorary medal named after Professor G.G. Winberg in order to commemorate his 100-th anniversary and to distinguish the prominent Russian and foreign scientists who had contributed significantly to the development of Limnology and basic Hydrobiology, as well as to international cooperation in this field. First Laureates of the Honorary Winberg Medal 2006 were Academician, Professor Alexander F. ALIMOV (Russia), Academician, Professor Leonid M. SUSCHENYA (Byelorussia), and Professor Winfried LAMPERT (Germany).

One of the central events of the X Congress of the Russian Hydrobiological Academic Society was the announcement of the honorary winberg medal laureates 2009: Professor Vyacheslav P. Shuntov (Russia), Professor Alexander A. Protasov (Ukraine), and Dr. Ramesh D. Gulati (The Netherlands). The RHAS congratulates the Laureates of this exceptional award for their outstanding achievements in Theoretical Limnology and General Hydrobiology and their remarkable contribution to the international scientific cooperation.

Pic: The Honorary Winberg Medal established by the Russian Hydrobiological Academic Society in 2006 to distinguish the prominent Russian and foreign scientists who had contributed significantly to the development of Limnology and basic Hydrobiology and to the international cooperation in this field.

**History of the Russian Hydrobiological Academic Society is described in: Skryabina E.S. 1984, The All-Union Hydrobiological Society, Hand-book. M., Nauka; Alimov A.F., Kuderskiy L.A., Telesh I.V. 2002, Society of Russian Hydrobiologists: ideas, plans, perspectives. Herald Russ. Acad. Sci.*

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The 28th ADLaF Meeting

Banyuls/mer, France, Sept. 6 to Sept. 10 2009

The 28th ADLaF (Association des Diatomistes de Langue Française), French speaking diatomists meeting, was held in Banyuls/mer (OOB, Observatoire Océanologique de Banyuls/mer, France) during Sept. 6-10, 2009. Eighty researchers from all over Europe, but also from Senegal, Algeria and Canada.attended this meeting. , Thirty posters and thirty-two oral communications were presented, varying from fossil, recent diatoms to marine and fresh water environments, including many aspects of the diatom research, i.e. taxonomy, geology, physiology, genetics or phylogeny. The proceedings of the meeting, together with the contribution of several invited diatomists, will be published in late 2010 by "Vie&Milieu/Life and Environment" journal.

The next ADLaF 2010 meeting, may be held in Québec, as proposed by Dr Isabelle Lavoie.

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Photo: 2009 ADLaF Attendees

13th World Lake Conference, China Lake Ecosystem Restoration: Global Challenges and the Chinese Innovations

Wuhan, China, 2-5 November 2009

Photo: Chinese Water Resources Minister Chen Lei addresses the opening ceremony of the 13th World Lake Conference in Wuhan, capital of central China's Hubei Province, Nov. 2, 2009. (Source: Xinhua/Cheng Min)

The 13th World Lake Conference opened on Monday 2 November 2009 in Wuhan, a city at the confluence of the Yangtze River and its tributary Hanjiang River in central 's Hubei Province. The conference was jointly organized by Chinese Society for Environmental Sciences (CSES), Chinese Research Academy of Environmental Sciences (CRAES) and Wuhan Municipality. The World Lake Conference is a series of academic conferences held every 2 years. It was first initiated by International Lake Environment Committee (ILEC) in 1984. China previously also hosted this biennial conference in 1990 in Hangzhou, Zhejiang Province. Other countries that have hosted the World Lake Conference before are: Japan, United States, Hungary, Italy, Argentina, Denmark, Kenya and India.

The host city Wuhan, capital of Hubei Province, has 166 lakes, 272 reservoirs and 165 rivers or streams, which cover >25% of its land area. It is called "the city of a hundred lakes." The Hubei Province, once known as "a province with 1,000 lakes," has just 2,438 square kilometers of lakes left, i.e. about one-third the number in the 1950s. The contraction of lakes, water pollution and the degradation of ecological functions call for careful development of lakeside industries and rehabilitation of lake ecosystems.

Addressing the Conference at its opening ceremony. Mrs Chen Zhili, vice chairwoman of the Standing Committee of the National People's Congress, called for the establishment of laws to protect lakes and implement strict judicial and administrative means to supervise industrial, agricultural and household and industrial wastes waste, such as from paper mills and chemical plants. According to her, in China on average of 20 lakes disappeared every year, and almost 90 percent of the lakes were polluted. Some ministerial level officials, including those from Ministries of Environmental Protection , Water Resource in China, Housing and Urban Delopment and Agriculture, officials from China Association from Science and Technology, Chinese Academy of Science, Senior Officials of the Hubei Province and Municipality of Wuhan attended the opening ceremony of the Conference on 2 November.

About 1500 environmental experts, scientists and government officials from more than 40 countries participated in the conference. The conference focused on the lake eco-system restoration and pollution control. There were about 450 oral lectures focusing on the impact of global warming on lakes, strategies and policies on management of lake water environment, approaches to pollution control and ecological conservation concerning lakes. These lectures presented the latest strategies on lake protection and their sustainable application. China International Lake Management and Technology & Equipment Exhibition was held concurrently with 13th World Lake Conference. The exhibition showcased China's achievements in lake management, with exhibits from NGOs worldwide and enterprises from Japan, Europe and North America.

