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SIL news

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In This Issue

Material for the June 2009 issue should be sent to the Editor by:

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

Editorial

The present Issue of *SILnews* 53 starts with obituaries and a tabulated list of colleagues who passed away in the period August 2007 to July 2008. I use this opportunity to pay respectful tributes, on behalf of the members of the SIL Secretariat, including myself, to all limnologists who died in the last one-year as mentioned above. Because of the space restrictions, I include here detailed obituaries of only Dr. Peter Cullen and Dr Walter Koste. All the deceased are listed in a Table after these two obituaries. As Editor of the *SILnews*, I use my editorial privilege to pay a tribute to my departed colleague and a friend, Herman Gons, at the Centre of Limnology, Nieuwersluis (See Table). Herman's untimely death last year came as a very rude shock to the community of limnologists in the Netherlands in general but especially to his family members and immediate colleagues at the Centre of Limnology at Nieuwersluis. I worked together with Herman since he joined the Centre in late 1970s.

I am pleased that Dr. Brian Moss (SIL President) and Dr. Morten Sondergaard (SIL Secretary) sent their short contributions for this newsletter; also Dr. Judit Padisak (SIL Vice President) accepted my invitation to write for the newsletter. I hope that the both SIL officers and SIL members (also non-SIL members) will volunteer to contribute to the *SILnews* in coming years as well. I especially look forward to receiving brief contributions from the regions from where our members have recently not contributed to the newsletter. These include Scandinavian countries, Central European countries, Japan, Australia and New Zealand. I plan to invite some of them personally to do so but I also welcome those who offer to contribute after reading this invitation.

Reporting on news in regional limnology is always an exciting experience for me. I have continued such a coverage in this Issue from the point I left it last time. Again, the reports cover both different areas and subjects. This time I was able to get some interesting contributions on waterbodies ranging from, e.g. haors in Bangladesh (how many of our readers had heard before this of waterbodies called haors?) to larger lakes and interesting inputs from South Africa and Zimbabwe and Kazakhstan (Aral Sea).

It is encouraging to receive from SIL working-groups several announcements of meeting and WG reports. These only substantiate intensive scientific contacts and activities among our vast community of fresh-water scientists. I like to refer to a brand new group Winter Limnology, which was formed last year and had announced its first symposium (24-28 May 2008) in the *SILnews* 51. This group reports in this Issue the deliberations of its maiden Symposium held at Kilpisjärvi in northern Finland (Arctic Circle), a befitting venue and equally apt weather conditions to convene such a meet. I also had the opportunity to attend this Symposium, and think that the new discussion group fills an important niche to investigate limnological phenomena under severe winter conditions. The announcement of a follow-up meeting, the second Winter Limnology Symposium, to be held in June 2010 in Germany (see announcement in this issue), is a testimonial to the group's head-on start. I hope this new working group will soon request the SIL Secretariat to become a SIL working group.

Ramesh D. Gulati
Editor, *SILnews*

Peter Cullen (1946-2008)

Peter Cullen was an extraordinary person as he very effectively straddled the gap between the demanding strictures in seeking scientific truths and the difficult and diplomatic requirements in getting scientific messages to politicians, managers and the public. Messages that were sought to increase an awareness of ecological issues and that were calling for action. In dealing with the oft-volatile issues of water resource management and seeking ecological sustainability of freshwater ecosystems, Peter

Peter Cullen

was a gifted and convincing communicator and a knowledgeable and an insightful advisor. There is no doubt that Peter was a driving force in driving governmental water reforms, such as the National Water Initiative, an initiative that recognized ecological imperatives and problems along with social and economic concerns in water resource management . His advocacy over the years that the environment must be fully considered in water resource planning and management at last, after many setbacks, appears to have been recognized and even acted upon.

Born in Melbourne he attended Balwyn High School in Melbourne and then studied for a B. Agr. Sc. and a M.Agr. Sc. at the University of Melbourne. He was greatly influenced by the scholarly Professor Geoffrey Leeper, as wise aphorisms of this professor were often used to great effect by Peter. After teaching at Balwyn High School, tutoring at the University of Melbourne and then working for the Port Phillip Bay Authority, in 1973 Peter went to Canberra to be a lecturer in resource management at the Canberra College of Advanced Education. Subsequently, he became a Professor in the University of Canberra and developed a very active School in Applied Ecology and Resource Management, and from 1993 to 1991 he was Dean of the Faculty of Applied Science. His scientific research focused on nutrient and water quality problems (e.g. eutrophication in lakes and wetlands).This work included studies with Ron Rosich on the nutrient dynamics of Lake Burley Griffin, the lake in the centre of Canberra, the national capital. At the same time he was advocating the need for resource managers to become ecologically aware and he was very active in assessing and solving water quality problems in freshwater systems.

In 1991 Peter almost single-handedly put together a bid for a CRC of Freshwater Ecology. The bid was made as the world's longest blue-green algal bloom unfolded in the Darling River. However, in spite of such a vivid example of a dire water resource problem, the bid was unsuccessful. But not to be deterred, a new bid was submitted and this time it was successful with environmental flows and river condition assessment being the major themes. So the CRC for Freshwater Ecology was launched under Peter's Directorship with the MDFRC at Albury being the original home base. Setting up the CRC involved many meetings, many negotiations, heated discussions and flurries of fiery and amusing faxes. Very quickly the CRC took shape and under Peter's directorship it evolved into a very effective research and educational hub for freshwater research. Not all the research was applied; basic ecology, "blue sky" research was strongly supported by Peter as a critical component of the research agenda.

The CRC became a source of knowledge and advice on water management and ecology. Peter built a versatile "knowledge broker" team producing many reports and statements, but most of all under Peter's leadership with numerous press statements, the CRC was actively involved in the resource-ecology water debate. Indeed, as the current "drying phase" developed in southern Australia and managerial shortcomings became very evident, Peter became a central figure in the water debate, actively and fluently engaging in it, being asked and providing independent and wise advice and fearlessly pointing out the sad ecological state of our rivers and wetlands (especially in the Murray-Darling system) and suggesting feasible solutions.

There were many meetings in the CRC. Under Peter's leadership many of these were stimulating affairs with questions of science and of water management being pursued along with questions of strategy and effectiveness. In the CRC and in many of its committees, Peter was a diligent listener, a great distiller of relevant points and a lucid synthesizer of ideas and actions. But, it is also important to remember that Peter had a great sense of humour and of comradeship, so that very rarely in my experience were there moments of acrimonious disagreement.

During the CRC time Peter worked hard to get not just freshwater ecology research noticed by politicians, but for scientific endeavours in general to be recognized and built into the political agenda. He became President of the Federation of Australian Scientific and Technological Societies (FASTS) and was an enthusiastic promoter of the Annual "Science meets Parliament" event that began in 1999. His influence in government policy relevant was strengthened when he became a member of the Prime Minister's Science, Engineering and Innovation Council in 1998 and was elected a Fellow of the Australian Academy of technological Sciences and Engineering. His strong advocacy of water issues was recognized when he was awarded the Prime Minister's Prize for Environmentalist of the year in 2001, and in 2004 he was awarded the Order of Australia for his services to freshwater ecology.

Peter was an active member of the Australian Society for Limnology attending many of the annual conferences from Jabiru to Queenstown NZ. Indeed, it was at the latest ASL Conference in Queenstown NZ that Peter gave a stimulating and challenging address "Adapting to water scarcity: A global challenge for the 21st century" in which he stressed that the research findings of freshwater ecologists are now being incorporated into water resource management, but such incorporation is still being resisted by self-interested groups. He urged "freshwater ecologists to work within the Australian Society of Limnology and develop some strategic ways forward to guide science investment in Australia" and that limnologists need to ensure that "our freshwater ecology is made accessible to Governments and our community as we confront serious water scarcity".

Peter was an active member of SIL and at the 29th SIL Congress at Lahti, Finland in 2004, he was awarded the Naumann-Thienemann medal for his leadership in communicating "complex limnological and water resource issues to colleagues and especially to decision makers, which over the past three decades have led to improved understanding about, and wiser allocation of, critical water resources in Australia". In 2006 Peter gave an invited plenary address at the annual conference of the North American Benthological Society in Anchorage entitled "Science and politics--speaking truth to power", in which among

many salient points, he warned scientists that if they enter the public debate they need "to understand that they are leaving a world where finding the truth is the most important goal, for a world where winning is most important".

It seems that his experience with the CRC was instrumental in giving him the strength to pursue water reform in a more emphatic and determined way when he retired. In 2002 he became a founding member of the Wentworth Group of Concerned Scientists and immediately applied his energy to the collective effort of producing the controversial and influential "Blueprint for a Living Continent" in late 2002. Many disagreed with its messages, but to this day it is very obvious that the document has had a strong influence on public debate and government policy—though we still have a very long way to go to achieve any semblance of ecological sustainability in most of our ecosystems. It is extraordinary that although his mobility was increasingly limited and he did have lingering health problems that right to the end, he was so active and dedicated to the cause of ecologically-based water reform. He was a Commissioner of the National Water Commission, Chair of the Scientific Advisory Panel of the Lake Eyre Basin Ministerial Forum, Chair of the Victorian Water Trust Advisory Council, Member of the National Heritage Trust Advisory Committee and of the International Water Academy. At the same time not only was he attending numerous meetings, but was writing and giving stimulating and goading speeches.

His ability to see the "big picture" and to not only describe the problems, but to offer solutions made him a much-heeded and influential environmentalist. He urged people to think in a holistic way, the ecosystem way, to see the large scale and to identify the necessary connections that allow ecosystems to function. Peter was such an open, generous and fair-minded person that people warmed to him even if they disagreed with his views. As a scientist and as an educator he was a great encourager, eager to learn what students and fellow scientists were thinking and doing, and eager to help others in difficulties. . He will be missed as a wonderful person to have debates and discussions with and as an innervating and generous leader that motivated many from scientists, managers to fellow citizens.

In seeing the "big picture", in his dedication to the effective reform of water and catchment management and in his capacity to successfully bridge the gaps between science and resource management and policy, he will be greatly missed. Peter is survived by his wife Vicky and by his two daughters Belinda and Michelle.

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Walter Koste (1912–2007)

(From Int. Rev. Hydrobiologie 93: 129-130)

Walter Koste

Walter Koste, the Grand Seigneur of Rotiferology, passed away on November 11, 2007 in his hometown Quakenbrück at the age of 95 years. In his death we have lost an excellent taxonomist and a good friend.

Walter Koste life's work was greatly appreciated by all who knew him personally and even by those who knew him only through his scientific publications. SCHWOERBEL (1987) and LAXHUBER (1993) have chronicled his life, and three years ago it was my pleasure to provide a review of his scientific career (WALZ, 2005). Nevertheless, this contribution has been very difficult for me to write; how does one express one's deepest feelings for such a good friend and mentor?

Walter was born on July 19th, 1912 in Stolp, which is now part of Poland. In 1934 he joined the army because he had no other way to earn a living during the period of economic hardship that existed between the two world wars. A soldier in World War II, Walter was held captive as prisoner of war by the Russian Army, but was released in 1948 due to a severe illness. At the age of 36 Walter was unable to further his education at university because he needed to care for his family, which by then included a son. However, he secured a position as a teacher in an elementary school, and with further examinations at the college level, was promoted to teach in secondary school. Walter eventually became headmaster of Artland Secondary School in Quakenbrück. During this time he began to distinguish himself as a gifted student of the local rotifer fauna and gave lectures in hydrobiology at the College of Education, later University of Osnabrück. However, retirement from teaching in 1974 permitted him more research time and he intensified his rotifer studies. Thus in 1978 Walter published the two volume work of his now famous revision of "Rotatoria – The Rotifers of Middle Europe", which had been initiated by MAX VOIGT some years earlier.

Walter's revision of this work quickly became an important resource for aquatic biologists. However, he also authored or co-authored 153 publications dealing with rotifer taxonomy, most of which were published after his retirement. Walter received many awards, including Doctor honoris causa in 1980 from the University of Kiel and in 1981 the Federal Order of Merit from the Federal Republic of Germany.

However, Walter will remain in the memories of many in the rotifer family for reasons other than his numerous taxonomic contributions. When I announced Walter's passing to the rotifer family via Internet late last year I received an overwhelming response. Many people expressed their sadness and sympathy with deeply emotional words. This speaks to another aspect of Walter. All who met him were impressed by his warm personality and his open-hearted cordiality. He was always ready to share his knowledge with others and he would even accept plankton samples from students for identification. This fact is not surprising, as the education of young people was always close to Walter's heart and those who knew him saw an exceptionally gifted teacher and mentor. On social events he was more often found sitting with students than among the dignitaries, but Walter was able to communicate effectively to all.

He was a good and reliable friend to us throughout the years. For many the personal connection was very familiar; he was simply 'Uncle Walter'. We have much to thank him for: his scientific contributions, of course; but also for his direct taxonomic advice and for helping us identify rotifers from our samples. Those who knew him are especially thankful for many hours where we enjoyed his jokes and his stimulating spirit. He left us behind and we will miss him dearly, yet Uncle Walter will remain in the hearts and minds of the Rotifer family for a long time to come.

The improvement of the English style by Bob Wallace is acknowledged.

Laxhuber, R., 1993: Das Rädertierportrait: Walter Koste. – Hydrobiologia 255/256: xxiii–xxvi.

Schwoerbel, J., 1987: Dr. h.c. Walter Koste zum 75.

Geburtstag. – *Archiv für Hydrobiologie* 110:631–638.
Walz, N., 2005: Walter Koste – a K-strategist? A laudatio. – Hydrobiologia 546: 1–8.
Norbert Walz, Leibniz Institute of Freshwater Ecology and Inland Fisheries, Humboldt University, Berlin, Germany

whose honour the lecture was founded, made inspiring contributions.

It may seem early to do this but the next Congress, in Cape Town is only two years away and things always take much longer than you think to be decided! The medals will be awarded at the 2010 Congress; the nominated lecturers will give their lectures at the 2013 Congress in Hungary, but the nominations have to be agreed by the International Committee at the 2010 Congress.

NECROLOGY SIL Members (August 2007 – July 2008)

NAME	COUNTRY	INSTITUTIONAL AFFILIATION	YEARS IN SIL	DECEASED
Andrikovics, Sándor	Hungary	Eszterházy Károly Teachers Training College	35	January 2008
Boisson, J.C.	France	E.N.T.P.E.	23	25 April 2008
Cullen, Peter**	**Australia**	**University of Canberra**	**24**	**April 2008**
Gons, Herman	The Netherlands	NIOO-Centre for Limnoloty	30	September 2007
Koste, Walter	Germany	Quakenbrück		11 November 2007
Leentvaar, P.	The Netherlands	Rijks Instituut voor Natuurbeheer (Alterra)	60	October 2007
Pöpperl, Rainer	Germany			5 August 2007
Pourriot, Roger	France			
Radwan, Stanislaw	Poland	Academy of Agriculture	28	5 March 2008
Saijo, Yatsuka	Japan	Nagoya University	25	9 October 2007
Schiewer, Ulrich	Germany	Universität Rostock	14	23 May 2007
Szitó András	Hungary	Fisheries Research Institute	34	December 2007
Vidal-Celma, Antonio	Spain	Aigues Ter-Llobregat (ATLL), Drinking Water supply workstation	38	6 November 2007

[** Dr. Peter Cullen was awarded the Naumann-Thienemann Medal at The 29th SIL Congress at Lahiti (Finland) in 2004, See also his Obituary elsewhere in this Issue).

Message from the President

At its triennial congresses, SIL honours some of its members in two ways. First it appoints limnologists of distinction to give the Baldi memorial and the Kilham lectures. Secondly it awards the Naumann-Thienemann medals, one for each year of the triennium. The International Committee nominates committees to make these recommendations and as President I chair these particular committees. I would like nominations to come from as wide a constituency as possible and so I am inviting you to forward suggestions to me (brmoss@liverpool.ac.uk). These need not be lengthy but should establish a convincing case and ideally should come from groups of proposers rather than individuals and preferably from members in more than one country. There are few restrictions and you can read the details on the SIL website, but the medals are awarded for outstanding scientific contributions to limnology, the Baldi lecture is given as a synthesis of a subject within theoretical limnology, and the Kilham lecture has, as its subject, one or more of the following areas: African limnology, biogeochemistry, ecology and physiology of planktonic diatoms, comparative ecology of lakes and oceans, paleolimnology, or saline lakes. These were all areas in which Peter Kilham, in

And on the subject of things taking time, the Publications Committee has been hard at work negotiating with publishers about how we can launch a journal that will still give a wide opportunity for members from all over the world to publish short papers, acquire recognition in the form of a citation index and remain within our financial means. Discussions are still in progress but I hope we will be able to give some firm news soon.

With best wishes,
Brian Moss

Great data - no paper?

Some of you may have experienced looking at a great set of data; however, the person who has the data does not have the experience or linguistic skills to synthesise the data into a scientific paper of a quality acceptable by a reasonable journal with a peer-review system. This person might be a student or a young scientist working in an academic environment where the international publication experience is low or even absent. One reason that the data never gets published may also be the hurdle created by a foreign language -English for most people.