Due to the rapid economic development of China thousands of lakes either severely damaged or threatened due to eutrophication. A fundamental theme of this 13th World Lake Conference, therefore, is that we must enhance control of lake pollution and rehabilitate lakes overloaded with pollutants, so as to restore their ecosystem services as soon as possible and make contributions to the development of ecological civilization. This holds particularly for Lake Taihu, Lake Dianchi and Chaohu Lake. The Chinese government attaches great importance to the lake environment protection and has decided to take a several measures to ameliorate water quality of lakes. The Government has put forth the strategy of "recovering the rivers, lakes, and seas under extreme stress" in addition to "control and management of water contamination". This is reflected in the theme of the conference in China, namely, "Lake Ecosystem Restoration: Global Challenges and the Chinese Innovations". The 13th World Lake Conference recommended that governments, communities, enterprises, water users and providers and all other relevant lake basin stakeholders jointly undertake the sacral actions summarized in the Preamble. The Wuhan Declaration issued on 5 November reiterated that water is essential for all life on our planet and that adequate supplies of freshwater of acceptable quality are a prerequisite for human health, food security, industrialization and economic well-being. The aquatic and terrestrial ecosystems that provide life-supporting ecosystem services also are fundamental to human existence. The lakes support a range of human activities, including agriculture, commerce, transportation, recreation, tourism, and food and energy production; they also provide important habitat for a diverse array of organisms.

The prestigious Kasumigaura Prize was awarded to 5 participants from developing countries to support their participation in the conference.

The next Conference will be held in Texas (USA) in November 2011.

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International Symposium on Terminus Lakes: Preserving Endangered Lakes Through Research

October 26-29, 2009, Joe Crowley Student Union. University of Nevada, Reno, Reno, Nevada, USA

The latest research and findings on closed-basin lakes were presented at the "International Symposium on Terminus Lakes: Preserving Endangered Lakes through Research" Oct. 26-29, sponsored by the University of Nevada, Reno and DRI.

Keynote speaker was Wallace Broecker, Ph.D., world-renowned climate change researcher at Columbia University's Lamont-Doherty Earth Observatory, and Berry Lyons, Ph.D., director of the Byrd Polar Research Center and professor at The Ohio State University will present current research on international terminus lakes. Lectures on watershed research in the Western United States and internationally were presented by other attending researchers.

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Announcements

Speakers Announced for ASLO/NABS Summer 2010 Joint Meeting

Members of two major scientific societies, ASLO, Advancing the Science of Limnology and Oceanography, and NABS, the North American Benthological Society, will have a joint meeting in Santa Fe, New Mexico, from June 6 to11, 2010. This meeting is open to all who are interested in the aquatic sciences.

This meeting, emphasizing Aquatic Sciences: Global Changes from the Center to the Edge, will be an important venue for scientific exchange across broad aquatic science disciplines, including physical, biological, chemical, and geological aspects, all branches of limnology, hydrology, and multidisciplinary topics ranging from evolution to climate change.

In addition to morning plenary sessions featuring two speakers, a special evening outreach session is planned on Tuesday, 8 June, featuring Maude Barlow, National Chairperson of The Council of Canadians, in Ottawa, Ontario, Canada. Other featured speakers confirmed to date include Stuart Bunn, Director of Australian Rivers Institute, Griffith University in Queensland, Australia; Steve Carpenter, Center for Limnology, University of Wisconsin in Madison, Wisconsin, USA; Cliff Dahm, Lead Scientist, Science Program, CALFED Bay – Delta Program in Sacramento, California, USA; Scott Glenn, Institute of Marine and Coastal Sciences Rutgers, The State University of New Jersey, New Brunswick, New Jersey, USA; Jane Lubchenco (Confirmation Pending), Under Secretary of Commerce and Administrator of National Oceanic and Atmospheric Administration (NOAA), Washington, DC, USA; Emma Rosi-Marshall, Assistant Professor, Department of Biology, Loyola University Chicago in Chicago, Illinois, USA; Jake Vander Zanden, Center for Limnology, University of Wisconsin in Madison, Madison, Wisconsin, USA and Ellen Van Donk, Netherlands Institute of Ecology (NIOO – CL) Center for Limnology, The Netherlands.

The 2010 ASLO-NABS meeting's theme, Global Changes from the Center to the Edge, draws attention to the entirety of aquatic systems on which humans depend. Topics of discussion during this meeting will encompass and embrace the entire hydrological cycle and shine light on many types of connections, whether thematic or interdisciplinary. A joint meeting of these societies and is an efficient and effective means for those who participate to hear the latest scientific findings and results.

Abstract submissions will be due online 12 February 2010. To submit an abstract and for more information on the meeting, please go to http://www.aslo.org/meetings/santafe2010/

For more information about the meeting, please contact Helen Schneider Lemay, ASLO Business Manager, ASLO Business Office, Voice: 800.929.ASLO or 254.399.9635,
Fax: 254.776.3767 or E-mail: business@aslo.org

Working Group on Plankton Ecology (PEG)

The PEG is among the oldest working groups of the SIL. Since its inception in 1974, PEG has organised more than 20 meetings, including both symposia and workshops, which stimulated cooperative international studies. One of the most cited papers in plankton ecology (~750, Sommer et al. 1986) was the result of these meetings in early 1980s. In this paper, numerous fresh water systems were compared and the seasonal dynamics in plankton communities evaluated in a conceptual framework: the PEG model.

After the publication of the PEG-model, the group has been active for another 15 years. In March 2001 PEG supported the symposium "Recent Developments in Fundamental and Applied Plankton Research" (Hydrobiologia 491: 378 pages, 2003), which was PEG's last activity about plankton succession and dynamics. Since then the PEG has been dormant for 9 years and meanwhile not only the perspective on plankton ecology has undergone a lot of changes, but also our environment is changing at an unprecedented rate. Here, we see an interesting challenge for the PEG in assessing how temporal dynamics of aquatic ecosystem will alter in the light of global change.

For example, climate induced species-specific changes in the seasonal timing of life-cycle events may result in decoupling of trophic relationships as well as of cascading effects on food-web functioning. Recently, predictability of plankton dynamics has been under debate, with the application of Lorenz' chaos theory to plankton dynamics. In this modern day field of plankton ecology with its continuous flow of new challenging ideas to be tested, we would like to bring together creative minds in plankton ecology to invoke discussion on three topical subjects:

- Chaos vs. predictability in plankton dynamics,
- Global patterns vs. regional differences in plankton dynamics, and
- Climate induced changes in plankton dynamics.

Keeping in mind current day paradigms, perspectives and environment changes, our ultimate goal is to revisit our views on seasonal dynamics of plankton. We are, therefore, pleased to organize a 3-day meeting "Predictability of plankton communities in an unpredictable world" from 7-10 April, 2010 in Amsterdam, The Netherlands.

We aim at bringing together a broad group of plankton ecologists that supports an integrated approach to the science of plankton ecology. We look forward to a fruitful and stimulating meeting with plenty of room for exchanging of ideas and information. Of course, any suggestions are welcome. Please contact us on the email address: sil-peg@live.nl if you are interested in attending the meeting.

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Shaking Hands with a Limnologist: The Great Limnologist—Gene E. Likens

On Nov. 6, 2009, the Jinan University* (Guangzhou, China) conferred Honorary Professorship to Prof. Gene E. Likens (Founding Director and President Emeritus of the Institute of Ecosystem Studies, Millbrook NY, USA) at a solemn ceremony held at the Science Hall at the campus of the University. In addition to the President of the Jinan University, Prof. Hu Jun,. more than 350 scientists, research scholars, students, and the Heads of the Office of the International Affairs and Science and Technology Research Department of the University attended the ceremony. Two senior guests scientists from abroad , Prof. Henri I. Dumont (University of Gent, Belgium), and one of the undersigned Dr. Ramesh D. Gulati (the Netherlands Institute for Ecology, Nieuwersluis, The Netherlands) were also present at the ceremony.

The ceremony was hosted by Prof. Yuan-Ming Zhang, the Dean of College of Life Science and Technology, of the Jinan University. Prof. Jun Hu delivered the welcome address, and Prof. Bo-Ping Han (Head, Institute of Hydrobiology) gave a brief introduction to the research interests, experiences and life-time academic achievements of Prof. Likens. The Vice President of Jinan University, Prof. Jie-Sheng Liu, announced the decision to confer the title of Honorary Professor of Jinan University to Prof. Gene E. Likens. Prof. Jun Hu awarded the 'Certificate' of Honorary Professorship Title to Prof. Gene E. Likens. Prof. Likens replied by thanking the University for honoring him and gave a talk entitled "*Limnology: The Queen of Natural Sciences – its Role in Understanding Water Resource Protection and Use.*" In his lecture, he reminded the audience about the major changes taking place on our planet Earth: population explosion, CO_2 increase in the atmosphere and a great increase in energy use. It is the human beings that accelerate environmental changes and that the global environmental problems such as global warming, acid rain, and eutrophication, cannot be solved in piecemeal, because everything is connected to everything else. Therefore, the environmental problem should be solved at the

ecosystem level or watershed scale, i.e. through an holistic approach. In this regard he gave some excellent examples of how Air-Land-Water Interactions make piecemeal solutions impossible.

Prof. Gene E. Likens, the former chairman of American Society for Oceanography and Limnology (1976 1977), Ecological Society of America, ESA (1981 1982) and of the International Society of limnology, SIL (2001 2007), is among the foremost and famous limnologists/ecologists in the world. He has received many national and international awards and honors. In 2006, Prof. Likens was elected a member of the American Philosophical Society, having previously been elected to the National Academy of Sciences (1981) and the American Academy of Arts and Sciences (1979). He was a co-recipient, with his long-term collaborator, Dr. F. H. Bormann, of the 2003 Blue Planet Prize for outstanding scientific research that helps to solve global environmental problems. The Blue Planet Prize is recognized as the environmental equivalent of the Nobel Prize in Ecology. In 2002 Dr. Likens was awarded the 2001 National Medal of Science, the nation's highest science honor, for his outstanding contributions to the field of ecology. He has published more than 400 research papers in international scientific journals, including 36 papers in Science and Nature, and nine textbooks including An Ecosystem Approach to Aquatic Ecology: Mirror Lake and Its Environment and Encyclopedia on Inland Waters (3 Volumes; Academic, Publishers). The main research fields covered by Dr. Likens works include long-term ecosystem studies on lakes and rivers, including, hydrobiology, limnology and freshwater ecology and environmental sciences.