Many senior scientists with a lot of review experience have most probably been in a situation where a rejection goes something like: "The data are most probably valid and interesting, but the presentation and language make it very difficult to judge the quality, and I do not have the time to do a total re-write." Our Editor-in-Chief, Jack Jones sometimes has used a lot of energy and time to bring a manuscript across the hurdle (not the highest in the world) of our Proceedings. More people should give a helping hand.

The SIL Executive Committee has discussed if and how we (the SIL membership at large) can serve those members, who have a problem passing the publication hurdle, and also include students and young scientists, who are potential members. One idea could be a mentorship between a senior member and a student/young scientist to provide serious help before a rejection letter with some harsh comments and rejection hits the computer screen or the desk.

SIL seeks MENTORS!

We won't want to tell Mentors exactly what to do, but the help may include:

- Screening of data to find out if the next step toward a paper should be taken and advice if data can rather easily be improved. Encouragement is the keyword if the potential is present (of course rejection to proceed is an option)
- Provide sound advice on a target journal (ideally our eventual new Journal) but which may be local and not necessarily with the highest ranking in the world; rather few have data for a paper in Nature or Science. More modest targets are still worthwhile
- Prepare the paper together in a constructive and professional atmosphere
- Follow-up after the review process; new encouragement may be necessary
- Advice on career planning may also be an issue

SIL has a fine history concerning limnology in developing countries, but the present scheme is not only directed for people from developing countries but also for others needing extra help or support. It is not a shame to seek outside professional advice; most of us need to do so.

The Mentor-system is not to replace responsibilities normally carried out by the adviser or supervisor provided by universities but to give an equal opportunity for young limnologists, if the expertise, whether linguistic or publication

advice, is not present in the local environment. SIL would like to get involved and help bring interesting limnological data and results into the open and not to "die in the drawer". We shall provide encouragement to do good limnology.

We should also mention that the Mentor-system can be viewed in connection with our new journal (the first Volume will hopefully come out in 2010). At the moment the linkage is tentative, but if we get the Mentor-system to work many SIL members may find it easier to get to the pages of the new journal with a little help from a friend. Furthermore, some of the Mentors may want to join an Editorial Board; however, this would not be a commitment.

You are a senior scientist, perhaps a retired member, have experience with scientific publication in English, will enjoy using time on community work and to help young or fellow limnologists, who did not have much opportunity to learn scientific writing in English. Morten Søndergaard outburst: "I just "hate" reviewers telling me my English is not too good; of course it is not perfect; it is not my first language, you should try to write a paper in Danish."

We ask you to join the SIL Mentor-system. We need your name, affiliation, e-mail and a few key words on your expertise area to guide contact with potential users. Make your review skills and commitment to limnology work outside the narrow space of online reviews to major journals, whether commercial or non-profit.

In the next *SIL News* we hope to announce an existing list of Mentors, which would also be available on our home page. Joining the list is not a commitment to waste your time but an opportunity to get in contact with serious students and young scientists out there needing you. We hope you will find it personally rewarding.

Join the Mentor-system simply by telling Denise Johnson denisej@email.unc.edu

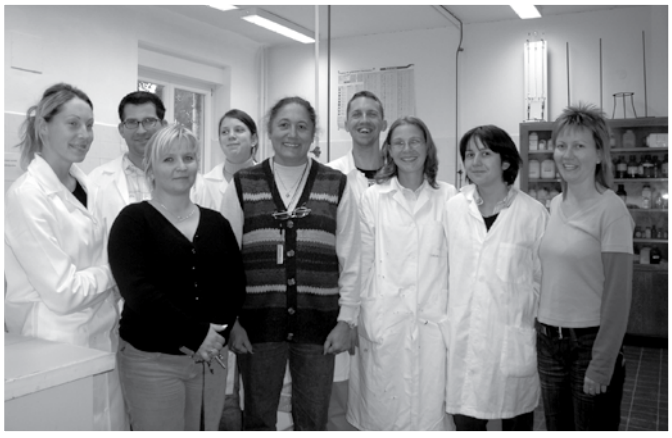
Brian Moss, President SIL
Morten Søndergaard,
General Secretary-Treasurer SIL

QUALI – European Quality Standards in Limnology Education

"Where did you study limnology?" I was asked some 30 years ago by an acknowledged Hungarian limnologist. Indeed, where? As a biology student aiming to study terrestrial botany, I accidentally came across phytoplankton and found it so fascinating that I could never escape its physical and intellectual beauty. I took a very basic course in Hydrobiology at the university, read books, tried to obtain experience in different institutions, participated in local conferences and somehow managed to become a limnologist. Most of us could relate a similar career; as biologist, chemist, geologist or physicist, the limnetic environment trapped us.

It has become a commonplace that water is the key element of the future. Widespread issues like shortage of safe drinking water, eutrophication, acidification, fish kills, cyanotoxicity, and many others have helped societies realize the real value of water. In most of the developed countries, monitoring services have been installed and national or supra-national programmes (like the European Water Framework Directive) have been developed to help preserve the biodiversity, functions and services of aquatic environments. There is an increasing need for trained limnologists.

Nevertheless, most large universities do not have departments of limnology and organized curricula are exceptional. Despite a long history of limnological research in Hungary, the first Department of Limnology has now been established at the University of Pannonia (Veszprém, Hungary) and I have the honour and the responsibility of being its first professor and to organize both research and education. It has fortunately been quite easy to make our students in environmental science interested in studying limnology and our national and international research projects have supplied us with challenging tasks.



Prof. Padisak & some of her students

To internationalize our education programme, in partnership with the Universities of Girona (Spain; Prof. Sergi Sabater-Cortes), Potsdam (Germany; Prof. Ursula Gaedke), Uppsala (Sweden; Prof. Kurt Pettersson) and Zagreb (Croatia; Prof. Anelka Plenkovi-Moraj) we successfully applied for a TEMPUS grant with a proposal titled "QUALI – European Quality Standards in Limnology Education 2007-2009" (http://www.quali-limn.org/eschool/). Together we shall develop modules in theoretical and applied limnology in furtherance of the implementation of the EU Water Framework Directive. In addition, courses in scientific communication and teaching approaches were also included to satisfy demands for environmental education. Course materials are being developed and in February-July 2009, ten students will participate in the courses to be variously held in the partner universities. Our other international education programme, a SEE-ERA summer course on cyanotoxicity, http://www.limnologia.hu/cyanotraining/, was completed successfully in summer, 2008.

Hungary has joined Bologna process, aiming to organize a three-level (B.Sc., M.Sc., Ph.D.) higher education system and the first bulk-cohort of students started their studies according to this system in 2006. The University of Pannonia began a B.Sc. degree in environmental science that has a specialization in limnology. Students gain about one-third of their credits in specific limnology courses (at present taught in Hungarian). This year the Hungarian Accreditation Committee gave permission to start an M.Sc. curriculum in "Environmental Science – Limnology" to be taught exclusively in English and this will start in September 2009. B.Sc. graduates in natural science are accepted, and basic knowledge and, above all, interest in studying limnology are required. Students from all over the world are welcome and information will be made available at www.limnologia.hu.

Where did I study limnology? In no one particular place but in contrast my priority now is to establish an international school of limnology that trains the younger generation to understand, appreciate and love biota, diversity and functional properties of aquatic ecosystems as a way of contributing to preservation of water, the resource of the future.

Judit Padisák
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Announcement of 31st SIL Congress 15-20 August 2010 Cape Town, South Africa

The 31st Congress of SIL will be held from 15 - 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, which 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

Johan U. Grobbelaar
Chairperson of the LOC
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(Text reprinted from SIL News 52)

REPORTS FROM WORKING GROUPS

The Group for Aquatic Primary Productivity (GAP)

The Group for Aquatic Primary Productivity (GAP) arose in 1980 from discussions during the SIL Congress in Kyoto. After a long day of plenaries, Zvy Dubinsky, Max Tilzer, Mitsuro Sakamoto and Tom Berman discussed possibilities for a "different kind of meeting" and the idea of GAP took shape. The GAP format is a hands-on Workshop, focusing on topics relevant to measuring aquatic primary production, intended to attract both freshwater and marine scientists. Participants bring state-of- the- science equipment and methodology to actually run experiments that are later published in a peer-reviewed journal. Attendees are a mix of distinguished elder practitioners, younger scientists and students to enhance exchange of experience and expertise.

Country of Participants	Number
Australia	6
Austria	1
Belgium	1
Canada	1
Chile	1
Greece	1
Czech Repubic	7
Denmark	1
Germany	8
Hong Kong	1
Israel	46
Italy	1
The Netherlands	1
Portugal	4
Slovenia	2
Spain	4
UK	6
USA	3
Total	**96**
Students	**40**
Faculty	**56**

Table 1: Registrations for GAP-Eilat according to country of participants

Attendees of GAP 8 at the Inter University Institute (IUI) of Marine Sciences, Eilat, Israel.

In the 28 years since inception, there have been 8 such GAP Workshops, the most recent being held between 30 March and 8 April, 2008 at the Inter University Institute (IUI) of Marine Sciences, Eilat in Israel, and organized by Ilana Berman-Frank and Zvy Dubinsky. Ilana and Zvy were ably assisted by a local organizing committee and by Dr. Noga Stambler (BIU) who oversaw the complex mission of coordinating all the required equipment, consumables and infrastructure for the experimental work as well as making sure that all packages/boxes of equipment that were pre- mailed arrived on time and did not get stuck in Customs or Security.

GAP-Eilat had over ninety registered participants from across the globe (56 senior researchers and 40 graduate students; see Table 1). In the history of the GAP workshops, this was the largest meeting and the most diverse in the experimental environments and participants. During the first two days of the meeting, presentations were made by keynote speakers and group leaders. These lectures were open to all faculty and staff of IUI in addition to GAP members, and were attended by over 100 people. The major focus of the workshop was the experimental work done over the ensuing 6-7 days by seven working groups, spanning diverse habitats and organisms: 1) an Open-Water group; 2) phytoplankton-respiration; 3) Macroalgae; 4) Seagrasses; 5) Saltern Group - looking at the photosynthetic organisms of the nearby saltern-ponds; 6) the Coral Reef Group; 7) a group looking at growth and photosynthesis of microalgae in bioreactors. Two of the workgroups (3 & 7)

A crust from a saltern pond showing bands of different photoautotrophic groups.

were hosted by the IOLR National Center for Mariculture in Eilat. The workshop concluded with summaries and presentations by each of the groups on their preliminary results. During the workshop Prof. Zvy Dubinsky delivered a free public lecture entitled "Life and Death in the Coral Reef", which was attended by ~100 people from Eilat and the vicinity. The invited presentations and the papers resulting from the experimental work will be published by a special volume of Aquatic Microbial Ecology (AME) in 2009.

After many years of service, Tom Berman and Zvy Dubinsky stepped down from the committee at the Eilat meeting and the GAP membership owes them a great debt for their role in initiating the organization and contributing to it ever since - and even now we are sure we can count on their continued advice and participation in workshops!

A new international committee for GAP that was elected comprises: John Beardall (Australia) and Vivian Montecino (Chile) (joint chairpersons), Ilana Berman-Frank (Israel), Pat Neale (USA), Ruben Sommaruga (Austria), Katrin Teubner (Austria), Jean-Pierre Gattuso (France), Jacco Kromkamp (The Netherlands) and Félix Figueroa (Spain).

Félix Figueroa has agreed to investigate the possibilities for running the next GAP Workshop in Spain in early 2011. Ilana Berman-Frank has also agreed to keep the web site open and

GAP co-chairperson, John Beardall, pondering the complexities of photosynthesis in a bioreactor!

details of the next meeting will be posted there (http://www.gap-aquatic.org/) as soon as they become available.

Contact Person: John Beardall (john.beardall@sci.monash.edu.au) and Vivian Montecino (vivianmontecino@uchile.cl), Joint Chairpersons, GAP International Organising Committee.

Report on the Working Group on Macrophytes (2006-2008)

The SIL Working Group on Macrophytes met during the 29th SIL Congress at Lahti (Finland) in 2004. One of main aims of this meeting was to build a network of scientists working on the macrophytes. Considering that many of the working-group members work in isolation, we thought it essential to get special sessions devoted to macrophytes at the SIL congresses.

A website with a forum has been built (Dr Kris Szozskiewicz: kszoszk@au.poznan.pl; http://www.au.poznan.pl/keios/forum (9th September 2008). We have now 47 registered users and they have posted a total of 127 articles and 115 topics. The website was used by 8716 visitors.

The WG met from 11 to 14 January, 2006, in Brussels (Belgium) at the "International Symposium on Aquatic Vascular Plants: 25 Years after, ISAVP" . At this symposium many SIL WG members participated. We were invited to organise a scientific session at the 30th Congress of the SIL at Montreal from 12 to 18 August, 2007. A successful scientific session "Ecology of Benthic Vegetation" organized at Montreal was chaired by Jacques Haury, Antonella Cattanea, Patricia Chambers and Chantal Vis. The session comprised 20 oral presentations and 4 poster presentations related to ecology of aquatic macrophytes and benthic algae. The lectures were very well attended with more than hundred participants. The discussions were very lively and concerned the current popular issues. Twenty two scientists participated in a meeting organized by Seppo Hellsten and Jacques Haury to strengthen our network. We decided to organise small workshops and to develop comparative approaches on topics such as 1) River Monitoring and Indices; 2) Reference Communities; and 3) Adaptation of Northern Methods to Mediterranean Areas. We also intend to organise specialized sessions within larger meetings.

Prof. Jacques Haury (Chairperson of the SIL WG Aquatic Macrophytes) ; and Dr Seppo Hellsten (Secretary, and Symposium Organiser)

Contact Person: Prof. Dr Jacques Haury – Jacques.Haury@agrocampus-ouest.fr

1st Symposium of Winter Limnology

(http://www.jyu.fi/bio/hyb/winter/)

The 1st International Winter Limnology Symposium was held from 24 to 28 May, 2008, in Finland at the Kilpisjärvi Biological Station situated on the bank of Lake Kilpisjärvi, with the mountain landscape as the backdrop. The Symposium was hosted jointly by the Universities of Helsinki, Joensuu and Jyväskylä and it was supported by the Academy of Finland. Altogether 50 participants from fourteen countries attended the symposium so that the capacity of the venue was stretched to its extreme. Due to many theoretical and practical reasons winter limnology has received relatively little attention. Often winter has been considered as a quantitatively unimportant season and its harsh conditions probably have not been conducive to research . On the other hand, the rapidly increased interest in climate warming and its consequences are now strongly increasing research activity in cold marine and inland water environments. This development is manifested in the organization of the International Polar Year (http://www.ipy.org/), which is a large two- year scientific program focused on the Arctic and the Antarctic, started in March 2007. The aim of the Winter Limnology Symposium was to stimulate research ideas and increase contacts between different disciplines. I believe that this goal was successfully achieved.

There were four plenary lectures given by Prof. Per-Arne Amundsen (fish), Dr. Paul Blanchfield (fish), Prof. Martin Dokulil (phytoplankton) and Dr. Arkady Terzhevik (physics). There were 24 oral presentations and 18 posters. During the symposium an enthusiastic atmosphere developed with lots of discussions, which stimulated thinking over a wide perspective, including regional and global ones, promoting future collaboration. The initiative to start a series of Winter Limnology Symposia was greeted and unanimously approved. The interest of several participants to arrange the next Symposium is a convincing signal of the value of this kind of communication. The next Symposium will be held in Germany in 2010 (see an Announcement elsewhere in this SILnews).

Climate warming related aspects also aroused wide interest among local and regional press

and radio. Among the public there appears to be a wide and genuine interest, if not a worry, about the ongoing environmental changes.

The Symposium programme also included an excursion to a local mountain environment. Moreover, in the closing banquet native Sami singers introduced the participants to *joiks*, the singing style of aboriginal people.

The staff responsible for providing technical facilities for the Symposium had put their heart into the effort to make the meeting a success, and deserves our sincerest thanks. Finally, I believe the symposium was a great success and hope that more such meetings will follow.

Kalevi Salonen
University of Jyväskylä
Finland

(Proceedings of the 1st symposium of Winter Limnology will be published in *Aquatic Ecology* in summer 2009. Editor SILnews)

Expect "Ecological Surprises" Is The Key Message From The First International Summit In Aquatic Biology

Sixty-six of the most eminent freshwater biologists in the world gathered at a week long summit hosted by the Freshwater Biological Association at its headquarters in the English Lake District (1 - 4 September 2008).

Opening the summit, Professor John Beddington, the Chief Scientific Advisor to the UK Government, stressed the importance of water, its conservation and biodiversity, for food production, and to the emerging conflicts between urban and agricultural users in the face of rapid human population growth.

Water resources are subject to many different stressors, including nutrient enrichment from pollution, invasion by alien species, over-abstraction and the changing global climate.

The meeting found that each of these has an individual effect, but most water bodies are being simultaneously impacted by several major stressors, and understanding their combined impacts is crucial if we are to maintain freshwater ecosystems in a sustainable state.