Eutrophication as in many other developing countries and global warming are the main water quality concerns in China. The country has been experiencing serious problems relating to water shortages, water quality and ecosystem degradation due to nutrient enrichments from the catchment and direct discharges. Prof. Gene E. Likens who is an highly experienced scientist in research and education in the field of watershed and acid-rain research, stressed the need for paying more attention to such problems in near future.

So, shaking hands with the great limnologist—Gene E. Likens, was a lifetime experience for us. A further exchange of ideas and information and cooperation will greatly benefit limnologists, environmental ecologist in both China and the United States.

Some of the representative papers of Prof. Gene E. Likens and his colleagues:

Likens, G. E. and F. H. Bormann. 1974. Acid rain: a serious regional environmental problem. *Science* 184(4142):1176-1179.

Likens, G. E., F. H. Bormann, R. S. Pierce and W. A. Reiners. 1978. Recovery of a deforested ecosystem. *Science* 199:492-496.

Likens, G. E. (ed.). 1985. An Ecosystem Approach to Aquatic Ecology: Mirror Lake and its Environment. Springer-Verlag New York Inc. 516 pp.

Likens, G. E. 1992. The Ecosystem Approach: Its Use and Abuse. Excellence in Ecology, Book 3. Ecology Institute, Oldendorf-Luhe, Germany. 166 pp.

Likens, G. E., C. T. Driscoll and D. C. Buso. 1996. Long-term effects of acid rain: response and recovery of a forest ecosystem. *Science* 272:244-246.

Likens, G. E., S. L. Tartowski, T. W. Berger, D. G. Richey, C. T. Driscoll, H. G. Frank and A. Klein. 1997. Transport and fate of trifluoroacetate in upland forest and wetland ecosystems. *Proc. National Academy of Sciences* 94:4499-4503.

Larison, J. R., G. E. Likens, J. W. Fitzpatrick and J. G. Crock. 2000. Cadmium toxicity among wildlife in the Colorado Rocky Mountains. *Nature* 406:181-183.

Likens, G. E. 2004. Some perspectives on long-term biogeochemical research from the Hubbard Brook Ecosystem Study. *Ecology* 85(9):2355-2362.

Likens, G. E. and D. C. Buso. 2006. Variation in streamwater chemistry throughout the Hubbard Brook Valley. *Biogeochemistry* 78:1-30.

Photo: Prof. Jun Hu President of the Jinan University awarded the 'Certificate' of Honorary Professorship Title to Prof. Gene E. Likens.

I thank Dr. Xiufeng Zhang (Jinan University, China) for providing information that helped me write this report.

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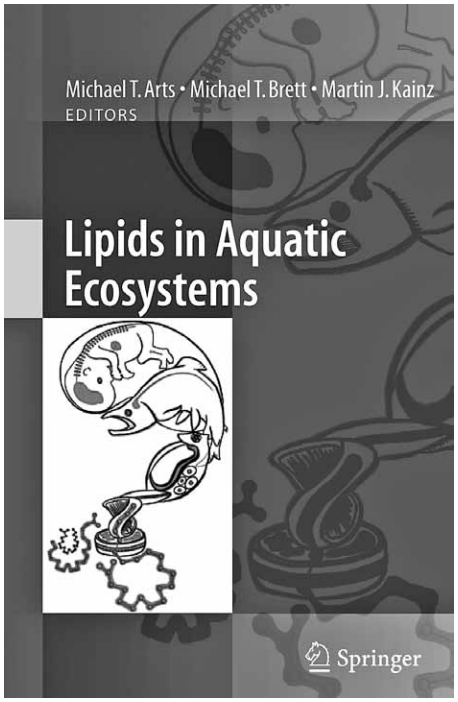
** The Jinan University, Guangzhou, is one of the oldest universities and one of the "211" key national universities in China. It is famous for its overseas students. Currently there are about 34,000 students studying at this university, including 13500 students from abroad. Hydrobiology, is one of the main study and research subjects at the university. The research in limnology, comprises studies on lake and reservoir ecology, and river and wetland ecology.*

Reviews & Studies

Book Review

Reprinted from Aquatic Ecology, *Vol. 43 (4):1201-1205, 2009.*

Michael T. Arts, Michael T. Brett and Martin J. Kainz (eds): **Lipids in aquatic ecosystems.** Springer Publishers, 2009, XX, 377 p, 63 illus, Hardcover ISBN: 978-0-387-88607-7 Price 66,95 €



In 1999, I reviewed for *Aquatic Ecology* (Vol 33:215 217) the previous lipids book *Lipids in Freshwater Ecosystems* edited by Michael T. Arts and Bruce C. Wainman. Therefore, on getting an invitation to review this new book, a decade later, I thought it is new revised edition of the earlier book. However, strictly speaking it is not quite true: first, because this new book expands the previous books contents to *Lipids in Aquatic Ecosystems* in general; and second, only the lead Editor, Dr. Michael T. Arts (Environmental Canada, Burlington, Canada), is also senior editor for this new book. The two co-editors of the present book, Drs. Michael T. Brett and Martin Kainz, are eminent scientists in the field of lipid research, respectively, at the University of Washington, Seattle (USA), and WasserKluster Lunz—Biologische Station GmbH, Lunz am See, Austria. I believe that the new book will have a much wider scope as well as readership. It is a very good attempt to provide an update on the role of lipids in the growth and reproduction of organisms in aquatic environments in general. But I think the book has more to offer!

I observed a subtle difference from the previous book already after looking at the books front cover figure. As far as I can visualise, the figure draws the readers attention to the vital importance of fatty acids (FAs) already during the embryological development of different organs. The book broadly sums up the recent literature on the role of lipids in different types of aquatic systems. Popularly known as omega-3 and omega-6 FAs, these EFAs have in recent years increasingly acquired our attention to the both scientific and popular health literature. We know now that the EFAs play critical roles in regulating the structural properties of cell membranes as well as serve as precursors of prostaglandins, prostacyclins, the thromboxanes and the leukotrienes.

The Foreword to the book by Winfred Lampert rightly links the advances in FA research to methodological progress, i.e. FA analyses have become more main stream, because new, less expensive instruments have become available for ecological laboratories and because ecology, in general, has more diversified and integrated with other disciplines. It is, therefore, right to presume that lipid research in aquatic organisms has profited from the growing connection to human nutritional science interested in the importance of highly unsaturated FAs (HUFA: FAs with ≥20 carbons and ≥3 double bonds).

The book has 14 chapters, and at the end, a 10-page name index and a 9-page subject index. But for one or two chapters, each chapter sums up the main findings as conclusions or summary conclusions followed by references. A cursory look at the chapter contents should convince the reader of the wide range of study aspects: lipids in algae; FAs, their formation and transformation in aquatic microbial food webs; sterols and their ecological significance in aquatic food webs; lipids and contaminants integration in aquatic ecology and ecotoxicology; FA composition of crustacean zooplankton; FA in freshwater fish, zoobenthos; the export of omega-3 highly unsaturated FAs (EPA + DHA) from aquatic to terrestrial ecosystems; biosynthesis of polyunsaturated FAs in aquatic ecosystems: the influence of lipids on membrane competency and immune response; lipids in marine copepods with their latitudinal characteristics and perspective to global warming; tracing aquatic food webs using FAs; EFAs in aquatic food webs; and the last chapter that relates to human life is a review that summarises information on the health consequences of the molecular events relating to molecular transformation within the organisms.¶

In the Introduction Lipids in aquatic ecosystems, the editors put lipid research into a broader ecological perspective; they consider lipids as global currency with their far-reaching physiological roles in both terrestrial and aquatic biota. The present book has an extended scope because it includes studies on lipids in both freshwater and marine ecosystems.

I briefly highlight here the chapter-wise book contents. The chapter 1 Algal lipids and effect of environment on their biochemistry traces the synthesis of algal lipids in relation to environmental stresses of light and temperature and nutrients. Such limitations are reported to lead to lower levels of EPA and DHA. Also, a general reduction in the degree of FAs under saturation in response to elevated CO_2 has been reported. Specific P effects on FA production seem to have been relatively less explored although for P-starved cells of *Chlorella kessleri,* an elevated level of unsaturated FAs was found in all the identified individual levels. The chapters main message rather than the conclusion is "there is plenty of work to do." Desvilettes and Bec (Chap. 2) provide details on biosynthesis for polyunsaturated FAs in heterotrophic protists, which are considered to trophically upgrade some FAs molecules to more active forms for zooplankton. In systems dominated by prokaryotic picoplankton, the heterotrophic protists constitute a necessary biosynthetic step and provide essential lipid compounds for growth of crustacean zooplankton. Thanks to some very interesting published papers by Dominik Martin-Creuzberg and Eric Von Elert (see Chap. 3: References), we are now demonstrated convincingly the key role that sterols play in the physiological processes of all eukaryotic organisms. The authors show that at sterol concentrations <5.4 µg mg^{-1} dietary carbon, a limitation of somatic growth is a likely scenario for herbivorous zooplankton, e.g. *Daphnia* spp. However,

certain compensatory mechanisms due to *trophic upgrading* of the prey will lead to reduce the extent of sterol limitation.