"The complex nature of multiple interacting processes means that 'ecological surprises' are to be expected", said Mike Dobson, FBA Director. "Take, for example, Lake Victoria (Africa), where something went very wrong with the ecological balance. Having been present for about 20 years without any problem, the population of the introduced Nile perch suddenly exploded. Apparently, nutrient enrichment and increased temperature brought about an algal bloom and reduced clarity of the water. These conditions tipped the balance in favor of the voracious Nile perch and against the many smaller native fish species that were previously able to eat its eggs and fry, causing perhaps the greatest extinction event of modern times. This example emphasizes that ecological thinking is needed in order to explain such events and to give us the ability to predict potential new impacts and avoid further surprises".

The summit demonstrated the unique strengths of ecological science as a tool in the management of our precious water resources – including lakes, rivers ponds, pools and wetlands - and their wildlife, all of which are a major part of worldwide biodiversity. The increasing threat to fresh waters, however, comes at a time when the research capacity of the UK in this field is declining.

A position statement on the value of ecology in delivering effective water management tools will be delivered to key decision makers in the UK.

For further information on the FBA or any aspect of this press release contact: Christian Ripley, Marketing and Communications, The Freshwater Biological Association, The Ferry Landing, Far Sawrey, Ambleside, Cumbria, LA22 0LP, UK, Email: cripley@fba.org.uk, Phone: +44 (0) 1539 442468

Regional Limnology

Haors: The Freshwater Seas of Bangladesh

What is an haor?

Bangladesh is a land of wetlands. About 26% of the country is made up of different types of wetlands of which over three-fourth are seasonal floodplains. The country being in the estuary of Ganges-Brahmaputra-Meghna river system, the dynamics of her water bodies is mainly governed by the water flow from the upper riparian catchment and rainfall.

A view of Tanguar Haor, Sunamganj, October 2007. Photo: Haseeb Md. Irfanullah

Haor is a special type of freshwater ecosystem located in northeastern Bangladesh (Kishorganj, Habiganj, Moulvi Bazar, Netrokona, Sunamganj and Sylhet districts). The *haors* are formed in tectonic depressions between natural levees of rivers with some saucer-shaped deeper parts, locally called beels. The beels are perennial water bodies, while surrounding shallower parts only carry water in the rainy season when the whole basin becomes flooded. Often several *haors* merge and the whole area look like a very big lake and in some cases 'sea' without boundaries.

There are about 50 big *haors* of varying sizes, from several hundred to thousands of hectares, and around 6,300 beels. The number of beels per *haor* varies, for example, Hakaluki *Haor* (18,115 ha) has more than 80 beels, Tanguar *Haor* (9,727 ha) has 46 beels and Hail *Haor* (9,400 ha) is apparently a single water body (FAP 6, 1995; NCSIP-1, 2001a). Some *haors* are of global and national significance. For instance, Tanguar *Haor* was declared as the second Ramsar Site of Bangladesh in 2000, while this *haor* and Hakaluki *Haor* were notified as Ecologically Critical Areas by the Government of Bangladesh in 1999.

Inundation or flooding in monsoon is an obvious phenomenon for *haor* basin and governs its social, economic and ecological activities. Detailed information on hydrology and meteorology is available for a few important *haors* (Nishat et al., 1993; FAP-6, 1995; Choudhury and Nishat, 2005). *Haor* areas remain under water every year for 7-8 months. The maximum depth of most of the *haors* ranges from 2 to 10 m in normal years. Unusually high water level, and frequent and intense floods are the devastating ones, as was witnessed in 2007. Given the exposed vastness of *haors*, turbulence in the hoars can be extremely destructive as it can sweep isolated villages in one night.

What goods and services do the haors provide?

The importance of *haors* is immense – both economically and ecologically. In an economic evaluation study (IUCN Bangladesh, 2006, unpublished), the total value of annual productivity of Hakaluki *Haor* (both goods and services) was estimated about US$ 8.4 million. With fish harvest contributing 32% followed by rice production (20%) and fish trading (12%). Wetland services, on the other hand, comprised 16% of the total value, of which biodiversity (8%) and flood control (5%) were the main sources of benefits.

In terms of biodiversity, most *haors* are very rich. For example, Tanguar *Haor*, considered as the 'mother fishery' of Bangladesh, comprises 119 fish species, while the total for all the inland species of Bangladesh is 266. This internationally important *haor* also harbours 10 amphibian species, 35 reptiles species, 233 bird species (including 55 migratory and 44 waterfowl species) and 25 mammals species; there are 78 species of higher plants (NC-SIP-1, 2001a, b). Several bird species found in Tanguar *Haor* are listed as globally endangered. *Haors* act as resting grounds for migratory water birds in early and late winter months. Regular bird counts by different academic and amateur agencies estimate several hundred thousands of migratory water birds visiting these *haors* every year.

Freshwater swamp forests – areas for fish spawning – used to be abundant in the recent past making up the *haor* landscape: they protected the villages from severe wave actions and erosion of land. But now they have almost disappeared due to unsustainable harvesting making waves more devastating in the monsoon. Not only the forests, the biodiversity of *haor* as a whole is diminishing in the recent decades due to over-exploitation, siltation, pollution and unplanned developmental works.

How important is human dimension in the *haors*?

Social aspects have always been a big issue in the *haor* basins. Although Bangladesh is the most densely populated country in the world, the population density is relatively lower in *haor* basins. Due to high wave action, erosion of village mounds results in extremely congested housing on the mounds surviving in the middle of the *haors*. These villages look like islands in full monsoon. Because of inundation in most of the area, there is only one annual crop, mainly rice, in the dry season. People are therefore almost job-less in monsoon when migration to other parts of the country is common in many *haor* areas. Despite fisheries being the biggest source of living, the access to fish is mostly limited to lease-holders in the peak season.

The vulnerability of the *haor* dwellers is therefore severe as identified by many socio-developmental initiatives and research. This has led to many projects and studies to address socio-economic development and community-based resource management in the *haors* by different government, non-government and research organizations (e.g. IUCN Bangladesh, 2005; Kabir and Amin, 2007). Community Based *Haor* Resource Management Project (1999-2005), Community Based Fisheries Management -2 (CBFM-2, 2001-2006), Management of Aquatic Ecosystem through Community Husbandry (MACH, 19982007) and Coastal and Wetland Biodiversity Management Project (CWBMP, 20032009) are a few important examples in this connection. In Tanguar *Haor*, where traditional leasing was stopped in 2000, a participatory wetland management system is being tested (2006–2008) by the Government of Bangladesh (www.iucnbd.org/tangua/). Ecological research per se is, however, missing in almost all of these projects.

Ecological studies conducted on *haors*?

In the first comprehensive account on wetlands of Bangladesh (Nishat et al., 1993), issues concerning *haor* basins were addressed along with other types of wetlands. Topics included hydrology, ecology, biodiversity, fisheries, agriculture, socio-economics and, of course, management of wetlands.

Islam and Paul (1978) were probably the first to study the hydrobiology of a *haor*, Hakaluki *Haor*. They reported species of phytoplankton and macrophytes as well as described some important ecological aspects of the *hoar*. Later, Islam and Haroon (1980) reported a large number of desmid taxa (*Chlorophyceae, Desmidaceae*) based on a study of only four samples from this *haor*. They found four taxa, namely

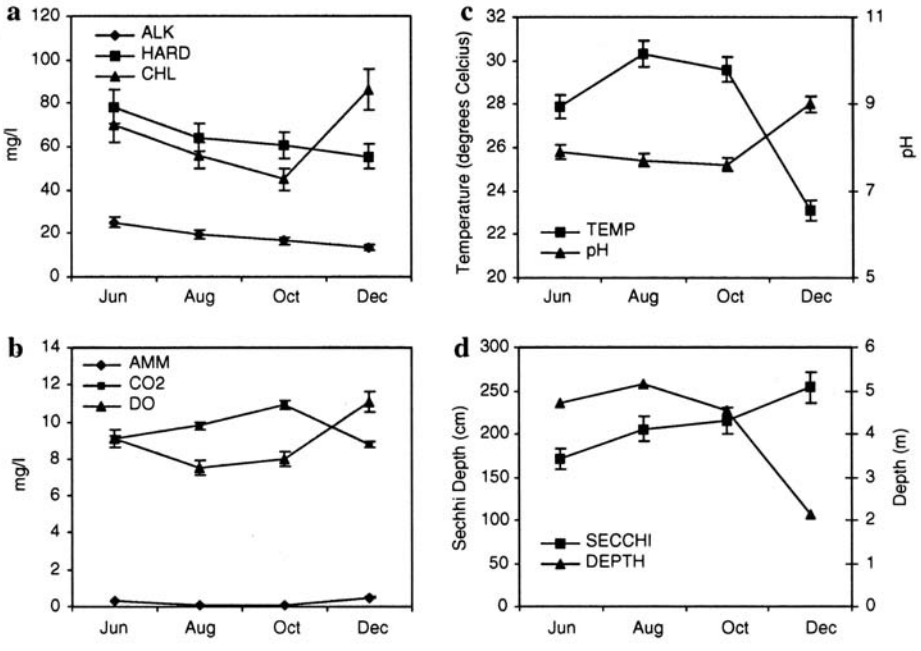

Fig. 2: Comparison of some physicochemical variables of water in Tanguar Haor, June-December 2002; a) ALK alkalinity, HARD hardness, CHL Chloride; b) AMM ammonium nitrogen, CO2 carbon dioxide, DO dissolved oxygen; c) TEMP temperature and pH; and d) Sechhi depth and approximate water depth in one site. Error bars represent standard errors of the mean. Reproduced from Muzaffar and Ahmed (2007), © Springer.

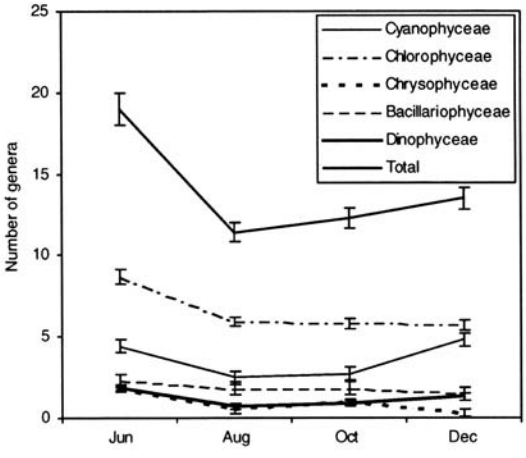

Fig. 3: Variation in the richness of genera of major phytoplankton classes in Tanguar Haor, June-December 2002. Error bars represent standard errors of the mean. Reproduced from Muzaffar and Ahmed (2007), © Springer.

Cosmarium paulii, *C. stigmosum* (Nordst.) Turner var. hakalukiense, *Euastrum sinuosum* Lenorm. var. hakalukiense, and *Staurastrum pinnatum* Turner var. hakalukiens new to science. Thus, the amount of genetic diversity waiting to be explored in this part of the world may be quite high. Recently, a six-month study (June-December) was conducted on the water quality and phytoplankton of Tanguar *Haor* to understand the effects of floods on *haors* (Muzaffar and Ahmed, 2007). This study highlights the fact that this *haor* is still an undisturbed ecosystem given the extent of degradation in many major water bodies of Bangladesh.

In the 1990's, biodiversity was monitored in detail in several *haors* on a few occasions (FAP 6, 1995; NCSIP-1, 2001a, b). Scientific research carried out by different research organizations focussed mainly on fisheries resources. Fisheries data are also collected occasionally from different *haors* in different socio-development projects. Most of these data are, however, not available due a lack of appropriate database management.

What are the scopes of studying *haors*?

The limnological studies in Bangladesh are mostly done by the university departments of botany, zoology, fisheries and environmental sciences. Because of their limited resources and experts, most of such departments work in a restricted number of geographical areas and ecosystems. Therefore, there are limited number of studies in *haors* on fisheries and general limnology. Nonetheless, with superb dynamism, rich biodiversity and importance to national economy, these water bodies are, indeed, suitable sites for undertaking limnological and fisheries research.

Since Bangladesh is a low-lying country, effects of climate change and climate variability have so far been emphasized largely on coastal areas (salinity, water-logging, natural calamities) and northern areas (droughts). But given the impacts of climate variability on waters, *haor* basin could be a very suitable object for research studies, with especial emphasis on aquatic protein yield, since in Bangladesh 80% of animal proteins comes from fish.

References

Choudhury, G.A. and Nishat, A. 2005. Hydro-meteorological Characteristics of Hakaluki *Haor*. IUCN Bangladesh Country Office, Dhaka, 91 p.

FAP 6 1995. Specialist study: wetland resources (Annexes). Flood Action Plan 6, Northeast Regional Water Management Project. Canadian International Development Agency, Dhaka.

Islam, A.K.M. Nurul and Paul, N. 1978. Hydrobiological study of the *haor* Hakaluki in Sylhet. J. Asiatic Soc. Bangladesh (Sc.) 4: 89-91.

Islam, A.K.M. and Haroon, A.K.Y. 1980. Desmids of Bangladesh. Int. Revue. ges. Hydrobiol. 65: 551-604.

IUCN Bangladesh 2005. Major Interventions for Sustainable Wetland Resource Management. IUCN Bangladesh Country Office, Dhaka, 134 p.

Kabir, M.H. and Amin, S.M.N. 2007. Tanguar *Haor*: A Diversified Freshwater Wetland. Academic Press and Publishers Library, Dhaka, 137 pp.

Muzaffar, S.B. and Ahmed, F.A. 2007. The effects of the flood cycle on the diversity and composition of the phytoplankton community of a seasonally flooded Ramsar wetland in Bangladesh. Wetlands Ecol. Manage. 15: 81-93.

NCSIP-1 2001a. Survey of flora. National Conservation Strategy Implementation Project-1 (NCSIP-1). Ministry of Environment and Forest, Government of the People's Republic of Bangladesh, Dhaka, 384 p.

NCSIP-1 2001b. Survey of fauna. National Conservation Strategy Implementation Project-1 (NCSIP-1). Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, Dhaka, 324 p.

Nishat, A., Hussain, Z., Roy, M.K. and Karim, A. (Eds) 1993. Freshwater Wetlands in Bangladesh: issues and Approaches for Management. IUCN, Gland, Switzerland, 283 p.

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No Need to Reduce Nitrogen for Eutrophication Mitigation: Findings of a Long-Term Limnological Study in China

During a long-term study on 45 shallow lakes in Yangtze area (China), the research group headed by Prof. Hong-Zhu Wang tested whether N can be the long-term limiting nutrient in the field. The results (Wang et al., 2008) indicated that it is P (Phosphorus) and not N that determines the amount of total phytoplankton in the lakes on a long-term scale.

For a given amount of total phosphorus (TP), phytoplankton chlorophyll a (Chl *a*) varies regardless of the changes of total nitrogen (TN; Figure 1).

However, for a given amount of TN, Chl *a* increases rapidly with the increase of TP (Figure 2).

These findings at odds with the prevailing idea to use the ratio of N to P as an index to discriminate if lakes are N- or P-limited. Importantly, the findings of this study reveal that N reduction may fail to decrease phytoplankton in the lakes.

The findings over several lakes (Wang et al. 2008) are supported by the ongoing experiment for >35 years in Lake 227, a small lake in the Experimental Lakes Area (ELA: Winnipeg, Manitoba, Canada). In these lakes, Schindler and his associates have clearly demonstrated that P inputs alone control algae blooms (Schindler et al. 2008). In the present study we show that if N inputs are decreased without decreasing P inputs, blooms of N-fixing algae increase even more. Given enough P and time, N fixation was sufficient to allow biomass to continue to be produced in proportion to P, and the lakes remained highly eutrophic.

From regional comparisons and long-term monitoring data we can generalize that reduction of N loading alone cannot decrease the amount of total phytoplankton, and only phosphorus control can effectively mitigate the problems of eutrophication and recurrence of cyanobacteria blooms. The N_2 gas can be fixed through natural process (including lightning and biological N-fixation) to offset any N deficiency in aquatic systems. Roughly half of the global input of newly- fixed nitrogen

Fig. 1: A view of Lake Qiaodunhu that is located south of the middle Yangtze River and 27km northwest of Daye City, Hubei Province, P.R. China (114°39'-49'E, 30°12'-18'N; area, 8.0 km²; Z_{Max}, 3.3m; Z_{Mean}, 2.1m). The Photo was taken soon after the lake had experienced a shift from a macrophyte-dominated state to a phytoplankton-dominated state in the autumn of 2006. The shift was triggered mainly by high stocking rate of Chinese mitten crab and high input of fertilizer.