Susan Watson et al. (Chap. 4) demonstrate how subtle are chemical communications in aquatic ecosystems. They show that certain lipids, i.e. PUFA derivatives, e.g. aldehydes, can cause certain adverse effects in aquatic organisms. It is interesting that confronted with such stress effects, these organisms can detoxify these toxic lipids or deal with them. Apparently, studies dealing with these toxic substances are still in infancy due to inadequate availability of techniques of measurements. Martin Kainz and Aaron Fisk (Chap. 5) deal with lipids and accumulation of lipophilic contaminants in aquatic organisms and their effect on both organisms and food web. These contaminants also include the so-called xenobiotics. Although both FAs and contaminants are trophically transferred through aquatic food webs, potentially they have different effects and relevance. In addition, beneficial effects of increased dietary supply of PUFA are considered. The literature data show that increasing stress from climate change may result in significant alterations in dynamics of contaminants and lipids in ecosystem. Interestingly, most contaminants are highly soluble in lipids but insoluble in water. Moreover, whereas contaminants are possibly bioaccumulated, i.e. their concentrations increase, lipids are selectively regulated depending on their physiological requirement. The chapter authors quite stick to the theme of the chapter and also cross-refer to the other book chapters and more relevant literature.

Michael Brett, Dörthe Müller-Navarra and Jonas Persson provide a state-of-the-art summary on the FA composition of zooplankton, both freshwater and marine, in Chap. 6 entitled "Crustacean zooplankton FA composition." These two groups of zooplankton markedly differ in their FA composition: for example, whereas marine copepods in temperate and polar regions store large amounts of lipids as wax esters, their freshwater counterpart accumulates EPA and DHA, e.g. the freshwater Cladocera are known to accumulate EPA. In general, most zooplankton accumulate relatively more n-3 and n-6 HUFA than is present in their diets. Thus, whereas the diet has very strong effect on FA composition, especially in *Daphnia* spp., it is less so in copepods. Interestingly, zooplankton generally exhibits a clear homeostatic FA response to diets that widely vary in FA composition. Cold stress leads to increased retention of n-3 and n-6 HUFAs.

Gunnel Ahlgren and her two colleagues co-author the Chap. 7, which deals with Fatty acid ratios in freshwater fish, zooplankton and zoobenthos. This is essentially a review chapter that provides a wealth of information taken from the authors own published works and literature. Salient piece of information is that the freshwater organisms, indeed, exhibit specific differences in n-3 PUFA: n-6 PUFA ratios and DHA (docosahexaenoic) : ARA (arachidonic acid) ratios. Interestingly, the FA ratios are rather stable and lower for herbivorous-omnivorous fish and higher and more variable for carnivorous-benthivorous. According to the authors, the diet seems to have strong effect on PUFA composition, which also explains the relatively small variation in wild piscivorous fish. The ratios do not clearly differ for copepod and cladoceran zooplankton. Among the zoobenthos, in ephemerids and chironomids, DHA was found rarely or was lacking. This is true also for aquatic insects. The chapter provides several detailed tables as Addendum on DHA:ARA ratios of different *Daphnia* spp and freshwater zoobenthos.

In chapter 8, Michail Gladyshev, his colleague Nadezhda Sushchik and Michael Arts try to establish the (missing) link between aquatic and terrestrial ecosystems regarding the fate and distribution of EFAs, i.e. the export of omega-3 (EPA + DHA) from aquatic to terrestrial ecosystems. This work seems to me quite fascinating and original but it is also challenging because it involves a search for appropriate data sources. Quantifying the gross export is probably more exigent because what is recovered in terrestrial systems may be only a fraction of that is transferred due to lack of literature data. Also, critical here is that (I quote from the authors Conclusions and Perspectives) "the consumption of the n-3 HUFA by humans is suspected as being insufficient even in the Western developed countries." This terrestrial link will become crucial for populations, especially those in developing countries, as we learn more about the role of omega FAs for human health. Unfortunately, we know little at present how the eutrophication process and climate change will (negatively) affect the HUFA production, because both Cyanobacteria and warmer temperatures are likely to reduce both EPA andDHA. I believe reading the conclusions and perspectives will drive many a reader to go through the chapter contents. But for the space constraint, I have more to say about this chapter than I do.

Chapter 9 (Michael Bell and Dougla Tocher) deals with biosynthesis of n-3 HUFAs in aquatic ecosystems, especially from ALA in fish. Because these HUFAs are highly essential for human health, but are in a limiting supply, this chapter assumes quite an imperative place in the book. We are reminded that fish is a major source of theses HUFAs in our diet, but since its populations are declining, and human populations are rapidly increasing, we will be ever more dependent on aquaculture for our supplies. Alternative sources of n-3 HUFA, i.e. microalgae and other unicellular organisms, including cloning of genes from marine microalgae, are explored. Thus, molecular mechanisms of HUFA synthesis in aquatic environment seem to be promising because they have provided highly interesting scientific information as well as valuable molecular tools (genes) involved in HUFA synthesis.

In "Health and Conditions in Fish" (Chap. 10), Michael Arts and Christopher Kohler focus on the two main roles that lipids play in mediating the health and condition of teleost fish. The study includes the influence of lipids on membrane fluidity, which is particularly important at colder temperatures. Among the ectothermic animals, much of the work derives from studies on invertebrates and fish. In humans, as in fish, there is strong evidence of a connection between n-3 HUFA in the diet and enhanced membrane fluidity, or better cold tolerance, or both. Apparently, the fluidity plays a role in preventing mortality due to exposure to cold. Other aspects of lipid composition in fish relate to controlling fluidity, environmental effects on HUFA supply and how dietary FAs can modulate immune response in fish, i.e. provide protection against pathogenic vectors. This is generally an interesting review of the role of FAs in relation to immune system of teleost fish, compared with other vertebrates. The short chapter by Gerhard Kattner and Wilhelm Hagen (Chap. 11) deals with lipids in marine copepods in relation to global warming. It seems that species shifts and lipid profiles are not unambiguously predictable. Numerous life cycle strategies used by copepods make it cumbersome to determine the extent of their lipid dependence. It is, however, clear that high latitude copepods are much more lipid dependent than their tropical counterpart. Lipid levels in zooplankton in polar regions can comprise >50% of the total body carbon *versus* virtually no lipid-bound carbon in pelagic zooplankton in tropics.

Unfortunately, we still know little about the lipid contents of early development stages of copepods. The reader should also read a recent workshop paper *Perspectives on marine zooplankton lipids* by Kattner et al. (19 authors: see References in Chap. 11).

The chapters 12, 13 and 14 are single-author chapters. Sara Iversen (Chap. 12) provides an overreview of how and why FAs are used as trophic tracers. She also discusses qualitative and quantitative use of lipids in studies relating to food web and foraging ecology mainly based on marine ecosystem studies. In addition to discussing *de novo* FA biosynthesis, digestion and depositions of dietary lipids are considered. Quantitative FA signature analysis (QFASA) is a new general tool designed to quantify predator diet using FA signatures. The chapter also discusses how—by applying different approaches—the lipids and FAs can be used to trace trophic pathways. Certain FAs or combinations of FAs appear to act as useful trophic markers at higher trophic levels. For this purpose, both the tissue sampling and predator and prey sampling are the primary requisites. The extended summary conclusions were rather helpful for me to understand the chapter contents more clearly. I do see possibilities of applying the knowledge based on this chapter to understand the link regarding transfer of FAs from aquatic to terrestrial systems (see Chap. 8), e.g. the reference to blubber of seals and polar bear (p. 289, under prey sampling). In chapter 13, "Essential Fatty Acids in Aquatic Food Webs," the author, Christopher C. Parrish, defines EFAs and then goes on to highlight their main effects on aquatic organisms. There are probably several FAs that are essential, depending on the organism, its life stages and the environmental conditions. That an FA is essential can be checked from growth response, i.e. FA composition of membranes. Membranes phospholipids may be important to many of the mechanisms of health effects of EFAs. It seems a higher dietary ratios of DHA:EPA is a more general requirement for better life history parameters in many marine copepods. Finally, the author convincingly pleads for considering n-6 FAs (e.g. 22:55n-6) as an EFA.

Last, chapter 14 by William E. M. Lands entitled "Human Life: Caught in the Food Web," represents a climax as to the role of FAs for our animal kingdom. This is because as the book editors have appositely commented in their Introduction to the book (top line on p. xix) that *humans occupy a singularly unique position in the global food chain*. Dr. Lands provides a Table on page 347 giving the current average dietary intakes of three major PUFAs and n-3 HUFAs for 13 countries. Obviously, even within the human populations in the developed world, the current average of n-3 HUFA needed to balance the other EFA and maintain tissue biomarker level of 40% n-6 in HUFA, greatly differs: 1,000 mg/day in Denmark compared with 3,667 mg/day in the USA. Thus, the ratio of PUFA:HUFA based on dietary intake expressed as % energy intake is crucial rather than absolute amounts of PUFA and HUFAs. The main message from this chapter is (I quote Dr. Lands) awareness of the contents of PUFA and HUFA may someday be a priority in efforts to sustain a healthy food web for humans. On my request to understand technicalities relating to physiology a bit better, Dr Lands sent me an email saying that "The tissue balance (PUFAs and HUFA) is the important dimension regulating physiology." I think it is a befitting moment to end the chapter reviews here and say briefly about the book as whole.

I enjoyed every bit of reading the book although I feel that reviewing a specialised book like this is hard work for a non-specialist as I am. It is, however, quite satisfying to note the pace of progress of studies on lipids in the last 10 years. The link that the lipids in the aquatic food web lay towards our terrestrial ecosystems and humans, makes the studies all the more fascinating. The present book should pave the way for more interaction between ecologists and food science specialists to provide information on supplementary diets, especially in the daily food menu of people in the developing countries who are deprived of a decent, balanced diet with EFAs in right proportions. As a vegetarian, I invariably ask a question to myself: do I have to survive on diet that at its best may be rich in n-3 and n-6 PUFAs but with little or no n-3 HUFA? I think there is scope of finding/developing vegetarian products that can serve as reasonable substitutes for the "human vegetarians," i.e. plant materials as source of the EFAs.