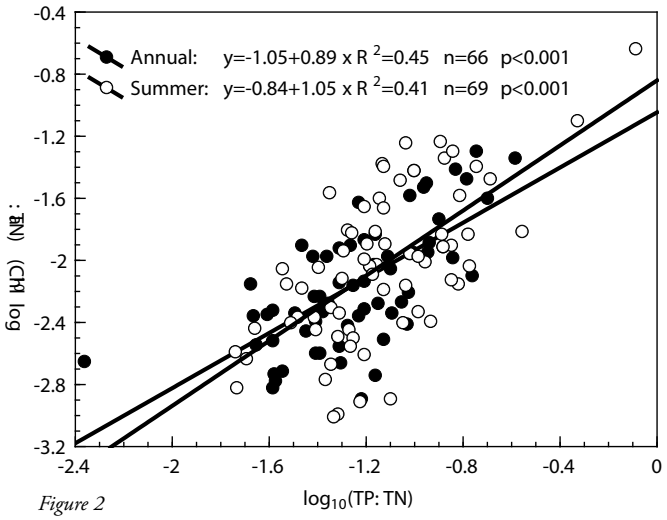

Figure 2

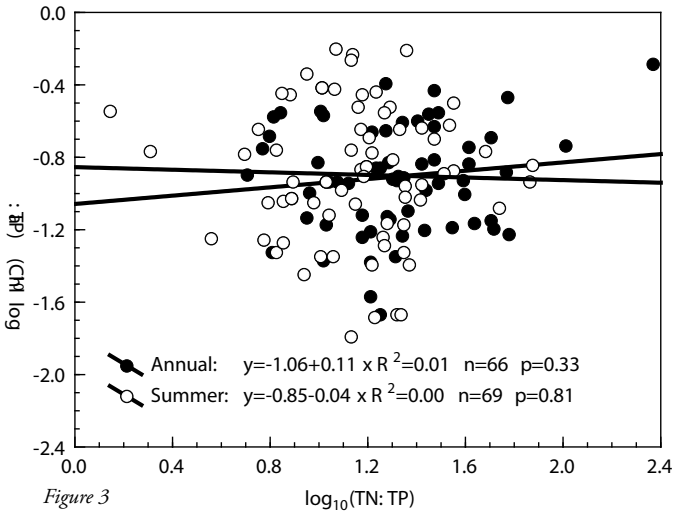

Figure 3

Figures 2 and 3: Relationships between ratio of chlorophyll a to total phosphorus (Chl a/TP) and ratio of total nitrogen to total phosphorus (TN/TP) (1) and between Chl a/TN – TP/TN (2).

(including industrial production of N fertilizer) can be attributed to natural processes. However, there is no such natural mechanism for P to compensate for P deficiency. Moreover, solubility in water of P compounds present in lakes is usually low.

In short, in lake management studies aimed at reducing eutrophication, the focus must be on decreasing inputs of P. Whereas to promote growth of phytoplankton, both N and P are essential, to limit phytoplankton growth, only P control is sufficient. Thus, there is no need to reduce N for eutrophication mitigation, except when N concentration is too high to induce direct toxic impacts on human or other organisms. Lastly, by focusing on P control, the cost to mitigate eutrophication can be greatly reduced.

References

Wang, H. J., X. M. Liang, P. H. Jiang, J. Wang, S. K. Wu and H. Z. Wang, 2008. TN: TP ratio and planktivorous fish do not affect nutrient-chlorophyll relationships in shallow lakes. Freshwater Biol, 53: 935-944.

Schindler, D. W., R. E. Hecky, D. L. Findlay, M. P. Stainton, B. R. Parker, M. J. Paterson, K. G. Beaty, M. Lyng and S. E. M. Kasian, 2008. Eutrophication of lakes cannot be controlled by reducing nitrogen input: Results of a 37-year whole-ecosystem experiment. Proc Natl Acad Sci USA, 105: 11254-11258.

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The Coastal Lakes of South Africa

South Africa has no lakes of tectonic origin of the scale of the Great Rift Valley Lakes. Only L. Fundudzi in the Limpopo Province may just qualify as it was formed by a natural rock fall that blocked the flow of a river. The extensive and dramatic inland delta, the Okavango Swamps, owes its origin to tectonic activity extending from the Great Rift Valley.

The remaining natural lakes are largely shallow depressions or *pans* on the elevated post-Gondwana landscape called the Highveld, and a necklace of coastal lakes and barrier lagoons set within the verdant luxury of an extensive dune cordon that stretches in an interrupted manner along the coastline of KwaZulu-Natal, the Eastern Province and the Cape south coast. These varied limnological sites are shown in Figure 1.

Each lake system owes it origin to falling sea level during the Flandrian glacial period when the continental shelf of South Africa became increasingly exposed and allowed the coastal rivers to extend their reaches across its sandy floor. With the end of the Flandrian period, melting ice caused the sea to once again transgress across the shelf and because of the marked temperature difference between the land and the cold seas, strong winds were set that built the dune cordons behind which barrier lagoons formed and through which rivers formed estuaries.

By the Holocene the coastal lakes were formed, although much more ex*pans*ive than at present. Gradually their volumes and surface areas were reduced by segmentation. Linked to this process was a gradual sealing of the river channels from their estuaries and with the increase in the proportion of freshwater the lakes passed from salty to brackish and in the case of L. Sibaya on the peneplain of KwaZulu-Natal fresh, with the merest hint of its former salinity through an elevated chloride signature, to freshwater.

The physical and chemical limnology of the lakes varies considerably. Some are shallow systems while others are deep as Lake Sibaya and L. Nhlange with basins below and the surface of the lake well above sea level that show weak stratification in summer. A detailed analysis of the bathymetry and other geological features of L. Sibaya are given by Miller (2001). Yet others are meromictic with deep saline monimolimnia sustained by the occasional ingress of seawater as found in Swartvlei on the Cape South coast and L. Mpungwini, one of a chain of lakes making up the Kosi system of northern KwaZulu-Natal. The meromixis in L. Mpungwini is permanent, only disturbed by infrequent storms; that of Swartvlei is easily eroded by seasonal winds and reset by tidal flows when the estuary mouth is open.

All are invariably oligotrophic, frequently in association with peat stained surface inflows as in the case of Swartvlei, or because of their dependence upon aquifer discharge (Colvin et al. 2007) and rain to maintain water levels, they are clear water systems, with an elevated sodium level, above that introduced by cyclic salt.

The best known lake phytoplankton array is that of L. Sibaya that was described by Hart and Hart (1977) in which they point to the importance of nanoplankters in the operation of the community: a feature that has been confirmed in later studies of estuarine - lake systems. And of particular interest and significance are R.C.Hart's intensive studies of the

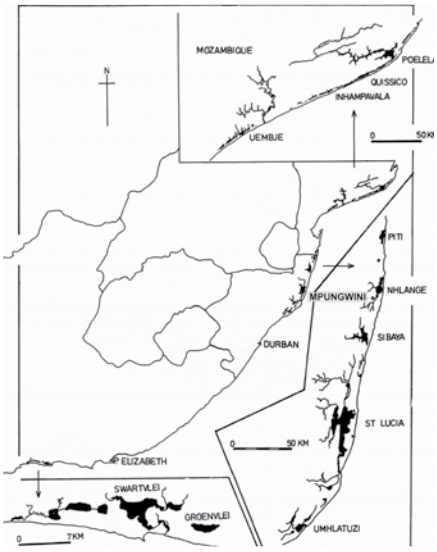

Figure 1. The distribution of a number of costal lakes in South Africa and southern Mozambique. From Hill (1975)

calanoid copepod, *Pseudodiaptomus hessei* (Hart 1977) in which it has been possible to examine feeding rhythmicity and diel vertical distribution.

Early studies on L. Sibaya revealed a relict estuarine fauna (Allanson et al. 1966) including exciting finds of the crab *Hymenosoma orbiculare*, previously only known from estuaries, and here it was in a freshwater lake with a chlorinity of 135 mg/l. Later studies in our laboratories showed that this crab along with an array of Amphipoda and Tanaidacea are efficient osmoregulators. Later surveys of coastal lakes on the KwaZulu-Natal peneplain confirmed the wide distribution of these faunal elements in other land-locked systems.

The fish fauna of the lakes is equally interesting. Bruton (1979) has shown the co-existence of a Limpopo freshwater fauna with that of estuarine taxa, for example the estuarine round-herring *Gilchristella aestuarius* and three gobies of which *Silhouettea sibayi* Farquharson 1970 has L. Sibaya as its type locality.

Of equal importance is the richness of the littoral of the lakes. Swartvlei has the highest macrophyte biomass of the array. The mean annual dry mass of production of *Potamogeton pectinatus* recorded by Howard-Williams (1979) was 2088 g $m^{-2}y^{-1}$. This contrasts with L. Sibaya where the littoral production is a mere 220 g m^{-2} y^{-1} offset by a phytoplankton production of 300 g.$m^{-2}y^{-1}$: an order of magnitude higher that in Swartvlei, (Allanson 2004).

The rapid cycling of phosphorus in the littoral of Swartvlei was hypothesized as the reason for the high production in an otherwise oligotrophic, dystrophic lake, and experimental studies using ^{32}P confirmed the validity of this hypothesis (Howard-Williams and Allanson 1981).

Each of the lake ecosystems is increasingly threatened by the demands of human activities either associated with the littoral or as a source of freshwater. These insistent demands are creating impacts far removed from the environmental history of the lakes, and underline the passage from the Holocene to the more demanding Anthropocene Era, (Crossland et al. 2005). Fortunately, our understanding of these sensitive systems is such that it is possible to provide wise advice to the decision makers on how the lakes are to be used and maintained – but success depends upon the political will of the decision makers.

References

Allanson B. R., Hill, B. J., Bolt R. E., and Schultz, V. (1966) An estuarine fauna in a freshwater lake in South Africa. Nature. Lond. 209:532 – 533.

Allanson, B.R. (2004). Limnology of South Africa: Past and present Status and Future Needs. In (Eds) Gopal, B. and Wetzel, R.G.: Limnology in Developing Countries. International Association of Limnology (SIL) pp 1 – 116. International Scientific Publications, New Delhi, India.

Colvin, C. Le Maitre, D. Saayman,I. and Hughes, S. (2007). An Introduction to Aquifer Dependent Ecosystems in South Africa. pp 1 - 74 Water Research Commission Report No TT 301/07, Pretoria.

Crossland J. C., Baird D., Ducrotoy, J-P. and Lindeboom, H. (2005). The Coastal Zone – A Domain of Global Interactions. In Crossland, C. J., Kremer, Lindeboom,H.H., Marshall Crossland, H. I. M. and Le Tisser, M. D. A. (Eds) Coastal Fluxes in the Anthropocene: pp 1 – 37. Springer-Verlag, Berlin.

Bruton, M. N. (1979) The fishes of Lake Sibaya. In Lake Sibaya (Ed) B R Allanson Dr W Junk The Hague pp162 – 245.

Hart R.C. (1977) Feeding rhythmicity in a migratory copepod (Pseudodiaptomus hessei Mrázek). *Freshwater Biology* 7: 1 – 9.

Hart, R.C., and Hart, R. (1977) The seasonal cycles of phytoplankton in subtropical Lake Sibaya: A preliminary Investigation. Archiv fur Hydrobiologie. 80: 85 – 107.

Hill, B.J. (1975) The origin of Southern African coastal lakes. Transactions of the Royal Society of South Africa. 41:225 – 240.

Howard-Williams C. (1981). Growth and production of aquatic macrophytes in a south temperate saline lake. Verhandlungen Vereingung fur theoretische und angewandte Limnologie 20: 1153 – 1158.

Howard-Williams C. and Allanson, B.R. \ (1981). Phosphorus cycling in a dense Potamogeton pectinatus L. bed. Oecologia (Berlin) 49: 56 – 66.

Millar, W.R. (2001). The Bathymetry, Sedimentology and Seismic Stratiography of Lake Sibaya – Northern KwaZulu-Natal. Council for Geoscience, Bulletin 131, i – vii pp 1 – 94. Pretoria South Africa.

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Ecological Informatics Modeling In Selected Hypertrophic South African Reservoirs

The occurrence and extent of cyanobacteria and dinoflagellates seem to be increasing in South Africa, raising a major management concern. Development of predictive capability to allow water resource managers to forewarn potable water suppliers and recreational users of these incidents becomes an essential part of management interventions.

An holistic approach was required in the present study to accommodate different levels of external (climate) and internal (trophic linkages and benthic-pelagic coupling) variability and their interactions. The integration of biological and meteorological information was done to investigate and develop prediction capability that will consider climatic variations on the development of toxic cyanobacterial blooms.

Five warm, monomictic hypertrophic reservoirs, Bon Accord, Hartbeespoort, Klipvoor, Rietvlei and Roodeplaat, situated downstream of the most populated areas were used as test cases. These reservoirs all experience similar climatic conditions of warm wet summers and dry, fairly cold winters, and are known to experience annual cyanobacterial blooms, especially of the toxin producing *Microcystis aeruginosa*. During a five year study, Hartbeespoort and Roodeplaat were dominated primarily by *M. aeruginosa*, while Bon Accord, Klipvoor and Rietvlei reservoirs experienced both *M. aeruginosa* and *Ceratium hirundinella* blooms.

Maximum total microcystin (TM) concentrations were 2-3 orders of magnitude higher in these South Africa reservoirs (>10,000µg/L) than in other countries (between 10µg/L and 100µg/L). The presence of TM's in the

reservoirs was primarily associated with the dominance of and blooms of *Microcystis*. The depth distribution of the toxins measured in the Hartbeespoort and Roodeplaat Reservoirs indicated that during the periods of excessive *Microcystis* biovolume, toxins are found throughout the water column.

Multivariate analyses of the data indicated that the five reservoirs are similar in both algal community and physico-chemical variables. These analyses also showed that of the environmental factors, temperature is the most important climatic factor in the development of cyanobacteria biovolume in these systems. Other environmental variables important to the development of algal blooms are dissolved inorganic phosphorus (DIP), dissolved inorganic nitrogen (DIN), the DIN:DIP ratio; total phosphorus (TP), total nitrogen (TN) and Chl a concentration.

A number of generic and deterministic ecological models were tested on the data to determine their applicability for predicting harmful algal blooms in hypertrophic reservoirs in the central, northern parts of South African:

- The relatively simple Vollenweider model is easy to apply and provides a manager with a quick answer. Relatively little information is needed to apply the model. It also provides the manager with the possibility of testing different management scenarios.
- The simulation library SALMO-OO allows forecasting abundances of cyanobacteria, green algae and diatoms in response to eutrophication control scenarios. It takes the complex limnological characteristics of reservoirs into consideration and it supplies the manager with a tool to test different management scenarios to assist in decision-making. The results were, however, only partly successful, with both large over- and under- predictions of nutrients and algal groups, even after the growth equations were adapted.
- Artificial neural network modelling techniques, both the supervised multilayered feed forward neural network and the non-supervised self-organising mapping method were tested for their applicability to predict algal blooms in these hypertrophic South African reservoirs.

The multi-layered feed-forward, neural network model tested, provides visual predicted successes, but the strict tolerances set by the model to determine acceptable prediction, as part of its outcome, may be a problem to validate the results and ensure that an acceptable number of good predictions is obtained.

The Self Organising Mapping (SOM) technique is applicable to investigate before and after impact scenarios. This is more of a knowledge development tool than a predictive tool.

- The Hybrid Evolutionary Algorithm (HEA) method was used to develop algorithms for algal bloom prediction. Within this method, a rule set is discovered by the model to enable real-time and short-term predictions of both *Microcystis* and *Ceratium*. The developed rule sets proved to be highly successful within the hypertrophic reservoirs examined (see Figure 1). However, these methods need to be tested in other South African reservoirs to determine their applicability under different trophic status and different climatic conditions.

From these methods, the hybrid evolutionary algorithm technique seems to be quite applicable in the development of predictive capability for cyanobacteria and dinoflagellate species in the short-term.

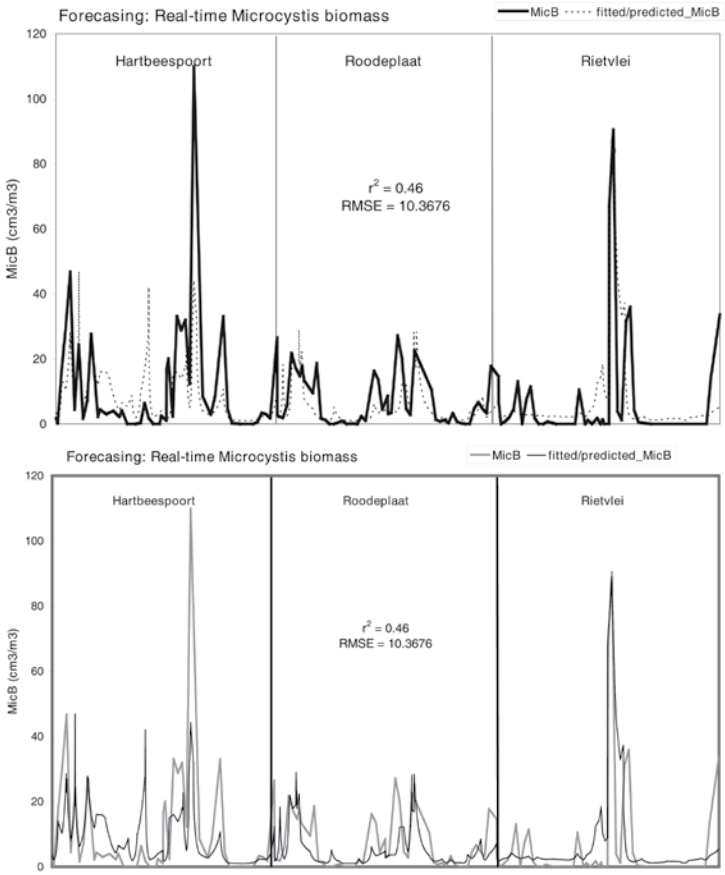

Figure 1/2 Testing results for the developed Rule Set, developed for real-time prediction of Microcystis biomass, in three reservoirs.