Lastly, I congratulate the editors, Michael Arts, Michael Brett and Martin Kainz, for presenting the aquatic ecologist with a second lipids book within a decade. The book with its readable format and moderate price should sell quite well. Considering the pace of progress in lipids research, I have no hesitation in assuming that a revised edition of this book in about 5 years time will be realistic option that Michael Arts and his co-editors must bear in mind if they do not want the readers to wait too long

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Ph.D. Overview: The Effect of Free-Floating Plants on Phytoplankton Ecology

My Ph.D. study related to the role that free floating plants (FFP) play in the functioning and the structure of shallow lakes. I explored the mechanisms characterizing the auto-stabilizing states of FFP and phytoplankton dominance, and how these two communities shift in response to environmental change. I assessed the effects of FFP occurrence and extent of their cover on phytoplankton ecology (composition, productivity and diversity) and on ecosystem functioning. Results from the different time scales (days, months and years), nature of experiments (indoor, outdoor experiments and filed surveys) and level analyzed (population or community), show contrasting phytoplankton and ecosystem responses depending on degree of FFP cover. In a nutshell, the dense FFP cover determined an almost dark and anoxic water column that triggered the release of nutrients from the sediments; the strong light limitation exerted a strong control on phytoplankton biomass regardless of the nutrient status. This resulted in stable phytoplankton assemblages with low richness, but high evenness and similar specific composition. Conversely, in the absence of FFP (optimal light climate) phytoplankton biomass reached high levels, the water column became well oxygenated and nutrient concentrations decreased because of increased biological uptake by phytoplankton. In such clear-cut scenarios, the absolute and relative nutrient concentrations played a major role in structuring the phytoplankton composition and abundance. In situations of high nitrogen to phosphorus (N:P) supply ratios, green algae dominated, whereas in low N:P supply ratios nitrogen fixing cyanobacteria (*Anabaena flos-aquae* Bréb.) prevailed. The periodic fluctuation in

the FFP cover resulted in a quick environmental response, yet a poor control on phytoplankton biomass and diversity (Fig. 1).

A copy of the Ph.D. and its publications* can be requested by e-mail.

Publications

de Tezanos Pinto, P., Allende L., and O'Farrell I. 2007. Influence of free-floating plants on the structure of a natural phytoplankton assemblage: an experimental approach. Journal of Plankton Research. 29: 47-56

O'Farrell I., de Tezanos Pinto P. and Izaguirre I., 2007. A pattern of morphological variability in phytoplankton in response to different light conditions. Hydrobiologia, 578, 65–77

O'Farrell I, de Tezanos Pinto, P., Rodríguez P., Chaparro G. and Pizarro H. 2009. Experimental evidence of the dynamic effect of free-floating plants on phytoplankton ecology, Freshwater Biology. 54, 363-375

de Tezanos Pinto P. and Litchman E. Interactive effects of N:P ratios and light on nitrogen fixer abundance. Oikos Article accepted.

de Tezanos Pinto P. and Litchman E. Eco-physiological responses of filamentous nitrogen-fixing cyanobacteria to light. Hydrobiologia. Article accepted.

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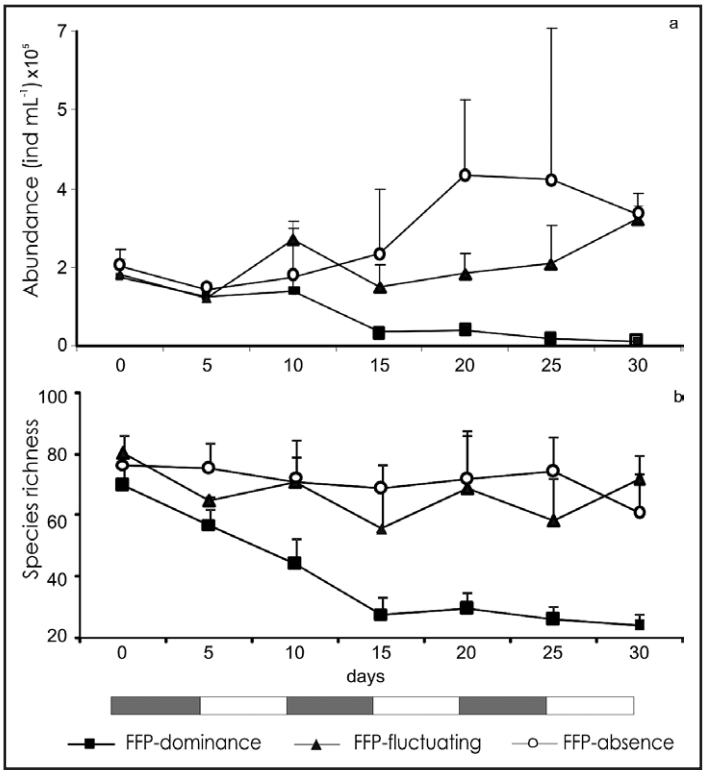

Fig. 1. Phytoplankton abundance (a) and species richness (b) response to different free floating plants cover regimes. A permanent FFP cover (FFP-dominance) generated a strong phytoplankton control, but periodic fluctuations in the cover (FFP-fluctuating) did not exert control on phytoplankton. Responses in FFP-fluctuating were similar to those in FFP-absence. Different colors in the horizontal legend bar denote periods with cover (gray) and without cover (white) in the FFP-fluctuating treatment. Error bars indicate standard deviation (n=3). Modified from) O'Farrell et al. 2009

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