Bibliography

Cao H, Recknagel F, Welk A, Kim B and N Takamura, 2006. Hybrid Evolutionary Algorithm for Rule Set Discovery in Time-Series Data to Forecast and Explain Algal Population Dynamics in Two Lakes Different in Morphometry and Eutrophication. In: Recknagel, F. (ed.), 2006. *Ecological Informatics. 2nd Edition*. Springer-Verlag Berlin, Heidelberg, New York, 347-367.

Recknagel F (1997) ANNA – Artificial neural network model for predicting species abundance and succession of blue-green algae. *Hydrobiologia*, 349, 47-57.

Van Ginkel, C.E. (2004). *A National Survey of the incidence of cyanobacterial blooms and toxin production in major impoundments*. Internal Report No. N/0000/00/

Photo 1: Two manifestations of eutrophication in Roodeplant Dam: cyanobacterial scum caught in water hyacinth.

DEQ/0503. Resource Quality Services, Department of Water Affairs and Forestry. Pretoria.
Van Ginkel C, Cao H, Recknagel F & Du Plessis S (2007) Forecasting of dino-flagellate blooms in warm-monomictic hypertrophic reservoirs in South Africa by means of rule-based agents. *WaterSA*, 33 (4), 1-8.
Van Ginkel CE, Hohls BC and Vermaak E (2001) A *Ceratium hirundinella* (O.F. Müller) bloom in Hartbeespoort Dam, South Africa. Water SA, 27 (2), 269-276.
Van Ginkel CE, Silberbauer MJ, Du Plessis S, Carelsen CIC (2006) Monitoring microcystin toxin and chlorophyll in five South African impoundments. *Verh. Internat. Verein. Limnol.*, 29, 1611 – 1616.
Van Ginkel CE (2008) Investigating the applicability of ecological informatics modelling techniques for predicting harmful algal blooms in hypertrophic reservoirs of South Africa. Doctor of Philosophy Dissertation, North-West University, Potchefstroom, South Africa.

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Eutrophication Challenges in South Africa

South Africa, with a land area of 1.2 million km^2 and a population of 45 million, is the most water stressed country in SADC, facing an absolute scarcity by 2025, at which time its per capita water availability will be 1/8th that of our desert neighbour, Namibia! It lacks natural inland lakes and is entirely dependent on reservoir lakes and run-of-river abstractions for water supply. Only one major river is not yet impounded. Increasing water quality problems, posed by eutrophication and/or industrial or mining effluents, threaten both lentic and lotic environments. Thirty-five percent of the total storage is eutrophic to hypertrophic – including grossly-enriched reservoirs that far exceed the globally-accepted definition of hypertophy. Failing infrastructure and polluted urban runoff comprising a significant fraction of flows to inland reservoirs, particularly in the economic heartland, exacerbate the situation. The marketability of agricultural produce is threatened by the quality of irrigation water abstracted from rivers. Environmental flow analyses have failed to integrate the role played by dams in an arid environment. With 66% of the country lying within international river basins, our demand for quantity, and inability to manage quality, have significant knock-on effects for other, poorer countries.

Despite the arid South African climate, long-recognized threats posed by eutrophication were ignored during the latter 20th century – based on the economic costs of nutrient removal outweighing the returns! The fallacy of this short-sighted approach is now glaringly evident as water quality declines, treatment costs climb and recreational-use becomes increasingly constrained. Eutrophication guidelines remain based on nutrient concentrations, rather than adopting the long-recommended load-based approach. Treatment of wastewater effluents in South Africa does not target phosphorus removal. While reductions in effluent-borne nutrients have been achieved in a few instances, increasing volumes have rapidly negated the benefits. While much attention has been paid to the protection of rivers and streams, equivalent attention has not been paid to reservoirs.

Fundamental to South Africa's lack of proactive and meaningful attention to eutrophication, has been an almost total loss of relevant skills and experience, this coupled to a lack of skills training and capacity development. Officials lack the necessary limnological understanding to be able to make appropriate decisions or recommend interventions. Proposals to provide a transfer of skills have been declined on the basis of insufficient funding. Career opportunities in limnology are largely non-existent with few incentives for those with developed skills. Public awareness and education programmes are non-existent. The lack of an informed human resource base is rendered further problematical by an expectation for "quick fixes", as opposed to the concerted and long-term remedial efforts that are needed. Within this scenario there exists the opportunity for the unscrupulous marketing of "miracle solutions". There is a lack of integration of research programmes in the best interests of common national goals. In summary, social, economic and political barriers remain the biggest obstacles to the implementation of pragmatic and reasoned interventions to combat eutrophication in South Africa, while emerging effects of climate change compound the problems.

There are, however, positives within an otherwise gloomy situation. There is an emerging recognition that two timeframes are involved: Firstly, meaningful removal of phosphorus from effluents will be long-term and require both massive capital investment and a mindset change within the wastewater engineering fraternity. Secondly, substantial short to medium-term relief may be possible via re-shaping of fishery foodwebs, using an economically self-funding and job-creation approach. Research in this particular direction is already well advanced and includes Danish and Australian collaborators. A variety of eutrophication assessment tools have recently become available – these also provide a medium of education. Renewed attention is being paid to the phosphate-free detergents.

Eutrophication is a long-term, national problem in South Africa and we are only at the beginning! The problem is not the sole responsibility of a single government department. It is a national crisis involving the coordinated response from a variety of governmental, local authority and public stakeholders. It requires commensurate attention!

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A Limnological Milestone: Half a Century of Lake Kariba

In December 1958 the Kariba Dam on the Zambezi River was closed and Lake Kariba, then the world's largest man-made lake (surface

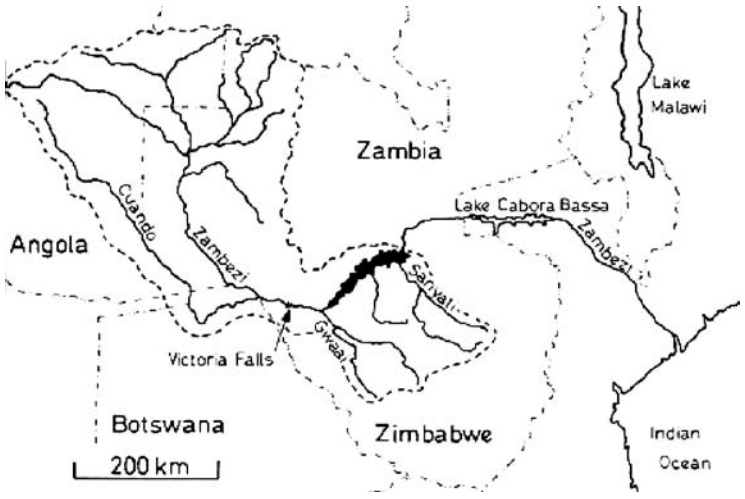

Figure 1. The location of Lake Kariba and its drainage basin in central Africa.

area about 5,400 km2), came into being. There were few limnologists or fish biologists in central Africa and it was not until 1963 that the Lake Kariba Fisheries Research Institute, a joint project sponsored by the Rhodesian and Zambian Governments and FAO, was established while the University of Rhodesia (now University of Zimbabwe) set up a research station on the lake in 1966. Unfortunately, the almost constant political crisis in the region has disrupted the continuity of research but one of the lasting legacies of Lake Kariba is the awakening of limnological interest in the region.

No one had a clear idea of what would happen in the lake as it filled: the explosive growth of the water fern *Salvinia molesta* that began almost at once came as a surprise and evoked concern verging on panic. This plant benefited from the lake's initial eutrophic conditions resulting from nutrients leaching from the drowned land and vegetation. At one point the mats of this weed were spreading at a rate of about 1 km^2 per day and by 1963 these mats covered 22% of the lake's surface. This was the first major outbreak of a floating weed in an African lake and perhaps also been the first successful example of biological control following the introduction of the grasshopper *Paulinia acuminata* (Mitchell & Rose, 1979). The weed mats diminished rapidly in the mid-1970s and *Salvinia* has now almost completely disappeared. The lake became more oligotrophic with time and water hyacinth *Eichhornia crassipes*, which first appeared in the 1990s, never grew as rapidly and was easily controlled biologically.

The lake's catchment area is divided into two distinct zones. The upper catchment, above Victoria Falls (Figure 1), supplies about 70% of the inflow to the lake and is covered by nutrient-poor Kalahari Sands and so the Zambezi has low conductivity (about 40 µS cm^{-1}) and low concentrations of nutrients. The lower catchment supplies about 22% of the inflow (the balance is direct rainfall) and drains a geologically diverse area and the rivers draining it have higher conductivity (seasonally variable but up to 300 µS cm^{-1}) and higher nutrient concentrations (Balon & Coche, 1974).

The lake is monomictic being stratified from about August to June and isothermal for the rest of the year. The hypolimnion was at first almost completely anaerobic because of the large quantity of decaying organic matter drowned by the lake but the intensity of deoxygenation decreased quite rapidly over a period of about four years. This was attributed to the rapid loss of nutrients through the outflow (hydraulic retention time = 2-3 years) and a tentative nutrient budget indicated that nutrient losses through the outflow exceeded the inputs from all sources (Balon & Coche, 1974). When the lake filled its conductivity rose to about 120 µS cm^{-1} in 1959 but fell thereafter to 75 µS cm^{-1} in 1963 and then appeared to have stabilised at around 80 µS cm^{-1} in open water although reaching 100 µS cm^{-1} in shallow inshore areas. A gradient in the conductivity has been noted, which ranges from about 40 µS cm^{-1} at the western end of the lake to 80 µS cm^{-1} in the east. It was attributed to evaporative concentration of salts as a result of global warming (Anon., 2008) but evidence to support this conclusion is lacking. This gradient most probably reflects the influence of the Zambezi River which determines both the physico-chemical characteristics and fish species composition in the western basins.

In contrast, the eastern basins are more strongly influenced by rivers draining the lower catchment and the impact of these rivers may have become more significant because of land use changes in the drainage basin. When Lake Kariba was created the lower catchment was sparsely populated and large areas were infested with tsetse flies, which inhibited settlement and excluded livestock. The eradication of tsetse flies in the 1980s led to a major increase in the human population and their livestock. For instance, in the Sebungwe region of Zimbabwe, located between the rivers Gwaai and Sanyati (see Figure 1), the human population nearly doubled in little more than a decade while the cultivated area trebled. The numbers of cattle, sheep and goats, and donkeys increased by factors of 38, 56 and 13, respectively (Table 1). Elephant numbers did not increase as rapidly but their range got smaller and the natural woodland has been almost totally destroyed in areas where they occur. The consequent overgrazing and deforestation has increased the export of dissolved salts to Lake Kariba through runoff.

The hydrology of the lake determines many ecological processes, either through the supply of nutrients or through fluctuations in the water level that are governed by the seasonal inflow. Much of the early work on invertebrates, for example, was concerned with the release of nutrients during periods when the lake level was rising and how these two affected the populations of chironomids and other benthic groups, notably submerged macrophytes and molluscs. Concerns were also expressed about the possible impact of water level changes on fish, especially the economically important tilapias which used macrophyte beds as nursery areas but these fears seem to have been groundless.

Table 1. Changes in the density (no. km^{-2}) of humans, livestock and elephants, and the proportion of cultivated land in the Sebungwe region, Zimbabwe (Cumming & Lynam, 1997)

	(a) 1980-82	(b) 1993-96	Increase (b/a)
Humans	8.95	16.20	1.8
Cattle	0.03	1.13	37.7
Sheep & goats	0.38	21.30	56.0
Donkeys	0.01	0.13	13.0
Elephants	0.24	0.30	1.3
Area cultivated (%)	4.81	12.49	2.6

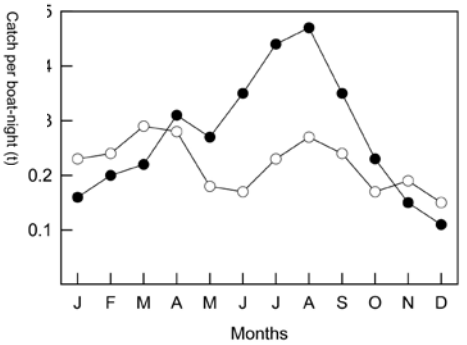

Fig. 1 The relative abundance of Limnothrissa in the Sanyati basin following years of high and low inflows. ● = 1981 (total inflow, 62.2 km3) ○ = 1982 (total inflow, 26.0 km3). The inflow is the flow of the Zambezi and its tributaries into the lake during the previous hydrological year (October-September). Data from Lake Kariba Fisheries Research Institute and Zambezi River Authority.

A major event in the history of Lake Kariba was the introduction of the pelagic clupeid *Limnothrissa miodon* from Lake Tanganyika in 1967-68, because none of the native Zambezi River fishes were able to colonise the open waters of the new lake. By 1970 it was distributed throughout the lake and had escaped through the outflow and could thus colonise Lake Cahora Bassa in Mozambique. This species is short-lived in Kariba, with few individuals surviving for more than six months and so they are sensitive to seasonal changes in the environment. Anecdotal reports from the early 1970s indicate that many of them died of starvation from August onwards after the lake had restratified, locking nutrients in the hypolimnion and causing a decrease in the zooplankton population. The population of *Limnothrissa* is also affected by the volume of water (and nutrients) carried into the lake during the rainy season, and severe droughts can reduce the fish catches (Figure 2).

At the beginning of the year, at the peak of the rainy season, rivers carry nutrients into the lake but these are trapped in the hypolimnion and plankton populations and fish catches are relatively As stratification begins to break down, the plankton populations and fish catches increase to reach a peak in August after which the lake begins to stratify and both plankton populations and fish

catches decline markedly. This pattern is clearly exhibited in seasons with good rainfall (e.g. 1981) but it breaks down in years of low rainfall (e.g. 1982) when nutrient inflows were so low that the August peak failed to develop.

The impacts of *Limnothrissa* in Lake Kariba were similar to those of other planktivorous species noted elsewhere. Prior to its introduction, the zooplankton of Lake Kariba was dominated by large copepods and cladocerans with Chaoborus being the major large predator. These species were soon eliminated by *Limnothrissa* leaving only rotifers, nauplius larvae and *Bosmina longirostris*, the smallest cladoceran in the lake (Marshall, 1991). The zooplankton biomass is, of course, much reduced and can only support the *Limnothrissa* population because of its high production/biomass ratio. The fishery is evidently experiencing difficulties (Anon., 2008), which may reflect excessive fishing effort but could also be due to fundamental changes in the zooplankton stocks.

Less was known about the phytoplankton before the introduction of *Limnothrissa* but there has been a shift from Chlorophyta in the earlier years to small cyanophyte species (notably *Cylindrospermopsis*) subsequently. The causes of this shift are unclear but may have been a cascading effect following the elimination of the larger zooplankton grazerss. A shift to unpalatable cyanophytes might have contributed to problems in the fishery by causing a further reduction in the zooplankton population.

The fishes of Lake Kariba have attracted considerable interest because fisheries were meant to compensate the displaced population for the loss of their agricultural land along the river. The earliest surveys in the Zambezi River found relatively few tilapia species and so about 50 tons of cichlid fingerlings were introduced in 1959 although this proved to be unnecessary because the populations of native species exploded as the lake filled. The introduced fish came from the Kafue River (ichthyologically similar to the upper Zambezi) and almost certainly included species native to that system, which caused some confusion later.

Eugene Balon collected about 120,000 specimens at various localities along the northern shore from 1968-72 and provided the first estimates of biomass, growth and mortality for most of the 45 species found in the lake (Balon & Coche, 1974). Of particular interest was the presence, in small numbers, of several species typically found in the upper Zambezi above Victoria Falls and Balon concluded that they were in the process of invading the lake. With the possible exception of the cichlid *Serranochromis macrocephalus*, which spread through the lake over a period of about 20 years none of these species have survived in the lake (Zengeya & Marshall, 2008). The most likely explanation for their presence in the early years is that they were introduced from the Kafue River in 1959 but ultimately could not compete with the native species.

Fish populations have changed over the years with an almost immediate loss of some fluvial species that had been common in the river while groups that favoured standing waters (e.g. cichlids) became much more abundant. Species that favour submerged macrophytes (e.g. *Tilapia sparrmanii*) only became numerous much later because of the time it took for these plants to become established. Other fish, such as *Synodontis zambezensis*, are reported to have increased because of the removal of competitors by commercial fishing although they were equally abundant in fished and protected areas (T.A. Zengeya, unpublished). Some variations in species abundance are inexplicable at present and this highlights the need for a detailed ecosystem approach in future research. An example of this can be seen in the tigerfish *Hydrocynus vittatus* which is both an important commercial species and a popular angling fish.

Two long-term data sets are available for this species (Figure 3). The first is its relative abundance in a fleet of research gillnets, which mostly caught fish less than one year old, while the other is data from an angling tournament where most fish are more than five years old. Catches at the tournament rose sharply between 1995 and 2000 but this could not have been predicted from the gillnet catches and no one knows why there was such an unpredictable increase in older fish. Although Lake Kariba is well-studied in comparison to many other African lakes phenomena like these suggest that much remains to challenge the scientist.

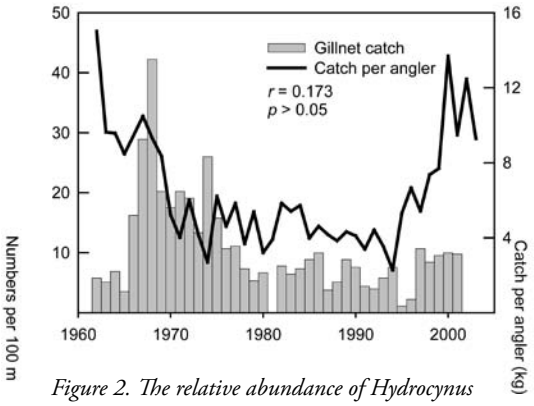

Figure 2. The relative abundance of Hydrocynus vittatus in research gillnets (no per 100 m) and in the Kariba International Tigerfish Tournament (no per angler), 1962-2001.

What of the future? In evolutionary terms Lake Kariba was created instantaneously, setting in train a series of dramatic biological changes, and one of the questions posed by early workers was how long would it take for the ecosystem to stabilise. It seems likely that change will continue, being driven both by events within the lake and by external forces. An example of the former is the introduction of the cichlid *Oreochromis niloticus* in the 1990s, which is displacing the native *O. mortimeri*. Elsewhere, as in Lake Victoria, *O. niloticus* has proved to be highly flexible in its diet and shifted from feeding mainly on algae to include insects, fish and plant material. Has it has done the same in Lake Kariba and what might the impacts be?

External influences include the growth of the human population and its environmental consequences. Most of the catchment area is rural and levels of direct pollution are low but there has been concern over the use of DDT for tsetse and mosquito control. The discovery of two cormorants that died from mercury poisoning drew attention to the possible impact of gold mining in the lower catchment. Climate change will, of course, have impacts but these have yet to be determined. Anon. (2008) asserted that "the rise in lake temperature, changes in phytoplankton composition, decline in entomostracan populations and of pelagic fishery point to the impact of global warming" but this is not entirely correct. Changes in water temperatures have yet to be fully documented, but the changes in the zooplankton are reflect selective predation by *Limnothrissa*, and these may have cascaded to the phytoplankton. The most important impacts of climate change are likely to result from changes in rainfall patterns and the consequent alteration in the river flow and lake level fluctuations.

I first visited Lake Kariba in 1962 and have been fortunate enough to have worked on it at various times ever since and met many who contributed to our knowledge of the lake. I regret that it is not possible to cite all their work in this short review although I should like to acknowledge their contributions. The two principal research institutions on Lake Kariba, both in Zimbabwe, are severely debilitated at present through a lack of resources and the loss of trained personnel. It is to be hoped that a solution to the country's political and economic problems will be found and these two institutions can return to their former excellence.

References

Anon. 2008. Limnology news from Zimbabwe. SIL News 52: 12-13.

Balon E.K., Coche A.G. (eds) *Lake Kariba: A Man-made Tropical Ecosystem in Central Africa*. Dr W Junk, The Hague: pp 249-647.

Cumming D.H.M., Lynam T.J.P. 1997. Landuse changes, wildlife conservation and utilisation, and the sustainability of agro-ecosystems in the Zambezi Valley. Final Technical Report, Volume 1: 138 pp. World Wildlife Fund, Harare.

Marshall B.E. 1991. The impact of introduced sardines on the ecology of Lake Kariba. Biol. Cons. 55: 151-165.

Mitchell D.S., Rose D.J.W. 1979. Factors affecting fluctuations in extent of *Salvinia molesta*. *PANS* 25:171-177.

Zengeya T.A., Marshall B.E. 2008. The inshore fish community of Lake Kariba half a century after its creation: what happened to the upper Zambezi invasion? *Afr. J. Aquat. Sci*. 33: 99-103.

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The Aral Sea: Hydrological Changes and Rehabilitation

The Aral Sea is a terminal lake located amidst the great deserts of Central Asia. The balance between discharge from two rivers, the Amu and Syr, and net evaporation (surface evaporation minus precipitation) fundamentally determines the lake's water level. With an area of > 67,000 km^2, the Aral Sea, was considered the world's fourth largest inland water-body in 1960. Although a brackish-water lake with salinity around 10 g l-1, its main fish species were of fresh-water origin. The sea supported a major fishery and it functioned as a key regional transportation route. The extensive deltas of the rivers Syr Dar'ya and Amu Dar'ya sustained a diversity of flora and fauna. They also supported irrigated agriculture, animal husbandry, hunting and trapping, fishing, and harvesting of reeds.

The water balance, morphology, ecology and economy of the Aral Sea have changed dramatically over the past 45 years. The sea has shrunk markedly in its area and become significantly salinized (Fig 1 & Table 1), owing to withdrawal of the river water for irrigation purposes and that has reduced river inflow to a fraction of its earlier inflow level. The Aral Sea got separated into two water bodies in the late 1980s: a "Small" Aral Sea (Fig 2) in the north and a "Large" Aral Sea" in the south. The river Syr flows into the former, and the Amu into the latter. Today (2008), the Large Aral Sea has further divided into a deep western basin and a shallow eastern basin, connected by a narrow, long strait and a cutoff former gulf. Between 1960 and mid 2008, the level of the Large Aral Sea fell by more than 24 metres.

The desiccation of the Aral Sea i.e. decrease in water level, has had severe negative impacts on the fishery and socio-economic conditions of the inhabitants. The important commercial fishing industry collapsed by the early 1980s as indigenous fish disappeared due to rising

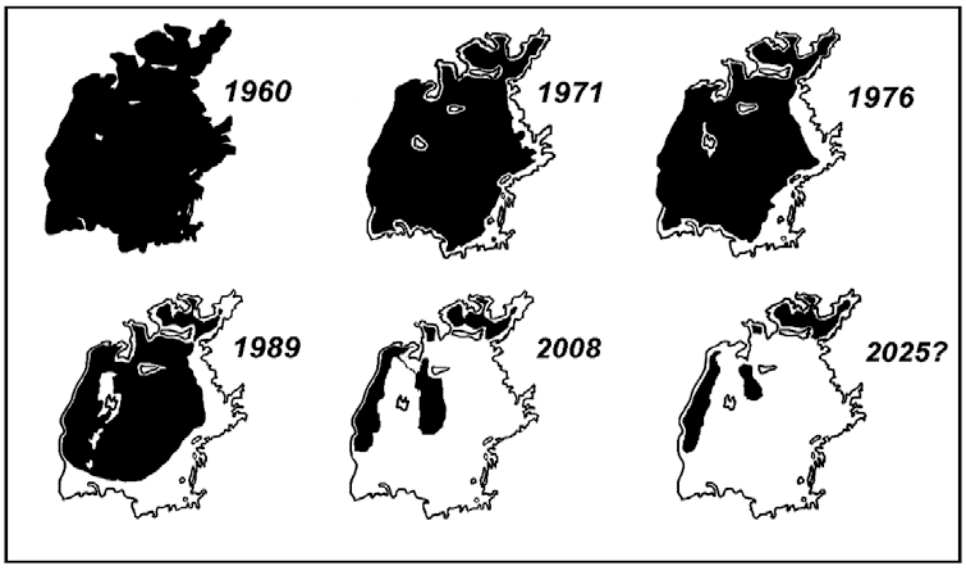

Figure 1. The Aral Sea, 1960 -2025

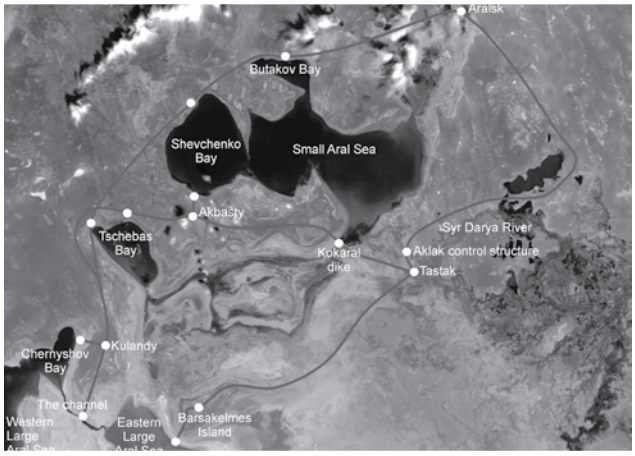

Figure 2. An aerial map of Aral Sea with small Aral Sea seen prominently.

Table 1. Changes in the main hydrological and hydrobiological characteristics of the Aral Sea, 1901-2007

Aral Sea and its constituent parts	Level, meters above sea level)	Area in km^2	Volume in km^3	Avg. salinity, ‰	Number of free-living invertebrate species		Number of fish species	
					aboriginal	alien	aboriginal	alien
Aral Sea, 1901	53.6	66,724	1102	10	148	-	18	-
Aral Sea, 1961	53.4	66,511	1,089	10	148	5	18	11
Small Aral Sea, 1989	40.6	2984	20	30	7*	4*	-	6
Large Aral Sea, 1989	39.07	37,410	350	30	7*	5*	-	6
Small Aral Sea, 2007	42	3487	27	11–14	10*	6*	3	7
Tschebas Bay, 2007	30.	105	0.2	90	8	2	-	-
Eastern Large Aral Sea, 2007	29.5	6117	9.5	120–160	-	1	-	-
Western Large Aral Sea, 2007	29.5	4226	58	100	8	2	-	-

* – without Protozoa, tiny Metazoa and scarce species.

salinity and loss of shallow spawning and feeding areas, causing unemployment of thousands of fishermen. The degradation of the biologically rich and diverse ecosystems of the extensive Amu and Syr deltas caused substantial losses of both plant and animal species. Recurrent windstorms transport sand, salt and dust from the dried areas of the Aral Sea onto surrounding lands adversely affected both the environment and human health. The climate has become drier and more continental in about 100 km wide span along the former shoreline.

The situation is probably less hopeless than it seemed. The World Bank and the Government of Kazakhstan financed an 85 million USD project to build a dike and dam to prevent and regulate the flow from the Small Sea to the two Large Sea basins. Completed in August 2005, the dike facilitated a rapid rise of the water level of the Small Aral Sea by two metres as well as lowering of its salinity level, compared with that in in the 1960s. Consequently, by fall 2007 many of the indigenous fish had returned in substantial numbers from the Syr River and its deltaic lakes, including the prized sudak or pike-perch (*Lucioperca lucioperca*) and sazan or common carp (*Cyprinus carpio*). Since the completion of dike, fish catches have risen sharply, reviving not only the subsistence of local fishing economy but has initiated small-scale commercial fishing as well. So far, the North Aral Project has considerably exceeded expectations. A follow-up project to raise part of the Small Aral by an additional 4 meters, is being seriously considered at a cost of 127 million USD., However, the three lakes comprising the former Large Aral Sea on the south continue to shrink as flow from Amu river no longer reaches the eastern basin from the south and it is supplied with water only during the spring/early summer high flow period on river Syr when sufficient water is supplied to permit some overflow from the Small Aral. This basin could shrink to a shallow, < one metre deep, hypersaline pond within the next five years. The deeper basin will continue to recede but would stabilize at a still significant size when net evaporation is offset by the substantial groundwater inflow into it. This basin could be partially rehabilitated if the flow of the Amu in its lower reaches were diverted into it, stabilizing the level and reducing salinity. This potential project has so far received little evaluation of its cost and benefits, although the former would be considerably more than that for rehabilitating the Small Aral.

Further Reading

Philip Micklin and Nikolay V. Aladin, "Reclaiming the Aral Sea," Scientific American, April 2008, pp. 64-71.

Philip Micklin, "The Aral Sea Disaster," Annual Review of Earth and Planetary Sciences, Vol. 35, 2007, pp. 47-72.

Nikolay Aladin, Philip Micklin and Igor Plotnikov, "Biodiversity of the Aral Sea and its Importance to the Possible Ways of Rehabilitating and Conserving its Remnant Water Bodies," in Jiaguo Qi, and Kyle T. Evered, (Eds.), Environmental Problems of Central Asia and their Economic, Social and Security Impacts, forthcoming from Springer in December 2008.

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Small Saline Meromictic Lakes Provide Excellent Systems For Limnological Teaching And Research

Limnologists as well as undergraduate and graduate students at the University of British Columbia, Vancouver, nearby Salmon Fraser University, and others from world-wide institutions, have had year-round opportunities since the early 1960s to compare the unusual limnological features of small saline and meromictic Mahoney Lake (Fig. 1a,b - next page) with adjacent non-meromictic Green Lake (Northcote & Halsey 1969). Thereafter a series of limnologists and students have worked on Mahoney Lake as well as other meromictic lakes in south-central and even coastal B.C. ones, assembling well over two dozen primary publications on them. See also Northcote & Hall 1983, Northcote & Hall 1990, Overmann et al. 1991, 1993, Lowe et al. 1997, Overmann et al. 1999, Northcote & Hall 2005), as well as with other such small lakes in south-central British Columbia that we are now studying.

Therefore the June 2008 note (in SILnews 52) by Degermandzhy & Zadereev on salt lake studies opening new perspectives for limnologists stressed a long-term approach that we and our colleagues have used not only for limnologists themselves but also for training students interested in that field. In doing so we perhaps have followed an approach championed by the many branches of the medical profession, namely to fully understand the proper function of the human body and brain one must carefully follow their unusual manifestations. The note on saline Shira Lake in southern Siberia (Khakasia) makes an old limnologist (T.G.N.) strongly wish that he could see and examine limnological features of at least a few of the over 100 saline lakes in Khakasia, but time does not permit!

References

Northcote, T.G. & T.G. Halsey. 1969. Seasonal changes in the limnology of some meromictic lakes in southern British Columbia. Journal of the Fisheries Research Board of Canada 26: 1763-1787.

Northcote, T.G. & K.J. Hall. 1983. Limnological contrasts and anomalies in two adjacent saline lakes. Hydrobiologia 105: 179-194.

Northcote, T.G. & K.J. Hall. 1990. Vernal microstratification patterns in a meromictic saline lake: their causes and biological significance. Hydrobiologia 197: 105-114.

Lowe, D.J., J.D. Green, T.G. Northcote & K.J. Hall. 1997. Holocene fluctuations of a meromictic lake in southern British Columbia. Quartenary Research 48: 100 – 113.

Overmann, J., J.T. Beatty, K.J. Hall, N. Pfennig, and T.G. Northcote. 1991. Characterization of a dense, purple sulfur bacterial layer in a meromictic salt lake. Limnology and Oceanography 36: 846-859.

Overmann, J., G.Sandmann, K.J. Hall and T.G. Northcote. 1993. Fossil carotenoids and paleolimnology of meromictic Mahoney Lake, British Columbia. Aquatic Sciences 55/1: 31-39.

Overmann, J., K.J. Hall, T.G. Northcote, W. Ebenhoh, M.A. Chapman and T. Beatty. 1999a. Structure of the aerobic food chain in a meromictic lake dominated by purple sulphur bacteria. *Archiv für Hydrobiologie* 144: 127-156.

Overmann, J., K.J. Hall, T.G. Northcote and J.T. Beatty. 1999b. Grazing of the copepod Diaptomus connexus on purple sulfur bacteria in a meromictic salt lake. Environmental Microbiology 1: 213-221.

Northcote , T.G. and K.J. Hall. 2005. Effects of water-level change on morphometric production indicators in two meromictic lakes. Verhandlungen Internationale Vereinigen für theoretische und angewandte Limnologie 29: 1492-1496.

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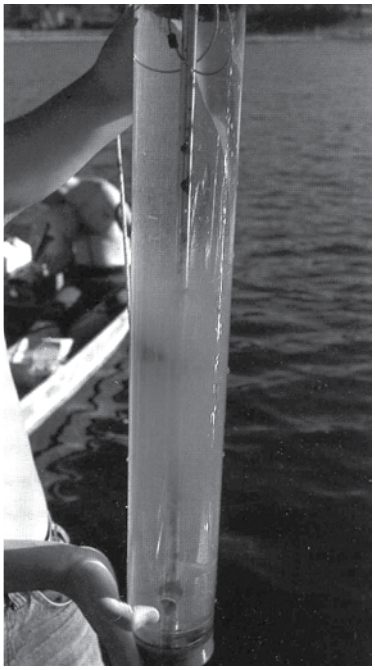

Fig. 1a. Its purple sulphur bacterial plate entrapped in a 3.75 l van Dorn bottle (68 cm long) taken from a depth of 7m on 4 October 1980. See Northcote & Hall (1983).

Fig. 1b. Mahoney Lake, B.C. in the mid 1980s. Further water-level decline up to 2008 has virtually eliminated its small SW and SE bays, as its NW bay.

Report From Laboratories

Factors Governing The Phytoplankton Spring Bloom In A Shallow Temperate Lake: A Paradox Of Warming?

Limnologists are generally used to aquatic ecosystems at times not behaving as they would expect. This may be because interactions among the ecosystem components can produce ecological surprises. We have been studying the effects of spring warming on phytoplankton and have recently encountered a set of interactions which, according to us, is an example of a "Paradox of Warming", i.e. a case where warm winter/spring periods tend to favour cold-adapted species of phytoplankton1. Interestingly, this paradox of warming can help also explain why some species of Oscillatoriales persistently dominate throughout the vegetation period in shallow temperate lakes.

The physical factors such as temperature, daylength and the light supply govern phytoplankton growth in early spring until nutrient limitation and zooplankton grazing become dominant and initiate the clear-water phase. The relationship between the physical factors has been altered by the recent warming trend. In shallow, temperate Lake Müggelsee (Berlin, http://www.igb-berlin.de/abt2/ms/ms_dat.shtml), average spring water temperatures increased by 0.5–2 °C between 1979 and 1987 and 1988 and 1998 with an abrupt change to warmer temperatures following the winter of 1987/88. Therefore, shorter day lengths now usually occur at higher temperatures and lower daily global radiation, which should influence the composition of the phytoplankton community if there are species-specific nonlinear growth responses of phytoplankton to interactions between these factors.

We used two different approaches: we made a statistical comparison of field data of phytoplankton of Lake Müggelsee over a 25-year period and applied a laboratory-based growth model of four different species to the abiotic conditions of the lake in this period.

To overcome some former limitations of analysis we defined the spring period not according to the calendar but to some physical and biological events[1].The spring period of phytoplankton growth in temperate lakes essentially begins when the ice cover thaws and ends with the clear water phase. To account for years with no ice cover and/or no clear water phase, we defined the start of the spring-growth period as the time when the water reached 3 °C after the winter minimum, and which was closest to the start of exponential growth of phytoplankton (generally one week after ice thaw). We defined the end of the spring period as the time of the first cladoceran peak, which generally coincided with the clear water phase.

Following this definition, in warmer years with mild winters, the spring period began earlier due to a shorter duration of ice cover, the phytoplankton peak occurred earlier and the average water temperature in the growth period was lower than in years with long, cold winters. This leads to the paradox where warmer years produce relatively colder spring growth periods and vice versa. We have termed this inconsistency the "paradox of warming".

The analysis showed that, whereas the start of the spring period and the phytoplankton peak were strongly dependent on the previous winter conditions, the timing of the cladoceran peak was relatively independent of the winter conditions (Fig.). It follows that in warm years, the spring period lasts longer and the time delay between the phytoplankton peak and cladoceran peak increases. This uncoupling of the phytoplankton peak from the main grazers in warm years has been observed also in other lakes and has consequences for both the algal species composition and higher trophic levels. In addition to lower mean temperatures, mean daylength and mean daily global radiation also decreased in warm years due to the shift of the spring growth period. This should favour algae adapted to lower temperatures, shorter daylength and lower irradiance. Our analysis confirmed that the proportion of centric diatoms was negatively but that of pennate diatoms was weakly positively correlated with the mean temperature, which shows that the lower temperatures in warmer years favour centric over pennate diatoms, with *Stephanodiscus neoastraea* as dominant species. Centric diatoms are typically early spring species with lower temperature demands than pennate diatoms, which occur later in spring.

We tried to also explain why Oscillatoriales dominated in some years but not in others during the hypertrophic period. One basic condition is a high molar P:Si ratio (TP:DRSi > 1:17) which can cause Si-limitation of diatoms. We have now shown a second condition: enough time between the phytoplankton peak and cladoceran peak to enable Oscillatoriales to attain a high biomass such that they cannot be grazed down by cladocerans. This extra time is available in warm years only.

If nutrients and zooplankton grazing are not the governing factors during the spring bloom, do light and temperature govern phytoplankton dominance and periodicity? Our calculations with a model of the interactive effects of temperature and light, including the temporal pattern of light as an independent factor (daylength, mixing induced light fluctuations), showed that both temperature and the length of the photoperiod have an essential species-specific effect, whereas the mean daily irradiance in the mixed layer is seldom limiting in this shallow lake (mean depth 4.9m)[5]. This weak effect of light exposure was surprising as light limitation in spring is like a dogma. However, it seems that this evaluation comes from measurements of photosynthesis – in algae growing at light saturation at a maximum rate, photosynthesis is unsaturated and only becomes saturated under light intensities about 3 times higher. For example, the growth of *Planktothrix agardhii* (Cyanobacteria) and *Stephanodiscus neoastraea* (Bacillariophyceae) is light-saturated at 120 µmol m^{-2} s^{-1} under a 12:12 h light/dark-period with constant light supply at 20°C, but the photosynthesis of these species acclimated to growth saturating irradiance is saturated at 300 µmol m^{-2} s^{-1} (*Planktothrix*) or as high as 400 µmol m^{-2} s^{-1} (*Stephanodiscus*)[6].

All in all, our results show that warming can have unexpected consequences, which arise through complex interactions between species, nutrients and trophic levels. A more direct effect of warming in temperate lakes is a shift in species composition towards cold-adapted, early spring species (diatoms) due primarily to lower temperatures during the spring-growth period, which occurs earlier in warm years. The protracted time lag between phytoplankton and cladoceran peaks has the indirect effect of 'opening the door' for Oscillatoriales when diatoms are silicon limited. Concerning light limitation in spring, we need to examine more carefully whether photosynthesis or growth is light limited.

References

Shatwell, T, Köhler, J, Nicklisch, A (2008) Warming promotes cold-adapted phytoplankton in temperate lakes and opens a loophole for Oscillatoriales in spring, *Global Change Biology*, 14, 2194-2200.

Köhler J, Hilt S, Adrian R, Nicklisch A, Kozerski HP, Walz N (2005) Long-term response of a shallow, moderately flushed lake to reduced external phosphorus and nitrogen loading. *Freshwater Biology*, 50, 1639-1650.

Müller-Navarra DC, Güss S, von Storch H (1997) Interannual variability of seasonal successional events in a temperate lake and its relation to temperature variability. *Global Change Biology*, 3, 429-438.

Sommer U (1989) The Role of Competition for Resources in Phytoplankton Succession. In: *Plankton Ecology: Succession in Plankton Communities* (ed Sommer U), pp. 57-106, Springer-Verlag, Berlin.

Nicklisch A, Shatwell T, Köhler J (2008) Analysis and modelling of the interactive effects of temperature and light on phytoplankton growth and relevance for the spring bloom. *Journal of Plankton Research*, 30, 75-91.

Nicklisch, A, Fietz, S (2001) The influence of light fluctuations on growth and photosynthesis of *Stephanodiscus neoastraea* (diatoms) and *Planktothrix agardhii* (cyanobacteria). *Archiv für Hydrobiologie*, 151, 41–156.

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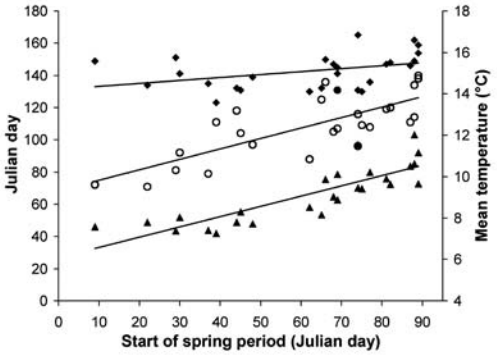

Figure. Mean temperature in the spring growth period (triangles), timing of the phytoplankton peak (open circles), timing of the cladoceran peak (closed diamonds) vs. the timing of the start of the spring period over a 25 year period in Lake Müggelsee.

Macroecology and Population Ecology – Two Faces of the Same Science

Nature, like two-faced Janus, is both variable and relatively constant, and ecology deals with both these facets of reality. Depending on the scale of observations, ecology in general, and freshwater ecology in particular, may be considered to split into four subfields: macroecology (Brown and Maurer 1989), ecosystem ecology, community ecology (focusing on species interactions), and population ecology, with communities and populations referring to species at smaller scales as compared with marcoecology (Lawton 1999). Similar to classical zoology and botany, macroecology often employs a comparative method, which has a strong predictive power. As noted by V.N. Beklemishev (1964), 'Had the ancients had a comparative anatomy view, they could have never envisioned dragons with wings on the back and snake-legged giants' (by snake-legged giants Vladimir Nikolaevich apparently meant sculptures at the Altar of Zeus at Pergamum, now in the Pergamon Museum in Berlin). In aquatic macroecology, comparative method is illustrated, e.g., by the relationship between metabolic rate and body mass in fishes (Winberg 1956) or by consumption rate versus body mass in crustaceans. In aquatic ecosystem ecology, such a comparative method is represented, for instance, by the regression relationships between spring phosphorous level and summer chlorophyll concentration in lakes or between annual primary productivity and annual fish yield. These examples show that comparative approach can be used in regard to both species and ecosystem properties. The approach as in the last two examples was routinely used already in the framework of the IBP.

The feature of a comparative method is its ability to predict some variables on the basis of some others, though one should always be careful about uncertainty inherent in such calculations. Predictive power distinguishes hard science from soft science, and ecology must become a hard science, as emphasized by Rob Peters, one of the strongest advocates of the comparative approach in ecology. However, in population ecology, the main focus of this note, comparative methods usually do not apply. This is because the fate of any population is unique and what happens to one population is not easily transmitted to other populations of the same species, let alone other species. Population ecology seems at risk of becoming a casebook of heterogeneous examples, a 'collection of stamps', according to an acid remark by Ernest Rutherford, i.e., a purely empirical science that falls short of guiding theoretical principles. The way population ecology can be transformed into a hard science remains illusive.

What if population ecology lacks sufficiently universal and thus predictive relationships similar, for example, to Newton's second law of motion (Ghilarov 2001)? What if some parts of reality (that studied by population ecology being perhaps among them) do not agree with description in terms of universal laws because of a great variability inherent in them? A way out may be to develop sufficiently universal methods and approaches appropriate to

solving a broad class of problems. These methods when available are like having a thermometer, a universal tool allowing one to measure the temperature of very different objects, from a gas mixture to a human body. Measuring temperature is of course not the same as predicting it. The knowledge of temperature is not the same as the knowledge of a universal relationship that involves temperature (e.g. the ideal gas law); yet, it is a source of important information – from the state of gas to the state of a human's health.

As an example of a universal approach in population ecology, I would like to refer to contribution analysis, which has evolved in connection with population projection (Leslie) matrices (Caswell 1989) but acquired a more general meaning. Contribution analysis applies when the behaviour of a system can be described by means of an analytical function of several variables, e.g. $u = f(x, y, z)$ where u is the output variable, and x, y and z are input variables (its number is arbitrary). Often, this function is merely a simple formula such as the Edmondson-Paloheimo estimator for birth rate in *Daphnia* and other zooplankton species: $b = (1/D)\ln(1+F A)$ where D is egg duration time, F is fecundity, i.e. no. eggs per adult female, A is proportion of adults. But it may be as complex as population growth rate λ being an implicit function of the age-specific survival and reproduction rates entering into a population projection matrix. This analysis estimates how changes in the input variables contribute to the resulting change in u where an input variable's contribution is the product of the partial derivative of u with respect to this variable (e.g. $\partial u/\partial x$) times its actual change (i.e. Δx). The contributions of all input variables sum up to the resulting change in u and thus reveal which variable's change, and the process underlying it, is the principle cause of the change of the state of the system. There are many useful examples of contribution analysis. First, it permits one to judge which age-specific survival or reproduction rate largely affects λ and, hence, which age is most sensitive to the effect of a toxicant in life table response experiments (Caswell 1989). Second, it allows one to assess which factor, the intensity or frequency of disturbance, mainly determines changes in the species diversity of phytoplankton when the system is traversing the disturbance gradient (Polishchuk 1999). The result has been interpreted in terms of competitive interactions between species, which demonstrates the potential of the method in community ecology. Third, contribution analysis shows which factor – standard somatic mass, clutch size or individual egg mass – primarily affects the dynamics of body mass in *Daphnia* when trophic conditions are changing, with the results fitting well into optimal allocation theory (Polishchuk and Vijverberg 2005: see Figure). Fourth, measuring contributions of A and F from the Edmondson-Paloheimo model allows one to determine which effect – predators (top-down) or food (bottom-up) – dominates *Daphnia* birth rate dynamics: the larger the contribution of A relative to F, the stronger is the effect of size-selective predators relative to the effect of food (Polishchuk, Vijverberg, Mooij and Voronov, in prep.).

To summarize, the power of macroecology and, to some extent, of ecosystem ecology lies in comparative method, which takes simple metrics (e.g. body mass, primary production, fish yield) and produces sufficiently universal and thus predictive relationships, mostly represented by statistical regressions of various types. In population ecology, this method may not apply. Instead, population ecology may enjoy using sufficiently universal measurement tools, which would give rise to less trivial metrics (such as a common measure for top-down versus bottom-up effects obtained on the basis of contributions). With these new metrics, individual case studies will be easier to place into the context of more general theories. Moreover, these metrics might open the way to predictive rules and perhaps even laws in population ecology – similarly as in physics the discovery of new laws has been often preceded by more sophisticated measurements. For this to happen, we need to develop better tools and more widely use those already available.

References

Beklemishev, V.N. 1964. Principles of com parative anatomy of invertebrates, v. 1. Moscow, Nauka Publishers (in Russian).

Brown, J.H., Maurer, B.A. 1989. Macroecol ogy: the division of food and space among species on continents. Science 243: 1145-1150.

Caswell, H. 1989. Analysis of life table response experiments. I. Decomposition of effects on population growth rate. Ecol. Model. 46: 221–237.

Ghilarov, A.M. 2001. The changing place of theory in 20th century ecology: from universal laws to array of methodologies. Oikos 92: 357-362.

Lawton, J.H. 1999. Are there general laws in ecology? Oikos 84: 177-192.

Polishchuk, L.V. 1999. Contribution analysis of disturbance-caused changes in phytoplankton diversity. Ecology 80: 721–725.

Polishchuk, L.V., Vijverberg, J. 2005. Con tribution analysis of body mass dynamics in *Daphnia*. Oecologia 144: 268–277.

Winberg, G.G. 1956. Rate of metabolism and food requirements of fishes. Minsk, Belorussian State Univ. Publishers (in Russian).

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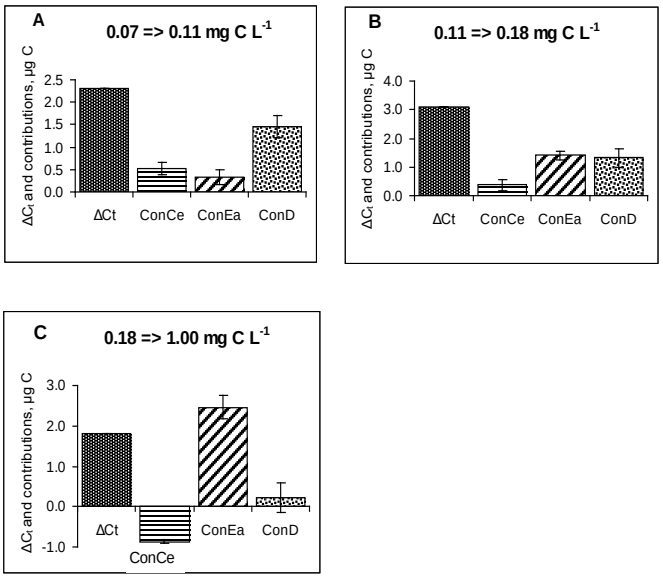

Figure. Contribution analysis as applied to body mass dynamics of Daphnia galeata along a trophic gradient. Each panel corresponds to a certain shift in the food concentration – from 0.07 to 0.11 (A), from 0.11 to 0.18 (B) and from 0.18 to 1.00 (C) mg C L^{-1} – and shows how an increase in the total body mass (ΔC_t) is decomposed into three contributions, each contribution being associated with a single trait – individual egg mass (Con C_e), clutch size (Con E_a) or standard somatic mass (Con D); the sum of the trait contributions equals ΔC_t. The graph demonstrates that when recovering from poor food conditions just above the threshold food concentration Daphnia primarily increase their standard somatic mass, that is, restore body condition (A), whereas when food is no limiting factor, almost all resources are committed to boost clutch size (C); under intermediate food conditions, resources are invested equally to enhance body condition and to increase clutch size (B). While individual egg mass also varies, it never attracts more resources than the shift in the most prioritized trait. See Polishchuk L.V., Vijverberg J. 2005. Oecologia 144: 268-277 for details.

ANNOUNCEMENTS (Meetings, New Books)

Working Group on Macrophytes: Announcement

Invitation

European Weed Research Society (EWRS) will organise a meeting on aquatic plants in Finland in August 2009 (The EWRS promotes and co-ordinates scientific research into all aspects of weeds). This meeting will be co-organised by SIL WG Aquatic Macrophytes.

The EWRS Website is: http://www.ewrs.org/IW/contributions.asp

Official webpage: http://www.environment.fi/default.asp?contentid=284014&lan=EN

We hope to see all of you in Finland next year !

Prof. Dr. Jacques Haury
(Chairperson of the SIL WG Aquatic Macrophytes);

Dr Seppo Hellsten
(Secretary and Symposium Organiser)

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6th International Symposium

LIMNOLOGY AND AQUATIC BIRDS:

Monitoring, Modeling and Management
HUESCA, Spain, 27-30 October 2009.
Convened by Aquatic Birds Working Group

History of the Working Group

The main objective of the Working Group on Aquatic Birds is to integrate waterbirds into hydrobiology and treat water-bird studies in a limnological context. To achieve this goal, the Working Group organizes conferences to facilitate communications among limnologists interested in aquatic birds and ornithologists interested in the aquatic habitat. These conferences are held at least once every three years between SIL Congresses since 1994. The proceedings of these conferences are published in refereed journals such as Hydrobiologia.

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SIL Meeting 24-27 October, 2009 Nanjing, China

Theme: Global Change and Freshwater Environments

During the 30th SIL Congress in Montreal in August 2007, a motion encouraging non-Congress SIL meetings was passed by the International Committee. Such meetings are considered to serve the society at large. The follow-up meeting will be held from October 24 to 27, 2009 in Nanjing, China. The theme of the meeting is "*Global change and freshwater environments*", and the topics include:

1) Global change and its impact on freshwater ecosystems;
2) Human accelerated environmental changes in freshwaters;
3) Algal blooms in freshwaters: ecological mechanisms and consequences;
4) Aquatic toxicology and water quality safety of freshwaters;
5) Resource use and conservation of freshwaters; and
6) Ecosystem services and restoration of freshwaters

There will be a special session for students to discuss their respective studies in limnology and exchange information. A limited number of scholarships is available for supporting students to participate in this meeting. The scholarships will cover registration fee, meals and accommodation.

Prof. Gene Likens has kindly agreed to act as chairman of the scientific committee and Prof. Zhengwen Liu is the chair of the organizing committee. For more informaton please contact:

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2nd Symposium of Winter Limnology

The 2nd Meeting in Winter Limnology will be held from 29th May to 2nd June 2010 in Liebenberg close to Berlin (see Report of the Ist Symposium on Winter Limnology, held in Finland in June 2008, elsewhere in this SILnews). The theme of the upcoming symposium will be "Lakes during winter under a changing climate". The idea is to bring scientists from different disciplines together to discuss the current state of knowledge about winter limnology and the observed and expected changes in biogeochemical cycles in lakes. Further information will follow at the beginning of 2009.

The symposium will be organized by Heike Zimmermann-Timm (Potsdam Institute for Climate Impact Research), Christof Engelhardt (Leibniz-Institute for Freshwater Biology and Inland Fishery) and Georgy Kirillin (Leibniz-Institute for Freshwater Biology and Inland Fishery).

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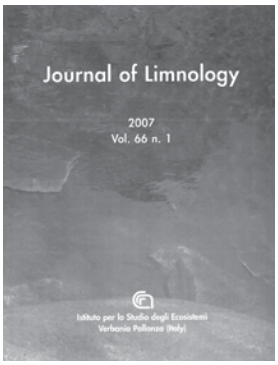
The Journal of Limnology: An Announcement



I am pleased to inform that the Journal of Limnology, received in June 2008 an Impact Factor (IF) of 2.375 by the Institute for Scientific Information (ISI). The first issue of the journal under its new name (*J. Limnol*) was published in 1999 following the tradition of its predecessor the *Memorie dell'Istituto Italiano di Idrobiologia*, which has been published since 1942. *The Journal of Limnology* is published by CNR - Institute of Ecosystem Study, Verbania, Pallanza (Italy), formerly *Istituto Italiano di Idrobiologia*. The Journal is published every six months, and it accepts peer-reviewed, original papers in the field of limnology, with occasional supplementary issues (Monographs, Proceedings, etc.). The paper edition of the journal is available on subscription; in addition, there is Web-Edition that appears a little earlier.

The papers up to now published are on-line (free download of Abstract and full text is available as PDF) in the new website of the journal: http://www.jlimnol.it. On the same webpage information is available on the editorial policy and scope of the journal, together with Instructions for the preparation of the manuscripts, and their submission.

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A Mechanistic Approach to Plankton Ecology' by Thomas Kiørboe.

Princeton University (Publishers); Publication date: 29, October 2008;
ISBN: 978-0-691-13422-2; Price: £23.95.

This book offers a mechanistic approach to the study of ocean ecology by exploring biological interactions in plankton at the individual level. The book focuses on encounter mechanisms, since the pace of life in the ocean intimately relates to the rate at which encounters happen. Most of the book's chapters consist of a theoretical introduction followed by examples of how the theory might be applied to real-world problems. In the final chapters, mechanistic insights of individual-level processes help to describe broader population dynamics and pelagic food web structure and function.

Springer Books

Lake Taihu, China. Dynamics and Environmental Change. Qin, Boqiang (Ed.) 2008, XIV, 342 p. With CD-ROM., Hardcover. ISBN: 978-1-4020-8554-3. Published August 2008.

Ecological Effects of Water-level Fluctuations in Lakes. Series: Developments in Hydrobiology , Vol. 204. Wantzen, K.M.; Rothhaupt, K.-O.; Mörtl, M.; Cantonati, M.; G.-Tóth, L.; Fischer, P. (Eds.). Reprinted from HYDROBIOLOGIA 613, 2008, 184 p., Hardcover. ISBN: 978-1-4020-9191-9.

Backhuys Publishers Upcoming (Expected in December 2008)

Aquatic Ecosystems and Development (In the series:"Biology of Inland Waters"): Comparative Asian Perspectives in Series ; Biology of Inland Waters. Edited by Fritz Schiemer, David Simon, Upali S. Amarasinghe & Jacques Moreau. 2008; XII + 512pp.; numerous figures and tables, hardbound. ISBN 978-3-8236-1530-9 (D) € 180,-. ISBN 978-90-5782-201-8 (NL) € 180,-

Order with: Germany: inbox@margraf-publishers.com / The Netherlands: backhuys@backhuys.com

Editors' introductory comments

The EU funded FISHSTRAT project on a Holistic approach to sustainable reservoir and lacustrine fisheries in three tropical Asian countries. It encompasses the broad research context and rationale of research. The study linked three diverse disciplines, namely limnology, fisheries and socio-economic development. The importance of such holistic, catchment-oriented approaches to research and management is increasingly widely recognised.

The five water bodies considered are: Minneriya, Udawalawe and Victoria reservoirs in Sri Lanka, Ubolratana reservoir in Thailand's Khon Kaen Province, and Lake Taal, a natural volcanic lake south of Manila on Luzon Island in the Philippines. These selected reservoirs represent a wide range of annual productivities and trophic structures of fish communities, as well as a variety of direct and indirect impacts from human activities in their respective catchment areas. This enabled us to understand better the impact of limited biological productivity upon commercial fish yields as well as the extent of any unexploited fish populations.

The volume provides a comprehensive overview of the principal research findings and policy conclusions, structured broadly in line with our objectives and the implications of our interdisciplinary and comparative methodology. The 22 chapters following the Introduction are divided into six sections, on the basis of coherence and progressively increasing degrees of interdisciplinary integration and comparative analysis.

The Section A (Chapters 1-4) provides general description of physical, hydrological and catchment characteristics of the water bodies in the three countries as the basis for the more detailed analysis that follows. The key conditions for understanding the limnological processes are set by the overall catchment characteristics, its human utilisation and the seasonality of the monsoonal climate. Section B (Chapters 5-9) examines comparative aspects of the aquatic ecosystems, focusing successively on phytoplankton; the regulation of phytoplankton primary production; microbial aspects of carbon dynamics and the detrital food chain; the effects of seasonality on zooplankton populations and status; and the biomass, production and productivity of copepods and cladocerans. In Section C (Chapters 10-14) the focus shifts to fish ecology. The important themes covered include the innovative use of hydroacoustics for assessing fish stocks; feeding ecology of fish assemblages; ecomorphological aspects of diet; selective feeding of small zooplanktivorous pelagic fish species; and a modelling approach to daily feeding patterns and food consumption in certain fish populations. Section D (Chapters 15-18) addresses fisheries and aquaculture, analysing capture fisheries; population dynamics of non-exploited and under-exploited fish species; population dynamics of commercially important species; and the status and significance of aquaculture.

Chapter 18 also examines the socio-economics of aquaculture, thereby providing a useful bridge to Section E (Chapters 19-20) on socio-economics, which comprises detailed surveys of the social economy of fish and fishing in littoral communities, and of fish trading and marketing.

Finally, Section F (Chapters 21-23) attempts to draws together the principal findings and conclusions from each disciplinary area and part of the investigation. This part offers a holistic analysis as the basis for more appropriate policy and management guidelines for the promotion of sustainable resource utilisation. Moreover, Chapter 23 assesses the overall contribution of the study, summarises and explains the principal findings and conclusions, and finally explores the implications for sustainable resource utilisation and management.

Fritz Schiemer
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Forthcoming Books

Spawning Migration of the European Eel Reproduction index, a useful tool for conservation management. Series: Fish & Fisheries Series , Vol. 30. van den Thillart, Guido; Dufour, Sylvie; Rankin, J. Cliff (Eds.). 2009, Approx. 490 p., Hardcover. ISBN: 978-1-4020-9094-3 -

Biology, Conservation and Sustainable Development of Sturgeons Series: Fish & Fisheries Series , Vol. 29. . Carmona, R.; Domezain, A.; García-Gallego, M.; Hernando, J.A.; Rodríguez, F.; Ruiz-Rejón, M. (Eds.). 2009, Approx. 450 p., Hardcover ISBN: 978-1-4020-8436-2 -

Handbook of Alien Species in Europe. Series: Invading Nature - Springer Series in Invasion Ecology , Vol. 3. DAISIE 2009, Approx. 370 p. 200 Illus. in color, Hardcover
ISBN: 978-1-4020-8279-5 -

Alien Reptiles and Amphibiansa Scientific Compendium and Analysis. Series: Invading Nature - Springer Series in Invasion Ecology, Vol. 4. Kraus, Fred 2009, Approx. 580 p. With CD-ROM., Hardcover. ISBN: 978-1-4020-8945-9-

Symoens Prize for Tropical Limnology

In 1992 the Belgian Royal Academy for Overseas Sciences set up a fund for a triennial Prize of 2,500 Euros, named the 'Jean-Jacques & Berthe Symoens Prize for Tropical Limnology', which is intended to reward a memoir

of great scientific value on a subject related to tropical limnology.

The Prize has been awarded for the fifth time this year to Dr Hugo Sarmento (Portugal) for his study "Phytoplankton Ecology of Lake Kivu (Eastern Africa)". Next awarding will occur in 2011. Information about this Prize may be obtained at: Royal Academy for Overseas Sciences, rue Defacqz 1, boîte 3, B-1000 Brussels, Belgium. Tel. 32-2-538 02 11. Fax 32-2-539 23 53. E-mail: kaowarsom@skynet.be. Website: http://www.kaowarsom.be

Meeting Announcement: ASLO 2009 Aquatic Sciences Meeting

ASLO (Advancing the Science of Limnology and Oceanography) will hold its 2009 Aquatic Sciences Meeting 25-30 January at the Centre de Congrès Acropolis (The Acropolis) in Nice, France. This is the third international ASLO Meeting in Europe and the only ASLO meeting in 2009. Set among the picturesque coasts and towns of Southern France, the meeting will offer a lively exchange of scientific findings and viewpoints among colleagues from all over the world. A new plenary lecture format will be introduced at this conference. The topic of the day will be covered by two different speakers with either controversial or complementary viewpoints in order to solicit a lively discussion among the participants in the day's sessions that will follow. Increasing emphasis will be placed on poster sessions. ASLO award talks also will be presented at this meeting.

The committee has developed a scientific program that will cover all topics in aquatic sciences. To see descriptions of the topical sessions for this meeting and abstracts of the plenary talks to be presented, please go to the meeting web site: http://www.aslo.org/nice2009

Abstracts of papers presented during the meeting will be published on the ASLO web site (http://aslo.org) as well as archived on the site following the meeting. If you have questions regarding the scientific program to be presented at this meeting, please contact the following meeting co-chairs:

Markus Weinbauer
Observatoire Océanologique de Villefranche-sur-mer
E-mail: wein@obs-vlfr.fr

Jean-Pierre Gattuso
Observatoire Océanologique de Villefranche-sur-mer
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Peter Bossard
EAWAG
E-mail: peter.bossard@eawag.ch

While we know there will be great science presented at this meeting, as well as the opportunity to get together with colleagues, the city of Nice is a remarkable place to meet! Nice is located on the French Riviera and was a part of the "Duché de Savoie" until 1860, the date of its attachment to France. It has a sunny, temperate climate and attracts many visitors. Nice is France's fifth largest city and has the second busiest airport -- situated only 7 km from the city! Nice is easy to get to from most anywhere in the world and is a major transportation hub in Europe. Many major airlines offer frequent flights to Nice from London, Paris and other cities. With about 40 airlines from 29 countries flying into Nice, there are many direct flights from other European cities as well as outside Europe, including Montreal, Moscow, and New York (JFK). A high-speed rail service is also available between Paris and Nice, not to mention access to many major European cities via motorways. It takes approximately nine hours from Paris to Nice by car.

Nice and the towns along the Côte d'Azur are well known for their extraordinary artistic and cultural heritage. The Chagall and Matisse Museums and the Museum of Modern and Contemporary Art are the most visited in Nice. One of the highlights of the city is the old town that must be explored by walking. On the famous Cours Saleya, brightly colored stands with local products on display and perfumes from the flower market arouse the senses. The old town is bordered by the harbor, the beach, and the, now, subterranean river. Nice offers topnotch restaurants, museums, nightlife, and shopping.

Many towns with well-known visitors' attractions are within quick and easy access of Nice via the public transport, such as Cannes (film festival), Grasse (capital of perfumery), Antibes (Picasso museum) and Monaco, which at just half an hour away is home to the Oceanographic Museum (http://www.oceano.mc). Areas that can be reached within a few hours are the famous Provence, the Parc National du Mercantour (a national park, where wolves still live) and Corsica (in French: Ile de Beauté; i.e. Island of Beauty).

The deadline for abstract submissions to the 2009 ASLO Aquatic Sciences Meeting is 3 October 2008. We encourage your participation to benefit from the science to be presented.
You may register for the meeting through the conference website: http://aslo.org/nice2009

If you need additional information about ASLO or the 2009 Aquatic Sciences Meeting, please contact the following:

2009 Aquatic Sciences Meeting
ASLO Business Office / 5400 Bosque Boulevard, Suite 680 / Waco, Texas 76710-4446
business@aslo.org (E-mail) / http://www.aslo.org/nice2009 (Web)
800-929-ASLO (Phone – Within the U.S., Canada, and the Carribean)
254-399-9635 (Phone – All other countries)
254-776-3767 (Fax)

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SILnews is the official newsletter of the Societas Internationalis Limnologiae (SIL) - International Association of Theoretical and Applied Limnology. SILnews is published three times each year and is distributed to about 3,100 SIL members, libraries and organizations world-wide. SILnews has been published since 1987 and is non-profit.

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We look forward to being of service to you.

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Attention: Manufacturers of Limnological Equipment and Publishers

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SILnews is distributed twice a year to more than 3,000 SIL members and libraries world-wide. If your company is interested in acquiring advertising space in *SILnews,* please contact Ramesh D. Gulati (r.gulati@nioo.knaw.nl) or Ms. Denise Johnson (denisej@unc.edu) the Editorial Office for rates, or use the mailing address indicated on the front page.

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Limnology Jobs and Studentship Notices

Notices on the availability of limnologically-oriented jobs and graduate student opportunities are now accepted for publication in the *SILnews* and displayed on the SIL web site at http://www.limnology.org. There is no charge for the service at this time, which is available to both SIL members and non-members.

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Submissions may be edited for length and clarity. Those deemed inappropriate to the SIL mandate will be rejected at the discretion of the *SILnews* Editor or the Webmaster. Submissions for the print edition of *SILnews* should be sent to the editor at the address on the cover of this issue.

Submissions for the SIL web site should be sent by e-mail to webmaster@limnology.org or by fax to the attention of Gordon Goldsborough at: +1 (204) 474-7618.

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The International Society of Limnology (formerly International Association of Theoretical and Applied Limnology; Societas Internationalis Limnologiae, SIL) works worldwide to understand lakes, rivers, and wetlands and to use knowledge gained from research to manage and protect these diverse, inland aquatic ecosystems.

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